IMPORTANT

WARNING/CAUTION/NOTE

Please read this manual and follow its instructions carefully. To emphasize special information, the words **WARNING, CAUTION** and **NOTE** have special meanings. Pay special attention to the messages highlighted by these signal words.

WARNING:
Indicates a potential hazard that could result in death or injury.

CAUTION:
Indicates a potential hazard that could result in vehicle damage.

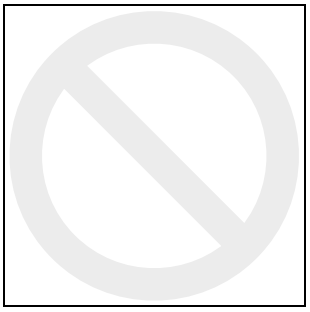
NOTE:
Indicates special information to make maintenance easier or instructions clearer.

WARNING:
This service manual is intended for authorized Suzuki dealers and qualified service mechanics only. Inexperienced mechanics or mechanics without the proper tools and equipment may not be able to properly perform the services described in this manual.
Improper repair may result in injury to the mechanic and may render the vehicle unsafe for the driver and passengers.

WARNING:
For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **If the air bag system and another vehicle system both need repair, Suzuki recommends that the air bag system be repaired first, to help avoid unintended air bag system activation.**
- **Do not modify the steering wheel, instrument panel or any other air bag system component (on or around air bag system components or wiring). Modifications can adversely affect air bag system performance and lead to injury.**
- **If the vehicle will be exposed to temperatures over 93°C (200°F) (for example, during a paint baking process), remove the air bag system components beforehand to avoid component damage or unintended activation.**

The circle with a slash in this manual means "Do not do this" or "Do not let this happen".



FOREWORD

This manual contains procedures for diagnosis, maintenance, adjustments, minor service operations, replacement of components (Service) and for disassembly and assembly of major components (Unit Repair-Overhaul).

Applicable model: RM413

The contents are classified into sections each of which is given a section number as indicated in the Table of Contents on following page. And on the first page of each individual section is an index of that section.
This manual should be kept in a handy place for ready reference of the service work.
Strict observance of the so specified items will enable one to obtain the full performance of the vehicle.

When replacing parts or servicing by disassembling, it is recommended to use SUZUKI genuine parts, tools and service materials (lubricant, sealants, etc.) as specified in each description.

All information, illustrations and specifications contained in this literature are based on the latest product information available at the time of publication approval. And used as the main subject of description is the vehicle of standard specifications among others.
Therefore, note that illustrations may differ from the vehicle being actually serviced.
The right is reserved to make changes at any time without notice.

RELATED MANUAL:

Manual Name	Manual No.
IGNIS (RM413/415/413D) Wiring Diagram Manual	99512U86G20-669

MAGYAR SUZUKI CORPORATION

TABLE OF CONTENTS

NOTE:

The screen toned Section 8A is in Wiring Diagram Manual mentioned in FOREWORD of this manual.

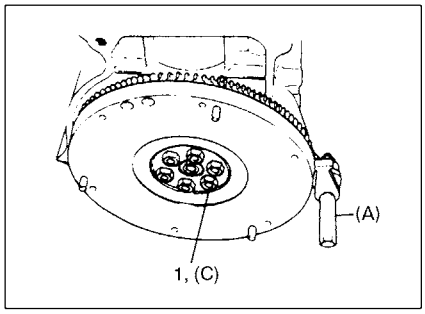
SECTION 0A

GENERAL INFORMATION

CONTENTS

How to Use This Manual

1) There is a “TABLE OF CONTENTS” on the third page of this manual, whereby you can easily find the section that offers the information you need. Also, there is a “Contents” on the first page of each section, where the main items in that section are listed.
2) Each section of this manual has its own pagination. It is indicated at the top of each page along with the Section name.
3) The special tool usage and torque specification are given as shown in the figure.



6) Install oil pump. Refer to “Oil pump” in this section.
7) Install flywheel (for M/T vehicle) or drive plate (for A/T vehicle). Using special tool, lock flywheel or drive plate, and tighten flywheel or drive plate bolts (1) to specified torque.

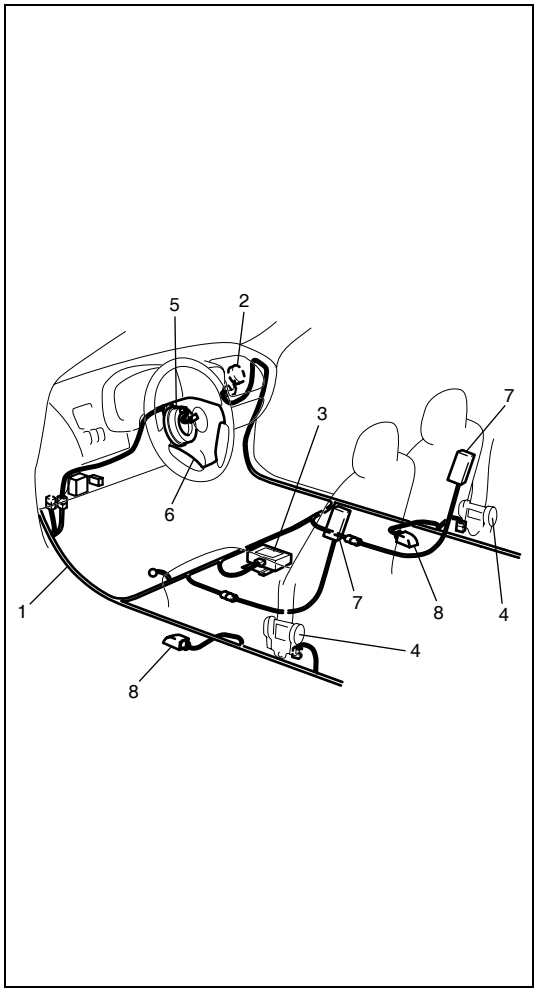
Special Tool
(A) : 09924-17810

Tightening Torque
(c) : 78 N·m (7.8 kg-m, 56.0 lb-ft)

4) A number of abbreviations and symbols are used in the text. For their full explanations, refer to “Abbreviations and Symbols May be Used in This Manual” in this section.
5) The SI, metric and foot-pound systems are used as units in this manual.
6) “Diagnosis” are included in each section as necessary.
7) At the end of each section, there are descriptions of “Special Tool”, “Required Service Material” and “Tightening Torque Specification” that should be used for the servicing work described in that section.

Precautions

Precaution for Vehicles Equipped with a Supplemental Restraint (Air Bag) System



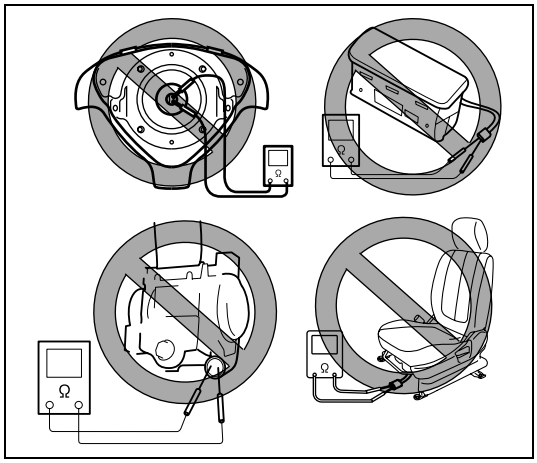
WARNING:

- **The configuration of air bag system parts are as shown in the figure. When it is necessary to service (remove, reinstall and inspect) these parts, be sure to follow procedures described in Section 10B. Failure to follow proper procedures could result in possible air bag system activation, personal injury, damage to parts or air bag system being unable to activate when necessary.**
- **If the air bag system and another vehicle system both need repair, SUZUKI recommends that the air bag system be repaired first, to help avoid unintended air bag system activation.**
- **Do not modify the steering wheel, dashboard, or any other air bag system components. Modifications can adversely affect air bag system performance and lead to injury.**
- **If the vehicle will be exposed to temperatures over 93°C (200°F) (for example, during a paint baking process), remove the air bag system components beforehand to avoid component damage or unintended air bag system activation.**

1. Air bag wire harness (in floor harness)	5. Contact coil
2. Passenger air bag (inflator) module	6. Driver air bag (inflator) module
3. SDM	7. Side air bag (inflator) module (if equipped)
4. Seat belt pretensioner	8. Side sensor (if equipped)

Diagnosis

- When troubleshooting air bag system, be sure to follow “Diagnosis” in Section 10B. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacement.
- Never use electrical test equipment other than that specified in this manual.

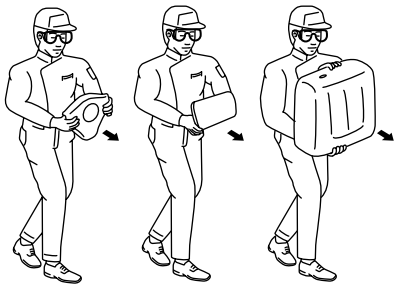


WARNING:

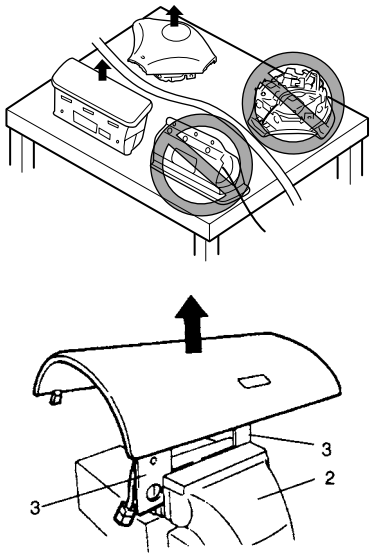
Never attempt to measure the resistance of the air bag (inflator) modules (driver, passenger and side) and seat belt pretensioners (driver and passenger). It is very dangerous as the electric current from the tester may deploy the air bag or activate the pretensioner.

Servicing and handling

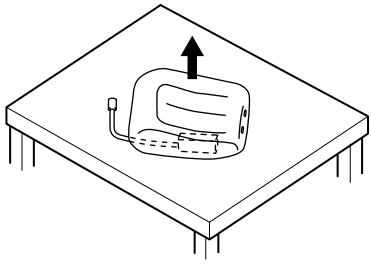
[A]



[B]



[C]



WARNING:

Many of service procedures require disconnection of "AIR BAG" fuse and all air bag (inflator) module(s) from initiator circuit to avoid an accidental deployment.

Driver, Passenger and side Air Bag (Inflator) Modules

- **For handling and storage of a live air bag (inflator) module, select a place where the ambient temperature below 65 °C (150 °F), without high humidity and away from electric noise.**
- **When carrying a live air bag (inflator) module, make sure the bag opening is pointed away from you. In case of an accidental deployment, the bag will then deploy with minimal chance of injury. Never carry the air bag (inflator) module by the wires or connector on the underside of the module. When placing a live air bag (inflator) module on a bench or other surface, always face the bag up, away from the surface. As the live passenger air bag (inflator) module must be placed with its bag (trim cover) facing up, place it on the workbench with a slit (1) or use the workbench vise (2) to hold it securely at its lower mounting bracket (3). The front seat back with the live air bag (inflator) module must be placed with its frontal seat cover facing up. It is also prohibited to place anything on top of the trim cover and stack air bag (inflator) modules. This is necessary so that a free space is provided to allow the air bag to expand in the unlikely event of accidental deployment. Otherwise, personal injury may result.**
- **Never dispose of live (undeployed) air bag (inflator) modules (driver, passenger and side). If disposal is necessary, be sure to deploy them according to deployment procedures described in Section 10B before disposal.**
- **The air bag (inflator) module immediately after deployment is very hot. Wait for at least half an hour to cool it off before proceeding the work.**
- **After an air bag (inflator) module has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by-products of the chemical reaction. As with many service procedures, gloves and safety glasses should be worn.**

[A] :	Always carry air bag (inflator) module with trim cover (air bag opening) away from body.
[B] :	Always place air bag (inflator) module on workbench with trim cover (air bag opening) up, away from loose objects.
[C] :	Always place with its frontal seat cover facing up, away from loose objects.

WARNING:

SDM

- **For handling and storage of a SDM, select a place where the ambient temperature below 65°C (150°F), without high humidity and away from electric noise.**
- **During service procedures, be very careful when handling a Sensing and Diagnostic Module (SDM). Never strike or jar the SDM.**
- **Never power up the air bag system when the SDM is not rigidly attached to the vehicle. All SDM and mounting bracket fasteners must be carefully torqued and the arrow must be pointing toward the front of the vehicle to ensure proper operation of the air bag system.**
  The SDM could be activated when powered while not rigidly attached to the vehicle which could cause deployment and result in personal injury.

WARNING:

Driver and Passenger Seat Belt Pretensioners (If equipped)

- **For handling and storage of a live seat belt pretensioner, select a place where the ambient temperature below 65°C (150°F), without high humidity and away from electric noise.**
- **Never carry seat belt pretensioner by wire or connector of pretensioner. When placing a live seat belt pretensioner on the workbench or some place like that, never put something on seat belt pretensioner. Otherwise, personal injury may result.**
- **Never dispose of live (inactivated) seat belt pretensioners (drive and passenger). If disposal is necessary, be sure to activate them according to activation procedures described in Section 10B before disposal.**
- **The seat belt pretensioner immediately after activation is very hot. Wait for at least half an hour to cool it off before proceeding the work.**
- **With many service procedures, gloves and safety glasses should be worn to prevent any possible irritation of the skin or eyes.**

- **Even when the accident was light enough not to cause air bags to activate, be sure to inspect system parts and other related parts according to instructions under "Repairs and Inspections Required after an Accident" in Section 10B.**
- **When servicing parts other than air bag system, if shocks may be applied to air bag system component parts, remove those parts beforehand.**
- **When handling the air bag (inflator) modules (driver, passenger and side), seat belt pretensioners (driver and passenger), side sensors or SDM, be careful not to drop it or apply an impact to it. If an excessive impact was applied, never attempt disassembly or repair but replace it with a new one.**
- **When grease, cleaning agent, oil, water, etc. has got onto air bag (inflator) modules (driver, passenger and side) or seat belt pretensioners (drive and passenger), wipe off immediately with a dry cloth.**
- **Air bag wire harness is included in floor and instrument panel wire harnesses. Air bag wire harness branched off from floor and instrument panel wire harnesses can be identified easily as it is covered with a yellow protection tube and it has yellow connectors. Be very careful when handling it.**
- **When an open in air bag wire harness, damaged wire harness, connector or terminal is found, replace wire harness, connectors and terminals as an assembly.**
- **Do not apply power to the air bag system unless all components are connected or a diagnostic chart requests it, as this will set a diagnostic trouble code.**
- **Never use air bag system component parts from another vehicle.**
- **When using electric welding, be sure to disconnect all air bag (inflator) module connectors and pretensioner connectors from air bag wire harness respectively.**
- **Never expose air bag system component parts directly to hot air (drying or baking the vehicle after painting) or flames.**

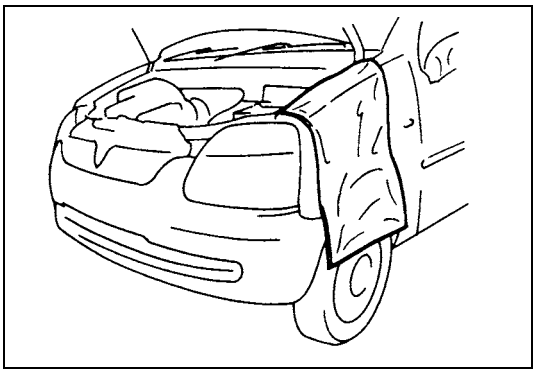
- **WARNING / CAUTION labels are attached on each part of air bag system components. Be sure to follow the instructions.**
- **After vehicle is completely repaired, perform "Air Bag Diagnostic System Check" in Section 10B.**

General Precautions

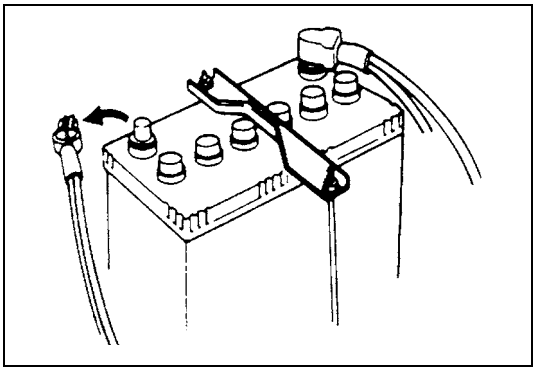
The WARNING and CAUTION below describe some general precautions that you should observe when servicing a vehicle. These general precautions apply to many of the service procedures described in this manual, and they will not necessarily be repeated with each procedure to which they apply.

WARNING:

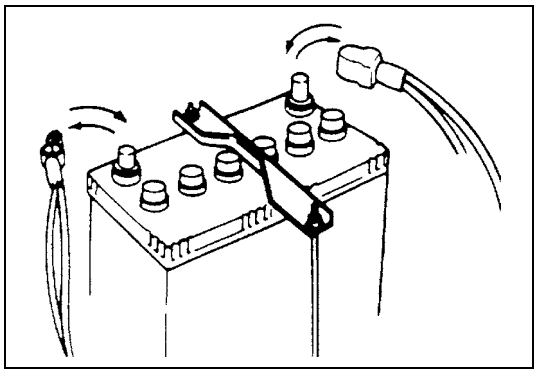
- **Whenever raising a vehicle for service, be sure to follow the instructions under "Vehicle Lifting Points" in this section.**
- **When it is necessary to do service work with the engine running, make sure that the parking brake is set fully and the transmission is in Neutral (for manual transmission vehicles) or Park (for automatic transmission vehicles), Keep hands, hair, clothing, tools, etc. away from the fan and belts when the engine is running.**
- **When it is necessary to run the engine indoors, make sure that the exhaust gas is forced outdoors.**
- **Do not perform service work in areas where combustible materials can come in contact with a hot exhaust system. When working with toxic or flammable materials (such as gasoline and refrigerant), make sure that the area you work in is well-ventilated.**
- **To avoid getting burned, keep away from hot metal parts such as the radiator, exhaust manifold, tail pipe, muffler, etc.**
- **New and used engine oil can be hazardous. Children and pets may be harmed by swallowing new or used oil. Keep new and used oil and used engine oil filters away from children and pets.**
  Continuous contact with used engine oil has been found to cause [skin] cancer in laboratory animals. Brief contact with used oil may irritate skin. To minimize your exposure to used engine oil, wear a long-sleeve shirt and moisture-proof gloves (such as dish washing gloves) when changing engine oil. If engine oil contacts your skin, wash thoroughly with soap and water. Launder any clothing or rags if wet with oil, recycle or properly dispose of used oil and filters.
- **Make sure the bonnet is fully closed and latched before driving. If it is not, it can fly up unexpectedly during driving, obstructing your view and resulting in an accident.**



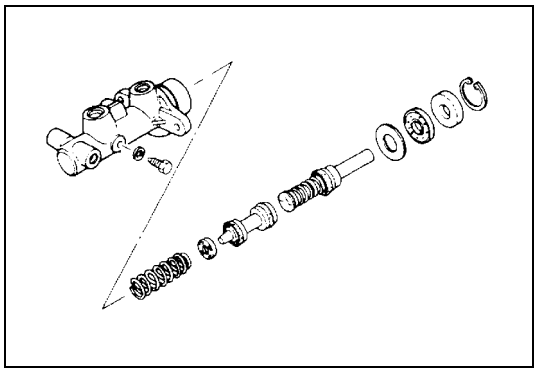
- **Before starting any service work, cover fenders, seats and any other parts that are likely to get scratched or stained during servicing. Also, be aware that what you wear (e.g, buttons) may cause damage to the vehicle's finish.**



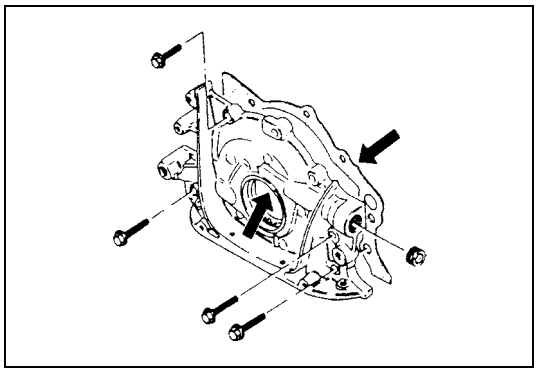
- **When performing service to electrical parts that does not require use of battery power, disconnect the negative cable of the battery.**



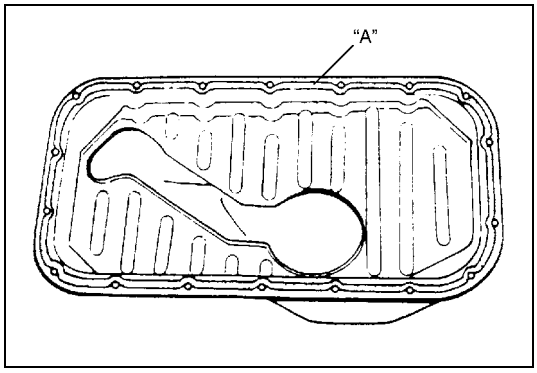
- **When removing the battery, be sure to disconnect the negative cable first and then the positive cable. When reconnecting the battery, connect the positive cable first and then the negative cable, and replace the terminal cover.**



- **When removing parts that are to be reused, be sure to keep them arranged in an orderly manner so that they may be reinstalled in the proper order and position.**

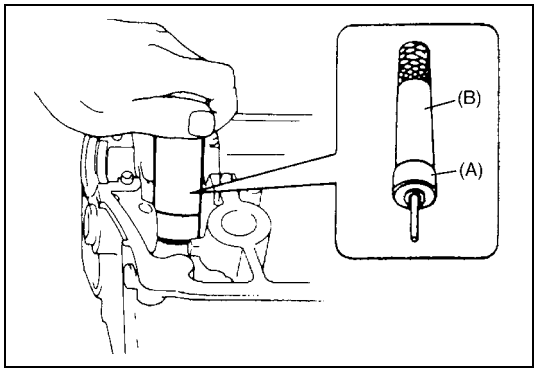


- **Whenever you use oil seals, gaskets, packing, O-rings, locking washers, split pins, self-locking nuts, and certain other parts as specified, be sure to use new ones. Also, before installing new gaskets, packing, etc., be sure to remove any residual material from the mating surfaces.**



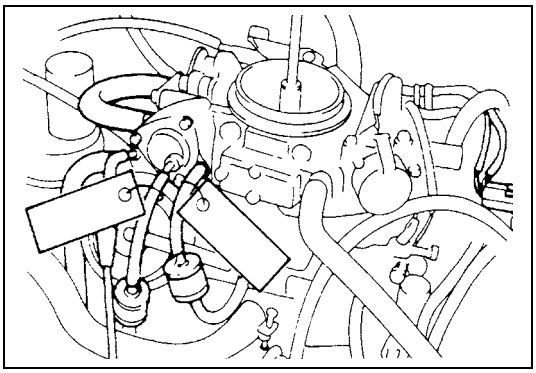
- **Make sure that all parts used in reassembly are perfectly clean.**
  When use of a certain type of lubricant, bond or sealant is specified, be sure to use the specified type.

"A": Sealant 99000-31250

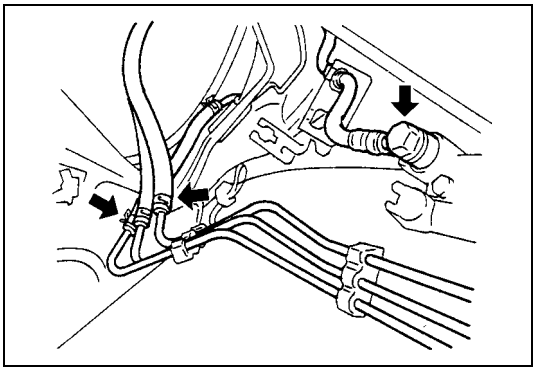


- **Be sure to use special tools when instructed.**

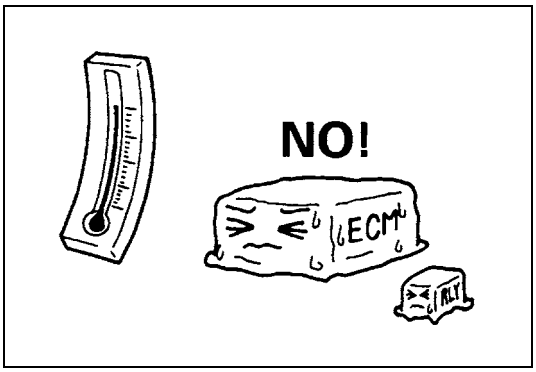
Special tool
(A) : 09917-98221
(B) : 09916-58210



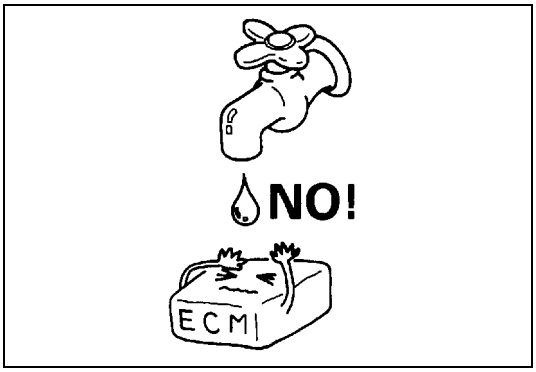
- **When disconnecting vacuum hoses, attach a tag describing the correct installation positions so that the hoses can be reinstalled correctly.**



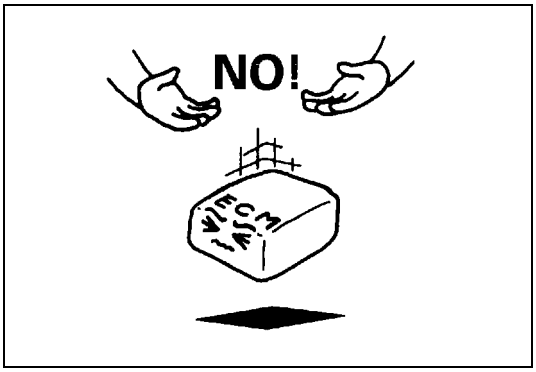
- **After servicing fuel, oil, coolant, vacuum, exhaust or brake systems, check all lines related to the system for leaks.**
- **For vehicles equipped with fuel injection systems, never disconnect the fuel line between the fuel pump and injector without first releasing the fuel pressure, or fuel can be sprayed out under pressure.**



- **When performing a work that produces a heat exceeding 80°C (176°F) in the vicinity of the electrical parts, remove the heat sensitive electrical part(s) beforehand.**



- **Use care not to expose connectors and electrical parts to water which will be a cause of a trouble.**



- **Always be careful not to handle electrical parts (computer, relay, etc.) in a rough manner or drop them.**

Precaution for Wheel (with Tire) Removal

Each wheel of this vehicle is installed using wheel bolts. When removing any of these wheels, never remove all wheel bolts at the same time. Leave at least 1 bolt for each wheel as it is to prevent wheel from dropping. When removing this remaining 1 bolt, hold wheel and tire so as not to allow them to come off.

Precautions for Catalytic Converter

For vehicles equipped with a catalytic converter, use only unleaded gasoline and be careful not to let a large amount of unburned gasoline enter the converter or it can be damaged.

- **Conduct a spark jump test only when necessary, make it as short as possible, and do not open the throttle.**
- **Conduct engine compression checks within the shortest possible time.**
- **Avoid situations which can result in engine misfire (e.g. starting the engine when the fuel tank is nearly empty.)**

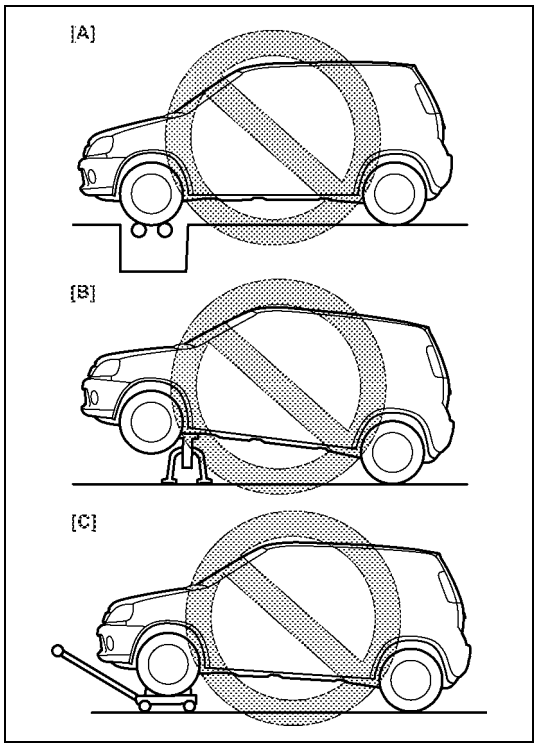
Precaution for Installing Mobile Communication Equipment

When installing mobile communication equipment such as CB (Citizens-Band) -radio or cellular-telephone, be sure to observe the following precautions.
Failure to follow cautions may adversely affect electronic control system.

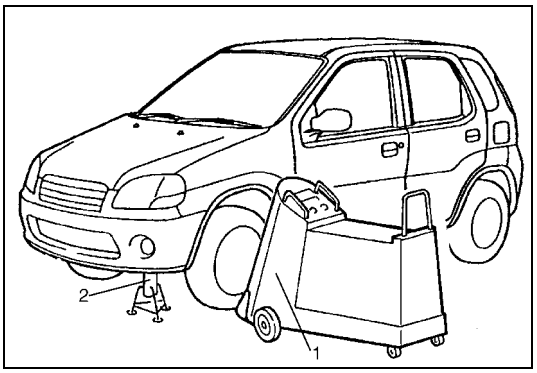
- **Keep the antenna as far away as possible from the vehicle's electronic control unit.**
- **Keep the antenna feeder more than 20 cm (7.9 in) away from electronic control unit and its wire harnesses.**
- **Do not run the antenna feeder parallel with other wire harnesses.**
- **Confirm that the antenna and feeder are correctly adjusted.**

Precaution in Servicing Full-Time 4WD Vehicle

This full-time 4WD vehicle can not be converted to 2WD manually.
Observe the following caution in servicing. Otherwise, front wheels drive rear wheels or vise-versa and vehicle accidents, drivetrain damage and personal injury may result.



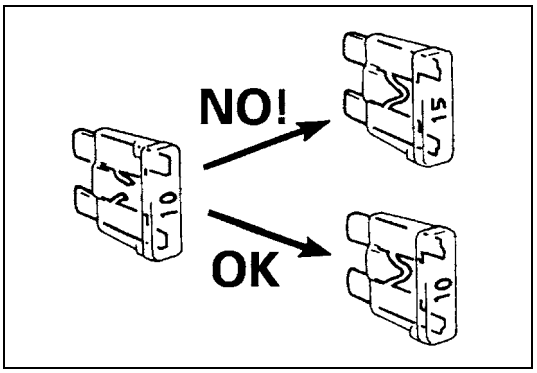
- **Never perform any of the following types of service work.**
  [A]: Testing with 2-wheel chassis dynamometer, speedometer tester or brake tester.
  [B]: Driving front wheels, which are jacked up.
  [C]: Towing under the condition where either front or rear wheels can not rotate.
- **When testing with 2-wheel chassis dynamometer, speedometer tester or brake tester, be sure to make the vehicle as front wheel drive by removing propeller shaft.**



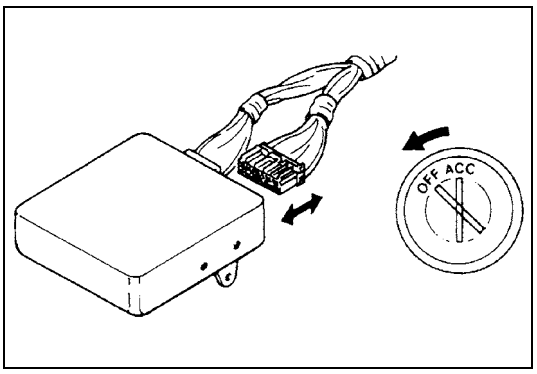
- **When using On-vehicle type wheel balancing equipment (1), be sure to jack up all four wheels, off the ground completely and support vehicle with safety stands (2). Be careful of the other wheels, which will rotate at the same time.**

- **This vehicle should be towed under one of the following conditions :**
  - **With all wheels on a flatbed truck.**
  - **With front or rear wheels lifted and a dolly under the other wheels.**

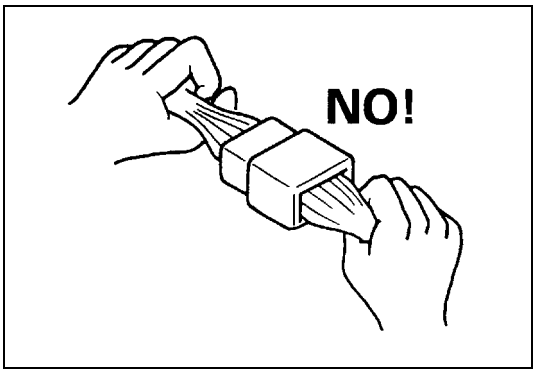
Precautions for Electrical Circuit Service



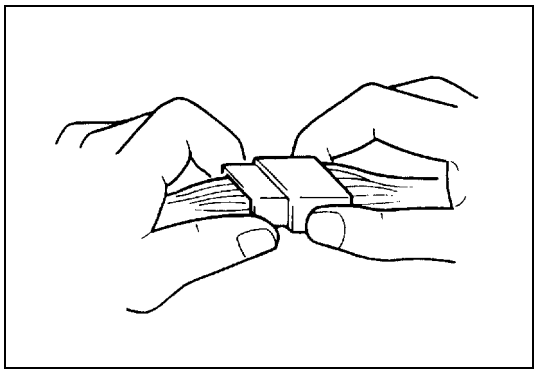
- **When replacing a fuse, make sure to use a fuse of the specified capacity. Use of a fuse with a larger capacity will cause a damage to the electrical parts and a fire.**



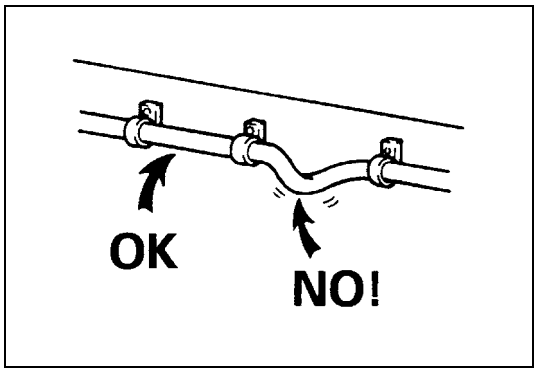
- **When disconnecting and connecting coupler, make sure to turn ignition switch OFF, or electronic parts may get damaged.**



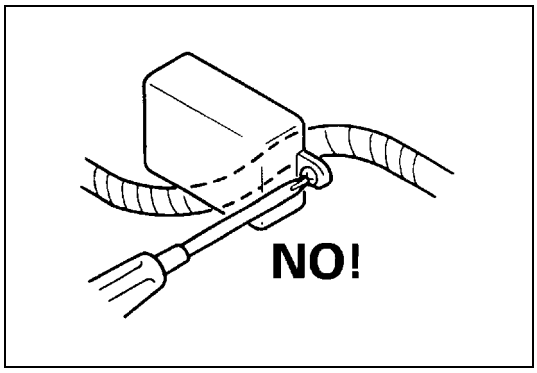
- **When disconnecting connectors, never pull the wiring harness. Unlock the connector lock first and then pull them apart by holding connectors themselves.**



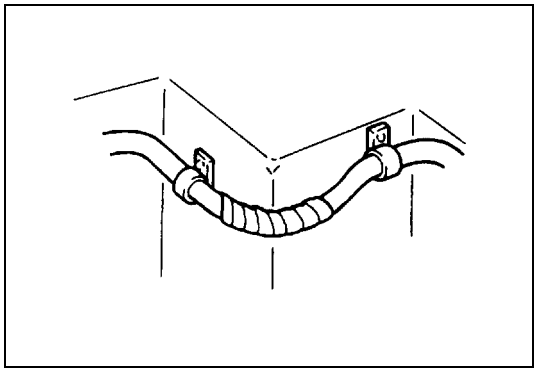
- When connecting connectors, also hold connectors and put them together until they lock securely (a click is heard).



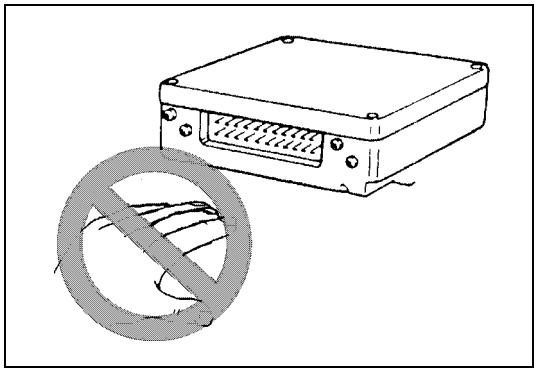
- When installing the wiring harness, fix it with clamps so that no slack is left.



- When installing vehicle parts, be careful so that the wiring harness is not interfered with or caught by any other part.

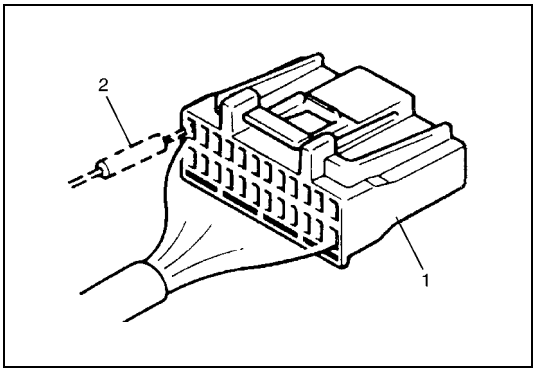


- To avoid damage to the harness, protect its part which may contact against a part forming a sharp angle by winding tape or the like around it.

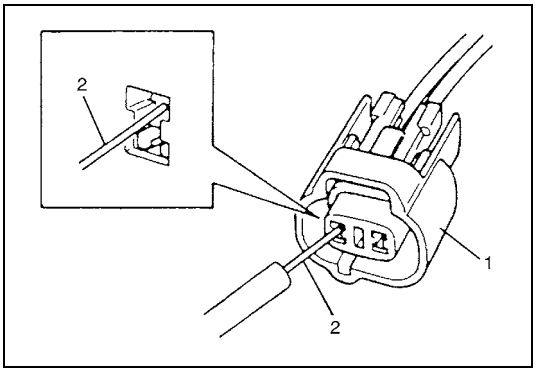


- Be careful not to touch the electrical terminals of parts which use microcomputers (e.g. electronic control unit like as ECM, PCM, P/S controller, etc.). The static electricity from your body can damage these parts.
- Never connect any tester (voltmeter, ohmmeter, or whatever) to electronic control unit when its coupler is disconnected. Attempt to do it may cause damage to it.

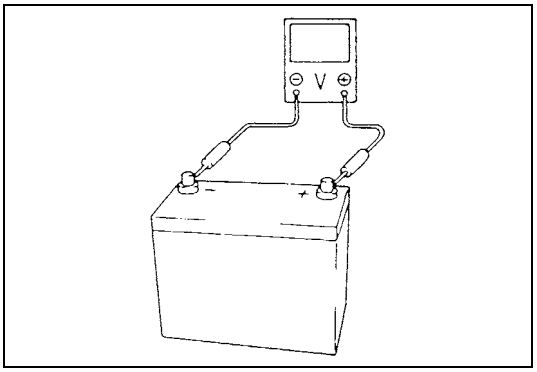
- **Never connect an ohmmeter to electronic control unit with its coupler connected to it. Attempt to do it may cause damage to electronic control unit and sensors.**
- **Be sure to use a specified voltmeter/ohmmeter. Otherwise, accurate measurements may not be obtained or personal injury may result. If not specified, use a voltmeter with high impedance (MΩ / V minimum) or a digital type voltmeter.**



- **When taking measurements at electrical connectors using a tester probe, be sure to insert the probe (2) from the wire harness side (backside) of the connector (1).**



- **When connecting meter probe (2) from terminal side of coupler (1) because it can't be connected from harness side, use extra care not to bend male terminal of coupler of force its female terminal open for connection.**
  In case of such coupler as shown connect probe as shown to avoid opening female terminal.
  Never connect probe where male terminal is supposed to fit.
- **When checking connection of terminals, check its male half for bend and female half for excessive opening and both for locking (looseness), corrosion, dust, etc.**



- **Before measuring voltage at each terminal, check to make sure that battery voltage is 11 V or higher. Such terminal voltage check at low battery voltage will lead to erroneous diagnosis.**

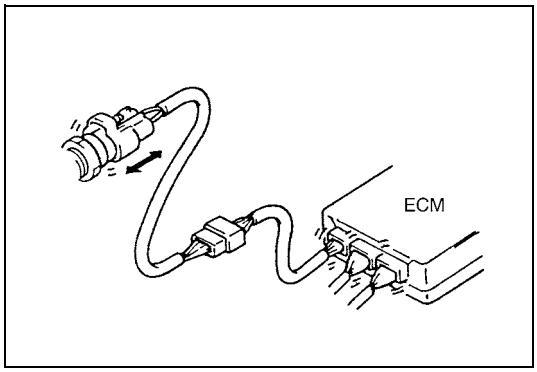
Electrical Circuit Inspection Procedure

While there are various electrical circuit inspection methods, described here is a general method to check its open and short circuit by using an ohmmeter and a voltmeter.

Open circuit check

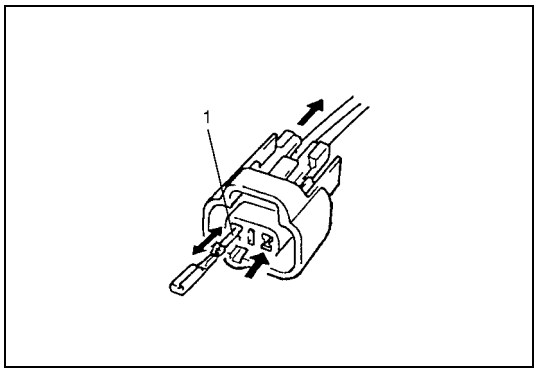
Possible causes for the open circuit are as follows. As the cause is in the connector or terminal in many cases, they need to be checked particularly carefully.

- Loose connection of connector
- Poor contact of terminal (due to dirt, corrosion or rust on it, poor contact tension, entry of foreign object etc.)
- Wire harness being open



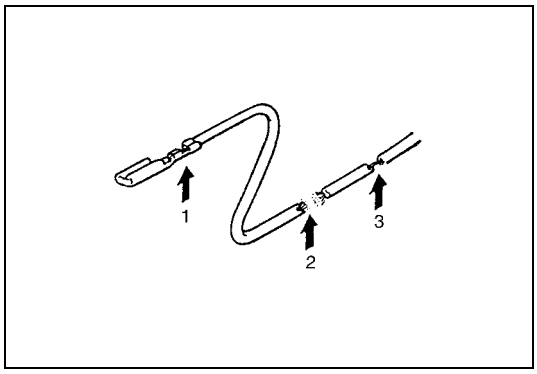
When checking system circuits including an electronic control unit such as ECM, TCM, ABS control module, etc., it is important to perform careful check, starting with items which are easier to check.

1) Disconnect negative (–) cable from battery
2) Check each connector at both ends of the circuit being checked for loose connection. Also check lock condition of connector if equipped with connector lock.



3) Using a test male terminal, check both terminals of the circuit being checked for contact tension of its female terminal.
   Check each terminal visually for poor contact (possibly caused by dirt, corrosion, rust entry of foreign object, etc.).
   At the same time, check to make sure that each terminal is locked in the connector fully.

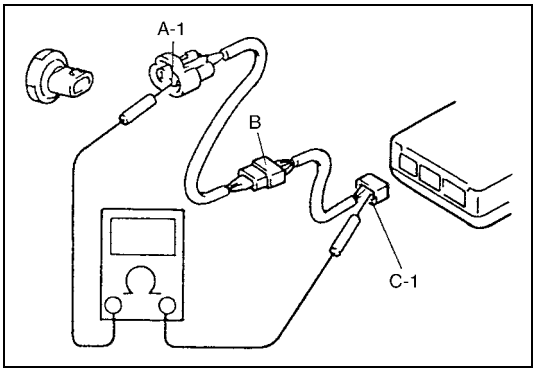
1. Check contact tension by inserting and removing just for once.



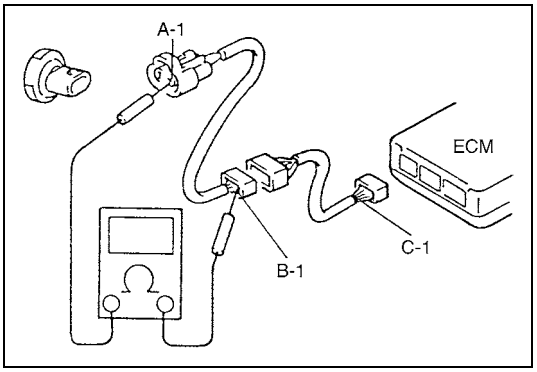
4) Using continuity check or voltage check the following procedure, check the wire harness for open circuit and poor connection with its terminals. Locate abnormality, if any.

1. Looseness of crimping
2. Open
3. Thin wire (single strand of wire)

Continuity check



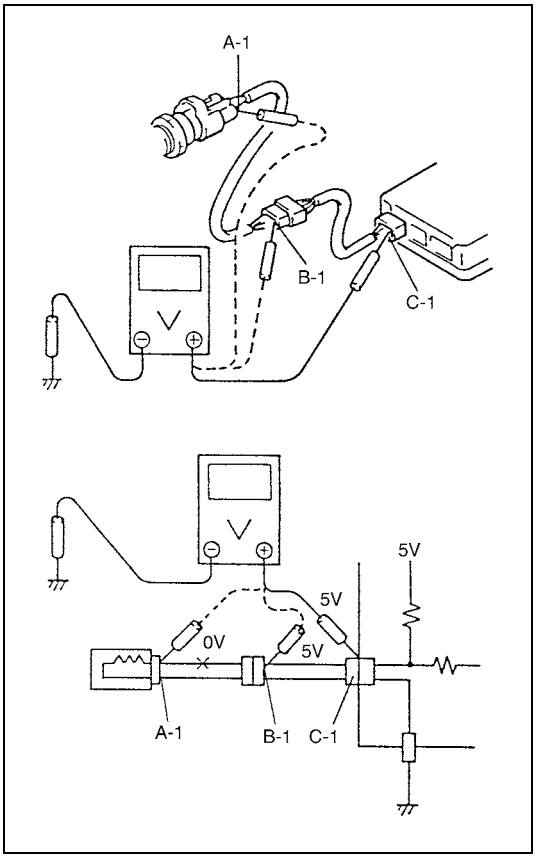
1) Measure resistance between connector terminals at both ends of the circuit being checked (between A-1 and C-1 in the figure). If no continuity is indicated (infinity or over limit), that means that the circuit is open between terminals A-1 and C-1.



2) Disconnect the connector included in the circuit (connector-B in the figure) and measure resistance between terminals A-1 and B-1.
   If no continuity is indicated, that means that the circuit is open between terminals A-1 and B-1. If continuity is indicated, there is an open circuit between terminals B-1 and C-1 or an abnormality in connector-B.

Voltage check

If voltage is supplied to the circuit being checked, voltage check can be used as circuit check.



1) With all connectors connected and voltage applied to the circuit being checked, measure voltage between each terminal and body ground.
   a) If measurements were taken as shown in the figure and results were as listed below, it means that the circuit is open between terminals B-1 and A-1.

Voltage between
C-1 and body ground : Approx. 5 V
B-1 and body ground : Approx. 5 V
A-1 and body ground : 0 V

   b) Also, if measured values were as listed below, it means that there is a resistance (abnormality) of such level that corresponds to the voltage drop in the circuit between terminals A-1 and B-1.

Voltage between
C-1 and body ground : Approx. 5 V
B-1 and body ground : Approx. 5 V
A-1 and body ground : Approx. 3 V

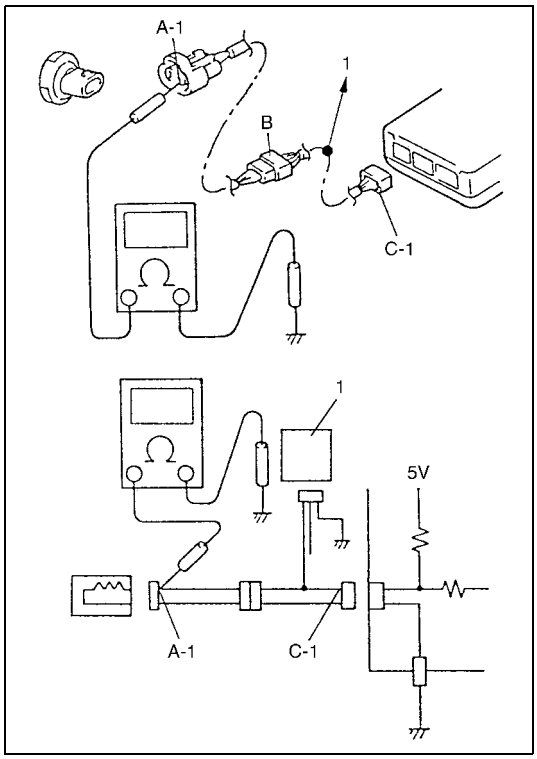
Short circuit check (wire harness to ground)

1) Disconnect negative (–) cable at battery.
2) Disconnect connectors at both ends of the circuit to be checked.

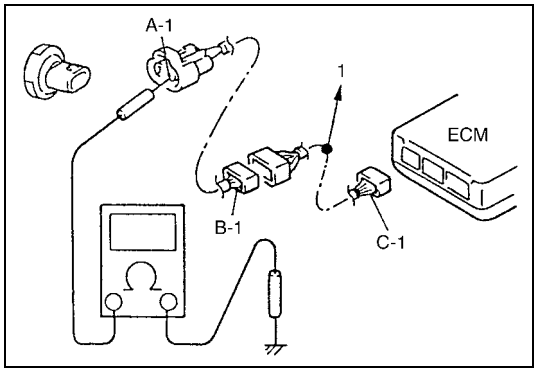
NOTE:

If the circuit to be checked is connected to other parts (1), disconnect all connectors of those parts. Otherwise, diagnosis will be misled.

3) Measure resistance between terminal at one end of circuit (A-1 terminal in the figure) and body ground. If continuity is indicated, it means that there is a short to ground between terminals A-1 and C-1 of the circuit.



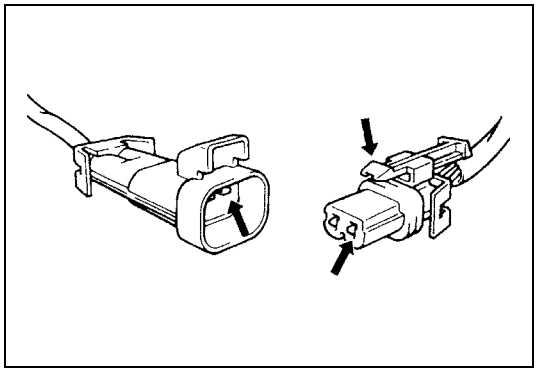
4) Disconnect the connector included in circuit (connector B) and measure resistance between A-1 and body ground.
If continuity is indicated, it means that the circuit is shorted to the ground between terminals A-1 and B-1.



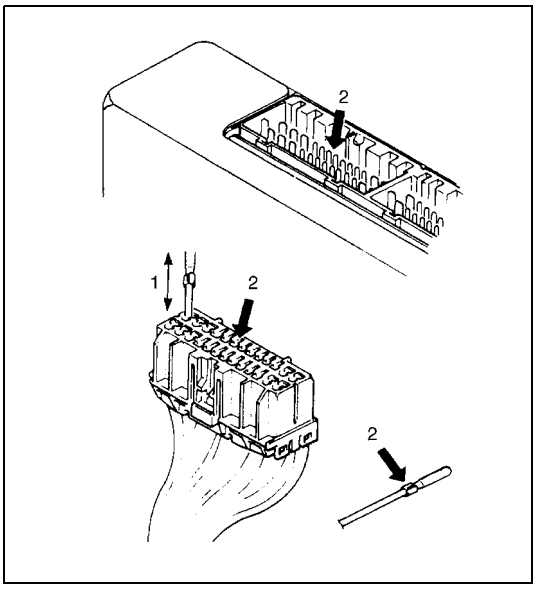
1. To other parts

Intermittent and Poor Connection

Most intermittent are caused by faulty electrical connections or wiring, although a sticking relay or solenoid can occasionally be at fault. When checking it for proper connection, perform careful check of suspect circuits for :

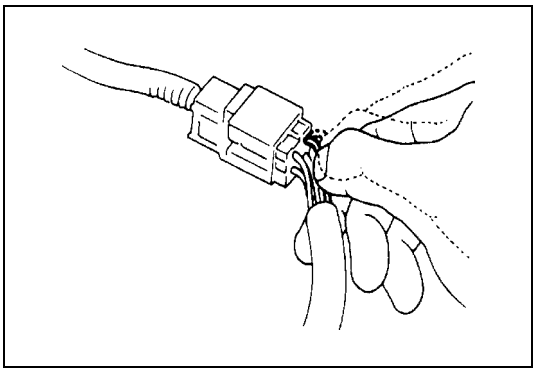


- Poor mating of connector halves, or terminals not fully seated in the connector body (backed out).
- Dirt or corrosion on the terminals. The terminals must be clean and free of any foreign material which could impede proper terminal contact. However, cleaning the terminal with a sand paper or the like is prohibited.
- Damaged connector body, exposing the terminals to moisture and dirt, as well as not maintaining proper terminal orientation with the component or mating connector.

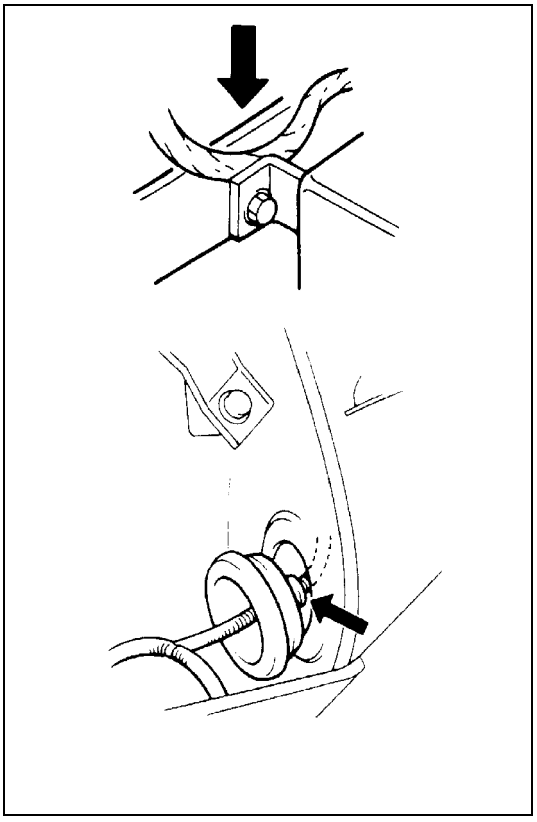


- Improperly formed or damaged terminals.
  Check each connector terminal in problem circuits carefully to ensure good contact tension by using the corresponding mating terminal.
  If contact tension is not enough, reform it to increase contact tension or replace.

1. Check contact tension by inserting and removing just once.
2. Check each terminal for bend and proper alignment.



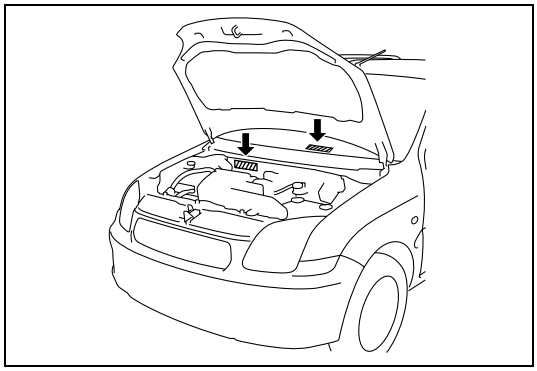
- Poor terminal-to-wire connection.
  Check each wire harness in problem circuits for poor connection by shaking it by hand lightly. If any abnormal condition is found, repair or replace.



- Wire insulation which is rubbed through, causing an intermittent short as the bare area touches other wiring or parts of the vehicle.
- Wiring broken inside the insulation. This condition could cause continuity check to show a good circuit, but if only 1 or 2 strands of a multi-strand-type wire are intact, resistance could be far too high.
  If any abnormality is found, repair or replace.

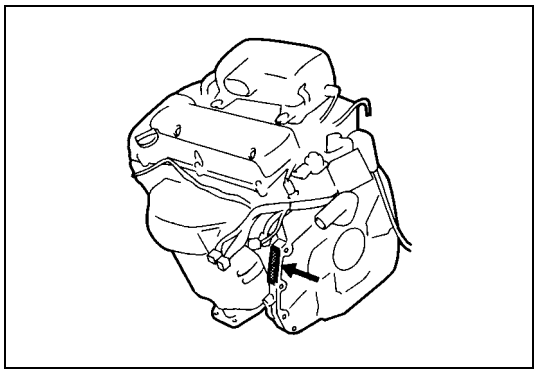
Identification Information

Vehicle Identification Number



The number is punched on front dash panel in engine room and it is also on the left side of instrument panel depending on the vehicle specification.

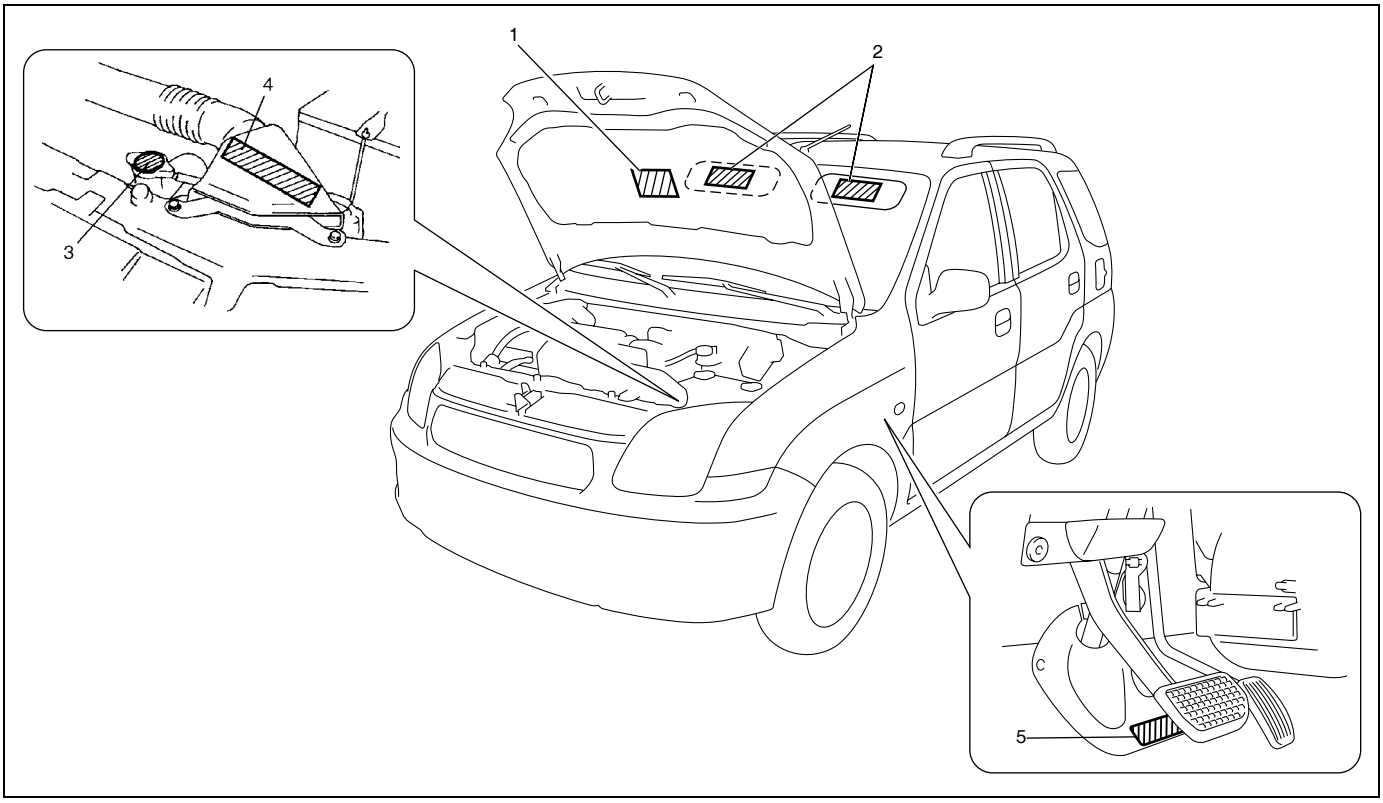
Engine Identification Number



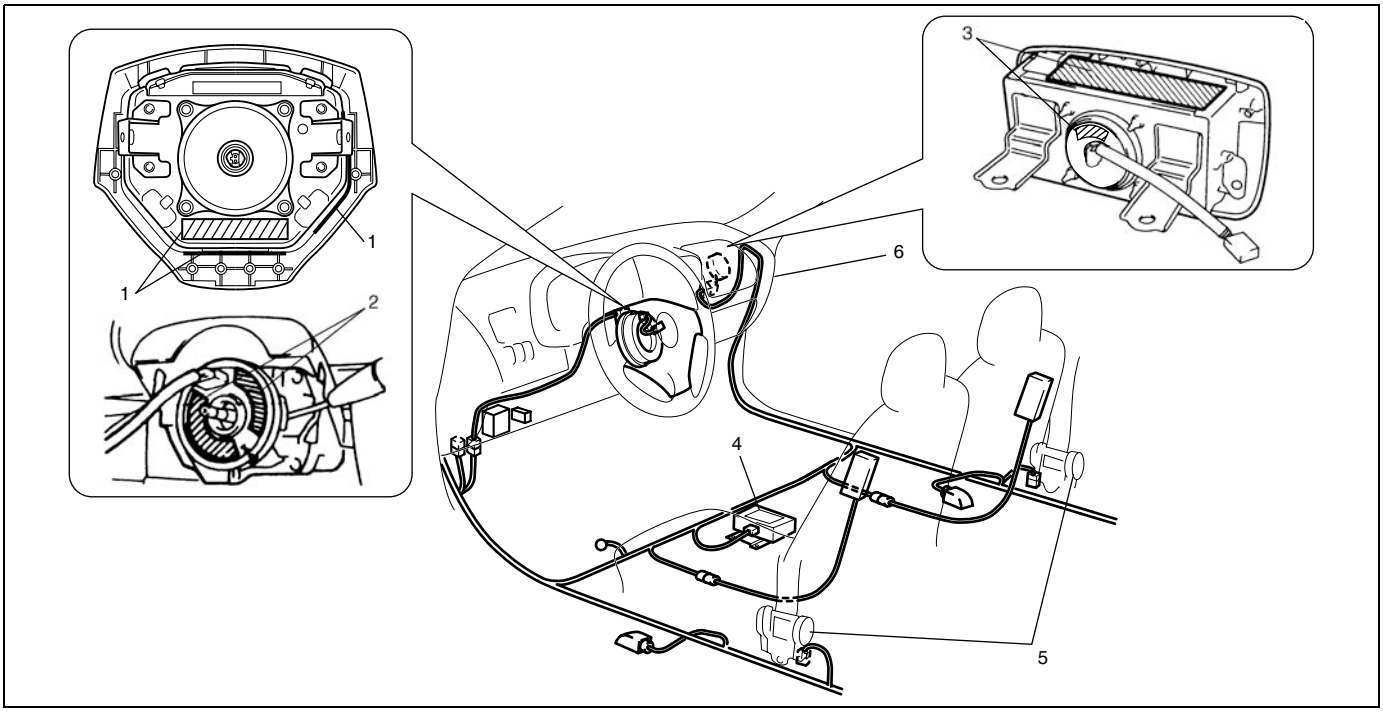
The number is punched on cylinder block.

Warning, Caution and Information Labels

The figure below shows main labels among others that are attached to vehicle component parts.
When servicing and handling parts, refer to WARNING/CAUTION instructions printed on labels.
If any WARNING/CAUTION label is found stained or damaged, clean or replace it as necessary.



1. Air bag label on back side of engine hood (if equipped)	4. Engine cooling fan label
2. Air bag label on sun visor (if equipped)	5. Steering shaft joint cover label (if equipped)
3. Radiator cap label	



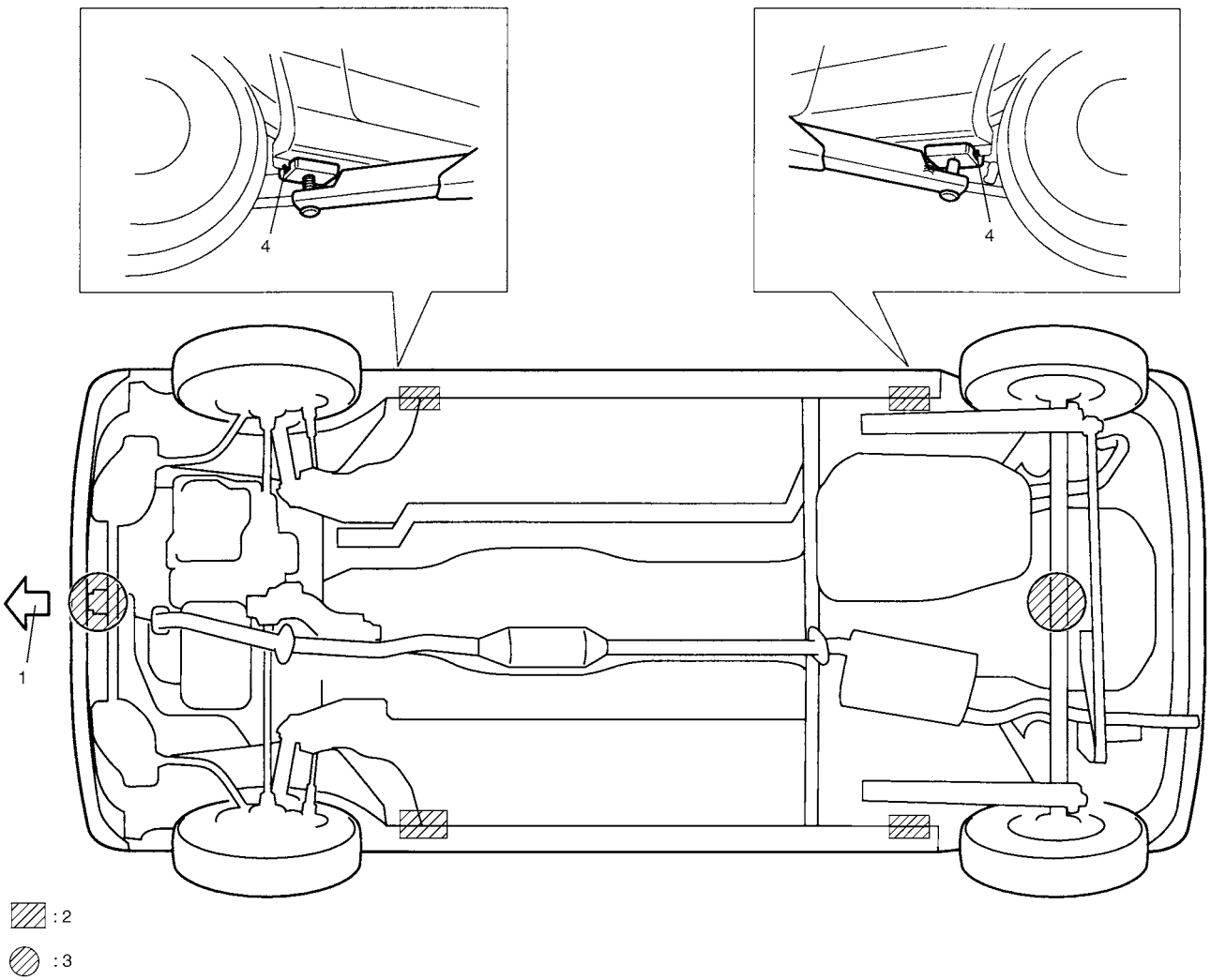
1. Air bag label on driver air bag (inflator) module	5. Pretensioner label on seat belt retractor
2. Air bag label on combination switch and contact coil assembly	6. Child seat label
3. Air bag label on passenger air bag (inflator) module	[A]: These labels are attached on vehicle equipped with air bag system only.
4. Air bag label on SDM	

Vehicle Lifting Points

WARNING:

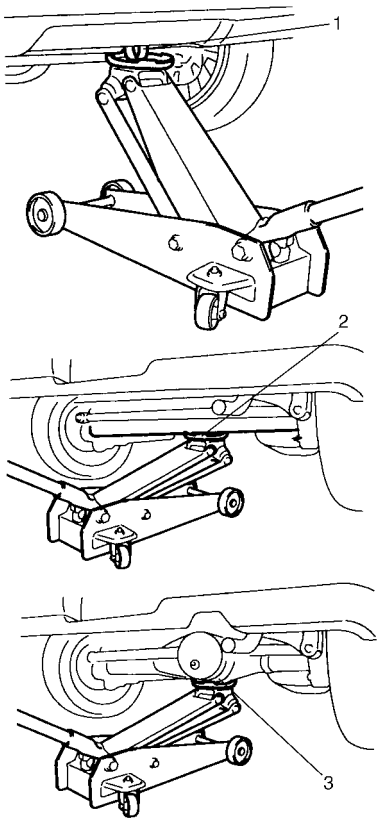
- **Before applying hoist to underbody, always take vehicle balance throughout service into consideration. Vehicle balance on hoist may change depending on what part to be removed.**
- **Before lifting up the vehicle, check to be sure that end of hoist arm is not in contact with brake pipe, fuel pipe, bracket or any other part.**
- **When using frame contact hoist, apply hoist as shown (right and left at the same position). Lift up the vehicle till 4 tires are a little off the ground and make sure that the vehicle will not fall off by trying to move vehicle body in both ways. Work can be started only after this confirmation.**
- **Make absolutely sure to lock hoist after vehicle is hoisted up.**

When using frame contact hoist



1.	Vehicle front
2.	Support position for frame contact hoist and safety stand
3.	Floor jack position
4.	Embossed-mark

When using floor jack



WARNING:

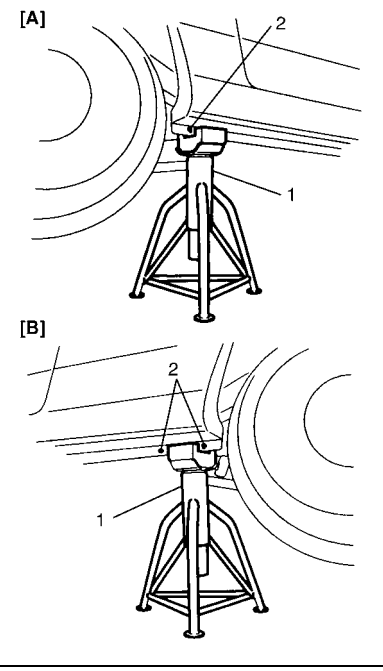
If the vehicle to be jacked up only at the front or rear end, be sure to block the wheels on ground in order to ensure safety.

After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on the vehicle raised on jack alone.

CAUTION:

Never apply jack against suspension parts (i.e., stabilizer, etc.) or vehicle floor, or it may get deformed.

In raising front or rear vehicle end off the floor by jacking, be sure to put the jack against the front jacking bracket (1), the center portion of rear axle (2) (2WD vehicle) or rear axle housing (3) (4WD vehicle).



To perform service with either front or rear vehicle end jacked up, be sure to place safety stands (1) under vehicle body so that vehicle body is securely supported. And then check to ensure that vehicle body does not slide on safety stands (1) and the vehicle is held stable for safety's sake.

[A] :	Front
[B] :	Rear
2.	Embossed mark

Abbreviations and Symbols May be Used in This Manual

Abbreviations

A	ABS	Anti-lock Brake System
	ATDC	After Top Dead Center
	API	American Petroleum Institute
	ATF	Automatic Transmission Fluid
	ALR	Automatic Locking Retractor
	AC	Alternating Current
	A/T	Automatic Transmission
	A/C	Air Conditioning
	ABDC	After Bottom Dead Center
	A/F	Air Fuel Mixture Ratio
	A-ELR	Automatic-Emergency Locking Retractor
B	B+	Battery Positive Voltage
	BTDC	Before Top Dead Center
	BBDC	Before Bottom Dead Center
C	CKT	Circuit
	CKP sensor	Crankshaft Position Sensor
	CMP sensor	Camshaft Position Sensor
	CO	Carbon Monoxide
	CPP switch	Clutch Pedal Position Switch (Clutch Switch, Clutch Start Switch)
	CPU	Central Processing Unit
	CRS	Child Restraint System
D	DC	Direct Current
	DLC	Data Link Connector (Assembly Line Diag. Link, ALDL, Serial Data Link, SDL)
	DOHC	Double Over Head Camshaft
	DOJ	Double Offset Joint
	DRL	Daytime Running Light
	DTC	Diagnostic Trouble Code (Diagnostic Code)
E	EBCM	Electronic Brake Control Module, ABS Control Module
	EBD	Electronic Brake Force Distribution
	ECM	Engine Control Module
	ECT sensor	Engine Coolant Temperature Sensor (Water Temp. Sensor, WTS)
	EGR	Exhaust Gas Recirculation
	EGRT sensor	EGR Temperature Sensor (Recirculated Exhaust Gas Temp. Sensor, REGTS)
	EFE Heater	Early Fuel Evaporation Heater (Positive Temperature Coefficient, PTC Heater)
E	EPS	Electronic Power Steering
	EVAP	Evaporative Emission
	EVAP Canister	Evaporative Emission Canister (Charcoal Canister)
F	4WD	4 Wheel Drive
G	GEN	Generator
	GND	Ground
H	HC	Hydrocarbons
	HO2S	Heated Oxygen Sensor
I	IAC Valve	Idle Air Control Valve (Idle Speed Control Solenoid Valve ISC Solenoid Valve)
	IAT Sensor	Intake Air Temperature Sensor (Air temperature Sensor, ATS)
	ICM	Immobilizer Control Module
	IG	Ignition
	ISC Actuator	Idle Speed Control Actuator
L	LH	Left Hand
	LSPV	Load Sensing Proportioning Valve
M	MAF Sensor	Mass Air Flow Sensor (Air Flow Sensor, AFS, Air Flow Meter, AFM)
	MAP Sensor	Manifold Absolute Pressure Sensor (Pressure Sensor, PS)
	Max	Maximum
	MFI	Multiport Fuel Injection (Multipoint Fuel Injection)
	MIN	Minimum
	MIL	Malfunction Indicator Lamp (“SERVICE ENGINE SOON” Light)
	M/T	Manual Transmission
N	NOx	Nitrogen Oxides
O	OBD	On-Board Diagnostic System (Self-Diagnosis Function)
	O/D	Overdrive
	OHC	Over Head Camshaft
	O2S	Oxygen Sensor
P	PNP	Park/Neutral Position
	P/S	Power Steering

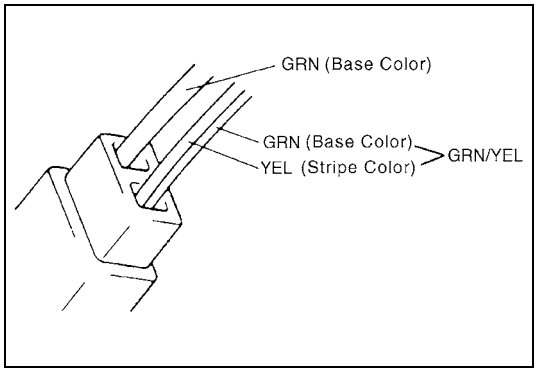
P	PSP Switch	Power Steering Pressure Switch (P/S Pressure Switch)
	PCM	Powertrain Control Module
	PCV	Positive Crankcase Ventilation
R	RH	Right Hand
S	SAE	Society of Automotive Engineers
	SDM	Sensing and Diagnostic Module (Air bag controller, Air bag control module)
	SFI	Sequential Multiport Fuel Injection
	SOHC	Single Over Head Camshaft
T	TBI	Throttle Body Fuel Injection (Single-Point Fuel Injection, SPI)
	TCC	Torque Converter Clutch
	TCM	Transmission Control Module (A/T Controller, A/T Control Module)
	TP Sensor	Throttle Position Sensor
	TVV	Thermal Vacuum Valve (Thermal Vacuum Switching Valve, TVSV, Bimetal Vacuum Switching Valve, BVSV)
	TWC	Three Way Catalytic Converter (Three Way Catalyst)
	2WD	2 Wheel Drive
V	VIN	Vehicle Identification Number
	VSS	Vehicle Speed Sensor
	VVT	Variable Valve Timing
W	WU-OC	Warm Up Oxidation Catalytic Converter
	WU-TWC	Warm Up Three Way Catalytic Converter

Symbols

SYMBOL	DEFINITION	SYMBOL	DEFINITION
	Tightening torque	1216B	Apply SEALANT 1216B 99000-31230
OIL	Apply oil (engine, transmission, transfer, differential)	Si	Apply SILICONE SEALANT 99000-31120
FLD	Apply fluid (brake, power steering or automatic transmission fluid)	366E	Apply SEALING COMPOUND 366E 99000-31090
A	Apply GREASE A 99000-25010		
C	Apply GREASE C 99000-25030	1322	Apply THREAD LOCK 1322 99000-32110
E	Apply GREASE E 99000-25050	1333B	Apply THREAD LOCK 1333B 99000-32020
H	Apply GREASE H 99000-25120	1342	Apply THREAD LOCK 1342 99000-32050
I	Apply GREASE I 99000-25210		
1215	Apply SEALANT 1215 99000-31110		Do not reuse
1207F	Apply SEALANT 1207F 99000-31250		Note on reassembly

Wire Color Symbols

Symbol		Wire Color	Symbol		Wire Color
B	BLK	Black	O, Or	ORN	Orange
Bl	BLU	Blue	R	RED	Red
Br	BRN	Brown	W	WHT	White
G	GRN	Green	Y	YEL	Yellow
Gr	GRY	Gray	P	PNK	Pink
Lbl	LT BLU	Light blue	V	PPL	Violet
Lg	LT GRN	Light green			

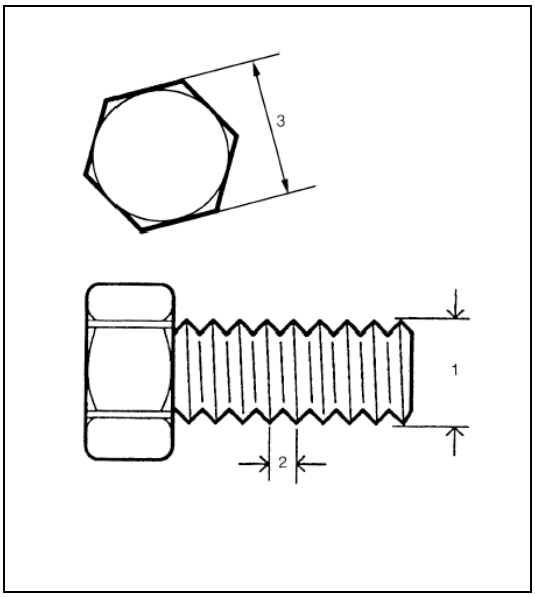


There are two kinds of colored wire used in this vehicle. One is single-colored wire and the other is dual-colored (striped) wire.
The single-colored wire uses only one color symbol (i.e. “GRN”).
The dual-colored wire uses two color symbols (i.e. “GRN/YEL”).
The first symbol represents the base color of the wire (“GRN” in the figure) and the second symbol represents the color of the stripe (“YEL” in the figure).

Fastener Information

Metric Information

Metric Fasteners



Most of the fasteners used for this vehicle are JIS-defined and ISO-defined metric fasteners. When replacing any fasteners, it is most important that replacement fasteners be the correct diameter, thread pitch and strength.

CAUTION:

Even when the nominal diameter (1) of thread is the same, the thread pitch (2) or the width across flats (3) may vary between ISO and JIS. Refer to JIS-TO-ISO Main Fasteners Comparison Table below for the difference.
Installing a mismatched bolt or nut will cause damage to the thread.
Before installing check the thread pitch for correct matching and then tighten it by hand temporarily. If it is tight, recheck the thread pitch.

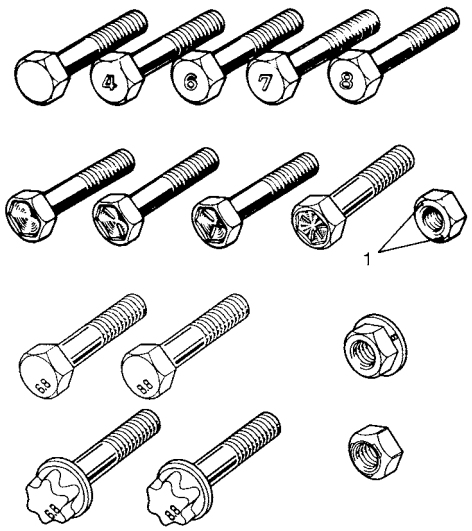
JIS-TO-ISO Main Fasteners Comparison Table

Standard \ Nominal diameter		M6	M8	M10	M12	M14
JIS	Thread pitch	1.0	1.25	1.25	1.25	1.5
	Width accross flats	10	12	14	17	19
ISO	Thread pitch	1.0	1.25	1.5	1.5	1.5
	Width accross flats	10	13	16	18	21

Fastener Strength Identification

Most commonly used metric fastener strength property classes are 4T, 6.8, 7T, 8.8 and radial line with the class identification embossed on the head of each bolt. Some metric nuts will be marked with punch, 6 or 8 mark strength identification on the nut face. Figure shows the different strength markings.
When replacing metric fasteners, be careful to use bolts and nuts of the same strength or greater than the original fasteners (the same number marking or higher). It is likewise important to select replacement fasteners of the correct diameter and thread pitch. Correct replacement bolts and nuts are available through the parts division.

Metric bolts : Identification class numbers or marks correspond to bolt strength (increasing numbers represent increasing strength).



1. Nut strength identification

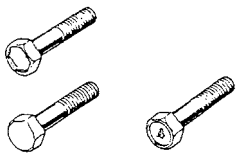
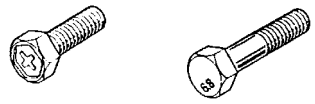
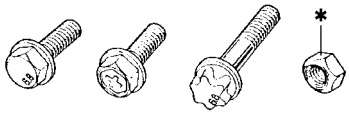
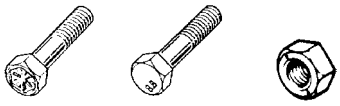
Standard Tightening Torque

Each fastener should be tightened to the torque specified in each section of this manual. If no description or specification is provided, refer to the following Tightening torque chart for the applicable torque for each fastener. When a fastener of greater strength than the original one is used, however, use the torque specified for the original fastener.

NOTE:

- **For the flanged bolt, flanged nut and self-lock nut of 4T and 7T strength, add 10% to the tightening torque given in the chart below.**
- **The chart below is applicable only where the fastened parts are made of steel light alloy.**

Tightening torque chart :

			Thread Diameter (Nominal Diameter) (mm)								
			4	5	6	8	10	12	14	16	18
Strength	A equivalent of 4T strength fastener 	N·m	1.5	3.0	5.5	13	29	45	65	105	160
		kg-m	0.15	0.30	0.55	1.3	2.9	4.5	6.5	10.5	16
		lb-ft	1.0	2.5	4.0	9.5	21.0	32.5	47.0	76.0	116.0
	A equivalent of 6.8 strength fastener without flange 	N·m	2.4	4.7	8.4	20	42	80	125	193	280
		kg-m	0.24	0.47	0.84	2.0	4.2	8.0	12.5	19.3	28
		lb-ft	2.0	3.5	6.0	14.5	30.5	58.0	90.5	139.5	202.5
	A equivalent of 6.8 strength fastener with flange 	N·m	2.4	4.9	8.8	21	44	84	133	203	298
		kg-m	0.24	0.49	0.88	2.1	4.4	8.4	13.3	20.3	29.8
		lb-ft	2.0	3.5	6.5	15.5	32.0	61.0	96.5	147.0	215.5
	A equivalent of 7T strength fastener 	N·m	2.3	4.5	10	23	50	85	135	210	240
		kg-m	0.23	0.45	1.0	2.3	5.0	8.5	13.5	21	24
		lb-ft	2.0	3.5	7.5	17.0	36.5	61.5	98.0	152.0	174.0
	A equivalent of 8.8 strength fastener without flange 	N·m	3.1	6.3	11	27	56	105	168	258	373
		kg-m	0.31	0.63	1.1	2.7	5.6	10.5	16.8	25.8	37.3
		lb-ft	2.5	4.5	8.0	19.5	40.5	76.0	121.5	187.0	270.0
	A equivalent of 8.8 strength fastener with flange 	N·m	3.2	6.5	12	29	59	113	175	270	395
		kg-m	0.32	0.65	1.2	2.9	5.9	11.3	17.5	27	39.5
		lb-ft	2.5	5.0	9.0	21.0	43.0	82.0	126.5	195.5	286.0

*: Self-lock nut

SECTION 0B

MAINTENANCE AND LUBRICATION

WARNING:

For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in Section 10B in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in Section 10B before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

Maintenance Schedule

Maintenance Schedule Under Normal Driving Conditions

NOTE:

- **This interval should be judged by odometer reading or months, whichever comes first.**
- **This table includes service as scheduled up to 90,000 km (54,000 miles) mileage. Beyond 90,000 km (54,000 miles), carry out the same services at the same intervals respectively.**

Interval			Km (x 1,000)	15	30	45	60	75	90
			Miles (x 1,000)	9	18	27	36	45	54
			Months	12	24	36	48	60	72
ENGINE									
Drive belt				–	–	I	–	–	R
Valve lash (clearance)				–	I	–	I	–	I
Engine oil and oil filter				R	R	R	R	R	R
Engine coolant				–	–	R	–	–	R
Exhaust system				–	I	–	I	–	I
IGNITION SYSTEM									
✱Spark plugs	When unleaded fuel is used	Vehicle without HO2S	Iridium plug	–	–	–	R	–	–
		Vehicle with HO2S	Iridium plug	Replace every 105,000 km (63,000 miles) or 84 months					
	When leaded fuel is used, refer to “Maintenance Recommended Under Severe Driving Conditions” in this section.								
FUEL SYSTEM									
Air cleaner filter			Paved-road	I	I	R	I	I	R
			Dusty conditions	Refer to “Maintenance Recommended Under Severe Driving Conditions” in this section.					
Fuel lines and connections				–	I	–	I	–	I
Fuel tank				–	–	I	–	–	I
EMISSION CONTROL SYSTEM									
✱PCV valve		Vehicle without HO2S		–	–	I	–	–	I
		Vehicle with HO2S		–	–	–	–	–	I
✱Fuel evaporative emission control system				–	–	–	–	–	I

NOTE:

- **“R” : Replace or change**
- **“I” : Inspect and correct, replace or lubricate if necessary**
- **For Sweden, items with ✱ (asterisk) should be performed by odometer reading only.**
- **For spark plugs, replace every 50,000 km if the local law requires.**
- **Iridium spark plug: IFR6J11 (NGK)**

Interval	Km (x 1,000)	15	30	45	60	75	90
	Miles (x 1,000)	9	18	27	36	45	54
	Months	12	24	36	48	60	72
BRAKE							
Brake discs and pads (thickness, wear, damage)		I	I	I	I	I	I
Brake drums and shoes (wear, damage)		–	I	–	I	–	I
Brake hoses and pipes (leakage, damage, clamp)		–	I	–	I	–	I
Brake fluid		–	R	–	R	–	R
Brake lever and cable (damage, stroke, operation)		Inspect at first 15,000 km (9,000 miles only)					
CHASSIS AND BODY							
Clutch (pedal height and travel)		–	I	–	I	–	I
Tires (wear, damage, rotation) / wheels (damage)		I	I	I	I	I	I
Suspension system (tightness, damage, rattle, breakage)		–	I	–	I	–	I
Steering system (tightness, damage, breakage, rattle)		–	I	–	I	–	I
Drive shaft (axle) boots / Propeller shafts (4WD)		–	–	I	–	–	I
Manual transmission oil (leakage, level) (I : 1st 15,000 km only)		I	–	R	–	–	R
Transfer oil (4WD) (leakage, level)		I	–	I	–	I	–
Rear differential oil (4WD) (leakage, level) (R : 1st 15,000 km only)		R or I	–	I	–	I	–
All latches, hinges and locks		–	I	–	I	–	I
Air conditioning filter (if equipped)		–	I	R	–	I	R

NOTE:

- **"R" : Replace or change**
- **"I" : Inspect and correct or replace if necessary**

Maintenance Recommended Under Severe Driving Conditions

If the vehicle is usually used under the conditions corresponding to any severe condition code given below, IT IS RECOMMENDED that applicable maintenance operation be performed at the particular interval as shown in the following table.

Severe condition code:

A: Repeated short trips
B: Driving on rough and/or muddy roads
C: Driving on dusty roads
D: Driving in extremely cold weather and/or salted roads
E: Repeated short trips in extremely cold weather
F: Leaded fuel use
G: – – – – –
H: Towing a trailer (if admitted)

Severe Condition Code	Maintenance		Maintenance Operation	Maintenance Interval
– B C D – – – –	Drive belt		I	Every 15,000 km (9,000 miles) or 12 months
			R	Every 45,000 km (27,000 miles) or 36 months
A – C D E F – H	Engine oil and oil filter		R	Every 5,000 km (3,000 miles) or 4 months
– – C – – – – –	Air cleaner filter ✱1		I	Every 2,500 km (1,500 miles)
			R	Every 30,000 km (18,000 miles) or 24 months
A B C – E F – H	Spark plugs	Iridium spark plug	R	Every 30,000 km (18,000 miles) or 24 months
– B C D – – – H	Wheel bearings		I	Every 15,000 km (9,000 miles) or 12 months
– B – D E – – H	Drive shafts and propeller shafts (4WD)		I	Every 15,000 km (9,000 miles) or 12 months
– B – – E – – H	Manual transmission, transfer (4WD) and differential oil (4WD)		R	First time only: 15,000 km (9,000 miles) or 12 months
				Second time and after: Every 30,000 km (18,000 miles) or 24 months reckoning from 0 km (0 miles) or 0 month

NOTE:

- **"I": Inspect and correct or replace if necessary**
- **"R": Replace or change**
- **✱1: Inspect more frequently if the vehicle is used under dusty conditions.**

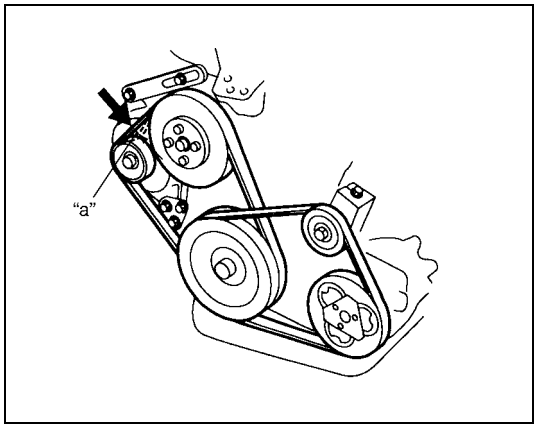
Maintenance Service

Drive Belt Inspection

WARNING:
All inspection and replacement are to be performed with ENGINE NOT RUNNING.

Water pump and generator drive belt inspection

1) Disconnect negative (–) cable at battery.



2) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If any defect exists, replace.
   Check belt for tension.

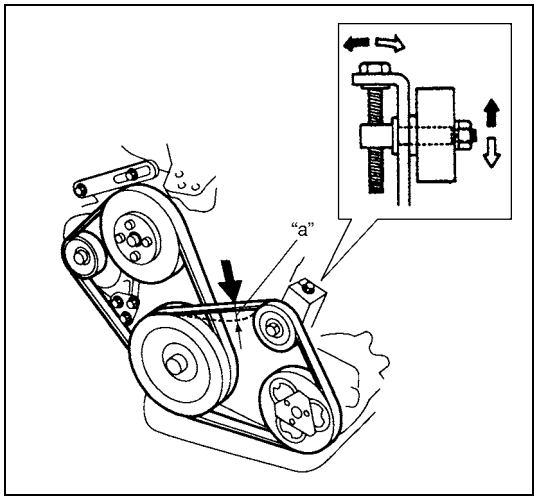
   Water pump and generator belt tension
   "a": 4.5 – 5.5 mm (0.18 – 0.22 in.) deflection under 100 N (10 kg, 22 lb) pressure

   NOTE:
   When replacing belt with a new one, adjust belt tension to 3 – 4 mm (0.12 – 0.16 in.)

3) If belt is too tight or too loose, adjust it to specification by adjusting alternator position.
4) Tighten alternator adjusting bolts and pivot bolt.
5) Connect negative (–) cable to battery.

A/C Compressor drive belt (if equipped) inspection

1) Disconnect negative (–) cable at battery.



2) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If any defect exists, replace.
   Check belt for tension.
   If belt tension is out of specification, adjust it referring to "Compressor drive belt tension" in Section 1B.

   A/C compressor drive belt tension
   "a": 3 – 5 mm (0.12 – 0.20 in.) deflection under 100 N (10 kg, 22 lb) pressure

3) Connect negative (–) cable to battery.

Drive Belt Replacement

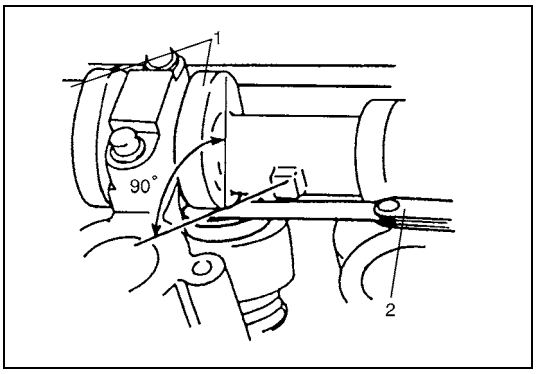
Water pump and generator drive belt replacement

Replace belt with new one referring to "Water Pump/Generator Drive Belt Removal and Installation" in Section 6B.

A/C Compressor drive belt (if equipped) replacement

Replace belt with new one referring to "Compressor Drive Belt Replacement" in Section 1B.

Valve Lash (Clearance) Inspection



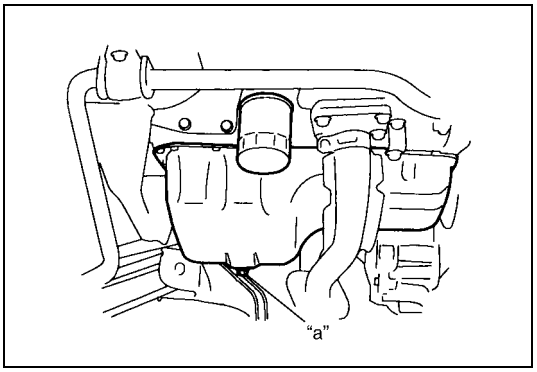
1) Inspect intake and exhaust valve lash and adjust as necessary.
   Refer to “Valve Lash (Clearance) Inspection” in Section 6A1 for valve lash inspection and adjustment procedure.

1.	Camshaft
2.	Thickness gauge

Engine Oil and Oil Filter Replacement

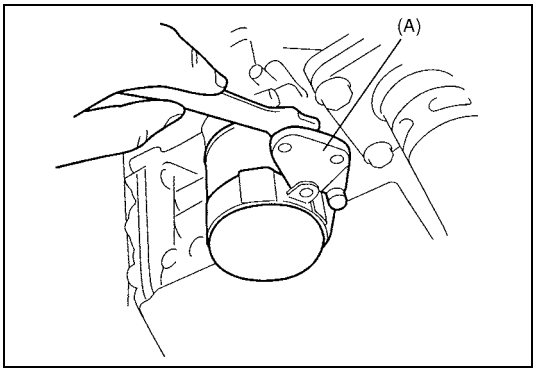
WARNING:
- **New and used engine oil can be hazardous. Be sure to read “WARNING” in General Precautions in Section 0A and observe what in written there.**
- **Step 1) – 7) outlined below must be performed with ENGINE NOT RUNNING. For step 8), be sure to have adequate ventilation while engine is running.**

Before draining engine oil, check engine for oil leakage. If any evidence of leakage is found, make sure to correct defective part before proceeding to the following work.



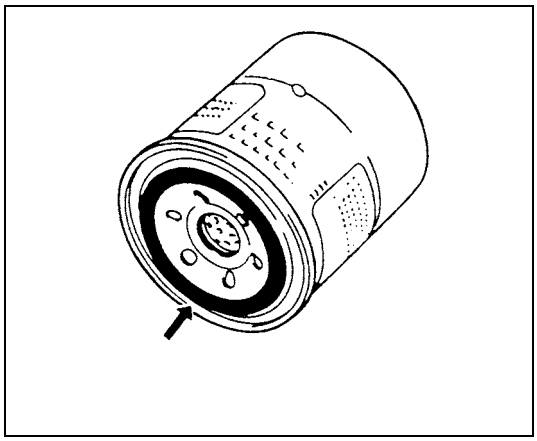
1) Drain engine oil by removing drain plug.
2) After draining oil, wipe drain plug clean. Reinstall drain plug, and tighten it securely as specified below.

Tightening torque
Engine oil drain plug (a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)



3) Loosen oil filter by using oil filter wrench (special tool).

Special tool
(A) : 09915-47330



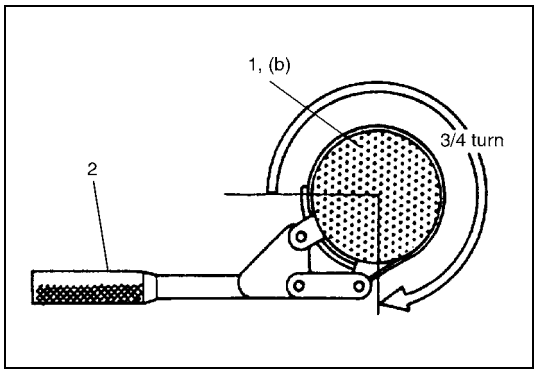
NOTE:

Before fitting new oil filter, be sure to oil its O-ring. Use engine oil for this purpose.

4) Screw new filter on oil filter stand by hand until the filter O-ring contacts the mounting surface.

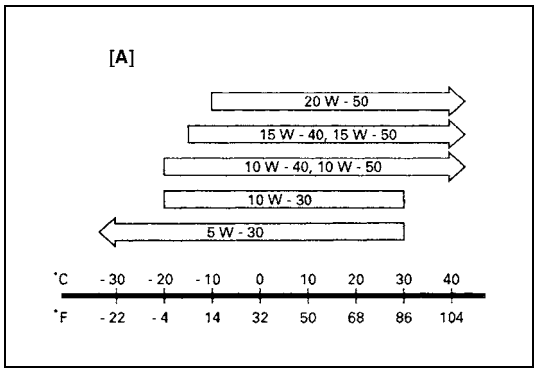
CAUTION:

To tighten oil filter properly, it is important to accurately identify the position at which filter O-ring first contacts the mounting surface.



5) Tighten the filter (1) 3/4 turn from the point of contact with the mounting surface using an oil filter wrench (2).

Tightening torque
Oil filter (b) : 14 N·m (1.4 kg-m, 10.5 lb-ft) (for reference)



6) Replenish oil until oil level is brought to FULL level mark on dipstick. (oil pan and oil filter capacity). The filler inlet is at the top of the cylinder head cover.
It is recommended to use engine oil of SG, SH, SJ or SL grade. Select the appropriate oil viscosity according to the proper engine oil viscosity chart [A].

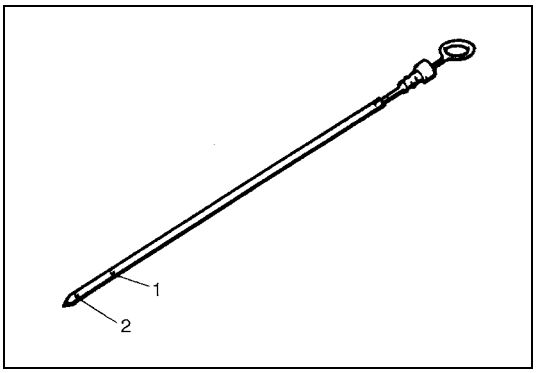
Engine oil specification

Oil pan capacity	About 3.6 liters (7.6/6.3 US/Imp pt.)
Oil filter capacity	About 0.2 liter (0.4/0.3 US/Imp pt.)
Others	About 0.3 liter (0.6/0.5 US/Imp pt.)
Total	About 4.1 liters (8.7/7.2 US/Imp pt.)

NOTE:

Engine oil capacity is specified. However, note that the amount of oil required when actually changing oil may somewhat differ from the data in the table depending on various conditions (temperature, viscosity, etc.)

7) Check oil filter and drain plug for oil leakage.



8) Start engine and run it for 3 minutes. Stop it and wait 5 minutes before checking oil level. Add oil, as necessary, to bring oil level to FULL level mark on dipstick.

1. Full level mark (hole)
2. Low level mark (hole)

Engine Coolant Replacement

WARNING:

To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

CAUTION:

When changing engine coolant, use mixture of 50% specified water and 50% ANTIFREEZE / ANTICORROSION COOLANT for the purpose of corrosion protection and lubrication.

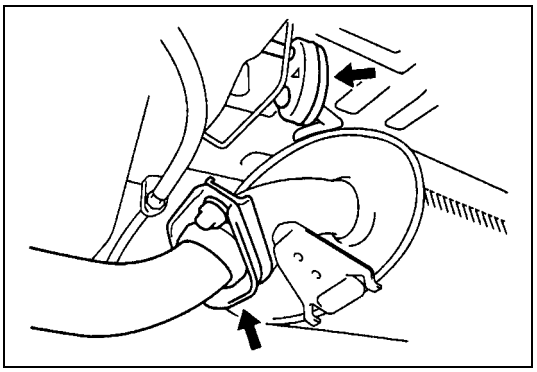
Change engine coolant with new one referring to “Cooling System Flush and Refill” in Section 6B.

Exhaust System Inspection

WARNING:

To avoid danger of being burned, do not touch exhaust system when it is still hot. Any service on exhaust system should be performed when it is cool.

When carrying out periodic maintenance, or the vehicle is raised for other service, check exhaust system as follows:



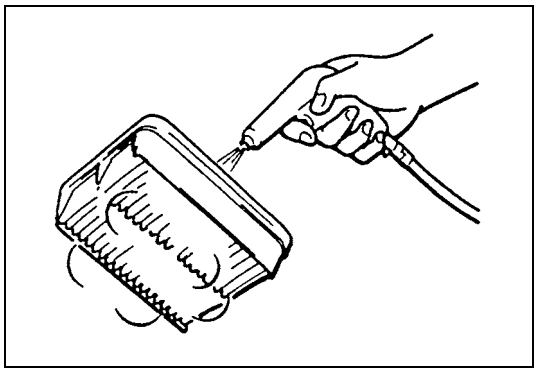
- Check rubber mountings for damage, deterioration, and out of position.
- Check exhaust system for leakage, loose connections, dents and damages.
  If bolts or nuts are loose, tighten them to specification.
- Check nearby body areas for damaged, missing, or mispositioned parts, open seams, holes, loose connections or other defects which could permit exhaust fumes to seep into the vehicle.
- Make sure that exhaust system components have enough clearance from the underbody to avoid overheating and possible damage to the floor carpet.
- Any defects should be fixed at once.

Spark Plugs Replacement

Replace spark plugs with new ones referring to “Spark Plugs Removal and Installation” in Section 6F1.

Air Cleaner Filter Inspection

1) Remove air cleaner case clamps.
2) Take air cleaner filter out of case.

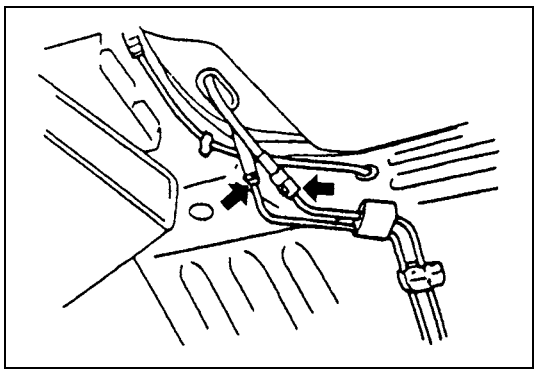


3) Check that filter is not excessively dirty, damaged or oily, clean filter with compressed air from air outlet side of filter.
4) Install air cleaner filter and clamp upper case securely.

Air Cleaner Filter Replacement

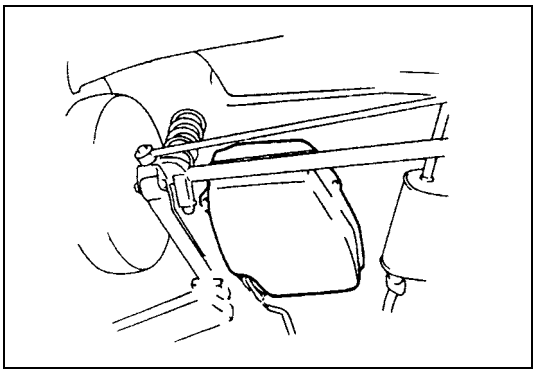
Replace air cleaner filter with new one according to steps 1), 2) and 4) of inspection procedure.

Fuel Lines and Connections Inspection



Visually inspect fuel lines and connections for evidence of fuel leakage, hose cracking and damage. Make sure all clamps are secure.
Repair leaky joints, if any.
Replace hoses that are suspected of being cracked.

Fuel Tank Inspection

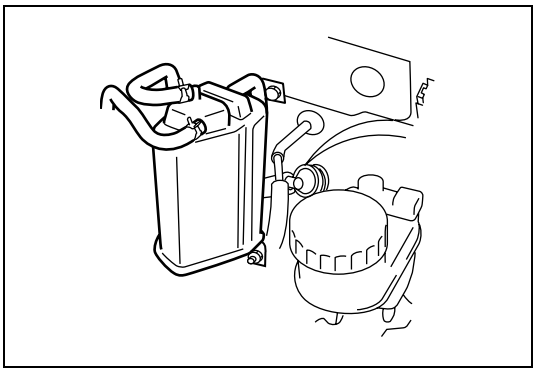


Check fuel tank damage, cracks, fuel leakage, corrosion and tank bolts looseness.
If a problem is found, repair or replace.

PCV Valve Inspection

Check crankcase ventilation hose and PCV hose for leaks, cracks or clog, and PCV valve for stick or clog. Refer to “PCV VALVE” under “PCV system inspection” of Section 6E1 for PCV valve checking procedure.

Fuel Evaporative Emission Control System Inspection

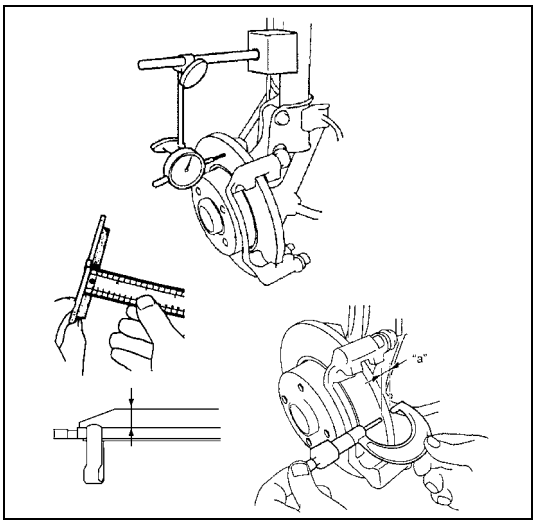


1) Visually inspect hoses for cracks, damage, or excessive bends. Inspect all clamps for damage and proper position.
2) Check EVAP canister for operation and clog, referring to “EVAP CANISTER” under “Evaporative emission control system inspection” in Section 6E1.

If a malfunction is found, repair or replace.

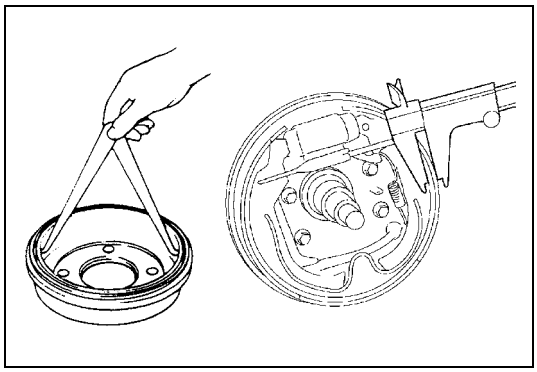
Brake Discs and Pads (Front) Inspection

1) Remove wheel and caliper but don’t disconnect brake hose from caliper.



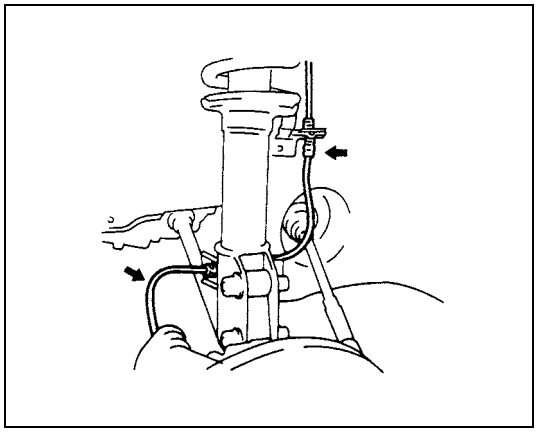
2) Check front disc brake pads and discs for excessive wear, damage and deflection. Replace parts as necessary. For details, refer to “Front Disc Brake Pad Inspection” and “Front Brake Disc Inspection” in Section 5B.
   Be sure to torque caliper pin bolts to specification.

Brake Drums and Shoes (Rear) Inspection



1) Remove wheel and brake drum.
2) Check rear brake drums and brake linings for excessive wear and damage, while wheels and drums are removed. At the same time, check wheel cylinders for leaks. Replace these parts as necessary.
   For details, refer to “Drum Brake Component Parts Inspection” in Section 5C.

Brake Hoses and Pipes Inspection



Perform this inspection where there is enough light and use a mirror as necessary.

- Check brake hoses and pipes for proper hookup, leaks, cracks, chafing and other damage.
- Check that hoses and pipes are clear of sharp edges and moving parts.

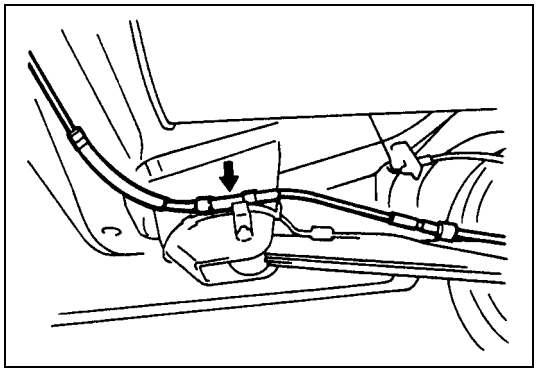
Repair or replace any of these parts as necessary.

CAUTION:
After replacing any brake pipe or hose, be sure to carry out air purge operation.

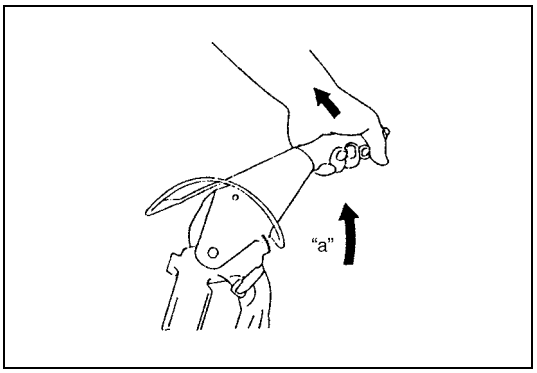
Brake Fluid Replacement

Change brake fluid as follows.
Drain existing fluid from brake system completely, fill system with specified fluid and carry out air purge operation.
For air purging procedure, refer to “Air Bleeding of Brake System” in Section 5.

Brake Lever and Cable Inspection



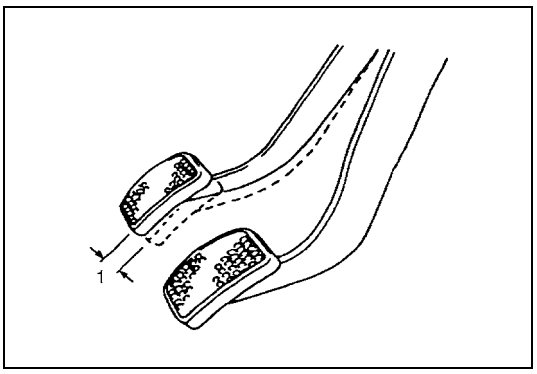
1) Inspect brake cable for damage and smooth movement. Replace cable if it is in deteriorated condition.



2) Check tooth tip of each notch for damage or wear. If any damage or wear is found, replace parking lever.
3) Check parking brake lever for proper operation and stroke, and adjust it if necessary.
   For checking and adjusting procedures, refer to "Parking Brake Inspection and Adjustment" in Section 5.

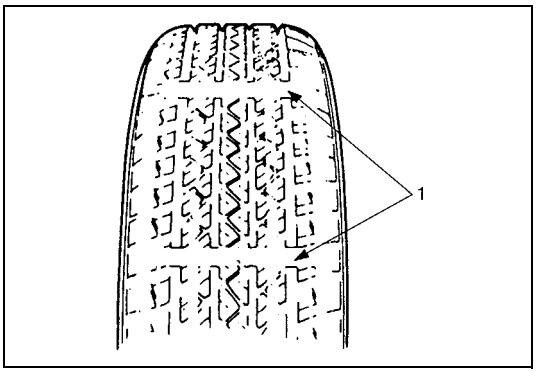
Parking brake lever stroke
"a":4 – 9 notches (with 20 kg (44 lbs) of pull pressure)

Clutch Inspection



Check clutch pedal for height and free travel (1) referring to "Clutch pedal height" and "Clutch pedal free travel" in Section 7C. Adjust or correct if necessary.

Tires Inspection



1) Check tires for uneven or excessive wear, or damage.
   If defective, replace.
   Refer to "Tire Diagnosis" in Section 3 for details.

1. Wear indicator

2) Check inflating pressure of each tire and adjust pressure to specification as necessary.

NOTE:

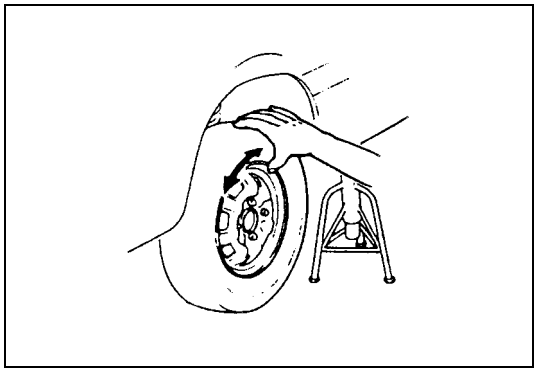
- **Tire inflation pressure should be checked when tires are cool.**
- **Specified tire inflation pressure should be found on tire placard or in owner's manual which came with the vehicle.**

3) Rotate tires.
   For details, refer to "Tire Rotation" in Section 3F.

Wheel Discs Inspection

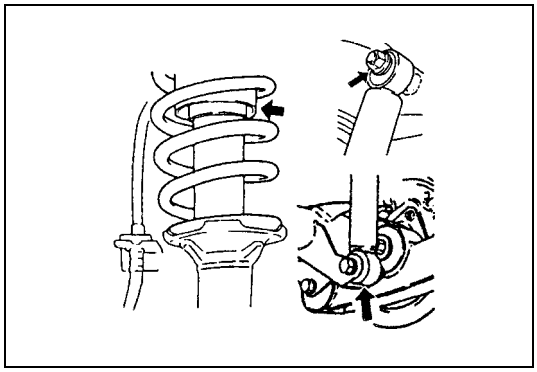
Inspect each wheel disc for dents, distortion and cracks. A disc in badly damaged condition must be replaced.

Wheel Bearing Inspection

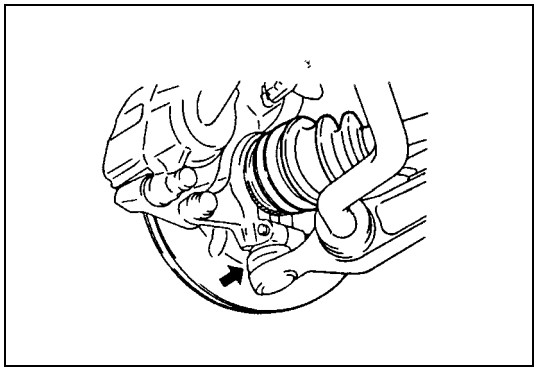


1) Check front wheel bearing for wear, damage, abnormal noise or rattles. For details, refer to “Wheel Disc, Bolt and Bearing Check” in Section 3D.
2) Check rear wheel bearing for wear, damage, abnormal noise or rattles. For details, refer to “Wheel Disc, Bolt and Bearing Check” in Section 3E.

Suspension System Inspection

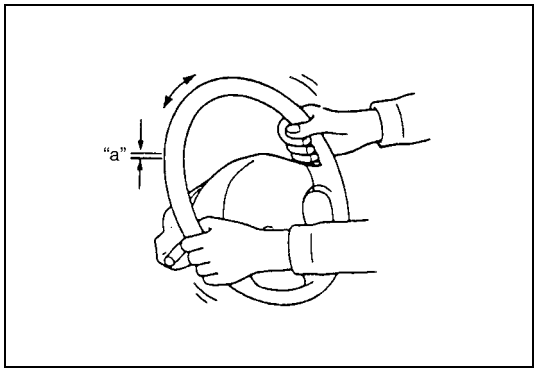


- Inspect front struts & rear shock absorbers for evidence of oil leakage, dents or any other damage on sleeves ; and inspect anchor ends for deterioration.
  Replace defective parts, if any.
- Check front and rear suspension systems for damaged, loose or missing parts ; also for parts showing signs of wear or lack of lubrication.
  Repair or replace defective parts, if any.



- Check front suspension arm ball joint stud dust seals for leakage, detachment, tear or any other damage.
  Replace defective boot, if any.

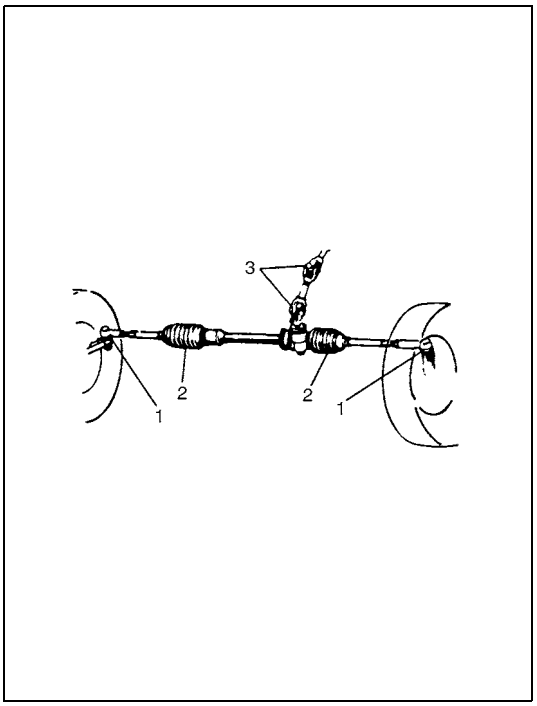
Steering System Inspection



1) Check steering wheel for play and rattle, holding vehicle straight on ground.

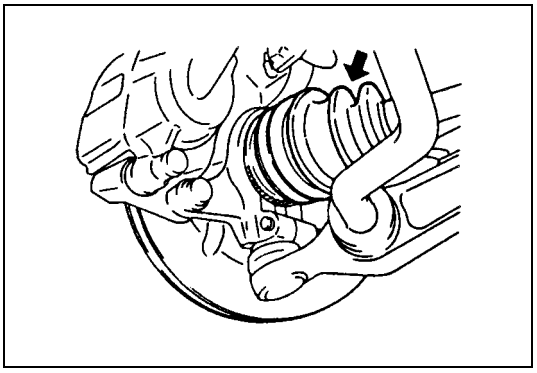
   Steering wheel play
   “a”: 0 – 30 mm (0 – 1.1 in.)

2) Check bolts and nuts for tightness and retighten them as necessary. Repair or replace defective parts, if any.



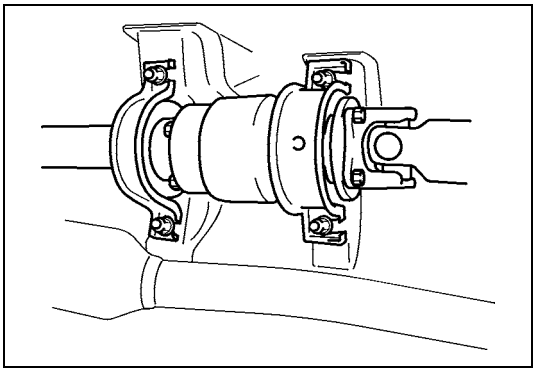
3) Check steering linkage for looseness and damage. Repair or replace defective parts, if any.
4) Check boots (1) and (2) of steering linkage and steering gear case for damage (leak, detachment, tear, etc.). If damage is found, replace defective boot with new one.
   If any dent is found on steering gear case boots, correct it to original shape by turning steering wheel to the right or left as far as it stops and holding it for a few seconds.
5) Check universal joints (3) of steering shaft for rattle and damage. If rattle or damage is found, replace defective part with a new one.
6) Check that steering wheel can be turned fully to the right and left. Repair or replace defective parts, if any.
7) If equipped with power steering system, check also, in addition to above check items, that steering wheel can be turned fully to the right and left more lightly when engine is running at idle speed than when it is stopped. Repair, if found faulty.
8) Check wheel alignment referring to “Front Wheel Alignment Inspection and Adjustment” in Section 3A.

Drive Shaft (Axle) Boots Inspection



Check drive shaft boots (wheel side and differential side) for leaks, detachment, tear or other damage.
Replace boot as necessary.

Propeller Shafts (4WD) Inspection



1) Check propeller shaft connecting bolts for looseness. If looseness is found, tighten to specified torque.
2) Check propeller shaft joints for wear, play and damage.
   If any defect is found, replace.
3) Check propeller shaft center support for biting of foreign matter, crack, abnormal noise and damage. If any defect is found, replace.

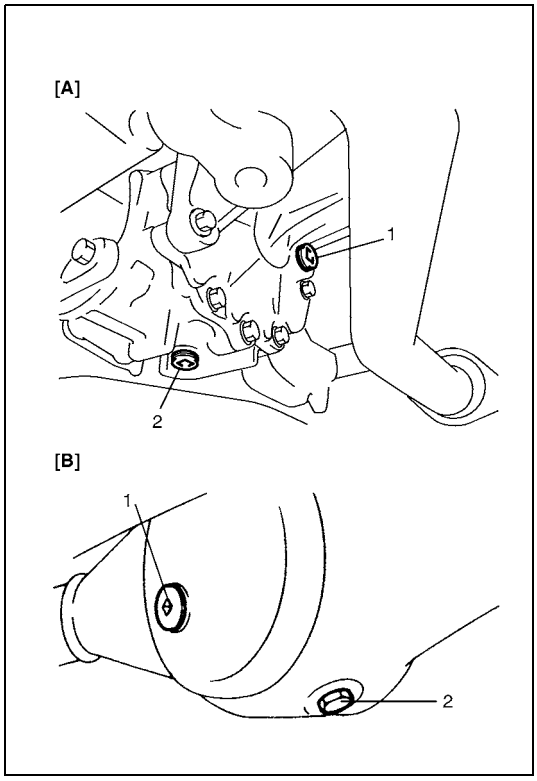
Manual Transmission Oil Inspection

1) Inspect transmission case for evidence of oil leakage.
   Repair leaky point if any.
2) Make sure that vehicle is placed level for oil level check.
3) Remove oil filler/level plug (1) of transmission.
4) Check oil level.
   Oil level can be checked roughly by means of filler/level plug hole. That is, if oil flows out of level plug hole or if oil level is found up to hole when level plug is removed, oil is properly filled.
   If oil is found insufficient, pour specified oil up to level hole.
   For specified oil, refer to “Manual Transaxle Oil Change” in Section 7A.
5) Apply sealant to filler/level plug and tighten it to specified torque.

Manual Transmission Oil Replacement

1) Place the vehicle level and drain oil by removing drain plug (2).
2) Apply sealant to drain plug after cleaning it and tighten drain plug to specified torque.
3) Pour specified oil up to level hole.
4) Tighten filler plug to specified torque.
   For recommended oil, its amount and tightening torque data, refer to “Manual Transaxle Oil Change” in Section 7A.

Transfer Oil (4WD) and Rear Differential Oil (4WD) Inspection



1) Check transfer case or differential for evidence of oil leakage.
   Repair leaky point if any.
2) Make sure that vehicle is placed level for oil level check.
3) Remove level plug of transfer or differential and check oil level.
   Oil level can be checked roughly by means of level plug hole. That is, if oil flows out of level plug hole or if oil level is found up to hole when level plug is removed, oil is properly filled.
   If oil is found insufficient, pour specified amount of specified oil referring to “Transfer Oil Change” in Section 7D or “Rear Differential Gear Oil Change” in Section 7F.

[A] : Transfer
[B] : Rear differential
1. Oil level/filler plug
2. Drain plug

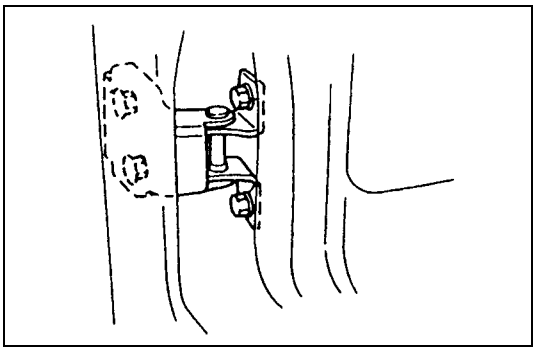
4) Tighten level plug to specified torque referring to “Transfer Oil Change” in Section 7D or “Rear Differential Gear Oil Change” in Section 7F.

Transfer Oil (4WD) and Rear Differential Oil (4WD) Replacement

Change transfer oil and differential oil with new specified oil referring to “Transfer Oil Change” in Section 7D or “Rear Differential Gear Oil Change” in Section 7F.

All Latches, Hinges and Locks Inspection

Doors

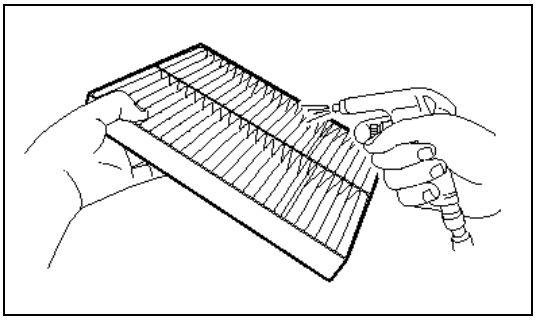


Check that each door of front, rear and back doors opens and closes smoothly and locks securely when closed.
If any malfunction is found, lubricate hinge and latch or repair door lock system.

Engine hood

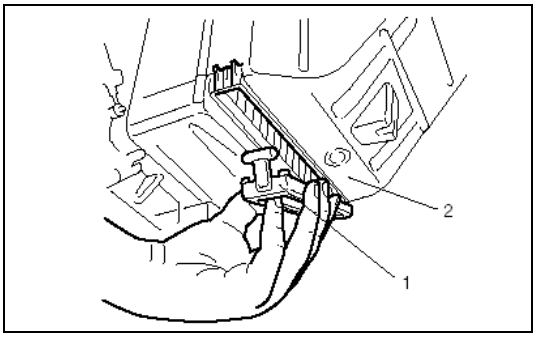
Check that secondary latch operates properly (check that secondary latch keeps hood from opening all the way even when pulling hood release handle inside vehicle.) Also check that hood opens and closes smoothly and properly and hood locks securely when closed.
If any malfunction is found, lubricate hinge and latch, or repair hood lock system.

Air Conditioning Filter (If Equipped) Inspection



1) Remove the air conditioning filter from the cooling unit referring to “Air Conditioning Filter (If Equipped) Replacement” in this section.
2) Check for dirt and dust. If the air conditioning filter is excessively dirty, replace the air conditioning filter with the new one. If not, go to the next step.
3) Blow compressed air on the air outlet side of the air conditioning filter for removing dust.
4) Install the air conditioning filter into the cooling unit by reversing the removal procedure.

Air Conditioning Filter (If Equipped) Replacement



1) Remove the air conditioning filter door (1) from the cooling unit (2).
2) Remove the air conditioning filter from the cooling unit.
3) Install the new air conditioning filter into the cooling unit.
4) Install the air conditioning filter door onto the cooling unit.

Final Inspection

WARNING:

When carrying out road tests, select a safe place where no man or no running vehicle is seen so as to prevent any accident.

SEATS

Check that seat slides smoothly and locks securely at any position. Also check that reclining mechanism of front seat back allows it to be locked at any angle.

SEAT BELT

Inspect belt system including webbing, buckles, latch plates, retractors and anchors for damage or wear.
Check that seat belt is securely locked. If “REPLACE BELT” label on front seat belt is visible, replace belt.

BATTERY ELECTROLYTE LEVEL CHECK

Check that the electrolyte level of all battery cells is between the upper and lower level lines on the case. If battery is equipped with built-in indicator, check battery condition by the indicator.

ACCELERATOR PEDAL OPERATION

Check that pedal operates smoothly without getting caught or interfered by any other part.

ENGINE START

Check engine start for readiness.

WARNING:

Before performing the following check, be sure to have enough room around the vehicle. Then, firmly apply both the parking brake and the regular brakes. Do not use the accelerator pedal. If the engine starts, be ready to turn off the ignition promptly. Take these precautions because the vehicle could move without warning and possibly cause personal injury or property damage.

On automatic transmission vehicles, try to start the engine in each select lever position. The starting motor should crank only in “P” (Park) or “N” (Neutral).
On manual transmission vehicles, place the shift lever in “Neutral,” depress clutch pedal fully any try to start.

EXHAUST SYSTEM CHECK

Check for leakage, cracks or loose supports.

CLUTCH (FOR MANUAL TRANSMISSION)

Check for the following.

- Clutch is completely released when depressing clutch pedal,
- No slipping clutch occurs when releasing pedal and accelerating.
- Clutch itself is free from any abnormal condition.

GEARSHIFT OR SELECT LEVER (TRANSMISSION)

Check gear shift or select lever for smooth shifting to all positions and for good performance of transmission in any position.
With automatic transmission equipped vehicle, also check that shift indicator indicates properly according to which position select lever is shifted to.
With automatic transmission equipped vehicle, make sure that vehicle is at complete stop when shifting select lever to “P” range position and release all brakes.

FOOT BRAKE

Check the followings:

- that brake pedal has proper travel,
- that brake works properly,
- that it is free from noise,
- that vehicle does not pull to one side when brake is applied.
- and that brake do not drag.

PARKING BRAKE

Check that lever has proper travel.

WARNING:

With vehicle parked on a fairly steep slope, make sure nothing is in the way downhill to avoid any personal injury or property damage. Be prepared to apply regular brake quickly even if vehicle should start to move.

Check to ensure that parking brake is fully effective when the vehicle is stopped on the safe slope and brake lever is pulled all the way.

STEERING

- Check to ensure that steering wheel is free from instability, or abnormally heavy feeling.
- Check that the vehicle does not wander or pull to one side.

ENGINE

- Check that engine responds readily at all speeds.
- Check that engine is free from abnormal noise and abnormal vibration.

BODY, WHEELS AND POWER TRANSMITTING SYSTEM

Check that body, wheels and power transmitting system are free from abnormal noise and abnormal vibration or any other abnormal condition.

METERS AND GAUGE

Check that speedometer, odometer, fuel meter, temperature gauge, etc. are operating accurately.

LIGHTS

Check that all lights operate properly.

WINDSHIELD DEFROSTER

Periodically check that air comes out from defroster outlet when operating heater or air conditioning.
Set mode control lever to defroster position and fan switch lever to “HI” position for this check.

Recommended Fluids and Lubricants

Engine oil	SG, SH, SJ or SL grade (Refer to “Engine Oil and Oil Filter Replacement” in this section for engine oil viscosity.)
Engine coolant (Ethylene glycol base coolant)	“Antifreeze / Anticorrosion coolant”
Brake fluid	DOT 4 or SAE J1704
Manual transmission oil	Refer to “Manual Transaxle Oil Change” in Section 7A.
Transfer oil (4WD)	Refer to “Transfer Oil Change” in Section 7D.
Differential oil (4WD)	Refer to “Rear Differential Gear Oil Change” in Section 7F.
Door hinges	Engine oil or water resistance chassis grease
Hood latch assembly	Engine oil or water resistance chassis grease
Key lock cylinder	Spray lubricant

SECTION 1A

HEATER AND VENTILATION

WARNING:

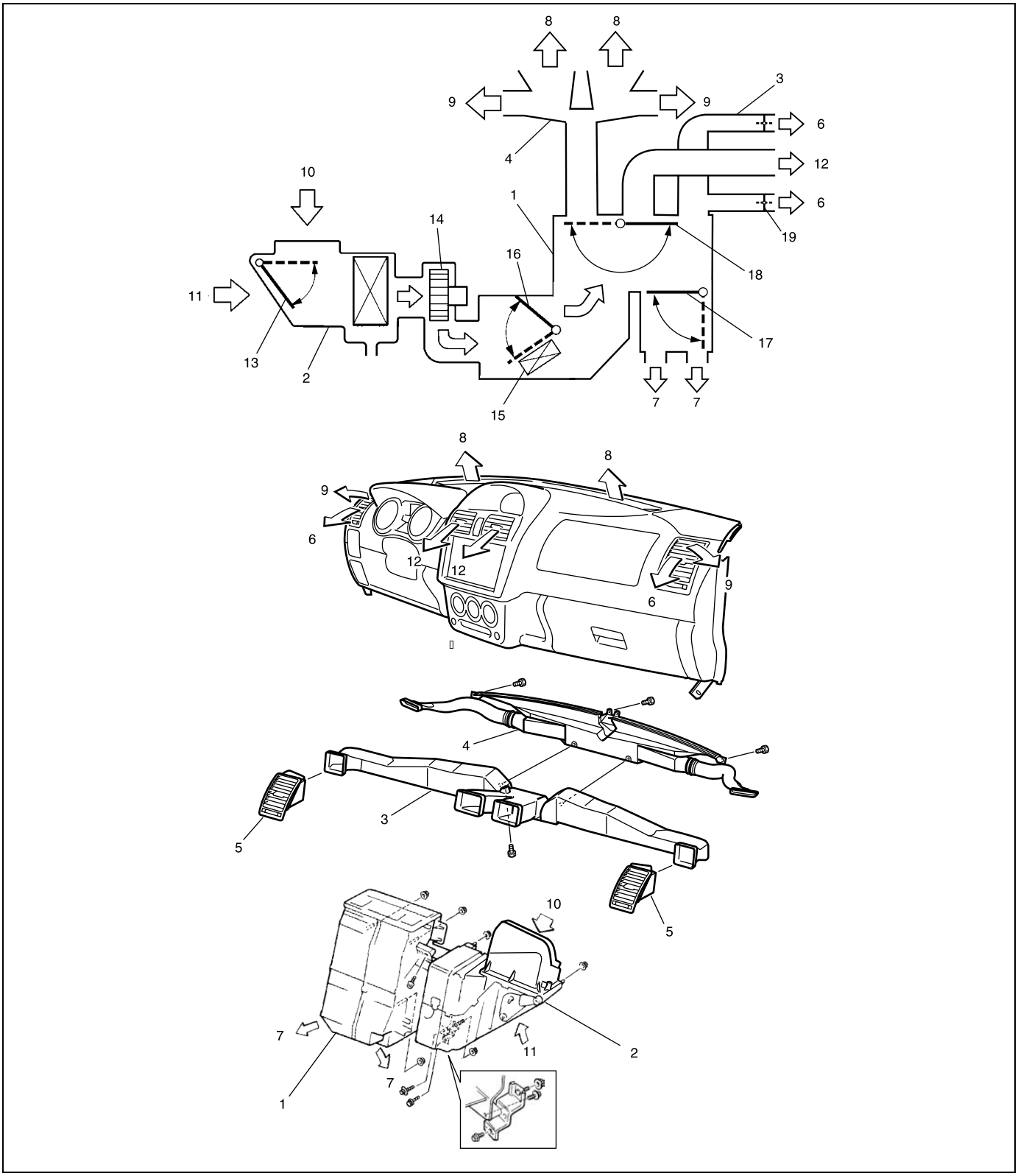
For vehicles equipped with Supplement Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either or these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

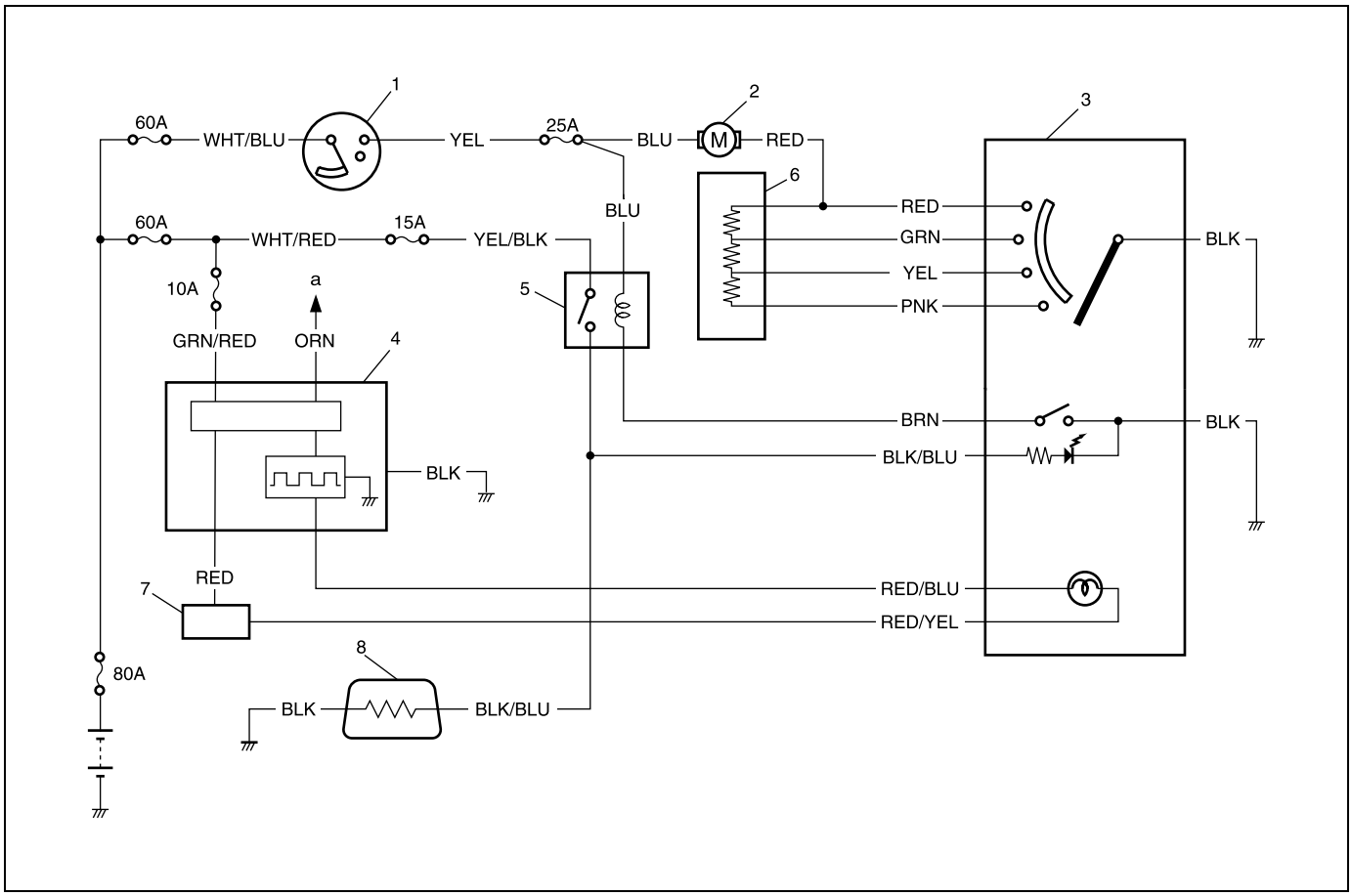
General Description

Heater and Ventilation Construction



1. Heater unit	6. Side ventilation air	11. Recirculation air	16. Temperature control door
2. Air inlet box	7. Foot air	12. Center ventilation air	17. Foot air control door
3. Ventilator duct	8. Front defroster air	13. Air inlet select door	18. Ventilation defroster air control door
4. Defroster nozzle	9. Side defroster air	14. Blower motor	19. Side ventilation control door
5. Ventilator outlet	10. Fresh air	15. Heater core	

Heater and Ventilation Wiring Circuit Diagram



1. Ignition switch	4. Lighting controller	7. Junction connector
2. Blower motor	5. Rear defogger relay	8. Rear defogger
3. Heater control panel	6. Blower motor resistor	a: To lighting switch

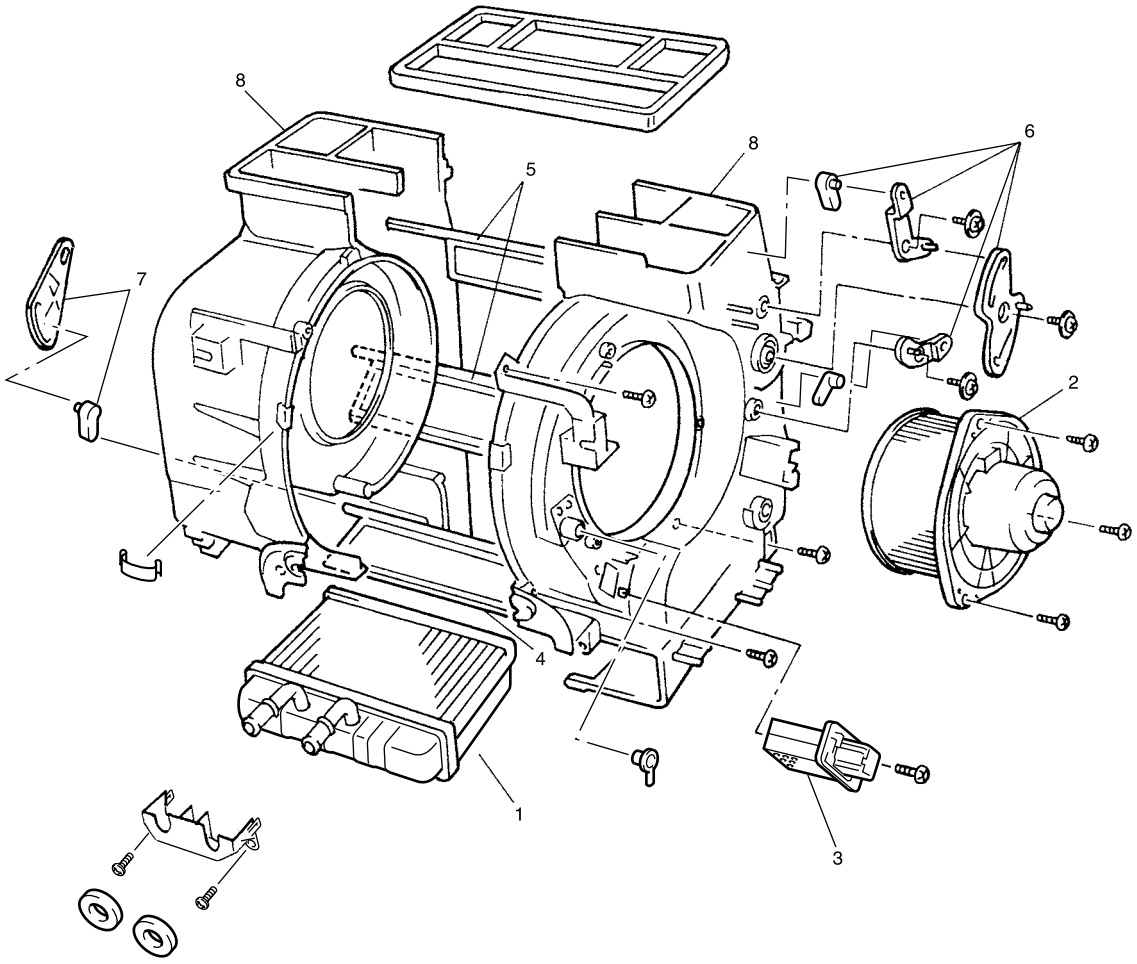
Diagnosis

Heater and Ventilation System Symptom Diagnosis

Condition	Possible Cause	Correction
Blower motor dose not work even when its switch is at operating position.	Fuse blown	Check “HEATER” fuse and main heater fuse, and then check for short circuit to ground.
	Blower motor resistor faulty	Check blower motor resistor.
	Blower speed selector faulty	Check blower speed selector.
	Blower motor faulty	Replace blower motor.
	Wiring or grounding faulty	Repair as necessary.
Blower speed selector dose not work when its switch is at maximum air flow position.	Blower speed selector faulty	Check blower speed selector.
	Wiring or grounding faulty	Check wiring and grounding, and then repair as necessary.
Incorrect temperature output.	Control cables broken or binding	Check control cables.
	Temperature control lever faulty	Check temperature control lever.
	Position of control cable clamp is faulty	Check position and adjust it as necessary.
	Temperature control door assembly broken	Repair temperature control door assembly.
	Air ducts clogged	Repair air ducts.
	Heater core leaking or clogged	Replace heater core.
	Heater hoses leaking or clogged	Replace heater hoses.
	Thermostat faulty	Check thermostat by referring to Section 6B.
When mode control lever is changed, air outlet port dose not change or lever position disagree with air outlet port.	Control cable broken or binding	Check control cable.
	Airflow control lever faulty	Check air flow control lever.
	Position of control cable clamp is faulty	Check position and adjust it as necessary.
	Control doors broken	Repair control doors.
	Air ducts leaking or clogged	Repair air ducts.

On-Vehicle Service

Heater Unit Components

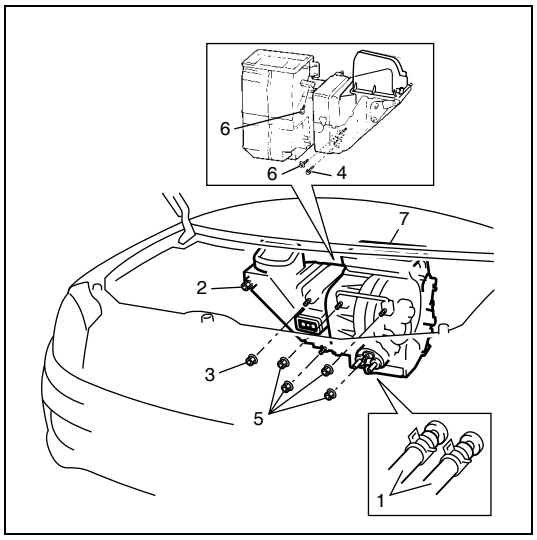


1. Heater core	4. Temperature control door assembly	7. Temperature control lever
2. Blower motor assembly	5. Air flow control door assembly	8. Heater case
3. Blower motor resistor	6. Air flow control lever	

Heater Unit Removal and Installation

REMOVAL

1) Disconnect negative (–) cable at battery.
2) If equipped with air bag system, disable air bag system referring to “Disabling air bag system” in Section 10B.



3) Drain engine coolant and disconnect heater hoses (1) from heater unit.
4) Remove instrument panel referring to “Instrument Panel Removal and Installation” in Section 9.
5) Loosen air inlet box (cooling unit) mounting nut (2), and remove mounting nut (3).
6) Remove bolts (4), nuts (5) and screws (6).
7) Remove heater unit (7).

INSTALLATION

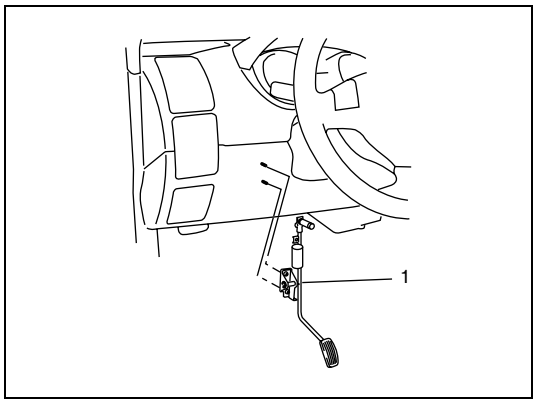
Reverse removal procedure install heater unit noting the following instructions.

- When installing each part, be careful not to catch any cable or wiring harness.
- Adjust control cables by referring to “Heater Unit Removal and Installation” in this section.
- Fill engine coolant to radiator.
- If equipped with air bag system, enable air bag system referring to “Enabling air bag system” in Section 10B.

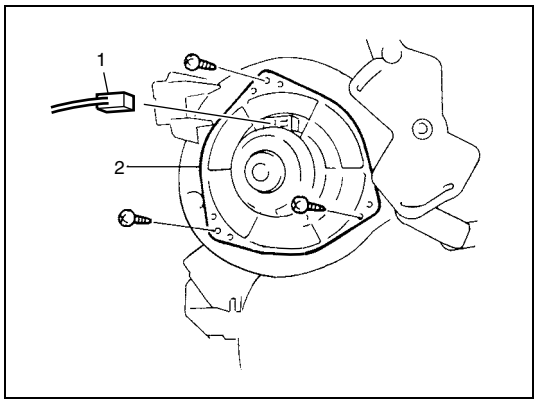
Blower Motor Removal and Installation

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Disable air bag system (if equipped) referring to “Disabling air bag system” in Section 10B.
3) Remove column hole cover.



4) Remove the pedal.
   - For RH steering vehicle, remove clutch pedal assembly.
   - For LH steering vehicle, remove accelerator pedal (1) assembly.

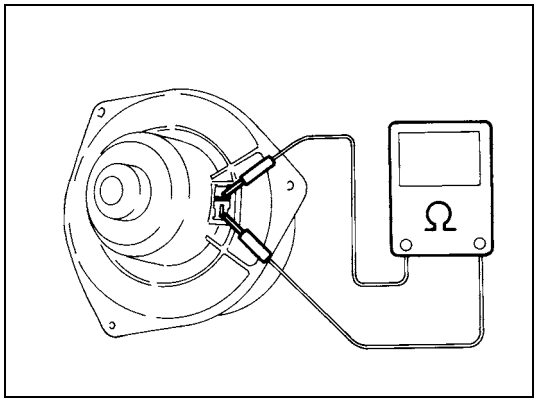


5) Disconnect blower motor coupler (1).
6) Remove blower motor (2).

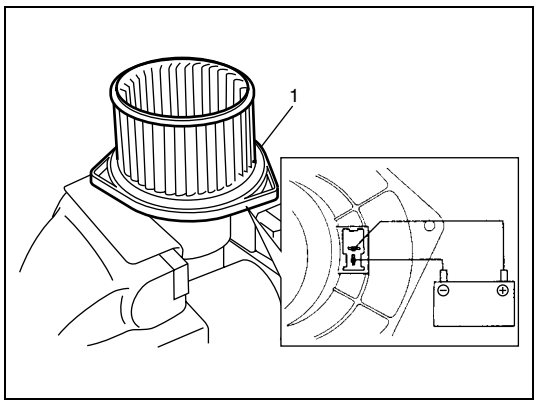
INSTALLATION

1) Reverse removal procedure for installation.
2) Enable air bag system (if equipped) referring to “Enabling air bag system” in Section 10B.

Blower Motor Inspection



1) Check for continuity between two terminals as shown in figure.
   If there is no continuity, replace blower motor.



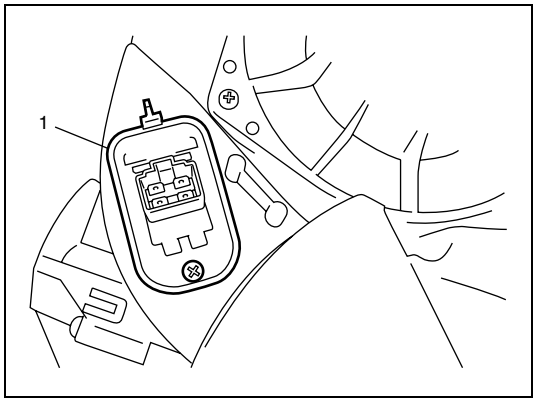
2) Check operation and current.
   a) Fix blower motor (1) by using vise.
   b) Connect battery to blower motor (1) as shown.
   c) Check if blower motor operates smoothly without abnormal noise.
   d) Check if ammeter indicates specified current.
      If measured current is incorrect, replace blower motor.

Blower specified current at 12 V
18 A maximum

Blower Motor Resistor Removal and Installation

REMOVAL

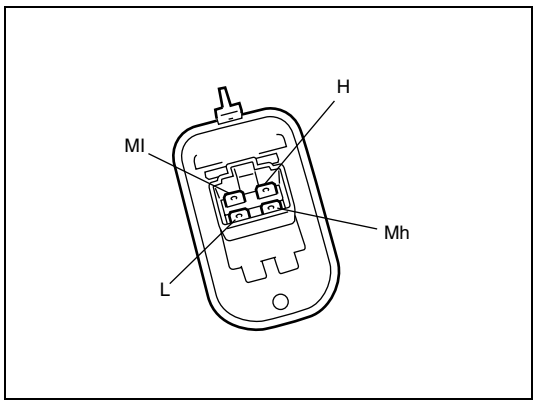
1) Disconnect negative (–) cable at battery.
2) Disable air bag system (if equipped) referring to “Disabling air bag system” in Section 10B.
3) Remove clutch pedal bracket (RH steering vehicle only).
4) Disconnect blower motor resistor coupler.
5) Remove blower motor resistor (1).



INSTALLATION

1) Reverse removal procedure for installation.
2) Enable air bag system (if equipped) referring to “Enabling air bag system” in Section 10B.

Blower Motor Resistor Inspection

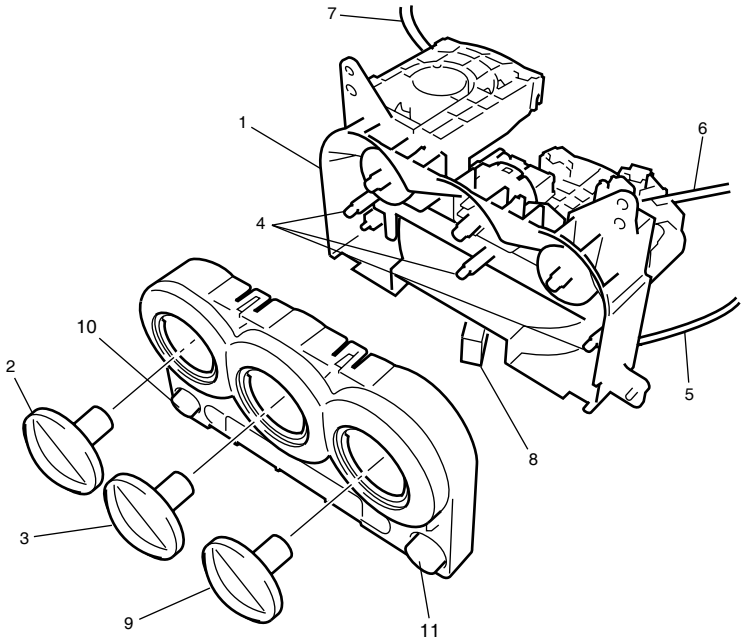


Measure each terminal-to-terminal resistance on resistor.
If measured resistance is incorrect, replace blower motor resistor.

Resistance

H – Mh: Approx. 0.4 Ω at 20 – 25 °C (68 – 77 °F)
Mh – Ml: Approx. 0.6 Ω at 20 – 25 °C (68 – 77 °F)
Ml – L: Approx. 1.0 Ω at 20 – 25 °C (68 – 77 °F)

Heater Control Lever Assembly Components

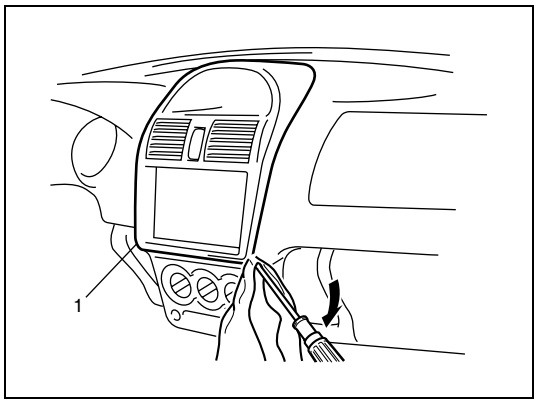


1. Heater control body assembly	4. Bulb	7. Airflow control cable	10. A/C switch
2. Airflow selector	5. Air intake control cable	8. Air intake selector	11. Rear defogger switch
3. Blower speed selector	6. Temperature control cable	9. Temperature selector	

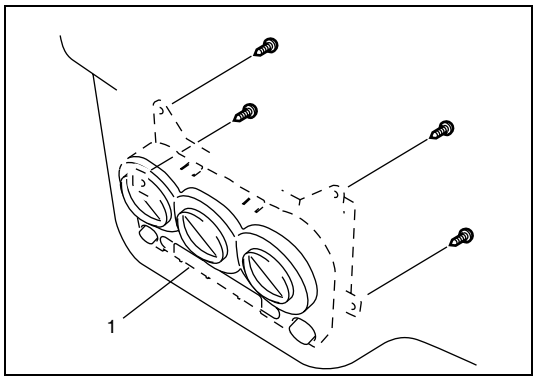
Heater Control Lever Assembly Removal and Installation

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Disable air bag system (if equipped) referring to “Disabling air bag system” in Section 10B.

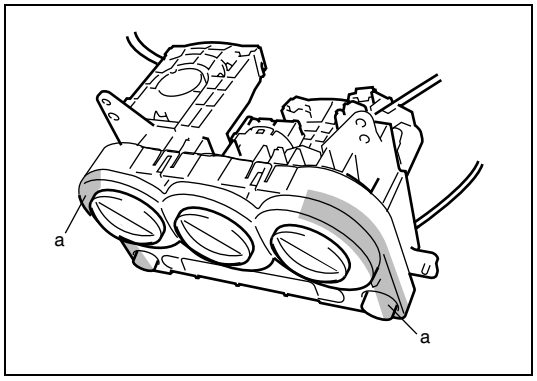


3) Remove center garnish (1) and radio or accessory case (if equipped).
4) Disconnect each heater control cables (airflow control, temperature control and air intake control) from heater unit and air inlet box.
5) Disconnect blower speed selector coupler and rear defogger (and A/C) switch coupler.



6) Remove heater control lever assembly (1).

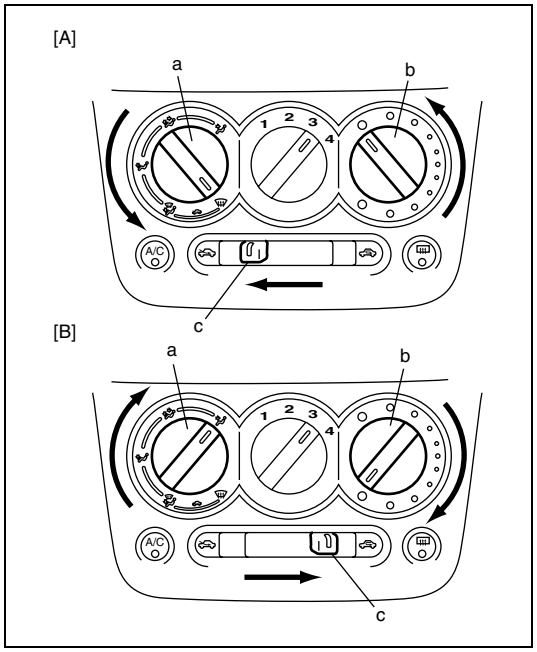
INSTALLATION



NOTE:

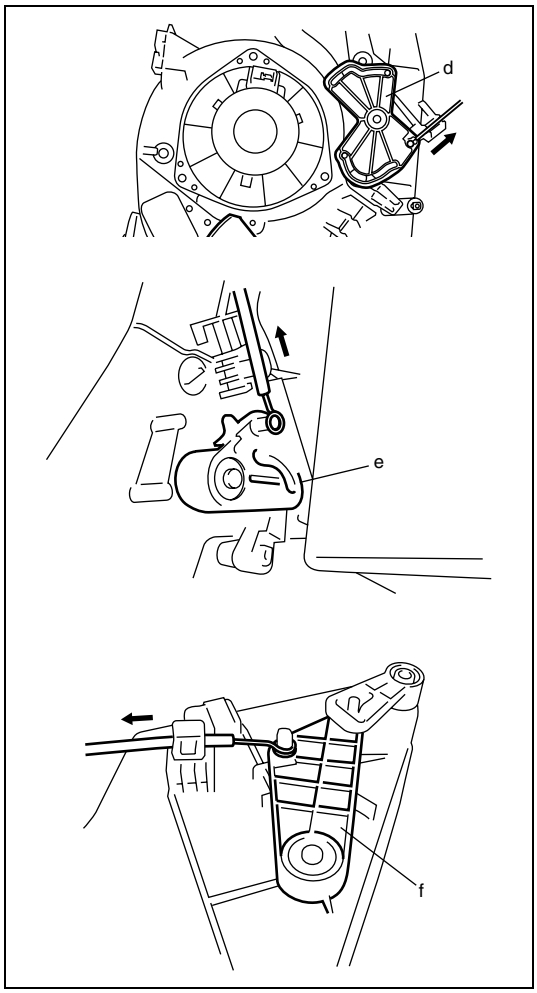
When installing heater control lever assembly, be careful not to damage the unit by taping (a) the unit for prorection.

1) Reverse removal procedure for installation.



2) Adjust cables as follows.
   a) Move airflow selector (a), temperature selector (b) and air intake selector (c) fully in arrow direction as shown in figure.

A: LH steering vehicle
B: RH steering vehicle



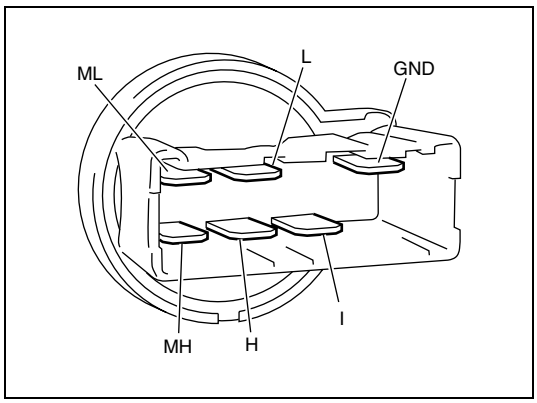
b) Push airflow control lever (d), temperature control lever (e) and door link (f) fully in arrow direction and fix cable with clamp in position as shown in figure.

NOTE:

After installing control cables, make sure that control levers move smoothly and stop at proper position.

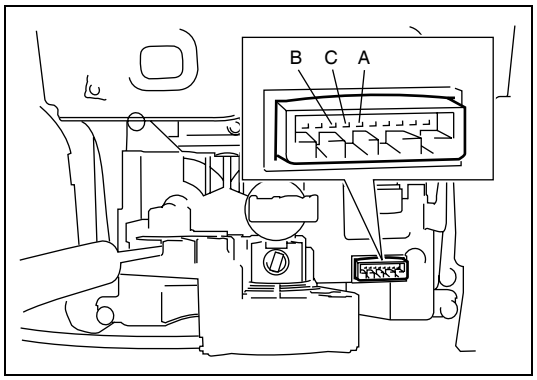
3) If equipped with air bag, enable air bag system referring to "Enabling air bag system" in Section 10B.

Blower Speed Selector Inspection



Check blower speed selector for each terminal-to-terminal continuity.

TERMINAL / POSITION	GND	I	L	ML	MH	H
OFF	O					
1	O	O	O			
2	O	O		O		
3	O	O			O	
4	O	O				O



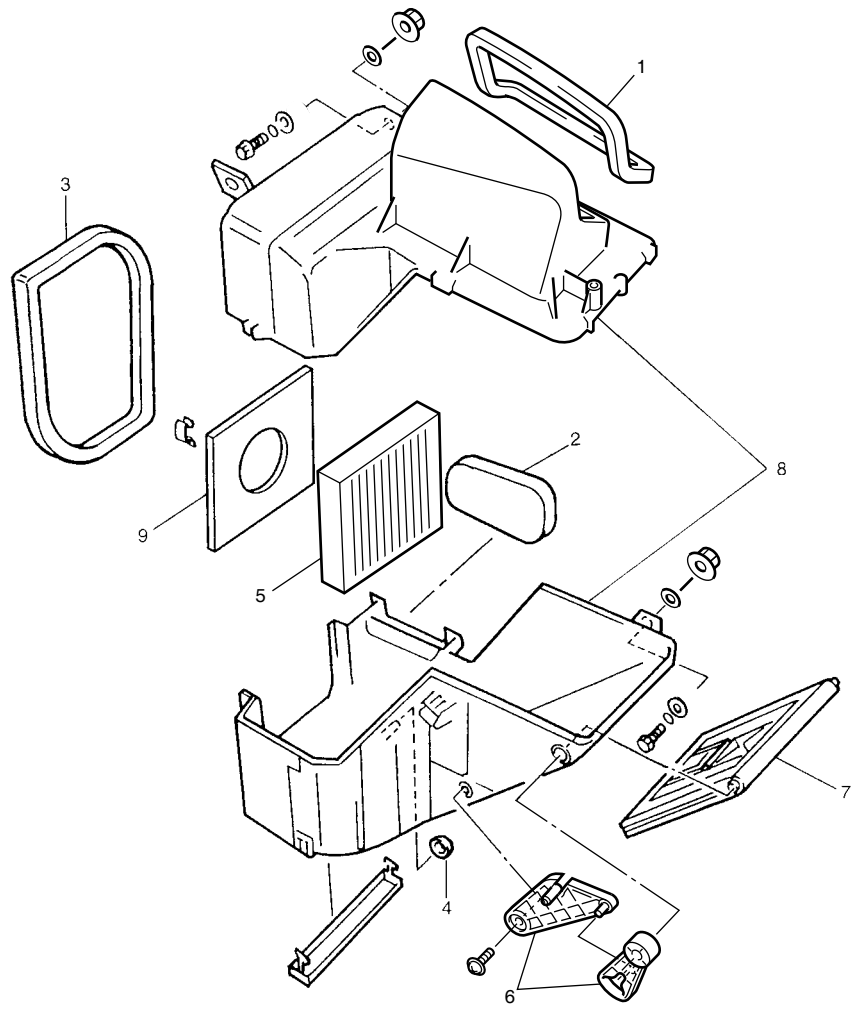
Rear Defogger Switch Inspection

Check for continuity between terminals at each switch position by referring to the table below.

TERMINAL / POSITION	A	B	C
OFF [a]			
ON [b]			

[a]: Switch button released
[b]: Switch button kept in push

Air Inlet Box Components



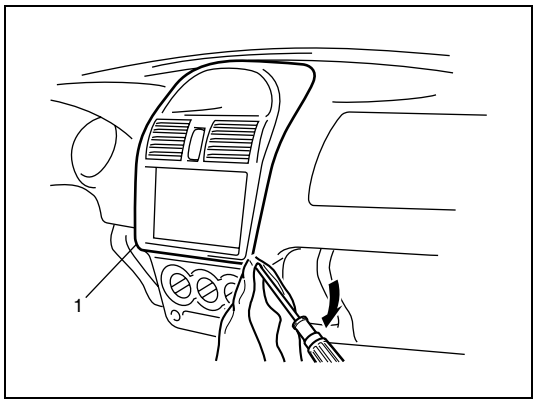
1. Air inlet box	4. Grommet	7. Air inlet door
2. Dash packing	5. Air filter (if equipped)	8. Air inlet box
3. Packing	6. Door link	9. Air resistance board

Air Inlet Box Removal and Installation

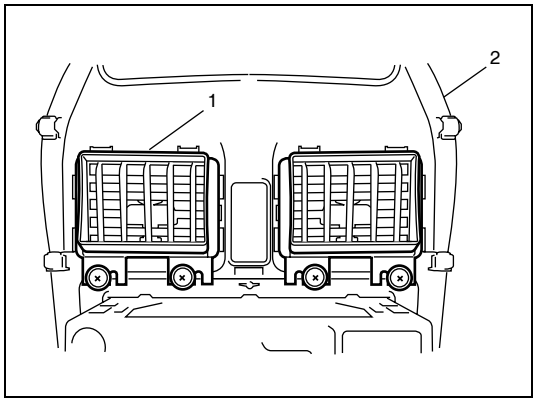
Refer to “Cooling Unit (Evaporator) Removal and Installation” in Section 1B.

Center Ventilation Louver Removal and Installation

REMOVAL



1) Remove center garnish (1).



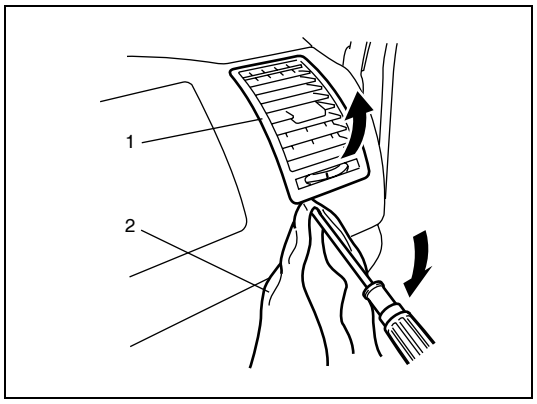
2) Remove center ventilation louver (1) from center garnish (2).

INSTALLATION

Reverse removal procedure for installation.

Side Ventilation Louver Removal and Installation

REMOVAL



1) Remove ventilation louver (1) as shown.

2. Rag

INSTALLATION

Reverse removal procedure for installation.

SECTION 1B

AIR CONDITIONING (OPTIONAL)

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CAUTION:

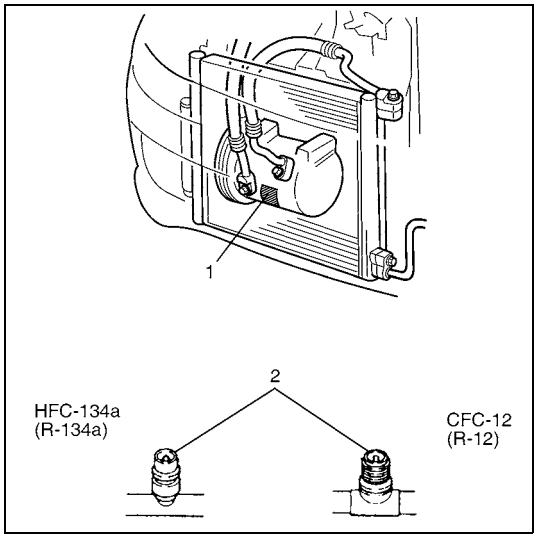
The air conditioning system of this vehicle uses refrigerant HFC-134a (R-134a).
None of refrigerant, compressor oil and component parts is interchangeable between two types of A/C: one using refrigerant CFC-12 (R-12) and the other using refrigerant HFC-134a (R-134a).
Be sure to check which refrigerant is used before any service work including inspection and maintenance. For identification between these two types, refer to "Refrigerant Type Construction" in page 1B-2.
When replenishing or changing refrigerant and compressor oil and when replacing parts, make sure that the material or the part to be used is appropriate to the A/C installed in the vehicle being serviced. Use of incorrect one will result in leakage of refrigerant, damage in parts or other faulty condition.

For basic servicing method of the air conditioning system that is not described in this section, refer to AIR CONDITIONINGBASIC MANUAL (P/No: 99520-02130).

CONTENTS

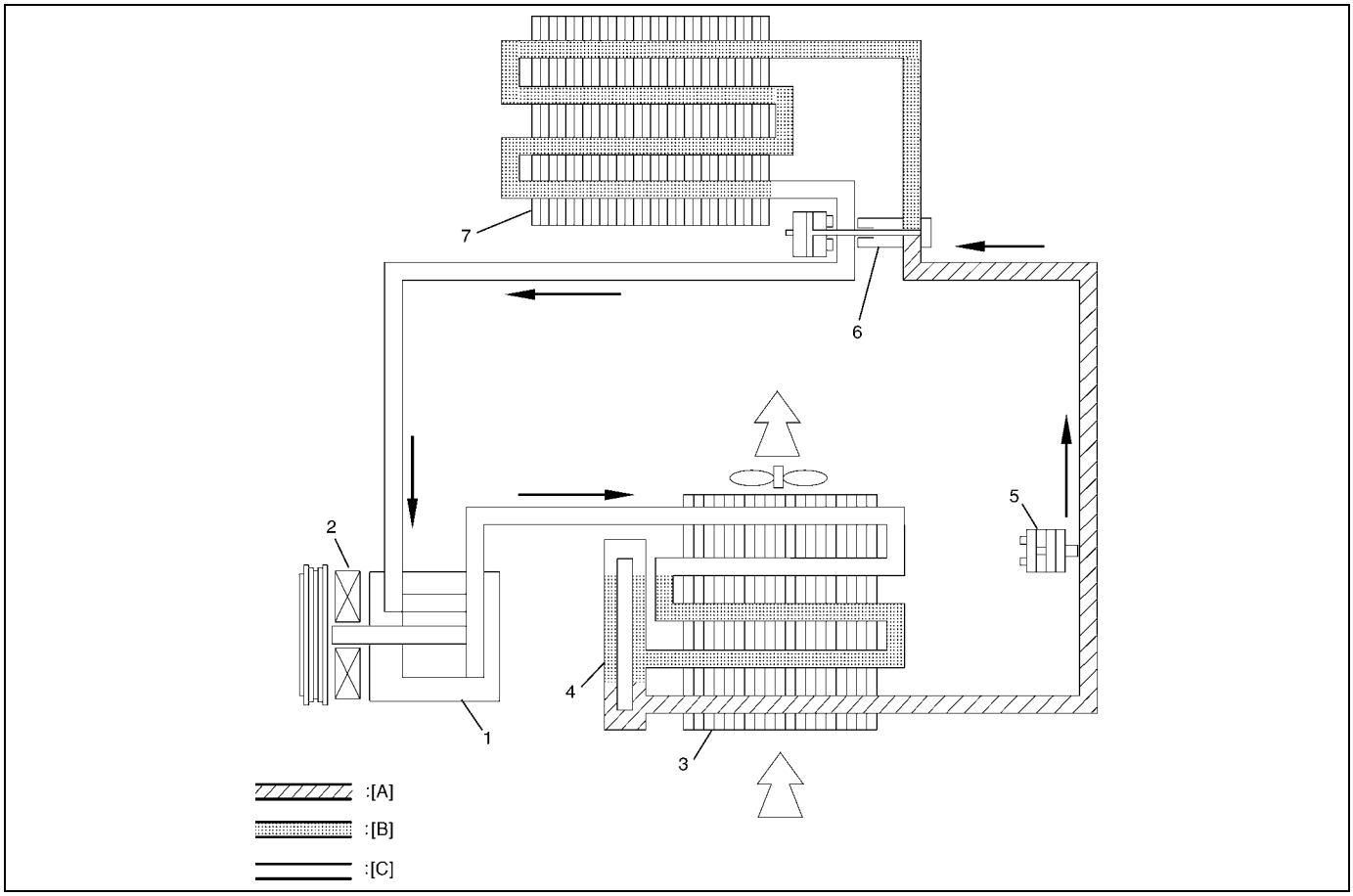
General Description

Refrigerant Type Construction



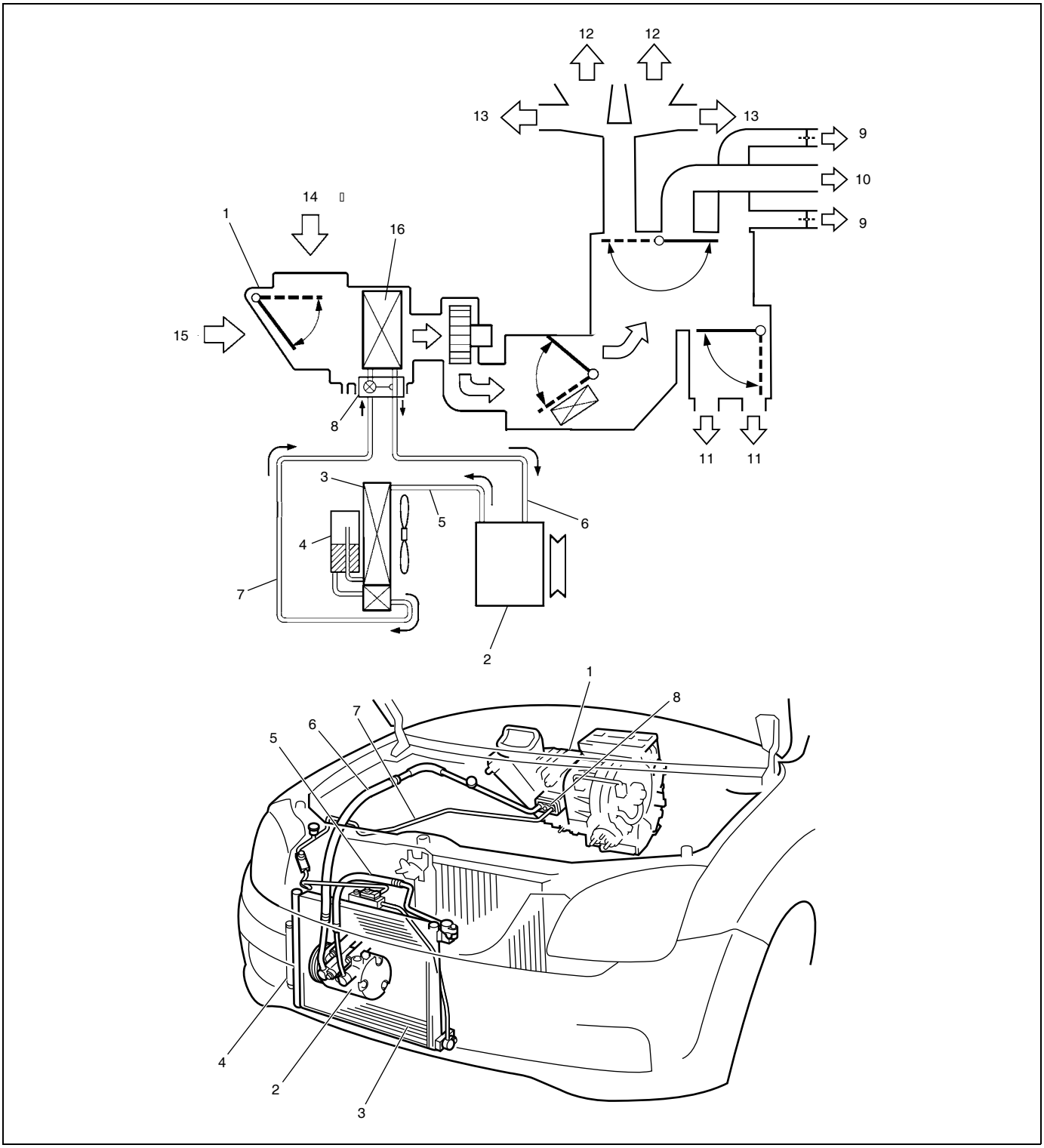
Whether the A/C in the vehicle being serviced uses HFC-134a (R-134a) or CFC-12 (R-12) is indicated on label (1) on the compressor. Also, it can be checked by the shape of the service (charge) valve (2).

Air Conditioning System Description



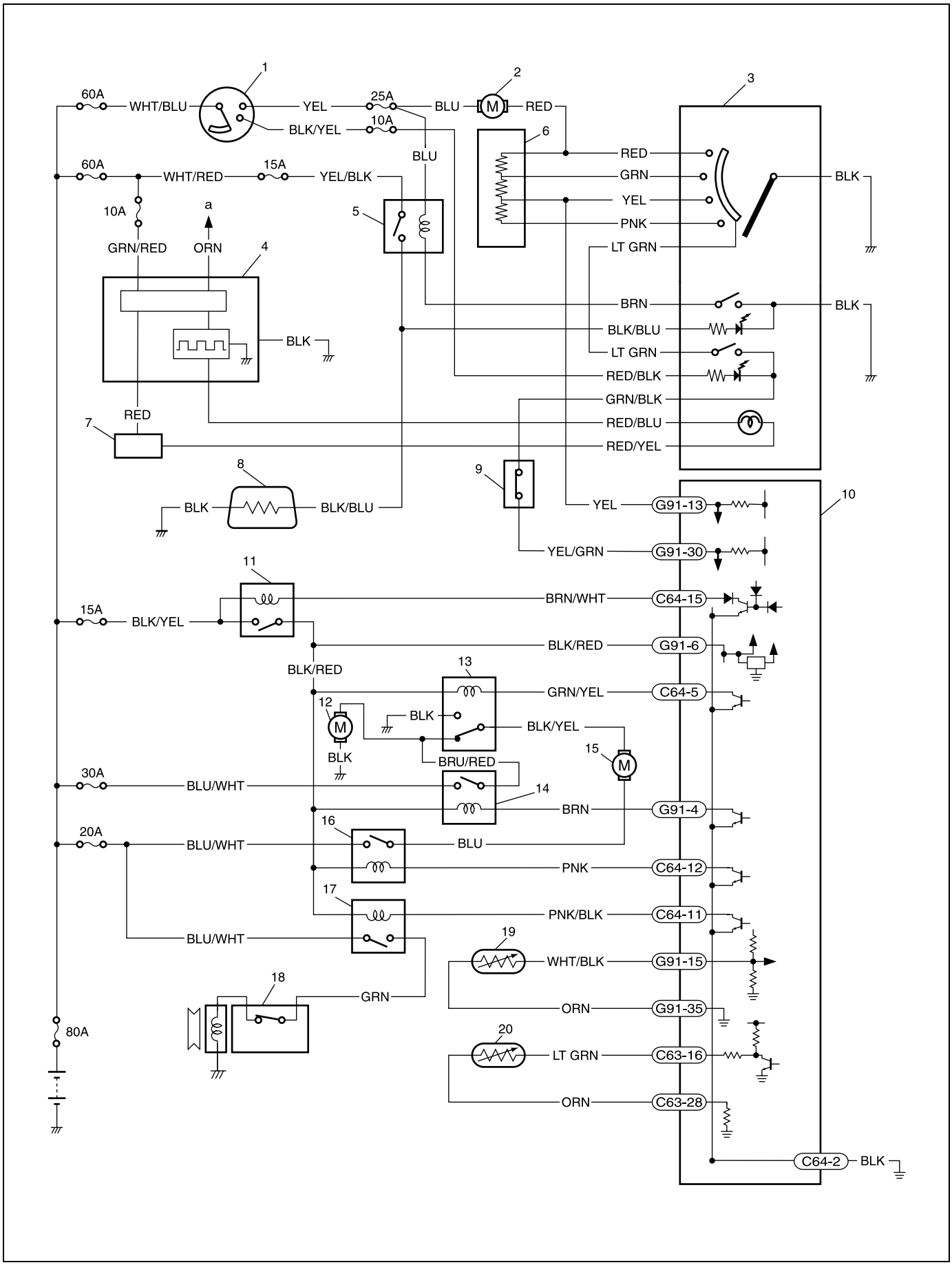
[A]: Liquid	1. Compressor	4. Receiver / dryer	7. Evaporator
[B]: Vapor	2. Magnet clutch	5. Pressure switch	
[C]: Superheated vapor	3. Condenser	6. Expansion valve	

Major Components of A/C System



1. Cooling unit	5. Discharge hose	9. Side ventilation air	13. Side defroster air
2. Compressor	6. Suction hose	10. Center ventilation air	14. Fresh air
3. Condenser assembly	7. Liquid pipe	11. Foot air	15. Recirculation air
4. Receiver / dryer	8. Expansion valve	12. Front defroster air	16. Evaporator

A/C System Wiring Circuit Diagram



1. Ignition switch	7. Junction connector	13. Condenser cooling fan relay No.2	19. A/C evaporator thermistor
2. Blower motor	8. Rear defogger	14. Radiator cooling fan relay	20. ECT sensor
3. Heater control panel	9. Dual pressure switch	15. Condenser cooling fan motor	a: To lighting switch
4. Lighting controller	10. ECM	16. Condenser cooling fan relay No.1	
5. Rear defogger relay	11. Main relay	17. Compressor relay	
6. Blower motor resistor	12. Radiator cooling fan motor	18. Compressor	

Diagnosis

A/C System Symptom Diagnosis

Condition	Possible Cause	Correction
No cool air comes out (A/C system does not operate)	No refrigerant	Perform recovery, evacuation and charge.
	Fuse blown	Check related fuses, and check short circuit to ground.
	A/C switch faulty	Check A/C switch.
	Blower speed selector faulty	Check blower speed selector referring to “Blower Speed Selector Inspection” in Section 1A.
	A/C evaporator temperature sensor faulty	Check A/C evaporator temperature sensor.
	Dual pressure switch faulty	Check dual pressure switch.
	Wiring or grounding faulty	Repair as necessary.
	ECT sensor faulty	Check ECT sensor referring to Section 6E1.
	ECM and/or its circuit faulty	Check ECM and its circuit referring to Section 6E1.
	Magnet clutch faulty	Check magnet clutch.
	Compressor drive belt loosened or broken	Adjust or replace drive belt.
	Compressor faulty	Check compressor.
	Compressor relay faulty	Check compressor relay.
No cool air comes out (A/C condenser cooling fan motor does not operate)	Fuse blown	Check related fuses, and check for short circuit to ground.
	Wiring or grounding faulty	Repair as necessary.
	Condenser cooling fan motor relay faulty	Check condenser cooling fan motor relay.
	Condenser cooling fan motor faulty	Check condenser cooling fan motor.
	ECM and/or its circuit faulty	Check ECM and its circuit referring to Section 6E1.

Condition	Possible Cause	Correction
No cool air comes out (Blower motor does not operate)	Fuse blown	Check related fuses, and check for short circuit to ground.
	Blower motor resistor faulty	Check blower motor resistor referring to “Blower Motor Resistor Inspection” in Section 1A.
	Blower speed selector faulty	Check blower speed selector referring to “Blower Speed Selector Inspection” in Section 1A.
	Wiring or grounding faulty	Repair as necessary.
	Blower motor faulty	Check blower motor referring to “Blower Motor Inspection” in Section 1A.
Cool air does not come out or insufficient cooling (A/C system normal operation)	Insufficient or excessive charge of refrigerant	Check charge of refrigerant and system for leaks.
	Condenser clogged	Check condenser.
	A/C evaporator clogged or frosted	Check A/C evaporator and A/C evaporator temperature sensor.
	A/C evaporator temperature sensor faulty	Check A/C evaporator temperature sensor.
	Expansion valve faulty	Check expansion valve.
	Desiccant clogged	Check receiver / dryer
	Compressor drive belt loosened or broken	Adjust or replace drive belt.
	Magnetic clutch faulty	Check magnetic clutch.
	Compressor faulty	Check compressor.
	Air in A/C system	Replace desiccant, and perform evacuation and charge.
	Air leaking from heater and cooling unit or air duct	Repair as necessary.
	Heater and ventilation system faulty	Check air inlet box (cooling unit), heater control assembly and heater unit.
	Blower motor faulty	Check blower motor referring to “Blower Motor Inspection” in Section 1A.
	Excessive compressor oil existing in A/C system	Pull out excess compressor oil in A/C system circuit, and check compressor.
Cool air does not come out only intermittently	Wiring connection faulty	Repair as necessary.
	Expansion valve faulty	Check expansion valve.
	Excessive moisture in A/C system	Replace receiver / dryer, and perform evacuation and charge.
	Magnetic clutch faulty	Check magnetic clutch.
	Excessive charge of refrigerant	Check charge of refrigerant.

Condition	Possible Cause	Correction
Cool air comes out only at high speed	Condenser clogged	Check condenser.
	Insufficient charge of refrigerant	Check for charge of refrigerant.
	Air in A/C system	Replace receiver / dryer, and perform evacuation and charge.
	Compressor drive belt loosened or broken	Adjust or replace drive belt.
	Compressor faulty	Check compressor.
	Condenser cooling fan motor faulty	Check condenser cooling fan motor.
	Condenser cooling fan motor relay faulty	Check condenser cooling fan motor relay.
	Condenser cooling fan blade faulty	Check condenser cooling fan blade.
Cool air does not come out only at high speed	Excessive charge of refrigerant	Check for charge of refrigerant.
	A/C evaporator frosted	Check A/C evaporator and A/C evaporator temperature sensor.
Insufficient airflow of cooled air	A/C evaporator clogged or frosted	Check A/C evaporator and A/C evaporator temperature sensor.
	Air leaking from cooling unit or air duct	Repair as necessary.
	Blower motor faulty	Check blower motor referring to “Blower Motor Inspection” in Section 1A.
	Wiring or grounding faulty	Repair as necessary.

Abnormal Noise Diagnosis of A/C System

Abnormal noise from compressor

Condition	Possible Cause	Correction
During compressor operation, a rumbling noise is heard proportional to engine revolutions.	Inadequate clearance in scroll area	Replace compressor.
A loud noise is heard at a certain rpm, disproportionately to engine revolution.	Loose or faulty compressor drive belt	Adjust drive belt tension or replace drive belt.
	Loose compressor mounting bolts	Tighten mounting bolts.
A loud rattle is heard at low engine rpm.	Loose compressor clutch plate bolt	Tighten clutch plate bolt.
		Replace compressor if it was operated in this condition for a long time.

Abnormal noise from magnetic clutch

Condition	Possible Cause	Correction
A rumbling noise is heard when compressor is not operating.	Worn or damaged bearings	Replace magnet clutch assembly.
A chattering noise is heard when compressor is engaged.	Faulty magnet clutch clearance (excessive clearance)	Adjust magnet clutch clearance.
	Worn magnet clutch friction surface	Replace magnet clutch assembly.
	Compressor oil leaked from shaft seal, contaminating the friction surface	Replace compressor body assembly.

Abnormal noise from tubing

Condition	Possible Cause	Correction
A droning noise is heard from inside of the vehicle, but not particularly noticeable in engine compartment.	Faulty tubing clamps	Reposition clamps or increase the number of clamps.
	Resonance caused by pulsation from variations in refrigerant pressure	Attach a silencer to tubing, or modify its position and length.

Abnormal noise from condenser assembly

Condition	Possible Cause	Correction
Considerable vibration in condenser assembly	Resonance from condenser assembly bracket and body	Firmly insert a silencer between condenser assembly bracket and body.
	Loose condenser cooling fan mounting bolts	Tighten mounting bolts.
	Faulty condenser cooling fan blade	Replace condenser cooling fan blade.

Abnormal noise from crankshaft pulley

Condition	Possible Cause	Correction
A loud rattling noise is heard at idle or sudden acceleration.	Loosen crankshaft pulley bolt	Tighten bolt.

Abnormal noise from tension pulley

Condition	Possible Cause	Correction
Clattering noise is heard from pulley.	Worn or damaged bearing	Replace tension pulley.
Pulley cranks upon contact.	Cracked or loose bracket	Replace or tighten bracket.

Abnormal noise from A/C evaporator

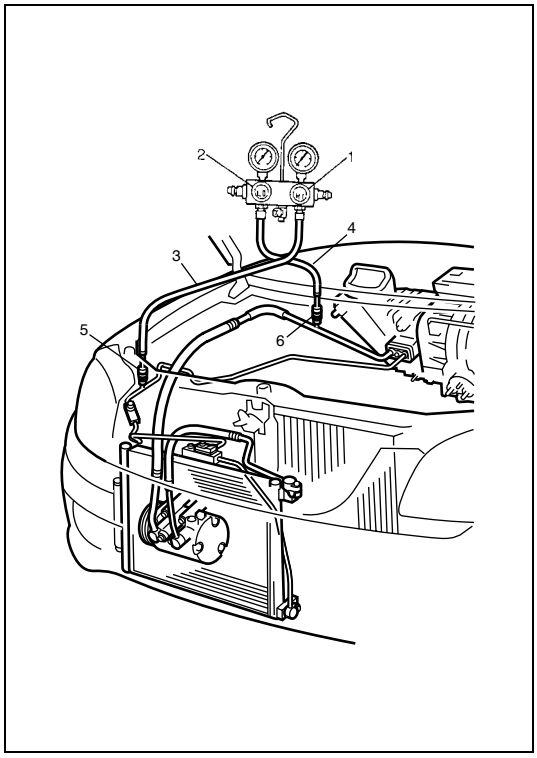
Condition	Possible Cause	Correction
Whistling sound is heard from A/C evaporator.	Depending on the combination of the interior/exterior temperatures, engine rpm and refrigerant pressure, the refrigerant flowing out of the expansion valve may, under certain conditions, make a whistling sound	At times, slightly decreasing refrigerant volume may stop this noise.
		Inspect expansion valve and replace if faulty.

Abnormal noise from blower motor

Condition	Possible Cause	Correction
Blower motor emits a chirping sound in proportion to its speed of rotation.	Worn or damaged motor brushes or commutator	Replace blower motor.
Fluttering noise or loud droning noise is heard from blower motor.	Leaves or other debris introduced from fresh air inlet to blower motor	Remove debris and make sure that the screen at fresh air inlet is intact.

A/C System Performance Inspection

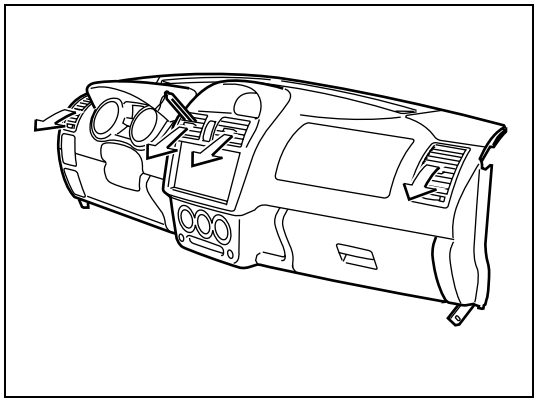
1) Confirm that vehicle and environmental conditions are as follows.
   – Vehicle is not exposed to direct sun.
   – Ambient temperature is within 15 °C – 35 °C (59 °F – 95 °F).



2) Make sure that high pressure valve (1) and low pressure valve (2) of manifold gauge are firmly closed.
3) Connect high pressure charging hose (3) to high pressure service valve (5) on vehicle, and connect low pressure charging hose (4) to low pressure service valve (6) on vehicle.
4) Bleed the air in charging hoses (3) and (4) by loosening their nuts respectively on manifold gauge, utilizing the refrigerant pressure. When a hiss is heard, immediately tighten nut.

CAUTION:
Do not interchange high and low pressure charging hoses by mistake.

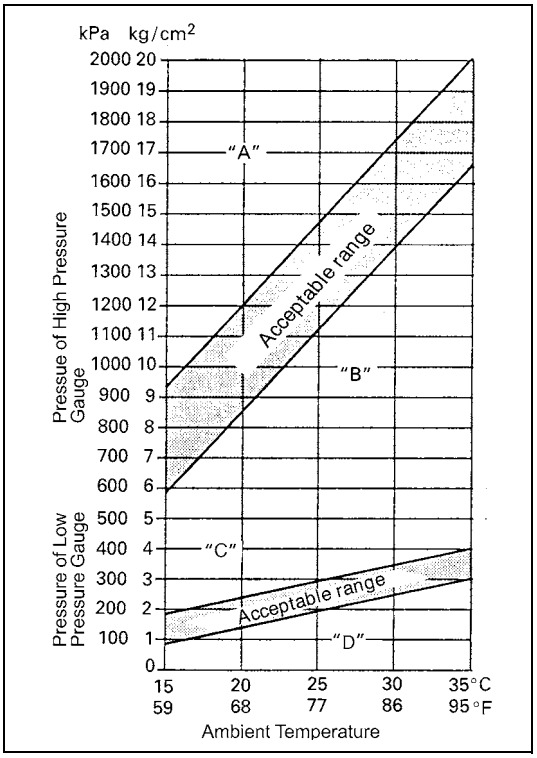
5) Warm up engine to normal operating temperature and keep it at specified idle speed.
6) Turn A/C switch ON, and set blower selector at "4" maximum, temperature selector at maximum cold, airflow selector at face, air intake selector at recirculation position. (Confirm that A/C compressor and condenser fans are working.)
7) Keep all windows, doors and engine food open.



Performance diagnosis condition

A/C inlet air temperature	**15 – 35 °C (59 – 95 °F)**
Engine rpm	**Keep 1,500 r/min.**
Blower fan switch	**"4" (maximum position)**
Temperature control	**Maximum cold**
Air outlet control	**Face**
Vehicle Doors	**All open**
Air inlet door position	**Recirculation**

8) With about 20 mm (0.8 in.) of dry bulb thermometer inserted into center duct air outlet and another one set near evaporator air inlet, read temperature difference between air outlet and air inlet.



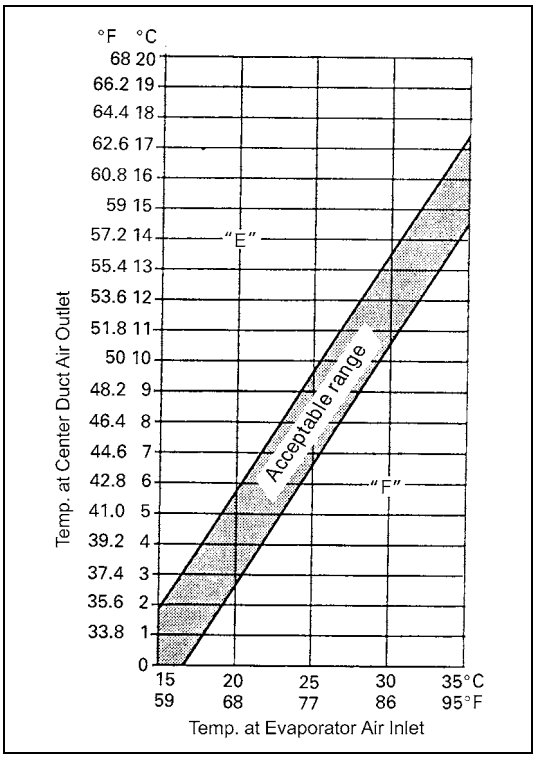
9) Check for each pressure of low side and high side if it is within shaded range of left graph.
   If each gauge reading is out of specified pressure, correct defective part referring to following Test Diagnosis table.

NOTE:

Pressure registered on gauge varies with ambient temperature. Therefore, use left graphs when determining if pressures are normal or not.

Example:

Gauges should read as follows when ambient temperature is 30 °C (86 °F)	
Pressure on high pressure gauge (HI):	**1400 – 1750 kPa** **14.0 – 17.5 kg/cm²**
Pressure on low pressure gauge (LO):	**230 – 350 kPa** **2.3 – 3.5 kg/cm²**



10) Check inlet port temperature-to-outlet port temperature relationship using graph at the left.
    For example, if evaporator inlet port temperature is 25 °C (77 °F) and center duct air outlet temperature is 8 °C (46.4 °F), their crossing point is within acceptable range as shown in graph at the left.
    In this case, cooling performance is satisfactory and proper.
11) If crossing point is out of acceptable range, diagnose trouble referring to following Test Diagnosis table.

Performance diagnosis table

NOTE:

If ambient temperature is approximately 30 °C (86 °F), it is possible to diagnose A/C system in detail referring to "DETAILED DIAGNOSIS TABLE (AMBIENT TEMPERATURE AT 30°C (86°F))" under "A/C System Performance Inspection" in this section.

HIGH PRESSURE GAUGE

Condition	Possible Cause	Correction
Pressure high ("A" area of high side graph)	Refrigerant overcharged	Recharge.
	Expansion valve frozen or clogged	Check expansion valve.
	Clogged refrigerant passage of high side	Clean or replace.
	Condenser cooling fan malfunction (Insufficient cooling of condenser)	Check condenser cooling fan.
	Dirty or bent condenser fins (Insufficient cooling of condenser)	Clean or repair.
	Compressor malfunction (Insufficient oil etc.)	Check compressor.
	Engine overheat	Check engine cooling system referring to Section 6B.
Pressure low ("B" area of high side graph)	Insufficient refrigerant (Insufficient charge or leakage)	Check for leakage, repair if necessary and recharge.
	Expansion valve malfunction (valve opens too wide)	Check expansion valve.
	Compressor malfunction (Insufficient compression)	Check compressor.

LOW PRESSURE GAUGE

Condition	Possible Cause	Correction
Pressure high ("C" area of low side graph)	Expansion valve malfunction (valve opens too wide)	Check expansion valve.
	Compressor malfunction (Insufficient compression)	Check compressor.
Pressure low ("D" area of low side graph)	Insufficient refrigerant (Insufficient charge or leakage)	Check for leakage, repair if necessary and recharge.
	Expansion valve malfunction (valve opens too narrow)	Check expansion valve.
	Clogged refrigerant passage (crashed pipe)	Repair or replace.

THERMOMETER AT CENTER DUCT

Condition	Possible Cause	Correction
Outlet air temperature at center duct is high (Crossing point is in area "E")	Insufficient or excessive charge of refrigerant	Check refrigerant pressure.
	Dirty or bent A/C evaporator fins	Clean or repair.
	Air leakage from cooling (heater) unit or air duct	Repair or replace.
	Malfunctioning, switch over function of door in cooling (heater) unit	Repair or replace.
	Compressor malfunction	Check compressor.
Outlet air temperature at center duct is low (Crossing point is in area "F")	Insufficient air volume from center duct (Heater blower malfunction)	Check blower motor and fan.
	Compressor malfunction	Check compressor.

DETAILED DIAGNOSIS TABLE (AMBIENT TEMPERATURE AT 30°C (86°F))

Condition			Possible Cause	Correction
Manifold Gauge	MPa (kg/cm^2) (psi)	Detail		
Lo	Hi			
0.23 – 0.35 (2.3 – 3.5) (33 – 50)	**1.4 – 1.75 (14 – 17.5) (200 – 249)**	**Normal condition**	–	–
Negative pressure	**0.5 – 0.6 (5 – 6) (71.2 – 85.3)**	**The low pressure side reads a negative pressure, and the high pressure side reads an extremely low pressure. Presence of frost around tubing to and from receiver / dryer and expansion valve.**	Dust particles or water droplets are either stuck or frozen inside expansion valve, preventing the refrigerant from flowing	Clean expansion valve. Replace it if it cannot be cleaned. Replace receiver / dryer. Evacuate the A/C system and recharge with fresh refrigerant.
Normal : 0.23 – 0.35 (2.3 – 3.5) (33 – 50) ↑↓ Abnormal : Negative pressure	**Normal : 1.4 – 1.75 (14 – 17.5) (200 – 249) ↑↓ Abnormal : 0.7 – 1.0 (7 – 10) (100 – 142)**	**During A/C operation, the low pressure side sometimes indicates negative pressure, and sometimes normal pressure. Also high pressure side reading fluctuates between the abnormal and normal pressure.**	Expansion valve is frozen due to moisture in the system, and temporarily shuts off the refrigeration cycle	Replace expansion valve. Replace receiver / dryer. Evacuate A/C system and recharge with fresh refrigerant.
0.05 – 0.15 (0.5 – 1.5) (4.2 – 21.3)	**0.7 – 1.0 (7 – 10) (100 – 142)**	**Both low and high pressure sides indicate low readings. Continuous air bubbles are visible through sight glass. Output air is slightly cold.**	Insufficient refrigerant in system (Refrigerant leaking)	Using leak detector, check for leaks and repair as necessary. Recharge refrigerant to a specified amount. If the pressure reading is almost 0 when the manifold gauges are attached, check for any leaks, repair them, and evacuate the system.
0.4 – 0.6 (4 – 6) (56.9 – 85.3)		**Pressure on low pressure side is high. Pressure on high pressure side is low. Both pressure becoming equal right after A/C is turned OFF.**	Internal leak in compressor	Inspect compressor and repair or replace as necessary.

Condition			Possible Cause	Correction
Manifold Gauge	MPa (kg/cm^2) (psi)	Detail		
Lo	Hi			
0.35 – 0.45 (3.5 – 4.5) (50 – 64)	**2.0 – 2.5 (20 – 25) (285 – 355)**	**High pressure reading on both low and high pressure sides. Air bubbles are not visible even when engine rpm is lowered.**	Overcharged A/C system Faulty condenser cooling operation Faulty condenser cooling fan operation	Adjust refrigerant to specified amount. Clean condenser. Inspect and repair condenser cooling fan.
		High pressure reading on both low and high pressure sides. Low pressure side tubing is not cold when touched. Air bubbles are visible through sight glass.	Presence of air in A/C system (Improperly evacuated)	Replace receiver / dryer. Inspect quantity of compressor oil and presence of contaminants in oil. Evacuate system and recharge with fresh refrigerant.
0.45 – 0.55 (4.5 – 5.5) (64 – 78)		**High pressure reading on both low and high pressure sides. Large amount of frost or dew on the low pressure side tubing.**	Faulty expansion valve Refrigerant flow is not regulated properly	Replace expansion valve.

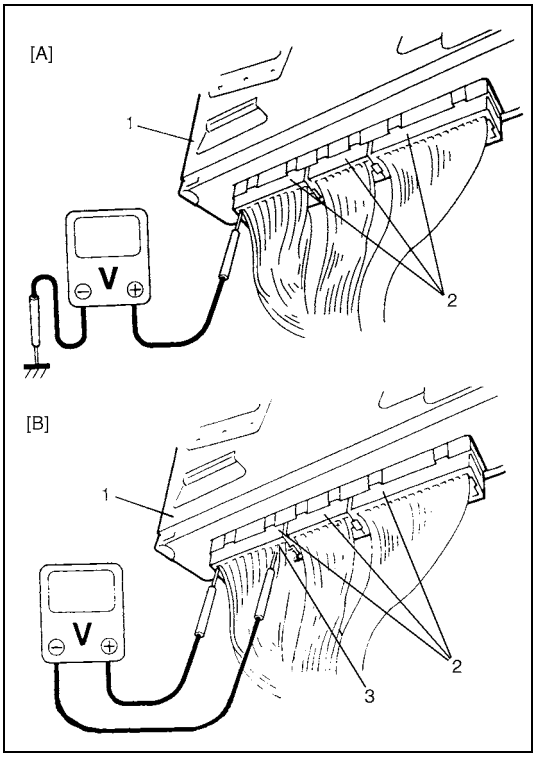
A/C System Inspection of ECM

ECM and circuits can be checked at ECM wiring couplers by measuring voltage.

CAUTION:

ECM cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM with couplers disconnected from it.

Voltage check



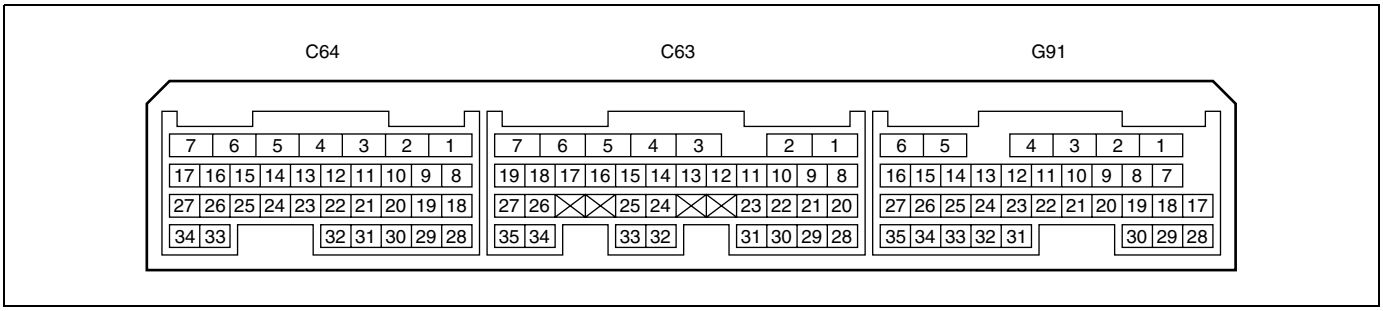
1) Remove ECM (1) from vehicle.
2) Connect ECM couplers (2) to ECM.
3) Check voltage at each terminal of couplers connected. Refer to “Fuel injector on-vehicle inspection” in Section 6E.

NOTE:

As each terminal voltage is affected by the battery voltage, confirm that it is 11 V or more when ignition switch is ON position.

[A]:	Fig. A
[B]:	Fig. B
3.	C64-2

Terminal arrangement of ECM coupler (viewed from harness side)



ECM voltage values table for relation of A/C control

Terminal	Wire	Circuit	Measurement Ground	Normal Value	Condition
C63-16	LT GRE	Engine coolant temperature sensor input	Ground to engine (Fig B)	3.7 – 3.85 V	Ignition switch ON, ECT at 0 °C (32 °F)
				1.45 – 1.6 V	Ignition switch ON, ECT at 50 °C (122 °F)
				0.4 – 0.5 V	Ignition switch ON, ECT at 100 °C (212 °F)
C63-28	ORN	Sensor ground	Ground to engine (Fig B)	–0.5 – 0 V	Ignition switch ON
C64-2	BLK	ECM ground for sensor circuit	Ground to body (Fig A)	–0.5 – 0 V	Ignition switch ON
C64-5	GRN/YEL	Condenser cooling fan relay No.2 output	Ground to engine (Fig B)	0 – 1 V	Ignition switch ON, Engine coolant temperature more than 110 °C (230 °F) or A/C request signal low input
				10 – 14 V	Ignition switch ON, Engine coolant temperature under 113 °C (235 °F) or A/C request signal high input
C64-11	PNK/BLK	Magnet clutch relay output	Ground to engine (Fig B)	0 – 1 V	Engine running, A/C request signal low input and engine coolant temperature less than 110 °C (230 °F)
				10 – 14 V	Engine running, A/C request signal high input and engine coolant temperature more than 113 °C (235 °F)
C64-12	PNK	Condenser cooling fan relay No.1 output	Ground to engine (Fig B)	0 – 1 V	Ignition switch ON, Engine coolant temperature more than 110 °C (230 °F) or A/C request signal low input
				10 – 14 V	Ignition switch ON, Engine coolant temperature under 113 °C (235 °F) or A/C request signal high input
C64-15	BRN/WHT	Main relay	Ground to engine (Fig B)	0 – 1 V	Ignition switch ON
				10 – 14 V	Ignition switch OFF
G91-4	BRN	Radiator cooling fan relay output	Ground to engine (Fig B)	0 – 1 V	
				10 – 14 V	
G91-6	BLK/RED	Power supply for engine control	Ground to engine (Fig B)	10 – 14 V	Ignition switch ON
G91-13	YEL	Blower fan switch	Ground to engine (Fig B)	0 – 2 V	Blower fan switch 2nd or 3rd or 4th position with ignition switch ON
				3 – 6 V	Blower fan switch 1st position with ignition switch ON
				10 – 14 V	Blower fan switch OFF position with ignition switch ON
G91-15	WHT/BLK	Evaporator thermistor temp. input	Ground to engine (Fig B)	1.9 – 2.3 V (1940 – 2060 Ω)	Evaporator thermistor temperature at approximately 25 °C (77 °F) with ignition switch ON
				3.3 – 3.8 V (6450 – 6850 Ω)	Evaporator thermistor temperature at approximately 0 °C (32 °F) with ignition switch ON

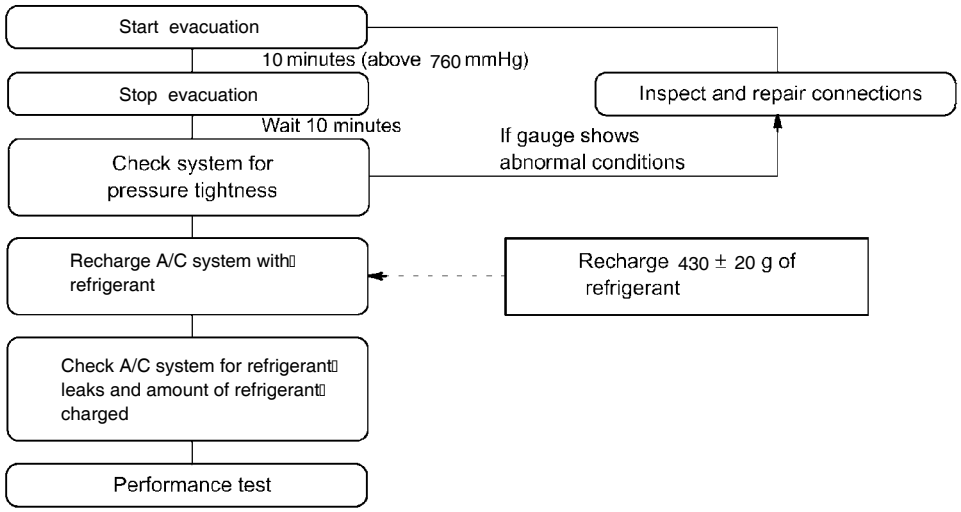
Terminal	Wire	Circuit	Measurement Ground	Normal Value	Condition
G91-30	YEL/GRN	A/C switch input	Ground to engine (Fig B)	0 – 1 V	Blower fan switch and A/C switch ON with ignition switch ON
				10 – 14 V	Blower fan switch and A/C switch OFF with ignition switch ON
G91-35	PNK/BLU	Blower fan speed input	Ground to engine (Fig B)	–0.5 – 0 V	Ignition switch ON

On-Vehicle Service

Operation Procedure for Refrigerant Charge

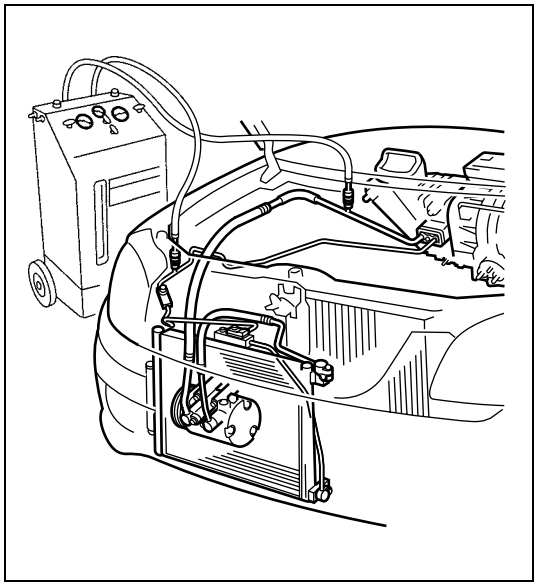
WARNING:

- **Your eyes should not be exposed to refrigerant (liquid).**
  Any liquid HFC-134a (R-134a) escaping by accident shows a temperature as low as approximately –6 °C (21 °F) below freezing point. Should liquid HFC-134a (R-134a) get into your eyes, it may cause a serious injury. To protect your eyes against such accident, it is necessary to always wear goggles. Should it occur that HFC-134a (R-134a) strikes your eyes, consult a doctor immediately.
  - **Do not use your hand to rub the affected eye(s). Instead, use quantities of fresh cold water to splash it over the affected area to gradually raise temperature of such area above freezing point.**
  - **Obtain proper treatment as soon as possible from a doctor or eye specialist.**
- **Should the HFC-134a (R-134a) liquid come into contact with your skin, the affected area should be treated in the same manner as when skin is frostbitten or frozen.**
- **Refrigerant must not be handled near where welding or steam cleaning is performed.**
- **Refrigerant should be kept at a cold and dark place. It should never be stored where a high temperature is anticipated, e.g. where exposed to direct sun light, close to fire or inside vehicle (including trunk room).**
- **Avoid breathing fumes produced when HFC-134a (R-134a) is burned. Such fumes may be hazardous to health.**



Recovery

REFRIGERANT RECOVERY

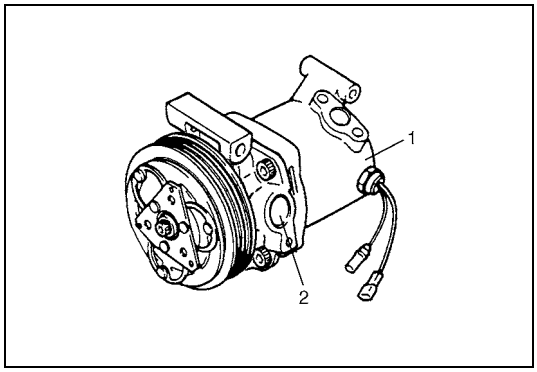


When discharging refrigerant out of A/C system, always recover it by using refrigerant recovery and recycling equipment because discharging refrigerant HFC-134a (R-134a) into atmosphere would cause adverse effect to environments.

NOTE:

- **After recovering refrigerant from system, the amount of removed compressor oil must be measured for replenishing compressor oil.**
- **When handling recovery and recycling equipment, be sure to follow the instruction manual for the equipment.**

Replenishing compressor oil



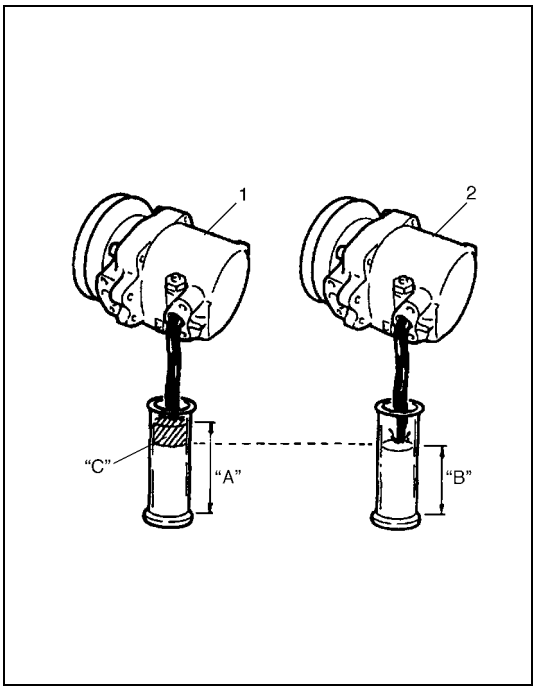
It is necessary to replenish specified amount of compressor oil to compressor (1) from compressor suction side hole (2) before evacuating and charging refrigerant.

WHEN CHARGING REFRIGERANT ONLY

When charging refrigerant without replacing any component part, replenish the same amount of measured oil when recovering refrigerant (if not measured, replenish 30 cc oil).

WHEN REPLACING COMPRESSOR

CAUTION:
Be sure to use P/N: 99000-99085-00A compressor oil or an equivalent compressor oil.



Compressor oil is sealed in each new compressor by the amount required for A/C system. Therefore, when using a new compressor for replacement, drain oil from it by the amount calculated as follows.

"C" = "A" – "B"
"C": Amount of oil to be drained
"A": Amount of oil sealed in a new compressor
"B": Amount of oil remaining in removed compressor

NOTE:
Compressor assembly supplied from factory is filled up with the following amount of oil.

Oil amount in compressor
90 ± 10 cm^3 (90 ± 10 cc, 5.49 ± 0.61 in^3)

1. New compressor
2. Removed compressor

When replacing other part

Replenish the following amount of oil to compressor.

Amount of compressor oil to be replenished

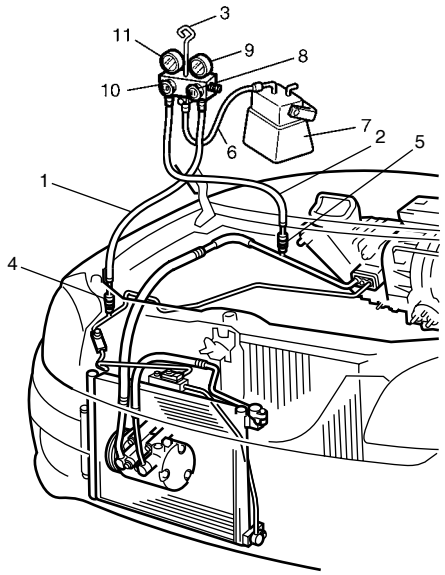
Replaced part	Amount of compressor oil
Evaporator	25 cm^3 (25 cc, 1.53 in^3)
Condenser	15 cm^3 (15 cc, 0.92 in^3)
Dryer	20 cm^3 (20 cc, 1.22 in^3)
Hoses	10 cm^3 (10 cc, 0.61 in^3) each
Pipes	10 cm^3 (10 cc, 0.61 in^3) each

Evacuation of A/C system

EVACUATING PROCEDURE

CAUTION:
Do not evacuate before recovering refrigerant in system.

NOTE:
Once air conditioning system circuit is opened (exposed) to atmospheric air, system must be evacuated by using a vacuum pump. The system should be attached with a manifold gauge set, and should be evacuated for approximately 15 minutes.



1) Connect high charging hose (1) and low charging hose (2) of manifold gauge set (3) respectively as follows:
   High charging hose (1) → High pressure charging valve (4) on condenser outlet pipe.
   Low charging hose (2) → Low pressure charging valve (5) on suction pipe.
2) Attach center charging hose (6) of manifold gauge set (3) to vacuum pump (7).
3) Operate vacuum pump (7), and then open discharge side valve (Hi) (8) of manifold gauge set (3).
   If there is no blockage in the system, there will be an indication on high pressure gauge (9).
   In this case, open the other side valve (Lo) (10) of the set and repair the system.
4) Approximately 10 minutes later, low pressure gauge (11) should show a vacuum lower than –760 mmHg providing no leakage exists.

NOTE:

- **If the system does not show a vacuum below –760 mmHg, close both valves, stop vacuum pump and watch movement of low pressure gauge.**
- **Increase in the gauge reading suggests existence of leakage. In this case, repair the system before continuing its evacuation.**
- **If the gauge shows a stable reading (suggesting no leakage), continue evacuation.**

5) Evacuation should be carried out for a total of at least 15 minutes.
6) Continue evacuation until low pressure gauge (11) indicates a vacuum less than –760 mmHg, and then close both valves (8), (10).
7) Stop vacuum pump (7). Disconnect center charging hose (6) from pump inlet. Now, the system is ready for charging refrigerant.

A/C system check for pressure leaks

After completing the evacuation, close manifold gauge high pressure valve and low pressure valve and wait 10 minutes. Verify that low pressure gauge reading has not changed.

CAUTION:

If the gauge reading moves closer to "0", there is a leak somewhere. Inspect the tubing connections, make necessary corrections, and evacuate system once again, making sure that there are no leaks.

Charge

CAUTION:

- **Always charge through low pressure side of A/C system at after the initial charging is performed from the high pressure side with the engine stopped.**
- **Never charge to high pressure side of A/C system with engine running.**
- **Do not charge while compressor is hot.**
- **When installing tap valve to refrigerant container to make a hole there through, carefully follow directions given by manufacturer.**
- **A pressure gauge should always be used before and during charging.**
- **The refrigerant container should be emptied of refrigerant when discarding it.**
- **The refrigerant container should not be heated up to 40 °C (104 °F) or over.**
- **Refrigerant container should not be reversed in direction during charging. Reversing in direction causes liquid refrigerant to enter compressor, causing troubles, such as compression of liquid refrigerant and the like.**

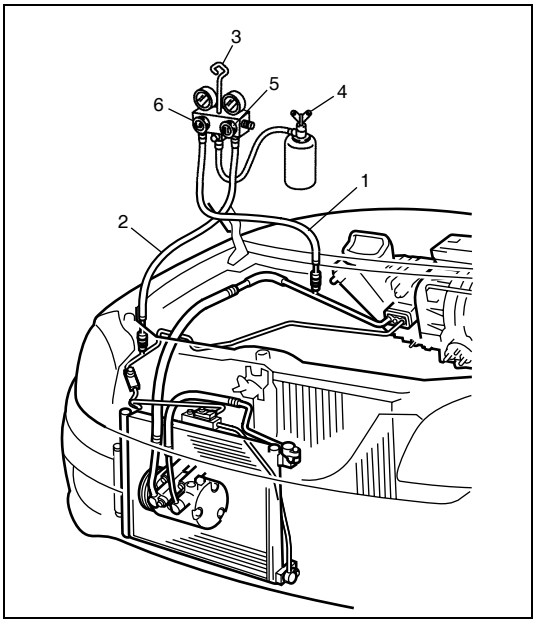
NOTE:

The air conditioning system contains HFC-134a (R-134a).
Described here is a method to charge the air conditioning system with refrigerant from the refrigerant service container. When charging refrigerant by using the refrigerant and recycling equipment (when recycling refrigerant), follow the procedure described in the equipment manufacturer's instruction manual.

CHARGING PROCEDURE

The initial charge of the A/C system is performed from the high pressure side with the engine stopped. And next, this method must be followed by charging from the low pressure side with the engine running.

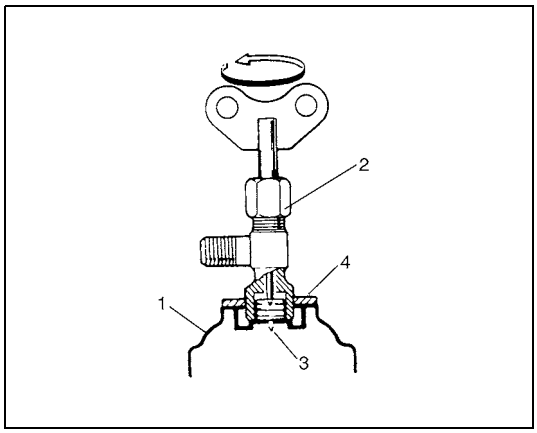
1) Check if hoses are routed properly after evacuating the system.



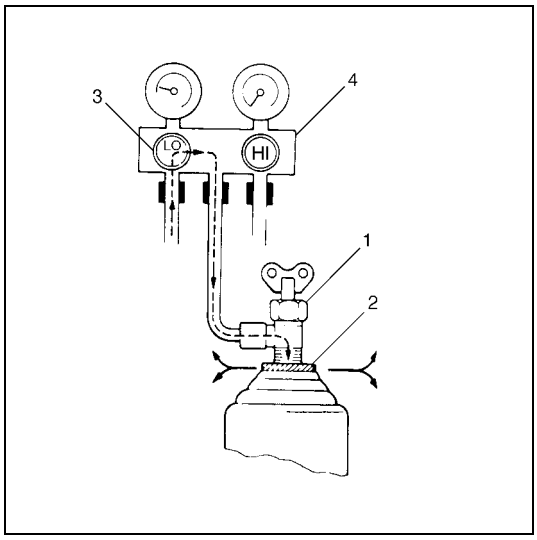
2) Connect low charging hose (1) and high charging hose (2) of the manifold gauge set (3) in position. Then, open refrigerant container valve (4) to purge the charging line.
3) Open the high pressure side valve (5) and charge refrigerant to system.
4) After a while, open the low pressure side valve (6) and close the high pressure side valve (5).

WARNING:
Make sure that high pressure side valve is closed securely.

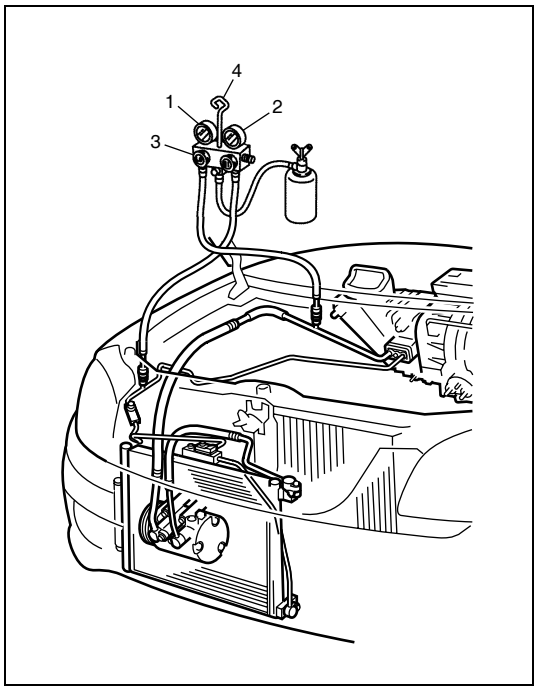
5) Start engine and keep engine speed at 1500 r/min. Then, operate air conditioning.
6) Charge A/C system with refrigerant in vapor state. At this time, refrigerant container (4) should be held upright.



7) When refrigerant container (1) is emptied, use the following procedure to replace it with a new refrigerant container (1).
   a) Close low pressure valve.
   b) Replace empty container (1) with a refrigerant container which has been charged with refrigerant. When using refrigerant container tap valve (2), use the following procedure for replacement.
      i) Retract needle (3) and remove refrigerant container tap valve (2) by loosening its plate nut (4).
      ii) Install previously-removed refrigerant container tap valve (2) to a new refrigerant container (1).



   c) Purge any air existing in center charging hose
      When using refrigerant container tap valve, use the following procedure to purge air.
      i) Once fully tighten refrigerant container tap valve (1), and then loosen (open) plate nut (2) slightly.
      ii) Open low pressure side valve (3) of manifold gauge set (4) a little.
      iii) As soon as refrigerant comes out with a “hiss” through a clearance between refrigerant container and tap valve, tighten plate nut (2) as well as low pressure side valve (3).
      iv) Turn handle of tap valve (1) clockwise so that its needle is screwed into the new container to make a hole for refrigerant flow.



8) After the system has been charged with specified amount (430 ± 20 g) of refrigerant or when low pressure gauge (1) and high pressure gauge (2) have indicated the following specified value, close low pressure side valve (3) on manifold gauge set (4).

Low side and high side pressure example

Gauges should read as follows when ambient temperature is 30 °C (86 °F).	
Pressure on high pressure gauge	**1400 – 1750 kPa** **14.0 – 17.5 kg/cm^2** **199.1 – 248.9 psi**
Pressure on low pressure gauge	**230 – 350 kPa** **2.3 – 3.5 kg/cm^2** **32.7 – 49.8 psi**

Removing manifold gauge set

WARNING:
High pressure side is naturally under high pressure. So, care must be used to protect your eyes and skin.

When A/C system has been charged with a specified amount of refrigerant, remove manifold gauge set as follows:

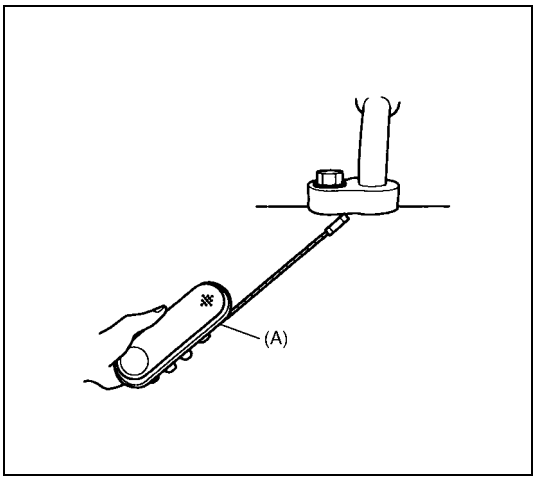
1) Close low pressure side valve of manifold gauge set. (The high pressure side valve is closed continuously during the process of charging.)
2) Close refrigerant container valve.
3) Stop engine.
4) Using shop rag, remove charging hoses from service valves. This operation must be performed rapidly.
5) Put caps on service valves.

Leak test

Whenever a refrigerant leak is suspected in the system or any service operation has been performed which may result in disturbing lines or connections, it is advisable to test for leaks.
Common sense should be used in performing any refrigerant leak test, since the need and extent of any such test will, in general, depend upon the nature of a complaint and the type of a service performed on the system.

LIQUID LEAK DETECTORS

WARNING:
- **To prevent explosions or fires, make sure that there are no flammables in the vicinity.**
- **When exposed to fire, the refrigerant turns into a poisonous gas (phosgene). Do not inhale this gas.**



There are a number of fittings and places throughout the air conditioning system where a liquid leak detector solution may be used to pinpoint refrigerant leaks.
By merely applying the solution to the area in question with a swab, such as attached to the cap of a vial, bubbles will form within seconds if there is a leak.
For confined areas, such as sections of the evaporator and condenser, an electronic (refrigerant) leak detector is more practical for determining leaks.

Special tool
(A): 09990 - 86011

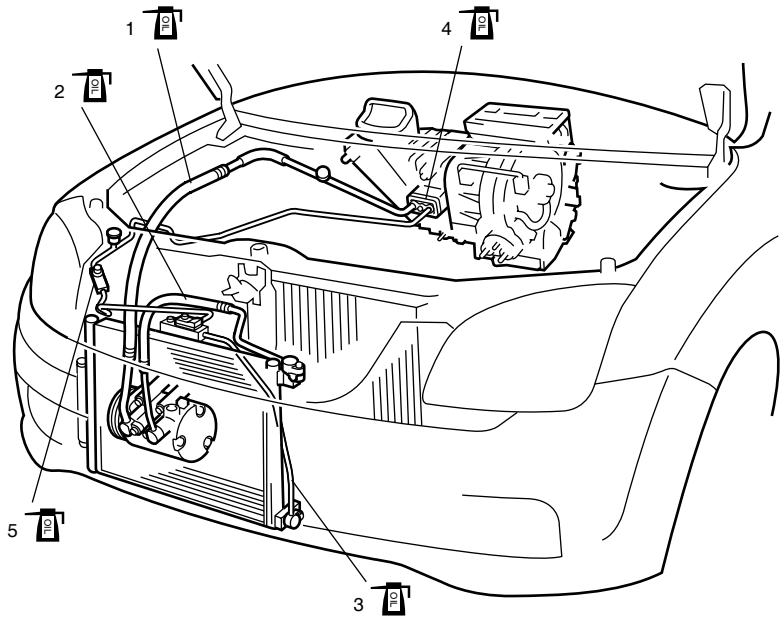
Precautions on Servicing A/C System

WARNING:

Should refrigerant HFC-134a (R-134a) strike your eye(s), consult a doctor immediately.

- **Do not use your hand to rub affected eye(s). Instead, use quantities of fresh cold water to splash it over affected area to thus gradually raise its temperature above the freezing point.**
- **Obtain proper treatment as soon as possible from a doctor or eye specialist. Should liquid refrigerant HFC-134a (R-134a) get on your skin, such affected part should be treated in the same manner as when skin is frostbitten or frozen.**

Refrigerant line



1. Suction hose: Apply compressor oil (refrigerant oil) to O-ring.	4. Expansion valve: Apply compressor oil (refrigerant oil) to O-ring.
2. Discharge hose: Apply compressor oil (refrigerant oil) to O-ring.	5. A/C refrigerant pressure switch: Apply compressor oil (refrigerant oil) to O-ring.
3. Condenser outlet pipe: Apply compressor oil (refrigerant oil) to O-ring.	

- Never use heat for bending pipes. When bending a pipe, try to make its bending angle as smooth as possible.
- Keep internal parts of air conditioning free from moisture and dirt. When disconnecting any line from system, install a blind plug or cap to the fitting immediately.
- When connecting hoses and pipes, apply a few drops of compressor oil (refrigerant oil) to seats of coupling nuts and O-ring.
- When tightening or loosening a fitting, use two wrenches, one for turning and the other for support.
- Route drain hose so that drained water does not make any contact to vehicle components.
- If pipes or hoses are replaced, replenish specified amount of compressor oil to compressor suction side by referring to “Replenishing compressor oil” under “Operation Procedure for Refrigerant Charge” in this section.
- Tighten flared nuts by the following specified torque.

Tightening torque
8 mm pipe: 13 N·m (1.3 kg-m, 9.5 lb-ft)
12 mm pipe: 23 N·m (2.3 kg-m, 16.6 lb-ft)
14.5 mm pipe: 33 N·m (3.3 kg-m, 23.8 lb-ft)

Handling refrigerant HFC-134a (R-134a)

- Always wear goggles to protect your eyes.
- Avoid you direct contact to liquid refrigerant.
- Do not heat refrigerant container higher than 40 °C (104 °F).
- Do not discharge refrigerant into atmosphere.
- Do not allow liquid refrigerant to touch bright metals. Refrigerant combined with moisture is corrosive and will tarnish surfaces of bright metals including chrome.

Refrigerant recovery

When discharging refrigerant out of A/C system, always recover it by using refrigerant recovery and recycling equipment. Discharging refrigerant HFC-134a (R-134a) into atmosphere would cause adverse effect to environments.

Refrigerant charge

After perform replenishing compressor oil and evacuating, charge a proper amount of refrigerant to A/C system referring to “Charge” under “Operation Procedure for Refrigerant Charge” in this section.

CAUTION:
Do not perform an additional refrigerant charging to A/C system. This cause it to overcharge.

Condenser Assembly On-Vehicle Inspection

Check the following.

- Clog of condenser fins.
  If, any clogs are found, condenser fins should be washed with water, and should be dried with compressed air.
- Condenser fins for leakage and breakage.
  If any defects are found, repair or replace condenser.
- Condenser fittings for leakage.
  If any defects are found, repair or replace condenser.

Condenser Assembly Removal and Installation

CAUTION:
Be careful not to damage condenser fins. If condenser fin is bent, straighten it by using flat head screwdriver or pair of pliers.

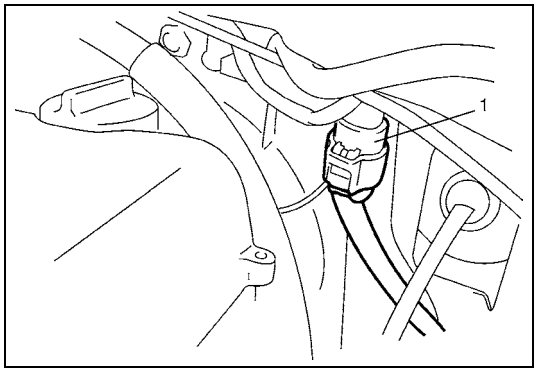
REMOVAL

1) Disconnect negative (–) cable at battery.
2) Recover refrigerant from A/C system by referring to “Recovery” under “Operation Procedure for Refrigerant Charge” in this section.

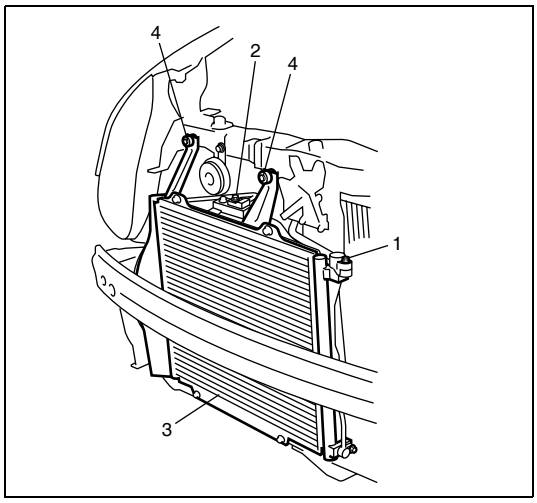
NOTE:

The amount of removed compressor oil must be measured for replenishing compressor oil.

3) Remove front bumper referring to “Front Bumper and Rear Bumper Removal and Installation” in Section 9.



4) Disconnect condenser cooling fan motor coupler (1).



5) Disconnect discharge hose (1) and liquid pipe (2) from condenser assembly (3).
6) Remove condenser assembly mounting bolts (4).
7) Remove condenser assembly (3).

INSTALLATION

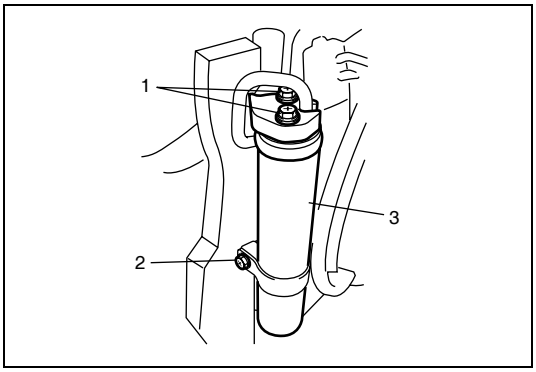
Reverse removal procedure to install condenser noting the following instructions.

- Replenish specified amount of compressor oil to compressor suction side by referring to “Replenishing compressor oil” under “Operation Procedure for Refrigerant Charge” in this section.
- Evacuate and charge refrigerant by referring to “Evacuation of A/C system” and “Charge” under “Operation Procedure for Refrigerant Charge” in this section.

Receiver / Dryer Removal and Installation

REMOVAL

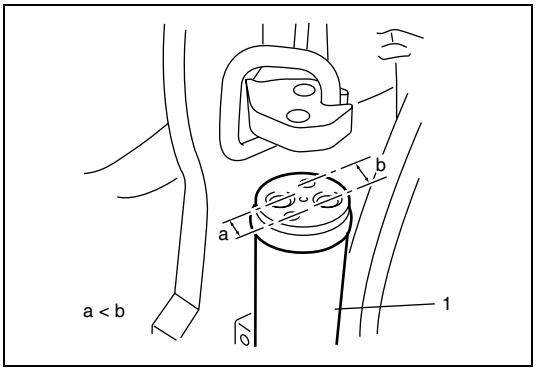
1) Remove condenser assembly referring to “Condenser Assembly Removal and Installation” in this section.



2) Loosen receiver / dryer attachment bolts (1), (2).
3) Remove receiver / dryer (3).

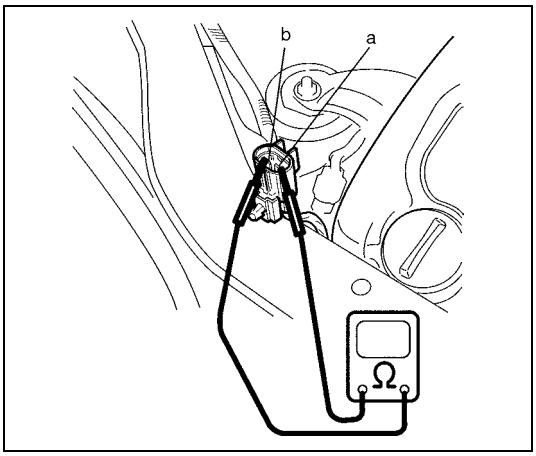
INSTALLATION

Reverse removal procedure to install receiver / dryer noting the following instructions.

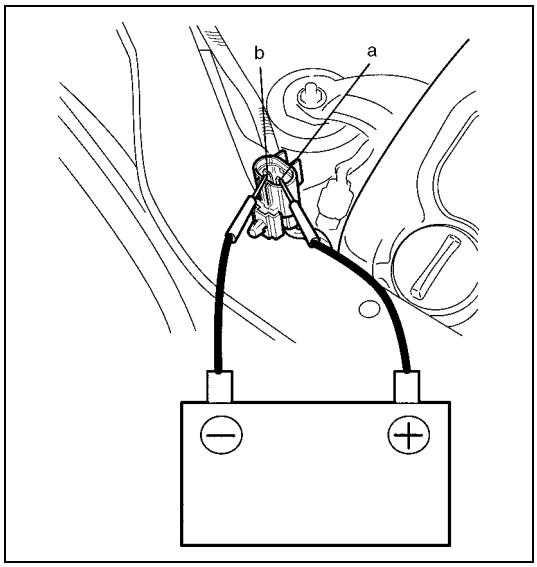


- Replenish specified amount of compressor oil to compressor suction side by referring to “Replenishing compressor oil” under “Operation Procedure for Refrigerant Charge” in this section.
- Be sure to install receiver / dryer (1) to proper direction as shown.
- Evacuate and charge refrigerant by referring to “Evacuation of A/C system” and “Charge” under “Operation Procedure for Refrigerant Charge” in this section.

Condenser Cooling Fan Motor On-Vehicle Inspection



1) Check condenser cooling fan motor for continuity between terminal “a” and “b” as shown.
   If there is no continuity, replace condenser cooling fan motor.



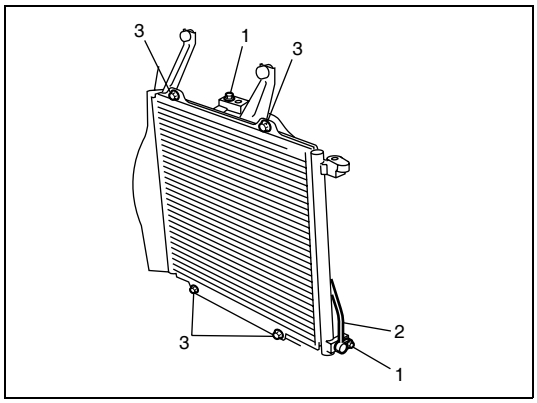
2) Connect battery to condenser cooling fan motor terminal “a” and “b” as shown in figure, then check that the condenser cooling fan motor operates smoothly.

Reference:
Condenser cooling fan specified current at 12 V
8 A maximum.

3) Check condenser cooling fan blade for damage. If any malfunction is found replace condenser cooling fan.

Condenser Cooling Fan Assembly Removal and Installation

REMOVAL



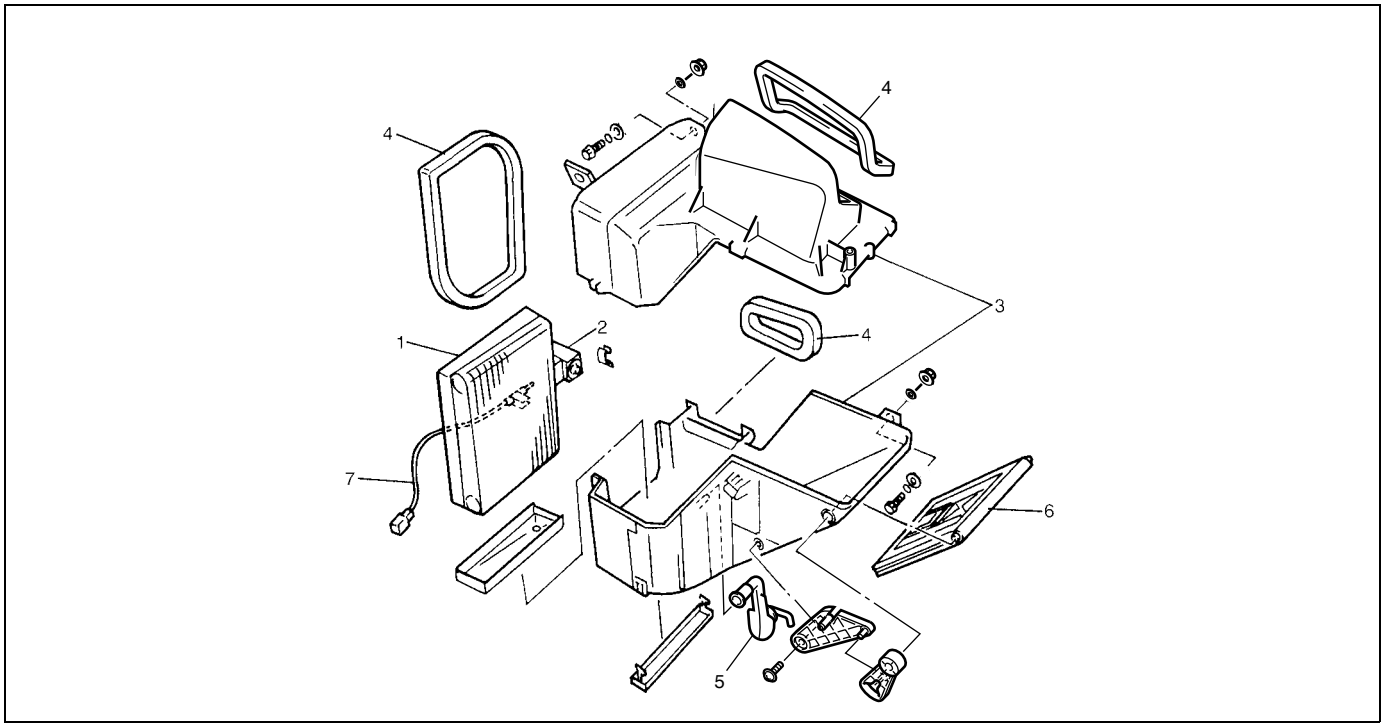
1) Remove condenser assembly referring to “Condenser Assembly Removal and Installation” in this section.
2) Remove condenser outlet pipe mounting bolts (1) and condenser outlet pipe (2).
3) Remove condenser cooling fan assembly mounting bolts (3).
4) Remove condenser cooling fan assembly from condenser.

INSTALLATION

Reverse removal procedure to install condenser cooling fan motor nothing the following instructions.

- Replenish specified amount of compressor oil to compressor suction side by referring to “Replenishing compressor oil” under “Operation Procedure for Refrigerant Charge” in this section.
- Evacuate and charge refrigerant by referring to “Evacuation of A/C system” and “Charge” under “Operation Procedure for Refrigerant Charge” in this section.

Cooling Unit (Evaporator) Components

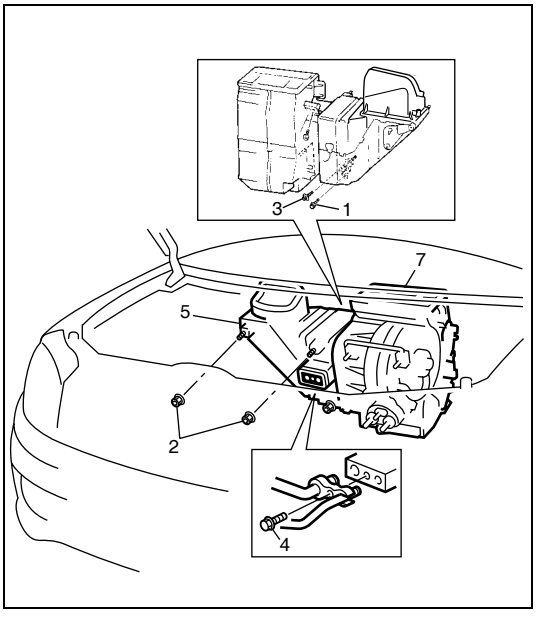


1. Evaporator	3. Evaporator case	5. Drain hose	7. Evaporator temperature sensor
2. Expansion valve	4. Packing	6. Air inlet door	

Cooling Unit (Evaporator) Removal and Installation

REMOVAL

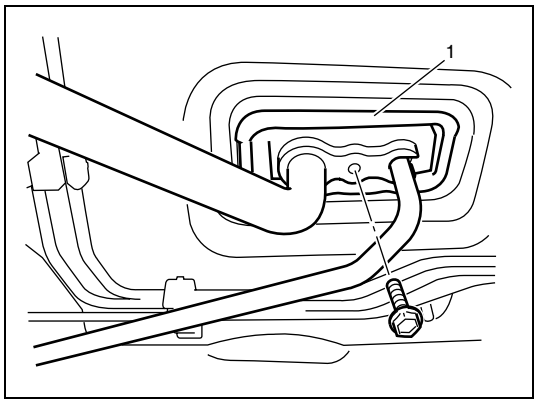
1) Disconnect negative (–) cable at battery.
2) If equipped with air bag system, disable air bag system referring to “Disabling air bag system” in Section 10B.
3) Recover refrigerant from refrigeration system by using recovery and recycling equipment referring to “Operation Procedure for Refrigerant Charge” in this section.
4) Remove heater control cable, main harness clamp.
5) Loosen suction hose & liquid pipe bolt (4).
6) Loosen cooling unit bolt (1), nut (2) and screw (3) as shown in figure.
7) Remove cooling unit (5).



INSTALLATION

Reverse removal sequence to install cooling unit, noting the following points.

- If cooling unit or evaporator is replaced, pour 25 cc of refrigerating oil to compressor suction-side.



- Install uniformly the padding (1) to installation hole.
- Evacuate and charge system according to previously described procedure.
- Adjust heater control cable, referring to “Heater Control Lever Assembly Removal and Installation” in Section 1A.
- Enable air bag system, if equipped.

Cooling Unit (Evaporator) Inspection

- Clog of A/C evaporator fins
  If any clogs are found, A/C evaporator fins should be washed with water and should be dried with compressed air.
- A/C evaporator fins for leakage and breakage
  If any defects are found, repair or replace A/C evaporator.
- A/C evaporator fittings for leakage
  If any defects are found, repair or replace A/C evaporator.

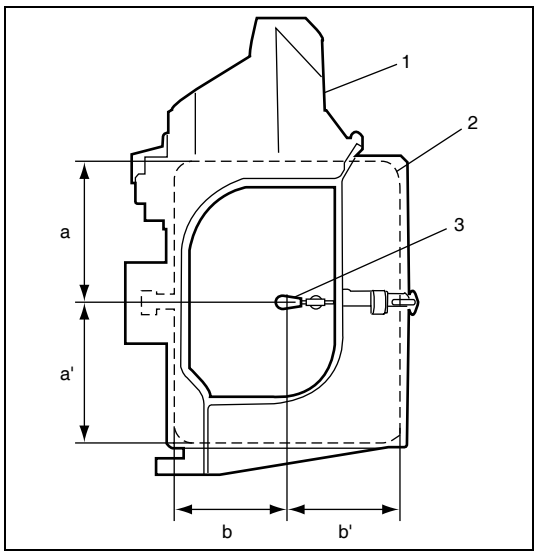
Evaporator Thermistor (Evaporator Temperature Sensor) Removal and Installation

REMOVAL

1) Remove evaporator referring to “Cooling Unit (Evaporator) Removal and Installation” in this section.
2) Remove evaporator thermistor.

INSTALLATION

Reverse removal sequence to install cooling unit, noting the following points.



Install Evaporator thermistor (Evaporator temperature sensor) (3) to its original position. When its original position is not sure, install to the center of evaporator referring to figure.

1.	Cooling unit
2.	Evaporator
	a = a’
	b = b’

Evaporator Thermistor (Evaporator Temperature Sensor) Inspection

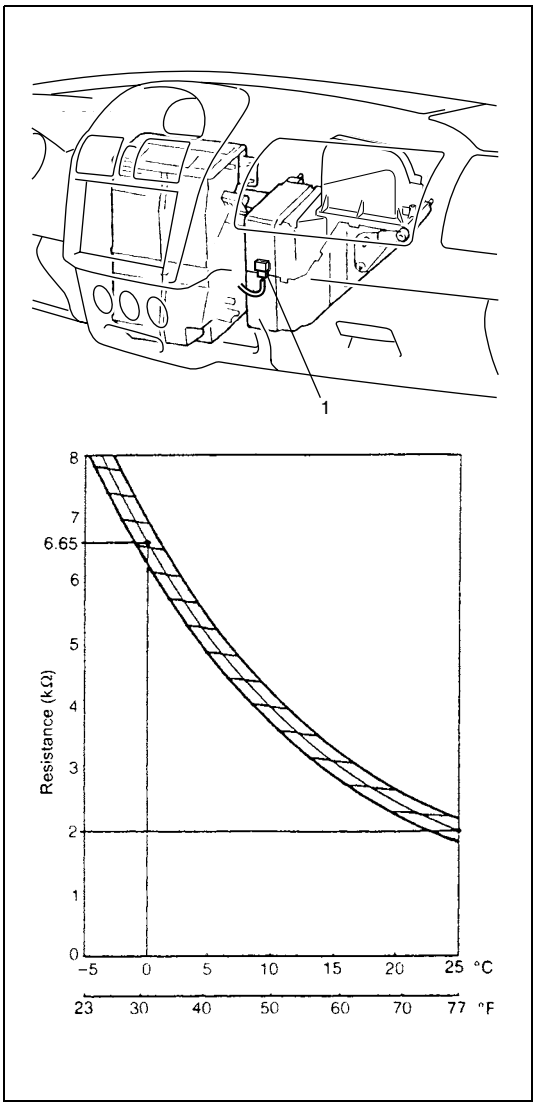
Check resistance between terminals for evaporator thermistor (1). If check results are as not specified, replace evaporator thermistor.

Evaporator thermistor resistance

Sensor Temperature (°C(°F))	Resistance (kΩ)
0 (32)	6.5 – 6.8
25 (77)	1.9 – 2.1

NOTE:

When the evaporator thermistor removed, its should be reinstalled in original position.



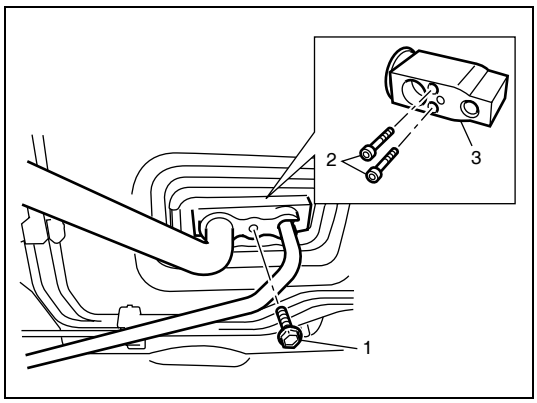
Expansion Valve Inspection

Refer to “A/C System Performance Inspection” earlier in this section.

Expansion Valve Removal and Installation

REMOVAL

1) Recover refrigerant from refrigeration system by using recovery and recycling equipment referring to “Operation Procedure for Refrigerant Charge” in this section.



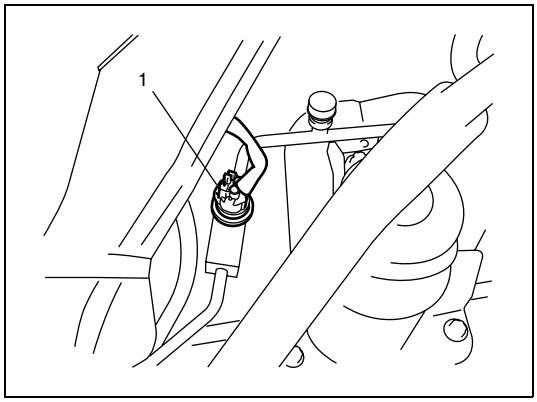
2) Loosen liquid pipe mounting bolt (1).
3) Loosen expansion attaching bolt (2) and remove expansion valve (3).

INSTALLATION

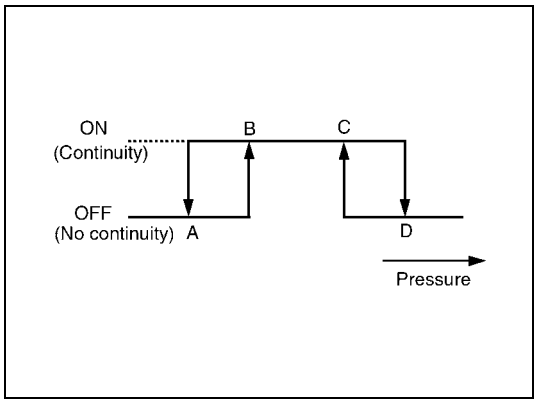
Reverse removal procedure for installation, noting the following points.

- Apply compressor oil to expansion valve O-ring and connecting hose and pipe O-ring.
- Evacuate and charge system according to previously described procedure.

Dual Pressure Switch Inspection



1) Check dual pressure switch (1) for continuity at normal temperature (approx. 25 °C (77 °F)) when A/C system has a proper charge of refrigerant and A/C system (compressor) is under operation. In each of these cases, switch should show proper continuity.



2) Check continuity between high and low pressure switch terminals at specified pressure as shown.

High and low pressure switch specification
A: Approximately 200 KPa (2.0 kg/cm^2, 28.5 psi)
B: Approximately 230 KPa (2.3 kg/cm^2, 32.5 psi)
C: Approximately 2600 KPa (26 kg/cm^2, 370 psi)
D: Approximately 3200 KPa (32 kg/cm^2, 455 psi)

Dual Pressure Switch Removal and Installation

REMOVAL

1) Recover refrigerant from refrigeration system by using recovery and recycling equipment referring to “Operation Procedure for Refrigerant Charge” in this section.
2) Disconnect negative (–) cable at battery.
3) Remove dual pressure switch.

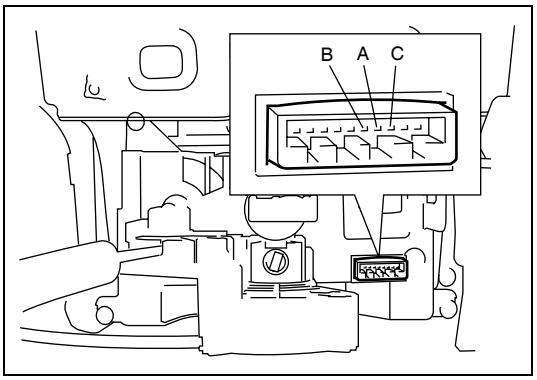
INSTALLATION

Reverse removal procedure for installation, noting the following points.

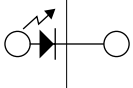
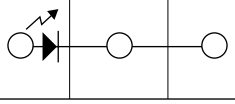
- Apply compressor oil to dual pressure switch O-ring.
- Evacuate and charge system according to previously described procedure.

Tightening torque
Pressure sensor: 11 N·m (1.1 kg-m, 8.0 lb-ft)

A/C Switch Inspection



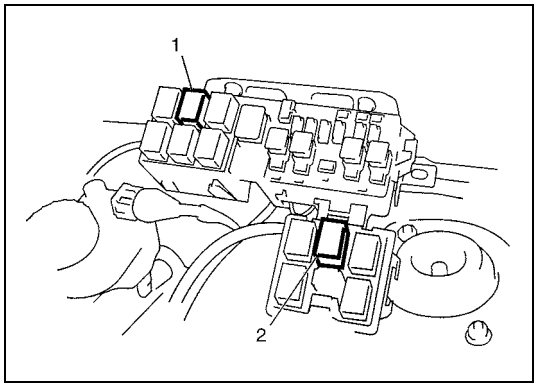
Check for continuity between terminals at each switch position by referring to the table below.
If continuity is not indicated as specified below, replace.

TERMINAL / POSITION	A	B	C
OFF [a]			
ON [b]			

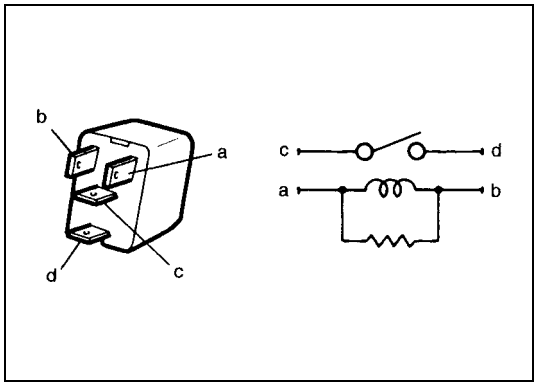
[a]: Switch button released
[b]: Switch button kept in push

Condenser Cooling Fan Relay (No.1 and No.2) Inspection

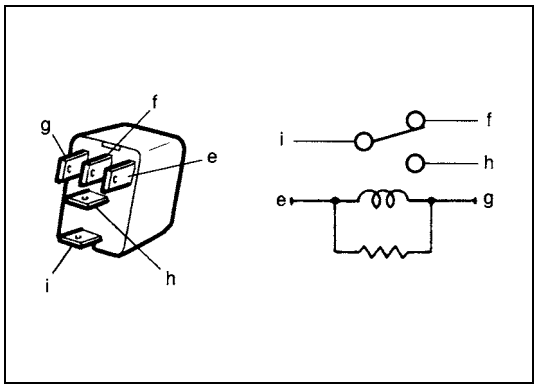
1) Disconnect negative cable at battery.



2) Remove condenser cooling fan relay No.1 (1) and No.2 (2) from relay box.

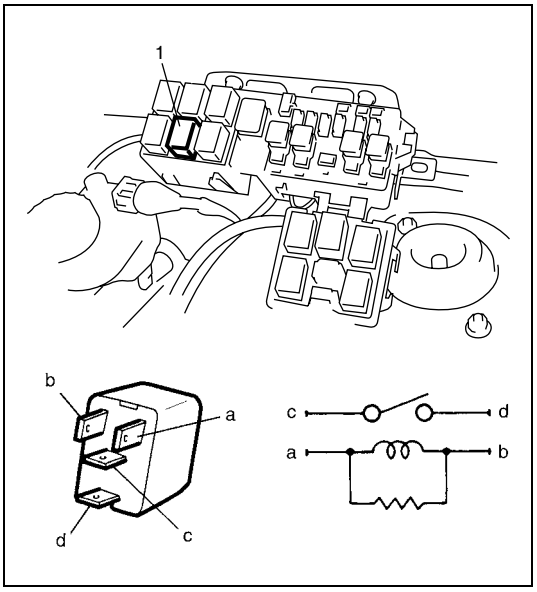


3) Check condenser cooling fan relay No.1.
   a) Check that there is no continuity between terminal “c” and “d”.
      If there is continuity, replace relay.
   b) Connect battery positive (+) terminal to terminal “b” of relay.
      Connect battery negative (–) terminal “a” of relay.
      Check continuity between terminal “c” and “d”.
      If there is no continuity when relay is connected to the battery, replace relay.



4) Check condenser cooling fan relay No.2.
   a) Check that there is continuity between terminal “i” and “f”.
      If there is no continuity, replace relay.
   b) Check that there is no continuity between terminal “i” and “h”.
      If there is continuity, replace relay.
   c) Connect battery positive (+) terminal to terminal “e” of relay.
      Connect battery negative (–) terminal “g” of relay.
      Check if there is no continuity between terminal “i” and “f”.
      If there is continuity when relay is connected to the battery, replace relay.
      Check if there is continuity between terminal “i” and “h”.
      If there is no continuity when relay is connected to the battery, replace relay.

Compressor Relay Inspection

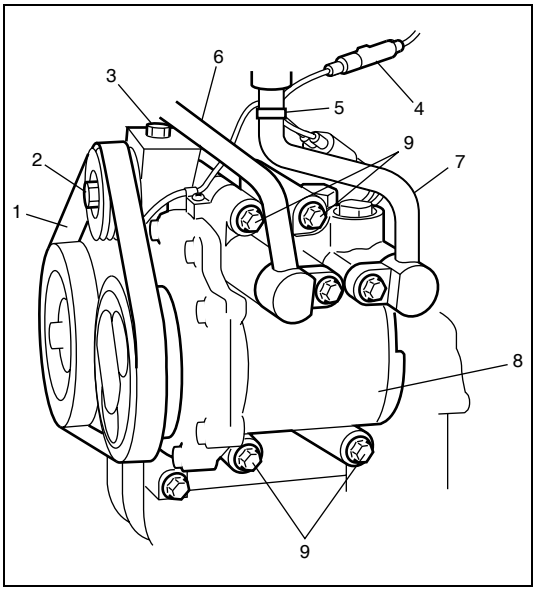


1) Disconnect negative (–) cable at battery.
2) Remove compressor relay (1) from main fuse box.
3) Check that there is no continuity between terminal “c” and “d”. If there is continuity, replace relay.
4) Connect battery positive (+) terminal to terminal “b” of relay.
   Connect battery negative (–) terminal “a” of relay.
   Check for continuity between terminal “c” and “d”.
   If there is no continuity when relay is connected to the battery, replace relay.

Compressor Assembly Removal and Installation

REMOVAL

1) Run engine at idle speed with air conditioning ON for 10 minutes. After that stop the engine.
2) Disconnect negative (–) cable at battery.
3) Remove front bumper by referring to “Front Bumper and Rear Bumper Removal and Installation” in Section 9.
4) Remove condenser assembly referring to “Condenser Assembly Removal and Installation” in this section.



5) Remove compressor drive belt (1) by loosening tension pulley nut (2) and adjusting bolt (3).
6) Disconnect magnet clutch lead wire coupler (4).
7) Remove magnet clutch lead clamp (5).
8) Disconnect suction pipe (6) and discharge hose (7) from compressor (8).

NOTE:

Cap open fittings immediately to keep moisture out of system.

9) Remove compressor mounting bolts (9), and then remove compressor (8) from its bracket.

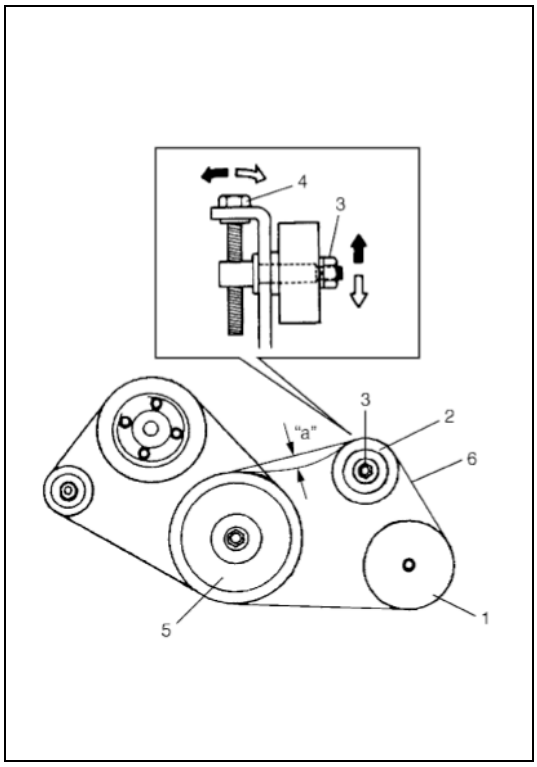
INSTALLATION

Reverse removal procedure to install compressor noting the following instructions.

- If compressor is replaced, pour new compressor oil by referring to “Replenishing compressor oil” under “Operation Procedure for Refrigerant Charge” in this section.
- Evacuate and charge system by referring to “Recovery” under “Operation Procedure for Refrigerant Charge” in this section.
- Adjust drive belt tension by referring to “Compressor Drive Belt Inspection and Adjustment” in this section.

Compressor Drive Belt Inspection and Adjustment

INSPECTION



- Check compressor drive belt (6) for wear and cracks, and replace as required.
- Check compressor drive belt (6) tension by measuring how much it deflects when pushed at intermediate point between tension pulley (2) and crank pulley (5) with about 100 N (10 kg) force after crankshaft pulley 1 rotating.
  If belt tension is without specification, adjust belt tension referring to procedures below.

Compressor drive belt tension
“a”: 3 – 5 mm (0.12 – 0.20 in.)
New compressor drive belt tension
“a”: 2 – 4 mm (0.08 – 0.16 in.)

ADJUSTMENT

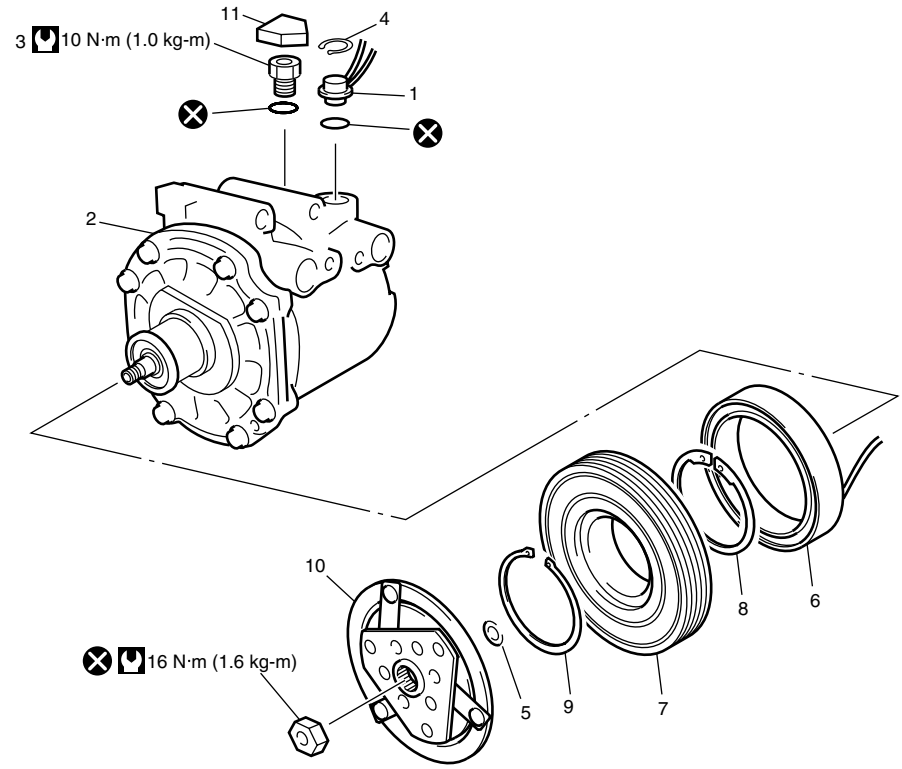
1) Loosen tension pulley nut (3).
2) Adjust belt tension by tighten or loosen tension pulley adjusting bolt (4).
3) Tighten tension pulley nut (3).
4) Turn the crank pulley (5) 1 revolution, then check belt tension.

Compressor Drive Belt Replacement

REPLACEMENT

1) Loosen tension pulley nut.
2) Loosen belt tension by loosen tension pulley adjusting bolt.
3) Remove compressor drive belt.
4) Install new compressor drive belt.
5) Adjust belt tension referring to above procedure.

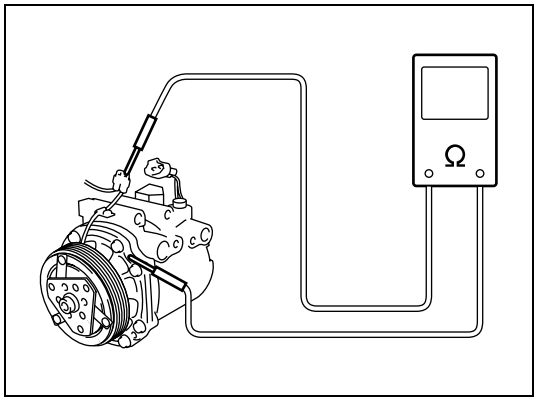
Compressor Assembly Components



1. Thermal switch	5. Shim	9. Circlip	Tightening torque
2. Compressor	6. Magnet clutch coil	10. Armature	Do not use.
3. Relief valve	7. Magnet clutch pulley	11. Cap	
4. Circlip	8. Circlip		

Magnet Clutch Inspection

- Check armature plate and magnet clutch pulley for wear and oil soaked conditions respectively.
- Check magnet clutch pulley bearing for noise, wear and grease leakage.



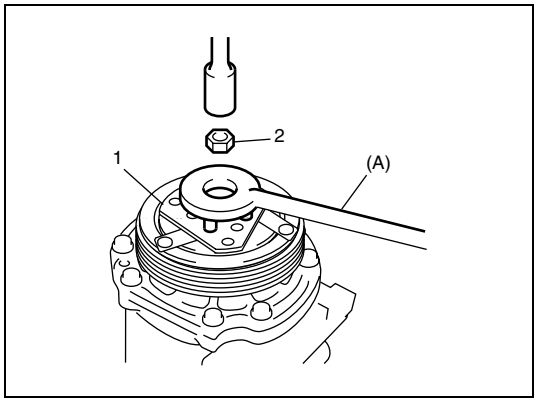
- Measure magnet clutch coil for resistance at 20 °C (68 °F).
  If the measured resistance does not remain within above tolerance, replace magnet clutch assembly.

Standard Resistance: 4.0 – 4.4 Ω

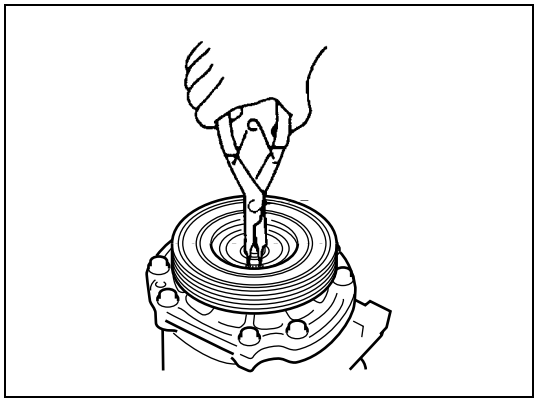
Magnet Clutch Removal and Installation

REMOVAL

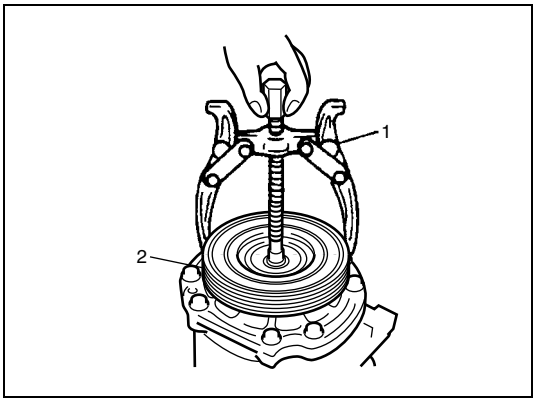
1) Remove compressor from vehicle referring to “Compressor Assembly Removal and Installation” in this section.



2) Fix armature plate (1) with special tool (A) and remove armature plate nut (2).
   Special tool
   (A): 09920–55810
3) Remove armature plate (1).



4) Remove shims from shaft.
5) Remove circlip.



6) Remove magnet clutch pulley (2).

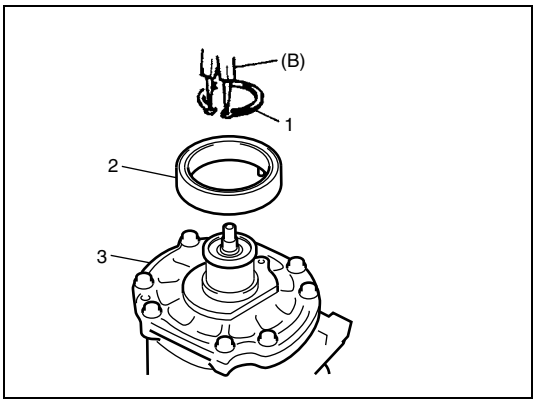
NOTE:

If it is difficult to remove magnet clutch pulley by hand, use puller (1).

CAUTION:

When using puller, turn the center bolt of puller by hand. Otherwise, magnet clutch pulley might be distorted.

7) Disconnect magnet clutch lead wire coupler and removal magnet clutch lead wire clamp.

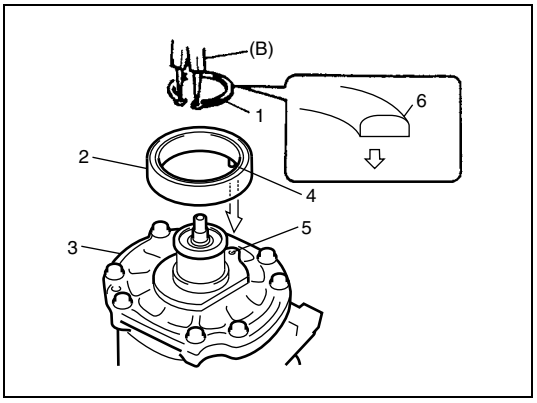


8) Remove circlip (1) by using special tool.

Special tool
(B):09900–06107

9) Remove magnet clutch coil (2) from compressor (3).

INSTALLATION

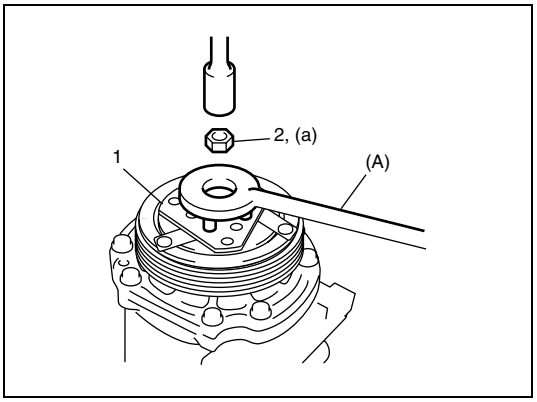


1) Install magnet clutch coil (2) fitting protrusion (4) of magnet clutch coil into hole (5) of compressor case (3).
2) Install circlip (1) directing chamfer side (6) upward.

Special tool
(B):09900–06107

3) Connect magnet clutch lead wire coupler and install magnet clutch lead wire clamp.

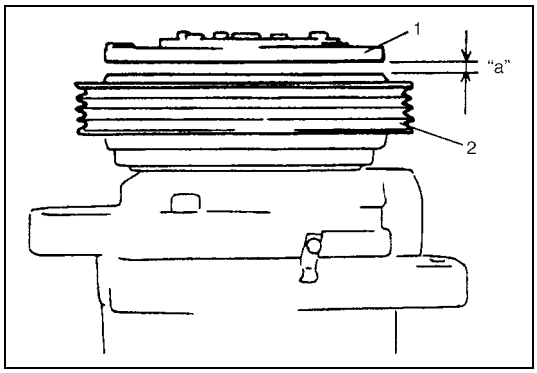
4) Install magnet clutch pulley (1) and circlip.



5) Tighten new armature plate nut (2) as specified below.

Tightening t que
Clutch plate nut (a): 16 N·m (1.6 kg-m, 11.5 lb-ft)

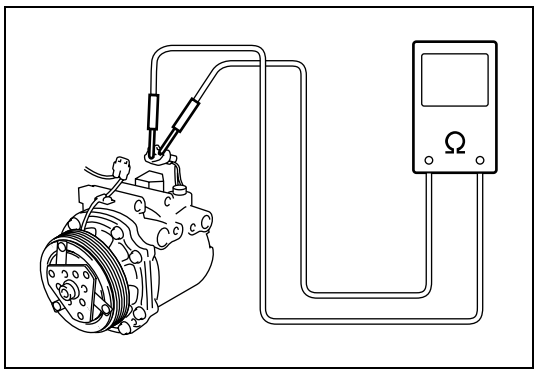
Special tool
(A): 09920-55810



6) Check clearance between armature plate (1) and magnet clutch pulley (2).
   If the clearance comes off the standard clearance, adjust the clearance by putting shim(s) on compressor shaft.

Standard clearance "a": 0.25 – 0.5 mm (0.010 – 0.019 in)

Thermal Switch Inspection



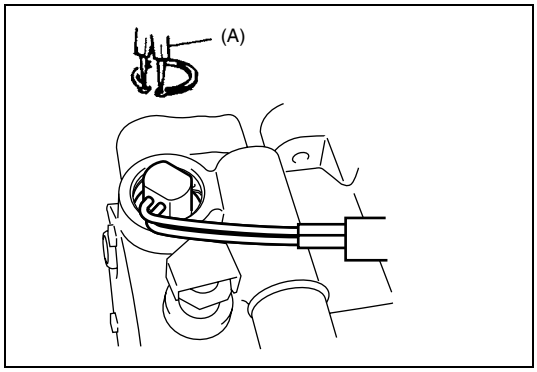
Measured thermal switch for resistance at 20 °C (68 °F)

Standard Resistance: 55 mΩ (DC 1.5 V, 100 mA)

Thermal Switch Removal and Installation

REMOVAL

1) Removal compressor from engine referring to "Compressor Assembly Removal and Installation" in this section.



2) Removal circlip using special tool.

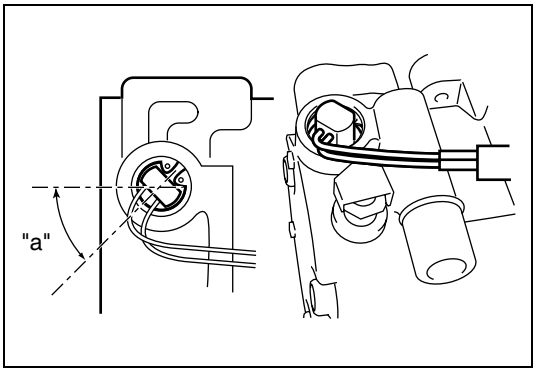
Special tool
(A): 09900–06107

3) Remove thermal switch and O-ring.

INSTALLATION

Reverse removal procedure noting the following point.

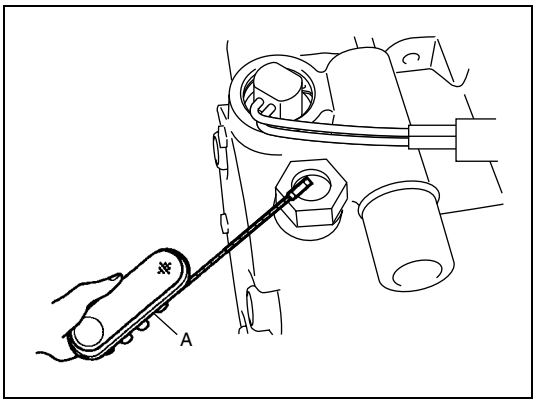
- Apply compressor oil to O-ring.
- Evacuate and charge system according to previously described procedure.



- Install thermal switch with aligning to angle “a” (approx. 45°) in the figure.

“a”: approx. 45°

Relief Valve Inspection



By using special tool, check if there is refrigerant leakage.
If there is refrigerant leakage, replace the relief valve.

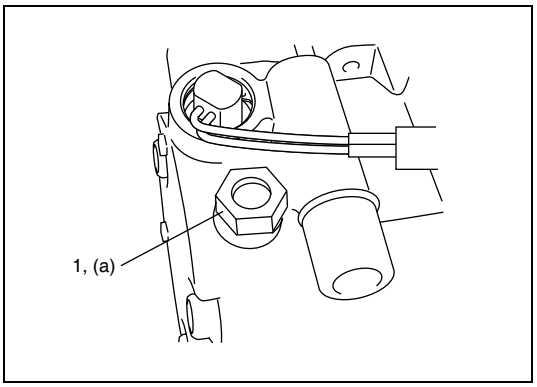
Special tool
(A): 09990–86011

Relief valve Removal and Installation

REMOVAL

1) Removal compressor from vehicle. Referring to “Compressor Assembly Removal and Installation” in this section.
2) Remove cap, relief valve and O-ring.

INSTALLATION



1) Install relief valve (1) and O-ring.

NOTE:

Apply compressor oil to relief valve O-ring.

Tightening torque
Relief valve (a): 10 N·m (1.0 kg-m, 7.2 lb-ft)

2) Install cap.
3) Install compressor to engine referring to “Compressor Assembly Removal and Installation” in this section.

Specifications

Tightening Torque Specifications

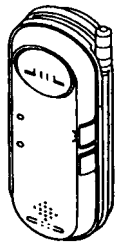
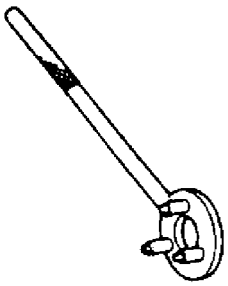
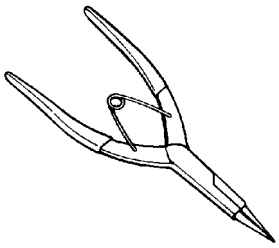
Fastening part		Tightening torque		
		N•m	kg-m	lb-ft
Refrigerant line	8 mm pipe	13	1.3	9.5
	12 mm pipe	23	2.3	16.6
	14.5 mm pipe	33	3.3	23.8
Magnet clutch plate		16	1.6	11.5
Relief valve		10	1.0	7.2

Special Tools and Equipment

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Compressor oil (refrigerant oil)	COMPRESSOR OIL P/No.: 99000-99095-00A	• O-ring • Each component

Special Tool

		
09990-86011 Gas leak detector	09920-55810 Spanner, armature plate	09900-06107 Snap ring puller (Opening type)

SECTION 3

STEERING, SUSPENSION, WHEELS AND TIRES

CONTENTS

Diagnosis

General Diagnosis

Since the problems in steering, suspension, wheels and tires involve several systems, they must all be considered when diagnosing a complaint. To avoid using the wrong symptom, always road test the vehicle first. Proceed with the following preliminary inspection and correct any defects which are found.

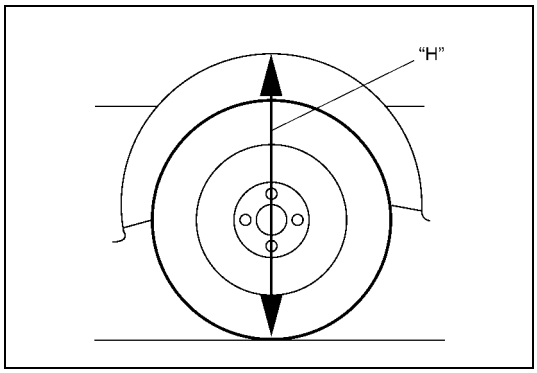
1) Inspect tires for proper pressure and uneven wear.
2) Raise vehicle on a hoist and inspect front and rear suspension and steering system for loose or damaged parts.
3) Spin front wheels. Inspect for out-of-round tires, out-of-balance tires, bent rims, loosen and/or rough wheel bearings.

Diagnosis Table

Condition	Possible Cause	Correction
Vehicle Pulls (Leads)	Mismatched or uneven tires	Replace tire.
	Tires not adequately inflated	Adjust tire pressure.
	Broken or sagging springs	Replace spring.
	Radial tire lateral force	Replace tire.
	Disturbed wheel alignment	Check and adjust wheel alignment.
	Brake dragging in one road wheel	Repair brake.
	Loose, bent or broken front or rear suspension parts	Tighten or replace suspension parts.
Abnormal or Excessive Tire Wear	Sagging or broken spring	Replace spring.
	Tire out of balance	Adjust balance or replace tire.
	Disturbed wheel alignment	Check and adjust wheel alignment.
	Faulty strut (shock absorber)	Replace strut.
	Hard driving	Replace tire.
	Overloaded vehicle	Replace tire.
	Not rotating tire	Replace or rotate tire.
	Worn or loose wheel bearing	Replace wheel bearing.
	Wobbly wheel or tire	Replace wheel or tire.
	Tires not adequately inflated	Adjust tire pressure.
Wheel Tramp	Blister or bump on tire	Replace tire.
	Improper strut (shock absorber) action	Replace strut.
Shimmy, Shake or Vibration	Tire or wheel out of balance	Balance wheels or replace tire and/or wheel.
	Loose wheel bearings	Replace wheel bearing.
	Worn tie rod ends	Replace tie rod end.
	Worn lower ball joints	Replace front suspension arm.
	Excessive wheel runout	Repair or replace wheel and/or tire.
	Blister or bump on tire	Replace tire.
	Excessively loaded radial runout of tire / wheel assembly	Replace tire or wheel.
	Disturbed wheel alignment	Check and adjust wheel alignment.
	Loose or worn steering linkage	Tighten or replace steering linkage.
	Loose steering gear case bolts	Tighten case bolts.

Condition	Possible Cause	Correction
Hard Steering	Tire not adequately inflated	Inflate tires to proper pressure.
	Malfunction of power steering system	Check and correct.
	Bind in tie rod end ball studs or lower ball joints	Replace tie rod end or front suspension arm.
	Disturbed front wheel alignment	Check and adjust front wheel alignment.
	Rack and pinion adjustment	Check and adjust rack and pinion torque.
	Bind in steering column	Repair or replace steering column.
Too Much Play in Steering	Wheel bearings worn	Replace wheel bearing.
	Loose steering gear case bolts	Tighten gear case bolts.
	Rack and pinion adjustments	Check and adjust rack and pinion torque.
	Worn steering shaft joints	Replace joint.
	Worn tie rod ends or tie rod inside ball joints	Replace tie rod end or tie rod.
	Worn lower ball joints	Replace front suspension control arm.
Poor Returnability	Bind in tie rod end ball studs	Replace tie rod end.
	Bind in ball joints	Replace front suspension arm.
	Bind in steering column	Repair or replace steering column.
	Poorly lubricated rack and pinion	Check, repair or lubricate rack and pinion.
	Disturbed front end alignment	Check and adjust front end alignment.
	Rack and pinion adjustment	Check and adjust rack and pinion torque.
	Tires not adequately inflated	Adjust tire pressure.
Rack and Pinion Noise (Rattle or Chuckle)	Loose steering gear case bolts	Tighten steering gear case bolts.
	Worn rack bush	Replace rack bush.
	Rack and pinion adjustment	Check and adjust rack and pinion torque.
Abnormal Noise, Front End	Worn, sticky or loose tie rod ends, lower ball joints, tie rod inside ball joints or drive shaft joints	Replace tie rod end, suspension arm, tie rod or drive shaft joint.
	Damaged struts or mountings	Repair or replace.
	Worn suspension arm bushings	Replace arm bushings.
	Loose stabilizer bar	Tighten bolts or nuts, replace bushes.
	Loose wheel bolts (or nuts)	Tighten wheel bolts (or nuts).
	Loose suspension bolts or nuts	Tighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings	Replace wheel bearings.
	Broken suspension springs	Replace springs.
	Poorly lubricated or worn strut bearings	Replace strut bearing.

Condition	Possible Cause	Correction
Wander or Poor Steering Stability	Mismatched or uneven tires	Replace or inflate tires to proper pressure.
	Loose ball joints and tie rod ends	Replace suspension arm or tie rod end.
	Faulty struts or mountings	Replace strut or repair mounting.
	Loose stabilizer bar	Tighten or replace stabilizer bar or bush.
	Broken or sagging springs	Replace spring.
	Rack and pinion adjustment	Check and adjust rack and pinion torque.
	Disturbed front wheel alignment	Check and adjust front wheel alignment.
Erratic Steering When Braking	Worn wheel bearings	Replace wheel bearing.
	Broken or sagging springs	Replace coil spring.
	Wheel tires are inflated unequally	Inflate tires to proper pressure.
	Disturbed front wheel alignment	Check and adjust front wheel alignment.
	Brakes not working in unison	Check and repair brake system.
	Leaking wheel cylinder or caliper	Repair or replace wheel cylinder or caliper.
	Warped discs	Replace brake disc.
	Badly worn brake linings	Replace brake shoe lining.
	Drum is out of round in some brakes	Replace brake drum.
	Defective wheel cylinders	Replace or repair wheel cylinder.
Low or Uneven Trim Height **NOTE:** **See NOTE *1.**	Broken or sagging suspension springs	Replace suspension spring.
	Over loaded	Check loading.
	Incorrect suspension springs	Replace suspension spring.
Ride Too Soft	Faulty struts (shock absorber)	Replace struts or absorber.
Suspension Bottoms	Overloaded	Check loading.
	Faulty struts (shock absorber)	Replace strut.
	Incorrect, broken or sagging springs	Replace springs.
Body Leans or Sways in Corners	Loose stabilizer bar	Tighten stabilizer bar bolts or nuts, or replace bushes.
	Faulty struts (shock absorbers) or mountings	Replace strut or tighten mounting.
	Broken or sagging springs	Replace suspension springs.
	Overloaded	Check loading.
Cupped Tires	Front struts defective	Replace struts.
	Worn wheel bearings	Replace wheel bearings.
	Excessive tire or wheel run-out	Replace tire or wheel disc.
	Worn ball joints	Replace front suspension arm.
	Tire out of balance	Adjust tire balance.

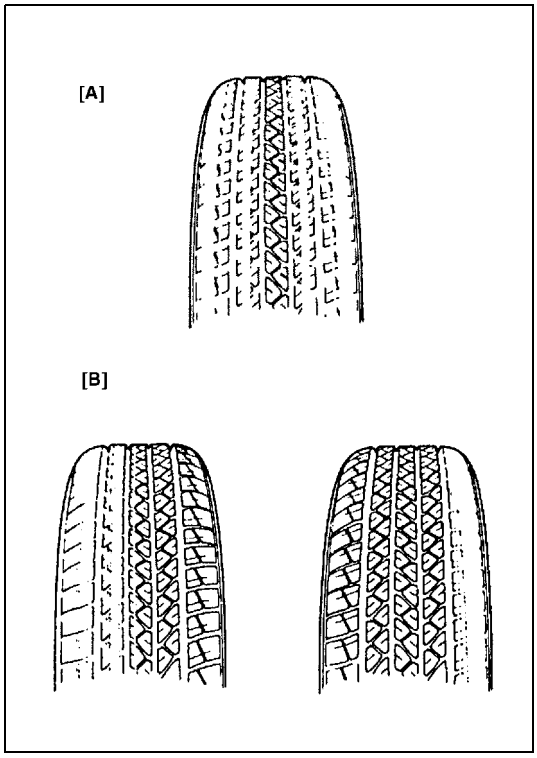


NOTE:

***1: Right-to-left trim height ("H") difference should be within 15 mm (0.6 in.) with curb weight. (same with rear side.)**

Tire Diagnosis

Irregular and/or premature wear



Irregular and premature wear has many causes. Some of them are: incorrect inflation pressures, lack of tire rotation, driving habits, improper alignment.

If the following conditions are noted, rotation is necessary:

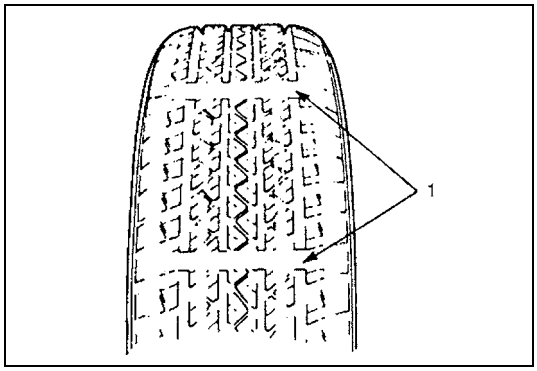
- Front tire wear is different from rear.
- Uneven wear exists across the tread of any tire.
- Front tire wear is unequal between the right and left.
- Rear tire wear is unequal between the right and left.
- There is cupping, flat spotting, etc.

A wheel alignment check is necessary if following conditions are noted:

- Front tire wear is unequal between the right and left.
- Wear is uneven across the tread of any front tire.
- Front tire treads have scuffed appearance with "feather" edges on one side of tread ribs or blocks.

[A] :	Hard cornering, under inflation or lack of tire rotation
[B] :	Incorrect wheel alignment, tire construction not uniform or wheel heavy acceleration

Wear indicators

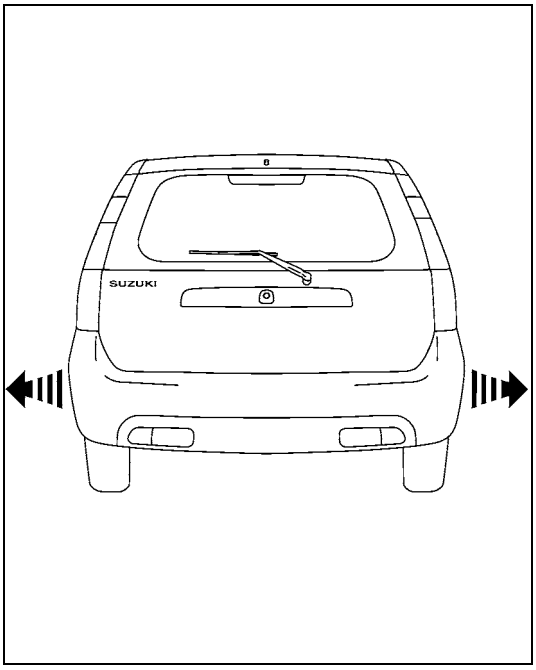


Original equipment tires have built-in tread wear indicators (1) to show when they need replacement.

These indicators (1) will appear as approx. 12 mm (0.47 in) wide bands when the tire tread depth becomes 1.6 mm (0.063 in).

When the indicators (1) appear in 3 or more grooves at 6 locations, tire replacement is recommended.

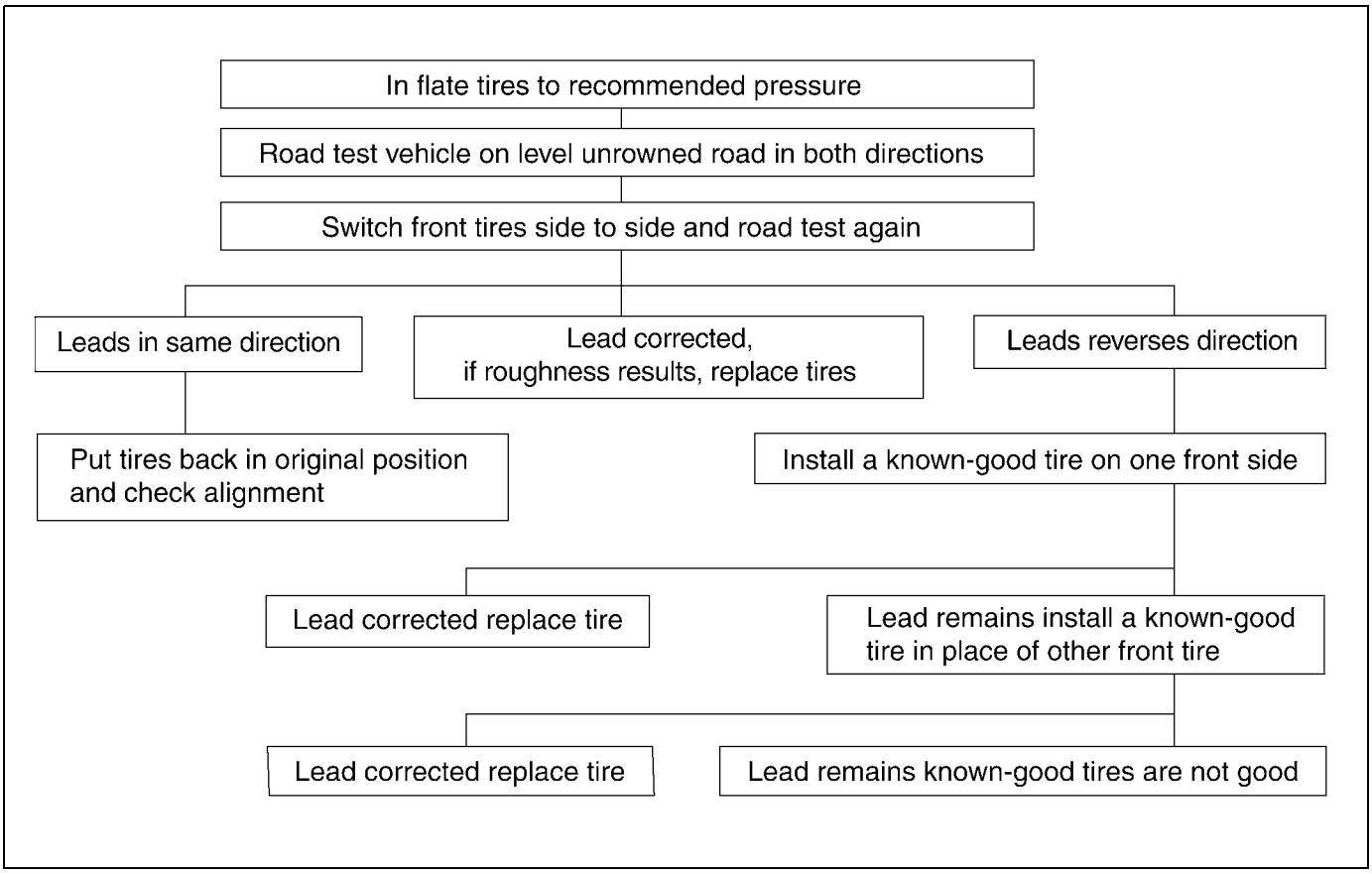
Radial tire waddle



Waddle is side to side movement at the front and/or rear of the vehicle. It is caused by the steel belt not being straight within the tire. It is most noticeable at a low speed, 8 to 48 kph (5 to 30 mph). It is possible to locate the faulty tire by road testing the vehicle. If it is on the rear, the rear end of the vehicle shakes from side to side or “waddles”. To the driver in the seat, it feels as though someone is pushing on the side of vehicle.
If the faulty tire is on the front, waddling is more visual. The front sheet metal appears to be moving back and forth and the driver feels as though he is at the pivot point in vehicle.
Waddle can be quickly diagnosed by using Tire Problem Detector (TPD) and following the equipment manufacture’s recommendations.
If TPD is not available, an alternative method of substituting known-good tire / wheel assemblies can be used as follows, although it takes a longer time.

1) Ride vehicle to determine whether the front or rear waddles.
2) Install tires and wheels that are known to be good (on similar vehicle) in place of those on waddling end of vehicle. If waddling end cannot be identified, substitute rear ones.
3) Road test again. If improvement is noted, reinstall originals one at a time till waddle causal tire is found. If no improvement is noted, install known-good tires in place of all four. Then reinstall originals in the same manner as above.

EQUIPMENT MANUFACTURE’S RECOMMENDATIONS



Radial tire lead

"Lead" is the deviation of the vehicle from a straight path on a level rod even with no pressure on the steering wheel.

Lead is usually caused by:

- Incorrect alignment.
- Uneven brake adjustment.
- Tire construction.

The way in which a tire is built can produce lead in a vehicle. An example of this is placement of the belt. Off center belts on radial tires can cause the tire to develop a side force while rolling straight down the road. If one side of the tire has a little larger diameter than the other, the tire will tend to roll to one side. This will develop a side force which can produce vehicle lead.

The procedure in previous page should be used to make sure that front alignment is not mistaken for tire lead.

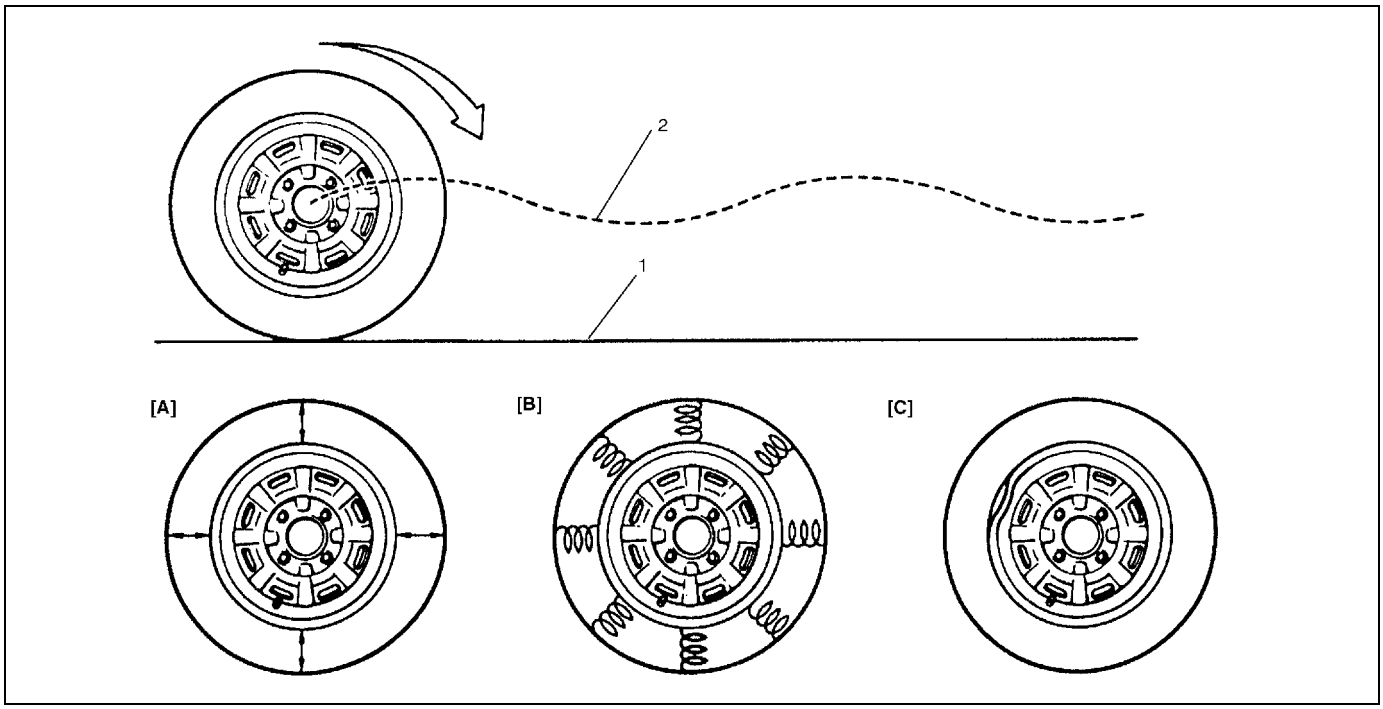
- Part of the lead diagnosis procedure is different from the proper tire rotation pattern currently in the owner and service manuals. If a medium to high mileage tire is moved to the other side of the vehicle, be sure to check that ride roughness has not developed
- Rear tires will not cause lead.

Vibration Diagnosis

Wheel unbalance causes most of the highway speed vibration problems. If a vibration remains after dynamic balancing, its possible causes are as follows.

- Tire runout.
- Wheel runout.
- Tire stiffness variation.

Measuring tire and/or wheel free runout will uncover only part of the problem. All three causes, known as loaded radial runout, must be checked by using a Tire Problem Detector (TPD). If TPD is not available, alternative method of substituting known-good tire and wheel assemblies on the problem vehicle can be used, although it takes a longer time.



[A] : Caused by tire out of round	1. Smooth road
[B] : Caused by tire stiffness variation	2. Suspension movement (loaded runout)
[C] : Caused by rim bent or out of round	

SECTION 3A

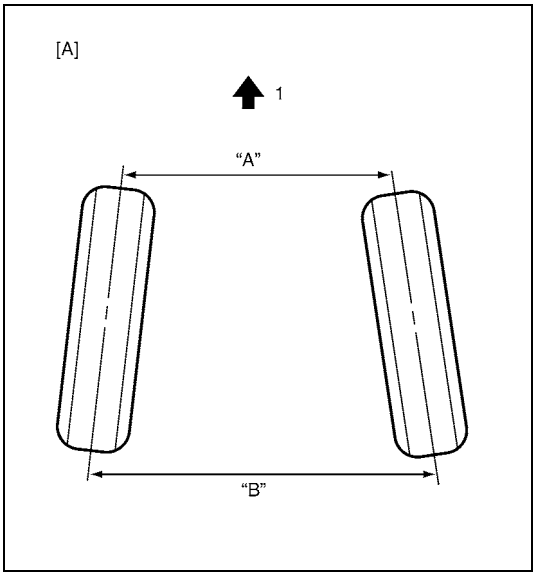
FRONT WHEEL ALIGNMENT

CONTENTS

General Description

Front Wheel Alignment Construction

Front alignment refers to the angular relationship between the front wheels, the front suspension attaching parts and the ground. Generally, the only adjustment required for front alignment is toe setting.
Camber and caster can't be adjusted. Therefore, should camber or caster be out of specification due to the damage caused by hazardous road conditions or collision, whether the damage is in body or in suspension should be determined.
If the body is damaged, it should be repaired and if suspension is damaged, it should be replaced.

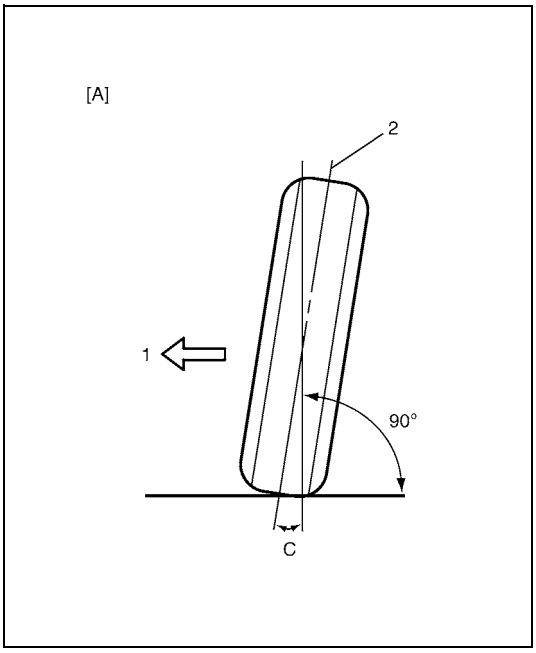


Toe setting

Toe is the turning in or out of the front wheels. The purpose of a toe specification is to ensure parallel rolling of the front wheels (Excessive toe-in or toe-out may increase tire wear).
Amount of toe can be obtained by subtracting "A" from "B" as shown in figure and therefore is given in mm (in.).

[A]: Wheel top view
1. Forward

Camber



Camber is the tilting of the front wheels from the vertical, as viewed from the front of the vehicle. When the wheels tilt outward at the top, the camber is positive. When the wheels tilt inward at the top, the camber is negative. The amount of tilt is measured in degrees.

1. Body center	[A]: Front view
2. Center line of wheel	

Diagnosis

Diagnosis Table

For the details, refer to “Diagnosis Table” in Section 3.

Wheel Alignment Specifications

Front Wheel Alignment Specifications

Item		Front Wheel	
		2WD	4WD
Toe (total)		IN 2 ± 1 mm	←
Camber		0 ° ± 1 °	←
Caster		3 ° 09’ ± 1 °	←
Side Slip Limit mm/m (in./ 3.3 ft)		IN 3 – 0	←
Steering Angle (Turning angle)	Inside	35 ° ± 2 °	←
	Outside	31 ° (Reference)	←

NOTE:

Toe value in the specifications table was measured by using a toe-in gauge.

Repair Instruction

Front Wheel Alignment Inspection and Adjustment

Preliminary checks prior to adjusting front alignment

Steering and vibration complaints are not always the result of improper alignment. An additional item to be checked is the possibility of tire lead due to worn or improperly manufactured tires. “Lead” is the deviation of the vehicle from a straight path on a level road without hand pressure on the steering wheel. Procedure for determining the presence of a tire lead problem contains in Section 3. Before making any adjustment affecting toe setting, the following checks and inspections should be made to ensure correctness of alignment readings and alignment adjustments:

- Check all tires for proper inflation pressures and approximately the same tread wear.
- Check for loose of ball joints. Check tie-rod ends; if excessive looseness is noted, it must be corrected before adjusting.
- Check for run-out of wheels and tires.
- Check vehicle trim heights; if out of limits and a correction is to be made, it must be made before adjusting toe.
- Check for loose of suspension arms.
- Check for loose or missing stabilizer bar attachments.
- Consideration must be given to excess loads, such as tool boxes. If this excess load is normally carried in vehicle, it should remain in vehicle during alignment checks.
- Consider condition of equipment being used to check alignment and follow manufacturer's instructions.
- Regardless of equipment used to check alignment, vehicle must be on a level surface both fore and aft and transversely.

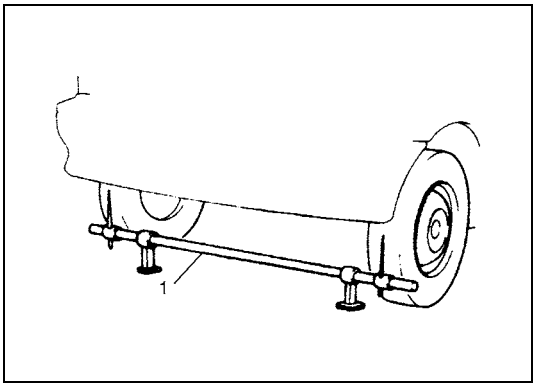
NOTE:

To prevent possible incorrect reading of camber of caster, vehicle front (or rear) end must be moved up and down a few times before inspection.

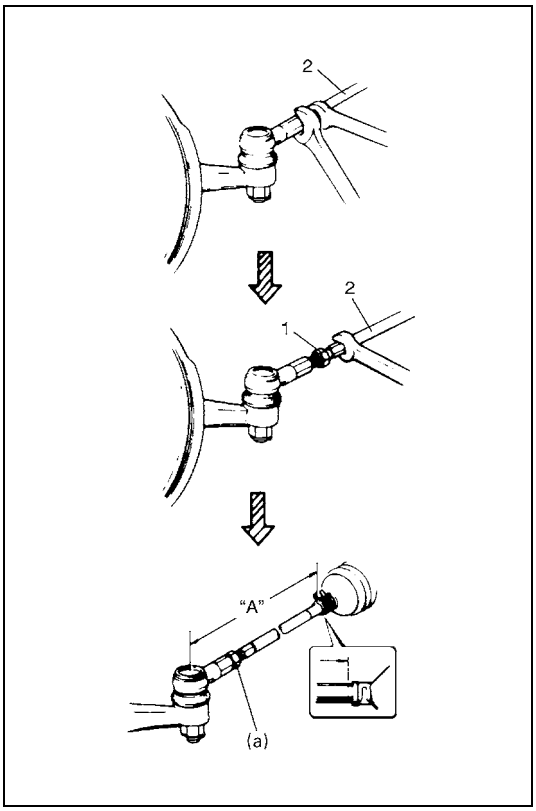
Toe inspection and adjustment

Preparation for toe inspection and adjustment.

- Place vehicle in non-loaded state on level floor.
- Set steering wheel in straight state.
- Check that inflation pressure of each tire is adjusted properly and disc wheel is free from deflection.
- Check that each suspension part is free from bend, dent, wear or damage in any other form.
- Check that ground clearance at the right and left is just about the same.



1) Check toe with toe-in gauge (1). Refer to “Wheel Alignment Specifications” for specified value. It is out of specification, adjust it as follows.



2) Toe is adjusted by changing tie-rod length.
3) Loosen right and left tie-rod end lock nuts (1) first.

NOTE:

Before rotating tie-rods (2), apply grease between tie-rods and rack boots so that boots won't be twisted.

4) Rotate right and left tie-rods (2) by the same amount to align toe to specification. In this adjustment, right and left tie-rods (2) should become equal in length “A”.
5) After adjustment, tighten lock nuts (1) to specified torque.

Tightening torque
Tie-rod end lock nut (a): 45 N·m (4.5 kg-m, 32.5 lb-ft)

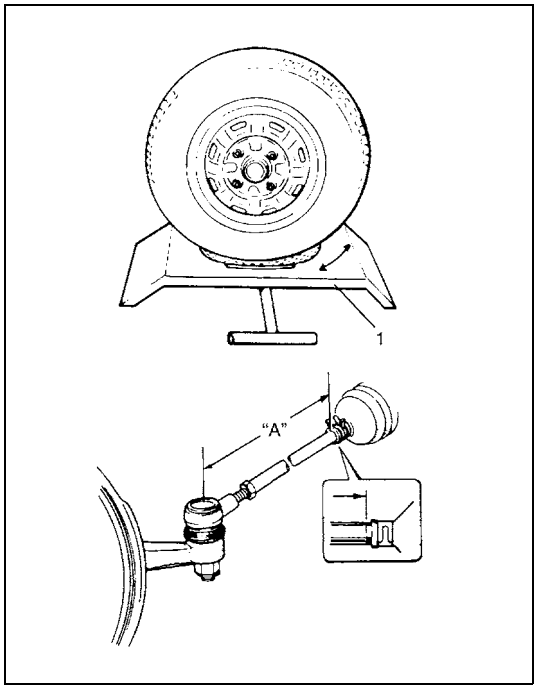
NOTE:

Make sure that rack boots are not twisted.

Camber and caster check and adjustment

1) To prevent possible incorrect reading of camber or caster, vehicle front end must be moved up and down a few times before inspection.
2) Check camber and caster using camber and caster gauge. Refer to “Wheel Alignment Specifications:” for specified value.
3) Should camber or caster be found out of specifications upon inspection, locate its cause first. if it is in damaged, loose, bent, dented or worn suspension parts, they should be replaced. If it is in body, repair it so as to attain specifications.

Steering angle check and adjustment



When tie-rod or tie-rod end was replaced, check toe and then also steering angle with turning radius gauge (1).
If steering angle is not correct, check if right and left tie-rods are equal in length (“A” in figure).

NOTE:

If tie-rod lengths were changed to adjust steering angle, reinspect toe.

1. Turning radius gauge

Side slip (reference information)

For inspecting front wheel side slip with side slip tester:
If side slip exceeds limit, toe or front wheel alignment may not be correct.

NOTE:

When side slip limit is exceeded or when adjusting wheel alignment while doing some other work, adjust alignment so as to obtain above side slip adjusting value.

Tightening Torque Specifications

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Tie-rod end lock nut	45	4.5	32.5

SECTION 3B

MANUAL RACK AND PINION

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

NOTE:

All steering gear fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

CONTENTS

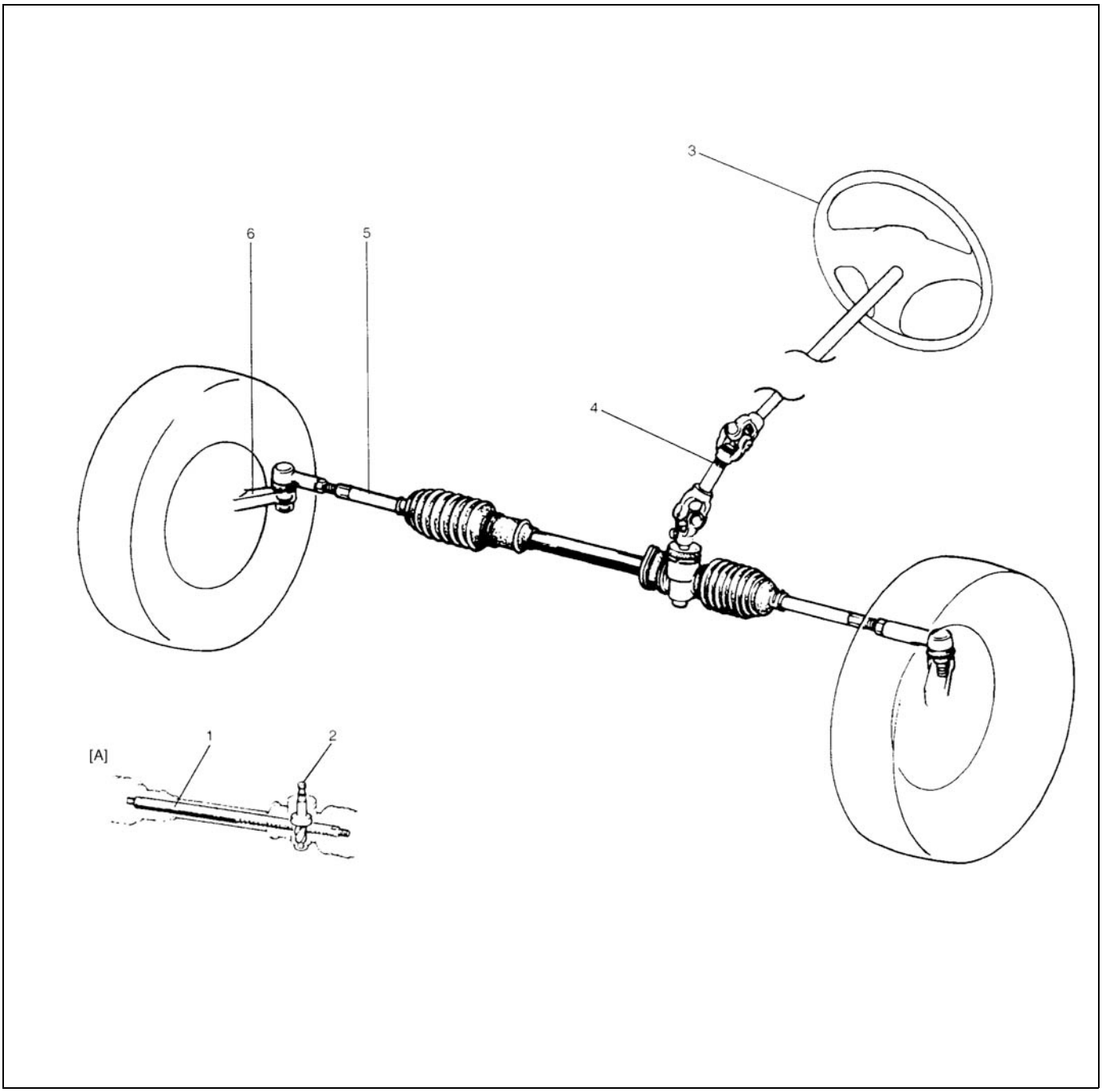
General Description

Rack and Pinion Steering Construction

The rack and pinion steering system consists of two components, the rack (1) and the pinion (2). When the steering wheel (3) is turned, the motion is transmitted to the steering shaft joint (4) and then to the pinion (2). Since the pinion teeth mesh with teeth on rack, the motion is further transferred to the rack and changed to linear motion. The force is then transmitted through the tie rods (5) to the steering knuckles (6) which turn wheels.

NOTE:

Although the figure below shows only the left-hand steering vehicle, the same work procedure and data apply to the right-hand steering vehicle.



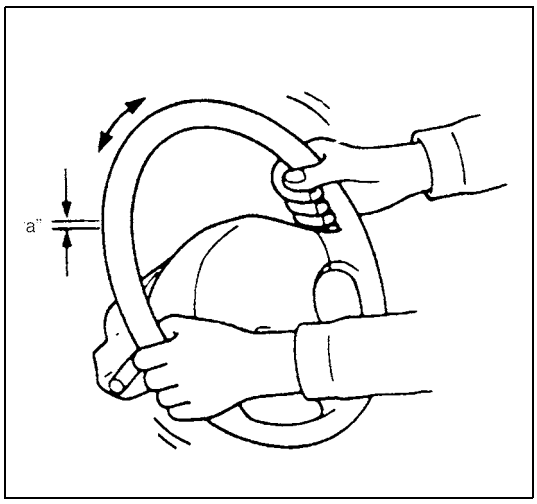
[A]: Rack and Pinion

Diagnosis

Diagnosis Table

Refer to Section 3.

Steering Wheel Check



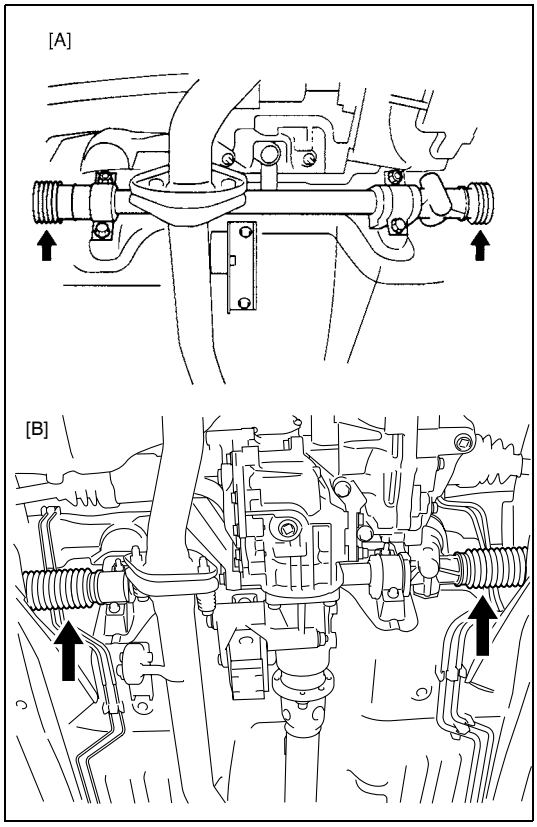
Check steering wheel for play and rattle, holding vehicle in straight forward condition on the ground.

Steering wheel play
"a": 0 – 30 mm (0 – 1.1 in.)

If steering wheel play is not within specification, inspect as follows and replace if found defective.

- Tie-rod end ball stud for wear (Ball stud should move when more than 0.2 N·m (2 kg-cm,0.44 lb-ft) torque is applied.)
- Lower ball joint for wear
- Steering shaft joint for wear
- Steering pinion or rack gear for wear or breakage
- Each part for looseness

Steering Rack Boot Check

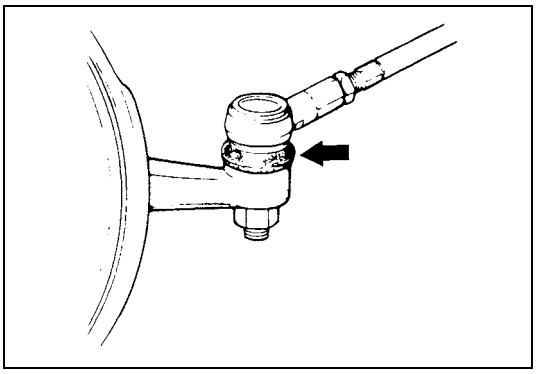


Hoist vehicle.
Inspect each boot for tear. A torn boot allows entry of dust and water which can cause wear to steering rack and pinion to produce noise as well as rust to result in malfunction of steering system.
If even a small tear is noted, replace with new one.
Also, check each boot for dent. If there is a dent, keep boot in most compressed state for some seconds to correct dent.

Boots should be visually inspected for any damage, dent and tear during every periodical inspection at specified intervals and whenever vehicle is hoisted for any other purpose.

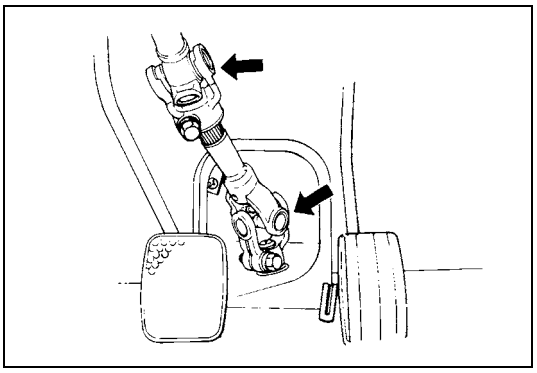
[A]: 2WD model
[B]: 4WD model

Tie Rod End Boot Check



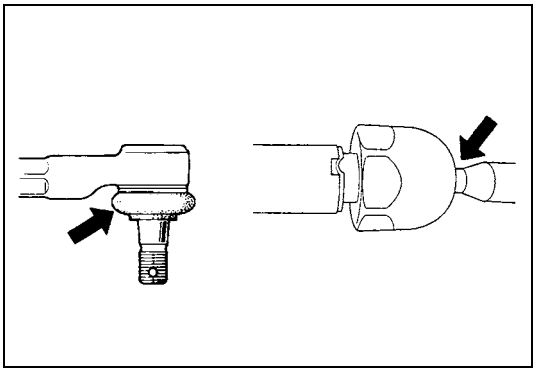
Inspect each boot for tear. If even a small tear is noted, replace with new one.

Steering Shaft Joint Check



Check shaft joint for wear, breakage and other damage and replace if any defect exists.

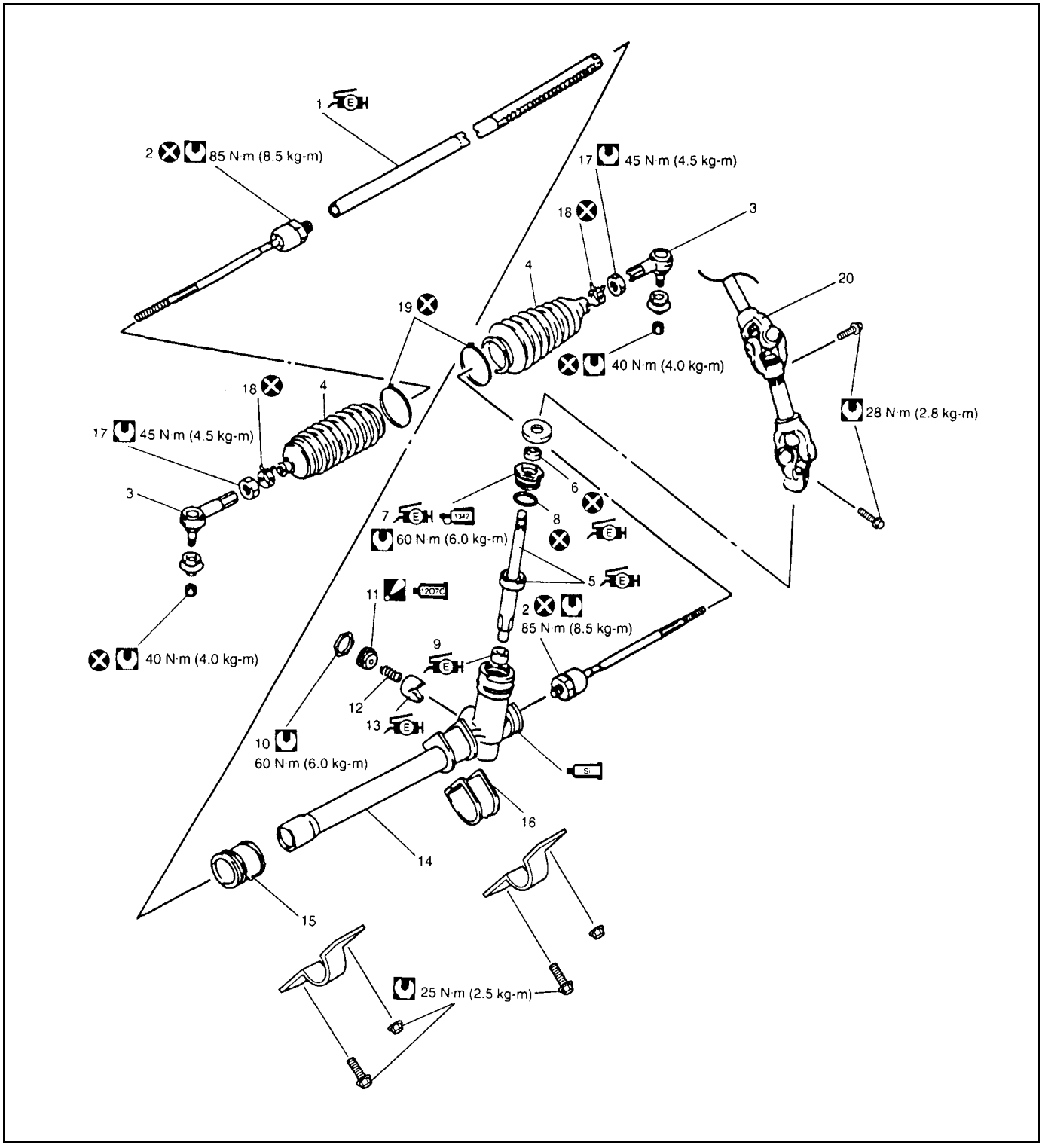
Tie Rod End Check



1) Inspect for play in ball joint.
2) Inspect for play in rack end ball joint.
   In either case, if found defective, replace.

On-Vehicle Service

Rack and Pinion Assembly Components

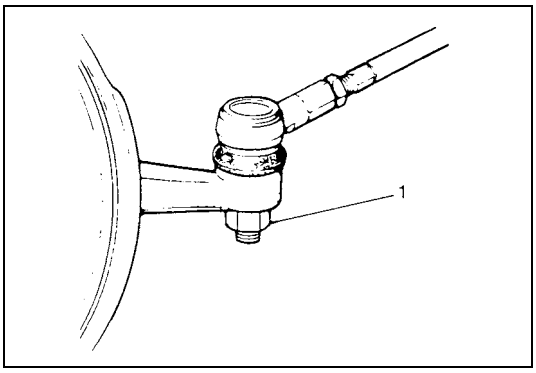


	1. Steering rack : Apply grease 9900-25050 to teeth surface of rack.		12. Rack plunger spring
	2. Steering tie rod		13. Steering rack plunger : Apply grease 99000-25050 to sliding part of plunger.
	3. Tie rod end	Si	14. Steering rack housing and gear case : Apply sealant 99000-31120 between boot and grooves of gear case.
	4. Boot		15. Steering rack side mount
	5. Steering pinion : Apply grease 99000-25050 to pinion shaft.		16. Steering pinion side mount
	6. Steering gear case oil seal : Apply grease 99000-25050 to oil seal lip.		17. Tie rod end lock nut
1342	7. Pinion bearing plug : Apply grease 99000-25050 to inside of pinion bearing plug. : Apply thread lock cement 1342 99000-32050 to plug thread.		18. Rack boot clip
	8. O-ring : Apply grease 99000-25050 to O-ring		19. Band
	9. Steering pinion needle bearing : Apply grease 99000-25050 to rollers of bearing.		20. Steering shaft joint
	10. Lock nut		Tightening torque
1207D	11. Rack damper screw : Tighten rack damper screw so that rotation torque becomes as specified. : Apply sealant 99000-31250 to all around thread part of rack damper screw.		Do not reuse.

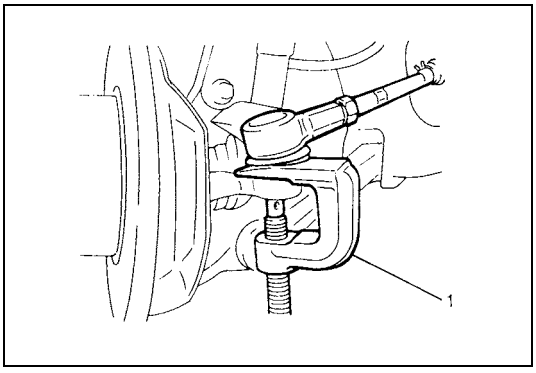
Tie Rod End Removal and Installation

REMOVAL

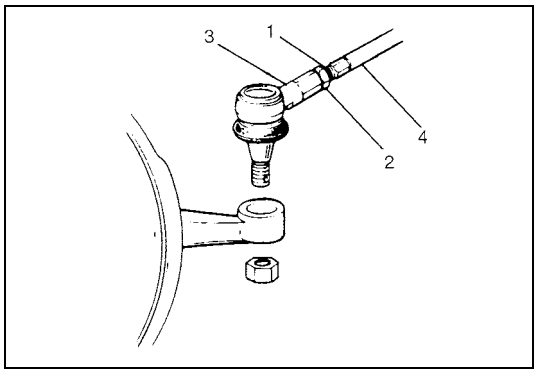
1) Hoist vehicle and remove wheel referring to “Wheel Removal and Installation” in Section 3F.



2) Remove tie rod end nut (1) from steering knuckle.

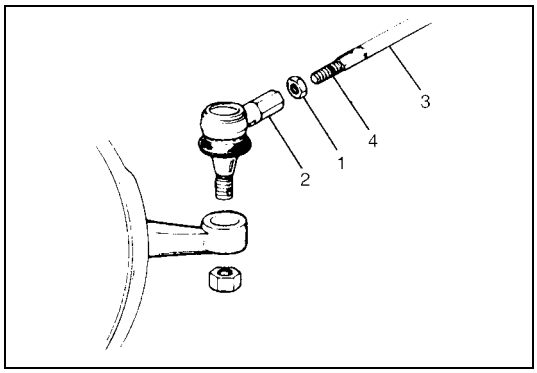


3) Disconnect tie rod end from knuckle, using puller (1).

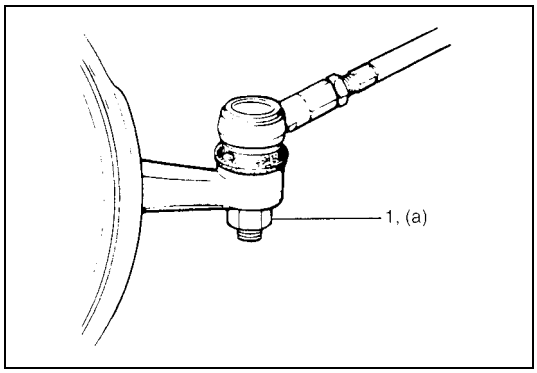


4) For ease of adjustment after installation, make marking (1) of tie rod end lock nut (2) position on tie rod end thread. Then loosen lock nut (2) and remove tie rod end (3) from tie rod (4).

INSTALLATION



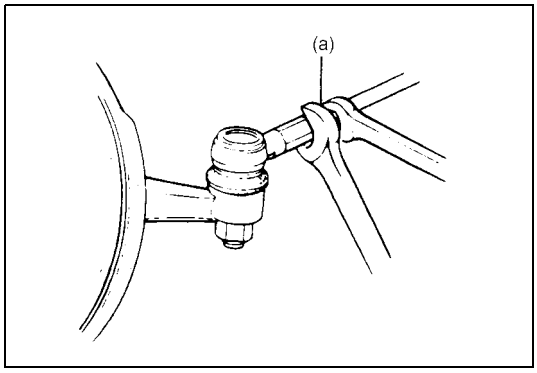
1) Install tie rod end lock nut (1) and tie rod end (2) to tie rod (3). Align lock nut with mark (4) on tie rod thread.



2) Connect tie rod end to knuckle. Tighten new tie rod end nut (1) to specified torque.

Tightening torque
Tie rod end nut (a): 40 N·m (4.0 kg-m, 29.0 lb-ft)

3) Inspect for proper toe (Refer to “FRONT WHEEL ALIGNMENT”).



4) After confirming proper toe, tighten tie rod end lock nut to specified torque.

Tightening torque
Tie rod end lock nut (a): 45 N·m (4.5 kg-m, 32.5 lb-ft)

5) Tighten wheel bolts to specified torque and lower hoist.

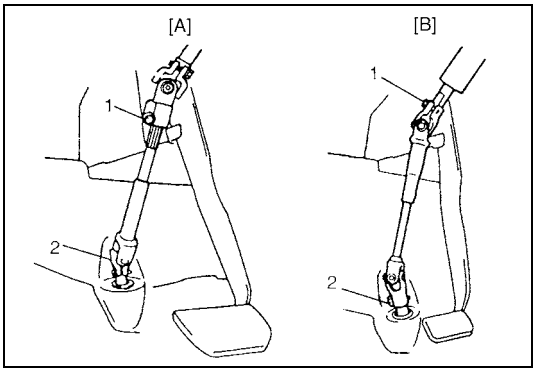
Tightening torque
Wheel bolt: 95 N·m (9.5 kg-m, 69.0 lb-ft)

Steering Gear Case Removal and Installation

REMOVAL

CAUTION:
Be sure to set front wheels in straight direction and remove ignition key from key cylinder before these steps, otherwise contact coil of air bag system may get damaged.

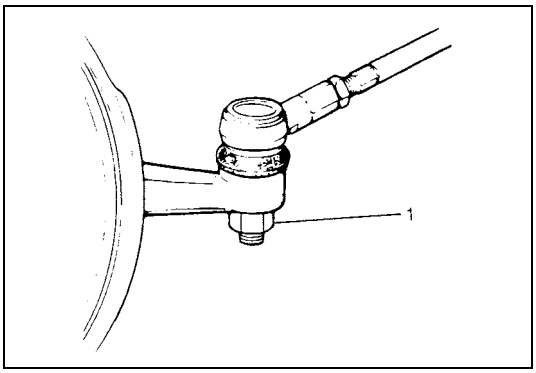
1) Slide driver's seat as far back as possible.



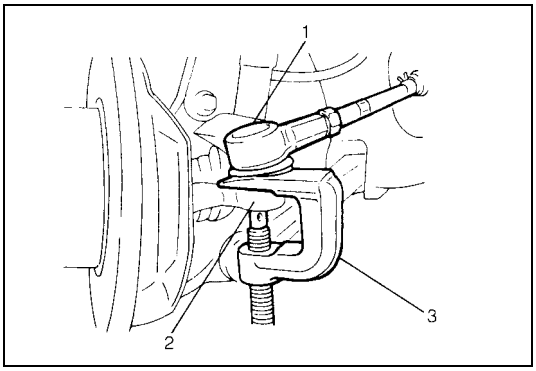
2) For ease of installation, loosen steering shaft upper joint bolt (1) but don't remove.
3) Remove steering shaft lower joint bolt (2).
4) Disconnect lower joint from pinion.

[A]: Power steering
[B]: Manual steering

5) Hoist vehicle and remove both wheels referring to "Wheel Removal and Installation" in Section 3F.

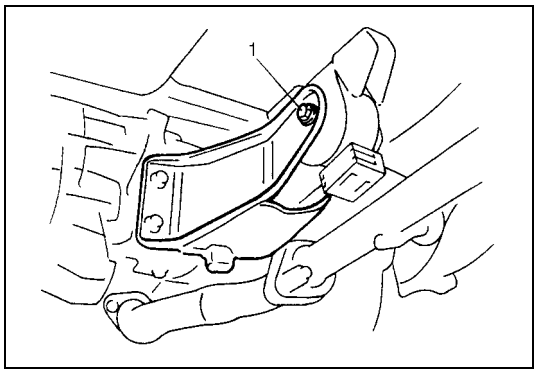


6) Remove tie rod end nuts (1) from both steering knuckles.



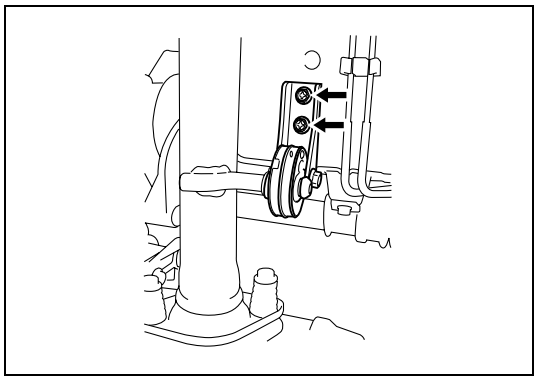
7) Disconnect both tie rod ends (1) from knuckles (2), using puller (3).

8) To remove the steering gear case easily, lower the engine with transmission, but don't remove.



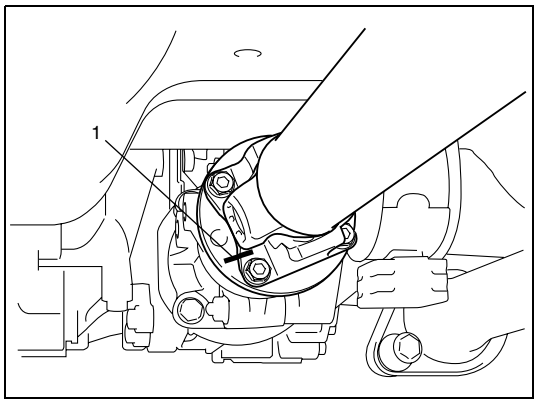
• 2WD model

a) Support engine with transmission by transmission jack and then remove engine rear mounting bolt (1).

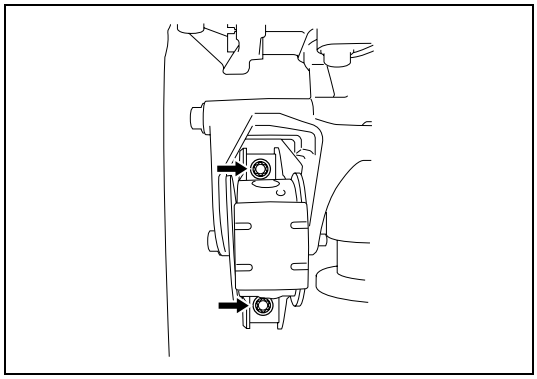


• 4WD model

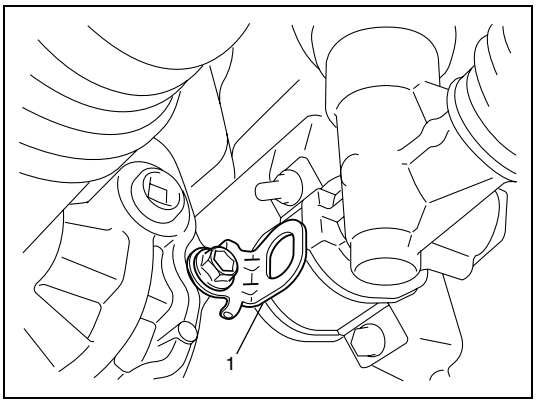
a) Remove exhaust pipe bracket bolts.



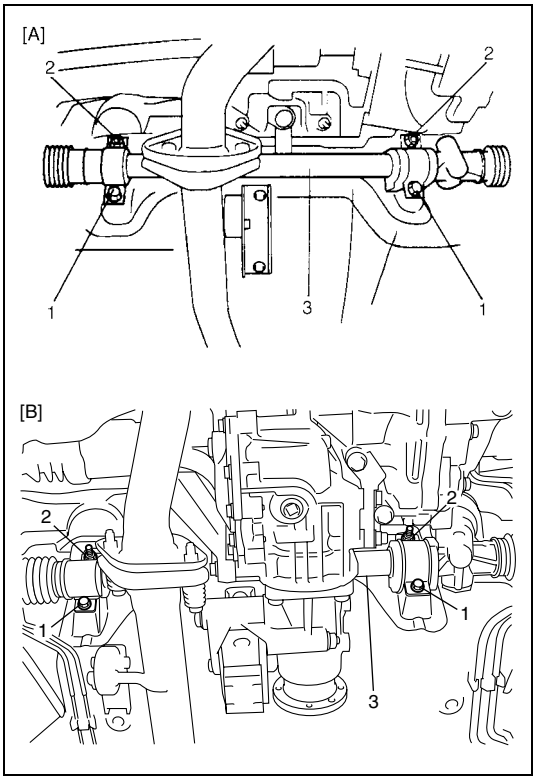
b) Make marking (1) on propeller shaft and joint flange as shown, and then remove the universal joint bolts.



c) Support engine with transmission by transmission jack and then remove engine rear mount bracket from floor panel.



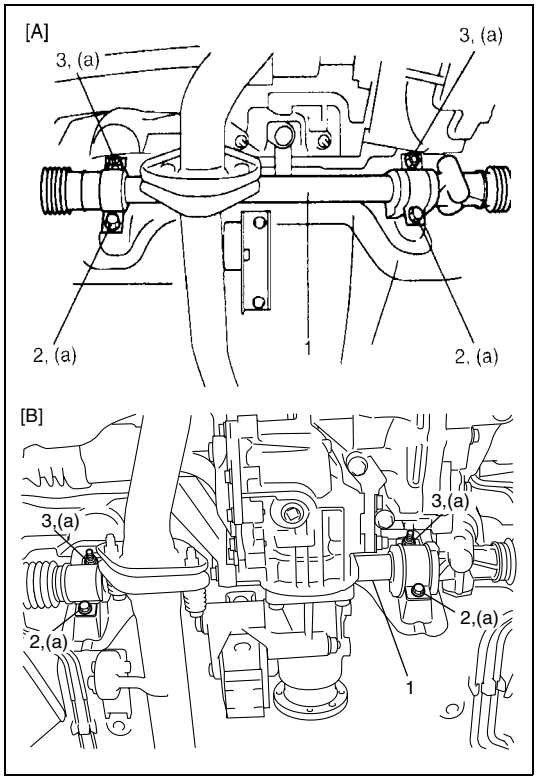
d) Remove bracket (1).



9) Remove steering gear case mount bolts (1), nuts (2) and gear case brackets, then remove gear case (3).

[A]: 2WD model
[B]: 4WD model

INSTALLATION

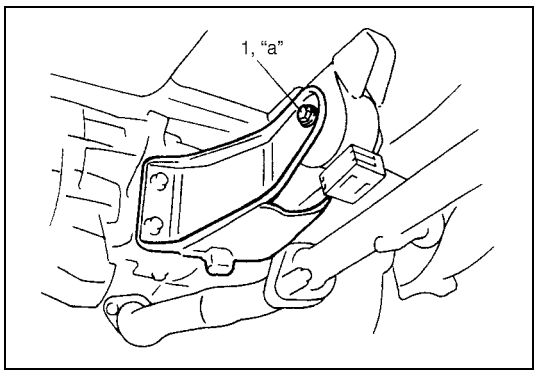


1) Apply grease to inside of pinion packing and install pinion packing onto pinion. Mount steering gear case (1) to body and tighten gear case mounting bolts (2) and nuts (3) to specified torque.

Tightening torque
Steering gear case mounting bolt and nut
(a): 25 N·m (2.5 kg-m, 18.0 lb-ft)

[A]: 2WD model
[B]: 4WD model

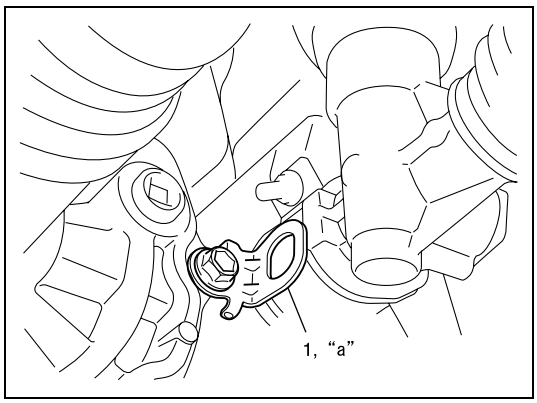
2) Remount the engine with transmission.



- 2WD model

a) Install engine rear mounting bolt (1).

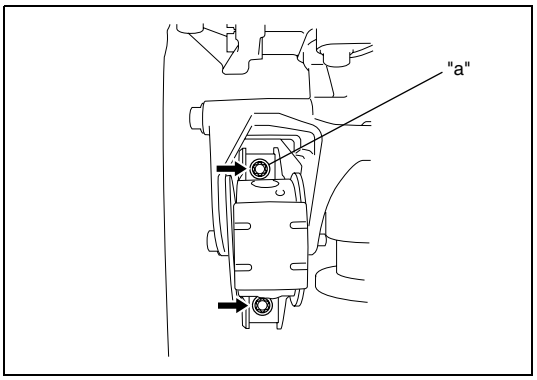
Tightening torque
Engine rear mounting bolt (a): 55 N·m (5.5 kg-m, 40 lb-ft)



- 4WD model

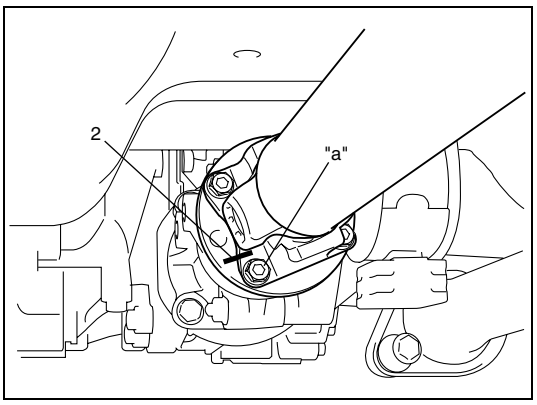
a) Install bracket (1).

Tightening torque
Transmission bracket bolt
(a): 18.5 N·m (1.85 kg-m, 13.3 lb-ft)



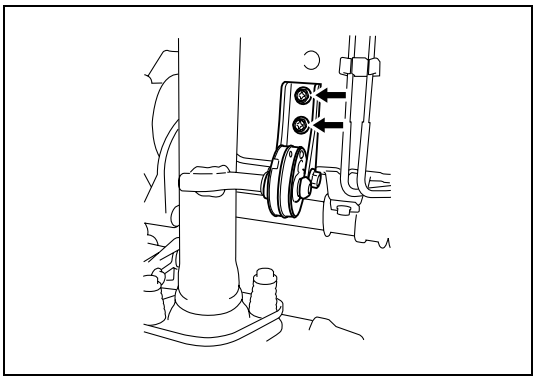
b) Install engine rear mount bracket.

Tightening torque
Engine rear mount bracket bolt
(a): 55 N·m (5.5 kg-m, 40 lb-ft)



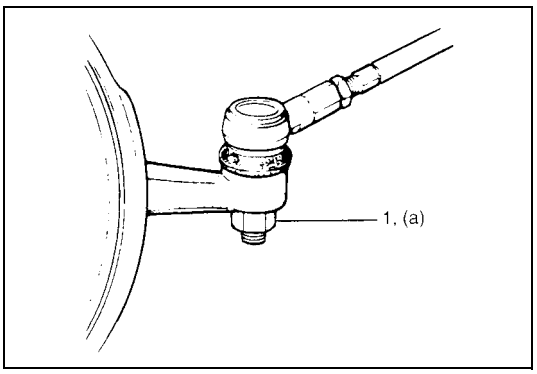
c) Install propeller shaft to joint flange aligning match marks (2) and tighten flange bolts to specified torque.

Tightening torque
Propeller shaft joint bolt (a): 23 N·m (2.3 kg-m, 16.6 lb-ft)



d) Install exhaust pipe bracket.

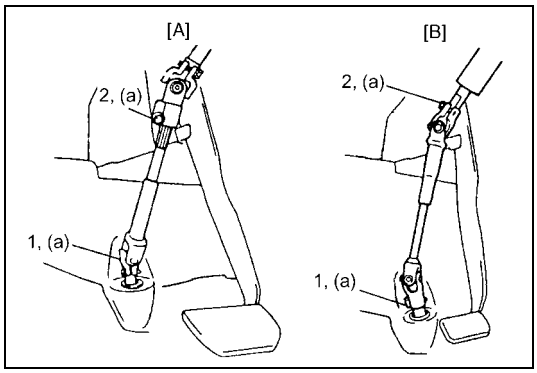
3) Remove transmission jack.



4) Install tie rod ends to knuckles (right & left). Tighten each new tie rod end nut (1) to specified torque.

Tightening torque
Tie rod end nut (a): 40 N·m (4.0 kg-m, 29.0 lb-ft)

5) Be sure that steering wheel and brake discs (right & left) are all straight-ahead position and then insert steering lower joint into steering pinion shaft.



6) Tighten steering shaft joint bolts (1) and (2) to specified torque (Lower side first and then upper side).

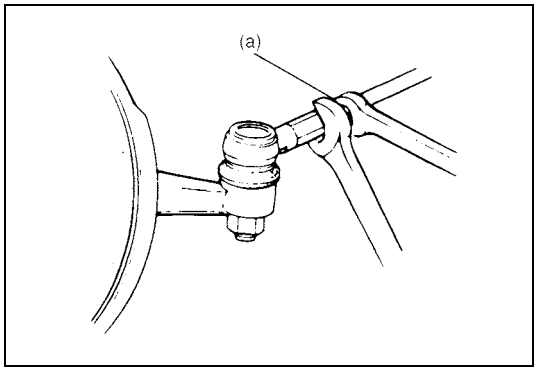
Tightening torque
Steering shaft joint bolt (a): 28 N·m (2.8 kg-m, 20.5 lb-ft)

[A]:	Power steering
[B]:	Manual steering

7) Install both wheels and tighten wheel bolts to specified torque.

Tightening torque
Wheel bolt: 95 N·m (9.5 kg-m, 69.0 lb-ft)

8) Lower hoist.
9) Check toe setting. Adjust as required (refer to “Front Wheel Alignment Construction” in Section 3A).

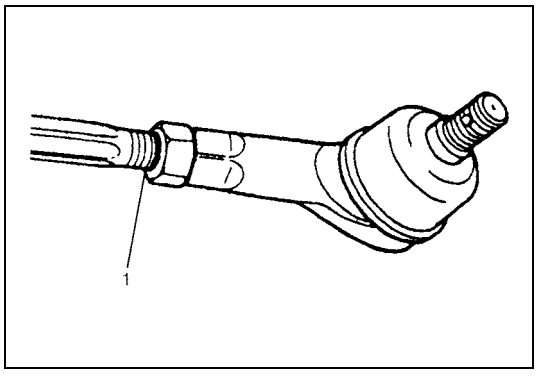


10) Tighten both tie rod end lock nuts to specified torque.

Tightening torque
Tie rod end lock nut (a): 45 N·m (4.5 kg-m, 32.5 lb-ft)

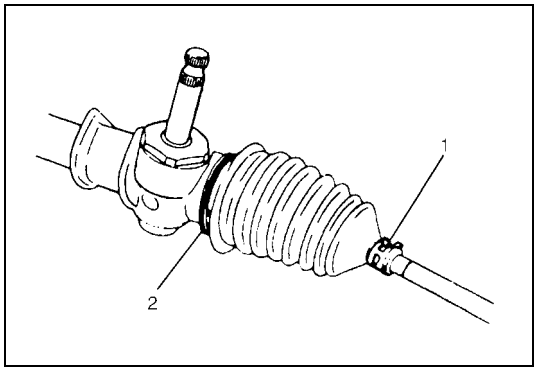
Unit Repair

Rack Boot / Tie Rod Removal and Installation

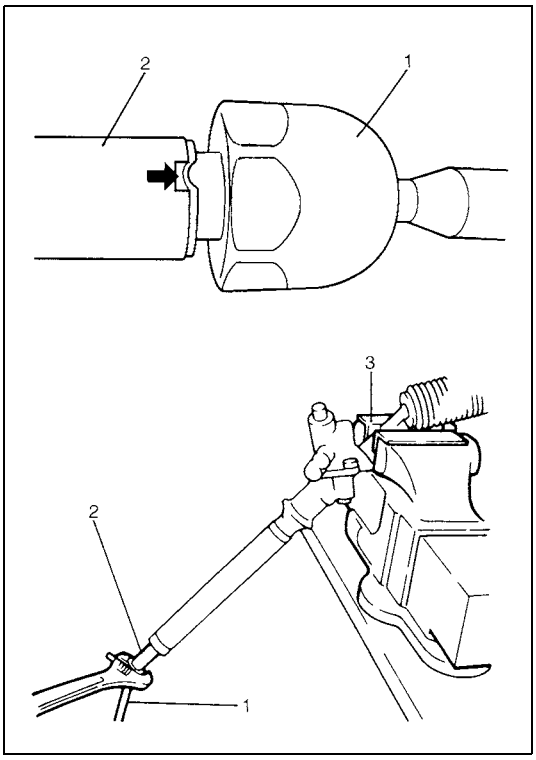


REMOVAL

1) Remove steering gear case referring to “Steering Gear Case Removal and Installation” in this section.
2) For ease of adjustment after installation, make marking (1) of tie rod end lock nut position of tie rod end thread.
3) Loosen tie rod end lock nut and remove tie rod end.

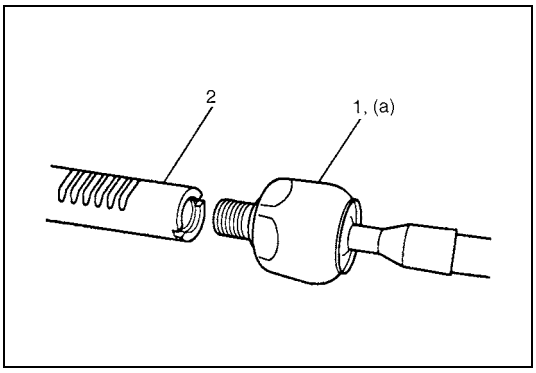


4) Remove boot band (2) and clip (1).
5) Remove boot from tie rod.



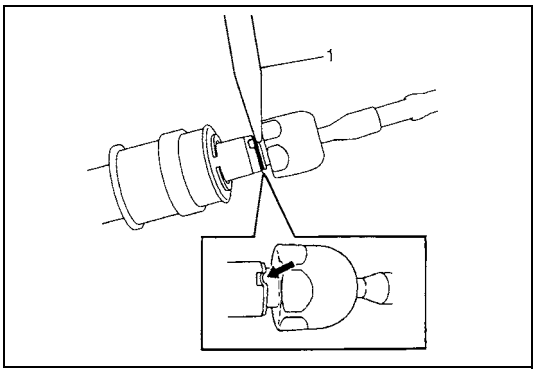
6) Unbend bent part of tie rod (1).
7) Hold rack with soft jawed vise (3) and remove tie rod from rack (2).

INSTALLATION

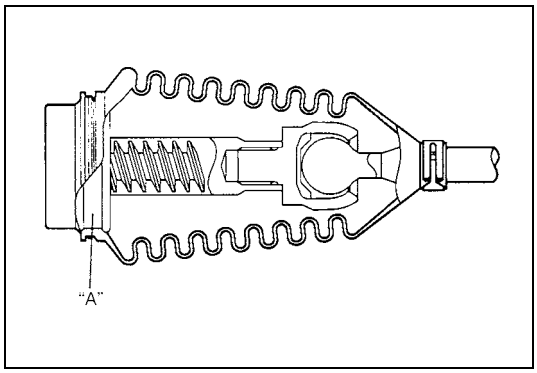


1) Install new tie rod (1) to rack (2).
2) Hold rack with soft jawed vise and tighten tie rod to specifiedtorque.

Tightening torque
Tie rod (a): 85 N·m (8.5 kg-m, 61.5 lb-ft)



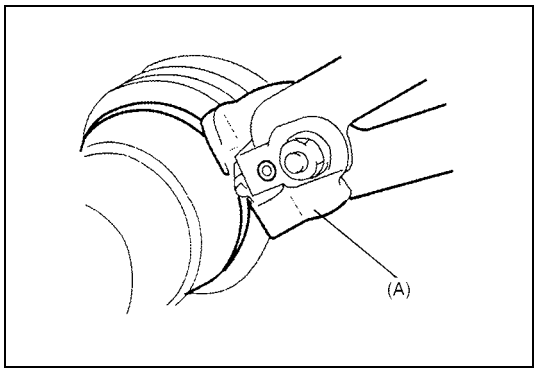
3) Caulk a part of tie rod indicated in figure with punch (1).



4) Apply sealant to gear case groove "A" indicated in figure.

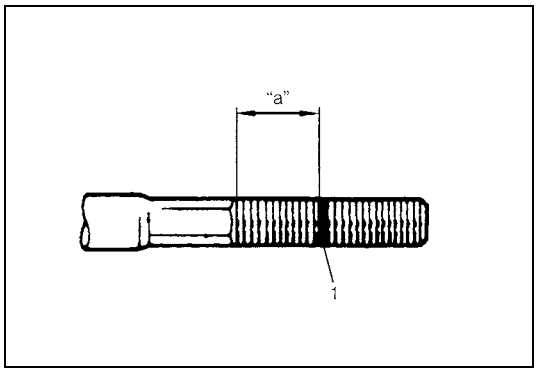
"A": Sealant, 99000-31120

Position boot properly in grooves of gear case (or rack side mount) and tie rod.
After this, check to ensure that boot is free from twist and dent.



5) Fasten boot with new band and clip securely.

Special tool
(A): 09943-55010



6) Install tie rod end lock nut and tie rod end to tie rod.
Position lock nut to marking (1) made in removal.

NOTE:

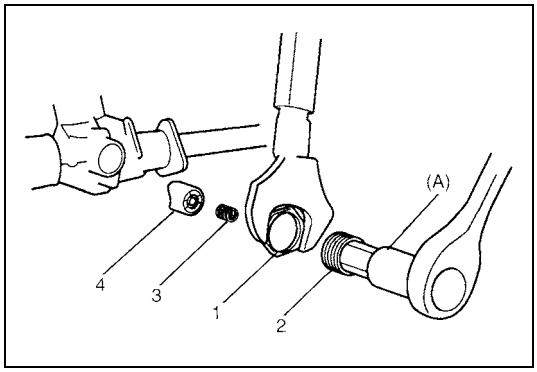
When tie rod was replaced, measure length "a" on removed tie rod and use it on new replacement tie rod so as to position lock nut properly.

7) Remount steering gear case referring to "Steering Gear Case Removal and Installation".

Steering Rack Plunger Removal and Installation

REMOVAL

1) Remove rack boots and tie rods referring to "Rack Boot / Tie Rod Removal and Installation".

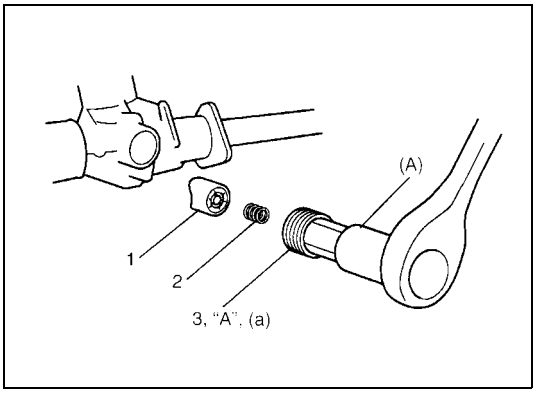


2) Loosen lock nut (1) with holding damper screw (2) with special tool.

Special tool
(A): 09944-28320

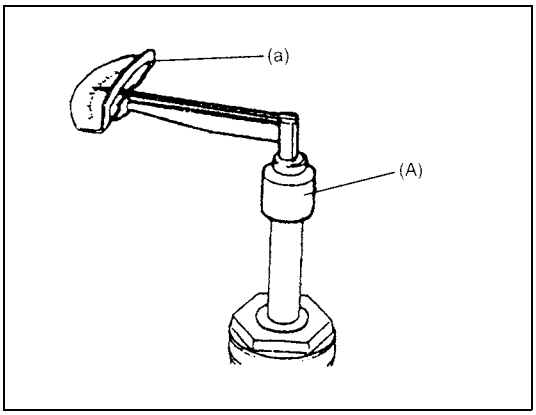
3) Remove lock nut (1), rack damper screw (2), rack plunger spring (3) and rack plunger (4).

INSTALLATION



1) Apply grease lightly to sliding part of plunger (1) against rack.
2) Install plunger and spring (2) as shown.
3) Apply sealant to all around thread part of rack damper screw (3) and tighten it to specified torque with special tool.

Special tool
(A): 09944-28320
"A": Sealant 1207F, 99000-31250
Tightening torque
Rack damper screw
(a): 7 – 12 N·m (0.7 – 1.2 kg-m, 5.5 – 8.5 lb-ft)

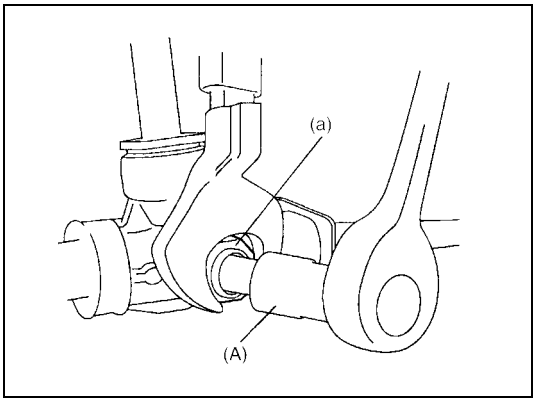


4) After tightening rack damper screw to specified torque, turn it back by 30° – 60° so that rotation torque becomes as specified below.
Pinion rotation torque should be checked with rack position centered.

Special tool
(A): 09944-18310

Rotation Torquer of pinion
(a): 0.5 – 1.2 N·m (0.05 – 0.12 kg-m, 0.36 – 0.87 lb-ft)

Also, check if rack as a whole moves smoothly.

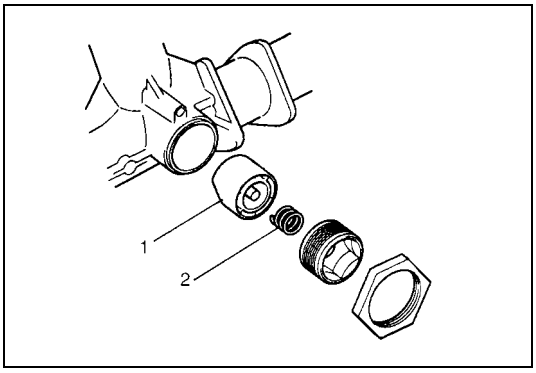


5) After adjustment, tighten lock nut to specified torque with holding damper screw at the position.

Special tool
(A): 09944-28320

Tightening torque
Rack damper screw lock nut
(a): 60 N·m (6.0 kg-m, 43.5 lb-ft)

Steering Rack Plunger Inspection

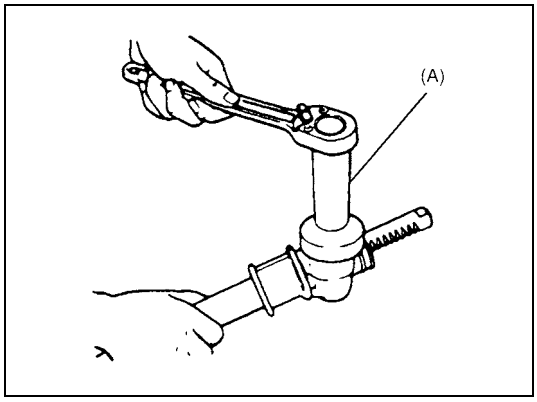


- Inspect rack plunger (1) for wear or damage.
- Inspect rack plunger spring (2) for deterioration.
In either case, if found defective, replace.

Steering Pinion Removal and Installation

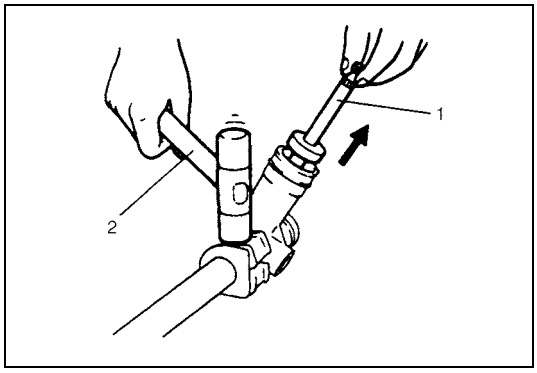
REMOVAL

1) Remove rack plunger referring to “Steering Rack Plunger Removal and Installation”.

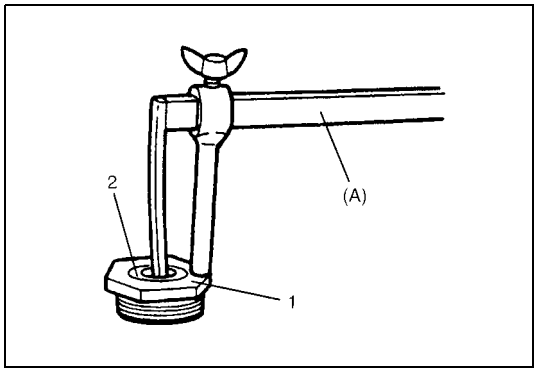


2) Remove bearing plug with special tool.

Special tool
(A): 09944-28310



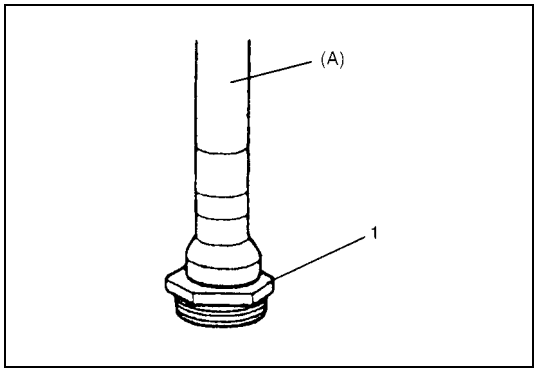
3) Tap on position as shown with plastic hammer (2) to separate pinion assembly (1) from housing, and remove pinion assembly (1).



4) Remove oil seal (2) with special tool from pinion bearing plug (1).

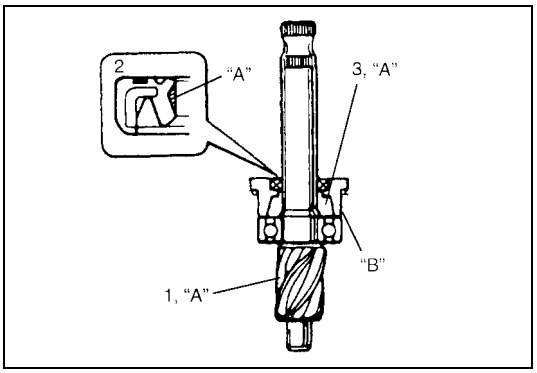
Special tool
(A): 09913-50121

INSTALLATION



1) Install new oil seal with special tool to pinion bearing plug (1).

Special tool
(A): 09925-98210

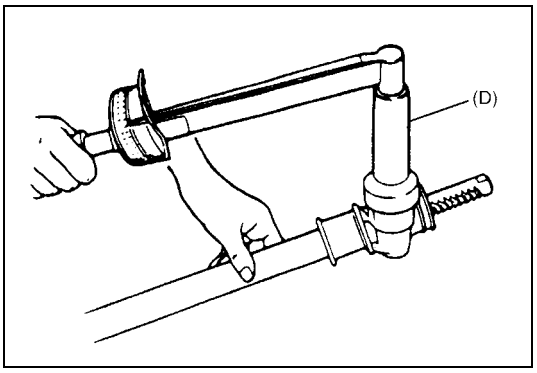


2) Apply grease to all around pinion teeth (1), pinion needle bearing, gear case, O-ring and gear case oil seal lip (2). Fill inside of pinion bearing plug (3) with grease.

"A": Grease E, 99000-25050

3) Apply thread lock cement to pinion bearing plug thread. Install pinion assembly to steering gear case.

"B": Thread lock cement 1342, 99000-32050



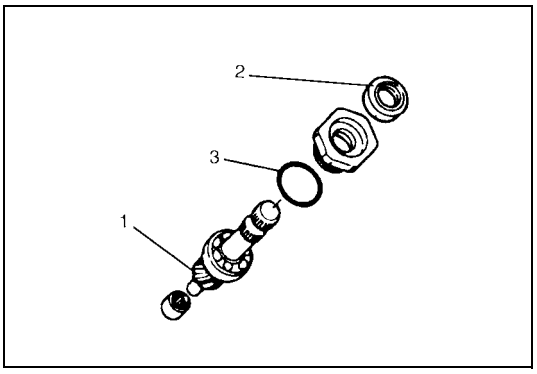
4) Tighten pinion bearing plug to specified torque.

Tightening torque
Pinion bearing plug: 60 N·m (6.0 kg-m, 43.5 lb-ft)

Special tool
(D): 09944-28310

5) Install rack plunger referring to "Steering Rack Plunger Removal and Installation" in this section.

Steering Pinion Inspection

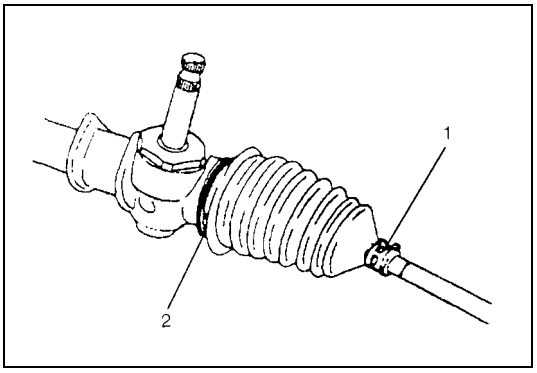


- Inspect pinion teeth surface (1) for wear or damage.
- Inspect oil seal (2) for damage.
- Inspect O-ring (3) for damage.
- Check rotation condition of bearing and inspect for wear. If found defective, replace.

Steering Rack Removal and Installation

REMOVAL

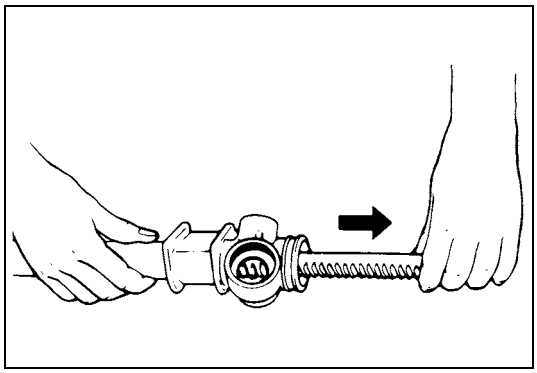
1) Remove steering gear case.



2) Remove boot bands (2) and clips (1).
3) Move both boots toward tie rod end.

4) Remove tie rods (right and left) from steering rack referring to "Rack Boot / Tie Rod Removal and Installation" in this section.
5) Mark left and right tie rods accordingly.

6) Remove rack plunger and pinion assembly from gear case referring to “Steering Pinion Removal and Installation” in this section.

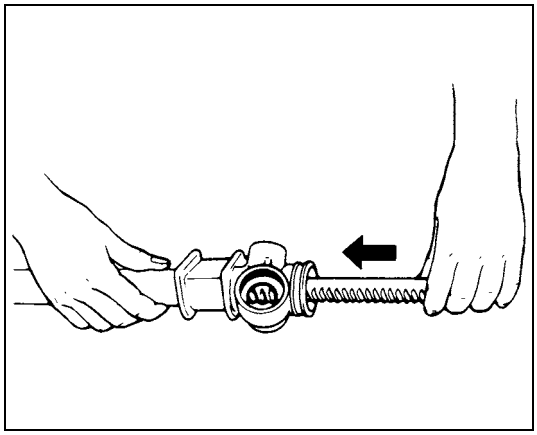


7) Remove rack from gear case. Direction for rack removal is as shown.

CAUTION:
Inside of steering rack bushing is coated with special coating. As it is damageable, be very careful not to cause damage to it when removing rack from steering gear case.

INSTALLATION

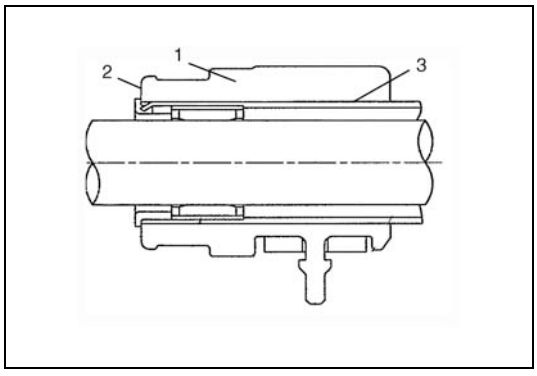
1) Apply grease to entire teeth surface of rack and its periphery.



2) Slide rack into steering gear case in the direction as shown.

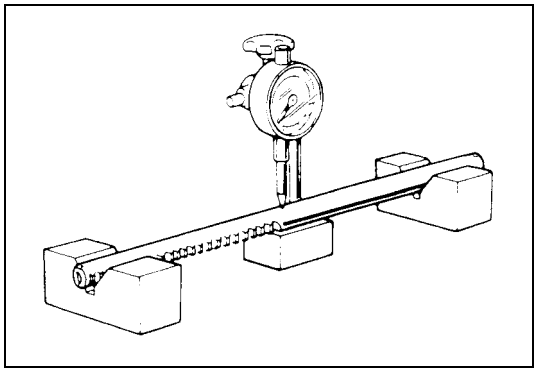
CAUTION:
Inside of steering rack bushing is coated with special coating. As it is damageable, be very careful not to cause damage to it when inserting rack into steering gear case.

3) Install pinion assembly to gear case referring to “Steering Pinion Removal and Installation” in this section.
4) Install Steering Rack Plunger referring to “Steering Rack Plunger Removal and Installation” in this section.



5) Before installing boot to steering rack housing (3), position rack side mount (1) so that its end (2) is flush with housing end. Install tie rods to rack referring to “Rack Boot / Tie Rod Removal and Installation” in this section.

Steering Rack Inspection



Inspect for deflection, teeth wear, or damage, back surface wear or damage.

CAUTION:
Do not use a wire brush when cleaning.

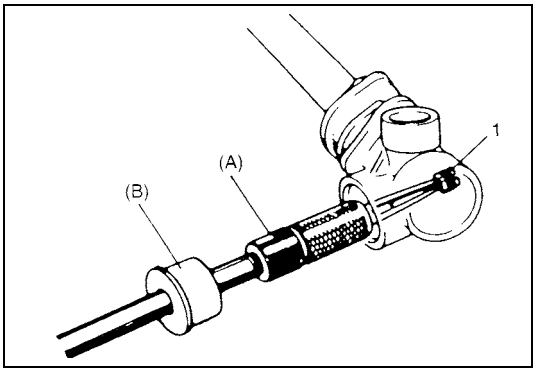
Limit of rack deflection
: 0.4 mm (0.016 in.)

If deflection exceeds limit, replace rack.

Pinion Bearing Removal and Installation

REMOVAL

1) Remove rack from steering gear case referring to “Steering Rack Removal and Installation” in this section.

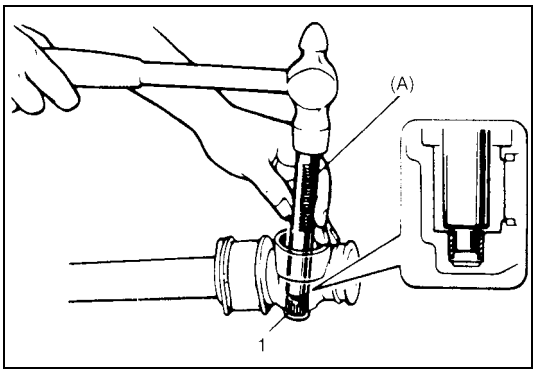


2) Remove pinion bearing (1) from gear case with special tools as shown.

Special tool
(A): 09921-20200
(B): 09930-30104

INSTALLATION

1) Apply grease to rollers of pinion bearing.



2) Press-fit pinion bearing (1) into gear case with special tool as shown.
After press-fitting, make sure that bearing rollers are installed properly.

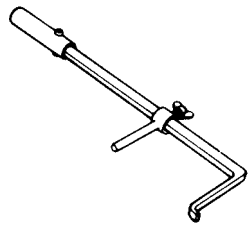
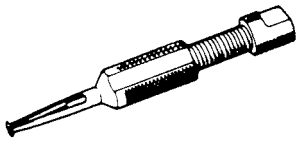
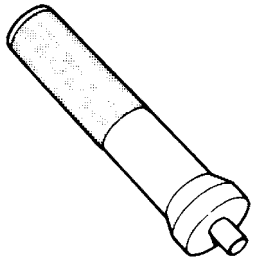
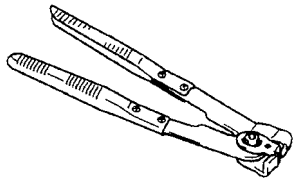
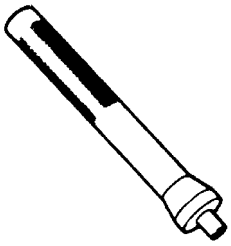
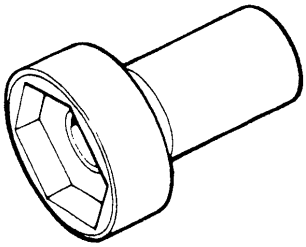
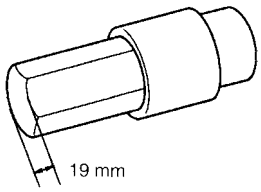
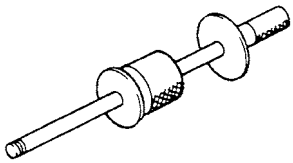
Special tool
(A): 09943-88211

3) Install rack referring to “Steering Rack Removal and Installation” in this section to complete installation.

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Lithium Grease (Should be applicable for –40 C° – 130 °C or –40 °F – 266 °F)	SUZUKI SUPER GREASE (E) (99000-25050)	• Sliding part of rack against steering housing (All around rack plunger and rack) • Sliding part against steering pinion (Oil seal lip, needle bearing) • Steering rack and pinion gear teeth • Rack end ball joint
Lock cement	THREAD LOCK CEMENT 1342 (99000-32050)	• Pinion bearing plug thread
Sealant	SUZUKI BOND NO. 1207F (99000-31250)	• All around thread part of rack damper screw
Silicon sealant	SUZUKI SILICONE SEAL (99000-31120)	• Contacting parts of gear case groove and pinion side boot

Special Tool

 09913-50121 Oil seal remover	 09921-20200 Pinion bearing remover	 09925-98210 Bearing installer	 09943-55010 (J-22610) Boot clamp plier
 09943-88211 Pinion bearing installer	 09944-18310 Pinion torque checking socket	 09944-28310 42 mm Socket (Pinion bearing plug socket)	 09944-28320 Hexagon bit (19 mm)
 09930-30104 Sliding hummer			

SECTION 3B1

ELECTRICAL POWER STEERING (P/S) SYSTEM

WARNING:

For vehicles equipped with a Supplemental Restraint (Air Bag) System :

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in Section 10B in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in Section 10B before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

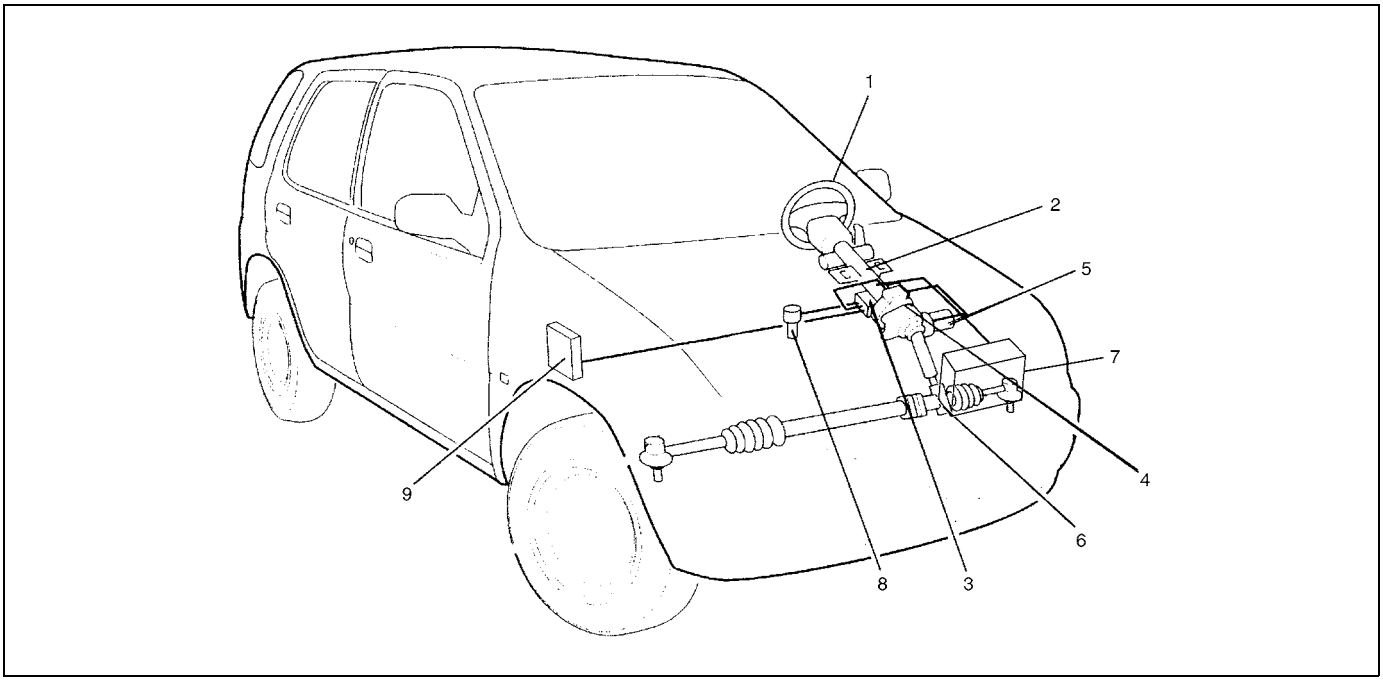
General Description

P/S System Construction

This power steering (P/S) system consists of a P/S control module, a torque sensor, a motor and a clutch installed to the steering column. In this system, the P/S control module determines the level and direction of the assist force for the steering wheel according to the signals from the torque sensor and the vehicle speed sensor (VSS). The P/S control module runs the motor so as to assist the operation of the steering wheel.

The P/S control module diagnoses troubles which may occur in the area including the following components when the ignition switch is ON and the engine is running. When the P/S control module detects any malfunction, it stops the motor and clutch operation.

- Torque sensor
- Vehicle speed sensor (VSS) circuit
- Engine speed signal circuit
- Motor
- Clutch
- P/S control module

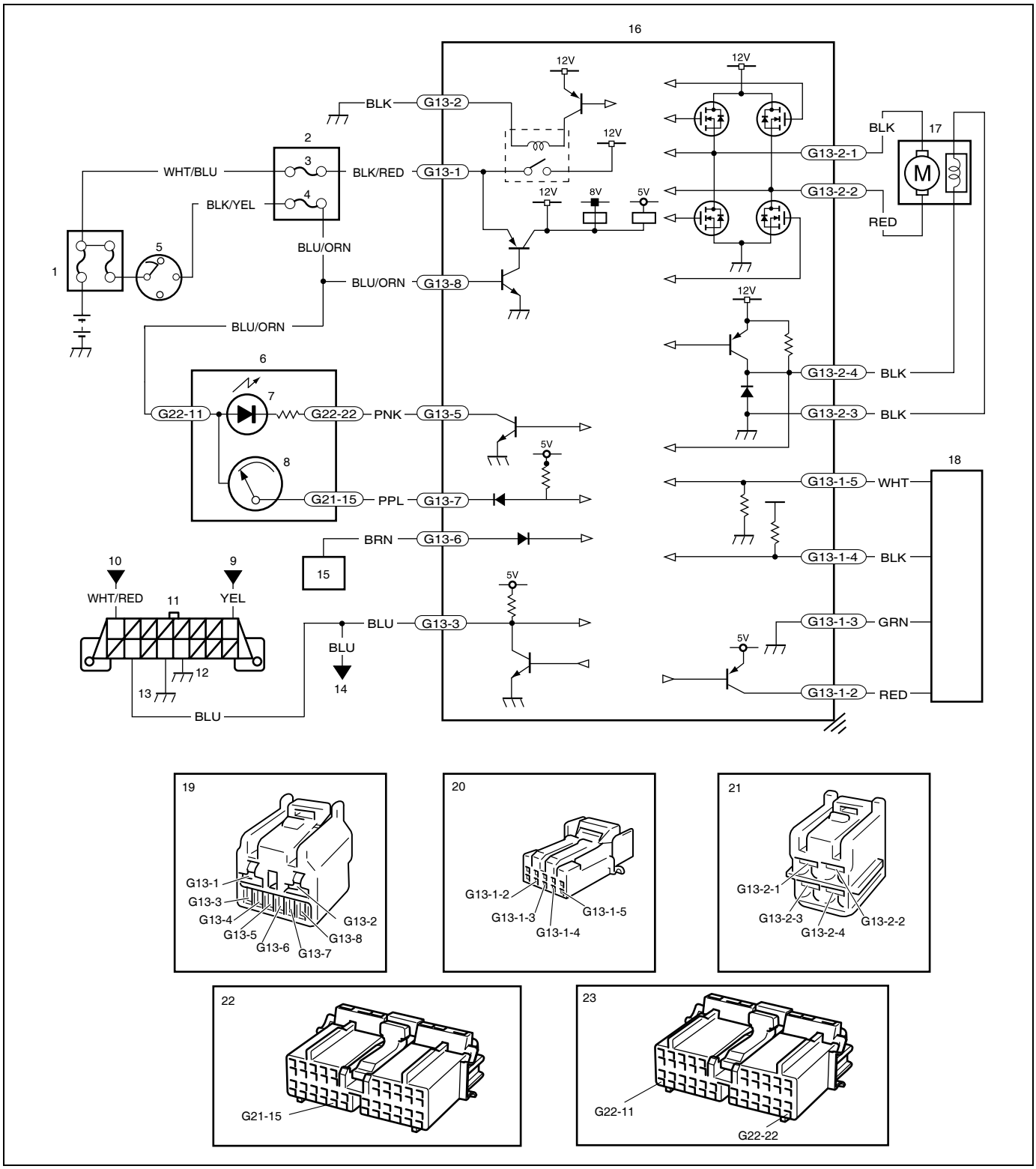


1. Steering wheel	4. Torque sensor	7. Battery
2. Steering column assembly	5. Motor and clutch	8. Vehicle speed sensor (VSS)
3. P/S control module	6. Steering gear box	9. ECM

NOTE:

For vehicle with a right-hand steering wheel, position of each component is symmetrical.

EPS System Wiring Circuit Diagram

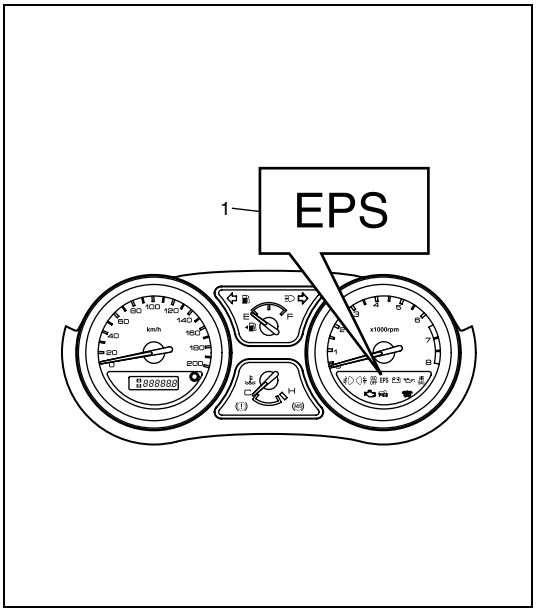


1. Main fuse box	9. From immobilizer control module	17. Motor assembly (with clutch incorporated)
2. Circuit fuse box	10. From circuit fuse box	18. Torque sensor
3. “P/S” fuse (30 A)	11. Data link connector (DLC)	19. Connector G13 (viewed from terminal side)
4. “METER” fuse (10 A)	12. Ground on engine block	20. Connector G13-1 (viewed from terminal side)
5. Ignition switch	13. Ground on body	21. Connector G13-2 (viewed from terminal side)
6. Combination meter	14. To ECM, Air bog SDM and ABS hydraulic unit/control module assembly (if equipped)	22. Connector G21 (viewed from terminal side)
7. “EPS” warning lamp	15. ECM	23. Connector G22 (viewed from terminal side)
8. Speedometer	16. P/S control module	

Diagnosis

The P/S system in this vehicle is controlled by the P/S control module. The P/S control module has an on-board diagnostic system which detects a malfunction in this system. When diagnosing troubles, be sure to have full understanding of the outline of “On-Board Diagnostic System Description” and each item in “Precaution in Diagnosing Troubles”, and then execute diagnosis according to “EPS System Check”.

On-Board Diagnostic System Description



The P/S control module performs the on-board diagnosis (self-diagnosis) on the system and operates the “EPS” warning lamp (1) as follows.

- The “EPS” warning lamp lights when the ignition switch is turned to ON position (but the engine at stop) regardless of the condition of the P/S control system. This is only to check if the “EPS” warning lamp is operated properly.
- If the areas monitored by the P/S control module is free from any trouble after the engine start (while engine is running), the “EPS” warning lamp turns OFF.
- When the P/S control module detects a trouble which has occurred in the monitored areas the “EPS” warning lamp flashes ON and OFF while the engine is running to warn the driver of such occurrence of the trouble and at the same time it stores the exact trouble area in memory inside of the P/S control module.

Precautions in Diagnosing Troubles

- Take a note of DTC (diagnostic trouble code) indicated on the Suzuki Scan Tool.
- Before inspection, be sure to read “Precautions for Electrical Circuit Service” in Section 0A and understand what is written there.
- DTC C1122 (engine speed signal failure) is indicated when ignition switch is at ON position and engine is not running, but it means there is nothing abnormal if indication changes to a normal one when engine is started.
- As DTC is stored in memory of the P/S control module, be sure to clear memory after repair by performing the procedure described in “DTC Clearance”.

EPS System Check

Step	Action	Yes	No
1	1) Record details of the problem. For your record, use of a questionnaire form as shown will facilitate collecting information for proper analysis and diagnosis. 2) Check if the problem described in “CUSTOMER QUESTIONNAIRE” actually occurs in the vehicle. (This step should be performed with the customer if possible.) 3) Check for operation of the “EPS” warning lamp referring to ““EPS” Warning Lamp Check”. 4) Check for DTC referring to “DTC Check” in this section, and then record DTC(s). 5) Clear DTC if any DTC exists referring to “DTC Clearance” in this section, and then recheck for DTC. Is any DTC still detected?	Go to Step 2.	Go to Step 3.
2	1) Inspect and repair referring to applicable “DTC Table” in this section. 2) Clear DTC referring to “DTC Clearance” in this section. Does the trouble recur?	Go to Step 5.	Go to Step 4.
3	1) Test drive the vehicle and turn the steering wheel fully to the right and left during the test drive. Check if any trouble exists. See WARNING. 2) Inspect and repair basic parts referring to “Diagnosis Table” in Section 3. 3) If the trouble cannot be repaired in Step 3-2), inspect and repair referring to “Trouble Diagnosis (For Trouble Not Indicated by On-Board Diagnostic System)” in this section. Does the trouble recur?	Go to Step 5.	Go to Step 4.
4	1) Confirm if the problem is solved and the P/S system is free from any abnormal conditions. If what has been repaired is related to the DTC, clear the DTC once and perform the test drive in Step 3-1), and then confirm that no DTC is indicated. Is any malfunction DTC detected?	Go to Step 5.	END
5	1) Check for DTC referring to “DTC Check” in this section. Is any DTC detected?	Go to Step 2.	Go to Step 3.

WARNING:
Carry out test drive in light traffic area to prevent an accident.

NOTE:

- **As execution of “DTC Clearance” will clear all DTCs, be sure to record all DTCs before service.**
- **DTC C1122 is indicated when ignition switch is at ON position and engine is not running, it means that nothing is abnormal.**
- **Current DTC and history DTC can be identified by condition of the “EPS” warning lamp. “EPS” warning lamp operates as follows.**

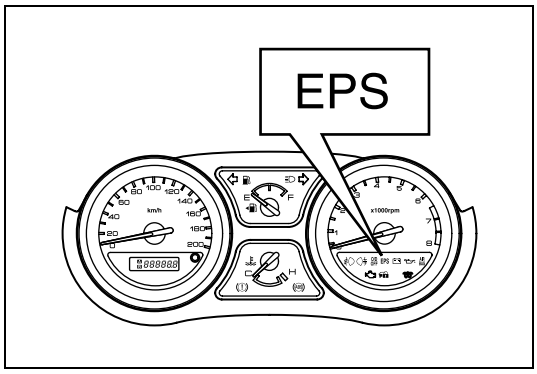
	Current DTC is set. (Abnormality exists at present.)	**Only history DTC is set. (Faulty condition occurred once in the past, but normal condition is detected at present.)**	**Current and history DTC exist.**
"EPS" warning lamp after engine started	Remains ON.	Turns OFF.	Remains ON.

CUSTOMER QUESTIONNAIRE (EXAMPLE)

Customer's name:	Model:	VIN:	
Date of issue:	Date Reg.	Date of problem:	Mileage:

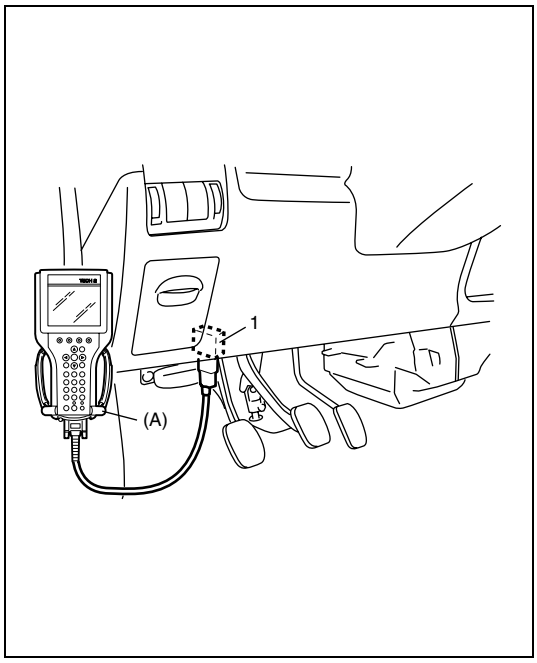
Problem Symptoms	• Steering wheel feels heavy • Vehicle pulls to one side during straight driving • Poor recovery from turns • Too much play in steering • Abnormal noise while vehicle is running: from motor, from rack and pinon, other_____ • Other_____
Frequency of Occurrence	• Continuous/Intermittent (times a day, a month)/ other_____
Conditions for Occurrence of Problem	• Vehicle at stop & ignition switch ON: • When starting: at initial start only/at every start/Other_____ • Vehicle speed: while: while accelerating/while decelerating/at stop/ while turning/while running at constant speed/ other_____ • Road surface condition: Paved road/rough road/snow-covered road/other_____ • Chain equipment:
Environmental Condition	• Weather: fair/cloudy/rain/snow/other_____ • Temperature: °F (°C)
DTC	• First check: Normal code/malfunction code ( ) • Second check after driving test: Normal code/malfunction code ( )

"EPS" Warning Lamp Check



1) Turn ignition switch to ON position (but without running engine) and check if the "EPS" warning lamp lights up. If the lamp dose not light up, go to ""EPS" Warning Lamp Dose Not Come ON at Ignition Switch ON But Leaving Engine OFF" of the diagnostic flows.
2) Start engine and check if the "EPS" warning lamp turns OFF. If the lamp comes OFF, the P/S system is in good condition.

DTC Check



1) Turn ignition switch to OFF position.
2) Connect Suzuki Scan Tool to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

Special tool
(A): Suzuki Scan Tool

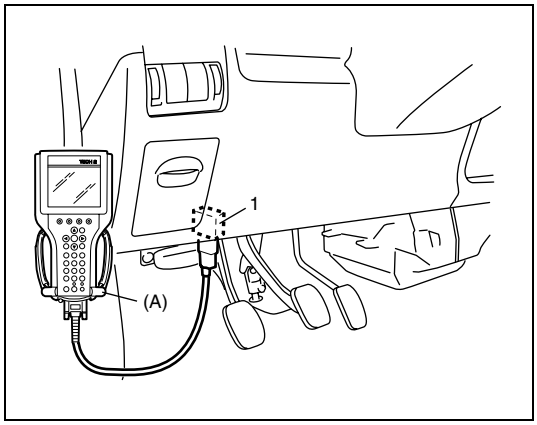
3) Turn ignition switch to ON position.
4) Read DTC according to the instructions displayed on Suzuki Scan Tool. For further details, refer to operator's manual for Suzuki Scan Tool.

NOTE:

If communication between Suzuki Scan Tool and the vehicle can not be established, perform "Serial Data Link Circuit Check" described in this section.

5) After completing the check, turn ignition switch to OFF position and disconnect Suzuki Scan Tool from DLC.

DTC Clearance



1) Turn ignition switch to OFF position.
2) Connect Suzuki Scan Tool to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

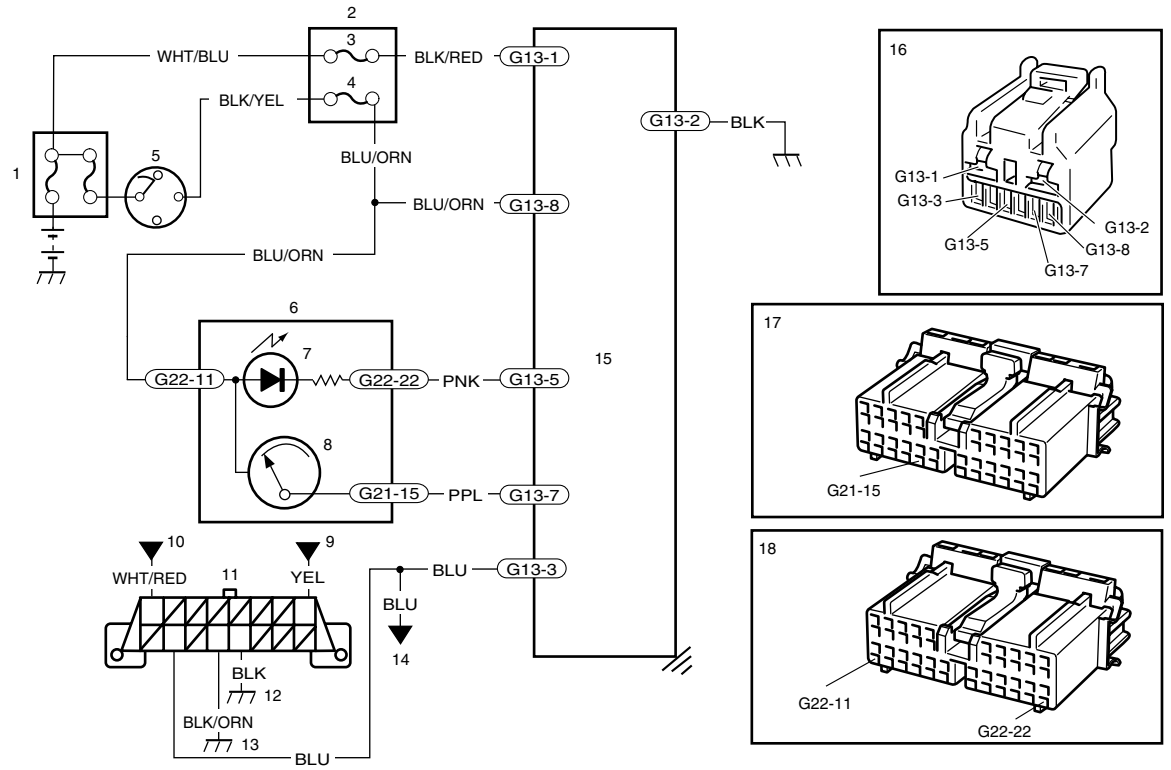
Special tool
(A): Suzuki Scan Tool

3) Turn ignition switch to ON position.
4) Erase DTC according to the instructions displayed on Suzuki Scan Tool. For further details, refer to operator's manual for Suzuki Scan Tool.
5) After completing the clearance, turn ignition switch to OFF position and disconnect Suzuki Scan Tool from DLC.

Serial Data Link Circuit Check

CAUTION:
Be sure to perform "EPS System Check" before starting "DTC Troubleshooting".

WIRING DIAGRAM

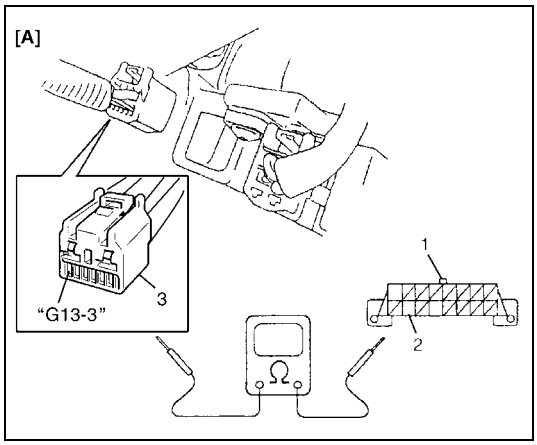


1. Main fuse box	7. "EPS" warning lamp	13. Ground on body
2. Circuit fuse box	8. Speedometer	14. To ECM, Air bag SDM and ABS hydraulic unit/control module assembly (if equipped)
3. "P/S" fuse (30 A)	9. From immobilizer control module	15. P/S control module
4. "METER" fuse (10 A)	10. From circuit fuse box	16. Connector G13 (viewed from terminal side)
5. Ignition switch	11. Data link connector (DLC)	17. Connector G21 (viewed from terminal side)
6. Combination meter	12. Ground on engine block	18. Connector G22 (viewed from terminal side)

TROUBLESHOOTING

Step	Action	Yes	No
1	Was "EPS System Check" performed?	Go to Step 2.	Go to "EPS System Check" in this section.
2	1) Make sure that Suzuki Scan Tool is free from malfunction and that correct program card (software) for P/S system is used. 2) Turn ignition switch to OFF position. 3) Check proper connection of Suzuki Scan Tool to DLC. Is connection in good condition?	Go to Step 3.	Connect Suzuki Scan Tool to DLC properly.

Step	Action	Yes	No
3	1) Check if communication is possible by making communication with other controllers (ECM, ABS hydraulic unit/control module assembly (if equipped) or SDM) or other vehicles. Is it possible to communicate with the other controllers?	Go to Step 4.	Repair open in common section of serial data circuit (“BLU” wire circuit) used by all controllers or short to ground or power circuit which has occurred somewhere in serial data circuit (“BLU” wire circuit).
4	1) With ignition switch at OFF position, disconnect G13-8 terminal from P/S control module. 2) Check proper connection at “G13-3” (“BLU” wire) terminal for serial data circuit. 3) If OK, then check resistance between “G13-3” (“BLU” wire) terminal and “BLU” wire terminal for serial data circuit in DLC. Is resistance 1 Ω or less?	Substitute a known-good P/S control module and recheck. If communication is possible, replace the original P/S control module with a known-good P/S control module.	Repair high resistance or open in “BLU” wire circuit for P/S system.



[A]: Fig. for Step 4
1. DLC
2. “BLU” wire terminal
3. Connector “G13” (viewed from terminal side)

DTC Table

CAUTION:
Be sure to perform the "EPS System Check" before starting troubleshooting corresponding to each DTC.

DTC (displayed on Suzuki Scan Tool)	Diagnosis	
No DTC	Normal	This is displayed on Suzuki Scan Tool when there is no problem with EPS system.
C1111	Torque sensor main circuit failure	Perform diagnosis corresponding to each DTC.
C1113	Torque sensor main and sub circuit failure	
C1114	Torque sensor 5 V power supply circuit failure	
C1115	Torque sensor sub circuit failure	
C1121	VSS circuit failure	
C1123		
C1124		
C1122	Engine speed signal circuit failure	
C1141	Motor circuit failure	
C1142		
C1143		
C1144		
C1145		
C1151	Clutch circuit failure	
C1152	P/S control module power supply circuit failure	
C1154		
C1155		
C1153	P/S control module power supply circuit failure	

Scan Tool Data

Scan Tool Data	Normal Condition
BATTERY VOLT	10 – 14 V
TQS POWER SUPPL	7.5 – 10 v
MOT POWER SUPPL	ON
MOTOR VOLT	1.5 – 2 V
TQS MAIN TORQUE	0 N·m
TQS SUB TORQUE	0 N·m
ASSIST TORQUE	0 N·m
MOTOR (CON)	0 A
MOTOR (MON)	0 A
CLUTCH (CON)	ON
CLUTCH (MON)	ON
VEHICLE SPEED	0 km/h 0 MPH
ENGINE SPEED	700 ± 50 rpm
IGNITION SWITCH	ON

Scan tool data definitions

BATTERY VOLT

Battery Voltage is an analog input signal read by the ECU.

TQS POWER SUPPL

This parameter indicates the power supply voltage which the EPS controller supplies to the torque sensor.

MOT POWER SUPPL

This parameter indicates the condition of the power supply to the motor.

MOTOR VOLT

This parameter indicates the voltage between motor terminals.

TQS MAIN TORQUE

The torque sensor is installed to detect the steering force and the steering direction. It consists of two potentiometers and the main torque sensor is one of these.

TQS SUB TORQUE

The torque sensor is installed to detect the steering force and the steering direction. It consists of two potentiometers and the sub-torque sensor is one of these. Its output characteristics are compared with those of the main torque sensor.

ASSIST TORQUE

This parameter is an internal parameter of the EPS controller. It is obtained by computing the torque sensor input signal.

MOTOR (CON)

Based on the input signal, the EPS controller determines the assist amount and controls the current to the motor suitable for that assist amount. This parameter indicates that control value.

MOTOR (MON)

This parameter indicates the actually measured value of the current flowing to the motor. The motor circuit condition is diagnosed by comparing this parameter with “MOTOR (CON)” parameter described previously.

CLUTCH (CON)

This parameter indicates whether the EPS controller controls the motor clutch or not.

CLUTCH (MON)

This parameter indicates the connection condition of the clutch from the clutch voltage monitored by the EPS controller.

VEHICLE SPEED

The AC voltage signal produced by the vehicle speed sensor (VSS) is divided and adjusted by the speedometer and thus the vehicle speed signal is obtained. The EPS controller determines the amount of power assist based on this vehicle speed signal and the torque sensor signal.

ENGINE SPEED

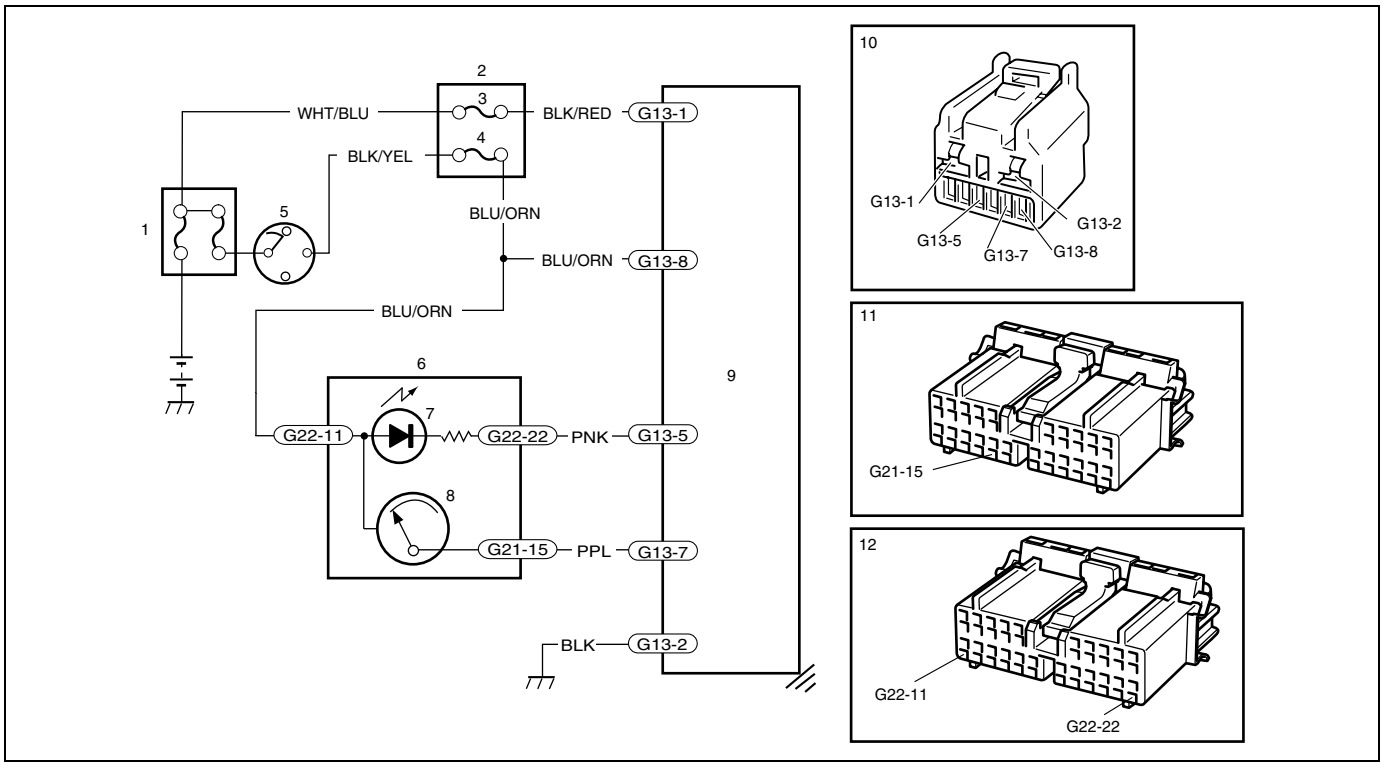
Engine speed signal is fed from the ECM so that it can be used for trouble diagnosis of the electric power steering system.

IGNITION SWITCH

This parameter indicates the condition of the power supply through the ignition switch.

"EPS" Warning Lamp Does Not Come ON at Ignition Switch ON But Leaving Engine OFF

WIRING DIAGRAM



1. Main fuse box	5. Ignition switch	9. P/S control module
2. Circuit fuse box	6. Combination meter	10. Connector G13 (viewed from terminal side)
3. "P/S" fuse (30 A)	7. "EPS" warning lamp	11. Connector G21 (viewed from terminal side)
4. "METER" fuse (10 A)	8. Speedometer	12. Connector G22 (viewed from terminal side)

TROUBLESHOOTING

Step	Action	Yes	No
1	1) Turn ignition switch ON. Do the other warning lamps come on?	Go to Step 2.	"BLK/YEL", "BLU/ORN" wire circuit or "METER" fuse open or short to ground.
2	1) Ignition switch OFF. 2) Remove and inspect the "P/S" fuse. Is fuse in good condition?	Reinstall the "P/S" fuse, and then go to Step 3.	Check "BLK/RED" wire circuit for short to ground. If OK, replace the "P/S" fuse.
3	1) With ignition switch OFF, disconnect P/S control module connector ("G13"). 2) Check for proper connection to the P/S control module at "G13-2" terminal. 3) Measure resistance between "G13-2" ("BLK" wire) terminal and body ground. Is it infinite (∞)?	"BLK" wire circuit open.	Go to Step 4.

Step	Action	Yes	No
4	1) Check for proper connection to P/S control module at “G13-1” terminal. 2) If OK, check for voltage between “G13-1” (“BLK/RED” wire) terminal and body ground with ignition switch ON. Is it 10 – 14 V?	Go to Step 5.	“WHT/BLU” or “BLK/RED” wire circuit open or short to ground.
5	1) Check for proper connection to the P/S control module at “G13-8” terminal. 2) If OK, check voltage between “G13-8” (“BLU/ORN” wire) terminal and body ground with ignition switch ON. Is it 10 – 14 V?	Go to Step 6.	“BLU/ORN” wire circuit open or short to ground.
6	1) Remove combination meter and disconnect combination meter connector (“G22”) with ignition switch turned OFF. 2) Check for proper connection to the combination meter at “G22-11” terminal. 3) If OK, check voltage between “G22-11” (“BLU/ORN” wire) terminal and body ground with ignition switch ON. Is it 10 – 14 V?	Go to Step 7.	“BLU/ORN” wire circuit open or short to ground.
7	1) Check for proper connection to the combination meter at “G22-22” terminal and P/S control module at “G13-5” terminal. 2) Measure resistance between the combination meter at “G22-22” terminal and the P/S control module at “G13-5” terminal. Is it infinite (∞)?	“PNK” wire circuit open.	Connect combination meter connector (“G22”) with ignition switch turned OFF. Go to Step 8.
8	1) Check for voltage between “G13-5” (“PNK” wire) terminal and body ground with ignition switch ON. Is it 10 – 14 V?	Replace the P/S control module.	Replace the combination meter.

“EPS” Warning Lamp Come ON at Ignition Switch ON But Leaving Engine OFF

WIRING DIAGRAM

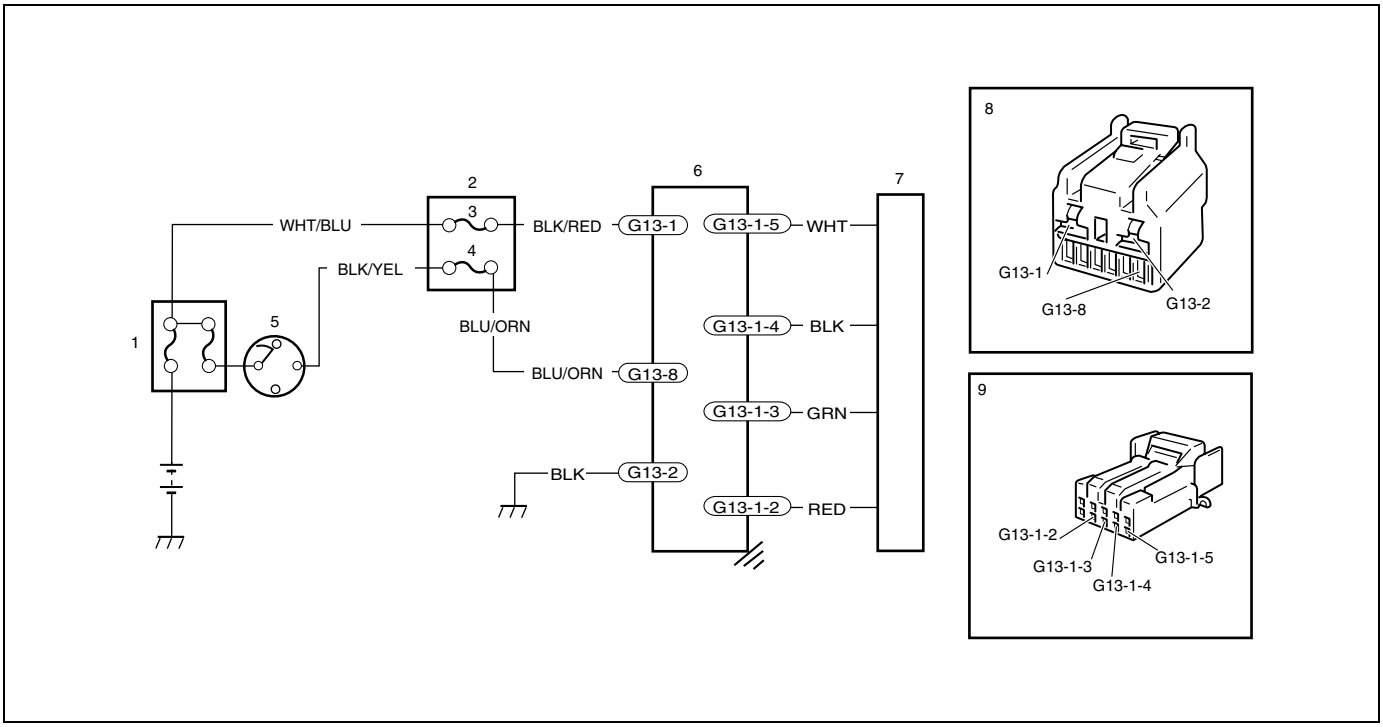
Refer to ““EPS” Warning Lamp Does Not Come ON at Ignition Switch ON But Leaving Engine OFF” in this section.

TROUBLESHOOTING

Step	Action	Yes	No
1	1) Perform diagnostic trouble code check. Is there any DTC (NO CODES on Suzuki Scan Tool) exists?	Go to Step 2.	Go to Step 3.
2	1) Does malfunction DTC exist at Step 1?	Go to Step 5 of “EPS System Check” in this section.	Go to Step 3.
3	1) With ignition switch OFF, disconnect P/S control module connector (“G13”). 2) Check for proper connection to the P/S control module at “G13-5” terminal. 3) If OK then ignition switch ON. Does EPS warning lamp turn on?	Connect P/S control module connector (“G13”) with ignition switch turned OFF. Go to Step 4.	Replace the P/S control module.
4	1) Remove combination meter and disconnect combination meter connector (“G22”). 2) Check for proper connection to combination meter at “G22-22” terminal. 3) If OK then ignition switch ON. Does EPS warning lamp turn on?	Replace the combination meter.	“PNK” wire circuit short to ground.

DTC C1111 Torque Sensor Main Circuit Failure
DTC C1113 Torque Sensor Main and Sub Circuit Failure
DTC C1115 Torque Sensor Sub Circuit Failure

WARING DIAGRAM



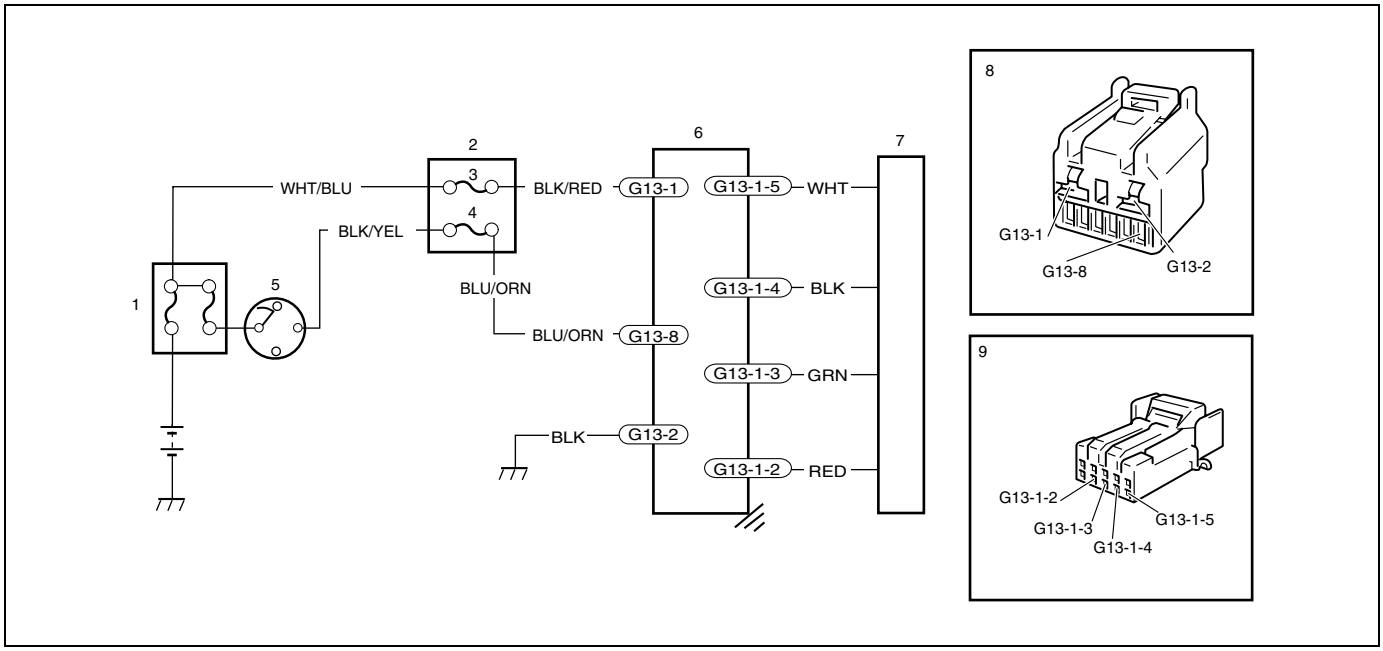
1. Main fuse box	4. "METER" fuse (10 A)	7. Torque sensor
2. Circuit fuse box	5. Ignition switch	8. Connector G13 (viewed from terminal side)
3. "P/S" fuse (30 A)	6. P/S control module	9. Connector G13-1 (viewed from terminal side)

DTC TROUBLESHOOTING

Step	Action	Yes	No
1	1) Was "EPS System Check" performed?	Go to Step 2.	Go to "EPS System Check".
2	1) Is DTC C1114 indicated, too?	Go to flow table corresponding to the DTC No.	Go to Step 3.
3	1) Check for proper connection for 5-terminals connector ("G13-1") to the P/S control module. 2) If OK, check torque sensor and its circuit referring to "Torque Sensor On-Vehicle Inspection" in this section. Is torque sensor in good condition?	Substitute the original P/S control module with a known-good P/S control module, and then recheck.	Replace the steering column assembly, and then recheck.

DTC C1114 Torque Sensor 5 V Power Supply Circuit Failure

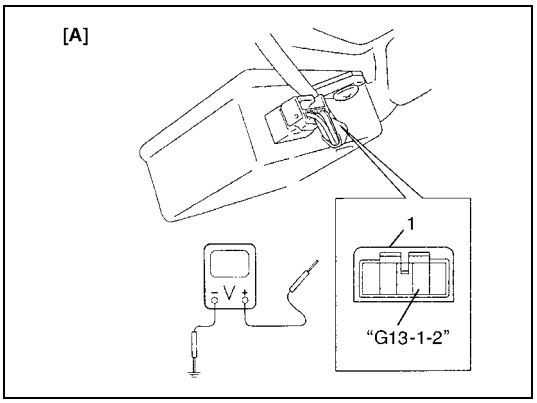
WIRING DIAGRAM



1. Main fuse box	4. "METER" fuse (10 A)	7. Torque sensor
2. Circuit fuse box	5. Ignition switch	8. Connector G13 (viewed from terminal side)
3. "P/S" fuse (30 A)	6. P/S control module	9. Connector G13-1 (viewed from terminal side)

DTC TROUBLESHOOTING

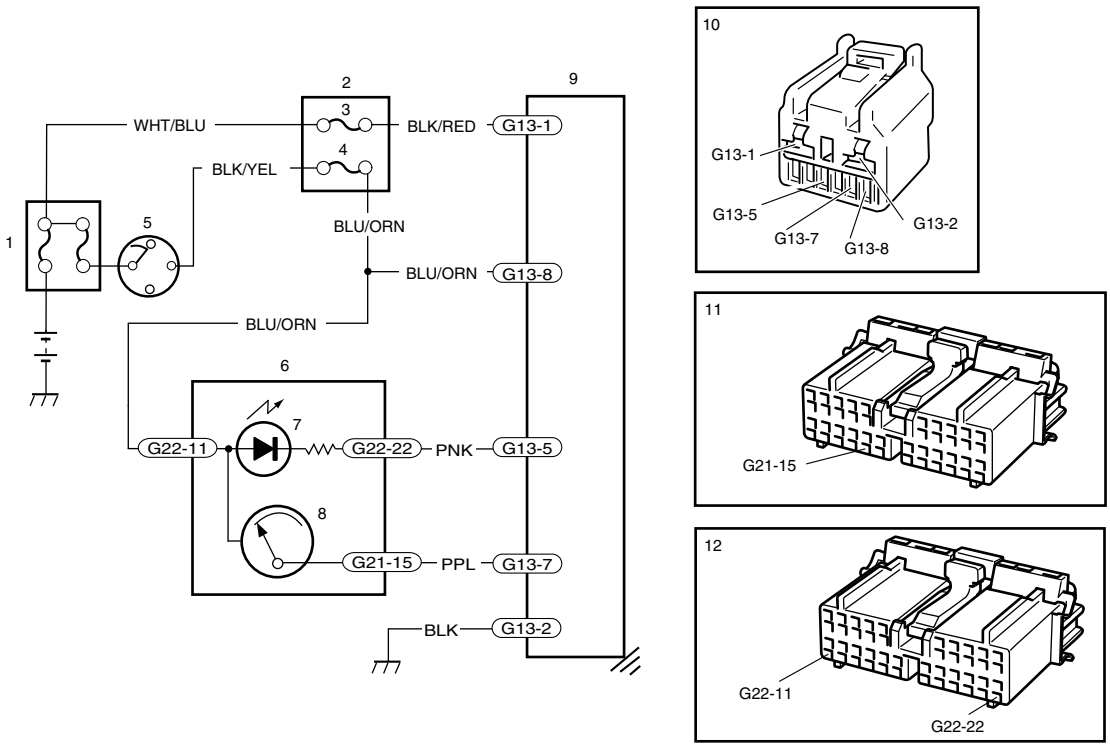
Step	Action	Yes	No
1	Was "EPS System Check" performed?	Go to Step 2.	Go to "EPS System Check".
2	1) Remove steering column hole cover. 2) Check for proper connection for 5-terminals connector ("G13-1") to the P/S control module. 3) If OK, turn ignition switch ON. 4) Check for voltage between "G13-1-2" ("RED" wire) terminal of 5-terminals connector ("G13-1") and body ground with connector ("G13-1") connected to the P/S control module. Is it about 5 V?	Go to Step 3.	Repair high resistance, open or short to power circuit or ground in 5V power supply ("RED" wire) circuit.
3	1) Check torque sensor and its circuit referring to "Torque Sensor On-Vehicle Inspection" in this section. Is torque sensor in good condition?	Substitute the original P/S control module with a known-good P/S control module, and then recheck.	Replace the steering column assembly, and then recheck.



[A]: Fig. for Step 2
1. Connector “G13-1” (viewed from harness side)

DTC C1121/C1123/C1124 VSS Circuit Failure

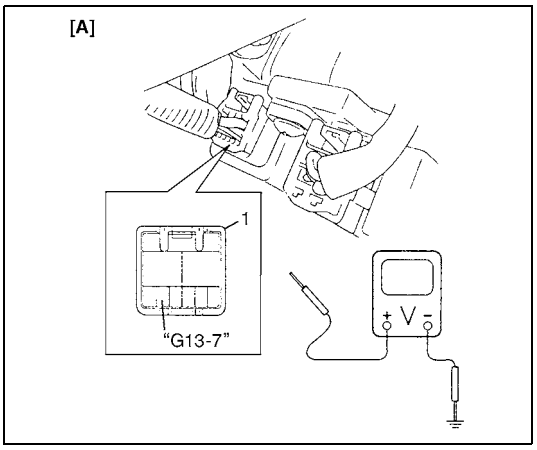
WIRING DIAGRAM



1. Main fuse box	5. Ignition switch	9. P/S control module
2. Circuit fuse box	6. Combination meter	10. Connector G13 (viewed from terminal side)
3. "P/S" fuse (30 A)	7. "EPS" warning lamp	11. Connector G21 (green connector) (viewed from terminal side)
4. "METER" fuse (10 A)	8. Speedometer	12. Connector G22 (blue connector) (viewed from terminal side)

DTC TROUBLESHOOTING

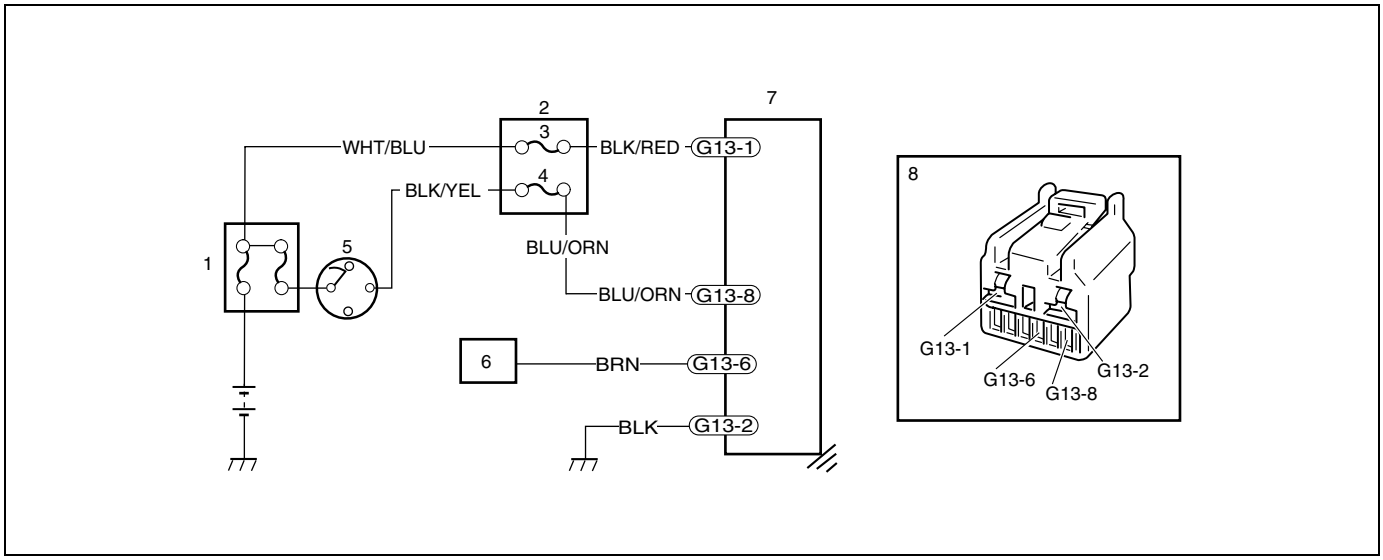
Step	Action	Yes	No
1	Was "EPS System Check" performed?	Go to Step 2.	Go to "EPS System Check".
2	1) Ignition switch OFF. 2) Remove steering column lower cover. 3) Disconnect 8-terminals connector ("G13") from P/S control module. 4) Check for proper connection to the P/S control module at "G13-7" ("PPL" wire) terminal. 5) If OK, connect voltmeter between "G13-7" ("PPL" wire) terminal and body ground with connector ("G13") connected. 6) Hoist front end of vehicle and lock front right tire. 7) Turn front left tire quickly with ignition switch ON. Does voltmeter indicate deflection between 0 – 1 V and 9 – 11 V a few times while tire is turned one revolution?	Check for intermittent trouble referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute the original P/S control module with a known-good P/S control module, and then recheck.	Repair VSS or its ("PPL" wire) circuit.



[A]: Fig. for Step 2
1. Connector "G13" (viewed from harness side)

DTC C1122 Engine Speed Signal Circuit Failure

WIRING DIAGRAM



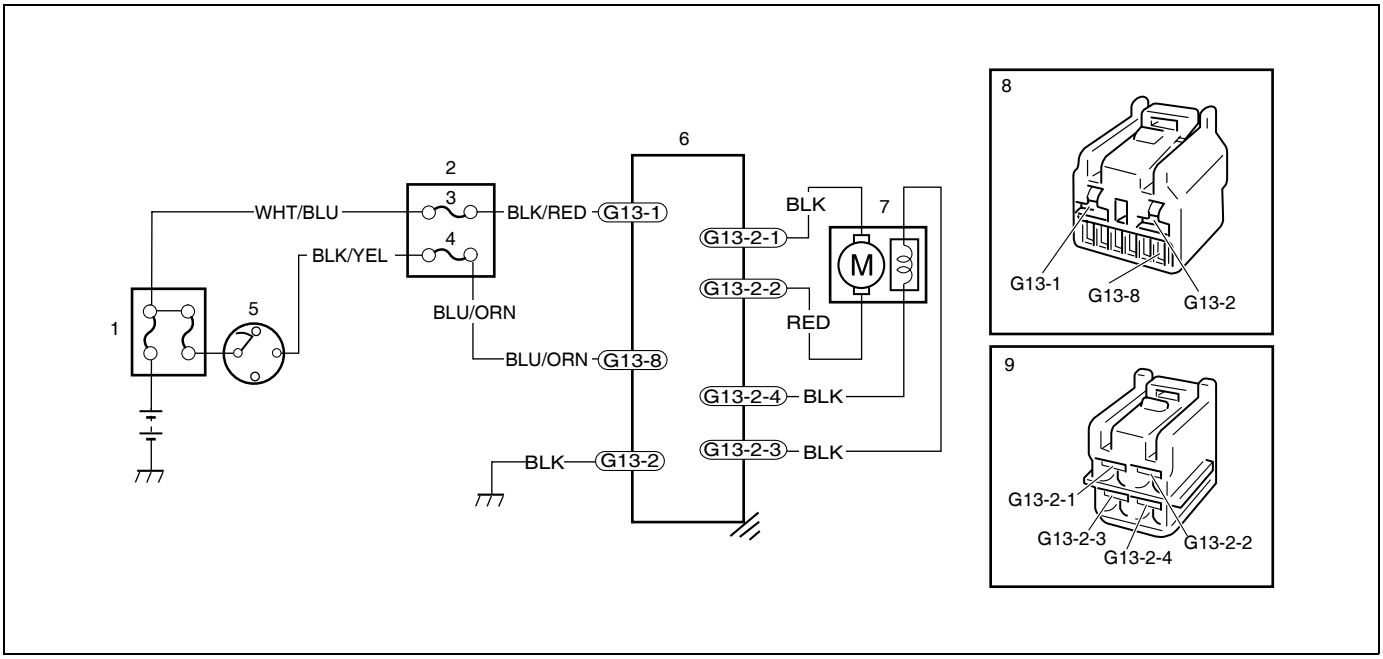
1. Main fuse box	4. "METER" fuse (10 A)	7. P/S control module
2. Circuit fuse box	5. Ignition switch	8. Connector G13 (viewed from terminal side)
3. "P/S" fuse (30 A)	6. ECM	

DTC TROUBLESHOOTING

Step	Action	Yes	No
1	Was "EPS System Check" performed?	Go to Step 2.	Go to "EPS System Check".
2	1) Recheck DTC with engine running. Is DTC C1122 indicated?	Go to Step 3.	P/S system is in normal condition.
3	1) Check for proper connection to the P/S control module and ECM at each "BRN" wire terminal (P/S control module side: "G13-6" terminal, ECM side: Refer to "ECM INPUT/OUTPUT CIRCUIT DIAGRAM" under "Electronic Control System Description" in Section 6E1), then check for intermittent trouble referring to "Intermittent and Poor Connection" in Section 0A. 2) If they are OK, check for high resistance, open or short to power circuit or ground in "BRN" wire circuit. Is check result in good condition?	Substitute the original P/S control module with a known-good P/S control module, and then recheck.	Repair.

DTC C1141/C1142/C1143/C1144/C1145 Motor Circuit Failure

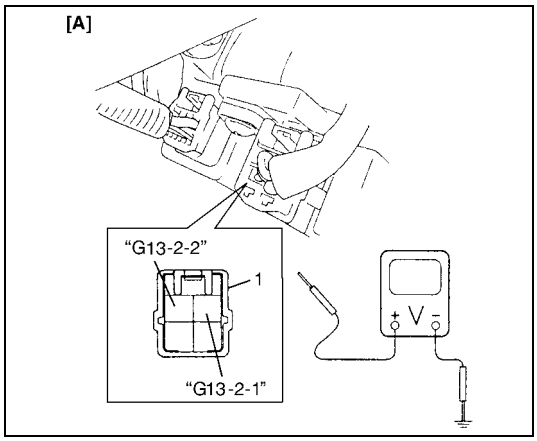
WIRING DIAGRAM



1. Main fuse box	4. "METER" fuse (10 A)	7. Motor assembly (with clutch incorporated)
2. Circuit fuse box	5. Ignition switch	8. Connector G13 (viewed from terminal side)
3. "P/S" fuse (30 A)	6. P/S control module	9. Connector G13-2 (viewed from terminal side)

DTC TROUBLESHOOTING

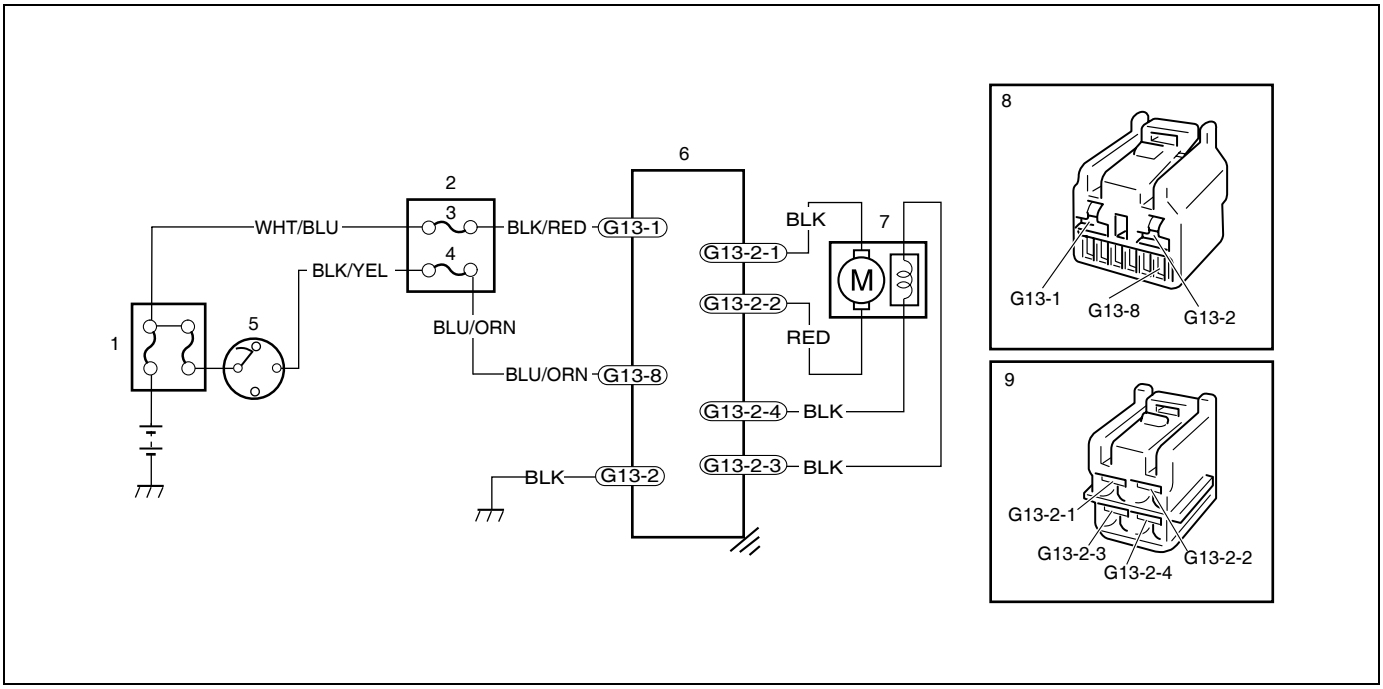
Step	Action	Yes	No
1	Was "EPS System Check" performed?	Go to Step 2.	Go to "EPS System Check".
2	1) Remove steering column hole cover. 2) Check for proper connection for 4-terminals connector ("G13-2") to P/S control module. 3) If OK, start engine. 4) Check for voltage between "G13-2-1" ("BLK" wire) terminal and body ground and "G13-2-2" ("RED" wire) terminal and body ground with connector ("G13-2") connected to the P/S control module. Are they 5 – 7 V with steering wheel at straight position?	Go to Step 3.	Repair poor connection, high resistance, open or short to power circuit or ground in "G13-2-1" ("BLK" wire) or "G13-2-2" ("RED" wire) circuit.
3	1) Check motor and its circuit referring to "Motor Assembly (with Clutch Incorporated) On-Vehicle Inspection". Is motor and clutch in good condition?	Substitute the original P/S control module with a known-good P/S control module, and then recheck.	Replace the steering column assembly, and then recheck.



[A]: Fig. for Step 2
1. Connector "G13-2" (viewed from harness side)

DTC C1151 Clutch Circuit Failure

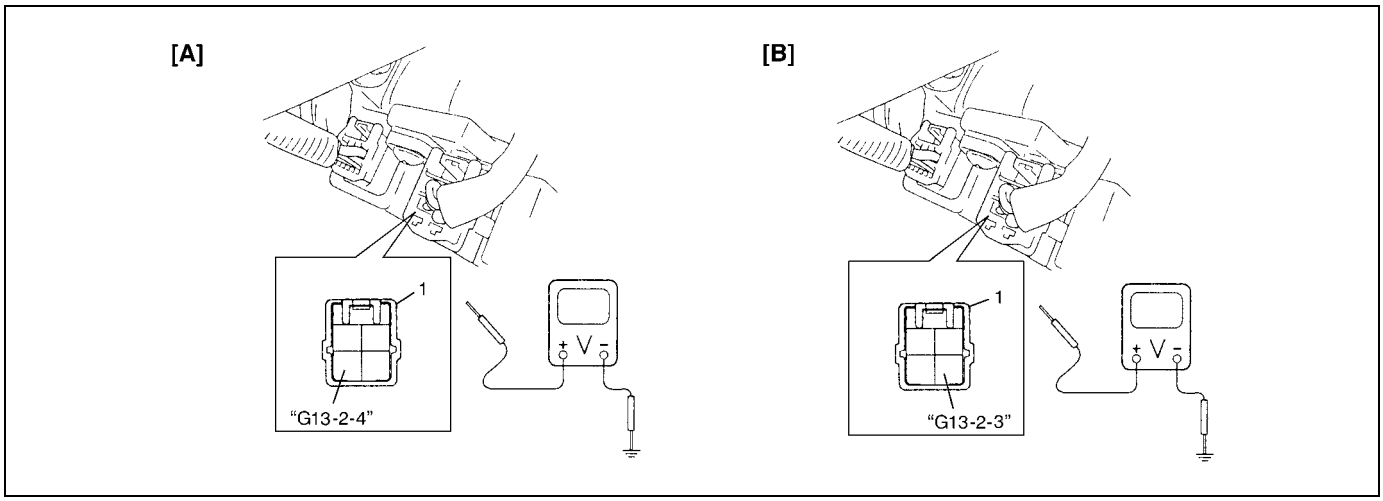
WIRING DIAGRAM



1. Main fuse box	4. "METER" fuse (10 A)	7. Motor assembly (with clutch incorporated)
2. Circuit fuse box	5. Ignition switch	8. Connector G13 (viewed from terminal side)
3. "P/S" fuse (30 A)	6. P/S control module	9. Connector G13-2 (viewed from terminal side)

DTC TROUBLESHOOTING

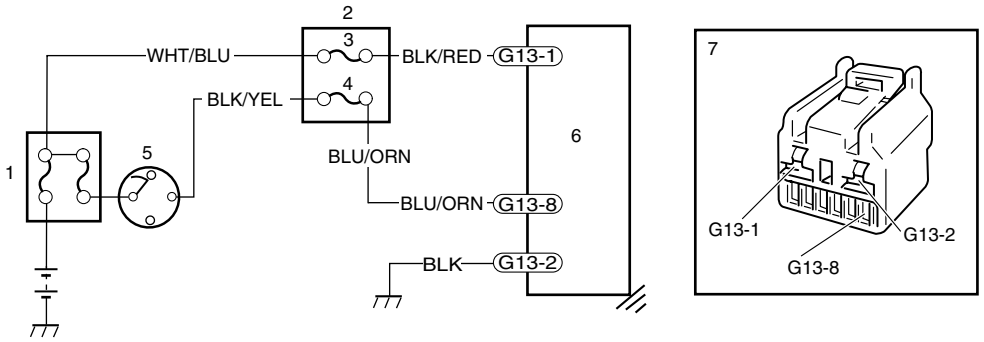
Step	Action	Yes	No
1	Was "EPS System Check" performed?	Go to Step 2.	Go to "EPS System Check".
2	1) Remove steering column hole cover. 2) Check for proper connection for 4-terminals connector ("G13-2") to the P/S control module. 3) If OK, start engine. 4) Check for voltage between "G13-2-4" ("BLK" wire) terminal and body ground with connector ("G13-2") connected to the P/S control module. Is it 0 V?	Go to Step 3.	Repair poor connection, high resistance, open or short to power circuit or ground in "G13-2-4" ("BLK" wire) circuit.
3	1) Check for voltage between "G13-2-3" ("BLK" wire) terminal and body ground with connector ("G13-2") connected to P/S control module. Is it 10 – 14 V with steering wheel at straight position?	Go to Step 4.	Repair poor connection, high resistance, open or short to power circuit or ground in "G13-2-3" ("BLK" wire) circuit.
4	1) Check motor and its circuit referring to "Motor Assembly (with Clutch Incorporated) On-Vehicle Inspection". Is motor and clutch in good condition?	Substitute the original P/S control module with a known-good P/S control module, and then recheck.	Replace the steering column assembly, and then recheck.



[A]:	Fig. for Step 2
[B]:	Fig. for Step 3
1.	Connector "G13-2" (viewed from harness side)

DTC C1153 P/S Control Module Power Supply Circuit Failure

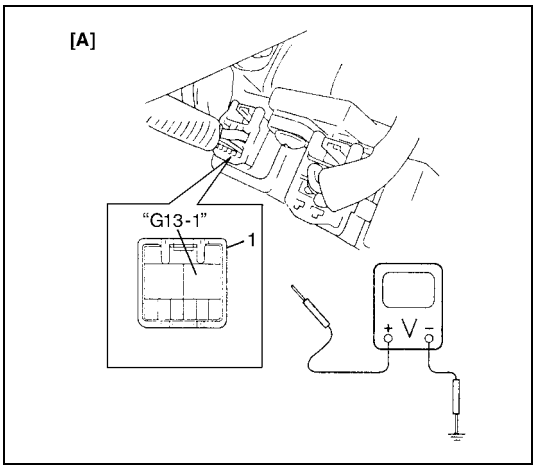
WIRING DIAGRAM



1. Main fuse box	3. "P/S" fuse (30 A)	5. Ignition switch	7. Connector G13 (viewed from terminal side)
2. Circuit fuse box	4. "METER" fuse (10 A)	6. P/S control module	

DTC TROUBLESHOOTING

Step	Action	Yes	No
1	Was "EPS System Check" performed?	Go to STEP 2.	Go to "EPS System Check".
2	1) Remove steering column hole cover. 2) Check "P/S" fuse and check for proper connection to the P/S control module at "G13-1" ("BLK/RED" wire) terminal. 3) If OK, check voltage between "G13-1" terminal and body ground with connector ("G13") connected to the P/S control module. Is it 10 – 14 V?	Check for intermittent trouble referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute the original P/S control module with a known-good P/S control module, and then recheck.	Repair poor connection or high resistance in "G13-1" ("BLK/RED" wire) circuit.



[A]: Fig. for Step 3
1. Connector "G13" (viewed from harness side)

DTC C1152/C1154/C1155 P/S Control Module Failure

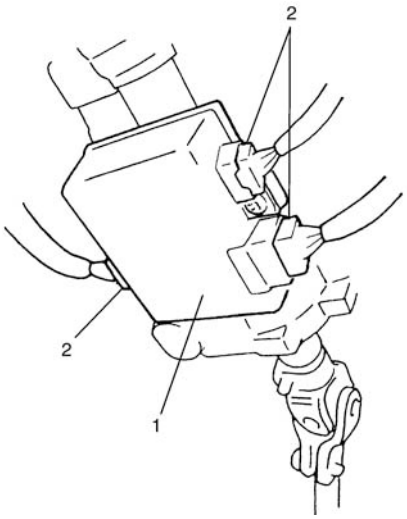
Substitute the original P/S control module with a known-good P/S control module, and then recheck.

Trouble Diagnosis (For Trouble Not Indicated by On-Board Diagnostic System)

This section describes trouble diagnosis of the P/S system parts whose trouble is not indicated by the on-board diagnostic system (self-diagnostic function). When no malfunction is indicated by the on-board diagnostic system (self-diagnosis function) and assuredly those steering basic parts as described in “Diagnosis Table” in Section 3 are all in good condition, check the following power steering system parts which may be a possible cause for each symptom of the steering.

Condition	Possible Cause	Correction
Steering wheel feels heavy (Perform “Steering Force Check” in this section before diagnosis.)	Steering wheel installed improperly (twisted)	Install steering wheel correctly.
	Poor performance of torque sensor	Check torque sensor referring to “Torque Sensor On-Vehicle Inspection” in this section.
	Poor performance of motor and clutch	Check motor and clutch referring to “Motor Assembly (with Clutch Incorporated) On-Vehicle Inspection” in this section”.
	Steering column faulty	Replace.
	Poor performance of VSS	Check VSS referring to “DTC P0500 Vehicle Speed Sensor (VSS) Malfunction” in Section 6.
Vehicle pulls to one side during straight driving	Poor performance of torque sensor	Check torque sensor referring to “Torque Sensor On-Vehicle Inspection” in this section.
Poor recovery after turns	Poor performance of torque sensor	Check torque sensor referring to “Torque Sensor On-Vehicle Inspection” in this section.
	Steering column faulty	Replace.

Inspection of P/S Control Module and Its Circuits



The P/S control module (1) and its circuits can be checked at the P/S control module wiring couplers (2) by measuring voltage and resistance.

CAUTION:

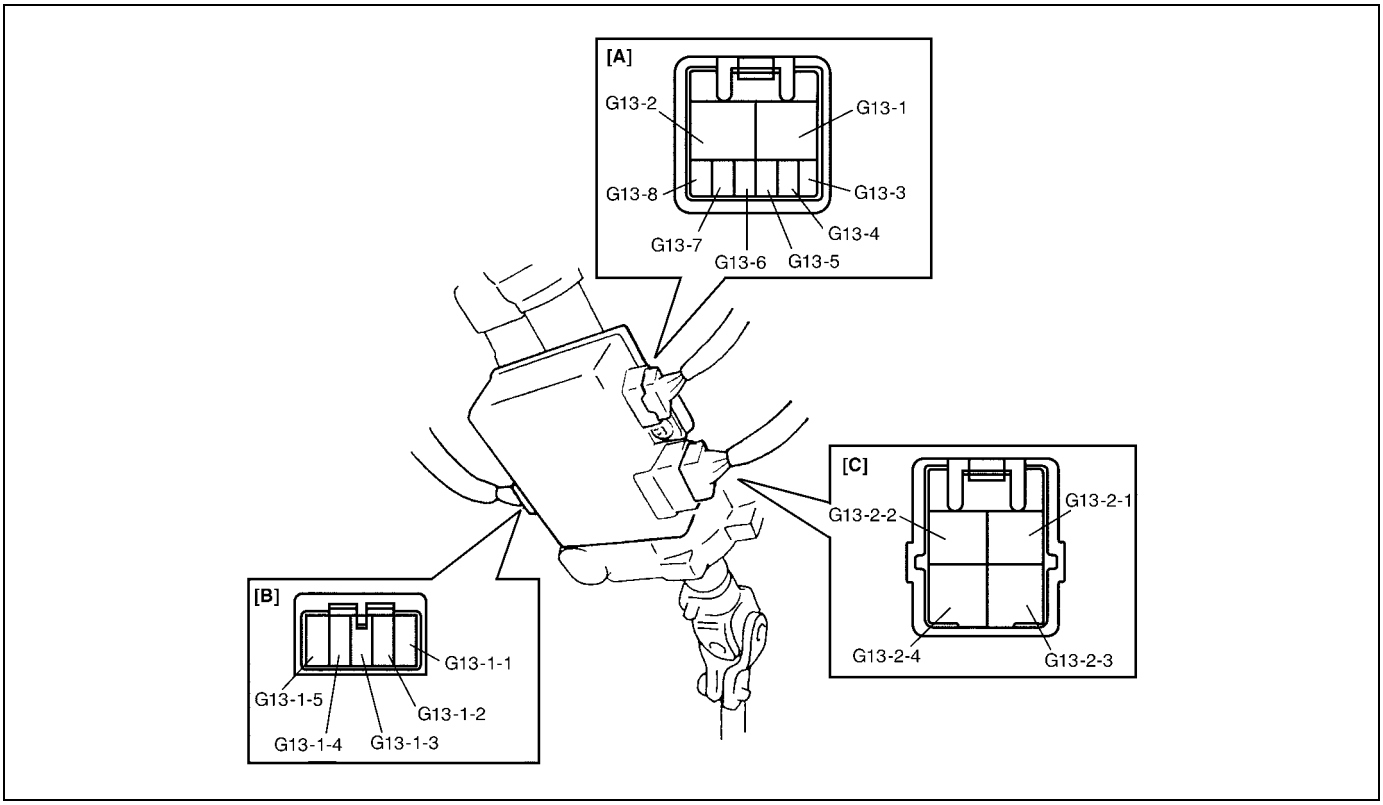
P/S control module cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to the P/S control module with connectors disconnected from the P/S control module.

VOLTAGE CHECK

1) Remove steering column hole cover with ignition switch OFF position.
2) Check for voltage at each terminal with connectors (2) connected to the P/S control module.

NOTE:

As each terminal voltage is affected by the battery voltage, confirm if the battery voltage is 11V or more when ignition switch is ON.



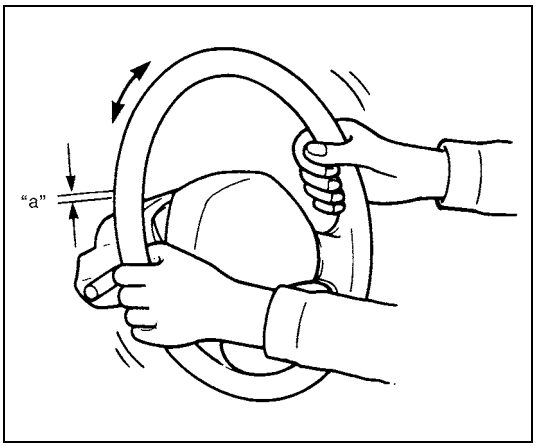
[A]: Connector “G13” (viewed from harness side)
[B]: Connector “G13-1” (viewed from harness side)
[C]: Connector “G13-2” (viewed from harness side)

Terminal	Circuit	Normal Voltage	Condition
G13-1	P/S control module power supply from battery	10 – 14 V	–
G13-2	Ground	–	–
G13-3	Data link connector	–	–
G13-5	“EPS” light	0 V	“EPS” warning lamp ON
G13-6	Engine speed signal	✱ Indicator deflection repeated 0 – 1 V and 10 – 6 V	Engine idling
G13-7	VSS	✱ Indicator deflection repeated 0 – 1 V and 9 – 11 V	• Ignition switch ON • Front left tire turned quickly with right tire locked
G13-8	P/S control module power supply from ignition switch	10 – 14 V	Ignition switch ON
G13-1-2	5V power supply for torque sensor	About 5 V	• Ignition switch ON • Check voltage between “G13-1-2” and “G13-1-4” terminals
G13-1-3	Torque sensor (GND)	0 V	–
G13-1-4	Torque sensor (Sub)	About 2.5 V	• Ignition switch ON and steering wheel at straight position • Check voltage between “G13-1-4” and “G13-1-3” terminals
G13-1-5	Torque sensor (Main)	About 2.5 V	• Ignition switch ON and steering wheel at straight position • Check voltage between “G13-1-5” and “G13-1-4” terminals
G13-2-1	Motor output 1	5 – 7 V	Engine idling and steering wheel at straight position
G13-2-2	Motor output 2	5 – 7 V	Engine idling and steering wheel at straight position
G13-2-3	Clutch output 1	10 – 14 V	Engine idling
G13-2-4	Clutch output 2	0 V	–

NOTE:

✱: The voltage of this circuit may not be checked by voltmeter. If so, use oscilloscope.

Steering Wheel Play Check



- Check steering wheel for looseness or rattle by moving it in its shaft direction and lateral direction. If found to be defective, repair or replace.
- Check steering wheel play, holding vehicle in straight forward condition on the ground and with engine stopped.

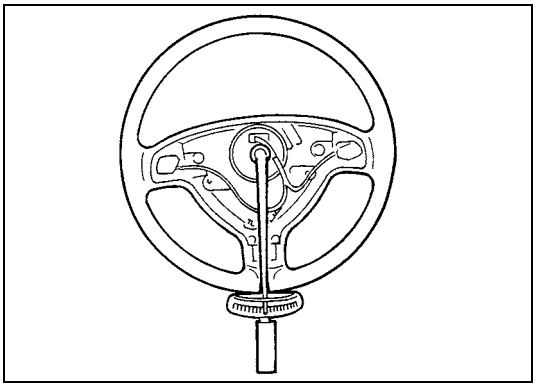
Steering wheel play
"a": 0 – 30 mm (0 – 1.2 in.)

If steering wheel play is not within specification, inspect as follows and replace if found to be defective.

- Tie rod end ball stud for wear
- Lower ball joint for wear
- Steering shaft joint for wear
- Steering pinion or rack gear for wear or breakage
- Each part for looseness

Steering Force Check

1) Place vehicle on level road and set steering wheel at straight-ahead position.
2) Check if tire inflation pressure is as specified on tire placard on vehicle.
3) Remove driver air bag (inflator) module referring to "Driver Air Bag (Inflator) Module Removal and Installation" in Section 3C.
4) Start engine.



5) With engine idling, measure steering force by turning torque wrench.

Steering force
Less than 6.4 N·m (0.64 kg-m, 4.6 lb-ft)

6) Install driver air bag (inflator) module referring to "Driver Air Bag (Inflator) Module Removal and Installation" in Section 3C.

On-Vehicle Service

Steering Column Removal and Installation

Refer to “Steering Column Removal and Installation” in Section 3C for removal and installation of steering column assembly, but perform the following step beforehand.

1) Remove steering column hole cover.
2) Disconnect all couplers from P/S control module.

CAUTION:

Never disassemble steering column assembly and remove torque sensor or motor assembly (with clutch incorporated). Performing any of these prohibited services will affect original performance of EPS system.

Checking Steering Column Check After Accident Damage

NOTE:

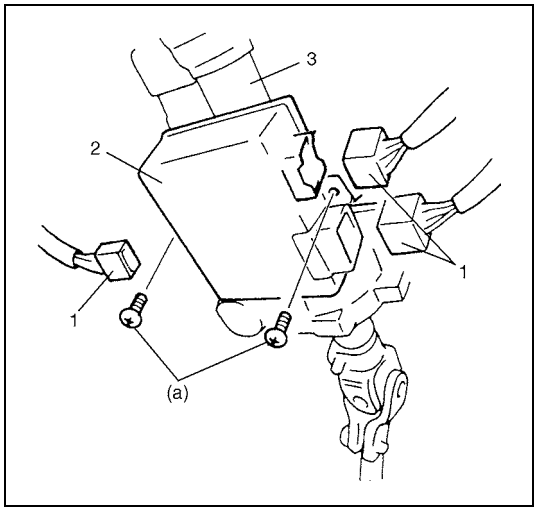
Vehicles involved in accidents resulting in body damage, where steering column has been impacted (or air bag deployed) may have a damaged or misaligned steering column.

Refer to “Checking Steering Column For Accident Damage” in Section 3C.

P/S Control Module Removal and Installation

REMOVAL

1) Disconnect negative cable at battery.
2) Remove steering column hole cover.
3) Disconnect connectors (1) from P/S control module.
4) Remove P/S control module (2) from steering column assembly (3).



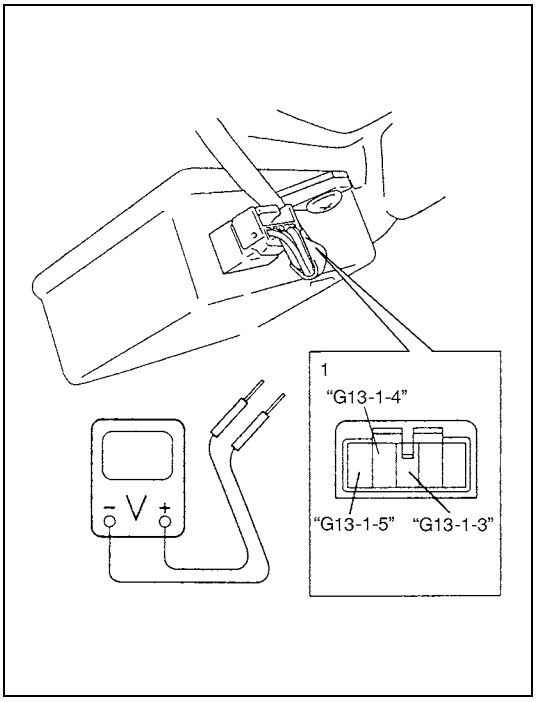
INSTALLATION

Reverse removal procedure for installation noting the following.

- Tighten P/S control module screw to the specified torque.

P/S control module screw
(a) : 3 N·m (0.3 kg-m, 2.0 lb-ft)

Torque Sensor On-Vehicle Inspection



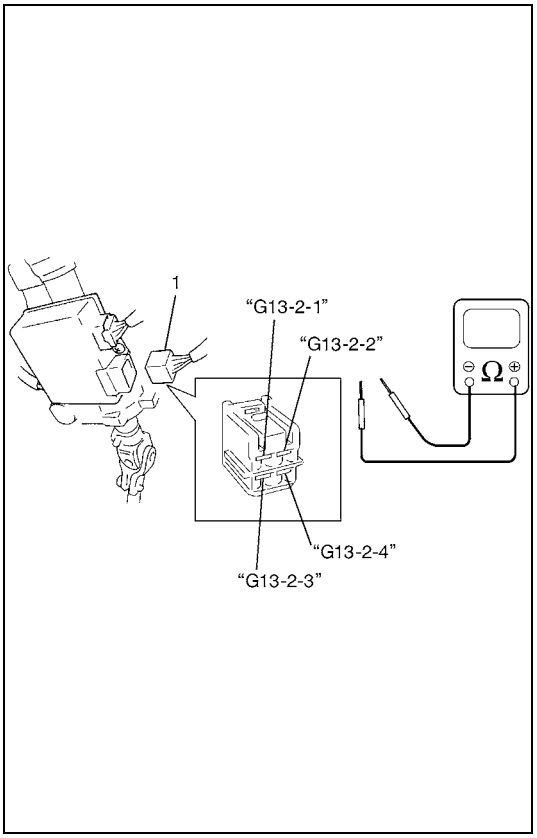
1) Remove steering column hole cover.
2) Turn ignition switch to ON position.
3) Check for voltage between terminals of torque sensor connector with connecting it to P/S control module and not running engine. If check result is not satisfactory, replace steering column assembly.

Torque sensor specification

	Steering wheel fully turned right	Steering wheel held at position for run straight	Steering wheel fully turned left
Main sensor ("G13-1-5" – "G13-1-3")	Above 3.9 V	About 2.5 V	Above 1.1 V
Sub sensor ("G13-1-4" – "G13-1-3")	Above 1.1 V	About 2.5 V	Above 3.9 V

1. Connector "G13-1" (viewed from harness side)

Motor Assembly (with Clutch Incorporated) On-Vehicle Inspection



1) Remove steering column hole cover.
2) Disconnect motor and clutch connector (1) from P/S control module with ignition switch OFF.
3) Check for resistance between terminals of motor and clutch connector (1).

Motor and clutch circuit resistance

"G13-2-2" and "G13-2-1" (For motor)	About 1 Ω
"G13-2-4" and "G13-2-3" (For clutch)	About 12 Ω (at 20°C (68°F))

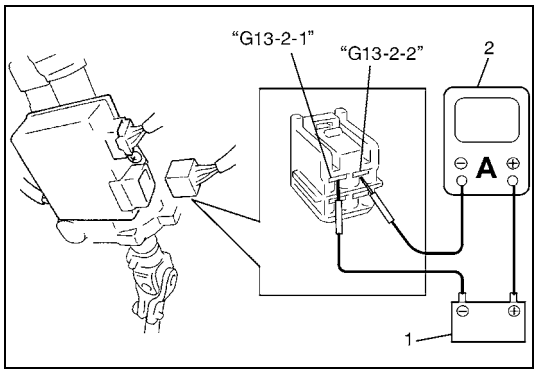
If check result is not as specified above, replace steering column assembly.

4) Check for continuity between terminal of motor and clutch connector (1) and body ground.

Motor and clutch circuit resistance

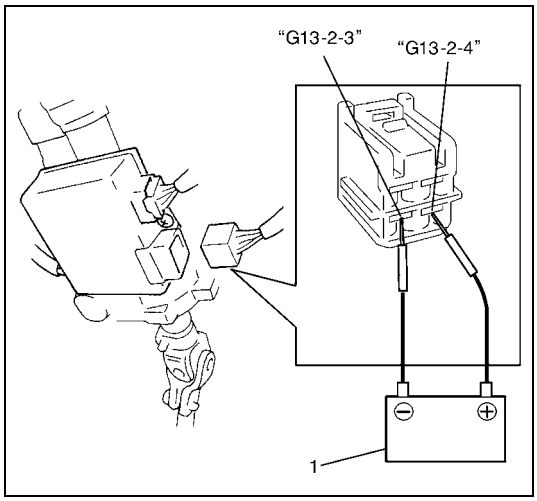
"G13-2-4" and body ground	No continuity
"G13-2-2" and body ground	No continuity

If check result is not as specified above, replace steering column assembly.



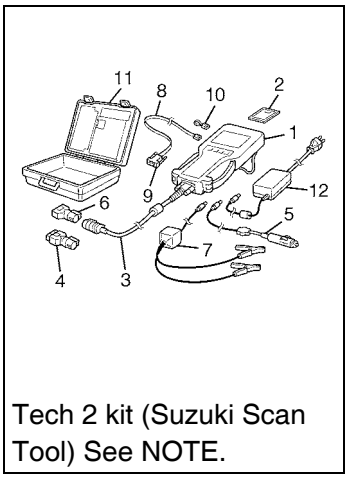
5) Connect battery (1) between "G13-2-2" and "G13-2-1". Check if motor rotates smoothly, and then measure current between "G13-2-1" and "G13-2-2" using ammeter (2) as shown in figure. If check result is not satisfactory, replace steering column assembly.

Motor and clutch circuit current (reference value)
Standard: About 0.65 A



6) Connect battery (1) between "G13-2-4" and "G13-2-3", and then check that sound of clutch operation is heard. If check result is not satisfactory, replace steering column assembly.

Special Tool



Tech 2 kit (Suzuki Scan Tool) See NOTE.

NOTE:

This kit includes the following items.
1. Tech 2, 2. PCMCIA card, 3. DLC cable, 4. SAE 16/19 adapter, 5. Cigarette cable, 6. DLC loopback adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loopback connector, 11. Storage case, 12. Power supply

SECTION 3C

STEERING WHEEL AND COLUMN

WARNING:

For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Please observe all WARNINGS and "Service Precautions" under "General Description" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **The procedures in this section must be followed in the order listed to temporarily disable the air bag system and prevent false diagnostic codes from setting. Failure to follow procedures could result in possible air bag system activation, personal injury or otherwise unneeded air bag system repairs.**

CAUTION:

When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread-locking compound, will be called out. The correct torque value must be used when installing fasteners that require it. If the above procedures are not followed, parts or system damage could result.

CONTENTS

Precautions

Service Precautions of Air Bag Steering Wheel and Column

For service precautions, refer to “Service Precautions” in Section 10B.

Service and Diagnosis of Air Bag Steering Wheel and Column

For diagnosis and servicing, refer to “Service and diagnosis” under “Service Precautions” in Section 10B.

Disabling Air Bag System of Air Bag Steering Wheel and Column

For disabling air bag system, refer to “Disabling air bag system” under “Service Precautions” in Section 10B.

Enabling Air Bag System of Air Bag Steering Wheel and Column

For enabling air bag system, refer to “Enabling air bag system” under “Service Precautions” in Section 10B.

Handling and Storage of Air Bag Steering Wheel and Column

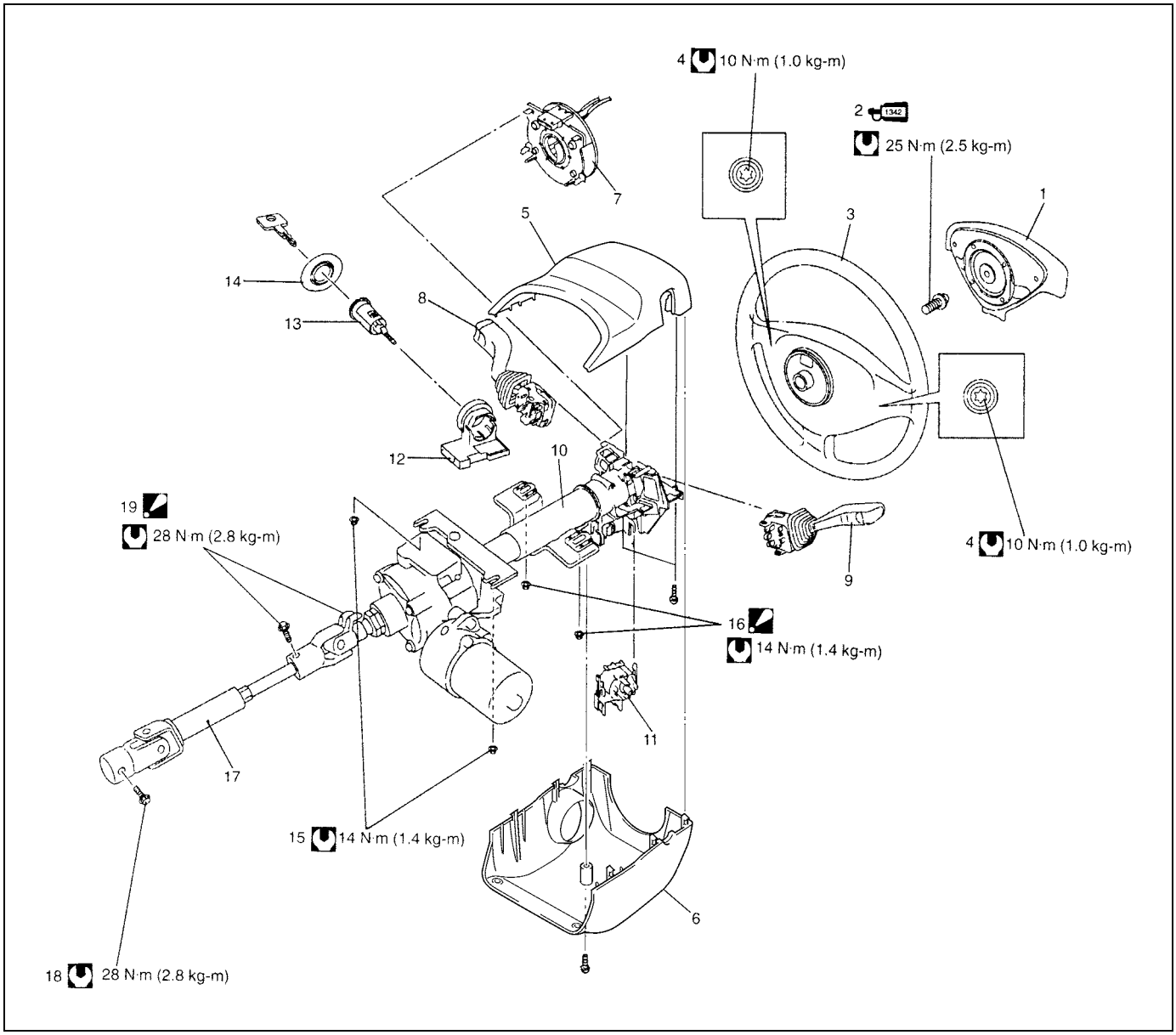
For handling and storage, refer to “Handling and storage” under “Service Precautions” in Section 10B.

Disposal of Air Bag Steering Wheel and Column

For disposal, refer to “Deployment/Activation Outside of Vehicle” and “Deployment/Activation Inside of Vehicle” in Section 10B.

On-Vehicle Service

Steering Wheel and Column Components Location



1. Driver air bag (inflator) module	8. Wiper switch assembly	15. Steering column lower mounting nut
1207D 2. Steering shaft bolt : Apply thread lock cement 1342 99000-32050 to all around thread part of steering shaft bolt.	9. Turn & dimmer switch assembly	16. Steering column upper mounting nut: After tightening lower nut, tighten upper nut.
3. Steering wheel	10. Steering column assembly	17. Lower shaft
4. Driver air bag (inflator) module mounting bolt	11. Ignition switch assembly	18. Lower joint bolt
5. Steering column upper cover	12. Immobilizer control module	19. Upper joint bolt: After tightening lower joint bolt, tighten upper joint bolt.
6. Steering column lower cover	13. Ignition switch cylinder assembly	: Tightening torque
7. Contact coil cable assembly	14. Ignition switch protector	

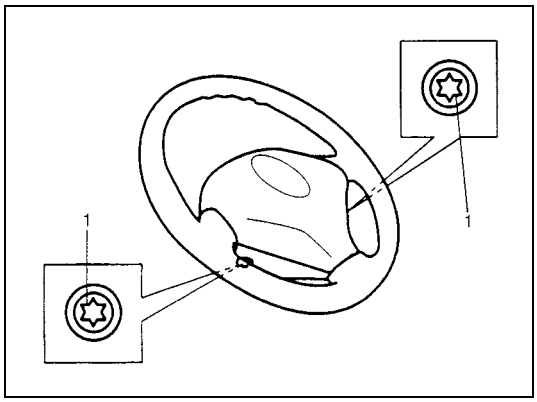
Driver Air Bag (Inflator) Module Removal and Installation

WARNING:

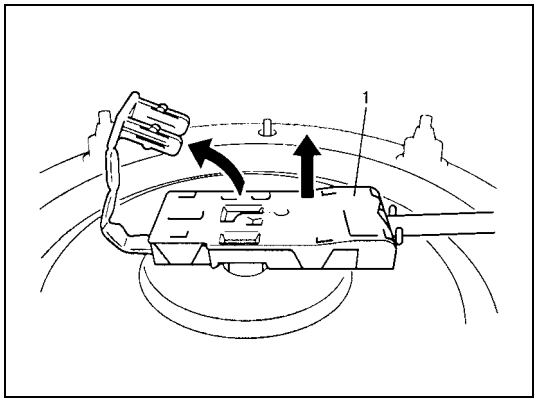
When handling an air bag (inflator) module, be sure to read "Service Precautions of Air Bag Steering Wheel and Column" given earlier in this section and observe each instruction. Failure to follow them could cause a damage to the air bag (inflator) module or result in personal injury.

REMOVAL

1) Disconnect negative battery cable at battery terminal.
2) Disable air bag system. Refer to "Disabling air bag system" in Section 10B.

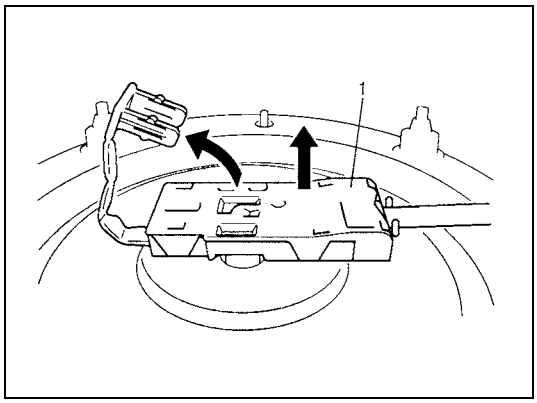


3) Loosen 2 bolts (1) mounting driver air bag (inflator) module till it turns freely.



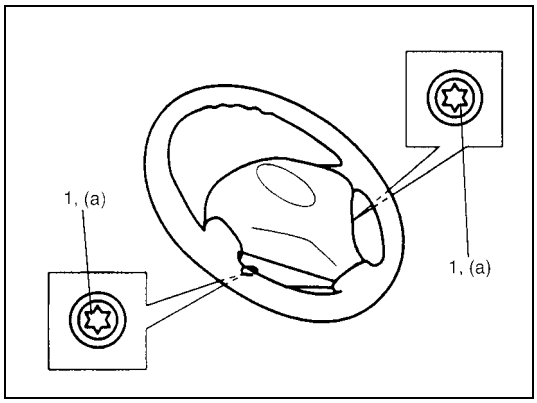
4) Remove air bag (inflator) module from steering wheel.
5) Disconnect yellow connector (1) of driver air bag (inflator) module as shown in figure.

INSTALLATION



1) Connect yellow connector (1) of driver air bag (inflator) module and then lock (2) securely as shown in figure.

2) Install driver air bag (inflator) module to steering wheel, taking care so that no part of wire harness is caught between them.

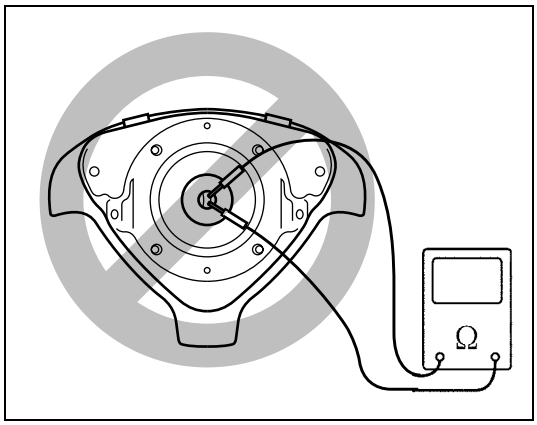


3) Tighten driver air bag (inflator) module mounting bolts (1) to specified torque.

Tightening torque
Air bag module mounting bolt
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

4) Make sure that clearance between module and steering wheel is uniform all the way.
5) Connect negative battery cable.
6) Enable air bag system. Refer to “Enabling air bag system” in Section 10B.

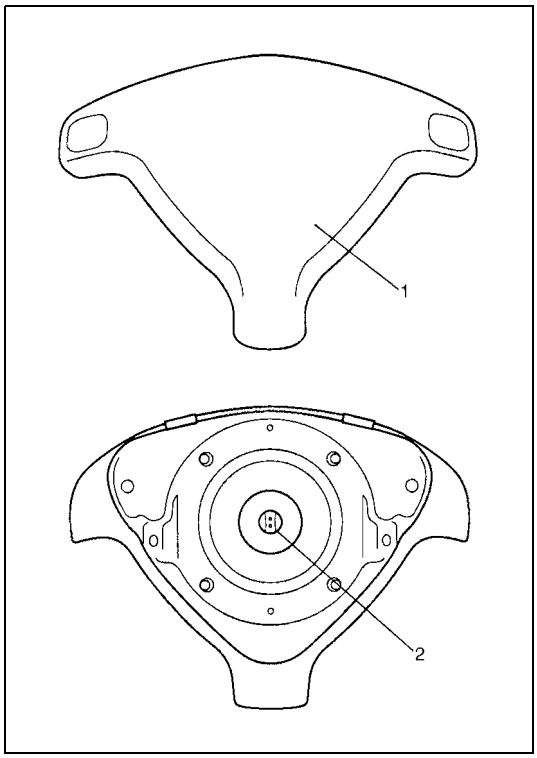
Driver Air Bag (Inflator) Module Inspection



WARNING:
Never disassemble air bag (inflator) module or measure its resistance. Otherwise, personal injury may result.

CAUTION:
If air bag (inflator) module was dropped from a height of 90 cm (3 ft) or more, it should be replaced.

Check air bag (inflator) module visually and if any of the following is found, replace it with a new one.



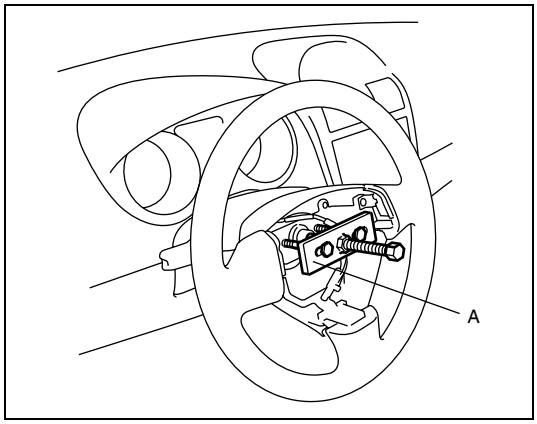
- Air bag being deployed
- Trim cover (pad surface) (1) being cracked
- Terminal (2) being damaged
- Air bag (inflator) module being damaged or having been exposed to strong impact (dropped)

Steering Wheel Removal and Installation

CAUTION:
Do not turn the contact coil more than allowable number of turns (about two and a half turns from the center position clockwise or counterclockwise respectively) with steering wheel removed, or coil will break.

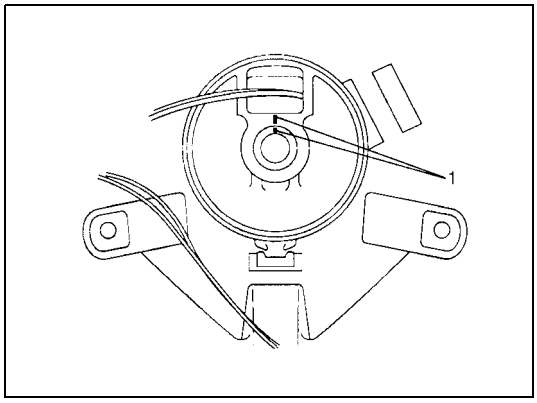
REMOVAL

1) Disconnect negative battery cable at battery terminal.
2) Disable air bag system. Refer to “Disabling air bag system” in Section 10B.
3) Remove driver air bag (inflator) module from steering wheel. Refer to “Driver Air Bag (Inflator) Module Removal and Installation” in this section.
4) Disconnect horn connector.
5) Lift up and turn steering shaft bolt from steering shaft about 3 times.



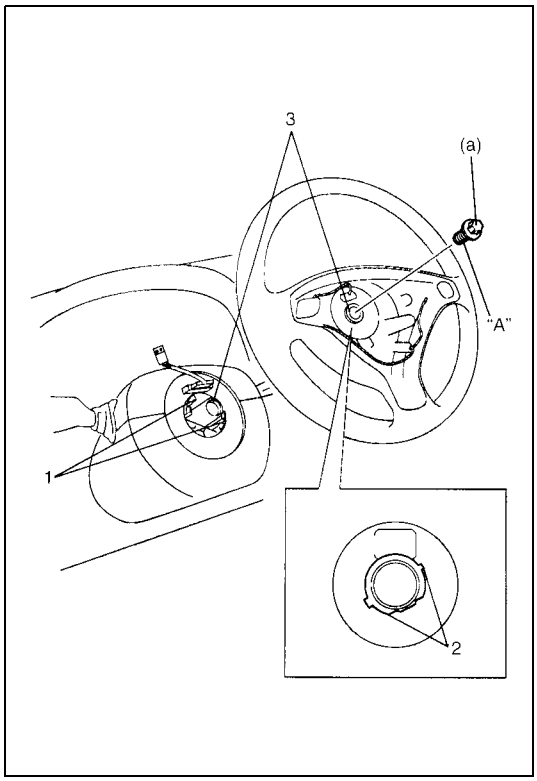
6) Lift up steering wheel in the front by using special tool.
   Special tool
   “A”: 09944-36011

CAUTION:
Do not hammer the end of the shaft. Hammering it will loosen the plastic shear pins which maintain the column length and impair the collapsible design of the column.



7) Remove steering shaft bolt and then make alignment marks (1) on steering wheel and shaft for a guide during reinstallation.
8) Remove steering wheel.

INSTALLATION

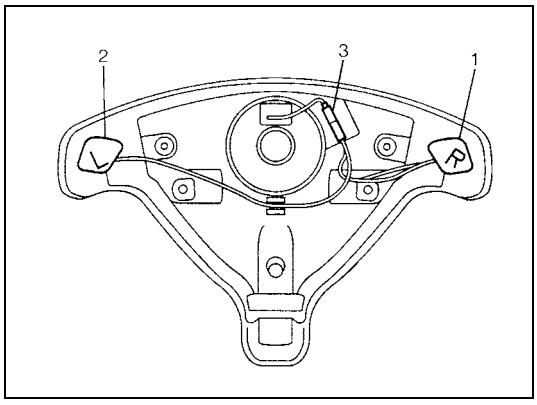


1) Check that vehicle's front tires are at straight-ahead position and contact coil is centered. If contact coil is turned after removing steering wheel, center contact coil referring to "Centering Contact Coil Cable Assembly" in this section.

CAUTION:
These two conditions are prerequisite for installation of steering wheel. If steering wheel has been installed without these conditions, contact coil will break when steering wheel is turned.

2) Install steering wheel to steering shaft with 2 grooves (1) on contact coil fitted in two lugs (2) in the back of steering wheel and also aligning marks (3) on steering wheel and steering shaft.
3) Apply thread lock to all around thread part of steering shaft bolt and tighten to specified torque.

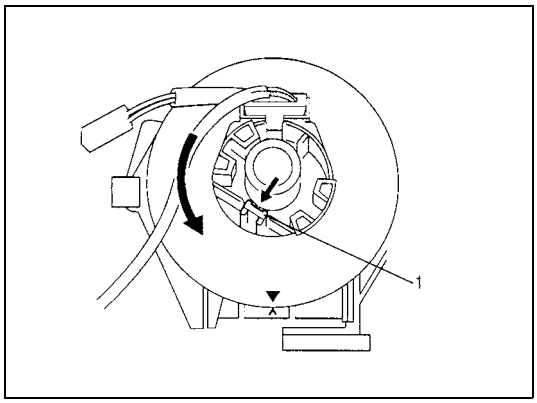
"A": Thread lock cement 1342, 99000-32050
Tightening torque
Steering shaft bolt (a): 25 N·m (2.5 kg-m, 18.5 lb-ft)



4) Install horn buttons, right (1) and left (2), and fix connector (3) securely.
5) Install driver air bag (inflator) module to steering wheel. Refer to "Driver Air Bag (Inflator) Module Removal and Installation" in this section.
6) Connect negative battery cable.
7) Enable air bag system. Refer to "Enabling air bag system" in Section 10B.

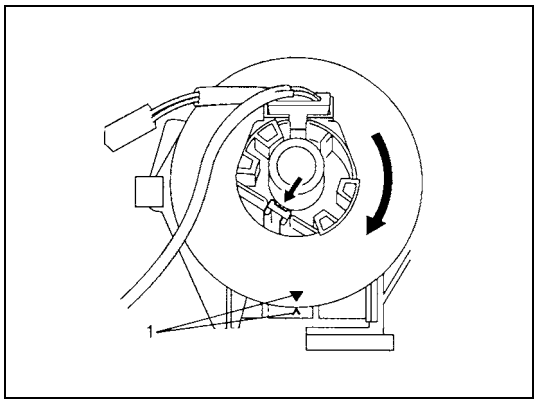
Centering Contact Coil Cable Assembly

1) Check that vehicle's wheels (front tires) are set at straight-ahead position.
2) Check that ignition switch is at "LOCK" position.



3) With pushing lock lever (1) and releasing contact coil lock, turn contact coil counterclockwise slowly with a light force till contact coil will not turn any further.

NOTE:
Contact coil can turn about 5 turns at maximum, that is, if it is at the center position, can turn about two and a half turns both clockwise and counterclockwise.



4) From the position where contact coil became unable to turn any further (it stopped), turn it back clockwise about two and a half rotations and align center mark with alignment mark (1).

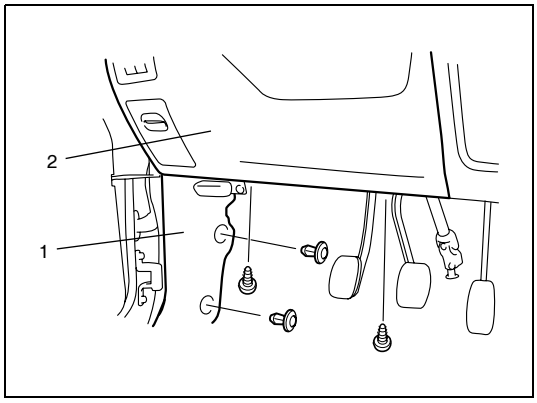
Contact Coil Cable Assembly Removal and Installation

CAUTION:

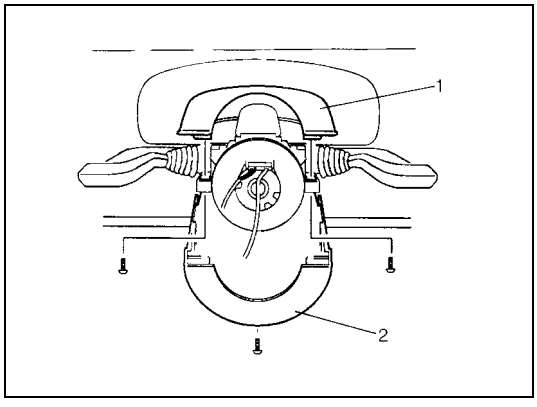
Do not turn contact coil more than allowable number of turns (about two and a half turns from the center position clockwise or counterclockwise respectively), or coil will break.

REMOVAL

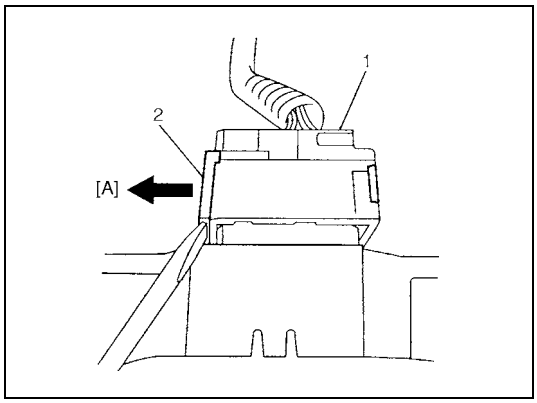
1) Disconnect negative battery cable at battery terminal.
2) Disable air bag system. Refer to “Disabling air bag system” in Section 10B.
3) Remove steering wheel from steering column. Refer to “Steering Wheel Removal and Installation” in this section.



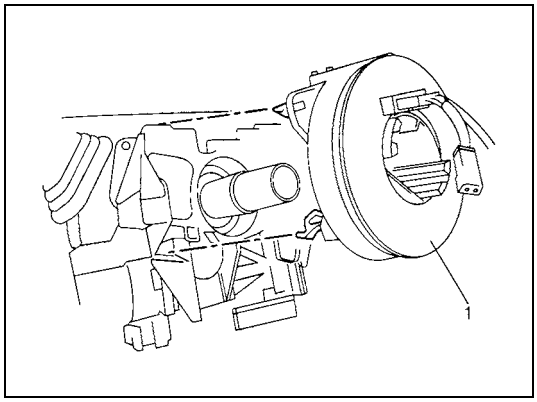
4) Remove dash side trim (1) and steering column hole cover (2).



5) Remove steering column lower cover (2) and upper cover (1).

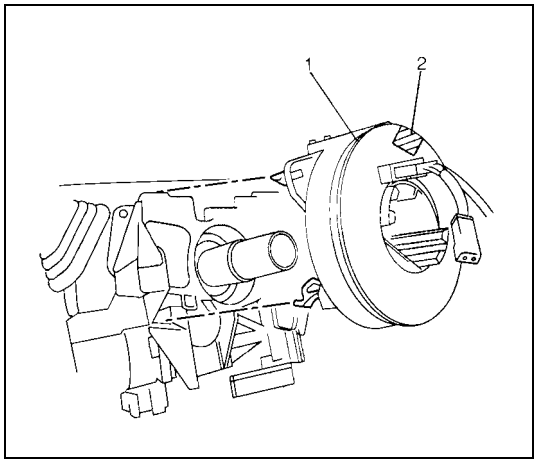


6) Disconnect connector (1) from contact coil cable assembly by pulling connector lock (2) to the outside (A).



7) Remove contact coil cable assembly (1) from steering column.

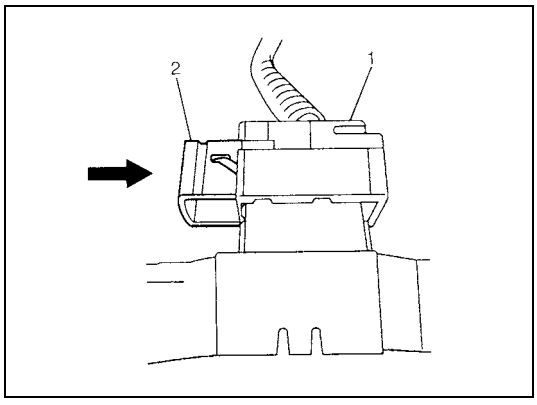
INSTALLATION



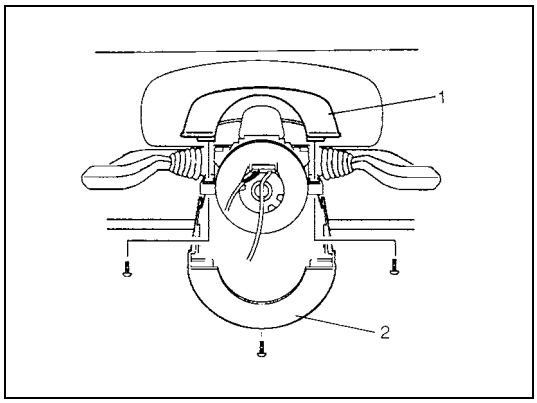
1) Check to make sure that vehicle's front tires are set at straight-ahead position and then ignition switch is at "LOCK" position.
2) Install contact coil cable assembly (1) to steering column securely.

NOTE:

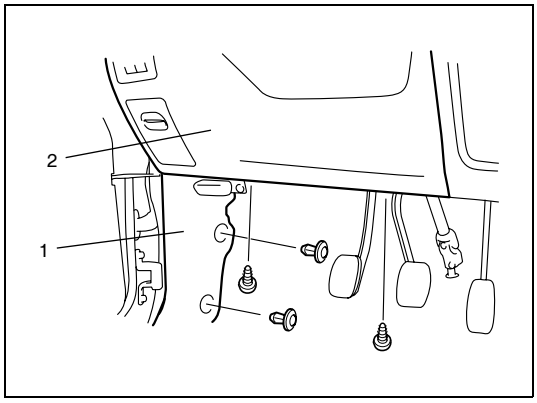
New contact coil cable assembly is supplied with contact coil set and held at its center position with a seal (2). Peel this seal after installing contact coil cable assembly to steering column.



3) Connect connector (1) to contact coil cable assembly by pushing connector lock (2) into connector.



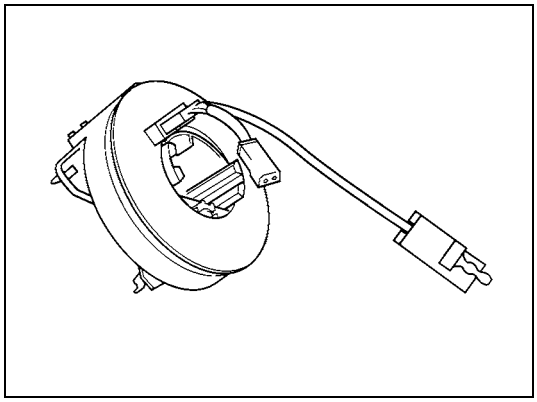
4) Install steering column upper cover (1) and lower cover (2).



5) Install steering column hole cover (2) and dash side trim (1).

6) Install steering wheel to steering column referring to “Steering Wheel Removal and Installation” in this section.
7) Connect battery negative cable.
8) Enable air bag system referring to “Enabling air bag system” in Section 10B.

Contact Coil Cable Assembly Inspection



Check contact coil cable assembly wire harness for any signs of scorching, melting or other damage. If it is damaged, replace.

Steering Column Removal and Installation

CAUTION:

Once the steering column is removed from the vehicle, the column is extremely susceptible to damage.

- **Dropping the column assembly on its end could collapse the steering shaft or loosen the plastic shear pins which maintain column length.**
- **Leaning on the column assembly could cause it to bend or deform.**

Any of the above damage could impair the column's collapsible design.

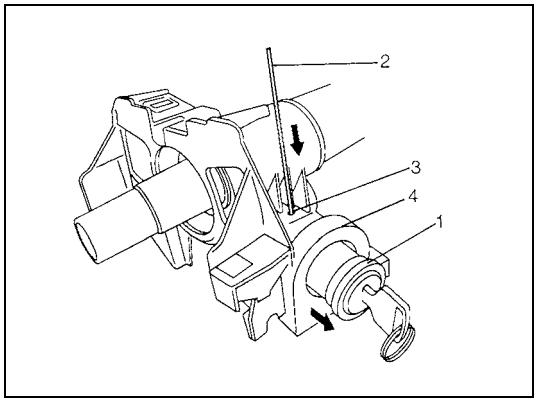
Steering column mounting nuts should not be loosened with steering shaft joint upper side bolt tightened as this could cause damage to shaft joint bearing.

NOTE:

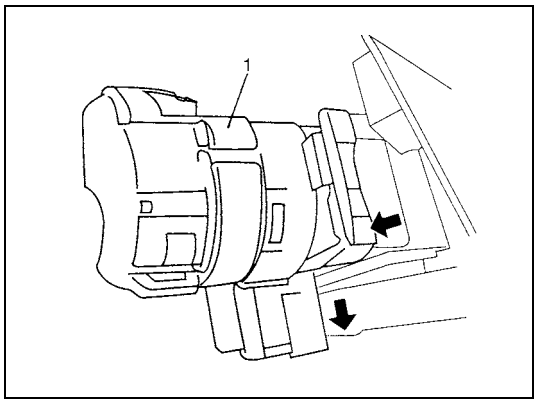
When servicing steering column or any column-mounted component, remove steering wheel. But when removing steering column simply to gain access to instrument panel components, leave steering wheel installed on steering column.

REMOVAL

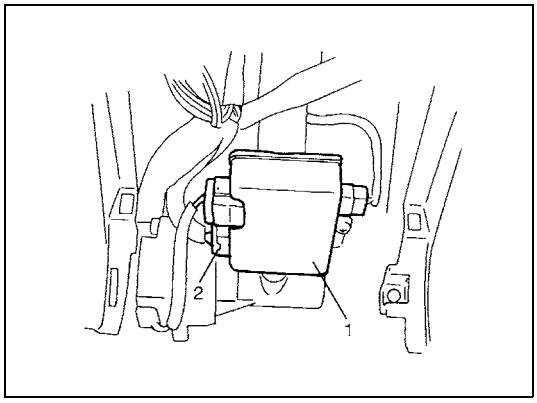
1) Disconnect negative battery cable at battery terminal.
2) Disable air bag system referring to "Disabling air bag system" in Section 10B.
3) Remove steering wheel and contact coil cable assembly referring to "Steering Wheel Removal and Installation" and "Contact Coil Cable Assembly Removal and Installation" in this section.
4) Detach turn & dimmer switch assembly and wiper switch assembly from steering column.



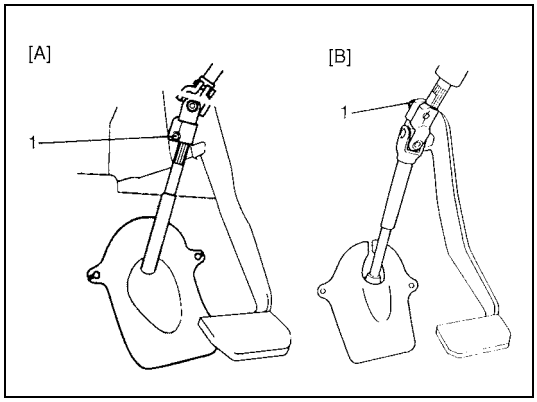
5) Remove ignition switch cylinder assembly (1) as follows.
   a) Turn ignition switch key to "ACC" position.
   b) Insert 2 mm (0.078 in.) rod (2) through hole (3) and push ignition switch cylinder lock.
6) Remove immobilizer control module (4) from steering column.



7) Detach ignition switch assembly (1) from steering column.

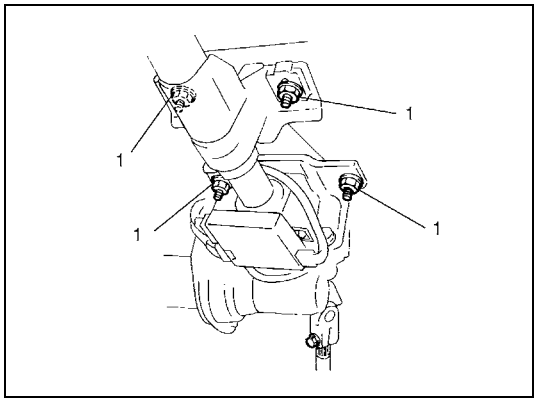


8) Disconnect connector (2) from P/S control module (1) if equipped.



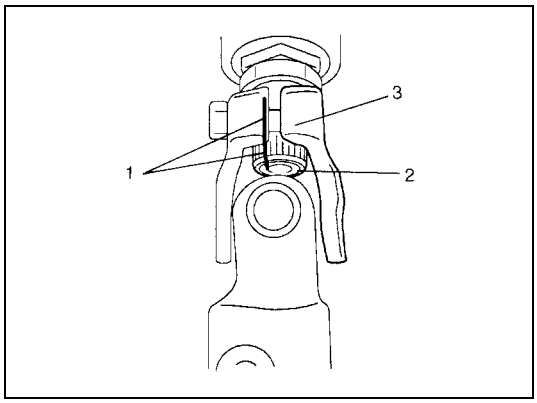
9) Remove steering shaft upper joint bolt (1).

[A]: Power steering
[B]: Manual steering



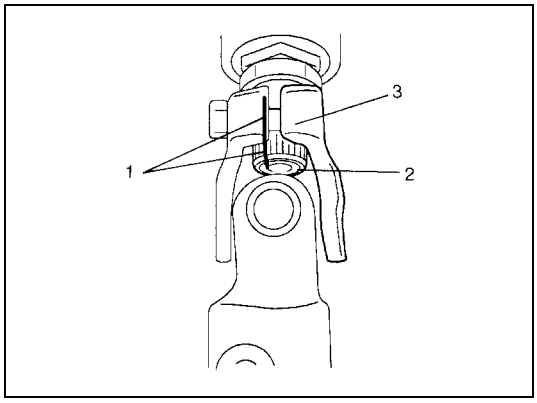
10) Remove steering column mounting nuts (1).
11) Remove steering column from vehicle.

WARNING:
Never rest a steering column assembly on the steering wheel with the air bag (inflator) module face down and column vertical. Otherwise, personal injury may result.

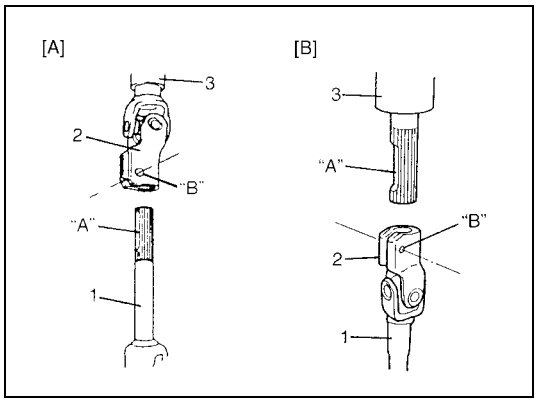


12) When disconnecting upper joint (3) from power steering column shaft (2), make alignment marks (1) on column shaft and upper joint.

INSTALLATION

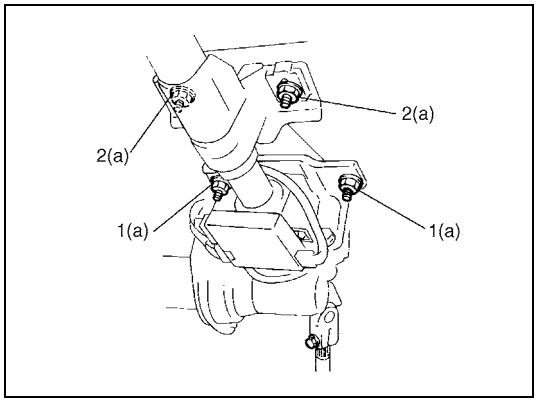


1) Install upper joint (3) and steering column shaft (2) according to alignment mark (1).



2) Connect steering column to lower shaft.
   For power steering, align flat part "A" of lower shaft (1) with bolt hole "B" of upper joint (2) as shown. Then insert upper joint (2) onto lower shaft (1).
   For manual steering, align flat part "A" of steering column (3) with bolt hole "B" of upper joint (2) and insert steering column shaft into upper joint (2) of lower shaft (1).

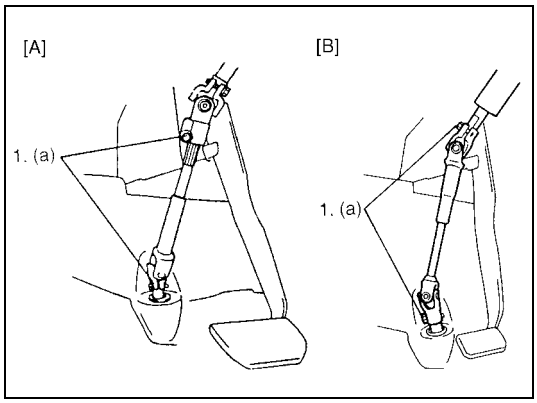
[A]: Power steering
[B]: Manual steering



3) Install steering column assembly to lower and upper brackets. Torque steering column lower nuts (1) first and then upper nuts (2) to specifications as given below.

Tightening torque

Steering column nut (a): 14 N·m (1.4 kg-m, 10.5 lb-ft)



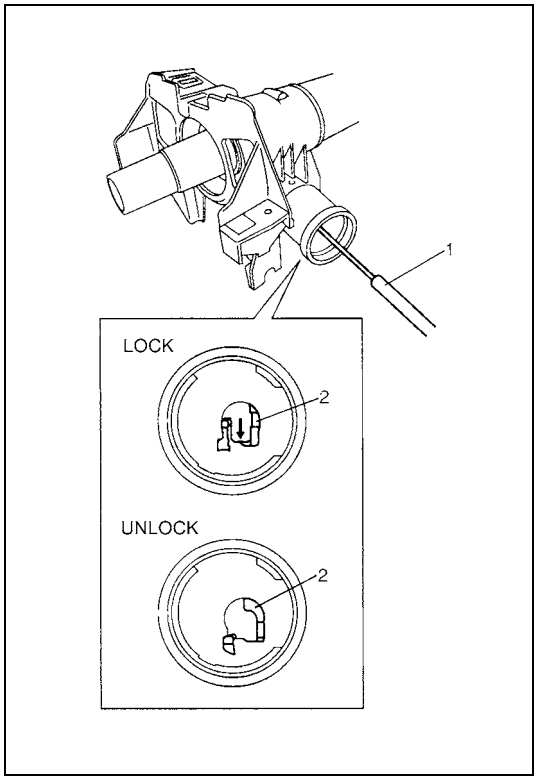
4) Install bolt (1) to steering shaft upper joint and tighten it to specified torque.

CAUTION:
After tightening column nuts, tighten steering shaft upper joint bolt. Otherwise shaft joint bearing is damaged.

Tightening torque
Steering shaft upper joint bolt
(a): 28 N·m (2.8 kg-m, 20.5 lb-ft)

[A]:	Power steering
[B]:	Manual steering

5) Install ignition switch assembly and immobilizer control module to steering column.



6) Install ignition switch cylinder assembly as follows.
   a) Push steering lock (2) down till it clicks, using screw driver (1), so that it is at unlock position.
   b) Turn ignition key of ignition switch cylinder assembly to "ACC" position.
   c) In this state, push ignition switch cylinder assembly into steering column till it clicks.
7) Install turn & dimmer switch, wiper switch and ignition switch protector to steering column.
8) Connect all connectors that have been removed in "Removal".
9) Install contact coil cable assembly and steering wheel refer to "Contact Coil Cable Assembly Removal and Installation" and "Steering Wheel Removal and Installation" in this section.
10) Connect negative battery cable.
11) Enable air bag system referring to "Enabling air bag system" in section 10B.

Steering Column Inspection

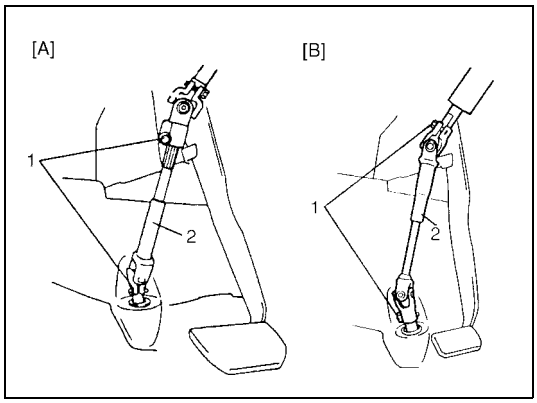
Check steering column for damage and operation referring to "Checking Steering Column For Accident Damage" in this section.

Steering Lower Shaft Removal and Installation

REMOVAL

1) Turn steering wheel so that vehicle's front tires are at straight-ahead position.
2) Turn ignition switch to "LOCK" position and remove key.

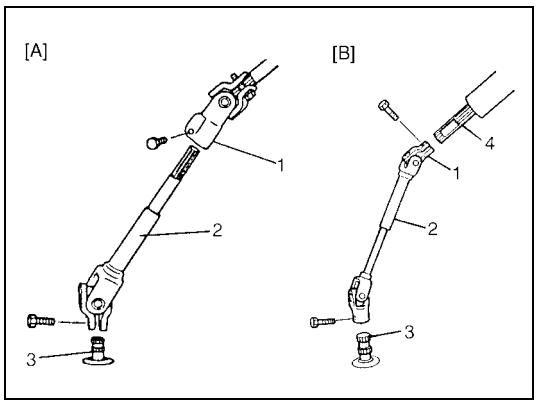
CAUTION:
Never turn steering wheel while steering lower shaft is removed. Should it have been turned and contact coil have got out of its centered position, it needs to be centered again. Also, turning steering wheel more than about two and a half turns will break contact coil.



3) Remove steering shaft joint bolts (1) and then remove steering lower shaft (2).

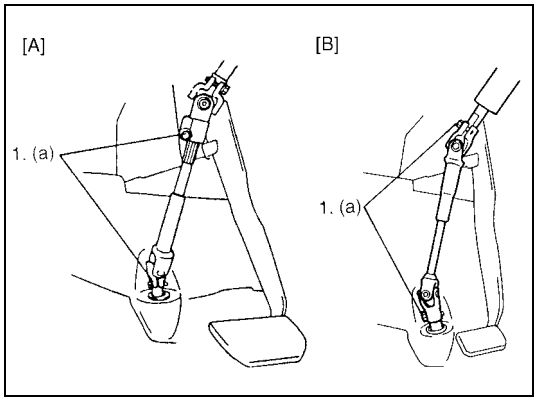
[A]: Power steering
[B]: Manual steering

INSTALLATION



1) Align flat part of steering lower shaft (2) or steering column (4) with bolt hole of upper joint (1) as shown. Then insert lower shaft or steering column into upper joint.
2) Be sure that front wheels and steering wheel are in straightforward state and insert lower joint into steering pinion shaft (3).

[A]: Power steering
[B]: Manual steering



3) Tighten steering shaft joint bolts (1) to specification (lower side first and then upper side).

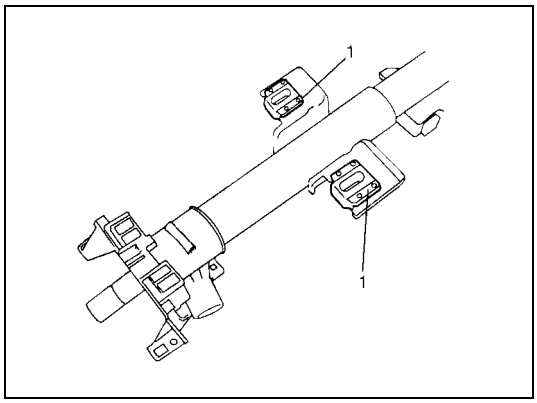
Tightening torque
Steering shaft joint bolt (a): 28 N·m (2.8 kg-m, 20.5 lb-ft)

[A]: Power steering
[B]: Manual steering

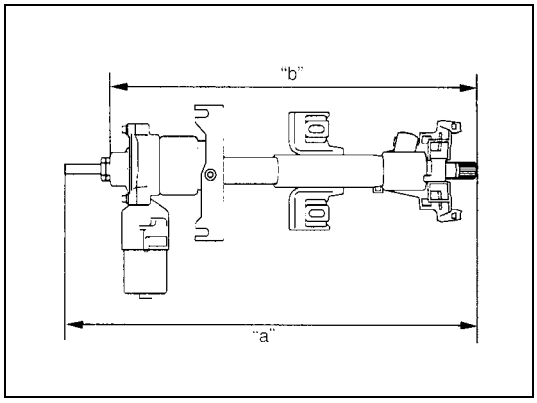
Checking Steering Column For Accident Damage

NOTE:
Vehicles involved in accidents resulting in body damage, where steering column has been impacted or air bag deployed, may have a damaged or misaligned steering column.

CHECKING PROCEDURE

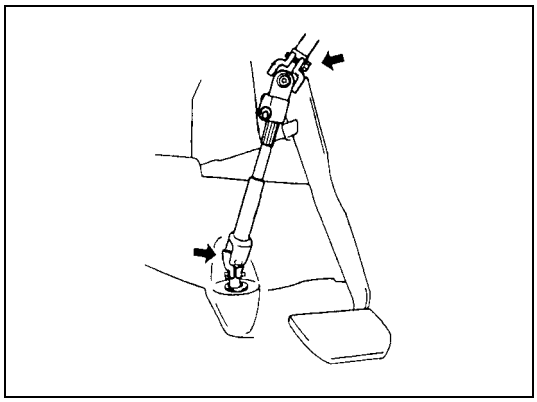


1) Check that two capsules (1) are attached to steering column bracket securely. If found loose, replace steering column assembly.



2) Take measurement "a" and "b" as shown. If it is shorter than specified length, replace column assembly with new one.

Power steering column length
"a": 520 ± 1.5 mm (20.5 ± 0.06 in.)
"b": 475.5 ± 1.5 mm (18.7 ± 0.06 in.)
Manual steering column length
"a": 508 ± 1.5 mm (20.0 ± 0.06 in.)
"b": 440 ± 1.5 mm (17.3 ± 0.06 in.)



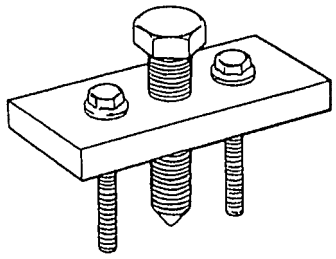
3) Check steering shaft joints and shaft for any damages such as crack, breakage, malfunction or excessive play. If anything is found faulty, replace as lower joint assembly or column assembly.

4) Check steering shaft for smooth rotation. If found defective, replace as column assembly.
5) Check steering shaft and column for bend, cracks or deformation. If found defective, replace.

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Thread lock cement	THREAD LOCK CEMENT1342 (99000-32050)	• Steering shaft bolt

Special Tool



09944-36011
Steering wheel remover

SECTION 3D

FRONT SUSPENSION

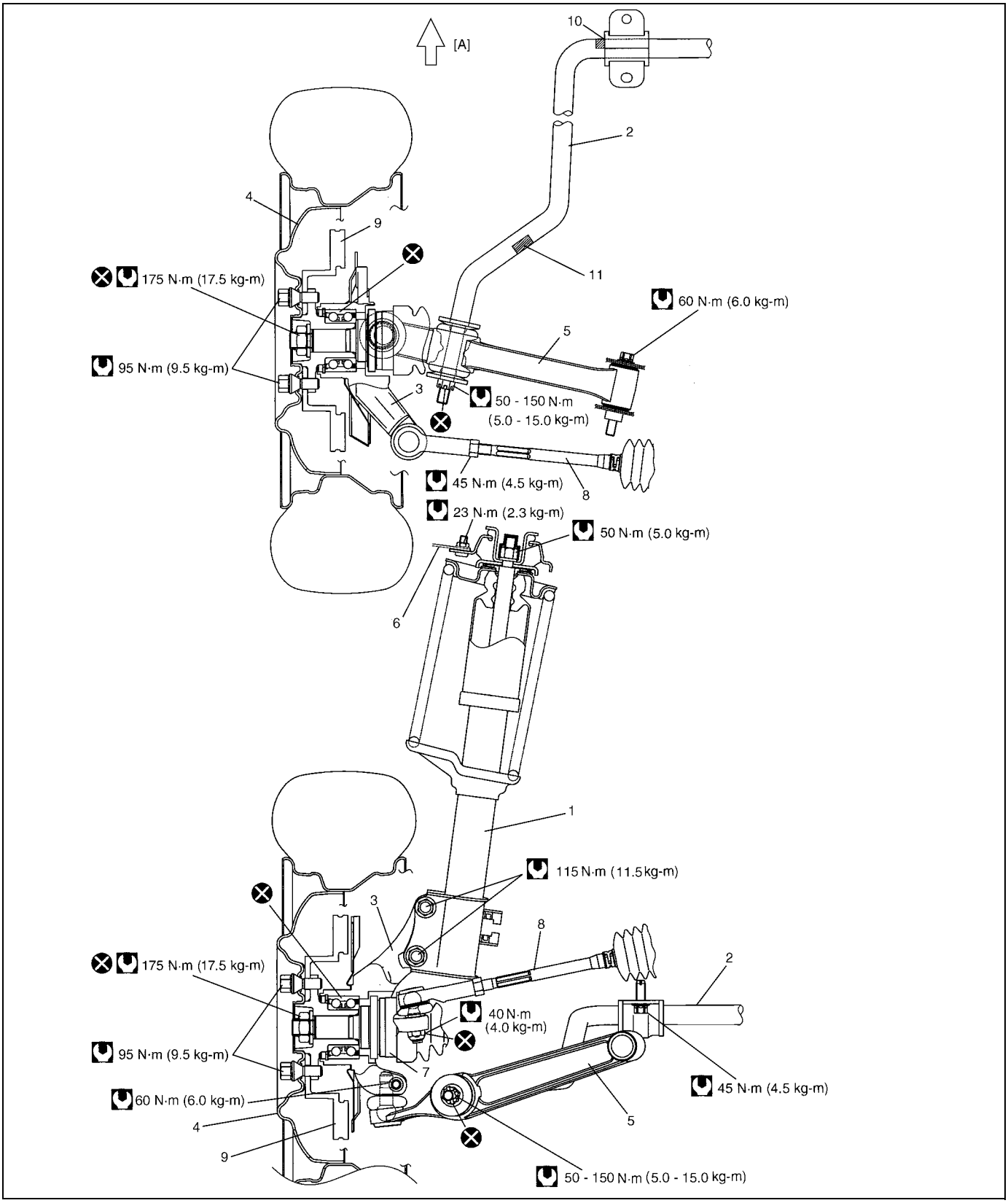
NOTE:

- **All front suspension fasteners are an important attaching part in that it could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.**
- **Never attempt to heat, quench or straighten any front suspension part. Replace it with a new part or damage to the part may result.**

CONTENTS

General Description

Front Suspension Construction



1. Strut assembly	4. Wheel	7. Drive shaft	10. Paint mark	Tightening torque
2. Stabilizer bar	5. Suspension control arm	8. Tie rod	11. Paint mark (only RH side)	Do not reuse.
3. Steering knuckle	6. Vehicle body	9. Brake disc	[A] : Forward	

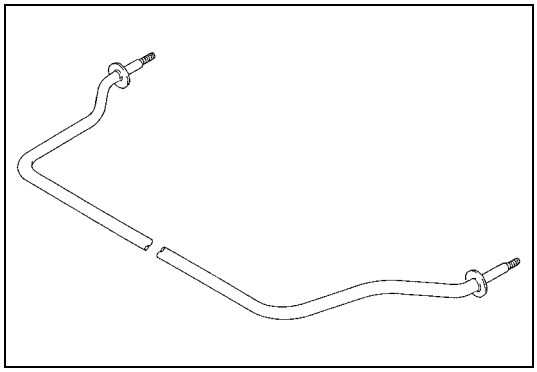
Diagnosis

Diagnosis Table

Refer to “Diagnosis Table” in Section 3.

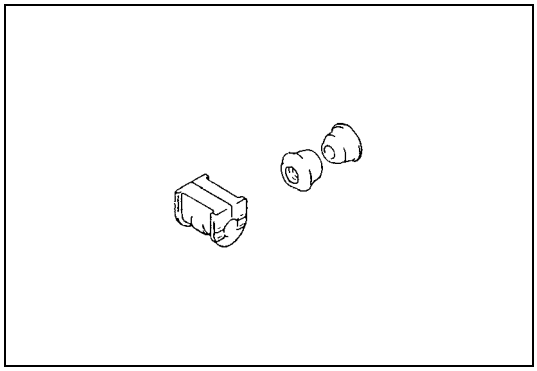
Stabilizer Bar and Bushing Check

Bar



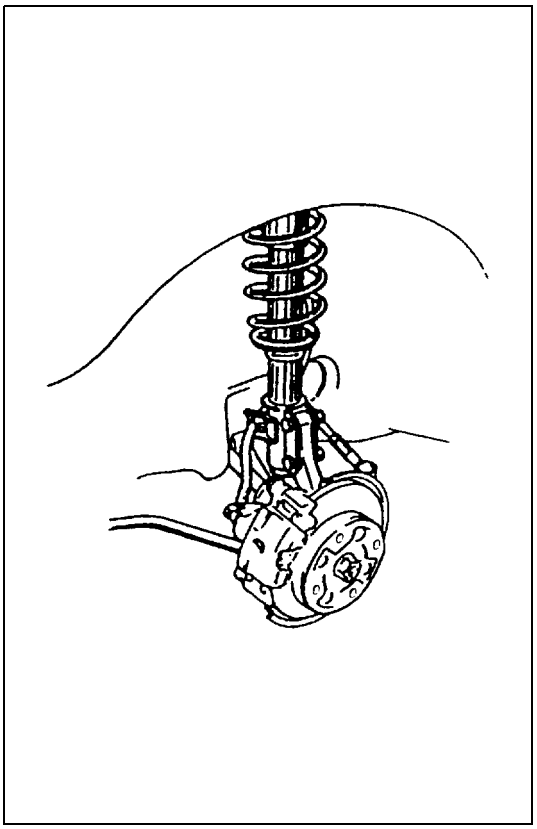
Inspect for damage or deformation.
If defective, replace.

Bushing



Inspect for damage, wear or deterioration.
If defective, replace.

Strut Assembly Check



- Inspect strut for oil leakage, damage or deformation.
- If strut is found faulty, replace it as an assembly unit, because it can not be disassembled.
- Inspect strut function refer to the following procedures.

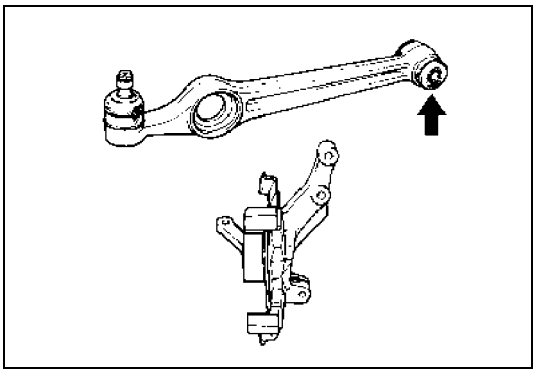
1) Check and adjust tire pressures as specified.
2) Bounce vehicle body 3 or 4 times continuously by pushing front end on the side with strut to be checked.
3) Apply the same amount of force at each push and note strut resistance both when pushed and rebounding.
4) Also, note how many times vehicle body rebounds before coming to stop after hands are off. Do the same for strut on the other side.
5) Compare strut resistance and number of rebound on the right with those on the left. And they must be equal in both. With proper strut, vehicle body should come to stop the moment hands are off or after only one or two small rebounds.

If conditions of struts are in doubt, compare them with known-good vehicle or strut.

- Inspect bearing for wear, abnormal noise or gripping.
  If defective, replace.
- Inspect spring seat for cracks or deformation.
  If defective, replace.
- Inspect bump stopper for deterioration.
  If defective, replace.
- Inspect rebound stopper and strut mount for wear, cracks or deformation.
  If defective, replace.

Suspension Control Arm / Steering Knuckle Check

Steering Knuckle

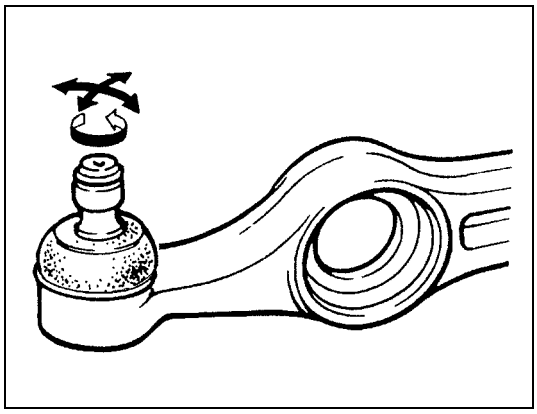


Inspect for cracks, deformation or damage.
If defective, replace.

Suspension Control Arm / bushing

Inspect for damage, wear or deterioration.
If defective, replace.

Suspension Control Arm Joint Check



- Check for smooth rotation.
- Inspect ball stud for damage.
- Inspect dust cover for damage.
- Inspect for play in ball joint. If found defective, replace.

NOTE:

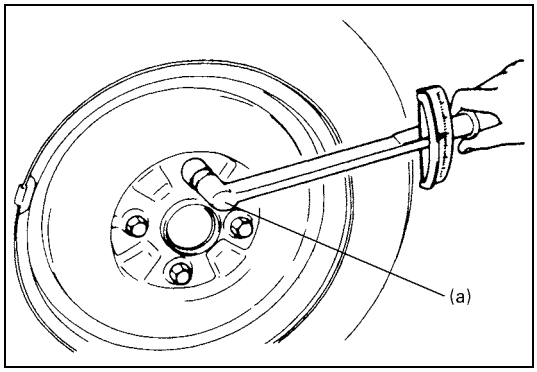
Suspension control arm and arm joint cannot be separated.

If there is any damage to either, control arm assembly must be replaced as a complete unit.

Front Suspension Fasteners Check

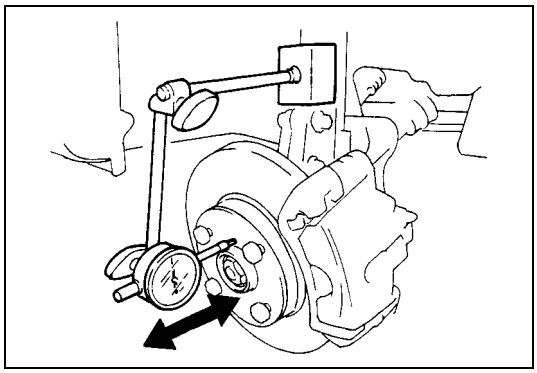
Check each bolt and nut fastening suspension parts for tightness. Tighten loose one, if any, to specified torque, referring to "General Description" in this section.

Wheel Disc, Bolt and Bearing Check



- Inspect each wheel disc for dents, distortion and cracks. A disc in badly damaged condition must be replaced.
- Check wheel bolts for tightness and, as necessary, retighten them to specification.

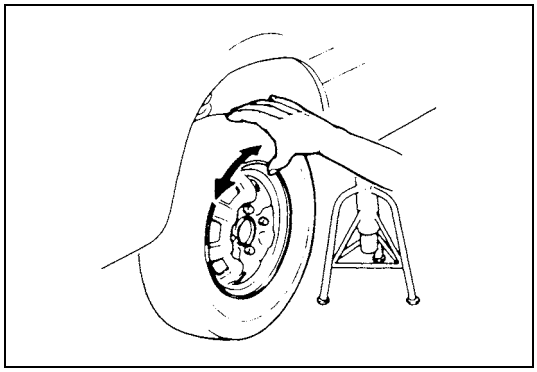
Tightening torque
Wheel bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)



- Check wheel bearing for wear.

a) Remove wheel, referring to "Wheel Removal and Installation" in Section 3F.
b) Fix brake disc tightening wheel bolts.
c) Set a dial gauge.
d) Check wheel bearing for thrust play.
When measurement exceeds limit, replace bearing.

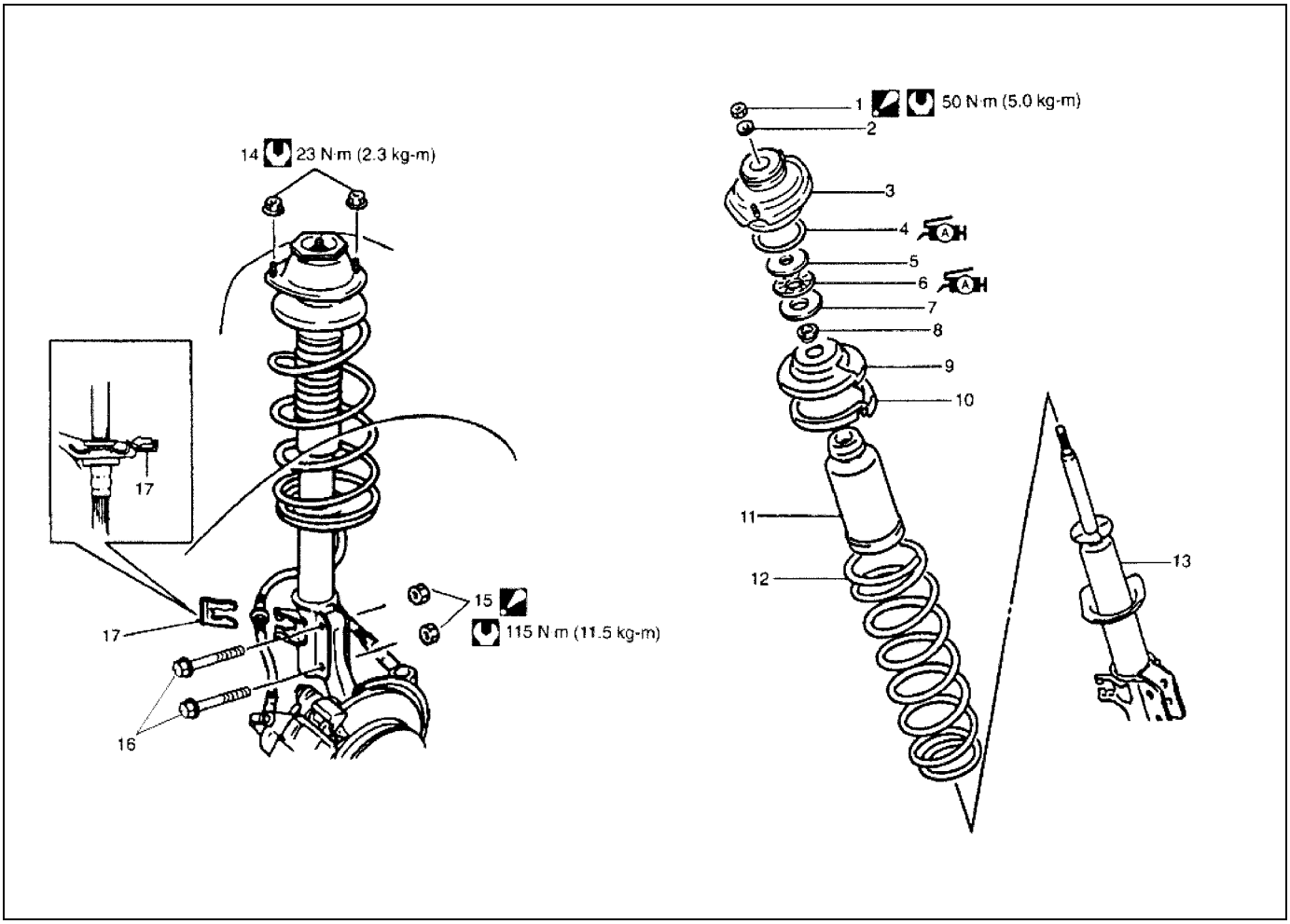
Thrust play limit:
0.1 mm (0.004 in.)



- By rotating wheel actually, check wheel bearing for noise and smooth rotation.
If defective, replace bearing.

On-Vehicle Service

Strut Assembly Component

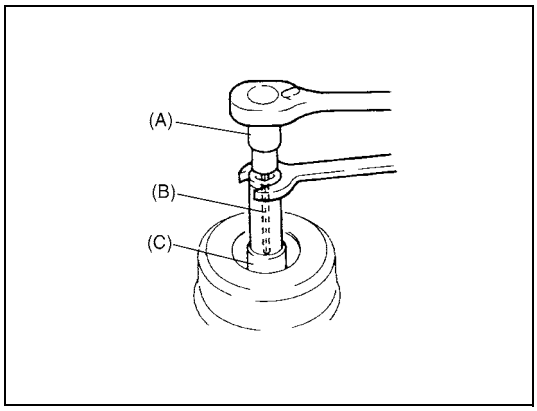


	1. Strut nut: Apply water-proof coating (paint or lacquer) all around nut and strut rod screw part.	8. Bearing spacer	14. Strut support nut.
	2. Strut lock washer	9. Coil spring upper seat	15. Strut bracket nut
	3. Strut support	10. Coil spring seat	16. Strut bracket bolt
	4. Bearing seal: Apply SUZUKI SUPER GREASE A 99000-25010	11. Bump stopper	17. E-ring
	5. Bearing upper washer	11-1. Strut dust cover	Tightening torque
	6. Strut bearing: Apply SUZUKI SUPER GREASE A (99000-25010) to all around bearing.	12. Coil spring	
	7. Bearing lower washer	13. Shock absorber	

Strut Assembly Removal and Installation

REMOVAL

1) Disconnect negative cable at battery.

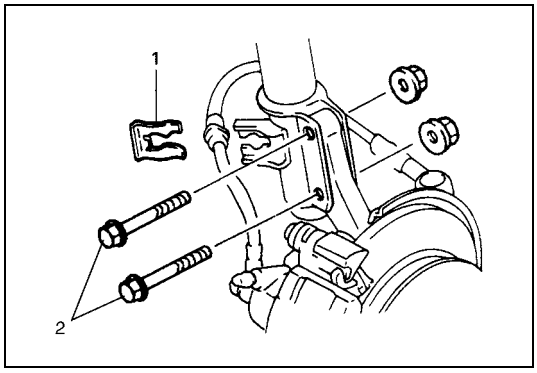


NOTE:

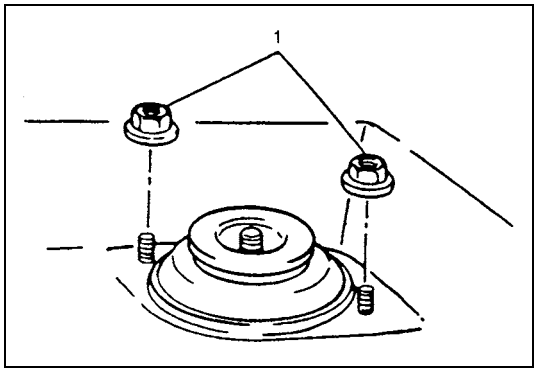
When disassembling strut assembly, loosen strut nut a little before removing strut assembly from vehicle. This will make disassembly easier. Note, however, nut must not be removed at this point.

Special tool
(A): 09900-00411
(B): 09900-00414
(C): 09945-26010

2) Hoist vehicle, allowing front suspension to hang free.
3) Remove wheel, referring to “Wheel Removal and Installation” in Section 3F.



4) Remove E-ring (1) securing brake hose and take brake hose off strut bracket as shown.
5) Remove ABS wheel speed sensor harness clamp bolt from strut (if equipped).
6) Remove strut bracket bolts (2).



7) Remove strut support nuts (1).

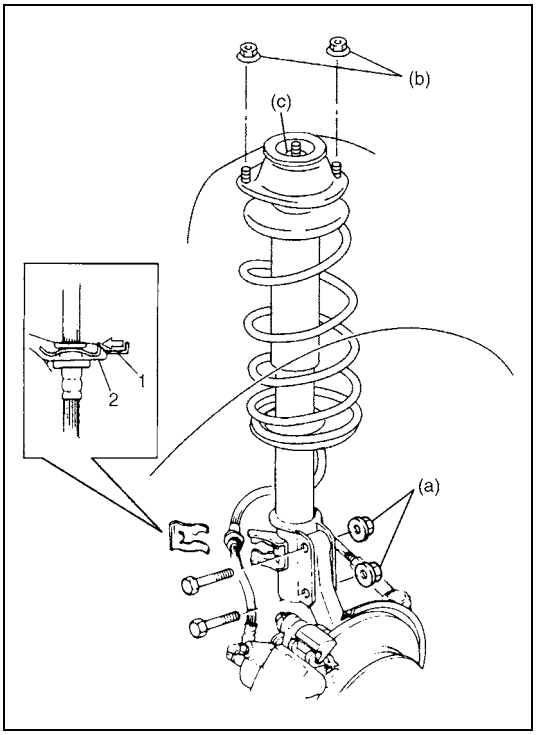
NOTE:

Hold strut by hand so that it will not fall off.

8) Remove strut assembly.

INSTALLATION

Install strut assembly by reversing removal procedure, noting the following instructions.



- Insert bolts in such direction as shown in figure.
- Tighten all fasteners to specified torque.

Tightening torque
Strut bracket nut (a): 115 N·m (11.5 kg-m, 83.0 lb-ft)
Strut support nut (b): 23 N·m (2.3 kg-m, 17.0 lb-ft)
Strut nut (c): 50 N·m (5.0 kg-m, 36.5 lb-ft)

CAUTION:
- **Don't twist brake hose when installing it.**
- **Install E-ring (1) as far as it fits to bracket (2) as shown in figure.**

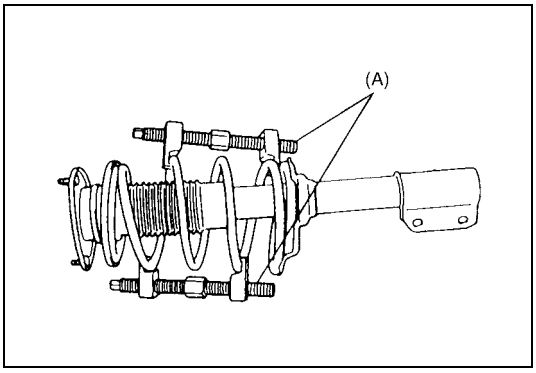
- Tighten wheel bolts to specified torque.

Tightening torque
Wheel bolt: 95 N·m (9.5 kg-m, 69.0 lb-ft)

- After installation, confirm front wheel alignment referring to "Preliminary checks prior to adjusting front alignment" in Section 3A.

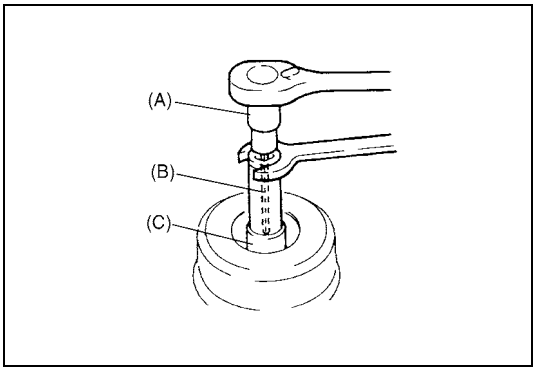
Strut Assembly Disassembly and Assembly

DISASSEMBLY



1) With special tool (A) placed to spring as shown, turn special tool bolts alternately until spring tension is released. Whether it is released or not can be known by whether strut turns lightly while strut spring is held stationary.

Special tool
(A): 09940-71431



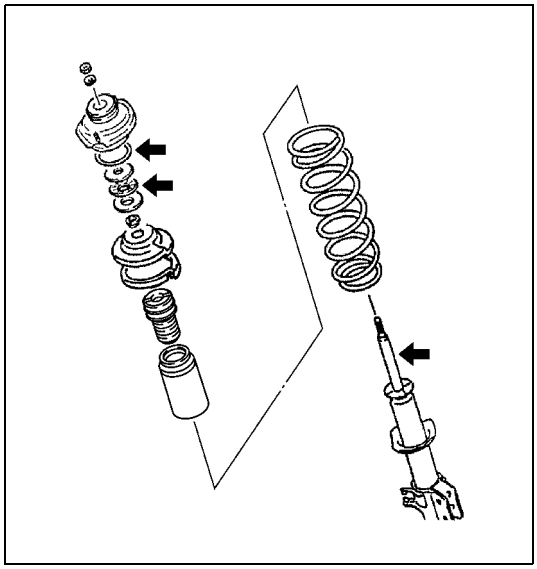
2) Remove strut nut with special tools while coil spring is compressed.

Special tool
(A) : 09900-00411
(B) : 09900-00414
(C) : 09945-26010

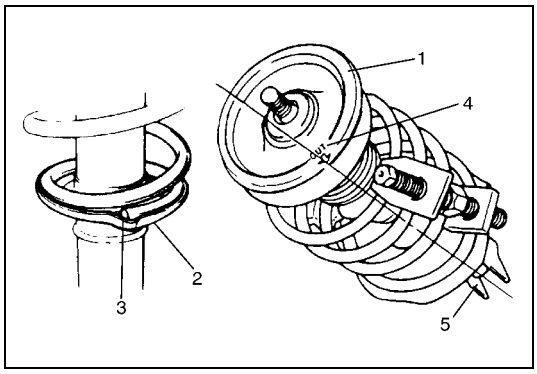
3) Disassemble strut assembly.

ASSEMBLY

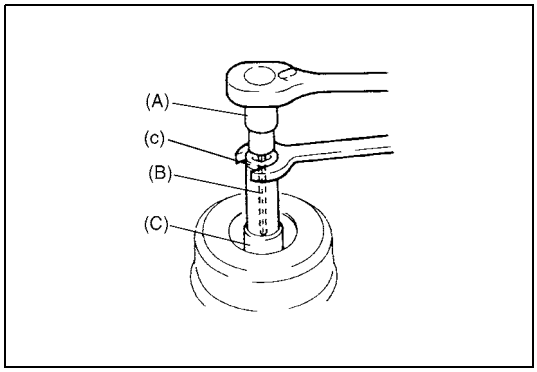
For assembly, reverse disassembly procedure, noting the following instructions.



- Apply grease to bearing seal, strut bearing and sliding part of strut rod.



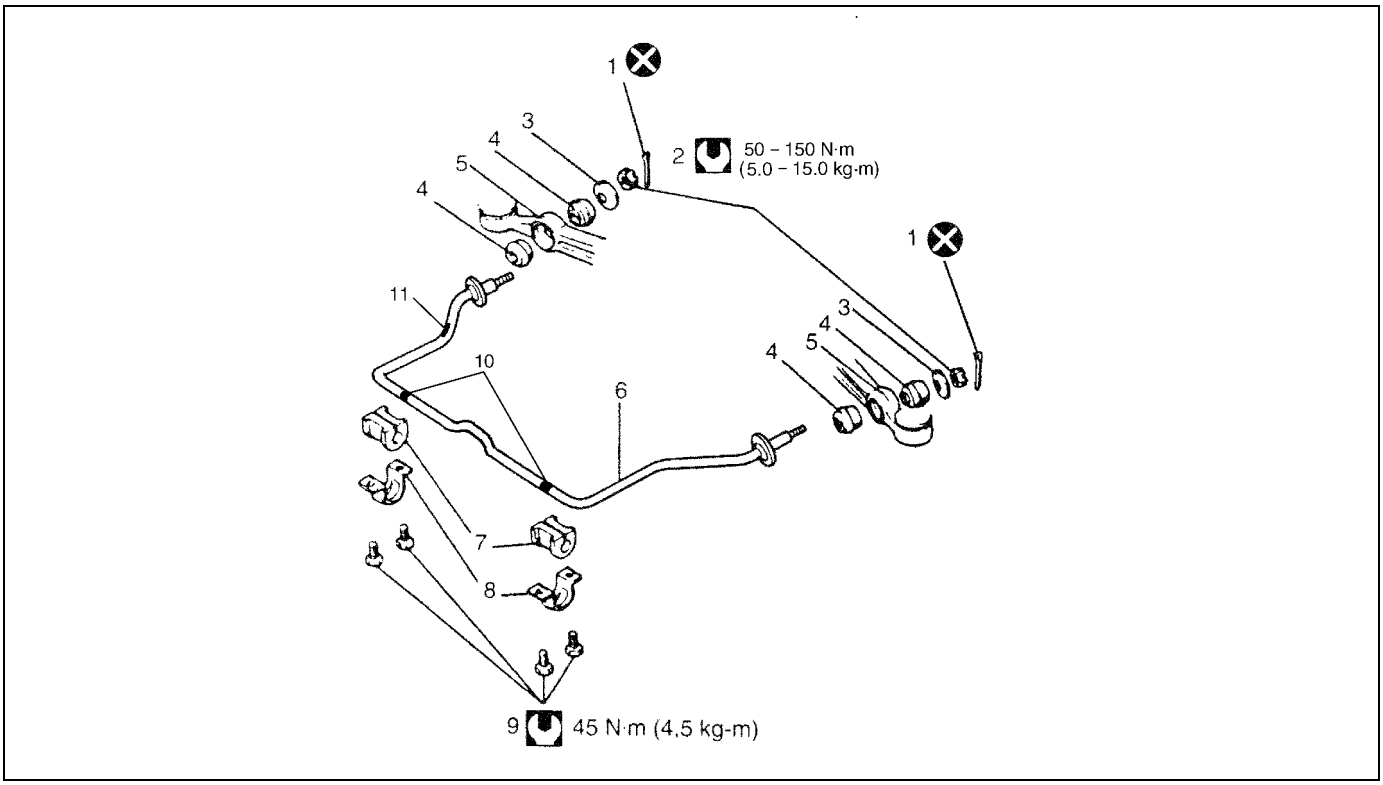
- Mate spring end with stepped part (3) of spring lower seat (2) as shown.
- Install spring seat on coil spring and then spring upper seat (1) aligning “OUT” mark (4) on spring upper seat and center of strut bracket (5).
- Install bearing spacer, bearing, bearing seal, strut support and strut unit in this sequence.



- Tighten strut nut temporarily at this step.

Special tool
(A) : 09900-00411
(B) : 09900-00414
(C) : 09945-26010

Stabilizer Bar and Bushings Component

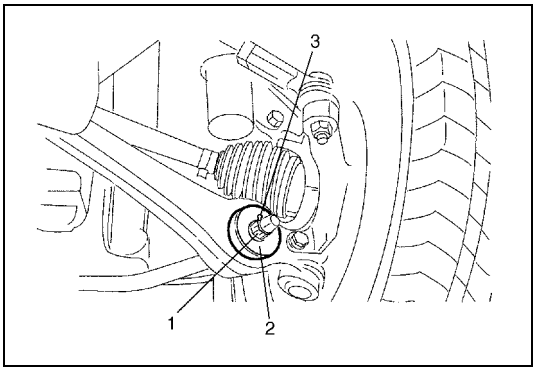


1. Split pin	5. Control arm	9. Stabilizer bar mounting bracket bolt	Tightening torque
2. Stabilizer bar nut	6. Stabilizer bar	10. Paint mark	Do not reuse.
3. Washer	7. Mount bushing	11. Paint mark (RH side)	
4. Bushing	8. Mount bracket: Oblong hole side comes to the rear.		

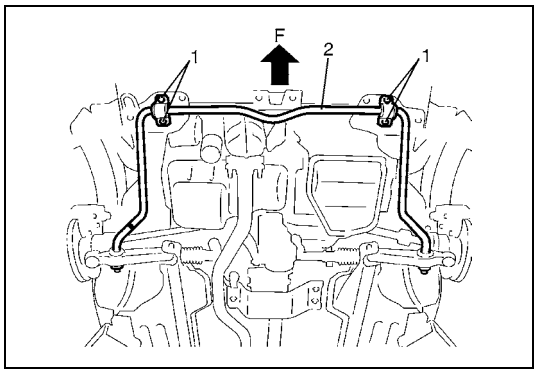
Stabilizer Bar and Bushings Removal and Installation

REMOVAL

1) Hoist vehicle and allow front suspension control arms to hang free.
2) Remove front wheels, referring to “Wheel Removal and Installation” in Section 3F.



3) Remove stabilizer bar split pins (3), nuts (1) and washers (2).



4) Remove stabilizer bar mounting bracket bolts (1).
5) Remove stabilizer bar (2).

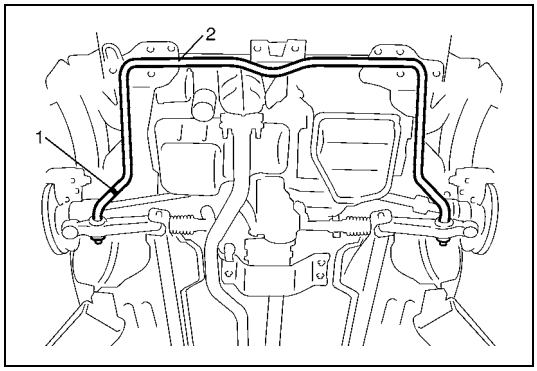
NOTE:

If it is hard to remove stabilizer bar, set tires in contact with ground (with suspension compressed).

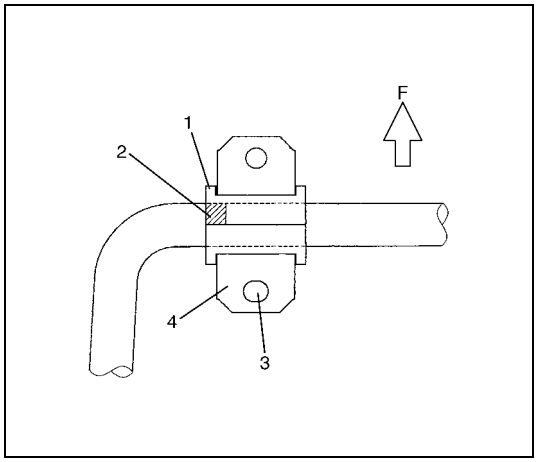
F. Forward

INSTALLATION

For installation, reverse removal procedure, noting the following instructions.



- Install stabilizer bar (2) so that paint mark (1) on it comes to the right side of vehicle.

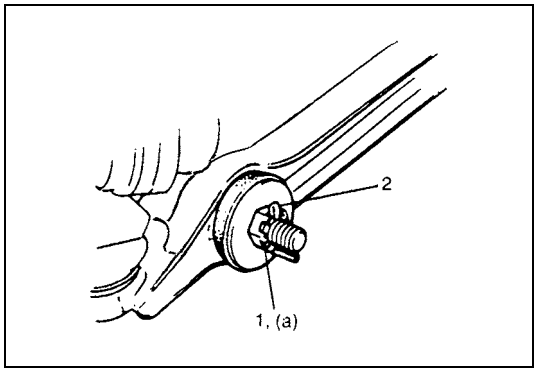


- Align the outside edge (1) of mount bushing with the outside edge (2) of paint mark as shown in figure.
- Install mount brackets (4) so that its oblong hole side (3) comes to the rear.

F: Forward

- Tighten stabilizer bar mounting bracket bolts to specified torque.

Tightening torque
Stabilizer bar mounting bracket bolt:
45 N·m (4.5 kg-m, 32.5 lb-ft)



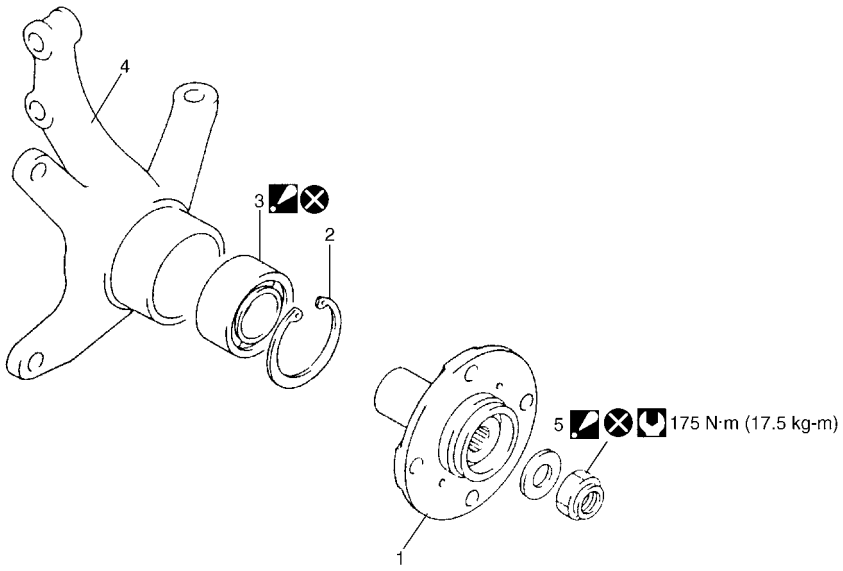
- Tighten stabilizer bar nuts (1) to specified torque.

Tightening torque
Stabilizer bar nut
(a): 50 – 150 N·m (5.0 – 15.0 kg-m, 36.5 – 108.0 lb-ft)

- Install new split pins (2) as shown.
- Tighten wheel bolts to specified torque.

Tightening torque
Wheel bolt: 95 N·m (9.5 kg-m, 69.0 lb-ft)

Wheel Hub and Steering Knuckle Component

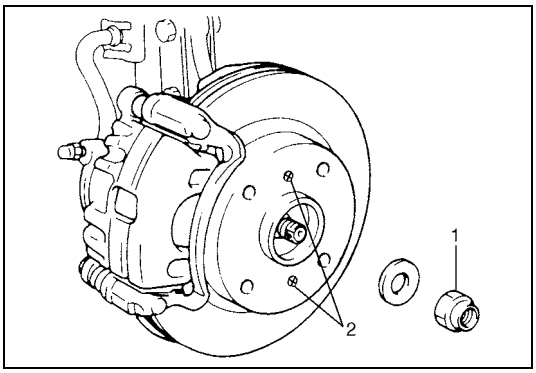


	1. Front wheel hub		4. Steering knuckle		Tightening torque
	2. Circlip		5. Drive shaft nut : Calk, after tightening.		Do not reuse.
	3. Wheel bearing : Face grooved rubber seal side to wheel hub.				

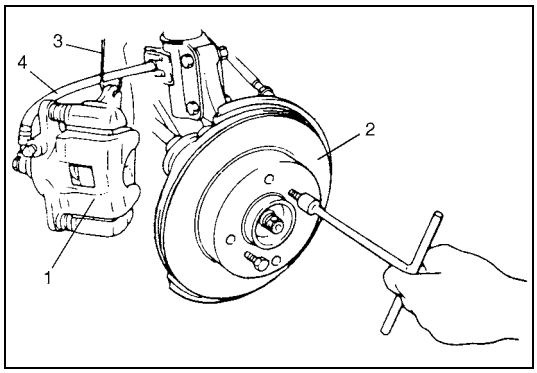
Wheel Hub and Steering Knuckle Removal and Installation

REMOVAL

1) Hoist vehicle and remove wheel, referring to “Wheel Removal and Installation” in Section 3F.



2) Uncaulk drive shaft nut (1).
3) Depress foot brake pedal and hold it there. Remove drive shaft nut (1).
4) Remove brake disc screws (2) and caliper carrier bolts.

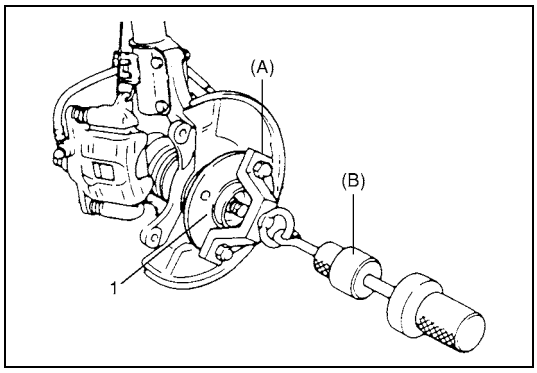


5) Remove caliper (1) with carrier.

NOTE:

Hang removed caliper with a wire hook or the like (3) so as to prevent brake hose (4) from bending and twisting excessively or being pulled.
Don't operate brake pedal with pads removed.

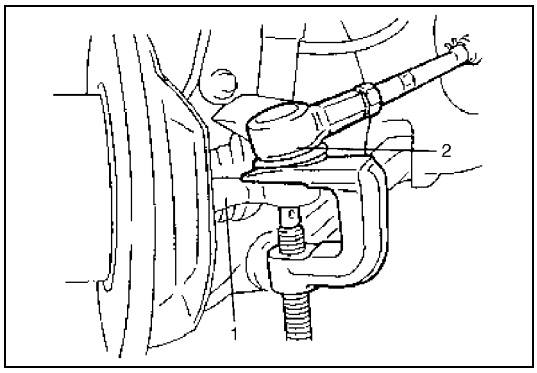
6) Pull brake disc (2) off by using two 8 mm bolts.



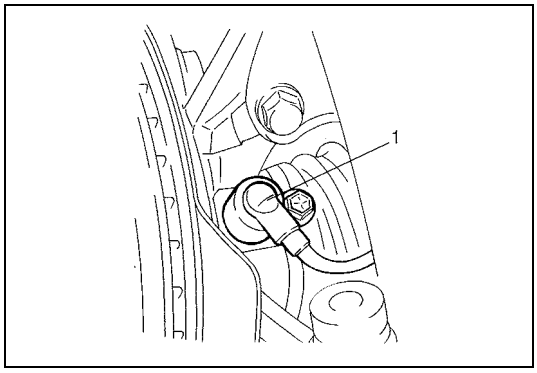
7) Pull out wheel hub (1) with special tools.

Special tool
(A): 09943-17912
(B): 09942-15511

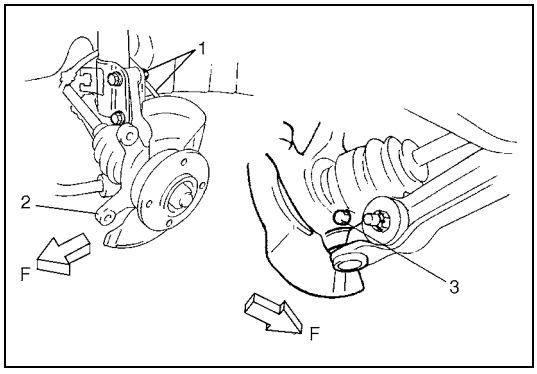
CAUTION:
When wheel hub is removed, replace wheel bearing as a set.



8) Disconnect tie rod end (2) from steering knuckle (1) with puller.



9) Remove wheel speed sensor (1) from knuckle (if equipped with ABS).

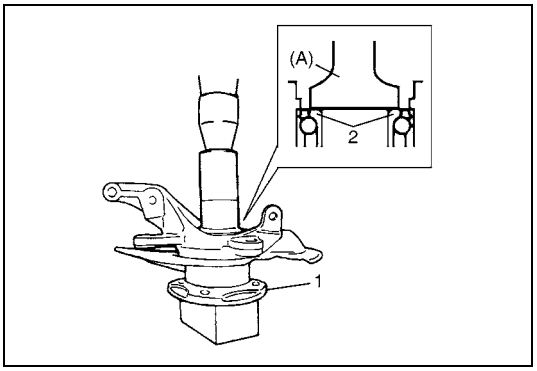


10) Loosen strut bracket nuts (1).

F: Forward

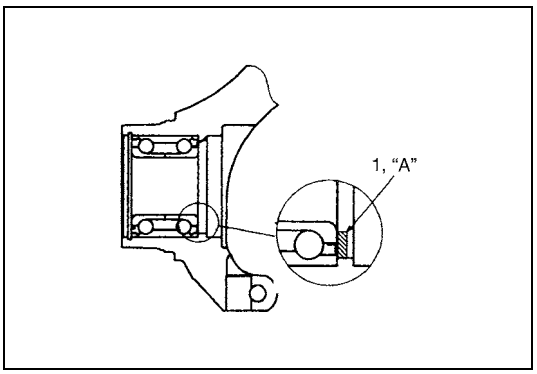
11) Remove ball joint bolt (3).
12) Remove strut bracket bolts from strut bracket and then steering knuckle (2).

INSTALLATION



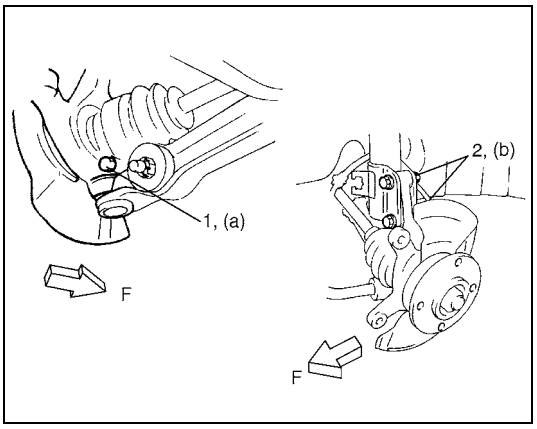
1) Using special tool and hydraulic press, press-fit wheel hub (1) into wheel bearing (2) (Face grooved rubber seal side to wheel hub).

Special tool
(A): 09913-75810



2) Apply grease lightly to contact part (1) of wheel bearing and drive shaft.

"A": Grease 99000-25050



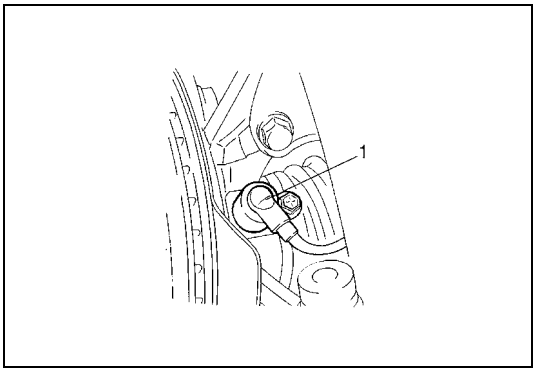
3) Install ball joint bolt (1) from the direction as shown.
4) Tighten suspension arm ball joint bolt (1) to specified torque.

Tightening torque
Suspension arm ball joint bolt
(a): 60 N·m (6.0 kg-m, 43.5 lb-ft)

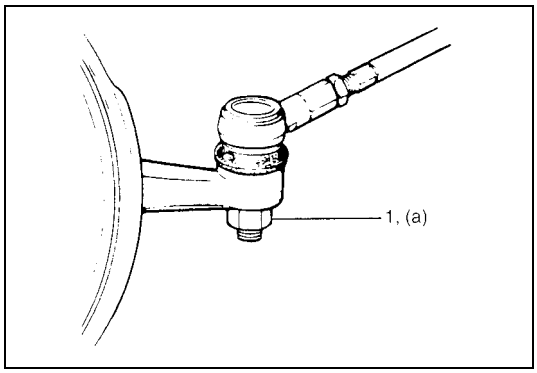
5) Tighten strut bracket nuts (2) to specified torque.

Tightening torque
Strut bracket nut (b): 115 N·m (11.5 kg-m, 83.0 lb-ft)

F: Forward

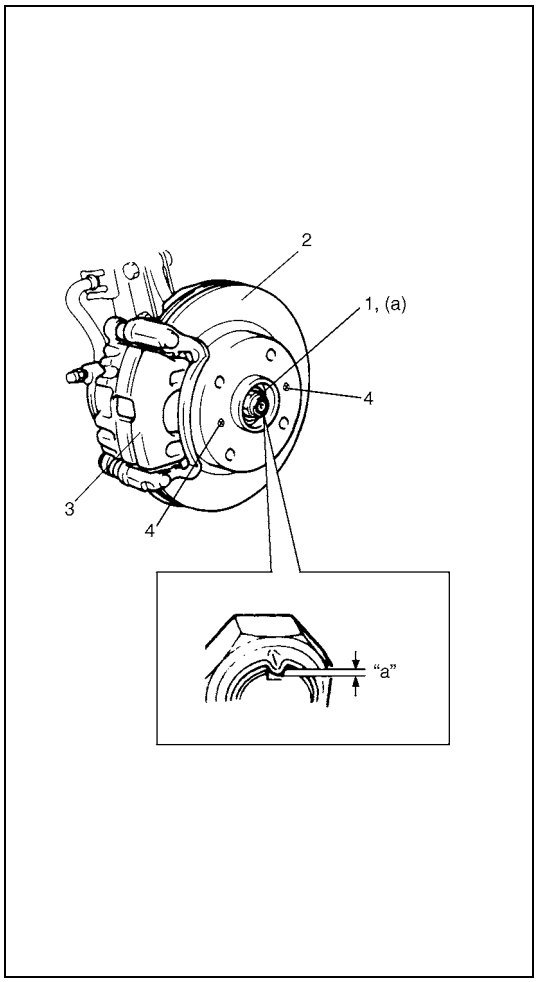


6) Install wheel speed sensor (1) (if equipped with ABS).



7) Connect tie rod end to steering knuckle, install new tie rod end nut and tighten nut (1) to specified torque.

Tightening torque
The rod end nut (a): 40 N·m (4.0 kg-m, 29.0 lb-ft)



8) Install brake disc (2) and brake caliper (3).
9) Tighten brake disc screws (4) and brake caliper bolt to specified torque.

Tightening torque
Brake disc screw: 9 N·m (0.9 kg-m, 6.5 lb-ft)
Brake caliper bolt: 95 N·m (9.5 kg-m, 69.0 lb-ft)

10) Depress foot brake pedal and hold it there.
Tighten new drive shaft nut (1) to specified torque.

Tightening torque
Drive shaft nut (a): 175 N·m (17.5 kg-m, 127.0 lb-ft)

CAUTION:
Never reuse drive shaft nut (1).

11) Caulk drive shaft nut (1) as shown.

Caulking specification "a": 0.5 mm (0.02 in.) or more

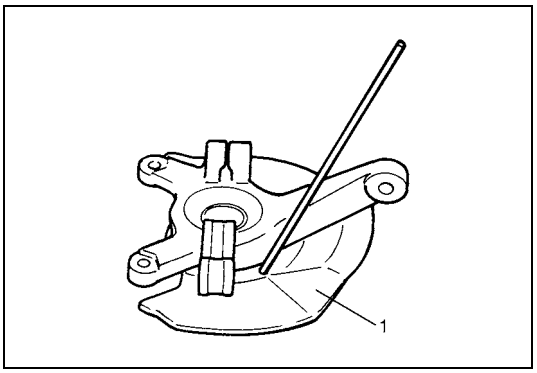
CAUTION:
Be careful while caulking nut so that no crack will occur in caulked part of nut. Cracked nut must be replaced with new one.

12) Tightening wheel bolts to specified torque.

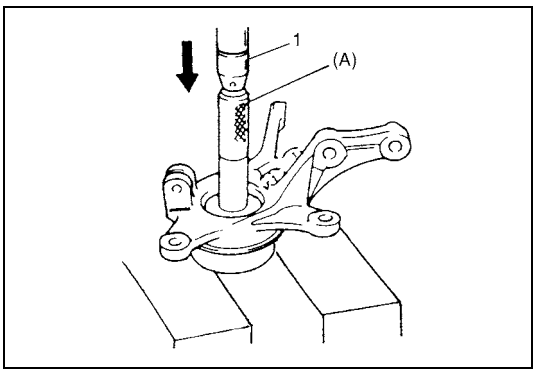
Tightening torque
Wheel bolt: 95 N·m (9.5 kg-m, 69.0 lb-ft)

Wheel Hub and Steering Knuckle Disassembly and Assembly

DISASSEMBLY



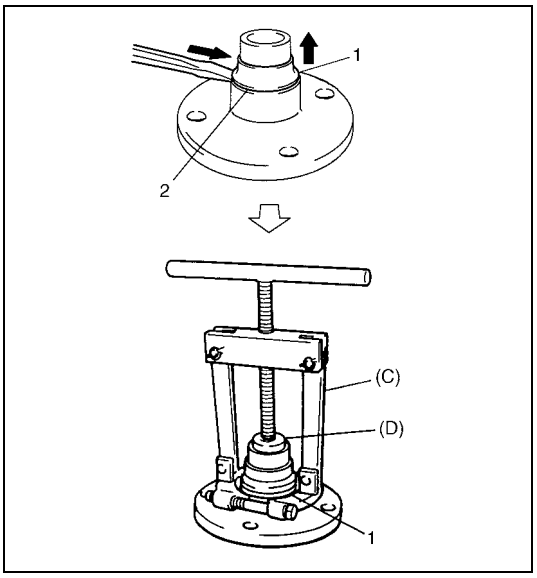
1) Uncaulk and remove dust cover (1).
2) Remove wheel bearing circlip.



3) Remove wheel bearing using hydraulic press (1) and special tool.

Special tool
(A): 09913-75520

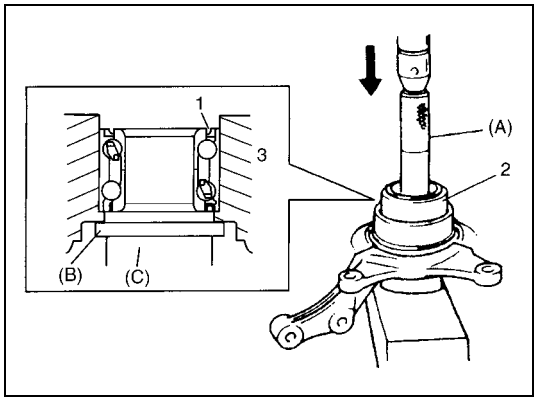
CAUTION:
When installing wheel bearing, replace it with new one.



4) Remove wheel bearing outside inner race (1) as shown by hammering lightly at 3 locations around it so as not to cause damage to seating part (2) of wheel hub.

Special tool
(C): 09913-65810
(D): 09926-37610-003

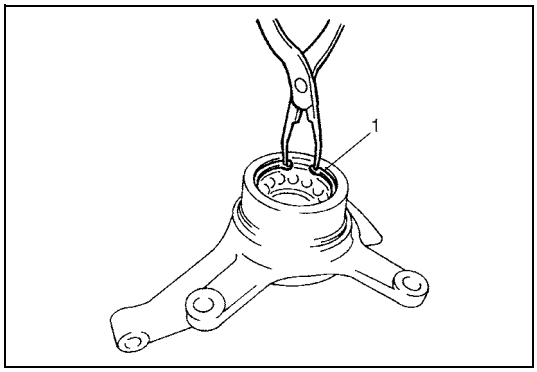
ASSEMBLY



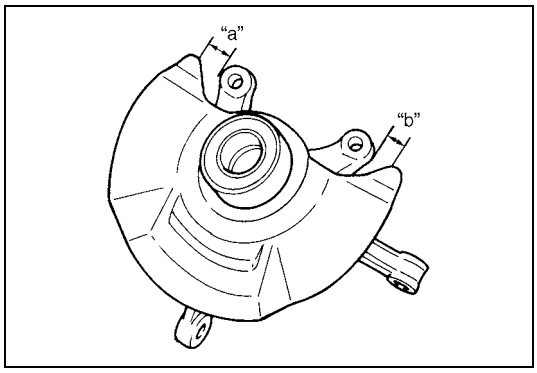
1) Face rubber seal side (1) of new wheel bearing (2) upward as shown in figure and press-fit it into knuckle (3) using special tools.

Special tool
(A): 09913-75510
(B): 09926-68310
(C): 09951-18210

CAUTION:
When replacing bearing, inner races or outer race, be sure to replace them with new ones as a set.

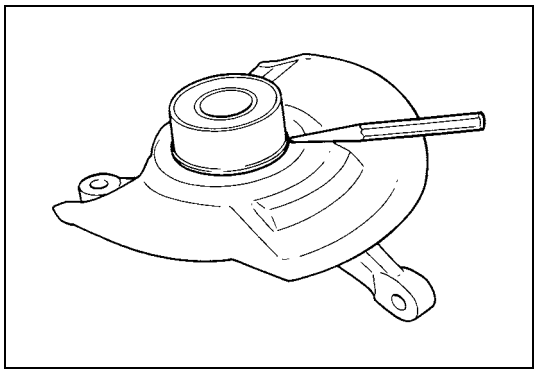


2) Install wheel bearing circlip (1).



3) Drive in dust cover so that dimensions "a" and "b" become equal as shown in figure.

CAUTION:
When drive in dust cover, be careful not to deform it.

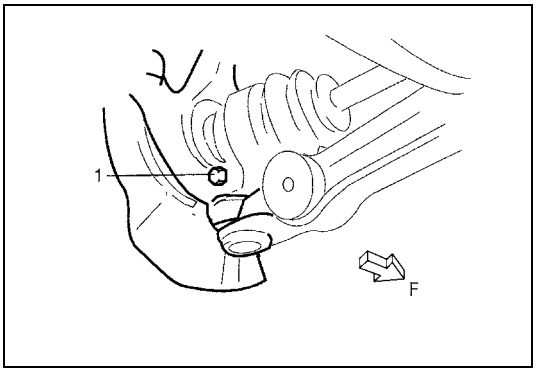


4) Caulk with a punch.

Suspension Control Arm / Bushing Removal and Installation

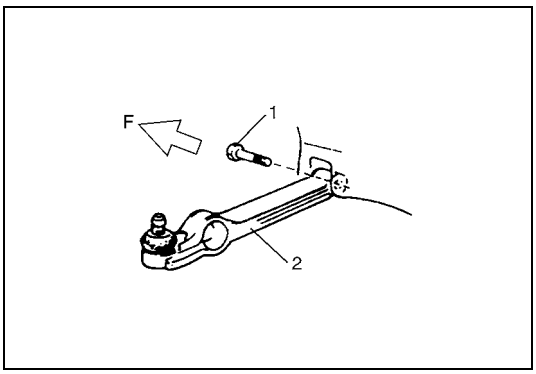
REMOVAL

1) Remove stabilizer bar refer to “Stabilizer Bar and Bushings Removal and Installation” in this section.



2) Remove suspension control arm ball joint bolt (1).

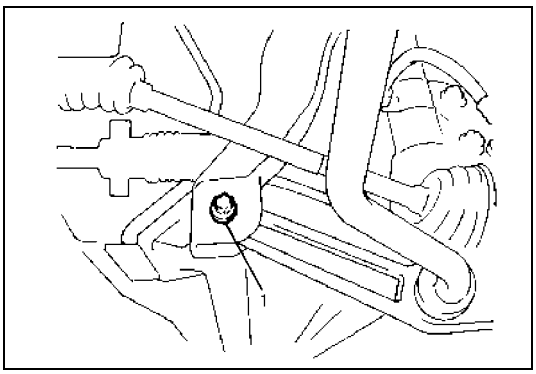
F: Forward



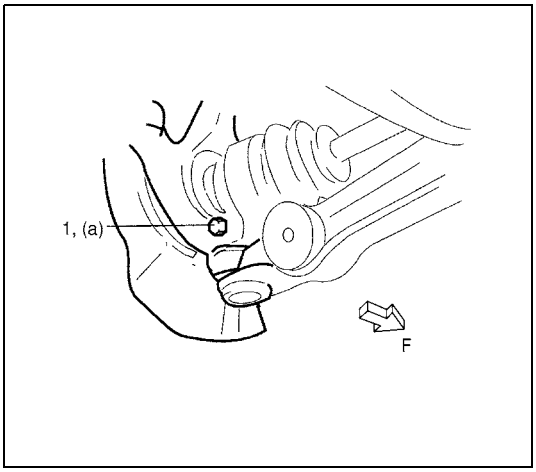
3) Remove suspension control arm bolt and washer (1).
4) Remove suspension control arm (2).

F: Forward

INSTALLATION



1) Install body side of suspension control arm but tighten suspension control arm bolt and washer (1) only temporarily.

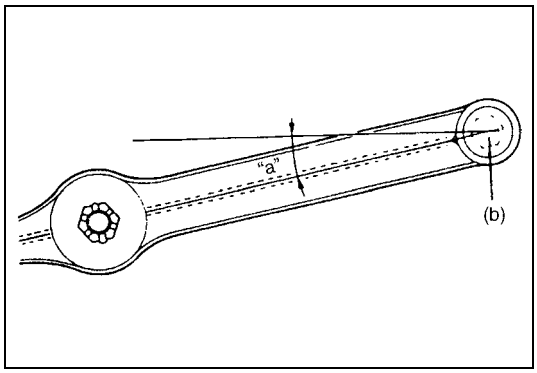


2) Install suspension control arm ball joint to steering knuckle. Align ball stud groove with steering knuckle bolt hole. Then install ball joint bolt (1) from the direction as shown in figure. Tighten suspension arm ball joint bolt (1) to specified torque.

Tightening torque
Suspension arm ball joint bolt
(a): 60 N·m (6.0 kg-m, 43.5 lb-ft)

3) Install stabilizer bar, referring to “Stabilizer Bar and Bushings Removal and Installation” in this section.

F: Forward



4) Lower hoist and vehicle in non-loaded condition, tighten control arm bolt to specified torque at the position where control arm is installed at angle "a" as shown below.

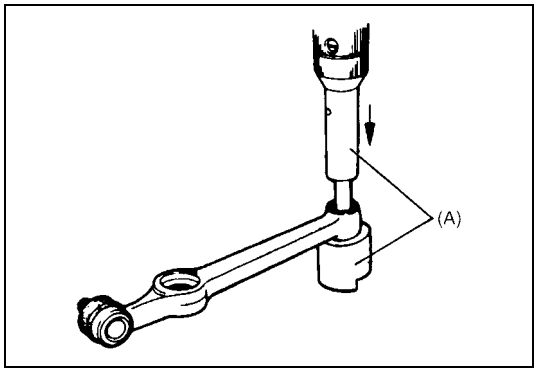
Angle "a": 15 ° ± 5 °

Tightening torque
Control arm bolt (b): 60 N·m (6.0 kg-m, 43.5 lb-ft)
Control arm member bolt: 60 N·m (6.0 kg-m, 43.5 lb-ft)

5) Confirm front wheel alignment referring to "Front Wheel Alignment Inspection and Adjustment" in Section 3A.

Suspension Control Arm / Bushing Disassembly and Assembly

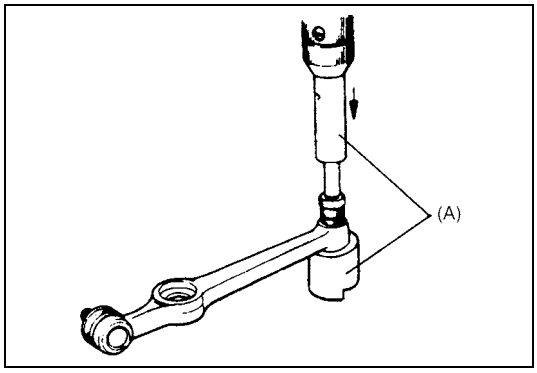
DISASSEMBLY



1) Remove bushing.
Place suspension control arm onto flat surface side of special tool and push out bushing with special tool and oil hydraulic press as shown.

Special tool
(A) : 09943-77910

ASSEMBLY



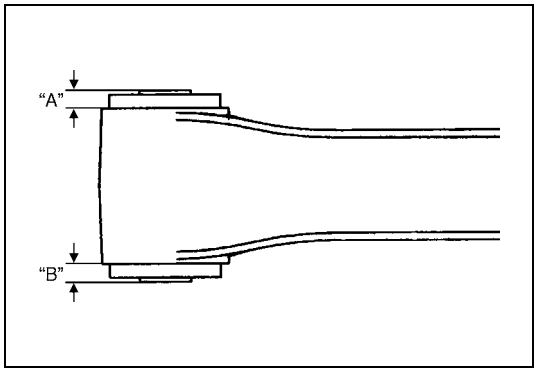
1) Press-fit bushing by using special tool and press.

Special tool
(A) : 09943-77910

CAUTION:
Be sure to use new bushing.

NOTE:

- **Before installing bushing, apply soap water on its circumference to facilitate installation.**
- **When installed, bush should be equal on the right and left of arm as shown.**



2) Press-fit bushing so that dimensions "A" and "B" in figure become equal.

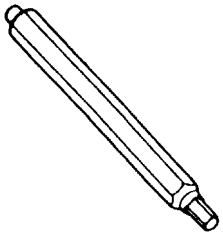
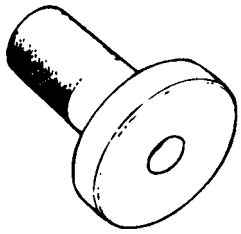
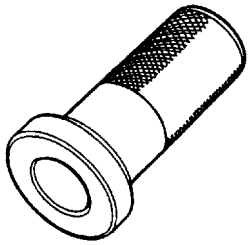
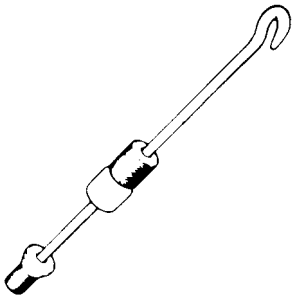
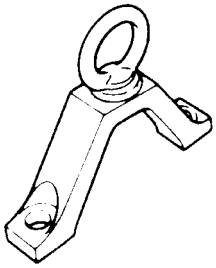
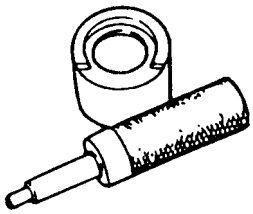
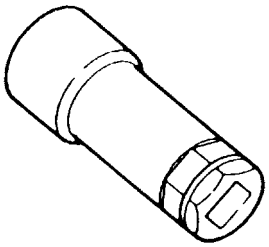
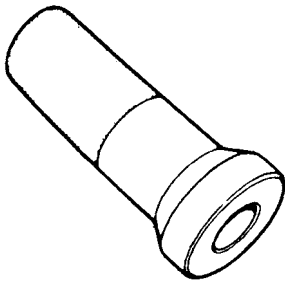
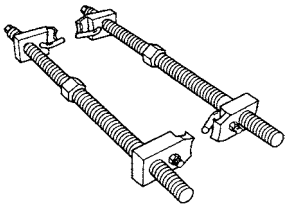
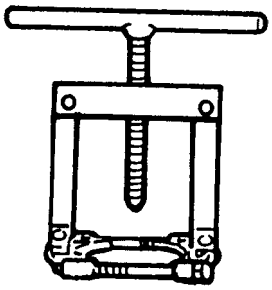
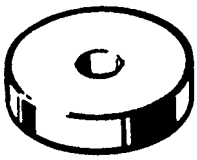
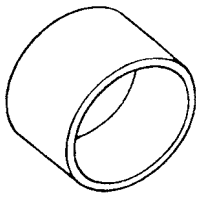
Tightening Torque Specifications

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Brake caliper bolt	95	9.5	69.0
Brake disc screw	9	0.9	6.5
Control arm bolt	60	6.0	43.5
Control arm member bolt	60	6.0	43.5
Drive shaft nut	175	17.5	127.0
Stabilizer bar mounting bracket bolt	45	4.5	32.5
Stabilizer bar nut	50 – 150	5.0 – 15.0	36.5 – 108.0
Strut bracket nut	115	11.5	83.0
Strut nut	50	5.0	36.5
Strut support nut	23	2.3	17.0
Suspension arm ball joint bolt	60	6.0	43.5
The rod end nut	40	4.0	29.0
Control arm crossmember bolt	60	6.0	43.5
Wheel bolt	95	9.5	69.0

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Strut bearing
Lithium grease	SUPER GREASE E (99000-25050)	• Mating surfaces of wheel bearing and CV joint

Special Tool

 09900-00411 Hexagon wrench socket	 09900-00414 Hexagon wrench bit 6 mm	 09913-75520 Bearing installer	 09913-75810 Bearing installer
 09942-15511 Sliding hammer	 09943-17912 Front wheel hub remover	 09943-77910 Bushing remover	 09945-26010 Socket wrench 17 mm
 09913-75510 Bearing installer	 09940-71431 Spring compressor	 09913-65810 Bearing puller	 09926-37610-003 Bearing puller attachment
 09926-68310 Bevel pinion bearing installer	 09951-18210 Remover booster body oil No.2		

SECTION 3E

REAR SUSPENSION

NOTE:

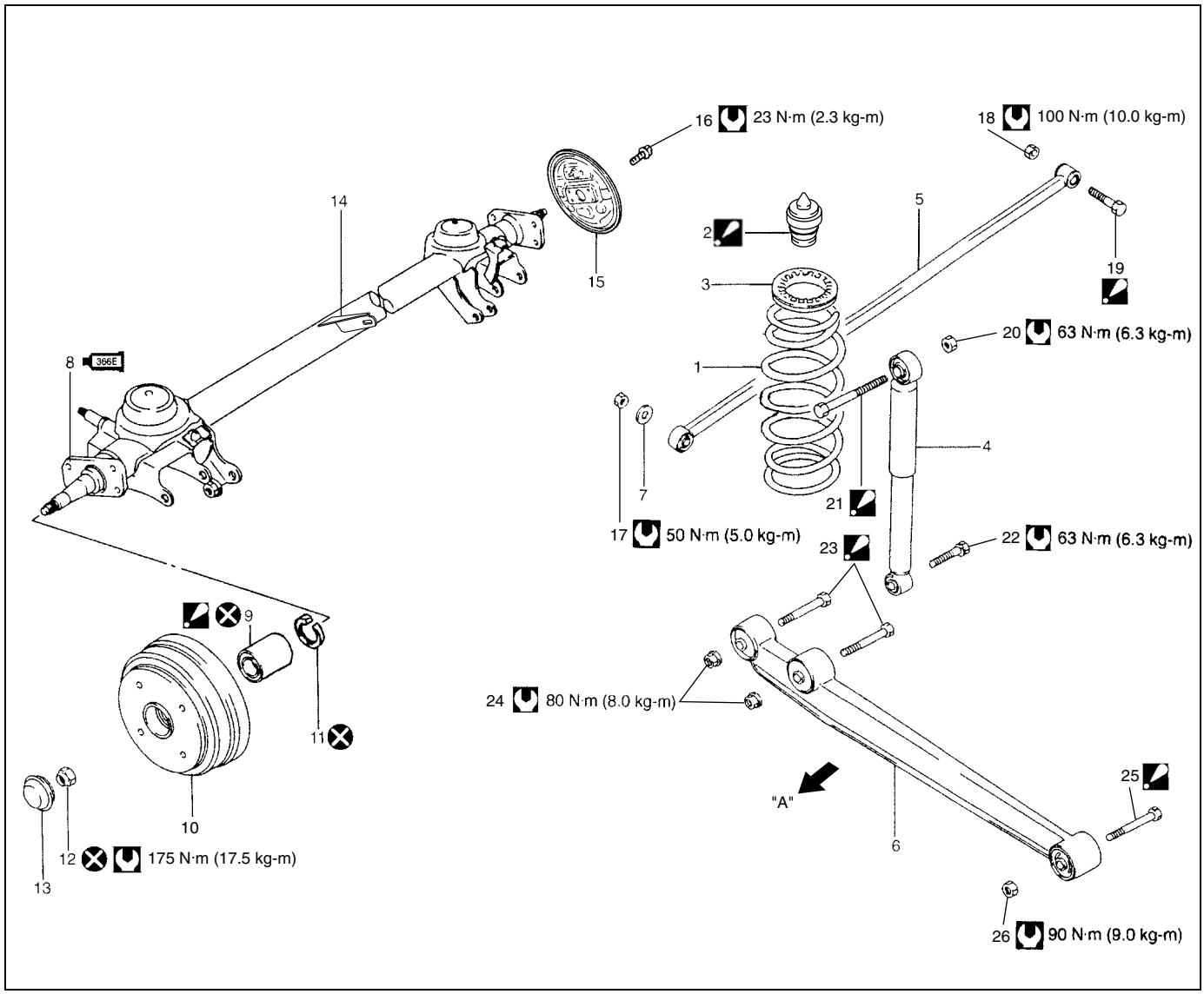
- **All suspension fasteners are an important attaching part in that it could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.**
- **Never attempt to heat, quench or straighten any suspension part. Replace it with a new part, or damage to the part may result.**

CONTENTS

General Description

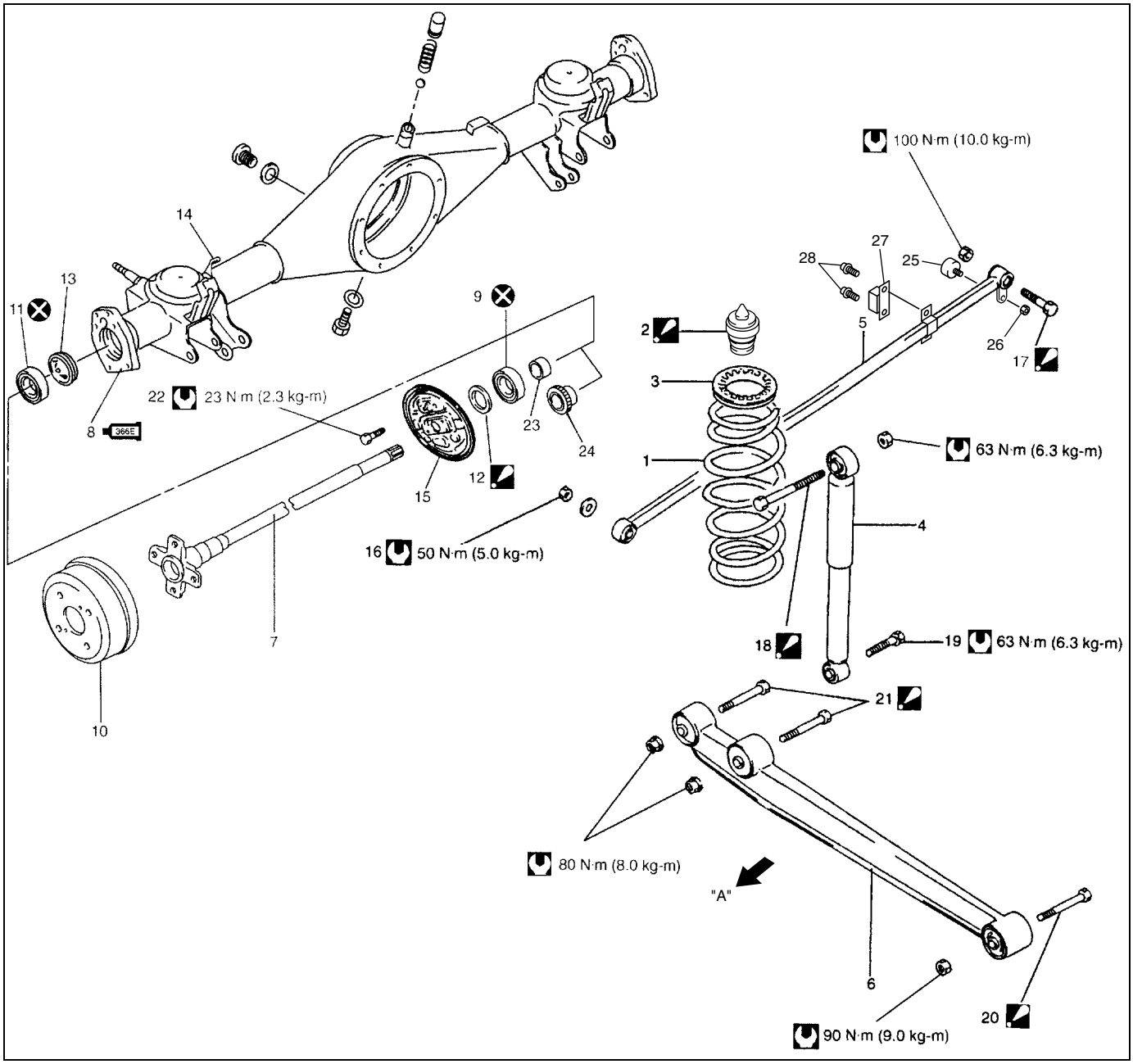
Rear Suspension Component Locator

2WD model



"A": Body outside	366E 8. Rear axle	16. Brake back plate bolt	24. Trailing arm rear nut
1. Rear coil spring	9. Bearing :Seal side of bearing comes brake back plate side.	17. Lateral rod axle housing side nut	25. Trailing arm front bolt :Insert from vehicle inside.
2. Rear bump stopper :Apply soap water, when installing.	10. Brake drum	18. Lateral rod body side nut	26. Trailing arm front nut
3. Rear spring upper seat	11. Circlip	19. Lateral rod bolt :Insert from the direction as shown.	Tightening torque
4. Rear shock absorber	12. Spindle nut	20. Rear shock absorber upper nut	Do not reuse
5. Lateral rod	13. Spindle cap	21. Rear shock absorber upper bolt :Insert from vehicle outside.	
6. Trailing arm	14. LSPV bracket (only vehicle with LSPV)	22. Rear shock absorber lower bolt	
7. Lateral rod outer washer	15. Brake back plate	23. Trailing arm rear bolt :Insert from vehicle inside.	

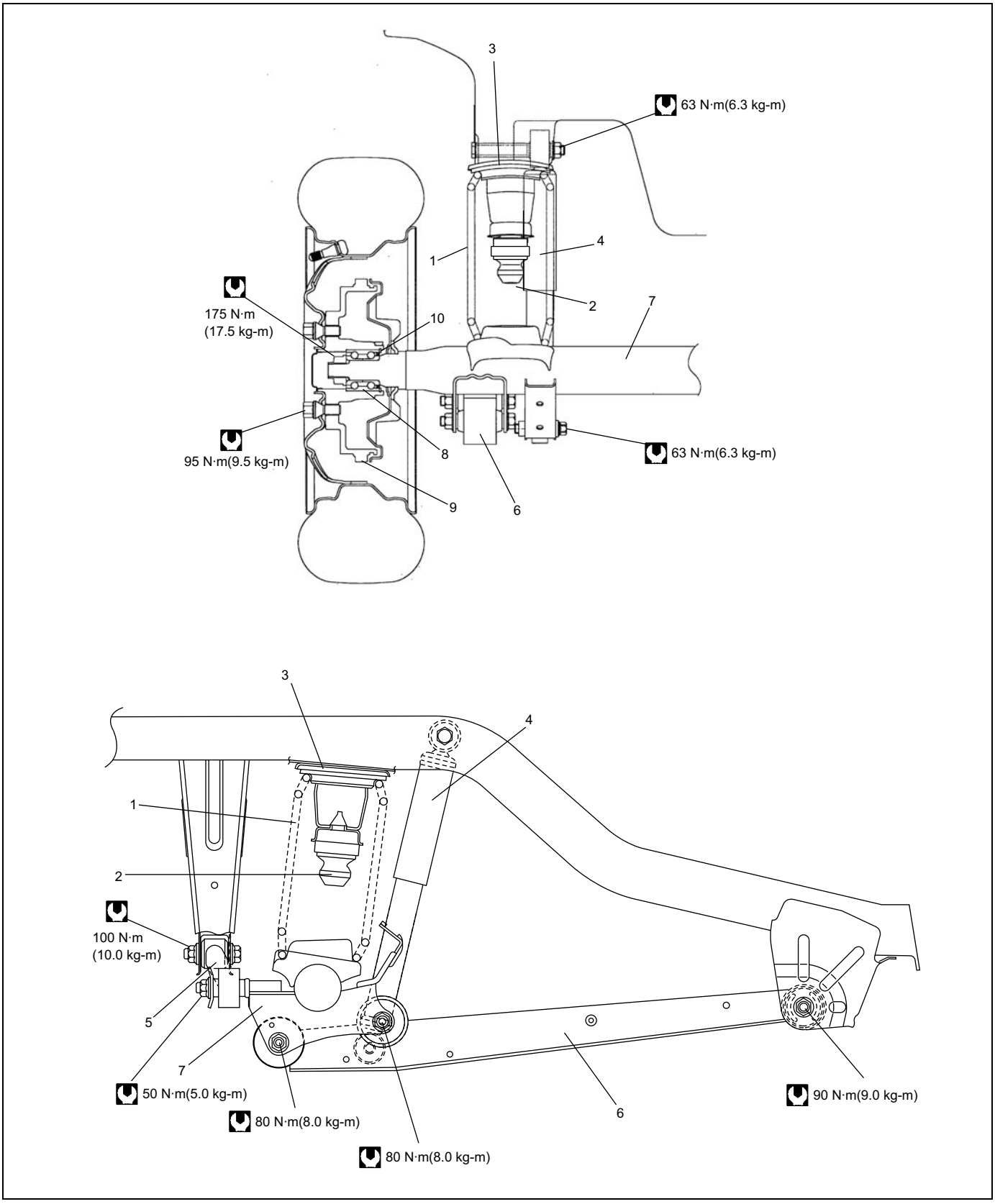
4WD model



"A": Body outside	11. Oil seal	22. Brake back plate bolt
1. Rear coil spring	12. Spacer : The tapered side of spacer inner diameter directed toward outside (brake drum side).	23. Bearing retainer ring (without ABS)
2. Rear bump stopper : Apply soap water, when installing.	13. Oil seal protector	24. Bearing retainer ring (with ABS)
3. Rear spring upper seat	14. LSPV bracket (only vehicle with LSPV)	25. Lateral rod dumper
4. Rear shock absorber	15. Brake back plate	26. Lateral rod dumper nut
5. Lateral rod	16. Lateral rod axle housing side nut	27. Lateral rod dumper
6. Trailing arm	17. Lateral rod body side bolt : Insert from the direction as shown.	28. Lateral rod dumper bolt
7. Rear axle shaft	18. Shock absorber upper bolt : Insert from vehicle outside.	Tightening torque
366E 8. Rear axle housing : Apply water tight sealant 99000-31090 to joint of plate and axle housing.	19. Shock absorber lower bolt	Do not reuse
9. Bearing	20. Trailing arm front bolt : Insert from vehicle inside.	
10. Brake drum	21. Trailing arm rear bolt : Insert from vehicle inside.	

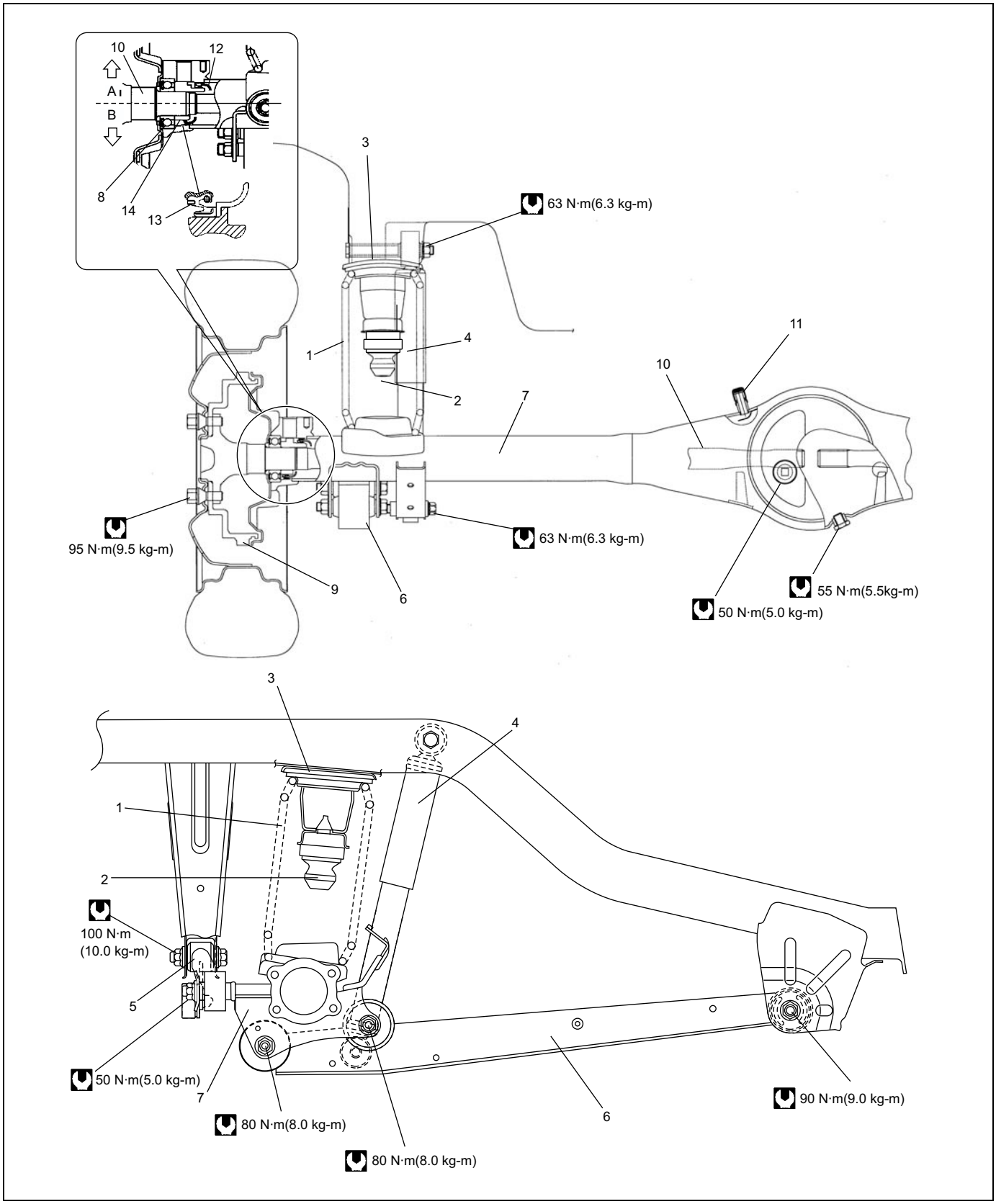
Rear Suspension Construction

2WD model



1. Rear coil spring	4. Rear shock absorber	7. Rear axle	10. Circlip
2. Rear bump stopper	5. Lateral rod	8. Wheel bearing	Tightening torque
3. Rear spring upper seat	6. Trailing arm	9. Brake drum	

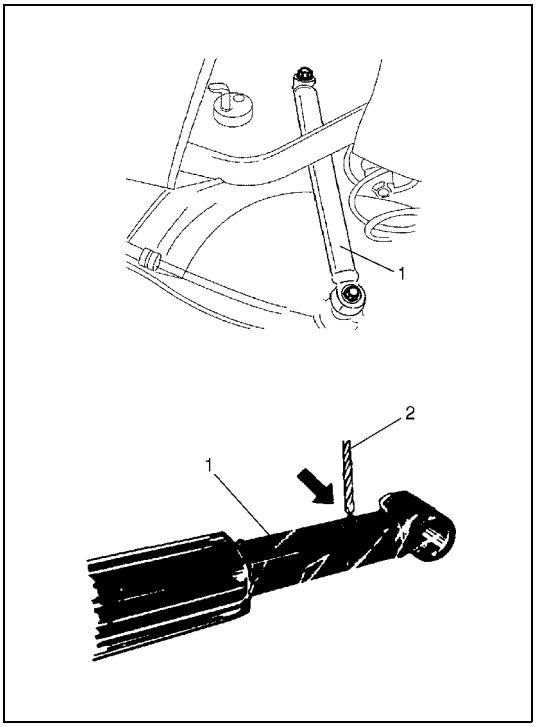
4WD model



A: With ABS	4. Rear shock absorber	9. Brake drum	14. Wheel bearing retainer ring or rear wheel sensor ring (if equipped with ABS)
B: Without ABS	5. Lateral rod	10. Rear axle shaft	Tightening torque
1. Rear coil spring	6. Trailing arm	11. Breather cap	
2. Rear bump stopper	7. Rear axle housing	12. Oil seal protector	
3. Rear spring upper seat	8. Wheel bearing	13. Oil seal	

Diagnosis

Rear Shock Absorber Check



- Inspect for deformation or damage.
- Inspect bushings for wear or damage.
- Inspect for evidence of oil leakage.

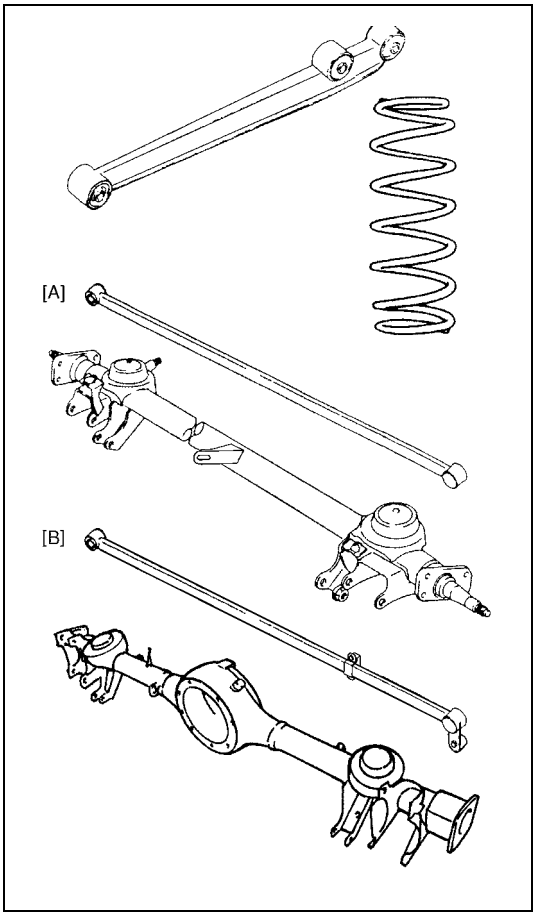
Replace any defective part.

WARNING:

When handling rear shock absorber (1) in which high-pressure gas is sealed, make sure to observe the following precautions.

- **Don't disassemble it.**
- **Don't put it into the fire.**
- **Don't store it where it gets hot.**
- **Before disposing it, be sure to drill a hole (approximately 3 mm (0.12 in.) diameter) (2) in it where shown by an arrow in figure and let gas and oil out.**
  Lay it down sideways for this work. The gas itself is harmless but it may issue out of the hole together with chips generated by the drill. Therefore, be sure to wear goggle.

Trailing Arm, Lateral Rod, Rear Axle, Rear Axle (Housing) and Coil Spring Check

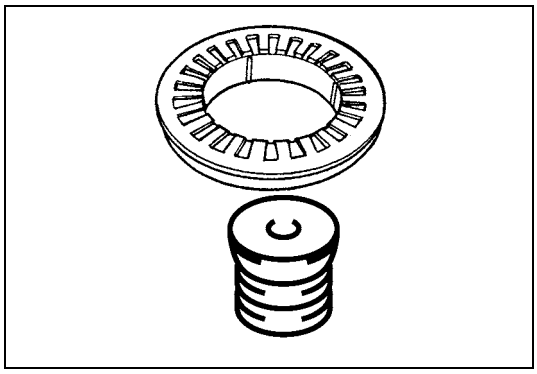


- Inspect for cracks, deformation or damage.
- Inspect bushing for damage, wear or breakage.

Replace any defective part.

[A]: 2WD model
[B]: 4WD model

Bump Stopper / spring Upper Seat Check



- Inspect for cracks, deformation or damage.

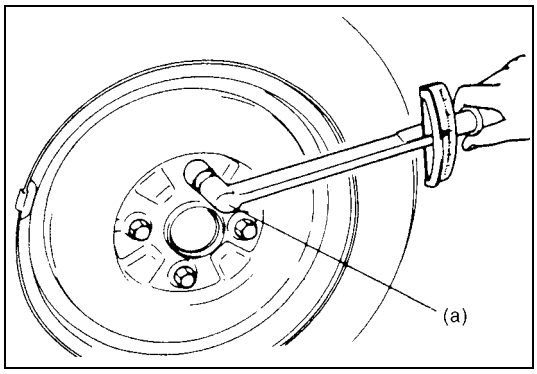
Replace any defective part.

Rear Suspension Fasteners

Check each bolt and nut fastening suspension parts for tightness.Tighten loose one, if any, to specified torque referring to the figure in “Rear Suspension Construction” in this section.

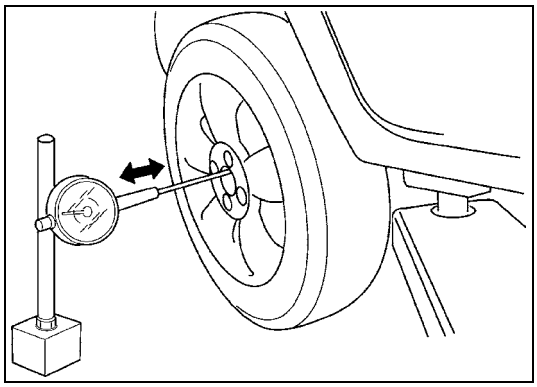
Wheel Disc, Bolt and Bearing Check

- Inspect each wheel disc for dents, distortion and cracks.
  A disc in badly damaged condition must be replaced.



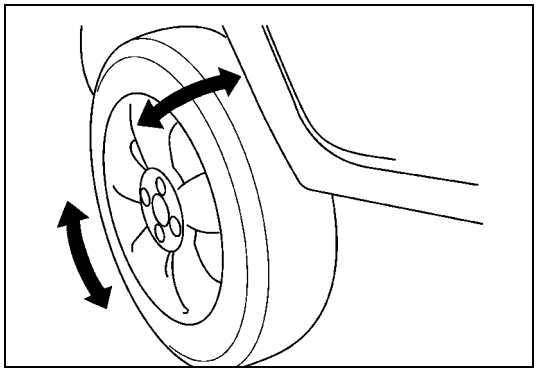
- Check wheel bolts for tightness and, as necessary, retighten to specification.

Tightening torque
Wheel bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)



- Check wheel bearings for wear. When measuring thrust play, apply a dial gauge to axle shaft center.
  When measurement exceeds limit, replace bearing.

Thrust play limit
“a”: 0.1 mm (0.004 in.)



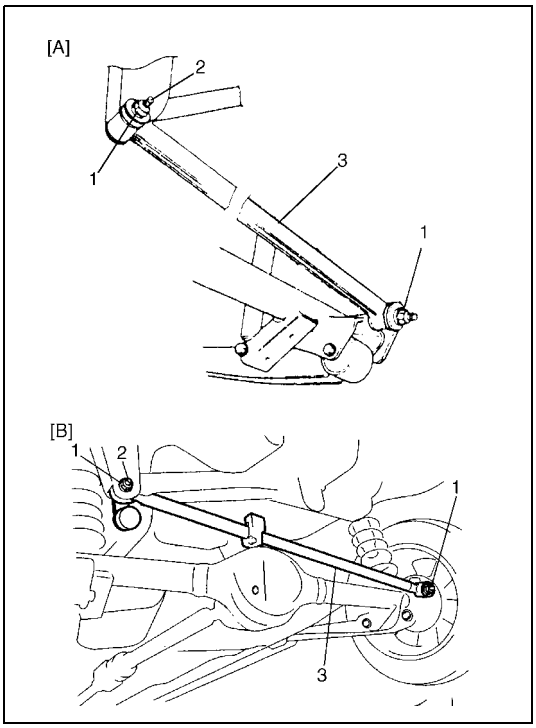
- By rotating wheel actually, check wheel bearing for noise and smooth rotation. If it is defective, replace bearing.

On-vehicle Service

Lateral Rod Removal and Installation

REMOVAL

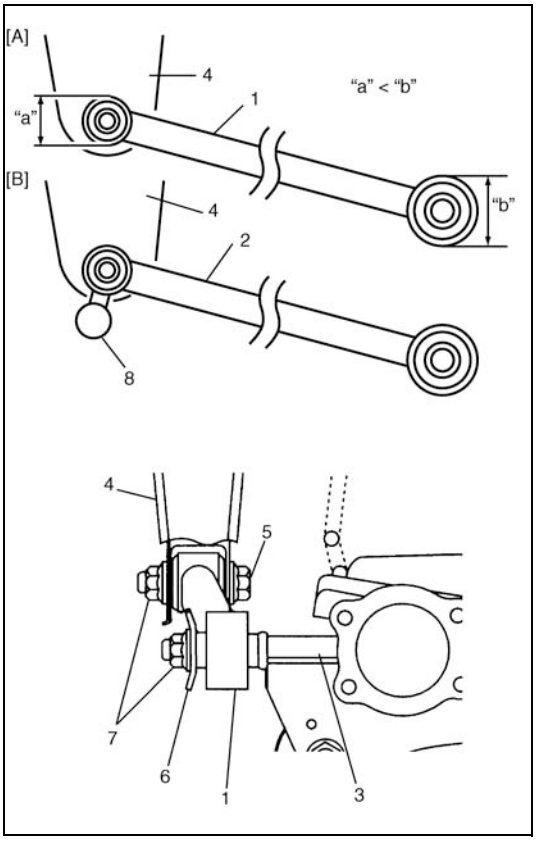
1) Hoist vehicle.



2) Remove lateral rod nuts (1) and bolt (2).
3) Remove lateral rod (3).

[A]: 2WD model
[B]: 4WD model

INSTALLATION



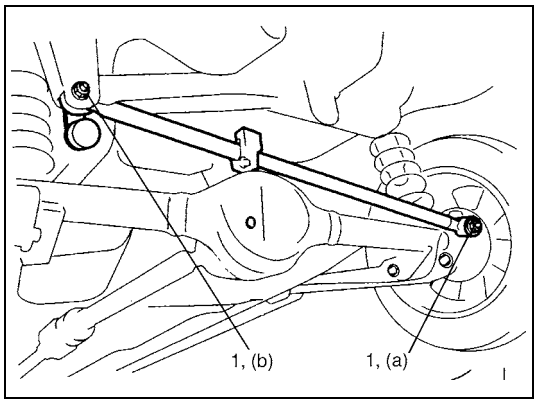
1) Install lateral rod (1) or (2) to rear axle (or axle housing) (3) and vehicle body (4) referring to figure for proper installing direction of bolt (5) and washer (6).
   Tighten nuts (7) temporarily at this step.

NOTE:

- **When installing Rod (1) for 2WD, identify rod end by smaller diameter "a" and install that end to vehicle body side.**
- **When installing rod (2) for 4WD, identify rod end by damper (8) and install that end to vehicle body side. Also make sure that both dampers are directed rearward of vehicle.**

[A]: 2WD model
[B]: 4WD model

2) Lower hoist.



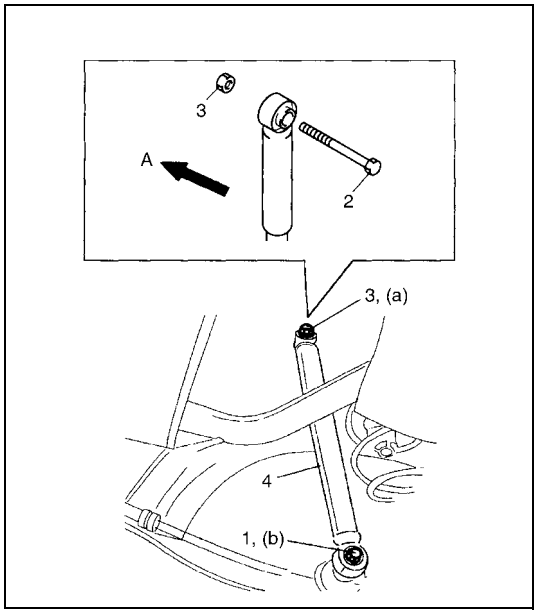
3) Tighten lateral rod nuts (1) to specified torque. It is the most desirable to have vehicle off hoist and in non-loaded condition when tightening them.

Tightening torque
Lateral rod axle side nut (a): 50 N·m (5.0 kg-m, 36.5 lb-ft)
Lateral rod body side nut (b): 100 N·m (10.0 kg-m, 72.5 lb-ft)

Rear Shock Absorber Removal and Installation

REMOVAL

1) Hoist vehicle.
2) Support rear axle (or axle housing) by using floor jack to prevent it from lowering.



3) Remove lower bolt (1).
4) Remove upper bolt (2) and nut (3). Then remove shock absorber (4).

INSTALLATION

1) Install shock absorber (4) referring to figure.
   Tighten bolt and nut temporarily at this step.
2) Remove floor jack from rear axle (or axle housing) and lower hoist.
3) Tighten bolts and nut to specified torque.

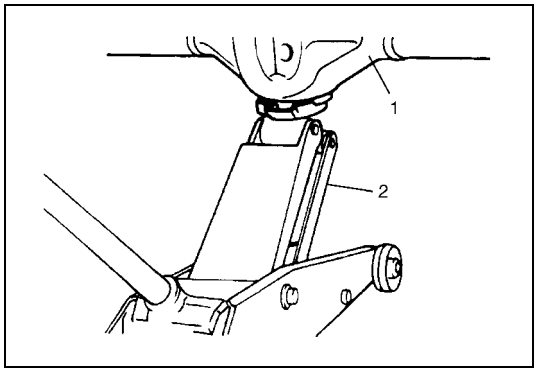
Tightening torque
Rear shock absorber upper nut
(a): 63 N·m (6.3 kg-m, 45.5 lb-ft)
Rear shock absorber lower bolt
(b): 63 N·m (6.3 kg-m, 45.5 lb-ft)

A: Vehicle inside

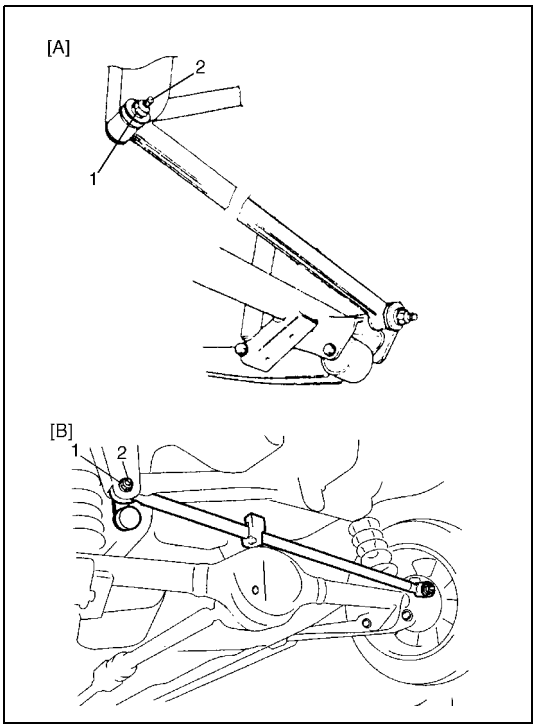
Coil Spring Removal and Installation

REMOVAL

1) Hoist vehicle and remove rear wheel referring to “Wheel Removal and Installation” in Section 3F.

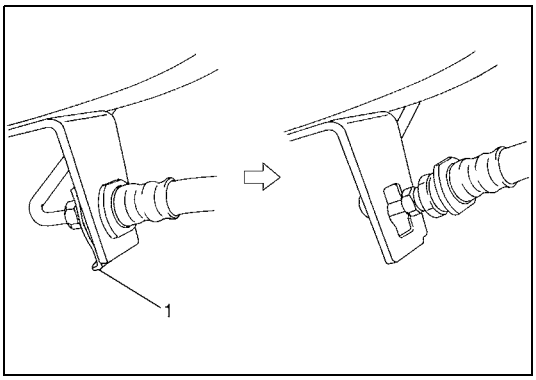


2) Support rear axle (or axle housing) (1) by using floor jack (2) to prevent it from lowering.

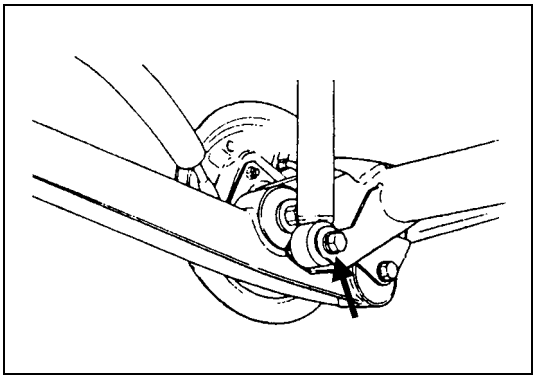


3) Remove lateral rod body side bolt (1) and nut (2).
4) Detach lateral rod from vehicle body.

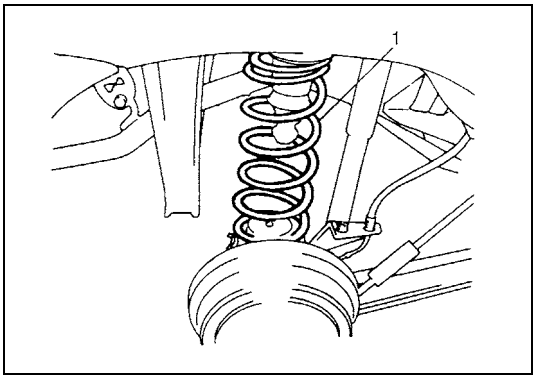
[A]: 2WD model
[B]: 4WD model



5) Remove brake flexible hose E-ring (1).
6) Remove LSPV adjust nut and detach spring end from rear axle (if equipped with LSPV).



7) Detach shock absorber lower side from rear axle (or axle housing).

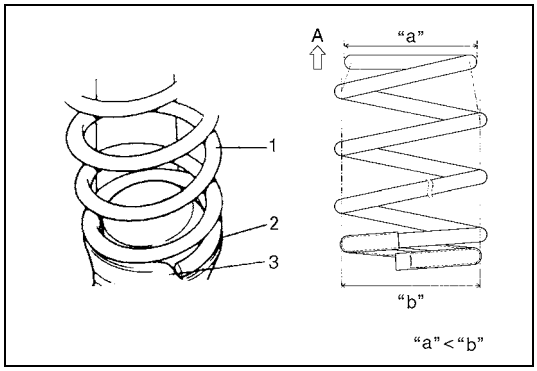


8) Lower rear axle (or axle housing) gradually as far down as where coil spring (1) can be removed.

CAUTION:
Be careful not to let rear axle (or axle housing) down too much.
It may cause damage to brake flexible hose and parking brake cable.

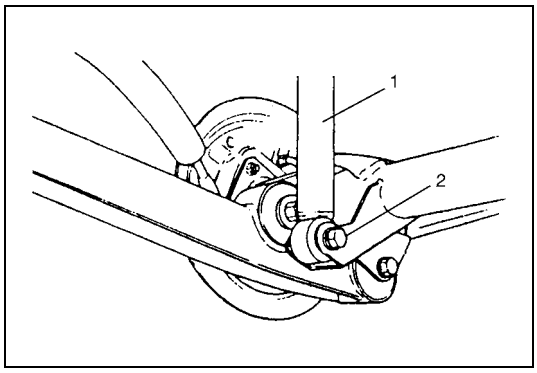
9) Remove coil spring.

INSTALLATION

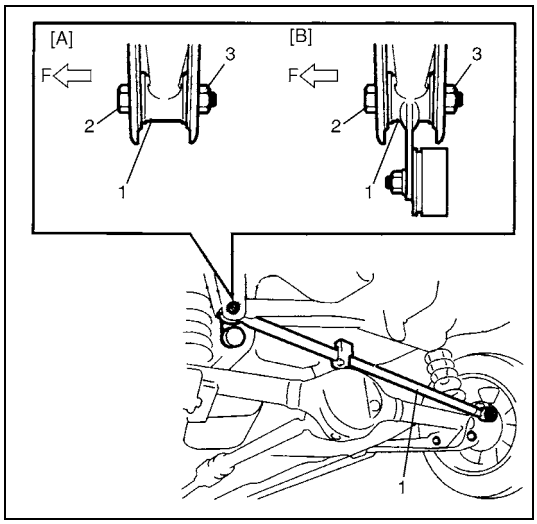


1) Install coil spring (1) on spring seat (2) of rear axle (or axle housing) and mate spring open end with stepped part (3) of spring lower seat and raise rear axle (or axle housing).

A :	Upper side
"a"	Small
"b"	Large



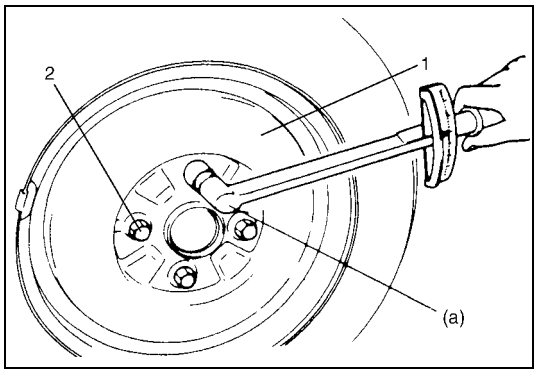
2) Install shock absorber (1) lower side to rear axle (or axle housing).
Tighten shock absorber lower bolt (2) temporarily by hand at this step.



3) Install lateral rod (1) to vehicle body, refer to the figure for proper installing direction of bolt (2).
Tighten nut (3) temporarily by hand at this step.
4) Remove floor jack from rear axle (or axle housing).

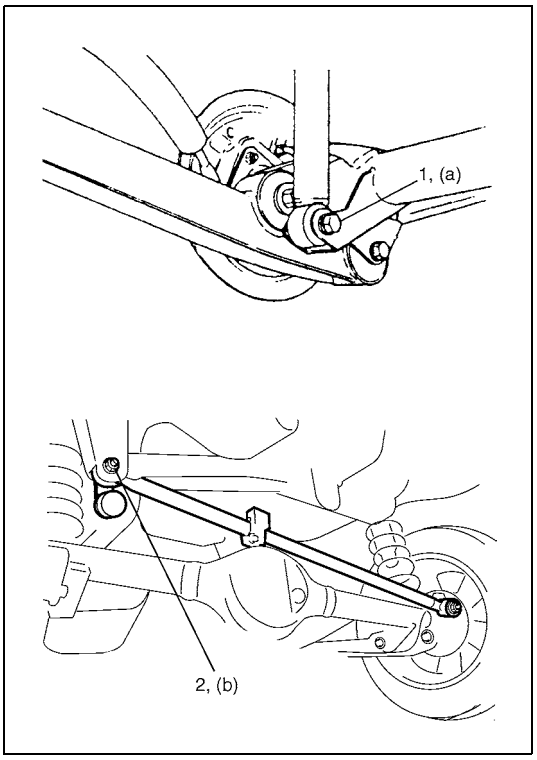
[A]:	2WD model
[B]:	4WD model
F:	Forward

5) Install brake flexible hose E-ring.
6) Install LSPV spring to rear axle. Tighten LSPV adjust nut temporarily at this step (if equipped with LSPV).



7) Install wheel (1) and tighten wheel bolts (2) to specified torque.

Tightening torque
Wheel bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)



8) Lower hoist and vehicle in non-loaded condition, tighten absorber lower bolt (1) and lateral rod body side nut (2) to specified torque.

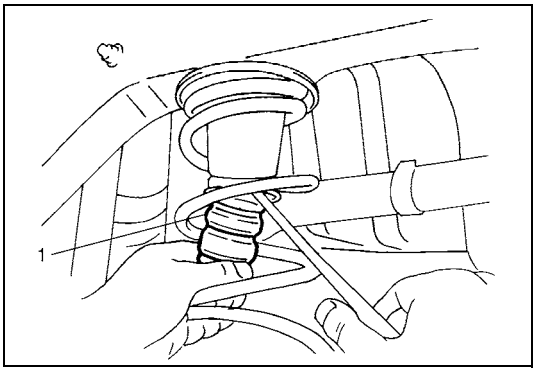
Tightening torque
Rear shock absorber lower bolt
(a): 63 N·m (6.3 kg-m, 45.5 lb-ft)
Lateral rod body side nut
(b): 100 N·m (10.0 kg-m, 72.5 lb-ft)

9) If equipped with LSPV, check and adjust LSPV spring referring to "LSPV (Load Sensing Proportioning Valve) Inspection and Adjustment" in Section 5A and "Brake Fluid Pressure Test (if equipped with LSPV)" in Section 5.

Bump Stopper Removal and Installation

REMOVAL

1) Hoist vehicle and remove rear wheel.

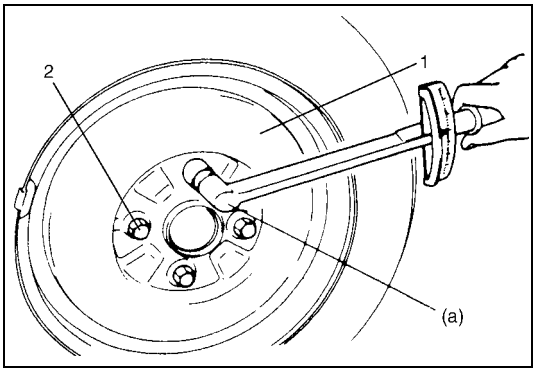


2) Remove bump stopper (1).

INSTALLATION

1) Install bumper stopper.

NOTE:
Before installing bushing, apply soap water on it.



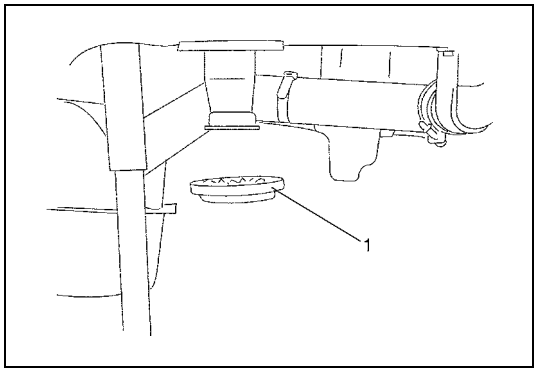
2) Install wheel (1) and tighten wheel bolts (2) to specified torque.

Tightening torque
Wheel bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)

Spring Upper Seat Removal and Installation

REMOVAL

1) Remove coil spring referring to “Coil Spring Removal and Installation” in this section.
2) Remove spring upper seat (1).

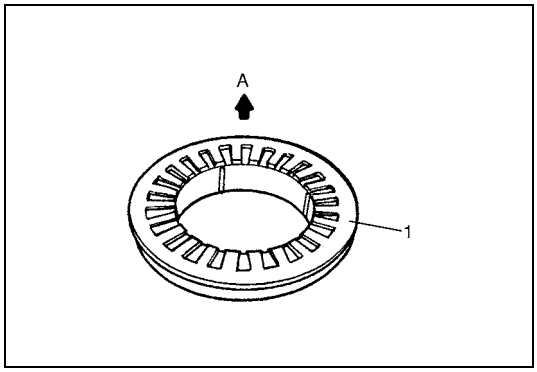


INSTALLATION

1) Install spring upper seat (1).

NOTE:

For proper installing direction of spring upper seat (1), refer to the figure.



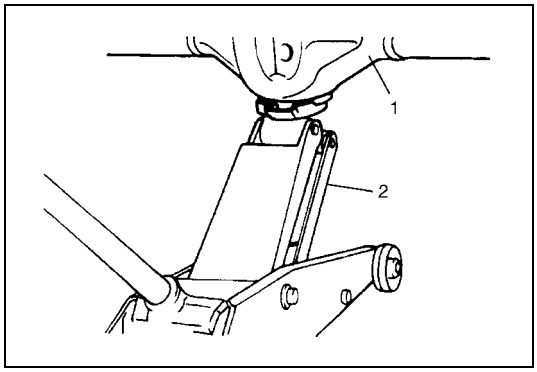
A : Vehicle body side (Upper side)

2) Install coil spring referring to “Coil Spring Removal and Installation” in this section.

Trailing Arm Removal and Installation

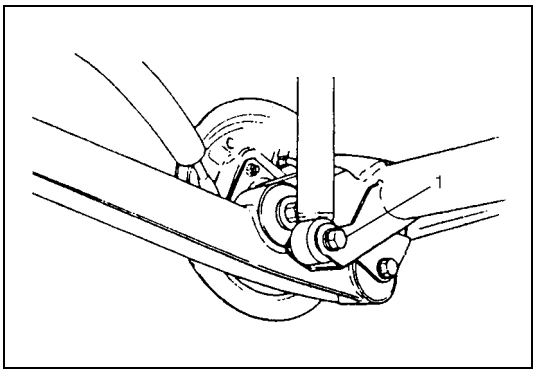
REMOVAL

1) Hoist vehicle and remove rear wheel referring to “Wheel Removal and Installation” in Section 3F.
2) Support rear axle (or axle housing) (1) by using floor jack (2).

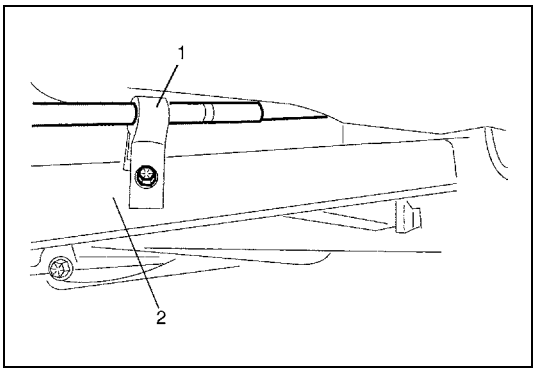


CAUTION:

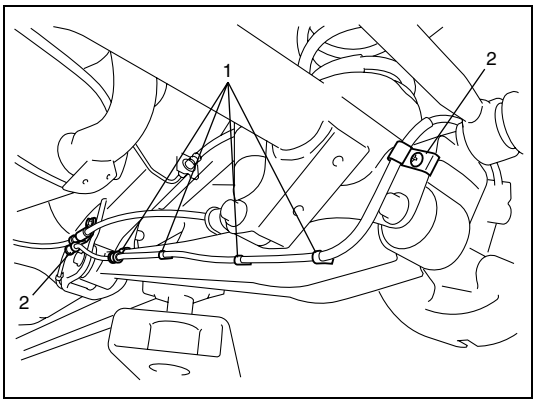
Never apply floor jack against lateral rod as it may get deformed.



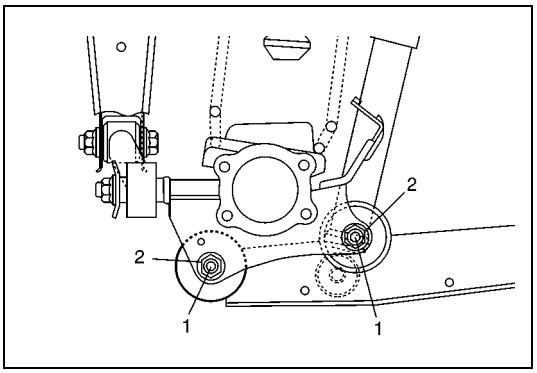
3) Remove shock absorber lower bolt (1) (right & left).



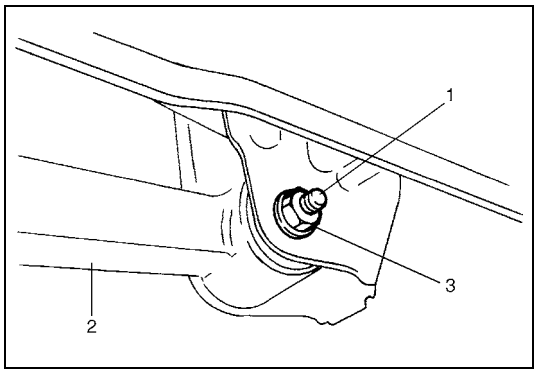
4) Remove parking brake cable clamp (1) from trailing arm (2).



5) Release wheel speed sensor lead wire clamps (1) and (2) from trailing arm (if equipped with ABS).

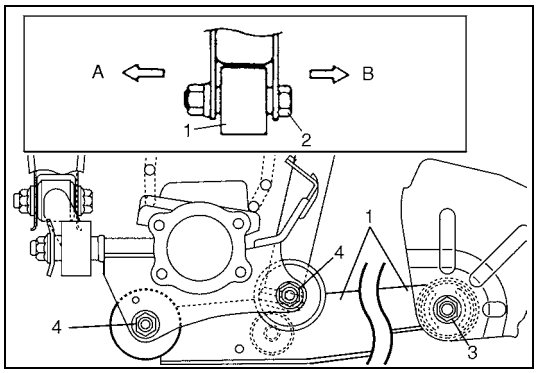


6) Remove trailing arm rear bolts (1) and nuts (2).



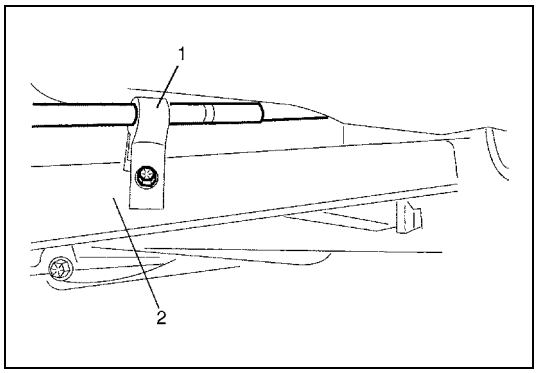
7) Remove trailing arm front bolt (1) and nuts (3) and then remove trailing arm (2).

INSTALLATION

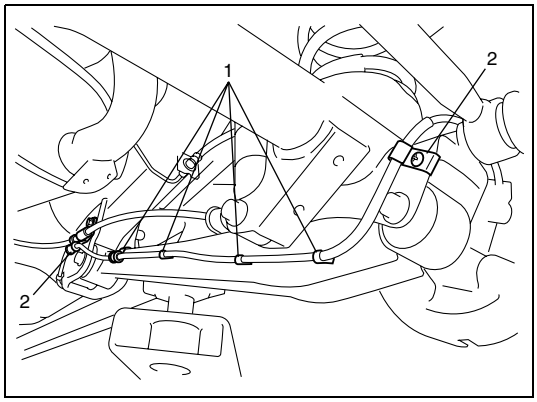


1) Install trailing arm (1) to vehicle body and rear axle (or axle housing) referring to figure for proper installing direction of bolts (2).
   Tighten front nut (3) and rear nuts (4) temporarily by hand at this step.

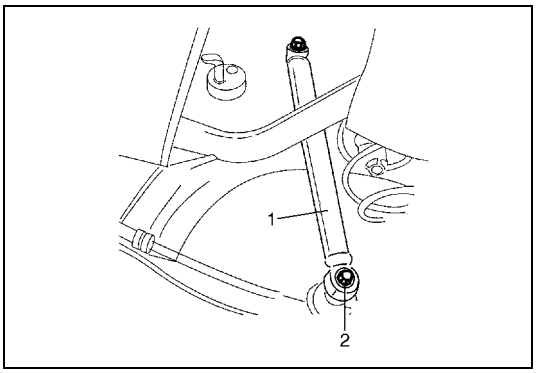
A :	Vehicle out side
B :	Vehicle center side



2) Install parking brake cable clamp (1) to trailing arm (2).



3) Clamp wheel speed sensor lead wire clamps (1) and (2) securely (if equipped with ABS).

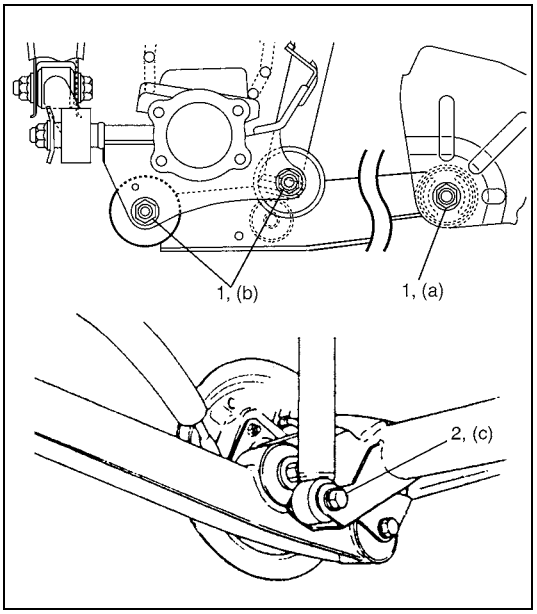


4) Install shock absorber (1) lower side to rear axle (or axle housing).
   Tighten shock absorber lower bolt (2) temporarily by hand at this step.

5) Remove floor jack from rear axle (or axle housing).
6) Install wheel and tighten wheel bolts to specified torque.

Tightening torque
Wheel bolt: 95 N·m (9.5 kg-m, 69.0 lb-ft)

7) Lower hoist.



8) Tighten front and rear trailing arm nuts (1), shock absorber lower bolts (2) and lateral rod right side nut (3) to specified torque.

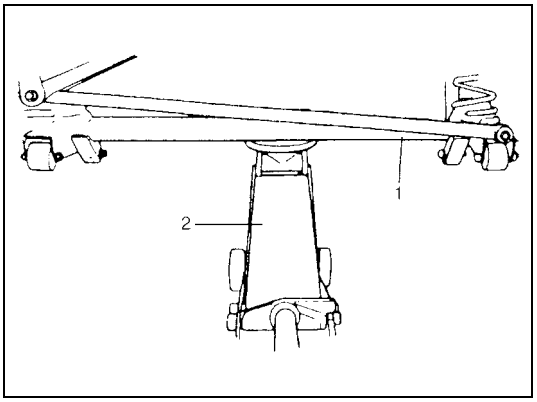
NOTE:
When tightening these nuts, be sure that vehicle is off hoist and in no-loaded condition.

Tightening torque
Front trailing arm nut (a): 90 N·m (9.0 kg-m, 65.0 lb-ft)
Rear trailing arm nut (b): 80 N·m (8.0 kg-m, 58.0 lb-ft)
Rear shock absorber lower bolt
(c): 63 N·m (6.3 kg-m, 45.5 lb-ft)

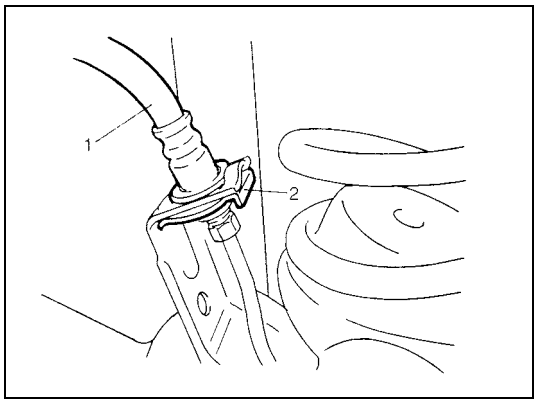
Rear Axle Removal and Installation (for 2WD Model)

REMOVAL

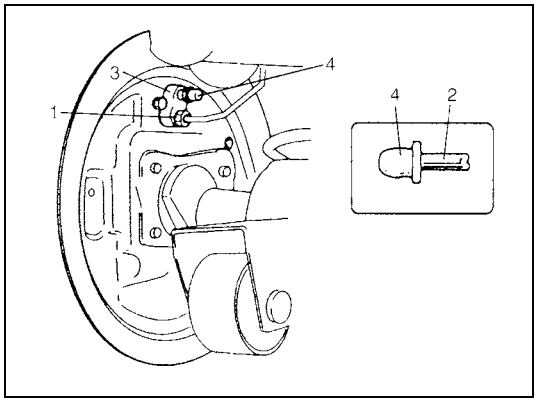
1) Hoist vehicle and remove rear wheels (right & left) referring to “Wheel Removal and Installation” in Section 3F.



2) Support rear axle (1) by using floor jack (2).
3) Remove rear brake drums (right & left). For details, refer to steps 2) to 6) of “Brake Drum Removal and Installation (for 2WD Model)” in Section 5C.

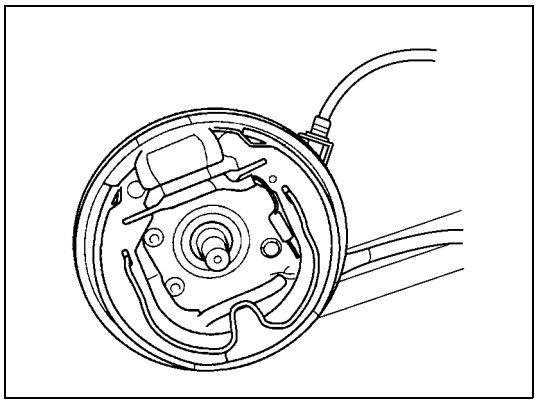


4) Remove E-rings (2) (right & left) securing brake hose (1).

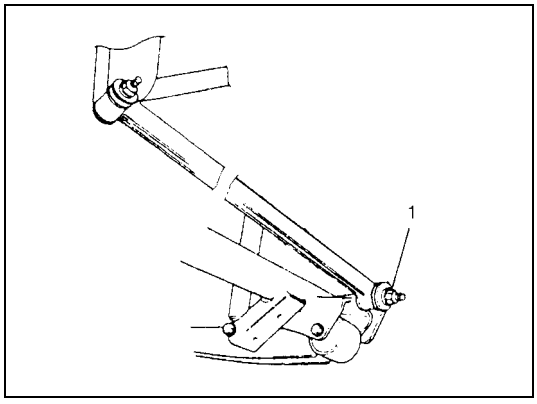


5) Disconnect brake pipe flare nuts (1) from wheel cylinders (3) (right & left) and put bleeder plug cap (4) onto pipe (2) to prevent fluid from spilling.

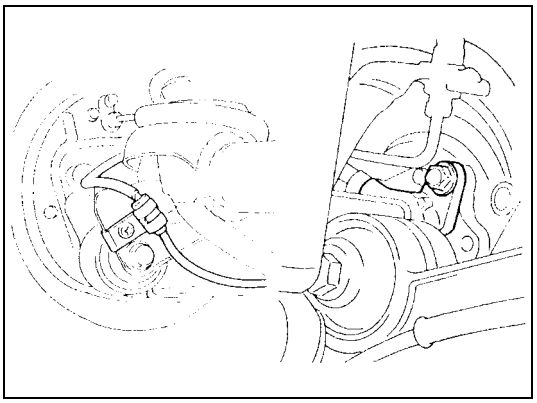
CAUTION:
Do not allow brake fluid to get on painted surfaces.



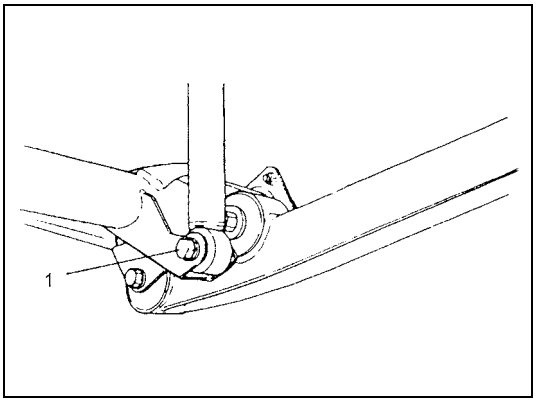
6) Remove brake back plates (1) (right & left) from rear axle and hang removed brake back plate with a wire hook.



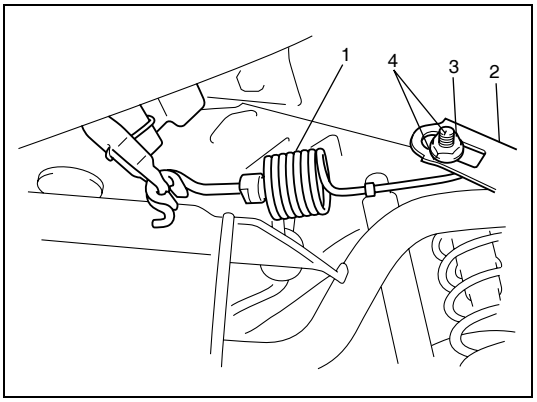
7) Remove lateral rod axle side nut (1).



8) Disconnect wheel speed sensor and lead wire clamps (right & left) (if equipped).



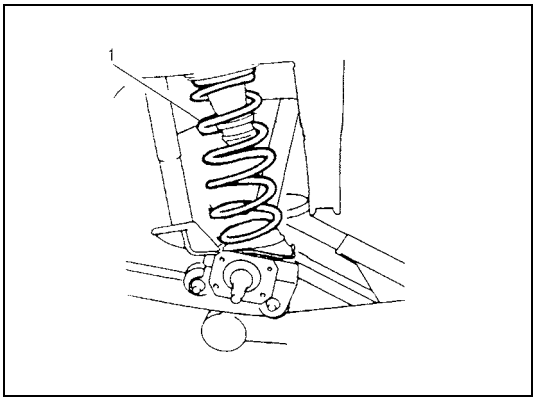
9) Remove shock absorber lower bolts (1) (right & left).



10) Remove LSPV spring end nut (3) and spring (1) from rear axle bracket (2) (if equipped).

NOTE:

When removing LSPV spring end nut (3) from bracket (2), put match marks (4) on bolt and bracket (2) to facilitate reassembly.

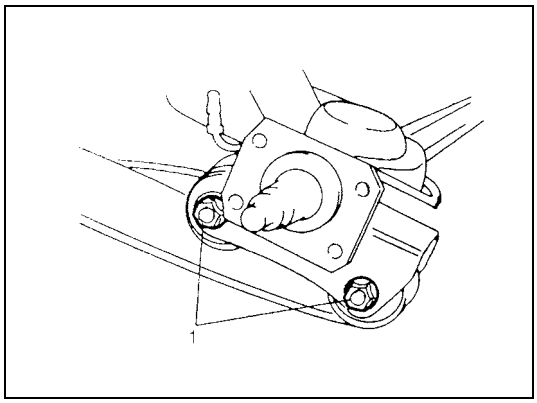


11) Lower rear axle gradually as far down as where coil springs (1) (right & left) can be removed.

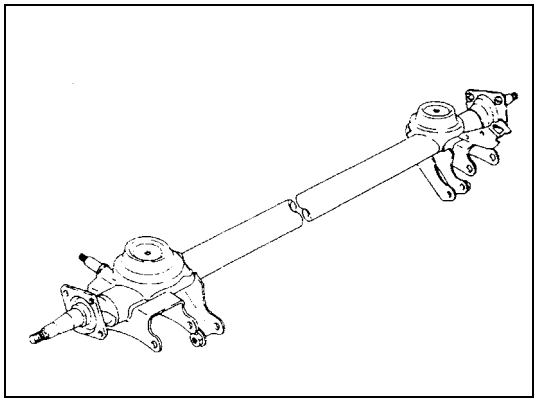
CAUTION:

Be careful not to let rear axle down too much.
It may cause damage to brake flexible hose and parking brake cable.

12) Remove coil springs (right & left).



13) Loosen trailing arm rear side nuts (1) but don't remove bolts (right & left).

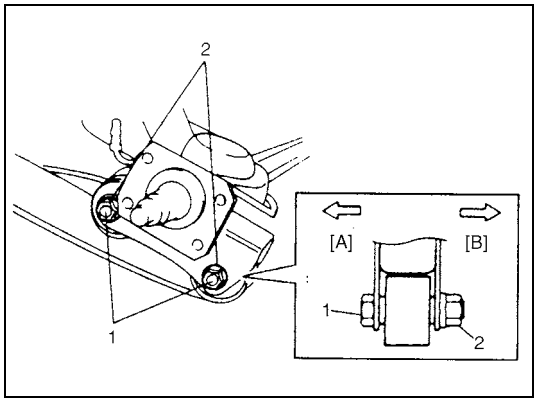


14) While supporting rear axle at both ends (right & left), remove trailing arm rear side bolts and then remove rear axle from chassis by lowering floor jack gradually.

INSTALLATION

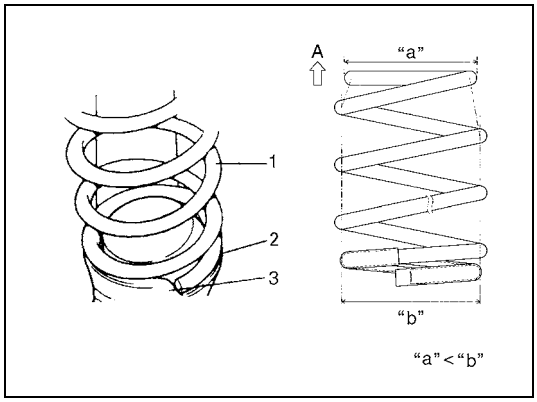
Install removed parts in reverse order of removal, noting the following points.

1) Place rear axle on floor jack. Then install lateral rod to rear axle and tighten nut temporarily by hand.



2) Install trailing arm rear bolts (1) (right & left) in proper direction as shown in figure. Then tighten nuts (2) temporarily by hand.

[A]:	Vehicle center side
[B]:	Vehicle outside

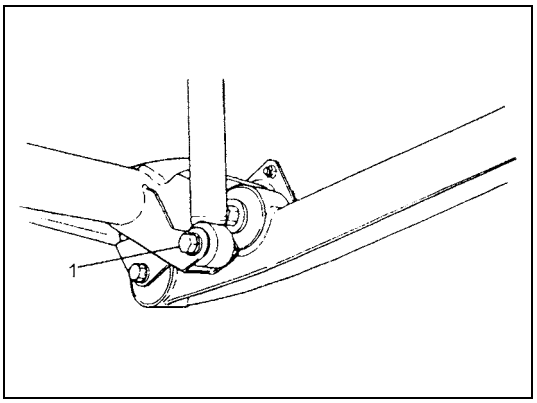


3) Install coil springs (1) (right & left) on spring seat (2) of rear axle as shown in figure and then raise rear axle.

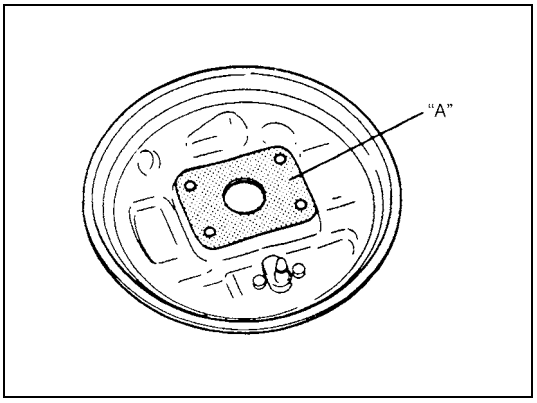
NOTE:

When seating coil spring (1), mate spring end with stepped part (3) of rear axle spring seat as shown.

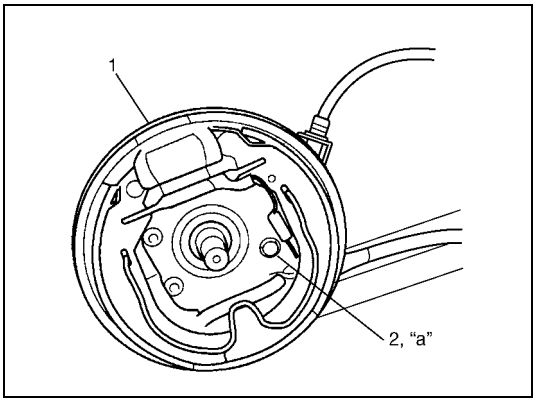
A:	Upper side
"a":	Small
"b":	Large



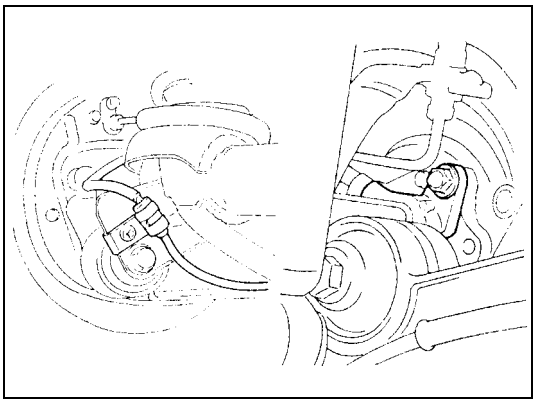
4) Tighten shock absorber lower bolts (1) (right & left) temporarily by hand.
5) Remove floor jack from rear axle.



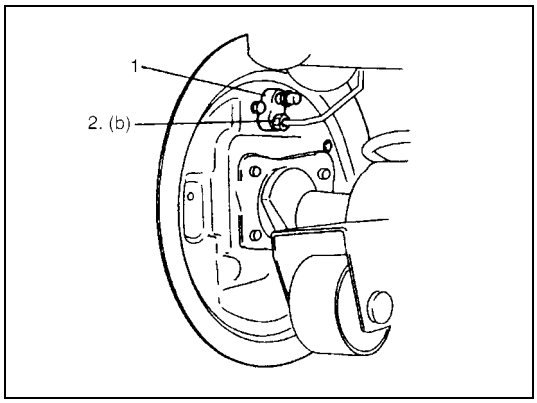
6) Clean mating surface of rear axle (right & left) with brake back plate and apply water tight sealant as shown in figure.
"A": Sealant 99000-31090



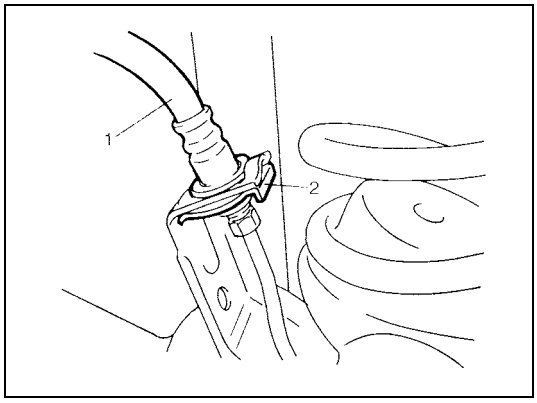
7) Install brake back plates (1) and tighten back plate bolts (2) to specified torque.
Tightening torque
Brake back plate bolt (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



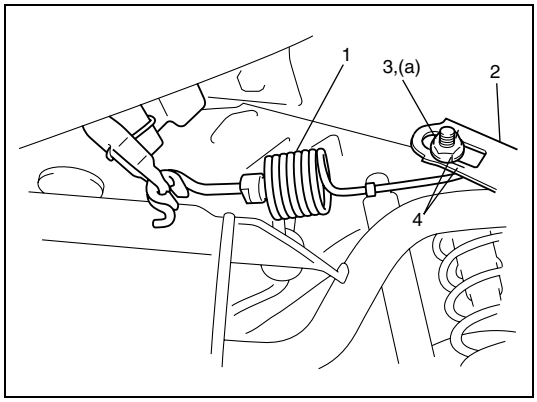
8) Connect wheel speed sensor and lead wire clamps (right & left) (if equipped with ABS).



9) Connect brake pipes to wheel cylinders (1) (right & left) and tighten brake pipe flare nuts (2) to specified torque.
Tightening torque
Brake pipe flare nut (b): 16 N·m (1.6 kg-m, 11.5 lb-ft)



10) Connect brake flexible hoses (1) (right & left) to bracket on rear axle and secure it with E-rings (2) (right & left).



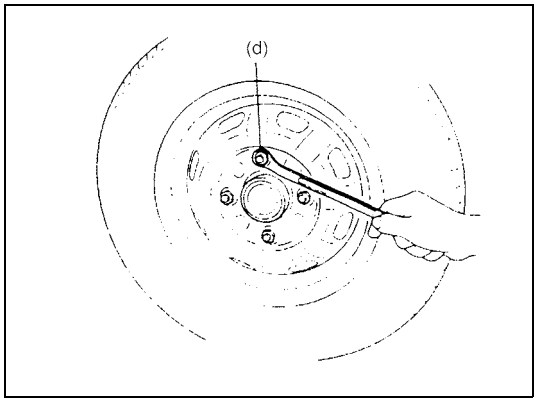
11) Install LSPV spring end nut (3) and spring (1) to rear axle bracket (2) (if equipped).

NOTE:

When installing LSPV spring end nut (3) to bracket (2), make sure to align match marks (4) made during removal.

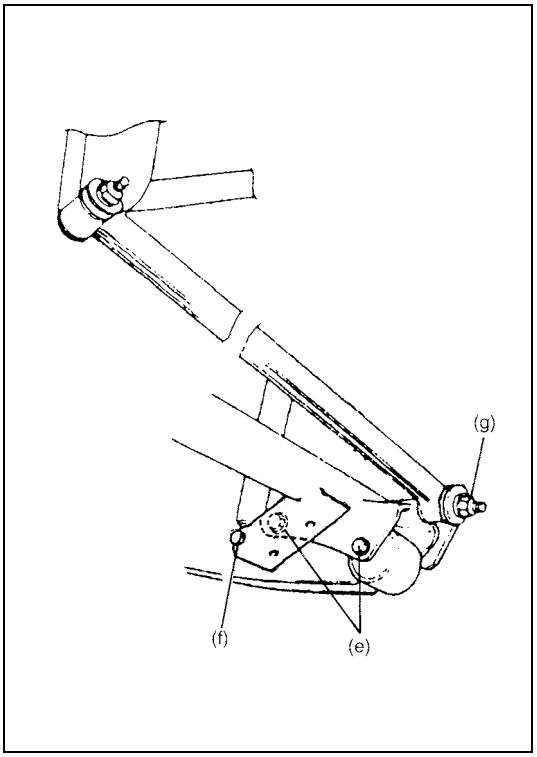
Tightening torque
LSPV spring end nut (a): 20 N·m (2.0 kg-m, 14.5 lb-ft)

12) Install brake drums (right & left). For details, refer to “Brake Drum Removal and Installation (for 2WD Model)” in Section 5C.
13) Fill reservoir with brake fluid and bleed brake system. (For Bleeding Operation, see SECTION 5.)



14) Install wheel and tighten wheel bolts to specified torque.
Tightening torque
Wheel bolt (d): 95 N·m (9.5 kg-m, 69.0 lb-ft)

15) Upon completion of all jobs, depress brake pedal with about 300 N (30 kg, 66 lbs) load three to five times so as to obtain proper drum-to-shoe clearance.
Adjust parking brake cable. (for ADJUSTMENT, see SECTION 5.)
16) Lower hoist and bounce vehicle up and down several times to stabilize suspension.



17) Tighten right and left trailing arm rear nuts, shock absorber lower bolts and lateral rod rear axle side nut to specified torque.

NOTE:

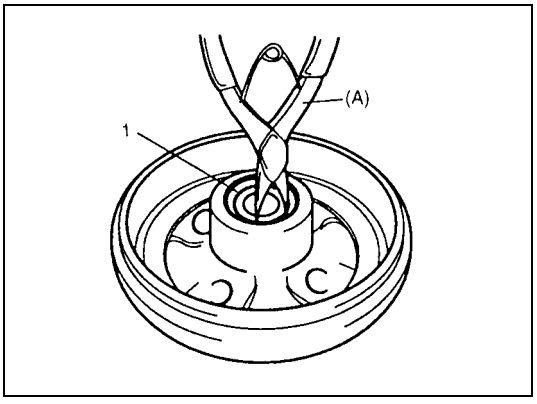
When tightening these nuts and bolts, be sure that vehicle is off hoist and in non loaded condition.

Tightening torque
Rear trailing arm nut
(e): 80 N·m (8.0 kg-m, 58.0 lb-ft)
Rear shock absorber lower bolt
(f): 63 N·m (6.3 kg-m, 45.5 lb-ft)
Lateral rod axle housing side nut
(g): 50 N·m (5.0 kg-m, 36.5 lb-ft)

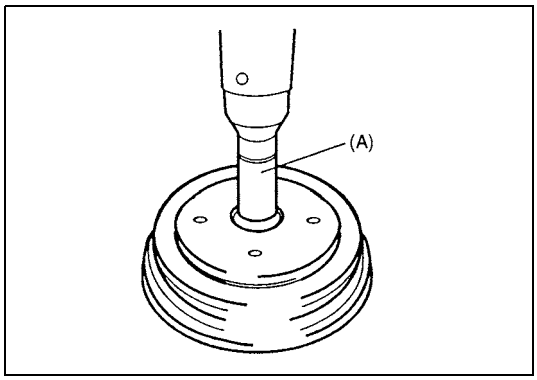
18) Check to ensure that brake drum is free from dragging and proper braking is obtained.
19) Perform brake test (foot brake and parking brake).
20) If equipped with LSPV, check and adjust LSPV spring referring to “LSPV (Load Sensing Proportioning Valve) Inspection and Adjustment” in Section 5A and perform “Brake Fluid Pressure Test (if equipped with LSPV)” in Section 5.
21) Check each installed part for oil leakage.

Wheel Bearing Removal and Installation (for 2WD Model)

REMOVAL



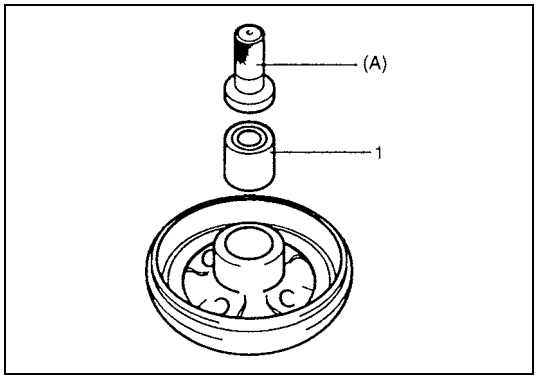
1) Remove rear brake drum referring to “Brake Drum Removal and Installation (for 2WD Model)” in Section 5C.
2) Remove circlip (1).
Special tool
(A): 09900-06108



3) Remove wheel bearing by using special tool and hydraulic press.
Special tool
(A): 09913-76010

CAUTION:
Never reuse wheel bearing.
Reused bearing should have excessive play.

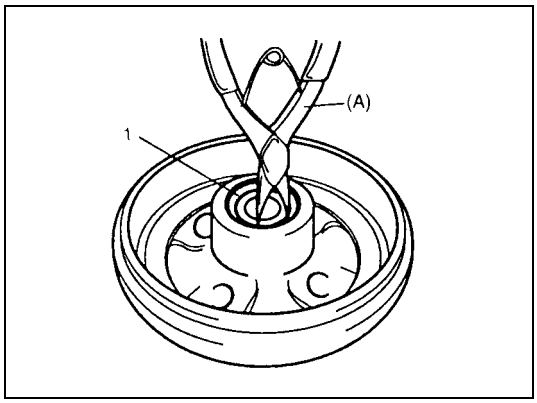
INSTALLATION



1) Install new wheel bearing (1) by using special tool and hydraulic press.

NOTE:
Seal side of bearing comes brake back plate side.

Special tool
(A): 09913-75810



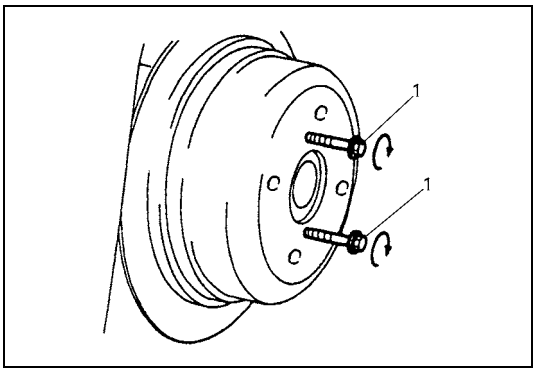
2) Install circlip (1).
Special tool
(A): 09900-06108

3) Install brake drum and wheel, referring to “Brake Drum Removal and Installation (for 2WD Model)” in Section 5C.

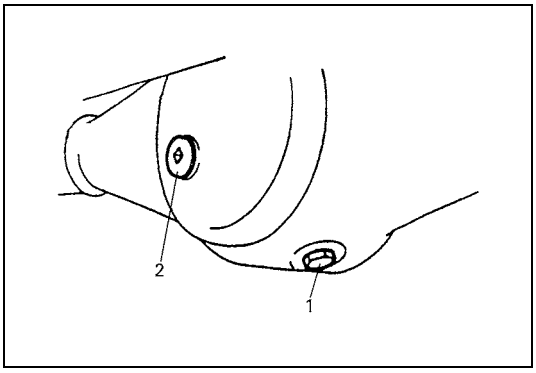
Rear Axle Shaft and Wheel Bearing Removal and Installation (for 4WD Model)

REMOVAL

1) Hoist vehicle and remove rear wheel and brake drum screw.



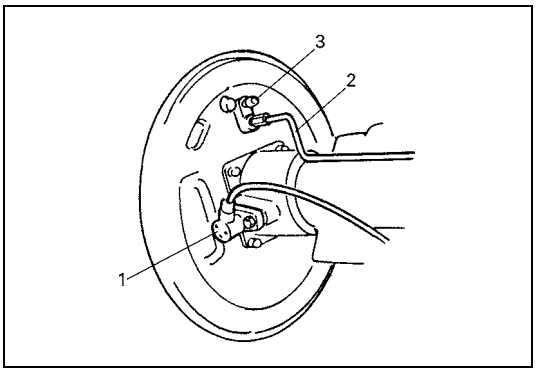
2) Remove rear brake drum by using two 8 mm bolts (1). For details referring " Brake Drum Removal and Installation (for 4WD Model)" to Section 5C.



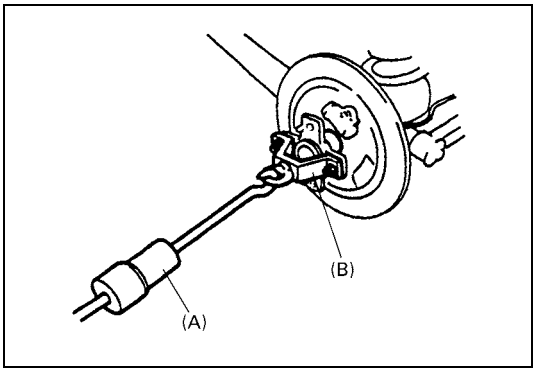
3) Drain gear oil from rear axle housing by loosening drain plug (1).

2. Filler and level plug

4) Remove brake shoe referring to "Brake Shoe Removal and Installation" in Section 5C.
5) Remove parking brake cable from brake back plate.

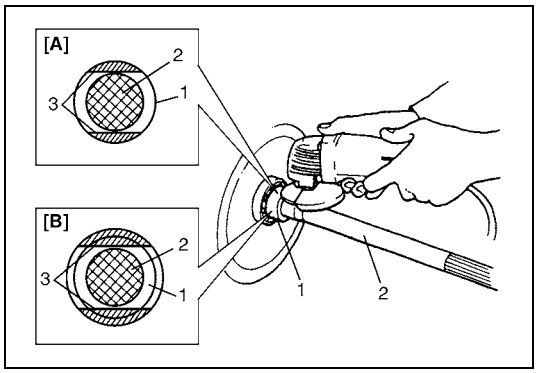


6) Disconnect brake pipe (2) from wheel cylinder and put wheel cylinder bleeder plug (3) cap onto pipe to prevent fluid from spilling.
7) Remove wheel speed sensor (1) from axle housing (if equipped with ABS).
8) Remove brake back plate bolts from axle housing.



9) Using special tools indicated, draw out axle shaft with brake back plate.

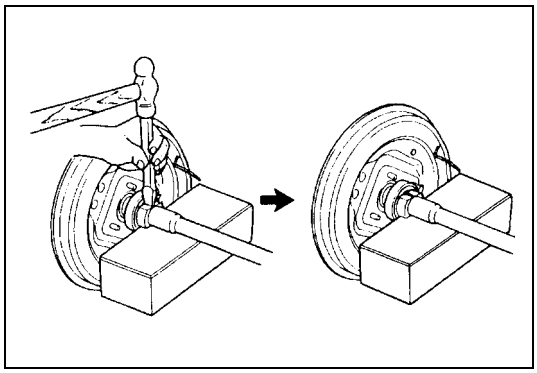
Special tool
(A): 09942-15511
(B): 09943-17912



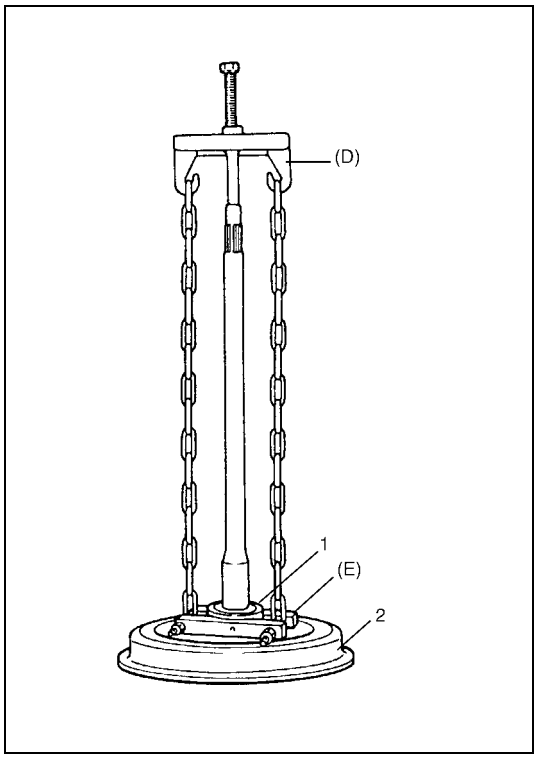
10) In order to remove the retainer ring (1) from the axle shaft (2), grind (3) with a grinder two parts of the bearing retainer ring as illustrated till it becomes thin.

CAUTION:
Be careful not to go so far as to grind the shaft.

[A]: Without ABS
[B]: With ABS



11) Break with a chisel the thin ground retainer ring, and it can be removed.

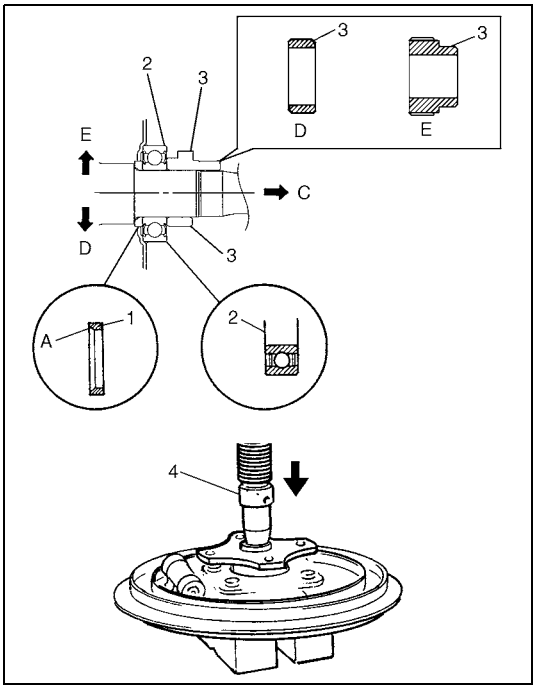


12) Using special tools, remove bearing (1) from shaft and then remove brake back plate (2).

Special tool
(D): 09927-18411
(E): 09921-57810

INSTALLATION

Install removed parts in reverse order of removal, noting the following points.

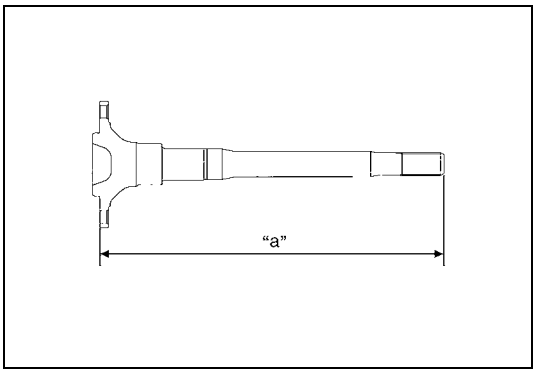


1) Install wheel bearing spacer (1) with the tapered side of its inner diameter directed toward outside, or brake drum side.
2) Press in a new bearing (2) and retainer ring (3) in order by using an hydraulic press (4).

NOTE:

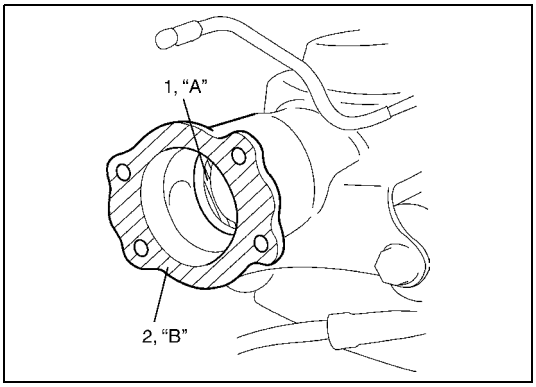
Use care not to cause any damage to outside of retainer ring.

A : Tapered side
B : Blank
C : Differential side
D : Without ABS
E : With ABS



3) Inspect axle shaft length.

Rear axle shaft length "a"
Left side: 792.0 mm (31.2 in.)
Right side: 673.0 mm (26.5 in.)



4) Apply grease to axle shaft oil seal (1) lip as shown.

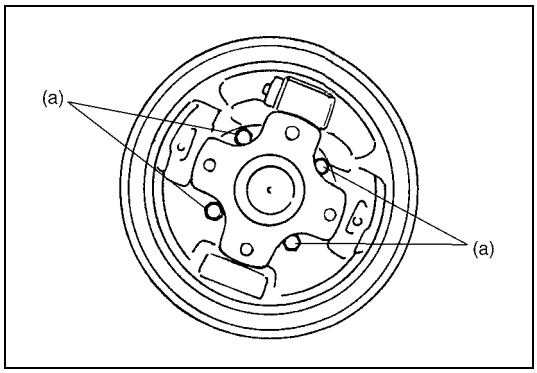
"A": Grease 99000-25010

5) Apply sealant to mating surface of rear axle housing (2) with brake back plate.

NOTE:

Make sure to remove old sealant before applying it anew.

"B": Sealant 99000-31090

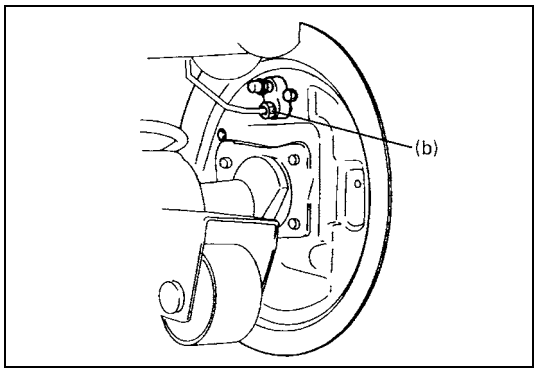


6) Install rear axle shaft to rear axle housing.
7) Tighten brake back plate bolts to specified torque.

NOTE:

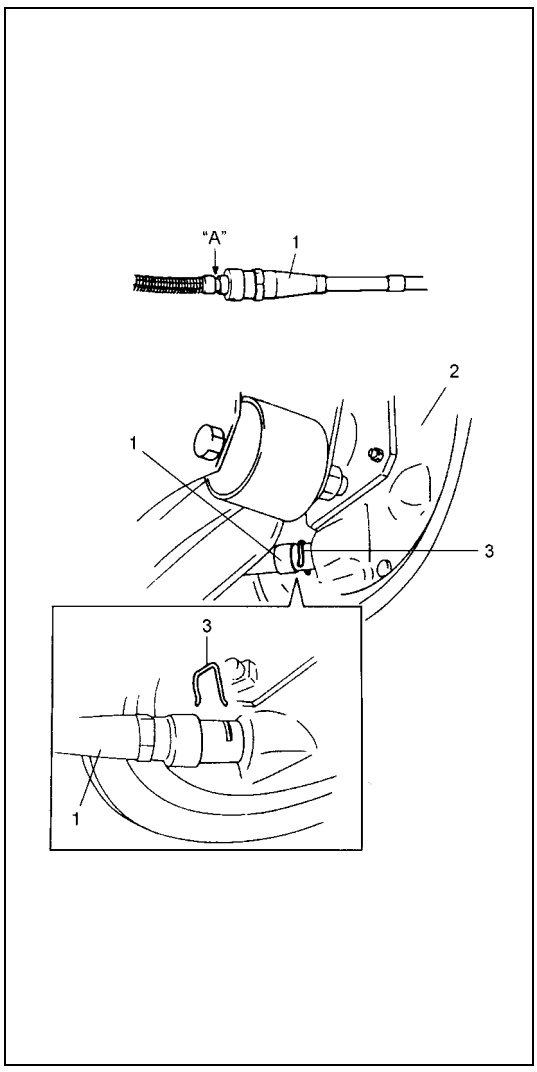
When installing rear axle shaft, be careful not to cause damage to oil seal lip in axle housing.

Tightening torque
Brake back plate bolt (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



8) Connect brake pipe to wheel cylinder and tighten brake pipe flare nut to specified torque.

Tightening torque
Brake pipe flare nut (b): 16 N·m (1.6 kg-m, 11.5 lb-ft)



9) Apply watertight sealant where plate and cable contact, and run parking brake cable (1) through brake back plate (2) and secure it with clip (3).

"A": Sealant 99000-31090

CAUTION:
Check to ensure that clip is in good condition before installing it. If deformed or broken, replace.

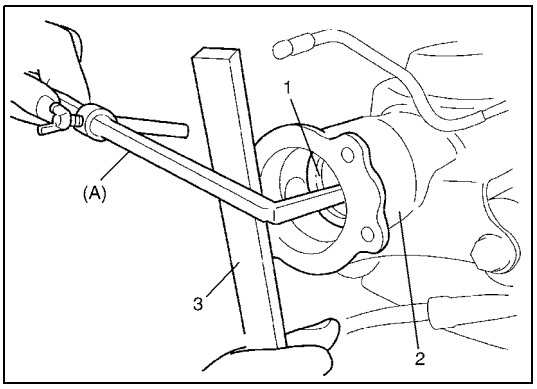
10) Install wheel speed sensor (if equipped with ABS).
11) Install brake shoe referring to "Brake Shoe Removal and Installation" in Section 5C.
12) Install brake drum. For details, refer to "Brake Drum Removal and Installation (for 2WD Model)" of Section 5C.
13) Tighten oil drain plug to specified torque and refill rear axle (differential) housing with new specified gear oil. Then tighten filler plug to specified torque. Refer to "Rear Differential Gear Oil Change" in Section 7F for refill.
14) Install wheel and tighten wheel bolts to specified torque.
15) Fill reservoir with brake fluid and breed brake system. (For bleeding operation, refer to "Air Bleeding of Brake System" in Section 5.)
16) Upon completion of all jobs, pull parking brake lever with about 200 N (20 kg, 44 lbs) load three to five times so as to obtain proper drum-to-shoe clearance.
    Adjust parking brake cable (for adjustment, refer to "Parking Brake Inspection and Adjustment" in Section 5).
17) Check to ensure that brake drum is free from dragging and proper braking is obtained.

18) Perform brake test (foot brake and parking brake).
(For brake test, refer to “Road Testing Brakes” in Section 5.)
19) Check each installed part for oil leakage.

Rear Axle Shaft Oil Seal Removal and Installation (for 4WD Model)

REMOVAL

1) Remove rear axle shaft. For details, refer to steps 1) to 9) of “Rear Axle Shaft and Wheel Bearing Removal and Installation (for 4WD Model)” in this section.

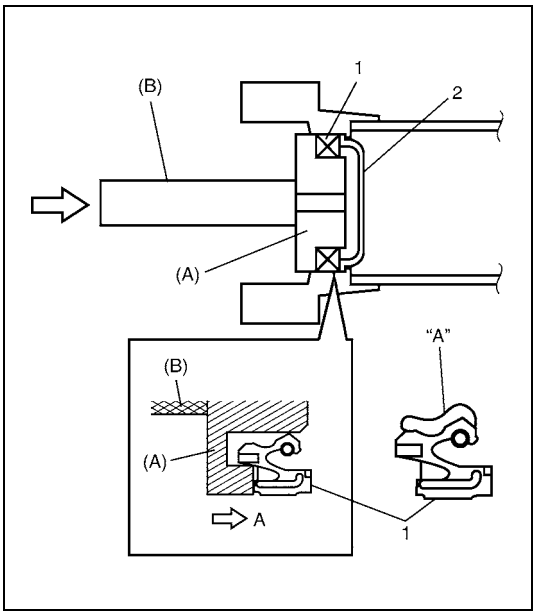


2) Remove axle shaft oil seal (1) from axle housing (2).

Special tool
(A): 09913-50121

3. Wooden block

INSTALLATION



1) Using special tools, drive in oil seal (1) until it contacts oil seal protector (2) in axle housing.

NOTE:

- **Make sure that oil seal is free from inclination as it is installed.**
- **Refer to the figure so that oil seal is installed in proper direction.**

Special tool
(A): 09944-67010
(B): 09924-74510
“A”: Grease 99000-25010

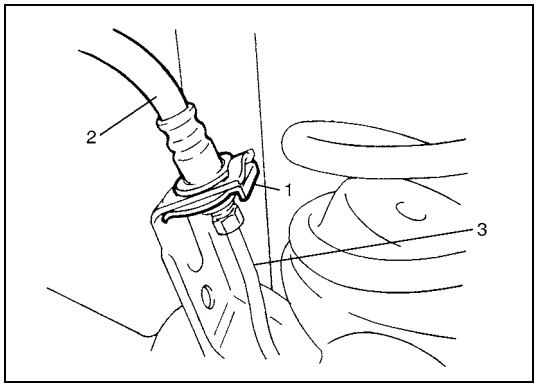
A: Differential side

2) For procedure hereafter, refer to Steps 3) to 18) of “Rear Axle Shaft and Wheel Bearing Removal and Installation (for 4WD Model)” in this section.

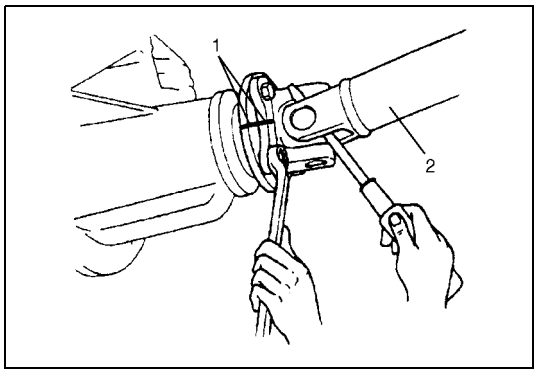
Rear Axle Housing Removal and Installation (for 4WD Model)

REMOVAL

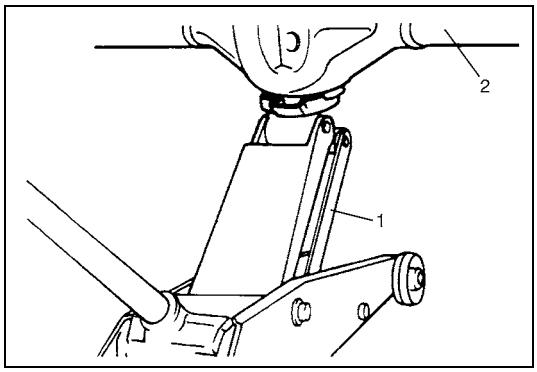
1) Hoist vehicle and remove rear wheels referring to “Wheel Removal and Installation” in Section 3F.
2) Remove rear axle shafts (right & left) referring to Steps 2) – 9) of “Rear Axle Shaft and Wheel Bearing Removal and Installation (for 4WD Model))” in this section.



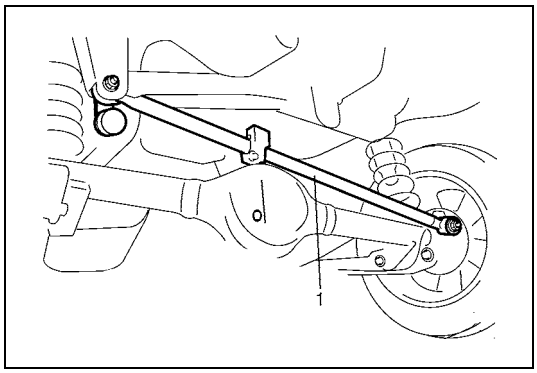
3) Disconnect brake pipes (3) (right & left) from flexible hoses (2) and remove E-rings (1).
4) Release wheel speed sensor clamps from axle housing (if equipped with ABS).



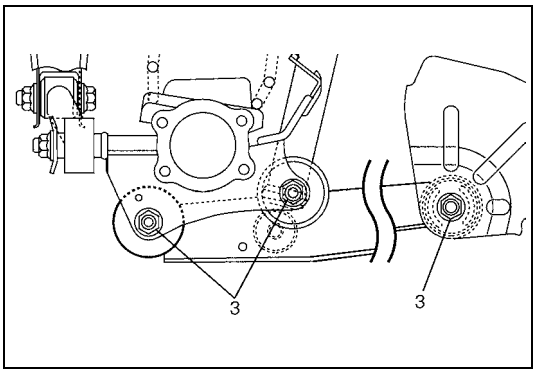
5) Before removing propeller shaft, give match marks (1) on joint flange and propeller shaft (2) as shown.
6) Remove propeller shaft.



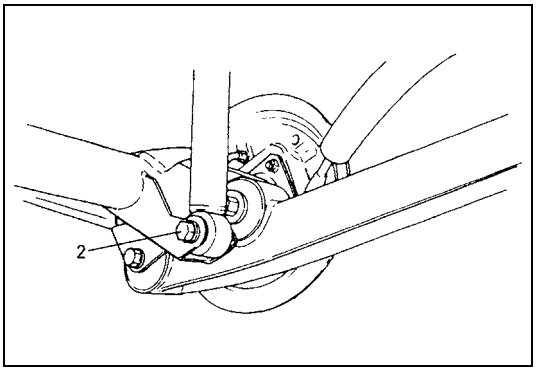
7) For jobs hereafter, support rear axle housing by using floor jack (1) under axle housing (2).
8) Remove differential carrier assembly.



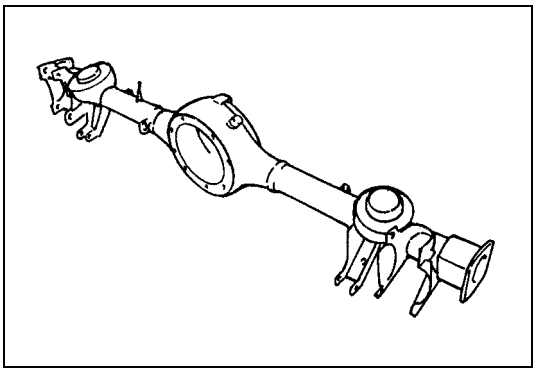
9) Remove lateral rod (1).



10) Loosen front and rear mounting nuts (3) of trailing arm but don't remove bolts.



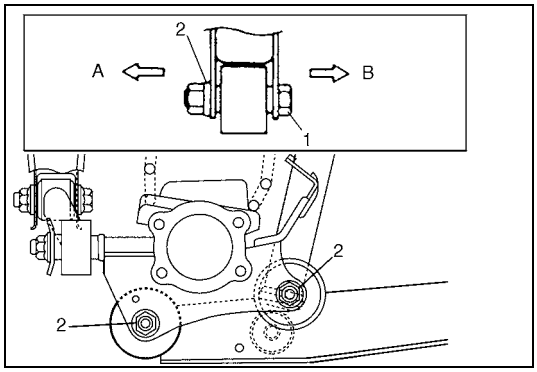
11) Remove shock absorber lower mounting bolts (2) (right & left).
12) Lower floor jack until tension of suspension coil spring becomes a little loose and remove rear mount bolts of trailing arms (right & left).
13) Lower rear axle housing gradually and remove coil springs (right & left).



14) Remove axle housing.

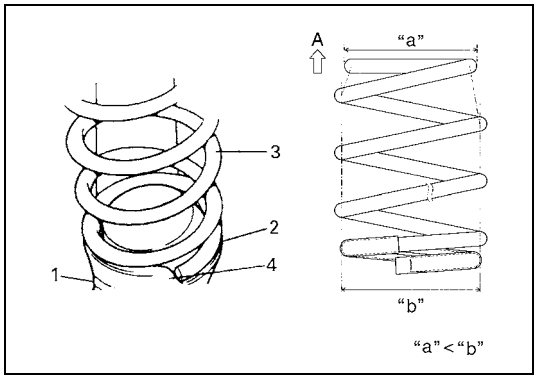
INSTALLATION

Install removed parts in reverse order of removal, noting the following.



1) Place rear axle housing on floor jack. Then install rear trailing arm bolts (1) (right & left) in proper direction as shown. Then tighten nuts (2) temporarily by hand.

A : Vehicle out side
B : Vehicle center side

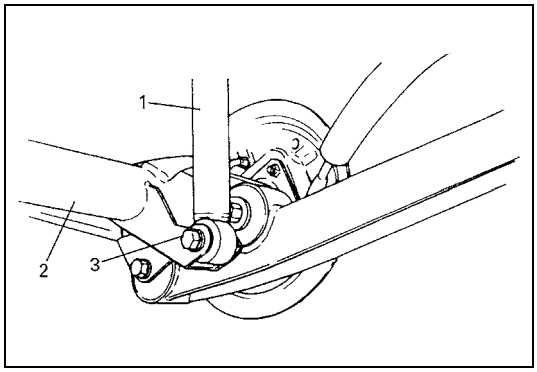


2) Install coil springs (3) (right & left) on spring seat (2) of axle housing (1) and raise axle housing.

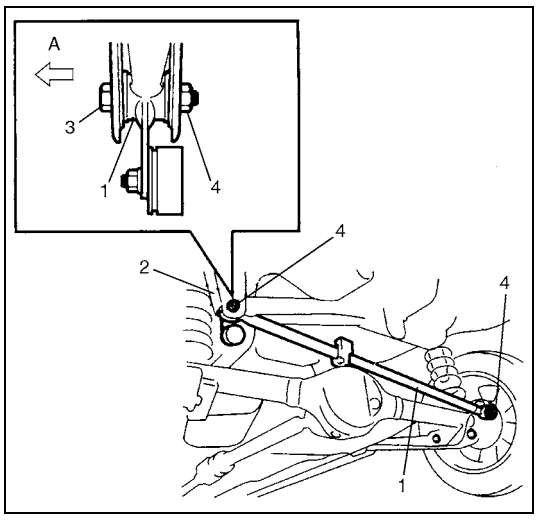
NOTE:

Upper and lower diameters of coil spring are different. Bring lager diameter end at bottom and set its open end in place on spring seat.

4. Stepped part
A : Upper side

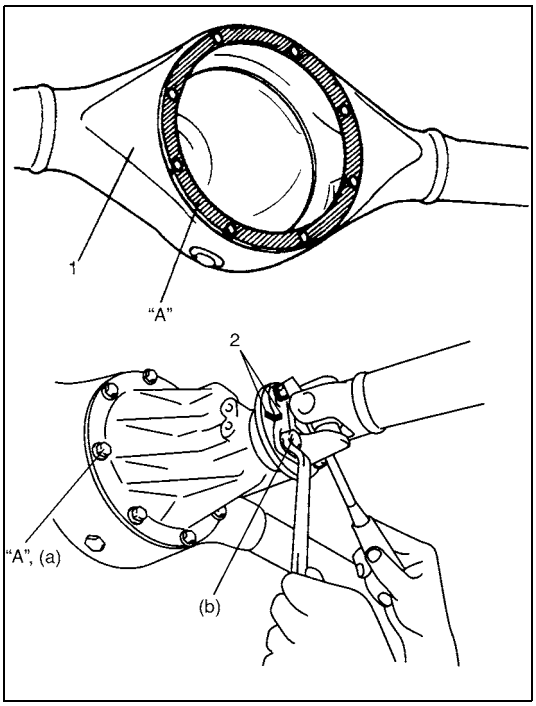


3) Install shock absorber (1) (right & left) to rear axle housing (2) and install bolts in proper direction as shown. Then tighten absorber lower bolts (3) (right & left) temporarily by hand at this step.



4) Install lateral rod (1) and install bolt (3) in proper direction as shown. Then tighten nuts (4) temporarily by hand.

2. Vehicle body
A : Forward



5) Clean mating surfaces of axle housing (1) and differential carrier and apply sealant to housing side.

"A": Sealant 99000-31110

6) Apply sealant to thread part of carrier bolts and tighten carrier bolts to specified torque.

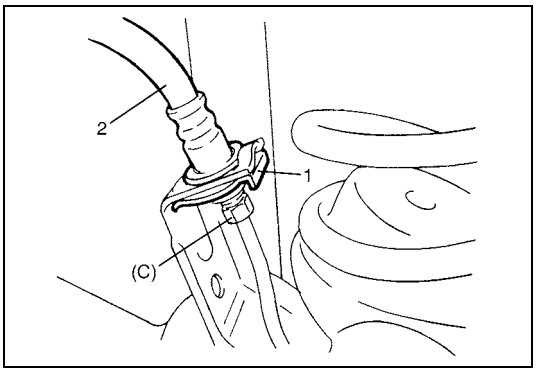
"A": Sealant 99000-31110

Tightening torque
Rear differential carrier bolt
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

7) Install propeller shaft to joint flange aligning match marks (2) and tighten flange bolts to specified torque.

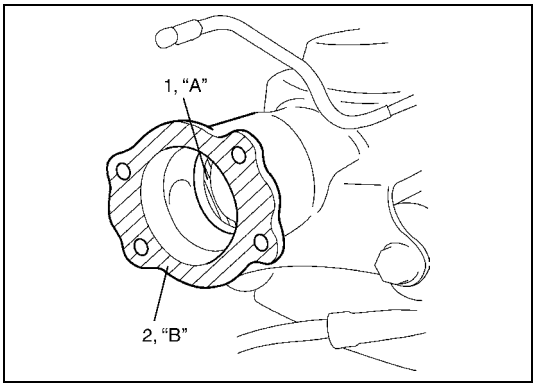
Tightening torque
Companion flange bolt (b): 23 N·m (2.3 kg-m, 17.0 lb-ft)

8) Remove floor jack from axle housing.



9) Connect brake flexible hoses (2) (right & left) to bracket on axle housing and secure it with E-rings (1).

Tightening torque
Brake pipe flare nut (C): 16 N·m (1.6 kg-m, 11.5 lb-ft)

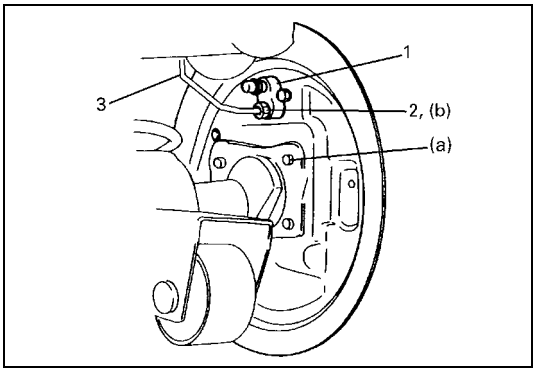


10) Apply grease to rear axle shaft oil seals (1) lip (right & left) as shown.

"A": Grease 99000-25010

11) Clean mating surface (2) (right & left) of rear axle housing and brake back plate and apply sealant as shown in figure.

"B": Sealant 99000-31090

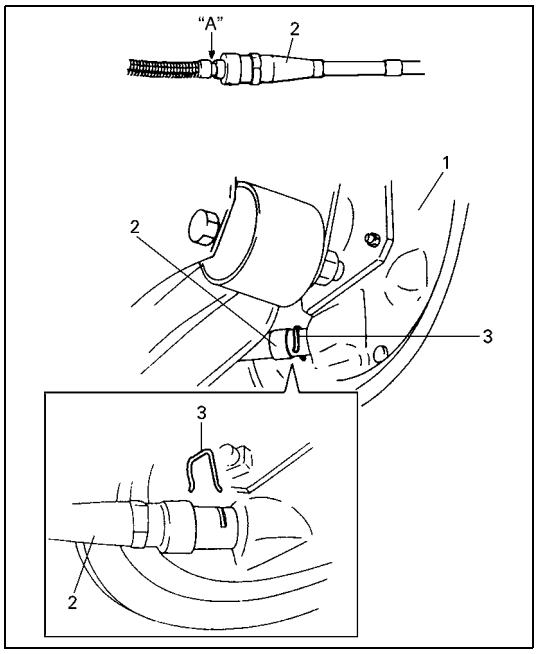


12) Install rear axle shaft (right & left) to rear axle housing.
13) Tighten brake back plate bolts to specified torque.

Tightening torque
Brake back plate bolt (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

14) Connect brake pipes (3) to wheel cylinders (1) (right & left) and tighten brake pipe flare nuts (2) to specified torque.

Tightening torque
Brake pipe flare nut (b): 16 N·m (1.6 kg-m, 11.5 lb-ft)



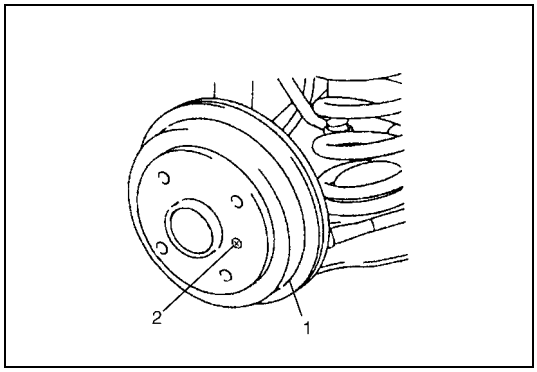
15) Apply water tight sealant where brake back plate (1) and parking brake cable contact.
Connect parking brake cable (2) to brake back plate (right & left) and secure it with clip (3).

"A": Sealant 99000-31090

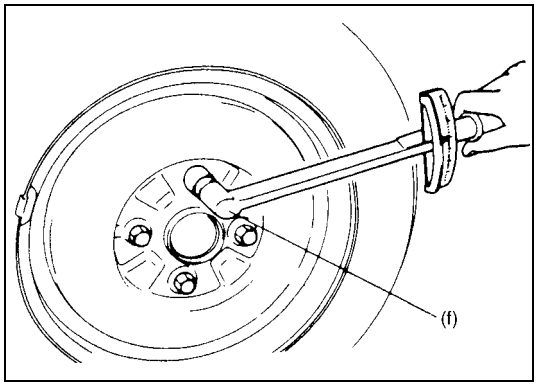
NOTE:

Check to ensure that clip is in good condition before installing it. If deformed or broken, replace.

16) Install parking brake cable clamps to trailing arm.
17) Install wheel speed sensors (right & left) and clamp wire securely (if equipped with ABS).
18) Install brake shoes (right & left) referring to "Brake Shoe Removal and Installation" in Section 5C.



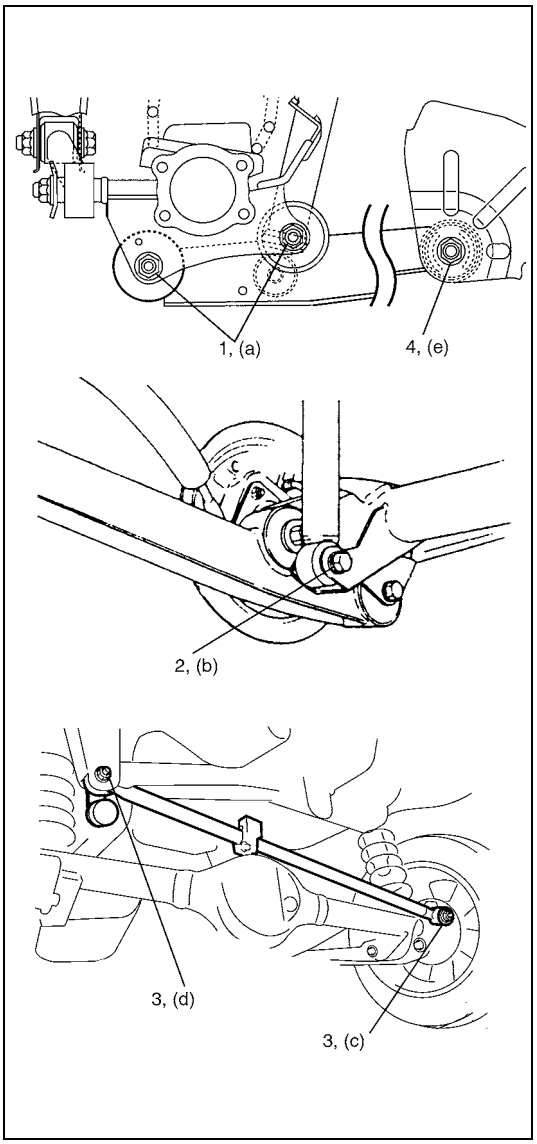
19) Install brake drums (1) (right & left) after making sure that inside of brake drum and brake shoes are free from dirt and oil. Then tighten brake drum screw (2).
20) Fill reservoir with brake fluid and bleed brake system. (For bleeding operation, refer to "Air Bleeding of Brake System" in Section 5.)
21) Refill differential gear housing with new specified gear oil. Refer to "Rear Differential Gear Oil Change" in Section 7F.



22) Install wheels and tighten wheel bolts to specified torque.

Tightening torque
Wheel bolt (f): 95 N·m (9.5 kg-m, 69.0 lb-ft)

23) Upon completion of all jobs, pull parking brake lever with about 200 N (20 kg, 44 lbs) load three to five times so as to obtain proper drum-to-shoe clearance.
Adjust parking brake cable referring to "Parking Brake Inspection and Adjustment" in Section 5.
24) Lower hoist.



25) Tighten right and left trailing arm nuts (1), (4) and shock absorber lower bolts (2) to specified torque.
Tighten lateral rod nuts (3) to specified torque.

NOTE:

When tightening these bolts and nuts, be sure that vehicle is off hoist and in non loaded condition.

Tightening torque
Rear trailing arm nut
(a): 80 N·m (8.0 kg-m, 58.0 lb-ft)
Rear shock absorber lower bolt
(b): 63 N·m (6.3 kg-m, 45.5 lb-ft)
Lateral rod axle housing side nut
(c): 50 N·m (5.0 kg-m, 36.5 lb-ft)
Lateral rod body side nut
(d): 100 N·m (10.0 kg-m, 72.5 lb-ft)
Front trailing arm nut
(e): 90 N·m (9.0 kg-m, 65.0 lb-ft)

26) Check to ensure that brake drum is free from dragging and proper braking is obtained.
27) Perform brake test (foot brake and parking brake).
28) Check each installed part for oil leakage.

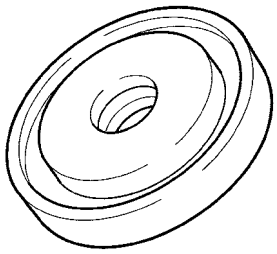
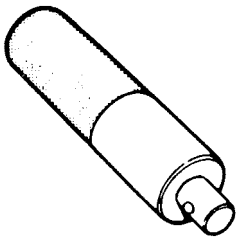
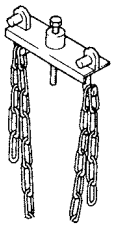
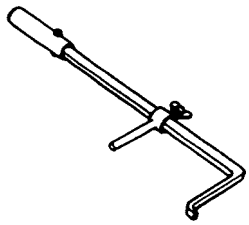
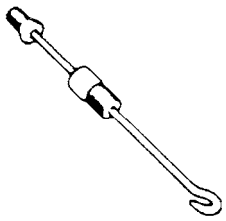
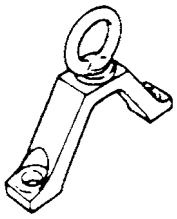
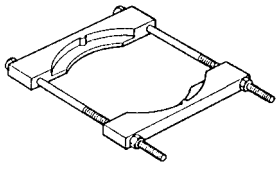
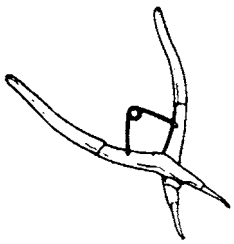
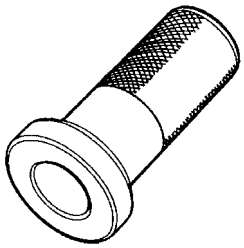
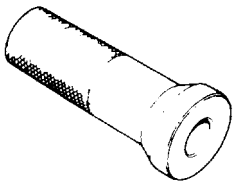
Tightening Torque Specifications

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Brake back plate bolt	23	2.3	17.0
Brake pipe flare nut	16	1.6	11.5
Companion flange bolt	23	2.3	17.0
Front trailing arm nut	90	9.0	65.0
Lateral rod axle (housing) side nut	50	5.0	36.5
Lateral rod body side nut	100	10.0	72.5
LSPV spring end nut (2WD Model)	20	2.0	14.5
Rear differential carrier bolt (4WD Model)	23	2.3	17.0
Rear shock absorber lower bolt	63	6.3	45.5
Rear shock absorber upper nut	63	6.3	45.5
Rear trailing arm nut	80	8.0	58.0
Wheel bolt	95	9.5	69.0

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Lithium grease	SUZUKI SUPER GREASE (A) (99000-25010)···(for 4WD Model)	• Axle shaft oil seal • Wheel bearing
Sealant	SUZUKI BOND NO. 1215 (99000-31110)···(for 4WD Model)	• Joint seam of differential carrier and axle housing • Differential carrier bolt
Gear oil	For gear oil information, refer to SECTION 7F. (for 4WD Model)	• Differential gear (Rear axle housing)
Water tight sealant	SUZUKI SEALING COMPOUND 366E (99000-31090)	• Joint seam of axle housing and brake back plate
Brake fluid	DOT 4 or SEA J1704	• To fill master cylinder reservoir • To clean and apply to inner parts of caliper and wheel cylinder when they are disassembled.

Special Tool

 09944-67010 Oil seal installer (for 4WD Model)	 09924-74510 Installer attachment (for 4WD Model)	 09927-18411 Universal puller (for 4WD Model)	 09913-50121 Oil seal remover (for 4WD Model)
 09942-15511 Sliding hammer	 09943-17912 Brake drum remover	 09921-57810 Bearing remover (for 4WD Model)	 09900-06108 Snap ring pliers (for 2WD Model)
 09913-75810 Bearing installer (for 2WD Model)	 09913-76010 Rear wheel bearing installer (for 2WD Model)		

SECTION 3F

WHEELS AND TIRES

NOTE:

All wheel fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts.

There is to be no welding as it may result in extensive damage and weakening of the metal.

CONTENTS

General Description

Tire and Wheel Description

This vehicle is equipped with the following tire and wheel.

Tire and wheel size (Standard): 165/70R14 ··· 14 x 4 1/2 J, 175/65R14 ··· 14 x 5J or 185/60R15 ··· 15 x 5J

The tire is of tubeless type. The tire is designed to operate satisfactorily with loads up to the full rated load capacity when inflated to the recommended inflation pressures.

Correct tire pressures and driving habits have an important influence on tire life. Heavy cornering, excessively rapid acceleration, and unnecessary sharp braking increase tire wear.

Replacement Tires

When replacement is necessary, the original equipment type tire should be used. Refer to the tire placard. Replacement tires should be of the same size, load range and construction as those originally on the vehicle. Use of any other size or type tire may affect ride, handling, speedometer / odometer calibration, vehicle ground clearance and tire or snow chain clearance to the body and chassis.

It is recommended that new tires be installed in pairs on the same axle. If necessary to replace only one tire, it should be paired with the tire having the most tread, to equalize braking traction.

WARNING:

Do not mix different types of tires on the same vehicle such as radial, bias and bias-belted tires except in emergencies, because handling may be seriously affected and may result in loss of control.

kPa	kgf/cm²	psi
160	1.6	23
180	1.8	26
200	2.0	29
220	2.2	32
240	2.4	35
260	2.6	38
280	2.8	41
300	3.0	44

The metric term for tire inflation pressure is the kilo pascal (kPa). Tire pressures is usually printed in kPa, kgf/cm^2 and psi on the tire placard.

Metric tire gauges are available from tool suppliers.

The chart, shown left table, converts commonly used inflation pressures from kPa to kgf/cm^2 and psi.

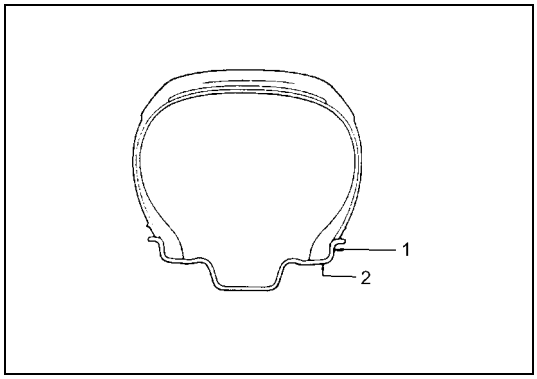
Replacement Wheel

Wheels must be replaced if they are bent, dented, have excessive
lateral or radial run-out, air leak through welds, have elongated bolt holes, if lug nuts won't stay tight, or if they are heavily rusted.

Wheels with greater run-out than shown in figure below may cause objectionable vibrations.

Replacement wheels must be equivalent to the original equipment wheels in load capacity, diameter, rim with offset and mounting configuration. A wheel of improper size or type may affect wheel and bearing life, brake cooling, speedometer / odometer calibration, vehicle ground clearance and tire clearance to body and chassis.

How to measure wheel run-out



To measure the wheel run-out, it is necessary to use an accurate dial indicator. The tire may be on or off the wheel. The wheel should be installed to the wheel balancer of the like for proper measurement.
Take measurements of both lateral run-out (1) and radial run-out (2) at both inside and outside of the rim flange. With the dial indicator set in place securely, turn the wheel one full revolution slowly and record every reading of the indicator.

NOTE:

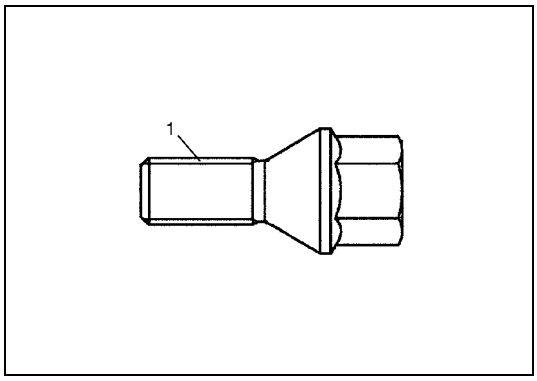
Total indicator reading ignore indicator "JUMP" due to weld seams, paint runs, scratches, etc.

When the measured run-out exceeds the specification and correction by the balancer adjustment is impossible, replace the wheel.If the reading is affected by welding, paint or scratch, it should be ignored.

Run-out limit

Radial run-out limit	Lateral run-out limit
2.0 mm (0.078 in.)	2.0 mm (0.078 in.)

Wheel Bolts

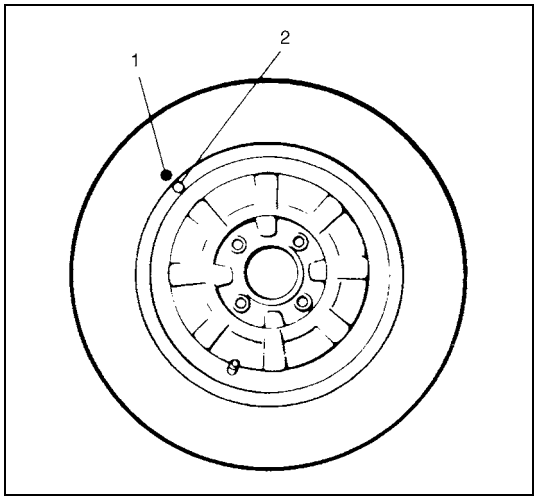


All models use metric lug wheel bolts.

Metric lug bolt size

(1): M12 x 1.5

Matched Tires and Wheels



Tires and wheels are match-mounted at the assembly plant.
This means that the radially stiffest part of the tire, or "high spot", is matched to the smallest radius or "low spot" of the wheel.
This is done to provide the smoothest possible ride.
The "high spot" of the tire is originally marked by paint dot (1) on the outboard sidewall. This paint dot will eventually be washed off the tire. The "low spot" of the wheel is originally marked by paint dot (2) on the wheel rim-flange. Properly assembled, the wheel rims' paint dot should be aligned with the tires' paint dot as shown in left figure.
Whenever a tire is dismounted from its wheel, it should be remounted so that the tire and wheel are matched. If the tire's paint dot cannot be located, a line should be scribed on the tire and wheel before dismounting to assure that it is remounted in the same position.

Diagnosis

Diagnosis Table

Refer to SECTION 3.

Maintenance and Minor Adjustments

Wheel Maintenance

Wheel repairs that use welding, heating, or peening are not approved.
All damaged wheels should be replaced.

Inflation of Tires

The pressure recommended for any model is carefully calculated to give a satisfactory ride, stability, steering, tread wear, tire life and resistance to bruises.
Tire pressure, with tires cold, (after vehicle has set for three hours or more, or driven less than one mile) should be checked monthly or before any extended trip. Set to the specifications on the tire placard located on the left door (right door for right-hand side steering vehicle) lock pillar.
It is normal for tire pressure to increase when the tires become hot during driving.
Do not bleed or reduce tire pressure after driving. Bleeding reduces the “Cold Inflation Pressure”.

Higher than recommended pressure can cause:

- Hard ride
- Tire bruising or carcass damage
- Rapid tread wear at center of tire

Unequal pressure on same axle can cause:

- Uneven braking
- Steering lead
- Reduced handling
- Swerve on acceleration

Lower than recommended pressure can cause:

- Tire squeal on turns
- Hard Steering
- Rapid and uneven wear on the edges of the tread
- Tire rim bruises and rupture
- Tire cord breakage
- High tire temperature
- Reduced handling
- High fuel consumption

Valve caps should be on the valves to keep dust and water out.

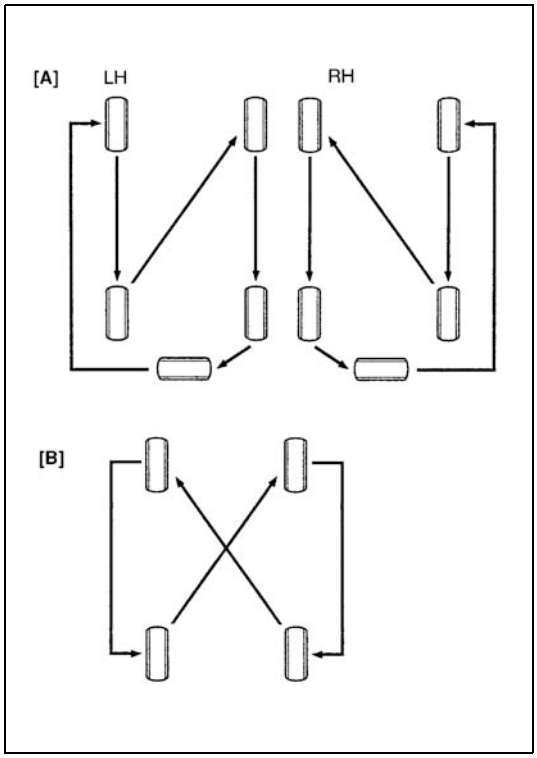
Tire Placard

The tire information placard is located on the left door (right door for right-hand side steering vehicle) lock pillar and should be referred to for tire information.
The placard lists the maximum load, tire size and cold tire pressure where applicable.

NOTE:

Whether rim size and/or maximum load are listed or not depends on regulations of each country.

Tire Rotation



To equalize wear, rotate tires according to left figure. Radial tires should be rotated periodically. Set tire pressure.

NOTE:

Due to their design, radial tires tend to wear faster in the shoulder area, particularly in front positions. This makes regular rotation especially necessary.

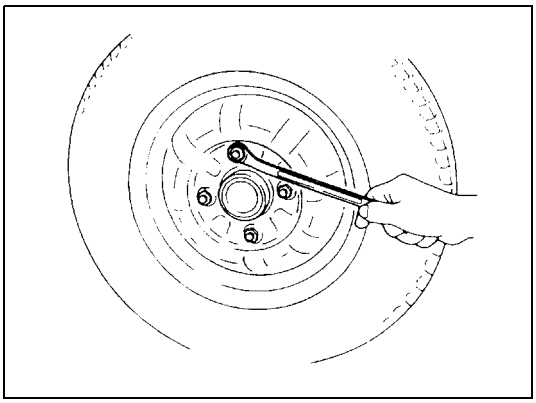
[A]:	5-tire rotation NOTE: Applicable to vehicles equipped with 5 tires including spare tire all of which are identical in size
[B]:	4-tire rotation
LH:	Left-hand steering vehicle
RH:	Right-hand steering vehicle

On-vehicle Service

Wheel Removal and Installation

REMOVAL

WARNING:
Do not removal all of the wheel bolts at once, because all the wheels of this vehicle are mounted by the wheel bolts.
Leave a bolt at least not to drop the wheel.
Support the wheel and/or tire and then remove the bolt(s) left with the wheel.



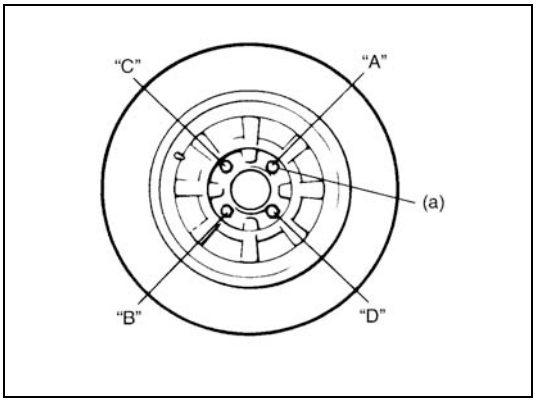
1) Loosen wheel bolts by approximately 180 ° (half a rotation).
2) Hoist vehicle.
3) Make sure that the Vehicle will not fall off by trying to more vehicle body in both ways.
4) Remove wheel bolts except one.
5) Support the wheel and/or tire not to drop the wheel and then remove the bolt left with the wheel.

CAUTION:
Never use heat to loosen tight wheel because application of heat to wheel can shorten life of wheel and damage wheel bearings.

INSTALLATION

For installation, reverse removal procedure, noting the flowing. Wheel bolts must be tightened in sequence and to proper torque to avoid bending wheel or brake disc, left figure.

NOTE:
Before installing wheels, remove any build-up of corrosion on wheel mounting surface and brake disc mounting surface by scraping and wire brushing. Installing wheels without good metal-to-metal contact at mounting surfaces can cause wheel bolts to loosen, which can later allow a wheel to come off while vehicle is moving.



Tightening order
"A" – "B" – "C" – "D":

Tightening torque
Wheel bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)

Tire Mounting and Dismounting

Use a tire changing machine to mount or dismount tires. Follow equipment manufacturer's instructions. Do not use hand tools or tire irons alone to change tires as they may damage tire beads or wheel rim.

Rim bead seats should be cleaned with a wire brush or coarse steel wool to remove lubricants, old rubber and light rust. Before mounting or dismounting a tire, bead area should be well lubricated with approved tire lubricant.

After mounting, inflate to specified pressure shown on tire information placard so that beads are completely seated.

WARNING:

Do not stand over tire when inflating. Bead may break when bead snaps over rim's safety hump and cause serious personal injury.

Do not exceed specified pressure when inflating. If specified pressure will not seat beads, deflate, re-lubricate and reinflate.

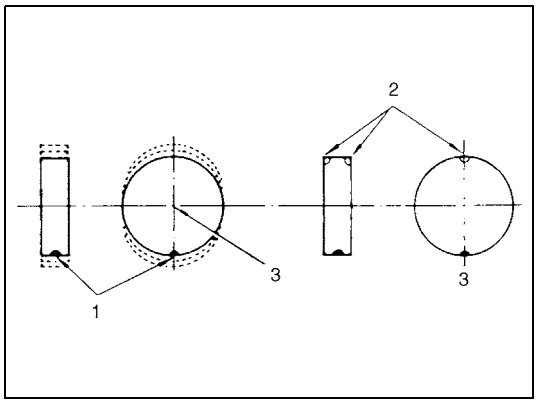
Over inflation may cause bead to break and cause serious personal injury.

Install valve core and inflate to proper pressure.

Tire Repair

There are many different materials and techniques on the market to repair tires. As not all of these work on all types of tires, tire manufacturers have published detailed instructions on how and when to repair tires. These instructions can be obtained from each tire manufacturer.

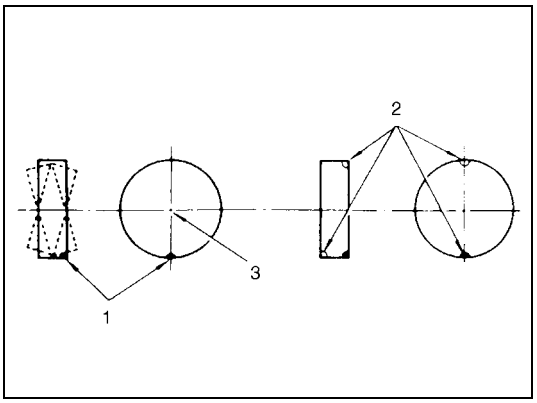
Balancing Wheels



There are two types of wheel and tire balance: static and dynamic.

Static balance, as shown in left figure, is the equal distribution of weight around the wheel. Wheels that are statically unbalanced cause a bouncing action called tramp. This condition will eventually cause uneven tire wear.

1. Heavy spot wheel tramp
2. Add balance weights here.
3. C/L of spindle



Dynamic balance, as shown in left figure, is the equal distribution of weight on each side of the wheel center line so that when the tire spins there is no tendency for the assembly to move from side to side. Wheels that are dynamically unbalanced may cause shimmy.

1. Heavy spot wheel shimmy
2. Add balance weights here.
3. C/L of spindle

General balance procedures

Deposits of mud, etc. must be cleaned from inside of rim.

WARNING:
Stones should be removed from the tread in order to avoid operator injury during spin balancing and to obtain good balance.

Each tire should be inspected for any damage, then balanced according to equipment manufacturer's recommendation.

Off-vehicle balancing

Most electronic off-vehicle balancers are more accurate than the on-vehicle spin balancers. They are easy to use and give a dynamic (two plane) balance. Although they do not correct for drum or disc unbalance as does on-vehicle spin balancing, this is overcome by their accuracy, usually to within 1/8 ounce.

On-vehicle balancing

On-vehicle balancing methods vary with equipment and tool manufacturers. Be sure to follow each manufacturer's instructions during balancing operation.

WARNING:
Wheel spin should be limited to 55 km/h (35 mph) as indicated on speedometer.
This limit is necessary because speedometer only indicates one-half of actual wheel speed when one drive wheel is spinning and the other drive wheel is stopped.
Unless care is taken in limiting drive wheel spin, spinning wheel can reach excessive speeds. This can result in possible tire disintegration or differential failure, which could cause serious personal injury or extensive vehicle damage.

Tightening Torque Specifications

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Wheel bolts	95	9.5	69.0

SECTION 4A

FRONT DRIVE SHAFT

CONTENTS

General Description

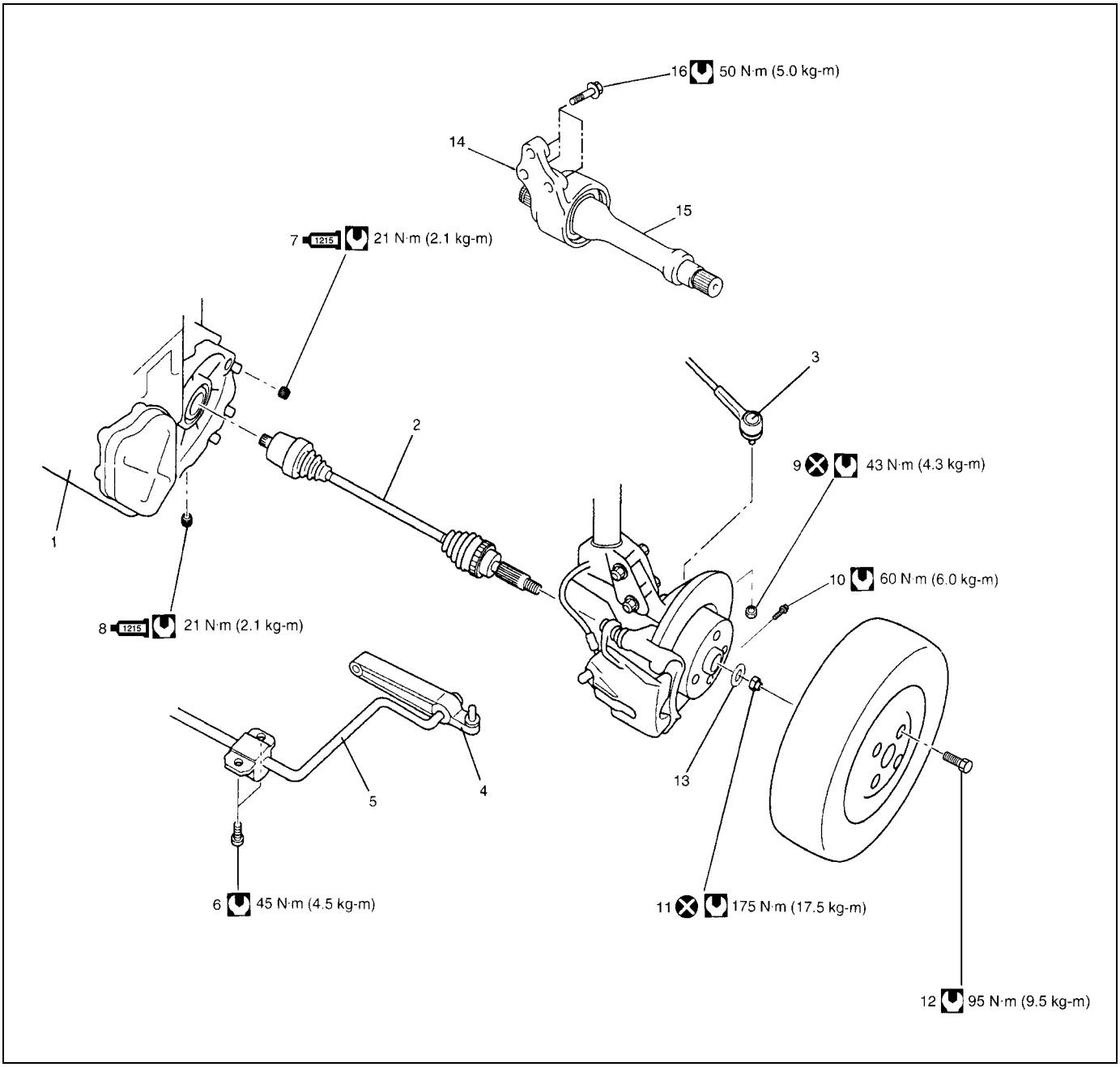
A constant velocity double offset joint (DOJ) is used on the differential side of both the right and left side drive shaft assembly. And, a constant velocity ball joint is used on the wheel side of both the right and left drive shaft assemblies. The drive shaft can slide through the DOJ in the extension/contraction direction.

Diagnosis

Condition	Possible Cause	Correction
Abnormal noise	Wear or breakage of the drive shaft joint	Replace.

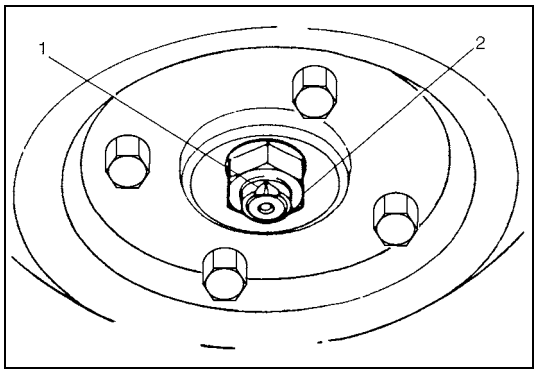
On-Vehicle Service

Front Drive Shaft Assembly Construction



1. Transaxle	7. Oil filler/level plug: Apply sealant 99000-31110 to plug thread	13. Drive shaft washer
2. Drive shaft assembly	8. Oil drain plug: Apply sealant 99000-31110 to plug thread	14. Center bearing support
3. Tie-rod end	9. Tie-rod end nut	15. Center shaft
4. Suspension control arm	10. Ball stud bolt	16. Center bearing support bolts
5. Stabilizer	11. Drive shaft nut	Do not reuse.
6. Stabilizer mount bracket bolt	12. Wheel bolt	Tightening torque

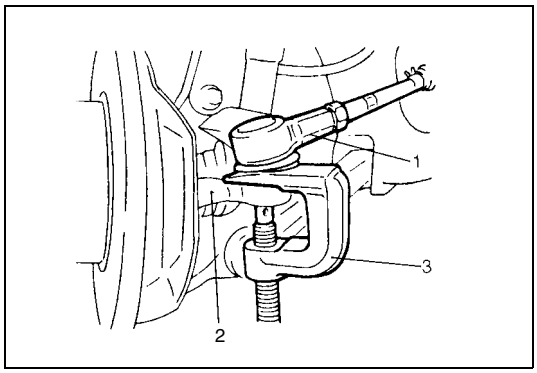
Front Drive Shaft Assembly Removal and Installation



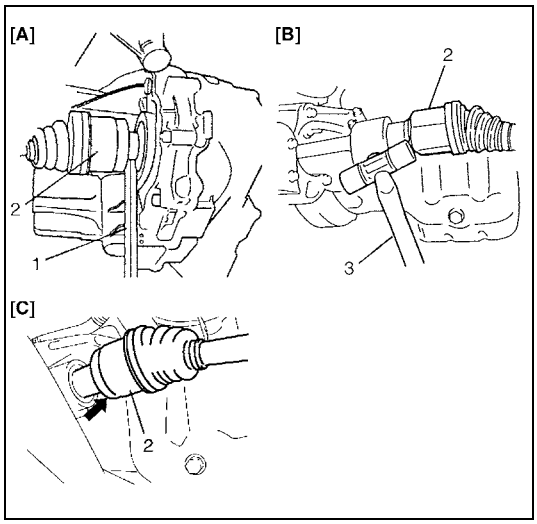
Removal

CAUTION:
To prevent the breakage of boots, be careful not to damage the boots when removing drive shaft assembly.

1) Undo caulking (1) and remove drive shaft nut (2).
2) Loosen wheel bolts.
3) Hoist vehicle.
4) Remove wheel.
5) Drain transaxle oil and transfer oil referring to “Manual Transaxle Oil Change” in Section 7A1 and “Transfer Oil Change” in Section 7D.
6) Remove tie-rod end nut.



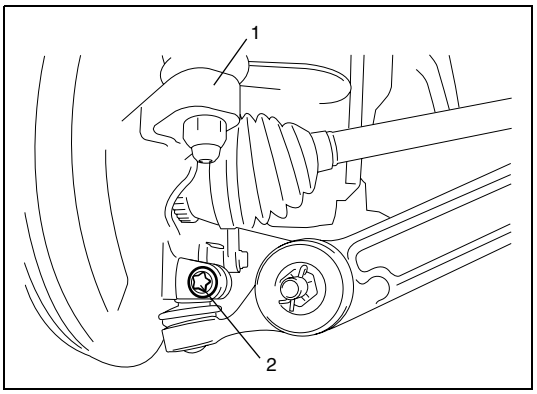
7) Disconnect tie-rod end (1) from steering knuckle (2) by using puller (3).



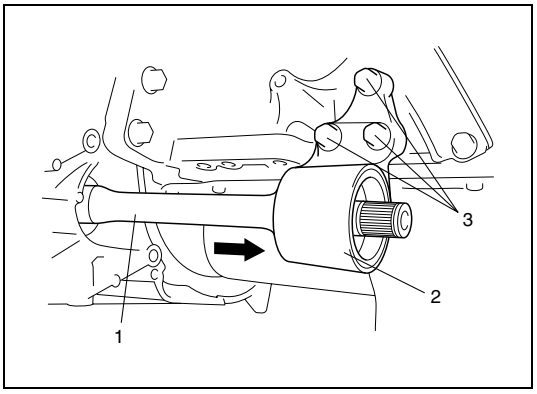
8) Pull out drive shaft joint (2) as follows.
   a) Left side of 2WD vehicle and 4WD vehicle
      Using tire lever (1), pull out drive shaft joint (2) so as to release snap ring fitting of joint spline at differential side.
   b) Right side of 2WD vehicle
      Using plastic hammer (3), drive out drive shaft joint (2) so as to release snap ring fitting of joint spline at center shaft.
   c) Right side of 4WD vehicle
      Using plastic hammer, drive out drive shaft joint (2) so as to release snap ring fitting of joint spline at transfer side.

[A] : Left side of 2WD vehicle and 4WD vehicle
[B] : Right side of 2WD vehicle
[C] : Right side of 4WD vehicle

9) Remove two stabilizer mount brackets from vehicle body.



10) Disconnect front suspension control arm ball joint stud from steering knuckle (1) by pushing down stabilizer bar after removing ball joint bolt (2).
11) Remove drive shaft assembly.



12) For vehicle with center shaft, remove center bearing support bolts (3) and remove center bearing support (2) with center shaft (1) from differential side gear.

Installation

CAUTION:
- **Be careful not to damage oil seals and boots when installing drive shafts.**
- **Do not hit joint boot with hammer. Inserting joint only by hands is allowed.**
- **Make sure that differential side joint is inserted fully and its snap ring is seated as it was.**

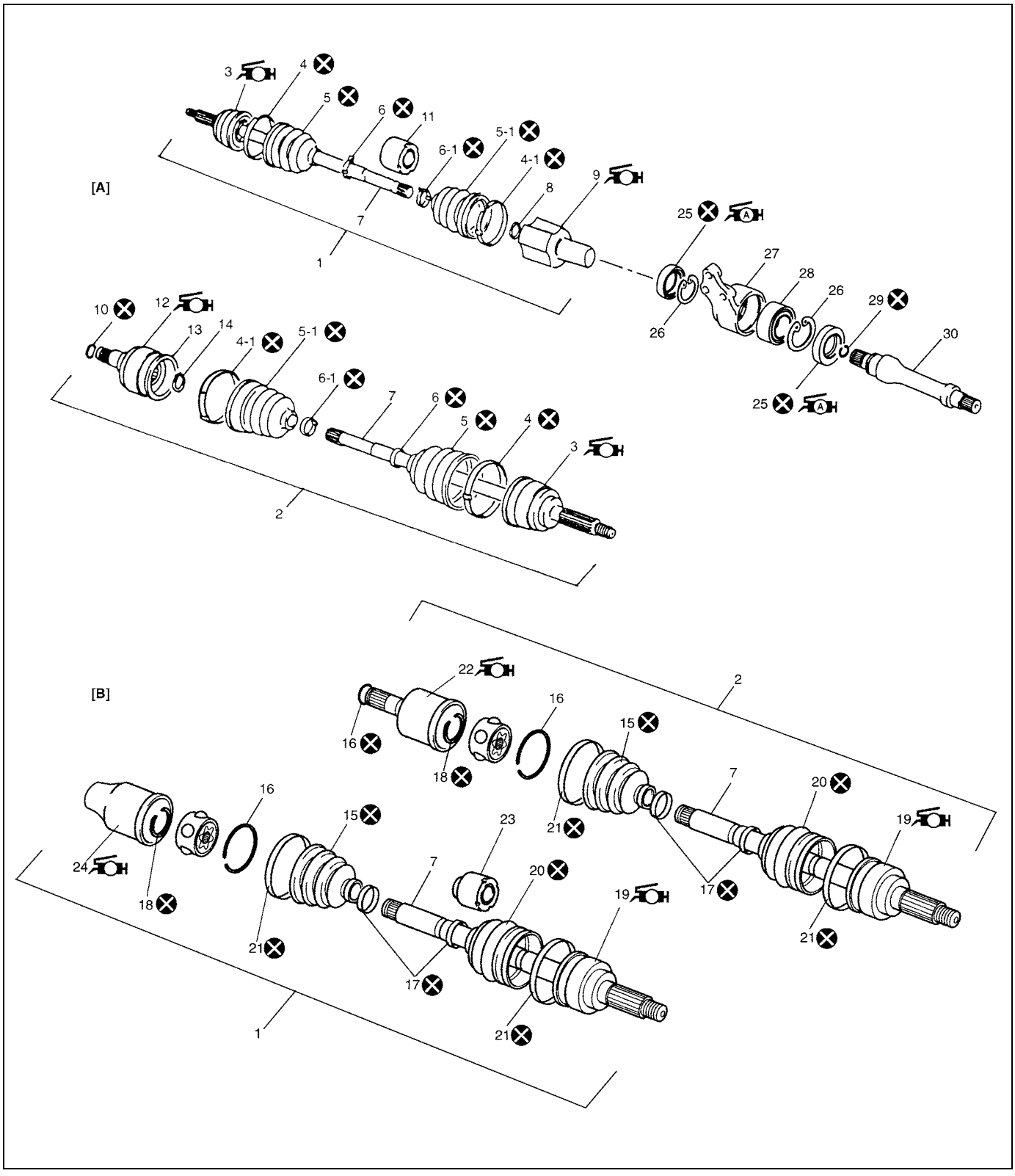
Install drive shaft assembly by reversing removal procedure noting the following points.
- Install wheel side joint to steering knuckle first, and then differential side joint to transaxle.
- Tighten each bolt and nut to the specified torque referring to “Front Drive Shaft Components” in this section.
- Apply sealant to drain plug of manual transaxle.
- Fill transaxle with oil as specified referring to “Manual Transaxle Oil Change” in Section 7A1.
- Check toe setting and adjust as required.

Front Drive Shaft Assembly Inspection

Inspection

- Check boots for breakage or deterioration.
- Check wheel side joint for rattle or smoothness.
- Check differential side joint for smoothness.
  If any abnormality is found, replace.

Front Drive Shaft Components

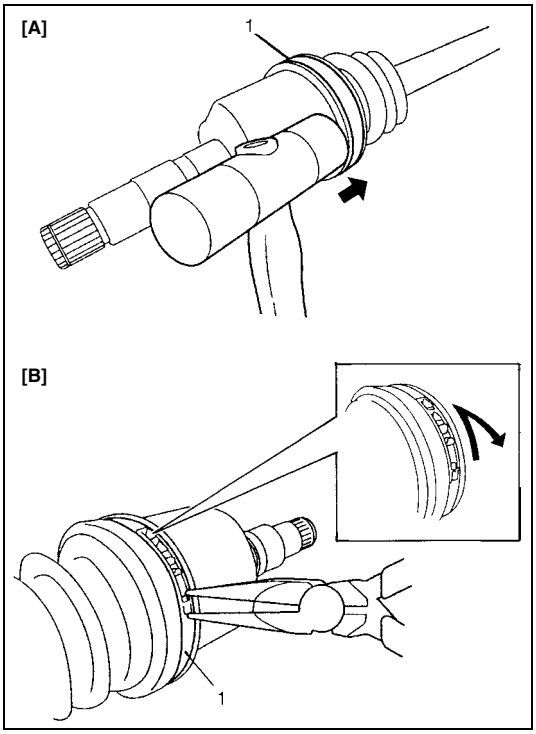


[A] : 2WD model	8. Snap ring	20. Boot (Wheel side)
[B] : 4WD model	9. Center shaft side joint (Constant velocity DOJ joint) : Apply grease included in spare parts to DOJ joint.	21. Boot big band
1. Right side drive shaft assembly	10. Snap ring	22. Differential side joint : Apply grease included in spare part to joint.
2. Left side drive shaft assembly	11. Damper	23. Damper (RH)
3. Wheel side joint (constant velocity ball joint) : Apply grease included in spare parts to ball joint.	12. Differential side joint (Constant velocity DOJ) : Apply grease included in spare parts to DOJ	24. Transfer side joint (RH) : Apply grease included in spare part to joint.
4. Ball joint boot big band	13. Snap ring	25. Oil seal
4-1. DOJ boot big band	14. Retaining ring	26. Center bearing support circlip
5. Ball joint boot	15. Boot (Differential or transfer side)	27. Center bearing support
5-1. DOJ boot	16. Circlip	28. Center bearing
6. Ball joint boot small band	17. Boot small band	29. Snap ring
6-1. DOJ boot small band	18. Snap ring	30. Center shaft
7. Drive shaft for DOJ	19. Wheel side joint (Constant velocity joint) : Apply grease included in spare part to joint.	Do not reuse.

Front Drive Shaft Disassembly and Assembly

Disassembly

For 2WD vehicle



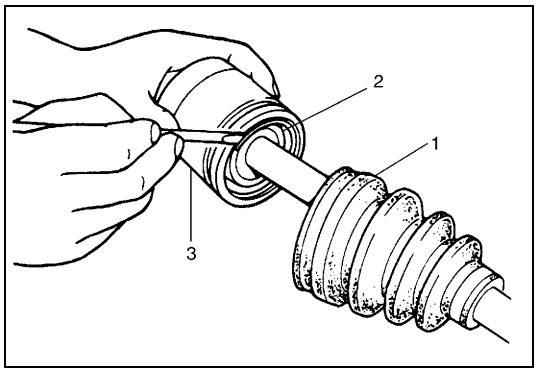
CAUTION:

Disassembly of wheel side joint is not allowed. If any abnormality is found, replace it as assembly.

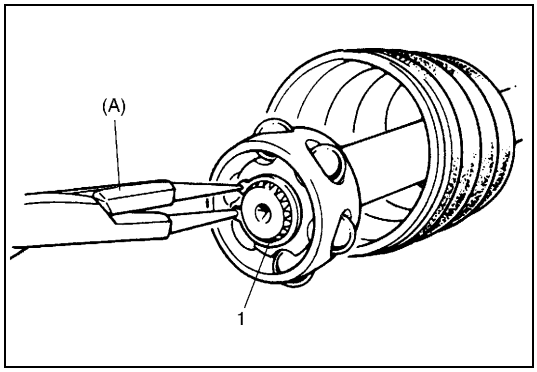
1) Remove differential side boot big band (1) as follows.
   a) For boot big band without joint
      i) Remove boot big band by tapping boot and band with plastic hammer. If it is hard to remove boot big band, cut it using a nipper or a iron saw with care not to damage DOJ housing.
   b) For boot big band with joint
      i) Draw hooks of boot big band together and remove band.

[A] : For boot big band without joint
[B] : For boot big band with joint

2) Remove DOJ from shaft as follows.

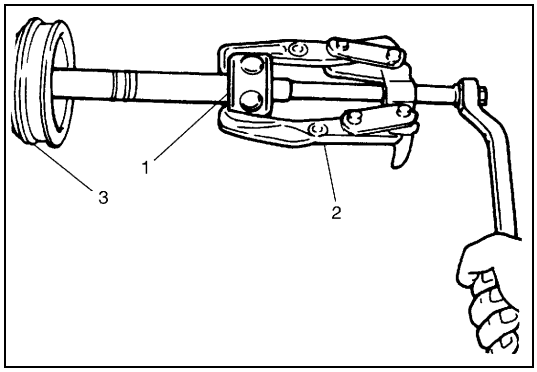


a) Right side
   i) Side boot (1) toward the center of shaft and remove circlip (2) from joint housing, and then take shaft out of joint housing (3).

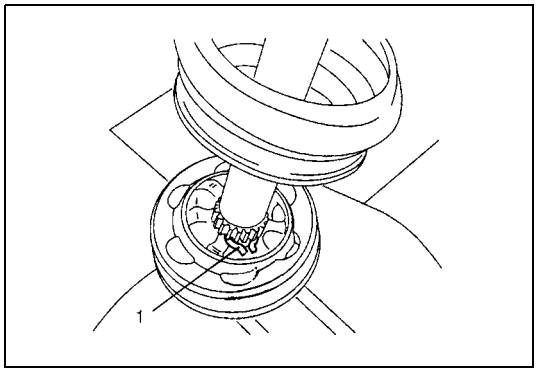


   ii) Wipe off grease and remove snap ring (1) used to fix cage by using special tool.

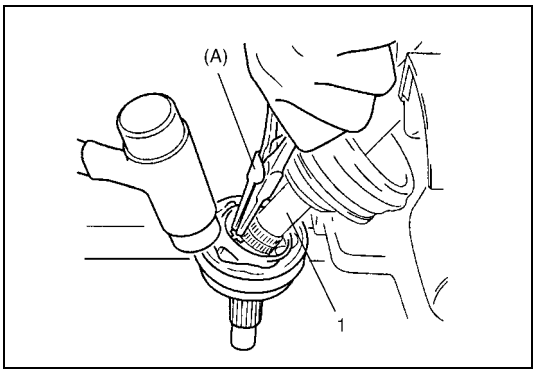
Special tool
(A) : 09900-06107



   iii) Draw away cage (1) by using bearing puller (2), and then remove boot (3) from shaft.

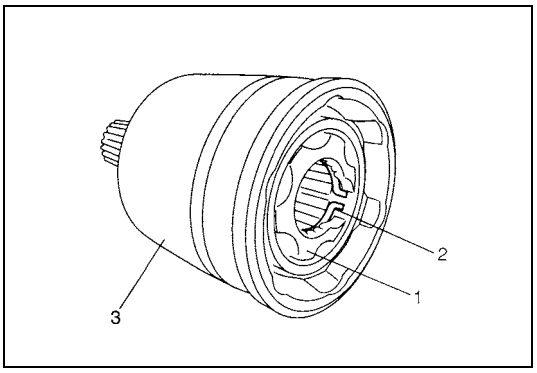


b) Left side
   i) Fold over boot and remove old grease so that retaining ring (1) is accessible.



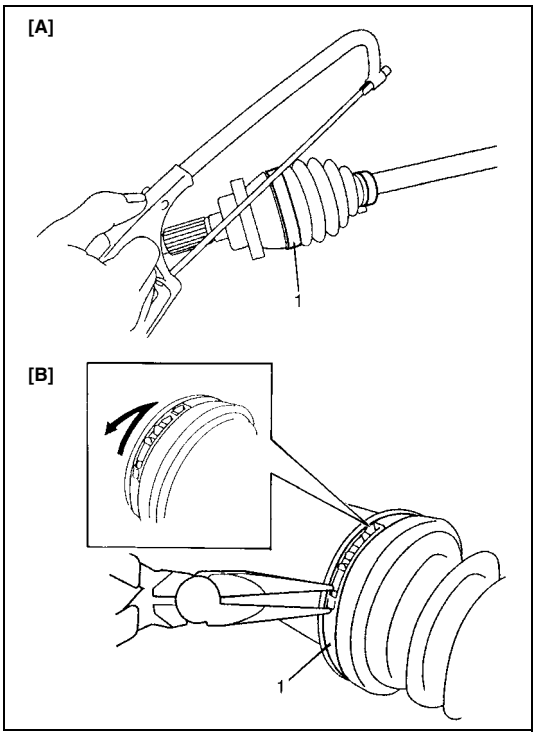
ii) Clamp drive shaft in soft jawed vise, and then open retaining ring using special tool and tap DOJ of drive shaft (1) using plastic hammer until retaining ring no longer engages in groove of shaft.

Special tool
(A) : 09900-06107



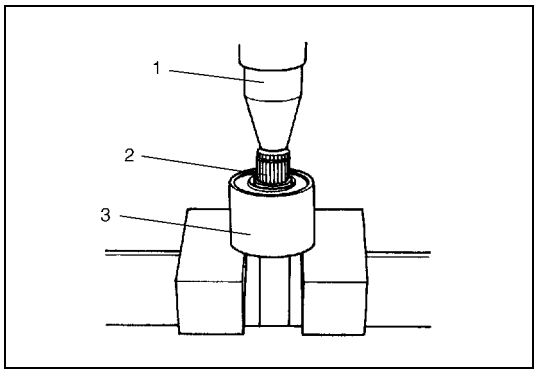
iii) Remove cage (1) with retaining ring (2) from housing (3) if necessary.

3) Remove boot small band, and then pull out differential side boot from shaft.
4) Pull out damper through shaft.



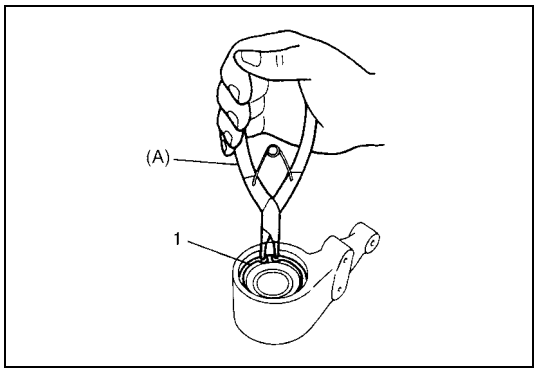
5) Remove wheel side boot big band (1) as follows.
   a) For boot big band without joint
      i) Cut boot big band using a iron saw or a nipper with care not to damage wheel side joint housing.
   b) For boot big band with joint
      i) Draw hooks of boot big band together and remove band.
6) Remove wheel side small band, and then pull out wheel side boot from shaft.

[A] : For boot big band without joint
[B] : For boot big band with joint



For center shaft and center bearing support

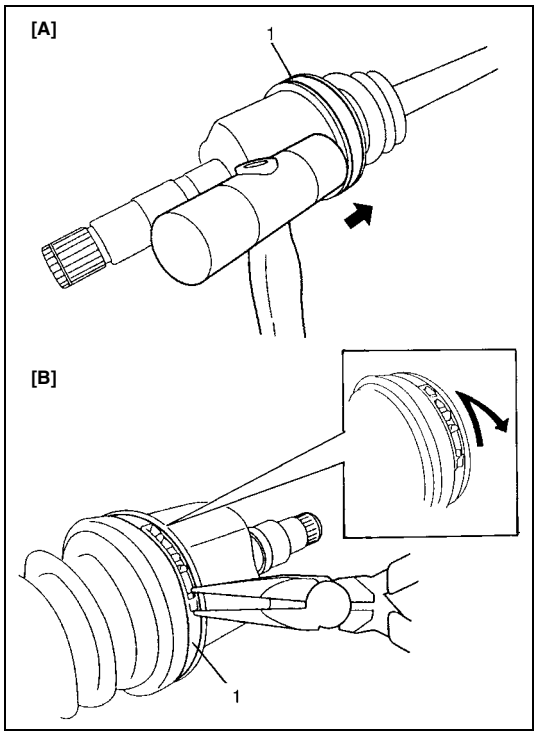
1) Using hydraulic press (1), draw out center shaft (2) from center bearing.
2) Remove oil seals from center bearing support (3).



3) Remove bearing support circlips (1).

Special tool
(A) : 09900-06108

4) Remove center bearing from center bearing support.

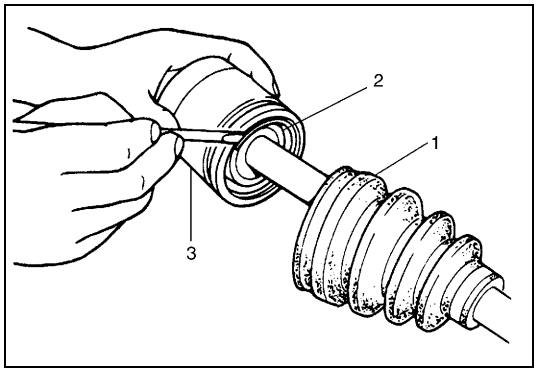


For 4WD vehicle

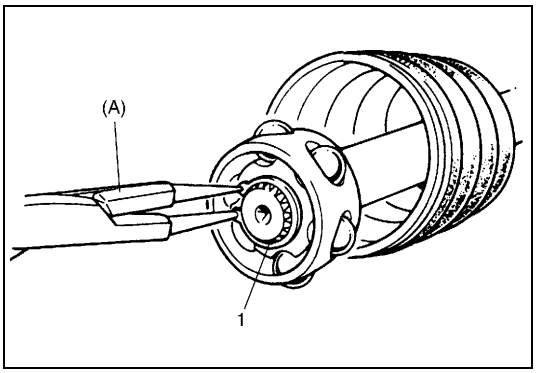
CAUTION:
Do not disassemble wheel side joint. If any malcondition is found in any joint, replace it as assembly.

1) Remove differential side boot big band (1) as follows.
   a) For boot big band without joint
      i) Remove boot big band by tapping boot and band with plastic hammer. If it is hard to remove boot big band, cut it using a nipper or a iron saw with care not to damage differential side joint housing.
   b) For boot big band with joint
      i) Draw hooks of boot big band together and remove band.

[A] : For boot big band without joint
[B] : For boot big band with joint

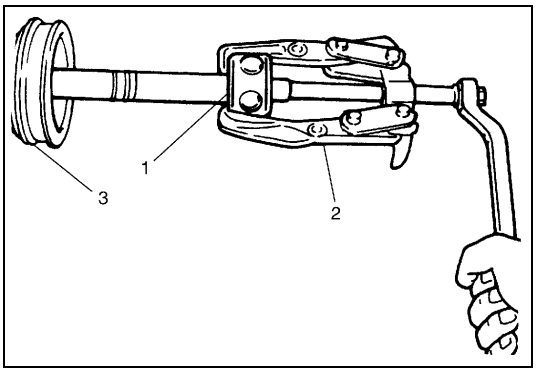


2) Side boot (1) toward the center of shaft and remove snap ring (2) from joint housing, and then take shaft out of joint housing (3).



3) Wipe off grease and remove circlip (1) used to fix cage by using special tool.

Special tool
(A) : 09900-06107



4) Draw away cage (1) by using bearing puller (2), and then remove boot (3) from shaft.

5) Remove small boot band, and then pull out differential side boot from shaft.
6) Pull out damper through shaft. (if equipped)
7) Remove boot bands of wheel side joint boot, and then pull out boot through shaft.

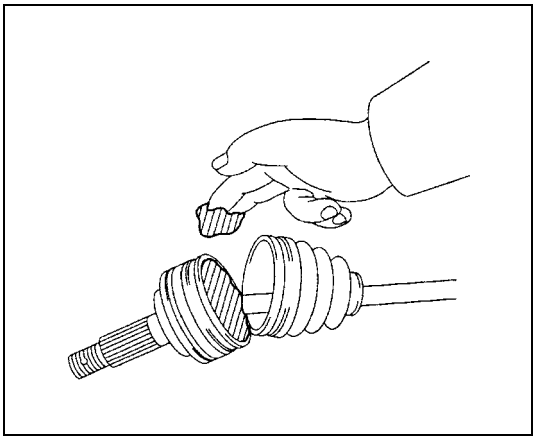
Assembly

For 2WD vehicle

1) Wash disassembled parts (except boots), and then dry parts completely by blowing air.
2) Clean boots with cloth.

NOTE:

Do not wash boot in degreaser, such as gasoline or kerosene, etc. Washing in degreaser causes deterioration of boot.

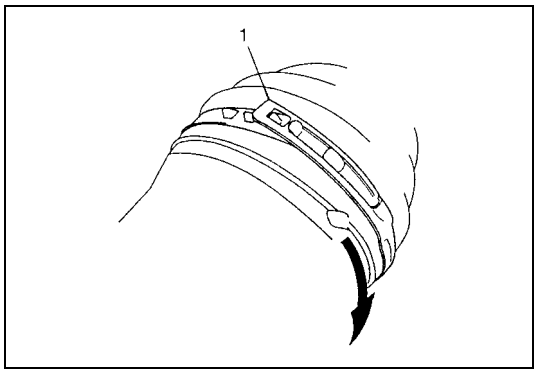


3) Install new wheel side boot on shaft temporarily.
4) Apply grease in the supplied parts to wheel side joint.

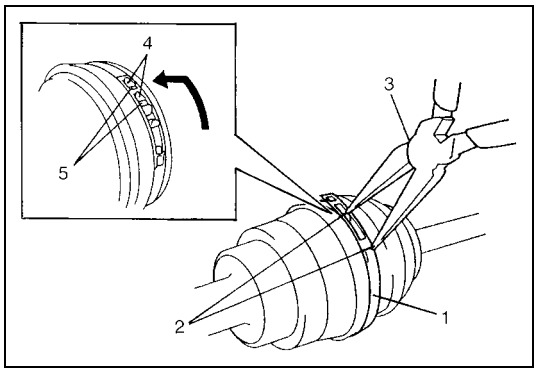
Color
For right side shaft : Black
For left side shaft : Black

Amount
For right side shaft : 60 – 80 g (2.1 – 2.8 oz)
For left side shaft : About 110 g (3.85 oz)

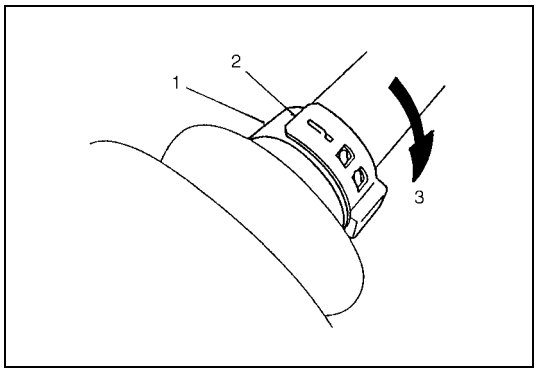
5) Fit wheel side boot onto grooves of housing and shaft.



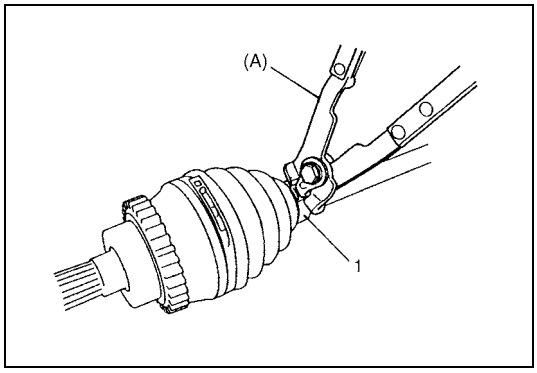
6) Place new wheel side big band onto boot putting band outer end (1) against forward rotation (2) as shown in figure.



7) Fasten boot big band (1) by drawing hooks (2) with plier (3) and engage hooks (4) in slot and window (5).

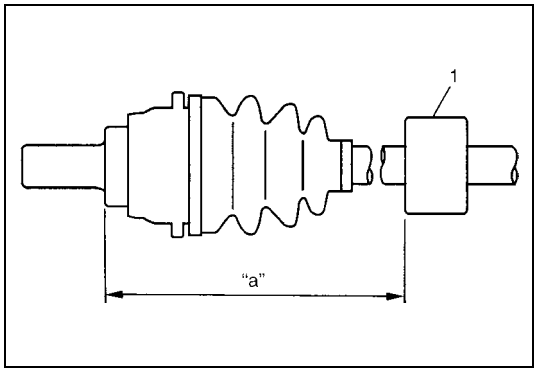


8) Place new wheel side small band (1) onto boot putting band outer end (2) against forward rotation (3) as shown in figure.



9) Confirm that wheel side boot is not stretched or contracted, and then fasten boot small band (1) securely using special tool.

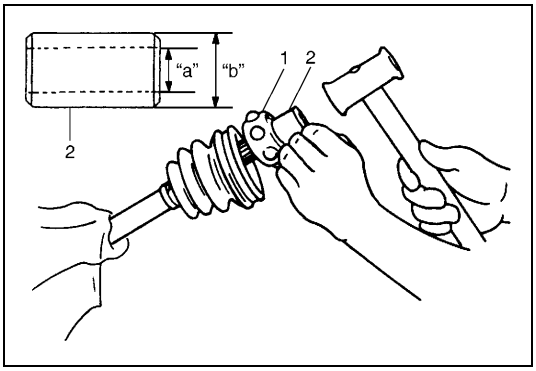
Special tool
(A) : 09943-55010



10) Install damper (1) on right side drive shaft according to dimension specified below.

Length "a": 174 – 180 mm (6.83 – 7.06 in.)

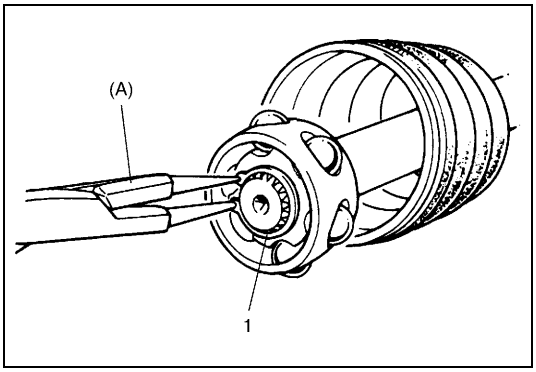
11) Install cage into joint housing
a) Right side
i) Set new differential side small band and differential side boot on shaft temporarily.



ii) Driver in the cage (1) by using pipe (2).

Drive shaft joint cage installing pipe diameter
"a" : 25.0 mm (0.984 in.) or more
"b" : 33.0 mm (1.299 in.) or less

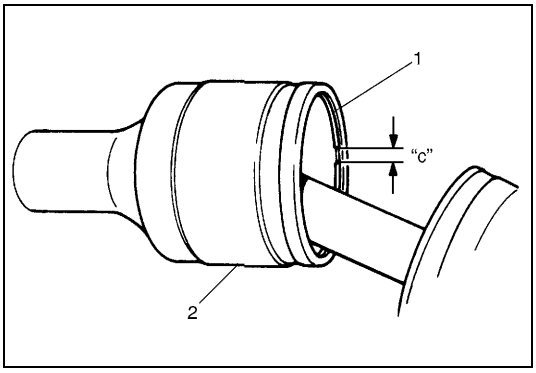
CAUTION:
Install cage directing smaller outside diameter side to wheel side.



iii) Install circlip (1) by using special tool.

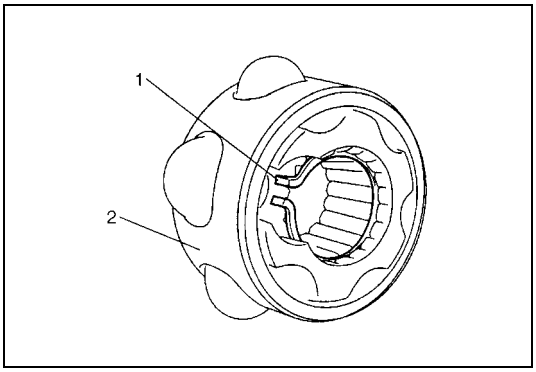
Special tool
(A) : 09900-06107

iv) Apply grease in the supplied parts to the entire surface of cage.

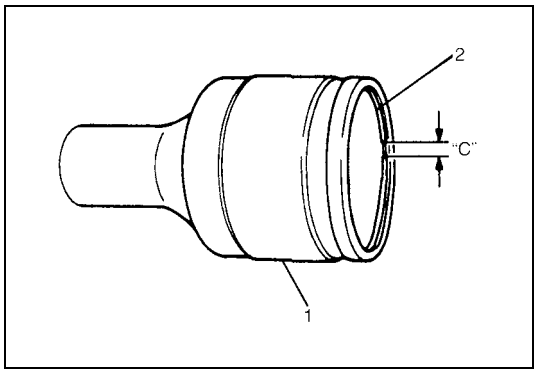


v) Insert cage into joint housing and fit snap ring (1) into groove of joint housing (2).

CAUTION:
Position opening of snap ring "c" so that it will not be lined up with a ball.

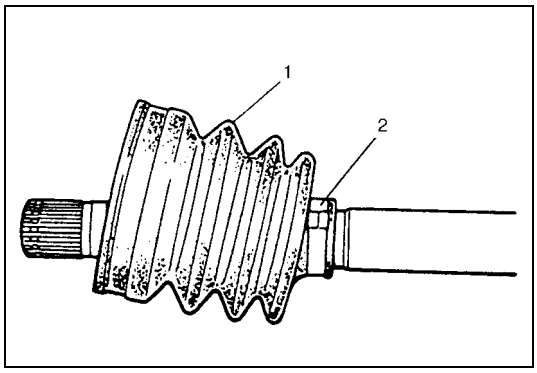


b) Left side
i) Install retaining ring (1) to cage (2).

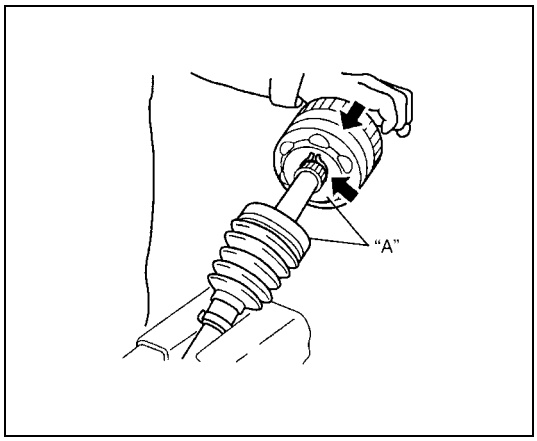


ii) Insert cage into housing (1) and fit snap ring (2) into groove of housing.

CAUTION:
Position opening of snap ring "c" so that it will not be lined up with a ball.



iii) Set new differential side small band (2) and differential side boot (1) on shaft temporarily.

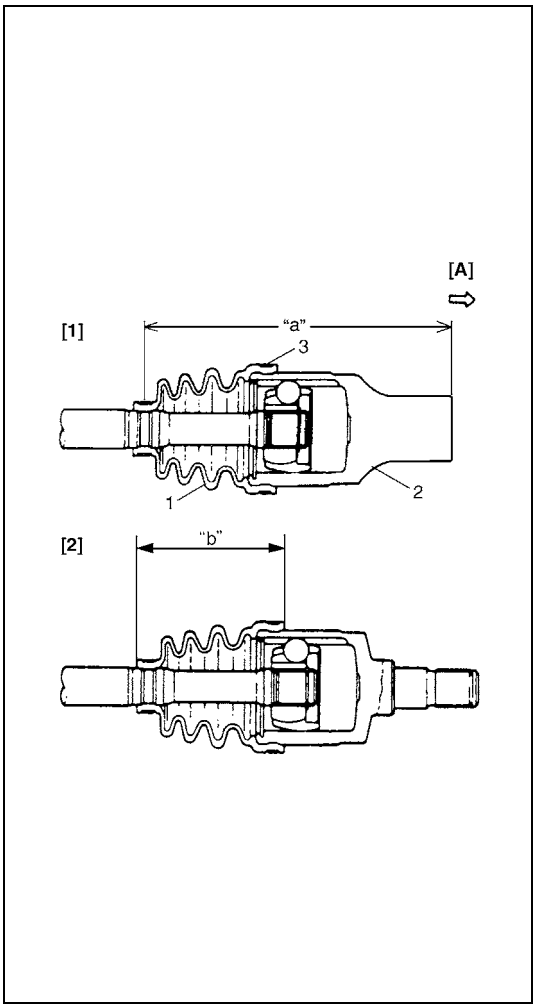


12) Apply grease in the supplied parts to DOJ and inside of housing.

Color
For right side shaft : Black and grey
For left side shaft : Black

Amount
For right side shaft : 75 – 95 g (2.7 – 3.4 oz)
For left side shaft : About 100 g (3.6 oz)

13) Place DOJ onto spline of drive shaft and drive onto drive shaft by using plastic hammer until retaining ring engages.



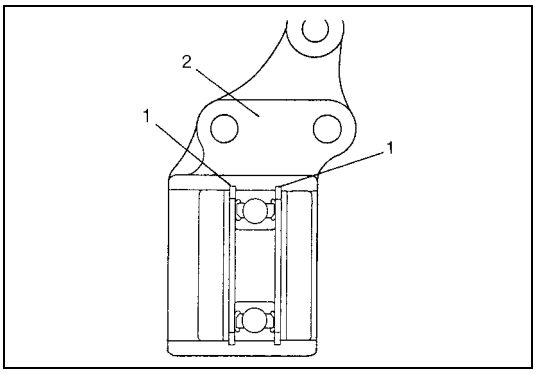
14) Install boot on joint housing.
   a) Right side
      When fixing boot (1) to joint housing (2) with differential side big band (3), adjust so that measurements become as indicated below.
   b) Left side
      Fit boot to grooves of shaft and housing and adjust length "d" to specification below.
      Insert screwdriver into boot and allow air to enter boot so that air pressure in boot becomes the same as atmospheric pressure.

Length "a": 187.8 mm (7.39 in.)
"b": 94.5 mm (3.72 in.)

[A] :	Differential side
[1] :	Right side
[2] :	Left side

CAUTION:
- **To prevent any problem caused by washing solution, do not wash joint boots. Degreasing of those parts with cloth in allowed.**
- **Do not squeeze or distort boot when fastening it with bands.**
  Distorted boot caused by squeezing air may reduce its durability.

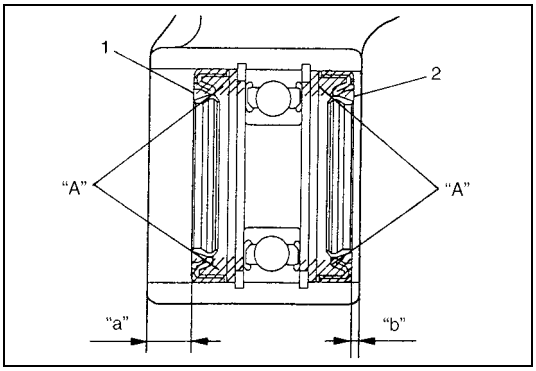
15) Install and fasten new big and small bands at the position of step 14) referring to steps 6) to 9).



For center shaft and center bearing support

Install center shaft by reversing removal procedure and noting following points

- When installing bearing support circlip (1), make sure that it fits in circlip groove in center bearing support (2) securely as shown.

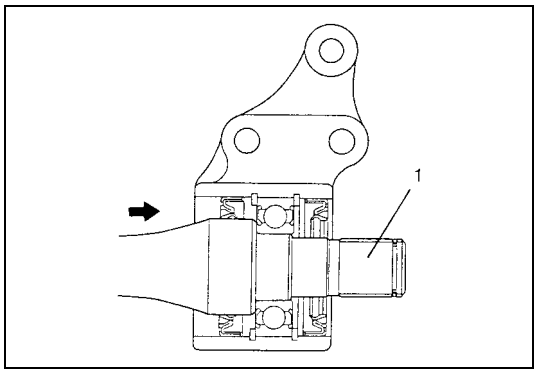


- When installing left oil seal (1) and right oil seal (2), use care so that oil seals in proper direction and position as shown figure.

Distance "a": 11 – 12 mm (0.43 – 0.47 in.)
"b": 2 – 3 mm (0.08 – 0.12 in.)

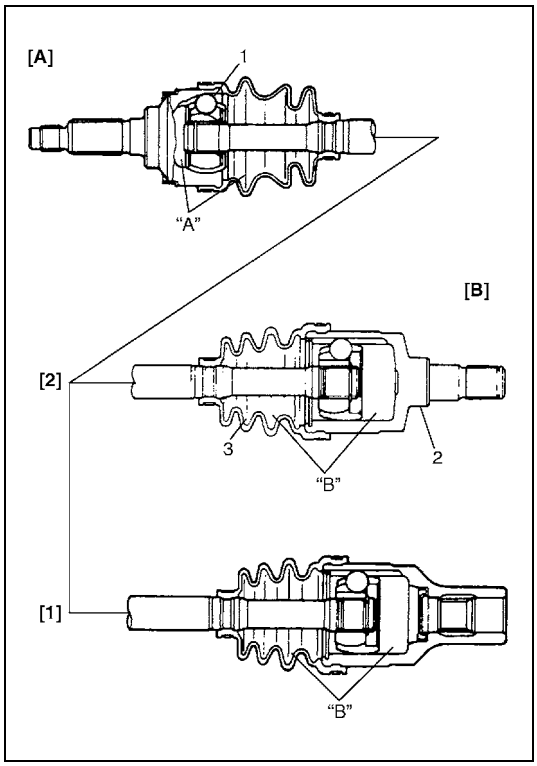
- Be sure to apply grease to oil seal lip and bearing side space indicated in figure.

"A" : Grease 99000-25010



- Press-fit center shaft (1) from left oil seal side.

For 4WD vehicle



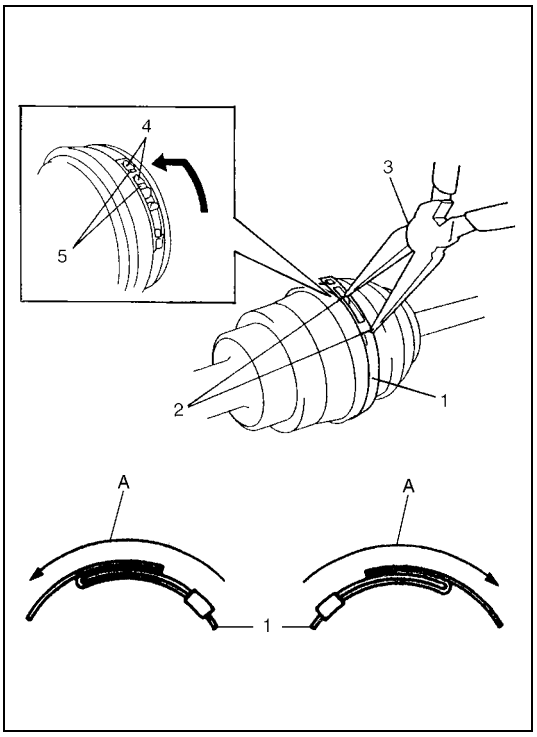
Judging from abnormality noted before disassembly and what is found though visual check of component parts after disassembly, prepare replacing parts and proceed to reassembly.
Make sure that wheel side joint assembly (1) and DOJ housing (2) are washed thoroughly and air dried, and boots (3) are cleaned with cloth if they are to be reused.

CAUTION:
To ensure full performance of joint as designed, be sure to distinguish between two types of grease in repair set and apply specified volume to respective joint.

[A] :	Wheel side
[B] :	Transaxle or transfer side
[1] :	Right side
[2] :	Left side

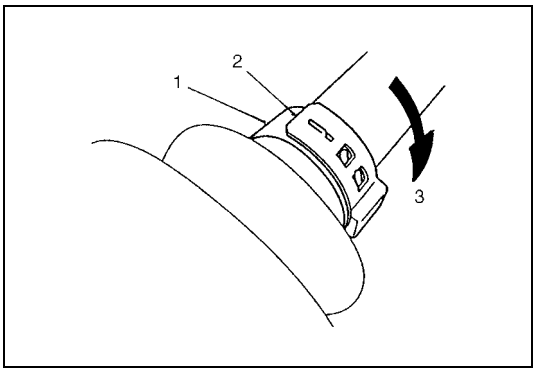
1) Wash disassembled parts (except boots). After washing, dry parts completely by blowing air.
2) Clean boots with cloth. Do not wash boots in degreaser, such as gasoline or kerosene, etc.
   Washing in degreaser causes deterioration of boot.
3) Apply grease in the supplied parts to wheel side joint.

Color : Black
Amount : 60 – 80 g (2.1 – 2.8 oz)

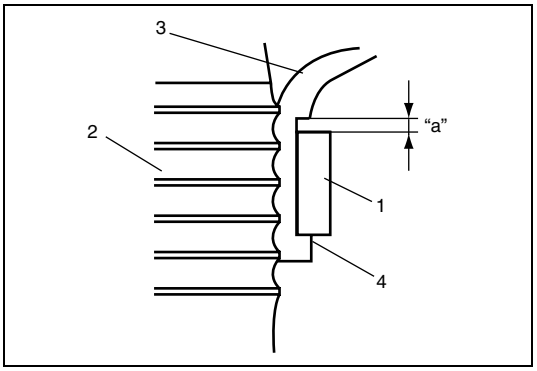


4) Install wheel side boot on shaft, fill up boot inside with grease and then fasten boot big band (1) by drawing hooks (2) with plier (3) and engage hooks (4) in slot and window (5).

CAUTION:
- **Bend each boot band against forward rotation (A).**
- **Do not squeeze or distort boot when fastening it with bands.**
  Distorted boot caused by squeezing air may reduce its durability.

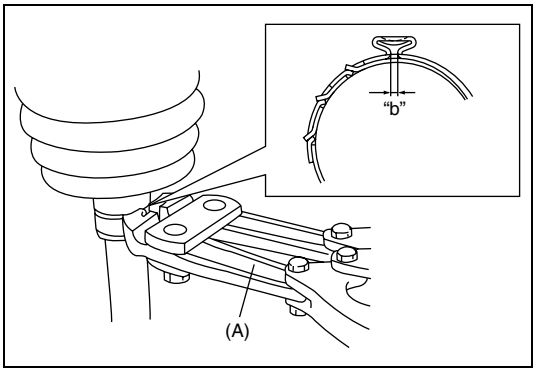


5) Place new wheel side small band (1) onto boot putting band outer end (2) against forward rotation (3) as shown in figure.



6) Install wheel side small band (1), putting its lower edge against projected end (4) of boot (3) so that clearance "a" is provided as shown in figure.

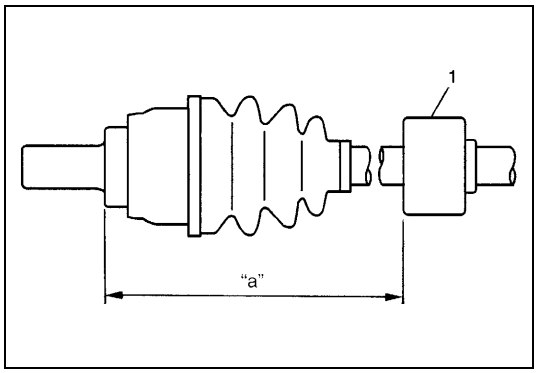
2. Shaft



7) Fasten small band by using special tool.

NOTE:
- **Small band must not come out of its installation section.**
- **Be sure to caulk small band securely until complete contact "b" is obtained.**

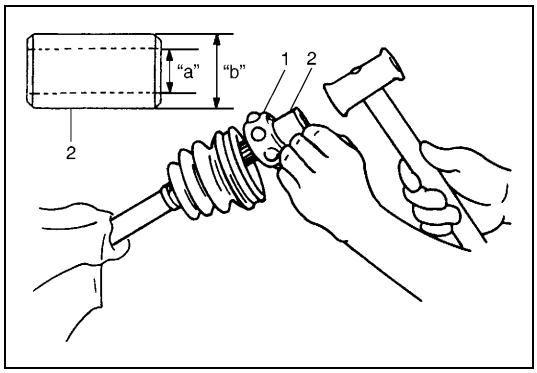
Special tool
(A) : 09943-57010



8) Install dynamic damper (1) on right side drive shaft according to dimension specified below.

Dynamic damper installing position
"a" : 174 – 180 mm (6.89 – 7.13 in.)

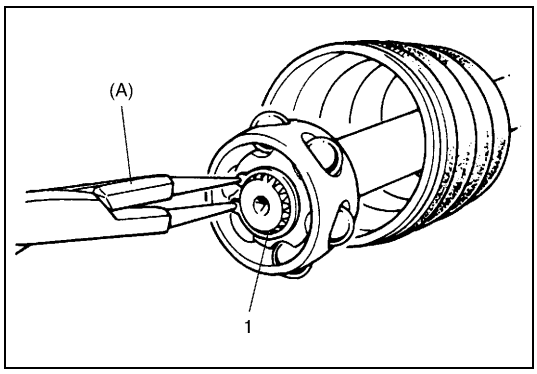
9) Set new differential side small band and differential side boot on shaft temporarily.



10) Driver in the cage (1) by using pipe (2).

Drive shaft joint cage installing pipe diameter
"a" : 25.0 mm (0.984 in.) or more
"b" : 33.0 mm (1.299 in.) or less

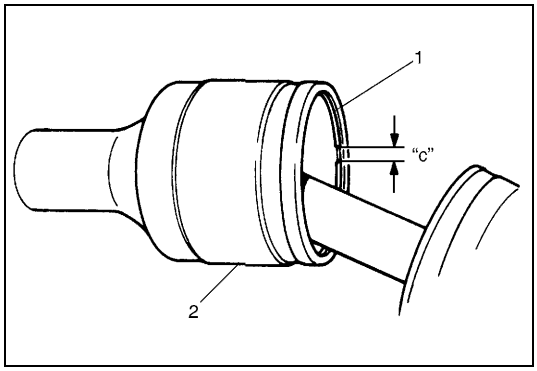
CAUTION:
Install cage directing smaller outside diameter side to wheel side.



11) Install circlip (1) by using special tool.

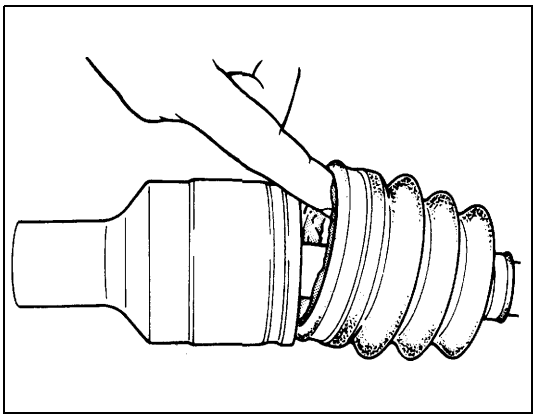
Special tool
(A) : 09900-06107

12) Apply grease to entire surface of cage.
Use specified grease in tube included in spare parts.



13) Insert cage into joint housing and fit snap ring (1) into groove of joint housing (2).

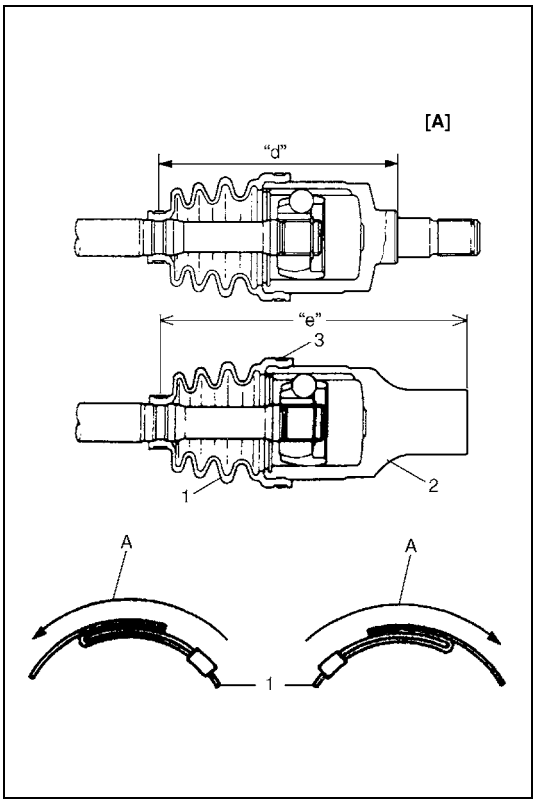
CAUTION:
Position opening of snap ring "c" so that it will not be lined up with a ball.



14) Apply grease to inside of joint housing, and fit boot to joint housing. After fitting boot, insert screwdriver into boot on joint housing side and allow air to enter boot so that air pressure in boot becomes the same as atmospheric pressure.

Color
For right side shaft : Black and grey
For left side shaft : Black and grey

Amount
For right side shaft : 75 – 95 g (2.7 – 3.4 oz)
For left side shaft : 70 – 90 g (2.5 – 3.2 oz)



15) When fixing boot (1) to joint housing (2) with differential side big band (3), adjust so that measurements become as indicated below. For fixing boot band, refer to steps 4) to 7).

Drive shaft boot fixing position
"d" : 154.5 mm/6.09 in. for left side drive shaft
"e" : 192.8 mm/7.60 in. for right side drive shaft

CAUTION:
To prevent any problem caused by washing solution, do not wash joint boots. Degreasing of those parts with cloth is allowed.

CAUTION:
- **Bend each boot band against forward rotation (A).**
- **Do not squeeze or distort boot when fastening it with bands.**
  Distorted boot caused by squeezing air may reduce its durability.

[A] : Differential side

Front Drive Shaft Inspection

Inspection

- Check shaft and joint for damage, wear or bend.
  Replace them as necessary.
- Check retaining ring and snap ring for breakage or deformation.
  Replace as necessary.

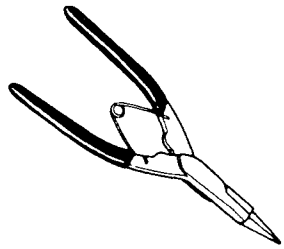
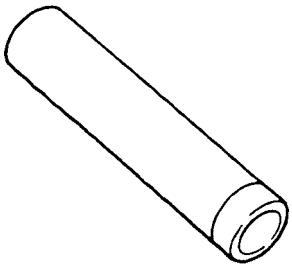
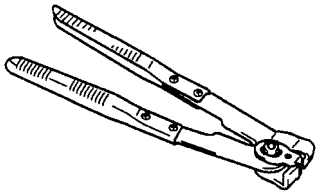
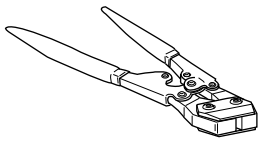
Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Transfer oil filler/level and drain plugs	21	2.1	15.5
Transmission oil filler/level and drain plugs	23	2.3	17.0
Ball stud bolt	60	6.0	43.5
Tie rod end nut	30 – 50	3.0 – 5.0	22.0 – 37.0
Drive shaft nut	175	17.5	127.0
Wheel bolt	95	9.5	69.0
Stabilizer mount bracket bolt	45	4.5	33.0
Center bearing support bolts	50	5.0	37.0

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	• Oil drain and filler/level plugs for manual transmission

Special Tools

			
09900-06107 Snap ring pliers (Open type)	09925-98221 Bearing installer	09943-55010 (J-22610) Boot clamp plier	09943-57010 Band compressor

SECTION 4B

PROPELLER SHAFTS

CONTENTS

General Description

Propeller Shaft Description

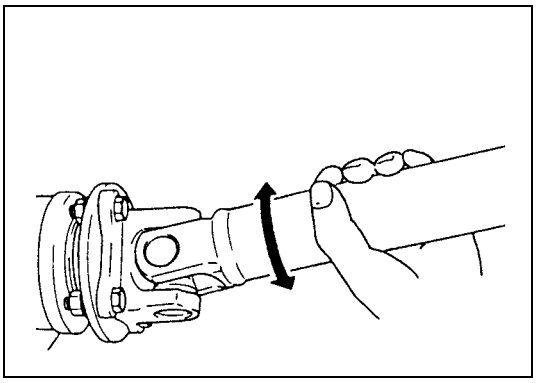
Most universal and constant velocity joints require no maintenance. They are lubricated for life and can not be lubricated on the vehicle. If universal and constant velocity joints becomes noisy or worn, it must be replaced.
The propeller shaft is a balanced unit. Handle it carefully so that balance can be maintained.
A viscous coupling is used for the coupling system which distributes an optimum driving force to the front and rear wheels according to the driving conditions. It is located at the center of the propeller shaft.

Diagnosis

Propeller Shaft Symptom Diagnosis

Condition	Possible Cause	Correction
Abnormal noise	• Loose universal joint bolt	Tighten universal joint bolt.
	• Spider bearing worn out or stuck	Replace.
	• Worn or broken constant velocity joint	Replace.
	• Worn or broken center support bearing	Replace.
	• Broken center support rubber	Replace.
	• Wear spider	Replace propeller shaft.
Vibration	• Performed propeller shaft	Replace.

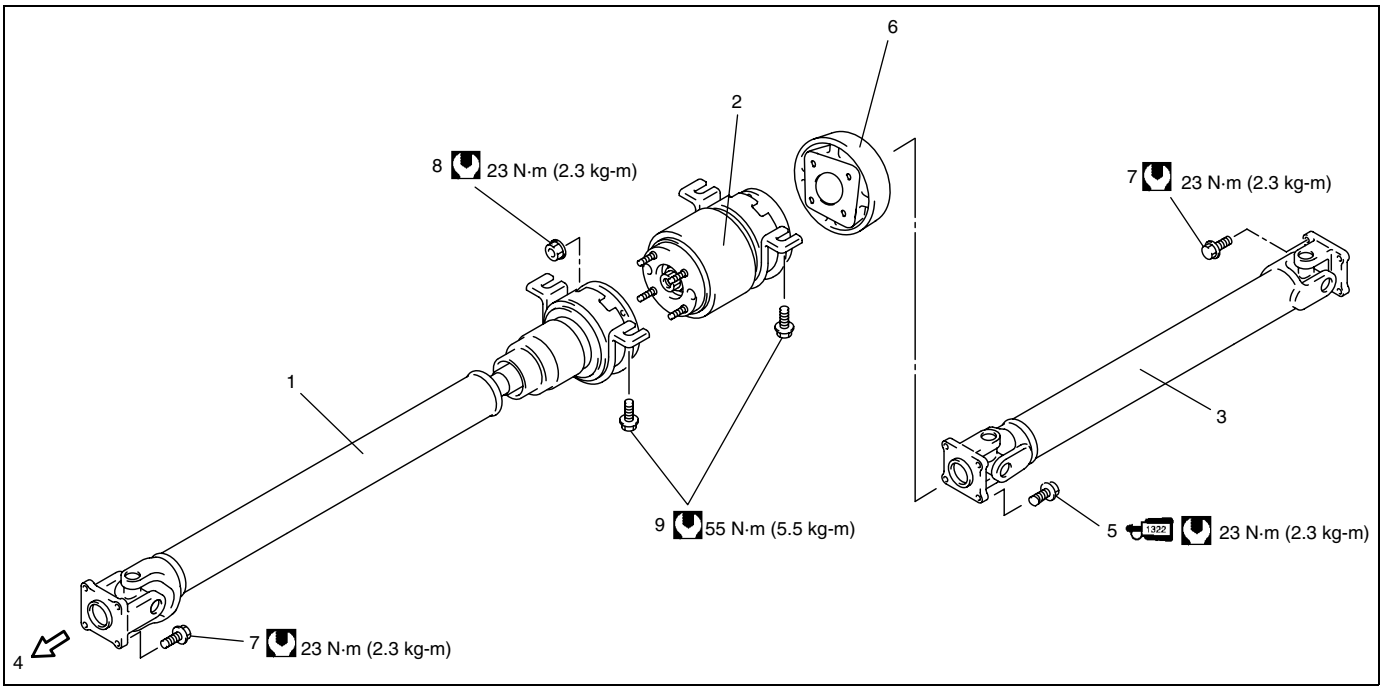
Propeller shaft joint check



If universal joints are suspected of producing chattering or rattling noise, inspect them for wear. Check if cross spider rattles in yokes and replace defective propeller shaft with new one.
Noise coming from universal joint can be easily distinguished from other noises because rhythm of chattering or rattling is in step with cruising speed. Noise is pronounced particularly on standing start or in coasting condition (when braking effect of engine is showing in the drive line).

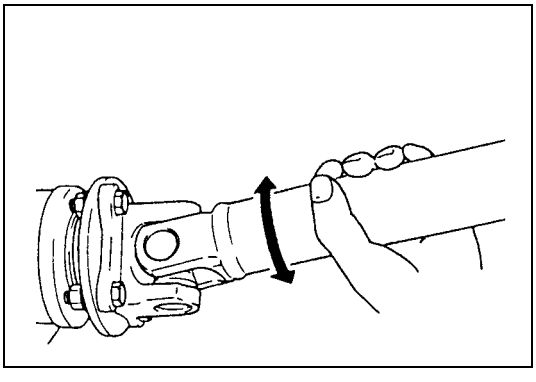
On-Vehicle Service

Propeller Shaft Component



1. Propeller shaft No.1 with center support	5. Propeller shaft No.2 bolt : Apply thread lock 99000-32110 to thread.	9. Center support bolt
2. Viscous coupling with center support	6. Dynamic damper	Tightening torque
3. Propeller shaft No.2	7. Propeller shaft bolt	
4. Forward	8. Viscous coupling nut	

On-Vehicle Inspection

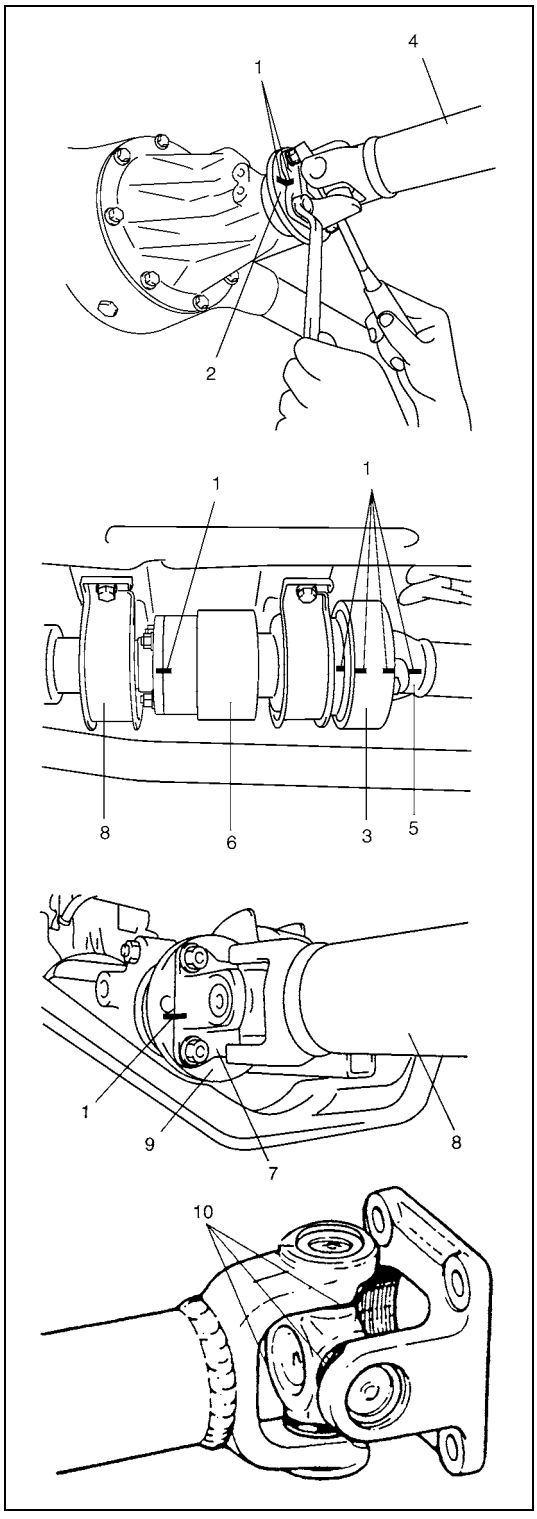


- Check propeller shaft connecting bolts for looseness. If looseness is found, tighten to specified torque.
- Check propeller shaft joints for wear, rattle and damage. If any defect is found, replace.
- Check propeller shaft center support for biting of foreign matter, crack, abnormal noise and damage. If any defect is found, replace.

Propeller Shaft Removal and Installation

Removal

1) Hoist vehicle.

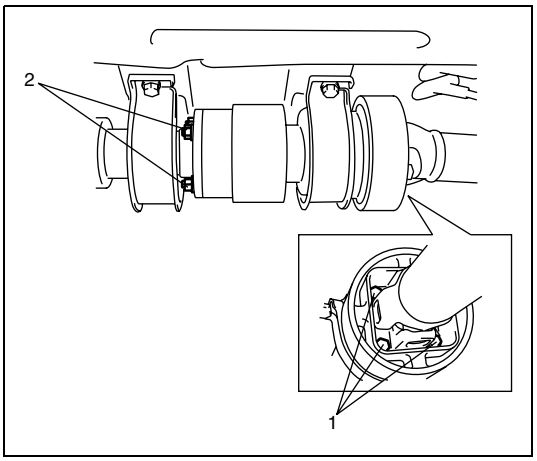


2) Before removing propeller shafts, give match marks (1) on propeller shaft No.2 (4) and companion flange (2) of rear differential as shown. Also give match marks (1) on propeller shaft No.2 yoke (5), dynamic damper (3), viscous coupling with center support (6), yoke (7) of propeller shaft No.1 with center support (8) and transfer output flange (9).

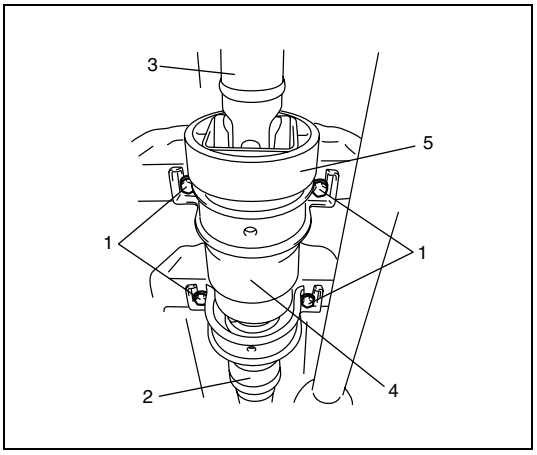
CAUTION:

Don't damage joint seal (10) to prevent lubrication defect of joint.

3) Loosen propeller shaft bolts at front and rear end, and separate propeller shafts from transfer and rear differential.

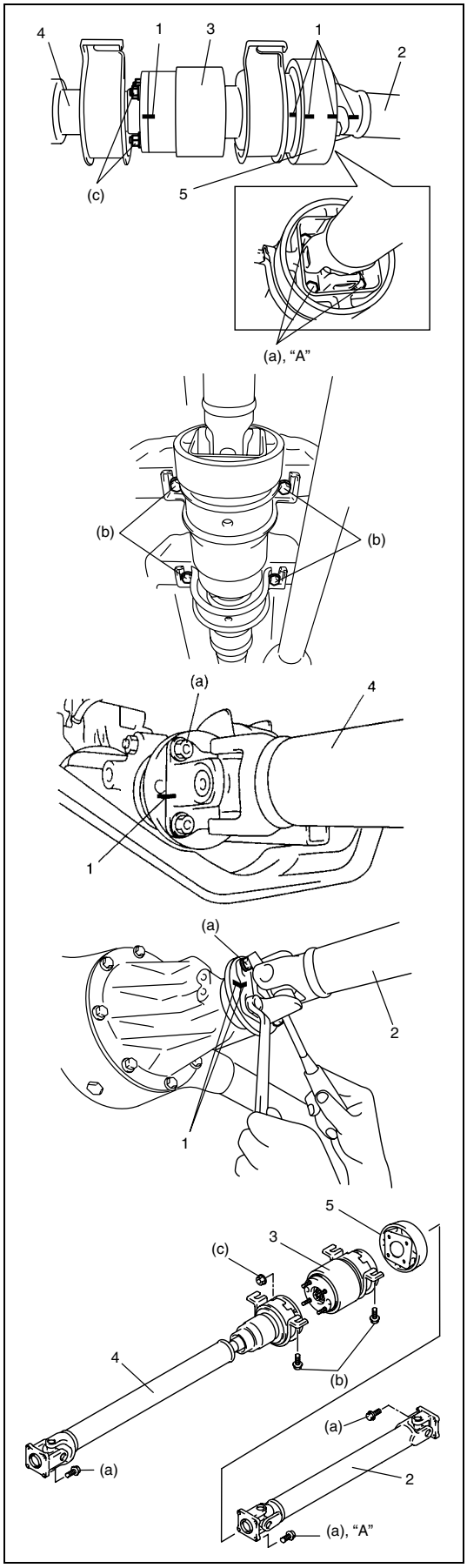


4) If disassembling propeller shaft assembly is necessary, loosen propeller shaft No.2 bolts (1) and viscous coupling nuts (2) to facilitate subsequent disassembling, but keeping each connection provisionally.



5) Loosen center support bolts (1), then remove propeller shaft No.1 with center support (2), propeller shaft No.2 (3), dynamic damper (5) and viscous coupling with center support (4) all together.

6) Disconnect propeller shaft No.1 with center support and propeller shaft No.2 from viscous coupling with center support.



Installation

Reverse removal procedure to install propeller shafts noting the following points.

- When installing propeller shafts, dynamic damper and viscous coupling with center support, align the match marks (1). Otherwise, vibration may occur during driving.
- Apply thread lock cement to thread of propeller shaft No.2 bolts.

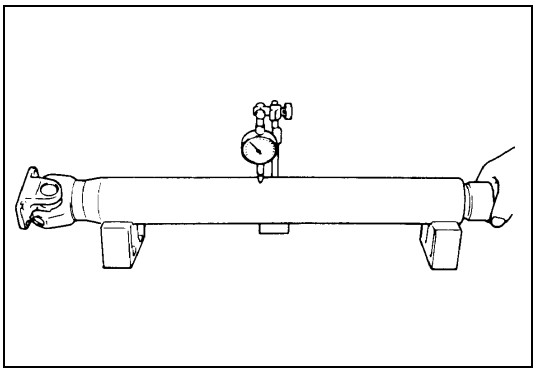
"A" : Cement 99000-32110

- Use following specification to torque bolts.

Tightening torque
Propeller shaft bolts (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)
Center support bolts (b) : 55 N·m (5.5 kg-m, 40.0 lb-ft)
Viscous coupling nuts (c) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

2.	Propeller shaft No.2
3.	Viscous coupling with center support
4.	Propeller shaft No.1 with center support
5.	Dynamic damper

Propeller Shaft Inspection



- Inspect propeller shaft and flange yoke for damage.
- Inspect propeller shaft for runout.
  If damage is found or shaft runout exceeds its limit, replace.

Propeller shaft runout
Limit : 0.7 mm (0.028 in.)

Tightening Torque Specification

Fastening portion	Tightening torque		
	N•m	kg-m	lb-ft
Propeller shaft bolts	23	2.3	17.0
Propeller shaft No.2 bolt	23	2.3	17.0
Center support bolt	55	5.5	40.0
Viscous coupling nut	23	2.3	17.0

Required Service Material

Material	Recommended SUZUKI Material (Part Number)	Use
Thread lock cement	THREAD LOCK CEMENT 1322 (99000-32110)	• Propeller shaft No.2 bolt

SECTION 5

BRAKES

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

NOTE:

- **When inspecting and servicing vehicle equipped with ABS, be sure to refer to SECTION 5E first.**
- **All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.**

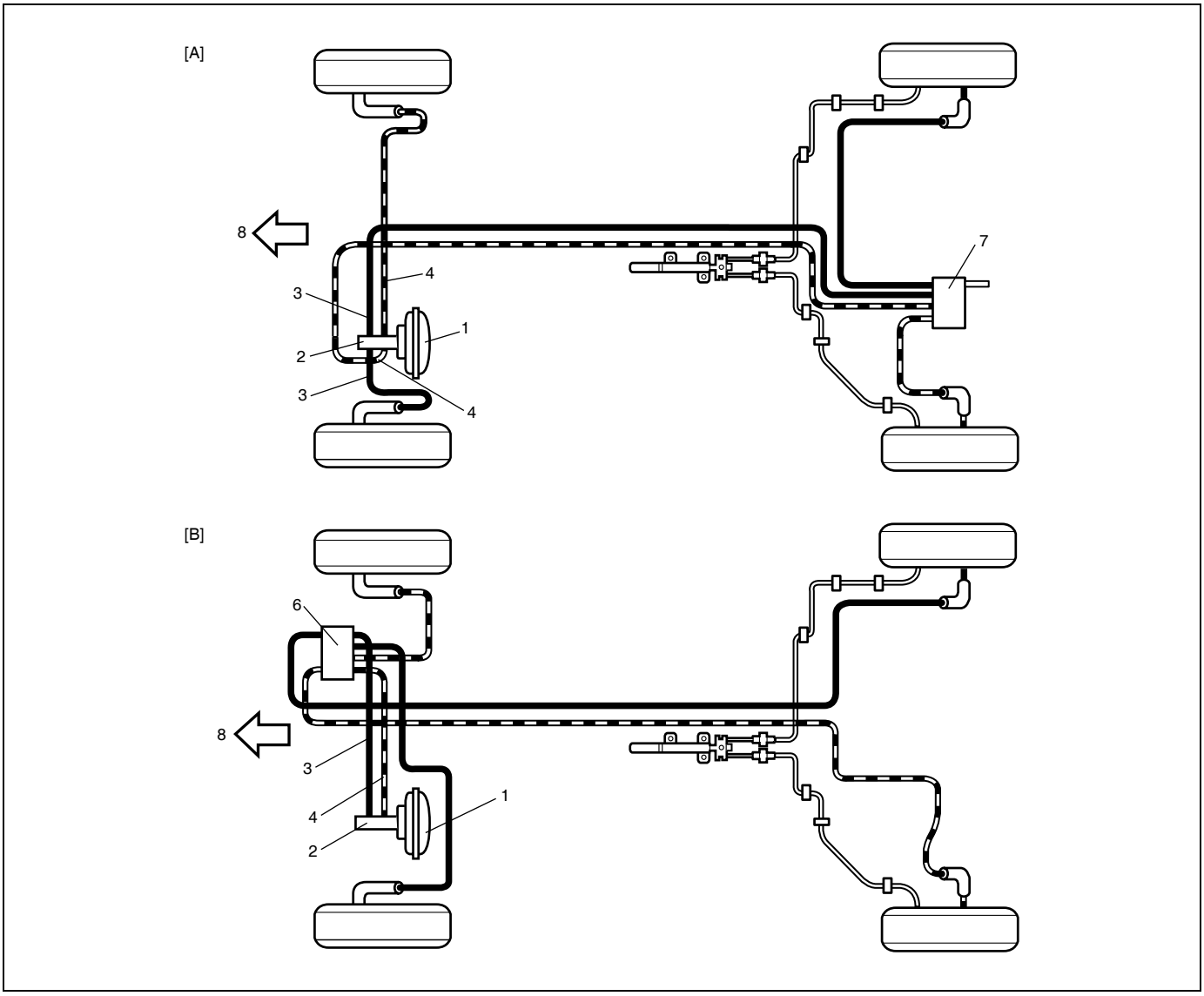
CONTENTS

General Description

When the foot brake pedal is depressed, hydraulic pressure is developed in the master cylinder to actuate pistons (two in front and four in rear).
The master cylinder is a tandem master cylinder. Brake pipes are connected to the master cylinder and they make two independent circuits. One connects front right & rear left brakes and the other connects front left & rear right brakes.
The load sensing proportioning valve (LSPV) is included in these circuits between the master cylinder and the rear brake for the vehicle without ABS.
In this brake system, the disc brake type is used for the front wheel brake and a drum brake type (leading / trailing shoes) for the rear brake.
The parking brake system is mechanical. It applies brake force to only rear wheels by means of the cable and mechanical linkage system. The same brake shoes are used for both parking and foot brakes.

NOTE:

The figures shows left-hand steering vehicle.
The figure for right-hand steering vehicle should be symmetrical.



[A]: For vehicle without ABS	3. Secondary side	7. LSPV (Load Sensing Proportioning Valve)
[B]: For vehicle with ABS	4. Primary side	8. Forward
1. Brake booster	5. Blank	
2. Master cylinder	6. ABS hydraulic unit / control module assembly	

Diagnosis

Road Testing Brakes

Brakes should be tested on dry, clean, smooth and reasonably level roadway which is not crowned. Road test brakes by making brake applications with both light and heavy pedal forces at various speeds to determine if the vehicle stops evenly and effectively.

Also drive vehicle to see if it leads to one side or the other without brake application. If it does, check the tire pressure, front wheel alignment and front suspension attachments for looseness. See diagnosis table for other causes.

Brake Fluid Leaks

Check the master cylinder fluid levels. While a slight drop in reservoir level does result from normal lining wear, an abnormally low level indicates a leak in the system. In such a case, check the entire brake system for leakage. If even a slight evidence of leakage is noted, the cause should be corrected or defective parts should be replaced.

If fluid level is lower than the minimum level of reservoir, refilling is necessary. Fill reservoir with specified brake fluid.

Brake fluid: Refer to reservoir tank cap.

CAUTION:

Since brake system of this vehicle is factory filled with brake fluid indicated on reservoir tank cap, do not use or mix different type of fluid when refilling; otherwise serious damage will occur.

Do not use old or used brake fluid, or any fluid from a unsealed container.

Substandard or Contaminated Brake Fluid

Improper brake fluid, mineral oil or water in the fluid may cause the brake fluid to boil or the rubber components in the hydraulic system to deteriorate.

If deterioration of rubber is evident, disassemble all hydraulic parts and wash with alcohol. Dry these parts with compressed air before assembly to keep alcohol out of the system. Replace all rubber parts in the system, including hoses. Also, when working on the brake mechanisms, check for fluid on the linings. If excessive fluid is found, replace the linings.

The system must be flushed if there is any doubt as to the grade of fluid in the system or if fluid has been used which contained parts that have been subjected to contaminated fluid.

Diagnosis Table

Condition	Possible Cause	Correction
Not enough braking force	Brake fluid leakage from brake lines	Locate leaking point and repair.
	Overheated brakes	Determine cause and repair.
	Poor contact of shoes on brake drum	Repair for proper contact.
	Brake shoes linings stained with oil or wet with water	Replace.
	Badly worn brake linings	Replace pads or shoes.
	Defective wheel cylinders	Repair or replace.
	Malfunctioning caliper assembly	Repair or replace.
	Air in system	Bleed system.
	Maladjusted sensor spring length of LSPV, if equipped	Check or adjust.
	Broken sensor spring of LSPV, if equipped	Replace.
	Defective LSPV, if equipped	Replace.
	Malfunctioning ABS (Antilock brake system), if equipped	Check system and replace as necessary.
Brake pull (Brakes not working in unison)	Pad linings and/or shoe linings are wet with water or stained with oil in some brakes	Replace.
	Drum-to-shoe clearance out of adjustment in some brakes (Malfunctioning auto adjusting mechanism)	Check for inoperative auto adjusting mechanism.
	Disc and/or drum is out of round in some brakes	Replace.
	Wheel tires are inflated unequally	Inflate equally.
	Malfunction in wheel cylinders	Repair or replace.
	Disturbed front wheel alignment	Adjust as prescribed.
	Unmatched tires on same axle	Tires with approximately the same amount of tread should be used on the same axle.
	Restricted brake pipes or hoses	Check for soft hoses and damaged lines. Replace with new hoses and new double-walled steel brake tubing.
	Malfunctioning caliper assembly	Check for stuck or sluggish pistons and proper lubrication of caliper slide bush. Caliper should slide.
	Loose suspension parts	Check all suspension mountings.
	Loose calipers	Check and torque bolts to specifications.
Noise (high pitched squeak without brake applied)	Front lining worn out	Replace linings.
	Contact wear indicator to brake disc	Replace pads.
Rear brake locked prematurely	Maladjusted sensor spring length of LSPV, if equipped	Check or adjust.
	Malfunction LSPV assembly, if equipped	Replace assembly.

Condition	Possible Cause	Correction
Excessive pedal travel (Pedal stroke too large)	Partial brake system failure	Check brake systems and repair as necessary.
	Insufficient fluid in master cylinder reservoirs	Fill reservoirs with approved brake fluid. Check for leaks and air in brake system. Check warning light. Bleed system if required.
	Air in system (soft / spongy pedal)	Bleed system.
	Rear brake system not adjusted (malfunctioning auto adjusting mechanism)	Repair auto adjusting mechanism. Adjust rear brakes.
	Bent brake shoes	Replace brake shoes.
	Worn rear brake shoes	Replace brake shoes.
Brake locked (For vehicle equipped with ABS)	Malfunctioning ABS	Check system referring to “ABS Diagnostic Flow Table” in Section 5E.
Dragging brakes (A very light drag is present in all brakes immediately after pedal is released)	Master cylinder pistons not returning correctly	Replace master cylinder.
	Restricted brake pipes or hoses	Check for soft hoses or damaged pipes and replace with new hoses and/or new double-walled steel brake piping.
	Incorrect parking brake adjustment on rear brakes	Check and adjust to correct specifications.
	Weakened or broken return springs in the brake	Replace.
	Sluggish parking brake cables or linkage	Repair or replace.
	Wheel cylinder or caliper piston sticking	Repair as necessary.
	Badly worn piston seal in caliper	Replace piston seal.
Pedal pulsation (Pedal pulsates when depressed for braking)	Damaged or loose wheel bearings	Replace wheel bearings.
	Distorted steering knuckle or rear axle shaft	Replace knuckle or rear axle shaft.
	Excessive disc lateral runout	Check per instructions. If not within specifications, replace or machine disc.
	Parallelism between pad and disc not within specifications	Check per instructions. If not within specifications, replace or machine disc.
	Rear drums out of round	Check runout. Repair or replace drum as necessary.
Braking noise	Glazed shoe linings or foreign matters stuck to linings	Repair or replace shoe linings.
	Worn or distorted shoe linings	Replace shoe lining (or pad).
	Loose front wheel bearings	Replace wheel bearing.
	Distorted backing plates or loose mounting bolts	Replace or retighten securing bolts.
	Contact wear indicator to brake disc	Replace pads.

Condition	Possible Cause	Correction
Brake warning lamp lights after engine start	Parking brake applied	Release parking brake and check that brake warning lamp turns off.
	Insufficient amount of brake fluid	Add brake fluid.
	Brake fluid leaking from brake line	Investigate leaky point, correct it and add brake fluid.
	Brake warning lamp circuit faulty	Repair circuit.
	Malfunctioning ABS system, if equipped with ABS.	Check system referring to “ABS Diagnostic Flow Table” in Section 5E.
Brake warning lamp turns on when brake is applied	Brake fluid leaking from brake line	Investigate leaky point, correct it and add brake fluid.
	Insufficient amount of brake fluid	Add brake fluid.
Brake warning lamp fails to turn on even when parking brake is applied	Brake warning lamp circuit faulty	Replace bulb or repair circuit.
ABS warning lamp turns on after engine start (If equipped)	Malfunctioning ABS	Check system referring to “ABS Diagnostic Flow Table” in Section 5E.
ABS warning lamp turns on when brake is applied (If equipped)	Brake fluid leaking from brake line	Investigate leaky point, correct it and add brake fluid.
	Insufficient amount of brake fluid	Add brake fluid.
	Malfunctioning ABS	Check system referring to “ABS Diagnostic Flow Table” in Section 5E.
ABS warning lamp does not turn on for 2 sec. after ignition switch has turned ON	Bulb burnt out	Replace bulb.
	Malfunctioning ABS	Check system referring to “ABS Diagnostic Flow Table” in Section 5E.

Check and Adjustment

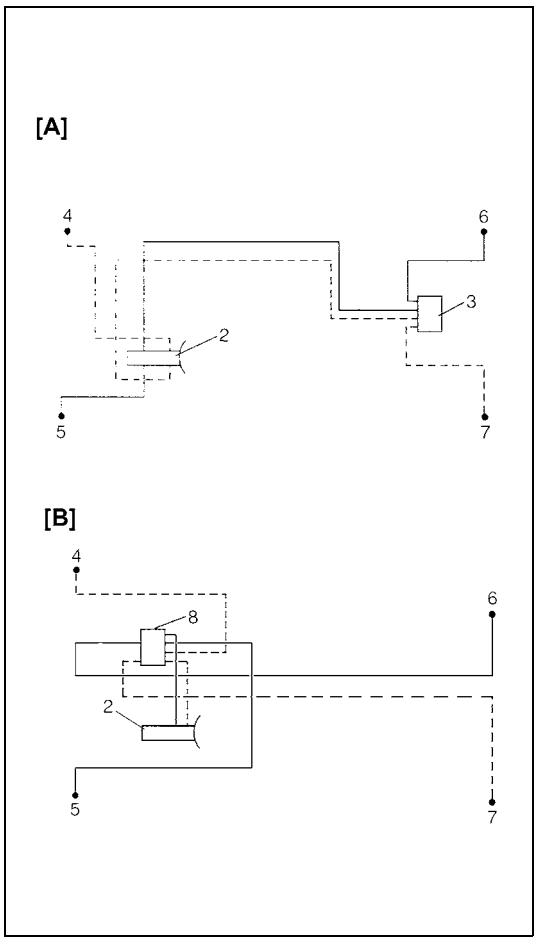
Air Bleeding of Brake System

CAUTION:

Brake fluid is extremely damaging to paint. If fluid should accidentally touch painted surface, immediately wipe fluid from paint and clean painted surface.

NOTE:

For vehicle equipped with ABS, make sure that ignition switch is turned off.



Bleeding operation is necessary to remove air whenever it entered hydraulic brake system.

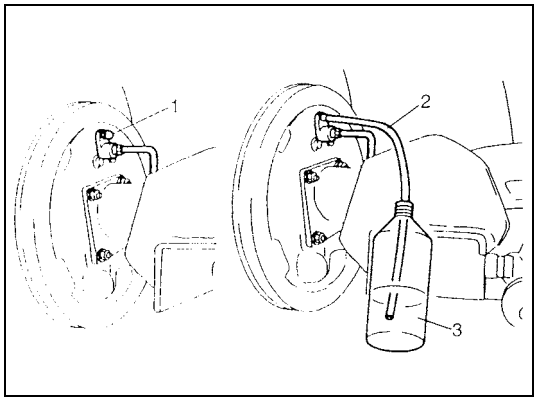
Hydraulic lines of brake system are based on the diagonal split system. When a brake pipe or hose was disconnected at the wheel, bleeding operation must be performed at both ends of the line of the removed pipe or hose. When any joint part of the master cylinder or other joint part between the master cylinder and each brake (wheel) was removed, the hydraulic brake system must be bled at all 4 wheel brakes.

NOTE:

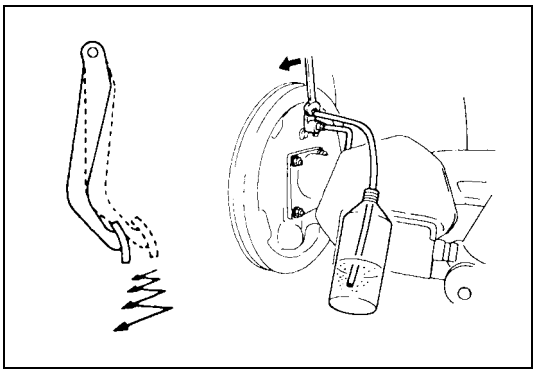
Perform bleeding operation starting with wheel cylinder farthest from master cylinder and then at front caliper of the same brake line. Do the same on the other brake line.

[A]:	Without ABS
[B]:	With ABS
1.	Blank
2.	Master cylinder
3.	LSPV
4.	Right brake caliper
5.	Left brake caliper
6.	Right wheel cylinder
7.	Left wheel cylinder
8.	ABS hydraulic unit
●:	Air bleeding point

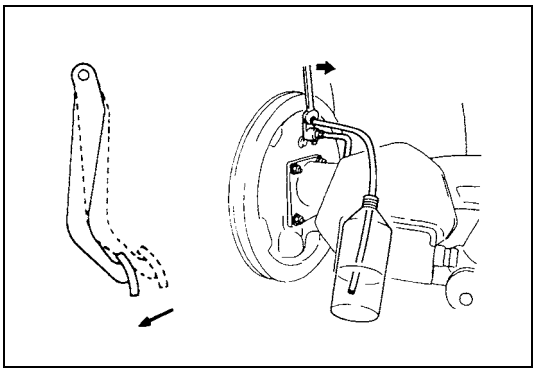
1) Fill master cylinder reservoir with brake fluid and keep at least one-half full of fluid during bleeding operation.



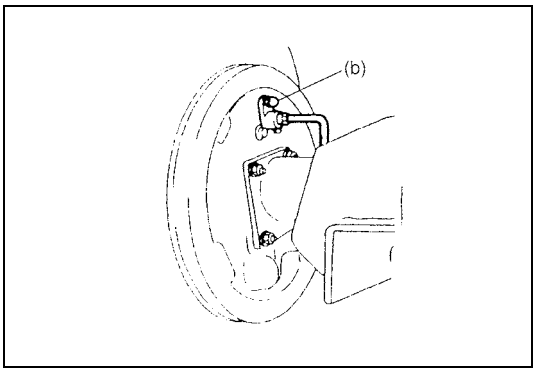
2) Remove bleeder plug cap (1).
   Attach a vinyl tube (2) to bleeder plug of wheel cylinder, and insert the other end into container (3).



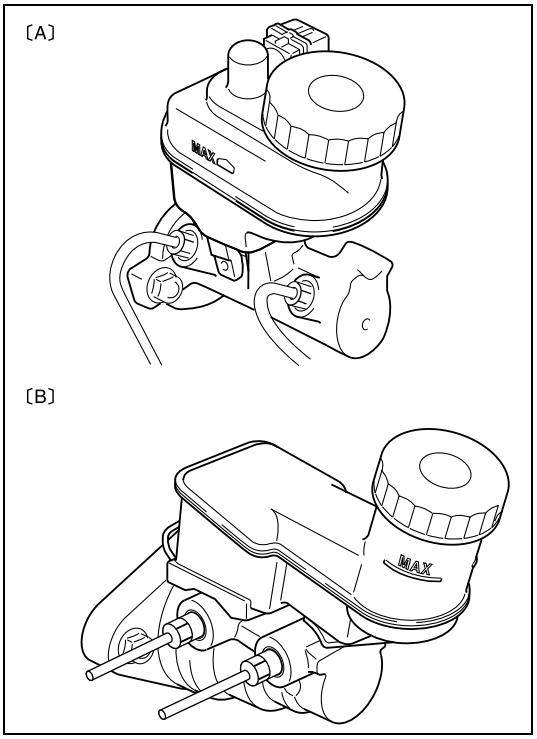
3) Depress brake pedal several times, and then while holding it depressed, loosen bleeder plug about one-third to one half turn.



4) When fluid pressure in the cylinder is almost depleted, retighten bleeder plug.
5) Repeat this operation until there are no more air bubbles in hydraulic line.



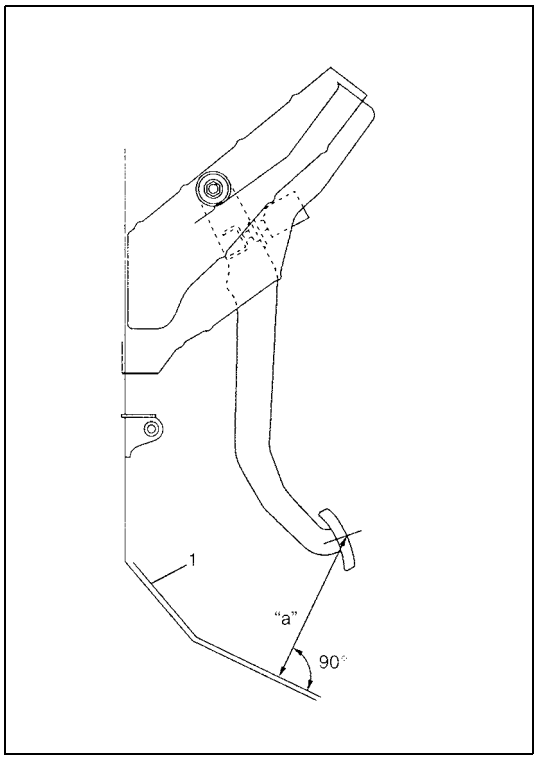
6) When bubbles stop, with depressing brake pedal, tighten bleeder plug.
Tightening torque
Bleeder plug
(b): 8.5 N·m (0.85 kg-m, 6.5 lb-ft) for rear brake
Bleeder plug
(b): 6.5 N·m (0.65 kg-m, 5.0 lb-ft) for front brake
7) Then attach bleeder plug cap.
8) After completing bleeding operation, apply fluid pressure to pipe line and check for leakage.



9) Replenish fluid into reservoir up to specified level.
10) Check brake pedal for “sponginess”. If found spongy, repeat entire procedure of bleeding.

[A]: Left-hand steering vehicle
[B]: Right-hand steering vehicle

Brake Pedal Free Height Check

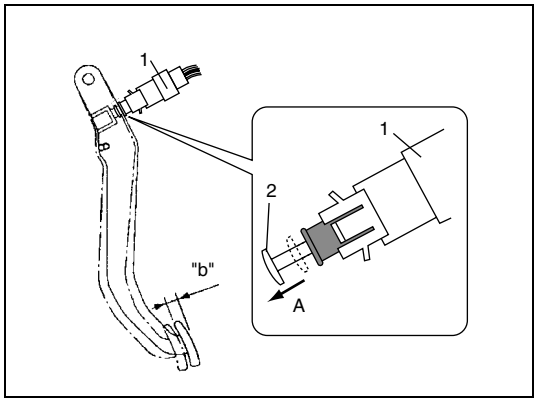


Peel off carpet and check brake pedal for free height.
If it is not within specification, check and adjust the following items.

Brake pedal free height
"a" from silencer (1): 152 – 162 mm (6.0 – 6.4 in.)

- Check brake pedal for dent.
- Check that brake booster is installed securely.
- Check stop light switch position referring to "Brake (Stop) Light Switch Check" below.
- Check measurement between booster mounting surface and center of clevis pin hole referring to "Brake Booster Inspection (for LH Model)" or "Brake Booster Inspection and Adjustment (for RH Model)" in Section 5A.

Brake (Stop) Light Switch Check

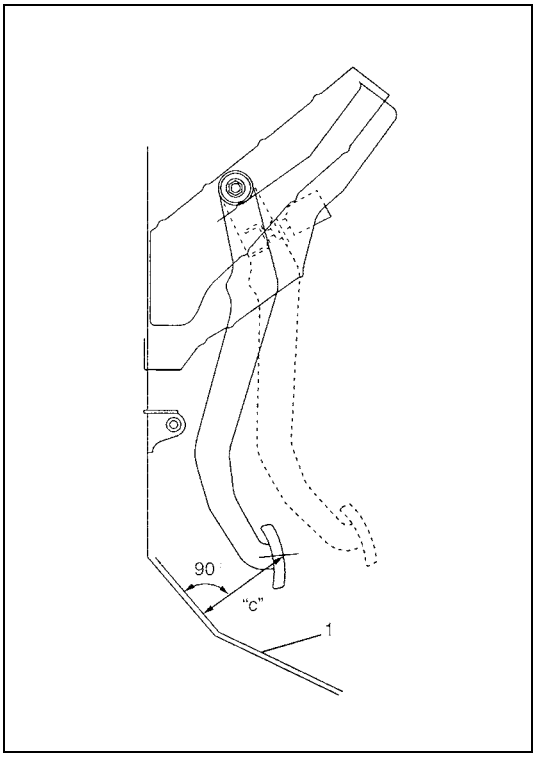


1) Check that stop light lights when brake pedal is depressed the specified distance.
   If the measured value is below the specified value, pull switch slider (2) of brake light switch (1) in the direction of arrow (A) in the figure to measure the distance again. Though the measured value is below or above the specified value, check the following and replace if found defective.

   Distance "b": 3.5 – 14 mm (0.14 – 0.55 in.)

   a) Check brake light switch referring to "Brake Light Switch Inspection" in Section 8A.
   b) Check brake pedal for dent.
   c) Check brake booster for installation.
   d) Check brake booster distance between booster installation surface and the center of clevis pin hole to standard value referring to "Brake Booster Inspection (for LH Model)" or "Brake Booster Inspection and Adjustment (for RH Model)" in Section 5A.
2) Check that stop light is turned off when brake pedal released.

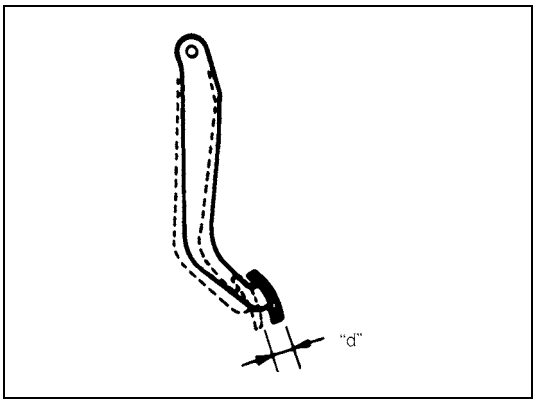
Excessive Pedal Travel Check



1) Peel off carpet and start engine.
2) Depress brake pedal a few times.
3) With brake pedal depressed with approximately 300 N (30kg, 66 lbs) load, measure pedal to silencer (1) clearance "c".
4) If clearance "c" is less than specification, the most possible cause is either rear brake shoes are worn out beyond limit or air is in lines.
   Should clearance "c" is remained less than specification even after replacement of brake shoes and bleeding of system, other possible but infrequent cause is malfunction of rear brake shoe adjusters or booster push rod length out of adjustment.
   – Bleed brake system. Refer to "Air Bleeding of Brake System" in this section.
   – Remove brake drums for adjuster inspection. (Refer to "Brake Drum Removal and Installation (for 2WD Model)" in Section 5C.) If defective, correct or replace.

Clearance between brake pedal and dash panel silencer
"c": Over 115 mm (4.53 in.)··· Left-hand steering vehicle
"c": Over 88 mm (3.46 in.)··· Right-hand steering vehicle

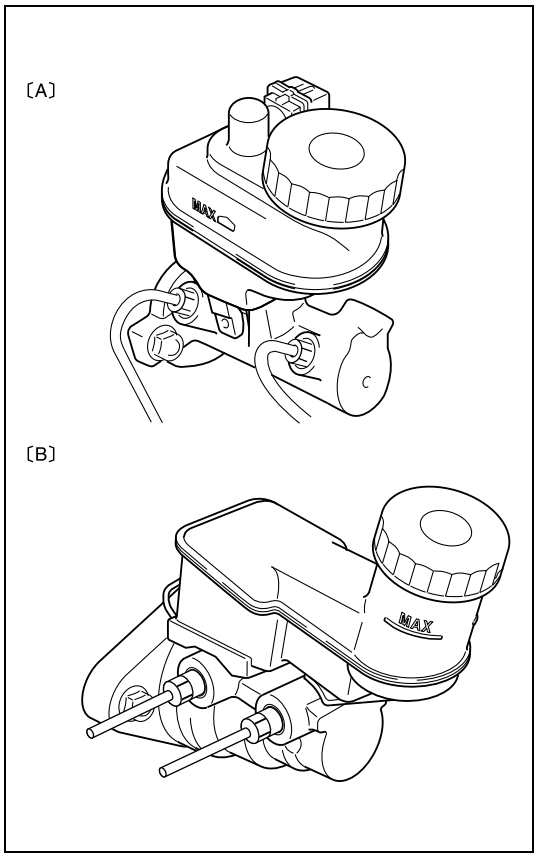
Brake Pedal Play Check



Pedal play should be within specification. If out of specification, check brake light switch for proper installation position and adjust if necessary.
Also check pedal shaft bolt and master cylinder pin installation for looseness and replace if defective.

Pedal play
"d": 1 – 8 mm (0.04 – 0.32 in.)

Brake Fluid Level Check



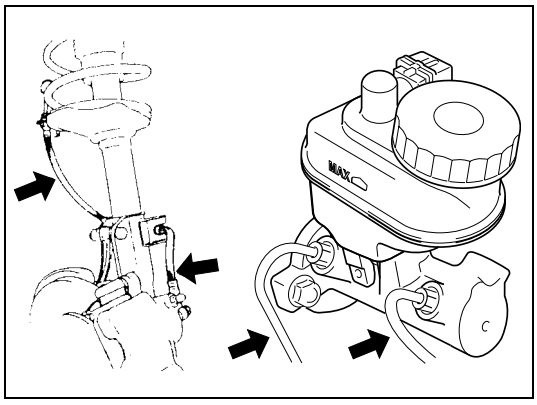
Be sure to use particular brake fluid either as indicated on reservoir cap of that vehicle or recommended in owner's manual which comes along with that vehicle.
Use of any other fluid is strictly prohibited.
Fluid level should be between MIN and MAX lines marked on reservoir.
When warning light lights sometimes during driving, replenish fluid to MAX line.
When fluid decreases quickly, inspect brake system for leakage. Correct leaky points and then refill to specified level.

CAUTION:

Do not use shock absorber fluid or any other fluid which contains mineral oil. Do not use a container which has been used for mineral oil or a container which is wet from water.
Mineral oil will cause swelling and distortion of rubber parts in hydraulic brake system and water mixed into brake fluid will lower fluid boiling point. Keep all fluid containers capped to prevent contamination.

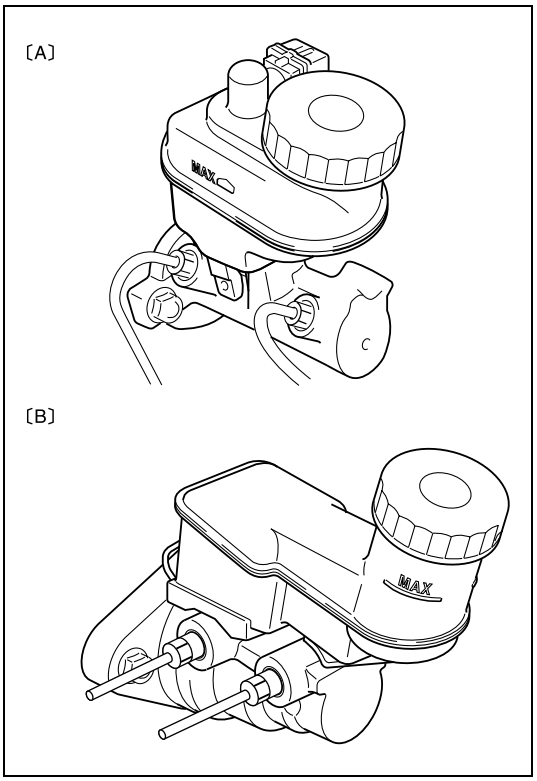
[A]: Left-hand steering vehicle
[B]: Right-hand steering vehicle

Brake Hose and Pipe Check



The brake hose assembly should be checked for road hazard damage, for cracks and chafing of the outer cover, for leaks and blisters.
A light and mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, it is necessary to replace it.
Inspect the pipe for damage, cracks, dents and corrosion. If any defect is found, replace it.

Master Cylinder Check



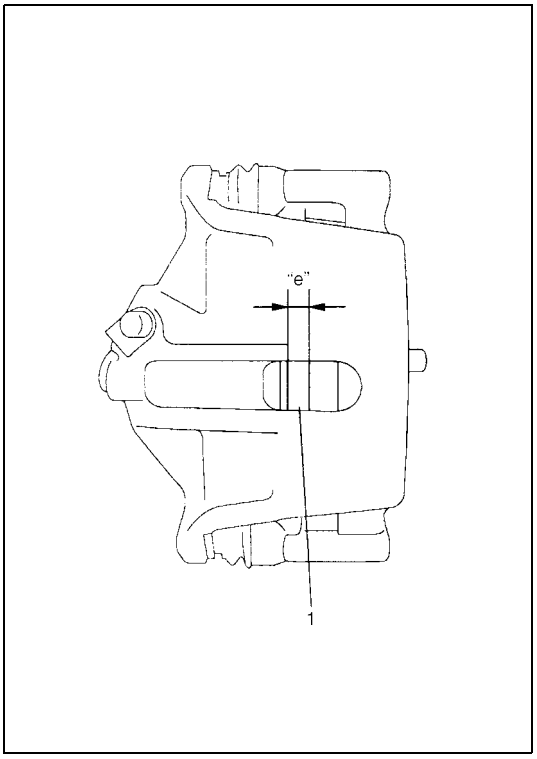
Check master cylinder and reservoir tank for crack, damage and brake fluid leakage. If any faulty condition exists, correct or replace.

[A]: Left-hand steering vehicle
[B]: Right-hand steering vehicle

Brake Disc Check

Refer to item “Front Disc Brake Pad Inspection” of Section 5B for inspection point and procedure.

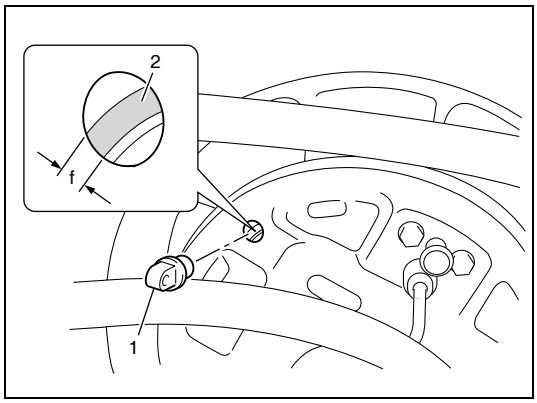
Brake Pad Check



Inspect pad linings periodically according to maintenance schedule whenever wheels are removed (for tire rotation or other reason).
Take a look through hole of caliper and check lining (1) thickness of each pad.
If one of brake pad is worn to service limit, all linings must be replaced at the same time.

Thickness “e”
Service limit: 2.0 mm (0.08 in.)

Brake Shoe Check



Inspection should be carried out on the following points after brake pedal travel “c” (pedal to silencer clearance) check as described on previous page of this section, even when it is more than specification.

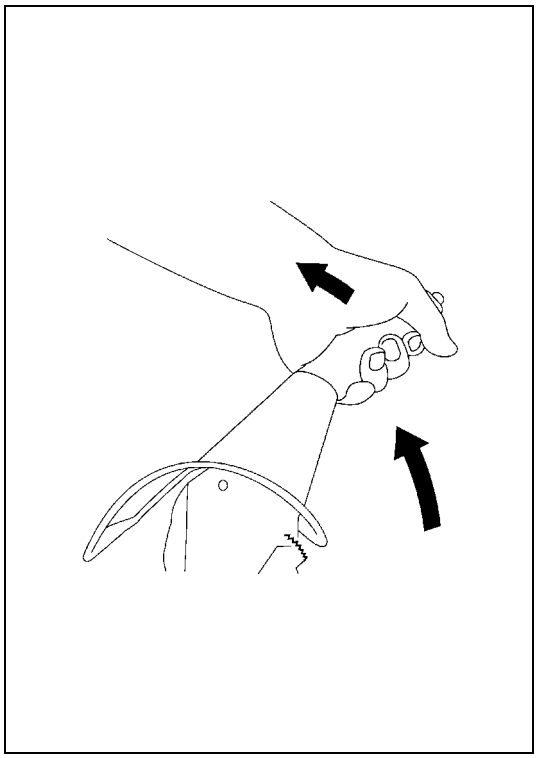
Amount of brake shoe wear can be checked as follows.

1) Hoist vehicle.
2) Remove rubber cover (plug) (1) from brake back plate.
3) Through hole of back plate, visually check for thickness of brake shoe lining (2). If lining thickness “f” is less than specified wear limit, replace all brake shoes with new ones.

Thickness “f”
Service limit: 1.0 mm (0.04 in.)

Parking Brake Inspection and Adjustment

INSPECTION



Hold center of parking brake lever grip and pull it up with 200 N (20 kg, 44 lbs) force.

With parking brake lever pulled up as shown, count ratchet notches. There should be 4 to 9 notches.

Also, check if both right and left rear wheels are locked firmly.

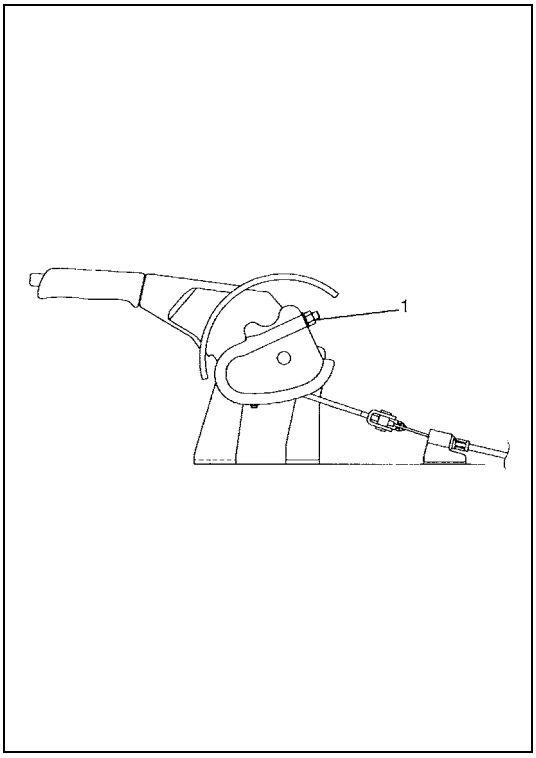
To count number of notches easily, listen to click sounds that ratchet makes while pulling parking brake lever without pressing its button.

One click sound corresponds to one notch.

If number of notches is out of specification, adjust cable referring to adjustment procedure so as to obtain specified parking brake stroke.

NOTE:

Check tooth tip of each notch for damage or wear. If any damage or wear is found, replace parking brake lever.



ADJUSTMENT

NOTE:

Make sure for the following conditions before cable adjustment.

- **No air is trapped in brake system.**
- **Brake pedal travel is proper.**
- **Brake pedal is depressed repeatedly with about 300 N (30 kg, 66 lbs) load until adjuster actuator clicking sound can not be heard from drum brake.**
- **Parking brake lever is pulled up a few times with about 200 N (20 kg, 44 lbs) force.**
  If parking brake cable is replaced with new one, pull up parking brake lever a few times with about 500 N (50 kg, 110 lbs) force.
- **Rear brake shoes are not worn beyond limit, and self adjusting mechanism operates properly.**
- **If parking brake lever stroke is less than specification, loosen adjusting nut (1) as far as end of bolt. Then depress brake pedal repeatedly with about 300 N (30 kg, 66 lbs) load until adjuster actuator clicking sound can not be heard from drum brake.**

After confirming that above conditions are all satisfied, adjust parking brake lever stroke by loosening or tightening adjust nut.

CAUTION:
Check brake drum for dragging after adjustment.

Parking brake stroke
(When lever is pulled up at 200 N (20 kg, 44 lbs).):
4 to 9 notches

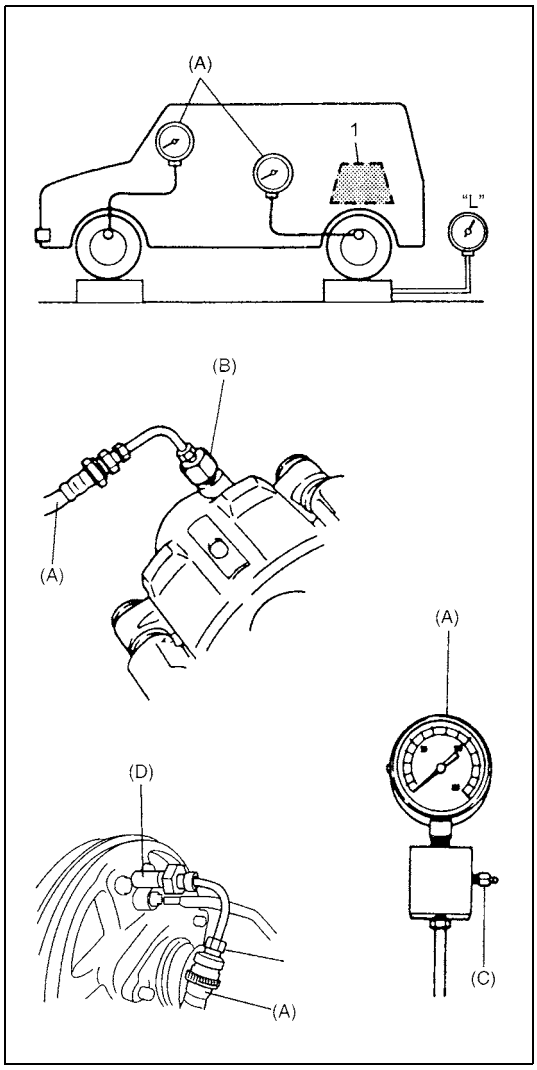
Flushing Brake Hydraulic System

It is recommended that entire hydraulic system be thoroughly flushed with clean brake fluid whenever new parts are installed in hydraulic system.
Periodical change of brake fluid is also recommended.

Brake Fluid Pressure Test (if equipped with LSPV)

Test procedure for LSPV assembly is as follows.
Before testing, confirm the following.

- Fuel tank is filled with fuel fully.
- Vehicle is equipped with spare tire, tools, jack and jack handle.



1) Place vehicle on level floor and set approximately about 1,000 N (100 kg, 220 lbs) weight (1) on rear housing so that rear axle weighs 4,500 N (450 kg, 992 lbs).

Rear axle weight
"L": 4,500 N (450 kg, 992 lbs)

2) Install special tool to front and rear brake.

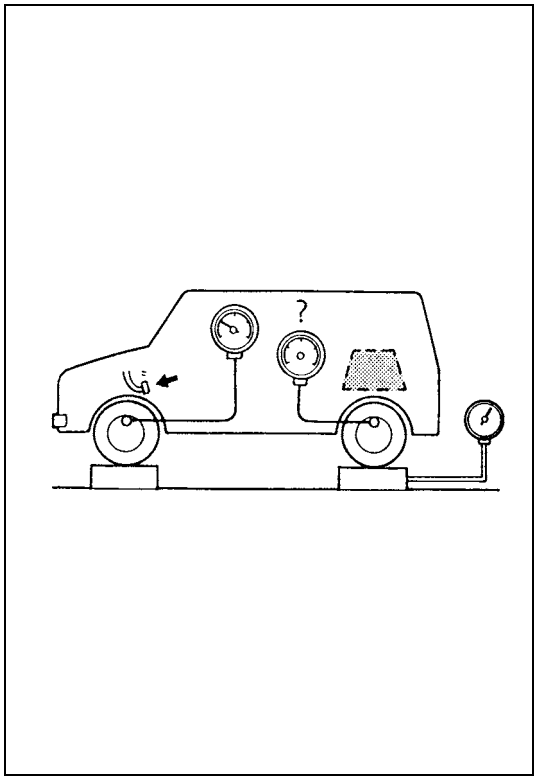
NOTE:

Pressure gauge should be connected to bleeder plug hole of front (left side brake) and rear (right side brake). After testing front left side and rear right side, test front right side and rear left side in the same way.

NOTE:

For front brake, use special tool (B) instead of thread diameter 10 mm attachment included in special tool (A).

Special tool
(A): 09956-02311
(B): 09952-36311 (Front wheel brake)
(C): 55473-82030 (Air bleeder plug as a spare part)
(D): 09952-48320 (Rear wheel brake)



3) Depress brake pedal gradually till fluid pressure of front brake becomes as specified below and check corresponding pressure of rear brake then. It should be within specification given below.

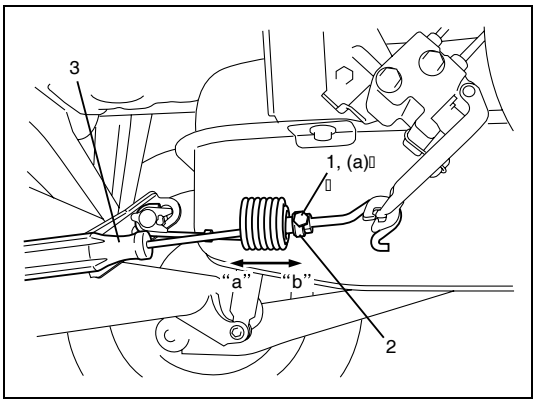
Rear brake pressure with applied by 75 kg/cm^2 on front brake

Front brake	Rear brake
7,500 kPa (75 kg/cm^2, 1,067 psi)	3,750 – 5,250 kPa (37.5 – 52.5 kg/cm^2, 533 – 747 psi)

4) As done above, apply 100 kg/cm^2 pressure to front brake and check that rear brake pressure then is within specification as given below.

Rear brake pressure with applied by 100 kg/cm^2 on front brake

Front brake	Rear brake
10,000 kPa (100 kg/cm^2, 1,422 psi)	4,250 – 5,750 kPa (42.5 – 57.5 kg/cm^2, 605 – 818 psi)



5) If rear brake pressure is not within specification, adjust it by changing spring bracket (2) position as follows.
   Make sure that this adjustment dose not cause any play between bracket (2) and spring (looseness in "a" to "b" direction as indicated in figure).
   - If rear brake pressure is higher than specification, move spring bracket (2) to direction "a" and if it is lower, to direction "b" by pushing spring bracket with a screw driver (3).
   - Repeat steps 3) and 4) until rear brake pressure is within specification.
   - After adjustment, be sure to torque screw (1) to specification.

   Tightening torque
   Setting screw (a): 9 N·m (0.9 kg-m, 6.5 lb-ft)
6) Upon completion of fluid pressure test, bleed brake system and perform brake test.

Booster Operation Check

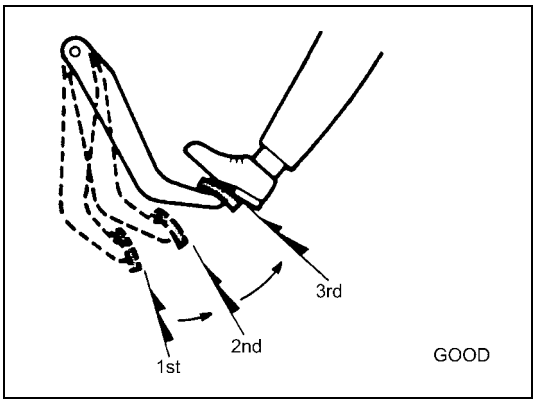
There are two ways to perform this inspection, with and without a tester. Ordinarily, it is possible to roughly determine its condition without using a tester.

NOTE:

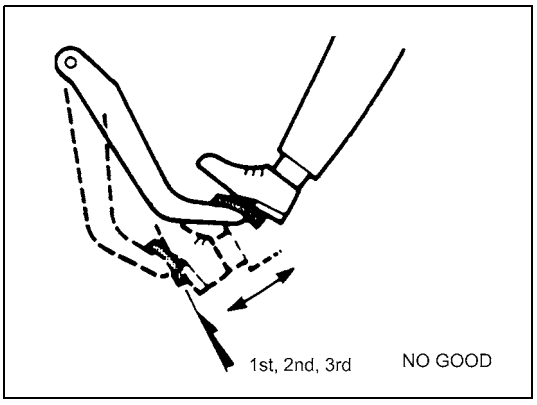
For this check, make sure that no air is in hydraulic line.

Check air tightness

1) Start engine.
2) Stop engine after running for 1 to 2 minutes.



3) Depress brake pedal several times with the same load as in ordinary braking and observe pedal travel. If pedal goes down deep the first time but its travel decreases as it is depressed the second and more times, air tightness is obtained.

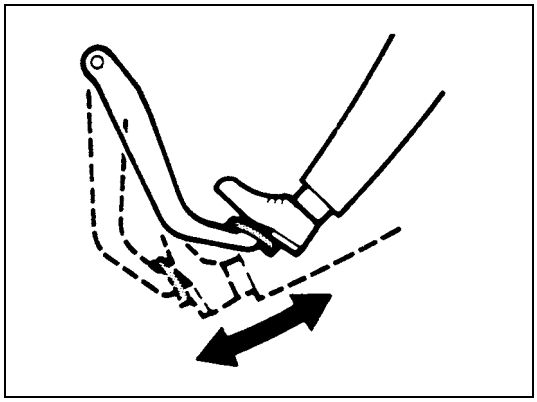


4) If pedal travel doesn't change, air tightness isn't obtained.

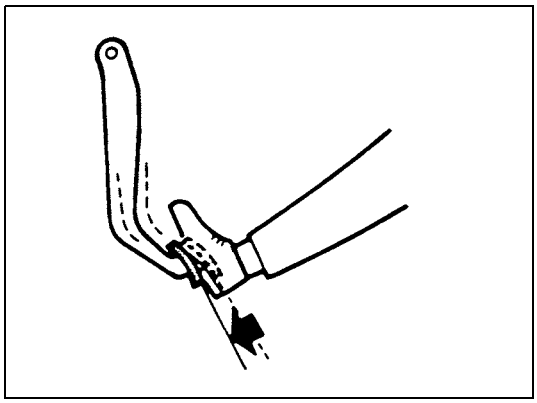
NOTE:

If defective, inspect vacuum lines and sealing parts, and replace any faulty part.
When this has been done, repeat the entire test.

Check operation

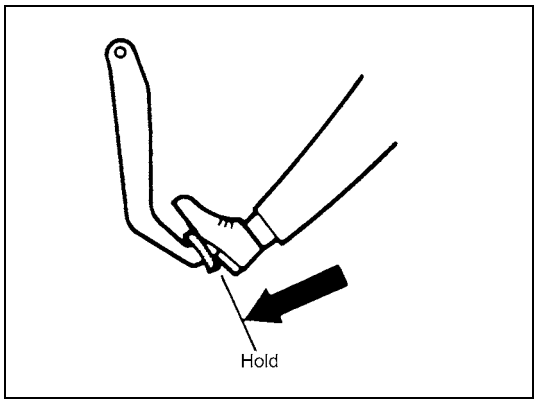


1) With engine stopped, depress brake pedal several times with the same load and make sure that pedal travel doesn't change.

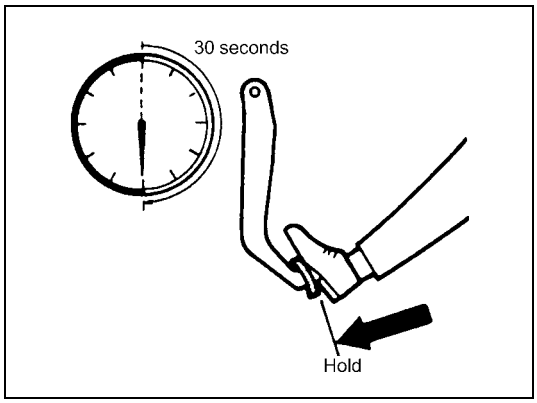


2) Start engine while depressing brake pedal. If pedal travel increases a little, operation is satisfactory. But no change in pedal travel indicates malfunction.

Check air tightness under load



1) With engine running, depress brake pedal. Then stop engine while holding brake pedal depressed.



2) Hold brake pedal depressed for 30 seconds. If pedal height does not change, condition is good. But it isn't if pedal rises.

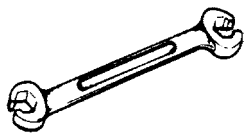
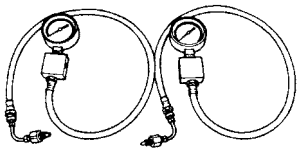
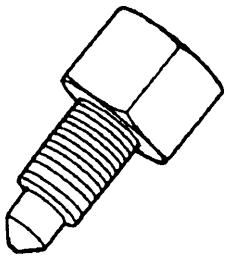
Tightening Torque Specifications

Fastening part		Tightening torque		
		N•m	kg-m	lb-ft
Brake pipe flare nut		16	1.6	11.5
Brake bleeder plug	Front caliper	6.5	0.65	5.0
	Wheel cylinder	8.5	0.85	6.5
LSPV mounting bolt		26	2.6	19.0
LSPV spring end nut		20	2.0	14.5
LSPV spring bracket screw		9	0.9	6.5
Wheel bolt		95	9.5	69.0

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Brake fluid	DOT 4 or SAE J1704	• To fill master cylinder reservoir • To clean and apply to inner parts of caliper and wheel cylinder when they are disassembled

Special Tool

			
09950-78230 Flare nut wrench (10 x 11 mm)	09956-02311 Fluid pressure gauge	09952-36311 Pressure gauge attachment	09952-48320 Pressure gauge attachment

SECTION 5A

BRAKES PIPE / HOSE / MASTER CYLINDER

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

NOTE:

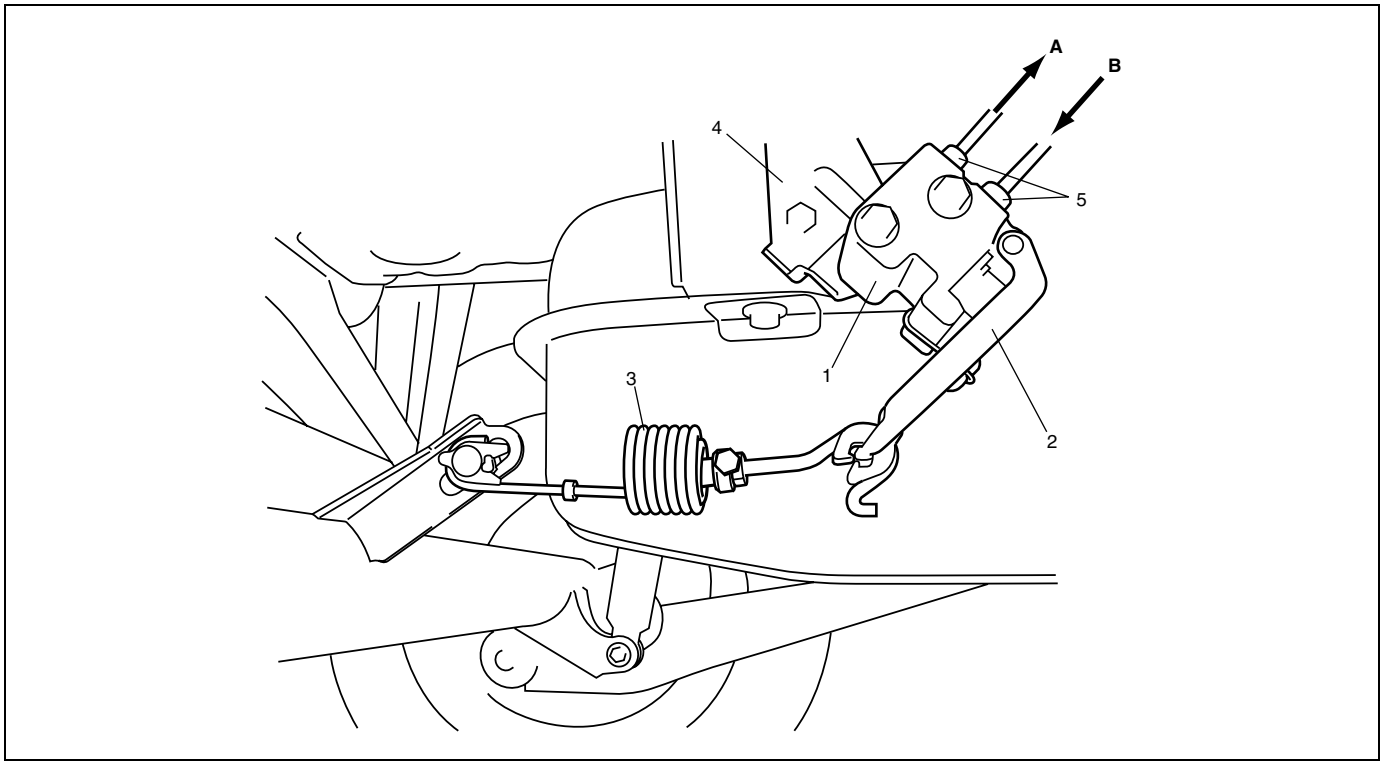
All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.

CONTENTS

General Description

LSPV (Load Sensing Proportioning Valve) Assembly Description (if equipped)

As shown in the figure below, LSPV is included within the brake circuit which connects the master cylinder and the rear wheel brake. It controls the hydraulic pressure applied to the rear wheel brake according to the loaded state of the vehicle (or weight of the load), whereby preventing the rear wheels from getting locked prematurely.



1. LSPV assembly	3. Spring	5. Brake pipe flare nut	B. from master cylinder
2. LSPV lever	4. Bracket	A. to rear brake	

Diagnosis

Refer to Section 5 BRAKES.

Check and Adjustment

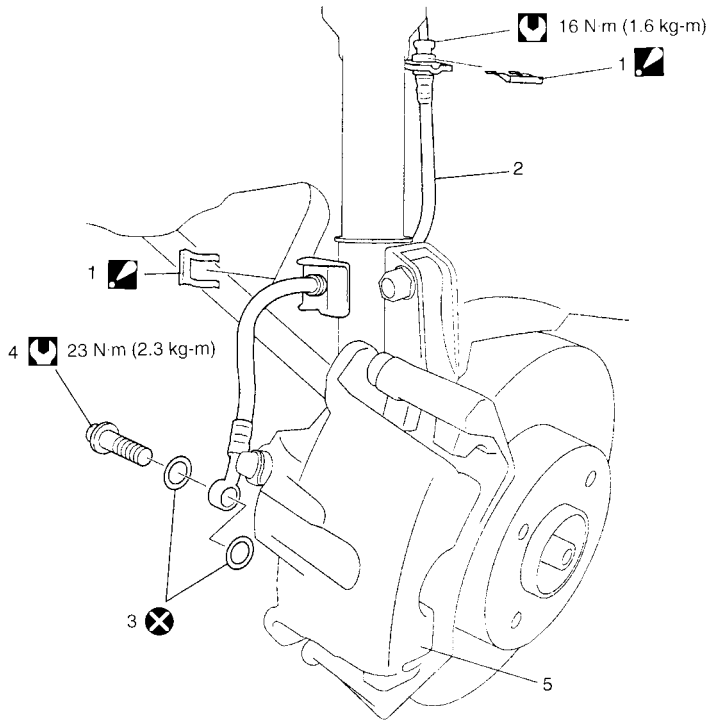
Refer to Section 5 BRAKES.

On-Vehicle Service

CAUTION:

- **Lubricate rubber parts with clean, fresh brake fluid to ease assembly.**
- **Do not use lubricated shop air on brake parts as damage to rubber components may result.**
- **If any hydraulic component is removed or brake line disconnected, bleed the brake system.**
- **The torque values specified are for dry, unlubricated fasteners.**
- **Do not allow brake fluid to get on painted surfaces. Painted surfaces will be damaged by brake fluid.**

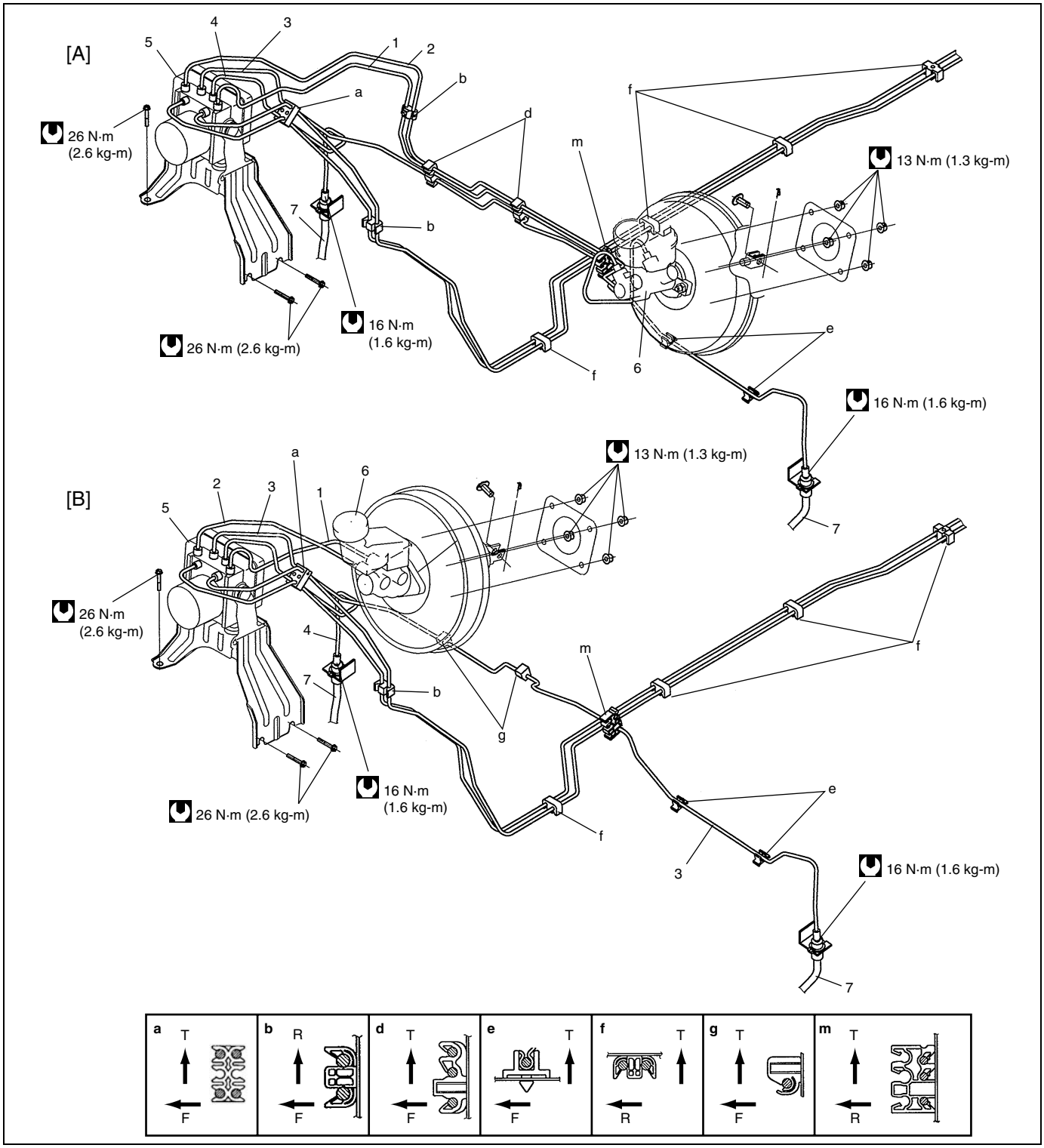
Front Brake Hose Components Location



◪	1. E-ring: Insert E-ring till its end surface is flush with or deeper than bracket end surface.	3. Hose washer	5. Bracket caliper	Tightening torque
	2. Flexible hose	4. Hose bolt		⊗ Do not reuse

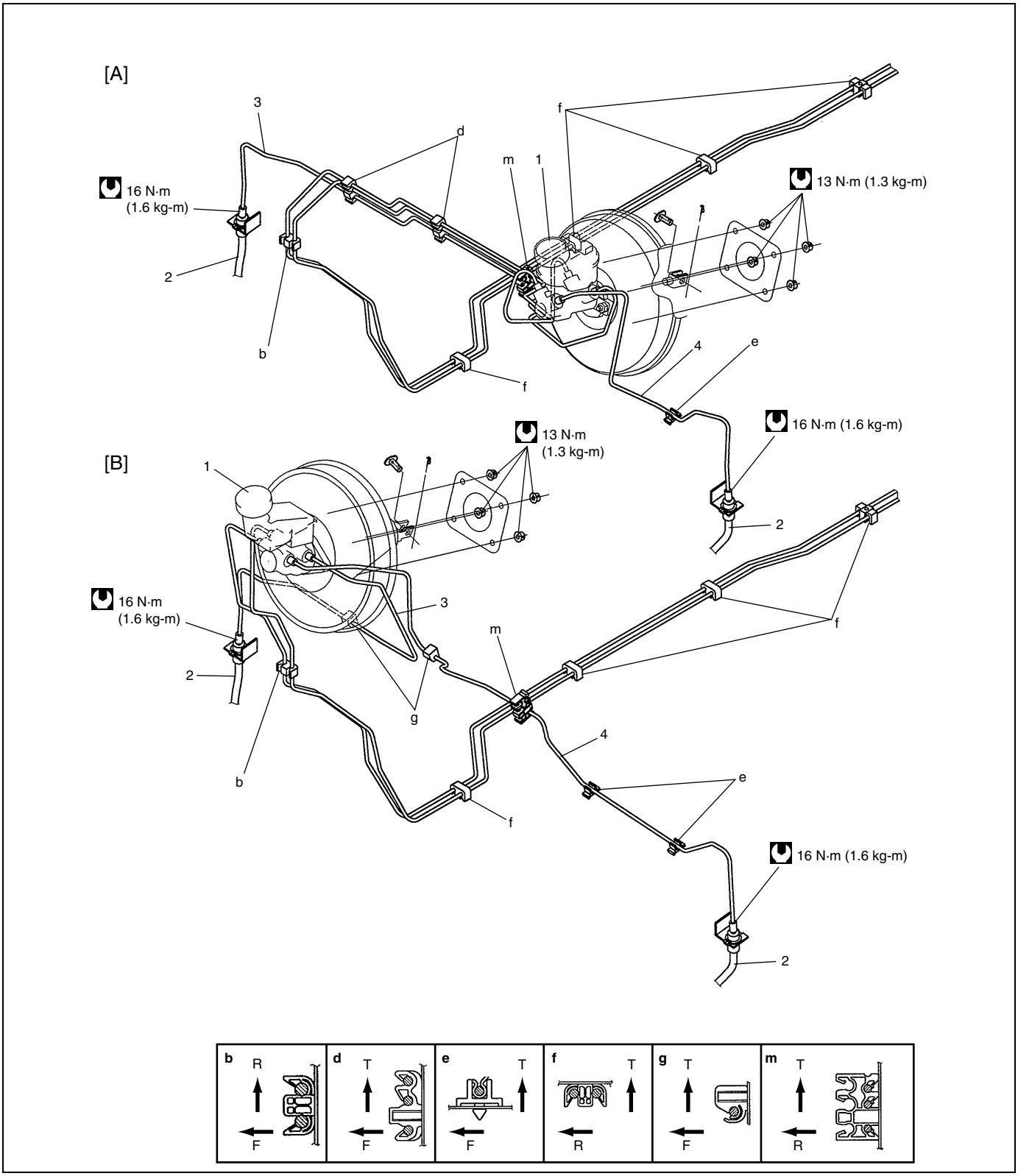
Front Brake Pipe Components Location

For vehicle with ABS



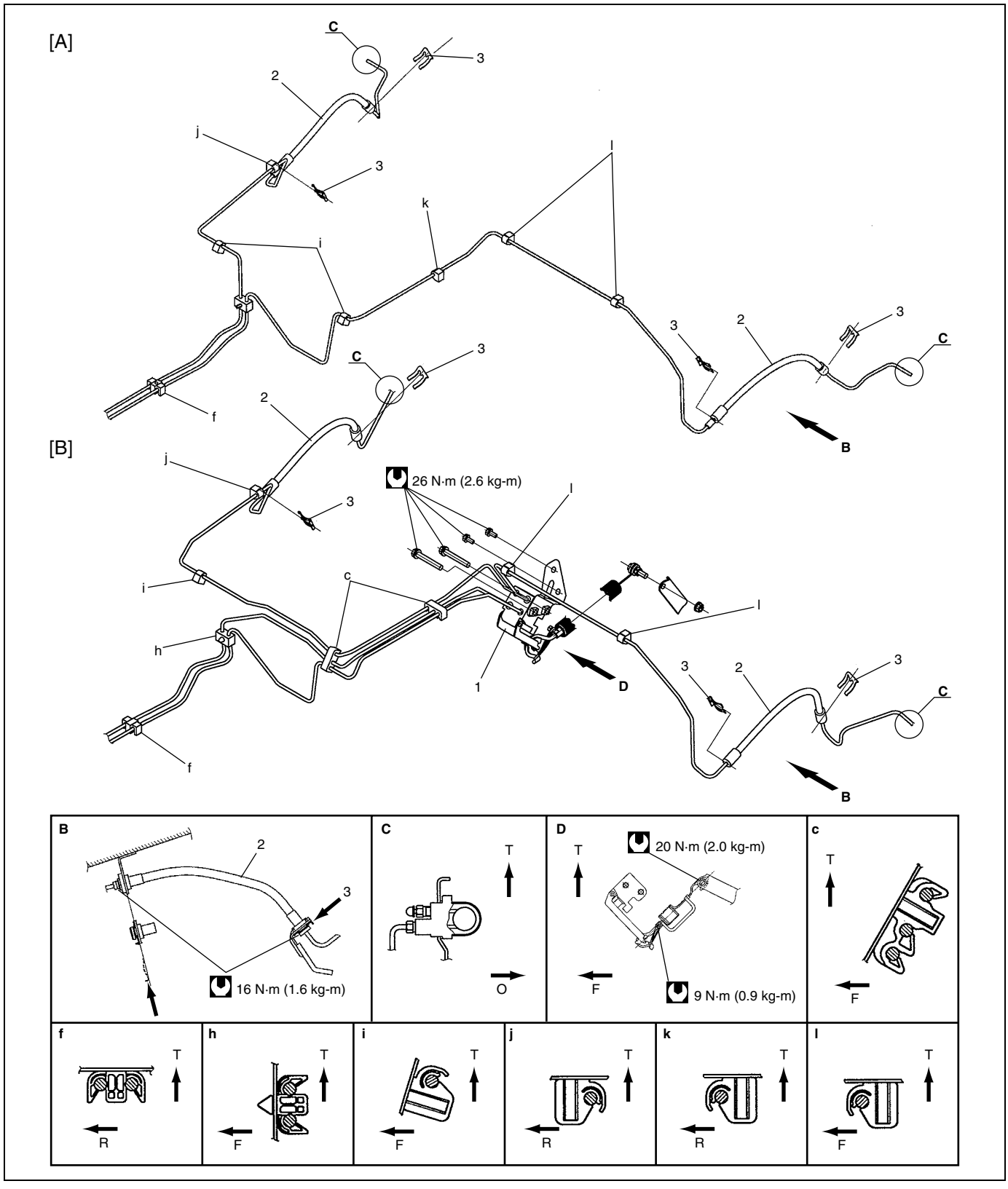
T: Top side	1. from master cylinder primary to ABS hydraulic unit	5. ABS hydraulic unit	[A]: For left-hand steering vehicle
F: Front side	2. from master cylinder secondary to ABS hydraulic unit	6. Master cylinder	[B]: For right-hand steering vehicle
R: Right side	3. from ABS hydraulic unit to left front brake	7. Front brake hose	Tightening torque
a-m: Clamp	4. from ABS hydraulic unit to right front brake		

For vehicle without ABS



T: Top side	1. Master cylinder	[A]: For left-hand steering vehicle
F: Front side	2. Front brake hose	[B]: For right-hand steering vehicle
R: Right side	3. from master cylinder primary to right front brake	Tightening torque
b-m: Clamp	4. from master cylinder secondary to left front brake	

Rear Brake Hose / Pipe Components Location



T: Top side	B. View B	1. LSPV assembly	[A]: with ABS
F: Front side	C. Detail	2. Rear brake hose	[B]: with LSPV
R: Right side	D. View D	3. E-ring	Tightening torque
L: Left side	c-l: Clamp		

Brake Hose / Pipe Removal and Installation

REMOVAL

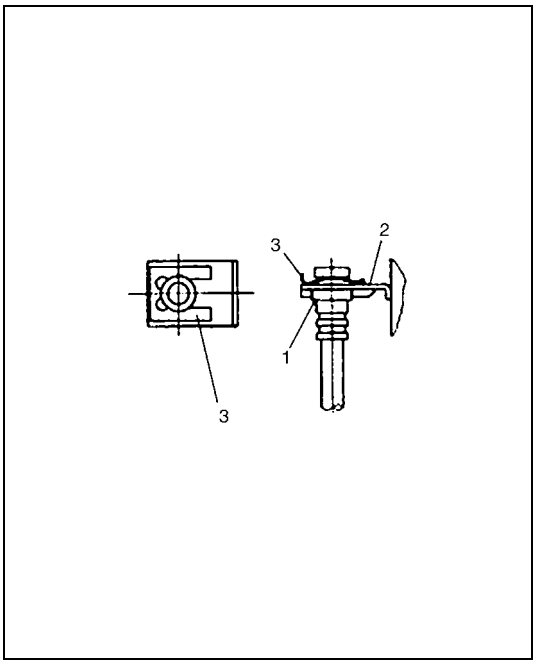
1) Raise and support vehicle properly. Remove tire and wheel referring to “Wheel Removal and Installation” in Section 3F.
2) Clean dirt and foreign material from both flexible hose end and pipe end fittings.
3) Drain brake fluid in reservoir.

CAUTION:
Do not allow brake fluid to get on painted surface. painted surface will be damaged by brake fluid, flush it with water immediately if any fluid is spilled.

4) Remove brake flexible hose or pipe.

INSTALLATION (FOR FRONT BRAKE)

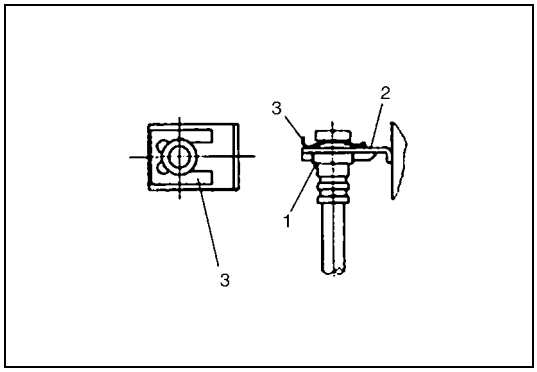
Reverse brake flexible hose installation procedure, noting the following.



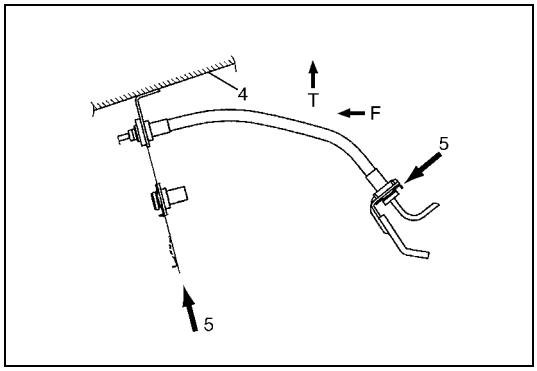
- Install brake hose securely, making sure that there is no faulty condition such as inclination of metal fitting (1) of hose relative to bracket (2) of vehicle body.
- Install E-ring (3) securely, making sure that it does not project from end face of bracket (2).
  After installing E-ring (3), check to make sure that tip end of ring is not open and that there is no clearance between metal fitting of hose end bracket.
- Make sure that steering wheel is in straight-forward position and flexible hose has not twist or kink.
- Check to make sure that flexible hose doesn't contact any part of suspension, both in extreme right and extreme left turn conditions. If it does at any point, remove and correct.
- Fill and maintain brake fluid level in reservoir.
- Bleed brake system. Refer to “Air Bleeding of Brake System” in Section 5.
- Perform brake test and check installed part for fluid leakage.

INSTALLATION (FOR REAR BRAKE)

Reverse brake flexible hose installation procedure, nothing the followings.



- Install brake hose securely, making sure that there is no faulty condition such as inclination of metal fitting (1) of hose relative to bracket (2) of vehicle body.
- Install E-ring (3) securely, making sure that it does not project from end face of bracket (2).
  After installing E-ring (3), check to make sure that tip end of ring is not open and that there is no clearance between metal fitting of hose end bracket.



T: Top side	4. Side member
F: Front side	5. E-ring Insure direction

- Fill and maintain brake fluid level in reservoir.
- Bleed brake system. Refer to “Air Bleeding of Brake System” in Section 5.
- Perform brake test and check each installed part for fluid leakage.
- Install clamps properly referring to figure and tighten bolts.
- When installing hose, make sure that it has no twist or kink.

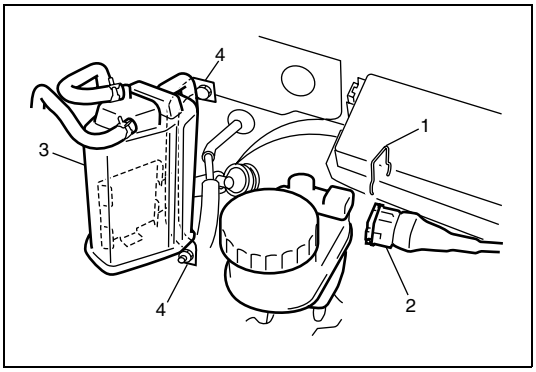
Master Cylinder Reservoir Removal and Installation (for LH Model)

CAUTION:

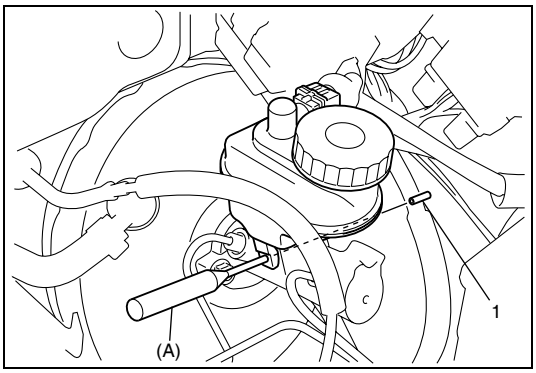
Observe CAUTION at the beginning of On-Vehicle Service.

REMOVAL

1) Clean outside of reservoir.

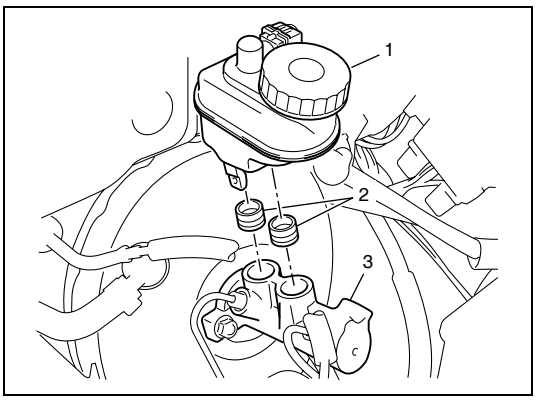


2) Remove switch lock pin (1) and disconnect coupler (2).
3) Remove EVAP canister (3) and bracket (4).
4) Take out fluid with syringe or such.



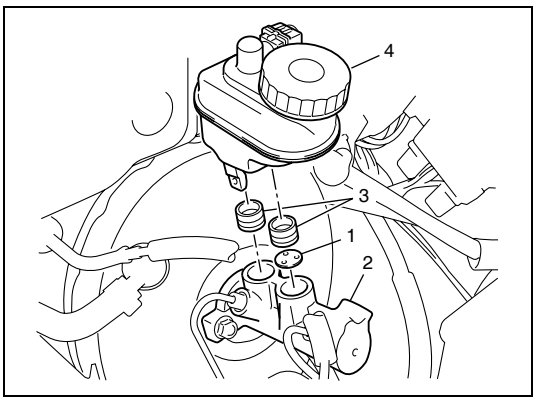
5) Remove reservoir connector pin (1) using special tool.

Special tool
(A): 09922-85811

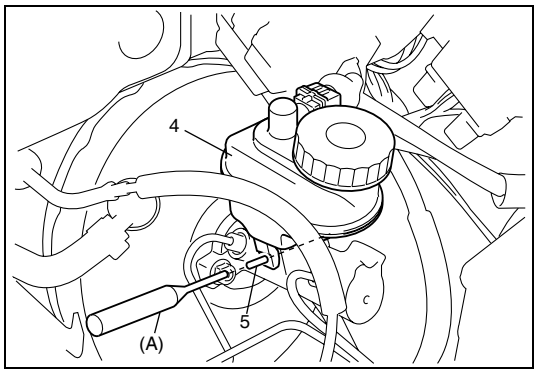


6) Remove reservoir (1) and grommets (2) from master cylinder(3).

INSTALLATION



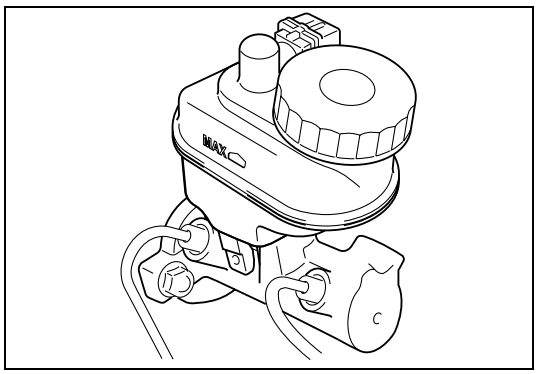
1) Install pin washer retainer (1) to secondary reservoir port of master cylinder (2) if removed.
2) When using new grommets, lubricate them with the same fluid as the one to fill reservoir with. Then fit grommets (3) to master cylinder. Grommets must be seated in place.



3) Install reservoir (4) and drive in reservoir pin (5).
   Drive in reservoir pin till both of its ends at the right and left of reservoir becomes the same length.

Special tool
(A): 09922-85811

4) Connect coupler and install lock pin.
5) Install EVAP bracket and canister.

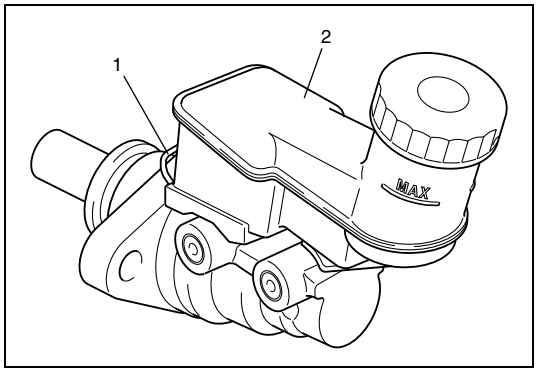


6) Fill reservoir with specified brake fluid up to MAX mark on it and bleed air from brake system. Refer to “Air Bleeding of Brake System” in Section 5.
7) Upon completion of installation, check for fluid leakage.

Master Cylinder Reservoir Removal and Installation (for RH Model)

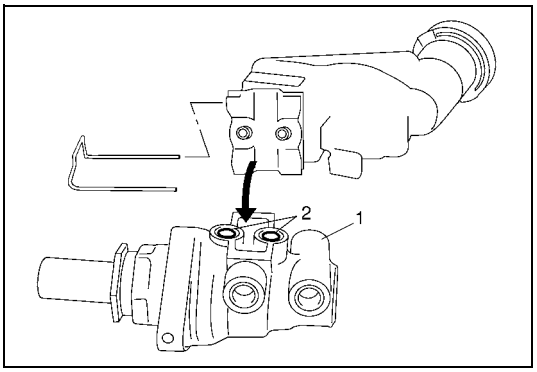
REMOVAL

1) Remove master cylinder referring to “Master Cylinder Removal and Installation (for RH Model)” in this section.



2) Pull out retainer (1) and remove reservoir (2).

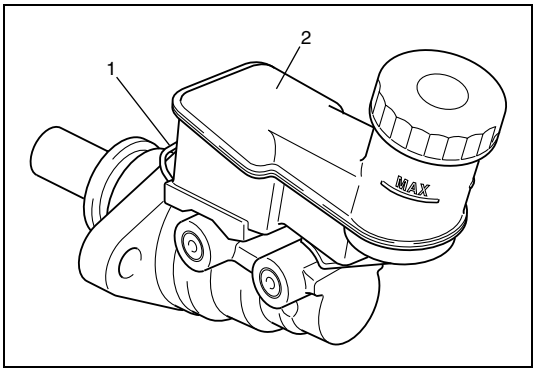
INSTALLATION



1) Apply brake fluid to new grommets and attach grommets (2) to master cylinder (1).

NOTE:

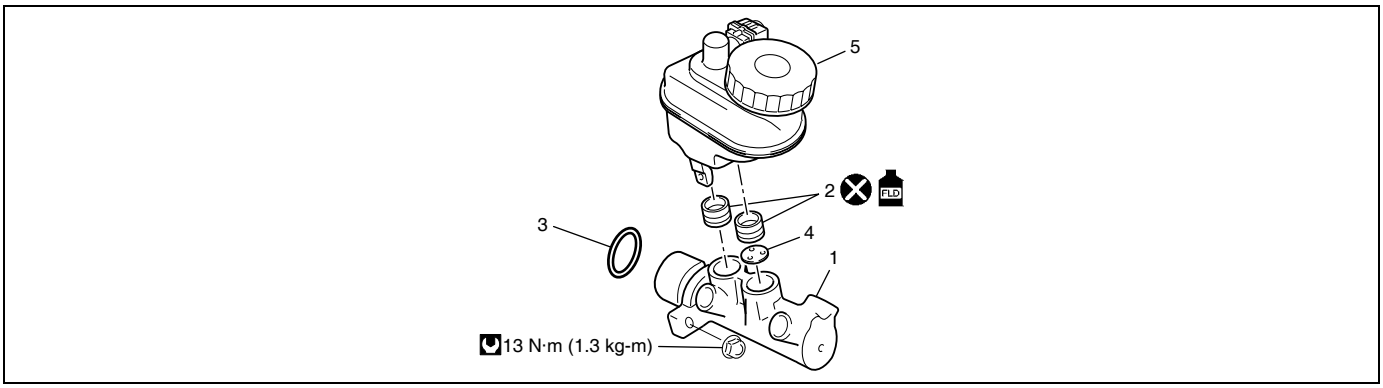
Be sure to use new grommets.



2) Install reservoir (2) to master cylinder and insert retainer (1).
3) Install master cylinder referring to “Master Cylinder Removal and Installation (for RH Model)” in this section.
4) Fill reservoir with specified brake fluid up to MAX mark on it.
5) After installation, bleed air from system and check for brake fluid leakage.

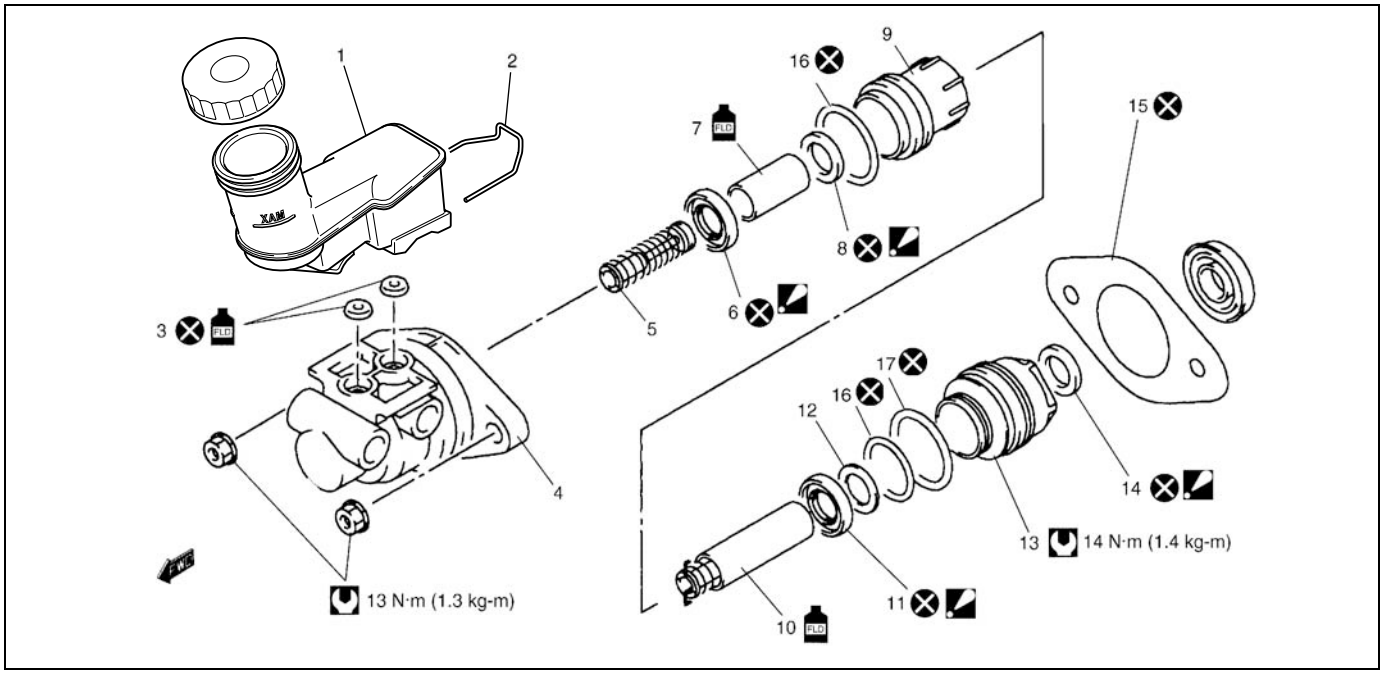
Master Cylinder Components

Left-hand Steering Vehicle



1. Master cylinder body	3. O-ring	5. Reservoir	Do not reuse
2. Grommet: :Apply brake fluid.	4. Pin washer retainer (with ABS)	Tightening torque	

Right-hand Steering Vehicle



	1. Reservoir		10. Primary piston : Apply brake fluid to contact surface of cup.		Tightening torque
	2. Retainer		11. Primary cup : Confirm installing direction.		Do not reuse.
	3. Grommet : Apply brake fluid.		12. Cup spacer		
	4. Master cylinder body		13. Cap		
	5. Secondary return spring		14. Cap cup : Confirm installing direction.		
	6. Secondary cup : Confirm installing direction Size of cup.		15. Master cylinder gasket		
	7. Secondary piston : Apply brake fluid to contact surface of cup.		16. O-ring (small)		
	8. Sleeve cup : Confirm installing direction.		17. O-ring (large)		
	9. Sleeve				

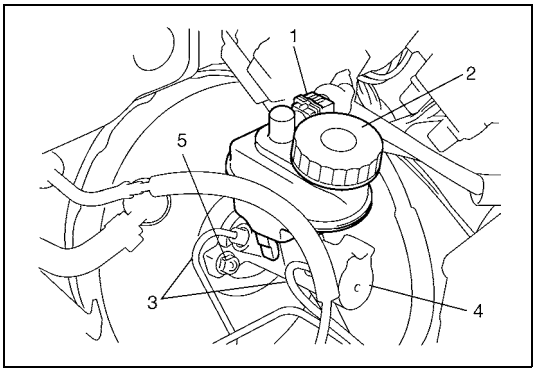
Master Cylinder Removal and Installation (for LH Model)

CAUTION:

- **Never disassemble master cylinder. Disassembly will spoil its original performance. If faulty condition is found, replace it with new one.**
- **Observe CAUTION at the beginning of On-Vehicle Service.**

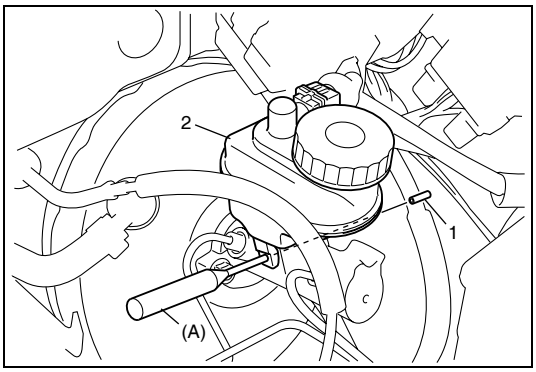
REMOVAL

1) Clean around master cylinder and reservoir.



2) Disconnect fluid level switch coupler (1) on reservoir.
3) Remove reservoir cap (2) and take out fluid with syringe or such.
4) Disconnect brake pipes (3) connected with master cylinder (4).
5) Remove master cylinder mounting nuts (5).

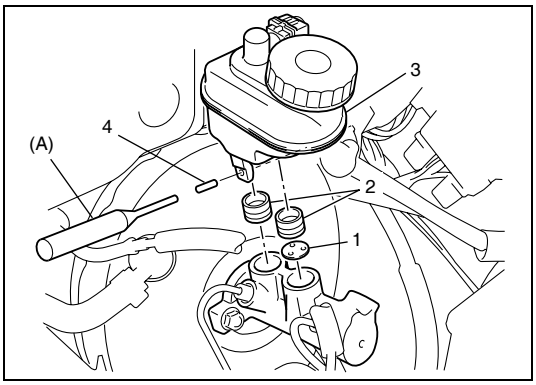
6) Remove master cylinder from brake booster.



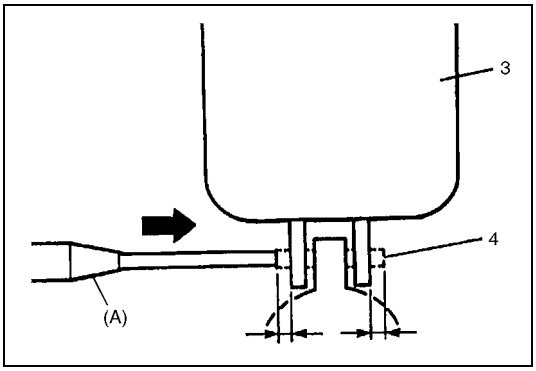
7) Remove reservoir pin (1) and reservoir (2) by using special tool.

Special tool
(A): 09922-85811

INSTALLATION



1) Install pin washer retainer (1) if removed.
Apply thin coat of brake fluid to all around new grommets (2) and install them to cylinder body, then install reservoir (3).

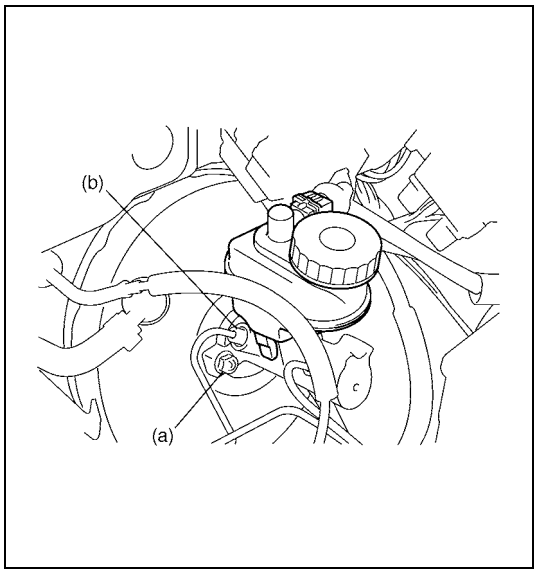


2) Drive in reservoir connector pin (4).

NOTE:

Drive in reservoir pin (4) till both of its ends at the right and left of reservoir becomes the same length.

Special tool
(A): 09922-85811



3) Install master cylinder to brake booster.
4) Torque master cylinder mounting nuts to specification.

Tightening torque
Cylinder mounting nut (a): 13 N·m (1.3 kg-m, 9.5 lb-ft)

5) Connect hydraulic lines and torque flare nuts to specification.

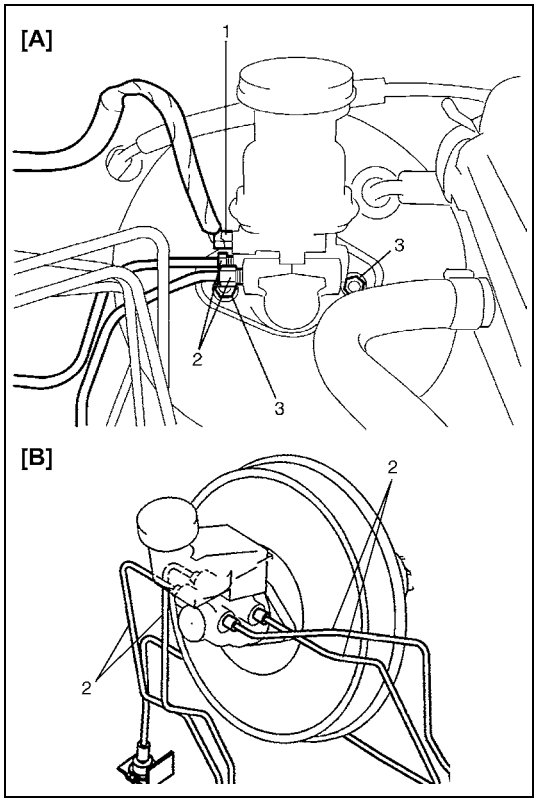
Tightening torque
Brake pipe flare nut (b): 16 N·m (1.6 kg-m, 11.5 lb-ft)

6) Connect reservoir lead wire.
7) Fill reservoir with specified brake fluid up to MAX mark on it.
8) After installing, check brake pedal play and bleed air from system.
9) Perform brake test and check each installed part for fluid leakage.

Master Cylinder Removal and Installation (for RH Model)

REMOVAL

1) Clean outside of master cylinder.
2) Drain brake fluid in reservoir.



3) Disconnect fluid level switch coupler (1) on reservoir.
4) Disconnect brake pipes (2) connected to master cylinder.

[A]: with ABS
[B]: without ABS

5) Remove master cylinder mounting nuts (3).
6) Remove master cylinder and master cylinder gasket.

INSTALLATION

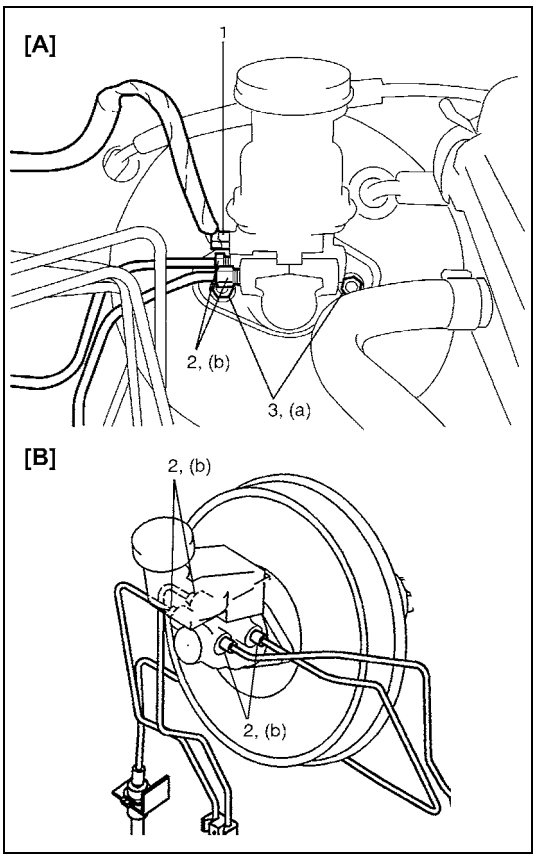
1) Install new master cylinder gasket to booster.
2) Install master cylinder to booster and tighten master cylinder mounting nuts (3) to specified torque.

Tightening torque
Master cylinder mounting nuts
(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)

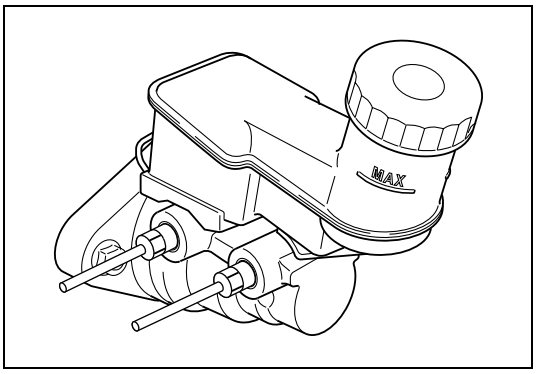
3) Connect brake pipe to master cylinder and tighten flare nut (2) to specified torque.

Tightening torque
Brake pipe flare nut (b): 16 N·m (1.6 kg-m, 11.5 lb-ft)

4) Connect fluid level switch connector (1) of reservoir.



[A]:	with ABS
[B]:	without ABS

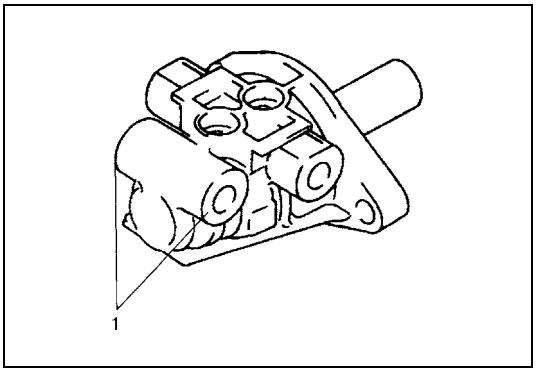


5) Fill reservoir with specified brake fluid up to its MAX mark.
6) After completing above work, bleed air and check brake pedal for play.
7) Perform brake test and check each installed part for fluid leakage.

Master Cylinder Disassembly and Assembly (for RH Model)

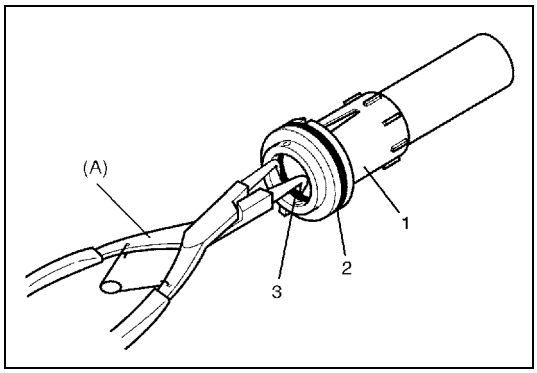
DISASSEMBLY

1) Loosen cap and remove it.



NOTE:
For this work, apply a cloth to outlet port at the tip end (1) of master cylinder body and secure cylinder using soft jawed vise.

2) Remove component parts from master cylinder body.



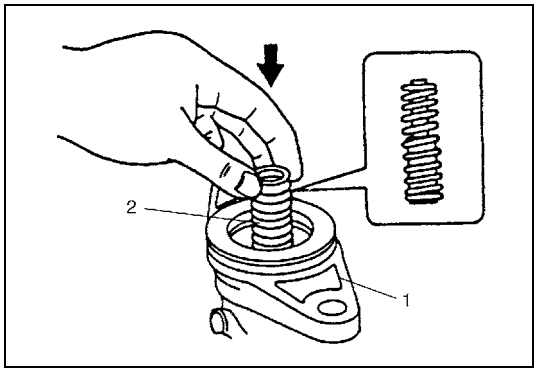
3) Remove sleeve cap (3) and O-ring (2) from sleeve (1).

Special tool
(A): 09900-06106

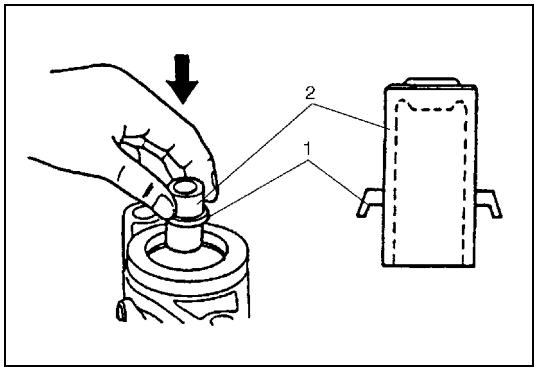
CAUTION:
Do not cause any damage to inside of sleeve. If caused, replace primary piston assembly.

ASSEMBLY

CAUTION:
- **Never use any mineral oil such as kerosene oil and gasoline when washing and assembling parts.**
- **Check inside of cylinder (sleeve, cap) wall, pistons and cup seals are free from any foreign objects such as dust and dirt and use case not to cause any damage with a tool during assembly.**
- **Do not drop parts. Do not use any part which has been dropped.**

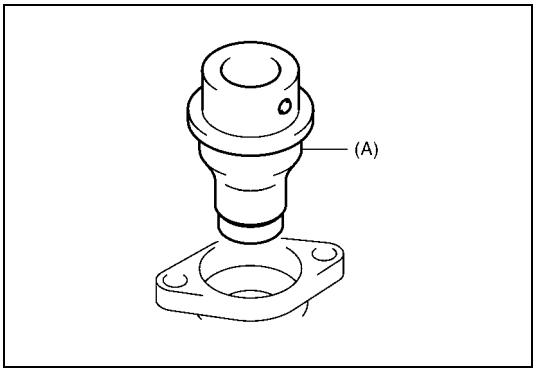


1) Apply brake fluid to inside of cylinder (Sleeve, cap), cups, O-rings and contact surface of piston assembly.
Install secondary return spring (2) to cylinder body (1) with noting spring direction.



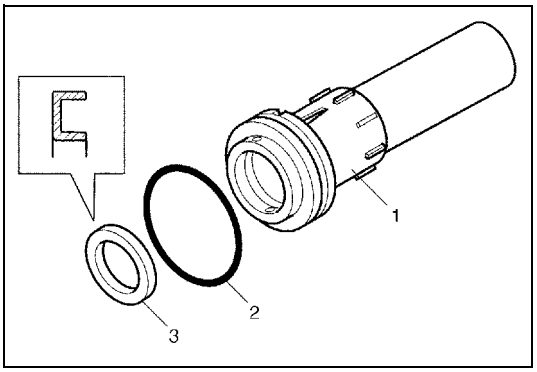
2) Attach secondary cup (1) to secondary piston (2), they install it to cylinder such a direction as shown.

NOTE:
- **Secondary cup is the same as primary cup.**
- **Diameter of secondary cup is the largest compared with sleeve cup and cap cup.**



3) Push secondary cup to the bottom by using special tool.

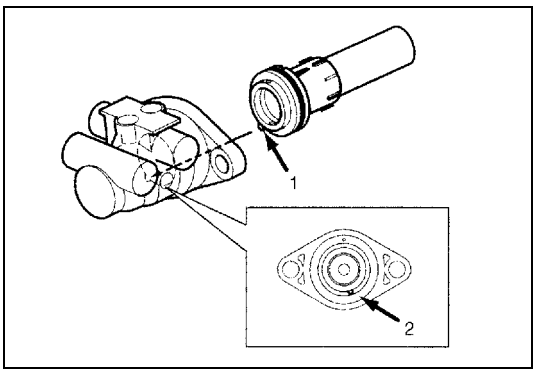
Special tool
(A): 09951-18220



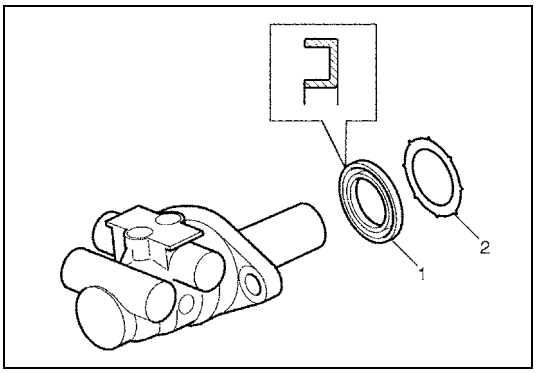
4) Install sleeve cup (3) and O-ring (2) to sleeve (1) such a direction as shown.

NOTE:

- **Diameter of sleeve cup and O-ring are smaller than those of cap.**
- **O-ring is the same as that of smaller one of cap O-ring.**



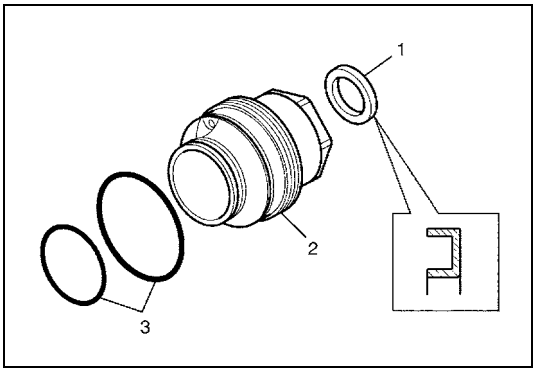
5) Install sleeve assembly with aligning protrusion (1) of sleeve and dent (2) of cylinder body.



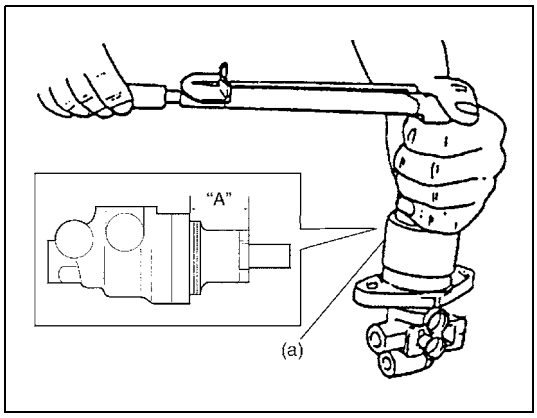
6) Install primary cup (1) and spacer (2) such a direction as shown.

NOTE:

- **Primary cup is the same as secondary cup.**
- **Primary cup is the largest compared with that of cap and sleeve.**



7) Remove old cap cup (1) from cap with caring not to cause any damage to inside of cap (2).
8) Install new cap cup (1) and O-rings (3) to cap such a direction as shown.



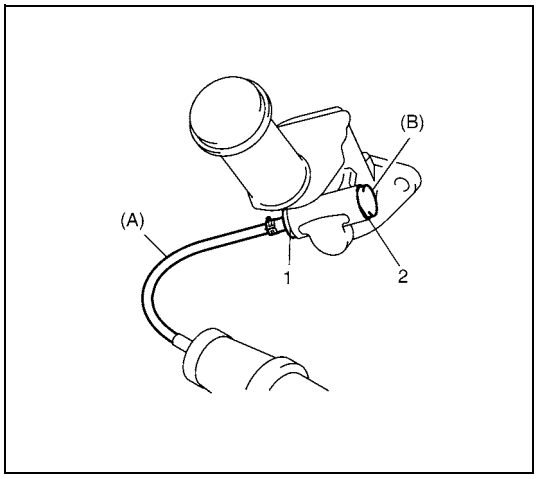
9) Install cap and tighten it to specified torque, then confirm the length "A".

Tightening torque
Master cylinder cap (RH vehicle)
(a): 14 N·m (1.4 kg-m, 10.5 lb-ft)

Cap installation position
"A": Less than 26 mm (1.02 in.)

CAUTION:
Whenever master cylinder is assembled, make sure all the function of master cylinder assembly referring to "Master Cylinder Assembly Inspection (for RH Model)".

Master Cylinder Assembly Inspection (for RH Model)

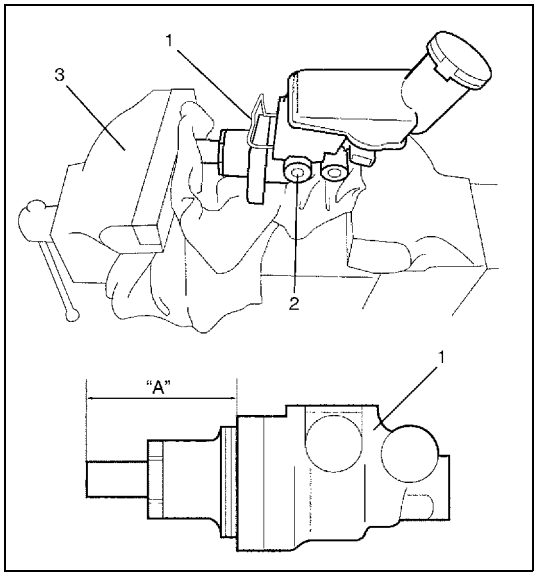


1) Install radiator cap tester with special tool to master cylinder port (1).

NOTE:
For without ABS vehicle, install special tool (B) to opposite side port (2).

Special tool
(A): 09952-46010
(B): 09952-26020

2) Apply air and confirm that pressure is not applied.

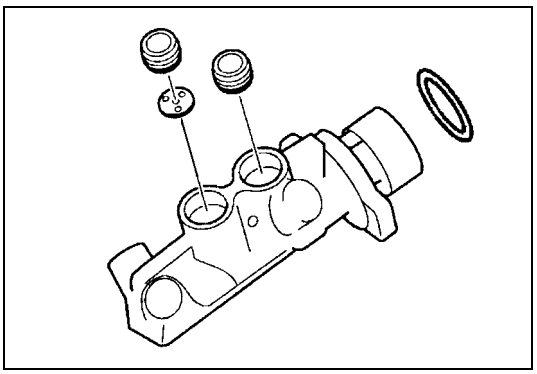


3) Set master cylinder (1) on vise (3) and adjust "A" to be the following.

Cap adjustment position
"A": 50 mm (1.97 in.)

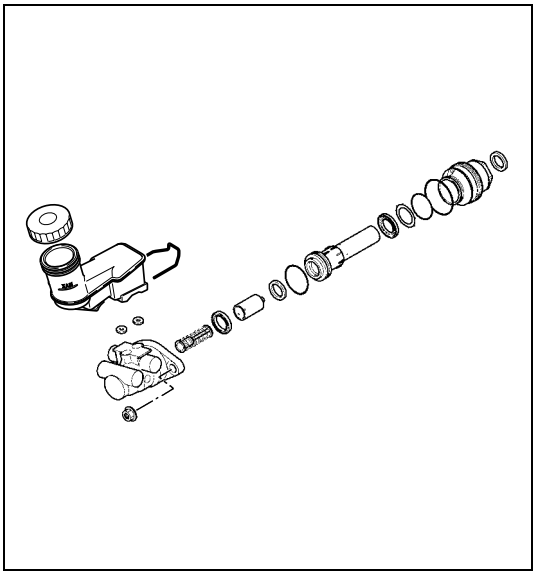
4) Apply air with radiator cap tester, and confirm that 50 kPa pressure is applied.
5) Perform same steps 1) – 4) for port (2).

Master Cylinder Check (for LH Model)



Inspect each parts for wear, deterioration or damage, and replace parts if necessary.
Inspect master cylinder for scoring, corrosion and smooth operation. It is best to replace corroded cylinder.
Corrosion can be identified as pits or excessive roughness.

Master Cylinder Check (for RH Model)



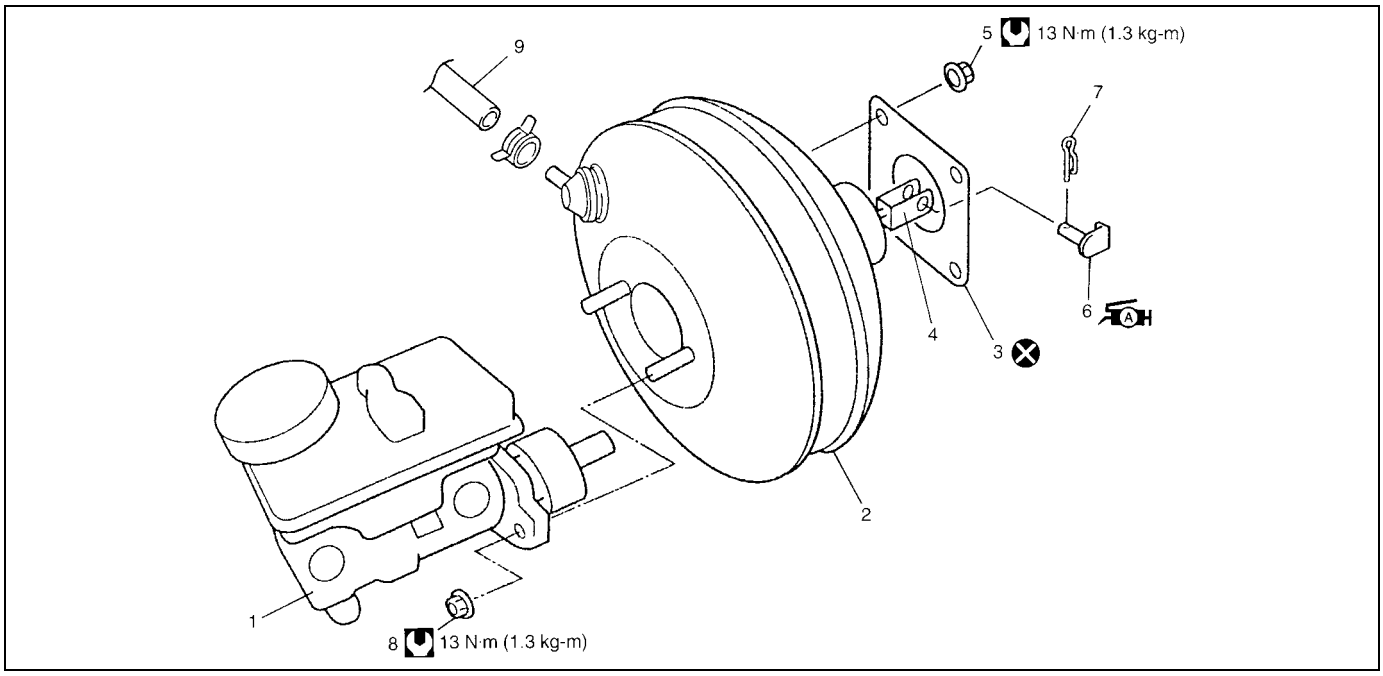
1) Check all disassembled parts for wear, damage, corrosion and smooth operation.
   If anything faulty is found, replace.

CAUTION:
- **Wash disassembled parts with brake fluid.**
- **Do not reuse piston cups and O-rings.**

2) Check screw hole in master cylinder for gall or corrosion.
   If anything faulty is found, replace.

CAUTION:
Wash master cylinder with new brake fluid. Do not use cloth to dry cylinder so as to avoid fibers being attached to internal surface of cylinder.

Brake Booster Components Locator



1. Brake master cylinder assembly	4. Push rod clevis	7. Clip	Tightening torque
2. Brake booster assembly	5. Nut	8. Nut	Do not reuse
3. Gasket	6. Clevis pin: Apply SUZUKI SUPER GREASE A 99000-25010 to clevis pin.	9. Brake vacuum hose	

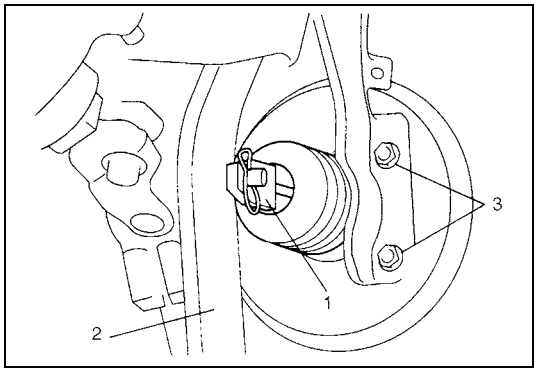
Brake Booster Removal and Installation (for LH Model)

CAUTION:

- **Never disassemble brake booster. Disassembly will spoil its original function. If it is found faulty, replace it with new one.**
- **Observe CAUTION at the beginning of On-Vehicle Service.**

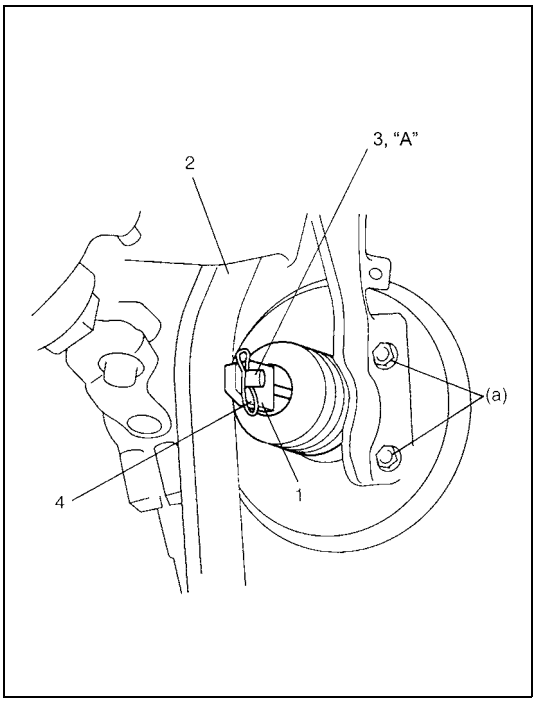
REMOVAL

1) Remove master cylinder assembly, referring to “Master Cylinder Removal and Installation (for LH Model)” in this section.
2) Disconnect brake vacuum hose from brake booster.



3) Disconnect push rod clevis (1) from brake pedal arm (2).
4) Remove attaching nuts (3) and then booster.

INSTALLATION



NOTE:

Check for push rod length referring to "Brake Booster Inspection (for LH Model)".

1) Install new gasket and booster to dash panel as shown. Then connect booster push rod clevis (1) to pedal arm (2) with clevis pin (3) and clip (4).

"A": Grease A 99000-25010

2) Tighten booster mounting nuts to the specified torque.

Tightening torque
Booster mounting nut (a): 13 N·m (1.3 kg-m, 9.5 lb-ft)

3) Connect brake vacuum hose to brake booster.
4) Install master cylinder, referring to "Master Cylinder Removal and Installation (for LH Model)" of this section.
5) After installing, perform "Booster Operation Check" referring to Section 5.

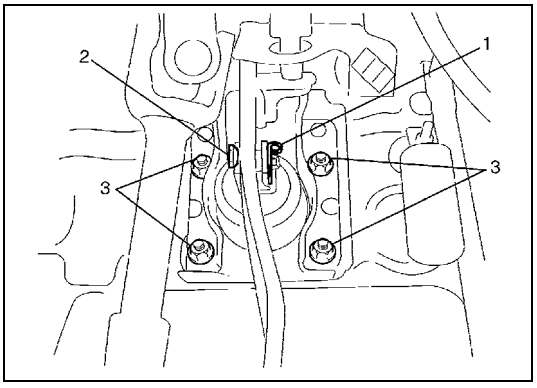
Brake Booster Removal and Installation (for RH Model)

CAUTION:

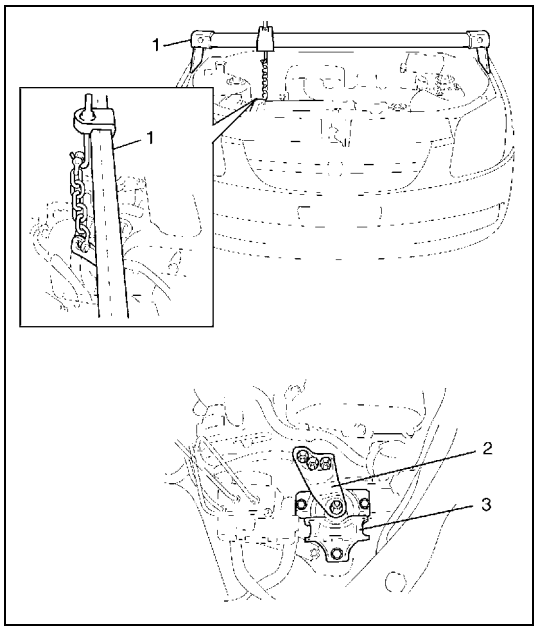
Never disassemble brake booster. Disassembly will spoil its original function. If faulty condition is found, replace it with new one.

REMOVAL

1) Remove master cylinder assembly from booster. Refer to "Master Cylinder Removal and Installation (for RH Model)" in this section.
2) Disconnect vacuum hose from booster.



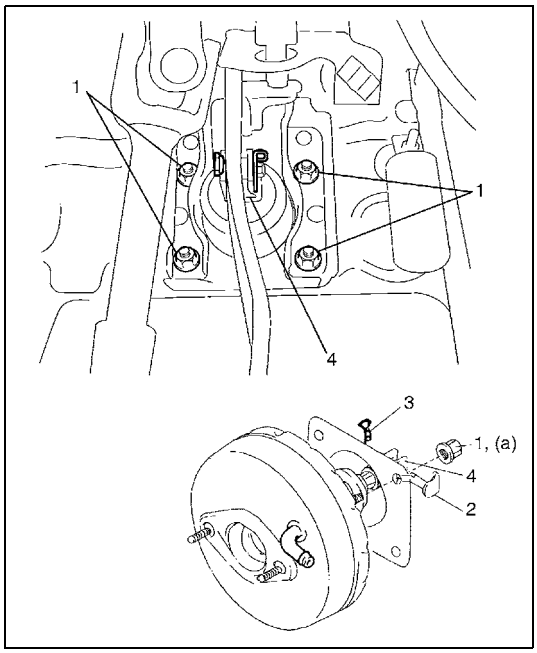
3) Remove push rod clevis clip (1), pin (2) and brake booster mounting nuts (3).
   If brake booster contacts engine and makes it difficult to remove it, perform following steps.



a) Support engine right side by using support device (1).
b) Remove engine right side mounting (3) with bracket (2).
c) Lower engine right side a little and remove brake booster.

INSTALLATION

1) Check and adjust clearance between booster piston rod and master cylinder piston referring to “Brake Booster Inspection and Adjustment (for RH Model)” in this section.
2) Check and adjust position of push rod devise referring to “Brake Booster Inspection and Adjustment (for RH Model)” in this section.

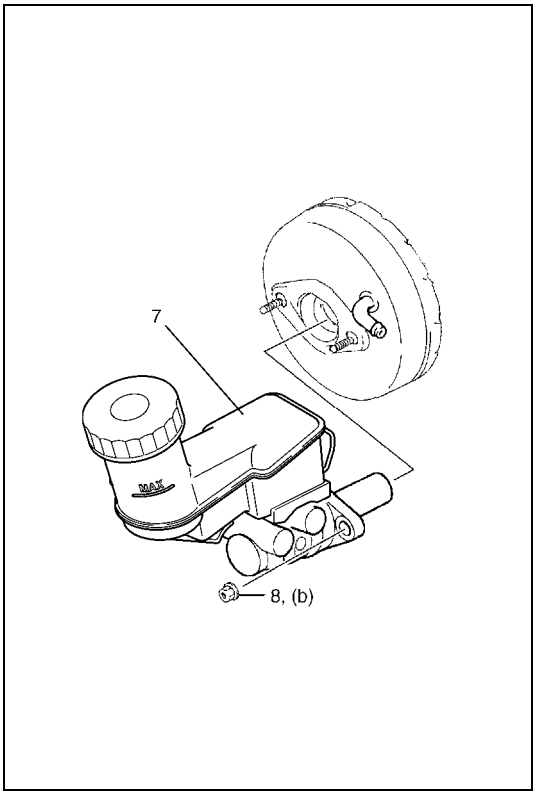


3) Install brake booster to brake pedal and dash panel. Then tighten booster mounting nuts (1) to specified torque and connect push rod clevis (4) to pedal arm with clevis pin (2) and clip (3).

Tightening torque
Booster mounting nut (a): 13 N·m (1.3 kg-m, 9.5 lb-ft)

4) If engine mounting has been removed when removing booster:
Tighten engine right side mounting and bracket bolts and nuts to specified torque. Remove support device. For tightening torque, refer to “Engine Mountings Components” in Section 6A1.

5) Install new master cylinder gasket to booster.



6) Install master cylinder (7) to booster.
7) Tighten master cylinder mounting nuts (8) to specified torque.

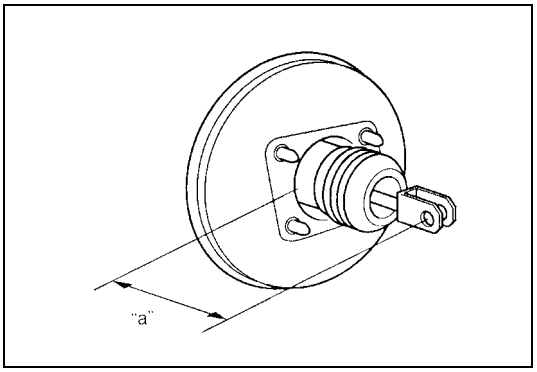
Tightening torque
Master cylinder mounting nut
(b): 13 N·m (1.3 kg-m, 9.5 lb-ft)

8) Connect brake pipes and tighten flare nuts to specified torque.

Tightening torque
Brake pipe flare nut: 16 N·m (1.6 kg-m, 11.5 lb-ft)

9) Connect reservoir lead wire connector and booster vacuum hose.
10) Fill reservoir with specified fluid.
11) Bleed air from brake system. Refer to “Air Bleeding of Brake System” in Section 5.
12) After installing, check pedal height and play referring to “Brake Pedal Free Height Check” and “Brake Pedal Play Check” in Section 5.
13) Perform brake test and check each installed part for fluid leakage.

Brake Booster Inspection (for LH Model)

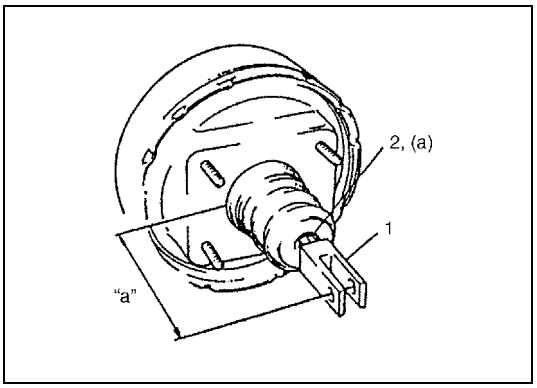


- Check brake booster for damage and operation, boot for damage and deterioration
- Check for push clevis rod distance.
  If any malfunction is found, replace brake booster.

Clevis rod distance
“a”: 97.0 – 98.0 mm (3.82 – 3.85 in.)

Brake Booster Inspection and Adjustment (for RH Model)

INSTALLATION POSITION OF PUSH ROD CLEVIS

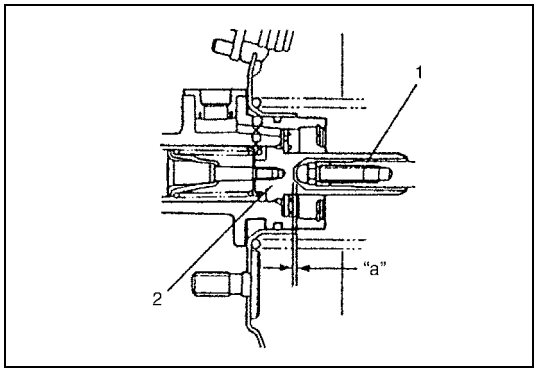


Inspect and adjust distance between booster installation surface (without including packing) and the center of clevis (1) pin hole to standard value “a” and tighten nut (2) to specified torque.

Distance “a” between center of booster clevis pin hole and booster surface
Standard: 97 – 98 mm (3.82 – 3.85 in.)

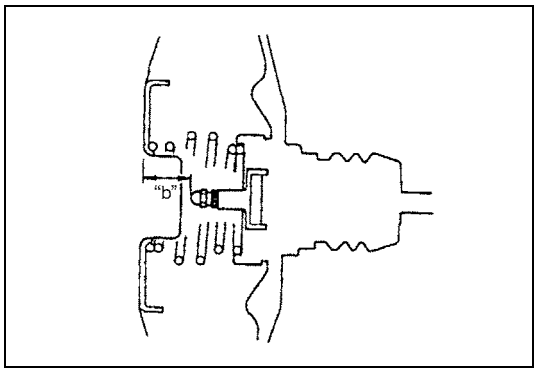
Tightening torque
Clevis pin lock nut (a): 19 N·m (1.9 kg-m, 14.0 lb-ft)

CLEARANCE BETWEEN BOOSTER PISTON ROD AND MASTER CYLINDER PISTON



The length of booster piston rod (1) is adjusted to provide specified clearance "a" between piston rod (1) end and master cylinder piston (2).

- Before measuring clearance, push piston rod several times so as to make sure reaction disc is in place.
- Keep inside of booster at atmospheric pressure for measurement.

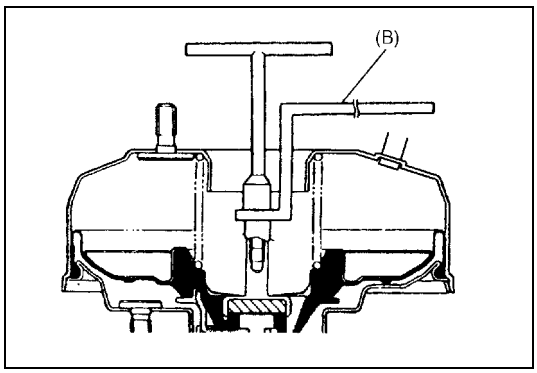


Measure length "b" of piston rod, i.e. distance between piston rod and mating surface of booster-to-master cylinder.

Length "b" of piston rod
30.3 – 30.5 mm (1.193 – 1.200 in.)

NOTE:

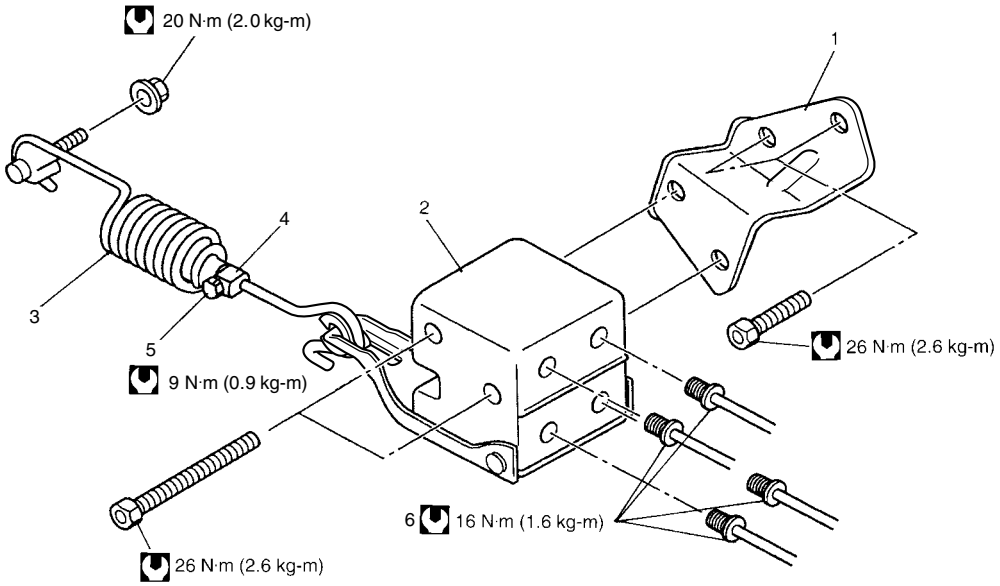
Remove gasket from booster, if equipped.



If measurement is out of specification, adjust piston rod by turning adjusting screw of piston rod.

Special tool
(B): 09952-16021

LSPV (Load Sensing Proportioning Valve) Assembly Components Locator (if equipped)

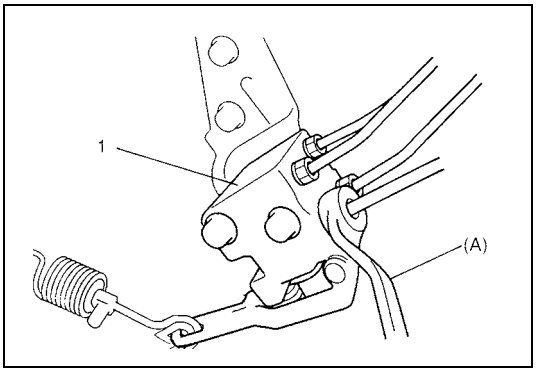


1. LSPV bracket	3. Spring	5. Spring bracket bolt	Tightening torque
2. LSPV assembly	4. Spring bracket	6. Brake pipe flare nut	

CAUTION:
- **Never disassemble LSPV assembly. Disassembly will spoil its original performance. Replace with new one if detective.**
- **Observe CAUTION at the beginning of On-Vehicle Service.**

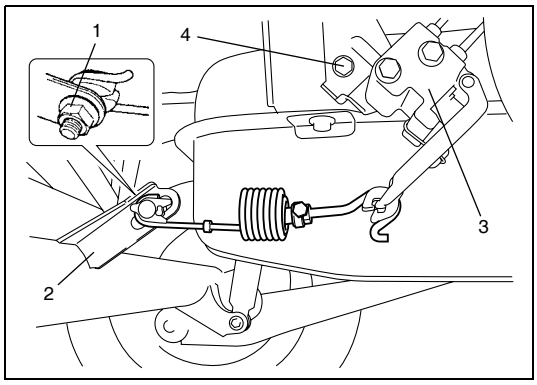
LSPV (Load Sensing Proportioning Valve) Removal and Installation

REMOVAL



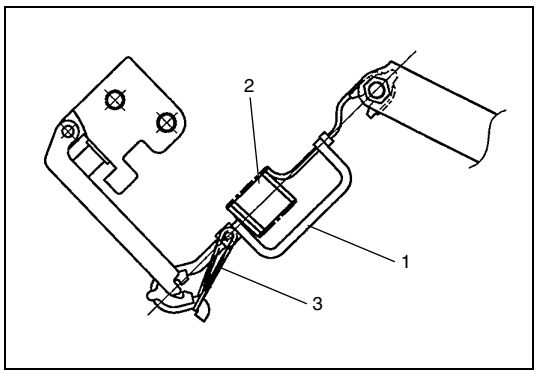
1) Clean around reservoir cap and take out fluid with syringe or such.
2) Hoist vehicle.
3) Disconnect brake pipes from LSPV assembly (1).

Special tool
(A): 09950-78230 (10 x 11 mm)



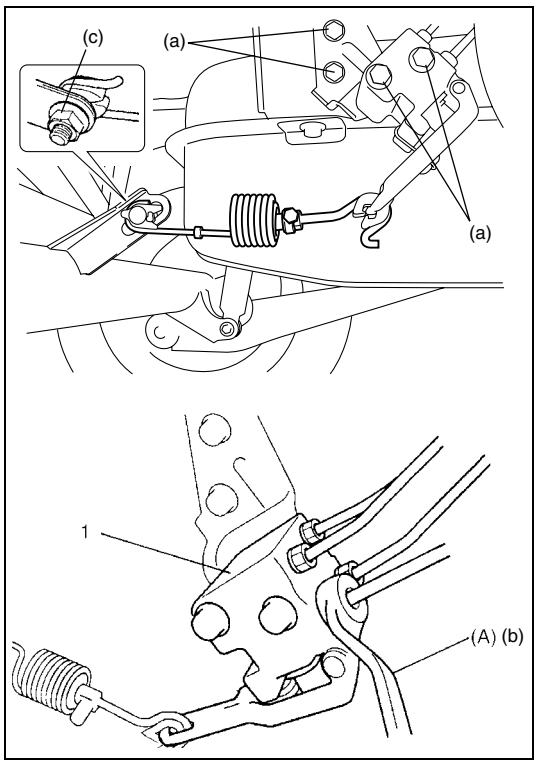
4) Remove nut (1) and detach spring end from rear axle (2).
5) Remove LSPV assembly (3) with bracket (4) from vehicle body.

INSTALLATION



NOTE:

New LSPV assembly is supplied with held in specified spring length with adjusting block (1).
Do not remove rubber band (3) and adjusting block until spring (2) installation position is adjusted.



1) Install LSPV assembly (1) with bracket to vehicle body.
2) Torque each bolt and nut to specification as indicated respectively in figure.

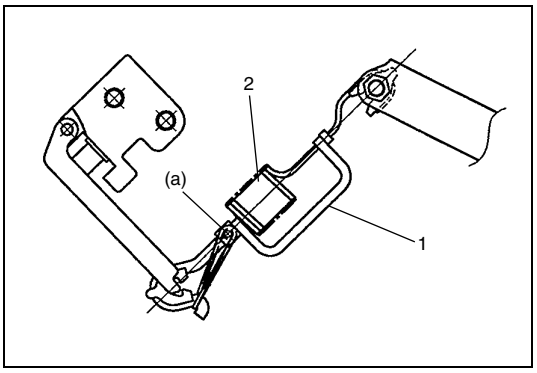
Special tool
(A): 09950-78230 (10 x 11 mm)

Tightening torque
LSPV bracket bolt (a): 26 N·m (2.6 kg-m, 19.0 lb-ft)
Brake flare nut (b): 16 N·m (1.6 kg-m, 11.5 lb-ft)
LSPV spring end nut (c): 20 N·m (2.0 kg-m, 14.5 lb-ft)

3) Fill reservoir with specified fluid and bleed air from brake system.

4) Check or adjust spring installation position.
For used LSPV assembly, check that it is installed properly referring to the following “LSPV (Load Sensing Proportioning Valve) Inspection and Adjustment”.
For new LSPV assembly, adjust spring installation position as follows.

a) Confirm the following before adjustment.
- Fuel level meter indicates around “E” (Empty). (Fuel tank holds about 5 liters.)
- Vehicle is equipped with spare tire, tools, jack and jack handle.
- Vehicle is free from any other load.
- Vehicle is placed on level floor.



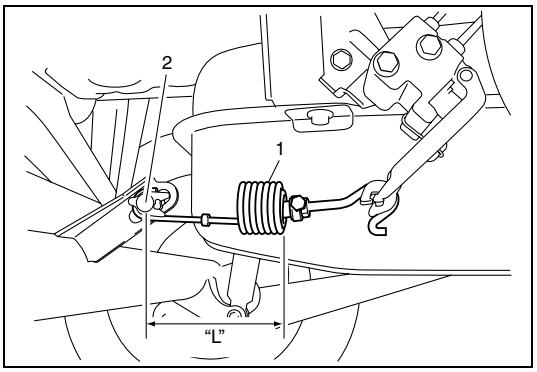
b) Tighten spring bracket bolt to specified torque.

Tightening torque
LSPV spring bracket bolt (a): 9 N·m (0.9 kg-m, 6.5 lb-ft)

c) Remove adjusting block (1) from spring (2).
d) Confirm fluid pressure referring to “Brake Fluid Pressure Test (if equipped with LSPV)” in Section 5.

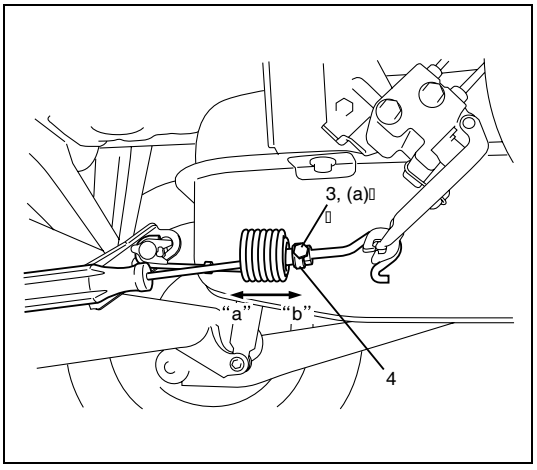
LSPV (Load Sensing Proportioning Valve) Inspection and Adjustment

1) Confirm the following before inspection and adjustment.
- Fuel tank is filled with fuel fully.
- Vehicle is equipped with spare tire, tools, jack and jack handle.
- Vehicle is free from any other load.
- Vehicle is placed on level floor.



2) Check spring length between spring end (1) and spring bolt center (2).
If it is out of specification, adjust it as follows.

LSPV spring length
“L”: About 99.3 mm (3.9 in.)

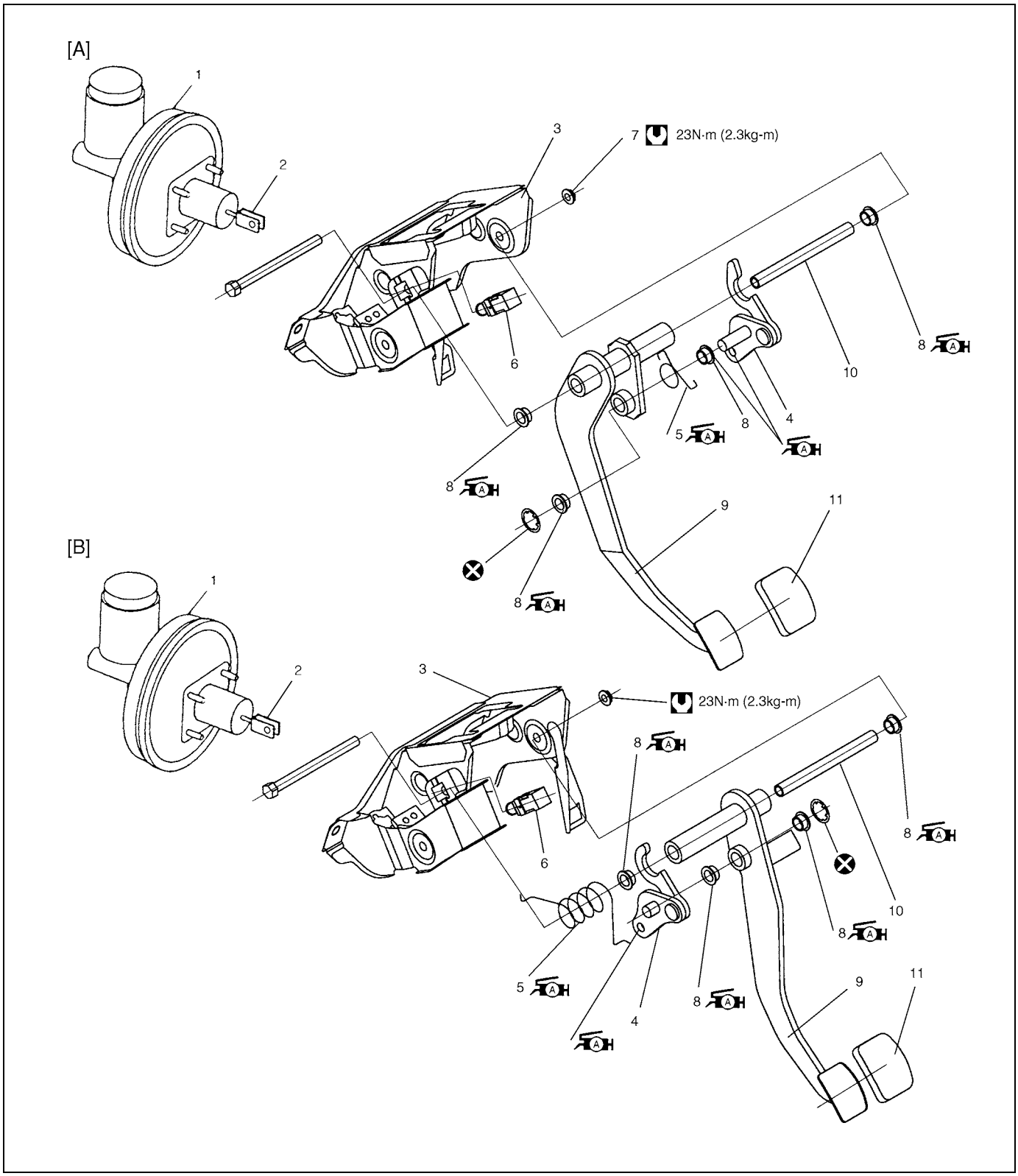


3) Loosen spring bracket bolt (3) and stretch spring to specified length by pushing spring bracket (4) with a driver or the like. Make sure that this adjustment does not cause any play between bracket (4) and spring (looseness in “a” to “b” direction as indicated in figure).
4) At that position in step 3), tighten spring bracket bolt to specified torque.

Tightening torque
LSPV spring bracket bolt (a): 9 N·m (0.9 kg-m, 6.5 lb-ft)

5) Confirm fluid pressure referring to “Brake Fluid Pressure Test (if equipped with LSPV)” in Section 5.

Brake Pedal and Brake Pedal Bracket Components Location



1. Brake booster assembly	5. Spring	9. Brake pedal	[A]: Left-hand steering vehicle
2. Push rod clevis	6. Stop light switch	10. Pedal shaft spacer: Apply SUZUKI SUPER GREASE A 99000-25010 to outside surface of spacer.	[B]: Right-hand steering vehicle
3. Brake pedal bracket	7. Brake pedal lever nut	11. Pedal pad:	Tightening torque
4. Brake pedal lever	8. Pedal bush		Do not reuse

Brake Pedal and Brake Pedal Bracket Removal and installation

REMOVAL

1) Disconnect stop light switch coupler.
2) Disconnect push rod clevis from brake pedal.
3) Remove attaching nuts.
4) Remove brake pedal bracket with brake pedal.
5) Remove each parts, if necessary.

INSTALLATION

Reverse removal procedure for installation, noting the following.

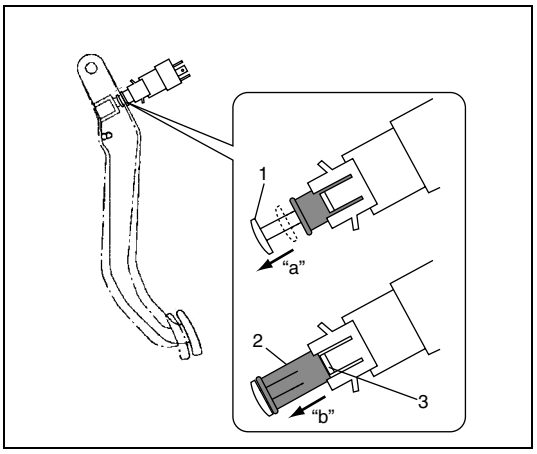
- Tighten each nuts and screws to specified torque as indicated above figure.

Tightening torque
Brake pedal mounting nut: 23 N·m (2.3 kg-m, 17.0 lb-ft)

- After installing, check brake pedal play and perform brake test.

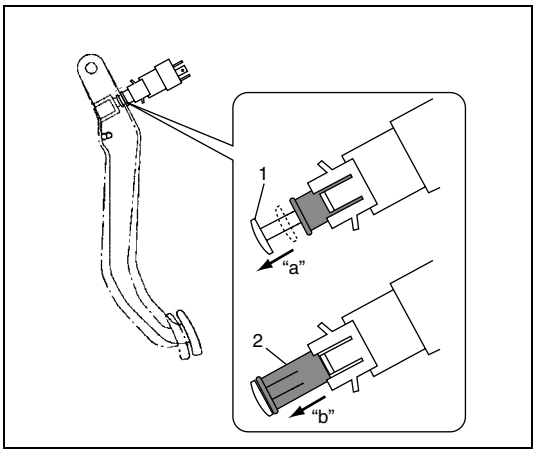
Stop (Brake) Lamp Switch Removal and Installation

REMOVAL



1) Disconnect stop lamp switch coupler.
2) Pull out switch slider (1) of stop lamp switch in the direction of arrow “a” in the illustration.
   Then, pull out adjuster (2) in the direction of arrow “b” in the illustration.
3) Remove stop lamp switch with pressing its pin (3) to inside.

INSTALLATION



1) Pull out switch slider (1) of stop lamp switch in the direction of arrow “a” in the illustration.
   Then, pull out adjuster (2) in the direction of arrow “b” in the illustration.
2) Install stop lamp switch.
3) Adjustment of stop lamp switch is un necessary.
   When brake pedal is depressed, adjuster adjust the suitable distance automatically.

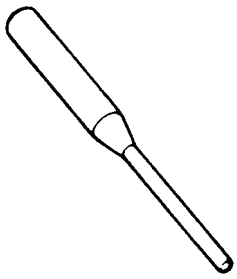
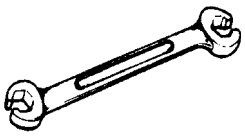
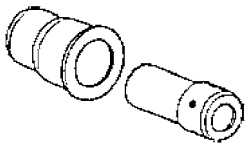
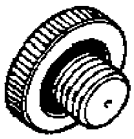
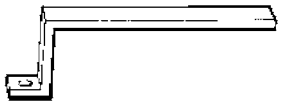
Tightening Torque Specifications

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
ABS hydraulic unit mounting bolt	26	2.6	18.8
Booster mounting nut	13	1.3	9.5
Brake pedal mounting nut	23	2.3	17.0
Brake pipe flare nut	16	1.6	11.5
Master cylinder cap (RH vehicle)	14	1.4	10.5
Clevis pin lock nut	19	1.9	14.0
LSPV bracket bolt	26	2.6	19.0
Master cylinder mounting nut	13	1.3	9.5
LSPV spring bracket bolt	9	0.9	6.5
LSPV spring end nut	20	2.0	14.5

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Brake fluid	DOT4 or SAE J1704	• To fill master cylinder reservoir. • To clean and apply to inner parts of caliper and wheel cylinder when they are disassembled.
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Clevis pin • Pedal shaft spacer

Special Tools

 09922-85811 Connector pin remover	 09950-78230 Flare nut wrench (10 – 11 mm)	 09951-18220 Secondary cup installer	 09952-46010 Master cylinder attachment
 09952-26020 Master cylinder plug	 09952-16021 Booster piston rod adjuster		

SECTION 5B

FRONT BRAKE

NOTE:

All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.

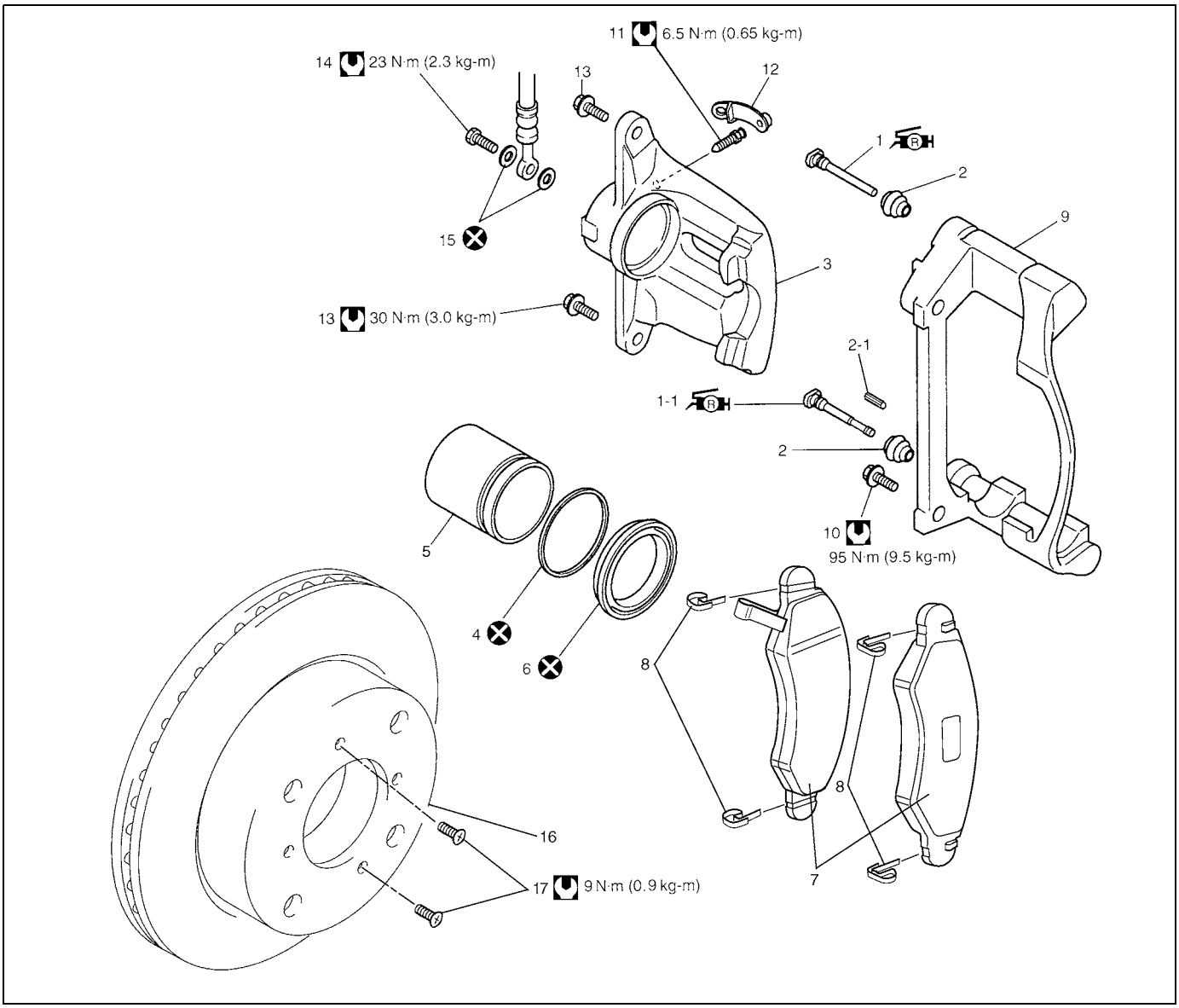
CONTENTS

General Description

Front Brake Component Location

CAUTION:

Lubricate parts as specified. Do not use lubricated shop air on brake parts as damage to rubber components may result. If any component is removed or line disconnected, bleed the brake system. Replace pads in axle sets only. The torque values specified are for dry, unlubricated fasteners.



R	1. Guiding pin	6. Piston boot	13. Caliper pin bolt
R	1-1. Locking pin: Apply specified rubber grease to guiding and locking pins surfaces for smooth movement.	7. Disc brake pad	14. Flexible hose bolt
	2. Pin boot	8. Pad spring	15. Blank
	2-1. Rubber tube	9. Brake caliper carrier	16. Brake disk
	3. Disc brake caliper (disc brake cylinder)	10. Caliper bolt	17. Brake disk screw
	4. Piston seal	11. Bleeder plug	Tightening torque
	5. Disc brake piston	12. Bleeder plug cap	Do not reuse

Diagnosis

Refer to Section 5 (BRAKES).

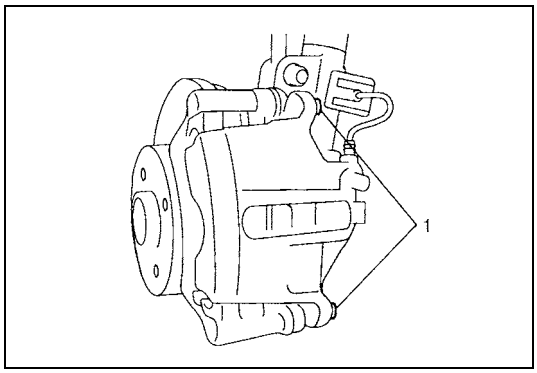
Check and Adjustment

Refer to Section 5 (BRAKES).

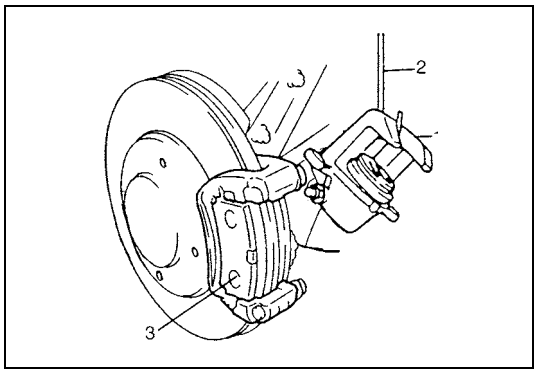
On-Vehicle Service

Front Disc Brake Pad Removal and Installation

REMOVAL



1) Hoist vehicle and remove wheel referring to “Wheel Removal and Installation” in Section 3F.
2) Remove caliper pin bolts (1).



3) Remove E-ring from strut and then remove caliper (1) from caliper carrier.

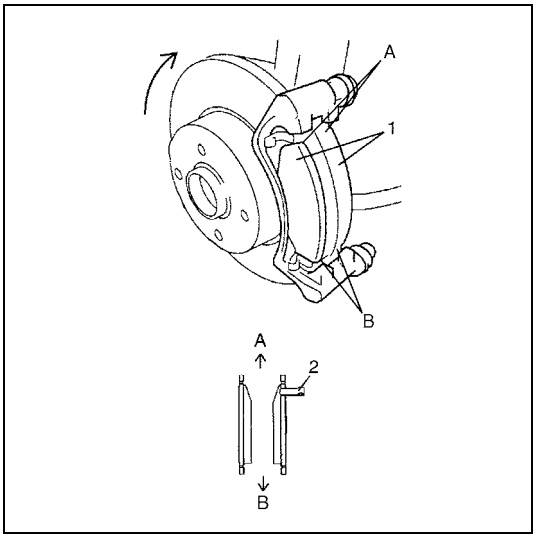
NOTE:

Hang removed caliper with a wire hook (2) or the like so as to prevent brake hose from bending and twisting excessively or being pulled. Don’t operate brake pedal with pads removed.

4) Remove pads (3).

INSTALLATION

CAUTION:
Observe CAUTION at the beginning of "Front Brake Component Location" in this section.

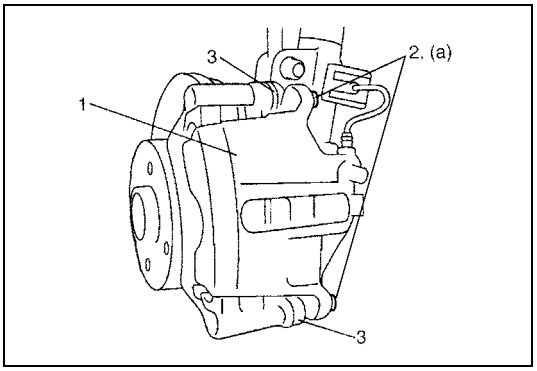


1) Install pads (1).

NOTE:

- **When installing brake pad, make sure that its tapered side is positioned upward (A) as shown in figure.**
- **Install pad with sensor (2) to vehicle center side on right wheel brake.**

A:	Upper side
B:	Lower side

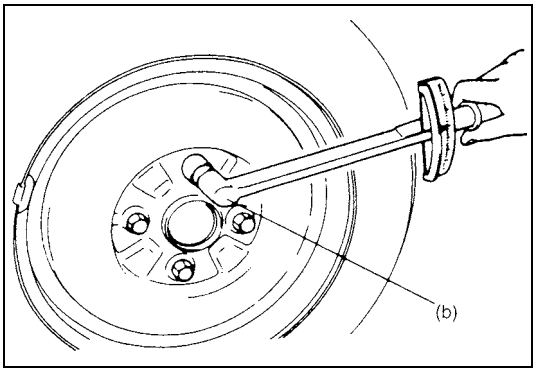


2) Install caliper (1) and tighten caliper pin bolts (2) to specification.

Tightening torque
Caliper pin bolt (a): 30 N·m (3.0 kg-m, 22.0 lb-ft)

NOTE:

Make sure that boots (3) are fit into groove securely.

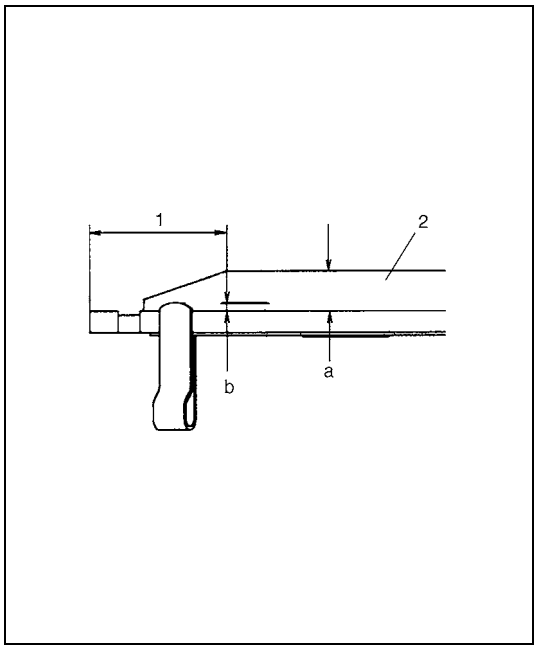


3) Tighten front wheel bolts to specification.

Tightening torque
Wheel bolt (b): 95 N·m (9.5 kg-m, 69.0 lb-ft)

4) Upon completion of installation, perform brake test.

Front Disc Brake Pad Inspection



Check pad lining (2) for wear. If one of brake pad is worn to service limit, all pads must be replaced at the same time.

CAUTION:

Never polish pad lining with sandpaper. If lining is polished with sandpaper, hard particles of sandpaper will be deposited in lining and may damage disc. When pad lining requires correction, replace it with a new one.

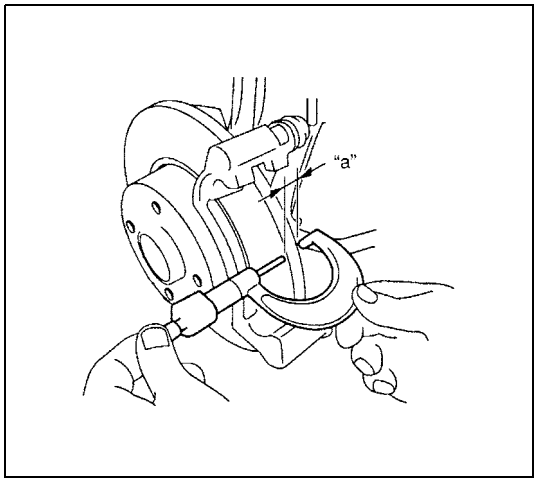
Pad (lining) thickness
Standard (a): 9.5 mm (0.374 in.)
Service limit (b): 2.0 mm (0.078 in.)

1. 35 mm (1.38 in.)

NOTE:

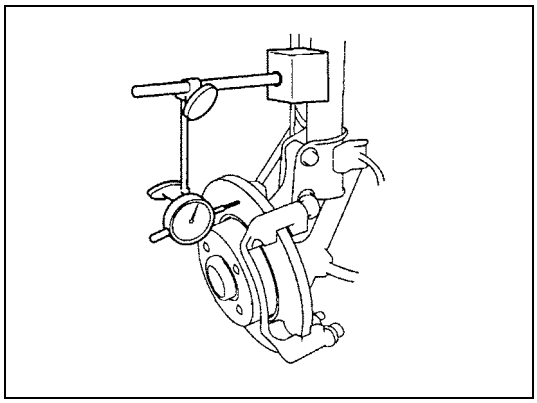
When pads are removed, visually inspect caliper for brake fluid leak. Correct leaky point, if any.

Front Brake Disc Inspection



1) Remove brake caliper, referring to "Front Disc Brake Pad Removal and Installation" in this section.
2) Check disc surface for scratches in wearing parts. Scratches on disc surface noticed at the time of specified inspection or replacement are normal and disc is not defective unless they are serious.
   But when there are deep scratches or scratches all over disc surface, replace it. When only one side is scratched, polish and correct that side.

Disc thickness "a"
Standard: 17.0 mm (0.67 in.)
Service limit: 15.0 mm (0.59 in.)



3) Hold the disc securely against the hub, then mount a dial indicator as shown and measure the run-out at 20 mm (0.79 in.) from the outer edge of the disc.

Limit on disc deflection: 0.15 mm (0.006 in.)

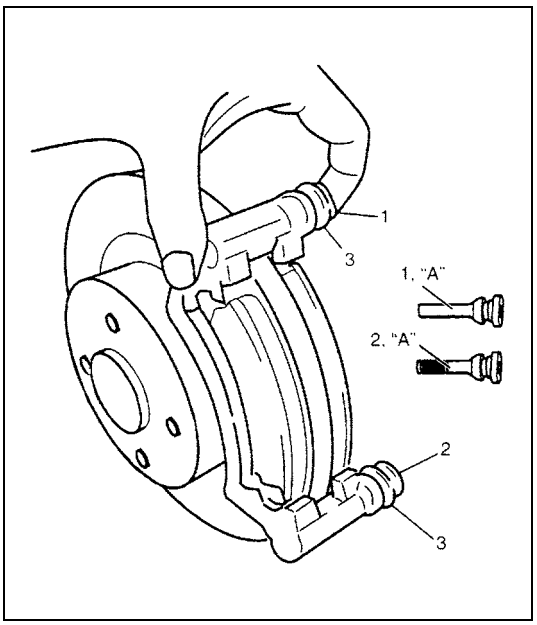
NOTE:

Check front wheel bearing for looseness before measurement.

Brake Caliper Carrier Inspection

Remove brake caliper, referring to “Front Disc Brake Pad Removal and Installation”

Cylinder Slide Guiding and Locking Pins



Check guiding pin (1) and locking pin (2) for smooth movement as shown.
If it is found faulty, correct or replace. Apply rubber grease to guiding and locking pins outer surface.
Rubber grease should be the on whose viscosity is less affected by such low temperature a –40°C (–40°F).

“A”: Rubber grease

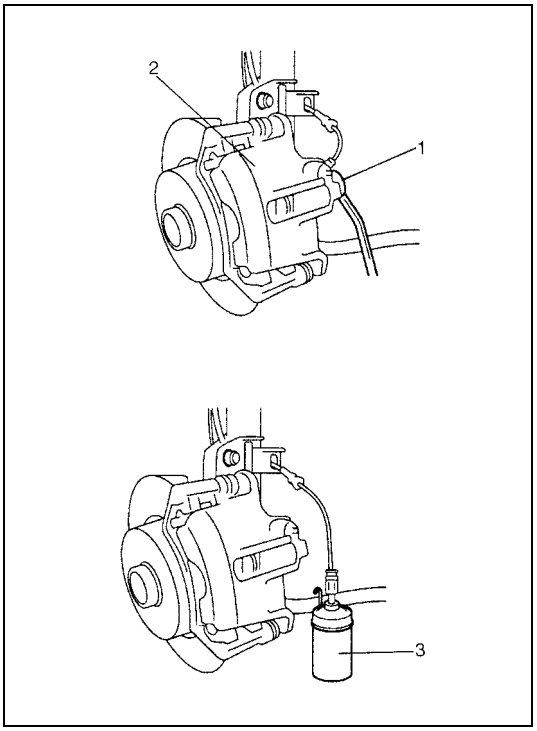
Locking pin (2) has grooves and rubber tube but guiding pin (1) has no groove. Install guiding pin (1) into pin hole of carrier upper side.

Dust Boot

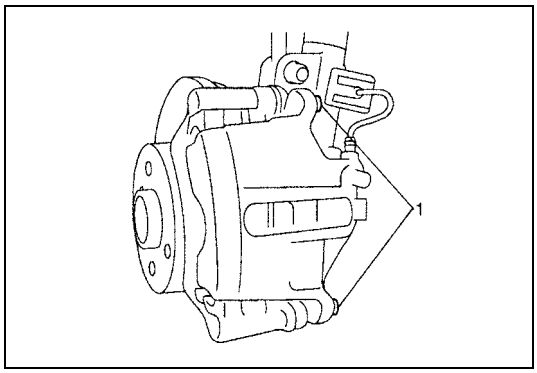
Check boot (3) for breakage, crack and damage. If defective, replace.

Front Disc Brake Caliper Removal and Installation

REMOVAL



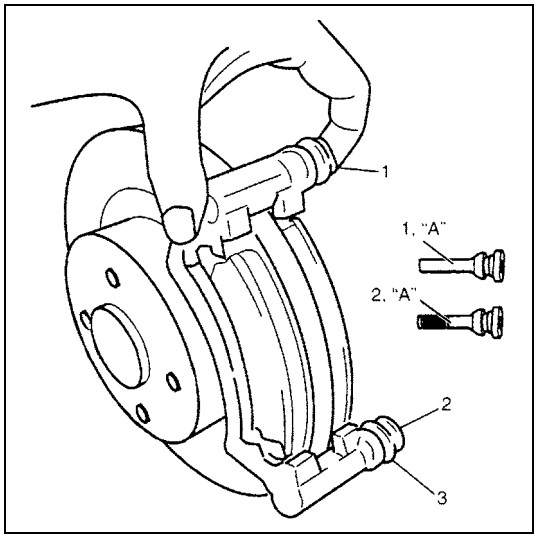
1) Hoist vehicle and remove wheel referring to “Wheel Removal and Installation” in Section 3F.
2) Remove brake flexible hose bolt (1) from caliper (2). As this will allow fluid to flow out of hose, have a container (3) ready before-hand.



3) Remove caliper pin bolts (1).
4) Remove caliper.

INSTALLATION

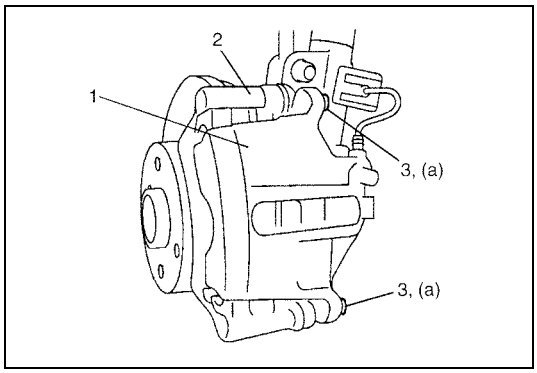
CAUTION:
Observe CAUTION at the beginning of "Front Brake Component Location" in this section.



Before installing caliper (cylinder body) to carrier, check to ensure that guiding pin (1) and locking pin (2) inserted in each caliper carrier hole can be moved smoothly in thrust direction.

NOTE:
Use rubber grease whose viscosity varies very little even at –40 °C (–40 °F) if applied.

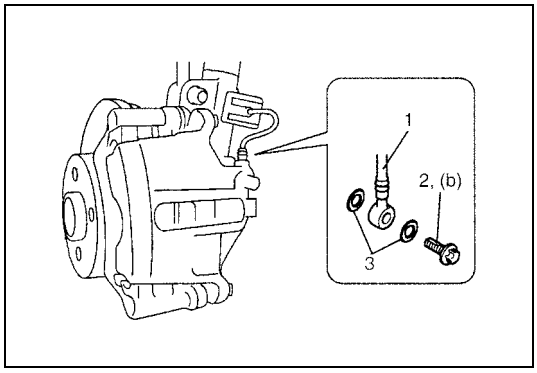
"A": Rubber grease



1) Install caliper (1) to caliper carrier (2).
2) Tighten caliper pin bolts (3) to specifications.

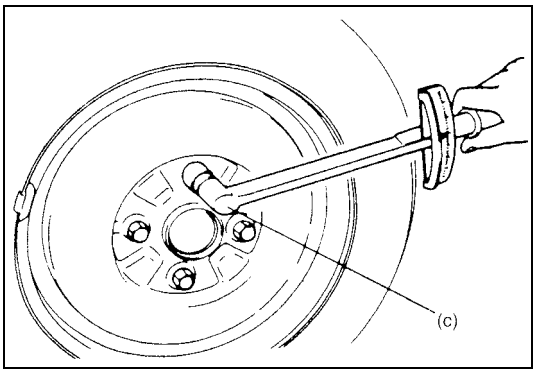
Tightening torque
Caliper pin bolt (a): 30 N·m (3.0 kg-m, 22.0 lb-ft)

NOTE:
Make sure that boots are fit into groove securely.



3) Install brake flexible hose (1) and new gaskets (3) as shown and tighten hose bolt (2) to specification.

Tightening torque
Flexible hose bolt (b): 23 N·m (2.3 kg-m, 17.0 lb-ft)

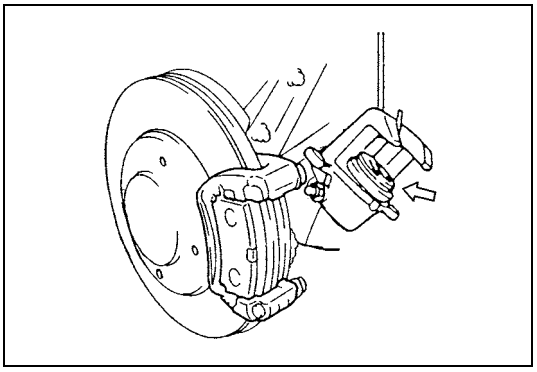


4) Tighten wheel bolts to specification.

Tightening torque
Wheel bolt (c): 95 N·m (9.5 kg-m, 69.0 lb-ft)

5) After completing installation, fill reservoir with brake fluid and bleed brake system. Perform brake test and check each installed part for oil leakage.

Front Disc Brake Caliper Boot Inspection



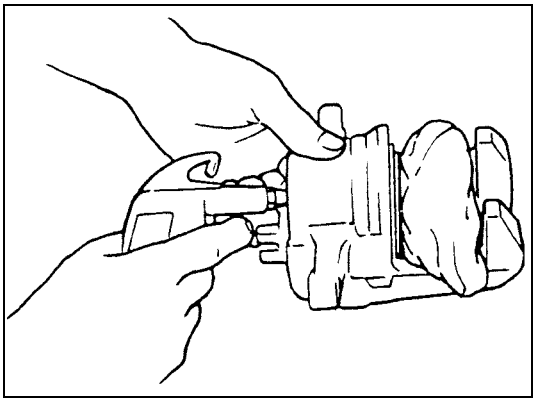
Check boot for breakage, crack, damage and leakage. If defective, replace piston seal and piston boot.

Front Disc Brake Caliper Disassembly and Assembly

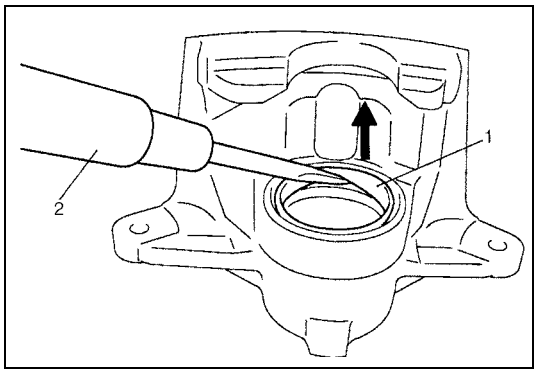
DISASSEMBLY

WARNING:
Do not apply too much highly compressed air which will cause piston to jump out of cylinder. It should be taken out gradually with moderately compressed air. Do not place your fingers in front of piston when using compressed air.

Before disassembly, clean all around caliper with brake fluid.

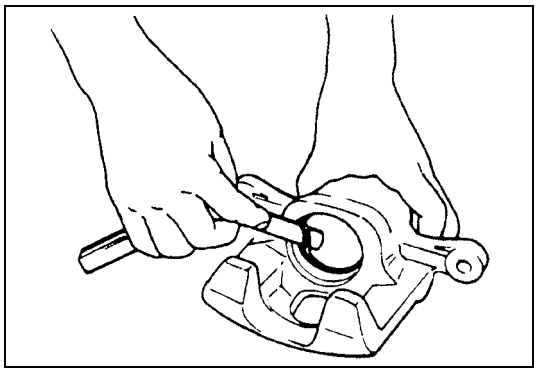


1) Blow compressed air into cylinder through bolt hole where flexible hose was fitted.
With this air pressure, piston can be pushed out of cylinder.



2) Remove piston boot (1) prying it with a metal tool (2) (no sharp edge).

CAUTION:
Be careful not to damage inside (bore side) of cylinder.



3) Remove piston seal using a thin blade like a thickness gauge, etc.

CAUTION:
Be careful not to damage inside (bore side) of cylinder.

ASSEMBLY

Reassemble front brake in reverse order of disassembly, noting the following points.

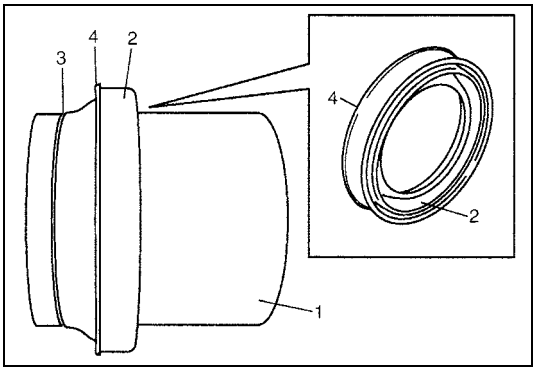
CAUTION:
- **Wash each part cleanly before installation in the same fluid as the one used in master cylinder reservoir.**
- **Never use other fluid or thinner.**
- **Before installing piston and piston seal to cylinder, apply fluid to them.**
- **After reassembling brake lines, bleed air from them.**

Piston Seal, Piston and Boot

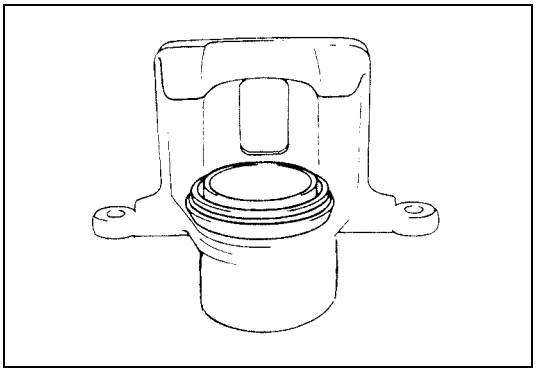
NOTE:

Piston seal is used to seal piston and cylinder and to adjust clearance between pad and disc. Replace with a new one at every overhaul.

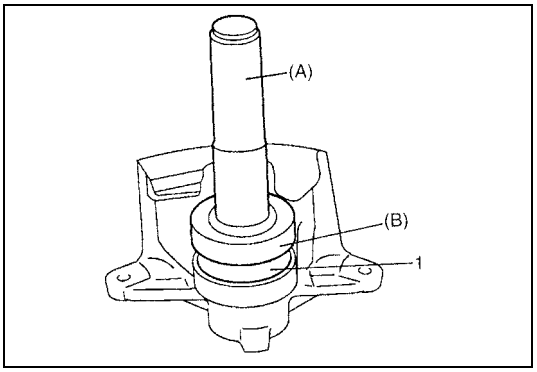
1) Fit piston seal into groove in cylinder taking care not to twist it.



2) Fit new boot (2) in groove (3) of piston (1) facing stepped end (4) of boot to groove side.



3) Insert piston into cylinder by hand.



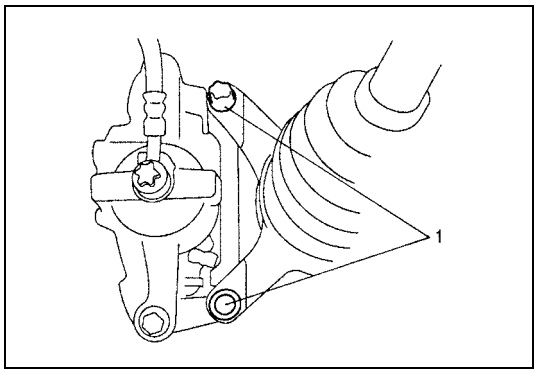
4) Drive in boot (1) into cylinder till its end surface becomes flush with cylinder end surface using special tools.

Special tool
(A): 09924-74510
(B): 09944-88210

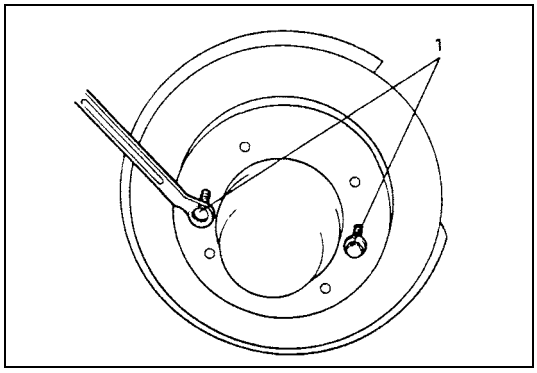
Front Brake Disc Removal and Installation

CAUTION:
During removal, be careful not to damage brake flexible hose and not to depress brake pedal.

REMOVAL

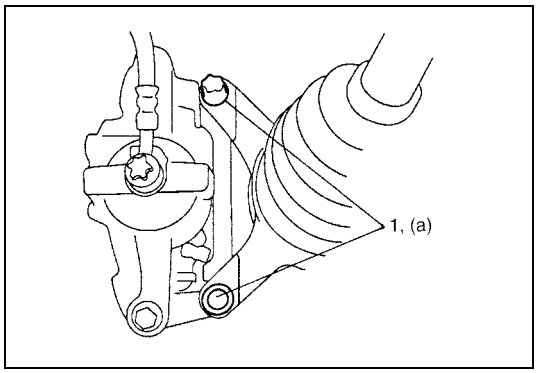


1) Hoist vehicle and remove wheel referring to “Wheel Removal and Installation” in Section 3F.
2) Remove caliper assembly by loosening carrier bolts (1).
3) Remove brake disc securing screws.



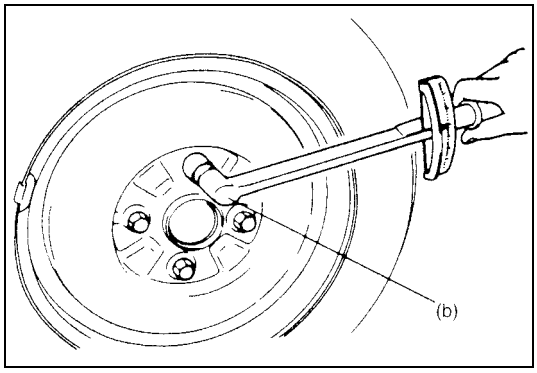
4) Remove disc by using 8 mm bolts (1) (2 pcs).

INSTALLATION



1) Install disc to wheel hub and tighten disc securing screws.
2) Install caliper assembly to steering knuckle.
3) Tighten caliper carrier bolts (1) to specification.

Tightening torque
Caliper carrier bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)



4) Tighten front wheel bolts to specifications.

Tightening torque
Wheel bolt (b): 95 N·m (9.5 kg-m, 69.0 lb-ft)

5) Upon completion of installation, perform brake test.

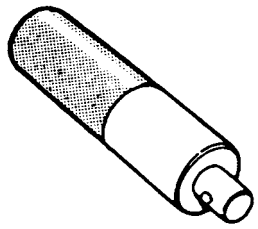
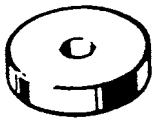
Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Caliper pin bolt	30.0	3.0	22.0
Wheel bolt	95.0	9.5	69.0
Flexible hose bolt	23.0	2.3	17.0
Caliper carrier bolt	95.0	9.5	69.0
Brake disc securing screw	9.0	0.9	6.5

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Brake fluid	DOT4 or SEA J1704	• To fill master cylinder reservoir • To clean and apply to inner parts of caliper and wheel cylinder when they are disassembled
Rubber grease	Molykoto G807 or equivalent	To caliper guiding and locking pins

Special Tool

	
09924-74510 Bearing installer	09944-88210 Bearing installer

SECTION 5C

PARKING AND REAR BRAKE

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

NOTE:

All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.

CONTENTS

Diagnosis

Refer to Section 5 (Brakes).

Check and Adjustment

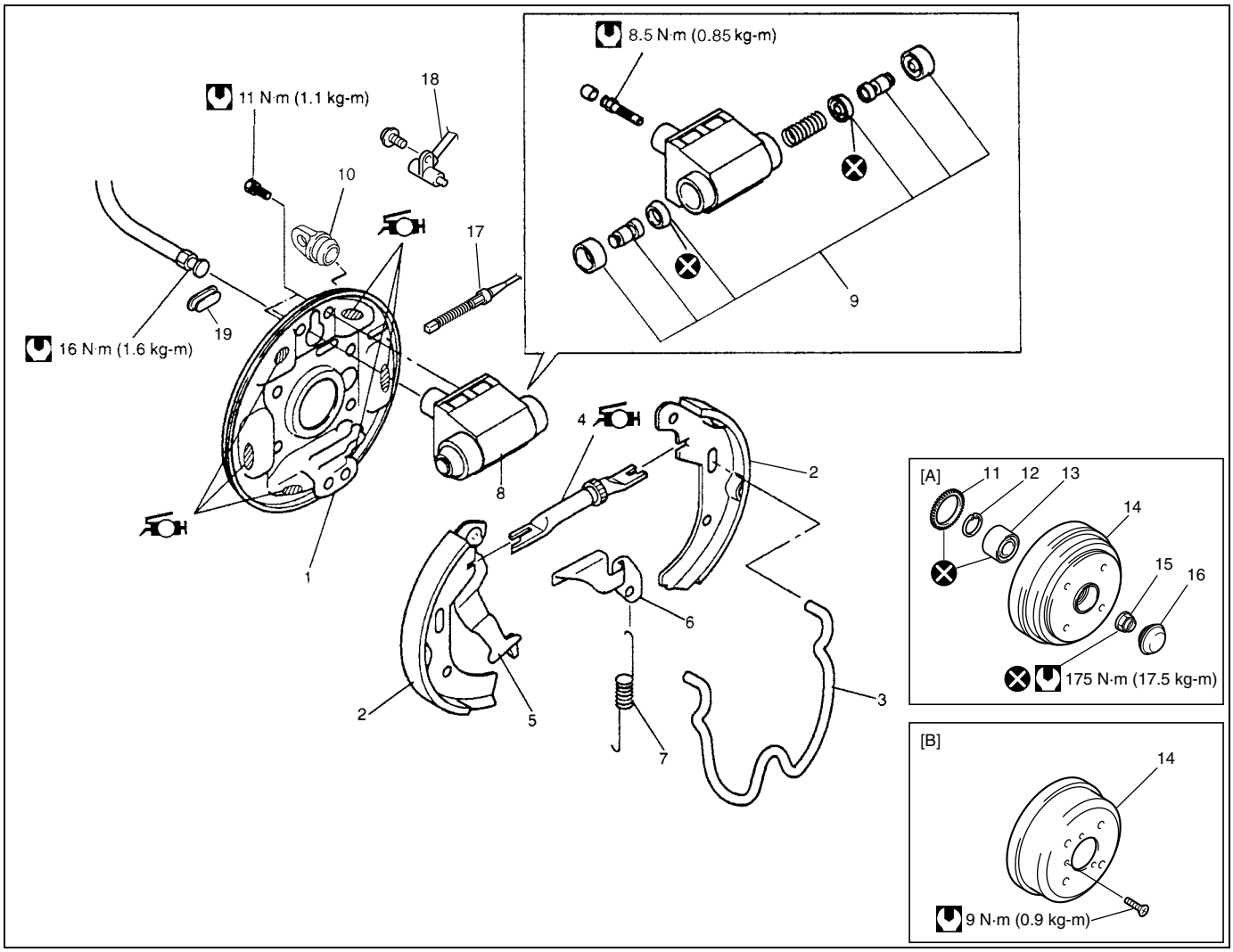
Refer to Section 5 (Brakes).

On-Vehicle Service

Brake Drum Component Location

CAUTION:

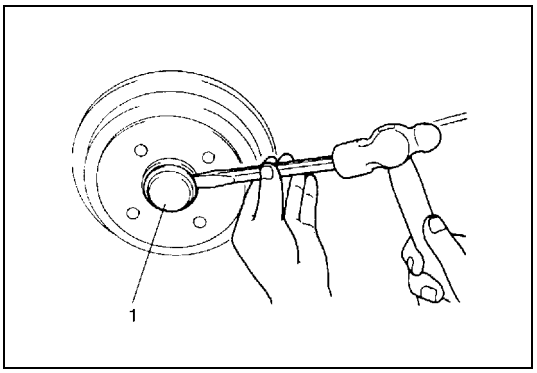
- **Replace all components included in repair kits to service this drum brake. Lubricate parts as specified.**
- **If any hydraulic component is removed or brake line disconnected, bleed the brake system.**
- **The torque values specified are for dry, unlubricated fasteners.**



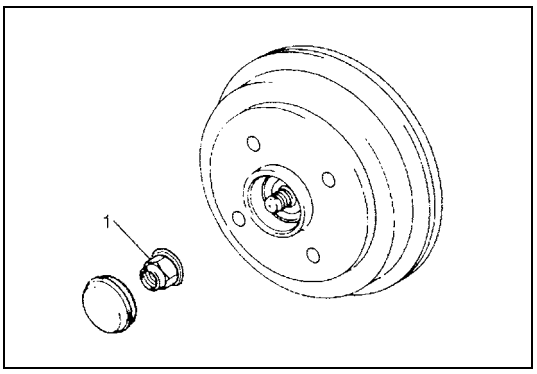
⚙	1. Brake back plate: Clean back plate and apply thin coat of Bentonite base brake grease (anti-squeal agent) to six surfaces on which shoe rims rest.	9. Piston assembly	17. Parking brake cable
	2. Brake shoe	10. Cover	18. Wheel speed sensor ***if equipped with ABS
	3. Retractor spring	11. Sensor ring ***if equipped with ABS	19. Adjuster cover
⚙	4. Brake adjuster (strut): Apply Bentonite base brake grease between actuator and shoe rim and at actuator pivot points.	12. Circlip	[A] 2WD model
	5. Parking brake shoe lever	13. Wheel bearing	[B] 4WD model
	6. Adjuster actuator	14. Brake drum	Tightening torque
	7. Adjuster spring	15. Spindle nut	Do not reuse
	8. Wheel cylinder	16. Spindle cap	

Brake Drum Removal and Installation (for 2WD Model)

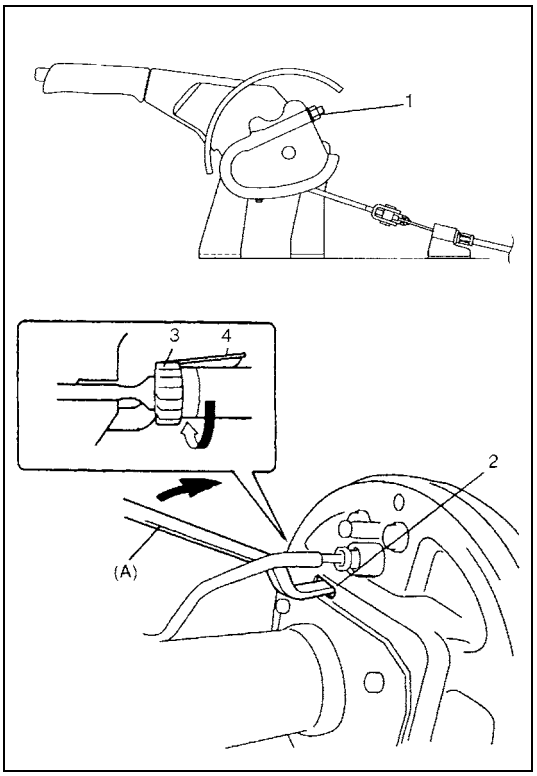
REMOVAL



1) Hoist vehicle and remove wheel referring to “Wheel Removal and Installation” in Section 3F.
2) Remove spindle cap (1) as shown (by hammering lightly at 3 locations around it so as not to deform or cause damage to seating part of cap).



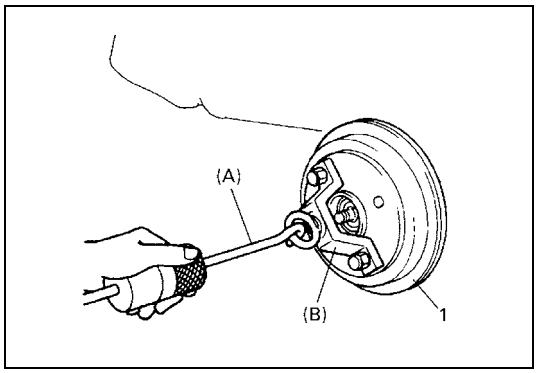
3) Uncaulk spindle nut, remove spindle nut (1).



4) Release parking brake lever.
5) Remove brake drum.
   If brake drum can not be removed easily, increase clearance between brake shoes and drum as follows.
   a) Remove console box cap and loosen parking brake cable adjusting nut (1).
   b) Remove adjuster cover on back plate.
   c) Insert special tool through hole (2) in back plate.

   Special tool
   (A): Snap-on Part No. B3404B or equivalent

   d) Pressing adjuster actuator (4) to the outside of the vehicle, turn adjuster (3) with special tool (A) in such direction as indicated in figure so as to obtain larger clearance.



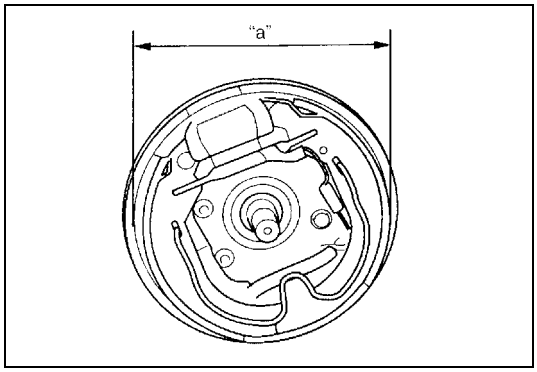
e) Pull brake drum (1) off by hand.
If it is hard to remove, use special tools.

Special tool
(A): 09942-15111
(B): 09943-17912

NOTE:

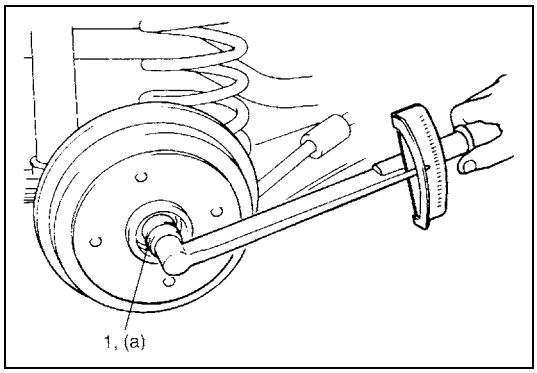
When drum is removed, visually inspect wheel cylinder for brake fluid leakage. Correct leaky point if any.

INSTALLATION



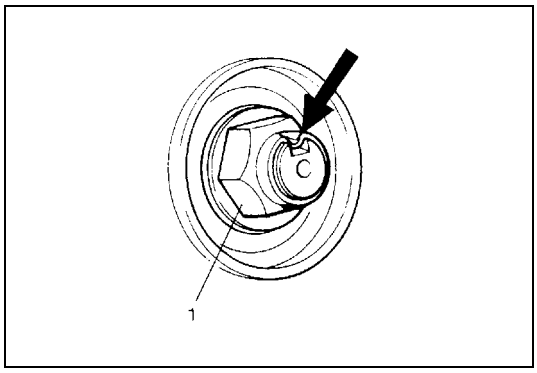
1) Before installing brake drum, check outer diameter "a" of brake shoes. If it is not within value as specified below, adjust it to specification by turning adjuster.

Brake shoes outer diameter "a"	=	Measured brake drum inside diameter	–	0.5 to 1.0 mm (0.02 to 0.04 in.)



2) Install brake drum after making sure that inside of brake drum and brake shoes are free from dirt and oil.
3) Install new spindle nut (1).
4) Tighten spindle nut (1) to specified torque.

Tightening torque
Spindle nut (a): 175 N·m (17.5 kg-m, 126.5 lb-ft)

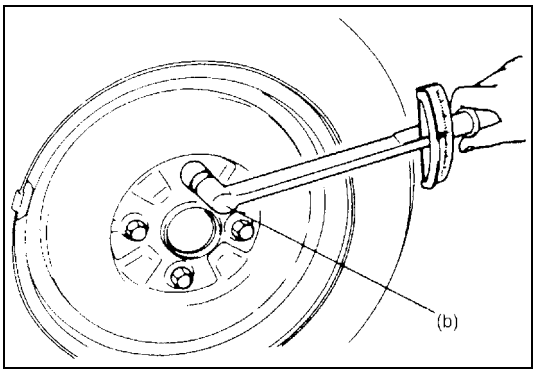


5) Calk spindle nut (1).
6) Install spindle cap.

NOTE:

- **When installing spindle cap, hammer lightly several locations on the collar of cap until collar comes closely into contact with brake drum.**
- **If fitting part of cap is deformed or damaged or if it is fitted loosely, replace with new one.**

7) Upon completion of all jobs, depress brake pedal with about 300 N (30 kg, 66 lbs) load at least 15 – 20 times until adjuster actuator clicking sound from drum brake can not be heard so as to obtain proper drum-to-shoe clearance.
Adjust parking brake cable. For adjustment, refer to "Parking Brake Inspection and Adjustment" in Section 5.
8) Install console box cap if removed.



9) Install wheel and tighten wheel bolts to specified torque.

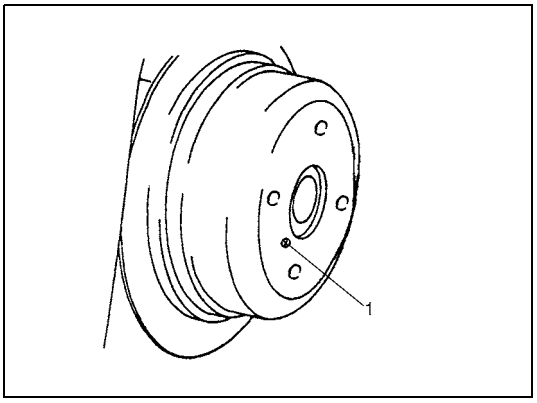
Tightening torque
Wheel bolt (b): 95 N·m (9.5 kg-m, 69.0 lb-ft)

10) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then remove vehicle from hoist and perform brake test (foot brake and parking brake).

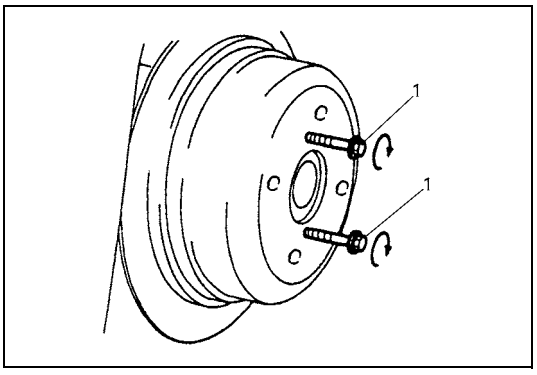
Brake Drum Removal and Installation (for 4WD Model)

REMOVAL

1) Hoist vehicle and remove wheel referring to “Wheel Removal and Installation” in Section 3F.



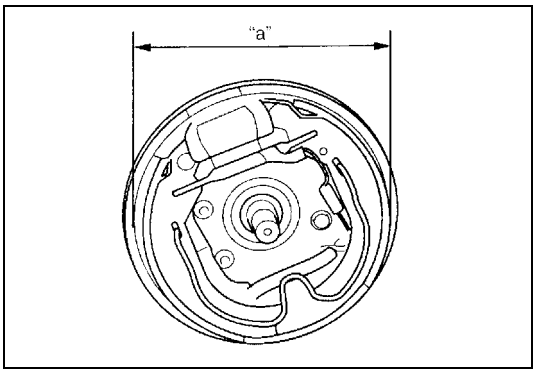
2) Remove brake drum screw (1) and release parking brake lever.



3) Remove brake drum.
If brake drum can not be removed easily, increase clearance between brake shoes and drum, referring to step a) – d) in “Brake Drum Removal and Installation (for 2WD Model)”.
a) Pull brake drum off by using 8 mm bolts (1).

NOTE:
When drum is removed, visually inspect wheel cylinder for brake fluid leakage. Correct leaky point, if any.

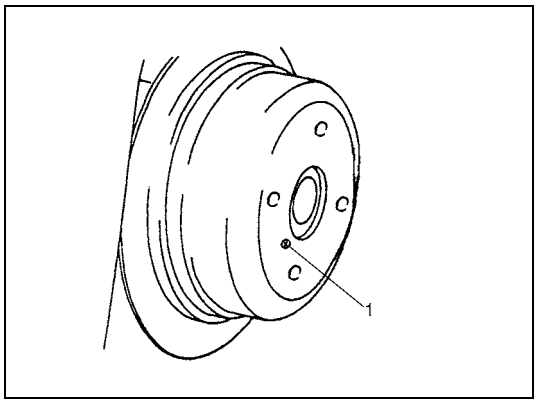
INSTALLATION



1) Before installing brake drum, check outer diameter “a” of brake shoes. If it is not within value as specified below, adjust it to specification by turning adjuster.

Brake shoes outer diameter “a”	=	Measured brake drum inside diameter	–	0.5 to 1.0 mm (0.02 to 0.04 in.)

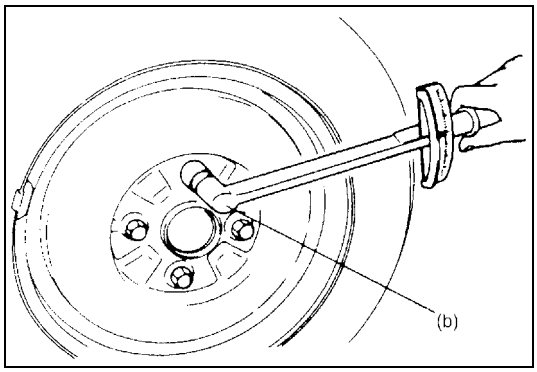
2) Install brake drum after making sure that inside of brake drum and brake shoes are free from dirt and oil.



3) Tighten screw (1) to specified torque.

Tightening torque
Brake drum screw (a): 9 N·m (0.9 kg-m, 6.5 lb-ft)

4) Upon completion of all jobs, depress brake pedal with about 300 N (30 kg, 66 lbs) load at least 15 – 20 times until adjuster actuator clicking sound from drum brake can not be heard so as to obtain proper drum-to-shoe clearance.
   Adjust parking brake cable. For adjustment refer to “Parking Brake Inspection and Adjustment” in Section 5.
5) Install console box cap if removed.



6) Install wheel and tighten wheel bolts to specified torque.

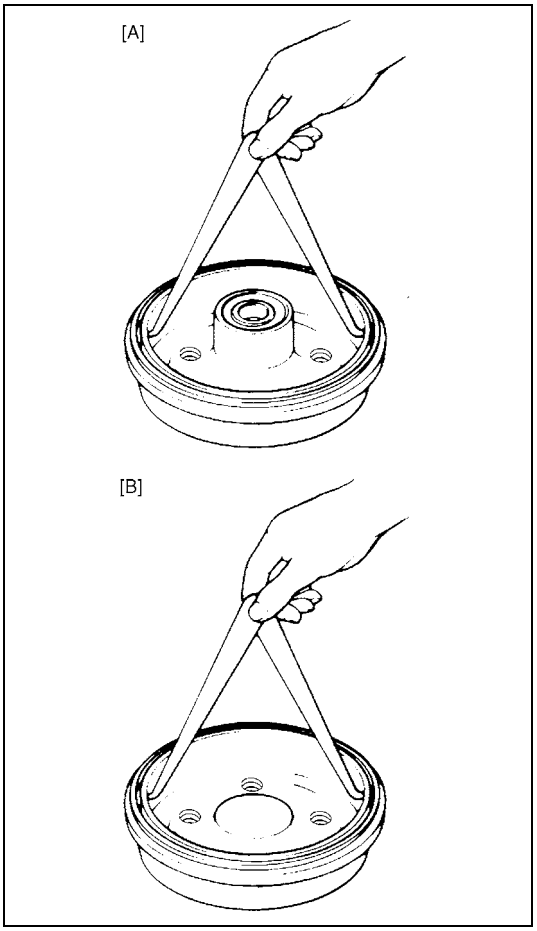
Tightening torque
Wheel bolt (b): 95 N·m (9.5 kg-m, 69.0 lb-ft)

7) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then remove vehicle from hoist and perform brake test (foot brake and parking brake).

Drum Brake Component Parts Inspection

BRAKE DRUM

Inside diameter



Inspect drum for cleanliness. Check wear of its braking surface by measuring its inside diameter.

Brake drum inside diameter
Standard: 200 mm (7.87 in.)
Service Limit: 202 mm (7.95 in.)

Whenever brake drums are removed, they should be thoroughly cleaned and inspected for cracks, scores, deep grooves.

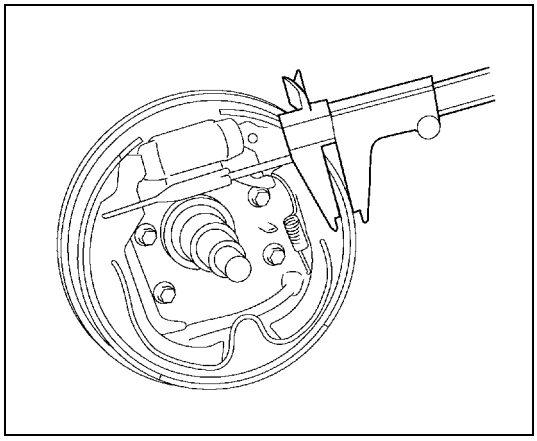
[A] 2WD model
[B] 4WD model

Cracked, scored, or grooved drum

A cracked drum is unsafe for further service and must be replaced. Do not attempt to weld a cracked drum.
Smooth up any slight scores. Heavy or extensive scoring will cause excessive brake lining wear and it will probably be necessary to resurface drum braking surface.
If brake linings are slightly worn and drum is grooved, drum should be polished with fine emery cloth but should no be turned.

BRAKE SHOE

Brake shoe thickness (wear)



Where lining is worn out beyond service limit, replace shoe.

Thickness (lining + shoe rim)
Standard: 6.4 mm (0.25 in.)
Service limit: 3.6 mm (0.14 in.)

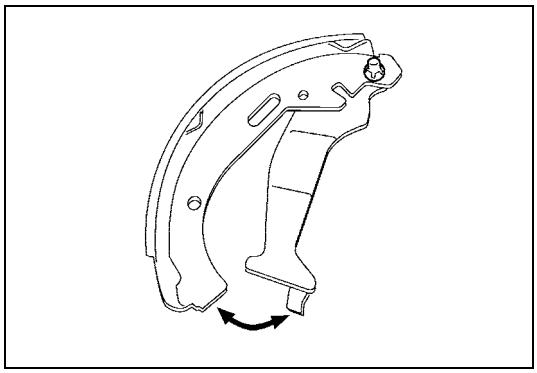
If one of brake linings is to service limit, all linings must be replaced at the same time.

CAUTION:
Never polish lining with sandpaper. If lining is polished with sandpaper, hard particles of sandpaper will be deposited in lining and may damage drum. When it is required to correct lining, replace it with a new one.

WHEEL CYLINDER

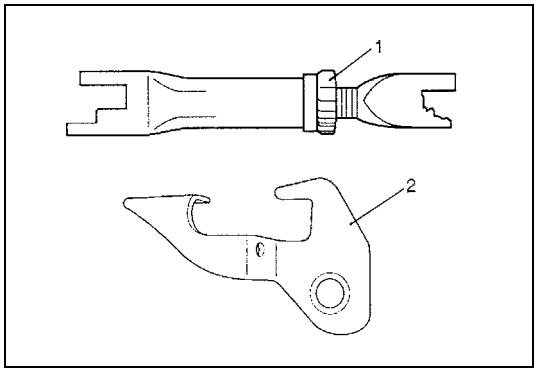
Visually inspect wheel cylinder for brake fluid leakage.

PARKING SHOE LEVER



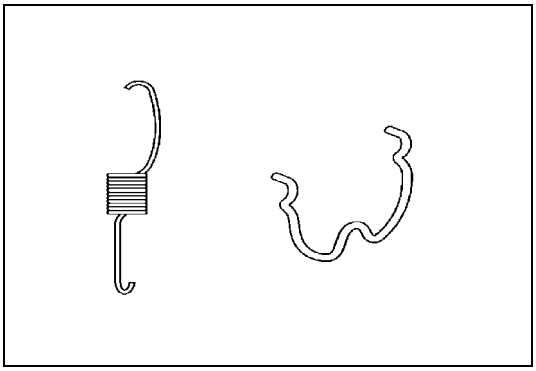
Inspect brake shoe lever for smooth movement along shoe rim. If defective, correct or replace.

BRAKE ADJUSTER (STRUT) AND ADJUSTER ACTUATOR



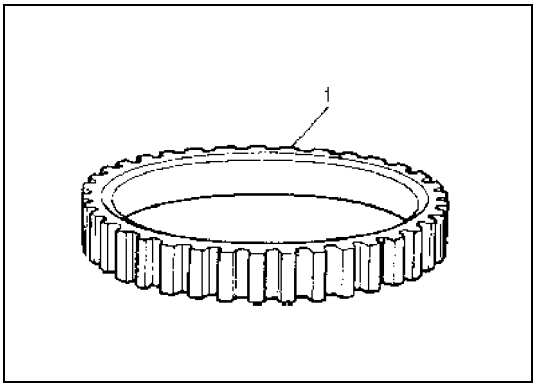
Check ratchet (1) of adjuster and adjuster actuator (2) for operation, wear or damage.

SPRINGS



Inspect for damage or weakening.
Inspect each part for rust. If found defective, replace.

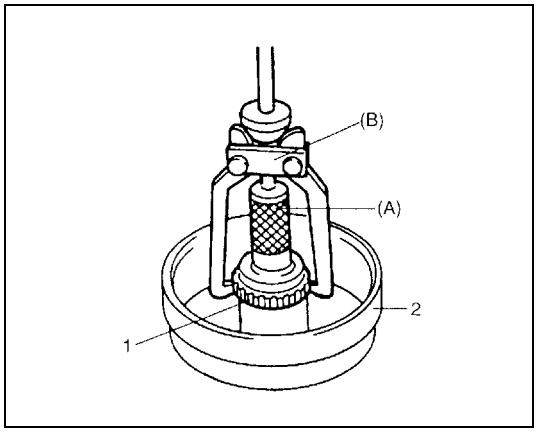
ABS SENSOR RING (IF EQUIPPED)



- Check ring serration (teeth) for being missing, damaged or deformed.
- Check sensor ring (1) for being deformed (warped).
- Check that no foreign material is attached.
  If any malfunction is found, repair or replace.

ABS Sensor Ring Replacement (for 2WD Model)

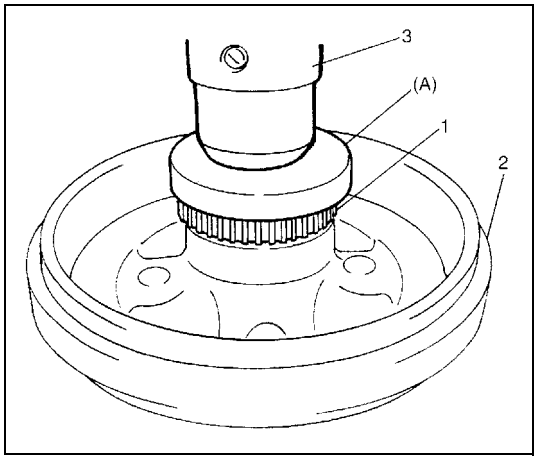
CAUTION:
Do not reuse (reinstall) removed ABS sensor ring.



1) Remove sensor ring (1) from brake drum (2) using special tool.

CAUTION:
Pull out sensor ring from brake drum gradually and evenly. Attempt to pull it out partially may cause it to be deformed.

Special tool
(A): 09913-75520
(B): 09913-65135



2) Install new sensor ring (1) to brake drum (2) by using special tool and hydraulic press (3).

CAUTION:
Used sensor ring can not be press-fitted securely.

Special tool
(A): 09926-68310

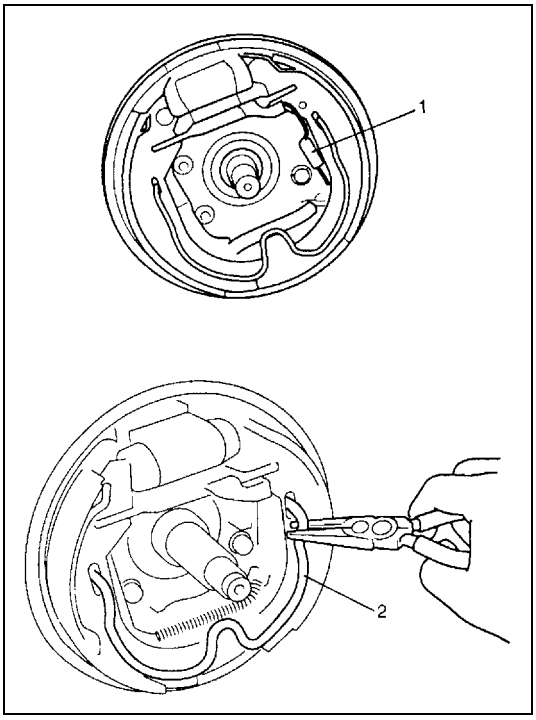
ABS Sensor Ring Replacement (for 4WD Model)

CAUTION:
Do not reuse (reinstall) removed ABS sensor ring.

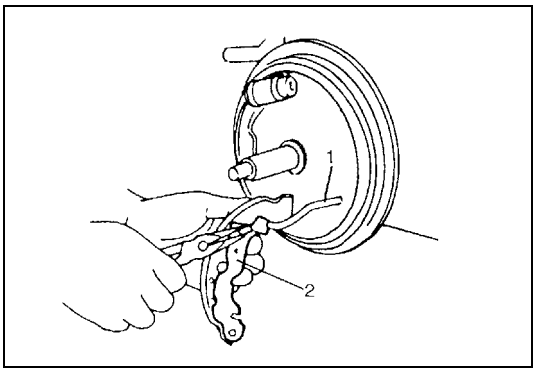
Replace ABS sensor ring, referring to “Rear Axle Shaft and Wheel Bearing Removal and Installation (for 4WD Model)” in section 3E.

Brake Shoe Removal and Installation

REMOVAL

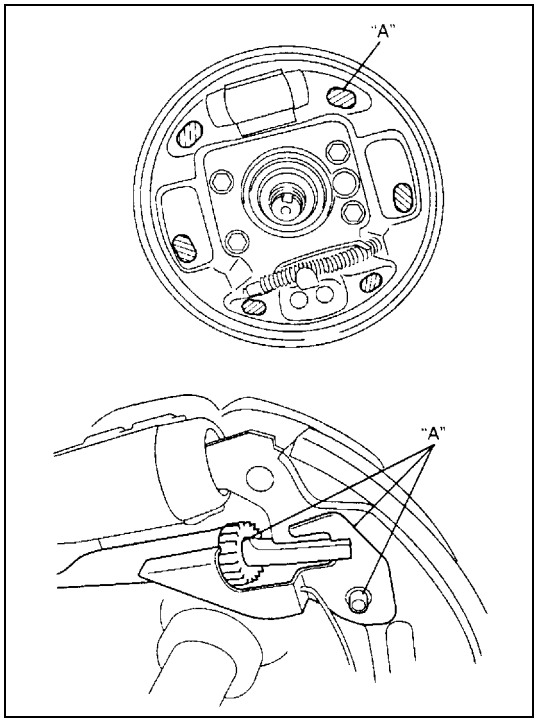


1) Remove brake drum, referring to “REMOVAL” under “Brake Drum Removal and Installation (for 2WD Model)”.
2) Remove adjuster spring (1).
3) Remove retractor spring (2) as shown.



4) Remove brake shoes and disconnect parking brake cable (1) from parking brake shoe lever (2).

INSTALLATION

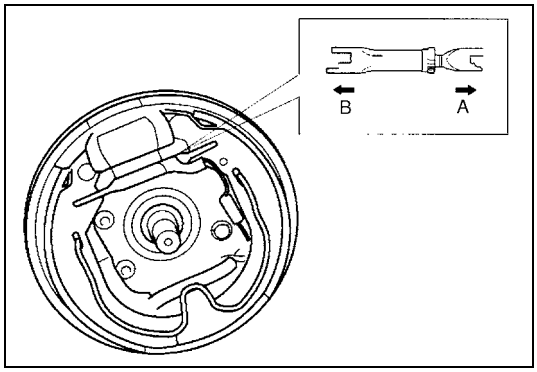


1) When reinstalling brake adjuster, disassemble and thoroughly clean screw threads with a wire brush and apply grease to screw threads.
   Clean brake back plate and apply thin coat of grease to six surface on which shoe rims rest.

"A": Bentonite base brake grease (Anti-squeal agent)

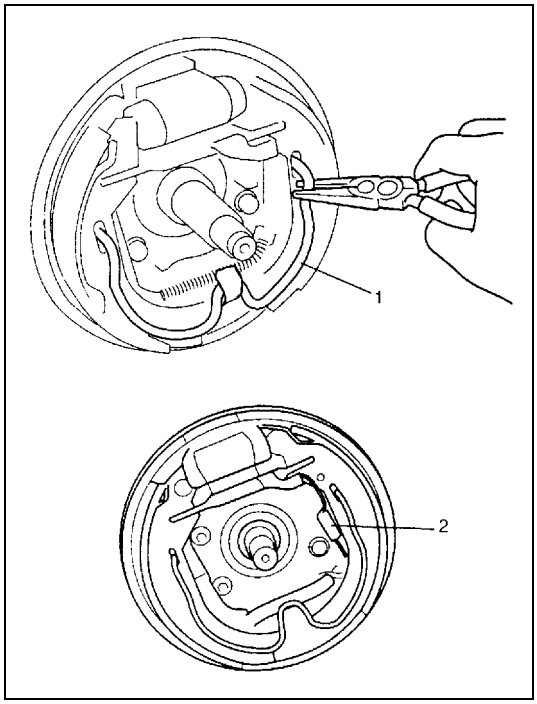
2) Apply thinly grease between actuator and shoe rim, and at actuator pivot point.

"A": Bentonite base brake grease (Anti-squeal agent)



3) Assemble parts as shown in reverse order of Removal.

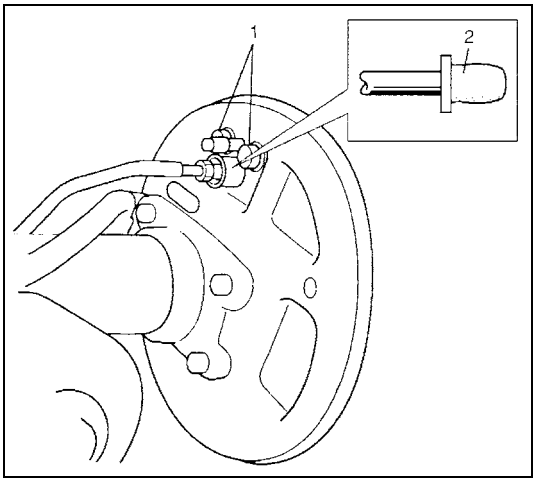
[A]	Forward
[B]	Rearward



4) Install retractor spring (1) as shown.
5) Install adjuster spring (2) as shown, with loop facing outward.
6) Install brake drum referring to "Brake Drum Removal and Installation (for 2WD Model)" or "Brake Drum Removal and Installation (for 4WD Model)" in this section.

Wheel Cylinder Removal and Installation

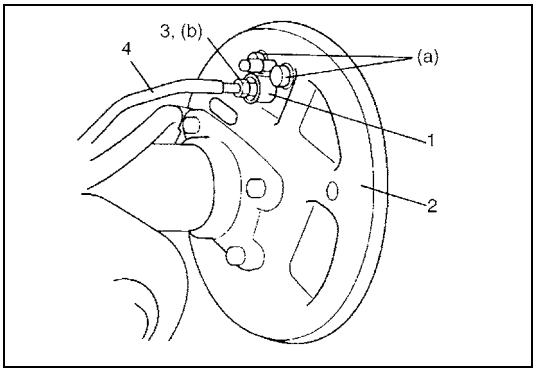
REMOVAL



1) Remove brake drum referring to “Brake Drum Removal and Installation (for 2WD Model)” or “Brake Drum Removal and Installation (for 4WD Model)” in this section.
2) Remove brake shoe referring to “Brake Drum Removal and Installation (for 2WD Model)” or “Brake Drum Removal and Installation (for 4WD Model)” in this section.
3) Loosen brake pipe flare nut but only within the extent that fluid does not leak.
4) Remove wheel cylinder mounting bolts (1). Disconnect brake pipe from wheel cylinder and put wheel cylinder bleeder plug cap (2) onto pipe to prevent fluid from spilling.

INSTALLATION

1) Take off bleeder plug cap from brake pipe and connect pipe (for pipes) to wheel cylinder just enough to prevent fluid from leaking.



2) Tighten wheel cylinder (1) to brake back plate (2) to specified torque.
3) Torque flare nut (3) of brake pipe (4) which was connected in step 1) to specification.

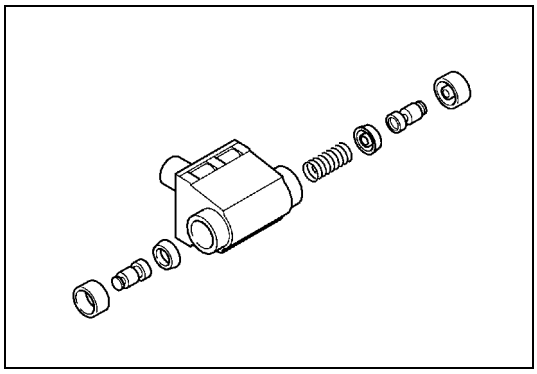
Tightening torque
Wheel cylinder bolt (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)
Brake pipe flare nut (b): 16 N·m (1.6 kg-m, 12.0 lb-ft)

4) Install bleeder plug cap taken off from pipe back to bleeder plug.
5) For procedure hereafter, refer to “INSTALLATION” under “Brake Shoe Removal and Installation”.

NOTE:

Be sure to bleed brake system. (For bleeding operation, refer to “Air Bleeding of Brake System” in Section 5.)

Wheel Cylinder Inspection



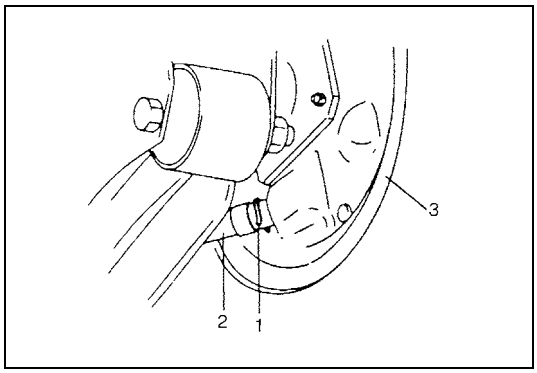
Inspect wheel cylinder disassembled parts for wear, cracks, corrosion or damage.

NOTE:
Clean wheel cylinder components with brake fluid.

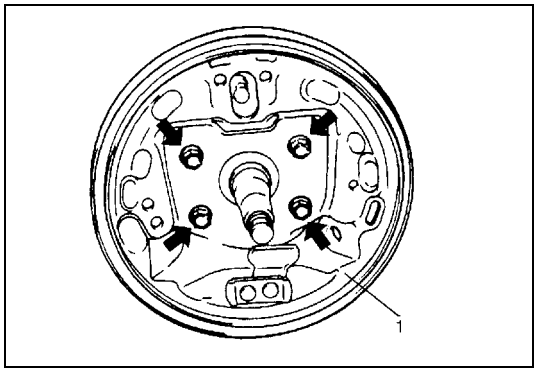
Brake Back Plate Removal and Installation (for 2WD Model)

REMOVAL

1) Remove brake drum referring to “Brake Drum Removal and Installation (for 2WD Model)”.
2) Remove brake shoe referring to “Brake Shoe Removal and Installation”.
3) Remove wheel cylinder referring to “Wheel Cylinder Removal and Installation”.

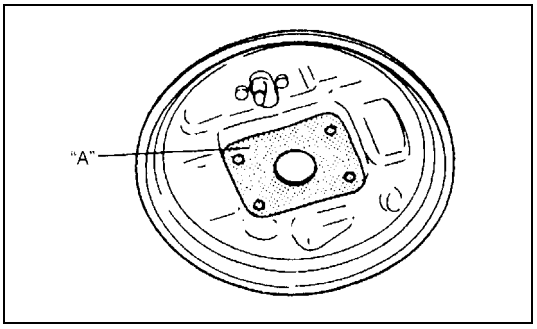


4) Remove parking brake cable securing clip (1) and disconnect brake cable (2) from brake back plate (3).



5) Remove brake back plate (1) from rear axle.

INSTALLATION

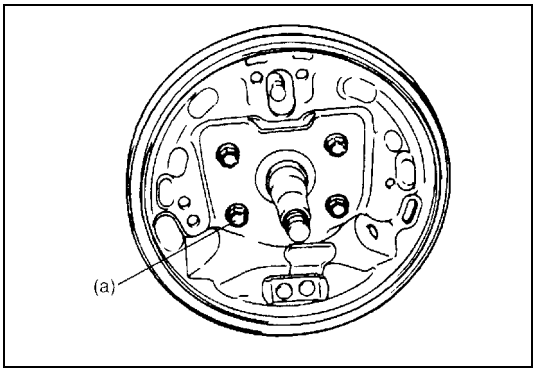


1) Apply water tight sealant to mating surfaces of brake back plate and rear axle.

"A": Sealant 366E, 99000-31090

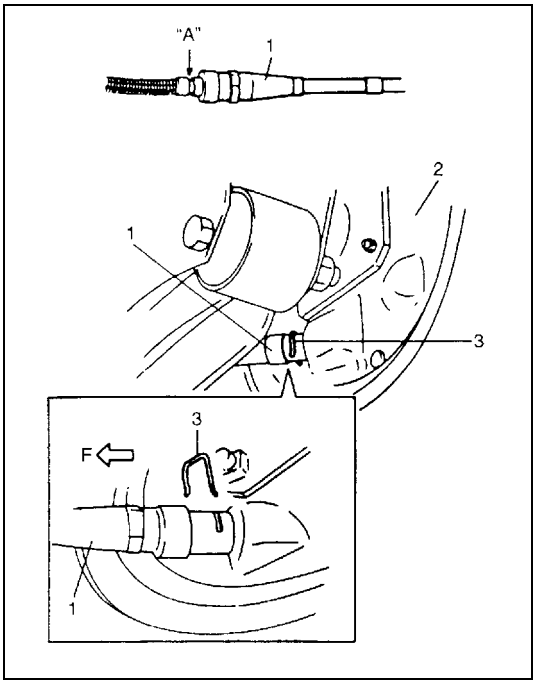
NOTE:

In case of vehicle equipped with ABS, do not apply sealant around hole for wheel speed sensor.



2) Install brake back plate and tighten back plate bolts to specified torque.

Tightening torque
Brake back plate bolt (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

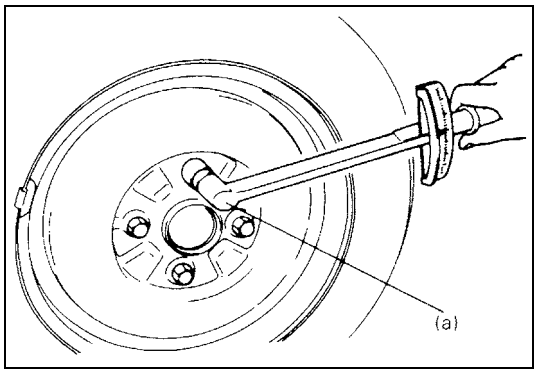


3) Apply water tight sealant where plate and cable contact, and run parking brake cable (1) through brake back plate (2) and secure it with clip (3).

"A": Sealant 366E, 99000-31090

F: Forward

4) Install wheel cylinder, and tighten wheel cylinder bolts and brake pipe flare nut to specified torque. Refer to "Installation" of "Wheel Cylinder Removal and Installation" in this section.
5) Install brake shoe referring to "INSTALLATION" of "Brake Shoe Removal and Installation" in this section.
6) Install brake drum. Refer to "INSTALLATION" of "Brake Drum Removal and Installation (for 2WD Model)" or to "INSTALLATION" of "Brake Drum Removal and Installation (for 4WD Model)" in this section.
7) Fill reservoir with brake fluid and bleed brake system. For bleeding operation, referring to "Air Bleeding of Brake System" in Section 5.



8) Install wheel and tighten wheel bolts to specified torque.

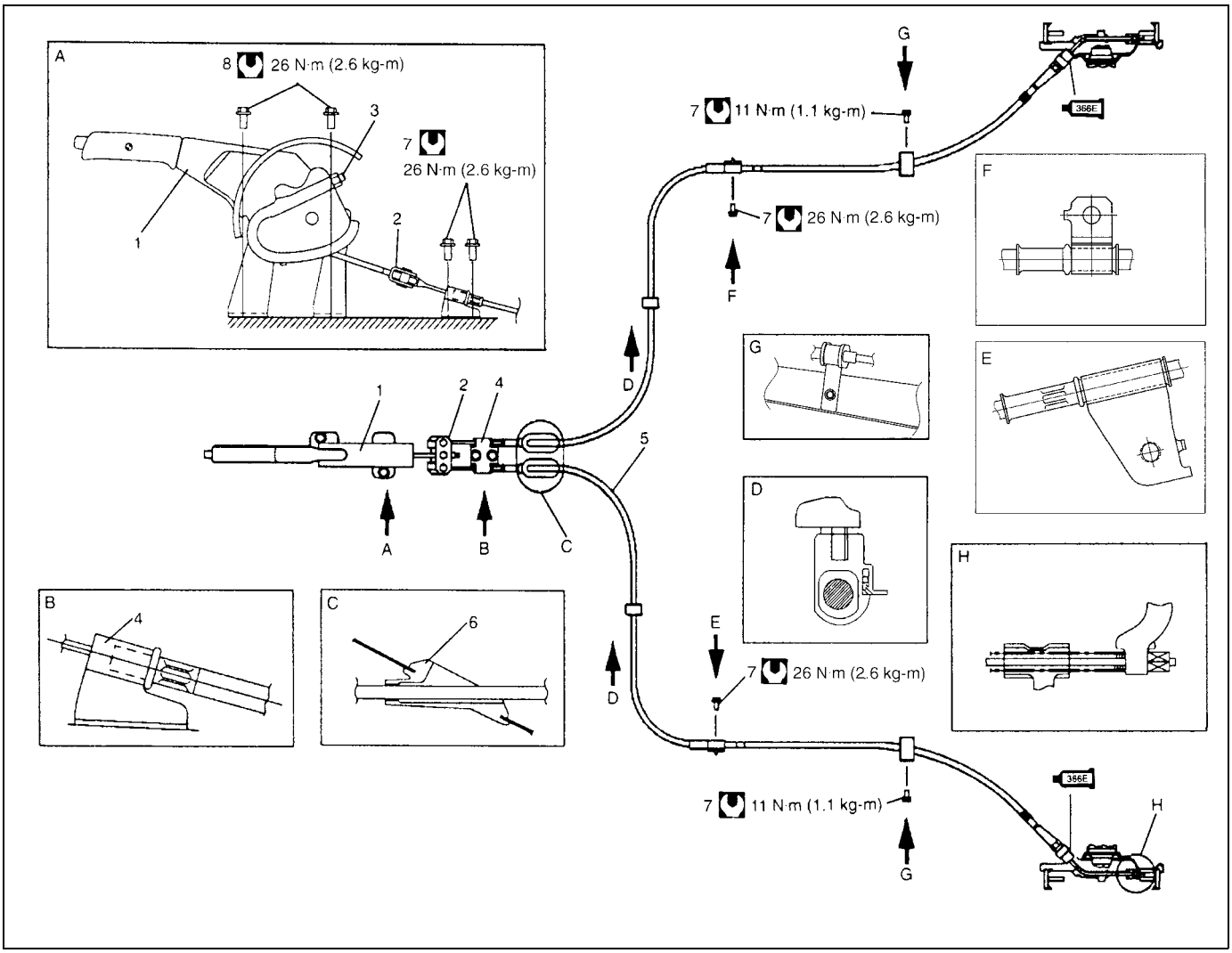
Tightening torque
Wheel bolt (a): 95 N·m (9.5 kg-m, 69.0 lb-ft)

9) Upon completion of all jobs, depress brake pedal with about 300 N (30 kg, 66 lbs) load at least 10 – 15 times until adjuster actuator clicking sound from drum brake can not be heard so as to obtain proper drum-to-shoe clearance.
   Adjust parking brake cable. (For adjustment, refer to "Parking Brake Inspection and Adjustment" in Section 5.)
10) Install console box cap.
11) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then remove vehicle from hoist and perform brake test (foot brake and parking brake).
12) Check each installed part for oil leakage.

Brake Back Plate Removal and Installation (for 4WD Model)

Refer to "Rear Axle Shaft and Wheel Bearing Removal and Installation (for 4WD Model)" in Section 3E.

Parking Brake Cable Component Location



1. Parking brake lever assembly	4. Parking cable bracket	7. Parking brake cable bolt
2. Equalizer	5. Parking brake cable: Apply water tight sealant 99000-31090 to plate and cable contact.	8. Parking brake lever bolt
3. Adjusting nut	6. Grommet	Tightening torque

Parking Brake Cable Removal and Installation

REMOVAL

1) Remove brake drum. Refer to “Brake Drum Removal and Installation (for 2WD Model)” or “Brake Drum Removal and Installation (for 4WD Model)” in this section.
2) Disconnect parking brake cable from brake shoe lever. Refer to “Brake Shoe Removal and Installation” in this section.
3) Disconnect brake cable from brake back plate. Refer to “Brake Back Plate Removal and Installation (for 2WD Model)” of this section or “Rear Axle Shaft and Wheel Bearing Removal and Installation (for 4WD Model)” in Section 3E.

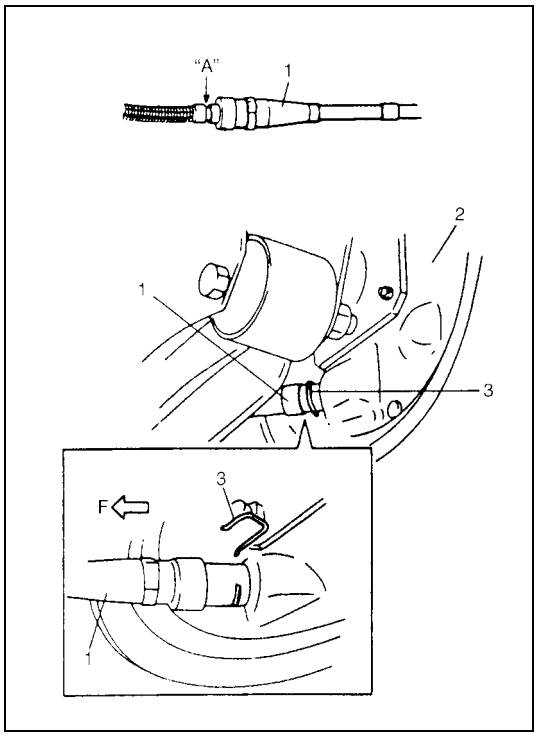
NOTE:

When it is necessary to remove both right and left parking brake cables, repeat above steps 1) and 2) on right and left wheels.

4) Remove cable from equalizer.

INSTALLATION

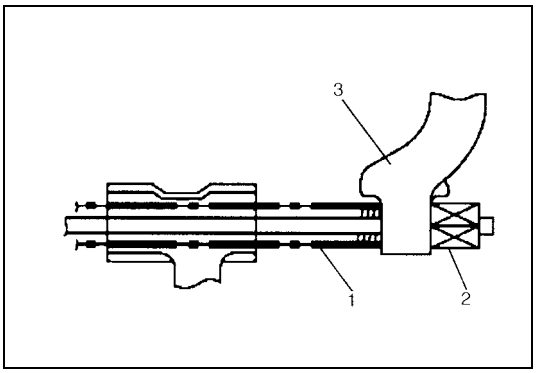
Install parts in reverse order of removal procedure, noting the following.



1) Distinguish right side parking brake cable from left side one with its clamp width.
   Parking brake cable with narrow clamp should be installed to right side of vehicle.
2) Apply water tight sealant where plate and cable contact, and run parking brake cable (1) through brake back plate (2) and secure it with clip (3).

“A”: Sealant 366E, 99000-31090

F: Forward

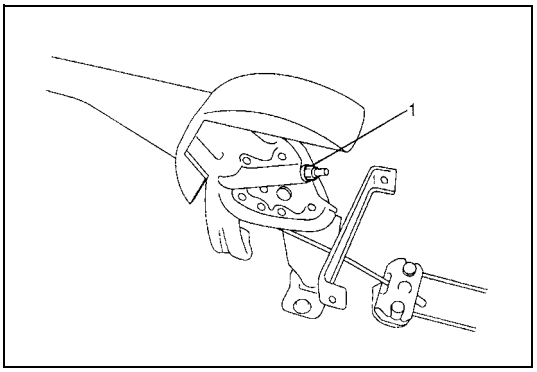


3) Install brake cable spring (1) and nipple end (2) to parking brake shoe lever (3) securely as shown in figure.

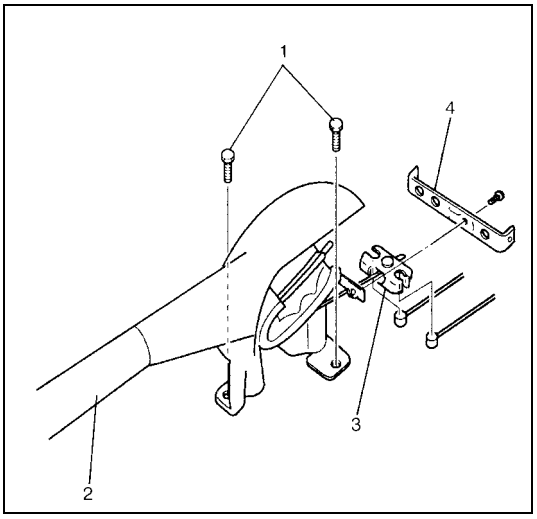
4) Install brake shoe referring to “Brake Shoe Removal and Installation” in this section.
5) Install brake drum referring to “Brake Drum Removal and Installation (for 2WD Model)” or “Brake Drum Removal and Installation (for 4WD Model)” in this section.
6) For proper routing and secure clamping of parking brake cable.
7) Install cable to equalizer.
8) Upon completion of installation, adjust cable. Refer to “Parking Brake Inspection and Adjustment” in Section 5. Then check brake drum for dragging and brake system for proper performance. After removing vehicle from hoist, brake test should be performed.

Parking Brake Lever Removal and Installation

REMOVAL



1) Disconnect negative (–) cable at battery.
2) Remove console box.
3) Block vehicle wheels and release parking brake lever.
4) Disconnect lead wire of parking brake switch at coupler.
5) Loosen parking brake cable adjusting nut (1).

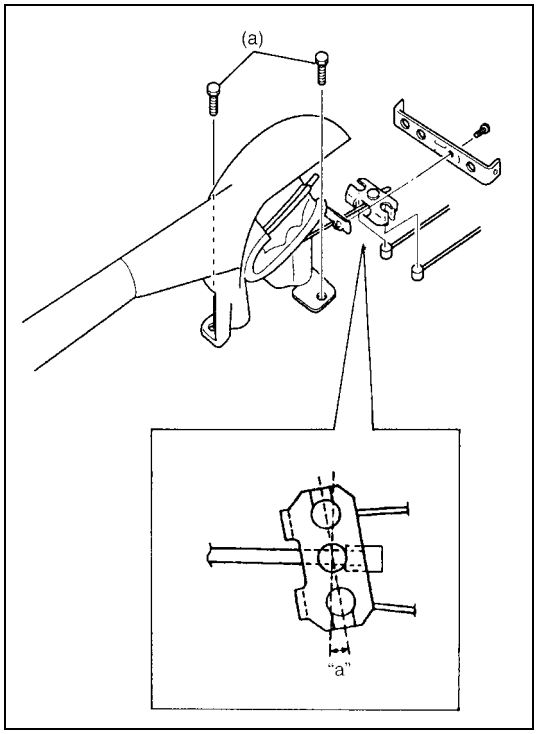


6) Remove parking brake lever bolts (1) and then remove parking brake lever assembly (2) with equalizer (3).
7) Remove console box bracket (4) from parking brake lever assembly.

NOTE:

Don’t disassemble parking brake lever switch. It must be removed and installed as a complete switch assembly.

INSTALLATION



1) Install in reverse order of removal procedure.
   Check equalizer inclined angle.

   Angle "a": within 15 degrees

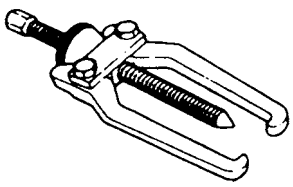
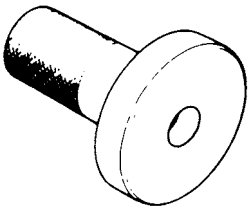
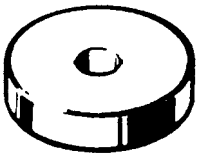
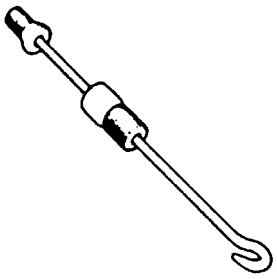
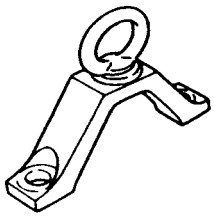
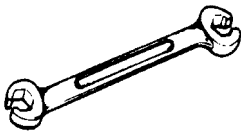
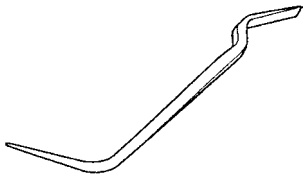
   Tightening torque
   Parking brake lever mounting bolt
   (a): 26 N·m (2.6 kg-m, 19.0 lb-ft)

2) After all parts are installed, parking brake lever needs to be adjusted. Refer to "Parking Brake Inspection and Adjustment" in Section 5.
3) Check brake drum for dragging and brake system for proper performance.

Required Service Materials

Material	Recommended SUZUKI product (Part Number)	Use
Brake fluid	DOT 4 or SEA J1704	• To fill master cylinder reservoir. • To clean and apply to inner parts of caliper and wheel cylinder when they are disassembled.
Water tight sealant	SEALING COMPOUND 366E 99000-31090	• To apply to mating surfaces of brake back plate and rear wheel cylinder. • To apply to contact position of parking brake cable and back plate. • To apply to mating surfaces of brake back plate and rear axle.
Bentonite base brake grease (Anti-squeal agent)	—	• To coat thinly to surface on which shoe rims rest. • To coat thinly between actuator and shoe rim, and at actuator pivot points.

Special Tools

 09913-65135 Bearing puller (for 2WD model)	 09913-75520 Bearing installer (for 2WD model)	 09926-68310 Bearing installer (for 2WD model)	 09942-15111 Sliding hammer
 09943-17912 Brake drum remover (Front wheel hub remover)	 09950-78230 Flare nut wrench (10 – 11 mm)	 Snap-on Part NO. B3404B or equivalent	

SECTION 5E

ANTILOCK BRAKE SYSTEM (ABS)

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

NOTE:

All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.

CONTENTS

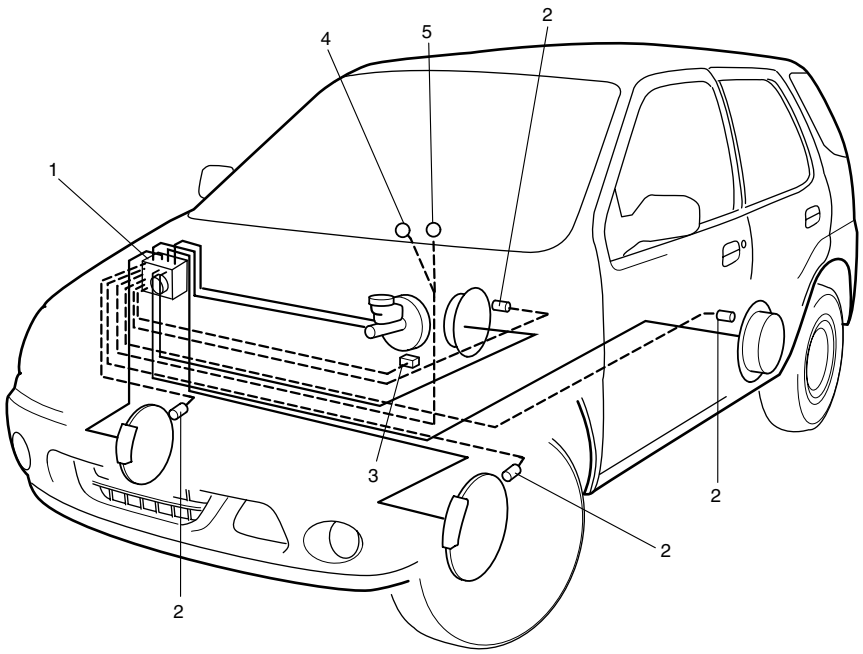
General Description

Components and Parts Location

The ABS (Antilock Brake System) controls the fluid pressure applied to the Wheel cylinder of each brake from the master cylinder so that each wheel is not locked even when hard braking is applied.
This ABS has also the following function.
While braking is applied, but before ABS control becomes effective, braking force is distributed between the front and rear so as to prevent the rear wheels from being locked too early for better stability of the vehicle.
The main component parts of this ABS include the following parts in addition to those of the conventional brake system.

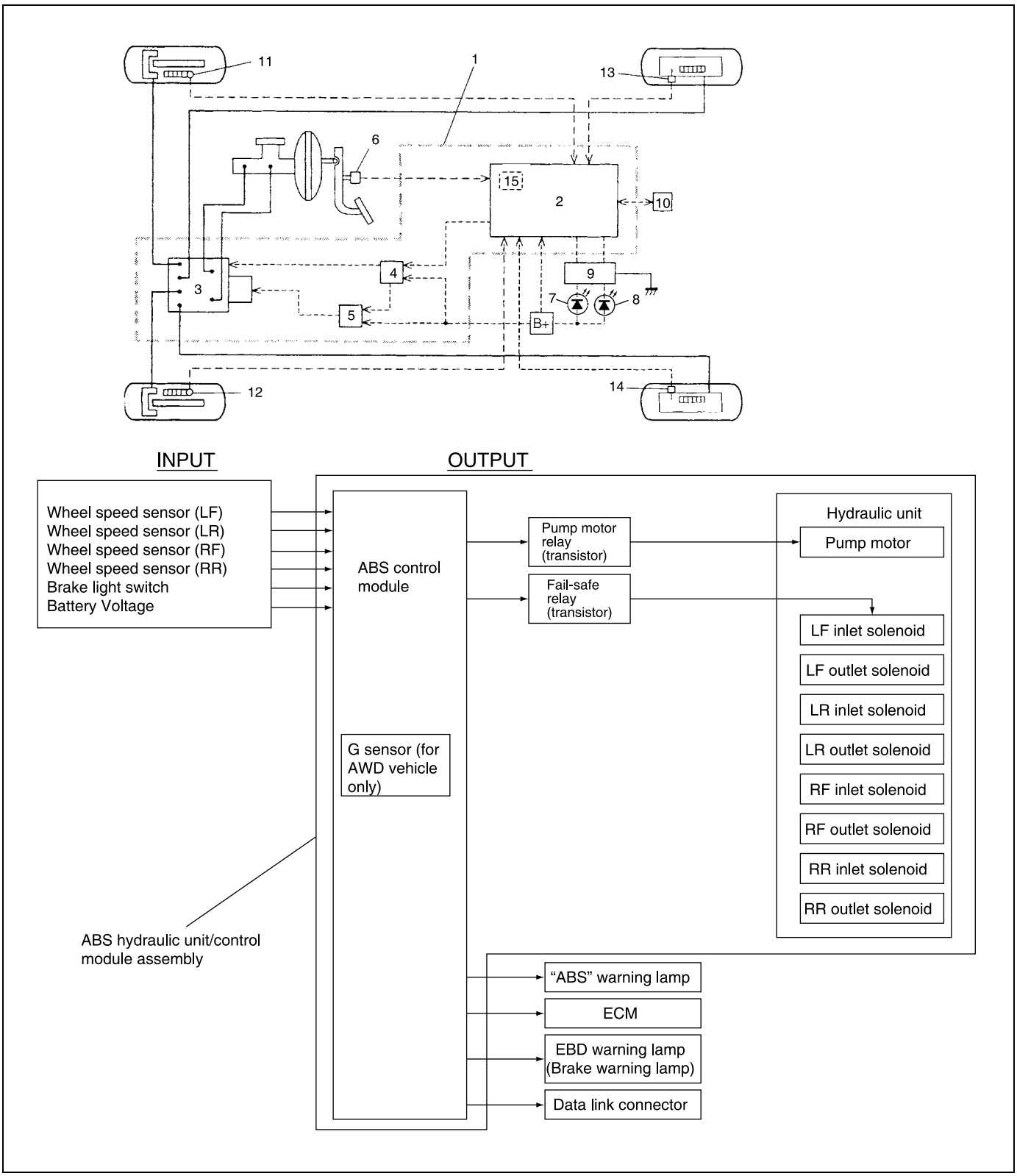
- Wheel speed sensor which senses revolution speed of each wheel and outputs its signal.
- "ABS" warning lamp which lights to inform abnormality when system fails to operate properly.
- ABS hydraulic unit/control module assembly is incorporated ABS control module, ABS hydraulic unit (actuator assembly), fail-safe relay (transistor) and pump motor relay (transistor).
  - ABS control module which sends operation signal to ABS hydraulic unit to control fluid pressure applied to each wheel cylinder based on signal from each wheel speed sensor so as to prevent wheel from locking.
  - ABS hydraulic unit which operates according to signal from ABS control module to control fluid pressure applied to wheel cylinder of each 4 wheels.
  - Fail-safe relay (solenoid valve relay) which supplies power to solenoid valve in ABS hydraulic unit.
  - Pump motor relay which supplies power to pump motor in ABS hydraulic unit.
- G sensor which detects vehicle deceleration speed. (For 4WD model only)

This ABS is equipped with Electronic Brake force Distribution (EBD) system that controls a fluid pressure of rear wheels to best condition, which is the same function as that of proportioning valve, by the signal from wheel speed sensor independently of change of load due to load capacity and so on. And if the EBD system fails to operate properly, the brake warning lamp lights to inform abnormality.



[A]: LH steering vehicle shown	2. Wheel speed sensor	4. ABS warning lamp
1. ABS hydraulic unit/control module assembly (including G sensor (For 4WD model))	3. Brake light switch	5. EBD warning lamp (Brake warning lamp)

System Schematic



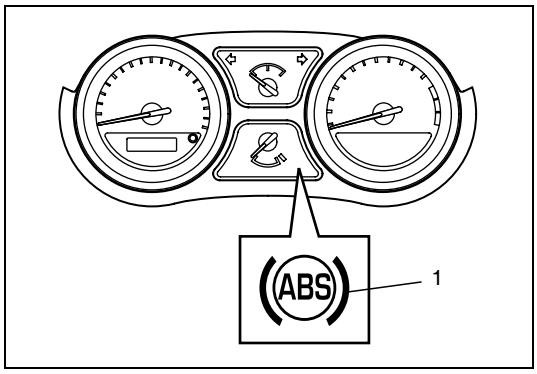
1. ABS hydraulic unit/control module assembly	6. Stop lamp switch	11. Wheel speed sensor (Right-front)
2. ABS control module	7. "ABS" warning lamp	12. Wheel speed sensor (Left-front)
3. ABS hydraulic unit	8. "EBD" warning lamp (Brake warning lamp)	13. Wheel speed sensor (Right-rear)
4. Fail safe relay (transistor)	9. Lamp driver module	14. Wheel speed sensor (Left-rear)
5. Pump motor relay (transistor)	10. Data link connector	15. G sensor (For 4WD model only)

ABS Hydraulic Unit/Control Module Assembly

ABS control module is a component of ABS hydraulic unit/control module assembly and has the following functions.

Self-diagnosis function

ABS control module diagnoses conditions of the system component parts (whether or not there is any abnormality) all the time and indicates the results (warning of abnormality occurrence and DTC) through the ABS warning lamp (1) as described below.

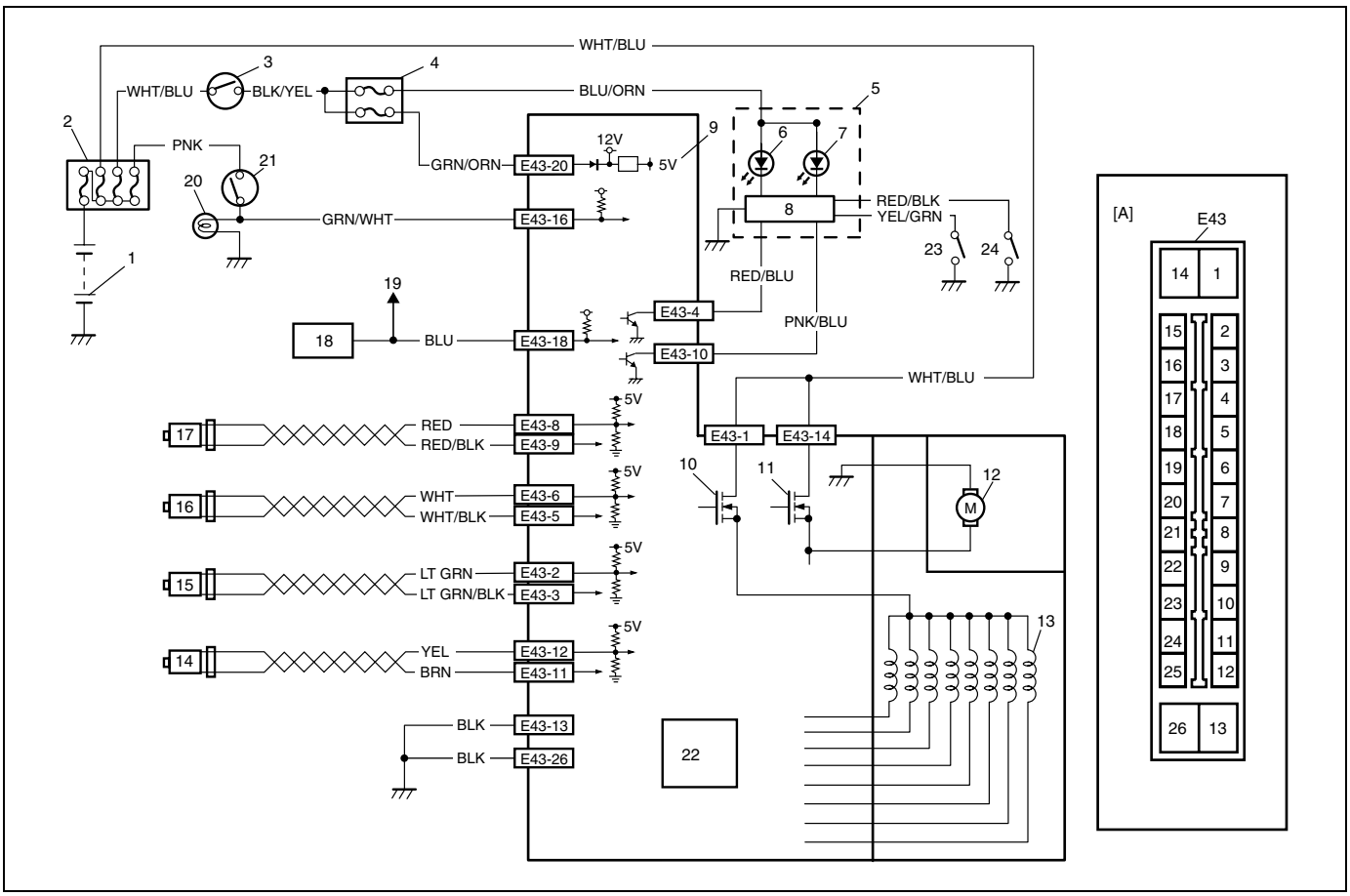


1) When ignition switch is turned ON, ABS warning lamp lights for 2 seconds to check lamp circuit.
2) When no abnormality has been detected (the system is in good condition), ABS warning lamp turns OFF after 2 seconds.
3) When an abnormality in the system is detected, ABS warning lamp lights and the area where that abnormality lies is stored in the memory of EEPROM in ABS control module.

Fail-safe function

When an abnormality occurs (an abnormal DTC is detected), ABS control module turns OFF the fail-safe relay (transistor) which supplies power to ABS hydraulic unit. Thus, with ABS not operating, brakes function just like the brake system of the vehicle without ABS.

System Circuit



[A]: Terminal arrangement of ABS hydraulic unit/ control module assembly	9. ABS hydraulic unit/control module assembly	18. Data link connector
1. Battery	10. ABS fail-safe relay (transistor) (Solenoid valve relay (transistor))	19. To ECM, TCM, SDM and P/S control module (if equipped)
2. Main fuses	11. ABS pump motor relay (transistor)	20. Stop lamp
3. Ignition switch	12. Pump motor	21. Brake light switch
4. Circuit fuses	13. Solenoid valves	22. G sensor (For 4WD model only)
5. Combination meter	14. Right-rear wheel speed sensor	23. Brake fluid level switch
6. ABS warning lamp	15. Left-rear wheel speed sensor	24. Parking brake switch
7. Brake warning lamp	16. Right-front wheel speed sensor	
8. Lamp driver module	17. Left-front wheel speed sensor	

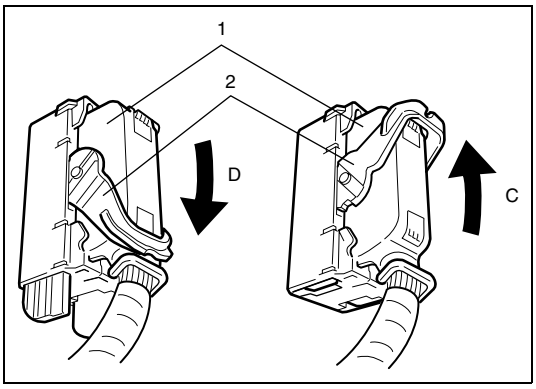
TERMINAL		CIRCUIT
E43	1	ABS fail-safe relay (transistor)
	2	Left-rear wheel speed sensor (+)
	3	Left rear wheel speed sensor (–)
	4	“ABS” warning lamp
	5	Right-front wheel speed sensor (–)
	6	Right-front wheel speed sensor (+)
	7	–
	8	Left-front wheel speed sensor (+)
	9	Left front wheel speed sensor (–)
	10	Brake warning lamp
	11	Right-rear wheel speed sensor (+)
	12	Right-rear wheel speed sensor (–)
	13	Ground
	14	ABS pump motor relay (transistor)
	15	–
	16	Brake light switch
	17	–
	18	Data link connector
	19	–
	20	Ignition switch
	21	–
	22	–
	23	–
	24	–
	25	–
	26	Ground

Diagnosis

To ensure that the trouble diagnosis is done accurately and smoothly, observe “Precaution in Diagnosing Troubles” and follow “ABS Diagnostic Flow Table”.

Precaution in Diagnosing Troubles

- If the vehicles was operated in any of the following ways, ABS warning lamp may light momentarily but this does not indicate anything abnormal in ABS.
  – The vehicle was driven with parking brake pulled.
  – The vehicle was driven with brake dragging.
  – The vehicle was stuck in mud, sand, etc.
  – Wheel spin occurred while driving.
  – Wheel(s) was rotated while the vehicle was jacked up.
- Be sure to read “Precautions for Electrical Circuit Service” in Section 0A before inspection and observe what is written there.
- Be sure to use the trouble diagnosis procedure as described in the flow table. Failure to follow the flow table may result in incorrect diagnosis. (Some other diagnosis trouble code may be stored by mistake in the memory of ABS control module during inspection.)



- When disconnecting ABS hydraulic unit/control module connector (1), turn down lock (2) of connector.
  When connecting, set the connector on ABS hydraulic unit/control module assembly and push the lock (2) up.

C: Turn down to disconnect
D: Turn up to connect

ABS Diagnostic Flow Table

Refer to the following pages for the details of each step.

Step	Action	Yes	No
1	1) Perform “Customer Complaint Analysis”. 2) Perform “Problem Symptom Confirmation”. 3) Perform “Diagnostic Trouble Code Check, Record and Clearance”. Is there any malfunction DTC?	Go to Step 2.	Go to Step 5.
2	1) Perform “DRIVING TEST”. Is trouble symptom identified?	Go to Step 3.	Go to Step 6.
3	1) Check DTC. Is it malfunction DTC?	Go to Step 4.	Go to Step 5.
4	1) Inspect and repair referring to applicable DTC table in this section. 2) Perform “FINAL CONFIRMATION TEST” after cleared DTC. Does trouble recur?	Go to Step 7.	End.
5	1) Inspect and repair referring to “Diagnosis” in Section 5. 2) Perform “FINAL CONFIRMATION TEST”.	Go to Step 7.	End.
6	1) Check intermittent troubles referring to “Intermittent and Poor Connection” in Section 0A and related circuit of trouble code recorded in Step 2. 2) Perform “FINAL CONFIRMATION TEST” after cleared DTC. Does trouble recur?	Go to Step 7.	End.
7	1) Perform “Diagnostic Trouble Code Check, Record and Clearance”. Is there any malfunction DTC?	Go to Step 2.	Go to Step 5.

1) MALFUNCTION ANALYSIS

a) Customer Complaint Analysis

Record details of the problem (failure, complaint) and how it occurred as described by the customer.
For this purpose, use of such a questionnaire form as shown below will facilitate collecting information to the point required for proper analysis and diagnosis.

CUSTOMER QUESTIONNAIRE (EXAMPLE)

Customer's name:	Model:	VIN:	
Date of issue:	Date of Reg:	Date of problem:	Mileage:

Problem Symptoms	• ABS warning lamp abnormal: fails to turn on/fails to go off/flashes • Abnormal noise while vehicle is running: from motor, from valve, other_____ • Wheel is locked at braking: • Pump motor does not stop (running): • Braking does not work: • Other:
Frequency of occurrence	• Continuous/Intermittent (times a day, a month)/ other_____
Conditions for Occurrence of Problem	• Vehicle at stop & ignition switch ON: • When starting: at initial start only/at every start/Other_____ • Vehicle speed: while accelerating/while decelerating/at stop/ while turning/while running at constant speed/ other_____ • Road surface condition: Paved road/rough road/snow-covered road/ other_____ • Chain equipment:
Environmental Condition	• Weather: fair/cloudy/rain/snow/other_____ • Temperature: °F (°C)
Diagnostic Trouble Code	• First check: Normal code/malfunction code ( ) • Second check after test drive: Normal code/malfunction code ( )

b) Problem Symptom Confirmation

Check if what the customer claimed in "CUSTOMER QUESTIONNAIRE" is actually found in the vehicle and if that symptom is found, whether it is identified as a failure. (This step should be shared with the customer if possible.) Check warning lamps related to brake system referring to "EBD Warning Lamp (Brake Warning Lamp) Check" and "ABS Warning Lamp Check" in this section.

c) Diagnostic Trouble Code (DTC) Check, Record and Clearance
Perform “Diagnostic Trouble Code (DTC) Check” procedure in this section, record it and then clear it referring to “Diagnostic Trouble Code (DTC) Clearance” in this section.
If the malfunction DTC which was once displayed and then cleared cannot be detected (indicated) again when the ignition switch is turned ON, attempt to diagnose the trouble based on the DTC recorded in this step may mislead the diagnosis or make diagnosing difficult. Proceed to Step 2) to check control module for proper self-diagnosis function.
If the malfunction DTC which was once displayed and then cleared can be detected (indicated) again when ignition switch is turned ON, proceed to Step 3).

2) DRIVING TEST
Test drive the vehicle at 40 km/h for more than a minute and check if any trouble symptom (such as abnormal lighting of ABS warning light) exists.
If the malfunction DTC is confirmed again at ignition switch ON, driving test as described in above is not necessary. Proceed to Step 3).

3) DIAGNOSTIC TROUBLE CODE CHECK
Recheck diagnostic trouble code referring to “Diagnostic Trouble Code (DTC) Check” as shown in the following page.

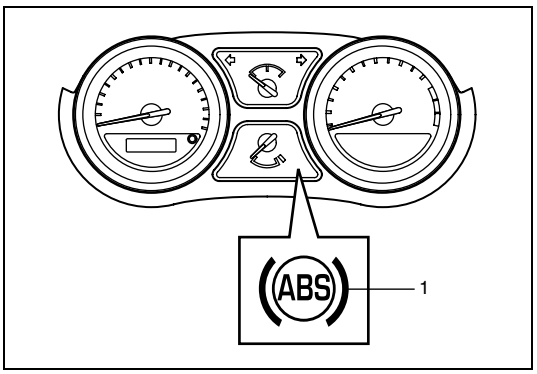
4) DIAGNOSTIC TROUBLE CODE FLOW TABLE
According to Diagnostic flow table for the diagnostic trouble code confirmation in Step 3), locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator assembly or other part and repair or replace faulty parts.

5) “Diagnosis” IN SECTION 5
Check the parts or system suspected as a possible cause referring to “Diagnosis” in Section 5 and based on symptoms appearing on the vehicle (symptom obtained through Steps 1)-a, 1)-b and 2) and repair or replace faulty parts, if any).

6) CHECK FOR INTERMITTENT PROBLEM
Check parts where an intermittent trouble is easy to occur (e.g., wire harness, connector, etc.), referring to “Intermittent and Poor Connection” in Section 0A and related circuit of trouble code recorded in Step 1)-c.

7) FINAL CONFIRMATION TEST
Confirm that the problem symptom has gone and the ABS is free from any abnormal conditions. If what has been repaired is related to the malfunction DTC, clear the DTC once and perform test driving and confirm that no DTC is indicated.

ABS Warning Lamp Check

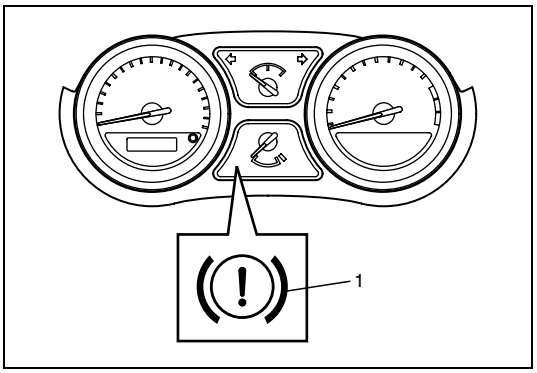


1) Turn ignition switch ON.
2) Check that ABS warning lamp (1) comes ON for about 2 seconds and then goes off.
   If any faulty condition is found, advance to Diagnostic Flow Table-A, B, or C.

EBD Warning Lamp (Brake Warning Lamp) Check

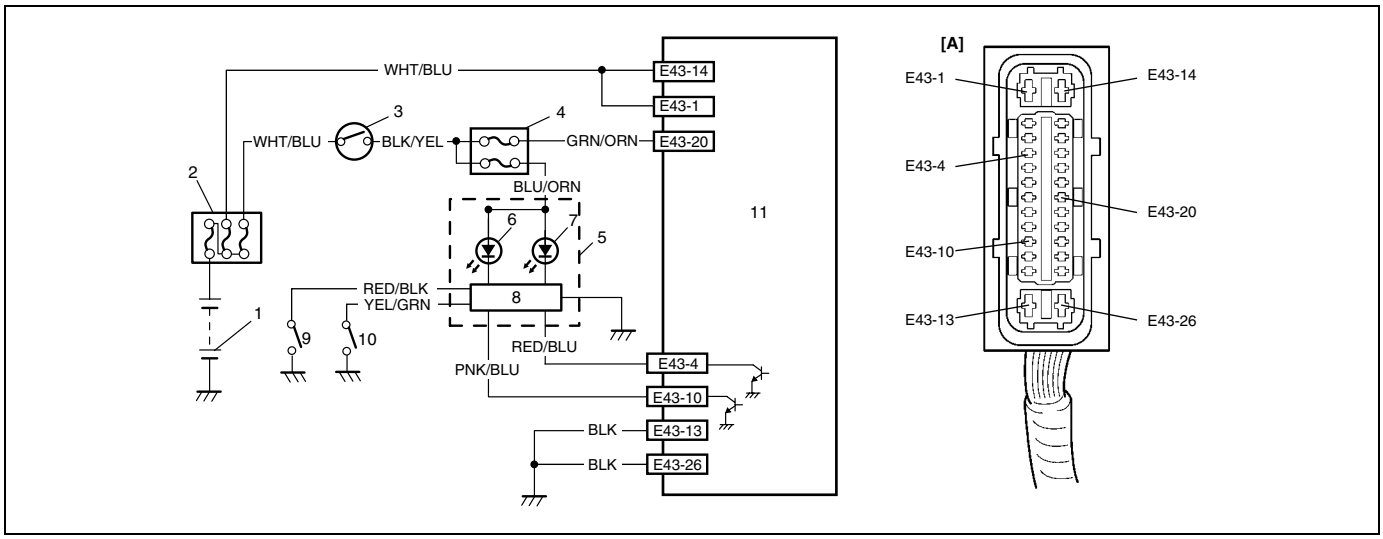
NOTE:

Perform this check on a level place.



1) Turn ignition switch ON with parking brake applied.
2) Check that EBD warning lamp (brake warning lamp) (1) is turned ON.
3) Release parking brake with ignition switch ON and check that EBD warning lamp (brake warning lamp) goes off.
   If it doesn't go off, go to "Table – D EBD Warning Lamp (Brake Warning Lamp) Check – Lamp Comes "ON" Steady" in this section.

Table – A ABS Warning Lamp Circuit Check – Lamp Does Not Come "ON" at Ignition Switch ON



[A]: ABS hydraulic unit/control module connector E43	4. Circuit fuse	8. Lamp driver module
1. Battery	5. Combination meter	9. Brake fluid level switch
2. Main fuse	6. Brake warning lamp	10. Parking brake switch
3. Ignition switch	7. ABS warning lamp	11. ABS hydraulic unit/control module assembly

CIRCUIT DESCRIPTION

Operation (ON/OFF) of ABS warning lamp is controlled by ABS control module through lamp driver module in combination meter.

If the Antilock brake system is in good condition, ABS control module turns ABS warning lamp ON at the ignition switch ON, keeps it ON for 2 seconds and then turns it OFF. If an abnormality in the system is detected, ABS warning lamp is turned ON continuously by ABS control module. Also, it is turned ON continuously by lamp driver module when the connector of ABS control module is disconnected.

INSPECTION

Step	Action	Yes	No
1	1) Turn ignition switch to ON position. Do other warning lamps come ON?	Go to Step 2.	Go to Step 4.
2	1) Turn OFF ignition switch. 2) Disconnect ABS hydraulic unit/control module connector. 3) Turn ON ignition switch. Does ABS warning lamp light with ignition switch ON?	Replace ABS hydraulic unit/control module assembly.	Go to Step 3.
3	1) Remove combination meter with ignition switch turned OFF. 2) Measure resistance between "RED/BLU" wire of combination meter connector and ground. Is it infinite (∞)?	Go to Step 6.	"RED/BLU" circuit shorted to ground.
4	Is "METER" fuse in good condition?	Go to Step 5.	Replace fuse and check for short circuit to ground.

Step	Action	Yes	No
5	1) Remove combination meter with ignition switch turned OFF. 2) Check for roper connection to “BLU/ORN” wire of combination meter connector. 3) If OK, turn ON ignition switch and measure voltage at “BLU/ORN” wire of combination meter connector. Is it 10 – 14 V?	Go to Step 6.	“BLU/ORN” circuit open.
6	1) Measure resistance between “BLK” wire of combination meter connector and ground. Is resistance below 5 Ω?	Replace combination meter.	“BLK” circuit open or high resistance.

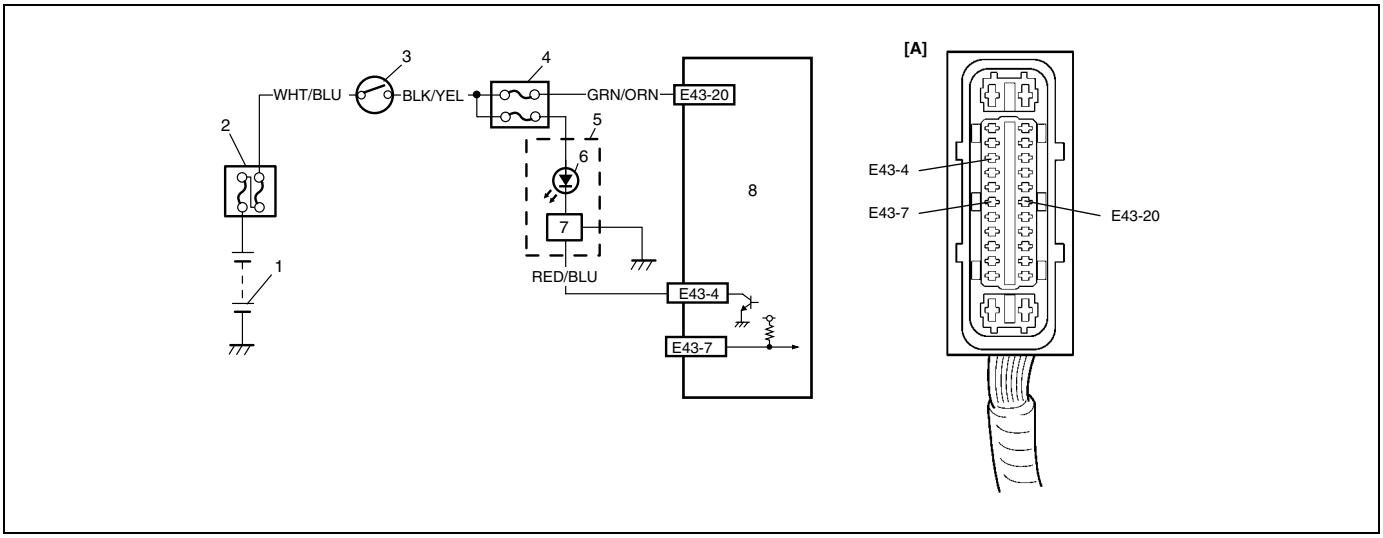
Table – B ABS Warning Lamp Circuit Check – Lamp Comes "ON" Steady

Refer to TABLE – A for System Circuit Diagram and Circuit Description.

INSPECTION

Step	Action	Yes	No
1	Perform diagnostic trouble code check. Is there any DTC?	Go to Step 7 of "ABS Diagnostic Flow Table" in this section.	Go to Step 2.
2	1) Disconnect ABS hydraulic unit/control module connector. 2) Check for proper connection to ABS hydraulic unit/control module connector at terminals "E43-4", "E43-20" and "E43-13". 3) If OK then ignition switch ON and measure voltage at terminal "E43-20" of connector. Is it 10 – 14 V?	Go to Step 3.	"GRN/ORN" circuit open.
3	1) With ABS hydraulic unit/control module connector disconnected, turn ignition switch ON and light ABS warning lamp. 2) Connect terminal "E43-4" of disconnected connector to ground using service wire. Does ABS warning lamp turn off?	Go to Step 4.	"RED/BLU" circuit open. If wire and connection are OK, replace combination meter.
4	1) Measure resistance from connector terminal "E43-13 and 26" to body ground. Is continuity indicated?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	"BLK" circuit open.

Table – C ABS Warning Lamp Circuit Check – The Lamp Flashes Continuously While Ignition Switch is ON



[A]: ABS hydraulic unit/control module connector E43	3. Ignition switch	6. "ABS" warning lamp
1. Battery	4. Circuit fuse	7. Lamp driver module
2. Main fuse	5. Combination meter	8. ABS hydraulic unit/control module assembly

INSPECTION

Step	Action	Yes	No
1	1) Check for proper connection to ABS control module at ABS hydraulic unit/control module connector. Is it in good condition?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	"E43-7" terminal shorted to ground.

Table – D EBD Warning Lamp (Brake Warning Lamp) Check – Lamp Comes "ON" Steady

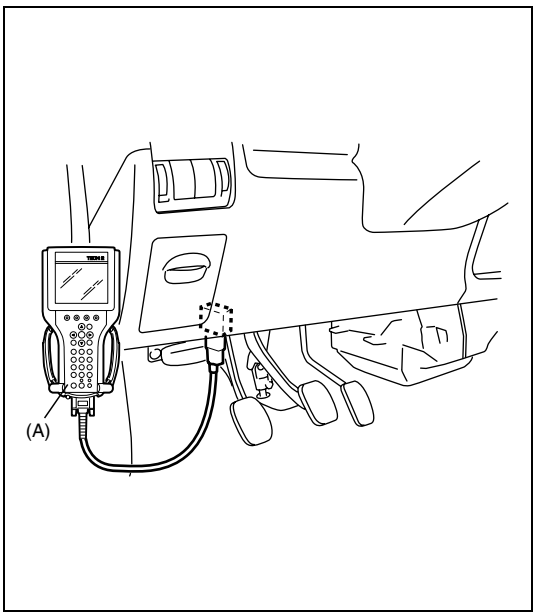
CIRCUIT DESCRIPTION

EBD warning lamp (Brake warning lamp) is controlled by parking brake switch, brake fluid level switch and ABS control module/hydraulic unit assembly through lamp driver module in combination meter. Refer to "TABLE – A" for circuit diagram.

INSPECTION

Step	Action	Yes	No
1	1) Make sure that: • Parking brake is completely released. • Brake fluid level is upper than the minimum level. Are the check results OK?	Go to Step 2.	Release parking brake completely and/or replenish brake fluid.
2	Does "ABS" warning lamp come on?	Perform "TABLE – B ABS Warning Lamp Circuit Check – Lamp Comes "ON" Steady" previously outlined.	Go to Step 3.
3	1) Disconnect ABS hydraulic unit/control module connector. 2) Check for proper connection to ABS hydraulic unit/control module connector at terminals "E43-10". 3) If OK, apply chocks to wheels and select gear in neutral position. 4) Keep brake pedal depressed and start engine. Release parking brake. 5) Connect terminal "E43-10" of disconnected connector to ground using service wire. Does brake warning lamp turn off?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	"PNK/BLU" circuit open. If wire and connection are OK, replace combination meter.

Diagnostic Trouble Code (DTC) Check



1) Turn ignition switch to OFF position.
2) Connect Suzuki Scan Tool to data link connector.

Special tool
(A): Suzuki Scan Tool

3) Turn ignition switch ON.
4) Read DTC according to instructions displayed on Suzuki Scan Tool and print it or write it down. Refer to Suzuki Scan Tool operator's manual for further details.

NOTE:

If Suzuki Scan Tool cannot communicate ABS hydraulic unit/control module, perform "Serial Data Link Circuit Check" described in this section.

5) After completing the check, turn ignition switch off and disconnect Suzuki Scan Tool from DLC.

Diagnostic Trouble Code (DTC) Clearance

WARNING:

When performing a driving test, select a safe place where there is neither any traffic nor any traffic accident possibility and be very careful during testing to avoid occurrence of an accident.

After repair or replace malfunction part(s), clear all DTCs by performing the following procedure.

1) Connect Suzuki Scan Tool to data link connector in the same manner as when making this connection for DTC check.
2) Turn ignition switch ON.
3) Erase DTC according to instructions displayed on scan tool. Refer to scan tool operator's manual for further details.
4) After completing the clearance, turn ignition switch off and disconnect scan tool from data link connector.

Diagnostic Trouble Code (DTC) Table

DTC (displayed on Suzuki Scan Tool)	DIAGNOSTIC ITEMS	
NO DTC	Normal	
C1015	G sensor circuit	
C1021	RF	Wheel speed sensor circuit
C1025	LF	
C1031	RR	
C1035	LR	
C1022	RF	Wheel speed sensor circuit or sensor ring
C1026	LF	
C1032	RR	
C1036	LR	
C1041	RF	Inlet solenoid valve circuit
C1042		Outlet solenoid valve circuit
C1045	LF	Inlet solenoid valve circuit
C1046		Outlet solenoid valve circuit
C1051	RR	Inlet solenoid valve circuit
C1052		Outlet solenoid valve circuit
C1055	LR	Inlet solenoid valve circuit
C1056		Outlet solenoid valve circuit
C1057	Power source	
C1061	ABS pump motor and/or motor relay circuit	
C1063	Fail-safe relay	
C1071	ABS control module	

Scan Tool Data

The parameter deta in the table below are values measured with the scan tool when the vehicle is under the following conditions. When taking measurements for comparison by using the scan tool, be sure to check that the vehicle is under the following conditions.

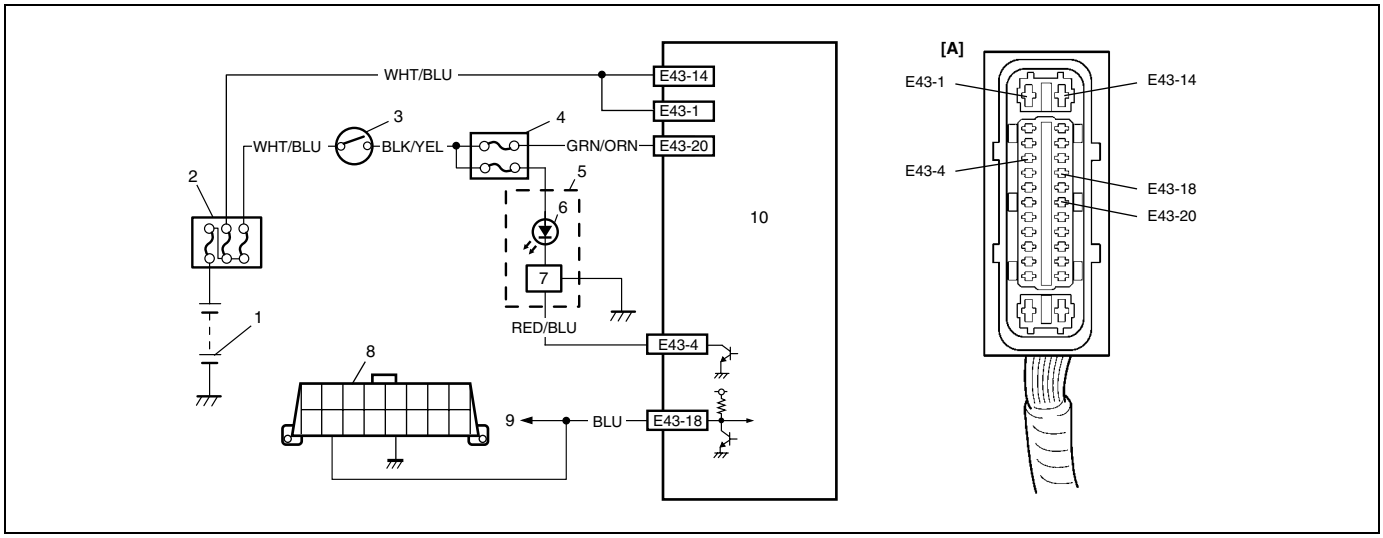
- Apply parking brake and block wheels.
- Ignition switch ON.
- Turn OFF air conditioner (if equipped).
- Apply no load to power steering (‘if equipped). (Don’t turn it)
- Turn OFF all electric loads (except ignition).
- No DTC.
- ABS is not operated. (Normal braking operation)

Scan Tool Data	Standards	Condition
RF WHEEL SPEED	0 km/h, 0 MPH	Vehicle stop
LF WHEEL SPEED	0 km/h, 0 MPH	Vehicle stop
RR WHEEL SPEED	0 km/h, 0 MPH	Vehicle stop
LR WHEEL SPEED	0 km/h, 0 MPH	Vehicle stop
G SENSOR	0G (4WD)	Place vehicle on the level
	–2.5 G (2WD)	
BATTERY VOLT	10 – 17 V	–
PUMP MOTOR RELAY	0 V	–
BRAKE SWITCH	ON	Brake pedal depressed
	OFF	Brake pedal released

Scan Tool Data Definition

RF Wheel Speed, LF Wheel Speed, RR Wheel Speed and LF Wheel Speed (Km/h, MPH): Wheel speed is an ABS control module internal parameter. It is computed by reference pulses from the Wheel Speed Sensor.
G Sensor (G): The G-Sensor converts gravity during the vehicle acceleration/deceleration into a voltage conditions and controls the ABS for 4WD vehicle.
Battery Volt (V): Battery Voltage is an analog input signal read by the ABS control module.
Certain ABS control module functions will be modified if the battery voltage falls below or rises above programmed thresholds.
Pump Motor Relay (V): This parameter indicates the operational condition of the Pump Motor Relay (Transistor).
Brake Switch (ON, OFF): This switch signal informs the ABS control module whether the brake is active or not.

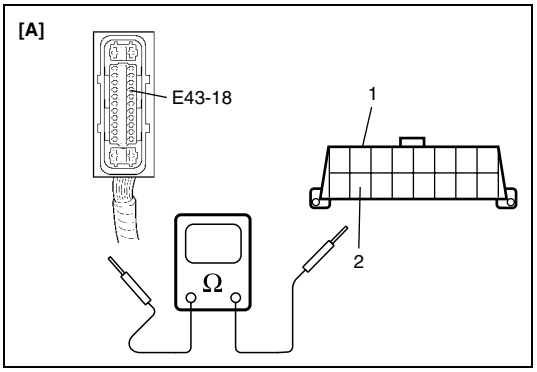
Serial Data Link Circuit Check



1. Battery	4. Circuit fuse	7. Lamp driver module	10. ABS hydraulic unit/control module assembly
2. Main fuse	5. Combination meter	8. Data link connector (DLC)	
3. Ignition switch	6. "ABS" warning lamp	9. To ECM, TCM, P/S control module and SDM	

INSPECTION

Step	Action	Yes	No
1	Was "ABS Diagnostic Flow Table" performed?	Go to Step 2.	Go to "ABS Diagnostic Flow Table" in this section.
2	1) Make sure that Suzuki Scan Tool is free from malfunction and correct PC card. 2) Turn ignition switch to OFF position. 3) Check proper connection of Suzuki Scan Tool to DLC. Is connection in good condition?	Go to Step 3.	Properly connect Suzuki Scan Tool to DLC.
3	1) Check if communication is possible by trying communication with other controller (ECM, TCM, P/S control module or SDM). Is it possible to communicate with other controller?	Go to Step 4.	Repair open in common section of serial data circuit ("BLU" wire circuit) used by all controllers or short to ground or power circuit which has occurred somewhere in serial data circuit ("BLU" wire circuit).
4	1) With ignition switch OFF position, disconnect ABS hydraulic unit/control module connector from ABS hydraulic unit/control module. 2) Check proper connection at "E43-18" ("BLU" wire) terminal for serial data circuit. 3) If OK, then check resistance between "E43-18" ("BLU" wire) terminal and "W/R" wire terminal for serial data circuit in DLC. Is resistance 1 Ω or less?	Substitute a known-good ABS hydraulic unit/control module and recheck.	Repair high resistance or open in "BLU" wire circuit for ANTI LOCK BRAKE system.



[A]:	Fig. for Step 4
1.	DLC
2.	“BLU” wire terminal

DTC C1015 – G Sensor Circuit

DESCRIPTION

If the signal voltage of G sensor while at a stop does not vary from that while running, this DTC is set.
Therefore, this DTC may be set when a vehicle is lifted up and its wheel(s) is turned. In such case, clear the DTC and check again.

INSPECTION

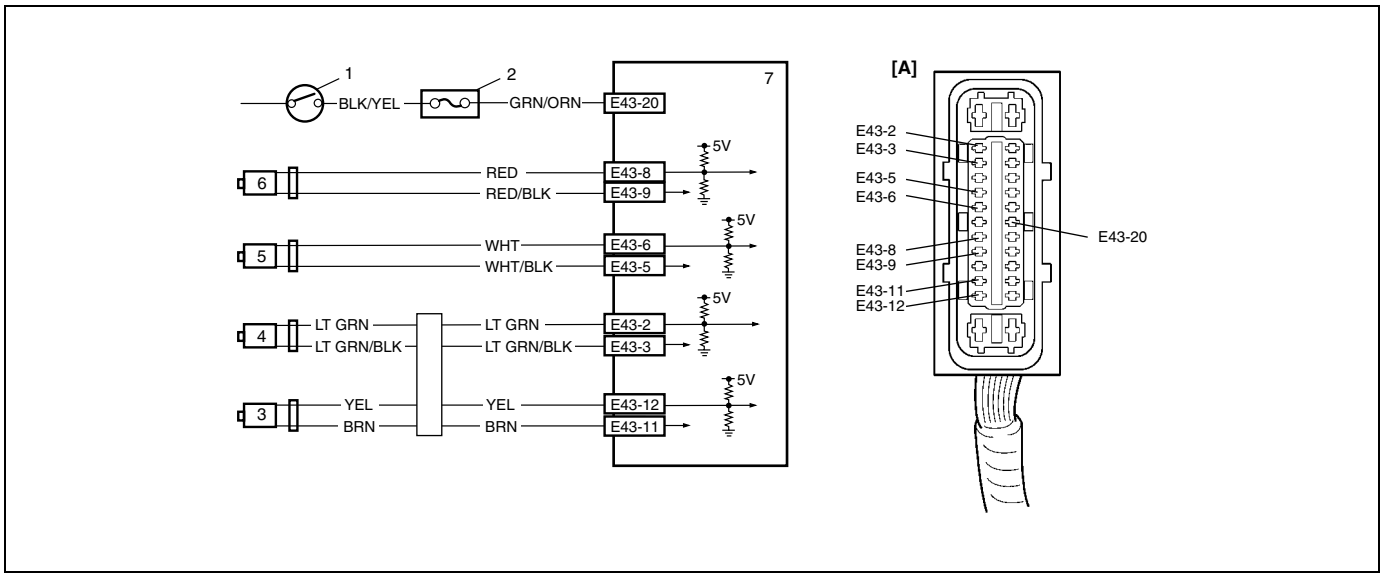
1) Ignition switch OFF.
2) Check for proper connection from harness to control module.
3) If OK, substitute an ABS hydraulic unit/control module assembly with correct part number.
4) Recheck system.

DTC C1021, DTC C1022 – Right-Front Wheel Speed Sensor Circuit or Sensor Ring

DTC C1025, DTC C1026 – Left-Front Wheel Speed Sensor Circuit or Sensor Ring

DTC C1031, DTC C1032 – Right-Rear Wheel Speed Sensor Circuit or Sensor Ring

DTC C1035, DTC C1036 – Left-Rear Wheel Speed Sensor Circuit or Sensor Ring



[A]: ABS hydraulic unit/control module connector E43	3. Right-rear wheel speed sensor	6. Left-front wheel speed sensor
1. Ignition switch	4. Left-rear wheel speed sensor	7. ABS hydraulic unit/control module assembly
2. Circuit fuse	5. Right-front wheel speed sensor	

DESCRIPTION

The ABS control module monitors the voltage at the terminal of each sensor while the ignition switch is ON. When the voltage is not within the specified range, an applicable DTC will be set. Also, when no sensor signal is inputted at starting or while running, an applicable DTC will be set.

NOTE:

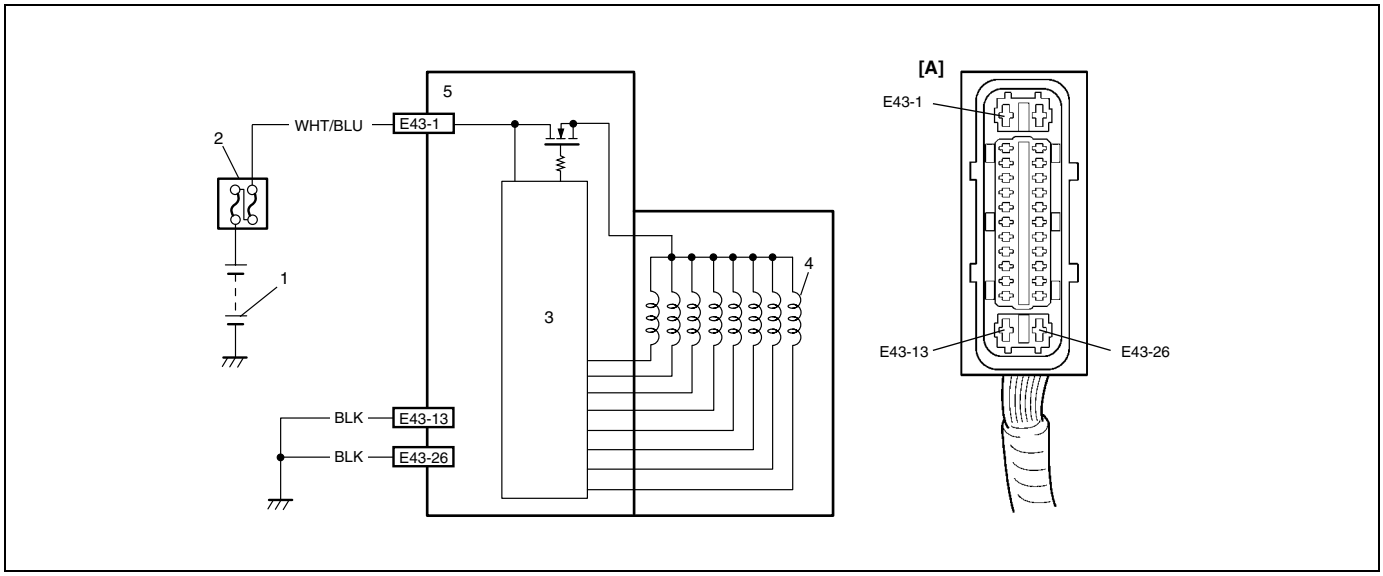
When the vehicle was operated in any of the following ways, one of these DTCs may be set even when the sensor is in good condition. If such possibility is suspected, repair the trouble (dragging of brake, etc.) of the vehicle, clear DTC once and then after performing the driving test as described in Step 2 of "ABS Diagnosis Flow Table", check whether or not any abnormality exists.

- **The vehicle was driven with parking brake pulled.**
- **The vehicle was driven with brake dragging.**
- **Wheel spin occurred while driving.**
- **Wheel(s) was turned while the vehicle was jacked up.**
- **The vehicle was stuck.**

INSPECTION

Step	Action	Yes	No
1	Was “ABS Diagnostic Flow Table” performed?	Go to Step 2.	Go to “ABS Diagnostic Flow Table” in this section.
2	1) Disconnect applicable ABS wheel speed sensor coupler with ignition switch OFF. 2) Measure resistance between terminals of ABS wheel speed sensor. Refer to “Front Wheel Speed Sensor Inspection” and/or “Rear Wheel Speed Sensor Inspection” in this section. Is measured resistance value as specified?	Go to Step 3.	Replace ABS wheel speed sensor assembly.
3	1) Turn ignition switch OFF. 2) Disconnect ABS hydraulic unit/control module connector. 3) Check for proper connection to ABS control module at each sensor terminal. 4) If OK, then turn ignition switch ON and measure voltage between sensor terminal of module connector and body ground. Is it 0V?	Go to Step 4.	ABS wheel speed sensor circuit shorted to power.
4	1) Turn ignition switch OFF. 2) Connect ABS wheel speed sensor coupler. 3) Measure resistance between the following points. • Both ABS hydraulic unit/control module connector terminals of the corresponding sensor. This check result should be the same as above Step 1. • Either terminal of wheel speed sensor coupler and body ground. This check result should be no continuity. Are both check results OK?	Go to Step 5.	Circuit open or shorted to ground.
5	1) Remove applicable ABS wheel speed sensor. 2) Check sensor for damage or foreign material attached. Is it in good condition?	Go to Step 6.	Clean, repair or replace.
6	Check front and/or rear sensor ring for the following (remove rear drum as necessary): • Rotor serration (teeth) neither missing nor damaged. • No foreign material being attached. • Rotor not being eccentric. • Wheel bearing free from excessive play. Are they in good condition?	Go to Step 7.	Clean, repair or replace.
7	1) Install ABS wheel speed sensor to knuckle. 2) Tighten sensor bolt to specified torque and check that there is no clearance between sensor and knuckle. Is it OK?	Go to Step 8.	Replace ABS wheel speed sensor.
8	Refer to “Reference” of “Front Wheel Speed Sensor On-Vehicle Inspection” and/or “Reference” of “Rear Wheel Speed Sensor On-Vehicle Inspection” in this section, check output voltage or waveform. Is specified voltage and/or waveform obtained?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	Replace sensor and recheck.

DTC C1041 – Right-Front Inlet Solenoid Circuit
DTC C1045 – Left-Front Inlet Solenoid Circuit
DTC C1051 – Right-Rear Inlet Solenoid Circuit
DTC C1055 – Left-Rear Inlet Solenoid Circuit
DTC C1042 – Right-Front Outlet Solenoid Circuit
DTC C1046 – Left-Front Outlet Solenoid Circuit
DTC C1052 – Right-Rear Outlet Solenoid Circuit
DTC C1056 – Left-Rear Outlet Solenoid Circuit



[A]: ABS hydraulic unit/control module assembly connector E43	2. Main fuse	4. Solenoid valve
1. Battery	3. ABS power control module	5. ABS hydraulic unit/control module assembly

DESCRIPTION

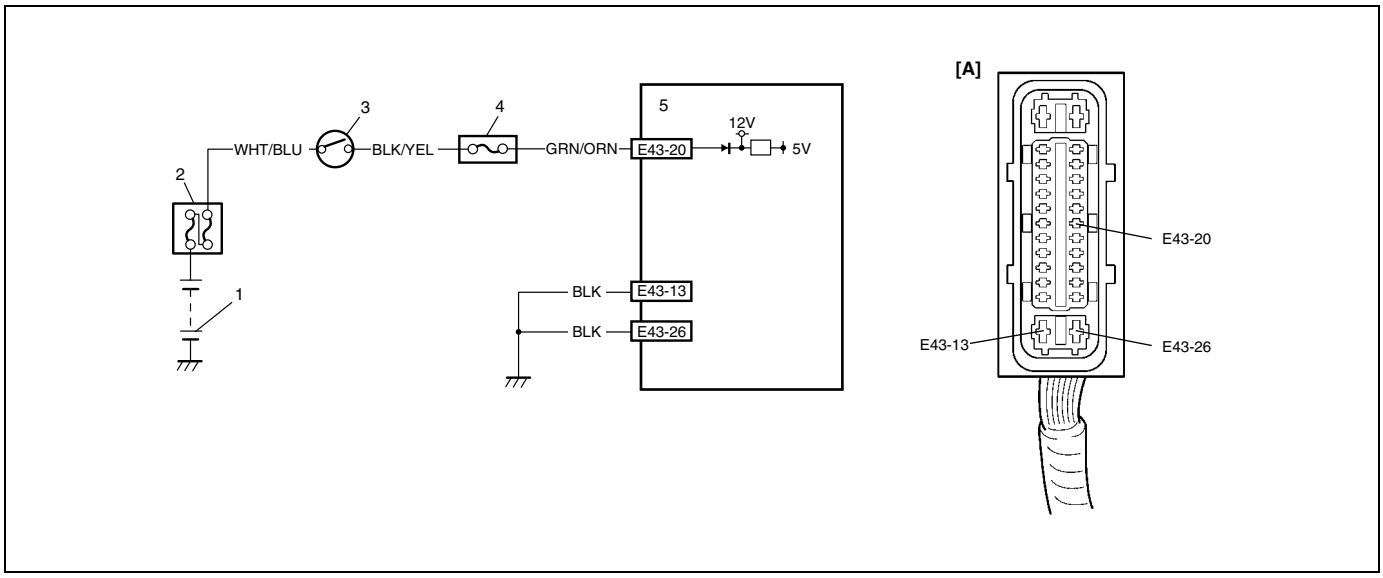
The ABS control module monitors the output from the valve.
When the output of each valve exceeds the specified value compared with the signal sent from ABS control module, this DTC is set.

INSPECTION

Step	Action	Yes	No
1	Was “ABS Diagnostic Flow Table” performed?	Go to Step 2.	Go to “ABS Diagnostic Flow Table” in this section.
2	1) Check solenoid operation referring to item “ABS Hydraulic Unit Operation Check” in this section. Is it in good condition?	Check terminal “E43-1” connection. If connection is OK, substitute a known-good ABS hydraulic unit/control module assembly and recheck.	Go to Step 3.

Step	Action	Yes	No
3	1) Turn ignition switch to OFF position. 2) Disconnect ABS hydraulic unit/control module connector. 3) Check for proper connection to ABS hydraulic unit/control module connector at terminal “E43-1”. 4) If OK, then measure voltage between terminal “E43-1” of module connector and “E43-13 and 26”. Is it 10 – 14 V?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	“WHT/BLU” or “BLK” circuit open.

DTC C1057 – Power Source Circuit



[A]: ABS hydraulic unit/control module connector E43	2. Main fuse	4. Circuit fuse
1. Battery	3. Ignition switch	5. ABS hydraulic unit/control module assembly

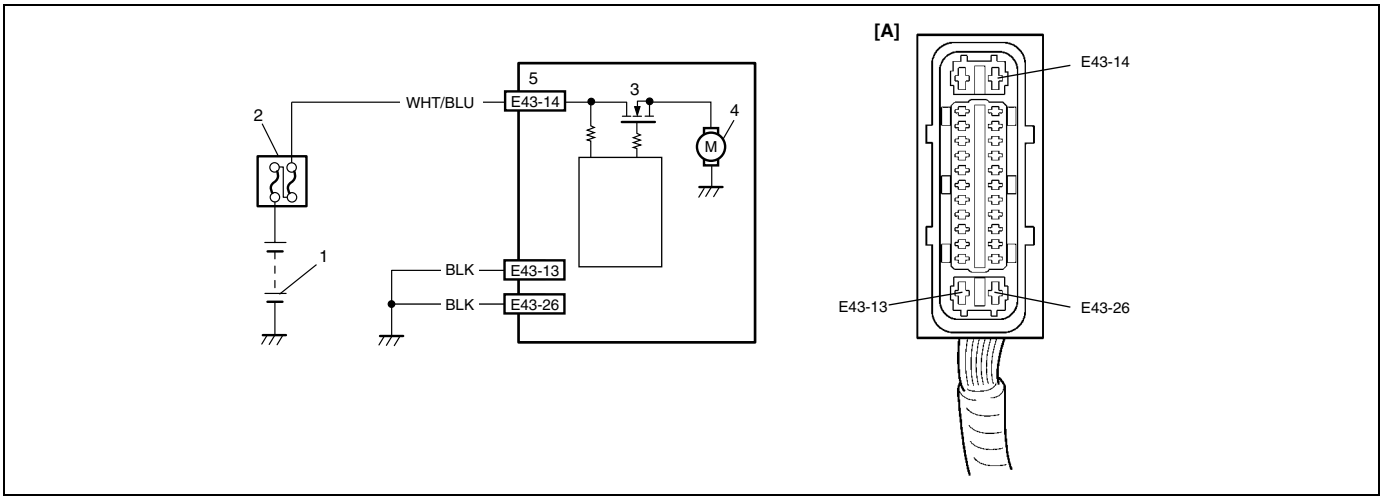
DESCRIPTION

The ABS control module monitors the power source voltage at terminal “E43-20”. When the power source voltage becomes extremely high or low, this DTC will be set. As soon as the voltage rises or lowers to the specified level, the set DTC will be cleared.

INSPECTION

Step	Action	Yes	No
1	Was “ABS Diagnostic Flow Table” performed?	Go to Step 2.	Go to “ABS Diagnostic Flow Table” in this section.
2	1) Connect a voltmeter between battery positive (+) terminal and body ground. 2) Start the engine and measure the maximum voltage when racing the engine. Is it over 18 V?	Check charging system referring to “Overcharged battery” in Section 6H.	Go to Step 3.
3	1) Disconnect ABS hydraulic unit/control module connector. 2) Keep the engine idling, measure the voltage between terminal “E43-20” of ABS control module and body ground. Is it always under 9 V?	Check charging system referring to “Undercharged battery” in Section 6H. Imperfect short between wire “GRN/ORN” and ground.	Poor connection of terminal “E43-20” or “E43-13 and 26” of the ABS control module. If the above are in good condition, substitute a known-good ABS hydraulic unit/control module and recheck.

DTC C1061 – ABS Pump Motor Circuit



[A]: ABS hydraulic unit/control module connector E43	2. Main fuse	4. ABS pump motor
1. Battery	3. Pump motor relay (transistor)	5. ABS hydraulic unit/control module assembly

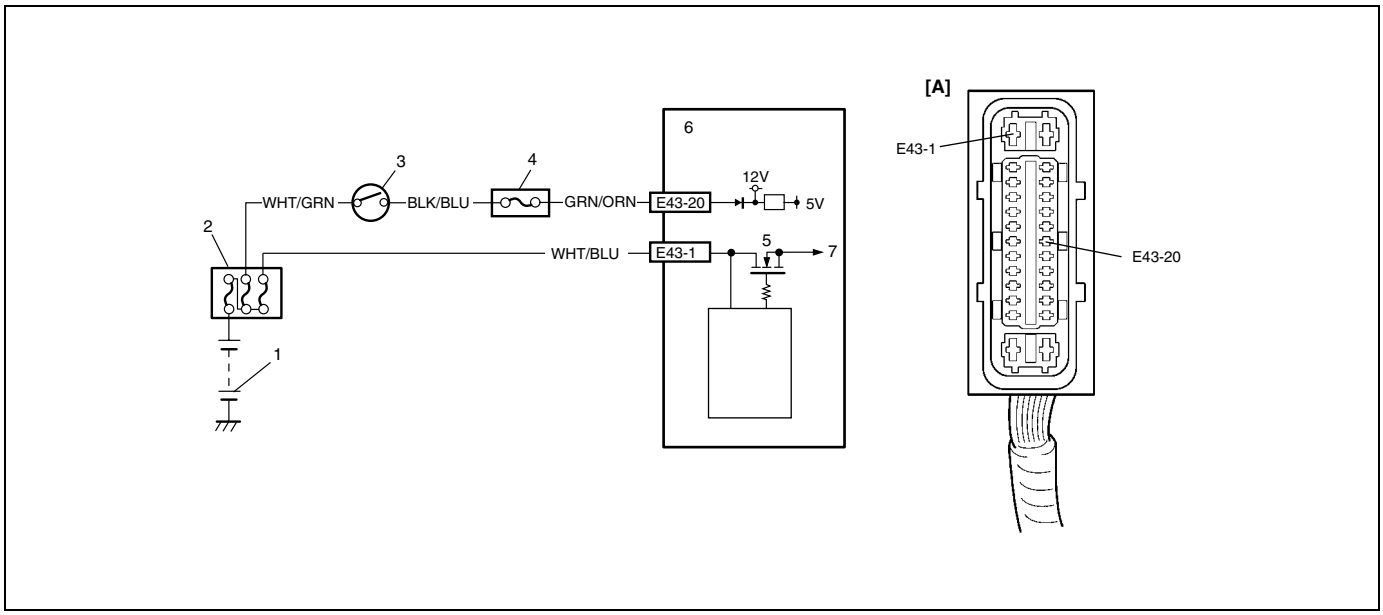
DESCRIPTION

The ABS control module monitors the voltage at monitor terminal of pump motor circuit constantly with the ignition switch turned ON. It sets this DTC when the voltage at the monitor terminal does not become high/low according to ON/OFF commands to the motor relay (transistor) of the module (does not follow these commands).

INSPECTION

Step	Action	Yes	No
1	Was “ABS Diagnostic Flow Table” performed?	Go to Step 2.	Go to “ABS Diagnostic Flow Table” in this section.
2	1) Check pump motor referring to “ABS Hydraulic Unit Operation Check” in this section. Is it in good condition?	Check terminals “E43-14” and “E43-13 and 26” connection. If connections OK, substitute a known-good ABS hydraulic unit/control module assembly and recheck.	Go to Step 3.
3	1) Turn Ignition switch to OFF position. 2) Disconnect ABS hydraulic unit/control module connector. 3) Check for proper connection to ABS hydraulic unit/control module connector at terminal “E43-14”. 4) If OK, then measure voltage between terminal “E43-14” of module connector and body ground. Is it 10 – 14 V?	Go to Step 4.	“WHT/BLU” circuit open.
4	Measure resistance between terminal “E43-13 and 26” of ABS hydraulic unit/control module connector and body ground. Is it infinite (∞)?	“BLK” circuit open.	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.

DTC C1063 – ABS Fail-Safe Relay Circuit



[A]: ABS hydraulic unit/control module connector E43	2. Main fuse	4. Circuit fuse	6. ABS hydraulic unit/control module assembly
1. Battery	3. Ignition switch	5. Fail safe relay (transistor)	7. To solenoid valve

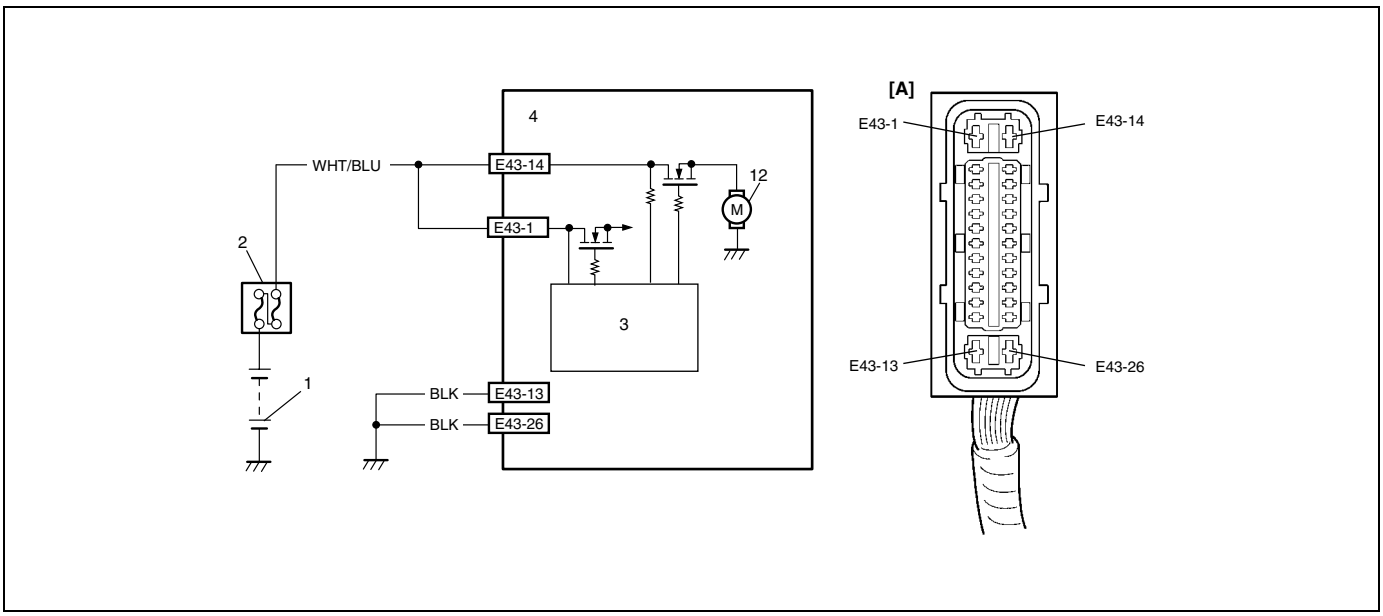
DESCRIPTION

ABS control module monitors the voltage at the terminal of solenoid circuit constantly with ignition switch turned ON. Also, immediately after ignition switch is turned ON, perform initial check as follows.
Switch fail-safe relay (transistor) in the order of OFF → ON and check if voltage changes to Low → High. If anything faulty is found in the initial check and when the voltage is low with ignition switch turned ON, this DTC will be set.

INSPECTION

Step	Action	Yes	No
1	Was “ABS Diagnostic Flow Table” performed?	Go to Step 2.	Go to “ABS Diagnostic Flow Table” in this section.
2	Check battery voltage. Is it about 11 V or higher?	Go to Step 3.	Check charging system referring to “Undercharged battery” in Section 6H.
3	Check ABS main fuse and connection. Is it in good condition?	Go to Step 4.	Repair and/or replace fuse.
4	1) Turn ignition switch to OFF position. 2) Disconnect ABS hydraulic unit/control module connector. 3) Check proper connection to ABS hydraulic unit/control module at terminal “E43-1”. 4) If OK, then measure voltage between connector terminal “E43-1” and body ground. Is it 10 – 14 V?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	“WHT/BLU” circuit open or short to ground.

DTC C1071 – ABS Control Module



[A]: ABS hydraulic unit/control module connector E43	2. Main fuse	4. ABS hydraulic unit/control module assembly
1. Battery	3. ABS power control module	

DESCRIPTION

This DTC will be set when an internal malfunction is detected in the ABS control module.

INSPECTION

Step	Action	Yes	No
1	Was “ABS Diagnostic Flow Table” performed?	Go to Step 2.	Go to “ABS Diagnostic Flow Table” in this section.
2	Clear all DTCs and check DTC. Is it DTC C1071?	Go to Step 3.	Could be a temporary malfunction of the ABS control module.
3	1) Check proper connection of ABS hydraulic unit/control module connector. 2) If OK, disconnect ABS hydraulic unit/control module connector and check the followings. • Voltage “E43-14” terminal: 10 – 14 V • Resistance between “E43-13 and 26” and body ground: Continuity Are the check result as specified above?	Replace ABS hydraulic unit/control module assembly.	Repair and recheck.

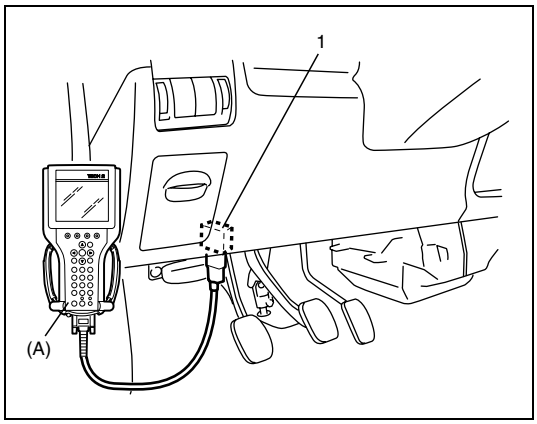
On-Vehicle Service

Precautions

When connector is connected to ABS hydraulic unit/control module assembly, do not disconnect connectors of sensors with ignition switch ON. Then DTC will be set in ABS control module.

ABS Hydraulic Unit Operation Check

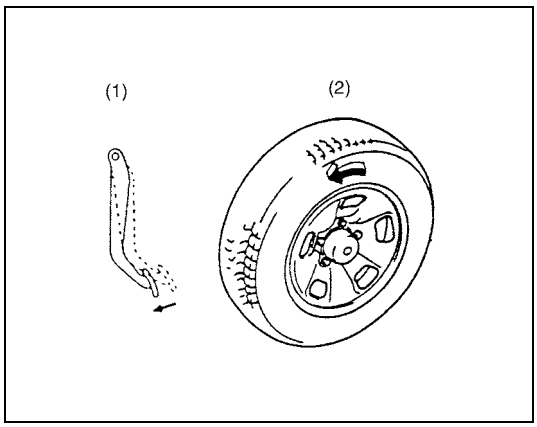
1) Check that basic brake system other than ABS is in good condition.
2) Check that battery voltage is 11 V or higher.
3) Lift up vehicle.
4) Set transmission to neutral and release parking brake.
5) Turn each wheel gradually by hand to check if brake dragging occurs. If it does, correct.



6) Connect Suzuki Scan Tool to data link connector (DLC) (1) with ignition switch OFF.

Special tool
(A): Suzuki Scan Tool

7) Turn ignition switch to ON position and select menu to "HYDRAULIC CONTROL TEST" under "miscellaneous test" ("MISC. TEST") mode of Suzuki Scan Tool.

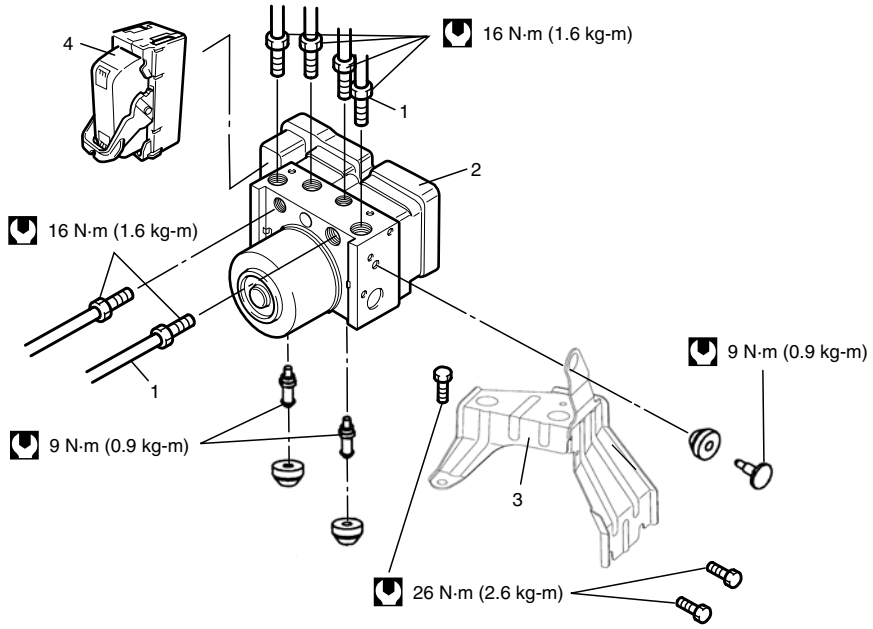


8) Perform the following checks with help of another person.
   Brake pedal (1) should be depressed and then select testing wheel by Suzuki Scan Tool and the wheel (2) should be turned by another person's hand. At this time, check that:
   - Operation sound of solenoid is heard and the wheel turns only about 0.5 sec. (Brake force is depressurized).
   - Operation sound of pump motor is heard and pulsation is felt at brake pedal.
9) Check for all 4-wheels condition respectively. If a faulty condition is found, replace hydraulic unit/control module assembly.
10) After completing the check, turn ignition switch to OFF position and disconnect Suzuki Scan Tool from DLC.

ABS Hydraulic Unit/Control Module Assembly Components

CAUTION:

Never disassemble ABS hydraulic unit/control module assembly, loosen blind plug or remove motor. Performing any of these prohibited services will affect original performance of ABS hydraulic unit/ control module assembly.



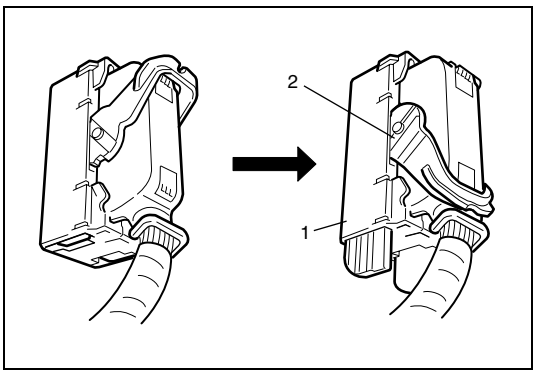
1. Brake pipe	3. Bracket
2. ABS hydraulic unit/control module assembly	4. Connector

ABS Hydraulic Unit Control Module Inspection

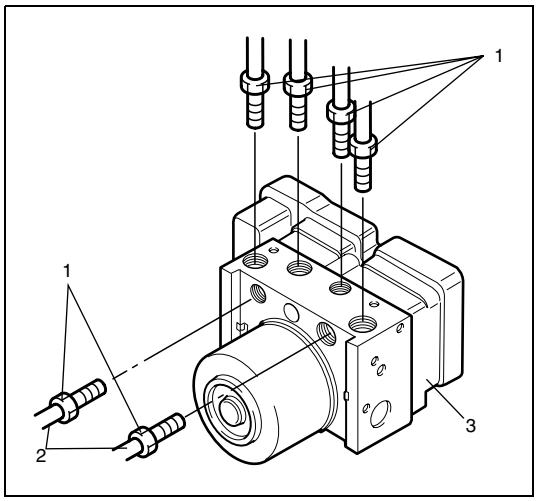
Check hydraulic unit for fluid leakage.
If any, repair or replace.

ABS Hydraulic Unit/Control Module Removal and Installation

Removal



1) Disconnect negative cable from battery.
2) Disconnect ABS hydraulic unit/control module assembly connector (1) by turning down lock (2).

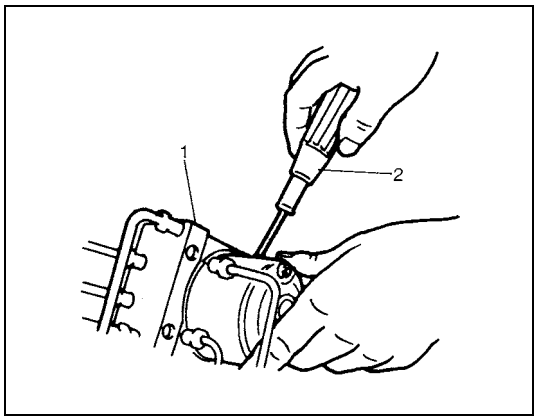


3) Using special tool, loosen flare nuts (1) and disconnect brake pipes (2) from ABS hydraulic unit/control module assembly (3).

Special tool
: 09950-78220

NOTE:

Put bleeder plug cap onto pipe to prevent fluid from spilling. Do not allow brake fluid to get on painted surfaces.

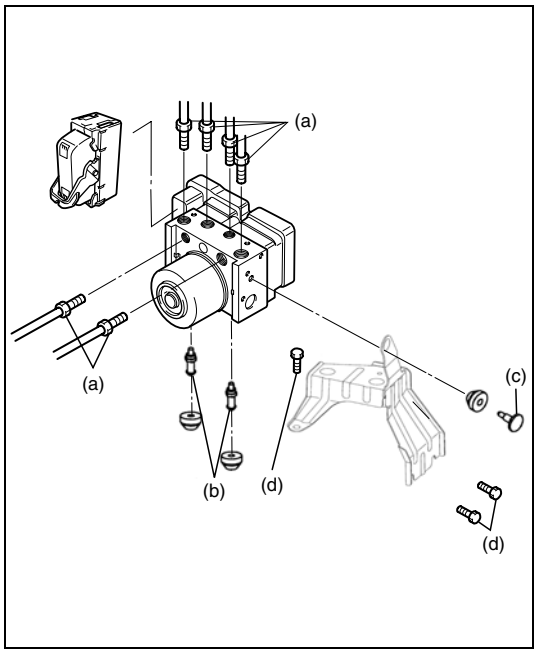


4) Remove one screw and disconnect take out ABS hydraulic unit/control module assembly (1) from bracket using screwdriver (2).

CAUTION:

- **Do not give an impact to hydraulic unit.**
- **Use care not to allow dust to enter hydraulic unit.**
- **Do not place hydraulic unit on its side or upside down. Handling it in inappropriate way will affect its original performance.**

Installation



1) Install hydraulic unit by reversing removal procedure.

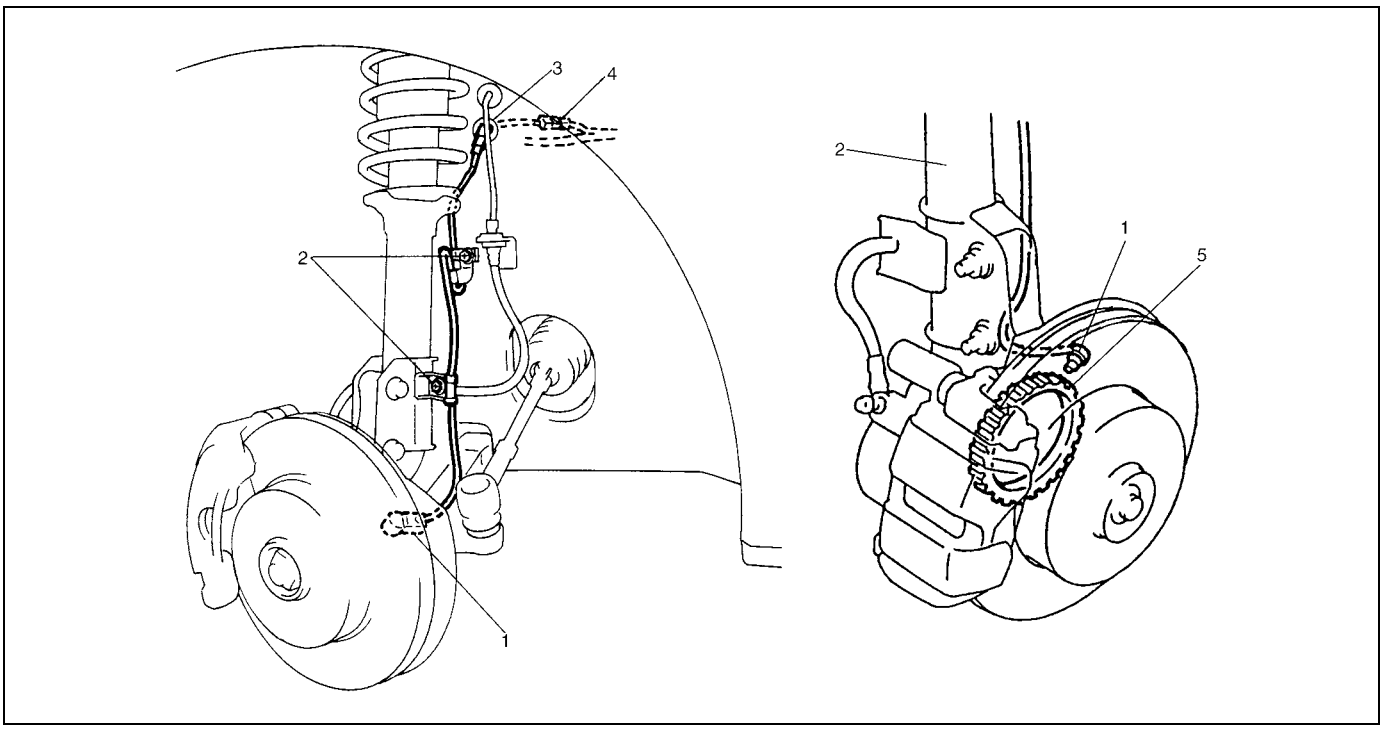
Tightening torque
(a): 16 N·m (1.6 kg-m, 11.5 lb-ft)
(b): 9 N·m (0.9 kg-m, 6.5 lb-ft)
(c): 9 N·m (0.9 kg-m, 6.5 lb-ft)
(d): 26 N·m (2.6 kg-m, 18.0 lb-ft)

2) Bleed air from brake system referring to “Air Bleeding of Brake System” in Section 5.
3) Check each installed part for fluid leakage and perform “ABS Hydraulic Unit Operation Check” in this section.

NOTE:

For new ABS hydraulic unit/control module assembly, if “ABS Hydraulic Unit Operation Check” procedure has not been performed, “ABS” warning lamp may flash when ignition switch is turned ON position.

Front Wheel Speed Sensor Components

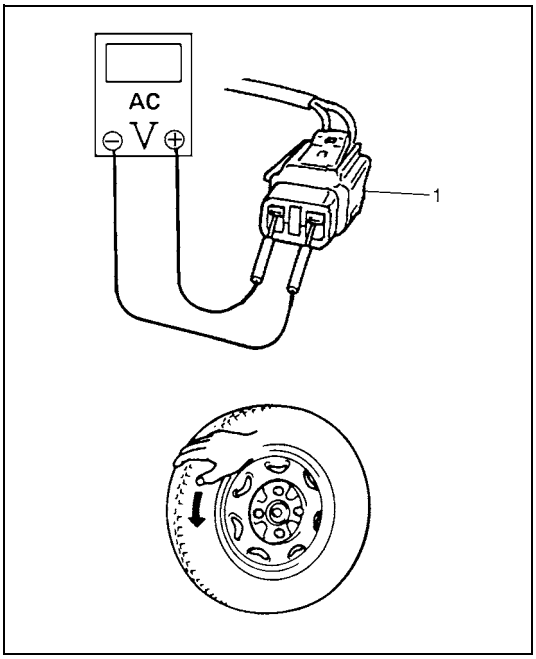


1. Left front wheel speed sensor	3. Grommet	5. Sensor ring
2. Clamp bolt	4. Connector	

Front Wheel Speed Sensor On-Vehicle Inspection

Output Voltage Inspection

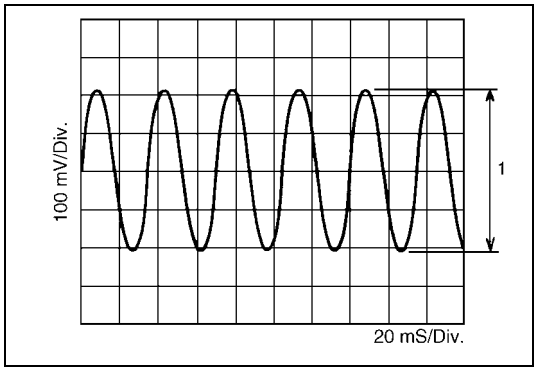
1) Turn ignition switch OFF.
2) Hoist vehicle a little.
3) Disconnect wheel speed sensor connector.
4) Disconnect wheel speed sensor grommet from vehicle body.



5) Connect voltmeter between connector (1) terminals.
6) While turning wheel by hand at a speed of approximately 1 full rotation to 1 1/3 rotation per second, check AC voltage of sensor.

Output AC voltage at 1 to 1 1/3 rotation per second
: 100 mV or more

7) If measured voltage is not as specified, check sensor, rotor and their installation conditions.



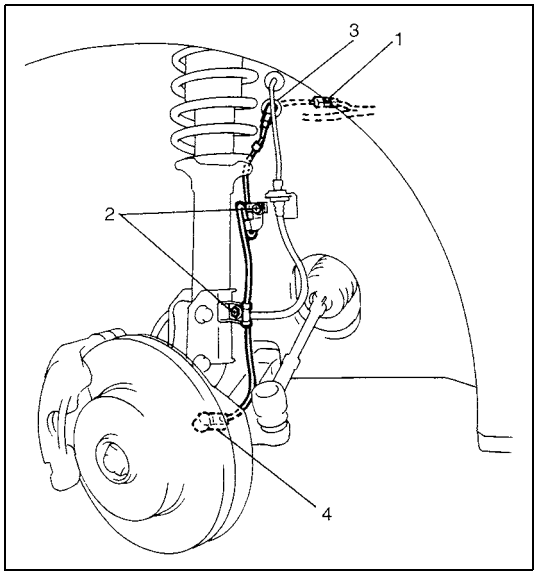
Reference

When using oscilloscope for this check, check if peak-to-peak voltage (1) meets specification and waveform is complete.

Peak-to-peak voltage at 1 to 1 1/3 rotation per second : 280 mV or more at 43 – 57 Hz

Front Wheel Speed Sensor Removal and Installation

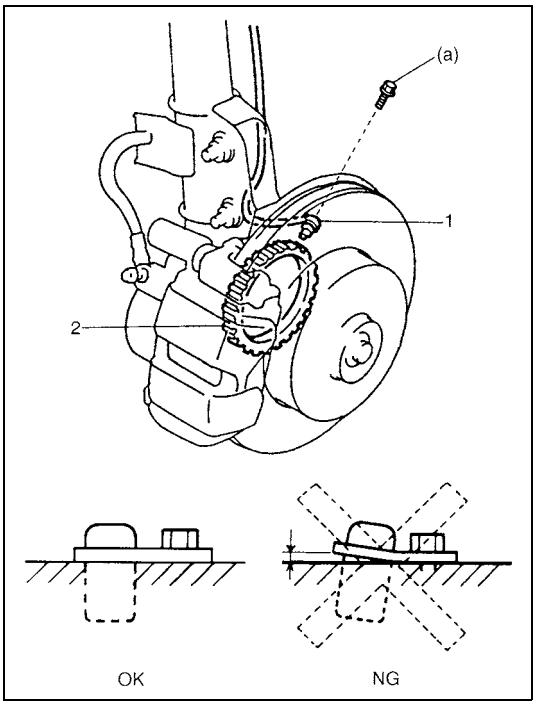
Removal



1) Disconnect negative cable at battery.
2) Disconnect front wheel speed sensor coupler (1).
3) Hoist vehicle and remove wheel.
4) Remove harness clamp bolts (2) and grommet (3).
5) Remove front wheel speed sensor (4) from knuckle.

CAUTION:

- **Do not pull wire harness when removing front wheel speed sensor.**
- **Do not cause damage to surface of front wheel speed sensor and do not allow dust, etc. to enter its installation hole.**



Installation

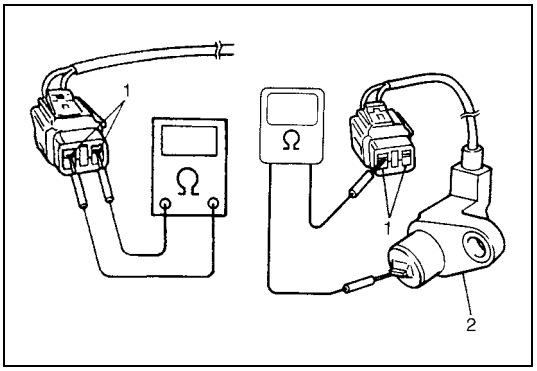
1) Check that no foreign material is attached to sensor (1) and sensor ring (2).
2) Install it by reversing removal procedure.

Tightening torque
Front wheel speed sensor bolt
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

CAUTION:
Do not pull or twist wire harness more than necessary when installing front wheel speed sensor.

3) Check that there is no clearance between sensor and knuckle.

Front Wheel Speed Sensor Inspection



- Check sensor for damage.
- Check sensor for resistance and continuity.

Between both terminals (1) sensor
: 1.2 – 1.6 kΩ at 20°C (68°F)

Between sensor terminal and sensor body (2)
: No continuity

- If the check result is not as specified and any malfunction is found, replace.

Front Wheel Speed Sensor Ring Removal and Installation

NOTE:
The front wheel sensor ring can not be removed or replaced alone. If front wheel sensor ring needs to be replaced, replace it as a wheel side joint assembly of drive shaft.

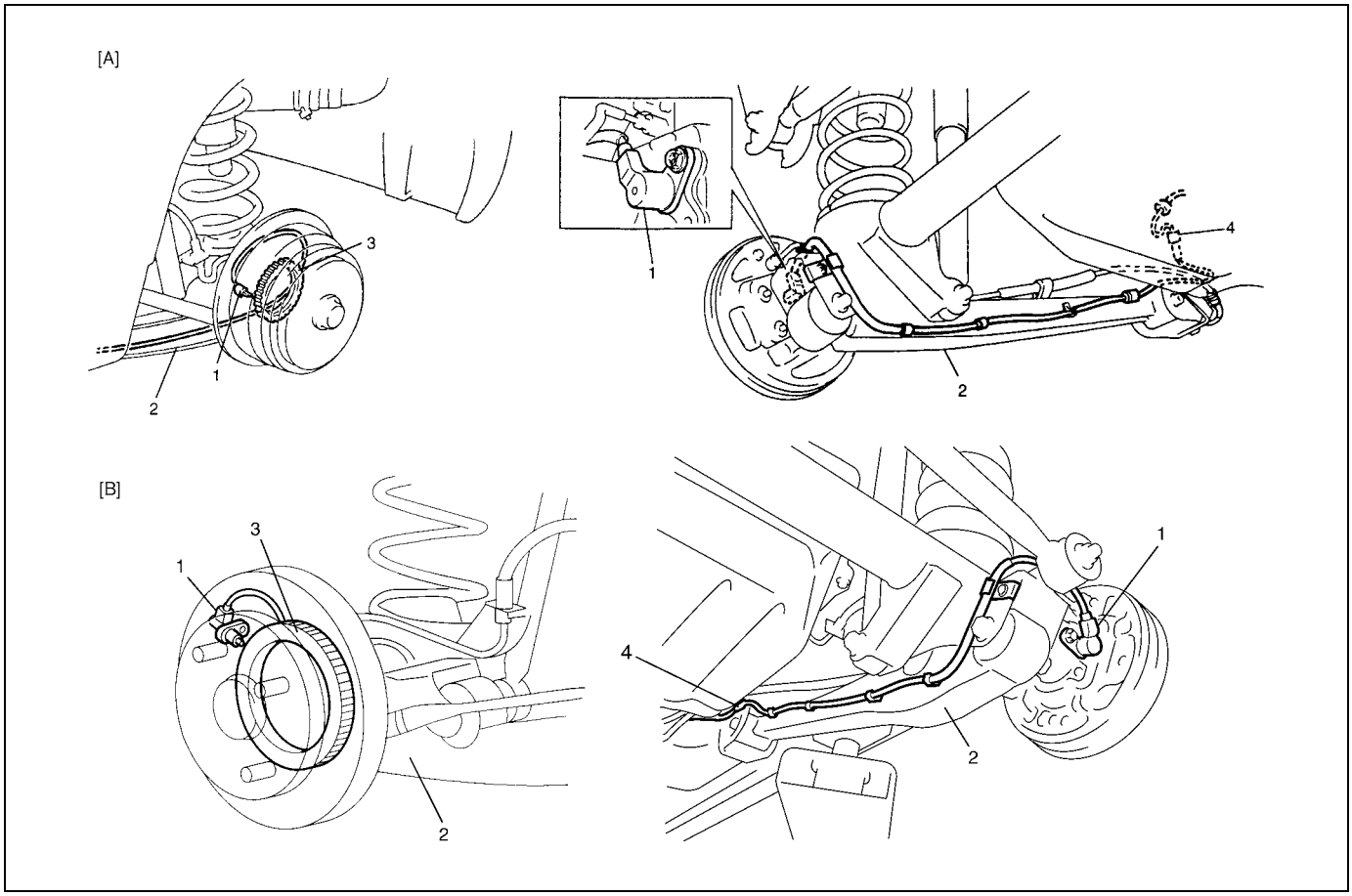
For removal and installation of wheel side joint assembly of drive shaft, refer to “Front Drive Shaft Assembly Removal and Installation” in Section 4A.

Front Wheel Speed Sensor Ring Inspection

- Check ring for being missing, damaged or deformed.
- Turn drive shaft and check if ring rotation is free from eccentricity and looseness.
- Check that no foreign material is attached.

If any faulty is found, repair or replace. Refer to “Front Drive Shaft Assembly Removal and Installation” in Section 4A.

Rear Wheel Speed Sensor Components

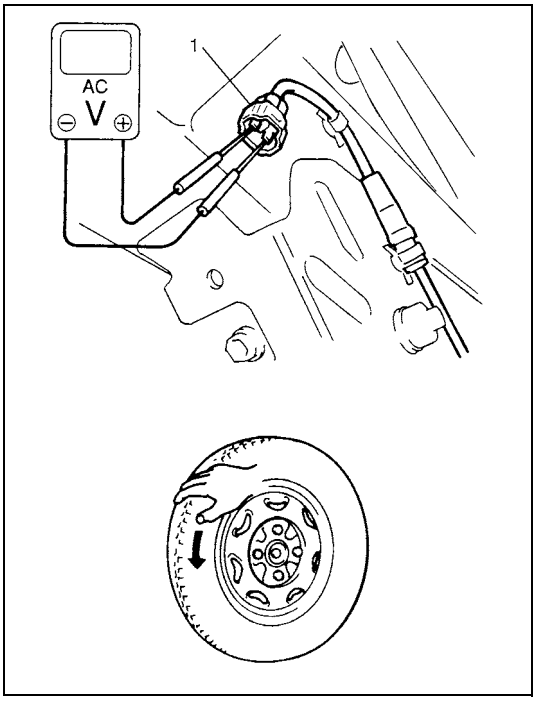


[A]: For 2WD	1. Left rear wheel sensor	3. Sensor ring	5. Right rear wheel sensor	7. Forward
[B]: For 4WD	2. Trailing arm	4. Sensor coupler	6. Rear axle housing	8. Vehicle inside

Rear Wheel Speed Sensor On-Vehicle Inspection

Output Voltage Inspection

1) Turn ignition switch OFF.
2) Remove rear seat referring to Section 9.
3) Turn over floor carpet.
4) Hoist vehicle.
5) Disconnect connector of wheel speed sensor.

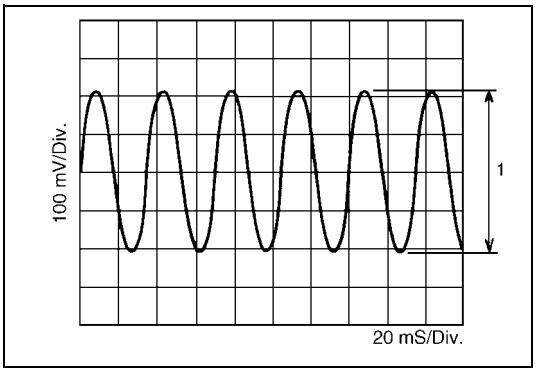


6) Connect voltmeter between connector (1) terminals.
7) While turning wheel at a speed of approximately 1 rotation to 1 1/3 rotation per second, check AC voltage of sensor.

Output AC voltage at 1 to 1 1/3 rotation per second
100 mV or more

8) If measured voltage is not as specified, check sensor, rotor and their installation conditions.

Reference



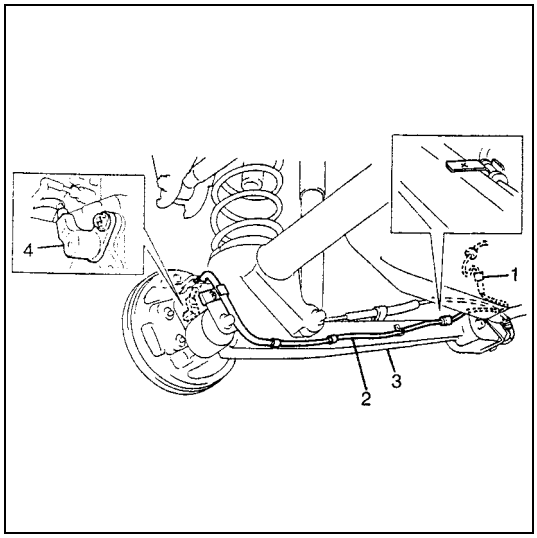
When using oscilloscope for this check, check if peak-to-peak voltage (1) meets specification and waveform is complete.

Peak-to-peak voltage at 1 to 1 1/3 rotation per second
280 mV or more at 43 – 57 Hz

Rear Wheel Speed Sensor Removal and Installation

Removal

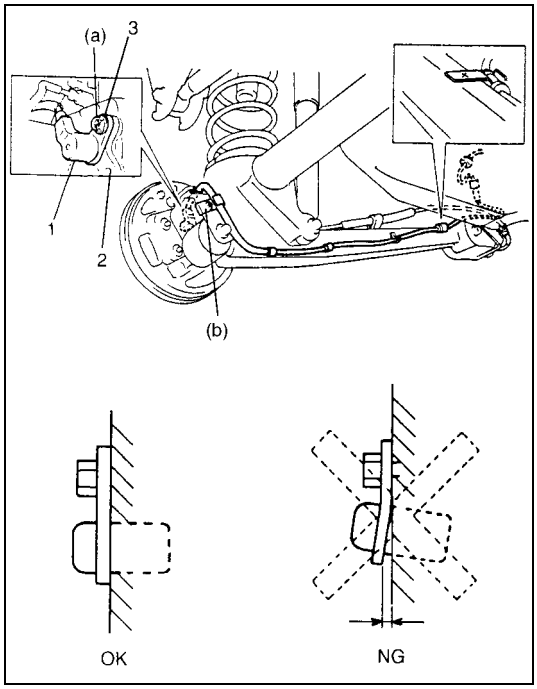
1) Disconnect negative cable from battery.
2) Hoist vehicle.



3) Disconnect rear wheel speed sensor coupler (1).
4) Detach ABS wheel sensor wire harness (2) from suspension frame (3).
   Do not detach clip of rear wheel speed sensor connector from vehicle body unless replacement is necessary.
5) Remove rear wheel speed sensor (4) from rear axle housing.

CAUTION:
- **Do not pull wire harness when removing rear wheel speed sensor.**
- **Do not cause damage to surface of rear wheel speed sensor and do not allow dust, etc. to enter its installation hole.**

Installation



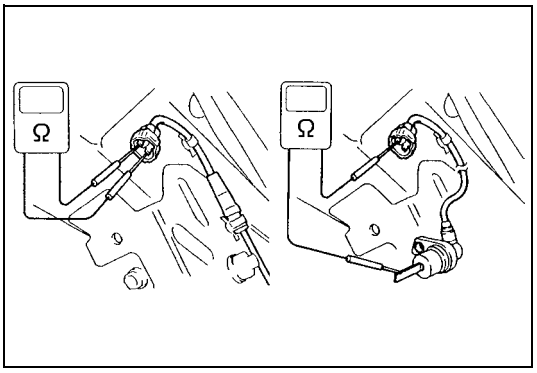
1) Check that no foreign material is attached to sensor (1) and ring.
2) Reverse removal procedure for installation noting the following.
   - There is another bolt hole (2) that is fit for wheel speed sensor bolt by proper bolt hole (3).
     Be sure to install wheel speed sensor and its bolt at the correct (upper) position as shown in figure.

Tightening torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)
(b): 2.5 N·m (0.25 kg-m, 1.8 lb-ft)

CAUTION:
Do not pull or twist wire harness more than necessary when installing rear wheel speed sensor.

3) Check that there is no clearance between sensor and rear axle shaft.

Rear Wheel Speed Sensor Inspection



- Check sensor for damage.
- Check sensor for resistance and continuity.

Between both terminals of sensor
2WD vehicle: 0.9 – 1.3 kΩ at 20°C (68°F)
4WD vehicle: 1.2 – 1.6 kΩ at 20°C (68°F)

Between sensor terminal and sensor body
: No continuity

- If the check result is not as specified and any malfunction is found, replace.

Rear Wheel Speed Sensor Ring (For 2WD Vehicle) Removal and Installation

For removal, inspection and installation of rear wheel sensor ring, refer to “Brake Drum Removal and Installation (for 2WD Model)” in Section 5C.

Rear Wheel Speed Sensor Ring (For 2WD Vehicle) Inspection

For inspection of rear wheel speed sensor ring, refer to “Drum Brake Component Parts Inspection” in Section 5C.

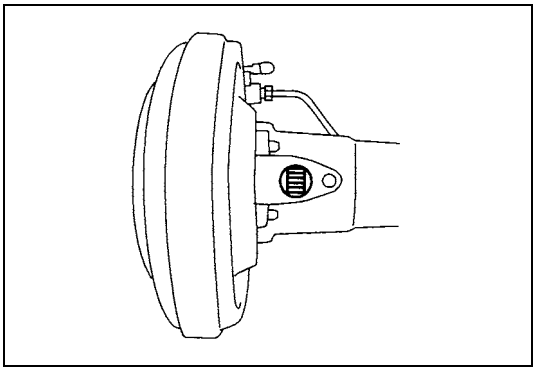
Rear Wheel Speed Sensor Ring (For 4WD Vehicle) Removal and Installation

NOTE:

The rear wheel speed sensor ring can not be removed or replaced alone. If rear wheel speed sensor ring needs to be replaced, replace it as a retainer ring of rear axle shaft.

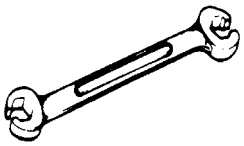
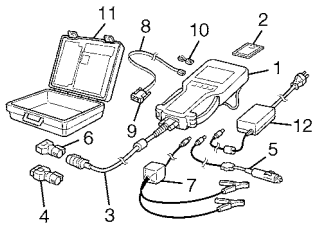
For removal and installation of retainer ring of rear axle shaft, refer to “Rear Axle Shaft and Wheel Bearing Removal and Installation (for 4WD Model)” in Section 3E.

Rear Wheel Speed Sensor Ring (For 4WD Vehicle) Inspection



- Check rotor serration (teeth) for being missing damaged or deformed.
- Turn wheel and check if rotor rotation is free from eccentricity and looseness.
- Check that no foreign material is attached.
- If any faulty is found, repair or replace.

Special Tool

	
09950-78220 Flare nut wrench (10 mm)	Tech 2 kit (Suzuki Scan Tool) See NOTE below.

NOTE:

This kit includes the following items.
1. Tech 2, 2. PCMCIA card, 3. DLC cable, 4. SAE 16/19 adapter, 5. Cigarette cable, 6. DLC loopback adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loopback connector, 11. Storage case, 12. Power supply

SECTION 6

ENGINE GENERAL INFORMATION AND DIAGNOSIS

WARNING:

For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

General Information

Statement on Cleanliness and Care

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousands of an millimeter (ten thousands of an inch).

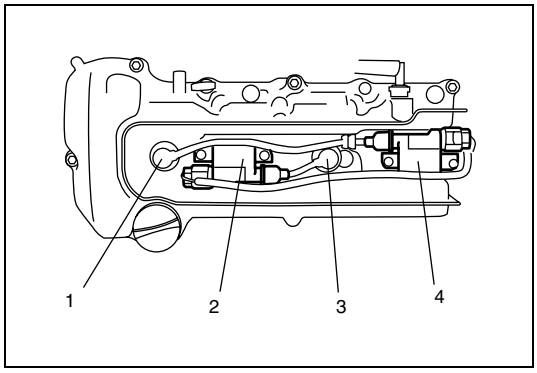
Accordingly, when any internal engine parts are serviced, care and cleanliness are important.

Throughout this section, it should be understood that proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order.

  At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine.

  Failure to disconnect cables may result in damage to wire harness or other electrical parts.
- Throughout this manual, the four cylinders of the engine are identified by numbers; No.1 (1), No.2 (2), No.3 (3) and No.4 (4) counted from crankshaft pulley side to flywheel side.



Precaution

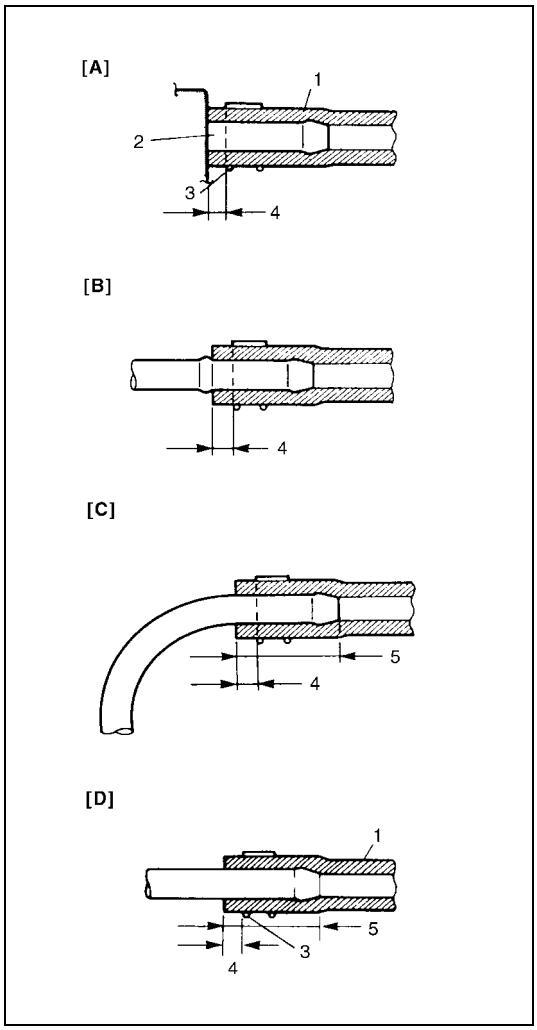
Precaution on engine service

THE FOLLOWING INFORMATION ON ENGINE SERVICE SHOULD BE NOTED CAREFULLY, AS IT IS IMPORTANT IN PREVENTING DAMAGE, AND IN CONTRIBUTING TO RELIABLE ENGINE PERFORMANCE.

- When raising or supporting engine for any reason, do not use a jack under oil pan. Due to small clearance between oil pan and oil pump strainer, jacking against oil pan may cause it to be bent against strainer resulting in damaged oil pick-up unit.
- It should be kept in mind, while working on engine, that 12-volt electrical system is capable of violent and damaging short circuits.
  When performing any work where electrical terminals can be grounded, ground cable of the battery should be disconnected at battery.
- Any time the air cleaner, throttle body or intake manifold is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material which could follow intake passage into cylinder and cause extensive damage when engine is started.

Precaution on fuel system service

- Work must be done with no smoking, in a well-ventilated area and away from any open flames.
- As fuel feed line (between fuel pump and fuel pressure regulator) is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected.
  Before loosening or disconnecting fuel feed line, make sure to release fuel pressure according to “Fuel Pressure Relief Procedure”. A small amount of fuel may be released after the fuel line is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth. Put that cloth in an approved container when disconnection is completed.
- Never run engine with fuel pump relay disconnected when engine and exhaust system are hot.



- Fuel or fuel vapor hose connection varies with each type of pipe. When reconnecting fuel or fuel vapor hose, be sure to connect and clamp each hose correctly referring to the figure Hose Connection.
  After connecting, make sure that it has no twist or kink.
- When installing injector, fuel feed pipe or lubricate its O-ring with gasoline.

[A]:	With short pipe, fit hose as far as it reaches pipe joint as shown.
[B]:	With following type pipe, fit hose as far as its peripheral projection as shown.
[C]:	With bent pipe, fit hose as its bent part as shown or till pipe is about 20 to 30 mm (0.79 – 1.18 in.) into the hose.
[D]:	With straight pipe, fit hose till pipe is, about 20 to 30 mm (0.79 – 1.18 in.) into the hose.
1.	Hose
2.	Pipe
3.	Clamp
4.	Clamp securely at a position 3 to 7 mm (0.12 – 0.27 in.) from hose end.
5.	20 to 30 mm (0.79 – 1.18 in.)

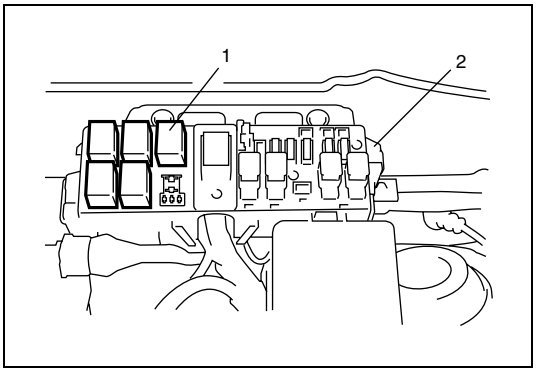
Fuel pressure relief procedure

CAUTION:
This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

NOTE:
If any service shown below is performed, ECM may detect DTC(s). Therefore, clear DTC(s) by referring to "Diagnostic Trouble Code (DTC) Clearance" in this section in case that DTC(s) is detected after all services are done.

After making sure that engine is cold, release fuel pressure as follows.

1) Place transmission gear shift lever in "Neutral" (Shift selector lever to "P" range for A/T model), set parking brake, and block drive wheels.
2) Remove relay/fuse box cover.



3) Disconnect fuel pump relay (1) from relay/fuse box (2).
4) Remove fuel filter cap to release fuel vapor pressure in fuel tank and then reinstall it.
5) Start engine and run it till it stops for lack of fuel. Repeat cranking engine 2-3 times for about 3 seconds each time to dissipate fuel pressure in lines. Fuel connections are now safe for servicing.
6) Upon completion of servicing, connect fuel pump relay (1) to relay/fuse box (2) and install relay/fuse box cover.

Fuel leakage check procedure

After performing any service on fuel system, check to make sure that there are no fuel leakages as follows.

1) Turn ON ignition switch for 3 seconds (to operate fuel pump) and then turn it OFF.
   Repeat this (ON and OFF) 3 or 4 times and apply fuel pressure to fuel line (till fuel pressure is felt by hand placed on fuel feed hose).
2) In this state, check to see that there are no fuel leakages from any part of fuel system.

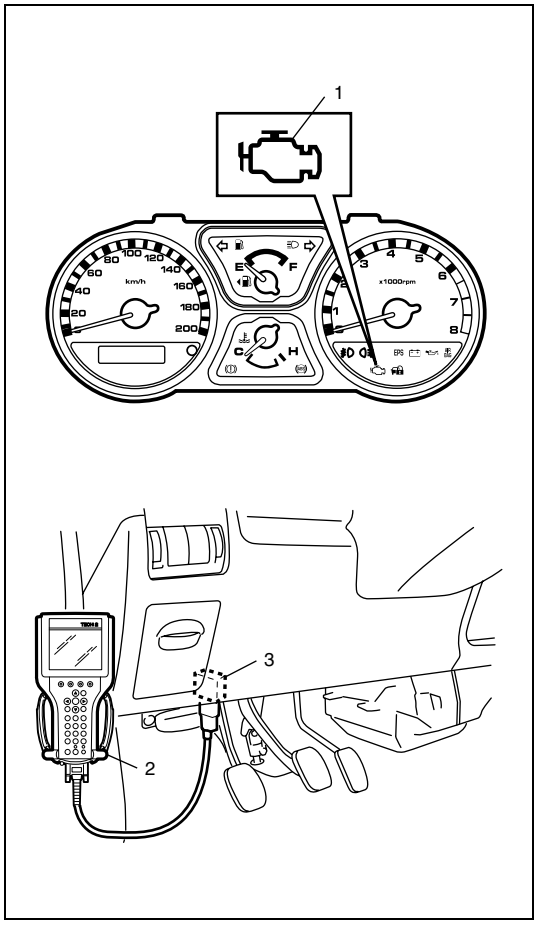
Diagnosis

Engine Diagnosis General Description

This vehicle is equipped with an engine and emission control system which are under control of ECM.
The engine and emission control system in this vehicle are controlled by ECM. ECM has an On-Board Diagnostic system which detects a malfunction in this system and abnormality of those parts that influence the engine exhaust emission. When diagnosing engine troubles, be sure to have full understanding of the outline of "On-Board Diagnostic System" and each item in "Precaution in Diagnosing Trouble" and execute diagnosis according to "Engine and Emission Control System Check".
There is a close relationship between the engine mechanical, engine cooling system, ignition system, exhaust system, etc. and the engine and emission control system in their structure and operation. In case of an engine trouble, even when the malfunction indicator lamp (MIL) doesn't turn ON, it should be diagnosed according to this flow.

On-Board Diagnostic System Description

ECM in this vehicle has following functions.



- When the ignition switch is turned ON with the engine at a stop, malfunction indicator lamp (MIL) (1) turns ON to check the circuit of the malfunction indicator lamp (1).
- When ECM detects a malfunction which gives an adverse effect to vehicle emission while the engine is running, it makes the malfunction indicator lamp (1) in the meter cluster of the instrument panel turn ON or flash (flashing only when detecting a misfire which can cause damage to the catalyst) and stores the malfunction area in its memory.
  (If it detects that continuously 3 driving cycles are normal after detecting a malfunction, however, it makes MIL (1) turn OFF although DTC stored in its memory will remain.)
- As a condition for detecting a malfunction in some areas in the system being monitored by ECM and turning ON the malfunction indicator lamp (1) due to that malfunction, 2 driving cycle detection logic is adopted to prevent erroneous detection.
- When a malfunction is detected, engine and driving conditions then are stored in ECM memory as freeze frame data. (For the details, refer to description on FREEZE FRAME DATA.)
- It is possible to communicate by using not only Suzuki Scan Tool (2) but also OBD generic scan tool. (Diagnostic information can be accessed by using a scan tool.)

3. Data link connector (DLC)

WARM-UP CYCLE

A warm-up cycle means sufficient vehicle operation such that the coolant temperature has risen by at least 22°C (40°F) from engine starting and reaches a minimum temperature of 70°C (160°F).

DRIVING CYCLE

A “Driving Cycle” consists of engine startup and engine shutoff.

2 DRIVING CYCLE DETECTION LOGIC

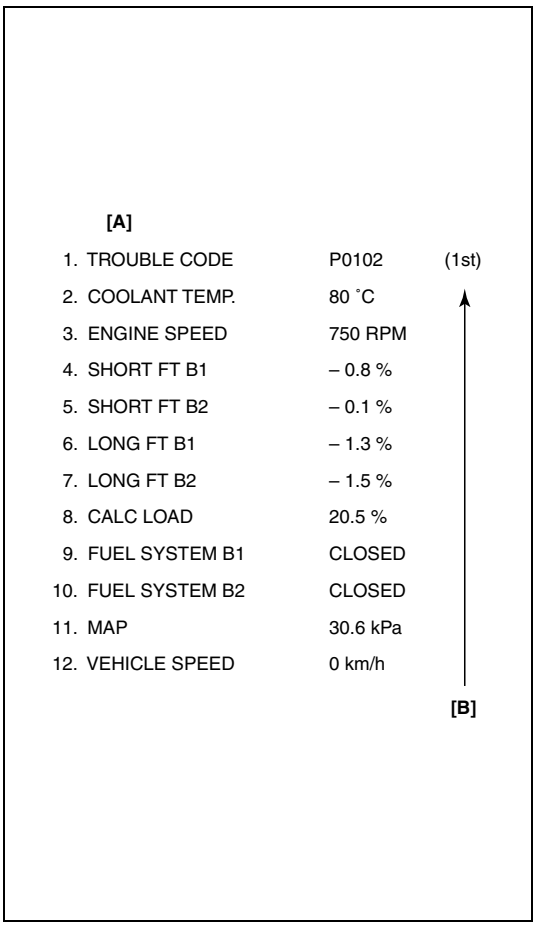
The malfunction detected in the first driving cycle is stored in ECM memory (in the form of pending DTC) but the malfunction indicator lamp does not light at this time. It lights up at the second detection of same malfunction also in the next driving cycle.

PENDING DTC

Pending DTC means a DTC detected and stored temporarily at 1 driving cycle of the DTC which is detected in the 2 driving cycle detection logic.

FREEZE FRAME DATA

ECM stores the engine and driving conditions (in the form of data as shown in the figure) at the moment of the detection of a malfunction in its memory. This data is called “Freeze frame data”. Therefore, it is possible to know engine and driving conditions (e.g., whether the engine was warm or not, where the vehicle was running or stopped, where air/fuel mixture was lean or rich) when a malfunction was detected by checking the freeze frame data. Also, ECM has a function to store each freeze frame data for three different malfunctions in the order as the malfunction is detected. Utilizing this function, it is possible to know the order of malfunctions that have been detected. Its use is helpful when rechecking or diagnosing a trouble.



PRIORITY OF FREEZE FRAME DATA:

ECM has 4 frames where the freeze frame data can be stored. The first frame stores the freeze frame data of the malfunction which was detected first. However, the freeze frame data stored in this frame is updated according to the priority described below. (If malfunction as described in the upper square “1” below is detected while the freeze frame data in the lower square “2” has been stored, the freeze frame data “2” will be updated by the freeze frame data “1”.)

[A]: An Example of Freeze Frame Data
[B]: 1st, 2nd or 3rd in parentheses here represents which position in the order the malfunction is detected.

PRIORITY	FREEZE FRAME DATA IN FRAME 1
1	Freeze frame data at initial detection of malfunction among misfire detected (P0300-P0304), fuel system too lean (P0171) and fuel system too rich (P0172)
2	Freeze frame data when a malfunction other than those in “1” above is detected

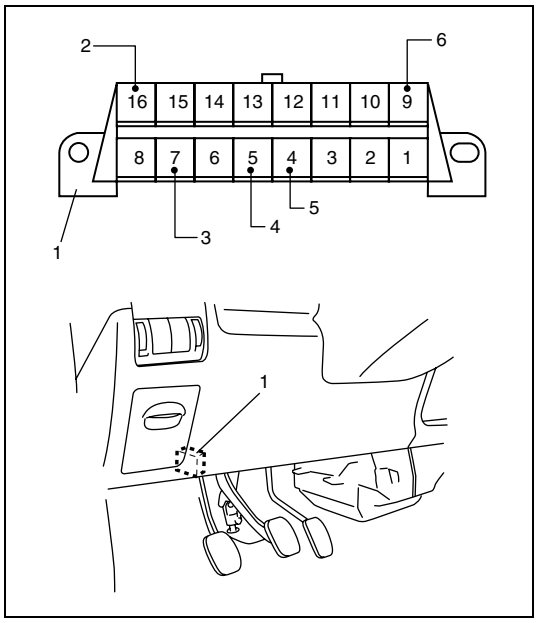
In the 2nd through the 4th frames, the freeze frame data of each malfunction is stored in the order as the malfunction is detected. These data are not updated.
Shown in the table below are examples of how freeze frame data are stored when two or more malfunctions are detected.

			FRAME			
			FRAME 1	FRAME 2	FRAME 3	FRAME 4
			FREEZE FRAME DATA to be updated	1st FREEZE FRAME DATA	2nd FREEZE FRAME DATA	3rd FREEZE FRAME DATA
MALFUNCTION DETECTED ORDER		No malfunction	No freeze frame data			
	1	P0401 (EGR) detected	Data at P0401 detection	Data at P0401 detection	–	–
	2	P0171 (Fuel system) detection	Data at P0171 detection	Data at P0401 detection	Data at P0171 detection	–
	3	P0300 (Misfire) detected	Data at P0171 detection	Data at P0401 detection	Data at P0171 detection	Data at P0300 detection
	4	P0301 (Misfire) detected	Data at P0171 detection	Data at P0401 detection	Data at P0171 detection	Data at P0300 detection

FREEZE FRAME DATA CLEARANCE:

The freeze frame data is cleared at the same time as clearance of diagnostic trouble code (DTC).

DATA LINK CONNECTOR (DLC)



DLC (1) is in compliance with SAE J1962 in the shape of connector and pin assignment.

OBD serial data line (3) (K line of ISO 9141) is used for Suzuki Scan Tool or OBD generic scan tool to communicate with ECM, Air bag SDM and ABS control module.
SUZUKI serial data line (6) is used for Suzuki Scan Tool to communicate with immobilizer control module.

2. B + (Unswitched Vehicle Battery Positive)
4. ECM ground (Signal Ground)
5. Vehicle body ground (Chassis Ground)

Precaution in Diagnosing Trouble for Engine

- Don't disconnect couplers from ECM, battery cable from battery, ECM ground wire harness from engine or main fuse before confirming diagnostic information (DTC, freeze frame data, etc.) stored in ECM memory. Such disconnection will erase memorized information in ECM memory.
- Diagnostic information stored in ECM memory can be cleared as well as checked by using Suzuki Scan Tool or OBD generic scan tool. Before using scan tool, read its Operator's (Instruction) Manual carefully to have good understanding as to what functions are available and how to use it.
- Priorities for diagnosing troubles
  If two or more diagnostic trouble codes (DTCs) are stored, proceed to the flow table of the DTC which has detected earliest in the order and follow the instruction in that table.
  If no instructions are given, troubleshoot diagnostic trouble codes according to the following priorities.
  - Diagnostic trouble codes (DTCs) other than DTC P0171/P0172 (Fuel system too lean/too rich), DTC P0300/P0301/P0302/P0303/P0304 (Misfire detected) and DTC P0401/P0402 (EGR flow malfunction)
  - DTC P0171/P0172 (Fuel system too lean/too rich) and DTC P0401/P0402 (EGR flow malfunction)
  - DTC P0300/P0301/P0302/P0303/P0304 (Misfire detected)
- Be sure to read "Precautions for Electrical Circuit Service" in Section 0A before inspection and observe what is written there.
- ECM Replacement
  When substituting a known-good ECM, check for the following conditions. Neglecting this check may cause damage to a known-good ECM.
  - Resistance value of all relays, actuators is as specified respectively.
  - MAP sensor and TP sensor are in good condition and none of power circuits of these sensors is shorted to ground.

Engine and Emission Control System Check

Refer to the following items for the details of each step.

Step	Action	Yes	No
1	Customer Complaint Analysis 1) Perform customer complaint analysis referring to “1. CUSTOMER COMPLAINT ANALYSIS” in followings. Was customer complaint analysis performed?	Go to Step 2.	Perform customer complaint analysis.
2	Diagnostic Trouble Code (DTC) and Freeze Frame Data Check, Record and Clearance 1) Check for DTC (including pending DTC) referring to the “2. DIAGNOSTIC TROUBLE CODE (DTC)/ FREEZE FRAME DATA CHECK, RECORD AND CLEARANCE” in followings. Is there any DTC(s)?	Print DTC and freeze frame data or write them down and clear them by referring to “Diagnostic Trouble Code (DTC) Clearance” in this section, and go to Step 3.	Go to Step 4.
3	Visual Inspection 1) Perform visual inspection referring to the “3. and 4. VISUAL INSPECTION” in followings. Is there any faulty condition?	Repair or replace malfunction part, and go to Step 11.	Go to Step 5.
4	Visual Inspection 1) Perform visual inspection referring to the “3. and 4. VISUAL INSPECTION” in followings. Is there any faulty condition?		Go to Step 8.
5	Trouble Symptom Confirmation 1) Confirm trouble symptom referring to the “5. TROUBLE SYMPTOM CONFIRMATION” in followings. Is trouble symptom identified?	Go to Step 6.	Go to Step 7.
6	Rechecking and Record of DTC/Freeze Frame Data 1) Recheck for DTC and freeze frame data referring to “Diagnostic Trouble Code (DTC) Check” in this section. Is there any DTC(s)?	Go to Step 9.	Go to Step 8.
7	Rechecking and Record of DTC/Freeze Frame Data 1) Recheck for DTC and freeze frame data referring to “Diagnostic Trouble Code (DTC) Check” in this section. Is there any DTC(s)?		Go to Step 10.
8	Engine Basic Inspection and Engine Symptom Diagnosis 1) Check and repair according to “Engine Basic Inspection” and “Engine Symptom Diagnosis” in this section. Are check and repair complete?	Go to Step 11.	Check and repair malfunction part(s). Go to Step 11.
9	Trouble Shooting for DTC 1) Check and repair according to applicable DTC diag. flow table. Are check and repair complete?		
10	Check for Intermittent Problems 1) Check for intermittent problems referring to “10. CHECK FOR INTERMITTENT PROBLEM” in followings. Is there any faulty condition?	Repair or replace malfunction part(s), and go to Step 11.	Go to Step 11.

Step	Action	Yes	No
11	Final Confirmation Test 1) Clear DTC if any. 2) Perform final confirmation test referring to “11. FINAL CONFIRMATION TEST” in followings. Is there any problem symptom, DTC or abnormal condition?	Go to Step 6.	End.

1. CUSTOMER COMPLAINT ANALYSIS

Record details of the problem (failure, complaint) and how it occurred as described by the customer. For this purpose, use of such an inspection form will facilitate collecting information to the point required for proper analysis and diagnosis.

2. DIAGNOSTIC TROUBLE CODE (DTC)/FREEZE FRAME DATA CHECK, RECORD AND CLEARANCE

First, check DTC (including pending DTC), referring to “Diagnostic Trouble Code (DTC) Check” in this section. If DTC is indicated, print it and freeze frame data or write them down and then clear them by referring to “Diagnostic Trouble Code (DTC) Clearance” in this section. DTC indicates malfunction that occurred in the system but does not indicate whether it exists now or it occurred in the past and the normal condition has been restored now. To check which case applies, check the symptom in question according to Step 4 and recheck DTC according to Step 6 and 7.
Attempt to diagnose a trouble based on DTC in this step only or failure to clear the DTC in this step will lead to incorrect diagnosis, trouble diagnosis of a normal circuit or difficulty in troubleshooting.

3. and 4. VISUAL INSPECTION

As a preliminary step, be sure to perform visual check of the items that support proper function of the engine referring to “Visual Inspection” in this section.

5. TROUBLE SYMPTOM CONFIRMATION

Based on information obtained in Step 1 Customer complaint analysis and Step 2 DTC/freeze frame data check, confirm trouble symptoms. Also, reconfirm DTC according to “DTC Confirmation Procedure” described in each “DTC Diagnosis Flow Table”.

6. and 7. RECHECKING AND RECORD OF DTC/FREEZE FRAME DATA

Refer to “Diagnostic Trouble Code (DTC) Check” in this section for checking procedure.

8. ENGINE BASIC INSPECTION AND ENGINE SYMPTOM DIAGNOSIS

Perform basic engine check according to the “Engine Basic Inspection” first. When the end of the flow table has been reached, check the parts of the system suspected as a possible cause referring to “Engine Symptom Diagnosis” and based on symptoms appearing on the vehicle (symptoms obtained through steps of customer complaint analysis, trouble symptom confirmation and/or basic engine check) and repair or replace faulty parts, if any.

9. DIAGNOSTIC TROUBLE CODE FLOW TABLE (See each DTC Diag. Flow Table)

Based on the DTC indicated in Step 6 or 7 and referring to the applicable DTC diag. flow table in this section, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ECM or other part and repair or replace faulty parts.

10. CHECK FOR INTERMITTENT PROBLEM

Check parts where an intermittent trouble is easy to occur (e.g., wire harness, connector, etc.), referring to “Intermittent and Poor Connection” in Section 0A and related circuit of DTC recorded in Step 2.

11. FINAL CONFIRMATION TEST

Confirm that the problem symptom has gone and the engine is free from any abnormal conditions. If what has been repaired is related to the DTC, clear the DTC once, perform DTC confirmation procedure and confirm that no DTC is indicated.

Customer Problem Inspection Form (Example)

User name:	Model:	VIN:	
Date of issue:	Date Reg.	Date of problem:	Mileage:

PROBLEM SYMPTOMS	
☐ **Difficult Starting** ☐ No cranking ☐ No initial combustion ☐ No combustion ☐ Poor starting at (☐cold ☐warm ☐always) ☐ Other_____	☐ **Poor Driveability** ☐ Hesitation on acceleration ☐ Back fire/☐After fire ☐ Lack of power ☐ Surging ☐ abnormal knocking ☐ Other_____
☐ **Poor Idling** ☐ Poor fast idle ☐ Abnormal idling speed (☐High ☐Low) (r/min.) ☐ Unstable ☐ Hunting (r/min. to r/min.) ☐ Other_____	☐ **Engine Stall when** ☐ Immediately after start ☐ Accel. pedal is depressed ☐ Accel. pedal is released ☐ Load is applied ☐ A/C ☐Electric load ☐P/S ☐ Other_____ ☐ Other_____
☐ OTHERS:	

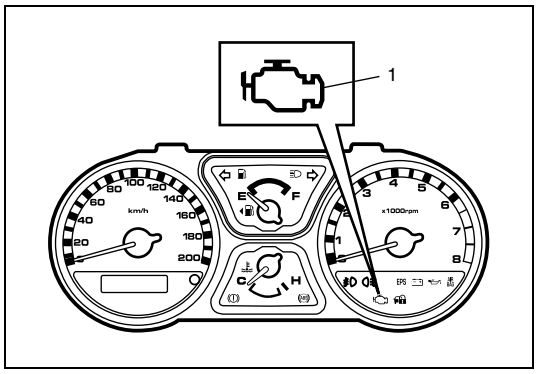
VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather Temperature Frequency Road	☐Fair ☐Cloudy ☐Rain ☐Snow ☐Always ☐Other_____ ☐Hot ☐Warm ☐Cool ☐Cold (°F/ °C) ☐Always ☐Always ☐Sometimes (times/ day, month) ☐Only once ☐Under certain condition ☐Urban ☐Suburb ☐Highway ☐Mountainous (☐Uphill ☐Downhill) ☐Tarmacadam ☐Gravel ☐Other_____
Vehicle Condition	
Engine condition	☐Cold ☐Warming up phase ☐Warmed up ☐Always ☐Other at starting ☐Immediately after start ☐Racing without load ☐Engine speed (r/min)
Vehicle condition	During driving: ☐Constant speed ☐Accelerating ☐Decelerating ☐Right hand corner ☐Left hand corner ☐When shifting (Lever position) ☐At stop ☐Vehicle speed when problem occurs (km/h, Mile/h) ☐Other

Malfunction indicator lamp condition	☐Always ON ☐Sometimes ON ☐Always OFF ☐Good condition
Diagnostic trouble code	First check: ☐No code ☐Malfunction code ( )
	Second check: ☐No code ☐Malfunction code ( )

NOTE:

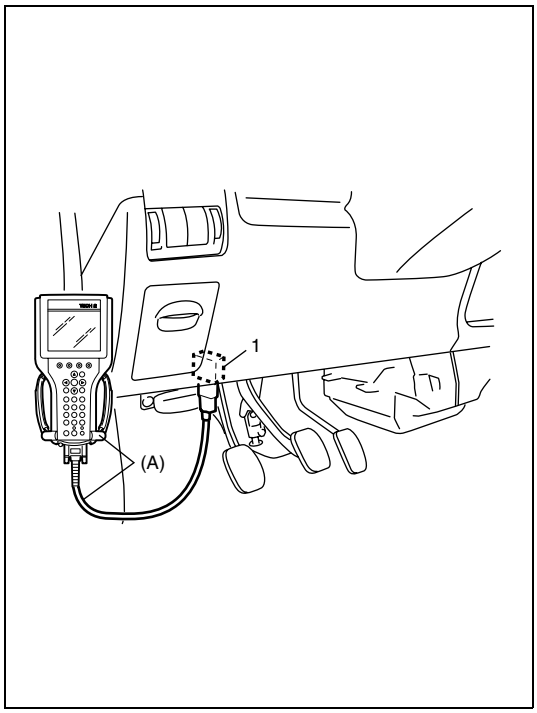
The above form is a standard sample. It should be modified according to conditions characteristic of each market.

Malfunction Indicator Lamp (MIL) Check



1) Turn ON ignition switch (but the engine at stop) and check that MIL (1) lights.
   If MIL does not light up (or MIL dims), go to "Malfunction Indicator Lamp Does Not Come "ON" at Ignition Switch ON (But Engine Stops)" for troubleshooting.
2) Start engine and check that MIL turns OFF.
   If MIL remains ON and no DTC is stored in ECM, go to "Malfunction Indicator Lamp Remains "ON" after Engine Starts" for troubleshooting.

Diagnostic Trouble Code (DTC) Check



1) Prepare OBD generic scan tool or Suzuki Scan Tool.
2) With ignition switch OFF, connect it to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

   Special tool
   (A): Suzuki Scan Tool

3) Turn ignition switch ON and confirm that MIL lights.
4) Read DTC, pending DTC and freeze frame data according to instructions displayed on scan tool and print it or write it down. Refer to scan tool operator's manual for further details.
   If communication between scan tool and ECM is not possible, check if scan tool is communicable by connecting it to ECM in another vehicle. If communication is possible in this case, scan tool is in good condition. Then check data link connector and serial data line (circuit) in the vehicle with which communication was not possible.
5) After completing the check, turn ignition switch off and disconnect scan tool from data link connector.

Diagnostic Trouble Code (DTC) Clearance

1) Connect OBD generic scan tool or Suzuki Scan Tool to data link connector in the same manner as when making this connection for DTC check.
2) Turn ignition switch OFF and then ON.
3) Erase DTC and pending DTC according to instructions displayed on scan tool. Refer to scan tool operator's manual for further details.
4) After completing the clearance, turn ignition switch off and disconnect scan tool from data link connector.

NOTE:

DTC and freeze frame data stored in ECM memory are also cleared in the following cases. Be careful not to clear them before keeping their record.

- **When power to ECM is cut off (by disconnecting battery cable, removing fuse or disconnecting ECM connectors).**
- **When the same malfunction (DTC) is not detected again during 40 engine warm-up cycles (see item "WARM-UP CYCLE" of "On-Board Diagnostic System Description" in this section).**

DTC Table

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0010	Camshaft position actuator circuit	Actual valve timing fails to become close to target advance level of each function although advance control function or retarding control function is at work.	2 driving cycles
P0011	Camshaft position - timing over-advanced or system performance	Actual valve of advanced valve timing does not reach target value, or valve timing is advanced although ECM command is most retarding.	1 driving cycle
P0012	Camshaft position - timing over-retarded		1 driving cycle
P0031	HO2S heater control circuit low (Sensor–1)	Heater current is lees than specification while heater ON.	2 driving cycles
P0032	HO2S heater control circuit high (Sensor–1)	Heater current is more than specification while heater ON.	2 driving cycles
P0037	HO2S heater control circuit low (Sensor–2)	Heater current is lees than specification while heater ON.	2 driving cycles
P0038	HO2S heater control circuit high (Sensor–2)	Heater current is more than specification while heater ON.	2 driving cycles
P0101	Mass air flow circuit range/ performance	Poor performance of MAF sensor	2 driving cycles
P0102	Mass air flow circuit low input	Low voltage	1 driving cycle
P0103	Mass air flow circuit high input	High voltage	
P0107	Manifold absolute pressure low input	Low voltage (or manifold absolute pressure sensor circuit open or shorted to ground)	1 driving cycle
P0108	Manifold absolute pressure high input	High voltage (or manifold absolute pressure sensor circuit shorted to power circuit)	1 driving cycle
P0112	Intake air temperature sensor circuit low	High temperature – low voltage (or IAT sensor circuit shorted to ground)	1 driving cycle
P0113	Intake air temperature sensor circuit high	Low temperature – high voltage (or IAT sensor circuit open)	
P0117	Engine coolant temperature sensor circuit low	High temperature – low voltage (or ECT sensor circuit shorted to ground)	1 driving cycle
P0118	Engine coolant temperature sensor circuit high	Low temperature – high voltage (or ECT sensor circuit open)	
P0121	Throttle position circuit range/performance	Poor performance of TP sensor	2 driving cycles
P0122	Throttle position circuit low	Low voltage (or TP sensor circuit shorted to ground)	1 driving cycle
P0123	Throttle position circuit high	High voltage (or TP sensor circuit open)	

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0131	O2 sensor (HO2S) circuit low voltage (Sensor–1)	Min. output voltage of HO2S–1 higher than specification	2 driving cycles
P0132	O2 sensor (HO2S) circuit high voltage (Sensor–1)	Max. output voltage of HO2S–1 is lower or higher than specification	
P0133	O2 sensor (HO2S) circuit slow response (Sensor–1)	Response time of HO2S–1 output voltage between rich and lean is longer than specification.	
P0134	O2 sensor (HO2S) circuit no activity detected (Sensor–1)	Output voltage of HO2S–1 fails to go above specification. (or HO2S–1 circuit open or short)	2 driving cycles
P0137	O2 sensor (HO2S) circuit low voltage (Sensor–2)	Min. output voltage of HO2S–2 is higher than specification	2 driving cycles
P0138	O2 sensor (HO2S) circuit high voltage (Sensor–2)	Max. output voltage of HO2S–2 is lower or higher than specification	2 driving cycles
P0171	System too lean	Total fuel trim is larger than specification for specified time or longer. (Fuel trim toward rich side is large.)	2 driving cycles
P0172	System too rich	Total fuel trim is smaller than specification for specified time or longer. (Fuel trim toward lean side is large.)	2 driving cycles
P0300	Random misfire detected	Misfire of such level as to cause damage to three way catalyst.	*1 driving cycle
P0301 P0302 P0303 P0304	Cylinder 1 misfire detected Cylinder 2 misfire detected Cylinder 3 misfire detected Cylinder 4 misfire detected	Misfire of such level as to deteriorate emission but not to cause damage to three way catalyst.	2 driving cycles
P0327	Knock sensor circuit low	Knock sensor circuit shorted to ground (low voltage)	1 driving cycle
P0328	Knock sensor circuit high	Knock sensor circuit open (high voltage)	1 driving cycle
P0335	Crankshaft position sensor circuit	No signal during engine running	1 driving cycle
P0340	Camshaft position sensor circuit	No reference signal during engine cranking or pulse number of position signal is out of specification.	
P0401	Exhaust gas recirculation flow insufficient detected	Insufficient EGR flow	2 driving cycles
P0402	Exhaust gas recirculation flow excessive detected	Excessive EGR flow	2 driving cycles
P0403	Exhaust gas recirculation control circuit	Low voltage (or EGR valve stepping motor coil circuit open or shorted to ground)	1 driving cycle
P0420	Catalyst system efficiency below threshold	Output waveforms of HO2S–1 and HO2S–2 are similar.	2 driving cycles
P0443	Evaporative emission system purge control valve circuit	Monitor signal of EVAP canister purge valve is different from command signal (circuit open or shorted to ground)	2 driving cycles
P0462	Fuel level sensor circuit low	Low voltage	2 driving cycles
P0463	Fuel level sensor circuit high	High voltage	2 driving cycles

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0480	Fan 1 (Radiator cooling fan) control circuit	Radiator cooling fan relay terminal voltage is low when cooling temp. is lower than specification.	2 driving cycles
P0481	Fan 2 (A/C condenser fan) control circuit	Monitor signal of A/C condenser fan relay is different from command signal.	2 driving cycles
P0500	Vehicle speed sensor	No signal during fuel cut for specified time or longer	2 driving cycles
P0505	Idle air control system	Voltage is out of specification for longer than specified time	1 driving cycle
P0506	Idle air control system RPM lower than expected	Engine idle speed is lower than target speed out of specified value for longer than specified time	2 driving cycles
P0507	Idle air control system RPM higher than expected	Engine idle speed is higher than target speed out of specified value for longer than specified time	2 driving cycles
P0601	Internal control module memory check sum error	Data write error or check sum error	1 driving cycle
P0602	Control module programming error	Data programming error	1 driving cycle
P0616	Starter relay circuit low	Starter signal circuit open (low voltage)	2 driving cycles
P0617	Starter relay circuit high	Starter signal circuit shorted to power supply (high voltage)	2 driving cycles
P1510	ECM backup power supply malfunction	Backup power voltage is out of specification after starting engine.	1 driving cycle
P2227	Barometric pressure circuit range/performance	Difference between barometric pressure sensor value and calculated barometric pressure value is larger than specification.	2 driving cycles
P2228	Barometric pressure circuit low	Barometric pressure sensor circuit shorted to ground.	1 driving cycle
P2229	Barometric pressure circuit high	Barometric pressure sensor circuit open	1 driving cycle
P1620	ECU code not registered	Refer to “DTC Table” in Section 8G.	
P1621	No ECU code transmitted from Immobilizer Control Module		
P1622	Fault in ECM		
P1623	ECU code not matched		

NOTE:

- **1 driving cycle: MIL lights up when DTC is detected while 1 driving cycle.**
- **2 driving cycles: MIL lights up when the same DTC is detected also in the next driving cycle after DTC is detected and stored temporarily in the first driving cycle.**
- ***1 driving cycle:**
  MIL blinks or lights up. Refer to “DTC P0300 Random Misfire Detected / DTC P0301 Cylinder 1 Misfire Detected / DTC P0302 Cylinder 2 Misfire Detected / DTC P0303 Cylinder 3 Misfire Detected / DTC P0304 Cylinder 4 Misfire Detected” for details.

Fail-Safe Table

When any of the following DTCs is detected, ECM enters fail-safe mode as long as malfunction continues to exist but that mode is canceled when ECM detects normal condition after that.

DTC NO.	DETECTED ITEM	FAIL-SAFE OPERATION
P0102	Mass air flow circuit low input	• ECM controls injector drive time (fuel injection volume) according to throttle valve opening (closed throttle position or not). • ECM stops EGR control.
P0103	Mass air flow circuit high input	
P0112	Intake air temperature sensor circuit low	• ECM controls actuators assuming that intake air temperature is 23°C (73.4°F).
P0113	Intake air temperature sensor circuit high	
P0117	Engine coolant temperature circuit low	• ECM controls actuators assuming that engine coolant temperature is 30°C (86°F). • ECM operates radiator fan.
P0118	Engine coolant temperature circuit high	
P0122	Throttle position circuit low input	• ECM controls actuators assuming that throttle opening is about 12.5°.
P0123	Throttle position circuit high input	
P0335	Crankshaft position sensor circuit	• Fix ignition timing. • ECM changes injection control system from sequential injection to simultaneous one.
P0340	Camshaft position sensor circuit	ECM changes injection control system from sequential injection to simultaneous one.
P0500	Vehicle speed sensor	ECM controls actuators assuming vehicle speed is 0 km/h (0 mile/h).
P2227	Barometric pressure sensor performance problem	ECM controls actuators assuming that barometric pressure is 100 kPa (760 mmHg).

Visual Inspection

Visually check following parts and systems.

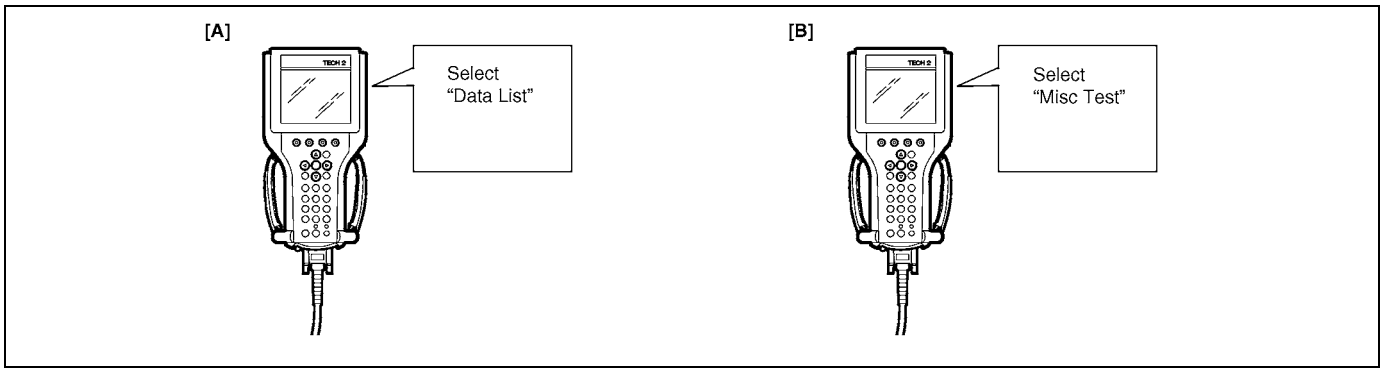
INSPECTION ITEM	REFERRING SECTION
• Engine oil – level, leakage	"Engine Oil and Oil Filter Replacement" in Section 0B.
• Engine coolant – level, leakage	"Engine Coolant Replacement" in Section 0B.
• Fuel – level, leakage	"Fuel Lines and Connections Inspection" in Section 0B.
• Air cleaner element – dirt, clogging	"Fuel Lines and Connections Inspection" in Section 0B.
• Battery – fluid level, corrosion of terminal	
• Water pump belt – tension damage	"Drive Belt Inspection" in Section 0B.
• Throttle cable – play (under warm engine), installation	"Accelerator cable adjustment" in Section 6E1.
• Vacuum hoses of air intake system – disconnection, looseness, deterioration, bend	"Evaporative emission control system inspection" in Section 6E1.
• Connectors of electric wire harness – disconnection, friction	
• Fuses – burning	
• Parts – installation, bolt – looseness	
• Parts – deformation	
• Other parts that can be checked visually	
Also check the following items at engine start, if possible	
• Malfunction indicator lamp – Operation	"Malfunction Indicator Lamp (MIL) Check" in this section.
• Charge warning lamp – Operation	"Charging indicator lamp operation" in Section 6H.
• Engine oil pressure warning lamp – Operation	"Engine Oil Pressure Switch Inspection" in Section 8.
• Engine coolant temp. meter – Operation	"Engine Coolant Temperature (ECT) Gauge Inspection" in Section 8.
• Fuel level meter – Operation	"Fuel Gauge Inspection" in Section 8.
• Tachometer – Operation	
• Abnormal air being inhaled from air intake system	
• Exhaust system – leakage of exhaust gas, noise	
• Other parts that can be checked visually	

Engine Basic Inspection

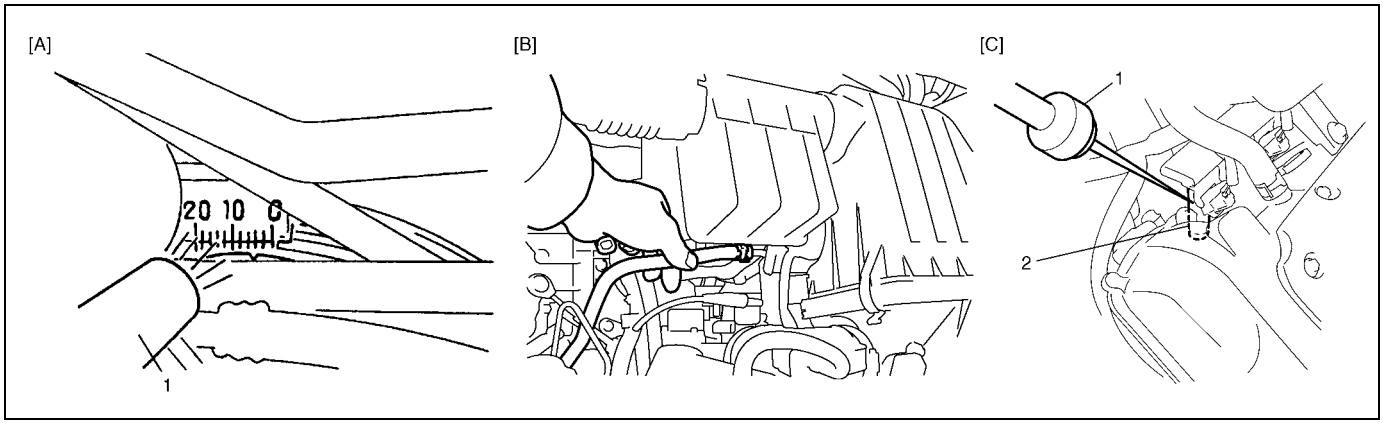
This check is very important for troubleshooting when ECM has detected no DTC and no abnormality has been found in visual inspection.
Follow the flow table carefully.

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	Check battery voltage. Is it 11 V or more?	Go to Step 3.	Charge or replace battery.
3	Is engine cranked?	Go to Step 4.	Go to “Diagnosis” in Section 6G.
4	Does engine start?	Go to Step 5.	Go to Step 7.
5	Check idle speed as follows: 1) Warm up engine to normal operating temp. 2) Shift transmission to neutral position for M/T. 3) All of electrical loads are switched off. 4) Check engine idle speed with scan tool. See Fig. 1. Is it 650 – 750 r/min?	Go to Step 6.	Go to “Engine Symptom Diagnosis”.
6	Check ignition timing as follows: 1) Using Suzuki Scan Tool, select “MISC” mode on Suzuki Scan Tool and fix ignition timing to initial one. See Fig. 2. 2) Using timing light (1), check initial ignition timing. See Fig. 3. Is it 5° ± 3° BTDC at specified idle speed?	Go to “Engine Symptom Diagnosis”.	Check ignition control related parts referring to “Ignition Timing Inspection” in Section 6F1.
7	Is immobilizer control system equipped?	Go to Step 8.	Go to Step 9.
8	Check immobilizer system malfunction as follows. 1) Check immobilizer indicator lamp for flashing. Is it flashing when ignition switch is turned to ON position?	Go to “DTC Check” in Section 8G.	Go to Step 9.
9	Check fuel supply as follows: 1) Check to make sure that enough fuel is filled in fuel tank. 2) Turn ON ignition switch for 3 seconds and then OFF. Repeat this a few times. See Fig. 4. Is fuel pressure felt from fuel feed hose (4) when ignition switch is turned ON?	Go to Step 11.	Go to Step 10.
10	Check fuel pump for operating. Was fuel pump operating sound heard from fuel filler for about 3 seconds after ignition switch ON and stop?	Go to “Table B-3 Fuel Pressure Check”.	Go to “Table B-2 Fuel Pump and Its Circuit Check”.
11	Check ignition spark as follows: 1) Disconnect injector couplers. 2) Remove spark plugs and connect them to high-tension cords or ignition coils. 3) Ground spark plugs. 4) Crank engine and check if each spark plug sparks. Is it in good condition?	Go to Step 12.	Go to “Ignition Spark Test” in Section 6F1.

Step	Action	Yes	No
12	Check fuel injector for operation as follows: 1) Install spark plugs and connect injector connectors. 2) Using sound scope (1), check operating sound of each injector (2) when cranking engine. See Fig. 5. Was injector operating sound heard from all injectors?	Go to “Engine Symptom Diagnosis”.	Go to “Table B-1 Fuel Injector Circuit Check” in this section.



[A]: Fig. 1 for Step 5
[B]: Fig. 2 for Step 6



[A]: Fig. 3 for Step 6
[B]: Fig. 4 for Step 9
[C]: Fig. 5 for Step 12

Engine Symptom Diagnosis

Perform troubleshooting referring to following table when ECM has detected no DTC and no abnormality has been found in visual inspection and engine basic inspection previously.

Condition	Possible Cause	Reference Item
Hard Starting (Engine cranks OK)	Faulty spark plug	"Spark Plugs Removal and Installation" in Section 6F1.
	Leaky high-tension cord	"High-Tension Cords Removal and Installation" in Section 6F1.
	Loose connection or disconnection of high-tension cords or lead wires	"High-Tension Cords Removal and Installation" in Section 6F1.
	Faulty ignition coil	"Ignition Coil Assembly (Including Ignitor) Inspection" in Section 6F1.
	Dirty or clogged fuel hose or pipe	"Table B-3 Fuel Pressure Check" in this section.
	Malfunctioning fuel pump	"Table B-3 Fuel Pressure Check" in this section.
	Air inhaling from intake manifold gasket or throttle body gasket	
	Faulty idle air control system	"Table B-4 Idle Air Control System Check" in this section.
	Faulty ECT sensor or MAF sensor	"Engine coolant temperature sensor (ECT sensor) inspection" or "Mass air flow (MAF) and intake air temperature (IAT) sensor inspection" in Section 6E1.
	Faulty ECM	
	Low compression	"Compression Check" in Section 6A1.
	Poor spark plug tightening or faulty gasket	"Spark Plugs Removal and Installation" in Section 6F1.
	Compression leak from valve seat	"Valves and Cylinder Head Inspection" in Section 6A1.
	Sticky valve stem	"Valves and Cylinder Head Inspection" in Section 6A1.
	Weak or damaged valve springs	"Valves and Cylinder Head Inspection" in Section 6A1.
	Compression leak at cylinder head gasket	"Valves and Cylinder Head Inspection" in Section 6A1.
	Sticking or damaged piston ring	"Pistons, Piston Rings, Connecting Rods and Cylinders Inspection" in Section 6A1.
	Worn piston, ring or cylinder	"Pistons, Piston Rings, Connecting Rods and Cylinders Inspection" in Section 6A1.
	Malfunctioning PCV valve	"PCV system inspection" in Section 6E1.
	VVT system out of order	"Diagnostic Flow Table B-10" in this section or "Oil control valve inspection" in Section 6E1.

Condition	Possible Cause	Reference Item
Low oil pressure	Improper oil viscosity	"Engine Oil and Oil Filter Replacement" in Section 0B.
	Malfunctioning oil pressure switch	"Engine Oil Pressure Switch Inspection" in Section 8.
	Clogged oil strainer	"Oil Pan and Oil Pump Strainer Removal and Installation" in Section 6A1.
	Functional deterioration of oil pump	"Oil Pan and Oil Pump Strainer Removal and Installation" in Section 6A1.
	Worn oil pump relief valve	"Oil Pan and Oil Pump Strainer Removal and Installation" in Section 6A1.
	Excessive clearance in various sliding parts	
Engine noise **Note: Before checking mechanical noise, make sure that:** **Specified spark plug is used.** **Specified fuel is used.**	Improper valve lash	"Valves and Cylinder Head Inspection" in Section 6A1.
	Worn valve stem and guide	"Valves and Cylinder Head Inspection" in Section 6A1.
	Weak or broken valve spring	"Valves and Cylinder Head Inspection" in Section 6A1.
	Warped or bent valve	"Valves and Cylinder Head Inspection" in Section 6A1.
	Worn piston, ring and cylinder bore	"Pistons, Piston Rings, Connecting Rods and Cylinders Inspection" in Section 6A1.
	Worn rod bearing	"Pistons, Piston Rings, Connecting Rods and Cylinders Inspection" in Section 6A1.
	Worn crank pin	"Pistons, Piston Rings, Connecting Rods and Cylinders Inspection" in Section 6A1.
	Loose connecting rod nuts	"Pistons, Piston Rings, Connecting Rods and Cylinders Inspection" in Section 6A1.
	Low oil pressure	"Low oil pressure" in this table.
	Low oil pressure	"Low oil pressure" in this table.
	Worn bearing	"Main Bearings, Crankshaft and Cylinder Block Inspection" in Section 6A1.
	Worn crankshaft journal	"Main Bearings, Crankshaft and Cylinder Block Inspection" in Section 6A1.
	Loose bearing cap bolts	"Main Bearings, Crankshaft and Cylinder Block Inspection" in Section 6A1.
	Excessive crankshaft thrust play	"Main Bearings, Crankshaft and Cylinder Block Inspection" in Section 6A1.

Condition	Possible Cause	Reference Item
Overheating	Inoperative thermostat	“Thermostat Inspection” in Section 6B.
	Poor water pump performance	“Water Pump Inspection” in Section 6B.
	Clogged or leaky radiator	“Radiator Inspection” in Section 6B.
	Improper engine oil grade	“Engine Oil and Oil Filter Replacement” in Section 0B.
	Clogged oil filter or oil strainer	“Oil Pressure Check” in Section 6A1.
	Poor oil pump performance	“Oil Pressure Check” in Section 6A1.
	Faulty radiator fan control system	“Table B-7 Radiator Fan Control System Check” in this section.
	Dragging brakes	“Diagnosis Table” in Section 5.
	Slipping clutch	“Diagnosis Table” in Section 7C1.
	Blown cylinder head gasket	“Valves and Cylinder Head Inspection” in Section 6A1.
Poor gasoline mileage	Leaks or loose connection of high-tension cord	“High-Tension Cords Removal and Installation” in Section 6F1.
	Faulty spark plug (improper gap, heavy deposits and burned electrodes, etc.)	“Spark Plugs Removal and Installation” in Section 6F1.
	Malfunctioning EGR valve	“EGR valve inspection” Section 6E1.
	High idle speed	“Improper engine idling or engine fails to idle” in this table.
	Poor performance of TP sensor, ECT sensor or MAF sensor	“Throttle position sensor (TP sensor) on-vehicle inspection”, “Engine coolant temperature sensor (ECT sensor) inspection” or “Mass air flow (MAF) and intake air temperature (IAT) sensor inspection” in Section 6E1.
	Faulty fuel injector(s)	“Table B-1 Fuel Injector Circuit Check” in this section.
	Faulty ECM	
	Low Compression	“Low compression” in this table.
	Poor valve seating	“Valves and Cylinder Head Inspection” in Section 6A1.
	Dragging brakes	“Diagnosis Table” in Section 5.
	Slipping clutch	“Diagnosis Table” in Section 7C1.
	Thermostat out of order	“Thermostat Inspection” in Section 6B.
	Improper tire pressure	“Wheel Maintenance” in Section 3F.
	VVT system out of order	“Diagnostic Flow Table B-10” in this section or “Oil control valve inspection” in Section 6E1.

Condition	Possible Cause	Reference Item
Excessive engine oil consumption	Blown cylinder head gasket	"Valves and Cylinder Head Inspection" in Section 6A1.
	Leaky camshaft oil seals	"Camshaft, Tappet and Shim Inspection" in Section 6A1.
	Sticky piston ring	"Pistons, Piston Rings, Connecting Rods and Cylinders Inspection" in Section 6A1.
	Worn piston and cylinder	"Pistons, Piston Rings, Connecting Rods and Cylinders Inspection" in Section 6A1.
	Worn piston ring groove and ring	"Pistons, Piston Rings, Connecting Rods and Cylinders Inspection" in Section 6A1.
	Improper location of piston ring gap	"Pistons, Piston Rings, Connecting Rods and Cylinders Disassembly and Assembly" in Section 6A1.
	Worn or damaged valve stem seal	"Valves and Cylinder Head Disassembly and Assembly" in Section 6A1.
	Worn valve stem	"Valves and Cylinder Head Inspection" in Section 6A1.
Engine hesitates (Momentary lack of response as accelerator is depressed. Can occur at all vehicle speeds. Usually most severe when first trying to make vehicle move, as from a stop sign.)	Spark plug faulty or plug gap out of adjustment	"Spark Plugs Removal and Installation" in Section 6F1.
	Leaky high-tension cord	"High-Tension Cords Removal and Installation" in Section 6F1.
	Fuel pressure out of specification	"Table B-3 Fuel Pressure Check" in this section.
	Malfunctioning EGR valve	"EGR valve inspection" in section 6E1.
	Poor performance of TP sensor, ECT sensor or MAF sensor	"Throttle position sensor (TP sensor) removal and installation", "Engine coolant temperature sensor (ECT sensor) inspection" or "Mass air flow (MAF) and intake air temperature (IAT) sensor inspection" in Section 6E1.
	Faulty fuel injector	"Table B-1 Fuel Injector Circuit Check" in this section.
	Faulty ECM	
	Engine overheating	"Overheating" in this table.
	Low compression	"Low Compression" in this table.
	VVT system out of order	"Diagnostic Flow Table B-10" in this section or "Oil control valve inspection" in Section 6E1.

Condition	Possible Cause	Reference Item
Surge (Engine power variation under steady throttle or cruise. Feels like vehicle speeds up and down with no change in accelerator pedal.)	Leaky or loosely connected high-tension cord	"High-Tension Cords Removal and Installation" in Section 6F1.
	Faulty spark plug (excess carbon deposits, improper gap, and burned electrodes, etc.)	"Spark Plugs Removal and Installation" in Section 6F1.
	Variable fuel pressure	"Table B-3 Fuel Pressure Check" in this section.
	Kinky or damaged fuel hose and lines	
	Faulty fuel pump (clogged fuel filter)	
	Malfunctioning EGR valve	"EGR valve inspection" in Section 6E1.
	Poor performance of MAF sensor	"Mass air flow (MAF) and intake air temperature (IAT) sensor inspection" in Section 6E1.
	Faulty fuel injector	"Table B-1 Fuel Injector Circuit Check" in this section.
	Faulty ECM	
Excessive detonation (Engine makes continuously sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.)	Faulty spark plug	"Spark Plugs Removal and Installation" in Section 6F1.
	Loose connection of high-tension cord	"High-Tension Cords Removal and Installation" in Section 6F1.
	Engine overheating	"Overheating" in this table.
	Clogged fuel filter (faulty fuel pump) or fuel lines	"Table B-1 Fuel Injector Circuit Check" or "Table B-2 Fuel Pump and Its Circuit Check" in this section.
	Air inhaling from intake manifold or throttle body O-ring	
	Malfunctioning EGR valve	"EGR valve inspection" in Section 6E1.
	Poor performance of knock sensor, ECT sensor or MAF sensor	"DTC P0325 Flow Table" in this section, "Engine coolant temperature sensor (ECT sensor) inspection" or "Mass air flow (MAF) and intake air temperature (IAT) sensor inspection" in Section 6E1.
	Faulty fuel injector(s)	"Table B-1 Fuel Injector Circuit Check" in this section.
	Faulty ECM	
	Excessive combustion chamber deposits	"Pistons, Piston Rings, Connecting Rods and Cylinders Components" in Section 6A1.
	VVT system out of order	"Diagnostic Flow Table B-10" in this section or "Oil control valve inspection" in Section 6E1.

Condition	Possible Cause	Reference Item
Engine has no power	Faulty spark plug	"Spark Plugs Removal and Installation" in Section 6F1.
	Faulty ignition coil with ignitor	"Ignition Coil Assembly (Including Ignitor) Inspection" in Section 6F1.
	Leaks, loose connection or disconnection of high-tension cord	"High-Tension Cords Removal and Installation" in Section 6F1.
	Faulty knock sensor	"DTC P0325 Flow Table" in this section.
	Clogged fuel hose or pipe	"Table B-3 Fuel Pressure Check" in this section.
	Malfunctioning fuel pump	"Table B-2 Fuel Pump and Its Circuit Check" in this section.
	Air inhaling from intake manifold gasket or throttle body gasket	
	Engine overheating	"Overheating" in this table.
	Malfunctioning EGR valve	"EGR valve inspection" in Section 6E1.
	Maladjusted accelerator cable play	"Accelerator cable adjustment" in Section 6E1.
	Poor performance of TP sensor, ECT sensor or MAF sensor	"Throttle position sensor (TP sensor) on-vehicle inspection", "Engine coolant temperature sensor (ECT sensor) inspection" or "Mass air flow (MAF) and intake air temperature (IAT) sensor inspection" in Section 6E1.
	Faulty fuel injector(s)	"Table B-1 Fuel Injector Circuit Check" in this section.
	Faulty ECM	
	Dragging brakes	"Diagnosis Table" in Section 5.
	Slipping clutch	"Diagnosis Table" in Section 7C1.
	Low compression	"Compression Check" in Section 6A1.
	VVT system out of order	"Diagnostic Flow Table B-10" in this section or "Oil control valve inspection" in Section 6E1.

Condition	Possible Cause	Reference Item
Improper engine idling or engine fails to idle	Faulty spark plug	"Spark Plugs Removal and Installation" in Section 6F1.
	Leaky or disconnected high-tension cord	"High-Tension Cords Removal and Installation" in Section 6F1.
	Faulty ignition coil with ignitor	"Ignition Coil Assembly (Including Ignitor) Inspection" in Section 6F1.
	Fuel pressure out of specification	"Table B-3 Fuel Pressure Check" in this section.
	Leaky manifold, throttle body, or cylinder head gasket	
	Malfunctioning EGR valve	"EGR valve inspection" in Section 6E1.
	Faulty idle air control system	"Table B-4 Idle Air Control System Check" in this section.
	Faulty evaporative emission control system	"Evaporative emission control system inspection" in Section 6E1.
	Faulty EGR system	"EGR valve inspection" in Section 6E1.
	Faulty fuel injector(s)	"Table B-1 Fuel Injector Circuit Check" in this section.
	Poor performance of ECT sensor, TP sensor or MAF sensor	"Throttle position sensor (TP sensor) removal and installation", "Engine coolant temperature sensor (ECT sensor) inspection" or "Mass air flow (MAF) and intake air temperature (IAT) sensor inspection" in Section 6E1.
	Faulty ECM	
	Loose connection or disconnection of vacuum hoses	
	Malfunctioning PCV valve	"PCV system inspection" in Section 6E1.
	Engine overheating	"Overheating" in this section.
	Low compression	"Compression Check" in Section 6A1.
	VVT system out of order	"Diagnostic Flow Table B-10" in this section or "Oil control valve inspection" in Section 6E1.

Condition	Possible Cause	Reference Item
Excessive hydrocarbon (HC) emission or carbon monoxide (CO)	Faulty spark plug	"Spark Plugs Removal and Installation" in Section 6F1.
	Leaky or disconnected high-tension cord	"High-Tension Cords Removal and Installation" in Section 6F1.
	Faulty ignition coil with ignitor	"Ignition Coil Assembly (Including Ignitor) Inspection" in Section 6F1.
	Low compression	"Compression Check" in Section 6A1.
	Lead contamination of three way catalytic converter	Check for absence of filler neck restrictor.
	Faulty evaporative emission control system	"Evaporative emission control system inspection" in Section 6E1.
	Fuel pressure out of specification	Table B-3 Fuel Pressure Check.
	Closed loop system (A/F feed back compensation) fails • Faulty TP sensor • Poor performance of ECT sensor or MAF sensor	 "Throttle position sensor (TP sensor) on-vehicle inspection" in Section 6E1. "Engine coolant temperature sensor (ECT sensor) inspection" or "Mass air flow (MAF) and intake air temperature (IAT) sensor inspection" in Section 6E1.
	Faulty injector(s)	"Table B-1 Fuel Injector Circuit Check" in this section.
	Faulty ECM	
	Engine not at normal operating temperature	
	Clogged air cleaner	
	Vacuum leaks	
	VVT system out of order	"Diagnostic Flow Table B-10" in this section or "Oil control valve inspection" in Section 6E1.
Excessive nitrogen oxides (NOx) emission	Improper ignition timing	"Ignition Timing Inspection" in Section 6F1.
	Lead contamination of catalytic converter	Check for absence of filler neck restrictor.
	Faulty EGR system	"EGR valve inspection" in Section 6E1.
	Fuel pressure out of specification	"Table B-3 Fuel Pressure Check" in this section.
	Closed loop system (A/F feed back compensation) fails • Faulty TP sensor • Poor performance of ECT sensor or MAF sensor	 "Throttle position sensor (TP sensor) on-vehicle inspection" in Section 6E1. "Engine coolant temperature sensor (ECT sensor) inspection" or "Mass air flow (MAF) and intake air temperature (IAT) sensor inspection" in Section 6E1.
	Faulty injector(s)	"Table B-1 Fuel Injector Circuit Check" in this section.
	Faulty ECM	
	VVT system out of order	"Diagnostic Flow Table B-10" in this section or "Oil control valve inspection" in Section 6E1.

Scan Tool Data

As the data values given below are standard values estimated on the basis of values obtained from the normally operating vehicles by using a scan tool, use them as reference values. Even when the vehicle is in good condition, there may be cases where the checked value does not fall within each specified data range. Therefore, judgment as abnormal should not be made by checking with these data alone.
Also, conditions in the table below that can be checked by the scan tool are those detected by ECM and output from ECM as commands and there may be cases where the engine or actuator is not operating (in the condition) as indicated by the scan tool. Be sure to use the timing light to check the ignition timing.

NOTE:

- **With the generic scan tool, only star (∗) marked data in the table below can be read.**
- **When checking the data with the engine running at idle or racing, be sure to shift M/T gear to the neutral gear position and A/T gear to the "Park" position and pull the parking brake fully. Also, if nothing or "no load" is indicated, turn OFF A/C, all electric loads, P/S and all the other necessary switches.**

	SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
∗	COOLANT TEMP (ENGINE COOLANT TEMP.)	At specified idle speed after warming up		80 – 100°C, 176 – 212°F
∗	INTAKE AIR TEMP	At specified idle speed after warming up		–5°C (23°F) + environmental temp. to 40°C (104°F) + environmental temp.
∗	ENGINE SPEED	At idling with no load after warming up		Desired idle speed ±50 r/min
	INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH)	At specified idle speed with no load after warming up		2.0 – 4.0 msec.
		At 2500 r/min with no load after warming up		2.0 – 3.6 msec.
	TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE)	Ignition switch ON/ warmed up engine stopped	Accelerator pedal released	0.5 – 1.0 V
			Accelerator pedal depressed fully	Less than 4.8 V
	DESIRED IDLE (DESIRED IDLE SPEED)	At idling with radiator cooling fan stopped and all electrical parts turned OFF after warming up, M/T at neutral		700 r/min
	IAC FLOW DUTY (IDLE AIR CONTROL FLOW DUTY)	At idling with no load after warming up		5 – 55%
∗	SHORT FT B1 (SHORT TERM FUEL TRIM)	At specified idle speed after warming up		– 20 – +20%
∗	LONG FT B1 (LONG TERM FUEL TRIM)	At specified idle speed after warming up		– 20 – +20%
∗	MAF (MASS AIR FLOW RATE)	At specified idle speed with no load after warming up		1.0 – 4.0 g/s 0.14 – 0.52 lb/min
		At 2500 r/min with no load after warming up		4.0 – 12.0 g/s 0.53 – 1.58 lb/min

	SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
✱	CALC LOAD (CALCULATED LOAD VALUE)	At specified idle speed with no load after warming up		10 – 20%
		At 2500 r/min with no load after warming up		10 – 18%
✱	THROTTLE POSITION (ABSOLUTE THROTTLE POSITION)	Ignition switch ON/ warmed up engine stopped	Accelerator pedal released	9 – 19%
			Accelerator pedal depressed fully	70 – 90%
✱	O2S B1 S1 (HEATED OXYGEN SENSOR–1)	At specified idle speed after warming up		0 – 0.95 V
✱	O2S B1 S2 (HEATED OXYGEN SENSOR–2)	When engine is running at 2000 r/min. for 3 min or longer after warming up.		0 – 0.95 V
	FUEL SYSTEM B1 (FUEL SYSTEM STATUS)	At specified idle speed after warming up		CLOSED (closed loop)
	TOTAL FUEL TRIM	At specified idle speed after warming up		– 35 – +35%
✱	MAP (INTAKE MANIFOLD ABSOLUTE PRESSURE)	At specified idle speed with no load after warming up		24 – 38 kPa 180 – 285 mmHg
	BAROMETRIC PRES	–		Display the barometric pressure
	STEP EGR FLOW DUTY	At specified idle speed after warming up		0%
	FUEL CUT	When engine is at fuel cut condition		ON
		Other than fuel cut condition		OFF
	CLOSED THROTTLE POS (CLOSED THROTTLE POSITION)	Throttle valve at idle position		ON
		Throttle valve opens larger than idle position		OFF
	CANIST PRG DUTY (EVAP CANISTER PURGE FLOW DUTY)	At specified idle speed after warming up		0%
✱	IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER)	At specified idle speed with no load after warming up		3 – 13° BTDC
	BATTERY VOLTAGE	Ignition switch ON/engine stop		10 – 14 V
	FUEL PUMP	Within 3 seconds after ignition switch ON or engine running		ON
		Engine stop at ignition switch ON		OFF
	ELECTRIC LOAD	Ignition switch ON/Headlight, small light, all turned OFF		OFF
		Ignition switch ON/Headlight, small light, turned ON		ON
	BRAKE SWITCH	Ignition switch ON	Brake pedal is released	OFF
			Brake pedal is depressed	ON
	RADIATOR FAN (RADIATOR FAN CONTROL RELAY)	Ignition switch ON	Engine coolant temp.: Lower than 95°C (203°F)	OFF
			Engine coolant temp.: 97.5°C (208°F) or higher	ON

	SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
	BLOWER FAN	Ignition switch ON	Blower fan switch: 2nd speed position or more	ON
			Blower fan switch: under 2nd speed position	OFF
	A/C SWITCH (if equipped with A/C)	Engine running after warming up, A/C not operating		OFF
		Engine running after warming up, A/C operating		ON
	A/C MAG CLUTCH (if equipped with A/C)	Engine running	A/C switch and blower motor switch turned ON	ON
			A/C switch and blower motor switch turned OFF	OFF
	A/C COND FAN (if equipped with A/C)	Engine running	Blower motor switch and A/C switch turned ON	ON
			Blower motor switch and/ or A/C switch turned OFF	OFF
	VVT GAP (TARGET-ACTUAL POSITION)	At specified idle speed after warming up		0 – 3°

SCAN TOOL DATA DEFINITIONS

COOLANT TEMP (ENGINE COOLANT TEMPERATURE, °C, °F)

It is detected by engine coolant temp. sensor.

INTAKE AIR TEMP. (°C, °F)

It is detected by intake air temp. sensor.

ENGINE SPEED (rpm)

It is computed by reference pulses from the camshaft position sensor.

INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH, msec.)

This parameter indicates time of the injector drive (valve opening) pulse which is output from ECM (but injector drive time of NO.1 cylinder for multiport fuel injection).

TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE, V)

The Throttle Position Sensor reading provides throttle valve opening information in the form of voltage.

DESIRED IDLE (DESIRED IDLE SPEED, rpm)

The Desired Idle Speed is an ECM internal parameter which indicates the ECM requested idle. If the engine is not running, this number is not valid.

IAC FLOW DUTY (IDLE AIR (SPEED) CONTROL DUTY, %)

This parameter indicates current flow time rate within a certain set cycle of IAC valve (valve opening rate) which controls the amount of bypass air (idle speed).

SHORT FT B1 (SHORT TERM FUEL TRIM, %)

Short term fuel trim value represents short term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

LONG FT B1 (LONG TERM FUEL TRIM, %)

Long term fuel trim value represents long term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

MAF (MASS AIR FLOW RATE, g/s, lb/min)

It represents total mass of air entering intake manifold which is measured by mass air flow sensor.

CALC LOAD (CALCULATED LOAD VALUE, %)

Engine load displayed as a percentage of maximum possible load. Value is calculated mathematically using the formula: actual (current) intake air volume ÷ maximum possible intake air volume x 100%

THROTTLE POS (ABSOLUTE THROTTLE POSITION, %)

When throttle position sensor is fully closed position, throttle opening is indicated as 0% and 90 – 100% full open position.

O2S SENSOR B1 S1 (HEATED OXYGEN SENSOR–1, V)

It indicates output voltage of HO2S–1 installed on exhaust manifold (pre-catalyst).

O2S SENSOR B1 S2 (HEATED OXYGEN SENSOR–2, V)

It indicates output voltage of HO2S–2 installed on exhaust pipe (post-catalyst). It is used to detect catalyst deterioration.

FUEL SYSTEM (FUEL SYSTEM STATUS)

Air/fuel ratio feedback loop status displayed as one of the followings.
OPEN: Open loop-has not yet satisfied conditions to go closed loop.
CLOSED: Closed loop-using oxygen sensor(s) as feedback for fuel control.
OPEN-DRIVE COND: Open loop due to driving conditions (Power enrichment, etc.).
OPEN SYS FAULT: Open loop due to detected system fault.
CLOSED-ONE O2S: Closed loop, but fault with at least one oxygen sensor-may be using single oxygen sensor for fuel control.

TOTAL FUEL TRIM B1 (%)

The value of Total Fuel Trim is obtained by calculating based on values of short Term Fuel Trim and Long Term Fuel Trim. This value indicates how much correction is necessary to keep the air/fuel mixture stoichiometrical.

MAP (MANIFOLD ABSOLUTE PRESSURE, mmHg, kPa)

This value indicates how much correction is necessary to keep the air/fuel mixture stoichiometrical.
It is detected by manifold absolute pressure sensor.

BAROMETRIC PRESS (kPa, inHg)

This parameter represents a measurement of barometric air pressure and is used for altitude correction of the fuel injection quantity and IAC valve control.

STEP EGR FLOW DUTY (%)

This parameter indicates opening rate of EGR valve which controls the amount of EGR flow.

FUEL CUT (ON/OFF)

ON: Fuel being cut (output signal to injector is stopped)
OFF: Fuel not being cut

CLOSED THROTTLE POSITION (ON/OFF)

This parameter will read ON when throttle valve is fully closed, or OFF when the throttle is not fully closed.

CANIST PURGE DUTY (EVAP CANISTER PURGE FLOW DUTY, %)

This parameter indicates valve ON (valve open) time rate within a certain set cycle of EVAP canister purge valve which controls the amount of EVAP purge.

IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER, °)

Ignition timing of NO.1 cylinder is commanded by ECM. The actual ignition timing should be checked by using the timing light.

BATTERY VOLTAGE (V)

This parameter indicates battery positive voltage inputted from main relay to ECM.

FUEL PUMP (ON/OFF)

ON is displayed when the ECM activates the fuel pump via the fuel pump relay switch.

ELECTRIC LOAD (ON/OFF)

ON: Headlight or small light ON signal inputted.
OFF: Above electric loads all turned OFF.

BRAKE SW (ON/OFF)

This parameter indicates the state of the brake switch.

RADIATOR FAN (RADIATOR FAN CONTROL RELAY, ON/OFF)

ON: Command for radiator fan control relay operation being output.
OFF: Command for relay operation not being output.

BLOWER FAN (ON/OFF)

This parameter indicates the state of the blower fan motor switch.

A/C SWITCH (ON/OFF)

ON: Command for A/C operation being output from ECM to A/C amplifier.
OFF: Command for A/C operation not being output.

A/C MAG SWITCH (A/C COMPRESSOR RELAY, ON/OFF)

This parameter indicates the state of the A/C switch.

A/C COND FAN (ON/OFF)

This parameter indicates the state of the A/C Condenser Fan control signal.

VVT GAP [TARGET-ACTUAL POSITION] (°)

It is calculated using the formula: target valve timing advance – actual valve timing advance.

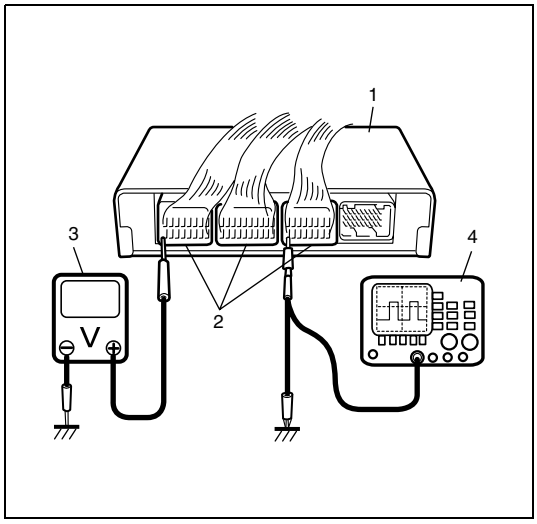
Inspection of ECM and Its Circuits

ECM and its circuits can be checked at ECM wiring couplers by measuring voltage, pulse signal and resistance.

CAUTION:

ECM cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM with coupler disconnected from it.

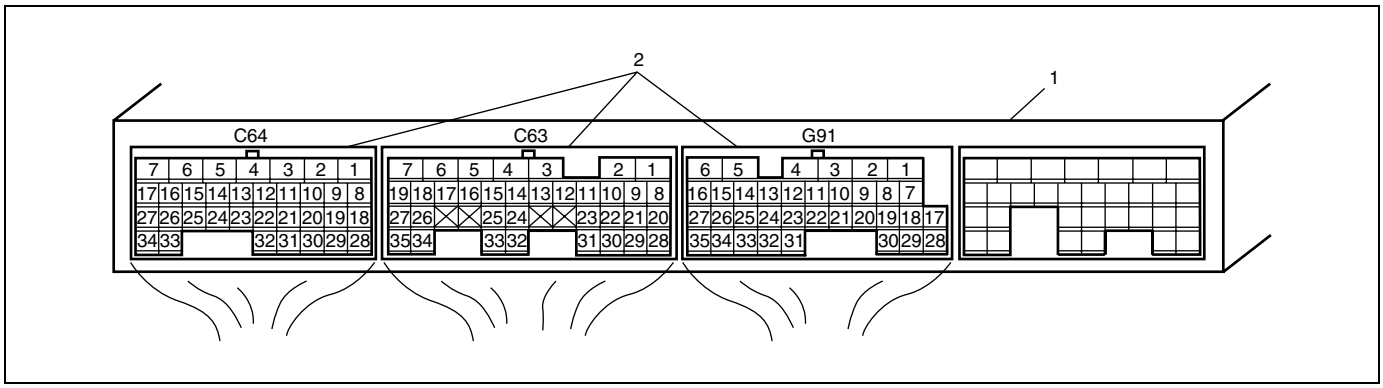
VOLTAGE CHECK



1) Remove ECM (1) from vehicle body referring to "Engine control module (ECM) removal and installation" in Section 6E1.
2) Check voltage and/or pulse signal at each terminal of couplers (2) connected, using voltmeter (3) and oscilloscope (4).

NOTE:

- **As each terminal voltage is affected by the battery voltage, confirm that it is 11 V or more when ignition switch is turned ON.**
- **Voltage with asterisk(*) cannot be measured by voltmeter because it is pulse signal.**
  Check it with oscilloscope if necessary.



1.	ECM
2.	ECM couplers (Viewed from harness side)

TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
C64-1	BLK/ORN	Ground for ECM	Below 0.3 V	Ignition switch turned ON
C64-2	BLK	Ground for ECM	Below 0.3 V	Ignition switch turned ON
C64-3	RED/BLU	Heater output of heated oxygen sensor–2	10 – 14 V	Ignition switch turned ON
			0 – 1 V (Reference waveform No.1)	Engine running at idling after vehicle running over 30 km/h, 19ml/h for 5 min.
C64-4	BLK/WHT	Heater output of heated oxygen sensor–1	10 – 14 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 13.5 –14.8 V (Reference waveform No.2 and No.3)	Engine running at idling with after warming up. (Output signal is active low duty pulse. Duty ratio varies depending on engine condition.)
C64-5	GRN/YEL	A/C condenser fan motor relay No.2 output (if equipped)	10 – 14 V	Engine running, engine coolant temperature more than 113°C, 235°F or for about 7 sec. after A/C operated (A/C request signal inputted low voltage).
			0 – 1 V	Engine running, engine coolant temperature under than 110°C, 230°F and after about 7 sec. after A/C operated (A/C request signal inputted low voltage) or A/C OFF.
C64-6	PNK	Fuel cost output	*0 – 2 V ↑↓ 13.5 – 14.8 V	Engine running at idling with after warming up. (Output signal is 3.33 Hz duty pulse. Duty ratio varies depending on vehicle condition.)
C64-7	–	–	–	–
C64-8	RED/YEL	IAC valve output (stepper motor coil 3)	0 – 1 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference waveform No.4)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)
C64-9	RED/BLU	IAC valve output (stepper motor coil 2)	8 – 14 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference waveform No.4)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)
C64-10	RED/WHT	IAC valve output (stepper motor coil 1)	0 – 1 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference waveform No.4)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)

TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
C64-11	PNK/BLK	A/C compressor relay output (if equipped)	10 – 14 V	Engine running, A/C request signal high input
			0 – 1 V	Engine running, A/C request signal low input
C64-12	PNK	A/C condenser fan motor relay No.1 output (if equipped)	10 – 14 V	Ignition switch turned ON, coolant temperature under 113°C, 235°F or A/C request signal high input
			0 – 1 V	Ignition switch turned ON, coolant temperature more than 110°C, 230°F or A/C request signal low input
C64-13	BLU/BLK	EVAP canister purge valve output	10 – 14 V	Ignition switch turned ON with engine stop
			*0 – 0.6 V ↑↓ 10 – 14 V (Reference waveform No.25)	Engine running and vehicle running over 40 km/h, 25 ml/h (Output signal is 10 Hz duty pulse. Duty ratio varies depending on vehicle condition.)
C64-14	GRN	Fuel pump relay output	0 – 2.5 V	For 3 sec. from the time is ignition switch turned to ON or while engine is running
			10 – 14 V	On and after 3 sec. from the time is ignition switch turned to ON or while engine is stop
C64-15	BRN/WHT	Main power supply relay output	10 – 14 V	Ignition switch is turned OFF
			0 – 2 V	Ignition switch is turned ON
C64-16	WHT/RED	EGR valve (stepper motor coil 3) output	10 – 14 V	Ignition switch is turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference waveform No.5)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)
C64-17	GRN/RED	EGR valve (stepper motor coil 1) output	0 – 2 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference waveform No.5)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)
C64-18	–	–	–	–
C64-19	–	–	–	–
C64-20	–	–	–	–
C64-21	–	–	–	–
C64-22	–	–	–	–
C64-23	–	–	–	–
C64-24	–	–	–	–
C64-25	–	–	–	–
C64-26	–	–	–	–
C64-27	–	–	–	–

TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
C64-28	RED/BLK	IAC valve output (stepper motor coil 4)	8 – 14 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference waveform No.4)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending vehicle condition)
C64-29	–	–	–	–
C64-30	–	–	–	–
C64-31	GRN/WHT	Ignition coil No.2 and No.3 output	0 – 0.6 V	Ignition switch turned ON
			*0 – 0.6 V ↑↓ 2 – 5 V (Reference waveform No.6)	Engine running (Output signal is active high pulse. Pulse frequency varies depending on engine speed.)
C64-32	GRN/YEL	Ignition coil No.1 and No.4 output	0 – 0.6 V	Ignition switch turned ON
			*0 – 0.6 V ↑↓ 2 – 5 V (Reference waveform No.7)	Engine running (Output signal is active high pulse. Pulse frequency varies depending on engine speed.)
C64-33	BRN/YEL	EGR valve (stepper motor coil 4) output	0 – 2 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference waveform No.5)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)
C64-34	GRN/ORN	EGR valve (stepper motor coil 2) output	10 – 14 V	Ignition switch turned ON
			*0 – 2 V ↑↓ 8 – 14 V (Reference waveform No.5)	Ignition switch is turned to ST (cranking) position. (Output signal is active low duty pulse. Pulse generated times depending on vehicle condition)
C63-1	BLK/ORN	Ground for ECM	Below 0.3 V	Ignition switch turned ON
C63-2	BLU	Oil control valve output	*0 – 0.6 V ↑↓ 13 – 14 V (Reference waveform No.8 and No.9)	Ignition switch turned ON
				While engine running. (Output signal is active low duty pulse. Duty ratio varies depending on vehicle condition)
C63-3	–	–	–	–
C63-4	BLU/ORN	Fuel injector No.4 output	10 – 14 V	Ignition switch turned ON
			*0 – 0.6 V ↑↓ 10 – 14 V (Reference waveform No.10 and No.11)	Engine running (Output signal is active low pulse. Pulse frequency varies depending on engine speed.)

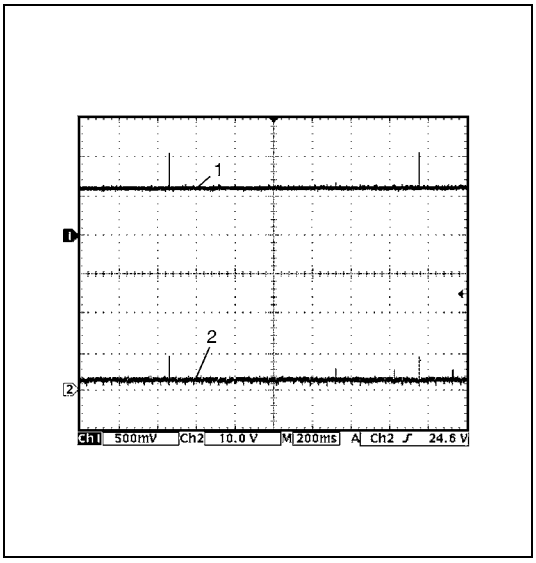
TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
C63-5	BLU/RED	Fuel injector No.3 output	10 – 14 V	Ignition switch turned ON
			*0 – 0.6 V ↑↓ 10 – 14 V (Reference waveform No.10 and No.12)	Engine running (Output signal is active low pulse. Pulse frequency varies depending on engine speed.)
C63-6	BLU/WHT	Fuel injector No.2 output	10 – 14 V	Ignition switch turned ON
			*0 – 0.6 V ↑↓ 10 – 14 V (Reference waveform No.10 and No.13)	Engine running (Output signal is active low pulse. Pulse frequency varies depending on engine speed.)
C63-7	BLU/YEL	Fuel injector No.1 output	10 – 14 V	Ignition switch turned ON
			*0 – 0.6 V ↑↓ 10 – 14 V (Reference waveform No.10 and No.14)	Engine running (Output signal is active low pulse. Pulse frequency varies depending on engine speed.)
C63-8	GRY/RED	Output of 5 V power source for throttle position (TP) sensor	4.5 – 5.5 V	Ignition switch turned ON
C63-9	RED	Knock sensor signal	*2 – 3 V (Reference waveform No.15 and No.16)	Ignition switch turned ON
				Engine running at idling with after warming up
C63-10	RED/YEL	Reference (classified cylinder) signal for CMP sensor	*0 – 0.6 V ↑↓ 4 – 5 V (Reference waveform No.17)	Engine running at idling with after warming up (Sensor signal is pulse. Pulse frequency varies depending on engine speed.) (6 pulses are generated par 1camshaft revolution)
C63-11	WHT	Oxygen signal of heated oxygen sensor–1	0.5 – 1.5 V	Ignition switch turned ON
			*Deflects between over 0.5 V and under 0.45 V (Reference waveform No.2 and No.3)	While engine running at 2,000 r/min. for 1min. or longer after warmed up
C63-12	–	–	–	–
C63-13	–	–	–	–
C63-14	PNK/BLK	Mass air flow (MAF) sensor signal	0.5 – 1.5 V	Ignition switch turned ON and engine stops
			1.3 – 1.8 V (Reference waveform No.18)	When engine running at specified idle speed after warming up

TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
C63-15	RED/WHT	Manifold absolute pressure (MAP) sensor signal	About 4 V (Reference waveform No.19)	Ignition switch turned ON with barometric pressure at 100kPa, 760mmHg
			0.4 – 1.8 V (Reference waveform No.20)	While specified idle speed after warming up with barometric pressure at 100kPa, 760mmHg
C63-16	LT GRN	Engine coolant temp. (ECT) sensor signal	3.3 – 3.6 V	Ignition switch turned ON, ECT at 0°C, 32°F
			1.1 – 1.5 V	Ignition switch turned ON, ECT at 50°C, 122°F
			0.3 – 0.45 V	Ignition switch turned ON, ECT at 100°C, 212°F
C63-17	LT GRN/ BLK	Intake air temperature (IAT) sensor signal	3.3 – 3.6 V	Ignition switch turned ON, IAT at 0°C, 32°F
			1.6 – 1.9 V	Ignition switch turned ON, IAT at 40°C, 104°F
			0.6 – 0.8 V	Ignition switch turned ON, IAT at 80°C, 176°F
C63-18	–	–	–	–
C63-19	YEL	Vehicle speed sensor signal	*0 – 1 V ↑↓ 10 – 14 V (Reference waveform No.21)	Vehicle running. (Sensor signal is pulse. Pulse frequency varies depending on vehicle speed. (8190 pulses are generated par 60 km/h, 37.5 ml/h)
C63-20	–	–	–	–
C63-21	–	–	–	–
C63-22	–	–	–	–
C63-23	–	–	–	–
C63-24	–	–	–	–
C63-25	–	–	–	–
C63-26	–	–	–	–
C63-27	–	–	–	–
C63-28	ORN	Ground for sensors	Below 0.3 V	Ignition switch turned ON
C63-29	–	–	–	–
C63-30	PNK	CKP sensor signal	0 – 1 V	Ignition switch turned ON
			*4.4 – 4.6 V ↑↓ 0.1 – 0.3 V (Reference waveform No.17)	Engine running at idling with after warming up. (Sensor signal is pulse. Pulse frequency varies depending on engine speed.) (31(34–4) pulses are generated par 1crankshaft revolution)
C63-31	GRN/YEL	Ground of ECM for shield wire	Below 0.3 V	Ignition switch turned ON
C63-32	–	–	–	–

TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
C63-33	BRN	Oxygen signal of heated oxygen sensor–2	0.5 – 1.5 V	Ignition switch turned ON
			*Deflects between over 0.5 V and under 0.45 V (Reference waveform No.1)	While engine running at 2,000 r/min. for 1min. or longer after vehicle running over 30 km/h, 19 ml/h
C63-34	GRY/BLU	Throttle position (TP) sensor signal	0.5 – 1.0 V	Ignition switch turned ON and throttle valve at idle position with warmed engine
			3.4 – 4.7 V	Ignition switch turned ON and throttle valve at full open position
C63-35	BLK/YEL	Starting motor signal	0 – 1 V	Ignition switch turned ON
			6 – 14 V	While engine cranking
G91-1	PPL/WHT	MIL (Malfunction indicator lamp) output	0 – 2.5 V	Ignition switch turned ON with engine stop
			10 – 14 V	Engine running
G91-2	LT GRN/ BLK	Immobilizer indicator lamp output (if equipped)	10 – 14 V	While engine running
			0 – 1 V	Ignition switch turned ON with engine stop
G91-3	–	–	–	–
G91-4	BRN	Radiator fan motor relay output	10 – 14 V	Ignition switch turned ON, engine coolant temperature under 95°C, 203°F
			0 – 1 V	Ignition switch turned ON, engine coolant temperature more than 97.5°C, 207.5°F
G91-5	BLK/RED	Main power supply	10 – 14 V	Ignition switch turned ON
G91-6	BLK/RED	Main power supply	10 – 14 V	Ignition switch turned ON
G91-7	–	–	–	–
G91-8	–	–	–	–
G91-9	GRN/WHT	Electric load signal for stop lamp	0 – 1 V	Ignition switch turned ON, stop lamp not lighted up
			10 – 14 V	Ignition switch turned ON, stop lamp lighted up
G91-10	YEL	Serial communication line of data link connector 5 V	4 – 6 V	Ignition switch turned ON
G91-11	BLU	Serial communication line of data link connector 12 V	10 – 14 V	Ignition switch turned ON
G91-12	BRN	Engine revolution signal output for tachometer	0 – 0.8 V	Ignition switch turned ON with engine stop
			*0 – 1 V ↑↓ 8 – 14 V (Reference waveform No.22 and No.23)	While engine running. (Output signal is pulse. Pulse frequency varies depending on engine speed.) (2 pulses are generated par 1crankshaft revolution.) (3000 r/min = 100 Hz)

TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
G91-13	YEL	Electric load signal for heater blower motor	10 – 14 V	Ignition switch turned ON, blower fan selector selected at OFF
			0 – 1 V	Ignition switch turned ON, blower fan selector selected at 2nd speed position or more
G91-14	YEL/RED	Fuel level sensor signal	0 – 6 V	Ignition switch turned ON Voltage depends on fuel level
G91-15	WHT/BLK	A/C evaporator outlet air temp. sensor signal (if equipped)	3.3 – 3.8 V	Ignition switch turned ON at A/C evaporator inlet air temperature 0°C (32°F)
			2.5 – 2.9 V	Ignition switch turned ON at A/C evaporator inlet air temperature 15°C (59°F)
			1.9 – 2.3 V	Ignition switch turned ON at A/C evaporator inlet air temperature 25°C (77°F)
G91-16	WHT/RED	Power source for ECM internal memory	10 – 14 V	Ignition switch turned ON and turned OFF
G91-17	–	–	–	–
G91-18	–	–	–	–
G91-19	–	–	–	–
G91-20	–	–	–	–
G91-21	–	–	–	–
G91-22	–	–	–	–
G91-23	–	–	–	–
G91-24	–	–	–	–
G91-25	–	–	–	–
G91-26	–	–	–	–
G91-27	–	–	–	–
G91-28	BLK/WHT	Ignition switch signal	0 – 1 V	Ignition switch turned OFF
			10 – 14 V	Ignition switch turned ON
G91-29	–	–	–	–
G91-30	YEL/GRN	A/C request signal (if equipped)	10 – 14 V (High input)	Ignition switch turned ON, blower fan selector selected OFF position or A/C switch turned OFF or A/C evaporator temp. less than 2.5°C, 36.5°F
			0 – 1 V (Low input)	Ignition switch turned ON, blower fan selector selected other than OFF position and A/C switch turned ON with A/C evaporator temp. more than 4°C, 39.2°F
G91-31	PPL	Vehicle speed sensor signal for speedometer	*0 – 1 V ↑↓ 10 – 14 V (Reference waveform No.21)	Vehicle running. (Sensor signal is pulse. Pulse frequency varies depending on vehicle speed.) (8190 pulses/sec. are generated par 60 km/h, 37.5 ml/h)
G91-32	GRY	ECT sensor signal for combination meter	*0 – 0.6 V ↑↓ 13 – 14 V (Reference waveform No.24)	Ignition switch turned ON (Output signal is 5 Hz active low duty pulse. Duty ratio varies depending on ECT.) ECT –30°C = 10% ON duty ECT 130°C = 90% ON duty

TERMINAL NUMBER	WIRE COLOR	CIRCUIT	NORMAL VOLTAGE	CONDITION
G91-33	RED/YEL	Electric load signal for clearance lamp	0 – 1 V	Ignition switch turned ON, clearance lamp not lighted up
			10 – 14 V	Ignition switch turned ON, clearance lamp lighted up
G91-34	–	–	–	–
G91-35	ORN	Ground for A/C evaporator outlet air temp. sensor (if equipped)	Below 0.3 V	Ignition switch turned ON

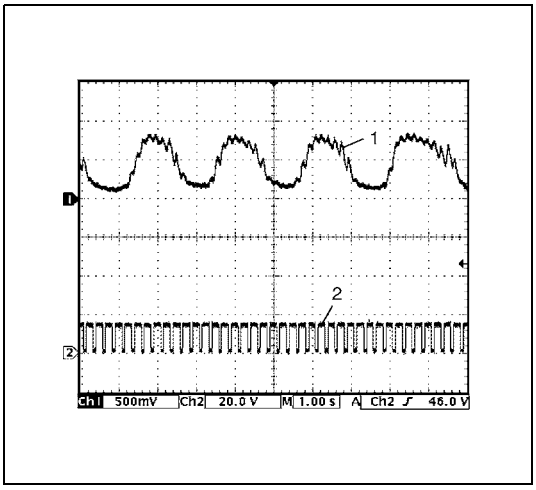


1. Reference waveform No.1

Heated oxygen sensor–2 heater signal at engine idling

Measurement terminal	CH1: C63-33 to C64-1 CH2: C64-3 to C64-1
Oscilloscope setting	CH1: 500 mV/DIV, CH2: 10 V/DIV TIME: 200 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Drive vehicle at 60 km/h (37 mil/h) for 10 min. • Engine at specified idle speed

1. Heated oxygen sensor–2 signal
2. Heated oxygen sensor–2 heater signal

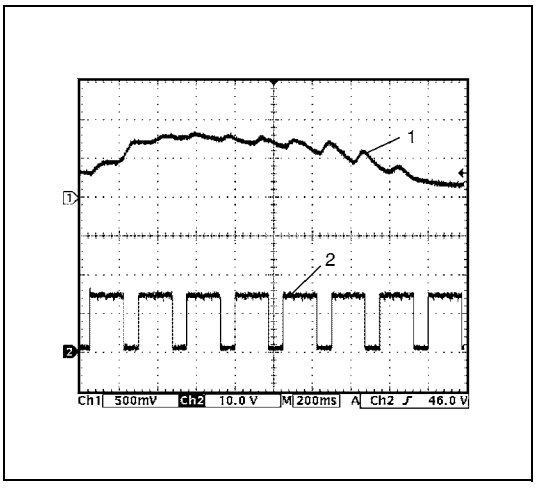


2. Reference waveform No.2

Heated oxygen sensor–1 signal at engine idling

Measurement terminal	CH1: C63-11 to C64-1 CH2: C64-4 to C64-1
Oscilloscope setting	CH1: 500 mV/DIV, CH2: 20 V/DIV TIME: 1 s/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

1. Heated oxygen sensor–1 signal
2. Heated oxygen sensor–1 heater signal

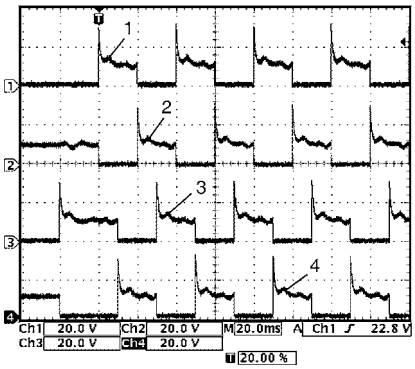


3. Reference waveform No.3

Heated oxygen sensor–1 heater signal at engine idling

Measurement terminal	CH1: C63-11 to C64-1 CH2: C64-4 to C64-1
Oscilloscope setting	CH1: 500 mV/DIV, CH2: 10 V/DIV TIME: 200 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

1. Heated oxygen sensor–1 signal
2. Heated oxygen sensor–1 heater signal

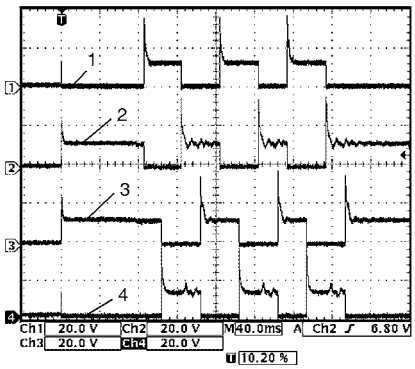


4. Reference waveform No.4

IAC valve signal

Measurement terminal	CH1: C64-10 to C64-1 CH2: C64-9 to C64-1 CH3: C64-8 to C64-1 CH4: C64-28 to C64-1
Oscilloscope setting	CH1: 20 V/DIV, CH2: 20 V/DIV CH3: 20 V/DIV, CH4: 20 V/DIV TIME: 20 ms/DIV
Measurement condition	Ignition switch turned ON from ST (cranking) position

1. IAC valve stepper motor coil 1 signal
2. IAC valve stepper motor coil 2 signal
3. IAC valve stepper motor coil 3 signal
4. IAC valve stepper motor coil 4 signal

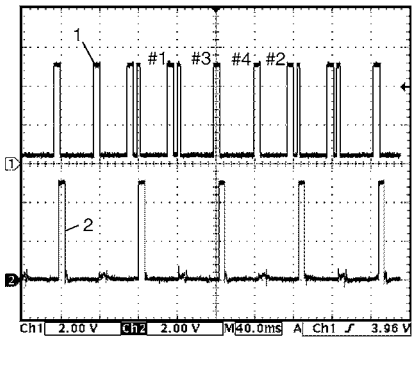


5. Reference waveform No.5

EGR valve signal

Measurement terminal	CH1: C64-17 to C64-1 CH2: C64-34 to C64-1 CH3: C64-16 to C64-1 CH4: C64-33 to C64-1
Oscilloscope setting	CH1: 20 V/DIV, CH2: 20 V/DIV CH3: 20 V/DIV, CH4: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	At the moment of the ignition switch in turned on

1. EGR valve stepper motor coil 1 signal
2. EGR valve stepper motor coil 2 signal
3. EGR valve stepper motor coil 3 signal
4. EGR valve stepper motor coil 4 signal

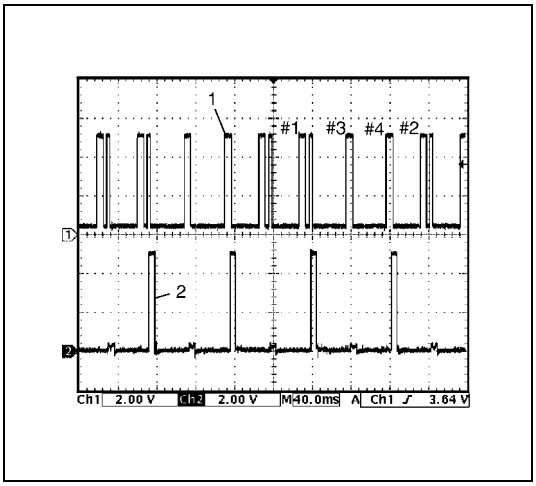


6. Reference waveform No.6

Ignition coil No.2 and No.3 signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C64-31 to C64-1
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

1. Cylinder reference signal (CMP reference signal)
2. No.2 and No.3 ignition signal

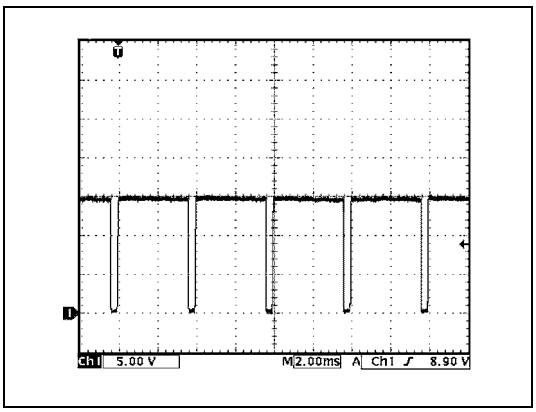


7. Reference waveform No.7

Ignition coil No.1 and No.4 signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C64-32 to C64-1
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

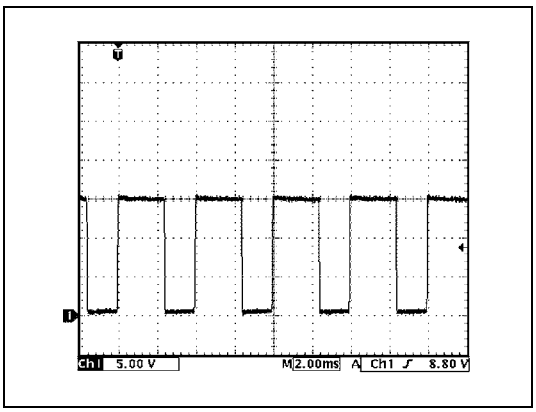
1. Cylinder reference signal (CMP reference signal)
2. No.1 and No.4 ignition signal



8. Reference waveform No.8

Oil control valve signal at engine idling

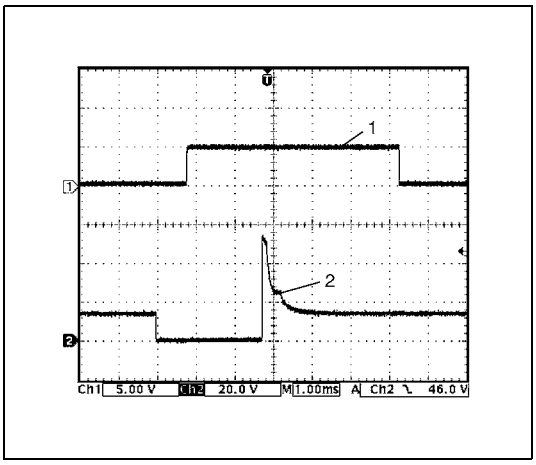
Measurement terminal	CH1: C63-2 to C64-1
Oscilloscope setting	CH1: 5 V/DIV TIME: 2 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed



9. Reference waveform No.9

Oil control valve signal at engine racing

Measurement terminal	CH1: C63-2 to C64-1
Oscilloscope setting	CH1: 5 V/DIV TIME: 2 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at racing

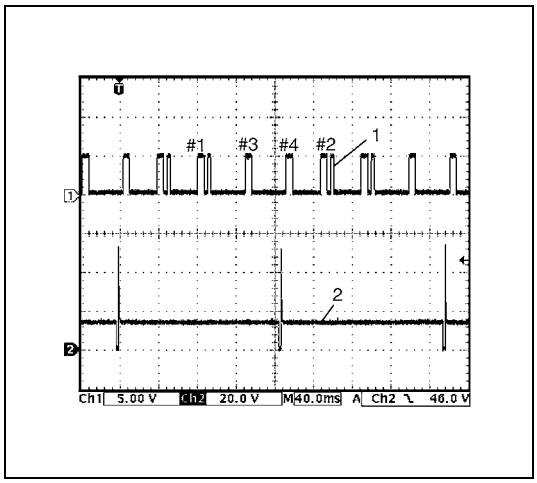


10. Reference waveform No.10

Fuel injector signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C63-6 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 1 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

1. Cylinder reference signal (CMP reference signal)
2. Fuel injector signal

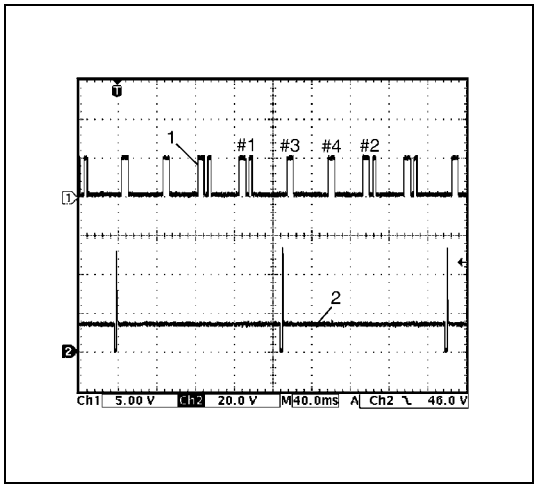


11. Reference waveform No.11

No.4 fuel injector signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C63-4 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

1. Cylinder reference signal (CMP reference signal)
2. No.4 fuel injector signal\

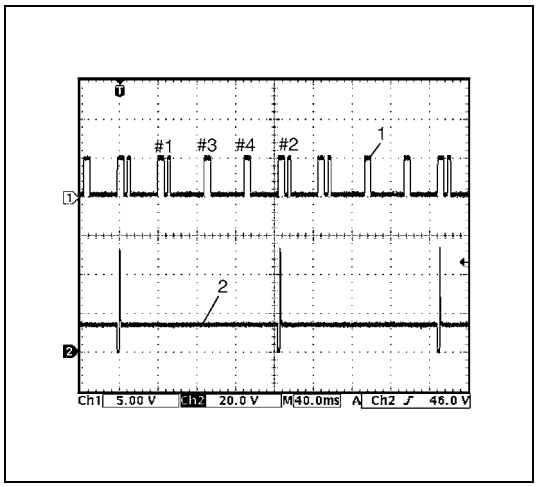


12. Reference waveform No.12

No.3 fuel injector signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C63-5 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

1. Cylinder reference signal (CMP reference signal)
2. No.3 fuel injector signal

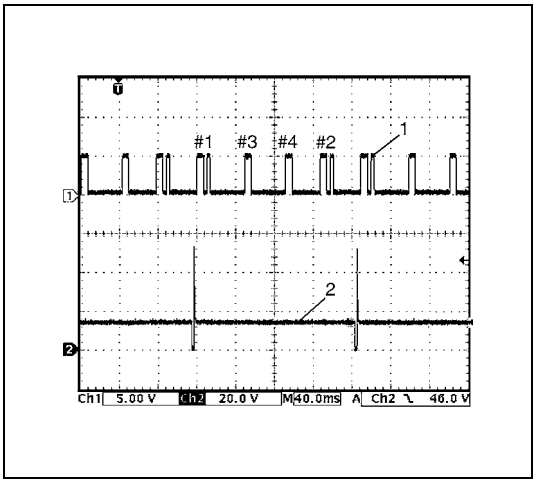


13. Reference waveform No.13

No.2 fuel injector signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C63-6 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

1. Cylinder reference signal (CMP reference signal)
2. No.2 fuel injector signal

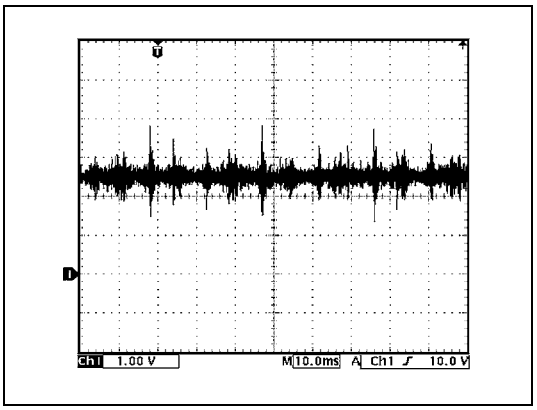


14. Reference waveform No.14

No.1 fuel injector signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C63-7 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

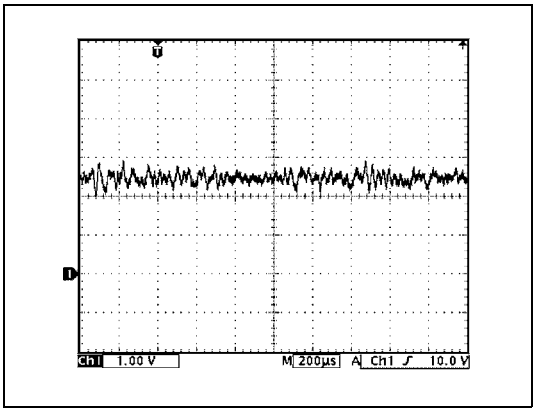
1. Cylinder reference signal (CMP reference signal)
2. No.1 fuel injector signal



15. Reference waveform No.15

Knock sensor signal at engine speed 4000 r/min.

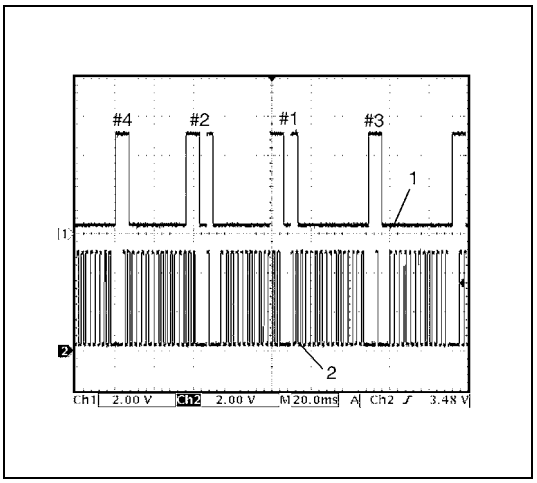
Measurement terminal	CH1: C63-9 to C64-1
Oscilloscope setting	CH1: 1 V/DIV TIME: 10 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Run engine at 4000 r/min.



16. Reference waveform No.16

Knock sensor signal at engine speed 4000 r/min.

Measurement terminal	CH1: C63-9 to C64-1
Oscilloscope setting	CH1: 1 V/DIV TIME: 200 µs/DIV
Measurement condition	• After warmed up to normal operating temperature • Run engine at 4000 r/min.

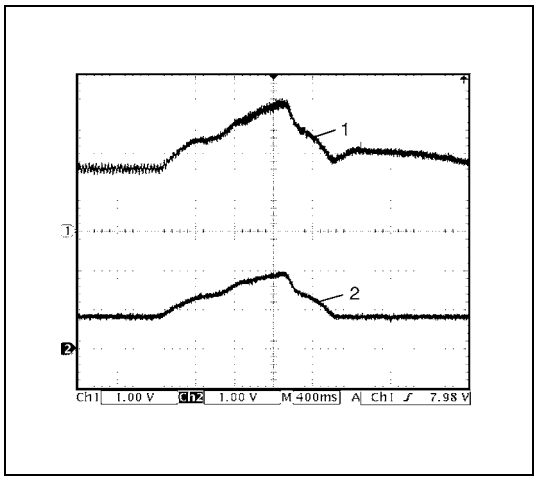


17. Reference waveform No.17

CMP sensor signal at engine idling

Measurement terminal	CH1: C63-10 to C64-1 CH2: C63-30 to C64-1
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 20 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

1. Cylinder reference signal (CMP reference signal)
2. CKP signal

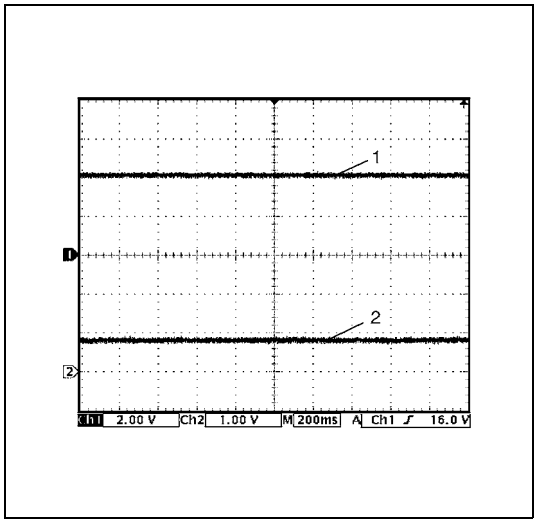


18. Reference waveform No.18

Mass air flow sensor signal at engine racing

Measurement terminal	CH1: C63-14 to C63-28 CH2: C63-34 to C63-28
Oscilloscope setting	CH1: 1 V/DIV, CH2: 1 V/DIV TIME: 400 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine racing

1. Mass air flow sensor signal
2. Throttle position sensor signal

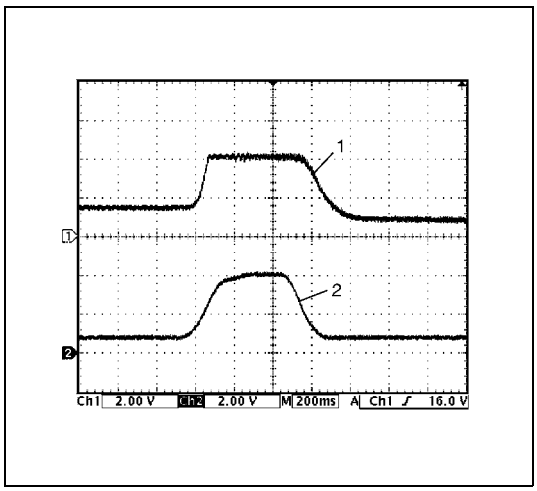


19. Reference waveform No.19

Manifold absolute pressure sensor signal at ignition switch turned ON

Measurement terminal	CH1: C63-15 to C63-28 CH2: C63-34 to C63-28
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 200 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Ignition switch turned ON

1. Manifold absolute pressure sensor signal
2. Throttle position sensor signal

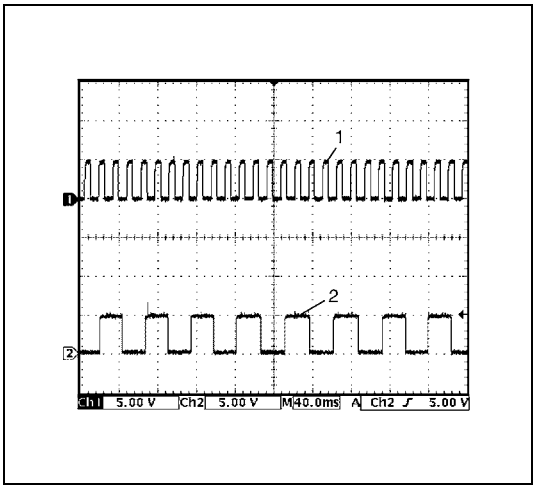


20. Reference waveform No.20

Manifold absolute pressure sensor signal at engine racing

Measurement terminal	CH1: C63-15 to C63-28 CH2: C63-34 to C63-28
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 200 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine racing

1. Manifold absolute pressure sensor signal
2. Throttle position sensor signal

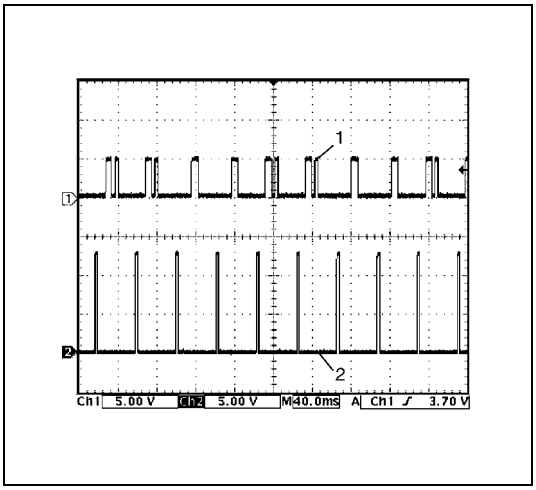


21. Reference waveform No.21

VSS signal at 30 km/h (19 mil/h)

Measurement terminal	CH1: G91-31 to C64-1 CH2: C63-19 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 5 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Drive vehicle at 30 km/h (19 mil/h)

1. VSS signal for speedometer
2. VSS signal

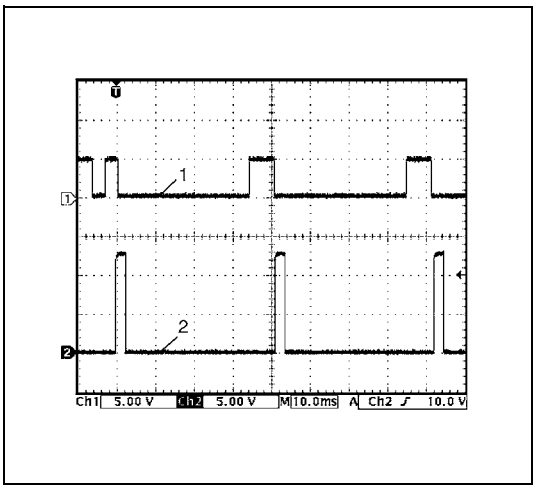


22. Reference waveform No.22

Ignition pulse (engine revolution) signal at engine idling

Measurement terminal	CH1: G63-10 to C64-1 CH2: G91-12 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 5 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

1. Cylinder reference signal (CMP reference signal)
2. Ignition pulse signal

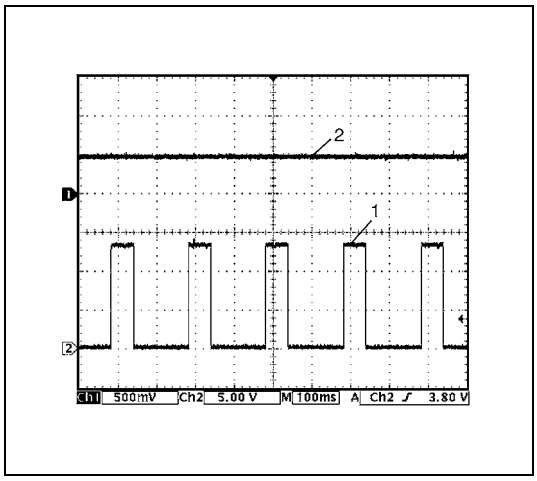


23. Reference waveform No.23

Ignition pulse (engine revolution) signal at engine idling

Measurement terminal	CH1: G63-10 to C64-1 CH2: G91-12 to C64-1
Oscilloscope setting	CH1: 5 V/DIV, CH2: 5 V/DIV TIME: 10 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

1. Cylinder reference signal (CMP reference signal)
2. Ignition pulse signal

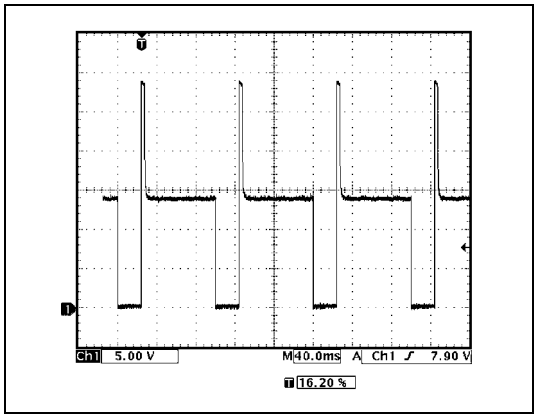


24. Reference waveform No.24

Engine coolant temperature signal at engine idling

Measurement terminal	CH1: C63-16 to C63-28 CH2: G91-32 to C64-1
Oscilloscope setting	CH1: 500 mV/DIV, CH2: 5 V/DIV TIME: 100 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

1. Engine coolant temperature signal for combination meter
2. Engine coolant temperature sensor signal

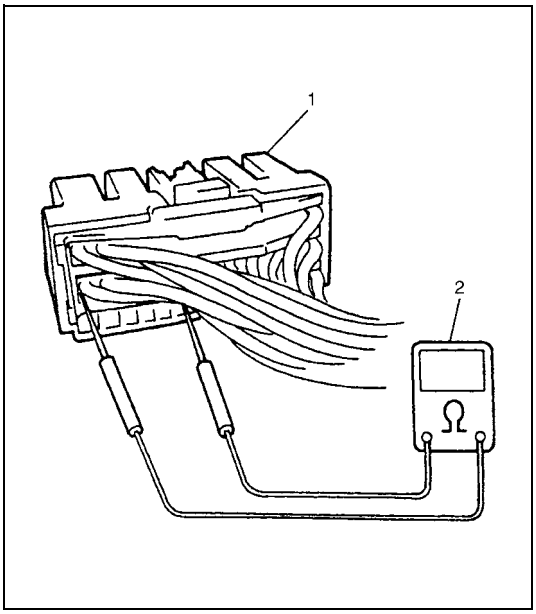


25. Reference waveform No.25

EVAP canister purge valve signal

Measurement terminal	CH1: G64-13 to C64-1
Oscilloscope setting	CH1: 5 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Drive vehicle at 40 km/h (25 mil/h) or more

Resistance Check



1) Disconnect ECM couplers (1) from ECM with ignition switch OFF.

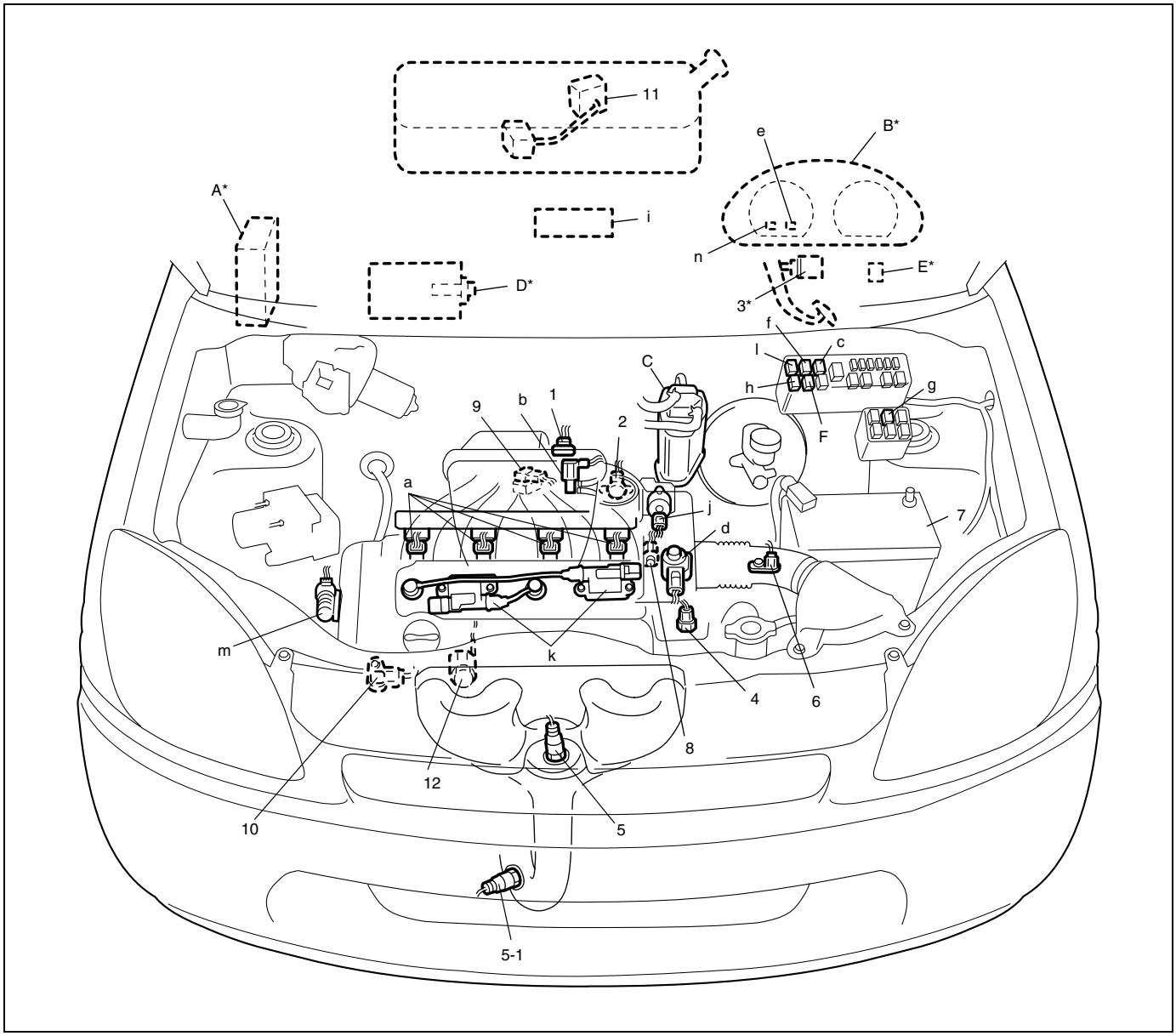
CAUTION:
Never touch terminals of ECM itself or connect voltmeter or ohmmeter (2).

2) Check resistance between each pair of terminals of disconnected couplers as listed in the following table.

CAUTION:
- **Be sure to connect ohmmeter probe from wire harness side of coupler.**
- **Be sure to turn OFF ignition switch for this check.**
- **Resistance in table below represents that when parts temperature is 20°C (68°F).**

TERMINALS	CIRCUIT	STANDARD RESISTANCE	CONDITION
C64-3 to G91-28	Heater of HO2S–2	4 – 15 Ω	–
G91-4 to G91-5/6	Radiator fan relay	160 – 240 Ω	–
G64-15 to G91-28	Main relay	160 – 240 Ω	Battery disconnected and ignition switch ON
C64-14 to G91-28	Fuel pump relay	160 – 240 Ω	–
C64-5 to G91-5/6	A/C condenser fan relay No.2 (if equipped)	100 – 150 Ω	–
C63-5 to G91-5/6	No.3 fuel injector	10.8 – 18.2 Ω	–
C63-4 to G91-5/6	No.4 fuel injector		
C64-17 to G91-5/6	EGR valve (stepping motor No.1 coil)	20 – 29 Ω	–
C64-13 to G91-5/6	EVAP canister purge valve	28 – 35 Ω	–
C63-6 to G91-5/6	No.2 fuel injector	10.8 – 18.2 Ω	–
C64-34 to G91-5/6	EGR valve (stepping motor No.2 coil)	20 – 31 Ω	–
C64-33 to G91-5/6	EGR valve (stepping motor No.4 coil)		
C64-16 to G91-5/6	EGR valve (stepping motor No.3 coil)		
C64-4 to G91-28	Heater of HO2S–1	2 – 11 Ω	–
C63-7 to G91-5/6	No.1 fuel injector	10.8 – 18.2 Ω	–
C64-10 to G91-5/6	Idle air control valve (stepper motor coil 1)	24 – 35 Ω	–
C64-9 to G91-5/6	Idle air control valve (stepper motor coil 2)	24 – 35 Ω	–
C64-8 to G91-5/6	Idle air control valve (stepper motor coil 3)	24 – 35 Ω	–
C64-28 to G91-5/6	Idle air control valve (stepper motor coil 4)	24 – 35 Ω	–
C64-11 to G91-5/6	A/C compressor relay (if equipped)	160 – 240 Ω	–
C63-2 to G91-5/6	Oil control valve	6 – 15 Ω	–

COMPONENT LOCATION



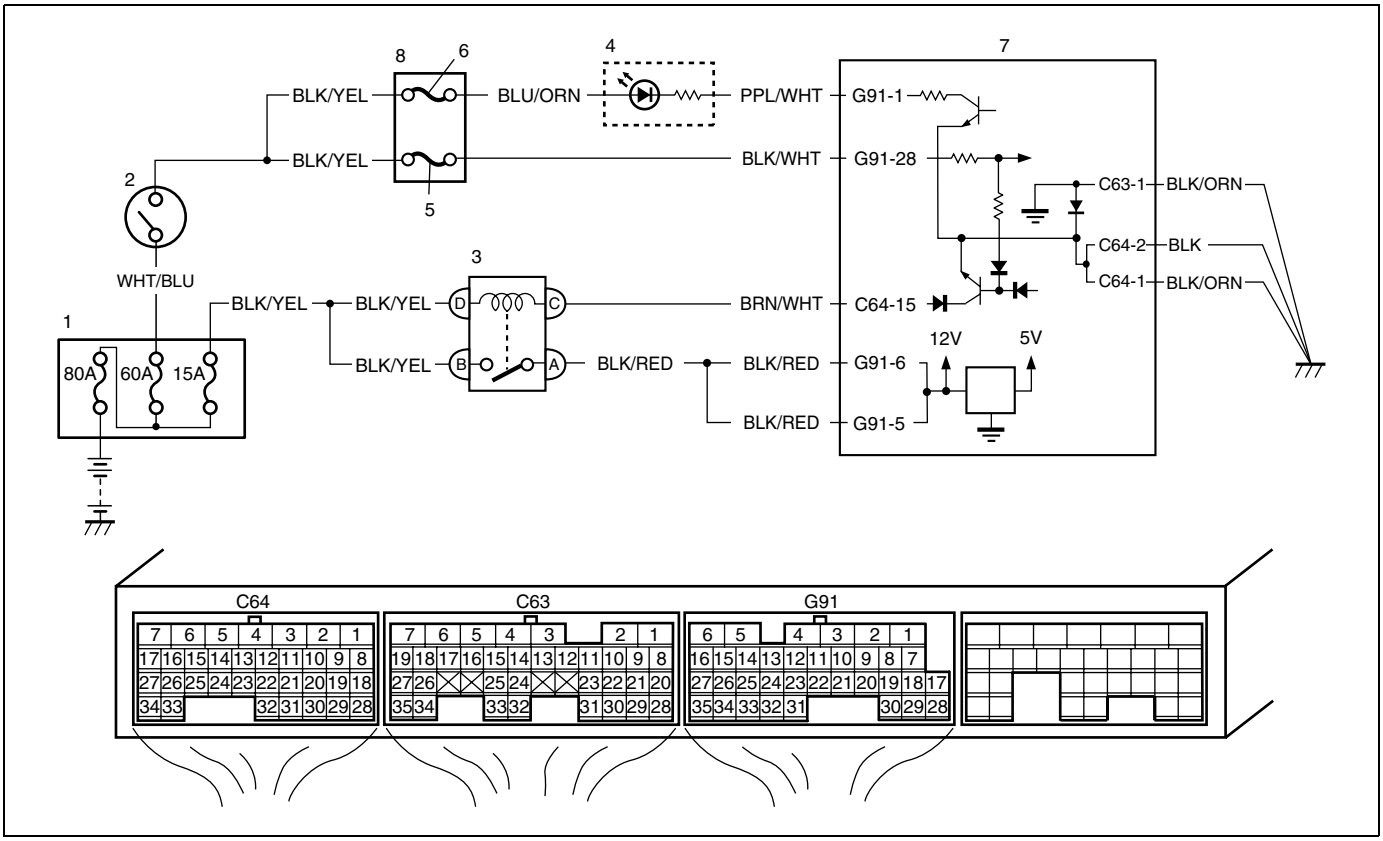
INFORMATION SENSORS	CONTROL DEVICES	OTHERS
1. MAF and IAT sensor	a: Fuel injector	A: ECM
2. TP sensor	b: EVAP canister purge valve	B: Combination meter
3. Stop lamp switch	c: Fuel pump relay	C: EVAP canister
4. ECT sensor	d: EGR valve	D: A/C evaporator inlet air temp. sensor (if equipped)
5. Heated oxygen sensor–1	e: Malfunction indicator lamp	E: Data link connector
5-1. Heated oxygen sensor–2	f: A/C condenser fan relay No.1 (if equipped)	F: A/C compressor relay (if equipped)
6. VSS	g: A/C condenser fan relay No.2 (if equipped)	
7. Battery	h: Radiator fan control relay	
8. CMP sensor	i: Fuel cost meter	
9. MAP sensor	j: IAC valve	
10. CKP sensor	k: Ignition coil assembly (with ignitor)	
11. Fuel level sensor	l: Main relay	
12. Knock sensor	m: Oil control valve	
	n: Immobilizer indicator lamp	

NOTE:

Above figure shows left-hand steering vehicle. For right-hand steering vehicle, parts with (*) are installed at the opposite side.

Table A-1 Malfunction Indicator Lamp Circuit Check – Lamp Does Not Come "ON" with Ignition Switch ON (But Engine Stops)

WIRING DIAGRAM



1. Relay/fuse box	4. Malfunction indicator lamp in combination meter	7. ECM
2. Ignition switch	5. "IG" fuse	8. Circuit fuse box
3. Main relay	6. "METER" fuse	

CIRCUIT DESCRIPTION

When the ignition switch is turned ON, ECM causes the main relay to turn ON (close the contact point). Then, ECM being supplied with the main power, turns ON the malfunction indicator lamp (MIL). When the engine starts to run and no malfunction is detected in the system, MIL goes OFF but if a malfunction was or is detected, MIL remains ON even when the engine is running.

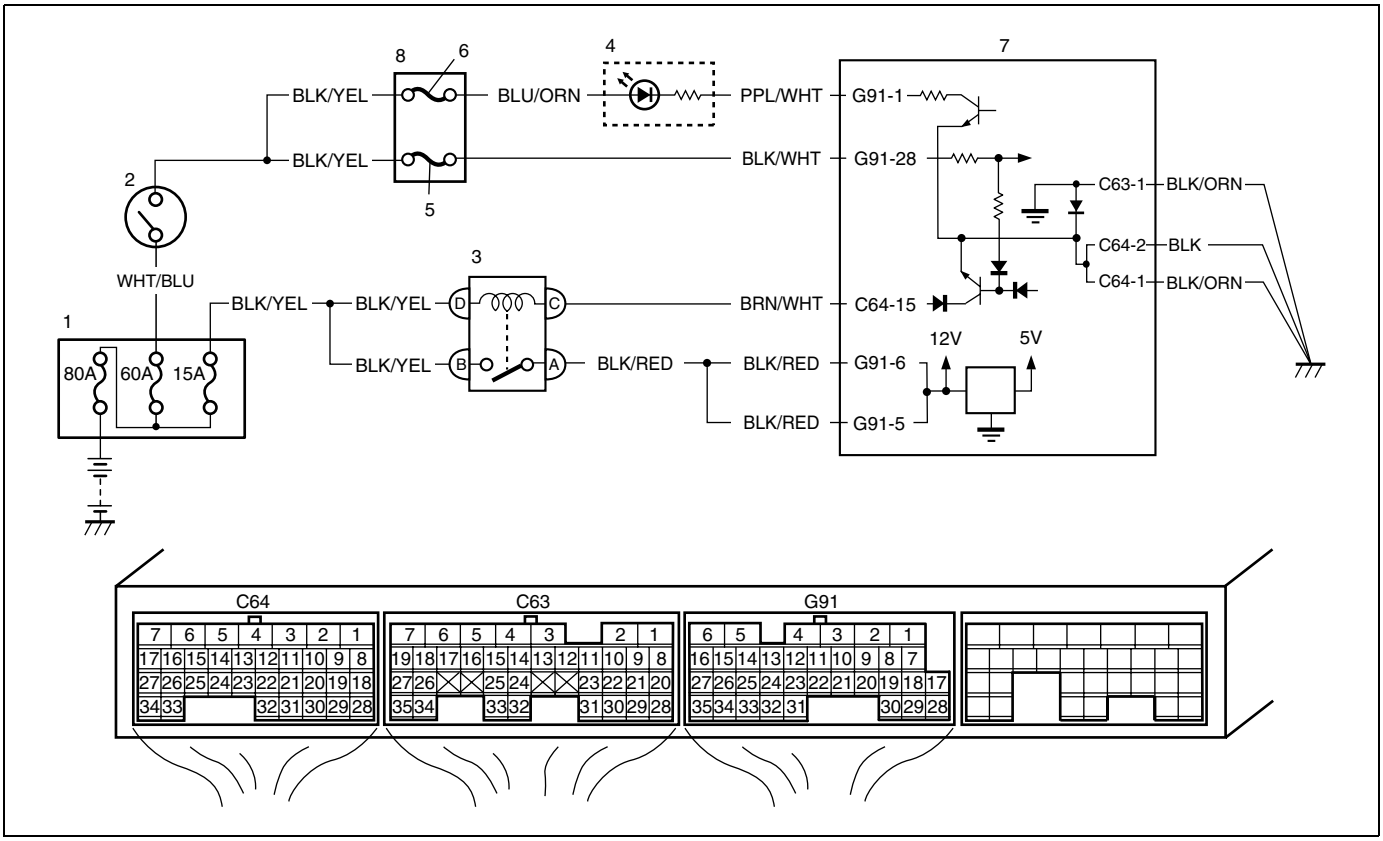
TROUBLESHOOTING

Step	Action	Yes	No
1	MIL Power Supply Check 1) Turn ignition switch to ON position. Do other warning lights come ON?	Go to Step 4.	Go to Step 2.
2	METER Fuse Check 1) Turn ignition switch to OFF position. 2) Check for fuse blow at "METER" fuse. Is "METER" fuse in good condition?	Go to Step 3.	Replace "METER" fuse and check for short.

Step	Action	Yes	No
3	MIL Power Supply Check 1) Disconnect ignition switch connector. 2) Remove "METER" fuse. 3) Measure resistance between "BLK/YEL" wire terminal of ignition switch connector and "BLK/YEL" wire terminal of "METER" fuse connector. Is resistance 1 Ω or less?	Go to Step 4.	"BLK/YEL" wire circuit open or poor connection.
4	MIL Power Supply Check 1) Connect ignition switch connector. 2) Install "METER" fuse. 3) Remove combination meter referring to "Combination Meter Removal and Installation" in Section 8. 4) Check for proper connection to combination meter connector at "BLU/ORN" wire and "PPL/WHT" wire terminals. 5) If OK, then turn ignition switch to ON position and measure voltage between combination meter connector at "BLU/ORN" wire terminal and body ground. Is it 10 – 14 V?	Go to Step 5.	"BLU/ORN" wire circuit open.
5	MIL Circuit Check 1) Turn ignition switch OFF position. 2) Disconnect ECM connector "G91". 3) Check for proper connection to ECM connector at "G91-1" wire terminal. 4) Measure resistance between "PPL/WHT" wire terminal of combination meter connector and "G91-1" wire terminal of ECM connector. Is resistance 1 Ω or less?	Go to Step 6.	"PPL/WHT" wire circuit open.
6	MIL Circuit Check 1) Connect combination meter connectors. 2) Turn ignition switch to ON position. 3) Using service wire, ground "G91-1" terminal wire of disconnected ECM connector. Does MIL turn ON?	Substitute a known-good ECM and recheck.	Replace combination meter.

Table A-2 Malfunction Indicator Lamp Circuit Check-lamp Remains "ON" after Engine Starts

WIRING DIAGRAM



1. Relay/fuse box	4. Malfunction indicator lamp in combination meter	7. ECM
2. Ignition switch	5. "IG" fuse	8. Circuit fuse box
3. Main relay	6. "METER" fuse	

CIRCUIT DESCRIPTION

When the ignition switch is turned ON, ECM causes the main relay to turn ON (close the contact point). Then, ECM being supplied with the main power, turns ON the malfunction indicator lamp (MIL). When the engine starts to run and no malfunction is detected in the system, MIL goes OFF but if a malfunction was or is detected, MIL remains ON even when the engine is running.

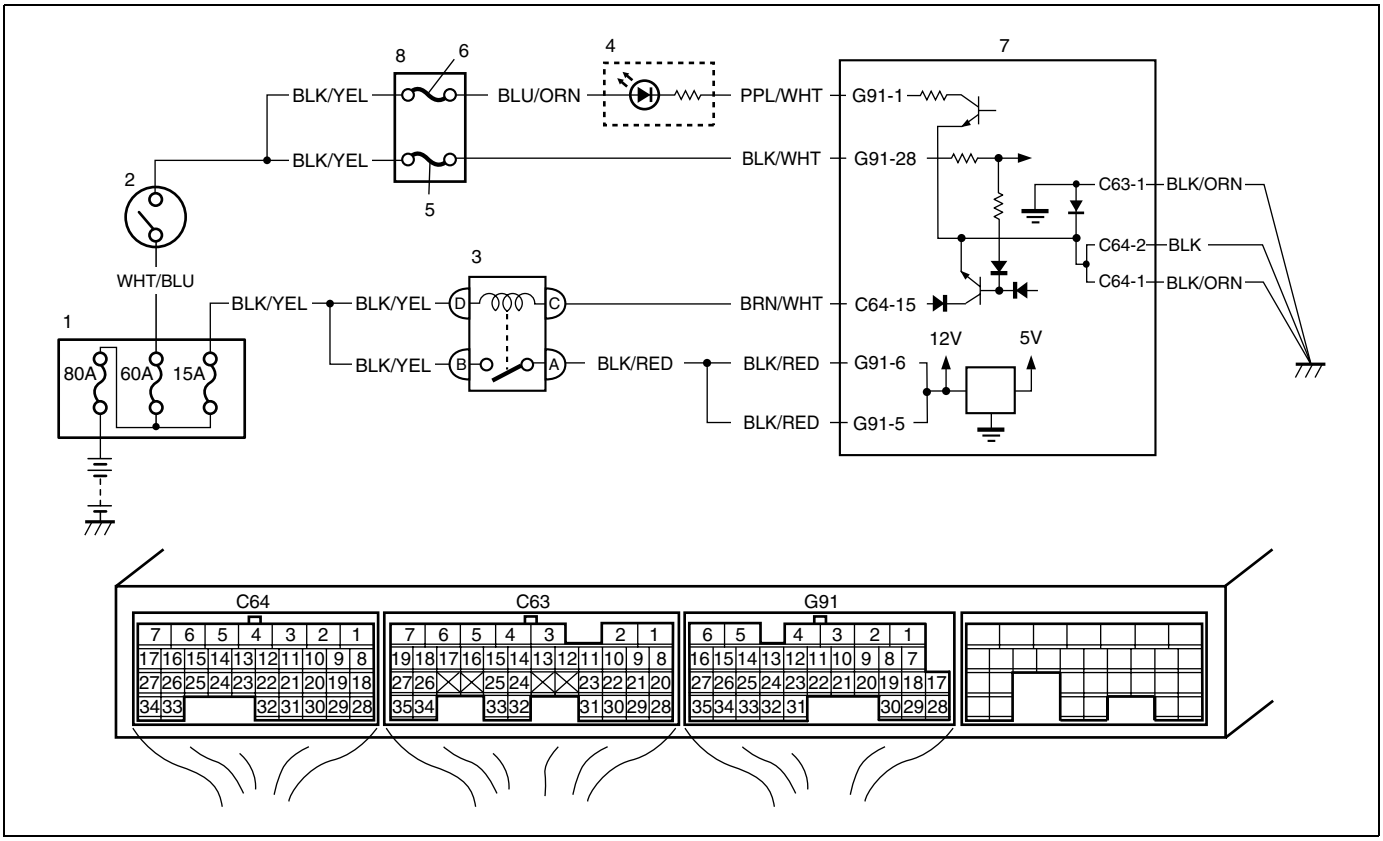
TROUBLESHOOTING

Step	Action	Yes	No
1	DTC Check 1) Check DTC referring to "Diagnostic Trouble Code (DTC) Check" in this section. Is there any DTC(s)?	Go to Step 2 of "Engine and Emission Control System Check" in this section.	Go to Step 2.
2	DTC Check 1) Start engine and recheck DTC while engine running. Is there any DTC(s)?	Go to Step 2 of "Engine and Emission Control System Check" in this section.	Go to Step 3.

Step	Action	Yes	No
3	MIL Circuit Check 1) Turn ignition switch to OFF position. 2) Remove combination meter referring to “Combination Meter Removal and Installation” in Section8. 3) Disconnect connectors from ECM. 4) Measure resistance between “PPL/WHT” wire terminal of combination meter connector and body ground. Is resistance infinity?	Go to Step 4.	“PPL/WHT” wire circuit shorted to ground.
4	MIL Circuit Check 1) Connect connectors to combination meter. Does MIL turn ON at ignition switch turned ON?	Replace combination meter.	Substitute a known-good ECM and recheck.

Table A-3 ECM Power and Ground Circuit Check-MIL Doesn't Light with Ignition Switch ON and Engine Doesn't Start Though It Is Cranked Up

WIRING DIAGRAM



1. Relay/fuse box	4. Malfunction indicator lamp in combination meter	7. ECM
2. Ignition switch	5. "IG" fuse	8. Circuit fuse box
3. Main relay	6. "METER" fuse	

CIRCUIT DESCRIPTION

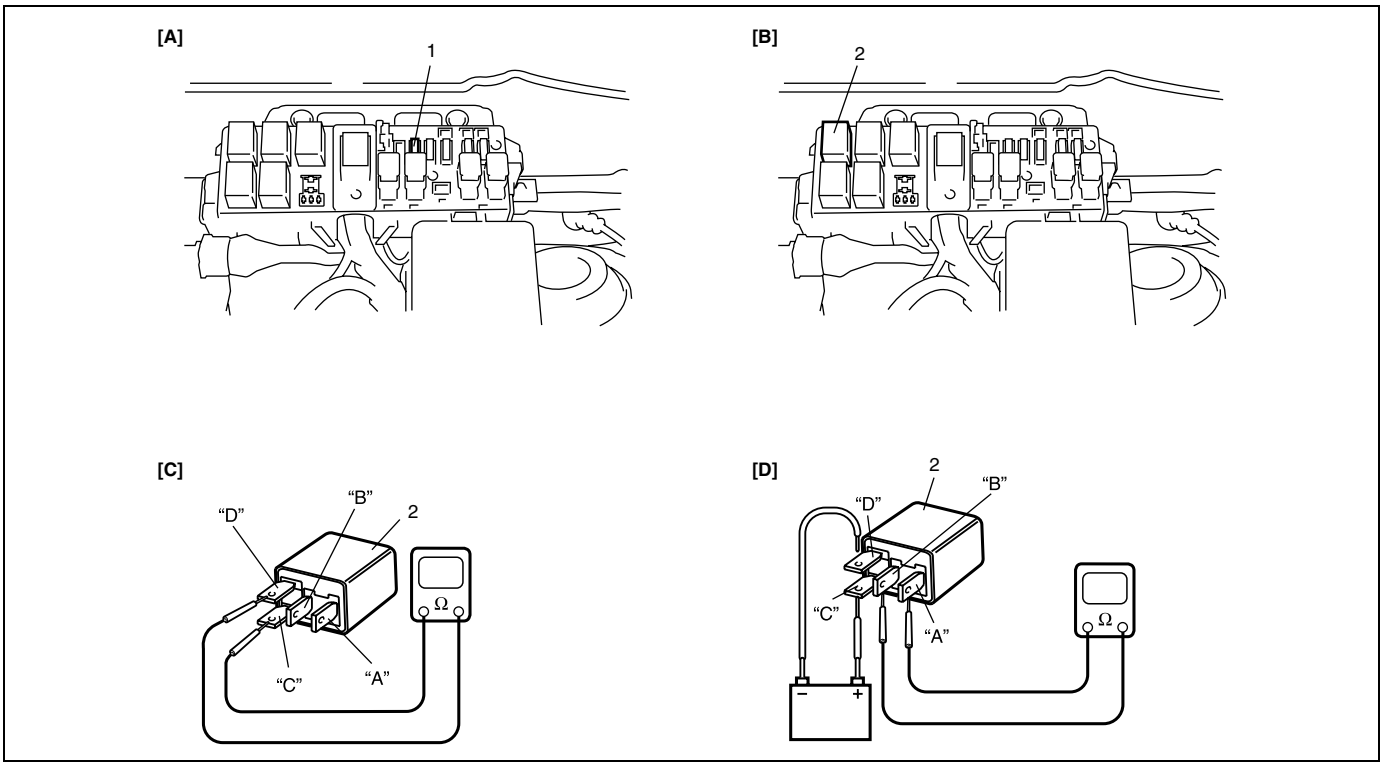
When the ignition switch tuned ON, the main relay turns ON (the contact point closes) and the main power is supplied to ECM.

TROUBLESHOOTING

Step	Action	Yes	No
1	IG Fuse Check 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection to ECM connector at "G91-1", "G91-28", "C64-15", "G91-6", "G91-5", "C63-1", "C64-1" and "C64-2" wire terminals. 3) If OK, check "IG" fuse for fuse blow. Is "IG" fuse in good condition?	Go to Step 2.	Replace fuse and check for short in circuits connected to this fuse.
2	Ignition Signal Check 1) Turn ignition switch to ON position. 2) Measure voltage between "G91-28" wire terminal of ECM connector and body ground. Is voltage 10 – 14 V?	Go to Step 3.	"BLK/WHT" or "BLK/YEL" wire circuit open.

Step	Action	Yes	No
3	Main Relay Circuit Check 1) Turn ignition switch to OFF position. 2) Check for fuse blow at main fuse (15 A). (See Fig. 1.) 3) If OK, measure voltage between “C64-15” wire terminal of ECM connector and body ground. Is voltage 10 – 14 V?	Go to Step 4.	Go to Step 8.
4	Main Relay Circuit Check 1) Remove ECM from vehicle body and connect connectors to ECM. 2) Turn ignition switch to ON position. 3) Measure voltage between “C64-15” wire terminal of ECM connector and body ground. Is voltage 0 – 1 V?	Go to Step 6.	Go to Step 5.
5	ECM Ground Circuit Check 1) Turn ignition switch to OFF position. 2) Disconnect connectors from ECM. 3) Measure resistance between each “C63-1”, “C64-1” and “C64-2” wire terminals of ECM connector and body ground. Is resistance 1 Ω or less?	Substitute a known-good ECM and recheck.	“BLK/ORN” or “BLK” wire open circuit or high resistance circuit.
6	Main Relay Circuit Check 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Using service wire, ground “C64-15” wire terminal of ECM connector and measure voltage between each “G91-5” and “G91-6” wire terminals of ECM connector and body ground. Is voltage 10 – 14 V?	Substitute a known-good ECM and recheck.	Go to Step 7.
7	Main Relay Circuit Check 1) Remove main relay from relay/fuse box. (See Fig. 2.) 2) Check for proper connection to main relay connector at “BLK/YEL” and “BLK/RED” wire terminals. 3) If OK, measure resistance between each “G91-5” and “G91-6” wire terminals of ECM connector and “BLK/RED” wire terminal of main relay connector. Is resistance 1Ω or less?	Go to Step 8.	“BLK/RED” wire open circuit or high resistance circuit.
8	Main Relay Circuit Check 1) Remove main relay from relay/fuse box. 2) Measure voltage between “BLK/YEL” wire terminals of main relay connector and body ground. Is voltage 10 – 14 V?	Go to Step 9.	“BLK/YEL” wire circuit open.

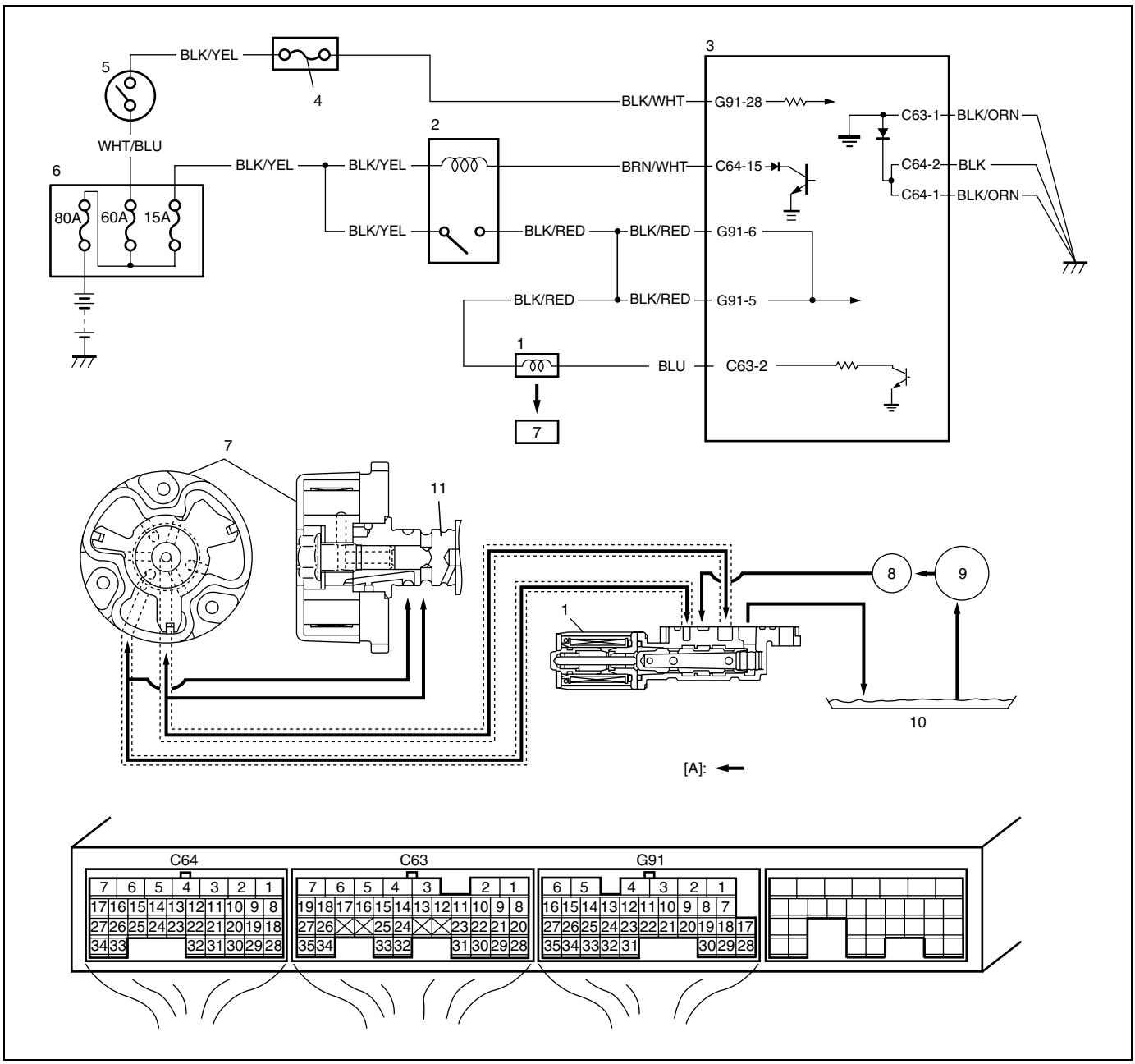
Step	Action	Yes	No
9	Main Relay Check 1) Measure resistance between each two terminals of main relay. (See Fig. 3). Between main relay terminals "A" and "B": Infinity "C" and "D": 160 – 240 Ω at 20°C (68°F) 2) Check that there is continuity between terminals "A" and "B" when battery is connected to terminals "C" and "D" (See Fig. 4). Is main relay in good condition?	"BRN/WHT" wire open circuit or high resistance circuit.	Replace main relay.



[A]: Fig. 1 for Step 3	[C]: Fig. 3 for Step 9	1. Main fuse (15 A)
[B]: Fig. 2 for Step 7	[D]: Fig. 4 for Step 9	2. Main relay

DTC P0010 Camshaft Position Actuator Circuit

WIRING DIAGRAM



[A]: Oil flow	3. ECM	6. Relay/fuse box	9. Oil pump
1. Oil control valve	4. "IG" fuse	7. Camshaft timing sprocket	10. Oil pan
2. Main relay	5. Ignition switch	8. Oil filter	11. Intake camshaft

CIRCUIT DESCRIPTION

Actual valve timing fails to become close to target advance level of each function although advance control function or retarded advance control function is at work.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Monitor signal of oil control valve is different from command signal. (Circuit open or short) (2 driving cycle detection logic)	• Oil control valve • Oil control valve circuit • ECM

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temperature: –7°C (19.4°F) or higher**
- **Engine coolant temperature: –7°C (19.4°F) or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Clear DTC. Refer to “Diagnostic Trouble Code (DTC) Clearance”.
2) Start engine.
3) Maintain engine speed at 2000 r/min. or higher for 5 seconds.
4) Check DTC. Refer “Diagnostic Trouble Code (DTC) Check”.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Check oil control valve power supply circuit. 1) Turn OFF ignition switch, disconnect connector from oil control valve. 2) Turn ignition switch ON, measure voltage between “BLK/RED” wire terminal of oil control valve connector and engine ground. Is voltage 10 – 14 V?	Go to Step 3.	“BLK/RED” wire open circuit.
3	Check wire circuit. 1) Turn OFF ignition switch, disconnect connectors from ECM. 2) Check for proper connection to “C63-2” wire terminal of ECM connector. 3) If OK, measure resistance between “C63-2” wire terminal of ECM connector and vehicle body ground. Is resistance infinity?	Go to Step 4.	“BLU” wire shorted to ground circuit.
4	Check wire circuit. 1) Turn ignition switch ON, measure voltage between “C63-2” wire terminal of ECM connector and engine ground. Is voltage 0 V?	Go to Step 5.	“BLU” wire shorted to power supply circuit.
5	Check wire circuit. 1) Turn OFF ignition switch, connect connector to oil control valve. 2) Turn ignition switch ON, measure voltage between “C63-2” wire terminal of ECM connector and engine ground. Is voltage 10 – 14 V?	Go to Step 6.	“BLU” wire open circuit.
6	Check oil control valve. 1) Check oil control valve referring to “Oil control valve inspection” in Section 6E1. Is it in good condition?	Go to Step 7.	Replace oil control valve.

Step	Action	Yes	No
7	Check oil control valve control circuit. 1) Check for proper connection to “G91-5” and “G91-6” wire terminals of ECM connector. 2) Turn OFF ignition switch, measure resistance between each “G91-5” and “G91-6” wire terminals of ECM connector and “C63-2” wire terminal of ECM connector. Is resistance 6 – 8.5 Ω at 20°C, 68°F?	Substitute a known-good ECM and recheck.	“BLK/RED” wire and/or “BLU” wire in high resistance circuit.

DTC P0011 Camshaft Position – Timing Over-Advanced or System Performance
DTC P0012 Camshaft Position – Timing Over-Retarded

DESCRIPTION

Actual value of advanced valve timing does not reach target value.
Valve timing is advanced although ECM command is most retarding.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Actual valve of advanced valve timing does not reach target value, or valve timing is advanced although ECM command is most retarding. (1 driving cycle detection logic)	• Oil control valve • Oil galleries of timing sprocket • Intake camshaft timing sprocket (VVT actuator)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temperature: –7°C (19.4°F) or higher**
- **Engine coolant temperature: –7°C (19.4°F) or higher**
- **Altitude (barometric pressure): 2500 m, 8200 ft or less (540 mmHg, 72 kPa or more)**

1) Clear DTC. Refer to “Diagnostic Trouble Code (DTC) Clearance”
2) Start engine and drive vehicle under usual driving condition for 5 minutes or longer until engine is warmed up to normal operating temperature.
3) Stop vehicle.
4) Run engine at idle speed for 1 minute.
5) Start vehicle and increase vehicle speed up to 80 km/h (50 mile/h).
6) Keep vehicle speed at 80 km/h (50 mile/h) for 1 minute or longer at 5th gear position or D range.
7) Decrease vehicle speed gradually.
8) Stop vehicle and ignition switch OFF.
9) Repeat step 4) to 7) one time.
10) Stop vehicle.

Check DTC. Refer to “Diagnostic Trouble Code (DTC) Check” in this section.

TROUBLESHOOTING

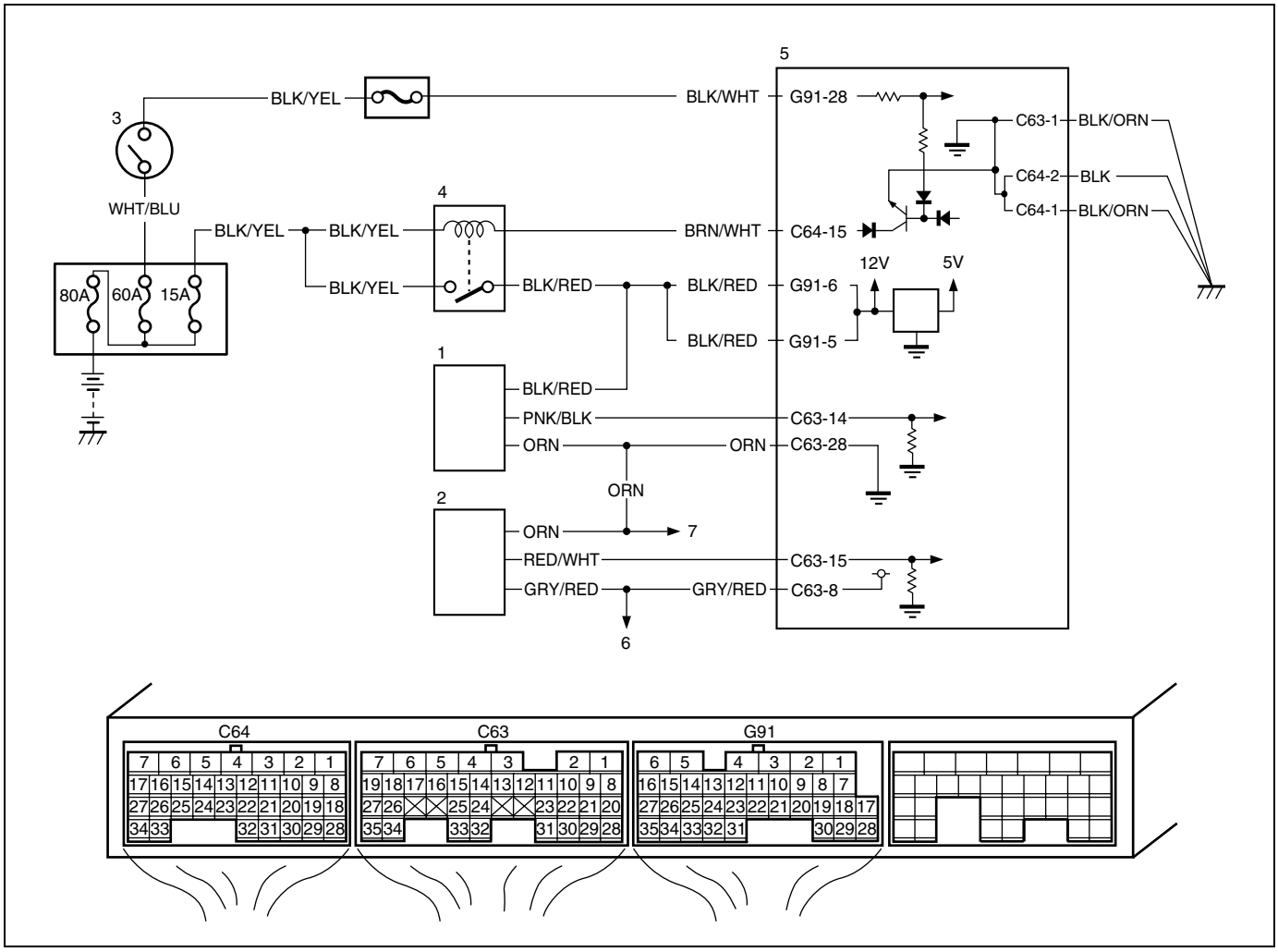
Step	Action	Yes	No
1	Is DTC P0010 detected together?	Go to "DTC P0010 Camshaft Position Actuator Circuit" in this section.	Go to Step 2.
2	Do you have Suzuki Scan Tool?	Go to Step 3.	Go to Step 5.
3	VVT GAP Check 1) With ignition switch turned OFF, connect Suzuki Scan Tool. 2) Start engine and warm up to normal operating temperature. 3) Select menu to DATA LIST. 4) Check that the VVT GAP displayed on Suzuki Scan Tool is 0 – 5°. Is it OK?	Go to Step 4.	Check valve timing referring to "Timing Chain and Chain Tensioner Removal and Installation" in Section 6A1. If OK, go to Step 5.
4	VVT Signal Check 1) Drive vehicle the following condition. • Vehicle speed at 80 km/h (50 mile/h). • Gear position at 5th or D range. 2) Check that the VVT GAP displayed on Suzuki Scan Tool is 0 – 5°. Is it OK?	Substitute a known-good ECM and recheck.	Go to Step 5.
5	Oil Control Circuit Visual Inspection 1) Remove cylinder head cover referring to "Cylinder Head Cover Removal and Installation" in Section 6A1. 2) Check oil pressure leakage from oil control circuit. Is it in good condition?	Go to Step 6.	Repair or replace.
6	Check Oil Control Circuit. 1) Remove oil control valve referring to "Oil control valve" in Section 6A1. 2) Remove oil gallery pipe referring to "Oil gallery pipe" in Section 6A1. 3) Check oil gallery pipe and oil control valve for clog or sludge. Is it in good condition?	Go to Step 7.	Clean oil control valve and oil gallery pipe. Replace oil control valve if a problem is not solved after cleaning oil control valve and oil gallery pipe.
7	Check Oil Control Valve 1) Check oil control valve referring to "Oil control valve inspection" in Section 6E1. Is it in good condition?	Replace camshaft timing sprocket.	Replace oil control valve.

NOTE:

Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.

DTC P0101 Mass Air Flow Circuit Range/Performance

WIRING DIAGRAM



1. MAF and IAT sensor	4. Main relay	7. To other sensors
2. MAP sensor	5. ECM	
3. Ignition switch	6. To TP sensor	

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Even if the voltage of the throttle position sensor changes, the voltage of the mass air flow sensor does not change normally. (2 driving cycle detection logic)	• Air intake system (clog or leakage) • High resistance in the sensor circuit • MAF sensor • TP sensor • ECM

DTC CONFIRMATION PROCEDURE

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 person, a driver and tester, on a level road.**

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

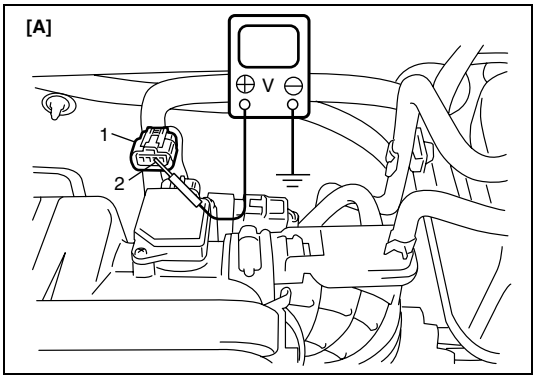
- **Intake air temperature: –7°C (19.4°F) or higher**
- **Engine coolant temperature: –7°C (19.4°F) or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature. (ECT approx. 90 – 95°C, 194 – 203°F)
4) Drive vehicle at 40 km/h (25 mile/h) at 5th gear or D range (engine speed: about 1250 rpm).
5) Increase vehicle speed to 45 km/h (28 mile/h) at 5th gear or D range (engine speed: about 1400 rpm).
6) Release accelerator pedal to decrease vehicle speed till 40 km/h (25 mile/h).
7) Repeat Step 4) to 6) for 5 times.
8) Stop vehicle and check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Visual inspection. Check MAF sensor and air intake system for: 1) Objects which block measuring duct and resistor of MAF sensor. 2) Other air flow which does not pass the MAF sensor. Are there in good condition?	Go to Step 3.	Repair or replace.
3	MAF sensor performance check. 1) With ignition switch turned OFF, install scan tool. 2) Start engine and warm up to normal operation temperature. 3) Check MAF value using scan tool, under the following conditions. **MAF value specification** **Idling: 1.5 – 4.0 g/sec.** **Racing at 2500 r/min: 5.0 – 10.0 g/sec.** Is each value as specified?	Go to Step 11.	Go to Step 4.
4	MAF sensor output voltage check. 1) Check voltage between “C63-14” and “C63-28” wire terminals under the following conditions. **Voltage between “C63-14” and “C63-28” wire terminals of ECM connector** **Ignition switch ON, leaving engine OFF: 0.5 – 1.2 V** **Idling: 1.3 – 1.8 V** Is each value as specified?	Poor “C63-14” or/and “C63-28” terminal connection. If OK, substitute a known-good ECM and recheck.	Go to Step 5.

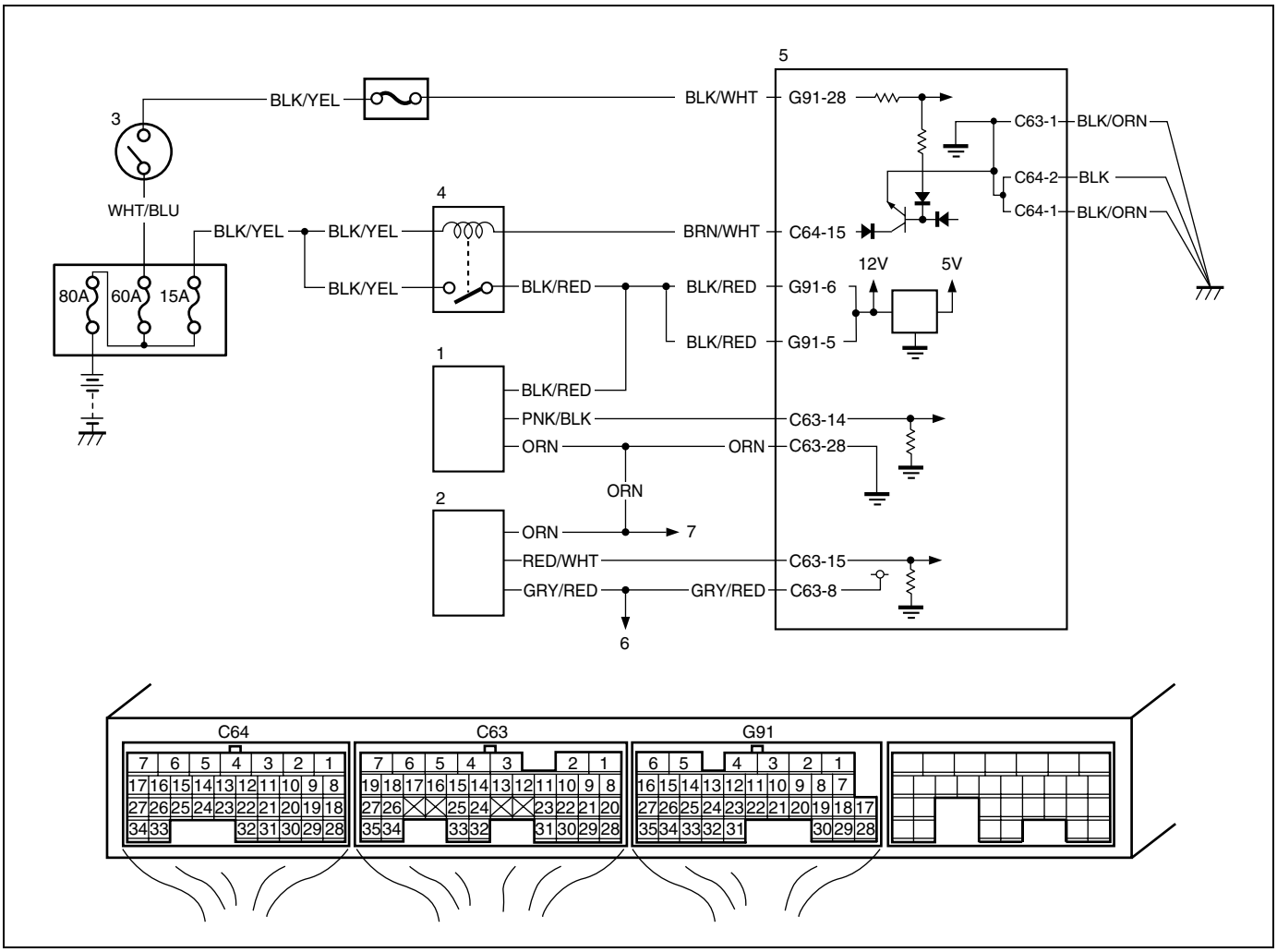
Step	Action	Yes	No
5	Check MAF sensor power supply voltage. 1) Disconnect connector from MAF sensor with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and “BLK/RED” wire terminal of MAF sensor connector. See Fig. 1. Is voltage 10 – 14 V?	Go to Step 6.	“BLK/RED” wire in open circuit.
6	Check MAF sensor ground circuit. 1) Measure resistance between “ORN” wire terminal of MAF sensor connector and engine ground. Is resistance below 5Ω?	Go to Step 8.	Go to Step 7.
7	Check ground circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and connect connectors to ECM. 3) Measure resistance between “C63-28” wire terminal of ECM connector and vehicle body ground. Is resistance below 5 Ω?	“ORN” wire in open or high resistance circuit.	ECM grounds “C63-1”, “C64-1” and/or “C64-2” circuit in open or high resistance. If wires are OK, substitute a known-good ECM and recheck.
8	Check MAF sensor signal circuit. 1) Turn ON ignition switch. 2) Measure voltage between “PNK/BLK” wire terminal of MAF sensor connector and engine ground. Is voltage 0 V?	Go to Step 9.	“PNK/BLK” wire shorted to others circuit.
9	Check MAF sensor signal circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “PNK/BLK” wire terminal of MAF sensor connector and vehicle body ground. Is resistance infinity?	Go to Step 10.	“PNK/BLK” wire shorted to ground circuit.
10	Check MAF sensor signal circuit. 1) Measure resistance between “PNK/BLK” wire terminal of MAF sensor connector and “C63-14” wire terminal of ECM connector. Is resistance below 3 Ω?	Faulty MAF sensor.	“PNK/BLK” wire in open or high resistance circuit.
11	Is DTC P0121 detected?	Go to “DTC P0121 Throttle Position Sensor Circuit Range / Performance” in this section.	Substitute a known-good ECM and recheck.



[A]: Fig.1 for Step 5
1. MAF sensor coupler
2. “BLK/RED” wire terminal

DTC P0102 Mass Air Flow Circuit Low Input

WIRING DIAGRAM



1. MAF and IAT sensor	4. Main relay	7. To other sensors
2. MAP sensor	5. ECM	
3. Ignition switch	6. To TP sensor	

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC will be set when all of the following conditions are detected for 5 seconds continuously. • Engine is running • Current of MAF sensor output is less than the specified value for the specified time continuously.	• Open or short in MAF sensor circuit • MAF sensor • ECM

DTC CONFIRMATION PROCEDURE

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC and pending DTC.

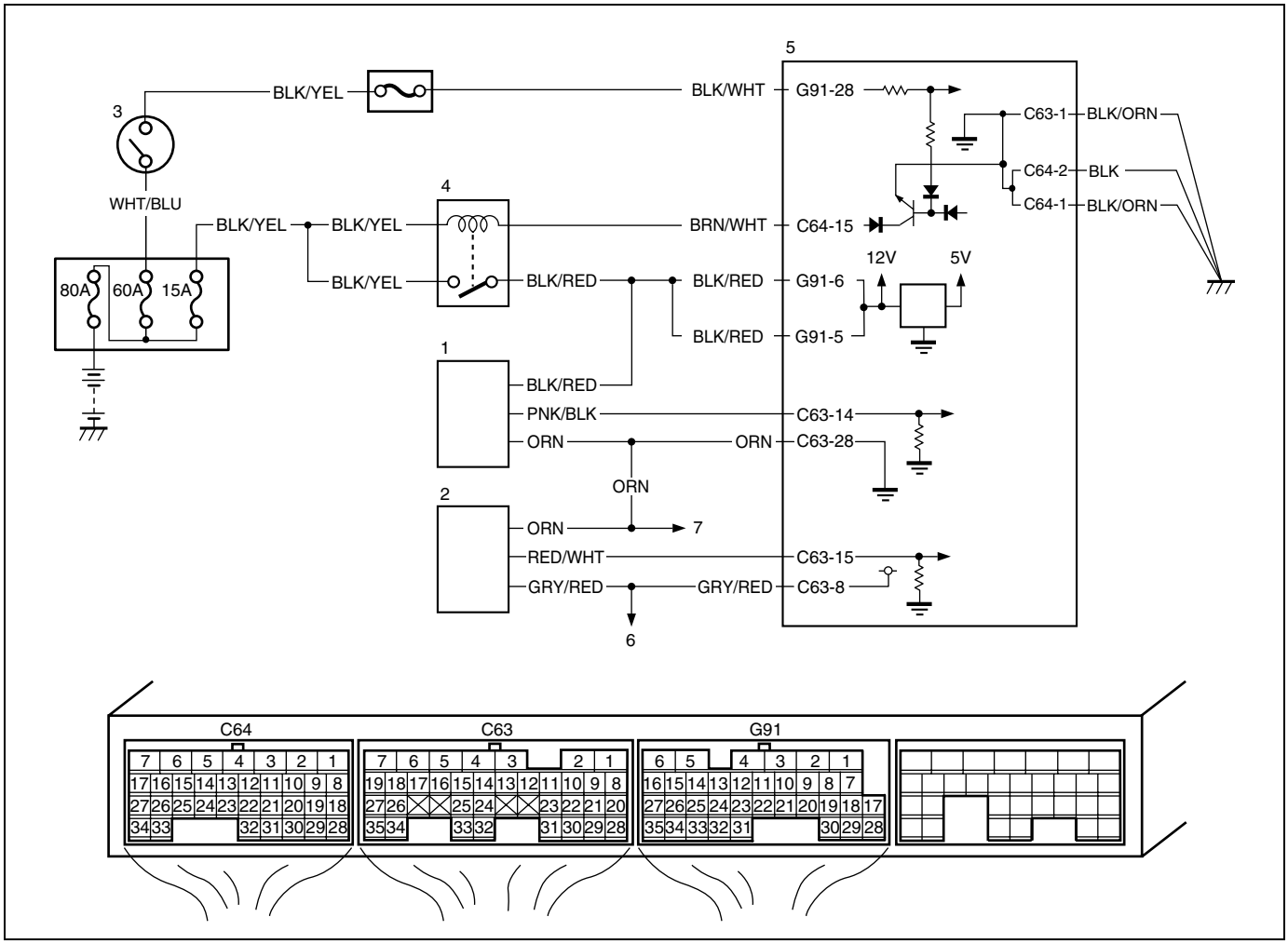
TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	MAF Sensor Check. 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Start engine and check MAF value displayed on scan tool. (Refer to “Scan Tool Data” in this section for normal value.) Is normal value indicated?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check MAF sensor power supply voltage. 1) Disconnect connector from MAF sensor with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and “BLK/RED” wire terminal of MAF sensor connector. Is voltage 10 – 14 V?	Go to Step 4.	“BLK/RED” wire in open circuit.
4	Check MAF sensor ground circuit. 1) Measure resistance between “ORN” wire terminal of MAF sensor connector and engine ground. Is resistance below 5 Ω?	Go to Step 6.	Go to Step 5.
5	Check ground circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and connect connectors to ECM. 3) Measure resistance between “C63-28” terminal of ECM connector and vehicle body ground. Is resistance below 5 Ω?	“ORN” wire in open or high resistance circuit.	ECM grounds “C63-1”, “C64-1” and/or “C64-2” circuit open or high resistance. If wires are OK, substitute a known-good ECM and recheck.

Step	Action	Yes	No
6	Check MAF sensor signal circuit. 1) Turn ON ignition switch. 2) Measure voltage between “PNK/BLK” wire terminal of MAF sensor connector and engine ground. Is voltage 0 V?	Go to Step 7.	“PNK/BLK” wire shorted to other circuit.
7	Check MAF sensor signal circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “PNK/BLK” wire terminal of MAF sensor connector and vehicle body ground. Is resistance infinity?	Go to Step 8.	“PNK/BLK” wire shorted to ground circuit.
8	Check MAF sensor signal circuit. 1) Measure resistance between “PNK/BLK” wire terminal of MAF sensor connector and “C63-14” terminal of ECM connector. Is resistance below 3 Ω?	Go to Step 9.	“PNK/BLK” wire in open or high resistance circuit.
9	Check MAF sensor output signal. 1) Connect ECM connectors to MAF sensor and ECM with ignition switch turned OFF. 2) Check voltage between “C63-14” and “C63-28” under the following condition. **Voltage between “C63-14” and “C63-28” of ECM connector at ignition switch ON, leaving engine stop: 0.5 – 1.2 V** **Idling: 1.3 – 1.8 V** Is each value as specified?	Substitute a known-good ECM and recheck.	Faulty MAF and IAT sensor.

DTC P0103 Mass Air Flow Circuit High Input

WIRING DIAGRAM



1. MAF and IAT sensor	4. Main relay	7. To other sensors
2. MAP sensor	5. ECM	
3. Ignition switch	6. To TP sensor	

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC will be set when all of the following conditions are detected for 5 seconds continuously. • Engine is running • After 3 seconds from ignition switch ON, and current of MAF sensor output is more than the specified value for the specified time continuously.	• Open or short in MAF sensor circuit • MAF sensor • ECM

DTC CONFIRMATION PROCEDURE

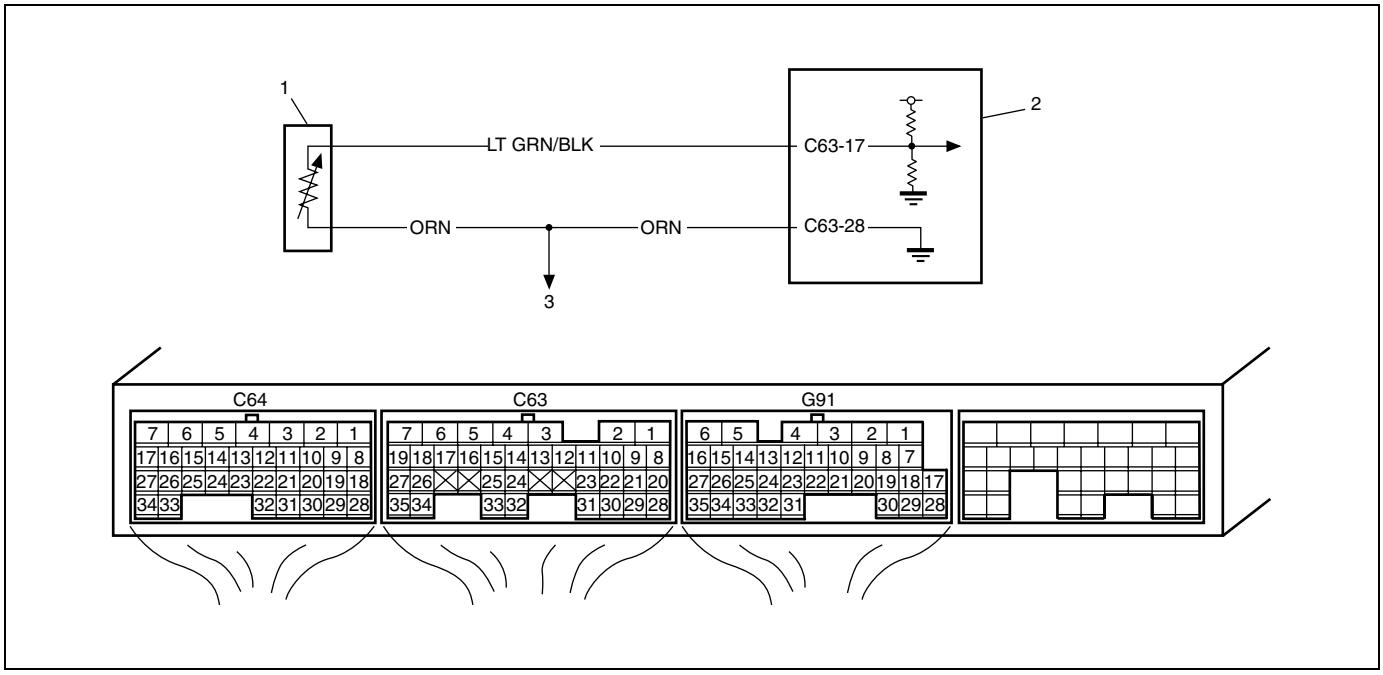
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	MAF sensor check. 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Start engine and check MAF value displayed on scan tool. (Refer to “Scan Tool Data” in this section for normal value.) Is normal value indicated?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check MAF sensor power supply voltage. 1) Disconnect connector from MAF sensor with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and “BLK/RED” wire terminal of MAF sensor connector. Is voltage 10 – 14 V?	Go to Step 4.	“BLK/RED” wire in open circuit.
4	Check MAF sensor ground circuit. 1) Measure resistance between “ORN” wire terminal of MAF sensor connector and engine ground. Is resistance below 5 Ω?	Go to Step 6.	Go to Step 5.
5	Check ground circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and connect connectors to ECM. 3) Measure resistance between “C63-28” terminal of ECM connector and vehicle body ground. Is resistance below 5 Ω?	“ORN” wire in open or high resistance circuit.	ECM grounds “C63-1”, “C64-1” and/or “C64-2” circuit in open or high resistance. If wires are OK, substitute a known-good ECM and recheck.
6	Check MAF sensor signal circuit. 1) Turn ON ignition switch. 2) Measure voltage between “PNK/BLK” wire terminal of MAF sensor connector and engine ground. Is voltage 0 V?	Go to Step 7.	“PNK/BLK” wire shorted to others circuit.
7	Check MAF sensor output signal 1) Connect connector to MAF sensor with ignition switch turned OFF. 2) Check voltage between “C63-14” and “C63-28” under the following condition. **Voltage between “C63-14” and “C63-28” of ECM connector at ignition switch ON, leaving engine OFF: 0.5 – 1.0 V** **Idling: 1.3 – 1.8 V** Is each value as specified?	Substitute a known-good ECM and recheck.	Faulty MAF and IAT sensor.

DTC P0112 Intake Air Temperature Sensor Circuit Low

WIRING DIAGRAM



1.	MAF and IAT sensor
2.	ECM
3.	To other sensor

DTC DETECTING CONDITION AND TROUBLE AREA

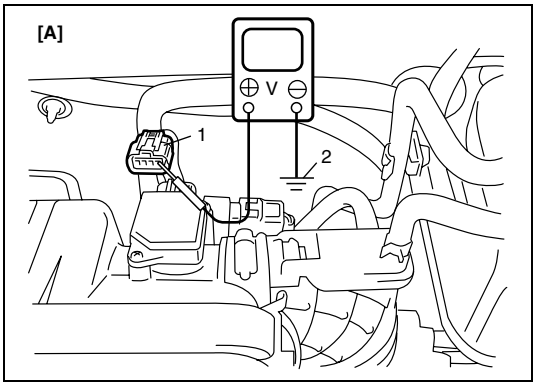
DTC DETECTING CONDITION	TROUBLE AREA
DTC will be set when all of the following conditions are detected for 5 seconds continuously. • Engine is running • Voltage of IAT sensor output is less than the specified value (High intake air temperature (low voltage/low resistance))	• IAT sensor circuit • IAT sensor • ECM

DTC CONFIRMATION PROCEDURE

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC and pending DTC.

TROUBLESHOOTING

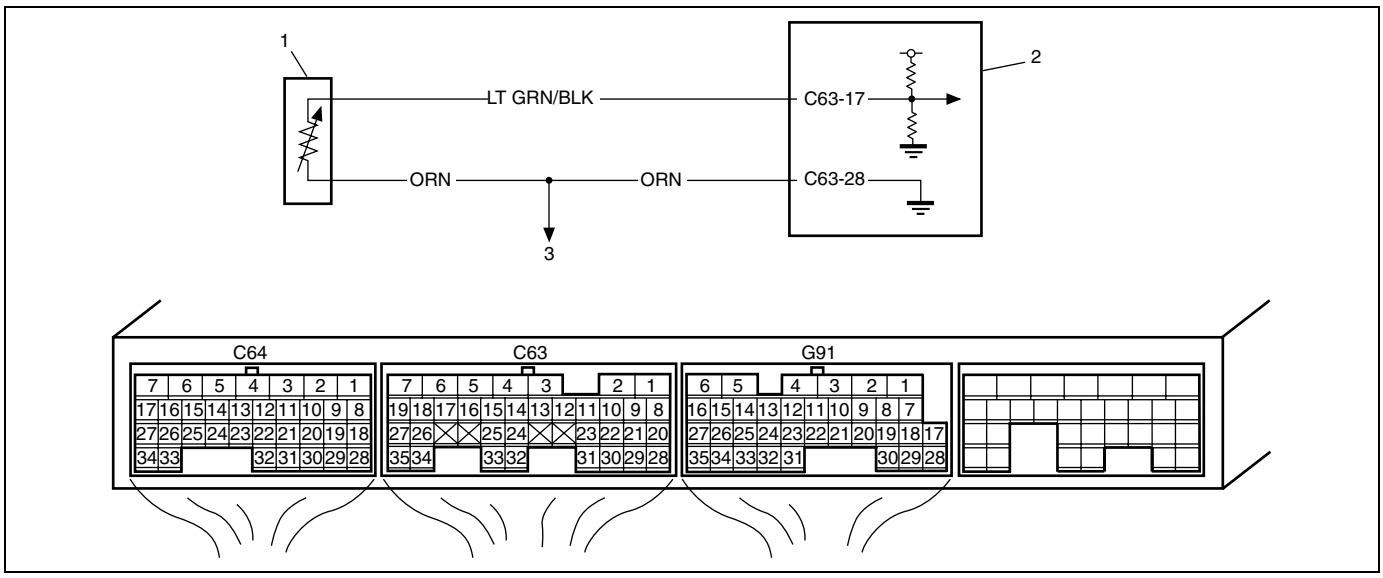
Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	IAT sensor and its circuit check. 1) Connect scan tool with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check intake air temp. displayed on scan tool. Is 165°C (329°F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.
3	Check ECM voltage. 1) Disconnect connector from IAT sensor with ignition switch turned OFF. 2) Check for proper connection to IAT sensor at “LT GRN/BLK” and “ORN” wire terminals. 3) If OK, then turn ON ignition switch, check voltage between “LT GRN/BLK” wire terminal of IAT sensor connector and vehicle body ground. See Fig. 1. Is voltage about 4 – 6 V?	Go to Step 6.	Go to Step 4.
4	Check IAT circuit insulation. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “LT GRN/BLK” wire terminal of IAT sensor connector and body ground. Is resistance infinity?	Go to Step 5.	“LT GRN/BLK” wire shorted to ground circuit. If wire are OK, substitute a known-good ECM and recheck.
5	Check IAT short circuit. 1) Turn ON ignition switch. 2) Check voltage between “LT GRN/BLK” wire terminal of IAT sensor connector and vehicle body ground. Is voltage about 0 V?	Go to Step 6.	“LT GRN/BLK” wire shorted to other circuits. If wire are OK, substitute a known-good ECM and recheck.
6	Check IAT sensor according to “Mass air flow (MAF) and intake air temperature (IAT) sensor inspection” in Section 6E1. Is it in good condition?	Substitute a known-good ECM and recheck.	Replace MAF and IAT sensor.



[A]: Fig.1 for Step 3
1. Disconnected MAF and IAT sensor connector
2. Engine ground

DTC P0113 Intake Air Temperature Sensor Circuit High

WIRING DIAGRAM



1.	MAF and IAT sensor
2.	ECM
3.	To other sensor

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC will be set when all of the following conditions are detected for 5 seconds continuously. • Engine is running • Voltage of IAT sensor output is more than the specified value (Low intake air temperature (high voltage/high resistance))	• IAT sensor circuit • IAT sensor • ECM

DTC CONFIRMATION PROCEDURE

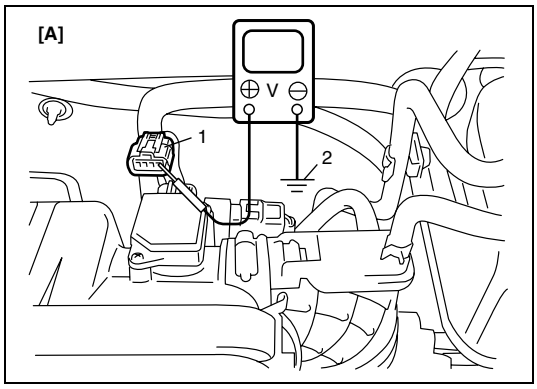
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	IAT sensor and its circuit check. 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check intake air temp. displayed on scan tool. Is –40°C (–40°F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.

Step	Action	Yes	No
3	Check IAT sensor voltage. 1) Disconnect connector from IAT sensor with ignition switch turned OFF. 2) Check for proper connection to IAT sensor at “LT GRN/BLK” and “ORN” wire terminals. 3) If OK, then turn ON ignition switch, check voltage between “LT GRN/BLK” wire terminal of IAT sensor connector and vehicle body ground. See Fig. 1. Is voltage about 4 – 6 V?	Go to Step 7.	Go to Step 4.
4	Check ECM voltage. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and connect connectors to ECM. 3) Check for proper connection of ECM connector at “C63-17” terminal. 4) If OK, then turn ON ignition switch, check voltage between “C63-17” terminal of ECM connector and vehicle body ground. Is voltage about 4 – 6 V?	“LT GRN/BLK” wire open circuit. If wire and connection are OK, go to Step 5.	Go to Step 5.
5	Check wire circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check voltage between “LT GRN/BLK” wire terminal of IAT sensor connector and vehicle body ground. Is voltage about 0 V?	Go to Step 6.	“LT GRN/BLK” wire shorted to other circuits. If wire are OK, substitute a known-good ECM and recheck.
6	Check wire circuit. 1) Measure resistance between “C63-17” terminal of ECM connector and “LT GRN/BLK” wire terminal of IAT sensor connector with ignition switch turned OFF. Is resistance below 5 Ω?	Go to Step 7.	“LT GRN/BLK” wire in high resistance circuit.
7	Check ground circuit. 1) Connect connectors to ECM. 2) Check for proper connection of IAT sensor connector at “ORN” wire terminal. 3) Measure resistance between “ORN” wire terminal of IAT sensor connector and body ground. Is resistance below 5 Ω?	Go to Step 9.	Go to Step 8.
8	Check ground circuit. 1) Measure resistance between “C63-28” terminal of ECM connector and body ground. Is resistance below 5 Ω?	“ORN” wire open circuit or high resistance circuit. Poor “C63-28” connection.	Faulty ECM ground circuit. If circuit are OK, substitute a known-good ECM and recheck.

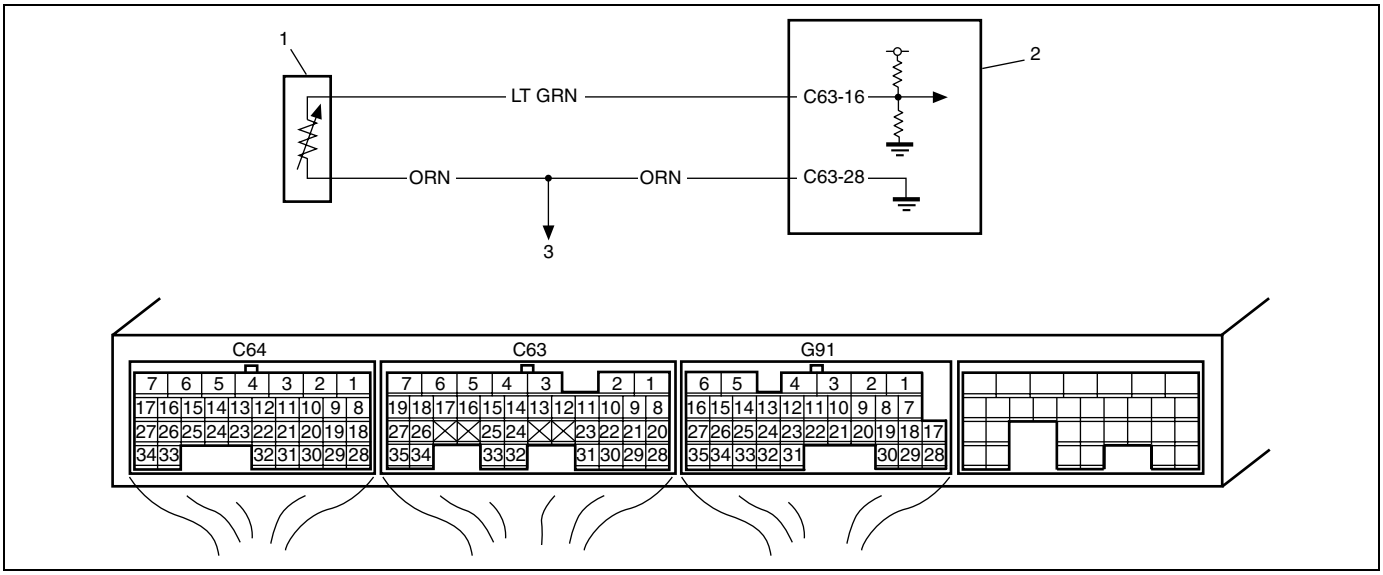
Step	Action	Yes	No
9	Check IAT sensor according to “Mass air flow (MAF) and intake air temperature (IAT) sensor inspection” in Section 6E1. Is it in good condition?	Substitute a known-good ECM and recheck.	Replace MAF and IAT sensor.



[A]: Fig. 1 for Step 3
1. Disconnected MAF and IAT sensor connector
2. Engine ground

DTC P0117 Engine Coolant Temperature Circuit Low

WIRING DIAGRAM



1. ECT sensor	2. ECM	3. To other sensors

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC will be set when all of the following conditions are detected for 5 seconds continuously. • Engine is running • Voltage of ECT sensor output is less than the specified value (High engine coolant temperature (low voltage/low resistance))	• ECT sensor circuit • ECT sensor • ECM

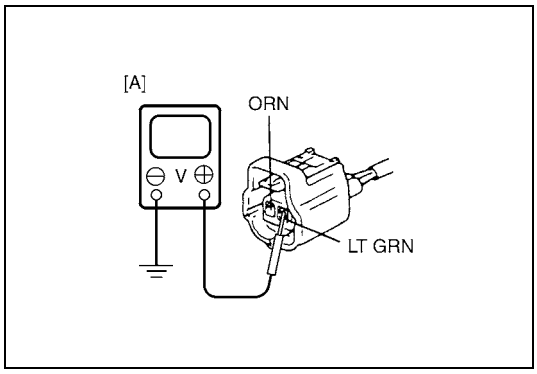
DTC CONFIRMATION PROCEDURE

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec. or more.
4) Check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	ECT sensor and its circuit check. 1) Connect scan tool with ignition switch turned OFF. 2) Turn ignition switch ON. 3) Check engine coolant temp. displayed on scan tool. Is 164°C (327°F) indicated?	Go to Step 3.	Intermittent trouble check for intermittent referring to “Intermittent and Poor Connection” in section 0A.

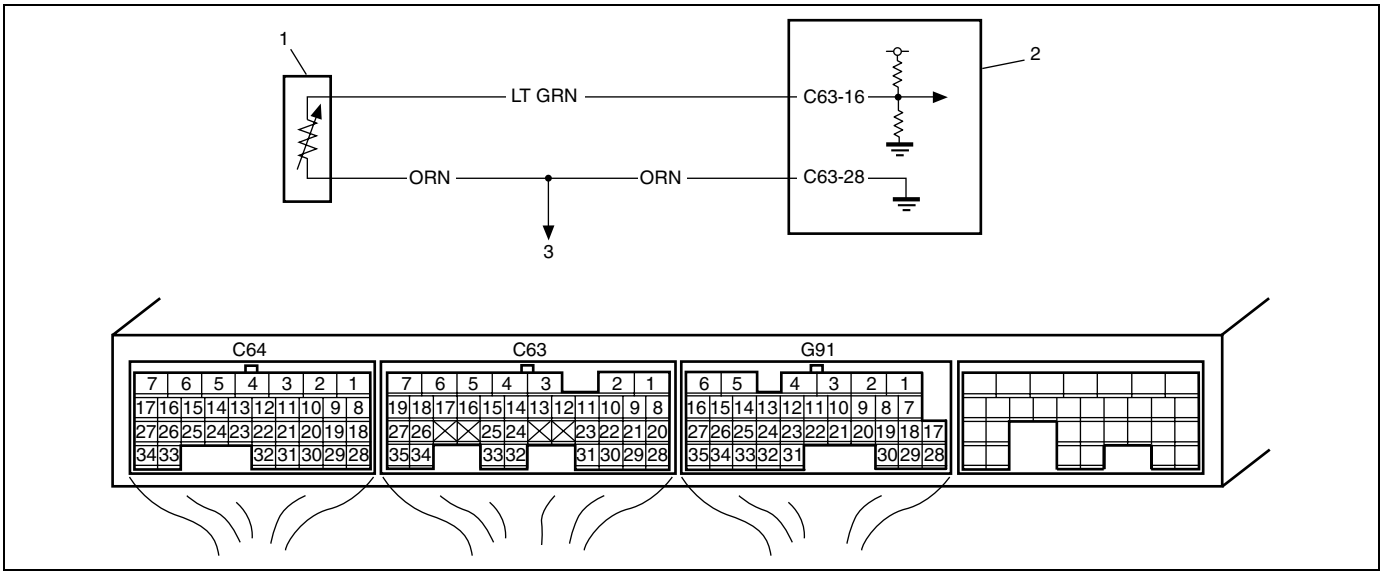
Step	Action	Yes	No
3	Check ECM voltage. 1) Disconnect connector from ECT sensor with ignition switch turned OFF. 2) Check for proper connection to ECT sensor at “LT GRN” and “ORN” wire terminals. 3) If OK, then turn ON ignition switch, check voltage between “LT GRN” wire terminal and vehicle body ground. See Fig. 1. Is voltage about 4 – 6 V?	Got to Step 6.	Go to Step 4.
4	Check ECT sensor circuit insulation. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “LT GRN” wire terminal of ECT sensor connector and body ground. Is resistance infinity?	Got to Step 5.	“LT GRN” wire shorted to ground circuit. If wire are OK, substitute a known-good ECM and recheck.
5	Check ECT sensor short circuit. 1) Turn ON ignition switch. 2) Check voltage between “LT GRN” wire terminal of ECT sensor connector and vehicle body ground. Is voltage about 0 V?	Got to Step 6.	“LT GRN” wire shorted to other circuits. If wire are OK, substitute a known-good ECM and recheck.
6	Check ECT sensor according to “Engine coolant temperature sensor (ECT sensor) inspection” in Section 6E1. Is it in good condition?	Substitute a known-good ECM and recheck.	Replace ECT sensor.



[A]: Fig. 1 for Step 3

DTC P0118 Engine Coolant Temperature Circuit High

WIRING DIAGRAM



1.	ECT sensor
2.	ECM
3.	To other sensors

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC will be set when all of the following conditions are detected for 5 seconds continuously. • Engine is running • Voltage of ECT sensor output is more than the specified value (Low engine coolant temperature (high voltage/high resistance))	• ECT sensor circuit • ECT sensor • ECM

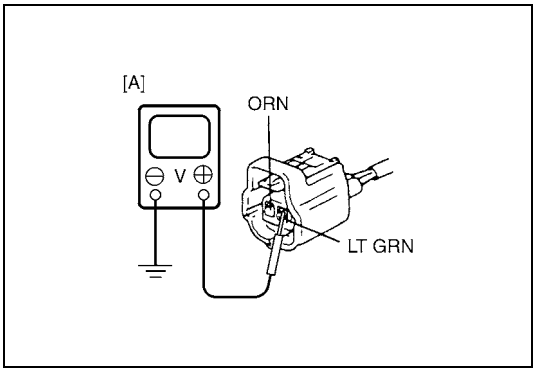
DTC CONFIRMATION PROCEDURE

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec. or more.
4) Check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	ECT sensor and its circuit check. 1) Connect scan tool with ignition switch turned OFF. 2) Turn ignition switch ON. 3) Check engine coolant temp. displayed on scan tool. Is –40°C (–40°F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.
3	Check ECT voltage. 1) Disconnect connector from ECT sensor with ignition switch turned OFF. 2) Check for proper connection to ECT sensor at “LT GRN” and “ORN” wire terminals. 3) If OK, then turn ON ignition switch, check voltage between “LT GRN” wire terminal of ECT sensor connector and vehicle body ground. See Fig. 1. Is voltage about 4 – 6 V?	Go to Step 6.	Go to Step 4.
4	Check ECM voltage. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and connect connectors to ECM. 3) Check for proper connection of ECM connector at “C63-16” terminals. 4) If OK, then turn ON ignition switch, check voltage between “C63-16” wire terminal of ECM connector and vehicle body ground. Is voltage about 4 – 6 V?	“LT GRN” wire open circuit. If wire and connection are OK, go to Step 5.	Go to Step 5.
5	Check ECT sensor harness voltage. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check voltage between “LT GRN” wire terminal of ECT sensor connector and vehicle body ground. Is voltage about 0 V?	Go to Step 6.	“LT GRN” wire shorted to other circuits. If wire are OK, substitute a known-good ECM and recheck.
6	Check ECT sensor harness resistance. 1) Measure resistance between “C63-16” terminal of ECM connector and “LT GRN” wire terminal of ECT sensor connector with ignition switch turn OFF. Is resistance below 5 Ω?	Go to Step 7.	“LT GRN” wire in high resistance circuit.

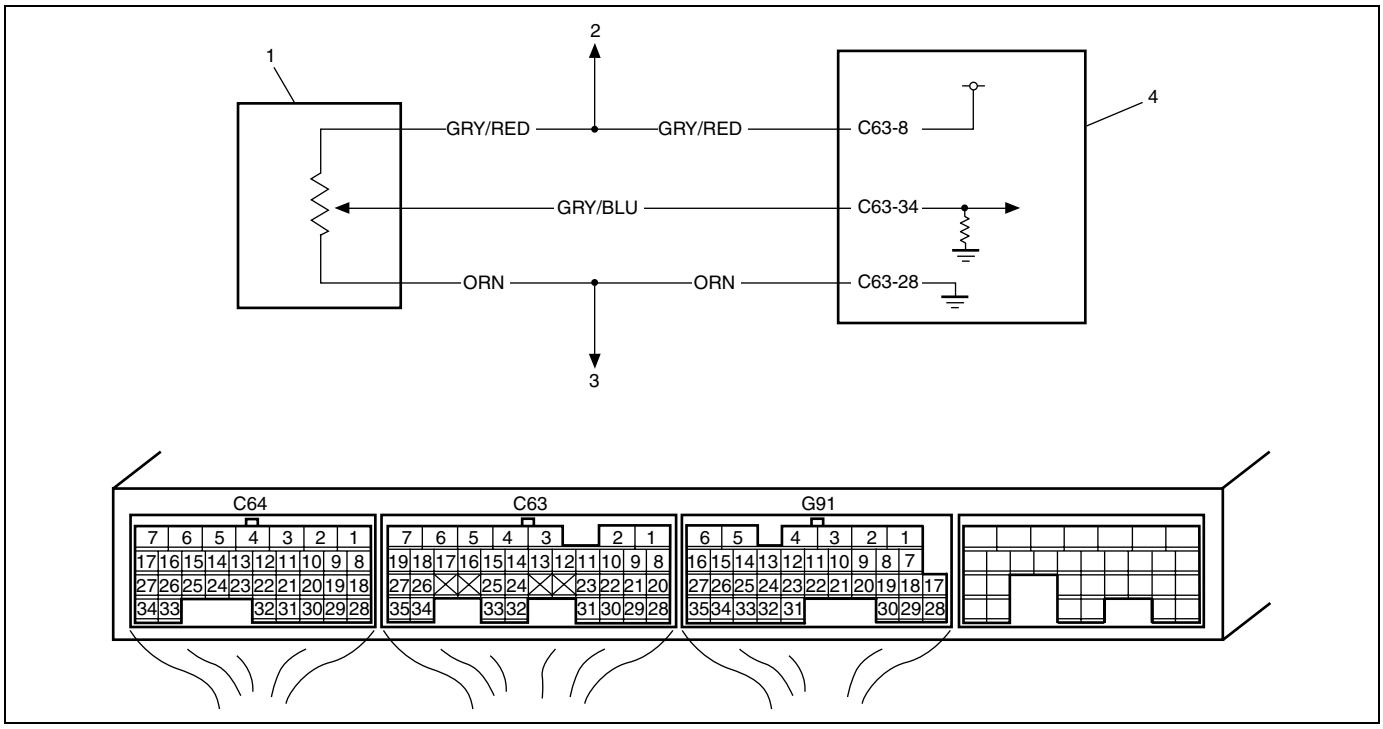
Step	Action	Yes	No
7	Check ECT sensor ground circuit. 1) Connect connectors to ECM. 2) Check for proper connection of ECT sensor connector at “ORN” wire terminal. 3) Measure resistance between “ORN” wire terminal of ECT sensor connector and vehicle body ground. Is resistance below 5 Ω?	Go to Step 9.	Go to Step 8.
8	Check ECT sensor ground circuit. 1) Measure resistance between “C63-28” terminal of ECM connector and vehicle body ground. Is resistance below 5 Ω?	“ORN” wire open circuit or high resistance circuit. Poor “C63-28” connection.	Faulty ECM ground circuit. If circuit are OK, substitute a known-good ECM and recheck.
9	Check ECT sensor according to “Engine coolant temperature sensor (ECT sensor) inspection” in Section 6E1. Is it in good condition?	Substitute a known-good ECM and recheck.	Replace ECT sensor.



[A]: Fig. 1 for Step 3

DTC P0121 Throttle Position Sensor Circuit Range / Performance

WIRING DIAGRAM



1. TP sensor	3. To other sensors
2. To MAP sensor	4. ECM

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Even if the voltage of the mass air flow sensor changes, the voltage of the throttle position sensor does not change normally. (2 driving cycle detection logic)	• Air intake system • TP sensor • TP sensor circuit • ECM • MAF sensor • Idle air control valve

DTC CONFIRMATION PROCEDURE

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –7°C, 19.4°F or higher**
- **Engine coolant temp.: –7°C, 19.4°F or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Drive vehicle at 60 km/h (38 mile/h) at 5th gear or D range.
5) Increase vehicle speed to 65 km/h (40 mile/h) at 5th gear or D range.
6) Release accelerator pedal to decrease vehicle speed till 60 km/h (38 mile/h).
7) Repeat Step 4) to 6) for 3 times.
8) Stop vehicle and check DTC and pending DTC.

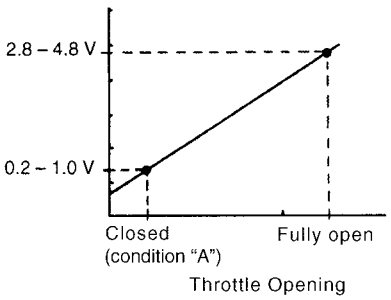
TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Check TP sensor and its circuit. 1) Turn OFF ignition switch and connect Suzuki Scan Tool to DLC. 2) Turn ON ignition switch and check TP sensor output voltage when throttle valve is at idle position and fully opened. See Fig. 1. Does voltage vary within specified value linearly as shown in figure?	Go to Step 11.	Go to Step 3.
3	Check TP sensor voltage. 1) Disconnect connector from TP sensor with ignition switch turned OFF. 2) Check for proper connection to TP sensor connector at “GRY/RED”, “GRY/BLU” and “ORN” wire terminals. 3) If OK, then with ignition switch turned ON, check voltage between “GRY/RED” wire terminal of TP sensor connector and body ground. Is voltage about 4 – 6 V?	Go to Step 7.	Go to Step 4.
4	Check ECM voltage. 1) Turn ignition switch to OFF position. 2) Check for proper connection of ECM connector at “C63-8” wire terminal. 3) If OK, disconnect connector from MAP sensor. 4) Turn ON ignition switch, check voltage between “C63-8” wire terminal of ECM connector and body ground. Is voltage about 4 – 6 V?	“GRY/RED” wire open or high resistance circuit. Faulty MAP sensor, check MAP sensor according to “MAP Sensor Individual Check” under “DTC P0108 Manifold Absolute Pressure High Input” in this section. If they are OK, go to Step 5.	Go to Step 5.

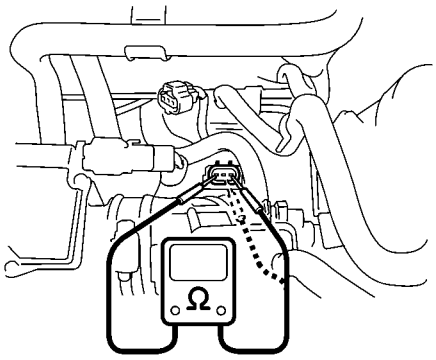
Step	Action	Yes	No
5	Check wire circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “GRY/RED” wire terminal of ECM connector and body ground and between “GRY/BLU” wire terminal of ECM connector and body ground. Is resistance infinity?	Go to Step 6.	“GRY/RED” and/or “GRY/BLU” wire shorted to ground circuit. If wire are OK, substitute a known-good ECM and recheck.
6	Check wire circuit. 1) Turn ON ignition switch. 2) Check voltage between “GRY/RED” wire terminal of ECM connector and body ground and between “GRY/BLU” wire terminal of ECM connector and body ground. Is voltage about 0 V at each terminal?	Go to Step 7.	“GRY/RED” and/or “GRY/BLU” wire shorted to power circuit. If wire are OK, substitute a known-good ECM and recheck.
7	Check wire circuit. 1) Measure resistance between “C63-34” wire terminal of ECM connector and “GRY/BLU” wire terminal of TP sensor connector with ignition switch turned OFF. Is resistance below 5 Ω?	Go to Step 8.	“GRY/BLU” wire in high resistance circuit.
8	Check ground circuit. 1) Connect connectors to ECM. 2) Check for proper connection of MAP sensor connector at “ORN” wire terminal. 3) Measure resistance between “ORN” wire terminal of MAP sensor connector and body ground. Is resistance below 5 Ω?	Go to Step 10.	Go to Step 9.
9	Check ground circuit. 1) Measure resistance between “C63-28” wire terminal of ECM connector and body ground. Is resistance below 5 Ω?	“ORN” wire open circuit or high resistance circuit. Poor “C63-28” connection.	Faulty ECM ground circuit. If circuit are OK, substitute a known-good ECM and recheck.
10	Check TP sensor. 1) Turn OFF ignition switch. 2) Disconnect TP sensor connector. 3) Check for proper connection to TP sensor at each terminal. 4) If OK, then measure resistance between TP sensor terminals and check if each measured value is as specified. See Fig. 2. **TP sensor resistance** **Between 1 and 3: 4.0 – 6.0 kΩ** **Between 1 and 2: 0.1 – 6.5 kΩ, varying according to throttle valve opening.** Are measured values as specified?	Go to Step 11.	Replace TP sensor.

Step	Action	Yes	No
11	Check MAF sensor for performance. 1) Check MAF sensor performance, referring to “DTC P0101 Mass Air Flow Circuit Range/Performance” in this section. Is it in good condition?	Go to Step 12.	Repair or replace it.
12	Is DTC P0506 or P0507 detected?	Go to applicable DTC diag. flow table.	Go to Step 13.
13	Check idle air control (IAC) valve 1) Check idle air control valve referring to “Idle air control (IAC) valve operation check” in this section. Is it in good condition?	Go to Step 14.	Repair or replace idle air control valve.
14	Check throttle body. 1) Check throttle body for clog or leak. Is it OK?	Substitute a known-good ECM and recheck.	Repair throttle body.

[A]



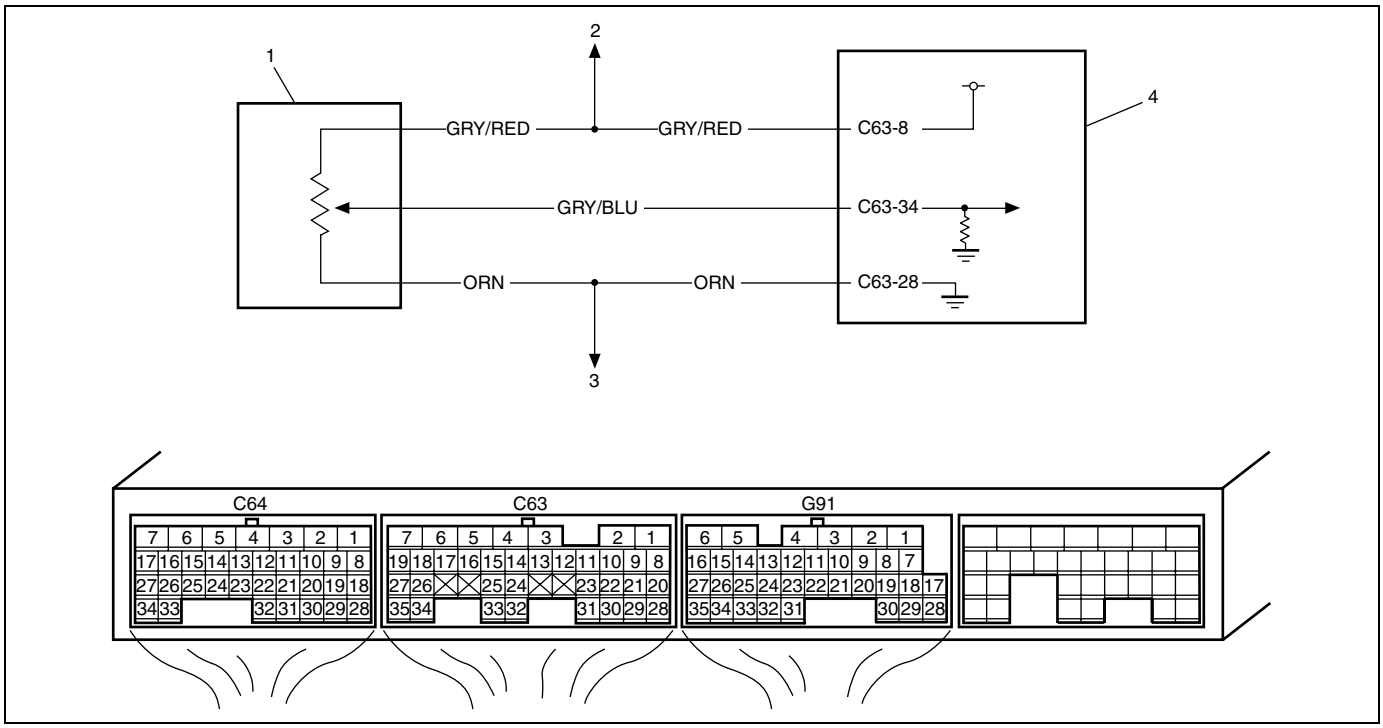
[B]



[A]: Fig. 1 for Step 2
[B]: Fig. 2 for Step 10

DTC P0122 Throttle Position Sensor Circuit Low

WIRING DIAGRAM



1. TP sensor	2. To MAP sensor	3. To other sensors	4. ECM

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC will be set when all of the following conditions are detected for 5 seconds continuously. • Engine is running • Voltage of TP sensor output is less than 0.15 V	• TP sensor circuit • TP sensor • ECM

DTC CONFIRMATION PROCEDURE

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec. or more.
4) Check DTC and pending DTC.

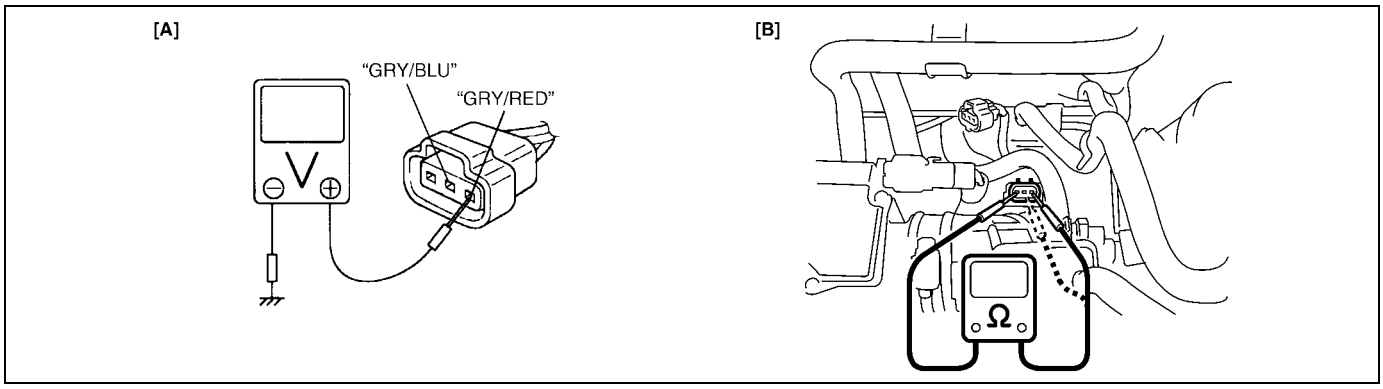
TROUBLESHOOTING

NOTE:

When this DTC and P1700 are stored together, also clear DTC stored in TCM after completion of repair.

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.

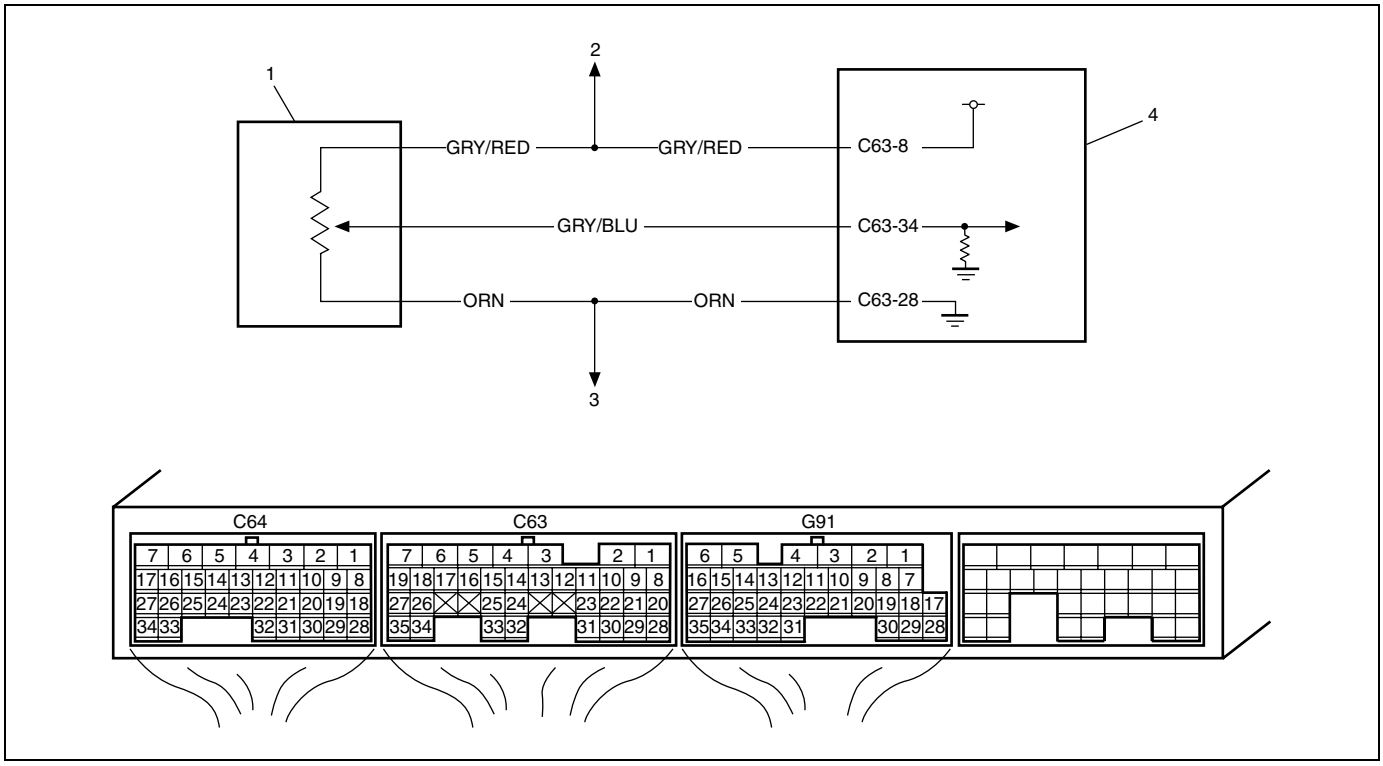
Step	Action	Yes	No
2	Check TP sensor and its circuit. 1) Connect scan tool to DLC with ignition switch turned OFF and then turn ON ignition switch. 2) Check throttle valve opening percentage displayed on scan tool. 3) Check throttle valve opening percentage displayed on scan tool while opening throttle valve from idle position to full open position. Is it displayed 0%?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.
3	Check wire harness. 1) Disconnect connector from TP sensor with ignition switch turned OFF. 2) Check for proper connection to TP sensor at “GRY/RED”, “GRY/BLU” and “ORN” wire terminals. 3) If OK, then with ignition switch turned ON, check voltage between “GRY/RED” wire terminal of TP sensor connector and body ground. See Fig. 1. Is voltage about 4 – 6 V at each terminal?	Go to Step 5.	Go to Step 4.
4	Check ECM voltage. 1) Check for proper connection of ECM connector at “C63-8” and “C63-34” wire terminals. 2) If OK, disconnect connector from MAP sensor. 3) Turn ON ignition switch, check voltage between “C63-8” wire terminal of ECM connector and body ground. Is voltage about 4 – 6 V at each terminal?	Check MAP sensor according to “MAP Sensor Individual Check” under “DTC P0108 Manifold Absolute Pressure High Input” in Section 6E1. If they are OK, go to Step 5.	Go to Step 5.
5	Check wire circuit. 1) Disconnect connectors from ECM with ignition switch turn OFF. 2) Check that there is insulation between “GRY/RED” wire terminal of TP sensor connector and body ground and between “GRY/BLU” wire terminal of TP sensor connector and body ground. Is there insulation?	Go to Step 6.	“GRY/RED” and/or “GRY/BLU” wire shorted to ground circuit. If wires are OK, substitute a known-good ECM and recheck.
6	Check TP sensor. 1) Check resistance between terminals of TP sensor. See Fig. 2. **TP sensor resistance** **Between 1 and 3: 4.0 – 6.0 kΩ** **Between 1 and 2: 0.1 – 6.5 kΩ** Are measured values within specifications?	Substitute a known-good ECM and recheck.	Replace TP sensor.



[A]: Fig. 1 for Step 3
[B]: Fig. 2 for Step 6

DTC P0123 Throttle Position Circuit High Input

WIRING DIAGRAM



1. TP sensor	3. To other sensors
2. To MAP sensor	4. ECM

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC will be set when all of the following conditions are detected for 5 seconds continuously. • Engine is running • Voltage of TP sensor output is more than 4.7 V	• TP sensor circuit • TP sensor • ECM

DTC CONFIRMATION PROCEDURE

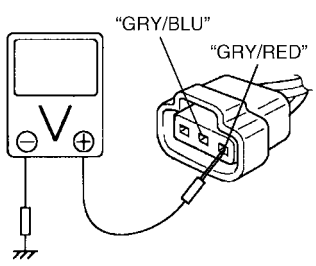
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec. or more.
4) Check DTC and pending DTC.

TROUBLESHOOTING

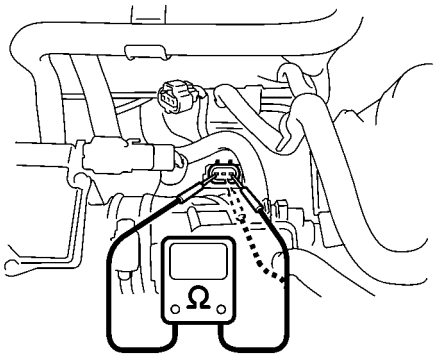
Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Check TP sensor and its circuit. 1) Connect scan tool to DLC with ignition switch turned OFF and then turn ignition switch ON. 2) Check throttle valve opening percentage displayed on scan tool. 3) Check throttle valve opening percentage displayed on scan tool while opening throttle valve from idle position to full open position. Is it displayed 100%?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.
3	Check wire harness. 1) Disconnect connector from TP sensor with ignition switch turned OFF. 2) Check for proper connection to TP sensor at “GRY/RED”, “GRY/BLU” and “ORN” wire terminals. 3) If OK, then with ignition switch turned ON, check voltage between “GRY/RED” wire terminal of TP sensor connector and body ground. See Fig. 1. Is voltage about 4 – 6 V at each terminal?	Go to Step 6.	Go to Step 4.
4	Check ECM voltage. 1) Check for proper connection of connector at “C63-8” and “C63-34” wire terminals. 2) If OK, disconnect connector from MAP sensor. 3) Turn ON ignition switch, check voltage between “C63-8” wire terminal of ECM connector and body ground. Is voltage about 4 – 6 V at each terminal?	“GRY/RED” and/or “GRY/BLU” wire open circuit. Check MAP sensor according to “MAP Sensor Individual Check” under “DTC P0108 Manifold Absolute Pressure High Input” in this section. If they are OK, go to Step 5.	Go to Step 5.

Step	Action	Yes	No
5	Check wire circuit. 1) Disconnect connector from ECM with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check voltage between “GRY/RED” wire terminal of TP sensor connector and body ground and between “GRY/BLU” wire terminal of TP sensor connector and body ground. Is voltage about 0 V at each terminal?	Go to Step 7.	“GRY/RED” and/or “GRY/BLU” wire shorted to power circuit. If wire are OK, substitute a known-good ECM and recheck.
6	Check wire circuit. 1) Measure resistance between “C63-34” wire terminal of ECM connector and “GRY/BLU” wire terminal of TP sensor connector with ignition switch turned OFF. Is resistance below 5 Ω?	Go to Step 8.	“GRY/BLU” wire open circuit or high resistance circuit.
7	Check ground circuit. 1) Connect connector to ECM. 2) Check for proper connection of MAP sensor at “ORN” wire terminal. 3) Measure resistance between “ORN” wire terminal of MAP sensor connector and body ground. Is resistance below 5 Ω?	Go to Step 9.	Go to Step 8.
8	Check ground circuit. 1) Measure resistance between “C63-28” wire terminal of ECM connector and body ground. Is resistance below 5 Ω?	“ORN” wire open circuit or high resistance circuit. Poor “C63-28” connection.	Faulty ECM ground circuit. If circuit are OK, substitute a known-good ECM and recheck.
9	Check TP sensor. 1) Check resistance between terminals of TP sensor. See Fig. 2. **TP sensor resistance** **Between 1 and 3: 4.0 – 6.0 kΩ** **Between 1 and 2: 0.1 – 6.5 kΩ** Are measured values within specifications?	Substitute a known-good ECM and recheck.	Replace TP sensor.

[A]



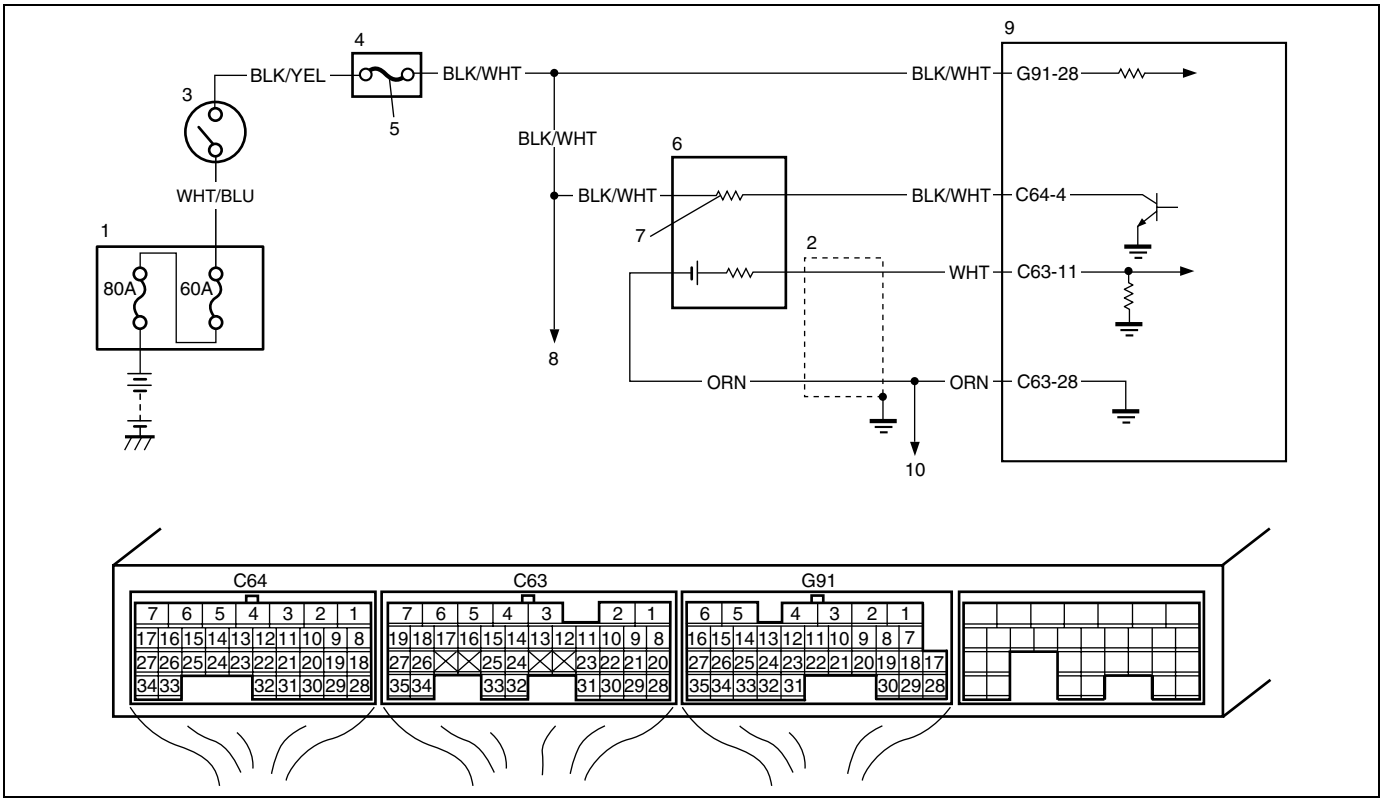
[B]



[A]: Fig. 1 for Step 3
[B]: Fig. 2 for Step 9

DTC P0131 O2 Sensor (HO2S) Circuit Low Voltage (Sensor-1)
DTC P0132 O2 Sensor (HO2S) Circuit High Voltage (Sensor-1)

WIRING DIAGRAM



1. Relay/fuse box	4. Circuit fuse box	7. Heater	10. To other sensor
2. Shield wire	5. "IG" fuse	8. To HO2S–2 heater	
3. Ignition switch	6. HO2S–1	9. ECM	

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC P0131: • HO2S voltage is higher than 4.5 V even after engine running for specified time continuously from engine start • Maximum HO2S voltage is less than 0.6 V or minimum HO2S voltage is less than 0.3 V (2 driving cycle detection logic) DTC P0132: • HO2S voltage is less than 3.0 V even after engine running for specified time continuously from engine start • Maximum HO2S voltage is 0.74 V or more or minimum HO2S voltage is 0.34 V or more (2 driving cycle detection logic)	• HO2S–1 sensor circuit • HO2S–1 sensor • Fuel system • ECM • Fuel shortage

DTC CONFIRMATION PROCEDURE

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 person, a driver and tester, on a level road.**

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –7°C, 19.4°F or higher**
- **Engine coolant temp.: –7°C, 19.4°F or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Drive vehicle at 40 mph (60 km/h) or higher. (engine speed: 2500 – 3000 r/min.)
5) Keep above vehicle speed for 6 min. or more. (Throttle valve opening is kept constant in this step.)
6) Release accelerator pedal and with engine brake applied, keep vehicle coasting (with fuel cut for 3 sec. or more) and then stop vehicle.
7) Check DTC and pending DTC.

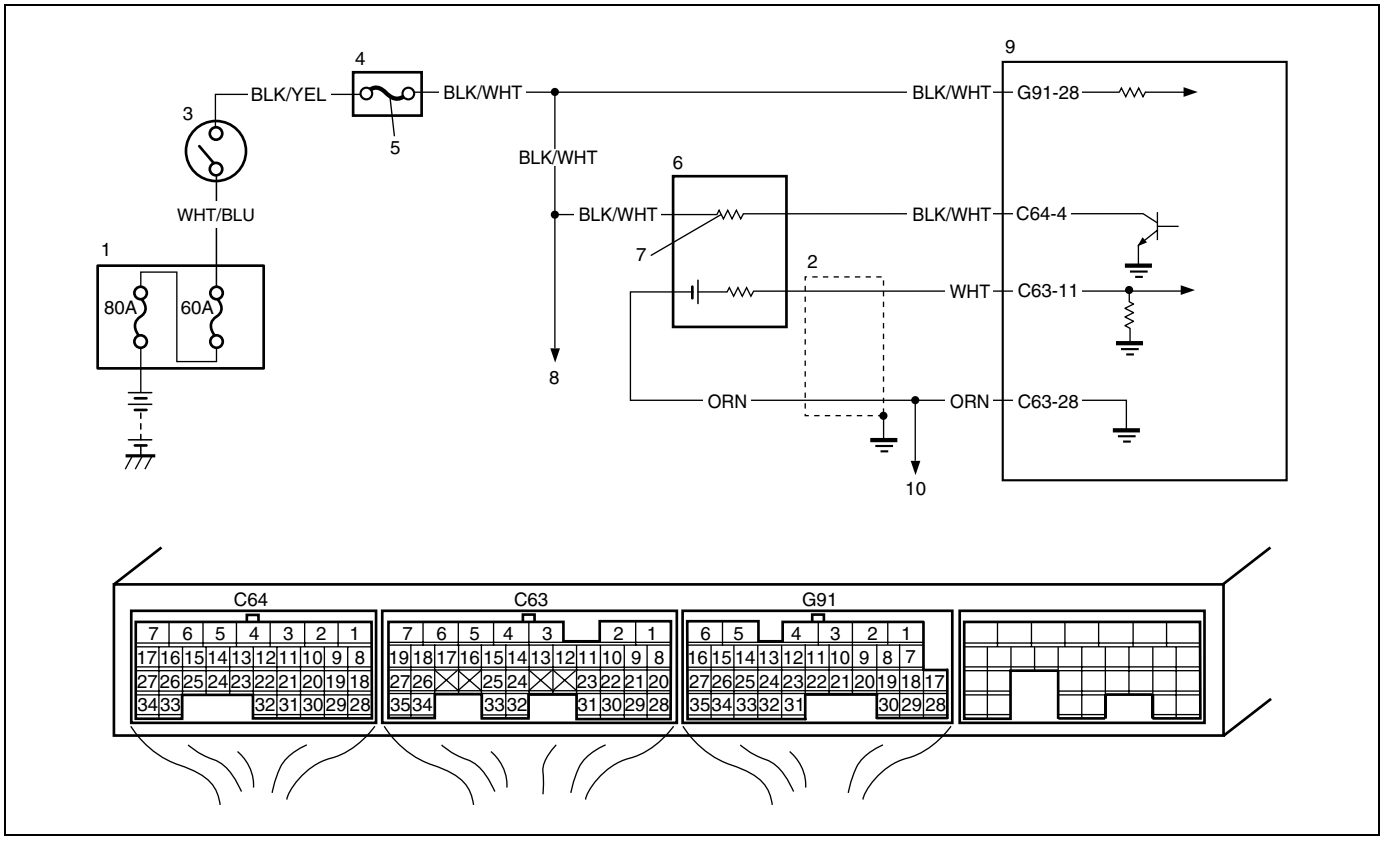
TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Is there DTC(s) other than HO2S–1?	Go to applicable DTC diag. flow table.	Go to Step 3.
3	Check HO2S–1 signal. 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously and take foot off from pedal to enrich and enlean A/F mixture). Does HO2S–1 output voltage deflect between below 0.3 V and over 0.74 V repeatedly?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A. If they are OK, go to Step 8.	Go to Step 4.
4	Check HO2S–1 sensor ground. 1) Disconnect connector from HO2S–1 sensor with ignition switch turned OFF. 2) Check for proper connection to HO2S–1 sensor connector at “WHT”, “ORN” and “BLK/WHT” wire terminals. 3) If wire and connection are OK, check there is continuity between “ORN” wire terminal of HO2S–1 sensor connector and engine ground. Is it continuity?	Go to Step 5.	“ORN” wire open circuit. Poor “C63-28” terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.

Step	Action	Yes	No
5	Check HO2S–1 sensor ground. 1) With ignition switch turned ON, check voltage between “ORN” wire terminal of HO2S–1 sensor connector and engine ground. Is voltage about 0.1 V or less?	Go to Step 6.	“ORN” wire high resistance circuit. Poor “C63-28” terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.
6	Check wire circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and connect connectors to ECM. 3) Measure resistance between “WHT” wire terminal of HO2S–1 connector and “C63-11” wire terminal of ECM connector. Is resistance less than 5 Ω?	Go to Step 7.	“WHT” wire high resistance circuit or open circuit. Poor “C63-11” terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.
7	Check wire circuit. 1) Disconnect connector from ECM with ignition switch turn OFF. 2) Measure resistance between “WHT” wire terminal of HO2S–1 sensor connector and body ground. Is resistance infinity?	Go to Step 8.	“WHT” wire shorted to ground circuit.
8	Check HO2S–1 signal circuit. 1) Measure voltage between “WHT” wire terminal of HO2S–1 connector and vehicle body ground. Is voltage 0 V?	Go to Step 9.	“WHT” wire shorted to others circuit.
9	Check HO2S–1 heater circuit. 1) Check HO2S–1 heater circuit, referring to “DTC P0031 HO2S Heater Control Circuit Low (Sensor-1) DTC P0032 HO2S Heater Control Circuit High (Sensor-1)”. Is circuit in good condition?	Go to Step 10.	Repair or replace it.
10	Check exhaust system. 1) Check exhaust system for exhaust gas leakage. Is it OK?	Go to Step 4 in DTC P0171 and P0172 diagnosis flow table. If it is in good condition, go to Step 11.	Repair exhaust system for leakage.
11	Check air intake system. 1) Check air intake system for clog or leak. Is it OK?	Check HO2S–1 sensor, referring to “Heated oxygen sensor (HO2S-1 and HO2S-2) heater on-vehicle inspection” in Section 6E1. If it in good condition, substitute a known-good ECM and recheck.	Repair or replace.

DTC P0133 O2 Sensor (HO2S) Circuit Slow Response (Sensor-1)

WIRING DIAGRAM



1. Relay/fuse box	4. Circuit fuse box	7. Heater	10. To other sensor
2. Shield wire	5. "IG" fuse	8. To HO2S–2 heater	
3. Ignition switch	6. HO2S–1	9. ECM	

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Response time (time to change from lean to rich or from rich to lean) of HO2S–1 output voltage is about 1 sec. at minimum or average time of 1 cycle is 5 sec. at minimum. (2 driving cycle detection logic)	• Heated oxygen sensor–1

DTC CONFIRMATION PROCEDURE

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 person, a driver and tester, on a level road.**

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –7°C (19.4°F) or higher**
- **Engine coolant temp.: –7°C (19.4°F) or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

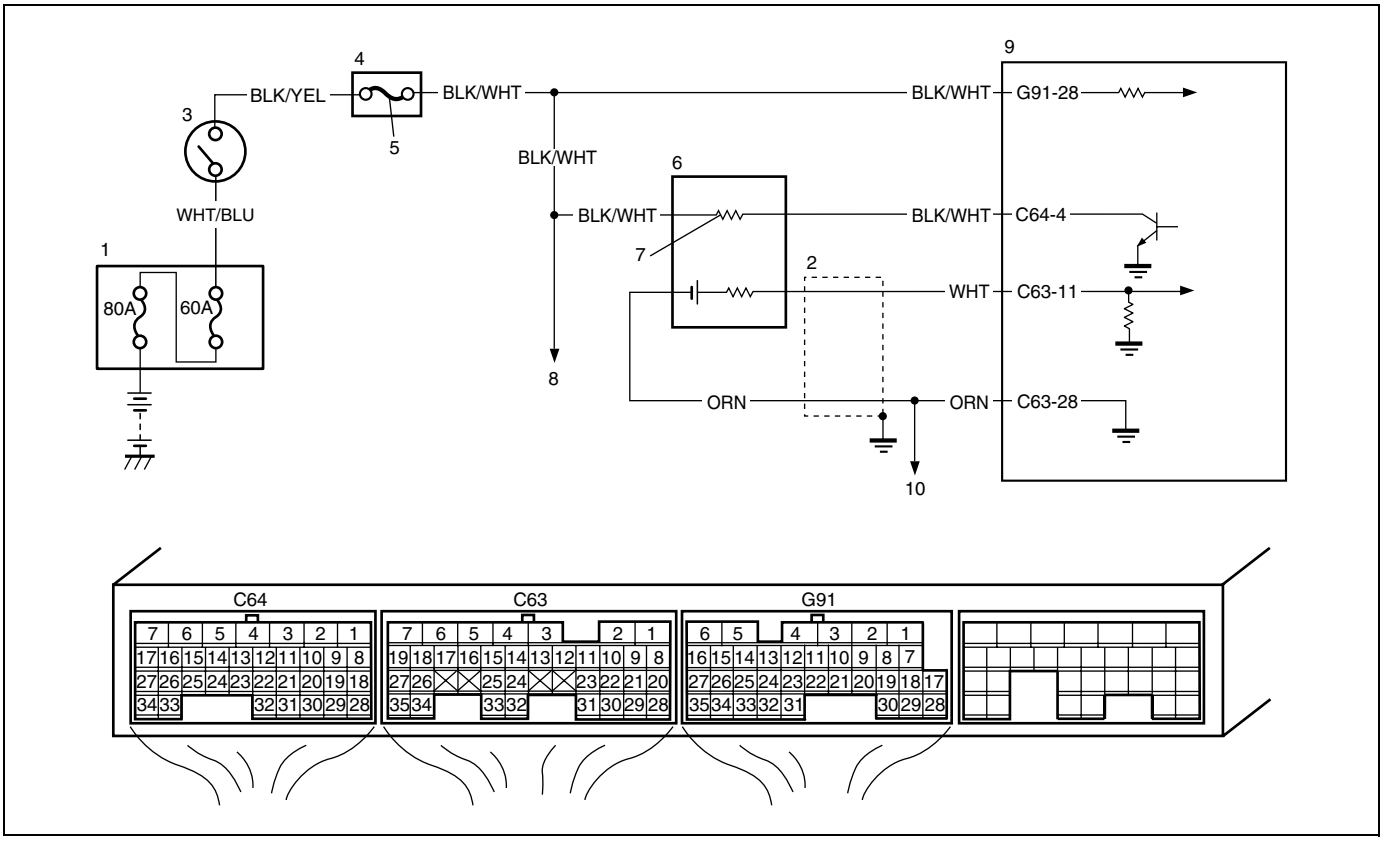
1) Perform step 1) to 6) of DTC P0131/P0132 confirmation procedure.
2) Check if DTC and pending DTC exists by using scan tool. If not, check if oxygen sensor monitoring test has completed by using scan tool. If not in both of above checks (i.e., no DTC and pending DTC and oxygen sensor monitoring test not completed), check vehicle condition (environmental) and repeat step 3) through 6) of DTC P0131/P0132 confirmation procedure.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Is there DTC(s) other than HO2S–1 (DTC P0133)?	Go to applicable DTC diag. flow table.	Replace HO2S–1.

DTC P0134 Heated Oxygen Sensor (HO2S) No Activity Detected (Sensor-1)

WIRING DIAGRAM



1. Relay/fuse box	4. Circuit fuse box	7. Heater	10. To other sensor
2. Shield wire	5. “IG” fuse	8. To HO2S–2 heater	
3. Ignition switch	6. HO2S–1	9. ECM	

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Maximum HO2S voltage is lower than 0.45 V. (2 driving cycle detection logic)	• HO2S–1 • HO2S–1 circuit • Fuel system • Exhaust gas leakage • ECM • Fuel shortage

DTC CONFIRMATION PROCEDURE

Refer to “DTC P0133 O2 Sensor (HO2S) Circuit Slow Response (Sensor-1)” in this section.

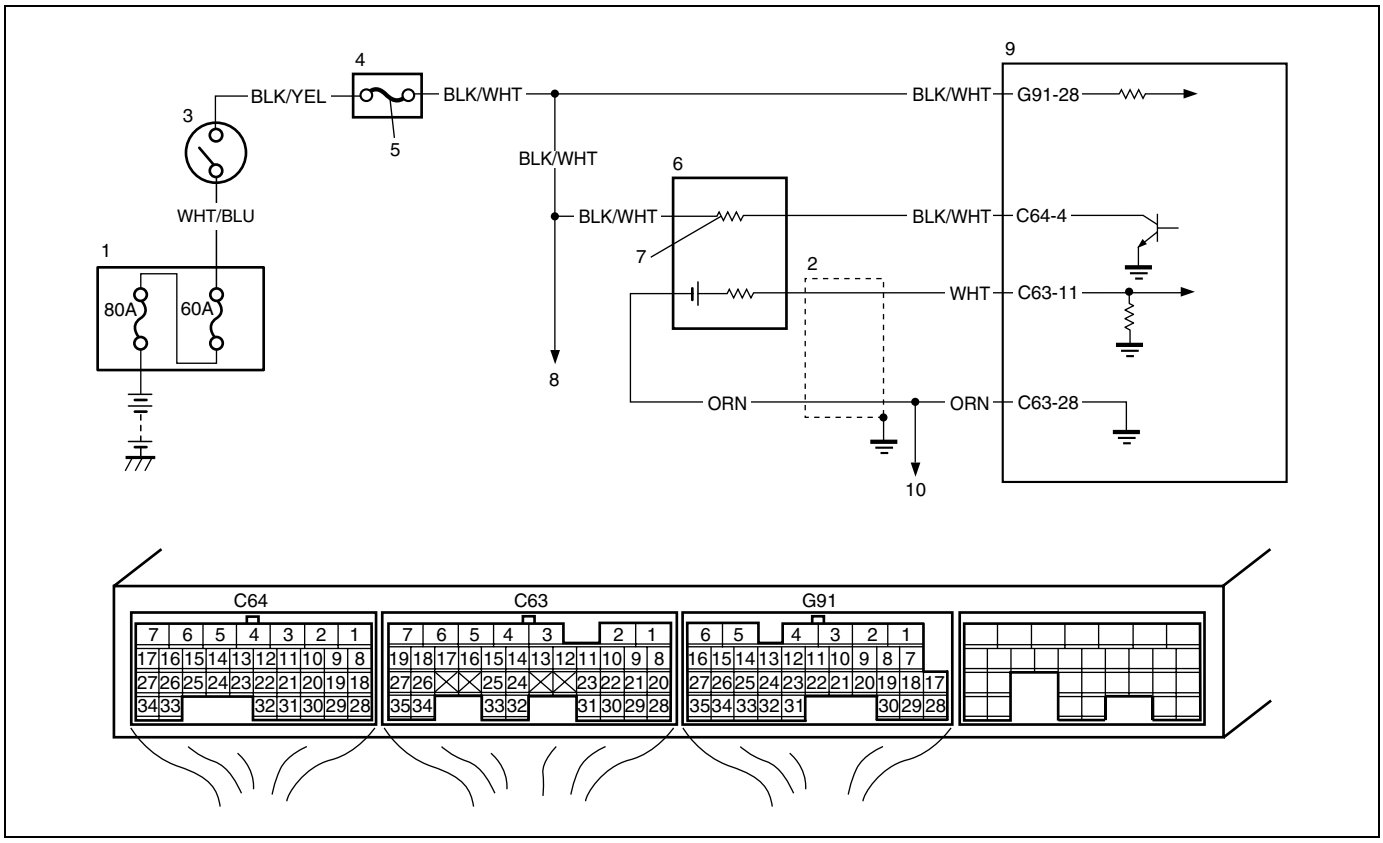
TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	HO2S–1 output voltage check. 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously to enrich A/F mixture and take foot off from pedal to enlean) and check HO2S output voltage displayed on scan tool. Is over 0.74 V and below 0.3 V indicated?	Go to Step 4.	Go to Step 3.
3	Check HO2S–1 sensor ground. 1) Disconnect connector from HO2S–1 sensor with ignition switch turned OFF. 2) Check for proper connection to HO2S–1 sensor at “WHT”, “ORN” and “BLK/WHT” wire terminals. 3) If wire and connection are OK, check there is continuity between “ORN” wire terminal of HO2S–1 sensor connector and engine ground. Is it continuity?	Go to Step 4.	“ORN” wire open circuit. Poor “C63-28” terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.
4	Check HO2S–1 sensor ground. 1) With ignition switch turn ON, check voltage between “ORN” wire terminal of HO2S–1 sensor connector and engine ground. Is voltage about 0.1 V or less?	Go to Step 5.	“ORN” wire high resistance circuit. Poor “C63-28” terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.

Step	Action	Yes	No
5	Check wire circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and connect connectors to ECM. 3) Measure resistance between “WHT” wire terminal of HO2S–1 harness connector and “C63-11” terminal. Is resistance less than 5 Ω?	Go to Step 6.	“WHT” wire high resistance circuit or open circuit. Poor “C63-11” terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.
6	Check wire circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “WHT” wire terminal of HO2S–1 sensor connector and body ground. Is resistance infinity?	Go to Step 7.	“WHT” wire shorted to ground circuit.
7	Check HO2S–1 heater circuit. 1) Check HO2S–1 heater circuit, referring to “DTC P0031 HO2S Heater Control Circuit Low (Sensor-1) DTC P0032 HO2S Heater Control Circuit High (Sensor-1)”. Is result in good condition?	Go to Step 8.	Repair or replace it.
8	Check exhaust system. 1) Check exhaust system for exhaust gas leakage. Is it OK?	Go to Step 4 in DTC P0171 and P0172 diagnosis flow table. If it is in good condition, go to Step 9.	Repair exhaust system for leakage.
9	Check air intake system. 1) Check air intake system for clog or leak. Is it OK?	Check HO2S–1 sensor, referring to “Heated oxygen sensor (HO2S-1 and HO2S-2) heater on-vehicle inspection” in Section 6E1. If it in good condition, substitute a known-good ECM and recheck.	Repair or replace.

DTC P0031 HO2S Heater Control Circuit Low (Sensor-1)
DTC P0032 HO2S Heater Control Circuit High (Sensor-1)

WIRING DIAGRAM



1. Relay/fuse box	4. Circuit fuse box	7. Heater	10. To other sensor
2. Shield wire	5. "IG" fuse	8. To HO2S–2 heater	
3. Ignition switch	6. HO2S–1	9. ECM	

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Current of HO2S–2 heater is more than specified value or lower than specified value for 3 seconds continuously (2 driving cycle detection logic)	• HO2S–1 heater • HO2S–1 heater circuit • ECM

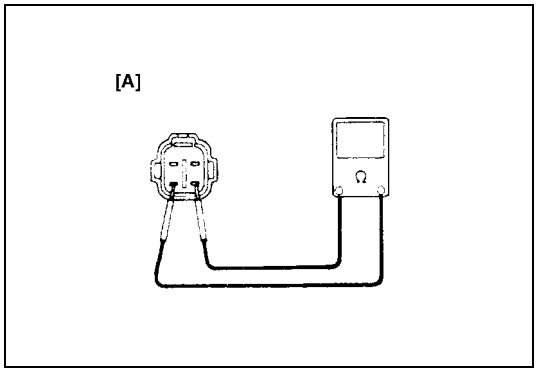
DTC CONFIRMATION PROCEDURE

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Run engine at idle speed for 1 min. or more.
5) Check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Check HO2S–1 heater power circuit. 1) Disconnect connector from HO2S–1 sensor with ignition switch turned OFF. 2) Check for proper connection to HO2S–1 sensor at “BLK/WHT” wire terminals. 3) If wire and connection are OK, measure voltage between “BLK/WHT” wire terminal and engine ground with ignition switch turned ON. Is voltage over 10 V?	Go to Step 3.	“BLK/WHT” wire open circuit or shorted to ground circuit.
3	Check HO2S–1 heater power circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “BLK/WHT” wire terminal of HO2S–1 connector and “C64-4” terminal wire of ECM connector. Is resistance below 5 Ω?	Go to Step 4.	“BLK/WHT” wire high resistance circuit.
4	Check HO2S–1 heater drive circuit. 1) Measure resistance between “C64-4” wire terminal of ECM connector and vehicle body ground. Is resistance infinity?	Go to Step 5.	“BLK/WHT” wire shorted to ground circuit.
5	Check HO2S–1 heater drive circuit. 1) Turn ON ignition switch. 2) Measure voltage between “C64-4” wire terminal of ECM connector and vehicle body ground. Is voltage 0 V?	Go to Step 6.	“BLK/WHT” wire shorted to power circuit.
6	Check HO2S–1 heater drive circuit. 1) Connect connector to HO2S–1 with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between “C64-4” wire terminal of ECM connector and vehicle body ground with disconnect connector from ECM. Is voltage over 10 V?	Go to Step 7.	“BLK/WHT” wire open circuit.
7	Check heater of sensor–1. 1) Disconnect HO2S–1 coupler with ignition switch turned OFF. 2) Check HO2S–1 heater resistance. See Fig. 1. It is 5.0 – 6.4 Ω at 20°C (68°F)?	Go to Step 8.	Replace HO2S–1.

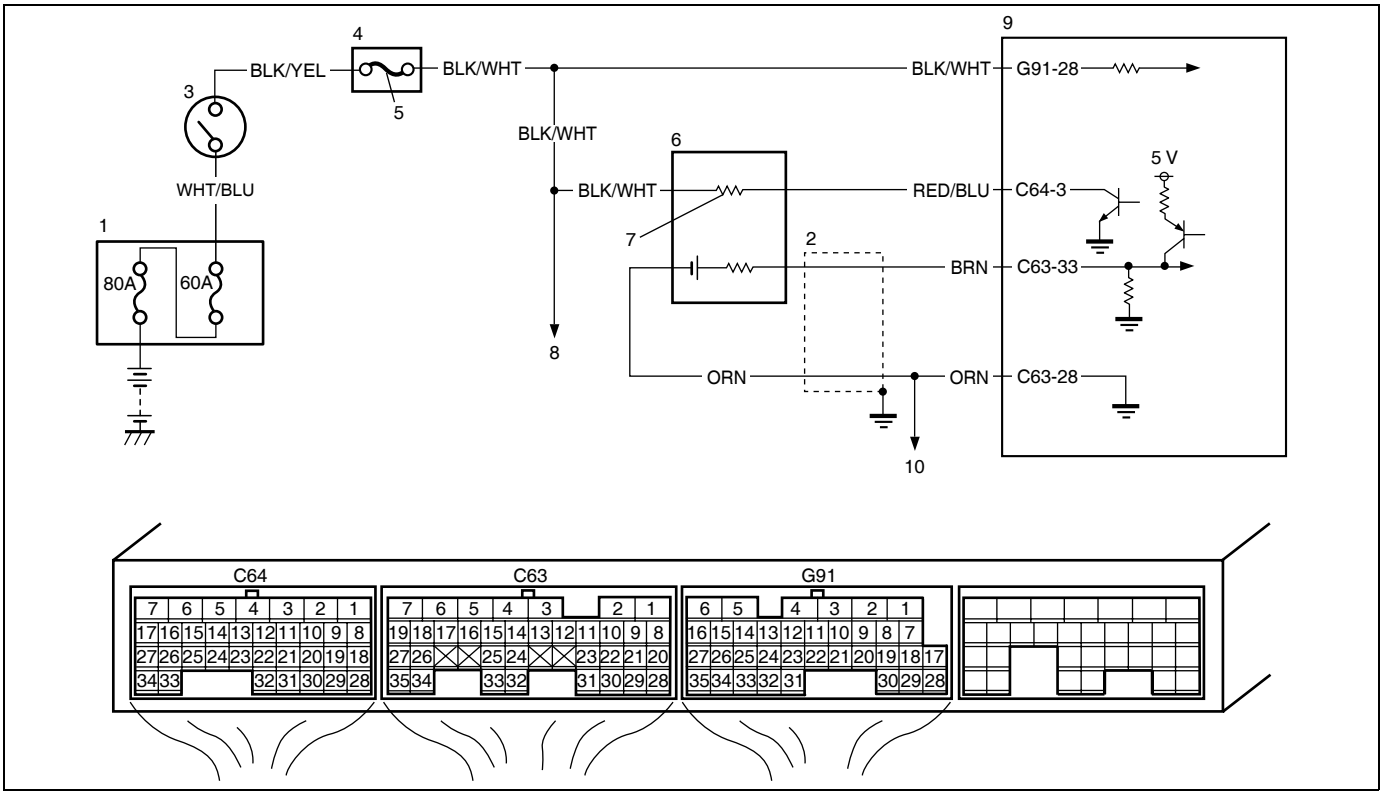
Step	Action	Yes	No
8	Check HO2S–1 heater power circuit. 1) Disconnect connector from ECM with ignition switch turned OFF. 2) Connect connector to HO2S–1 with ignition switch turned OFF. 3) Measure resistance between “C64-4” wire and “G91-28” wire terminals of ECM connector. It resistance below 12 Ω?	HO2S–1 heater circuit are OK. Substitute a known-good ECM and recheck.	“BLK/WHT” wire high resistance circuit.



[A]: Fig. 1 for Step 7

DTC P0137 O2 Sensor (HO2S) Circuit Low Voltage (Sensor-2)
DTC P0138 O2 Sensor (HO2S) Circuit High Voltage (Sensor-2)

WIRING DIAGRAM



1. Relay/fuse box	4. Circuit fuse box	7. Heater	10. To other sensor
2. Shield wire	5. "IG" fuse	8. To HO2S–1 heater	
3. Ignition switch	6. HO2S–2	9. ECM	

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC P0137: The voltage of HO2S–2 sensor is more than 4.5 V with HO2S–2 heater ON. DTC P0138: When the minimum voltage of HO2S–2 sensor is more than 0.4 V or the average voltage of the sensor is more than 0.9 V, DTC P0138 is detected after the following driving sequence. 1) Drive the vehicle with the speed of 80 km/h (50 mile/h) at 5th gear or D range. 2) Release the accelerator pedal for more than 4 seconds. 3) Stop the vehicle at the idle state for 6 seconds. (2 driving cycle detection logic)	• HO2S–2 • HO2S–2 circuit • Fuel system • ECM • Fuel shortage

DTC CONFIRMATION PROCEDURE

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 person, a driver and tester, on a level road.**

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –7°C, 19.4°F or higher**
- **Engine coolant temp.: –7°C, 19.4°F or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Increase vehicle speed to 60 – 80 km/h (37 – 50 mile/h) at 5th gear or D range.
5) Release accelerator pedal and with engine brake applied, keep vehicle coasting (with fuel cut for 4 sec. or more), then stop vehicle and run engine at idle speed for 6 sec. or more.
6) Repeat Step 4).
7) Keep above vehicle speed for 8 min. or more. (Throttle valve opening is kept constant in this Step.)
8) Repeat Step 5).
9) Check DTC and pending DTC.

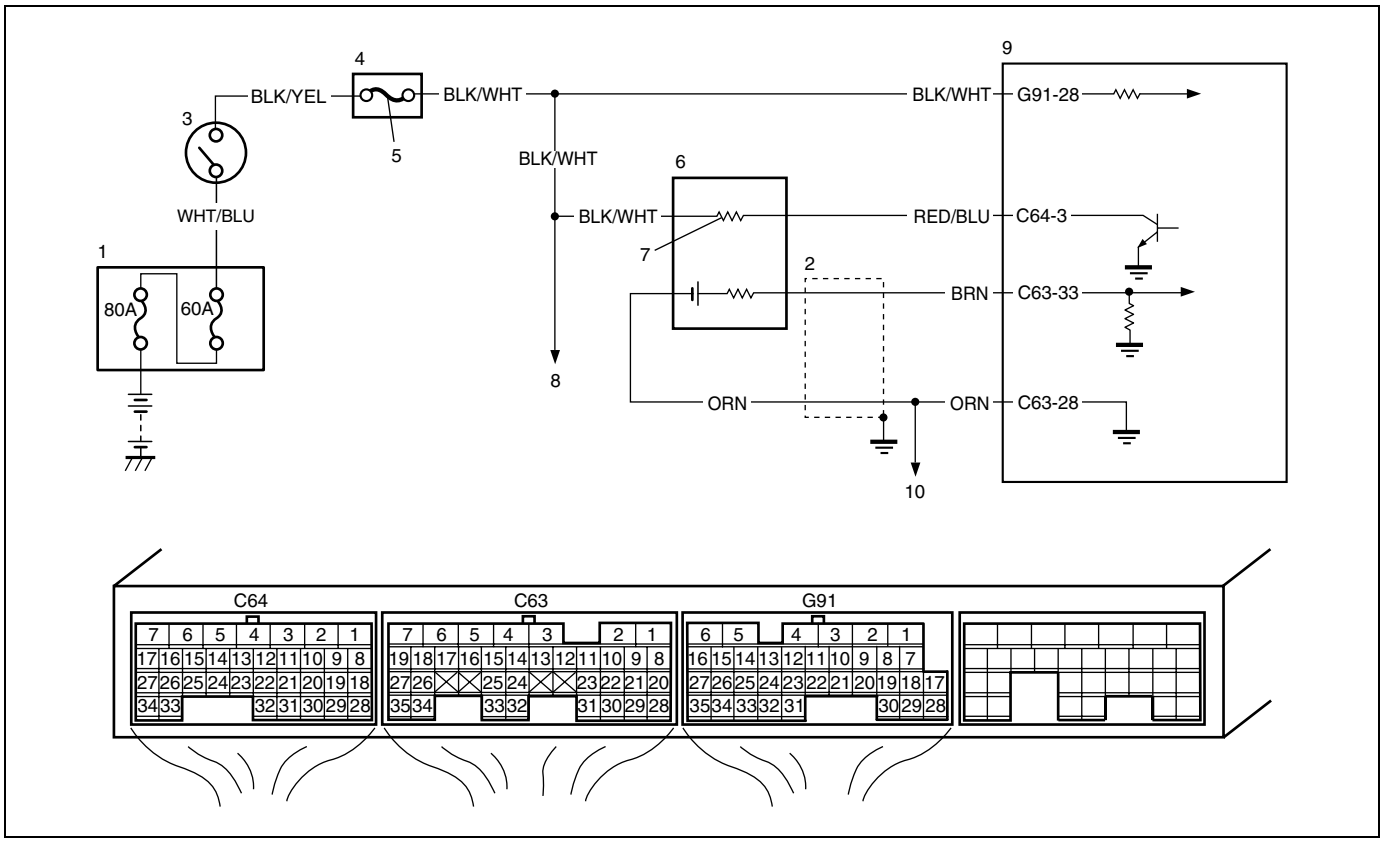
TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Is there DTC(s) other than fuel system (DTC P0171/P0172) and HO2S–2 (DTC P0134)?	Go to applicable DTC diag. flow table.	Go to Step 3.
3	Check HO2S–2 and its circuit. 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously and take foot off from pedal to enrich and enlean A/F mixture). Does HO2S–2 output voltage indicate deflect between over 0.35 V and below 0.25 V?	Go to DTC P0171 and P0172 diag. flow table (Fuel System Check).	Go to Step 4.
4	Check HO2S–2 sensor ground. 1) Disconnect connector from HO2S–2 sensor with ignition switch turned OFF. 2) Check for proper connection to HO2S–2 sensor connector at “BRN”, “ORN”, “RED/BLU” and “BLK/WHT” wire terminals. 3) If wire and connection are OK, check there is continuity between “ORN” wire terminal of HO2S–2 sensor connector and engine ground. Is it continuity?	Go to Step 5.	“ORN” wire open circuit. Poor “C63-28” terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.

Step	Action	Yes	No
5	Check HO2S–2 sensor ground. 1) With ignition switch turn ON, check voltage between “ORN” wire terminal of HO2S–2 sensor connector and engine ground. Is voltage about 0.1 V or less?	Go to Step 6.	“ORN” wire high resistance circuit. Poor “C63-28” terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.
6	Check wire circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and connect connectors to ECM. 3) Measure resistance between “BRN” wire terminal of HO2S–2 sensor connector and “C63-33” wire terminal of ECM connector. Is resistance less than 5 Ω?	Go to Step 7.	“WHT” wire high resistance circuit or open circuit. Poor “C63-33” terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.
7	Check wire circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “BRN” wire terminal of HO2S–2 sensor connector and body ground. Is resistance infinity?	Go to Step 8.	“BRN” wire shorted to ground circuit.
8	Check HO2S–2 signal circuit. 1) Measure voltage between “BRN” wire terminal of HO2S–2 sensor connector and vehicle body ground. Is voltage 0 V?	Go to Step 9.	“BRN” wire shorted to others circuit.
9	Check HO2S–2 heater circuit. 1) Check HO2S–2 heater circuit, referring to “DTC P0037 HO2S Heater Control Circuit Low (Sensor-2) DTC P0038 HO2S Heater Control Circuit High (Sensor-2)”. Is circuit in good condition?	Go to Step 10.	Repair or replace it.
10	Check exhaust system. 1) Check exhaust system for exhaust gas leakage. Is it OK?	Go to Step 4 in DTC P0171 and P0172 diagnosis flow table. If it is in good condition, go to Step 11.	Repair exhaust system for leakage.
11	Check air intake system. 1) Check air intake system for clog or leak. Is it OK?	Check HO2S–2 sensor, referring to “Heated oxygen sensor (HO2S-1 and HO2S-2) heater on-vehicle inspection” in Section 6E1. If it is in good condition, substitute a known-good ECM and recheck.	Repair or replace.

DTC P0037 HO2S Heater Control Circuit Low (Sensor-2)
DTC P0038 HO2S Heater Control Circuit High (Sensor-2)

WIRING DIAGRAM



1. Relay/fuse box	4. Circuit fuse box	7. Heater	10. To other sensor
2. Shield wire	5. "IG" fuse	8. To HO2S–1 heater	
3. Ignition switch	6. HO2S–2	9. ECM	

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Current of HO2S–2 heater is more than specified value or less than specified value for 3 seconds continuously (2 driving cycle detection logic)	• HO2S–2 heater • HO2S–2 heater circuit • ECM

DTC CONFIRMATION PROCEDURE

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 person, a driver and tester, on a level road.**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Run engine at idle speed for 1 min.
5) Check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Check HO2S–2 heater power circuit. 1) Disconnect connector from HO2S–2 sensor with ignition switch turned OFF. 2) Check for proper connection to HO2S–2 sensor at “BLK/WHT” and “RED/BLU” wire terminals. 3) If wire and connection are OK, measure voltage between “BLK/WHT” wire terminal of HO2S–2 sensor connector and engine ground with ignition switch turned ON. Is voltage over 10 V?	Go to Step 3.	“BLK/WHT” wire open circuit or shorted to ground circuit.
3	Check HO2S–2 heater power circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “BLK/WHT” wire terminal of HO2S–2 sensor connector and “G91-28” terminal wire of ECM connector. Is resistance below 5 Ω?	Go to Step 4.	“BLK/WHT” wire high resistance circuit.
4	Check HO2S–2 heater drive circuit. 1) Measure resistance between “RED/BLU” wire terminal of HO2S–2 sensor connector and vehicle body ground. Is resistance infinity?	Go to Step 5.	“RED/BLU” wire shorted to ground circuit.
5	Check HO2S–2 heater drive circuit. 1) Turn ON ignition switch. 2) Measure voltage between “RED/BLU” wire terminal of HO2S–2 sensor connector and vehicle body ground. Is voltage 0 V?	Go to Step 6.	“RED/BLU” wire shorted to power circuit.
6	Check HO2S–2 heater drive circuit. 1) Connect connector to HO2S–2 with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between “C64-3” wire terminal of disconnected ECM connector and vehicle body ground. Is voltage over 10 V?	Go to Step 7.	“RED/BLU” wire open circuit.
7	Check heater of sensor–2. 1) Disconnect HO2S–2 coupler with ignition switch turned OFF. 2) If OK, then check heater resistance. Is it 11.7 – 14.3 Ω at 20°C, 68°F?	Go to Step 8.	Replace HO2S–2.

Step	Action	Yes	No
8	Check HO2S–2 heater power circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Connect connector to HO2S–2 with ignition switch turned OFF. 3) Measure resistance between “C64-3” and “G91-28” wire terminals of ECM connector. Is resistance below 30 Ω?	HO2S–2 heater circuit are OK. Substitute a known-good ECM and recheck.	“RED/BLU” wire high resistance circuit.

DTC P0171 System Too Lean
DTC P0172 System Too Rich

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
P0171: Total fuel trim is higher than 43%. P0172: Total fuel trim is lower than –30%. (2 driving cycle detection logic)	• Vacuum leaks • Exhaust gas leakage • Fuel pressure out of specification • Fuel injector malfunction • Heated oxygen sensor–1 malfunction • MAF sensor malfunction • ECT sensor malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 person, a driver and tester, on a level road.**

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –7°C (19.4°F) or higher**
- **Engine coolant temp.: –7°C (19.4°F) or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Operate vehicle within freeze frame data condition as noted for 5 min.
5) Stop vehicle and check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Is there DTC(s) other than “P0171” and “P0172”?	Go to applicable DTC flow table.	Go to Step 3.
3	Check intake system and exhaust system for leakage. Are intake system and exhaust system in good condition?	Go to Step 4.	Repair or replace.
4	Check fuel pressure referring to “Table B-3 Fuel Pressure Check” in this section. Is check result satisfactory?	Go to Step 5.	Repair or replace.
5	Check fuel injectors referring to “Fuel injector inspection” in Section 6E1. Is check result satisfactory?	Go to Step 6.	Faulty injector(s) or its circuit.
6	Check fuel level sensor. Is DTC P0463 displayed?	Go to Step 7.	Faulty fuel level sensor or its circuit.
7	Check MAF sensor referring to Step 2 and 3 of “DTC P0101 Mass Air Flow Circuit Range/Performance”. Is check result satisfactory?	Go to Step 8.	Faulty MAF sensor or its circuit.
8	Check ECT sensor referring to Step 3 and 4 of “DTC P0118 Engine Coolant Temperature Circuit High”. Is check result satisfactory?	Go to Step 9.	Faulty ECT sensor or its circuit.
9	Check HO2S–1 referring to Step 2 of “DTC P0131 O2 Sensor (HO2S) Circuit Low Voltage (Sensor-1)”. Is check result satisfactory?	Substitute a known-good ECM and recheck.	Faulty HO2S–1 or its circuit.

DTC P0300 Random Misfire Detected
DTC P0301 Cylinder 1 Misfire Detected
DTC P0302 Cylinder 2 Misfire Detected
DTC P0303 Cylinder 3 Misfire Detected
DTC P0304 Cylinder 4 Misfire Detected

SYSTEM DESCRIPTION

ECM measure the angle of the crankshaft based on the pulse signal from the CKP sensor and CMP sensor for each cylinder. If it detects a large change in the angle speed of the crankshaft, it concludes occurrence of a misfire. When the number of misfire is counted by ECM beyond the DTC detecting condition, it determine the cylinder where the misfire occurred and output it as DTC.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
P0300 • Misfire, which causes catalyst to overheat during 200 engine revolutions, is detected at 2 or more cylinders. (MIL flashes as long as this misfire occurs continuously.) or • Misfire, which affects exhaust emission adversely during 1000 engine revolution, is detected at 2 or more cylinders. (2 driving cycle detection logic)	• Ignition system • Fuel injector and its circuit • Fuel pressure • EGR system • Fuel level sensor • Abnormal air drawn in • Engine compression • Valve lash adjuster • Valve timing • Fuel shortage
P0301, P0302, P0303, P0304 • Misfire, which causes catalyst to overheat during 200 engine revolutions, is detected at 1 cylinder. (MIL flashes as long as this misfire occurs continuously.) or • Misfire, which affects exhaust emission adversely during 1000 engine revolution, is detected at 1 cylinder. (2 driving cycle detection logic)	

DTC CONFIRMATION PROCEDURE

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 person, a driver and tester, on a level road.**

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –7°C, 19.4°F or higher**
- **Engine coolant temp.: –7°C (19.4°F) or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Drive vehicle under freeze frame data condition as noted for 1 min. or more.
4) Stop vehicle and check DTC and pending DTC.

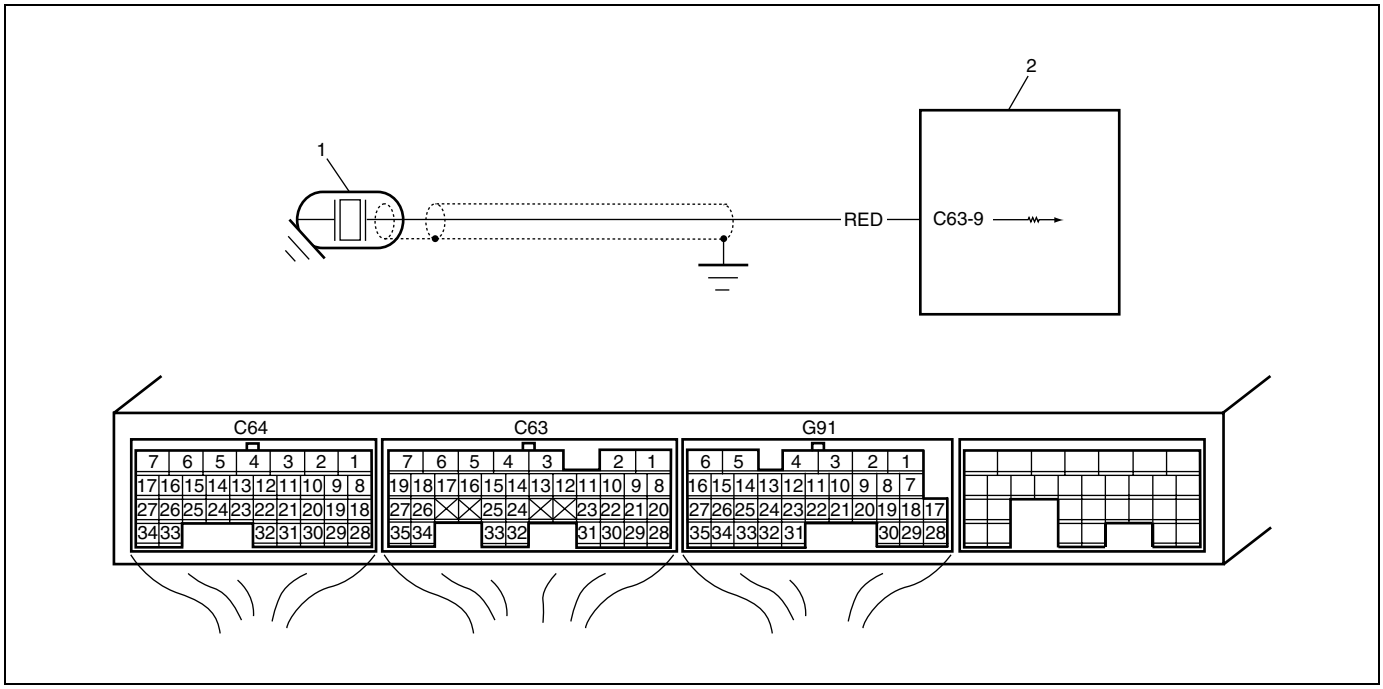
TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Does fuel level meter indicate “E” level (empty)?	Add fuel and recheck.	Go to Step 3.
3	Ignition system inspection. 1) Check spark plug and ignition spark of cylinder where misfire occurs, referring to “Spark Plugs Inspection” and “Ignition Spark Test” in Section 6F1. Is it in good condition?	Go to Step 4.	Faulty ignition coil, wire harness, spark plug or other system parts.
4	Fuel injector circuit check. 1) Using sound scope, check each injector operating sound at engine cranking or idling. Do all injectors make operating sound?	Go to Step 5.	Check coupler connection and wire harness of injector not making operating sound and injector itself. If OK, substitute a known-good ECM and recheck.
5	Fuel pressure inspection. 1) Check fuel pressure referring to “Table B-3 Fuel Pressure Check” in this section. Is check result satisfactory?	Go to Step 6.	Repair or replace.
6	Fuel injector inspection. 1) Check fuel injector(s) referring to “Fuel injector inspection” in Section 6E1. Is check result satisfactory?	Go to Step 7.	Replace.
7	Ignition timing inspection. 1) Check ignition timing referring to “Ignition Timing Inspection” in Section 6F1. Is check result satisfactory?	Go to Step 8.	Check related sensors.
8	EGR system inspection. 1) Check EGR system referring to “EGR valve inspection” in Section 6E1. Is check result satisfactory?	Go to Step 9.	Repair or replace.
9	Fuel level sensor inspection. 1) Check fuel level sensor referring to Step 2 of “DTC P0462 Fuel Level Sensor Circuit Low”. Is check result satisfactory?	Go to Step 10.	Repair or replace.

Step	Action	Yes	No
10	Engine mechanical systems check. Check engine mechanical parts or system which can cause engine rough idle or poor performance. – Engine compression (Refer to “Compression Check” in Section 6A1.) – Valve lash adjustor (Refer to “Valve Lash (Clearance) Inspection” in Section 6A1.) – Valve timing (Refer to “Timing Chain and Chain Tensioner Removal and Installation” in Section 6A1.) Are they in good condition?	Check wire harness and connection of ECM ground, ignition system and fuel injector for intermittent open and short.	Repair or replace.

DTC P0327 Knock Sensor Circuit Low
DTC P0328 Knock Sensor Circuit High

WIRING DIAGRAM



1. Knock sensor	2. ECM

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC will be set when all of the following conditions are detected for 5 seconds continuously. P0327 • Engine is running • Voltage of knock sensor is less than 0.9 V P0328 • Engine is running • Voltage of knock sensor is 4 V or more	• Open or short in knock sensor circuit • Knock sensor • ECM

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

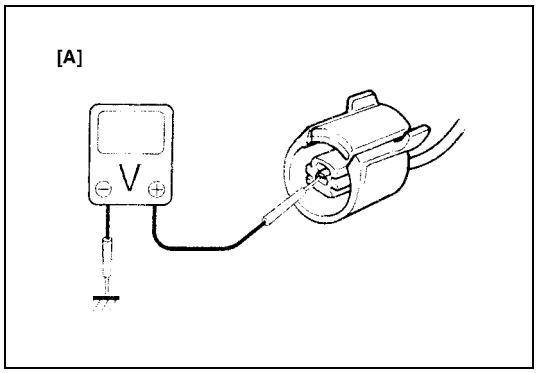
- **Intake air temp.: –7°C (19.4°F) or higher**
- **Engine coolant temp.: –7°C (19.4°F) or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC by using scan tool.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Check sensor circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and connect connectors to ECM. 3) Measure voltage between “C63-9” wire terminal of ECM connector and vehicle body ground with engine running. Is voltage within 0.9 – 4 V?	Intermittent trouble. Check for intermittent refer to “Intermittent and Poor Connection” in Section 0A. If OK, substitute a known-good ECM and recheck.	Go to Step 3.
3	Check sensor circuit for open. 1) Disconnect connector from knock sensor with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between “RED” wire of knock sensor connector and engine ground. See Fig. 1. Is voltage 4 – 6 V?	Go to Step 6.	Go to Step 4.
4	Check sensor circuit for open. 1) Turn ON ignition switch, measure voltage between “C63-9” wire terminal of ECM connector and engine ground. Is voltage 4 – 6 V?	“RED” wire in open circuit.	Go to Step 5.
5	Check sensor circuit for short. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “C63-9” terminal of ECM connector and vehicle body ground. Is resistance infinity?	Go to Step 6.	“RED” wire in shorted to ground circuit. If wire is OK, substitute a known-good ECM and recheck.

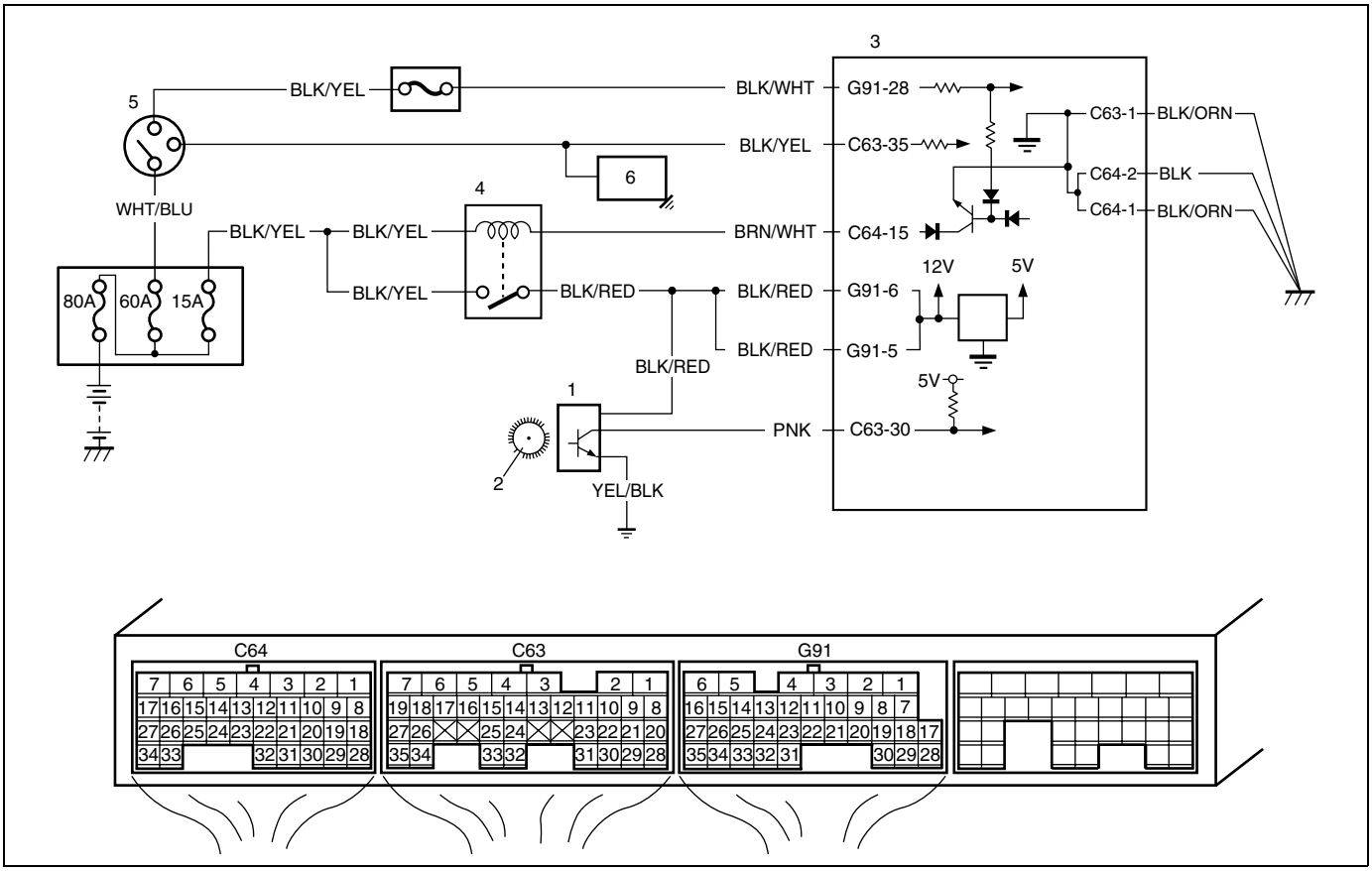
Step	Action	Yes	No
6	Check sensor circuit for short. 1) Turn ON ignition switch, measure voltage between “C63-9” terminal of ECM connector and vehicle body ground. Is voltage 0 V?	Go to Step 7.	“RED” wire in shorted to other circuit.
7	Check sensor circuit for high resistance. 1) Measure resistance between “C63-9” wire terminal of ECM connector and “RED” wire terminal of knock sensor harness connector. Is resistance below 5Ω?	Faulty knock sensor	“RED” wire in high resistance circuit.



[A]: Fig. 1 for Step 3

DTC P0335 Crankshaft Position (CKP) Sensor Circuit

WIRING DIAGRAM



1. CKP sensor	4. Main relay
2. Sensor plate on crankshaft	5. Ignition switch
3. ECM	6. Starting motor

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
No CKP sensor signal for 3 seconds at engine cranking while starting motor signal is inputting	• CKP sensor circuit open or short • Crankshaft timing pulley teeth damaged • CKP sensor malfunction, foreign material being attached or improper installation • ECM • Engine start signal circuit malfunction

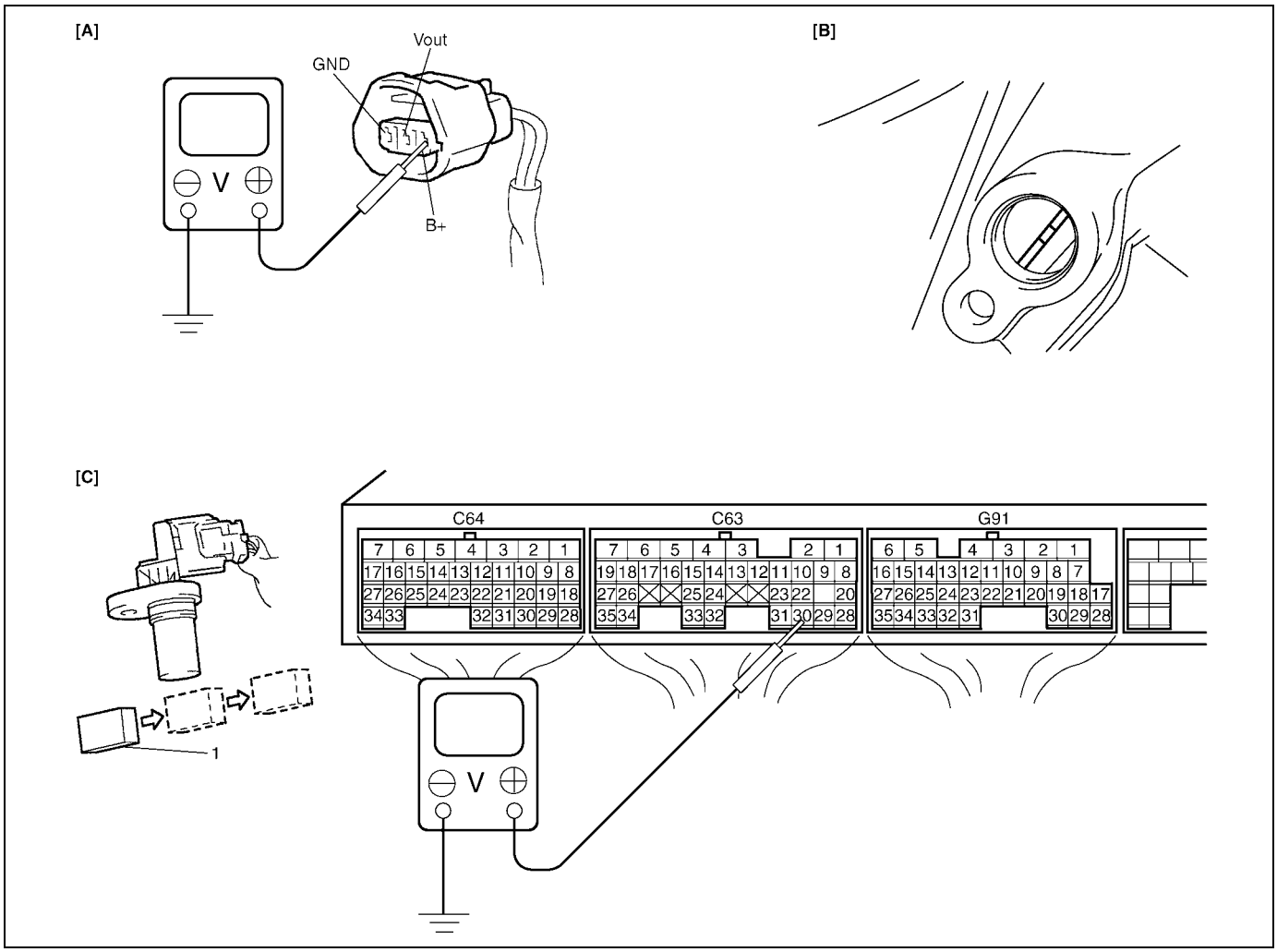
DTC CONFIRMATION PROCEDURE

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Crank engine for 3 – 5 sec.
4) Check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Check CKP sensor and connector for proper installation. Is CKP sensor installed properly and connector connected securely?	Go to Step 3.	Correct.
3	Check Wire Harness and Connection. 1) Disconnect connector from CKP sensor. 2) Check for proper connection to CKP sensor at “BLK/RED”, “PNK” and “YEL/BLK” wire terminals. 3) If OK, turn ignition switch ON and check for voltage at “BLK/RED”, “PNK” and “YEL/BLK” wire terminals of disconnected CKP sensor connector. See Fig. 1. Terminal “B+”: 10 – 14 V Terminal “Vout”: 4 – 5 V Terminal “GRD”: 0 V Is check result satisfactory?	Go to Step 5.	Go to Step 4.
4	Was terminal “Vout” voltage in Step 3 out of specification?	“PNK” wire open, short or poor connection. If wire and connection are OK, substitute a known-good ECM and recheck.	“BLK/RED” and “YEL/BLK” wire open, short or poor connection.
5	Check Ground Circuit. 1) Turn ignition switch to OFF position. 2) Measure resistance between “YEL/BLK” wire terminal of CKP sensor connector and engine ground. Is resistance below 5 Ω?	Go to Step 6.	“YEL/BLK” wire open or high resistance.
6	Check Engine Start Signal. 1) Check voltage between “C63-35” wire terminal of ECM connector and engine ground with engine cranking. Does it voltage more than 6 V?	Go to Step 7.	“BLK/YEL” wire circuit open, high resistance or shorted to ground. If wire are OK, check starting motor referring to “Starting Motor Inspection” in Section 6G.

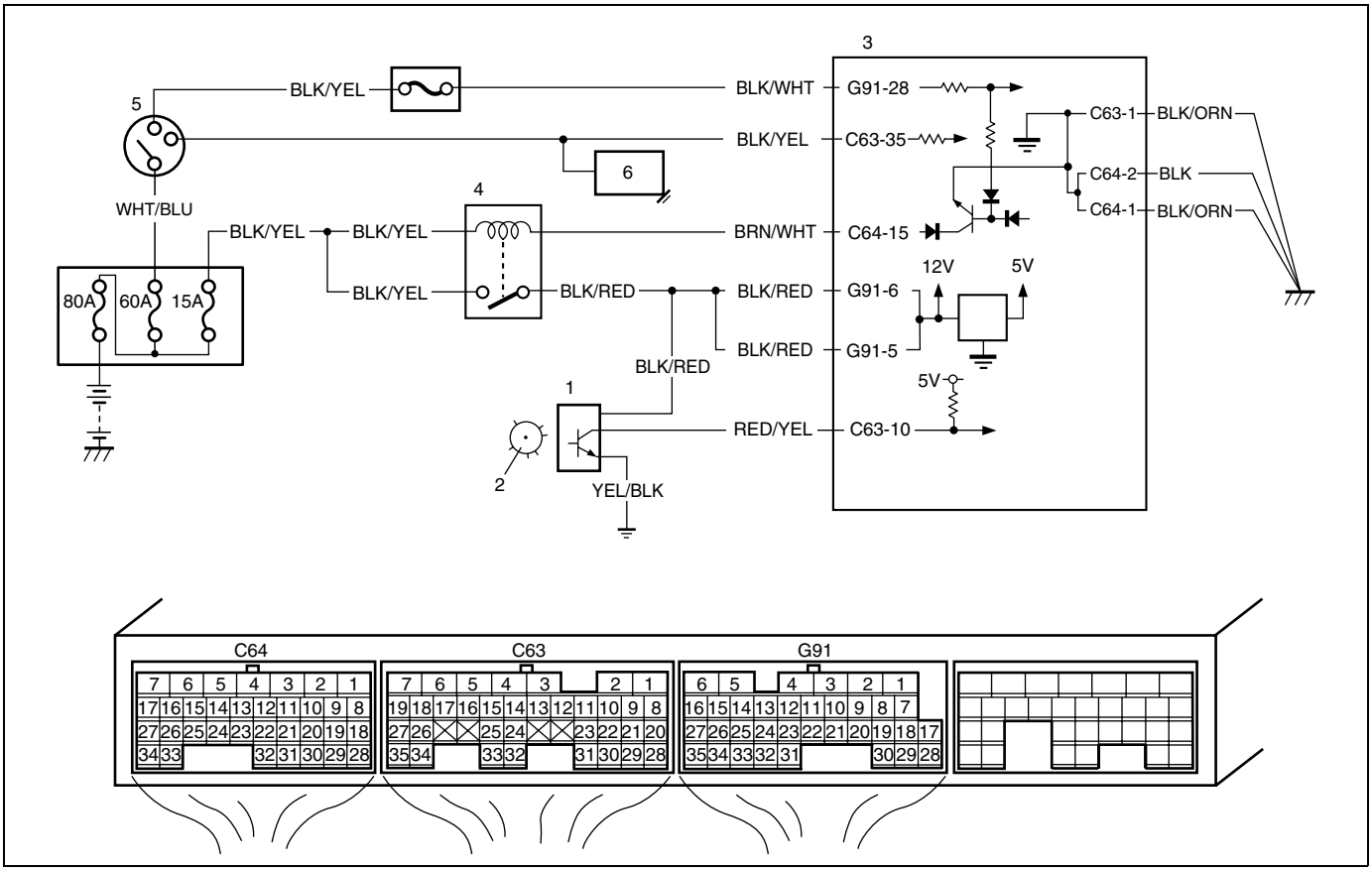
Step	Action	Yes	No
7	Check CKP Sensor. 1) Remove CKP sensor referring to “Crankshaft position sensor (CKP sensor) removal and installation” in Section 6E1. 2) Remove metal particles on end face of CKP sensor, if any. 3) Connect CKP sensor connector. 4) Turn ignition switch to ON position. 5) Check voltage between “C63-30” wire terminal of ECM connector and engine ground by passing magnetic substance (iron) (1) while keeping approx. 1 mm (0.03 in.) gap with respect to end face of CKP sensor. See Fig. 2. Does voltage vary from low (0 – 1 V) to high (4 – 5 V) or from high to low?	Go to Step 8.	Replace CKP sensor.
8	Check signal rotor for the following. See Fig. 3. • Damage • No foreign material attached Is it in good condition?	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Clean rotor teeth or replace signal rotor.



[A]: Fig. 1 for Step 3	[B]: Fig. 3 for Step 8	[C]: Fig. 2 for Step 7

DTC P0340 Camshaft Position Sensor Circuit

WIRING DIAGRAM



1. CMP sensor	3. ECM	5. Ignition switch
2. Signal rotor	4. Main relay	6. Starting motor

SYSTEM DESCRIPTION

The CMP sensor located on the transmission side of cylinder head consists of the signal generator (magnetic sensor) and signal rotor (intake camshaft portion).
The signal generator generates Reference signal through slits in the slit plate which turns together with the camshaft.

Reference signal

The CMP sensor generates 6 pulses of signals each of which has a different waveform length while the camshaft makes one full rotation. Refer to “Inspection of ECM and Its Circuits” in this section.
Based on these signals, ECM judges which cylinder piston is in the compression stroke and the engine speed.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
No CMP sensor signal for 3 seconds at engine cranking while starting motor signal is inputting	• CMP sensor circuit open or short • Signal rotor teeth damaged • CMP sensor malfunction, foreign material being attached or improper installation • ECM • Engine start signal circuit malfunction

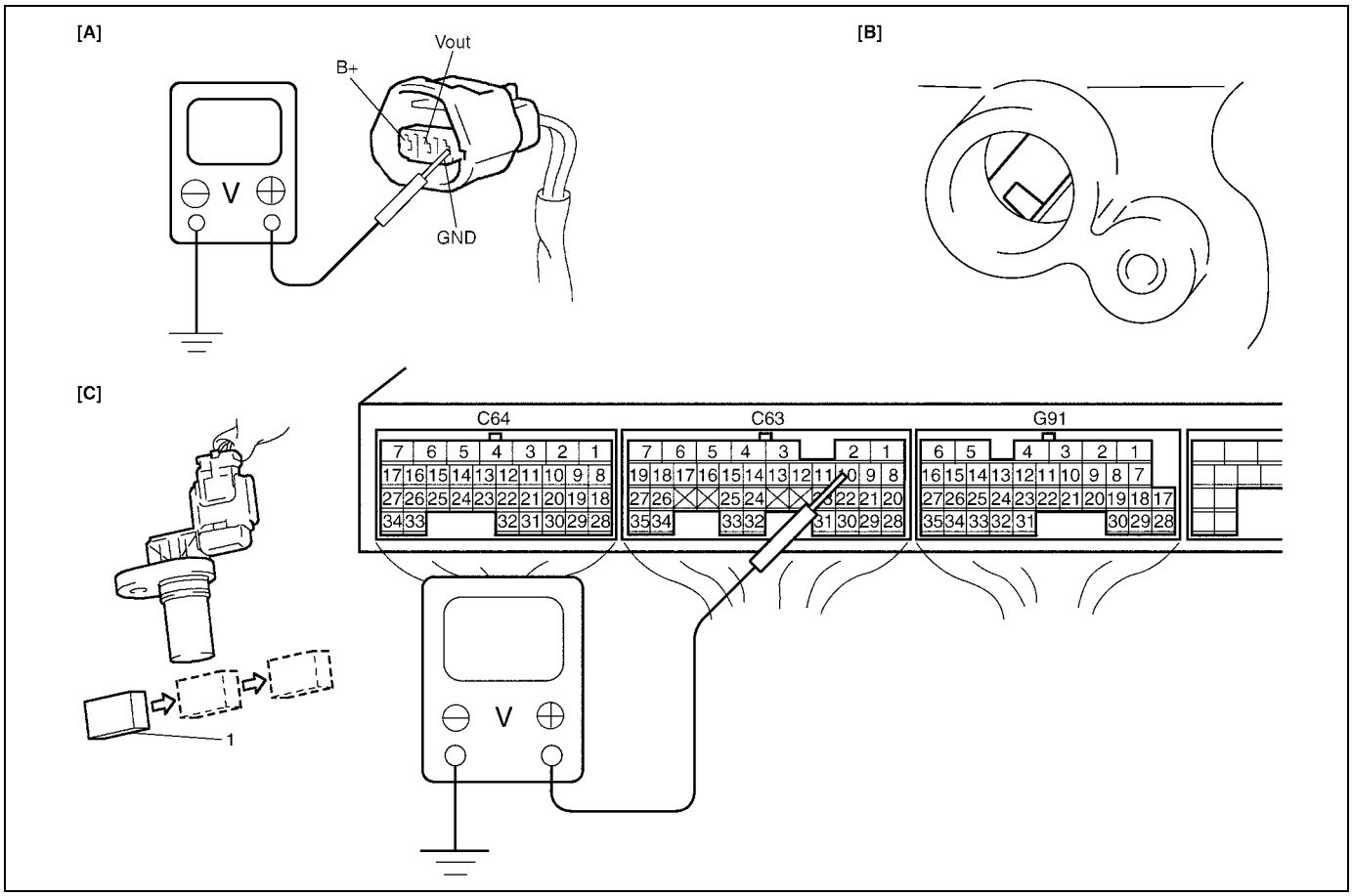
DTC CONFIRMATION PROCEDURE

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Crank engine for 5 sec.
4) Check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Check CMP sensor and connector for proper installation. Is CMP sensor installed properly and connector connected securely?	Go to Step 3.	Correct.
3	Check Wire Harness and Connection. 1) Disconnect connector from CMP sensor. 2) Check for proper connection to CMP sensor at “BLK/RED”, “RED/YEL” and “YEL/BLK” wire terminals. 3) If OK, turn ignition switch ON and check for voltage at “BLK/RED”, “RED/YEL” and “YEL/BLK” wire terminals of disconnected CMP sensor connector. See Fig. 1. Terminal “B+”: 10 – 14 V Terminal “Vout”: 4 – 5 V Terminal “GRD”: 0 V Is check result satisfactory?	Go to Step 5.	Go to Step 4.
4	Was terminal “Vout” voltage in Step 3 out of specification?	“RED/YEL” wire open, short or poor connection. If wire and connection are OK, substitute a known-good ECM and recheck.	“BLK/RED” and “YEL/BLK” wire open, short or poor connection.
5	Check Ground Circuit. 1) Turn ignition switch to OFF position. 2) Check for continuity between “YEL/BLK” wire terminal of CKP sensor connector and engine ground. Is continuity indicated?	Go to Step 6.	“YEL/BLK” wire open or poor connection.
6	Check Engine Start Signal. 1) Check voltage between “C63-35” wire terminal of ECM connector and engine ground with engine cranking. Does it voltage more than 6 V?	Go to Step 7.	“BLK/YEL” wire circuit open or shorted to ground. If wire are OK, check starting motor referring to “Starting Motor Inspection” in Section 6G.

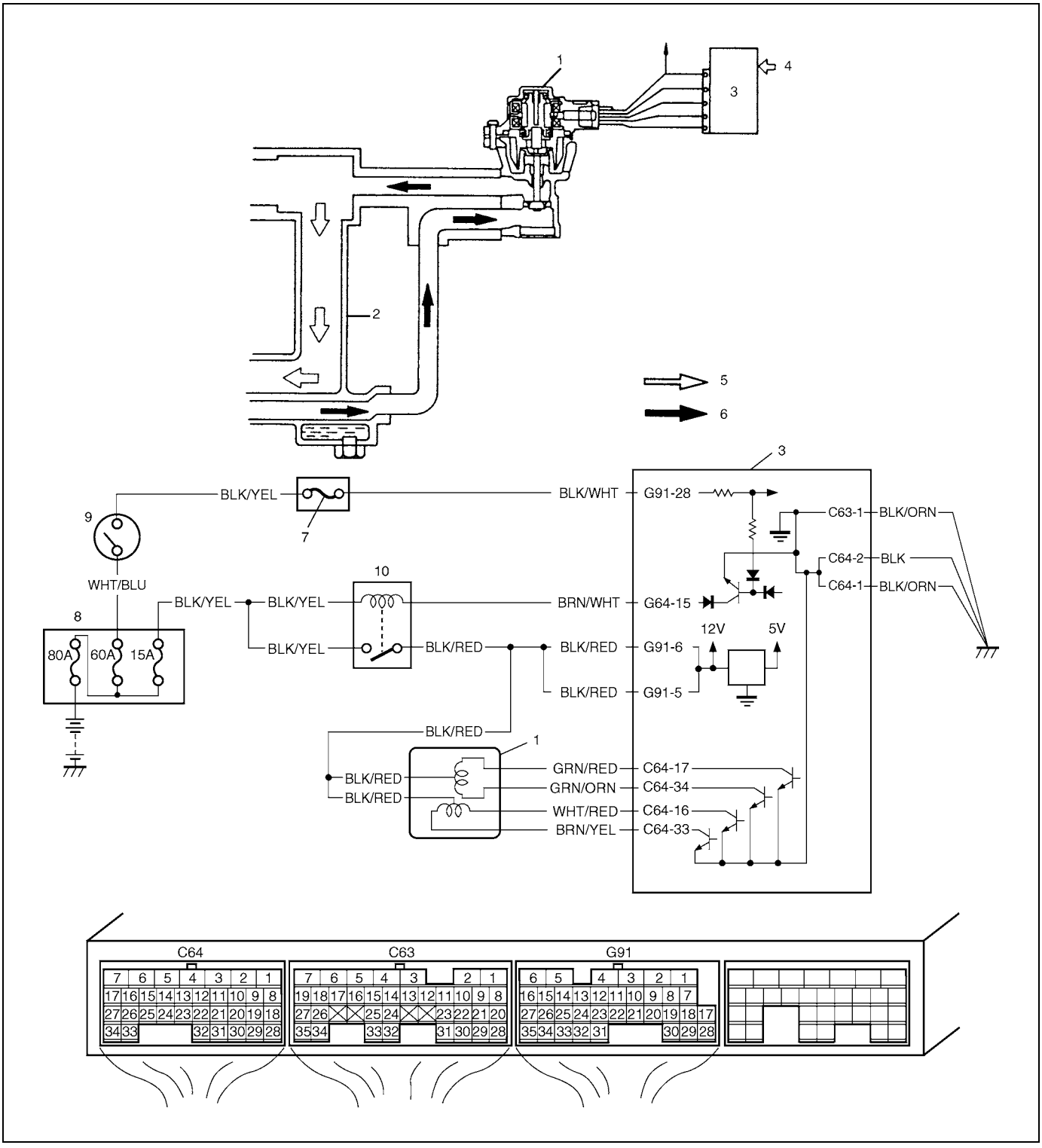
Step	Action	Yes	No
7	Check CMP Sensor. 1) Remove CMP sensor referring to “Camshaft position sensor (CMP sensor) removal and installation” in Section 6E1. 2) Remove metal particles on end face of CMP sensor, if any. 3) Connect CMP sensor connector. 4) Turn ignition switch to ON position. 5) Check voltage between “C63-10” wire terminal of ECM connector and engine ground by passing magnetic substance (iron) (1) while keeping approx. 1 mm (0.03 in.) gap with respect to end face of CMP sensor. See Fig. 2. Does voltage vary from low (0 – 1 V) to high (4 – 5 V) or from high to low?	Go to Step 8.	Replace CMP sensor.
8	Check signal rotor for the following. See Fig. 3. • Damage • No foreign material attached Is it in good condition?	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Clean rotor teeth or replace signal rotor.



[A]: Fig. 1 for Step 3	[B]: Fig. 3 for Step 8	[C]: Fig. 2 for Step 7

DTC P0401 Exhaust Gas Recirculation Flow Insufficient Detected
DTC P0402 Exhaust Gas Recirculation Flow Excessive Detected

SYSTEM/WIRING DIAGRAM



1. EGR value	4. Sensed information	7. "IG" fuse	10. Main relay
2. Intake manifold	5. Fresh air	8. Relay/fuse box	
3. ECM	6. Exhaust gas	9. Ignition switch	

DTC DETECTING CONDITION AND TROUBLE AREA (DTC P0401/P0402)

DTC DETECTING CONDITION	TROUBLE AREA
DTC P0401: Difference in intake manifold absolute pressure between opened EGR valve and closed EGR valve is smaller than specified value. DTC P0402: Difference in intake manifold absolute pressure between opened EGR valve and closed EGR valve is larger than specified value. (2 driving cycle detection logic)	• EGR valve • EGR passage • MAP sensor • ECM

DTC CONFIRMATION PROCEDURE (DTC P0401/P0402)

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –7°C (19.4°F) or higher**
- **Engine coolant temp.: –7°C (19.4°F) or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Increase engine speed to 3000 rpm in 3rd gear.
5) Release accelerator pedal and with engine brake applied, keep vehicle coasting for 5 sec. or more. (Keep fuel cut condition for 5 sec. or more) If fuel cut condition is not kept for 5 sec. or more, coast down a slope in engine speed 1000 – 3000 rpm for 5 sec. or more.
6) Step vehicle and run engine at idle.
7) Check DTC and pending DTC by using scan tool.

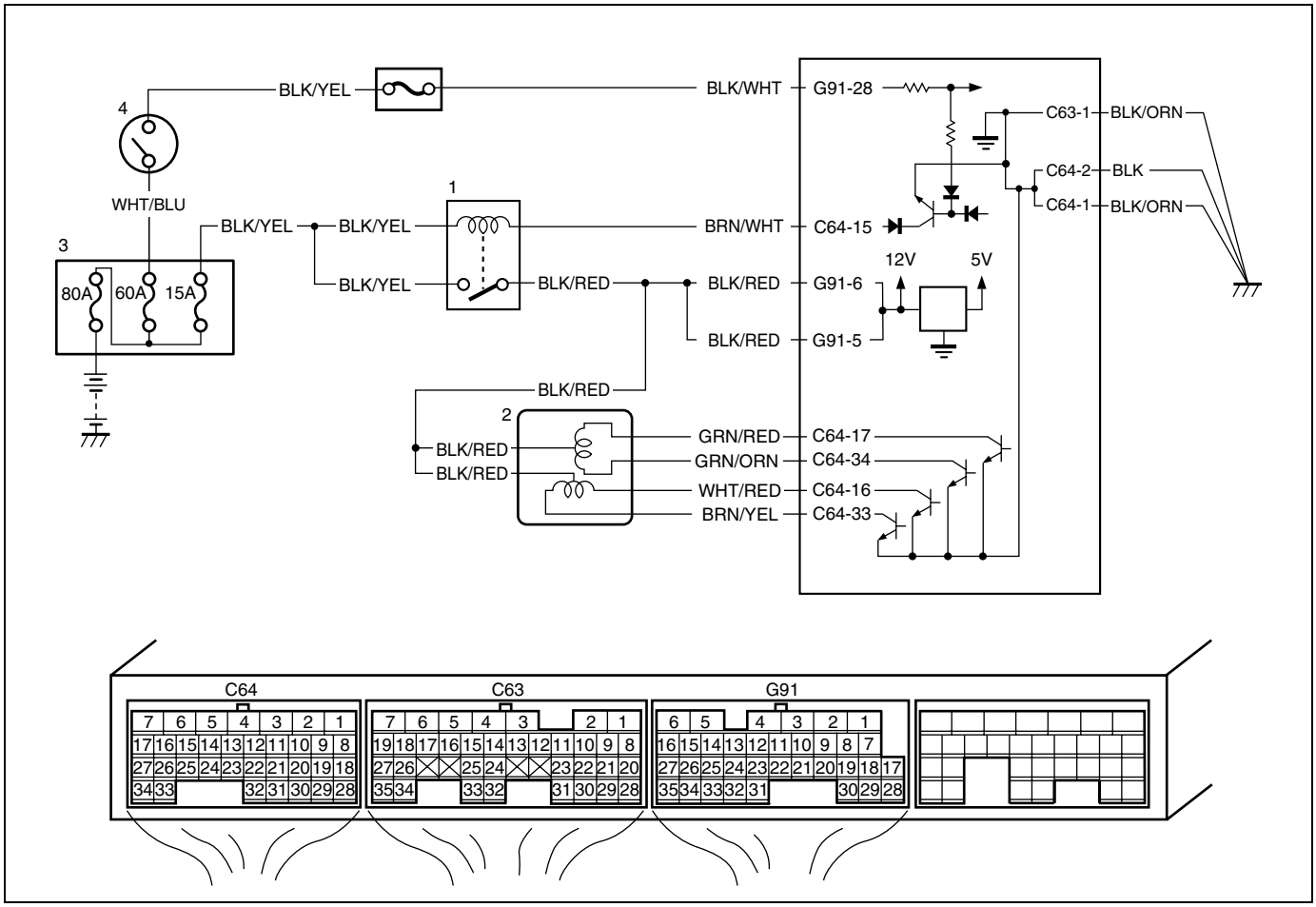
TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	EGR valve operation check. 1) With ignition switch turned OFF, install Suzuki Scan Tool. 2) Check EGR system referring to “EGR system inspection” in Section 6E1. Is it in good condition?	Go to Step 3.	Go to Step 4.

Step	Action	Yes	No
3	MAP sensor check. 1) Check MAP sensor for performance referring to "MAP Sensor Individual Check" in "DTC P0108 Manifold Absolute Pressure High Input" Diag. Flow Table. Is check result satisfactory?	Intermittent trouble or faulty ECM Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Repair or replace.
4	EGR valve power supply circuit check. 1) With ignition switch turned OFF, disconnect EGR valve coupler. 2) With ignition switch turned ON, check voltage between "BLK/RED" wire terminal of EGR valve coupler and engine ground. Is each voltage 10 – 14 V?	Go to Step 5.	Faulty "BLK/RED" wire.
5	Check wire circuit. 1) Measure voltage between engine ground and each "GRN/RED", "GRN/ORN", "WHT/RED" and "BRN/YEL" wire terminal of EGR valve connector. Is each voltage 0 V?	Go to Step 6.	Some wire shorted to other circuits. If wires are OK, substitute a known-good ECM and recheck.
6	Check wire circuit. 1) With ignition switch turned OFF, check that there are insulating between engine ground and each "GRN/RED", "GRN/ORN", "WHT/RED" and "BRN/YEL" wire terminal of EGR valve connector. Are there insulating?	Go to Step 7.	Some wire shorted to ground circuit. If wires are OK, substitute a known-good ECM and recheck.
7	EGR valve stepping motor coil circuit check. 1) With ignition switch turned OFF, connect EGR valve coupler and disconnect ECM couplers. 2) Check resistance between "G91-5/6" and "C64-17", "C64-34", "C64-16", "C64-33" wire terminal of ECM connector. Is each resistance 20 – 24Ω at 20°C, 68°F.	Go to Step 8.	Faulty "GRN/RED", "GRN/ORN", "WHT/RED" and "BRN/YEL" wire or EGR valve.
8	Check wire circuit. 1) Measure voltage between engine ground and each "GRN/RED", "GRN/ORN", "WHT/RED" and "BRN/YEL" wire terminal of EGR valve connector. Is each voltage 10 – 14 V?	Some wire in high resistance circuit. If wires are good condition, faulty EGR valve.	Some wire open circuit. If wires are good condition, faulty EGR valve.
9	MAP sensor check: 1) Check MAP sensor for performance referring to "MAP Sensor Individual Check" in "DTC P0108" Diag. Flow Table. Is check result satisfactory?	EGR passage clogged or EGR valve malfunction, If all above are OK, substitute known-good ECM and recheck.	Repair or replace.

DTC P0403 Exhaust Gas Recirculation Control Circuit

WIRING DIAGRAM



1. Main relay	2. EGR valve	3. Relay/fuse box	4. Ignition switch

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
EGR valve output voltage is low although ECM commanded EGR valve to turn OFF. (1 driving cycle detection logic)	• EGR valve circuit open • EGR valve • ECM

DTC CONFIRMATION PROCEDURE

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

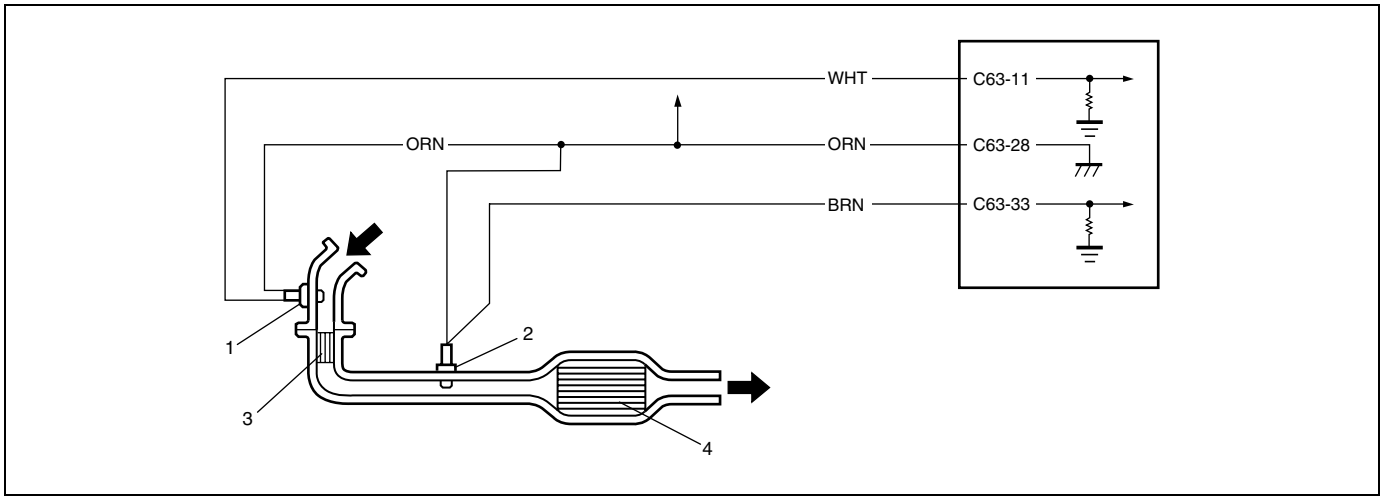
1) With ignition switch turned OFF, connect scan tool to DLC.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm it up to normal operating temperature.
4) Drive vehicle in 2000 – 3500 rpm of engine speed.
5) Keep above vehicle speed for 1 min. (Throttle valve opening is kept constant in this step.)
6) Stop vehicle and check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	EGR valve power supply circuit check. 1) Remove air intake pipe. 2) With ignition switch turned OFF, disconnect EGR valve coupler. 3) With ignition switch turned ON, check voltage between “BLK/RED” wire terminals of EGR valve coupler and body ground. Is check voltage 10 – 14 V?	Go to Step 3.	Faulty “BLK/RED” wire.
3	Check wire circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between engine ground and each “GRN/RED”, “GRN/ORN”, “WHT/RED”, “BRN/YEL” wire terminal of EGR valve connector. Is each voltage 0 V?	Go to Step 4.	Some wire shorted to other circuits. If wires are OK, substitute a known-good ECM and recheck.
4	Check wire circuit. 1) With ignition switch turned OFF, measure resistance between engine ground and each GRN/RED”, “GRN/ORN”, “WHT/RED”, “BRN/YEL” wire terminal of EGR valve connector. Is resistance infinity?	Go to Step 5.	Some wire shorted to ground circuit. If wires are OK, substitute a known-good ECM and recheck.
5	EGR valve stepper motor coil circuit check. 1) With ignition switch turned OFF, connect EGR valve coupler. 2) Check resistance between “G91-5/6” and each “C64-17”, “C64-34”, “C64-16”, “C64-33” wire terminal of ECM connector. Is each resistance 20 – 24 Ω at 20°C, 68°F?	Faulty ECM substitute a known-good ECM and recheck.	Go to Step 6.
6	Check wire circuit. 1) Connect connectors to ECM with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between engine ground and each “GRN/RED”, “GRN/ORN”, “WHT/RED”, “BRN/YEL” wire terminal of EGR valve connector. Is each voltage 10 – 14 V?	Some wire in high resistance circuit. If wires are good condition, faulty EGR valve.	Some wire open circuit. If wires are good condition, faulty EGR valve.

DTC P0420 Catalyst System Efficiency Below Threshold

SYSTEM/WIRING DIAGRAM

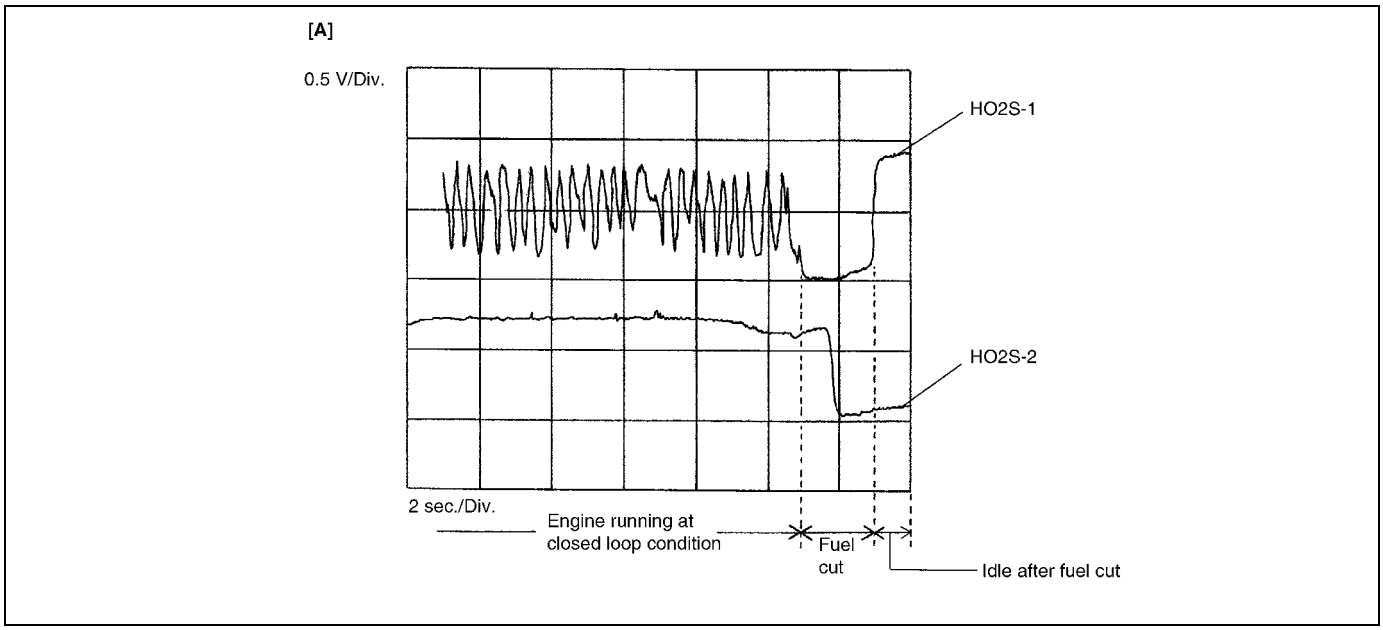


CIRCUIT DESCRIPTION

ECM monitors oxygen concentration in the exhaust gas which has passed the three way catalytic converter by HO2S–2 (2).

When the catalyst is functioning properly, the variation cycle of HO2S–2 (2) output voltage (oxygen concentration) is slower than that of HO2S–1 (1) output voltage because of the amount of oxygen in the exhaust gas which has been stored in warm up three way catalytic converter (4) and three way catalytic converter (4).

REFERENCE



[A]: Oscilloscope Waveforms

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
• While vehicle running at constant speed under other than high load. • Time from rich or lean switching command is output till HO2S–2 output voltage crosses 0.45 V is less than specified value. ✱2 driving cycle detection logic, monitoring once/1 driving	• Exhaust gas leak • Three way catalytic converter malfunction • HO2S–2 malfunction • HO2S–1 malfunction

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –7°C (19.4°F) or higher**
- **Engine coolant temp.: –7°C (19.4°F) or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

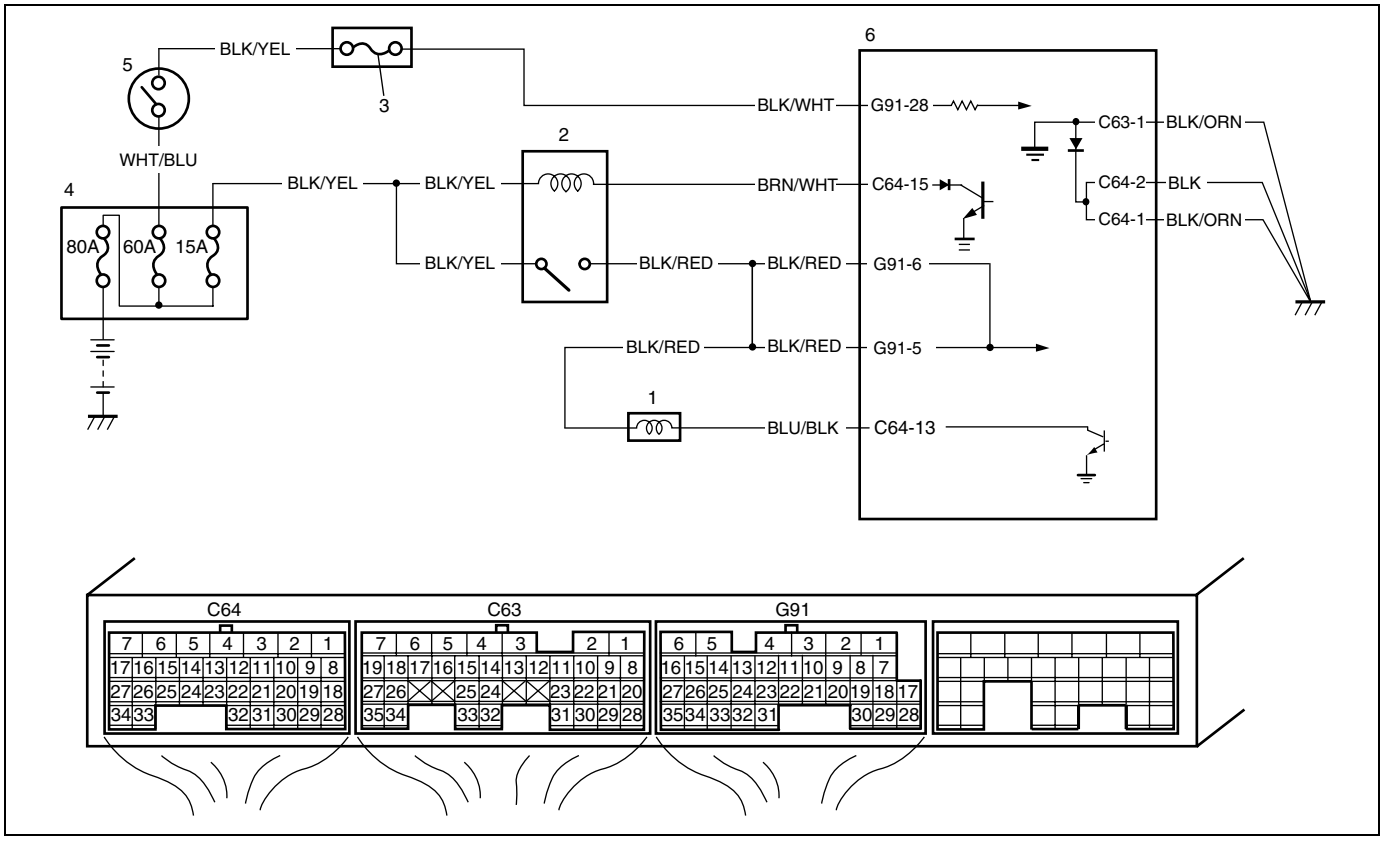
1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Increase vehicle speed to 50 – 60 mph, 80 – 100 km/h. (engine speed: 2500 – 3000 r/min.)
4) Keep above vehicle speed for 10 min. or more (Throttle valve opening is kept constant in this step).
5) Stop vehicle and check if DTC/pending DTC exists using scan tool. If not, check if catalyst monitoring test has completed using scan tool. If not in both of above checks (i.e., no DTC/pending DTC and catalyst monitoring test not completed), check vehicle condition (environmental) and repeat step 3) through 5).

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Exhaust system visual inspection. 1) Check exhaust system for leaks, damage and loose connection. Is it in good condition?	Go to Step 3.	Repair or replace.
3	HO2S–2 output voltage check. 1) Check output voltage of HO2S–2 referring to “DTC P0137 O2 Sensor (HO2S) Circuit Low Voltage (Sensor-2)” or “DTC P0138 O2 Sensor (HO2S) Circuit High Voltage (Sensor-2)”. Is check result satisfactory?	Replace three way catalytic converter.	Check “WHT” and “ORN” wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S–2.

DTC P0443 Evaporative Emission System Purge Control Valve Circuit

WIRING DIAGRAM



1. EVAP canister purge valve	3. "IG" fuse	5. Ignition switch
2. Main relay	4. Relay/fuse box	6. ECM

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Monitor signal of EVAP canister purge valve is different from command signal. (Circuit open or short) (2 driving cycle detection logic)	• EVAP canister purge valve • EVAP canister purge valve circuit • ECM

DTC CONFIRMATION PROCEDURE

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) With ignition switch OFF, connect scan tool to DLC.
2) Turn On ignition switch and clear DTC using scan tool.
3) Start engine and run engine at idle speed (600 rpm or more) for 1 minute with all electric loads turned OFF.
4) Check DTC and pending DTC.

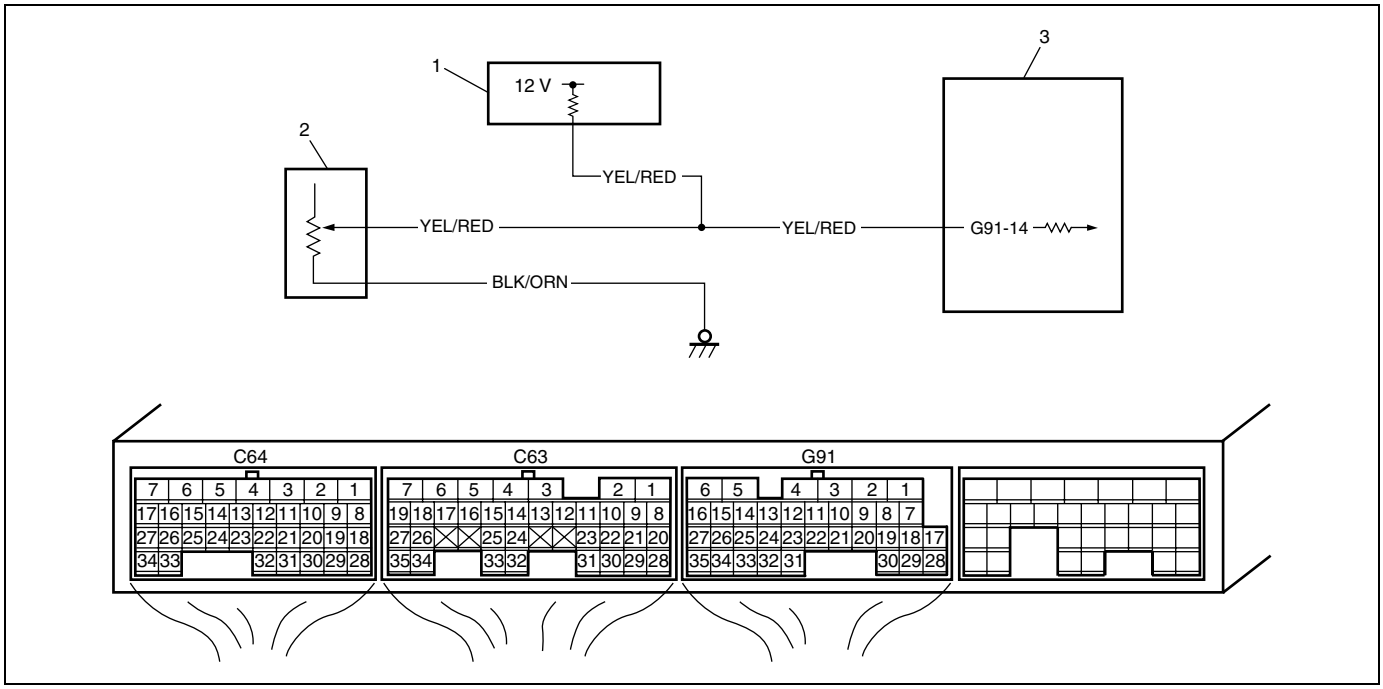
TROUBLESHOOTING

WARNING:
In order to reduce risk of fire and personal injury, this work must be performed in a well ventilated area and away from any open flames such as gas hot water.

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	Check EVAP canister purge power supply circuit. 1) Turn OFF ignition switch, disconnect connector from EVAP canister purge valve. 2) Measure voltage between engine ground and “BLK/RED” wire terminal of EVAP canister purge valve connector with ignition switch turned ON. Is it voltage 10 – 14 V?	Go to step 3.	“BLK/RED” wire open circuit.
3	Check wire circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “C64-13” terminal of ECM connector and vehicle body ground. Is resistance infinity?	Go to Step 4.	“BLU/BLK” wire shorted to ground circuit.
4	Check wire circuit. 1) Measure voltage between “C64-13” terminal of ECM connector and vehicle body ground. Is voltage 0 V?	Go to Step 5.	“BLU/BLK” wire shorted to others circuit.
5	Check wire circuit. 1) Connect connector to purge control valve with ignition switch turned OFF. 2) Remove ECM from vehicle body and then connect connectors to ECM. 3) Turn ON ignition switch, measure voltage between “C64-13” terminal of ECM connector and vehicle body ground. Is it voltage 10-14 V?	Go to Step 6.	“BLU/BLK” wire open circuit.
6	Check EVAP canister purge control valve. 1) Check EVAP canister purge control valve referring to “Evaporative emission control system inspection” in Section 6E1. Is it in good condition?	Go to Step 7.	Faulty EVAP canister purge control valve.
7	Check EVAP canister purge control circuit. 1) With ignition switch turn OFF, measure resistance between “G91-5/6” terminal and “C64-13” terminal of ECM connector. Is resistance below 40 Ω at 20°C, 68°F?	Faulty ECM, substitute a known-good ECM and recheck.	“BLK/RED” and/or “BLU/BLK” wire in high resistance circuit.

DTC P0462 Fuel Level Sensor Circuit Low

WIRING DIAGRAM



1. Fuel level meter in combination meter
2. Fuel level sensor (gauge)
3. ECM

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
• Fuel level sensor voltage is lower than 0.16 V for 5 seconds continuously. (2 driving cycle detection logic)	• "YEL/RED" circuit short • Fuel level sensor malfunction • ECM malfunction • Combination meter malfunction

DTC CONFIRMATION PROCEDURE

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 30 sec. or more.
4) Check DTC and pending DTC.

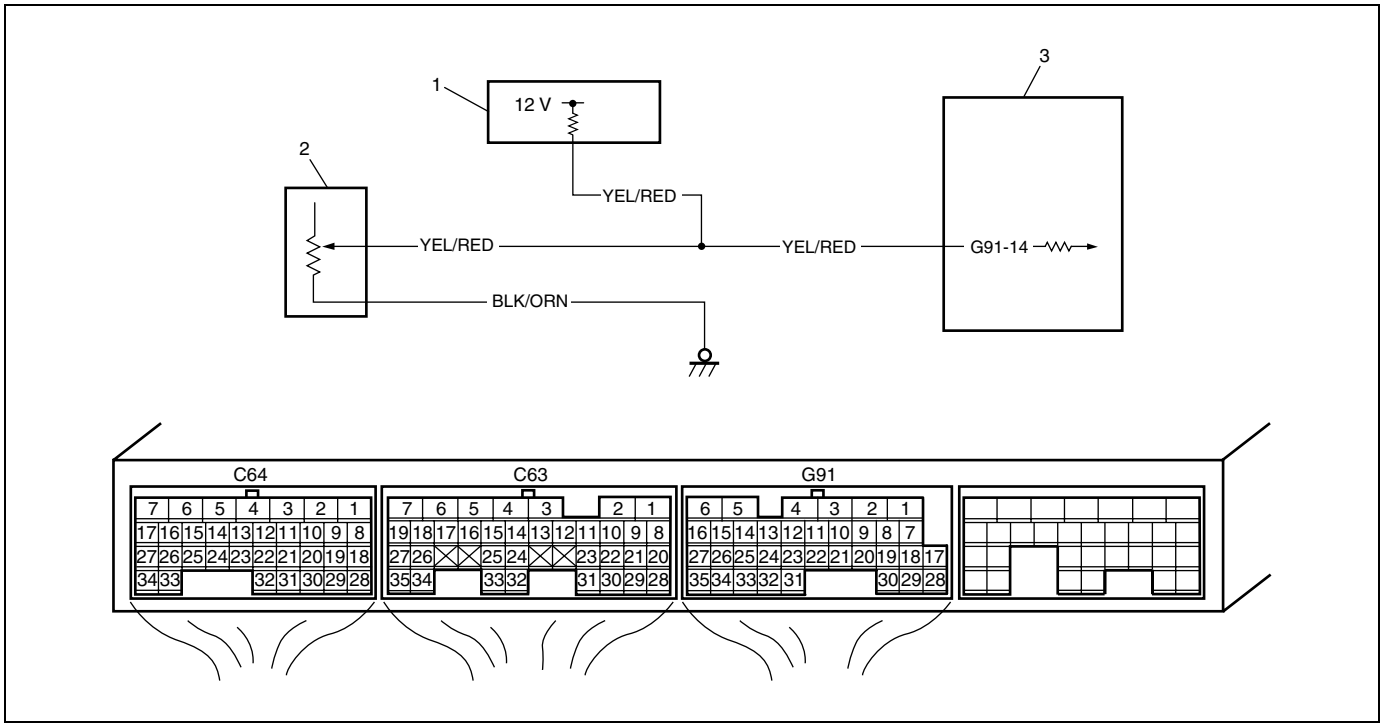
TROUBLESHOOTING

Step	Action	Yes	No
1	Was "Engine and Emission Control System Check" performed?	Go to Step 2.	Go to "Engine and Emission Control System Check" in this section.
2	Do you have Suzuki Scan Tool?	Go to Step 3.	Go to Step 4.

Step	Action	Yes	No
3	Fuel Level Sensor Output Signal Check with Suzuki Scan Tool 1) Connect Suzuki Scan Tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch and check fuel level displayed on Suzuki Scan Tool. Is 100% displayed?	Go to Step 5.	Intermittent trouble or faulty ECM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.
4	Fuel Level Sensor Output Signal Check 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and then connect connectors to ECM. 3) Turn ON ignition switch and measure voltage between "G91-14" wire terminal of ECM connector and vehicle body ground. Is voltage about 3.5 V or less?	Go to Step 5.	Intermittent trouble or faulty ECM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.
5	Fuel Level Sensor Output Signal Circuit Check 1) Disconnect connectors from combination meter referring to "Combination Meter Removal and Installation" in Section 8C. 2) Remove fuel pump referring to "Fuel Pump Assembly Removal and Installation" in Section 6C. 3) Disconnect connectors from ECM. 4) Measure resistance between "G91-14" wire terminal of ECM connector and vehicle body ground. Is it infinite?	Go to Step 6.	"YEL/RED" wire shorted to ground circuit.
6	Combination Meter Check 1) Check fuel gauge referring to Fuel Gauge Inspection" in Section 8C. Is it in good condition?	Go to Step 7.	Faulty combination meter.
7	Check Fuel Level Sensor 1) Check fuel level sensor referring to "Fuel Level Sensor (Gauge Unit) Inspection" in Section 8C. Is it in good condition?	Substitute a known-good ECM and recheck.	Faulty fuel level sensor.

DTC P0463 Fuel Level Sensor Circuit High

WIRING DIAGRAM



1.	Fuel level meter in combination meter
2.	Fuel level sensor (gauge)
3.	ECM

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
• Fuel level sensor voltage is higher than 7.1 V for 5 seconds continuously. (2 driving cycle detection logic)	• "YEL/RED" or "BLK/ORN" circuit open • Fuel level sensor malfunction • ECM malfunction • Combination meter faulty

DTC CONFIRMATION PROCEDURE

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 30 sec. or more.
4) Check DTC and pending DTC.

TROUBLESHOOTING

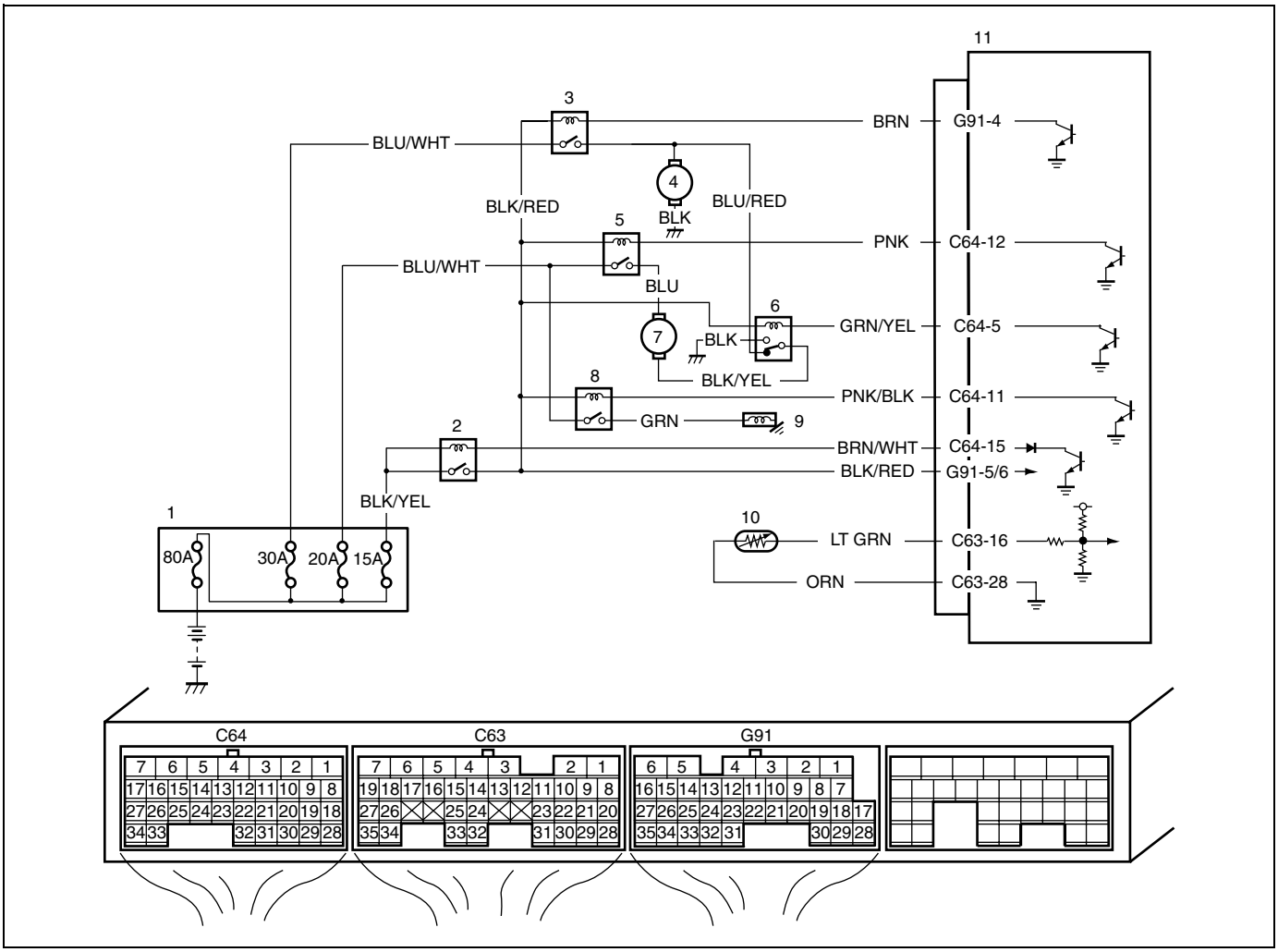
Step	Action	Yes	No
1	Was "Engine and Emission Control System Check" performed?	Go to Step 2.	Go to "Engine and Emission Control System Check" in this section.
2	Does fuel level meter in combination meter indicate "E" (empty)?	Replenish fuel tank with fuel and go to Step 3.	Go to Step 3.
3	Do you have Suzuki Scan Tool?	Go to Step 4.	Go to Step 5.

Step	Action	Yes	No
4	Fuel Level Sensor Output Signal Check with Suzuki Scan Tool 1) Connect Suzuki Scan Tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch and check fuel level displayed on Suzuki Scan Tool. Is it 3% or less?	Go to Step 6.	Intermittent trouble or faulty ECM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.
5	Fuel Level Sensor Output Signal Check 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and then connect connectors to ECM. 3) Turn ON ignition switch and measure voltage between "G91-14" wire terminal of ECM connector and vehicle body ground. Is voltage about 3.5 V or more?	Go to Step 6.	Intermittent trouble or faulty ECM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.
6	Fuel Level Sensor Circuit Resistance Check 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection to "G91-14" wire terminal of ECM connector. 3) If OK, measure resistance between "G91-14" wire terminal of ECM connector and vehicle body ground. Is resistance below 280 Ω?	Go to Step 7.	Go to Step 9.
7	Fuel Level Sensor Output Signal Circuit Check for Short 1) Disconnect connectors from combination meter referring to "Combination Meter Removal and Installation" in Section 8C. 2) Turn ON ignition switch and measure voltage between "G91-14" wire terminal of ECM connector and vehicle body ground. Is voltage 0 V?	Go to Step 8.	"YEL/RED" wire shorted to power supply circuit.
8	Check ECM Voltage 1) Connect connectors to ECM with ignition switch turned OFF. 2) Turn ON ignition switch and measure voltage between "G91-14" wire terminal of ECM connector and vehicle body ground. Is voltage below 0.1 V?	Faulty combination meter.	Substitute a known-good ECM and recheck.
9	Fuel Level Sensor Output Signal Circuit Check for Open 1) Turn OFF ignition switch and then disconnect combination meter connector referring to "Combination Meter Removal and Installation" in Section 8C. 2) Check for proper connection to "YEL/RED" wire terminal of combination meter connector. 3) If OK, measure resistance between "G91-14" wire terminal of ECM connector and "YEL/RED" wire terminal of combination meter connector. Is resistance below 10 Ω?	Go to Step 10.	"YEL/RED" wire in open or high resistance circuit at between ECM wire terminal and combination meter wire terminal.

Step	Action	Yes	No
10	Fuel Level Sensor Output Signal Circuit Check for Open 1) Remove fuel pump referring to “Fuel Pump Assembly Removal and Installation” in Section 6C. 2) Connect connectors to combination meter. 3) Turn ON ignition switch, measure voltage between “YEL/RED” wire terminal of disconnected fuel pump connector and vehicle body ground. Is voltage 10 – 14 V?	Go to Step 11.	“YEL/RED” wire circuit open.
11	Fuel Level Sensor Ground Circuit Check 1) Turn ignition switch to OFF position. 2) Check for proper connection to “BLK/ORN” wire terminal of fuel pump connector. 3) If OK, measure resistance between “BLK/ORN” wire terminal of fuel pump connector and vehicle body ground. Is resistance below 5 Ω?	Go to Step 12.	“BLK/ORN” wire in open or high resistance circuit.
12	Fuel Level Sensor Circuit Check for High Resistance 1) Check for proper connection to “YEL/RED” wire terminal of fuel pump connector. 2) If OK, measure resistance between “YEL/RED” wire terminal of fuel pump connector and “G91-14” wire terminal of ECM connector. Is resistance below 10 Ω?	Go to Step 13.	“YEL/RED” wire in high resistance circuit.
13	Check Fuel Level Sensor 1) Check fuel level sensor referring to “Fuel Level Sensor (Gauge Unit) Inspection” in Section 8C. Is it in good condition?	Faulty combination meter.	Faulty fuel level sensor.

DTC P0480 Fan 1 (Radiator Cooling Fan) Control Circuit

WIRING DIAGRAM



1. Relay/fuse box	4. Radiator fan motor	7. A/C condenser fan motor	10. ECT sensor
2. Main relay	5. A/C condenser fan relay No.1	8. A/C compressor relay	11. ECM
3. Radiator fan relay	6. A/C condenser fan relay No.2	9. A/C compressor	

CIRCUIT DESCRIPTION

Radiator fan relay is controlled by ECM if ECT is specified value.
When A/C condenser fan motor is running while head light is turned ON and engine is running at below 1500 r/min, radiator fan relay is turned OFF for 2 sec. by ECM.

DTC DETECTING CONDITION	TROUBLE AREA
• Monitor signal of radiator fan relay is different from command signal.	• "BLK/WHT", "BLK/RED" or "BRN" circuit open or short • Radiator fan relay malfunction • ECM malfunction

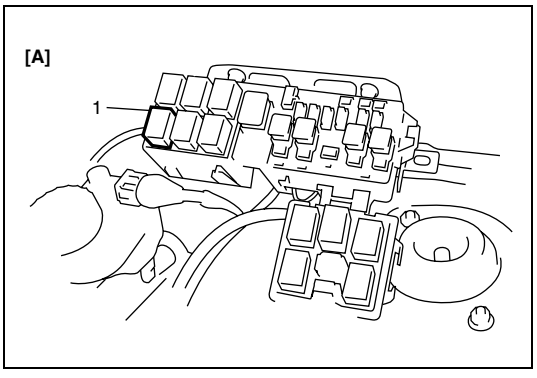
DTC CONFIRMATION PROCEDURE

1) Turn ignition switch turned OFF.
2) Clear DTC with ignition switch ON.
3) Warm up engine until radiator cooling fan starts to operate.
4) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Check Relay Circuit 1) Disconnect radiator fan relay from relay/fuse box with ignition switch turned OFF. (See Fig. 1.) 2) Turn ignition switch to ON position. 3) Measure voltage between “BLK/RED” wire terminal of radiator fan relay connector and engine ground. Is voltage 10 – 14 V?	Go to Step 3.	“BLK/RED” wire in open or high resistance circuit.
3	Check Relay Circuit 1) Turn ignition switch to OFF position. 2) Install radiator fan relay to relay/fuse box. 3) Disconnect connectors from ECM. 4) Remove ECM from vehicle body and then connect connectors to ECM. 5) Turn ignition switch to ON position. 6) Measure voltage between “G91-4” wire terminal of ECM connector and vehicle body ground. Is voltage 10 – 14 V?	Go to Step 4.	Go to Step 6.
4	Check Relay Circuit 1) Turn ignition switch to OFF position. 2) Disconnect connectors from ECM. 3) Remove radiator fan relay from relay/fuse box. 4) Measure voltage between “G91-4” wire terminal of ECM connector and vehicle body ground with ignition switch turned ON. Is voltage 0 V?	Go to Step 5.	“BRN” wire shorted to power circuit.
5	Radiator Fan Control Signal Check 1) Disconnect negative (–) cable at battery. 2) Disconnect connector from ECT sensor. 3) Connect connectors to ECM. 4) Install radiator fan relay to relay/fuse box. 5) Connect negative (–) cable to battery. 6) Measure voltage between “G91-4” wire terminal of ECM connector and vehicle body ground with ignition switch turned ON. Is voltage about 0 V?	System is in good condition.	Substitute a known-good ECM and recheck.

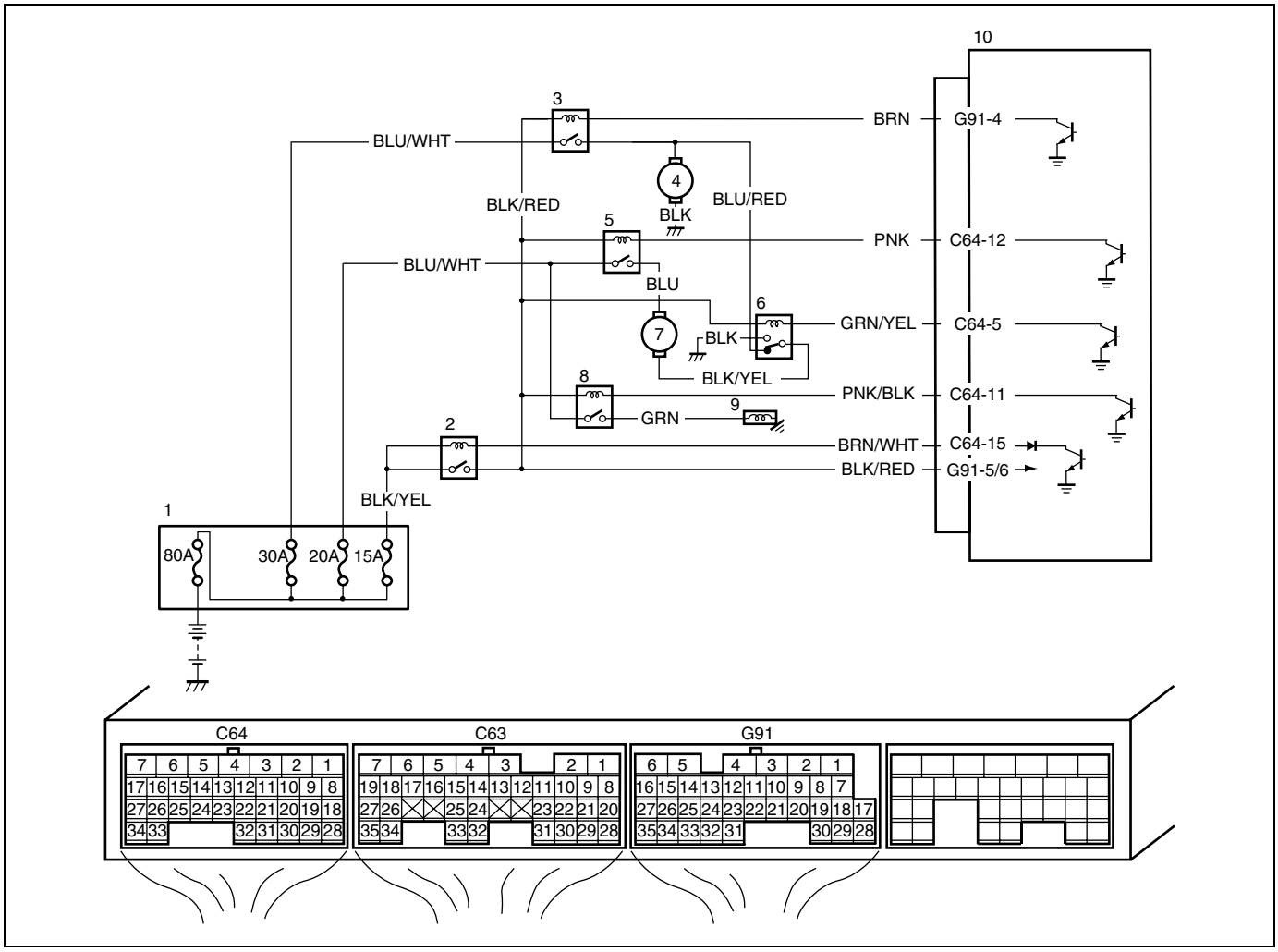
Step	Action	Yes	No
6	Radiator Fan Control Signal Check 1) Turn ignition switch to OFF position. 2) Install radiator fan relay to relay/fuse box. 3) Disconnect connectors from ECM. 4) Measure voltage between “G91-4” wire terminal of ECM connector and vehicle body ground with ignition switch turned ON. Is voltage 10 – 14 V?	Substitute a known-good ECM and recheck.	Go to Step 7.
7	Check Relay Circuit 1) Turn ignition switch to OFF position. 2) Disconnect connectors from ECM. 3) Remove radiator fan relay from relay/fuse box. 4) Check for proper connection to “G91-4” wire terminal of ECM connector and “BRN” wire terminal of radiator fan relay connector. 5) If OK, measure resistance between “G91-4” wire terminal of ECM connector and “BRN” wire terminal of radiator fan relay connector. Is resistance 1 Ω or less?	Go to Step 8.	“BRN” wire in open or high resistance circuit.
8	Check Relay Circuit 1) Measure resistance between “G91-4” wire terminal of ECM connector and vehicle body ground. Is it infinite?	Go to Step 9.	“BRN” wire shorted to ground circuit.
9	Check Radiator Fan Relay 1) Check radiator fan relay referring to “Main relay, fuel pump relay and radiator fan relay inspection” in Section 6E1. Is it in good condition?	System is in good condition. Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Replace radiator fan relay.



[A]: Fig. 1 for Step 2
1. Radiator fan relay

DTC P0481 Fan 2 (A/C Condenser Fan) Control Circuit

WIRING DIAGRAM



1. Relay/fuse box	4. Radiator fan motor	7. A/C condenser fan motor	10. ECM
2. Main relay	5. A/C condenser fan relay No.1	8. A/C compressor relay	
3. Radiator fan relay	6. A/C condenser fan relay No.2	9. A/C compressor	

CIRCUIT DESCRIPTION

A/C condenser fan motor is turned ON and OFF by its relay which ECM controls.
When A/C condenser fan motor starts is running while head light is turned ON and engine is running at below 1500 r/min, A/C condenser fan relay No.2 and radiator fan relay is turned OFF for 2 sec. by ECM.
Other than above condition, A/C condenser fan relay No.2 is leaving turned ON by ECM.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
• Monitor signal of A/C condenser fan relay is different from command signal.	• "PNK" or "BLU/WHT" circuit open or short • A/C condenser fan relay malfunction • ECM malfunction

DTC CONFIRMATION PROCEDURE

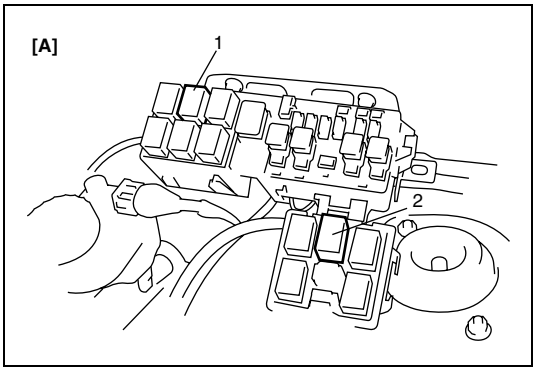
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up engine to normal operating temperature.
4) Run engine at idle and turn both A/C switch and heater blower switch ON (turn ON air conditioning) for 3 min. or more.
5) Check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Check Relay Circuit 1) Disconnect A/C condenser fan relay No.1 from relay/fuse box with ignition switch turned OFF. (See Fig. 1.) 2) Measure voltage between “BLK/RED” wire terminal of A/C condenser fan relay No.1 connector and engine ground with ignition switch turned ON. Is voltage 10 – 14 V?	Go to Step 3.	“BLK/RED” wire in open or high resistance circuit.
3	Check Relay Circuit 1) Disconnect A/C condenser fan relay No.2 from relay box with ignition switch turned OFF. (See Fig. 1.) 2) Measure voltage between “BLK/RED” wire terminal of A/C condenser fan relay No.2 connector and engine ground with ignition switch turned ON. Is voltage 10 – 14 V?	Go to Step 4.	“BLK/RED” wire in open or high resistance circuit.
4	Check Relay Circuit 1) Install A/C condenser fan relay No.1 and No.2 with ignition switch turned OFF. 2) Disconnect connectors from ECM. 3) Remove ECM from vehicle body and then connect connectors to ECM. 4) Measure voltage between each “C64-12” and “C64-5” wire terminal of ECM connector and vehicle body ground with ignition switch turned ON. Is each voltage 10 – 14 V?	Go to Step 5.	Go to Step 7.

Step	Action	Yes	No
5	Check Relay Circuit 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove A/C condenser fan relay No.1 and No.2. 3) Measure voltage between each “C64-12” and “C64-5” wire terminals of ECM connector and vehicle body ground with ignition switch turned ON. Is each voltage 0 V?	Go to Step 6.	“PNK” and “GRN/YEL” wire shorted to power circuit.
6	A/C Condenser Fan Control Signal Check 1) Connect connectors to ECM with ignition switch turned OFF. 2) Install A/C condenser fan relay No.1 and No.2. 3) Operate A/C system after an engine running. 4) Measure voltage between each “C64-12” and “C64-5” wire terminal of ECM connector and vehicle body ground. Is each voltage about 0 V?	System is in good condition.	Substitute a known-good ECM and recheck.
7	Check Relay Circuit 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove A/C condenser fan relay No.1 and No.2. 3) Check for proper connection to “C64-12” and “C64-5” wire terminals of ECM connector, “PNK” wire terminal of A/C condenser fan relay No.1 connector and “GRN/YEL” wire terminal of A/C condenser fan relay No.2 connector. 4) If OK, measure resistance between “C64-12” wire terminal of ECM connector and “PNK” wire terminal of A/C condenser fan relay No.1 connector and “C64-5” wire terminal of ECM connector and “GRN/YEL” wire terminal of A/C condenser fan relay No.2 connector. Is each resistance 1 Ω or less?	Go to Step 8.	“PNK” and “GRN/YEL” wire in open or high resistance circuit.
8	Check Relay Circuit 1) Measure resistance between each “C64-12” and “C64-5” wire terminals of ECM connector and vehicle body ground. Is each resistance infinite?	Go to Step 9.	“PNK” and “GRN/YEL” wire shorted to ground circuit.

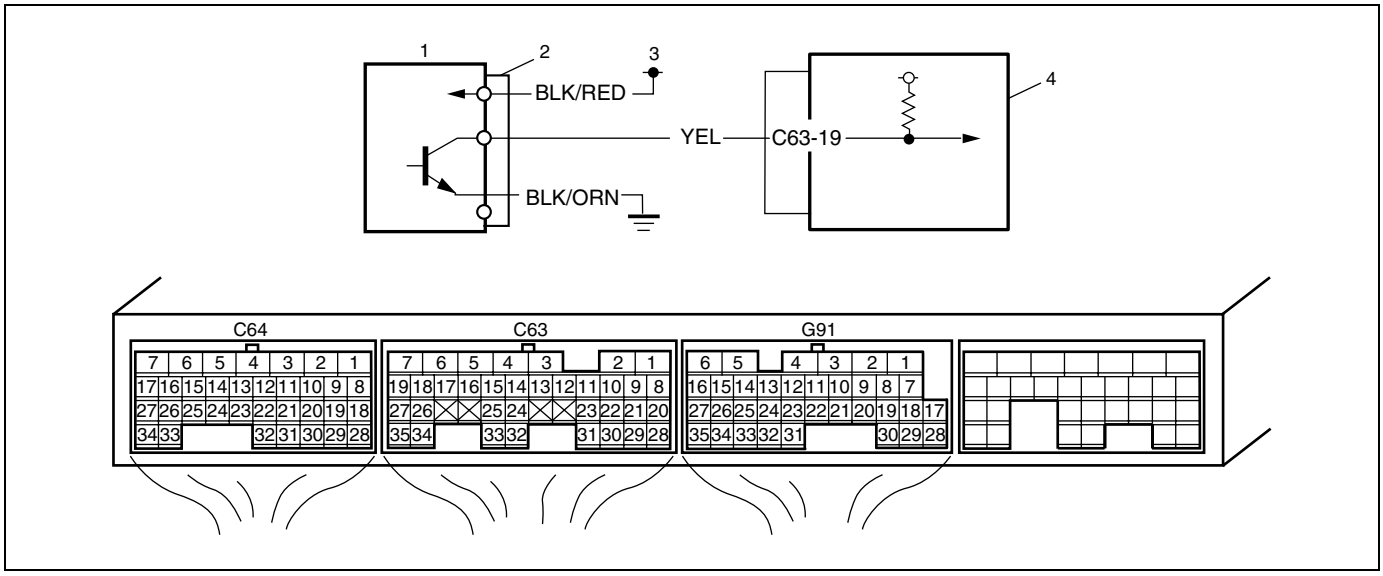
Step	Action	Yes	No
9	Check A/C Condenser Fan Relay No.1 and No.2 1) Check A/C condenser fan relay No.1 and No.2 referring to “Condenser Cooling Fan Relay (No.1 and No.2) Inspection” in Section 1B. Is each relay in good condition?	Go to Step 10.	Replace A/C condenser fan relay No.1 or No.2.
10	A/C Condenser Fan Control Signal Check 1) Connect connectors to ECM. 2) Install A/C condenser fan relay No.1 and No.2. 3) Start engine. 4) Measure voltage between each “C64-12” and “C64-5” wire terminal of ECM connector and vehicle body ground. Is each voltage 10 – 14 V?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Substitute a known-good ECM and recheck.



[A]: Fig. 1 for Step 2 and Step 3
1. A/C condenser fan relay No.1
2. A/C condenser fan relay No.2

DTC P0500 Vehicle Speed Sensor (VSS) Malfunction

WIRING DIAGRAM



1. VSS	3. To main relay
2. VSS connector	4. ECM

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
• Vehicle speed signal is not input while fuel cut at deceleration for 5 seconds continuously.	• "BLK/ORN" circuit open • "YEL" or "BLK/RED" circuit open or short • VSS malfunction • ECM malfunction

DTC CONFIRMATION PROCEDURE

WARNING:

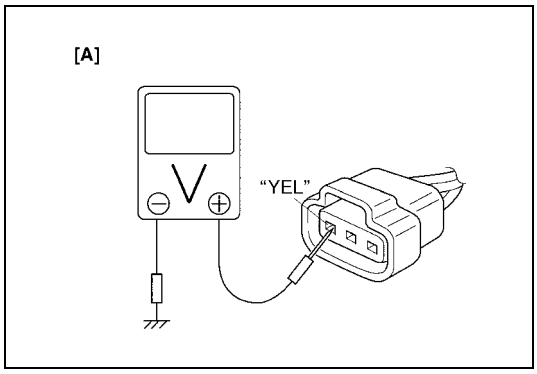
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Warm up engine to normal operating temperature.
4) Increase vehicle speed to 50 mph, 80 km/h.
5) Release accelerator pedal and with engine brake applied, keep vehicle coasting for 6 sec. or more (fuel cut condition for 5 sec. or more) and stop vehicle.
6) Check pending DTC and DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	Check vehicle speed signal. Is vehicle speed displayed on scan tool in step 2) and 3) of DTC confirmation procedure?	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check power supply circuit. 1) With OFF ignition switch turned, disconnect connector from VSS. 2) Check proper connection for “BLK/RED”, “BLK/ORN” and “YEL” wire terminal. 3) If wires are OK, turn ON ignition switch, measure voltage between engine ground and “BLK/RED” wire terminal. Is it voltage 10 – 14 V?	Go to Step 4.	“BLK/WHT” wire open circuit.
4	Check ground circuit. 1) Measure resistance between engine body ground and “BLK/ORN” wire terminal with ignition switch turn OFF. Is resistance below 5 Ω?	Go to Step 5.	“BLK/ORN” wire open or high resistance circuit.
5	Check wire circuit. 1) Turn ON ignition switch, measure voltage between engine ground and “YEL” wire terminal at VSS connector. See Fig. 1. Is it voltage 4 – 5 V?	Go to Step 9.	Go to Step 6.
6	Check ECM voltage. 1) Turn ON ignition switch, measure voltage between vehicle body ground and “C63-19” terminal at ECM connector. Is it voltage 4 – 5 V?	“YEL” wire open circuit.	Go to Step 7.
7	Check short circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and “C63-19” terminal. Is it voltage 0 V?	Go to Step 8.	“YEL” wire shorted to power supply circuit.
8	Check short circuit. 1) Measure resistance between engine ground and “C63-19” terminal with ignition switch turned OFF. Is resistance infinity?	Go to Step 9.	“YEL” wire shorted to ground circuit. If wire are OK, substitute a known-good ECM and recheck.

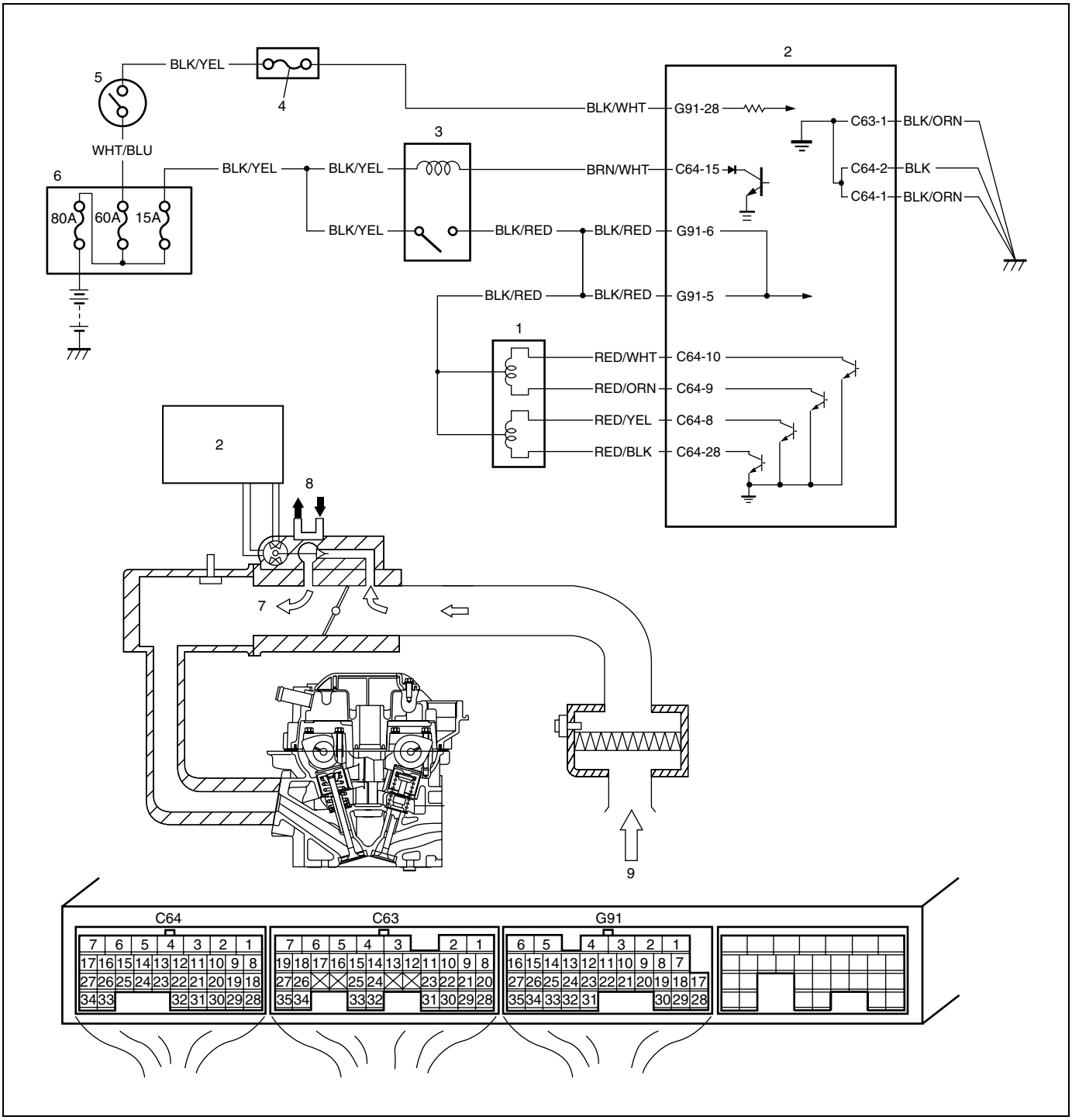
Step	Action	Yes	No
9	Check signal rotor. 1) Remove VSS referring to “Vehicle Speed Sensor (VSS) Removal and Installation” in Section 7A. 2) Visually inspect VSS sensor signal rotor for damage. Was any damage found?	Faulty VSS signal rotor.	Substitute a known-good VSS and recheck.



[A]: Fig. 1 for Step 5

DTC P0505 Idle Air Control System

SYSTEM/WIRING DIAGRAM



1. IAC valve	4. "IG" fuse	7. Bypass air
2. ECM	5. Ignition switch	8. Engine coolant
3. Main relay	6. Relay/fuse box	9. Intake air

DTC DETECTING CONDITION AND TROUBLE AREA (DTC P0505)

DTC DETECTING CONDITION	TROUBLE AREA
• IAC valve signal voltage is out of specification for about 2 sec. or more. • Engine revolution keeps excessively high for engine idling (1 driving cycle detection logic)	• Idle air control valve or its circuit • ECM • Intake air leakage

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

Electric load (lighting, heater blower, rear defogger, etc.) and A/C are turned OFF.

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature (80°C – 110°C, 176°F – 230°F).
4) Run engine at idle speed (600 – 1000 r/min.) for 1 min. or more.
5) Check DTC and pending DTC.

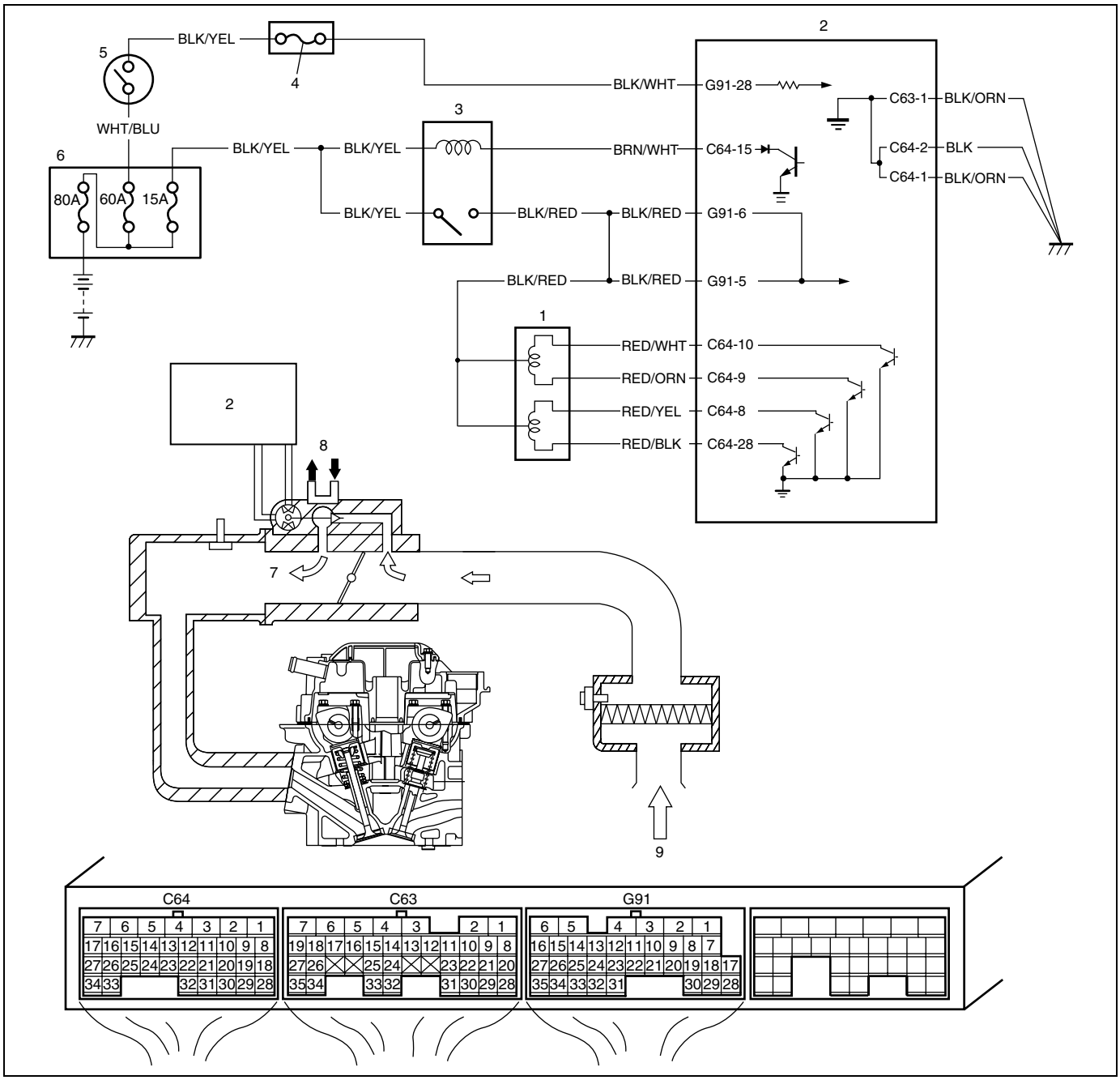
TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Idle Speed Check 1) Check idle speed/idle air control duty referring to “Idle speed/idle air control (IAC) duty inspection” in Section 6E1. Is check result as specified?	Go to Step 3.	Go to Step 4.
3	Idle Air Control Valve Operation Check 1) Check idle air control valve for operation referring to “Idle air control (IAC) valve operation check” in this section. Is check result satisfactory?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A. If OK, substitute a known-good ECM and recheck.	Go to Step 4.
4	Idle Air Control Valve Circuit Check 1) Disconnect connector from idle air control valve with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between “BLK/RED” wire terminals of idle air control valve connector and engine ground. Is voltage 10 – 14 V?	Go to Step 5.	“BLK/RED” wire in open or high resistance circuit.
5	Idle Air Control Valve Check 1) Check idle air control valve for resistance referring to “Idle air control (IAC) valve check” in this section. Is check result satisfactory?	Go to Step 6.	Replace idle air control valve.

Step	Action	Yes	No
6	Idle Air Control Valve Circuit Check 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “RED/WHT” wire terminal of idle air control valve connector and “C64-10” wire terminal of ECM connector, “RED/ORN” wire terminal of idle air control valve connector and “C64-9” wire terminal of ECM connector, “RED/YEL” wire terminal of idle air control valve connector and “C64-8” wire terminal of ECM connector, “RED/BLK” wire terminal of idle air control valve connector and “C64-28” wire terminal of ECM connector. Are resistance 1 Ω or less?	Go to Step 7.	“RED/WHT”, “RED/ORN”, “RED/YEL” or “RED/BLK” wire in open or high resistance circuit.
7	Idle Air Control Valve Circuit Check 1) Measure resistance between each “C64-10”, “C64-9”, “C64-8” and “C64-28” wire terminals of ECM connector and vehicle body ground. Is each resistance infinite?	Go to Step 8.	“RED/WHT”, “RED/ORN”, “RED/YEL” or “RED/BLK” wire in shorted to ground circuit.
8	Idle Air Control Valve Circuit Check 1) Connect connectors to ECM. 2) Turn ON ignition switch, measure voltage between each “C64-10”, “C64-9”, “C64-8” and “C64-28” wire terminals of ECM connector and vehicle body ground. Is each voltage 0 V?	Go to Step 9.	“RED/WHT”, “RED/ORN”, “RED/YEL” or “RED/BLK” wire in shorted to power circuit.
9	ECM Voltage Check 1) Connect connector to idle air control valve with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between each “C64-10”, “C64-9”, “C64-8” and “C64-28” wire terminals of ECM connector and vehicle body ground. • “C64-8” and “C64-10” wire terminals: 0 – 1 V • “C64-9” and “C64-28” wire terminals: 10 – 14 V Are check results satisfactory?	Go to Step 10.	Substitute a known-good ECM and recheck.
10	Make sure if the following conditions are satisfied. • The throttle valve is fully closed. • The air cleaner element is installed properly. Is it in good condition?	Replace idle air control valve.	Repair or replace.

DTC P0506 Idle Air Control System RPM Lower than Expected
DTC P0507 Idle Air Control System RRM Higher than Expected

SYSTEM/WIRING DIAGRAM



1. IAC valve	3. Main relay	5. Ignition switch	7. Bypass air	9. Intake air
2. ECM	4. "IG" fuse	6. Relay/fuse box	8. Engine coolant	

DTC DETECTING CONDITION AND TROUBLE AREA (DTC P0506/P0507)

DTC DETECTING CONDITION	TROUBLE AREA
DTC P0506: Engine idle speed is 100 r/min. or more lower than target idle speed for 20 sec. continuously when vehicle stops and closed throttle position (ON). DTC P0507: Engine idle speed is 200 r/min. or more higher than target idle speed for 20 sec. continuously when vehicle stops and closed throttle position (ON). (2 driving cycle detection logic)	• Idle air control valve or its circuit • Air intake system (clog or leakage) • Engine mechanical • Accessory engine load • ECM • Vehicle speed sensor

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temperature: –7°C (19.4°F) or higher**
- **Engine coolant temperature: –7°C (19.4°F) or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**
- **Transmission gear shift lever is shifted in "Neutral" for M/T**
- **Electric load (lighting, heater blower, rear defogger, etc.) and A/C are turned OFF.**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature (80°C – 110°C, 176°F – 230°F).
4) Run engine at idle speed (600 – 1000 r/min.) for 1 min. or more.
5) Check DTC and pending DTC.

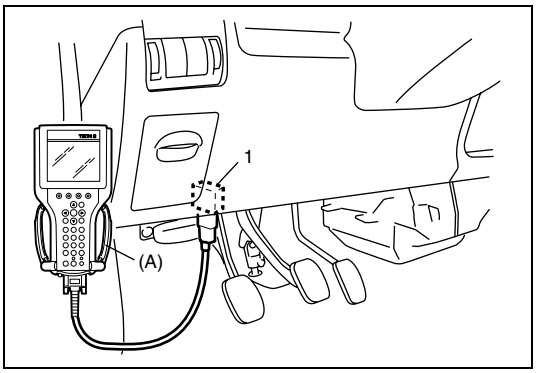
TROUBLESHOOTING

Step	Action	Yes	No
1	Was "Engine and Emission Control System Check" performed?	Go to Step 2.	Go to "Engine and Emission Control System Check" in this section.
2	DTC Check Is DTC P0505 displayed?	Go to "DTC P0505 Idle Air Control System" in this section.	Go to Step 3.
3	Idle Speed Check 1) Check idle speed/idle air control duty referring to "Idle speed/idle air control (IAC) duty inspection" in Section 6E1. Is check result as specified?	Go to Step 4.	Go to Step 5.
4	Vehicle Speed Sensor Signal Check Is vehicle speed displayed on scan tool when driving vehicle?	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute a known-good ECM and recheck.	Go to "DTC P0500 Vehicle Speed Sensor (VSS) Malfunction" in this section.

Step	Action	Yes	No
5	Air Intake System Check 1) Check air intake system for clog and inhaling. Is check result satisfactory?	Go to Step 6.	Repair or replace.
6	Idle Air Control Valve Operation Check 1) Check idle air control valve for operation referring to “Idle air control (IAC) valve operation check” in this section. Is check result satisfactory?	Go to Step 9.	Go to Step 7.
7	Idle Air Control Valve Circuit Check 1) Disconnect connector from idle air control valve with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between “BLK/RED” wire terminals of idle air control valve connector and engine ground. Is voltage 10 – 14 V?	Go to Step 8.	“BLK/RED” wire in open or high resistance circuit.
8	Idle Air Control Valve Check 1) Check idle air control valve for resistance referring to “Idle air control (IAC) valve check” in this section. Is check result satisfactory?	Go to Step 9.	Replace idle air control valve.
9	Idle Air Control System Check 1) Check parts or system which can cause engine low or high idle. • EGR valve malfunction (leakage) • EVAP system malfunction • Accessory engine load • Engine mechanical (engine compression) • Throttle body malfunction • PCV system malfunction • Accelerator cable (get stuck on) • Brake booster malfunction Are they in good condition?	Substitute a known-good ECM and recheck.	Repair or replace.

Idle air control (IAC) valve operation check

USING SUZUKI SCAN TOOL



1) Connect Suzuki Scan Tool to DLC (1) with ignition switch OFF.

Special tool
(A): Suzuki Scan Tool

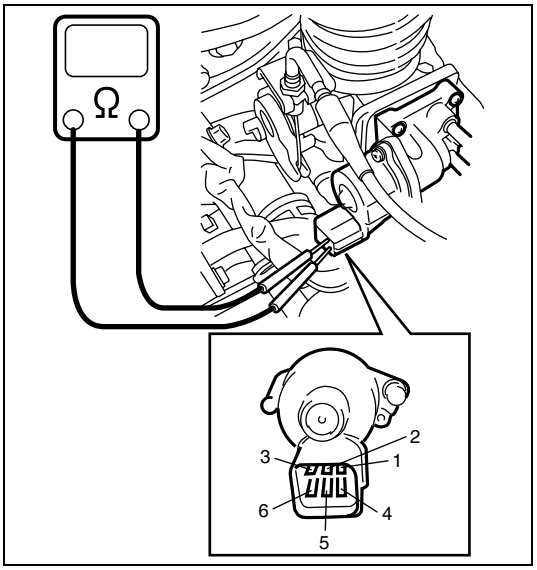
2) Warm up engine to normal operating temperature.
3) Clear DTC and select "MISC TEST" mode on Suzuki Scan Tool.
4) Check that idle speed increases and/or reduces when IAC valve is opened and/or when closed by Suzuki Scan Tool.
   If idle speed does not change, check IAC valve and wire harness.

NOT USING SUZUKI SCAN TOOL

1) Warm up engine to normal operating temperature.
2) Stop engine.
3) Turn ignition switch to ON position.
4) Disconnect IAC valve connector.
5) Start engine.
6) Connect IAC valve connector.
7) Check that idle speed increases and/or reduces when connector is connected to IAC valve.
   If idle speed does not change, check IAC valve and wire harness.

Idle air control (IAC) valve check

1) Disconnect negative cable at battery.
2) Disconnect connector from IAC valve.
3) Check for proper connection to IAC valve at each terminal.

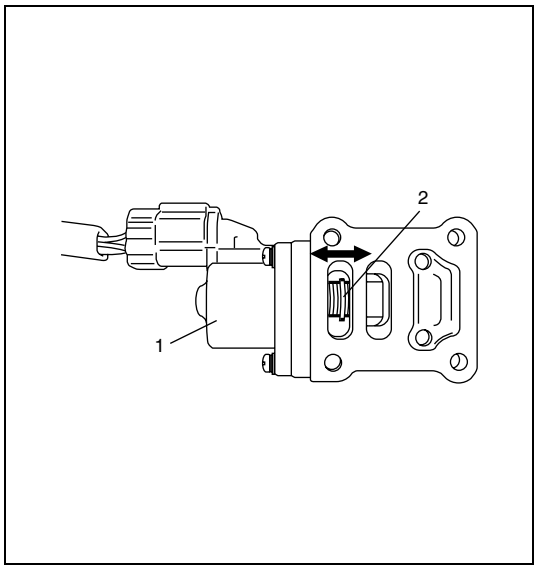


4) Check each coil of IAC valve for resistance.
   If resistance is out of specification, replace IAC valve.

IAC valve resistance specification

Terminals	Resistance
Between "1" and "2"	25.5 – 33.5 Ω (at 20°C, 68°F)
Between "3" and "2"	
Between "4" and "5"	
Between "6" and "5"	

5) Connect connector to IAC valve.
6) Remove IAC valve form throttle body referring to "Idle air control (IAC) valve removal and installation" in Section 6E1.



7) Check that valve (2) of IAC valve (1) opens and closes once and then stops in about 60 ms as soon as ignition switch is turned ON.

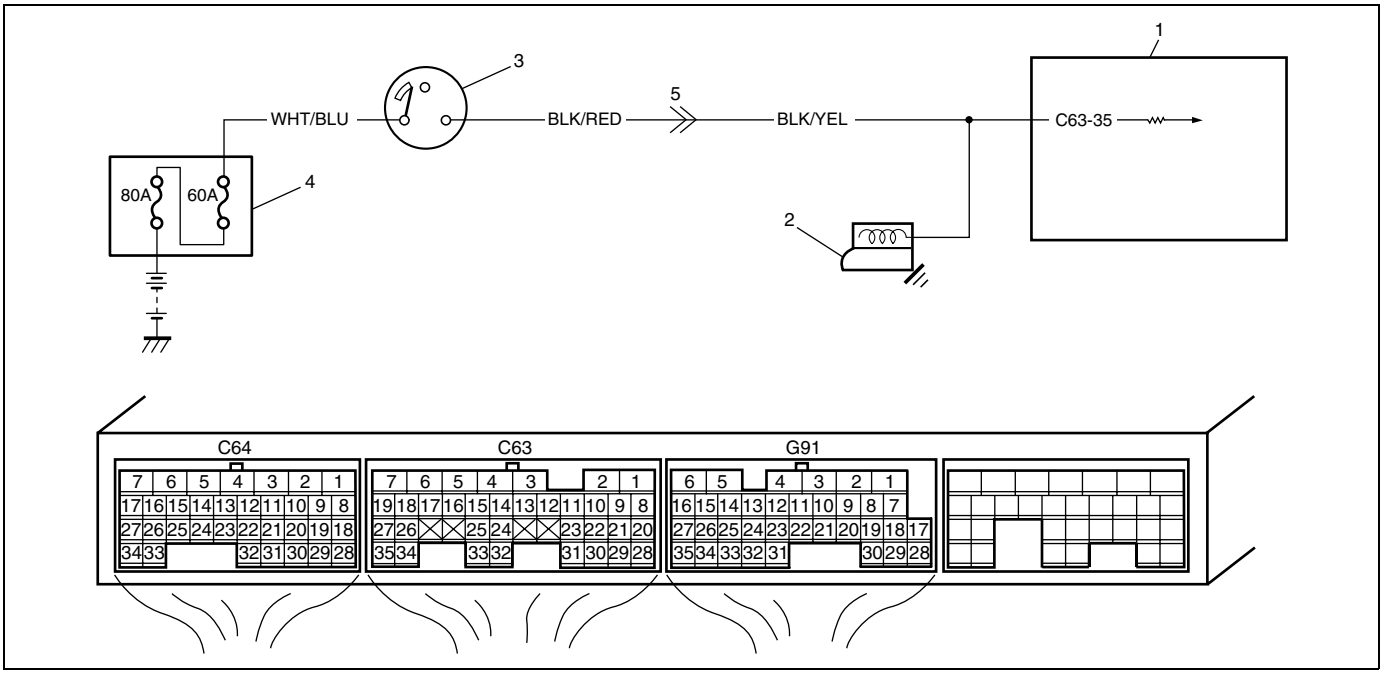
NOTE:

- **This check should be performed by two people, one person turns on ignition switch while the other checks valve operation.**
- **As valve operation is momentary, it may be overlooked. To prevent this operation check 3 times or more continuously.**
  If valve of IAC valve does not operate at all, check wire harness for open and short. If wire harness is in good condition, replace IAC valve and recheck.

8) Install IAC valve to throttle body referring to “Idle air control (IAC) valve removal and installation” in Section 6E1.
9) Connect negative cable at battery.

DTC P0616 Starter Relay Circuit Low

WIRING DIAGRAM



1. ECM	3. Ignition switch	5. Instrument panel harness/engine harness connector
2. Starter motor	4. Relay/fuse box	

DTC DETECTING CONDITION	TROUBLE AREA
Engine starts even though vehicle is at stop and engine starter signal is low voltage. (2 driving cycle detection logic)	• Engine starter signal circuit • ECM

DTC CONFIRMATION PROCEDURE

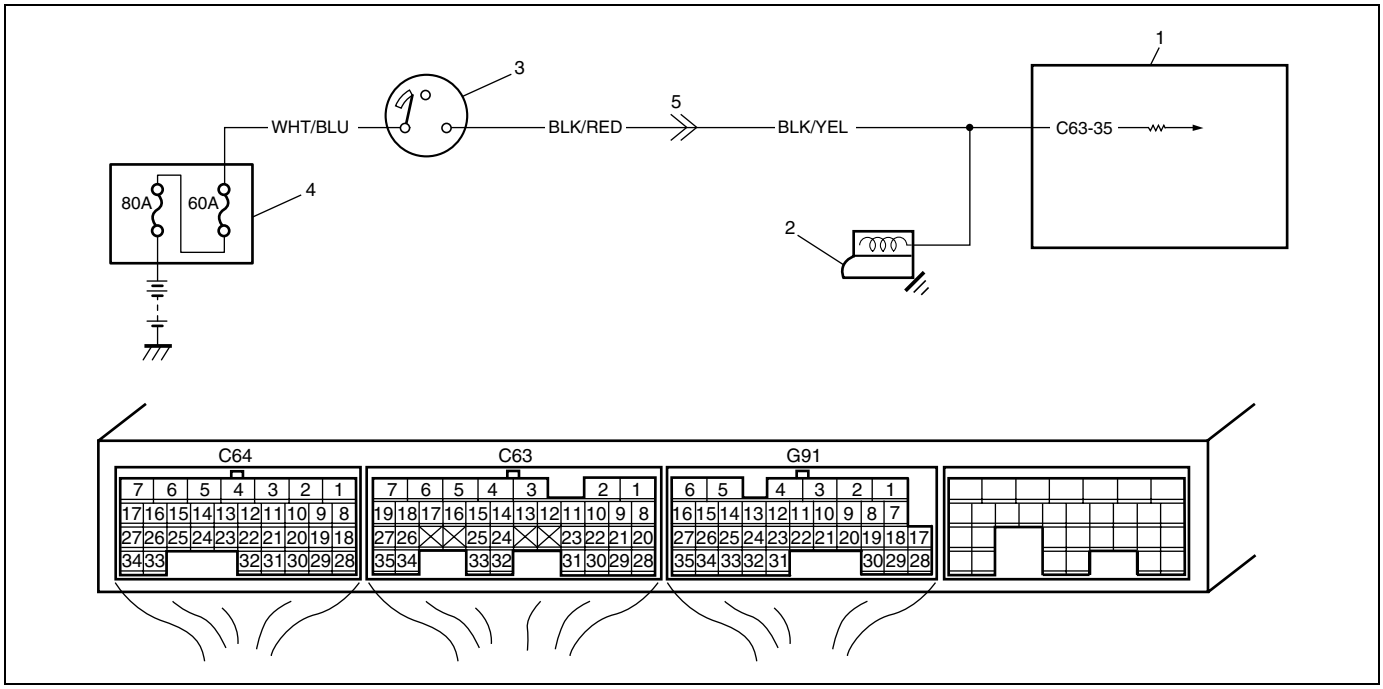
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine.
4) Check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	Signal circuit check 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and then connect connectors to ECM. 3) Check for voltage at terminal “C63-35”, under the following condition. While engine cranking: 6 – 14 V After starting engine: 0 – 1 V Is voltage as specified?	Poor “C63-35” connection or intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A. If wire and connections are OK, substitute a known-good ECM and recheck.	“BLK/YEL” wire or “BLK/RED” wire circuit open.

DTC P0617 Starter Relay Circuit High

WIRING DIAGRAM



1. ECM	4. Relay/fuse box
2. Starter motor	5. Instrument panel harness/engine harness connector
3. Ignition switch	

DTC DETECTING CONDITION	TROUBLE AREA
Engine starter signal is high voltage for 180 seconds continuously while engine is running. (2 driving cycle detection logic)	• Engine starter signal circuit • ECM

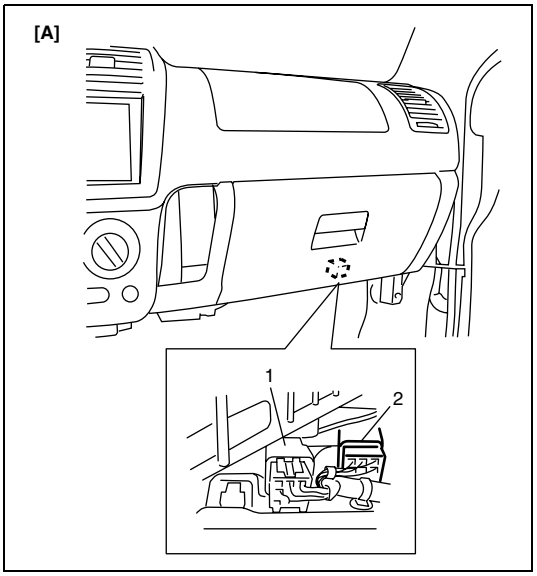
DTC CONFIRMATION PROCEDURE

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it at idle for 3 min. or more.
4) Check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in this section.
2	Starter Signal Check 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and then connect connectors to ECM. 3) Start engine, check voltage between “C63-35” wire terminal of ECM connector and vehicle body ground. Is voltage 0 – 1 V?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A. If OK, substitute a known-good ECM and recheck.	Go to Step 3.

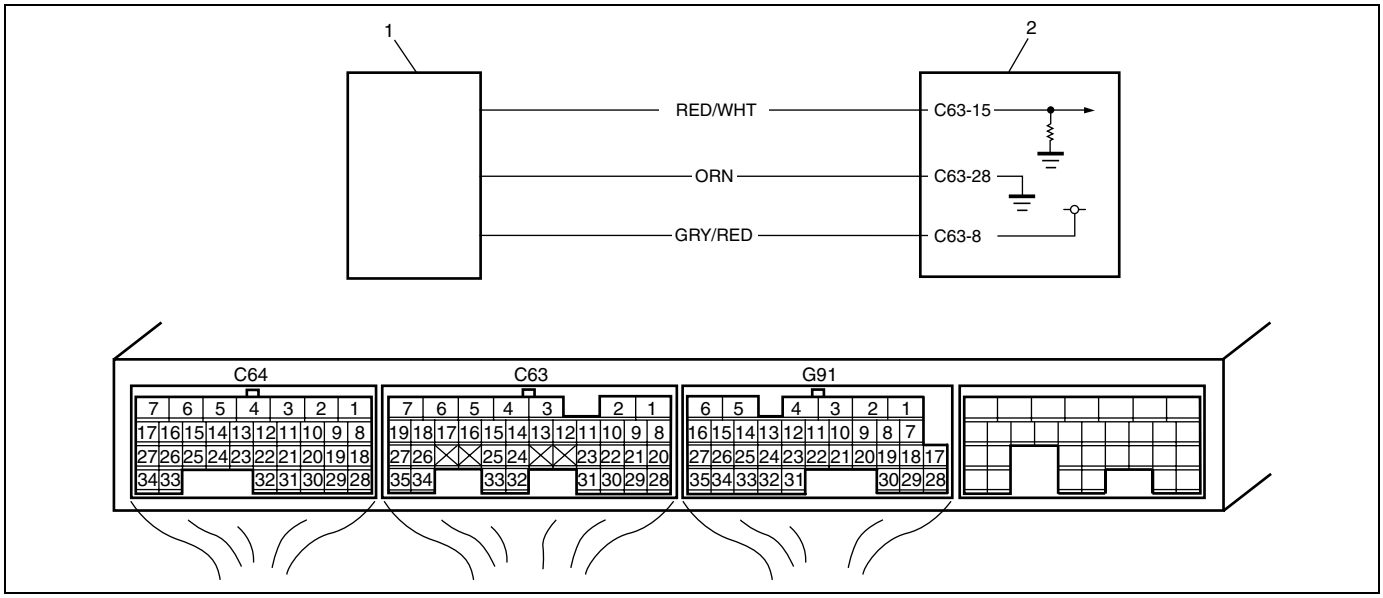
Step	Action	Yes	No
3	Starter Signal Circuit Check 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ON ignition switch, check voltage between “C63-35” wire terminal of ECM connector and vehicle body ground. Is voltage 0 – 1 V?	Substitute a known-good ECM and recheck.	Go to Step 4.
4	Starter Signal Circuit Check 1) Disconnect instrument panel harness/engine harness connector. (See Fig. 1) 2) Turn ON ignition switch, measure voltage between “BLK/RED” wire terminal of instrument panel harness/engine harness connector and vehicle body ground. Is voltage 0 – 1 V?	“BLK/YEL” wire shorted to power circuit.	Go to Step 5.
5	Ignition Switch Inspection 1) Check ignition switch referring to “Ignition (Main) Switch ON-Vehicle Inspection” in Section 8C. Is it in good condition?	“BLK/RED” wire shorted to power circuit.	Replace ignition switch.



[A]: Fig. 1 for Step 4
1. Front wiper intermittent timer
2. Instrument panel harness/engine harness connector

DTC P0107 Manifold Absolute Pressure Low Input

WIRING DIAGRAM



1. Manifold absolute pressure sensor	2. ECM

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
• Manifold absolute pressure sensor output voltage is lower than 0.2 V for 5 sec. continuously. (2 driving cycle detection logic)	• Manifold absolute pressure sensor circuit • Manifold absolute pressure sensor • Manifold absolute pressure sensor vacuum passage • ECM

DTC CONFIRMATION PROCEDURE

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

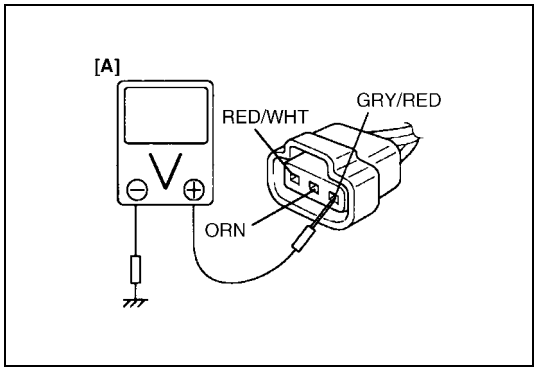
- **Intake air temperature: –7°C (19.4°F) or higher**
- **Engine coolant temperature: –7°C (19.4°F) or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC using scan tool and warm up engine completely.
3) Drive the vehicle with the speed of 40 km/h (25 mile/h) in the 5th gear or D range, and then accelerate the vehicle for more than 5 seconds by stepping only half of the accelerator pedal.
4) Check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	Check MAP sensor and its circuit. 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch ON. 3) Check intake manifold pressure. Is it 146 kPa (43.1 in.Hg) or 0 kPa (0 in.Hg)?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A. If OK, go to Step 9.
3	Check MAP sensor power supply voltage. 1) Disconnect connector from MAP sensor with ignition switch tuned OFF. 2) Check for proper connection of MAP sensor at “GRY/RED”, “ORN” and “RED/WHT”. 3) Turn ON ignition switch, measure voltage between engine ground and “GRY/RED” wire terminal. See Fig. 1. Is voltage 4 – 5 V?	Go to Step 6.	Go to Step 4.
4	Check MAP sensor power supply voltage. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and then connect connectors to ECM. 3) Turn ON ignition switch, measure voltage between vehicle body ground and “C63-8” terminal. Is voltage 4 – 5 V?	“GRY/RED” wire in open circuit.	Go to Step 5.
5	Check MAP sensor power supply circuit. 1) Disconnect connectors from TP sensor with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between vehicle body ground and “C63-8” terminal. Is voltage 4 – 5 V?	Faulty TP sensor.	“GRY/RED” wire shorted to ground or other circuit. If wires are OK, substitute a known-good ECM and recheck.
6	Check MAP sensor ground circuit. 1) Measure resistance between “ORN” wire terminal in MAP sensor harness connector and engine ground. Is resistance below 5Ω?	Go to Step 8.	Go to Step 7.
7	Check ground circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and connect connectors to ECM. 3) Measure resistance between “C63-28” terminal and vehicle body ground. Is resistance below 5Ω?	“ORN” wire in open or high resistance circuit.	ECM grounds “C63-28” and/or “C64-2” circuit in open or high resistance. If wires are OK, substitute a known-good ECM and recheck.

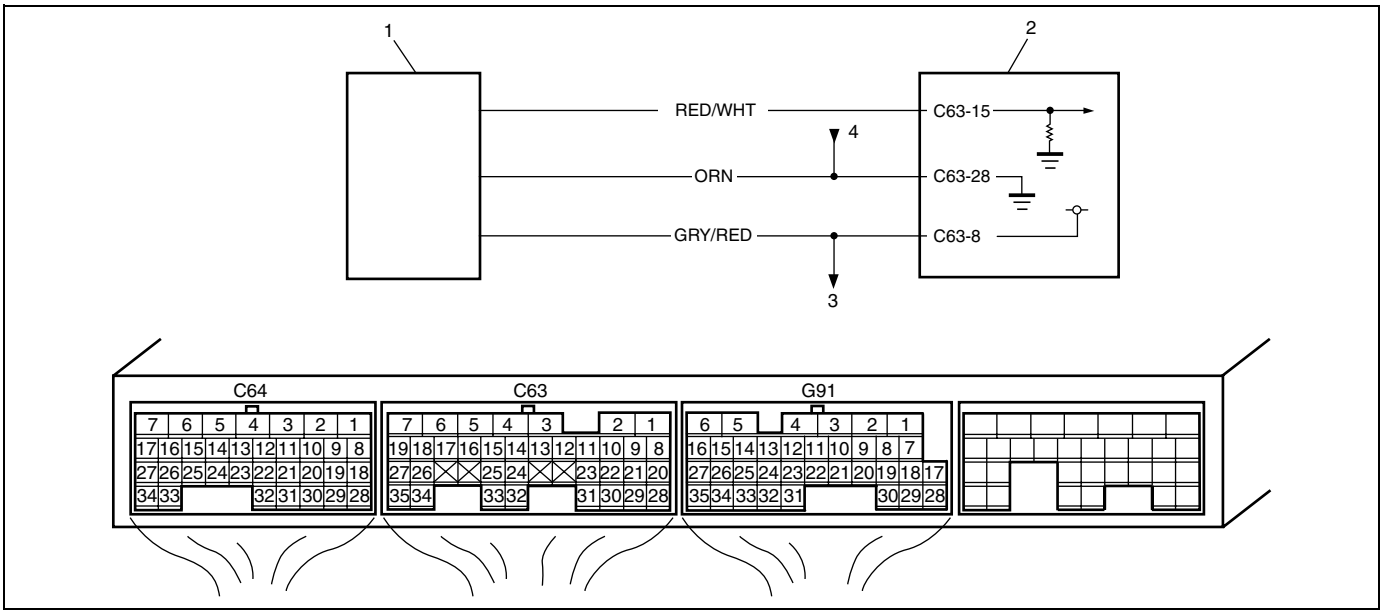
Step	Action	Yes	No
8	Check MAP sensor signal circuit. 1) Turn ON ignition switch. 2) Measure voltage between “RED/WHT” wire terminal in MAP sensor harness connector and engine ground. Is voltage 0 V?	Go to Step 9.	“RED/WHT” wire shorted to other circuit.
9	Check MAP sensor signal circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “C63-15” terminal and vehicle body ground. Is resistance infinity?	Go to Step 10.	“RED/WHT” wire shorted to ground circuit.
10	Check MAP sensor signal circuit. 1) Measure resistance between “RED/WHT” wire terminal in MAP sensor harness connector and “C63-15” terminal in ECM connector. Is resistance below 5 Ω?	Go to Step 11.	“RED/WHT” wire in open or high resistance circuit.
11	Check MAP sensor output signal. 1) Check MAP sensor according to “MAP Sensor Individual Check” in this section. Is it in good condition?	Substitute a known-good ECM and recheck.	Faulty MAP sensor.



[A]: Fig. 1 for Step 3

DTC P0108 Manifold Absolute Pressure High Input

WIRING DIAGRAM



1. Manifold absolute pressure sensor	3. To TP sensor
2. ECM	4. From other sensors

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
• Manifold absolute pressure sensor output voltage is 4.6 V or higher for 24 sec. continuously. (2 driving cycle detection logic)	• Manifold absolute pressure sensor circuit • Manifold absolute pressure sensor • Manifold absolute pressure sensor vacuum passage • ECM

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

NOTE:

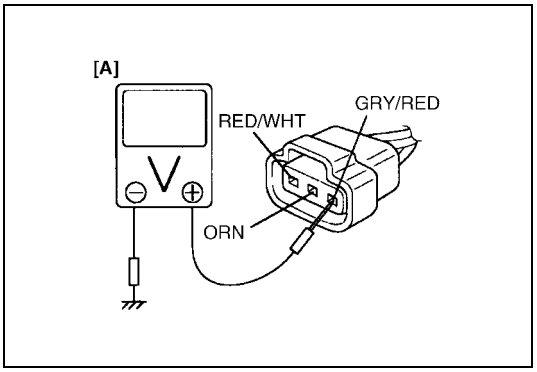
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temperature: –7°C (19.4°F) or higher**
- **Engine coolant temperature: –7°C (19.4°F) or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC using scan tool and warm up engine completely.
3) Run engine at idle speed for 1 min.
4) Check DTC and pending DTC.

TROUBLESHOOTING

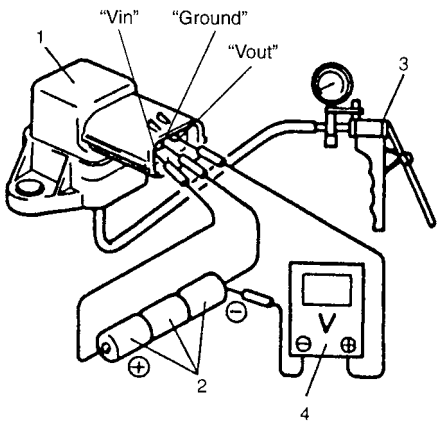
Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	Check MAP sensor and its circuit. 1) Connect scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON. 3) Check intake manifold pressure. Is it 146 kPa (43.1 in.Hg) or 0 kPa (0 in.Hg)?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A. If OK, go to Step 8.
3	Check MAP sensor power supply voltage. 1) Disconnect connector from MAP sensor with ignition switch tuned OFF. 2) Check for proper connection of MAP sensor at “GRY/RED”, “ORN” and “RED/WHT”. 3) Turn ON ignition switch, measure voltage between engine ground and “GRY/RED” wire terminal. See Fig. 1. Is voltage 4 – 5 V?	Go to Step 5.	Go to Step 4.
4	Check MAP sensor power supply voltage. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and then connect connectors to ECM. 3) Turn ON ignition switch, measure voltage between vehicle body ground and “C63-8” terminal. Is voltage 4 – 5 V?	“GRY/RED” wire in open circuit.	“GRY/RED” wire shorted to other circuit. If wires are OK, substitute a known-good ECM and recheck.
5	Check MAP sensor ground circuit. 1) Measure resistance between “ORN” wire terminal in MAP sensor harness connector and engine ground. Is resistance below 5 Ω?	Go to Step 7.	Go to Step 6.
6	Check ground circuit. 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and connect connectors to ECM. 3) Measure resistance between “C63-28” terminal and vehicle body ground. Is resistance below 5 Ω?	“ORN” wire in open or high resistance circuit.	ECM grounds “C63-28” and/or “C64-2” circuit in open or high resistance. If wires are OK, substitute a known-good ECM and recheck.
7	Check MAP sensor signal circuit. 1) Disconnect connectors from ECM with ignition switch turn OFF. 2) Turn ON ignition switch. 3) Measure voltage between “RED/WHT” wire terminal in MAP sensor harness connector and engine ground. Is voltage 0 V?	Go to Step 8.	“RED/WHT” wire shorted to power supply or other circuit.

Step	Action	Yes	No
8	Check MAP sensor output signal. 1) Check MAP sensor according to “MAP Sensor Individual Check” in this section. Is it in good condition?	Substitute a known-good ECM and recheck.	Faulty MAP sensor.



[A]: Fig. 1 for Step 3

MAP Sensor Individual Check



1) Disconnect connector from MAP sensor (1).
2) Remove MAP sensor (1).
3) Arrange 3 new 1.5 V batteries (2) in series (check that total voltage is 4.5 – 5.0 V) and connect its positive terminal to "Vin" terminal of sensor and negative terminal to "Ground" terminal. Then check voltage between "Vout" and "Ground". Also, check if voltage reduces when vacuum is applied up to 400 mmHg by using vacuum pump (3).

Output voltage (When input voltage is 4.5 – 5.5 V, ambient temp. 20 – 30°C, 68 – 86°F)

ALTITUDE (Reference)		BAROMETRIC PRESSURE		OUTPUT VOLTAGE
(ft)	(m)	(mmHg)	(kPa)	(V)
0 | 2 000	0 | 610	760 | 707	100 | 94	3.3 – 4.3
2 001 | 5 000	611 | 1 524	Under 707 over 634	94 | 85	3.0 – 4.1
5 001 | 8 000	1 525 | 2 438	Under 634 over 567	85 | 76	2.7 – 3.7
8 001 | 10 000	2 439 | 3 048	Under 567 over 526	76 | 70	2.5 – 3.3

If check result is not satisfactory, replace MAP sensor (1).

4) Install MAP sensor (1) securely.
5) Connect MAP sensor (1) connector securely.

4. Digital type voltmeter

DTC P0601 Internal Control Module Memory Check Sum Error
DTC P0602 Control Module Programming Error

SYSTEM DESCRIPTION

Internal control module is installed in ECM.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Data write error or check sum error	ECM

DTC CONFIRMATION PROCEDURE

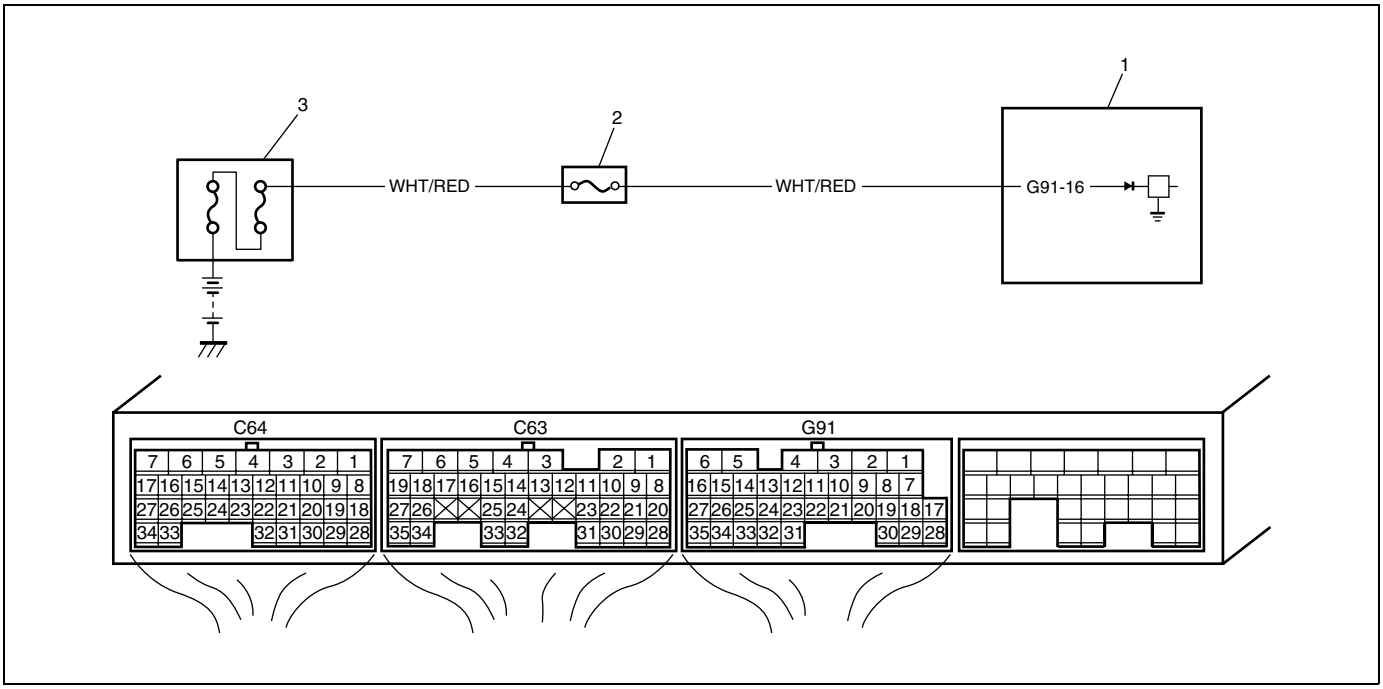
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool.
3) Start engine and run it at idle if possible.
4) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

Substitute a known-good ECM and recheck.

DTC P1510 ECM Back-up Power Supply Malfunction

WIRING DIAGRAM



1. ECM
2. “RADIO DOME” fuse
3. Relay/fuse box

CIRCUIT DESCRIPTION

Battery voltage is supplied so that diagnostic trouble code memory, values for engine control learned by ECM, etc. are kept in ECM even when the ignition switch is turned OFF.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Back-up circuit voltage is less than 5 V for 5 seconds continuously while engine running.	Battery voltage supply circuit

DTC CONFIRMATION PROCEDURE

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC using scan tool and run engine at idle speed for 1 min.
3) Check DTC and pending DTC.

TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	Battery voltage supply circuit check 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Remove ECM from vehicle body and then connect connectors to ECM. 3) While engine running, check voltage between “G91-16” and ground. Is voltage 10 – 14 V?	Poor “G91-16” connection or intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A. If wire and connections are OK, substitute a known-good ECM and recheck.	“RADIO DOME” fuse blown “WHT/RED” circuit open or short.

DTC P2227 Barometric Pressure Circuit Range/Performance
DTC P2228 Barometric Pressure Circuit Low
DTC P2229 Barometric Pressure Circuit High

SYSTEM DESCRIPTION

Barometric pressure sensor is installed in ECM (PCM).

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC P2227: While running under conditions described for "DTC Confirmation Procedure", barometric pressure value compared with intake manifold vacuum value in fuel cut state is not as specified. (2 driving cycle detection logic)	• Manifold absolute pressure sensor performance problem • Barometric pressure sensor in ECM
DTC P2228: Barometric pressure signal less than 1.5 V is detected.	• Barometric pressure sensor in ECM
DTC P2229: Barometric pressure signal more than 4.5 V is detected.	

DTC CONFIRMATION PROCEDURE

DTC P2228/P2229

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC by using scan tool and run engine for 1 min.
3) Check DTC and pending DTC by using scan tool.

DTC P2227

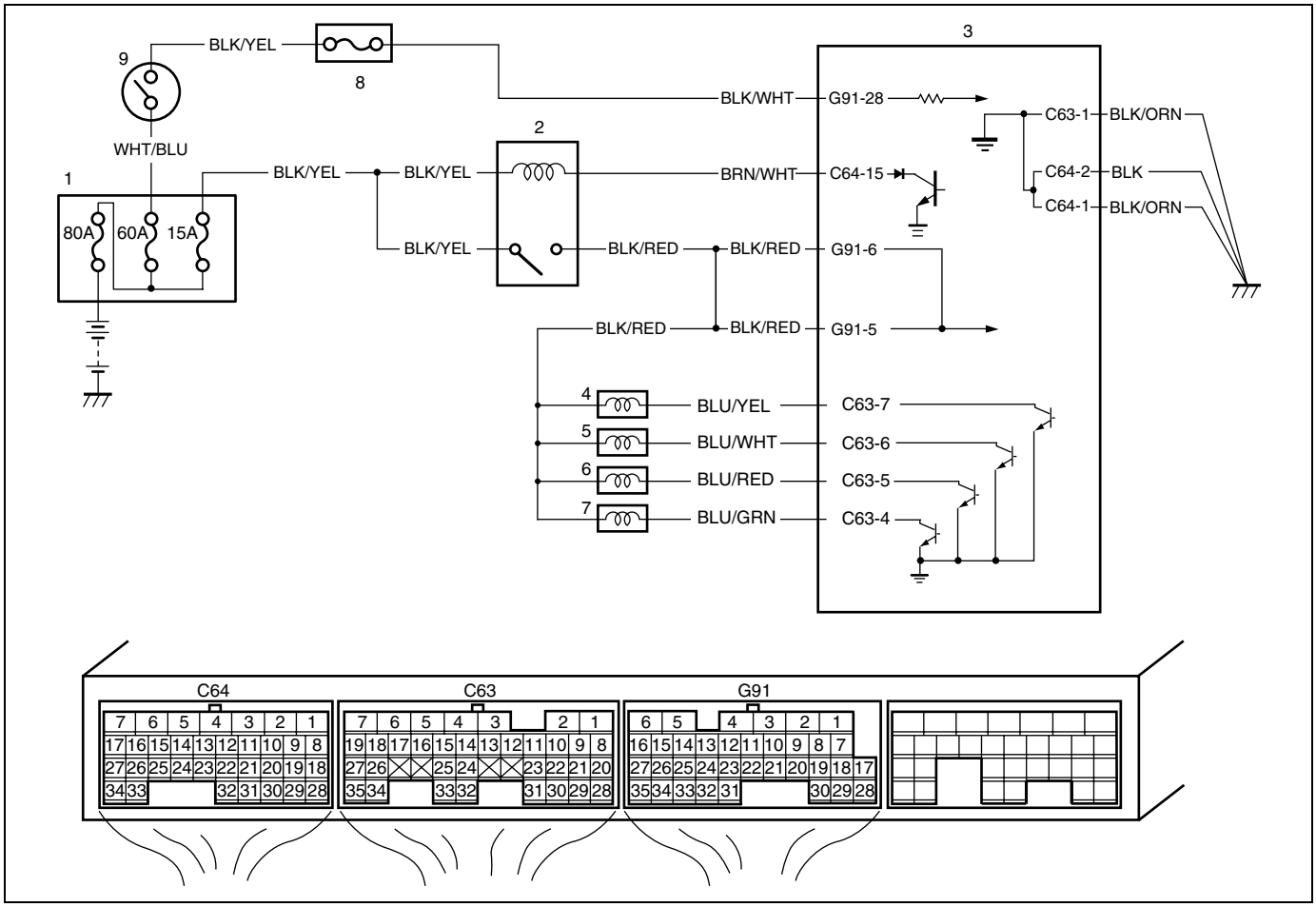
WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine to normal operating temperature.
3) Increase engine speed to 3000 rpm in 3rd gear in case of M/T.
4) Release accelerator pedal and with engine brake applied, keep vehicle coasting for 5 sec. or more. (Keep fuel cut condition for 5 sec. or more) If fuel cut condition is not kept for 5 sec. or more, coast down a slope in engine speed 1000 – 3000 rpm for 5 sec. or more.
5) Stop vehicle and run engine at idle.
6) Repeat Steps 3) – 5) 2 times.
7) Check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” performed?	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	Is DTC P2227 set?	Go to Step 3.	Substitute a known-good ECM and recheck.
3	MAP sensor check 1) Check MAP sensor and its circuit referring to “DTC P0107 Manifold Absolute Pressure Low Input” and “DTC P0108 Manifold Absolute Pressure High Input”. Is check result satisfactory?	Substitute a known-good ECM and recheck.	MAP sensor or its circuit malfunction.

Table B-1 Fuel Injector Circuit Check

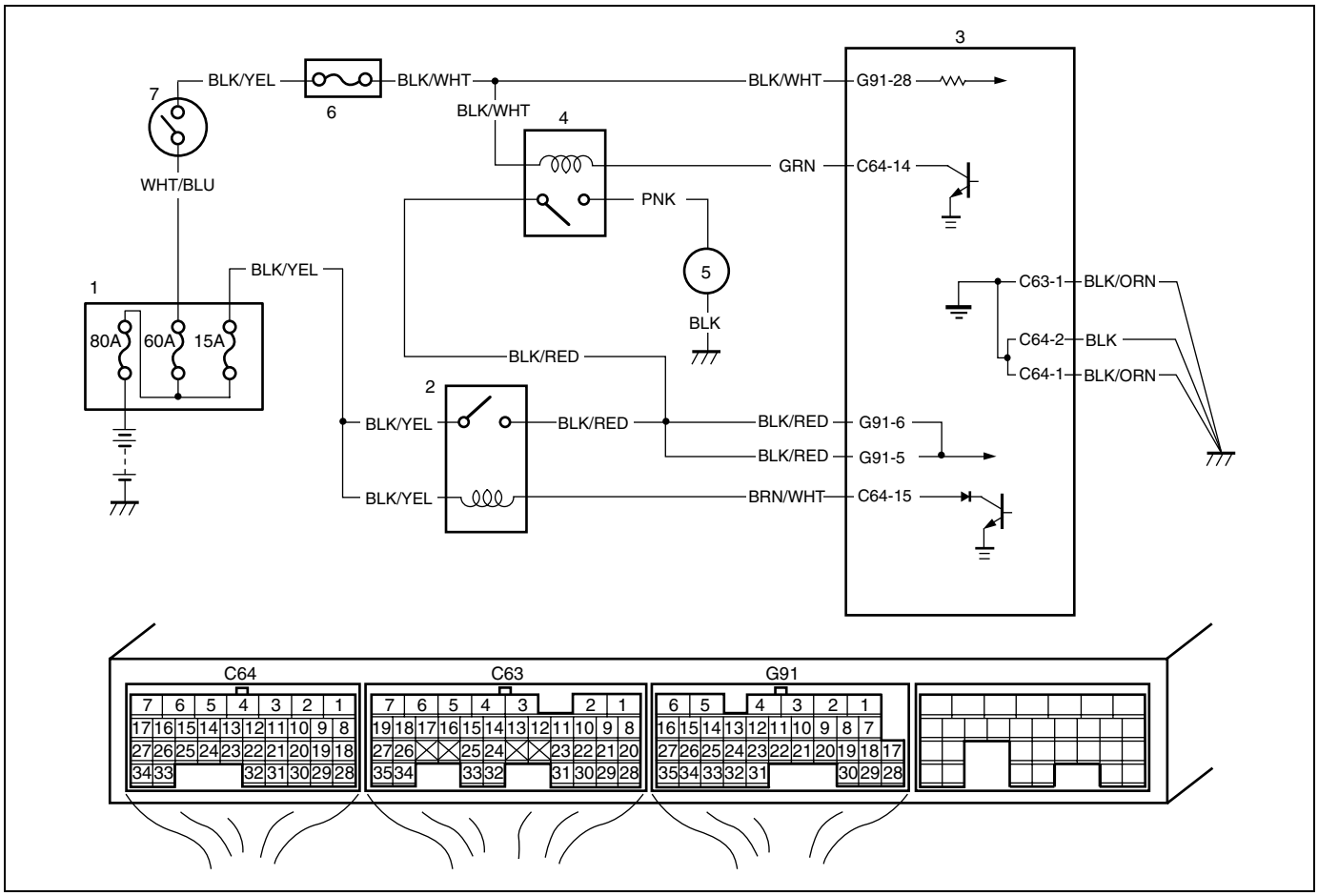


1. Relay/fuse box	4. No.1 injector	7. No.4 injector
2. Main relay	5. No.2 injector	8. “IG” fuse
3. ECM	6. No.3 injector	9. Ignition switch

TROUBLESHOOTING

Step	Action	Yes	No
1	Check each injector for operating sound at engine cranking using sound scope. Do all 4 injector make operating sound?	Fuel injector circuit is in good condition.	Go to Step 2.
2	Check fuel injector resistance. 1) Disconnect connectors from fuel injectors with ignition switch turn OFF. 2) Check for proper connection to fuel injector at each terminals. 3) If OK, check all 4 fuel injectors for resistance, referring to “Fuel injector inspection” in Section 6E1. Are all injectors in good condition?	Go to Step 3.	Faulty fuel injector.
3	Check fuel injector insulation resistance. 1) Check that there is insulating between each fuel injector terminals and engine ground. Is there insulating?	Go to Step 4.	Faulty fuel injector.
4	Check fuel injector power supply. 1) Measure voltage between each “BLK/RED” wire terminal and engine ground with ignition switch turned ON. Is voltage 10 – 14 V?	Go to Step 5.	“BLK/RED” wire in open circuit or shorted to ground circuit. If it is in good condition, go to diag flow table A-3.
5	Check wire circuit. 1) Turn OFF ignition switch. 2) Disconnect connectors from ECM. 3) Measure resistance between each “BLU/YEL”, “BLU/WHT”, “BLU/RED”, “BLU/GRN” wire terminal and vehicle body ground. Is resistance infinity?	Go to Step 6.	“BLU/YEL”, “BLU/WHT”, “BLU/RED”, “BLU/GRN” wire shorted to ground.
6	Check wire circuit. 1) Measure voltage between each “BLU/YEL”, “BLU/WHT”, “BLU/RED”, “BLU/GRN” wire terminal and vehicle body ground with ignition switch turned ON. Is voltage 0 V?	Go to Step 7.	“BLU/YEL”, “BLU/WHT”, “BLU/RED”, “BLU/GRN” wire shorted to power supply circuit.
7	Check fuel injector drive signal. 1) Connect connectors to each fuel injectors and ECM with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage “C63-7”, “C63-6”, “C63-5”, “C63-4” terminal and vehicle body ground. Is voltage 10 – 14 V?	Check fuel injector, referring to “Fuel injector inspection” in Section 6E1. If result in good condition, substitute a known-good ECM and recheck.	“BLU/YEL”, “BLU/WHT”, “BLU/RED”, “BLU/GRN” open circuit.

Table B-2 Fuel Pump and Its Circuit Check

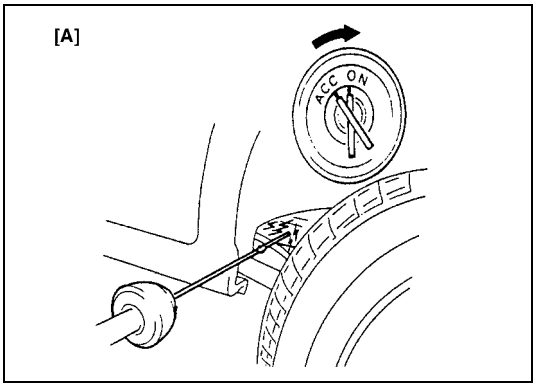


1. Relay/fuse box	4. Fuel pump relay	7. Ignition switch
2. Main relay	5. Fuel pump	
3. ECM	6. "IG" fuse	

TROUBLESHOOTING

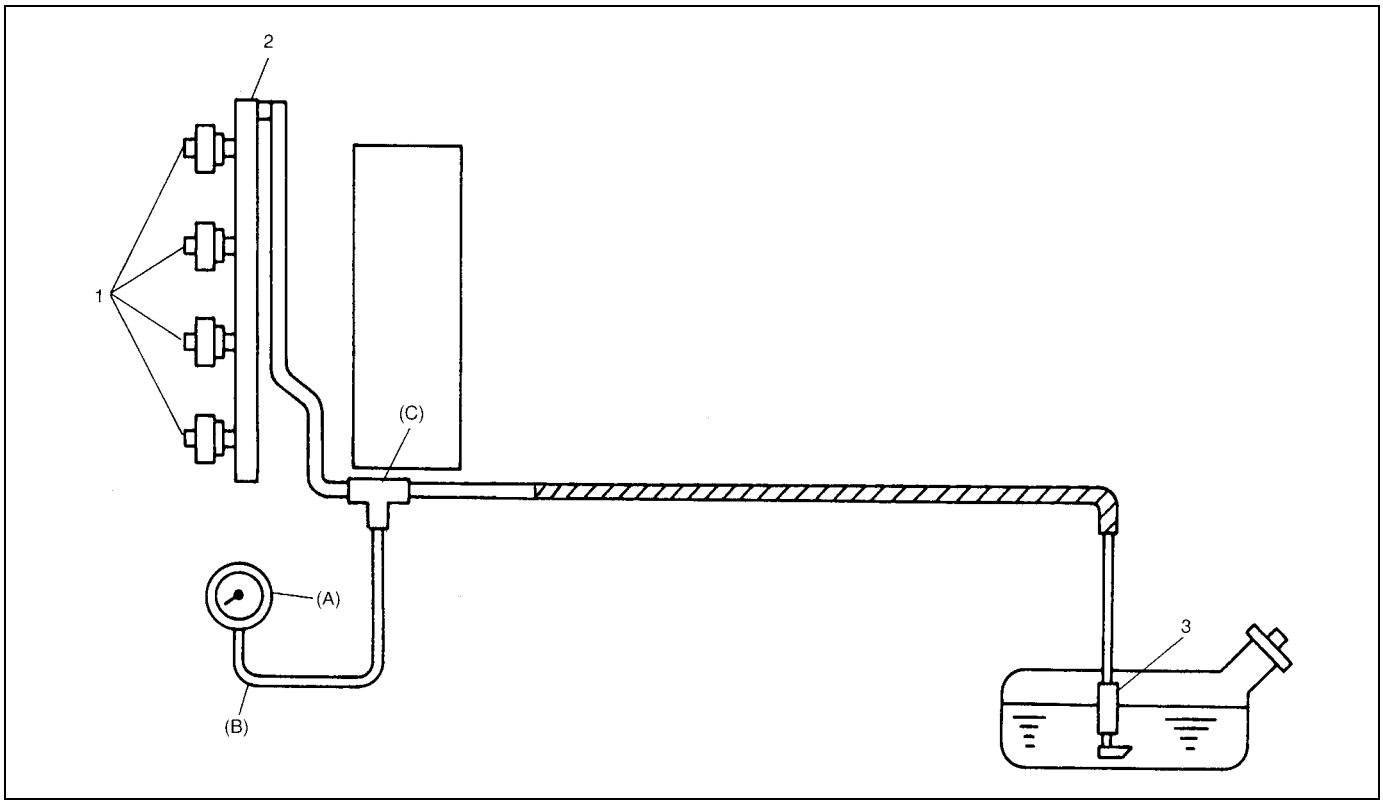
Step	Action	Yes	No
1	Check fuel pump control system for operation. See Fig. 1. Is fuel pump heard to operate for 3 sec. after ignition switch ON?	Fuel pump circuit is in good condition.	Go to Step 2.
2	Check fuel pump relay power supply. 1) Disconnect fuel pump relay from relay/fuse box with ignition switch turned OFF. 2) Check for proper connection to fuel pump relay at each terminals. 3) If OK, turn ON ignition switch, measure voltage between "BLK/WHT" wire terminal and engine ground. Is voltage 10 – 14 V?	Go to Step 3.	"BLK/WHT" wire open or shorted to ground circuit.
3	Check fuel pump relay power supply. 1) Turn ON ignition switch, measure voltage between "BLK/RED" wire terminal of fuel pump relay connector and engine ground. Is voltage 10 –14 V?	Go to Step 4.	"BLK/RED" wire open circuit.

Step	Action	Yes	No
4	Check fuel pump relay. 1) Check fuel pump relay, referring to “Main relay, fuel pump relay and radiator fan relay inspection” in Section 6E1. Is relay in good condition?	Go to Step 5.	Faulty relay.
5	Check fuel pump relay drive signal. 1) Connect fuel pump relay to relay/fuse box. 2) Connect voltmeter between “G64-14” terminal and vehicle body ground. 3) Measure voltage at after 3 second ignition switch turned ON. Is voltage 10 – 14 V?	Go to Step 6.	“BLK/WHT” wire open circuit or shorted to ground circuit.
6	Check fuel pump relay drive signal. 1) Measure voltage at within 3 second after ignition switch turned ON. Is voltage 0 – 1 V?	Go to Step 7.	Substitute a known-good ECM and recheck.
7	Check wire circuit. 1) Turn OFF ignition switch. 2) Detach fuel tank, referring to “Fuel Tank Removal and Installation” in Section 6C. 3) Disconnect connector from fuel pump. 4) Measure resistance between “PNK” wire terminal and vehicle body ground. Is resistance infinity?	Go to Step 8.	“PNK” wire shorted to ground.
8	Check fuel pump circuit. 1) Turn OFF ignition switch. 2) Connect service wire between “G64-14” terminal and vehicle body ground. 3) Turn ON ignition switch, measure voltage between “PNK” terminal at fuel pump connector and vehicle body ground. Is voltage 10 – 14 V?	Go to Step 9.	“PNK” wire open circuit.
9	Check fuel pump circuit. 1) Turn OFF ignition switch. 2) Check that there is continuity between “BLK” terminal at fuel pump connector and vehicle body ground. Is there continuity?	Faulty fuel pump.	“BLK” wire open circuit.



[A]: Fig. 1 for Step 1

Table B-3 Fuel Pressure Check



1. Injector	3. Fuel filter and fuel pump	B: Hose
2. Delivery pipe	A: Gauge	C: 3-way joint

TROUBLESHOOTING

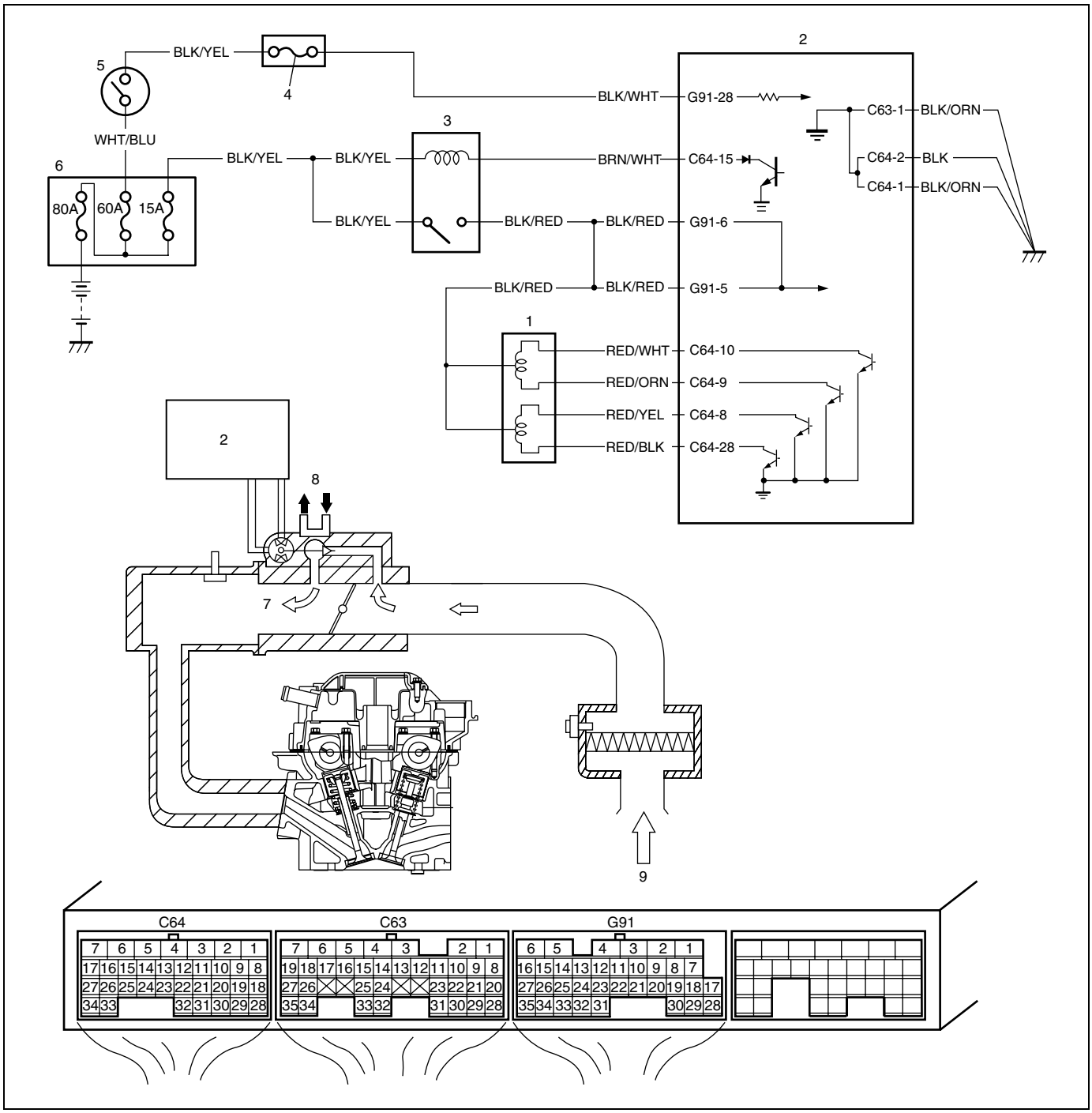
NOTE:

Before using the following table, check to make sure that battery voltage is higher than 11 V. If battery voltage is low, pressure becomes lower than specification even if fuel pump and line are in good condition.

Step	Action	Yes	No
1	Fuel Pressure Check 1) Check fuel pressure referring to “Fuel pressure inspection” under “Fuel Delivery System Description” in Section 6E1. Are they satisfied each condition?	Go to Step 2.	Go to Step 5.
2	Fuel Pressure Check 1) Start engine and warm it up to normal operating temperature. 2) Keep engine speed to 4000 rpm. Does fuel pressure shows the value which is about the same as Step 1?	Go to Step 3.	Go to Step 8.
3	Fuel Line Check 1) Check fuel pipe, fuel hose and joint for fuel leakage. Are they in good condition?	Go to Step 4.	Repair or replace.

Step	Action	Yes	No
4	Fuel Line Check 1) Check fuel pipe, fuel hose and joint for damage or deform. Are they in good condition?	Faulty fuel pressure regulator.	Repair or replace.
5	Was fuel pressure higher than specification in Step 1?	Go to Step 6.	Go to Step 7.
6	Fuel Line Check 1) Check fuel pipe, fuel hose and joint for damage or deform. Are they in good condition?	Faulty fuel pressure regulator.	Repair or replace.
7	Fuel Pump Operating Sound Check 1) Remove fuel filler cap and then turn ON ignition switch. Can you hear operation sound?	Go to Step 8.	Faulty fuel pump.
8	Fuel Line Check 1) Check fuel pipe, fuel hose and joint for damage or deform. Are they in good condition?	Clogged fuel filter, faulty fuel pump, faulty fuel pressure regulator or fuel leakage from hose connection in fuel tank.	Repair or replace.

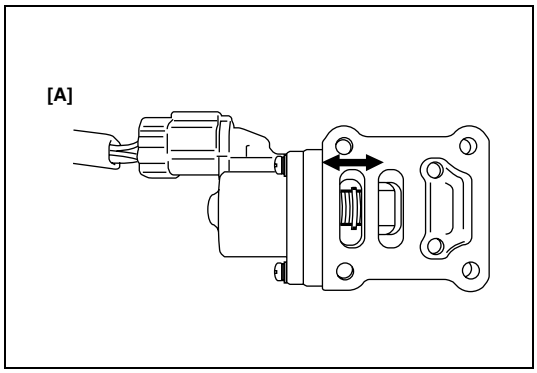
Table B-4 Idle Air Control System Check



1. IAC valve	4. "IG" fuse	7. Bypass air
2. ECM	5. Ignition switch	8. Engine coolant
3. Main relay	6. Relay/fuse box	9. Intake air

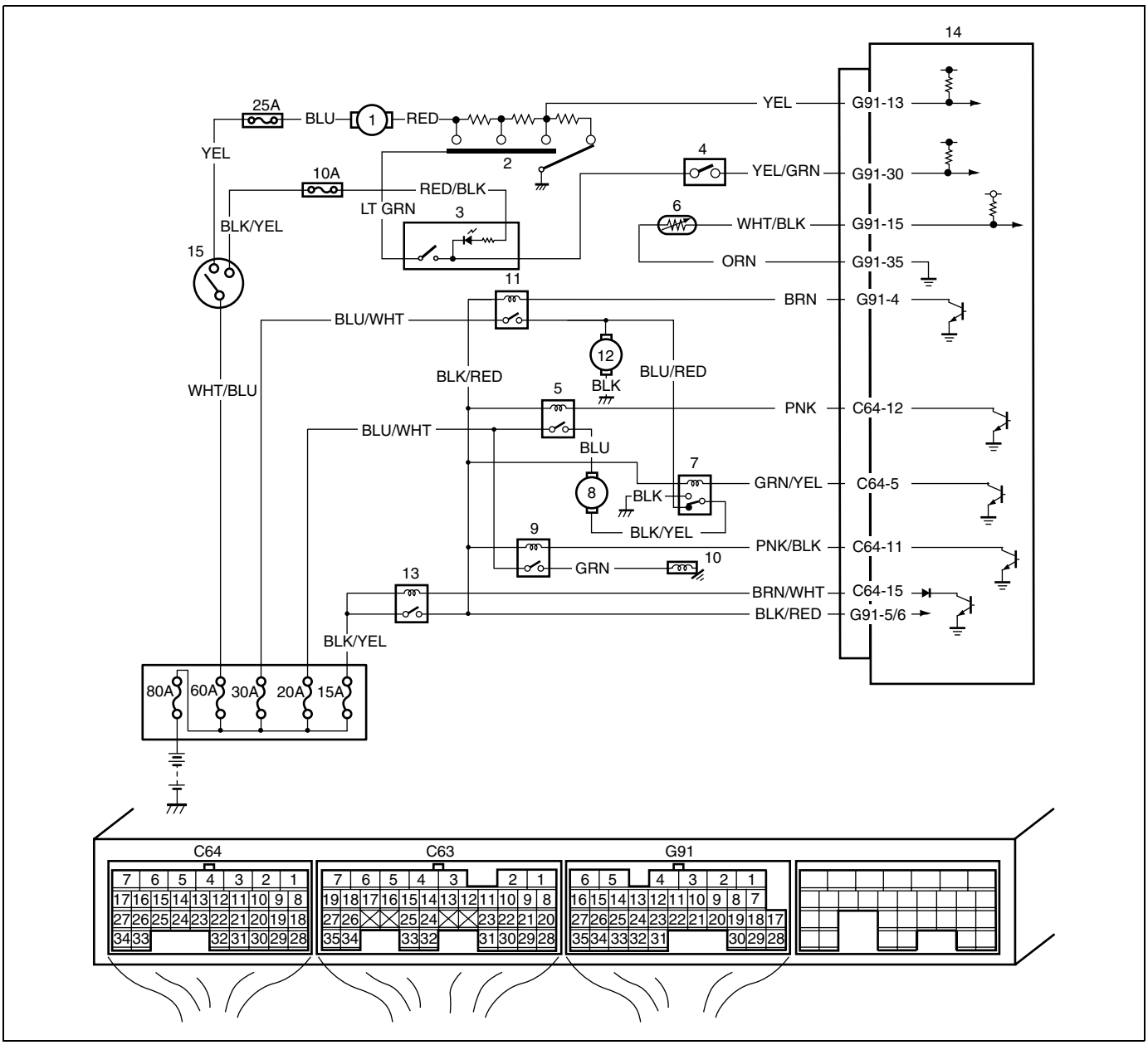
TROUBLESHOOTING

Step	Action	Yes	No
1	Check engine idle speed and IAC duty referring to “Idle speed/idle air control (IAC) duty inspection” in Section 6E1. Is idle speed within specification?	Go to Step 2.	Go to Step 4.
2	Is IAC duty within specification in Step 1?	Go to Step 3.	Check for followings: Vacuum leak EVAP canister purge control system Clog of IAC air passage Accessory engine load “Table B-6 Electric Load Signal Circuit Check” Closed throttle position (TP sensor) Stuck to PCV valve.
3	Is engine idle speed kept specified speed even with headlight ON?	System is in good condition.	Go to Step 6.
4	Was idle speed higher than specification in Step 1?	Go to Step 5.	Go to Step 6.
5	Check A/C (input) signal circuit referring to Step 1 of “Table B-5 A/C Signal Circuits Check (Vehicle with A/C)”, if equipped. Is it in good condition?	Go to Step 6.	Repair or replace A/C signal circuit or A/C system.
6	Check Idle Air Control system. 1) Remove IAC valve from throttle body referring to “Idle air control (IAC) valve removal and installation” in Section 6E1. 2) Check IAC valve for operation referring to “Idle air control (IAC) valve inspection” in Section 6E1. See Fig. 1. Is check result satisfactory?	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 7.
7	Check Wire Harness for Open or Short. 1) Turn ignition switch OFF. 2) Disconnect IAC valve connector. 3) Check for proper connection to IAC valve at each terminals. 4) If OK, disconnect connectors from ECM. 5) Check for proper connection to ECM at “C64-10”, “C64-9”, “C64-8” and “C64-28” terminals. 6) If OK, check “BLK/RED”, “RED/WHT”, “RED/ORN”, “RED/YEL” and “RED/BLK” circuit for open or short. Are they in good condition?	Replace IAC valve and recheck.	Repair or replace.



[A]: Fig. 1 for Step 6

Table B-5 A/C Signal Circuits Check (Vehicle with A/C)



1. Blower fan motor	5. A/C condenser fan relay No.1	9. A/C compressor relay	13. Main relay
2. Blower fan switch	6. A/C evaporator inlet air temp. sensor	10. A/C compressor	14. ECM
3. A/C switch	7. A/C condenser fan relay No.2	11. Radiator fan motor relay	15. Ignition switch
4. A/C pressure switch	8. A/C condenser fan motor	12. Radiator fan motor	

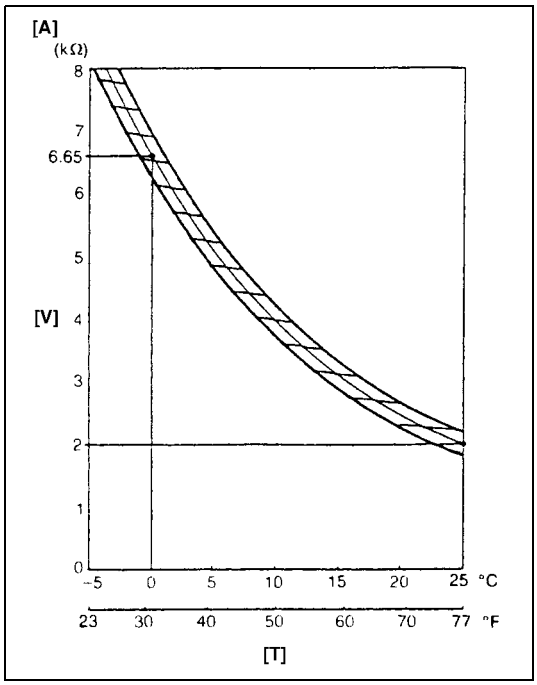
TROUBLESHOOTING

Step	Action	Yes	No
1	Check Evaporator Temp. Sensor 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection to “G91-15” and “G91-35” wire terminals of ECM connector. 3) If OK, measure resistance between “G91-15” and “G91-35” wire terminals of ECM connector. (See Fig. 1.) At 0°C: 6.3 – 7.0 kΩ At 25°C: 1.8 – 2.2 kΩ Is it within specification?	Go to Step 2.	Faulty A/C evaporator temperature sensor or its circuit.
2	Check A/C signal 1) Measure voltage between “G91-30” wire terminal of ECM connector and vehicle body ground under the following condition. With ignition switch ON and A/C switch OFF: 10 – 14 V With ignition switch ON, A/C and heater blower switch ON: 0 – 1 V Is check result as specified?	Go to Step 3.	A/C and heater blower switch circuit, A/C refrigerant pressure switch or heater controller malfunction.
3	Check A/C signal 1) Connect connectors to ECM with ignition switch turned OFF. 2) Measure voltage between “G91-30” wire terminal of ECM connector and vehicle body ground under the following condition. With ignition switch ON and A/C switch OFF: 10 – 14 V With ignition switch ON, A/C and heater blower switch ON: 0 – 1 V Is check result as specified?	Go to Step 4.	Poor “G91-30” terminal connection. If OK, substitute a known–good ECM and recheck.
4	Check A/C Condenser Fan Control System Is A/C cooling fan started when A/C and heater blower switch turned ON?	Go to Step 8.	Go to Step 5.
5	Check Condenser Fan Control Circuit 1) Check DTC with scan tool. Is DTC P0481 displayed?	Go to “DTC P0481 Fan 2 (A/C Condenser Fan) Control Circuit” in this section.	Go to Step 6.
6	Check Condenser Fan Relay 1) Check A/C condenser fan relay No.1 and No.2 referring to “Condenser Cooling Fan Relay (No.1 and No.2) Inspection” in Section 1B. Are check result satisfactory?	Go to Step 7.	Replace A/C condenser fan relay No.1 and No.2.

Step	Action	Yes	No
7	Check Condenser Fan 1) Check condenser fan referring to "Condenser Cooling Fan Motor On-Vehicle Inspection" in Section 1B. Is check result satisfactory?	A/C condenser fan drive circuit malfunction. If circuit OK, go to Step 8.	Replace A/C condenser fan motor.
8	Check A/C Compressor Control System Is A/C compressor started when A/C and heater blower switch turned ON while engine running?	A/C system is in good condition.	Go to Step 9.
9	Check A/C Compressor Relay Circuit 1) Check voltage between "C64-11" wire terminal of ECM connector and vehicle body ground under the following condition. While engine running and A/C switch OFF: 10 – 14 V While engine running, A/C and heater blower switch ON: 0 – 1 V Are check result satisfactory?	Go to Step 10.	Go to Step 11.
10	Check A/C Compressor Relay 1) Check A/C compressor relay referring to "Compressor Relay Inspection" in Section 1B. Is it in good condition?	Check A/C Compressor referring to "Compressor Relay Inspection" in Section 1B.	Replace A/C compressor relay.
11	Check A/C Compressor Relay Circuit 1) Remove A/C compressor relay with ignition switch turned OFF. 2) Turn ON ignition switch, check voltage between "BLK/RED" wire terminal of A/C compressor relay connector and vehicle body ground. Is voltage 10 –14 V?	Go to Step 12.	"BLK/RED" wire circuit open.
12	Check A/C Compressor Relay 1) Check A/C compressor relay referring to "Compressor Relay Inspection" in Section 1B. Is it in good condition?	"PNK/BLK" wire circuit open. If OK, substitute a known-good ECM and recheck.	Replace A/C compressor relay.

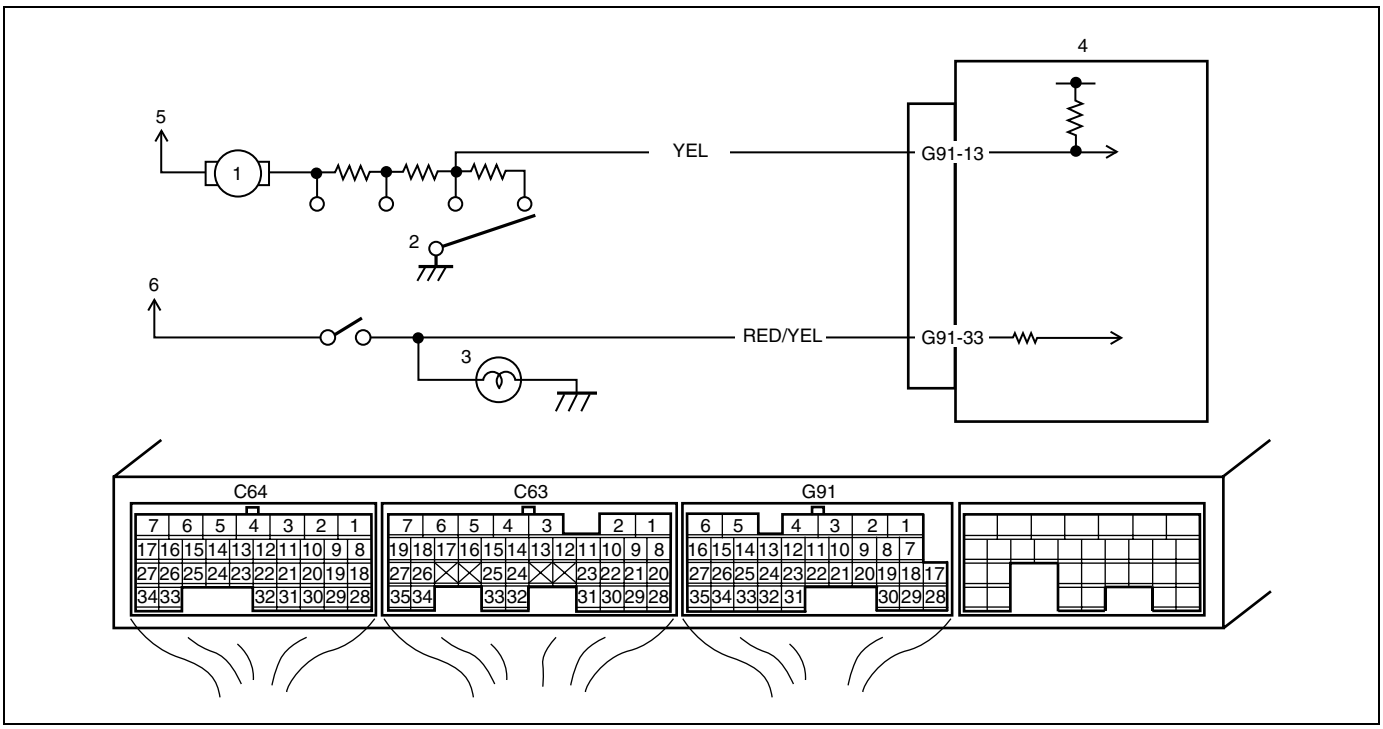
NOTE:

When A/C evaporator thermistor temp. is below 2.5°C (36.5°F), A/C remains OFF (C64-11 terminal voltage becomes 0 – 1 V). This condition is not abnormal.



[A]: Fig. 1 for Step 1
[V]: Resistance
[T]: Temperature

Table B-6 Electric Load Signal Circuit Check



1. Blower fan motor	3. Position lamp	5. To “HEATER” fuse
2. Blower fan switch	4. ECM	6. To “TAIL” fuse

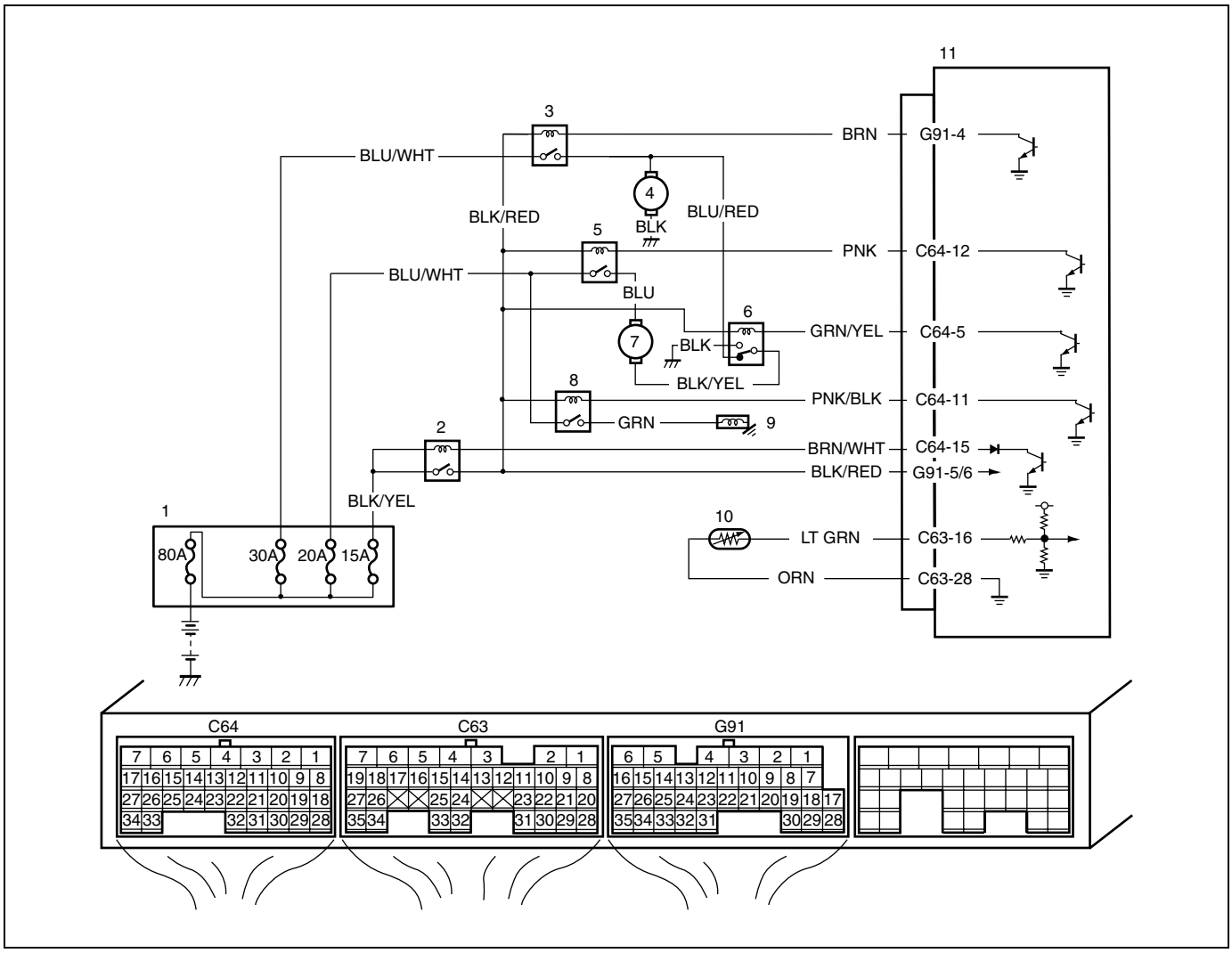
TROUBLESHOOTING

Step	Action	Yes	No
1	Do you have Suzuki Scan Tool?	Go to Step 2.	Go to Step 3.
2	Check electric load signal circuit. 1) Connect Suzuki Scan Tool to DLC with ignition switch OFF. 2) Start engine and select “DATA LIST” mode on scan tool. 3) Check electric load signal under following each condition. See Table 1. Is check result satisfactory?	Electric load signal circuit is in good condition.	“YEL” and/or “RED/YEL” circuit open or short, electric load diodes malfunction or each electric load circuit malfunction.
3	Check electric load signal circuit. 1) Turn ignition switch ON. 2) Check voltage at each terminals “G91-13” and “G91-33” of ECM connector connected, under above each condition. See Table 1. Is each voltage as specified?	Electric load signal circuit is in good condition.	“YEL” and/or “RED/YEL” circuit open or short, electric load diodes malfunction or each electric load circuit malfunction.

Table 1 for Step 2 and 3

		Scan tool or voltmeter		
		SUZUKI SCAN TOOL	VOLTAGE AT G91-33	VOLTAGE AT G91-13
Ignition switch ON, Small light and heater blower fan all turned	OFF	OFF	0 V	10 – 14 V
	ON	ON	10 – 14 V	0 V

Table B-7 Radiator Fan Control System Check



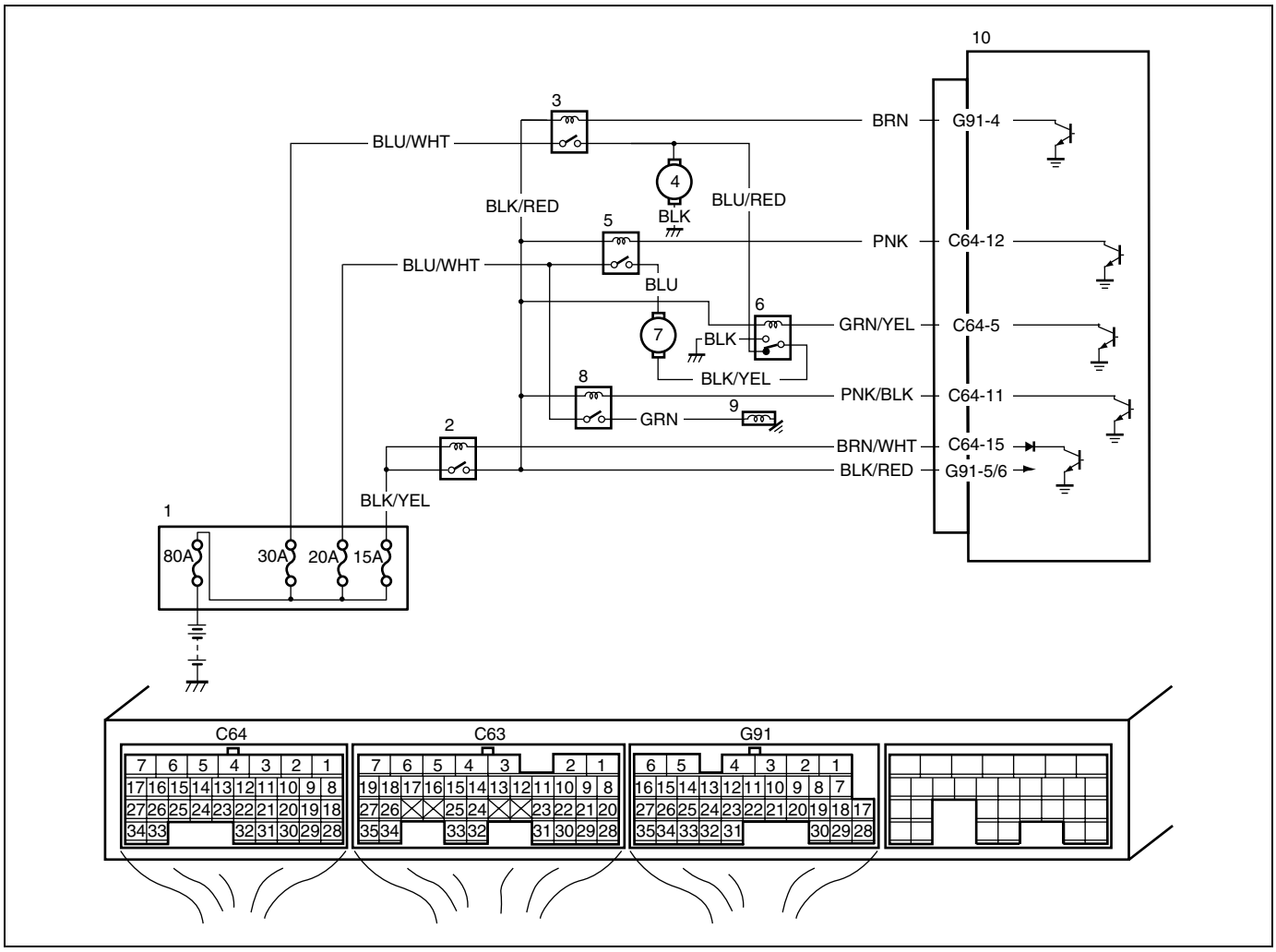
1. Relay/fuse box	5. A/C condenser fan relay No.1	9. A/C compressor
2. Main relay	6. A/C condenser fan relay No.2	10. ECT sensor
3. Radiator fan relay	7. A/C condenser fan motor	11. ECM
4. Radiator fan motor	8. A/C compressor relay	

TROUBLESHOOTING

Step	Action	Yes	No
1	DTC Check Is there DTC(s) ETC sensor circuit (DTC P0117/P0118) and/or radiator fan circuit (DTC P0480) displayed?	Go to corresponding DTC diag. flow table.	Go to Step 2.
2	Radiator Fan Motor Check 1) Disconnect negative cable at battery. 2) Disconnect connector from ECT sensor. 3) Connect negative cable to battery. Does radiator fan motor rotate at ignition switch turned ON?	System is in good condition.	Go to Step 3.

Step	Action	Yes	No
3	Main Fuse Check 1) Turn ignition switch to OFF position. 2) Disconnect connector from ECT sensor. 3) Remove main fuse from relay/fuse box. Is main (30 A) fuse in good condition?	Go to Step 4.	Replace main fuse.
4	Radiator Fan Motor Circuit Check 1) Remove radiator fan relay from relay/fuse box. 2) Measure voltage between "BLU/WHT" wire terminal of radiator fan relay connector and vehicle body ground. Is voltage 10 – 14 V?	Go to Step 5.	"BLU/WHT" wire open or high resistance circuit.
5	Check Radiator Fan Relay 1) Check radiator fan relay referring to "Main relay, fuel pump relay and radiator fan relay inspection" in Section 6E1. Is it in good condition?	Go to Step 6.	Replace radiator fan relay.
6	Radiator Fan Control Circuit Check 1) Disconnect radiator fan motor connector. 2) Measure resistance between "BLU/RED" wire terminal of radiator fan motor connector and "BLU/RED" wire terminal of radiator fan relay connector. Is resistance 1Ω or less?	Go to Step 7.	"BLU/RED" wire circuit open or poor connection.
7	Radiator Fan Control Circuit Check 1) Measure resistance between "BLU/RED" wire terminal of radiator fan motor connector and vehicle body ground. Is it infinite?	Go to Step 8.	"BLU/RED" wire circuit shorted to ground.
8	Radiator Fan Control Circuit Check 1) Turn ON ignition switch. 2) Measure voltage between "BLU/RED" wire terminal of radiator fan motor connector and vehicle body ground. Is voltage 0 V?	Go to Step 9.	"BLU/RED" wire shorted to power circuit.
9	Radiator Fan Control Circuit Check 1) Measure resistance between "BLK" wire terminal of radiator fan motor connector and vehicle body ground. Is resistance 1Ω or less?	Replace radiator fan motor.	"BLK" wire open or high resistance circuit.

Table B-8 A/C Condenser Fan Control System



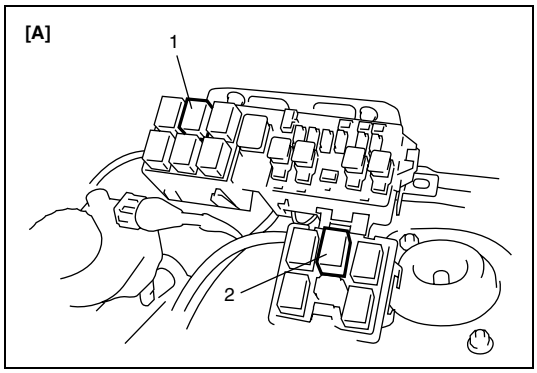
1. Relay/fuse box	5. A/C condenser fan relay No.1	9. A/C compressor
2. Main relay	6. A/C condenser fan relay No.2	10. ECM
3. Radiator fan relay	7. A/C condenser fan motor	
4. Radiator fan motor	8. A/C compressor relay	

TROUBLESHOOTING

Step	Action	Yes	No
1	DTC Check 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Check pending DTC and DTC with scan tool. IS DTC P0480 and/or P0481 displayed?	Go to corresponding DTC diag. Flow table.	Go to Step 2.
2	Check A/C condenser Fan Control System 1) Start engine. 2) Turn ON A/C switch and operate blower fan motor. Is A/C condenser fan motor started?	Go to Step 3.	Go to Step 4.

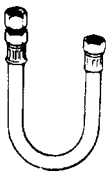
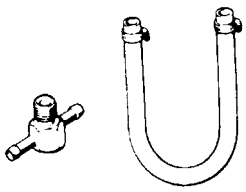
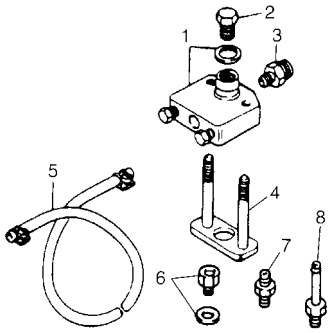
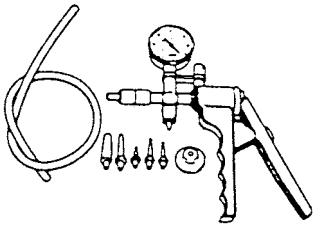
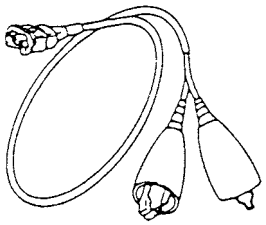
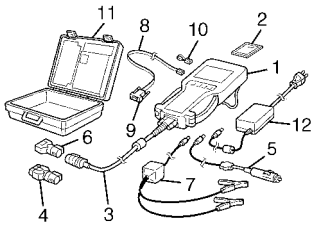
Step	Action	Yes	No
3	Check A/C condenser fan control system. 1) Run engine and warm up it normal operating temperature. 2) Turn ON lighting switch and blower motor switch. 3) Check that A/C condenser fan motor and radiator fan motor operation as follows. • A/C condenser fan motor and radiator fan motor is low speed drive for 2 seconds when A/C switch is ON with engine idling. • A/C condenser fan motor is high speed drive and radiator fan motor is stopped after 2 seconds when A/C switch is ON with engine idling. Is check result satisfactory?	A/C condenser fan control system is in good condition.	Go to Step 6.
4	Check A/C Refrigerant 1) Check amount of A/C refrigerant referring to “Refrigerant charge” in Section 1B. Is it in good condition?	Go to Step 5.	Recharge refrigerant.
5	Check A/C Condenser Fan Relay 1) Check A/C condenser fan relay No.1 and No.2 referring to “Condenser Cooling Fan Relay (No.1 and No.2) Inspection” in Section 1B. Are check result in good condition?	Go to Step 6.	Replace A/C condenser fan relay No.1 or No.2.
6	Check Main Fuse 1) Remove main (20 A) fuse from relay/fuse box. Is it in good condition?	Go to Step 7.	Replace main fuse.
7	Check Wire Circuit 1) Remove A/C condenser fan relay No.1 and No.2 with ignition switch turned OFF. (See Fig. 1.) 2) Turn ON ignition switch, measure voltage between “BLU/WHT” wire terminal of A/C condenser fan relay No.1 connector and vehicle body ground, “BLU/WHT” wire terminal of A/C condenser fan relay No.2 connector and vehicle body ground. Are voltage 10 – 14 V?	Go to Step 8.	“BLU/WHT” wire in open or high resistance circuit.
8	Check Wire Circuit 1) Disconnect A/C condenser fan motor connector with ignition switch turned OFF. 2) Measure resistance between “BLU” wire terminal of A/C condenser fan relay No.1 connector and “BLU” wire terminal of A/C condenser fan motor connector. Is resistance 1Ω or less?	Go to Step 9.	“BLU” wire in open or high resistance circuit.

Step	Action	Yes	No
9	Check Wire Circuit 1) Turn ON ignition switch, measure voltage between “BLU” wire terminal of A/C condenser fan relay No.1 connector and vehicle body ground. Is voltage 0 V?	Go to Step 10.	“BLU” wire shorted to power circuit.
10	Check Wire Circuit 1) Turn OFF ignition switch, measure resistance between “BLU/YEL” wire terminal of A/C condenser fan relay No.2 connector and “BLU/YEL” wire terminal of A/C condenser fan motor connector. Is resistance 1Ω or less?	Go to Step 11.	“BLU/YEL” wire shorted to power circuit.
11	Check Wire Circuit 1) Turn ON ignition switch, measure voltage between “BLU/YEL” wire terminal of A/C condenser fan relay No.2 connector and vehicle body ground. Is voltage 0 V?	Go to Step 12.	“BLU/YEL” wire in open or high resistance circuit.
12	Check Wire Circuit 1) Turn OFF ignition switch, measure resistance between “BLK” wire terminal of A/C condenser fan relay No.2 connector and vehicle body ground. Is resistance 1Ω or less?	Go to Step 13.	“BLK” wire in open or high resistance circuit.
13	Check A/C Condenser Fan Motor 1) Check A/C condenser fan motor operation referring to “Condenser Cooling Fan Motor On-Vehicle Inspection” in Section 1B. Is it in good condition?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A. If OK, substitute a known-good ECM and recheck.	Replace A/C condenser fan motor.



[A]: Fig. 1 for Step 7
1. A/C condenser relay No.1
2. A/C condenser relay No.2

Special Tool

 09912-58442 Pressure gauge	 09912-58432 Pressure hose	 09912-58490 3-way joint & hose	 09912-58421 Checking tool set (See NOTE "A".)
 09917-47011 Vacuum pump gauge	 09930-88530 Injector test lead	 Tech 2 kit (Suzuki Scan Tool) (See NOTE "C".)	 09912-57610 Checking tool plate

NOTE:

- **"A": This kit includes the following items.**
  1. Tool body & washer, 2. Body plug, 3. Body attachment, 4. Holder, 5. Return hose & clamp, 6. Body attachment-2 & washer, 7. Hose attachment-1, 8. Hose attachment-2
- **"C": This kit includes the following items.**
  1. Tech 2, 2. PCMCIA card, 3. DLC cable, 4. SAE 16/19 adapter, 5. Cigarette cable, 6. DLC loopback adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loopback connector, 11. Storage case, 12. Power supply

SECTION 6A1

ENGINE MECHANICAL (M13 ENGINE)

WARNING:

For vehicles equipped with a Supplemental Restraint (Air Bag) System :

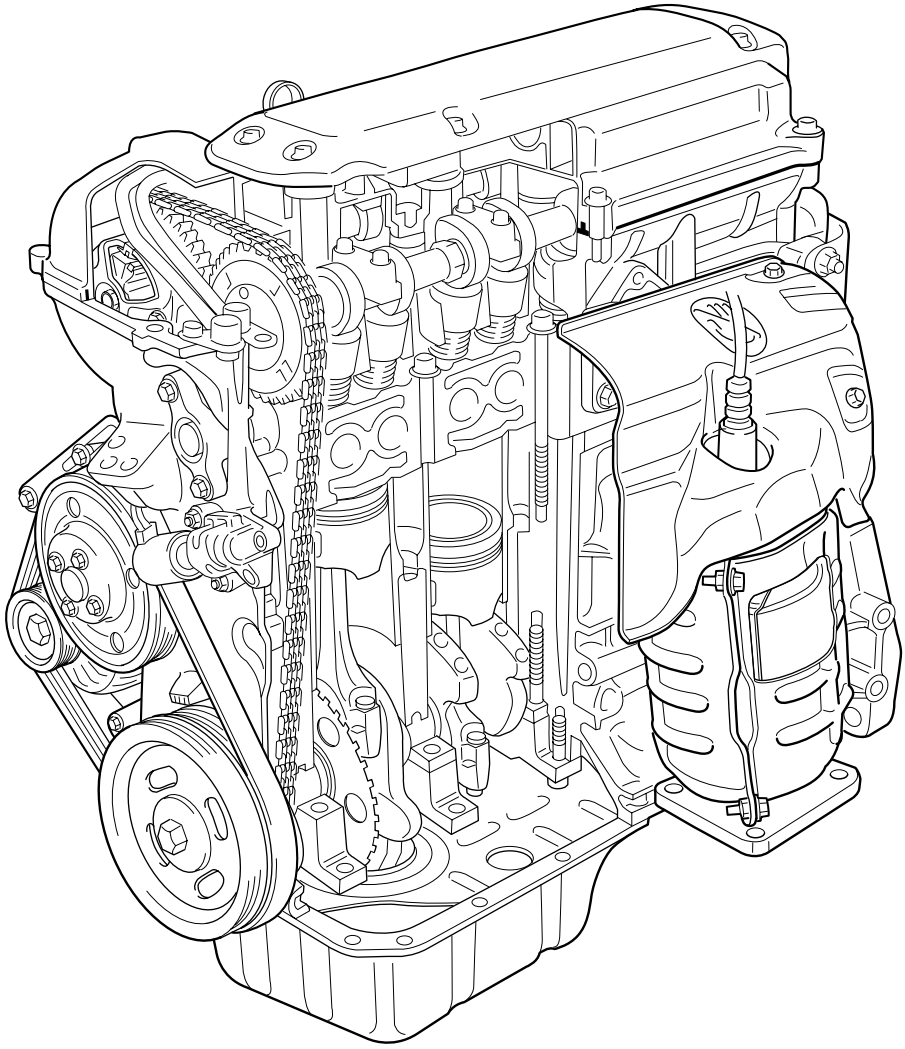
- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

General Description

Engine Construction Description

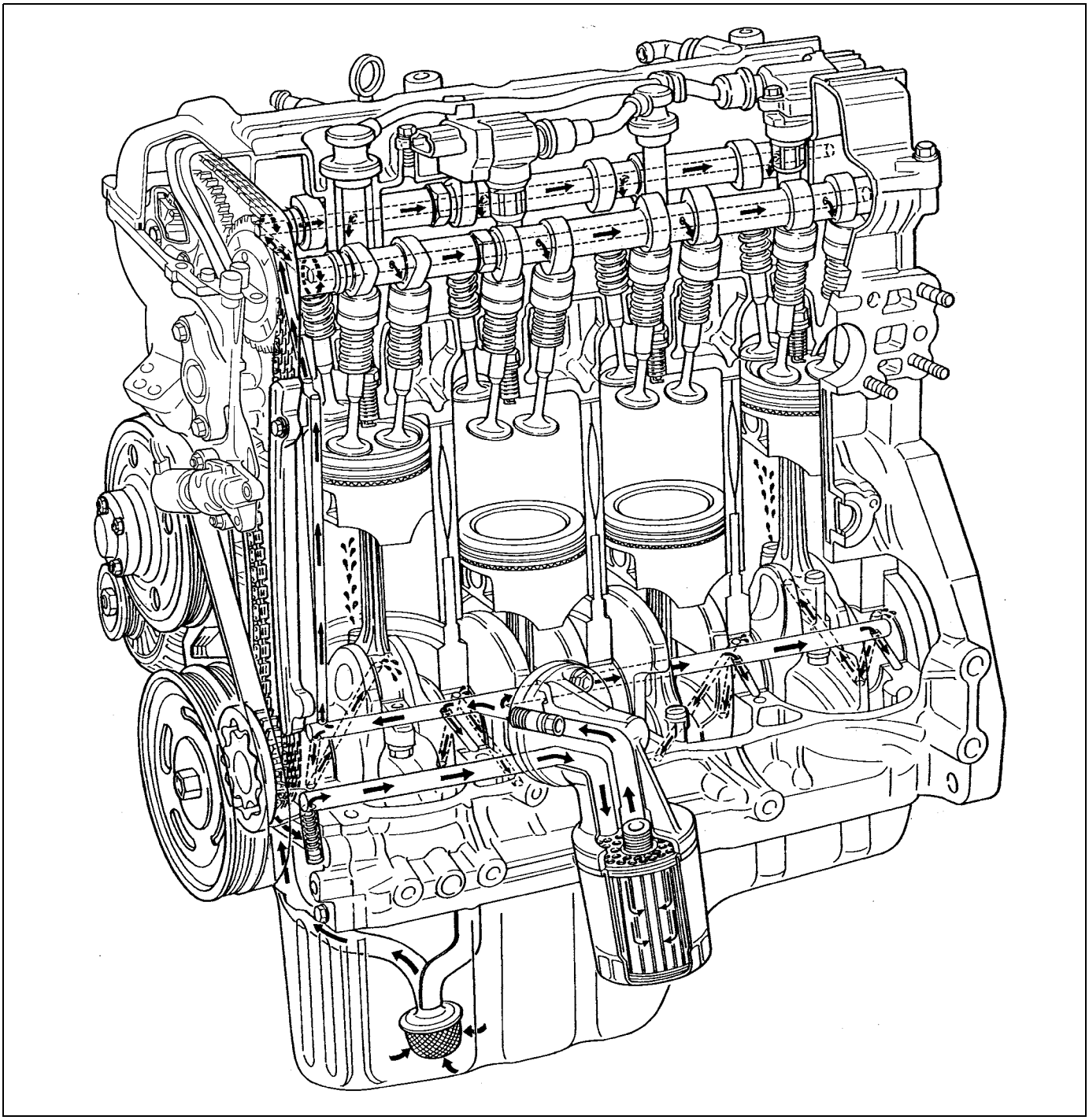
The engine is water-cooled, in line 4 cylinders, 4 stroke cycle gasoline unit with its DOHC (Double overhead camshaft) valve mechanism arranged for “V” type valve configuration and 16 valves (4 valves/one cylinder). The double overhead camshaft is mounted over the cylinder head; it is driven from crankshaft through timing chain, and no push rods are provided in the valve train system.



Engine Lubrication Description

The oil pump is of a trochoid type, and mounted on the crankshaft. Oil is drawn up through the oil pump strainer and passed through the pump to the oil filter.
The filtered oil flows into 2 paths in cylinder block.
In one path, oil reaches the crankshaft journal bearings. Oil from the crankshaft journal bearings is supplied to the connecting rod bearings by means of intersecting passages drilled in the crankshaft, and then injected from the big end of connecting rod to lubricate piston, rings, and cylinder wall.
In other path oil goes up to the cylinder head and lubricates valves and camshafts, etc., after passing through the internal oilway of camshafts.

An oil relief valve is provided on the oil pump. This valve starts relieving oil pressure when the pressure exceeds about 390 kPa (3.9 kg/cm^2, 56.6 psi).



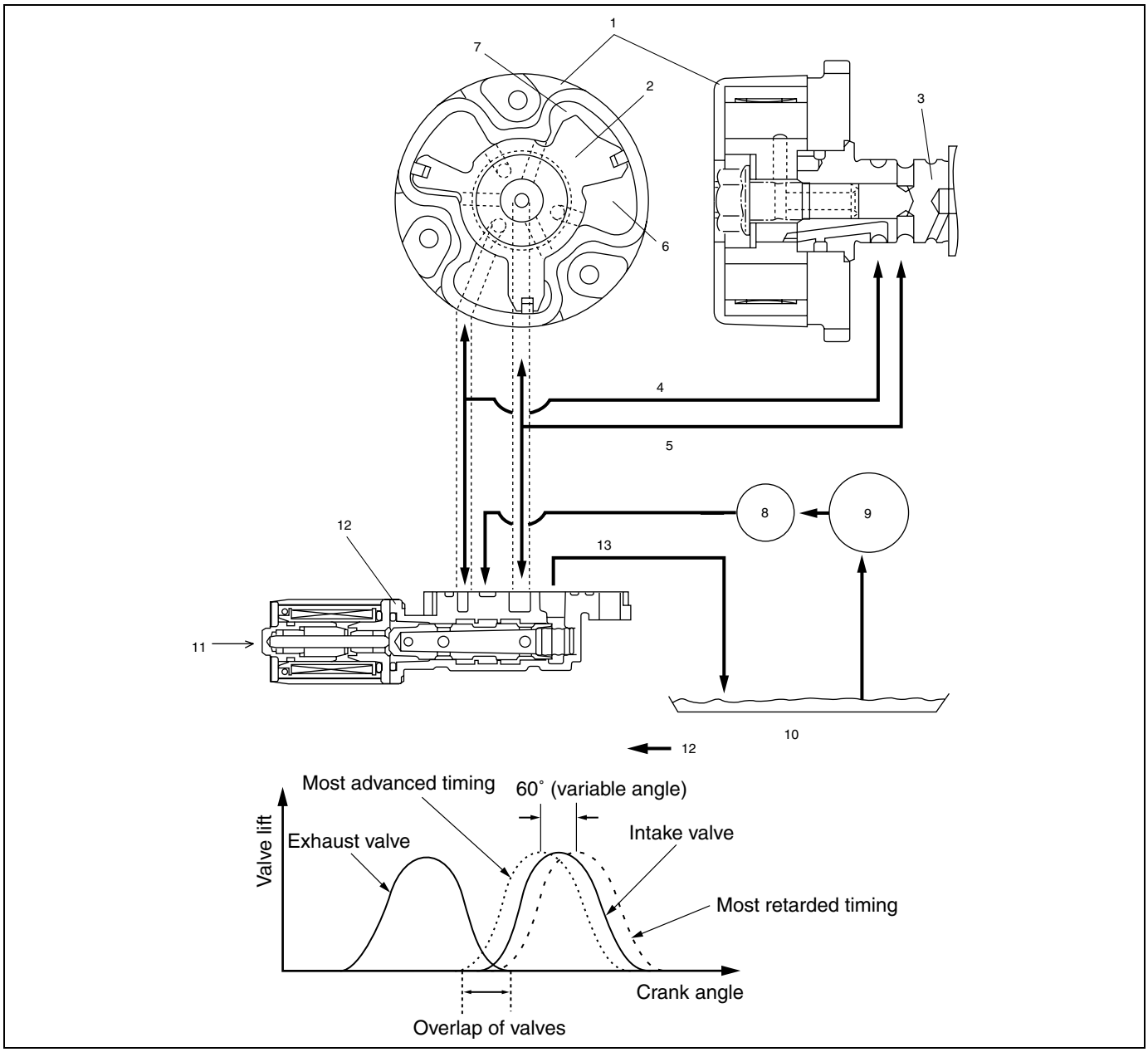
Variable Valve Timing (VVT) System Description

System description

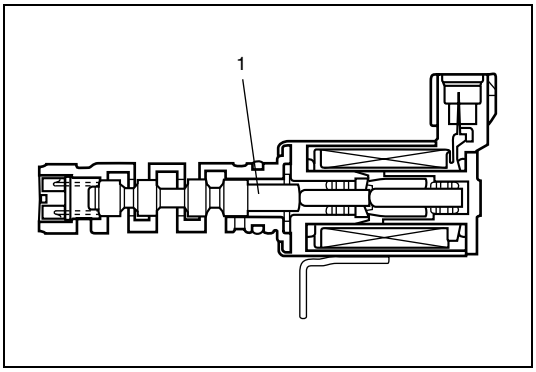
The VVT system is an electronic control system which continuously vary and optimize the intake valve timing in response to the engine operating condition.

The optimized intake valve timing produce such an air intake with high efficiency that both the higher power generation and lower fuel consumption can be attained in the whole engine speed range from low to high. In the area of the average engine load, low emission of nitrogen oxides (NOx) and high fuel efficiency can also be attained by making the valve opening overlap between the intake and exhaust valves longer.

For the brief of the system operation, the intake valve timing is varied by the cam timing sprocket (1) which varies the rotational phase between the intake camshaft (3) and sprocket. The rotor (2) in the cam timing sprocket is actuated by switching or adjusting the hydraulic pressure applied to the chambers for the timing advancing (7) and/or retarding (6). To switch or adjust the hydraulic pressure appropriately, ECM operates the oil control valve (12) with detecting the engine speed, intake air value, throttle opening, engine coolant temperature and camshaft position (angle).

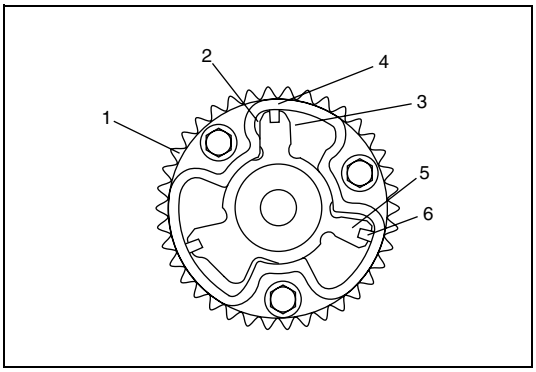


4. Oil passage to chamber for timing retarding	8. Oil filter	10. Oil pan	12. Oil flow
5. Oil passage to chamber for timing advancing	9. Oil pump	11. Control signal from ECM	



Oil control valve

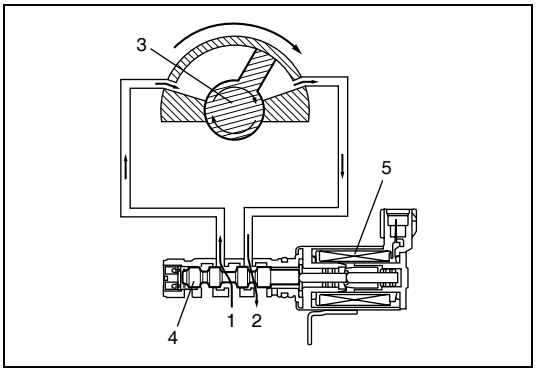
The oil control valve switches and adjusts the hydraulic pressure applied to the cam timing sprocket by moving the spool valve (1) according to the duty pulse signals output from the ECM. By this operation, the intake valve timing is varied continuously. Signals output from the ECM are the duty pulse of about 240 Hz.



Cam timing sprocket

The cam timing sprocket is equipped with the chambers for timing advancing (2) and retarding (3) which are separated by the rotor (5). The rotor rotates receiving the hydraulic pressure applied to both the chambers. The sprocket (1) is installed on the housing (4) and the rotor is secured on the intake camshaft by fastening the bolts. Therefore, the actuation of the rotor makes the phase difference between the sprocket and intake camshaft.

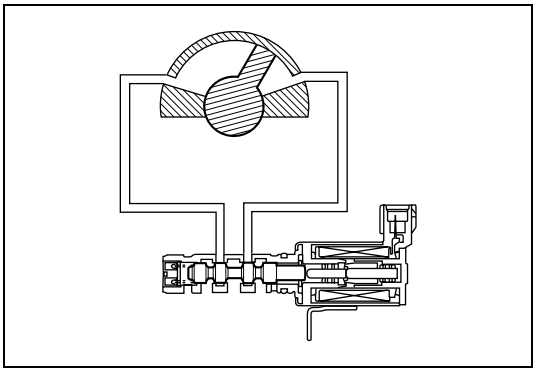
6. Seal



Timing advancing

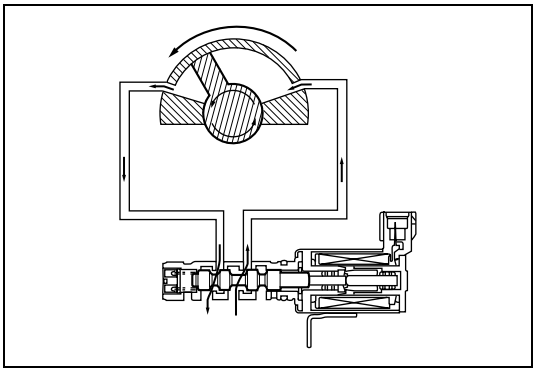
When the duty ratio of the signal output from the ECM is heavy, the spool valve (4) of the oil control valve moves to the left (opposite direction against the coil (5)). By this spool valve movement, the pressurized oil (1) is led into the chambers for timing advancing and the oil in the chambers for timing retarding is drained. This operations actuate the rotor (3) and result in the advanced timing of the intake valve.

2. Drain



Timing holding

When the duty ratio of the signal output from the ECM shows that of holding, the spool valve of the oil control valve is located at hold position. Because this condition generates no oil pressure changes in both chambers, the rotor is fixed at a target position.



Timing retarding

When the duty ratio of the signal output from the ECM is light, the spool valve of the oil control valve moves to the right (head for the coil). By this spool valve movement, the pressurized oil is led into the chambers for timing retarding and the oil in the chambers for timing advancing is drained. This operations actuate the rotor and result in the retarded timing of the intake valve.

Targeted timing varying operation

DRIVING CONDITION	VALVE TIMING	TARGET OF CONTROL	EFFECT
Engine running at idle speed	Most retarded	To shorten the valve opening overlap in order to prevent the exhaust gas counterflow to intake manifold.	Stabilization of the engine rotation at idle speed.
Average engine load range	To the advanced side	To lengthen the valve opening overlap in order to enhance the internal exhaust gas recirculation and reduce the pumping loss.	Improvement of the fuel efficiency. Lowering of the exhaust emission.
Light engine load range	To the retarded side	To shorten the valve opening overlap in order to prevent the exhaust gas counterflow to intake manifold.	Keeping of the engine stability.
Low or average engine speed range with heavy engine load	To the advanced side	To advance the closing timing of the intake valve in order to improve the volumetric efficiency.	Improvement of generating the engine torque at low and average engine speed.
High engine speed range with heavy engine load	To the retarded side	To retard the closing timing of the intake valve in order to improve the volumetric efficiency.	Improvement of generating the engine power.
Low engine coolant temperature	Most retarded	To shorten the valve opening overlap in order to prevent the exhaust gas counterflow to intake manifold and reduce the fuel increasing. To slow the fast idle speed of the engine as a result of stabilizing the engine idling.	Stabilization of the fast idling of the engine. Improvement of the fuel efficiency.
At engine starting and stopping	Most retarded	To shorten the valve opening overlap in order to prevent the exhaust gas counterflow to intake manifold.	Improvement of start ability

Diagnosis

Diagnosis Table

Refer to “Engine Symptom Diagnosis” in Section 6.

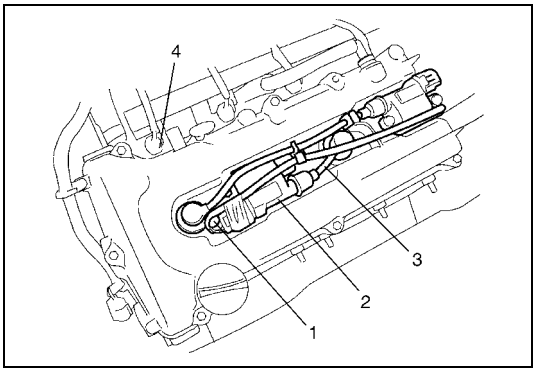
Compression Check

Check compression pressure on all 4 cylinders as follows:

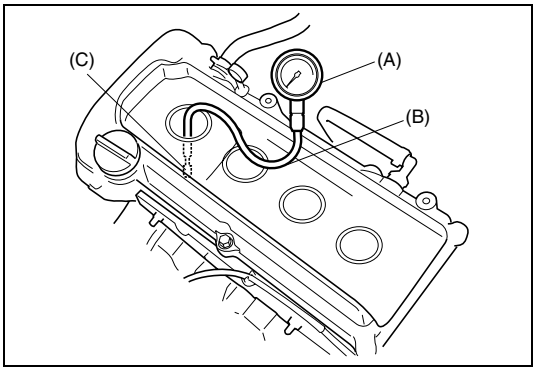
1) Warm up engine to normal operating temperature.
2) Stop engine after warming up.

NOTE:

After warming up engine, place transaxle gear shift lever in “Neutral” (shift selector lever to “P” range for A/T model), and set parking brake and block drive wheels.

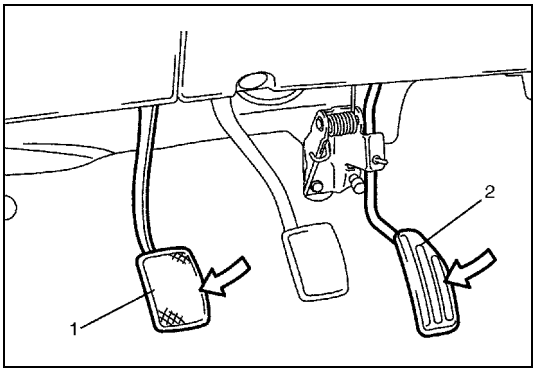


3) Disconnect ignition coil couplers (1).
4) Remove ignition coil assemblies (2) with high-tension cord (3).
5) Remove all spark plugs.
6) Disconnect fuel injector wires (4) at the coupler.



7) Install special tools (compression gauge) into spark plug hole.

Special tool
(A) : 09915-64512
(B) : 09915-64530
(C) : 09915-67010



8) Disengage clutch (1) (to lighten starting load on engine) for M/T vehicle, and depress accelerator pedal (2) all the way to make throttle fully open.
9) Crank engine with fully charged battery, and read the highest pressure on compression gauge.

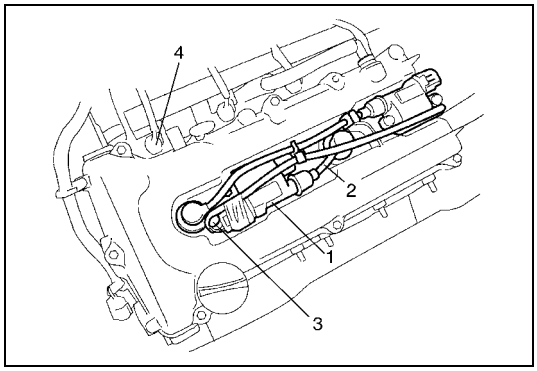
NOTE:

- **For measuring compression pressure, crank engine at least 250 rpm by using fully charged battery.**
- **If measured compression pressure is lower than limit value, check installation condition of special tool. If it is properly installed, possibility is compression pressure leakage from where piston ring or valve contact.**

Compression pressure

Standard	**1400 kPa (14.0 kg/cm^2, 199.0 psi)**
Limit	**1100 kPa (11.0 kg/cm^2, 156.0 psi)**
Max. difference between any two cylinders	**100 kPa (1.0 kg/cm^2, 14.2 psi)**

10) Carry out Steps 7) through 9) on each cylinder to obtain 4 readings.



11) After checking, install spark plugs and ignition coil assemblies (1) with high-tension cord (2).
12) Connect ignition coil couplers (3).
13) Connect fuel injector wires(4) at the coupler.

Engine Vacuum Check

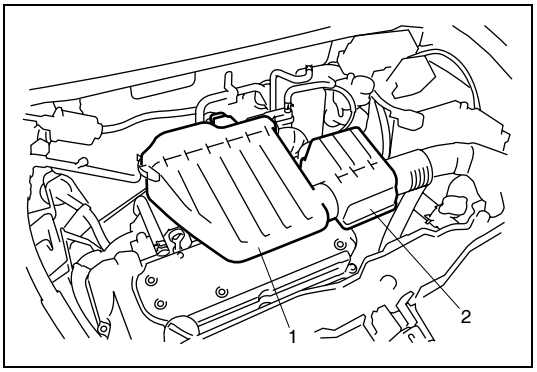
The engine vacuum that develops in the intake line is a good indicator of the condition of the engine. The vacuum checking procedure is as follows :

1) Warm up engine to normal operating temperature.

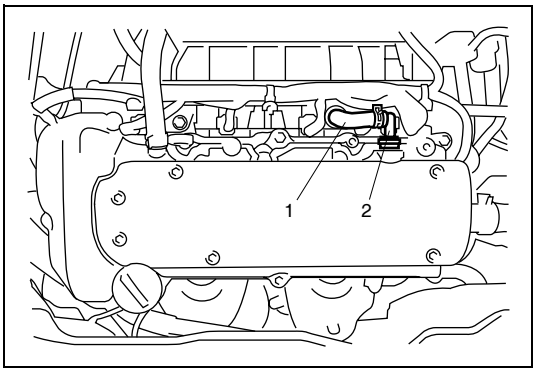
NOTE:

After warming up engine, be sure to place transaxle gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake and block drive wheels.

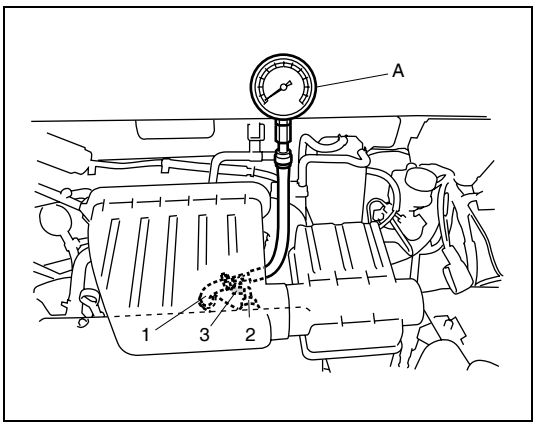
2) Stop engine and turn off the all electric switches.



3) Remove air cleaner case (1) and resonator (2).



4) Remove PCV hose (1) from PCV valve (2).



5) Connect special tool (Vacuum gauge) to PCV hose (1).

Special tool
(A) : 09915-67311

6) Blind PCV valve (2) using tape (3) or the like.
7) Install air cleaner case and resonator.
8) Run engine at specified idle speed and read vacuum gauge. Vacuum should be within specification.

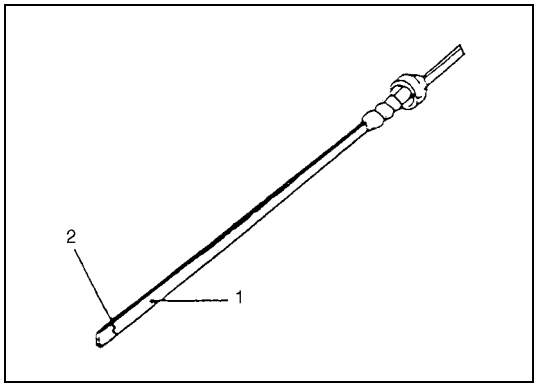
Vacuum specification (at sea level)
59 – 73 kPa (45 – 55 cmHg, 17.7 – 21.6 inHg)
at specified idle speed

9) After checking, disconnect special tool (Vacuum gauge) from PCV valve.
10) Detach blind cap from PCV valve.
11) Install air cleaner case and resonator.

Oil Pressure Check

NOTE:

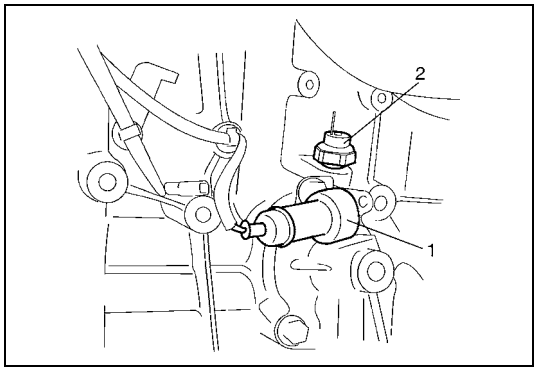
Prior to checking oil pressure, check the following items.



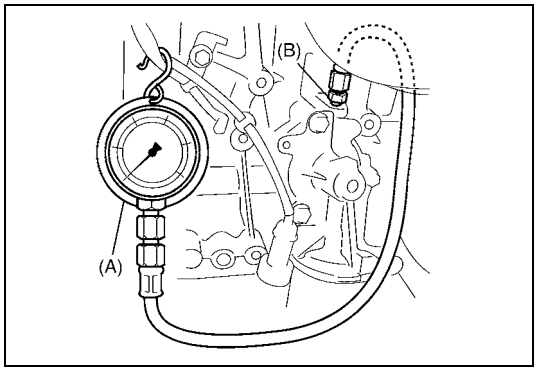
- Oil level in oil pan
  If oil level is low, add oil up to Full level mark (hole) on oil level gauge.
- Oil quality
  If oil is discolored or deteriorated, change it.
  For particular oil to be used, refer to “Engine Oil and Oil Filter Replacement” in Section 0B.

1.	Full level mark (hole)
2.	Low level mark (hole)

- Oil leaks
  If leak is found, repair it.



1) Disconnect oil pressure switch coupler (1).
2) Remove exhaust manifold cover, if necessary.
3) Remove oil pressure switch (2) from cylinder block.



4) Install special tools (Oil pressure gauge) to threaded hole of oil pressure switch.

Special tool
(A) : 09915-77310
(B) : 09915-78211

5) Start engine and warm it up to normal operating temperature.

NOTE:

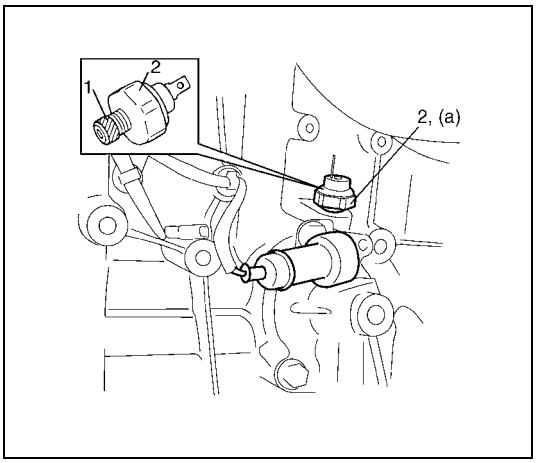
Be sure to place transaxle gear shift lever in “Neutral” (shift selector lever to “P” range for A/T model), and set parking brake and block drive wheels.

6) After warming up, raise engine speed to 4,000 rpm and measure oil pressure.

Oil pressure specification

More than 270 kPa (2.7 kg/cm^2, 39.8 psi) at 4,000 rpm

7) Stop engine and remove oil pressure gauge and attachment.



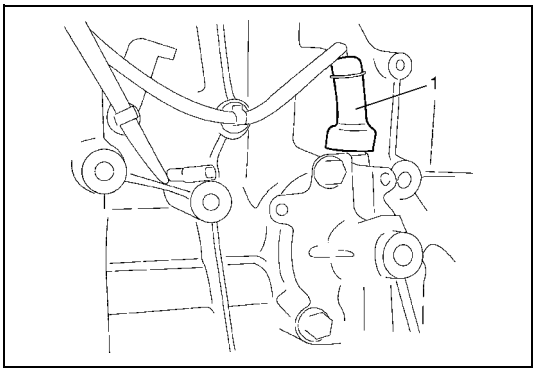
8) Before reinstalling oil pressure switch (2), be sure to wrap its screw threads with sealing tape (1) and tighten switch to specified torque.

NOTE:

If sealing tape edge is bulged out from screw threads of switch, cut it off.

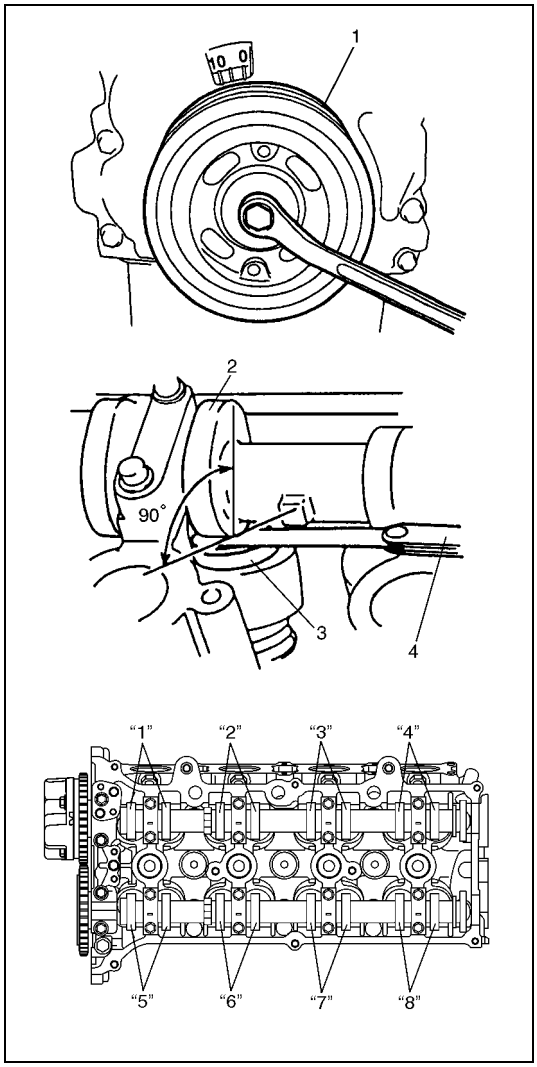
Tightening torque
Oil pressure switch (a) : 14 N·m (1.4 kg-m, 10.5 lb-ft)

9) Start engine and check oil pressure switch (2) for oil leakage. If oil leakage is found, repair it.



10) Connect oil pressure switch coupler and fit cover (1) firmly.

Valve Lash (Clearance) Inspection



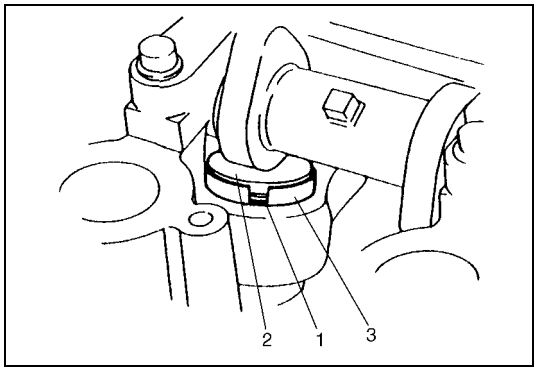
1) Remove negative cable at battery.
2) Remove cylinder head cover referring to "Cylinder Head Cover Removal and Installation" in this section.
3) Remove right side engine under cover, if necessary.
4) Using 17 mm wrench, turn crankshaft pulley (1) clockwise until cam lobes (2) become perpendicular to shim faces (3) at valves "1" and "7" as shown in figure.
5) Check valve lashes with thickness gauge (4) according to the following procedure.
   a) Check valve lashes at valves "1" and "7".
   b) Turn camshafts by 90° (by turning crankshaft with wrench).
   c) Make sure that cam lobes (2) are perpendicular to shim faces (3) at valves to be checked (in this case, "3" and "8"), if not, adjust it by turning crankshaft. Check valve lashes.
   d) In the same manner as b) – c), check valve lashes at valves "4" and "6".
   e) In the same manner as b) – c) again, check valve lashes at valves "2" and "5".

If valve lash is out of specification, record valve lash and adjust it to specification referring to "Shim Replacement" in this section.

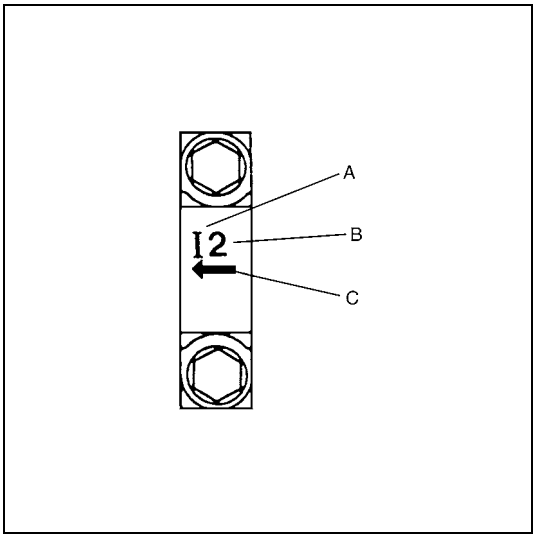
Valve clearance specification

	When cold (Coolant temperature is 15 – 25°C (59 – 77°F))	**When hot (Coolant temperature is 60 – 68°C (140 – 154°F))**
Intake	**0.18 – 0.22 mm (0.007 – 0.009 in.)**	**0.21 – 0.27 mm (0.008 – 0.011 in.)**
Exhaust	**0.28 – 0.32 mm (0.011 – 0.013 in.)**	**0.30 – 0.36 mm (0.012 – 0.014 in.)**

Shim Replacement



1) Close the valve whose shim (2) is to be replaced by turning crankshaft, then turn tappet (3) till its cut section (1) faces inside as shown in figure.
2) Lift down the valve by turning crankshaft to 360°.
3) Hold tappet at that position using special tool as follows.
   a) Remove its housing bolts.

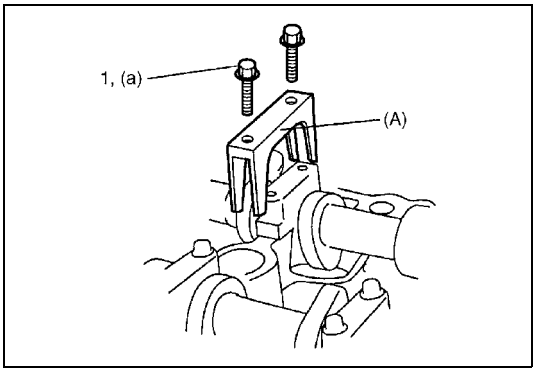


b) Check housing No. and select special tool corresponding to housing No. referring to “the following table”.

Special tool selection table

No. on camshaft housing	Embossed mark on special tool
I2	IN2
I3, I4, I5	IN345
E2	EX2
E3, E4, E5	EX345

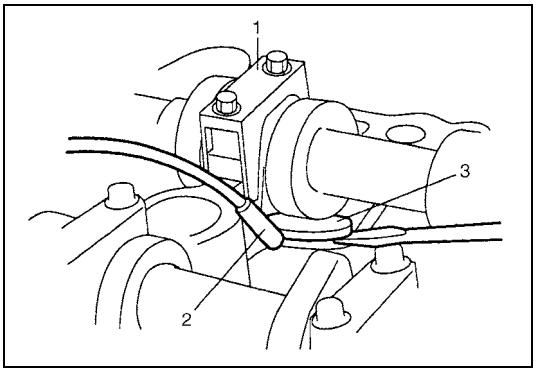
A: I : Intake side or E : Exhaust side
B: Position from timing chain side
C: Pointing to timing chain side



c) Hold down the tappet so as not to contact the shim by installing special tool on camshaft housing with housing bolt (1) tighten housing bolts to specified torque.

Special tool
(A) : 09916-67020 or 09916-67021

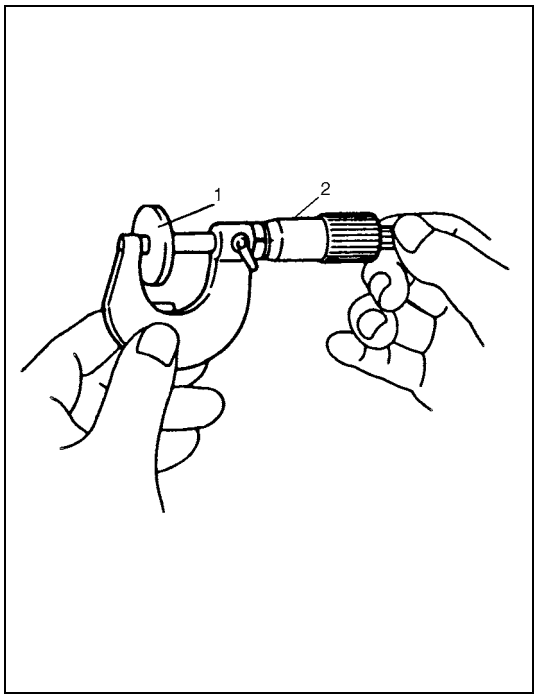
Tightening torque
Camshaft housing bolts (for tightening of special tool)
(a) : 8 N·m (0.8 kg-m, 6.0 lb-ft)



4) Turn camshaft by approximately 90° clockwise and remove shim (3).

WARNING:
Never put in the hand between cam shaft and tappet.

1. Special tool
2. Magnet

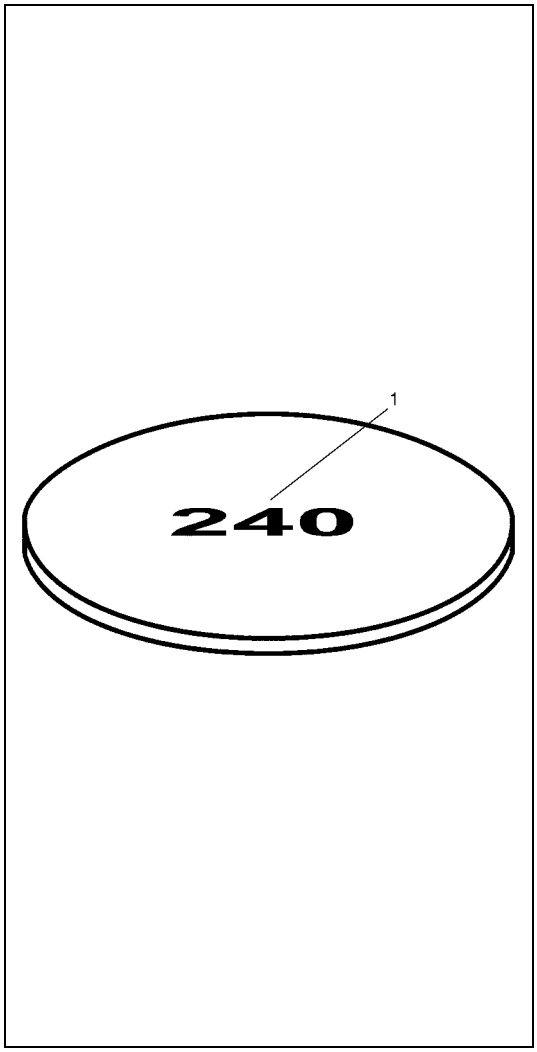


5) Using a micrometer (2), measure the thickness of the removed shim (1), and determine replacement shim by calculating the thickness of new shim with the following formula and table.

Intake side:
A = B + C – 0.20 mm (0.008 in.)
Exhaust side:
A = B + C – 0.30 mm (0.012 in.)

A : Thickness of new shim
B : Thickness of removed shim
C : Measured valve clearance

For example of intake side :
When thickness of removed shim is 2.40 mm (0.094 in.), and measured valve clearance is 0.45 mm (0.018 in.).
A = 2.40 mm (0.094 in.) + 0.45 mm (0.018 in.) – 0.20 mm (0.008 in.) = 2.65 mm (0.104 in.)
Calculated thickness of new shim = 2.65 mm (0.104 in.)

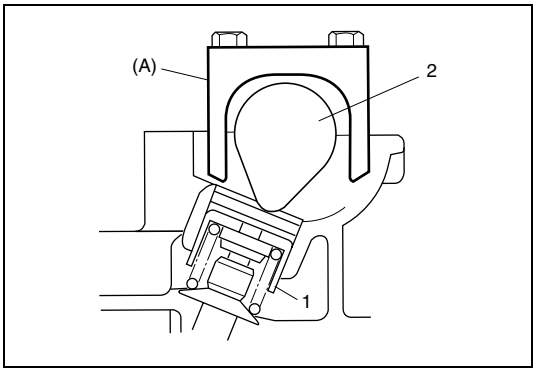


6) Select new shim No. (1) with a thickness as close as possible to calculated value.

Available new shims No.

Thickness mm (in.)	Shim No.	Thickness mm (in.)	Shim No.
2.175 (0.0856)	218	2.675 (0.1053)	268
2.200 (0.0866)	220	2.700 (0.1063)	270
2.225 (0.0876)	223	2.725 (0.1073)	273
2.250 (0.0886)	225	2.750 (0.1083)	275
2.275 (0.0896)	228	2.775 (0.1093)	278
2.300 (0.0906)	230	2.800 (0.1102)	280
2.325 (0.0915)	233	2.825 (0.1112)	283
2.350 (0.0925)	235	2.850 (0.1122)	285
2.375 (0.0935)	238	2.875 (0.1132)	288
2.400 (0.0945)	240	2.900 (0.1142)	290
2.425 (0.0955)	243	2.925 (0.1152)	293
2.450 (0.0965)	245	2.950 (0.1161)	295
2.475 (0.0974)	248	2.975 (0.1171)	298
2.500 (0.0984)	250	3.000 (0.1181)	300
2.525 (0.0994)	253		
2.550 (0.1004)	255		
2.575 (0.1014)	258		
2.600 (0.1024)	260		
2.625 (0.1033)	263		
2.650 (0.1043)	265		

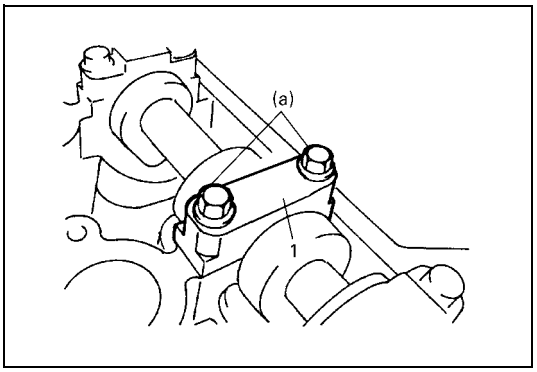
7) Install new shim facing shim No. side with tappet.



8) Lift valve by turning crankshaft counterclockwise (in opposite direction against above Step 4) and remove special tool.

Special tool
(A) : 09916-67020 or 09916-67021

1.	Tappet
2.	Camshaft



9) Install camshaft housing (1) and tighten bolts to specified torque.

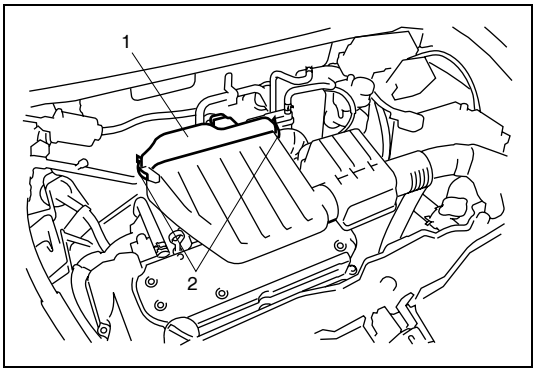
Tightening torque
Camshaft housing bolts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)

10) Check valve clearance again after adjusting it.
11) After checking and adjusting all valves.
12) Install cylinder head cover referring to “Cylinder Head Cover Removal and Installation” in this section.

On-Vehicle Service

Air Cleaner Element Removal and Installation

Removal

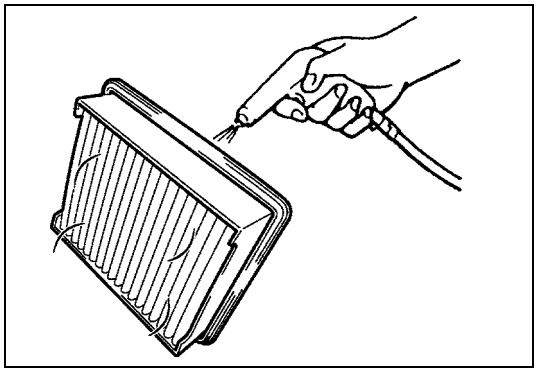


1) Open air cleaner case (1) by unhooking its clamps (2).
2) Remove air cleaner element from case.

Installation

Reverse removal procedure for installation.

Air Cleaner Element Inspection and Cleaning



- Check air cleaner element for dirt. Replace excessively dirty element.
- Blow off dust by compressed air from air outlet side of element.

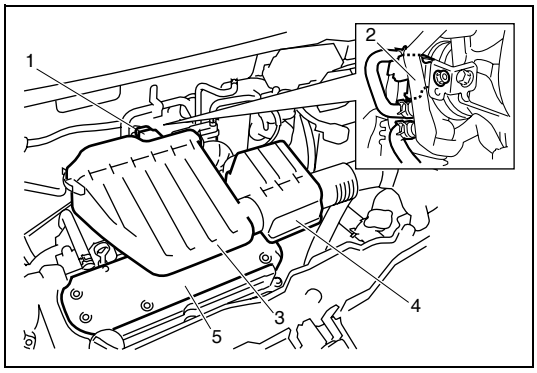
Knock Sensor Removal and Installation

Refer to “Knock sensor removal and installation” in Section 6E1.

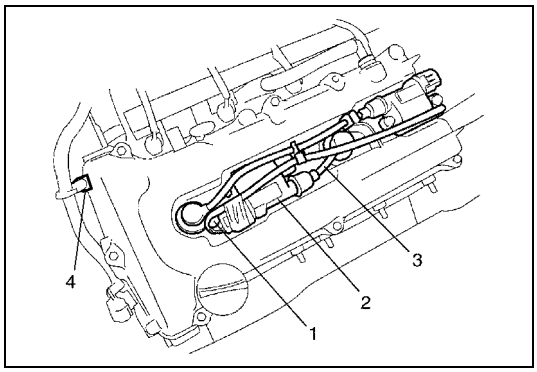
Cylinder Head Cover Removal and Installation

Removal

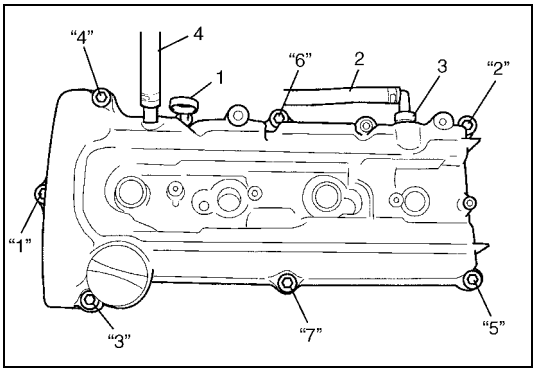
1) Disconnect negative cable at battery.



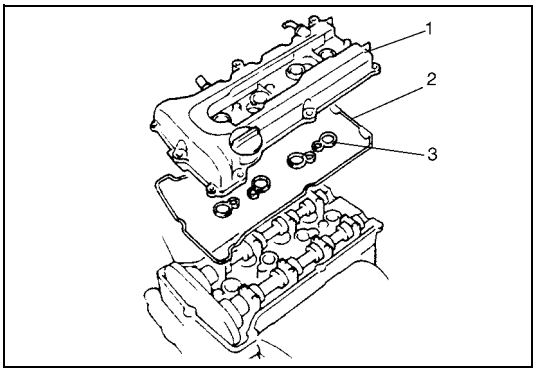
2) Disconnect MAF sensor coupler (1).
3) Remove EVAP canister purge valve (2).
4) Remove air cleaner case (3) and resonator (4).
5) Remove cylinder head upper cover (5).



6) Disconnect ignition coil couplers (1).
7) Remove ignition coil assemblies (2) with high-tension cord (3).
8) Remove wire harness clamp (4) from cylinder head cover.

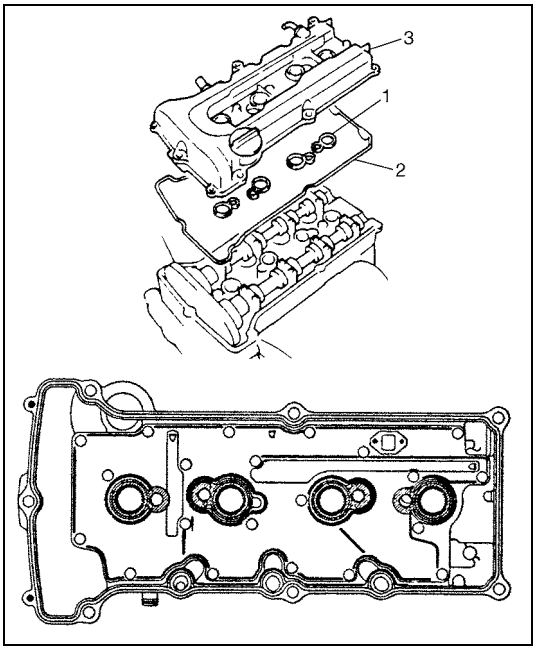


9) Remove oil level gauge (1).
10) Disconnect PCV hose (2) from PCV valve (3) and disconnect breather hose (4) from cylinder head cover.
11) Remove cylinder head cover mounting bolts in such order as indicated in figure.

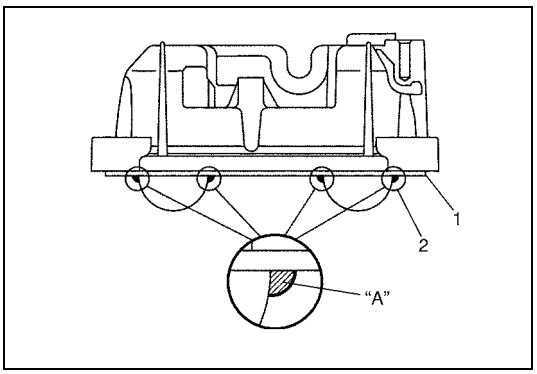


12) Remove cylinder head cover (1) with cylinder head cover gasket (2) and spark plug hole gasket (3).

Installation

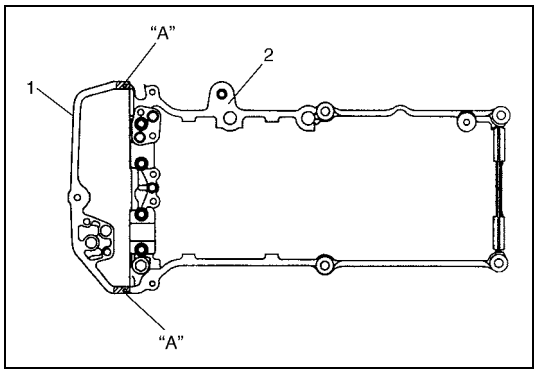


1) Install new spark plug hole gaskets (1) and new cylinder head cover gasket (2) to cylinder head cover (3) as shown in figure.



2) Remove oil, old sealant and dust from sealing surface on cylinder head and cover. After cleaning, apply sealant "A" to the following point.
   - Cylinder head cover gasket (1) sealing surface area (2) as shown.

"A" : Sealant 99000-31250



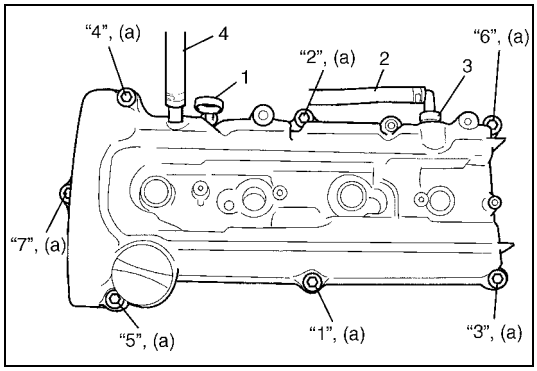
- Timing chain cover (1) and cylinder head (2) mating surface as shown.

"A" : Sealant 99000-31250

3) Install cylinder head cover to cylinder head.

NOTE:

When installing cylinder head cover, use care so that cylinder head cover gasket or spark plug hole gaskets will not get out of place or fall off.



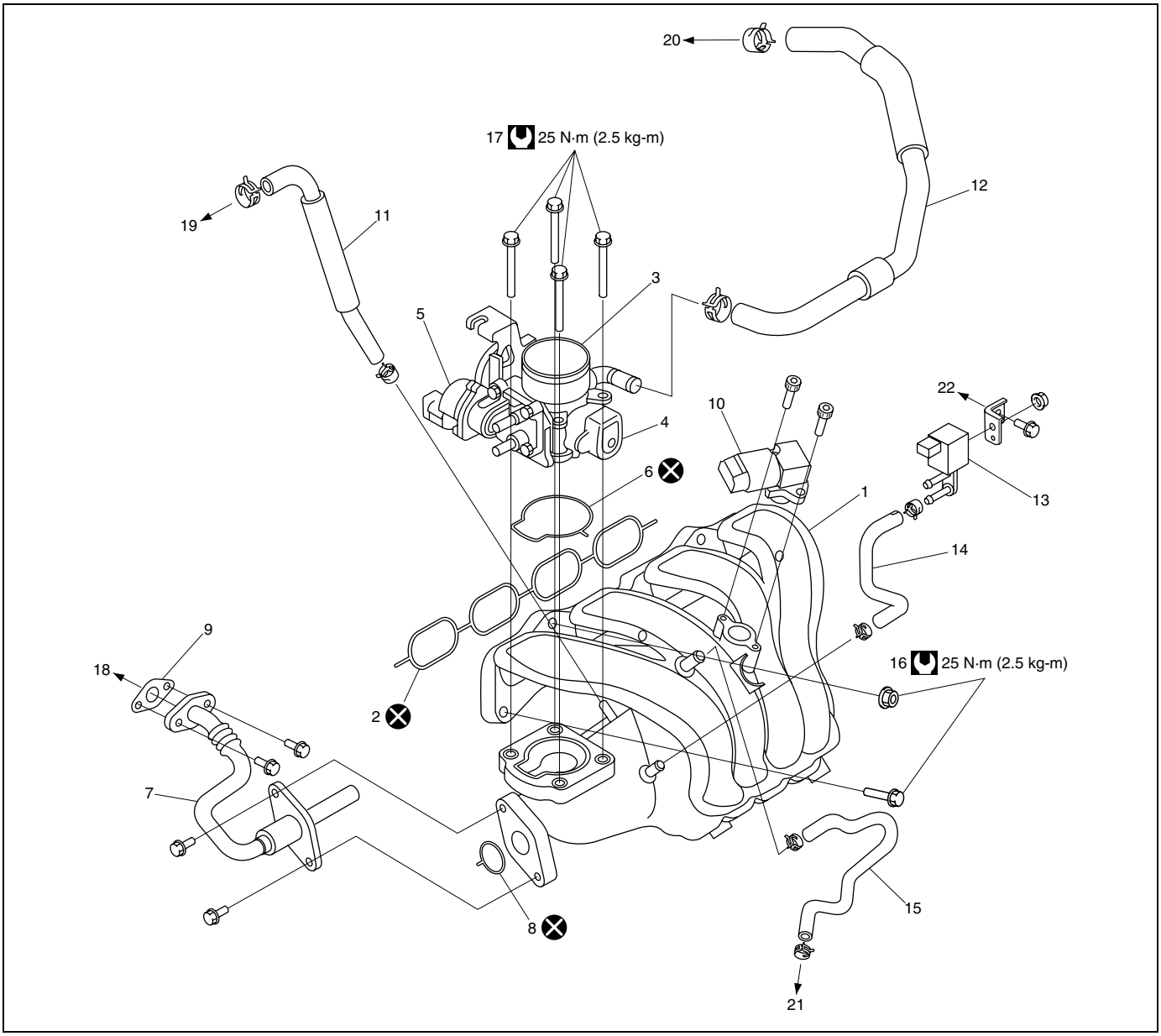
4) Tighten bolts in such order as indicated in figure a little at a time till they are tightened to specified torque.

Tightening torque
Cylinder head cover bolts (a) : 8 N·m (0.8 kg-m, 6.0 lb-ft)

5) Connect PCV hose (2) to PCV valve (1).
6) Connect breather hose (4).
7) Install oil level gauge (3).

8) Install wire harness clamp to cylinder head cover.
9) Install ignition coil assemblies with high-tension cord.
10) Connect ignition coil couplers and clamp harness securely.
11) Install cylinder head upper cover.
12) Install air cleaner case and resonator.
13) Connect negative cable at battery.

Throttle Body and Intake Manifold Components

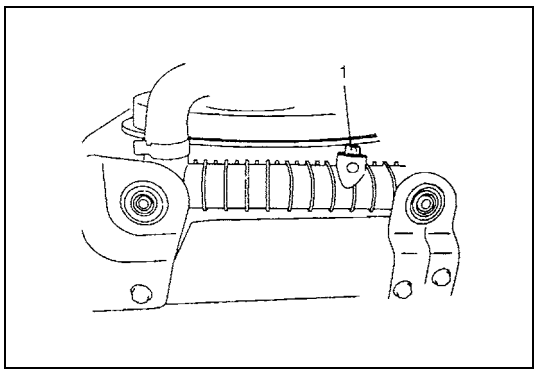


1. Intake manifold	7. EGR pipe	13. EVAP canister purge valve	19. To PCV valve
2. Intake manifold O-Ring	8. O-Ring	14. EVAP canister purge valve hose	20. To cylinder head cover
3. Throttle body	9. Gasket	15. Brake booster hose	21. To brake booster
4. TP sensor	10. MAP sensor	16. Intake manifold mounting bolt and nut	22. To air cleaner case
5. IAC valve	11. PCV valve hose	17. Throttle body mounting bolt	Tightening torque
6. O-Ring	12. Breather hose	18. To EGR valve	Do not reuse.

Throttle Body Removal and Installation

Removal

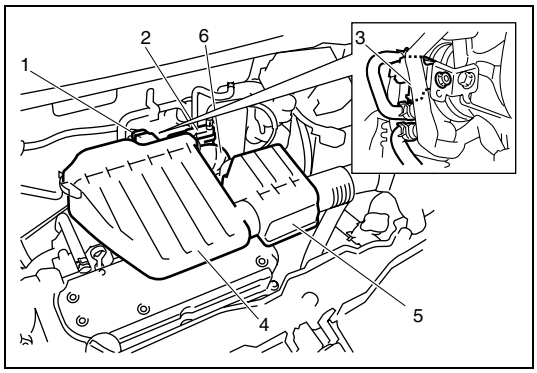
1) Relieve fuel pressure referring to “Fuel pressure relief procedure” in Section 6.
2) Disconnect negative cable at battery.



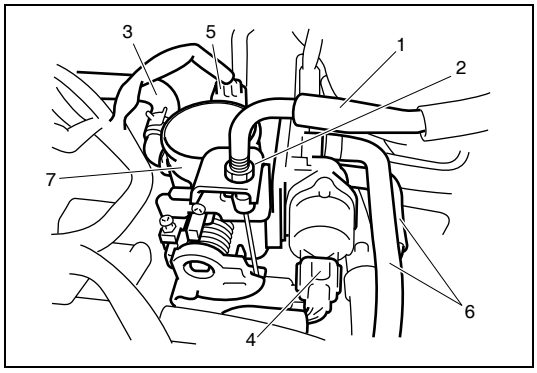
3) Drain coolant by loosening drain plug (1).

WARNING:

To help avoid danger of being burned, do not remove drain plug (1) and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.



4) Disconnect MAF sensor coupler (1).
5) Remove EVAP canister purge valve chamber (2) from air cleaner outlet hose.
6) Remove EVAP canister purge valve (3).
7) Remove air cleaner case (4) and resonator (5).
8) Remove air cleaner outlet hose (6).



9) Remove accelerator cable (1) by loosening lock nut (2).
10) Disconnect breather hose (3) and water hoses (6) from throttle body.
11) Disconnect IAC valve coupler (4) and TP sensor coupler (5).
12) Remove throttle body (7) from intake manifold.

Installation

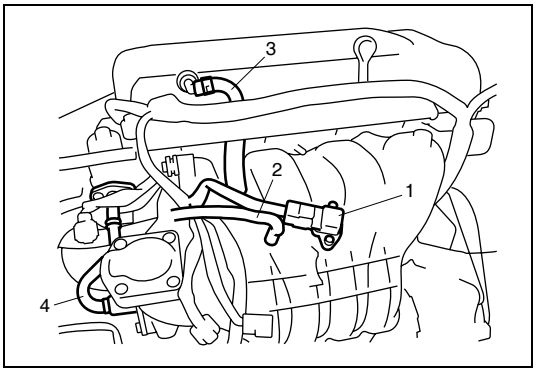
Reverse removal procedure for installation noting the followings.

- Use new throttle body O-ring.
- Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
- Adjust accelerator cable play referring to “Accelerator cable adjustment” in Section 6E1.
- Refill cooling system referring to “Cooling System Flush and Refill” in Section 6B.
- Upon completion of installation, turn ignition switch ON but engine OFF and check for fuel leaks.
- Finally, start engine and check for engine coolant leaks.

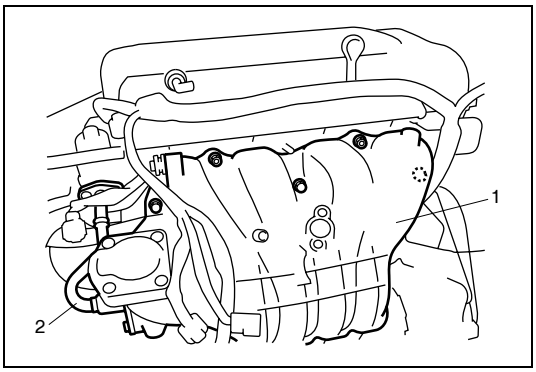
Intake Manifold Removal and Installation

Removal

1) Remove throttle body referring to “Throttle Body Removal and Installation” in this section.



2) Disconnect MAP sensor coupler (1).
3) Disconnect the following hoses :
   - Brake booster hose (2) from cylinder head cover
   - PCV hose (3) from PCV valve
4) Disconnect EGR pipe (4) from EGR valve.

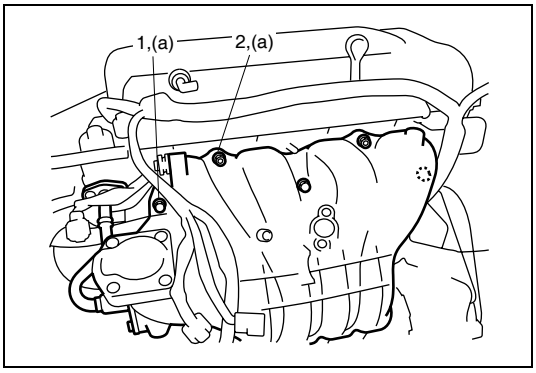


5) Remove intake manifold (1) and EGR pipe (2) from cylinder head, and then remove its gasket and O-ring.

Installation

Reverse removal procedure for installation noting the followings.

- Use new intake manifold O-ring.
- Use new EGR pipe gasket and O-ring.

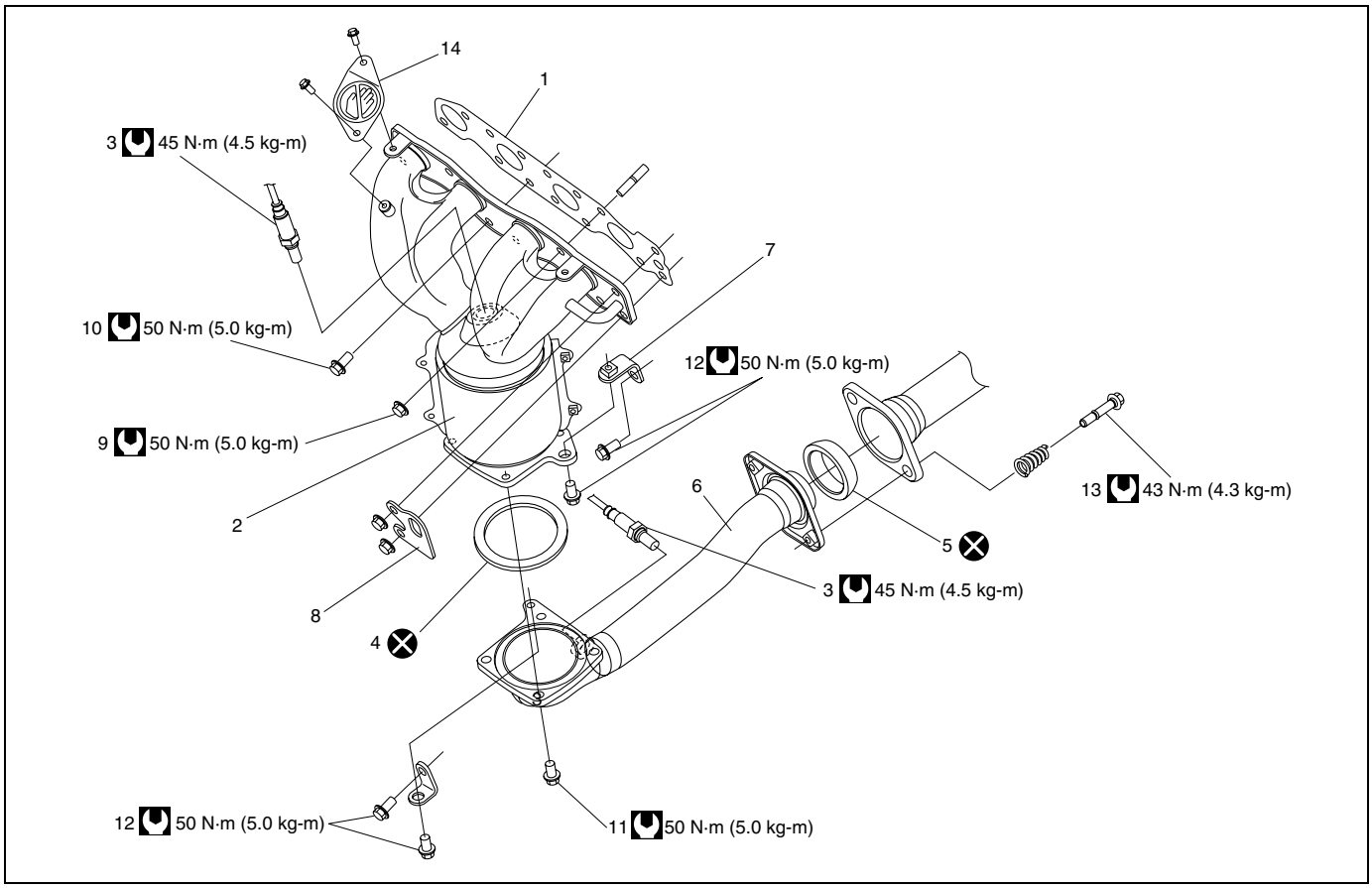


- Tighten bolts (1) and nuts (2) to specified torque.

Tightening torque
Intake manifold bolts and nuts
(a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

- Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
- Adjust accelerator cable play referring to “Accelerator cable adjustment” in Section 6E1.
- Refill cooling system referring to “Cooling System Flush and Refill” in Section 6B.
- Upon completion of installation, turn ignition switch ON but engine OFF and check for fuel leaks.
- Finally, start engine and check for engine coolant leaks.

Exhaust Manifold Components



1. Exhaust manifold gasket	7. Exhaust manifold stiffener	13. Exhaust pipe No.2 bolt
2. Exhaust manifold	8. Engine hook	14. Caution plate
3. Exhaust oxygen sensor	9. Exhaust manifold mounting nut	Tightening torque
4. Exhaust pipe gasket	10. Exhaust manifold mounting bolt	Do not reuse.
5. Seal ring No.1	11. Exhaust pipe No.1 bolt	
6. Exhaust No.1 pipe	12. Exhaust manifold stiffener bolt	

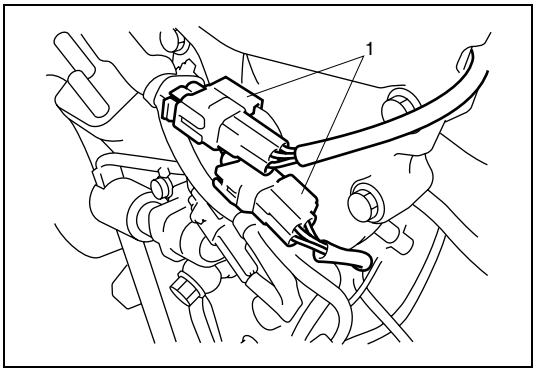
Exhaust Manifold Removal and Installation

WARNING:

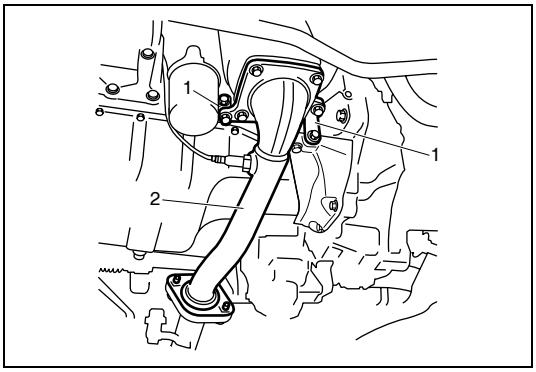
To avoid danger of being burned, do not service exhaust system while it is still hot. Service should be performed after system cools down.

Removal

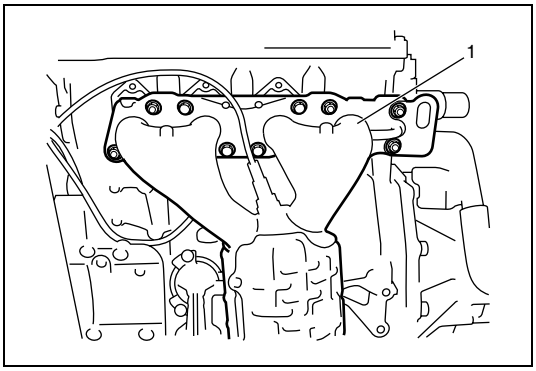
1) Disconnect negative cable at battery.
2) Remove front bumper with front grille referring to “Front Bumper and Rear Bumper Removal and Installation” in Section 9.
3) Remove radiator referring to “Radiator Removal and Installation” in Section 6B for equipped with A/C.
4) With hose connected, detach A/C condenser from vehicle body for equipped with A/C.



5) Disconnect heated oxygen sensor coupler (1) and detach it from its stay.

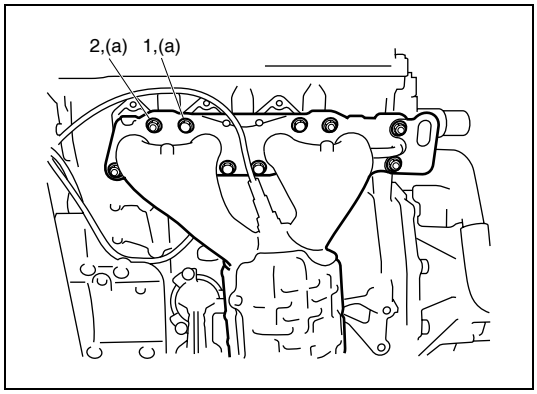


6) Remove exhaust manifold stiffener (1).
7) Disconnect exhaust No.1 pipe (2) from exhaust manifold.



8) Remove exhaust manifold (1) and its gasket from cylinder head.

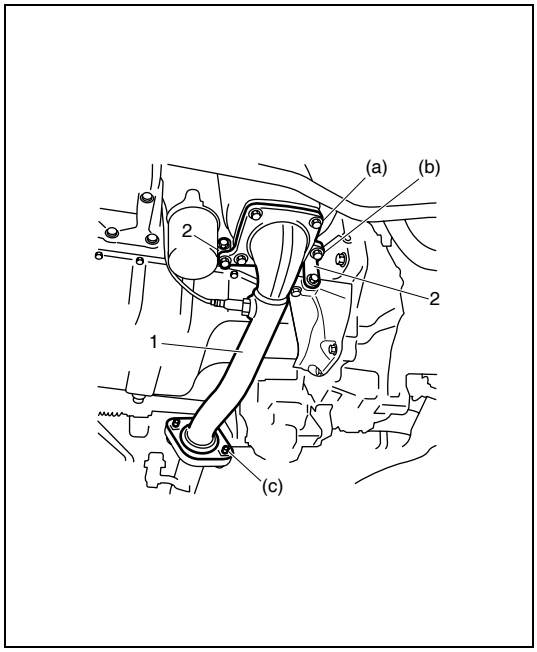
Installation



1) Install new gasket to cylinder head.
   Then install exhaust manifold.
   Tighten manifold bolts (1) and nuts (2) to specified torque.

Tightening torque
Exhaust manifold bolts and nuts
(a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

NOTE:
The figure on the left varies with specification.



2) Install new seal ring and connect exhaust No.1 pipe (1) to exhaust manifold.
   Tighten pipe fasteners to specified torque.

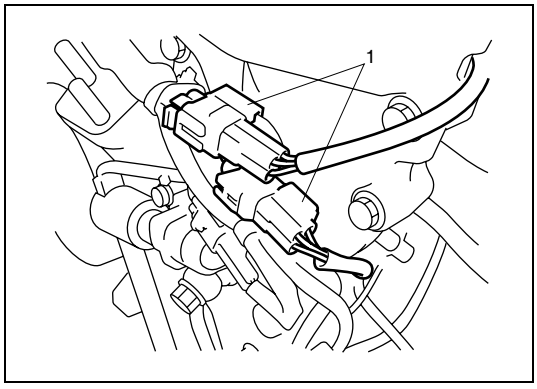
Tightening torque
Exhaust No.1 pipe bolts (a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

3) Install exhaust manifold stiffener (2).
   Tighten exhaust manifold stiffener bolts to specified torque.

Tightening torque
Exhaust manifold stiffener bolts
(b) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

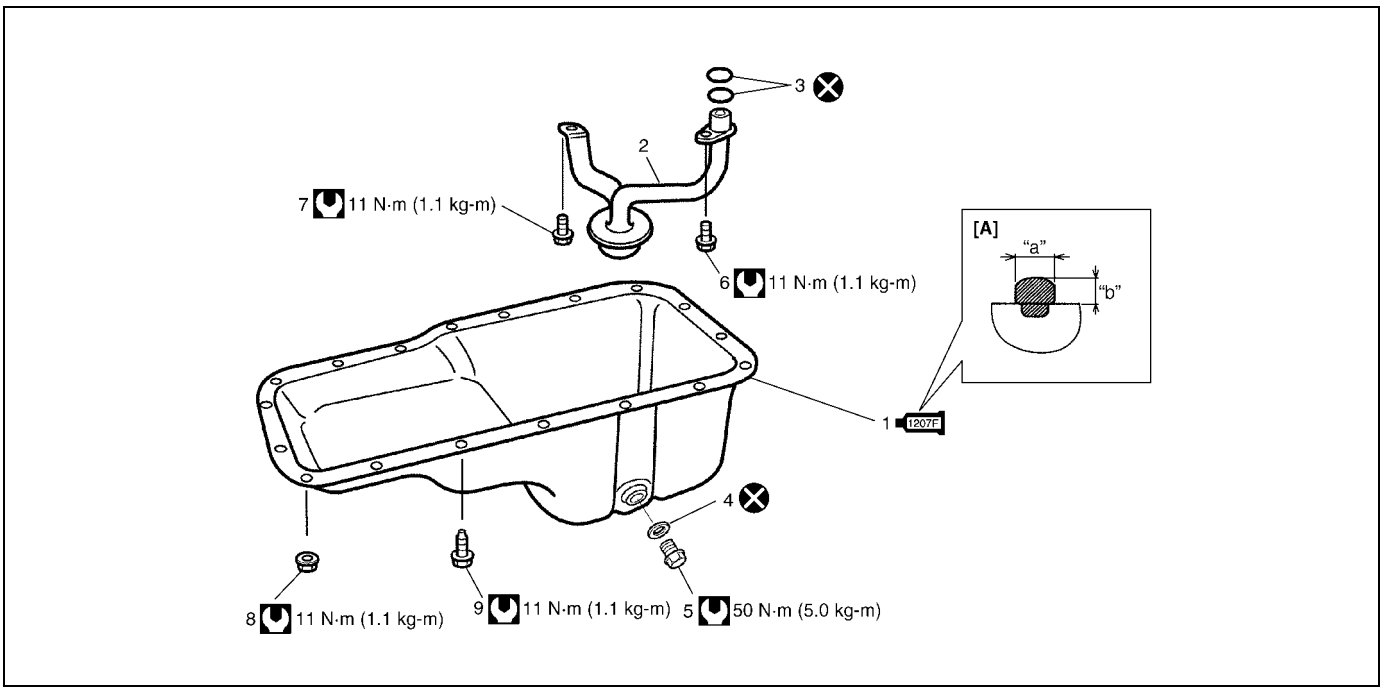
4) Install new seal ring and connect exhaust No.1 pipe (1) to exhaust No.2 pipe.
   Tighten pipe fasteners to specified torque.

Tightening torque
Exhaust No.2 pipe bolts (c) : 43 N·m (4.3 kg-m, 31.5 lb-ft)



5) Connect heated oxygen sensor coupler (1) and fit coupler to bracket securely.
6) Install A/C condenser to vehicle body for equipped with A/C.
7) Install radiator referring to “Radiator Removal and Installation” in Section 6B for equipped with A/C.
8) Install front bumper with front grille by referring to “Front Bumper and Rear Bumper Removal and Installation” in Section 9.
9) Connect negative cable to battery.
10) Check exhaust system for exhaust gas leakage.

Oil Pan and Oil Pump Strainer Components

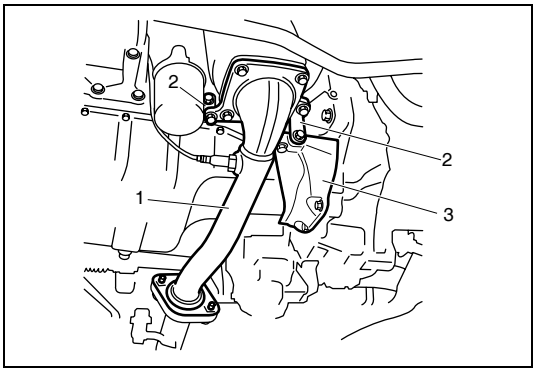


[A] : Sealant application amount	3. O-ring	8. Oil pan nut
"a" : 3 mm (0.12 in.)	4. Gasket	9. Oil pan bolt
"b" : 2 mm (0.08 in.)	5. Drain plug	Tightening torque
1207F 1. Oil pan : Apply sealant 99000-31250 to mating surface.	6. Strainer bolt	Do not reuse.
2. Strainer	7. Bracket bolt	

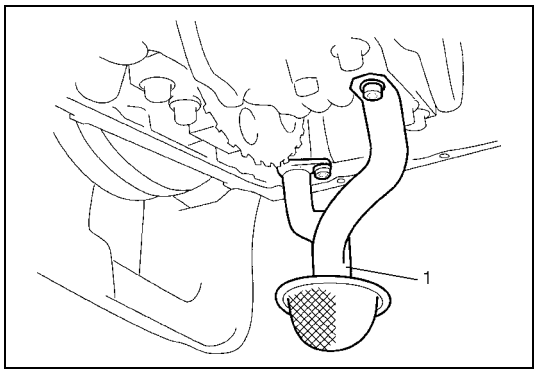
Oil Pan and Oil Pump Strainer Removal and Installation

Removal

1) Remove oil level gauge.
2) Drain engine oil by removing drain plug.

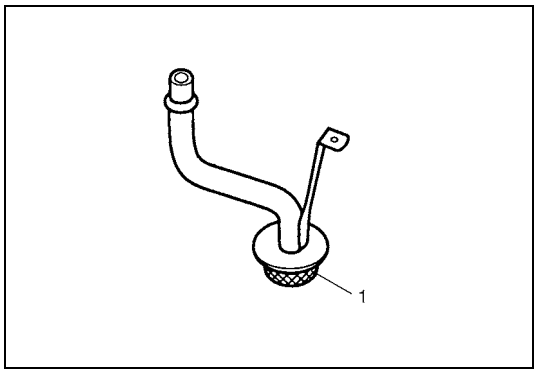


3) Remove exhaust No.1 pipe (1), exhaust manifold stiffener (2) and transaxle stiffener (3).
4) For 2WD vehicle, remove engine rear mounting bracket.
5) For 4WD vehicle, remove transfer referring to "Transfer Dismounting and Mounting" in Section 7D.

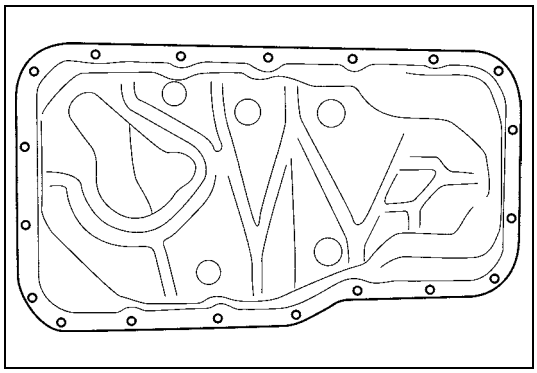


2) Remove oil pan and then oil pump strainer (1) from cylinder block.

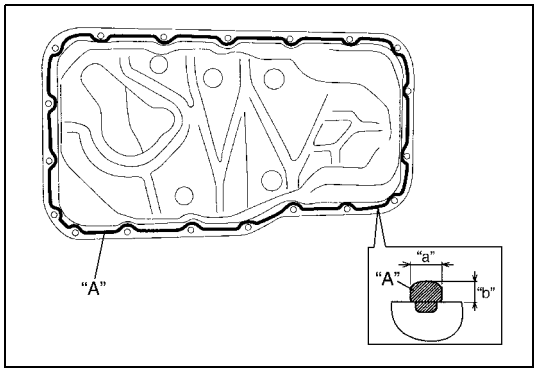
Installation



1) Clean oil pump strainer screen (1).



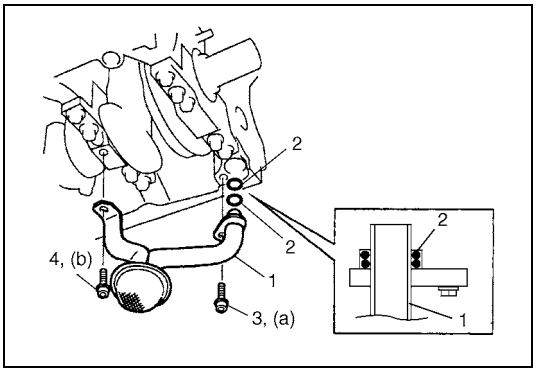
2) Clean sealing surface on oil pan and cylinder block. Remove oil, old sealant and dust from sealing surface.



3) Apply sealant continuously to oil pan mating surface as shown in figure.

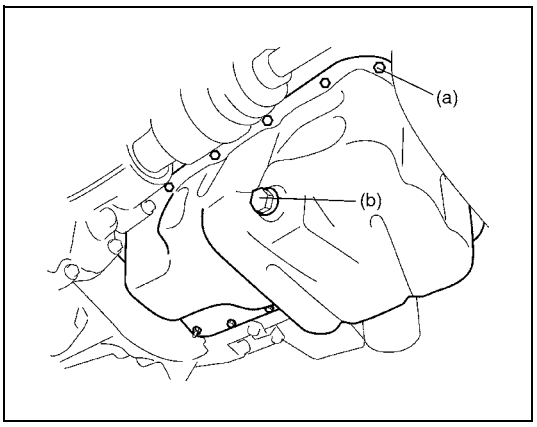
"A" : sealant 99000-31250

Sealant amount for oil pan
Width "a" : 3 mm (0.12 in.)
Height "b" : 2 mm (0.08 in.)



4) Install new O-rings (2) in the position as shown in figure and install oil pump strainer (1).
Tighten strainer bolt (3) first and then bracket bolt (4) to specified torque.

Tightening torque
Oil pump strainer bolt (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)
Oil pump strainer bracket bolt
(b) : 11 N·m (1.1 kg-m, 8.0 lb-ft)



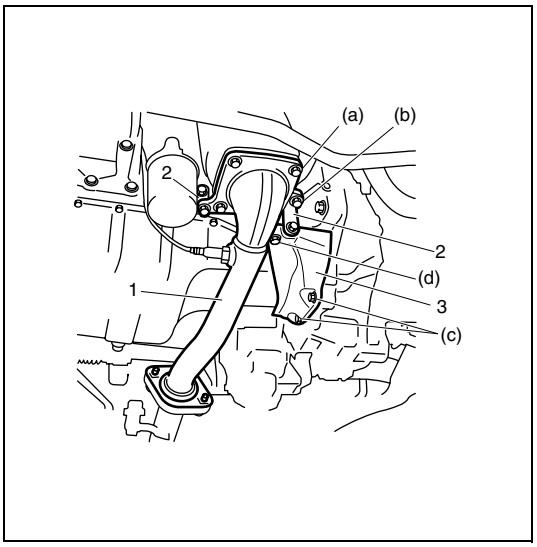
5) After fitting oil pan to cylinder block, run in securing bolts and start tightening at the center :
move wrench outward, tightening one bolt at a time. Tighten bolts and nuts to specified torque.

Tightening torque
Oil pan bolts and nuts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)

6) Install new gasket and drain plug to oil pan.
Tighten drain plug to specified torque.

Tightening torque
Oil pan drain plug bolt (b) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

7) For 2WD vehicle, install Engine rear mounting bracket.
8) For 4WD vehicle, install transfer referring to “Transfer Dismounting and Mounting” in Section 7D.



9) Install transaxle stiffener (3).
Tighten transaxle stiffener bolts (c) first and next (d) with specified torque.

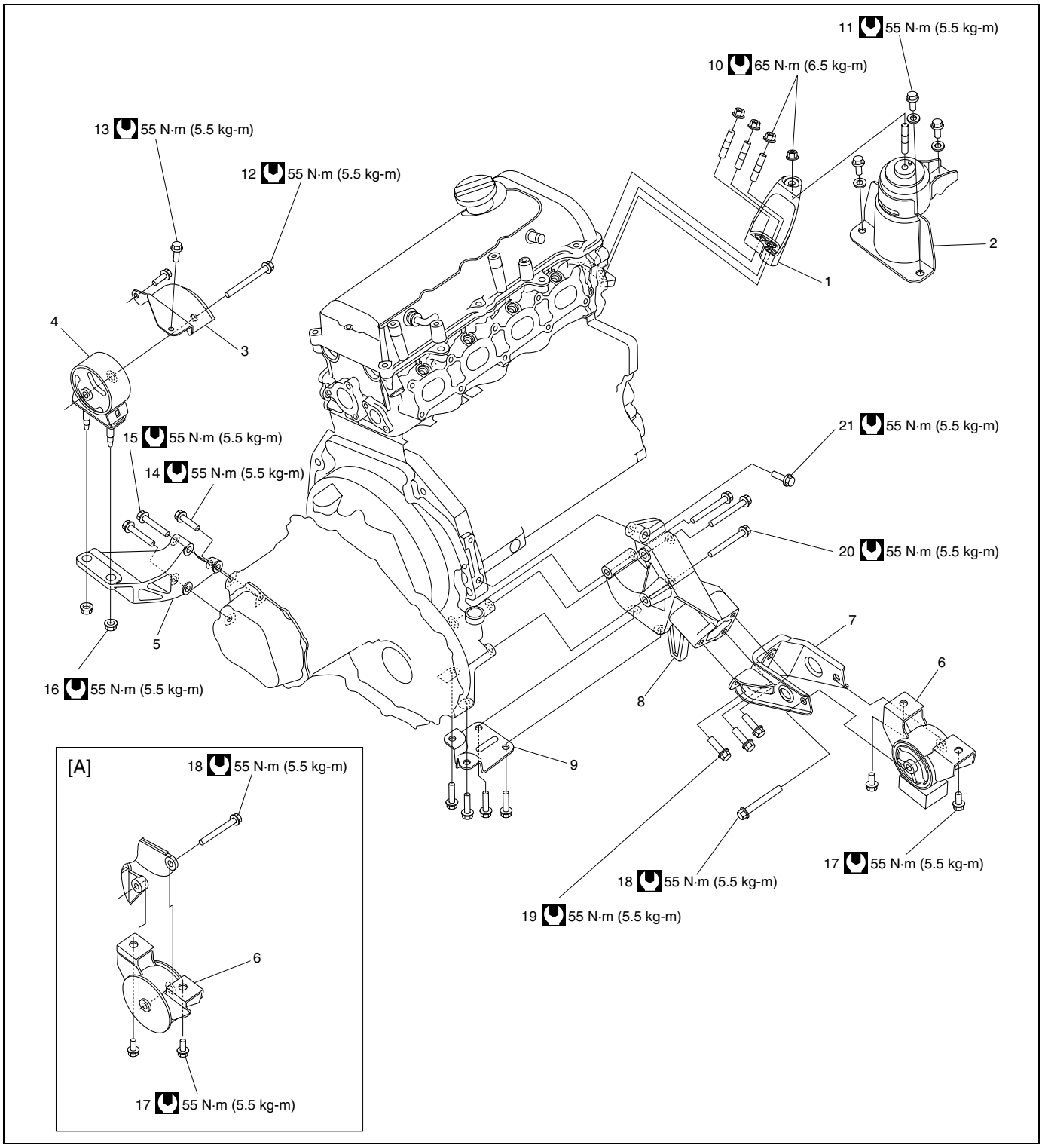
Tightening torque
Transaxle stiffener bolts (c and d) :
50 N·m (5.0 kg-m, 36.5 lb-ft)

10) Install exhaust manifold stiffener (2) and exhaust No.1 pipe (1).
Tighten bolts to specified torque.

Tightening torque
Exhaust No.1 pipe bolts (a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)
Exhaust manifold stiffener bolts (b) :
50 N·m (5.0 kg-m, 36.5 lb-ft)

11) Install oil level gauge.
12) Refill engine with engine oil referring to “Engine Oil and Oil Filter Replacement” in Section 0B.
13) Verify that there is no engine oil leakage and exhaust gas leakage at each connection.

Engine Mountings Components



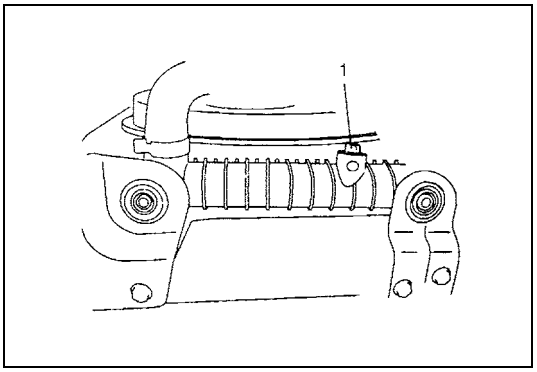
[A] : 4WD MODEL	8. Engine rear mounting No.2 bracket	16. Engine left mounting bracket nut
1. Engine right mounting	9. Engine rear mounting bracket stiffener	17. Engine rear mounting bolt
2. Engine right body side bracket	10. Engine right mounting nut	18. Engine rear mounting bolt
3. Engine left body side bracket	11. Engine right body side bracket bolt	19. Engine rear mounting No.1 bracket bolt
4. Engine left mounting	12. Engine left mounting bolt	20. Engine rear mounting No.2 bracket bolt
5. Engine left mounting bracket	13. Engine left body side bracket bolt	21. Engine rear mounting No.2 bracket bolt
6. Engine rear mounting	14. Engine left mounting bracket bolt (short)	Tightening torque
7. Engine rear mounting No.1 bracket	15. Engine left mounting bracket bolt (long)	

Unit Repair Overhaul

Engine Assembly Removal and Installation

Removal

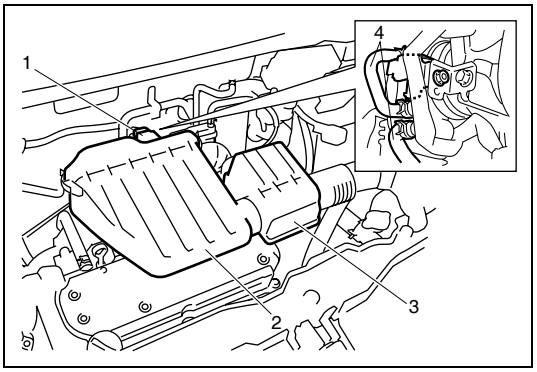
1) Relieve fuel pressure referring to “Fuel pressure relief procedure” in Section 6.
2) Disconnect negative and positive cables at battery.
3) Remove engine hood after disconnecting windshield washer hose.
4) Remove right and left side engine under covers.
5) Remove A/C compressor belt by referring to “Compressor Assembly Removal and Installation” in Section 1B (if equipped).
6) Drain engine oil referring to “Engine Oil and Oil Filter Replacement” in Section 0B.
7) Drain transaxle oil referring to “Manual Transaxle Oil Change” in Section 7A1.
8) Drain transfer oil referring to “Transfer Oil Change” in Section 7D (for 4WD vehicle).



9) Drain coolant by referring to “Cooling System Flush and Refill” in Section 6B.

WARNING:

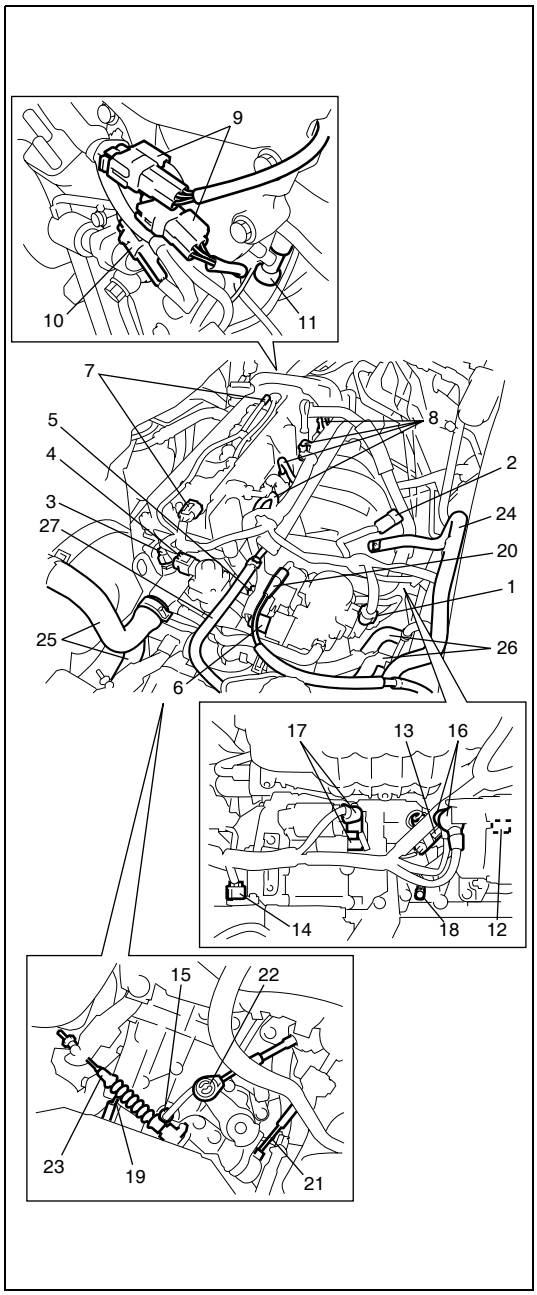
To help avoid danger of being burned, do not remove drain plug (1) and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.



10) Disconnect MAF sensor coupler (1).
11) Remove air cleaner case (2) and resonator (3).
12) Remove canister purge hose (4) from EVAP canister purge valve.
13) With hose connected, detach A/C compressor from its bracket (if equipped).

NOTE:

Suspend removed A/C compressor at a place where no damage will be caused during removal and installation of engine assembly.

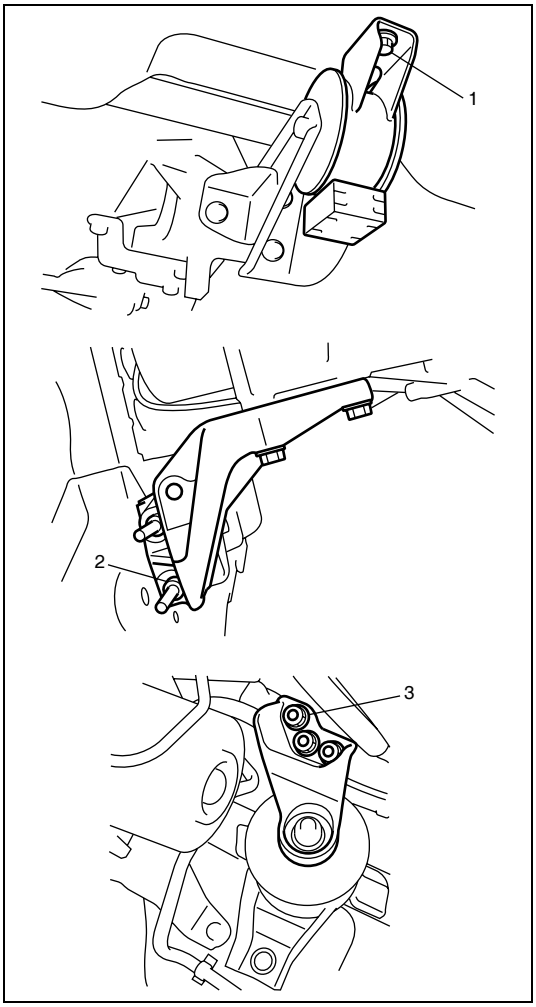


14) Disconnect the following electric lead wires:
- TP sensor (1)
- MAP sensor (2)
- ECT sensor (3)
- EGR valve (4)
- CMP sensor (5)
- IAC valve (6)
- Ignition coil assembly (7)
- Injectors (8)
- Heated oxygen sensor (9)
- Oil control valve (10)
- Engine oil pressure switch (11)
- CKP sensor (12)
- Knock sensor (13)
- VSS (14)
- Back up light switch (15)
- Generator (16)
- Starting motor (17)
- Ground terminal (18) from cylinder block
- Battery ground cable (19) from transaxle
- Magnet clutch switch of A/C compressor (if equipped)
- Each wire harness clamps

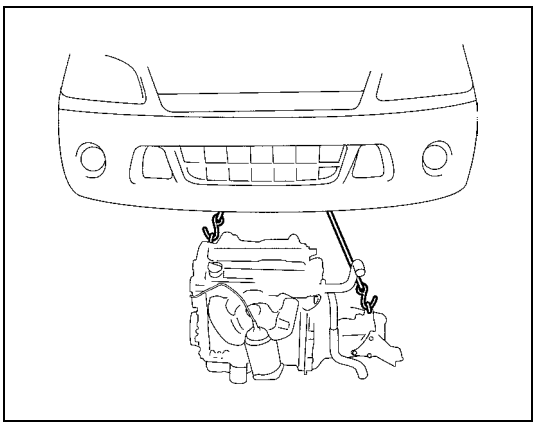
15) Remove fuse box from its bracket.
16) Disconnect the following cables :
- Accelerator cable (20)
- Gear select control cable (21)
- Gear shift control cable (22)
- Clutch cable (23)

17) Disconnect the following hoses :
- Brake booster hose (24) from intake manifold
- Radiator inlet and outlet hoses (25) from each pipe
- Heater inlet and outlet hoses (26) from each pipe
- Fuel feed hoses (27) from fuel feed pipe

18) Remove exhaust No.1 pipe referring to “Exhaust Manifold Removal and Installation” in this section.
19) Disconnect right and left drive shaft joints to differential gear referring to “Front Drive Shaft Assembly Removal and Installation” in Section 4A.
For engine and transaxle removal, it is not necessary to remove drive shafts from steering knuckle.
20) For 4WD vehicle, remove propeller shaft referring to “Propeller Shaft Removal and Installation” in Section 4B.



21) Install lifting device.
22) Remove engine rear mounting bolts (1), engine left mounting bracket nuts (2) and engine right mounting nuts (3).



23) Before removing engine with transaxle from body, recheck to make sure all hoses, electric wires and cables are disconnected from engine and transaxle.
24) Lower engine with transaxle from body.

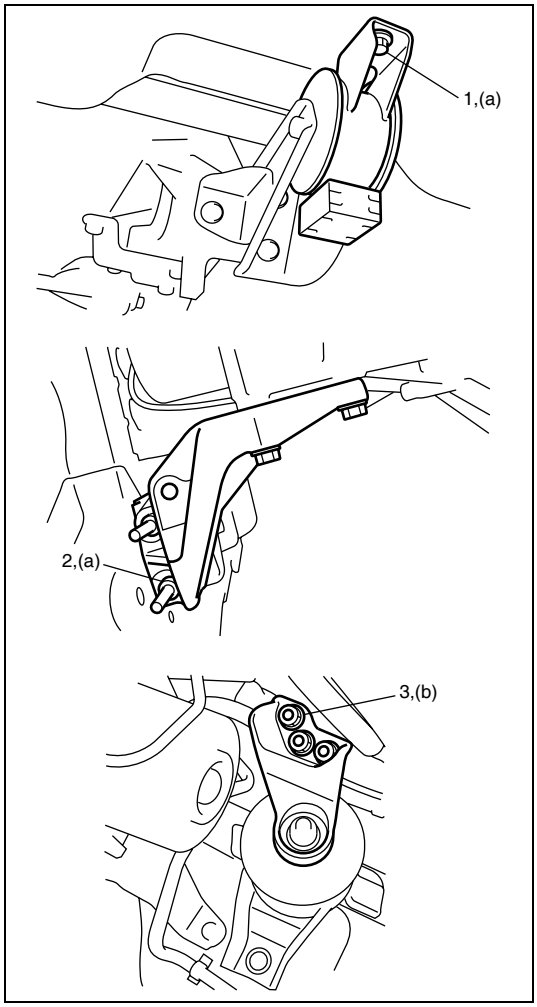
NOTE:

Before lowering engine, to avoid damage to A/C compressor, raise it through clearance made on engine crankshaft pulley side. At this time, use care so that no excessive force is applied to hoses.

25) Disconnect transaxle from engine referring to “Transaxle Unit Dismounting and Remounting” in Section 7A1.
26) Remove clutch cover and clutch disk referring to “Clutch Cover, Clutch Disc and Flywheel Removal and Installation” in Section 7C1.

Installation

1) Install clutch cover and clutch disk referring to “Clutch Cover, Clutch Disc and Flywheel Removal and Installation” in Section 7C1.
2) Connect transaxle to engine referring to “Transaxle Unit Dismounting and Remounting” in Section 7A1.

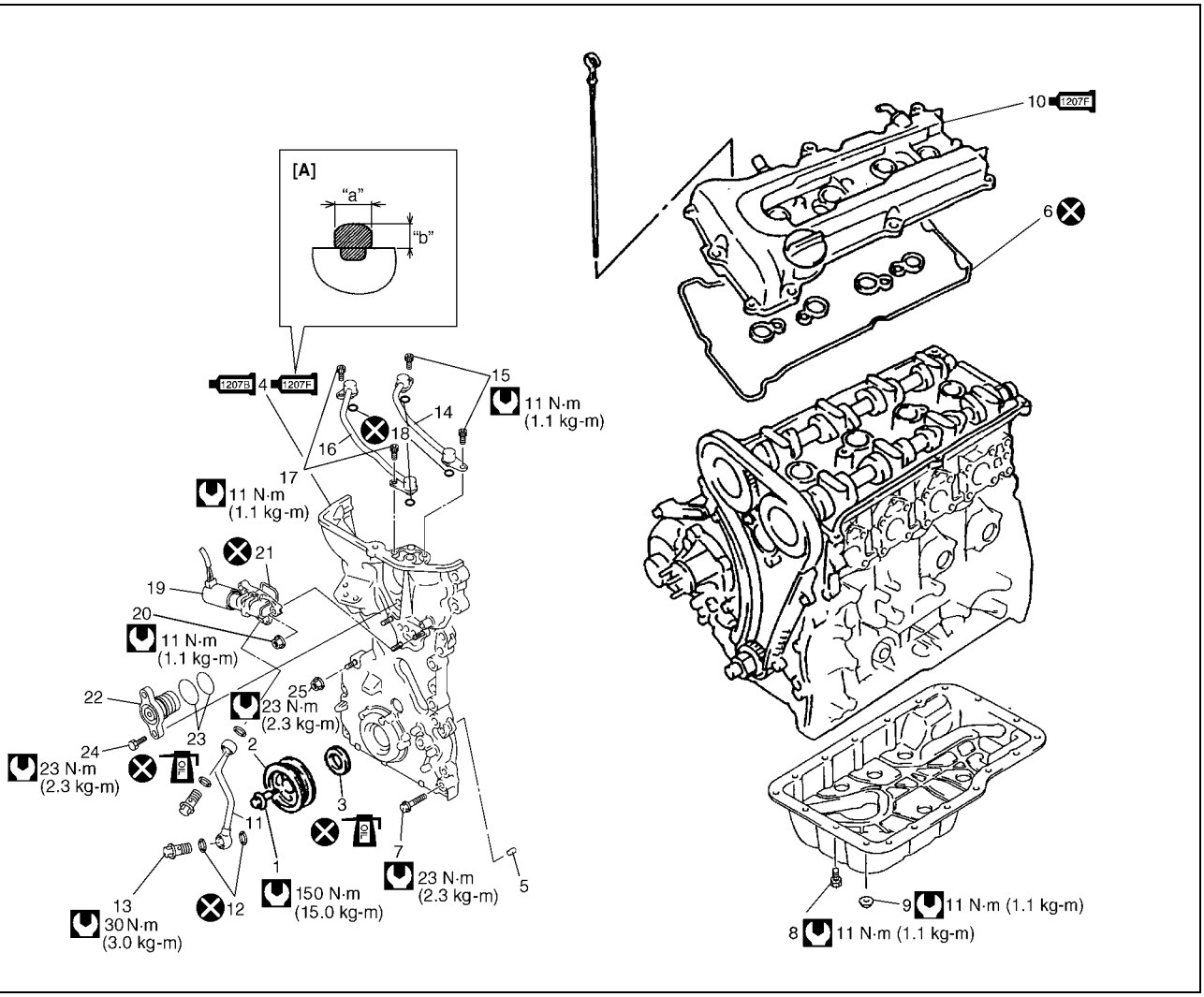


3) Lift engine with transaxle into engine compartment, but do not remove lifting device.
4) Install engine rear mounting bolts (1), engine left mounting bracket nuts (2) and engine right mounting nuts (3).
   Tighten these bolts and nuts to specified torque.

Tightening torque
Engine left mounting bolts
(a) : 55 N·m (5.5 kg-m, 40.0 lb-ft)
Engine right mounting bracket nuts
(b) : 65 N·m (6.5 kg-m, 47.0 lb-ft)

5) Remove lifting device.
6) For 4WD vehicle, install propeller shaft referring to “Propeller Shaft Removal and Installation” in Section 4B.
7) Connect drive shaft joints referring to Section 4A.
8) Install exhaust No.1 pipe referring to “Exhaust Manifold Removal and Installation” in this section.
9) Reverse disconnected hoses, cables and electric wires for connection.
10) Install air cleaner case and resonator.
11) Install A/C compressor to its bracket (if equipped).
12) Adjust A/C compressor belt tension (if equipped) referring to “Compressor Drive Belt Inspection and Adjustment” in Section 1B.
13) Adjust accelerator cable play referring to “Accelerator cable adjustment” in Section 6E1.
14) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
15) Refill cooling system with coolant referring to “Cooling System Flush and Refill” in Section 6B.
16) Refill engine with engine oil referring to “Engine Oil and Oil Filter Replacement” in Section 0B.
17) Refill transaxle with transaxle oil referring to “Manual Transaxle Oil Change” in Section 7A1.
18) Refill transfer with transfer oil referring to “Transfer Oil Change” in Section 7D (for 4WD vehicle).
19) Connect negative cable at battery.
20) Verify that there is no fuel leakage, coolant leakage, oil leakage and exhaust gas leakage at each connection.

Timing Chain Cover Components



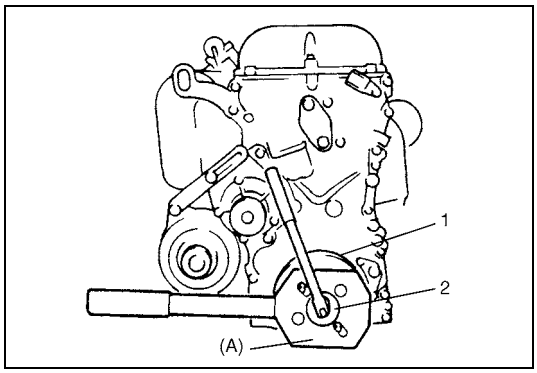
[A]: Sealant application amount	8. Oil pan mounting bolt	18. O ring
"a": 3 mm (0.12 in.)	9. Oil pan mounting nut	19. Oil control valve
"b": 2 mm (0.08 in.)	1207F 10. Cylinder head cover : Apply sealant 99000-31250 to the sealing point for timing chain cover mating surface and cylinder head gasket sealing point referring to "Installation" under "Cylinder Head Cover Removal and Installation" in this section.	20. Oil control valve mounting nut
1. Crankshaft pulley bolt	11. Oil gallery pipe No.1	21. O ring
2. Crankshaft pulley	12. Copper washer	22. Cap
O 3. Oil seal : Apply engine oil to oil seal lip.	13. Oil gallery pipe No.1 bolt	O 23. O ring
1207B 1207F 4. Timing chain cover : Apply sealant 99000-31140 to the mating surface of cylinder and cylinder head. : Apply sealant 99000-31250 to the mating surface of timing chain cover referring to the figure of Step 1) of "Installation" under "Timing Chain Cover Removal and Installation" in this section.	14. Oil gallery pipe No.2	24. Cap bolt
5. Pin	15. Oil gallery pipe No.2 bolt	25. Timing chain cover mounting nut
6. Cylinder head cover gasket	16. Oil gallery pipe No.3	Tightening torque
7. Timing chain cover mounting bolts	17. Oil gallery pipe No.3 bolt	Do not reuse.

Timing Chain Cover Removal and Installation

Removal

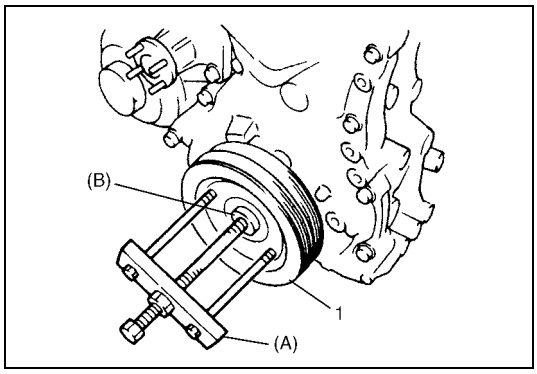
CAUTION:
- **Keep working table, tools and hands clean while overhauling.**
- **Use special care to handle aluminum parts so as not to damage them.**
- **Do not expose removed parts to dust. Keep them always clean.**

1) Remove engine assembly from vehicle referring to “Engine Assembly Removal and Installation” in this section.



2) Remove crankshaft pulley bolt (2).
   To lock crankshaft pulley (1), use special tool with it as shown in figure.

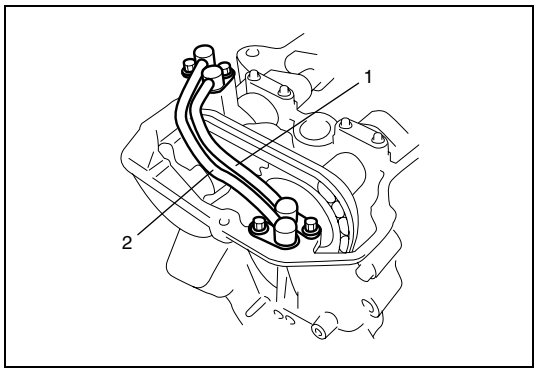
   Special tool
   (A) : 09917-68221



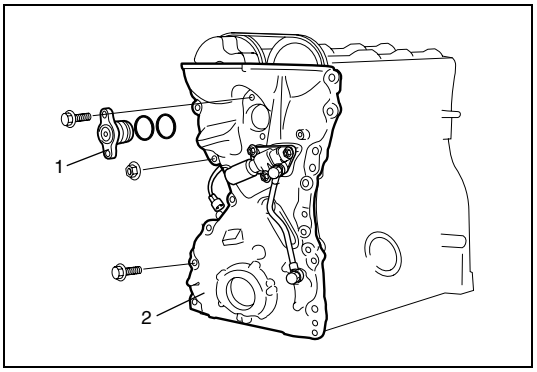
3) Remove crankshaft pulley (1).
   If it is hard to remove, use special tools as shown in figure.

   Special tool
   (A) : 09944-36011
   (B) : 09926-58010

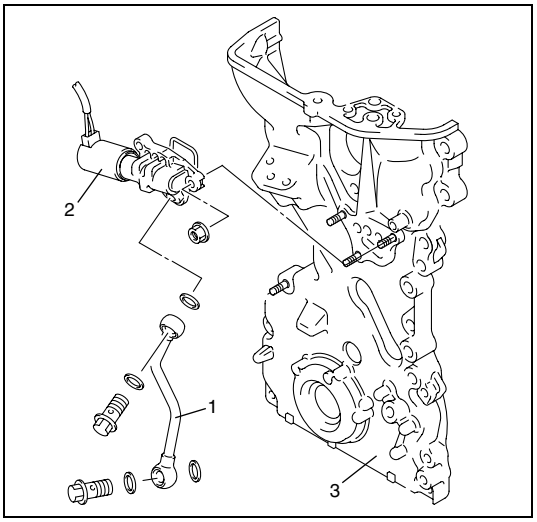
4) Remove cylinder head cover referring to “Cylinder Head Cover Removal and Installation” in this section.
5) Remove oil pan referring to “Oil Pan and Oil Pump Strainer Removal and Installation” in this section.
6) Remove water pump pulley.



7) Remove oil gallery pipes No.2 (1) and No.3 (2).



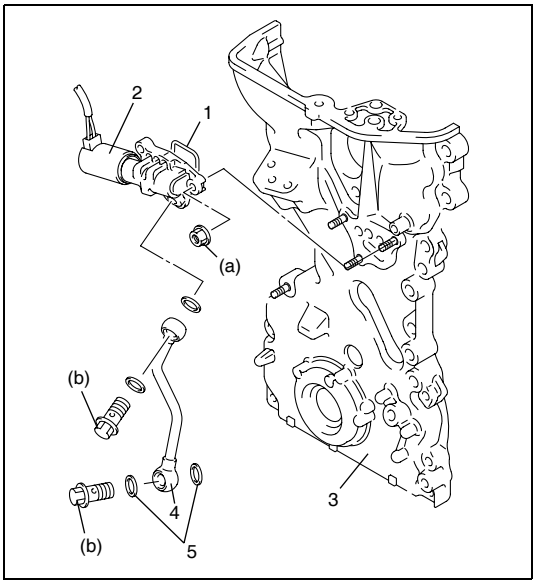
8) Remove cap (1) from timing chain cover (2).
9) Remove timing chain cover.



10) Remove oil gallery pipe No.1 (1) and oil control valve (2) from timing chain cover (3).

Installation

1) Clean sealing surface on timing chain cover, cylinder block and cylinder head.
   Remove oil, old sealant and dust from sealing surface.

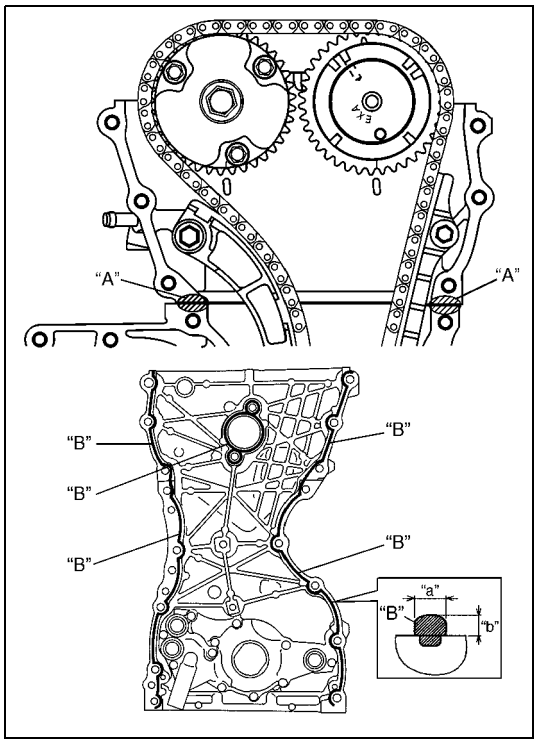


2) Install new O-ring (1) to oil control valve (2).
3) Install oil control valve to timing chain cover (3).
   Tighten nuts to specification.

Tightening torque
Oil control valve mounting nuts
(a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)

4) Install oil gallery pipe No.1 (4) with new copper washers (5) to timing chain cover.
   Tighten bolts to specification.

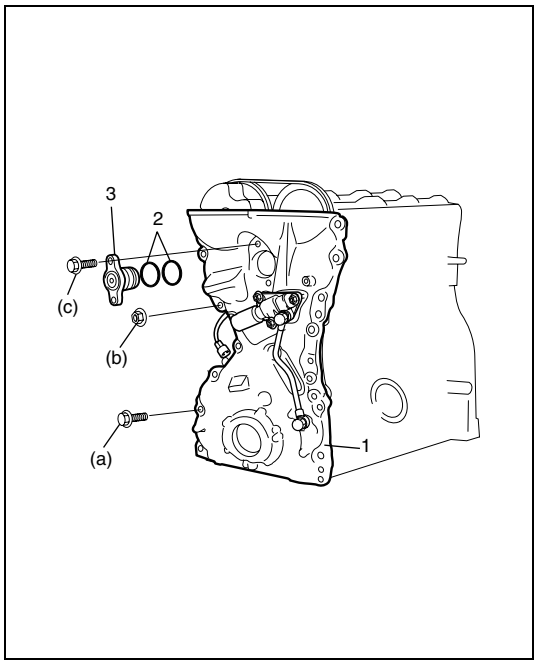
Tightening torque
Oil gallery pipe No.1 bolts
(b) : 30 N·m (3.0 kg-m, 21.5 lb-ft)



5) Apply sealant "A" to mating surface of cylinder and cylinder head and "B" to mating surface of timing chain cover as shown in figure.

"A" : Sealant 99000-31140
"B" : Sealant 99000-31250

Sealant amount for timing chain cover
Width "a" : 3 mm (0.12 in.)
Height "b" : 2 mm (0.08 in.)



6) Apply engine oil to oil seal lip, then install timing chain cover (1).
Tighten bolts and nut to specified torque.

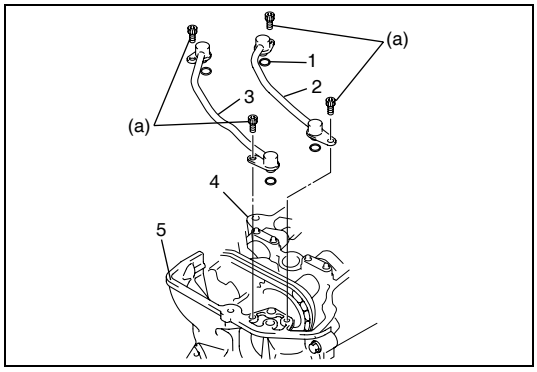
NOTE:

Before installing timing chain cover, check that pin is securely fitted.

Tightening torque
Timing chain cover bolts (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)
Timing chain cover nut (b) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

7) Apply engine oil to new O-rings (2) and install them to cap (3).
8) Install cap (3) to timing chain cover (1).
Tighten bolts to specified torque.

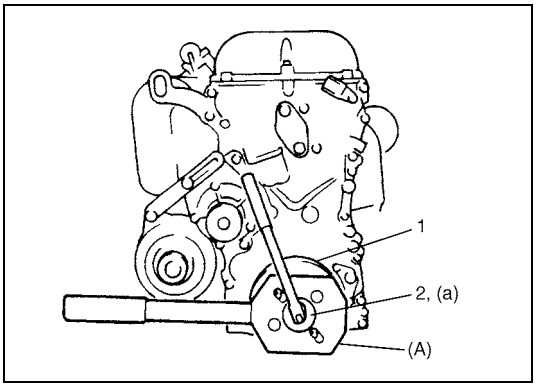
Tightening torque
Cap bolts (c) : 23 N·m (2.3 kg-m, 17.0 lb-ft)



9) Install new O-ring (1) to oil gallery pipes No.2 (2) and No.3 (3).
10) Install oil gallery pipes No.2 and No.3 to cylinder head (4) and timing chain cover (5).
Tighten bolts to specified torque.

Tightening torque
Oil gallery pipes No.2 and No.3 bolts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)

11) Install water pump pulley.
12) Install cylinder head cover referring to “Cylinder Head Cover Removal and Installation” in this section.
13) Install oil pan referring to “Oil Pan and Oil Pump Strainer Removal and Installation” in this section.



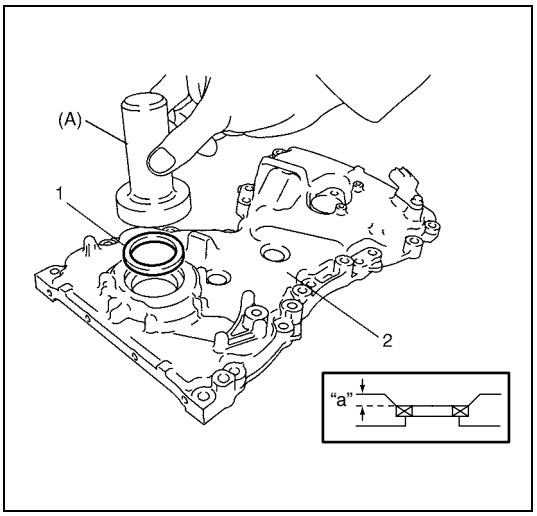
14) Install crankshaft pulley (1). Tighten bolt (2) to specified torque. To lock crankshaft pulley, use special tool with it as shown in the figure.

Special tool
(A) : 09917-68221

Tightening torque
Crankshaft pulley bolt (a) : 150 N·m (15.0 kg-m, 108.5 lb-ft)

15) Install engine assembly to vehicle referring to “Engine Assembly Removal and Installation” in this section.

Timing Chain Cover Inspection



Oil seal

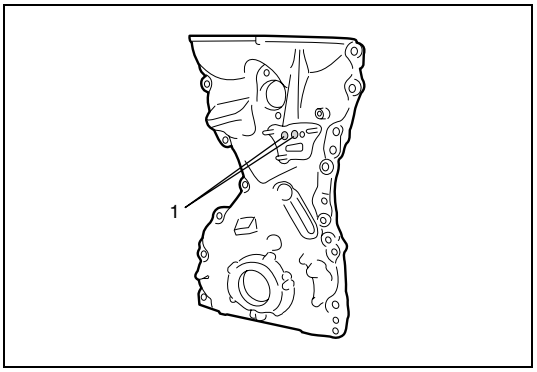
- Check oil seal (1) lip for fault or other damage.
  Replace as necessary.

NOTE:

When installing new oil seal, press fit to timing chain cover (2) by using special tool (Bearing installer) as shown in the figure.

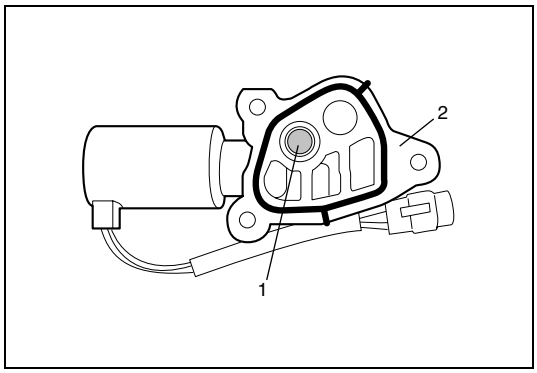
Special tool
(A) : 09913-75810

Drive in dimension
“a” : 1.5 mm (0.06 in.)



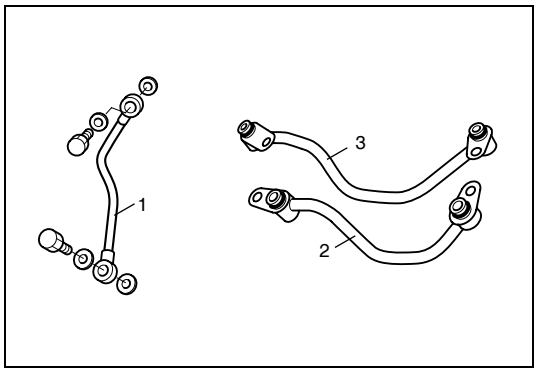
Timing chain cover

Inspect strainer (1) of oil passage for driving intake cam timing sprocket assembly (VVT actuator).
If clog or foreign matter exists, clean strainer.



Oil control valve

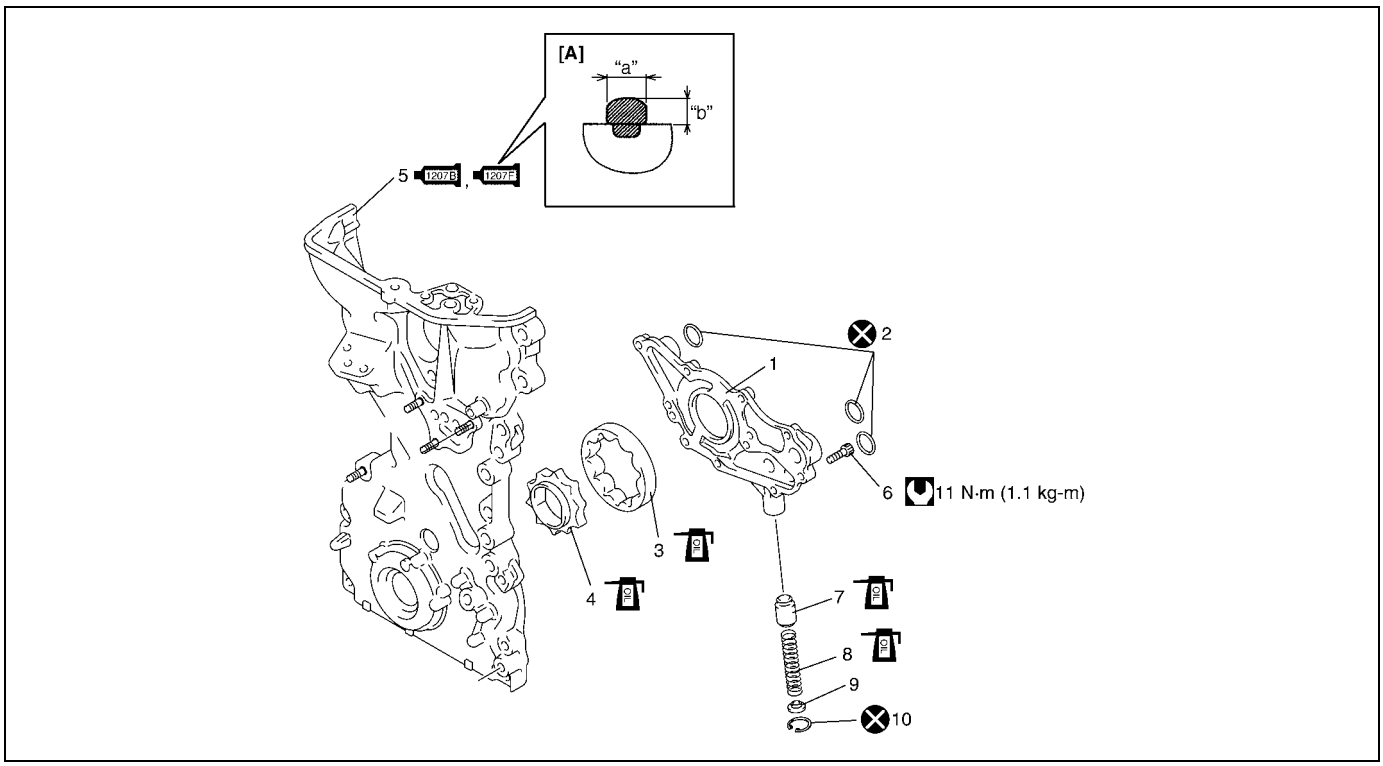
Inspect strainer (1) and mating surface (2) of oil control valve.
Clean oil control valve.



Oil gallery pipe

Inspect oil gallery pipes No.1 (1), No.2 (2) and No.3 (3).
Replace if crack, deformation or clog exists.

Oil Pump Components



[A] : Sealant application amount	4. Inner rotor	10. Circlip
"a" : 3 mm (0.12 in.)	5. Timing chain cover : Apply sealant 99000-31140 to the mating surface of cylinder and cylinder head. : Apply sealant 99000-31250 to mating surface of timing chain cover referring to the figure of Step 4) of "Installation" under "Timing Chain Cover Removal and Installation" in this section.	Tightening torque
"b" : 2 mm (0.08 in.)	6. Rotor plate bolt	Do not reuse.
1. Rotor plate	7. Relief valve	Apply thin coat of engine oil to sliding surface of each parts.
2. O ring	8. Spring	
3. Outer rotor	9. Retainer	

Oil Pump Removal and Installation

Removal

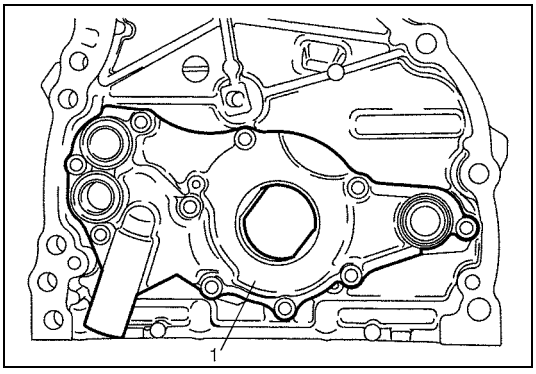
Remove timing chain cover referring to "Timing Chain Cover Removal and Installation" in this section.

Installation

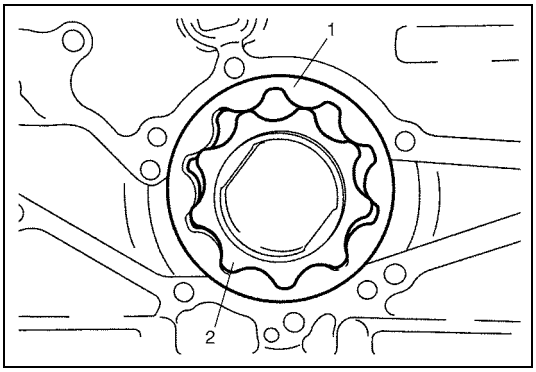
For installation referring to "Timing Chain Cover Removal and Installation" in this section.

Oil Pump Disassembly and Assembly

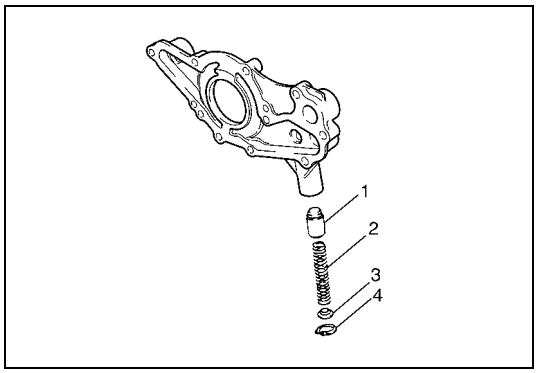
Disassembly



1) Remove rotor plate (1) by removing its mounting bolts.



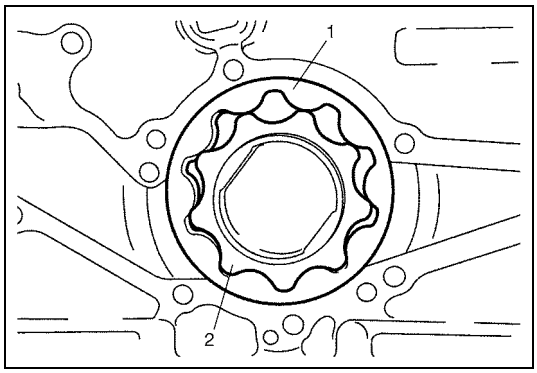
2) Remove outer rotor (1) and inner rotor (2).



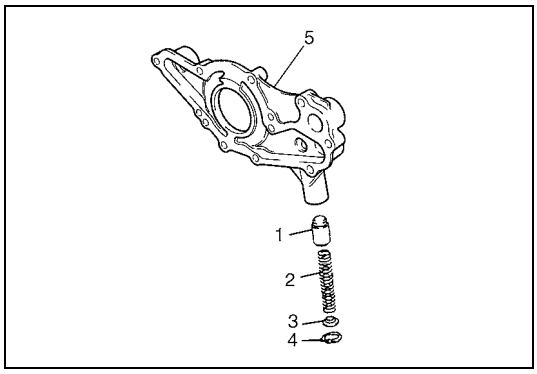
3) Remove relief valve (1), spring (2) and retainer (3) by removing circlip (4).

Assembly

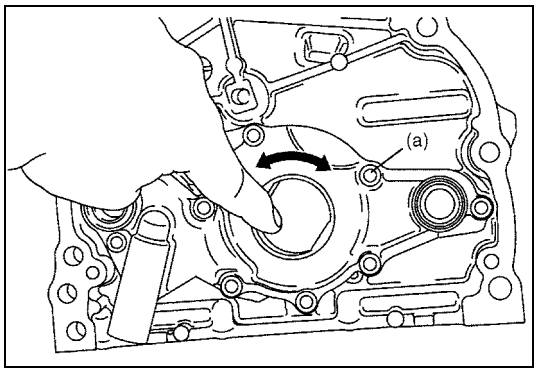
1) Wash, clean and then dry all disassembled parts.
2) Apply thin coat of engine oil to inner and outer rotors, oil seal lip portion, inside surfaces of oil pump case and plate.



3) Install outer (1) and inner rotors (2) to oil pump case.



4) Apply engine oil to relief valve (1) and spring (2), and install them with retainer (3) and new circlip (4) to rotor plate (5).

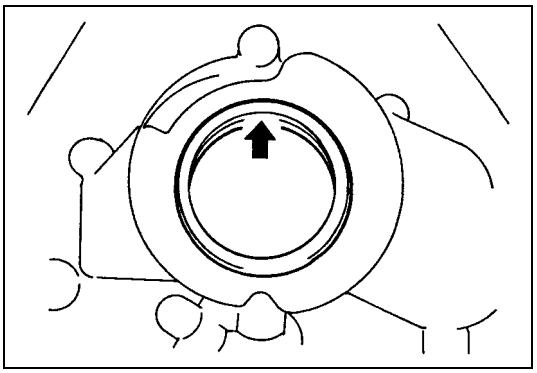


5) Install rotor plate and tighten all bolts to specified torque.
After installing plate, check to be sure that rotors turn smoothly by hand (0.3 N·m (0.03 kg-m, 0.25 lb-ft) torque or below).

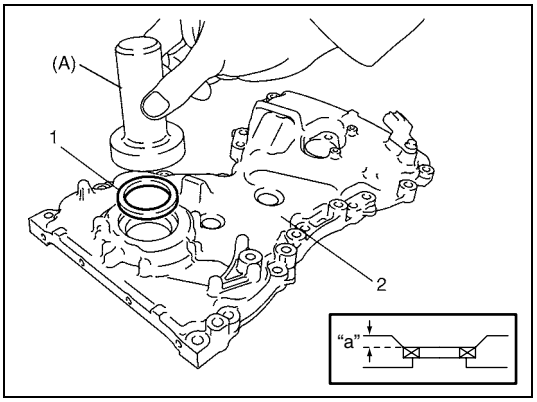
Tightening torque
Oil pump rotor plate bolts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)

Oil Pump Inspection

Oil seal



- Check oil seal lip for fault or other damage. Replace as necessary.



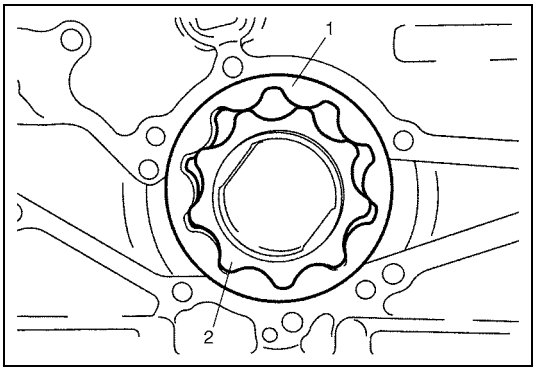
NOTE:

When installing new oil seal (1), press-fit it to oil pump case (2) by using special tool as shown in the figure.

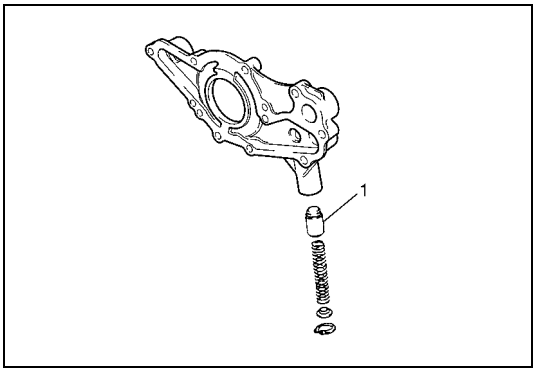
Special tool
(A) : 09913-75810

Drive in dimension
"a" : 1.5 mm (0.06 in.)

Oil pump assembly

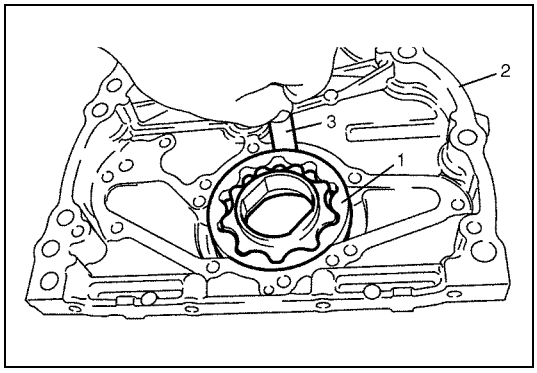


- Check outer (1) and inner rotors (2), rotor plate, and oil pump case for excessive wear or damage.



- Check relief valve (1) for excessive wear or damage and operates smoothly.

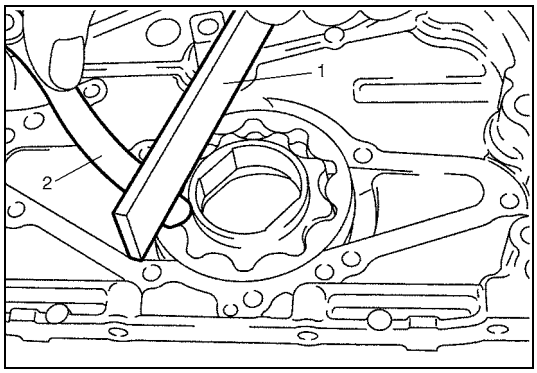
Radial clearance



Check radial clearance between outer rotor (1) and case (2), using thickness gauge (3).
If clearance exceeds its limit, replace oil pump assembly.

Limit on radial clearance between outer rotor and case for oil pump
: 0.310 mm (0.0122 in.)

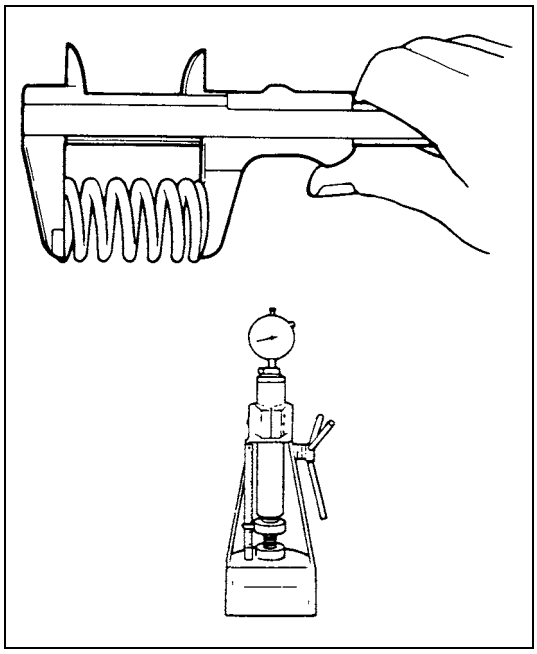
Side clearance



Using straight edge (1) and thickness gauge (2), measure side clearance.
If clearance exceeds its limit, replace oil pump assembly.

Limit on side clearance for oil pump inner rotor
: 0.15 mm (0.0059 in.)

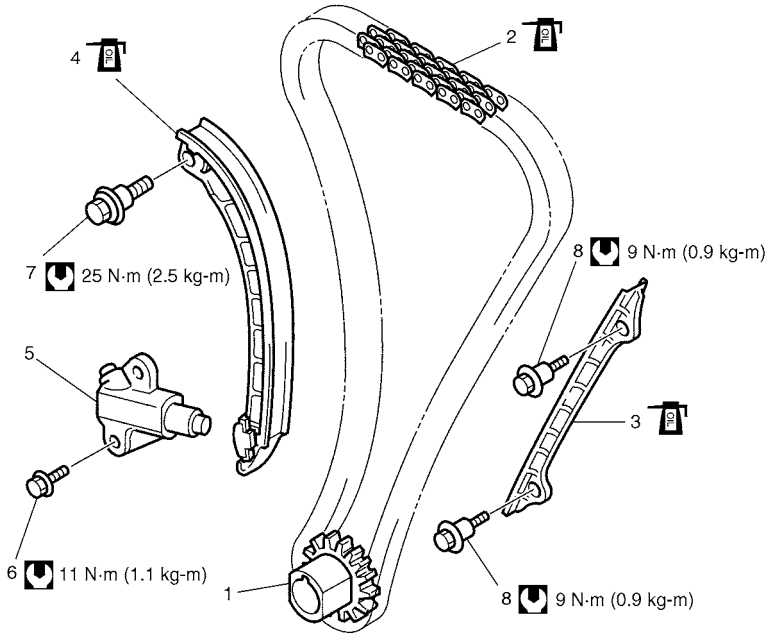
Relief valve spring free length and load



Check relief valve spring free length and load as shown in figure.
If the measured valve spring length is lower than the specification, replace relief valve spring.

	Standard	Limit
Free length	**52.4 mm (2.06 in.)**	**–**
Load at spring length 38.5 mm (1.52 in.)	**77 N (7.7 kgf, 17.0 lb)**	**69 N (6.9 kgf, 15.0 lb)**

Timing Chain and Chain Tensioner Components



1. Crankshaft timing sprocket	4. Timing chain tensioner : Apply engine oil to sliding surface.	7. Chain tensioner mounting bolt
2. Timing chain : Apply engine oil.	5. Timing chain tensioner adjuster assembly	8. Chain guide mounting bolt
3. Timing chain No.1 guide : Apply engine oil to sliding surface.	6. Chain tensioner adjuster mounting bolt	Tightening torque

Timing Chain and Chain Tensioner Removal and Installation

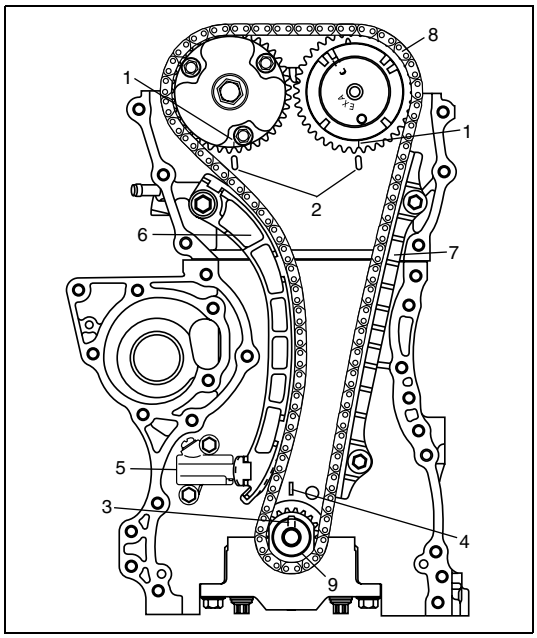
Removal

CAUTION:

After timing chain is removed, never turn crankshaft and camshafts independently more than its allowable turning range described in "Installation" section.

If turned, interference may occur between piston and valves and valves themselves, and parts related to piston and valves may be damaged.

1) Remove timing chain cover referring to "Timing Chain Cover Removal and Installation" in this section.



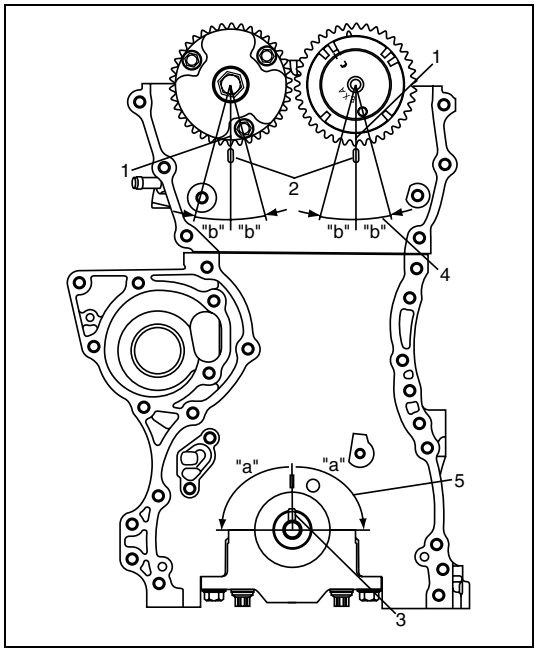
2) By turing crankshaft, align both intake and exhaust camshaft timing sprocket marks (1) with notches (2) of cylinder head respectively and align crank shaft sprocket key (3) with notch of cylinder block (4).
3) Remove timing chain tensioner adjuster assembly (5).
4) Remove timing chain tensioner (6).
5) Remove timing chain No.1 guide (7).
6) Remove timing chain (8) with crankshaft timing sprocket (9)

Installation

CAUTION:

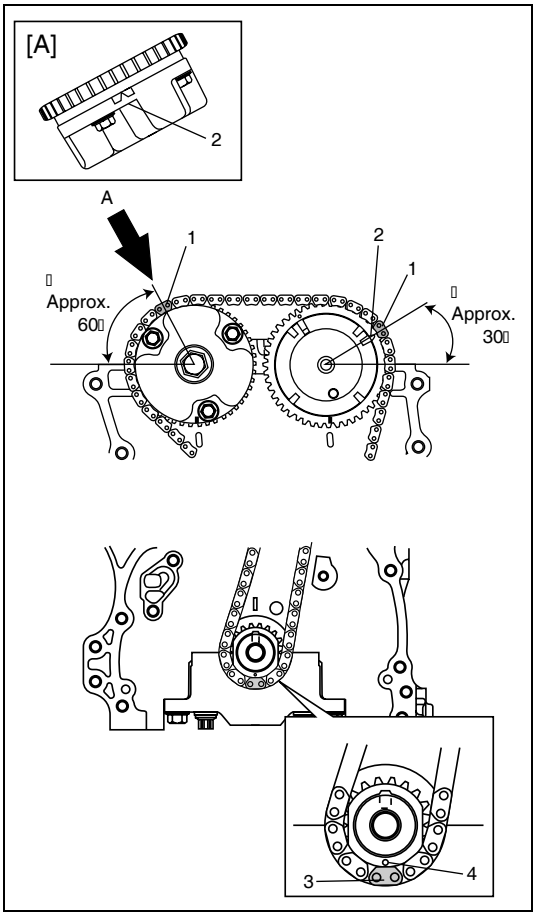
After timing chain is removed, never turn crankshaft and camshafts independently more than such an extent ("a", "b") as shown in figure.

If turned, interference may occur between piston and valves and valves themselves, and parts related to piston and valves may be damaged.



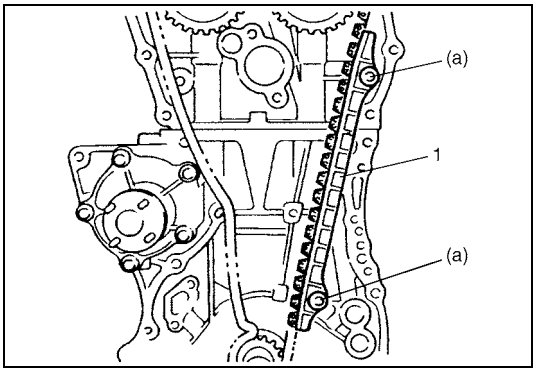
1) Check that match marks (1) on intake and exhaust camshaft timing sprockets are in match with notches (2) on cylinder head as shown in figure.
2) Set key (3) and turn crankshaft to position key on upside of crankshaft.

"a" : 90°	4. Camshaft (IN and EX) allowable turning range. By marks on camshaft timing sprocket within 15° from notches on cylinder head on both right and left.
"b" : 15°	5. Crankshaft allowable turning range. By key on crankshaft, within 90° from top on both right and left.



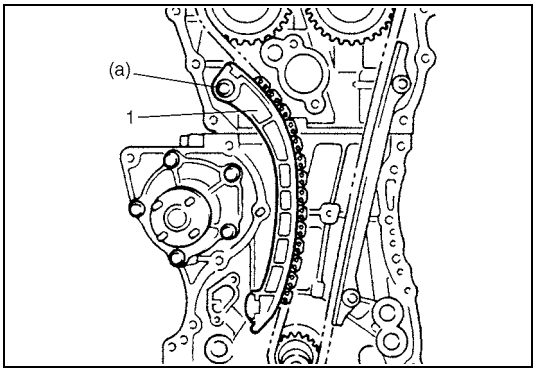
3) Install timing chain by aligning dark blue plate (1) of timing chain and triangle mark (2) on camshaft timing sprocket as shown in figure.
4) Fit crankshaft timing sprocket to timing chain by aligning gold plate (3) of timing chain and circle mark (4) on crankshaft timing sprocket. Then install crankshaft timing sprocket fitted with chain to crankshaft.

[A] : View A



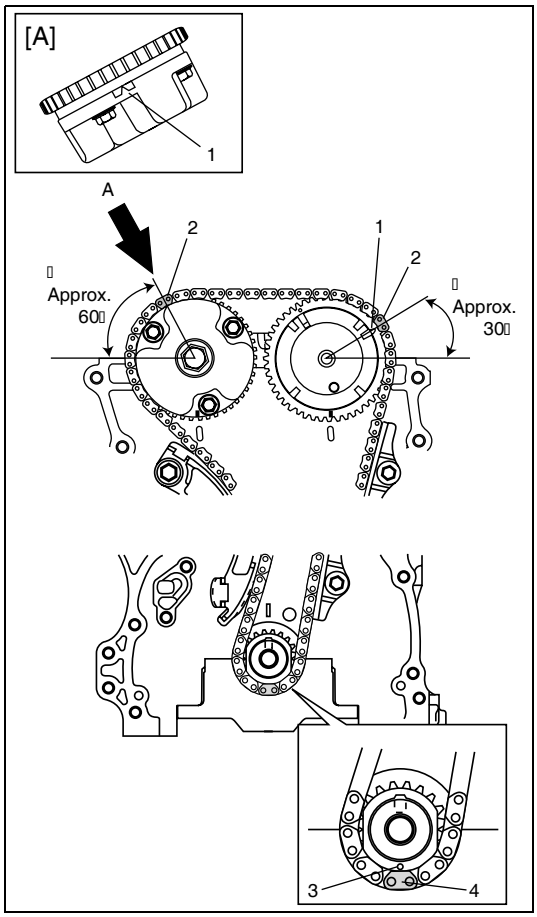
5) Apply engine oil to sliding surface of timing chain No.1 guide (1) and install it as shown in figure.
Tighten guide bolts to specified torque.

Tightening torque
Timing chain No.1 guide bolts
(a) : 9 N·m (0.9 kg-m, 6.5 lb-ft)



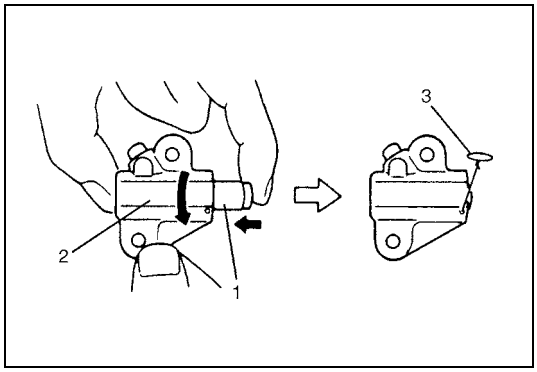
6) Apply engine oil to sliding surface of chain tensioner (1) and install chain tensioner and spacer.
Tighten tensioner bolt to specified torque

Tightening torque
Timing chain tensioner bolt
(a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

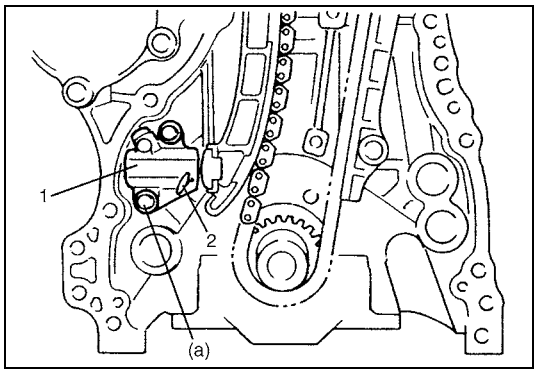


7) Check that match marks (1) on intake and exhaust camshaft timing sprockets are in match with marking of timing chain (2) and match mark on crankshaft timing sprocket (3) are in with marking of timing chain (4).

[A] : View A

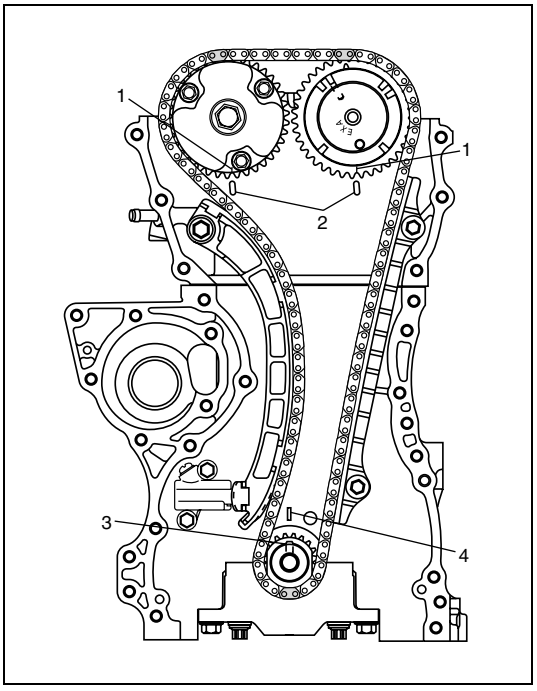


8) Screw in plunger (1) by turning body (2) in arrow direction and install a retainer (3) (wire) to hold plunger in place.



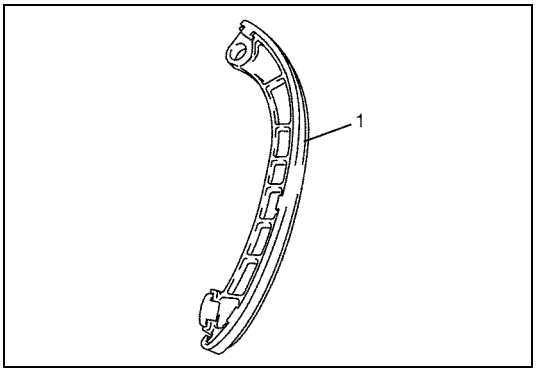
9) Install timing chain tensioner adjuster assembly (1) with a retainer (2).
Tighten adjuster bolts to specified torque and then remove a retainer from chain tensioner adjuster assembly.

Tightening torque
Timing chain tensioner adjuster bolts
(a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)



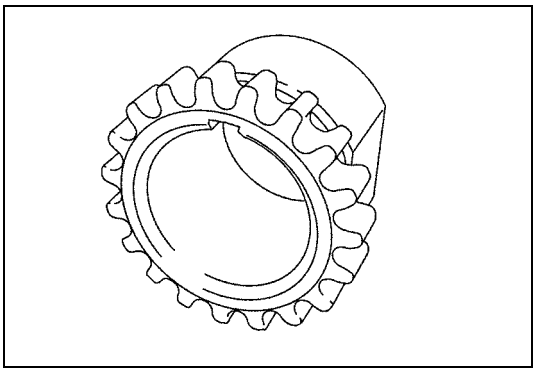
10) Apply engine oil to timing chain and then turn crankshaft clockwise by 2 revolutions and check that match marks (1) on intake and exhaust camshaft timing sprockets are in match with notches (2) on cylinder head and key (3) is in match with notch (4) on cylinder block as shown in figure.
    If each marking chain and each match mark are no matches, adjust each sprockets and timing chain.
11) Install timing chain cover referring to “Timing Chain Cover Removal and Installation” in this section.
12) Perform Steps 3) to 8) of “Installation” of “Timing Chain Cover Removal and Installation” in this section.

Timing Chain and Timing Chain Tensioner Inspection



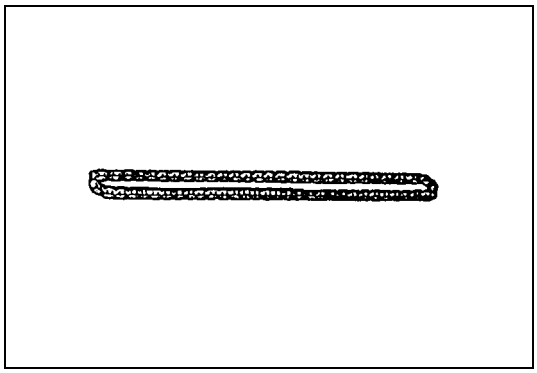
Timing chain tensioner

- Check shoe (1) for wear or damage.



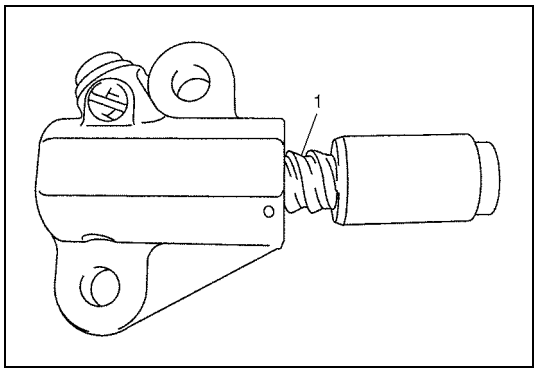
Crankshaft timing sprocket

- Check teeth of sprocket for wear or damage.



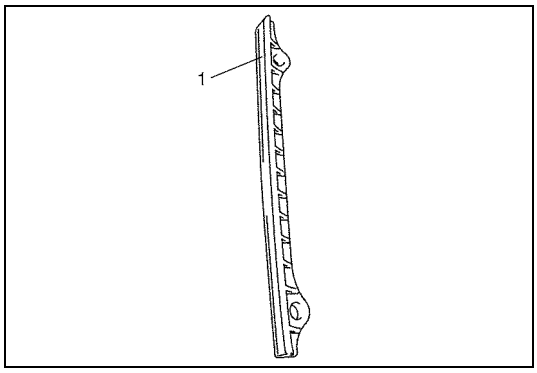
Timing chain

- Check timing chain for wear or damage.



Timing chain tensioner adjuster

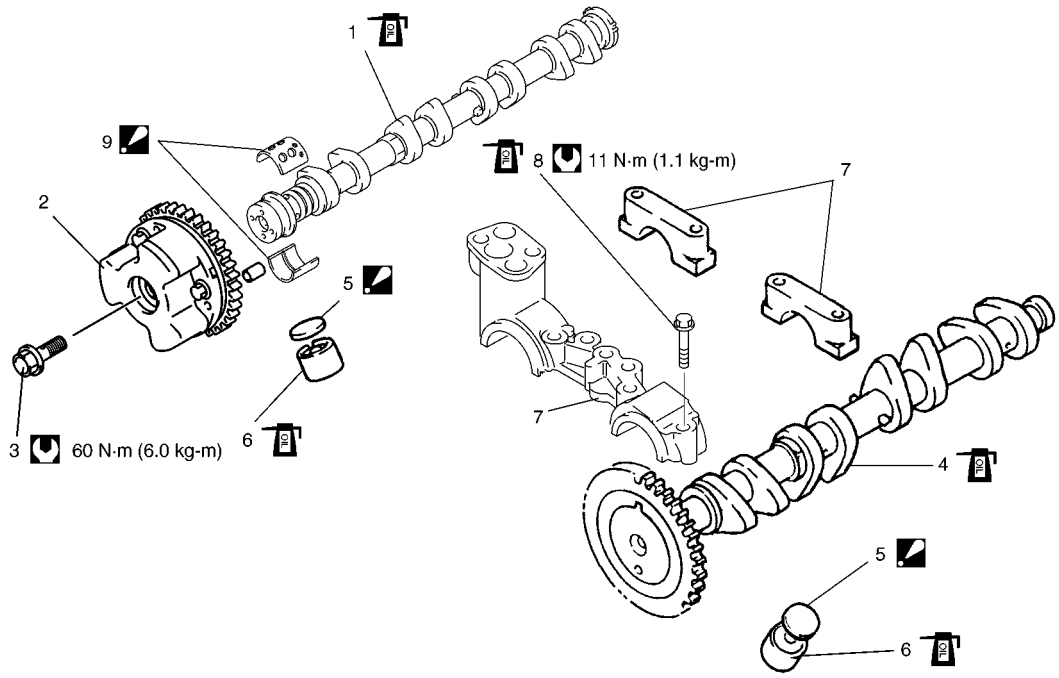
- Check that tooth surface (1) are free from damage.



Timing chain No.1 guide

- Check shoe (1) for wear or damage.

Camshaft, Tappet and Shim Components



1. Intake camshaft	5. Shim : Shim No. on it faces tappet side.	9. Upper camshaft bearing : Install a bearing half with some holes to upper side of intake camshaft No.1 bearing.
2. Intake camshaft sprocket assembly	6. Tappet	Tightening torque
3. Intake camshaft sprocket bolt	7. Camshaft housing	Apply engine oil to sliding surface of each part.
4. Exhaust camshaft	8. Camshaft housing bolt	

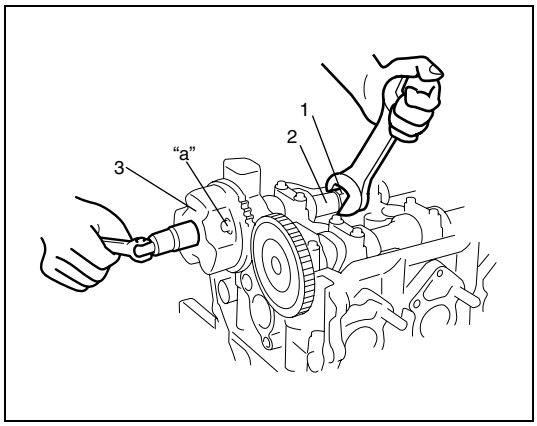
Camshaft, Tappet and Shim Removal and Installation

Removal

CAUTION:

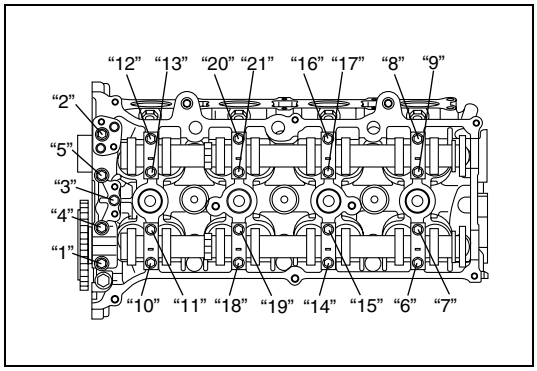
- **Keep working table, tools and hands clean while overhauling.**
- **Use special care to handle aluminum parts so as not to damage them.**
- **Do not expose removed parts to dust. Keep them always clean.**

1) Remove timing chain cover referring to “Timing Chain Cover Removal and Installation” in this section.
2) Remove timing chain referring to “Timing Chain and Chain Tensioner Removal and Installation” in this section.

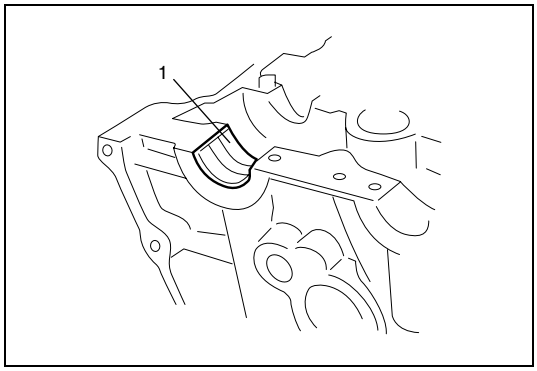


3) With hexagonal section (1) of intake camshaft (2) held stationary with spanner or the like, loosen mounting bolt of intake cam timing sprocket assembly (3) and remove it.

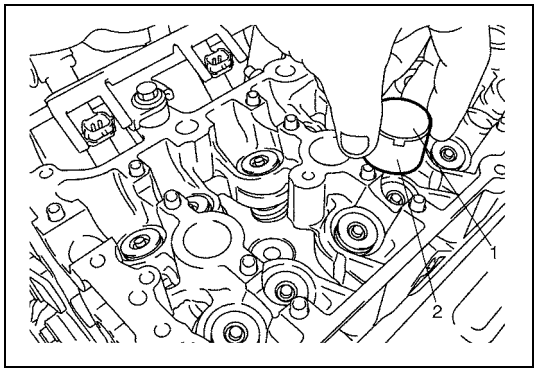
CAUTION:
Never attempt to loosen mounting bolt with intake cam timing sprocket assembly held stationary. Failure to follow this could result in damage to lock pin.
Do not loosen bolt "a" because intake cam timing sprocket assembly is not serviceable.



4) Loosen camshaft housing bolts in such order as indicated in figure and remove them.
5) Remove camshaft housings.
6) Remove intake and exhaust camshafts.

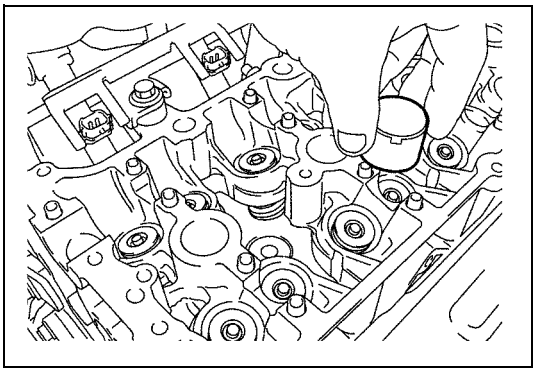


7) Remove camshaft bearing (1).



8) Remove tappets (2) with shims (1).

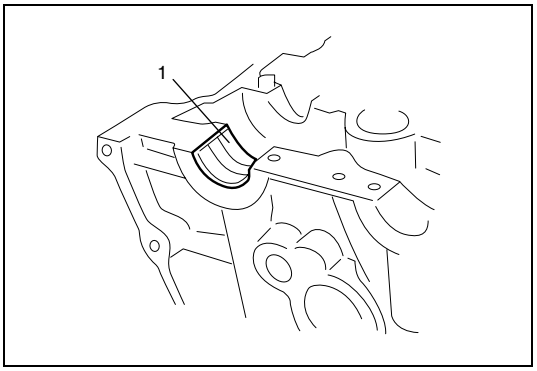
Installation



1) Install tappets and shims to cylinder head.
   Apply engine oil around tappet and then install it to cylinder head.

NOTE:

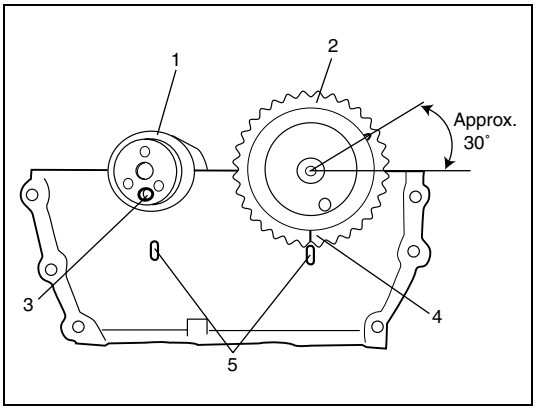
When installing shim, make sure to direct shim No. side toward tappet.



2) Install camshaft bearing (1) to cylinder head.

CAUTION:

Do not apply engine oil to camshaft bearing back.
Only a upper half bearing of intake camshaft bearing No.1 has some holes. Other bearings.

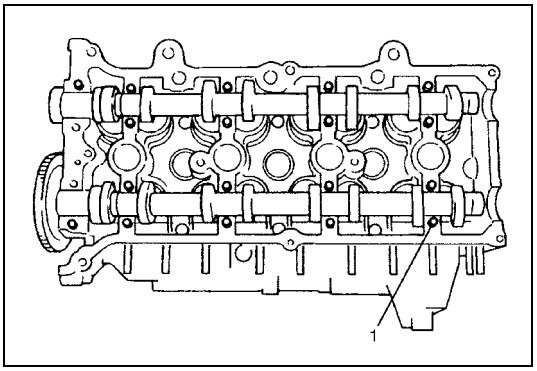


3) Install intake camshaft (1) and exhaust camshaft (2).
   Align knock pin (3) and match mark (4) with notches (5) as shown in the figure.

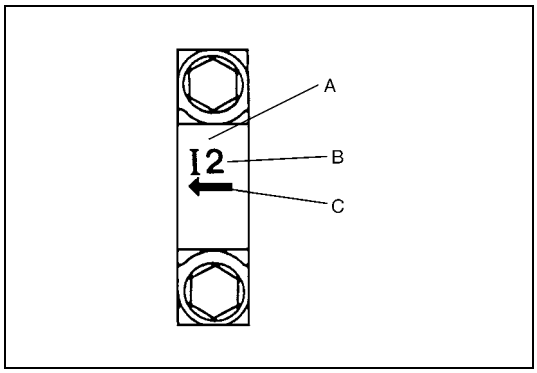
NOTE:

Before installing camshafts, turn crankshaft until key faces upward. Refer to "Timing Chain and Chain Tensioner Components".

4) Apply engine oil to sliding surface of each camshaft and camshaft journal then install them as shown in figure.

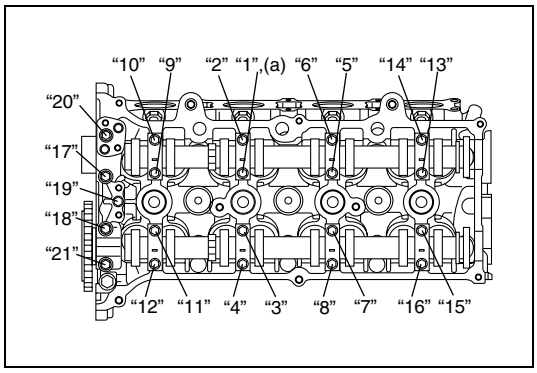


5) Install camshaft housing pins (1) as shown in figure.



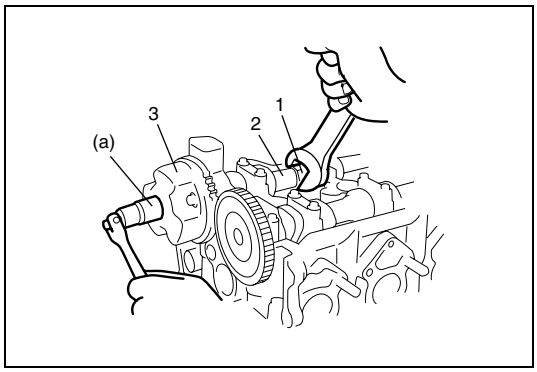
6) Check position of camshaft housings.
Embossed marks are provided on each camshaft housing, indicating position and direction for installation. Install housings as indicated by these marks.

A.	I : Intake side or E : Exhaust side
B.	Position from timing chain side
C.	Pointing to timing chain side



7) After applying engine oil to housing bolts, tighten them temporarily first. Then tighten them by the numerical order in figure. Tighten a little at a time and evenly among bolts and repeat tightening sequence two or three times before they are tightened to specified torque.

Tightening torque
Camshaft housing bolts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)

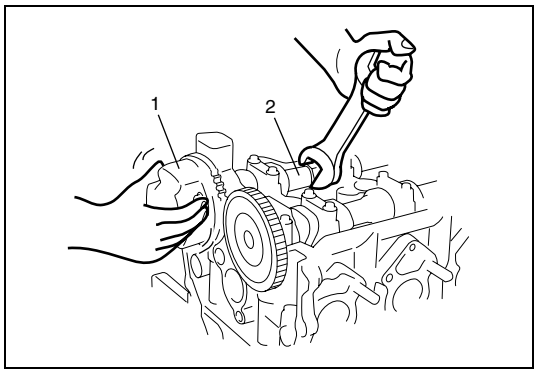


8) With hexagonal section (1) of intake camshaft (2) held stationary with spanner or the like, tighten bolt of intake cam timing sprocket assembly (3) to specification.

Tightening torque
Intake cam timing sprocket bolts
(a) : 60 N·m (6.0 kg-m, 43 lb-ft)

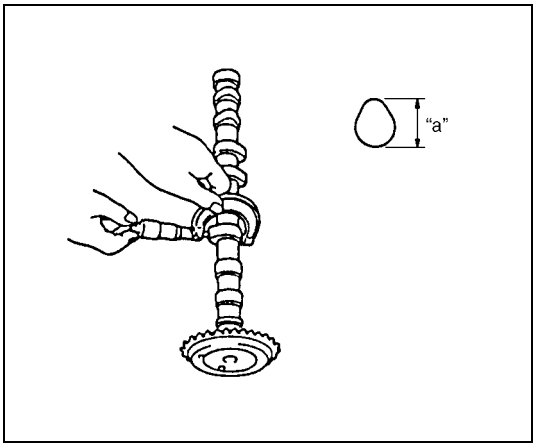
9) Install timing chain with crankshaft sprocket referring to "Timing Chain and Chain Tensioner Removal and Installation" in this section.
10) Install timing chain cover referring to "Timing Chain Cover Removal and Installation" in this section.
11) Check valve lashes as previously outlined.
12) Perform Steps 3) to 8) of "Installation" of "Timing Chain Cover Removal and Installation" in this section.

Camshaft, Tappet and Shim Inspection



Intake cam timing sprocket assembly

Fit intake cam timing sprocket assembly to camshaft (2) and hold hexagonal section of camshaft by using spanner or the like.
Check if sprocket (1) is not turned by hand.
If moved, replace intake cam timing sprocket assembly.

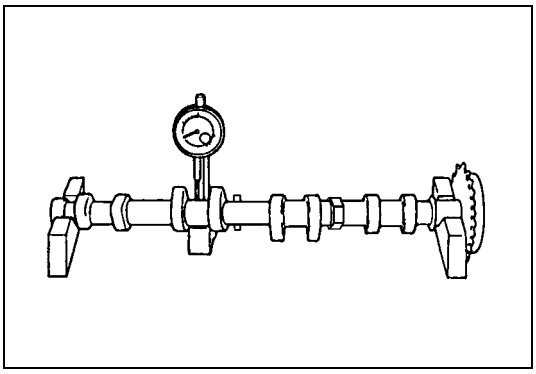


Cam wear

Using a micrometer, measure cam height "a". If measured height underruns its limit, replace camshaft.

Cam height "a" of camshaft

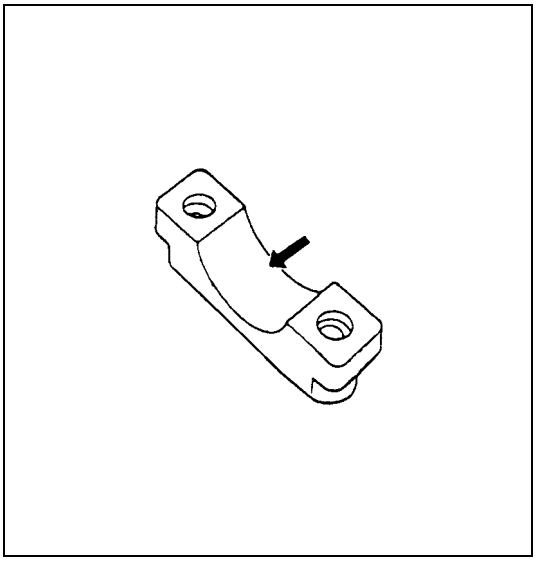
	Standard	Limit
Intake cam	**44.929 – 45.089 mm (1.769 – 1.775 in.)**	**44.80 mm (1.764 in.)**
Exhaust cam	**44.399 – 44.559 mm (1.748 – 1.754 in.)**	**44.28 mm (1.743 in.)**



Camshaft runout

Set camshaft between two "V" blocks, and measure its runout by using a dial gauge.
If measured runout exceeds limit, replace camshaft.

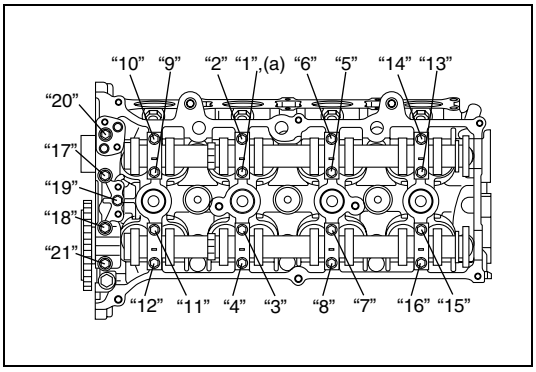
Camshaft runout limit
: 0.10 mm (0.0039 in.)



Camshaft journal wear

Check camshaft journals and camshaft housings for pitting, scratches, wear or damage.
If any malcondition is found, replace camshaft or cylinder head with housing. Never replace cylinder head without replacing housings.
Check clearance by using gaging plastic. Checking procedure is as follows.

1) Clean housings and camshaft journals.
2) Remove all tappets with shims.
3) Install camshafts to cylinder head.
4) Place a piece of gaging plastic to full width of journal of camshaft (parallel to camshaft).
5) Install camshaft housing.

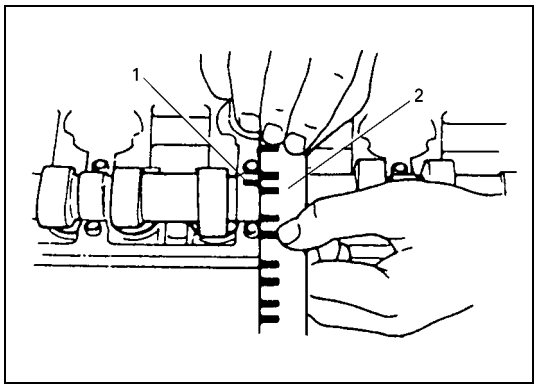


6) Tighten camshaft housing bolts in such order as indicated in figure a little at a time till they are tightened to specified torque.

NOTE:

Do not rotate camshaft while gaging plastic is installed.

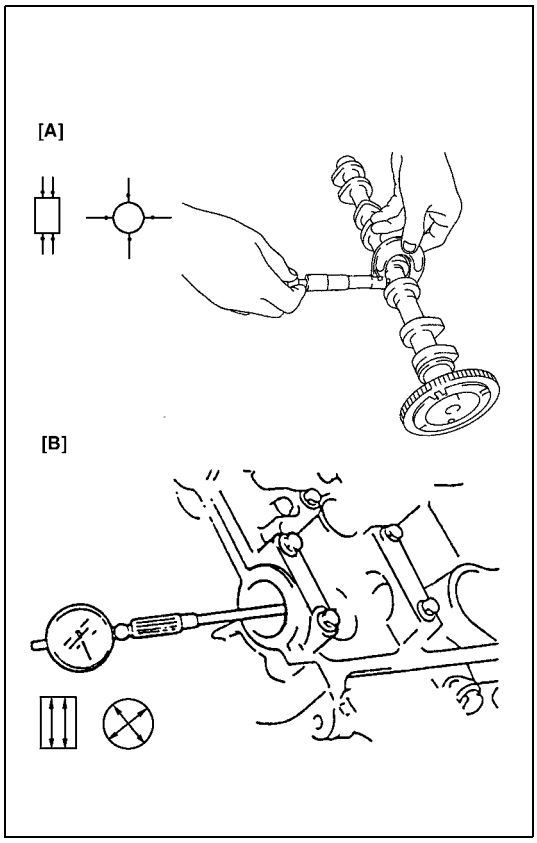
Tightening torque
Camshaft housing bolts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)



7) Remove housing, and using scale (2) on gaging plastic (1) envelop, measure gaging plastic width at its widest point.

Camshaft journal clearance

	Standard	Limit
Intake side No.1 housing	0.020 – 0.072 mm (0.0008 – 0.0028 in.)	0.10 mm (0.0039 in.)
Others	0.045 – 0.087 mm (0.0018 – 0.0034 in.)	0.12 mm (0.0047 in.)



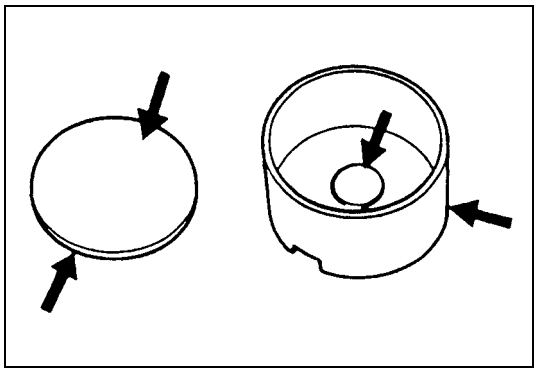
If measured camshaft journal clearance exceeds limit, measure journal (housing) bore and outside diameter of camshaft journal. Replace camshaft or cylinder head assembly whichever the difference from specification is greater.

Camshaft journal diameter [A]

Item	Standard
Intake side No.1 housing	26.940 – 26.955 mm (1.0606 – 1.0612 in.)
Exhaust side No.1 housing	26.934 – 26.955 mm (1.0604 – 1.0612 in.)
Others	22.934 – 22.955 mm (0.9029 – 0.9037 in.)

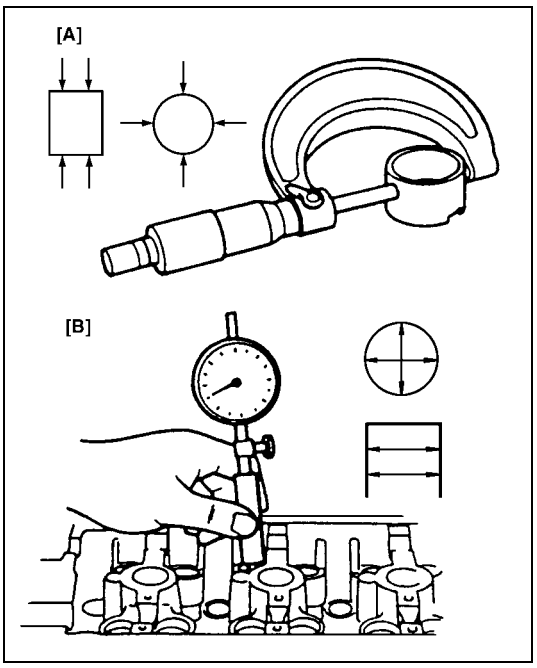
Camshaft journal bearing bore [B]

Item	Standard
Intake side No.1 housing	–
Exhaust side No.1 housing	27.000 – 27.021 mm (1.0630 – 1.0638 in.)
Others	23.000 – 23.021 mm (0.9055 – 0.9063 in.)



Wear of tappet and shim

Check tappet and shim for pitting, scratches or damage.
If any malcondition is found, replace.



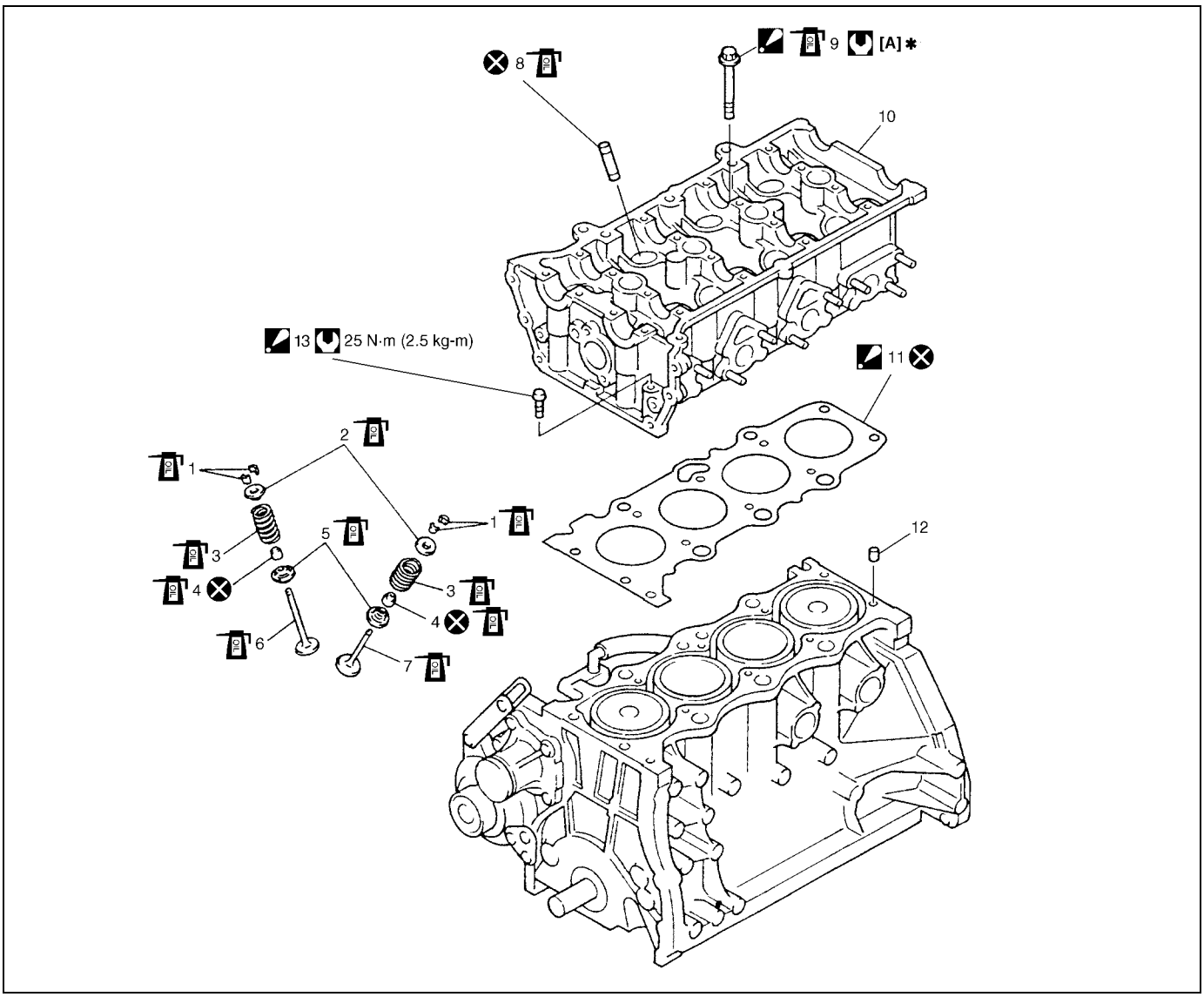
Measure cylinder head bore and tappet outside diameter to determine cylinder head-to-tappet clearance. If clearance exceeds limit, replace tappet or cylinder head.

Cylinder head to tappet clearance
Standard : 0.025 – 0.066 mm (0.0010 – 0.0026 in.)
Limit : 0.15 mm (0.0059 in.)

Tappet outside diameter [A]
Standard : 30.959 – 30.975 mm (1.2189 – 1.2195 in.)

Cylinder head tappet bore [B]
Standard : 31.000 – 31.025 mm (1.2205 – 1.2215 in.)

Valves and Cylinder Head Components

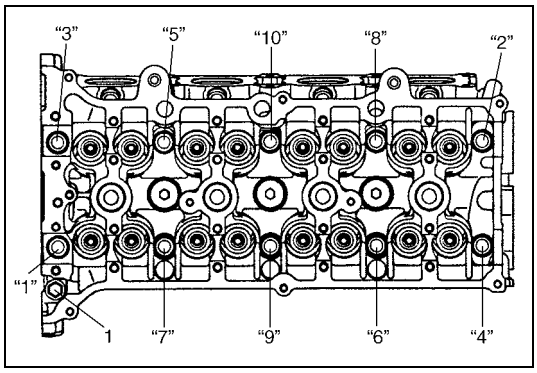


[A]✱ 1) Tighten all bolts at 20 N·m (2.0 kg-m) 2) Tighten all bolts at 40 N·m (4.0 kg-m) 3) Then retighten all bolts by turning through 60° 4) Repeat step 3) again	6. Intake valve	12. Knock pin
1. Valve cotters	7. Exhaust valve	13. Cylinder head bolt (M8) : Be sure to tighten cylinder head bolt (M8) after securing the other cylinder head bolt (M10).
2. Valve spring retainer	8. Valve guide	Tightening torque
3. Valve spring	9. Cylinder head bolt (M10) : Never reuse cylinder head bolts once disassembled it due to plastic deformation tightening. Be sure to use new cylinder head bolts when installing.	Do not reuse.
4. Valve stem seal	10. Cylinder head	Apply engine oil to sliding surface of each part.
5. Valve spring seat	11. Cylinder head gasket : "TOP" mark provided on gasket comes to crankshaft pulley side, facing up.	

Valves and Cylinder Head Removal and Installation

Removal

1) Remove engine assembly from vehicle referring to "Engine Assembly Removal and Installation" in this section.
2) Remove oil pan referring to "Oil Pan and Oil Pump Strainer Removal and Installation" in this section.
3) Remove cylinder head cover referring to "Cylinder Head Cover Removal and Installation" in this section.
4) Remove timing chain cover referring to Steps 2) to 7) of "Removal" in "Timing Chain Cover Removal and Installation" in this section.
5) Remove timing chain referring to Steps 2) to 6) of "Removal" under "Timing Chain Cover Removal and Installation" in this section.
6) Remove intake and exhaust camshafts referring to Steps 3) to 7) of "Removal" under "Camshaft, Tappet and Shim Removal and Installation" in this section.



7) Loosen cylinder under head bolts in such order as indicated in figure by using a 12 corner socket wrenches and remove them.

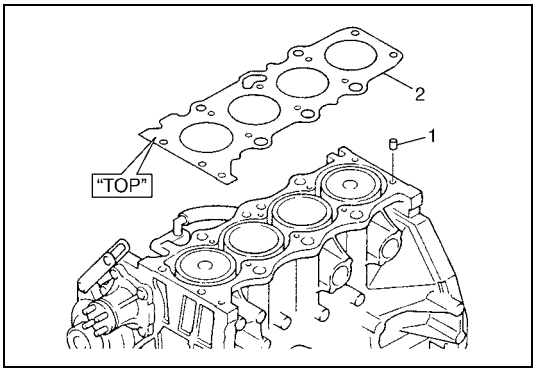
NOTE:

- **Don't forget to remove bolt (M8) (1) as shown in figure.**
- **Never reuse cylinder head bolts once disassembled it due to plastic deformation tightening. Be sure to use new cylinder head bolts when installing.**

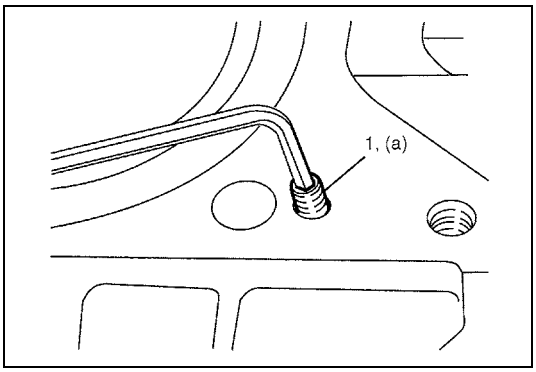
8) Check all around cylinder head for any other parts required to be removed or disconnected and remove or disconnect whatever necessary.
9) Remove exhaust manifold, if necessary, referring to "Exhaust Manifold Removal and Installation" in this section.
10) Remove cylinder head with intake manifold and exhaust manifold. Use lifting device, if necessary.

Installation

1) Clean mating surface of cylinder head and cylinder block. Remove oil, old gasket and dust from mating surface.

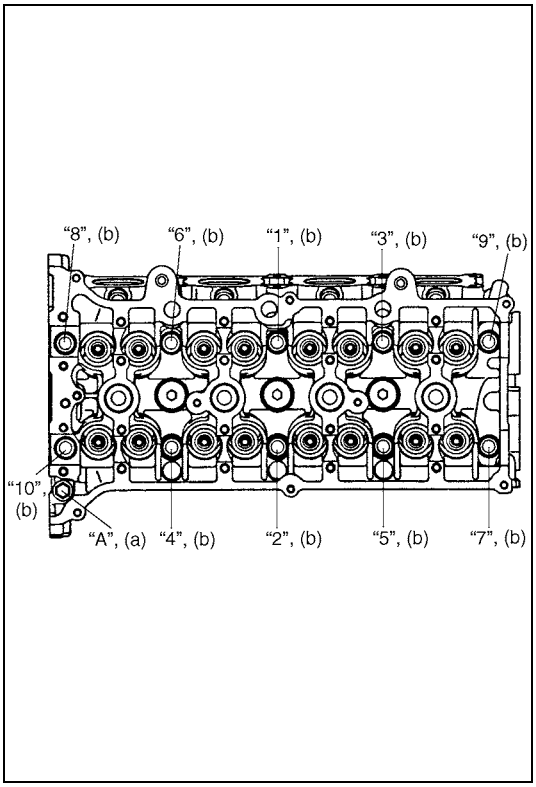


2) Install knock pins (1) to cylinder block.
3) Install new cylinder head gasket (2) to cylinder block. "TOP" mark provided on gasket comes to crankshaft pulley side, facing up (toward cylinder head side).



4) Make sure that oil jet (venturi plug) (1) is not clogged. If it is not installed, install it as specified torque.

Tightening torque
Venturi plug (a) : 5 N·m (0.5 kg-m, 3.5 lb-ft)

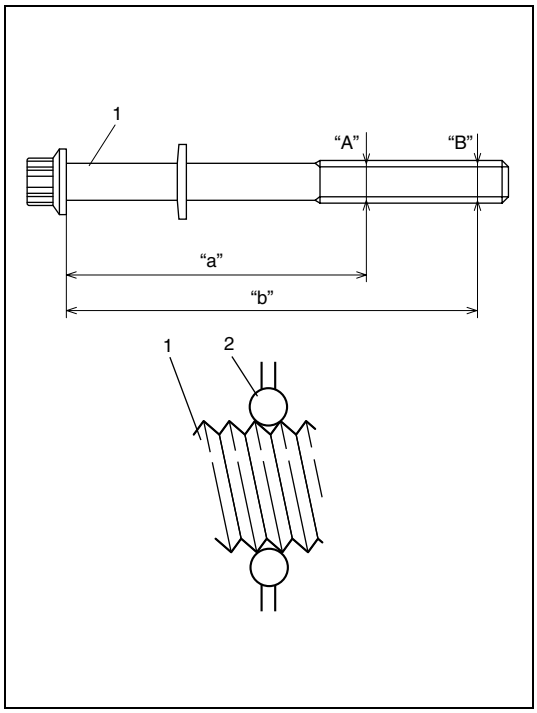


5) Install cylinder head to cylinder block.
   Apply engine oil to new cylinder head bolts and tighten them gradually as follows.
   a) Tighten cylinder head bolts ("1" – "10") to 20 N·m (2.0 kg-m, 14.5 lb-ft) according to numerical order as shown by using a 12 corner socket wrenches.
   b) In the same manner as in Step a), tighten them to 40 N·m (4.0 kg-m, 29.0 lb-ft).
   c) Turn all bolts 60° according to numerical order in figure.
   d) Repeat Step c).
   e) Tighten bolt "A" to specified torque.

NOTE:

Be sure to tighten M8 bolt ("A") after securing the other bolt.

Tightening torque
Cylinder head bolt for M8 (a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)
Cylinder head bolts for M10
(b) : 20 N·m (2.0 kg-m, 14.5 lb-ft), 40 N·m (4.0 kg-m, 29.0 lb-ft) and then retighten by turning through 60° twice



NOTE:

If they are reused, check thread diameters of cylinder head bolt (1) for deformation according to the follows and replace them with new ones if thread diameter difference exceeds limit.

Measure each thread diameter of cylinder head bolt (1) at "A" on 83.5mm(2.81in.) from seat side of flange bolt and "B" on 115mm(4.53in.) from seat side of flange bolt by using a micrometer (2).
Then calculate difference in diameters ("A" – "B").
If it exceeds limit, replace with new one.

Cylinder head bolt diameter measurement points
"a" : 83.5mm (2.81in.)
"b" : 115mm (4.53in.)

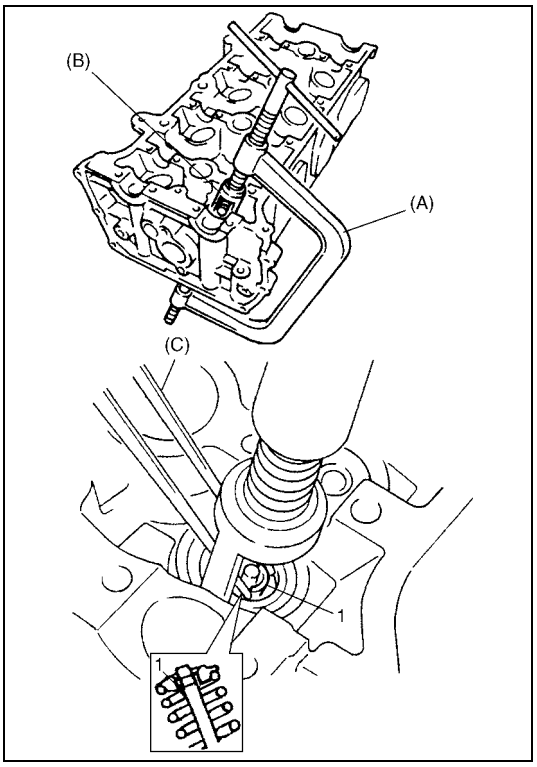
Cylinder head bolt diameter difference (deformation)
Limit ("A" – "B") : 0.1mm (0.004in.)

6) Install camshafts, tappet and shim referring to "Camshaft, Tappet and Shim Removal and Installation" in this section.
7) Install timing chain referring to "Timing Chain and Chain Tensioner Removal and Installation" in this section.
8) Install timing chain cover referring to "Timing Chain and Chain Tensioner Removal and Installation" in this section.
9) Install cylinder head cover referring to "Cylinder Head Cover Removal and Installation" in this section.
10) Install oil pan referring to "Oil Pan and Oil Pump Strainer Removal and Installation" in this section.

Valves and Cylinder Head Disassembly and Assembly

Disassembly

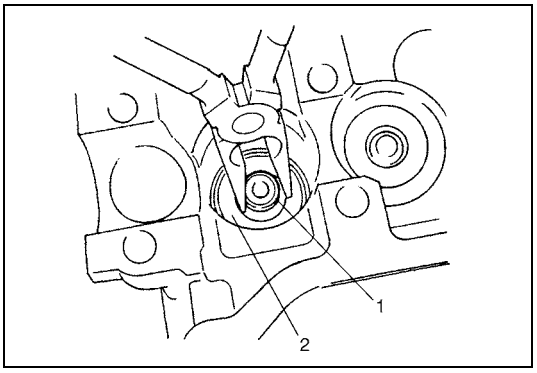
1) For ease in servicing cylinder head, remove intake manifold, injectors and exhaust manifold from cylinder head.



2) Using special tools (valve lifter), compress valve spring and then remove valve cotters (1) by using special tool (forceps).

Special tool
(A) : 09916-14510
(B) : 09916-14521
(C) : 09916-84511

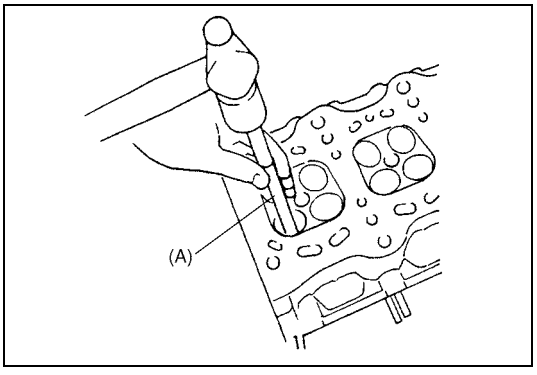
3) Release special tools (valve lifter), and remove spring retainer and valve spring.
4) Remove valve from combustion chamber side.



5) Remove valve stem seal (1) from valve guide and valve spring seat (2).

NOTE:

Do not reuse valve stem seal (1) once disassembled. Be sure to use new valve stem seal when assembling.



6) Using special tool (valve guide remover), drive valve guide out from combustion chamber side to valve spring side.

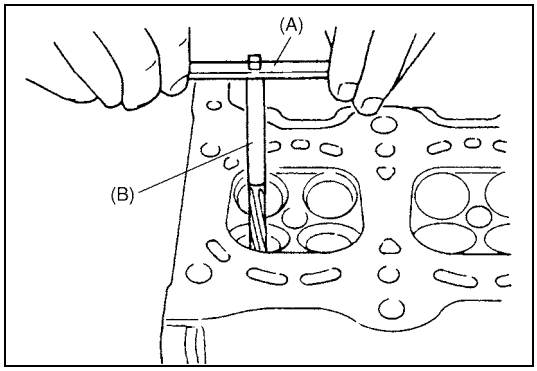
Special tool
(A) : 09916-44910

NOTE:

Do not reuse valve guide once disassembled. Be sure to use new valve guide (oversize) when assembling.

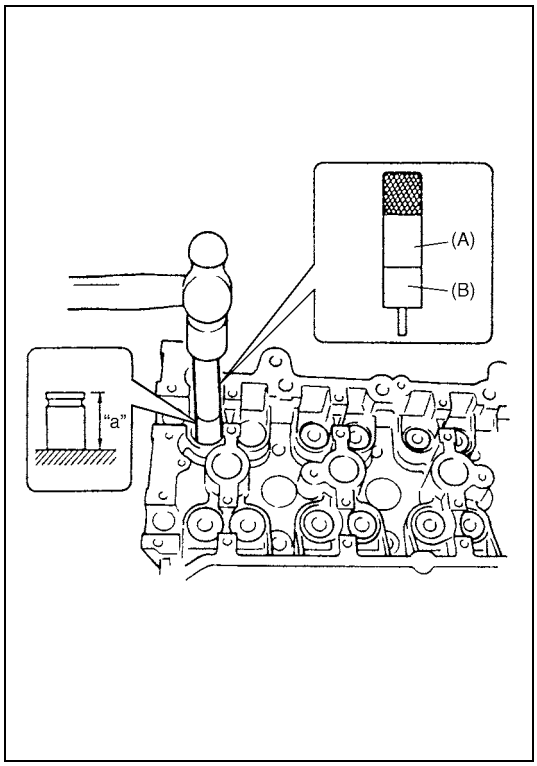
7) Place disassembled parts except valve stem seal and valve guide in order so that they can be installed in their original position.

Assembly



1) Before installing valve guide into cylinder head, ream guide hole with special tool (10.5 mm reamer) so as to remove burrs and make it truly round.

Special tool
(A) : 09916-34542
(B) : 09916-37320



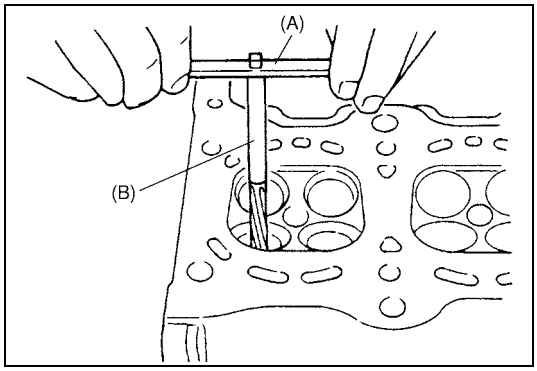
2) Install valve guide to cylinder head.
Heat cylinder head uniformly to a temperature of 80 to 100 °C (176 to 212 °F) so that head will not be distorted, and drive new valve guide into hole with special tools. Drive in new valve guide until special tool (Valve guide installer) contacts cylinder head.
After installing, make sure that valve guide protrudes by specified dimension "a" from cylinder head.

Special tool
(A) : 09916-58210
(B) : 09916-56011

NOTE:

- **Never reuse once-disassembled valve guide. Make sure to install new valve guide.**
- **Intake and exhaust valve guides are identical.**

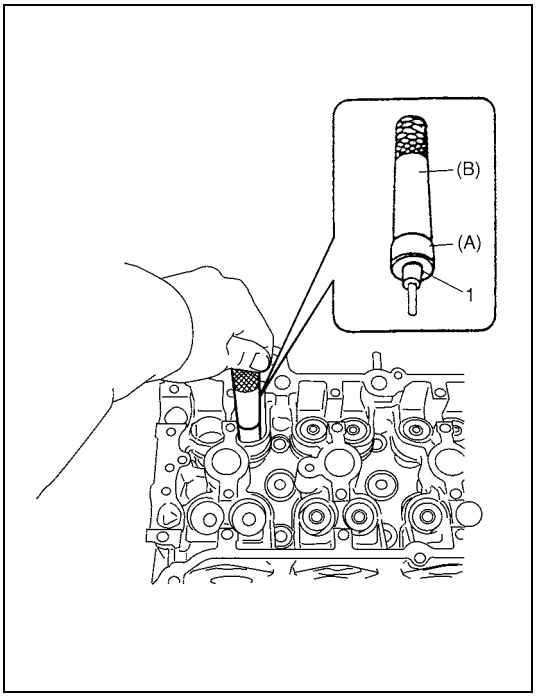
Specification for valve guide protrusion "a"
Intake side : 11.3 mm (0.44 in.)
Exhaust side : 11.3 mm (0.44 in.)



3) Ream valve guide bore with special tool (5.5 mm reamer). After reaming, clean bore.

Special tool
(A) : 09916-34542
(B) : 09916-34550

4) Install valve spring seat to cylinder head.

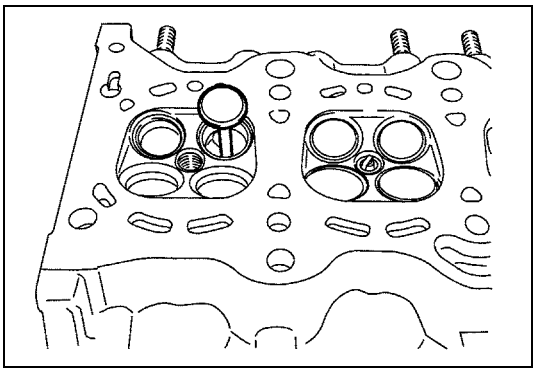


5) Install new valve stem seal (1) to valve guide.
After applying engine oil to seal and spindle of special tool (Valve guide installer handle), fit oil seal to spindle, and then install seal to valve guide by pushing special tool by hand.
After installing, check to be sure that seal is properly fixed to valve guide.

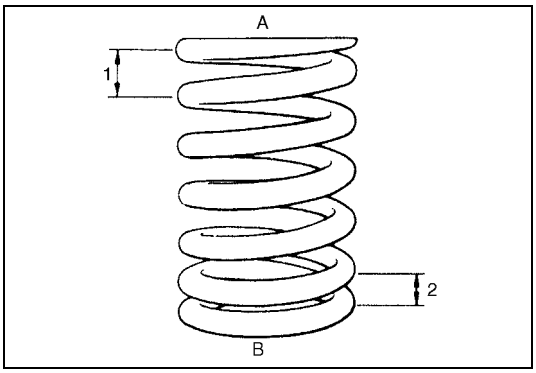
Special tooll
(A) : 09916-58210
(B) : 09917-98221

NOTE:

- **Do not reuse once-disassembled seal. Be sure to install new seal.**
- **When installing, never tap or hit special tool with a hammer or else. Install seal to guide only by pushing special tool by hand. Tapping or hitting special tool may cause damage to seal.**

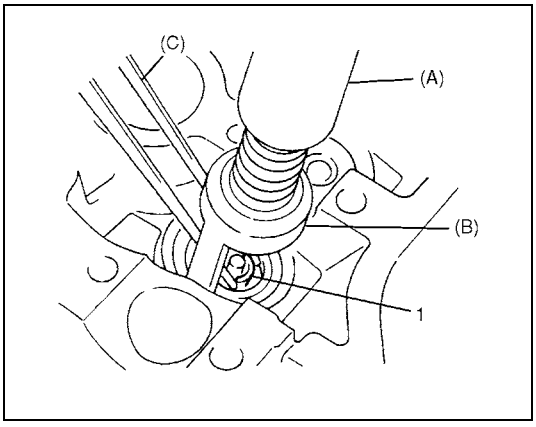


6) Install valve to valve guide.
Before installing valve to valve guide, apply engine oil to stem seal, valve guide bore and valve stem.



7) Install valve spring and spring retainer.
Each valve spring has top end (large-pitch end (1)) and bottom end (small-pitch end (2)). Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).

A :	Valve spring retainer side
B :	Valve spring seat side



8) Using special tools (Valve lifter), compress valve spring and fit two valve cotters (1) into groove in valve stem.

Special tool
(A) : 09916-14510
(B) : 09916-14521
(C) : 09916-84511

NOTE:

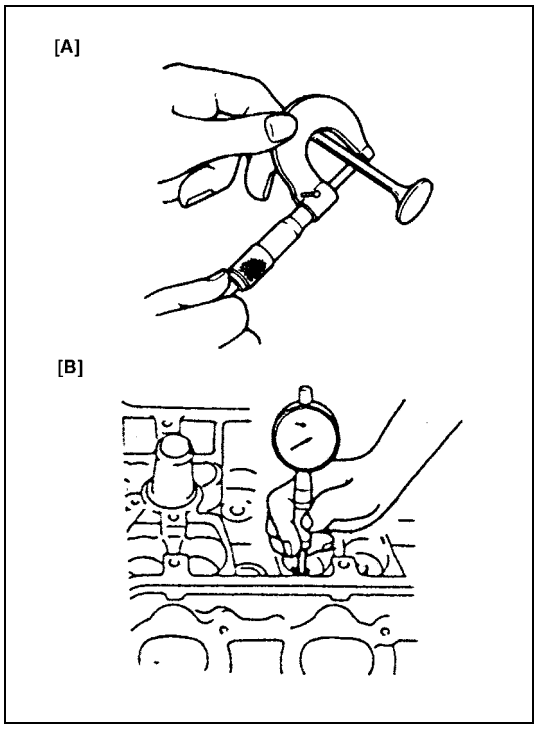
When compressing the valve spring, be carefully to free from damage in inside face of tappet installing hole.

9) Install intake manifold referring to “Intake Manifold Removal and Installation” in this section.
10) Install fuel injectors referring to “Fuel injector removal and installation” in Section 6E1.
11) Install exhaust manifold referring to “Exhaust Manifold Removal and Installation” in this section.

Valves and Cylinder Head Inspection

Valve guides

Valve stem-to-guide clearance



Using a micrometer and bore gauge, take diameter readings on valve stems and guides to check stem-to-guide clearance. Be sure to take reading at more than one place along the length of each stem and guide.
If clearance exceeds limit, replace valve and valve guide.

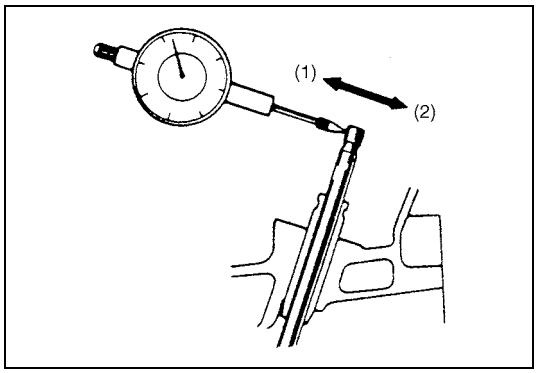
Valve stem-to-guide clearance

Item	Standard	Limit
In	0.020 – 0.047 mm (0.0008 – 0.0018 in.)	0.07 mm (0.0028 in.)
Ex	0.045 – 0.072 mm (0.0017 – 0.0028 in.)	0.09 mm (0.0035 in.)

Valve stem diameter [A] standard
In : 5.465 – 5.480 mm (0.2150 – 0.2157 in.)
Ex : 5.440 – 5.455 mm (0.2142 – 0.2148 in.)

Valve guide bore [B] standard
In and Ex : 5.500 – 5.512 mm (0.2165 – 0.2170 in.)

Valve stem end deflection



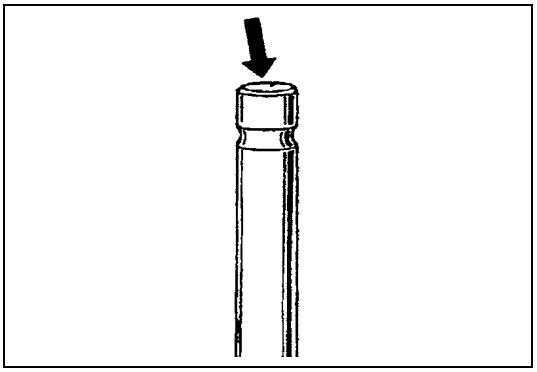
If bore gauge is not available, check end deflection of valve stem with a dial gauge instead.
Move stem end in directions (1) and (2) to measure end deflection.
If deflection exceeds its limit, replace valve stem and valve guide.

Valve stem end deflection limit
In : 0.14 mm (0.005 in.)
Ex : 0.18 mm (0.007 in.)

Valves

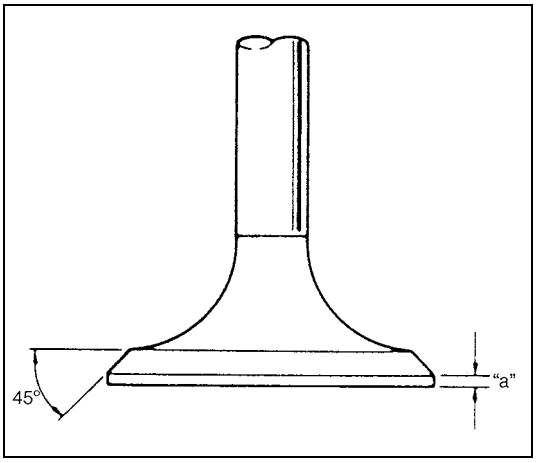
Visual inspection

- Remove all carbon from valves.
- Inspect each valve for wear, burn or distortion at its face and stem end, as necessary, replace it.



- Inspect valve stem end face for pitting and wear. If pitting or wear is found there, valve stem end may be resurfaced, but not too much to grind off its chamber. When it is worn out too much that its chamber is gone, replace valve.

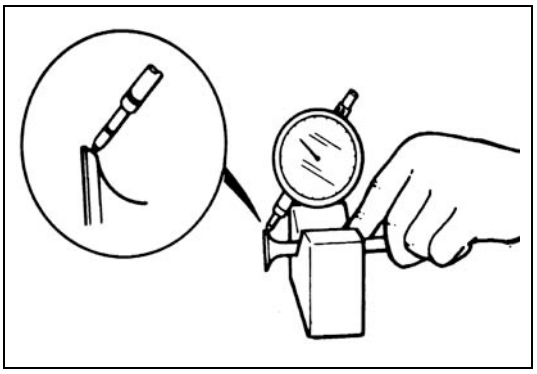
Valve head thickness



Measure thickness "a" of valve head. If measured thickness exceeds limit, replace valve.

Valve head thickness "a" (In and Ex)
Standard : 1.25 – 1.55 mm (0.049 – 0.061 in.)
Limit : 0.9 mm (0.035 in.)

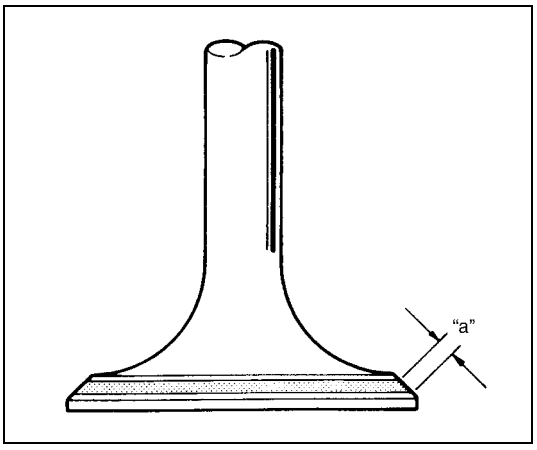
Valve head radial runout



Check each valve for radial runout with a dial gauge and "V" block. To check runout, rotate valve slowly. If runout exceeds its limit, replace valve.

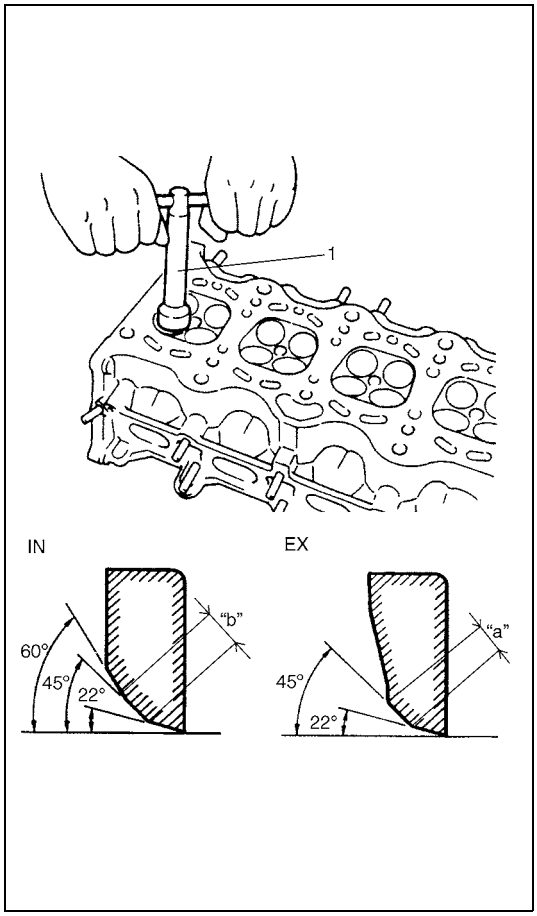
Limit on valve head radial runout
0.08 mm (0.003 in.)

Seating contact width



Create contact pattern on each valve in the usual manner, i.e. by giving uniform coat of marking compound to valve seat and by rotatingly tapping seat with valve head. Valve lapper (tool used in valve lapping) must be used.
Pattern produced on seating face of valve must be a continuous ring without any break, and the width of pattern must be within specified range.

Standard seating width "a" revealed by contact pattern on valve face
In and Ex : 1.0 - 1.4 mm (0.0389 - 0.0551 in.)



Valve seat repair

A valve seat not producing a uniform contact with its valve or showing width of seating contact that is out of specified range must be repaired by regrinding or by cutting and regrinding and finished by lapping.

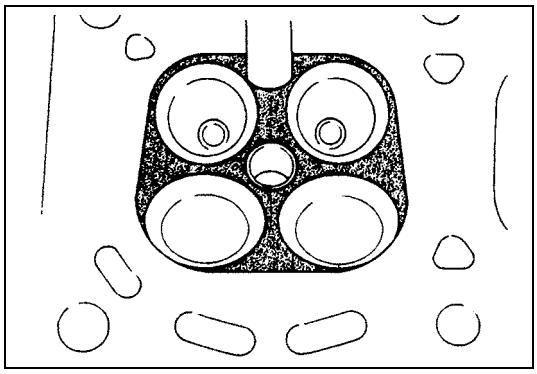
1) EXHAUST VALVE SEAT : Use valve seat cutters (1) to make two cuts as illustrated in figure. Two cutters must be used: the first for making 22° angle, and the second for making 45° angle. The second cut must be made to produce desired seat width.

Seat width for exhaust valve seat
"a" : 1.0 – 1.4 mm (0.0389 – 0.0551 in.)

2) INTAKE VALVE SEAT : Use valve seat cutters (1) to make three cuts as illustrated in figure. Three cutters must be used: the 1st for making 15° angle, the 2nd for making 60° angle, and 3rd for making 45° angle. The 3rd cut (45°) must be made to produce desired seat width.

Seat width for intake valve seat
"b" : 1.0 – 1.4 mm (0.0389 – 0.0551 in.)

3) VALVE LAPPING : Lap valve on seat in two steps, first with coarse size lapping compound applied to face and the second with fine-size compound, each time using valve lapper according to usual lapping method.

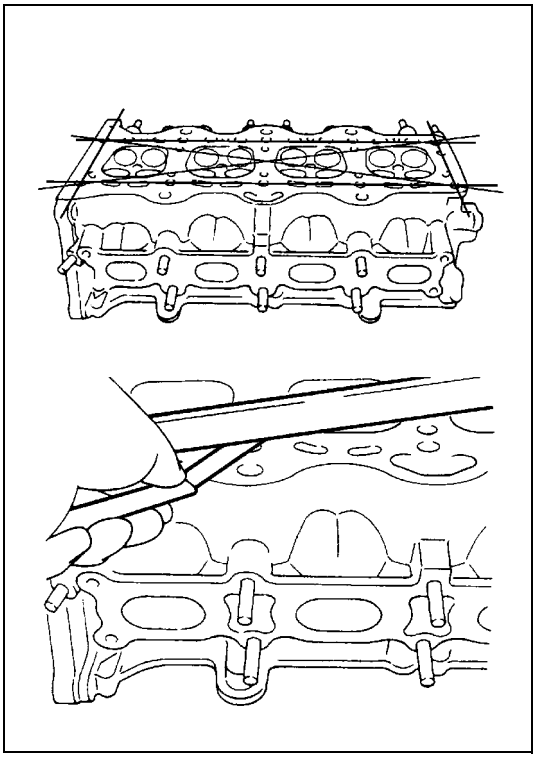


Cylinder head

- Remove all carbon deposits from combustion chambers.

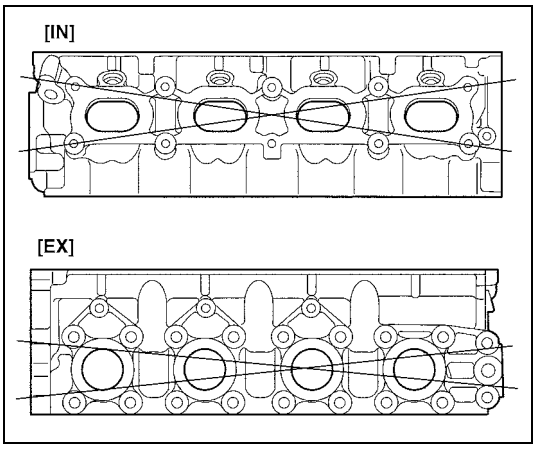
NOTE:

Do not use any sharp-edged tool to scrape off carbon deposits. Be careful not to scuff or nick metal surfaces when decarbonizing. The same applies to valves and valve seats, too.



- Check cylinder head for cracks on intake and exhaust ports, combustion chambers, and head surface.
  Using a straightedge and thickness gauge, check flatness of gasketed surface at a total of 6 locations. If distortion limit, given below, is exceeded, correct gasketed surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper): place abrasive paper on and over surface plate, and rub gasketed surface against paper to grind off high spots. Should this fail to reduce thickness gauge readings to within limit, replace cylinder head.
  Leakage of combustion gases from this gasketed joint is often due to warped gasketed surface: such leakage results in reduced power output.

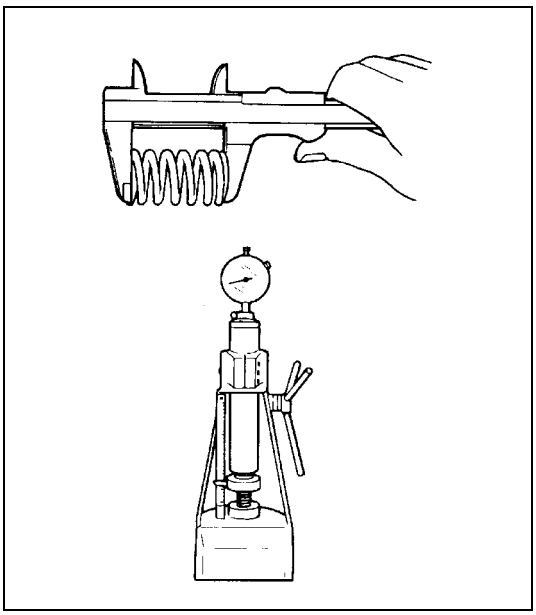
Limit of distortion for cylinder head surface on piston side : 0.03 mm (0.001 in.)



- Distortion of manifold seating faces:
  Check seating faces of cylinder head for manifolds, using a straightedge and thickness gauge, in order to determine whether these faces should be corrected or cylinder head replaced.

Limit of distortion for cylinder head surface on intake and exhaust manifold
0.05 mm (0.002 in.)

Valve springs

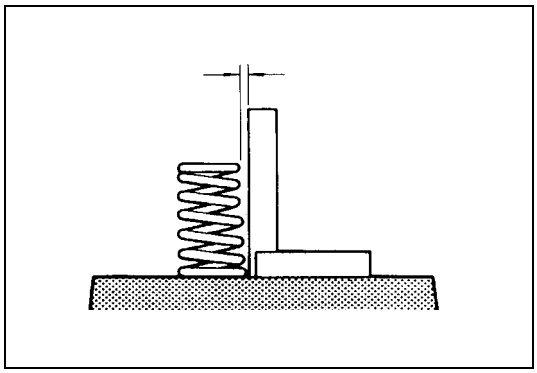


Valve spring free length and preload

Referring to data given below, check to be sure that each spring is in sound condition, free of any evidence of breakage or weakening. Remember, weakened valve springs can cause chatter, not to mention possibility of reducing power output due to gas leakage caused by decreased seating pressure.

Valve spring free length
Standard : 36.83 mm (1.450 in.)
Limit : 35.83 mm (1.411 in.)

Valve spring preload
Standard : 107 – 125 N (10.7 – 12.5 kg) for 31.50 mm (23.6 – 27.6 lb/1.240 in.)
Limit : 102 N (10.2 kg) for 31.5 mm (22.5 lb/1.240 in.)

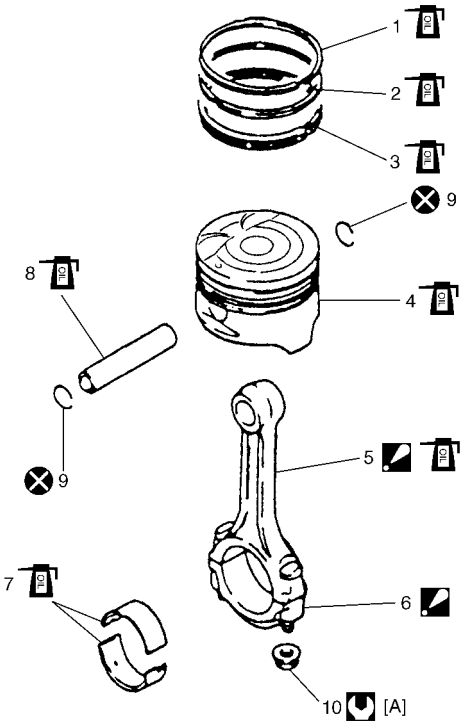


Spring squareness

Use a square and surface plate to check each spring for squareness in terms of clearance between end of valve spring and square. Valve springs found to exhibit a larger clearance than limit given below must be replaced.

Valve spring squareness limit
1.6 mm (0.079 in.)

Pistons, Piston Rings, Connecting Rods and Cylinders Components

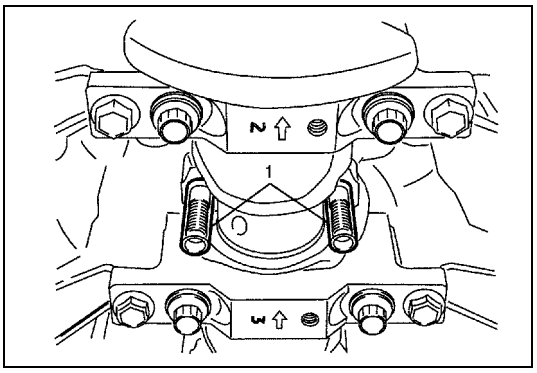


	[A] : 1) Tighten all nuts to 15 N·m (1.5 kg-m) 2) Then retighten all nuts by turning through 45° 3) Repeat step 2) again	7.	Connecting rod bearing
	1. Top ring	8.	Piston pin
	2. 2nd ring	9.	Piston pin circlip
	3. Oil ring	10.	Bearing cap nut
	4. Piston		Tightening torque
	5. Connecting rod : Apply engine oil to sliding surface except inner surface of big end, and rod bolts. Make sure rod bolt diameter when reuse it due to plastic deformation tightening. Refer to “INSPECTION” of “Connecting rod”.		Apply engine oil to sliding surface of each parts.
	6. Connecting rod bearing cap : Point arrow mark on cap to crankshaft pulley side.		Do not reuse.

Pistons, Piston Rings, Connecting Rods and Cylinders Removal and Installation

Removal

1) Remove engine assembly from vehicle referring to “Engine Assembly Removal and Installation” in this section.
2) Remove cylinder head referring to “Valves and Cylinder Head Removal and Installation”.
3) Mark cylinder number on all pistons, connecting rods and connecting rod caps using silver pencil or quick drying paint.
4) Remove rod bearing caps.



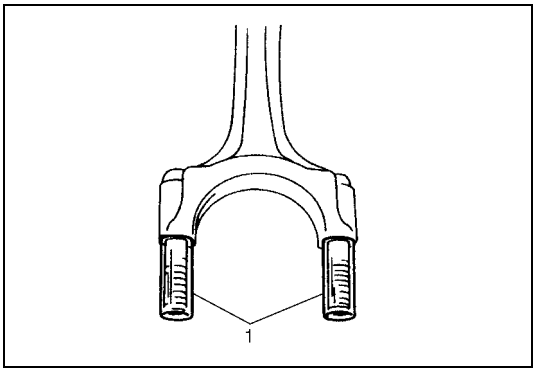
5) Install guide hose (1) over threads of rod bolts.
   This prevents damage to bearing journal and rod bolt threads when removing connecting rod.
6) Decarbonize top of cylinder bore before removing piston from cylinder.
7) Push piston and connecting rod assembly out through the top of cylinder bore.

Installation

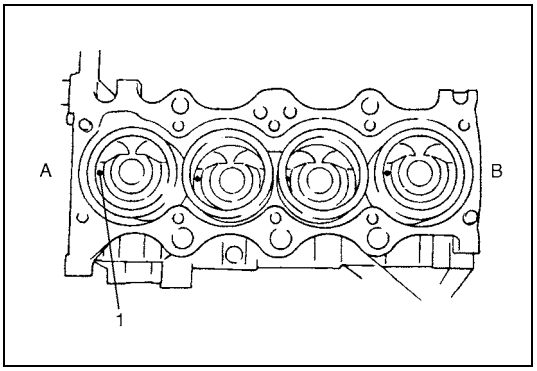
1) Apply engine oil to pistons, rings, cylinder walls, connecting rod bearings and crank pins.

NOTE:

Do not apply oil between connecting rod and bearing or between bearing cap and bearing.

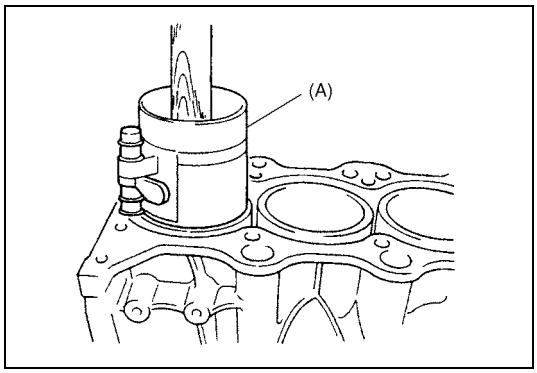


2) Install guide hoses (1) over connecting rod bolts.
   These guide hoses protect crank pin and threads of rod bolt from damage during installation of connecting rod and piston assembly.



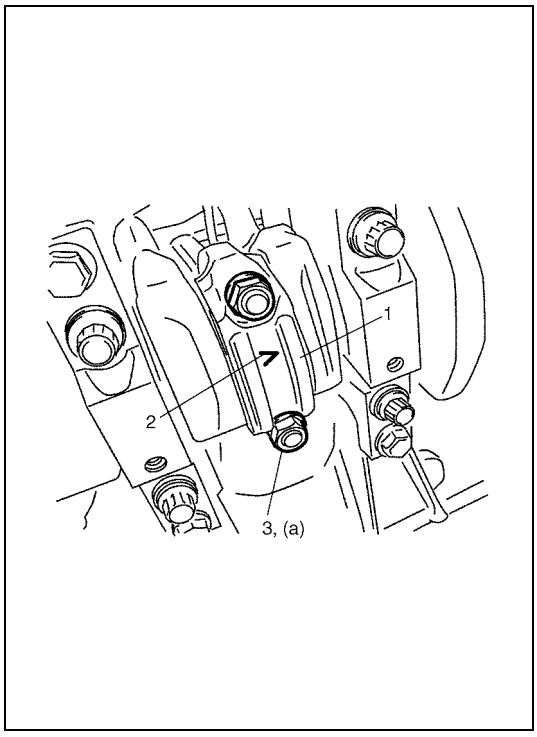
3) When installing piston and connecting rod assembly into cylinder bore, point front mark (1) on piston head to crankshaft pulley side.

A :	Crankshaft pulley side
B :	Flywheel side



4) Install piston and connecting rod assembly into cylinder bore. Use special tool (Piston ring compressor) to compress rings. Guide connecting rod into place on crankshaft.
Using a hammer handle, tap piston head to install piston into bore. Hold ring compressor firmly against cylinder block until all piston rings have entered cylinder bore.

Special tool
(A) : 09916-77310



5) Install bearing cap (1):
Point arrow mark (2) on cap to crankshaft pulley side.
After applying oil to rod bolts and tighten cap nuts (3) gradually as follows.
a) Tighten all cap nuts to 15 N·m (1.5 kg-m, 11.0 lb-ft).
b) Retighten them to 45°.
c) Repeat Step b) once again.

Tightening torque
Connecting rod bearing cap nuts
(a) : 15 N·m (1.5 kg-m, 11.0 lb-ft), and then retighten by turning through 45° twice.

NOTE:

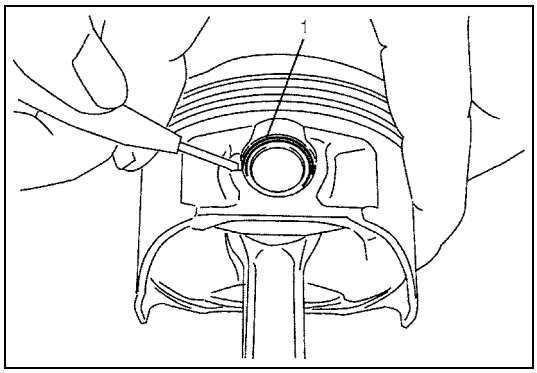
Before installing bearing cap, make sure that checking for connecting rod bolt deformation.
Refer to "Connecting rod" of "Pistons, Piston Rings, Connecting Rods and Cylinders Inspection" in this section.

6) Install cylinder head referring to "Valves and Cylinder Head Removal and Installation" in this section.

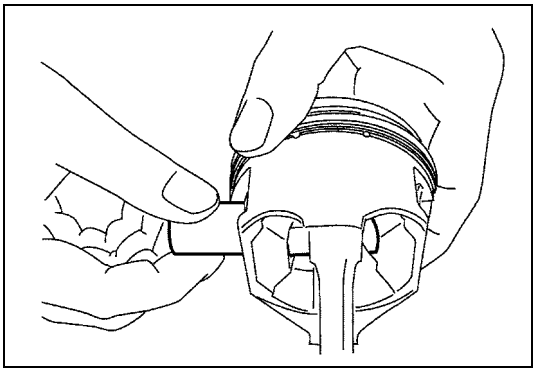
Pistons, Piston Rings, Connecting Rods and Cylinders Disassembly and Assembly

Disassembly

1) Using piston ring expander, remove two compression rings (Top and 2nd) and oil ring from piston.
2) Remove piston pin from connecting rod as follows.



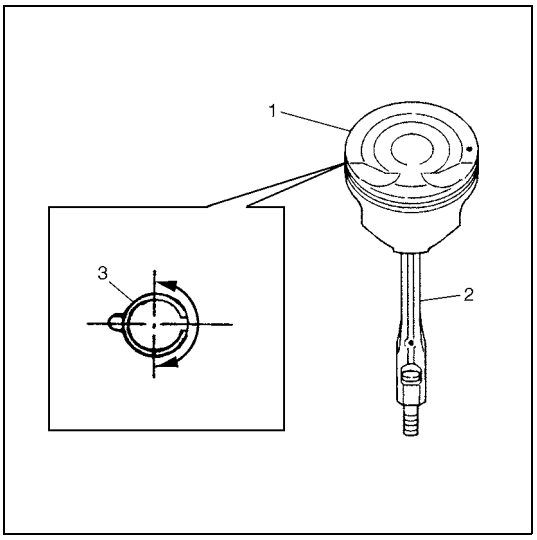
a) Ease out piston pin circlips (1), as shown.



b) Force piston pin out.

Assembly

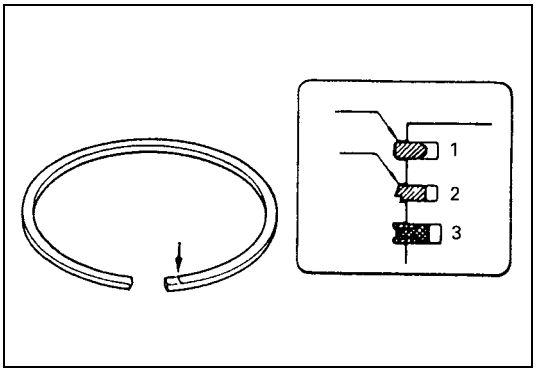
1) Decarbonize piston head and ring grooves using a suitable tool.



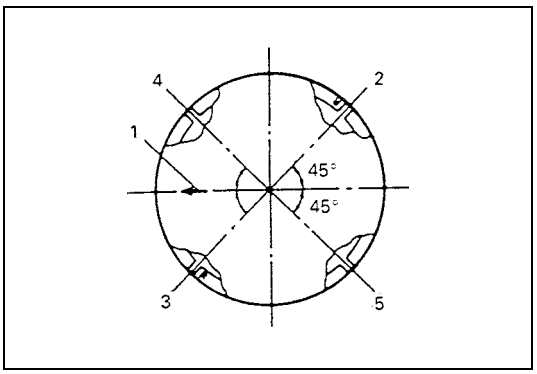
2) Install piston pin to piston (1) and connecting rod (2) :
   a) After applying engine oil to piston pin and piston pin holes in piston and connecting rod.
   b) Fit connecting rod as shown in figure.
   c) Insert piston pin to piston and connecting rod.
   d) Install piston pin circlips (3).

NOTE:

Circlip should be installed with its cut part facing as shown in figure. Install so that circlip end gap comes within such range as indicated by arrow.



3) Install piston rings to piston :
   a) As indicated in figure, 1st and 2nd rings have “T” mark respectively. When installing these piston rings to piston, direct marked side of each ring toward top of piston.
   b) 1st ring (1) differs from 2nd ring (2) in thickness, shape and color of surface contacting cylinder wall.
   Distinguish 1st ring from 2nd ring by referring to figure.
   c) When installing oil ring (3) install spacer first and then two rails.



4) After installing three rings (1st, 2nd and oil rings), distribute their end gaps as shown in figure.

1. Arrow mark
2. 1st ring end gap
3. 2nd ring end gap and oil ring spacer gap
4. Oil ring upper rail gap
5. Oil ring lower rail gap

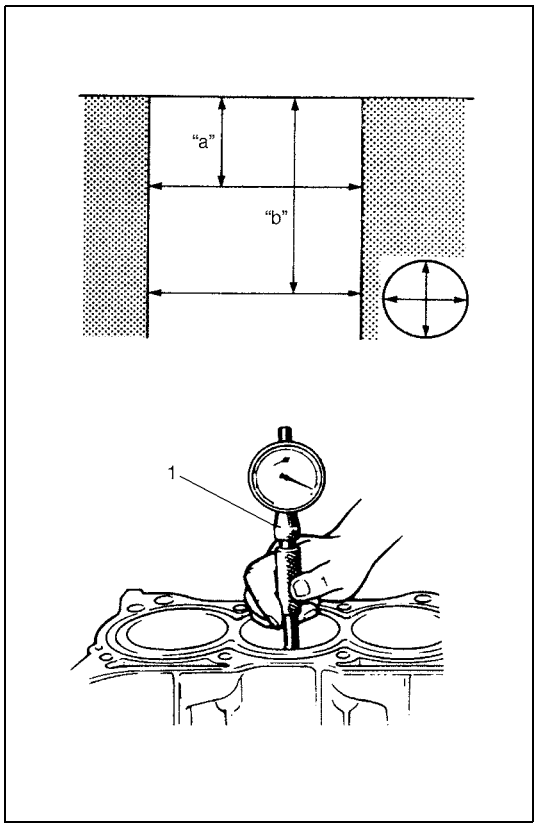
Pistons, Piston Rings, Connecting Rods and Cylinders Inspection

Cylinder

Visual inspection

Inspect cylinder walls for scratches, roughness or ridges which indicate excessive wear. If cylinder bore is very rough or deeply scratched or ridged, rebore cylinder and use oversize piston.

Cylinder bore diameter, taper and out-of-round



Using a cylinder gauge (1), measure cylinder bore in thrust and axial directions at two positions ("a" and "b") as shown in figure.
If any of the following conditions is noted, rebore cylinder.

1) Cylinder bore dia. exceeds limit.
2) Difference of measurements at two positions exceeds taper limit.
3) Difference between thrust and axial measurements exceeds out-of-round limit.

Cylinder bore diameter
Standard : 78.00 – 78.014 mm (3.0709 – 3.0714 in.)
Limit : 78.050 mm (3.073 in.)

Cylinder taper and out-of-round
Limit : 0.10 mm (0.004 in.)

"a" : 50 mm (1.96 in.)
"b" : 100 mm (3.94 in.)

NOTE:

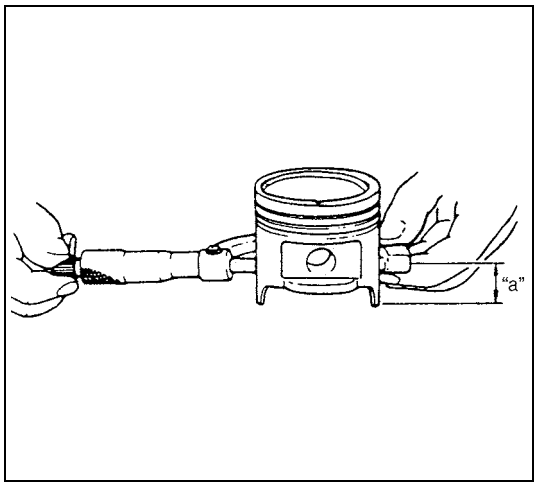
If any one of four cylinders has to be rebored, rebore all four to the same next oversize. This is necessary for the sake of uniformity and balance.

Pistons

Visual inspection

Inspect piston for faults, cracks or other damaged.
Damaged or faulty piston should be replaced.

Piston diameter

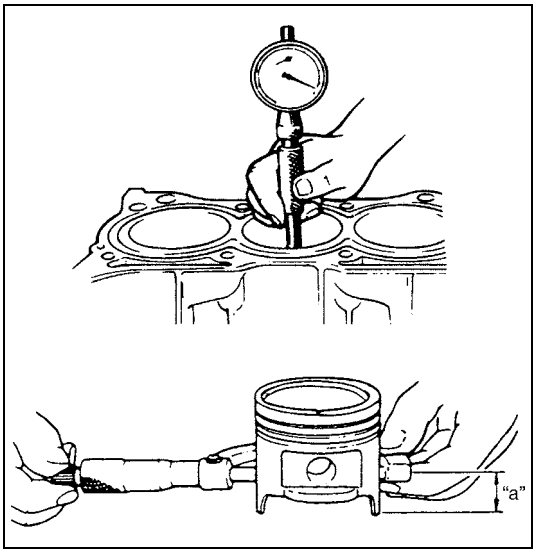


As indicated in figure, piston diameter should be measured at a position 19.5 mm (0.77 in.) from piston skirt end in the direction perpendicular to piston pin.

Piston diameter specification

Standard size	**77.953 – 77.968 mm (3.0690 – 3.0696 in.)**
Oversize 0.50 mm (0.0196 in.)	**78.453 – 78.468 mm (3.0887 – 3.0893 in.)**

"a" : 19.5 mm (0.77 in.)



Piston clearance

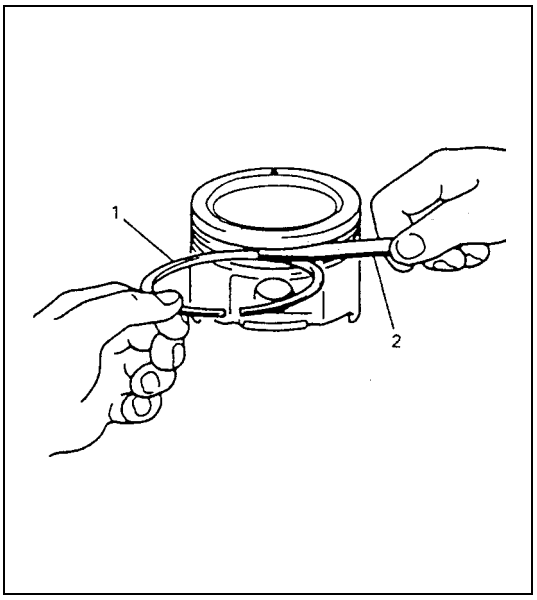
Measure cylinder bore diameter and piston diameter to find their difference which is piston clearance. Piston clearance should be within specification as given below. If it is out of specification, rebore cylinder and use oversize piston.

Piston clearance
Standard : 0.032 – 0.061 mm (0.0013– 0.0024 in.)

NOTE:

Cylinder bore diameters used here are measured in thrust direction at two positions.

"a" : 19.5 mm (0.77 in.)



Ring groove clearance

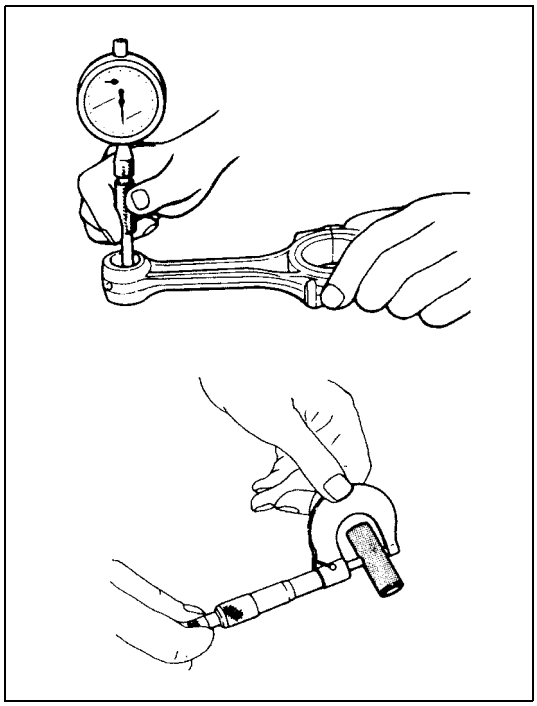
Before checking, piston grooves must be clean, dry and free of carbon deposits.
Fit new piston ring (1) into piston groove, and measure clearance between ring and ring land by using thickness gauge (2). If clearance is out of limit, replace piston.

Ring groove clearance
Top ring
Standard : 0.03 – 0.07 mm (0.0012 – 0.0028 in.)
Limit : 0.12 mm (0.0047 in.)
2nd ring
Standard : 0.02 – 0.06 mm (0.0008 – 0.0024 in.)
Limit : 0.10 mm (0.0039 in.)
Oil ring
Standard : 0.03 – 0.17 mm (0.0012 – 0.0067 in.)

Piston pin

Visual inspection

Check piston pin, connecting rod small end bore and piston bore for wear or damage, paying particular attention to condition of small end bore bush. If pin, connecting rod small end bore or piston bore is badly worn or damaged, replace pin, connecting rod and/or piston.



Piston pin clearance

Check piston pin clearance in small end and piston. Replace connecting rod and/or piston if its small end is badly worn or damaged or if measured clearance exceeds limit.

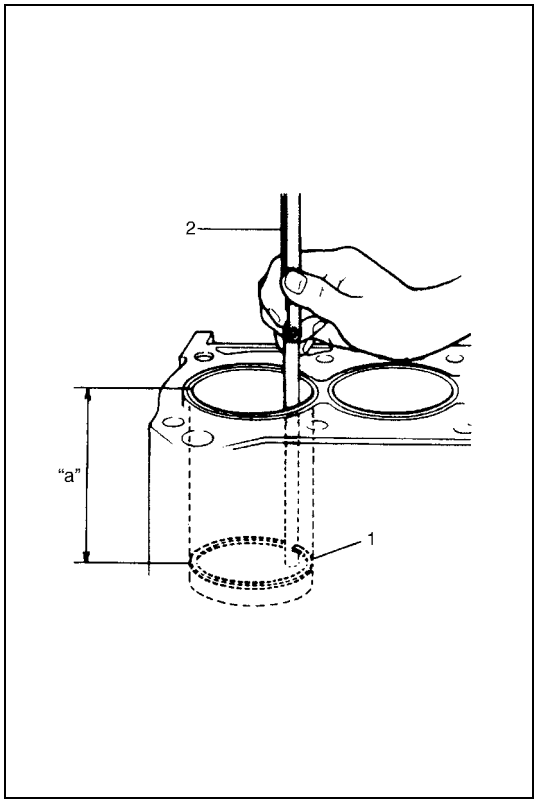
Piston pin clearance in connecting rod small end
Standard : 0.003 – 0.014 mm (0.0001 – 0.0006 in.)
Limit : 0.05 mm (0.0020 in.)

Piston pin clearance in piston
Standard : 0.006 – 0.017 mm (0.00024 – 0.00067 in.)
Limit : 0.05 mm (0.0020 in.)

Small-end bore
20.003 – 20.011 mm (0.7875 – 0.7878 in.)

Piston pin dia.
19.997 – 20.000 mm (0.7873 – 0.7874 in.)

Piston bore
20.006 – 20.014 mm (0.7876 – 0.7880 in.)



Piston rings

Piston ring end gap

To measure end gap, insert piston ring (1) into cylinder bore and then measure the gap by using thickness gauge (2).
If measured gap exceeds limit, replace ring.

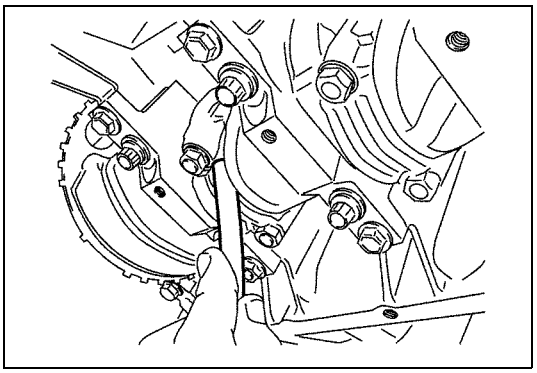
NOTE:
Decarbonize and clean top of cylinder bore before inserting piston ring.

Piston ring end gap

Item	Standard	Limit
Top ring	0.20 – 0.35 mm (0.0079 – 0.0138 in.)	0.7 mm (0.0276 in.)
2nd ring	0.30 – 0.45 mm (0.0118 – 0.0177 in.)	1.0 mm (0.0394 in.)
Oil ring	0.20 – 0.70 mm (0.0079 – 0.0276 in.)	1.2 mm (0.0472 in.)

"a" : 120 mm (4.72 in.)

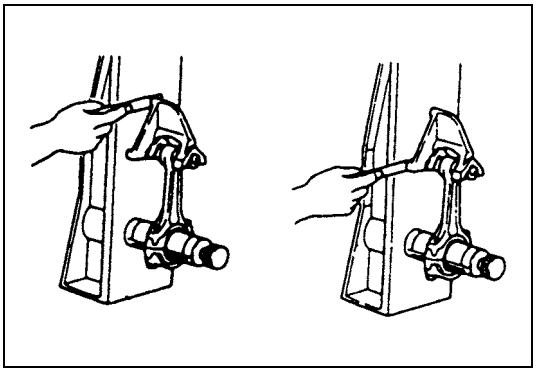
Connecting rod



Big-end side clearance

Check big-end of connecting rod for side clearance, with rod fitted and connected to its crank pin in the normal manner. If measured clearance is found to exceed its limit, replace connecting rod.

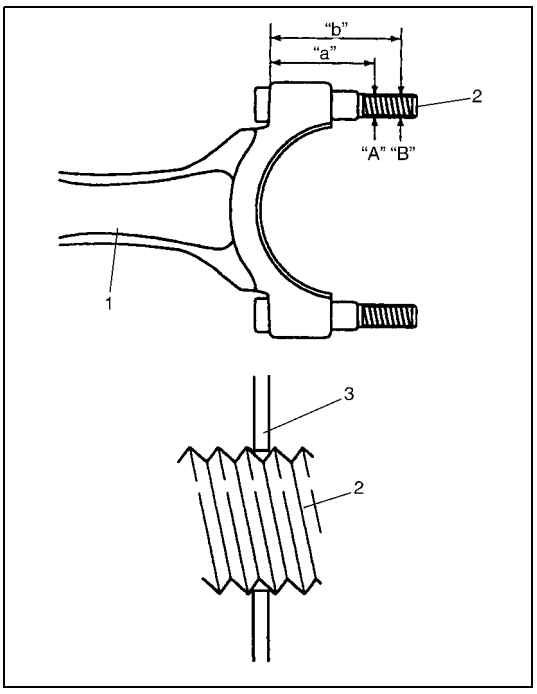
Big-end side clearance
Standard : 0.25 - 0.40 mm (0.0098 - 0.0157 in.)
Limit : 0.55 mm (0.0217 in.)



Connecting rod alignment

Mount connecting rod on aligner to check it for bow and twist. If the measured value exceeds the limit, replace it.

Connecting rod alignment
Limit on bow : 0.05 mm (0.0020 in.)
Limit on twist : 0.10 mm (0.0039 in.)



Connecting rod bolt deformation (Plastic deformation tightening bolt)

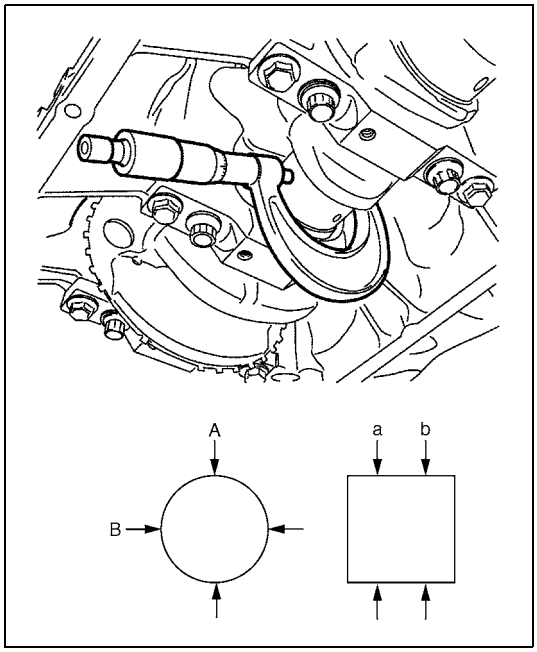
Measure each thread diameter of connecting rod (1) bolt (2) at "A" on 32 mm (1.25 in.) from bolt mounting surface and "B" on 40 mm (1.57 in.) from bolt mounting surface by using a micrometer (3). Calculate difference in diameters ("A" – "B"). If it exceeds limit, replace connecting rod.

Connecting rod bolt measurement points
"a" : 32 mm (1.25 in.)
"b" : 40 mm (1.57 in.)

Connecting rod bolt diameter difference limit ("A" – "B") : 0.1 mm (0.004 in.)

Crank pin and connecting rod bearings

Crank pin diameter



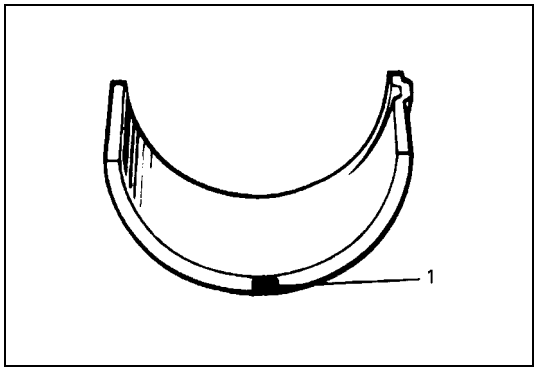
Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged or out-of round or taper is out of limit, replace crankshaft or regrind crank pin to undersize and use undersize bearing.

Crank pin diameter

Connecting rod bearing size	Crank pin diameter
Standard	41.982 – 42.000 mm (1.6528 – 1.6535 in.)
Undersize 0.25 mm (0.0098 in.)	41.732 – 41.750 mm (1.6430 – 1.6437 in.)

Crank pin taper and out-of-round
Limit : 0.01 mm (0.0004 in.)
Out-of-round : A – B
Taper : a – b

Connecting rod bearing general information



Service connecting rod bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and standard size bearing has 5 kinds of bearings differing in tolerance.
For identification of undersize bearing, it is painted red at the position as indicated in figure, undersize bearing thickness is 1.605 – 1.615 mm (0.0632 – 0.0635 in.) at the center of it.

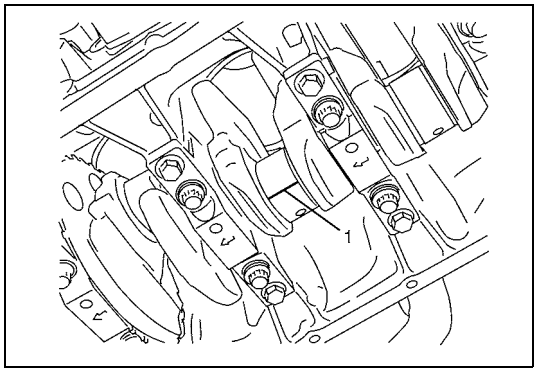
1. Painting

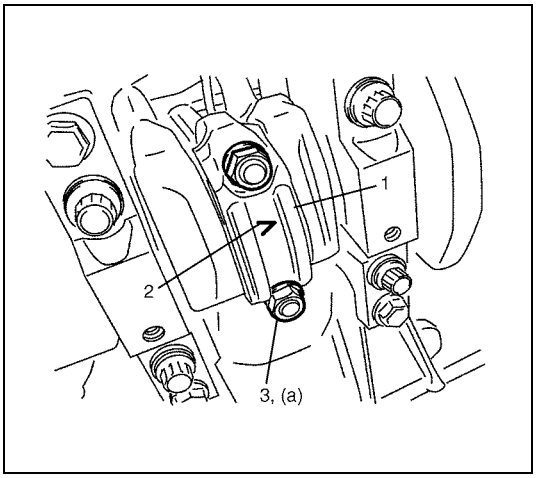
Connecting rod bearing visual inspection

Inspect bearing shells for signs of fusion, pitting, burn or flaking and observe contact pattern. Bearing shells found in defective condition must be replaced.

Connecting rod bearing clearance

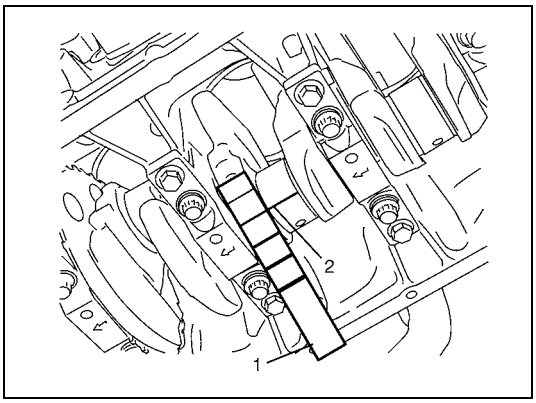
1) Before checking bearing clearance, clean bearing and crank pin.
2) Install bearing in connecting rod and bearing cap.
3) Place a piece of gaging plastic (1) to full width of crank pin as contacted by bearing (parallel to crankshaft), avoiding oil hole.





4) Install rod bearing cap (1) to connecting rod.
When installing cap, be sure to point arrow mark (2) on cap to crankshaft pulley side, as shown in figure. After applying engine oil to rod bolts and tighten cap nuts (3) gradually as follows.
a) Tighten all cap nuts to 15 N·m (1.5 kg-m, 11.0 lb-ft).
b) Retighten them to 45°.
c) Repeat step b) once again.

Tightening torque
Connecting rod bearing cap nuts
(a) : 15 N·m (1.5 kg-m, 11.0 lb-ft), and then retighten by turning through 45° twice



5) Remove cap and using a scale (1) on gaging plastic (2) envelope, measure gaging plastic width at the widest point (clearance).
If clearance exceed its limit, use a new standard size bearing referring to “Selection of connecting rod bearings” in this section.
After selecting new bearing, recheck clearance.

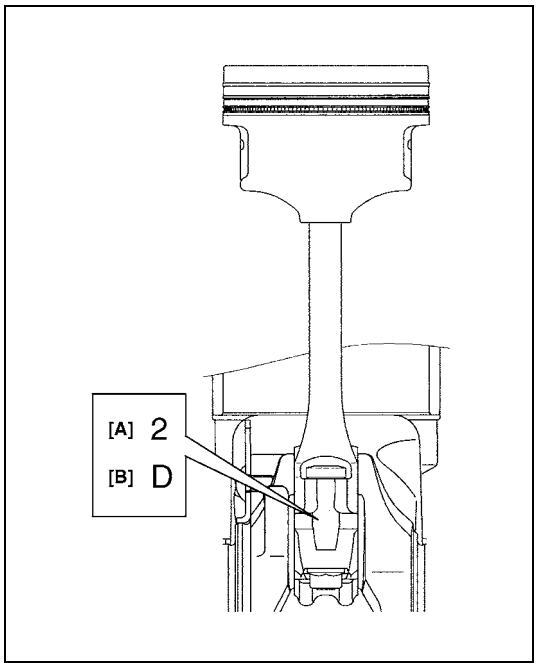
Connecting rod bearing clearance
Standard : 0.029 – 0.047 mm (0.0011 – 0.0018 in.)
Limit : 0.065 mm (0.0026 in.)

6) If clearance can not be brought to its limit even by using a new standard size bearing, regrind crank pin to undersize and use 0.25 mm undersize bearing.

NOTE:
After checking the rod bearing clearance, make sure that checking for Connecting rod bolt deformation.
Refer to “Connecting rod” of “Pistons, Piston Rings, Connecting Rods and Cylinders Inspection”.

Selection of connecting rod bearings

NOTE:
- **If bearing is in malcondition, or bearing clearance is out of specification, select a new standard bearing according to the following procedure and install it.**
- **When replacing crankshaft or connecting rod and its bearing due to any reason, select new standard bearings to be installed by referring to numbers stamped on connecting rod and its cap and/or alphabets stamped on crank web of No.3 cylinder.**

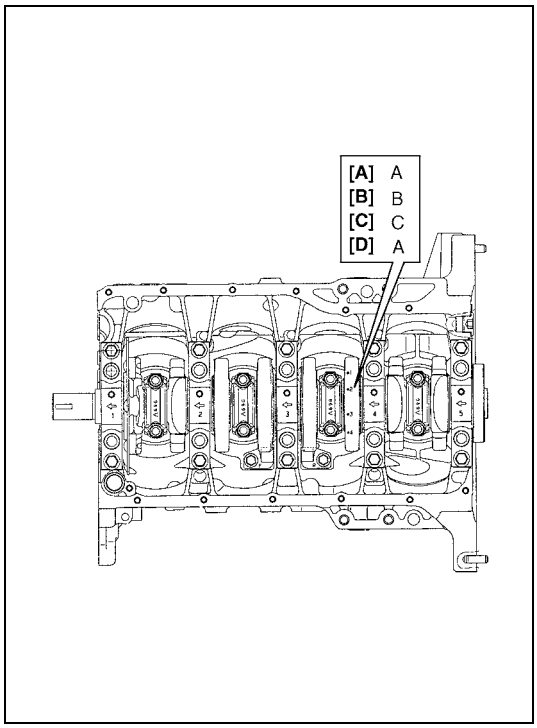


1) Check stamped numbers on connecting rod and its cap as shown.
   Three kinds of numbers ("1", "2" and "3") represent the following connecting rod big end inside diameters.
   For example, stamped number "1" indicates that corresponding connecting rod big end inside diameter is 45.000 – 45.006 mm (1.7717 – 1.7718 in.).

Connecting rod big end inside diameter

Stamped numbers	connecting rod big end inside diameter
1	45.0000 – 45.0060 mm (1.7717 – 1.7718 in.)
2	45.0061 – 45.0120 mm (1.7719 – 1.7721 in.)
3	45.0121 – 45.0180 mm (1.7722 – 1.7723 in.)

[A]: Weight indication mark
[B]: Connecting rod big end inside diameter number

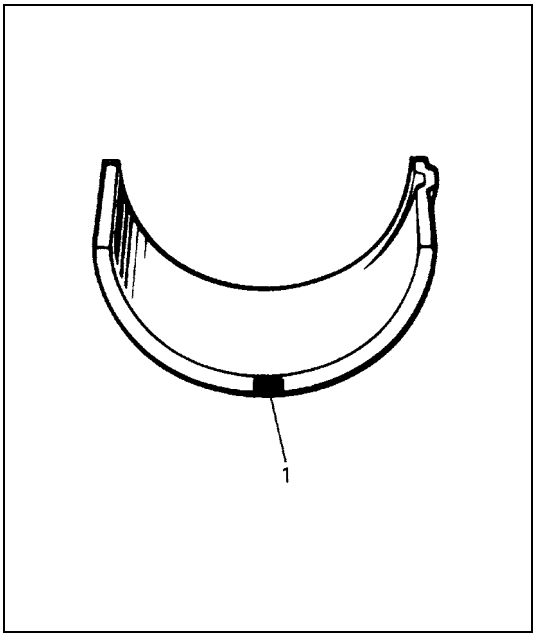


2) Next, check crankshaft pin diameter. On crank web No.3, four alphabets are stamped as shown in figure.
   Three kinds of alphabet ("A", "B" and "C") represent the following crankshaft pin diameter respectively.
   For example, stamped "A" indicates that corresponding crankshaft pin diameter is 41.994 – 42.000 mm (1.6533 – 1.6534 in.).

Crankshaft pin outer diameter

Stamped alphabet	Crankshaft pin diameter
A	41.9940 – 42.0000 mm (1.6533 – 1.6534 in.)
B	41.9880 – 41.9939 mm (1.6531 – 1.6532 in.)
C	41.9820 – 41.9879 mm (1.6529 – 1.6530 in.)

[A]: Crankshaft pin diameter for No.1 cylinder
[B]: Crankshaft pin diameter for No.2 cylinder
[C]: Crankshaft pin diameter for No.3 cylinder
[D]: Crankshaft pin diameter for No.4 cylinder



3) There are five kinds of standard bearings differing in thickness. To distinguish them, they are painted in the following colors at the position as indicated in figure.
Each color indicated the following thickness at the center of bearing.

Standard size of connecting rod bearing thickness

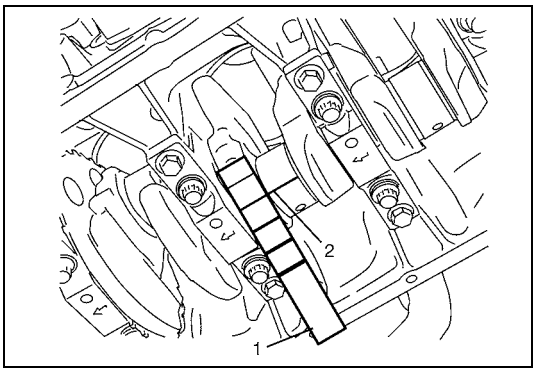
Color painted	Bearing thickness
Blue	1.4991 – 1.5020 mm (0.05902 – 0.05913 in.)
Yellow	1.4961 – 1.4990 mm (0.05890 – 0.05901 in.)
Nothing	1.4931 – 1.4960 mm (0.05878 – 0.05889 in.)
Black	1.4901 – 1.4930 mm (0.05867 – 0.05877 in.)
Green	1.4870 – 1.4900 mm (0.05855 – 0.05866 in.)

1. Paint

4) From number stamped on connecting rod and its cap and alphabets stamped on crank web No.3, determine new standard bearing to be installed to connecting rod big end inside, by referring to table.
For example, if number stamped on connecting rod and its cap is “1” and alphabet stamped on crank web No.3 is “B”, install a new standard bearing painted in “Black” to its connecting rod big end inside.

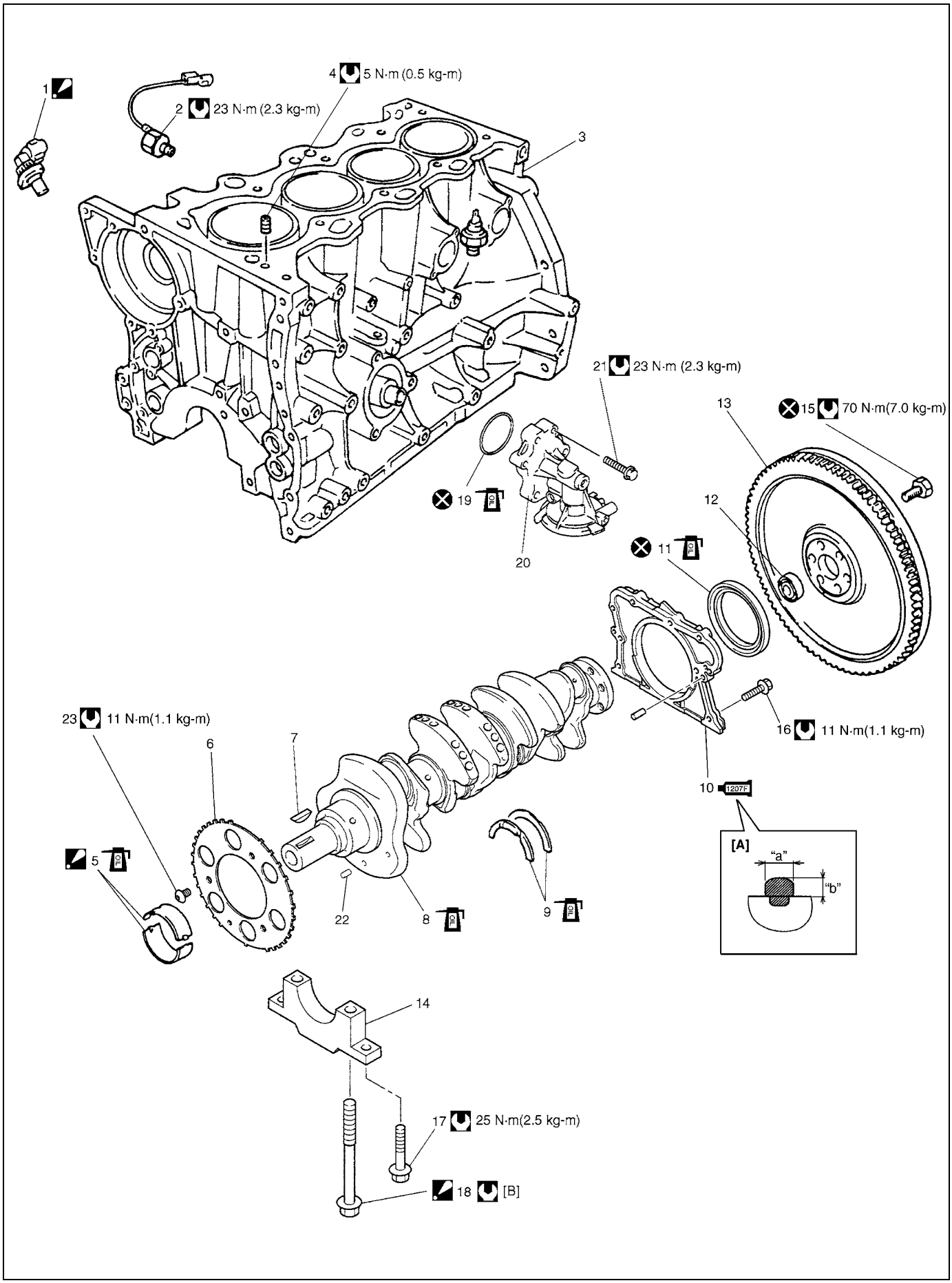
Specification of new standard connecting rod bearing size

		Number stamped on connecting rod and its cap (connecting rod big end inside diameter)		
		1	2	3
Alphabet stamped on crank web No.3 (Crankshaft pin diameter)	A	Green	Black	Nothing
	B	Black	Nothing	Yellow
	C	Nothing	Yellow	Blue
		New standard bearing to be installed.		



5) Using scale (1) on gaging plastic (2), check bearing clearance with newly selected standard bearing.
If clearance still exceeds its limit, use next thicker bearing and recheck clearance.

Main Bearings, Crankshaft and Cylinder Block Components

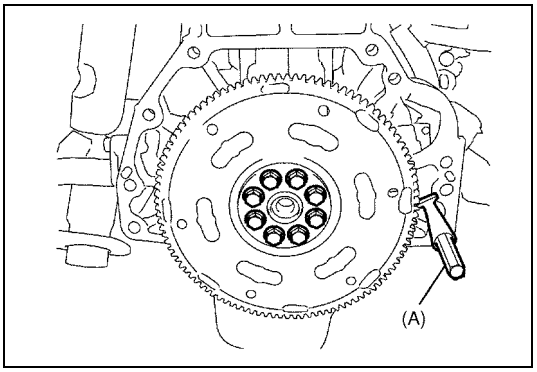


[A] : Sealant application amount	4. Venturi plug	14. Main bearing cap
[B] : 1) Tighten all bolts to 30 N·m (3.0 kg-m) 2) Tighten all bolts to 50 N·m (5.0 kg-m) 3) Then retighten all bolts by turning through 60°	5. Main bearing : Upper half of bearing has an oil groove	15. Flywheel mounting bolt
Tightening torque	6. Sensor plate	16. Rear oil seal housing mounting bolt
Do not reuse.	7. Crankshaft timing sprocket key	17. Main bearing cap No.2 bolt
Apply engine oil to inside / sliding surface.	8. Crankshaft	18. Main bearing cap No.1 bolt : Never reuse main bearing cap No.1 bolts once disassembled it due to plastic deformation tightening. Be sure to use new main bearing cap No.1 bolts when installing.
"a" : 3 mm (0.12 in.)	9. Thrust bearing	19. O-ring
"b" : 2 mm (0.08 in.)	10. Rear oil seal housing : Apply sealant 99000-31250 to mating surface.	20. Oil filter adapter case
1. CKP sensor (if equipped) : When installing CKP sensor, use new sensor mounting bolt.	11. Rear oil seal	21. Oil filter adapter bolt
2. Knock sensor	12. Input shaft bearing	22. Spring pin
3. Cylinder block	13. Flywheel	23. Sensor plate bolt

Main Bearings, Crankshaft and Cylinder Block Removal and Installation

Removal

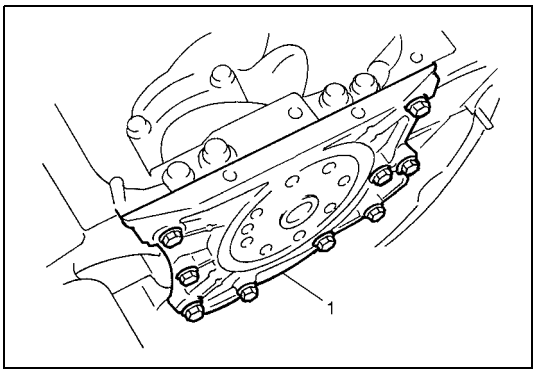
1) Remove engine assembly from vehicle referring to "Engine Assembly Removal and Installation" in this section.



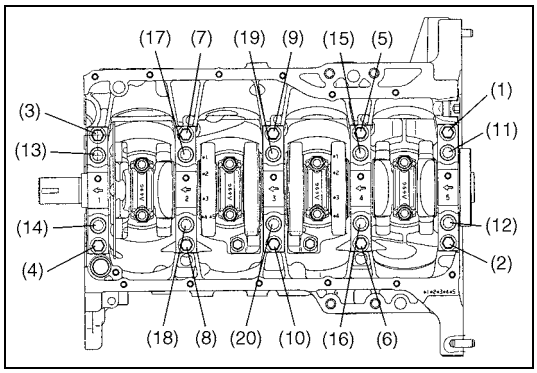
2) Remove clutch cover, clutch disc and flywheel (drive plate for A/T) by using special tool.

Special tool
(A) : 09924-17810

3) Remove piston and connecting rod referring to "Pistons, Piston Rings, Connecting Rods and Cylinders Removal and Installation" in this section.



4) Remove rear oil seal housing (1).

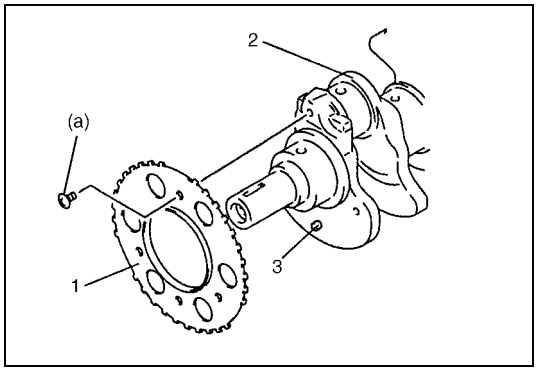


5) Loosen main bearing cap No.1 and No.2 bolts in such order as indicated in figure and remove them.
6) Remove crankshaft from cylinder block.

Installation

CAUTION:

- **Use new bearing cap No.1 bolts. They are deformed once they are used because they are plastic deformation tightening bolts.**
- **All parts to be installed must be perfectly clean.**
- **Be sure to oil crankshaft journals, journal bearings, thrust bearings, crankpins, connecting rod bearings, pistons, piston rings and cylinder bores.**
- **Journal bearings, bearings caps, connecting rods, rod bearings, rod bearing caps, pistons and piston rings are in combination sets. Do not disturb such combination and make sure that each part goes back to where it came from, when installing.**

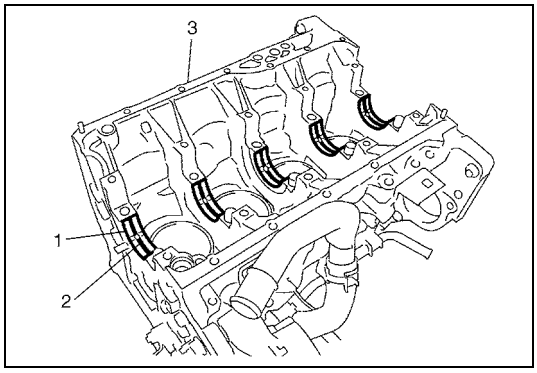


1) Install sensor plate (1) to crankshaft (2) and tighten bolts to specified torque.

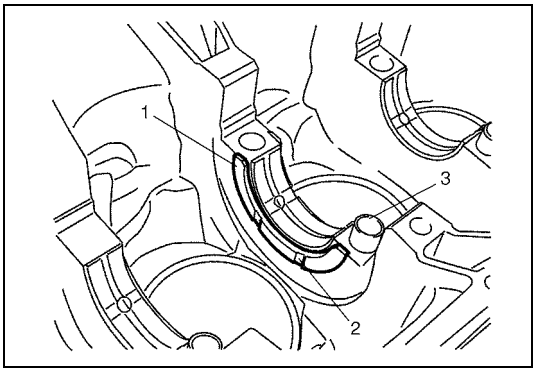
NOTE:

When installing sensor plate, align spring pin (3) on crankshaft and hole of sensor plate.

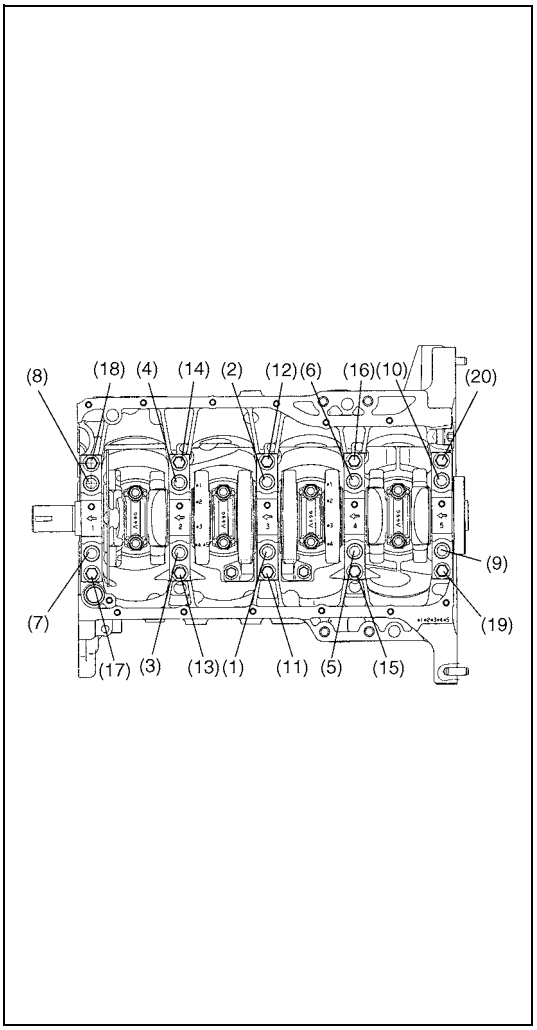
Tightening torque
Sensor plate bolts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)



2) Install main bearings to cylinder block.
Upper half of bearing (1) has an oil groove (2).
Install it to cylinder block (3), and the other half without oil groove to bearing cap.
Make sure that two halves are painted in the same color.



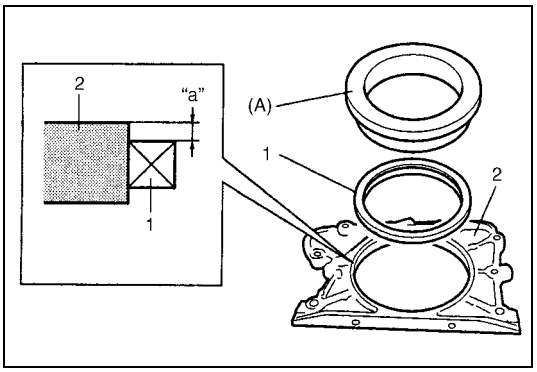
3) Install thrust bearings (1) to cylinder block between No.2 and No.3 cylinders. Face oil groove (2) sides to crank webs.
4) Confirm that dowel pins (3) are installed to intake side of each journal.
5) Install crankshaft to cylinder block.



6) Install bearing cap to cylinder block, making sure to point arrow mark (on each cap) to crankshaft pulley side. Fit them sequentially in ascending order, 1, 2, 3, 4 and 5, starting from pulley side.
   After applying engine oil to main bearing cap No.1 bolts ((1) – (10)) and main bearing cap No.2 bolts ((11) – (20)), tighten them gradually as follows.
   a) Tighten bolts (1) – (10) to 30 N·m (3.0 kg-m, 22.0 lb-ft) according to numerical order as shown by using a 12 corner socket wrenches.
   b) In the same manner as in Step a), tighten them to 50 N·m (5.0 kg-m, 36.5 lb-ft).
   c) In the same manner as in Step a), retighten them to 60°.
   d) Tighten bolts (11) – (20) to 25 N·m (2.5 kg-m, 18.0 lb-ft) according to numerical order as shown.

Tightening torque
Main bearing No.1 bolts (1) – (10)
: 30 N·m (3.0 kg-m, 22.0 lb-ft), 50 N·m (5.0 kg-m, 36.5 lb-ft) and then retighten by turning through 60°
Main bearing No.2 bolts (11) – (20)
: 25 N·m (2.5 kg-m, 18.0 lb-ft)

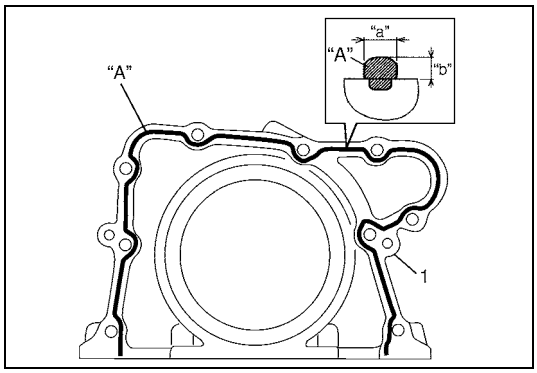
CAUTION:
After tightening cap bolts, check to be sure that crankshaft rotates smoothly when turning it by 12 N·m (1.2 kg-m, 9.0 lb-ft) torque or below.



7) If necessary, press-fit rear oil seal (1) to oil seal housing (2) by using special tool as shown in the figure.

Special tool
(A) : 09911-97820

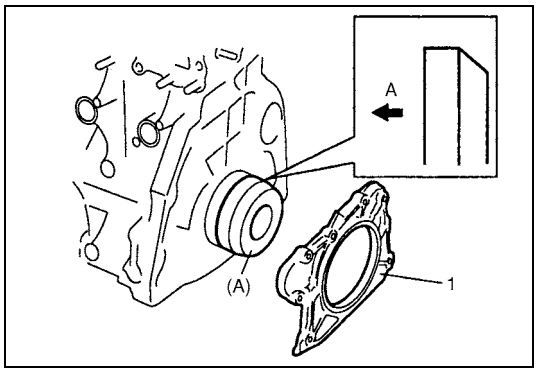
Crank rear oil seal installing position (dimension)
"a" : 3 mm (0.12 in.)



8) Apply sealant to mating surface of rear oil seal housing (1).

"A" : Sealant 99000-31250

Sealant amount for rear oil seal housing
Width "a" : 3 mm, 0.12 in.
Height "b" : 2 mm, 0.08 in.

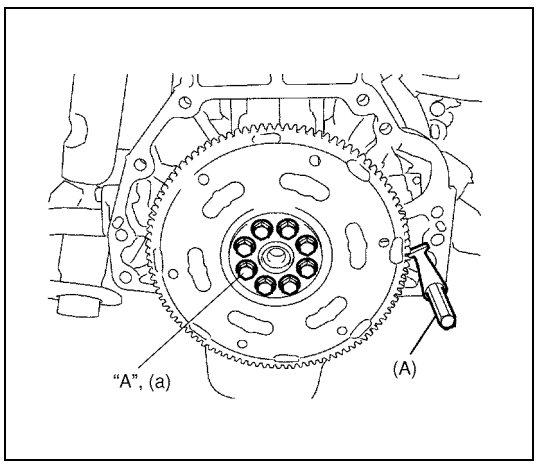


9) Install rear oil seal housing (1) and tighten bolts to specified torque by using special tool.

Special tool
(A) : 09911-97720

Tightening torque
Rear oil seal housing bolts : 11 N·m (1.1 kg-m, 8.0 lb-ft)

A : Crankshaft side



10) Install flywheel ((for M/T) or drive plate (for A/T)).
Using special tool, lock flywheel or drive plate, and tighten flywheel or drive plate bolts to specified torque.

NOTE:

Use new flywheel or drive plate bolts.

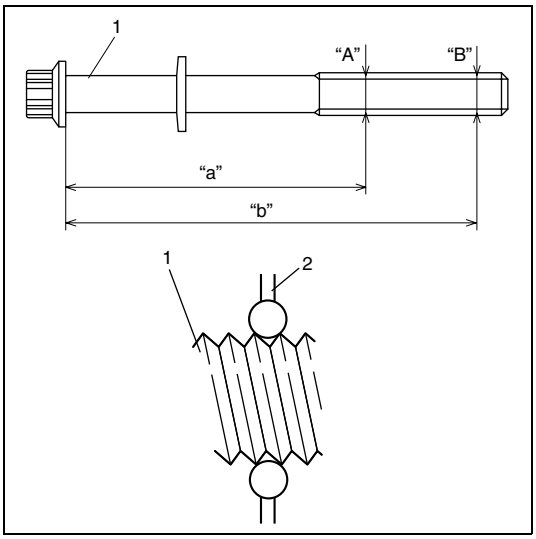
Special tool
(A) : 09924-17810

Tightening torque
Flywheel or drive plate bolts
(a) : 70 N·m (7.0 kg-m, 51.0 lb-ft)

11) Install piston and connecting rod referring to "Pistons, Piston Rings, Connecting Rods and Cylinders Removal and Installation" in this section.
12) Install engine assembly to vehicle referring to "Engine Assembly Removal and Installation" in this section.

Main Bearings, Crankshaft and Cylinder Block Inspection

Main bearing cap No.1 bolt



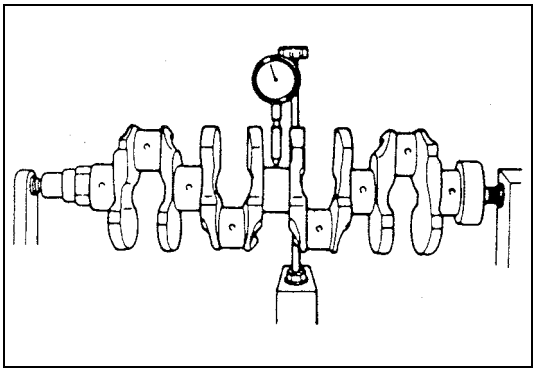
Measure each thread diameter main bearing cap No.1 bolts (1) at "A" on 60mm(2.36in.) from seat side of flange bolt and "B" on 90mm(3.54in.) from seat side of flange bolt by using a micrometer (2).
Calculate difference in diameters ("A" – "B").
If it exceeds limit, replace with new one.

Main bearing cap No.1 bolt diameter measurement points
"a" : 60mm (2.36in.)
"b" : 90mm (3.54in.)

Main bearing cap No.1 bolt diameter difference
Limit ("A" – "B") : 0.2mm (0.008in.)

Crankshaft

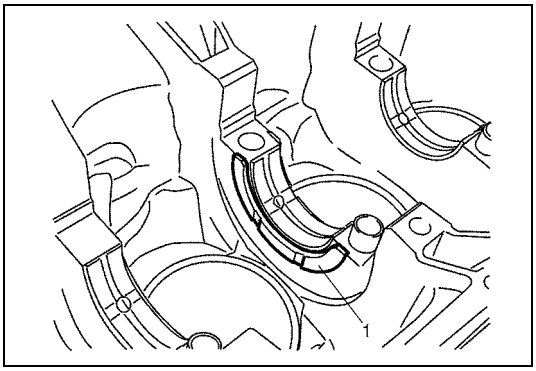
Crankshaft runout



Using a dial gauge, measure runout at center journal. Rotate crankshaft slowly. If runout exceeds its limit, replace crankshaft.

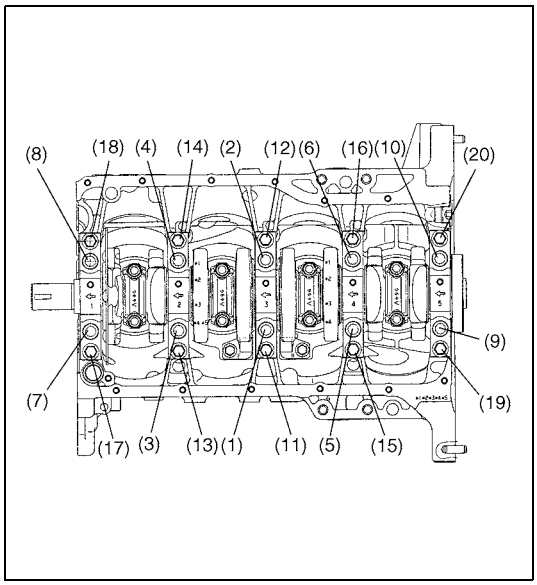
Crankshaft runout
Limit : 0.02 mm (0.0008 in.)

Crankshaft thrust play



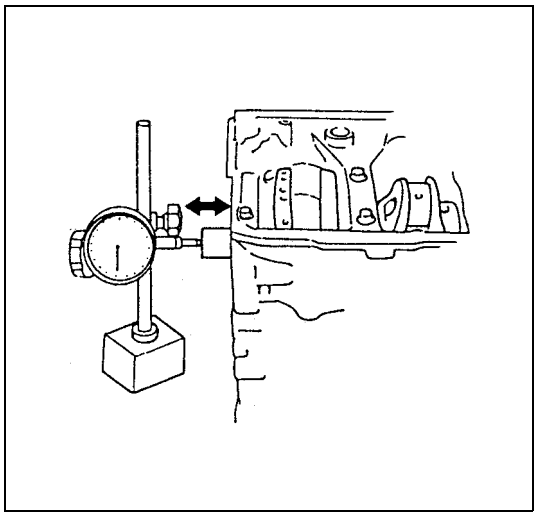
1) Measure this play with crankshaft set in cylinder block in the normal manner, that is with thrust bearing (1) and journal bearing caps installed.

Thickness of crankshaft thrust bearing
Standard : 2.500 mm (0.0984 in.)
Oversize (0.125 mm (0.0049 in.)) : 2.563 mm (0.1009 in.)



2) Tighten main bearing cap No.1 bolts (1) – (10) and main bearing cap No.2 bolts (11) – (20) gradually as follows.
   a) Tighten bolts (1) – (10) to 30 N·m (3.0 kg-m, 22.0 lb-ft) according to numerical order in figure.
   b) In the same manner as in Step 1), tighten them to 50 N·m (5.0 kg-m, 36.5 lb-ft).
   c) In the same manner as in step 1), retighten them to 60°.
   d) Tighten bolts (11) – (20) to 25 N·m (2.5 kg-m, 18.0 lb-ft) according to numerical order in figure.

Tightening torque
Main bearing cap No.1 bolts (1) – (10) :
30 N·m (3.0 kg-m, 21.5 lb-ft), 50 N·m (5.0 kg-m, 36.5 lb-ft) and then retighten by turning through 60 °
Main bearing cap No.2 bolts (11) – (20) :
25 N·m (2.5 kg-m, 18.0 lb-ft)



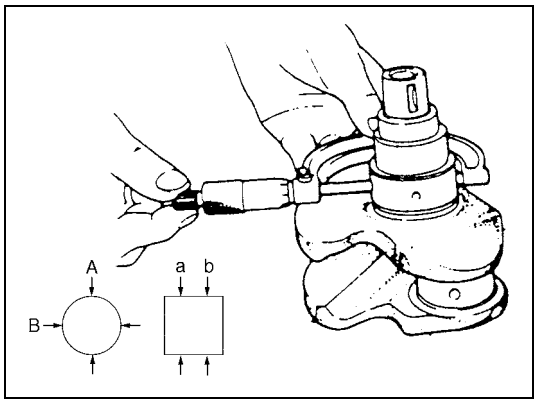
3) Use a dial gauge to read displacement in axial (thrust) direction of crankshaft.
   If its limit is exceeded, replace thrust bearing with new standard one or oversize one to obtain standard thrust play.

Crankshaft thrust play
Standard : 0.11 – 0.31 mm (0.0043 – 0.0122 in.)
Limit : 0.35 mm (0.0138 in.)

NOTE:

After checking the thrust play, make sure that thread deformation of each main bearing cap No.1 bolt referring to "Main bearing cap No.1 bolt" in this section.

Out-of-round and taper (uneven wear) of journals



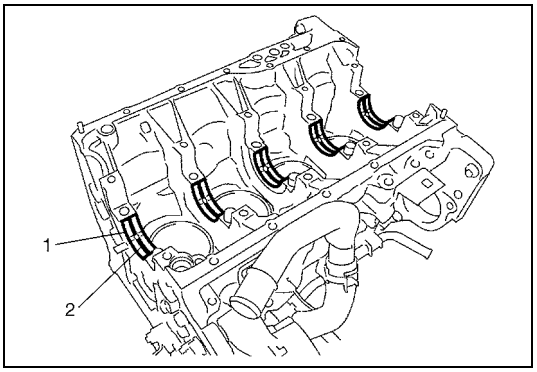
An unevenly worn crankshaft journal shows up as a difference in diameter at a cross section or along its length (or both). This difference, if any, is determined by taking micrometer readings. If any one of journals is badly damaged or if amount of uneven wear in the sense explained below exceeds its limit, regrind or replace crankshaft.

Crankshaft out-of-round and taper
Limit : 0.01 mm (0.0004 in.)
Out-of-round : A – B
Taper : a – b

Main bearings

General information

- Service main bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and each of them has 5 kinds of bearings differing in tolerance.



- Upper half of bearing (1) has an oil groove (2) as shown in figure.
  Install this half with oil groove to cylinder block.
- Lower half of bearing does not have an oil groove.

Visual inspection

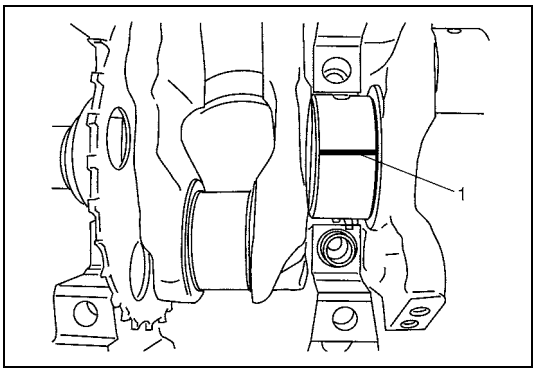
Check bearings for pitting, scratches, wear or damage.
If any malcondition is found, replace both upper and lower halves.
Never replace either half without replacing the other half.

Main bearing clearance

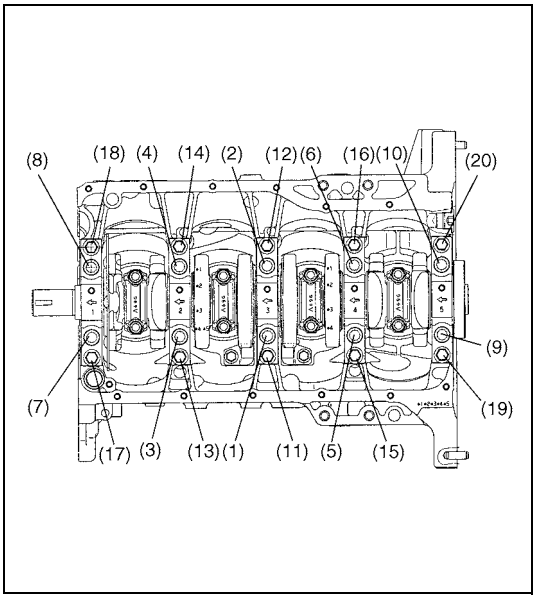
CAUTION:
Do not rotate crankshaft while gaging plastic is installed.

Check clearance by using gaging plastic according to the following procedure.

1) Remove bearing caps.
2) Clean bearings and main journals.

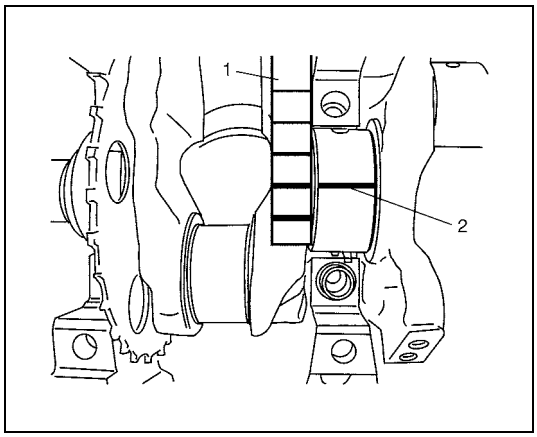


3) Place a piece of gaging plastic (1) the full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.



4) Tighten main bearing cap No.1 bolts (1) – (10) and main bearing No.2 cap bolts (11) – (20) gradually as follows.
   a) Tighten bolts (1) – (10) to 30 N·m (3.0 kg-m, 22.0 lb-ft) according to numerical order in figure.
   b) In the same manner as in Step a), tighten them to 50 N·m (5.0 kg-m, 36.5 lb-ft).
   c) In the same manner as in step a), retighten them to 60°.
   d) Tighten bolts (11) – (20) to 25 N·m (2.5 kg-m, 18.0 lb-ft) according to numerical order in figure.

Tightening torque
Main bearing cap No.1 bolts (1) – (10) :
30 N·m (3.0 kg-m, 22.0 lb-ft), 50 N·m (5.0 kg-m, 36.5 lb-ft) and then retighten by turning through 60°
Main bearing cap No.2 bolts (11) – (20) :
25 N·m (2.5 kg-m, 18.0 lb-ft)



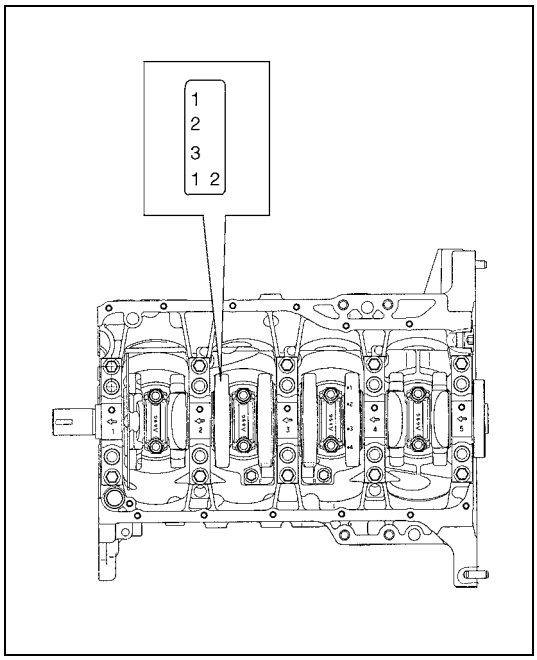
5) Remove bearing caps and using scale (1) on gaging plastic (2) envelop, measure gaging plastic width at its widest point. If clearance exceeds its limit, replace bearing. Always replace both upper and lower inserts as a unit.
   A new standard bearing may produce proper clearance. If not, it will be necessary to regrind crankshaft journal for use of 0.25 mm (0.0098 in.) undersize bearing.
   After selecting new bearing, recheck clearance.

Main bearing clearance
Standard : 0.025 – 0.045 mm (0.0010 – 0.0018 in.)
Limit : 0.058 mm (0.0023 in.)

Selection of main bearings

Standard bearing

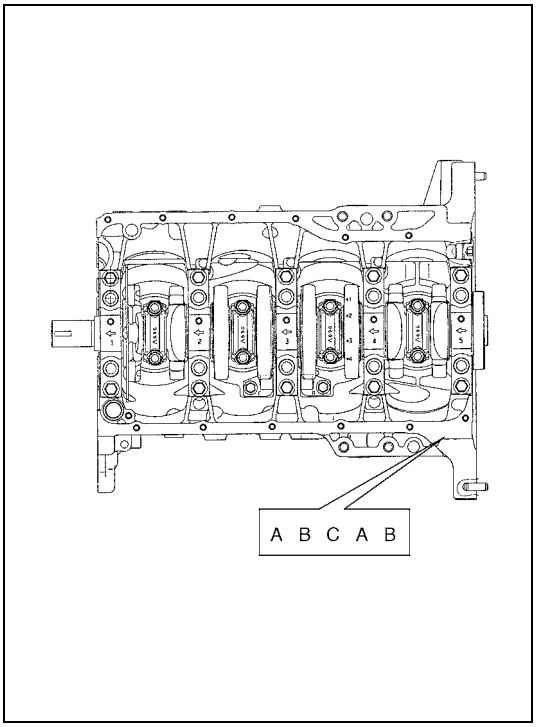
If bearing is in malcondition, or bearing clearance is out of specification, select a new standard bearing according to the following procedure and install it.



1) First check journal diameter. As shown in figure, crank web No.2 has stamped numbers.
   Three kinds of numbers (“1”, “2” and “3”) represent the following journal diameters.
   Stamped numbers on crank web No.2 represent journal diameters marked with an arrow in figure respectively.
   For example, stamped number “1” indicates that corresponding journal diameter is 44.994 – 45.000 mm (1.7714 – 1.7717 in.).

Crankshaft journal diameter

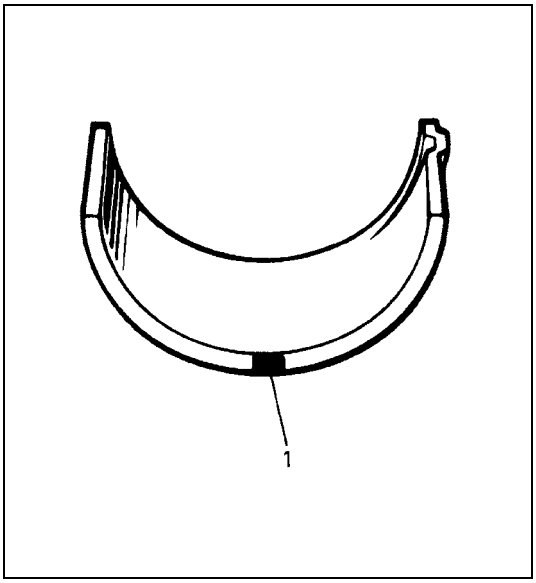
Stamped numbers	Journal diameter
1	44.994 – 45.000 mm (1.7714 – 1.7717 in.)
2	44.988 – 44.994 mm (1.7712 – 1.7714 in.)
3	44.982 – 44.988 mm (1.7709 – 1.7712 in.)



2) Next, check bearing cap bore diameter without bearing. On mating surface of cylinder block, five alphabets are stamped as shown in figure.
Three kinds of alphabets (“A”, “B” and “C”) or numbers (“1”, “2” and “3”) represent the following cap bore diameters.
Stamped alphabets or numbers on cylinder block represent bearing cap bore diameter marked with an arrow in figure respectively. For example, stamped “A” or “1” indicates that corresponding bearing cap bore diameter is 49.000 – 49.006 mm (1.9291 – 1.9294 in.).

Crankshaft bearing cap bore

Stamped alphabet (number)	Bearing cap bore diameter (without bearing)
A (1)	49.000 – 49.006 mm (1.9291 – 1.9294 in.)
B (2)	49.006 – 49.012 mm (1.9294 – 1.9296 in.)
C (3)	49.012 – 49.018 mm (1.9296 – 1.9298 in.)



3) There are five kinds of standard bearings differing in thickness. To distinguish them, they are painted in the following colors at the position as indicated in figure.
Each color indicated the following thickness at the center of bearing.

Standard size of crankshaft main bearing thickness

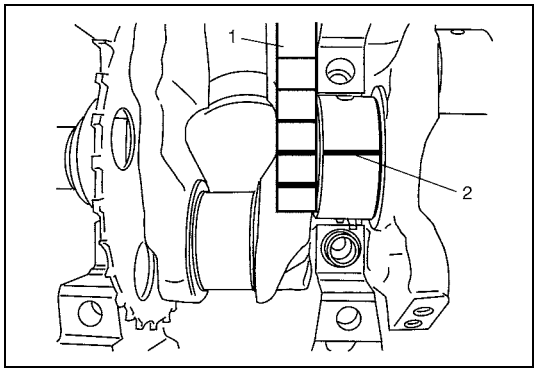
Color painted	Bearing thickness
Pink	1.990 – 1.994 mm (0.0783 – 0.0785 in.)
Purple	1.993 – 1.997 mm (0.0785 – 0.0786 in.)
Brown	1.996 – 2.000 mm (0.0786 – 0.0787 in.)
Green	1.999 – 2.003 mm (0.0787 – 0.0789 in.)
Black	2.002 – 2.006 mm (0.0788 – 0.0790 in.)

1. Paint

4) From number stamped on crank web No.2 and alphabets stamped on cylinder block, determine new standard bearing to be installed to journal, by referring to table shown below.
For example, if number stamped on crank web No.2 is “1” and alphabet stamped on cylinder block is “B”, install a new standard bearing painted in “Purple” to its journal.

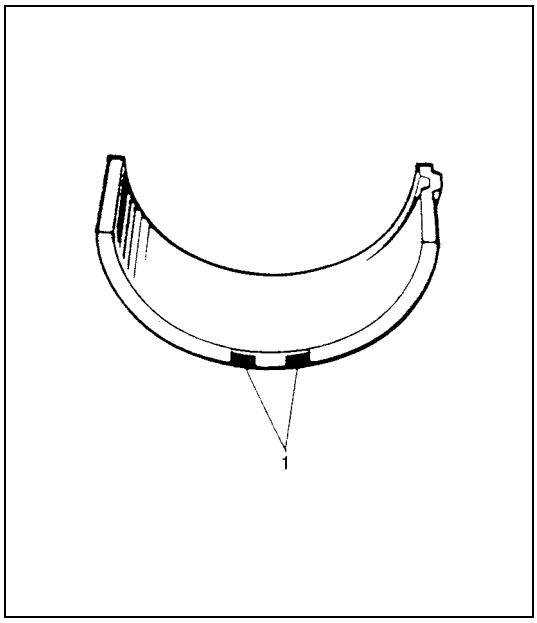
Specification of new standard crankshaft main bearing size

		Number stamped on crank web No.2 (Journal diameter)		
		1	2	3
Alphabet stamped on cylinder block (Cap bore dia.)	A (1)	Pink	Purple	Brown
	B (2)	Purple	Brown	Green
	C (3)	Brown	Green	Black
		New standard bearing to be installed.		



5) Using scale (1) on gaging plastic (2), check bearing clearance with newly selected standard bearing.
   If clearance still exceeds its limit, use next thicker bearing and recheck clearance.
6) When replacing crankshaft or cylinder block due to any reason, select new standard bearings to be installed by referring to number stamped on new crankshaft or alphabets stamped on new cylinder block.

Undersize bearing (0.25 mm (0.0098 in.))



- 0.25 mm (0.0098 in.) undersize bearing is available, in five kinds varying in thickness.
  To distinguish them, each bearing is painted in the following colors at such position as indicated in figure.
  Each color represents the following thickness at the center of bearing.

Undersize of crankshaft main bearing thickness

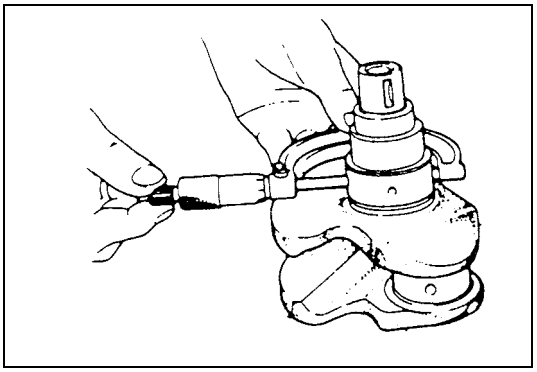
Color painted	Bearing thickness
Red and Pink	2.115 – 2.119 mm (0.0833 – 0.0834 in.)
Red and Purple	2.118 – 2.122 mm (0.0834 – 0.0835 in.)
Red and Brown	2.121 – 2.125 mm (0.0835 – 0.0837 in.)
Red and Green	2.124 – 2.128 mm (0.0836 – 0.0838 in.)
Red and Black	2.127 – 2.131 mm (0.0837 – 0.0839 in.)

1. Paint

- If necessary, regrind crankshaft journal and select undersize bearing to use with it as follows.

1) Regrind journal to the following finished diameter.

Finished diameter
44.732 – 44.750 mm (1.7611 – 1.7618 in.)

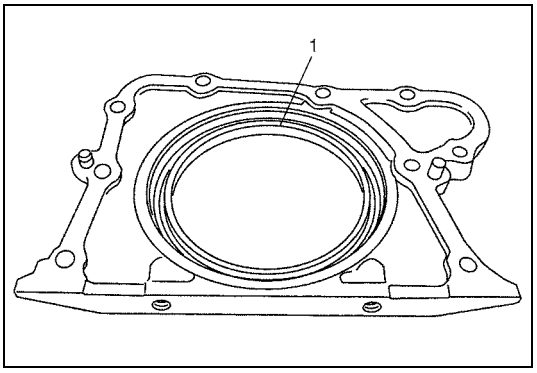


2) Using micrometer, measure reground journal diameter.
   Measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.
3) Using journal diameter measured above and alphabets stamped on cylinder block, select an undersize bearing by referring to table given below.
   Check bearing clearance with newly selected undersize bearing.

Specification of new standard undersize crankshaft main bearing

		Measured journal diameter		
		44.744 – 44.750 mm (1.7616 – 1.7618 in.)	44.738 – 44.744 mm (1.7613 – 1.7616 in.)	44.732 – 44.738 mm (1.7611 – 1.7613 in.)
Alphabets stamped on cylinder block	A (1)	Red and Pink	Red and Purple	Red and Brown
	B (2)	Red and Purple	Red and Brown	Red and Green
	C (3)	Red and Brown	Red and Green	Red and Black
		Undersize bearing to be installed		

Rear oil seal



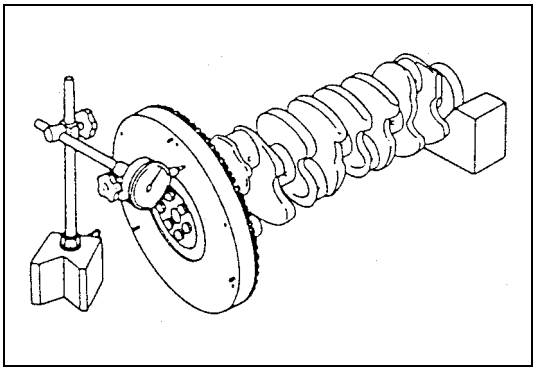
Carefully inspect oil seal (1) for wear or damage.
If its lip is worn or damaged, replace it.

Flywheel

Visual inspection

- If ring gear is damaged, cracked or worn, replace flywheel.
- If the surface contacting clutch disc is damaged, or excessively worn, replace flywheel.

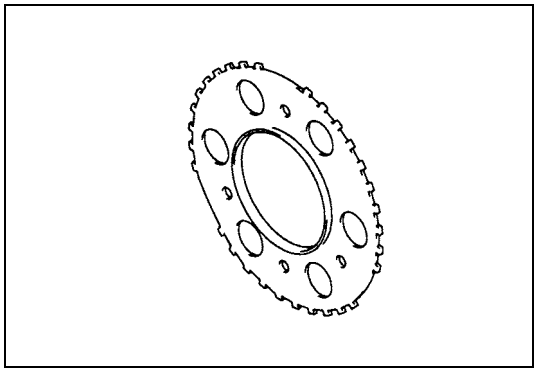
Flywheel face runout



Check flywheel face runout with a dial gauge.
If runout exceeds its limit, replace flywheel.

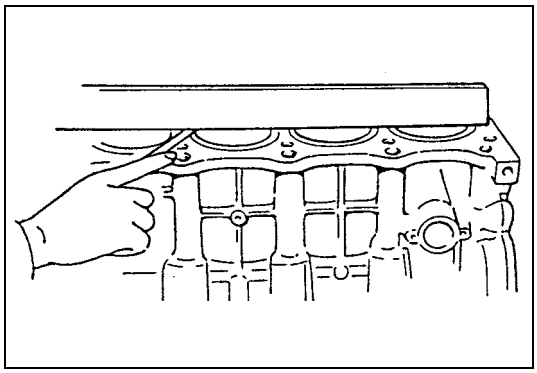
Flywheel face runout
Limit : 0.2 mm (0.0079 in.)

Sensor plate



Check sensor plate for crack or damage. If malcondition is found, replace it.

Cylinder block



Distortion of gasketed surface

Using straightedge and thickness gauge, check gasketed surface for distortion and, if flatness exceeds its limit, correct it.

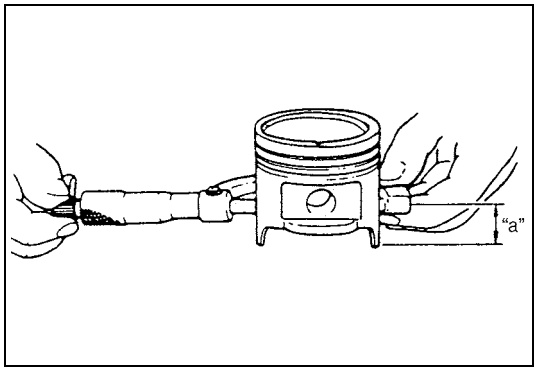
Cylinder block flatness
Limit : 0.03 mm (0.0012 in.)

Honing or reboring cylinders

1) When any cylinder needs reboring, all other cylinders must also be rebored at the same time.
2) Select oversized piston according to amount of cylinder wear.

Oversize piston diameter

Size	Piston diameter
Oversize 0.50	78.453 – 78.468 mm (3.0887 – 3.0893 in.)



3) Using micrometer, measure piston diameter.

Measurement position for piston diameter
"a" : 19.5 mm (0.77 in.)

4) Rebore and hone cylinder to the following dimension.

Cylinder bore diameter to be rebored
Oversize 0.50 : 78.500 – 78.514 mm (3.0906 – 3.0911 in.)

NOTE:

Before reboring, install all main bearing caps in place and tighten to specification to avoid distortion of bearing bores.

5) Measure piston clearance after honing.

Piston clearance : 0.032 – 0.061 mm (0.0013 – 0.0024 in.)

Required Service Material

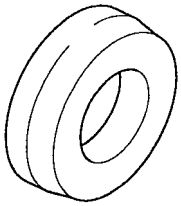
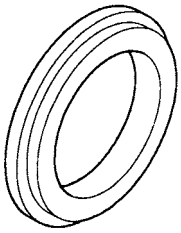
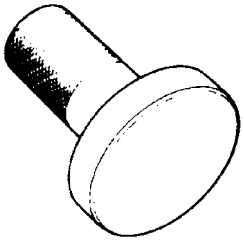
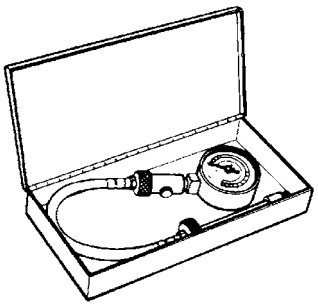
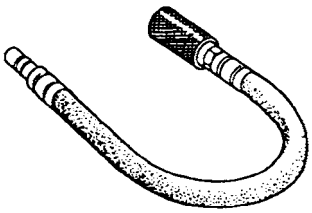
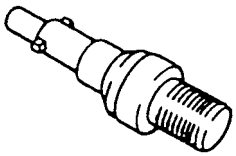
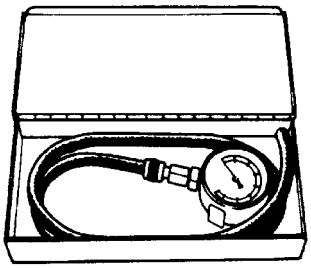
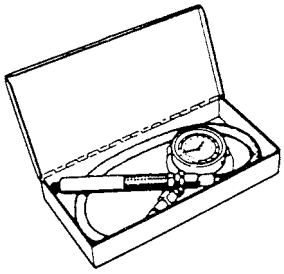
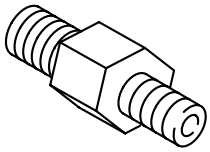
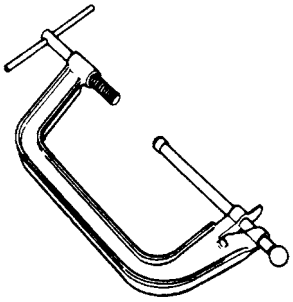
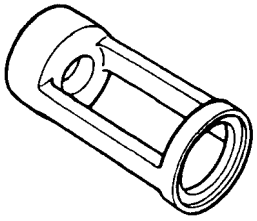
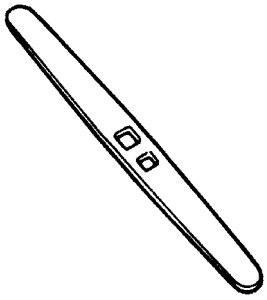
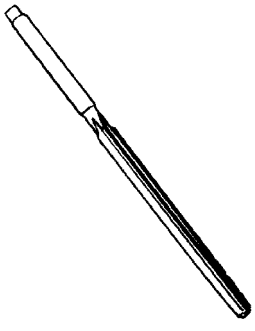
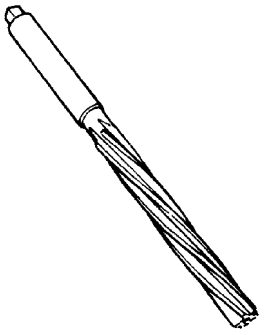
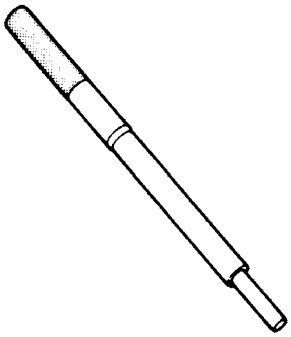
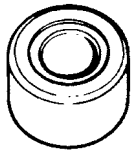
Material	Recommended product (Part Number)	Use
Sealant	Sealant 1207F (99000-31250)	• To apply to mating surfaces of cylinder block and oil pan. • To apply to mating surfaces of cylinder block and timing chain cover. • To apply to sealing surfaces of cylinder head cover. • To apply to mating surfaces to rear oil seal housing.
	Sealant 1207B (99000-31140)	• To apply to mating surface of cylinder block, cylinder head and timing chain cover.
	Sealant 1215 (99000-31110)	• To apply to the thread of the bolt of water outlet pipe.

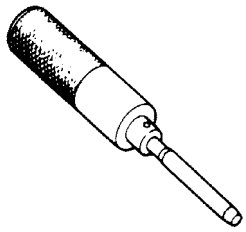
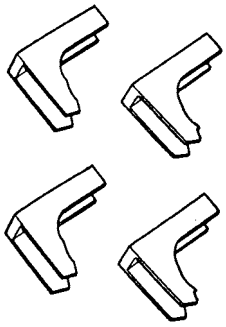
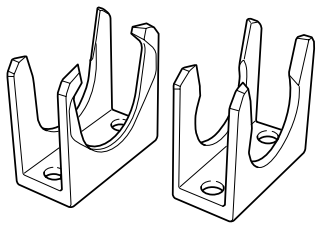
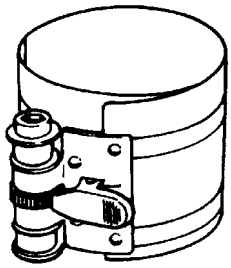
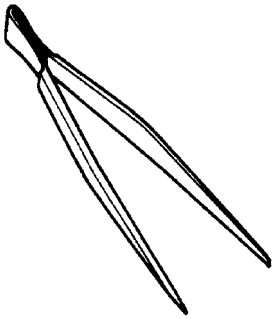
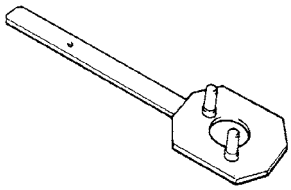
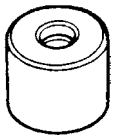
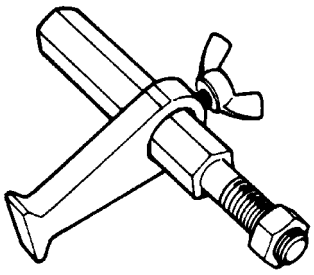
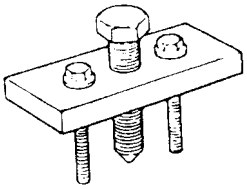
Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Oil pressure switch	14	1.4	10.5
Camshaft housing bolts (for replacement of shim)	8	0.8	6.0
Camshaft housing bolts	11	1.1	8.0
Engine cover bolts	8	0.8	6.0
Intake manifold bolts and nuts	25	2.5	18.0
Exhaust manifold bolts and nuts	50	5.0	36.5
Exhaust pipe No.1 bolts	50	5.0	36.5
Exhaust manifold stiffener bolts	50	5.0	36.5
Exhaust pipe No.2 bolts	43	4.3	31.5
Exhaust oxygen sensor	45	4.5	32.5
Oil pump strainer bolt	11	1.1	8.0
Oil pump strainer bracket bolt	11	1.1	8.0
Oil pan bolts and nuts	11	1.1	8.0
Oil pan drain plug bolt	50	5.0	36.5
Timing chain cover bolts	23	2.3	17.0
Crank shaft pulley bolt	150	15.0	108.5
Oil pump rotor plate bolts	11	1.1	8.0
Timing chain No.1 guide bolts	9	0.9	6.5
Timing chain tensioner adjuster bolts	11	1.1	8.0
Venturi plug	5	0.5	3.5
Cylinder head bolt for M8	25	2.5	18.0

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Cylinder head bolts for M10	a) Tighten 20 N·m b) Tighten 40 N·m c) Retighten by turning through 60° d) Retighten by turning through 60°	a) Tighten 2.0 kg-m b) Tighten 4.0 kg-m c) Retighten by turning through 60° d) Retighten by turning through 60°	a) Tighten 14.5 lb-ft b) Tighten 29.0 lb-ft c) Retighten by turning through 60° d) Retighten by turning through 60°
Connecting rod bearing cap nuts	a) Tighten 15 N·m b) Retighten by turning through 45° c) Retighten by turning through 45°	a) Tighten 1.5 kg-m b) Retighten by turning through 45° c) Retighten by turning through 45°	a) Tighten 11.0 lb-ft b) Retighten by turning through 45° c) Retighten by turning through 45°
Engine mounting bolts for M8	25	2.5	18.0
Engine mounting bolts and nuts for M10	55	5.5	40.0
Engine right mounting nuts	65	6.5	47.0
Main bearing cap No.1 bolts	a) Tighten 30 N·m b) Tighten 50 N·m c) Retighten by turning through 60°	a) Tighten 3.0 kg-m b) Tighten 5.0 kg-m c) Retighten by turning through 60°	a) Tighten 22.0 lb-ft b) Tighten 36.5 lb-ft c) Retighten by turning through 60°
Main bearing cap No.2 bolts	25	2.5	18.0
Sensor plate bolts	11	1.1	8.0
Rear oil seal housing bolts	11	1.1	8.0
Flywheel or drive plate bolts	70	7.0	51.0
Transaxle stiffener bolts	50	5.0	36.5
Timing chain tensioner bolt	25	2.5	18.0
Oil gallery pipe No.1 bolts	30	3.0	21.5
Oil gallery pipe No.2 bolts	11	1.1	8.0
Oil gallery pipe No.3 bolts	11	1.1	8.0
Oil control valve mounting nuts	11	1.1	8.0
Intake camshaft sprocket bolt	60	6.0	43.0

Special Tool

 09911-97720 Oil seal guide	 09911-97820 Oil seal installer	 09913-75810 Bearing installer	 09915-64512 Compression gauge
 09915-64530 Hose	 09915-67010 Attachment	 09915-67311 Vacuum gauge	 09915-77310 Oil pressure gauge
 09915-78211 Oil pressure gauge attachment	 09916-14510 Valve lifer	 09916-14521 Valve lifer attachment	 09916-34542 Reamer handle
 09916-34550 Reamer (5.5 mm)	 09916-37320 Reamer (10.5 mm)	 09916-44910 Valve guide remover	 09916-56011 Valve guide installer

 09916-58210 Valve guide installer handle	[A]  09916-67020 Tappet holder See NOTE below	[B]  09916-67021 Tappet holder	 09916-77310 Piston ring compressor
 09916-84511 Forceps	 09917-68221 Camshaft lock holder	 09917-98221 Valve stem seal installer	 09924-17810 Flywheel holder
 09926-58010 Bearing puller attachment	 09944-36011 Steering wheel remover		

NOTE:

[A] and [B] tools in the above table are interchangeable.

SECTION 6B

ENGINE COOLING

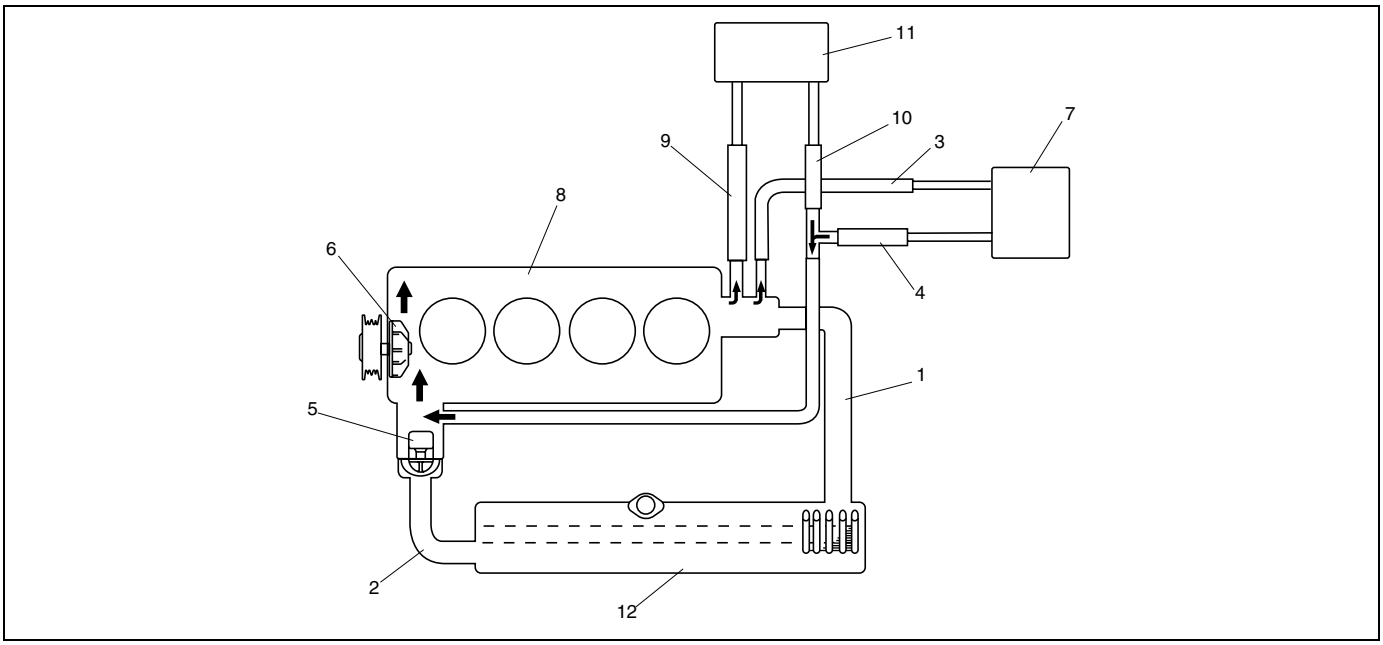
CONTENTS

General Description

The cooling system consists of the radiator cap, radiator, coolant reservoir, hoses, water pump, cooling fan and thermostat. The radiator is tube-and-fin type one.

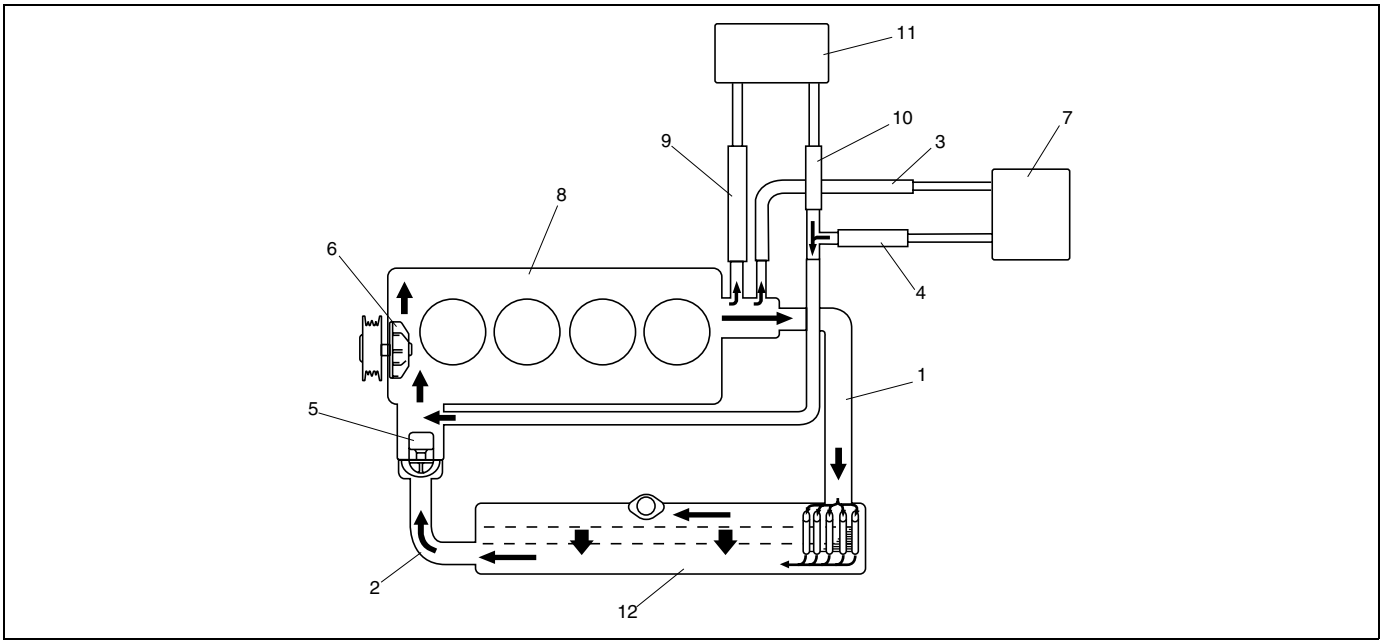
Cooling System Circulation

1) While the engine is warmed up (thermostat closed), coolant circulates as follows.



1. Radiator inlet hose	5. Thermostat	9. Heater core inlet hose
2. Radiator outlet hose	6. Water pump	10. Heater core outlet hose
3. Throttle body inlet hose	7. Throttle body	11. Heater core
4. Throttle body outlet hose	8. Engine	12. Radiator

2) When coolant is warmed up to normal temperature and the thermostat opens, coolant passes through the radiator core to be cooled as follows.



1. Radiator inlet hose	5. Thermostat	9. Heater core inlet hose
2. Radiator outlet hose	6. Water pump	10. Heater core outlet hose
3. Throttle body inlet hose	7. Throttle body	11. Heater core
4. Throttle body outlet hose	8. Engine	12. Radiator

Coolant

The coolant recovery system is standard. The coolant in the radiator expands with heat, and the coolant is overflowed to the reservoir.
When the system cools down, the coolant is drawn back into the radiator.

The cooling system has been filled with a quality coolant that is a 50/50 mixture of water and ethylene glycol antifreeze.

This 50/50 mixture coolant solution provides freezing protection to –36°C (–33°F).

- Maintain cooling system freeze protection at –36°C (–33°F) to ensure protection against corrosion and loss of coolant from boiling. This should be done even if freezing temperatures are not expected.
- Add ethylene glycol base coolant when coolant has to be added because of coolant loss or to provide added protection against freezing at temperature lower than –36°C (–33°F).

NOTE:

- **Alcohol or methanol base coolant or plain water alone should not be used in cooling system at any time as damage to cooling system could occur.**
- **Coolant must be mixed with demineraled water or distilled water.**

Anti-freeze proportioning table

		For M/T model	For A/T model
Freezing temperature	°C	–36	–36
	°F	–33	–33
Anti-freeze/Anti-corrosion coolant concentration	%	50	50
Ratio of compound to cooling water	ltr.	2.80/2.80	2.70/2.70
	US pt.	5.92/5.92	5.71/5.71
	Imp pt.	4.93/4.93	4.75/4.75

Coolant capacity

	For M/T model	For A/T model
Engine radiator and heater	5.0 liters (10.00/8.80 US/Imp. pt.)	4.8 liters (10.14/8.45 US/Imp. pt.)
Reservoir	0.6 liters (1.27/1.06 US/Imp. pt.)	0.6 liters (1.27/1.06 US/Imp. pt.)
Total	5.6 liters (11.84/9.86 US/Imp. pt.)	5.4 liters (11.41/9.51 US/Imp. pt.)

Diagnosis

Diagnosis Table

Condition	Possible Cause	Correction
Engine overheats (It is in case that radiator fan operates)	Loose or broken water pump belt	Adjust or replace.
	Not enough coolant	Check coolant level and add as necessary.
	Faulty thermostat	Replace.
	Faulty water pump	Replace.
	Dirty or bent radiator fins	Clean or remedy.
	Coolant leakage on cooling system	Repair.
	Clogged radiator	Check and replace radiator as necessary.
	Faulty radiator cap	Replace.
	Improper ignition timing	Adjust.
	Dragging brakes	Adjust brake.
	Slipping clutch	Adjust or replace.
	Poor charge battery	Check and replace as necessary.
	Poor generation generator	Check and repair.
	ECT sensor faulty	Check and replace as necessary.
	Radiator cooling fan relay faulty	Check and replace as necessary.
	ECM faulty	Check and replace as necessary.
	Wiring or grounding faulty	Repair and necessary.
	Equipped with too much electric load part(s)	Dismount.
	Radiator cooling fan motor faulty	Check and replace as necessary.
Engine overheats (It is in case that radiator fan won't operates)	Fuse blown	Check 30A fuse of relay/fuse box and check for short circuit to ground.
	Radiator cooling fan relay	Check and replace as necessary.
	ECT sensor faulty	Check and replace as necessary.
	Radiator cooling fan motor faulty	Check and replace as necessary.
	Wiring or grounding faulty	Repair as necessary
	ECM faulty	Check and replace as necessary.

System Circuit Inspection

Refer to "Table B-7 Radiator Fan Control System Check" in Section 6

Maintenance

WARNING:

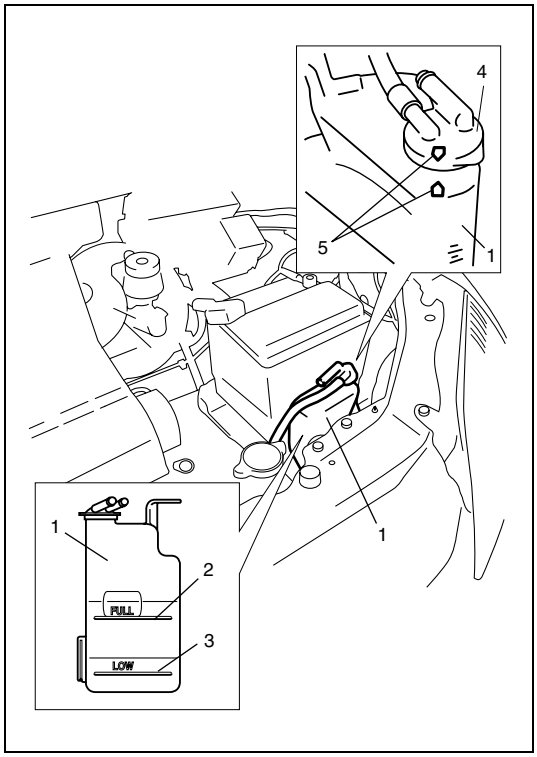
- **Do not remove radiator cap to check engine coolant level; check coolant visually at the see-through coolant reservoir.**
  Coolant should be added only to reservoir as necessary.
- **As long as there is pressure in the cooling system, the temperature can be considerably higher than the boiling temperature of the solution in the radiator without causing the solution to boil. Removal of the radiator cap while engine is hot and pressure is high will cause the solution to boil instantaneously and possibly with explosive force, spewing the solution over engine, fenders and person removing cap. If the solution contains flammable anti-freeze such as alcohol (not recommended for use at any time), there is also the possibility of causing a serious fire.**

Coolant Level Check

WARNING:

To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot.
Scalding fluid and steam can be blown out under pressure radiator cap is taken off too soon.

To check level, lift hood and look at “see-through” coolant reservoir.
It is not necessary to remove radiator cap to check coolant level.



When engine is cool, check coolant level in reservoir (1).
A normal coolant level should be between “FULL” mark (2) and “LOW” mark (3) on reservoir (1).
If coolant level is below “LOW” mark (3), remove reservoir cap (4) and add proper coolant to reservoir to bring coolant level up to “FULL” mark (2). Then, reinstall cap (4) and align match marks (5) on reservoir and cap (4).

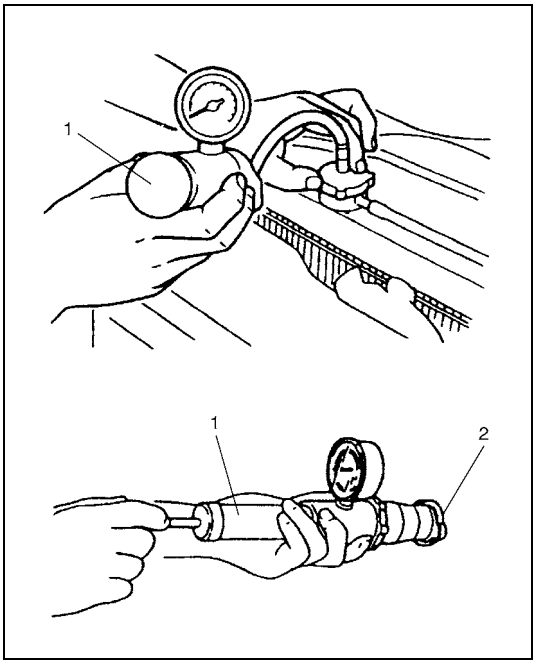
NOTE:

- **If proper quality antifreeze is used, there is no need to add extra inhibitors or additives that claim to improve system.**
  They may be harmful to proper operation of system, and are unnecessary expense.
- **When installing reservoir cap, align arrow marks (5) on reservoir and cap.**

Engine Cooling System Inspection and Service

WARNING:
To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

1) Check cooling system for leakage or damage.
2) Wash radiator cap and filler neck with clean water by removing radiator cap when engine is cold.
3) Check coolant for proper level and freeze protection.



4) Using a pressure tester (1), check system and radiator cap (2) for proper pressure holding capacity.
   If replacement of cap is required, use a proper cap for this vehicle.

   Cooling system and radiator cap holding pressure (for inspection)
   : 110 kPa (1.1 kg/cm^2, 15.6 psi)

   NOTE:
   After installing radiator cap to radiator, make sure that the ear of cap lines is parallel to radiator.

5) Tighten hose clamps and inspect all hoses. Replace hoses whenever cracked, swollen or otherwise deteriorated.
6) Clean frontal area of radiator core.

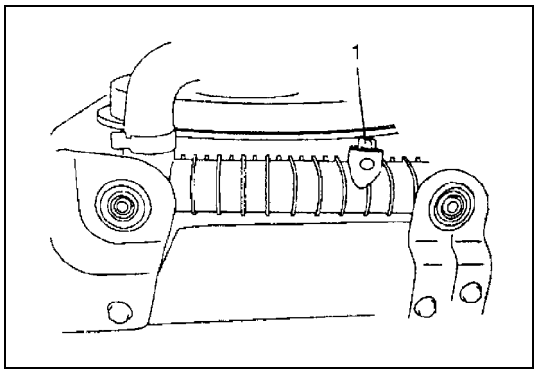
Cooling System Flush and Refill

WARNING:
To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

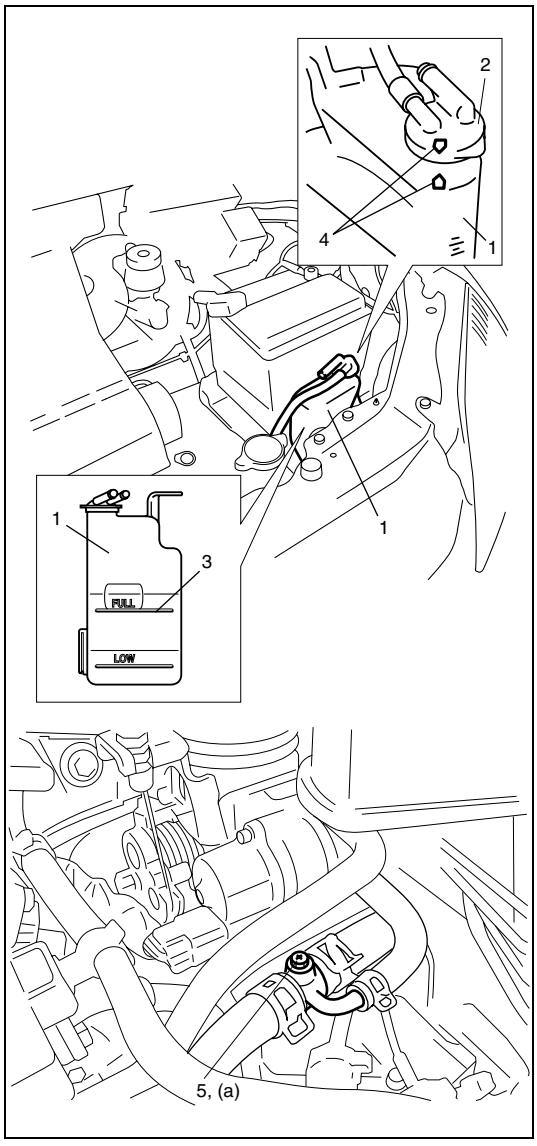
NOTE:
For detail of coolant specification, refer to "Coolant" in this section.

1) Remove radiator cap when engine is cool as follows.
   a) Turn cap counterclockwise slowly until it reaches a "stop". (Do not press down while turning it).
   b) Wait until pressure is relieved (indicated by a hissing sound) then press down on cap and continue to turn it counterclockwise.

2) With radiator cap removed, run engine until upper radiator hose is hot (this shows that thermostat is open and coolant is flowing through system).



3) Stop engine and drain coolant from radiator drain plug (1).
4) Close radiator drain plug (1). Add water until system is filled and run engine until upper radiator hose is hot again.
5) Repeat Steps 3) and 4) several times until drained liquid is nearly colorless.
6) Close radiator drain plug (1) tightly.



7) Remove reservoir (1), and remove cap (2) from reservoir (1).
8) Pour out any fluid, scrub and clean inside of reservoir with soap and water.
   Flush it well with clean water and drain. Reinstall reservoir.
9) Fill reservoir with coolant up to “Full” level mark (3).
10) Install reservoir cap (2) and align match marks (4) on reservoir and its cap.
11) Loosen air ventilation bolt (5) one and a half turns.
12) Fill radiator with coolant up to spilling coolant from air ventilation bolt (5).
13) Tighten air ventilation bolt (5) to specified torque.

Tightening torque
Air ventilation bolt (a) : 4.5 N·m (0.45 kg-m, 3.5 lb-ft)

14) Fill radiator with coolant up to bottom of radiator filler neck and install radiator cap, making sure that the ear of cap lines is parallel to radiator.
15) Run engine at idle speed.
16) Loosen air ventilation bolt (5) one and a half turns.
17) Run engine at 2000-3000 rpm, and tighten air ventilation bolt (5) to specified torque after spilling coolant from air ventilation bolt (5).

Tightening torque
Air ventilation bolt (a) : 4.5 N·m (0.45 kg-m, 3.5 lb-ft)

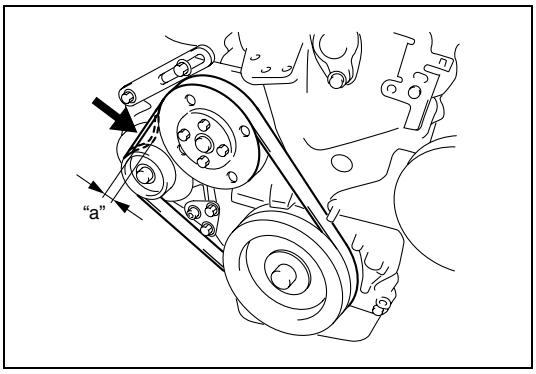
18) Run engine until radiator fan motor is operated.
19) Stop engine and wait until engine comes cooled down to help avoid danger of being burned.
20) Add coolant to radiator up to bottom of radiator filler neck, and install radiator cap, making sure that the ear of cap lines is parallel to radiator.
21) Repeat step 15) through 20).
22) Confirm that reservoir coolant level is “Full” level mark (3). If coolant is insufficient, repeat step 9) and 10).

Water Pump/Generator Drive Belt Tension Inspection and Adjustment

WARNING:

- **Disconnect negative cable at battery before checking and adjusting belt tension.**
- **To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.**

1) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If it is necessary to replace belt, refer to "Water Pump/ Generator Drive Belt Removal and Installation" in this section.



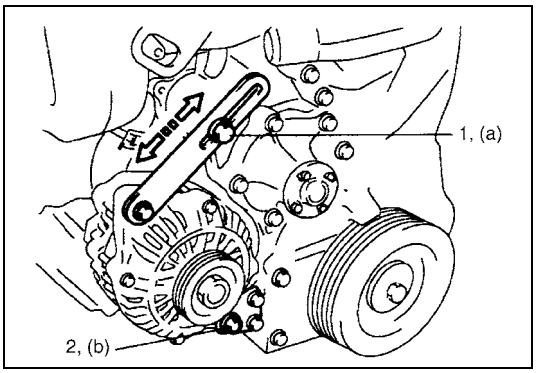
2) Check belt for tension. Belt is in proper tension when it deflects the following specification under thumb pressure (about 10 kg or 22 lb.).

Water pump / generator drive belt tension "a"
4.5 – 5.5 mm (0.18 – 0.22 in.) as deflection/10 kg (22 lbs)

NOTE:

When replacing belt with a new one, adjust belt tension to 3 – 4 mm (0.12 – 0.16 in.).

3) If belt is too tight or too loose, adjust it to proper tension by displacing generator position.



4) Tighten generator adjusting bolt (1) and pivot bolts (2) as specified torque.

Tightening torque
Generator adjusting bolt (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)
Generator pivot bolt (b) : 50 N·m (5.0 kg-m, 36.0 lb-ft)

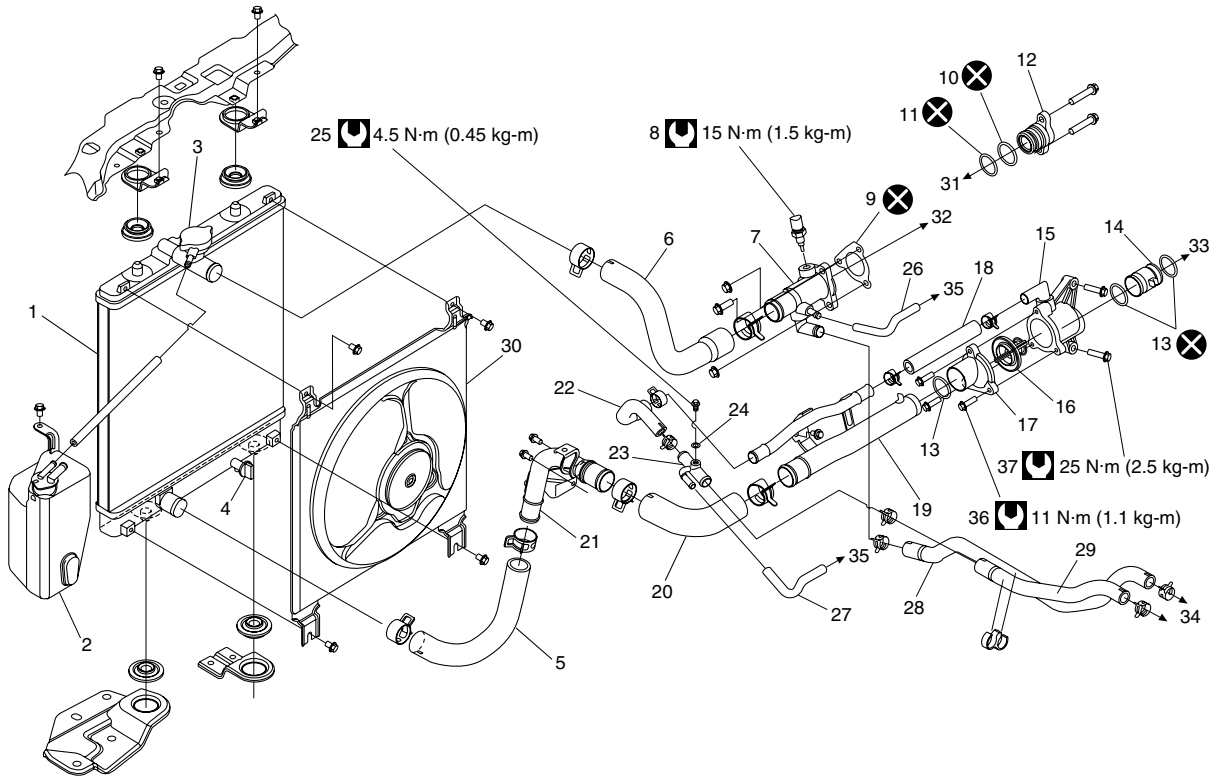
5) Connect negative cable at battery.

On-Vehicle Service

WARNING:

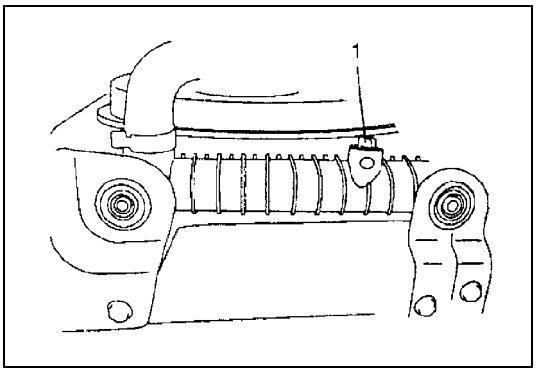
- **Check to make sure that engine coolant temperature is cold before removing any part of cooling system.**
- **Also be sure to disconnect negative cord from battery terminal before removing any part.**

Cooling System Components



1. Radiator	14. Thermostat case water outlet pipe	27. Throttle body outlet hose
2. Reservoir	15. Thermostat case	28. Heater core inlet hose
3. Radiator cap	16. Thermostat	29. Heater core outlet hose
4. Drain plug	17. Thermostat cap	30. Radiator cooling fan assembly
5. Radiator outlet hose	18. Water bypass hose	31. To timing chain cover
6. Radiator inlet hose	19. Water inlet pipe No.1	32. To cylinder head
7. Water outlet cap	20. Water inlet hose	33. To water pump
8. ECT sensor	21. Water inlet pipe No.2	34. To heater core
9. Gasket	22. Heater outlet hose No.2	35. To throttle body
10. Water outlet cap O-ring No.1	23. Heater union	36. Thermostat cap bolt
11. Water outlet cap O-ring No.2	24. Heater union gasket	37. Thermostat case bolt
12. Water outlet plug	25. Air ventilation bolt	Tightening torque
13. O-ring	26. Throttle body inlet hose	Do not reuse.

Cooling System Draining

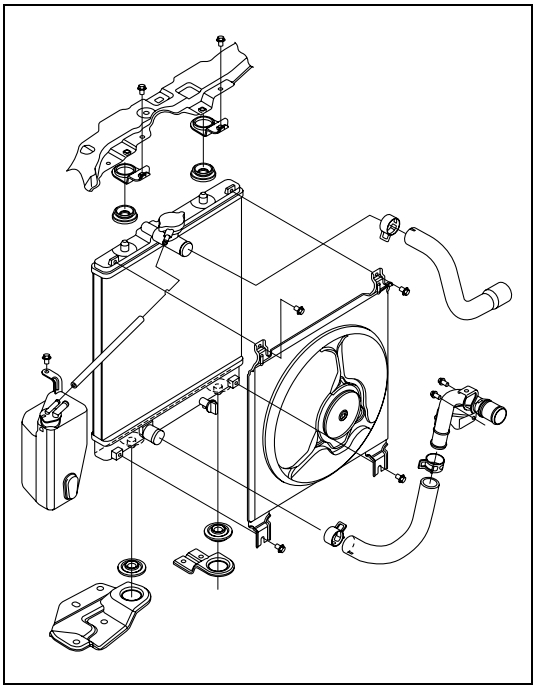


1) Remove radiator cap.
2) Drain coolant from radiator drain plug (1).
3) After draining coolant, be sure to tighten drain plug (1) securely.

Cooling System Refill

Refer to step 7) to 22) of “Cooling System Flush and Refill” in this section.

Cooling Water Pipes or Hoses



Removal

1) Drain coolant referring to “Cooling System Draining” in this section.
2) To remove these pipes or hoses, loosen clamp on each hose and pull hose end off.

Installation

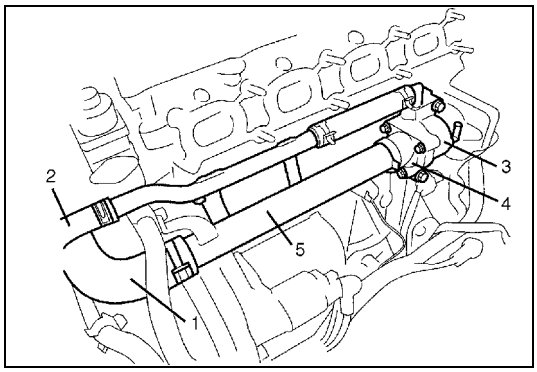
Install removed parts in reverse order of removal procedure, noting the following.

- Tighten each clamp securely.
- Refill cooling system referring to step 7) to 22) of “Cooling System Flush and Refill” in this section.

Thermostat Removal and Installation

Removal

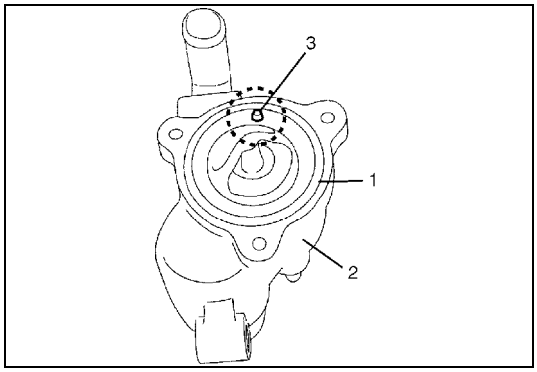
1) Drain coolant referring to “Cooling System Draining” in this section.
2) Remove intake manifold referring to “Intake Manifold Removal and Installation” in Section 6A1.
3) Remove generator referring to “Generator Dismounting and Remounting” in Section 6H.



4) Disconnect water hose (1) and heater hose (2) from each pipe.
5) Remove thermostat case (3) with thermostat cap (4) and water inlet pipe (5).
6) Remove water inlet pipe (5) with thermostat cap (4) from thermostat case.
7) Remove thermostat.

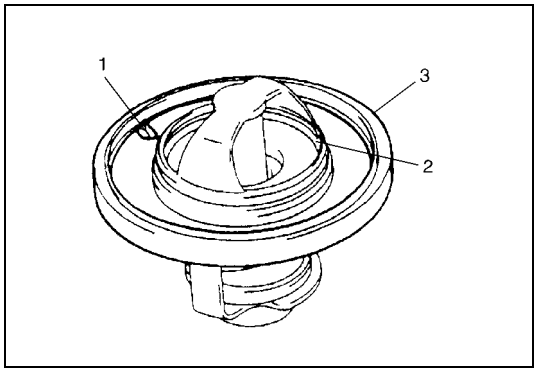
Installation

Reverse removal procedure for installation noting the following points.

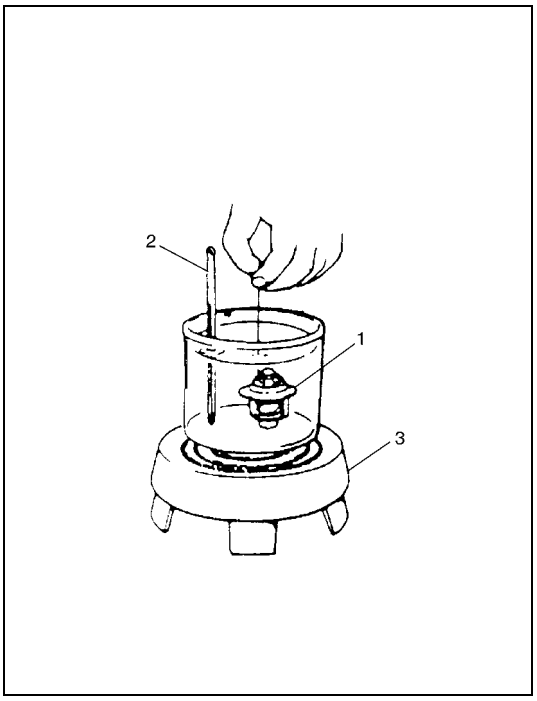


- When positioning thermostat (1) on thermostat case (2), be sure to position it so that air bleed valve (3) comes at position as shown in figure.
- Use new O-rings when installing.
- Adjust water pump belt tension referring to “Water Pump/ Generator Drive Belt Tension Inspection and Adjustment” in this section.
- Adjust A/C compressor belt tension (if equipped) referring to “Compressor Drive Belt Inspection and Adjustment” in Section 1B.
- Refill cooling system referring to step 7) to 22) of “Cooling System Flush and Refill” in this section.
- Verify that there is no coolant leakage at each connection.

Thermostat Inspection



- Make sure that air bleed valve (1) of thermostat is clean. Should this valve be clogged, engine would tend to overheat.
- Check to make sure that valve seat (2) is free from foreign matters which would prevent valve from seating tight.
- Check thermostat seal (3) for breakage, deterioration or any other damage.



- Check thermostatic movement of wax pellet as follows :

a) Immerse thermostat (1) in water, and heat water gradually as shown.
b) Check that valve starts to open at specific temperature.

Temperature at which valve begins to open
: 80 – 84°C (176 – 183°F)
Temperature at which valve become fully open
: 95 – 97°C (203°F)
Valve lift
: More than 8 mm at 95°C (203°F)

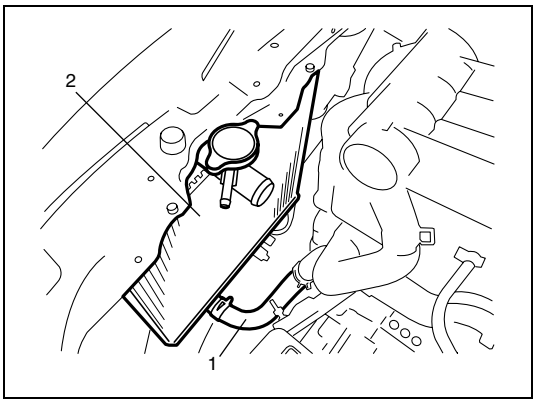
If valve starts to open at a temperature substantially below or above specific temperature, thermostat unit should be replaced with a new one. Such a unit, if reused, will bring about overcooling or overheating tendency.

2. Thermometer
3. Heater

Radiator Removal and Installation

Removal

1) Disconnect negative cable at battery.
2) Drain cooling system referring to “Cooling System Draining” in this section.
3) Remove cooling fan assembly referring to “Radiator Cooling Fan Removal and Installation” in this section.



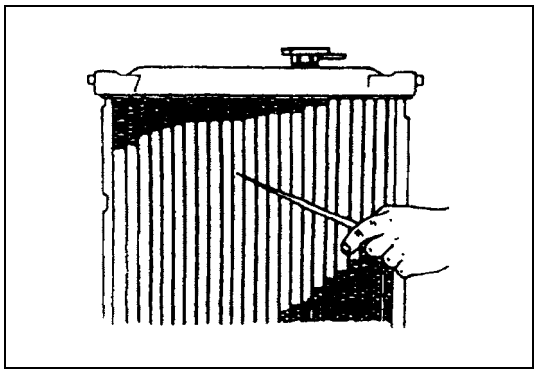
4) Remove radiator outlet hose (1) from radiator (2).
5) Remove radiator (2) from vehicle.

Installation

Reverse removal procedures noting the followings.

- Refill cooling system referring to step 7) to 22) of “Cooling System Flush and Refill” in this section.
- After installation, check each joint for leakage.

Radiator Inspection



Check radiator for leakage or damage. Straighten bent fins, if any.

Radiator Cleaning

Clean frontal area of radiator cores.

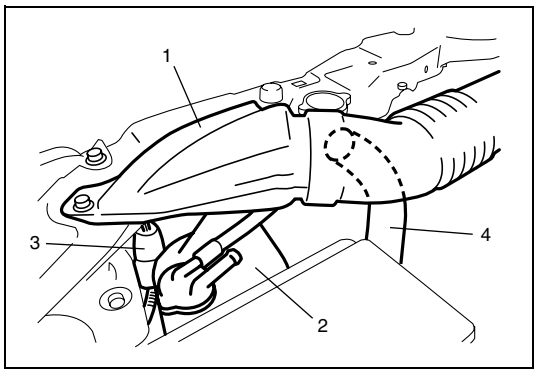
Radiator Cooling Fan Relay Inspection

Refer to “Main relay, fuel pump relay and radiator fan relay inspection” in Section 6E.

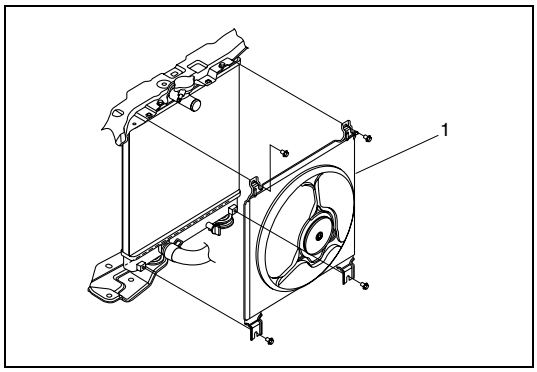
Radiator Cooling Fan Removal and Installation

Removal

1) Disconnect negative cable at battery.
2) Drain coolant referring to “Cooling System Draining” in this section.



3) Remove air cleaner suction pipe (1) and reservoir (2).
4) Disconnect cooling fan motor connector (3).
5) Remove radiator inlet hose (4) from radiator.



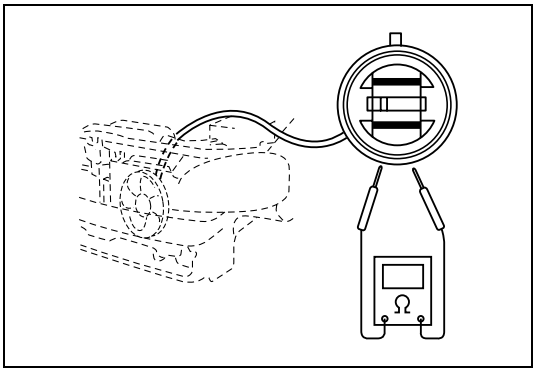
6) Remove radiator cooling fan motor (1) from radiator.

Installation

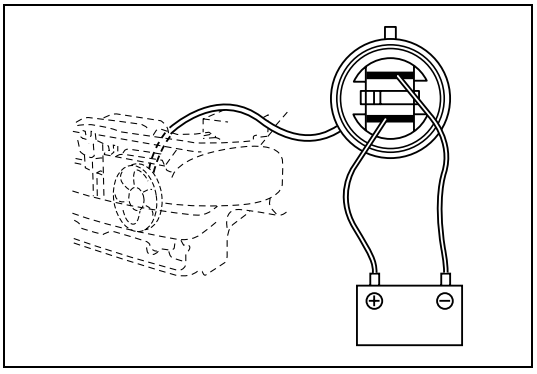
Reverse removal procedure for installation noting the following.

- Refill cooling system referring to step 7) to 18) of “Cooling System Flush and Refill” in this section.
- After installation, verify there is no coolant leakage at each connection.

Radiator Cooling Fan Inspection



1) Check continuity between terminals. If there is no continuity, replace radiator fan motor.



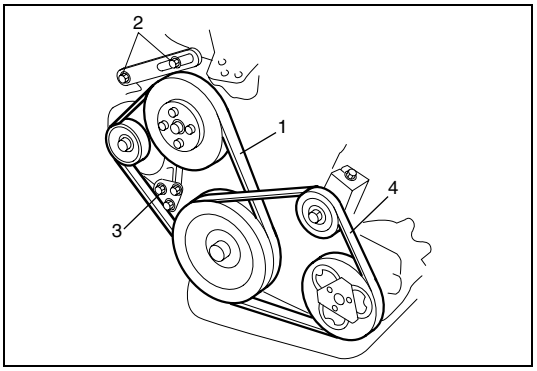
2) Connect battery to radiator fan motor coupler as shown in figure, then check that the radiator fan motor operates smoothly. If radiator fan motor does not operate smoothly, replace motor.

Radiator cooling fan motor specified current at 12 V
10.0 A maximum

Water Pump/Generator Drive Belt Removal and Installation

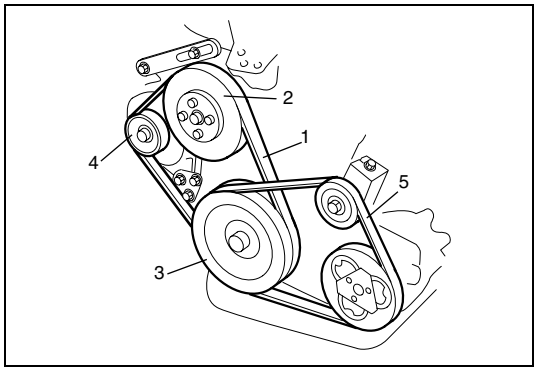
Removal

1) Disconnect negative cable at battery.



2) If vehicle equipped with A/C, remove compressor drive belt (4) before removing water pump belt (1).
   Refer to “Compressor Drive Belt Replacement” in Section 1B.
3) Loosen drive belt adjusting bolt (2) and generator pivot bolt (3).
4) Slacken belt by displacing generator and then remove it.

Installation

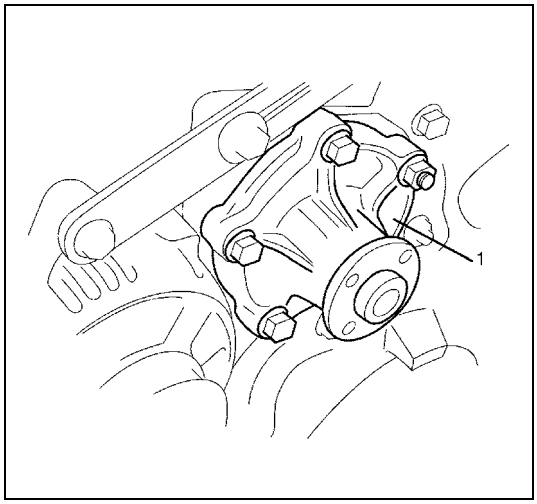


1) Install belt (1) to water pump pulley (2), crankshaft pulley (3) and generator pulley (4).
2) Adjust belt tension by referring to “Water Pump/Generator Drive Belt Tension Inspection and Adjustment” in this section.
3) If vehicle equipped with A/C, install compressor drive belt (5) referring to “Compressor Drive Belt Inspection and Adjustment” in Section 1B.
4) Connect negative cable at battery.

Water Pump Removal and Installation

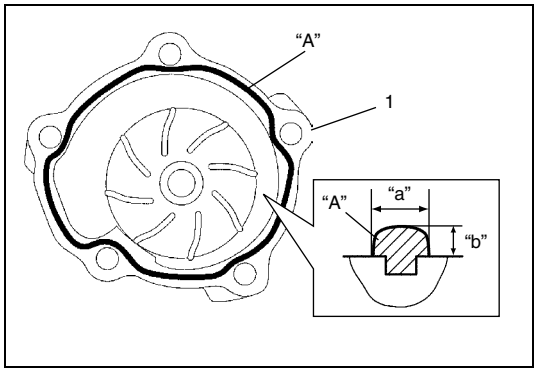
Removal

1) Disconnect negative cable at battery.
2) Drain coolant referring to “Cooling System Draining” in this section.
3) Remove water pump/generator drive belt referring to Water Pump/Generator Drive Belt Removal and Installation” in this section.



4) Remove water pump assembly (1).

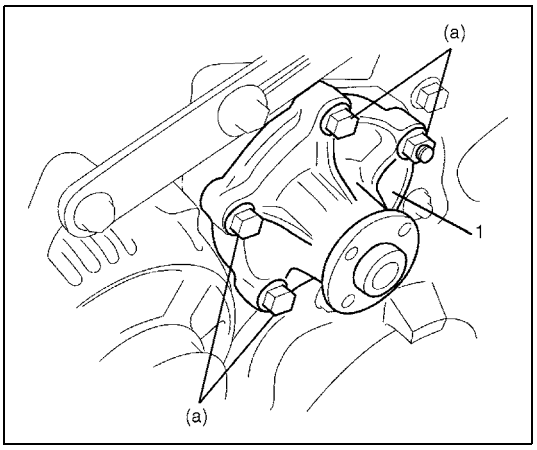
Installation



1) Apply sealant to mating surface of water pump (1) as shown in figure.

“A” : Sealant 99000-31150

Sealant quantity (to mating surface of water pump)
Width “a” : 3 mm (0.12 in.)
Height “b” : 2 mm (0.08 in.)



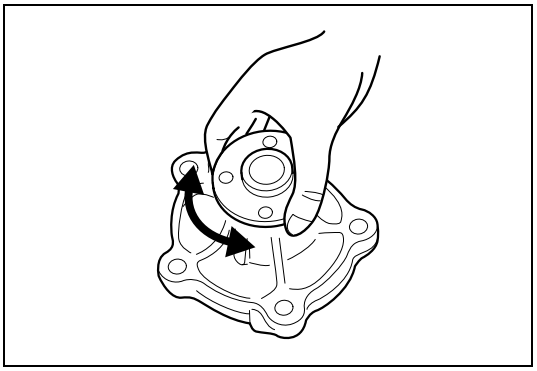
2) Install water pump assembly (1) to cylinder block and tighten bolts and nut to specified torque.

Tightening torque
Water pump bolts and nut (a) : 22 N·m (2.2 kg-m, 16.0 lb-ft)

3) Install water pump pulley.
4) Install water pump/generator drive belt referring to "Water Pump/Generator Drive Belt Removal and Installation" in this Section.
5) Install A/C compressor belt (if equipped) referring to "Compressor Drive Belt Inspection and Adjustment" in Section 1B.
6) Refill cooling system referring to step 7) to 22) of "Cooling System Flush and Refill" in this section.
7) Connect negative cable at battery.
8) Check each part for leakage.

Water Pump Inspection

CAUTION:
Do not disassemble water pump.
If any repair is required on pump, replace it as assembly.



- Rotate water pump by hand to check for smooth operation. If pump does not rotate smoothly or makes abnormal noise, replace it.

Engine Coolant Temperature Sensor (ECT Sensor) Removal and Installation

Refer to "Engine coolant temperature sensor (ECT sensor) removal and installation" in Section 6E1.

Engine Coolant Temperature Sensor (ECT Sensor) Inspection

Refer to "Engine coolant temperature sensor (ECT sensor) inspection" in Section 6E1.

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Ethylene glycol base coolant (Anti-freeze/ Anti-corrosion coolant)	—	Additive to engine cooling system for improving cooling efficiency and for protection against rusting.
Sealant	SUZUKI BOND NO. 1207C (99000-31150)	To apply to mating surface of water pump

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
ETC sensor	15	1.5	11.0
Air ventilation bolt	4.5	0.45	3.5
Thermostat cap bolts	11	1.1	8.0
Thermostat case bolts	25	2.5	18.0
Generator adjusting bolt	23	2.3	17.0
Generator pivot bolt	50	5.0	36.5
Water pump bolts and Nuts	22	2.2	16.0

SECTION 6C

ENGINE FUEL

WARNING:

For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CAUTION:

The engine of this vehicle requires the use of unleaded fuel only. Use of leaded and/or low lead fuel can result in engine damage and reduce the effectiveness of the emission control system.

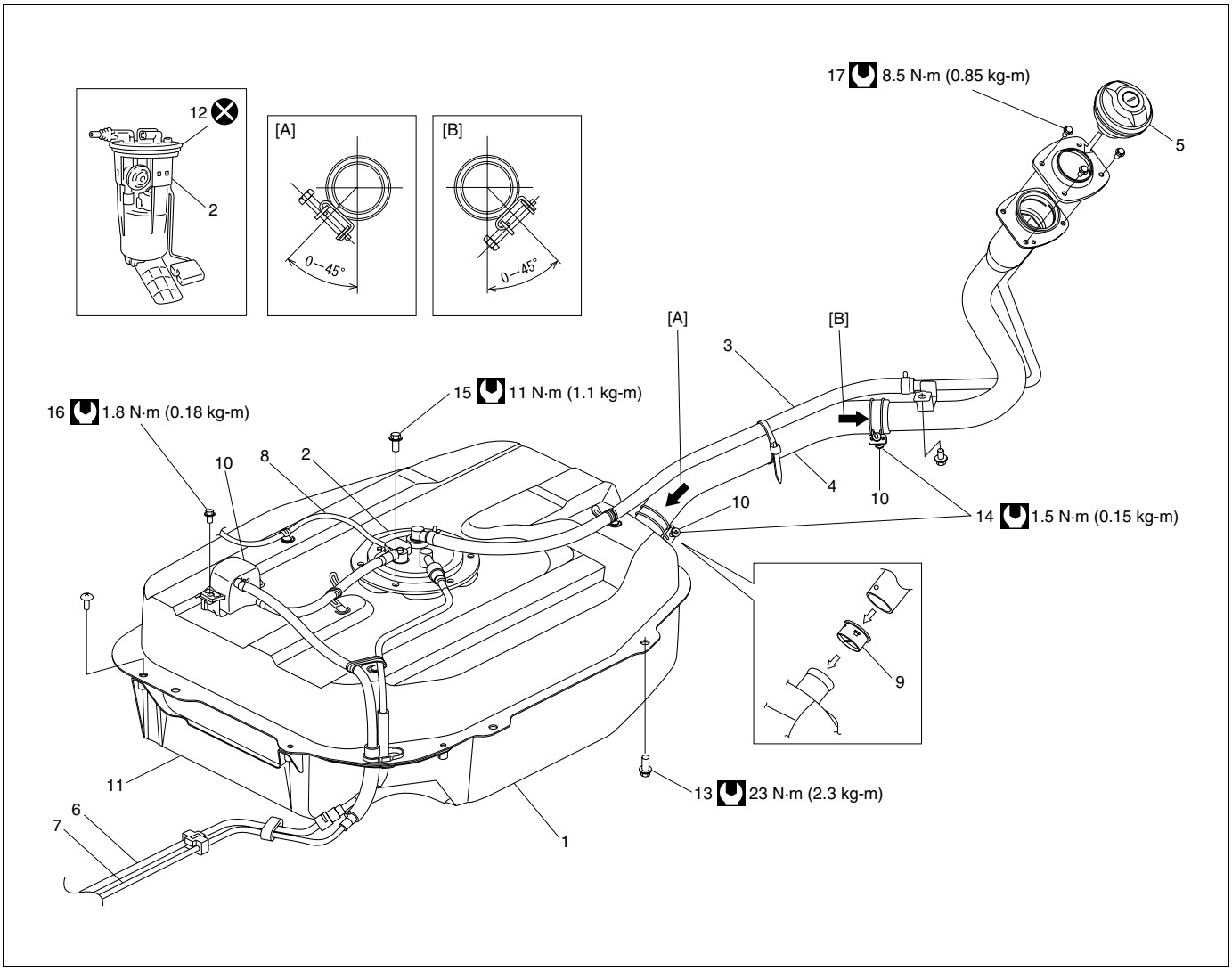
CONTENTS

General Description

The main components of the fuel system are fuel tank, fuel pump assembly (with fuel filter, fuel level gauge, fuel pressure regulator and tank pressure control valve), fuel/vapor separator fuel feed line and fuel vapor line.
For the details of fuel flow and fuel vapor flow, refer to "General Description" in Section 6E1.

On-Vehicle Service

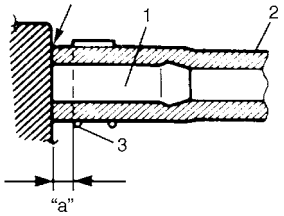
Fuel System Components



[A] : VIEW: X	4. Fuel tank filler hose	10. Fuel/vapor separator	16. Fuel/vapor separator screw
[B] : VIEW: Y	5. Fuel filler cap	11. Tank cover	17. Fuel filler neck screw
"A" : DOT MARK ON HOSE	6. Fuel feed line	12. Fuel pump gasket	⊗ Do not reuse.
1. Fuel tank	7. Fuel vapor line	13. Fuel tank bolt (4 pcs.)	Tightening torque
2. Fuel pump assembly	8. Wire harness for fuel pump	14. Fuel filler hose clamp screw	
3. Breather hose	9. Fuel tank inlet valve	15. Fuel pump bolt (6 pcs.)	

Precautions

[A]



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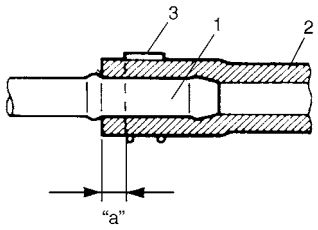

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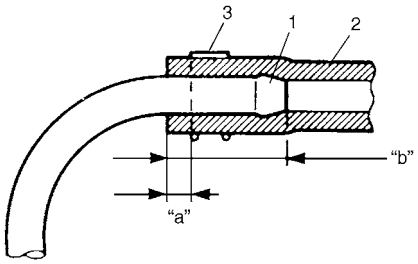

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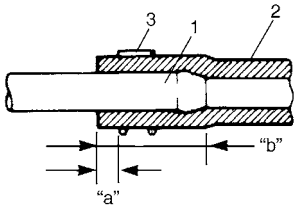

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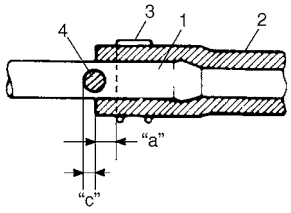
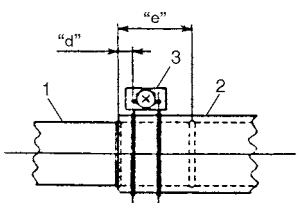


[F]



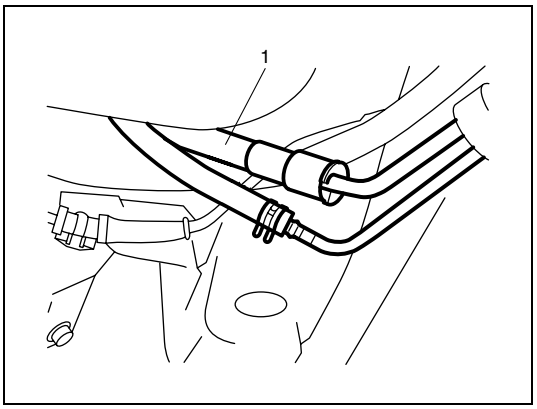
WARNING:

Before attempting service of any type on fuel system, the following should be always observed in order to reduce the risk or fire and personal injury.

- **Disconnect negative cable at battery.**
- **Do not smoke, and place no smoking signs near work area.**
- **Be sure to have CO_2 fire extinguisher handy.**
- **Be sure to perform work in a well-ventilated area and away from any open flames (such as gas hot heater).**
- **Wear safety glasses.**
- **To relieve fuel vapor pressure in fuel tank, remove fuel filler cap from fuel filler neck and then reinstall it.**
- **As fuel feed line is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected.**
  Before loosening or disconnecting fuel feed line, make sure to relieve fuel pressure "Fuel pressure relief procedure" in Section 6.
- **A small amount of fuel may be released after the fuel line is disconnected. In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth. Be sure to put that cloth in an approved container when disconnection is completed.**
- **Note that fuel hose connection varies with each type of pipe. Be sure to connect and clamp each hose correctly referring to the figure.**

[A] :	With short pipe, fit hose as far as it reaches pipe joint as shown.
[B] :	With the following type pipe, fit hose as far as its peripheral projection as shown.
[C] :	With bent pipe, fit hose as far as its bent part as shown or till depth "b".
[D] :	With straight pipe, fit hose till depth "b".
[E] :	With red marked pipe, fit hose end reaches red mark on pipe.
[F] :	For fuel tank filler hose, insert it to spool or welding-bead.
1.	Pipe
2.	Hose
3.	Clamp
4.	Ped mark
"a" :	Clamp securely at a position 3 – 7 mm (0.12 – 0.27 in.) from hose end.
"b" :	20 – 30 mm (0.79 – 1.18 in.)
"c" :	0 – 5 mm (0 – 0.19 in.)
"d" :	5 – 12 mm (0.2 – 0.47 in)
"e" :	40 mm (1.57 in)

Fuel Lines Inspection



CAUTION:
Due to the fact that fuel feed line (1) is under high pressure, use special care when servicing it.

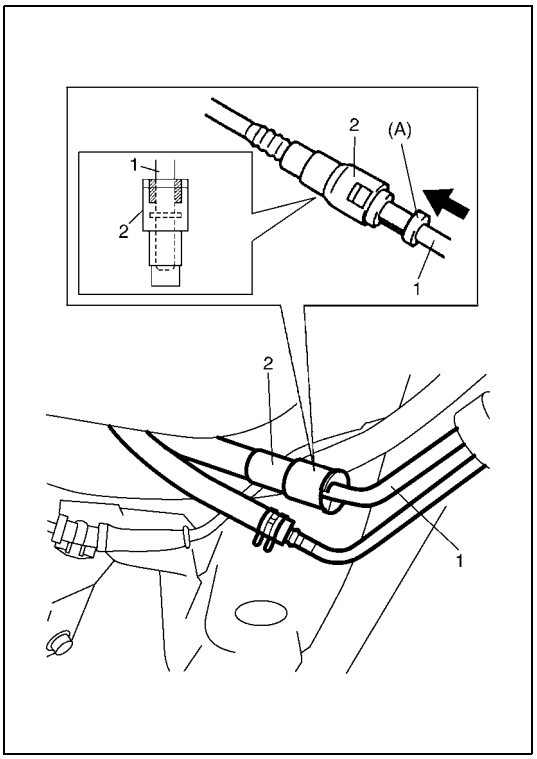
Visually inspect fuel lines for evidence of fuel leakage, hose crack and deterioration, or damage.
Make sure all clamps are secure.
Replace parts as needed.

Fuel Pipe Removal and Installation

WARNING:
A small amount of fuel may be released after disconnecting fuel hose. In order to reduce the chance of personal injury, cover hose and pipe to be disconnected with a shop cloth.
Be sure to put that cloth in an approved container when disconnection is completed.

Removal

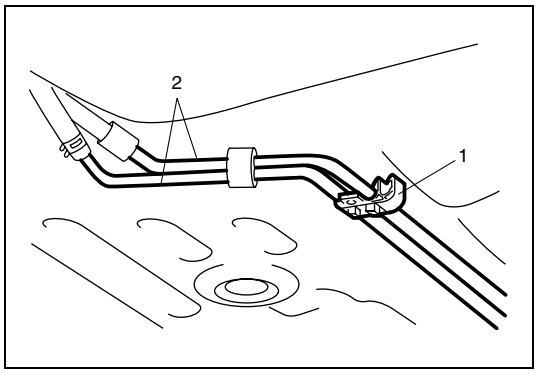
1) Relieve fuel pressure in fuel feed line according to “Fuel pressure relief procedure” in Section 6.
2) Disconnect negative cable at battery.



3) Disconnect fuel pipe joint and fuel hose from fuel pipe at the front and rear of each fuel pipe.
   For quick joint (2), disconnect it as follows :
   a) Remove mud, dust and/or foreign material between pipe (1) and joint by blowing compressed air.
   b) Unlock joint lock by inserting special tool between pipe and joint.

   Special tool
   (A) : 09919-47020

   c) Disconnect joint (2) from pipe (1).



4) Mark the location of clamps (1) on fuel pipes (2), so that the clamps can be reinstalled to where they were.
5) Remove pipes (2) with clamp (1) from vehicle.
6) Remove clamp (1) from pipes (2).

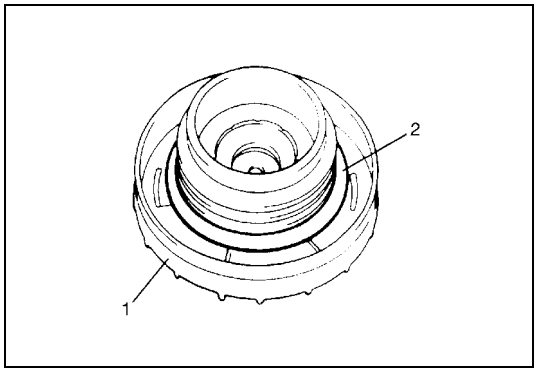
Installation

1) Install clamps to marked location on pipes. If clamp is deformed or its claw is bent or broken, replace it with new one.
2) Install pipes with pipe clamps to vehicle.
3) Connect fuel hoses and pipes to each pipe.

CAUTION:
When connecting joint, clean outside surfaces of pipe where joint is to be inserted, push joint into pipe till joint lock clicks and check to ensure that pipes are connected securely, or fuel leak may occur.

4) With engine OFF, turn ignition switch to ON position and check for fuel leaks.

Fuel Filler Cap Inspection



Remove cap (1), and check gasket for even filler neck imprint, and deterioration or any damage. If gasket (2) is in malcondition, replace cap.

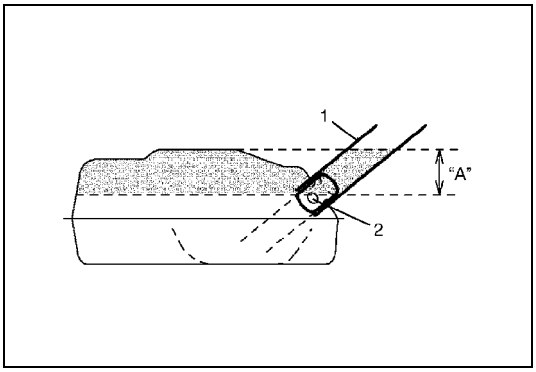
NOTE:
If cap requires replacement, only a cap with the same features should be used. Failure to use correct cap can result in critical malfunction of system.

Fuel Tank Inlet Valve Removal and Installation

WARNING:
Before starting the following procedure, be sure to observe "Precautions" in this section.

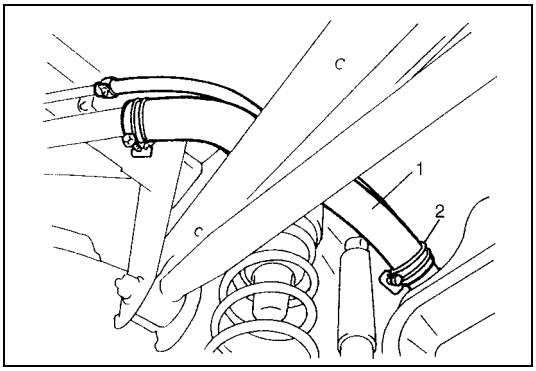
Removal

1) Remove fuel filler cap.

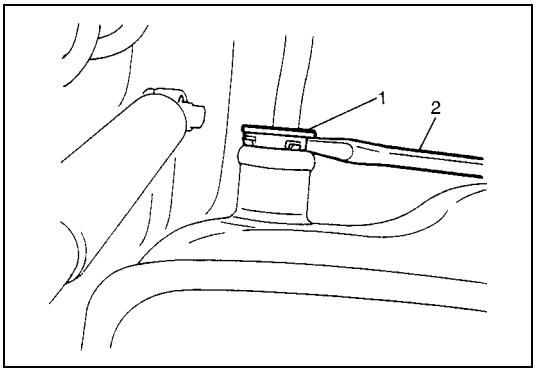


2) Insert hose of a hand operated pump into fuel filler hose (1) and drain fuel in space "A" in the figure.

CAUTION:
Do not force pump hose into fuel tank, or pump hose may damage fuel tank inlet valve (2).



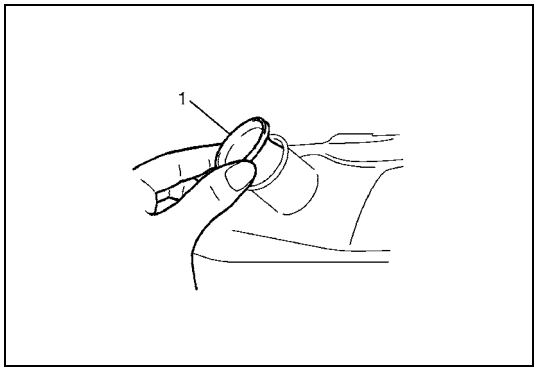
3) Hoist vehicle, and remove clamp (2) and fuel filler hose (1) from fuel tank.



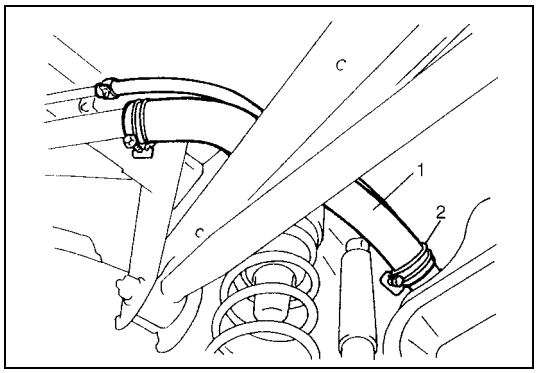
4) Remove fuel tank inlet valve (1) using flat head rod (2) or the like.

CAUTION:
Be careful not to damage fuel tank inlet valve (1) with flat head rod (2) or the like.

Installation

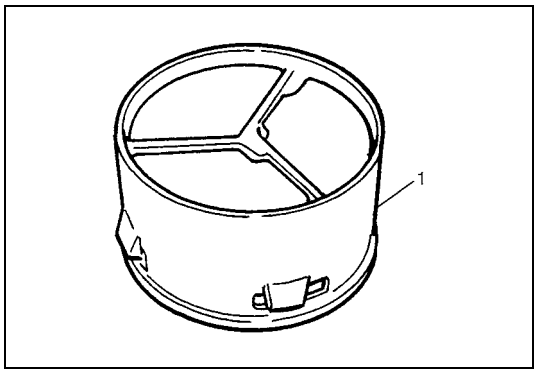


1) Install fuel tank inlet valve (1) to fuel tank.



2) Install fuel filler hose (1) to fuel tank and secure it with clamp (2).
   For proper installation, refer to “Fuel System Components” in this section.
3) Lower vehicle and install fuel filler cap.

Fuel Tank Inlet Valve Inspection



Check fuel tank inlet valve (1) for the following.

- Damage
- Smooth opening and closing

If any damage or malfunction is found, replace.

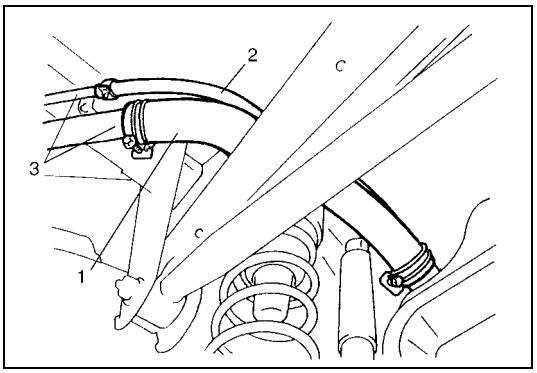
Fuel Tank Removal and Installation

Removal

WARNING:

- **Before starting the following procedure, be sure to observe “Precautions” in this section.**
- **A small amount of fuel may be released after the fuel hose is disconnected. In order to reduce the chance of personal injury, cover the hose and pipe to be disconnected with a shop cloth. Be sure to put that cloth in an approved container when disconnection is completed.**

1) Relieve fuel pressure in fuel feed line according to “Fuel pressure relief procedure” in Section 6.
2) Disconnect negative cable at battery.
3) Hoist vehicle.

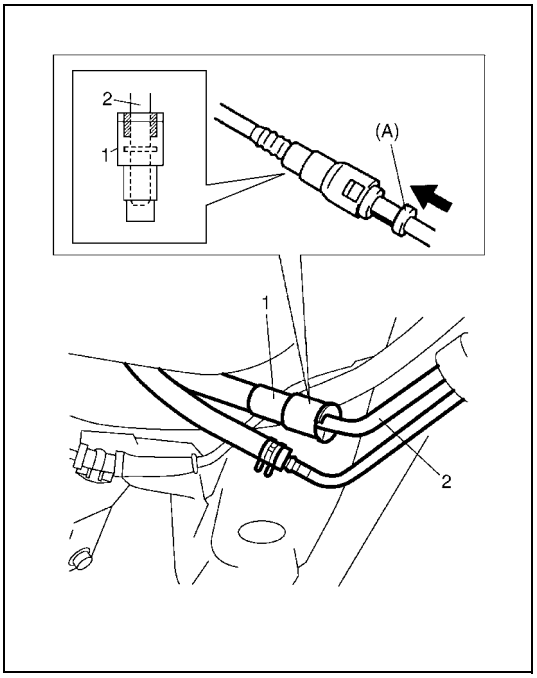


4) Disconnect fuel filler hose (1) and breather hose (2) from filler neck (3).

CAUTION:
Never disconnect fuel filler hose (1) from fuel tank inlet. If half or more of fuel is remaining to fuel tank, fuel over flows in this case and come out.

5) Due to absence of fuel tank drain plug, drain fuel tank by pumping fuel out through fuel tank filler.
Use hand operated pump device to drain fuel tank.

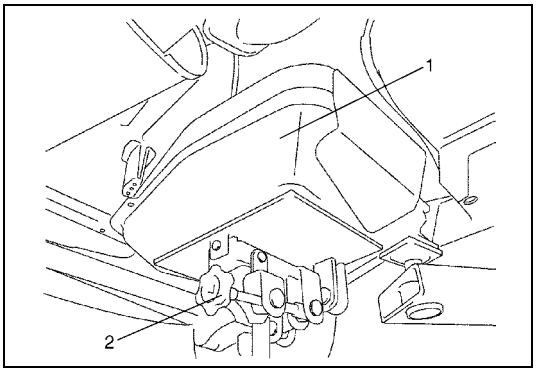
CAUTION:
- **Do not force pump hose into fuel tank, or pump hose may damage fuel tank inlet valve.**
- **Never drain or store fuel in an open container due to possibility of fire or explosion.**



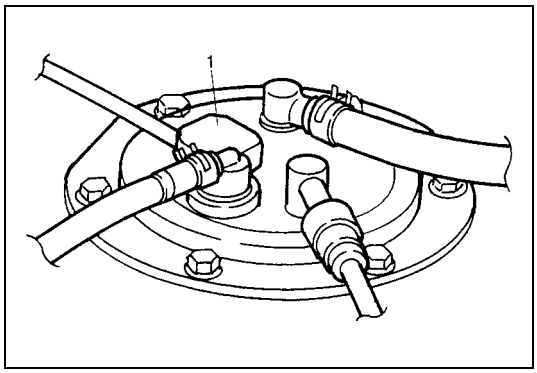
6) Disconnect fuel pipe joint and fuel hoses from pipes.
For quick joint, disconnect it as follows :
a) Remove mud, dust and/or foreign material between pipe and joint by blowing compressed air.
b) Unlock joint (1) lock by inserting special tool between pipe (2) and joint (1).

Special tool
(A) : 09919-47020

c) Disconnect joint from pipe.



7) Support fuel tank (1) with jack (2) and remove its mounting bolts.

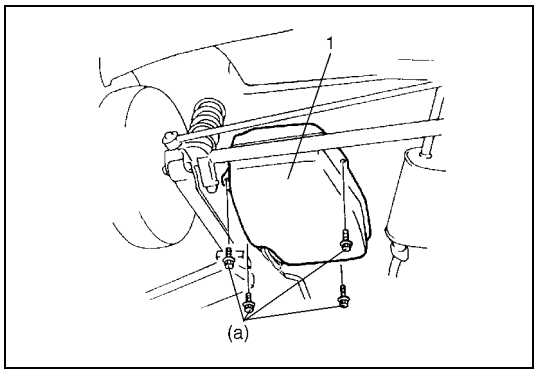


8) Lower fuel tank a little as to disconnect wire harness at connector (1), then remove fuel tank.

Installation

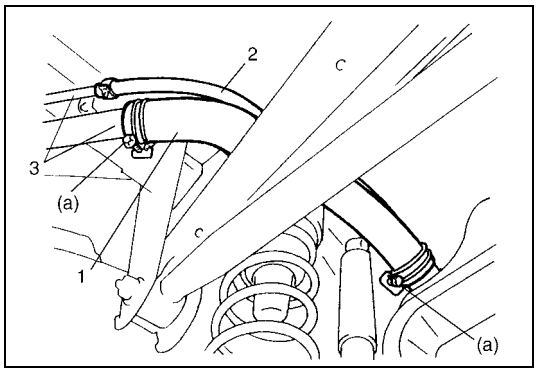
CAUTION:
- **When connecting joint, clean outside surfaces of pipe where joint is to be inserted, push joint into pipe till joint lock clicks and check to ensure that pipes are connected securely, or fuel leak may occur.**
- **Never let the fuel hoses touch the ABS sensor harness (if equipped).**

1) If parts have been removed from fuel tank, install them before installing fuel tank to vehicle.



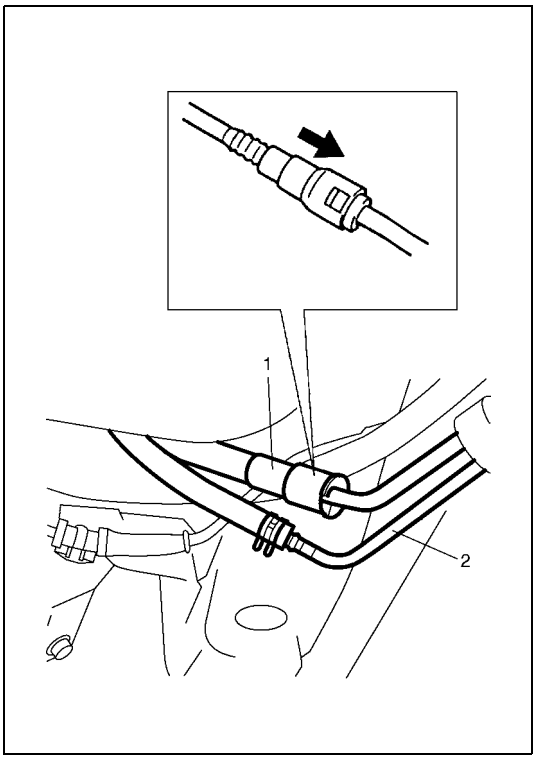
2) Raise fuel tank (1) with jack and connect connector of fuel pump and gauge and clamp wire harness.
3) Install fuel tank (1) to vehicle.

Tightening torque
Fuel tank bolt (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)



4) Connect fuel filler hose (1) and breather hose (2) to filler neck (3) as shown in figure and clamp them securely.

Tightening torque
Fuel filler hose clamp (a) : 1.5 N·m (0.15 kg-m, 1.0 lb-ft)



5) Connect fuel feed hose (1) and vapor hose (2) to each pipe as shown in figure and clamp them securely.
6) Connect negative cable at battery.
   With engine OFF, turn ignition switch to ON position and check for fuel leaks.

Fuel Tank Inspection

After removing fuel tank, check hoses and pipes connected to fuel tank for leaks, loose connections, deterioration or damage. Also check fuel pump assembly gaskets for leaks, visually inspect fuel tank for leaks and damage.
Replace any damaged or malconditioned parts.

Fuel Tank Purging Procedure

WARNING:
This purging procedure will not remove all fuel vapor. Do not attempt any repair on tank using heat of flame as an explosion resulting in personal injury could occur.

CAUTION:
Never remain water in fuel tank after washing, or fuel tank inside will get corrosion.

The following procedure are used for purging fuel tank.

1) After removing fuel tank, remove all hoses, pipes and fuel pump assembly from fuel tank.
2) Drain all remaining fuel from tank.
3) Place fuel tank to flushing area.
4) Fill tank with warm water or tap water, and agitate vigorously and drain. Repeat this washing until inside of tank is clean. Replace tank if its inside is rusty.
5) Completely flush out remaining water after washing.

Fuel Pump On-Vehicle Inspection

Refer to “Fuel Delivery System” and/or “Fuel pump with pressure regulator on-vehicle inspection” in Section 6E1.

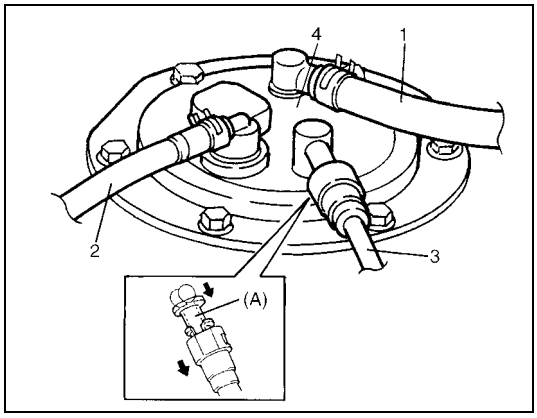
Fuel Pump Assembly Removal and Installation

WARNING:

Before starting the following procedure, be sure to observe “Precautions” in this section.

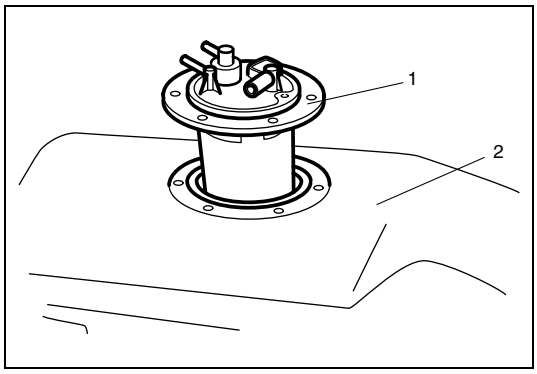
Removal

1) Remove fuel tank from vehicle referring to “Fuel Tank Removal and Installation” in this section.



2) Disconnect fuel breather hose (1), fuel vapor hose (2) and pipes from fuel pump assembly (4).
   When disconnecting joint of fuel feed line (3) from pipe, unlock joint by inserting special tool between pipe and joint lock first.

Special tool
(A) : 09919-47020

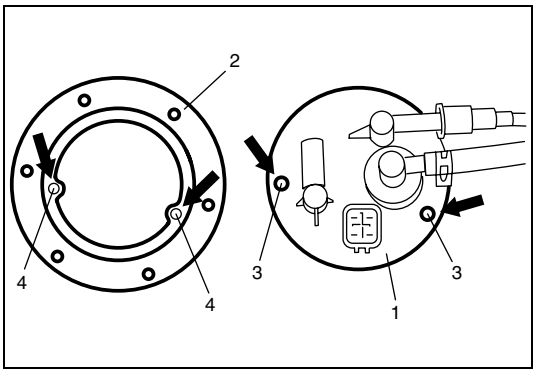


3) Remove fuel pump assembly (1) from fuel tank (2).

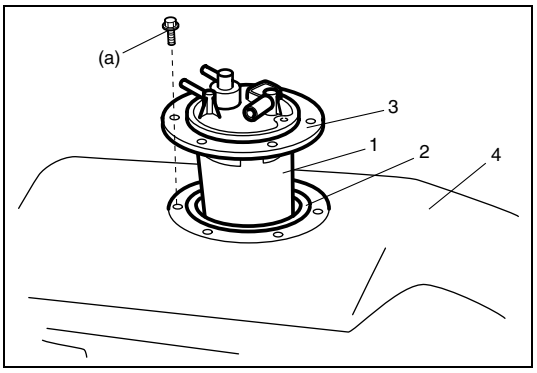
Installation

CAUTION:

When connecting joint, clean outside surface of pipe where joint is to be inserted, push joint into pipe till joint lock clicks and check to ensure that pipes are connected securely, or fuel leak may occur.

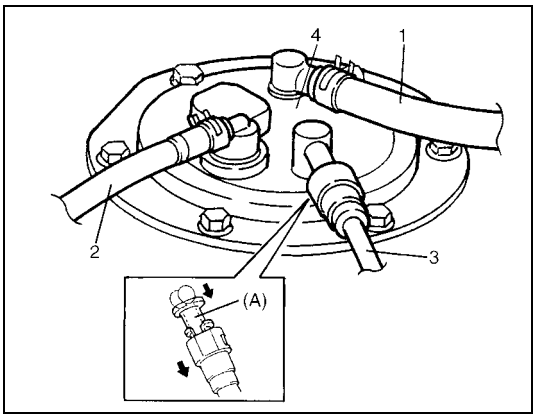


1) Clean mating surfaces of fuel pump assembly (1) and fuel tank.
2) Put plate (2) on fuel pump assembly (1) by matching the protrusion of fuel pump assembly (3) to plate hole (4) as shown.



3) Install new gasket (2) and fuel pump assembly (1) with plate (3) to fuel tank (4).

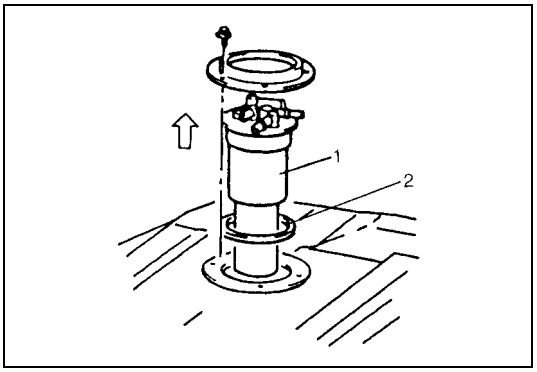
Tightening torque
Fuel pump assembly bolts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)



4) Connect fuel breather hose (1), fuel vapor hose (2) and fuel feed line (3) (pipe joint) to fuel pump assembly (4).

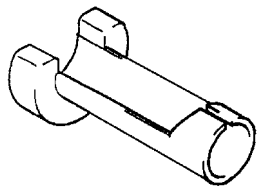
5) Install fuel tank (1) to vehicle referring to “Fuel Tank Removal and Installation” in this section.

Fuel Pump Inspection



- Check fuel pump assembly for damage.
- Check fuel suction filter (1) for evidence of dirt and contamination.
  If present, replace or clean and check for presence of dirt in fuel tank.
- For electrical circuit, refer to “Table B-3 Fuel Pressure Check” in Section 6.
- For inspection of fuel level gauge (2), refer to “Fuel Level Sensor (Gauge Unit) Inspection” in Section 8C.

Special Tool



09919-47020
Quick joint remover

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Fuel tank bolts	23	2.3	17.0
Fuel filler hose clamps	1.5	0.15	1.0
Fuel pump assembly bolts	11	1.1	8.0
Fuel filler neck bolts	8.5	0.85	6.5
Fuel/vapor separator screw	1.8	0.18	1.5

SECTION 6E1

ENGINE AND EMISSION CONTROL SYSTEM

WARNING:

For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in Section 10B in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in Section 10B before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

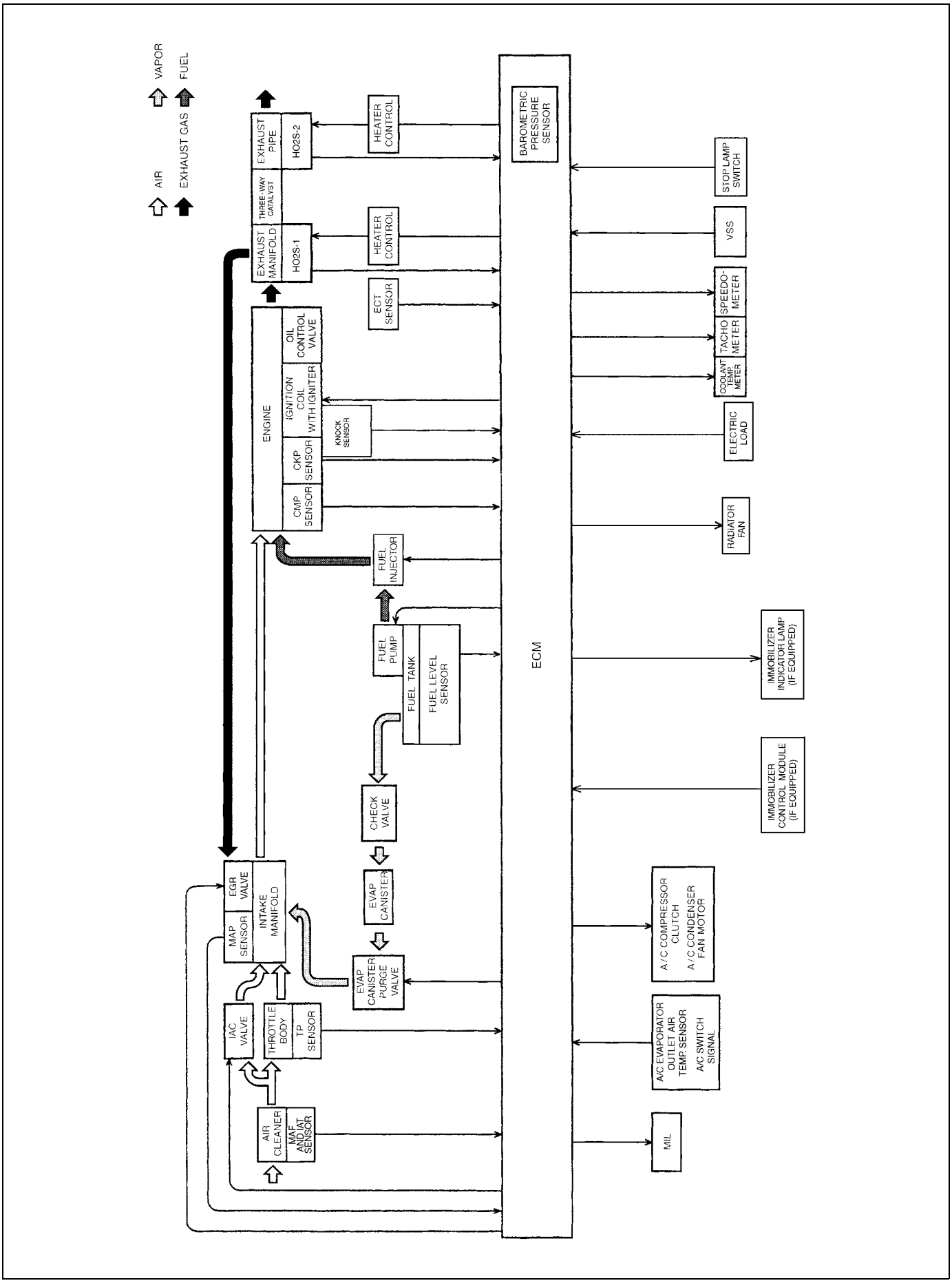
CONTENTS

General Description

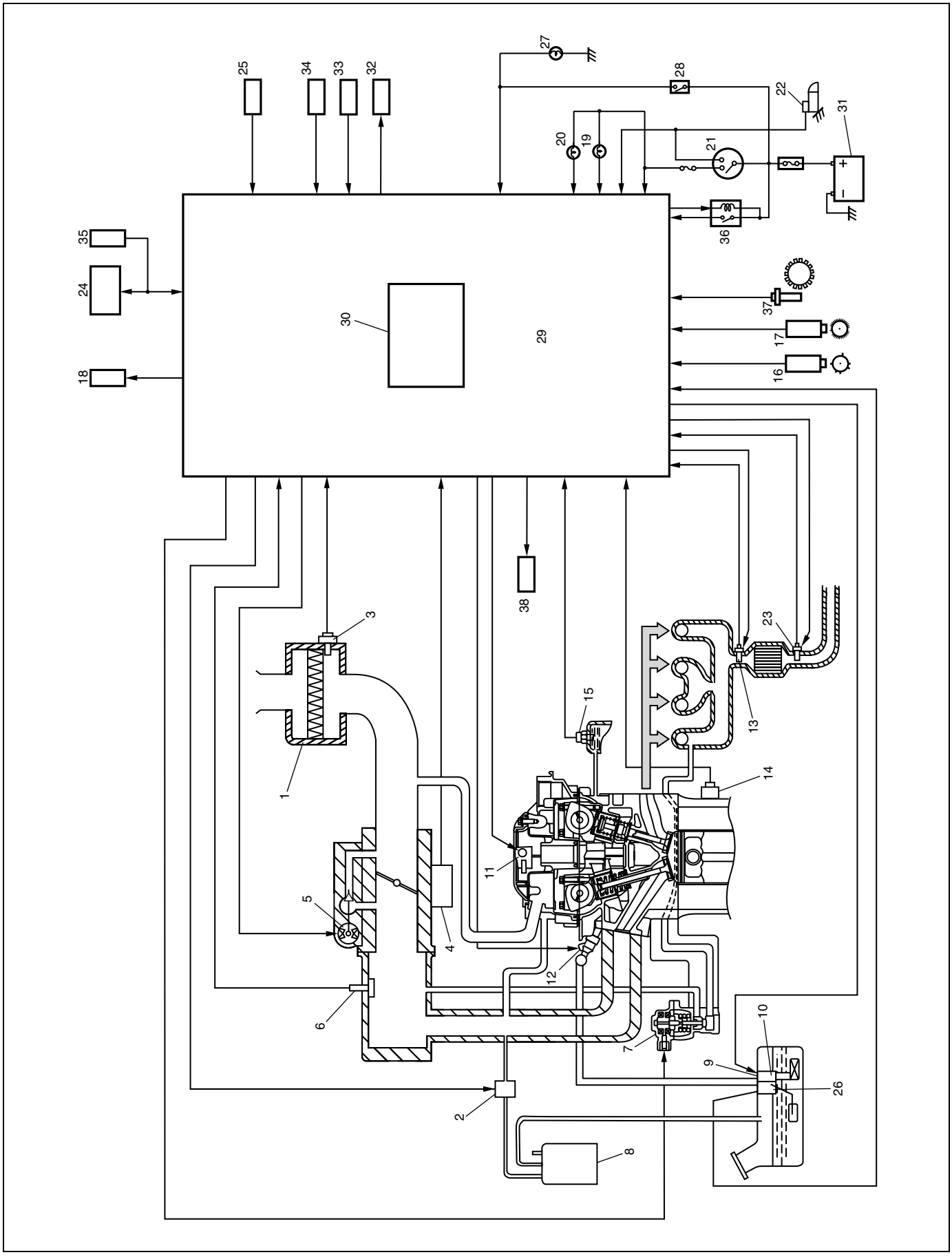
Engine and Emission Control System Construction

The engine and emission control system is divided into 4 major sub-systems: air intake system, fuel delivery system, electronic control system and emission control system.
Air intake system includes air cleaner, throttle body, IAC valve and intake manifold.
Fuel delivery system includes fuel pump, delivery pipe, etc. Electronic control system includes ECM, various sensors and controlled devices.
Emission control system includes EGR, EVAP and PCV system.

ENGINE AND EMISSION CONTROL SYSTEM FLOW DIAGRAM



ENGINE AND EMISSION CONTROL SYSTEM DIAGRAM



1. Air Cleaner	14. Knock sensor	27. Stop lamp
2. EVAP canister purge valve	15. ECT sensor	28. Stop lamp switch
3. MAF and IAT sensor	16. CMP sensor	29. ECM
4. TP sensor	17. CKP sensor	30. Barometric pressure sensor (if equipped)
5. IAC valve	18. Radiator fan	31. Battery
6. MAP sensor	19. Malfunction indicator lamp in combination meter	32. A/C compressor and condenser fan relay (if equipped)
7. EGR valve	20. Immobilizer indicator lamp in combination meter	33. A/C switch (if equipped)
8. EVAP canister	21. Ignition switch	34. A/C evaporator outlet air temp. sensor (if equipped)
9. Tank pressure control valve (built-in fuel pump)	22. Starter magnetic switch	35. Immobilizer control module (if equipped)
10. Fuel pump (with pressure regulator)	23. Heated Oxygen Sensor–2 (HO2S–2)	36. Main relay
11. Ignition coil assembly	24. DLC	37. VSS
12. Fuel injector	25. Electric load	38. Oil control valve
13. Heated Oxygen Sensor–1 (HO2S–1)	26. Fuel level sensor	

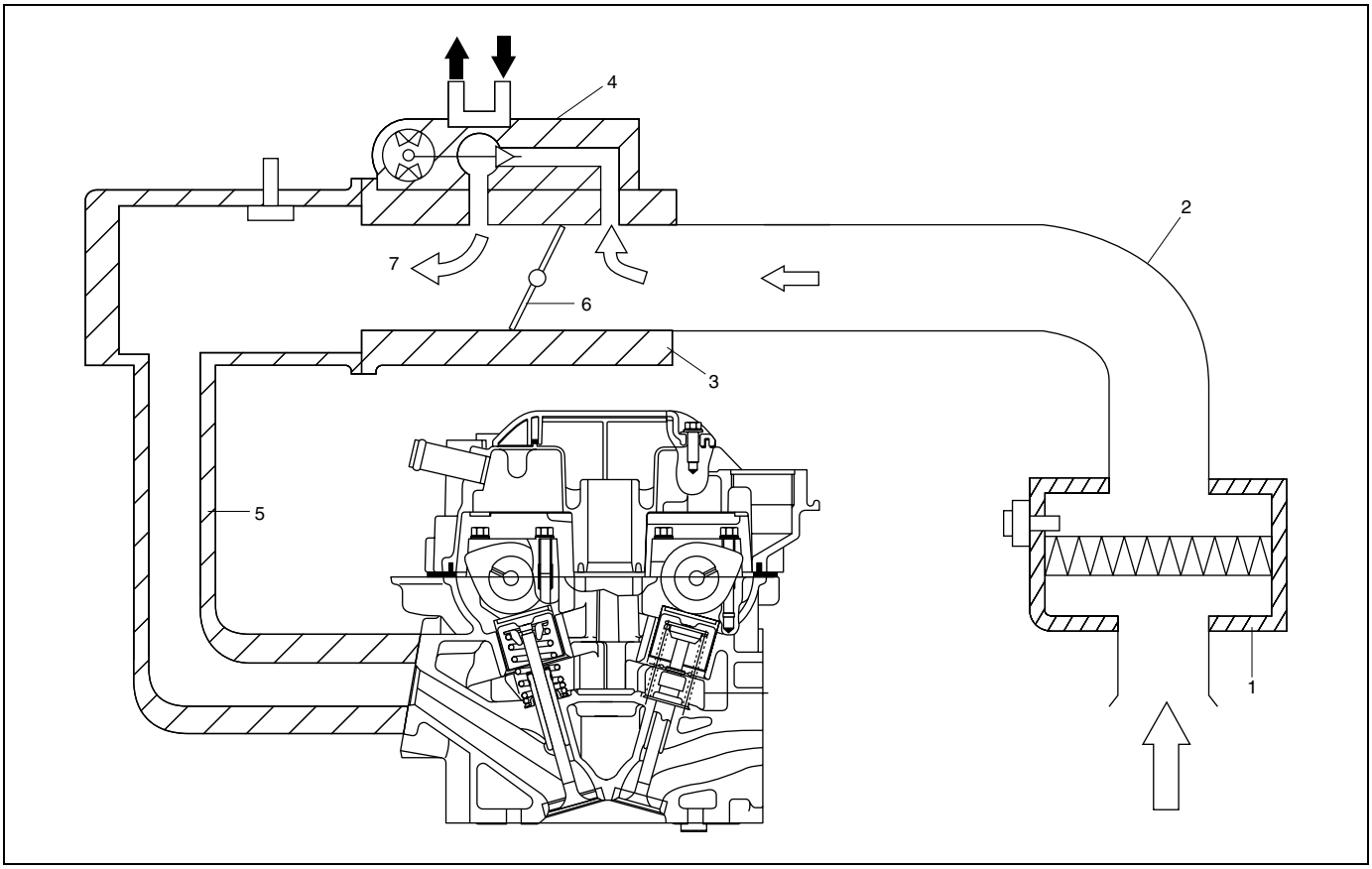
Air Intake System Description

The main components of the air intake system are air cleaner (1), air cleaner outlet hose (2), throttle body (3), idle air control valve (4) and intake manifold (5).

The air (by the amount corresponding to the throttle valve (6) opening and engine speed) is filtered by the air cleaner (1), passes through the throttle body (3), is distributed by the intake manifold (5) and finally drawn into each combustion chamber.

When the idle air control valve (4) is opened according to the signal from ECM, the air (7) bypasses the throttle valve (6) through bypass passage and is finally drawn into the intake manifold (5).

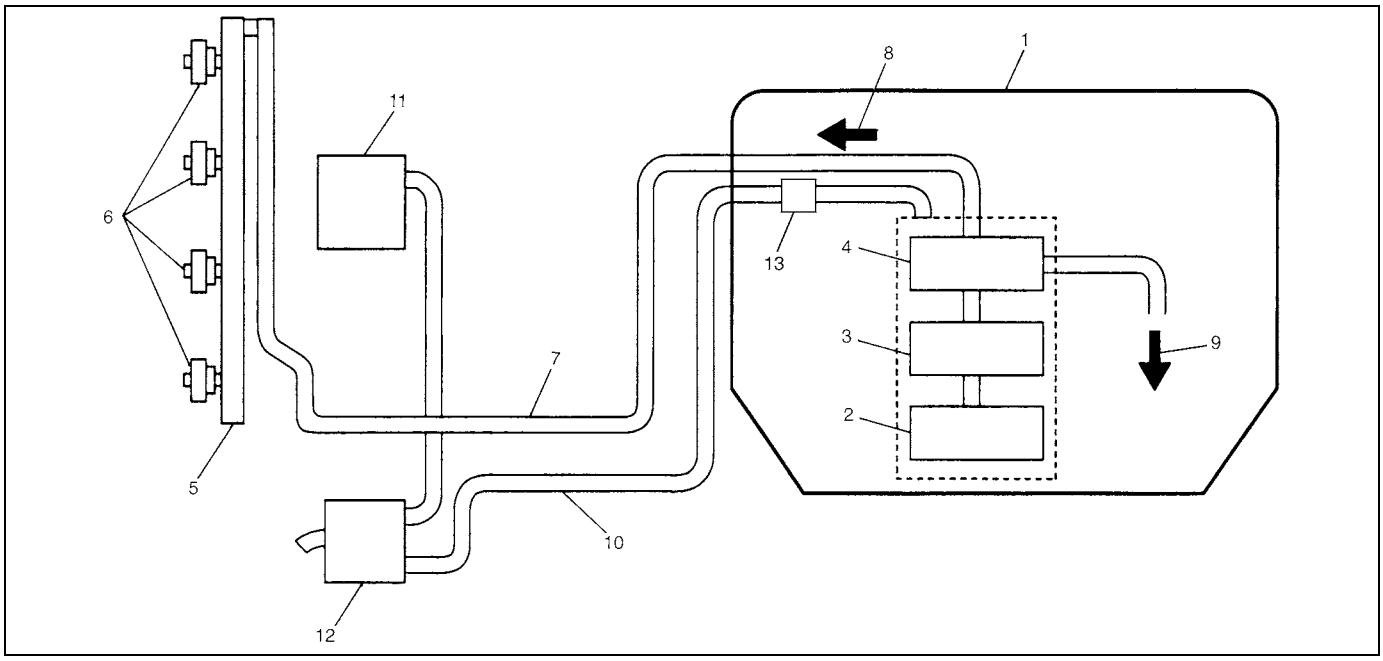
AIR INTAKE SYSTEM DIAGRAM



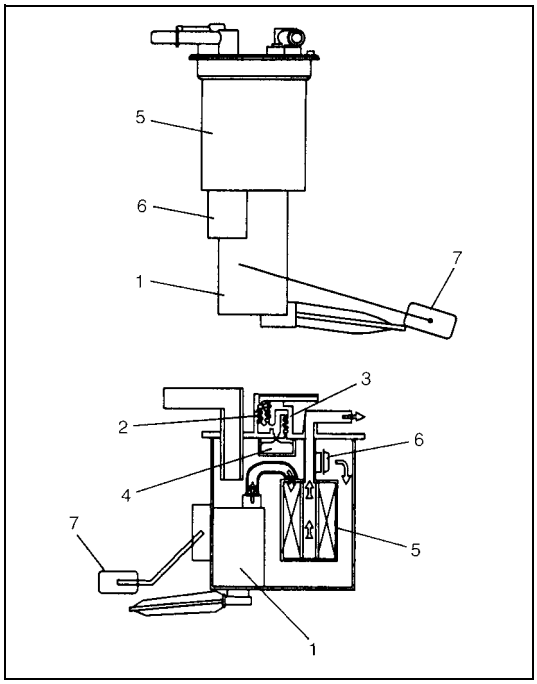
Fuel Delivery System Description

The fuel system consists of fuel tank (1), fuel pump (2) (with built-in fuel filter (3) and fuel pressure regulator (4)), delivery pipe (5), injectors (6) and fuel feed line (7).
The fuel (8) in the fuel tank (1) is pumped up by the fuel pump (2), sent into delivery pipe (5) and injected by the injectors (6).
As the fuel pump assembly is equipped with built-in fuel filter (3) and fuel pressure regulator (4), the fuel (8) is filtered and its pressure is regulated before being sent to the delivery pipe (5).
The excess fuel from fuel pressure regulation process is returned back (9) into the fuel tank.
Also, fuel vapor generated in fuel tank is led through the fuel vapor line (10) into the EVAP canister (12).

FUEL DELIVERY SYSTEM DIAGRAM



11. Intake manifold	13. Fuel vapor separator



FUEL PUMP

An in-tank type electric pump has been adopted for the fuel pump (1). Incorporated in the pump assembly are;

- Tank pressure control valve (2) which keeps the pressure in the fuel tank constant, and prevents the fuel from spouting and tank itself from being deformed.
- Relief valve (3) which prevents the pressure in tank from rising excessively.
- Fuel cut valve (4) which closes as the float rises so that the fuel will not enter the canister when the fuel level in the tank rises high depending on the fuel level in the tank and the vehicle tilt angle.

Also, a fuel filter (5) and a fuel pressure regulator (6) are included and a fuel level gauge (7) is attached.
Addition of the fuel pressure regulator (6) to the fuel pump makes it possible to maintain the fuel pressure at constant level and ECM controls compensation for variation in the intake manifold pressure.

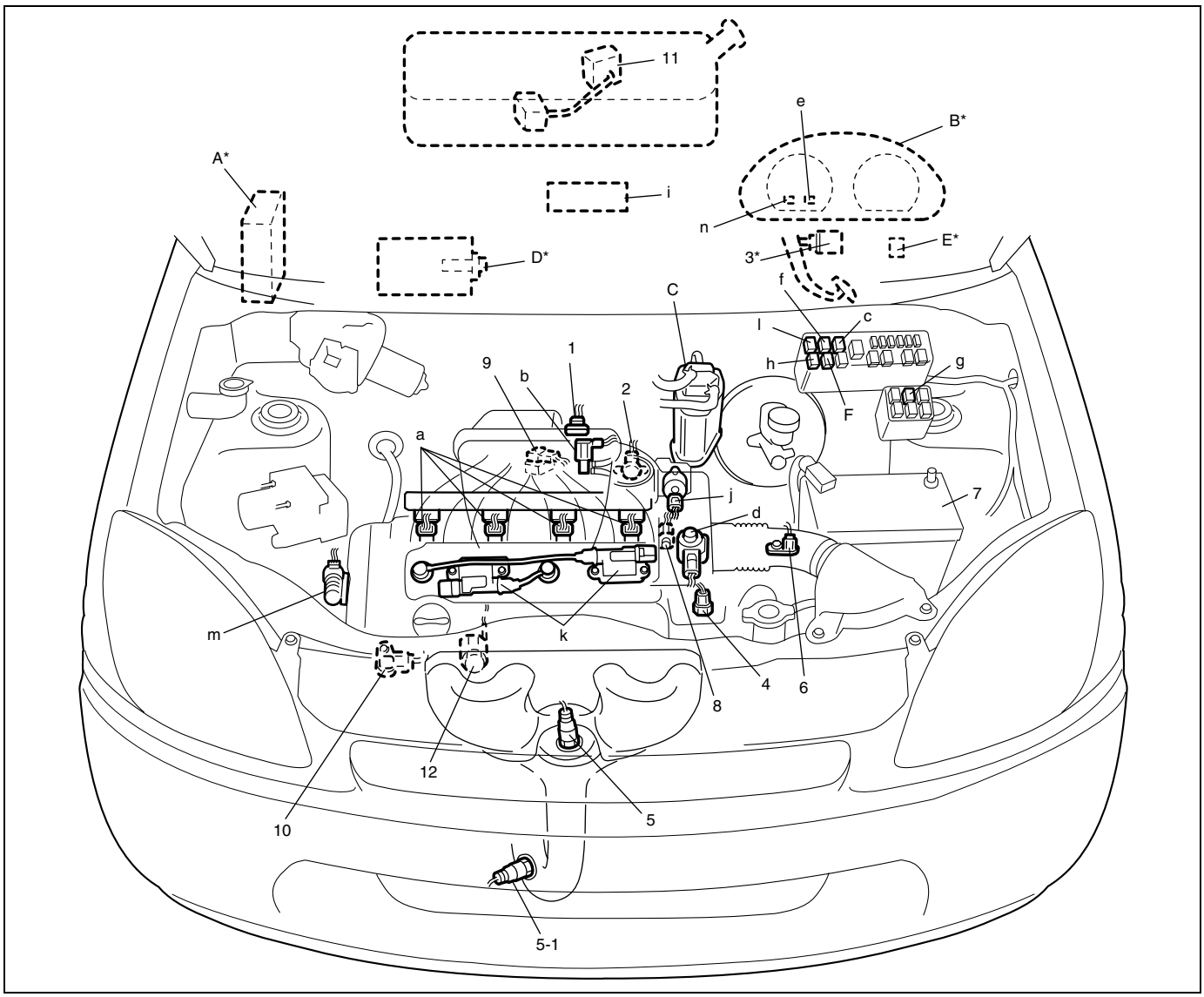
Electronic Control System Description

The electronic control system consists of 1) various sensors which detect the state of engine and driving conditions, 2) ECM which controls various devices according to the signals from the sensors and 3) various controlled devices.

Functionally, it is divided into nine sub systems:

- Fuel injection control system
- Idle speed control system
- Fuel pump control system
- A/C control system (if equipped)
- Radiator fan control system
- EGR system
- Evaporative emission control system
- Oxygen sensor heater control system
- Ignition control system

ELECTRONIC CONTROL SYSTEM COMPONENT LOCATION



INFORMATION SENSORS	CONTROL DEVICES	OTHERS
1. MAF and IAT sensor	a: Fuel injector	A: ECM
2. TP sensor	b: EVAP canister purge valve	B: Combination meter
3. Stop lamp switch	c: Fuel pump relay	C: EVAP canister
4. ECT sensor	d: EGR valve	D: A/C evaporator outlet air temp. sensor (if equipped)
5. Heated oxygen sensor–1	e: Malfunction indicator lamp	E: Data link connector
5-1. Heated oxygen sensor–2	f: A/C condenser fan relay No.1 (if equipped)	F: A/C compressor relay (if equipped)
6. VSS	g: A/C condenser fan relay No.2 (if equipped)	
7. Battery	h: Radiator fan relay	
8. CMP sensor	i: Fuel cost meter	
9. MAP sensor	j: IAC valve	
10. CKP sensor	k: Ignition coil assembly (with ignitor)	
11. Fuel level sensor	l: Main relay	
12. Knock sensor	m: Oil control valve	
	n: Immobilizer indicator lamp	

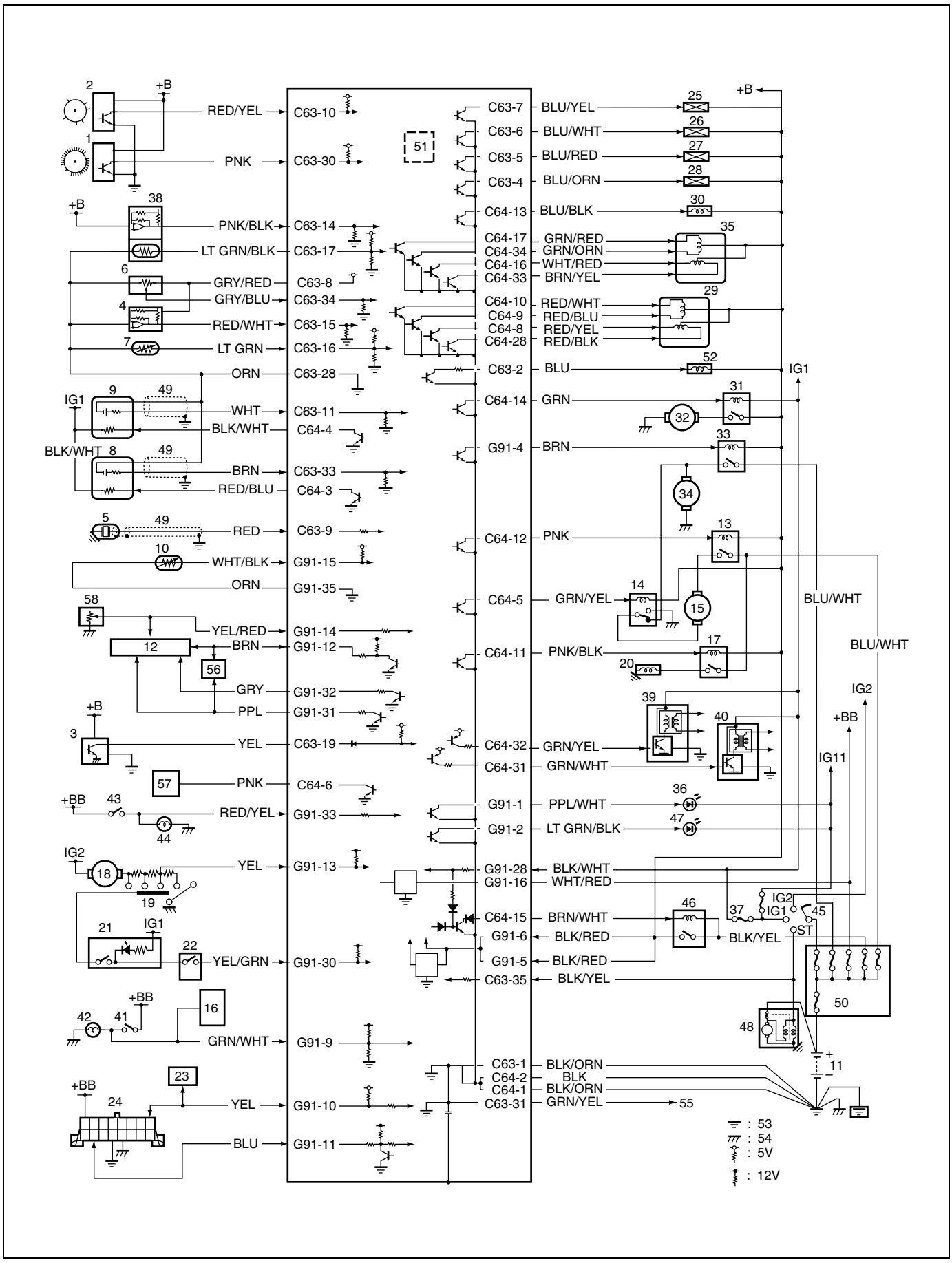
NOTE:

Above figure shows left-hand steering vehicle. For right-hand steering vehicle, parts with (*) are installed at the opposite side.

ENGINE AND EMISSION CONTROL INPUT/OUTPUT TABLE

INPUT \ OUTPUT		ELECTRIC CONTROL DEVICE											
		FUEL PUMP RELAY	FUEL INJECTOR	HO2S HEATER	IAC VALVE	IGNITION COIL WITH IGNITER	EGR VALVE	EVAP CANISTER PURGE VALVE	A/C COMPRESSOR AND CONDENSER FAN RELAY	RADIATOR FAN RELAY	MIL	MAIN RELAY	OIL CONTROL VALVE
SIGNAL FROM SENSOR, SWITCH AND CONTROL MODULE	FUEL LEVEL SENSOR	For detecting fuel level											
	BAROMETRIC PRESSURE SENSOR		○		○	○		○			○		
	STOP LAMP SWITCH				○								
	START SWITCH	○	○	○	○		○		○		○		○
	IGNITION SWITCH	○	○	○	○	○	○	○	○	○		○	○
	LIGHTING SWITCH				○								
	BLOWER SWITCH				○				○				
	A/C SWITCH				○			○	○	○			
	A/C EVAP OUTLET AIR TEMP. SENSOR				○				○				
	VSS		○		○		○		○	○	○		○
	HEATED OXYGEN SENSOR-1		○					○			○		
	HEATED OXYGEN SENSOR-2	For detecting deterioration of three way catalytic converter									○		
	MAF SENSOR		○	○	○	○	○	○			○		
	IAT SENSOR		○		○	○	○	○			○		
	ECT SENSOR		○	○	○	○	○	○	○	○	○		○
	TP SENSOR		○		○	○	○	○	○		○		○
	MAP SENSOR		○	○	○	○	○	○	○		○		○
	CMP SENSOR	○	○			○					○		○
	CKP SENSOR	○	○	○	○	○	○	○	○		○		○
	KNOCK SENSOR					○					○		

ECM INPUT/OUTPUT CIRCUIT DIAGRAM

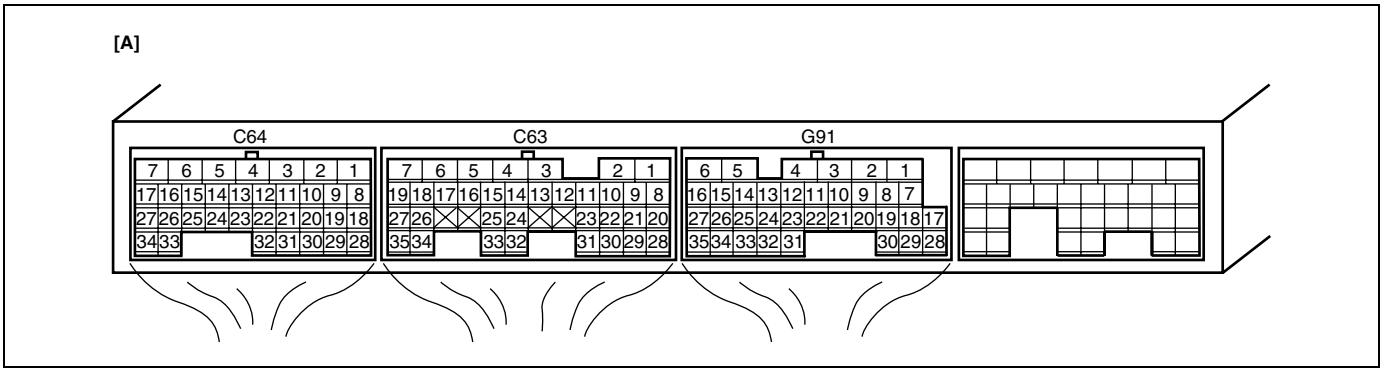


1. CKP sensor	21. A/C switch	41. Stop lamp switch
2. CMP sensor	22. A/C pressure switch	42. Stop lamp
3. VSS	23. Immobilizer control module	43. Lighting switch
4. MAP sensor	24. Data link connector	44. Position lamp
5. Knock sensor	25. Injector No.1	45. Ignition switch
6. TP sensor	26. Injector No.2	46. Main relay
7. ECT sensor	27. Injector No.3	47. Immobilizer indicator lamp
8. Heated oxygen sensor–2	28. Injector No.4	48. Starting motor
9. Heated oxygen sensor–1	29. IAC valve	49. Shield wire
10. A/C evaporator outlet air temp. sensor	30. EVAP canister purge valve	50. Main fuse
11. Battery	31. Fuel pump relay	51. Barometric pressure sensor
12. Combination meter	32. Fuel pump	52. Oil control valve
13. A/C condenser fan relay No.1	33. Radiator fan relay	53. Engine ground
14. A/C condenser fan relay No.2	34. Radiator fan motor	54. Body ground
15. A/C condenser fan motor	35. EGR valve	55. Shield ground
16. ABS control module	36. Malfunction indicator lamp	56. EPS control module
17. A/C compressor relay	37. “IG” fuse	57. Fuel cost meter in multi information display
18. Heater fan motor	38. MAF and IAT sensor	58. Fuel level sensor
19. Heater fan switch	39. Ignition coil assembly (for No.1 and No.4 spark plugs)	
20. A/C compressor clutch	40. Ignition coil assembly (for No.2 and No.3 spark plugs)	

ECM TERMINAL ARRANGEMENT TABLE

CON-NECTOR	TERMI-NAL	WIRE COLOR	CIRCUIT
C64	1	BLK/ORN	Ground for ECM
	2	BLK	Ground for ECM
	3	RED/BLU	Heater output of heated oxygen sensor–2
	4	BLK/WHT	Heater output of heated oxygen sensor–1
	5	GRN/YEL	A/C condenser fan motor relay No.2 output (if equipped)
	6	PNK	Fuel cost output
	7	–	–
	8	RED/YEL	IAC valve output (stepper motor coil 3)
	9	RED/BLU	IAC valve output (stepper motor coil 2)
	10	RED/WHT	IAC valve output (stepper motor coil 1)
	11	PNK/BLK	A/C compressor relay output (if equipped)
	12	PNK	A/C condenser fan motor relay No.1 output (if equipped)
	13	BLU/BLK	EVAP canister purge valve output
	14	GRN	Fuel pump relay output
	15	BRN/WHT	Main power supply relay output
	16	WHT/RED	EGR valve (stepper motor coil 3) output
	17	GRN/RED	EGR valve (stepper motor coil 1) output
	18	–	–
	19	–	–
	20	–	–
	21	–	–
	22	–	–
	23	–	–
	24	–	–
	25	–	–
	26	–	–
	27	–	–
	28	RED/BLK	IAC valve output (stepper motor coil 4)
	29	–	–
	30	–	–
	31	GRN/WHT	Ignition coil No.2 and No.3 output
	32	GRN/YEL	Ignition coil No.1 and No.4 output
	33	BRN/YEL	EGR valve (stepper motor coil 4) output
	34	GRN/ORN	EGR valve (stepper motor coil 2) output
C63	1	BLK/ORN	Ground for ECM
	2	BLU	Oil control valve output
	3	–	–
	4	BLU/ORN	Fuel injector No.4 output
	5	BLU/RED	Fuel injector No.3 output
	6	BLU/WHT	Fuel injector No.2 output
	7	BLU/YEL	Fuel injector No.1 output
	8	GRY/RED	Output of 5V power source for throttle position (TP) sensor
	9	RED	Knock sensor signal
	10	RED/YEL	Reference signal for CMP sensor
	11	WHT	Oxygen signal of heated oxygen sensor–1
	12	–	–
	13	–	–
	14	PNK/BLK	Mass air flow (MAF) sensor signal
	15	RED/WHT	Manifold absolute pressure (MAP) sensor signal
	16	LT GRN	Engine coolant temp. (ECT) sensor signal
	17	LT GRN/BLK	Intake air temperature (IAT) sensor signal
	18	–	–
	19	YEL	Vehicle speed sensor signal
	20	–	–

CON-NECTOR	TERMI-NAL	WIRE COLOR	CIRCUIT
C63	21	–	–
	22	–	–
	23	–	–
	24	–	–
	25	–	–
	26	–	–
	27	–	–
	28	ORN	Ground for sensors
	29	–	–
	30	PNK	CKP sensor signal
	31	GRN/YEL	Ground of ECM for shield wire
	32	–	–
	33	BRN	Oxygen signal of heated oxygen sensor–2
	34	GRY/BLU	Throttle position (TP) sensor signal
	35	BLK/YEL	Starting motor signal
G91	1	PPL/WHT	MIL (Malfunction indicator lamp) output
	2	LT GRN/BLK	Immobilizer indicator lamp output (if equipped)
	3	–	–
	4	BRN	Radiator fan motor relay output
	5	BLK/RED	Main power supply
	6	BLK/RED	Main power supply
	7	–	–
	8	–	–
	9	GRN/WHT	Electric load signal for stop lamp
	10	YEL	Serial communication line of data link connector 5 V
	11	BLU	Serial communication line of data link connector 12 V
	12	BRN	Engine revolution signal output for tachometer
	13	YEL	Electric load signal for heater blower motor
	14	YEL/RED	Fuel level sensor signal
	15	WHT/BLK	A/C evaporator outlet air temp. sensor signal (if equipped)
	16	WHT/RED	Power source for ECM internal memory
	17	–	–
	18	–	–
	19	–	–
	20	–	–
	21	–	–
	22	–	–
	23	–	–
	24	–	–
	25	–	–
	26	–	–
	27	–	–
	28	BLK/WHT	Ignition switch signal
	29	–	–
	30	YEL/GRN	A/C request signal (if equipped)
	31	PPL	Vehicle speed sensor signal for speedometer
	32	GRY	ECT sensor signal for combination meter
	33	RED/YEL	Electric load signal for clearance lamp
	34	–	–
	35	ORN	Ground for A/C evaporator outlet air temp. sensor (if equipped)



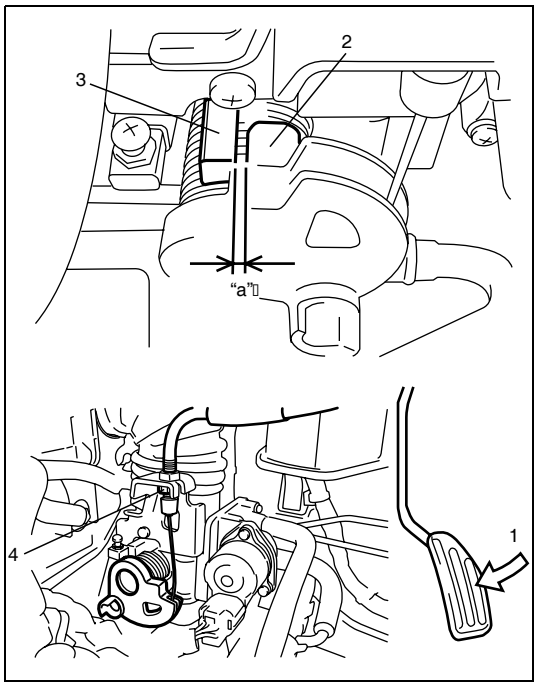
[A]: Terminal arrangement of ECM coupler (viewed from harness side)

NOTE:

For abbreviation of wire color, refer to "Abbreviations and Symbols May be Used in This Manual" in Section 0A.

On-Vehicle Service

Accelerator cable adjustment



With accelerator pedal depressed fully (1), check clearance between throttle lever (2) and lever stopper (3) of throttle body. If measured value is out of specification, adjust it to specification with cable adjusting nut (4).

Accelerator cable adjustment clearance (with pedal depressed fully)
"a": 0.5 – 2.0 mm (0.02 – 0.07 in.)

Idle speed/idle air control (IAC) duty inspection

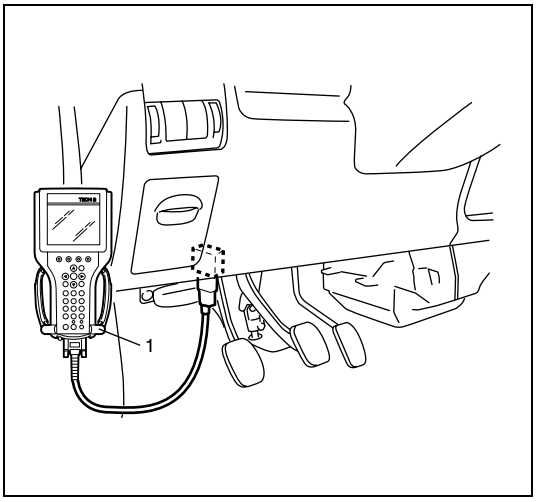
Before idle speed/IAC duty check, make sure of the following.

- Lead wires and hoses of Electronic Fuel Injection and engine emission control systems are connected securely.
- Accelerator cable has some play, that is, it is not tight.
- Valve lash is checked according to maintenance schedule.
- Ignition timing is within specification.
- All accessories (wipers, heater, lights, A/C, etc.) are out of service.
- Air cleaner has been properly installed and is in good condition.
- No abnormal air inhaling from air intake system.

After above items are all confirmed, check idle speed and IAC duty as follows.

NOTE:

Before starting engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T vehicle), and set parking brake and block drive wheels.



1) Connect scan tool (1) to DLC with ignition switch OFF.

2) Warm up engine to normal operating temperature.
3) Check engine idle speed and “IAC duty” by using “Data List” mode on scan tool to check “IAC duty”.
4) If duty and/or idle speed is out of specifications, inspect idle air control system referring to “Table B-4 Idle Air Control System Check” in Section 6.

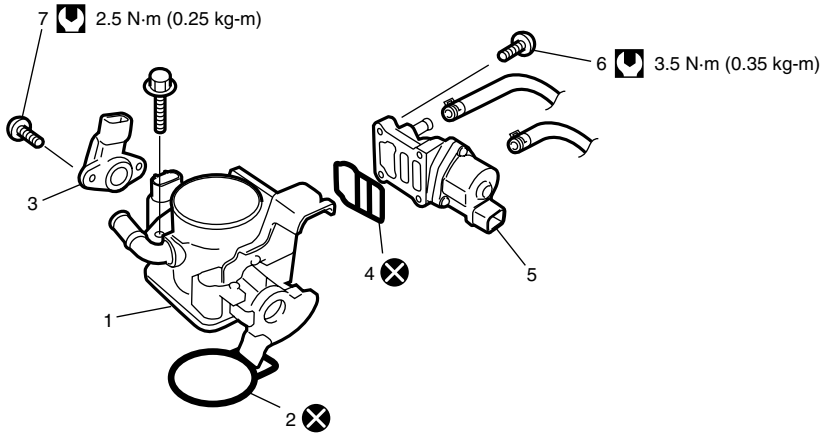
Engine idle speed and IAC duty

A/C OFF	A/C ON
700 ± 50 r/min (rpm) **10 – 55 %**	**850 ± 50 r/min (rpm)**

5) Check that specified engine idle speed is obtained with A/C ON if vehicle is equipped with A/C.
   If not, check A/C request signal circuit and idle air control system.

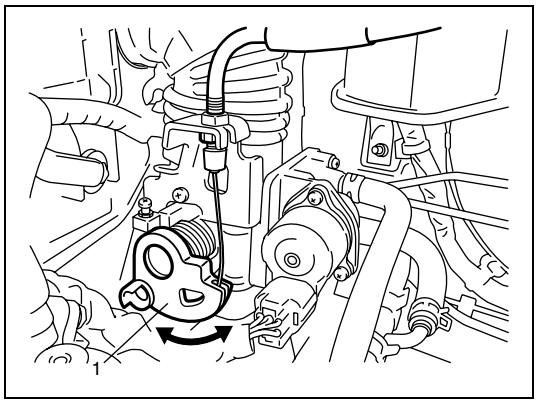
Air Intake System

Throttle body Components



1. Throttle body	4. Gasket	7. TP sensor screws
2. Throttle body gasket	5. Idle air control valve	Tightening torque
3. TP sensor	6. IAC valve screws	Do not reuse.

Throttle body on-vehicle inspection

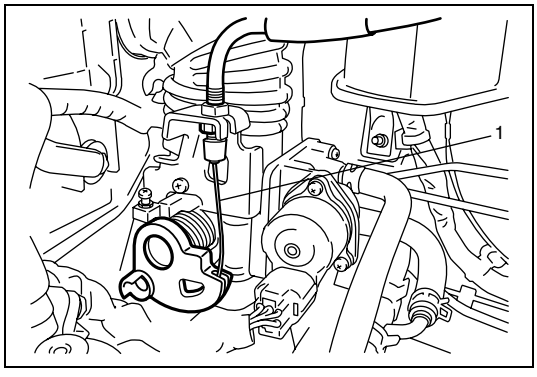


- Check that throttle valve lever (1) moves smoothly.

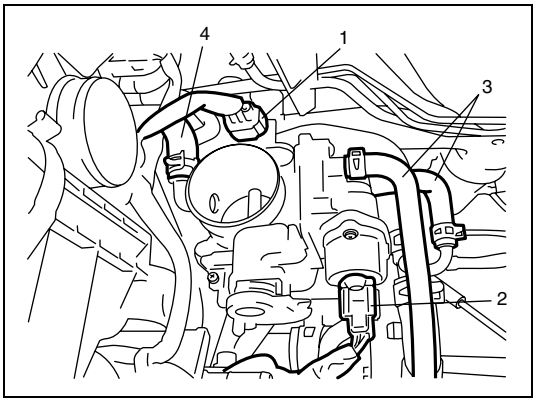
Throttle body removal and installation

REMOVAL

1) Disconnect negative cable at battery.
2) Drain coolant referring to “Cooling System Draining” in Section 6B.



3) Disconnect accelerator cable (1) from throttle body.
4) Detach EVAP canister and purge valve chamber, and remove air cleaner outlet hose.



5) Disconnect connectors from TP sensor (1) and IAC valve (2).
6) Disconnect engine coolant hoses (3) and breather hose (4) from throttle body.
7) Remove throttle body from intake manifold.

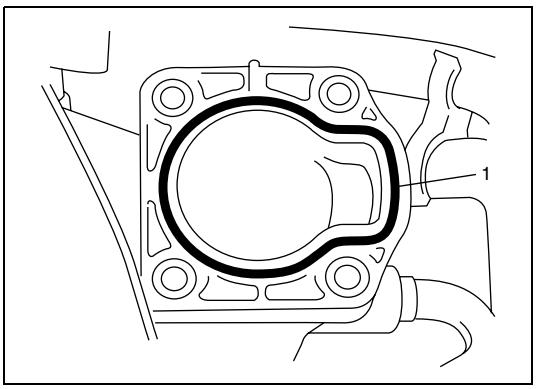
8) Remove TP sensor and IAC valve from throttle body.

NOTE:

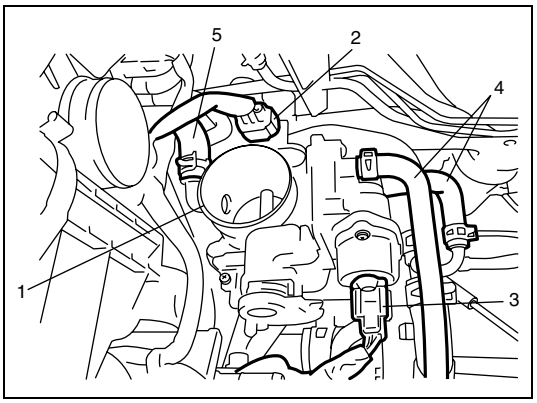
While disassembling and assembling throttle body, use special care not to deform levers on throttle valve shaft or cause damage to any other parts.

INSTALLATION

1) Install IAC valve to throttle body referring to “INSTALLATION” under “Idle air control (IAC) valve removal and installation” in this section.
2) Install TP sensor to throttle body referring to “INSTALLATION” under “Throttle position sensor (TP sensor) removal and installation” in this section.

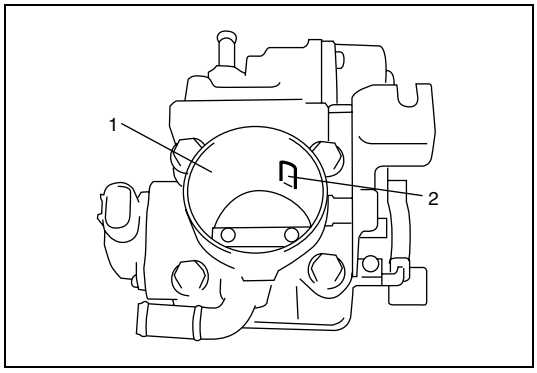


3) Clean mating surfaces and install new throttle body gasket (1) to intake manifold.



4) Install throttle body (1) to intake manifold.
5) Connect connectors to TP sensor (2) and IAC valve (3) securely.
6) Connect engine coolant hoses (4) and breather hose (5).
7) Connect accelerator cable and adjust cable play to specification.
8) Install air cleaner outlet hose, purge valve chamber and EVAP canister.
9) Refill coolant referring to “Cooling System Refill” in Section 6B.
10) Connect negative cable at battery.

Throttle body cleaning



Clean throttle body bore (1) and idle air passage (2) by blowing compressed air.

NOTE:

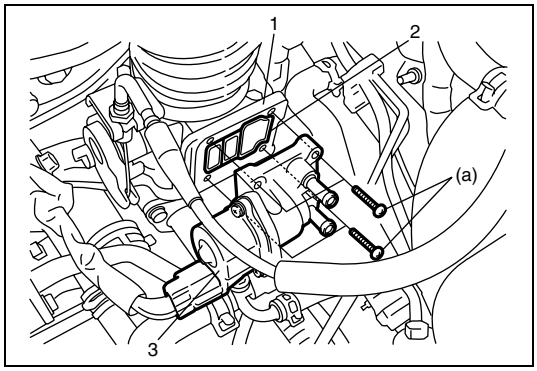
TP sensor, idle air control valve or other components containing rubber must not be placed in a solvent or cleaner bath. A chemical reaction will cause these parts to swell, harden or get distorted.

Idle air control (IAC) valve removal and installation

REMOVAL

1) Detach EVAP canister.
2) Drain coolant referring to “Cooling System Draining” in Section 6B.
3) Disconnect coolant hoses from IAC valve.
4) Remove IAC valve from throttle body.

INSTALLATION



1) Install new gasket (2) to throttle body (1).
2) Install IAC valve (3) to throttle body (1).
   Tighten IAC valve screws to specified torque.

Tightening torque
IAC valve screw (a): 3.5 N·m (0.35 kg-m, 2.5 lb-ft)

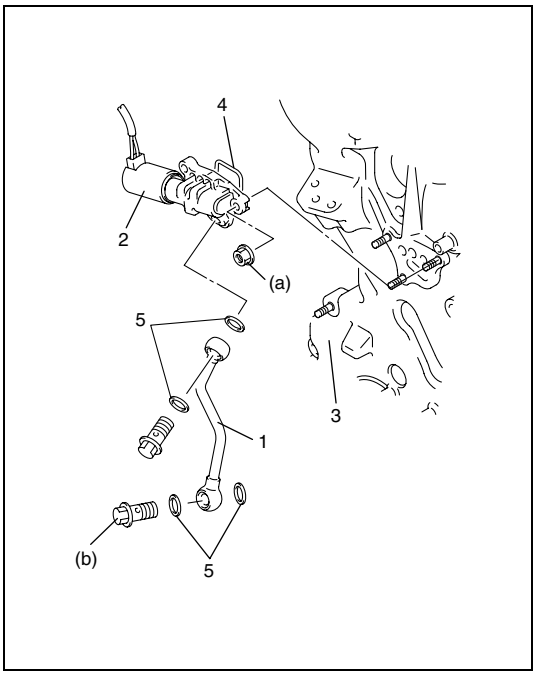
3) Connect coolant hoses to IAC valve.
4) Refill coolant referring to “Cooling System Refill” in Section 6B.
5) Install EVAP canister.

Idle air control (IAC) valve inspection

Refer to “Idle air control (IAC) valve check” under “DTC P0506 Idle Air Control System RPM Lower than Expected DTC P0507 Idle Air Control System RRM Higher than Expected” in Section 6.

Oil control valve removal and installation

REMOVAL



Remove oil gallery pipe No.1 (1) and oil control valve (2) from timing chain cover (3).

INSTALLATION

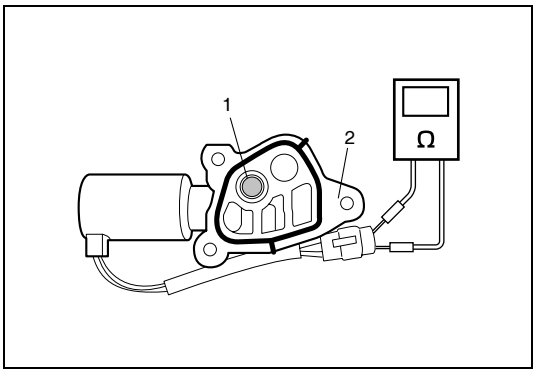
1) Install new O-ring (4) to oil control valve.
2) Install oil control valve to timing chain cover.
   Tighten nuts to specification.

Tightening torque
Oil control valve mounting nuts
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

3) Install oil gallery pipe No.1 with new copper washers (5) to timing chain cover.
   Tighten bolts to specification.

Tightening torque
Oil gallery pipe No.1 bolts
(b): 30 N·m (3.0 kg-m, 21.5 lb-ft)

Oil control valve inspection



1) Inspect strainer (1) and mating surface (2) of oil control valve for clog or damage. Clean oil control valve if clog or foreign matter is present on strainer or mating surface of oil control valve.
   Replace oil control valve if its mating surface is damaged.
2) Check resistance between terminals of oil control valve.

Resistance: 6.7 – 7.7 Ω (at 20°C (68°F))

Fuel Delivery System

Fuel pressure inspection

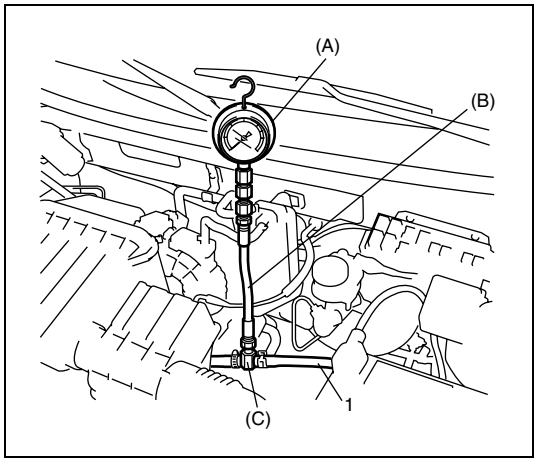
WARNING:

Be sure to perform work in a well-ventilated area and away from any open flames, or there is a risk of a fire breaking out.

1) Relieve fuel pressure in fuel feed line referring to “Fuel pressure relief procedure” in Section 6.
2) Disconnect fuel feed hose from fuel delivery pipe.

CAUTION:

A small amount of fuel may be released when fuel hose is disconnected. Place container under the joint with a shop cloth so that released fuel is caught in container or absorbed in cloth. Place that cloth in an approved container.



3) Connect special tools and hose between fuel delivery pipe and fuel feed hose (1) as shown in figure, and clamp hoses securely to ensure no leaks occur during checking.

Special tool
(A): 09912-58442
(B): 09912-58432
(C): 09912-58490

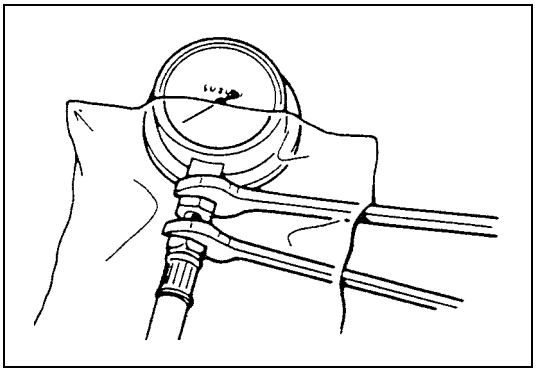
4) Check that battery voltage is above 11 V.

5) Turn ignition switch ON to operate fuel pump and after 2 seconds turn it OFF. Repeat this 3 or 4 times and then check fuel pressure.

Fuel pressure specification

CONDITION	FUEL PRESSURE
With fuel pump operating and engine stopped	**270 – 310 kPa (2.7 – 3.1 kg/cm^2, 38.4 – 44.0 psi)**
At specified idle speed	
With 1 min. after engine (fuel pump) stop (Pressure reduces as time passes)	**over 250 kPa (2.5 kg/cm^2, 35.6 psi)**

6) Start engine and warm it up to normal operating temperature.
7) Measure fuel pressure at idling.
   If measured pressure does not satisfy specification, refer to “Table B-3 Fuel Pressure Check” in Section 6 and check each possibly defective part. Replace if found defective.



8) After checking fuel pressure, remove fuel pressure gauge.

CAUTION:

As fuel feed line is still under high fuel pressure, make sure to release fuel pressure according to following procedures.

- **Place fuel container under joint.**
- **Cover joint with rag and loosen joint nut slowly to release fuel pressure gradually.**

9) Remove special tools from fuel delivery pipe and fuel feed hose.
10) Connect fuel feed hose to fuel delivery pipe and clamp it securely.
11) With engine "OFF" and ignition switch "ON", check for fuel leaks.

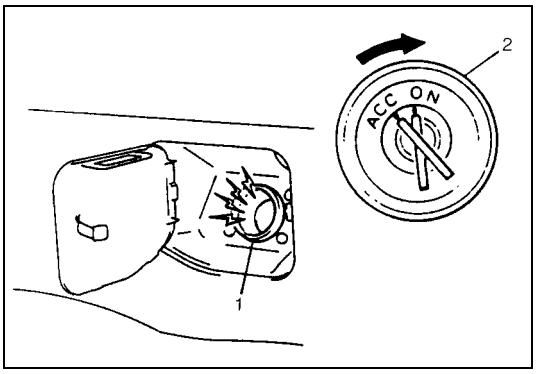
Fuel pump with pressure regulator on-vehicle inspection

CAUTION:

When fuel filler cap is removed in any procedure, work must be done in a well-ventilated area, keep away from any open flames and without smoking.

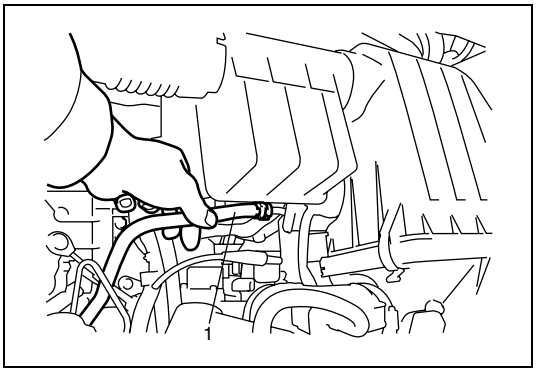
NOTE:

The fuel pressure regulator is the one body with the fuel pump assembly so individual inspection of it is impossible.



1) Remove filler cap and turn ON ignition switch. Then fuel pump operating sound should be heard from fuel filler for about 2 seconds and stop. Be sure to reinstall fuel filler cap after checking.
   If above check result is not satisfactory, advance to "Table B-2 Fuel Pump and Its Circuit Check" in Section 6.

1.	Fuel filler
2.	Ignition switch



2) Turn OFF ignition switch and leave over 10 minutes as it is.
3) Fuel pressure should be felt at fuel feed hose (1) for about 2 seconds after ignition switch ON.
   If fuel pressure is not felt, advance to "Table B-3 Fuel Pressure Check" in Section 6.

Fuel pump with pressure regulator removal and installation

REMOVAL

Remove fuel tank from body according to procedure described in “Fuel Tank Removal and Installation” of Section 6C and remove fuel pump from fuel tank.

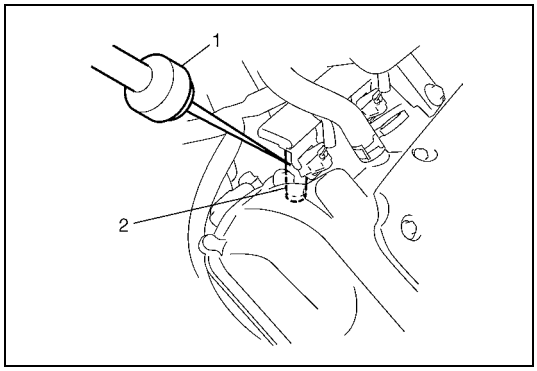
INSTALLATION

1) Install fuel pump to its bracket.
2) Install fuel pump to fuel tank and then install fuel tank to body according to procedure described in “Fuel Tank Removal and Installation” of Section 6C.

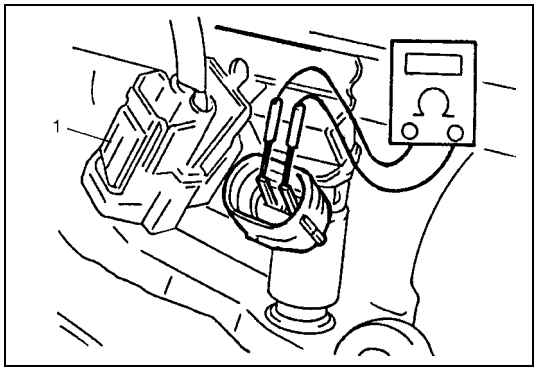
Fuel pump with pressure regulator inspection

Check fuel pump filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel tank.

Fuel injector on-vehicle inspection



1) Using sound scope (1) or such, check operating sound of injector (2) when engine is running or cranking.
   Cycle of operating sound should vary according to engine speed.
   If no sound or an unusual sound is heard, check injector circuit (wire or connector) or injector (2).



2) Disconnect connector (1) from injector, connect ohmmeter between terminals of injector and check resistance.
   If resistance is out of specification, replace.

   Resistance of fuel injector
   11.3 – 13.8 Ω at 20°C (68°F)

3) Connect connector (1) to injector securely.

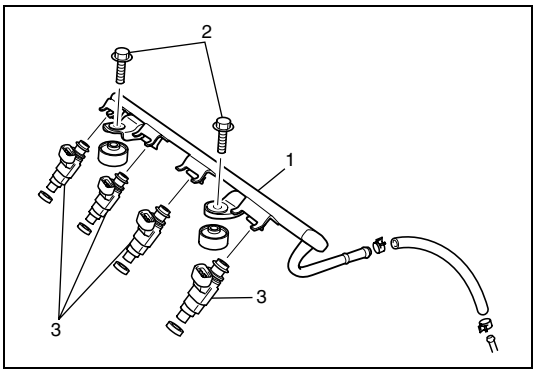
Fuel injector removal and installation

REMOVAL

CAUTION:

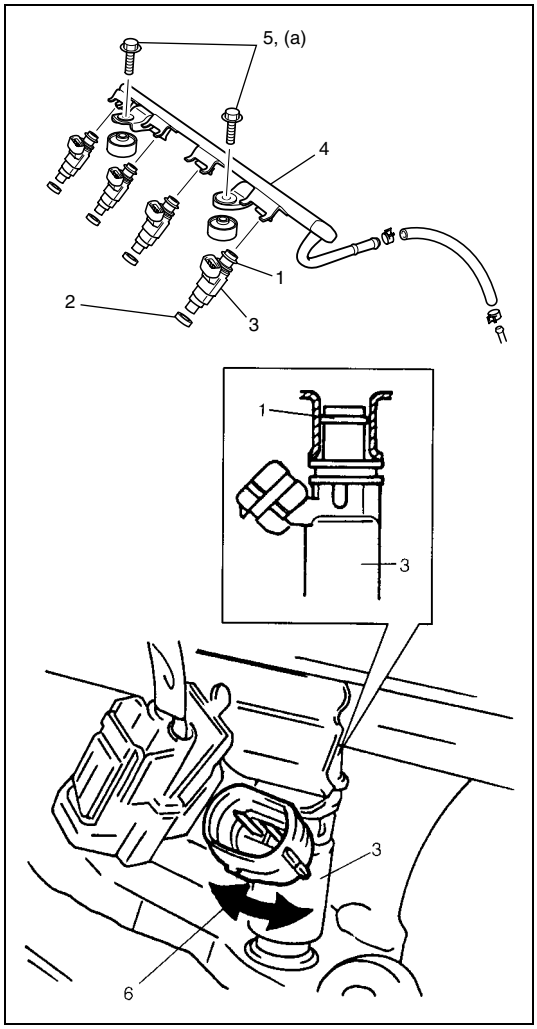
A small amount of fuel may come out after removal of fuel injectors, cover them with shop cloth.

1) Relieve fuel pressure according to procedure described in “Fuel pressure relief procedure” of Section 6.
2) Disconnect battery negative cable at battery.
3) Disconnect MAF and IAT sensor connector, and detach EVAP canister purge valve.
4) Remove air cleaner assembly with air intake pipe.
5) Disconnect fuel injector couplers.



6) Disconnect fuel feed hose from fuel delivery pipe (1).
7) Remove fuel delivery pipe bolts (2).
8) Remove fuel injector(s) (3).

INSTALLATION



For installation, reverse removal procedure and note following precautions.

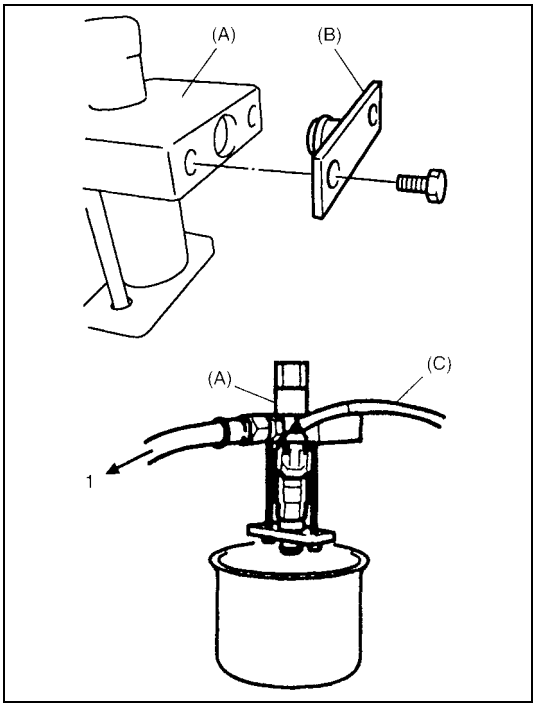
- Replace injector O-ring (1) with new one using care not to damage it.
- Check if cushion (2) is scored or damaged. If it is, replace with new one.
- Apply thin coat of fuel to O-rings (1) and then install injectors (3) into delivery pipe (4) and cylinder head.
  Make sure that injectors (3) rotate smoothly (6). If not, probable cause is incorrect installation of O-ring (1). Replace O-ring (1) with new one.
- Tighten delivery pipe bolts (5) and make sure that injectors (3) rotate smoothly (6).

Tightening torque
Delivery pipe bolts (a): 25 N·m (2.5 kg-m, 18.0 lb-ft)

- After installation, with engine “OFF” and ignition switch “ON”, check for fuel leaks around fuel line connection.

Fuel injector inspection

WARNING:
As fuel is injected in this inspection, perform in a well ventilated area and away from open flames.
Use special care to prevent sparking when connecting and disconnecting test lead to and from battery.

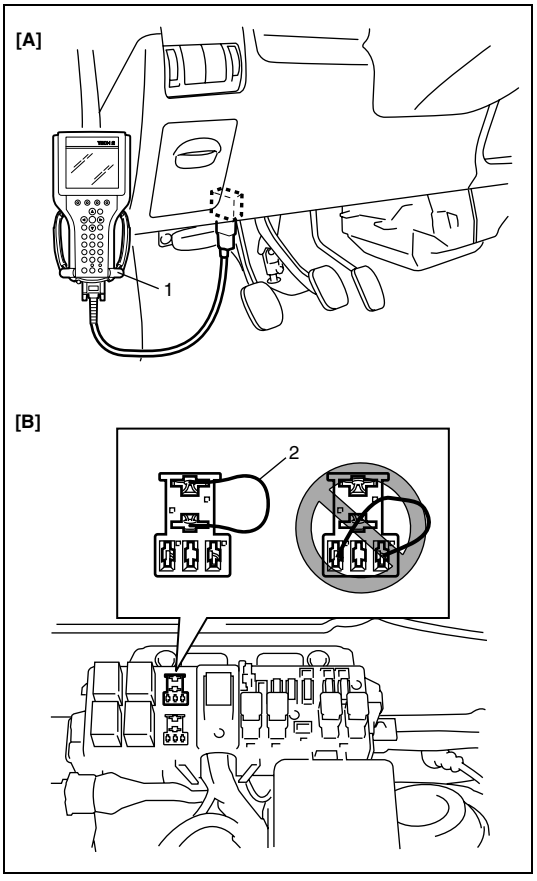


1) Install injector to special tool (injector checking tool).

Special tool
(A): 09912-58421
(B): 09912-57610

2) Connect special tools (hose and attachment) to fuel feed pipe (1) of vehicle.
3) Connect special tool (test lead) to injector.

Special tool
(C): 09930-88530

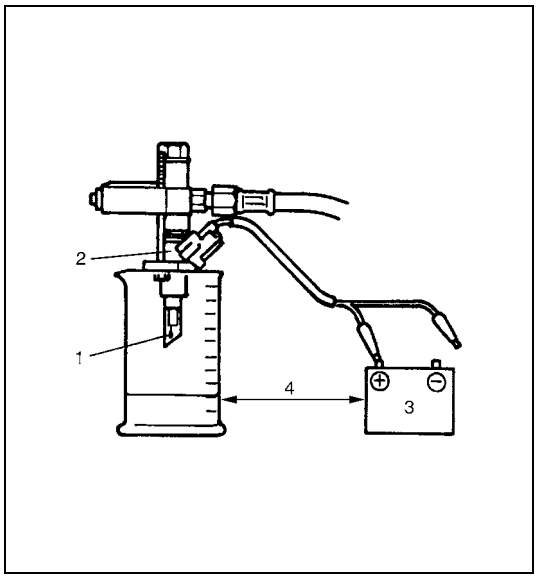


4) Install suitable vinyl tube onto injector nozzle to prevent fuel from splashing out when injecting.
5) Put graduated cylinder under injector.
6) Operate fuel pump and apply fuel pressure to injector as follows:
   a) When using scan tool:
      i) Connect scan tool (1) to DLC with ignition switch OFF.
      ii) Turn ignition switch ON, clear DTC and select “MISC TEST” mode on scan tool.
      iii) Turn fuel pump ON by using scan tool.
   b) Without using scan tool:
      i) Remove fuel pump relay from connector.
      ii) Connect two terminals of relay connector using service wire (2) as shown in figure.

CAUTION:
Check to make sure that connection is made between correct terminals. Wrong connection can cause damage to ECM, wire harness, etc.

      iii) Turn ignition switch ON.

[A]: When using Suzuki Scan Tool
[B]: When not using Suzuki Scan Tool



7) Apply battery voltage (3) to injector (2) for 15 seconds and measure injected fuel volume with graduated cylinder.
   Test each injector two or three times.
   If not within specification, replace injector.

Injected fuel volume
43 – 47 cc/15 sec. (1.45/1.51 – 1.58/ 1.65 US/Imp. oz/15 sec.)

8) Check fuel leakage from injector nozzle. Do not operate injector for this check (but fuel pump should be at work).
   If fuel leaks (1) more than following specifications, replace.

Fuel leakage
Less than 1 drop/min.

4. Keep as far apart as possible

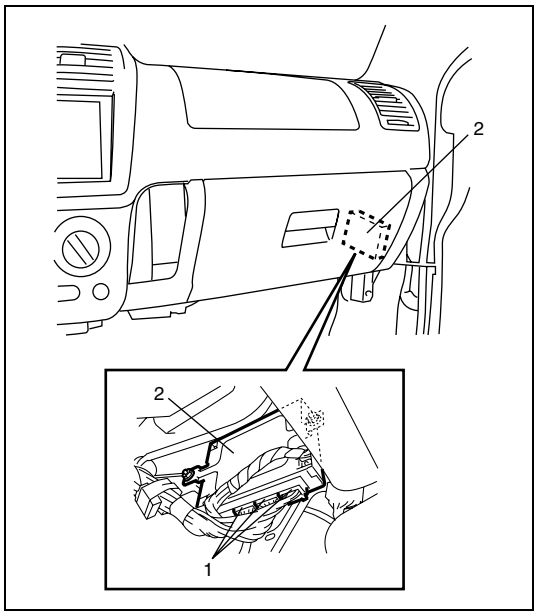
Electronic Control System

Engine control module (ECM) removal and installation

CAUTION:
As ECM consists of precision parts, be careful not to expose it to excessive shock.

REMOVAL

1) Disconnect battery negative cable at battery.
2) Disable air bag system, referring to “Disabling air bag system” in Section 10B if equipped.
3) Disconnect ECM connectors (1).
4) Remove ECM (2) by removing nuts.



INSTALLATION

Reverse removal procedure noting the following:

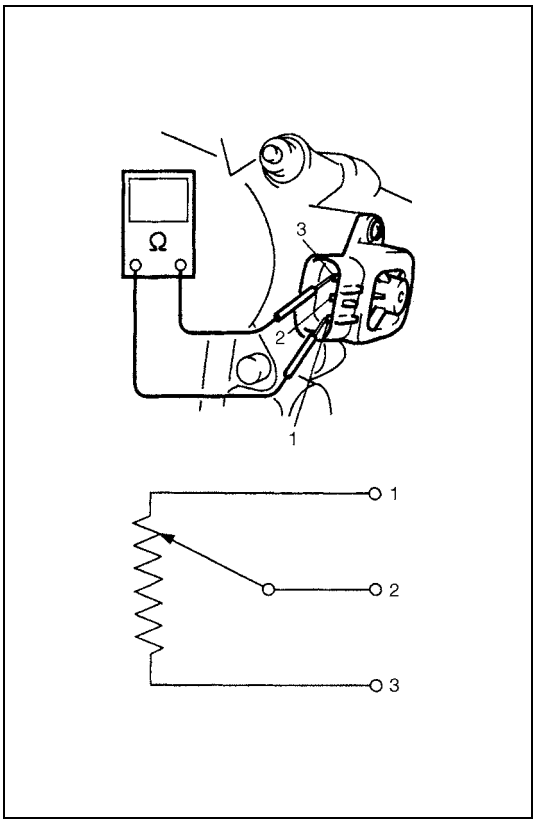
- Connect connectors to ECM securely.

Manifold absolute pressure sensor (MAP sensor) inspection

Check MAP sensor referring to “MAP Sensor Individual Check” under “DTC P0108 Manifold Absolute Pressure High Input” in Section 6. If malfunction is found, replace.

Throttle position sensor (TP sensor) on-vehicle inspection

1) Disconnect negative cable at battery.
2) Detach EVAP canister and purge valve chamber, and remove air cleaner outlet hose.
3) Disconnect TP sensor connector.
4) Using ohmmeter, check resistance between terminals under each condition given in table below.
   If check result is not satisfactory, replace TP sensor.



TP sensor resistance

TERMINALS	RESISTANCE
Between 1 and 3 terminals	**4.0 – 6.0 kΩ**
Between 2 and 3 terminals	**20 Ω – 6.0 kΩ, varying according to throttle valve opening.**

NOTE:

There should be more than 2 kΩ resistance difference between when throttle valve is at idle position and when it is fully open.

5) Connect TP sensor connector securely.
6) Connect negative cable to battery.

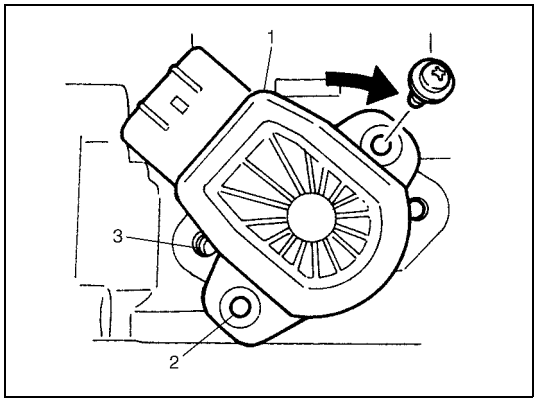
1. Reference voltage terminal
2. Output voltage terminal
3. Ground terminal

Throttle position sensor (TP sensor) removal and installation

REMOVAL

1) Disconnect battery negative cable at battery.
2) Detach EVAP canister and purge valve chamber, and remove air cleaner outlet hose.
3) Disconnect TP sensor connector and remove TP sensor from throttle body.

INSTALLATION



1) Install TP sensor (1) to throttle body.
   Fit TP sensor to throttle body in such way that its holes (3) are a little away from TP sensor screw holes (2) as shown in figure and turn TP sensor clockwise so that those holes align.

Tightening torque
TP sensor screw (a): 2.5 N·m (0.25 kg-m, 1.8 lb-ft)

2) Connect connector to TP sensor securely.
3) Connect battery negative cable to battery.

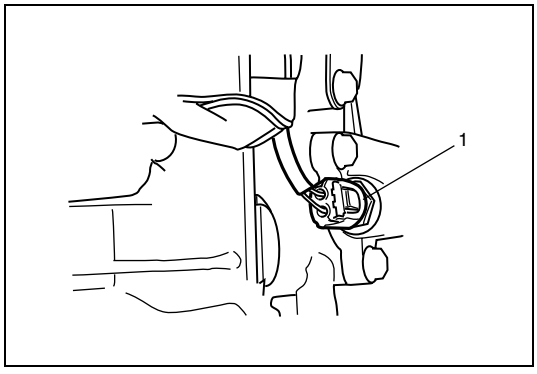
Engine coolant temperature sensor (ECT sensor) removal and installation

REMOVAL

1) Disconnect battery negative cable at battery.
2) Drain coolant referring to “Cooling System Draining” in Section 6B.

WARNING:
To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot.
Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

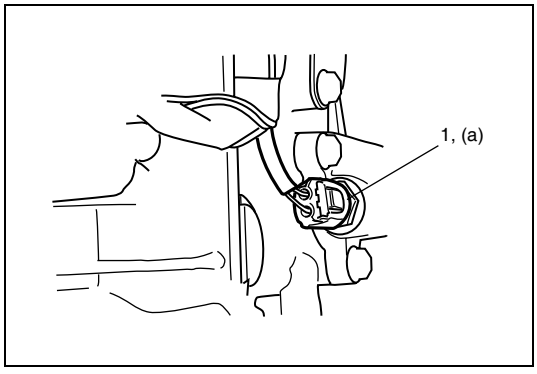
3) Remove air intake pipe.
4) Disconnect connector from ECT sensor.



5) Remove ECT sensor (1) from thermostat case.

INSTALLATION

Reverse removal procedure noting the following:

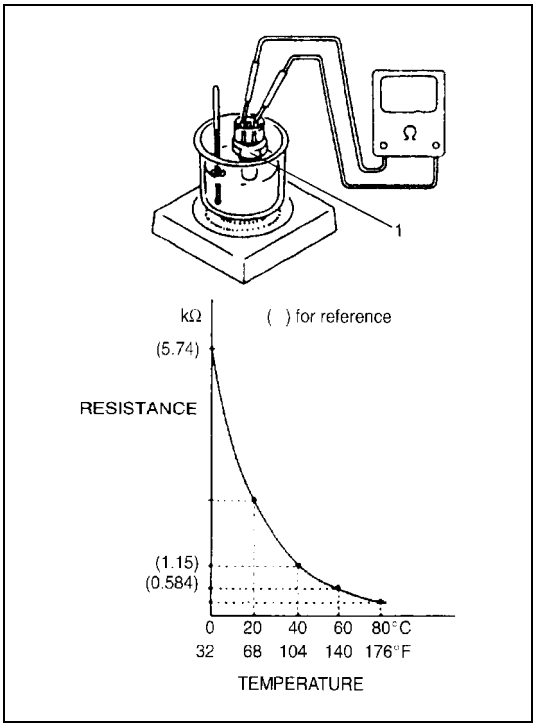


- Clean mating surfaces of ECT sensor (1) and thermostat case.
- Check O-ring for damage and replace if necessary.
- Tighten ECT sensor (1) to specified torque.

Tightening torque
ECT sensor (a): 15 N·m (1.5 kg-m, 11.5 lb-ft)

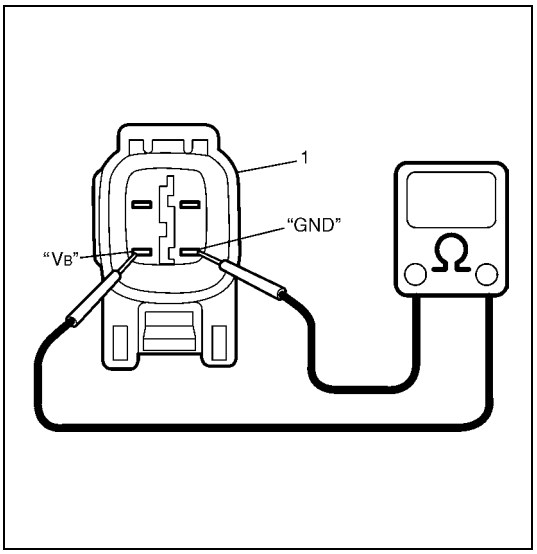
- Connect connector to ECT sensor (1) securely.
- Refill coolant referring to “Cooling System Refill” in Section 6B.

Engine coolant temperature sensor (ECT sensor) inspection



Immerse temperature sensing part of ECT sensor (1) in water (or ice) and measure resistance between terminal “A” and “B” while heating water gradually.
If measured resistance does not show such characteristic as shown in the graph, replace ECT sensor (1).

Heated oxygen sensor (HO2S-1 and HO2S-2) heater on-vehicle inspection



1) Disconnect sensor connector.
2) Using ohmmeter, measure resistance between terminals “V_B” and “GND” of sensor connector.
   If found faulty, replace oxygen sensor.

NOTE:

Temperature of sensor affects resistance value largely. Make sure that sensor heater is at correct temperature.

Resistance of oxygen sensor heater
HO2S–1: 5.0 – 6.4 Ω at 20°C (68°F)
HO2S–2: 11.7 – 14.3 Ω at 20°C (68°F)

3) Connect sensor connector securely.

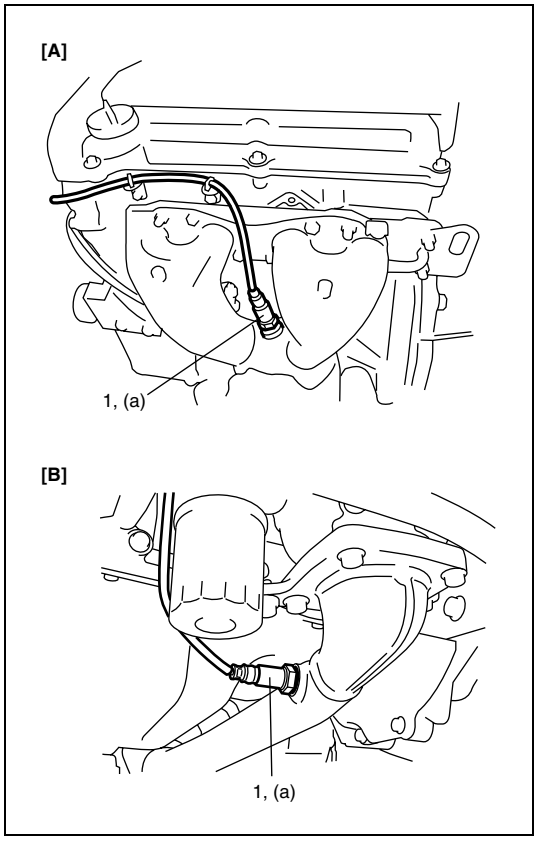
1. Viewed from terminal side

Heated oxygen sensor (HO2S-1 and HO2S-2) removal and installation

REMOVAL

WARNING:
To avoid danger of being burned, do not touch exhaust system when system is hot. Oxygen sensor removal should be performed when system is cool.

1) Disconnect negative cable at battery.
2) For HO2S–1, disconnect connector of heated oxygen sensor and release its wire harness from clamps.
   a) For vehicle not equipped with A/C, remove front bumper and engine front cover.
   b) For vehicle equipped with A/C, remove exhaust manifold referring to “Exhaust Manifold Removal and Installation” in Section 6A1.
3) For HO2S–2, disconnect connector of heated oxygen sensor and release its wire harness from clamp and hoist vehicle.
4) Remove heated oxygen sensor (1) from exhaust manifold or exhaust pipe.



[A]: HO2S–1
[B]: HO2S–2

INSTALLATION

Reverse removal procedure noting the following.

- Tighten heated oxygen sensor (1) to specified torque.

Tightening torque
Heated oxygen sensor (a): 45 N·m (4.5 kg-m, 32.5 lb-ft)

- For equipped with A/C, install exhaust manifold referring to “Exhaust Manifold Removal and Installation” in Section 6A1.
- Connect connector of heated oxygen sensor (1) and clamp wire harness securely.
- After installing heated oxygen sensor (1), start engine and check that no exhaust gas leakage exists.

Camshaft position sensor (CMP sensor) inspection

Check camshaft position sensor referring to “DTC P0340 Camshaft Position Sensor Circuit” in Section 6. If malfunction is found, replace.

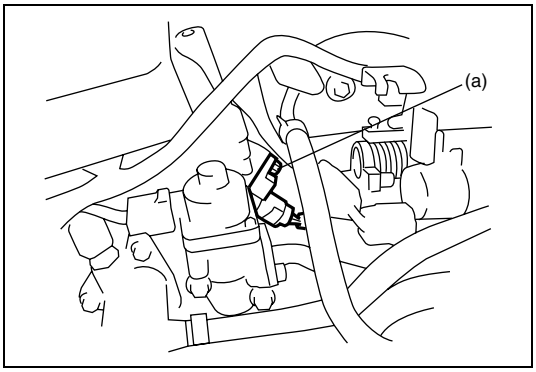
Camshaft position sensor (CMP sensor) removal and installation

REMOVAL

1) Disconnect negative cable at battery.
2) Disconnect connector from camshaft position sensor.
3) Remove camshaft position sensor from cylinder head.

INSTALLATION

1) Check that O-ring is free from damage.
2) Check that camshaft position sensor and signal rotor teeth are free from any metal particles and damage.



3) Install camshaft position sensor to cylinder head.

Tightening torque
Camshaft position sensor bolt
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

4) Connect connector to it securely.
5) Connect negative cable to battery.

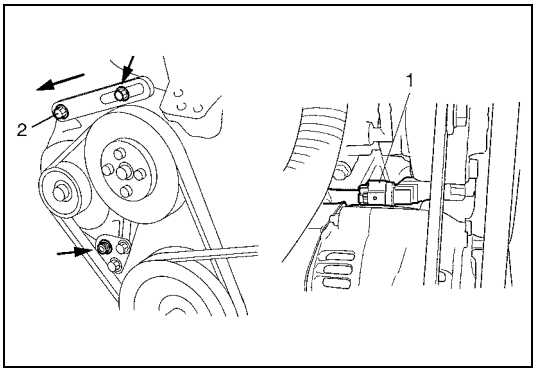
Crankshaft position sensor (CKP sensor) inspection

Check crankshaft position sensor referring to Steps 2 and 7 of "DTC P0335 Crankshaft Position (CKP) Sensor Circuit" in Section 6. If malfunction is found, replace.

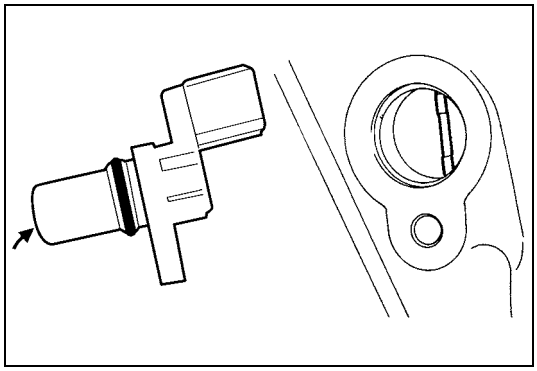
Crankshaft position sensor (CKP sensor) removal and installation

REMOVAL

1) Disconnect negative cable at battery.



2) Remove generator drive belt, loosen pivot bolt (2) and move generator rearward.
3) Disconnect connector from crankshaft position sensor.
4) Remove crankshaft position sensor (1) from cylinder block.



INSTALLATION

1) Check to make sure that crankshaft position sensor and pulley teeth are free from any metal particles and damage.
2) Install crankshaft position sensor to cylinder block.
3) Connect connector to it securely.
4) Adjust generator belt tension, refer to “Water Pump/Generator Drive Belt Tension Inspection and Adjustment” in Section 6B.
5) Connect negative cable to battery.

Fuel Level Sensor Removal and Installation

Refer to “Fuel Pump Assembly Removal and Installation” in Section 6C.

Fuel Level Sensor Inspection

Refer to “Fuel Level Sensor (Gauge Unit) Inspection” in Section 8.

Vehicle speed sensor (VSS) inspection

Check vehicle speed sensor referring to “DTC P0500 Vehicle Speed Sensor (VSS) Malfunction” in Section 6. If malfunction is found, replace.

Vehicle speed sensor (VSS) removal and installation

Refer to “Vehicle Speed Sensor (VSS) Removal and Installation” in Section 7A.

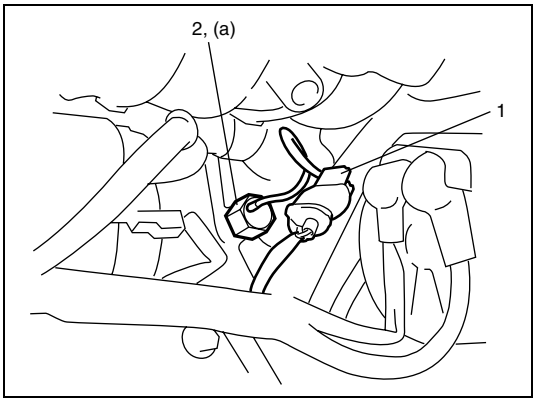
Knock sensor inspection

Check knock sensor referring to “DTC P0327 Knock Sensor Circuit Low DTC P0328 Knock Sensor Circuit High” in Section 6. If malfunction is found, replace.

Knock sensor removal and installation

REMOVAL

1) Disconnect negative cable from battery.
2) Hoist vehicle.



3) Disconnect knock sensor connector (1).
4) Remove knock sensor (2) from cylinder block.

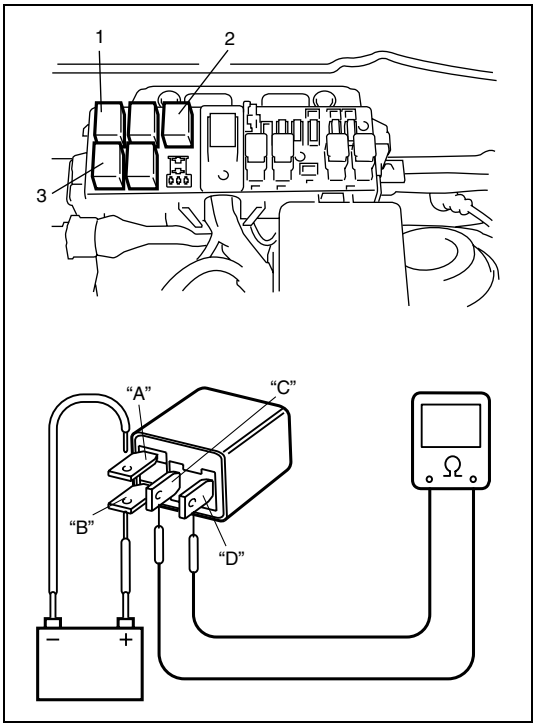
INSTALLATION

Reverse removal procedure for installation.

Tightening torque
Knock sensor (a): 22 N·m (2.2 kg-m, 16.0 lb-ft)

Main relay, fuel pump relay and radiator fan relay inspection

1) Disconnect negative cable at battery.

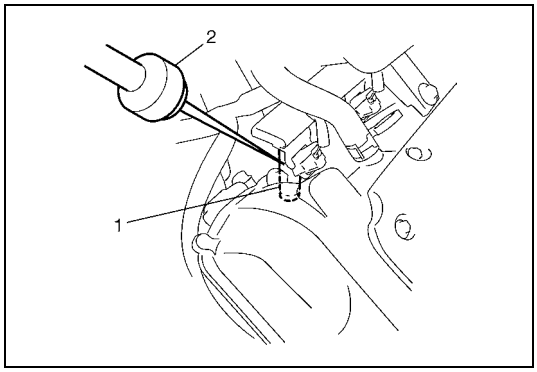


2) Remove main relay (1), fuel pump relay (2) and radiator fan relay (3) from relay/fuse box.
3) Check that there is no continuity between terminal "C" and "D". If there is continuity, replace relay.
4) Connect battery positive (+) terminal to terminal "B" of relay.
   Connect battery negative (–) terminal "A" of relay.
   Check continuity between terminal "C" and "D".
   If there is no continuity when relay is connected to the battery, replace relay.

Fuel cut operation inspection

NOTE:

Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in "P" range), A/C is OFF and that parking brake lever is pulled all the way up.



1) Warm up engine to normal operating temperature.
2) While listening to sound of injector (1) by using sound scope (2) or such, increase engine speed to higher than 3,000 r/min.
3) Check to make sure that sound to indicate operation of injector stops when throttle valve is closed instantly and it is heard again when engine speed is reduced to less than about 2,000 r/min.

Radiator fan control system inspection

SYSTEM INSPECTION

WARNING:

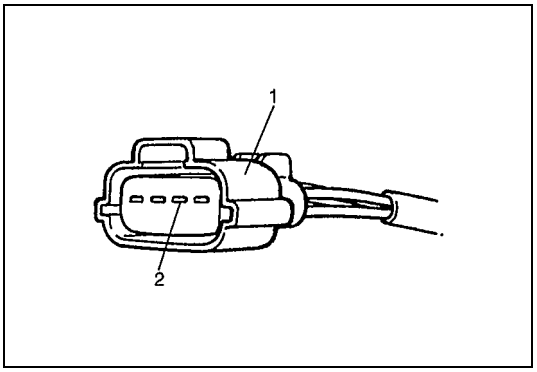
Keep hands, tools, and clothing away from engine cooling fan to help prevent personal injury. This fan is electric and can come on whether or not the engine is running. The fan can start automatically in response to the ECT sensor with the ignition switch in the "ON" position.

Check system for operation referring to "Table B-7 Radiator Fan Control System Check" in Section 6.

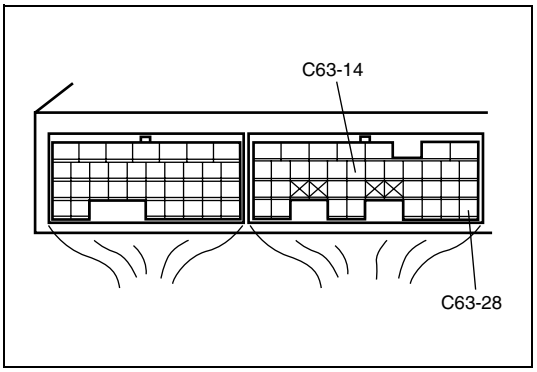
If radiator fan fails to operate properly, check relay, radiator fan and electrical circuit.

Mass air flow (MAF) and intake air temperature (IAT) sensor on-vehicle inspection

1) Remove ECM referring to "Engine control module (ECM) removal and installation" in this section.
2) Connect couplers to ECM.
3) Disconnect MAF and IAT sensor connector.



4) Connect voltmeter to “BLK/RED” wire terminal (2) of MAF and IAT sensor coupler (1) disconnected and ground.
5) Turn ignition switch ON and check that voltage is battery voltage.
   If not, check if wire harness is open or connection is poor.



6) Turn ignition switch OFF and connect coupler to MAF and IAT sensor.
7) Turn ignition switch ON and check MAF signal voltage between “C63-14” terminal and “C63-28” terminal of ECM coupler.

MAF signal voltage of MAF and IAT sensor at ignition switch ON: 0.5 – 1.0 V

1. ECM

8) Start engine and check that voltage is lower than 5 V and it rises as engine speed increases.

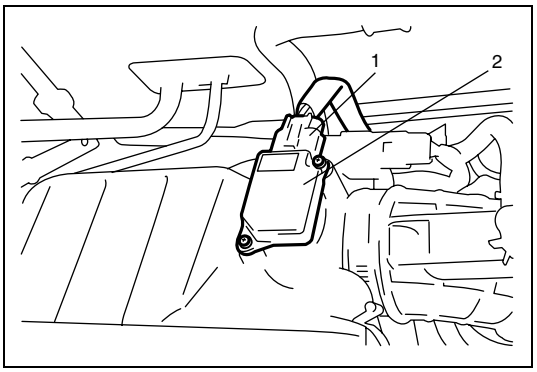
MAF signal reference voltage of MAF and IAT sensor at specified Idle speed: 1.3 – 1.8 V

9) If check result is not as specified above, cause may lie in wire harness, coupler connection, MAF and IAT sensor or ECM.

Mass air flow (MAF) and intake air temperature (IAT) sensor removal and installation

REMOVAL

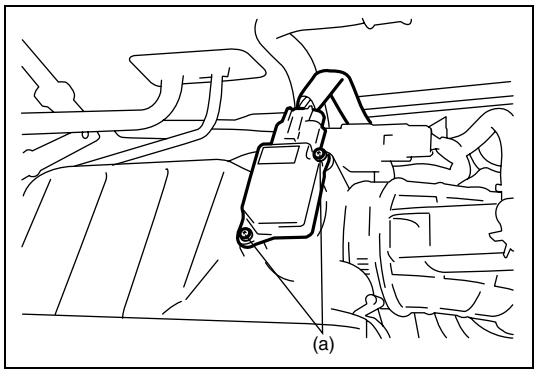
1) Disconnect negative cable at battery.



2) Disconnect MAF and IAT sensor coupler (1).
3) Remove MAF and IAT sensor (2) from air cleaner assembly.

INSTALLATION

Reverse removal procedure noting the followings.



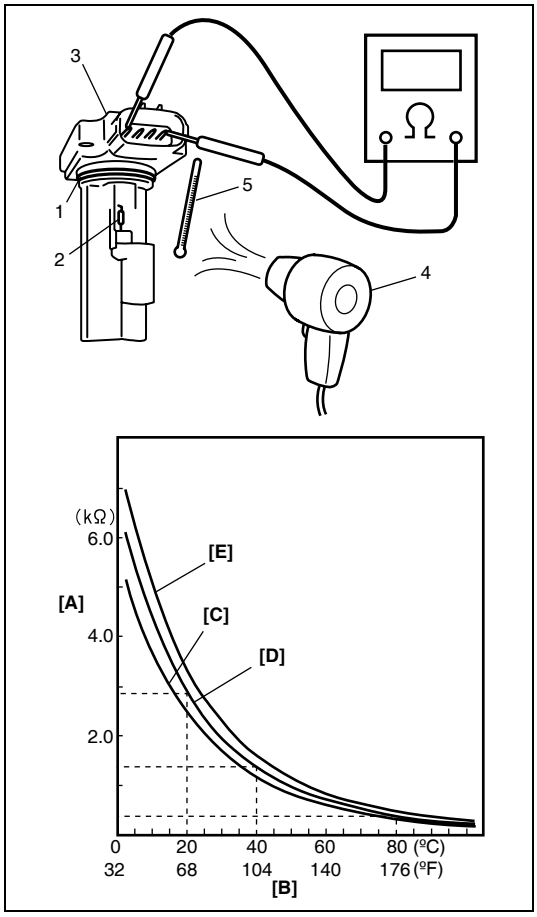
- Tighten MAF and IAT sensor screws to specified torque.

Tightening torque
MAF sensor screw (a): 2.5 N·m (0.25 kg-m, 1.8 lb-ft)

- Connect MAF and IAT sensor coupler securely.

Mass air flow (MAF) and intake air temperature (IAT) sensor inspection

CAUTION:
Do not heat up the MAF and IAT sensor more than 100°C (212°F). Otherwise, the MAF and IAT sensor is damaged.



- Check sensor O-ring (1) for damage and deterioration. Replace as necessary.
- Blow hot air to temperature sensing part (2) of MAF and IAT sensor (3) using hot air drier (4) and measure resistance between sensor terminals while heating air gradually.
  If measured resistance does not show such characteristic as shown, replace MAF and IAT sensor.

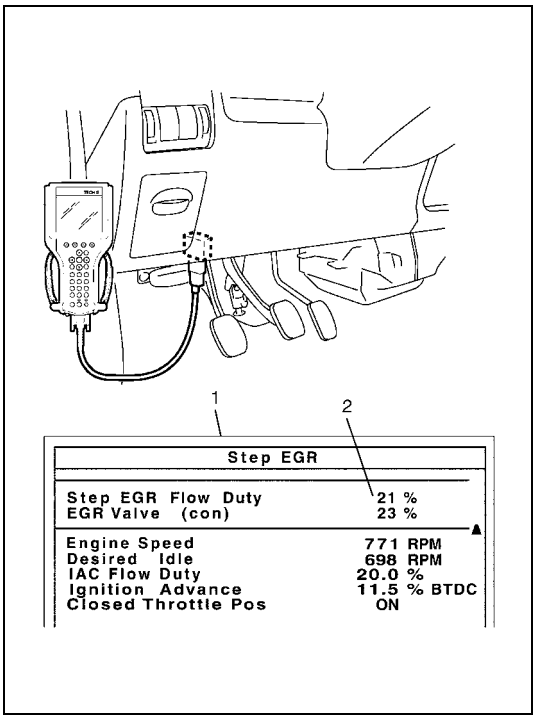
Intake air temperature sensor resistance

Temperature	Resistance
20°C (68°F)	2.33 – 2.97 kΩ
40°C (104°F)	1.08 – 1.47 kΩ
80°C (176°F)	0.309 – 0.432 kΩ

[A]:	Resistance
[B]:	Temperature
[C]:	Lower limit
[D]:	Nominal
[E]:	Upper limit
5.	Temperature gauge

Emission Control System

EGR system inspection



1) Connect Suzuki Scan Tool to data link connector (DLC) with ignition switch turn OFF.
2) Turn ON ignition switch and erase DTC using “CLEAR DTC” in “TROUBLU CODES” menu.
3) Start engine and warm up it to normal operating temperature then select “DTATA LIST” mode on scan tool.
4) Make sure that vehicle condition is as following.
   - Vehicle speed = 0 km/h (0 KPH)
   - Engine speed ≤ 900 rpm
   - Engine coolant temp. ≥ 90°C, 164°F
5) With engine idling (without depressing accelerator pedal), open EGR valve using “STEP EGR” mode in “MISC. TEST” menu.
   In this state, according as EGR valve opening increases engine idle speed drops. If not, possible cause is clogged EGR gas passage, stuck or faulty EGR valve.

1. Suzuki Scan Tool display
2. EGR valve opening (0: Close, 100: Full Open)

EGR valve removal and installation

REMOVAL

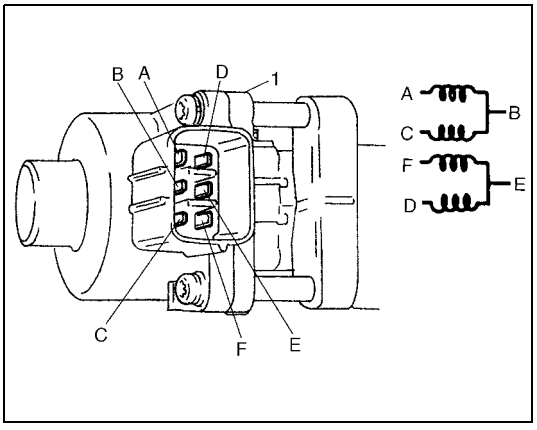
1) Disconnect negative cable at battery.
2) Remove air intake pipe.
3) Remove EGR pipe.
4) Disconnect EGR valve connector.
5) Remove EGR valve and gasket from cylinder head.

INSTALLATION

Reverse removal procedure noting following.

- Clean mating surface of valve and cylinder head.
- Use new gaskets.

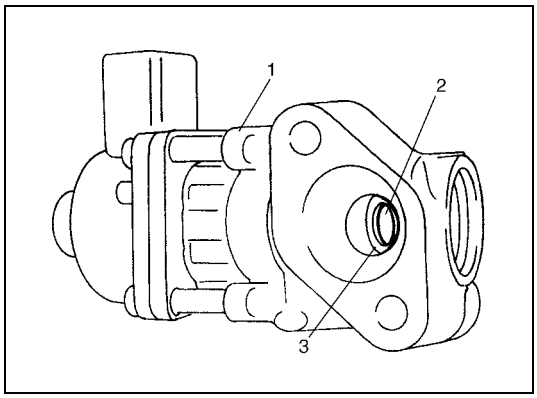
EGR valve inspection



1) Check resistance between following terminals of EGR valve (1) in each pair.
   If found faulty, replace EGR valve assembly.

EGR valve resistance

Terminal	Standard resistance
A – B **C – B** **F – E** **D – E**	**20 – 24 Ω**



2) Remove carbon from EGR valve gas passage.

NOTE:

Do not use any sharp–edged tool to remove carbon.
Be careful not to damage or bend EGR valve (1), valve seat (3) and rod.

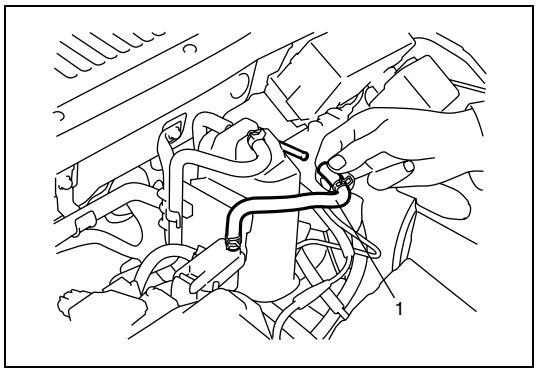
3) Inspect valve (2), valve seat and rod for fault, cracks, bend or other damage.
   If found faulty, replace EGR valve assembly.

Evaporative emission control system inspection

EVAP CANISTER PURGE

NOTE:

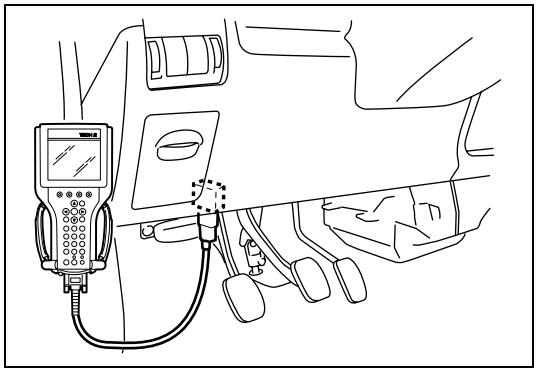
Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in "P" range) and that parking brake lever is pulled all the way up.



1) Disconnect purge hose (1) from EVAP canister.
2) Place finger against the end of disconnected hose and check that vacuum is not felt there when engine is cool and running at idle speed.
   If check result is not satisfactory, check EVAP canister purge valve, wire harness and ECM.

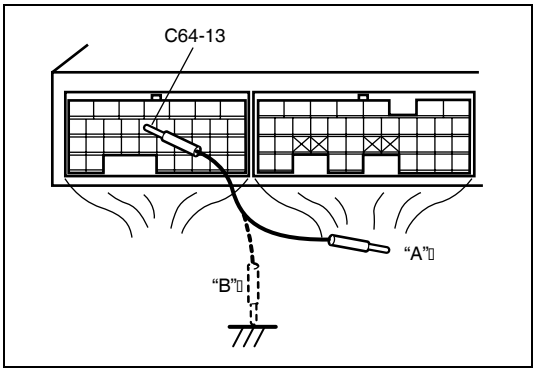
EVAP CANISTER PURGE VALVE and ITS CIRCUIT

1) Prepare to operate EVAP canister purge valve as follows.
   a) When using Suzuki Scan Tool:

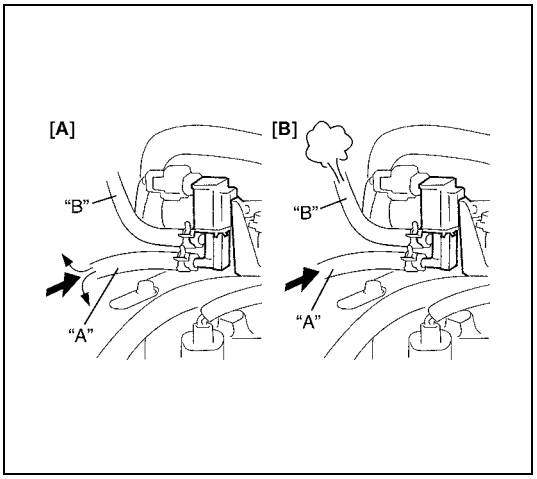


      i) Connect Suzuki Scan Tool to DLC with ignition switch OFF and disconnect purge valve vacuum hoses from intake manifold and purge valve chamber.
      ii) Turn ON ignition switch, clear DTC and select "MISC TEST" mode on Suzuki Scan Tool.

   b) When not using Suzuki Scan Tool:
      i) Disconnect purge valve vacuum hoses from intake manifold and purge valve chamber.



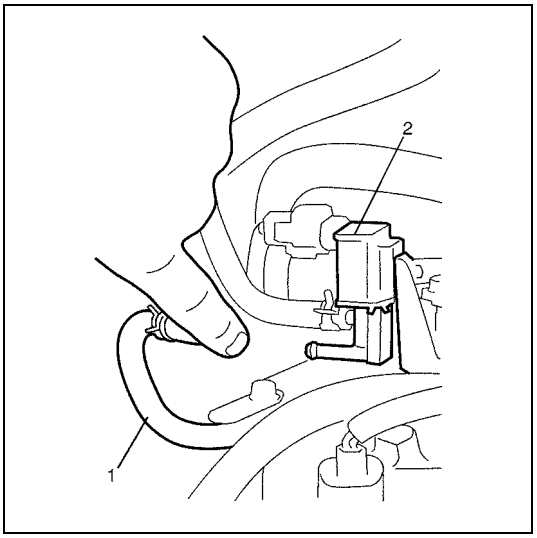
ii) Turn ON ignition switch.
Using service wire, ground C64-13 terminal of ECM connector (valve ON) "B" and unground it (valve OFF) "A".



2) Check purge valve for operation and vacuum passage for clog when valve is switched ON and OFF by using Suzuki Scan Tool or service wire.
If check result is not described, check vacuum hoses, EVAP canister purge valve, wire harness and connections.

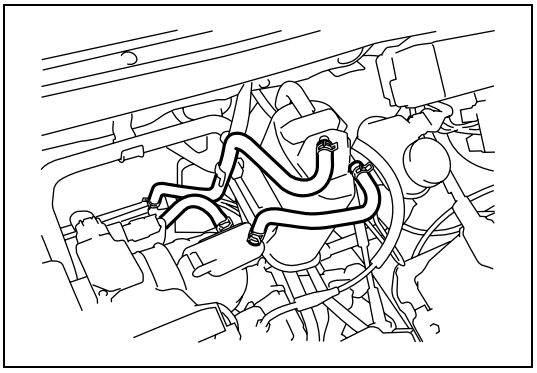
EVAP canister purge valve specification
[A] Valve OFF:
When blowing into hose "A", air should not come out of hose "B".
[B] Valve ON:
When blowing into hose "A", air should come out of hose "B".

VACUUM PASSAGE



Start engine and run it at idle speed. Disconnect vacuum hose (1) from EVAP canister purge valve (2). With finger placed against hose disconnected, check that vacuum is applied.
If it is not applied, clean vacuum passage by blowing compressed air.

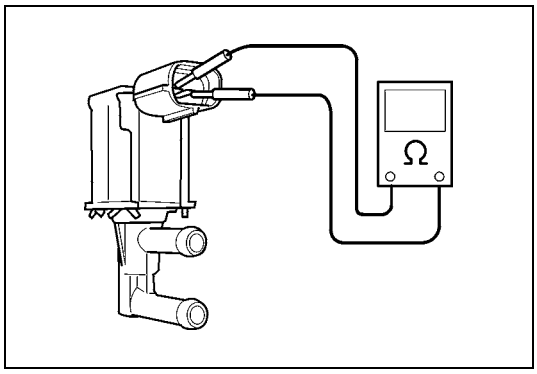
VACUUM HOSE



Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

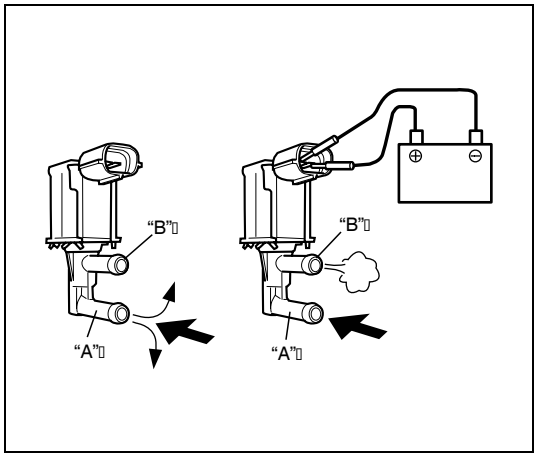
EVAP CANISTER PURGE VALVE

1) With ignition switch OFF, disconnect coupler from canister purge valve.
2) Remove EVAP canister purge valve from air cleaner assembly.



3) Check resistance between two terminals of EVAP canister purge valve.
   If resistance is not as specified, replace.

EVAP canister resistance
30 – 34 Ω at 20°C (68°F)



4) With coupler disconnected, blow into pipe "A". Air should not come out of pipe "B".
5) Connect 12 V-battery to EVAP canister purge valve terminals. In this state, blow pipe "A". Air should come out of pipe "B".
   If check result is not described, replace EVAP canister purge valve.

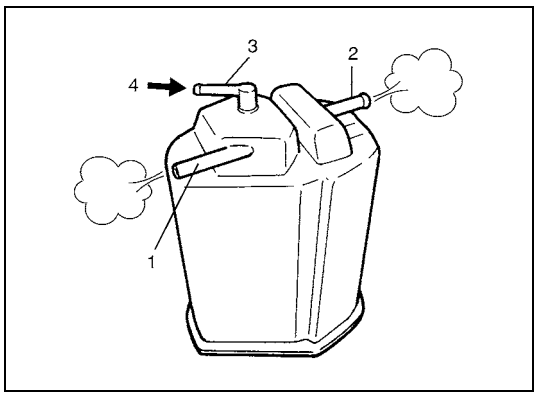
WARNING:
Do not suck the air through valve. Fuel vapor inside valve in harmful.

6) Install EVAP canister purge valve to air cleaner assembly.

EVAP CANISTER

WARNING:
DO NOT SUCK nozzles on EVAP canister. Fuel vapor inside EVAP canister is harmful.

1) Check outside of EVAP canister visually.
2) Disconnect vacuum hoses from EVAP canister.



3) Check that there should be no restriction of flow through purge pipe (1) and air pipe (2) when air is blown (4) into tank pipe (3).
   If any faulty condition is found in above inspection, replace.

PCV system inspection

NOTE:

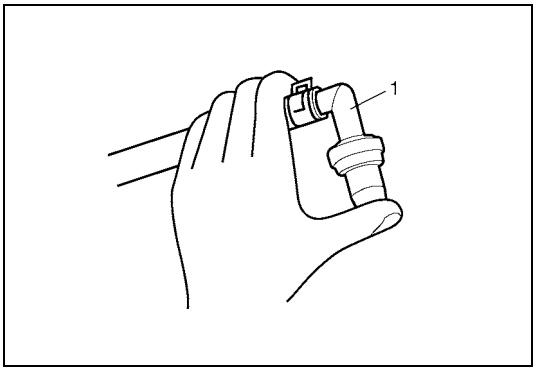
Be sure to check that there is no obstruction in PCV valve or its hoses before checking IAC duty, for obstructed PCV valve or hose hampers its accurate adjustment.

PCV HOSE

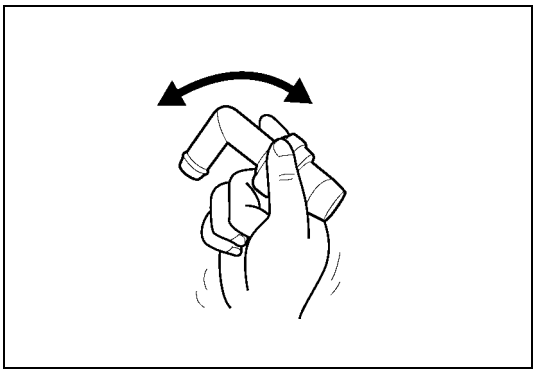
Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

PCV VALVE

1) Detach air cleaner assembly.
2) Disconnect PCV valve from cylinder head cover and install plug to head cover hole.
3) Install air cleaner assembly temporarily.
4) Run engine at idle.



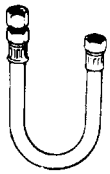
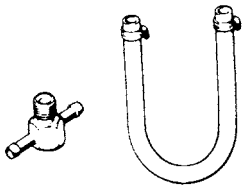
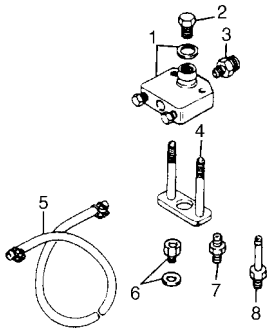
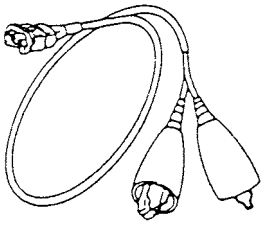
5) Place your finger over end of PCV valve (1) to check for vacuum.
   If there is no vacuum, check for clogged valve. Replace as necessary.



6) After checking vacuum, stop engine and remove PCV valve. Shake valve and listen for the rattle of check needle inside the valve. If valve does not the rattle, replace valve.

7) After checking, remove plug and install PCV valve.
8) Install air cleaner assembly securely.

Special Tool

 09912-58442 Pressure gauge	 09912-58432 Pressure hose	 09912-58490 3-way joint & hose	 09912-58421 Checking tool set (See NOTE "A".)
 09912-57610 Checking tool plate	 09930-88530 Injector test lead	 Tech 2 kit (Suzuki Scan Tool) (See NOTE "B".)	

NOTE:

- **"A": This kit includes the following items.**
  1. Tool body & washer, 2. Body plug, 3. Body attachment-1, 4. Holder, 5. Return hose & clamp, 6. Body attachment-2 & washer, 7. Hose attachment-1, 8. Hose attachment-2
- **"B": This kit includes the following items.**
  1. Tech 2, 2. PCMCIA card, 3. DLC cable, 4. SAE 16/19 adaptor, 5. Cigarette cable, 6. DLC loopback adaptor, 7. Battery power cable, 8. RS232 cable, 9. RS232 adaptor, 10. RS 232 loopback connector, 11. Storage case, 12. Power supply

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
TP sensor mounting screw	2.5	0.25	1.8
IAC valve screw	3.5	0.35	2.5
ECT sensor	15	1.5	11.5
Heated oxygen sensor	45	4.5	32.5
Camshaft position sensor	10	1.0	7.5
Knock sensor	22	2.2	16.0
Oil control valve mounting nut	11	1.1	8.0
Oil gallery pipe No.1 bolt	30	3.0	21.5
Delivery pipe bolt	25	2.5	18.0
MAF and IAT sensor screw	2.5	0.25	1.8

SECTION 6F1

IGNITION SYSTEM (ELECTRONIC IGNITION SYSTEM)

WARNING:

For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in Section 10B in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in Section 10B before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

General Description

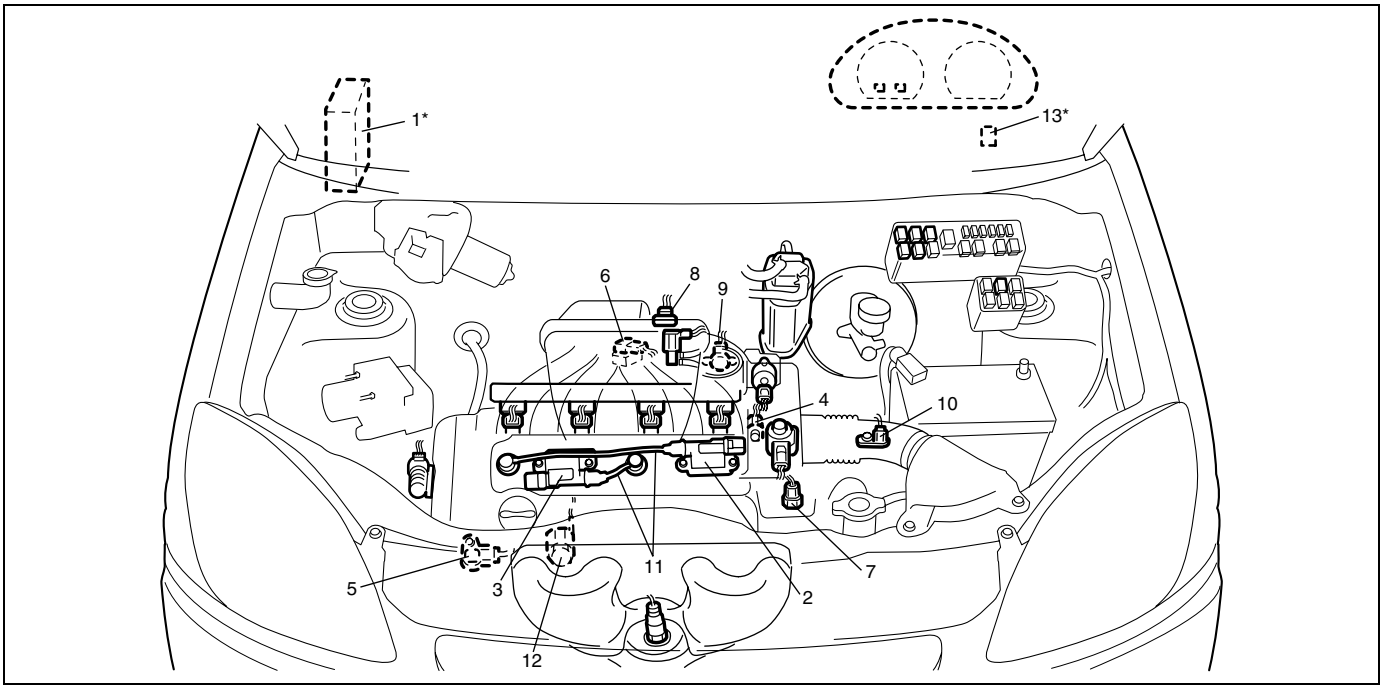
Ignition System Construction

The ignition system is an electronic (distributorless) ignition system. Its consists of the parts as described below.

- ECM
  It detects the engine and vehicle conditions through the signals from the sensors, determines the most suitable ignition timing and time for electricity to flow to the primary coil and sends a signal to the ignitor (power unit) in the ignition coil assembly.
- Ignition coil assembly (including an igniter)
  The ignition coil assembly has a built-in ignitor which turns ON and OFF the current flow to the primary coil according to the signal from ECM. When the current flow to the primary coil is turned OFF, a high voltage is induced in the secondary coil.
- High tension cords and spark plugs.
- CMP sensor (Camshaft position sensor) and CKP sensor (Crankshaft position sensor)
  Using signals from these sensors, ECM identifies the specific cylinder whose piston is in the compression stroke, detects the crank angle and adjusts initial ignition timing automatically.
- TP sensor, ECT sensor, MAP sensor and other sensors/switches
  Refer to “Electronic Control System Description” in Section 6E1 for details.

Although this ignition system does not have a distributor, it has two ignition coil assemblies (one is for No.1 and No.4 spark plugs and the other is for No.2 and No.3 spark plugs). When an ignition signal is sent from ECM to the ignitor in the ignition coil assembly for No.1 and No.4 spark plugs, a high voltage is induced in the secondary coil and that passes through the high-tension cords and causes No.1 and No.4 spark plugs to spark simultaneously. Likewise, when an ignition signal is sent to the ignitor in the other ignition coil assembly, No.2 and No.3 spark plugs spark simultaneously.

Ignition System Components Locator Diagram

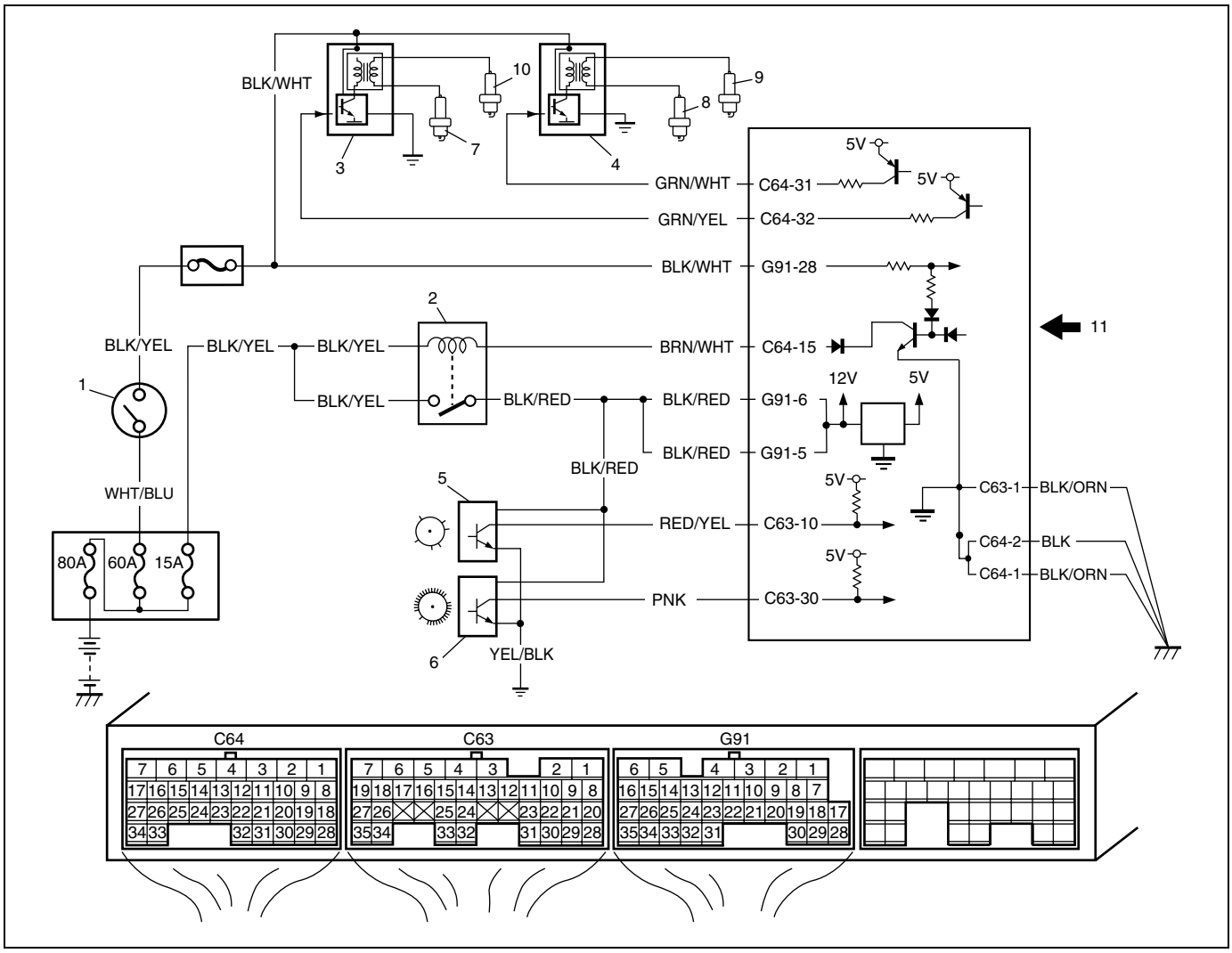


1. ECM	4. CMP sensor	7. ECT sensor	10. VSS	13. Data link connector
2. Ignition coil assembly for No.1 and No.4 spark plugs	5. CKP sensor	8. MAF and IAT sensor	11. High-tension cords	
3. Ignition coil assembly for No.2 and No.3 spark plugs	6. MAP sensor	9. TP sensor	12. Knock sensor	

NOTE:

Above figure shows left-hand steering vehicle. For right-hand steering vehicle, parts with (*) are installed at the opposite side.

Ignition System Wiring Circuit Diagram



1. Ignition switch	7. No.1 spark plug
2. Main relay	8. No.2 spark plug
3. Ignition coil assembly for No.1 and No.4 spark plugs	9. No.3 spark plug
4. Ignition coil assembly for No.2 and No.3 spark plugs	10. No.4 spark plug
5. CMP sensor	11. Sensed information (MAP sensor, ECT sensor, MAF and IAT sensor, TP sensor, Knock sensor, VSS, Electric load signal, Engine start signal)
6. CKP sensor	

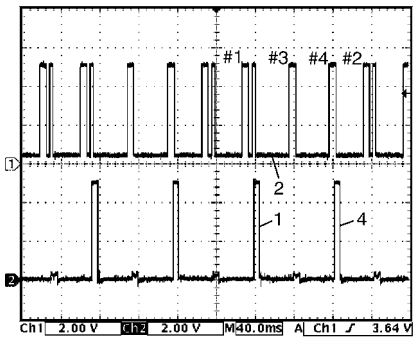
Diagnosis

Ignition System Symptom Diagnosis

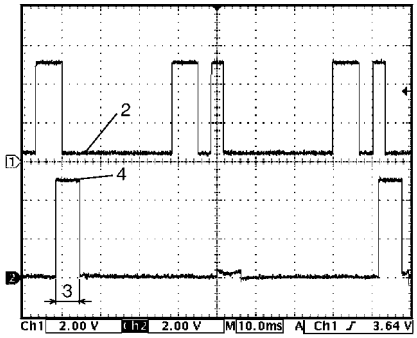
Condition	Possible Cause	Correction
Engine cranks, but will not start or hard to start (No spark)	Blown fuse for ignition coil	Replace.
	Loose connection or disconnection of lead wire or high-tension cord(s)	Connect securely.
	Faulty high-tension cord(s)	Replace.
	Faulty spark plug(s)	Adjust, clean or replace.
	Faulty ignition coil	Replace ignition coil assembly.
	Faulty CKP sensor or CKP sensor plate	Clean, tighten or replace.
	Faulty CMP sensor or sensor rotor tooth of camshaft	Clean, tighten or replace.
	Faulty ECM	Replace.
Poor fuel economy or engine performance	Incorrect ignition timing	Check related sensors and CKP sensor plate.
	Faulty spark plug(s) or high-tension cord(s)	Adjust, clean or replace.
	Faulty ignition coil assembly	Replace.
	Faulty CKP sensor or CKP sensor plate	Clean, tighten or replace.
	Faulty CMP sensor or sensor rotor tooth of camshaft	Clean, tighten or replace.
	Faulty ECM	Replace.

Reference Waveform

[A]



[B]



Oscilloscope waveforms of CMP sensor and No.1/No.4 ignition trigger signal are as shown in figure when connecting oscilloscope between terminals C63-10 of ECM connectors connected to ECM and ground, and between terminal C64-32 and ground.

Measurement condition for waveform [A]

Measurement terminal	**CH1: C63-10 to C64-1 CH2: C64-32 to C64-1**
Oscilloscope setting	**CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 40 ms/DIV**
Measurement condition	**After warmed up engine to normal operating temperature Engine at specified idle speed**

Measurement condition for waveform [B]

Measurement terminal	**CH1: C63-10 to C64-1 CH2: C64-32 to C64-1**
Oscilloscope setting	**CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 10 ms/DIV**
Measurement condition	**After warmed up engine to normal operating temperature Engine at specified idle speed**

[A]: Oscilloscope waveforms at specified idle speed
[B]: Detail waveforms at specified idle speed
1. No.1 ignition trigger signal
2. CMP sensor signal
3. Primary coil current flow time
4. No.4 ignition trigger signal

Ignition System Diagnostic Flow Table

Step	Action	Yes	No
1	Was “Engine and Emission Control System Check” in Section 6 performed?	Go to Step 2.	Go to “Engine and Emission Control System Check” in Section 6.
2	Ignition Spark Test 1) Check all spark plugs for condition and type referring to “Spark Plugs Inspection” in this section. 2) If OK, perform ignition spark test, referring to “Ignition Spark Test” in this section. Is spark emitted from all spark plugs?	Go to Step 11.	Go to Step 3.
3	Diagnostic Trouble Code (DTC) Check Is DTC stored in ECM?	Go to applicable “DTC Table” in Section 6.	Go to Step 4.

Step	Action	Yes	No
4	Electrical Connection Check 1) Check ignition coil assemblies and high-tension cords for electrical connection. Are they connected securely?	Go to Step 5.	Connect securely.
5	High-tension Cords Check 1) Check high-tension cord for resistance referring to “High-Tension Cords Inspection” in this section. Is check result satisfactory?	Go to Step 6.	Replace high-tension cord(s).
6	Ignition Coil Assembly Power Supply and Ground Circuit Check 1) Check ignition coil assembly power supply and ground circuits for open and short. Are circuits in good condition?	Go to Step 7.	Repair or replace.
7	Ignition Coil Assembly Check 1) Check ignition coil for resistance referring to “Ignition Coil Assembly (Including Ignitor) Inspection” in this section. Is check result satisfactory?	Go to Step 8.	Replace ignition coil assembly.
8	Crankshaft Position (CKP) Sensor Check 1) Check crankshaft position sensor referring to Step 2, 7 and 8 of “DTC P0335 Crankshaft Position (CKP) Sensor Circuit” in Section 6. Is check result satisfactory?	Go to Step 9.	Tighten CKP sensor bolt, replace CKP sensor or CKP sensor plate.
9	Ignition Trigger Signal Circuit Check 1) Check ignition trigger signal wire for open, short and poor connection. Is circuit in good condition?	Go to Step 10.	Repair or replace.
10	A Known-good Ignition Coil Assembly Substitution 1) Substitute a known-good ignition coil assembly and then repeat Step 2. Is check result of Step 2 satisfactory?	Go to Step 11.	Substitute a known-good ECM and then repeat Step 2.
11	Ignition Timing Check 1) Check initial ignition timing and ignition timing advance referring to “Ignition Timing Inspection” in this section. Is check result satisfactory?	System is in good condition.	Check CMP sensor, CMP sensor rotor tooth of camshaft, CKP sensor, CKP sensor plate and/or input signals related to this system.

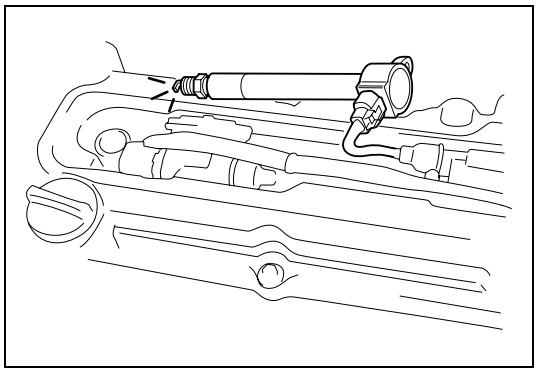
On-Vehicle Service

Ignition Spark Test

1) Remove air cleaner assembly with air intake pipe.
2) Disconnect all injector couplers from injectors.

WARNING:
Without disconnection of injector couplers, combustible gas may come out from spark plug holes during this test and may get ignited in engine room.

3) Remove spark plug and check it for condition and type referring to “Spark Plugs Removal and Installation” in this section.

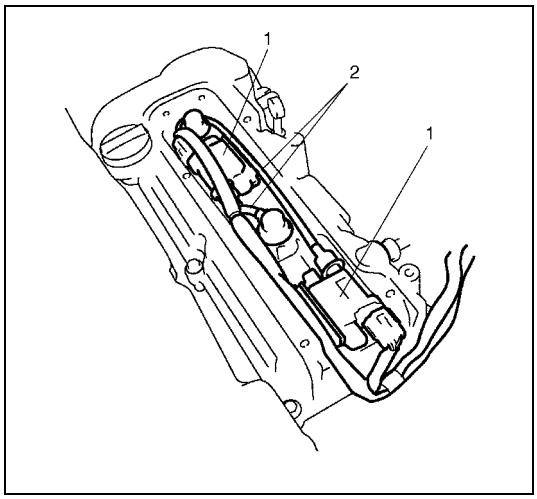


4) If OK, connect ignition coil coupler to ignition coil assembly and connect spark plug to ignition coil assembly or high-tension cord. Ground spark plug.
5) Crank engine and check if each spark plug sparks.
6) If no spark is emitted, inspect the related parts as described under “Ignition System Symptom Diagnosis” in this section.

High-Tension Cords Removal and Installation

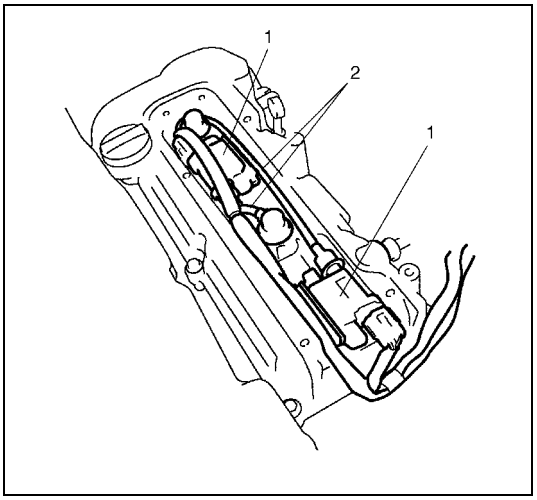
REMOVAL

1) Remove air cleaner assembly with air intake pipe and cylinder head upper cover.



2) Disconnect high-tension cords (2) from ignition coil assemblies (1) while gripping each cap.
3) Pull out high-tension cords from spark plugs while gripping each cap.

CAUTION:
- **Removal of high-tension cords together with clamps will be recommended so as not to damage their inside wire (resistive conductor).**
- **For the same reason, pull out each connection by gripping cap portion.**



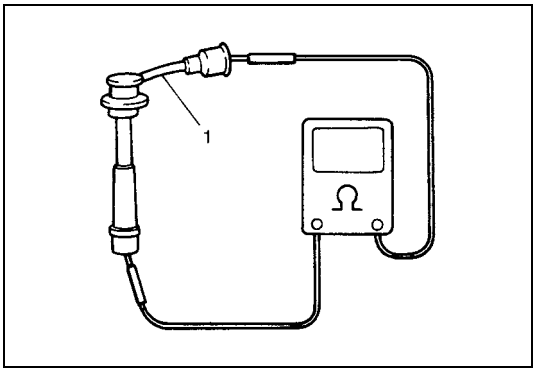
INSTALLATION

1) Install high-tension cords (2) to spark plugs and ignition coil assemblies (1) while gripping each cap.

CAUTION:
- **Never attempt to use metal conductor high-tension cords as replacing parts.**
- **Insert each cap portion fully when installing high-tension cords.**

2) Install cylinder head upper cover and air cleaner assembly with air intake pipe.

High-Tension Cords Inspection



Measure resistance of high-tension cord (1) by using ohmmeter. If resistance exceeds specification, replace high-tension cord(s).

No.1 high-tension cord resistance
1.4 – 4.0 kΩ

No.3 high-tension cord resistance
0.6 – 2.0 kΩ

Spark Plugs Removal and Installation

CAUTION:
- **When servicing the iridium/platinum spark plugs (slender center electrode type plugs), do not touch the center electrode to avoid damage to it. The electrode is not strong enough against mechanical force as it is slender and its material is not mechanically tough**
- **Do not clean or adjust gap for the iridium/platinum spark plugs.**

REMOVAL

1) Remove air cleaner assembly with air intake pipe and cylinder head upper cover.
2) Pull out high-tension cords by gripping their caps and then remove ignition coil assemblies referring to “Ignition Coil Assembly (Including Ignitor) Removal and Installation” in this section.
3) Remove spark plugs.

INSTALLATION

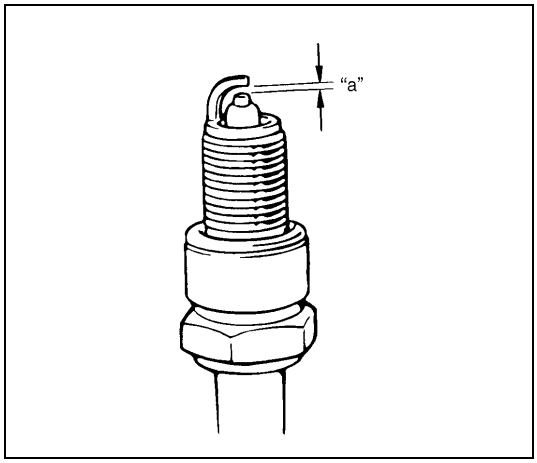
1) Install spark plugs and torque them to specification.

Tightening torque
Spark plug: 25 N·m (2.5 kg-m, 18.0 lb-ft)

2) Install ignition coil assemblies referring to “Ignition Coil Assembly (Including Ignitor) Removal and Installation” in this section.
3) Install high-tension cords securely by gripping their caps.
4) Install cylinder head upper cover and air cleaner assembly with air intake pipe.

Spark Plugs Inspection

- Inspect them for:
  – Electrode wear
  – Carbon deposits
  – Insulator damage



- If any abnormality is found, for spark plug other than iridium/platinum, adjust air gap, clean with spark plug cleaner or replace them with specified new pugs.
  For iridium/platinum spark plugs, replace them with new plugs.

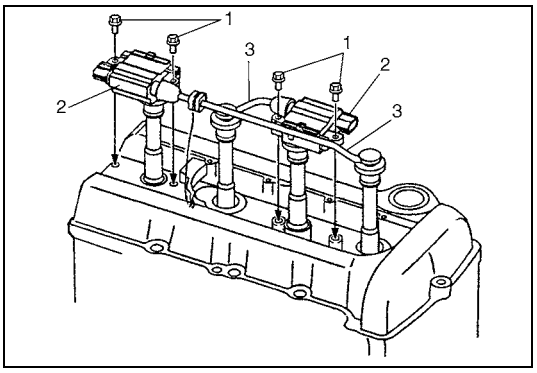
Spark plug air gap
“a”: 1.0 – 1.1 mm (0.040 – 0.043 in.)

Spark plug type
NGK: IFR6J11 (iridium/platinum spark plug)

Ignition Coil Assembly (Including Ignitor) Removal and Installation

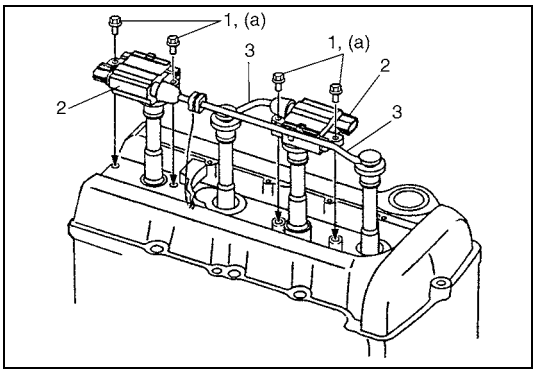
REMOVAL

1) Disconnect negative cable at battery.
2) Remove air cleaner assembly with air intake pipe and cylinder head upper cover.
3) Disconnect ignition coil coupler.



4) Disconnect high-tension cord (3) from ignition coil assembly (2).
5) Remove ignition coil bolts (1) and then pull out ignition coil assembly.

INSTALLATION

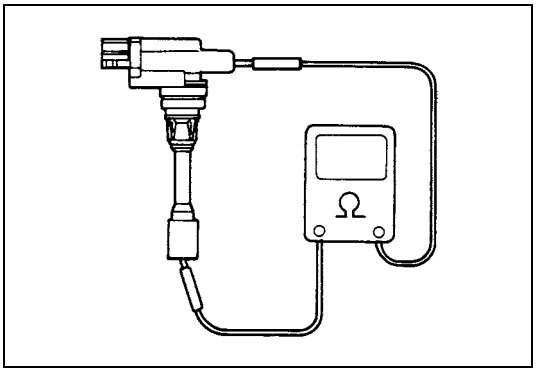


1) Install ignition coil assembly (2).
2) Tighten ignition coil bolts (1) to specified torque, and then connect ignition coil coupler.

Tightening torque
Ignition coil bolt (a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

3) Install high-tension cord (3) to ignition coil assembly while gripping its cap.
4) Install cylinder head upper cover and air cleaner assembly with air intake pipe.
5) Connect negative cable to battery.

Ignition Coil Assembly (Including Ignitor) Inspection



Measure secondary coil for resistance.
If resistance is out of specification, replace ignition coil assembly.

Secondary coil resistance
7.1 – 9.5 kΩ at 20°C, 68°F

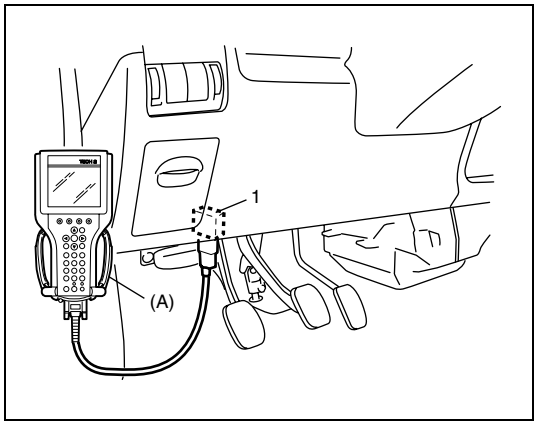
Crankshaft Position (CKP) Sensor

Refer to “Crankshaft position sensor (CMP sensor) removal and installation” and “Crankshaft position sensor (CKP sensor) inspection” in Section 6E1 for removal, inspection and installation.

Ignition Timing Inspection

NOTE:

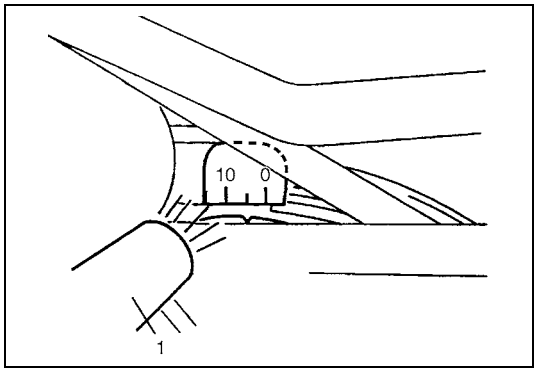
- **Ignition timing is not adjustable. If ignition timing is out of specification, check system related parts.**
- **Before starting engine, place transmission gear shift lever in “Neutral” (shift selector lever to “P” range for A/T model), and set parking brake.**



1) Connect scan tool to DLC (1) with ignition switch OFF.

   Special tool
   (A): Suzuki Scan Tool

2) Start engine and warm it up to normal operating temperature.
3) Make sure that all of electrical loads except ignition are switched off.
4) Check to be sure that idle speed is within specification referring to “Idle speed/idle air control (IAC) duty inspection” in Section 6E1.
5) Fix ignition timing by using “Fixed Spark” of “Misc Test” mode on scan tool.



6) Set timing light (1) to high-tension cord for No.1 cylinder and check that ignition timing is within specification.

   Initial ignition timing (fixed with scan tool)
   5 ± 3° BTDC at idle speed

   Ignition order
   1-3-4-2

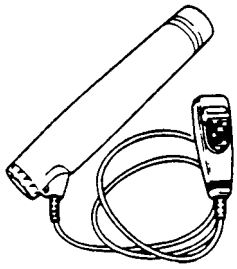
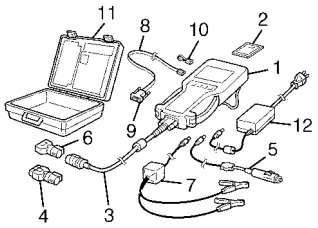
7) If ignition timing is out of specification, check the followings:
   - CKP sensor
   - CKP sensor plate
   - TP sensor
   - CMP sensor
   - CMP sensor rotor tooth of camshaft
   - VSS
   - Timing chain cover installation

8) After checking Initial Ignition Timing, release ignition timing fixation by using scan tool.
9) With engine idling (throttle opening at closed position and car stopped), check that ignition timing is about 3° – 13° BTDC. (Constant variation within a few degrees from 3° – 13° indicates no abnormality but proves operation of electronic timing control system.) Also, check that increasing engine speed advances ignition timing.
   If above check results are not satisfactory, check CKP sensor and ECM.

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Spark plug	25	2.5	18.0
Ignition coil bolt	10	1.0	7.5

Special Tool

	
09930-76420 Timing light (Dry cell type)	Tech 2 kit (Suzuki Scan Tool) (See NOTE.)

NOTE:

This kit includes the following items.

1. Tech 2, 2. PCMCIA card, 3. DLC cable, 4. SAE 16/19 adapter, 5. Cigarette cable, 6. DLC loopback adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loopback connector, 11. Storage case, 12. Power supply

SECTION 6G

CRANKING SYSTEM

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to System Components and Wiring Location View under General Description in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and Service Precautions under On-Vehicle Service in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

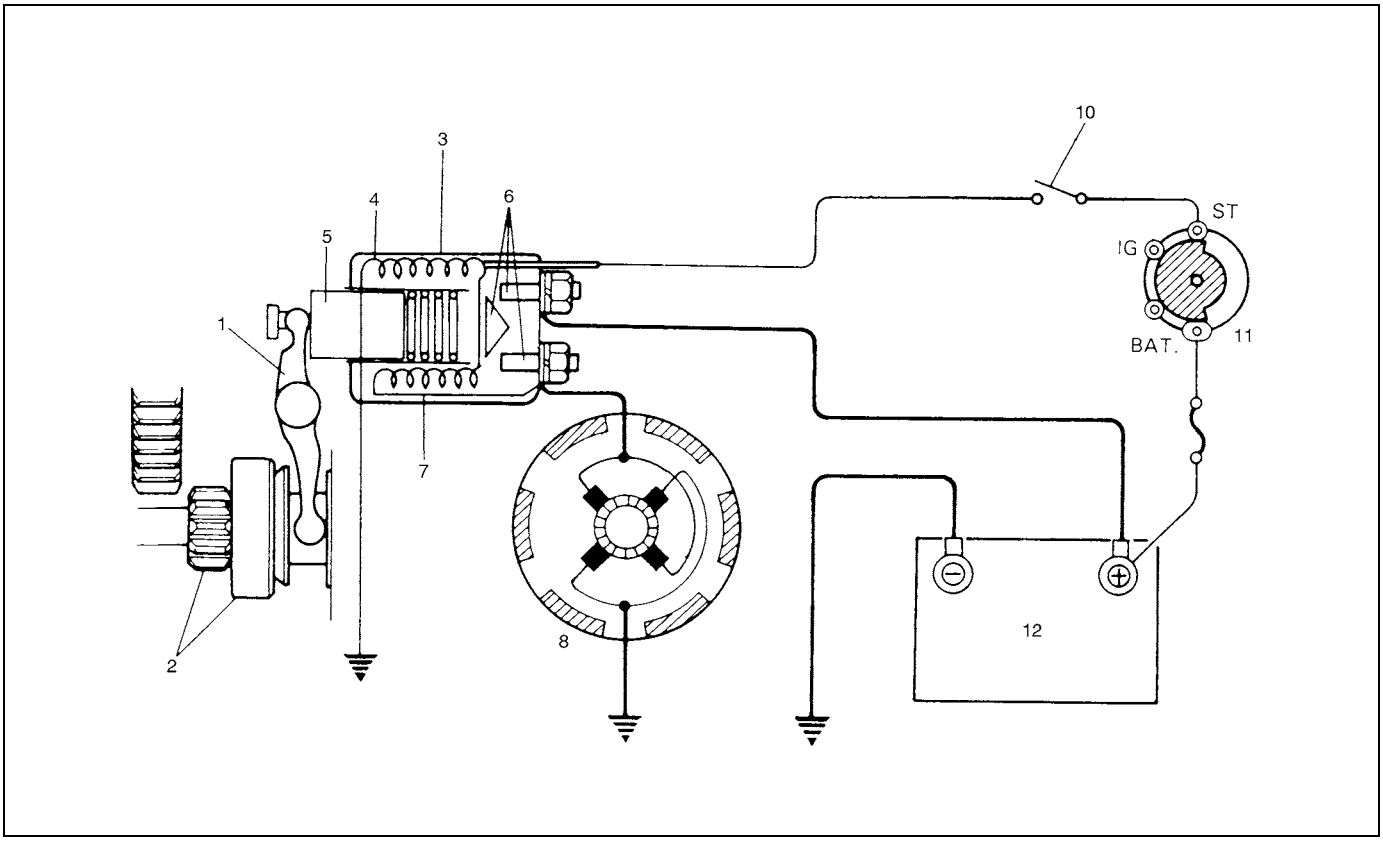
NOTE:

Starting motor varies depending on specifications, etc. Therefore, be sure to check model and specification of the vehicle being serviced before replacing parts.

CONTENTS

General Description

Cranking System Circuit Diagram



1. Pinion drive lever	5. Plunger	9. Blank
2. Pinion & Over-running clutch	6. Magnetic switch contacts	10. A/T: Transmission range switch (shift lever switch)
3. Magnetic switch	7. Pull-in coil	11. Ignition & Starter switch
4. Hold-in coil	8. Starting motor	12. Battery

Diagnosis

Cranking System Symptom Diagnosis

Possible symptoms due to starting system trouble would be as follows:

- Starting motor does not run (or runs slowly)
- Starting motor runs but fails to crank engine
- Abnormal noise is heard

Proper diagnosis must be made to determine exactly where the cause of each trouble lies.....in battery, wiring harness, (including starting motor switch), starting motor or engine.

Do not remove motor just because starting motor does not run. Check following items and narrow down scope of possible causes.

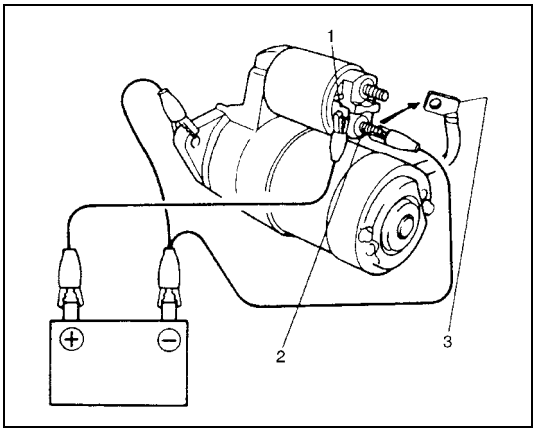
1) Condition of trouble
2) Tightness of battery terminals (including ground cable connection on engine side) and starting motor terminals
3) Discharge of battery
4) Mounting of starting motor

Condition	Possible Cause	Correction
Motor not running (No operating sound of magnetic switch)	Shift lever switch is not in P or N, or not adjusted (A/T)	Shift in P or N, or adjust switch.
	Battery run down	Recharge battery.
	Battery voltage too low due to battery deterioration	Replace battery.
	Poor contact in battery terminal connection	Retighten or replace.
	Loose grounding cable connection	Retighten.
	Fuse set loose or blown off	Tighten or replace.
	Poor contacting action of ignition switch and magnetic switch	Replace.
	Lead wire coupler loose in place	Retighten.
	Open-circuit between ignition switch and magnetic switch	Repair.
	Open-circuit in pull-in coil	Replace magnetic switch.
	Brushes are seating poorly or worn down	Repair or replace.
	Poor sliding of plunger and/or pinion	Repair.
Motor not running (Operating sound of magnetic switch heard)	Battery run down	Recharge battery.
	Battery voltage too low due to battery deterioration	Replace battery.
	Loose battery cable connections	Retighten.
	Burnt main contact point, or poor contacting action of magnetic switch	Replace magnetic switch.
	Brushes are seating poorly or worn down	Repair or replace.
	Weakened brush spring	Replace.
	Burnt commutator	Replace armature.
	Layer short-circuit of armature	Replace.
	Crankshaft rotation obstructed	Repair.
Starting motor running but too slow (small torque) (If battery and wiring are satisfactory, inspect starting motor)	Insufficient contact of magnetic switch main contacts	Replace magnetic switch.
	Layer short-circuit of armature	Replace.
	Disconnected, burnt or worn commutator	Repair commutator or replace armature.
	Worn brushes	Replace brush.
	Weakened brush springs	Replace spring.
	Burnt or abnormally worn end bush	Replace bush.
Starting motor running, but not cranking engine	Worn pinion tip	Replace over-running clutch.
	Poor sliding of over-running clutch	Repair.
	Over-running clutch slipping	Replace over-running clutch.
	Worn teeth of ring gear	Replace flywheel.
Noise	Abnormally worn bush	Replace bush.
	Worn pinion or worn teeth of ring gear	Replace pinion or flywheel.
	Poor sliding of pinion (failure in return movement)	Repair or replace.
	Worn internal or planetary gear teeth	Replace.
	Lack of oil in each part	Lubricate.
Starting motor does not stop running	Fused contact points of magnetic switch	Replace magnetic switch.
	Short-circuit between turns of magnetic switch coil (layer short-circuit)	Replace magnetic switch.
	Failure of returning action in ignition switch	Replace.

Cranking System Test

CAUTION:
Each test must be performed within 3 – 5 seconds to avoid coil from burning.

Pull-in test

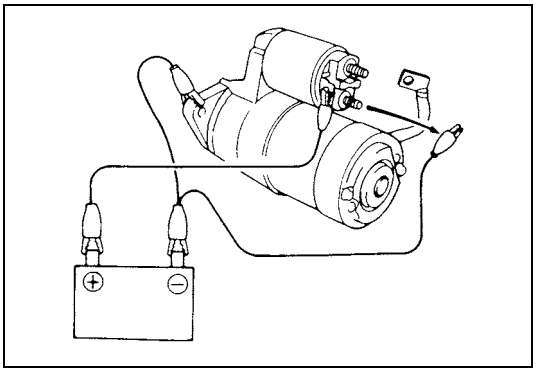


Connect battery to magnetic switch as shown.
Check that plunger and pinion move outward.
If plunger and pinion don't move, replace magnetic switch.

NOTE:
Before testing, disconnect lead wire from terminal M.

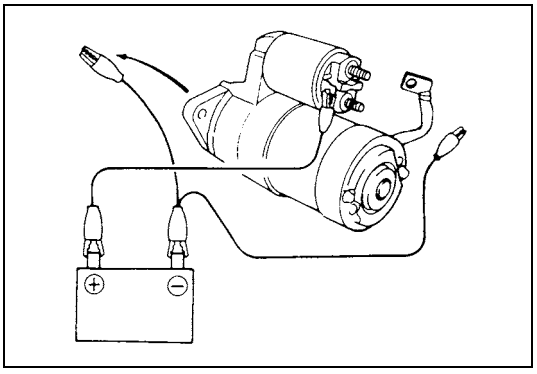
1.	Terminal "S"
2.	Terminal "M"
3.	Lead wire (switch to motor)

Hold-in test



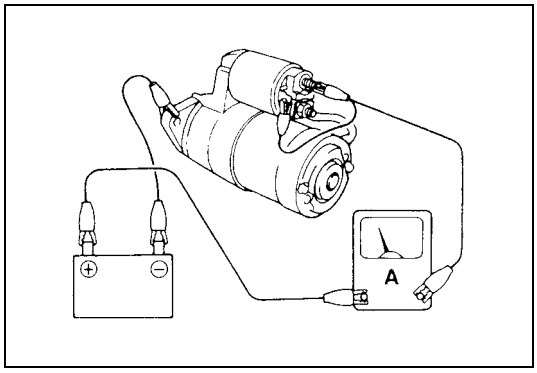
While connected as above with plunger out, disconnect negative lead from terminal "M".
Check that plunger and pinion remain out.
If plunger and pinion return inward, replace magnetic switch.

Plunger and pinion return test



Disconnect negative lead from starting motor body.
Check that plunger and pinion return inward.
If plunger and pinion don't return, replace magnetic switch.

No-load performance test

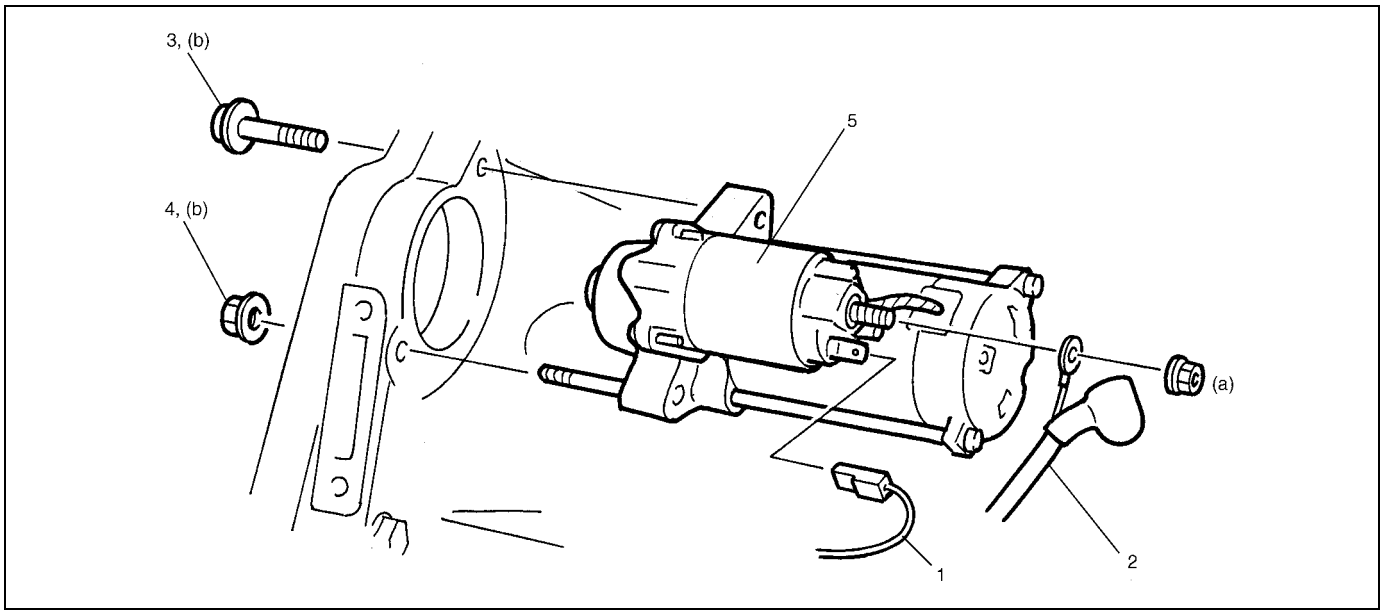


Connect battery and ammeter to starter as shown.
Check that starter rotates smoothly and steadily with pinion moving out. Check that ammeter indicates specified current.

Specified current (No-load performance test)
0.8 kW TYPE: 53 A MAX. at 11.5 V
1.2 kW TYPE: 90 A MAX. at 11 V

ON-Vehicle Service

Starting Motor Dismounting and Remounting



Dismounting

1) Disconnect negative (–) battery lead at battery.
2) Disconnect magnetic switch lead wire (1) and battery cable (2) from starting motor terminals.
3) Remove starting motor mount bolt (3) and nut (4).
4) Remove starting motor (5).

Remounting

Reverse the dismounting procedure.

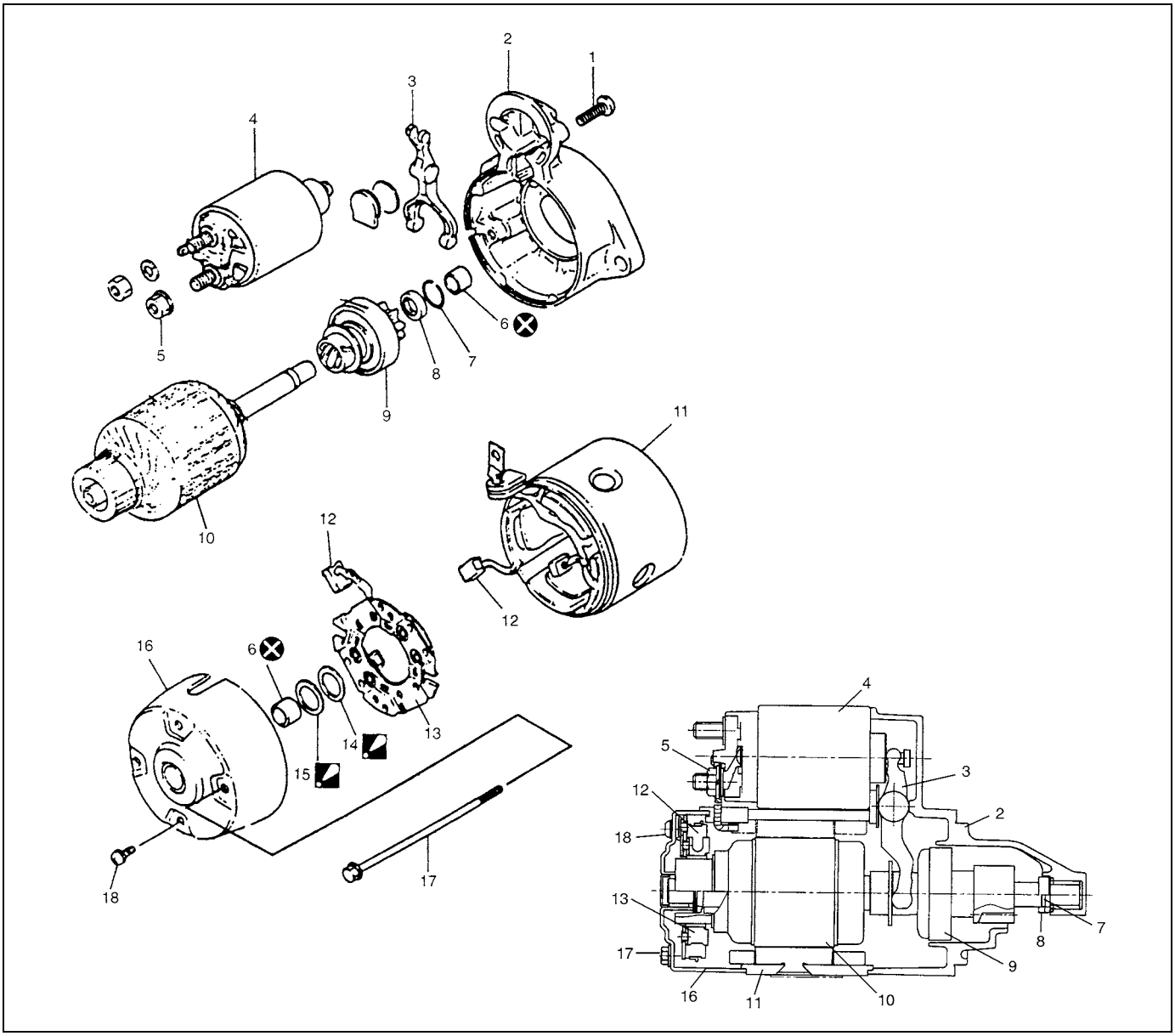
Tightening torque
Starting motor battery cable nut (a): 10 N·m (1.0 kg-m, 7.5 lb-ft)
Starting motor mount bolt and nut (b): 45 N·m (4.5 kg-m, 32.5 lb-ft)

Starting Motor Disassembly and Reassembly

0.8 kW TYPE

NOTE:

Apply grease (99500-25010) to sliding surface of each below part.

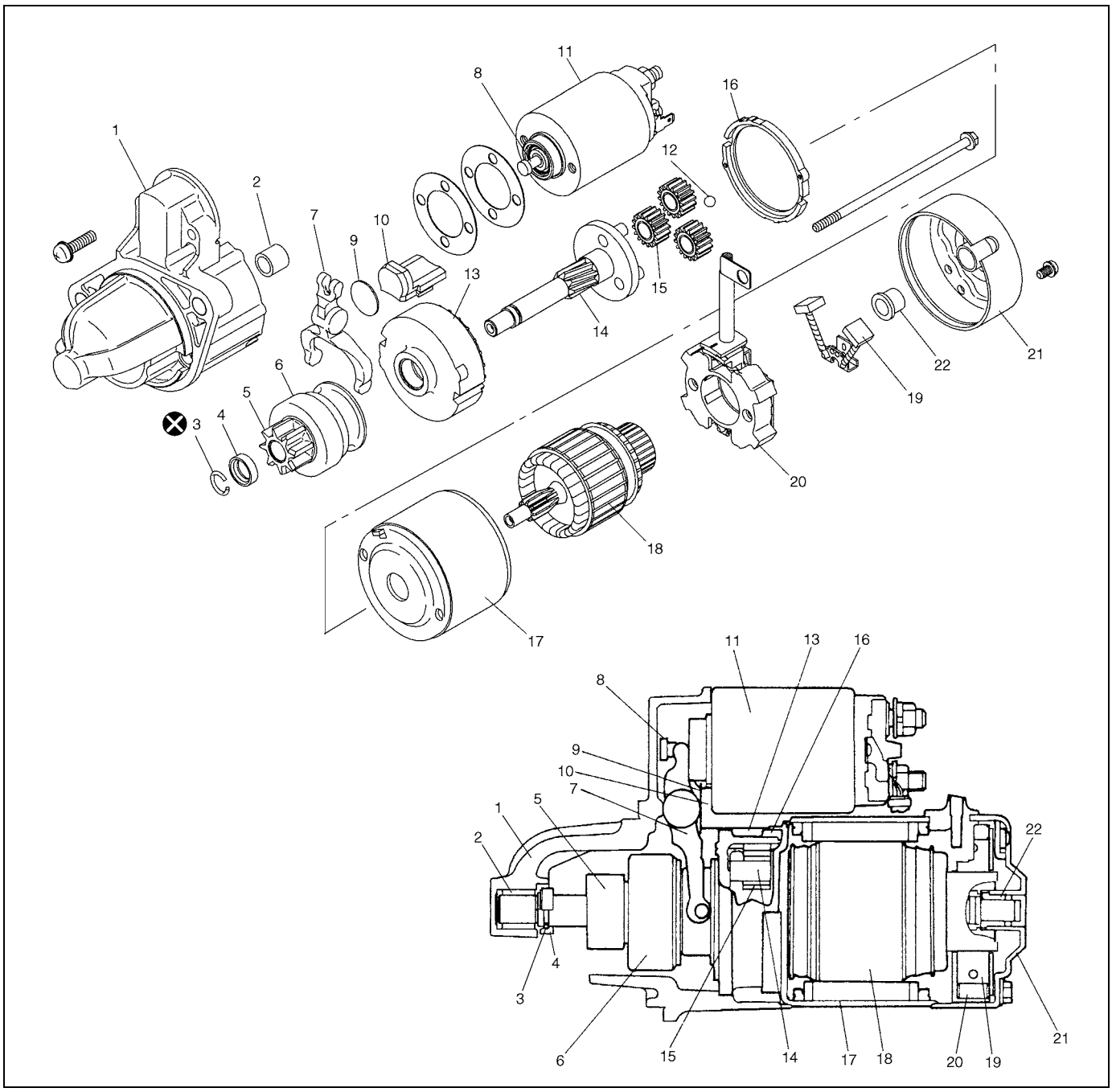


1. Magnetic switch mounting screw	8. Stop ring	15. Armature shaft washer : Thickness 0.5 mm (0.02 in.)
2. Front housing	9. Over-running clutch	16. Rear bracket
3. Pinion driver lever	10. Armature	17. Rear bracket bolt
4. Magnetic switch	11. Starting motor yoke	18. Rear bracket screw
5. Field coil lead nut	12. Brush	Do not reuse.
6. Armature shaft bush	13. Brush holder	
7. Snap ring	14. Armature shaft washer : Thickness 1.8 mm (0.07 in.)	

1.2 kW TYPE

NOTE:

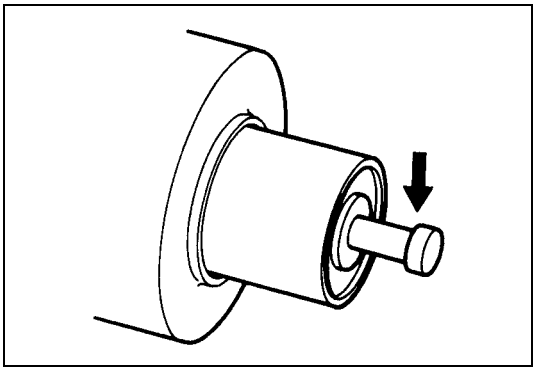
Apply grease (99500-25010) to sliding surface of each below part.



1. Front housing	7. Lever	13. Internal gear	19. Brush
2. Bush	8. Plunger	14. Planetary carrier shaft	20. Brush holder
3. Snap ring	9. Plate	15. Planetary gear	21. Rear bracket
4. Pinion stop ring	10. Seal rubber	16. Packing	22. Rear bush
5. Pinion gear	11. Magnetic switch	17. Yoke	⊗ Do not reuse.
6. Over-running clutch	12. Ball	18. Armature	

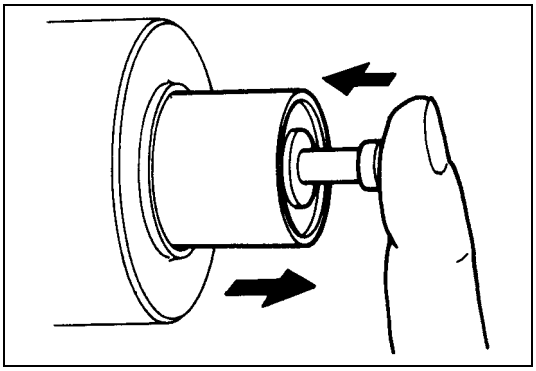
Starting Motor Inspection

PLUNGER



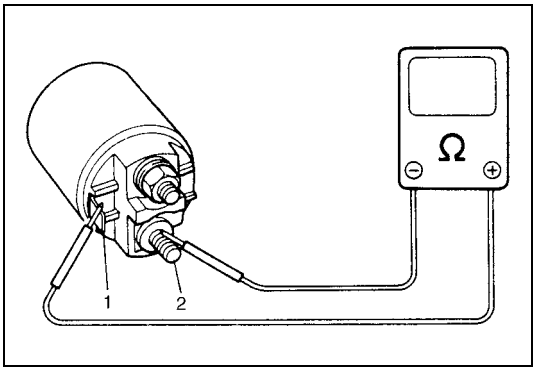
Inspect plunger for wear. Replace if necessary.

MAGNETIC SWITCH



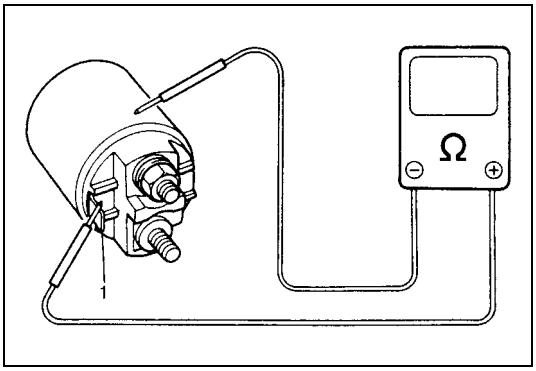
Push in plunger and release it. The plunger should return quickly to its original position. Replace if necessary.

Pull-in Coil Open Circuit Test



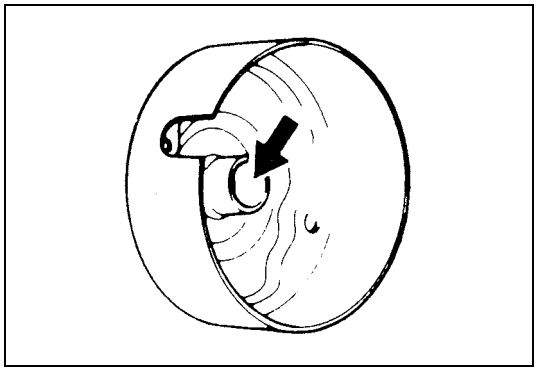
Check for continuity across magnetic switch 'S' terminal (1) and 'M' terminal (2). If no continuity, coil is open and should be replaced.

Hold-in Coil Open Circuit Test



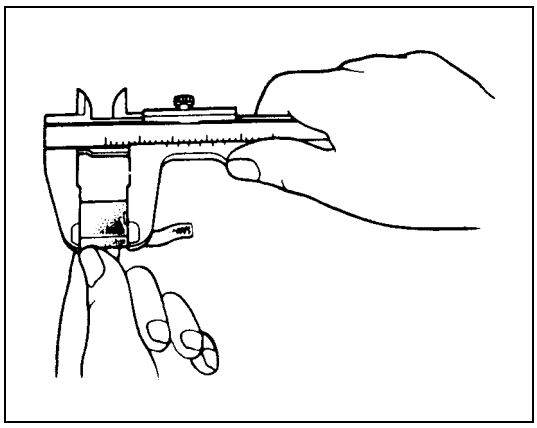
Check for continuity across magnetic switch 'S' terminal (1) and coil case. If no continuity, coil is open and should be replaced.

REAR BRACKET BUSH



Inspect bush for wear or damage. Replace if necessary.

BRUSH



- Check brushes for wear.
  Measure length of brushes and if below limit, replace brush.

Brush length

	0.8 kW	1.2 kW
Standard	17.0 mm (0.67 in.)	12.3 mm (0.48 in.)
Limit	11.5 mm (0.45 in.)	7.0 mm (0.28 in.)

- Install brushes to each brush holder and check for smooth movement.

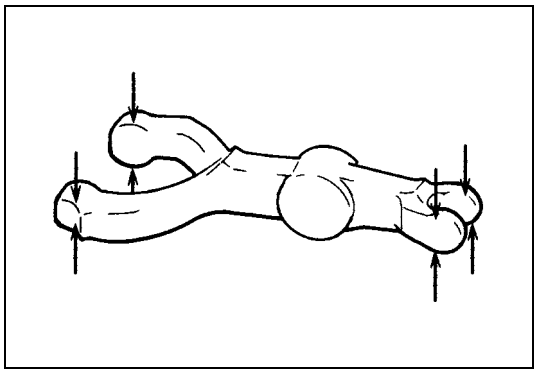
SPRING

Inspect brush springs for wear, damage or other abnormal conditions. Replace if necessary.

Brush spring tension

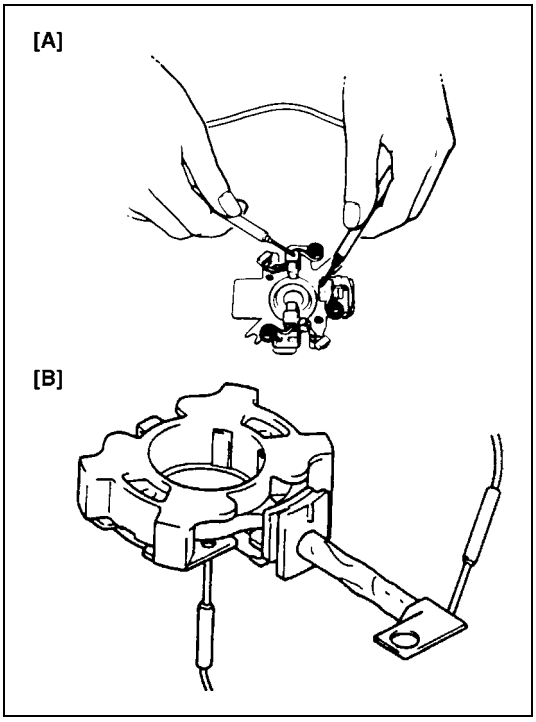
	0.8 kW	1.2 kW
Standard	1.95 kg (4.3 lb)	2.2 kg (4.85 lb)
Limit	0.9 kg (1.98 lb)	0.6 kg (1.32 lb)

DRIVE LEVER



Inspect drive lever for wear. Replace if necessary.

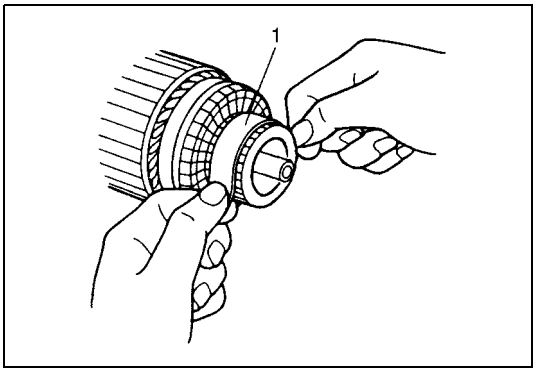
BRUSH HOLDER



- Check movement of brush in brush holder. If brush movement within brush holder is sluggish, check brush holder for distortion and sliding faces for contamination.
  Clean or correct as necessary.
- Check for continuity across insulated brush holder (positive side) and grounded brush holder (negative side).
  If continuity exists, brush holder is grounded due to defective insulation and should be replaced.

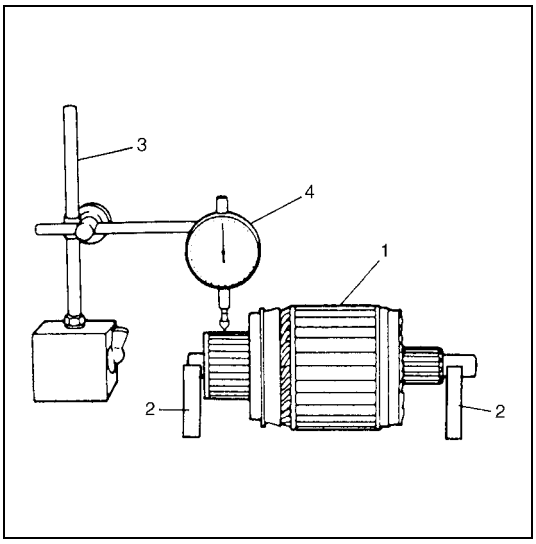
[A]: 0.8 kW
[B]: 1.2 kW

ARMATURE



- Inspect commutator for dirt or burn. Correct with sandpaper or lathe, if necessary.

1. Sandpaper of #300 – 400



- Check commutator for uneven wear with armature supported on V-blocks (2). If deflection of dial gauge (4) pointer exceeds limit, repair or replace.

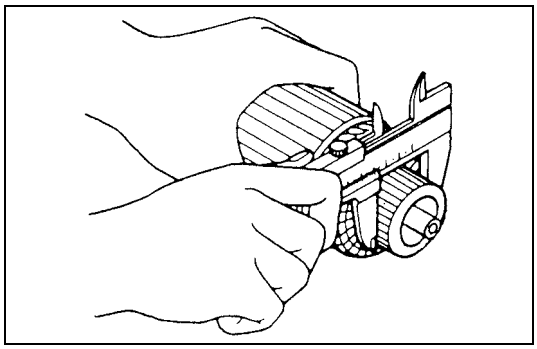
NOTE:

Below specification presupposes that armature is free from bend. Bent armature must be replaced.

Commutator out of round

	0.8 kW and 1.2 kW
Standard	0.05 mm (0.002 in.) or less
Limit	0.4 mm (0.015 in.)

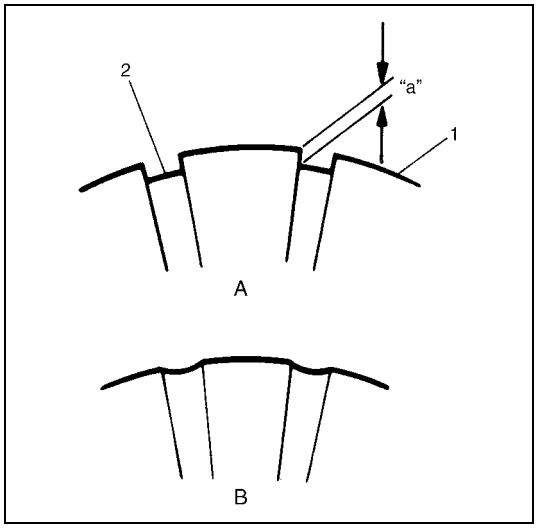
1. Armature
3. Magnetic stand



- Inspect commutator for wear. If diameter is below limit, replace armature.

Commutator outside diameter

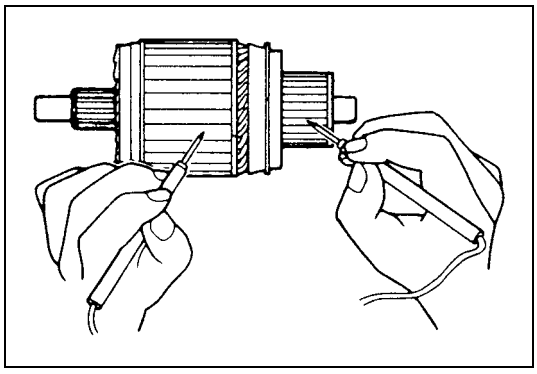
	0.8 kW	1.2 kW
Standard	32.0 mm (1.26 in.)	29.4 mm (1.16 in.)
Limit	31.4 mm (1.24 in.)	28.8 mm (1.13 in.)



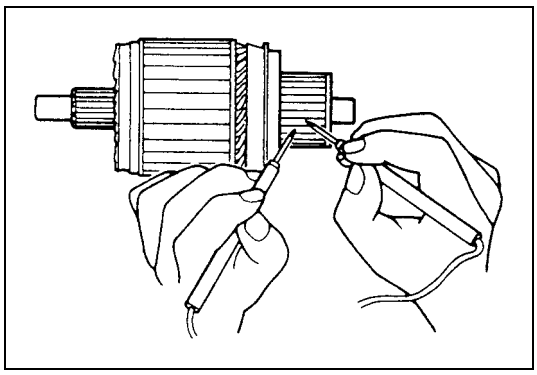
- Inspect commutator for insulator depth. Correct or replace if below limit.

Commutator insulator depth "a"
Standard: 0.4 – 0.6 mm (0.015 – 0.024 in.)
Limit: 0.2 mm (0.008 in.)

A: Correct
B: Incorrect
1. Commutator segment
2. Insulator



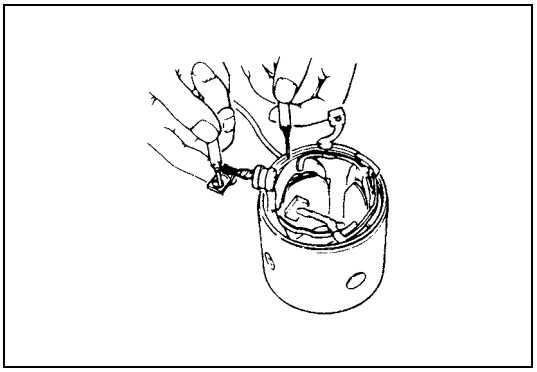
- Check commutator and armature core. If there is continuity, armature is grounded and must be replaced.



- Check for continuity between segments. If there is no continuity at any test point, there is an open circuit and armature must be replaced.

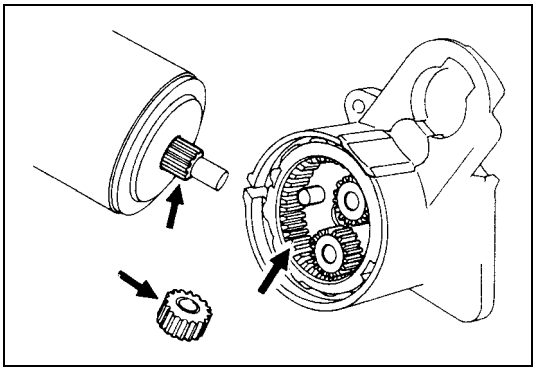
FIELD COIL (0.8 kW TYPE)

Ground Test



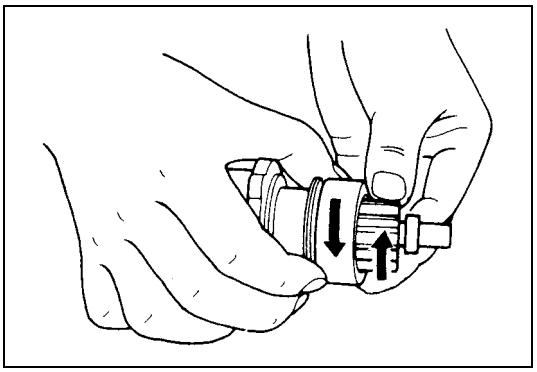
Check continuity between brush and bare surface.
If there is continuity, field windings are grounded.
The yoke assembly must be replaced.

GEARS (1.2 kW TYPE)

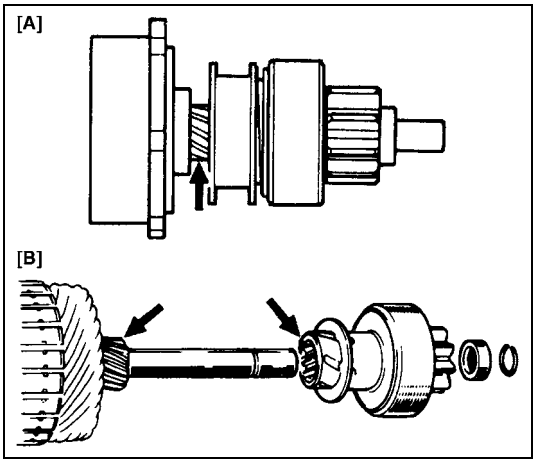


Inspect internal gear and planetary gears for wear, damage or other abnormal conditions. Replace if necessary.

PINION AND OVER-RUNNING CLUTCH

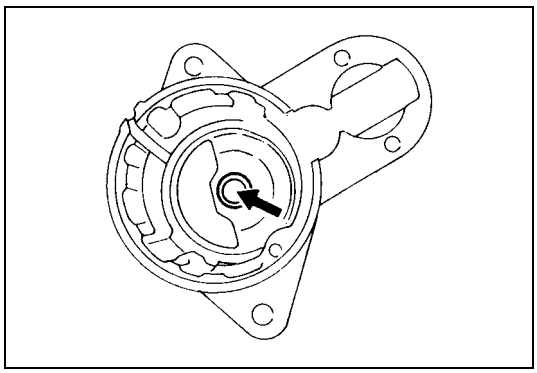


- Inspect pinion for wear, damage or other abnormal conditions.
  Check that clutch locks up when turned in direction of drive and rotates smoothly in reverse direction. Replace if necessary.



- Inspect spline teeth for wear or damage. Replace if necessary.
  Inspect pinion for smooth movement.

[A]: 1.2 kW
[B]: 0.8 kW



FRONT HOUSING NEEDLE BEARING OR BUSH

Inspect bush for wear or damage. Replace if necessary.

Specification

0.8 kW type

Voltage			12 volts	
Output			0.8 kW	
Rating			30 seconds	
Direction of rotation			Clockwise as viewed from pinion side	
Brush length			Standard: 17.0 mm (0.67 in.)	Limit: 11.5 mm (0.45 in.)
Number of pinion teeth			8	
Performance		Condition	Guarantee	
Around at 20°C (68°F)	No load characteristic	11.5 V	53 A maximum 6,000 rpm minimum	
	Load characteristic	9 V 150 A	2.8 N·m (0.28 kg-m, 2.0 lb-ft) minimum 2,000 rpm minimum	
	Locked characteristic	5 V	360 A maximum 6.86 N·m (0.7 kg-m, 5.1 lb-ft) minimum	
	Magnetic switch operating voltage		8 volts maximum	

1.2 kW type

Voltage			12 volts	
Output			1.2 kW	
Rating			30 seconds	
Direction of rotation			Clockwise as viewed from pinion side	
Brush length			Standard: 12.3 mm (0.48 in.)	Limit: 7.0 mm (0.27 in.)
Number of pinion teeth			8	
Performance		Condition	Guarantee	
Around at 20°C (68°F)	No load characteristic	11.0 V	90 A maximum 2,500 rpm minimum	
	Load characteristic	7.5 V 300 A	10.5 N·m (1.05 kg-m, 7.59 lb-ft) minimum 880 rpm minimum	
	Locked characteristic	4.0 V	760 A maximum 19.5 N·m (1.95 kg-m, 14.1 lb-ft) minimum	
	Magnetic switch operating voltage		8 volts maximum	

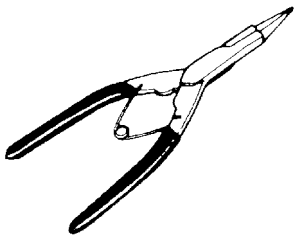
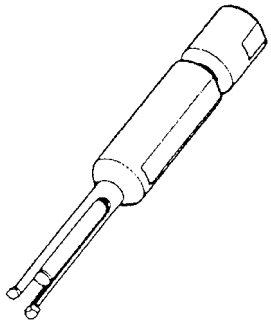
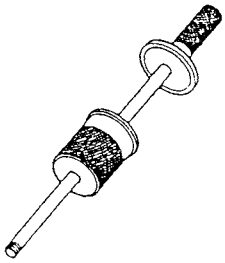
Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Starting motor battery cable nut	10	1.0	7.5
Starting motor mount bolt and nut	45	4.5	32.5

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Armature shaft (for 0.8 kW) • Over-running clutch (for 0.8 kW) • Armature shaft bushes (for 0.8 kW) • Drive lever (for 0.8 kW) • Front and rear bush (for 1.2 kW) • Plunger (for 1.2 kW) • Pinion drive lever (for 1.2 kW) • Internal gear (for 1.2 kW) • Planetary carrier shaft (for 1.2 kW) • Planetary gear (for 1.2 kW) • Ball (for 1.2 kW)

Special Tools

		
09900-06107 Snap ring pliers (Opening type)	09921-20200 Bearing remover	09930-30102 Sliding shaft

SECTION 6H

CHARGING SYSTEM

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in Section 10B in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in Section 10B before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

General Description

Battery Description

The battery has three major functions in the electrical system.

- It is a source of electrical energy for cranking the engine.
- It acts as a voltage stabilizer for the electrical system.
- It can, for a limited time, provide energy when the electrical load exceeds the output of the generator.

Carrier and hold-down

The battery carrier should be in good condition so that it will support the battery securely and keep it level.
Before installing the battery, the battery carrier and hold-down clamp should be clean and free from corrosion and make certain there are no parts in carrier.
To prevent the battery from shaking in its carrier, the hold-down bolts should be tight enough but not over-tightened.

Electrolyte freezing

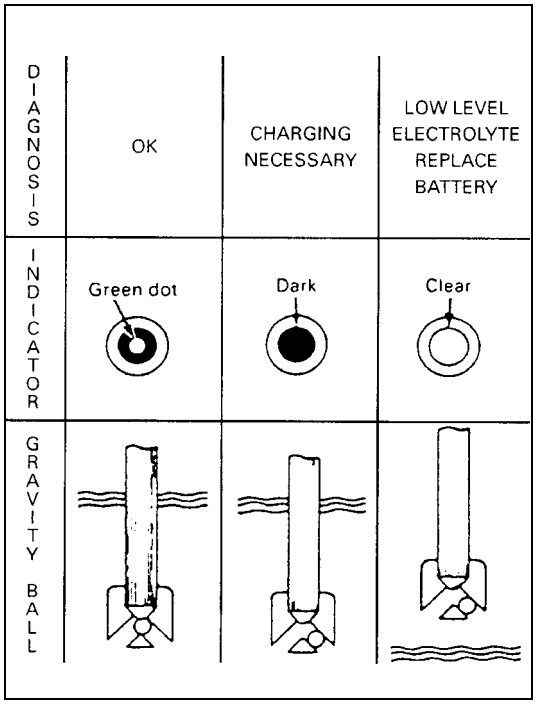
The freezing point of electrolyte depends on its specific gravity. Since freezing may ruin a battery, it should be protected against freezing by keeping it in a fully charged condition. If a battery is frozen accidentally, it should not be charged until it is warmed.

Sulfation

If the battery is allowed to stand for a long period in discharged condition, the lead sulfate becomes converted into a hard, crystalline substance, which will not easily turn back to the active material again during the subsequent recharging. “Sulfation” means the result as well as the process of that reaction. Such a battery can be revived by very slow charging and may be restored to usable condition but its capacity is lower than before.

Built-in indicator (if equipped)

The battery has a built-in temperature compensated indicator at the top of the battery. This indicator is to be used with the following diagnostic procedure. When checking the indicator, make sure that the battery has a clean top. A light may be needed in some poorly-lit areas.



Three types of indication available under normal operation are as follows.

- Green Dot
  Battery is sufficiently charged for testing.
- Dark
  Battery must be charged before testing.
  If there is a cranking complaint, battery should be tested as described in “Diagnosis” section. Charging and electrical systems should also be checked at this time.
- Clear or Light Yellow
  This means that fluid level is below the bottom of hydrometer. Its possible cause is excessive or prolonged charging, a broken case, excessive tipping or normal battery deterioration. When the battery is found in such condition, it is possible that high charging voltage is caused by the faulty charging system and therefore, charging and electrical systems need to be checked. If there is a trouble in cranking and its cause lies in the battery, it should be replaced.

Care of battery

WARNING:

- **Never expose battery to open flame or electric spark because of battery generate gas which is flammable and explosive.**
- **Do not allow battery fluid to contact eyes, skin, fabrics, or painted surfaces as fluid is a corrosive acid. Flush any contacted area with water immediately and thoroughly.**
- **Batteries should always be kept out of reach of children.**

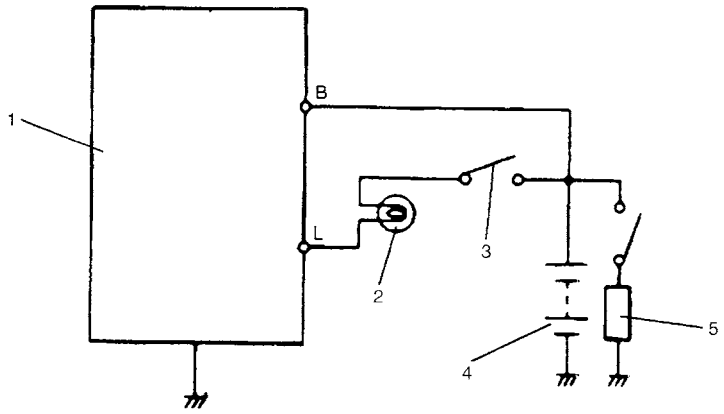
1) The battery is a very reliable component, but needs periodical attentions.
   - Keep the battery carrier clean
   - Prevent rust formation on the terminal posts
   - Keep the electrolyte up to the upper level uniformly in all cells.
   - When keeping battery on vehicle over a long period of time, follow instructions given below.
     – Weekly, start the engine and run it until it reaches normal operating temperature with engine speed of 2000 to 3000 rpm. Make sure all electric switches are off before storing the vehicle.
     – Recharge the battery twice a month to prevent it from discharging excessively. This is especially important when ambient temperature is low.
     The battery discharges even when it is not used, while vehicles are being stored. Battery electrolyte can freeze and battery case can crack at cold ambient condition if battery is not properly charged.
2) Keep the battery cable connections clean.
   The cable connections, particularly at the positive (+) terminal post, tend to become corroded. The product of corrosion, or rust, on the mating faces of conductors resists the flow of current.
   Clean the terminals and fittings periodically to ensure good metal-to-metal contact, and grease the connections after each cleaning to protect them against rusting.
3) Be always in the know as to the state of charge of the battery. The simplest way to tell the state of charge is to carry out a hydrometer test. The hydrometer is an instrument for measuring the specific gravity (S.G.) of the battery electrolyte. The S.G. of the electrolyte is indicative of the state of charge. Refer to “Hydrometer test” in this section.

Generator Description

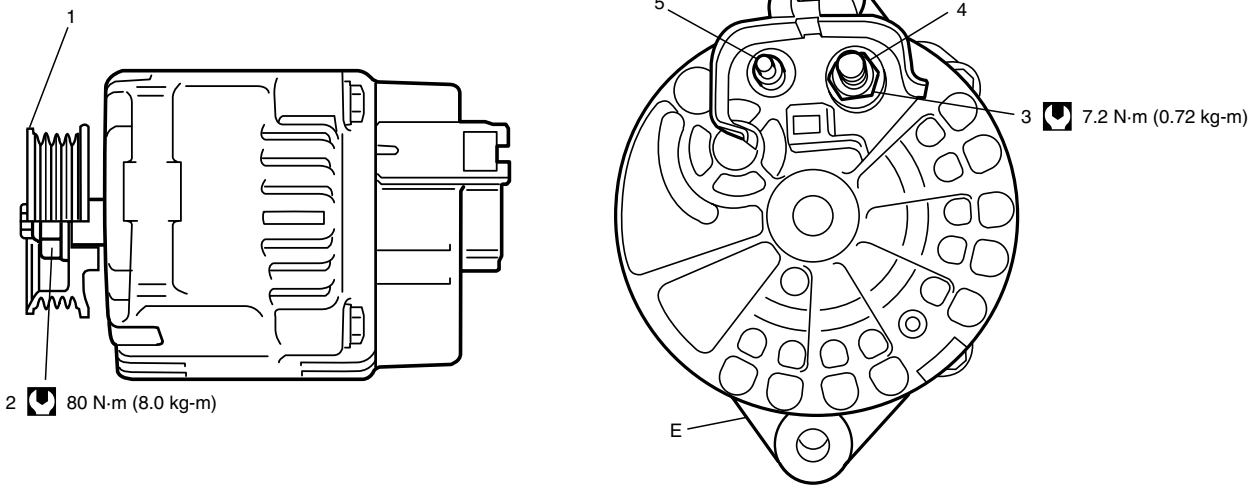
The generator is a small and high performance type with an IC regulator incorporated.
The internal components are connected electrically as shown below figure.

The generator features are as follows:

- Solid state regulator is mounted inside the generator.
- All regulator components are enclosed into a solid mold.
- This unit along with the brush holder assembly is attached to the rear housing.
- The IC regulator uses integrated circuits and controls the voltage produced by the generator, and the voltage setting cannot be adjusted.
- The generator rotor bearings contain enough grease to eliminate the need for periodic lubrication. Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long period of attention-free service.
- The stator windings are assembled on the inside of a laminated core that forms part of the generator frame.



1. Generator with regulator assembly	3. Ignition switch	5. Load
2. Charge indicator light	4. Battery	



1. Pulley	3. "B" terminal inner nut	5. "L" terminal
2. Pulley nut	4. "B" terminal	Tightening torque

Diagnosis

Battery Inspection

Visual inspection

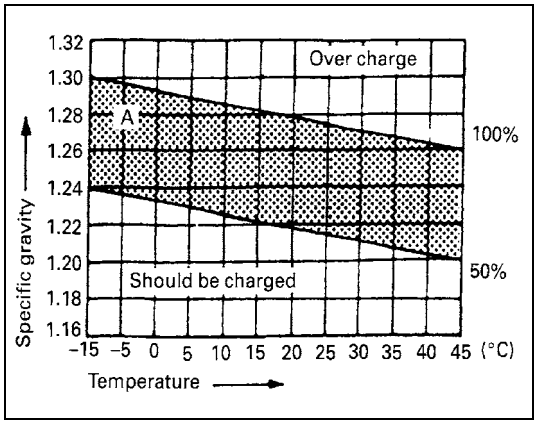
Check for obvious damage, such as cracked or broken case or cover, that could permit loss of electrolyte. If obvious damage is noted, replace battery. Determine cause of damage and correct as needed.

Hydrometer test

The direct method of checking the battery for state of charge is to carry out a high rate discharge test, which involves a special precise voltmeter and an expensive instrument used in the service shops, but not recommendable to the user of the vehicle.
At 20 °C of battery temperature (electrolyte temperature):

- The battery is in FULLY CHARGED STATE if the electrolyte S.G. is 1.280.
- The battery is in HALF CHARGED STATE if the S.G. is 1.220.
- The battery is in NEARLY DISCHARGED STATE if the S.G. is 1.150 and is in danger of freezing.

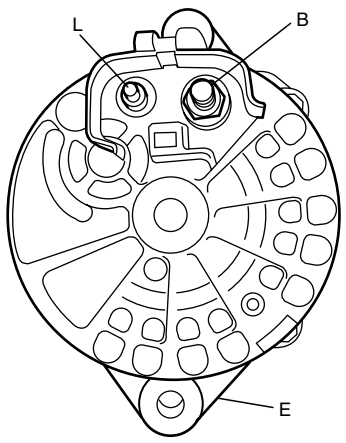
As the S.G. varies with the temperature, if battery temperature is not at 20°C (68°F), you have to correct your S.G. reading (taken with your hydrometer) to the value at 20°C (68°F) and apply the corrected S.G. value to the three-point guide stated value.
For the manner of correction, refer to the graph showing the relation between S.G. value and temperature as shown in the figure.



How to use the temperature-corrected state-of-charge graph

Suppose your S.G. reading is 1.28 and the battery temperature is –5°C (23°F). Locate the intersection of the –5°C line and the 1.28 S.G. line.
The intersection is within the “A” zone (shaded area in the graph) and that means CHARGED STATE.
To know how much the battery is charged, draw a line parallel to the zone demarcation line and extend it to the right till it meets with the percentage scale. In the present example, the line meets at about 85% point on the percentage scale. Therefore, the battery is charged up to the 85% level.

Generator Symptom Diagnosis



CAUTION:

- **Do not connect any load between L and E.**
- **When connecting charger or booster battery to vehicle battery, refer to "Jump Starting in Case of Emergency" in this section.**

Trouble in charging system will show up as one or more of the following conditions:

1) Faulty indicator lamp operation.
2) An undercharged battery as evidenced by slow cranking or indicator dark.
3) An overcharged battery as evidenced by excessive spewing of electrolyte from vents.

Noise from generator may be caused by loose drive pulley, loose mounting bolts, worn or dirty bearings, defective diode, or defective stator.

B: Generator output (Battery terminal)
E: Ground
L: Lamp terminal

Charging indicator lamp operation

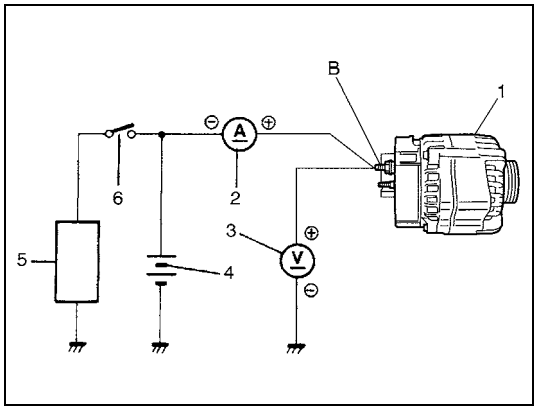
Condition	Possible Cause	Correction
Charge light does not light with ignition ON and engine off	Fuse blown	Check fuse.
	Light burned out	Replace light.
	Wiring connection loose	Tighten loose connection.
	IC regulator or field coil faulty	Check generator.
Charge light does not go out with engine running (battery requires frequent recharging)	Drive belt loose or worn	Adjust or replace drive belt.
	IC regulator or generator faulty	Check charging system.
	Wiring faulty	Repair wiring.
Noise from radio	Condenser faulty	Replace IC regulator assembly.

Undercharged battery

This condition, as evidenced by slow cranking or low specific gravity can be caused by one or more of the following conditions even though indicator lamp may be operating normal.
Following procedure also applies to cars with voltmeter and ammeter.

- Make sure that undercharged condition has not been caused by accessories left on for extended period of time.
- Check drive belt for proper tension.
- If battery defect is suspected, refer to “Battery Description” in this section.
- Inspect wiring for defects. Check all connections for tightness and cleanliness, battery cable connections at battery, starting motor and ignition ground cable.

NO-LOAD CHECK

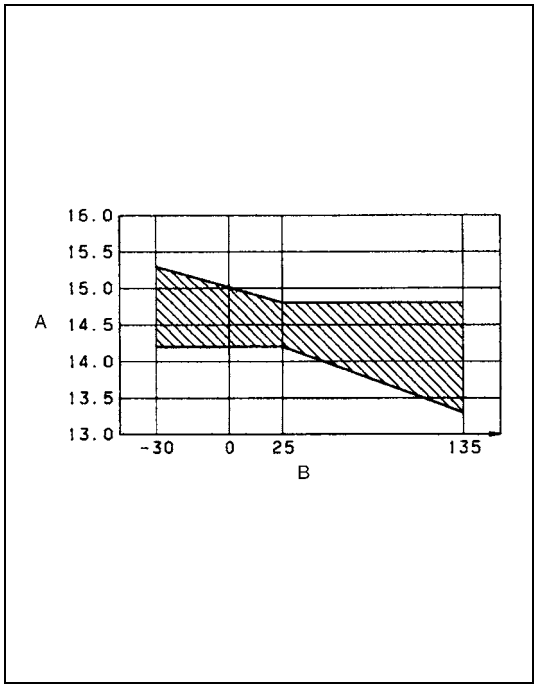


1) Connect voltmeter and ammeter as shown in the figure.

NOTE:

Use fully charged battery.

1.	Generator
2.	Ammeter (between generator (B) terminal and battery (+) terminal)
3.	Voltmeter (between generator (B) terminal and ground)
4.	Battery
5.	Load
6.	Switch



2) Run engine from idling up to 2,000 rpm with all accessories turned off and read meters.
If voltage is higher than standard value, check ground of brushes.
If brushes are not grounded, replace IC regulator.
If voltage is lower than standard value, proceed to following check.

Specification for undercharged battery (No-load check)
Current: 10 A
Standard voltage: 14.2 – 14.8 V at 20°C (68°F)

NOTE:

Consideration should be taken that voltage will differ somewhat with regulator case temperature as shown in the figure.

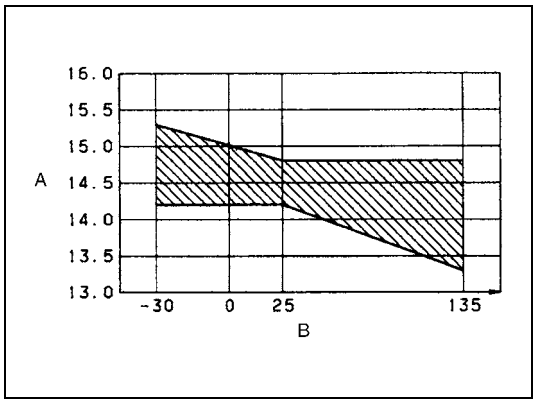
A:	Regulated voltage (V)
B:	Heatsink temperature (°C)

LOAD CHECK

1) Run engine at 2,000 rpm and turn on head light and heater motor.
2) Measure current and if it is less than 20 A repair or replace generator.

Overcharged battery

1) To determine battery condition, refer to “Battery Description” in this section.
2) If obvious overcharge condition exists as evidenced by excessive spewing of electrolyte, measure generator B terminal voltage at engine 2,000 rpm.
3) If measured voltage is higher than upper limit value, disassemble generator.
4) Check ground of brushes. If brushes are not grounded, replace IC regulator. Then check field coil for grounds and shorts.



A: Regulated voltage (V)
B: Heatsink temperature (°C)

On-Vehicle Service

Jump Starting in Case of Emergency

With auxiliary (booster) battery

CAUTION:

If vehicle is manual transmission model and has a catalytic converter, do not push or tow it to start. Damage to its emission system and/or to other parts may result.

Both booster and discharged battery should be treated carefully when using jumper cables. Follow procedure outlined below, being careful not to cause sparks.

WARNING:

- **Departure from these conditions or procedure described below could result in:**
  - **Serious personal injury (particularly to eyes) or property damage from such causes as battery explosion, battery acid, or electrical burns.**
  - **Damage to electronic components of either vehicle.**
- **Remove rings, watches, and other jewelry. Wear approved eye protection.**
- **Be careful so that metal tools or jumper cables do not contact positive battery terminal (or metal in contact with it) and any other metal on vehicle, because a short circuit could occur.**

WARNING:

Do not connect negative cable directly to negative terminal of dead battery.

1) Set parking brake and place NEUTRAL on manual transmission (automatic transmission in PARK). Turn off ignition, turn off lights and all other electrical loads.
2) Check electrolyte level. If it is below low level line, add distilled water.
3) Attach end of one jumper cable to positive terminal of booster battery and the other end of the same cable to positive terminal of discharged battery. (Use 12-volt battery only to jump start engine).
4) Attach one end of the remaining negative cable to negative terminal of booster battery, and the other end to a solid engine ground (such as exhaust manifold) at least 45 cm (18 in.) away from battery of vehicle being started.
5) Start engine of vehicle with booster battery and turn off electrical accessories. Then Start engine of the vehicle with discharged battery.
6) Disconnect jumper cables in the exact reverse order.

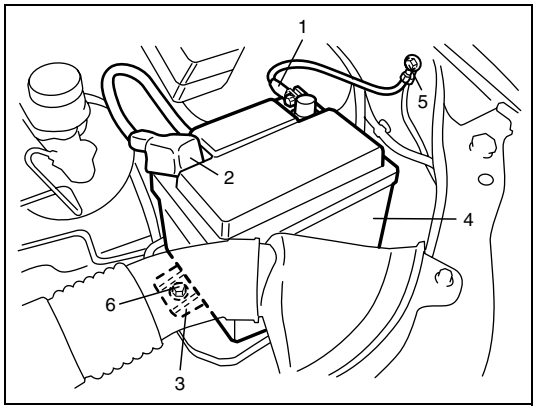
With charging equipment

CAUTION:

When jump starting engine with charging equipment, be sure equipment used is 12-volt and negative ground. Do not use 24-volt charging equipment. Using such equipment can cause serious damage to electrical system or electronic parts.

Battery Dismounting and Remounting

Dismounting



1) Disconnect negative cable (1).
2) Disconnect positive cable (2).
3) Remove retainer (3).
4) Remove battery (4).

5.	Body ground bolt
6.	Retainer bolt

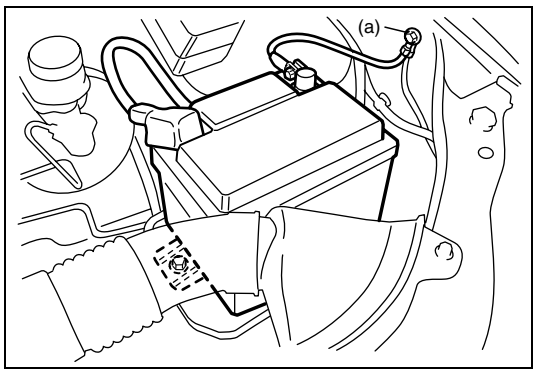
Handling

When handling battery, following safety precautions should be followed:

- Hydrogen gas is produced by battery. A flame or spark near battery may cause the gas to ignite.
- Battery fluid is highly acidic. Avoid spilling on clothing or other fabric. Any spilled electrolyte should be flushed with large quantity of water and cleaned immediately.

Remounting

1) Reverse removal procedure.
2) Torque battery cables to specification.



NOTE:

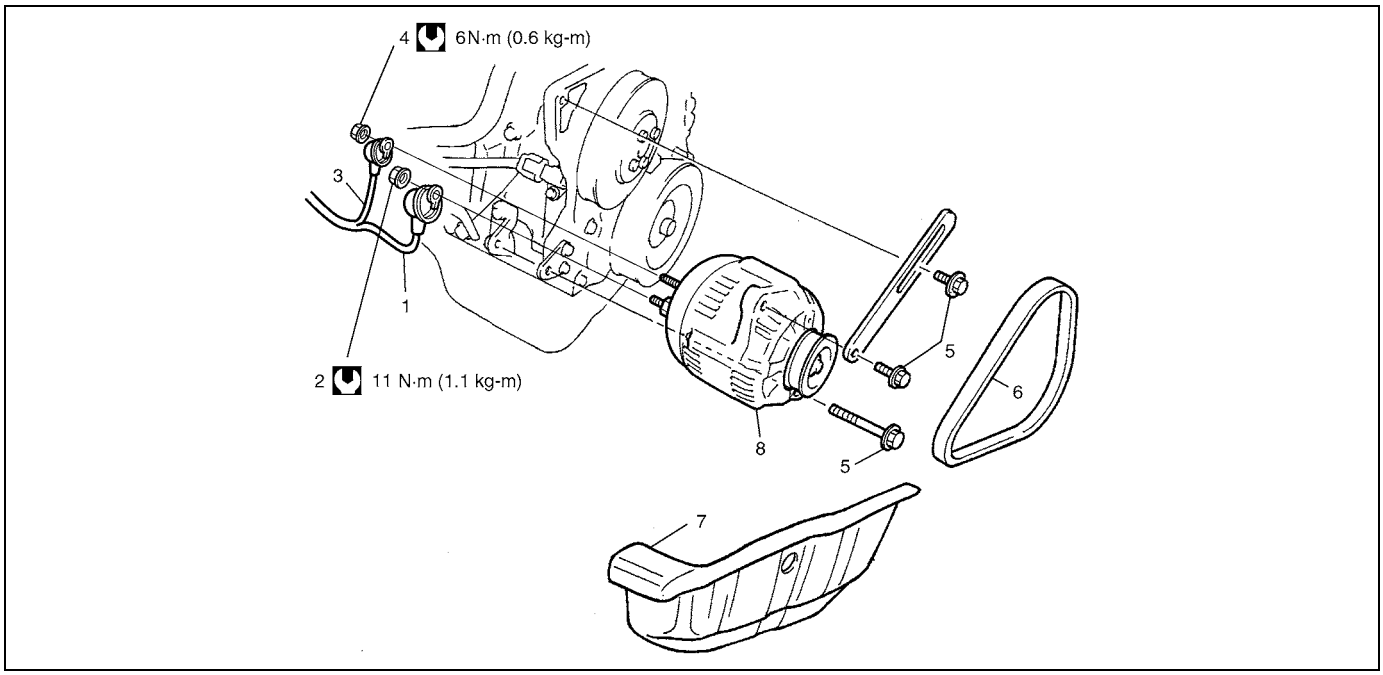
Check to be sure that ground cable has enough clearance to hood panel by terminal.

Tightening torque
Body ground bolt (a): 8.0 N·m (0.8 kg-m, 6.0 lb-ft)

Generator belt Inspection and Adjustment

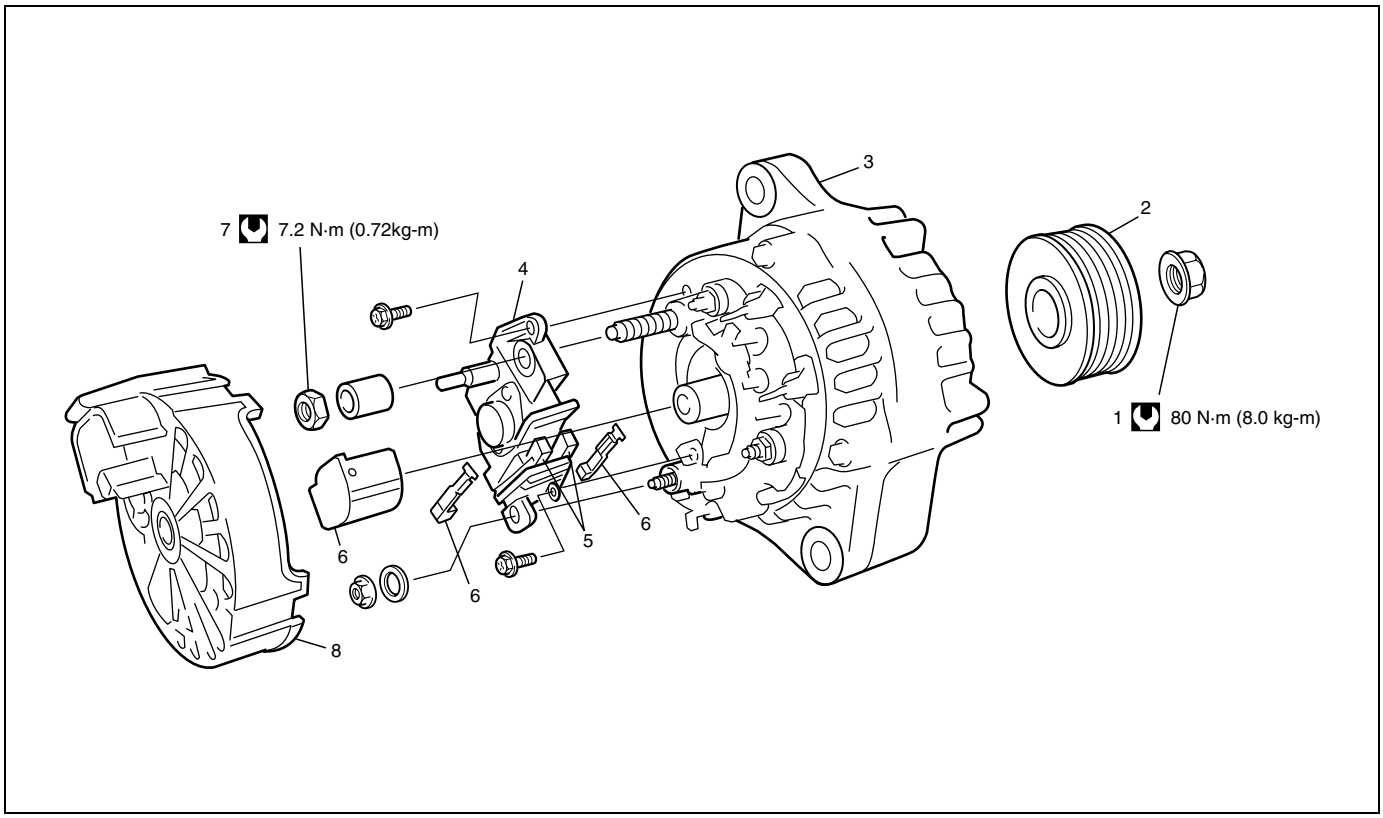
For removal, installation, inspection and adjustment referring to “Water Pump/Generator Drive Belt Tension Inspection and Adjustment” in Section 6B.

Generator Dismounting and Remounting



1. "B" terminal wire	3. "L" terminal wire	5. Generator bolt	7. Splash cover	Tightening torque
2. "B" terminal nut	4. "L" terminal nut	6. Generator belt	8. Generator	

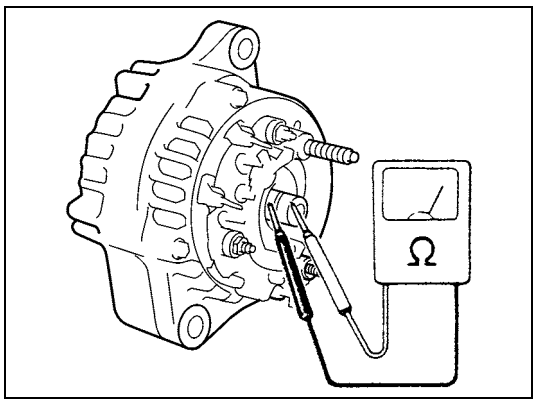
Generator Disassembly and Reassembly



1. Pulley nut	3. Generator assy	5. Brush	7. "B" terminal inner nut	Tightening torque
2. Pulley	4. Brush holder	6. Brush holder cover	8. Rear end cover	

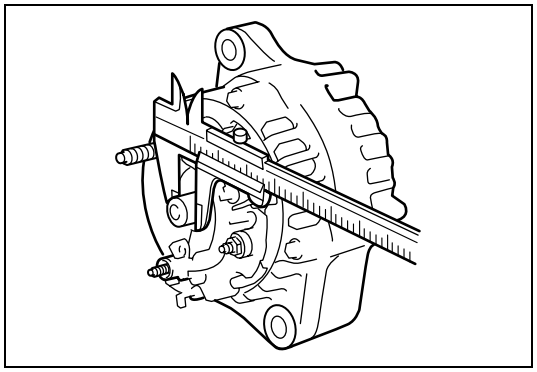
Generator Inspection

ROTOR



1) Using ohmmeter, check for continuity between slip rings of rotor. If there is no continuity, replace rotor.

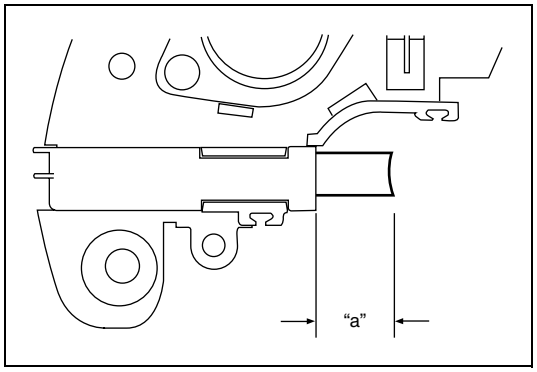
Standard resistance between slip rings of rotor
2.7 – 3.1 Ω at 20°C (68°F)



2) Check slip rings for roughness or scoring. If rough or scored, replace rotor.
Using a vernier caliper, measure the slip ring diameter.
If the diameter is less than minimum, replace the rotor.

Slip ring diameter
Standard: 16.1 – 16.3 mm (0.634 – 0.642 in.)
Limit: 15.0 mm (0.591 in.)

BRUSH



Check each brush for wear by measuring its length as shown. If brush is found worn down to service limit, replace brush.

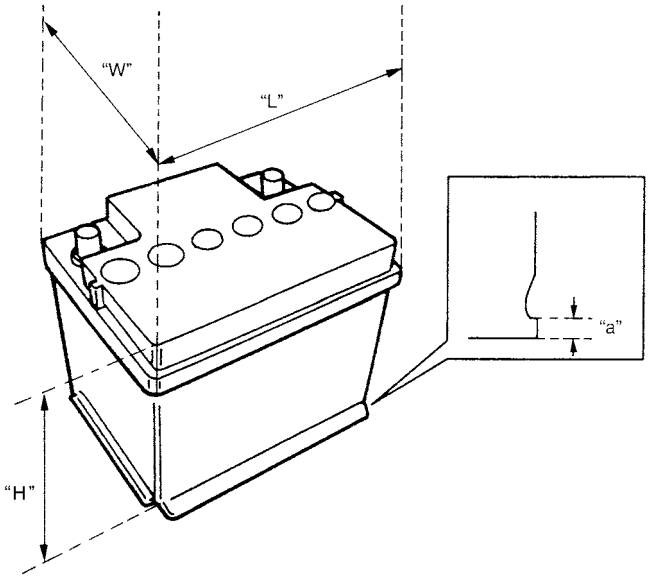
Exposed brush length "a"
Standard: 12.5 mm (0.492 in.)
Limit: 2.5 mm (0.098 in.)

Specification

Battery

NOTE:

The battery used in each vehicle is one of the following two types, depending on specification.

Battery type	CCA 180A	CCA 210A
Nominal output	12 V	
Rated capacity	36 Ah/20 h	44 Ah/20 h
	28 Ah/5 h	36 Ah/5 h
Cold cranking amperes	180 A (DIN)	210 A (DIN)
Electrolyte	3.8 L (8.03/6.69 US/Imp pt)	
Electrolyte specified gravity	1.28 when fully charged at 25°C (77°F)	
Battery dimension		

"L": 209 – 211 mm (8.23 – 8.31 in.)	"H": 172 – 175 mm (6.77 – 6.89 in.)
"W": 173 – 175 mm (6.81 – 6.89 in.)	"a": 10.5 mm (0.41 in.)

Generator

Type	70 A type
Rated voltage	12 V
Nominal output	70 A
Permissible max. speed	18000 r/min.
No-load speed	1230 r/min (rpm)
Setting voltage	14.2 to 14.8 V
Permissible ambient temperature	–30 to 90°C (–22 to 194°F)
Polarity	Negative ground
Rotation	Clockwise viewed from pulley side

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Body ground bolt	8	0.8	6.0
“B” terminal inner nut	4.2	0.42	3.0
“B” terminal outer nut	11	1.1	8.0
“L” terminal outer nut	6	0.6	4.5
Pulley nut	111	11.1	80.5

SECTION 6K

EXHAUST SYSTEM

CONTENTS

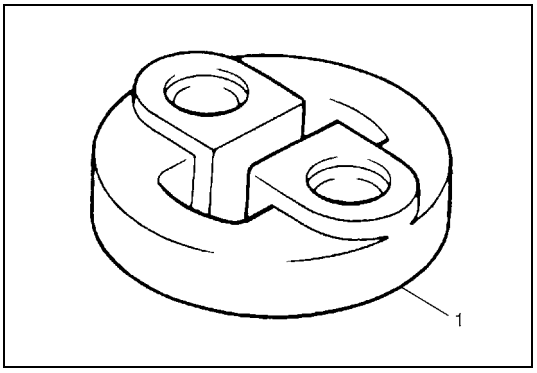
General Description

The exhaust system consists of an exhaust manifold, three-way catalytic converter (TWC) in catalyst case, exhaust pipes, a muffler and seals, gasket and etc.
The three-way catalytic converter is an emission control device added to the exhaust system to lower the levels of Hydrocarbon (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx) pollutants in the exhaust gas.

Maintenance

WARNING:
To avoid the danger of being burned, do not touch the exhaust system when the system is hot. Any service on the exhaust system should be performed when the system is cool.

At every interval of periodic maintenance service, and when vehicle is raised for other service, check exhaust system as follows:



- Check rubber mountings (1) for damage, deterioration, and out of position.
- Check exhaust system for leakage, loose connection, dent and damage.
- If bolts or nuts are loosened, tighten them to specified torque referring to “Exhaust System Components” in this section.
- Check nearby body areas damaged, missing, or mispositioned part, open seam, hole connection or any other defect which could permit exhaust fumes to seep into vehicle.

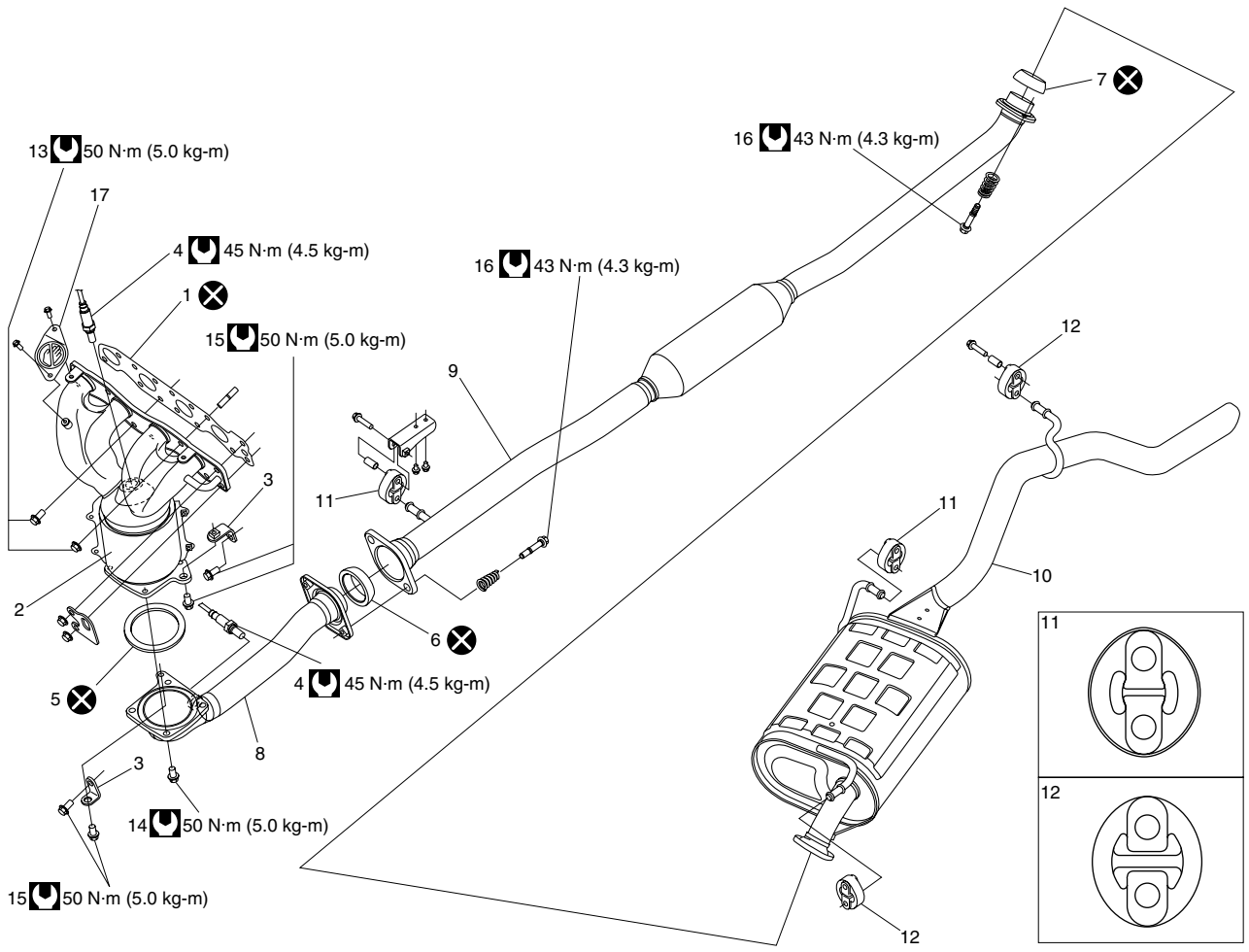
- Make sure that exhaust system components have enough clearance from underbody to avoid overheating and possible damage to passenger compartment carpet.
- Any defect should be fixed at once.

On-Vehicle Service

Exhaust System Components

WARNING:

To avoid the danger of being burned, do not touch the exhaust system when the system is hot. Any service on the exhaust system should be performed when the system is cool.



1. Gasket	8. Exhaust No.1 pipe	15. Exhaust manifold stiffener bolt
2. Exhaust manifold	9. Exhaust No.2 pipe	16. Exhaust No.2 pipe bolt
3. Exhaust manifold stiffener	10. Muffler	17. Caution plate
4. Oxygen sensor	11. Muffler mounting type 1	Tightening torque
5. Exhaust pipe gasket	12. Muffler mounting type 2	Do not reuse.
6. Seal ring No.1	13. Exhaust manifold bolt and nut	
7. Seal ring No.2	14. Exhaust No.1 pipe bolt	

Exhaust Manifold Removal and Installation

Removal and installation

Refer to “Exhaust Manifold Removal and Installation” in Section 6A1.

Exhaust Manifold Inspection

Check gasket and seal for deterioration or damage.
Replace them as necessary.

Exhaust Pipe Removal and Installation

Removal and installation

For replacement of exhaust pipe, be sure to hoist vehicle and observe “Warning” under “Maintenance” in this section and the following.

CAUTION:
Exhaust manifold have three way catalytic converter in it, it should not be exposed to any impulse. Be careful not to drop it or hit it against something.

- Tighten bolts and nuts to specified torque when reassembling referring to “Exhaust System Components” in this section.
- After installation, start engine and check each joint of exhaust system for leakage.

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Exhaust manifold bolts and nuts	50	5.0	36.5
Exhaust No.1 pipe bolts	50	5.0	36.5
Exhaust manifold stiffer bolts	50	5.0	36.5
Exhaust No.2 pipe bolts	43	4.3	31.5

SECTION 7A1

MANUAL TRANSAXLE

WARNING:

For vehicles equipped with a Supplemental Restraint (Air Bag) System :

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

General Description

Manual Transaxle Construction and Servicing

The transaxle provides five forward speeds and one reverse speed by means of three synchronizers and three shafts-input shaft, countershaft and reverse gear shaft. All forward gears are in constant mesh, and reverse uses a sliding idler gear arrangement.

The low speed synchronizer is mounted on counter shaft and engaged with counter shaft first gear or second gear, while the high speed synchronizer is done on input shaft and engaged with input shaft third gear or fourth gear.

The fifth speed synchronizer on input shaft is engaged with input shaft fifth gear mounted on the input shaft.

The double cone synchronizing mechanism is provided to 2nd gear synchromesh device for high performance of shifting to 2nd gear.

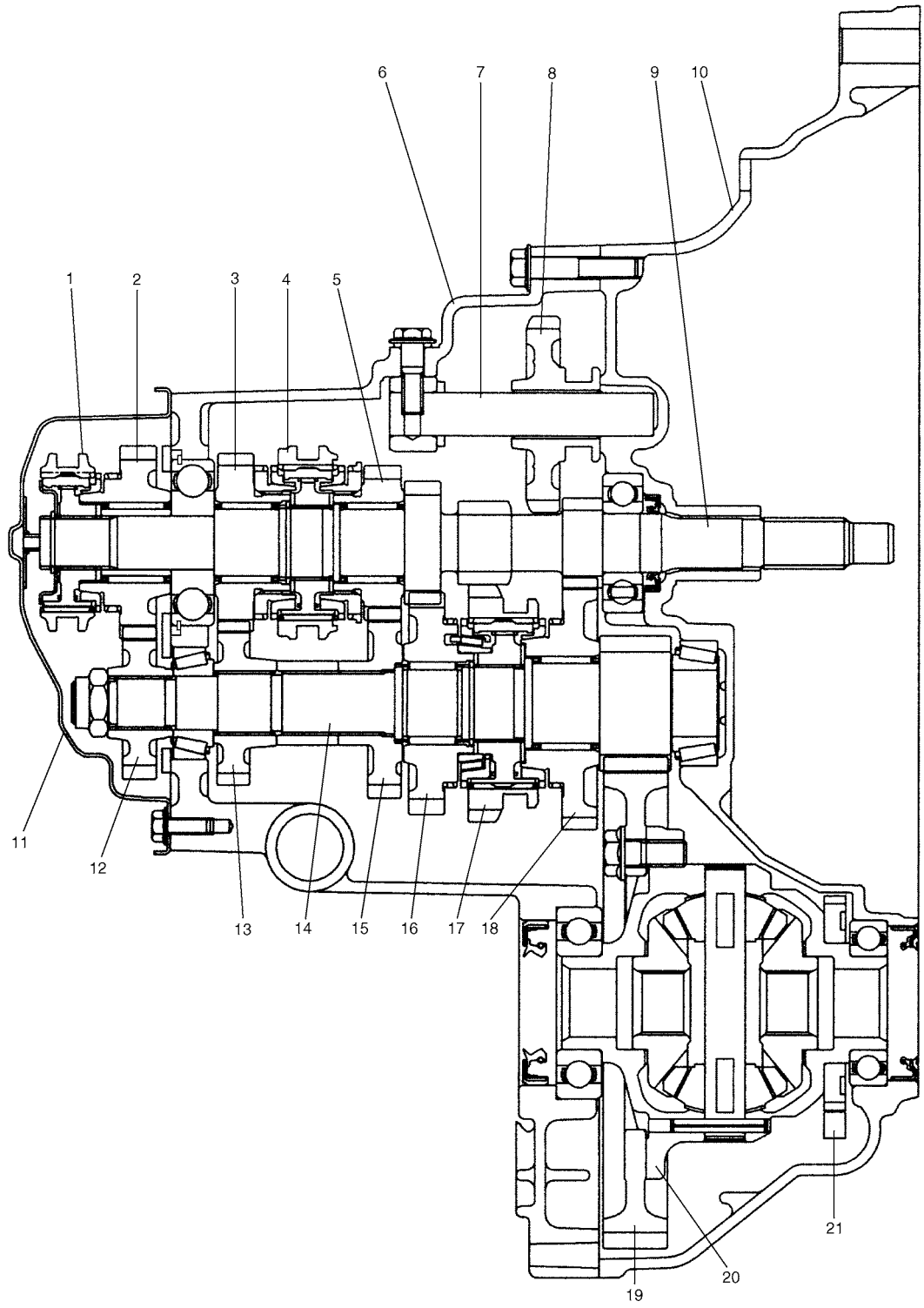
The countershaft turns the final gear and differential assembly, thereby turning the front drive shafts which are attached to the front wheels.

4WD model is equipped with transfer assembly on transaxle being mated to right side of differential output in transaxle.

For servicing, it is necessary to use genuine sealant or its equivalent on mating surfaces of transaxle case which is made of aluminum. The case fastening bolts must be tightened to specified torque by means of torque wrench. It is also important that all parts are thoroughly cleaned with cleaning fluid and air dried before reassembling.

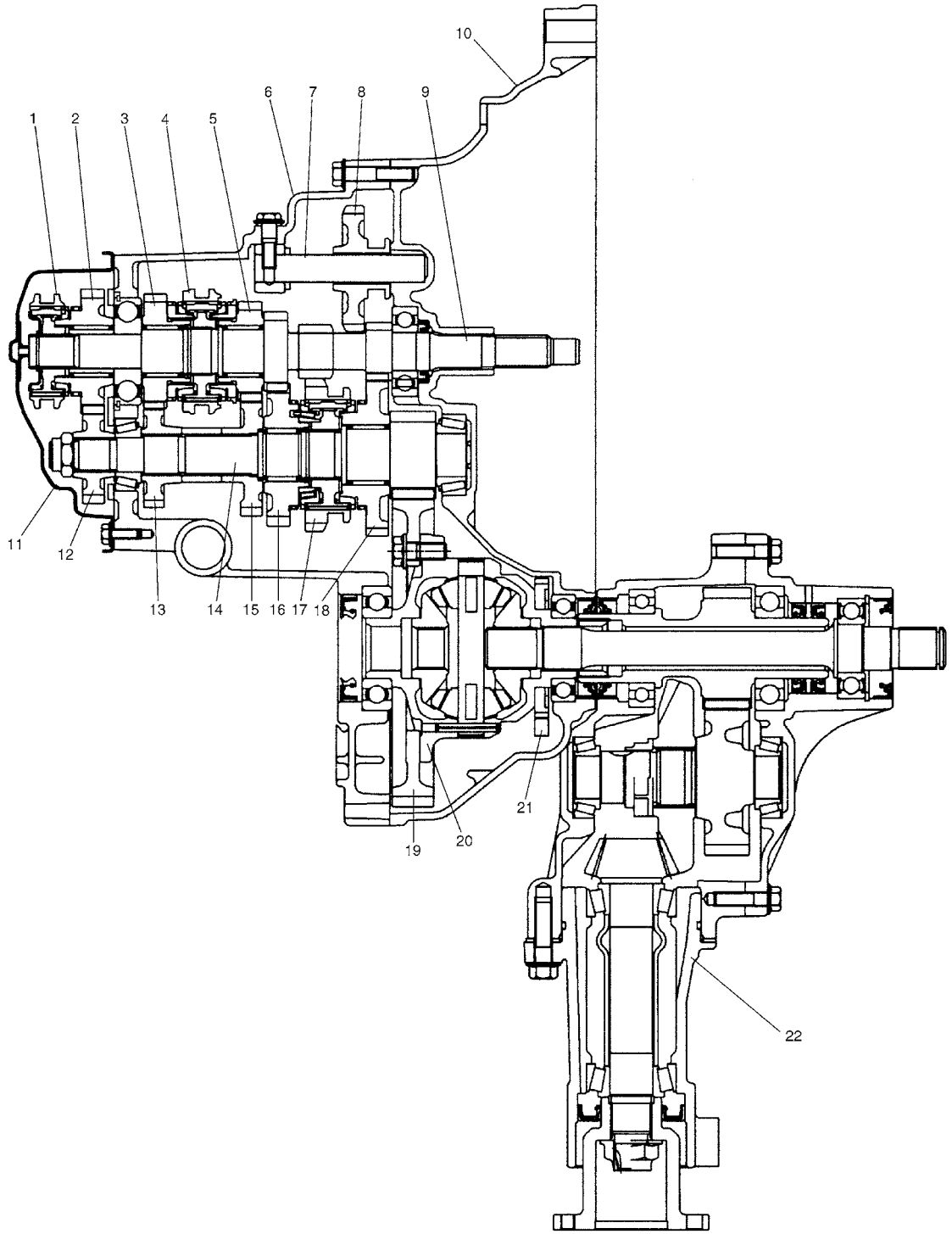
Further, care must be taken to adjust preload of counter shaft taper roller bearings. New synchronizer rings are prohibited from being lapped with respective gear cones by using lapping compound before they are assembled.

Transaxle for 2WD Model



1. 5th speed sleeve & hub	8. Reverse idler gear	15. Countershaft 3rd gear
2. Input shaft 5th gear	9. Input shaft	16. Countershaft 2nd gear
3. Input shaft 4th gear	10. Right case	17. Low speed sleeve & hub
4. High speed sleeve & hub	11. Side cover	18. Countershaft 1st gear
5. Input shaft 3rd gear	12. Countershaft 5th gear	19. Final gear
6. Left case	13. Countershaft 4th gear	20. Differential case
7. Reverse gear shaft	14. Countershaft	21. Vehicle speed sensor

Transaxle for 4WD Model



1. 5th speed sleeve & hub	7. Reverse gear shaft	13. Countershaft 4th gear	19. Final gear
2. Input shaft 5th gear	8. Reverse idler gear	14. Countershaft	20. Differential case
3. Input shaft 4th gear	9. Input shaft	15. Countershaft 3rd gear	21. Vehicle speed sensor
4. High speed sleeve & hub	10. Right case	16. Countershaft 2nd gear	22. Transfer assembly
5. Input shaft 3rd gear	11. Side cover	17. Low speed sleeve & hub	
6. Left case	12. Countershaft 5th gear	18. Countershaft 1st gear	

Diagnosis

Manual Transaxle Symptom Diagnosis

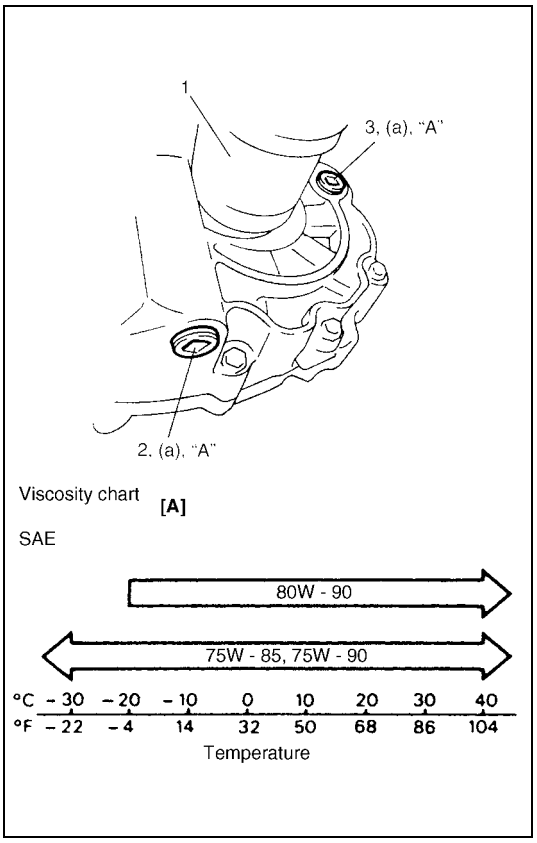
Condition	Possible Cause	Correction
Gears slipping out of mesh	Maladjusted gear shift/select control cables	Adjust.
	Worn shift fork shaft	Replace.
	Worn shift fork or synchronizer sleeve	Replace.
	Weak or damaged locating springs	Replace.
	Worn bearings on input shaft or counter shaft	Replace.
	Worn chamfered tooth on sleeve and gear	Replace sleeve and gear.
Hard shifting	Maladjusted gear shift/select control cables	Adjust.
	Inadequate or insufficient lubricant	Replenish.
	Improper clutch pedal free travel	Adjust.
	Distorted or broken clutch disc	Replace.
	Damaged clutch pressure plate	Replace clutch cover.
	Worn synchronizer ring	Replace.
	Worn chamfered tooth on sleeve or gear	Replace sleeve or gear.
	Worn gear shift/select control cables joint	Replace.
	Distorted shift shaft	Replace.
Noise	Inadequate or insufficient lubricant	Replenish.
	Damaged or worn bearing(s)	Replace.
	Damaged or worn gear(s)	Replace.
	Damaged or worn synchronizer parts	Replace.
	Maladjusted backlash between bevel pinion and gear	Adjust as prescribed
	Improper tooth contact in the mesh between bevel pinion and gear	Adjust or replace

On-Vehicle Service

CAUTION:
Do not reuse circlip, spring pin, E-ring, oil seal, gasket, self locking nut and specified parts. Reuse of it can result in trouble.

Manual Transaxle Oil Change

1) Before changing or inspecting oil, be sure to stop engine and lift vehicle horizontally.
2) With vehicle lifted up, check oil level and leakage.
   If leakage exists, correct it.
3) Drain old oil and fill new specified oil by specified amount (up to level hole).
4) Apply sealant to thread of drain plug (2) and level/filler plug (3) and torque them as specified below.



"A" : Sealant 99000-31110

Tightening torque
Transaxle oil level/filler and drain plugs
(a) : 21 N·m (2.1 kg-m, 15.5 lb-ft)

NOTE:

- **It is highly recommended to use API GL-4 75W-90 gear oil.**
- **Whenever vehicle is hoisted for any other service work than oil change, also be sure to check for oil leakage.**

Transaxle oil
: API GL-4
For SAE classification, refer to viscosity chart [A] in the figure.

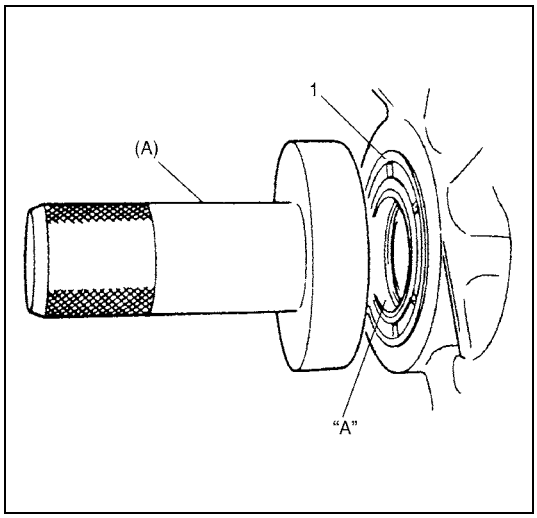
Transaxle oil capacity
: 2.2 liters (4.6/3.9 US/Imp. pt)

1. Drive shaft (LH)

Differential Side Oil Seal Replacement

Replacement

1) Lift up vehicle and drain transaxle oil.
2) Remove front drive shafts referring to "Front Drive Shaft Assembly Removal and Installation" in Section 4A.
3) Separate transfer from transaxle assembly. (for 4WD vehicle)
   For detail, refer to "Transfer Dismounting and Mounting" in Section 7D.



4) Remove oil seal (1) and install a new one until it becomes flush with case surface using special tool and hammer.

NOTE:

When installing oil seal, face its spring side inward.

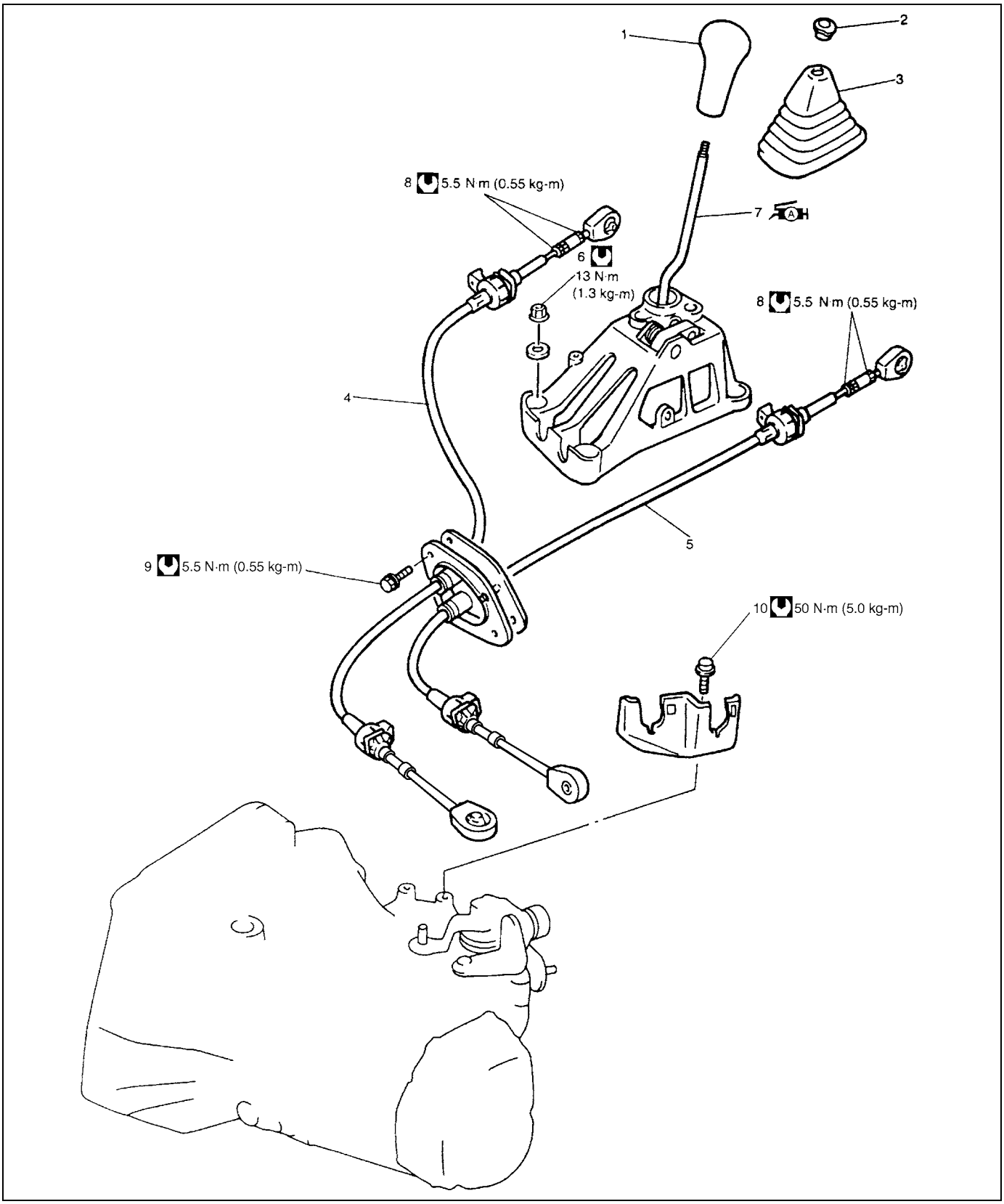
Special tool
(A) : 09913-75510 (2WD and LH of 4WD)
(A) : 09951-46010 (RH of 4WD)

5) Apply grease to oil seal lip and at the same time check drive shaft where oil seal contacts and make sure of its smoothness.

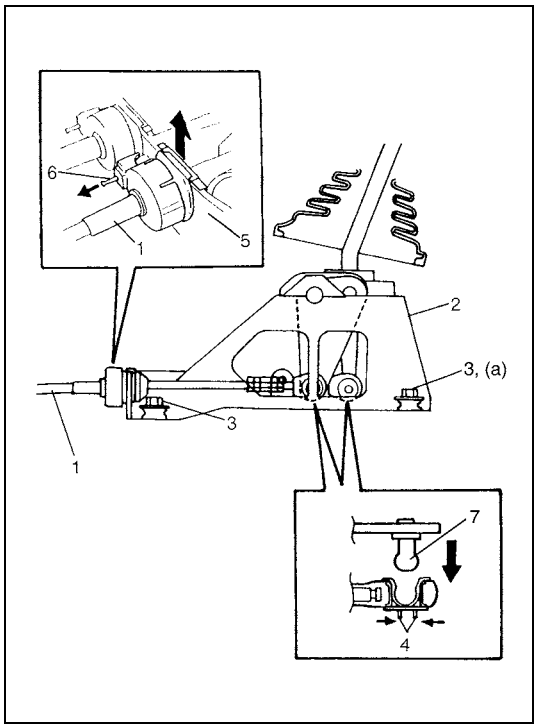
"A" : Grease 99000-25010

6) Install transfer referring to "Transfer Dismounting and Mounting" in Section 7D.
7) Insert front drive shafts referring to "Front Drive Shaft Assembly Removal and Installation" in Section 4A.
8) Install ball stud and stabilizer mount brackets referring to "Wheel Hub and Steering Knuckle Removal and Installation" and "Stabilizer Bar and Bushings Removal and Installation" in Section 3D.
9) Install tie-rod end referring to "Tie Rod End Removal and Installation" in Section 3B.
10) Fill transaxle oil as specified referring to "Manual Transaxle Oil Change" in this section, and make sure that oil has been sealed with oil seal.

Gear Shift Control Lever and Cable Components



1. Gear shift control lever knob	5. Gear select control cable	9. Cable mounting bolt
2. Lever boot holder	6. Gear shift control lever assembly mounting nut	10. Cable bracket bolt
3. Gear shift lever boot	A H 7. Gear shift control lever assembly : Apply grease 99000-25010 to pin ends to which shift and select cables are connected.	Tightening torque
4. Gear shift control cable	8. Cable lock nut	



Gear Shift Control Lever and Cable Removal and Installation

Removal

1) Remove console box.
2) Disconnect gear shift and select control cables (1) from gear shift control lever assembly (2).
   a) Disconnect cable end from pivot (7) while pushing cable end bush (4).
   b) Detach cable from bracket (5) while pulling pin (6).
3) Remove gear shift control lever assembly mounting nuts (3) and gear shift lever assembly (2) from body.
4) Disconnect shift and select cables (1) from transmission in the same manner as step 2).
5) Remove cable grommet and cable clamp, and then remove shift and select cables (1) from body.

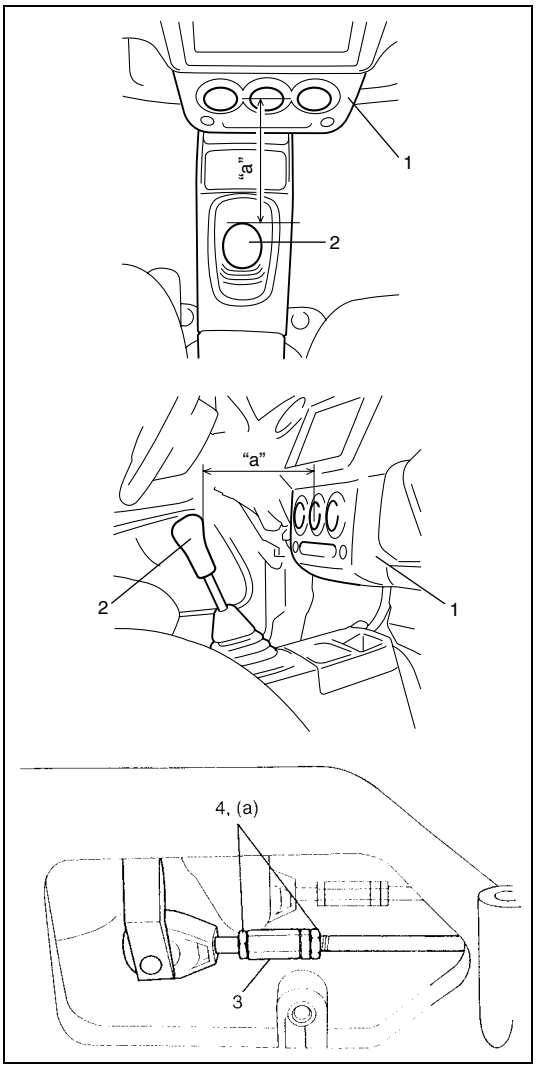
Installation

Reverse removal procedure for installation noting the following.

- Tighten gear shift control lever assembly mounting nuts (3) to specified torque.

Tightening torque
Gear shift control lever assembly mounting nut
(a) : 13 N·m (1.3 kg-m, 9.5 lb-ft)

Gear Shift Control Lever and Cable Adjustment



- Adjustment of shift cable:

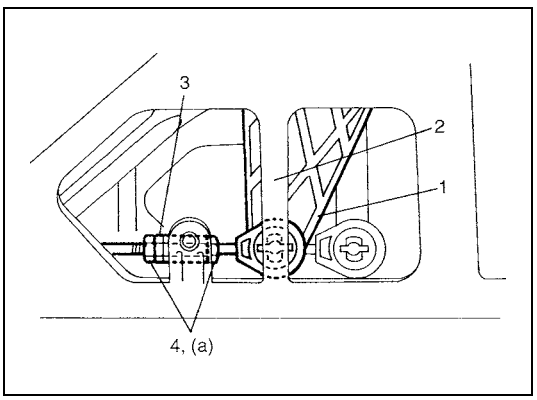
a) With shift control lever in "NEUTRAL" position, adjust shift cable adjusting nut (3) so that distance "a" between edge of instrument panel (1) and center of shift knob (2) measured as specified value.

Distance "a" : 215 mm (8.46 in.)

b) After shift cable adjustment, tighten cable lock nut (4) to specified torque.

Tightening torque
Cable lock nut (a) : 5.5 N·m (0.55 kg-m, 4.0 lb-ft)

c) Make sure that boots are installed correctly.



- Adjustment of select cable:

a) With shift control lever in "NEUTRAL" position, adjust select cable adjusting nut (3) so that the tip of select arm (cable joint point) (1) and the center rip of gear shift control lever assembly (2) are aligned as shown.

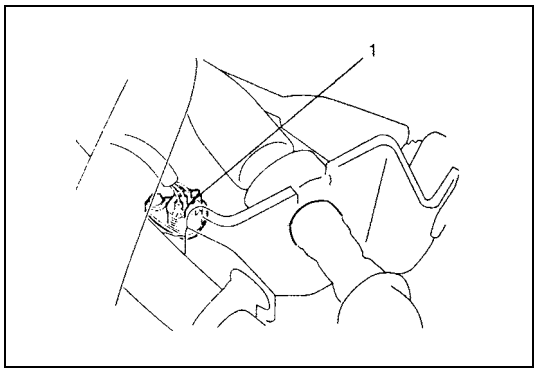
b) After select cable adjustment, tighten cable lock nut (4) to specified torque.

Tightening torque
Cable lock nut (a) : 5.5 N·m (0.55 kg-m, 4.0 lb-ft)

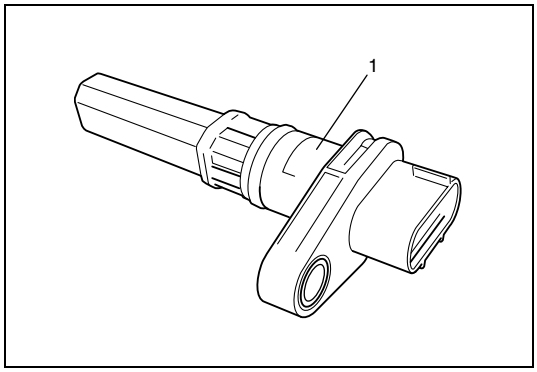
Vehicle Speed Sensor (VSS) Removal and Installation

Removal

1) Disconnect negative cable at battery.

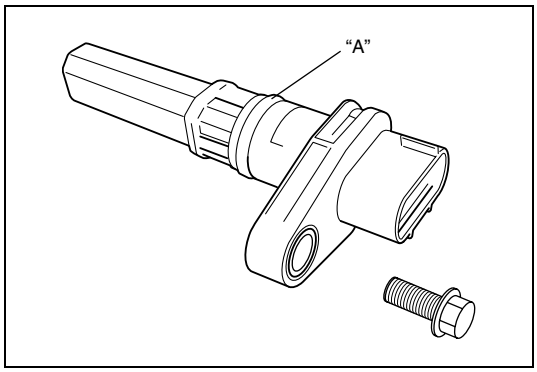


2) Disconnect VSS coupler (1).



3) Remove VSS (1).

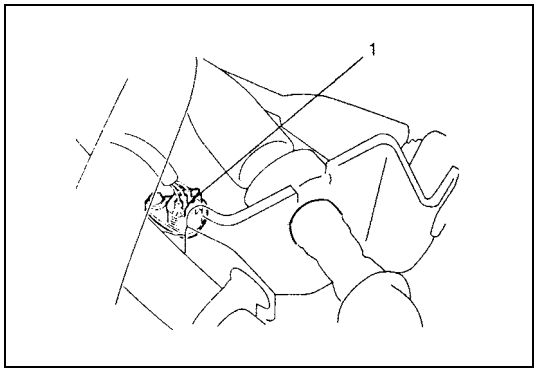
Installation



1) Apply grease to new O-ring and then install VSS to transaxle.

"A" : Grease 99000-25010

2) Connect negative cable at battery.

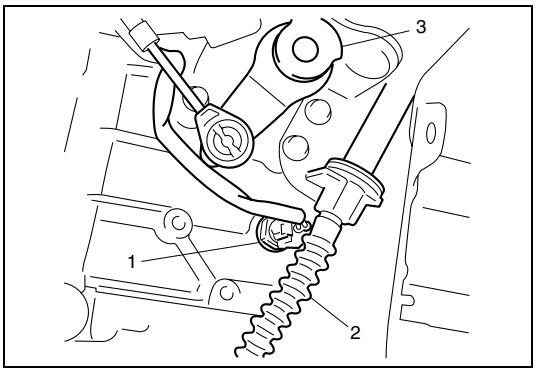


3) Connect VSS coupler (1).

Back Up Lamp Switch Removal and Installation

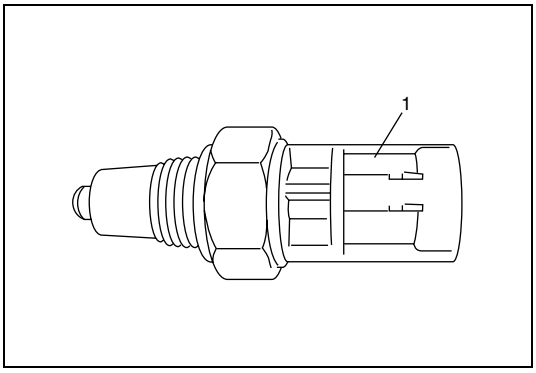
Removal

1) Disconnect negative cable at battery.



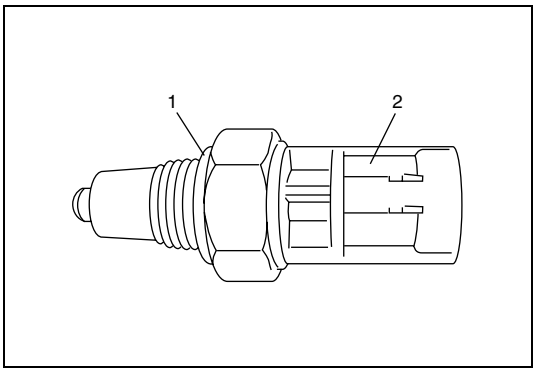
2) Disconnect back up lamp switch coupler (1).

2.	Clutch cable
3.	Gear shift and select shaft assembly



3) Remove back up lamp switch (1).

Installation

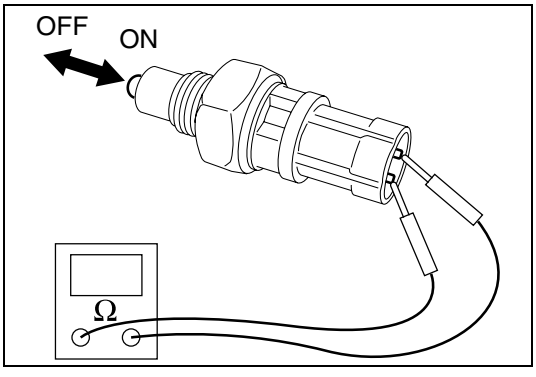


1) Apply grease to new O-ring (1) and tighten back up lamp switch (2) to specified torque.

Tightening torque
Back up lamp switch (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

2) Connect negative cable at battery.
3) Connect back up lamp switch coupler (1).

Back Up Lamp Switch Inspection

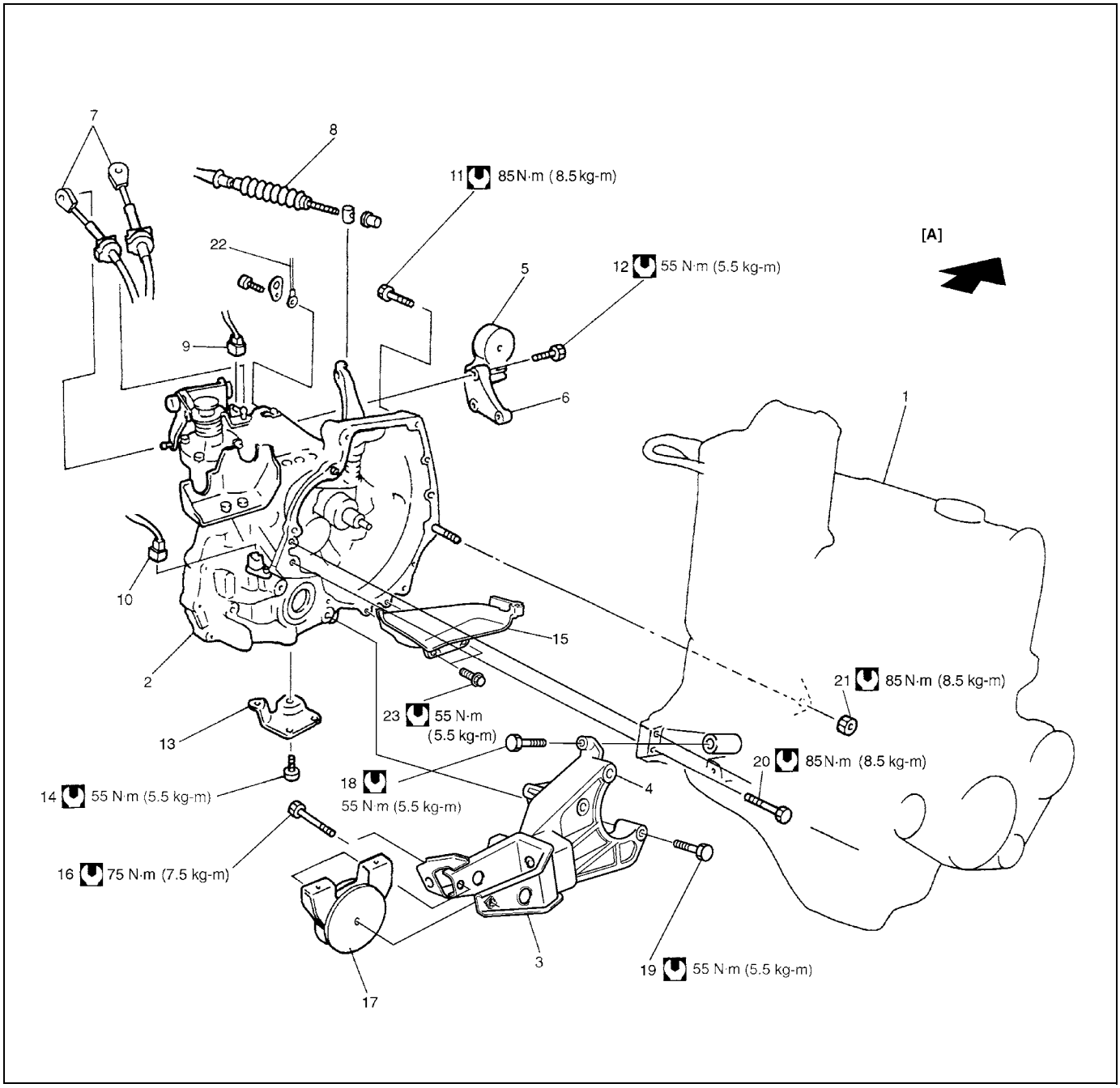


Check backup lamp switch for function using ohmmeter.

Switch ON : Continuity
Switch OFF : No continuity

Unit Repair Overhaul

Transaxle Unit Components



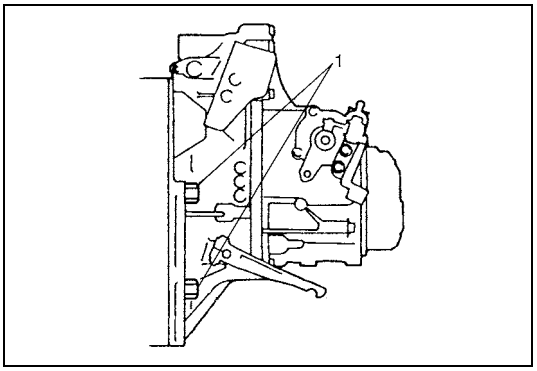
[A] : Forward	9. Backup lamp switch connector	18. Engine rear mounting No.2 bracket bolts
1. Engine	10. VSS connector	19. Transaxle to engine rear mounting No.2 bracket bolt
2. Transaxle	11. Transaxle to engine bolts	20. Transaxle to engine bolts
3. Engine rear mounting No.1 bracket	12. Engine left mounting bracket bolts	21. Transaxle to engine nut
4. Engine rear mounting No.2 bracket	13. Engine rear mounting bracket stiffener	22. Ground cable
5. Engine left mounting	14. Stiffener bolts	23. Clutch housing lower plate bolts
6. Engine left mounting bracket	15. Clutch housing lower plate	Tightening torque
7. Shift & select control cables	16. Engine rear mounting bolt	
8. Clutch cable	17. Engine rear mounting	

Transaxle Unit Dismounting and Remounting

Dismounting

Under hood

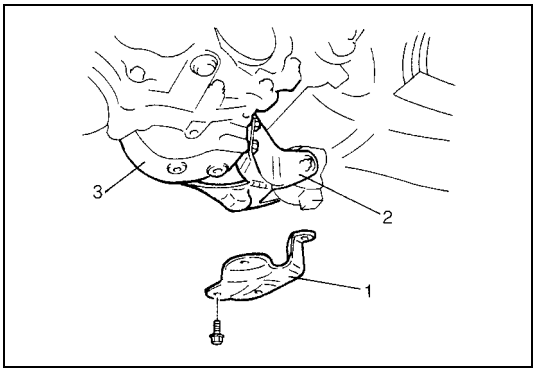
1) Disconnect negative cable at battery.
2) Undo wiring harness clamps, disconnect backup lamp switch coupler, VSS coupler and ground cable.
3) Disconnect clutch cable from clutch release lever and bracket.
4) Disconnect gear shift and select control cables.
5) Remove transaxle control cable bracket.
6) Remove water pipe bracket bolts from transaxle.



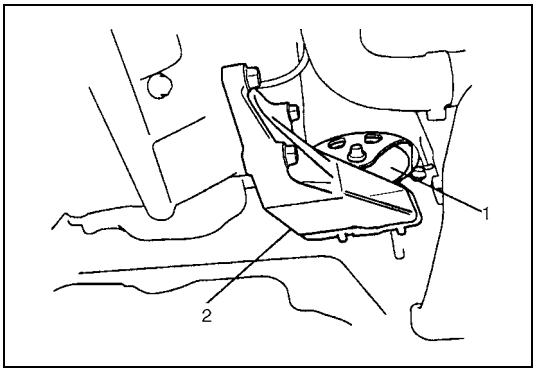
7) Remove transaxle to engine bolts (1).
8) Remove starting motor referring to “Starting Motor Dismounting and Remounting” in Section 6G.
9) Support engine by using lifting device.

On lift

10) Drain transaxle oil referring to “Manual Transaxle Oil Change” in this section.
11) Remove left and right drive shaft referring to “Front Drive Shaft Assembly Removal and Installation” in Section 4A.
12) Remove left side of engine under cover.



13) Remove engine rear mounting bracket stiffener (1).
14) Remove clutch housing lower plate.
15) Remove engine rear mounting No.1 bracket (2) with No.2 bracket (3).
16) Remove transfer referring to “Transfer Dismounting and Mounting” in Section 7D, if equipped.
17) Remove transaxle to engine bolts and nut.
18) Lower vehicle and support transaxle with transaxle jack.



19) Remove engine left mounting (1) with bracket (2).
20) Remove other attached parts from transaxle, if any.
21) Pull transaxle out so as to disconnect input shaft from clutch disc and then lower it.

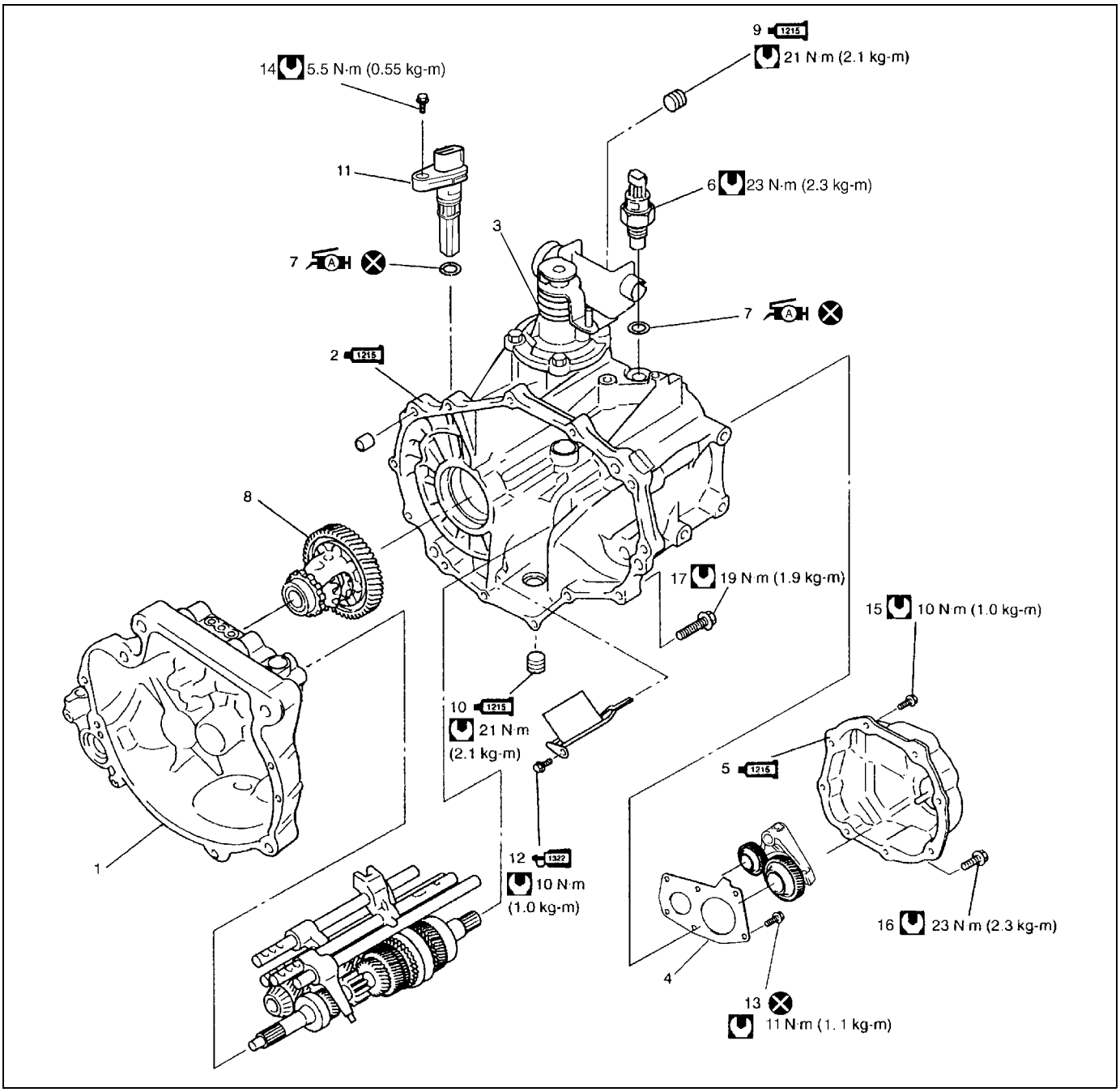
Remounting

CAUTION:
Care should be taken not to scratch oil seal lip with drive shaft while raising transaxle.
Do not hit drive shaft joint with hammer when installing it into differential gear.

Reverse dismounting procedure for remounting noting the following.

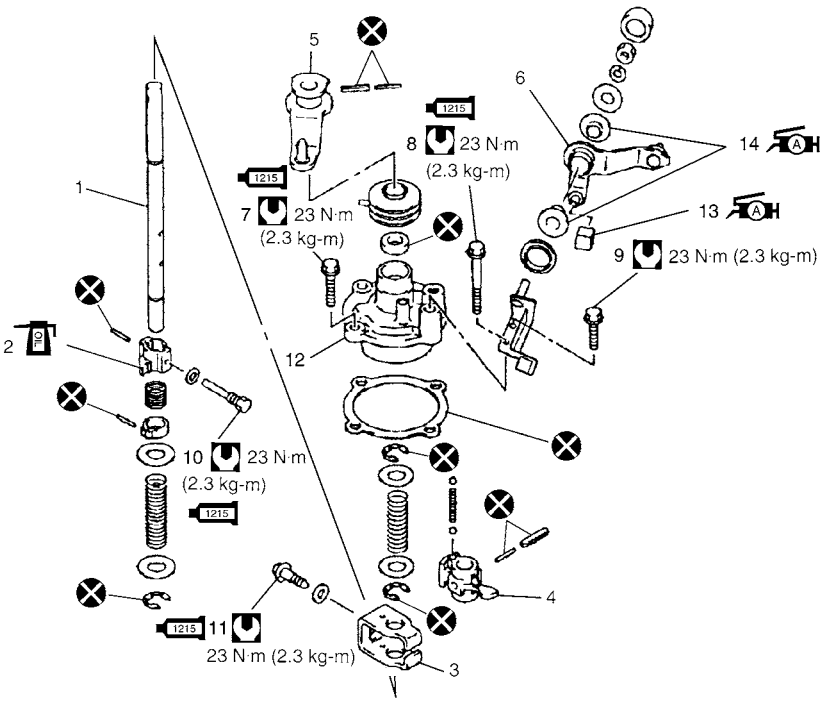
- Install transfer referring to “Transfer Dismounting and Mounting” in Section 7D, if equipped.
- Refer to “Transaxle Unit Components” for fastener specified torque.
- Push in drive shaft joints (right & left) fully so as to snap ring of shaft engages with differential gear.
- Set each clamp for wiring securely.
- Install starting motor referring to “Starting Motor Dismounting and Remounting” in Section 6G.
- After connecting clutch cable, be sure to adjust its play properly.
  Refer to “Clutch Pedal Inspection” in Section 7C.
- Fill transaxle with oil as specified referring to “Manual Transaxle Oil Change” in this section.
- Connect battery and check function of engine, clutch and transaxle.

Transaxle Case Components



	1. Transaxle right case	1322	12. Oil gutter bolt : Apply thread lock 99000-32110 to all around thread part of bolt.
1215	2. Transaxle left case : Apply sealant 99000-31110 to mating surface of left case and right case.		13. Left case plate screw and bolts
	3. Gear shift and select shaft assembly		14. VSS bolt
	4. Transaxle left case plate		15. Side cover bolt No.1
1215	5. Transaxle side cover : Apply sealant 99000-31110 to mating surface of side cover and left case.		16. Side cover bolt No.2
	6. Back up lamp switch		17. Transaxle case bolt
A	7. O-ring : Apply SUZUKI SUPER GREASE A 99000-25010 to O-ring.		18. Guide case bolt No.1
	8. Differential assembly		19. Guide case bolt No.2
1215	9. Oil level/filler plug : Apply sealant 99000-31110 to all around thread part of plug.		Tightening torque
1215	10. Oil drain plug : Apply sealant 99000-31110 to all around thread part of plug.		Do not reuse.
	11. VSS		

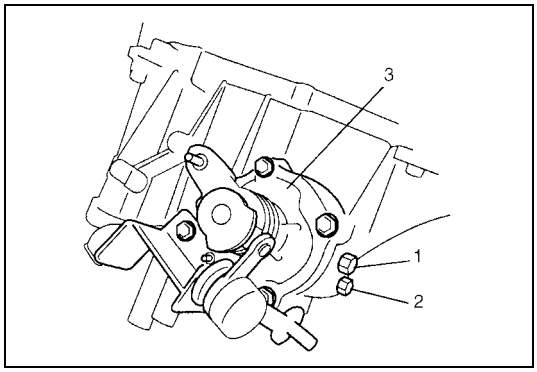
Gear Shift and Select Shaft Assembly Components



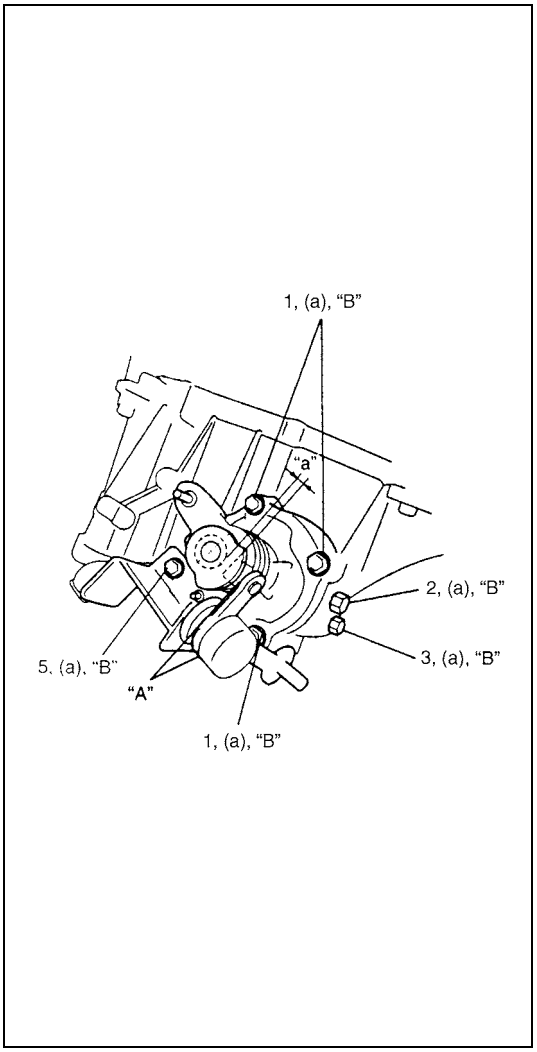
1.	Gear shift & select shaft	7.	Guide case bolt No.1	13.	Select lever shaft bush :Apply grease 99000-25010 to whole area of bush.
2.	5th & reverse gear shift cam	8.	Guide case bolt No.2	14.	Select lever boss :Apply grease 99000-25010 to internal and external diameter
3.	Gear shift interlock plate	9.	Select lever bracket bolt		Tightening torque
4.	Gear shift & select lever	10.	5th to reverse interlock guide bolt :Apply sealant 99000-31110 to bolt thread.		Do not reuse.
5.	Shift cable lever	11.	Gear shift interlock bolt :Apply sealant 99000-31110 to bolt thread.		Apply transaxle oil.
6.	Select cable lever	12.	Guide case		

Gear Shift and Select Shaft Assembly Removal and Installation

Removal



1) Remove gear shift interlock bolt (1) and 5th to reverse interlock guide bolt (2) from transaxle case.
2) Remove gear shift and select shaft assembly (3).



Installation

1) Apply grease to select lever shaft bush and select lever boss, and install gear shift and select shaft assembly with new gasket into transaxle.

"A" : Grease 99000-25010

2) Apply sealant to gear shift guide case No. 2 bolt (5). Tighten gear shift guide case No. 1 bolts (1) and No. 2 bolt (5) to specified torque at the position that clearance "a" is within 1 - 1.5 mm (0.04 - 0.06 in.).

Tightening torque
Gear shift guide case bolts
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

3) Install washer and gear shift interlock bolt (2) to which sealant have been applied and them tighten it to specified torque.

"B" : Sealant 99000-31110

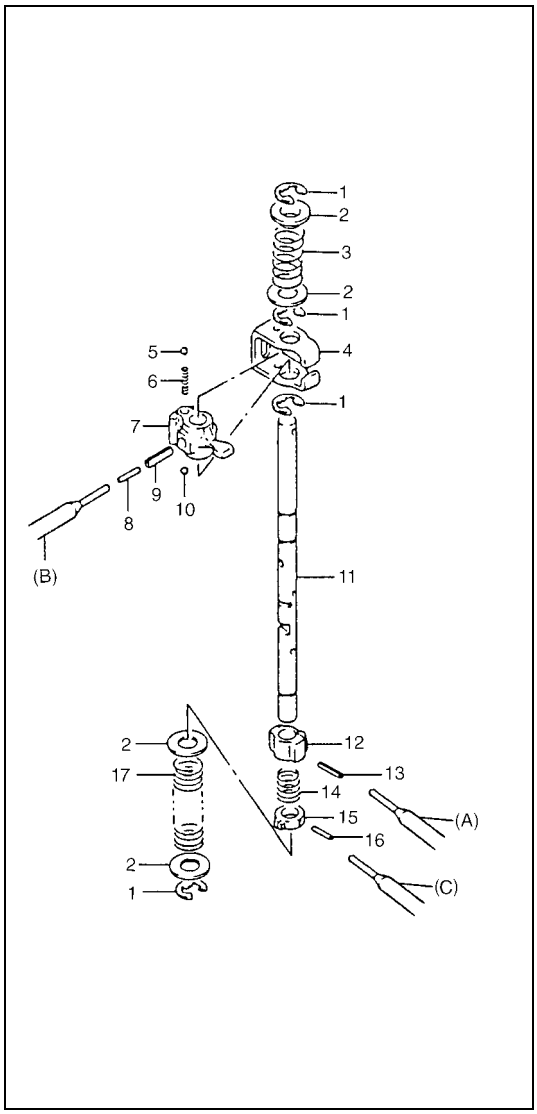
Tightening torque
Gear shift interlock bolt (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

4) Install washer and 5th to reverse interlock guide bolt (3) to which sealant have been applied and then tighten it to specified torque.

"B" : Sealant 99000-31110

Tightening torque
5th to reverse interlock guide bolt (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

Gear Shift and Select Shaft Disassembly and Assembly



1) Push spring pins out using specified spring pin removers as shown bellow.

Special tool
(A) : 09922-85811 (4.5 mm)
(B) : 09925-78210 (6.0 mm)
(C) : 2.8 – 3.0 mm (0.11 – 0.12 in.) Commercially available spring pin remover

2) Inspect component parts for wear, distortion or damage. If any detect is found, replace detective part with new one.

NOTE:

- **When driving in spring pins, prevent shaft from being bent by supporting it with wood block.**
- **Assemble 5th & reverse gear shift cam with its pit and spring pin aligned.**
- **Make sure to select an appropriate spring by identifying the painted colors to keep gear shifting performance as designed.**
  - **– Low speed select spring - No paint**
  - **– Reverse select spring - Pink**

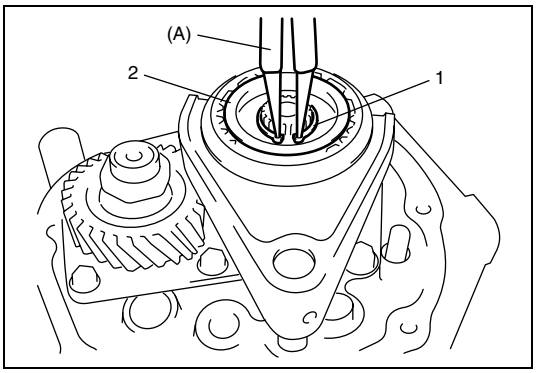
1. E-ring	10. Ball
2. Washer	11. Gear shift & select shaft
3. Reverse select spring	12. 5th & reverse gear shift cam
4. Gear shift interlock plate	13. Spring pin
5. Ball	14. Cam guide return spring
6. Gear shift interlock spring	15. 5th & reverse gear shift cam guide
7. Gear shift & select lever	16. Spring pin
8. Spring pin	17. Low speed select spring
9. Spring pin	

Fifth Gear Disassembly and Assembly

Disassembly

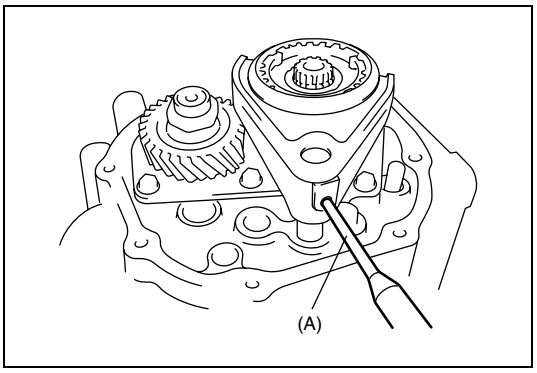
1) Remove side cover bolts and take off transaxle side cover.

CAUTION:
Care should be taken not to distort side cover when it is removed from left case.



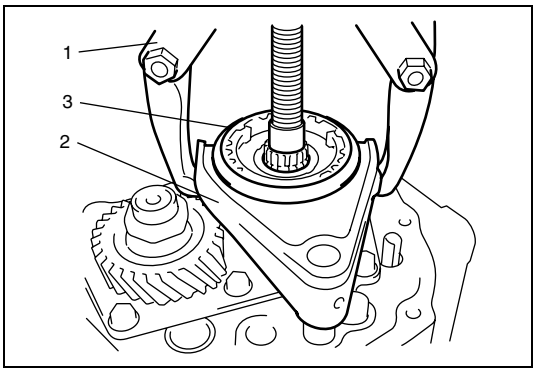
2) Using special tool, remove circlip (1) and then hub plate (2).

Special tool
(A) : 09900-06107

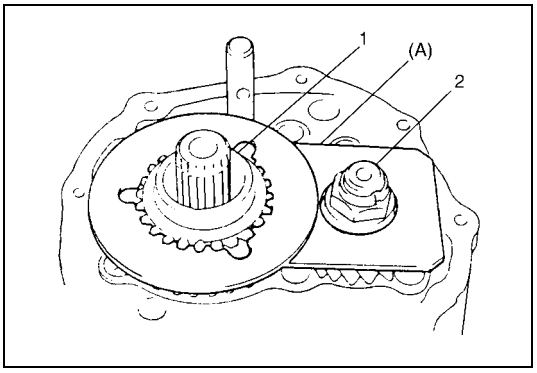


3) Drive out spring pin using special tool and hammer.

Special tool
(A) : 09922-85811



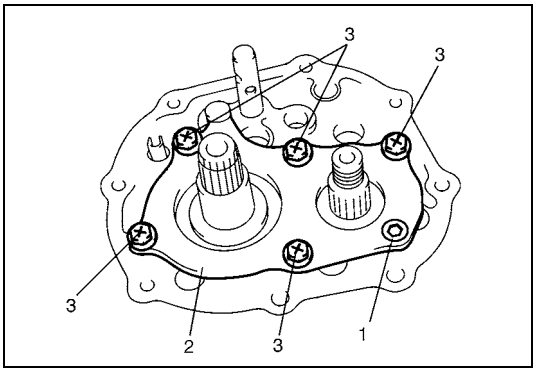
4) Remove gear shift fork (2), sleeve & hub assembly (3), synchronizer ring spring, synchronizer ring and 5th gear all together. Use gear puller (1) for removal if spline fitting of hub is tight.



5) Install input shaft 5th gear (1) and special tool to stop rotation of shafts, and remove countershaft nut (2).

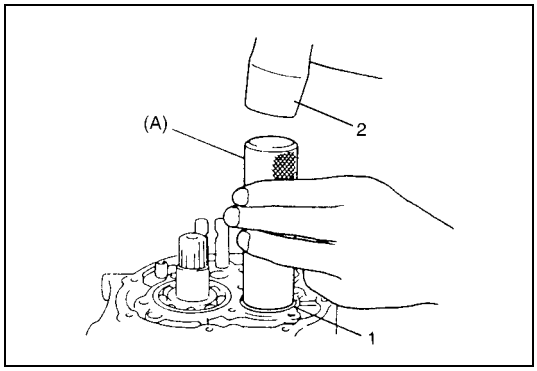
Special tool
(A) : 09927-76010

6) Remove special tool, input shaft 5th gear, needle bearing of separated steel cage type and then counter shaft 5th gear.



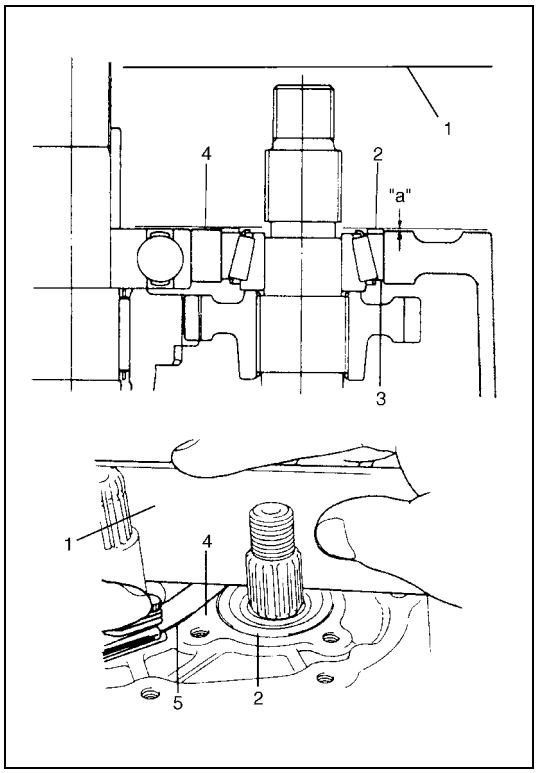
7) Remove left case plate screw (1) and bolts (3), and take off left case plate (2).
8) Remove bearing set shim.

Assembly



1) Install seat countershaft left bearing cup (1) to bearing cone, tap cup using special tool and plastic hammer (2).

Special tool
(A) : 09913-84510



2) With putting a shim (2) on bearing cup (3), place straight edge (1) over it and compress it by hand through straight edge, and then measure clearance “a” between case surface (4) and straight edge using feeler gauge (5).

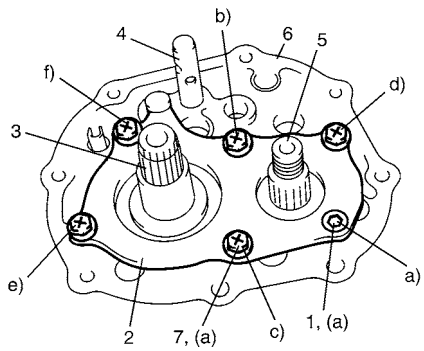
Clearance between case surface and straight edge
“a” : 0.13 – 0.17 mm (0.0051 – 0.0067 in.)
(Shim protrusion)

3) By repeating above step, select a suitable shim which adjusts clearance “a” to specification and put it on bearing cup.

NOTE:

Insert 0.15 mm (0.0059 in.) feeler to know whether or not a shim fulfills specification quickly.

Available shim thickness
0.40, 0.45, 0.50, 0.55, 0.6, 0.65,0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0,1.05, 1.1 and 1.15 mm (0.015, 0.017, 0.019, 0.021, 0.023,0.025, 0.027, 0.029, 0.031, 0.033,0.035, 0.037, 0.039, 0.041, 0.043 and 0.045 in.)



CAUTION:

Do not reuse left case plate screw (1) and bolts (7). Be sure to use new adhesive pre-coated screw and bolts. Otherwise, screw and bolts may loosen.

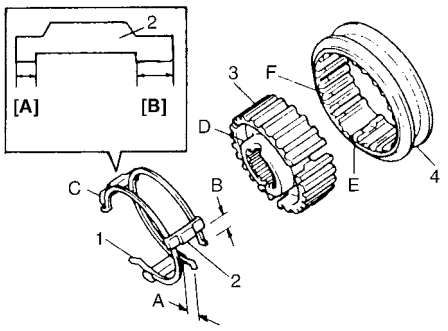
4) Place left case plate (2) inserting its end in groove of shift guide shaft (4) and tighten new adhesive pre-coated screw (1) and bolts (7) temporarily with less than specified toque.
5) Tighten new screw and new bolts to specified torque finally in the order of alphabet shown in figure.

NOTE:

After tightening screw and bolts, make sure that counter-shaft (5) can be rotated by hand feeling certain load.

Tightening torque
Left case plate screw and bolts
(a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)

3. Input shaft
6. Transaxle left case



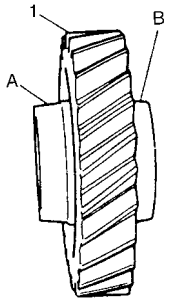
6) Assemble 5th speed synchronizer sleeve (4) and hub (3) with keys (2) and springs (1).

NOTE:

Short side C in keys, long flange D in hub and chamfered spline F in sleeve should face inward (5th gear side).

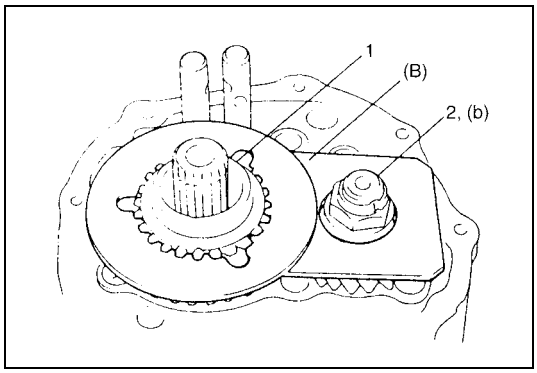
Synchronizer key installation position
: A = B

[A] : Short side C	D : Long flange (Inward)
[B] : Long side	E : Key way
C : Short side (Inward)	F : Chamfered spline (Inward)



7) Install 5th gear (1) to counter shaft facing machined boss A inward.

A : Machined boss (Inside)
B : No machining (Outside)

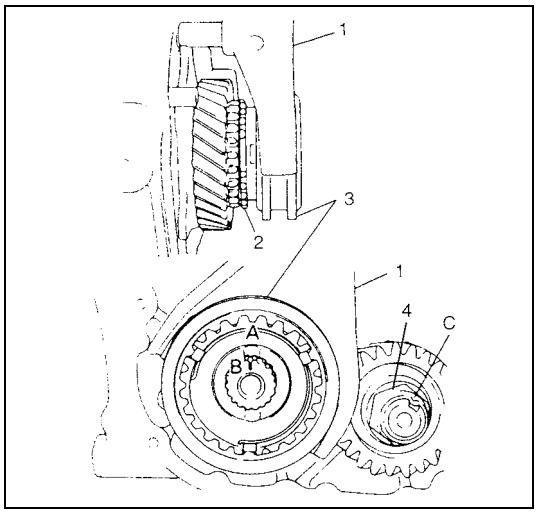


8) Install needle bearing of separated steel cage type to input shaft, apply oil then install 5th gear (1) and special tool to stop shaft rotation.

Special tool
(B) : 09927-76010

9) Install new countershaft nut (2) and tighten it to specification.

Tightening torque
Countershaft nut (b) : 70 N·m (7.0 kg-m, 51.0 lb-ft)

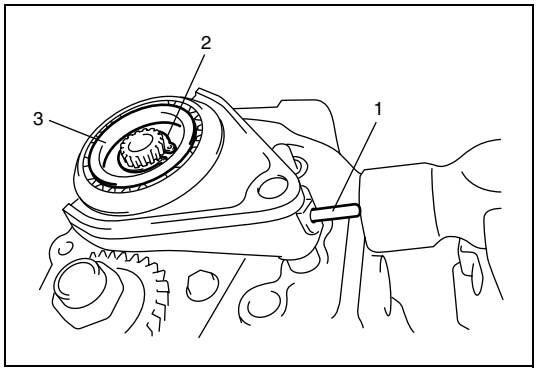


10) Remove special tool, then caulk countershaft nut (4) at C with caulking tool and hammer.
11) Install synchronizer ring (2).
12) Fit 5th gear shift fork (1) to sleeve & hub assembly (3) and install them into input shaft, shift shaft and shift guide shaft at once aligning hub oil groove A with shaft mark B.

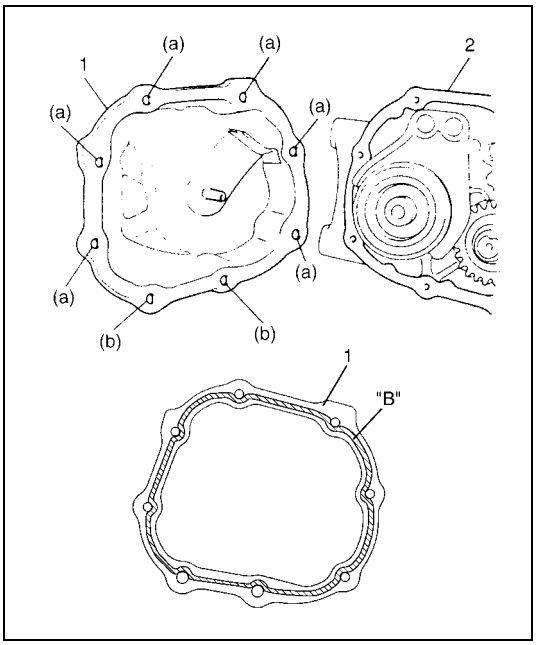
NOTE:

Long flange of hub faces inward (gear side).

A :	Oil groove (Align with B)
B :	Punch mark
C :	Caulking



13) Drive in spring pin (1).
14) Fit hub plate (3) and fix it with circlip (2).



15) Clean mating surface of both left case (2) and side cover (1), apply sealant to side cover (1) as shown in figure by such amount that its section is 1.5mm (0.059 in.) in diameter, mate it with left case and then tighten bolts.

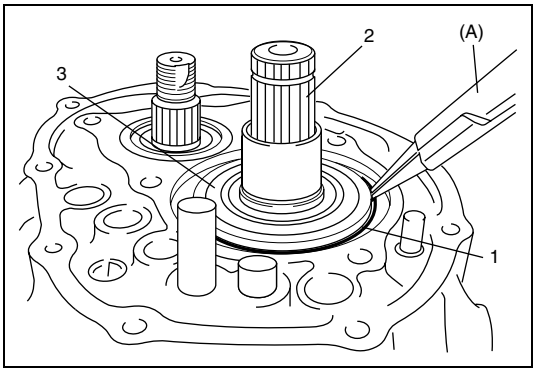
"B" : Sealant 99000-31110

Tightening torque
Side cover No.1 bolts (a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)
Side cover No.2 bolts (b) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

Gear Shift Shaft, Input Shaft and Counter Shaft Removal and Installation

Removal

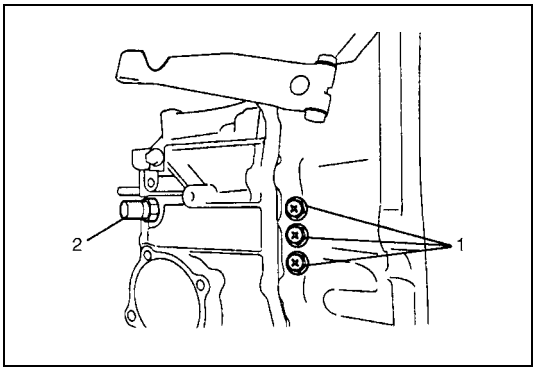
1) Remove gear shift and select shaft assembly referring to "Gear Shift and Select Shaft Assembly Removal and Installation" in this section.
2) Remove fifth gear referring to "Fifth Gear Disassembly and Assembly" in this section.



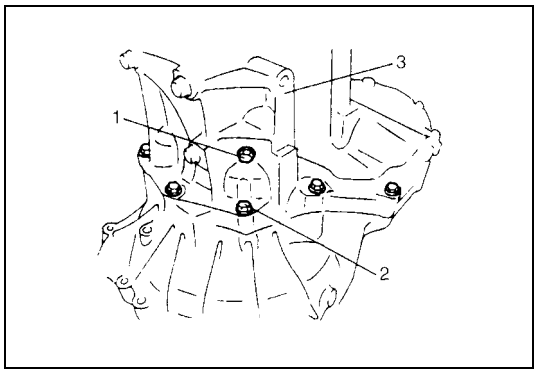
3) Remove snap ring (1) using special tool.

Special tool
(A) : 09900-06107

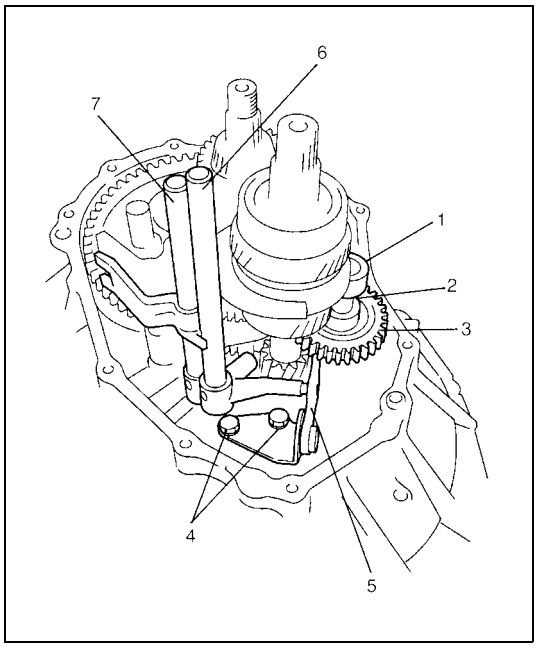
2. Input shaft
3. Input shaft left bearing



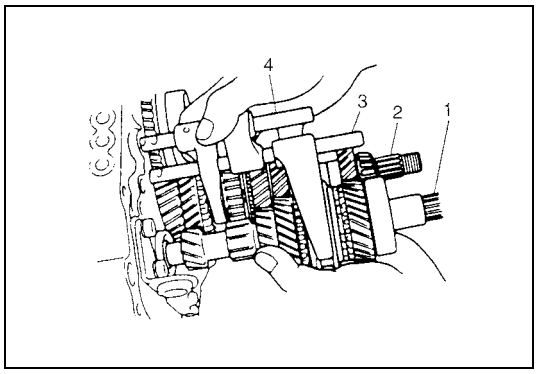
4) Remove gear shift locating bolts (1) with washers, then take out locating springs and steel balls.
5) Remove back up lamp switch (2).



6) Remove reverse shaft bolt (1) with washer.
7) Remove case bolts (2) from outside and another bolts from clutch housing side.
8) Tapping left case (3) flanges with plastic hammer, remove left case.

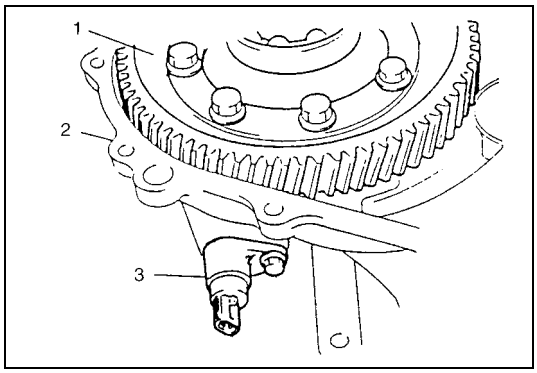


9) Pull out reverse gear shaft (1) with washer (2), then take off reverse idler gear (3).
10) Remove reverse gear shift lever bolts (4) and reverse gear shift lever (5).
11) Pull out 5th & reverse gear shift guide shaft (6) together with 5th & reverse gear shift shaft (7).



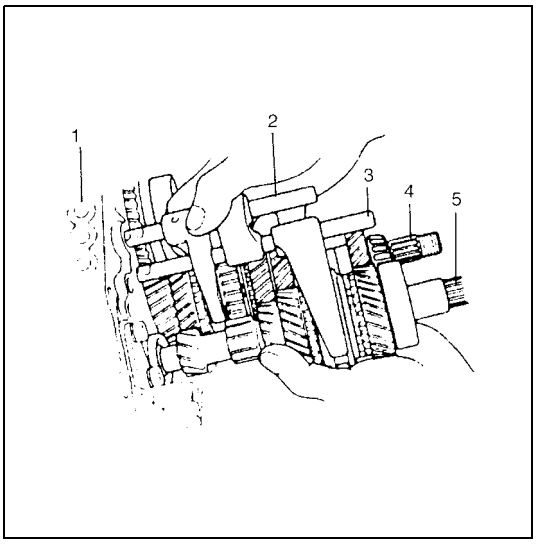
12) Tapping input shaft end with plastic hammer, push it out as assembly from case a little, then take out input shaft assembly (1), counter shaft assembly (2), high speed gear shift shaft (3) and low speed gear shift shaft (4) all at once.

Installation



1) Install differential assembly (1) into right case (2).
2) Insert VSS (3) with grease applied to its new O-ring, then tighten it with bolt.

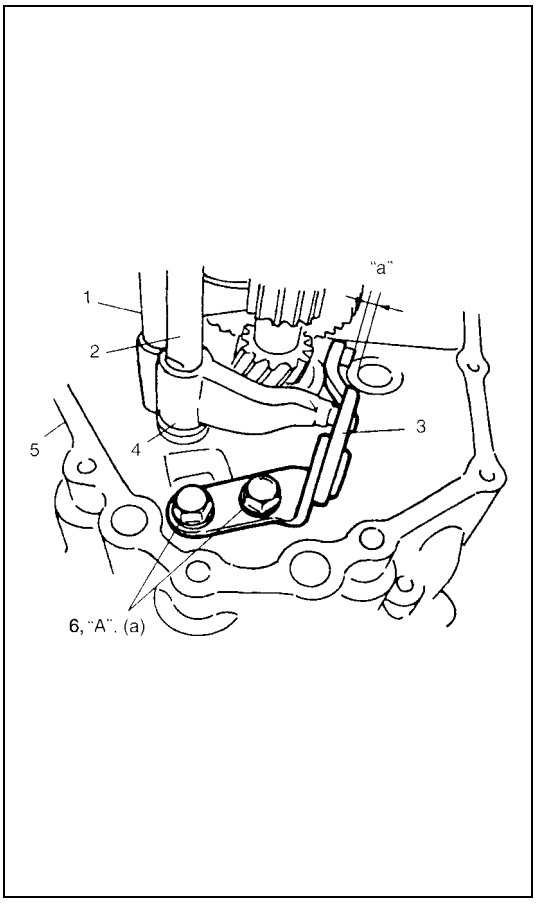
Grease 99000-25010



3) Join input shaft (5), countershaft (4), low speed gear shift shaft (2) and high speed gear shift shaft (3) assemblies all together, then install them into right case (1).

CAUTION:
Take care not to damage oil seal lip by input shaft, or oil leakage may take place.

NOTE:
- **Input shaft right bearing on shaft can be installed into right case tapping shaft with plastic hammer.**
- **Check to make sure that counter shaft is engaged with final gear while installing.**



4) Install 5th & reverse gear shift shaft (1) with 5th & reverse gear shift guide shaft (2) into right case (5). Reverse gear shift arm (4) has to be joined with reverse gear shift lever (3) at the same time.
5) Place reverse gear shift lever (3), fasten it with bolts (6) after applying thread lock cement.

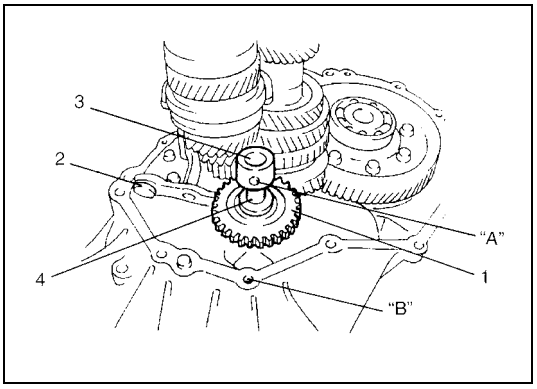
"A" : Thread lock cement 99000-32110

Tightening torque
Reverse gear shift lever bolts
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

NOTE:
- **When installing reverse gear shift lever (3), set it as the following specification.**

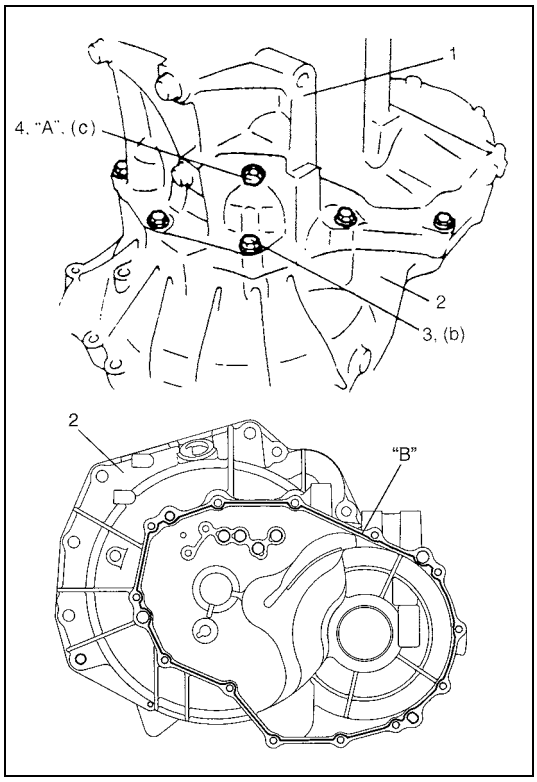
Distance between lever end and shaft bore
"a" : 5 mm (0.2 in.)

- **Distance "a" must be measured after installing reverse gear shaft.**
- **When "a" is 5 mm (0.2 in.), clearance between reverse idler gear groove and shift lever end will be 1 mm (0.04 in.).**



6) Make reverse idler gear (1) with reverse gear shift lever (2), insert reverse gear shaft (3) into case through idler gear and then align "A" in shaft with "B" in case.

NOTE:
- **Make sure that washer (4) has been installed in shaft at above the gear.**
- **Check to confirm that reverse gear shift lever end has clearance 1 mm (0.04 in.) to idler gear groove.**



7) Clean mating surfaces of both right and left cases, apply sealant to right case (2) as shown in figure by such amount that its section is 1.5mm (0.059 in.) in diameter then mate it with left case (1).

"B" : Sealant 99000-31110

8) Tighten case bolts (3) from left case side to specified torque.

Tightening torque
Transaxle case bolts (b) : 19 N·m (1.9 kg-m, 14.0 lb-ft)

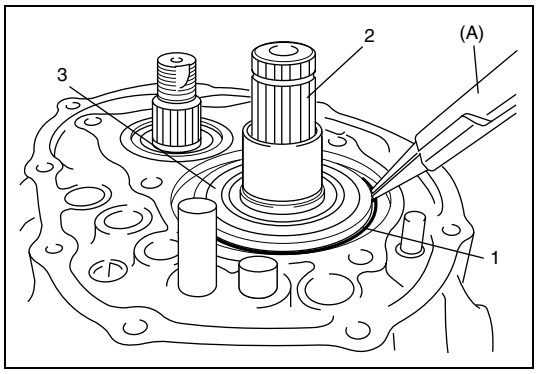
9) Install reverse shaft bolt (4) to which thread lock cement have been applied with aluminum washer and tighten it.

"A" : Thread lock cement 99000-32110

Tightening torque
Reverse shaft bolt (c) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

10) Install another case bolts from clutch housing side and tighten them to specification.

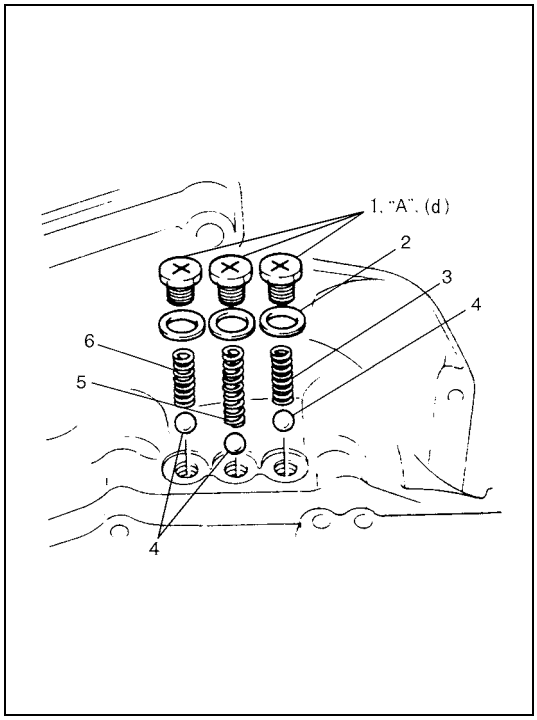
Tightening torque
Transaxle case bolts : 19 N·m (1.9 kg-m, 14.0 lb-ft)



11) Install new snap ring (1) using special tool.

Special tool
(A) : 09900-06107

2. Input shaft
3. Input shaft left bearing



12) Check locating spring for deterioration and replace with new one as necessary.

Locating spring free length
For Low speed (3) and 5th & reverse (6)
Standard : 26.1 mm (1.028 in.)
Service Limit : 25.0 mm (0.984 in.)
For High speed (5)
Standard : 40.1 mm (1.579 in.)
Service Limit : 39.0 mm (1.535 in.)

13) Install steel balls (4) and locating springs (4, 5 and 6) for respective gear shift shaft and tighten bolts (1) to which sealant have been applied to its thread part.

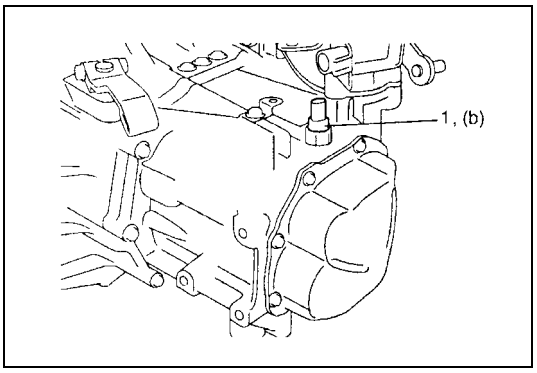
Sealant "A" : 99000-31110

Tightening torque
Gear shift locating bolt (d) : 13 N·m (1.3 kg-m, 9.5 lb-ft)

2. Washer

Assembly

1) Clean mating surface of guide case.
2) Install fifth gear referring to “Fifth Gear Disassembly and Assembly” in this section.
3) Install gear shift and select shaft assembly referring to “Gear Shift and Select Shaft Assembly Removal and Installation” in this section.



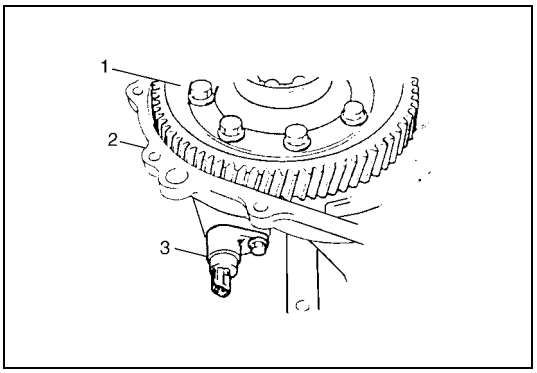
4) Tighten back up lamp switch (1) to specified torque.

Tightening torque
Back up lamp switch (b) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

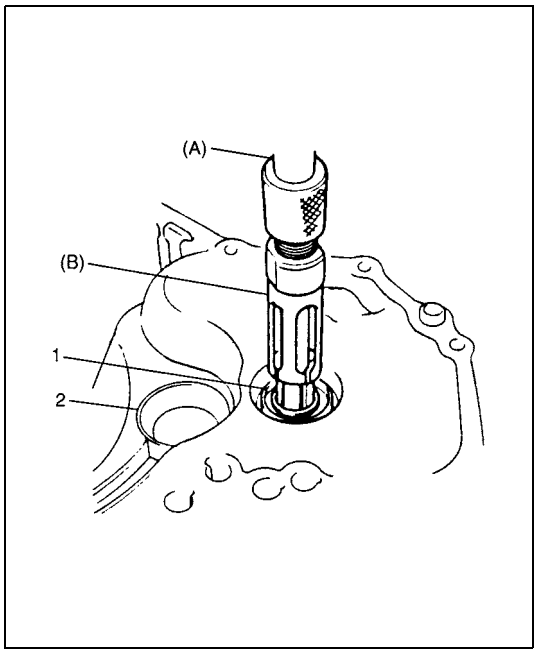
5) Check input shaft for rotation in each gear position.
6) Also confirm continuity of back up lamp switch in reverse position using ohmmeter.

Transaxle Case Disassembly and Assembly

Disassembly



1) Remove differential gear assembly (1) from right case (2).
2) Remove VSS (3).



3) Remove input shaft oil seal (1) using special tools, if necessary.

Special tool
(A) : 09930-30104
(B) : 09923-74510

4) If input shaft right bearing has been left in right case, pull it out using special tools.

Special tool
(A) : 09930-30104
(B) : 09923-74510

5) Also pull out countershaft right bearing cup (2) using special tools, if necessary.

Special tool
09941-64511
09930-30104

6) Remove counter shaft left bearing cup from left case using special tools.

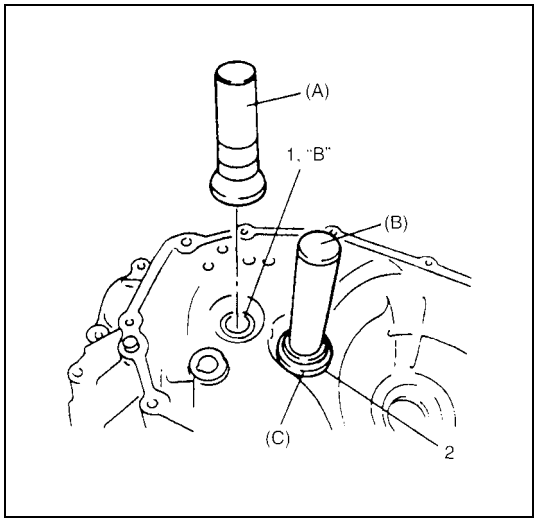
Special tool
09913-84510

7) Replace differential side oil seal(s) referring to "Differential Side Oil Seal Replacement" in this section, if necessary.
8) Remove oil gutter from left case, if necessary.

Assembly

NOTE:

Before installation, wash each part and apply specified transaxle oil to sliding faces of bearing and gear.



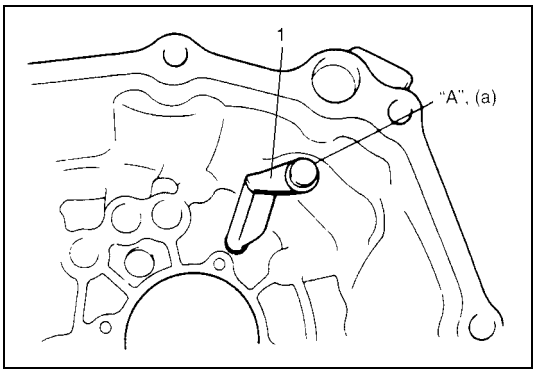
1) If input shaft oil seal (1) has been removed, install it with its spring side facing upward.
Use special tool and hammer for installation and apply grease to oil seal lip.

"B" : Grease 99000-25010

Special tool
(A) : 09951-76010

2) If counter shaft right bearing cup (2) has been removed, install it using special tools and hammer.

Special tool
(B) : 09924-74510
(C) : 09925-68210



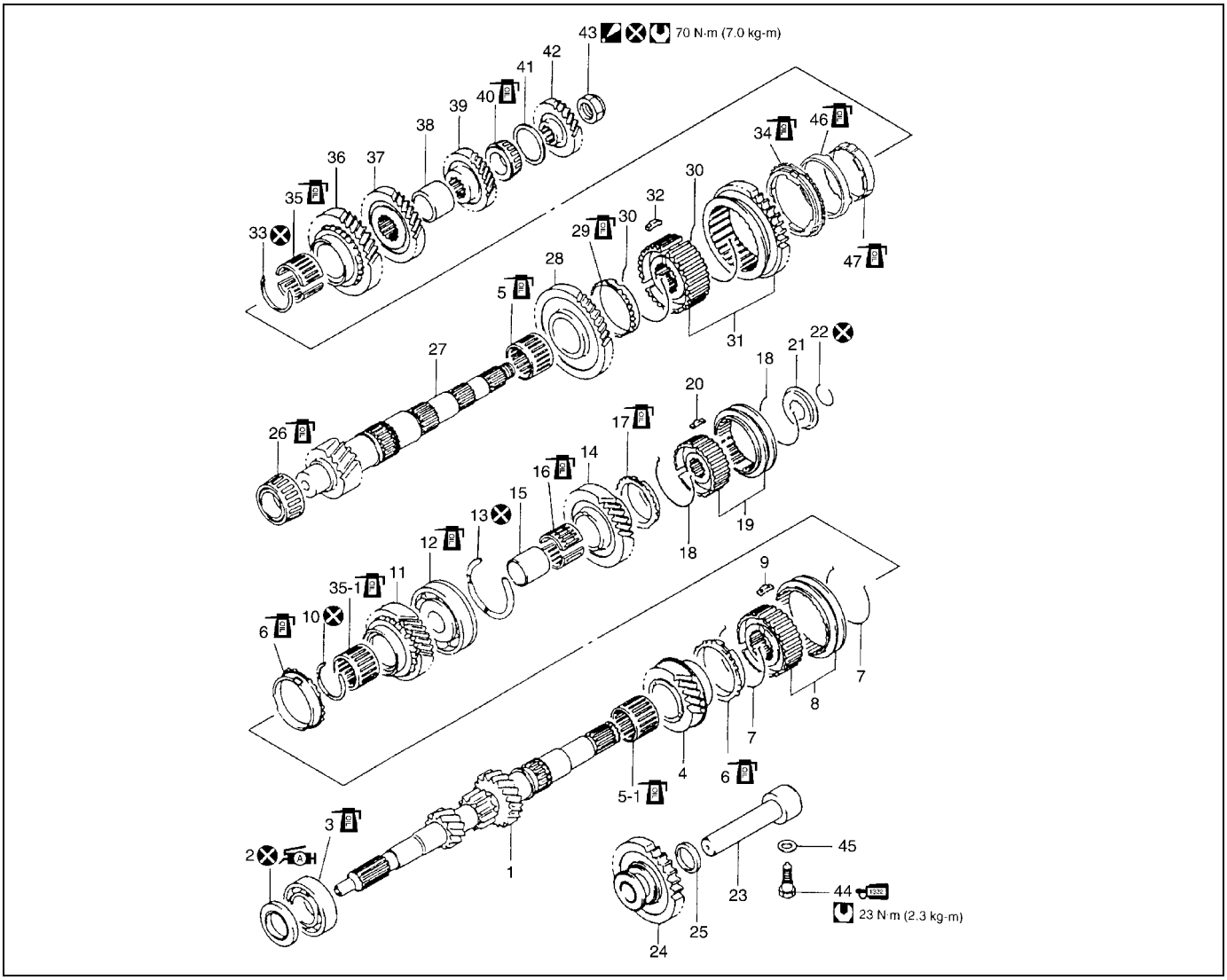
3) If input oil gutter (1) has been removed, install it with bolt to which thread lock cement have been applied.

"A" : Thread lock cement 99000-32110

Tightening torque
Oil gutter bolt (a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)

4) Install counter shaft left bearing cup into case bore tapping it with plastic hammer lightly.

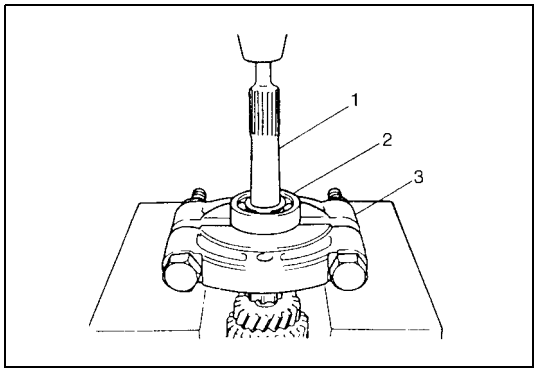
Input & Counter Shaft Components



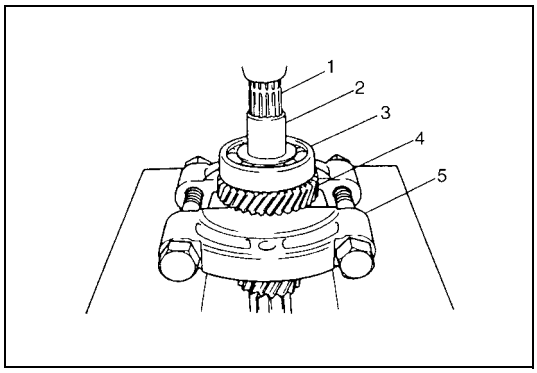
1. Input shaft	18. 5th synchronizer spring	35-1. Needle bearing (steel cage type)
2. Oil seal : Apply grease 99000-25010 to oil seal lip	19. 5th speed sleeve & hub	36. Countershaft 2nd gear
3. Input shaft right bearing	20. 5th synchronizer key	37. Countershaft 3rd gear
4. Input shaft 3rd gear	21. 5th synchronizer hub plate	38. 3rd & 4th gear spacer
5. Needle bearing (resin cage type)	22. Circlip	39. Countershaft 4th gear
5-1. Needle bearing (resin cage type)	23. Reverse gear shaft	40. Countershaft left bearing
6. High speed synchronizer ring	24. Reverse idler gear	41. Bearing set shim
7. High speed synchronizer spring	25. Reverse shaft washer	42. Countershaft 5th gear
8. High speed sleeve & hub	26. Countershaft right bearing	43. Countershaft nut : After tightening nut to specified torque, caulk nut securely.
9. High speed synchronizer key	27. Countershaft	44. Reverse shaft bolt : Apply thread lock cement 99000-32110 to thread part of bolt.
10. Circlip	28. Countershaft 1st gear	45. Washer
11. Input shaft 4th gear	29. 1st gear synchronizer ring	46. Center cone
12. Input shaft left bearing	30. Low speed synchronizer spring	47. 2nd gear synchronizer inner ring
13. Snap ring	31. Low speed sleeve & hub	Tightening torque
14. Input shaft 5th gear	32. Low speed synchronizer key	Do not reuse.
15. 5th gear spacer	33. Circlip	Apply transaxle oil.
16. 5th gear needle bearing (separated steel cage type)	34. 2nd gear synchronizer outer ring	
17. 5th speed synchronizer ring	35. Needle bearing (separated steel cage type)	

Input Shaft Disassembly and Assembly

Disassembly



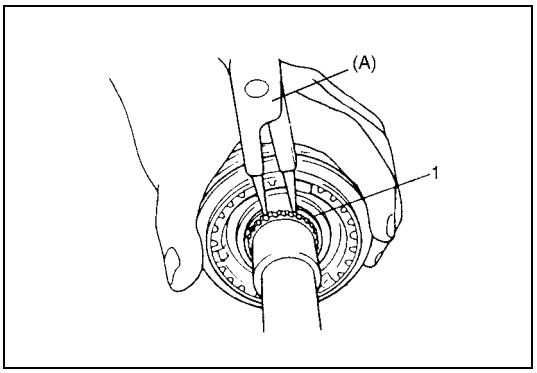
1) Remove input shaft right bearing (2) from input shaft (1) using bearing puller (3) and press.



2) Drive out 5th gear spacer (2), left bearing (3) and 4th gear (4) all at once from input shaft (1) using puller (5) and press.

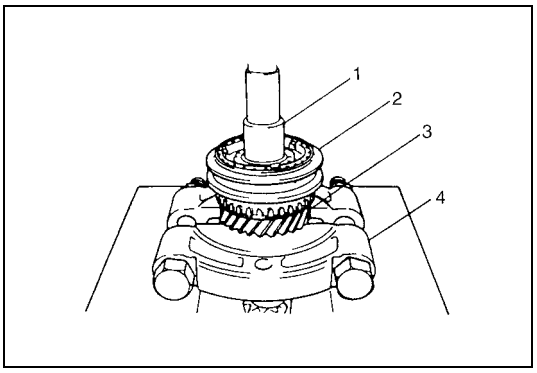
CAUTION:
To avoid gear tooth from being damaged, support it at flat side of bearing puller.

3) Take out 4th gear needle bearing and high speed synchronizer ring.



4) Using special tool, remove circlip (1).

Special tool
(A) : 09900-06107



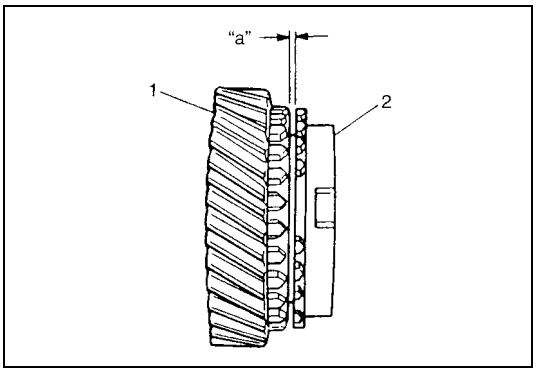
5) Drive out high speed synchronizer sleeve & hub assembly (2) together with 3rd gear (3) from input shaft (1) using puller (4) and press.

CAUTION:
Make sure to use flat side of puller to avoid causing damage to 3rd gear tooth.

6) Take out 3rd gear needle bearing from shaft.
7) Disassemble synchronizer sleeve & hub assembly.

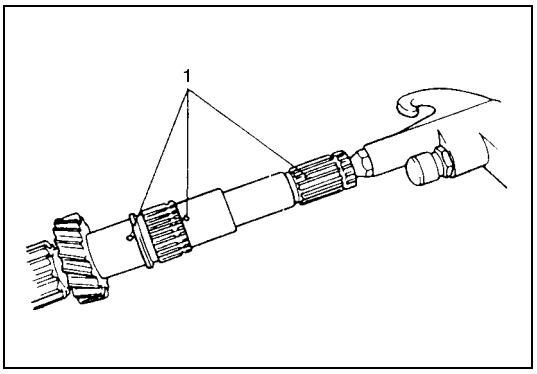
Assembly

1) Clean all components thoroughly, inspect them for any abnormality and replace with new ones as necessary.

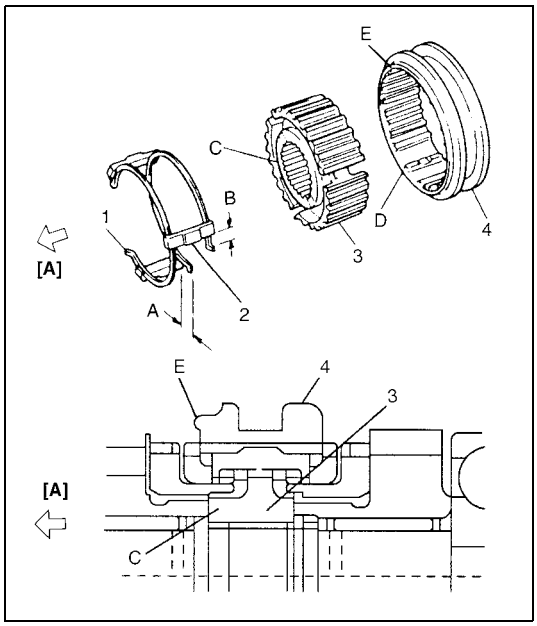


2) If synchronizer parts need to be repaired, check clearance "a" between ring (2) and gear (1), each chamfered tooth of gear, ring and sleeve, then determine parts replacement.

Clearance between synchronizer ring and gear
Standard "a" : 1.0 – 1.4 mm (0.039 – 0.055 in.)
Service limit "a" : 0.5 mm (0.019 in.)



3) To ensure lubrication, air blow oil holes (1) and make sure that they are free from any obstruction.



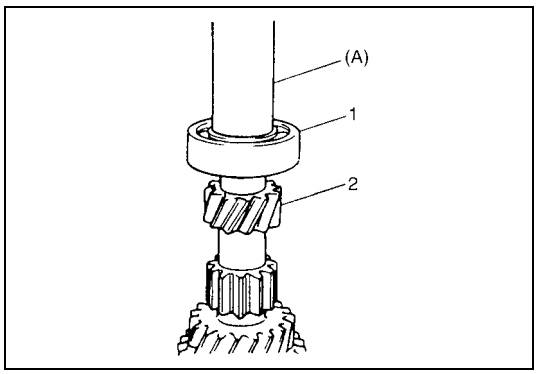
4) Fit high speed synchronizer sleeve (4) to hub (3), insert 3 keys (2) in it and then set springs (1) as shown in figure.

NOTE:

- **No specific direction is assigned to each key but it is assigned as sleeve & hub assembly.**
- **Size of high speed synchronizer sleeve, hub, keys and springs is between those of low speed and 5th speed ones.**

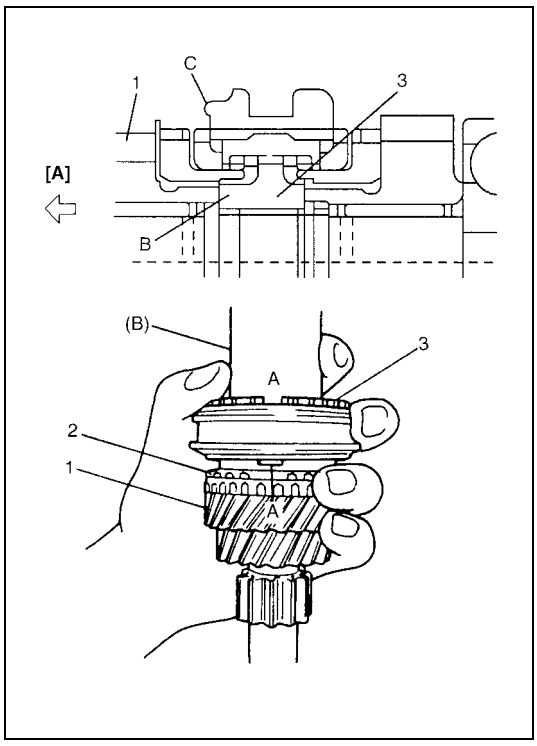
Synchronizer key installation position
: A = B

[A] :	3rd gear side
C :	Long flange
D :	Key way
E :	Projecting end



5) Drive in right bearing (1) to input shaft (2) using special tool and hammer.

Special tool
(A) : 09913-80112



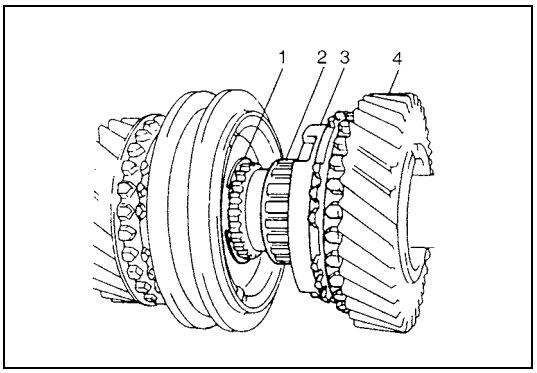
6) Install 3rd gear needle bearing of resin cage type, apply oil to it, then install 3rd gear (1) and synchronizer ring (2).
7) Drive in high speed sleeve & hub assembly (3) using special tool and hammer, facing long flange side of hub to 3rd gear.

NOTE:

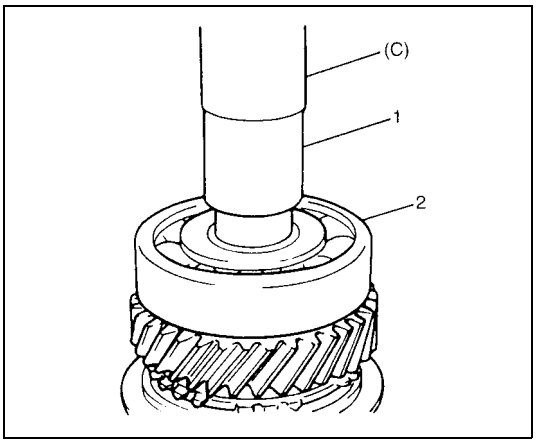
- **While press-fitting sleeve & hub, make sure that synchronizer ring key slots are aligned with keys in sleeve & hub assembly.**
- **Check free rotation of 3rd gear after press-fitting sleeve & hub assembly.**
- **Synchronizer rings for 3rd and 4th are identical.**

Special tool
(B) : 09913-84510

[A] :	3rd gear side
A :	Key way
B :	Long flange
C :	Projecting end



8) Install circlip (1) and confirm that circlip is installed in groove securely.
Install needle bearing (2) of steel cage type, apply oil to bearing and then install synchronizer ring (3) and 4th gear (4).



9) Press-fit left bearing (2) using special tool and hammer.

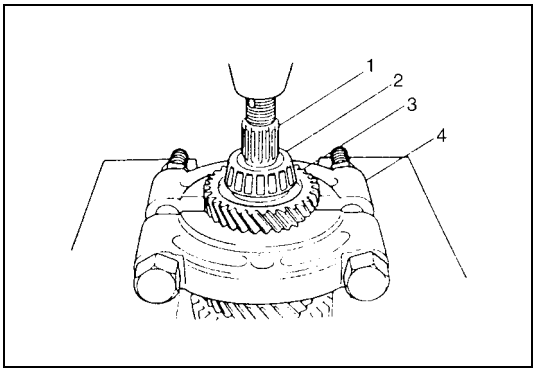
Special tool
(C) : 09925-98221

10) Using the same special tool at step 9), drive in 5th gear spacer (1).

CAUTION:
To prevent 5th gear spacer from being distorted because of excessive compression, do not press-fit it with left bearing at once.

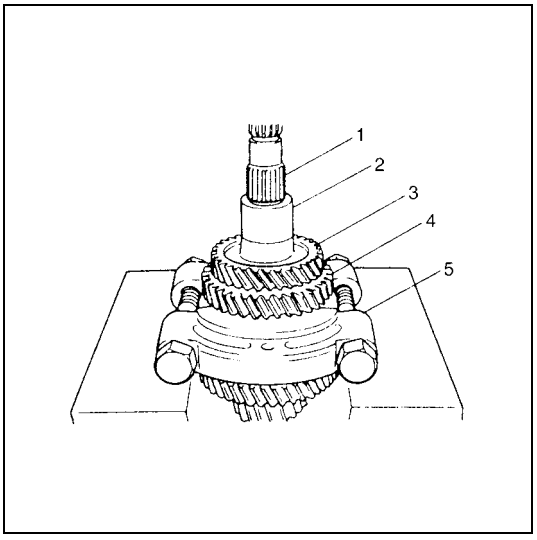
Counter Shaft Disassembly and Assembly

Disassembly



1) Drive out left bearing cone (2) with 4th gear (3) from counter shaft (1) using puller (4) and press.

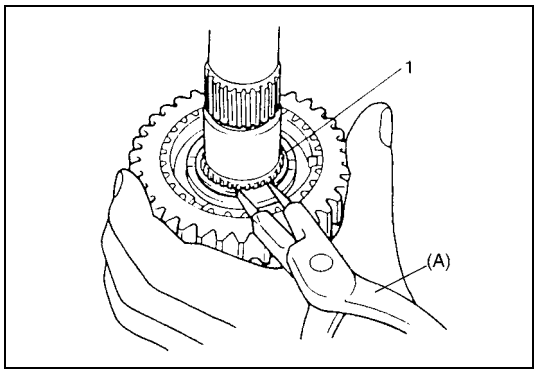
CAUTION:
- **Use puller and press that will bear at least 5 ton (11,000 lb) safely.**
- **To avoid tooth damage, support 4th gear at flat side of puller.**



2) Apply puller (5) to 2nd gear (4) and drive out 3rd & 4th gear spacer (2) and 3rd gear (3) together with 2nd gear (4) from counter shaft (1) using press. Take out needle bearing of separated steel cage type from counter shaft.

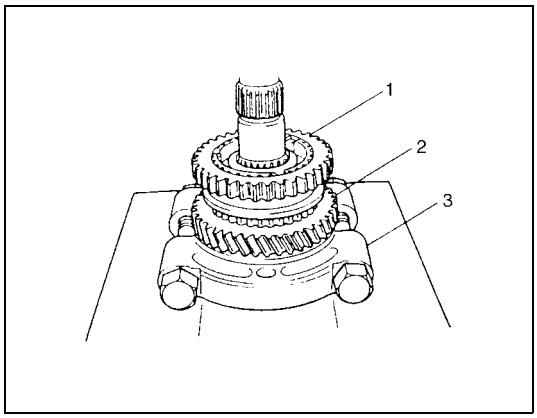
CAUTION:
- **If compression exceeds 5 ton (11,000 lb), release compression once, reset puller support and then continue press work again.**
- **To avoid gear tooth from being damaged, support it at flat side of bearing puller.**

3) Take out 2nd synchronizer outer ring, center cone and inner ring.



4) Using special tool, remove circlip (1).

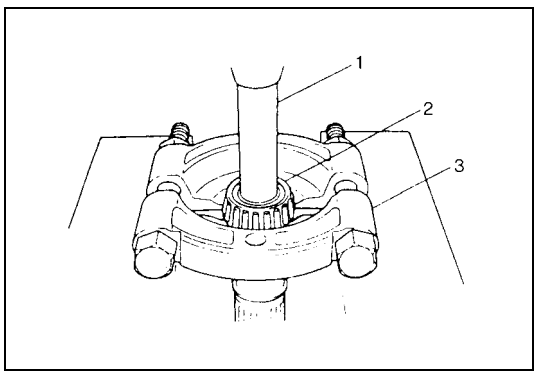
Special tool
(A) : 09900-06107



5) Apply puller (3) to 1st gear (2) and drive out low speed synchronizer sleeve & hub assembly (1) with 1st gear (1) using press.

CAUTION:
To avoid gear tooth from being damaged, support it at flat side of bearing puller.

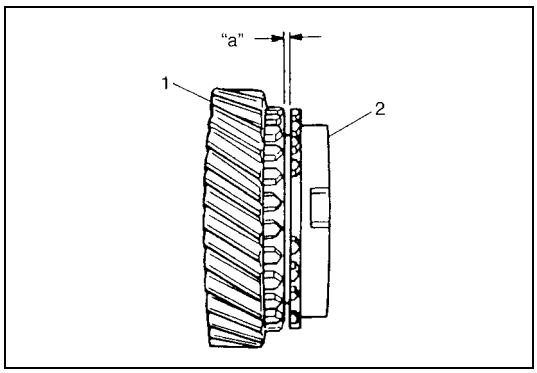
6) Disassemble synchronizer sleeve & hub assembly.
7) Take out 1st gear needle bearing of resin cage type from shaft.



8) Remove right bearing cone (2) using puller (3), metal stick (1) and press.

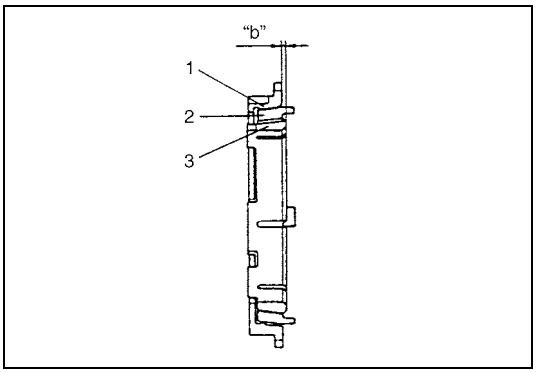
Assembly

1) Clean all components thoroughly, inspect them for any abnormality and replace with new ones as necessary.



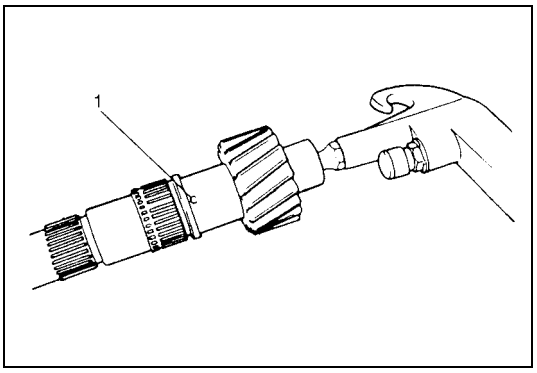
2) If synchronizer parts need to be repaired, check clearance "a" between ring (2) and gear (1), each chamfered tooth of gear, ring and sleeve, then determine parts replacement.

Clearance between synchronizer ring and gear
Standard "a" : 1.0 – 1.4 mm (0.039 – 0.055 in.)
Service limit "a" : 0.5 mm (0.019 in.)

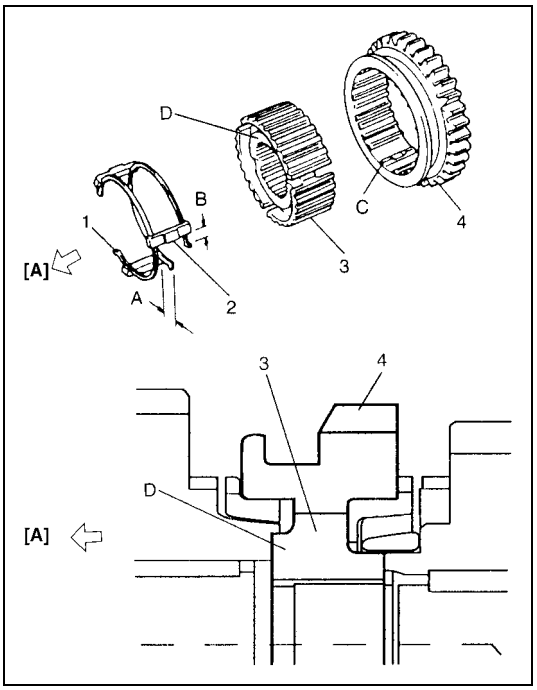


3) Put the synchronizer outer ring (1), inner ring (3) and the cone (2) together and then measure the step difference between the outer ring and the inner ring. And also check each chamfered tooth of gear and synchronizer ring and replace with new one, if necessary. Also, check gear tooth.

Difference between synchronizer outer ring and inner ring
Standard "b" : 1.0 – 1.4 mm (0.039 – 0.055 in.)
Service limit "b" : 0.5 mm (0.019 in.)



4) To ensure lubrication, air blow oil holes (1) and make sure that they are free from any obstruction.



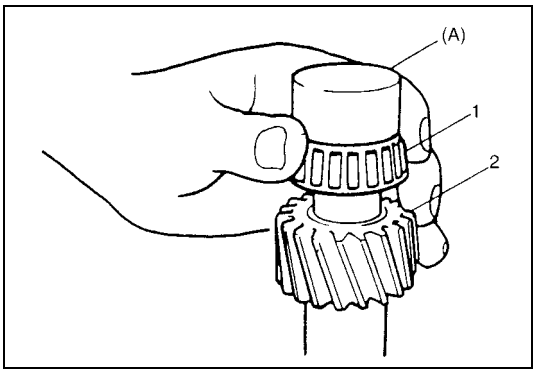
5) Fit low speed synchronizer sleeve (4) to hub (3), insert 3 keys (2) in it and then set springs (1) as shown in figure.

NOTE:

- **No specific direction is assigned to each key but it is assigned as sleeve & hub assembly.**
- **Size of low speed synchronizer keys and springs are the largest compared with those of high speed and 5th speed ones.**

Synchronizer key installation position
: A = B

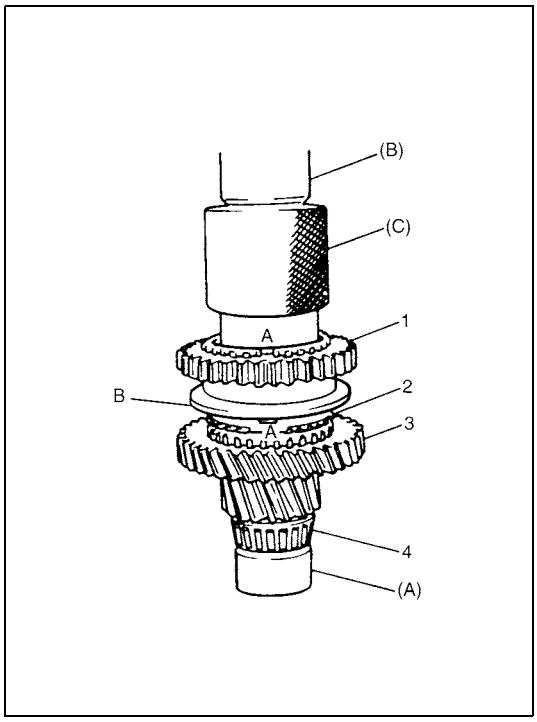
[A] :	1st gear side
C :	Key way
D :	Short flange



6) Install right bearing cone (1) to counter shaft (2) using special tool and hammer.

Special tool
(A) : 09923-78210

7) Install needle bearing of resin cage type, apply oil to it, then install 1st gear and 1st gear synchronizer ring.



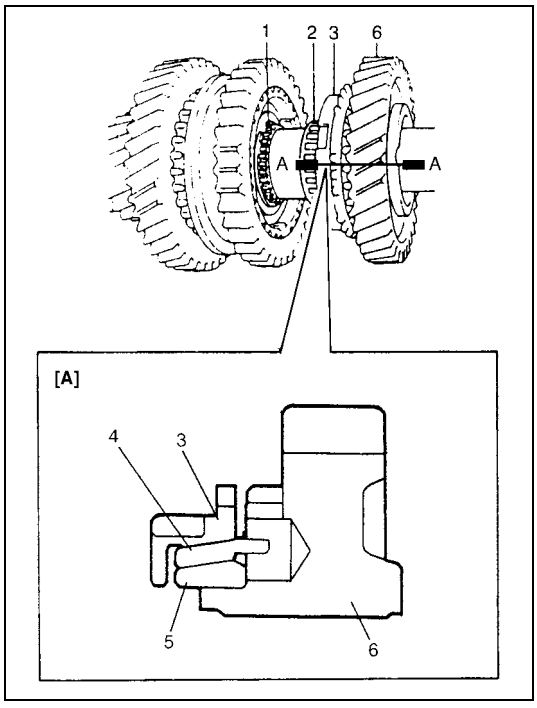
8) Drive in low speed sleeve & hub assembly (1) using special tools and hammer, facing “B” side of sleeve to 1st gear.

NOTE:

- **Support shaft with special tool as shown in figure so that retainer of bearing cone (4) will be free from compression.**
- **Make sure that synchronizer ring (2) key slots are aligned with keys while press-fitting sleeve & hub assembly.**
- **Check free rotation of 1st gear (3) after press-fitting sleeve & hub assembly.**

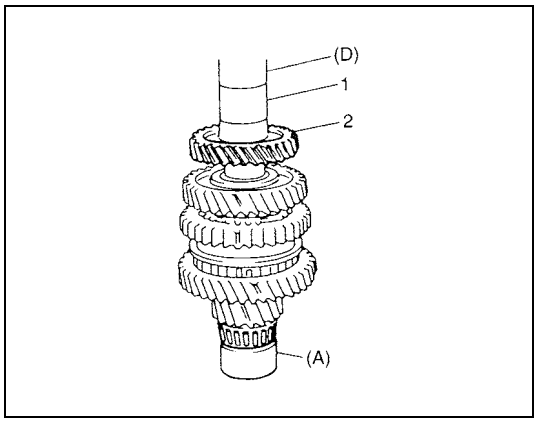
Special tool
(A) : 09923-78210
(B) : 09925-18011
(C) : 09940-53111

A : Align key slots with keys



9) Install circlip (1) and confirm that circlip is installed in groove securely.
Install needle bearing (2) of separated steel cage type, apply oil to bearing.
With synchronizer outer ring (3), center cone (4) & inner ring (5) put together and installed to 2nd gear (6) as shown in figure.

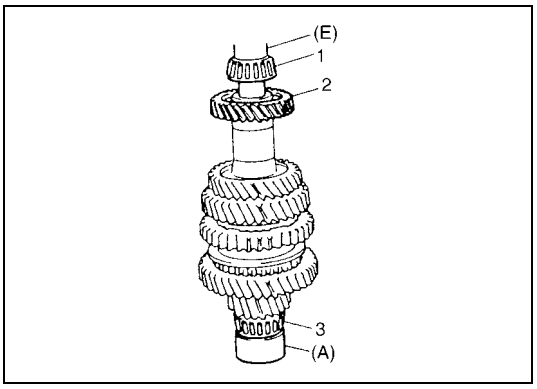
[A] : SECTION A - A



10) Press-fit 3rd gear (2) and spacer (1) using special tools and press.

CAUTION:
Press-fit 3rd gear (2) and spacer (1) first, and then 4th gear later separately so that counter shaft will not be compressed excessively.

Special tool
(A) : 09923-78210
(D) : 09913-80112



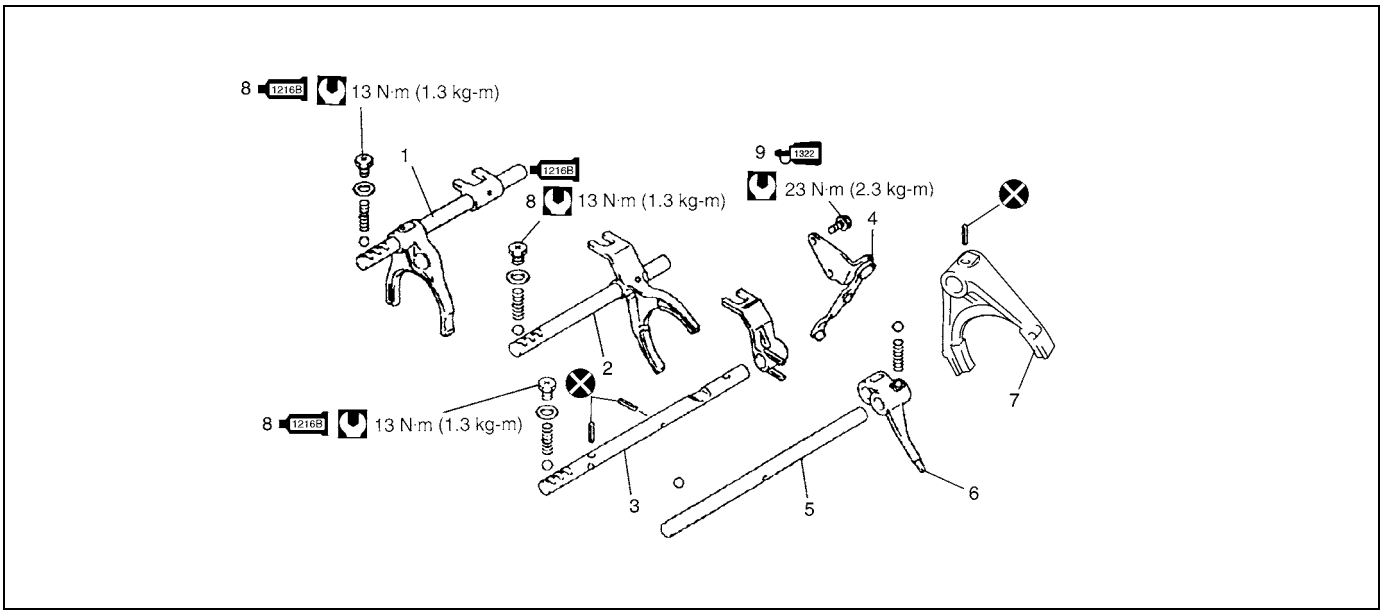
11) Press-fit 4th gear (2) using the same procedure as step 10).
12) Install left bearing cone (1) using special tools and hammer.

NOTE:

For protection of right bearing cone (3), always support shaft with special tool as illustrated.

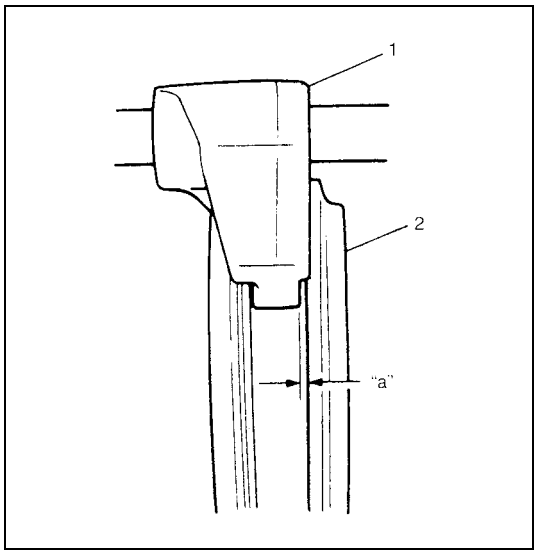
Special tool
(A) : 09923-78210
(E) : 09925-98221

Gear Shift Shaft Components



1. Low speed gear shift shaft	5. 5th & reverse gear shift guide shaft	1322 9. Reverse gear shift lever bolt :Apply thread lock 99000-32110 to all around thread part to bolt.
2. High speed gear shift shaft	6. Reverse gear shift arm	Tightening torque
3. 5th & reverse gear shift shaft	7. 5th gear shift fork	Do not reuse.
4. Reverse gear shift lever	1216B 8. Gear shift locating bolt	Apply transaxle oil.

High Speed and Low Speed Gear Shift Shafts Inspection



1) Using feeler gauge, check clearance between fork (1) and sleeve (2) and replace those parts if it exceeds limit below.

NOTE:

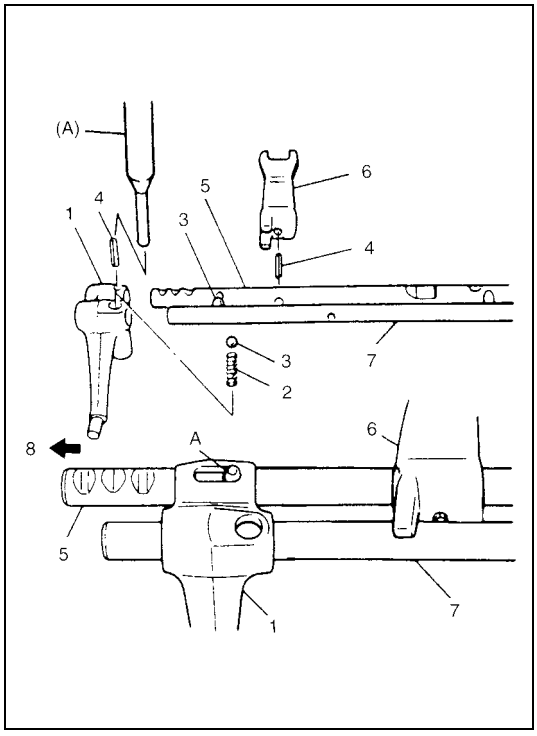
For correct judgement of parts replacement, carefully inspect contact portion of fork and sleeve.

Clearance between fork and sleeve
Service limit "a" : 1.0 mm (0.039 in.)

2) Insert each gear shift shaft into case and check that it moves smoothly. If it doesn't, correct using oilstone, reamer or the like.

5th & Reverse Gear Shift Shafts Disassembly and Assembly

Disassembly



Disassemble component parts using special tool and hammer.

Special tool
(A) : 09922-85811

Assembly

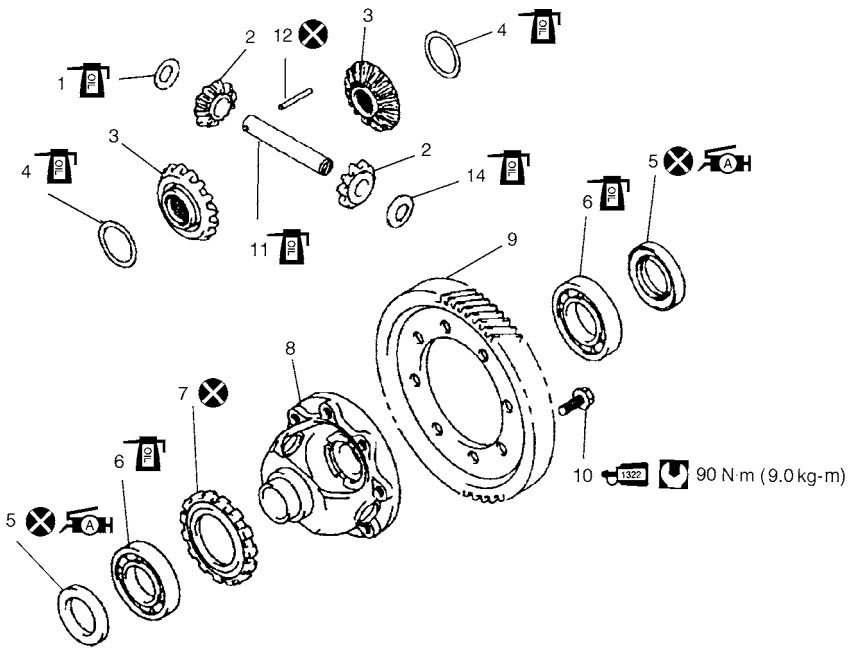
Replace or correct parts as required and assemble shafts making sure that component parts are in proper order as shown in figure.

NOTE:

- **Distinguish reverse gear shift arm spring (Blue) (2) from low speed locating spring (Yellow).**
- **Install 2 steel balls (3) in reverse gear shift arm (1) without fail.**
- **Drive in spring pin for reverse gear shift arm (1) facing slit A toward front.**

4. Spring pin	7. 5th & reverse gear shift guide shaft
5. 5th & reverse gear shift shaft	8. 5th gear side
6. 5th & reverse gear shift yoke	A: Face pin slit toward 5thn gear side

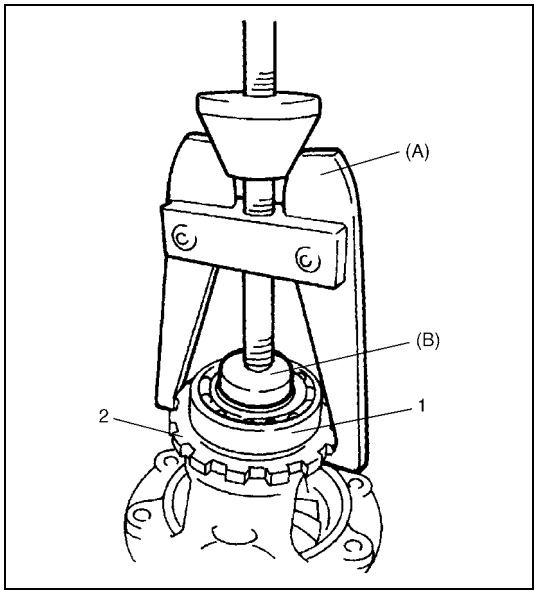
Differential Components



	1. Differential pinion washer		9. Final gear
	2. Differential side pinion gear	1322	10. Final gear bolt : Apply thread lock 99000-32110 to all around thread part of bolt
	3. Differential side gear		11. Differential pinion shaft
	4. Side gear washer		12. Differential pinion shaft pin
	5. Differential side oil seal : Apply grease 99000-25010 to oil seal lip.		Tightening torque
	6. Differential side bearing		Do not reuse.
	7. Speed sensor ring		Apply transaxle oil.
	8. Differential case		

Differential Disassembly and Assembly

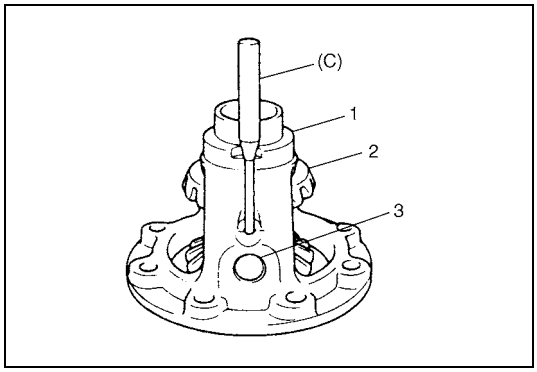
Disassembly



1) Using special tools, remove right bearing (1) and sensor rotor (2).

Special tool
(A) : 09913-60910
(B) : 09925-88210

2) Remove left bearing in the same manner at step 1).
3) Support differential case with soft jawed vise and remove final gear bolts then take out final gear.

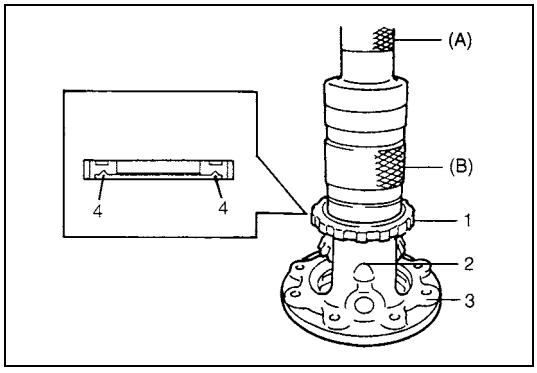


4) Using special tool and hammer, drive out differential pinion shaft pin and then disassemble component parts.

Special tool
(C) : 09922-85811

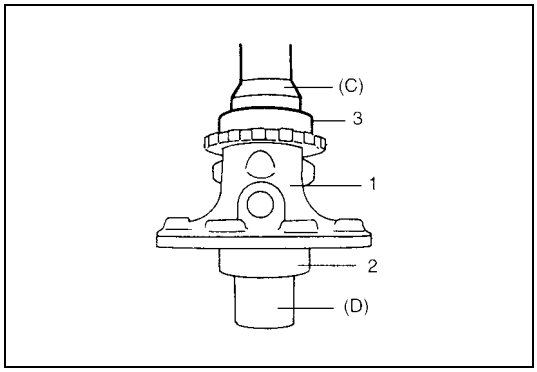
1.	Differential case
2.	Differential gear
3.	Differential pinion shaft

Assembly



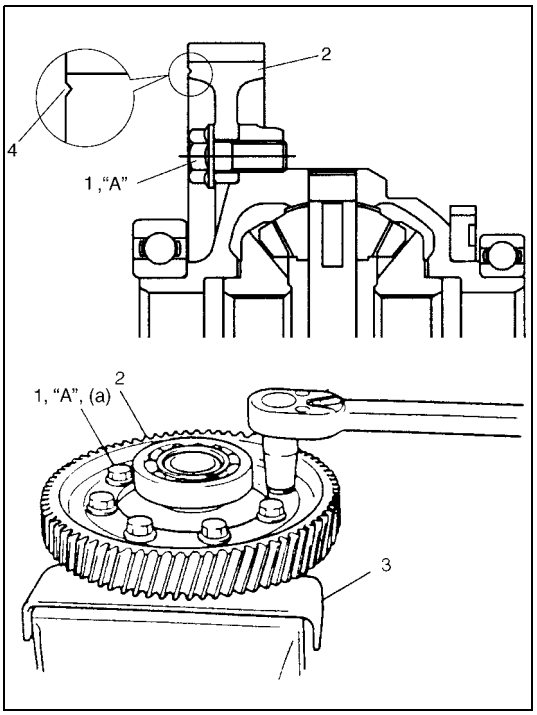
1) Drive in new differential pinion shaft pin (2) till the depth from differential case (3) surface is about 1 mm (0.04 in.).
2) Press-fit new sensor rotor (1) with groove (4) side downward as shown using special tools and copper hammer.

Special tool
(A) : 09913-75510
(B) : 09940-54910



3) Press-fit left bearing (2) using special tools and copper hammer.
4) Support differential assembly (1) as illustrated so as to left bearing (2) is floating, and then press-fit right bearing (3) like left bearing in Step 3).

Special tool
(C) : 09951-76010
(D) : 09951-16060



5) Hold differential assembly with soft jawed vise (3), install final gear (2) as shown in figure and then tighten bolts (1) with thread lock cement applied to specified torque.

NOTE:

Make sure to install final gear in correct installing direction.

CAUTION:

Use of any other bolts than specified ones is prohibited.

"A" : Thread lock cement 99000-32110

Tightening torque
Final gear bolts (a) : 90 N·m (9.0 kg-m, 65.0 lb-ft)

4. Groove

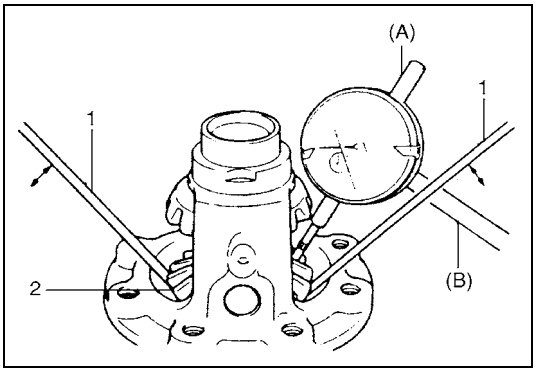
Differential Adjustment

Judging from abnormality noted before disassembly and what is found through visual check of component parts after disassembly, prepare replacing parts and proceed to reassembly. Make sure that all parts are clean.

1) Assemble differential gear and measure thrust play of differential gear as follows.

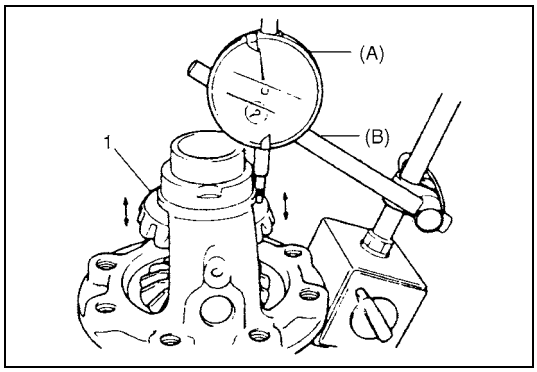
Differential gear thrust play
: 0.03 – 0.31 mm (0.001 – 0.012 in.)

- For left side



a) Hold differential assembly with soft jawed vise and apply measuring tip of dial gauge to top surface of gear.
b) Using 2 screwdrivers (1), move gear (2) up and down and read movement of dial gauge pointer.

Special tool
(A) : 09900-20606
(B) : 09900-20701



• For right side

a) Using similar procedure to the above, set dial gauge tip to gear (1) shoulder.
b) Move gear up and down by hand and read dial gauge.

Special tool
(A) : 09900-20606
(B) : 09900-20701

2) If thrust play is out of specification, select suitable thrust washer from among the following available size, install it and check again that specified gear play is obtained.

Available thrust washer thickness
0.9, 0.95, 1.0, 1.05, 1.1, 1.15 and 1.2 mm
(0.035, 0.037, 0.039, 0.041, 0.043, 0.045, and 0.047 in.)

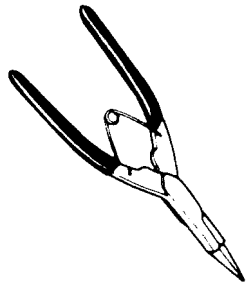
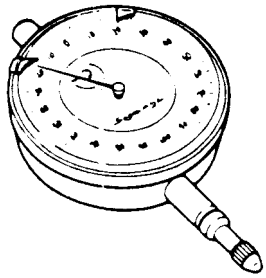
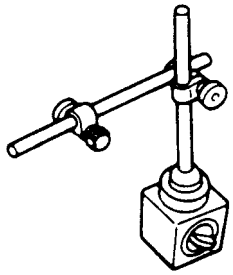
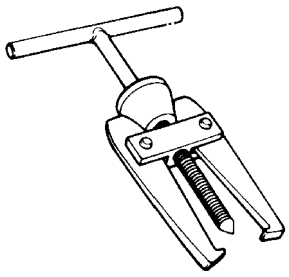
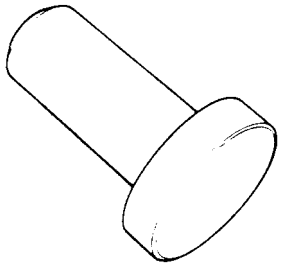
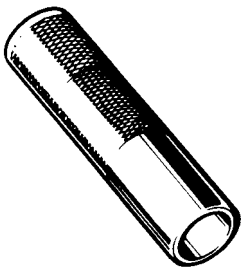
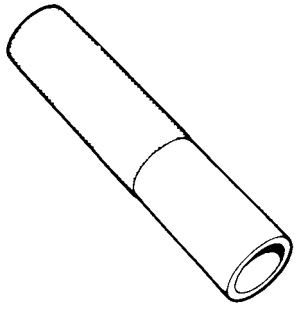
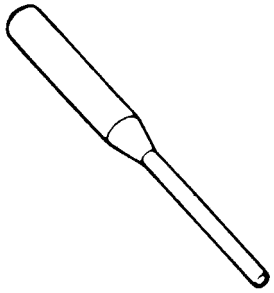
Tightening Torque Specification

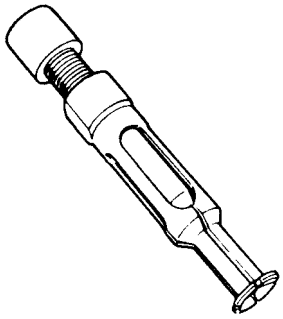
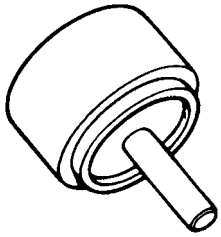
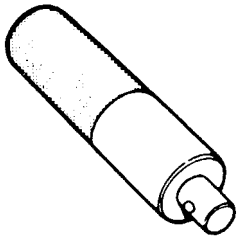
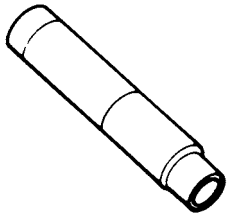
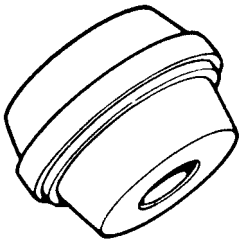
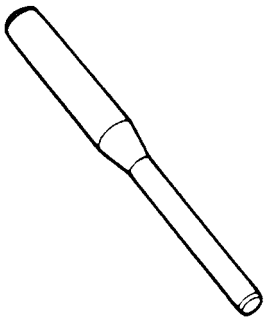
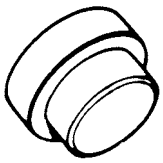
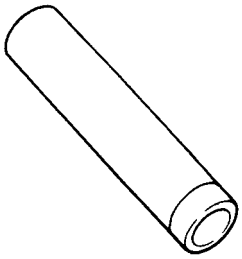
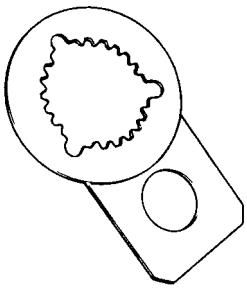
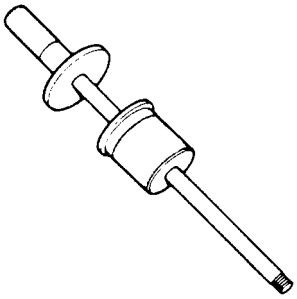
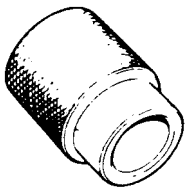
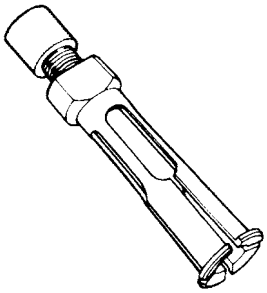
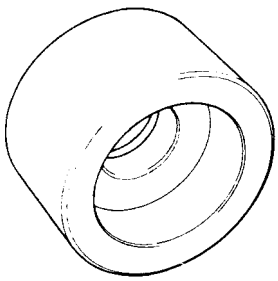
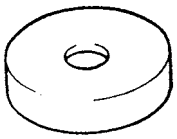
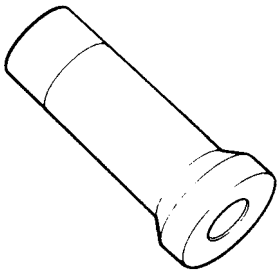
Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Transaxle oil level/filler and drain plugs	21	2.1	15.5
Oil gutter bolt	10	1.0	7.5
Final gear bolts	90	9.0	65.0
Reverse gear shift lever bolts	23	2.3	17.0
Transaxle case bolts	19	1.9	14.0
Reverse shaft bolt	23	2.3	17.0
Gear shift locating bolt	13	1.3	9.5
Left case plate screw and bolts	10	1.0	7.5
Countershaft nut	70	7.0	51.0
Side cover No.1 bolts	10	1.0	7.5
Side cover No.2 bolts	23	2.3	17.0
Gear shift guide case No.1 bolts	23	2.3	17.0
Gear shift guide case No.2 bolt	23	2.3	17.0
Gear shift interlock bolt	23	2.3	17.0
5th to reverse interlock guide bolt	23	2.3	17.0
Back up lamp switch	23	2.3	17.0
Gear shift control lever assembly mounting nut	13	1.3	9.5
Cable lock nut	5.5	0.55	4.0
Cable mounting bolt	5.5	0.55	4.0
Cable bracket bolt	50	5.0	37.5
Transaxle to engine bolts	85	8.5	63.5
Engine left mounting bracket bolts	55	5.5	42.0
Stiffener bolts	55	5.5	42.0
Engine rear mounting bolt	75	7.5	57.0
Engine rear mounting No.2 bracket bolts	55	5.5	42.0
Transaxle to engine rear mounting No.2 bracket bolt	55	5.5	42.0
Transaxle to engine nut	85	8.5	64.0
Clutch housing lower plate bolt	55	5.5	42.0
VSS bolt	5.5	0.55	4.0
Select lever bracket bolt	23	2.3	17.5

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Oil seal lips • O-rings • Select lever boss • Select lever shaft bush
Sealant	SUZUKI BOND NO.1215 (99000-31110)	• Oil drain plug and filler/level plug • Locating spring bolts • Mating surface of transaxle case • Mating surface of side cover • Gear shift interlock bolt • 5th to reverse interlock guide bolt • Guide case bolts
Thread lock cement	THREAD LOCK 1322 (99000-32110)	• Reverse gear shift lever bolts • Oil gutter bolt • Reverse shaft bolt • Final gear bolts

Special Tool

 09900-06107 Snap ring pliers (Opening type)	 09900-20606 Dial gauge	 09900-20701 Magnetic stand	 09913-60910 Bearing puller
 09913-75510 Bearing installer	 09913-80112 Bearing installer	 09913-84510 Bearing installer	 09922-85811 Spring pin remover 4.5 mm (0.18 in.)

 09923-74510 Bearing remover	 09923-78210 Bearing installer	 09924-74510 Installer attachment	 09925-18011 Bearing installer
 09925-68210 Bearing outer race installer	 09925-78210 Spring pin remover 6 mm (0.24 in.)	 09925-88210 Bearing puller attachment	 09925-98221 Bearing installer
 09927-76010 Gear holder	 09930-30104 Sliding shaft	 09940-53111 Bearing installer	 09940-54910 Sensor rotor installer
 09941-64511 Bearing remover	 09951-16060 Bush remover	 09951-46010 Bearing installer	 09951-76010 Bearing installer

SECTION 7C1

CLUTCH

WARNING:

For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

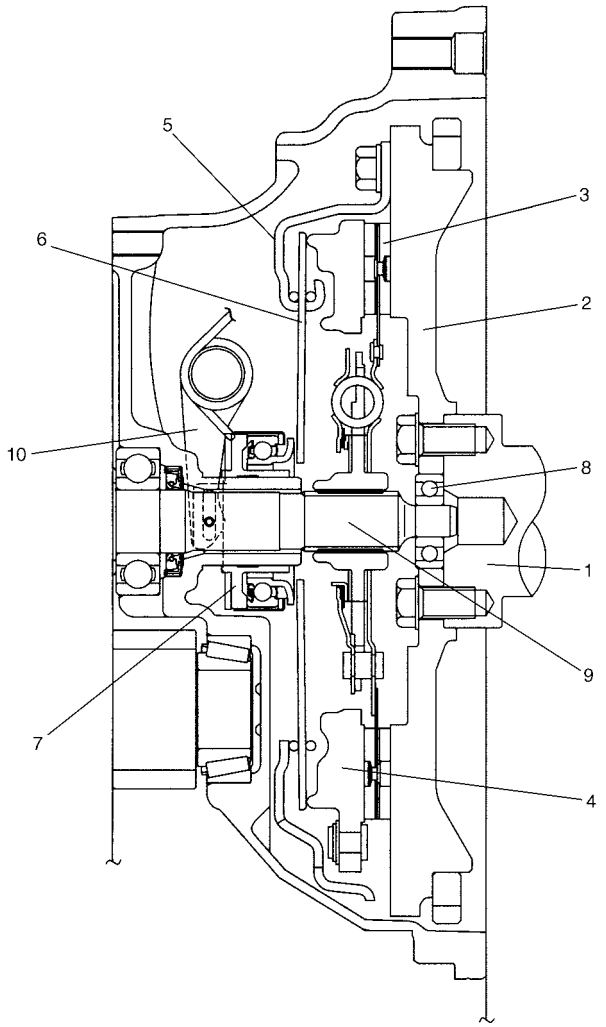
CONTENTS

General Description

The clutch is a diaphragm-spring clutch of a dry single disc type. The diaphragm spring is of a tapering-finger type, which is a solid ring in the outer diameter part, with a series of tapered fingers pointing inward.

The disc, carrying four torsional coil springs, is positioned on the transmission input shaft with an involute spline fit.

The clutch cover is secured to the flywheel, and carries the diaphragm spring in such a way that the peripheral edge part of the spring pushes on the pressure plate against the flywheel (with the disc in between), when the clutch release bearing is held back. This is the engaged condition of the clutch.
Depressing the clutch pedal causes the release bearing to advance and pushes on the tips of the tapered fingers of the diaphragm spring. When this happens, the diaphragm spring pulls the pressure plate away from the flywheel, thereby interrupting the flow of drive from flywheel through clutch disc to transmission input shaft.



1. Crankshaft	6. Diaphragm spring
2. Flywheel	7. Release bearing
3. Clutch disc	8. Input shaft bearing
4. Pressure plate	9. Input shaft
5. Clutch cover	10. Release shaft

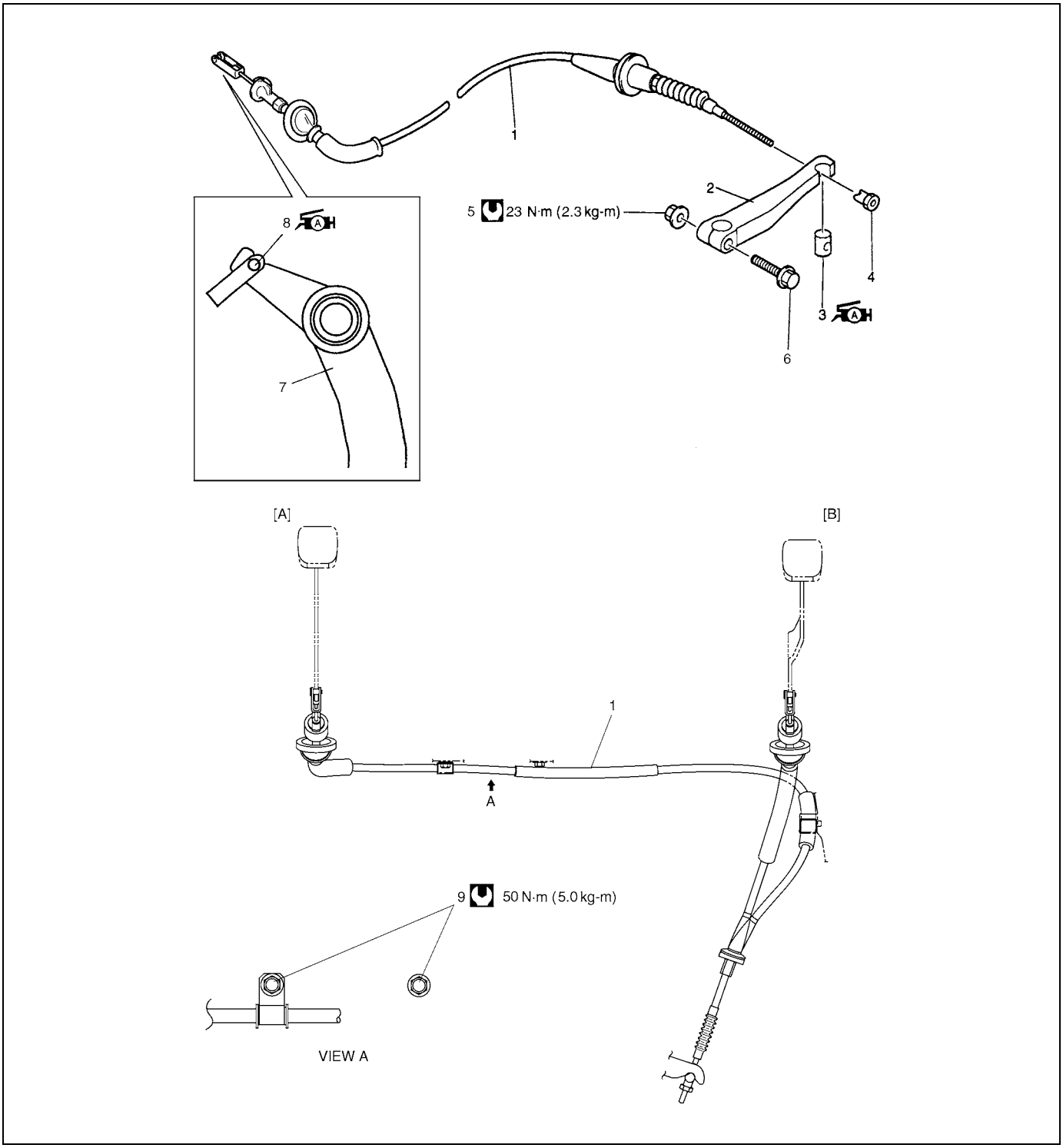
Diagnosis

Diagnosis Table

Condition	Possible Cause	Correction
Slipping	Improper clutch pedal free travel	Adjust free travel.
	Worn or oily clutch disc facing	Replace disc.
	Warped disc, pressure plate or flywheel surface	Replace disc, clutch cover or flywheel.
	Weakened diaphragm spring	Replace clutch cover.
	Rusted clutch cable	Replace cable.
Dragging clutch	Improper clutch pedal free travel	Adjust free travel.
	Weakened diaphragm spring, or worn spring tip	Replace clutch cover.
	Rusted input shaft splines	Lubricate.
	Damaged or worn splines of transmission input shaft	Replace input shaft.
	Excessively wobbly clutch disc	Replace disc.
	Clutch facings broken or dirty with oil	Replace disc.
Clutch vibration	Glazed (glass-like) clutch facings	Repair or replace disc.
	Clutch facings dirty with oil	Replace disc.
	Release bearing slides unsmoothly on input shaft bearing retainer	Lubricate or replace input shaft bearing retainer.
	Wobbly clutch disc, or poor facing contact	Replace disc.
	Weakened torsion springs in clutch disc	Replace disc.
	Clutch disc rivets loose	Replace disc.
	Distorted pressure plate or flywheel surface	Replace clutch cover or flywheel.
	Weakened engine mounting or loosened engine mounting bolt or nut	Retighten or replace mounting.
Noisy clutch	Worn or broken release bearing	Replace release bearing.
	Input shaft front bearing worn down	Replace input shaft bearing.
	Excessive rattle of clutch disc hub	Replace disc.
	Cracked clutch disc	Replace disc.
	Pressure plate and diaphragm spring rattling	Replace clutch cover.
Grabbing clutch	Clutch disc facings soaked with oil	Replace disc.
	Clutch disc facings excessively worn	Replace disc.
	Rivet heads showing out of facing	Replace disc.
	Weakened torsion springs	Replace disc.

On-Vehicle Service

Clutch Cable Components

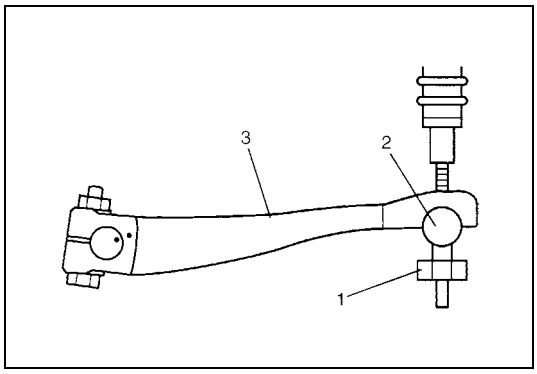


	[A]: For RH vehicle		5. Clutch release lever nut
	[B]: For LH vehicle		6. Clutch release lever bolt
	1. Clutch cable		7. Clutch pedal
A	2. Clutch release lever	A	8. Clutch cable hook : Apply grease 99000-25010 to cable hook.
	3. Clutch cable joint pin : Apply grease 99000-25010 to joint pin.		9. Clutch cable clamp bolt
	4. Clutch cable joint nut		Tightening torque

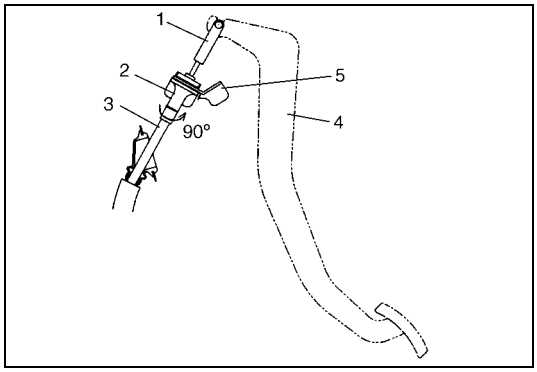
Clutch Cable Removal and Installation

Removal

1) Disconnect negative cable at battery.

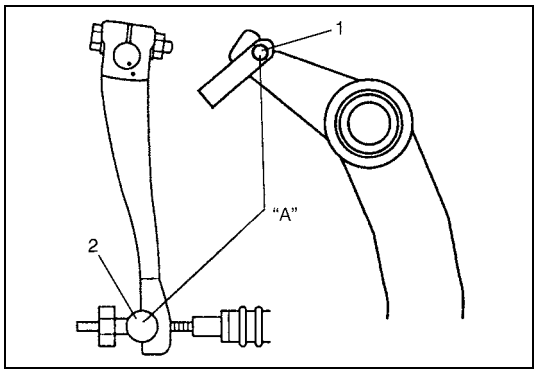


2) Remove clutch cable joint nut (1).
3) Remove joint pin (2) from clutch release lever (3).



4) Disconnect cable hook (1) from clutch pedal (4).
5) Remove clutch cable (3) from bracket (5) by turning cable cap (2) about 90° as shown.

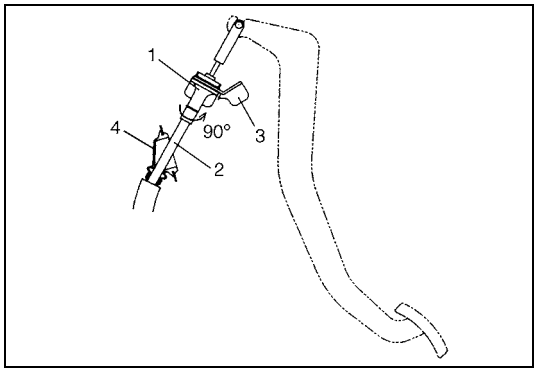
Installation



1) Apply grease to cable end hook (1) and also joint pin (2) before installing cable.

"A" : Grease 99000-25010

2) Hook cable end with pedal using screwdriver or long nose pliers from cabin inside, then join inner cable wire joint pin in release lever.



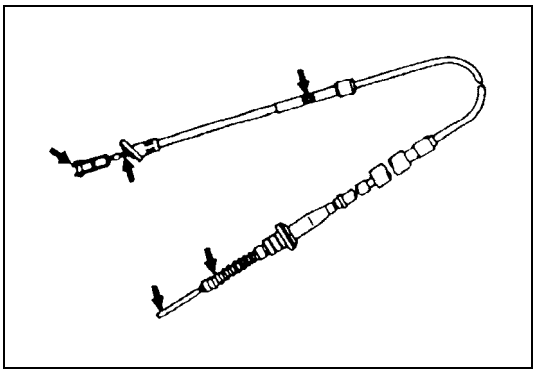
3) Install clutch cable (2) to bracket (3) by turning cable cap (1) about 90° as shown.
4) Screw in joint nut and adjust clutch pedal free travel referring to "Clutch pedal free travel" in this section.

NOTE:

Take care that cable grommet (4) has specific installing direction as shown in the figure.

5) Check clutch for proper function with engine running.

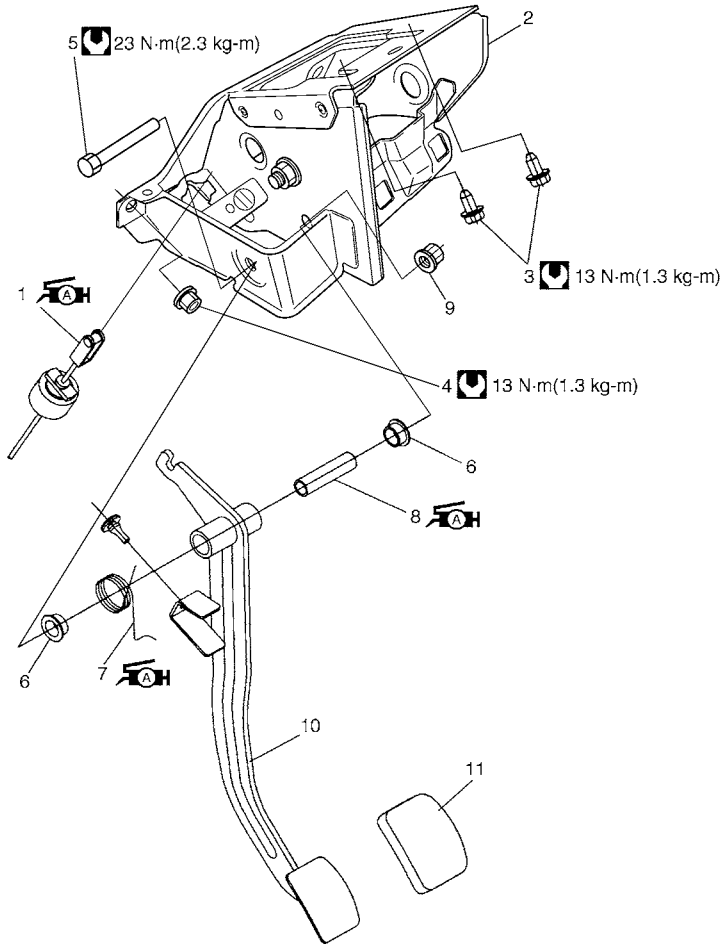
Clutch Cable Inspection



Inspect clutch cable and replace it for any of the following conditions.

- Excessive cable friction
- Frayed cable
- Bent or kinked cable
- Broken boots
- Worn end

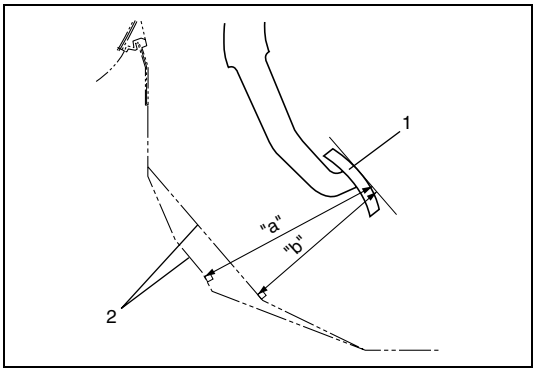
Clutch Pedal and Clutch Pedal Bracket Components



A	1. Clutch cable hook : Apply grease 99000-25010 to cable hook.	A	7. Pedal spring : Apply grease 99000-25010 to inside surface of spring.
	2. Clutch pedal bracket	A	8. Pedal shaft spacer : Apply grease 99000-25010 to outside surface of spacer.
	3. Pedal bracket bolt : Pedal bracket bolt must be tighten after pedal bracket nut.		9. Pedal shaft nut
	4. Pedal bracket nut		10. Clutch pedal
	5. Pedal shaft		11. Pedal pad
	6. Pedal bush		Tightening torque

Clutch Pedal Inspection

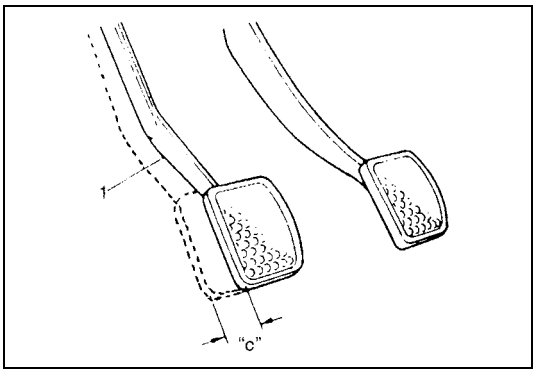
Clutch pedal height



Measure clutch pedal height (1), distance between dash panel silencer (2) and clutch pedal (1).

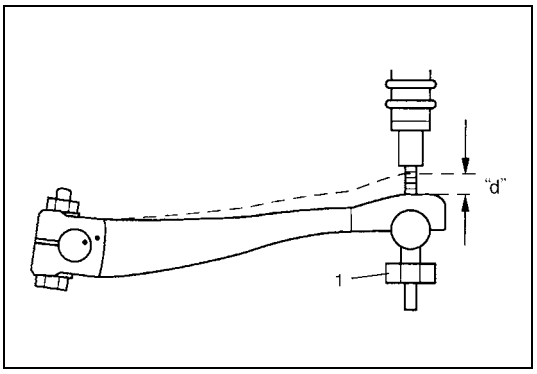
Reference height
"a" : 195 – 205 mm (7.80 – 8.20 in.) for RH vehicle
"b" : 163 – 173 mm (6.52 – 6.92 in.) for LH vehicle

Clutch pedal free travel



1) Depress clutch pedal (1), stop the moment clutch resistance is felt, and measure distance (clutch pedal free travel). Free travel should be within the following specification.

Pedal free travel
"c" : 15 – 20 mm (0.6 – 0.8 in.)



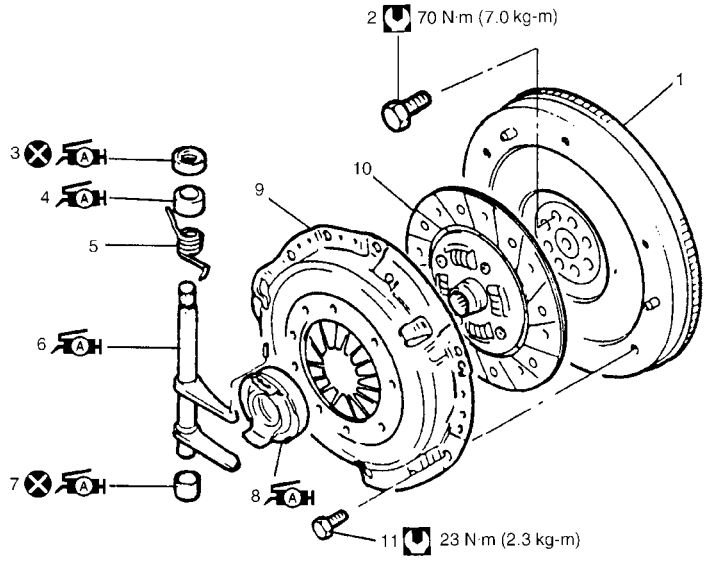
2) If free travel is out of specification, adjust it with cable joint nut (1).

Release lever free travel (Reference)
"d" : 0 – 2 mm (0 – 0.08 in.)

3) After checking clutch pedal free travel, also check clutch for proper function with engine running.

Unit Repair Overhaul

Clutch Cover, Clutch Disc and Flywheel Components



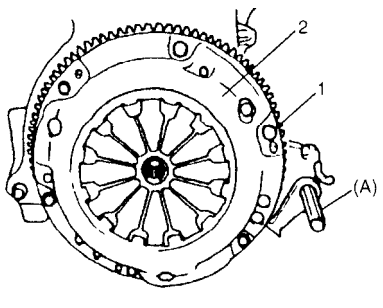
	1. Flywheel		8. Release bearing : Apply grease 99000-25010 to joint of bearing and release shaft and also bearing inside. (0.3 g (0.01 oz))
	2. Flywheel bolt		9. Clutch cover
	3. Clutch release shaft seal : Apply grease 99000-25010 to seal lip. (0.3 g (0.01 oz))		10. Clutch disc
	4. Clutch release shaft No.2 bush : Apply grease 99000-25010 to bush inside. (0.3 g (0.01 oz))		11. Clutch cover bolt
	5. Return spring		Tightening torque
	6. Clutch release shaft Apply grease 99000-25010 to the end of release shaft arm. (0.3 g (0.01 oz))		Do not reuse.
	7. Clutch release shaft No.1 bush : Apply grease 99000-25010 to bush inside. (0.3 g (0.01 oz))		

Clutch Cover, Clutch Disc and Flywheel Removal and Installation

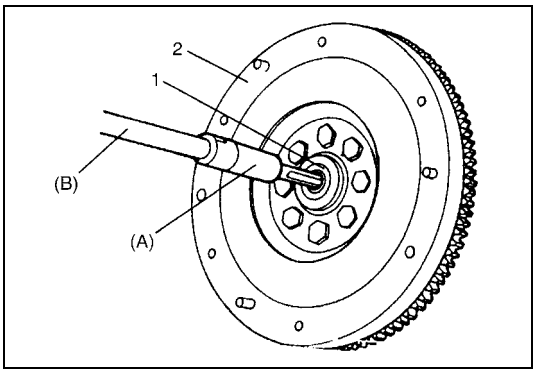
Removal

1) Dismount transaxle assembly referring to “Transaxle Unit Dismounting and Remounting” in Section 7A1.

2) Hold flywheel transaxle with special tool (A) and remove clutch cover bolts (1), clutch cover (2) and clutch disc.



Special tool
(A) : 09924-17810



3) Pull out input shaft bearing (1) from using the following special tools.

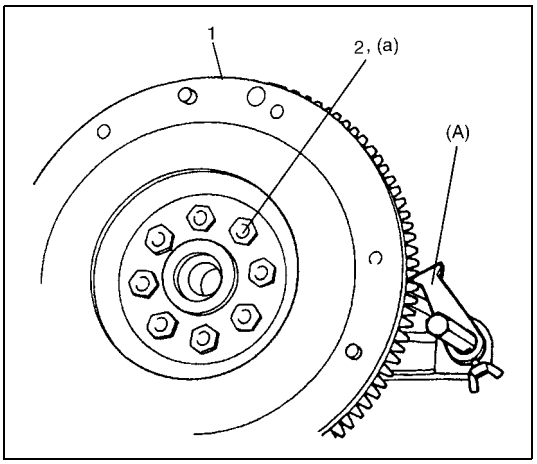
Special tool
(A) : 09921-26020
(B) : 09930-30104

2. Flywheel

Installation

NOTE:

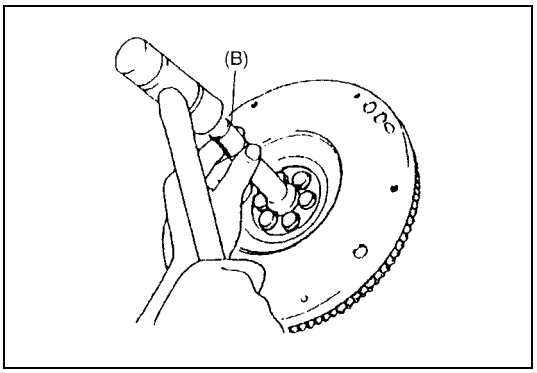
Before assembling, make sure that flywheel surface and pressure plate surface have been cleaned and dried thoroughly.



1) Install flywheel (1) to crankshaft and tighten bolts (2) to specified torque.

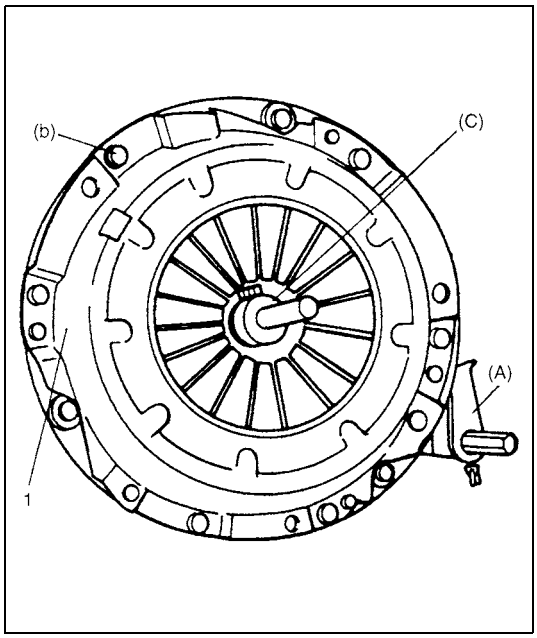
Special tool
(A) : 09924-17810

Tightening torque
Flywheel bolts (a) : 70 N·m (7.0 kg-m, 50.5 lb-ft)



2) Using special tool, install input shaft bearing to flywheel.

Special tool
(B) : 09925-98210



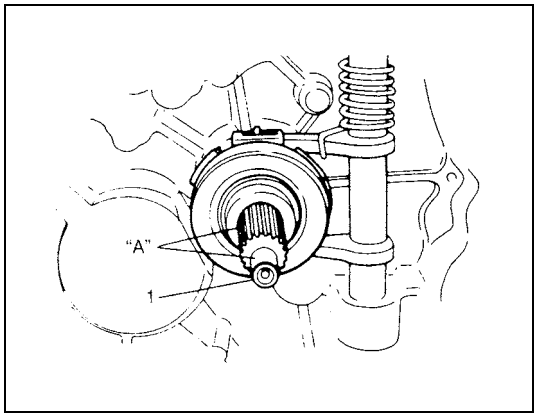
3) Aligning clutch disc to flywheel center using special tool, install clutch cover (1) and bolts. Then tighten bolts to specification.

NOTE:

- **While tightening clutch cover bolts, compress clutch disc with special tool (C) by hand so that disc centered.**
- **Tighten cover bolts little by little evenly in diagonal order.**

Special tool
(A) : 09924-17810
(C) : 09923-36320

Tightening torque
Clutch cover bolts (b) : 23 N·m (2.3 kg-m, 16.5 lb-ft)



4) Slightly apply grease to input shaft (1), then join transaxle assembly with engine referring to "Transaxle Unit Dismounting and Remounting" in Section 7A1.

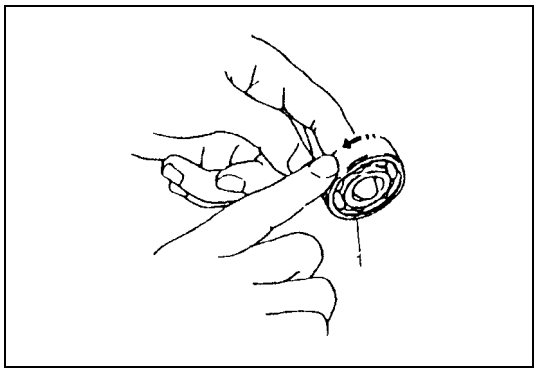
"A" : Grease, 99000-25210

NOTE:

When inserting transaxle input shaft to clutch disc, turn crankshaft little by little to match splines.

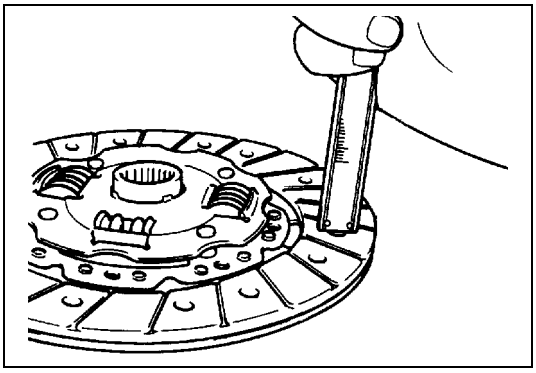
Clutch Cover, Clutch Disc and Flywheel Inspection.

Input shaft bearing



Check bearing (1) for smooth rotation and replace it if abnormality is found.

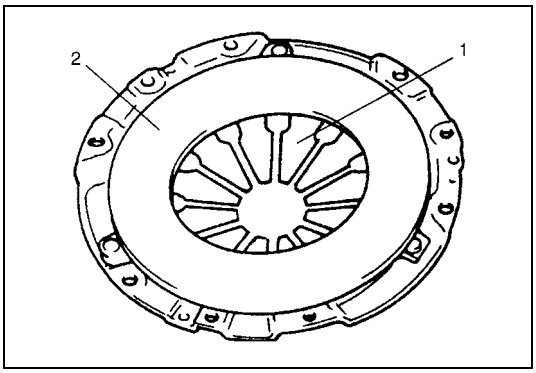
Clutch disc



Measure depth of rivet head depression, i.e. distance between rivet head and facing surface. If depression is found to have reached service limit at any of holes, replace disc assembly.

Rivet head depth
Standard : 1.65 – 2.25 mm (0.06 – 0.09 in.)
Service limit : 0.5 mm (0.02 in.)

Clutch cover



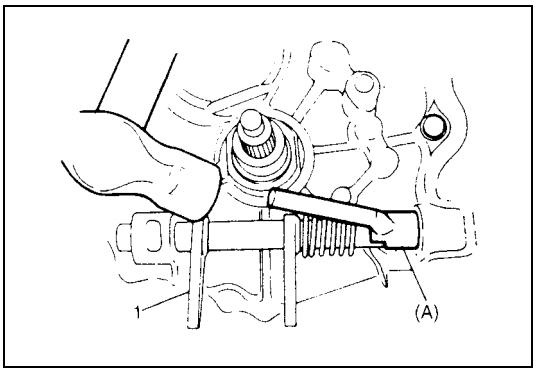
1) Check diaphragm spring (1) for abnormal wear or damage.
2) Inspect pressure plate (2) for wear or heat spots.
3) If abnormality is found, replace clutch cover. Do not disassemble it into diaphragm spring and pressure plate (2).

Flywheel

Check surface contacting clutch disc for abnormal wear or heat spots. Replace or repair as required.

Clutch Release Mechanism Removal and Installation

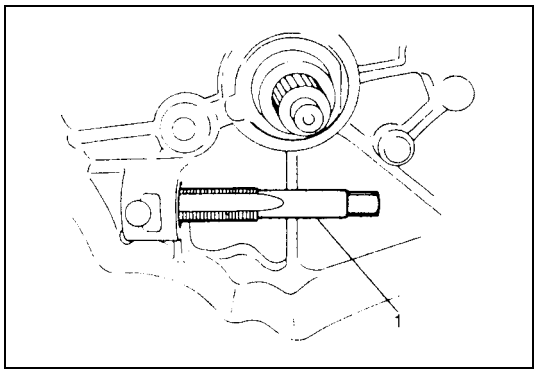
Removal



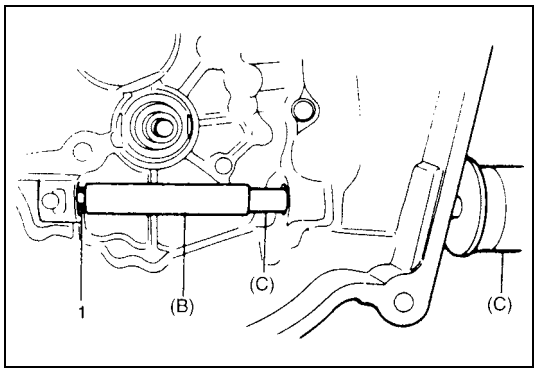
1) Remove release lever by loosening its bolt.
2) Take out release bearing by turning release shaft (1).
3) Unhook return spring (2) using pliers.
4) Drive out No.2 bush using special tool and hammer. Release shaft seal will also be pushed out.

Special tool
(A) : 09922-46010

5) Remove release shaft (1) and return spring (2).



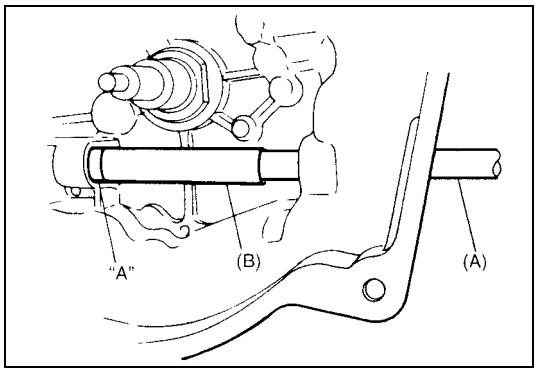
6) Install tap (M16 X 1.5) (1) to clutch release shaft No.1 bush.



7) Pull out No.1 bush using tap (1) and special tools.

Special tool
(B) : 09923-46020
(C) : 09930-30104

Installation



1) Drive in a new No.1 bush using special tools, and then apply grease to bush inside.

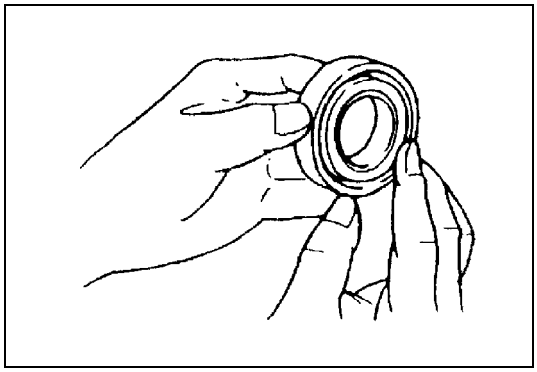
Special tool
(A) : 09930-30104
(B) : 09923-46030

"A" : Grease 99000-25010

2) Install release shaft with return spring.

Clutch Release Mechanism Inspection

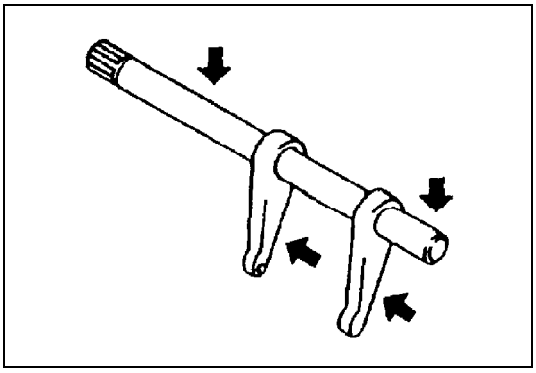
Clutch release bearing



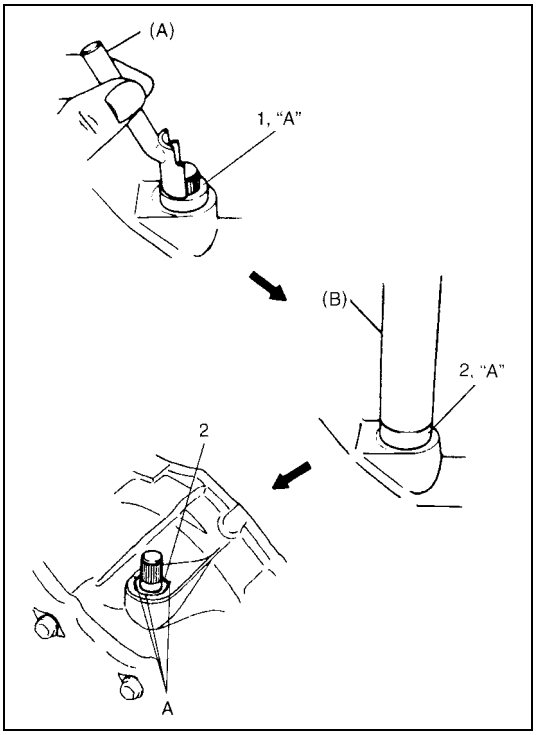
Check clutch release bearing for smooth rotation.
If abnormality is found, replace it.

CAUTION:
Do not wash release bearing. Washing may cause grease leakage and consequential bearing damage.

Clutch release shaft



Check clutch release shaft and its pin for deflection or damage. If abnormality is found, replace it.



3) Apply grease to No.2 bush (1) inside and press-fit it using the same special tool as in removal.

"A" : Grease 99000-25010

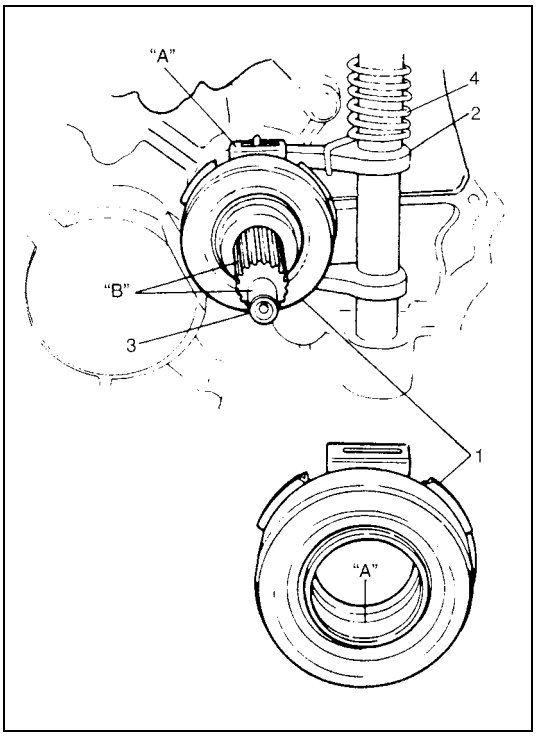
Special tool
(A) : 09922-46010

4) Coat grease to shaft seal (2) lip and then install it till it is flush with case surface. Use special tool for this installation and face seal lip downward (inside).

"A" : Grease 99000-25010

Special tool
(B) : 09925-98221

5) Caulk seal at A using caulking tool and hammer.

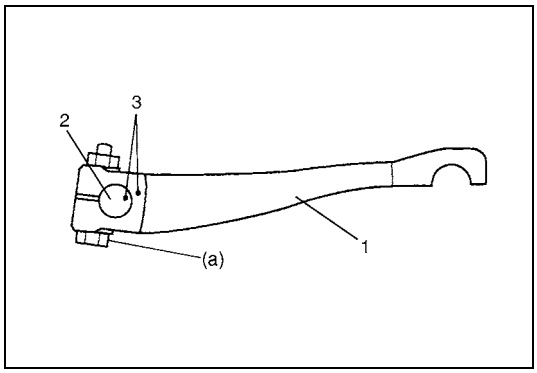


6) Hook return spring (4).
7) Apply grease to release bearing (1) inside and release shaft arm (2), then set release bearing (1).

"A" : Grease 99000-25010

8) Apply small amount of grease to input shaft (3) spline (0.3 g) (0.01 oz) and front end (0.15 g) (0.005 oz) as well.

"B" : Grease 99000-25210



9) Set release lever (1) to release shaft (2) aligning their punch marks (3), then tighten bolt.

Tightening torque
Release lever bolt (a) : 23 N·m (2.3 kg-m, 16.5 lb-ft)

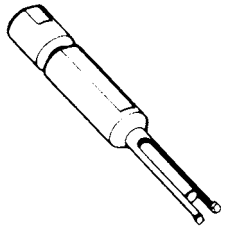
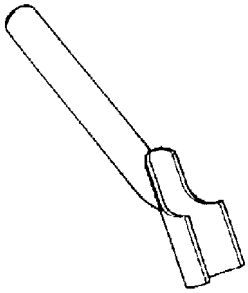
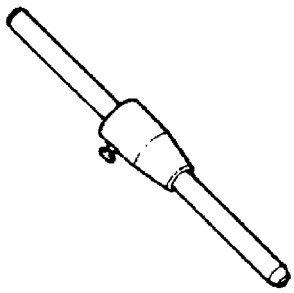
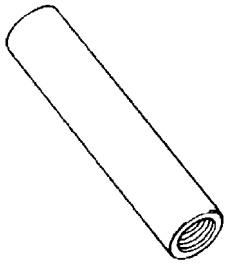
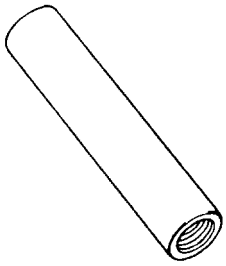
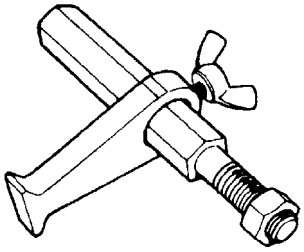
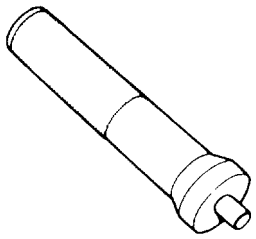
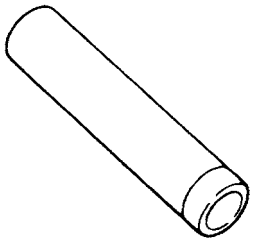
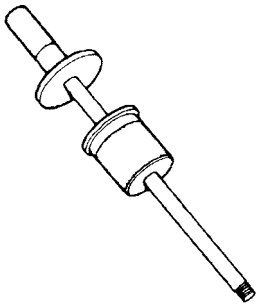
Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Flywheel bolts	70	7.0	50.5
Clutch cover bolts	23	2.3	16.5
Release lever bolt	23	2.3	16.5
Pedal bracket bolt	13	1.3	9.5
Pedal bracket nut	13	1.3	9.5
Pedal shaft nut	23	2.3	16.5
Clutch cable clamp bolt	50	5.0	36.5

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Cable end hook and joint pin. • Release shaft bushes and seal. • Release shaft. • Release bearing inside. • Pedal spring. • Pedal shaft spacer.
	SUZUKI SUPER GREASE I (99000-25210)	Input shaft spline and front end.

Special Tool

 09921-26020 Bearing remover	 09922-46010 Bush remover	 09923-36320 Clutch center guide	 09923-46020 Joint pipe
 09923-46030 Joint pipe	 09924-17810 Flywheel holder	 09925-98210 Input shaft bearing installer	 09925-98221 Bearing installer
 09930-30104 Sliding shaft			

SECTION 7D

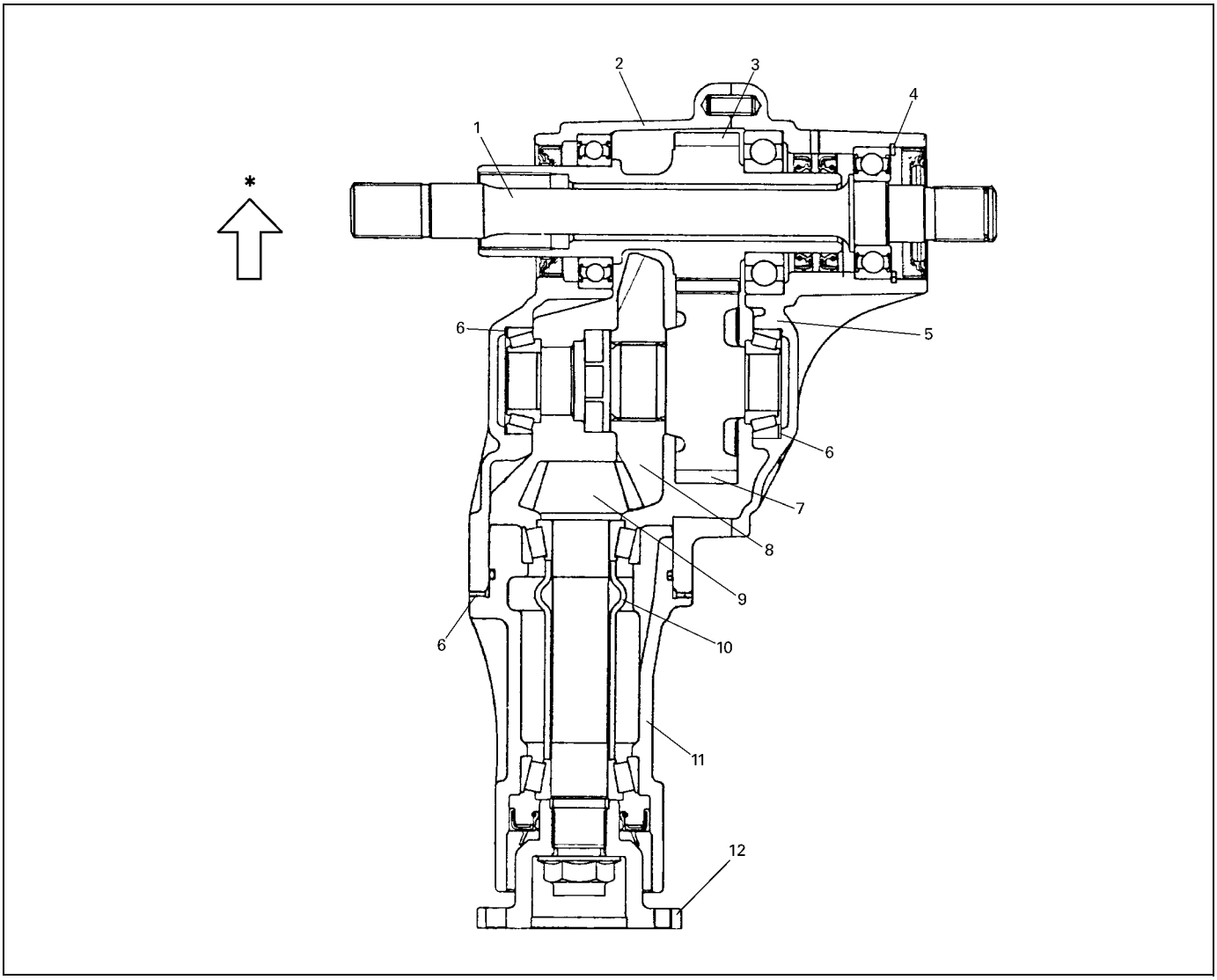
TRANSFER

CONTENTS

General Description

Transfer Description

The transfer consists of parts as shown in figure.



1. Intermediate shaft	6. Shim	11. Transfer output retainer
2. Left case	7. Reduction driven gear	12. Flange
3. Reduction drive gear	8. Bevel gear	✱: Forward
4. Circlip	9. Bevel pinion shaft	
5. Right case	10. Pinion shaft spacer	

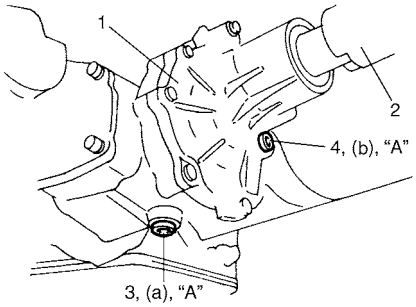
Diagnosis

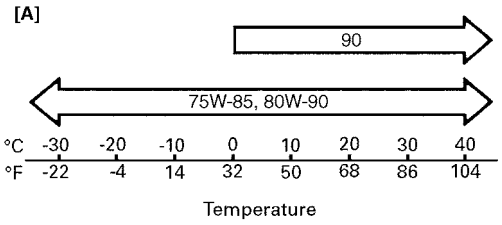
Transfer Diagnosis

Condition	Possible Cause	Correction
Noise	Inadequate or insufficient lubricant	Replenish.
	Damaged or worn bearing(s)	Replace.
	Damaged or worn gear(s)	Replace.
	Damaged or worn chamfered tooth on sleeve or gear	Replace.
	Preload of taper roller bearing is reduced	Adjust.

On-Vehicle Service

Transfer Oil Change





1) Before changing or inspecting oil, be sure to stop engine and lift vehicle horizontally.
2) With vehicle lifted up, check oil level and leakage. If leakage exists, correct or repair it.
3) Drain old oil, tighten drain plug (3) after applying sealant to its thread and fill new specified oil as shown below by specified amount (roughly up to level hole).

"A" : Sealant 99000-31230

Tightening torque
Transfer oil drain plug (a) : 21 N·m (2.1 kg-m, 15.5 lb-ft)

NOTE:

- **It is highly recommended to use SAE 80W-90 Hypoid gear oil API GL-5.**
- **Whenever vehicle is hoisted for any other service work than oil change, also be sure to check for oil leakage.**

Transfer gear oil
:Hypoid gear oil API GL-5
For oil viscosity, refer to the chart [A].

Oil Capacity
: 0.5 liters (1.1/0.9 US/Imp. pt)

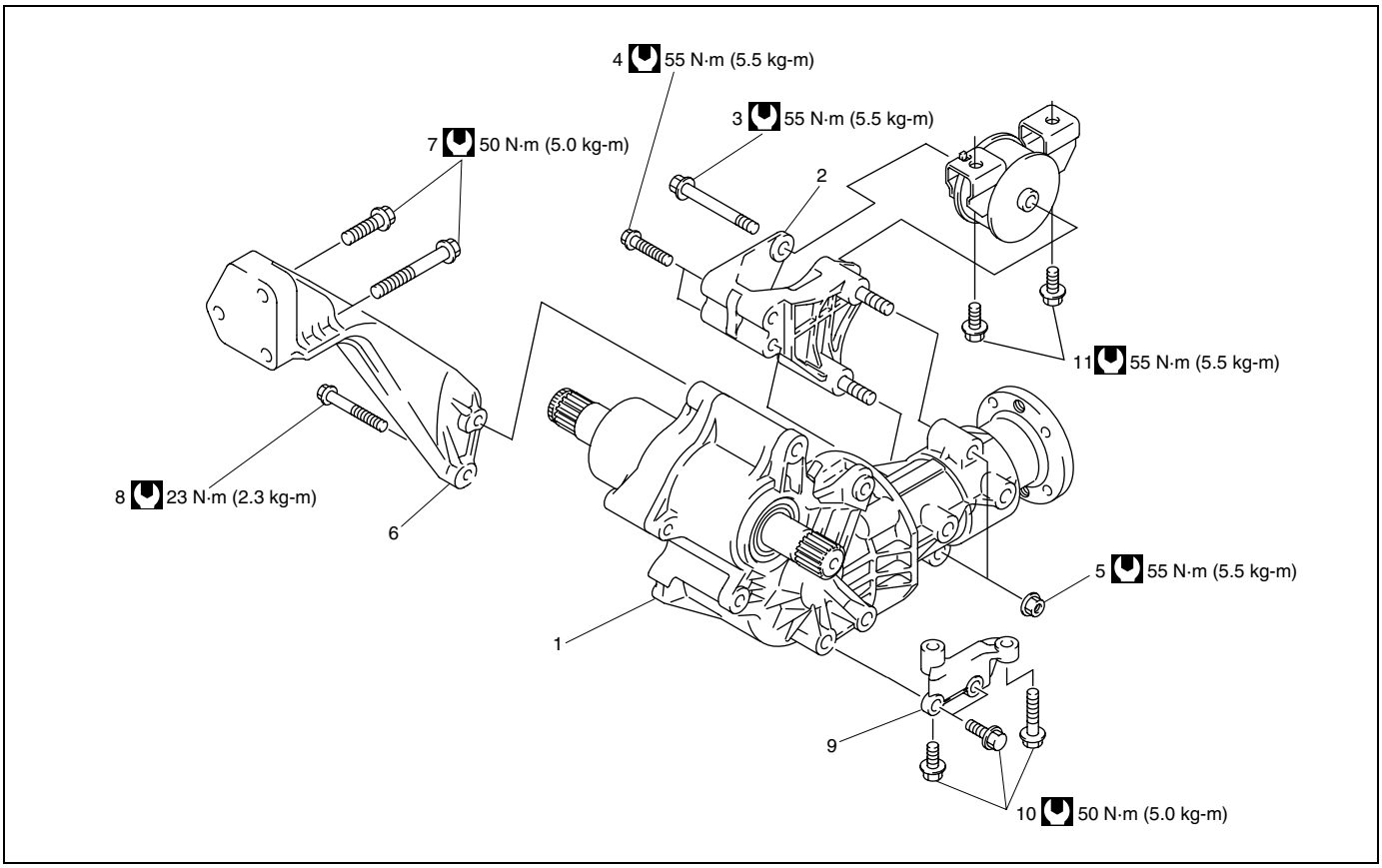
4) Torque level/filler plug (4) as specified below after applying sealant to its thread.

"A" : Sealant 99000-31230

Tightening torque
Transfer oil level / filler plug
(b) : 21 N·m (2.1 kg-m, 15.5 lb-ft)

1. Transfer
2. Drive shaft

Transfer Mounting Components

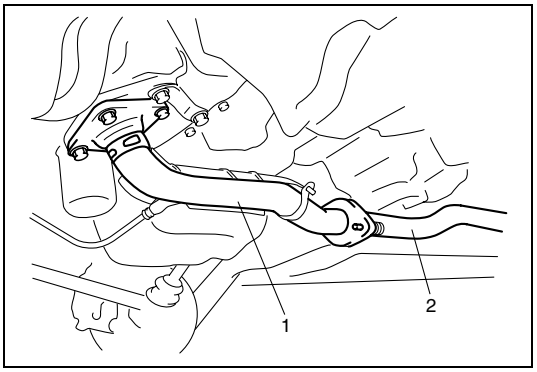


1. Transfer assy	7. Transfer to engine stiffener No.1 bolts
2. Mounting bracket	8. Transfer to engine stiffener No.2 bolts
3. Transfer mounting bolt	9. Transfer to transaxle stiffener
4. Transfer rear mounting bracket No.2 bolts	10. Transfer to transaxle stiffener bolts
5. Transfer rear mounting bracket nuts	11. Transfer rear mounting bracket bolts
6. Transfer to engine stiffener	Tightening torque

Transfer Dismounting and Mounting

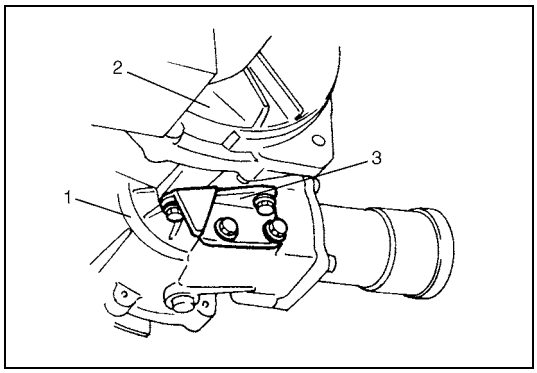
Dismounting

1) Disconnect negative cable at battery.
2) Hoist vehicle and remove wheels.
3) Drain transaxle oil referring to “Manual Transaxle Oil Change” in Section 7A1.
4) Drain transfer oil referring to “Transfer Oil Change” in this section.



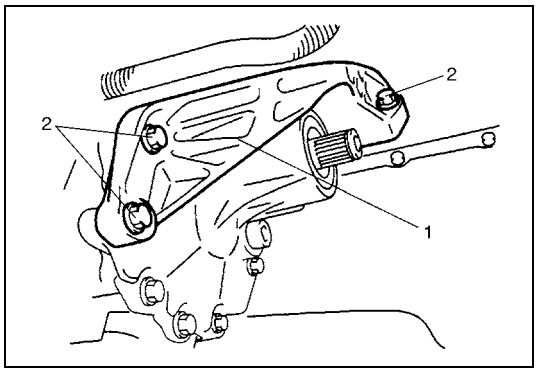
5) Remove exhaust No.1 pipe (1).
6) Remove propeller shaft referring to “Propeller Shaft Removal and Installation” in Section 4B.
7) Remove right side drive shaft (1) referring to “Front Drive Shaft Assembly Removal and Installation” in Section 4A.

2. Exhaust No.2 pipe

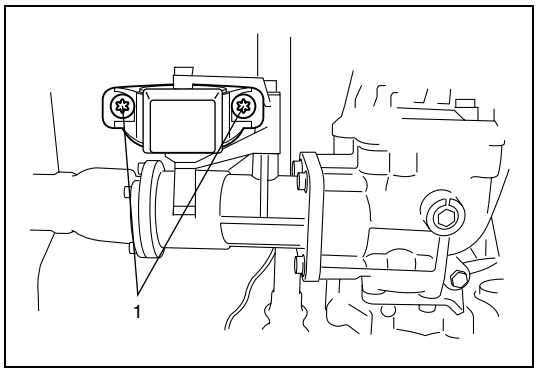


8) Remove transfer to transaxle stiffener (3).

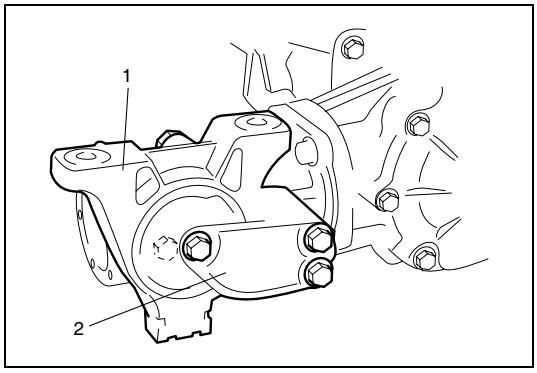
1.	Transfer
2.	Transaxle



9) Remove transfer to engine stiffener (1) removing stiffener bolts (2), if equipped.



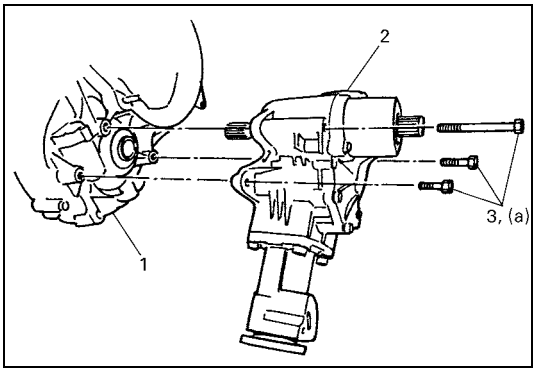
10) With transaxle assembly held on jack, remove rear mounting bracket bolts (1).
11) Remove transfer to transaxle bolts and draw out transfer assembly from transaxle assembly.



12) Remove mounting bracket (2) with mounting (1) from transfer assembly.

Mounting

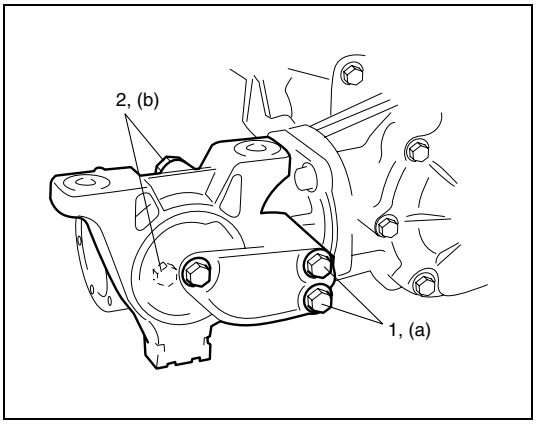
Reverse dismounting procedure for installation noting the following.



- Tighten transfer mounting bolts (3) to specified torque.

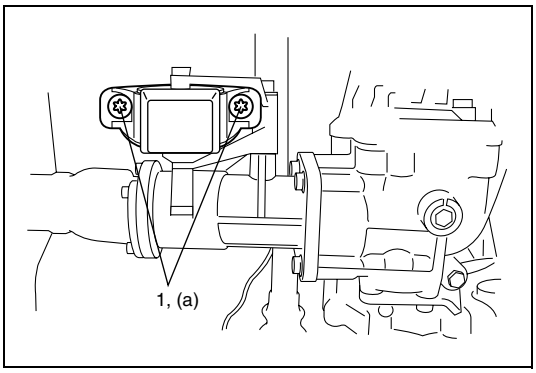
Tightening torque
Transfer mounting bolts (a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

1.	Transaxle
2.	Transfer assembly



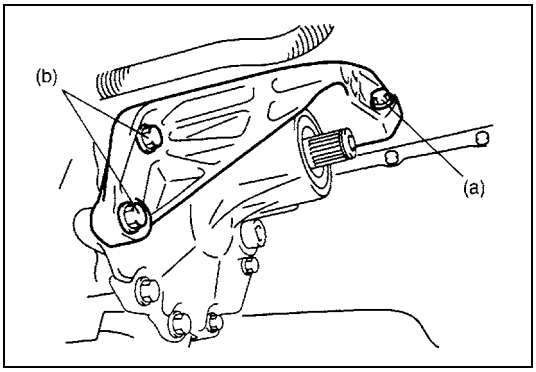
- Tighten transfer rear mounting bracket No.2 bolts (1) and transfer rear mounting bracket nuts (2) to specified torque.

Tightening torque
Transfer rear mounting bracket No.2 bolts
(a) : 55 N·m (5.5 kg-m, 40.0 lb-ft)
Transfer rear mounting bracket nuts
(b) : 55 N·m (5.5 kg-m, 40.0 lb-ft)



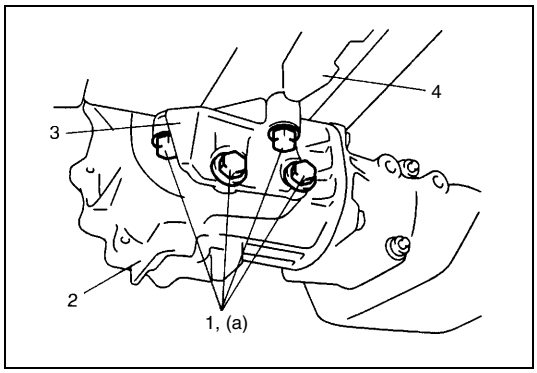
- Tighten transfer rear mounting bracket bolts (1) to specified torque.

Tightening torque
Transfer rear mounting bracket bolts
(a) : 55 N·m (5.5 kg-m, 40.0 lb-ft)



- Tighten transfer to engine stiffener bolts to specified torque, if equipped.

Tightening torque
Transfer to engine stiffener No.1 bolts
(a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)
Transfer to engine stiffener No.2 bolts
(b) : 23 N·m (2.3 kg-m, 17.0 lb-ft)



- Tighten transfer to transaxle stiffener bolts (1) to specified torque.

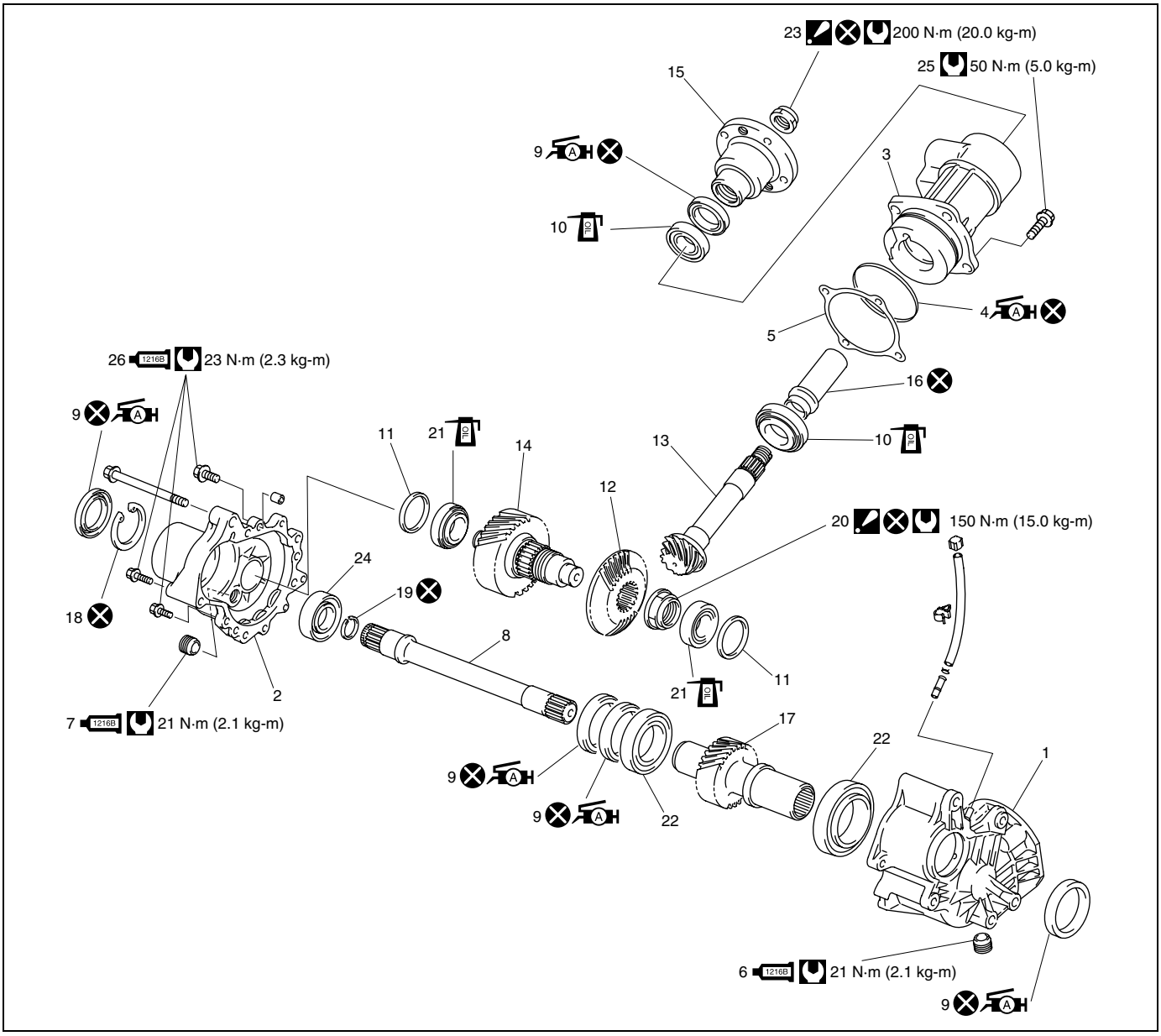
Tightening torque
Transfer to transaxle stiffener bolts (a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

2.	Transfer
3.	Stiffener
4.	Transaxle

- Install exhaust No.1 pipe referring to “Exhaust System Components” in Section 6K.
- Install right side drive shaft referring to “Front Drive Shaft Assembly Removal and Installation” in Section 4A.
- Install propeller shaft referring to “Propeller Shaft Removal and Installation” in Section 4B.
- Fill transfer with transfer oil referring to “Transfer Oil Change” in this section.

Unit Repair Overhaul

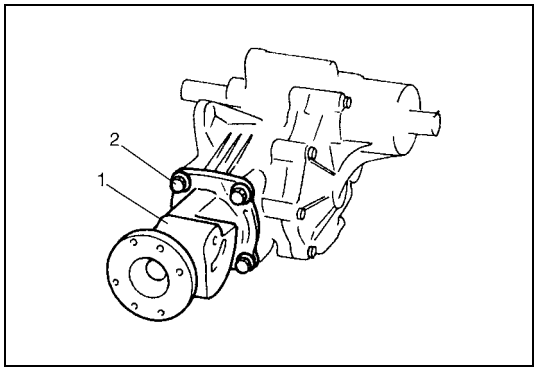
Transfer Components



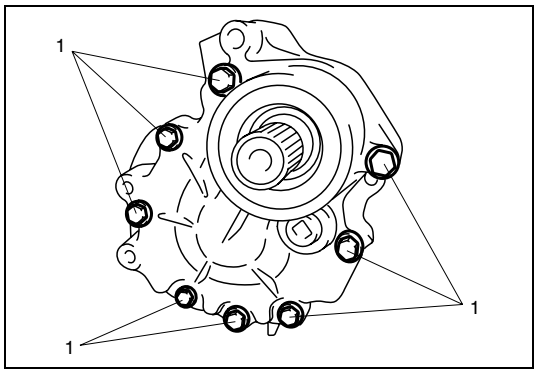
1. Transfer left case	11. Bevel gear shim	21. Driven gear bearing
2. Transfer right case	12. Bevel gear (Hypoid gear)	22. Reduction drive gear bearing
3. Transfer output retainer	13. Bevel pinion shaft (Hypoid gear)	23. Flange nut : After tightening nut so as rotation torque of bevel pinion shaft to be in specified value, caulk nut securely.
4. O-ring : Apply grease 99000-25010 to all around surface	14. Reduction driven gear	24. Intermediate right bearing
5. Bevel pinion shim	15. Flange	25. Transfer output retainer bolts
6. Transfer oil drain plug : Apply sealant 99000-31230 to all around thread part of drain plug	16. Pinion shaft spacer	26. Transfer case bolt
7. Transfer oil level/Filler plug : Apply sealant 99000-31230 to all around thread part of level plug	17. Reduction drive gear	Do not reuse.
8. Intermediate shaft	18. Snap ring	Tightening torque
9. Reduction drive gear oil seal : Apply SUZUKI SUPER GREASE A 99000-25010 to oil seal lip.	19. Circlip	Apply transfer oil.
10. Pinion shaft bearing	20. Bevel gear nut : After tightening nut to specified torque, caulk nut securely	

Transfer Disassembly and Assembly

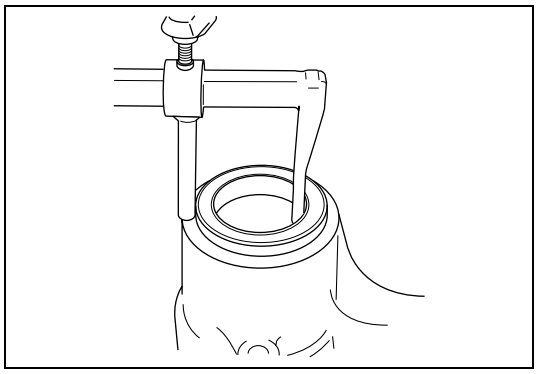
Disassembly



1) Remove retainer bolts (2) and remove transfer output retainer (1).



2) Remove transfer case bolts (1).
3) Separate right case with intermediate shaft from left case by tapping with plastic hammer.



4) If reduction drive gear oil seal replacement is necessary, remove oil seal from left case using special tool.

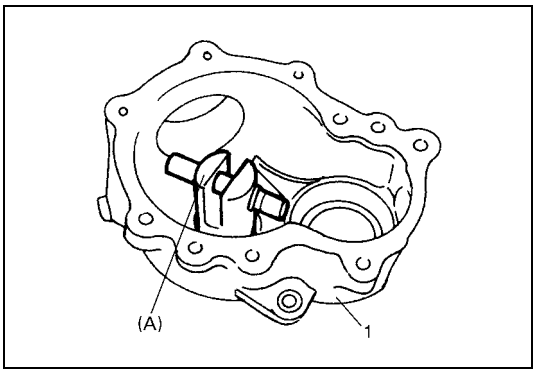
Special tool
(A) : 09913-50121

5) If bevel gear shim adjustment is necessary, remove driven gear bearing outer races as follows.

NOTE:

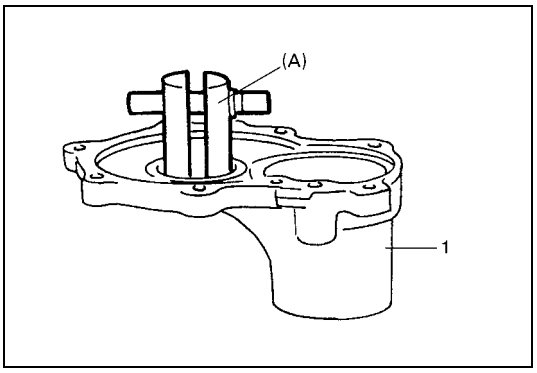
If either or both the following part(s) is/are replaced, bevel gear shim adjustment is necessary in assembly.

- **Driven gear bearing**
- **Bevel gear nut**
- **Bevel gear**
- **Reduction driven gear**



a) Remove driven gear bearing outer race from left case (1) using special tool.

Special tool
(A) : 09941-54911



b) Remove driven gear bearing outer race from right case (1) using special tool.

Special tool
(A) : 09941-54911

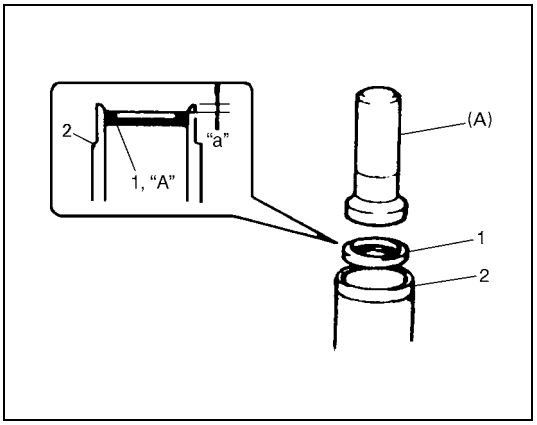
Assembly

1) Install bevel gear shims and driven gear bearing outer races to right and left cases.

NOTE:

If either or both the following part(s) is/are replaced, adjust bevel gear shim referring to "Bevel Gear Shim Adjustment" in this section.

- **Driven gear bearing**
- **Bevel gear nut**
- **Bevel gear**
- **Reduction driven gear**



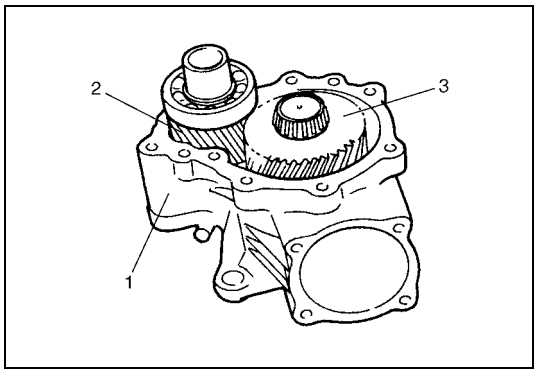
2) Install reduction drive gear oil seal (1) to left case (2) using special tool.

Special tool
(A) : 09913-75810

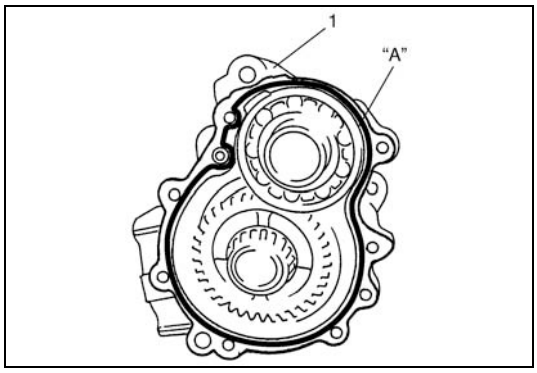
Transfer reduction drive gear oil seal installing depth
"a" : 1.5 – 2.0 mm (0.059 – 0.078 in.)

3) Fill grease to inside of oil seal about 3 g (0.11 oz), and apply grease to oil seal lip.

"A" : Grease 99000-25010

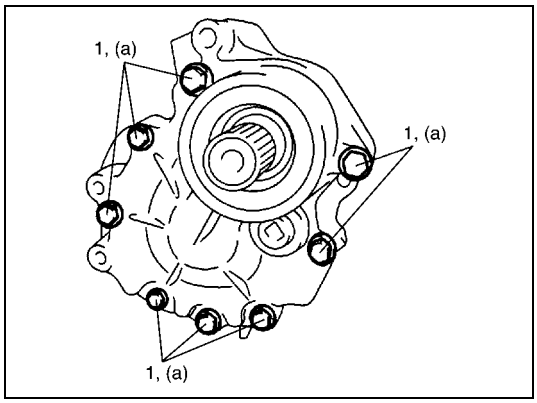


4) Install reduction drive gear (2) and reduction driven gear (3) to left case (1).



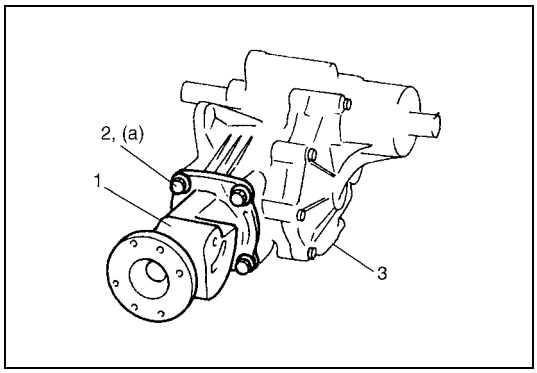
5) Clean mating surface of right case and left case (1), and apply sealant to left case (1) using a nozzle as shown in figure by such amount that its section is 1.5mm (0.059 in) in diameter.

"A" : Sealant 99000-31230



6) Tighten transfer case bolts (1) to specified torque.

Tightening torque
Transfer case bolts (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)



7) Install selected bevel pinion shim(s) to transfer assembly (3) according to "Transfer Output Retainer Adjustment" in this section.
8) Install transfer output retainer (1) to transfer case, and then tighten transfer output retainer bolts (2) to specified torque.

Tightening torque
Transfer output retainer bolts
(a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

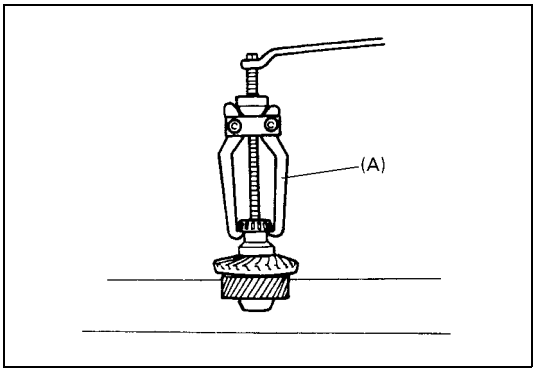
9) Measure bevel gear back lash according to "Measurement" under "Bevel Gear Back Lash Measurement and Adjustment" in this section.
If measured bevel gear back lash exceeds the specification, adjust bevel gear back lash according to "Adjustmentt" under "Bevel Gear Back Lash Measurement and Adjustment" in this section.

Transfer Inspection

- Check each bearing for smooth rotation, wear or discoloration.
  If found abnormal, replace.
- Check oil seal for leakage and its lip for excessive hardness.
  If either is found, replace.
- Check transfer case for cracks.
- Check bevel pinion and bevel gear for wear or cracks.
- Check pinion gear and pinon shaft for wear or damage.

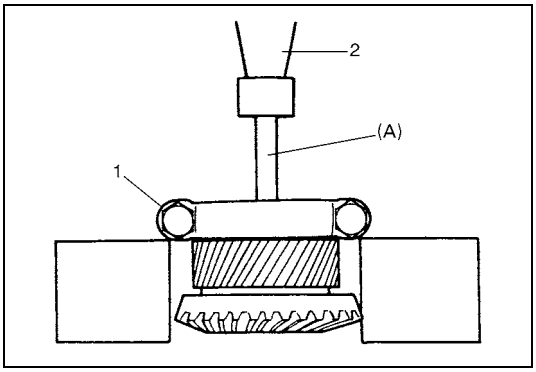
Reduction Driven Gear Disassembly and Assembly

Disassembly



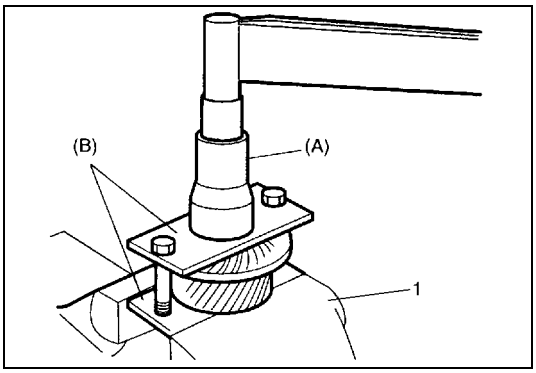
1) Drive out left side driven gear bearing using special tool.

Special tool
(A) : 09913-65135



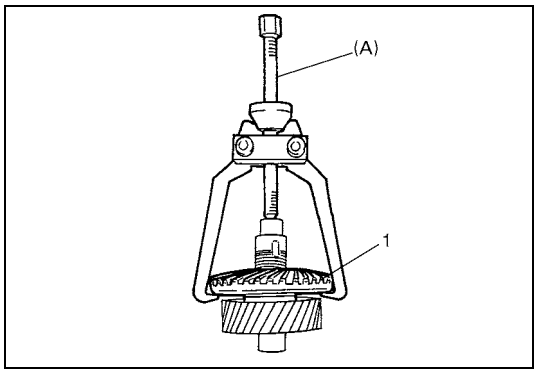
2) Drive out right side driven gear bearing using bearing puller (1), press (2) and special tool.

Special tool
(A) : 09925-58210



3) Uncaulk bevel gear nut, and remove bevel gear nut while holding bevel gear with special tool and vise (1).

Special tool
(A): 09941-58020
(B): 09924-57610



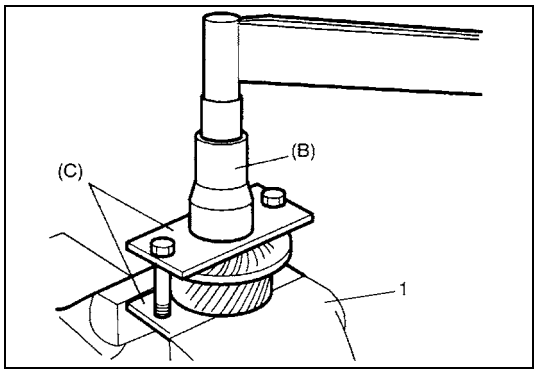
4) Drive out bevel gear (1) using special tool.

Special tool
(A): 09913-65135

Assembly

CAUTION:
- **Bevel gear and pinion must be replaced as a set when either replacement becomes necessary.**
- **When replacing taper roller bearing, replace as inner race & outer race assembly.**

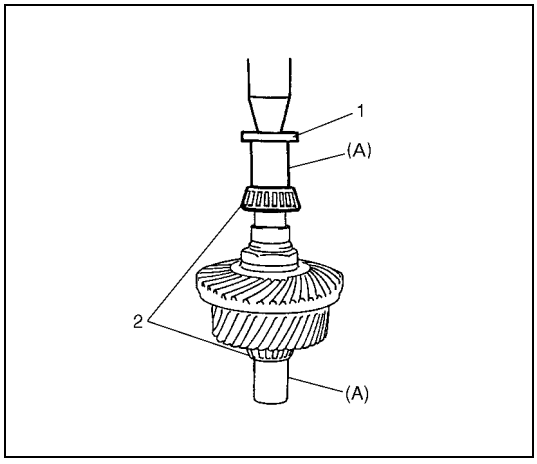
1) Drive in bevel gear to reduction driven gear.



2) Tighten bevel gear nut to specified torque while holding bevel gear with special tool and vise (1), and then caulk nut.

Tightening torque
Transfer bevel gear nut
: 150 N·m (15.0 kg-m, 108.5 lb.-ft.)

Special tool
(B): 09941-58020
(C): 09924-57610



3) Press-fit driven gear bearings (2) (right and left) to driven gear using special tools.

Special tool
(A): 09945-16070

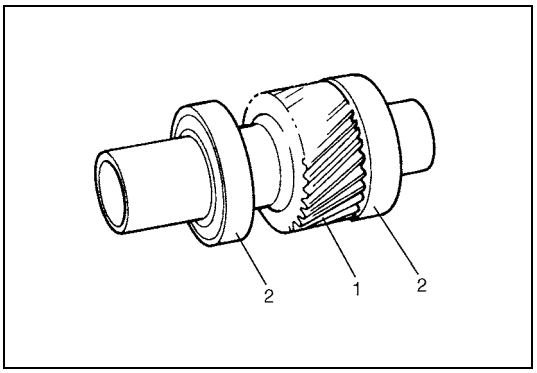
NOTE:

Support shaft with special tool as illustrated in the figure so that retainer of bearing cone will be free from compression.

1. Plate

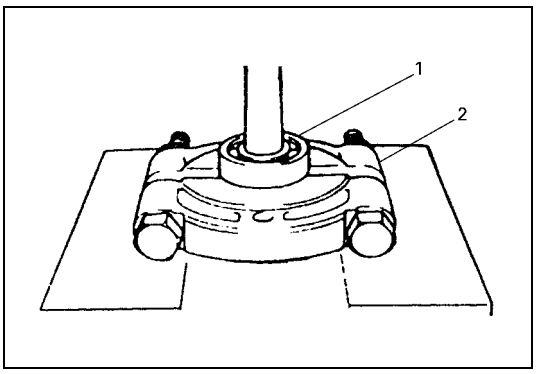
Reduction Drive Gear Disassembly and Assembly

Disassembly



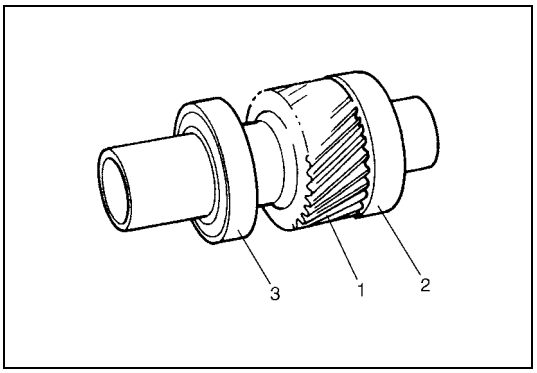
1) Remove reduction drive gear (1) from left case tapping with plastic hammer.

2. Bearing



2) Remove drive gear bearings (1) (right and left) from reduction drive gear using bearing puller (2).

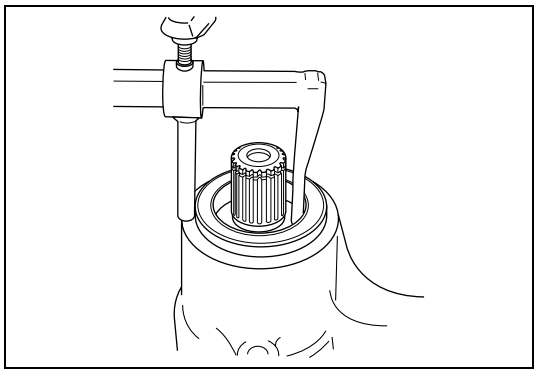
Assembly



1) Press-fit drive gear bearings (right (2) and left (3)) to reduction drive gear (1).
2) Apply gear oil to ball part of bearing.

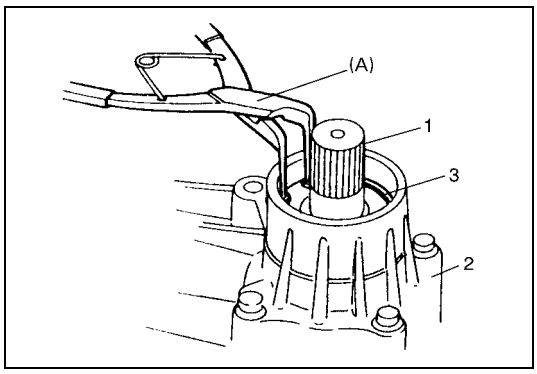
Intermediate Shaft Disassembly and Assembly

Disassembly



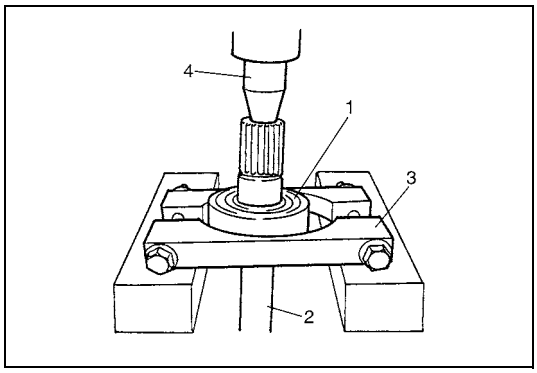
1) Remove reduction drive oil seal (1) using special tool.

Special tool
(A) : 09913-50121

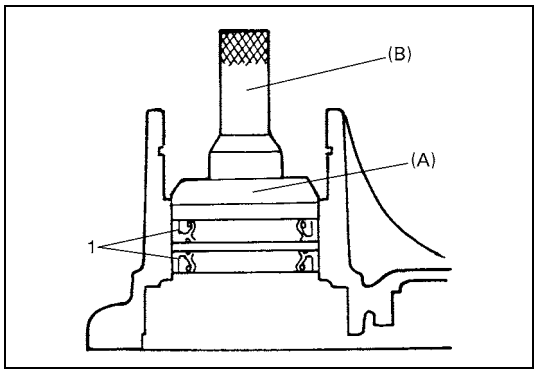


2) Remove snap ring (3) from right case (2) using special tool, and drive out intermediate shaft (1).

Special tool
(A) : 09952-76011



3) Drive out intermediate right bearing (1) from intermediate shaft (2) using bearing puller (3) and press (4).

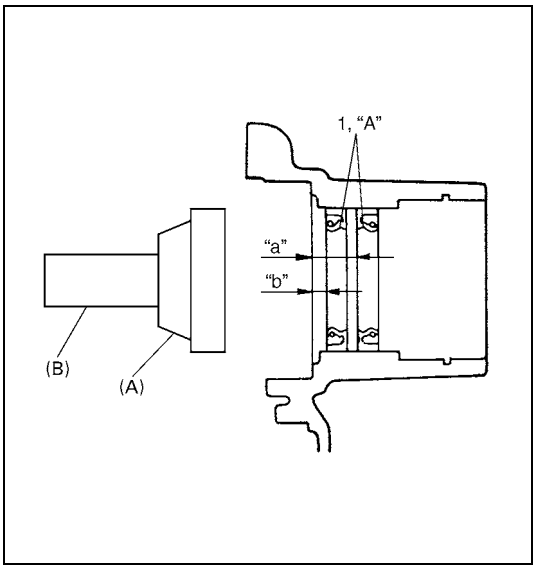


4) Remove intermediate center oil seals (1) using press and special tools.

Special tool
(A) : 09924-84510-005
(B) : 09913-75821

Assembly

1) Press-fit intermediate right bearing to intermediate shaft.



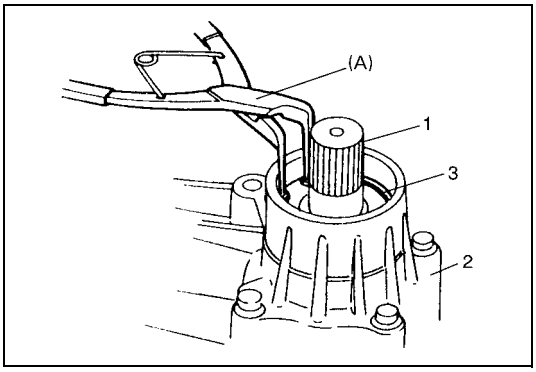
2) Install intermediate center oil seals (1) to case using special tool, and apply grease to oil seal lip.

CAUTION:
Use care the installation direction and depth of oil seals for correct installation.

Special tool
(A) : 09924-84510-005
(B) : 09913-75821

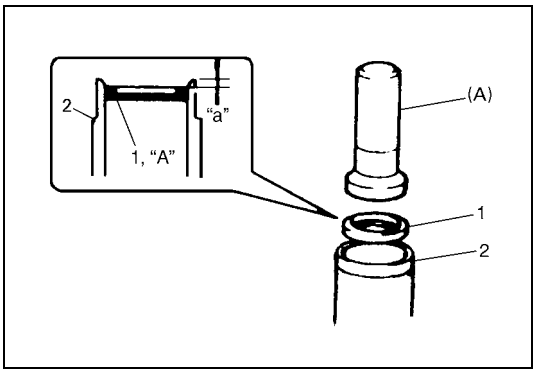
"A" : Grease 99000-25010

Transfer intermediate center oil seals installing depth
"a" : 16.0 – 16.5 mm (0.630 – 0.650 in.)
"b" : 4.0 – 4.5 mm (0.157 – 0.177 in.)



3) Install intermediate shaft (1) to right case (2), and install snap ring (3).

Special tool
(A) : 09952-76011



4) Install reduction drive gear oil seal (1) to right case (2).

Special tool
(A) : 09913-75810

Transfer right case oil seal installing depth
"a" : 1.0 – 1.5 mm (0.039 – 0.059 in.)

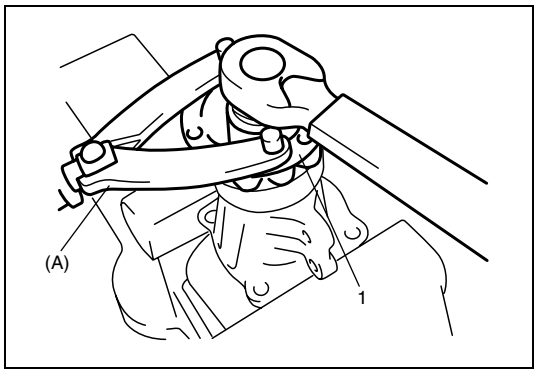
5) Fill grease to inside of oil seal about 3 g (0.11 oz), and apply grease to oil seal lip.

"A" : Grease 99000-25010

Transfer Output Retainer Disassembly and Assembly

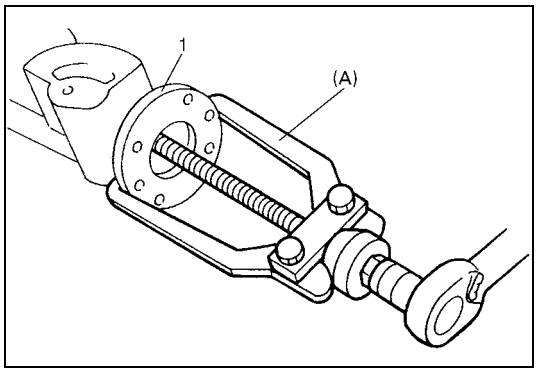
Disassembly

1) Uncaulk flange nut.



2) Remove flange nut while holding flange (1) with special tool.

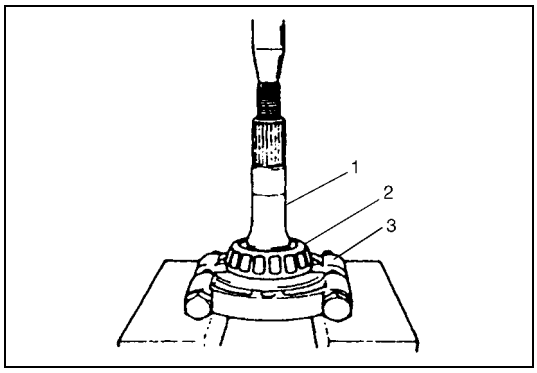
Special tool
(A) : 09930-40113



3) Remove flange (1) using special tool.

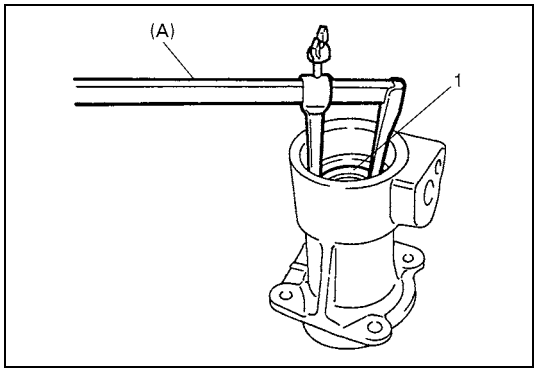
Special tool
(A) : 09913-65135

4) Drive out bevel pinion shaft from transfer output retainer tapping with plastic hammer.
5) Drive out pinion spacer from bevel pinion shaft.



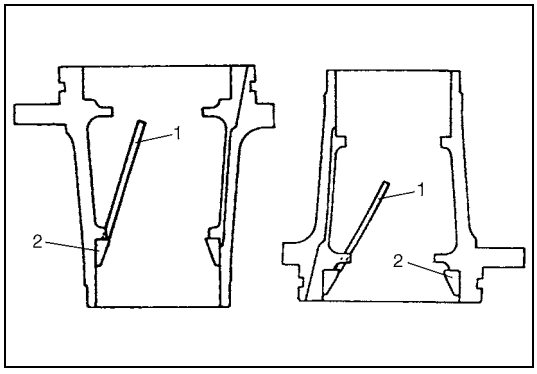
6) Drive out pinion shaft bearing (2) from bevel pinion shaft (1) using press.

3. Bearing puller



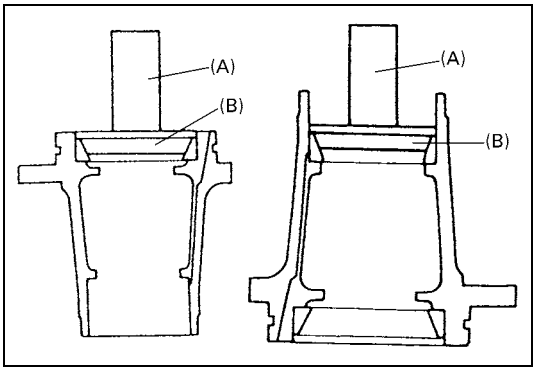
7) Remove pinion shaft oil seal (1) using special tool.

Special tool
(A) : 09913-50121



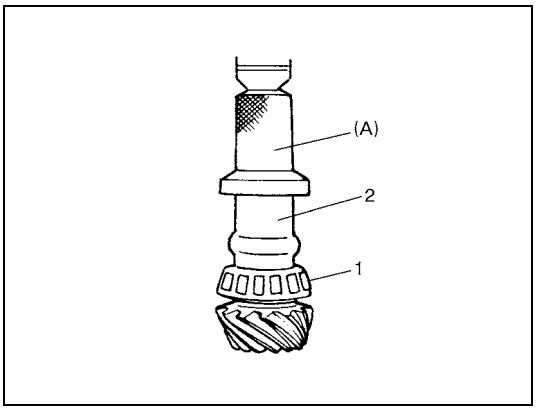
8) Drive out pinion shaft bearing outer races (2) (front and rear) using brass bar (1).

Assembly



1) Press-fit pinion shaft bearing outer races (front and rear) using special tools.

Special tool
(A) : 09913-75821
(B) : 09924-84510-005

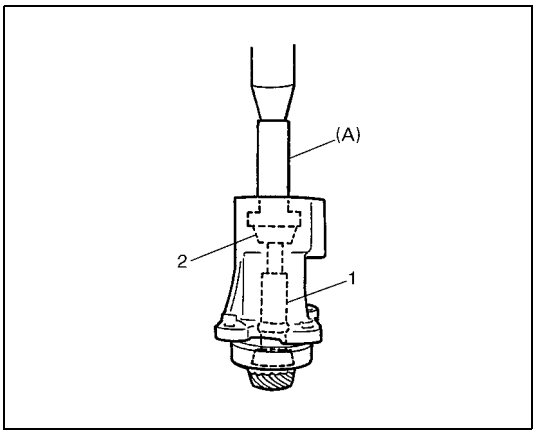


2) Press-fit pinion shaft bearing (front side) (1) using special tool, press and pinion shaft spacer (2).

Special tool
(A) : 09913-75810

NOTE:

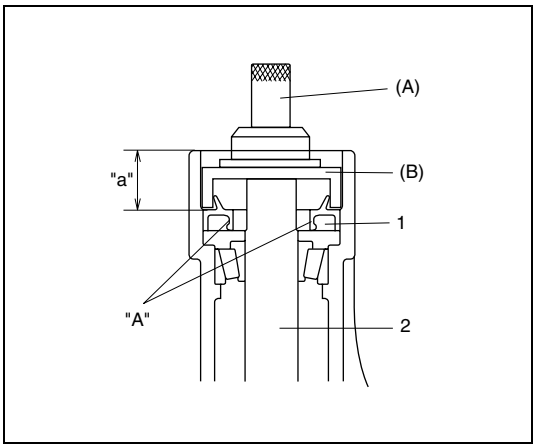
Use pinion shaft spacer "Which was assembled to transfer" in this procedure, and install new pinion shaft spacer at next step.



3) Install bevel pinion shaft with new pinion shaft spacer (1) to transfer output retainer.
4) Press-fit pinion shaft bearing (rear side) (2) using special tool (and press).

Special tool
(A) : 09913-75810

CAUTION:
Press-fit bearing to such an extent that spacer is not compressed.



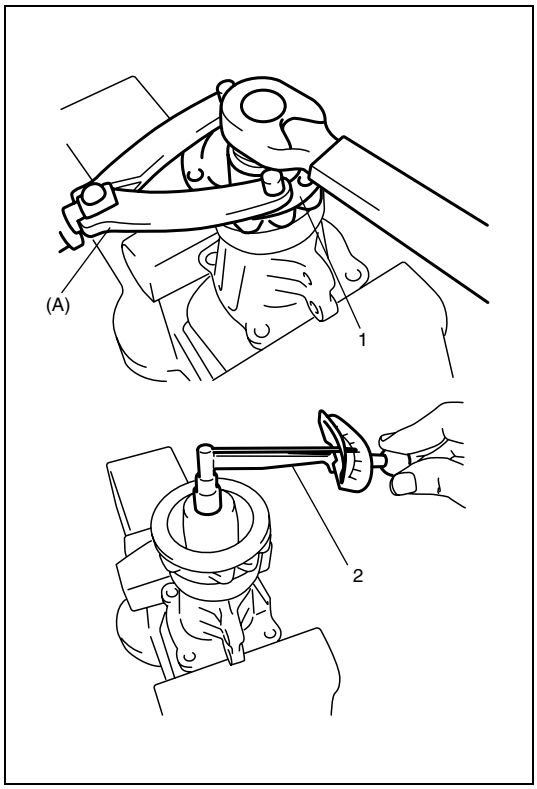
5) Drive in oil seal (1) using special tools and apply grease to oil seal lip.

Special tool
(A) : 09913-70123
(B) : 09924-07720

"A" : Grease 99000-25010

Transfer bevel pinion shaft oil seal installing depth
"a" : 27.0 – 27.5 mm (1.063 – 1.083 in.)

2. Bevel pinion shaft



6) Install flange (1) and tighten flange nut gradually so as rotational torque of bevel pinion shaft to be in specified value.

NOTE:

- **Before taking measurement of rotational torque, rotate pinion shaft over ten rounds in advance.**
- **For measuring bevel pinion shaft rotational torque, turning bevel pinion at about 50 rpm is required.**
- **If rotational torque of bevel pinion shaft is out of specification given below, replace pinion shaft spacer and tighten flange nut.**

Special tool
(A) : 09930-40113

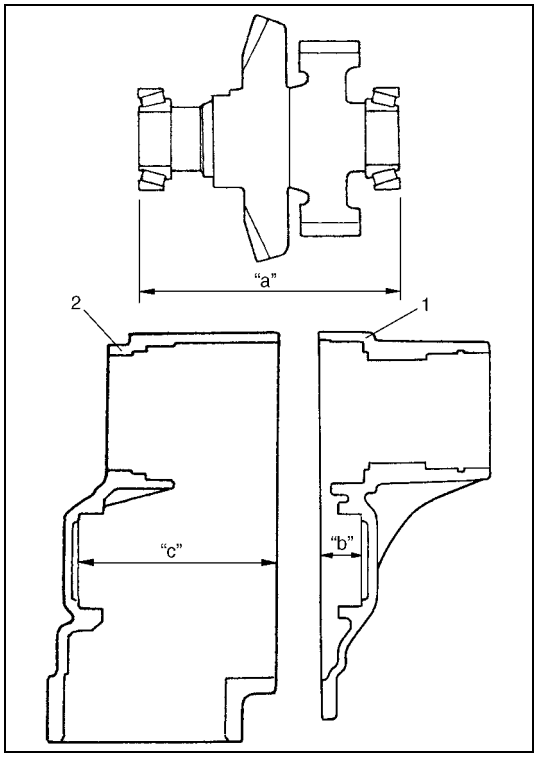
Flange nut
: 100 – 300 N·m (10.0 – 30.0 kg-m, 72.5 – 217.0 lb-ft)

Rotation torque for bevel pinion shaft
: 0.5 – 1.3 N·m (5.0 – 13.0 kg-cm, 0.30 – 0.90 lb-ft)

2. Torque wrench

7) Caulk flange nut.

Bevel Gear Shim Adjustment

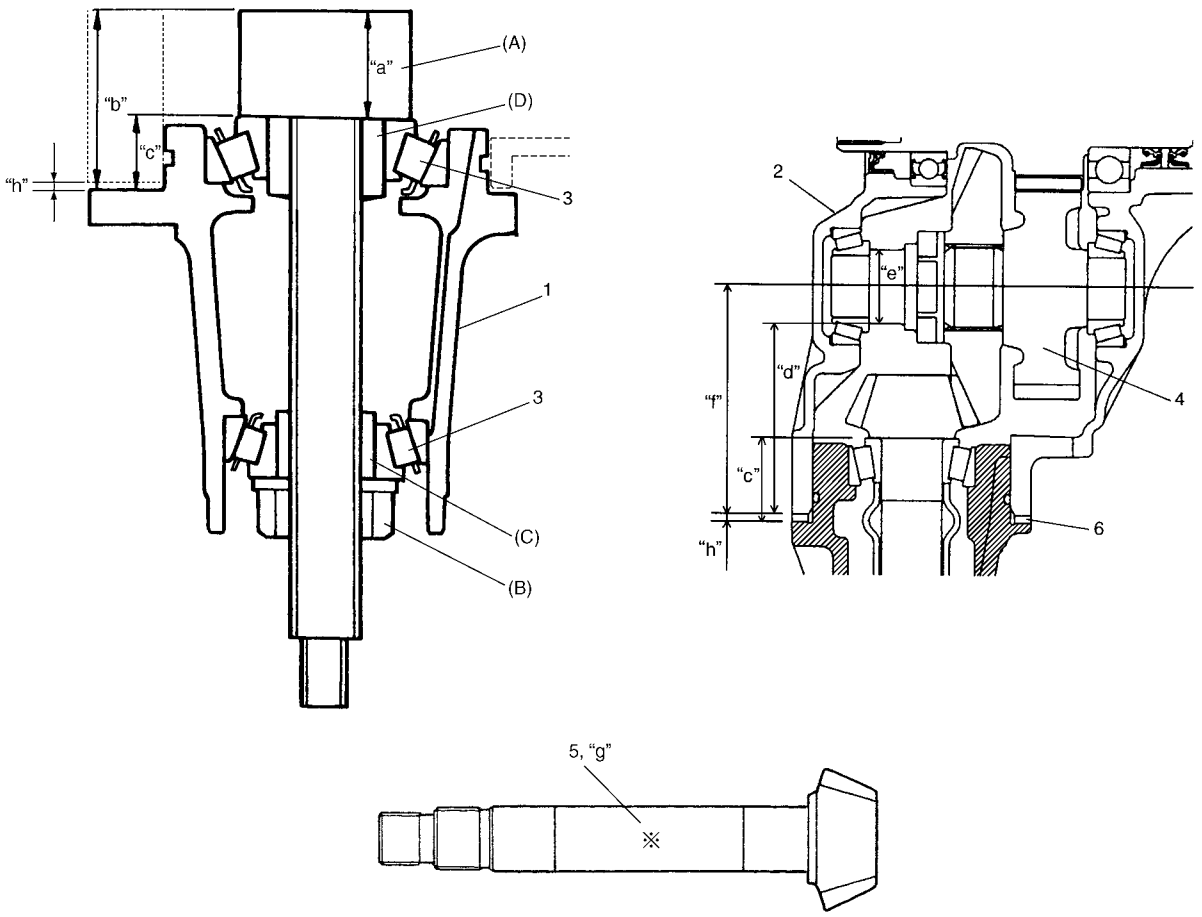


1) Install driven gear bearing outer races, and measure distance "a" between end faces of driven gear bearing outer races.
2) Measure depth "b" and "c" from mating face of right (left) case (to match with left (right) case) to face processed for installation of driven gear bearing.
3) Calculate shim thickness to be inserted.
   Shim thickness = {"b" + "c" – "a" + 0.1 mm (0.004 in.)}/2
4) Select shim closest to calculated value.

Available shims thickness
: 0.60, 0.65, 0.70, 0.75, 0.8, 0.85, 0.90, 0.95, 1.00 and 1.05 mm (0.024, 0.026, 0.028, 0.030, 0.031, 0.033, 0.035, 0.037, 0.040, and 0.041 in.)

1. Right case
2. Left case

Transfer Output Retainer Adjustment



"a": Pinion dummy (special tool) height 40 mm (1.575 in.)	1. Transfer output retainer
"b": Height from retainer installation face to pinion dummy	2. Left case
"c": Distance from retainer installation face to end face of bearing race ("b" – "a")	3. Pinion shaft bearing
"d": Distance from end face of left case to cylinder section of reduction driven gear	4. Reduction driven gear
"e": Outer diameter of cylinder section of reduction driven gear	5. Bevel pinion shaft
"f": Distance from end face of left case to center shaft of reduction driven gear ("d" + "e"/2)	
"g": Dimension marked on bevel pinion shaft (Marked in shaft in mm)	
"h": Shim size for mounting distance adjustment ("g" + "c" – "f")	

Special tool

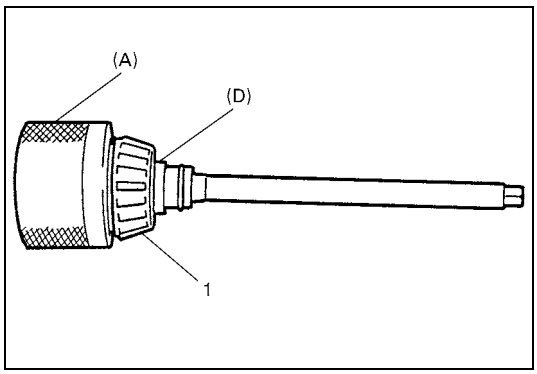
(A) : 09922-76140

(B) : 09922-76150

(C) : 09922-76340

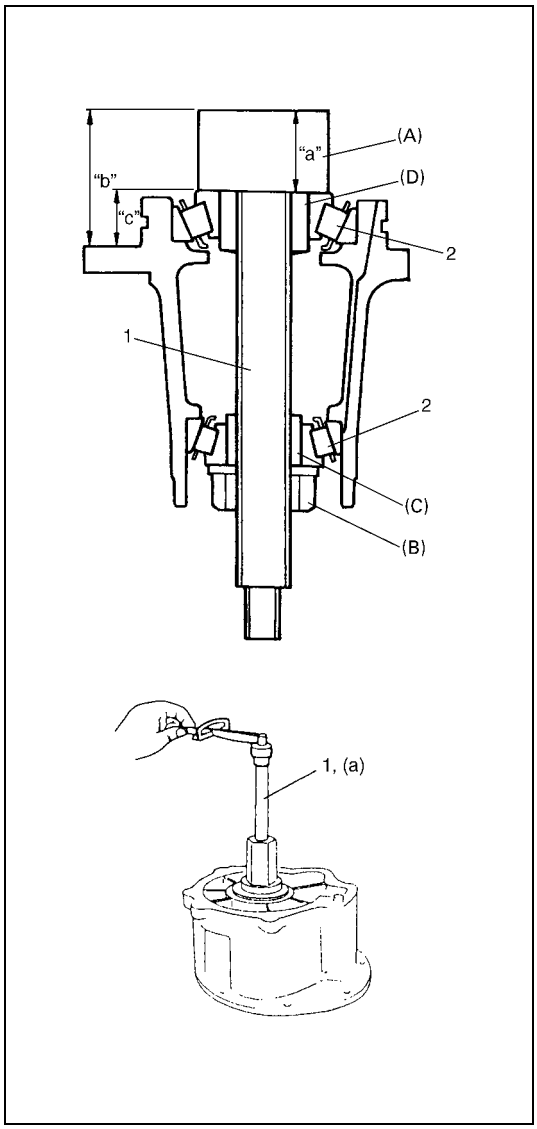
(D) : 09922-76430

To engage bevel pinion and gear correctly, it is prerequired to install bevel pinion to transfer output retainer properly by using adjusting shim (bevel pinion shim) as described as follows.
Shown in above-mentioned components are relative positions of bevel pinion, gear and transfer output retainer.



1) Install pinion shaft bearing (1) (front side) to special tools (bevel pinion dummy).

Special tool
(A) : 09922-76140
(D) : 09922-76430



2) Install bevel pinion dummy (1), pinion shaft bearing (2) (rear side) and special tool (A) by using special tool (B) to transfer output retainer.

Special tool
(A) : 09922-76140
(B) : 09922-76150
(C) : 09922-76340
(D) : 09922-76430

NOTE:

This installation requires no spacer or oil seal.

3) Tighten bevel pinion nut (special tool) so that specified bearing preload is obtained.

NOTE:

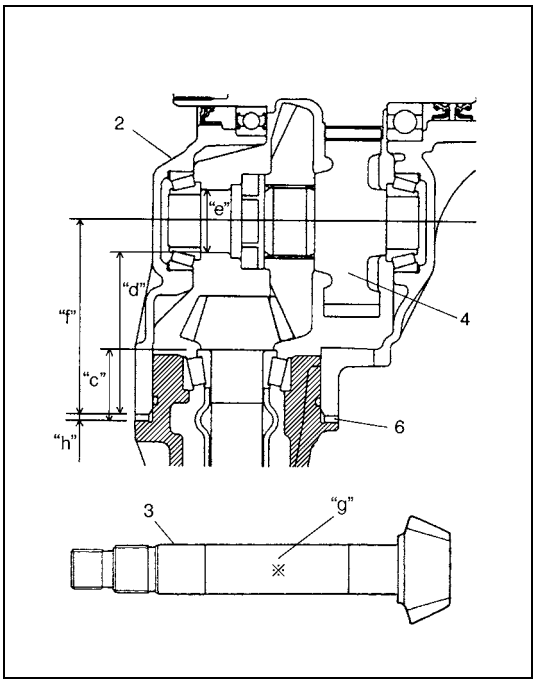
Before taking measurement, check for rotation by hand more than 15 revolutions.

Pinion shaft bearing preload
(a) : 0.5 – 1.3 N·m (5.0 – 13.0 kg-cm, 4.4 – 11.2 lb-ft)

4) Measure height "b" in figure using vernier caliper.
Calculate "c" using measured value.

Distance "c"	=	Height "b"	–	Height "a" : 40 mm (1.575 in.)

"a": Pinion dummy height
"b": Height from retainer installation face to pinion dummy
"c": Distance from retainer installation face to end face of bearing race



5) Install reduction driven gear (1) to left case (2) and right case and then measure distance “d” and “e” as indicated in figure. Calculate “f” using measured value.

Distance “f”	=	Distance “d”	+	“e”/2

6) Obtain adjusting shim thickness using calculated value in the following equation.

Necessary shim thickness “h”	=	Dimension “g”	+	Distance “c”	–	Distance “f”

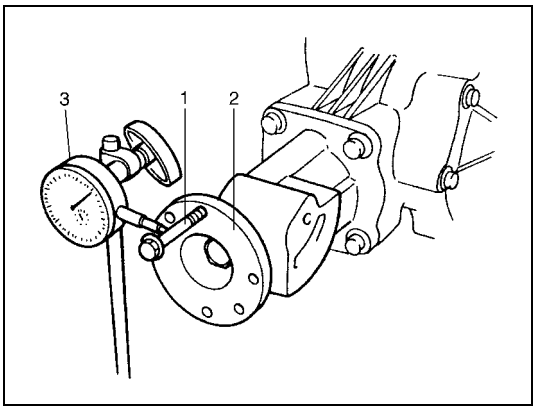
“f”:	Distance from end face of left case to center shaft of reduction driven gear
“d”:	Distance from end face of left case to cylinder section of reduction driven gear
“g”:	Dimension marked on bevel pinion shaft
3.	Bevel pinion shaft

7) Select adjusting shim closest to calculated value from among the following available sizes.

Available shims thickness
: 0.30, 2.00, 2.03, 2.06, 2.09, 2.12, 2.15, 2.18, 2.21, 2.24 and 2.27 mm (0.012, 0.079, 0.080, 0.081, 0.082, 0.083, 0.085, 0.086, 0.087, 0.088 and 0.089 in.)

Bevel Gear Back Lash Measurement and Adjustment

Measurement

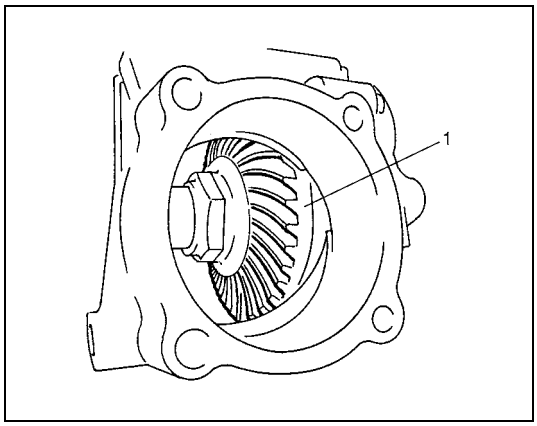


Install bolt to bolt hole of flange (2), set dial gauge (3) measuring tip at right angles to bolt (1) as shown in figure.
Take measurement backlash of pinion and bevel gear.

NOTE:

If backlash exceeds specification given below, replace bevel pinion shim (between transfer case and transfer output retainer) and measure backlash again.

Transfer pinion & bevel gear backlash
: 0.1 – 0.2 mm (0.0039 – 0.0078 in.)



Adjustment

Check gear tooth contact as follows.

1) After cleaning tooth surface of bevel gear (1), paint them with gear marking compound evenly by using brush or sponge etc.

NOTE:

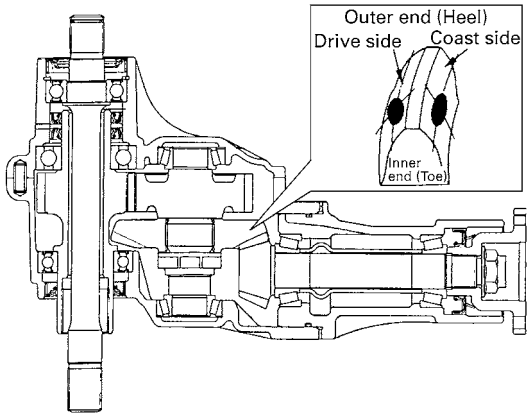
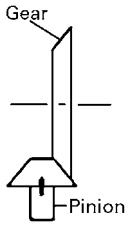
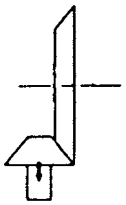
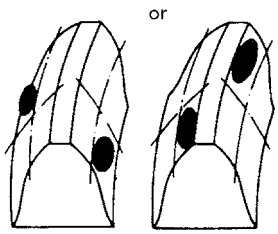
When applying red lead paste to teeth, be sure to paint tooth surfaces uniformly. The paste must not be too dry or too fluid.

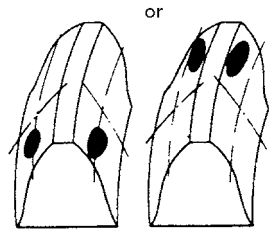
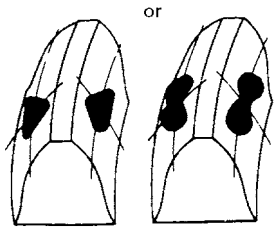
2) Turn gear to bring its painted part in mesh with bevel pinion and turn it back and forth by hand to repeat their contact.
3) Bring painted part up and check contact pattern referring to "Bevel gear tooth contact table" in this section.
   If contact pattern is not normal, readjust or replace as necessary according to instruction in table.

NOTE:

- **Be careful not to turn bevel gear more than one full revolution, for it will hinder accurate check.**
- **If bevel gear back lash and bevel pinion shims are adjusted properly, correct tooth contact should be provided.**
  If correct tooth contact is not provided even when they are adjusted properly, however, there may be an abnormal condition in worn tooth, transfer case or retainer. Check each component and replace as necessary.

Bevel gear tooth contact table

TOOTH CONTACT PATTERN	DIAGNOSIS AND REMEDY
	NORMAL
	HIGH CONTACT Pinion is positioned too fat from the center of drive bevel gear. 1) Decrease thickness of bevel pinion shim and position pinion closer to gear center. 2) Adjust drive bevel gear backlash to specification referring to “Bevel Gear Back Lash Measurement and Adjustment” in this section. 
	LOW CONTACT Pinion is positioned too close to the center of drive bevel gear. 1) Increase thickness of bevel pinion shim and position pinion farther from gear center. 2) Adjust drive bevel gear backlash to specification referring to “Bevel Gear Back Lash Measurement and Adjustment” in this section. 
	These contact patterns indicate that the “offset” of reduction driven gear is too much or too little. The remedy is to change the division of the bevel gear shim(s).

TOOTH CONTACT PATTERN	DIAGNOSIS AND REMEDY
	These contact patterns, located on toe or heel on both drive and coast sides, mean that 1) both pinion and gear are defective, 2) retainer is not true, or 3) gear is not properly seated on transfer case. The remedy is to replace the defective member.
	Irregular patterns: If the pattern is not oval, it means that bevel gear is defective. High or low spots on tooth surfaces or on the seat of bevel gear are the cause of irregular patterns appearing on some teeth. The remedy is to replace the pinion and gear set and, if the seat is defective, so is transfer case.

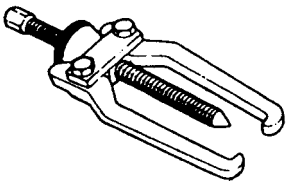
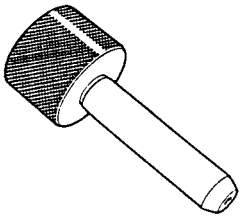
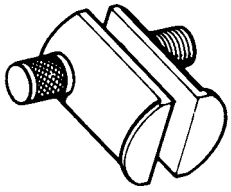
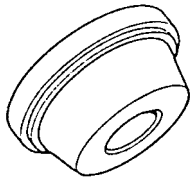
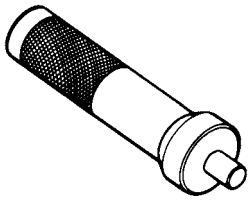
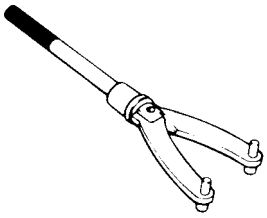
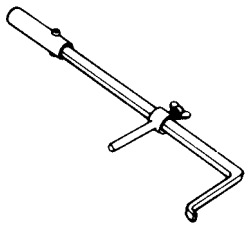
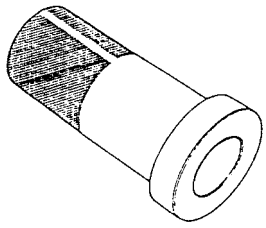
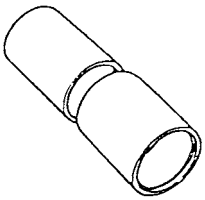
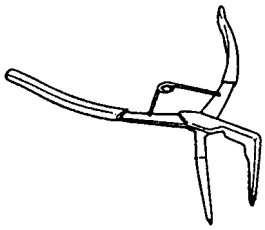
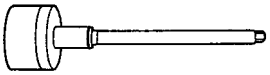
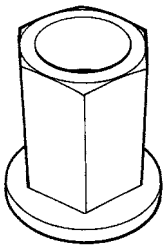
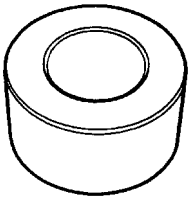
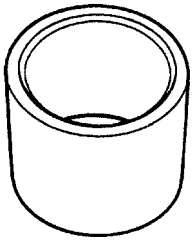
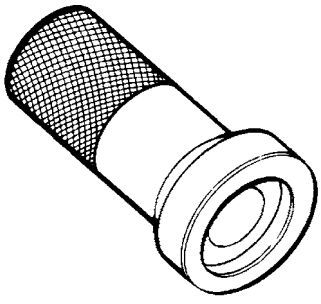
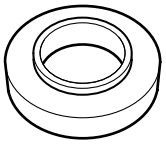
Tightening Torque Specification

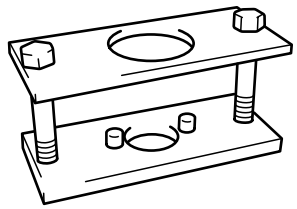
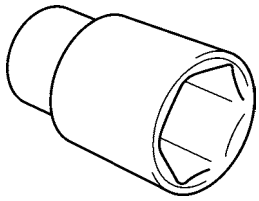
Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Transfer oil level/filler and drain plugs	21	2.1	15.5
Flange nut	100-300	10.0-30.0	72.5-217.0
Transfer case bolts	23	2.3	17.0
Transfer output retainer bolts	50	5.0	36.5
Transfer mounting bolts	50	5.0	36.5
Transfer rear mounting bracket bolts	55	5.5	40.0
Transfer rear mounting bracket nuts	55	5.5	40.0
Transfer mounting bolt	55	5.5	40.0
Transfer rear mounting bracket No.2 bolts	55	5.5	40.0
Transfer to engine stiffener No.1 bolts	50	5.0	36.5
Transfer to engine stiffener No.2 bolts	23	2.3	17.0
Transfer bevel gear nut	150	15.0	108.5
Transfer to transaxle stiffener bolts	50	5.0	36.5

Required Service Material

Material	Recommended SUZUKI products (Part Number)	Use
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Oil seal lips
Sealant	SUZUKI BOND NO. 1216B (99000-31230)	• Oil drain plug • Oil level plug • Mating surface of transfer case

Special Tool

 09913-65135 Bearing puller	 09925-58210 Oil seal installer	 09941-54911 Bearing outer race remover	 09924-84510-005 Bearing installer attachment
 09913-75821 Bearing installer attachment	 09930-40113 Rotor holder	 09913-50121 Oil seal remover	 09913-75810 Bearing installer
 09945-16070 Retainer ring installer set	 09952-76011 Snap ring pliers (closing type)	 09922-76140 Bevel pinion shaft	 09922-76150 Bevel pinion nut
 09922-76340 Rear collar	 09922-76430 Front collar	 09913-70123 Bearing installer	 09924-07720 Synchronizer hub installer

	
09924-57610 Gear holder	09941-58020 Socket wrench (40 mm)

SECTION 7F

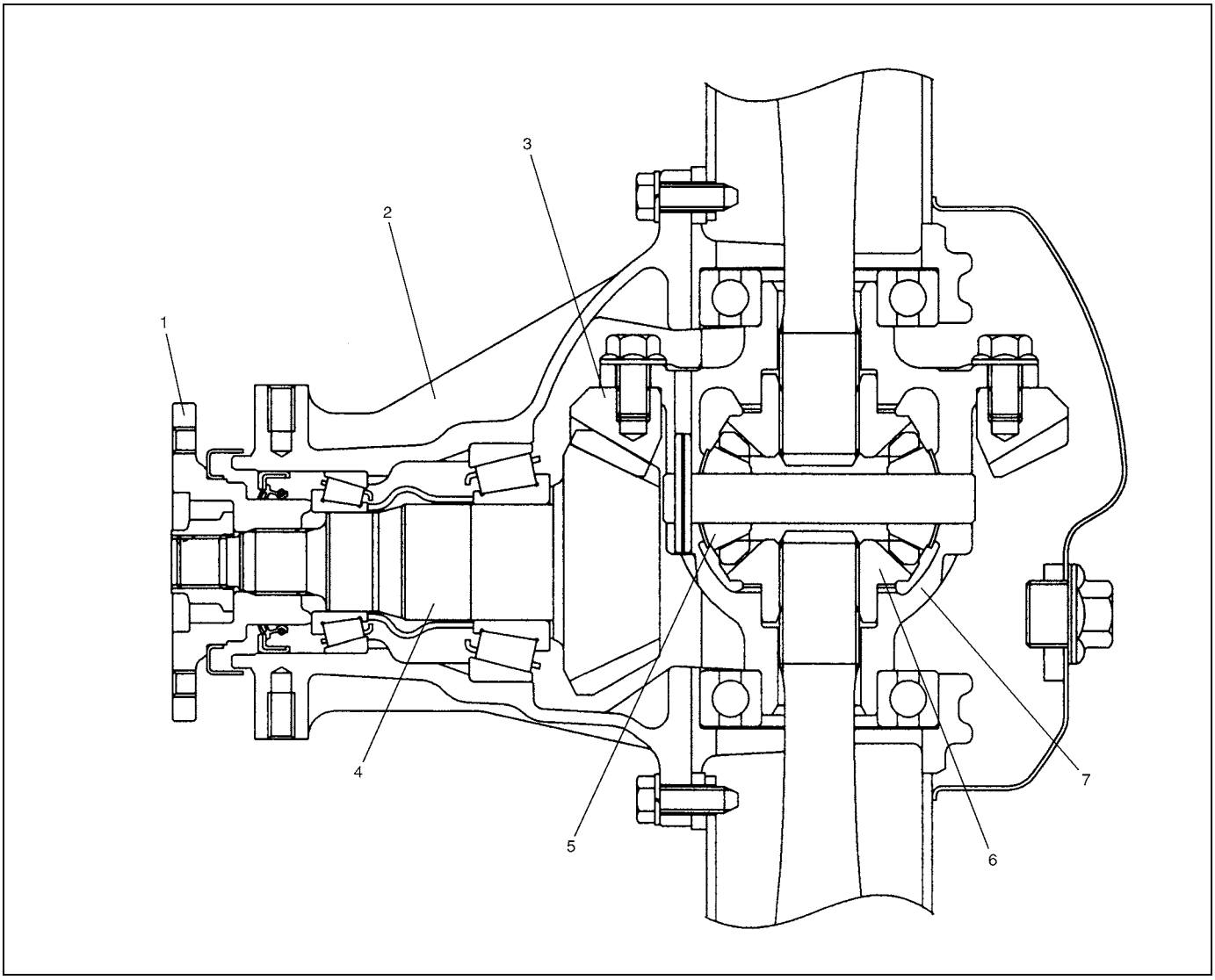
REAR DIFFERENTIAL

CONTENTS

General Description

Rear Differential Construction

The rear differential assembly for 4WD model uses a hypoid bevel pinion and gear.
The differential assembly is decisive in that the drive power is concentrated there. Therefore, use of genuine parts and specified torque is compulsory. Further, because of sliding tooth meshing with high pressure between bevel pinion and gear, it is mandatory to lubricate them by hypoid gear oil.
The hypoid gears have an advantage of preventing gear noise, at the same time, they require accurate adjustment of tooth contract and backlash.



1. Companion flange	5. Differential pinion
2. Differential carrier	6. Differential side gear
3. Drive bevel gear (hypoid gear)	7. Differential case
4. Drive bevel pinion (hypoid gear)	

Diagnosis

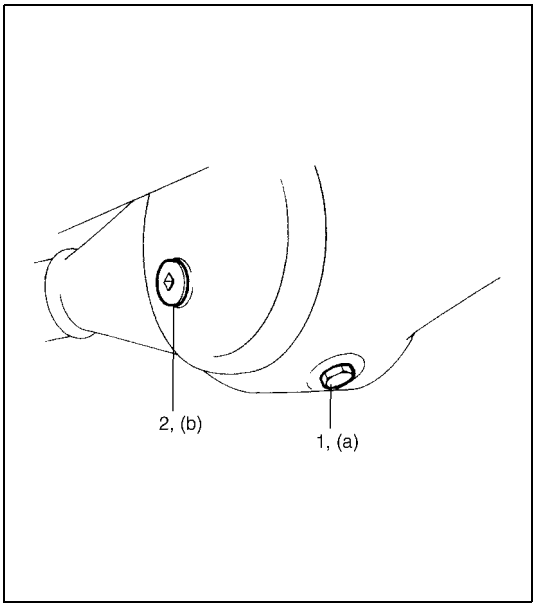
Rear Differential Symptom Diagnosis

Condition	Possible Cause	Correction
Gear noise	Deteriorated or water mixed lubricant	Repair and replenish.
	Inadequate or insufficient lubricant	Repair and replenish.
	Maladjusted backlash between bevel pinion and gear	Adjust and prescribed.
	Improper tooth contact in the mesh between bevel pinion and gear	Adjust or replace.
	Loose bevel gear securing bolts	Replace or retighten.
	Damaged side gear(s) or side pinion(s)	Replace.
Bearing noise	(Constant noise) Deteriorated or water mixed lubricant	Repair or replenish.
	(Constant noise) Inadequate or insufficient lubricant	Repair or replenish.
	(Noise while coasting) Damaged bearing(s) of bevel pinion	Replace.
	(Noise while turning) Damaged differential side bearing(s)	Replace.
Oil leakage	Clogged breather plug	Clean.
	Worn or damaged oil seal	Replace.
	Excessive oil	Adjust oil level.

On-Vehicle Service

Rear Differential Gear Oil Change

1) Before oil change or inspection, be sure to stop engine and set vehicle horizontally.
2) Check oil level and existence of leakage. For checking oil level roughly, lower point of level hole can be assumed to be standard point of level. If leakage is found, correct its cause.

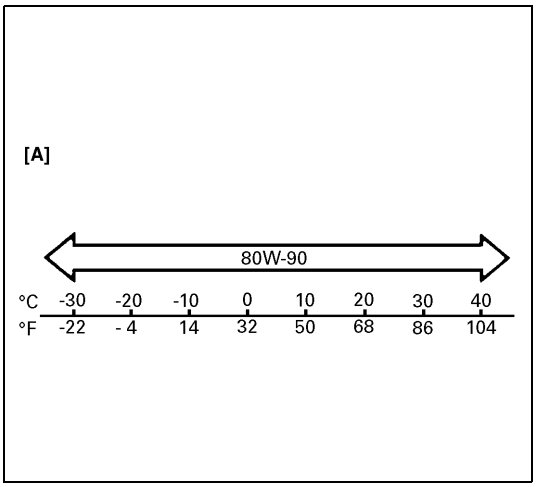


3) Remove level/filler plug (2) and drain plug (1), then drain differential oil.
4) Install new gasket to drain plug and tighten drain plug to specified torque.

Tightening torque
Rear differential oil drain plug
(a): 55 N·m (5.5 kg-m, 40.0 lb-ft)

5) Fill proper amount of new gear oil as specified below (roughly up to level hole).
6) Install new gasket to level/filler plug and tighten level/filler plug to specified torque.

Tightening torque
Rear differential oil level/filler plug
(b): 50 N·m (5.0 kg-m, 36.5 lb-ft)



NOTE:

- **It is highly recommended to use SAE 80W-90 viscosity.**
- **Whenever vehicle is hoisted for any other service work than oil change, also be sure to check for oil leakage.**

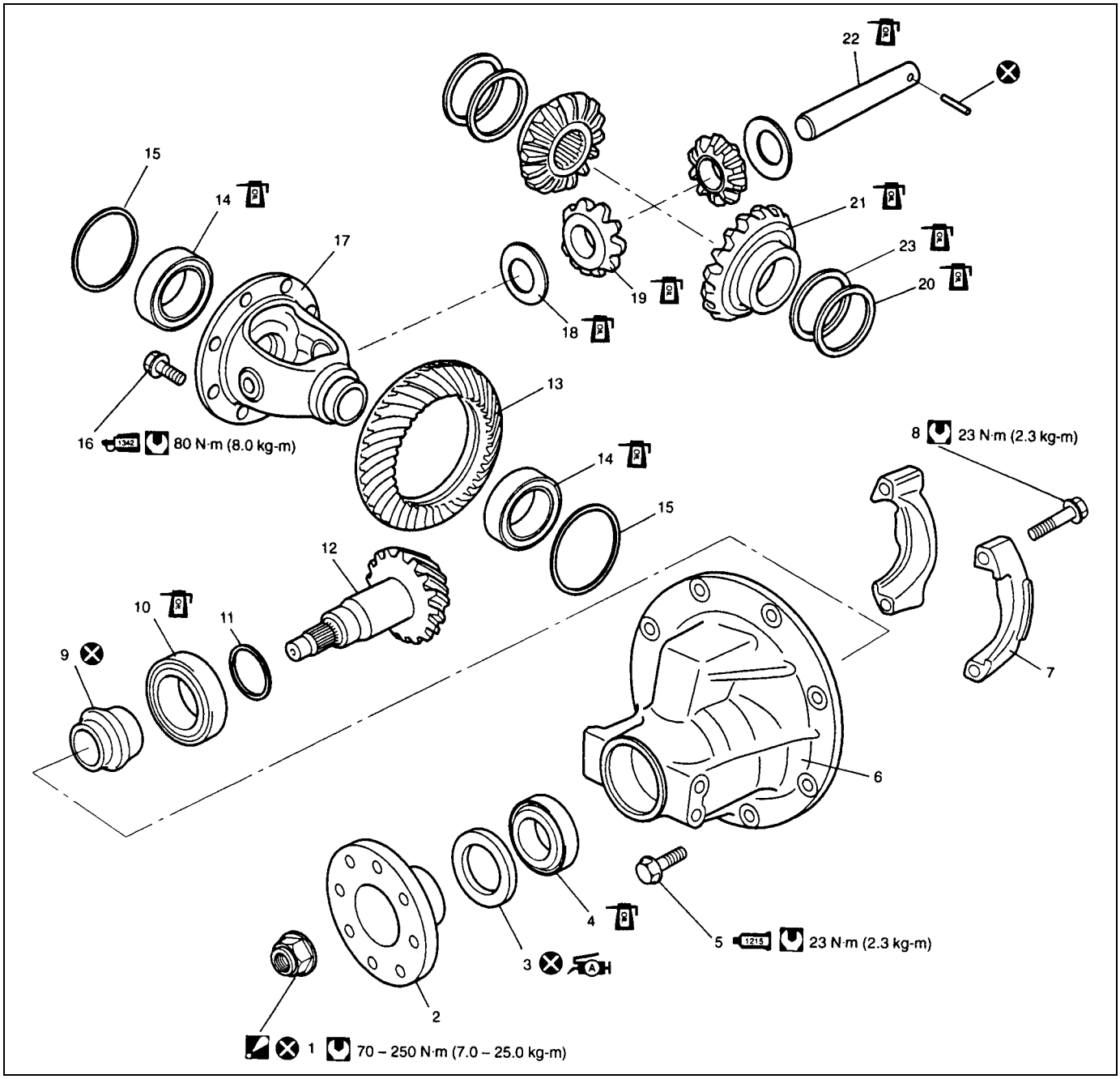
Differential oil
Hypoid gear oil API GL-5
For oil viscosity, refer to the chart.

Differential oil capacity
1.0 liters (2.1/1.8 US/Imp. pt)

[A]: Viscosity chart SAE

Unit Repair Overhaul

Rear Differential Components

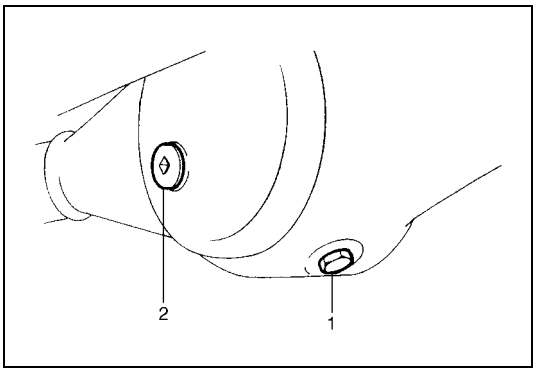


	1. Drive bevel pinion nut : After tightening nut so as rotational torque of drive bevel pinion to be in specified torque, caulk nut securely.	10. Drive bevel pinion rear taper roller bearing	19. Differential pinion
	2. Companion flange	11. Bevel pinion shim	20. Differential side washer
A H	3. Oil seal : Apply grease 99000-25010 to oil seal lip.	12. Drive bevel pinion (hypoid gear)	21. Differential side gear
	4. Drive bevel pinion front taper roller bearing	13. Drive bevel gear (hypoid gear)	22. Differential pinion shaft
1215	5. Differential carrier bolt : Apply sealant 99000-31110 to thread part.	14. Differential side bearing	23. Differential side spring washer
	6. Differential carrier	15. Shim	Do not reuse.
	7. Differential side bearing cap	1322 16. Drive bevel gear bolt : Apply thread lock cement 99000-32110 to thread.	Tightening torque
	8. Differential side bearing cap bolt	17. Differential case	OIL Apply differential oil.
	9. Spacer	18. Differential pinion washer	

Rear Differential Dismounting and Remounting

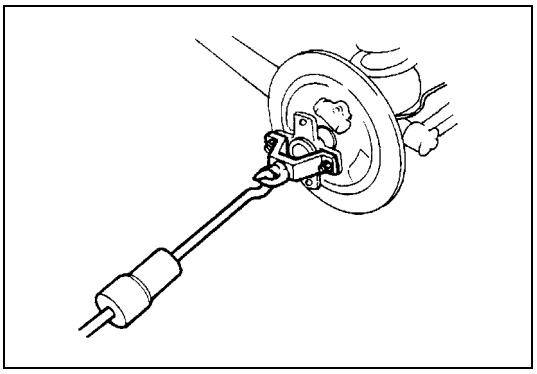
Dismounting

1) Hoist vehicle and remove wheels.

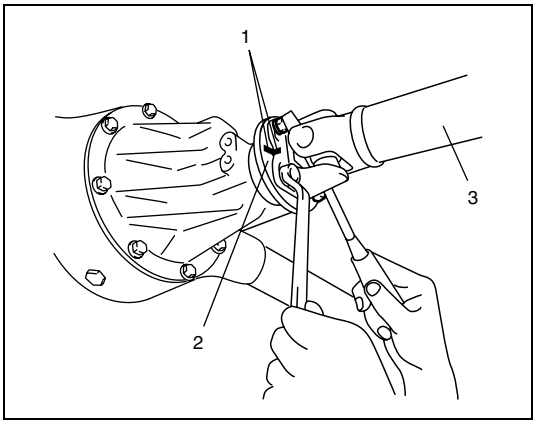


2) Drain oil from rear differential.

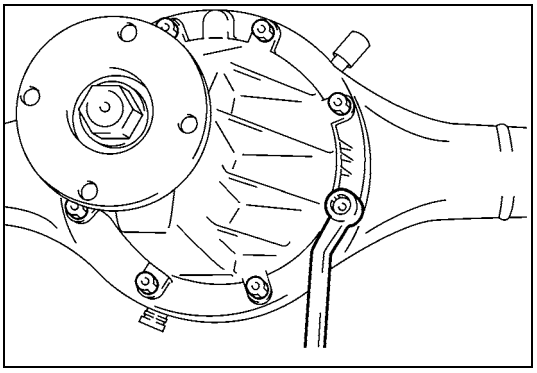
1.	Drain plug
2.	Level/filler plug



3) Remove brake drum and disconnect parking brake cable from brake back plate referring to “Parking Brake Lever Removal and Installation” in Section 5C.
4) Remove axle shafts referring to “Rear Axle Shaft and Wheel Bearing Removal and Installation (for 4WD Model)” in Section 3E.



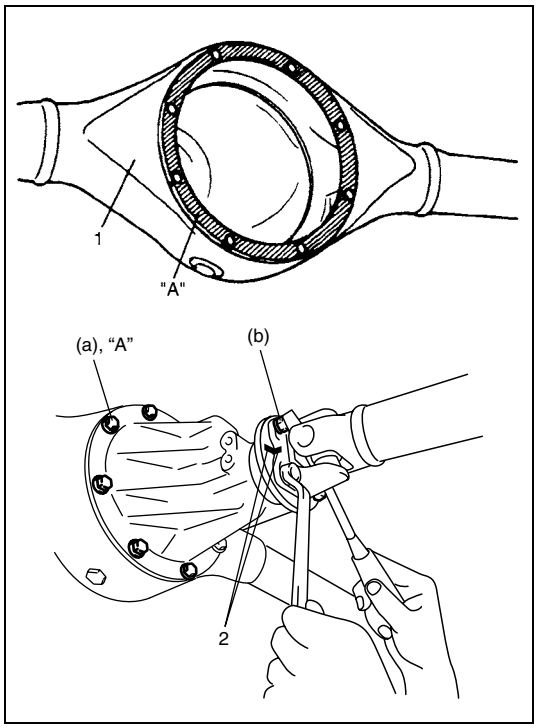
5) Before removing propeller shaft, give match marks (1) on companion flange (2) and propeller shaft (3) as shown.



6) Remove differential carrier bolts and differential assembly.

Remounting

Reverse removal procedure for installation, noting the following.



- Clean mating surfaces of axle housing (1) and differential carrier and apply sealant to housing side.

"A": Sealant 99000-31110

- Apply sealant to carrier bolts and tighten carrier bolts to specified torque.

"A": Sealant 99000-31110

Tightening torque
Differential carrier bolts
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

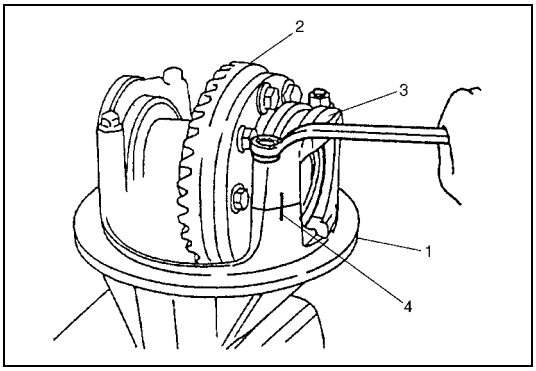
- Install propeller shaft to companion flange aligning match marks (2) and tighten propeller shaft bolts to specified torque.

Tightening torque
Propeller shaft bolts
(b): 23 N·m (2.3 kg-m, 17.0 lb-ft)

- For installation of rear axle shaft, refer to "Rear Axle Shaft and Wheel Bearing Removal and Installation (for 4WD Model)" in Section 3E.
- For installation of rear brake drum, refer to "Brake Drum Removal and Installation (for 4WD Model)" in Section 5C.
- Refill differential housing with new specified oil referring to "Rear Differential Gear Oil Change" in this section for refill.
- Make sure to purge air out of brake circuit referring to "Air Bleeding of Brake System" in Section 5. Then, ensure that joint seam of pipe is free from oil leak.

Rear Differential Disassembly

Disassembly



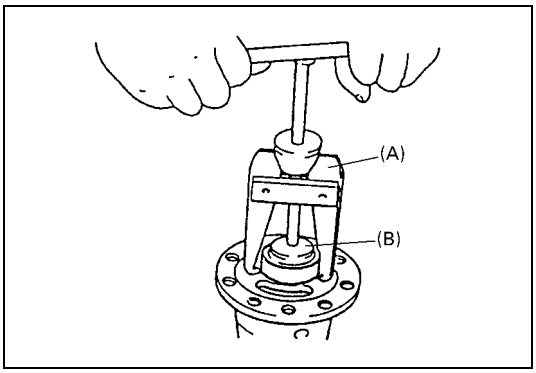
1) Put match marks (4) on differential side bearing caps (3) and differential carrier (1).

NOTE:

Check number of shims and thickness of each shim in advance.

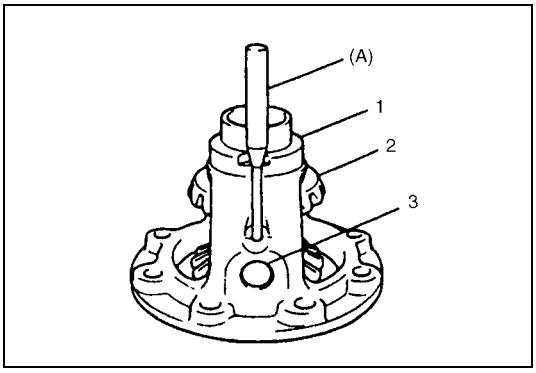
2) Take off differential side bearing caps by removing their bolts and remove differential gear assembly (2) with shims.

3) With aluminum plates placed on vise first, grip differential case with it and remove drive bevel gear by removing its bolts.



4) Using special tools, pull out differential side bearings.

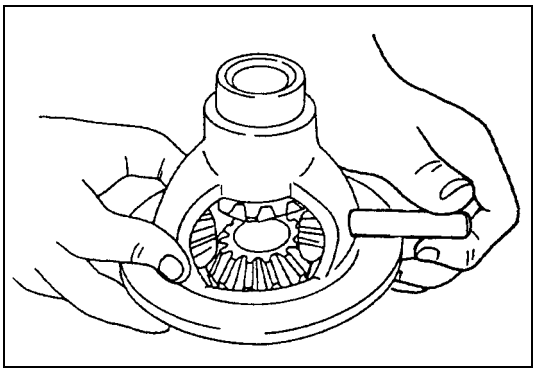
Special tool
(A): 09913-60910
(B): 09925-88210



5) Drive out spring pin with special tool.

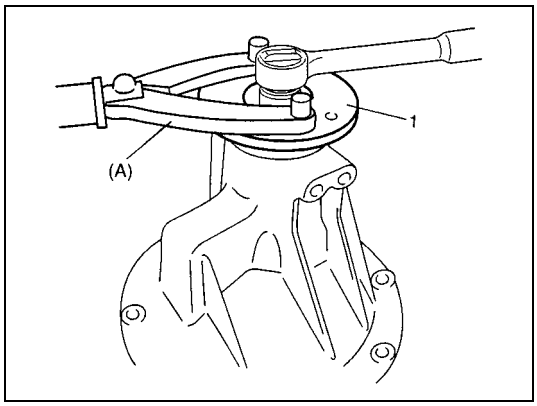
Special tool
(A): 09922-85811

1.	Differential case
2.	Differential side gear
3.	Differential pinion shaft



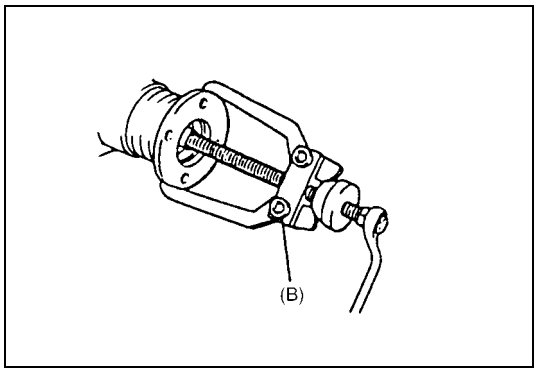
6) Remove differential pinion shaft.
7) Remove differential side gears, pinions and washers.

8) Uncaulk drive bevel pinion nut.



9) Hold companion flange (1) with special tool and then remove drive bevel pinion nut.

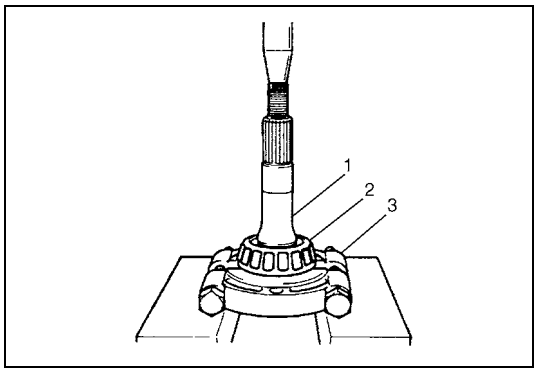
Special tool
(A): 09930-40113



10) Remove companion flange from drive bevel pinion. Use special tool if it is hard to remove.

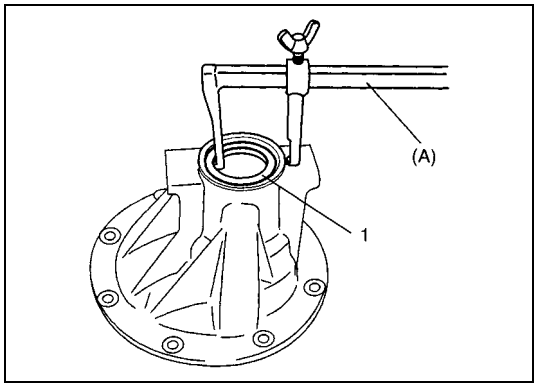
Special tool
(B): 09913-65135

11) Remove drive bevel pinion with rear bearing, and spacer from differential carrier.



12) Remove drive bevel pinion rear bearing (2) by using bearing puller (3) and hydraulic press.

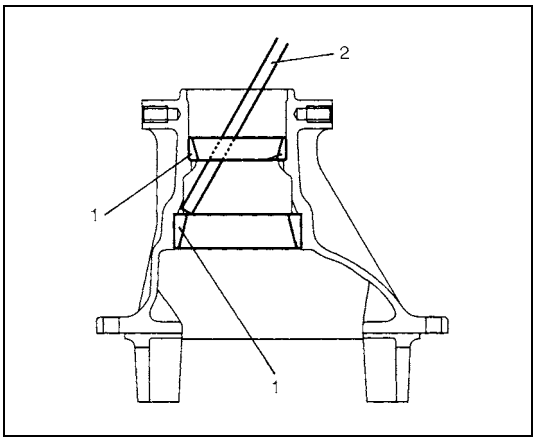
1. Drive bevel pinion



13) Remove oil seal (1) from differential carrier by using special tool.

Special tool
(A): 09913-50121

14) Remove drive bevel pinion front bearing.



15) Drive out drive bevel pinion bearing outer races (1) by using metallic stick (2).

Rear Differential Inspection

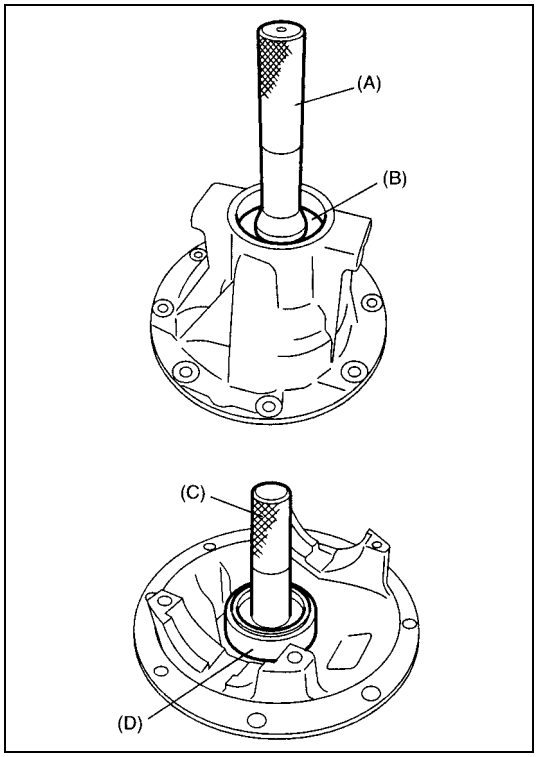
- Check companion flange for wear of damage.
- Check bearings for wear or discoloration.
- Check differential carrier for cracks.
- Check drive bevel pinion and bevel gear for wear or cracks.
- Check side gears, pinion gears and pinion shaft for wear or damage.
- Check side gear spline for wear or damage.

Rear Differential Adjustment and Assembly

CAUTION:
- **Drive bevel gear and pinion must be replaced as a set when either replacement becomes necessary.**
- **When replacing taper roller bearing, replace as inner race & outer race assembly.**

Judging from faulty conditions noted before disassembly and what is found through visual check of bearing and gear tooth etc. after disassembly, prepare replacing parts and proceed to reassembly according to procedures as described below. Make sure that all parts are clean.

Drive bevel pinion bearing outer race

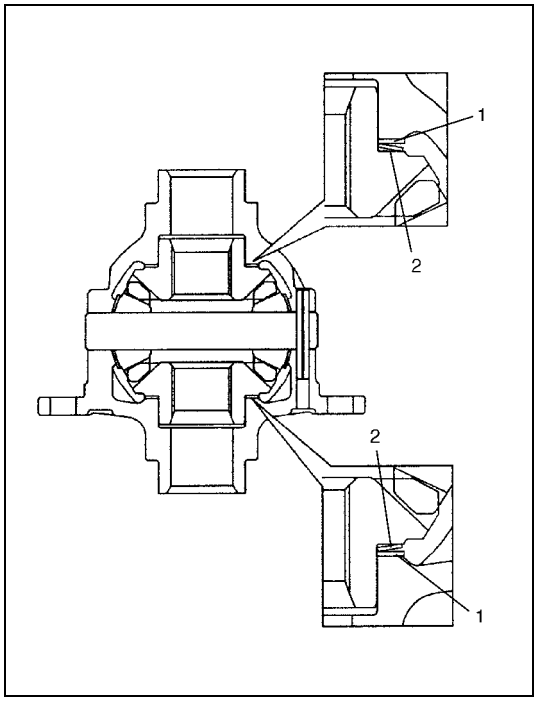


CAUTION:
Perform press-fitting carefully so as not to tilt outer race.

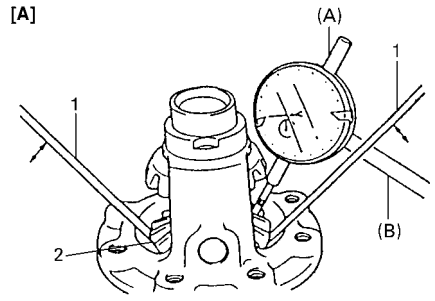
For press-fitting bevel pinion bearing outer races, use special tools as shown.

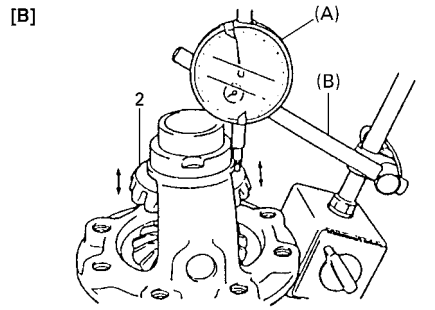
Special tool
(A): 09925-98210
(B): 09941-34513-004
(C): 09924-74510
(D): 09951-16090

Differential case assembly



1) Assemble differential case assembly noting installing position and direction of differential side washer (1) and spring washer (2).





2) Measure thrust play of differential gear (2) as follows.

Special tool
(A): 09900-20607
(B): 09900-20701

Differential gear thrust play
0 – 0.37 mm (0 – 0.014 in.)

[A]: Right side
[B]: Left side

Right side

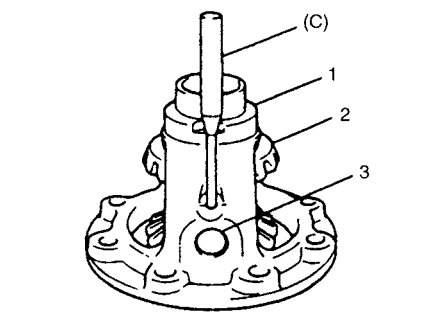
- Hold differential assembly with soft jawed vise and apply measuring tip of dial gauge to top surface of gear (2).
- Using 2 screwdrivers (1), move gear (2) up and down and read movement of dial gauge pointer.

Left side

- Using similar procedure to the above, set dial gauge tip to gear shoulder.
- Move gear (2) up and down by hand and read dial gauge.

3) If thrust play is out of specification, select suitable side washer from among the following available size, install it and check again that specified gear thrust play is obtained.

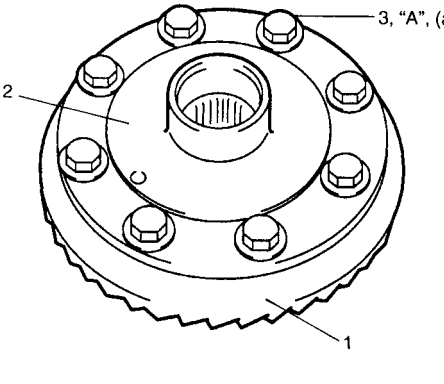
Available side washer thickness
0.10, 0.30, 0.50 and 0.70 mm (0.0039, 0.0118, 0.0196 and 0.0275 in.)



4) Drive in new spring pin for differential side pinion shaft till it is flush with differential case surface.

Special tool
(C): 09922-85811

1. Differential case
2. Differential gear
3. Differential pinon shaft

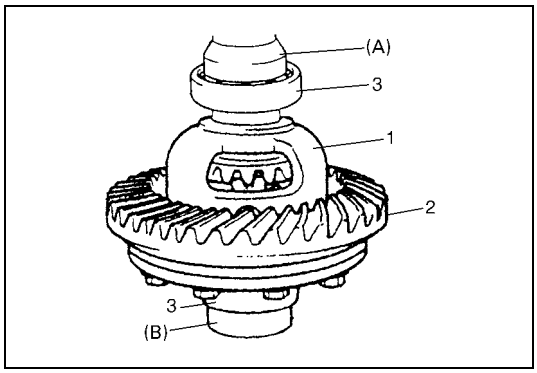


CAUTION:
Use of any other bolts than that specified is prohibited.

5) Put drive bevel gear (1) on differential case (2).
6) Apply thread lock cement to drive bevel gear bolts (3) and fasten drive bevel gear (1) on differential case (2) by tightening bolts to specified torque.

"A": Cement 99000-32110

Tightening torque
Drive bevel gear bolts
(a): 80 N·m (8.0 kg-m, 58.0 lb-ft)

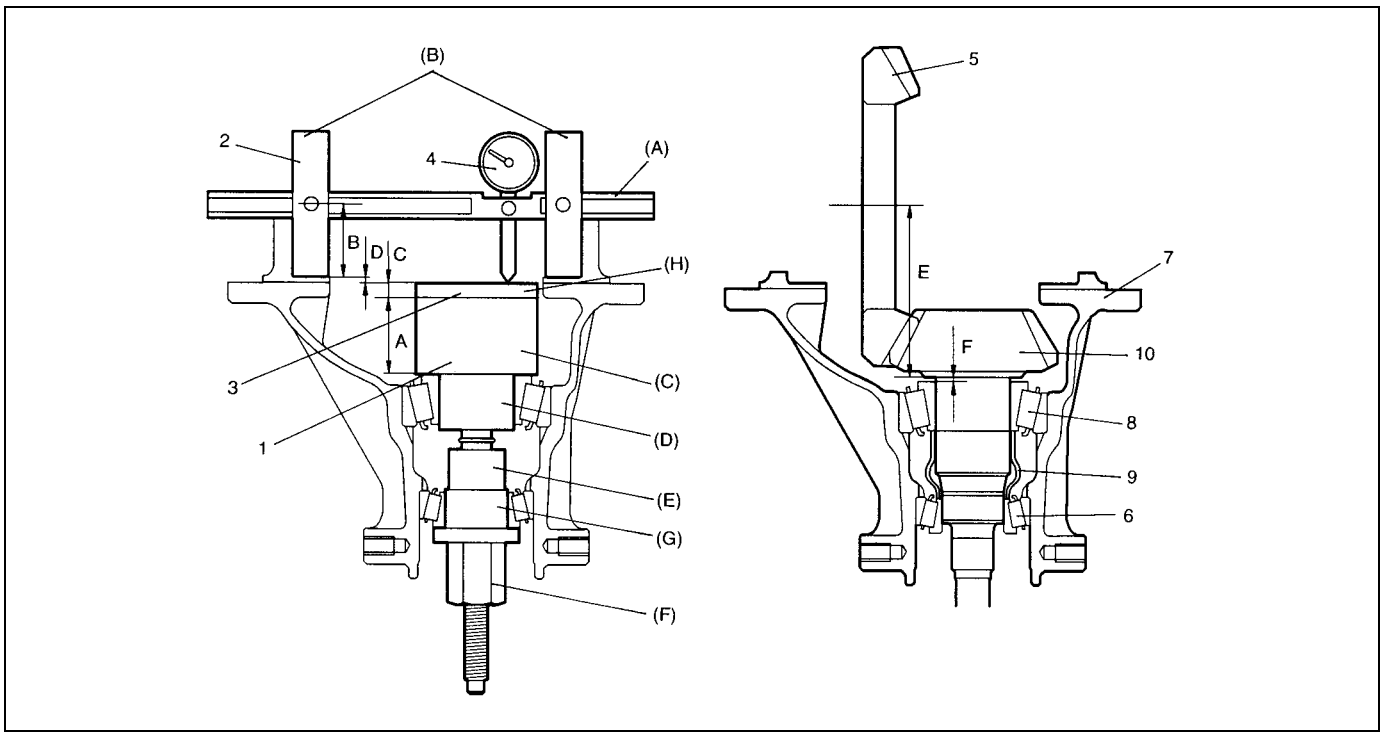


7) Press-fit differential side bearings (3) to differential case (1) by using special tools.

Special tool
(A): 09951-76010
(B): 09951-16060

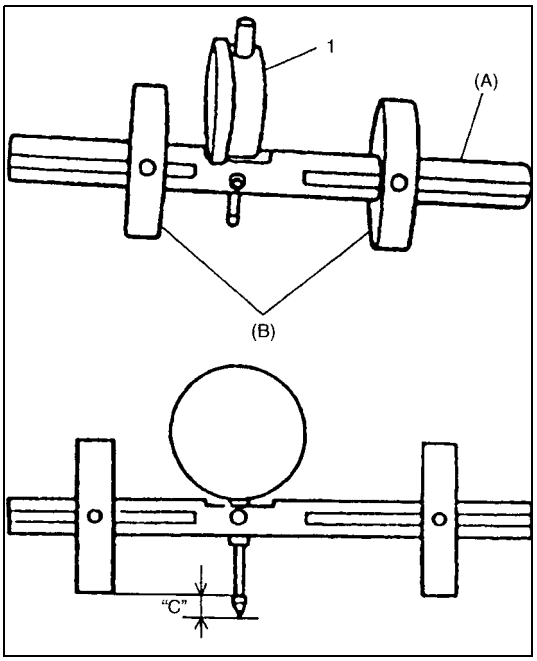
2. Drive bevel gear

Differential carrier and drive bevel pinion



A: Dummy height of pinion form dummy (= 40 mm/1.575 in.)	F: Shim thickness for mounting distance adjustment (= D)	6. Front bearing
B: Radius of bearing form dummy with dummy shaft (= 36 mm/1.417 in.)	1. Pinion form dummy	7. Differential carrier
C: Block dummy thickness (= 4 mm/0.1575 in.)	2. Bearing form dummy with dummy shaft	8. Rear bearing
A + B + C: Mounting distance adjusting dummy total size (= 80 mm/3.150 in.)	3. Block dummy	9. Spacer
D: Measured dimension	4. Dial gauge	10. Drive bevel pinion
E: Drive bevel pinion mounting distance (= 80 mm/3.150 in.)	5. Drive bevel gear	

Special tool
(A): 09922-76120
(B): 09922-76230
(C): 09922-76140
(D): 09922-76410
(E): 09922-76340
(F): 09922-76150
(G): 09922-76320
(H): 09922-76510

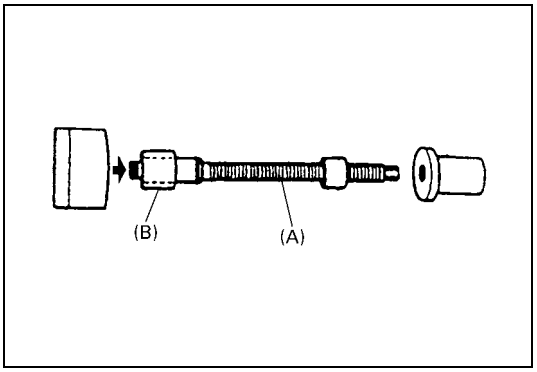


1) Assemble bearing form dummy with dummy shaft using special tools.

Special tool
(A): 09922-76120
(B): 09922-76230

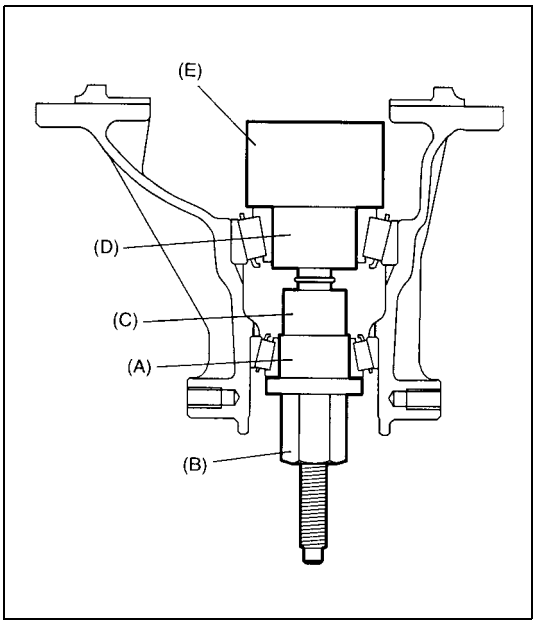
2) Install dial gauge (1) to bearing form dummy with dummy shaft as shown in figure.

Special tool set distance (reference)
"c": 2 – 3 mm (0.079 – 0.118 in.)



3) Assemble pinion form dummy using special tools.

Special tool
(A): 09922-76140
(B): 09922-76410

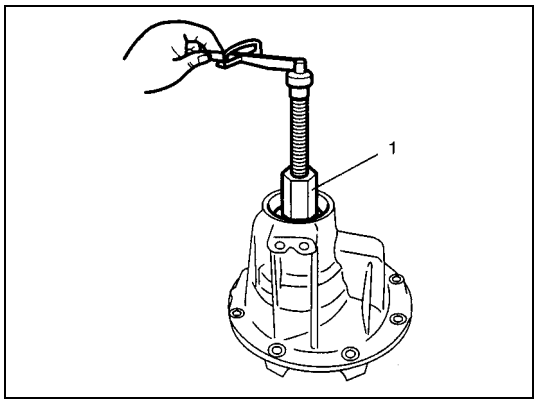


NOTE:

This installation requires no spacer or oil seal.

4) Apply gear oil to drive bevel pinion rear bearing, install rear bearing to pinion form dummy and then install pinion form dummy to differential carrier.
5) Apply gear oil to drive bevel pinion front bearing and install bearing to pinion form dummy with other special tools as shown in figure.

Special tool
(A): 09922-76320
(B): 09922-76150
(C): 09922-76340
(D): 09922-76410
(E): 09922-76140

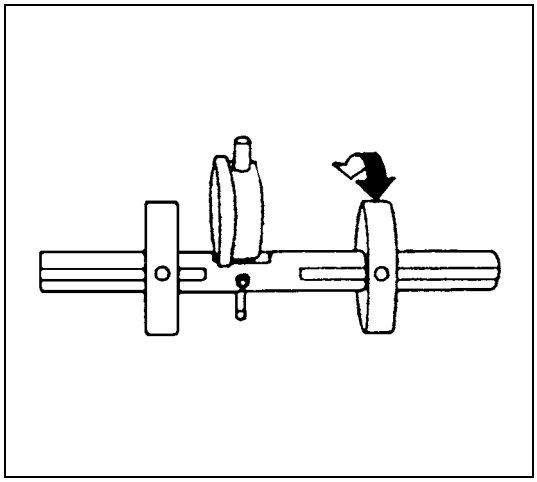


NOTE:

Before taking measurement, check for rotation by hand more than 15 revolutions.

6) Tighten bevel pinion nut (special tool) (1) so that specified bearing preload is obtained.

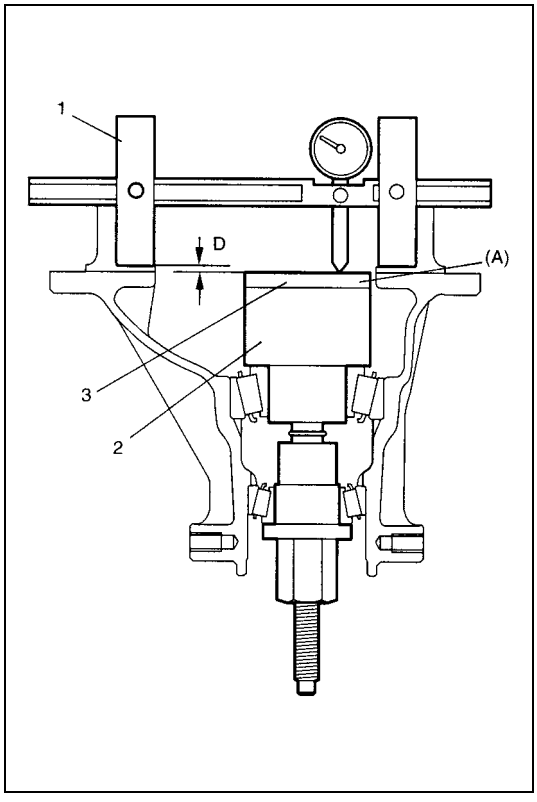
Drive bevel pinion bearing preload (at 50 rpm)
0.5 – 1.3 N·m (5.0 – 13.0 kg-cm, 0.35 – 0.90 lb-ft)



NOTE:

- **When setting dial gauge to bearing form dummy with dummy shaft, tighten screw lightly. Be careful not to overtighten it, which will cause damage to dial gauge.**
- **With dial gauge set, turn dummy back and forth by hand a couple of times and attain accurate 0 (zero) adjustment.**
- **It is desirable that short pointer indicates beyond 2 mm when long one is at 0 (zero).**

7) Set dial gauge to bearing form dummy with dummy shaft and make 0 (zero) adjustment on surface plate.



8) Put block dummy (3) on pinion form dummy (2).

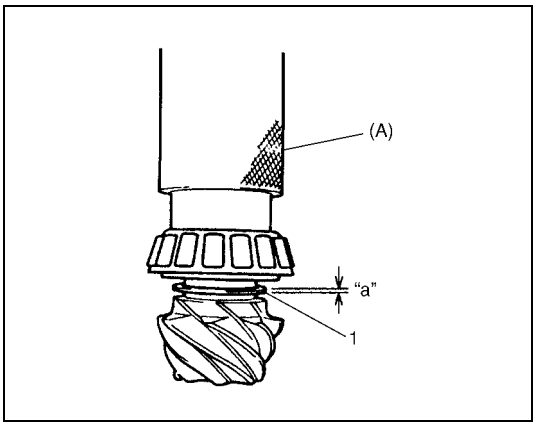
Special tool
(A): 09922-76510

NOTE:

- **Repeat turning back and forth of dummy and measure distance as far as top surface of block dummy accurately.**
- **When dial gauge measuring tip extends from 0 (zero) position, pointer turns counterclockwise.**
- **Measured value may exceed 1 mm. Therefore, it is also necessary to know reading of short pointer.**

9) Place zero-adjusted bearing form dummy with dummy shaft (1) and dial gauge set on block dummy (3) and take measurement between zero position and extended dial gauge measuring tip.
10) Obtain adjusting shim thickness by using measured value by dial gauge in the following equation.

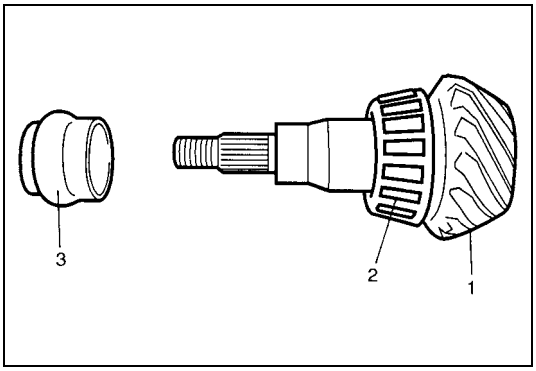
Necessary shim thickness	=	Dial gauge measured value D



11) Select adjusting shim(s) (1) closest to calculated value from among following available sizes and put it in place and then press-fit rear bearing.

Special tool
(A): 09940-51710

Available shim thickness
"a": 0.30, 1.00, 1.03, 1.06, 1.09, 1.12, 1.15, 1.18, 1.21, 1.24, 1.27, and 1.30 mm (0.012, 0.039, 0.041, 0.042, 0.043, 0.044, 0.045, 0.046, 0.048, 0.049, 0.050 and 0.051 in.)

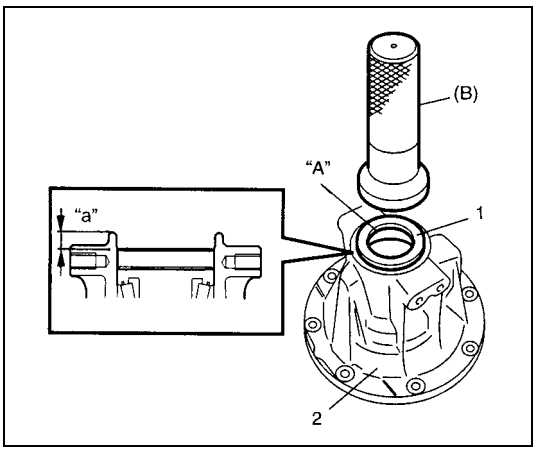


NOTE:

- **Make sure to use new spacer (3) for reinstallation.**
- **Apply differential oil to bearings.**

12) With new pinion spacer (3) inserted as shown, install front bearing to differential carrier.

1.	Drive bevel pinion
2.	Rear bearing



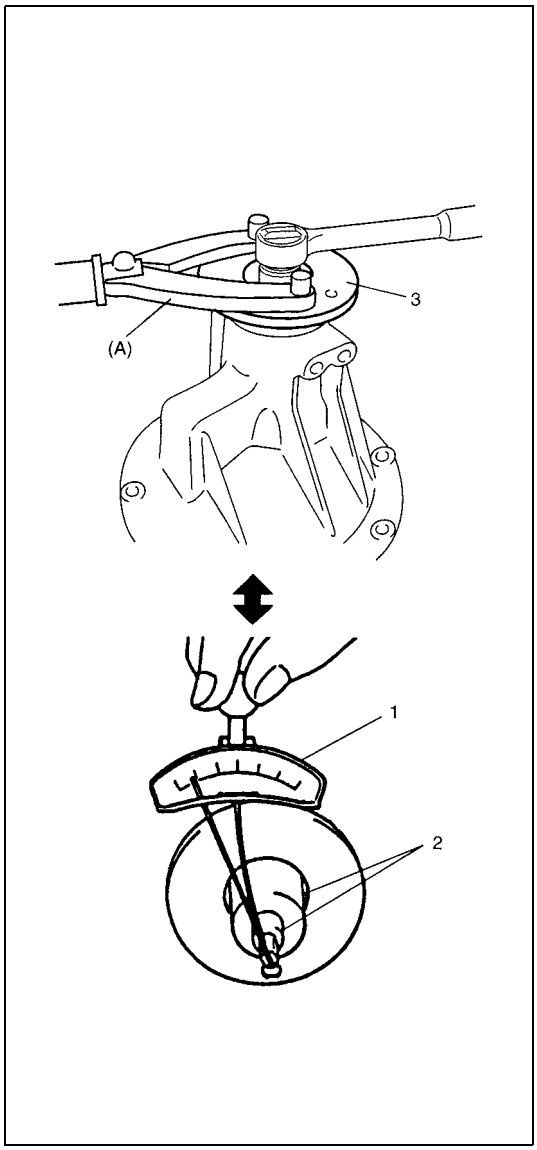
13) Install new oil seal (1) into differential carrier (2) by using special tool and hammer.

Special tool
(B): 09913-75810

Differential carrier oil seal installing depth
"a": 7.5 – 8.5 mm (0.295 – 0.335 in.)

14) Apply grease to new oil seal lip.

"A": Grease 99000-25010



NOTE:

- **Before taking measurement, check for smooth rotation by hand.**
- **Drive bevel pinion bearing preload is adjusted by tightening drive bevel pinon nut to deform spacer.**
  Therefore, be sure to use a new spacer for adjustment and tighten drive bevel pinion nut step by step and check for starting torque (preload) as often as tightening to prevent over crushing of spacer.
  If exceeds specification given below during adjustment, replace spacer and repeat preload adjustment procedure. Attempt to decrease starting torque (preload) by loosening drive bevel pinon nut will not do.
- **For measuring drive bevel pinion bearing preload, turning drive bevel pinion at about 50 rpm is required.**

15) Install companion flange (3) to drive bevel pinion and tighten drive bevel pinion nut gradually with special tool, set preload of bearing to specification.

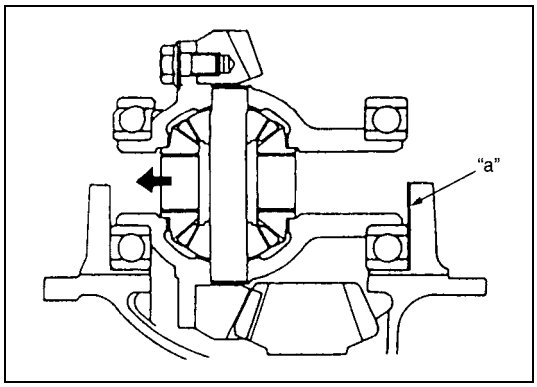
Tightening torque
Drive bevel pinion nut (reference)
70 – 250 N·m (7.0 – 25.0 kg-m, 51.0 – 181.0 lb-ft)

Drive bevel pinion bearing preload
0.5 – 1.3 N·m (5.0 – 13.0 kg-cm, 0.35 – 0.90 lb-ft)

Special tool
(A): 09930-40113

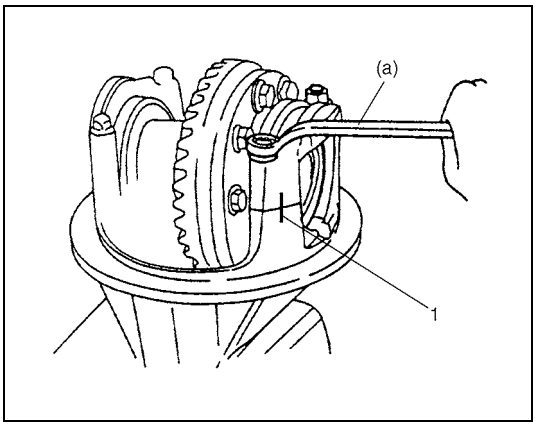
1.	Torque wrench
2.	Socket with adapter

Differential Assembly



1) Place differential gear case assembly to differential carrier, push differential case to left side as shown in figure.
   Then measure clearance "a" between side bearing and differential carrier by using thickness gauge.
   Select shims closest to measured value.

Available shim thickness
0.1, 0.3, 0.5 and 0.7 mm (0.0039, 0.0117, 0.0197 and 0.0276 in.)

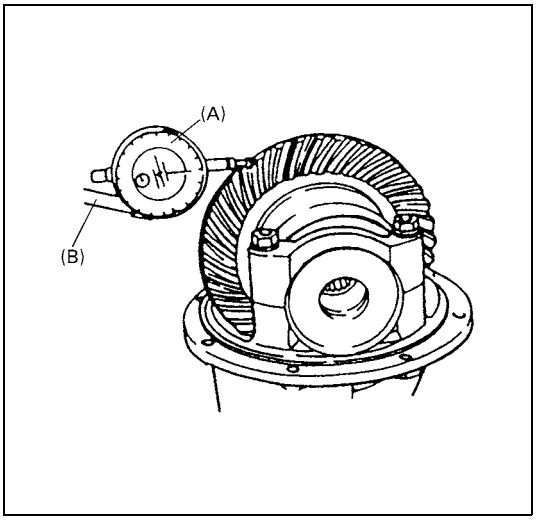


NOTE:

- **Align match marks (1) on caps and carrier.**
- **Apply differential gear oil to bearings.**

2) Divide selected shim(s) between both sides (right and left) and install them to differential carrier. Then install differential side bearing caps.

Tightening torque
Differential side bearing cap bolts
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



NOTE:

Be sure to apply measuring tip of dial gauge at right angles to convex side (drive side) of tooth.

3) Measure backlash by using dial gauge.
If backlash is out of specification, change division of shims so that backlash is within specification.

Drive bevel gear backlash
0.10 – 0.20 mm (0.0039 – 0.0078 in.)

Special tool
(A): 09900-20607
(B): 09900-20701

4) Check gear tooth contact as follows.

CAUTION:

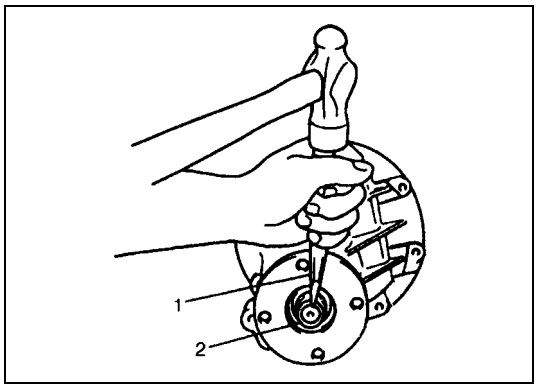
When applying red lead paste to teeth, be sure to paint tooth surfaces uniformly. The paste must not be too dry or too fluid.

a) After cleaning tooth surface of drive bevel gear, paint teeth with gear marking compound evenly by using brush or sponge etc.

NOTE:

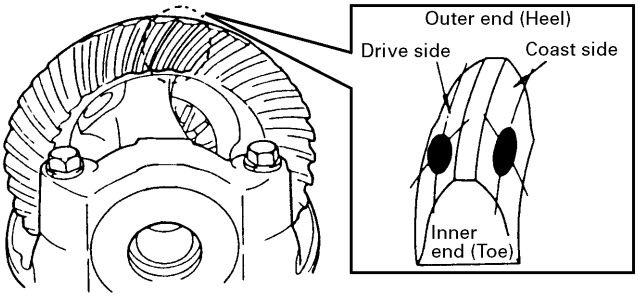
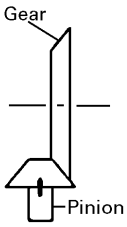
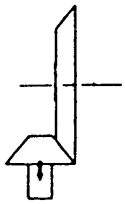
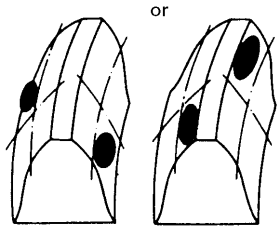
Be careful not to turn bevel gear more than one full revolution, or it will hinder accurate check.

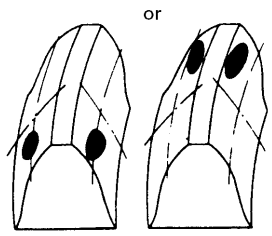
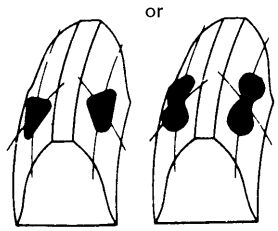
b) Turn gear to bring its painted part in mesh with bevel pinion and turn it back and forth by hand to repeat their contact.
c) Bring painted part up and check contact pattern, referring to the following chart. If contact pattern is not normal, readjust or replace as necessary according to instruction in chart.



5) After completing of gear tooth contact check, caulk drive bevel pinion nut (2) with caulking tool (1) and hammer.

Gear Tooth Contact

Tooth Contact Pattern	Diagnosis and Remedy
	NORMAL
	HIGH CONTACT Pinion is positioned too far from the center of drive bevel gear. 1) Increase thickness of pinion height adjusting shim and position pinion closer to gear center. 2) Adjust drive bevel gear backlash to specification. 
	LOW CONTACT Pinion is positioned too close to the center of drive bevel gear. 1) Decrease thickness of pinion height adjusting shim and position pinion farther from gear center. 2) Adjust drive bevel gear backlash to specification. 
	These contact patterns indicate that the “offset” of differential is too much or too little. The remedy is to replace the carrier with a new one.

Tooth Contact Pattern	Diagnosis and Remedy
	These contact patterns, located on toe or heel on both drive and coast sides, mean that 1) both pinion and gear are defective, 2) carrier is not true and square, or 3) gear is not properly seated on differential case. The remedy is to replace the defective member.
	Irregular patterns: If the pattern is not oval, it means that bevel gear is defective. High or low spots on tooth surfaces or on the seat of bevel gear are the cause of irregular patterns appearing on some teeth. The remedy is to replace the pinion and-gear set and, if the seat is defective, so is transfer case.

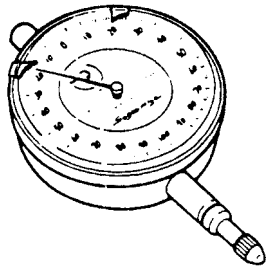
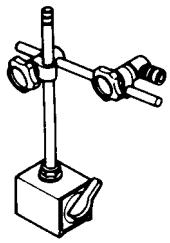
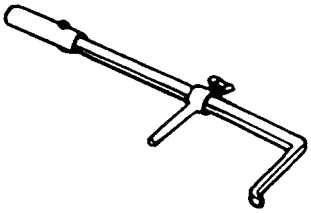
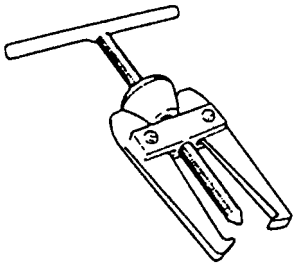
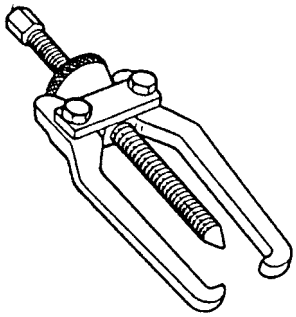
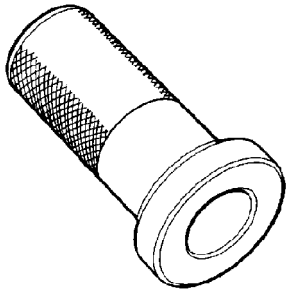
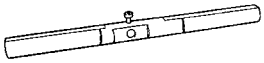
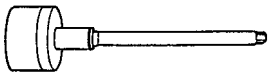
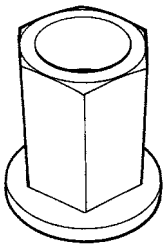
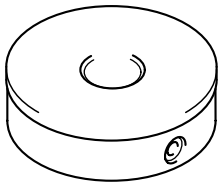
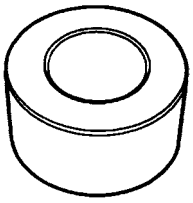
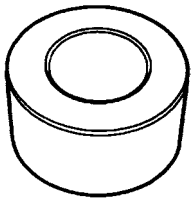
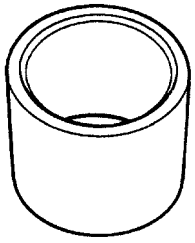
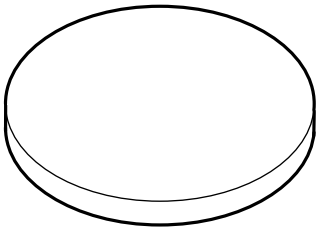
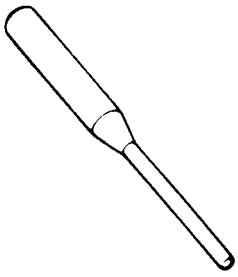
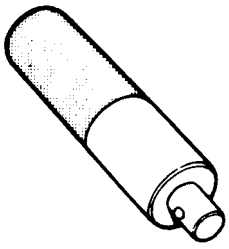
Tightening Torque Specification

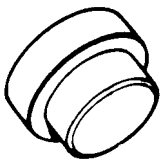
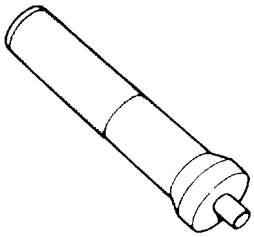
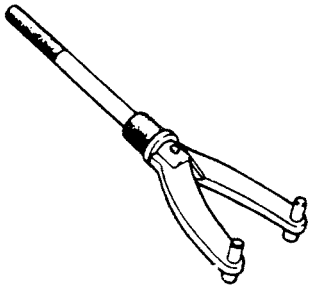
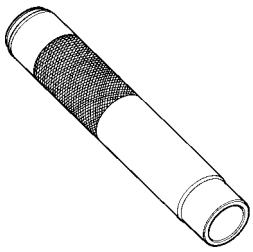
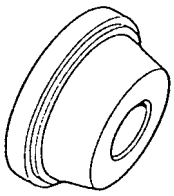
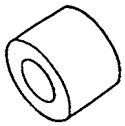
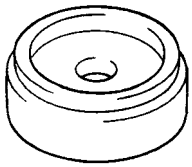
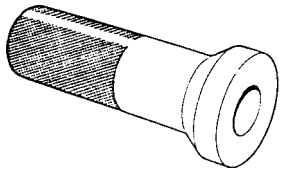
Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Rear differential oil drain plug	55	5.5	40.0
Rear differential oil level/filler plug	50	5.0	36.5
Drive bevel pinion nut (reference)	70 – 250	7.0 – 25.0	51.0 – 181.0
Drive bevel gear bolts	80	8.0	58.0
Differential side bearing cap bolts	23	2.3	17.0
Differential carrier bolts	23	2.3	17.0
Propeller shaft bolts	23	2.3	17.0

Required Service Material

Material	Recommended product (Part Number)	Use
Thread lock cement	THREAD LOCK CEMENT 1322 (99000-32110)	Drive bevel gear bolts
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	Oil seal lips
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	• Thread part of differential carrier bolt • Mating surface of differential carrier • Mating surface of rear axle housing

Special Tool

 09900-20607 Dial gauge	 09900-20701 Magnetic stand	 09913-50121 Oil seal remover	 09913-60910 Bearing puller
 09913-65135 Bearing puller	 09913-75810 Bearing installer	 09922-76120 Dummy shaft	 09922-76140 Bevel pinion shaft
 09922-76150 Bevel pinion nut	 09922-76230 Bevel gear dummy	 09922-76320 Rear collar	 09922-76340 Rear collar
 09922-76410 Front collar	 09922-76510 Gauge block	 09922-85811 Spring pin remover	 09924-74510 Bearing installer handle

			
09925-88210 Bearing puller attachment	09925-98210 Bearing installer	09930-40113 Flange holder	09940-51710 Bearing installer
			
09941-34513-004 Bearing installer	09951-16060 Lower arm bush remover	09951-16090 Oil seal installer	09951-76010 Bearing installer

SECTION 8

BODY ELECTRICAL SYSTEM

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

SECTION 8B

LIGHTING SYSTEM

WARNING:

For vehicles equipped with Supplement Restraint (Air Bag) System:

- **Service on around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" in Section 10B in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

Diagnosis

Headlight Symptom Diagnosis

Condition	Possible Cause	Correction
Only one light does not light	Bulb burnt out	Replace bulb.
	Main fuse blown	Replace fuse to check for short.
	Socket, wiring or grounding faulty	Repair socket or circuit.
No headlight light when lighting switch is in "HEAD" position	Main fuse blown	Replace fuse to check for short.
	Headlight relay faulty	Replace headlight relay
	Lighting or dimmer and passing switch faulty	Check lighting or dimmer and passing switch referring to "Light Control Switch Combination Unit Inspection" or "Dimmer/Passing Switch Inspection" in this section.

Headlight Leveling System Symptom Diagnosis

Condition	Possible Cause	Correction
Neither headlight moves	Fuse blown	Replace fuse to check for short.
	Headlight leveling switch faulty	Check headlight leveling switch referring to "Light Control Switch Combination Unit Inspection" in this section.
	Supply voltage too low	Check charging system referring to "Generator" in Section 6H.
Only one headlight does not move	Headlight leveling actuator faulty	Replace headlight housing.
	Socket, wiring or grounding faulty	Repair socket or circuit.

Daytime Running Light (D.R.L.) System (If Equipped) Symptom Diagnosis

Condition	Possible Cause	Correction
No headlight light when lighting switch is in "OFF" position and engine is running	Engine oil pressure switch faulty	Check engine oil pressure switch referring to "Engine Oil Pressure Switch Inspection" in Section 8C.
	Lighting switch faulty	Check lighting switch referring to "Light Control Switch Combination Unit Inspection" in this section.
	Wiring or grounding faulty	Repair circuit.
	Lighting controller faulty	Check lighting controller referring to "Lighting Controller Circuit Inspection" in this section.

Condition	Possible Cause	Correction
Headlights still light even if lighting switch is in "OFF" position and engine is stopped	Engine oil pressure switch	Check engine oil pressure switch referring to "Engine Oil Pressure Switch Inspection" in Section 8C.
	Lighting switch faulty	Check lighting switch referring to "Light Control Switch Combination Unit Inspection" in this section.
	Wiring or grounding faulty	Repair circuit.
	Lighting controller faulty	Check lighting controller referring to "Lighting Controller Circuit Inspection" in this section.
Headlights still light even if lighting switch is in "SMALL" position and engine is running	Lighting switch faulty	Check lighting switch referring to "Light Control Switch Combination Unit Inspection" in this section.
	Wiring or grounding faulty	Repair circuit.
	Lighting controller faulty	Check lighting controller referring to "Lighting Controller Circuit Inspection" in this section.

Turn Signal and Hazard Warning Light Symptom Diagnosis

Condition	Possible Cause	Correction
Flash rate high or one side only flashes	Wiring or grounding faulty	Repair circuit.
	Incorrect bulb	Replace bulb.
	Bulb burnt out	Replace bulb.
	Turn signal and hazard warning light relay faulty	Check turn signal and hazard warning light relay referring to "Turn Signal and Hazard Warning Light Relay Inspection" in this section.
	Open circuit or high resistance existing between turn signal switch and turn signal lights on one side	Repair circuit.
No flashing	Blown fuse on turn signal and hazard warning light circuit	Replace fuse to check for short.
	Open circuit or high resistance existing between battery and turn signal or hazard warning light switch	Repair circuit.
	Turn signal and hazard warning light relay faulty	Check turn signal and hazard warning light relay referring to "Turn Signal and Hazard Warning Light Relay Inspection" in this section.
	Turn signal switch faulty	Check turn signal switch referring to "Turn Signal Switch Inspection" in this section.
	Hazard warning light switch faulty	Check hazard warning light switch referring to "Hazard Warning Light Switch Inspection" in this section.

Condition	Possible Cause	Correction
Flash rate low	Supply voltage too low	Check charging system referring to "Generator" in Section 6H.
	Turn signal and hazard warning light relay faulty	Check turn signal and hazard warning light relay referring to "Turn Signal and Hazard Warning Light Relay Inspection" in this section.

Clearance, Tail and Licence Plate Lights Symptom Diagnosis

Condition	Possible Cause	Correction
One of lights does not light	Bulb burnt out	Replace bulb.
	Wiring or grounding faulty	Repair circuit.
No light comes on when lighting switch is in "SMALL" position	Fuse blown	Replace fuse to check for short.
	Lighting switch faulty	Check lighting switch referring to "Light Control Switch Combination Unit Inspection" in this section.

Backup Lights Symptom Diagnosis

Condition	Possible Cause	Correction
Backup lights do not light	Fuse blown	Replace fuse to check for short.
	Bulb burnt out	Replace bulb.
	Backup light switch faulty	Check backup light switch referring to "Back Up Lamp Switch Inspection" in Section 7A1.
	Wiring or grounding faulty	Repair circuit.
Backup lights remain ON	Wiring or grounding faulty	Repair circuit.
	Backup light switch faulty	Check backup light switch referring to "Back Up Lamp Switch Inspection" in Section 7A1.

Brake Lights Symptom Diagnosis

Condition	Possible Cause	Correction
Brake lights do not light	Fuse blown	Replace fuse to check for short.
	Bulb burnt out	Replace bulb.
	Brake light switch faulty	Adjust or replace brake light switch.
	Wiring or grounding faulty	Repair circuit.
Brake lights stay ON	Brake light switch faulty	Adjust or replace brake light switch.
Only one brake light does not light	Bulb burnt out	Replace bulb.
	Wiring or grounding faulty	Repair circuit.

Front Fog Lights (If Equipped) Symptom Diagnosis

Condition	Possible Cause	Correction
Only one front fog light does not light	Bulb burnt out	Replace bulb.
	Socket, wiring or grounding faulty	Repair socket or circuit.
No front fog light lights	Fuse blown	Replace fuse to check for short.
	Wiring or grounding faulty	Repair circuit.
	Front fog light switch faulty	Check front fog light switch referring to “Light Control Switch Combination Unit Inspection” in this section.
	Lighting switch faulty	Check lighting switch referring to “Light Control Switch Combination Unit Inspection” in this section.
	Lighting controller faulty	Check lighting controller referring to “Lighting Controller Circuit Inspection” in this section.

Rear Fog Light Symptom Diagnosis

Condition	Possible Cause	Correction
No rear fog light lights	Fuse blown	Replace fuse to check for short.
	Wiring or grounding faulty	Repair circuit.
	Rear fog light switch faulty	Check rear fog light switch referring to “Light Control Switch Combination Unit Inspection” in this section.
	Lighting switch faulty	Check Lighting switch referring to “Light Control Switch Combination Unit Inspection” in this section.
	Lighting controller faulty	Check lighting controller referring to “Lighting Controller Circuit Inspection” in this section.

Interior Light Symptom Diagnosis

Condition	Possible Cause	Correction
Interior light does not light up	Fuse blown	Replace fuse to check for short.
	Bulb burnt out	Replace bulb.
	Wiring or grounding faulty	Repair circuit.
	Door switch faulty	Check door switch referring to “Door Switch Inspection” in Section 8D.
	Interior light faulty	Check interior light.
	Interior light switch faulty	Check interior light switch referring to “Light Control Switch Combination Unit Inspection” in this section.

On-Vehicle Service

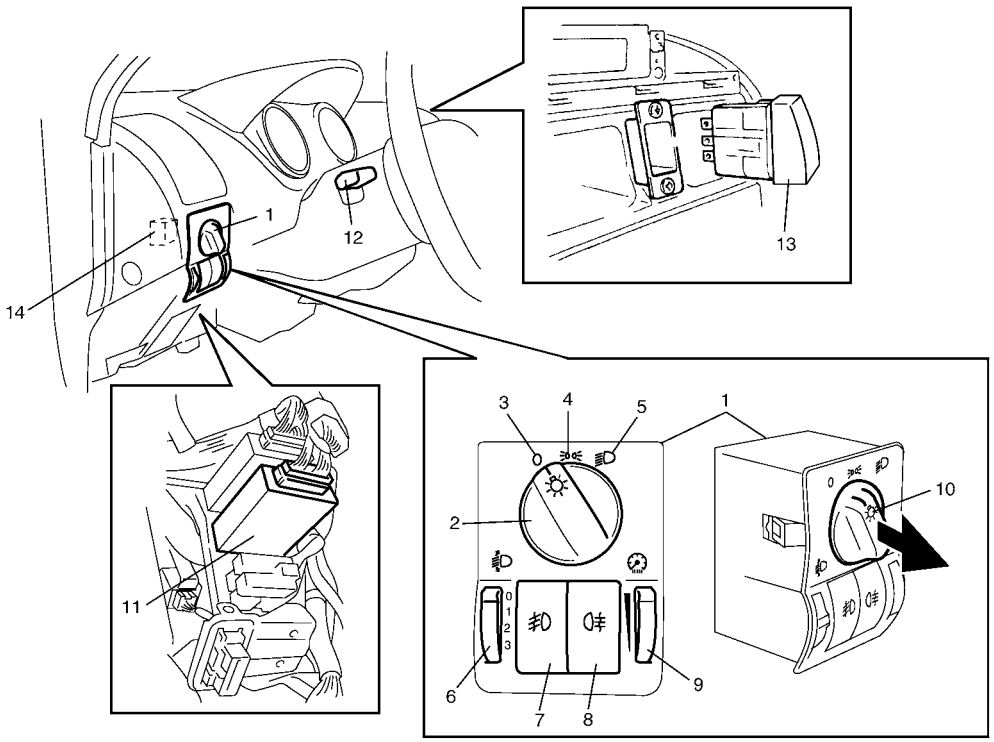
Cautions in Body Electrical System Servicing

When performing works related to electric system, observe the cautions described in “Precautions for Electrical Circuit Service” in Section 0A of this manual for the purpose of protection of electrical parts and prevention of a fire from occurrence.

Light Control Switch Combination Unit Description

Light control switch combination unit (1) contains each of the following switch.

- Lighting switch (2)
- Headlight leveling switch (6)
- Front fog light switch (7)
- Rear fog light switch (8)
- Illumination control switch (9)
- Interior light switch (10)



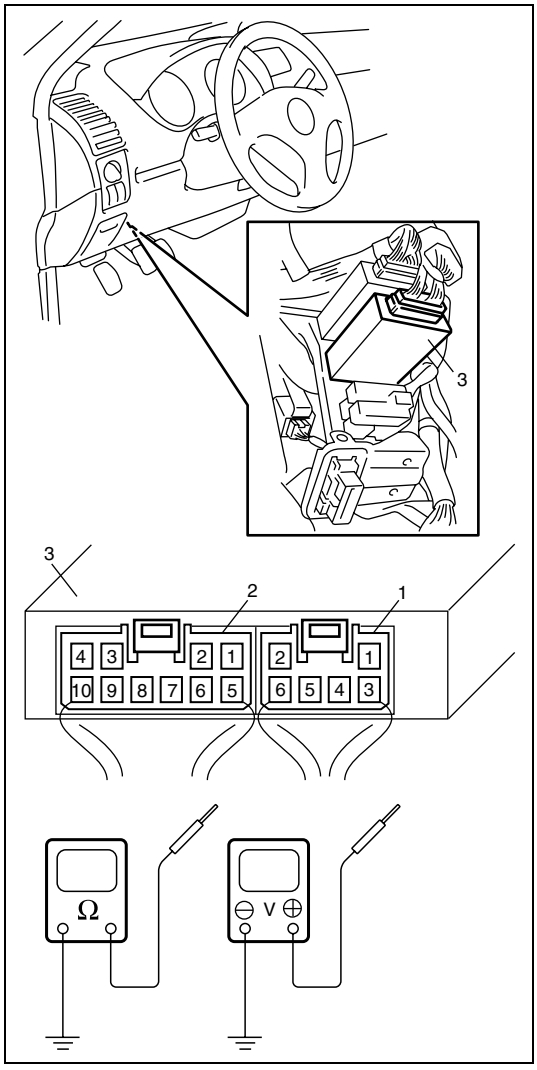
3. Lighting switch “OFF” position	12. Turn signal switch (in dimmer and passing switch)
4. Lighting switch “SMALL” position	13. Hazard warning light switch
5. Lighting switch “HEAD” position	14. Turn signal and hazard warning light relay
11. Lighting controller	

DRL System Operation Inspection

1) Apply parking brake.
2) Confirm that lighting switch is in OFF position.
3) Confirm that dimmer and passing switch is in low beam position.
4) Check the following operation.
   a) When turning ignition switch to ON, headlights do not light.
   b) When starting engine, headlights turn ON at low beam.
   c) When turning dimmer and passing switch to high beam position, headlights remain tuning ON at low beam.
   If check result is not satisfied, go to “Lighting Controller Circuit Inspection” in this section.

Lighting Controller Circuit Inspection

1) Confirm that lighting switch is in good condition referring to “Light Control Switch Combination Unit Inspection” in this section.
2) Confirm that oil pressure switch is in good condition referring to “Engine Oil Pressure Switch Inspection” in Section 8C. (If equipped with DRL system.)
3) Check that the voltage and continuity between the following terminals and body ground are as specification under each condition.
   If check result is not as specified, check relevant circuit.
   If circuit(s) is (are) normal, replace lighting controller.



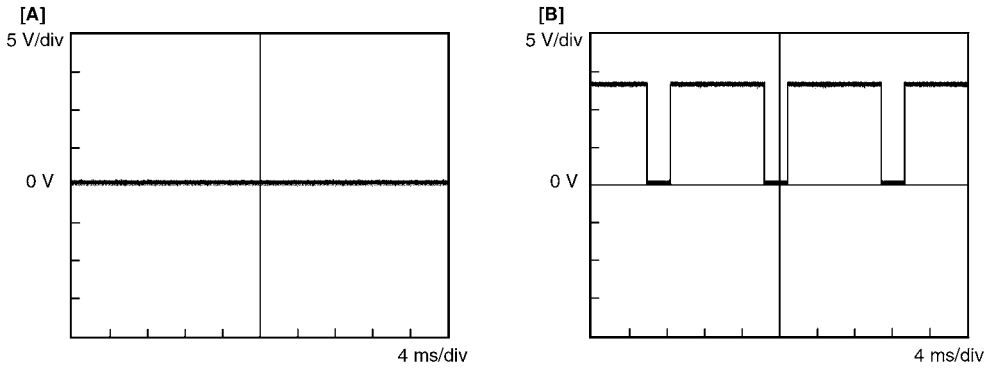
1.	Connector A
2.	Connector B
3.	Lighting controller

NOTE:

Item with the asterisk (*) is only for vehicle with the DRL system.

Terminal	Wire color	Circuit	Specification	Condition
A-1	RED/BLU	Illumination control circuit	Figure “A”	Lighting switch in positions other than OFF and illumination control switch in maximum position.
			Figure “B”	Lighting switch in positions other than OFF and illumination control switch in minimum position.
A-2	GRN/RED	Power source circuit	10 – 14 V	–
*A-3	RED/YEL	Tail light signal circuit	10 – 14 V	Lighting switch in positions other than OFF or with engine running, lighting switch in OFF position.
			Approx. 0 V	With engine stopping, lighting switch in OFF position.
A-4	YEL	Rear fog light circuit	10 – 14 V	Lighting switch in ON position and rear fog light switch pushed several times. The voltage changes between the two shown values alternately at each time the rear fog light switch is pushed.
			Approx. 0 V	
A-5	YEL/BLK	Front fog light circuit (if equipped)	10 – 14 V	Lighting switch in positions other than OFF and front fog light switch pushed several times. The voltage changes between the two shown values alternately at each time the front fog light switch is pushed.
			Approx. 0 V	
*A-6	ORN	Daytime running light (DRL) circuit	Approx. 0 V	Engine running and lighting switch in OFF position.
			10 – 14 V	Engine stopping or lighting switch in positions other then OFF.
B-1	BLK	Ground circuit	1 Ω or less	–
B-2	BRN	Rear fog light switch circuit	10 – 14 V (Non pushed)	Lighting switch in ON position and rear fog light switch pushed several times. The voltage changes between the two shown values alternately at each time the rear fog light switch is pushed.
			Approx. 0 V (Pushed)	
B-3	ORN	Illumination control switch signal circuit	Approx. 0 V	Lighting switch in positions other than OFF and illumination switch in maximum position.
			4.5 – 4.9 V	Lighting switch in positions other than OFF and illumination switch in minimum position.
B-4	–	–	–	–
*B-5	GRN/RED	Lighting switch lamp circuit	Approx. 0 V	Lighting switch in positions other than OFF or with engine running, lighting switch in OFF position.
			10 – 14 V	With engine stopping, lighting switch in OFF position.

Terminal	Wire color	Circuit	Specification	Condition
B-6	PPL	Front fog light switch circuit (if equipped)	10 – 14 V (Non pushed)	Lighting switch in positions other than OFF and front fog light switch pushed several times. The voltage changes between the two shown values alternately at each time the front fog light switch is pushed.
			Approx. 0 V (Pushed)	
*B-7	BLU	Engine oil pressure switch circuit	Approx. 0 V	Ignition switch in ON position (Engine stopping).
			10 – 14 V	Engine running.
B-8	RED/GRN	Lighting switch (dimmer position) signal circuit	Approx. 0 V	Lighting switch in OFF position.
			10 – 14 V	Lighting switch in dimmer position.
*B-9	BLU/ORN	Ignition switch signal circuit	0 V	Ignition switch in OFF position.
			10 – 14 V	Ignition switch in ON position.
B-10	RED	Lighting switch (small position) signal circuit	Approx. 0 V	Lighting switch in OFF position.
			10 – 14 V	Lighting switch in positions other than OFF.

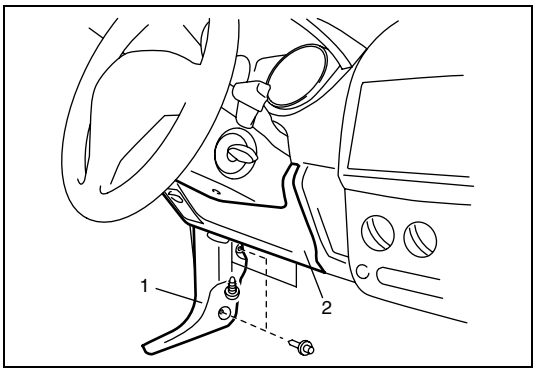


[A]: Figure “A”
[B]: Figure “B”

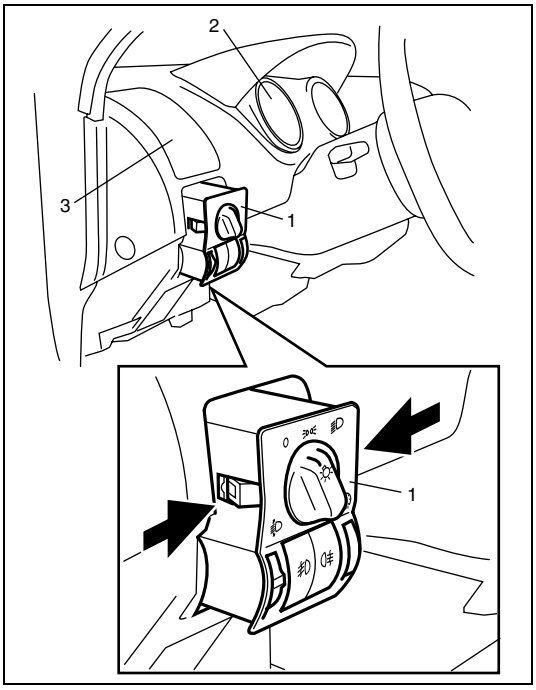
Light Control Switch Combination Unit Removal and Installation

REMOVAL

1) Disconnect negative (–) cable at battery.



2) Remove dash side trim (1) and steering column hole cover (2).



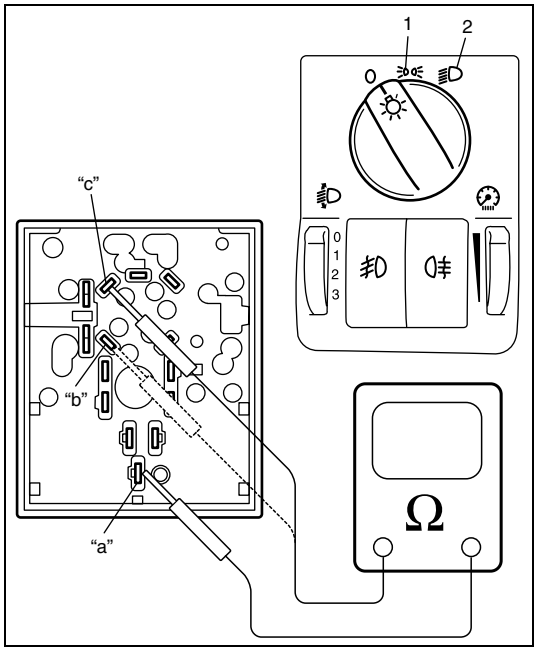
3) Remove combination meter (2) referring to “Combination Meter Removal and Installation” in this section.
4) Remove side ventilation louver (3) referring to “Side Ventilation Louver Removal and Installation” in Section 1A.
5) Remove light control switch combination unit (1) from instrument panel
6) Disconnect connector from light control switch combination unit.

INSTALLATION

Reverse removal procedure for installation.

Light Control Switch Combination Unit Inspection

Lighting switch

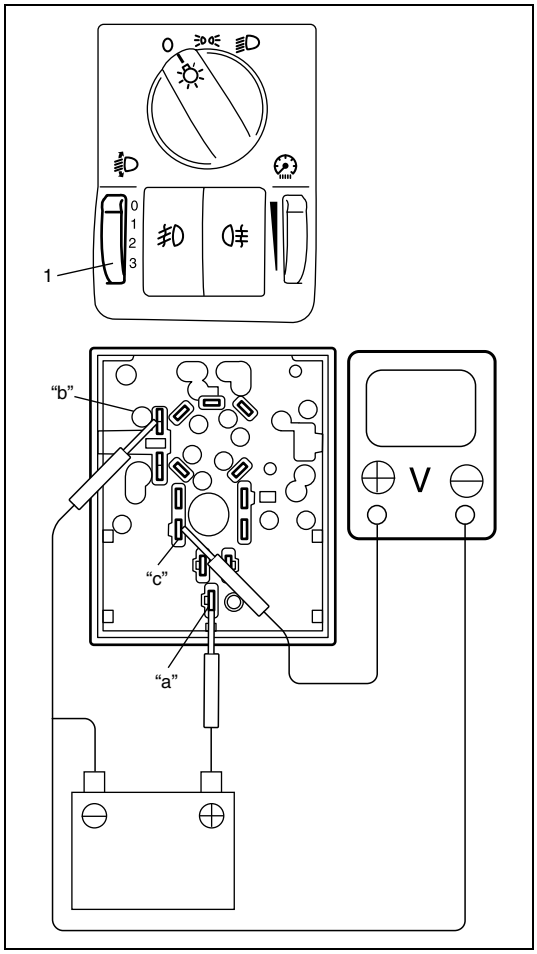


Check the continuity at each switch position. If any correct continuity is not obtained, replace light control switch combination unit.

Lighting switch specification

Switch Position \ Terminal	"a"	"b"	"c"
OFF			
SMALL (1)	○	○	
HEAD (2)	○	○	○

Headlight leveling switch



1) Connect 12 V battery positive (+) terminal to terminal "a" and battery negative (–) terminal to terminal "b".
2) Connect voltmeter positive (+) terminal to terminal "c" and voltmeter negative (–) terminal to battery negative (–) terminal.
3) Measure voltage at each position of headlight leveling switch (1).
   If any, correct voltage is not obtained, replace light control switch combination unit.

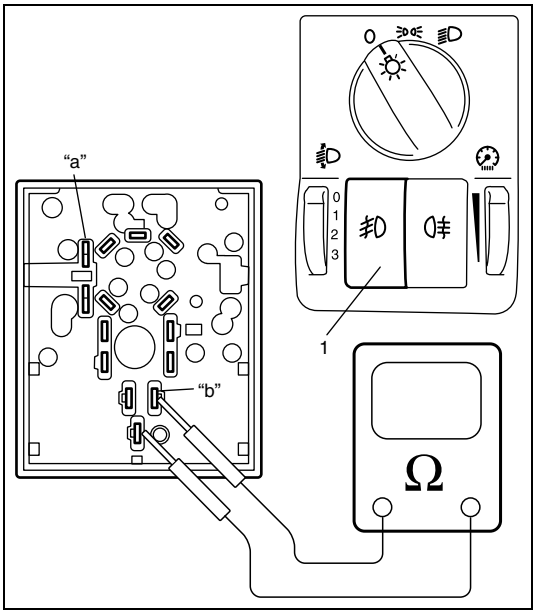
Headlight leveling switch voltage specification

NOTE:

- **Voltage values in the table are specified when battery voltage is 13.5 V.**
- **When measurement with 12 V battery, the values measured may get out of this specification slightly.**

Switch position	Voltage (V)
0	10.7 – 10.9
1	9.01 – 9.21
2	7.54 – 7.74
3	6.12 – 6.32

Front fog light switch

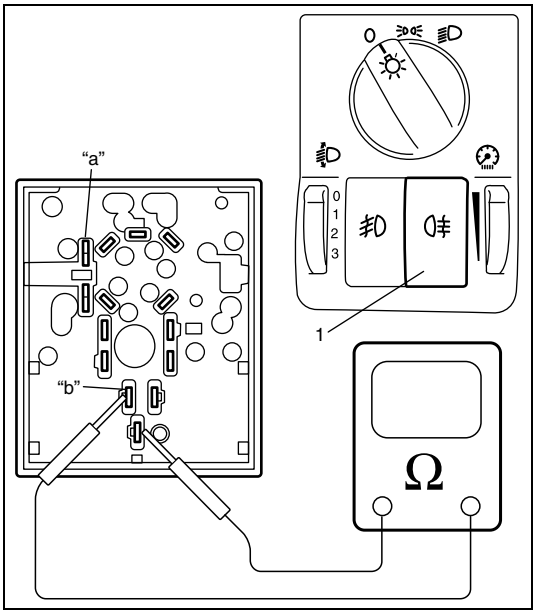


Check for continuity between the terminals "a" and "b" at each switch position.
If any correct continuity is not obtained, replace light control switch combination unit.

Front fog light switch specification

Front fog light switch (1)	Terminals "a" – "b"
Push	Continuity
Free	No continuity

Rear fog light switch

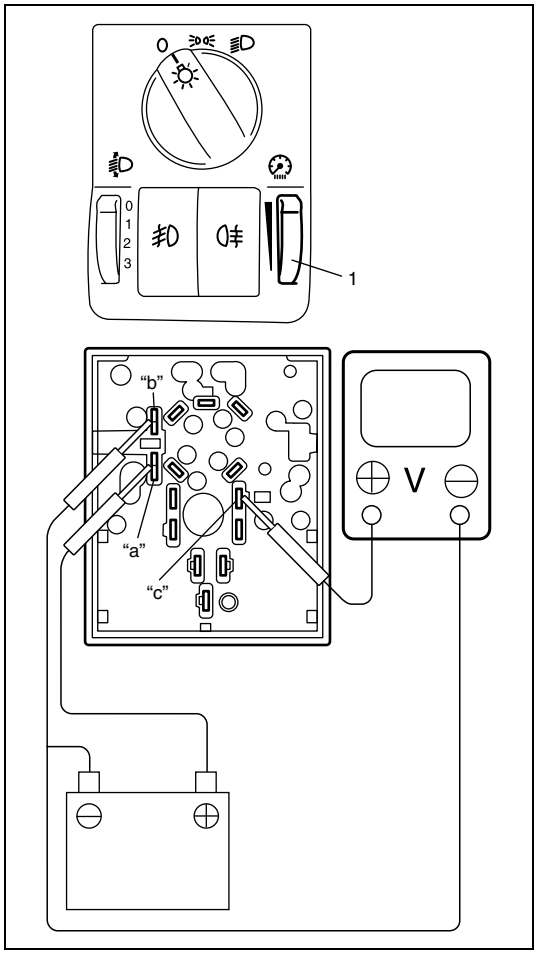


Check for continuity between the terminals "a" and "b" at each switch position.
If any correct continuity is not obtained, replace light control switch combination unit.

Rear fog light switch specification

Rear fog light switch (1)	Terminals "a" – "b"
Push	Continuity
Free	No continuity

Illumination control switch



1) Connect 12V battery positive (+) terminal to terminal "a" and battery negative (–) terminal to terminal "b".
2) Connect voltmeter positive (+) terminal to terminal "c" and voltmeter negative (–) terminal to battery negative (–) terminal.
3) Measure voltage at each position of illumination control switch (1).
   If any correct voltage is not obtained, replace light control switch combination unit.

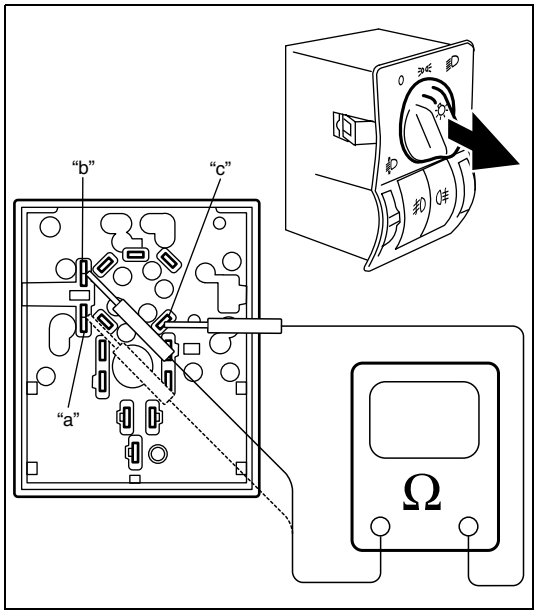
Illumination control switch specification

NOTE:

Depending on battery voltage condition, the measured values may get out of specification slightly.

Switch position	Voltage (V)
Maximum	0.1 – 0.3
Minimum	4.7 – 5.3

Interior light switch



Check the continuity at each switch position.
If any correct continuity is not obtained, replace light control switch combination unit.

Interior light switch specification

Terminal / Switch Position	"a"	"b"	"c"
OFF		○	○
ON	○	○	○

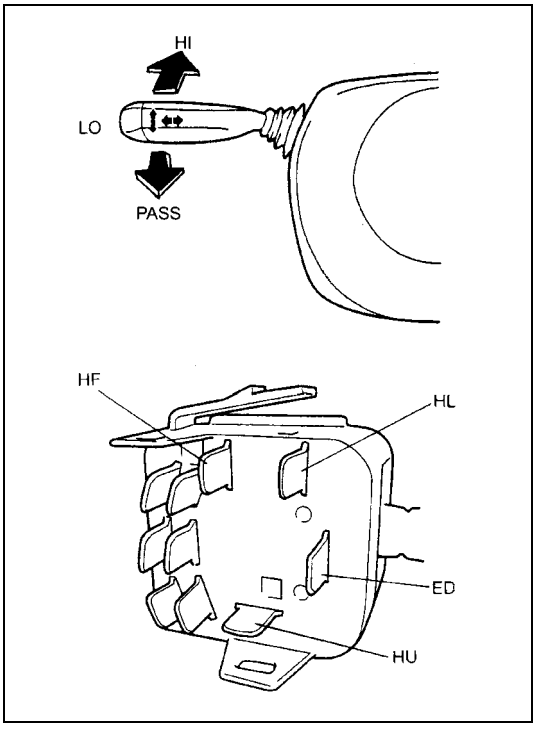
Headlight Leveling Actuator On-Vehicle Inspection

1) Make sure all headlight couplers and leveling actuator couplers are correctly connected.
2) Turn the ignition switch to ON position.
3) Check if the leveling actuator sounds slightly while the leveling switch is moved.
   If no sound is heard with the movement of the leveling switch, check headlight leveling switch and wiring.
   If headlight leveling switch and wiring are OK, replace head light housing.
4) Make sure the replaced leveling actuator operates correctly after replacement.

Dimmer/Passing Switch Removal and Installation

Dimmer/passing switch is incorporated in the turn signal switch. Refer to “Turn Signal Switch Removal and Installation” in this section for removal and installation of the dimmer/passing switch.

Dimmer/Passing Switch Inspection



Check the continuity at each switch position. If any correct continuity is not obtained, replace turn signal switch.

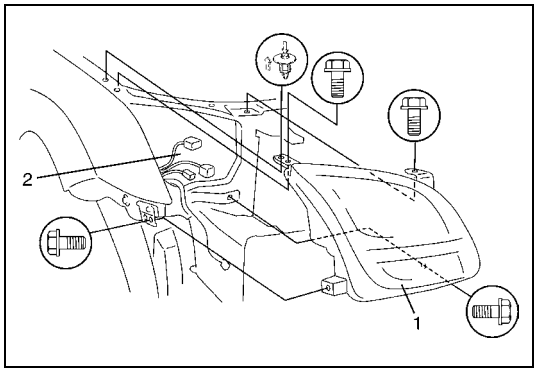
Dimmer/passing switch specification

Terminal / Switch Position	ED	HL	HU	HF
Passing (PASS)	○—○		○—○	
Low Beam (LO)	○—○			
High Beam (HI)	○		○	

Headlight Assembly Removal and Installation

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Remove front bumper referring to “Front Bumper and Rear Bumper Removal and Installation” in Section 9.
3) Remove headlight mounting bolts and clip.

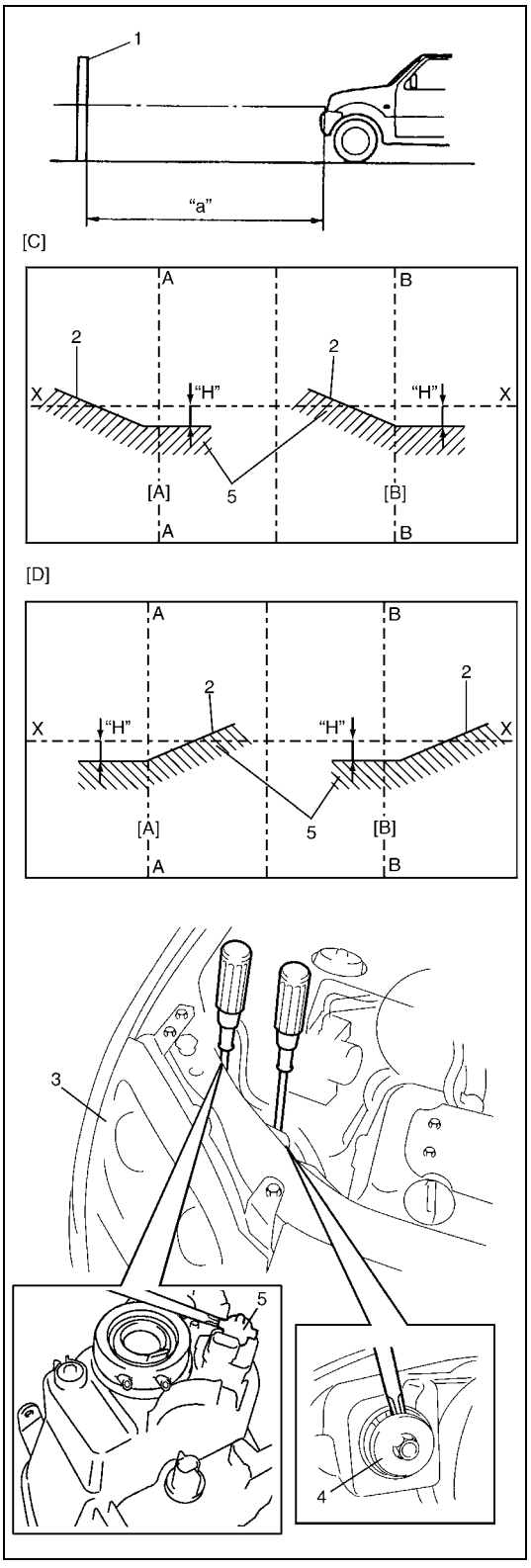


4) Detach headlight assembly (1) from vehicle.
5) Disconnect couplers (2) from headlight assembly (1).

INSTALLATION

Reverse removal procedure for installation noting the following.
After installation, be sure to inspect and adjust aiming referring to “Headlight Aiming Adjustment With Screen” in this section.

Headlight Aiming Adjustment With Screen



NOTE:

- **Unless otherwise obligated by local regulations, adjust headlight aiming according to the following procedure.**
- **When inspecting and adjusting headlight with leveling system, make sure to set the leveling switch to "0" position with ignition switch turned to ON.**

1) Make sure the following items.
   - Place vehicle on a flat surface in front of blank wall (screen) (1) ahead of headlight surface.

   Distance between screen and headlight
   "a": 10 m (32.8 ft.)

   - Adjust air pressure of all tires to the specified value respectively.
   - Bounce vehicle body up and down by hand to stabilize suspension.
   - Carry out aiming with a driver aboard.

   Driver's weight
   75 kg (165 lb)

2) Check to see if not spot (5) (high intensity zone) of each low beam axis falls as shown in the figure.

   Hot spot specification
   "H": Approx. 130 mm (5.15 in.)

3) Align headlight aiming to specification by adjusting aiming gear if it is not set properly.

2.	Cut line (bounding line)
3.	Heading assembly
4.	Aiming (for right/left adjustment)
5.	Aiming (headlight leveling actuator) (for up/down adjustment)
X-X:	Horizontal center line of headlights bulb
A-A:	Vertical center line of left headlight bulb
B-B:	Vertical center line of right headlight bulb
[A]:	LH headlight
[B]:	RH headlight
[C]:	RH steering vehicle shown
[D]:	LH steering vehicle shown

Headlight Bulb Replacement

WARNING:

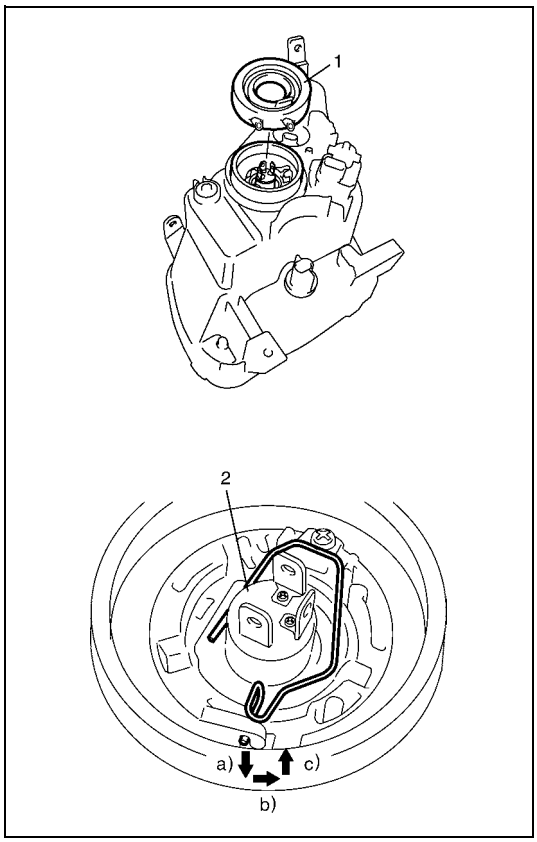
- **Light bulbs can be hot enough to burn your finger right after being turned off. This is true especially for halogen headlight bulbs. Replace the bulbs after they become cool enough.**
- **The headlight bulbs are filled with pressurized halogen gas.**

They can burst and injure you if they are hit or dropped. Handle them carefully.

CAUTION:

The oils from your skin may cause a halogen bulb to overheat and burst when the lights are on. Grasp a new bulb with a clean cloth.

1) Disconnect negative (–) cable at battery.
2) Disconnect coupler from bulb.
3) Remove socket cover (1).
4) Replace bulb (2).
5) Reverse removal procedure for installation.

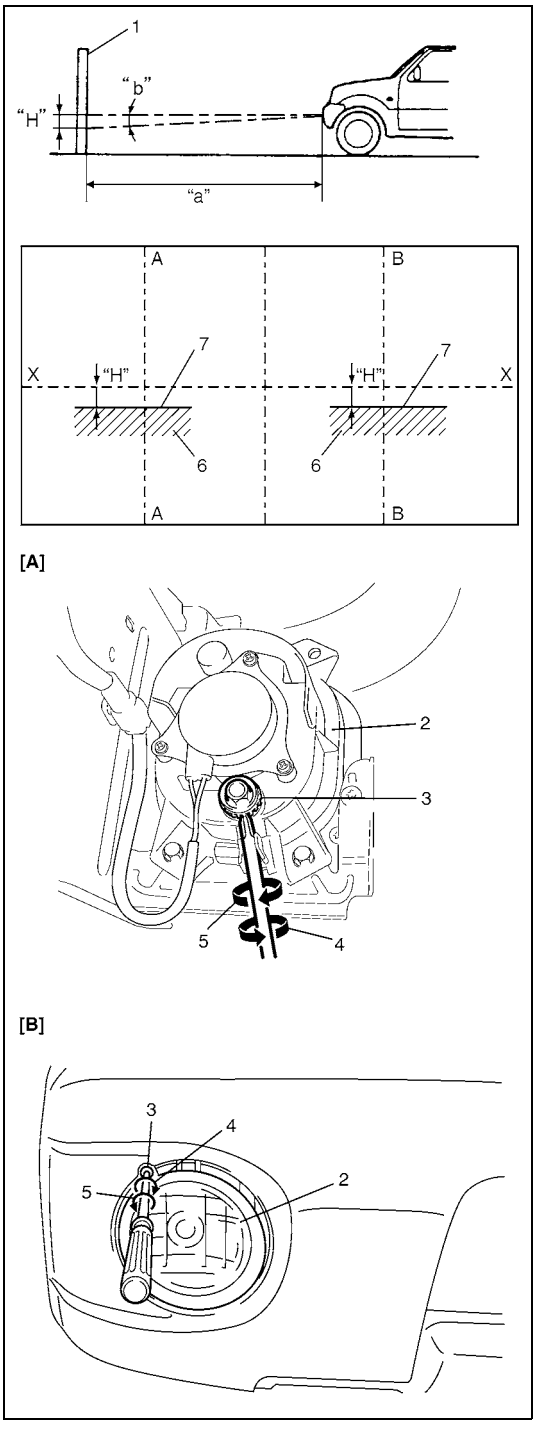


Front Fog Light Aiming Adjustment With Screen

Basic aiming

NOTE:

- **Unless otherwise obligated by local regulations, adjust front fog light aiming according to the following procedure.**
- **An example in case that the light-to-wall distance 10 m is shown in the illustration. The beam descending distance "H" is calculated when "a" is 10 m with the specification angle "b" (1.2°).**



1) Make sure the following items.
   - Place vehicle on a flat surface in front of blank wall (screen) (1) ahead of front fog light surface.

   Distance between screen and front fog light
   "a": 10m (32.8ft.)

   - Adjust air pressure of all tired to the specified value respectively.
   - Bounce vehicle body up and down by hand to stabilize suspension.
   - Carry out aiming with a driver aboard.

   Driver's weight
   75 kg (165 lb)

2) Check to see if hot spot (high intensity zone) of each front fog light axis falls as shown in the figure.

   Hot spot specification
   Angle "b": 1.2° (Specification)
   Calculated distance "H": Approx. 210 mm (8.27 in.)

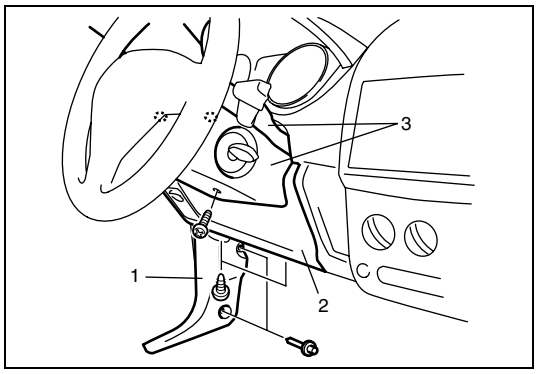
3) If it is not set properly, align front fog light to specification by rotating aiming gear.

2.	Front fog light assembly
3.	Aiming gear
4.	Aiming (for up adjustment)
5.	Aiming (for down adjustment)
6.	Hot spot
7.	Bounding line
X-X:	Horizontal center line of front fog light bulb
A-A:	Vertical center line of left front fog light bulb
B-B:	Vertical center line of right front fog light bulb
[A]:	Gear adjuster type
[B]:	Screw adjuster type

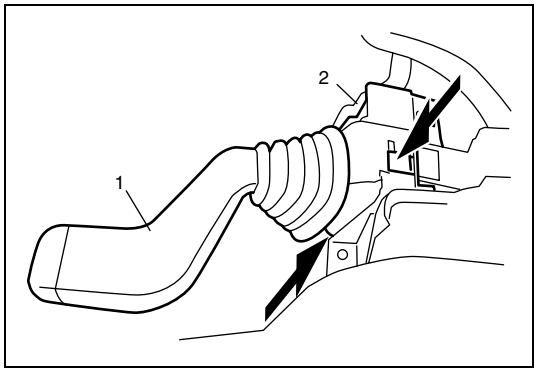
Turn Signal Switch Removal and Installation

REMOVAL

1) Disconnect negative (–) cable at battery.



2) Remove dash side trim (1), steering column hole cover (2) and steering column covers (3).

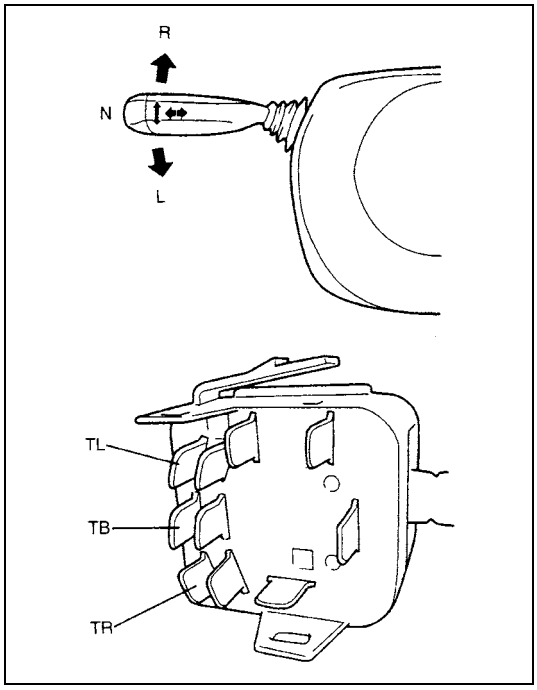


3) Remove turn signal switch (1) while releasing the locks.
4) Disconnect turn signal switch connector (2).

INSTALLATION

Reverse removal procedure for installation.

Turn Signal Switch Inspection



Check the continuity at each switch position. If any correct continuity is not obtained, replace turn signal switch.

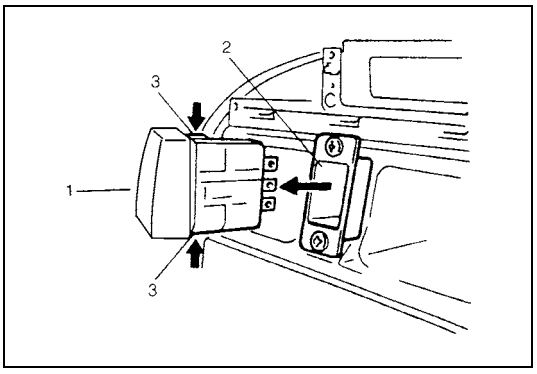
Turn signal switch specification

Terminal / Switch Position	TL	TB	TR
L	○—○		
N			
R		○—○	

Hazard Warning Light Switch Removal and Installation

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Remove audio unit (if equipped) and center upper garnish referring to Step2) to 3) of "Information Display Removal and Installation" in Section 8D.

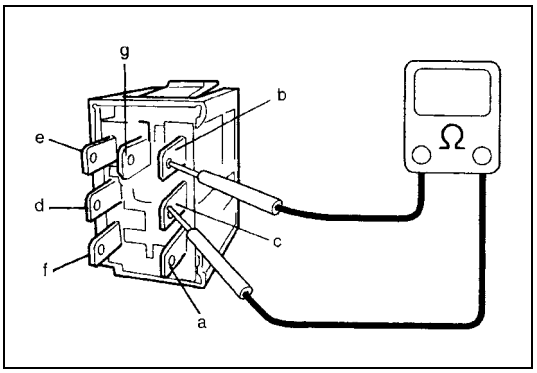


3) Remove hazard warning light switch (1) from switch case (2) while releasing the locks (3)

INSTALLATION

Reverse removal procedure for installation.

Hazard Warning Light Switch Inspection



Check the continuity of each switch position.
If any correct continuity is not obtained, replace hazard warning light switch.

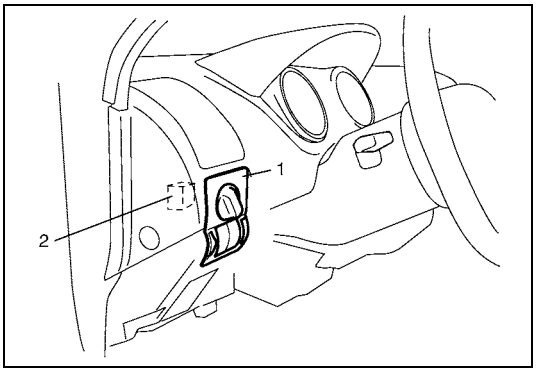
Hazard warning light switch specification

Terminal / Hazard Switch	a	b	c	d	e	f	g
OFF	○	○			∿	⊘	○
ON		○	○	○	○	○⊘○	

Turn Signal and Hazard Warning Light Relay Removal and Installation

REMOVAL

1) Disconnect negative (–) cable at battery.

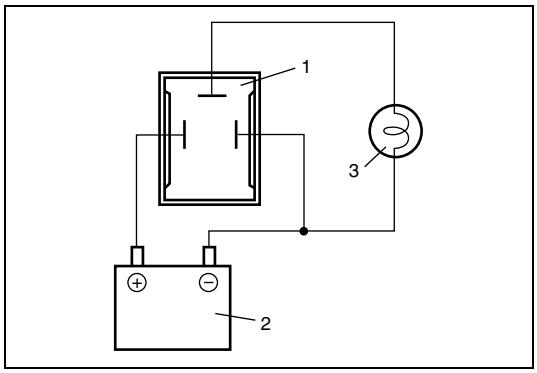


2) Remove light control switch combination unit (1) referring to "Light Control Switch Combination Unit Removal and Installation" in this section.
3) Remove turn signal and hazard warning light relay (2).

INSTALLATION

Reverse removal procedure for installation.

Turn Signal and Hazard Warning Light Relay Inspection



1) Connect turn signal and hazard warning light relay (1), battery (2) and test bulb (12 V, 48 W) (3) as shown.
2) Unless a continued flash on and off is visible, replace turn signal and hazard warning light relay.

Turn signal and hazard warning light relay flashing cycle specification
60 – 120 cycle/minute

SECTION 8C

INSTRUMENTATION/DRIVER INFORMATION

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

Diagnosis

Speedometer and VSS Symptom Diagnosis

Condition	Possible Cause	Correction
Speedometer shows no operation or incorrect operation	Fuse blown	Replace fuse to check for short.
	Wiring or grounding faulty	Repair circuit.
	Vehicle speed sensor (VSS) faulty	Check vehicle speed sensor referring to “Vehicle speed sensor (VSS) inspection” in Section 6.
	Combination meter faulty	Check combination meter circuit referring to “Combination Meter Circuit” in this section.
	Vehicle speed sensor (VSS) signal rotor faulty	Check vehicle speed sensor referring to “Vehicle speed sensor (VSS) inspection” in Section 6.

Fuel Meter and Fuel Gauge Unit Symptom Diagnosis

Condition	Possible Cause	Correction
Fuel meter shows no operation	Fuse blown	Replace fuse to check for short.
	Wiring or grounding faulty	Repair circuit
	Fuel gauge unit faulty	Check fuel gauge unit referring to “Fuel Level Sensor (Gauge Unit) Inspection” in this section.
	Combination meter faulty	Check combination meter circuit referring to “Fuel Gauge Inspection” in this section.

Engine Coolant Temperature (ECT) Gauge and ECT Sensor Symptom Diagnosis

Condition	Possible Cause	Correction
Engine coolant temperature meter shows no operation or incorrect operation	Fuse blown	Replace fuse to check for short.
	Wiring or grounding faulty	Repair circuit.
	ECT sensor faulty	Check ECT sensor referring to “Engine coolant temperature sensor (ECT sensor) inspection” in Section 6E1.
	Combination meter faulty	Check combination meter circuit referring to “Engine Coolant Temperature (ECT) Gauge Inspection” in this section.

Engine Oil Pressure Warning Light Symptom Diagnosis

Condition	Possible Cause	Correction
Engine oil pressure warning light does not light up when turning the ignition switch to ON position at engine OFF	Fuse blown	Replace fuse to check for short.
	Wiring or grounding faulty	Repair circuit.
	Engine oil pressure switch faulty	Check engine oil pressure switch referring to “Engine Oil Pressure Switch Inspection” in this section.
	Combination meter faulty	Check combination meter circuit referring to “Combination Meter Circuit” in this section.
Engine oil pressure warning light stays ON	Wiring faulty	Repair circuit.
	Engine oil pressure switch faulty	Check engine oil pressure switch referring to “Engine Oil Pressure Switch Inspection” in this section.

Brake System Warning Light (Parking Brake Indicator, Brake Fluid Warning and EBD System Warning Light)

Condition	Possible Cause	Correction
Brake system warning light does not light up (when fluid low level and/or parking brake pulled up)	Fuse blown	Replace fuse to check for short.
	Wiring or grounding faulty	Repair circuit.
	Brake fluid level switch faulty	Check brake fluid switch referring to “Brake Fluid Level Switch Inspection” in this section.
	Parking brake switch faulty	Check parking brake switch referring to “Parking Brake Switch Inspection” in this section.
Brake system warning light does not light up when cranking (when in turned position)	Wiring or grounding faulty	Repair circuit.
	Ignition switch faulty	Check ignition switch referring to “Ignition (Main) Switch ON-Vehicle Inspection” in this section.
	Combination meter faulty	Check combination meter circuit referring to “Combination Meter Circuit” in this section.
Brake system warning light stays ON	Wiring or grounding faulty	Repair circuit.
	Brake fluid level faulty	Check brake fluid level.
	Brake fluid level switch faulty	Check brake fluid switch referring to “Brake Fluid Level Switch Inspection” in this section.
	Parking brake switch faulty	Check parking brake switch referring to “Parking Brake Switch Inspection” in this section.
	ABS control module faulty	Check ABS control module referring to “Table – D EBD Warning Lamp (Brake Warning Lamp) Check – Lamp Comes “ON” Steady” in Section 5E.

Ignition Key Remainder and Light Remainder Warning Buzzer Symptom Diagnosis

Condition	Possible Cause	Correction
Ignition key remainder and light remainder warning buzzer show no sounding	Wiring or grounding faulty	Repair circuit.
	Driver side door switch faulty	Check door switch referring to "Door Switch Inspection" in this section.
	Ignition switch faulty	Check ignition switch referring to "Ignition (Main) Switch ON-Vehicle Inspection" in this section.

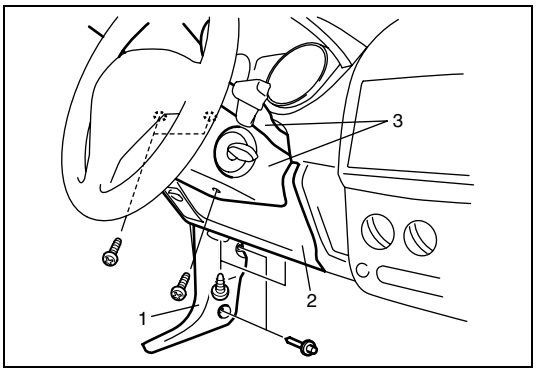
On-Vehicle Service

Cautions in Body Electrical System Servicing

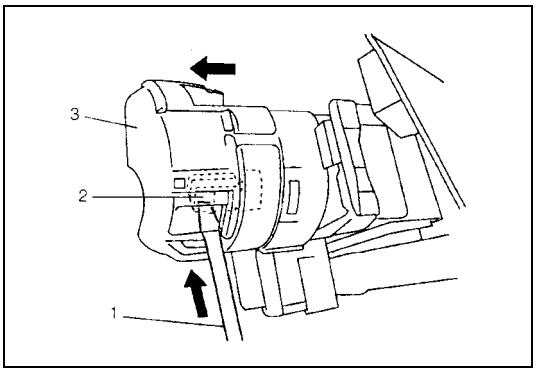
Refer to "Cautions in Body Electrical System Servicing" in Section 8B.

Ignition (Main) Switch ON-Vehicle Inspection

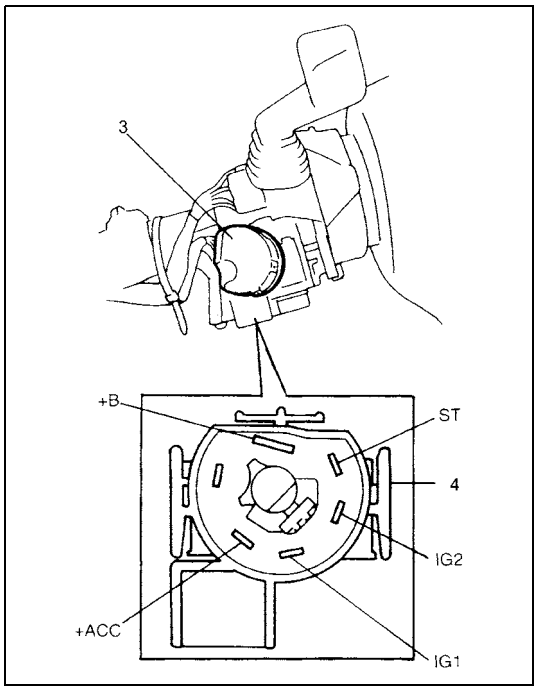
1) Disconnect negative cable at battery.



2) Remove dash side trim (1), steering hole cover (2) and steering column covers (3).



3) Disconnect ignition (main) switch coupler as follows.
   a) Turn ignition switch key to "ACC" position.
   b) Insert screw driver (1) in coupler hole.
   c) Unlock coupler lock (2) and hold it by pushing it in arrow direction with screw driver (1).
   d) With coupler lock unlocked, disconnect coupler (3).



4) Check continuity between terminals at each switch position. If continuity is not obtained according to the table, replace ignition (main) switch (4).

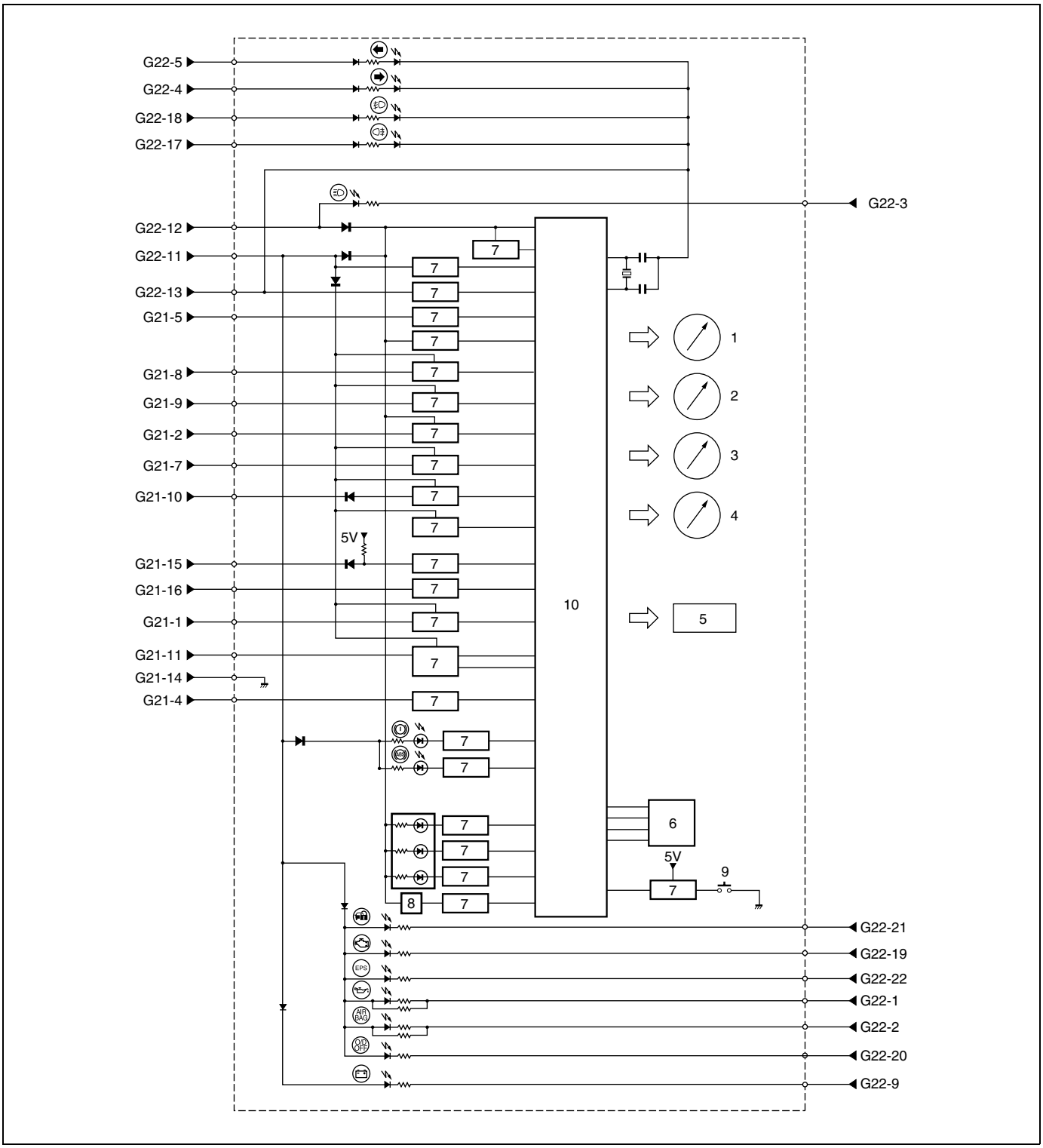
Ignition (main) switch specification

Key \ Terminal / Position		+B	+ACC	IG1	IG2	ST
OUT	LOCK	○				
IN	ACC	○	○			
	ON	○	○	○	○	
	START	○	○	○		○

Ignition (Main) Switch Removal and Installation

Refer to “Steering Column Removal and Installation” in Section 3C.

Combination Meter Circuit

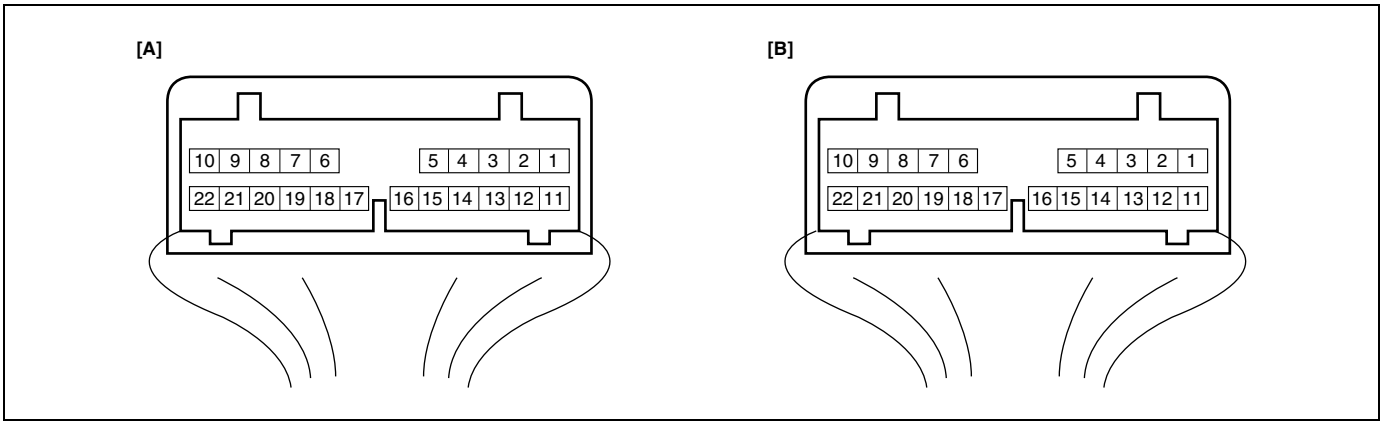


1. Speedometer	4. Engine coolant temperature gauge	7. Interface	10. CPU
2. Tachometer	5. ODO-TRIP	8. Buzzer	
3. Fuel gauge	6. EEPROM	9. Trip switch	

Terminal G21	Wire Color	Circuit
G21-1	GRY	To ECM (Engine coolant temperature meter signal)
G21-2	BLK/YEL	To door switch
G21-3	–	–
G21-4	ORN	To lighting switch (illumination control signal)
G21-5	WHT/BLK	To “ACC” fuse (key remainder signal)
G21-6	–	–
G21-7	PNK/BLU	To ABS control module (EBD warning indicator control signal)
G21-8	RED/BLU	To ABS control module (ABS indicator control signal)
G21-9	RED/BLU	To brake fluid level switch
G21-10	YEL/GRN	To parking brake switch
G21-11	YEL/RED	To fuel level gauge
G21-12	–	–
G21-13	–	–
G21-14	RED/YEL	To lighting switch
G21-15	PPL	To VSS (Speedometer signal)
G21-16	BRN	To ECM (Tachometer signal)
G21-17	–	–
G21-18	–	–
G21-19	–	–
G21-20	–	–
G21-21	–	–
G21-22	–	–

Terminal G22	Wire Color	Circuit
G22-1	BLU	To oil pressure switch
G22-2	YEL/RED	To SDM (AIR BAG indicator control signal)
G22-3	RED	To combination switch (High beam indicator control signal)
G22-4	BLU/YEL	To combination switch (Turn R signal indicator control signal)
G22-5	GRN/RED	To combination switch (Turn L signal indicator control signal)
G22-6	–	–
G22-7	–	–
G22-8	–	–
G22-9	WHT/BLU	To generator (charge warning indicator control signal)
G22-10	–	–
G22-11	BLU/ORN	To “METER” fuse (ignition ON signal)
G22-12	WHT/RED	To “RADIO DOME” fuse (power supply)
G22-13	BLK	To body ground
G22-14	BLK/ORN	To engine ground
G22-15	–	–
G22-16	–	–
G22-17	YEL	To lighting switch (rear fog lap indicator control signal)
G22-18	LT GRN	To lighting switch (front fog lamp indicator control signal)
G22-19	PPL/WHT	To ECM (MIL indicator control signal)
G22-20	RED/BLK	To TCM (O/D OFF indicator control signal) (if equipped)
G22-21	LT GRN/BLK	To ECM (Immobilizer indicator control signal)
G22-22	PNK	To EPS control module (EPS indicator control signal)

Terminal arrangement of combination meter connector viewed from harness side

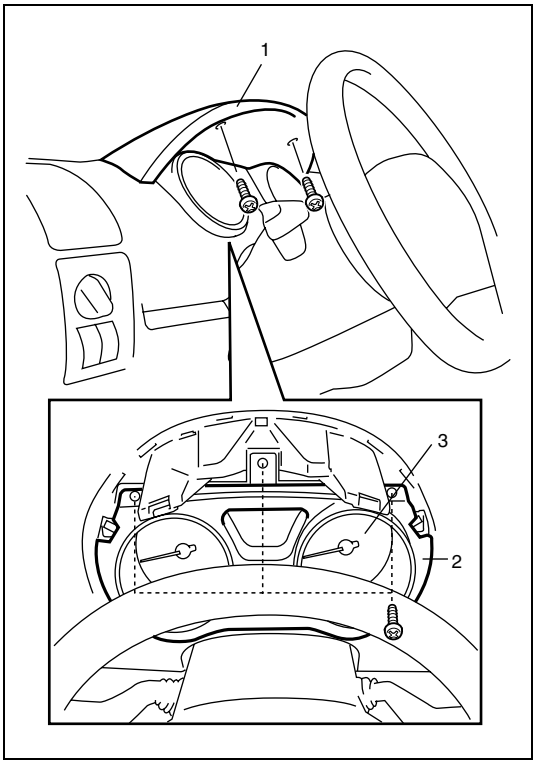


[A]: Connector “G21” (Green)
[B]: Connector “G22” (Light blue)

Combination Meter Removal and Installation

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Remove instrument cluster panel (1).
3) Remove meter cluster panel (2) and combination meter (3).
4) Disconnect all couplers from combination meter.



INSTALLATION

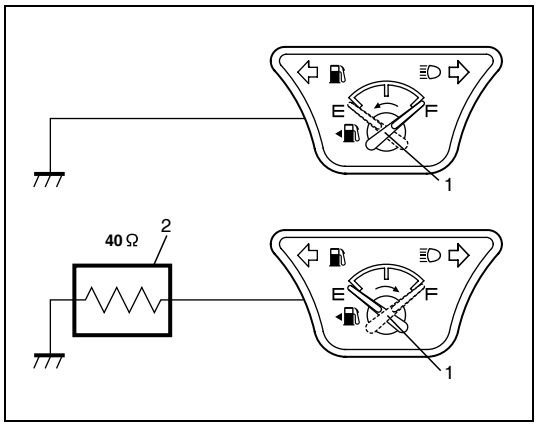
Reverse removal procedure for installation.

Fuel Gauge Inspection

NOTE:

Make sure that all related connector terminals are in good contact condition before combination meter inspection.

1) Remove combination meter referring to “Combination Meter Removal and Installation” in this section.
2) Connect combination meter connectors to combination meter.

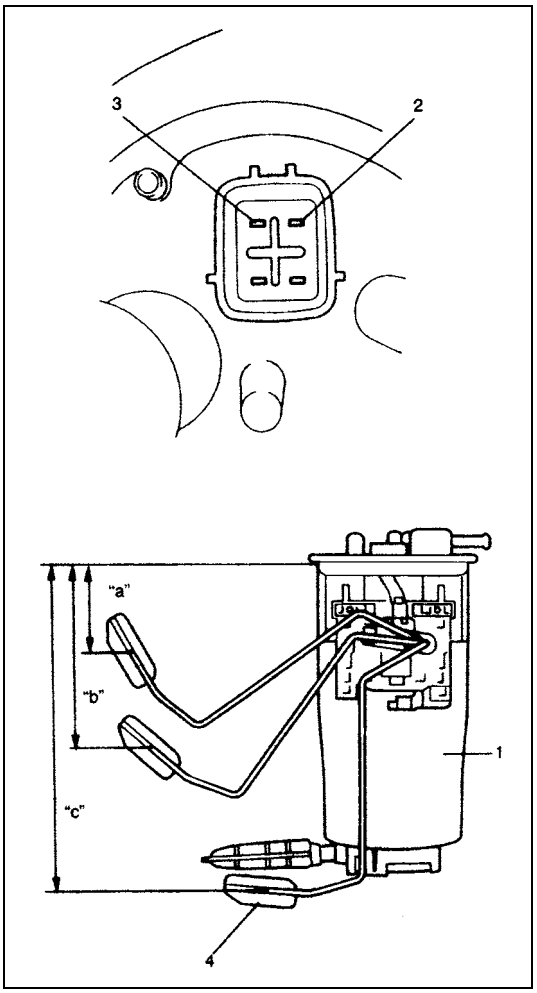


3) Short “YEL/RED” wire terminal of combination meter connector to body ground as shown.
4) Turn ignition switch to ON position, and check that meter pointer (1) of fuel level gauge indicates “E” and low fuel warning light turns on.
5) Turn ignition switch to OFF position.
6) Short “YEL/RED” wire terminal of combination meter connector to body ground through a resister (40Ω) (2) as shown.
7) Turn ignition switch to ON position, and check that meter pointer (1) of fuel level gauge indicates “F”.
   If check result is not satisfied, replace combination meter.

Fuel Level Sensor (Gauge Unit) Removal and Installation

Remove fuel pump assembly referring to “Fuel Pump Assembly Removal and Installation” in Section 6C.

Fuel Level Sensor (Gauge Unit) Inspection



- Check that resistance between terminals “2” and “3” of fuel level sensor changes with change of float position.
- Check resistance between terminals “2” and “3” in each float position.
  If the measured value is out of specification, replace fuel level sensor.

Fuel level sensor specification

Float Position		Resistance (Ω)
Full Upper “a”	56 mm (2.20 in.)	38 – 42
Middle (1/2) “b”	119.2 mm (4.69 in.)	157 – 163
Full Lower “c”	200.5 mm (7.89 in.)	276 – 284

1. Fuel pump assembly

VSS Removal and Installation

Refer to “Vehicle speed sensor (VSS) removal and installation” in Section 6E1.

VSS Inspection

Refer to “Vehicle speed sensor (VSS) inspection” in Section 6E1.

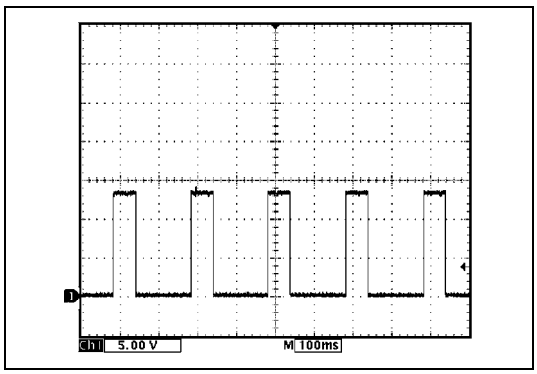
Engine Coolant Temperature (ECT) Gauge Inspection

Operation check

NOTE:

Make sure that all related connector terminals are in good contact condition before combination meter inspection.

1) Confirm that DTC P0117 and/or DTC P0118 are not detected.
   If it is detected, go to each diagnostic flow table.
2) Turn ignition switch to OFF position.
3) Remove combination meter referring to “Combination Meter Removal and Installation” in this section.
4) Confirm that there is no abnormal point in “GRY” wire of combination meter harness.
5) Confirm that there are no abnormal point in power and ground wire circuit of combination meter harness.
6) Connect combination meter connectors from combination meter.
7) Connect oscilloscope between terminals “GRY” and “BLK” wire of combination meter connector.
8) Turn ignition switch to ON position.



9) Check that there is waveform from ECM to engine coolant temperature meter.
   If check result is satisfied, replace combination meter.
   If check result is not satisfied, substitute a known-good ECM and recheck.

ECT sensor Removal and Installation

Refer to “Engine coolant temperature sensor (ECT sensor) removal and installation” in Section 6E1.

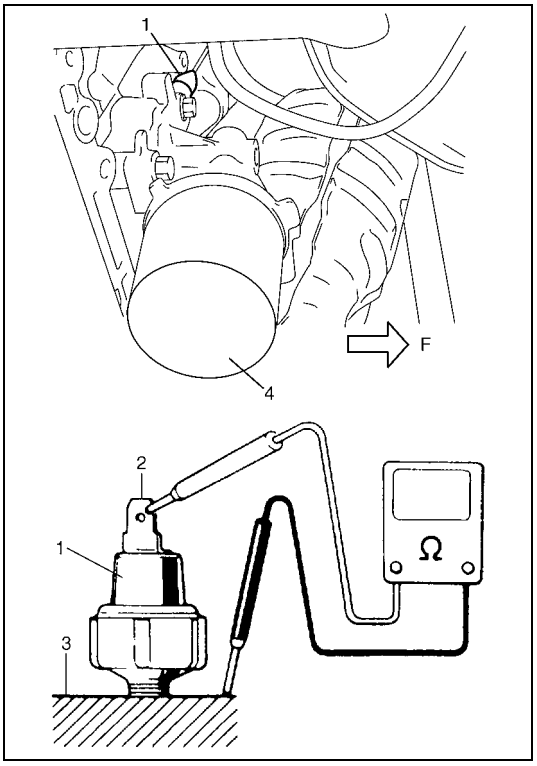
ECT Sensor Inspection

Refer to “Engine coolant temperature sensor (ECT sensor) inspection” in Section 6E1.

Ignition Key Remainder and Light Remainder Warning Buzzer Inspection

The ignition key and light remainder warning buzzer is integrated in combination meter.
Therefore, check the buzzer circuit referring to “Combination Meter Circuit” in this section.
If no failure is found, repair wiring harness. If a failure is found in the buzzer circuit, replace combination meter.

Engine Oil Pressure Switch Inspection



1) Disconnect engine oil pressure switch (1) lead wire.
2) Check for continuity between engine oil pressure switch terminal (2) and cylinder block (3) as shown in the figure.
   If not as specified, replace engine oil pressure switch (1).

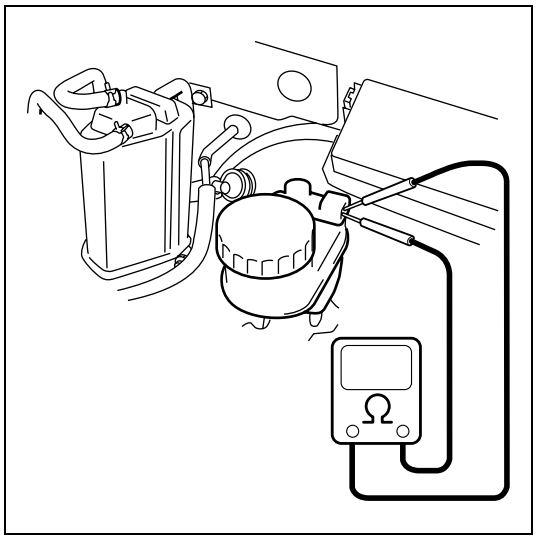
Engine oil pressure switch specification
During engine running: No continuity
At engine stop: Continuity

4.	Engine oil filter
F.	Front

Engine Oil Pressure Switch Removal and Installation

Refer to “Oil Pressure Check” in Section 6A1.

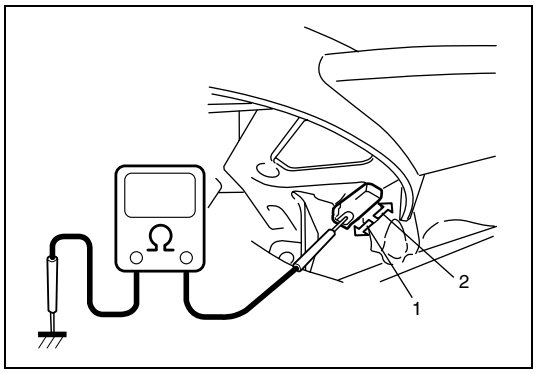
Brake Fluid Level Switch Inspection



Check for continuity between terminals of brake fluid level switch.
If found defective, replace master cylinder reservoir.

Brake fluid level switch specification
OFF position (float up): No continuity
ON position (float down): Continuity

Parking Brake Switch Inspection



Check for continuity between parking brake switch terminal and body ground.
If found defective, replace parking brake switch.

Parking brake switch specification
OFF position (parking brake released) (1):
No continuity
ON position (parking brake lever pulled up) (2):
Continuity

SECTION 8D

WINDOWS, MIRRORS, SECURITY AND LOCKS

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

Diagnosis

Rear Window Defogger Symptom Diagnosis

Condition	Possible Cause	Correction
Rear defogger does not operate	Fuse blown	Replace fuse to check for short.
	Wiring or grounding faulty	Repair circuit.
	Rear window defogger wire faulty	Check rear window defogger wire referring to “Rear Window Defogger Wire Inspection” in this section.
	Rear window defogger switch faulty	Check rear window defogger switch referring to “Rear Window Defogger Switch Inspection” in this section.

Front Wiper and Washer Symptom Diagnosis

Condition	Possible Cause	Correction
Front wipers do not operate or move at a specified speed	Fuse blown	Replace fuse to check for short.
	Wiring or grounding faulty	Repair circuit.
	Front wiper motor faulty	Check front wiper motor referring to “Front Wiper Motor Inspection” in this section.
	Wiper and washer switch faulty	Check wiper and washer switch referring to “Wiper and Washer Switch Inspection” in this section.
Front wipers do not return to original position	Loose installation of wiper arms	Reinstall wiper arms correctly.
	Wiring or grounding faulty	Repair circuit.
	Wiper and washer switch faulty	Check wiper and washer switch referring to “Wiper and Washer Switch Inspection” in this section.
	Front wiper motor faulty	Check front wiper motor referring to “Front Wiper Motor Inspection” in this section.
	Front wiper intermittent timer faulty	Check front wiper auto stop circuit referring to “Wiper Circuit Inspection” in this section.
Only front wiper intermittent wiper function does not operate	Wiring or grounding faulty	Repair circuit.
	Wiper and washer switch faulty	Check wiper and washer switch referring to “Wiper and Washer Switch Inspection” in this section.
	Front wiper intermittent timer faulty	Check front wiper intermittent circuit referring to “Wiper Circuit Inspection” in this section.

Condition	Possible Cause	Correction
Neither washer nor wiper operate when washer switch is in ON	Washer hose or nozzle clogged	Repair hose or nozzle
	Wiring or grounding faulty	Repair circuit.
	Washer pump faulty	Check washer motor referring to “Washer Pump Inspection” in this section.
	Wiper and washer switch faulty	Check wiper and washer switch referring to “Wiper and Washer Switch Inspection” in this section.
	Front wiper intermittent timer faulty	Check front washer linked circuit referring to “Wiper Circuit Inspection” in this section.

Rear Wiper and Washer (If Equipped) Symptom Diagnosis

Condition	Possible Cause	Correction
Rear wiper does not operate or does not return to original position	Loose installation of wiper arm	Reinstall wiper arm correctly.
	Wiring or grounding faulty	Repair circuit.
	Fuse blown	Replace fuse to check for short.
	Wiper and washer switch faulty	Check wiper and washer switch referring to “Wiper and Washer Switch Inspection” in this section.
	Rear wiper motor faulty	Check rear wiper motor referring to “Rear Wiper Motor Inspection” in this section.
	Rear wiper intermittent timer faulty	Check rear wiper auto stop circuit or rear wiper intermittent circuit referring to “Wiper Circuit Inspection” in this section.
Rear washer malfunction	Washer hose or nozzle clogged	Repair hose or nozzle.
	Wiring or grounding faulty	Repair circuit.
	Washer pump faulty	Check washer motor referring to “Washer Pump Inspection” in this section.
	Wiper and washer switch faulty	Check wiper and washer switch referring to “Wiper and Washer Switch Inspection” in this section.

Power Window Control System (If Equipped) Symptom Diagnosis

Condition	Possible Cause	Correction
None of power windows functions	Fuse blown	Replace fuse to check for short.
	Wiring or grounding faulty	Repair circuit.
	Ignition switch faulty	Check ignition switch referring to "Ignition (Main) Switch ON-Vehicle Inspection" in Section 8C.
	Power window main switch faulty	Check power window main switch referring to "Power Window Main Switch Inspection" in this section.
Only one power window does not function	Wiring or grounding faulty	Repair circuit.
	Power window main switch faulty	Check power window main switch referring to "Power Window Main Switch Inspection" in this section.
	Power window sub switch faulty	Check power window sub switch referring to "Power Window Sub Switch Inspection" in this section.
	Power window motor faulty	Check power window motor.

Power Door Lock System (If Equipped) Symptom Diagnosis

Condition	Possible Cause	Correction
No door is locked or unlocked by all switch	Fuse blown	Replace fuse to check for short.
	Door switch faulty	Check door switch referring to "Door Switch Inspection" in this section.
	Wiring or grounding faulty	Check power door lock system referring to "Power Door Lock System Circuit Inspection" in this section.
	Power door lock controller faulty	
No door is locked or unlocked by only power door lock switch	Power door lock switch faulty	Check power door lock switch referring to "Power Door Lock Switch Inspection" in this section.
	Wiring or grounding faulty	Check power door lock system referring to "Power Door Lock System Circuit Inspection" in this sectioin.
	Power door lock controller faulty	
No door is locked or unlocked by only driver side key cylinder switch	Driver side key cylinder switch faulty	Check driver side key cylinder switch referring to "Key Cylinder Switch Inspection" in this section.
	Wiring or grounding faulty	Check power door lock system referring to "Power Door Lock System Circuit Inspection" in this section.
	Power door lock controller faulty	
Only one door is not locked or unlocked	Wiring or grounding faulty	Repair circuit.
	Power door lock actuator faulty	Check power door lock actuator referring to "Door Lock Actuator Inspection" in this section.

Keyless Entry System (If Equipped) Symptom Diagnosis

NOTE:

Diagnose keyless entry system referring to the following table after confirming that power door lock system is good condition.

Condition	Possible Cause	Correction
No door is locked or unlocked by only keyless entry transmitter	Transmitter battery dead	Replace battery.
	Transmitter faulty	Replace transmitter.
	Code registration error	Perform code registration referring to “Transmitter Code Registration Procedure” in this section.
	Key remainder switch (in ignition switch) faulty	Check ignition switch referring to “Ignition (Main) Switch ON-Vehicle Inspection” in Section 8C.
	Wiring or grounding faulty	Check keyless entry system circuit referring to “Keyless Entry System Circuit Inspection” in this section.
	Power door lock controller faulty	
Turn signal lights are not flashed when doors are locked or unlocked by keyless entry transmitter	Wiring or grounding faulty	Check keyless entry system circuit referring to “Keyless Entry System Circuit Inspection” in this section.
	Power door lock controller faulty	
Interior light does not turn ON when doors are unlocked by keyless entry transmitter	Wiring or grounding faulty	Check keyless entry system circuit referring to “Keyless Entry System Circuit Inspection” in this section.
	Power door lock controller faulty	

Power Door Mirror Control System (If Equipped) Symptom Diagnosis

Condition	Possible Cause	Correction
No power door mirror operates	Fuse blown	Replace fuse to check for short.
	Wiring or grounding faulty	Repair circuit.
	Power door mirror switch faulty	Check power door mirror switch referring to “Power Door Mirror Switch Inspection” in this section.
One power door mirror does not operate	Wiring or grounding faulty	Repair circuit.
	Power door mirror switch faulty	Check power door mirror switch referring to “Power Door Mirror Switch Inspection” in this section.
	Power door mirror actuator faulty	Check power door mirror actuator referring to “Power Door Mirror Actuator Inspection” in this section.

Door Mirror Heater (If Equipped) Symptom Diagnosis

Condition	Possible Cause	Correction
No door mirror heater operates	Fuse blown	Replace fuse to check for short.
	Wiring or grounding faulty	Repair circuit.
	Rear window defogger switch faulty	Check rear window defogger switch referring to “Rear Window Defogger Switch Inspection” in this section.
One door mirror heater does not operate	Wiring or grounding faulty	Repair circuit.
	Door mirror heater faulty	Check door mirror heater referring to “Door Mirror Heater Switch Inspection” in this section.

Front Seat Heater (If Equipped) Symptom Diagnosis

Condition	Possible Cause	Correction
Neither seat back nor seat cushion becomes hot although seat heater switch is ON position	Fuse blown	Replace fuse to check for short.
	Wiring or grounding faulty	Repair circuit.
	Seat heater switch faulty	Check seat heater switch referring to “Seat Heater System Inspection” in this section.
	Seat heater circuit in seat back and/or seat cushion faulty	Check seat heater wire referring to “Seat Heater System Inspection” in this section.

Information Display Unit Symptom Diagnosis

NOTE:

This thermometer indicates the ambient temperature in front of the radiator. Under any one of the following listed conditions, however, even when the ambient temperature goes up, the thermometer display does not rise so as to correct the rise of the ambient temperature caused by the radiant heat of the engine. When the ambient temperature drops, the thermometer reading follows the change in the temperature.

Required Diagnosis Condition

- Turning the ignition switch on more than two hours after turning the ignition switch off
- At a vehicle speed of 30 km/h or higher (more than 30 seconds after the speed gets over 30 km/h)
- Ambient temperature between –30°C (–22°F) (exclusive) and 50°C (122°F) (exclusive)

If one or more of these conditions is (are) not satisfied, correct temperature will not be displayed.

Condition	Possible Cause	Correction
No displaying of information display unit	Fuse blown	Replace fuse to check for short.
	Wiring and/or grounding faulty	Repair or replace.
	Information display unit faulty	Replace information display unit.
Incorrect thermometer display	Outside air temperature sensor faulty	Inspect outside air temperature sensor referring to “Outside Air Temperature Sensor Inspection” in this section. Replace if faulty.
	VSS signal faulty	Inspect VSS referring to “DTC P0500 Vehicle Speed Sensor (VSS) Malfunction” in Section 6. Replace if faulty.
	Wiring and/or grounding faulty	Repair or replace.
Thermometer and fuel economy meter stay displaying “– –”.	Wiring and/or grounding faulty	Repair or replace.

On-Vehicle Service

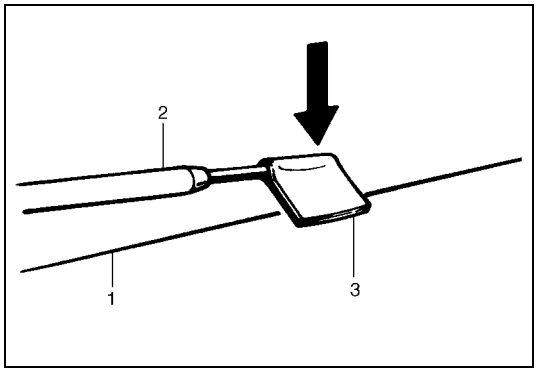
Cautions in Body Electrical System Servicing

Refer to “Cautions in Body Electrical System Servicing” in Section 8B.

Rear Window Defogger Switch Inspection

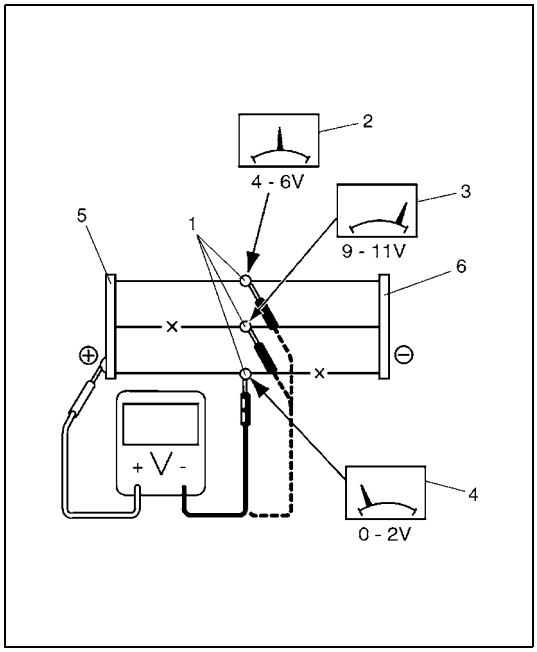
Refer to “Rear Defogger Switch Inspection” in Section 1A.

Rear Window Defogger Wire Inspection



NOTE:

- **When cleaning rear window glass, use a dry cloth and wipe it along heat wire (1) direction.**
- **When cleaning glass, do not use detergent or abrasive containing glass cleaner.**
- **When measuring wire voltage, use a tester with negative probe (2) wrapped with a tin foil (3) which should be held down on wire by finger pressure.**



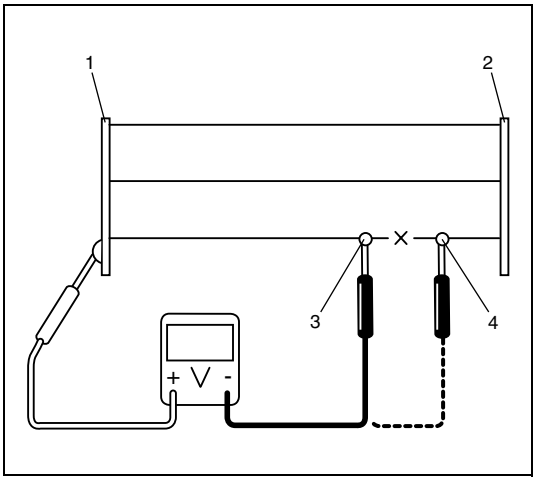
- Wire damage inspection.

a) Turn ignition switch ON.
b) Turn defogger switch ON.
c) Check voltage at the center (1) of each heat wire as shown below.
   If measured voltage is 10 V, wire must be damaged between its center and positive end (5).
   If voltage is 0 V, wire must be damaged between its center and ground end (6).

Defogger wire voltage

Voltage	Criteria
Approx. 4 – 6 V (2)	Good (No break in wire)
Approx. 9 – 11 V (3) or 0 – 2 V (4)	Broken wire

X: Damage point

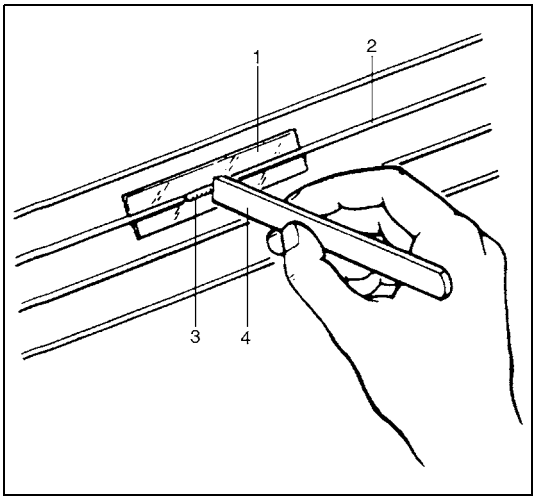


- Damage point locating.

a) Turn ignition switch ON.
b) Turn defogger switch ON.
c) Touch voltmeter positive (+) lead to heat wire positive terminal end (1).
d) Touch voltmeter negative (–) lead with a foil strip to heat wire positive terminal end (1), then move it along wire to the negative terminal end (2).
e) The place where voltmeter fluctuates from 0 – 2 V (3) to several volts (4) is where there is damage.

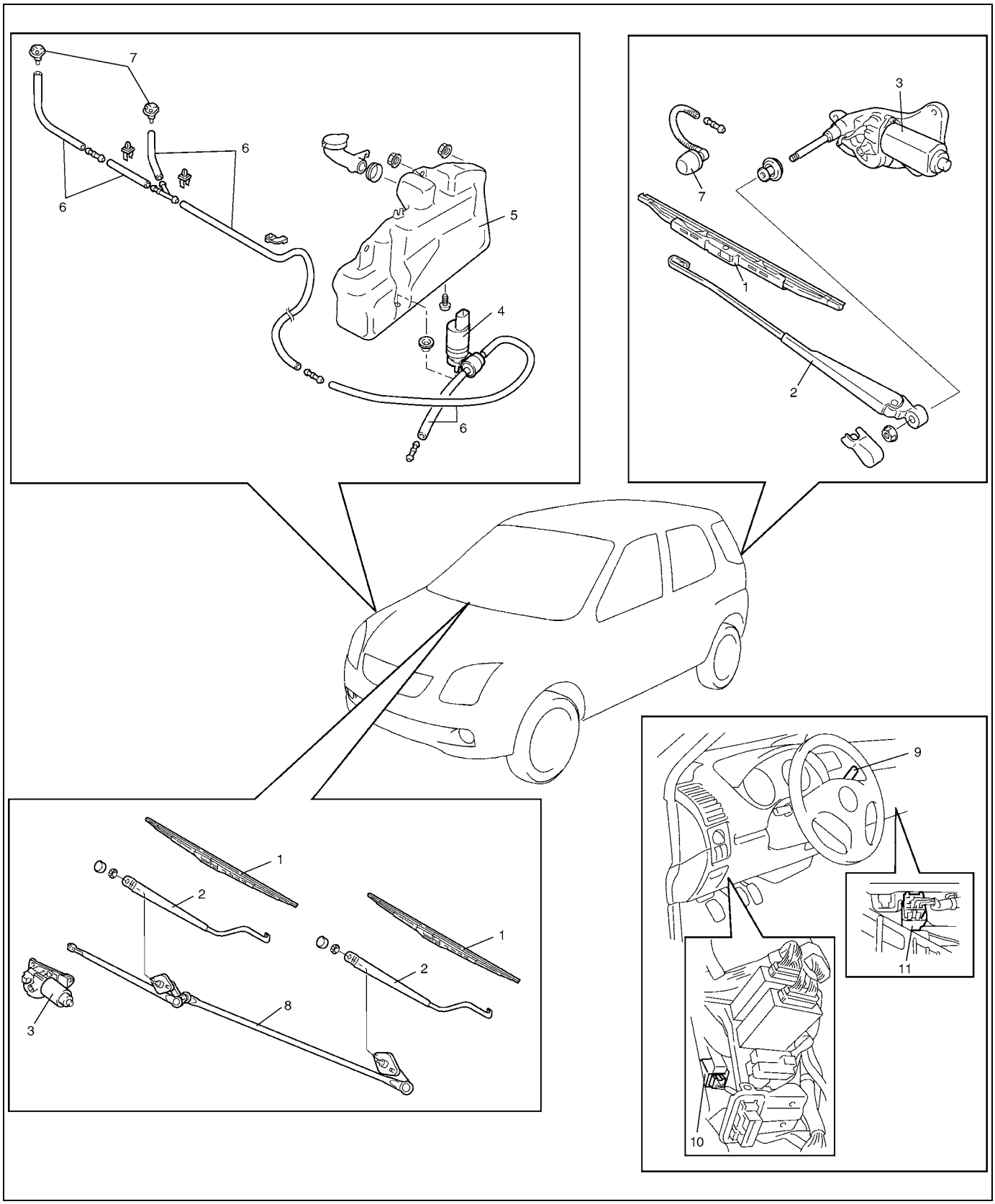
X: Damage point

Rear Window Defogger Wire Repair



1) Use white gasoline for cleaning.
2) Apply masking tape (1) at both upper and lower sides of heat wire (2) to be repaired.
3) Apply commercially-available repair agent (3) with a fine-tip brush (4).
4) 2 to 3 minutes later, remove masking tapes (1).
5) Leave repaired heat wire as it is for at least 24 hours before operating rear defogger again.

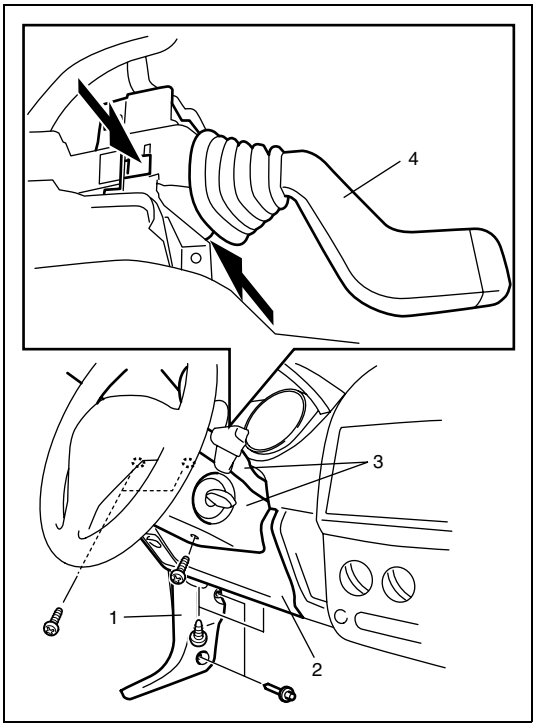
Wipers and Washers Components



1. Wiper blade	4. Washer pump	7. Washer nozzle	10. Rear wiper intermittent timer
2. Wiper arm	5. Washer tank	8. Wiper link	11. Front wiper intermittent timer
3. Wiper motor	6. Washer hose	9. Wiper switch	

Wiper and Washer Switch Removal and Installation

REMOVAL

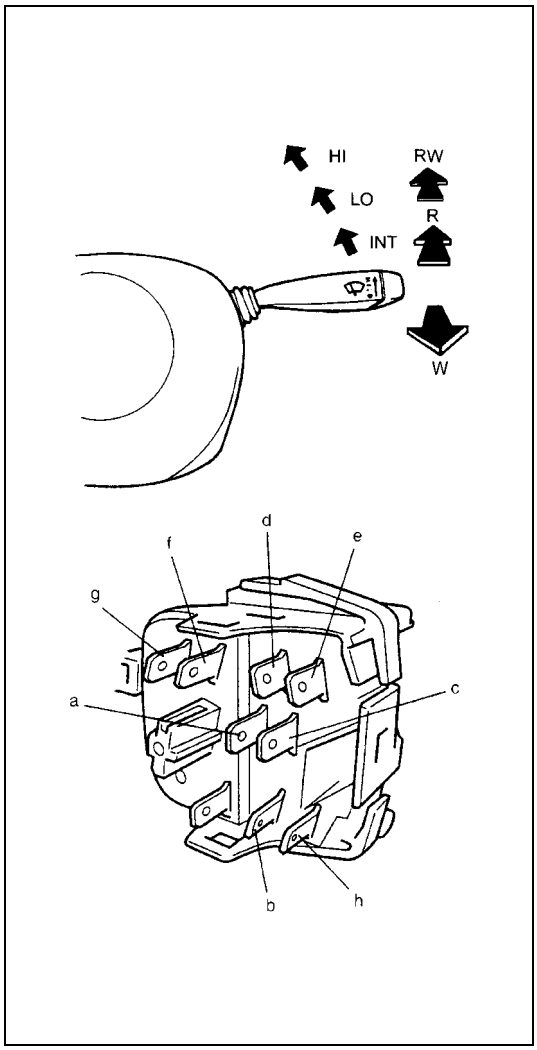


1) Disconnect negative (–) cable at battery.
2) Remove dash side trim (1), steering column hole cover (2) and steering column covers (3).
3) Remove wiper and washer switch (4) while releasing the locks.
4) Disconnect wiper and washer switch connector.

INSTALLATION

Reverse removal procedure for installation noting the followings.

- Connect wiper and washer switch connector securely.
- Push wiper and washer switch into steering lock assembly till it clicks.



Wiper and Washer Switch Inspection

Check for continuity between terminals at each switch position as shown below.
If check result is not as specified, replace wiper and washer switch.

Front wiper switch specification

Switch Position \ Terminal	a	b	c	d	e
OFF			○	○	
INT	○		○	○	○
LO	○		○		
HI	○	○			

Front washer switch specification

Switch Position \ Terminal	a	f	g	h
OFF		○	○	
ON (W)	○	○	○	○

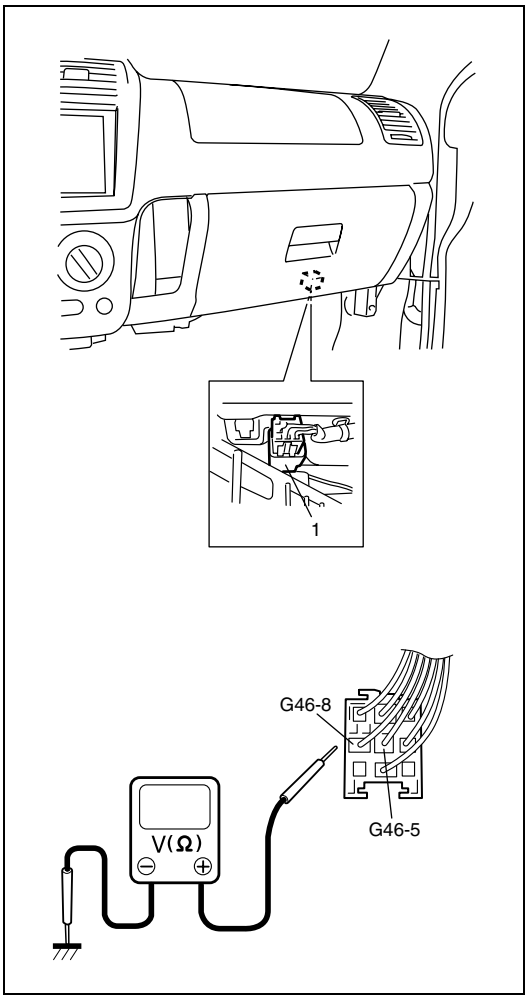
Rear wiper and washer switch specification

Switch Position \ Terminal	a	i	f	g	h
OFF			○	○	
ON (R)	○	○		○	○
REAR WASHER (RW)	○	○	○	○	○

Wiper Circuit Inspection

Front wiper auto stop circuit

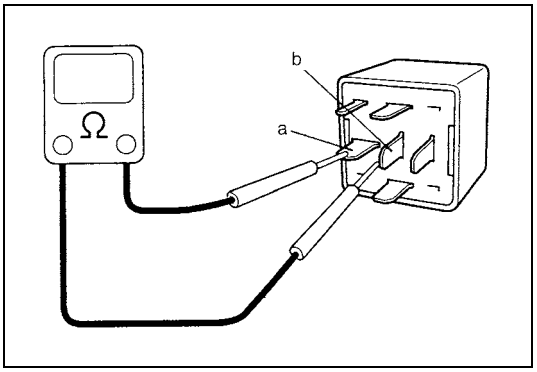
1) Check that wiper motor operates with the wiper switch at low position.
2) Disconnect negative cable at battery.
3) Disable air bag system. Refer to “Disabling air bag system” in Section 10B.



4) Pull out front wiper intermittent timer (1).
5) Disconnect coupler, and connect negative cable at battery.
6) Check that the voltage and resistance between the following terminals are as specification.

Terminals	Condition	Specification
G46-8 and ground	When ignition switch is in OFF.	Continuity
G46-5 and ground	When wiper blades are stopped at windshield base.	Continuity
	Turn ignition switch to ON. Turn front wiper switch to ON then to OFF so that wiper blades stop at the position except starting/returning point.	10 – 15 V

If check result is not satisfactory, repair wiring and check wiper motor.

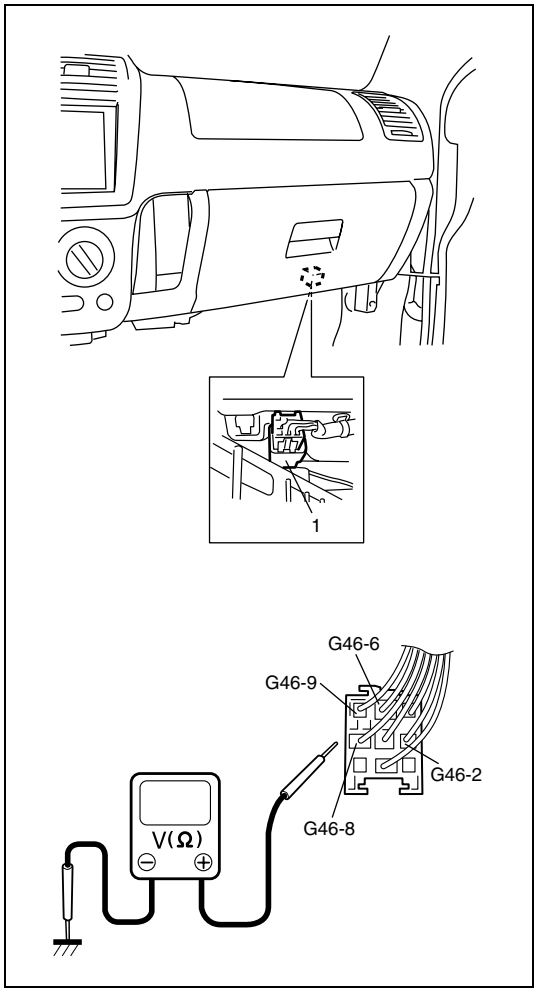


7) Check the continuity between terminals “a” and “b” of intermittent timer.
   If continuity is not obtained, replace intermittent timer and recheck.

8) After intermittent timer lead wire coupler is connected and intermittent timer is installed, enable air bag system. Refer to “Enabling air bag system” in Section 10B.

Front wiper intermittent circuit

1) Check that wiper motor operates with the wiper switch at low position, and return to original position with the wiper switch turned OFF.
2) Disconnect negative cable at battery.
3) Disable air bag system. Refer to “Disabling air bag system” in Section 10B.



4) Pull out front wiper intermittent timer (1).
5) Disconnect coupler, and connect negative cable at battery.
6) Check that the voltage and resistance between the following terminals are as specifications.

Terminals	Condition	Specification
G46-2 and ground	When ignition switch is in OFF.	0 V
	When ignition switch is in ON.	10 – 15 V
G46-6 and ground	When ignition switch is in OFF.	Continuity
G46-8 and ground	When ignition switch is in OFF.	Continuity
G46-9 and ground	When ignition switch is in ON and front wiper switch is in OFF.	0 V
	When ignition switch is in ON and front wiper switch is in intermittent position.	10 – 15 V

If check result is not satisfactory, repair wiring and check wiper motor.

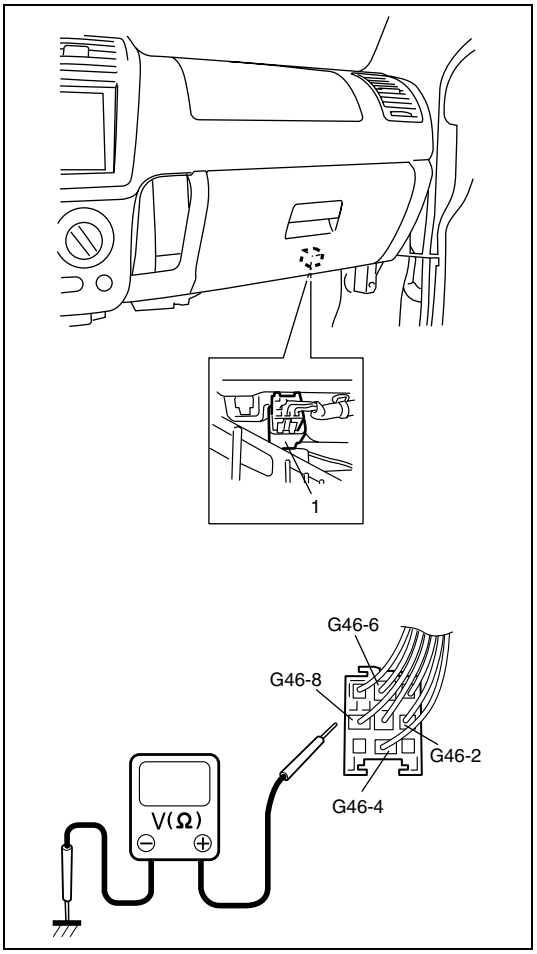
NOTE:

The wiper motor operates the wiper arms at an interval of approximately 6 seconds per one operation at low speed.

7) After intermittent timer lead wire coupler is connected and intermittent timer is installed, enable air bag system. Refer to “Enabling air bag system” in Section 10B.

Front washer linked circuit

1) Check that wiper motor operates with the wiper switch at low position, and return to original position with the wiper switch turned OFF.
2) Disconnect negative cable at battery.
3) Disable air bag system. Refer to “Disabling air bag system” in Section 10B.



4) Pull out front wiper intermittent timer (1).
5) Disconnect coupler, and connect negative cable at battery.
6) Check that the voltage and resistance between the following terminals are as specification.

Terminals	Condition	Specification
G46-2 and ground	When ignition switch is in OFF.	0 V
	When ignition switch is in ON.	10 – 15 V
G46-6 and ground	When ignition switch is in OFF.	Continuity
G46-8 and ground	When ignition switch is in OFF.	Continuity
G46-4 and ground	When ignition switch is in ON and front washer switch is in OFF.	0 V
	When ignition switch is in ON and front washer switch is in ON.	10 – 15 V

If check result is not satisfactory, repair wiring and check wiper motor.

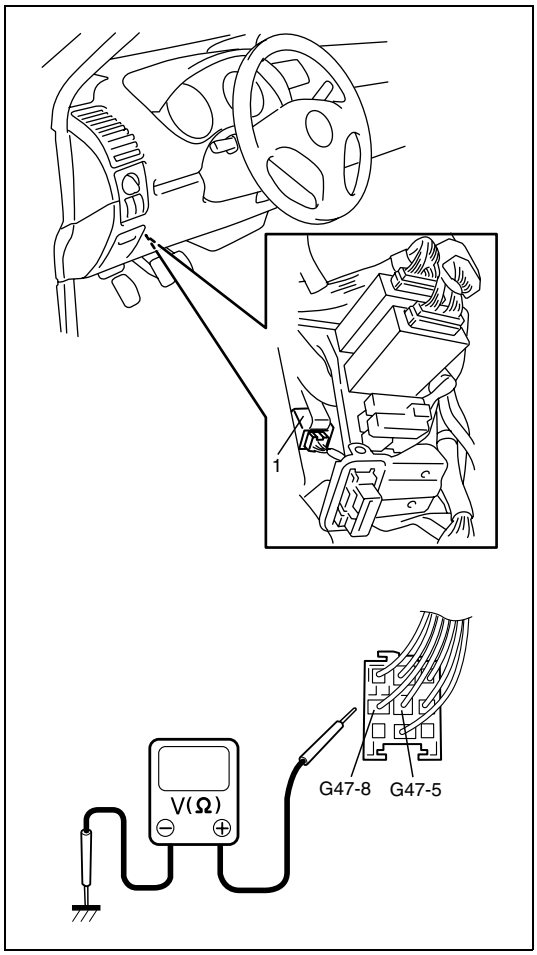
NOTE:

When front washer switch is in ON position for one second or more and then turned OFF, the wiper motor operates at low speed for approximately 5 seconds after front washer switch is turned OFF.

7) After intermittent timer lead wire coupler is connected and intermittent timer is installed, enable air bag system. Refer to “Enabling air bag system” in Section 10B.

Rear wiper auto stop circuit

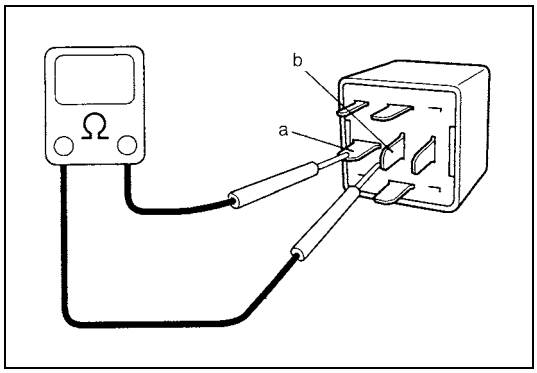
1) Check that wiper motor operates with the wiper switch at rear position.
2) Disconnect negative cable at battery.
3) Disable air bag system. Refer to “Disabling air bag system” in section 10B.



4) Pull out rear wiper intermittent timer (1).
5) Disconnect coupler, and connect negative cable at battery.
6) Check that the voltage and resistance between the following terminals are as specification.

Terminals	Condition	Specification
G47-8 and ground	When ignition switch is in OFF.	Continuity
G47-5 and ground	When wiper blades are stopped at windshield base.	Continuity
	Turn ignition switch to ON. Turn rear wiper switch to ON then to OFF so that wiper blades stop at the position except starting point.	10 – 15 V

If check result is not satisfactory, repair wiring and check wiper motor.

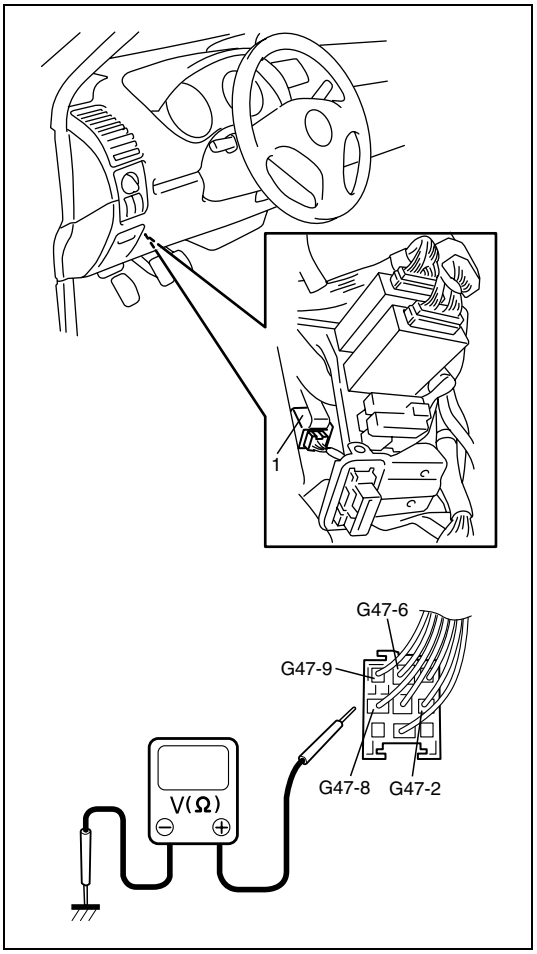


7) Check the continuity between terminals “a” and “b” of intermittent timer. If continuity is not obtained, replace intermittent timer and recheck.

8) After intermittent timer lead wire coupler is connected and intermittent timer is installed, enable air bag system. Refer to “Enabling air bag system” in Section 10B.

Rear wiper intermittent circuit

1) Check that wiper motor operates with the wiper switch at rear position, and return to original position with the wiper switch turned OFF.
2) Disconnect negative cable at battery.
3) Disable air bag system. Refer to “Disabling air bag system” in Section 10B.



4) Pull out rear wiper intermittent timer (1).
5) Disconnect coupler, and connect negative cable at battery.
6) Check that the voltage and resistance between the following terminals are as specifications.

Terminals	Condition	Specification
G47-2 and ground	When ignition switch is in OFF.	0 V
	When ignition switch is in ON.	10 – 15 V
G47-6 and ground	When ignition switch is in OFF.	Continuity
G47-8 and ground	When ignition switch is in OFF.	Continuity
G47-9 and ground	When ignition switch is in ON and rear wiper switch is in OFF.	0 V
	When ignition switch is in ON and rear wiper switch is in ON position.	10 – 15 V

If check result is not satisfactory, repair wiring and check wiper motor.

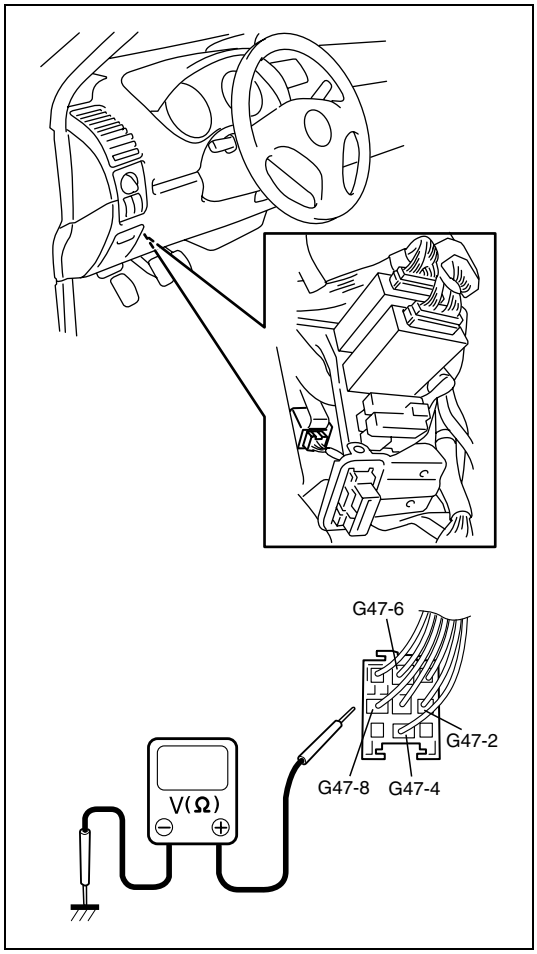
NOTE:

The wiper motor operates the wiper arms at an interval of approximately 6 seconds per one operation.

7) After intermittent timer lead wire coupler is connected and intermittent timer is installed, enable air bag system. Refer to “Enabling air bag system” in Section 10B.

Rear washer linked circuit

1) Check that wiper motor operates with the wiper switch at rear position, and return to original position with the wiper switch turned OFF.
2) Disconnect negative cable at battery.
3) Disable air bag system. Refer to “Disabling air bag system” in Section 10B.



4) Pull out rear wiper intermittent timer (1).
5) Disconnect coupler, and connect negative cable at battery.
6) Check that the voltage and resistance between the following terminals are as specification.

Terminals	Condition	Specification
G47-2 and ground	When ignition switch is in OFF.	0 V
	When ignition switch is in ON.	10 – 15 V
G47-6 and ground	When ignition switch is in OFF.	Continuity
G47-8 and ground	When ignition switch is in OFF.	Continuity
G47-4 and ground	When ignition switch is in ON and rear washer switch is in OFF.	0 V
	When ignition switch is in ON and rear washer switch is in ON.	10 – 15 V

If check result is not satisfactory, repair wiring and check wiper motor.

NOTE:

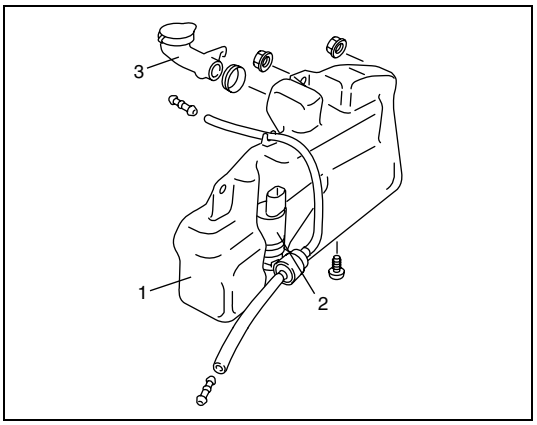
When rear washer switch is in ON position for one second or more and then turned OFF, the rear wiper motor operates for approximately 5 seconds after rear washer switch is turned OFF.

7) After intermittent timer lead wire coupler is connected and intermittent timer is installed, enable air bag system. Refer to “Enabling air bag system” in Section 10B.

Washer Tank and Washer Pump Removal and Installation

REMOVAL

1) Disconnect negative cable at battery.
2) Remove front fender lining (RH).

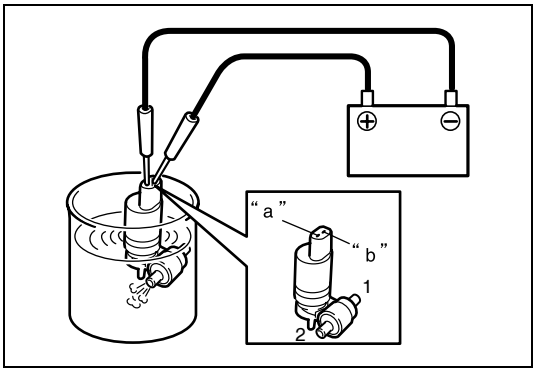


3) Remove washer tank attaching nuts and inlet pipe (3).
4) Disconnect pump lead wire coupler and hose(s).
5) Remove washer tank (1).
6) Remove washer pump (2) from washer tank (1).

INSTALLATION

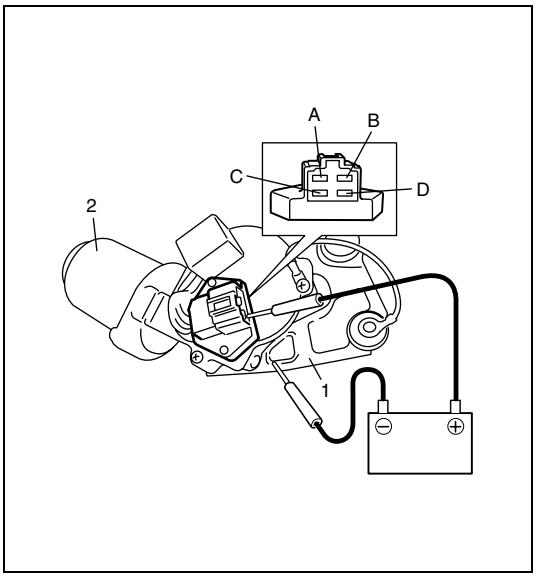
Reverse removal procedure for installation.

Washer Pump Inspection



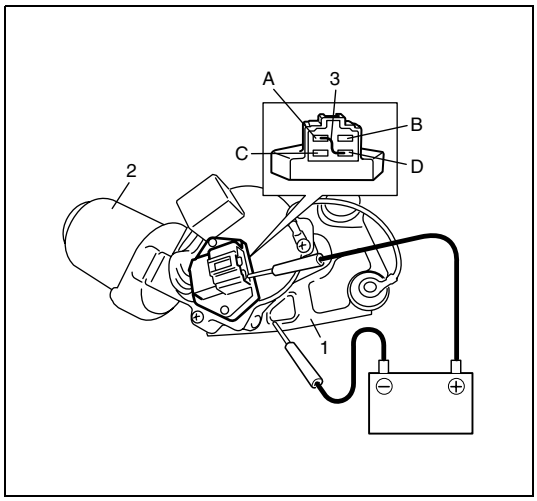
1) Connect battery (+) terminal to pump terminal “a”, and battery (–) terminal to pump terminal “b”.
   Check that water jets from front washer side (1).
2) Connect battery (+) terminal to pump terminal “b”, and battery (–) terminal to pump terminal “a”.
   Check that water jets from rear washer side (2).

Front Wiper Motor Inspection



1) For low speed check.
   a) Use a 12 V battery
   b) Connect battery positive (+) terminal to wiper motor terminal “A” and battery negative (–) terminal to wiper motor bracket (1) (wiper motor ground).
      If motor (2) rotates at low revolution speed of 44 to 52 rpm, it is proper.
2) For high speed check.
   a) Use a 12 V battery.
   b) Connect battery positive (+) terminal to wiper motor terminal “B” and battery negative (–) terminal to wiper motor bracket (1) (wiper motor ground).
      If motor (2) rotates at high revolution speed of 64 to 78 rpm, it is proper.

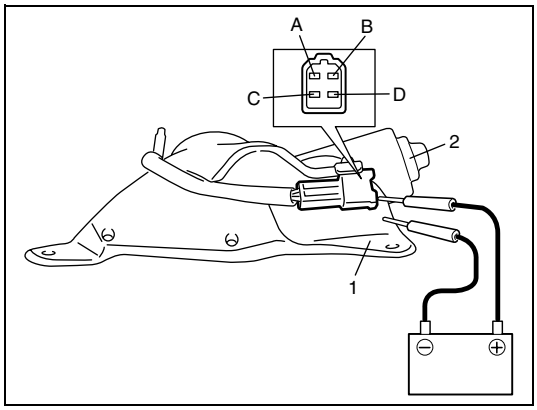
If check result is not as specified, replace wiper motor.



3) Automatic stop action check.
   a) Connect 12 V battery (+) terminal to wiper motor terminal "A" and battery (–) terminal to bracket (1) (wiper motor ground), and let the motor (2) turn.
   b) Disconnect wiper motor terminal "A" from battery, and let the motor (2) stop.
   c) Connect wiper motor terminal "A" and "D" with a jumper wire (3), and connect wiper motor terminal "C" to battery (+) terminal. Observe the motor (2) turns once again then stops at a given position.
   d) Repeat a) thru c) several times and inspect if the motor (2) stops at the given position every time.

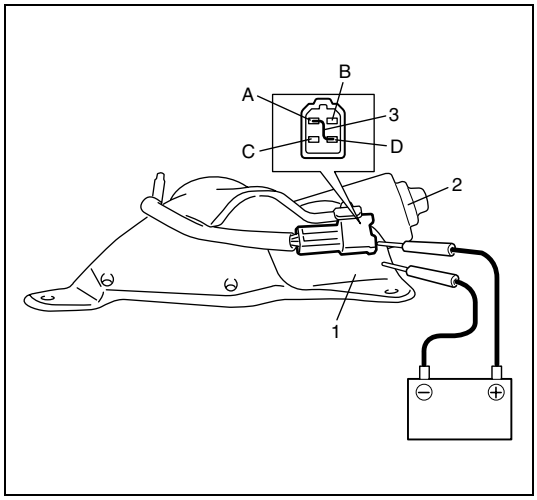
If check result is not as specified, replace wiper motor.

Rear Wiper Motor Inspection



1) Testing motor action.
   a) Use a 12 V battery.
   b) Connect battery positive (+) terminal to wiper motor terminal "A" and battery negative (–) terminal to wiper motor bracket (1) (wiper motor ground).
      If motor (2) rotates at low revolution speed of 35 to 45 rpm, it is proper.

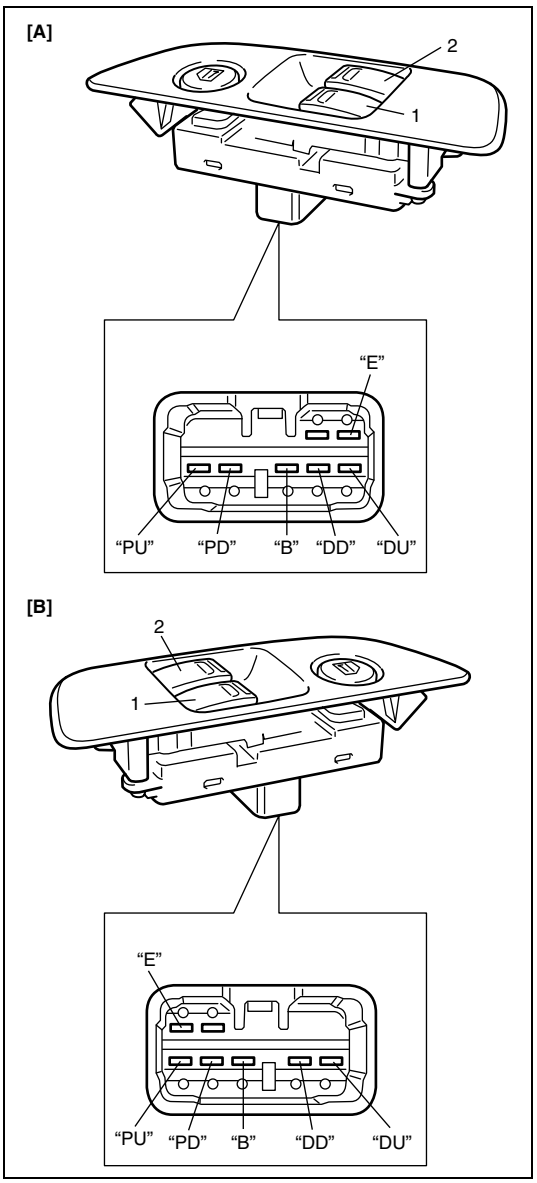
If check result is not as specified, replace rear wiper motor.



2) Automatic stop action check.
   a) Connect 12 V battery (+) terminal to wiper motor terminal "A" and battery (–) terminal to bracket (1) (wiper motor ground), and let the motor (2) turn.
   b) Disconnect wiper motor terminal "A" from battery, and let the motor (2) stop.
   c) Connect wiper motor terminal "A" and "D" with a jumper wire (3), and connect wiper motor terminal "C" to battery (+) terminal. Observe the motor (2) turns once again then stops at a given position.
   d) Repeat a) thru c) several times and inspect if the motor (2) stops at the given position every time.

If check result is not as specified, replace rear wiper motor.

Power Window Main Switch Inspection



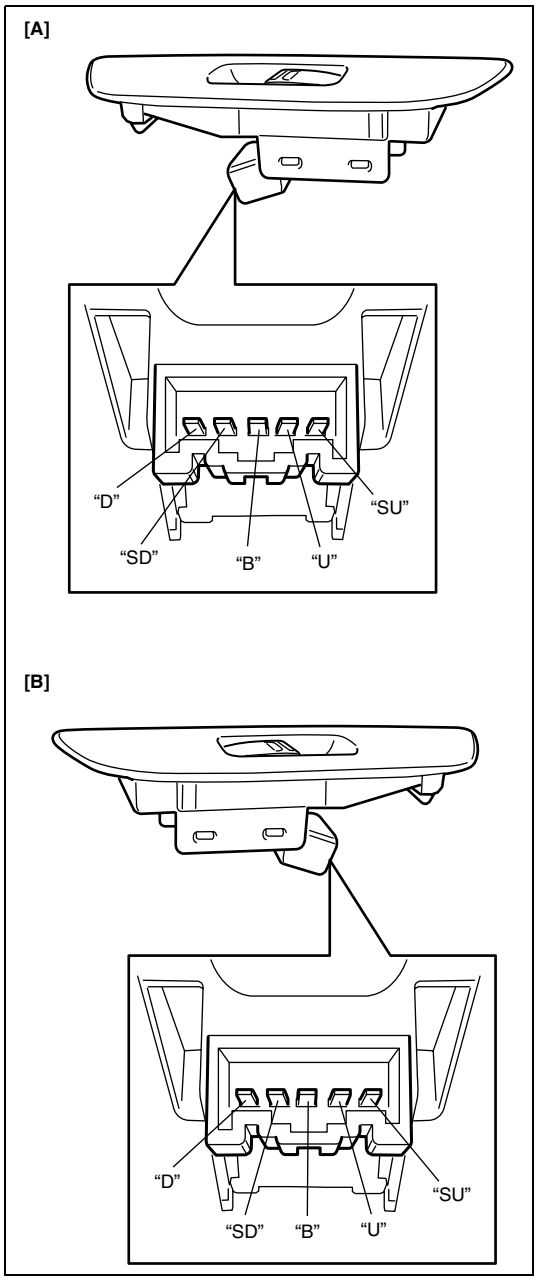
Check for continuity between terminals at each position.
If check result is not as specified, replace power window main switch.

Power window main switch specification

	Driver Side Window Switch (1)				Passenger Side Window Switch (2)			
Terminal / Switch Position	B	DU	DD	E	B	PU	PD	E
UP	○	○			○	○		
			○	○			○	○
OFF			○	○			○	○
		○		○		○		○
DOWN	○		○		○		○	
		○		○		○		○

[A]: LH steering vehicle
[B]: RH steering vehicle

Power Window Sub Switch Inspection



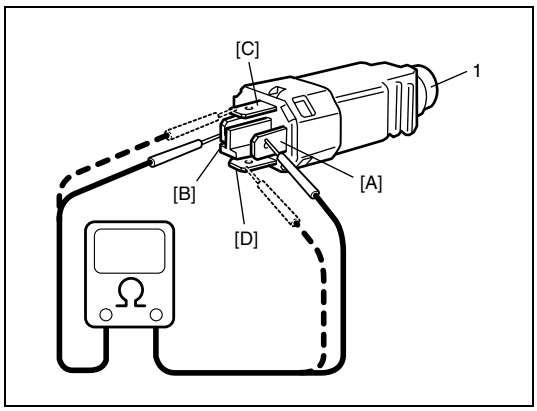
Check for continuity between terminals at each position.
If check result is not as specified, replace power window sub switch.

Power window sub switch specification

Switch Position \ Terminal	B	SU	SD	U	D
UP	○			○	
			○		○
OFF		○		○	
			○		○
DOWN	○		○		
				○	○

[A]: LH steering vehicle
[B]: RH steering vehicle

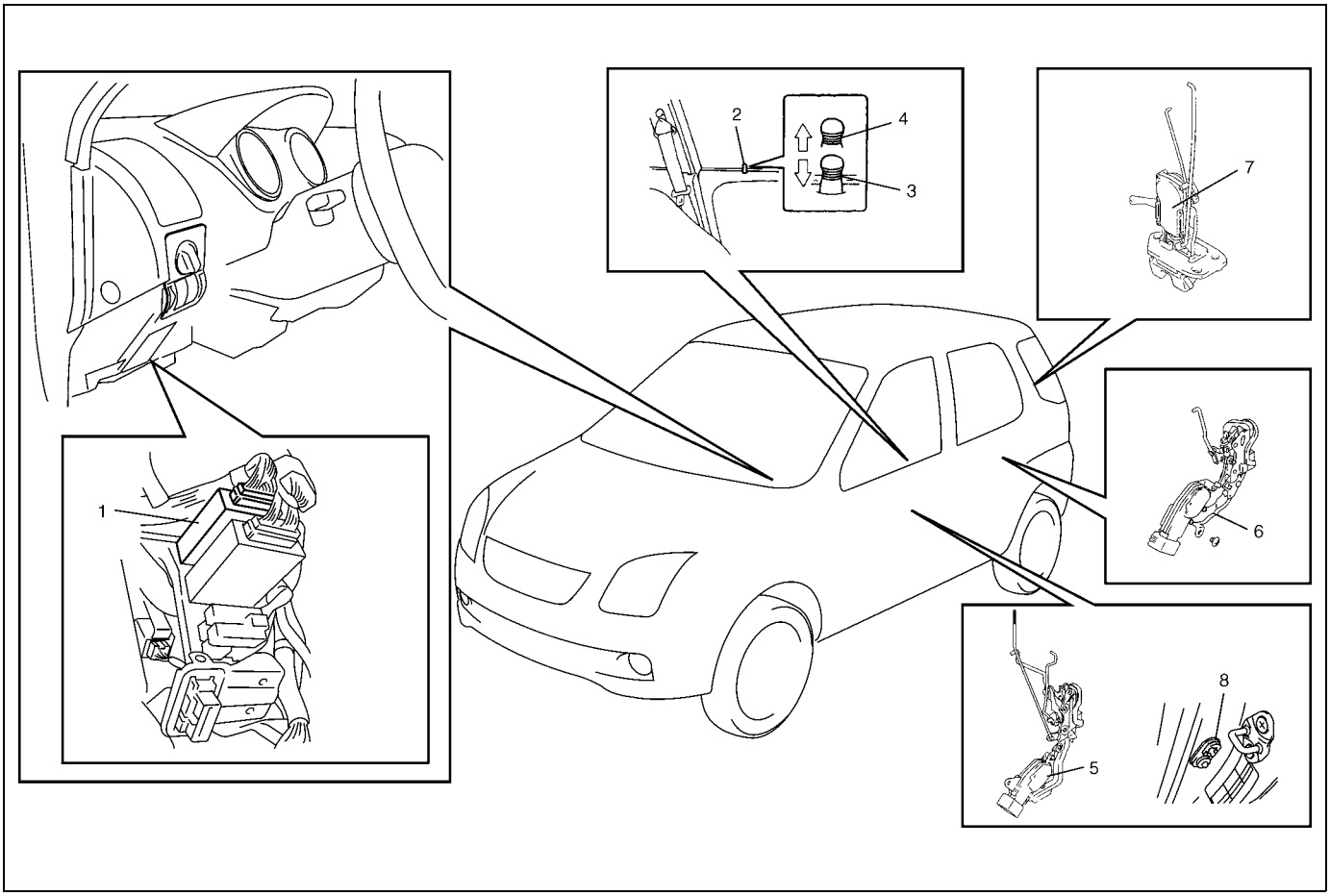
Stop Lamp (Brake) Switch Inspection



Check stop lamp (brake) switch for continuity as shown.
If check result is not as specified, replace stop lamp (brake) switch.

Stop lamp (brake) switch specification
Terminal [A] – [B]
Switch slider (1) pushed ON: Continuity
Switch slider (1) pushed OFF: No continuity
Terminal [C] – [D]
Switch slider (1) pushed ON: No continuity
Switch slider (1) pushed OFF: Continuity

Power Door Lock System Component Location



1. Power door lock controller	4. UNLOCK position	7. Back door actuator
2. Driver side door knob switch	5. Front door actuator	8. Door switch
3. LOCK position	6. Rear door actuator	

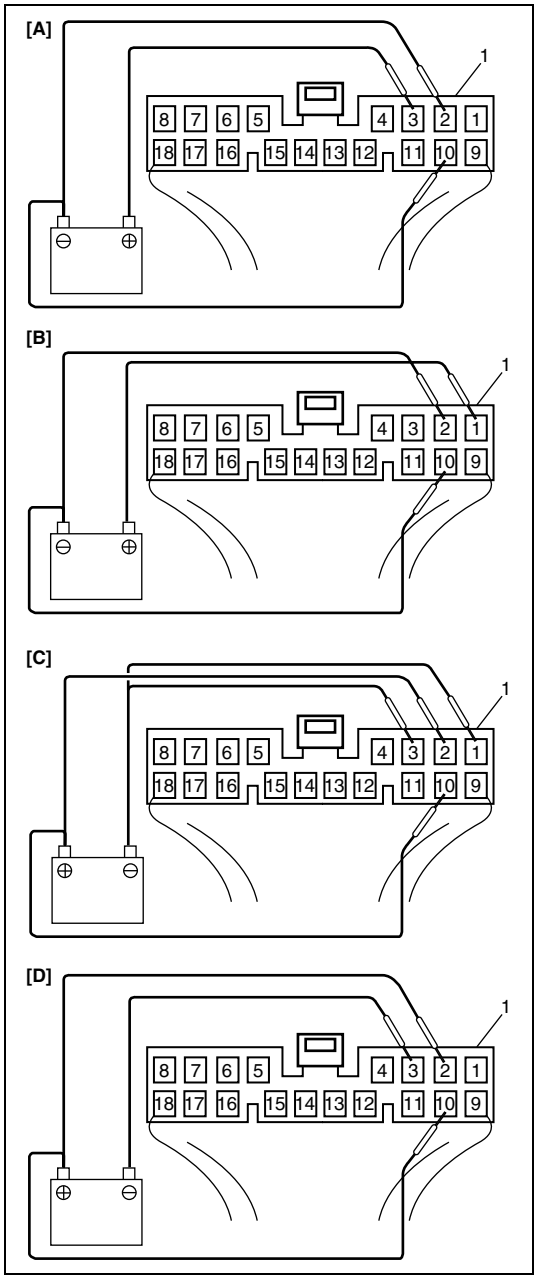
Power Door Lock System Operation Inspection

1) Check the following operation:
   a) When the driver side key cylinder is turned to LOCK once, check all doors lock.
   b) When the driver side door key cylinder is turned to UNLOCK twice, check if all doors unlock.
   c) For vehicle equipped dead lock system:
      When the driver side door key cylinder is turned to LOCK twice within 2 seconds, check if all doors lock and all door lock knobs not pulled up by hand.

If check result is not satisfied, go to “Power Door Lock System Circuit Inspection” in this section.

Power Door Lock System Circuit Inspection

1) Disconnect negative cable from battery.
2) Disconnect door lock controller coupler.



3) Confirm that all doors are unlocked. Connect battery positive (+) and negative (–) terminals to door lock controller coupler terminals and check power door lock operation as follows.
If it does not operate as specified, repair applicable circuit or check actuator. If it operates as satisfactory, go to next step.

Power door lock operation for vehicle with dead lock system

Step	TERMINAL				OPERATION
	G11-1	G11-2	G11-3	G11-10	
1	–	⊖	⊕	⊖	UNLOCK ⟶ LOCK
2	⊕	⊖	–	⊖	LOCK ⟶ DEAD LOCK
3	⊖	⊕	⊖	⊕	DEAD LOCK ⟶ UNLOCK

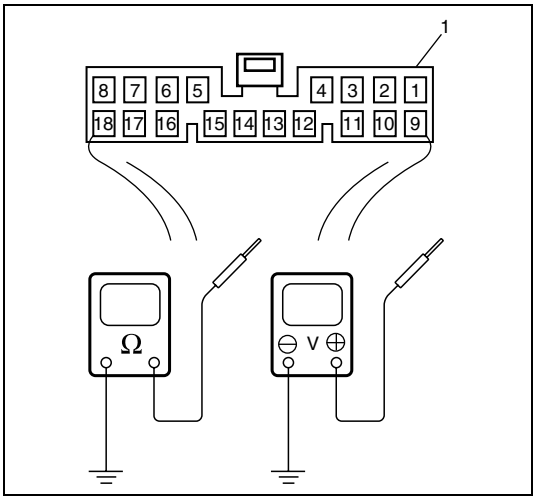
[A]:	Step1: Lock operation check
[B]:	Step 2: Dead lock operation check
[C]:	Step 3: Unlock operation check

Power door lock operation for vehicle without dead lock system

Step	TERMINAL			OPERATION
	G11-2	G11-3	G11-10	
1	⊖	⊕	⊖	UNLOCK ⟶ LOCK
2	⊕	⊖	⊕	LOCK ⟶ UNLOCK

[A]:	Step 1: Lock operation check
[D]:	Step 2: Unlock operation check
1.	Power door lock controller coupler “G11”

4) Connect negative (–) cable to battery.



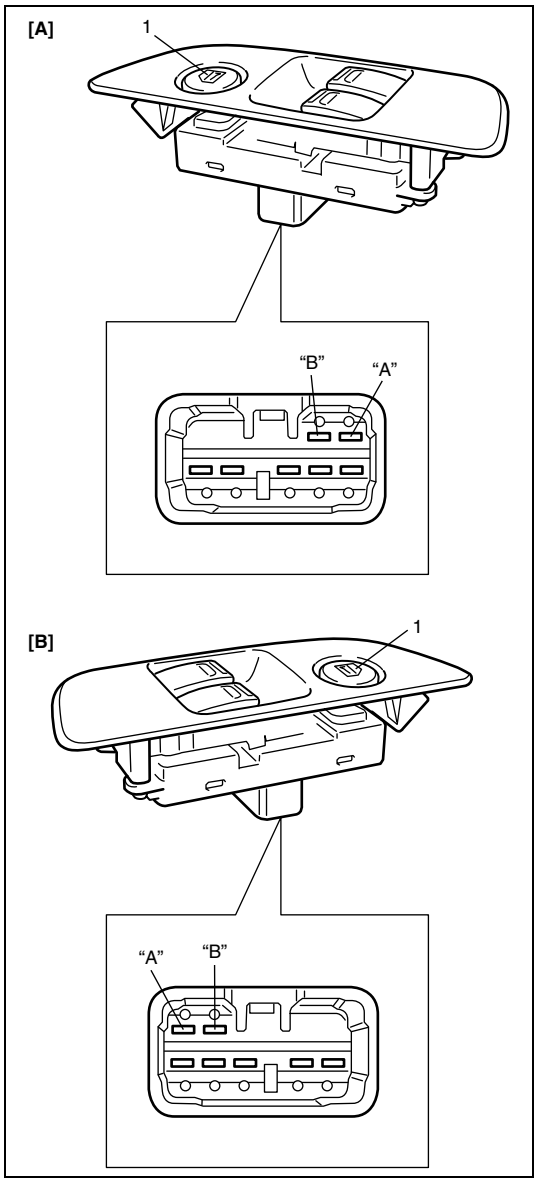
5) Check that the voltage and resistance between the following terminals and body ground are specifications under each conditions.
If check result is OK, replace door lock controller. If check result is not as specified, repair circuit.

1. Power door lock controller coupler “G11” viewed from harness side

Power door lock system circuit check

Terminal	Wire	Circuit	Specification	Condition
G11-6	WHT	Power door lock switch circuit	Continuity	Power door lock switch is in pushed position.
			No continuity	Power door lock switch is in free position.
G11-9	WHT/BLU	Main power supply	10 – 14 V	–
G11-11	WHT/BLK	Key remainder circuit	10 – 14 V	Ignition switch in ACC position.
			0 – 1 V	Ignition key is not in ignition.
G11-12	RED/BLK	Ignition switch circuit	10 – 14 V	Ignition switch is in ON position.
			0 – 1 V	Ignition switch is in OFF position.
G11-13	RED/BLU	Driver side key cylinder circuit (UNLOCK signal)	Continuity	Driver side key cylinder is in UNLOCK position.
			No continuity	Except the above-mentioned condition.
G11-14	WHT/RED	Driver side key cylinder circuit (LOCK signal)	Continuity	Driver side key cylinder is in LOCK position.
			No continuity	Except the above-mentioned condition.
G11-15	BLK/RED	Door switch circuit	0 – 1 V	Driver side, passenger side, rear driver side, rear passenger side or rear end door is open.
			10 – 14 V	All doors are close.
G11-17	BLK	Ground	1 Ω or less	–

Power Door Lock Switch Inspection



Check for continuity between terminals at each position.
If check result is not as specified, replace power window main switch.

Power door lock switch specification

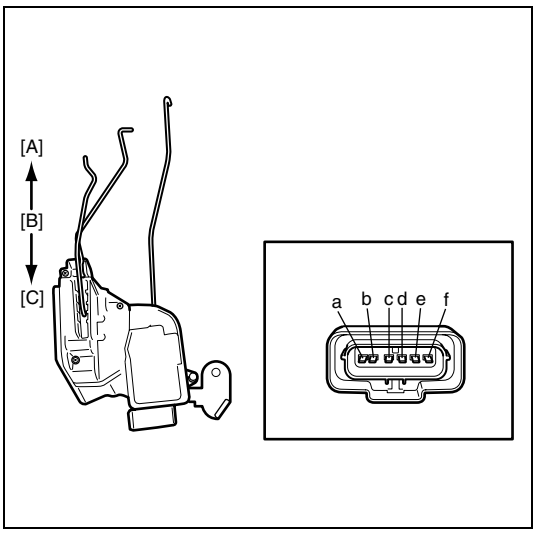
Terminal		A	B
Switch (1)	PUSH	○	○
	FREE		

[A]: LH steering vehicle
[B]: RH steering vehicle
1. Power door lock switch

Key Cylinder Switch Inspection

1) Disconnect negative (–) cable at battery.
2) Remove front door lock assembly referring to “Front Door Lock Assembly Inspection” in Section 9.
3) Inspect continuity between terminals under the following key position.

If check result is not as specified, replace door lock assembly.



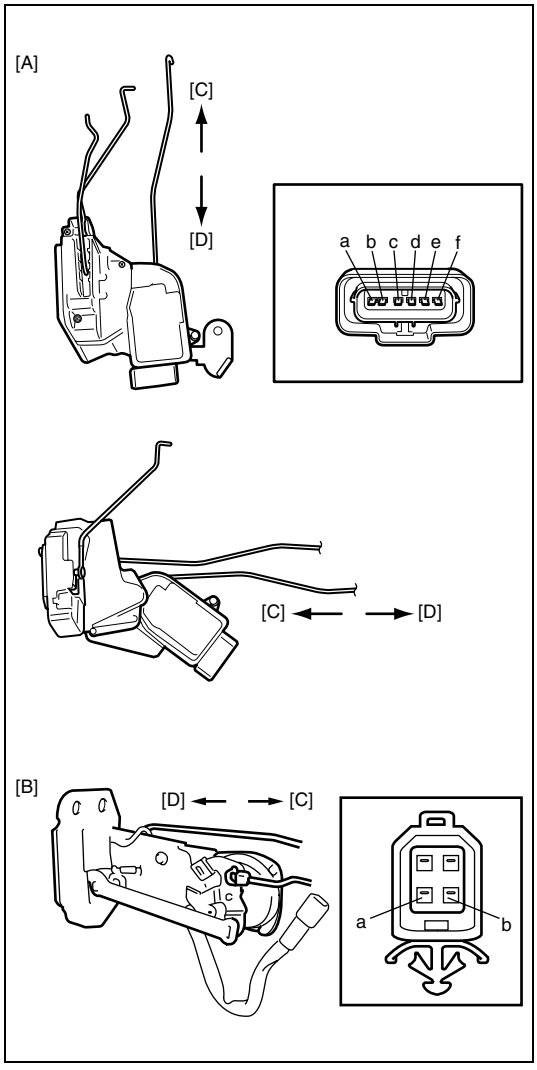
Key cylinder switch specification

Right side switch terminals		a	b	c
Left side switch terminals		f	e	d
Key position	Neutral			
	Unlock	○	○	
	Lock	○		○

[A]: Lock
[B]: Neutral
[C]: Lock

Door Lock Actuator Inspection

1) Disconnect negative (–) cable at battery.
2) Remove front door lock assembly referring to “Front Door Lock Assembly Inspection” in Section 9.
3) Remove rear door lock assembly referring to “Rear Door Lock Assembly Inspection” in Section 9.
4) Remove rear end door lock assembly referring to “Rearend Door Removal and Installation” in Section 9.
5) Connect 12 V battery positive and negative terminals to the door lock actuator terminals shown below.
   If it does not operate as specified in the table below, replace door lock assembly.



Front and rear door lock actuator specification

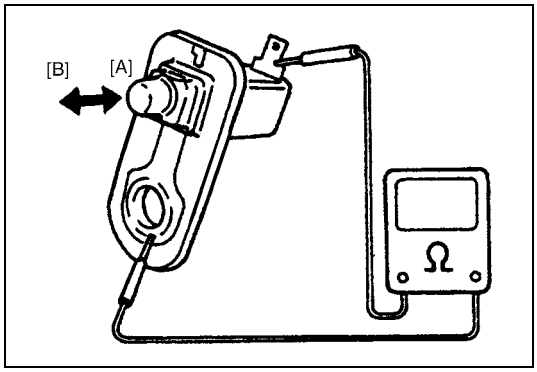
Right side switch terminals			f	e	d
Left side switch terminals			a	b	c
Unlock	⇒	Lock	⊖	⊖	⊕
Lock	⇒	Dead lock	⊖	⊕	⊕
Lock	⇒	Unlock	⊕	⊖	⊖
Dead lock	⇒	Unlock			

Rear end door lock actuator specification

			a	b
Unlock	⇒	Lock	⊕	⊖
Lock	⇒	Unlock	⊖	⊕

[A]: Front and rear door lock actuator
[B]: Rear end door lock actuator
[C]: Unlock
[D]: Lock

Door Switch Inspection

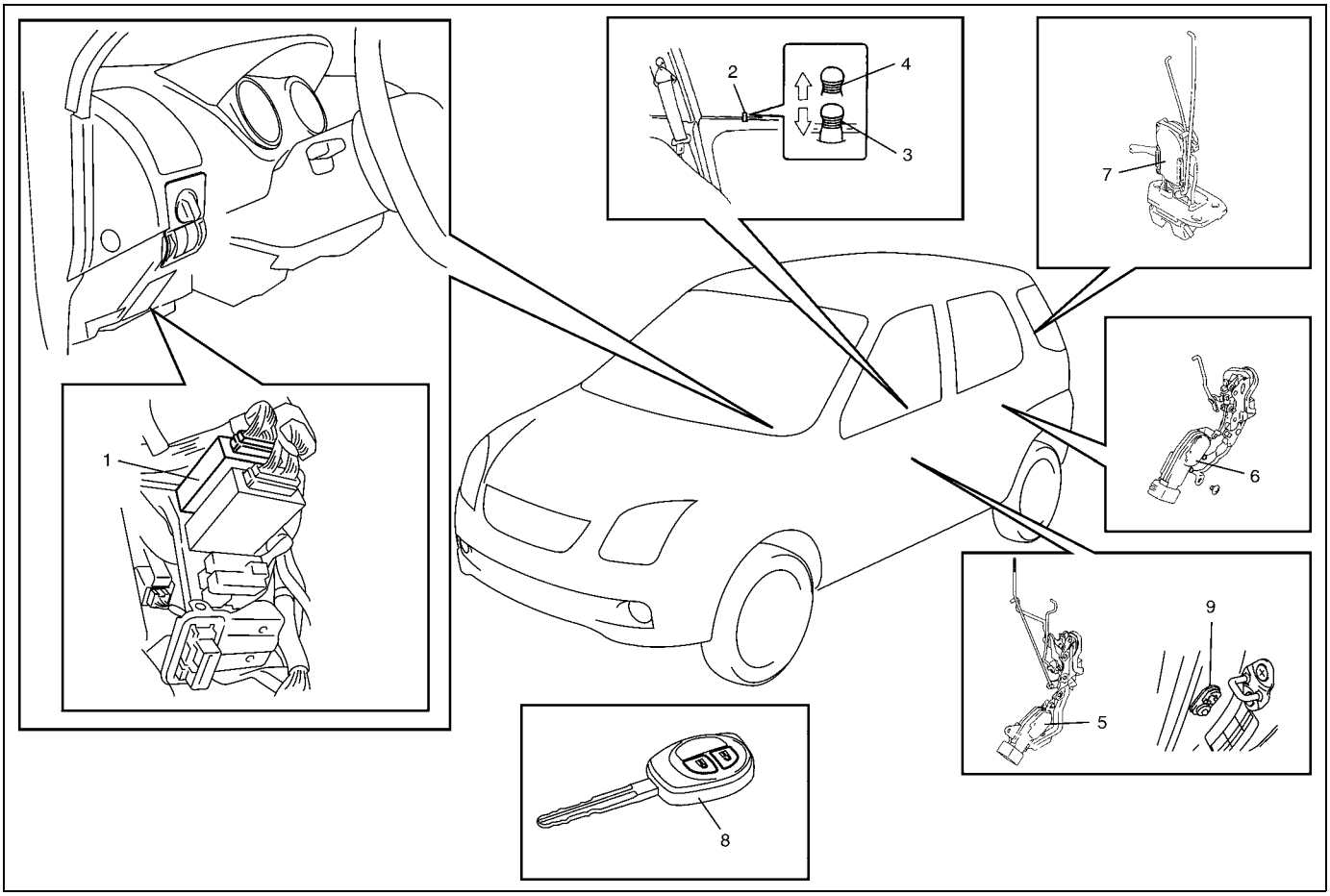


Remove door switch from body and check switch for continuity.
If found to be detective, replace switch.

Door switch specification

OFF [A] position (Door closed)	No continuity
ON [B] position (Door open)	Continuity

Power Door Lock System With Keyless Entry System Component Location



1. Power door lock controller	4. UNLOCK position	7. Back door actuator
2. Driver side door knob switch	5. Front door actuator	8. Transmitter
3. LOCK position	6. Rear door actuator	9. Door switch

System Description

The keyless entry system has the following signal modes in order to feed back the signal when the controller receives LOCK and UNLOCK signals from transmitter.

Received signal / Signal mode	LOCK signal	UNLOCK signal
Hazard warning light signal mode	The hazard warning lights flash once.	The hazard warning lights flash twice and the interior light turns on for about 15 seconds.
Interior light signal mode	The interior light flashes twice.	The interior light turns on for about 15 seconds.

NOTE:

- **These signal modes can be changed referring to “Change of Signal Mode” in this section.**
- **The initial condition is the hazard warning light signal mode.**

Change of Signal Mode

NOTE:

When the keyless entry signal mode is changed from the hazard warning signal mode to interior light signal mode, interior light will flash once.
When the signal mode is changed from interior light signal mode to hazard warning signal mode, hazard warning light will flash once.

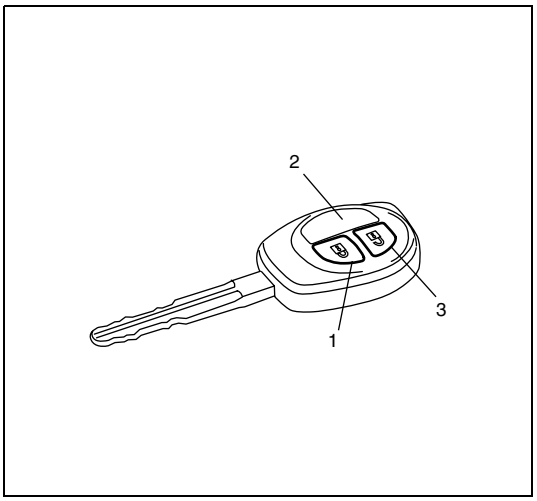
1) Make sure that all doors are closed and ignition key is out of ignition switch.
2) Perform the following procedures within 10 seconds.
   a) Insert ignition key to ignition switch.
   b) Turn ignition switch to “ACC” position, turn ignition switch to “OFF” position, and then pull off ignition key from ignition switch.
   c) Repeat step b).
   d) Turn ignition switch to “ACC” position, turn ignition switch to “OFF” position, and then push “UNLOCK” button on transmitter more than three times.
3) Confirm that either hazard warning light or interior light flash once. With this, change of signal mode is completed.

Keyless Entry System Operation Inspection

NOTE:

If keyless entry system is in interior light signal mode, change to hazard warning light signal mode referring to "Change of Signal Mode" in this section.

1) Confirm that power door lock system is in good condition referring to "Power Door Lock System Operation Inspection" in this section.
2) Confirm that turn signal and hazard waning light system is in good condition.
3) Check transmitter battery for dead. If battery is dead, replace battery referring to "Replacement of Transmitter Battery" in this section.
4) Confirm that all doors are closed and unlocked.



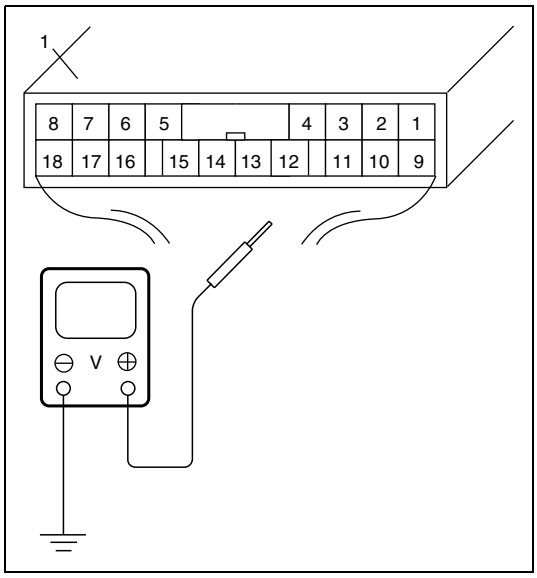
5) Check the following operation:
   a) When pushing "LOCK" button (1) on transmitter (2) once, check it all doors lock and hazard waning lights flash once.
   b) When pushing "UNLOCK" button (3) on transmitter (2) twice, check it all doors unlock, hazard waning lights flash twice and interior light turns on for several seconds with the interior light switch in the middle position.
   c) For vehicle equipped dead lock system:
      When pushing "LOCK" button (1) on transmitter (2) twice within 2 seconds, check that all doors lock and can not be all door lock knobs can not be by hand.

If check result is not satisfactory, go to "Keyless Entry System Circuit Inspection" in this section.

Keyless Entry System Circuit Inspection

NOTE:

If keyless entry system is in interior light signal mode, change to hazard warning light signal mode referring to "Change of Signal Mode" in this section.



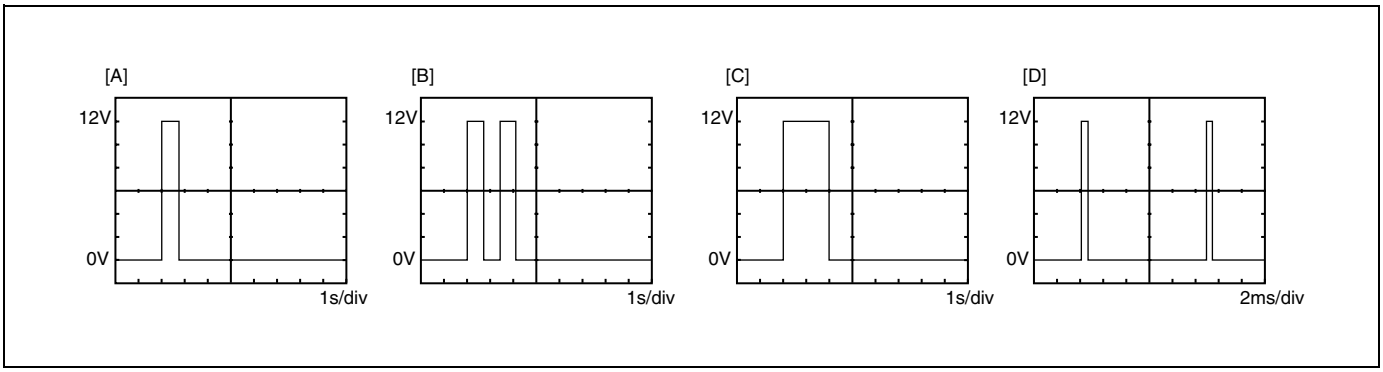
Keyless entry system circuit check

Check that the voltage and continuity between the following terminals and body ground are specifications under each conditions.
If check result is not as specified, check relevant circuit.
If circuit is normal, recheck keyless entry system circuit as follows.

1) Substitute a known-good door lock controller.
2) Register key code referring to "Transmitter Code Registration Procedure" in this section.
3) Recheck keyless entry system operation inspection.

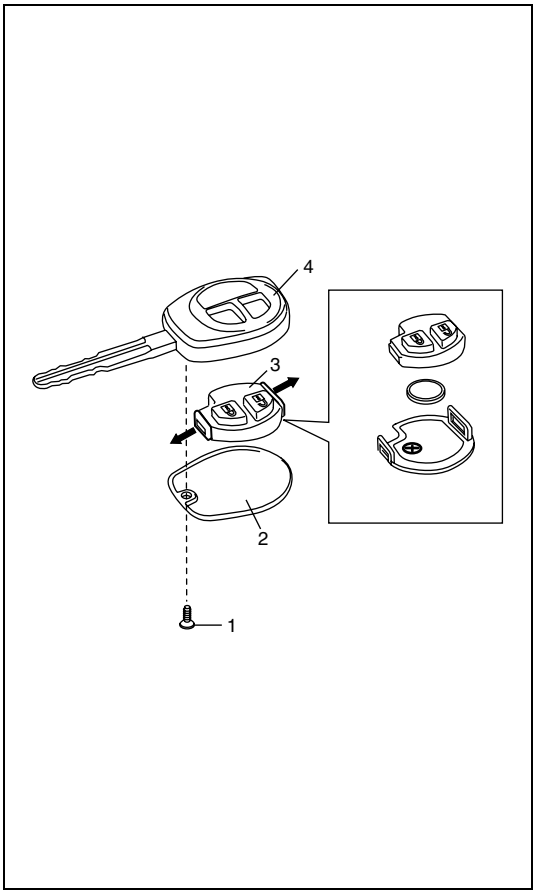
1. Door lock controller

Terminal	Wire	Circuit	Specification	Condition
G11-7	GRN/YEL	Hazard waning signal circuit (right side)	Figure "A"	Push "LOCK" button on transmitter once.
			Figure "B"	Push "UNLOCK" button on transmitter once.
			Figure "C"	Push "LOCK" button on transmitter twice within 2 seconds.
G11-8	GRN/RED	Hazard waning signal circuit (left side)	Figure "A"	Push "LOCK" button on transmitter once.
			Figure "B"	Push "UNLOCK" button on transmitter once.
			Figure "C"	Push "LOCK" button on transmitter twice within 2 seconds.
G11-15	BRN/RED	Door switch & interior light circuit	Figure "D"	Fulfill the following conditions. • All door is close. • Interior light switch is in middle position. • 20 seconds after pushing "UNLOCK" button on transmitter once.



[A]: Figure “A”
[B]: Figure “B”
[C]: Figure “C”
[D]: Figure “D”

Replacement of Transmitter Battery



If transmitter becomes unreliable, replace transmitter battery as follows.

1) Remove screw (1) and transmitter cover (2).
2) Remove transmitter (3) from transmitter holder (4).

CAUTION:
Use care not to allow grease or dirt to be attached on the printed circuit board and the battery.

3) Unhook tabs and remove transmitter.
4) Replace the battery (lithium disc-type CR1616 or equivalent battery) so its + terminal faces “+” mark on transmitter.
5) Fit together transmitter (3) and install it into transmitter holder (4).
6) Install transmitter cover (2) and screw (1).
7) Make sure the door locks can be operated with transmitter.

NOTE:

- **To prevent theft, be sure to break the transmitter before discarding it.**
- **Dispose of the used battery properly according to applicable rules or regulations. Do not dispose of lithium batteries with ordinary household trash.**

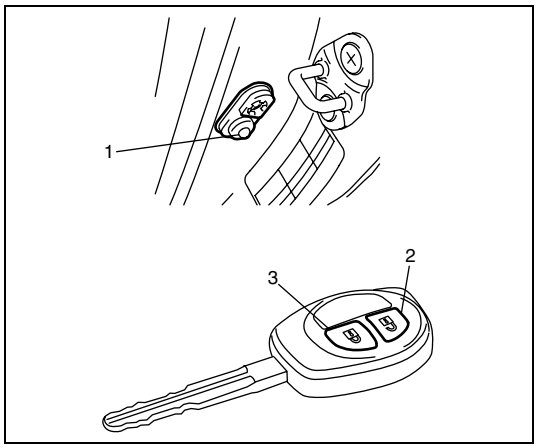
Transmitter Code Registration Procedure

NOTE:

- **Three transmitter codes can be registered at the same time.**
- **When the fourth transmitter code is registered, the oldest one will be cleared automatically.**

If transmitter or door lock controller is replaced with new one, register code as follows.

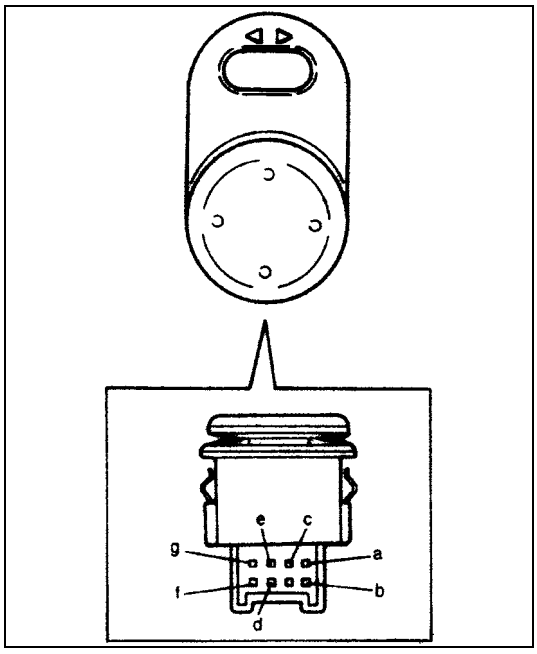
1) Make sure that all doors are closed and ignition key is out of ignition key cylinder
2) Open driver side door.
3) Turn ignition switch to ON position, and then remove ignition key from ignition key cylinder within 10 seconds after that.



4) Push and release driver side door switch (1) at 3 times by hand within 20 seconds after removing ignition key from ignition key cylinder.
5) Turn ignition switch to ON position, and then remove ignition key from ignition key cylinder within 10 seconds after that.
6) Push “UNLOCK” button (2) on transmitter (3) and confirm that all doors are operated from lock to unlock.
   With this, code registration is completed.

Power Door Mirror Switch Inspection

1) Disconnect negative cable at battery.
2) Pull out mirror switch from door trim.
3) Disconnect mirror switch lead wire coupler.



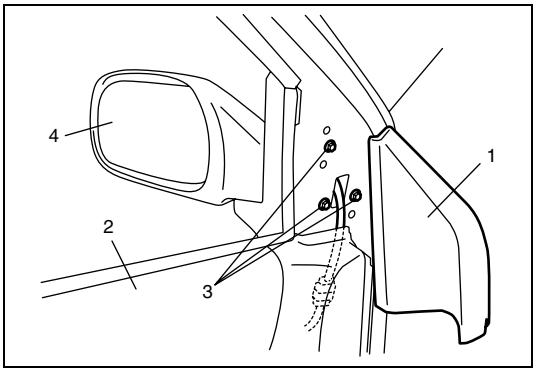
4) Check continuity between terminals at each switch position.
   If any correct continuity is not obtained, replace mirror switch.

Power door mirror switch specification

L / R	a	b	c	d / e	g / f
UP	○	○	○	○	
DOWN	○	○	○	○	
LEFT	○	○	○		○
RIGHT	○	○	○		○

Power Door Mirror Actuator Removal and Installation

REMOVAL



1) Remove door garnish (1) and front door trim (2) from door.
2) Disconnect door mirror coupler.
3) Remove door mounting bolts (3), and remove door mirror assembly (4).

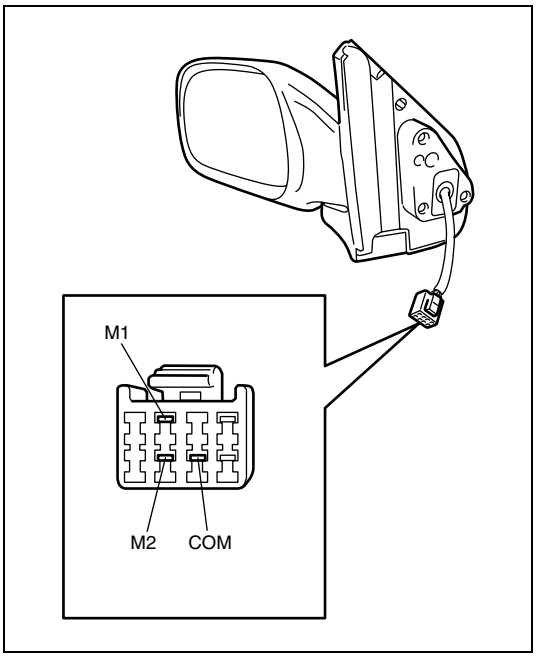
INSTALLATION

Reverse removal procedure to install door mirror assembly noting the following construction.

- Be careful not to pinch harness between door and door mirror.
- Connect door mirror connector securely.

Power Door Mirror Actuator Inspection

CAUTION:
Never short positive and negative probes to prevent wire harness from damage.



Check that door mirror operates properly when battery voltage is applied to connector terminals as follows.

- Connect battery positive and negative terminal to the door mirror terminal shown below.
  If it does not follow the table's operation, replace door mirror assembly.

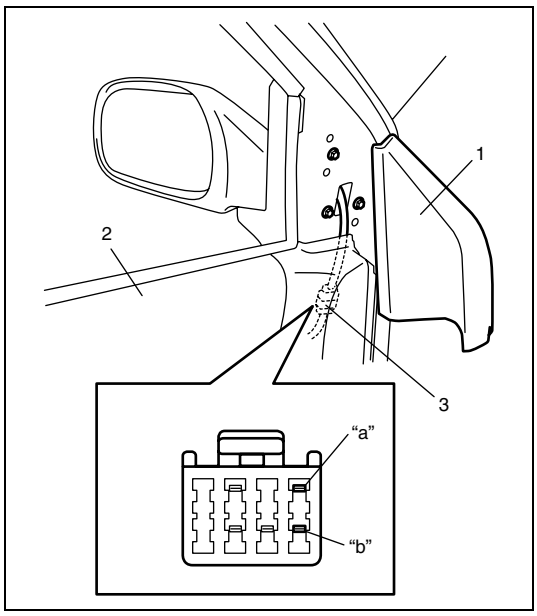
Power door mirror actuator specification

Terminal / Operation	COM	M1	M2
Up	⊖	⊕	
Down	⊕	⊖	
Left	⊖		⊕
Right	⊕		⊖

Door Mirror Heater Switch Inspection

The door mirror heater switch is integral with rear defogger switch.
Therefore, in the case of door mirror heater equipped vehicle, if rear defogger is operated with rear defogger switch, door mirror heater also operates at the same time.
For the inspection procedure of door mirror heater switch, refer to "Rear Defogger Switch Inspection" in Section 1A.

Mirror Heater Inspection

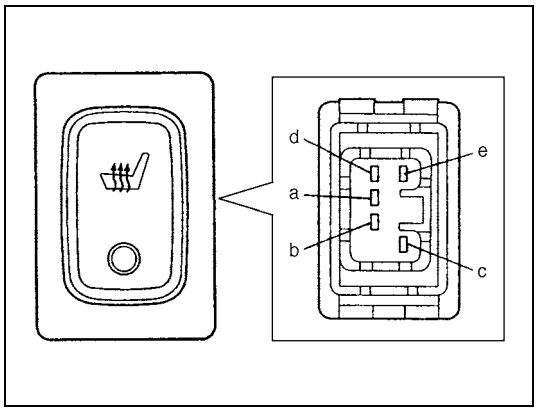


1) Remove door garnish (1) and front door trim (2).
2) Disconnect door mirror coupler (3).
3) Check for continuity between terminals "a" and "b".
   If there is no continuity replace outside mirror.

Seat Heater System Inspection

Seat heater switch

1) Confirm that ignition switch is in OFF position.
2) Remove parking lever garnish on center console box.
3) Pull out seat heater switch from parking lever garnish.
4) Disconnect seat heater switch coupler.

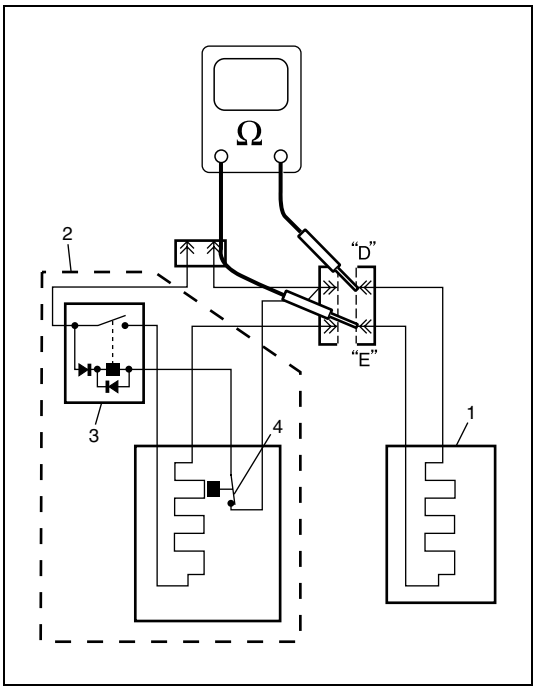


5) Check for continuity between terminals at each switch position as shown below. If check result is not as specified, replace front seat heater switch.

Seat heater switch specification

Position \ Terminal	a	b	c	d	e
FREE		○—○—○		○—○—○	
PUSH	○	○—○—○		○—○—○	

Seat back



1) Confirm that seat heater switch is in OFF position.
2) Disconnect seat back heater connector under the seat cushion.
3) Check for continuity between terminals "B" and "D" of seat back heater connector.
4) If there is no continuity, replace seat back as assembly.

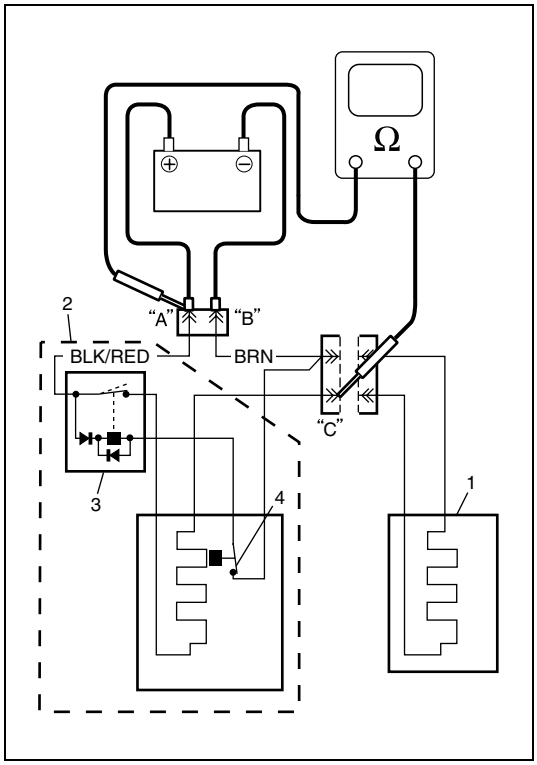
1. Seat back
2. Seat cushion
3. Relay
4. Bimetal

Seat cushion

The seat cushion heater consists of the heater wire, bimetal, relay and their connecting circuit wirings. Heater malfunction will be caused by damage of one or more of them.
As each part can not be inspected separately, inspect the cushion heater as a system as follows.

Relay switching/heater circuit function

1) Confirm that seat heater switch is in OFF position.
2) Disconnect two connectors of seat heater under the seat cushion.

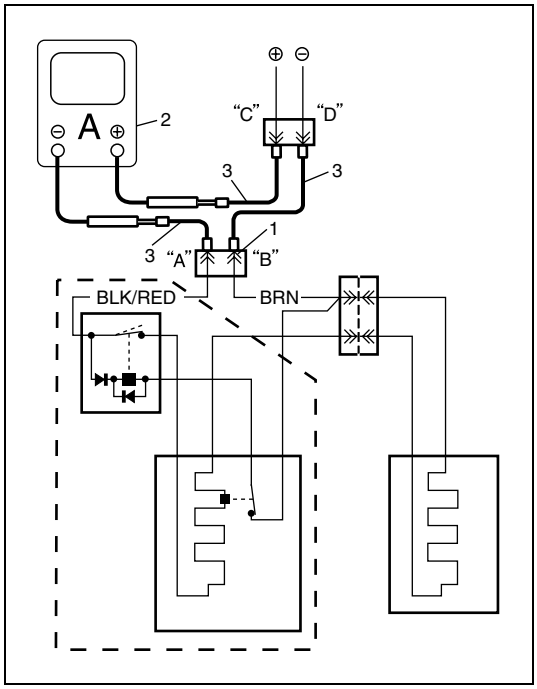


3) Connect battery positive (+) terminal to terminal "A" of seat heater connector and battery negative (–) terminal to terminal "B" of seat heater connector.
4) Check for continuity between seat heater connector terminals "A" and "C".
5) If there is no continuity, replace seat cushion as assembly. Either faulty relay switching or open heater circuit will be the cause of the malfunction.

1.	Seat back
2.	Seat cushion
3.	Relay
4.	Bimetal

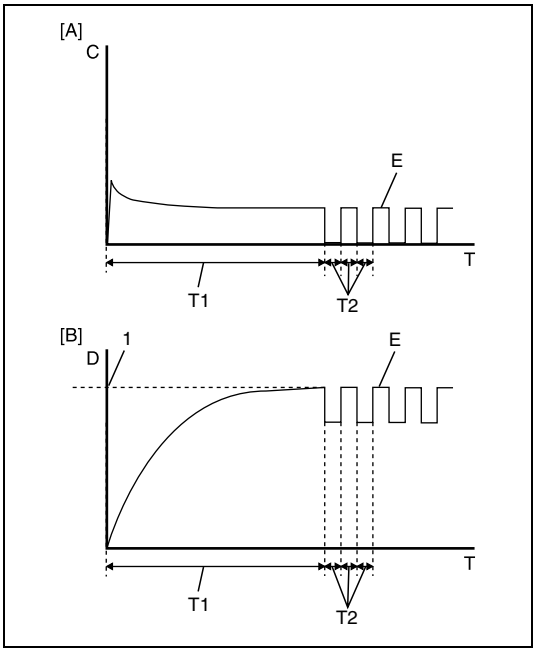
Bimetal/relay operation

1) Make sure that seat heater switch is in OFF position.
2) Disconnect seat heater connector (1).
3) Connect ammeter (2) and service wires (3) to seat heater connector as shown in the figure.
   Be sure to use an ammeter that can measure 10 A.



1.	Seat heater connector
2.	Ammeter
3.	Service wire

4) Turn ignition switch to ON position.
5) Operate seat heater by pushing seat heater switch.



6) Check if the ammeter shows the ON/OFF switching operation of bimetal as shown in the figure.
   If check result is not as specified, replace seat cushion as assembly.

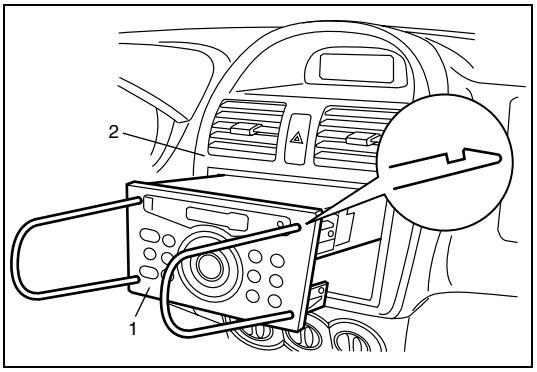
[A]:	Current on ammeter
[B]:	Heater/bimetal temperature
C:	Current
D:	Temperature
E:	Bimetal ON/OFF operation
T:	Time
T1:	Heating time at laboratory (Approx. 10 minutes) (Will vary depending on ambient/seat temperature)
T2:	Approx. 15 seconds
1.	Approx. 42°C (108°F) at bimetal (Will be lower on seat surface)

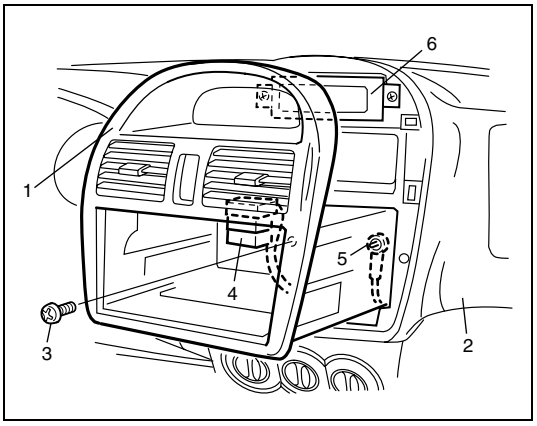
Recommended measurement condition
Room temperature: 20°C (68°F)

Information Display Removal and Installation

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Remove audio unit (1) from center upper garnish (2) as shown.



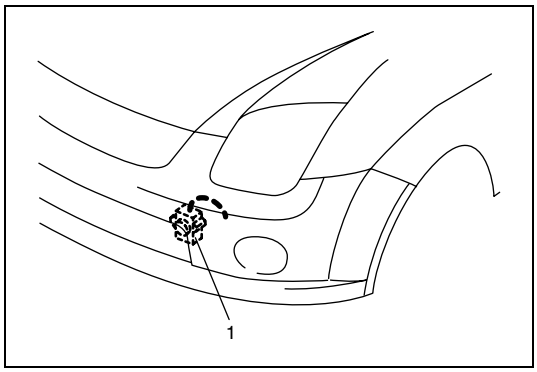


3) Remove center upper garnish (1) from instrument panel (2) by removing screw (3), audio unit connector (4) and antenna wiring (5).
4) Remove display unit (6) from instrument panel (2) by removing 2 screws.
5) Disconnect connector from display unit.

INSTALLATION

Reverse removal procedure to install display unit.

Outside Air Temperature Sensor Removal and Installation



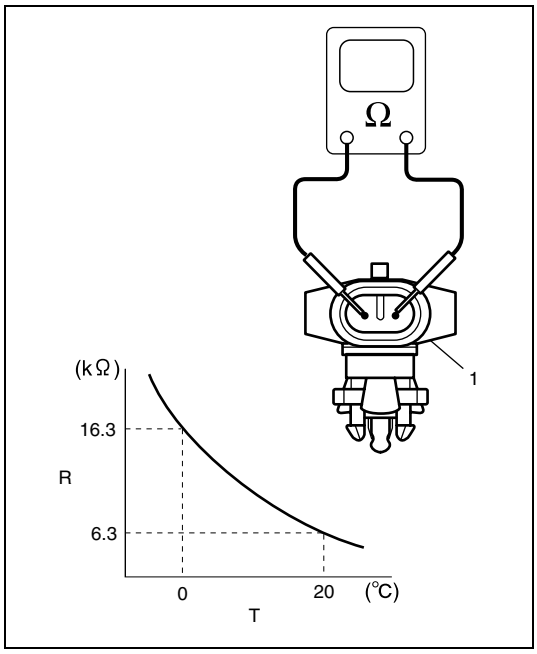
REMOVAL

1) Disconnect negative (–) cable at battery.
2) Remove outside air temperature sensor (1) from front bumper.
3) Disconnect outside air temperature sensor connector.

INSTALLATION

Reverse removal procedure to install outside air temperature sensor.

Outside Air Temperature Sensor Inspection



Immerse temperature sensing part of outside air temperature sensor (1) in ice water and measure resistance between sensor terminals while heating water gradually.

R.	Resistance
T.	Temperature

SECTION 8G

IMMOBILIZER CONTROL SYSTEM

WARNING:

For vehicles equipped with a Supplemental Restraint (Air Bag) System

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

CONTENTS

General Description

Immobilizer Control System Introduction

The immobilizer control system designed to prevent vehicle burglar consists of following components.

- Engine Control Module (ECM)
- Immobilizer Control Module (1) with coil antenna
- Ignition key (2) with built-in transponder
- Immobilizer indicator lamp (for self-diagnosis function)

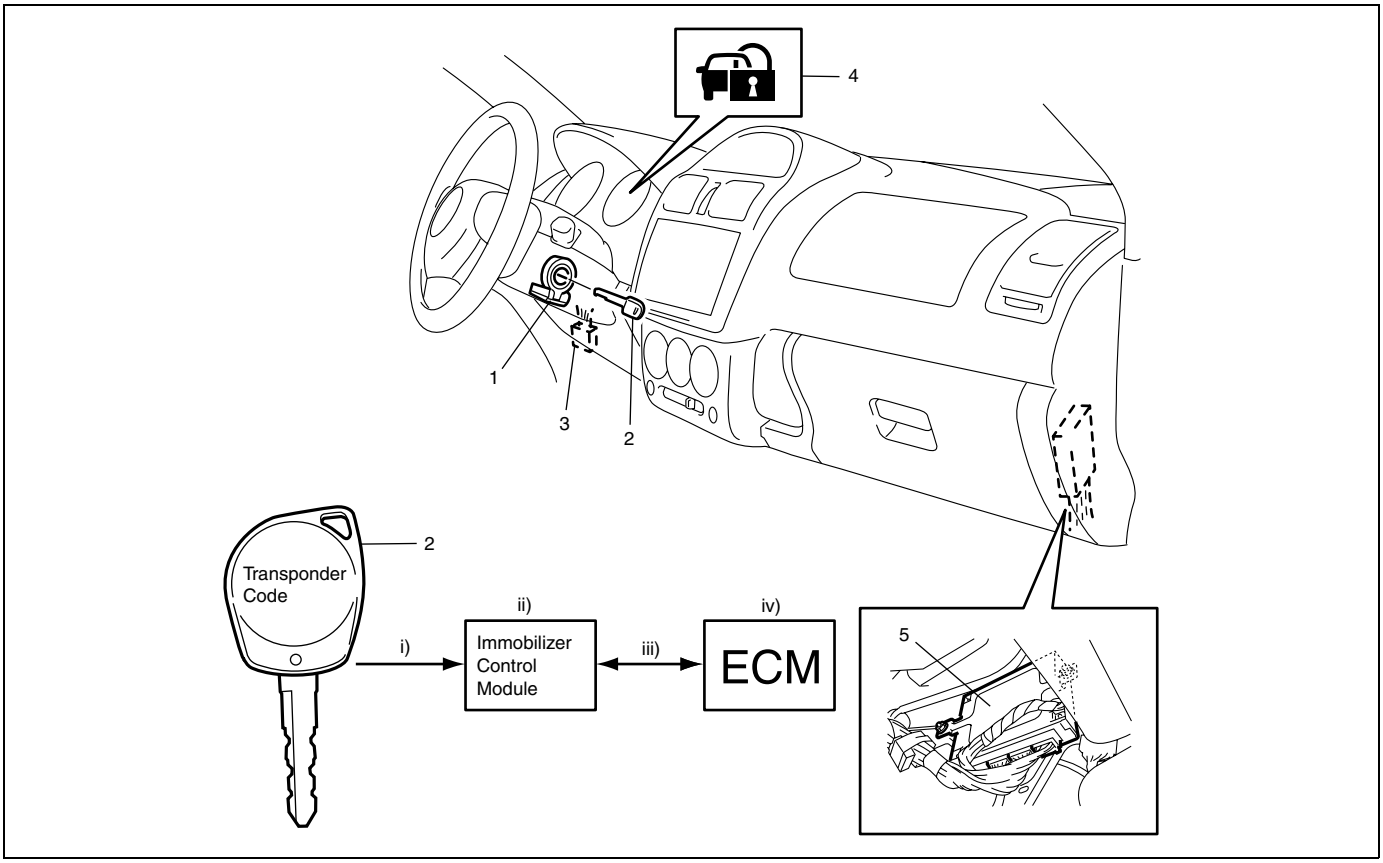
Operation of this system is as follows.

i) Each ignition key has its own code (Transponder code) stored in memory. When the ignition switch is turned ON, Immobilizer Control Module tries to read the Transponder code through the coil antenna installed onto the steering lock assembly.

ii) Immobilizer Control Module compares the Transponder code read in Step (i) and that registered in Immobilizer Control Module and checks if they match.

iii) When it is confirmed that two Transponder codes match each other as described above, Immobilizer Control Module and ECM check if ECM/Immobilizer Control Module codes registered in them respectively match.

iv) Only when it is confirmed that ECM/Immobilizer Control Module codes match, the engine starts running. If Transponder codes in Step (ii) or ECM/Immobilizer Control Module codes in Step (iii) do not match, ECM will stop operation of the injector and ignition of spark plug.

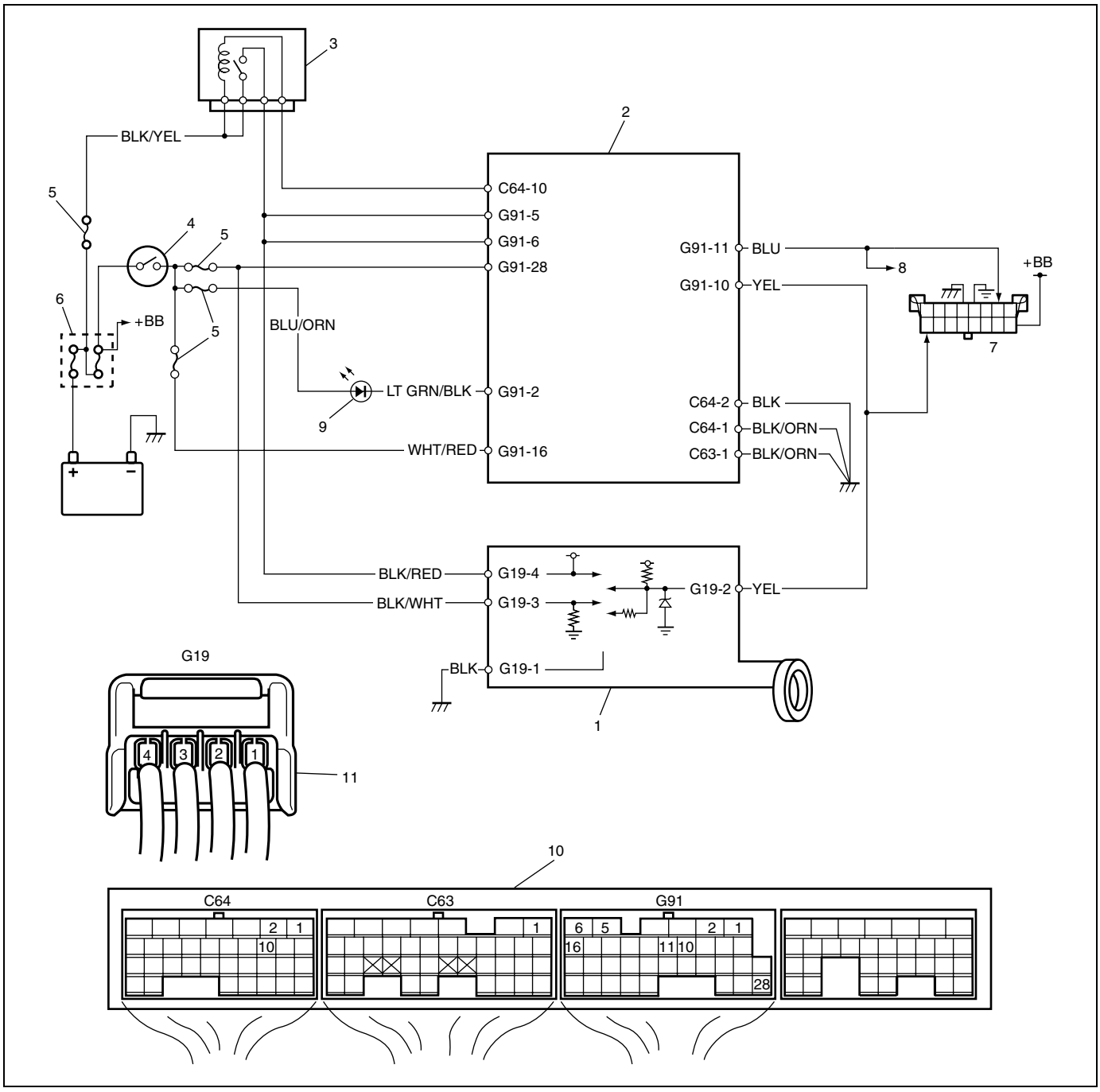


3.	Data link connector (DLC)
4.	Immobilizer indicator lamp
5.	ECM

NOTE:

For vehicle with a right-hand steering wheel, position of each component is symmetrical.

Immobilizer Control System Wiring Circuit Diagram



1. Immobilizer Control Module	5. Fuse	9. Immobilizer indicator lamp
2. ECM	6. Main fuse	10. ECM connector (viewed from harness side)
3. Main relay	7. Data link connector	11. Immobilizer Control Module connector (viewed from harness side)
4. Ignition switch	8. To ABS control module, SDM and TCM	

On-Board Diagnostic System Description

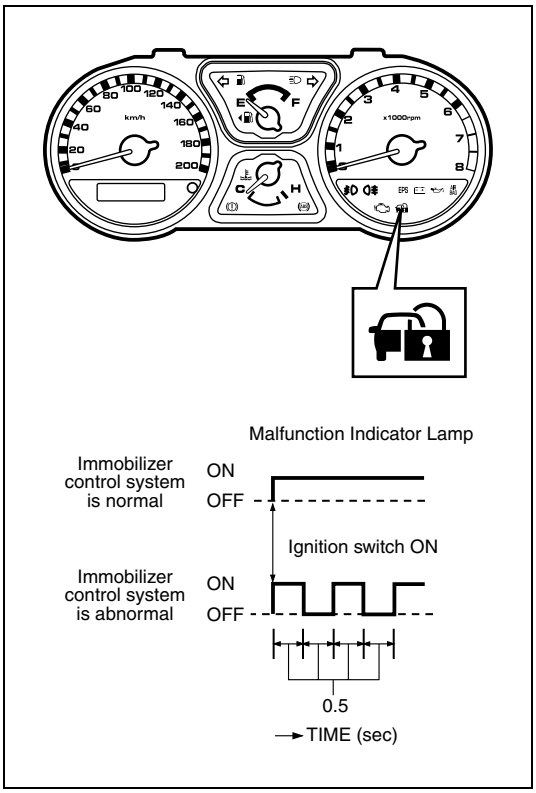
Immobilizer Control Module and ECM diagnose troubles which may occur in the area including the following parts when the ignition switch is ON.

ECM:

- ECM/Immobilizer Control Module code
- Serial data link circuit
- ECM

Immobilizer Control Module:

- Transponder code
- Coil antenna
- ECM/Immobilizer Control Module code
- Serial data link circuit
- Immobilizer Control Module
- Ignition signal



With the ignition switch turned ON (but the engine at stop) regardless of the condition of the engine and emission control system, ECM indicates whether a trouble has occurred in the immobilizer control system or not by causing the immobilizer indicator lamp to flash or turn ON.
Immobilizer indicator lamp is ON:
No trouble exists in the immobilizer control system.
Immobilizer indicator lamp is flashing:
ECM or Immobilizer Control Module has detected some trouble in the immobilizer control system.

NOTE:

As soon as the ignition switch is turned ON, ECM and Immobilizer Control Module diagnose if a trouble has occurred in the immobilizer control system. While the diagnosis is being made, the immobilizer indicator lamp stays ON and if the diagnosis result is "abnormal", it immediately changes to flashing but if the result is "normal", it remains ON. To complete diagnosis, it takes about three seconds at maximum.

When ECM and Immobilizer Control Module detects a trouble, it stores DTC in ECM and Immobilizer Control Module memories respectively.

DTCs stored in memory of each controller (Immobilizer Control Module and ECM) can be read by using the procedure described in "DTC Check" in this section.

Diagnosis

Precautions in Diagnosing Troubles

ECM

- Before identifying diagnostic trouble code indicated through Suzuki Scan Tool, don't disconnect couplers from ECM, battery cable from battery, ECM ground wire harness from engine.
  Such disconnection will clear trouble codes for engine and emission control system and immobilizer control system stored in memory of ECM.
- Take a note of diagnostic trouble code indicated first.

Immobilizer Control Module

- Take a note of diagnostic trouble code indicated first.

Intermittent troubles

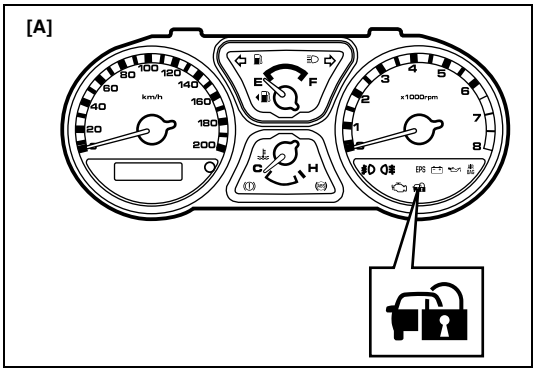
- There is case where Suzuki Scan Tool indicates a diagnostic trouble code representing a trouble which occurred only temporarily and has gone. In such case, good parts may be replaced unnecessarily. To prevent such replacement, be sure to follow instructions given below during performance of “Immobilizer Control System Check”.
  – When trouble can be identified, it is not an intermittent one:
    Check coil antenna, ignition key, wires and each connection and if they are all in good condition, substitute a known-good ECM and recheck.
  – When trouble can not be identified but Suzuki Scan Tool indicate a trouble code:
    Diagnose trouble by using that code No. and if ignition key, coil antenna, wires and each connection are all in good condition, turn OFF ignition switch and then ON.
- Then, check what Suzuki Scan Tool indicates. Only when they indicate trouble code again, substitute a known-good ECM or Immobilizer Control Module and check again.
  If they do not indicate any trouble code but normal code, it means that an intermittent trouble did occur and has gone. In this case, check wires and connections carefully again.
- When checking for continuity, be careful not to damage terminal. Damage of terminal might cause irregular contact. As a result of the irregular contact, immobilizer control system might fail to operate properly.

Immobilizer Control System Check

Step	Action	Yes	No
1	1) Check immobilizer indicator lamp while ignition switch is ON (but without starting engine). See Fig. 1. Does immobilizer indicator lamp flash?	Go to Step 3.	If immobilizer indicator lamp remains ON, go to Step 2. If immobilizer indicator lamp remains OFF, go to "Table A – Immobilizer Indicator Lamp Check (Immobilizer Indicator Lamp Does Not Light at Ignition Switch ON)" in this section.
2	1) Check DTC stored in ECM referring to "Immobilizer Control Module" under "DTC Check" in this section. Is there any DTC(s)?	Go to "Table B – Immobilizer Indicator Lamp Check (Immobilizer Indicator Lamp Remains ON After Engine Starts)" in this section.	Immobilizer control system is in good condition.
3	1) Check DTC stored in Immobilizer Control Module referring to "ECM" under "DTC Check" in this section. Is there any DTC(s)?	Go to flow table for DTC No.	Go to Step 4.
4	1) Check DTC stored in ECM referring to "Immobilizer Control Module" under "DTC Check" in this section. Is there any DTC(s) for immobilizer control system?	Go to flow table for DTC No.	Substitute a known-good ECM and recheck. See NOTE below.

NOTE:

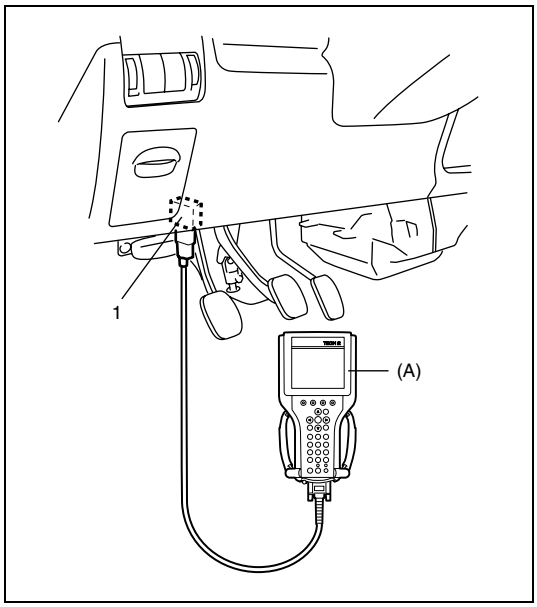
After replacing with a known-good ECM, register ECM/Immobilizer Control Module code in ECM by performing procedure described in "Procedure After ECM Replacement" in this section.



[A]: Fig. 1 for Step 1

DTC Check

Immobilizer Control Module

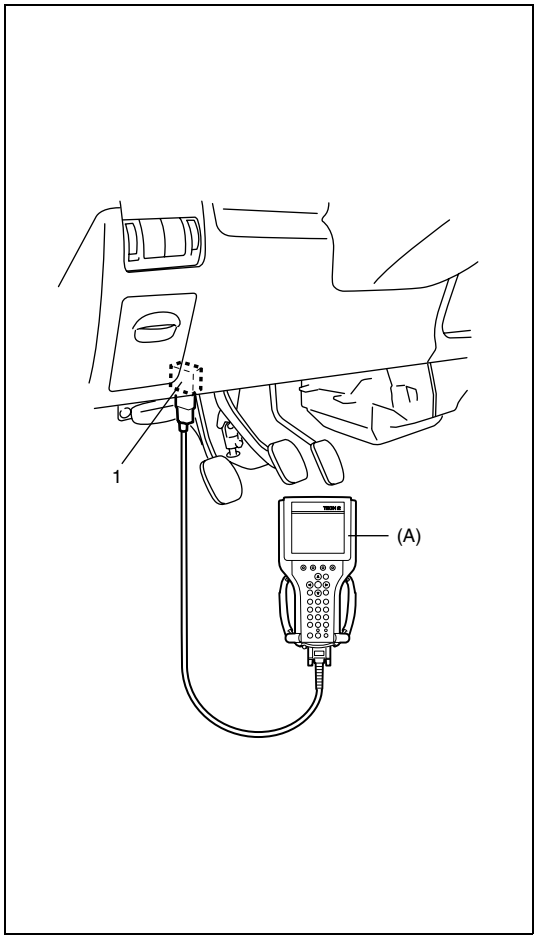


1) Turn ignition switch OFF.
2) After setting program card to Suzuki Scan Tool, connect it to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

Special tool
(A): Suzuki Scan Tool

3) Turn ignition switch ON.
4) Read DTC stored in Immobilizer Control Module according to instructions displayed on Suzuki Scan Tool, and print it or write it down. For further details, refer to operator's manual for Suzuki Scan Tool.
   If communication between Suzuki Scan Tool and immobilizer control module is not possible, go to "Diagnostic Flow Table C".
5) After completing the check, turn ignition switch OFF and disconnect Suzuki Scan Tool from data link connector (DLC).

ECM



1) Turn ignition switch OFF.
2) After setting program card to Suzuki Scan Tool, connect it to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

Special tool
(A): Suzuki Scan Tool

3) Turn ignition switch ON.
4) Read DTC stored in ECM according to instructions displayed on Suzuki Scan Tool and print it or write it down. For further details, refer to operator's manual for Suzuki Scan Tool.
   If communication between Suzuki Scan Tool and ECM is not possible, check if Suzuki Scan Tool is communicable by connecting it to ECM in another vehicle. If communication is possible in this case, Suzuki Scan Tool is in good condition. Then check data link connector and serial data line (circuit) in the vehicle with which communication was not possible.

NOTE:

If ECM detects a trouble in both engine and emission control system and immobilizer control system, Suzuki Scan Tool indicates trouble codes of both systems using "Engine" menu of the application.

5) After completing the check, turn ignition switch OFF and disconnect Suzuki Scan Tool from data link connector (DLC).

DTC Table

Immobilizer Control Module

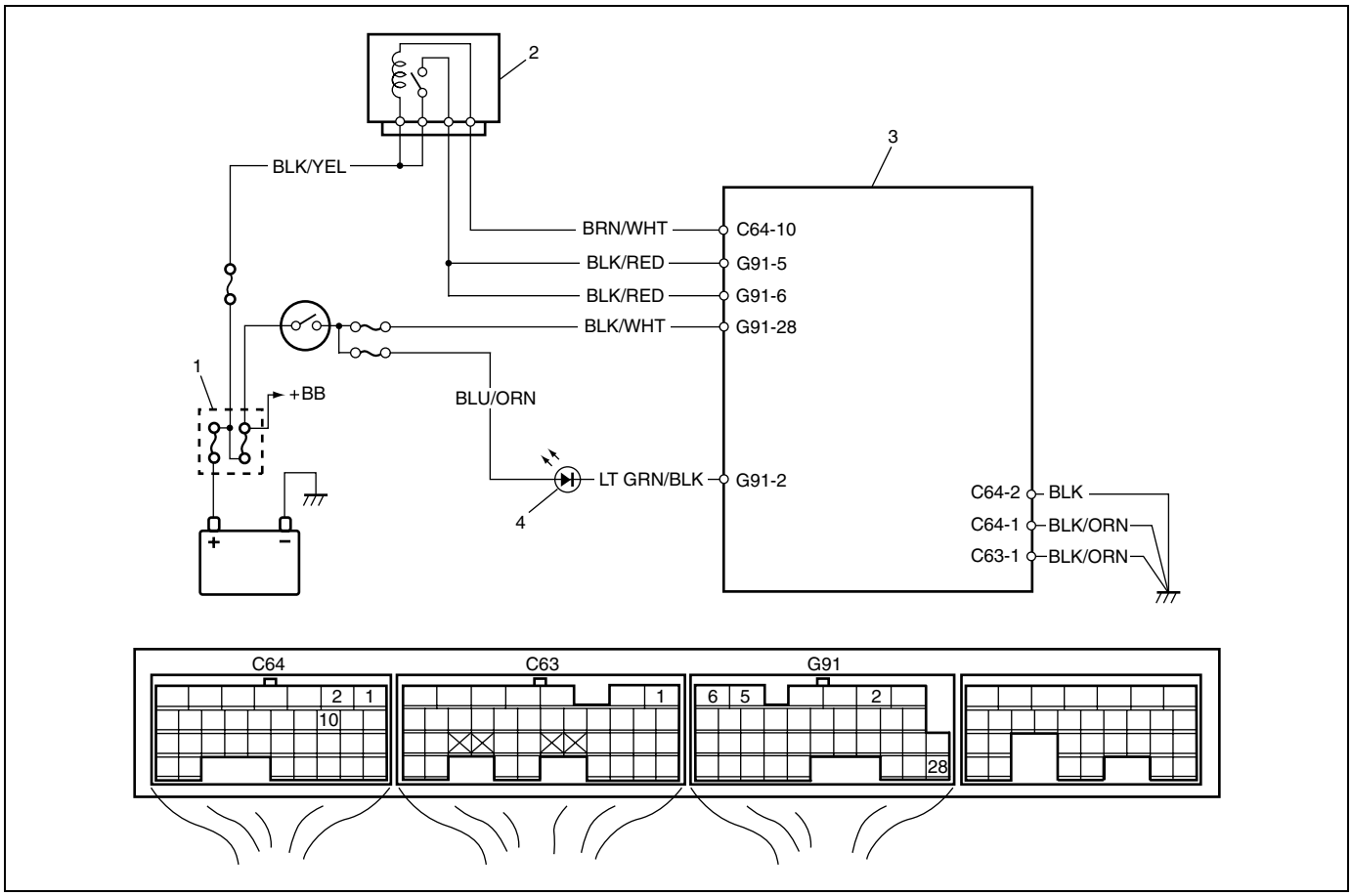
DTC (indicated on Suzuki Scan Tool)	Diagnostic Area	Diagnosis
NO DTC	–	This code appears when none of the other codes are identified.
11	Transponder code	Perform diagnosis corresponding to each code.
31		
32		
12	Immobilizer Control Module	
13	Coil antenna or ignition key with built-in transponder	
21	ECM/Immobilizer Control Module code	
22	Ignition switch circuit	
23	Serial data link circuit	

ECM

DTC (indicated on Suzuki Scan Tool)	Diagnostic Area	Diagnosis
NO DTC	–	This code appears when it is confirmed that none of other trouble codes is set for immobilizer control system or engine and emission control system.
P1623	ECM/Immobilizer Control Module code	Perform diagnosis corresponding to each code.
P1620		
P1622	ECM	
P1621	Serial data link wire	

Table A – Immobilizer Indicator Lamp Check (Immobilizer Indicator Lamp Does Not Light at Ignition Switch ON)

Wiring Diagram



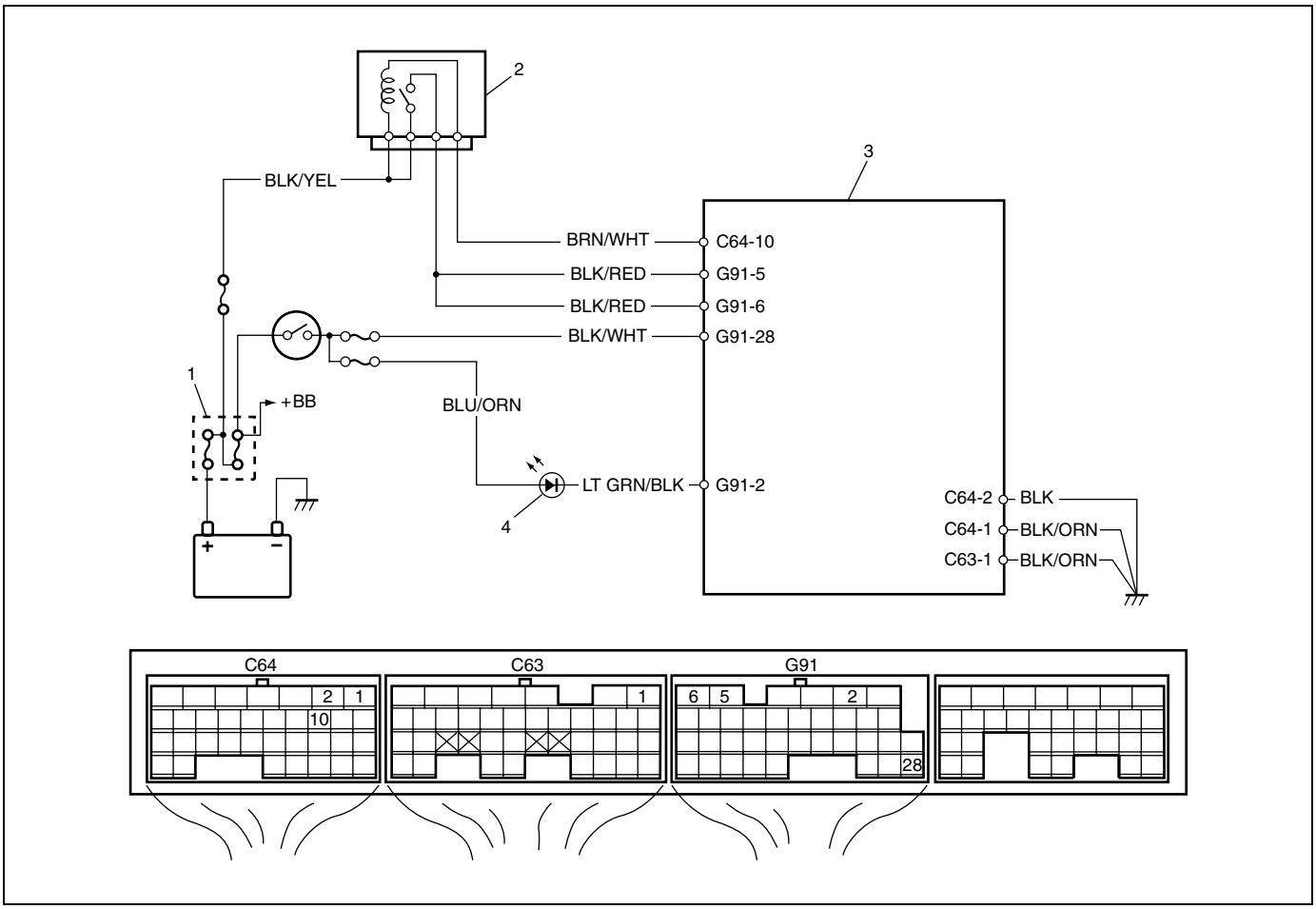
1. Main fuse	2. Main relay	3. ECM	4. Immobilizer indicator lamp

Troubleshooting

Step	Action	Yes	No
1	1) Turn ignition switch ON. Do other indicator/warning lights in combination meter come ON?	Go to Step 2.	"IG" fuse blown, main fuse blown, ignition switch malfunction, "BLK/WHT" circuit between "IG" fuse and combination meter or poor coupler connection at combination meter
2	1) Turn ignition switch OFF and disconnect connectors from ECM. 2) Check for proper connection to ECM at terminal G91-2. 3) If OK, then using service wire, ground terminal G91-2 in connector disconnected. Does immobilizer indicator lamp turn on at ignition switch ON?	Substitute a known-good ECM and recheck.	Immobilizer indicator lamp (LED) faulty or "LT GRN/BLK" wire circuit open

Table B – Immobilizer Indicator Lamp Check (Immobilizer Indicator Lamp Remains ON After Engine Starts)

Wiring Diagram



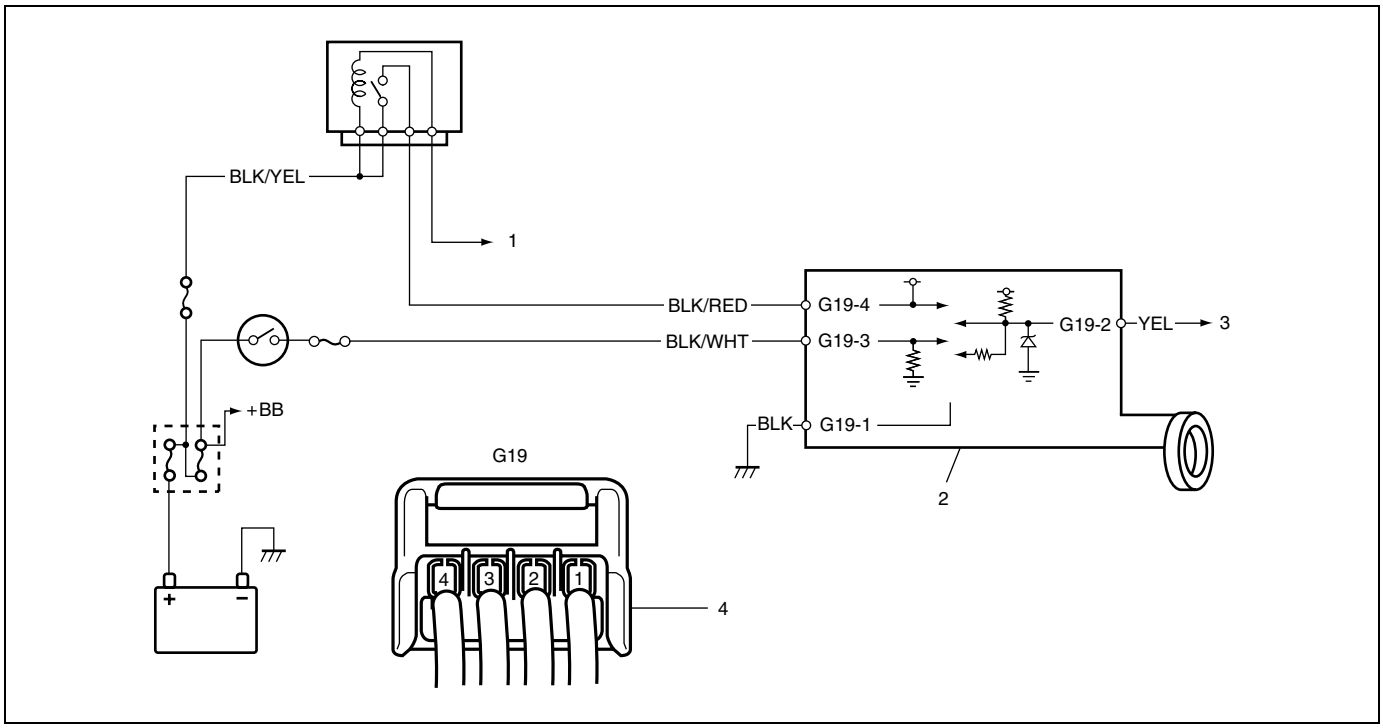
1. Main fuse	2. Main relay	3. ECM	4. Immobilizer indicator lamp

Troubleshooting

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect couplers from ECM. Does immobilizer indicator lamp turn ON at ignition switch ON?	"LT GRN/BLK" wire shorted to ground circuit	Substitute a known-good ECM and recheck.

Table C – Communication between Suzuki Scan Tool and Immobilizer Control Module is Not Established

Wiring Diagram



1. To ECM	2. Immobilizer control module	3. To #9-pin in DLC	4. Immobilizer Control Module connector (viewed from harness side)

Troubleshooting

NOTE:

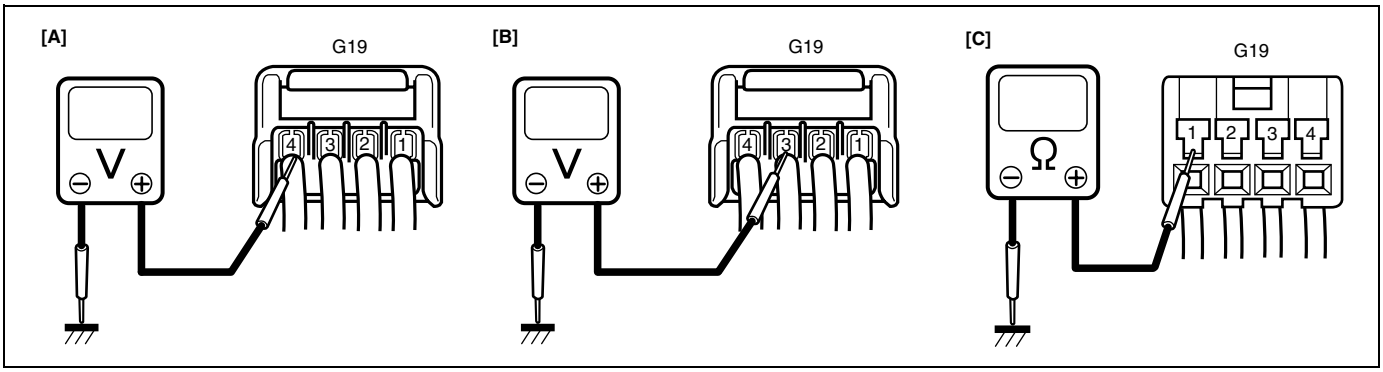
Before troubleshooting, make sure if Suzuki Scan Tool is free from any malfunction and if correct PC card is used. Also, make sure if Suzuki Scan Tool is properly connected to DLC.

Step	Action	Yes	No
1	Check voltage between G19-4 and body ground with ignition switch turned ON. See Fig. 1. Is it 10 – 14 V?	Go to Step 2.	• "BLK/RED" wire open or short • Fuse blown • Main relay faulty
2	Check voltage between G19-3 and body ground with ignition switch turned ON. See Fig. 2. Is it 10 – 14 V?	Go to Step 3.	• "BLK/WHT" wire open or short • Fuse blown
3	1) Disconnect coupler at Immobilizer Control Module. See Fig. 3. Is there continuity between coupler terminal G19-1 and body ground?	Go to Step 4.	"BLK" wire open

Step	Action	Yes	No
4	Check voltage between "YEL" wire terminal of DLC and body ground with ignition switch ON. Is it 4 – 5 V?	• Poor G19-1, G19-2, G19-3 or G19-4 connection • Poor 9th pin Connection in DLC • Serial data line "YEL" open or short If connections and line are in good condition, substitute Immobilizer Control Module with a known-good Immobilizer Control Module.	"YEL" wire open

NOTE:

After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure After Immobilizer Control Module Replacement" in this section.



[A]: Fig. 1 for Step 1	[B]: Fig. 2 for Step 2	[C]: Fig. 3 for Step 3

DTC11/32: Transponder Code Not Matched

DTC Detecting Condition

Immobilizer Control Module checks if Transponder code transmitted from ignition key and that registered in Immobilizer Control Module match when ignition switch is ON. If they do not, DTC 11 and/or 32 are set.

Troubleshooting

Register ignition key with built-in transponder by using Suzuki Scan Tool and performing following steps.

1) Register Transponder code in Immobilizer Control Module by performing procedure described in "How to Register Ignition Key".
2) Turn ignition switch OFF, then turn it ON and check that DTC11 and/or 32 are not set.

DTC31: Transponder Code Not Registered

DTC Detecting Condition

Immobilizer Control Module checks if Transponder code transmitted from ignition key and that registered in Immobilizer Control Module match when ignition switch is ON. If there is no Transponder code registered in Immobilizer Control Module, this DTC is set.

Troubleshooting

Register ignition key with built-in transponder by using Suzuki Scan Tool and performing following steps.

1) Register Transponder code in Immobilizer Control Module by performing procedure described in “How to Register Ignition Key”.
2) Turn ignition switch OFF, then turn it ON and check that DTC31 is not set.

DTC12: Fault in Immobilizer Control Module

DTC Detecting Condition

This DTC is set when an internal fault is detected in Immobilizer Control Module.

Troubleshooting

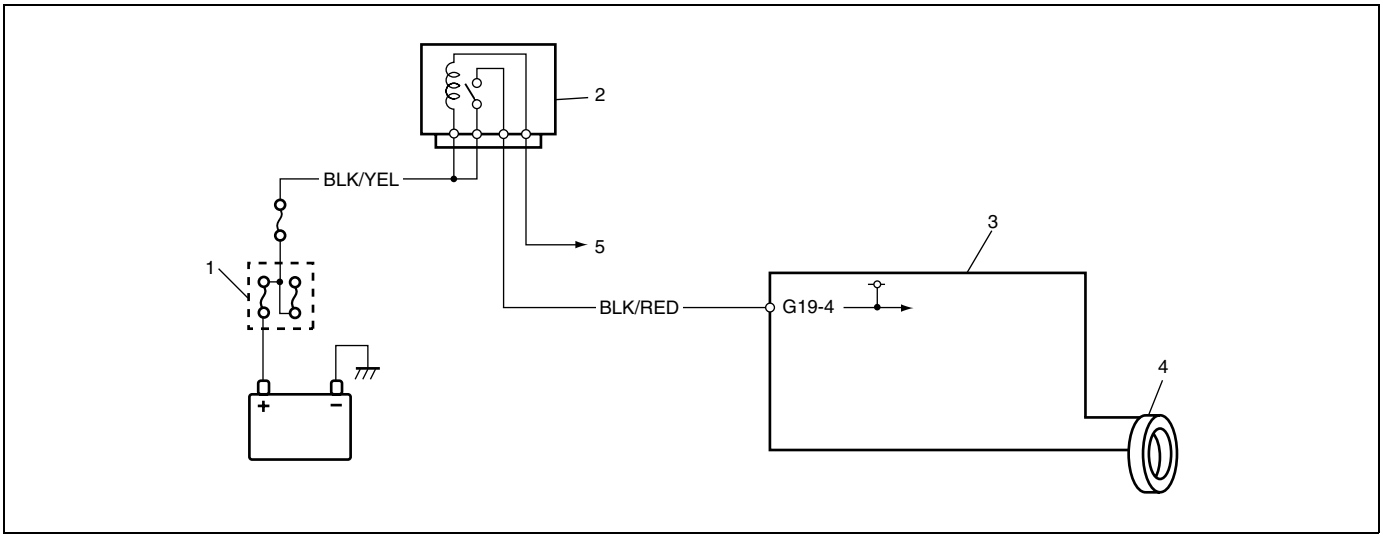
Step	Action	Yes	No
1	1) Ignition switch OFF. 2) Disconnect connectors from Immobilizer Control Module. 3) Check for proper connection to Immobilizer Control Module at all terminals. Are they in good condition?	Substitute a known-good Immobilizer Control Module and recheck. See NOTE below.	Repair or replace.

NOTE:

After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in “Procedure After Immobilizer Control Module Replacement” in this section.

DTC13: No Transponder Code Transmitted or Coil Antenna Opened/Shorted

Wiring Diagram



1. Main fuse	2. Main relay	3. Immobilizer Control Module	4. Coil antenna	5. To ECM

DTC Detecting Condition

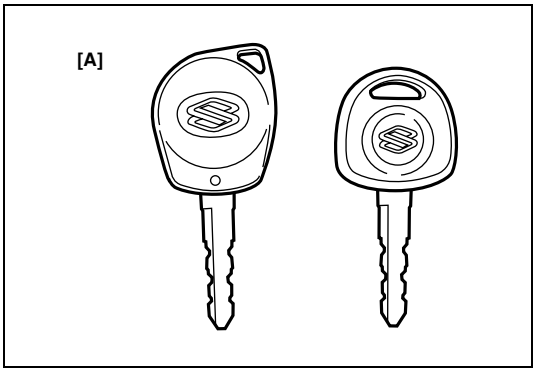
Immobilizer Control Module energizes the coil antenna when the ignition switch is ON and reads Transponder code from the ignition key. When Immobilizer Control Module cannot read Transponder code from the ignition key even when the coil antenna is energized, this DTC is set.

Troubleshooting

Step	Action	Yes	No
1	Check if shape and color of ignition key are as shown below. • Knob color: Black • Knob shape: See Fig. 1. Is it the original one?	Substitute a known-good Immobilizer Control Module and recheck. See NOTE below.	Replace ignition key with original one and follow "Immobilizer Control System Check" again.

NOTE:

After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure After Immobilizer Control Module Replacement" in this section.



[A]: Fig. 1 for Step 1

DTC21: ECM/Immobilizer Control Module Code Not Matched (Immobilizer Control Module Side)

DTC P1623: ECM/Immobilizer Control Module Code Not Matched (ECM Side)

DTC P1620: ECM/Immobilizer Control Module Code Not Registered

DTC Detecting Condition

- DTC21
  Immobilizer Control Module checks if ECM/Immobilizer Control Module code transmitted from ECM and that registered in Immobilizer Control Module match when ignition switch is ON. If they do not, this DTC is set.
- DTC P1623
  ECM checks if ECM/Immobilizer Control Module code transmitted from Immobilizer Control Module and that registered in ECM match when ignition switch is ON. If they do not, this DTC is set.
- DTC P1620
  ECM checks if code transmitted from Immobilizer Control Module and that registered in ECM match when ignition switch is ON. If there is no ECM/Immobilizer Control Module code registered in ECM, this DTC is set.

Troubleshooting

Perform procedure described in “Procedure After ECM Replacement” in the section.

DTC P1622: Fault in ECM

DTC Detecting Condition

This DTC is set when an internal fault is detected in ECM.

Troubleshooting

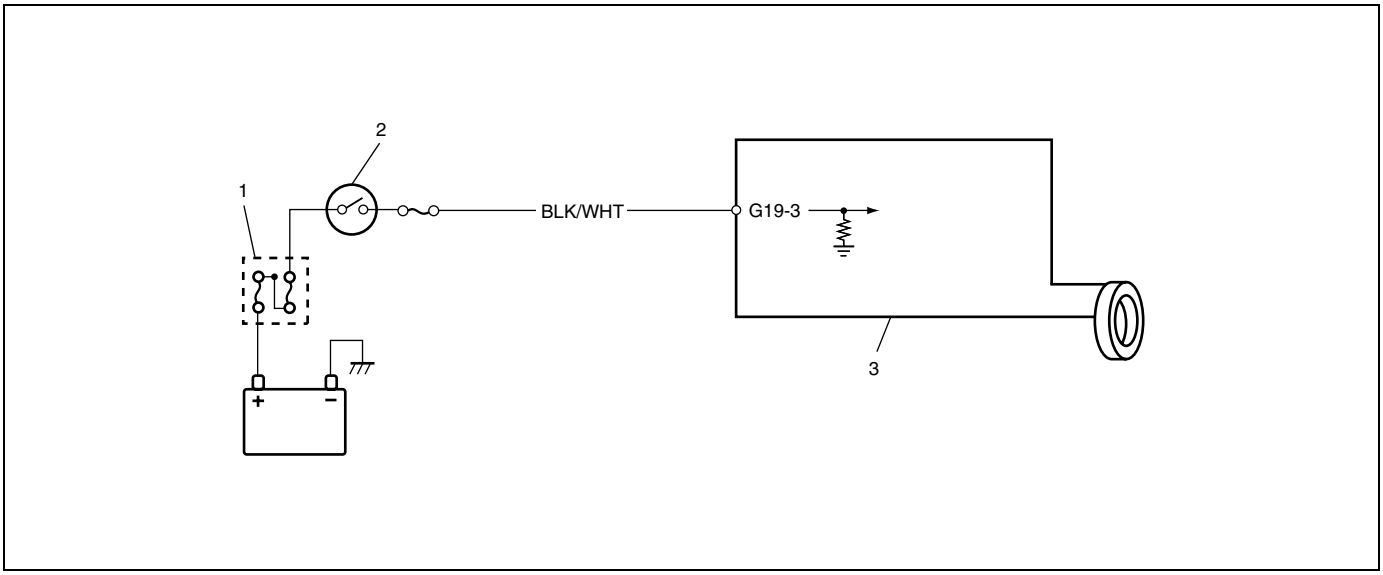
Step	Action	Yes	No
1	1) Ignition switch OFF. 2) Disconnect connectors from ECM. 3) Check for proper connection to ECM at all terminals. Are they in good condition?	Substitute a known-good ECM and recheck. See NOTE below.	Repair or replace.

NOTE:

After replacing with a known-good ECM, register ECM/Immobilizer Control Module code in ECM by performing procedure described in “Procedure After ECM Replacement” in this section.

DTC22: Ignition Switch Circuit Open/Short

Wiring Diagram



1. Main fuse	2. Ignition switch	3. Immobilizer Control Module

DTC Detecting Condition

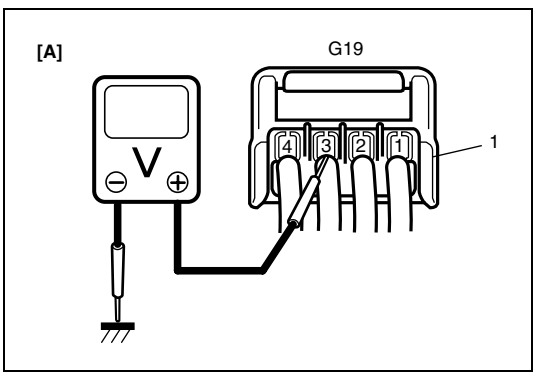
Immobilizer Control Module monitors ignition signal when the ignition switch is ON. This DTC is set when no ignition signal input is detected by Immobilizer Control Module.

Troubleshooting

Step	Action	Yes	No
1	Check voltage between Immobilizer Control Module (1) coupler terminal G19-3 and body ground with ignition switch turned ON. See Fig. 1. Is it 10 – 14V?	Poor G19-3 terminal connection. If connection is OK, substitute a known-good Immobilizer Control Module and recheck. See NOTE below.	"BLK/WHT" wire open or short

NOTE:

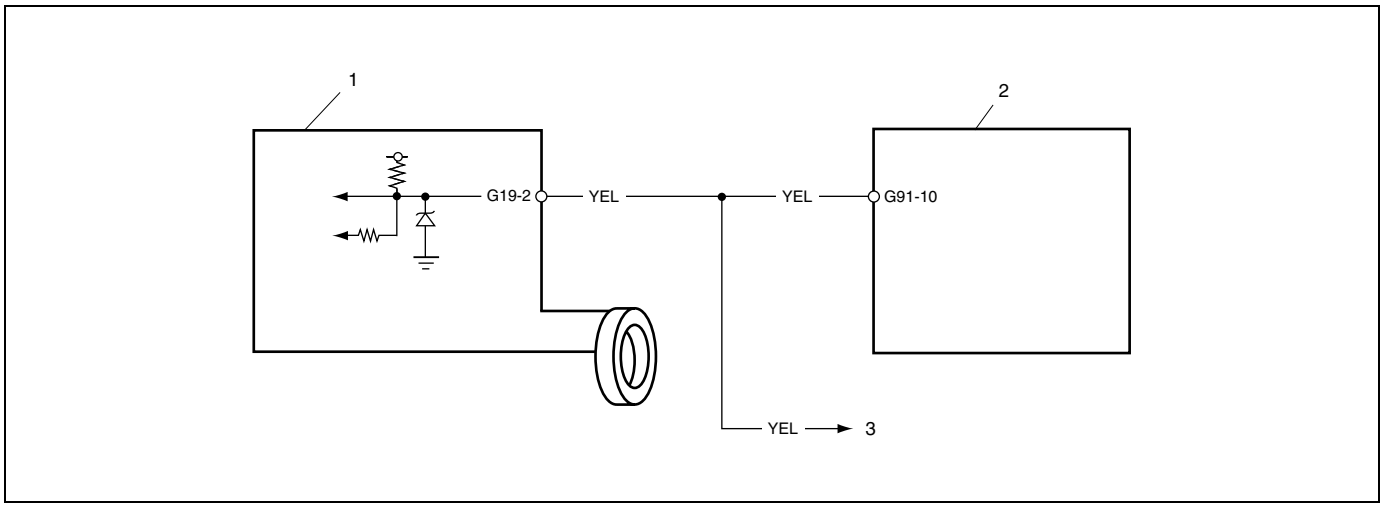
After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure After Immobilizer Control Module Replacement" in this section.



[A]: Fig. 1 for Step 1

DTC23: No ECM/Immobilizer Control Module Code Transmitted From ECM or DLC Circuit Opened/Shorted

DTC P1621: No ECM/Immobilizer Control Module Code Transmitted From Immobilizer Control Module or DLC Circuit Opened/Shorted



1. Immobilizer Control Module	2. ECM	3. To #9-pin in DLC

DTC Detecting Condition

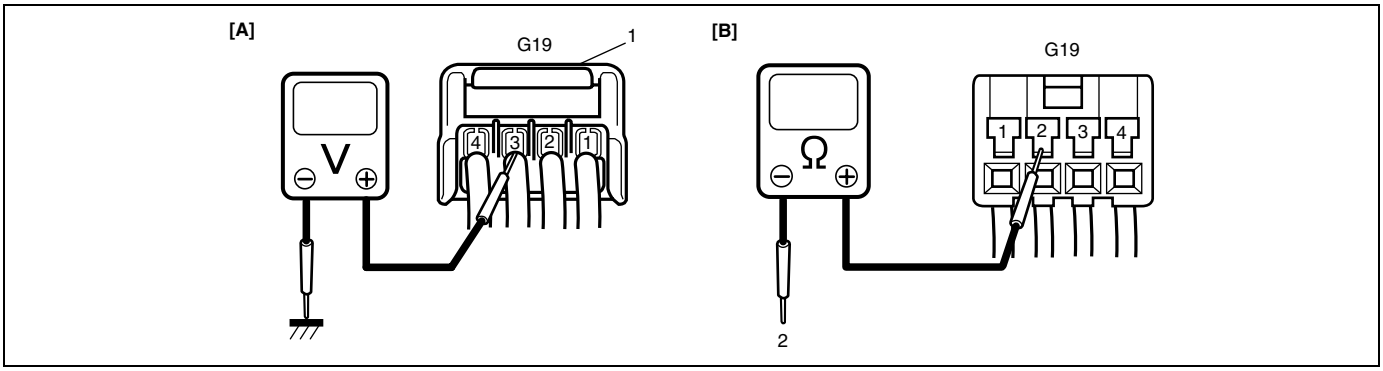
When the ignition switch is ON, Immobilizer Control Module requests ECM and ECM requests Immobilizer Control Module to transmit ECM/Immobilizer Control Module code. If ECM/Immobilizer Control Module code is not transmitted from ECM or Immobilizer Control Module, Immobilizer Control Module sets DTC23 and ECM sets DTC P1621.

Troubleshooting

Step	Action	Yes	No
1	Check voltage between Immobilizer Control Module (1) coupler terminal G19-2 and body ground with ignition switch turned ON. Is it 4 – 5V?	Go to Step 2.	"YEL" wire short
2	1) Disconnect ECM coupler with ignition switch turned OFF. 2) Is there continuity between Immobilizer Control Module coupler (1) terminal G19-2 and serial data link terminal (G91-10) of ECM coupler? (For positions of Data link connector terminal of ECM coupler, refer to "Immobilizer Control System Wiring Circuit Diagram" in this section.)	Poor G19-2 terminal connection (Immobilizer Control Module) or Poor Data link connector terminal connection (ECM). If connections are OK, substitute a known-good ECM or Immobilizer Control Module and recheck. See NOTE below.	"YEL" wire between Immobilizer Control Module and ECM open

NOTE:

- **After replacing with a known-good ECM, register ECM/Immobilizer Control Module code in ECM by performing procedure described in "Procedure After ECM Replacement" in this section.**
- **After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure After Immobilizer Control Module Replacement" in the section.**



[A]: Fig. 1 for Step 1
[B]: Fig. 2 for Step 2
2. Connect to serial data link terminal (G91-10) of ECM coupler disconnected

Inspection of ECM, Immobilizer Control Module and Its Circuit

ECM, Immobilizer Control Module and its circuit can be checked at ECM wiring couplers and Immobilizer Control Module wiring coupler by measuring voltage. Described here is only inspection of Immobilizer Control Module. For inspection of ECM, refer to "ENGINE AND EMISSION CONTROL INPUT/OUTPUT TABLE" in Section 6E1.

CAUTION:

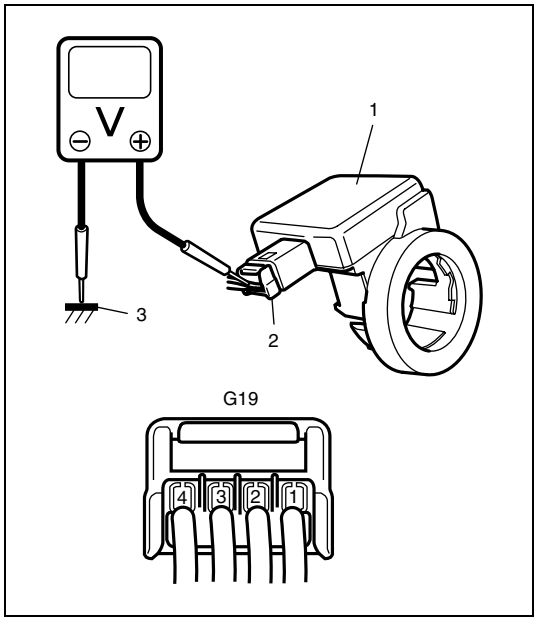
Immobilizer Control Module cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to Immobilizer Control Module with coupler disconnected from it.

Voltage Check

1) Remove Immobilizer Control Module from steering lock assembly with ignition switch OFF, referring to "Removal" of "Immobilizer Control Module Removal and Installation" in this section.
2) Connect Immobilizer Control Module coupler to Immobilizer Control Module.
3) Check voltage at each terminal of coupler connected.

NOTE:

As each terminal voltage is affected by the battery voltage, confirm that it is 11V or more when ignition switch is ON.

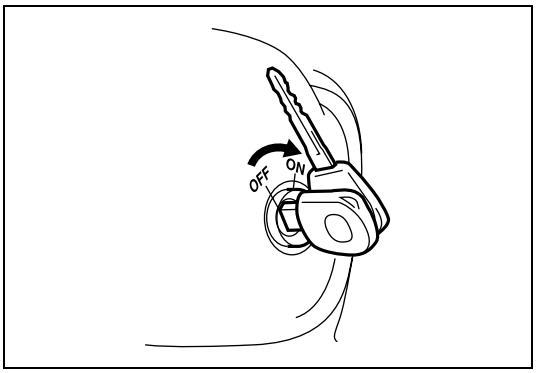


1.	Immobilizer Control Module
2.	Immobilizer Control Module coupler
3.	Body ground

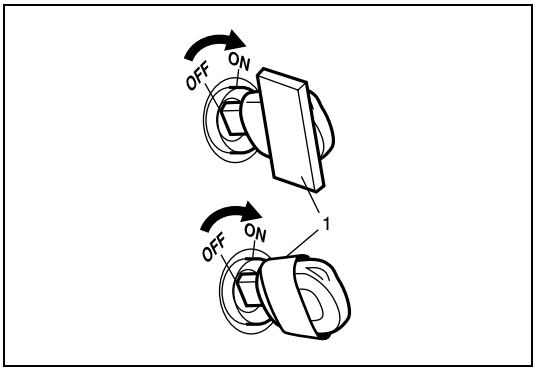
TERMINAL	CIRCUIT	NOMAL VOLTAGE	CONDITION
G19-1	Ground	–	–
G19-2	Data link connector (Serial data terminal)	4 – 5 V	Ignition switch ON
G19-3	Ignition signal	10 – 14 V	Ignition switch ON
		0 – 1 V	Ignition switch OFF
G19-4	Power source	10 – 14 V	Ignition switch ON

On-Vehicle Service

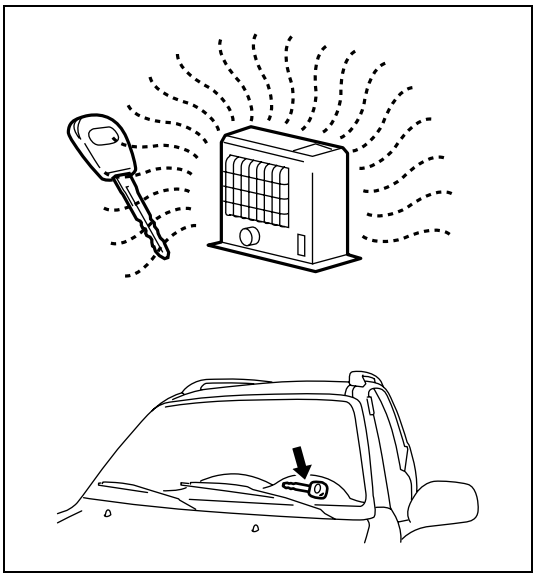
Precautions in Handling Immobilizer Control System



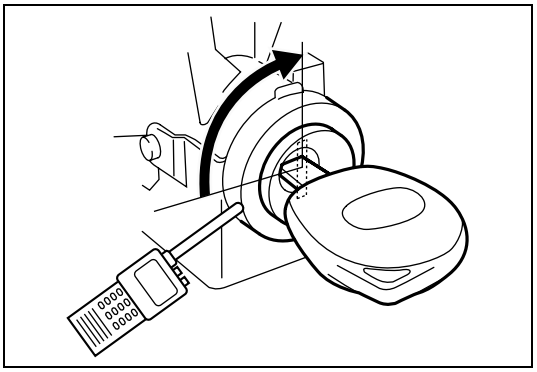
- Don't turn ON ignition switch with ignition key for immobilizer control system put together with another one or placed quite close to another one. Or the system may detect abnormal condition and prevent engine from starting.



- Do not turn ON ignition switch by using ignition key with any type of metal wound (1) around its grip or in contact with it. Or the system may detect abnormal condition and prevent engine from starting.



- Do not leave ignition key where high temperature is anticipated. High temperature will cause transponder in ignition key to be abnormal or damaged.

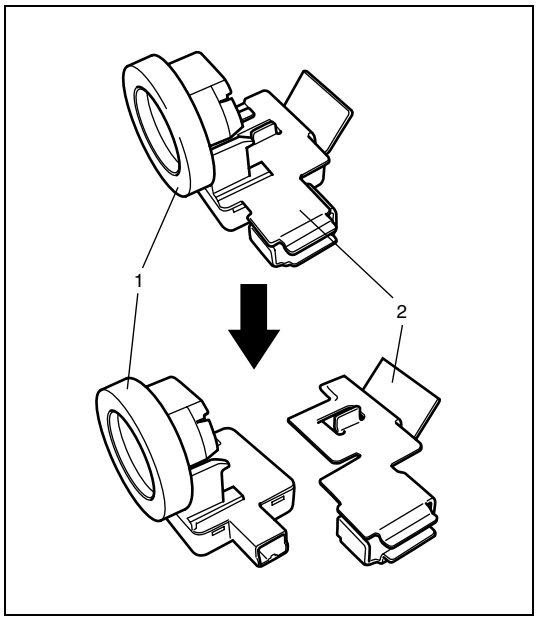


- Do not turn ON ignition switch with a radio antenna placed near Immobilizer Control Module. Or the system may detect abnormal condition and prevent engine from starting.

Immobilizer Control Module Removal and Installation

Removal

1) Disconnect negative (–) cable at battery.
2) Remove driver air bag (inflator) module from steering wheel referring to “Driver Air Bag (Inflator) Module Removal and Installation”.
3) Remove steering wheel referring to “Steering Wheel Removal and Installation”.
4) Remove steering column upper cover, steering column lower cover, contact coil and combination switch assembly referring to “Contact Coil Cable Assembly Removal and Installation”.
5) Remove key cylinder referring to “Steering Column Removal and Installation”.



6) Remove immobilizer control module (1) from steering column.
7) If immobilizer control module is equipped with metal cover (2), remove metal cover. If not, go to the next step.
8) Disconnect connector from immobilizer control module.

Installation

Reverse removal procedure for installation.

NOTE:

After replacing Immobilizer Control Module, be sure to register Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module and ECM/ Immobilizer Control Module code in ECM by performing procedure described in “Procedure After Immobilizer Control Module Replacement” in this section.

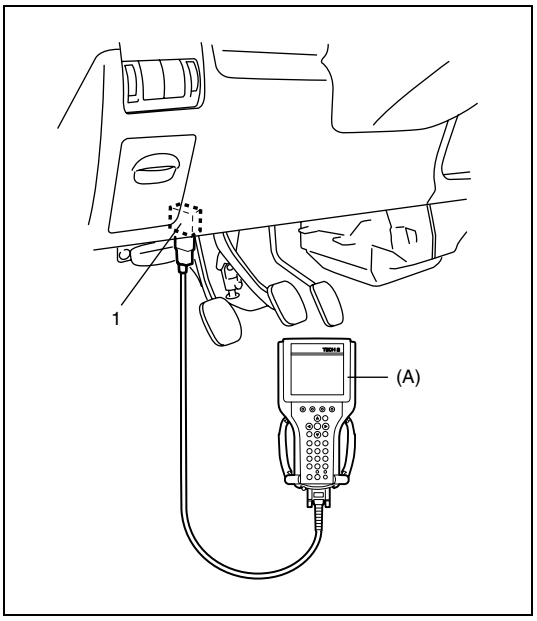
How to Register Ignition Key

Register the ignition key with a built-in transponder in Immobilizer Control Module by using the following procedure.

CAUTION:

When registering the ignition key including a transponder into the immobilizer control module by using Suzuki Scan Tool, confirm that the knob color of the ignition key to be registered for the vehicle is dark gray. The ignition key with wrong knob color cannot be registered.

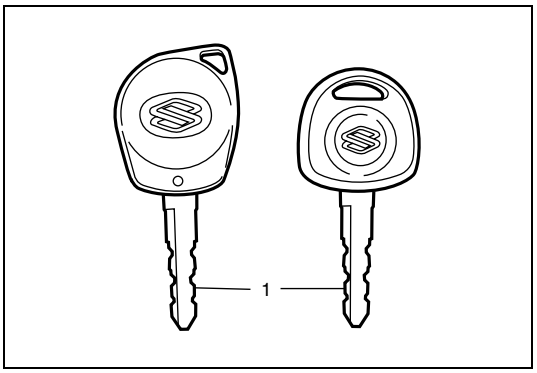
1) Prepare Suzuki Scan Tool for immobilizer control system.
2) With ignition switch OFF, connect Suzuki Scan Tool to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.



(A): Suzuki Scan Tool

NOTE:

For operation procedure of Suzuki Scan Tool, refer to operator's manual for Suzuki Scan Tool.



3) Prepare ignition key with a built-in transponder (1). And then turn ignition switch ON by using it.
4) Number of Transponder codes for ignition key with a built-in transponder that can be registered in Immobilizer Control Module is limited to 4. If needed, clear all Transponder codes for ignition key with a built-in transponder that have been registered in Immobilizer Control Module by using Suzuki Scan Tool.

NOTE:

When clearing Transponder code(s) with the immobilizer indicator lamp ON, it remains ON even after execution of that command is over. It will start flashing when the ignition switch is turned OFF once and then turned ON after some seconds.

5) Using Suzuki Scan Tool, register Transponder code in Immobilizer Control Module.
6) Make sure that immobilizer indicator lamp lights when ignition switch is turned OFF once and then ON.
7) If any other Transponder code for ignition key with a built-in transponder needs to be registered, repeat above steps 3), 5) and 6).

NOTE:

- **Up to 4 Transponder codes for ignition key with a built-in transponder can be registered.**
- **It is not possible to register the Transponder code which is already registered in Immobilizer Control Module.**

Procedure After Immobilizer Control Module Replacement

When Immobilizer Control Module was replaced, including when replaced because rechecking by using a known-good Immobilizer Control Module was necessary during trouble diagnosis, register Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module and ECM/Immobilizer Control Module code in ECM by performing following procedure.

CAUTION:

When registering the ignition key including a transponder into the immobilizer control module by using Suzuki Scan Tool, confirm that the knob color of the ignition key to be registered for the vehicle is dark gray. The ignition key with wrong knob color cannot be registered.

1) Perform steps 1) and 2) described in “How to Register Ignition Key”.
2) Prepare ignition key with a built-in transponder. And then turn ignition switch ON by using it.
3) Using Suzuki Scan Tool, clear all transponder codes registered in Immobilizer Control Module.

NOTE:

When clearing Transponder code(s) with the immobilizer indicator lamp ON, it remains ON even after execution of that command is over. It will start flashing when the ignition switch is turned OFF once and then turned ON after some seconds.

4) Using Suzuki Scan Tool, register Transponder code in Immobilizer Control Module.
5) Using Suzuki Scan Tool, register ECM/Immobilizer Control Module code in both Immobilizer Control Module and ECM.
6) Make sure that immobilizer indicator lamp lights when ignition switch is turned OFF once and then ON.
7) If any other Transponder code needs to be registered, repeat above steps 2), 4) and 6).

NOTE:

- **Up to 4 Transponder codes for ignition key with a built-in transponder can be registered.**
- **It is not possible to register the Transponder code which is already registered in Immobilizer Control Module.**

Procedure After ECM Replacement

When ECM was replaced, including when replaced because rechecking by using a known-good ECM was necessary during trouble diagnosis, register ECM/Immobilizer Control Module code in ECM by performing following procedure.

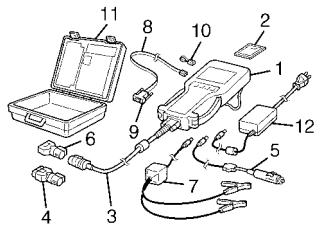
1) Perform steps 1) and 2) described in “How to Register Ignition Key”. And then turn ignition switch ON.
2) Using Suzuki Scan Tool, register ECM/Immobilizer Control Module code in ECM.

NOTE:

For operation procedure of Suzuki Scan Tool, refer to operator’s manual for Suzuki Scan Tool.

3) Make sure that malfunction indicator lamp lights when ignition switch is turned OFF once and then ON.

Special Tool



Tech 2 kit (Suzuki Scan Tool) See NOTE below.

NOTE:

This kit includes the following items.
1. Tech 2, 2. PCMCIA card, 3. DLC cable, 4. SAE16/19 adapter, 5. Cigarette cable,
6. DLC loopback adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter,
10. RS232 loopback connector, 11. Storage case, 12. Power supply

SECTION 9

BODY SERVICE

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Section System Components and Wiring Location View" under "Section General Description" in Section 10B in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Section Service Precautions" under "Section On-Vehicle Service" in Section 10B before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**
- **When body servicing, if shock may be applied to air bag system component parts, remove those parts beforehand. (Refer to Section 10B.)**

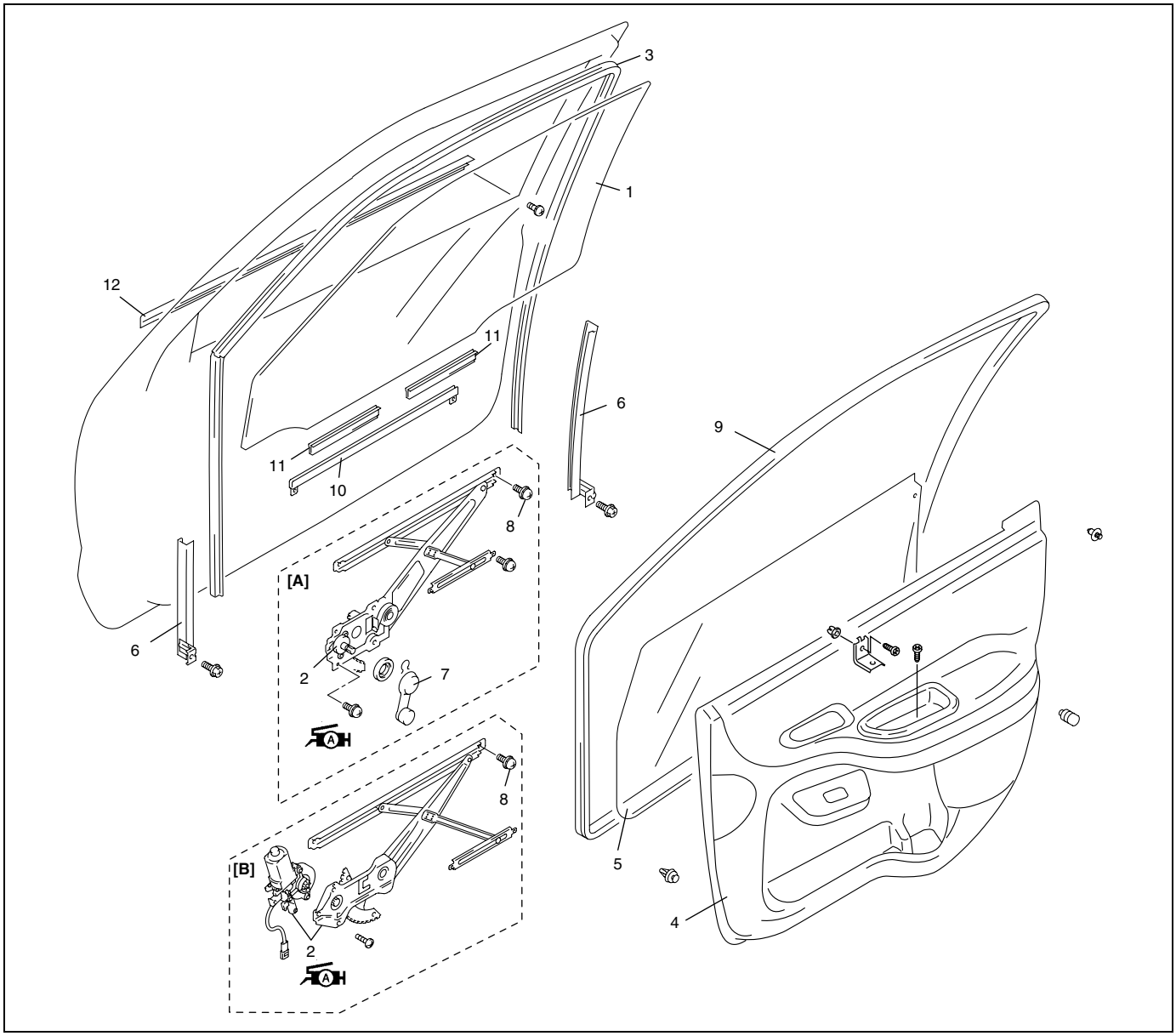
NOTE:

Fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number of with an equivalent part if replacement becomes necessary.
Do not use a replacement part of lesser quality or substitute a design. Torque values must be used as specified during reassembly to assure proper retention of these parts.

CONTENTS

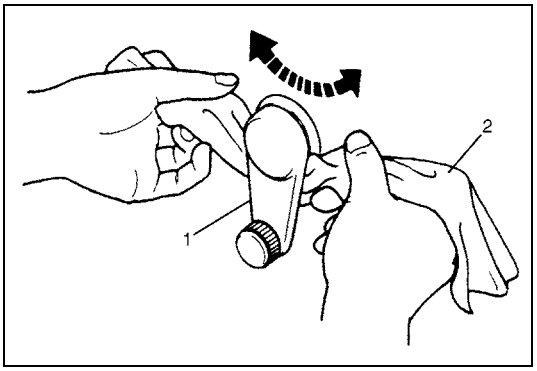
Glass, Windows and Mirrors

Front Door Window Removal and Installation

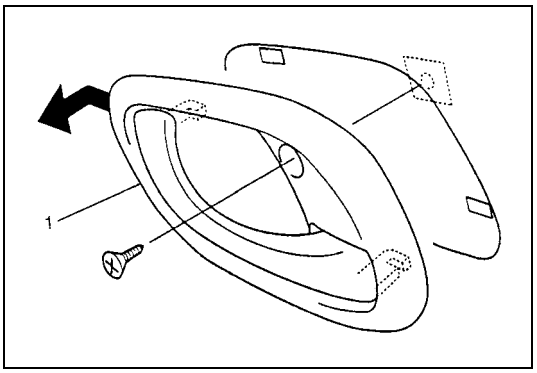


	1. Door glass	6. Door sash	11. Glass bottom rubber
A H	2. Window regulator assembly : Apply lithium grease 99000-25010 to sliding part.	7. Window regulator handle	12. Front door outer weather-strip
	3. Glass run	8. Bottom channel attaching screw	[A] Without power window
	4. Door trim	9. Door opening weather-strip	[B] With power window
	5. Door sealing cover	10. Glass bottom channel	

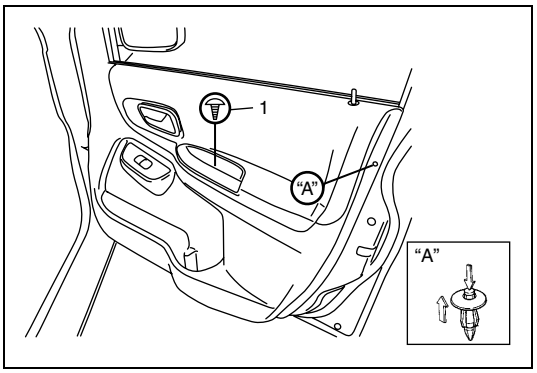
REMOVAL



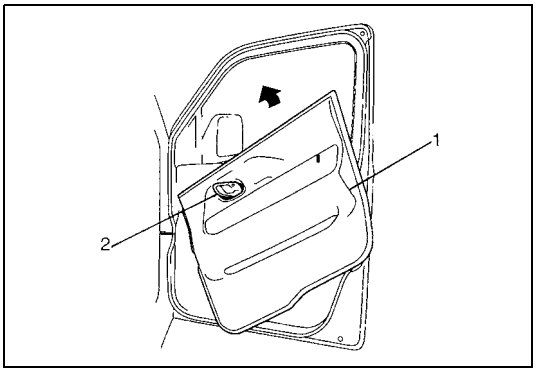
1) Remove window regulator handle (1) (if equipped).
   For its removal, push up snap off by using a cloth (2) as shown in figure.



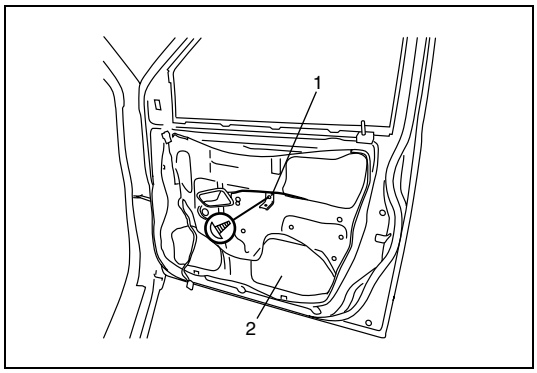
2) Remove inside handle bezel (1).



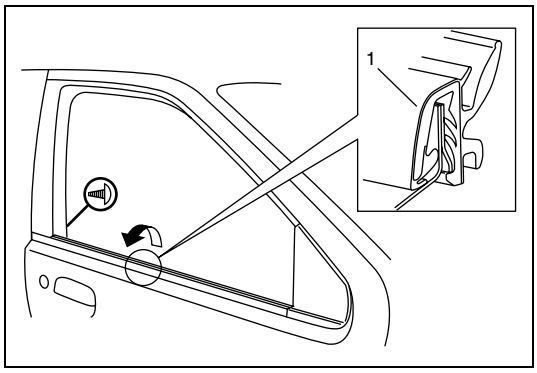
3) Remove mirror inner garnish.
4) Loosen door trim mounting screw (1).



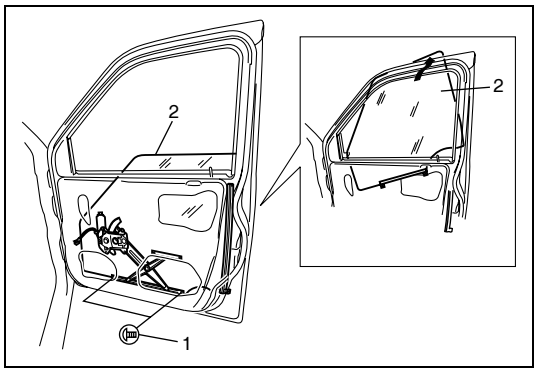
5) Remove door trim (1).
   With inside handle bezel (2) tilted as shown in figure.
6) Disconnect power window switch and mirror switch lead wire at coupler (if equipped).



7) Remove door trim bracket (1).
8) Remove door sealing cover (2).
9) Remove door mirror.
   Refer to “Door Mirror Removal and Installation” in this section.



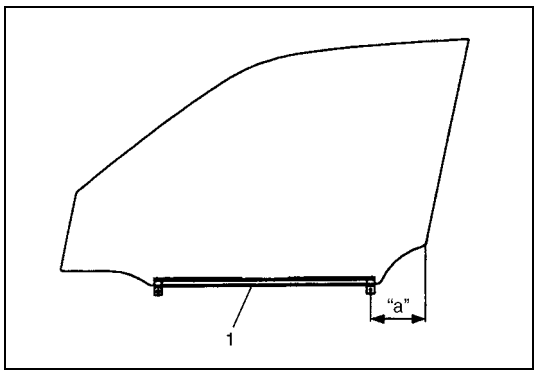
10) Remove outer weather-strip (1). Do not deform it when removal.
    Lower window all the way down. Then, pry off outer weather-strip using a tape-wrapped putty knife.



11) Remove bottom channel attaching screws (1).
12) Remove door glass (2) while tilting it as shown in figure.

INSTALLATION

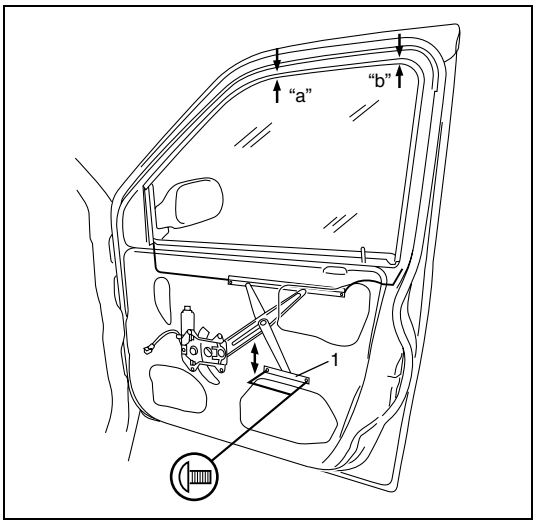
Reverse removal procedure to install door glass noting the following instructions.



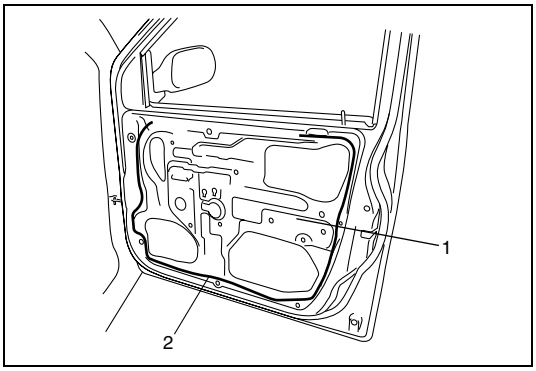
- Fit bottom channel (1) on glass bottom end as shown in figure.

Glass fitted position of bottom channel
“a”: 90.8 – 93.8 mm (3.57 – 3.69 in.)

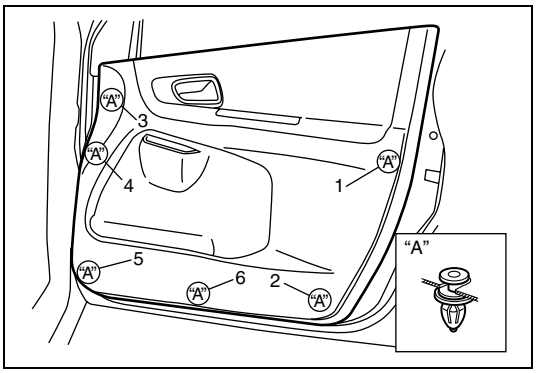
- Tighten bottom channel attaching screws. Tighten rear screw first, and then tighten front screw.



- Adjust equalizer (1) of window regular so that measurement "a" and "b" are equal.

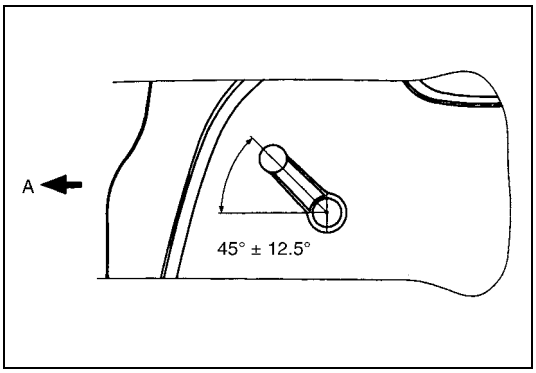


- Secure door sealing cover (1) with adhesive (2).



Install front door trim to proper attaching order.

Front door trim attaching order
(1) → (2) → (3) → (4) → (5) → (6)



- Install door window regulator handle (1) so that it has a 45° ± 12.5° angle when glass is fully closed as shown in figure.

A : Front

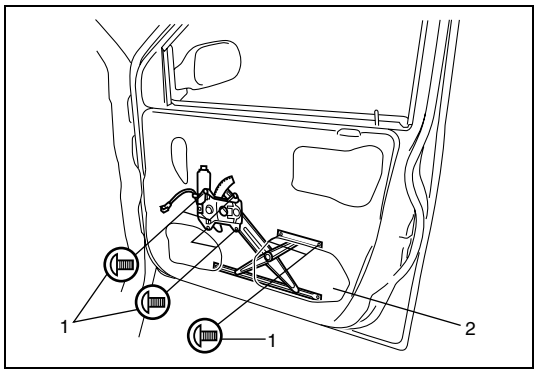
Front Door Window Inspection

Check deformity for glass run. If found defective, replace it with a new one.

Front Door Window Regulator Removal and Installation

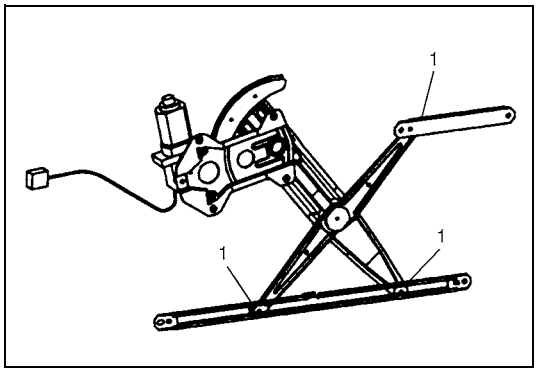
REMOVAL

1) Remove door glass referring to “Front Door Window Removal and Installation” in this section.
2) Disconnect power window motor lead wire at coupler and loosen clamp, if equipped.
3) Loosen regulator mounting screws (1) and take out regulator through hole (2) as shown in figure.



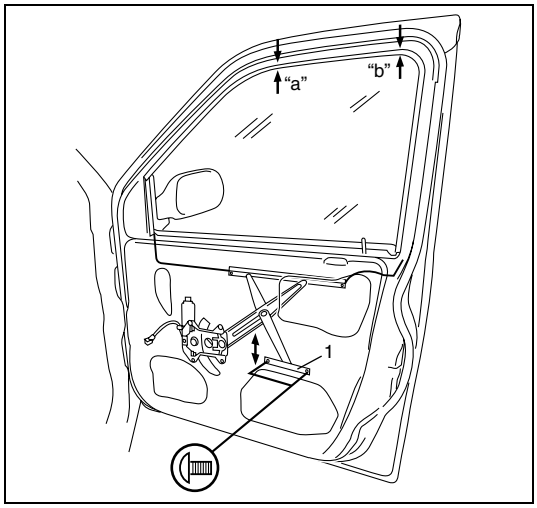
INSTALLATION

Reverse removal procedure to install window regulator noting the following instruction.



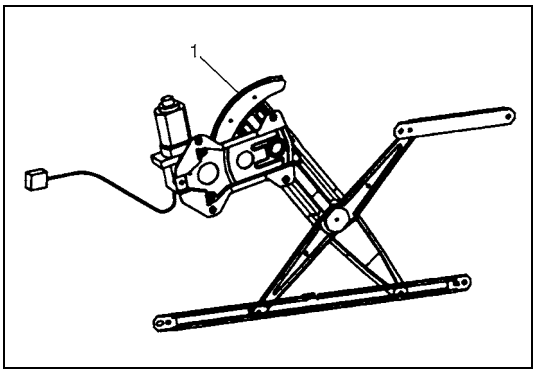
- Apply grease to sliding and rotating portions of regulator.

Grease 99000-25010



- When installing glass, check that the top part of the glass contacts the glass run evenly and that the glass moves up and down smoothly.
  If the glass is tilted with respect to the glass run, adjust equalizer (1) of window regulator so that measurement “a” and “b” are equal.

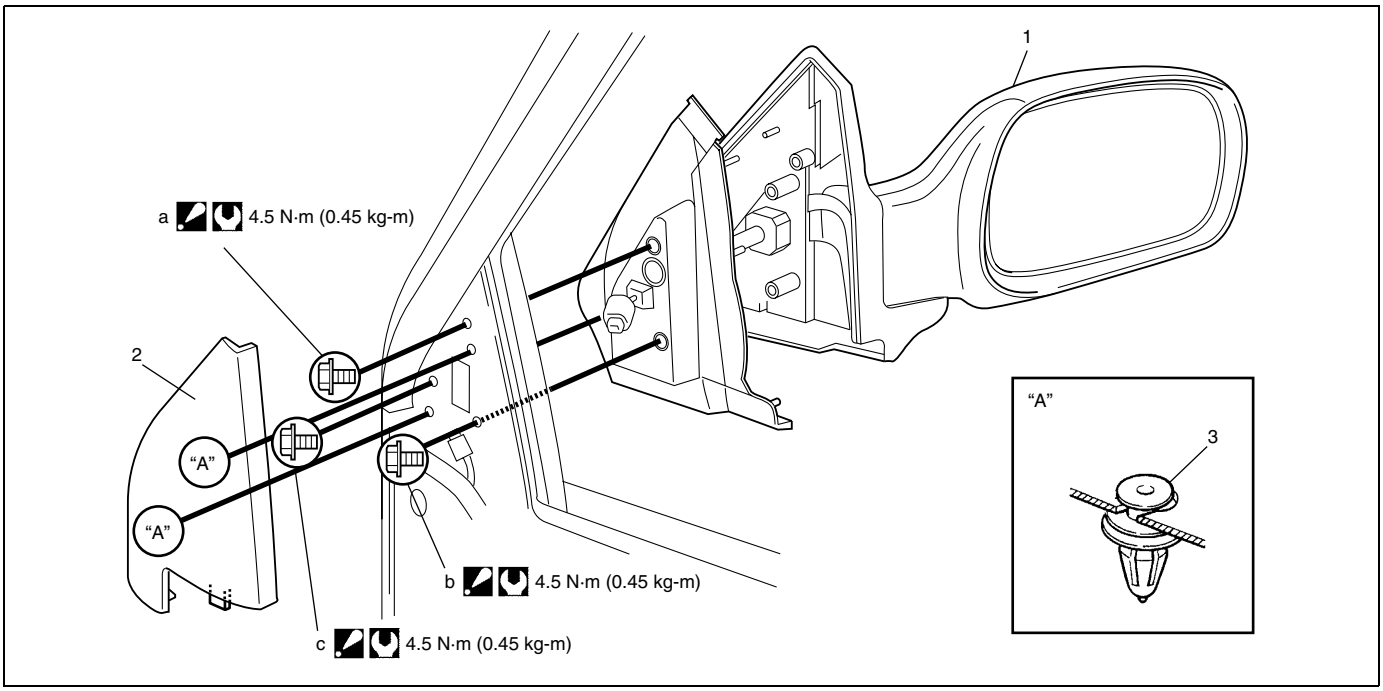
Front Door Window Regulator Inspection



Check rollers (1) for wear and damage. If found defective, replace it with a new one.

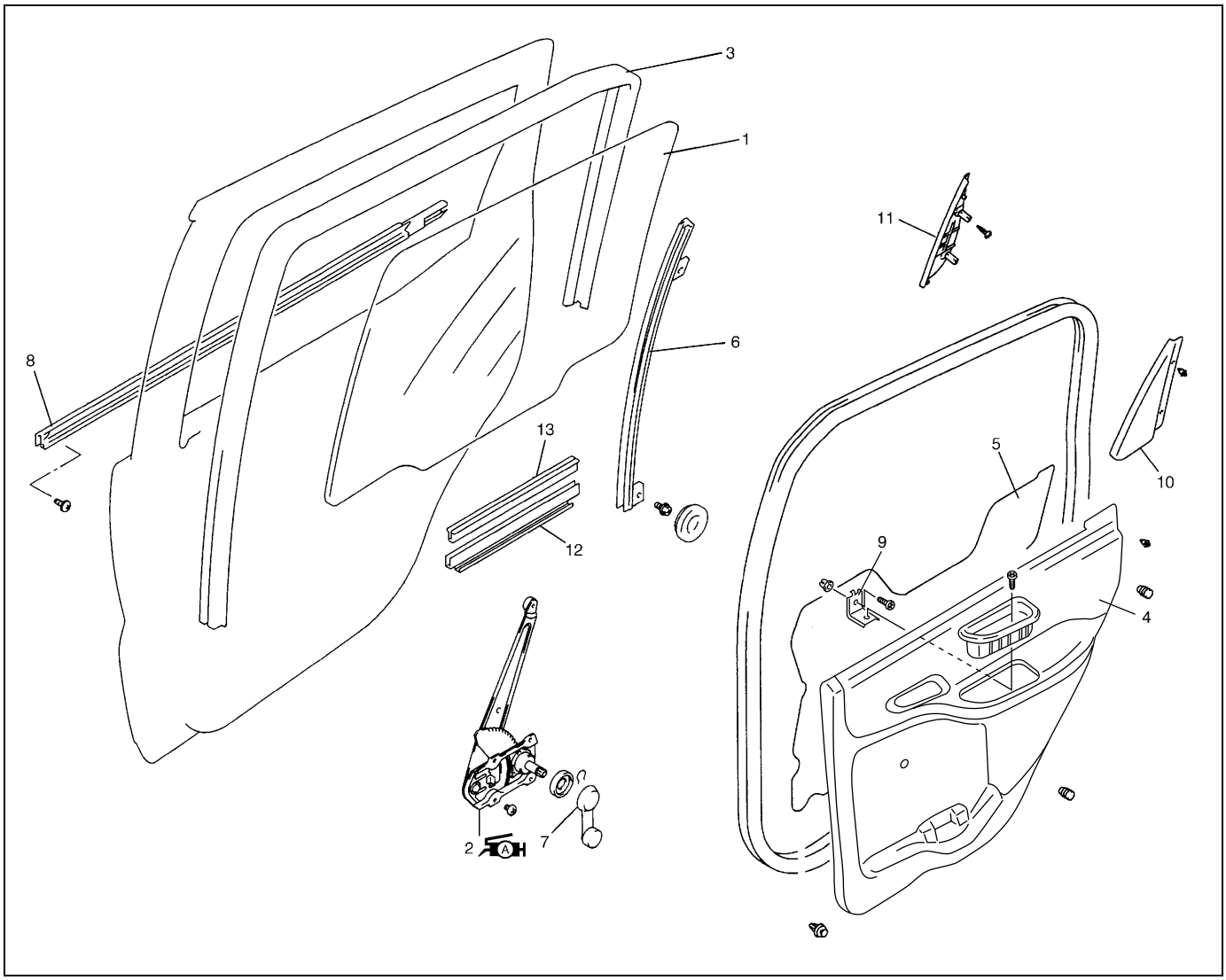
Door Mirror Removal and Installation

When removing or installing door mirror, refer to the figure.



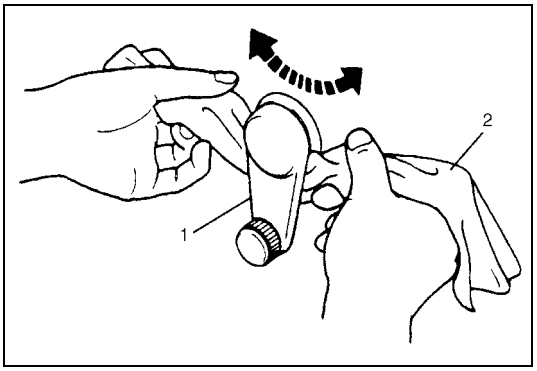
1. Door mirror	a. Mirror mount screw	Tightening order : a → b → c
2. Inner garnish	b. Mirror mount screw	Tightening torque
3. Clip	c. Mirror mount screw	

Rear Door Window Removal and Installation

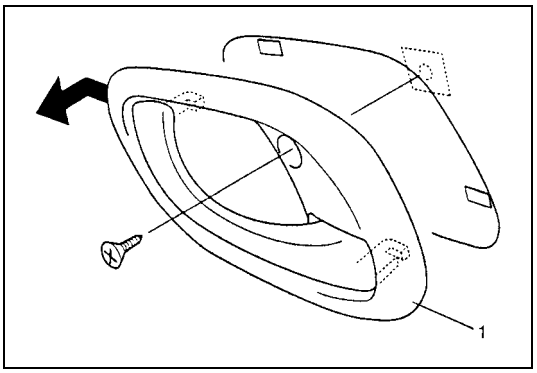


	1. Door glass	6. Door sash	11. Rear door outer garnish
A H	2. Window regulator assembly : Apply lithium grease 99000-25010 to moving section.	7. Window regulator handle	12. Glass bottom channel
	3. Glass run	8. Rear door outer weather-strip	13. Glass bottom rubber
	4. Door trim	9. Rear door inside pull handle bracket	
	5. Door sealing cover	10. Rear door inner garnish	

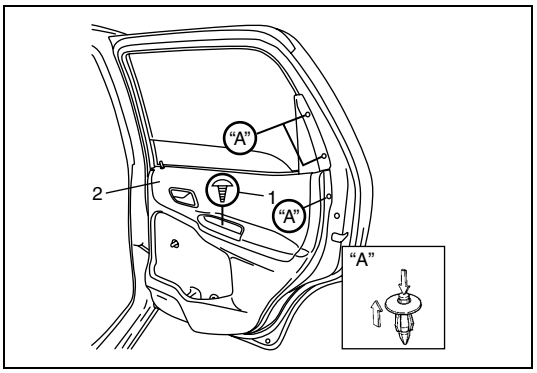
REMOVAL



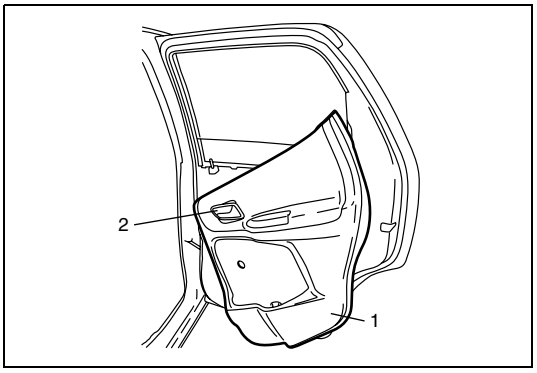
1) Remove window regulator handle (1).
   For its removal, push up snap off by using a cloth (2) as shown in figure.



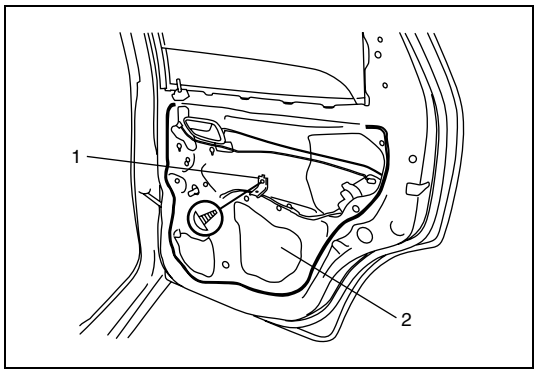
2) Remove inside handle bezel (1).



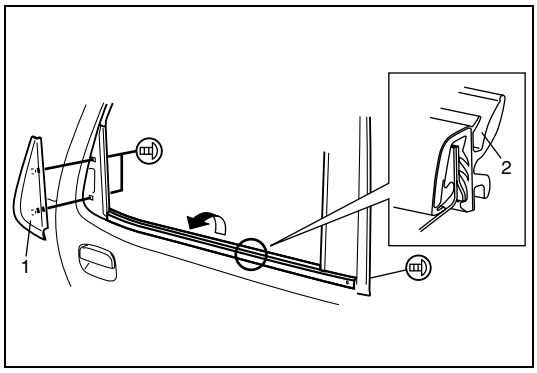
3) Loosen door trim mounting screw (1).
4) Remove rear door inner garnish (2).



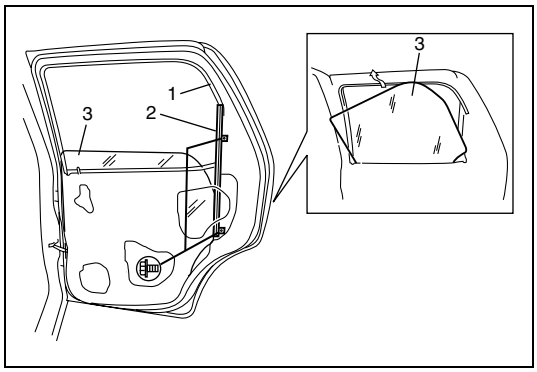
5) Remove door trim (1).
   With inside handle bezel (2) tilted as shown in figure.



6) Remove door trim bracket (1).
7) Remove door sealing cover (2).



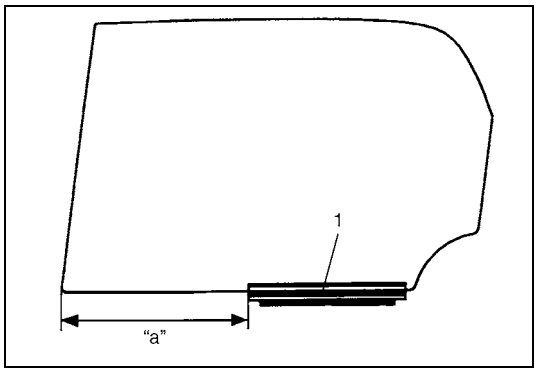
8) Remove rear door outer garnish (1).
9) Remove outer weather-strip (2). Do not deform it when removal.
   Lower window all the way down. Then, use a tape-wrapped putty knife (or screwdriver) to pry off outer weather-strip.



10) Detach rear part of glass run (1) from door sash (2).
11) Remove door sash (2).
12) Remove door glass (3) as shown in figure.

INSTALLATION

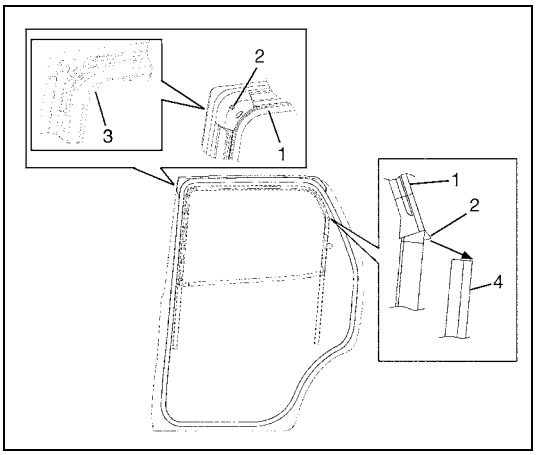
Reverse removal procedure to install door glass noting the following instructions.



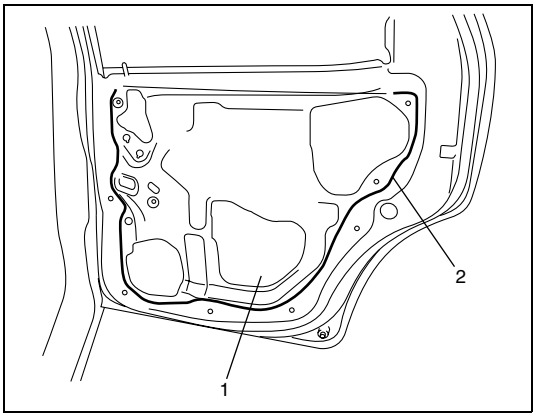
- Fit bottom channel (1) on glass bottom end as shown in figure.

  Glass fitted position of bottom channel
  "a": 201.9 – 204.9 mm (7.95 – 8.07 in.)

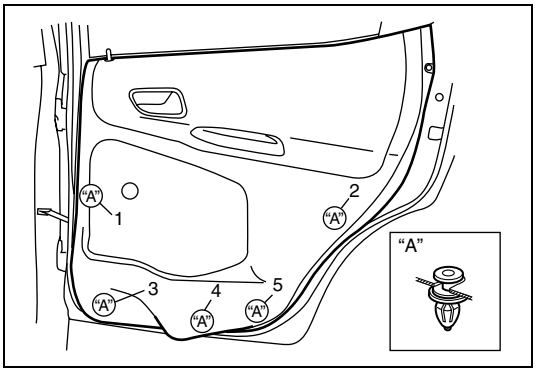
- Tighten bottom channel attaching screws. Tighten rear screw first, and then tighten front screw.



- When glass run (1) is installed, fit glass run convex part (2) to door panel cut part (3) and door sash (4).

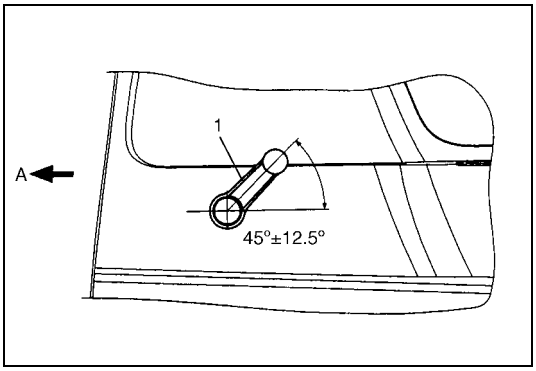


- Secure door sealing cover (1) with adhesive (2).



- Install rear door trim to proper attaching order.

Rear door trim attaching order
(1) → (2) → (3) → (4) → (5)



- Install door window regulator handle (1) so that it has a 45° ± 12.5° angle when glass is fully closed.

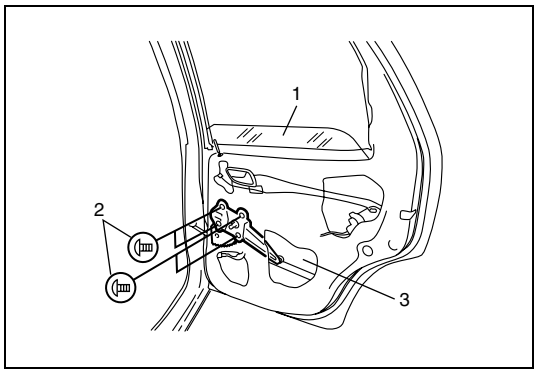
A : Front

Rear Door Window Inspection

Check deformity for glass run. If found defective, replace it with a new one.

Rear Door Window Regulator Removal and Installation

REMOVAL



1) Remove door glass (1) referring to “Rear Door Window Removal and Installation” in this section.
2) Loosen regulator mounting screws (2) and take out regulator through hole (3) as shown.

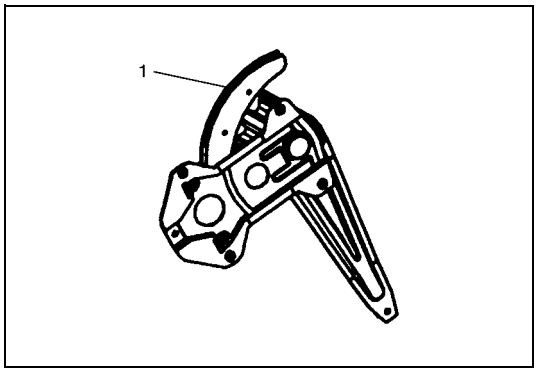
INSTALLATION

Reverse removal procedure to install window regulator noting the following instruction.

- Apply grease to sliding and rotating portions or regulator.

Grease 99000-25010

Rear Door Window Regulator Inspection

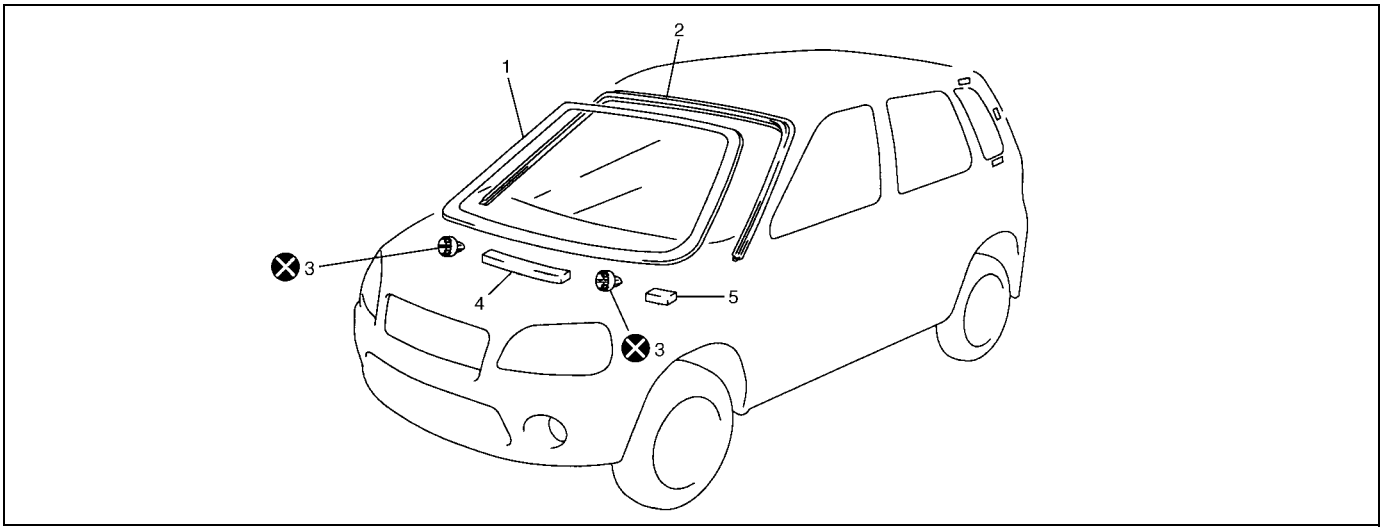


Check rollers (1) for wear and damage. If found defective, replace it with a new one.

Windshield Removal and Installation

Preparation

The front windshield is installed by using a special type of adhesive (that is, one component urethane adhesive used with primer). For the Windshield replacement, it is important to use an adhesive which provides sufficient adhesion strength and follow the proper procedure.



1. Windshield glass	3. Stopper	5. Side spacer
2. Windshield molding	4. Center spacer	⊗ Do not reuse.

CAUTION:

- **Described in this section is the glass replacement by using 3 types of primers and 1 type of adhesive made by YOKOHAMA (one component urethane adhesive to be used with primer in combination). When using primer and adhesive made by other manufacturers, be sure to refer to handling instructions supplied with them. Negligence in following such procedure or misuse of the adhesive in any way hinders its inherent adhesive property. Therefore, before the work, make sure to read carefully the instruction and description given by the maker of the adhesive to be used and be sure to follow the procedure and observe each precaution throughout the work.**
- **Should coated surface be scratched or otherwise damaged, be sure to repair damaged part, or corrosion may start from there.**

Use an adhesive of above mentioned type which has the following property.

Glass adhesive shearing strength

: 40 kg/cm^2 (569 lb/in^2) or more

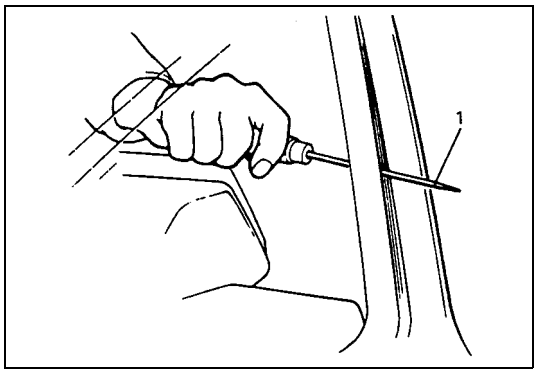
Adhesive materials and tools required for removal and installation.

- One component urethane adhesive and primers used in combination (For one sheet of windshield)
  - Adhesive (470 g (15.7 oz.))
  - Primer for glass (30 g (1.0 oz.))
  - Primer for body (30 g (1.0 oz.))
  - Primer for molding (30 g (1.0 oz.))
- Eyeleteer
- Piano string
- Windshield knife
- Brush for primer application (2 pcs)
- Knife
- Rubber sucker grip

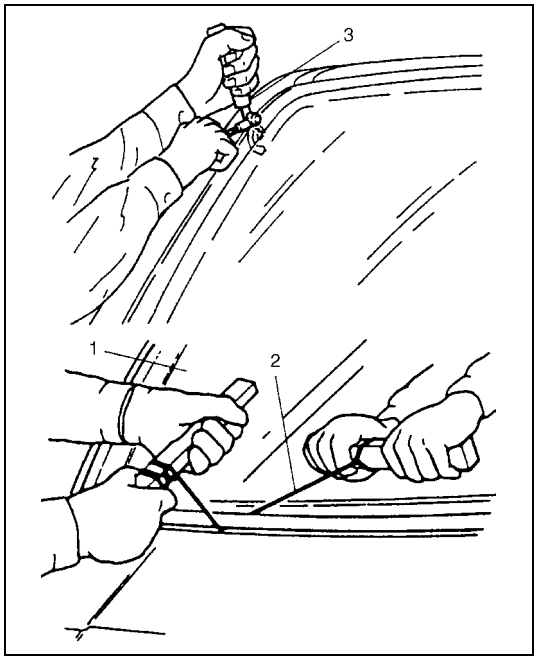
- Sealant gun (for filling adhesive)
- Putty spatula (for correcting adhered parts)

REMOVAL

1) Clean both inside and outside of glass and around it.
2) Remove wiper arms and garnish.
3) Using tape, cover body surface around glass to prevent any damage.
4) Remove rear view mirror, sun visor, and front pillar trims (right & left).
5) If necessary, remove instrument panel. Refer to “Instrument Panel Removal and Installation” in this section.
6) If necessary, remove head lining. Refer to “Head Lining Removal and Installation” in this section.
7) Remove (or cut) windshield molding.



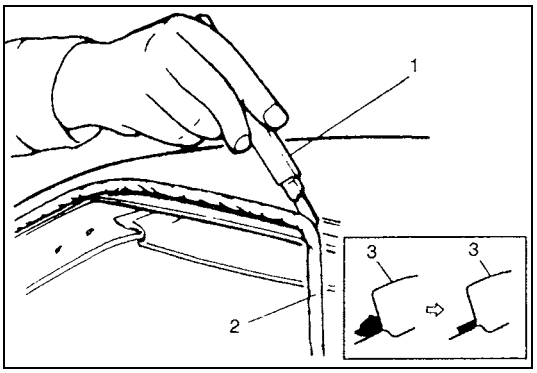
8) Drill hole with eyeleteer (1) through adhesive and let piano string through it.



9) Cut adhesive all around windshield (1) with piano string (2). When using tool, windshield knife (3), to cut adhesive, be careful not to cause damage to windshield. Use wire to cut adhesive along lower part of windshield.

NOTE:

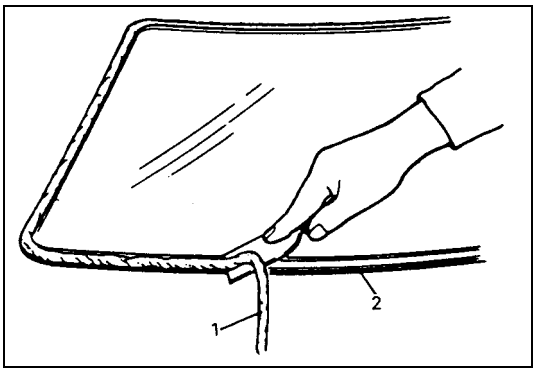
Use piano string (2) as close to glass as possible so as to prevent damage to body and instrument panel.



10) Using knife (1), smoothen adhesive (2) remaining on body side (3) so that it is 1 – 2 mm (0.039 – 0.078 in.) thick all around.

NOTE:

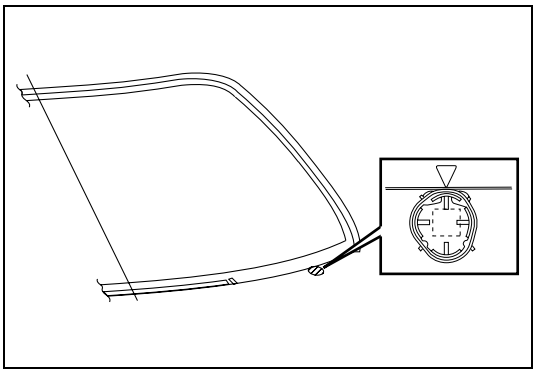
Before using knife (1), clean it with alcohol or the like to remove oil from it.



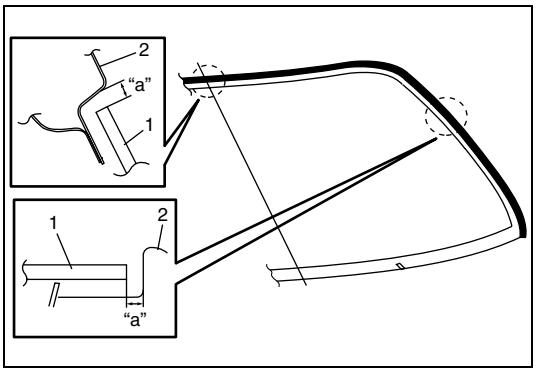
11) When reusing windshield, remove the adhesive (1) from it, using care not to damage primer coated surface (2).

INSTALLATION

1) Using cleaning solvent, clean windshield edge where windshield glass is to be adhered. (Let it dry for 10 minutes or more.)

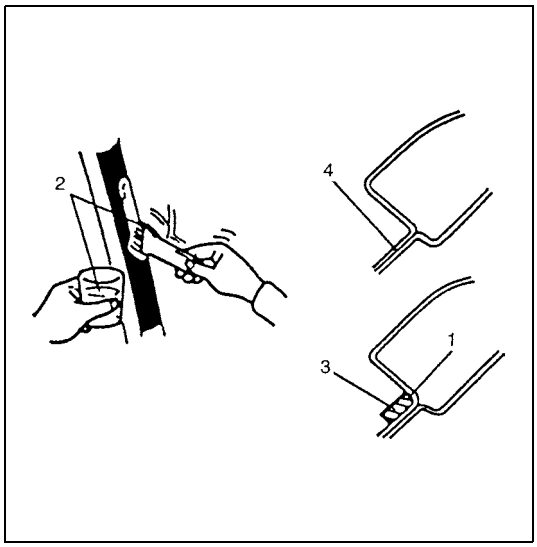


2) Install new glass stoppers (1) (2 pieces) to lower side of windshield.



3) To determine installing position of glass (1) to body (2), position glass against body so that clearance between upper end of glass (1) and body (2) is approximately 5 mm (0.197 in.) and clearances between each side end (right & left) of glass (1) and body (2) are even. Then mark mating marks on glass (1) and body (2) as shown. Upper clearance can be adjusted by moving glass stoppers position.

Windshield clearance
"a": approx. 5 mm (0.197 in.)

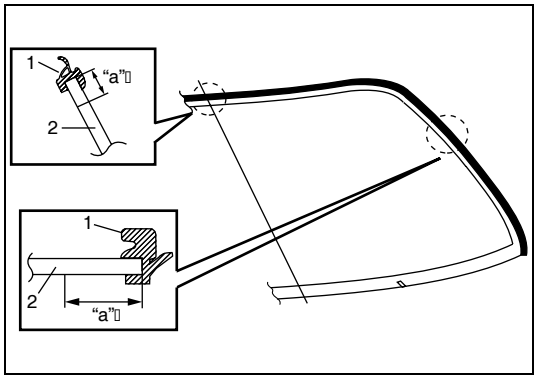


4) Clean contact surfaces of old adhesive (1), paint or bare metal thoroughly.
   If surfaces of paint or bare metal come out, apply primer (2) for body with caution not to apply primer (2) to surface of adhesive remaining on body.

NOTE:

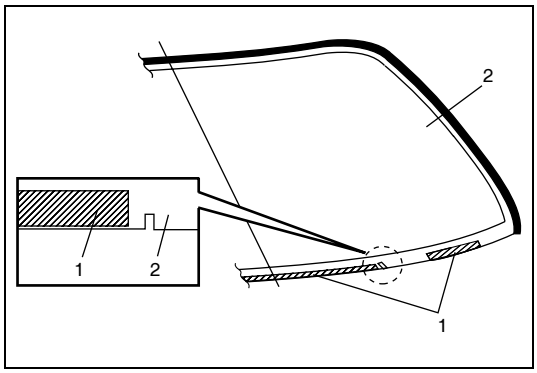
- **Be sure to refer to primer maker's instruction for proper handling and drying time.**
- **Do not touch body and old adhesive surfaces where glass is to be adhered.**

3.	Do not apply primer
4.	Apply primer

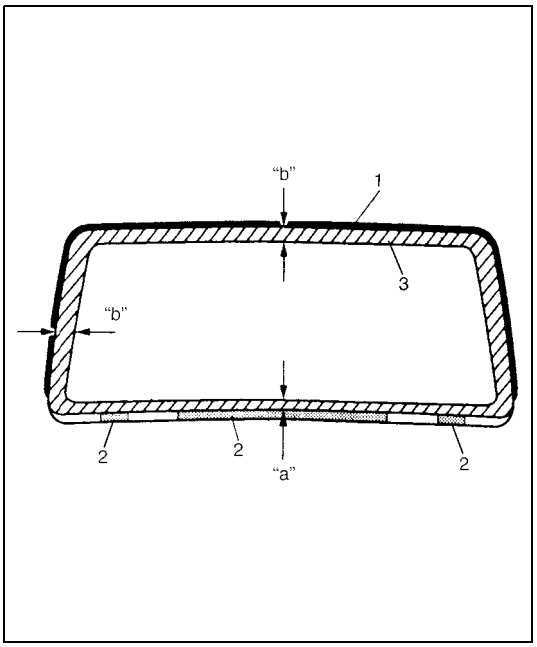


5) Install new molding (1) to glass (2).
6) Clean glass surface to be adhered to body with clean cloth. If cleaning solvent is used, let it dry for 10 minutes or more.

Cleaning Area for windshield (distance from the edge of glass or molding)
"a": 30 – 50 mm (1.18 – 1.97 in.)



7) Install new spacer (1) to windshield (2).



8) Using new brush, apply sufficient amount of primer for glass along glass surface to be adhered to body.

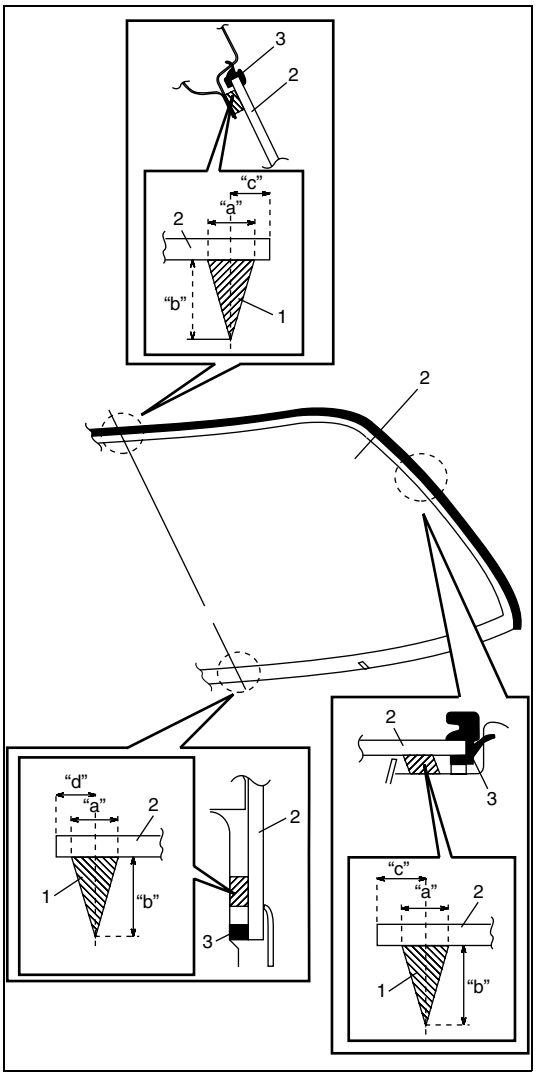
NOTE:

- **Be sure to refer to maker's instruction for proper handling and drying time.**
- **Do not apply primer on outside of ceramic coated surface.**
- **Do not touch primer coated surface.**

Width applied primer for windshield
"a": 22 mm (0.87 in.)
"b": 15 mm (0.59 in.)

1. Molding
2. Spacer
3. Apply primer

9) Apply primer for molding along molding surface all around.



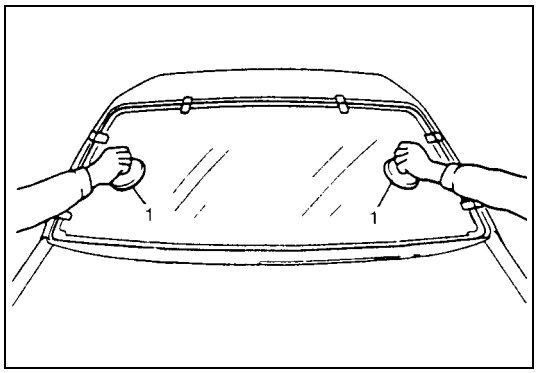
10) Apply adhesive (1) referring to figure.

NOTE:

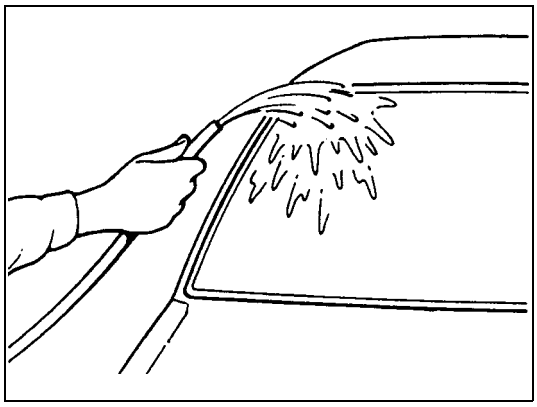
- **Press glass (2) against fittings surface of body panel quickly after adhesive (1) is applied.**
- **Use of rubber sucker grip is helpful to hold and carry glass after adhesive (1) is applied.**
- **Perform steps 8) to 9) within 10 min. to ensure sufficient adhesion.**
- **Be sure to refer to adhesive maker's instruction for proper handling and drying time.**
- **Start from bottom side of glass (2).**
- **Be careful not to damage primer.**

Adhesive amount specifications and position for windshield
Width "a": Approx. 7 mm (0.27 in.)
Height "b": Approx. 15 mm (0.59 in.)
Position "c": Approx. 10 mm (0.39 in.) for front, rear and upper sections
Position "d": Approx. 17 mm (0.67 in.) for bottom section.

3. Molding



11) Holding rubber sucker grips (1), place glass onto body by aligning mating marks marked in Step 3) and press it.



12) Check for water leakage by pouring water over windshield through hose. If leakage is found, dry windshield and fill leaky point with adhesive. If water still leaks even after that, remove glass and start installation procedure all over again.

NOTE:

- **Do not use high pressure water.**
- **Do not blow compressed air directly at adhesive applied part when drying.**
- **Do not use infrared lamp or like for drying.**

CAUTION:

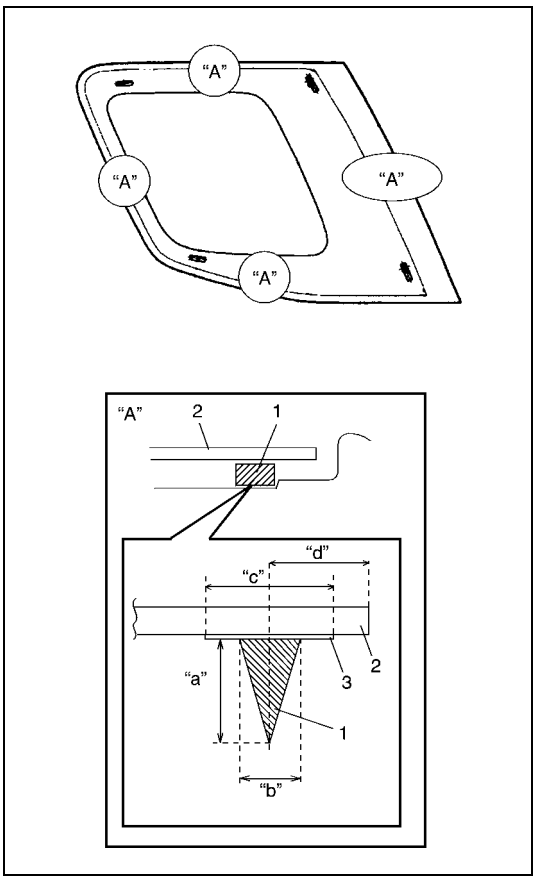
Upon completion of installation, note the following.

- **Sudden closing of door before adhesive is completely set may cause glass to become loose or to come off. Therefore, if door is opened or closed before adhesive is completely set, make sure to open all door glasses and use proper care.**
- **If molding is not securely in place, hold it down with a tape until adhesive is completely set.**
- **Each adhesive has its own setting time.**
- **Be sure to refer to its maker's instruction, check setting time of adhesive to be used and observe precautions to be taken before adhesive is set.**
- **Refrain from driving till adhesive is completely set so as to ensure proper and sufficient adhesion.**

Quarter Window Removal and Installation

REMOVAL AND INSTALLATION

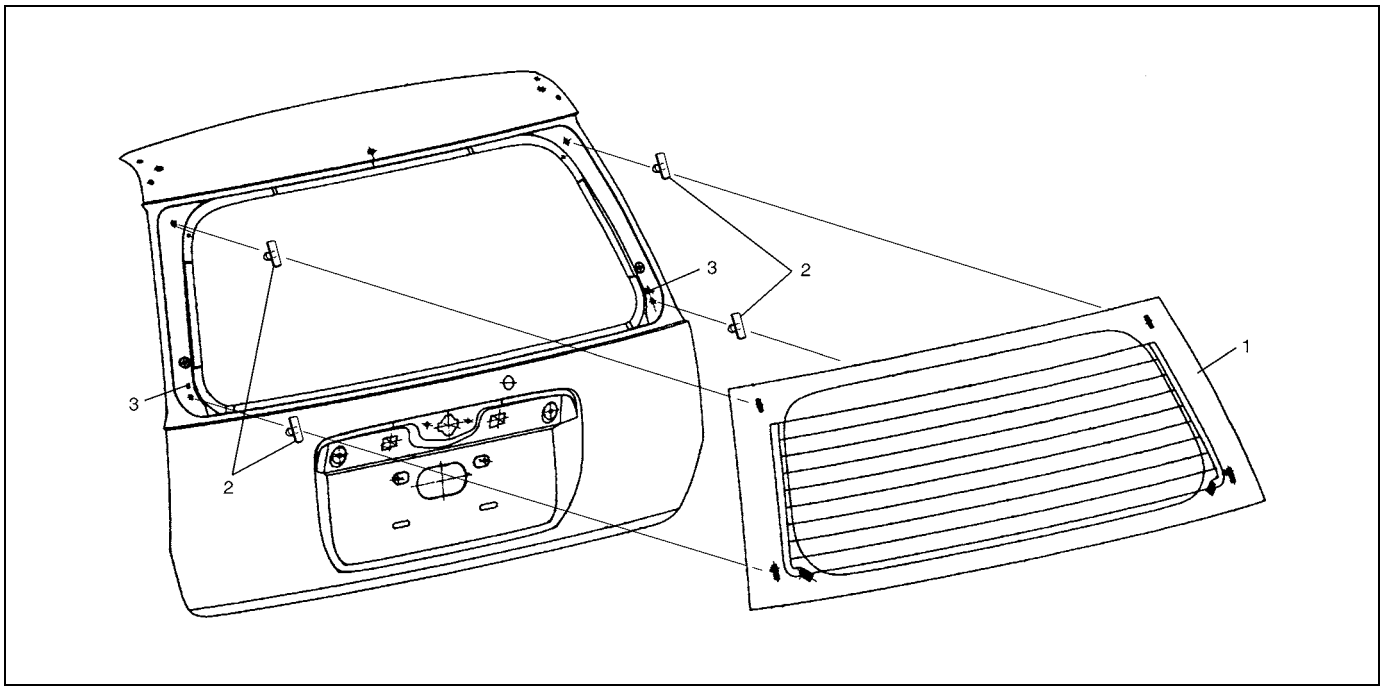
Refer to “Windshield Removal and Installation” in this section as removal and installation procedures are basically the same. However, note the following.



- Observe the following precautions when applying adhesive (1) along glass (2) edge.
- Adhesive (1) should be applied evenly especially in height.
- Be careful not to damage primer (3).
- Press glass against body quickly after adhesive (1) is applied.

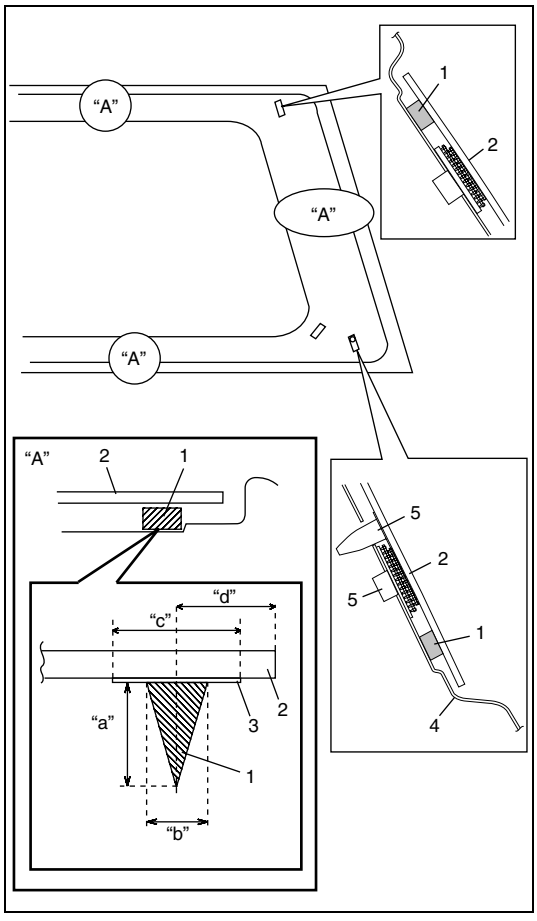
Adhesive amount specification and position for quarter window
Height “a”: 13 mm (0.51 in.)
Width “b”: 6 mm (0.24 in.)
Width “c”: 14 mm (0.55 in.)
Position “d”: 12 mm (0.47 in.) for glass front and bottom sections.
Position “d”: 11 mm (0.43 in.) for glass upper section
Position “d”: 45 mm (1.77 in.) for glass rear section

Rearend Glass Removal and Installation



1. Rearend door glass	2. Fastener	3. Mounting hole

Refer to “Windshield Removal and Installation” in this section as removal and installation procedures are basically the same. However, note the following.

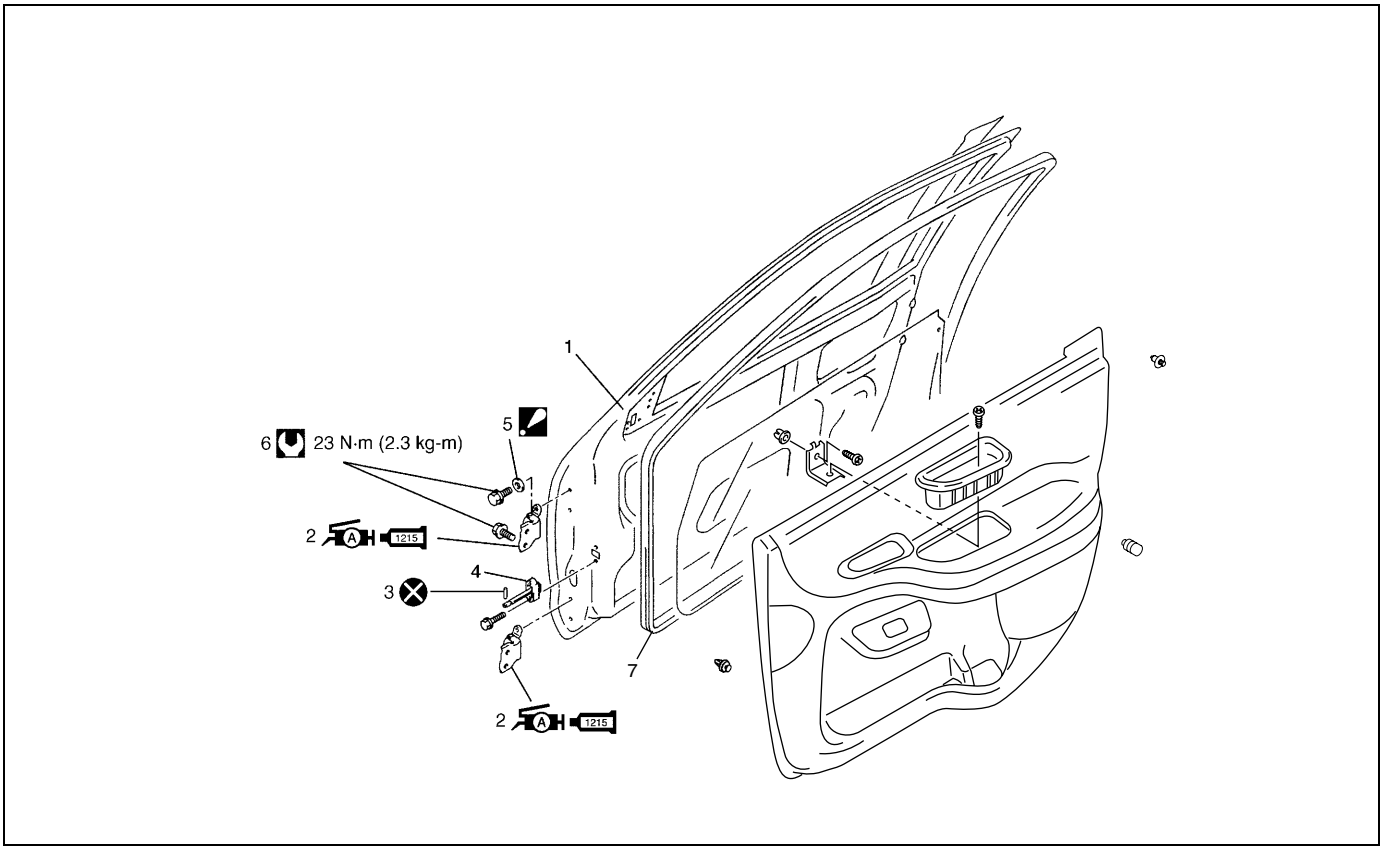


- Observe the following precautions when applying adhesive (1) along glass (2) edge.
- Adhesive (1) should be applied evenly especially in height.
- Be careful not to damage primer (3).
- With the position of fastener (5) properly aligned, install glass (2) on rear door panel (4).
- Press glass against body quickly after adhesive (1) is applied.

Adhesive amount specifications and position for rearend door glass
Height “a”: 13 mm (0.51 in.)
Width “b”: 6 mm (0.24 in.)
Width “c”: 14 mm (0.55 in.)
Position “d”: 14.5 mm (0.57 in.) for glass upper section
Position “d”: 16 mm (0.63 in.) for glass bottom section
Position “d”: 32 mm (1.26 in.) for glass side sections

Body Structure

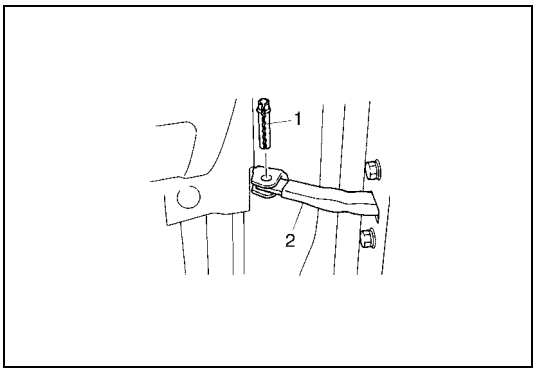
Front Door Removal and Installation

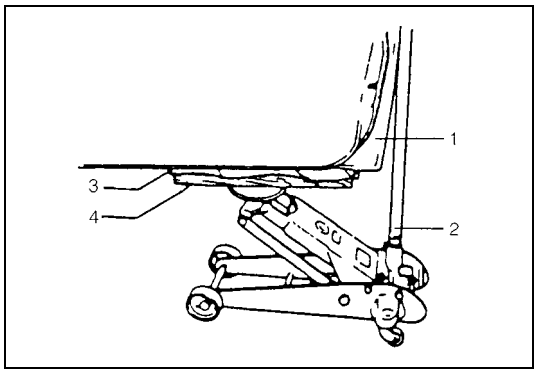


	1. Door panel	6.	Front door hinge bolt
1215	2. Door hinge : Apply lithium grease 99000-25010 to rotating part : Apply sealant 99000-31110 to contact face	7.	Weather-strip
	3. Door stopper pin		Tightening torque
	4. Door open stopper		Do not reuse.
	5. Door hinge washer : Not necessary to install		

REMOVAL

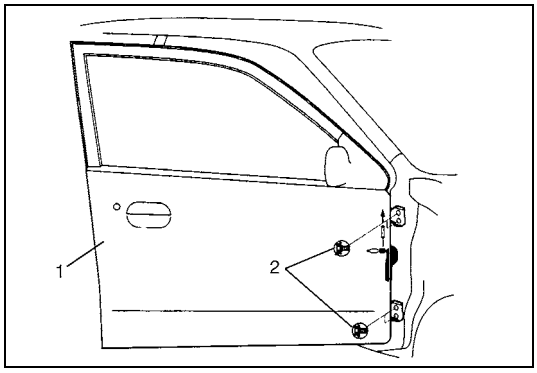
1) Remove front fender. Refer to “Front Fender Removal and Installation” in this section.
2) Disconnect door harness lead wires at each coupler (if equipped).
3) Remove stopper pin (1) from door open stopper (2).





4) Support door panel (1) using a jack (2) with a piece of wood placed (4) between jack (2) and panel (1) as shown.

3. Rags

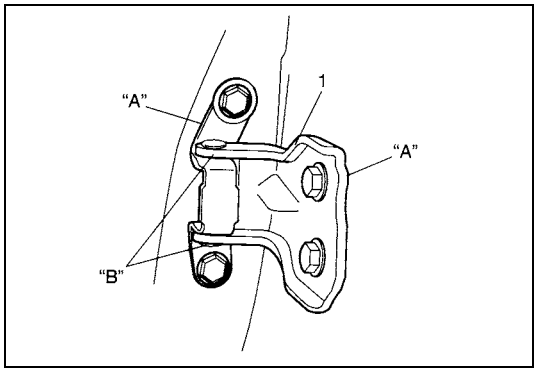


5) Remove door assembly (1) by loosening hinge mounting bolts (2).

INSTALLATION

Reverse removal procedure to install door assembly noting the following instructions.

- When replacing door, coat replacement door inside with wax for proper anti-corrosion treatment.
  Refer to “Anti-Corrosion Compound Application Area” in this section.

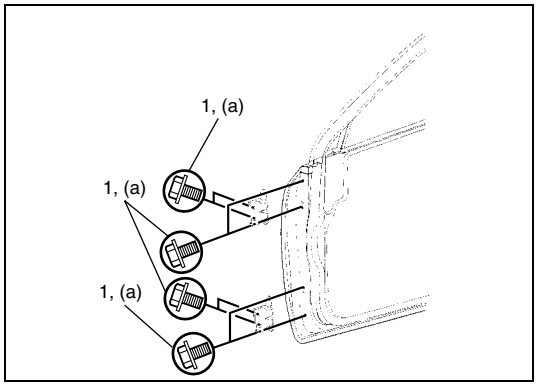


- Apply sealant to contact face “A” of hinge (1).

“A”: Sealant 99000-31110

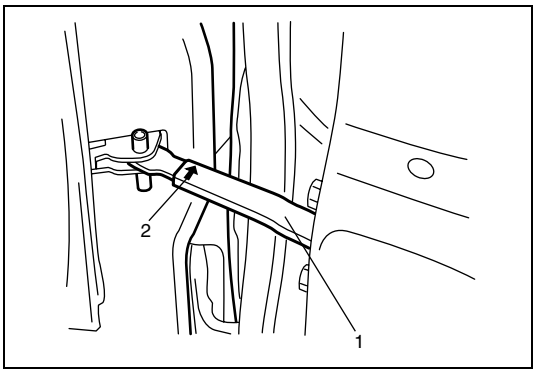
- Apply grease to rotating part “B” of hinge (1).

“B”: Lithium grease 99000-25010



- Tighten hinge bolt (1) to specified torque.

Tightening torque
Door hinge mounting bolt
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

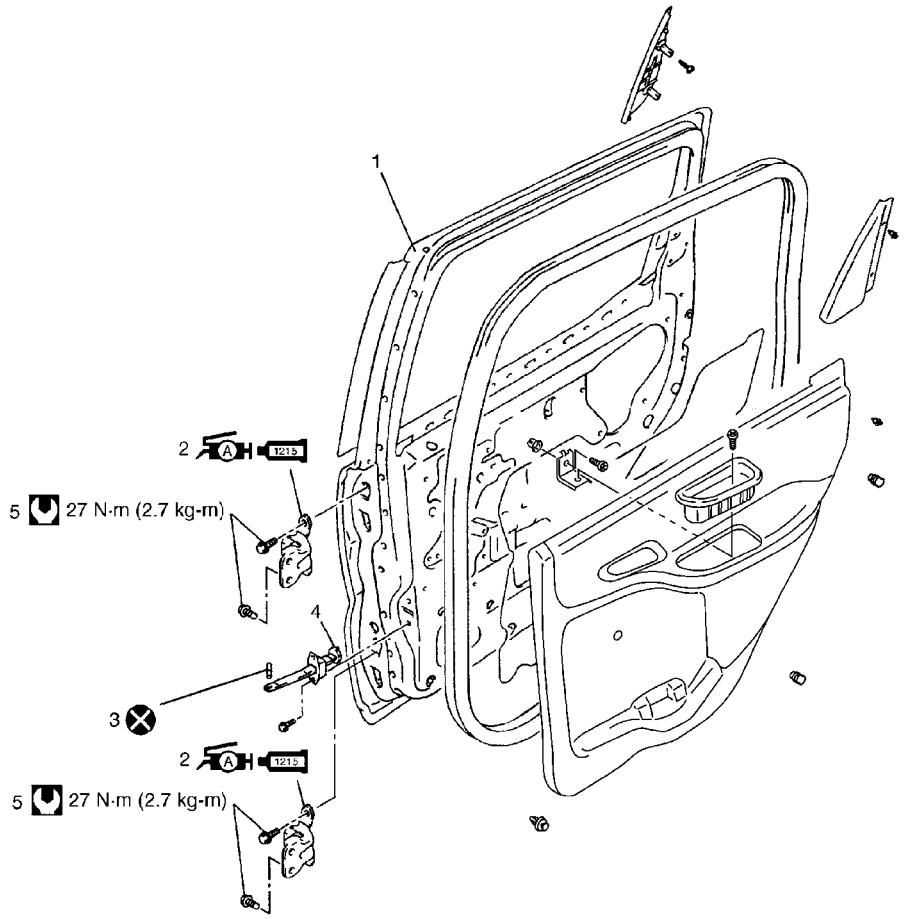


- Install door open stopper (1) as show in figure.

2. Mark

- Adjust door latch striker position referring to “Front Door Lock Assembly Removal and Installation” in this section.
- Adjust front door cushion so that door becomes flush with side body.
- After installation, open and close the door to check looseness.
  Replace door open stopper pin when there is looseness.
- When weather-strip is hardened, water leak may develop.
  In such case, replace it with a new one.

Rear Door Removal and Installation

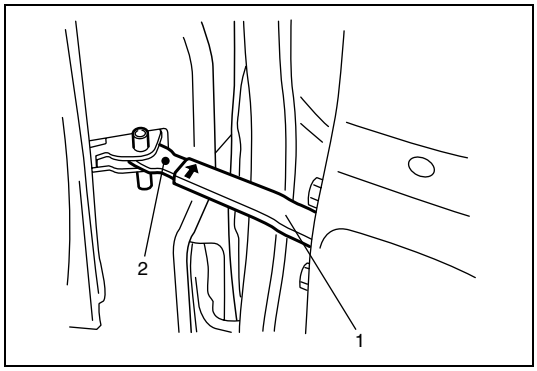


	1. Rear door panel	4. Door open stopper	Do not reuse.
1215	2. Rear door hinge : Apply lithium grease 99000-25010 to rotating part : Apply sealant 99000-31110 to contact face	5. Rear door hinge bolt	
	3. Rear door stopper pin	Tightening torque	

Refer to “Front Door Removal and Installation” in this section noting the following instructions.

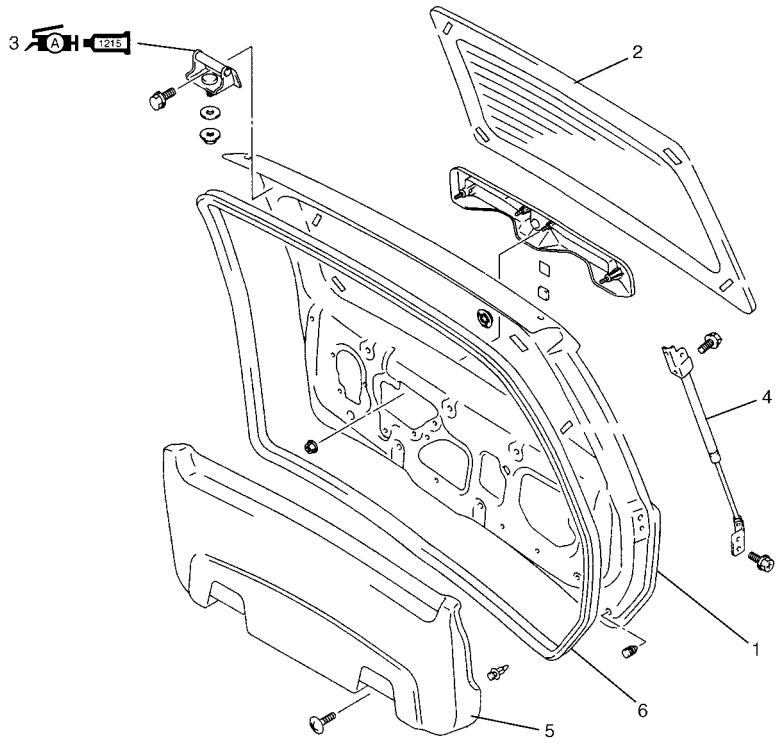
- Refer to above figure for tightening torque, grease and sealant.
- Install door open stopper (1) as specified below.

Door open stopper installing direction
Right side door: RR punch mark is upward.
Left side door: RL punch mark is upward.



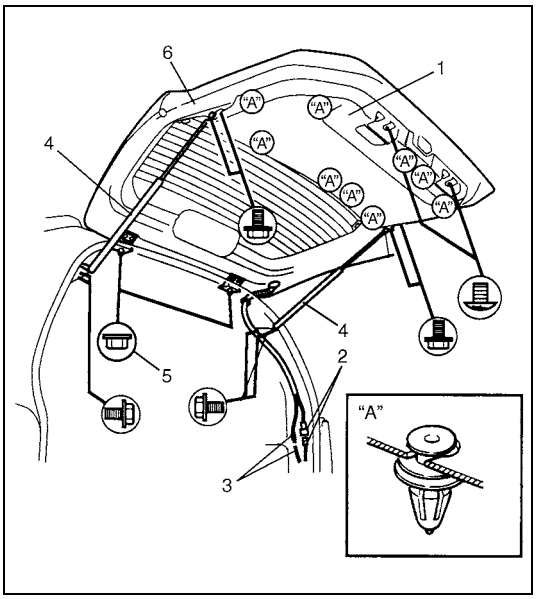
2. Punch mark

Rearend Door Removal and Installation

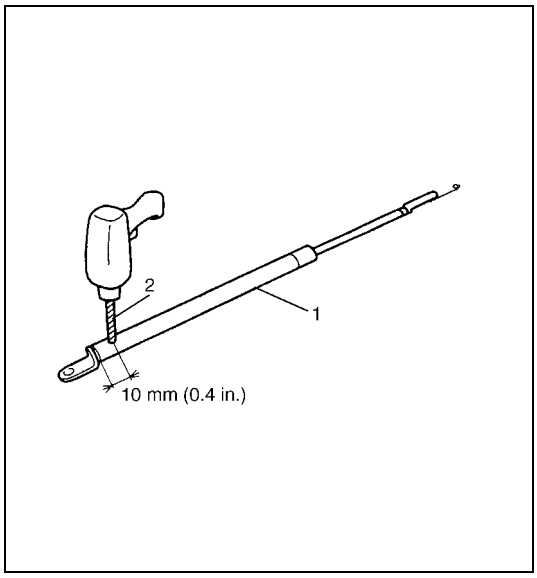


	1. Rearend door panel	4. Rearend door balancer unit
	2. Rearend door window glass	5. Rearend door trim
A 1215	3. Rearend door hinge : Apply lithium grease 99000-25010 to door hinge moving section : Apply sealant 99000-31110 to contact face	6. Weather strip

REMOVAL



1) Remove rearend door trim (1).
2) Remove related section of head lining and quarter trim.
3) Disconnect rearend door harness connectors (2) and washer hose (3).
4) Remove rearend door balancer (4) (first at its door side and next at its body side).
5) Remove door hinge nuts (5) and remove rearend door assembly (6).
6) Remove wiring harness connectors inside rearend door.



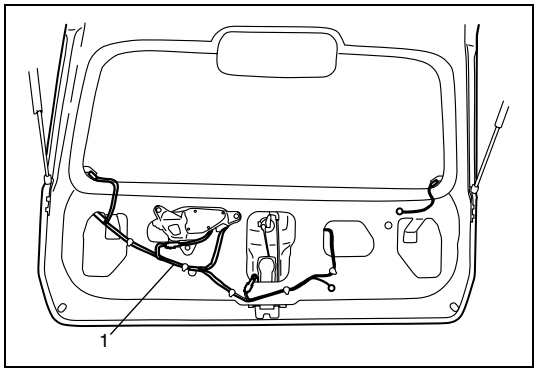
WARNING:

Handling of Rearend Door Balancer (Damper)

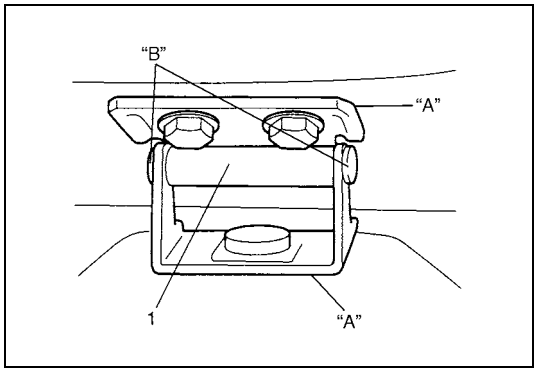
- **Do not disassemble balancer (1) because its cylinder is filled with gas.**
- **Handle balancer carefully. Do not scar or scratch exposed surface of its piston rod, and never allow any paint or oil to stick to its surface.**
- **Do not turn piston rod with balancer fully extended.**
- **When discarding removed rearend door balancer (damper), use a 2 – 3 mm (0.08 – 0.12 in.) drill (2) to make a hole as shown.**
- **The gas itself is harmless but it may issue out of the hole together with chips generated by the drill (2). Therefore, be sure to wear goggle.**

INSTALLATION

Reverse removal procedure to install rearend door noting the following instructions.



- Secure wiring harness (1).



- Apply sealant to contact face "A" of door hinge (1).

"A": Sealant 99000-31110

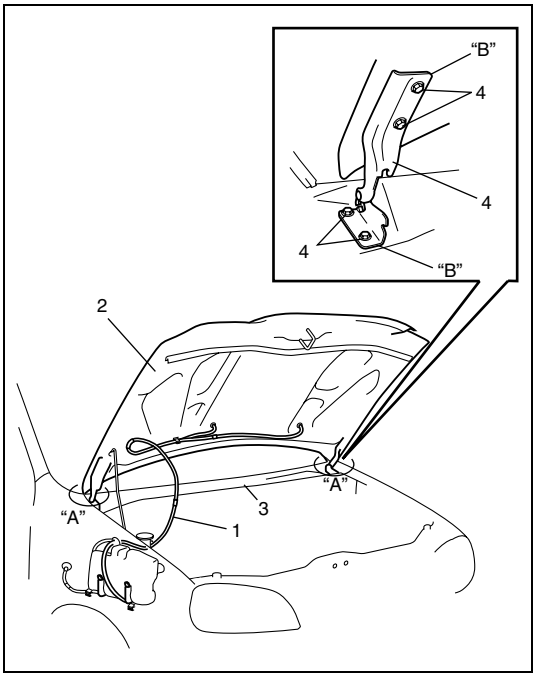
- Apply grease to rotating part "B" of hinge (1).

"B": Lithium grease 99000-25010

- Adjust door latch striker position by referring "Rearend Door Removal and Installation" in this section.
- Adjust door cushion so that door becomes flush with body.
- Adjust door clearance by loosening door hinge mounting bolts and nuts referring to "Panel Clearance" in this section.

Hood Removal and Installation

REMOVAL



CAUTION:
Place cloth on "A" in figure to prevent from any damage.

1) Remove window washer hose (1) from hood (2).
2) Remove cowl top garnish (3).
3) Remove 4 mounting bolts (4) to detach hood (2).

INSTALLATION

Reverse removal procedure to install hood noting the following instruction.

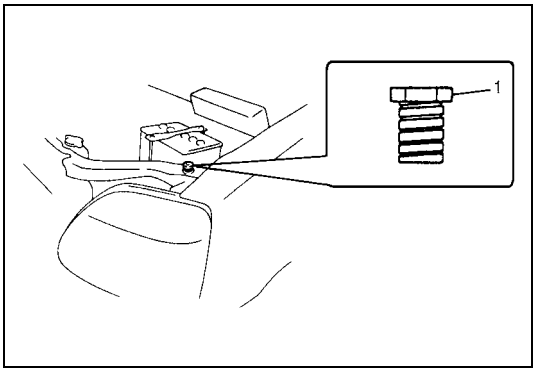
- Apply sealant to contact face "B" of hood hinge (4).

"B": Sealant 99000-3110

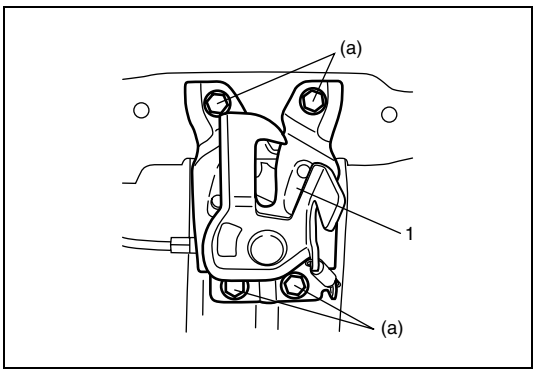
Hood Adjustment

Adjust the following point:

- Hood position adjustment.
  Fore-and-aft and right-and-left adjustment.
  Adjust hood clearance by loosening hood mounting bolts, refer to "Panel Clearance" in this section.



- Vertical adjustment
  If only one side (right or left) of hood is not level with front fender, make it level by tightening or loosening hood cushion (1).



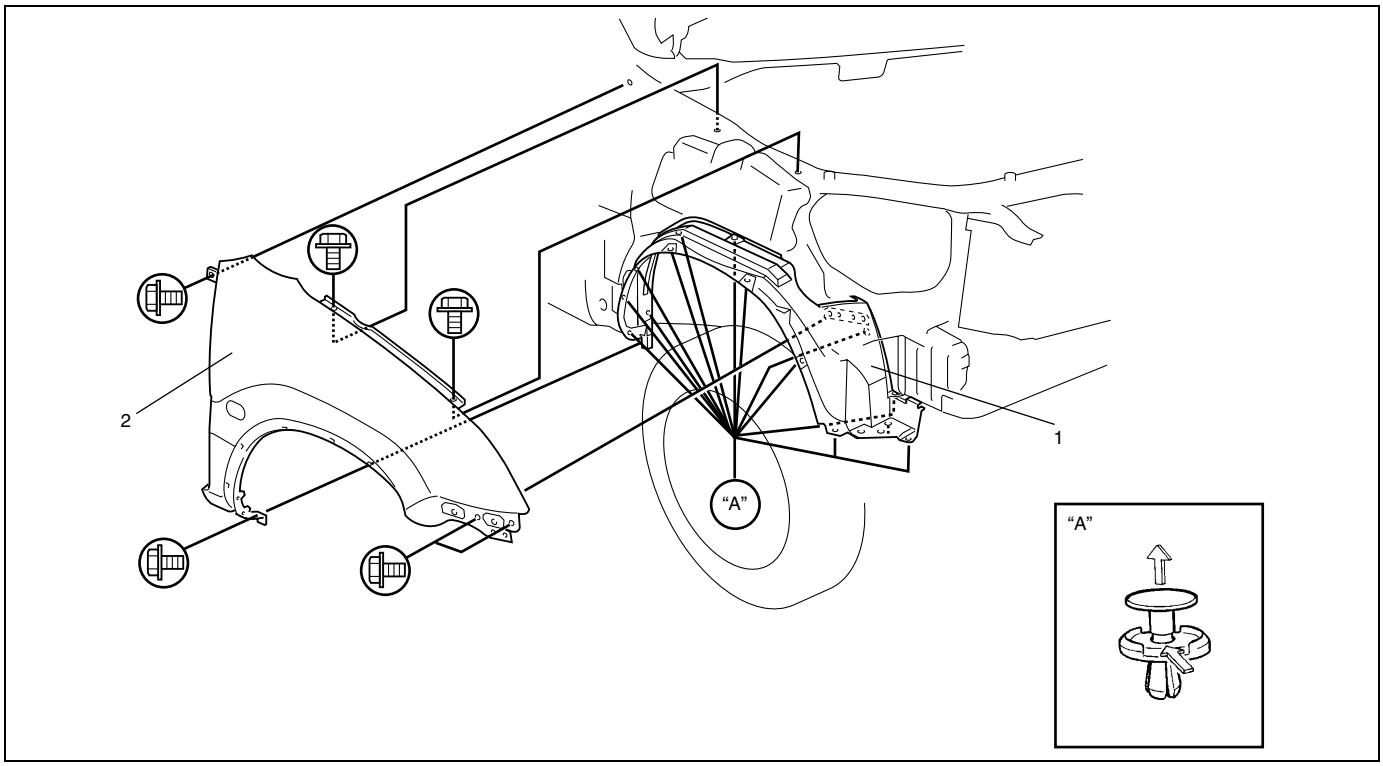
- Hood lock position adjustment
  When installing hood lock (1), bring bolt at highest position and move it in vertical direction for adjustment free from loose to hood striker.

Tightening torque
Hood latch bolts (a): 10 N·m (1.0 kg-m)

Hood Inspection

Check that hood opens and closes smoothly and properly. Lubricate if necessary. Also check that secondary latch operates properly (check that secondary latch keeps hood from opening all the way) and hood locks securely when closed.
Adjust hood locks position if necessary.

Front Fender Removal and Installation



1. Front fender lining	2. Front fender

REMOVAL

1) Remove front bumper.
2) Remove headlight assembly. Refer to "WARNING" in Section 8.
3) Disconnect side turn signal lamp connector.
4) Remove front fender lining.
5) Remove front fender.

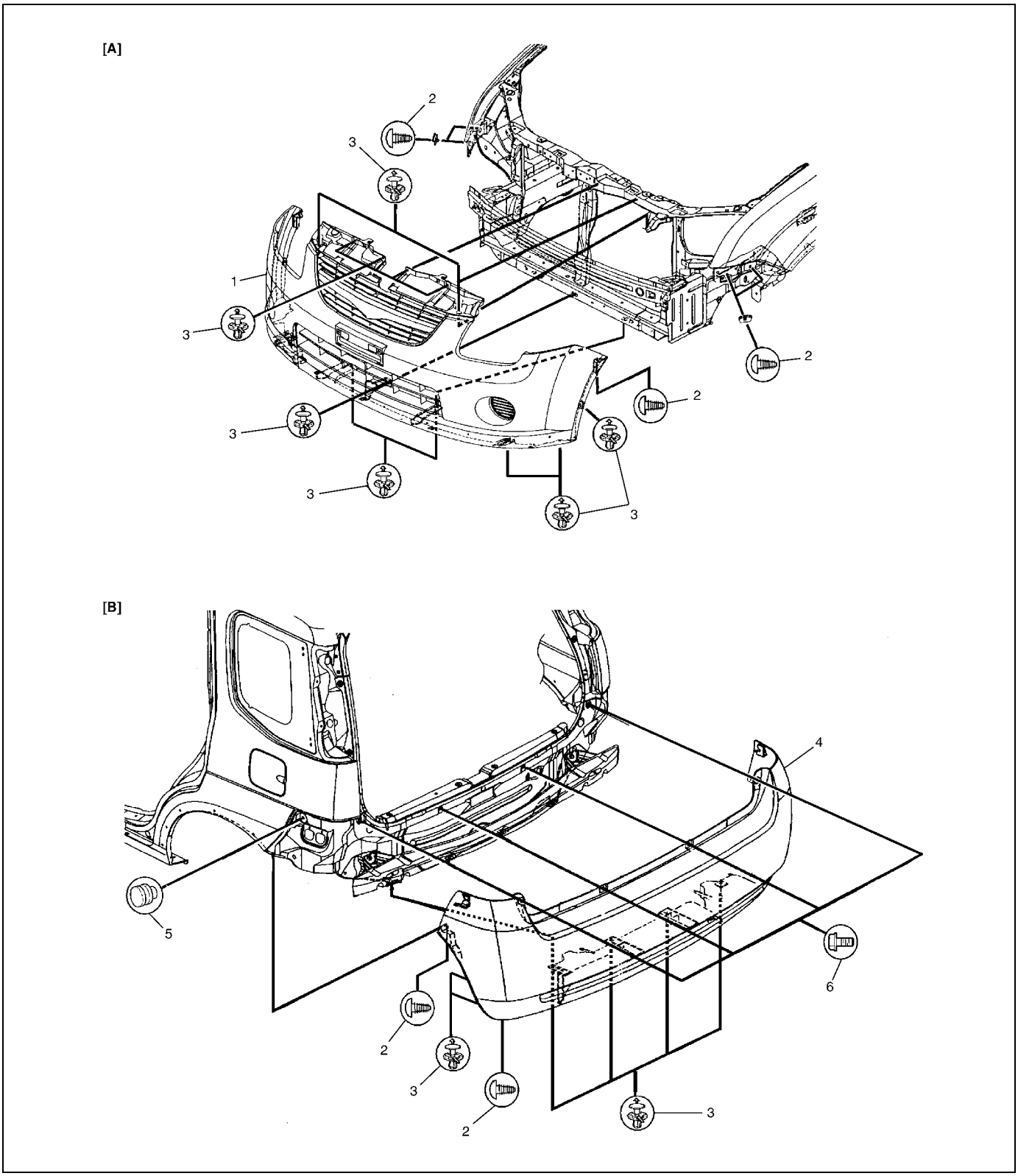
INSTALLATION

Reverse removal procedure to install front fender noting the following instructions.

- If paint on fender bolt is peeled off, be sure to apply paint again.
- Adjust panel clearance referring to "Panel Clearance" in this section.

Front Bumper and Rear Bumper Removal and Installation

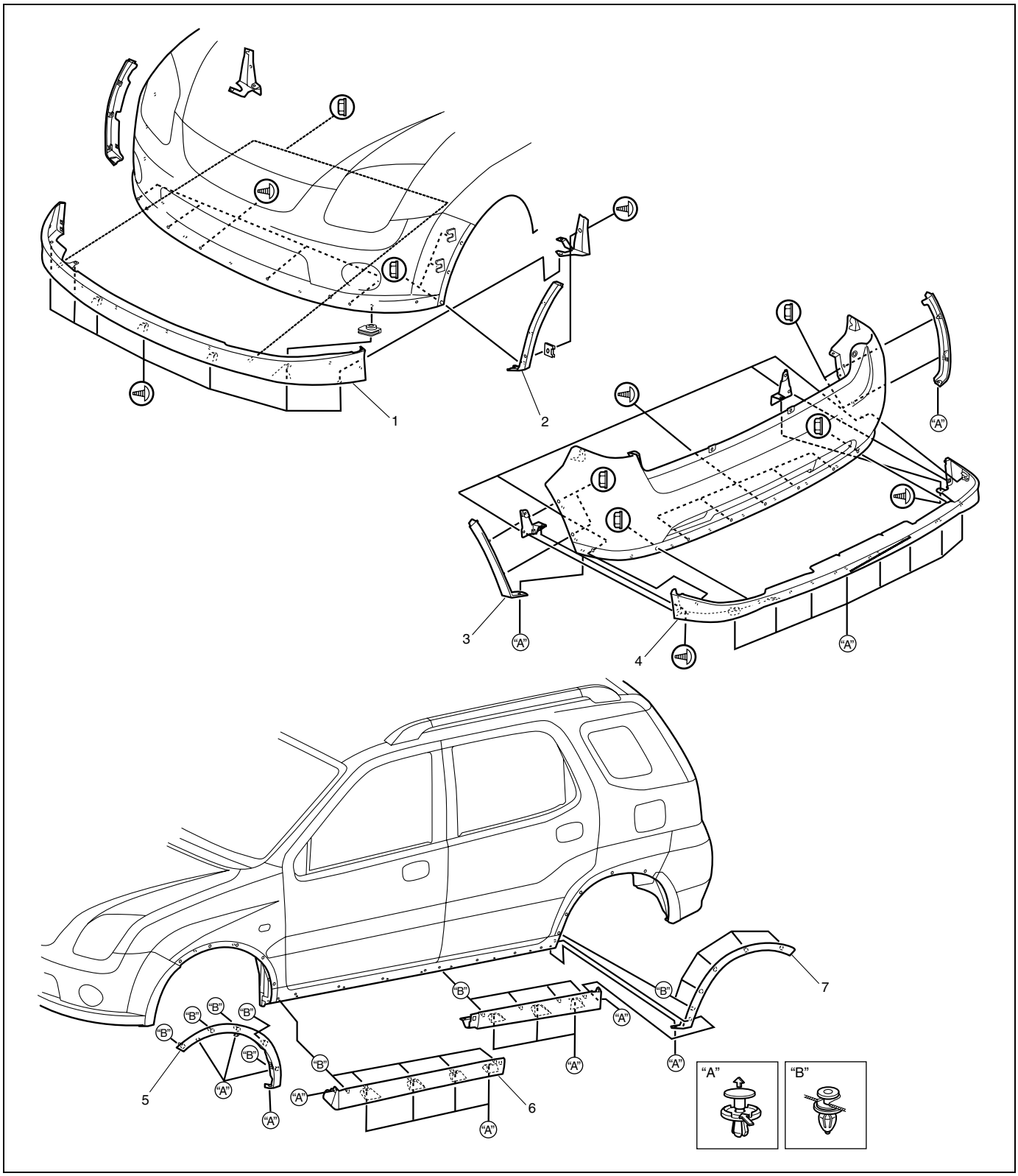
When removing or installing front bumper and rear bumper, refer to the figure.



[A]: Front bumper	1. Front bumper	3. Clip	5. Damper
[B]: Rear bumper	2. Screws	4. Rear bumper	6. Bolt

Bumper Extension and Splash Guard Removal and Installation (If Equipped)

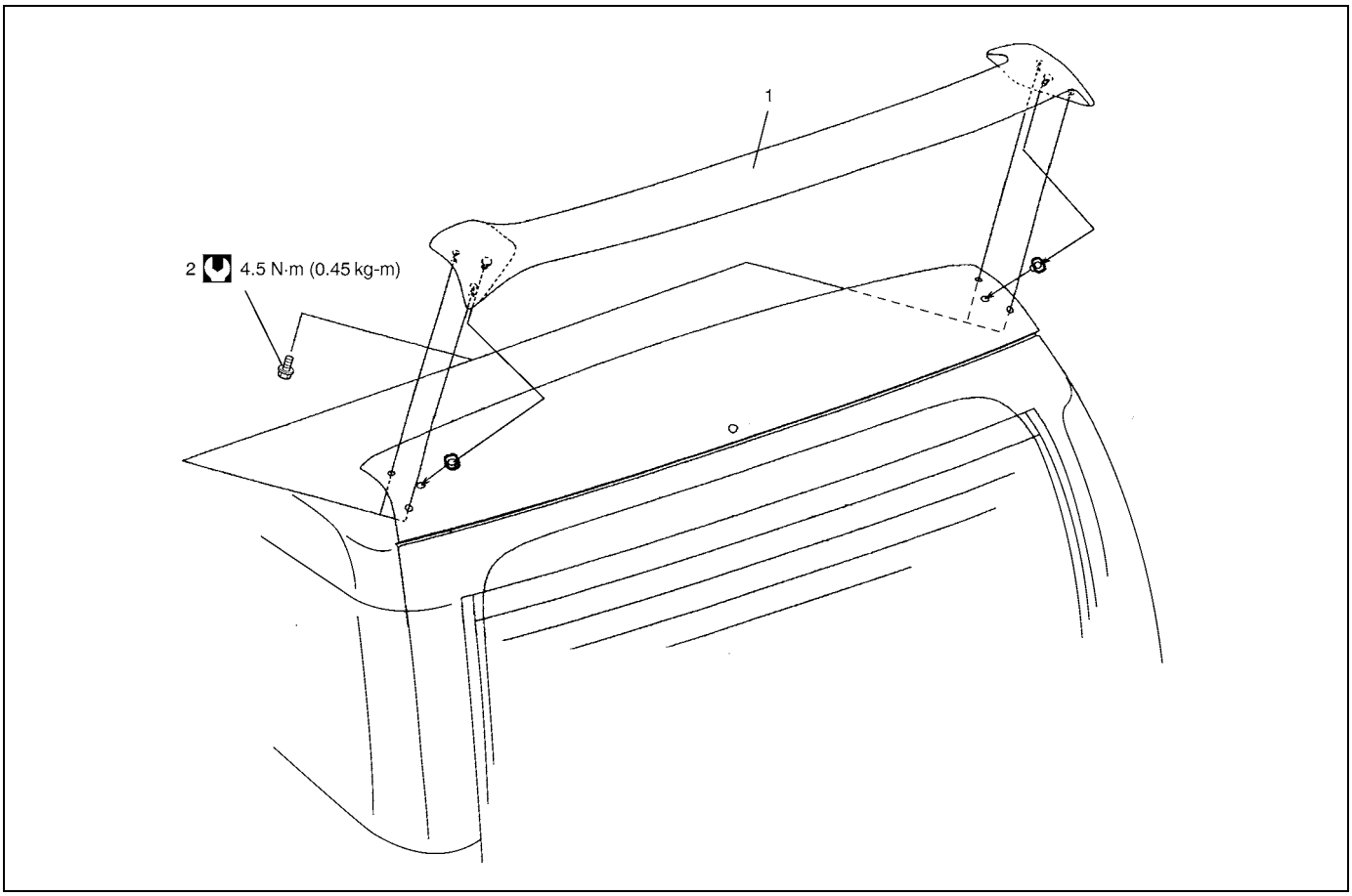
When removing or installing bumper extension and splash guard, refer to the figure.



1. Front bumper extension	3. Rear bumper extension	5. Front fender splash guard	7. Rear fender splash guard
2. Front bumper side extension	4. Rear bumper side extension	6. Side sill splash guard	

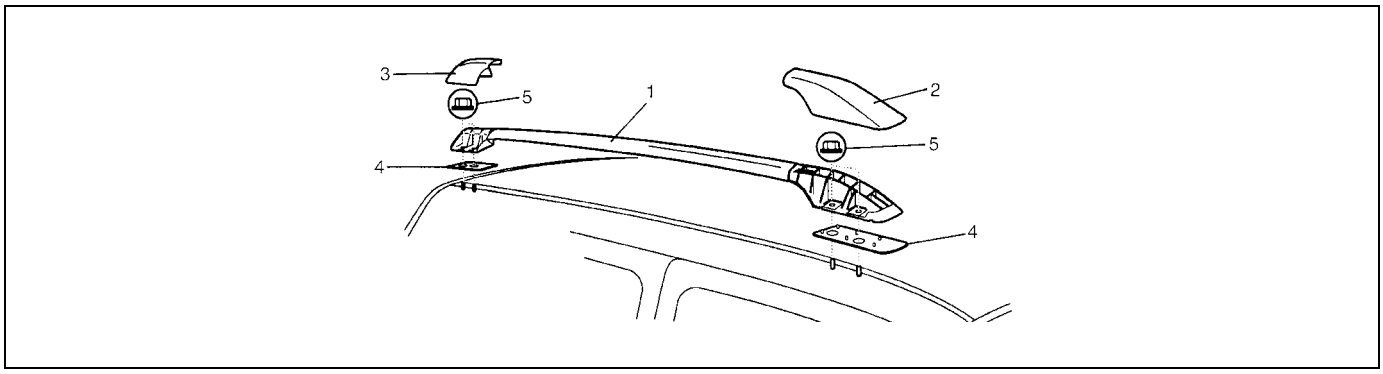
Rearend Door Spoiler Removal and Installation (If Equipped)

When removing or installing rearend door spoiler, refer to the figure.



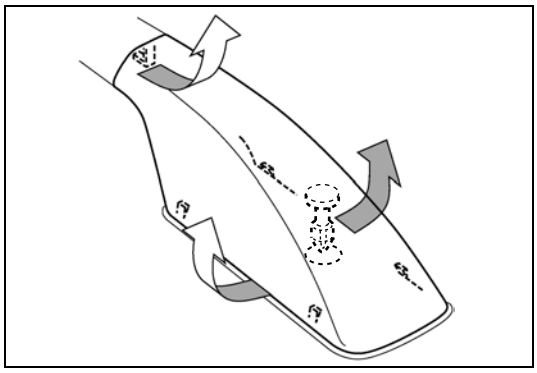
1. Rearend door spoiler	2. Rearend door spoiler mounting bolt	Tightening torque

Roof Rail Removal and Installation (If Equipped)



1. Roof rail	3. Rear cap	5. Nut
2. Front cap	4. Base seal	

REMOVAL



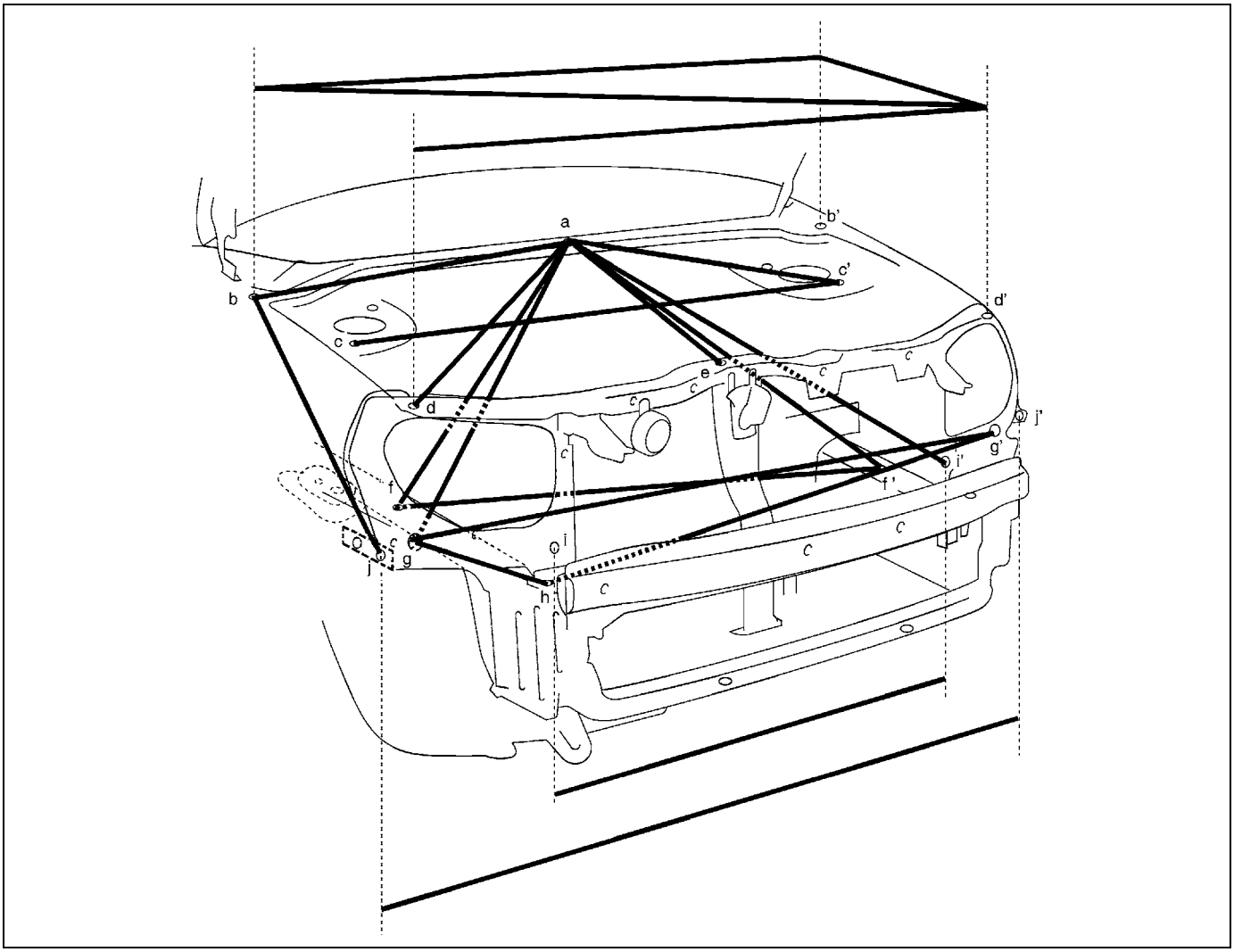
1) Remove roof rail front and rear caps as shown in figure.
2) Remove nuts.
3) Remove roof rail.

INSTALLATION

Reverse removal procedure for installation.
Confirm that each roof rail fixing nut is tightened securely.

Body Dimensions

Engine room

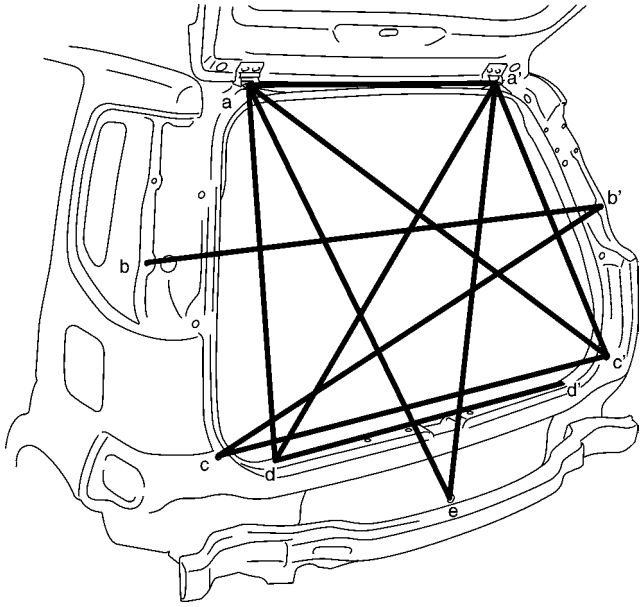


a. Garnish installation center hole (ϕ5)	e. Hood cushion installation hole	i (i'). Head light installation hole
b (b'). Front fender installation hole	f (f'). Engine mounting installation front hole	j (j'). Front fender installation hole
c (c'). Strut installation front hole	g (g'). Jig hole (ϕ15 mm)	
d (d'). Front fender installation hole	h. Bumper member upper side installation hole	

Hole to hole distance

a-b: 673 mm (26.50 in.)	**a-i': 799 mm (31.46 in.)**	**f-f': 952 mm (37.48 in.)**
a-c': 583 mm (22.95 in.)	**b-b': 1340 mm (52.76 in.)**	**g-g': 1315 mm (51.77 in.)**
a-d: 760 mm (29.92 in.)	**b-d': 1393 mm (58.84 in.)**	**g-h: 230 mm (9.06 in.)**
a-e: 599 mm (23.58 in.)	**b-j: 671 mm (26.42 in.)**	**g'-h: 1139 mm (44.84 in.)**
a-f: 774 mm (30.47 in.)	**b'-d': 401 mm (15.79 in.)**	**i-i': 922 mm (36.30 in.)**
a-f': 802 mm (31.57 in.)	**c-c': 1098 mm (43.23 in.)**	**j-j': 1343 mm (52.87 in.)**
a-g: 890 mm (35.04 in.)	**d-d': 1328 mm (52.28 in.)**	

Rearend door

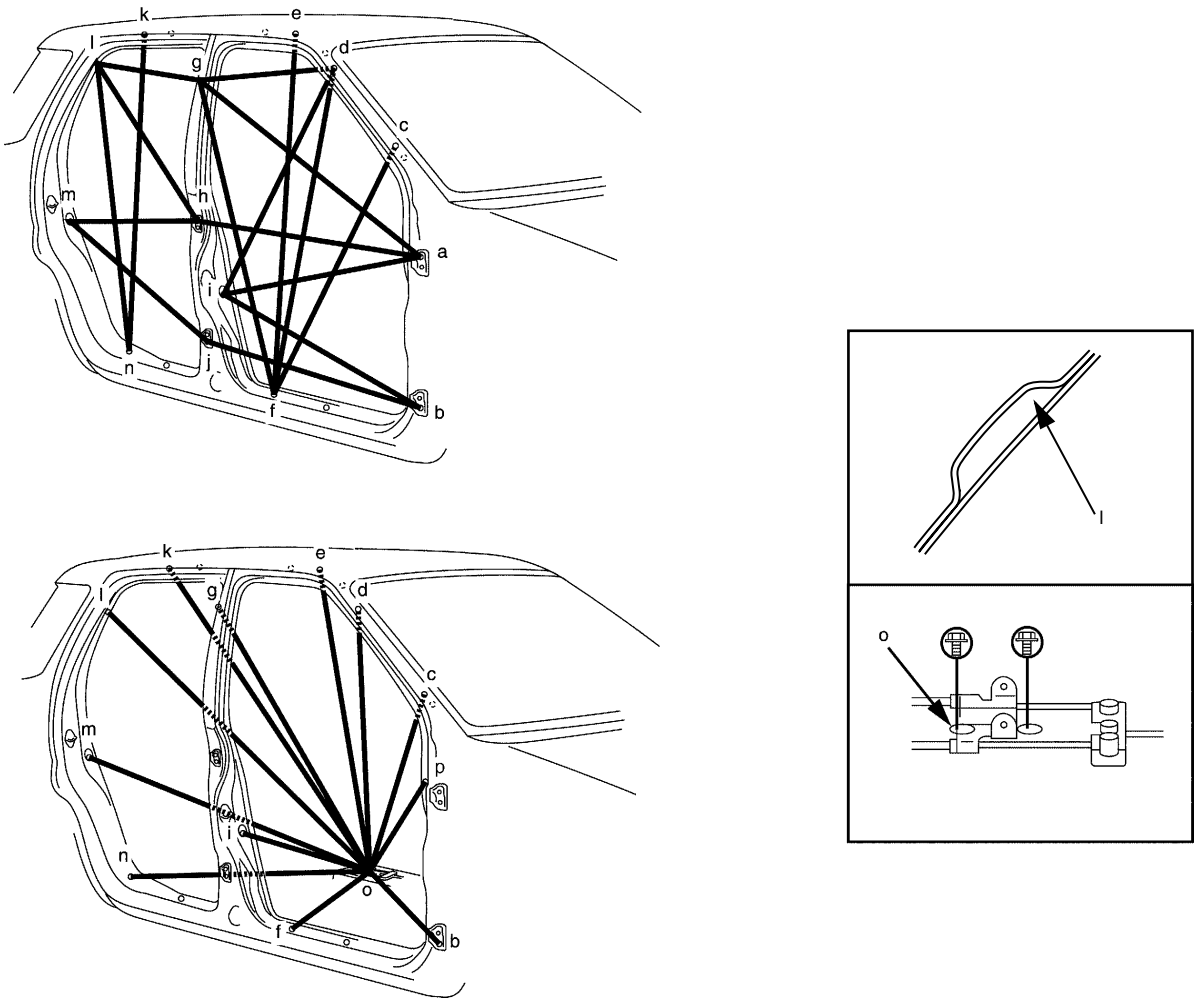


a (a'). Rearend door hinge installation hole	d (d'). Tail end member trim installation hole
b (b'). Rear combination lamp installation hole	e. Center jig hole (OVAL)
c (c'). Rear bumper installation hole	

Hole to hole distance

a-a': 725 mm (28.54 in.)	**a'-c': 794 mm (31.26 in.)**	**b'-c: 1340 mm (52.76 in.)**
a-c': 1230 mm (48.43 in.)	**a'-d: 1130 mm (44.49 in.)**	**c-c': 1215 mm (47.83 in.)**
a-d: 799 mm (31.46 in.)	**a'-e: 1119 mm (44.06 in.)**	**d-d': 875 mm (34.45 in.)**
a-e: 1119 mm (44.06 in.)	**b-b': 1340 mm (52.76 in.)**	

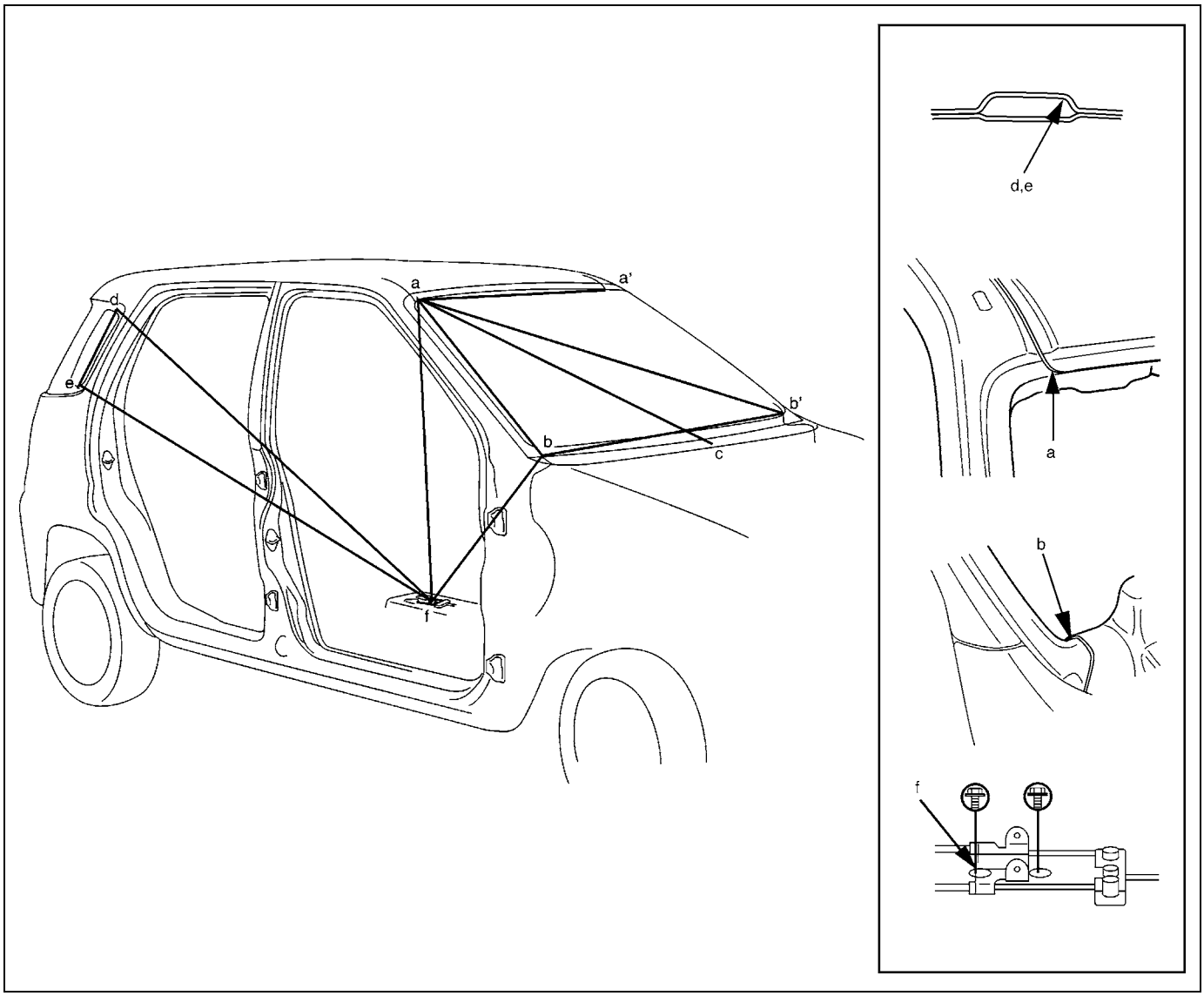
Side body



a. Front door upper hinge installation hole	g. Front shoulder adjuster installation upper hole	m. Rear door switch installation hole
b. Front door lower hinge installation hole	h. Rear door upper hinge installation hole	n. Side soil scuff installation rear hole
c. Front pillar inner trim installation lower hole	i. Front door switch installation hole	o. Parking brake cable bracket installation rear hole
d. Front pillar inner trim installation upper hole	j. Rear door lower hinge installation hole	p. Steering support member installation upper hole
e. Assistant grip installation front hole	k. Assistant grip installation hole	
f. Side sill scuff installation rear hole	l. Rear door rear notch	

Hole to hole distance

a-g:	**1155 mm (45.47 in.)**	**d-i:**	**819 mm (32.24 in.)**	**i-o:**	**742 mm (29.21 in.)**
a-h:	**942 mm (37.09 in.)**	**d-o:**	**1250 mm (49.21 in.)**	**j-m:**	**895 mm (35.24 in.)**
a-i:	**901 mm (35.47 in.)**	**e- f:**	**1061 mm (41.77 in.)**	**k-n:**	**1074 mm (42.28 in.)**
b-i:	**891 mm (35.08 in.)**	**e-o:**	**1232 mm (48.50 in.)**	**k-o:**	**1321 mm (52.01 in.)**
b-j:	**902 mm (35.51 in.)**	**f-g:**	**1084 mm (42.68 in.)**	**l-n:**	**953 mm (89.30 in.)**
b-o:	**1223 mm (48.15 in.)**	**f-o**	**785 mm (30.91 in.)**	**l-o:**	**1326 mm (52.20 in.)**
c-f:	**883 mm (34.76 in.)**	**g-l:**	**669 mm (26.34 in.)**	**m-o:**	**1112 mm (43.78 in.)**
c-o:	**1281 mm (50.43 in.)**	**g-o:**	**1177 mm (46.34 in.)**	**n-o:**	**813 mm (32.00 in.)**
d-f:	**992 mm (39.06 in.)**	**h-l:**	**850 mm (79.65 in.)**	**o-p:**	**1255 mm (49.41 in.)**
d-g:	**539 mm (21.22 in.)**	**h-m:**	**813 mm (32.01 in.)**		

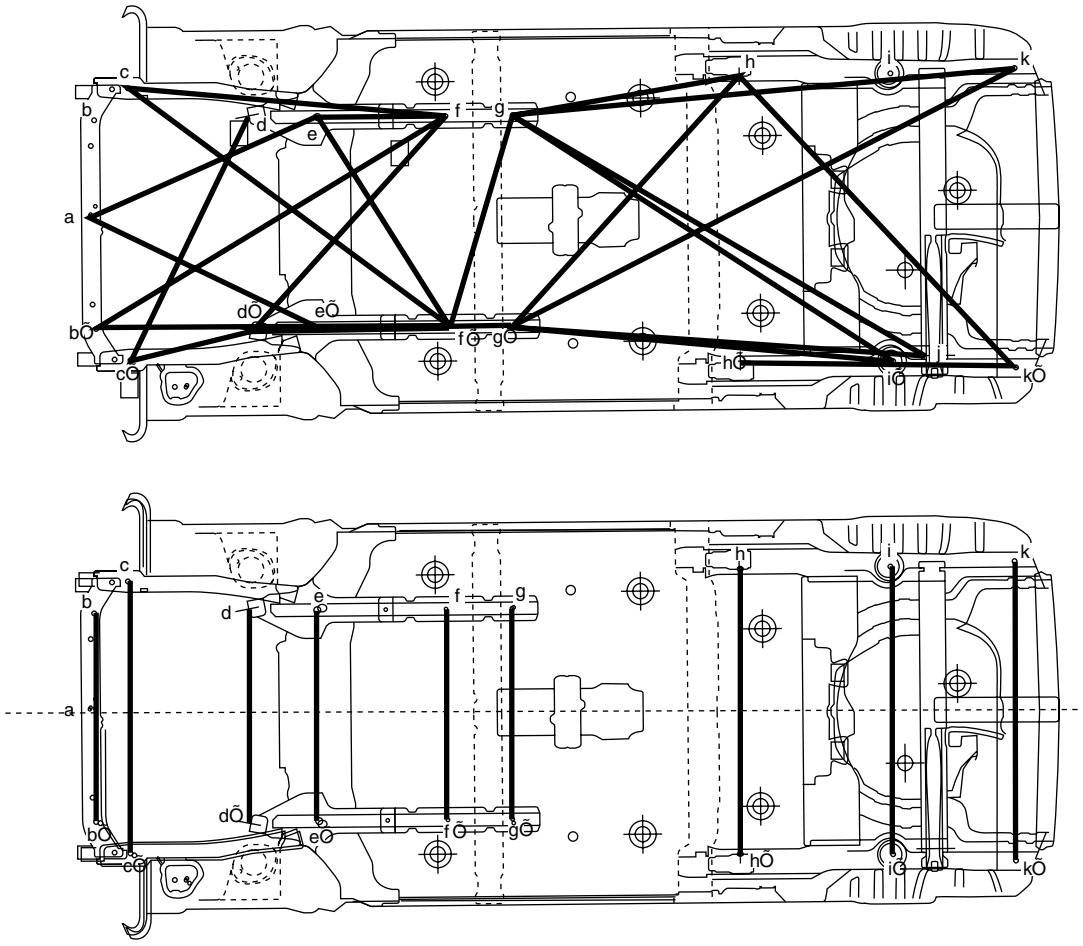


a (a'). Front end of front windshield upper installation section	d. Quarter window upper side notch
b (b'). Front end of front windshield lower installation section	e. Quarter window lower side notch
c. Garnish installation center hole (ϕ5 mm)	f. Parking brake cable bracket installation rear hole

Hole to hole distance

a-a': 1043 mm (41.06 in.)	**a-f: 1281 mm (50.43 in.)**	**d-f: 1496 mm (58.90 in.)**
a-b: 687 mm (27.05 in.)	**b-b': 1337 mm (52.64 in.)**	**e-f: 1452 mm (57.17 in.)**
a-b': 1366 mm (53.78 in.)	**b-f: 1412 mm (55.59 in)**	
a-c: 1032 mm (40.63 in)	**d-e: 302 mm (11.89 in)**	

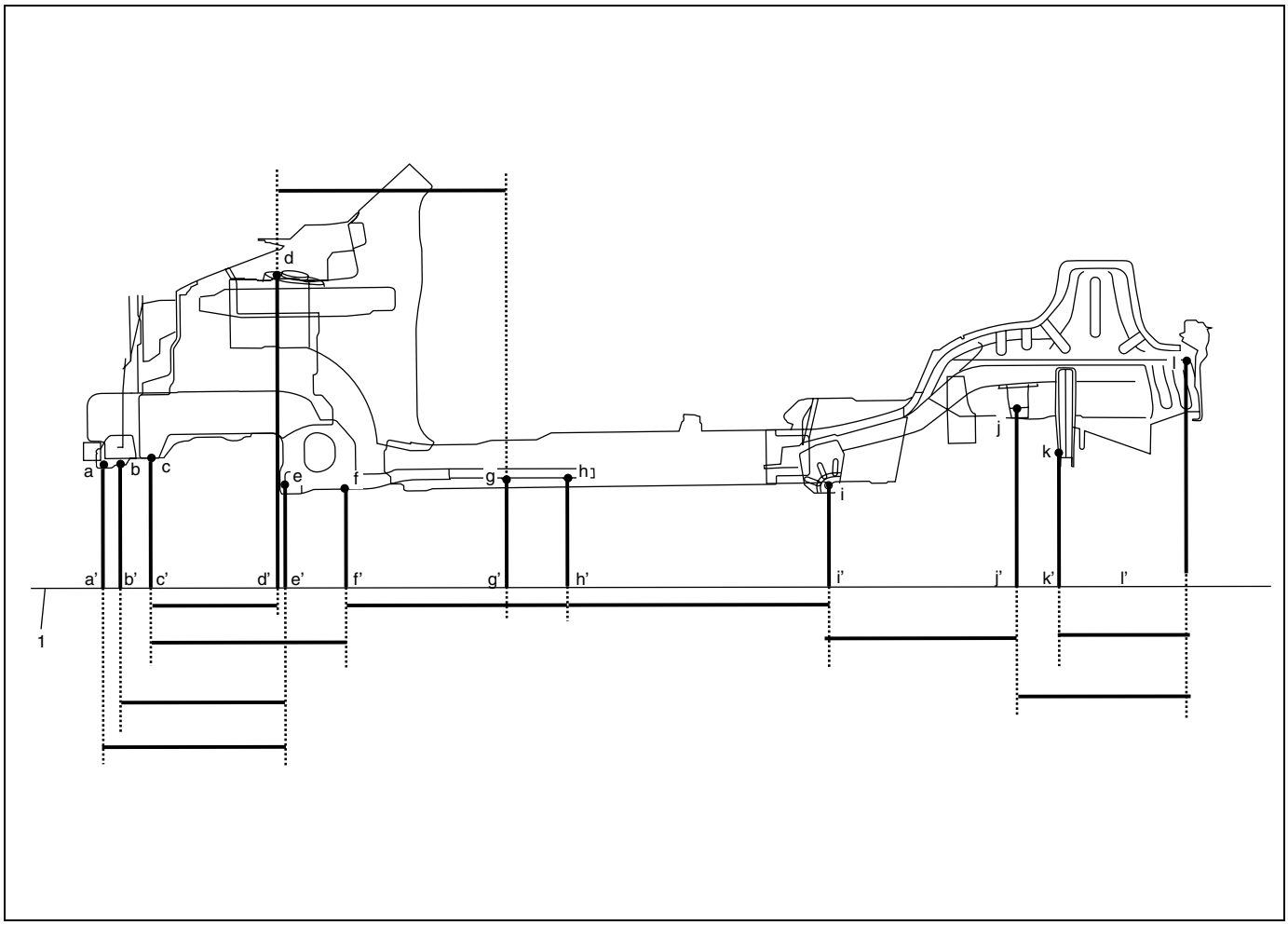
Under body



a. Jack bracket installation hole	g (g'). Jig hole (ϕ10 mm)
b (b'). Front stabilizer bracket front installation hole	h (h'). Trailing arm installation hole
c (c'). Front stabilizer bracket rear installation hole	i (i'). Bump stopper installation hole
d (d'). Suspension control arm installation hole	j. Lateral rod installation hole
e (e'). Jig hole (ϕ15 mm)	k (k'). Jig hole (ϕ16 mm)
f (f'). Jig hole (ϕ10 mm)	

Hole to hole distance

a-e: 862 mm (33.94 in.)	**d'-f': 710 mm (27.95 in.)**	**g-k: 1718 mm (67.64 in.)**
a-e': 909 mm (35.79 in.)	**e-e': 754 mm (29.68 in.)**	**g'-h: 1202 mm (47.32 in.)**
b-b': 740 mm (29.13 in.)	**e-f: 471 mm (18.54 in.)**	**g'-i': 1384 mm (54.45 in.)**
b-f: 1464 mm (57.64 in.)	**e-f': 889 mm (35.00 in.)**	**g'-j: 1496 mm (58.90 in.)**
b-f': 1259 mm (49.57 in.)	**f-f': 754 mm (29.68 in.)**	**g'-k: 1940 mm (76.38 in.)**
c-c': 968 mm (38.11 in.)	**f'-g: 791 mm (31.14 in.)**	**h-h': 1013 mm (39.88 in.)**
c-f: 1148 mm (45.20 in.)	**f'-g': 240 mm (9.45 in.)**	**h-k': 1387 mm (54.61 in.)**
c-f': 1431 mm (56.34 in.)	**g-g': 754 mm (29.68 in.)**	**h'-k': 913 mm (35.94 in.)**
c'-d: 969 mm (38.15 in.)	**g-h: 826 mm (32.52 in.)**	**i-i': 1028 mm (40.47 in.)**
c'-d': 451 mm (17.76 in.)	**g-i': 1641 mm (64.61 in.)**	**k-k': 1076 mm (42.36 in.)**
d-d': 760 mm (29.92 in.)		

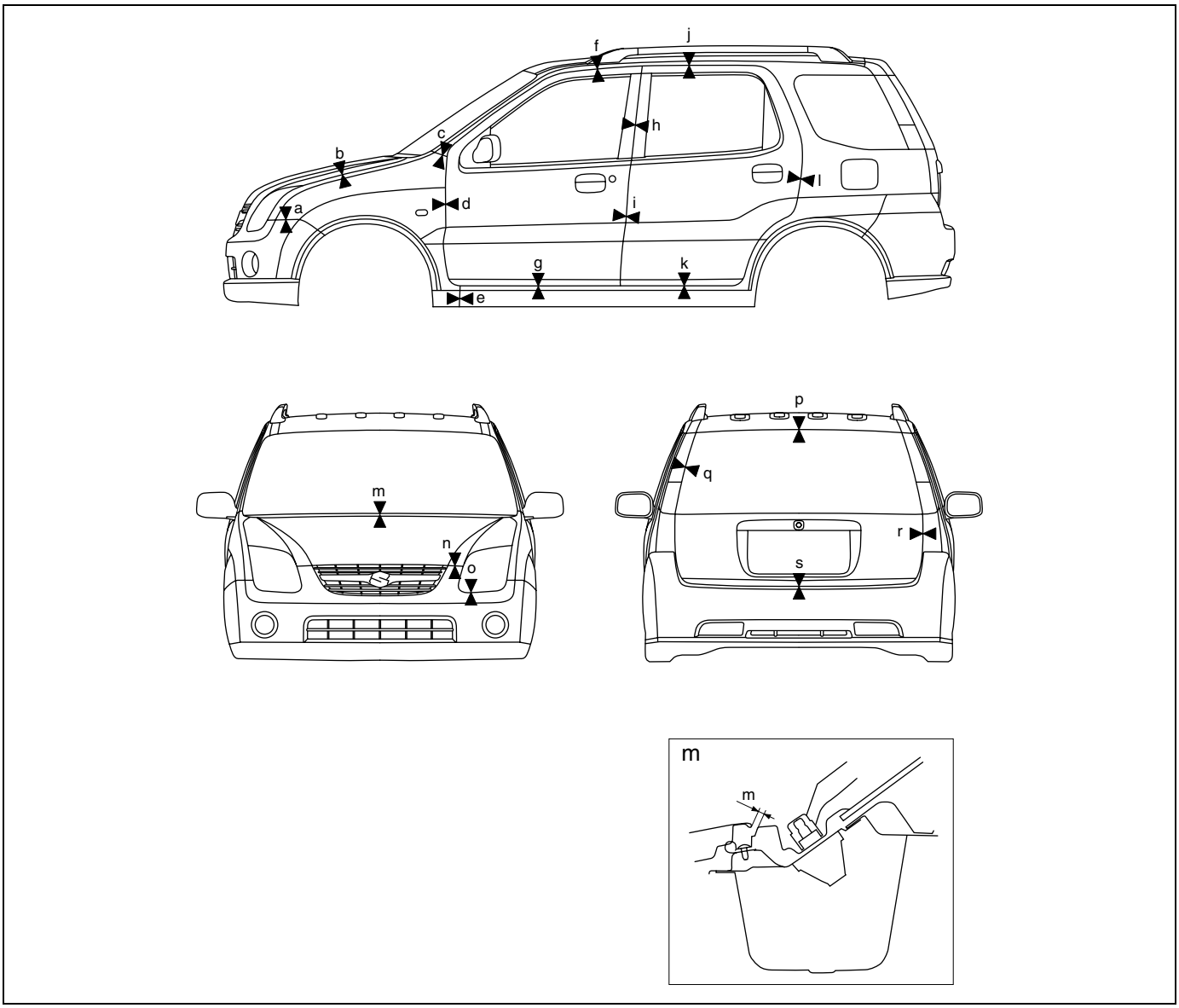


1. Virtual baseline	g. Jig hole (ϕ14 mm)
a. Jack bracket installation hole	h. Jig hole (ϕ14 mm)
b. Front stabilizer bracket front installation hole	i. Trailing arm installation hole
c. Front stabilizer bracket rear installation hole	j. Bump stopper installation hole
d. Strut installation front hole	k. Lateral rod installation hole
e. Suspension control arm installation front hole	l. Jig hole (ϕ16 mm)
f. Jig hole (ϕ15 mm)	

Point to point distance

a-a': 131 mm (5.16 in.)	**e-e': 77 mm (3.03 in.)**	**i-i': 100 mm (3.94 in.)**
a-e': 556 mm (21.89 in.)	**e'-f': 240 mm (9.45 in.)**	**i'-j': 546 mm (21.50 in.)**
b-b': 131 mm (5.16 in.)	**f-f': 53 mm (2.07 in.)**	**j-j': 292 mm (11.50 in.)**
b'-e': 548 mm (21.57 in.)	**f'-g': 470 mm (18.50 in.)**	**j'-l': 324 mm (12.76 in.)**
c-c': 161 mm (6.34 in.)	**g-g': 79 mm (3.11 in.)**	**k-k': 139 mm (5.47 in.)**
c'-d': 391 mm (15.39 in.)	**g'-h': 240 mm (9.45 in.)**	**k'-l': 194 mm (7.64 in.)**
c'-e': 430 mm (16.93 in.)	**h-h': 79 mm (3.11 in.)**	**l-l' 374 mm (14.74 in.)**
d-d': 650 mm (25.59 in.)	**h'-i' 815 mm (32.09 in.)**	
d'-g': 749 mm (29.49 in.)		

Panel Clearance



Panel to panel distance

a: 1.0 – 3.0 mm (0.039 – 0.138 in.)	**h: 3.7 – 5.7 mm (0.146 – 0.224 in.)**	**o: 3.5 – 5.5 mm (0.138 – 0.217 in.)**
b: 2.5 – 4.5 mm (0.098 – 0.177 in.)	**i: 4.2 – 6.2 mm (0.165 – 0.244 in.)**	**p: 7.9 – 9.4 mm (0.311 – 0.370 in.)**
c: 1.6 – 3.6 mm (0.063 – 0.142 in.)	**j: 5.0 – 7.0 mm (0.197 – 0.276 in.)**	**q: 5.0 – 7.0 mm (0.197 – 0.276 in.)**
d: 4.2 – 6.2 mm (0.165 – 0.244 in.)	**k: 4.8 – 6.8 mm (0.189 – 0.268 in.)**	**r: 3.7 – 5.7 mm (0.146 – 0.244 in.)**
e: 1.7 – 3.7 mm (0.067 – 0.146 in.)	**l: 3.7 – 5.7 mm (0.146 – 0.224 in.)**	**s: 5.3 – 7.3 mm (0.209 – 0.287 in.)**
f: 4.8 – 6.8 mm (0.189 – 0.268 in.)	**m: 4.8 – 6.8 mm (0.189 – 0.268 in.)**	
g: 4.8 – 6.8 mm (0.189 – 0.268 in.)	**n: 7.8 – 9.8 mm (0.307 – 0.386 in.)**	

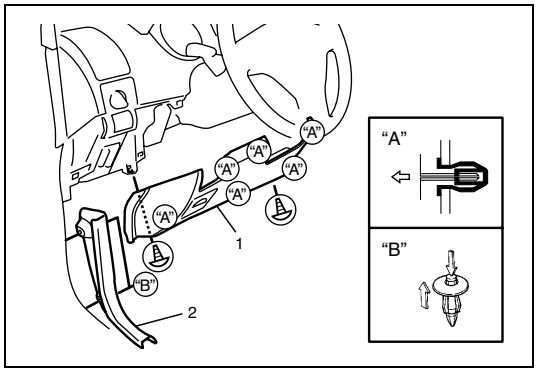
Instrumentation and Driver Information

Instrument Panel Removal and Installation

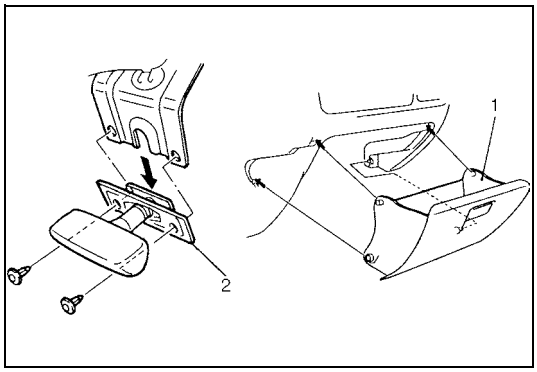
WARNING:
See WARNING at the beginning of this section.

REMOVAL

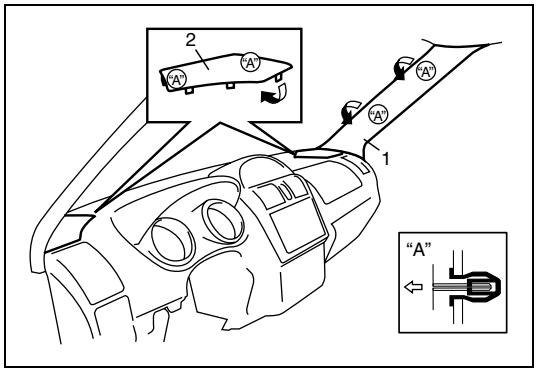
1) Disconnect negative cable at battery.
2) Disable air bag system, if equipped. Refer to “Disabling air bag system” in Section 10B.



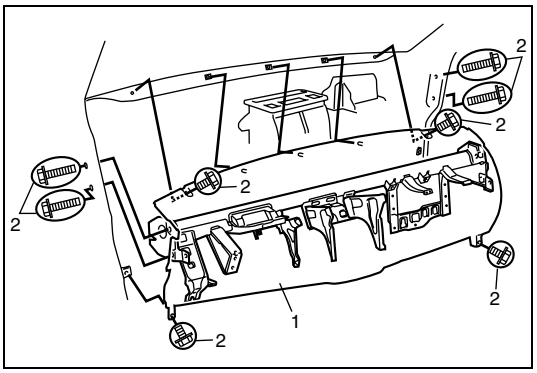
3) Remove steering column hole cover (1).
4) Remove dash side trims (2).
5) Remove steering column assembly referring to “Steering Column Removal and Installation” in Section 3C.



6) Remove glove box (1).
7) Remove hood latch release lever (2).
8) Disconnect instrument panel harness connectors, antenna and heater control cables which need to be disconnected for removal for instrument panel.
9) Remove instrument panel ground wire.



10) Remove front pillar trims (1).
11) Remove speaker covers (2).



12) Remove instrument panel mounting bolts (2).
13) Remove instrument panel (1) with steering support member and instrument panel harness.

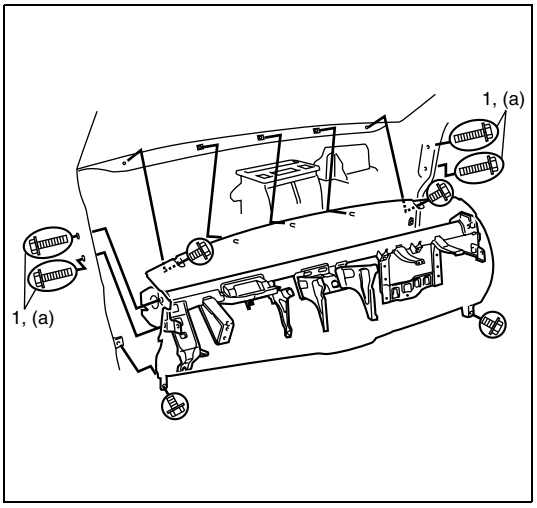
INSTALLATION

Reverse removal procedure to install instrument panel noting the following instructions.

- When installing each part, be careful not to catch any cable or wiring harness.
- Tighten instrument panel mounting bolts (1) to specified torque.

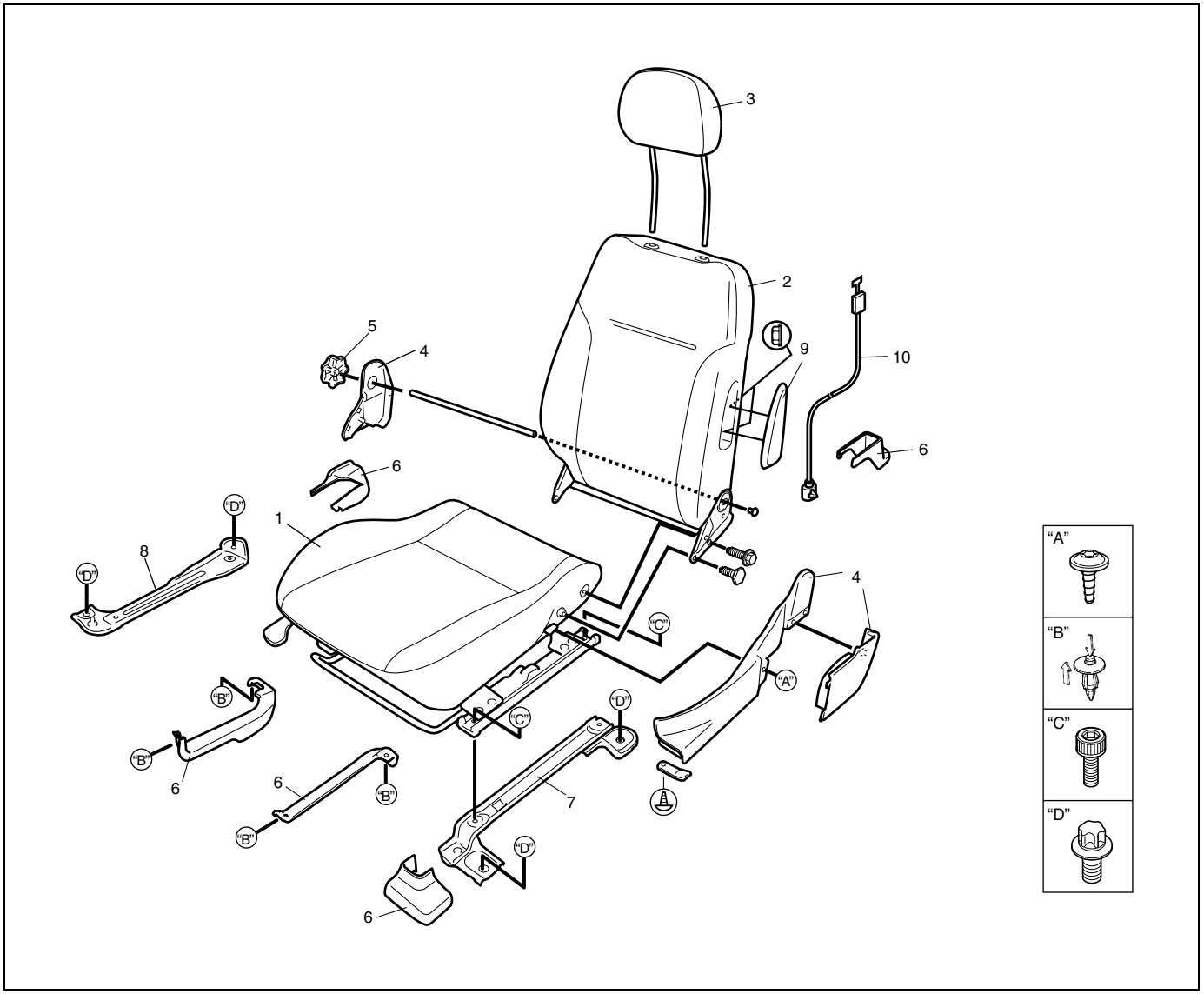
Tightening torque
Instrument panel mounting bolts
(a): 23 N·m (2.3 kg-m)

- When installing steering column assembly. Refer to “Steering Column Removal and Installation” in Section 3C.
- Adjust heater control cables. Refer to “Heater Unit Removal and Installation” in Section 1A.
- Enable air bag system if equipped. Refer to “Enabling air bag system” in Section 10B.



Seats

Front Seat Removal and Installation



1. Seat cushion assembly	4. Cover	7. Seat adjuster left bracket	10. Side air bag harness (if equipped)
2. Seat back	5. Knob	8. Seat adjuster light bracket	Tightening torque
3. Headrest	6. Cover	9. Side air bag module (if equipped)	

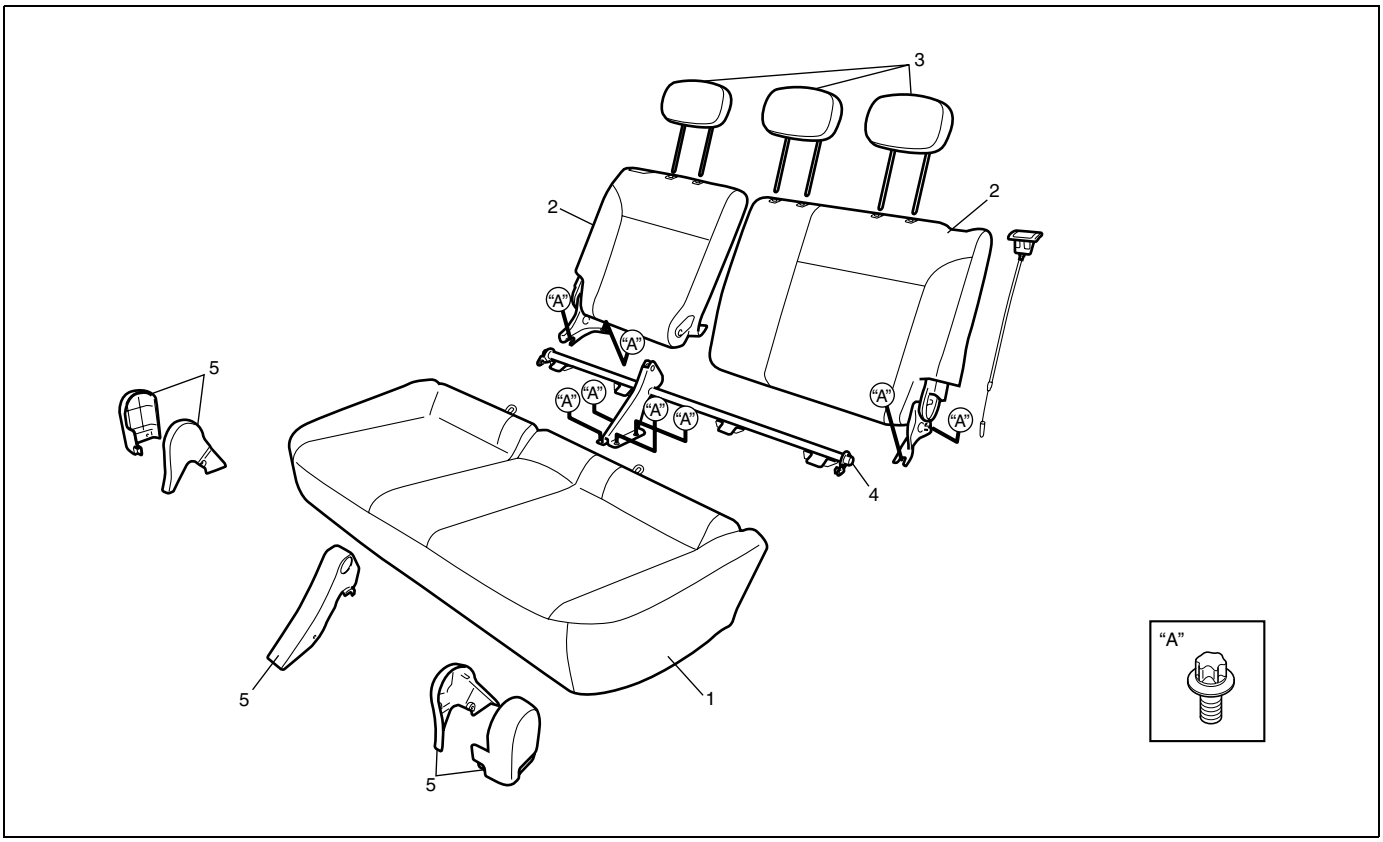
REMOVAL

1) Remove console box.
2) Disable air bag system referring to “Disabling air bag system” in Section 10B.
3) Disconnect heat seater coupler and side air bag coupler, if equipped.
4) Remove 4 mounting bolts to remove seat assembly.
5) Disassemble and repair seat as necessary.

INSTALLATION

Reverse removal procedure to install front seat.
Torque to specifications as shown in above figure.

Rear Seat Removal and Installation



1. Seat cushion	3. Headrest	5. Cover
2. Seat back	4. Rear seat back bracket	Tightening torquer

REMOVAL

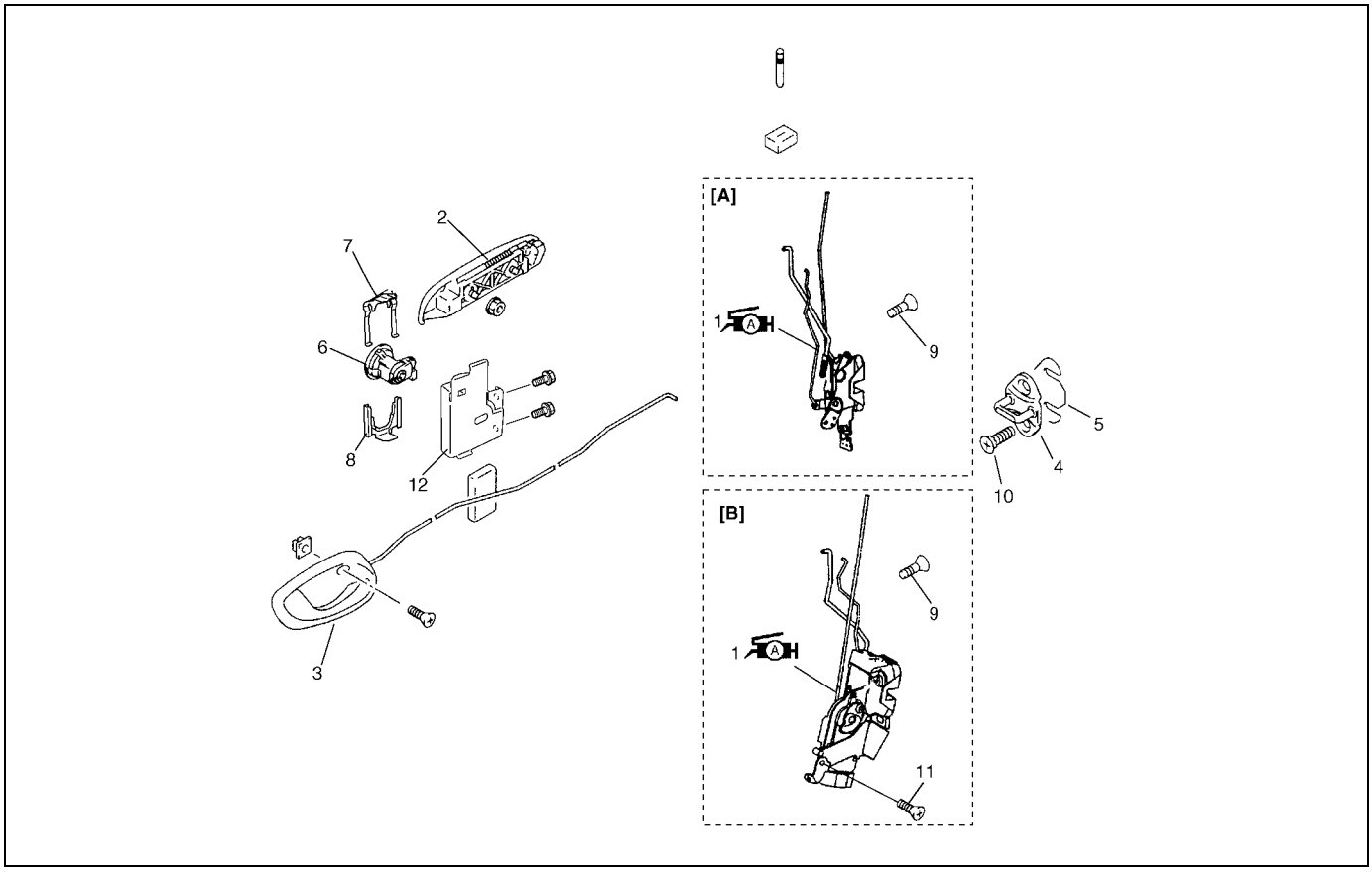
1) Remove seat cushion.
2) Remove 3 seat back bolts to remove seat back.
3) Disassemble and repair seat as necessary.

INSTALLATION

Reverse removal procedure to install rear seat.
Torque to specifications as shown in above figure.

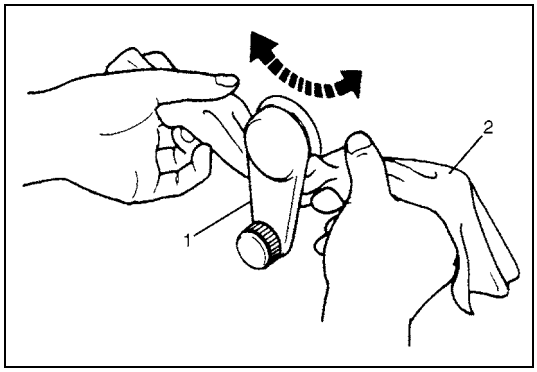
Security and Locks

Front Door Lock Assembly Removal and Installation

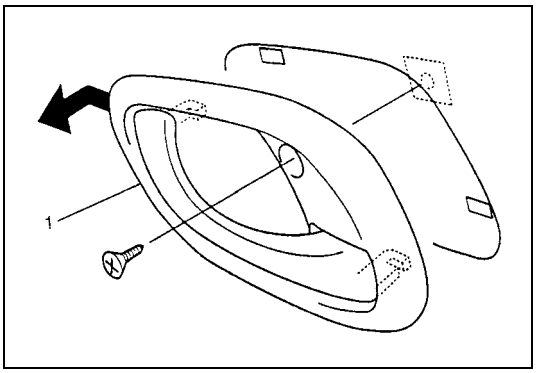


[A]: Without power door lock	4. Latch striker	9. Door latch screw
[B]: With power door lock	5. Shim	10. Door latch striker screw
1. Front door latch assembly : Apply lithium grease 99000-25010 to sliding part	6. Key cylinder	11. Door latch actuator screw
2. Outside handle	7. Key cylinder upper retainer	12. Key cylinder protector
3. Inside handle bezel	8. Key cylinder lower retainer	

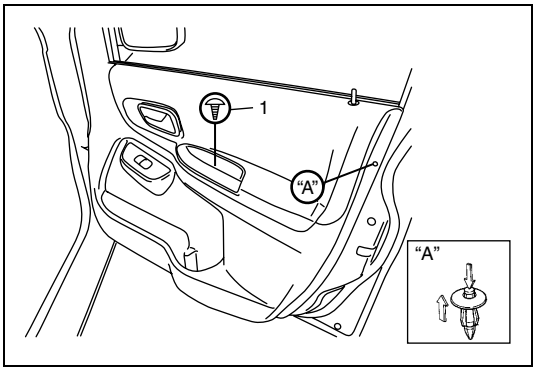
REMOVAL



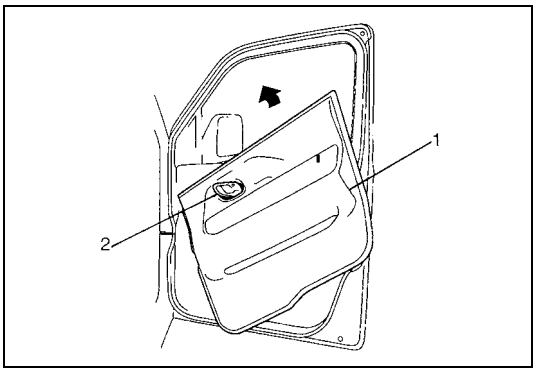
1) Remove window regulator handle (1) (if equipped).
   For its removal, push up snap off by using a cloth (2) as shown in figure.



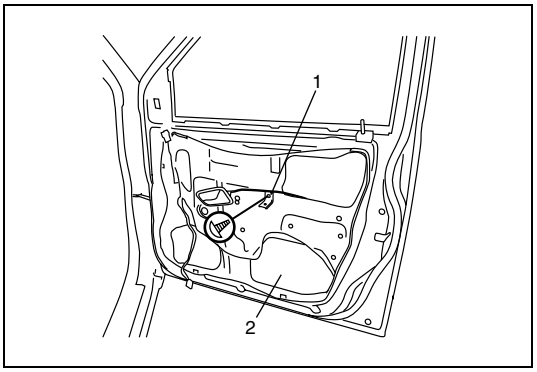
2) Remove inside handle bezel (1).



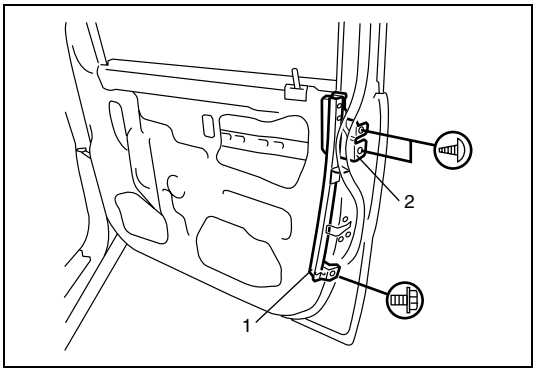
3) Remove mirror inner garnish.
4) Loosen door trim mounting screw (1).



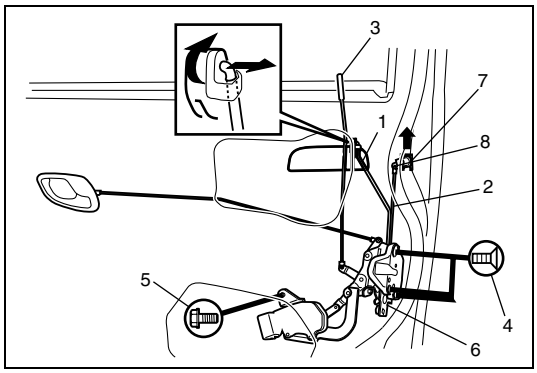
5) Remove door trim (1).
   With inside handle bezel (2) tilted as shown in figure.
6) Disconnect power window switch and mirror switch lead wire at coupler (if equipped).



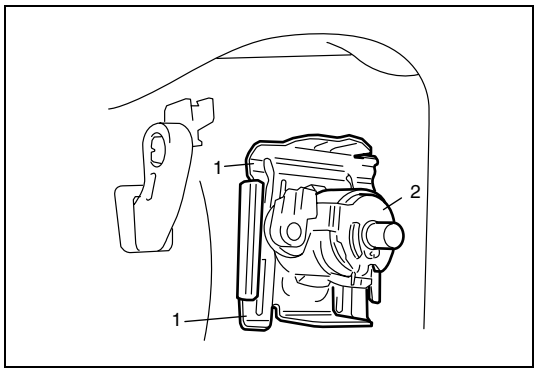
7) Remove door trim bracket (1).
8) Remove door sealing cover (2).
9) Raise window all the way up.



10) Remove door sash (1).
11) Remove key cylinder protector (2).



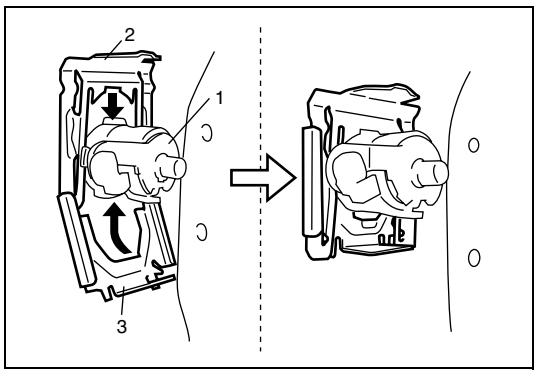
12) Disconnect door opening control rod (1) from outside handle.
13) Disconnect door latch control rod (2).
14) Disconnect door lock motor lead wire at coupler (if equipped).
15) Remove door lock knob (3).
16) Loosen door latch screw (4), door latch actuator bolt (5) (if equipped with power door lock) and remove door lock assembly (6).



17) Remove key cylinder retainers (1).
18) Remove key cylinder (2).

INSTALLATION

Reverse removal procedure to install front door lock assembly noting the following instructions.

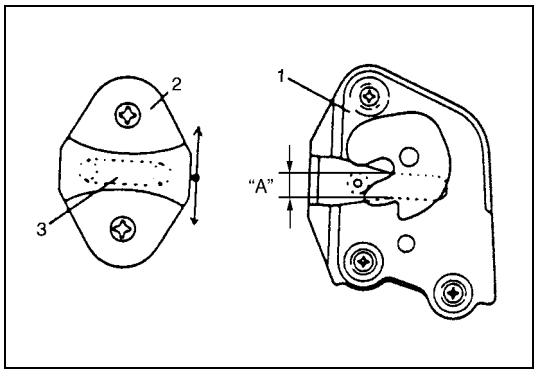


- Install key cylinder as fallows:

a) Install key cylinder (1) to front door panel.
b) Insert key cylinder upper retainer (2).
c) Insert key cylinder lower retainer (3).
d) Insert the retainers all the way until lower retainer tab engages with upper retainer cutout.

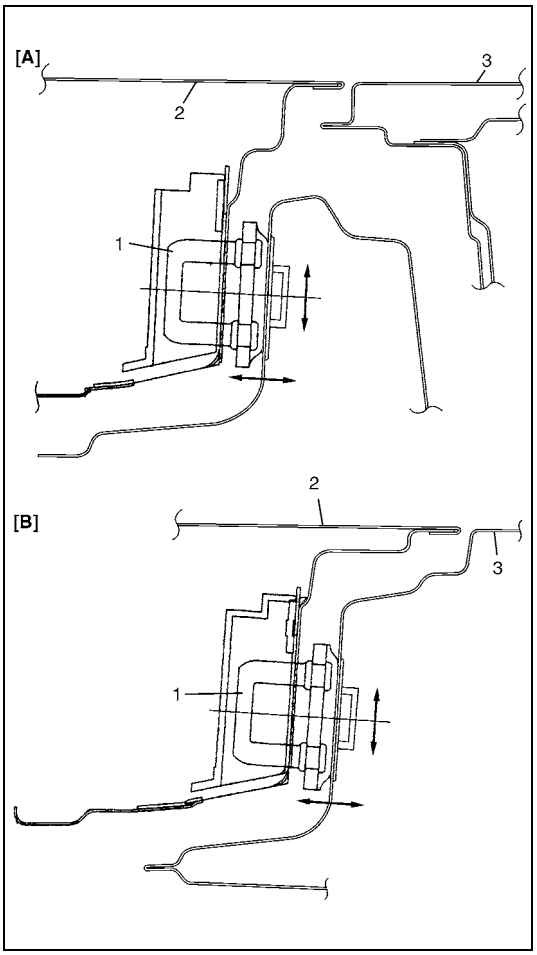
- Apply grease to sliding parts of door latch assembly.

Grease 99000-25010



- Move door latch striker (2) up or down so its center aligns with the center of groove "A" on the door lock assembly (1) as shown.
  Striker should be moved vertically and placed level. Do not adjust door lock.

3. Shaft



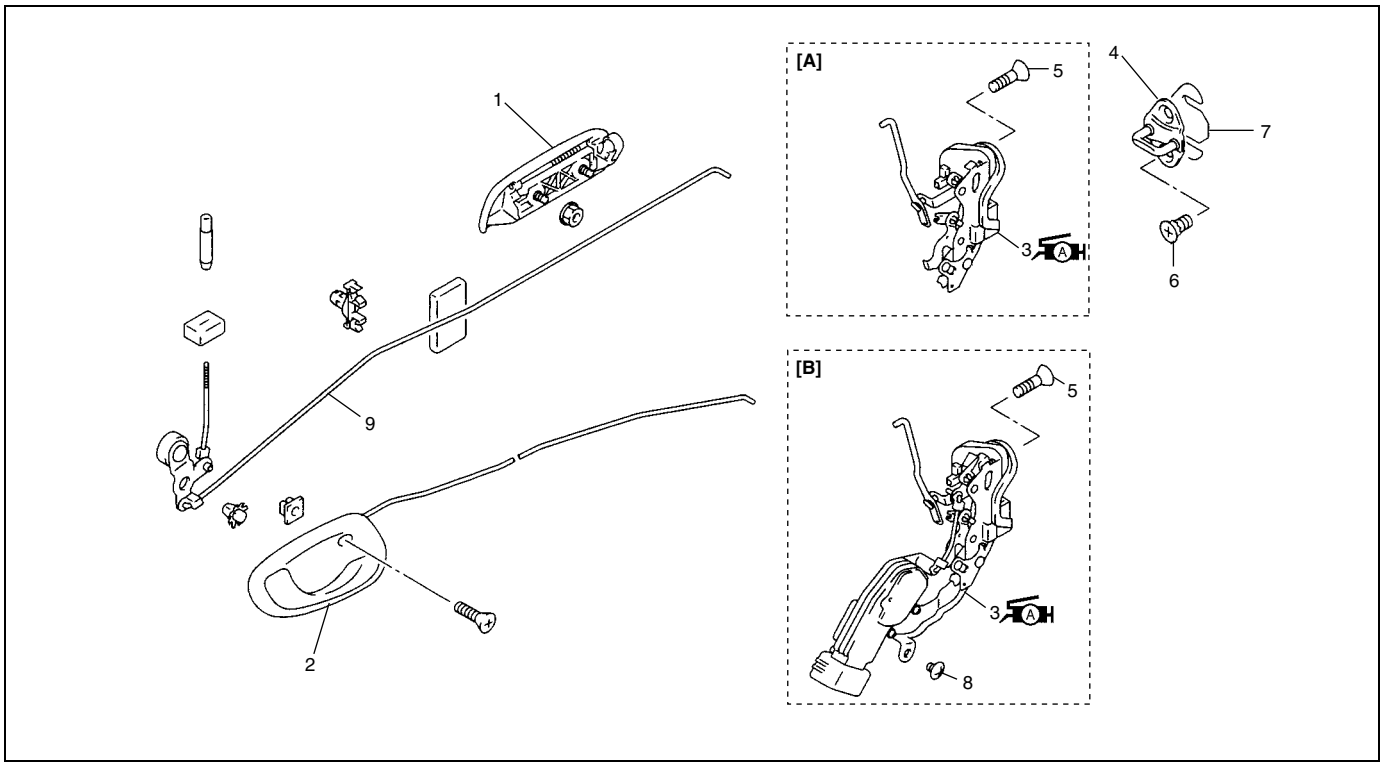
- Move door latch striker (1) sideways to adjust door outer panel surface (2) flush with rear door outer panel or body outer panel surface (3) as shown.
  In order to correctly obtain door lock operates, increase or decrease number of shims inserted between body and striker (1) to adjust it.

[A]: Front door
[B]: Rear door

Front Door Lock Assembly Inspection

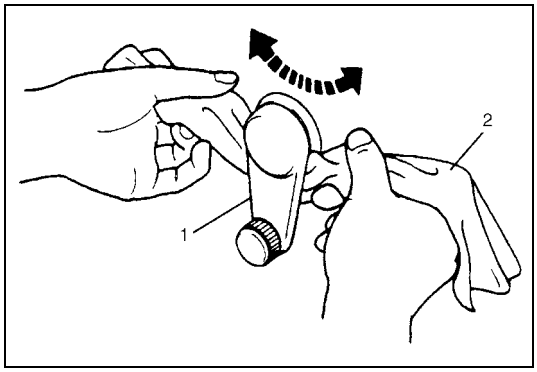
- Check that door opens and closes smoothly and properly.
- Check that door stops in the secondary latched position properly (preventing door from opening freely) and that door closes completely in the fully latched position.
- Adjust door latch striker position if necessary.

Rear Door Lock Assembly Removal and Installation

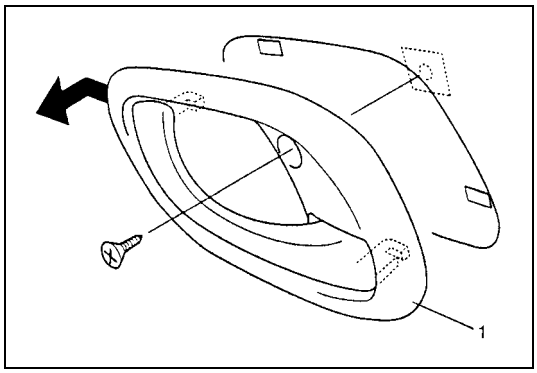


[A]: with out power door lock	2. Inside handle bezel	5. Door latch screw	8. Door latch actuator screw
[B]: with power door lock	3. Rear door latch assembly : Apply lithium grease 99000-25010 to sliding part	6. Door latch striker screw	9. Door lock control rod
1. Outside handle	4. Latch striker	7. Shim	

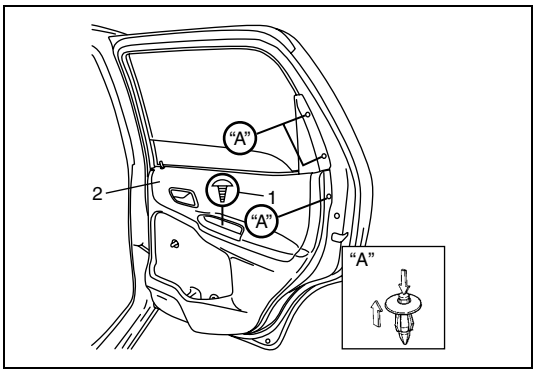
REMOVAL



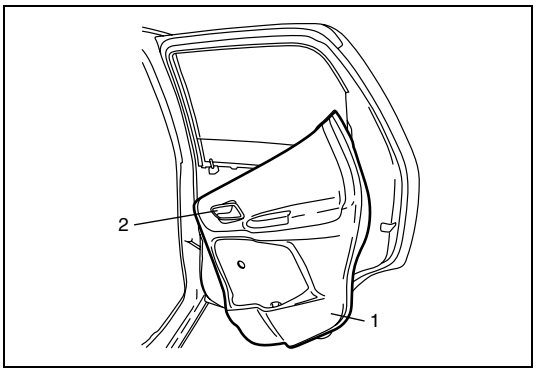
1) Remove window regulator handle (1).
   For its removal, push up snap off by using a cloth (2) as shown in figure.



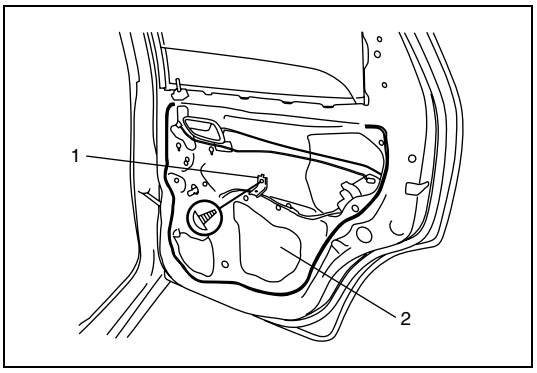
2) Remove inside handle bezel (1).



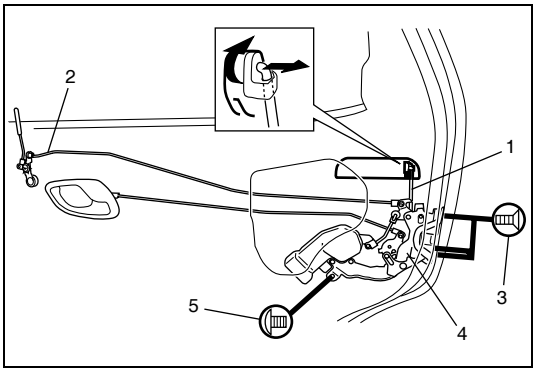
3) Loosen door trim mounting screw (1).
4) Remove rear door inner garnish (2).



5) Remove door trim (1).
With inside handle bezel (2) tilted as shown in figure.



6) Remove door trim bracket (1).
7) Remove door sealing cover (2).



8) Disconnect door opening control rod (1) and door latch control rod (2).
9) Disconnect door lock motor lead wire at coupler (if equipped).
10) Loosen door latch mounting screw (3), door latch actuator screw (5) (if equipped with power door lock) and remove door lock assembly (4).

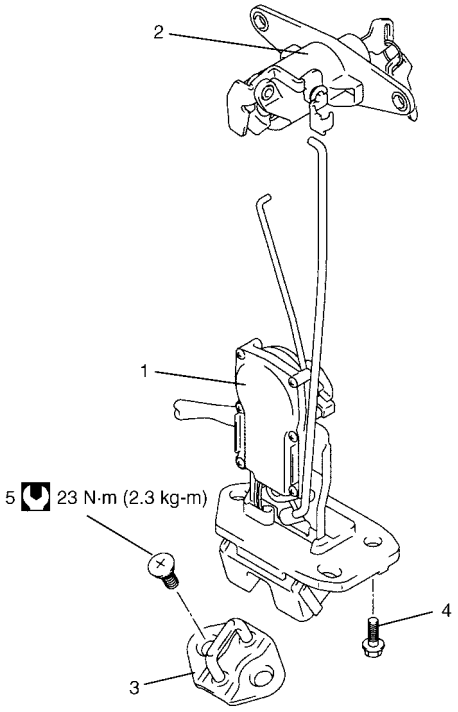
INSTALLATION

Reverse removal procedure to install rear door lock assembly referring to “Front Door Lock Assembly Removal and Installation” in this section.

Rear Door Lock Assembly Inspection

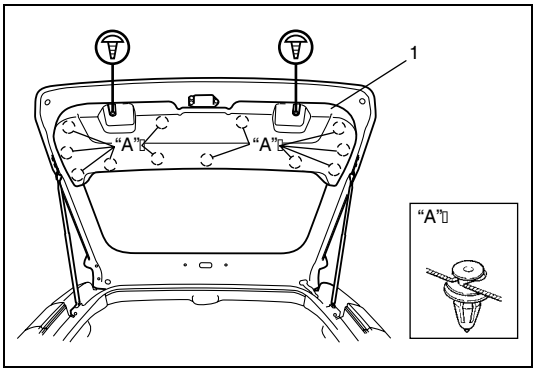
- Check that door opens and closes smoothly and properly.
- Check that door stops in the secondary latched position properly (preventing door from opening freely) and that door closes completely in the fully latched position.
- Adjust door latch striker position if necessary.

Rearend Door Lock Assembly Removal and Installation

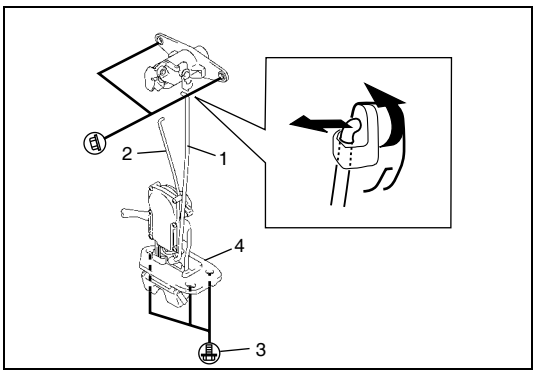


1. Rearend door latch assembly	3. Latch striker	5. Latch striker screw
2. Rearend door lock cylinder	4. Door latch screw	Tightening torque

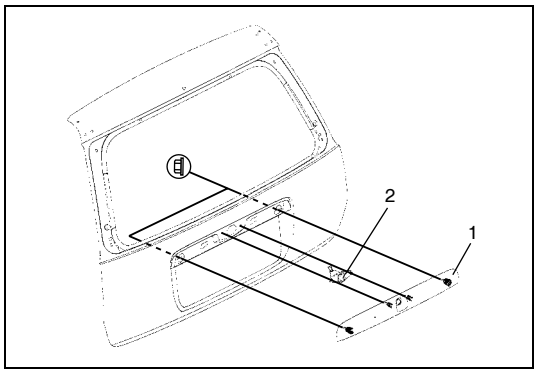
REMOVAL



1) Remove door trim (1).



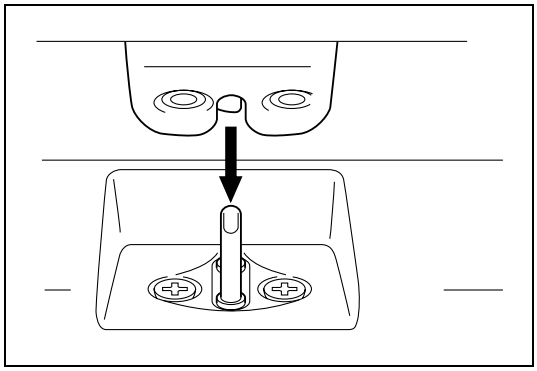
2) Disconnect door lock control rod (1) and control rod (2).
3) Disconnect door lock motor lead wire (if equipped).
4) Loosen door latch screw (3) and remove door latch assembly (4).



5) Remove back door licence garnish (1).
6) Remove back door lock cylinder (2).

INSTALLATION

Reverse removal procedure to install back door lock assembly noting the following instruction.



- Adjust door latch striker so that its center aligns with the center of groove in door latch base.

Rearend Door Lock Assembly Inspection

- Check that door opens and closes smoothly and properly.
- Check that door stops in the secondary latched position properly (preventing door from opening freely) and that door closes completely in the fully latched position.
- Adjust door latch striker position if necessary.

Key Coding

Key Usage and Identification

Key is used for ignition and door lock cylinder. Keys are cut on both edges to make them reversible.

Key identification is obtained from five character key code stamped on key code tag. Using this key code, key code cutting combination can be determined from a code list (available to owners of key cutting equipment from suppliers).

If key codes are not available from records or tags, key code can be obtained from the right hand door lock cylinder (if lock has not been replaced). Lock cylinders supplied by the factory as service parts are unmarked.

If original key is available, key code cutting combination can be determined by laying key.

Ignition switch lock cylinder removal and installation

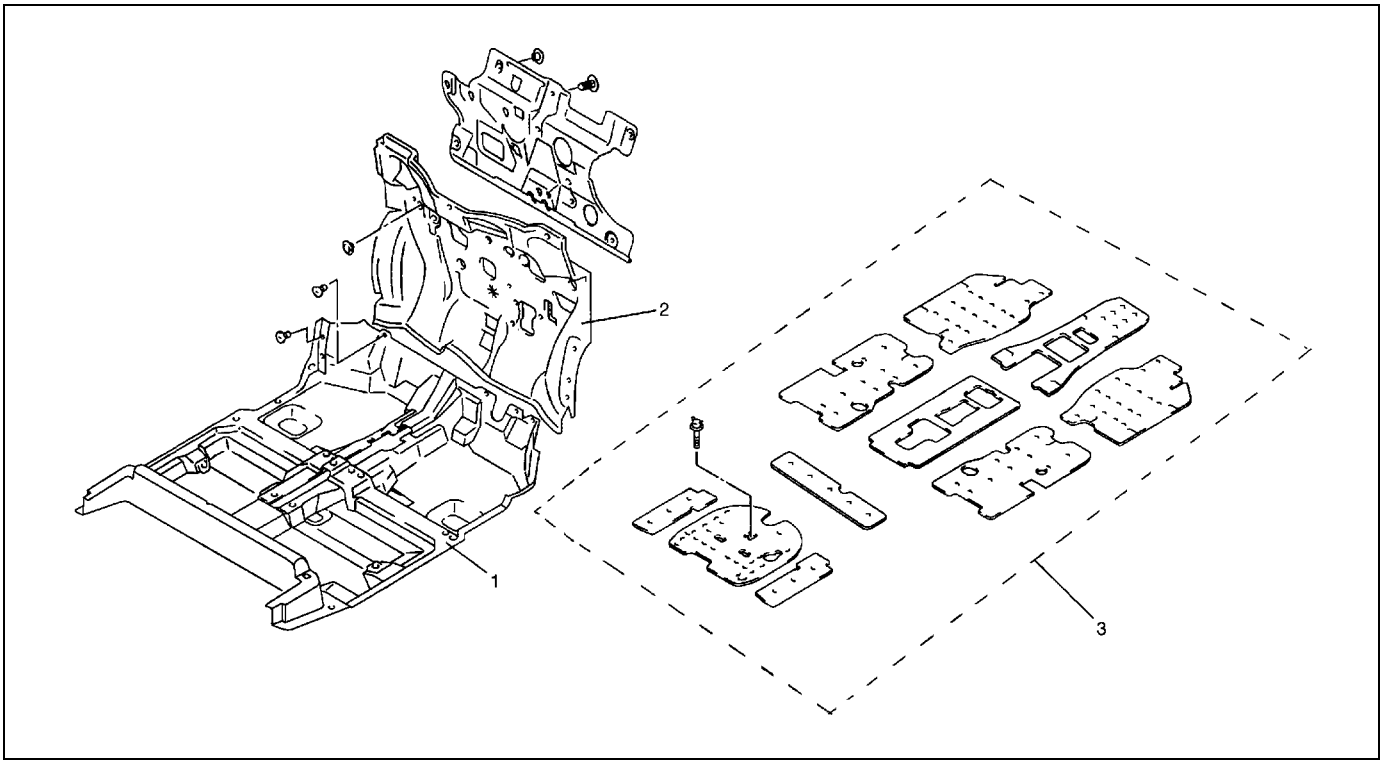
Refer to “Steering Column Removal and Installation” in Section 3C.

ELECTRICAL DIAGNOSIS

For ignition switch electrical troubleshooting, refer to “Ignition Switch Removal and Installation” in Section 8.

Exterior and Interior Trim

Floor Carpet Removal and Installation



1.	Floor carpet
2.	Dash panel silencer
3.	Silencer seat

REMOVAL

1) Remove front seats and rear seat cushion.
2) Remove seat belt lower anchor bolt. Refer to “Front Seat Belt Removal and Installation” in Section 10.
3) Remove dash side trims, front side sill scuffs, center pillar inner lower trims, quarter inner trims and rear side sill scuffs.
4) Remove parking brake lever cover and console box.
5) Remove floor carpet.

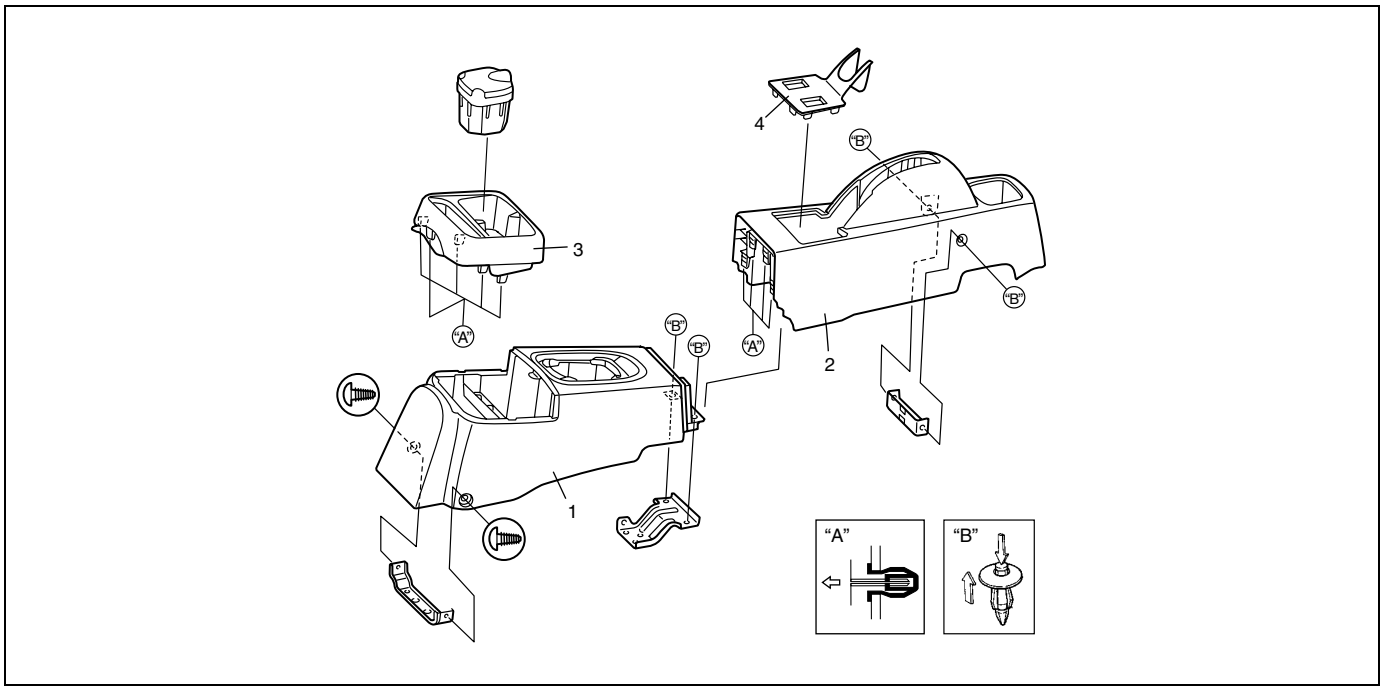
INSTALLATION

Reverse removal sequence to install front floor carpet, noting the following instruction.

- For tightening torque of seat belt anchor bolt. Refer to “Front Seat Belt Removal and Installation” in Section 10.

Center Console Box Removal and Installation

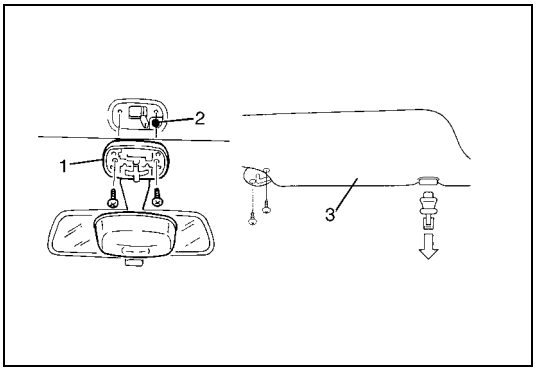
When removing or installing center console box, refer to the figure.



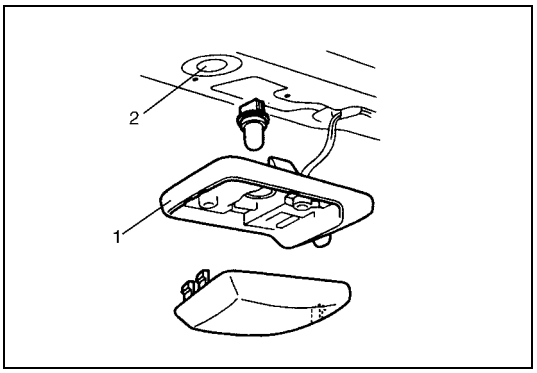
1.	Center console box front
2.	Center console box rear
3.	Center console garnish
4.	Center console cap

Head Lining Removal and Installation

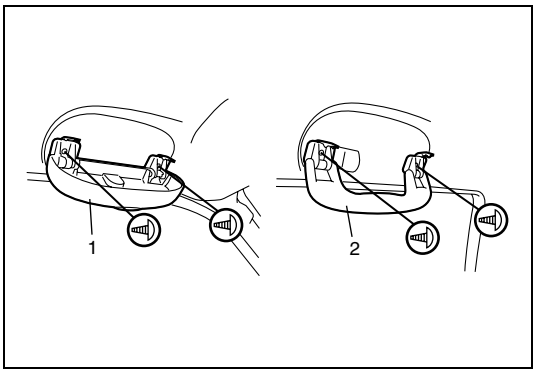
REMOVAL



1) Remove interior light (1).
2) Remove head lining clip (2).
3) Remove sun visor (3).

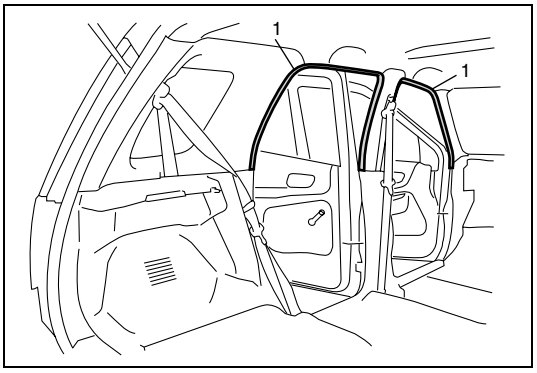


4) Remove luggage room light (1).
5) Remove head lining clip (2).

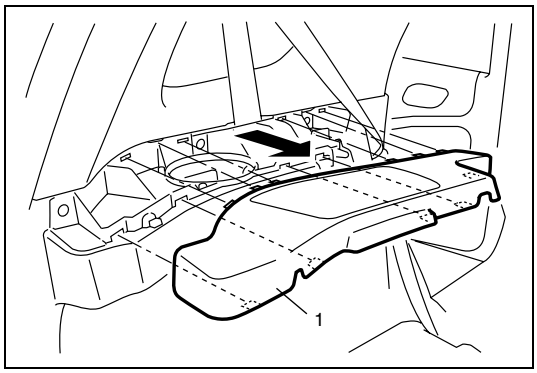


6) Remove assistant grip.

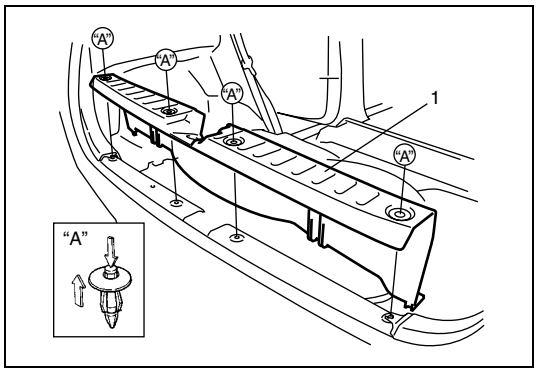
1.	Driver side
2.	Passenger side



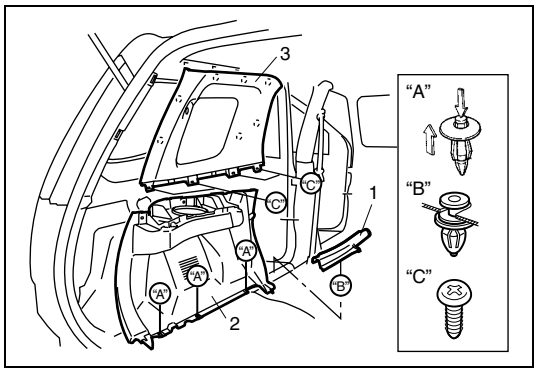
7) Remove door opening trim (1).



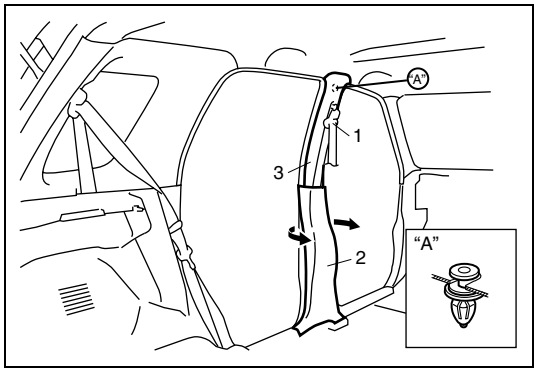
8) Remove rear speaker cover (1).



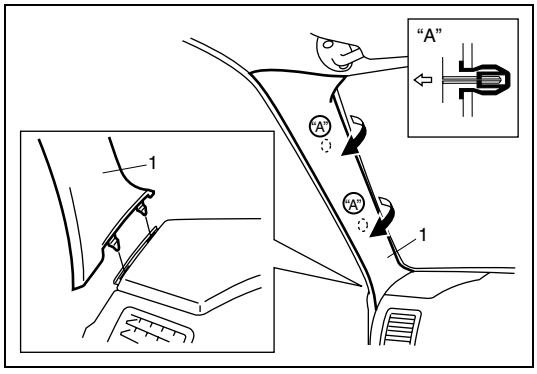
9) Remove tail end member trim (1).



10) Remove side sill rear scuff (1).
11) Remove quarter inner trim (2).
12) Remove quarter window trim (3).



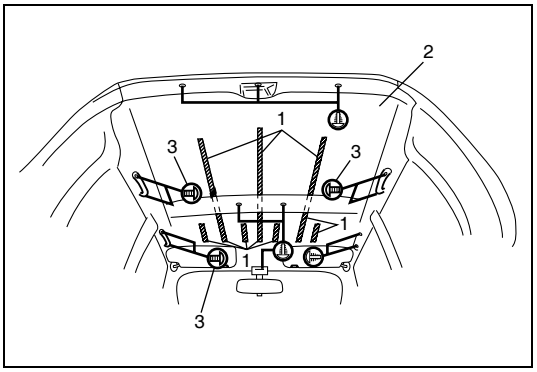
13) Remove front seat belt (1).
14) Remove center pillar lower trim (2).
15) Remove center pillar upper trim (3).



16) Remove front pillar inner trim (1).

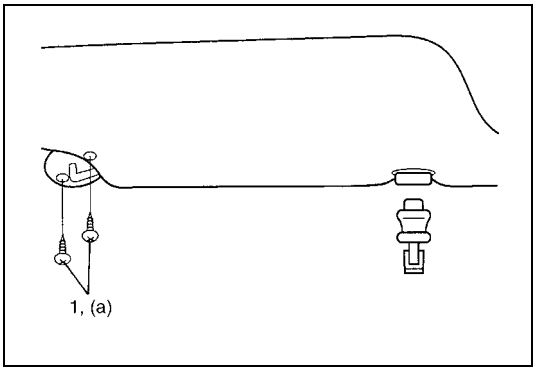
INSTALLATION

Reverse removal procedure to install head lining noting the following instructions.



- Apply double-face tape (1) to head lining (2) as shown figure, and then install head lining (2).
- Tighten assistant grip screw (3) to specified torque.

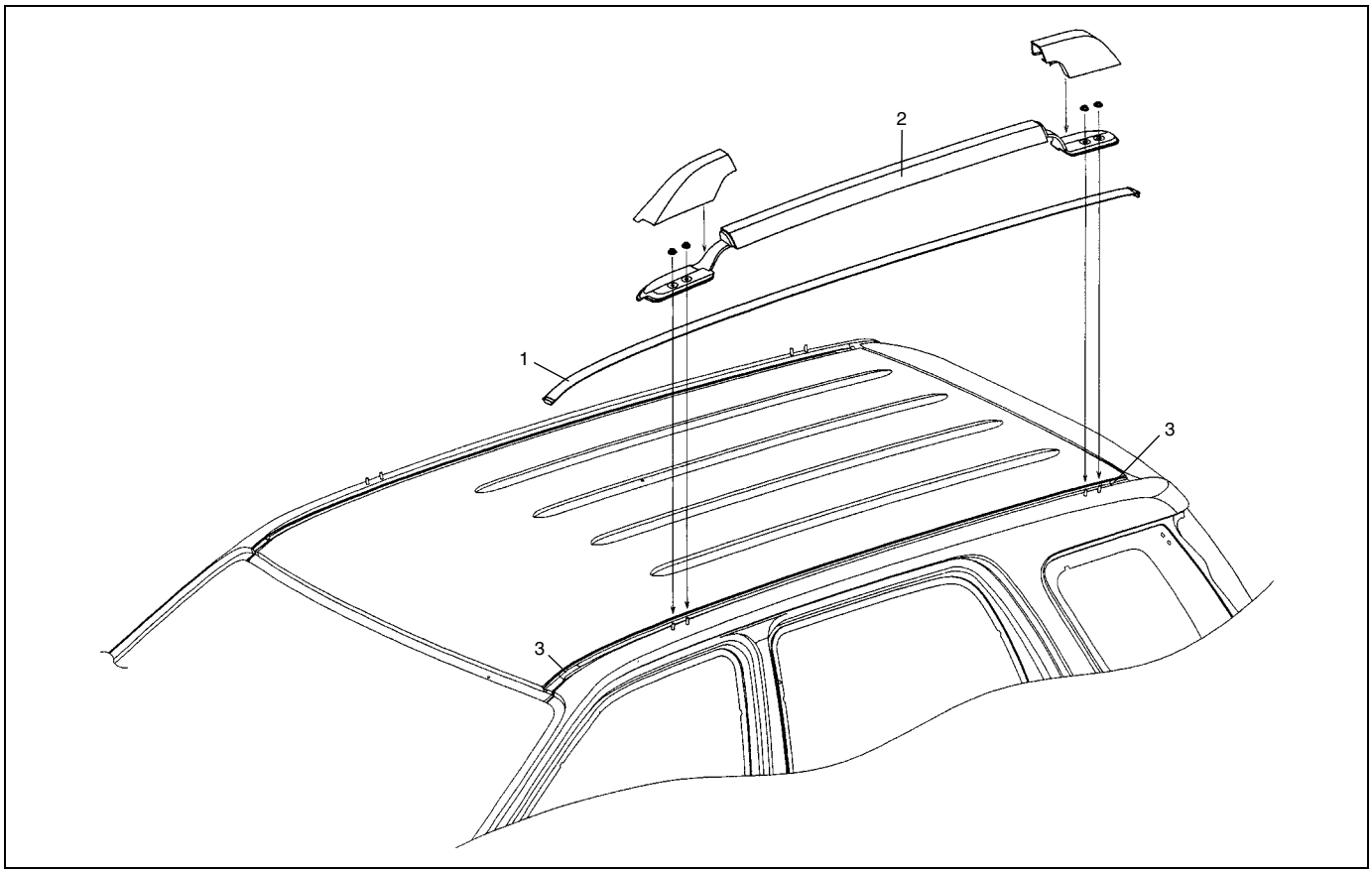
Tightening torque
Assistant grip screw: 4 N·m (0.4 kg-m)



- Tighten sun visor screw (1) to specified torque.

Tightening torque
Sun visor screw (a): 4 N·m (0.4 kg-m)

Roof Molding Removal and Installation



1. Roof molding	2. Roof rail	3. Adhesive

REMOVAL

1) Remove roof rail. Refer to “Roof Rail Removal and Installation (If Equipped)” in this section.
2) Remove roof molding.

INSTALLATION

Reverse removal procedure for installation.

Paint and Coatings

Anti-Corrosion Treatment

WARNING:
Standard shop practices, particularly eye protection, should be followed during the performance of the below-itemized operations to avoid personal injury.

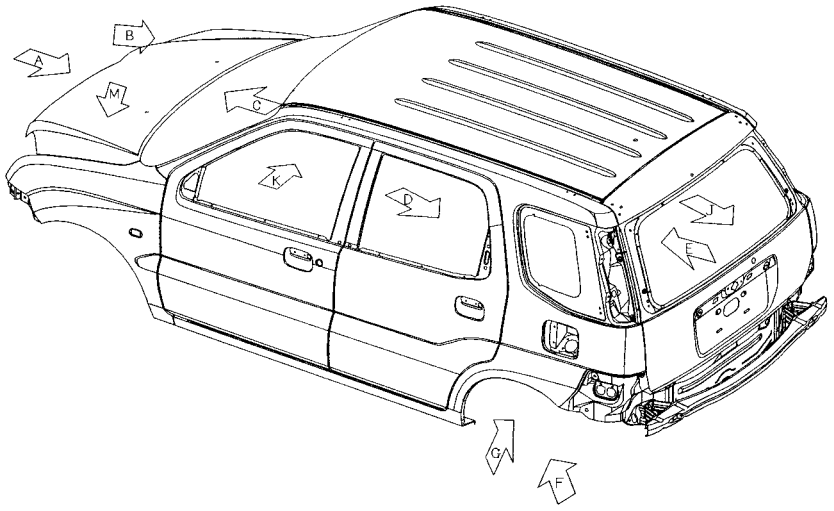
As rust proof treatment, steel sheets are given corrosion resistance on the interior and/or exterior.
These corrosion resistance steel sheet materials are called one of two-side galvanized steel sheets.
It is for the sake of rust protection that these materials are selected and given a variety of treatments as described blow.

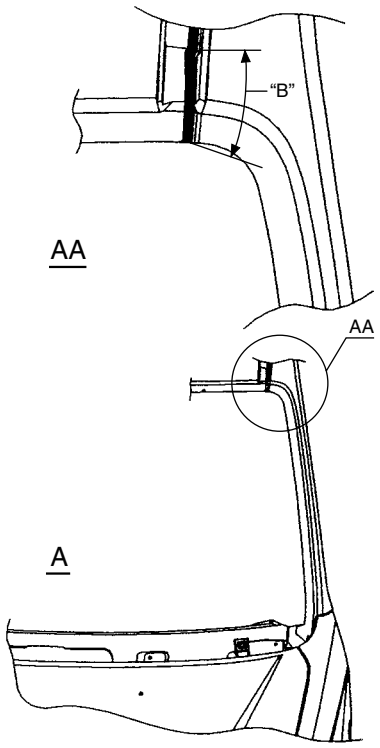
- Steel sheets are treated with cathodic electroprimer which is excellent in corrosion resistance.
- Rust proof wax coatings are applied to door and side sill insides where moisture is liable to stay.
- Vinyl coating is applied to body underside and wheel housing inside.
- Sealer is applied to door hem, engine compartment steel sheet-to-steel sheet joint, and the like portions to prevent water penetration and resulting in rust occurrence.

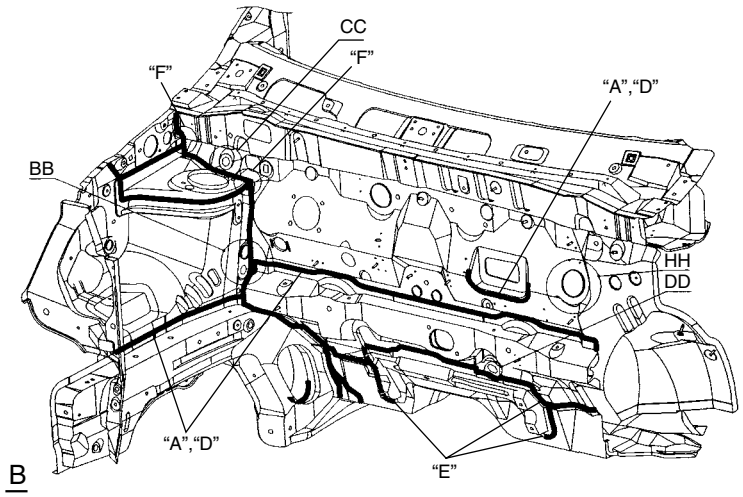
In panel replacement or collision damage repair, leaving the relevant area untreated as it is in any operation which does disturb the above-mentioned rust proof treatment will cause corrosion to that area. Therefore, it is the essential function of any repair operation to correctly recoat the related surfaces of the relevant area.
All the metal panels are coated with metal conditioners and primer coating during vehicle production. Following the repair and/or replacement parts installation, every accessible bare metal surface should be cleaned and coated with rust proof primer. Perform this operation prior to the application of sealer and rust proof wax coating.
Sealer is applied to the specific joints of a vehicle during production. The sealer is intended to prevent dust from entering the vehicle and serves also as an anticorrosion barrier. The sealer is applied to the door and hood hem areas and between panels. Correct and reseal the originally sealed joints if damaged. Reseal the attaching joints of a new replacement panel and reseal the hem area of a replacement door or hood.
Use a quality sealer to seal the flanged joints, overlap joints and seams. The sealer must have flexible characteristics and paint ability after it's applied to repair areas.
For the sealer to fill open joints, use caulking material. Select a sealer in conformance with the place and purpose of a specific use. Observe the manufacturer's label-stand instructions when using the sealer.
In many cases, repaired places require color painting. When this is required, follow the ordinary techniques specified for the finish preparation, color painting and undercoating build-up.
Rust proof wax, a penetrative compound, is applied to the metal-to-metal surfaces (door and side sill insides) where it is difficult to use ordinary undercoating material for coating. Therefore, when selecting the rust proof wax, it may be the penetrative type.
During the undercoating (vinyl coating) application, care should be taken that sealer is not applied to the engine-related parts and shock absorber mounting or rotating parts. Following the under coating, make sure that body drain holes are kept open.
The sequence of the application steps of the anti-corrosion materials are as follows:

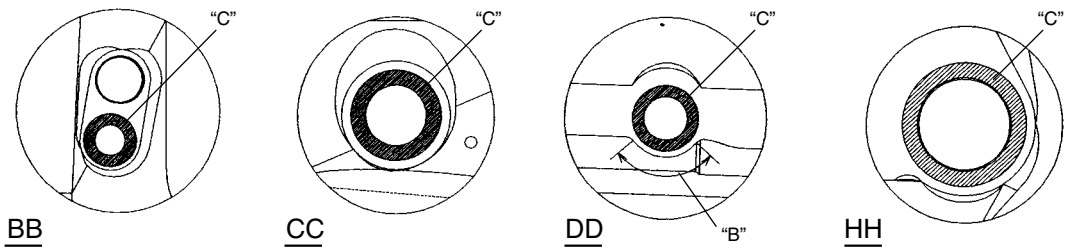
1) Clean and prepare the metal surface.
2) Apply primer.
3) Apply sealer (all joints sealed originally).
4) Apply color in areas where color is required such as hem flanges, exposed joints and under body components.
5) Apply anticorrosion compound (penetrative wax).
6) Apply undercoating (rust proof material).

Sealant Application Areas

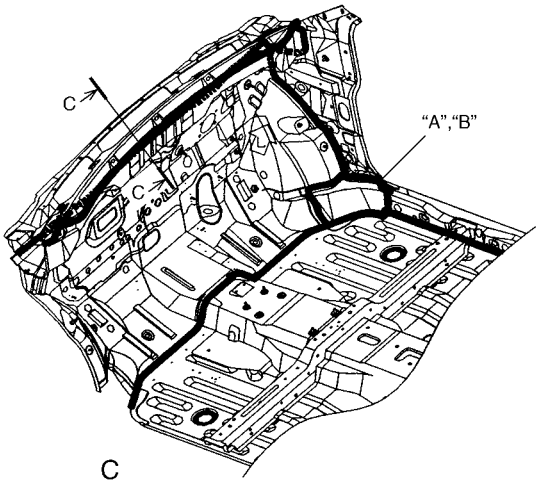








"A": Apply sealant	"C": Do not apply sealant	"E": Never fill up drain holes with sealant
"B": Wipe off excess sealant after application	"D": Smooth out sealant with a brush	"F": Fill gap/hole with sealant



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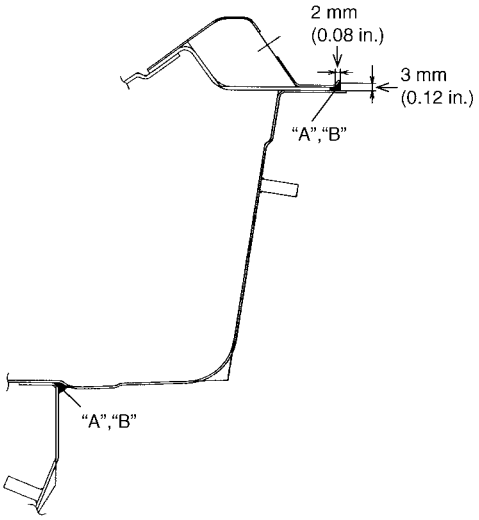
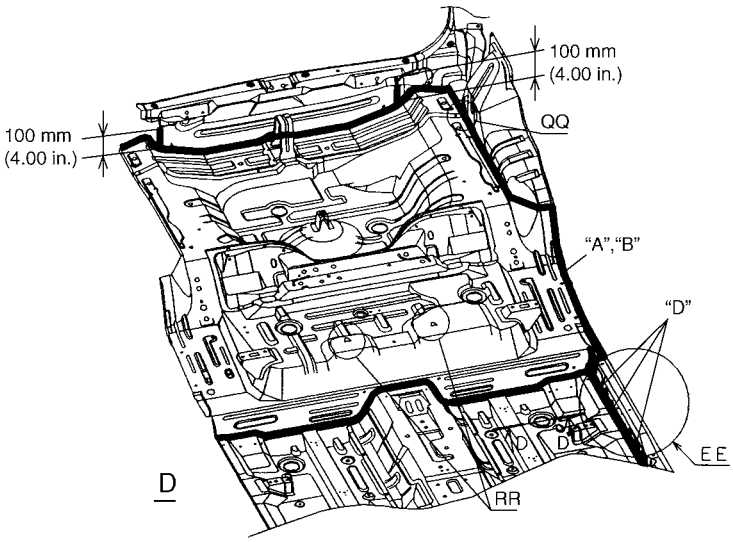


C-C



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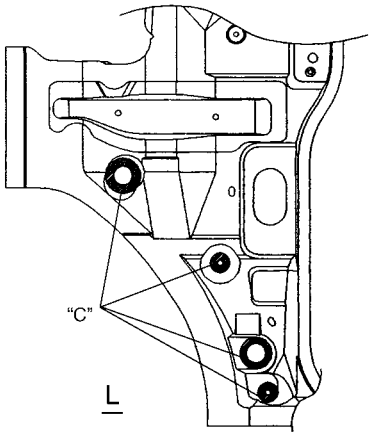

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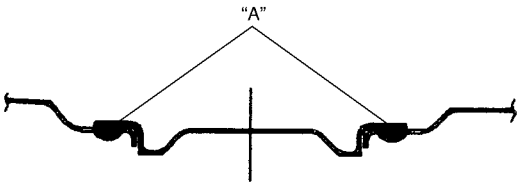
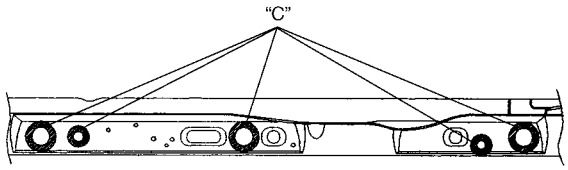


D-D



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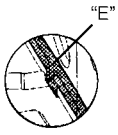

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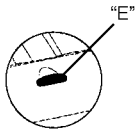
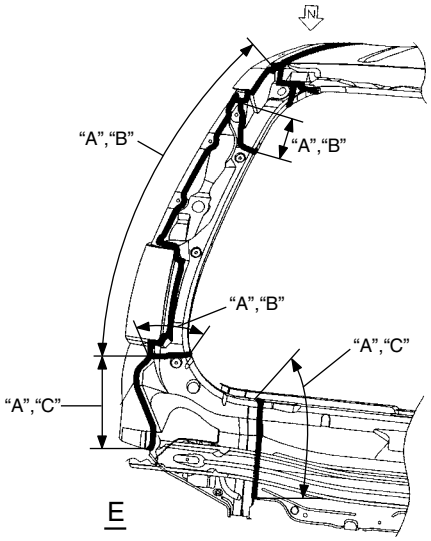


RR

"A": Apply sealant	"C": Do not apply sealant	"E": Fill gap/hole with sealant
"B": Smooth out sealant with a brush	"D": Never fill up drain holes with sealant	



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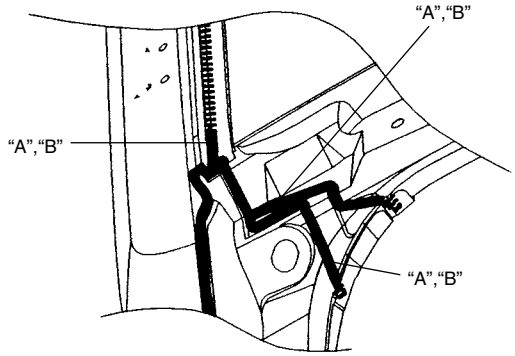

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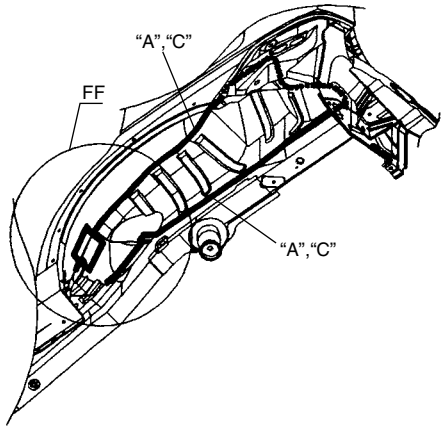

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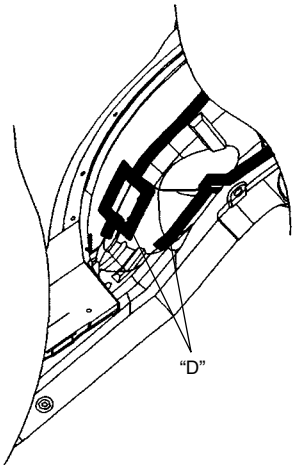

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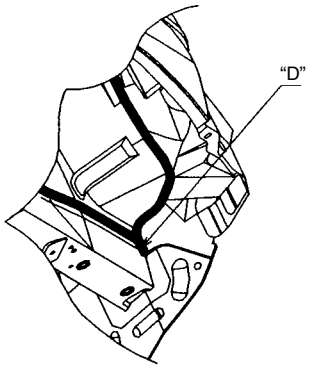

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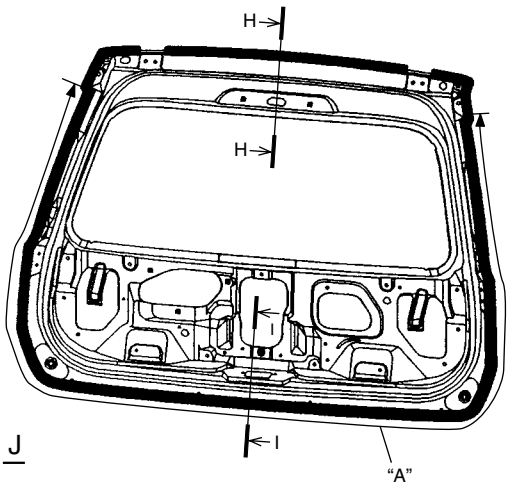

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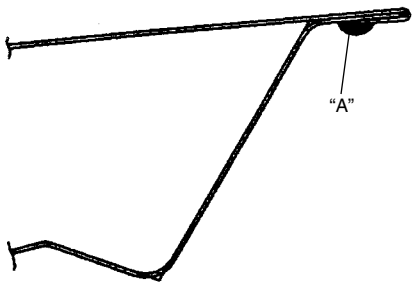
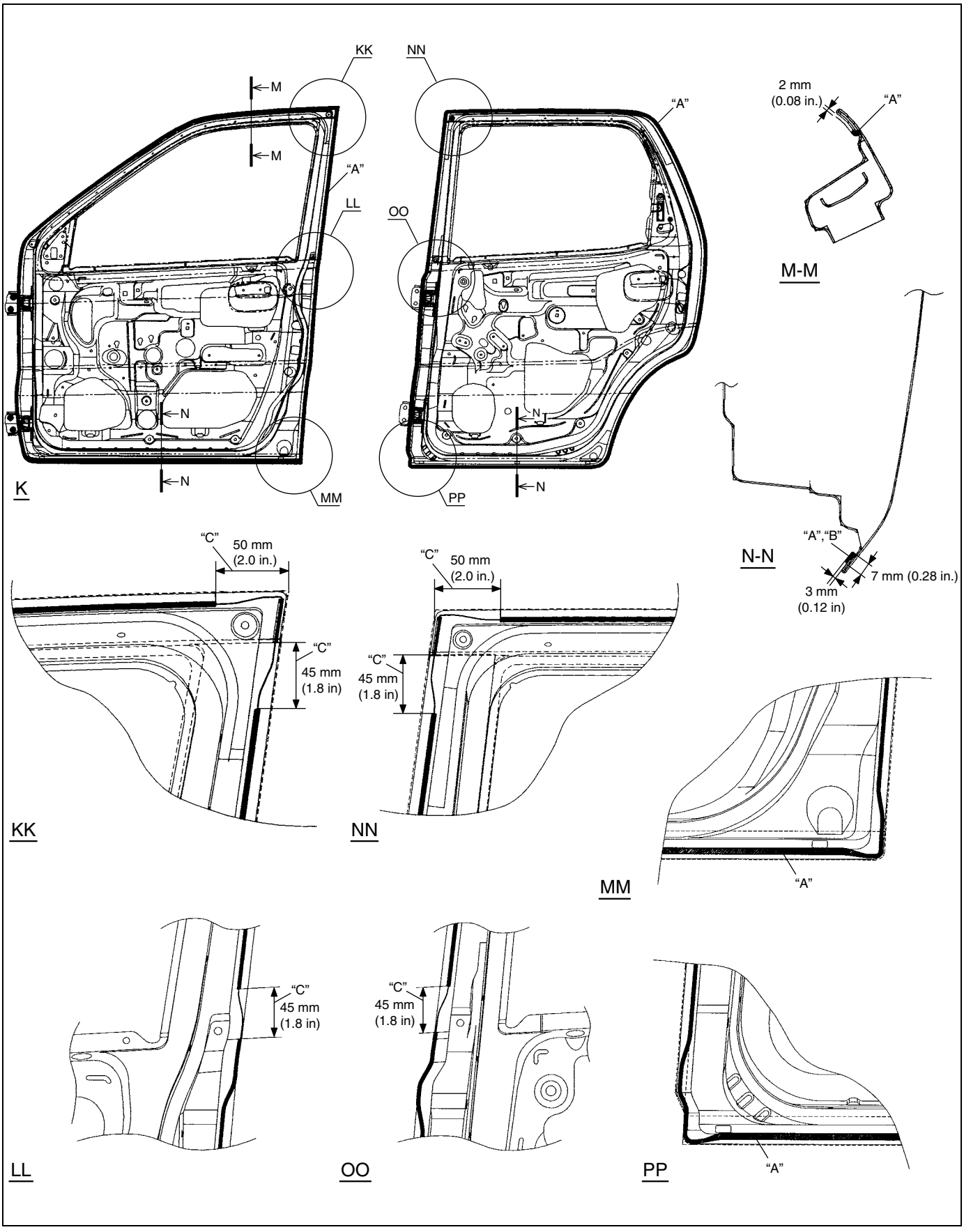


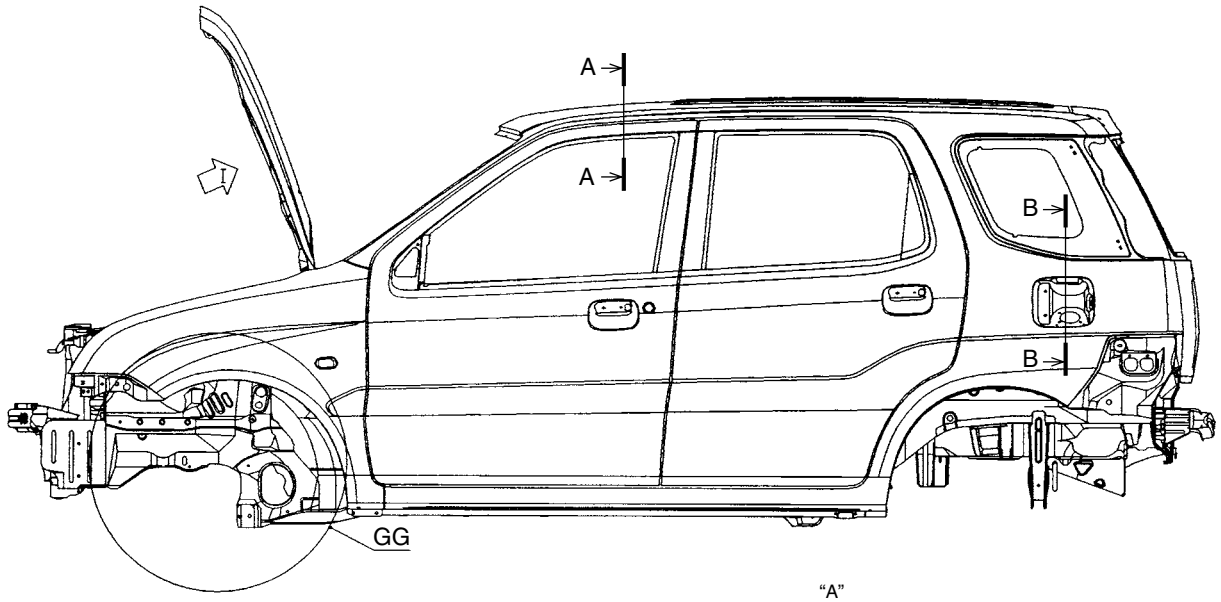
H-H

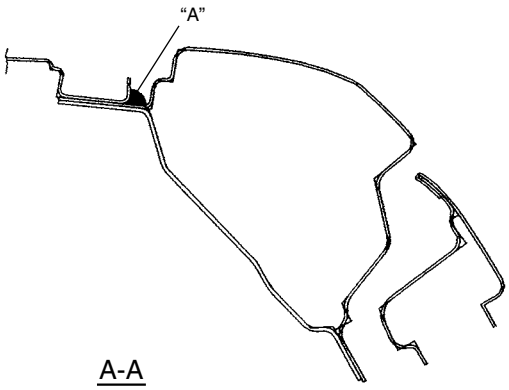
I-I

"A": Apply sealant	"C": Smooth out sealant with a brush
"B": Wipe off excess sealant after application	"D": Fill gap/hole with sealant

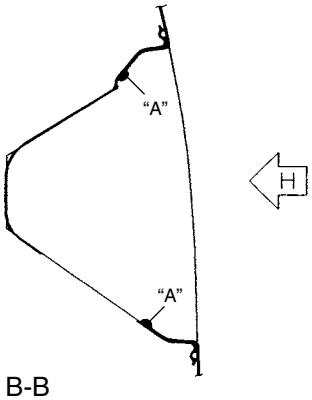


"A": Apply sealant	"C": Wipe off excess sealant after application
"B": Never fill up drain holes with sealant	

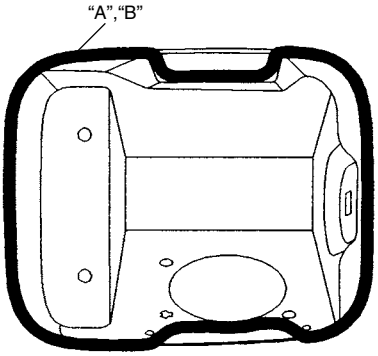




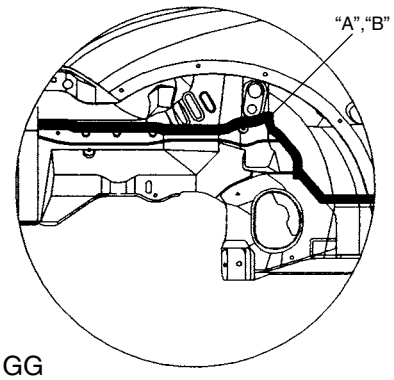
A-A



B-B

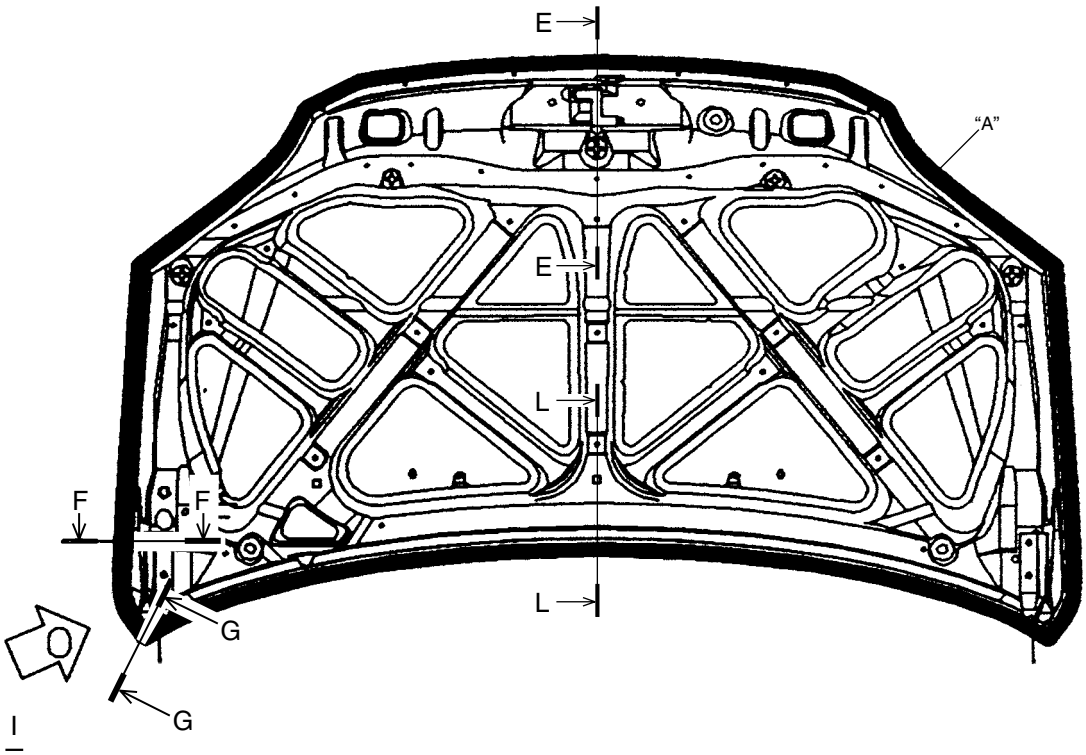


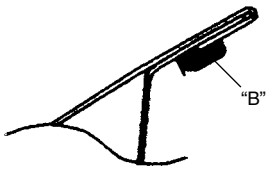
H



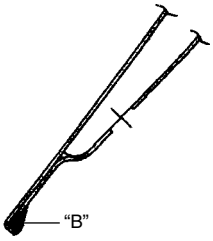
GG

"A":	Apply sealant
"B":	Smooth out sealant with a brush

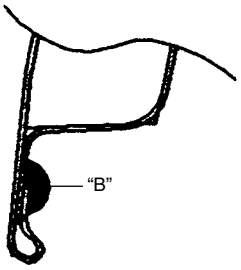




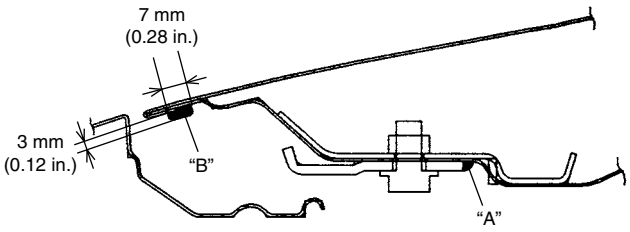
E-E



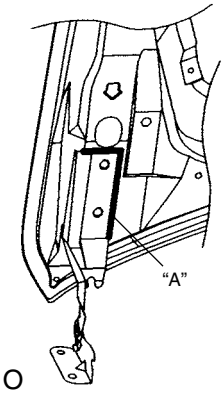
G-G



L-L



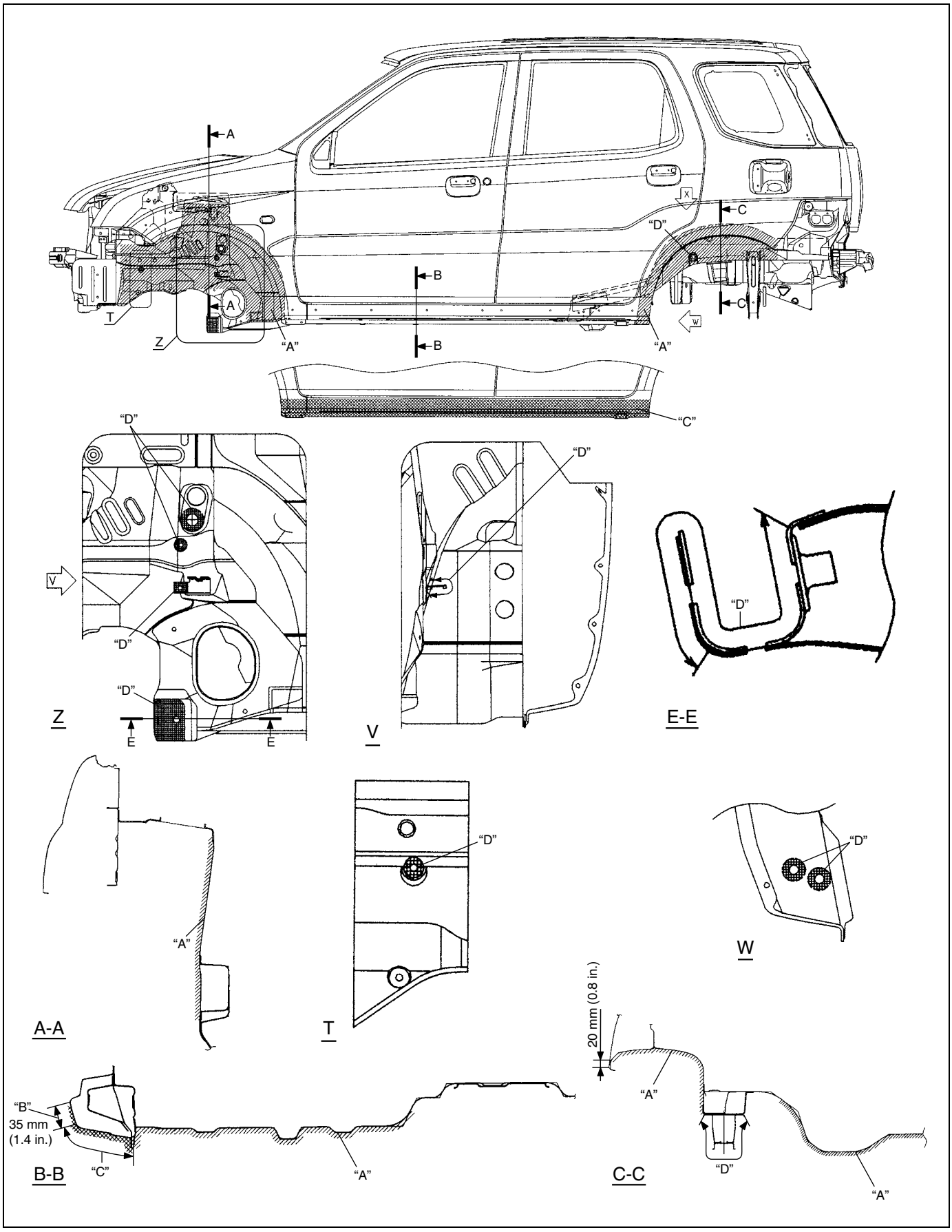
F-F



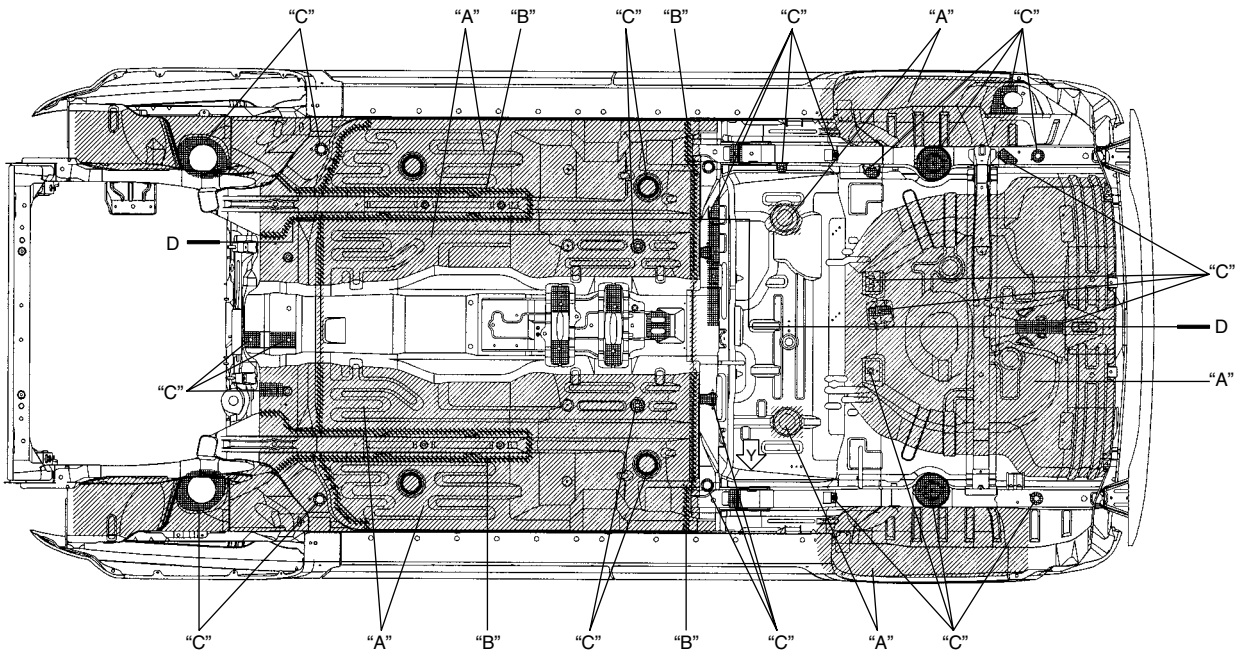
O

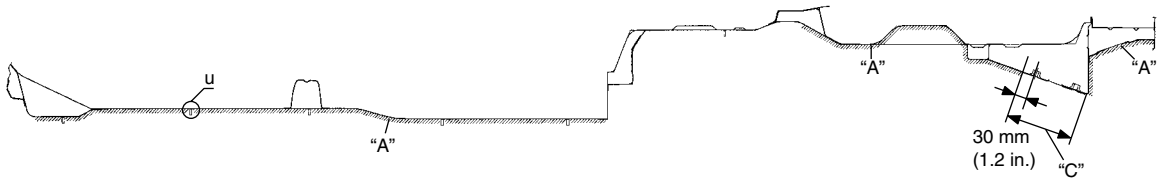
"A":	Apply sealant
"B":	Apply sealant so that top of flange covered up certainly

Under Coating Application Areas

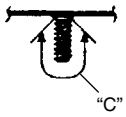


"A": Apply undercoating (PCV, 400 µm or more)	"C": Apply anti-chip coat (300 µm or more)
"B": Apply anti-chip coat (100 µm or more)	"D": Do not apply undercoating

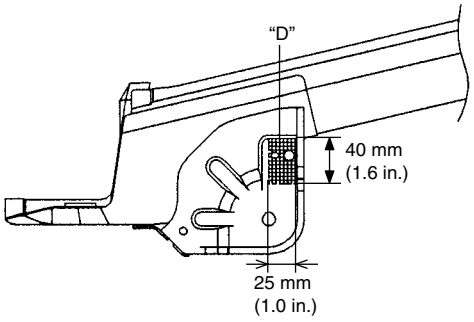




D-D



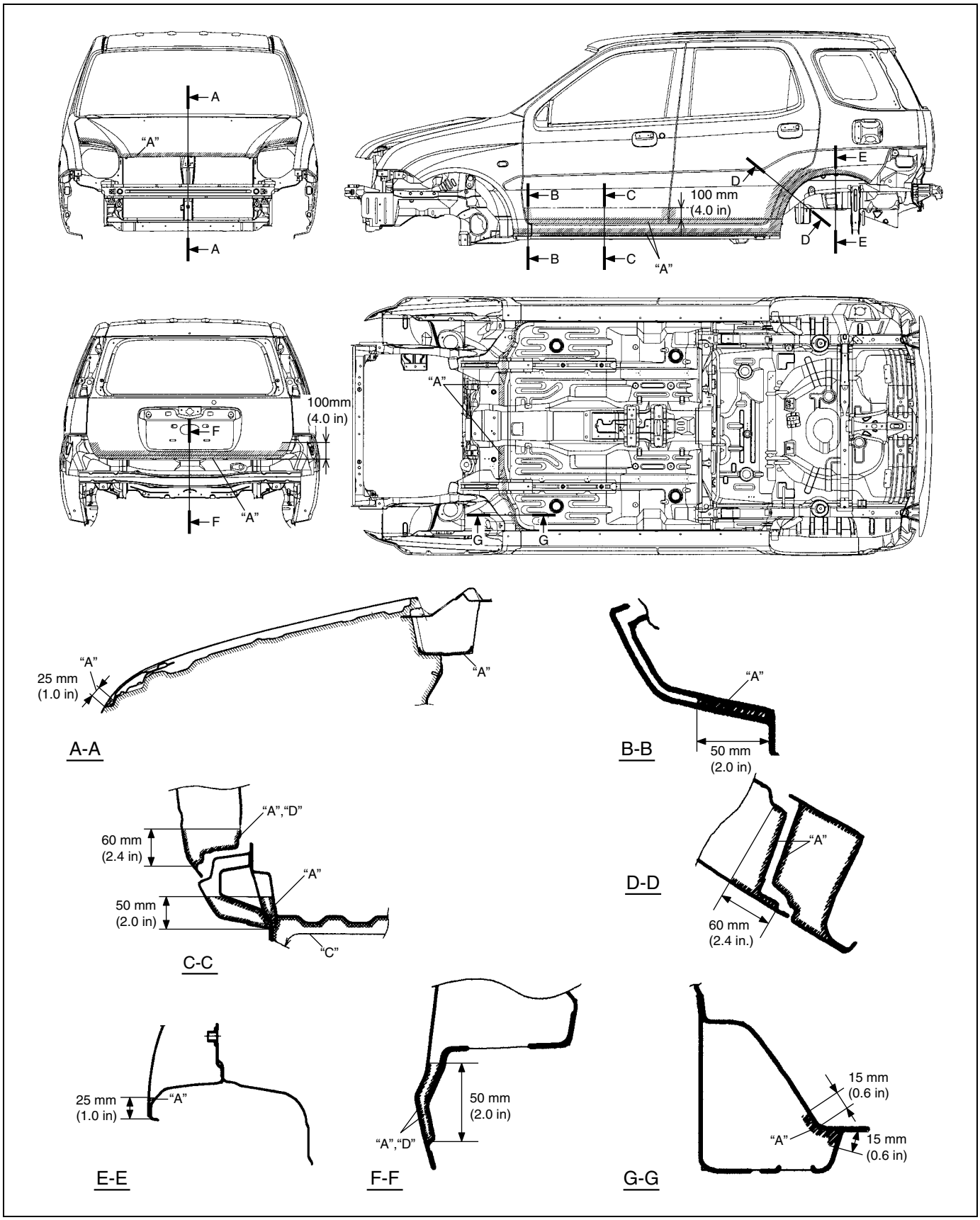
U



Y

"A":	Apply undercoating (PCV, 400 µm or more)
"B":	Apply undercoating (PCV, 600 µm or more)
"C":	Do not apply undercoating

Anti-Corrosion Compound Application Area



"A": Apply rust proof wax (hot wax 50 µm or more)	"C": Apply rust proof wax (high viscosity wax 50 µm or more)
"B": Apply rust proof wax (low viscosity wax 10 µm or more)	"D": Never fill up drain holes with rust proof wax

Plastic Parts Finishing

Paintable plastic parts are ABS plastic parts.

PAINTING

Rigid or hard ABS plastic needs no primer coating.
General acrylic lacquers can be painted properly over hard ABS plastic in terms of adherence.

1) Use cleaning solvent for paint finish to wash each part.
2) Apply conventional acrylic color lacquer to part surface.
3) Follow lacquer directions for required drying time. (Proper drying temperature range is 60 – 70 °C (140 – 158 °F)).

REFERENCE

Plastic parts employ not only ABS (Acrylonitrile Butadiene Styrene) plastic but also polypropylene, vinyl, or the like plastic. Burning test method to identify ABS plastic is described below.

1) Use a sharp blade to cut off a plastic sliver from the part at its hidden backside.
2) Hold sliver with pincers and set it on fire.
3) Carefully observe condition of the burning plastic.
4) ABS plastic must raise readily distinguishable back smoke while burning with its residue suspended in air temporarily.
5) Polypropylene must raise no readily distinguishable smoke while burning.

Required Service Material

Material	Recommended product	Use
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Window regulator • Door hinge
Sealant	SUZUKI BOND No. 1215 (99000-31110)	• Hood hinge • Door hinge

SECTION 10

RESTRAINT SYSTEM

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System with seat belt pretensioner:

- **Service on or around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in Section 10B before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **The procedures in this section must be followed in the order listed to disable the air bag system temporarily and prevent false diagnostic trouble codes from setting. Failure to follow procedures could result in possible activation of the air bag system, personal injury or otherwise unneeded air bag system repairs.**

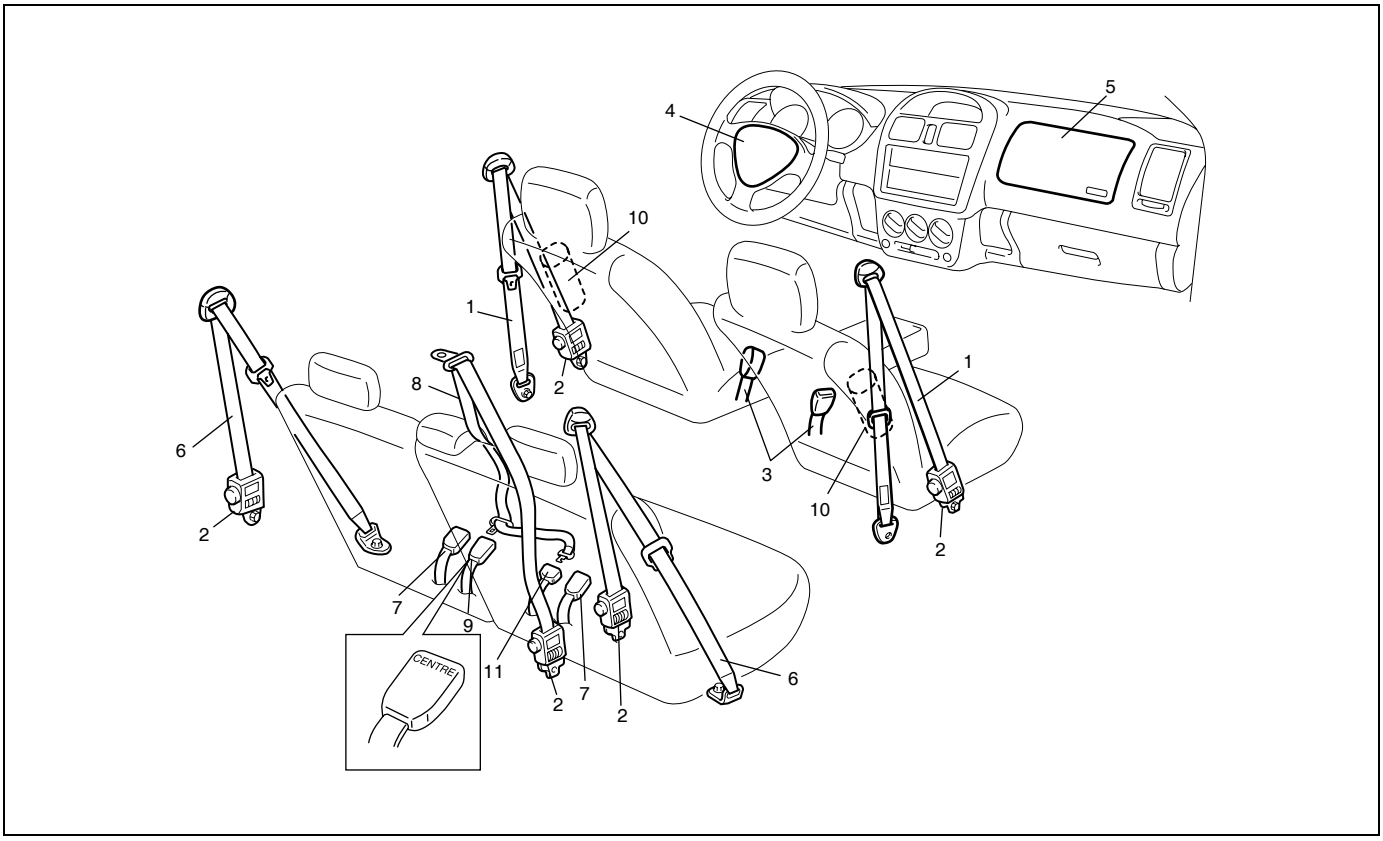
CAUTION:

When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread-locking compound, will be called out. The correct torque value must be used when installing fasteners that require it. If the above procedures are not followed, parts or system damage could result.

CONTENTS

General Description

Seat Belt Construction



1. Front seat belt	5. Passenger air bag (inflator) module	9. Buckle for rear center seat belt
2. Retractor assembly	6. Rear seat belt	10. Side air bag (inflator) module (if equipped)
3. Buckle for front seat belt	7. Buckle for rear seat belt	11. Connector for rear center seat belt
4. Driver air bag (inflator) module	8. Rear center seat belt	

Seat Belt with ELR

The seat belt with emergency locking retractor (ELR) is designed so that it locks immediately (to prevent the webbing from being pulled out of the retractor any further) when any of the following items is detected as exceeding each set value;

- Speed at which the webbing is pulled out of the retractor.
- Acceleration or deceleration of the vehicle speed.
- Inclination.

Seat Belt with A-ELR

The automatic and emergency locking retractor (A-ELR) works as an Emergency Locking Retractor (ELR) till its webbing is pulled all the way out and then on as an Automatic Locking Retractor (ALR) till it is retracted fully.
ALR: Automatically locks when the webbing is pulled out from the retractor and allowed to retract even a little. Then the webbing can not be pulled out any further, unless it is wound all the way back into the retractor, which releases the lock and allows the webbing to be pulled out.

Seat Belt wit ELR and Pretensioner

The seat belt with ELR and a pretensioner has a pretensioner mechanism which operates in linkage with the air bag in addition to the above described ELR. The pretensioner takes up the sag of the seat belt in occurrence of a front collision with an impact larger than a certain set value, thereby enhancing restraint performance.

There are three types of restraint system for this vehicle.

	Type 2	Type 3
Front seat belt	• Seat belt with ELR	• Seat belt with ELR
Rear seat belt	• Seat belt with A-ELR • Center seat belt with ELR	• Seat belt with A-ELR • Center seat belt with ELR
Supplemental restraint system	• Driver and front passenger air bags	• Driver and front passenger air bags
	• Driver and front passenger pretensioners	• Driver and front passenger pretensioners • Driver and front passenger side air bags

Seat Belt Pretensioner

The pretensioner is incorporated in retractor assembly and controlled by SDM as one of air bag system components. It will be activated at the same time as the air bag when an impact at the front of vehicle exceeds the specified value.
When servicing seat belt (retractor assembly) with pretensioner, be sure to observe all WARNINGS and CAUTIONS in this section and “Service Precautions” in Section 10B

CAUTION:
Do not reuse the seat belt pretensioner (retractor assembly) that has operated but replace it with a new one as an assembly. For checking procedure of its operation, refer to “Service Precautions” in Section 10B.

Diagnosis

For diagnosis of air bag system (including in seat belt pretensioner), refer to “Air Bag Diagnostic System Check” in Section 10B.

Inspection and Repair Required After Accident

After an accident, whether the seat belt pretensioner has been activated or not, be sure to perform checks and repairs described on “Repairs and Inspections Required after an Accident” in Section 10B.

On-Vehicle Service

Service Precautions

Service and diagnosis

WARNING:
If replacing seat belt is necessary, replace buckle and ELR (or webbing) together as a set. This is for the reason of ensuring locking of tongue plate with buckle.
If these parts are replaced individually, such a locking condition may become unreliable. For this reason, SUZUKI will supply only the spare buckle and ELR (or webbing) in a set part.

Before servicing or replacing seat belts, refer to the following precautionary items.

- Seat belts should be normal relative to strap retractor and buckle portions.
- Keep sharp edges and damaging objects away from belts.
- Avoid bending or damaging any portion of belt buckle or latch plate.
- Do not bleach or dye belt webbing. (Use only mild soap and lukewarm water to clean it.)
- When installing a seat belt anchor bolt, it should be tightened by hand at first to prevent cross-threading and then to specified torque.
- Do not attempt any repairs on retractor mechanisms or retractor covers. Replace defective assemblies with new replacement parts.
- Keep belts dry and clean at all times.
- If there exist any parts in question, replace such parts.
- Replace belts whose webbing is cut or otherwise damaged.
- Do not put anything into trim panel opening which seat belt webbing passes through.

For Seat Belt with Pretensioner

Refer to “Service and diagnosis” under “Service Precautions” in Section 10B.

WARNING:
When performing service on or around air bag system components or air bag system wiring, disable the air bag system. Refer to “Disabling air bag system” in Section 10B.
Failure to follow procedures could result in possible air bag activation, personal injury or unneeded air bag system repairs.

Disabling air bag system

Refer to “Disabling air bag system” in Section 10B.

Enabling air bag system

Refer to “Enabling air bag system” in Section 10B.

Handling and storage

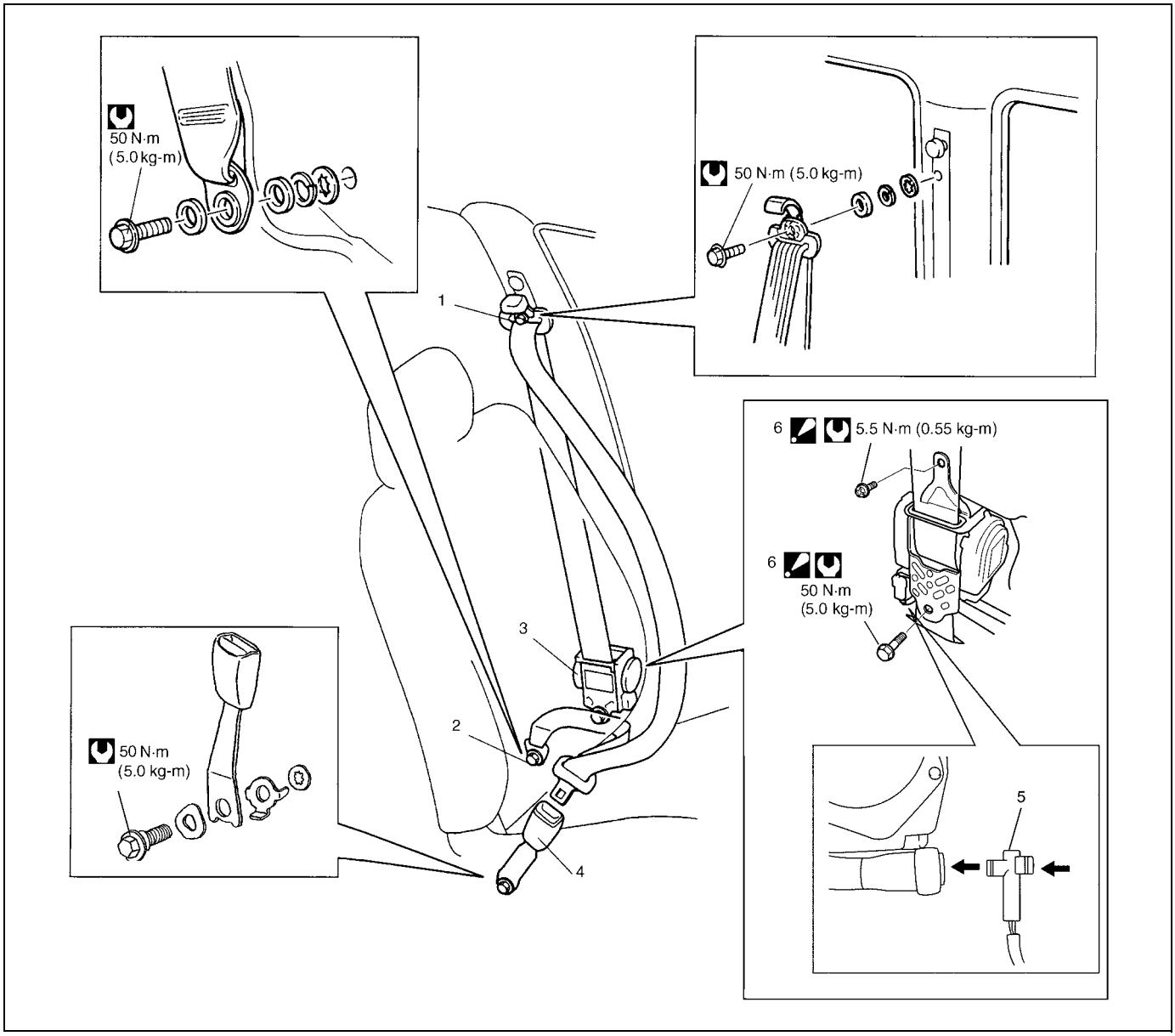
Refer to “Handling and storage” in Section 10B.

Disposal

Refer to “Disposal” under “Air Bag (Inflator) Module and Seat Belt Pretensioner Disposal” in Section 10B.

Front Seat Belt Components

Front seat belt



1. Upper anchor	4. Buckle	Tightening torque
2. Lower anchor	5. Yellow connector (for seat belt pretensioner)	
3. Retractor assembly	6. Retractor assembly mounting bolt : After tightening lower bolt, tighten upper screw	

Front Seat Belt Removal and Installation

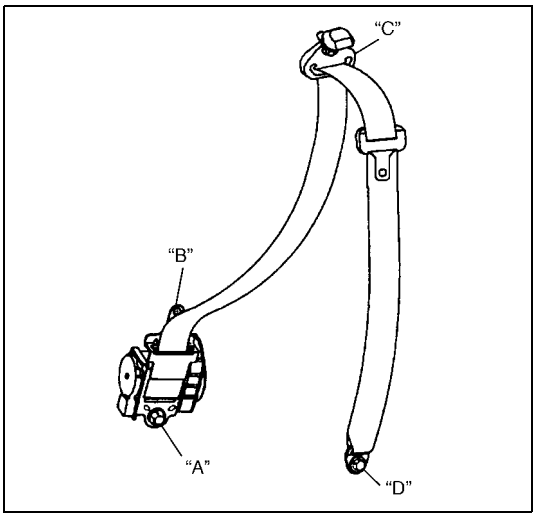
REMOVAL

WARNING:

- **Never attempt to disassemble or repair the seat belt pretensioner (retractor assembly). If any abnormality is found, be sure to replace it with new one as an assembly.**
- **Be sure to read "Service Precautions" in Section 10B, before starting to work and observe every precaution during work. Neglecting them may result in personal injury or unactivation of the seat belt pretensioner when necessary.**

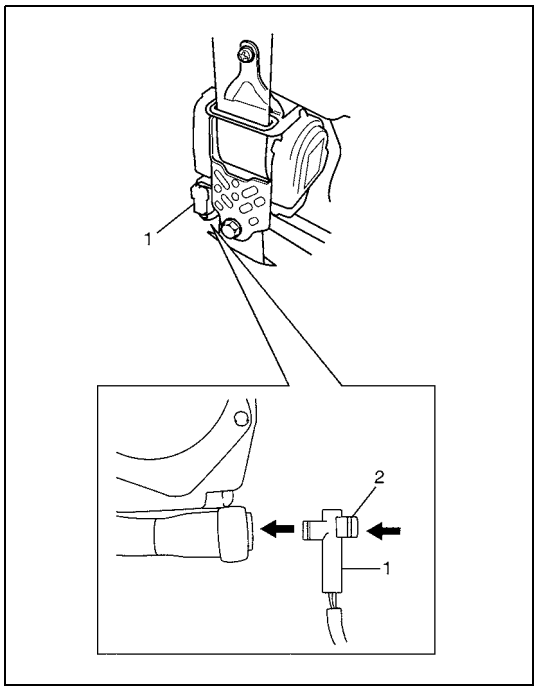
1) Disconnect negative battery cable at battery.
2) Disable air bag system. Refer to "Disabling air bag system" in Section 10B.
3) Remove center pillar lower trim.
4) Disconnect Yellow connector for seat belt pretensioner.
   a) Release locking of lock pin.
   b) After unlocked, disconnect connector from seat belt pretensioner.
5) Remove front seat belts from the vehicle.

INSTALLATION



Install in reverse order of removal, noting the following.

- Seat belt anchor bolts should have an unified fine thread (7/16-20 UNF). Under no circumstances should any different sized or metric screw threads be used.
- Be sure to tighten bolts and screw in order ("A" – "D") as shown.
- Tighten bolts and screw to specified torque referring to "Front Seat Belt Components" in this section.
- Confirm that seat belt is not twisted when installing seat belt.



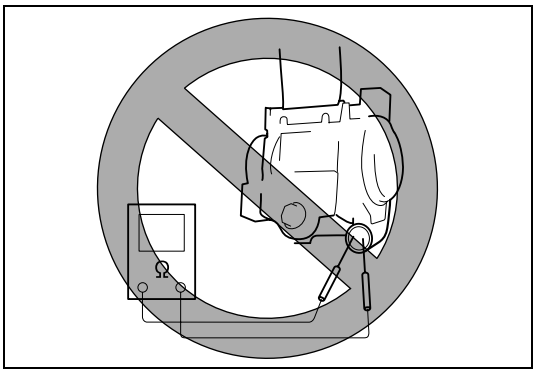
- Connect Yellow connector (1) to seat belt pretensioner securely.

a) Connect connector

b) Lock connector with lock pin (2)

- Enable air bag system. Refer to “Enabling air bag system” in Section 10B.

Front Seat Belt Inspection

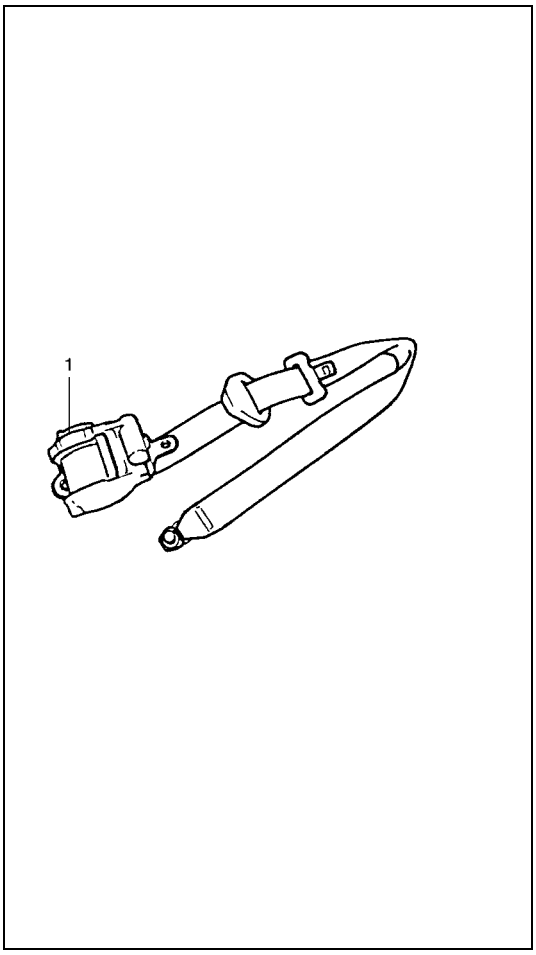


WARNING:

Never measure resistance of pretensioner or disassemble it. Otherwise, personal injury may result.

CAUTION:

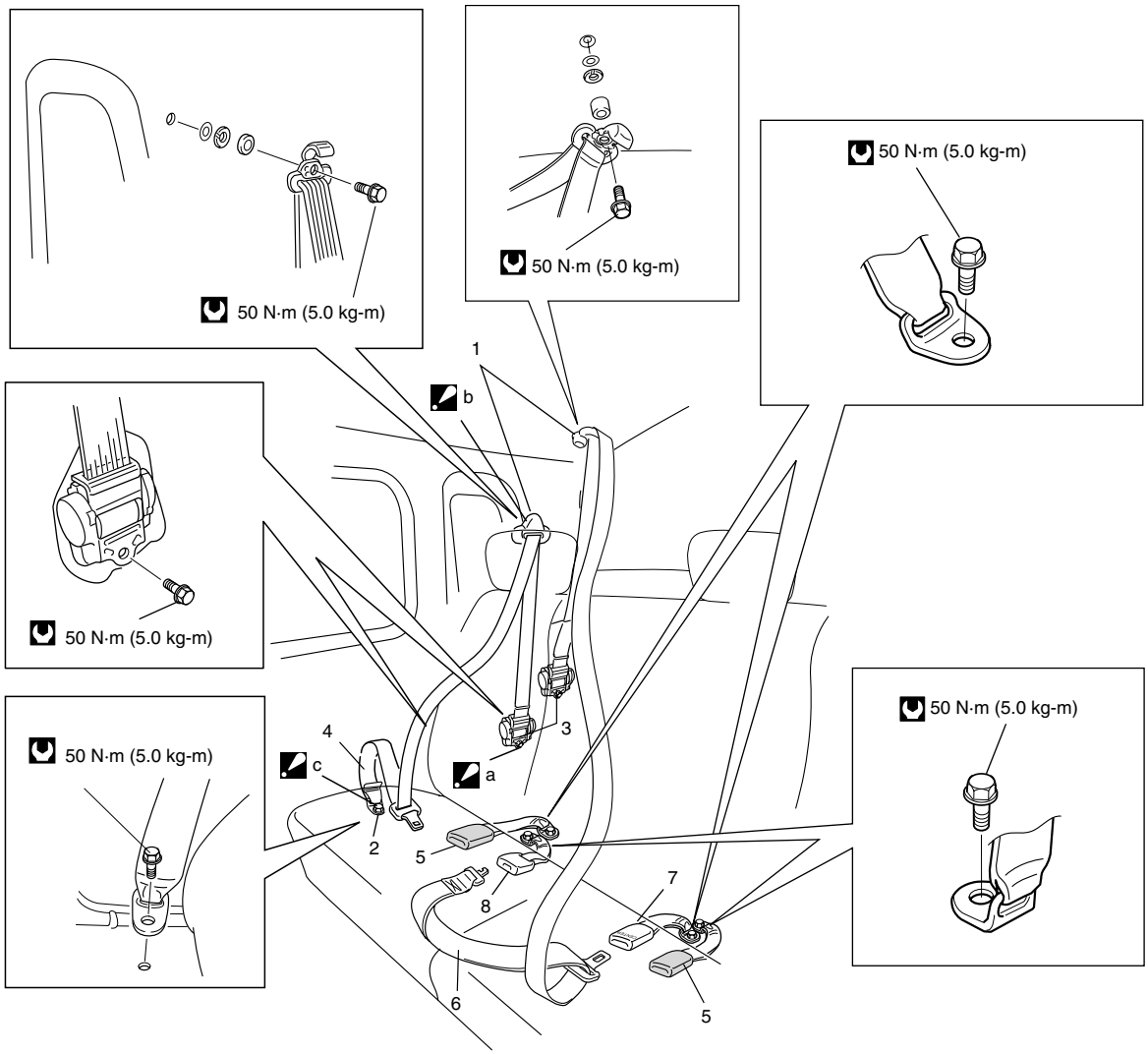
If seat belt pretensioner (retractor assembly) was dropped, it should be replaced.



Seat belts and attaching parts can affect the vital components and systems of a vehicle.
Therefore, they should be inspected carefully and replaced with genuine parts only.

- Seat belt
  Its webbing or strap should be free from damage.
- Retractor assembly
  It should lock webbing when pulled quickly.
  The front seat belt retractor assembly (1) should pass the above inspection and should lock webbing even when tilted (approx. 15°) toward the fore and aft or right and left directions.
  Check retractor assembly (1) with seat belt pretensioner appearance visually for following symptoms and if any one of them is applicable, replace it with a new one as an assembly.
- Pretensioner has activated.
- There is a crack in seat belt pretensioner (retractor assembly).
- Wire harness or connector is damaged.
- Seat belt pretensioner (retractor assembly) is damaged or a strong impact (e.g., dropping) was applied to it.
- Anchor bolt
  Anchor bolts should be torqued to specification.
- Belt latch
  It should be secure when latched.

Rear Seat Belt Components



1. Upper anchor	5. Buckle for rear seat belt	a. Retractor side rear seat belt mounting bolt : Tightening order: a → b → c
2. Lower anchor	6. Rear center seat belt with ELR	b. Upper anchor side rear seat belt mounting bolt : Tightening order: a → b → c
3. Retractor assembly	7. Buckle for rear center seat belt	c. Lower anchor side rear seat belt mounting bolt : Tightening order: a → b → c
4. Rear seat belt with A-ELR	8. Connector for rear center seat belt	Tightening torque

Rear Seat Belt Removal and Installation

REMOVAL

WARNING:
Be sure to read "Service Precautions" in Section 10B before starting to work and observe every precaution during work.

1) Remove rear seat cushion, if necessary.
2) Remove rear seat belt(s) as referring to "Rear Seat Belt Components" in this section.

INSTALLATION

Reverse removal procedure to install rear seat belt(s) noting the following constructions.

- Seat belt anchor bolts should have an unified fine thread (7/16-20 UNF). Under no circumstances should any different sized or metric screw threads be used.
- Be sure to tighten rear seat belt mounting bolts in order ("a" – "c") referring to "Rear Seat Belt Components" in this section.
- Tighten rear seat belt mounting bolts to specified torque referring to "Rear Seat Belt Components" in this section.

Rear Seat Belt Inspection

- Check the rear seat belt in the same way as "Front Seat Belt Inspection" in this section.
- As to seat belts with A-ELR, check them as follows in addition to above check.
  – With vehicle at stop, pull seat belt all the way out, let it retract a little and try to pull it. It should not be pulled out, that is, it should be locked where retracted.
  – Let seat belt retract to its original state. Next, pull it half way out, let it retract a little and try to pull it again. It should be pulled out smoothly, that is it should not be locked at this time.

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Upper and lower anchor bolt	50	5.0	36.0
Retractor assembly bolt	50	5.0	36.0
Retractor assembly screw	5.5	0.55	4.0
Buckle bolt	50	5.0	36.0

SECTION 10B

AIR BAG SYSTEM

WARNING:

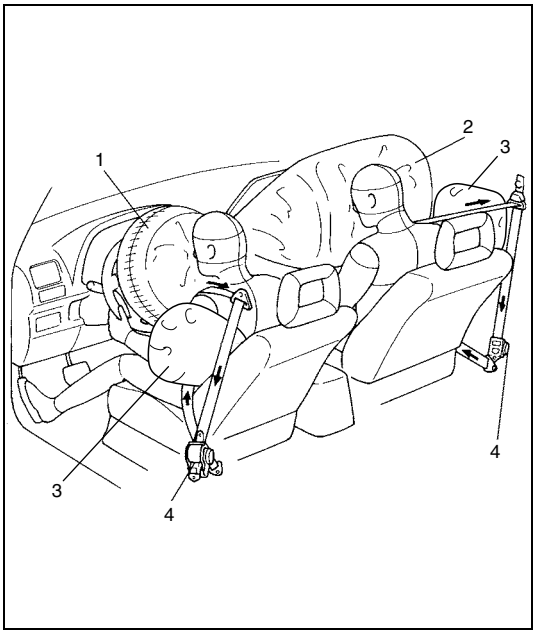
- **Service on or around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in this section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintended activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **The procedures in this section must be followed in the order listed to disable the air bag system temporarily and prevent false diagnostic trouble codes from setting. Failure to follow procedures could result in possible activation of the air bag system, personal injury or otherwise unneeded air bag system repairs.**

CAUTION:

When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread-locking compound, will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

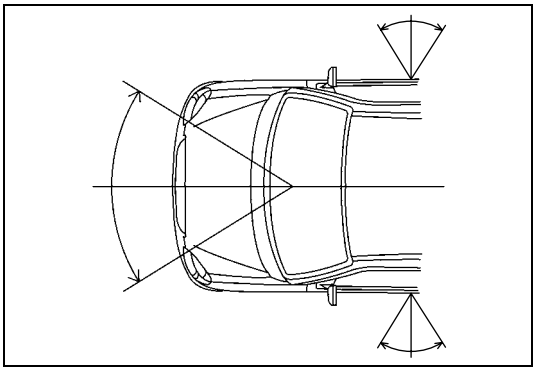
CONTENTS

General Description



With the air bag system which includes front air bags and side air bags for both the driver's and passenger's sides as well as the seat belt pretensioners, the sag of the seat belt is taken up (for seat belt with pretensioner), the driver air bag (inflator) module is deployed from the center of the steering column and the passenger air bag (inflator) module from the top of the instrument panel in front of the front passenger seat in occurrence of a front collision with an impact larger than a certain set value to supplement protection offered by the driver and front passenger seat belts. Side air bag (inflator) module is deployed from the side of the seat back in occurrence of a sideward collision with an impact larger than a certain set value.

1. Driver side air bag
2. Passenger side air bag
3. Side air bag
4. Seat belt pretensioner

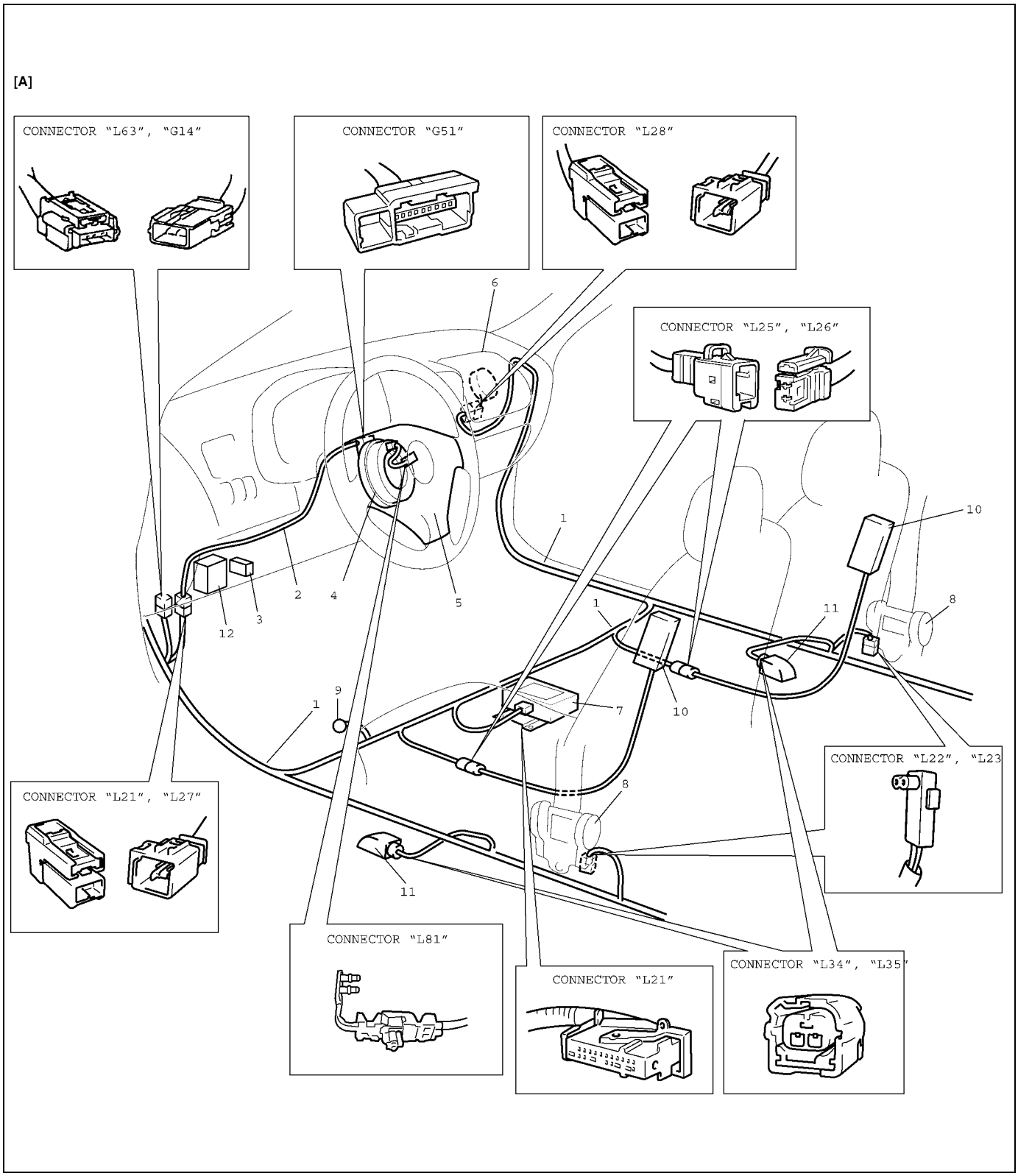


The air bag system is designed to activate only in severe frontal and sideward collisions. It is not designed to activate in rear impacts, rollovers, or minor frontal and sideward collisions, since it would offer no protection in those types of accidents.

Air Bag System Input/Output Table

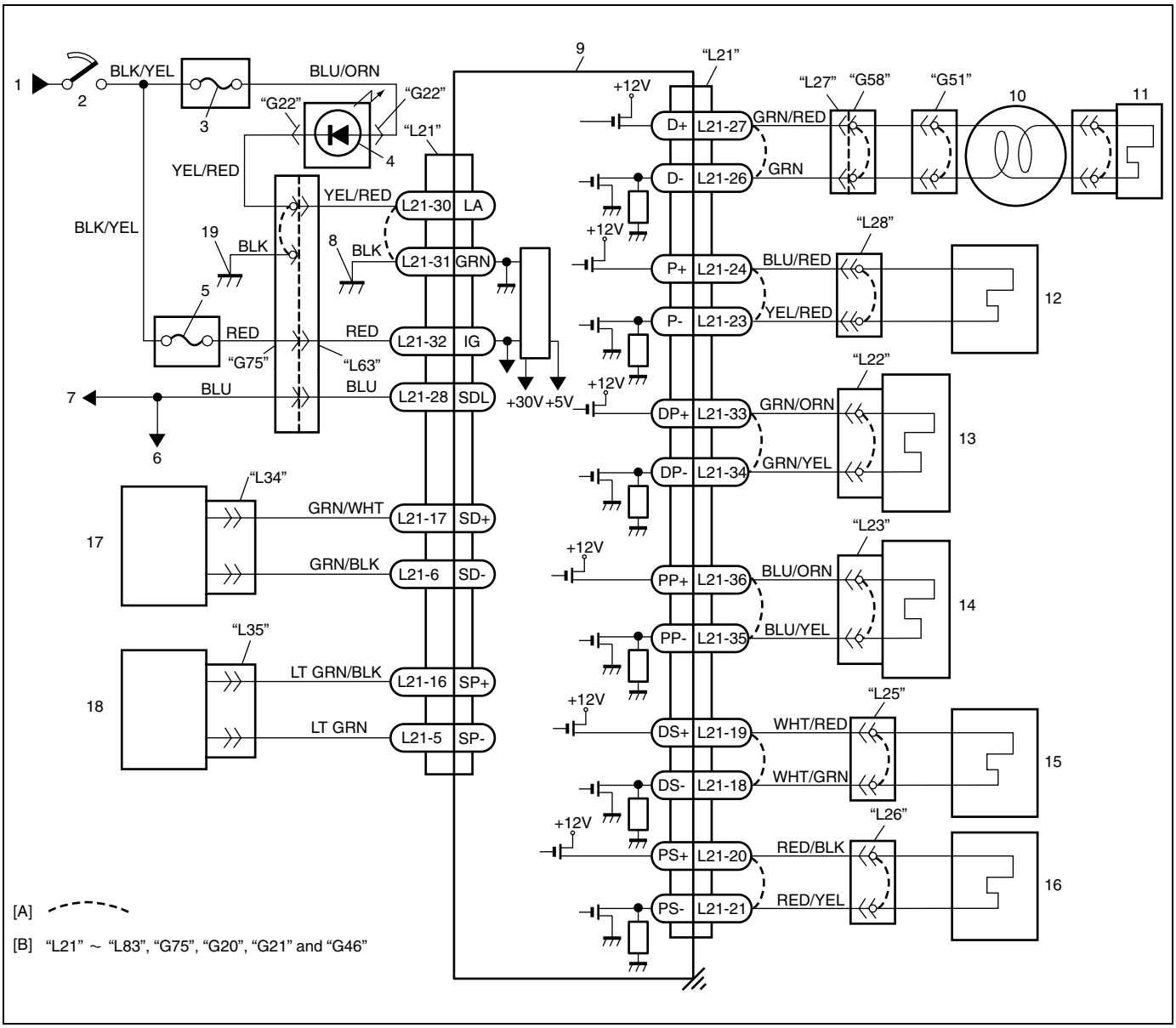
INPUT \ OUTPUT		Driver air bag, Passenger air bag, Seat belt with pretensioner (LH) and Seat belt with pretensioner (RH)	Right side air bag	Left side air bag
Signal from sensor	Sensor in SDM	○	—	—
	Right side sensor	—	○	—
	Left side sensor	—	—	○

System Components and Wiring Location View



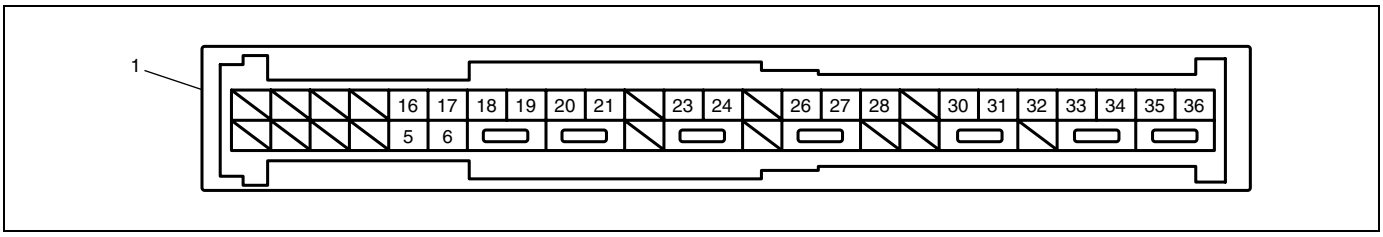
[A]: LH steering vehicle show	5. Driver air bag (inflator) module	10. Side air bag (inflator) module (if equipped)
1. Air bag harness in floor harness	6. Passenger air bag (inflator) module	11. Side Sensor (if equipped)
2. Air bag harness in instrument panel harness	7. SDM	12. Air bag fuse in circuit fuse box
3. DLC	8. Seat belt pretensioner (retractor assembly)	
4. Contact coil assembly	9. Ground for air bag system	

System Wiring Diagram



[A]: Shorting bar	6. To ECM and ABS control module (if equipped)	13. Driver seat belt pretensioner
[B]: Connector	7. To data link connector (DLC)	14. Passenger seat belt pretensioner
1. From main fuse	8. Ground for air bag system	15. Side air bag (inflator) module at driver side (if equipped)
2. Ignition switch	9. SDM	16. Side air bag (inflator) module at passenger side (if equipped)
3. "METER" fuse	10. Contact coil assembly	17. Side sensor at driver side (if equipped)
4. "AIR BAG" warning lamp in combination meter	11. Driver air bag (inflator) module	18. Side sensor at passenger side (if equipped)
5. "AIR BAG" fuse	12. Passenger air bag (inflator) module	19. Ground on body

TERMINAL ARRANGEMENT OF SDM CONNECTOR (VIEWED FROM HARNESS SIDE)



1. CONNECTOR "L21" (SDM CONNECTOR)

CONNECTOR “L21” (SDM connector)

TERMINAL	CIRCUIT		TERMINAL	CIRCUIT	
L21-1	–		L21-20	Side air bag (inflator) module (passenger side) (if equipped)	High
L21-2	–		L21-21		Low
L21-3	–		L21-22	–	
L21-4	–		L21-23	Passenger air bag (inflator) module	Low
L21-5	Side sensor (passenger side)	Low	L21-24		High
L21-6	Side sensor (driver side)	Low	L21-25	–	
L21-7	–		L21-26	Driver air bag (inflator) module	Low
L21-8	–		L21-27		High
L21-9	–		L21-28	Data link connector (DLC)	
L21-10	–		L21-29	–	
L21-11	–		L21-30	“AIR BAG” warning lamp	
L21-12	–		L21-31	Ground	
L21-13	–		L21-32	Ignition switch (power source)	
L21-14	–		L21-33	Driver pretensioner	High
L21-15	–		L21-34		Low
L21-16	Side sensor (passenger side) (if equipped)	High	L21-35	Passenger pretensioner	Low
L21-17	Side sensor (driver side) (if equipped)	High	L21-36		High
L21-18	Side air bag (inflator) module (driver side) (if equipped)	Low			
L21-19		High			

Diagnosis

WARNING:

To avoid deployment when troubleshooting the air bag system, do not use electrical test equipment such as a battery powered or AC powered voltmeter, ohmmeter, etc., or any type of electrical equipment other than that specified in this manual. Do not use a non-powered probe type tester. Instructions in this manual must be followed carefully, otherwise personal injury may result.

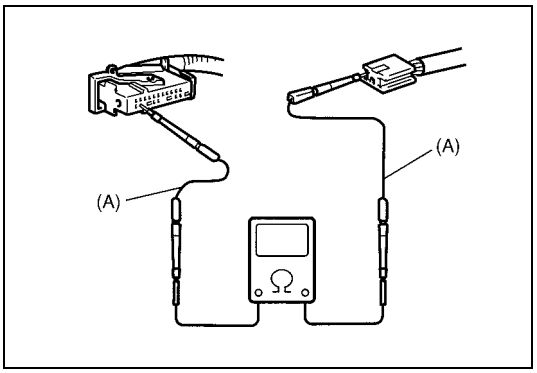
Diagnostic Trouble Code (DTC)

The “Air Bag Diagnostic System Check” must always be the starting point of any air bag system diagnosis. The “Air Bag Diagnostic System Check” checks for proper “AIR BAG” warning lamp operation and checks for air bag diagnostic trouble codes (DTCs) using Suzuki Scan Tool.

Use of Special Tool

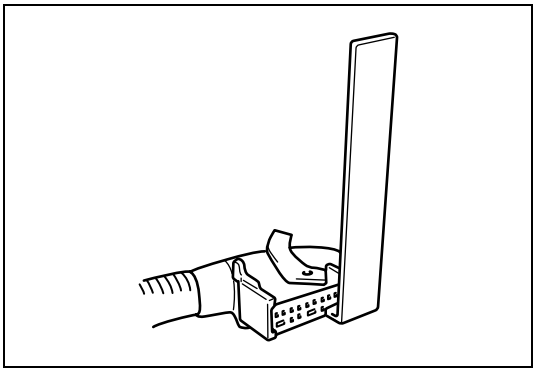
WARNING:
To avoid deployment when troubleshooting the air bag system, do not use electrical test equipment such as a battery powered or AC powered voltmeter, ohmmeter, etc., or any type of electrical equipment other than that specified in this manual. Do not use a non-powered probe type tester. Instructions in this manual must be followed carefully, otherwise personal injury may result.

You should be familiar with the tools listed in this section under the heading “Special Tool”. You should be able to measure voltage and resistance. You should be familiar with proper use of a scan tool such as Air Bag Driver/ Passenger Load Tool, Connector Test Adapter Kit and the Digital Multimeter.



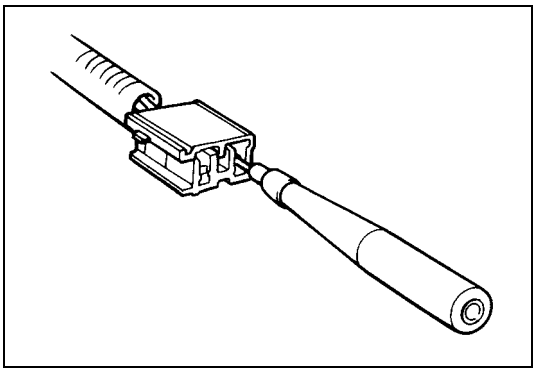
Special tool
(A): 09932-76010 (Connector Test Adapter Kit)

This must be used whenever a diagnostic procedure requests checking or probing a terminal.
Using the appropriate adapter in the special tool will ensure that no damage to the terminal will occur from the multimeter probe, such as spreading or bending.

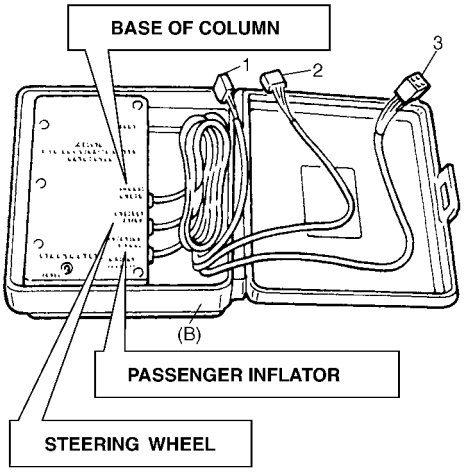


An SDM short bar release tool is included in the connector test adapter kit.

Inserting it into the SDM connector will release the shorting bar.



The adapter will also give an idea of whether contact tension is sufficient, helping to find an open or intermittent open due to poor terminal contact.



Special tool
(B): 09932-75010 (Air Bag Driver/Passenger Load Tool)

This tool is used only when called for in this section. It is used as a diagnostic aid and safety device to prevent inadvertent air bag (inflator) module deployment.
The load tool has three connectors attached to its case which are electrically functional and serve as resistive load substitutions.
No more than two connectors are used at any time.

One of connectors ("STEERING WHEEL") is used to substitute the load of followings.

- Driver air bag (inflator) module when it is connected at the top of the column to the contact coil assembly.
- Passenger air bag (inflator) module when it is connected to the air bag harness connector in floor harness for passenger air bag (inflator) module.
- Side air bag (inflator) module (driver and passenger side) when it is connected to the floor harness connector for side air bag (inflator) module.
- Each of driver and passenger seat belt pretensioners when it is connected to floor harness connector for driver and passenger seat belt pretensioners.

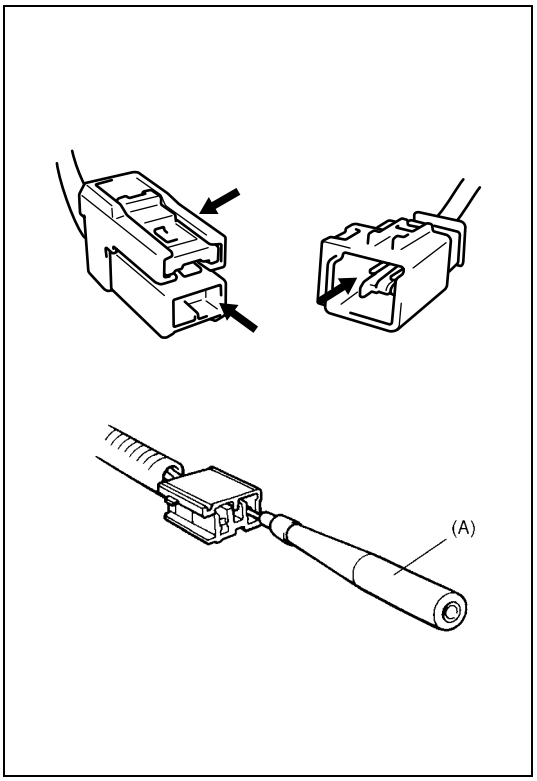
Another connector ("BASE OF COLUMN") is used to substitute the load of the driver air bag (inflator) module and the contact coil assembly when it is connected at the base of the column to the air bag wire harness in floor harness.
The third connector ("PASSENGER INFLATOR") is not used.

By substituting the resistance of the load tool when called for, a determination can be made as to whether an inflator circuit component is causing system malfunction and which component is causing the malfunction.
The load tool should be used only when specifically called for in the diagnostic procedures.

1. Connector for contact coil and driver air bag (inflator) module (Located near the base of the steering column)
2. Connector for driver and passenger air bag (inflator) module, side air bag (inflator) module (driver and passenger side) and driver and passenger seat belt pretensioners
3. Not used

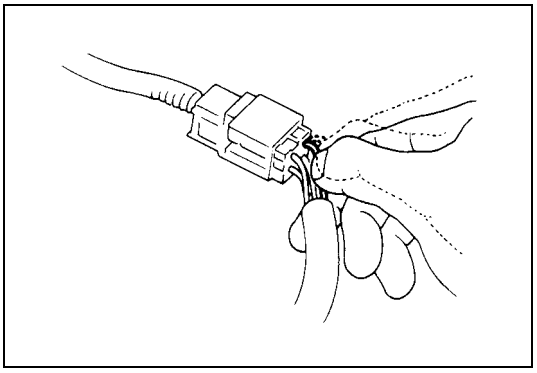
Intermittents and Poor Connections

Most intermittents are caused by faulty electrical connections or wiring. When a check for proper connection is requested in a diagnostic flow table, perform careful check of suspect circuits for:

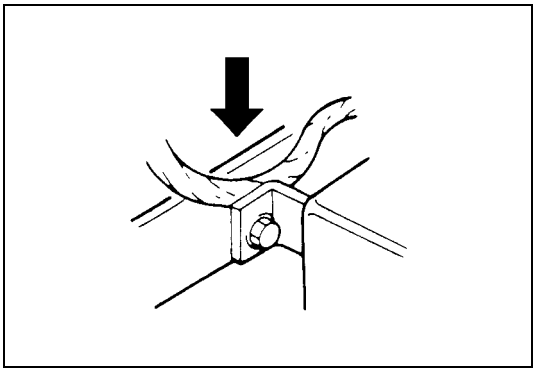


- Check connector for loose connection.
- Poor mating of connector halves, or terminals not fully seated in the connector body (backed out).
- Dirt or corrosion on the terminals. The terminals must be clean and free of any foreign material which could impede proper terminal contact.
  However, cleaning the terminal with a sand paper or the like is prohibited.
- Damaged connector body, exposing the terminals to moisture and dirt, as well as not maintaining proper terminal orientation with the component or mating connector.
- Improperly formed or damaged terminals.
  Check each connector terminal in problem circuits carefully to ensure good contact tension by using the corresponding mating terminal included in the connector test adapter kit (special tool).
  If contact tension is not enough, reform it to increase contact tension or replace.

Special tool
(A): 09932-76010 (Connector Test Adapter Kit)



- Poor terminal-to-wire connection.
  Check each wire harness in problem circuits for poor connection by shaking it by hand lightly. If any abnormal condition is found, change the wire harness assembly or component parts with new ones.



- Wire insulation which is rubbed through, causing an intermittent short as the bare area touches other wiring or parts of the vehicle.
- Wire broken inside the insulation. This condition could cause a continuity check to show a good circuit, but if only 1 or 2 strands of a multi-strand-type wire are intact, resistance could be far too high.

If any abnormality is found, repair or replace as a wire harness assembly.

Air Bag Diagnostic System Check

WARNING:

To avoid deployment when troubleshooting the air bag system, do not use electrical test equipment such as a battery powered or AC powered voltmeter, ohmmeter, etc., or any type of electrical equipment other than that specified in this manual. Do not use a non-powered probe type tester. Instructions in this manual must be followed carefully, otherwise personal injury may result.

CAUTION:

The order in which diagnostic trouble codes are diagnosed is very important. Failure to diagnose the diagnostic trouble codes in the order specified may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.

The diagnostic procedures used in this section are designed to find and repair air bag system malfunctions. To get the best results, it is important to use the diagnostic flow tables and follow the sequence listed below.

1) Perform the “Air Bag Diagnostic System Check Flow Table”.
   (The “Air Bag Diagnostic System Check Flow Table” must be the starting point of any air bag system diagnosis.
   The “Air Bag Diagnostic System Check Flow Table” checks for proper “AIR BAG” warning lamp operation through “AIR BAG” warning lamp and whether air bag diagnostic trouble codes exist.)
2) Refer to the proper diagnostic table as directed by the “Air Bag Diagnostic System Check Flow Table”.
   (The “Air Bag Diagnostic System Check Flow Table” will lead you to the correct table to diagnose any air bag system malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.)
3) Repeat the “Air Bag Diagnostic System Check Flow Table” after any repair or diagnostic procedures have been performed.
   (Performing the “Air Bag Diagnostic System Check Flow Table” after all repair or diagnostic procedures will ensure that the repair has been made correctly and that no other malfunctions exist.)

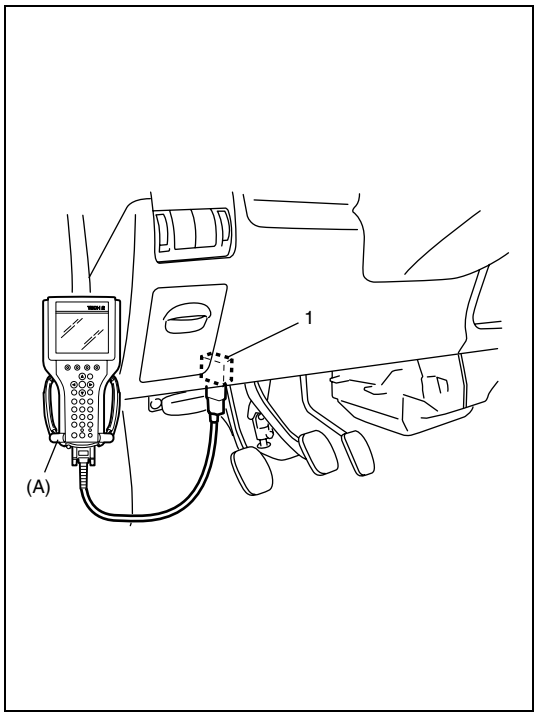
FLOW TABLE TEST DESCRIPTION

STEP 1: Check that “AIR BAG” warning lamp lights.
STEP 2: Check that “AIR BAG” warning lamp lights.
STEP 3: Check that “AIR BAG” warning lamp flashes 6 times after ignition switch is turned ON.
STEP 4: Check that history codes are in SDM memory.
STEP 5: Check that current code is in SDM memory.

Air Bag Diagnostic System Check Flow Table

Step	Action	Yes	No
1	1) Make sure that battery voltage is about 11 V or higher. 2) Note “AIR BAG” warning lamp as ignition switch is tuned ON. Does “AIR BAG” warning lamp come ON when ignition switch is tuned ON?	Go to step 2.	Proceed to “Table A – “AIR BAG” Warning Lamp Comes ON Steady Table B – “AIR BAG” Warning Lamp Does Not Come ON Table C – “AIR BAG” Warning Lamp Flashes” in this section.
2	Does “AIR BAG” warning lamp come ON steady?	Proceed to “Table A – “AIR BAG” Warning Lamp Comes ON Steady Table B – “AIR BAG” Warning Lamp Does Not Come ON Table C – “AIR BAG” Warning Lamp Flashes” in this section.	Go to step 3.
3	Does “AIR BAG” warning lamp turn OFF, after flashing 6 times?	“AIR BAG” warning lamp circuit is good condition. Go to step 4.	“AIR BAG” warning lamp circuit is good condition. Go to step 5.
4	1) Check DTC using Suzuki Scan Tool. Refer to “DTC Check” in this section. Is “NO CODES” displayed on Suzuki Scan Tool?	Air bag system is in good condition.	An intermittent trouble has occurred at some place. Check the connector harness, etc. related to the sensed DTC. Refer to “Intermittents and Poor Connections” in this section. Then clear DTC (Refer to “DTC Clearance” in this section.) and repeat this table.
5	1) Check DTC using Suzuki Scan Tool. Refer to “DTC Check” in this section. Is “NO CODES” displayed on Suzuki Scan Tool?	Substitute a known-good SDM and recheck.	Check and repair according to Flow Table corresponding to that DTC.

DTC Check



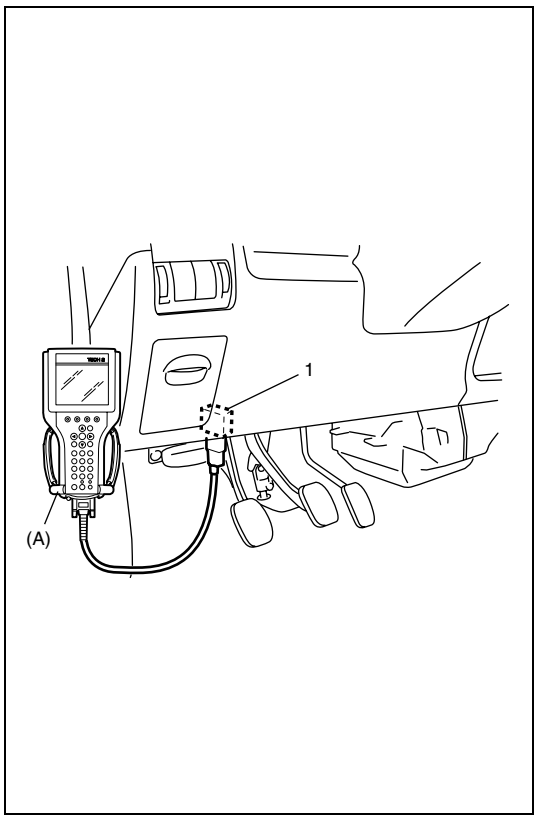
1) Turn ignition switch to OFF position.
2) After setting cartridge to Suzuki Scan Tool, connect it to data link connector (DLC) located on underside of instrument panel at driver's seat side.

Special tool
(A): Suzuki Scan Tooll

3) Turn ignition switch to ON position.
4) Read DTC according to instructions displayed on Suzuki Scan Tool and print it or write it down. Refer to Suzuki Scan Tool operator's manual for further details.
   If communication between scan tool and SDM is impossible, proceed to "Diagnostic Flow Table D" (Serial data check circuit).
5) After completing the check, turn ignition switch to OFF position and disconnect Suzuki Scan Tool from data link connector (DLC).

1. Data link connector (DLC)

DTC Clearance



1) Turn ignition switch to OFF position.
2) Connect Suzuki Scan Tool to data link connector (DLC) in the same manner as when making this connection for DTC check.

Special tool
(A): Suzuki Scan Tool

3) Turn ignition switch to ON position.
4) Erase DTC according to instructions displayed on Suzuki Scan Tool.
   Refer to Suzuki Scan Tool operator's manual for further details.
5) After completing the check, turn ignition switch to OFF position and disconnect Suzuki Scan Tool from DLC.
6) Perform "DTC Check" and confirm that normal DTC (NO CODES) is displayed and not malfunction DTC.

NOTE:

If DTC B1051, B1058, B1071 is stored in SDM, it is not possible to clear all DTC.

1. Data link connector (DLC)

DTC Table

DTC	Diagnosis		
–	Normal		–
B1015	Passenger air bag circuit	Resistance high	Diagnose trouble according to diagnostic flow table corresponding to each code No.
B1016		Resistance low	
B1018		Short to ground	
B1019		Short to power circuit	
B1021	Driver air bag circuit	Resistance high	
B1022		Resistance low	
B1024		Short to ground	
B1025		Short to power circuit	
B1031	Power source voltage	Too high	
B1032		Too low	
B1041	Driver pretensioner circuit	Resistance high	
B1042		Resistance low	
B1043		Short to ground	
B1044		Short to power circuit	
B1045	Passenger pretensioner circuit	Resistance high	
B1046		Resistance low	
B1047		Short to ground	
B1048		Short to power circuit	
B1051	SDM	Frontal crash detected	
B1056		Sideward crash (driver side) detected	
B1057		Sideward crash (passenger side) detected	
B1058		Frontal crash detected (pretensioner activation command outputted)	
B1061	“AIR BAG” warning lamp circuit	Circuit failure	
B1063	Side sensor circuit (driver side)	Short to ground	
B1064		Short to power circuit or open	
B1065	Side sensor circuit (passenger side)	Short to ground	
B1066		Short to power circuit or open	
B1071	SDM	Internal fault	
B1072	Side sensor (driver side)	Internal fault	
B1073	Side sensor circuit (driver side)	Correspondence abnormality	
B1074	Side sensor (passenger side)	Internal fault	
B1075	Side sensor circuit (passenger side)	Correspondence abnormality	
B1076	Side sensor (driver side)	Wrong ID	
B1077	Side sensor (passenger side)	Wrong ID	
B1081	Side air bag circuit (driver side)	Resistance high	
B1082		Resistance low	
B1083		Short to ground	
B1084		Short to power circuit	
B1085	Side air bag circuit (passenger side)	Resistance high	
B1086		Resistance low	
B1087		Short to ground	
B1088		Short to power circuit	

Scan Tool Data

As the data values given below are standard values estimated on basis of obtained from the normally operating vehicle by using a scan tool, use them as reference value.

NOTE:

When checking the data with the engine running at idle or racing, be sure to shift M/T gear to the neutral gear position and A/T gear to the "Park" position and pull the parking brake fully. Also, if nothing or "no load" is indicated, turn OFF A/C, all electric loads and all the other necessary switches.

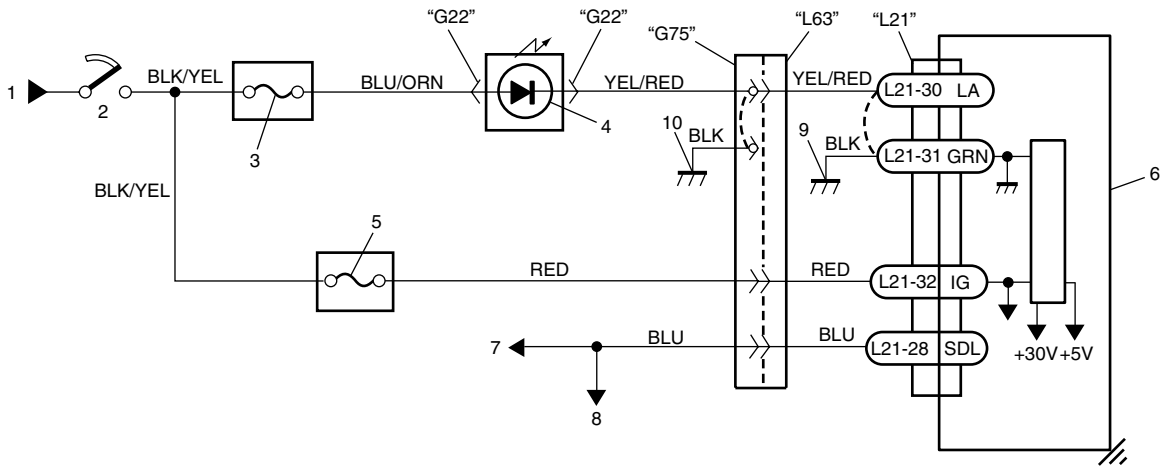
Scan Tool Data	Normal Condition/Reference Value
Back Up Volt	27.0 – 33.0 V
Battery Voltage	10.6 – 16.5 V
System ID	4 ch or 6 ch
Driv Air Bag Ini Res	2.5 – 3.4 OHMS
Pass Air Bag Ini Res	1.9 – 2.5 OHMS
Driv Preten Ini Res	1.8 – 2.5 OHMS
Pass Preten Ini Res	1.8 – 2.5 OHMS
Driv Sidebag Ini Res	1.7 – 2.3 OHMS
Pass Sidebag Ini Res	1.7 – 2.3 OHMS

Scan Tool Data Definition

Back Up Volt (V): This parameter indicates the capacity of the backup condenser installed to maintain the ignition current (as much as possible) even when the power supply to SDM that ignites the inflator is shut off.
Battery Voltage (V): Battery voltage is an analog input signal read by the SDM.
System ID (4 ch/6 ch): This parameter indicates the number of initiator circuits.
Driv Air Bag Ini Res (OHMS (Ω)): This parameter indicates the resistance of the driver's air bag initiator circuit.
Pass Air Bag Ini Res (OHMS (Ω)): This parameter indicates the resistance of the passenger's air bag initiator circuit.
Driv Preten Ini Res (OHMS (Ω)): This parameter indicates the resistance of the driver's seat belt pretensioner initiator circuit.
Pass Preten Ini Res (OHMS (Ω)): This parameter indicates the resistance of the passenger's seat belt pretensioner initiator circuit.
Driv Sidebag Ini Res (OHMS (Ω)): This parameter indicates the resistance of the driver's side air bag initiator circuit.
Pass Sidebag Ini Res (OHMS (Ω)): This parameter indicates the resistance of the passenger's side air bag initiator circuit.

Table A – "AIR BAG" Warning Lamp Comes ON Steady
Table B – "AIR BAG" Warning Lamp Does Not Come ON
Table C – "AIR BAG" Warning Lamp Flashes

WIRING DIAGRAM



1. From main fuse	5. "AIR BAG" fuse	9. Ground for air bag system
2. Ignition switch	6. SDM	10. Ground on body
3. "METER" fuse	7. To DLC	
4. "AIR BAG" warning lamp in combination meter	8. To ECM and ABS control module (if equipped)	

CAUTION:

- **Be sure to perform "Air Bag Diagnostic System Check" before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a tester along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to "Intermittents and Poor Connections" in this section.**
- **If there is open circuit in the air bag wire harness, connector or terminal is found damaged, replace the wire harness, connector and terminal as an assembly.**

TABLE TEST DESCRIPTION

Table A: "AIR BAG" Warning Lamp Come ON Steady

STEP 1: Check for "AIR BAG" fuse blown.
STEP 2: Check for loose connection between floor wire harness and instrument panel wire harness.
STEP 3: Check for loose connection between SDM connector and SDM.
STEP 4: Check for power supply circuit.
STEP 5: Check for short circuit between "AIR BAG" warning lamp circuit and ground.

Table B: "AIR BAG" Warning Lamp Does Not Come ON

STEP 1: Check for combination meter power supply circuit.
STEP 2: Check for "AIR BAG" warning lamp blown.
STEP 3: Check for open circuit in "AIR BAG" warning lamp circuit.
STEP 4: Check for short circuit between "AIR BAG" warning lamp circuit and power supply circuit.

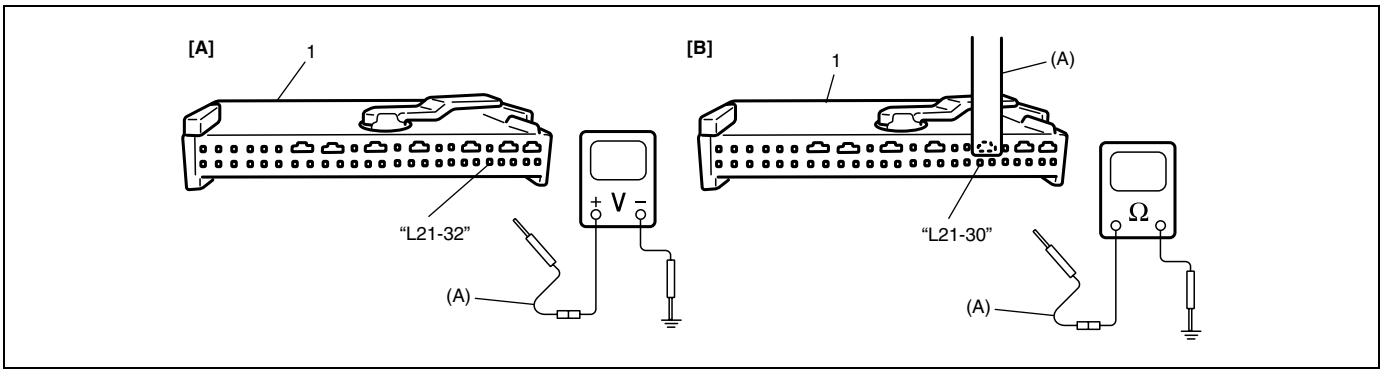
Table C: "AIR BAG" Warning Lamp Flashes

Check for short circuit between diagnosis switch circuit and ground.

DIAGNOSTIC FLOW TABLE

Table A: "AIR BAG" Warning Lamp Come ON Steady

Step	Action	Yes	No
1	1) Ignition switch turn to OFF position. 2) Remove and inspect "AIR BAG" fuse. Is fuse good?	Go to step 2.	Clear up short circuit between "RED" wire and ground. After clearing up, replace "AIR BAG" fuse.
2	1) Check for loose connection between "G75" and "L63" connectors. Is connection good?	Go to step 3.	Clear up loose connection between "G75" and "L63" connectors.
3	1) Check for loose connection between SDM connector "L21" and SDM. Is connection good?	Go to step 4.	Clear up loose connection between SDM connector "L21" and SDM.
4	1) Disconnect SDM connector "L21". 2) Turn ignition switch to ON position. 3) Measure voltage between "L21-32" terminal and body ground. Is it 10 – 14V?	Go to step 5.	Check and clear up the following possible cause. • Open circuit in "RED" or "BLK/YEL" wire. • Short circuit between "BLK/YEL" and ground.
5	1) Disconnect "G22" connector from combination meter referring to "Combination meter" in Section 8. 2) Release shorting bar of "L21-30" terminal inserting release tool (A). 3) Measure resistance between "L21-30" terminal and body ground. Is resistance infinity?	Substitute a known-good SDM and recheck.	Clear up short circuit between "YEL/RED" wire and ground.



[A]: Fig. for Step 4
[B]: Fig. for Step 5
1. SDM connector "L21"

Special tool
(A): 09932-76010

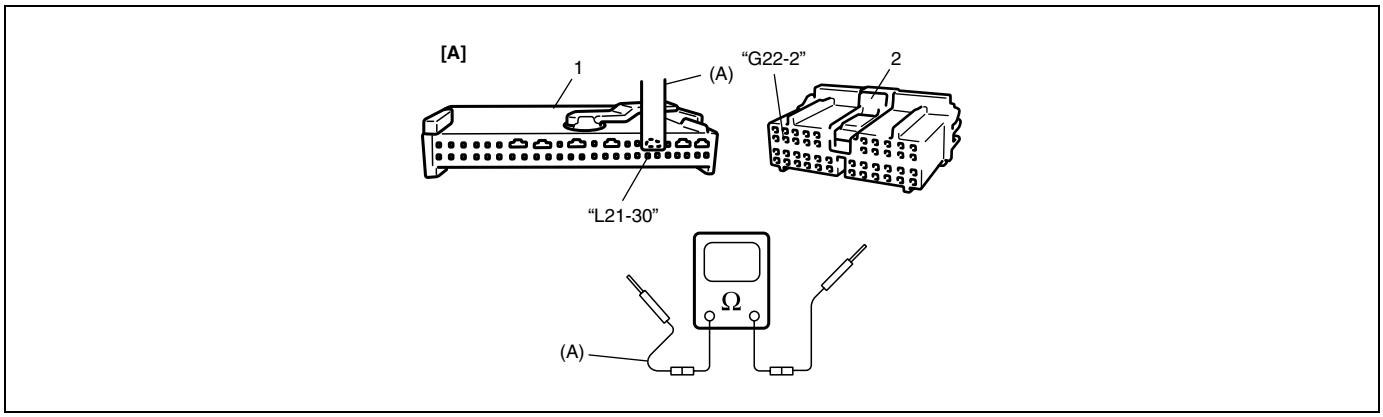
NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

Table B: "AIR BAG" Warning Lamp Does Not Come ON

Step	Action	Yes	No
1	1) Set parking brake. 2) Turn ignition switch to ON position. Does brake system warning light ("BRAKE") come ON?	Go to Step 2.	Check and clear up the following possible cause. • Open Circuit in "BLK/RED" or "BLK/YEL" wire. • Short circuit between "BLK/RED" or "BLK/YEL" and ground. • "METER" fuse blown.
2	1) Turn ignition switch to OFF position. 2) Disconnect SDM connector "L21". 3) Turn ignition switch to ON position. Does "AIR BAG" warning lamp come ON?	Substitute a known-good SDM and recheck.	Go to Step 3.
3	1) Turn ignition switch to OFF position. 2) Remove combination meter referring to "Combination Meter" in Section 8. 3) Release shorting bar of "L21-30" terminal inserting release tool (A). 4) Check continuity between "G22-2" and "L21-30" terminals. Is there any continuity?	Replace combination meter.	Go to Step 4.
4	1) Check for loose connection between "G75" and "L63" connector. Is connection good?	Clear up open circuit in "YEL/RED" wire.	Clear up loose connection between "G75" and "L63" connectors.



[A]: Fig. for Step 3
1. SDM connector "L21"
2. "G22" connector (22-pin) for combination meter

Special tool
(A): 09932-76010

NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

Table C: "AIR BAG" Warning Lamp Flashes

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect SDM connector "L21". 2) Check "L21-8" terminal of SDM. Is it shorted to ground terminal or harness.	Clean up terminal.	Substitute a known-good SDM and recheck.

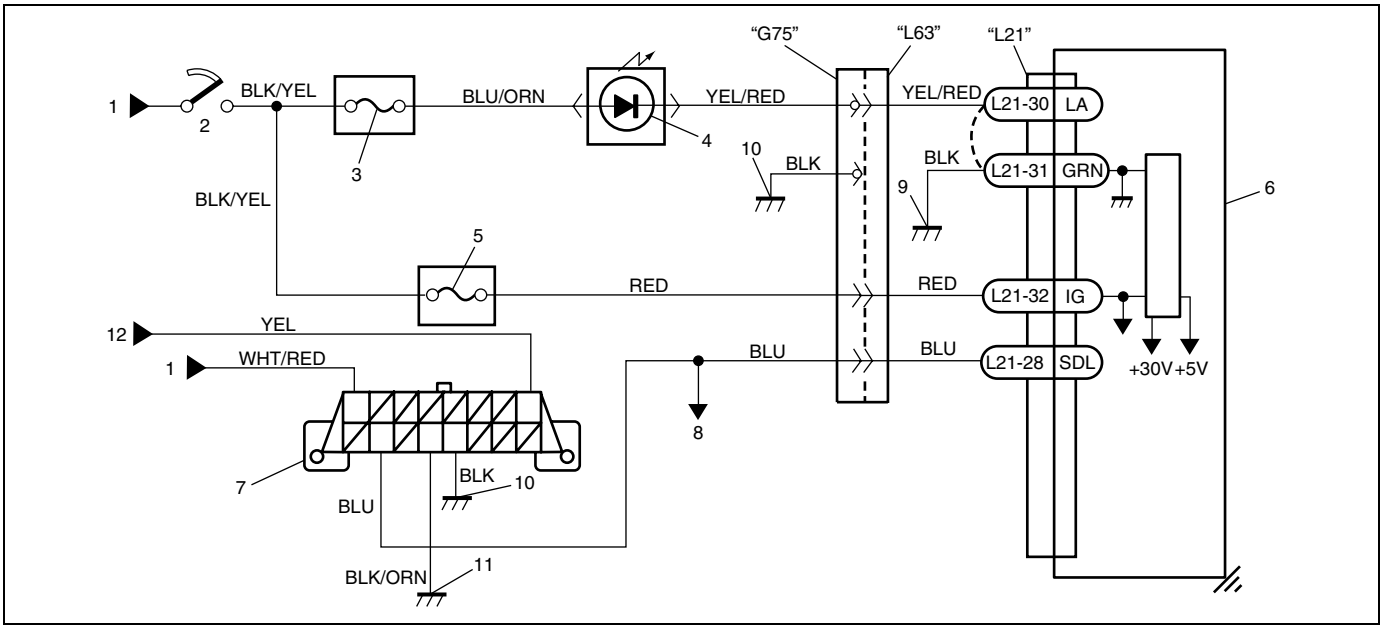
Special tool
(A): 09932-76010

NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

Table D – SDM Cannot Communicate Through the Serial Data Circuit

WIRING DIAGRAM



1. From main fuse	5. "AIR BAG" fuse	9. Ground for air bag system
2. Ignition switch	6. SDM	10. Ground on body
3. "METER" fuse	7. DLC	11. Ground on Engine block
4. "AIR BAG" warning lamp in combination meter	8. To ECM, and ABS control module (if equipped)	12. Immobilizer control module (if equipped)

CAUTION:

- **Be sure to perform "Air Bag Diagnostic System Check" before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a tester along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to "Intermittents and Poor Connections" in this section.**
- **If there is open circuit in the air bag wire harness, connector or terminal is found damaged, replace the wire harness, connector and terminal as an assembly.**

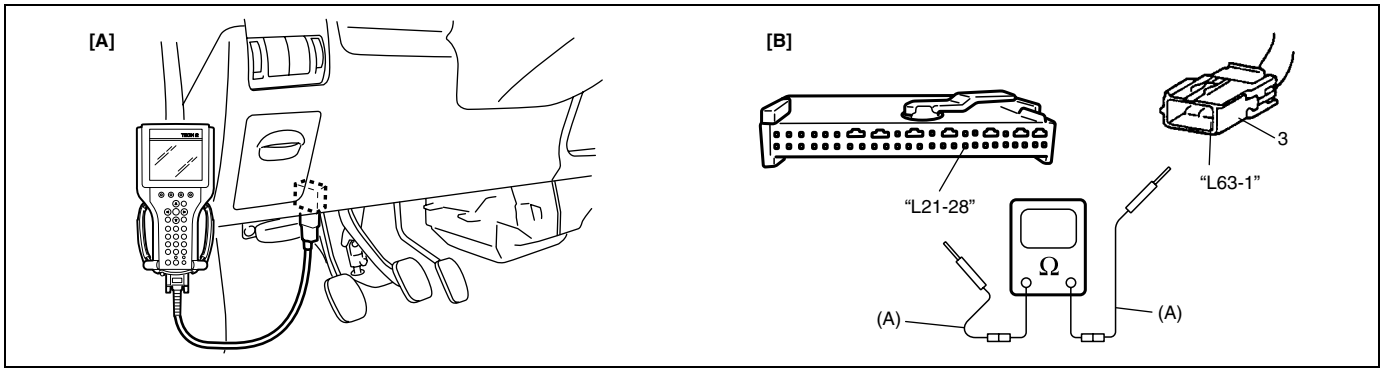
TABLE TEST DESCRIPTION

STEP 1: An improper connection to the data link connector (DLC) will prevent communications from being established.
STEP 2: This test checks whether it is possible to communicate with other control module.
STEP 3: This test checks for an open in "Serial data" circuit.

DIAGNOSTIC FLOW TABLE

Step	Action	Yes	No
1	1) Make sure that Suzuki Scan Tool is free from malfunction and correct PC card. 2) Ignition switch OFF. 3) Check proper connection of Suzuki Scan Tool to DLC. Is connection in good condition?	Go to step 2.	Properly connect Suzuki Scan Tool to DLC.

Step	Action	Yes	No
2	1) Check if communication is possible by trying communication with other control module (ECM or ABS control module (if equipped)). Is it possible to communicate with other control module?	Go to step 3.	Repair open in common section of serial data circuit (“BLU” wire circuit) used by all controllers or short to ground or power circuit which has occurred somewhere in serial data circuit (“BLU” wire circuit).
3	1) With ignition switch OFF, disconnect SDM connector “L21” and “L63” connector. 2) Check proper connection at “L63-1” (“BLU” wire) terminal for DLC. 3) If OK, then check resistance between “L63-1” (“BLU” wire) terminal and “L21-28” terminal of SDM connector “L21”. Is resistance 0 – 1 Ω?	Substitute a known-good SDM and recheck.	Repair high resistance or open in “BLU” wire circuit (between “L83” connector and SDM).



[A]: Fig. for STEP 1
[B]: Fig. for STEP 3
1. DLC
2. Scan tool
3. Floor harness side connector

Special tool
(A): 09932-76010

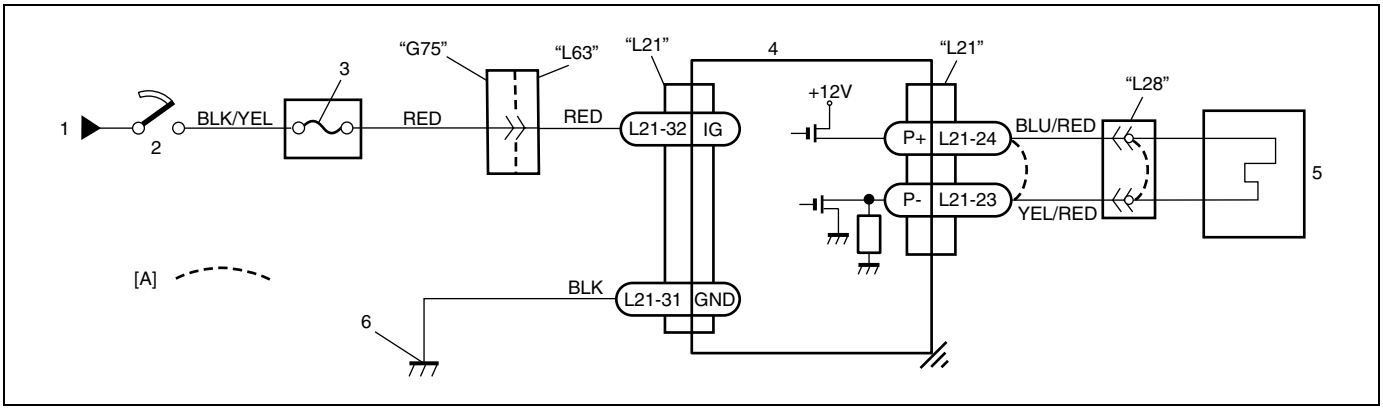
NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Repeat “Air Bag Diagnostic System Check” to confirm that the trouble has been corrected.**

DTC B1015 – Passenger Air Bag Initiator Circuit Resistance High
DTC B1016 – Passenger Air Bag Initiator Circuit Resistance Low
DTC B1018 – Passenger Air Bag Initiator Circuit Short to Ground
DTC B1019 – Passenger Air Bag Initiator Circuit Short to Power Circuit

WIRING DIAGRAM



[A]: Shorting bar	2. Ignition switch	4. SDM	6. Ground for air bag system
1. From main fuse	3. "AIR BAG" fuse	5. Passenger air bag (inflator) module	

CAUTION:

- **Be sure to perform "Air Bag Diagnostic System Check" before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a tester along with a correct terminal adaptor from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to "Intermittents and Poor Connections" in this section.**
- **If there is open circuit in the air bag wire harness, connector or terminal is found damaged, replace the wire harness, connector and terminal as an assembly.**

DTC WILL BE SET WHEN

DTC B1015:

The combined resistance of the passenger air bag (inflator) module, harness wiring and connector terminal contact is above a specified value for specified time.

DTC B1016:

The combined resistance of the passenger air bag (inflator) module, harness wiring and connector terminal contact is below a specified value for specified time.

DTC B1018:

The voltage measured at passenger air bag initiator circuit is below a specified value for specified time.

DTC B1019:

The voltage measured at passenger air bag initiator circuit is above a specified value for specified time.

TABLE TEST DESCRIPTION

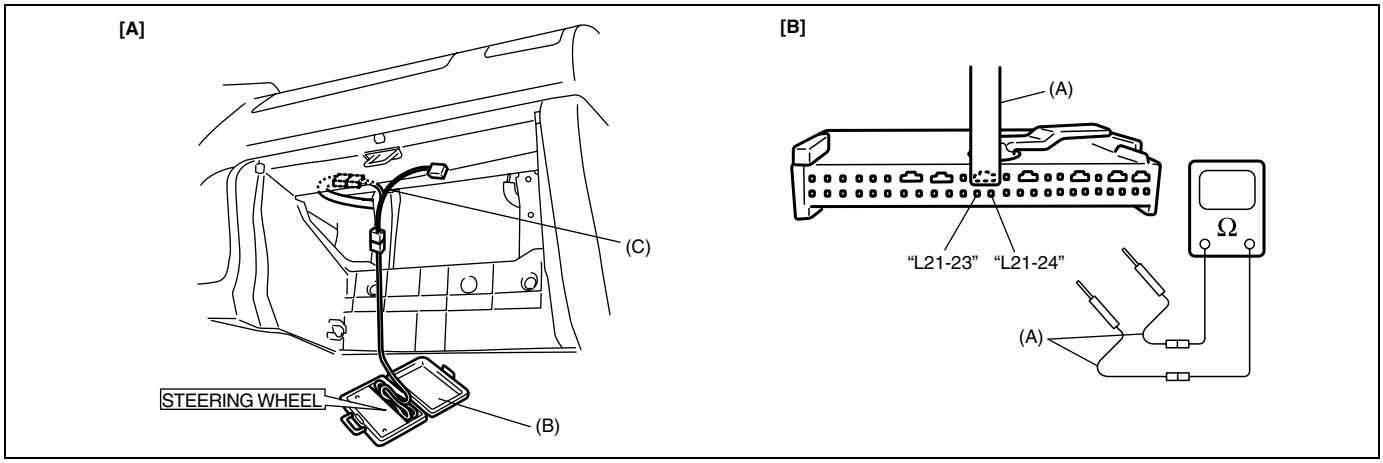
DTC B1015, B1016, B1018 or B1019:

STEP 1: Check whether malfunction is in passenger air bag (inflator) module.
STEP 2: Check passenger air bag (inflator) module initiator circuit in air bag harness.
STEP 3: Check passenger air bag (inflator) module initiator circuit in air bag harness. (for DTC B1019 only)

DIAGNOSTIC FLOW TABLE

DTC B1015:

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector “L28” behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in “L28” connector. 3) If OK, then connect Special Tool (B) and (C) to passenger air bag (inflator) module connector “L28” disconnected at the step 1). With ignition switch ON, is DTC B1015 current?	Go to step 2.	Ignition switch OFF. Replace passenger air bag (inflator) module (Refer to “Passenger Air Bag (Inflator) Module Inspection” in this section).
2	1) With ignition switch OFF, disconnect SDM connector “L21”. 2) Check proper connection to SDM at terminals “L21-24” and “L21-23”. 3) If OK, then measure resistance between “L21-24” and “L21-23” terminals with connected Special Tool (B). Is resistance 2.5 Ω or less?	Substitute a known-good SDM and recheck.	Repair high resistance or open in “BLU/RED” or “YEL/RED” wire circuit.



[A]: Fig. for STEP 1 and 2
[B]: Fig. for STEP 2

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78340

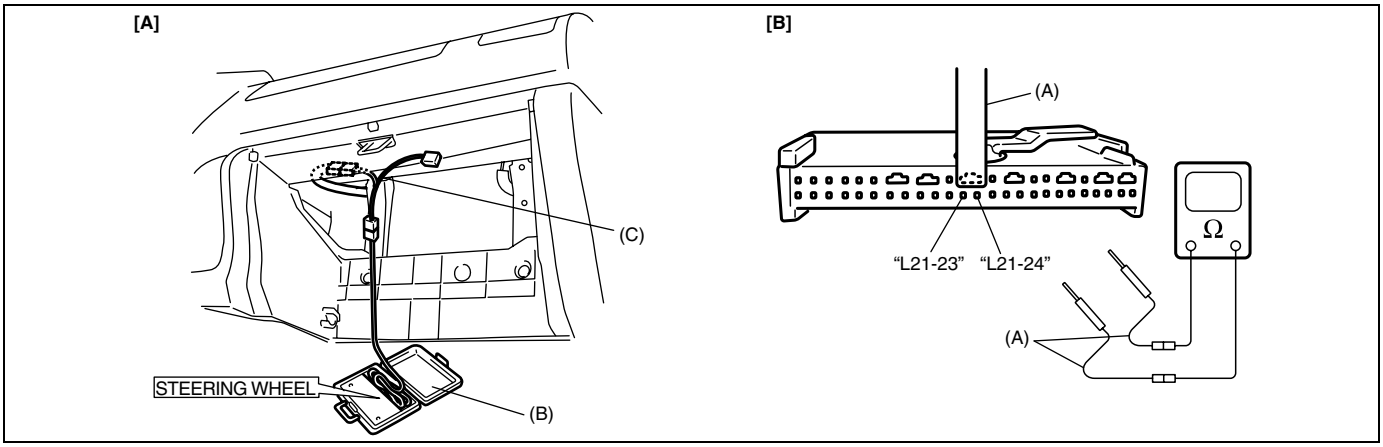
NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to “Diagnostic Trouble Code (DTC) Clearance”), if any.**
- **Repeat “Air Bag Diagnostic System Check” to confirm that the trouble has been corrected.**

DTC B1016:

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector "L28" behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in "L28" connector. 3) If OK, then connect Special Tool (B) and (C) to passenger air bag (inflator) module connector disconnected at the step 1). With ignition switch ON, is DTC B1016 current?	Go to step 2.	Ignition switch OFF. Replace passenger air bag (inflator) module (Refer to "Passenger Air Bag (Inflator) Module Inspection" in this section).
2	1) With ignition switch OFF, disconnect SDM connector "L21". 2) Check proper connection to SDM at terminals "L21-24" and "L21-23". 3) If OK, then measure resistance between "L21-24" and "L21-23" terminals with connected Special Tool (B). Is resistance 1.9 Ω or more?	Substitute a known-good SDM and recheck.	Repair short from "BLU/RED" wire circuit to "YEL/RED" wire circuit or from "BLU/RED" or "YEL/RED" wire circuit to other wire circuit.



[A]: Fig. for STEP 1 and 2
[B]: Fig. for STEP 2

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78340

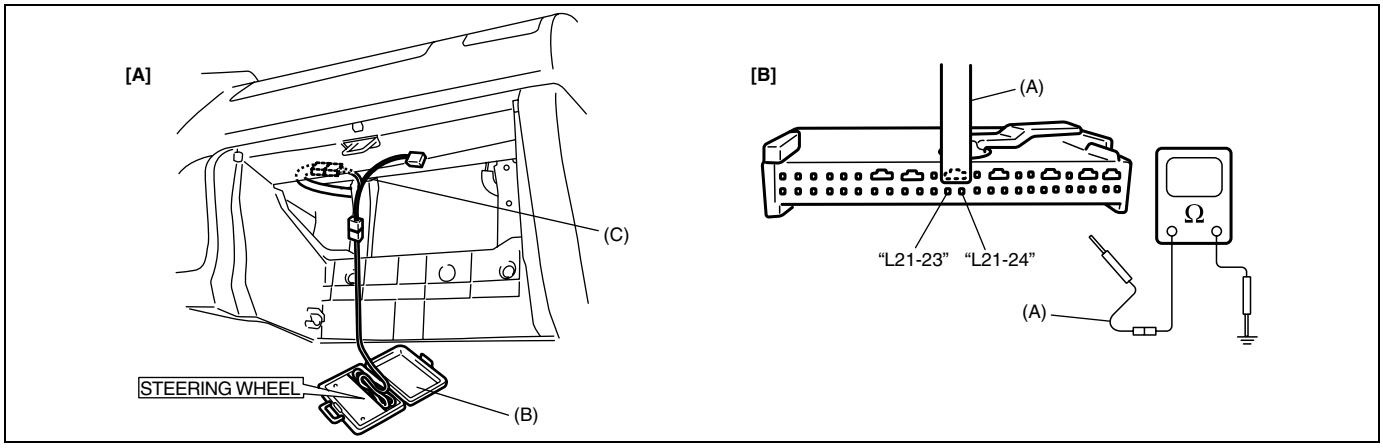
NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1018:

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector "L28" behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in "L28" connector. 3) If OK, then connect Special Tool (B) and (C) to passenger air bag (inflator) module connector "L28" disconnected at the step 1). With ignition switch ON, is DTC B1018 current?	Go to step 2.	Ignition switch OFF. Replace passenger air bag (inflator) module (Refer to "Passenger Air Bag (Inflator) Module Inspection" in this section).
2	1) With ignition switch OFF, disconnect Special Tool (B), (C) and SDM connector "L21". 2) Measure resistance between "L21-24" terminal and body ground. Is resistance infinity?	Go to step 3.	Repair short from "BLU/RED" wire circuit to ground.
3	1) Measure resistance between "L21-23" terminal and body ground. Is resistance infinity?	Substitute a known-good SDM and recheck.	Repair short from "YEL/RED" wire circuit to ground.



[A]: Fig. for STEP 1, 2 and 3
[B]: Fig. for STEP 2 and 3

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78340

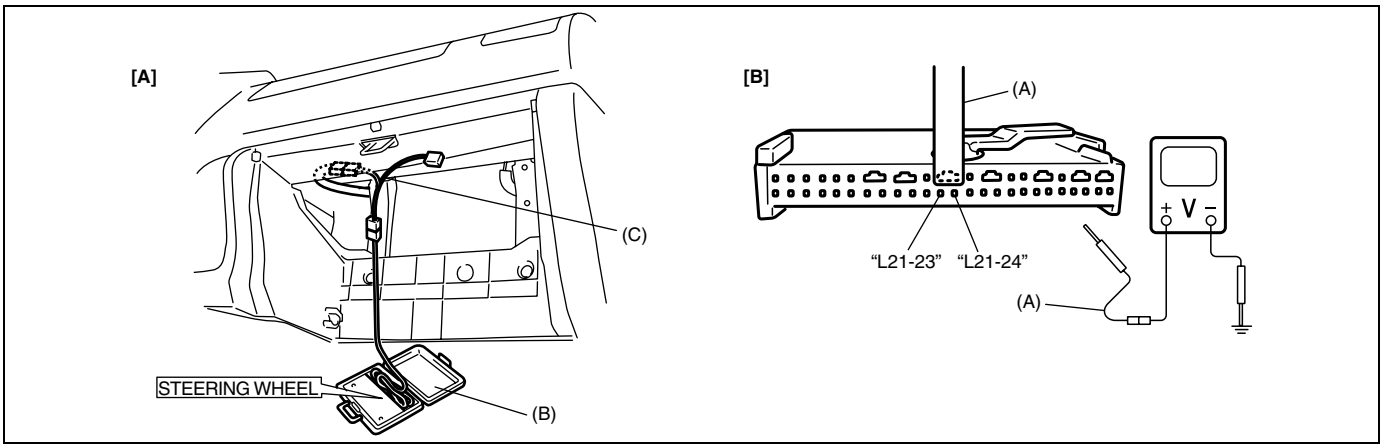
NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1019:

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector “L28” behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in “L28” connector. 3) If OK, then connect Special Tool (B) and (C) to passenger air bag (inflator) module connector “L28” disconnected at the step 1). With ignition switch ON, is DTC B1019 current?	Go to step 2.	Ignition switch OFF. Replace passenger air bag (inflator) module (Refer to “Passenger Air Bag (Inflator) Module Inspection” in this section).
2	1) With ignition switch OFF, disconnect Special Tool (B), (C) and SDM connector “L21”. 2) Measure voltage from “L21-24” terminal to body ground. With ignition switch ON, is voltage 0 – 1 V?	Go to step 3.	Repair short from “BLU/RED” wire circuit to power circuit.
3	1) Measure voltage from “L21-23” terminal to body ground. With ignition switch ON, is voltage 0 – 1 V?	Substitute a known-good SDM and recheck.	Repair short from “YEL/RED” wire circuit to power circuit.



[A]: Fig. for STEP 1, 2 and 3
[B]: Fig. for STEP 2 and 3

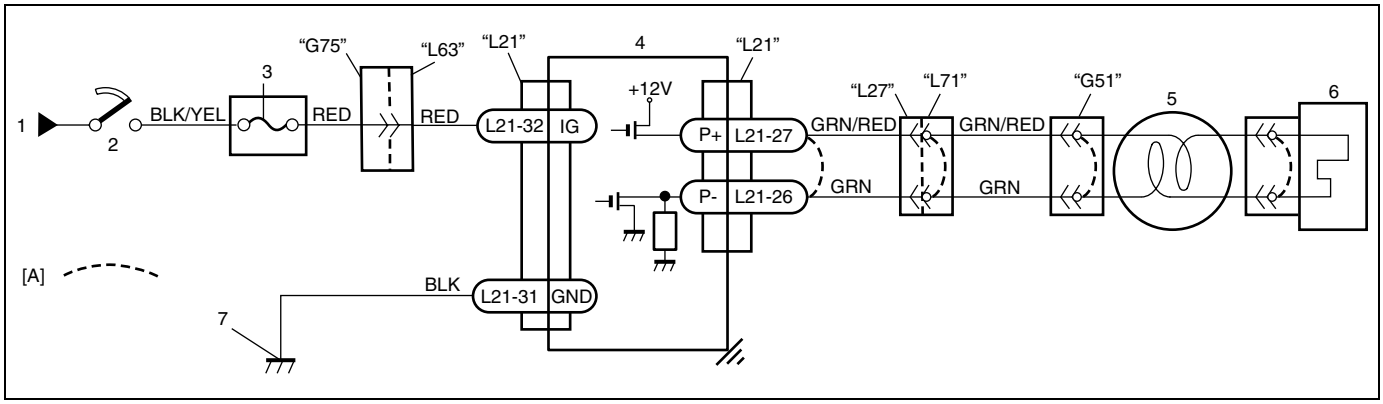
Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78340

NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to “Diagnostic Trouble Code (DTC) Clearance”), if any.**
- **Repeat “Air Bag Diagnostic System Check” to confirm that the trouble has been corrected.**

DTC B1021 – Driver Air Bag Initiator Circuit Resistance High
DTC B1022 – Driver Air Bag Initiator Circuit Resistance Low
DTC B1024 – Driver Air Bag Initiator Circuit Short to Ground
DTC B1025 – Driver Air Bag Initiator Circuit Short to Power Circuit

WIRING DIAGRAM



[A]: Shorting bar	3. "AIR BAG" fuse	6. Driver air bag (inflator) module
1. From main fuse	4. SDM	7. Ground for air bag system
2. Ignition switch	5. Contact coil assembly	

CAUTION:

- Be sure to perform "Air Bag Diagnostic System Check" before starting diagnosis according to flow table.
- When measurement of resistance or voltage is required in this table, use a tester along with a correct terminal adapter from special tool (Connector test adapter kit).
- When a check for proper connection is required, refer to "Intermittents and Poor Connections" in this section.
- If there is open circuit in the air bag wire harness, connector or terminal is found damaged, replace the wire harness, connector and terminal as an assembly.

DTC WILL BE SET WHEN

DTC B1021:

The combined resistance of the driver air bag (inflator) module, contact coil assembly, harness wiring and connector terminal contact is above a specified value for specified time.

DTC B1022:

The combined resistance of the driver air bag (inflator) module, contact coil assembly, harness wiring and connector terminal contact is below a specified value for specified time.

DTC B1024:

The voltage measured at driver air bag initiator circuit is below a specified value for specified time.

DTC B1025:

The voltage measured at driver air bag initiator circuit is above a specified value for specified time.

TABLE TEST DESCRIPTION

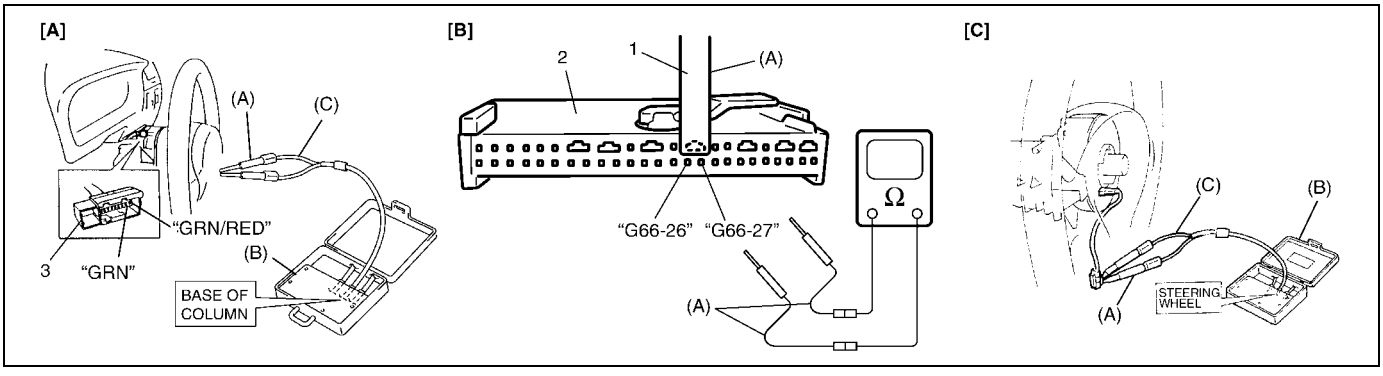
DTC B1021, B1022, B1024 or B1025:

STEP 1: Check whether malfunction is in contact coil and driver air bag (inflator) module or the others.
STEP 2: Check driver air bag (inflator) module initiator circuit.
STEP 3: Check whether malfunction is in contact coil or driver air bag (inflator) module.

DIAGNOSTIC FLOW TABLE

DTC B1021:

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect contact coil connector "G51" behind steering wheel. 2) Check proper connection to contact coil at terminals in "G51" connector. 3) If OK, then connect Special Tool (B) and (C) to contact coil connector "G51" disconnected at step 1). With ignition switch ON, is DTC B1021 current?	Go to step 2.	Go to step 3.
2	1) With ignition switch OFF, disconnect SDM connector "L21". 2) Check proper connection to SDM at terminals "L21-27" and "L21-26". 3) If OK, then measure resistance between "L21-27" and "L21-26" terminals with Special Tool (B) connected. Is resistance 3.4 Ω or less?	Substitute a known-good SDM and recheck.	Repair high resistance or open in "GRN/RED" or "GRN" wire circuit.
3	1) With ignition switch OFF, disconnect Special Tool (B) and (C) then reconnect contact coil connector "L71". 2) Remove driver air bag (inflator) module from steering wheel (Refer to "Driver Air Bag (Inflator) Module Removal and Installation" in Section 3C). 3) Check proper connection to driver air bag (inflator) module at terminals in driver air bag (inflator) module connector. 4) If OK, then connect Special Tool (B) and (C) to driver air bag (inflator) module connector. With ignition switch ON, is DTC B1021 current?	Ignition switch OFF. Replace contact coil assembly (Refer to "Contact Coil Cable Assembly Removal and Installation" in Section 3C).	Ignition switch OFF. Replace driver air bag (inflator) module (Refer to "Driver Air Bag (Inflator) Module Removal and Installation" in Section 3C).



[A]: Fig. for STEP 1 and 2	[B]: Fig. for STEP 2	[C]: Fig. for STEP 3

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78310

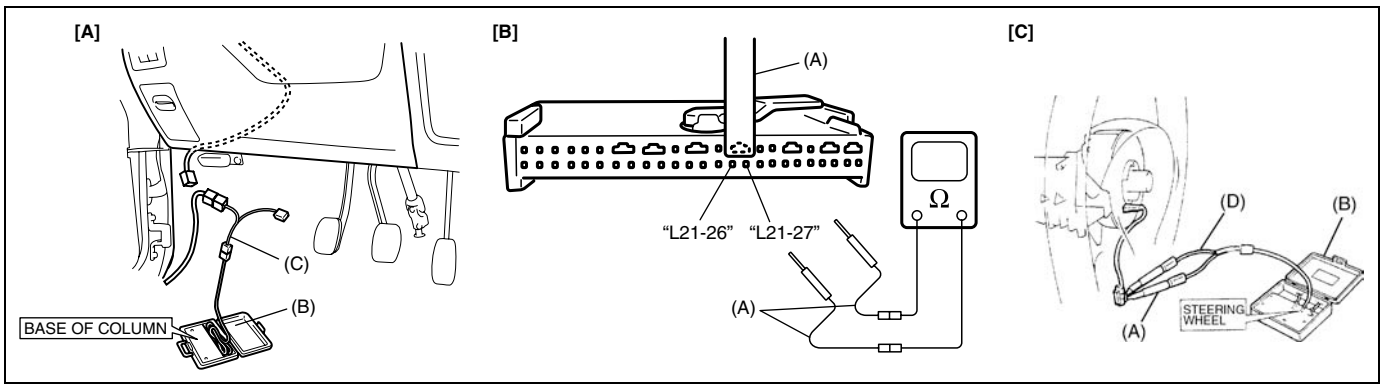
NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1022:

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect contact coil connector “L71” located near the base of the steering column. 2) Check proper connection to contact coil at terminals in “L71” connector. 3) If OK, then connect Special Tool (B) and (C) to contact coil connector “L71” disconnected at step 1). With ignition switch ON, is DTC B1022 current?	Go to step 2.	Go to step 3.
2	1) With ignition switch OFF, disconnect SDM connector “L21”. 2) Check proper connection to SDM at terminals “L21-27” and “L21-26”. 3) If OK, then measure resistance between “L21-27” and “L21-26” terminals with Special Tool (B) and (C) connected. Is resistance 2.5 Ω or more?	Substitute a known-good SDM and recheck.	Repair short from “GRN/RED” wire circuit to “GRN” wire circuit or from “GRN/RED” or “GRN” wire circuit to other wire circuit.
3	1) With ignition switch OFF, disconnect Special Tool (B) and (C), then reconnect contact coil connector “L71” located near the base of the steering column. 2) Remove driver air bag (inflator) module from steering wheel (Refer to “Driver Air Bag (Inflator) Module Removal and Installation” in Section 3C). 3) Check proper connection to driver air bag (inflator) module at terminals in driver air bag (inflator) module connector. 4) If OK, then connect Special Tool (B) and (C) to driver air bag (inflator) module connector. With ignition switch ON, is DTC B1022 current?	Ignition switch OFF. Replace contact coil assembly (Refer to “Contact Coil Cable Assembly Removal and Installation” in Section 3C).	Ignition switch OFF. Replace driver air bag (inflator) module (Refer to “Driver Air Bag (Inflator) Module Removal and Installation” in Section 3C).



[A]: Fig. for STEP 1 and 2	[B]: Fig. for STEP 2	[C]: Fig. for STEP 3

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78340
(D): 09932-78310

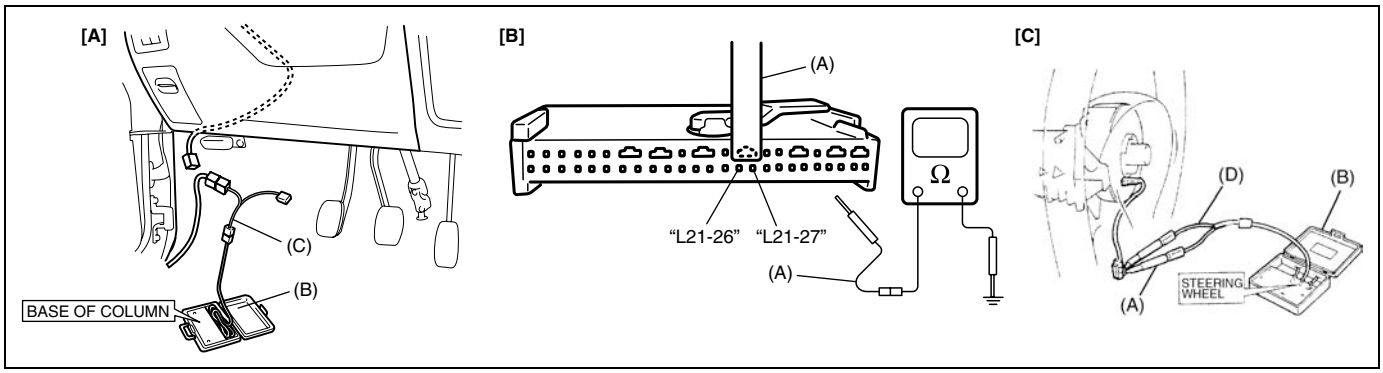
NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1024:

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect contact coil connector "L71" located near the base of the steering column. 2) Check proper connection to contact coil at terminals in "L71" connector. 3) If OK, then connect Special Tool (B) and (C) to contact coil connector "L71" disconnected at step 1). With ignition switch ON, is DTC B1024 current?	Go to step 2.	Go to step 3.
2	1) With ignition switch OFF, disconnect Special Tool (B), (C) and SDM connector "L21". 2) Measure resistance between "L21-27" terminal and body ground and between "L21-26" terminal and body ground. Are they infinity?	Substitute a known-good SDM and recheck.	Repair short from "GRN/RED" or "GRN" wire circuit to ground.
3	1) With ignition switch OFF, disconnect Special Tool (B) and (C), then reconnect contact coil connector "L71"located near the base of the steering column. 2) Remove driver air bag (inflator) module from steering wheel (Refer to "Driver Air Bag (Inflator) Module Removal and Installation" in Section 3C). 3) Check proper connection to driver air bag (inflator) module at terminals in driver air bag (inflator) module connector. 4) If OK, then connect Special Tool (B) and (C) to driver air bag (inflator) module connector. With ignition switch ON, is DTC B1024 current?	Ignition switch OFF. Replace contact coil assembly (Refer to "Contact Coil Cable Assembly Removal and Installation" in Section 3C).	Ignition switch OFF. Replace driver air bag (inflator) module (Refer to "Driver Air Bag (Inflator) Module Removal and Installation" in Section 3C).



[A]: Fig. for STEP 1 and 2	[B]: Fig. for STEP 2	[C]: Fig. for STEP 3

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78340
(D): 09932-78310

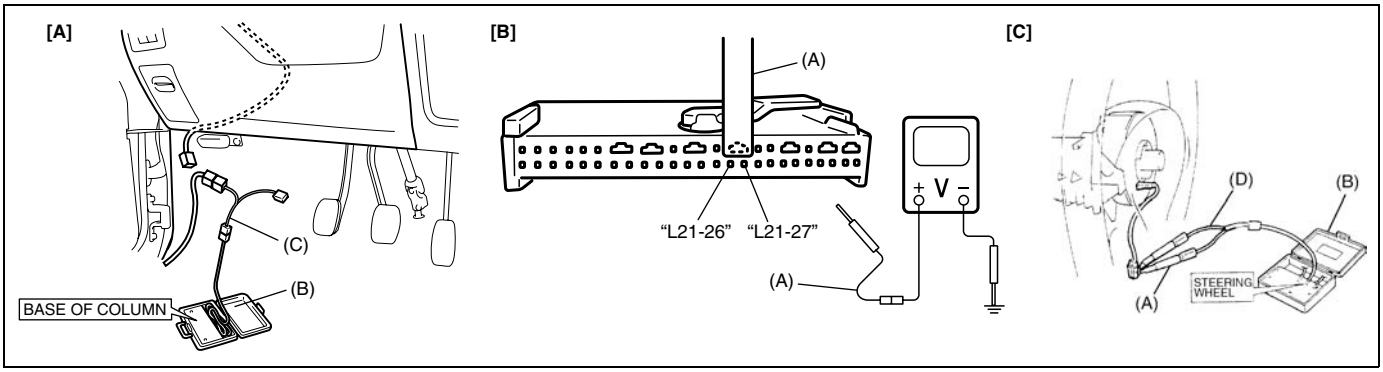
NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1025:

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect contact coil connector "L71" located near the base of the steering column. 2) Check proper connection to contact coil at terminals in "L71" connector. 3) If OK, then connect Special Tool (B) and (C) to contact coil connector "L71" disconnected at step 1). With ignition switch ON, is DTC B1025 current?	Go to step 2.	Go to step 3.
2	1) With ignition switch OFF, disconnect Special Tool (B), (C) and SDM connector "L21". 2) Measure voltage from "L21-27" terminal to body ground and from "L21-26" terminal to body ground. With ignition switch ON, are they 0 – 1V?	Substitute a known-good SDM and recheck.	Repair short from "GRN/RED" or "GRN" wire circuit to power circuit.

Step	Action	Yes	No
3	1) With ignition switch OFF, disconnect Special Tool (B) and (C), then reconnect contact coil connector "L71" located near the base of the steering column. 2) Remove driver air bag (inflator) module from steering wheel (Refer to "Driver Air Bag (Inflator) Module Removal and Installation" in Section 3C). 3) Check proper connection to driver air bag (inflator) module at terminals in driver air bag (inflator) module connector. 4) If OK, then connect Special Tool (B) and (C) to driver air bag (inflator) module connector. With ignition switch ON, is DTC B1025 current?	Ignition switch OFF. Replace contact coil assembly (Refer to "Contact Coil Cable Assembly Removal and Installation" in Section 3C).	Ignition switch OFF. Replace driver air bag (inflator) module (Refer to "Driver Air Bag (Inflator) Module Removal and Installation" in Section 3C).



[A]: Fig. for STEP 1 and 2	[B]: Fig. for STEP 2	[C]: Fig. for STEP 3

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78340
(D): 09932-78310

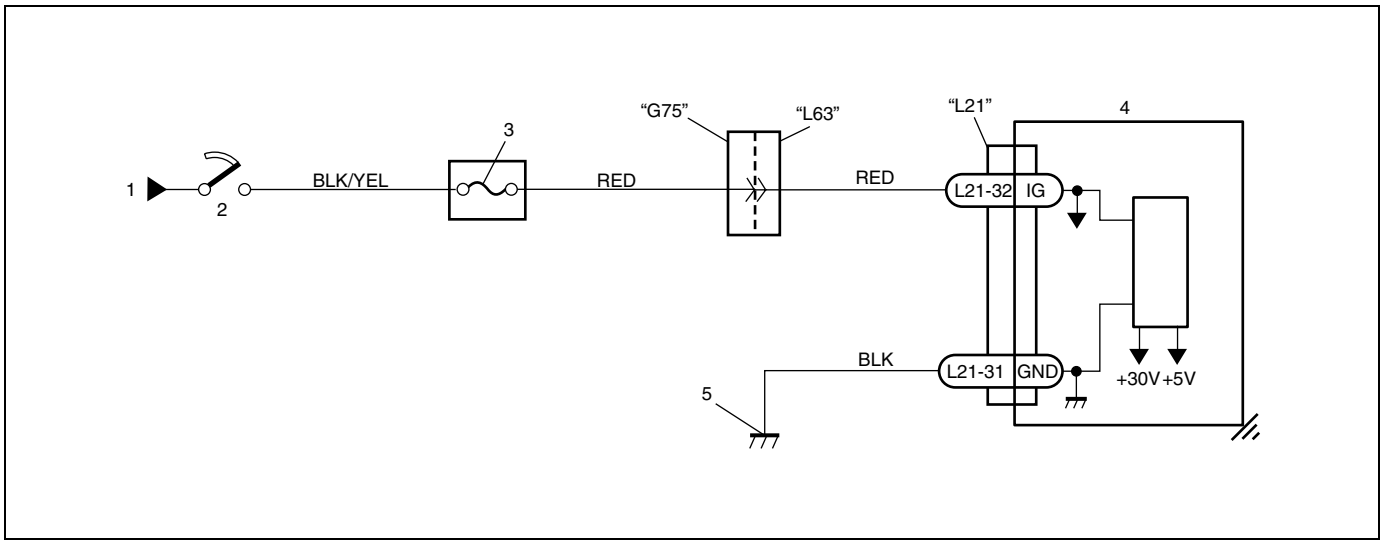
NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1031 – Power Source Voltage High
DTC B1032 – Power Source Voltage Low

WIRING DIAGRAM



1. From main fuse	3. "AIR BAG" fuse	5. Ground for air bag system
2. Ignition switch	4. SDM	

CAUTION:

- **Be sure to perform "Air Bag Diagnostic System Check" before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a tester along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to "Intermittents and Poor Connections" in this section.**
- **If there is open circuit in the air bag wire harness, connector or terminal is found damaged, replace the wire harness, connector and terminal as an assembly.**

DTC WILL BE SET WHEN

DTC B1031:

The power source voltage to SDM is above specified value for specified time.

DTC B1032:

The power source voltage is below an approx. 8V for specified time.

TABLE TEST DESCRIPTION

DTC B1031:

STEP 1: Check if voltage applied to SDM is within normal range.
STEP 2: Check if DTC B1031 still exists.

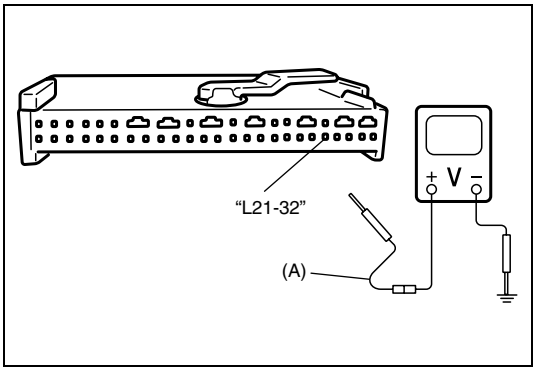
DTC B1032:

STEP 1: Check if voltage on battery is within normal range.
STEP 2: Check if voltage applied to SDM is within normal range.
STEP 3: Check if voltage applied to "G75" connector is within normal range.
STEP 4: Check if DTC B1032 still exists.

DIAGNOSTIC FLOW TABLE

DTC B1031:

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect SDM connector “L21” 2) Check proper connection to SDM at “L21-32” terminal. 3) If OK, then ignition switch ON, and then check voltage from “L21-32” terminal in SDM connector “L21” to body ground. Is voltage 14 V or less?	Go to step 2.	Check charging system referring to “Overcharged battery” in Section 6H.
2	1) With ignition switch OFF, reconnect SDM connector “L21”. With ignition switch ON, is DTC B1031 current?	Substitute a known-good SDM and recheck.	Intermittent trouble. Check for intermittent referring to “Intermittents and Poor Connections” in this section.



Special tool
(A): 09932-76010

NOTE:

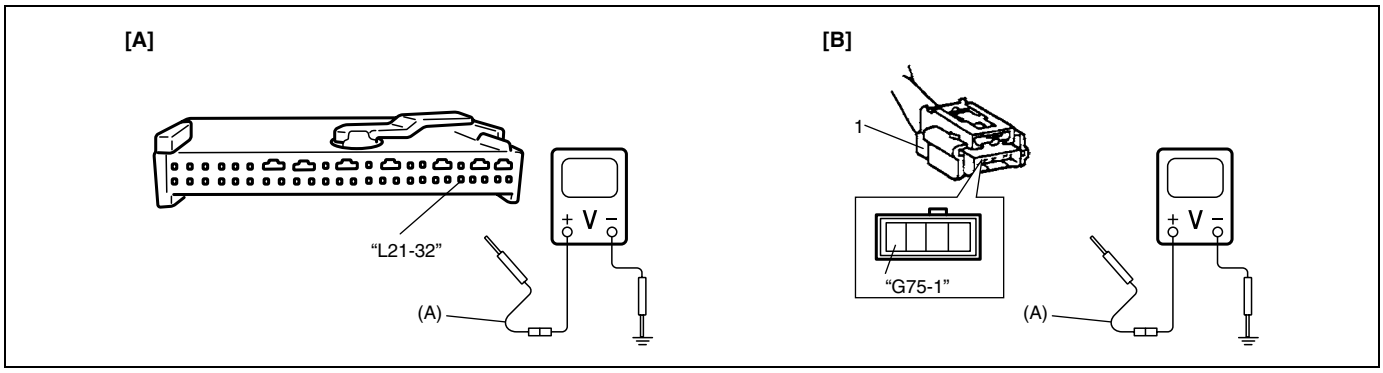
Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to “Diagnostic Trouble Code (DTC) Clearance”), if any.**
- **Repeat “Air Bag Diagnostic System Check” to confirm that the trouble has been corrected.**

DTC B1032:

Step	Action	Yes	No
1	1) Measure voltage on battery. Is voltage 11 V or more?	Go to Step 2.	Check charging system referring to “Under-charged battery in Section 6H.
2	1) With ignition switch OFF, disconnect SDM connector “L21”. 2) Check proper connection to SDM at “L21-32” terminal. 3) If OK, then ignition switch ON, and then check voltage from “L21-32” terminal in SDM connector to body ground. Is voltage 8 V or more?	Go to Step 4.	Go to Step 3.

Step	Action	Yes	No
3	1) With ignition switch OFF, disconnect “G75” connector in instrument panel harness. 2) Check proper connection at “G75-3” (“RED” wire) terminal. 3) If OK, then ignition switch ON, and then check voltage from “G75-3” (“RED” wire) terminal to body ground. Is voltage 8 V or more?	Check for proper connection at “L63-3” terminal. If OK, repair high resistance or open in “RED” wire (between “L63” connector and SDM).	Possibly faulty points are as follows. Check each of them and repair as necessary. • Circuit from battery to “G75” connector • Charging System (Refer to “Undercharged battery” in Section 6H.)
4	1) With ignition switch OFF, reconnect SDM connector “L21”. With ignition switch ON, is DTC B1032 current?	Substitute a known-good SDM and recheck.	Intermittent trouble check for intermittent referring to “Intermittents and Poor Connections” in this section.



[A]: Fig. for STEP 2
[B]: Fig. for STEP 3
1. Instrument panel harness side connector

Special tool
(A): 09932-76010

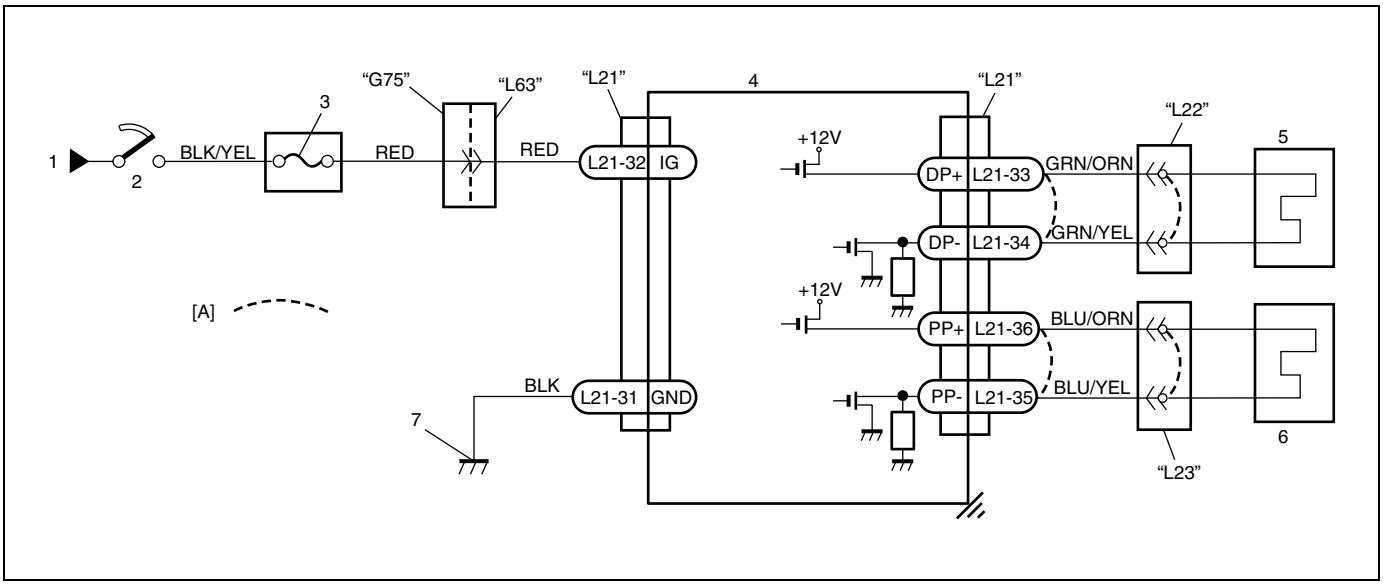
NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to “Diagnostic Trouble Code (DTC) Clearance”), if any.**
- **Repeat “Air Bag Diagnostic System Check” to confirm that the trouble has been corrected.**

DTC B1041 – Driver Pretensioner Initiator Circuit Resistance High
DTC B1042 – Driver Pretensioner Initiator Circuit Resistance Low
DTC B1043 – Driver Pretensioner Initiator Circuit Short to Ground
DTC B1044 – Driver Pretensioner Initiator Circuit Short to Power Circuit
DTC B1045 – Passenger Pretensioner Initiator Circuit Resistance High
DTC B1046 – Passenger Pretensioner Initiator Circuit Resistance Low
DTC B1047 – Passenger Pretensioner Initiator Circuit Short to Ground
DTC B1048 – Passenger Pretensioner Initiator Circuit Short to Power Circuit

WIRING DIAGRAM



[A]: Shorting bar	3. "AIR BAG" fuse	6. Passenger seat belt pretensioner
1. From main fuse	4. SDM	7. Ground for air bag system
2. Ignition switch	5. Driver seat belt pretensioner	

CAUTION:

- **Be sure to perform "Air Bag Diagnostic System Check" before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a tester along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to "Intermittents and Poor Connections" in this section.**
- **If there is open circuit in the air bag wire harness, connector or terminal is found damaged, replace the wire harness, connector and terminal as an assembly.**

DTC WILL BE SET WHEN

DTC B1041 or B1045:

The resistance of driver or passenger seat belt pretensioner initiator circuit is above a specified value for specified time.

DTC B1042 or B1046:

The resistance of driver or passenger seat belt pretensioner initiator circuit is below a specified value for specified time.

DTC B1043 or B1047:

The voltage measured at driver or passenger seat belt pretensioner initiator circuit is below a specified value for specified time.

DTC B1044 or B1048:

The voltage measured at driver or passenger seat belt pretensioner initiator circuit is above a specified value for specified time.

TABLE TEST DESCRIPTION

DTC B1041, B1042, B1043, B1044, B1045, B1046, B1047 or B1048:

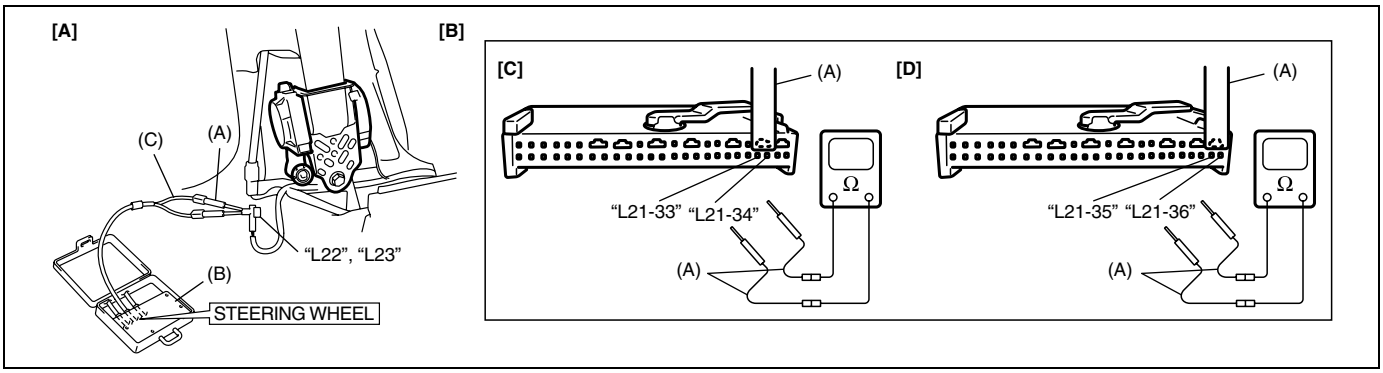
STEP 1: Check whether malfunction is in seat belt pretensioner.

STEP 2: Check seat belt pretensioner initiator circuit in air bag harness.

DIAGNOSTIC FLOW TABLE

DTC B1041 or B1045:

Step	Action	Yes	No
1	1) With ignition switch OFF, remove center pillar inner garnish of applicable side then disconnect seat belt pretensioner connector. 2) Check proper connection to applicable seat belt pretensioner at terminals in “L22” or “L23” connector. 3) If OK, then connect Special Tool (A), (B) and (C) to seat belt pretensioner connector disconnected at the step 1. With ignition switch ON, is DTC B1041 or B1045 still current?	Go to step 2.	Ignition switch OFF. Replace seat belt pretensioner (Refer to 10).
2	1) With ignition switch OFF, disconnect SDM connector “L21”. 2) Check proper connection to SDM at terminals “L21-33” and “L21-34” or “L21-36” and “L21-35”. 3) If OK, then measure resistance with connected Special Tool (A), (B) and (C). • DTC B1041: between “L21-33” and “L21-34” terminals. • DTC B1045: between “L21-36” and “L21-35” terminals. Is resistance 2.6 Ω or less?	Substitute a known-good SDM and recheck.	DTC B1041: Repair high resistance or open in “GRN/ORN” or “GRN/YEL” wire circuit. DTC B1045: Repair high resistance or open in “BLU/ORN” or “BLU/YEL” wire circuit.



[A]: Fig. for STEP 1 and 2
[B]: Fig. for STEP 2
[C]: For DTC B1041
[D]: For DTC B1045

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78310

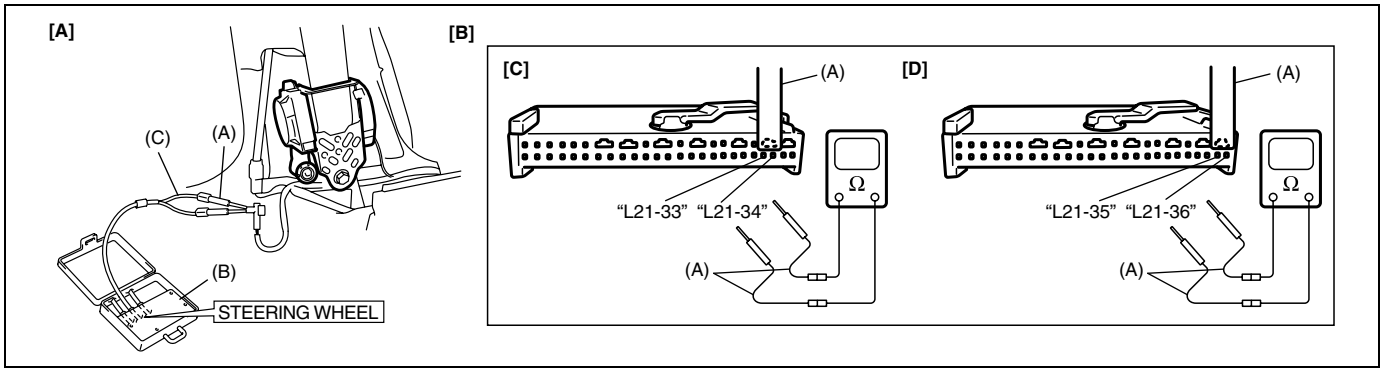
NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1042 or B1046:

Step	Action	Yes	No
1	1) With ignition switch OFF, remove center pillar inner garnish of applicable side then disconnect seat belt pretensioner connector. 2) Check proper connection to applicable seat belt pretensioner at terminals in "L22" or "L23" connector. 3) If OK, then connect Special Tool (A), (B) and (C) to seat belt pretensioner connector disconnected at the step 1. With ignition switch ON, is DTC B1042 or B1046 still current?	Go to step 2.	Ignition switch OFF. Replace seat belt pretensioner (Refer to 10).

Step	Action	Yes	No
2	1) With ignition switch OFF, disconnect SDM connector “L21”. 2) Check proper connection to SDM at terminals “L21-33” and “L21-34” or “L21-36” and “L21-35”. 3) If OK, then measure resistance with connected Special Tool (B). • DTC B1042: between “L21-33” and “L21-34” terminals. • DTC B1046: between “L21-36” and “L21-35” terminals. Is resistance 1.8 Ω or more?	Substitute a known-good SDM and recheck.	DTC B1042: Repair short from “GRN/ORN” wire circuit to “GRN/YEL” wire circuit, or from “GRN/ORN” or “GRN/YEL” wire circuit to other wire circuit. DTC B1046: Repair short from “BLU/ORN” wire circuit to “BLU/YEL” wire circuit, or from “BLU/ORN” or “BLU/YEL” wire circuit to other wire circuit.



[A]: Fig. for STEP 1 and 2
[B]: Fig. for STEP 2
[C]: For DTC B1042
[D]: For DTC B1046

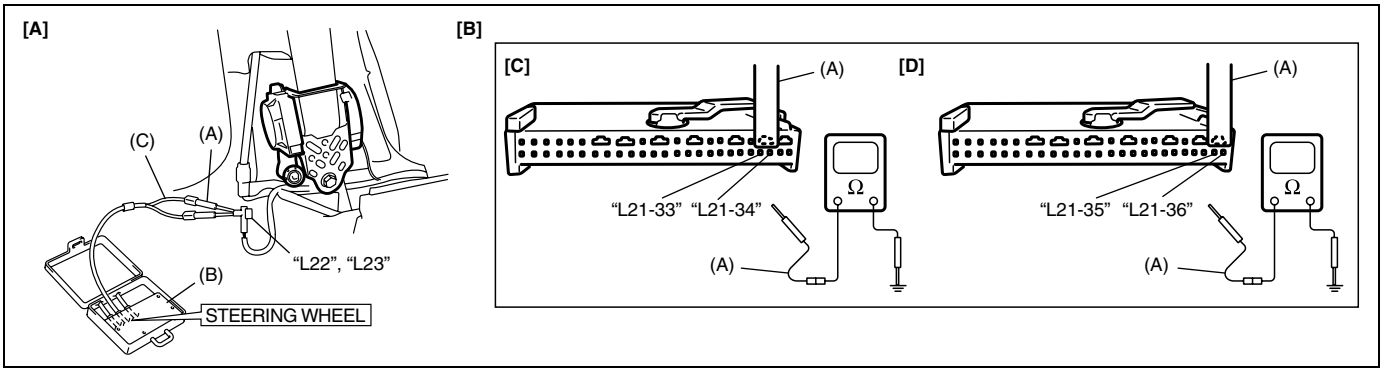
Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78310

NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to “Diagnostic Trouble Code (DTC) Clearance”), if any.**
- **Repeat “Air Bag Diagnostic System Check” to confirm that the trouble has been corrected.**

DTC B1043 or B1047:

Step	Action	Yes	No
1	1) With ignition switch OFF, remove center pillar inner garnish of applicable side then disconnect seat belt pretensioner connector. 2) Check proper connection to applicable seat belt pretensioner at terminals in “L22” or “L23” connector. 3) If OK, then connect Special Tool (A), (B) and (C) to seat belt pretensioner connector disconnected at the step 1. With ignition switch ON, is DTC B1043 or B1047 still current?	Go to step 2.	Ignition switch OFF. Replace seat belt pretensioner (Refer to 10).
2	1) With ignition switch OFF, disconnect Special Tool (A), (B) and (C) and SDM connector “L21”. 2) Measure resistance. • DTC B1043: between “L21-33” terminal and body ground, and between “L21-34” terminal and body ground. • DTC B1047: between “L21-36” terminal and body ground, and between “L21-35” terminal and body ground. Is resistance infinity?	Substitute a known-good SDM and recheck.	DTC B1043: Repair short “GRN/ORN” or “GRN/YEL” wire circuit to ground. DTC B1047: Repair short from “BLU/ORN” or “BLU/YEL” wire circuit to ground.



[A]: Fig. for STEP 1 and 2
[B]: Fig. for STEP 2
[C]: For DTC B1043
[D]: For DTC B1047

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78310

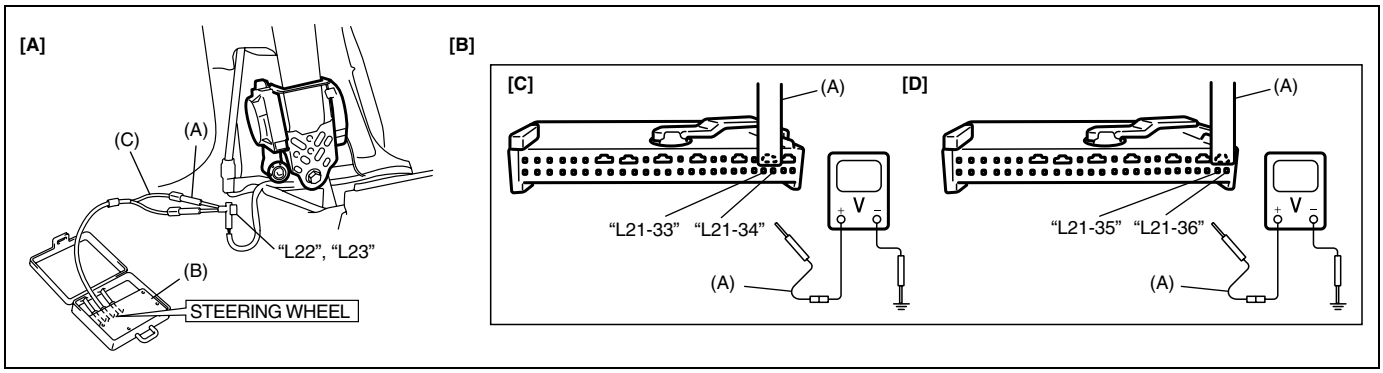
NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to “Diagnostic Trouble Code (DTC) Clearance”), if any.**
- **Repeat “Air Bag Diagnostic System Check” to confirm that the trouble has been corrected.**

DTC B1044 or B1048:

Step	Action	Yes	No
1	1) With ignition switch OFF, remove center pillar inner garnish of applicable side then disconnect seat belt pretensioner connector. 2) Check proper connection to applicable seat belt pretensioner at terminals in "L22" or "L23" connector. 3) If OK, then connect Special Tool (A), (B) and (C) to seat belt pretensioner connector disconnected at the step 1. With ignition switch ON, is DTC B1044 or B1048 still current?	Go to step 2.	Ignition switch OFF. Replace seat belt pretensioner (Refer to 10).
2	1) With ignition switch OFF, disconnect Special Tool (A), (B) and (C) and SDM connector "L21". 2) Measure voltage. • DTC B1044: between "L21-33" terminal and body ground, and between "L21-34" terminal and body ground. • DTC B1048: between "L21-36" terminal and body ground, and between "L21-35" terminal and body ground. With ignition switch ON, is voltage 0 – 1 V?	Substitute a known-good SDM and recheck.	DTC B1044: Repair short "GRN/ORN" or "GRN/YEL" wire circuit to power circuit. DTC B1048: Repair short from "BLU/ORN" or "BLU/YEL" wire circuit to power circuit.



[A]: Fig. for STEP 1 and 2
[B]: Fig. for STEP 2
[C]: For DTC B1044
[D]: For DTC B1048

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78310

NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1051 – Frontal Crash Detected (System Activation Command Outputted)

DTC WILL BE SET WHEN

The SDM detects a frontal crash of sufficient force to warrant activation of the air bag system. (SDM outputs a deployment command.)

TABLE TEST DESCRIPTION

STEP 1: Check that DTC B1051 has been set although air bag has not been deployed.
STEP 2: Check that DTC has been set due to failure of SDM.

NOTE:

Before executing items in this table, be sure to perform "Air Bag Diagnostic System Check".

DIAGNOSTIC FLOW TABLE

Step	Action	Yes	No
1	1) Ignition switch OFF. Has air bag system deployed?	Replace components and perform inspections as directed in "Repairs and Inspections Required After an Accident".	Go to step 2.
2	1) Inspect front of vehicle and undercarriage for signs of impact. Are there signs of impact?	Replace components and perform inspections as directed in "Repairs and Inspections Required After an Accident".	Substitute a known-good SDM and recheck.

NOTE:

- **DTC B1051 can never be cleared once it has been set.**
- **Upon completion of inspection and repair work, perform the following items.**
  - **Reconnect all air bag system components, ensure all components are properly mounted.**
  - **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1056 – Sideward Crash (Driver Side) Detected (Side Air Bag System Activation Command Outputted)
DTC B1057 – Sideward Crash (Passenger Side) Detected (Side Air Bag System Activation Command Outputted)

DTC WILL BE SET WHEN

DTC B1056 or B1057:

The SDM detects a sideward crash (driver or passenger side) of sufficient force to warrant activation of the side air bag system (driver or passenger side). (SDM outputs a deployment command.)

TABLE TEST DESCRIPTION

DTC B1056 or B1057:

STEP 1: Check that DTC B1056 or B1057 has been set although side air bag (driver or passenger side) has not been deployed.
STEP 2: Check that DTC has been set due to failure of SDM.

NOTE:

Before executing items in this table, be sure to perform "Air Bag Diagnostic System Check".

DIAGNOSTIC FLOW TABLE

DTC B1056 or B1057:

Step	Action	Yes	No
1	1) Ignition switch OFF. Has side air bag deployed?	Replace components and perform inspections as directed in "Repairs and Inspections Required After an Accident".	Go to step 2.
2	1) Inspect sideward of vehicle and undercarriage for signs of impact. Are there signs of impact?	Replace components and perform inspections as directed in "Repairs and Inspections Required After an Accident".	Substitute a known-good SDM and recheck.

NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1058 – Frontal Crash Detected (Pretensioner Activation Command Outputted)

DTC WILL BE SET WHEN

The SDM detects a frontal crash of sufficient force to warrant activation of pretensioner. (SDM outputs a activation command.)

TABLE TEST DESCRIPTION

STEP 1: Check that DTC B1058 has been set although pretensioner has not been activated.
STEP 2: Check that DTC has been set due to failure of SDM.

NOTE:

Before executing items in this table, be sure to perform "Air Bag Diagnostic System Check".

DIAGNOSTIC FLOW TABLE

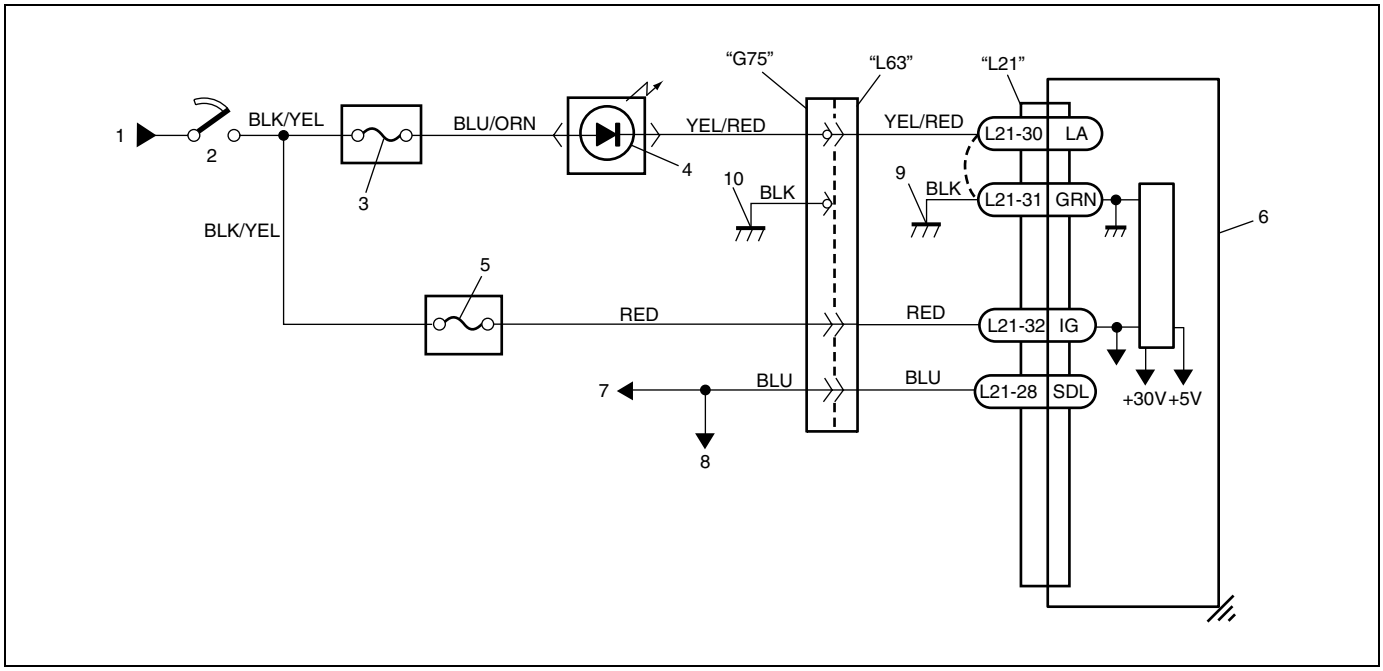
Step	Action	Yes	No
1	1) Ignition switch OFF. Has pretensioner activated?	Replace components and perform inspections as directed in "Repairs and Inspections Required After an Accident".	Go to step 2.
2	1) Inspect front of vehicle and undercarriage for signs of impact. Are there signs of impact?	Replace components and perform inspections as directed in "Repairs and Inspections Required After an Accident".	Substitute a known-good SDM and recheck.

NOTE:

- **DTC B1058 can never be cleared once it has been set.**
- **Upon completion of inspection and repair work, perform the following items.**
  - **Reconnect all air bag system components, ensure all components are properly mounted.**
  - **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1061 – “AIR BAG” Warning Lamp Circuit Failure

WIRING DIAGRAM



1. From main fuse	5. “AIR BAG” fuse	9. Ground for air bag system
2. Ignition switch	6. SDM	10. Ground on body
3. “METER” fuse	7. To DLC	
4. “AIR BAG” warning lamp in combination meter	8. To ECM and ABS control module (if equipped)	

CAUTION:

- **Be sure to perform “Air Bag Diagnostic System Check” before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a tester along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to “Intermittents and Poor Connections” in this section.**
- **If there is open circuit in the air bag wire harness, connector or terminal is found damaged, replace the wire harness, connector and terminal as an assembly.**

DTC WILL BE SET WHEN

The voltage at the “AIR BAG” warning lamp circuit terminal “L21-30” does not match the commanded state of the warning lamp driver for specified time.

TABLE TEST DESCRIPTION

STEP 1: This test rechecks “AIR BAG” warning lamp operation.
STEP 2: This test rechecks whether an abnormality is in SDM.

DIAGNOSTIC FLOW TABLE

Step	Action	Yes	No
1	1) This DTC is set when there is a trouble in "AIR BAG" warning lamp circuit. Failure to properly perform "Air Bag Diagnostic System Check" may also result in misdiagnosis. Therefore, check "AIR BAG" warning lamp circuit again according to "Air Bag Diagnostic System Check". Is "AIR BAG" warning lamp circuit in good condition?	Go to step 2.	Repair "AIR BAG" warning lamp circuit.
2	1) Clear DTC (Refer to "Diagnostic Trouble Code (DTC) Clearance"). 2) Check DTC (Refer to "Diagnostic Trouble Code (DTC) Check"). Is DTC B1061 set?	Substitute a known-good SDM and recheck.	Recheck air bag system. Refer to "Air Bag Diagnostic System Check".

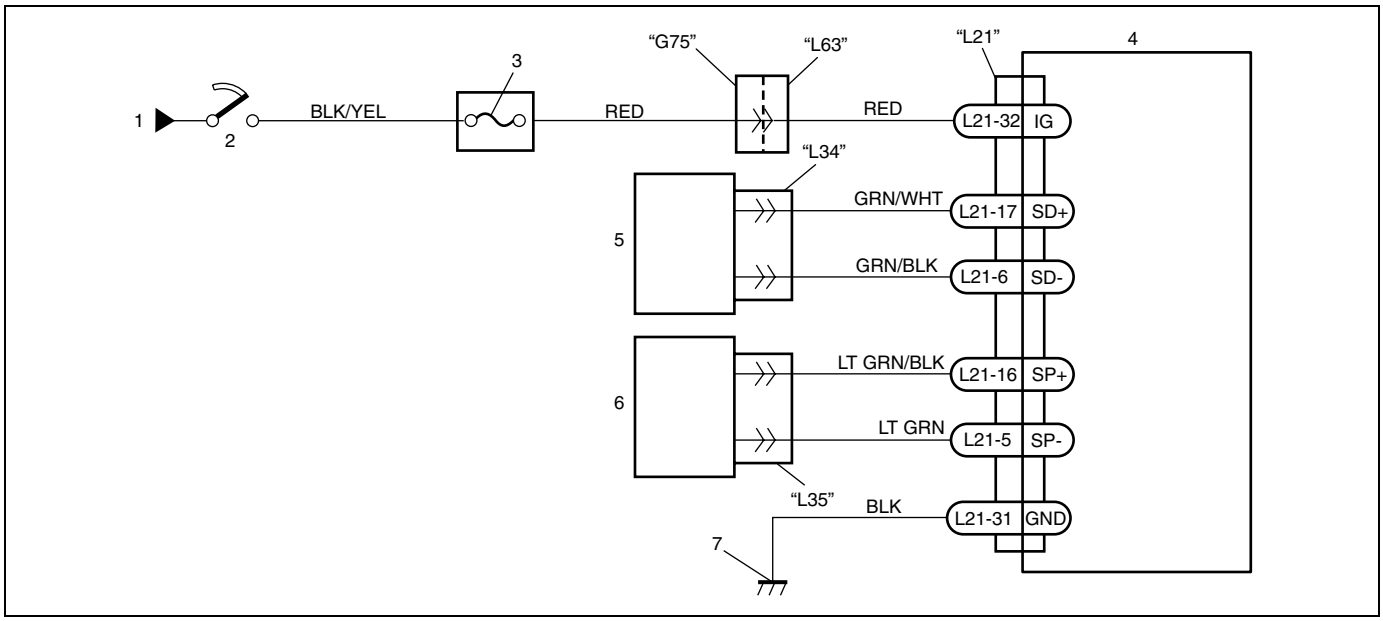
NOTE:

Upon completion of inspection and repair work, perform following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1063 – Side Sensor (Driver Side) Circuit Short to Ground
DTC B1064 – Side Sensor (Driver Side) Circuit Short to Power Circuit Or Open
DTC B1065 – Side Sensor (Passenger Side) Circuit Short to Ground
DTC B1066 – Side Sensor (Passenger Side) Circuit Short to Power Circuit or Open

WIRING DIAGRAM



1. From main fuse	4. SDM	7. Ground for air bag system
2. Ignition switch	5. Side sensor (driver side)	
3. "AIR BAG" fuse	6. Side sensor (passenger side)	

CAUTION:

- **Be sure to perform "Air Bag Diagnostic System Check" before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a tester along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to "Intermittents and Poor Connections" in this section.**
- **If there is open circuit in the air bag wire harness, connector or terminal is found damaged, replace the wire harness, connector and terminal as an assembly.**

DTC WILL BE SET WHEN

DTC B1063 or B1065:

The voltage measured at side sensor (driver or passenger side) circuit is below a specified value for specified time.

DTC B1064 or B1066:

The voltage measured at side sensor (driver or passenger side) circuit is above a specified value for specified time.

TABLE TEST DESCRIPTION

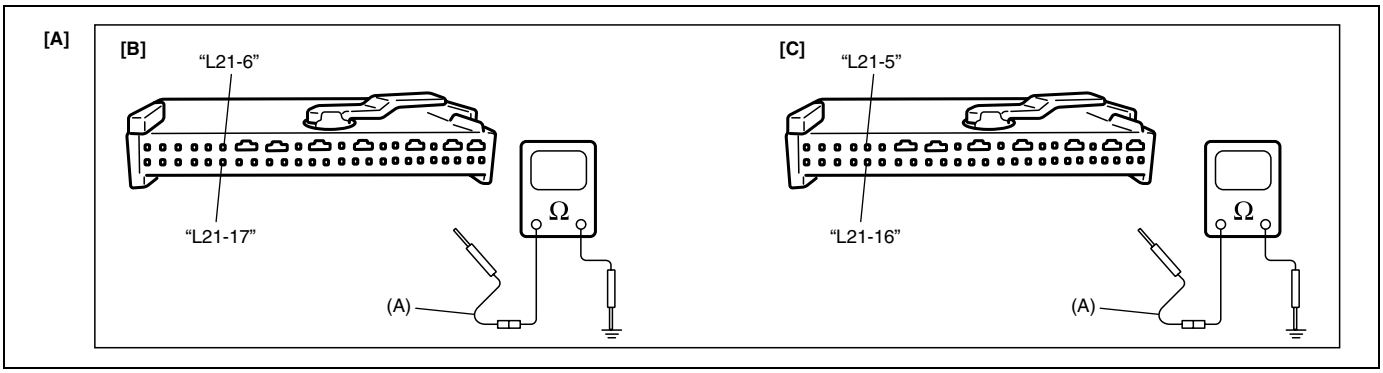
DTC B1063, B1064, B1065 or B1066:

STEP 1: Check side sensor (driver or passenger side) circuit in floor harness.
STEP 2: Check side sensor (driver or passenger side) circuit in floor harness. (for DTC B1064 and B1066 only)

DIAGNOSTIC FLOW TABLE

DTC B1063 or B1065:

Step	Action	Yes	No
1	1) With ignition switch OFF, remove center pillar lower trim and side sill scuff, then disconnect side sensor connector. 2) Disconnect SDM connector “L21”. 3) Check proper connection to applicable side sensor at terminals in “L34” or “L35” connector. 4) If OK, measure resistance. • DTC B1063: between “L21-17” terminal and body ground, and between “L21-6” terminal and body ground. • DTC B1065: between “L21-16” terminal and body ground, and between “L21-5” terminal and body ground. Is resistance infinity?	Substitute a known-good side sensor and/or SDM and recheck.	DTC B1063: Repair short “GRN/WHT” or “GRN/BLK” wire circuit to ground. DTC B1065: Repair short “LT GRN/BLK” or “LT GRN” wire circuit to ground.



[A]: Fig. for STEP 1	[B]: For DTC B1063	[C]: For DTC B1065

Special tool
(A): 09932-76010

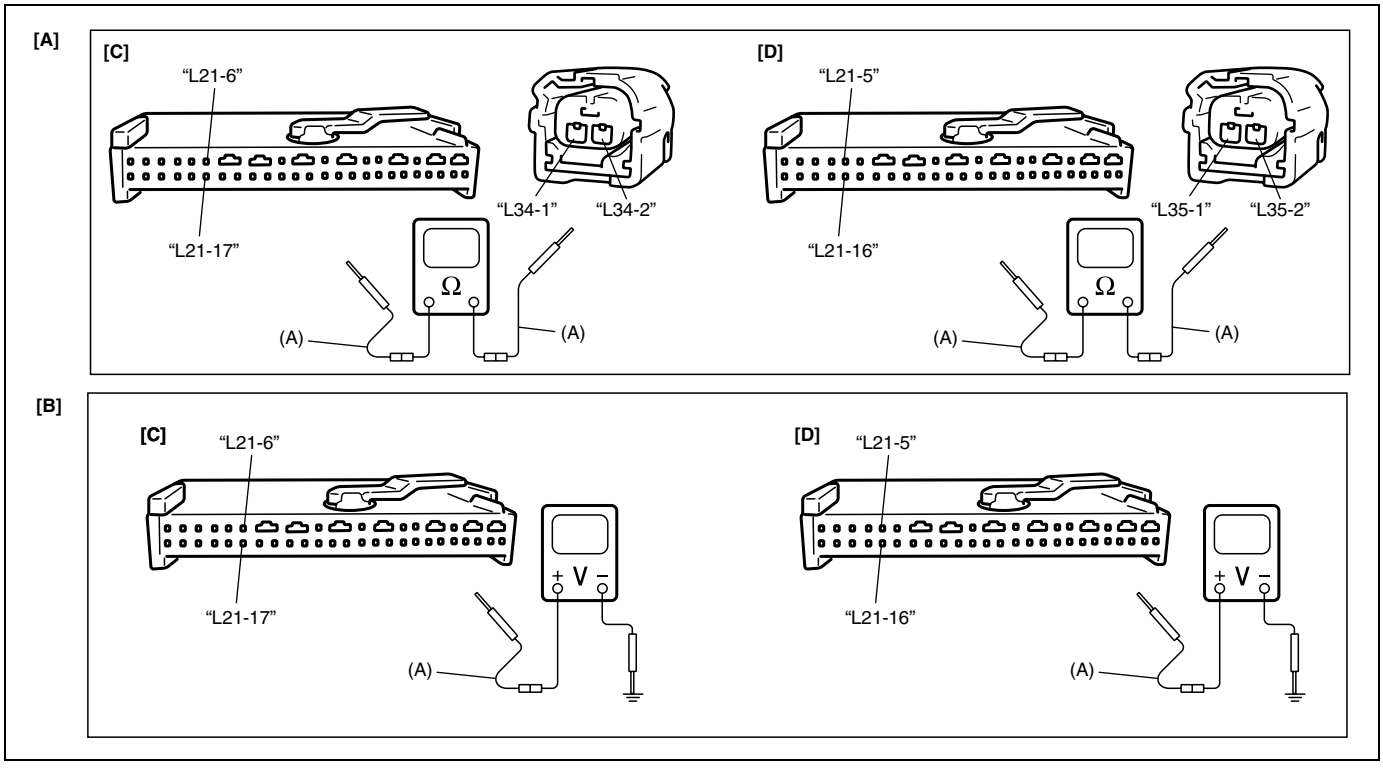
NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble code (Refer to “Diagnostic Trouble Code (DTC) Clearance”), if any.**
- **Repeat “Air Bag Diagnostic System Check” to confirm that the trouble has been corrected.**

DTC B1064 or B1066:

Step	Action	Yes	No
1	1) With ignition switch OFF, remove center pillar lower trim and side sill scuff, then disconnect side sensor connector. 2) Disconnect SDM connector "L21". 3) Check proper connection to applicable side sensor at terminals in "L34" or "L35" connector. 4) If OK, measure resistance. • DTC B1064: between "L34-1" and "L21-17" terminals, and between "L34-2" and "L21-6" terminals. • DTC B1066: between "L35-1" and "L21-16" terminals, and between "L35-2" and "L21-5" terminals. Is resistance 0 – 1 Ω?	Got to Step 2.	DTC B1064: Repair open in "GRN/WHT" or "GRN/BLK" wire circuit. DTC B1066: Repair open in "LT GRN/BLK" or "LT GRN" wire circuit.
2	1) Measure voltage. • DTC B1064: between "L21-17" terminal and body ground, and between "L21-6" terminal and body ground. • DTC B1066: between "L21-16" terminal and body ground, and between "L21-5" terminal and body ground. With ignition switch ON, is voltage 0 – 1 V?	Substitute a known-good side sensor and/or SDM and recheck.	DTC B1064: Repair short "GRN/WHT" or "GRN/BLK" wire circuit to power circuit. DTC B1066: Repair short "LT GRN/BLK" or "LT GRN" wire circuit to power circuit.



[A]: Fig. for STEP 1	[B]: Fig. for STEP 2	[C]: For DTC B1064	[D]: For DTC B1066

Special tool
(A): 09932-76010

NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble code (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1071 – Internal SDM Fault

DTC WILL BE SET WHEN

An internal SDM fault is detected by SDM.

NOTE:

Before executing items below, be sure to perform "Air Bag Diagnostic System Check".

NOTE:

DTC B1071 can never be cleared once it has been set.

1) Ignition switch OFF.
2) Replace SDM.
3) Repeat "Air Bag Diagnostic System Check".

DTC B1072 – Internal Side Sensor (Driver Side) Fault
DTC B1074 – Internal Side Sensor (Passenger Side) Fault

DTC WILL BE SET WHEN

DTC B1072 or B1074:

SDM receive internal fault signal from side sensor.

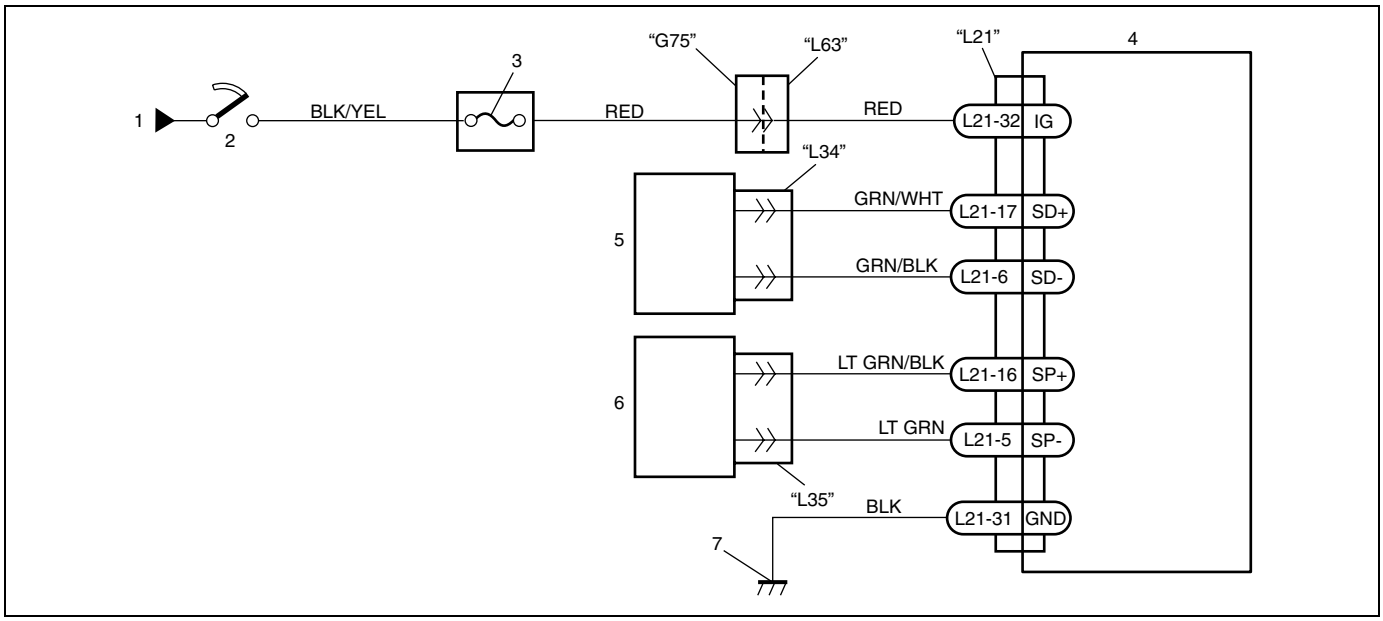
NOTE:

Before executing items below, be sure to perform "Air Bag Diagnostic System Check".

1) Ignition switch OFF.
2) Replace side sensor.
3) Repeat "Air Bag Diagnostic System Check".

DTC B1073 – Side Sensor (Driver Side) Correspondence Abnormality
DTC B1075 – Side Sensor (Passenger Side) Correspondence Abnormality

WIRING DIAGRAM



1. From main fuse	4. SDM	7. Ground for air bag system
2. Ignition switch	5. Side sensor (driver side)	
3. "AIR BAG" fuse	6. Side sensor (passenger side)	

CAUTION:

- **Be sure to perform "Air Bag Diagnostic System Check" before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a tester along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to "Intermittents and Poor Connections" in this section.**
- **If there is open circuit in the air bag wire harness, connector or terminal is found damaged, replace the wire harness, connector and terminal as an assembly.**

DTC WILL BE SET WHEN

DTC B1073 or B1075:

Side sensor abnormal signal is detected by SDM.

TABLE TEST DESCRIPTION

DTC B1073 or B1075:

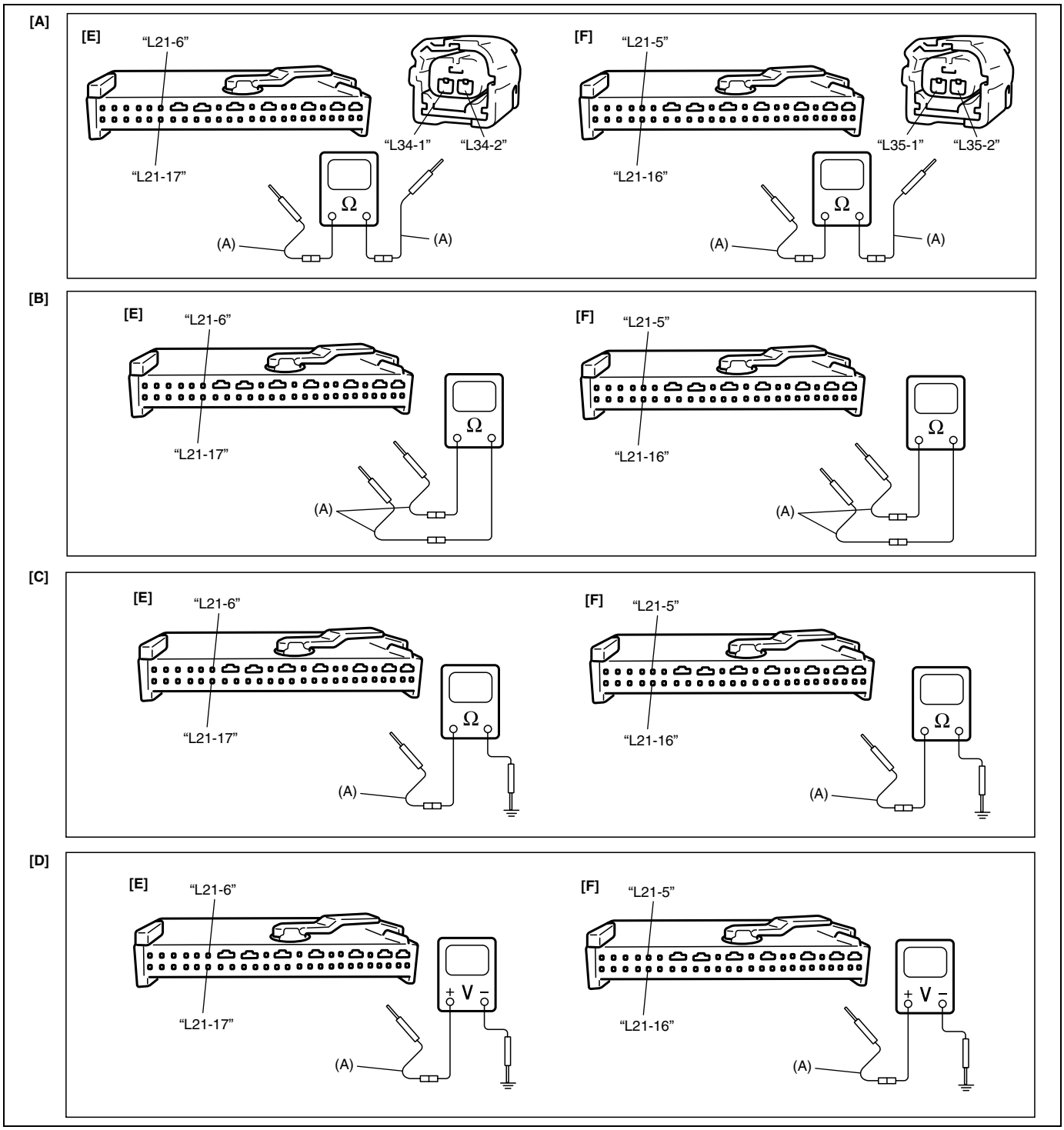
STEP 1 to 4: Check side sensor circuit in floor harness.

DIAGNOSTIC FLOW TABLE

DTC B1073 or B1075:

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect SDM connector “L21” and side sensor connector. 2) DTC B1073: Check proper connection to side sensor at terminals in “L34” connector and to SDM at “L21-17” and “L21-6” terminals in SDM connector “L21”. DTC B1075: Check proper connection to side sensor at terminals in “L35” connector and to SDM at “L21-16” and “L21-5” terminals in SDM connector “L21”. 3) DTC B1073: If OK, then measure resistance between “L34-1” and “L21-17” terminals, and between “L34-2” and “L21-6” terminals. Is resistance 0 – 1Ω? DTC B1075: If OK, then measure resistance between “L35-1” and “L21-16” terminals, and between “L35-2” and “L21-5” terminals. Is resistance 0 – 1Ω?	Go to step 2.	DTC B1073: Repair high resistance or open in “GRN/WHT” or “GRN/BLK” wire. DTC B1075: Repair high resistance or open in “LT GRN/BLK” or “LT GRN” wire.
2	1) DTC B1073: Measure resistance between “L21-17” and “L21-6” terminals. Is resistance infinity? DTC 1075: Measure resistance between “L21-16” and “L21-5” terminals. Is resistance infinity?	Go to step 3.	DTC B1073: Repair short from “GRN/WHT” wire to “GRN/BLK” wire. DTC B1075: Repair short from “LT GRN/BLK” wire to “LT GRN” wire.
3	1) DTC B1073: Measure resistance between “L21-17” terminal and body ground, and between “L21-6” terminal and body ground. Is resistance infinity? DTC 1075: Measure resistance between “L21-16” terminal and body ground, and between “L21-5” terminal and body ground. Is resistance infinity?	Go to step 4.	DTC B1073: Repair short from “GRN/WHT” or “GRN/BLK” wire to body ground. DTC B1075: Repair short from “LT GRN/BLK” or “LT GRN” wire to body ground.

Step	Action	Yes	No
4	1) DTC B1073: Measure voltage from “L21-17” and “L21-6” terminals to body ground. With ignition switch ON, is voltage 0 - 1V? DTC B1075: Measure voltage from “L21-16” and “L21-5” terminals to body ground. With ignition switch ON, is voltage 0 – 1V?	Substitute a known-good side sensor and/or SDM and recheck.	DTC B1073: Repair short from “GRN/WHT” or “GRN/BLK” wire to power circuit. DTC B1075: Repair short from “LT GRN/BLK” or “LT GRN” to power circuit.



[A]: Fig. for STEP 1	[B]: Fig. for STEP 2	[C]: Fig. for STEP 3	[D]: Fig. for STEP 4	[E]: For DTC B1073	[F]: For DTC B1075

Special tool
(A): 09932-76010

NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble code (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1076 – Wrong Side Sensor (Driver Side) ID
DTC B1077 – Wrong Side Sensor (Passenger Side) ID

DTC WILL BE SET WHEN

DTC B1076 or B1077:

SDM receive wrong ID (Part No.) signal from side sensor.

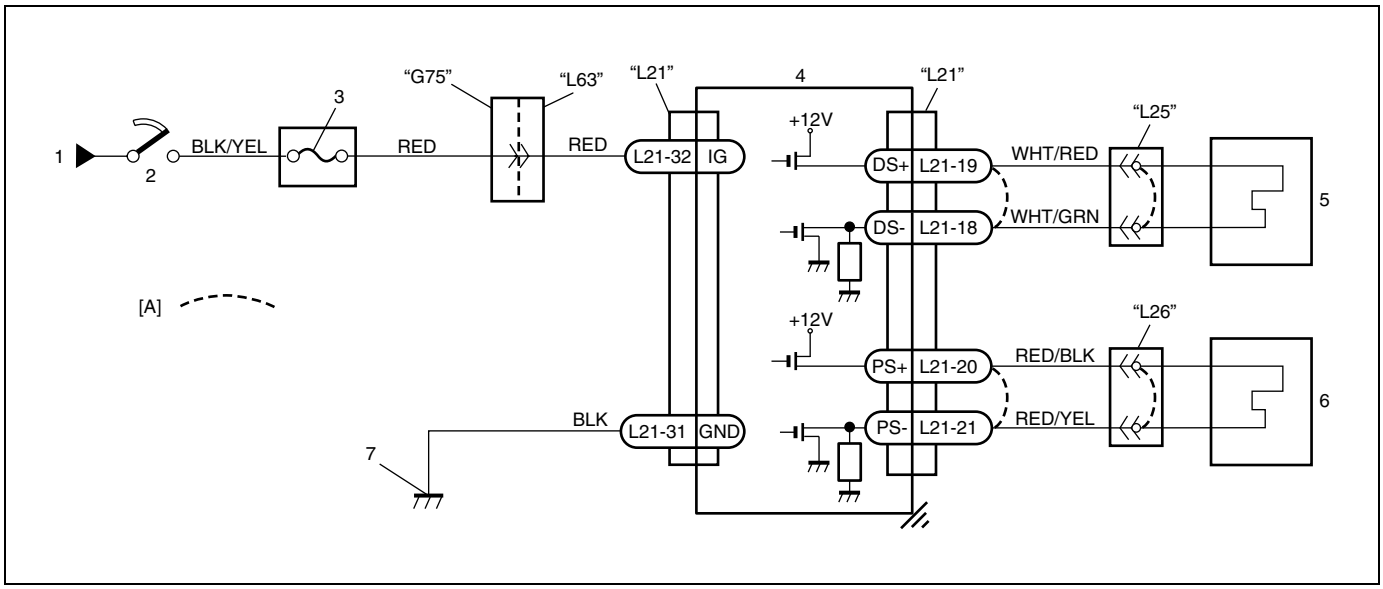
NOTE:

- **Be sure executing items below, be sure to perform "Air Bag Diagnostic System Check".**
- **Confirm the part number of side sensor which is installed.**

1) Ignition switch OFF.
2) Replace side sensor.
3) Repeat "Air Bag Diagnostic System Check".

DTC B1081 – Side Air Bag (Driver Side) Intiator Circuit Resistance High
DTC B1082 – Side Air Bag (Driver Side) Intiator Circuit Resistance Low
DTC B1083 – Side Air Bag (Driver Side) Intiator Circuit Short to Ground
DTC B1084 – Side Air Bag (Driver Side) Intiator Circuit Short to Power Circuit
DTC B1085 – Side Air Bag (Passenger Side) Intiator Circuit Resistance High
DTC B1086 – Side Air Bag (Passenger Side) Intiator Circuit Resistance Low
DTC B1087 – Side Air Bag (Passenger Side) Intiator Circuit Short to Ground
DTC B1088 – Side Air Bag (Passenger Side) Intiator Circuit Short to Power Circuit

WIRING DIAGRAM



[A]: Shorting bar	2. Ignition switch	4. SDM	6. Side air bag (passenger side) (inflator) module
1. From main fuse	3. "AIR BAG" fuse	5. Side air bag (driver side) (inflator) module	7. Ground for air bag system

CAUTION:

- **Be sure to perform "Air Bag Diagnostic System Check" before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a tester along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to "Intermittents and Poor Connections" in this section.**
- **If there is open circuit in the air bag wire harness, connector or terminal is found damaged, replace the wire harness, connector and terminal as an assembly.**

DTC WILL BE SET WHEN

DTC B1081 or B1085:

The combined resistance of the side air bag (inflator) module (driver or passenger side), harness wiring and connector terminal contact is above the specified value for specified time.

DTC B1082 or B1086:

The combined resistance of the side air bag (inflator) module (driver or passenger side), harness wiring and connector terminal contact is below the specified value for specified time.

DTC B1083 or B1087:

The voltage measured at side air bag (driver or passenger side) initiator circuit is below the specified value for specified time.

DTC B1084 or B1088:

The voltage measured at side air bag (driver or passenger side) initiator circuit is below the specified value for specified time.

TABLE TEST DESCRIPTION

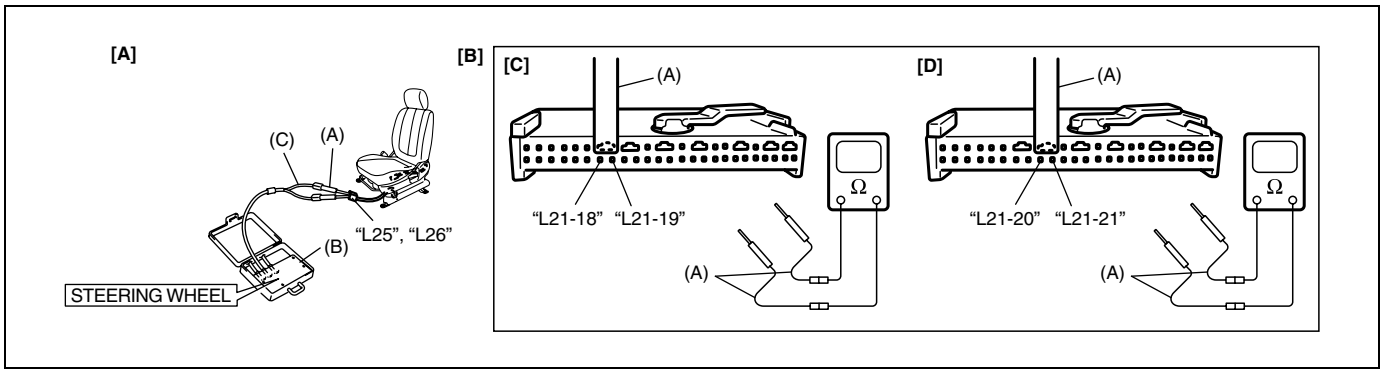
DTC B1081, B1082, B1083, B1084, B1085, B1086, B1087,or B1088:

STEP 1: Check whether malfunction is in side air bag (inflator) module.
STEP 2: Check side air bag initiator circuit in floor harness.

DIAGNOSTIC FLOW TABLE

DTC B1081 or B1085

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect side air bag (inflator) module connector under front seat cushion. 2) Check proper connection to applicable side air bag (inflator) module at terminals in "L25" or "L26" connector. 3) If OK, then connect Special tool (B) and (C) to side air bag (inflator) module connector disconnected at the step 1. With ignition switch ON, is DTC B1081 or B1085 still current?	Go to step 2.	Ignition switch OFF. Replace side air bag (inflator) module (Refer to "Side Air Bag (Inflator) Module (If Equipped) Inspection" in this section.).
2	1) With ignition switch OFF, disconnect SDM connector "L21". 2) Check proper connection to SDM at terminals "L21-19" and "L21-18" or "L21-20" and "L21-21". 3) If OK, then measure resistance with connected Special Tool (B) and (C). • DTC B1081: between "L21-19" and "L21-18" terminals. • DTC B1085: between "L21-20" and "L21-21" terminals. Is resistance 2.8 Ω or less?	Substitute a known-good SDM and recheck.	DTC B1081: Repair high resistance or open in "WHT/RED" or "WHT/GRN" wire circuit. DTC B1085: Repair high resistance or open in "RED/BLK" or "RED/YEL" wire circuit.



[A]: Fig. for STEP 1 and 2
[B]: Fig. for STEP 2
[C]: For DTC B1081
[D]: For DTC B1085

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78310

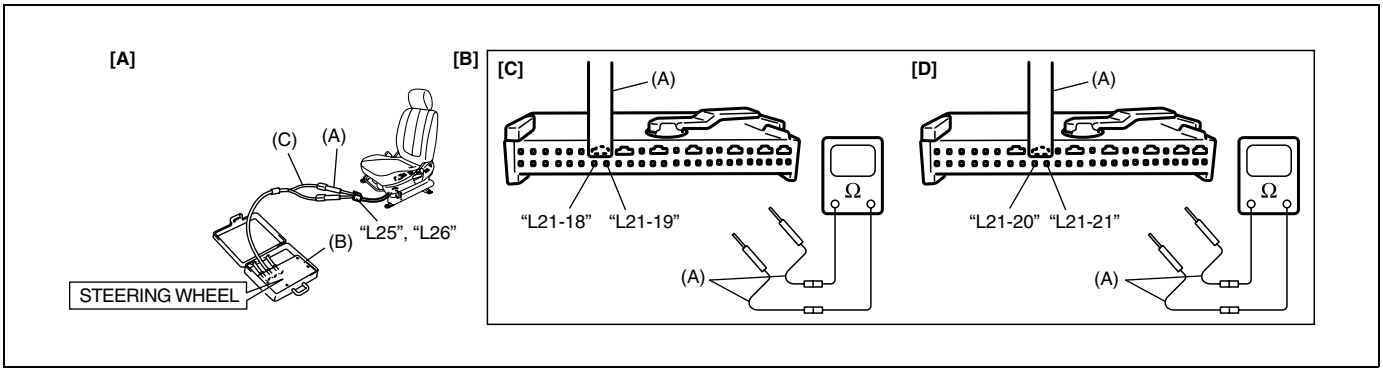
NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble code (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1082 or B1086

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect side air bag (inflator) module connector under front seat cushion. 2) Check proper connection to applicable side air bag (inflator) module at terminals in "L25" or "L26" connector. 3) If OK, then connect Special tool (B) and (C) to side air bag (inflator) module connector disconnected at the step 1. With ignition switch ON, is DTC B1082 or B1086 still current?	Go to step 2.	Ignition switch OFF. Replace side air bag (inflator) module (Refer to "Side Air Bag (Inflator) Module (If Equipped) Inspection" in this section.).

Step	Action	Yes	No
2	1) With ignition switch OFF, disconnect SDM connector “L21”. 2) Check proper connection to SDM at terminals “L21-19” and “L21-18” or “L21-20” and “L21-21”. 3) If OK, then measure resistance with connected Special Tool (B) and (C). • DTC B1082: between “L21-19” and “L21-18” terminals. • DTC B1086: between “L21-20” and “L21-21” terminals. Is resistance 1.8 Ω or more?	Substitute a known-good SDM and recheck.	DTC B1082: Repair short from “WHT/RED” wire circuit to “WHT/GRN” wire circuit or from “WHT/RED” or “WHT/GRN” wire circuit to other wire circuit. DTC B1086: Repair short from “RED/BLK” wire circuit to “RED/YEL” wire circuit or from “RED/BLK” or “RED/YEL” wire circuit to other wire circuit.



[A]: Fig. for STEP 1 and 2
[B]: Fig. for STEP 2
[C]: For DTC B1082
[D]: For DTC B1086

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78310

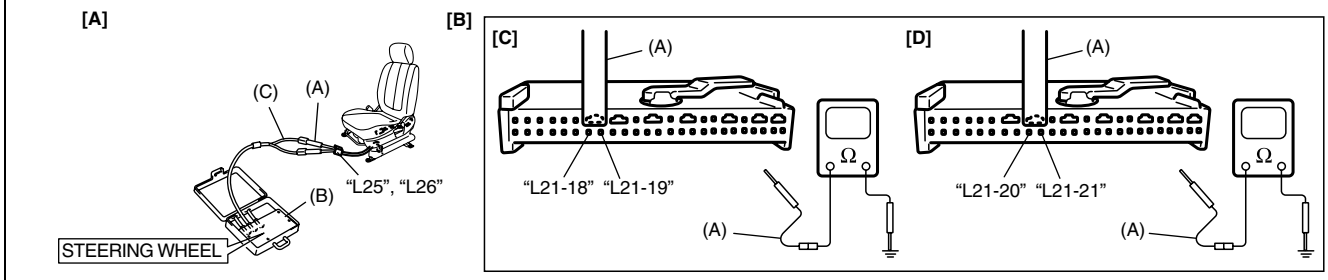
NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble code (Refer to “Diagnostic Trouble Code (DTC) Clearance”), if any.**
- **Repeat “Air Bag Diagnostic System Check” to confirm that the trouble has been corrected.**

DTC B1083 or B1087

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect side air bag (inflator) module connector under front seat cushion. 2) Check proper connection to applicable side air bag (inflator) module at terminals in "L25" or "L26" connector. 3) If OK, then connect Special tool (B) and (C) to side air bag (inflator) module connector disconnected at the step 1. With ignition switch ON, is DTC B1083 or B1087 still current?	Go to step 2.	Ignition switch OFF. Replace side air bag (inflator) module (Refer to "Side Air Bag (Inflator) Module (If Equipped) Inspection" in this section.).
2	1) With ignition switch OFF, disconnect Special Tool (B) and (C) and SDM connector "L21". 2) Measure resistance. • DTC B1083: between "L21-19" terminal and body ground, and between "L21-18" terminal and body ground. • DTC B1087: between "L21-20" terminal and body ground, and between "L21-21" terminal and body ground. Is resistance infinity?	Substitute a known-good SDM and recheck.	DTC B1083: Repair short from "WHT/RED" or "WHT/GRN" wire circuit to ground. DTC B1087: Repair short from "RED/BLK" or "RED/YEL" wire circuit to ground.



[A]: Fig. for STEP 1 and 2
[B]: Fig. for STEP 2
[C]: For DTC B1083
[D]: For DTC B1087

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78310

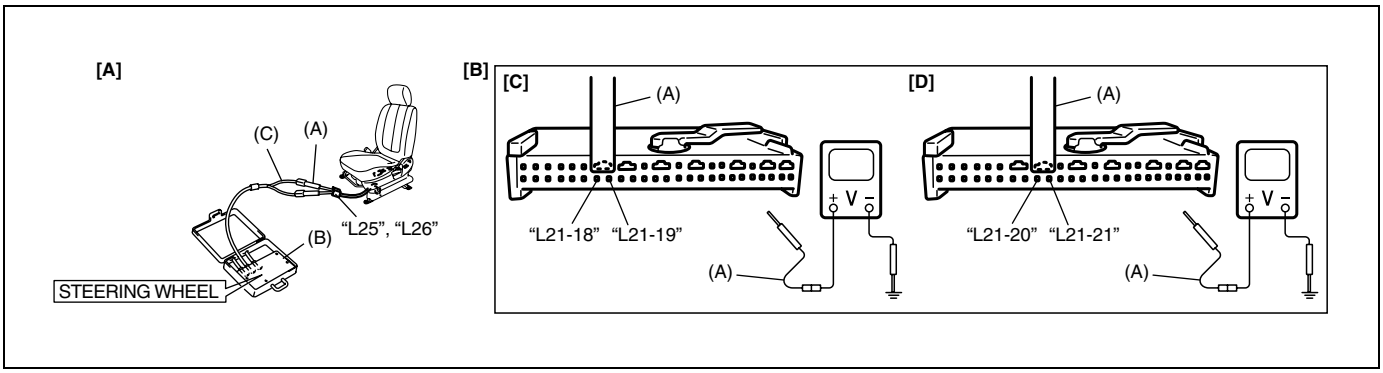
NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble code (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

DTC B1084 or B1088

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect side air bag (inflator) module connector under front seat cushion. 2) Check proper connection to applicable side air bag (inflator) module at terminals in "L25" or "L26" connector. 3) If OK, then connect Special tool (B) and (C) to side air bag (inflator) module connector disconnected at the step 1. With ignition switch ON, is DTC B1084 or B1088 still current?	Go to step 2.	Ignition switch OFF. Replace side air bag (inflator) module (Refer to "Side Air Bag (Inflator) Module (If Equipped) Inspection" in this section.).
2	1) With ignition switch OFF, disconnect Special Tool (B), (C) and SDM connector "L21". 2) Measure voltage. • DTC B1084: between "L21-19" terminal and body ground, and between "L21-18" terminal and body ground. • DTC B1088: between "L21-20" terminal and body ground, and between "L21-21" terminal and body ground. With ignition switch ON, is voltage 0 – 1 V?	Substitute a known-good SDM and recheck.	DTC B1084: Repair short from "WHT/RED" or "WHT/GRN" wire circuit to ground. DTC B1088: Repair short from "RED/BLK" or "RED/YEL" wire circuit to power circuit.



[A]: Fig. for STEP 1 and 2
[B]: Fig. for STEP 2
[C]: For DTC B1084
[D]: For DTC B1088

Special tool
(A): 09932-76010
(B): 09932-75010
(C): 09932-78310

NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble code (Refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.**
- **Repeat "Air Bag Diagnostic System Check" to confirm that the trouble has been corrected.**

On-Vehicle Service

Service Precautions

Service and diagnosis

WARNING/CAUTION labels are attached on each part of air bag system components (SDM, air bag (inflator) modules and seat belt pretensioners). Be sure to follow the instructions.

WARNING:

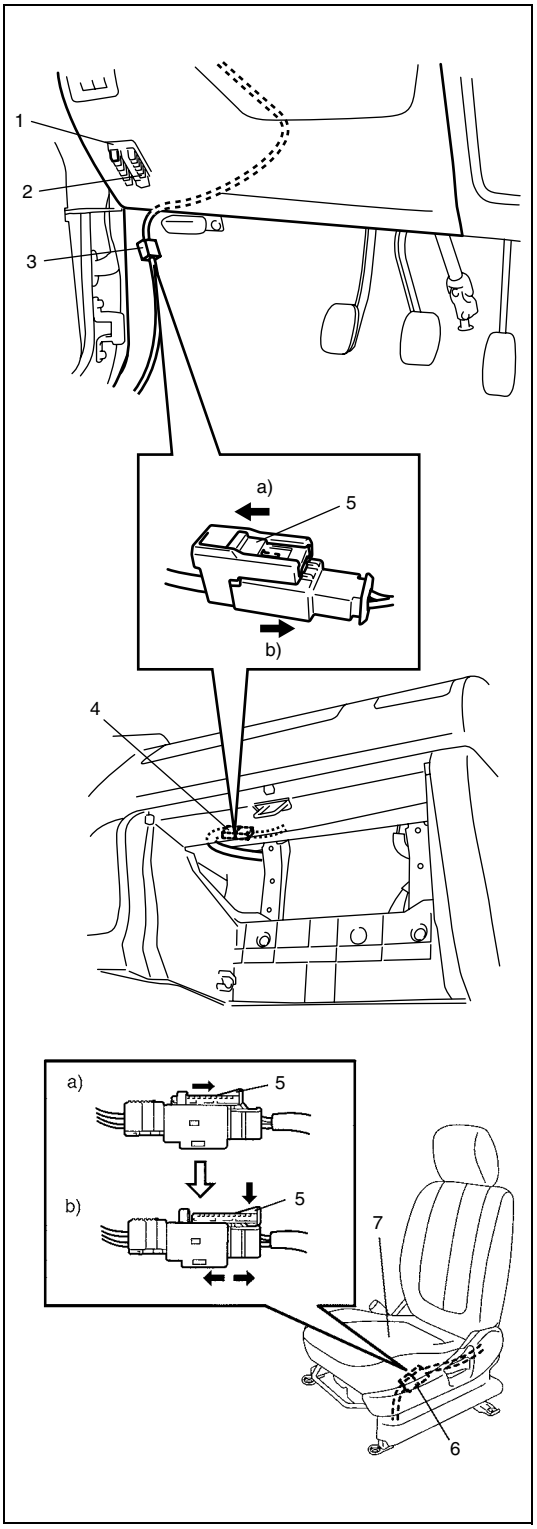
- **If the air bag system and another vehicle system both need repair, Suzuki recommends that the air bag system be repaired first, to help avoid unintended air bag system activation.**
- **Do not modify the steering wheel, dashboard or any other on or around air bag system components. Modifications can adversely affect air bag system performance and lead to injury.**
- **Failure to follow procedures could result in possible air bag system activation, personal injury or unneeded air bag system repairs.**

- Many of service procedures require disconnection of “AIR BAG” fuse and air bag (inflator) module(s) (driver, passenger and side of driver and passenger) from initiator circuit to avoid an accidental deployment.
- Do not apply power to the air bag system unless all components are connected or a diagnostic chart requests it, as this will set a diagnostic trouble code (DTC).
- The “Air Bag Diagnostic System Check” must be the starting point of any air bag diagnostics. The “Air Bag Diagnostic System Check” will verify proper “AIR BAG” warning lamp operation and will lead you to the correct table to diagnose any air bag malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacements.
- Never use air bag component parts from another vehicle.
- If the vehicle will be exposed to temperatures over 93°C (200°F) (for example, during a paint baking process), remove the air bag system components beforehand to avoid component damage or unintended system activation.
- When handling the air bag (inflator) modules (driver, passenger and side of driver and passenger), seat belt pretensioners (driver and passenger), side sensors or SDM, be careful not to drop it or apply an impact to it. If an excessive impact was applied (e.g., side sensors are dropped, SDM is dropped, air bag (inflator) module is dropped from a height of 90 cm (3 ft) or more, seat belt pretensioner (retractor assembly) is dropped from a height of 30 cm (1 ft) or more), never attempt disassembly or repair but replace it with a new one.
- When using electric welding, be sure to disconnect air bag (inflator) module connectors (driver, passenger and side of driver and passenger) and seat belt pretensioner connectors (driver and passenger) respectively.
- When applying paint around the air bag system related parts, use care so that the harness or connector will not be exposed to the paint mist.
- Never expose air bag system component parts directly to hot air (drying or baking the vehicle after painting) or flames.

WARNING:

When performing service on or around air bag system components or air bag wiring, follow the procedures listed in the following pages to temporarily disable the air bag system.
Failure to follow procedures could result in possible air bag system activation, personal injury or unneeded air bag system repairs.

Disabling air bag system

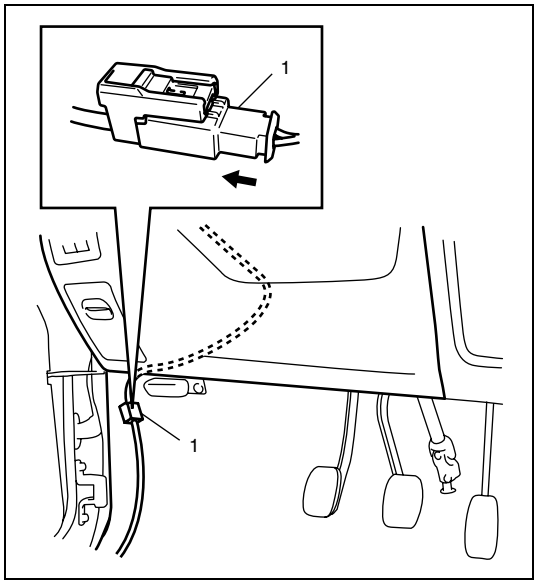


1) Turn steering wheel so that vehicle's wheels (front tires) and pointing straight ahead.
2) Turn ignition switch to "LOCK" position and remove key.
3) Remove "AIR BAG" fuse (2) from fuse box (1).
4) Disconnect Yellow connector (3) of contact coil and combination switch assembly as follows.
   a) Release locking of lock slider (5).
   b) After unlocked, disconnect connector.
5) In case of passenger air bag (inflator) module, pull out glove box while pushing its stopper from both right and left sides and disconnect Yellow connector (4) of passenger air bag (inflator) module.
   a) Release locking of lock slider (5).
   b) After unlocked, disconnect connector.
6) If equipped with side air bag (inflator) module, disconnect Yellow connector (6) of side air bag (inflator) module under front seat cushion (7).
   a) Release locking of lock slider (5).
   b) After unlocked, push down lock slider (5) and disconnect connector.

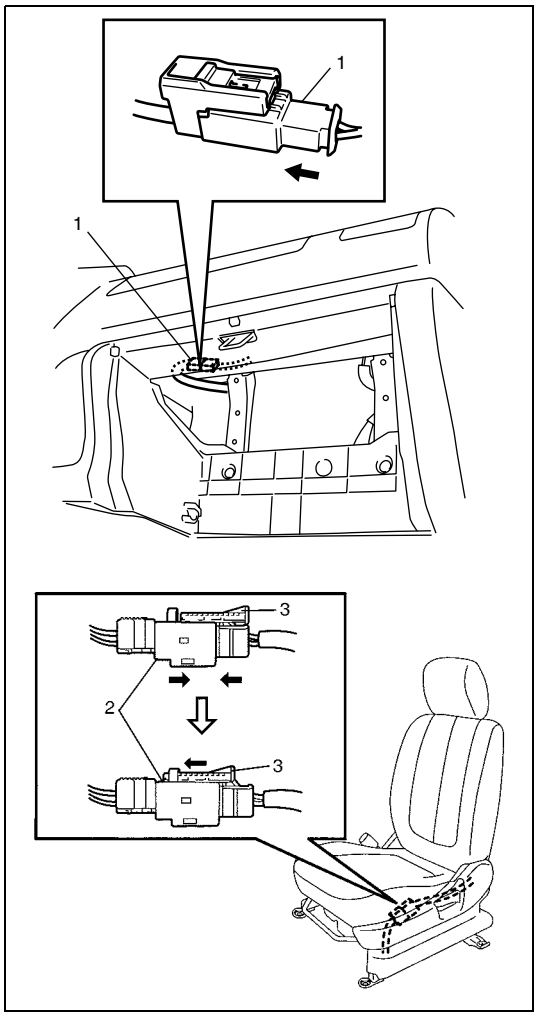
NOTE:

With "AIR BAG" fuse removed and ignition switch ON, "AIR BAG" warning lamp will be ON.
This is normal operation and does not indicate a air bag system malfunction.

Enabling air bag system



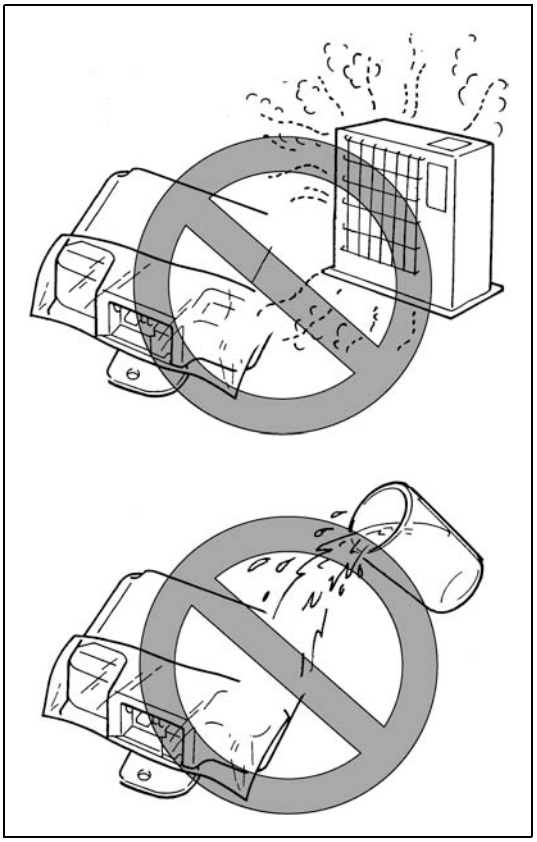
1) Turn ignition switch to “LOCK” position and remove key.
2) Connect Yellow connector (1) of contact coil and combination switch assembly by pushing connector till clicks heard from it.



3) In case of passenger air bag (inflator) module, connect Yellow connector (1) of passenger air bag (inflator) module by pushing connector till click is heard from it.
4) Install glove box.
5) If equipped with side air bag (inflator) module, connect Yellow connector (2) of side air bag (inflator) module, and be sure to lock connector with lock slider (3).
6) Install “AIR BAG” fuse to fuse box.
7) Turn ignition switch to ON position and verify that “AIR BAG” warning lamp flashes 6 times and then turns OFF.
   If it does not operate as described, perform “Air Bag Diagnostic System Check”.

Handling and storage

SDM



WARNING:

Never power up air bag system when SDM is not rigidly attached to the vehicle. Otherwise, personal injury may result.

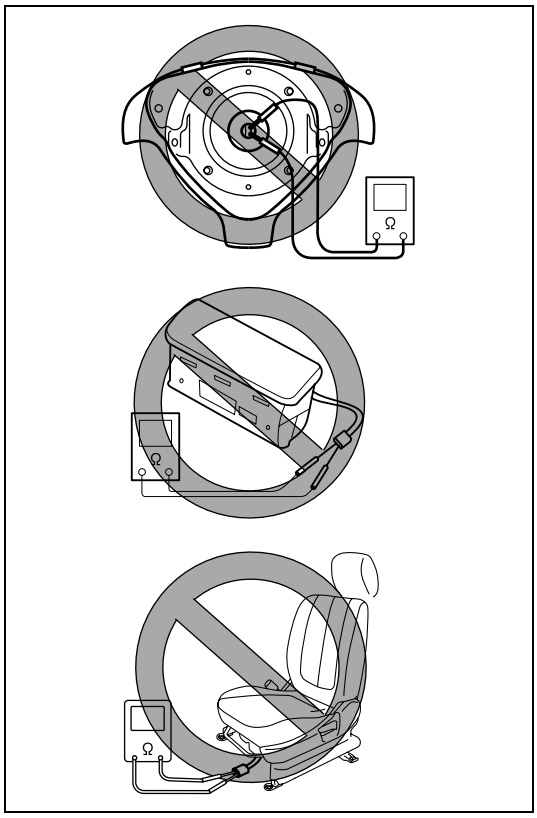
CAUTION:

After detecting one time of such collision as to meet deployment conditions, the SDM must not be used. Refer to "Air Bag Diagnostic System Check" when checking the SDM.

- Never attempt disassembly of SDM.
- When storing SDM, select a place where neither high temperature nor high humidity is anticipated and oil, water and dust are kept off.
- If SDM has been dropped, replace it with a new one.
- If installation part of SDM was damaged, repair that part completely before reinstallation.
- All SDM and mounting bracket fasteners must be carefully torqued and the arrow must be pointed toward the front of the vehicle to ensure proper operation of the air bag system.

LIVE (UNDEPLOYED) AIR BAG (INFLATOR) MODULES

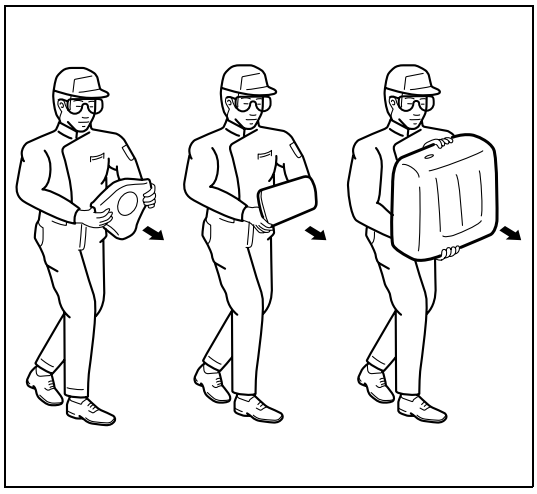
Special care is necessary when handling and storing a live (undeployed) air bag (inflator) modules.
The rapid gas generation produced during deployment of the air bag could cause the air bag (inflator) module, or an object in front of the air bag (inflator) module, to be thrown through the air in the unlikely event of an accidental deployment.



WARNING:

Never attempt to measure the resistance of the air bag (inflator) modules (driver, passenger and side). It is very dangerous as the electric current from the tester may deploy the air bag.

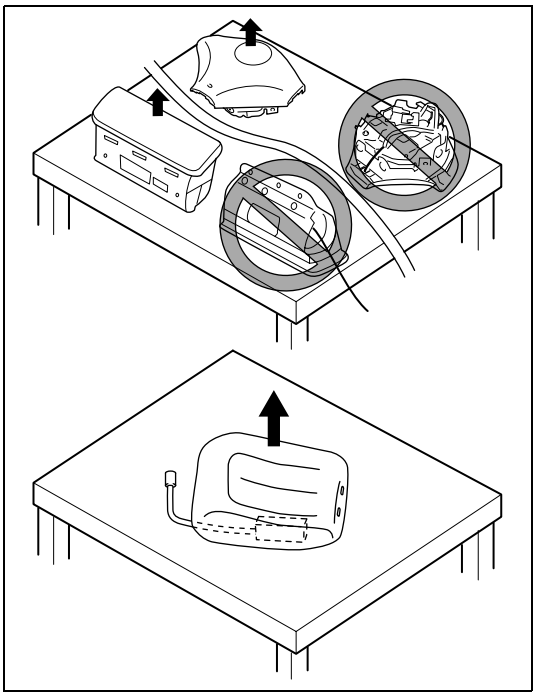
- Never attempt disassembly of the air bag (inflator) modules.
- If any abnormality is found, be sure to replace it with new one as an assembly.
- When an abnormality is noted as existing in the live (undeployed) air bag (inflator) module, be sure to deploy it before discarding it.
- When grease, cleaning agent, oil, water, etc., got on the air bag (inflator) modules (driver, passenger and side of driver and passenger), wipe it off immediately with a dry cloth.
- If air bag (inflator) module was dropped from a height of 90 cm (3 ft) or more, it should be replaced with a new one as an assembly.



WARNING:

- **For handling and storage of a live air bag (inflator) module, select a place where the ambient temperature below 65°C (150°F), without high humidity and away from electric noise.**
- **When carrying a live air bag (inflator) module, make sure the bag opening is pointed away from you. In case of an accidental deployment, the bag will then deploy with minimal chance of injury. Never carry the air bag (inflator) module by the wires or connector on the underside of the module.**

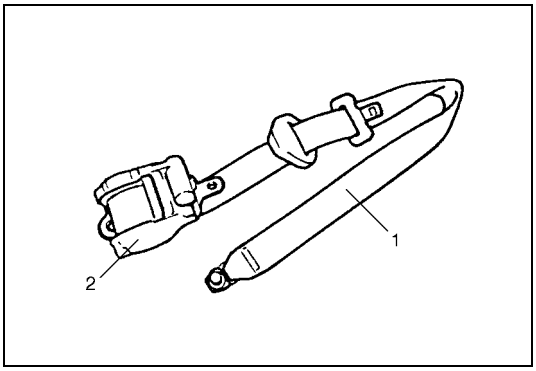
Otherwise, personal injury may result.



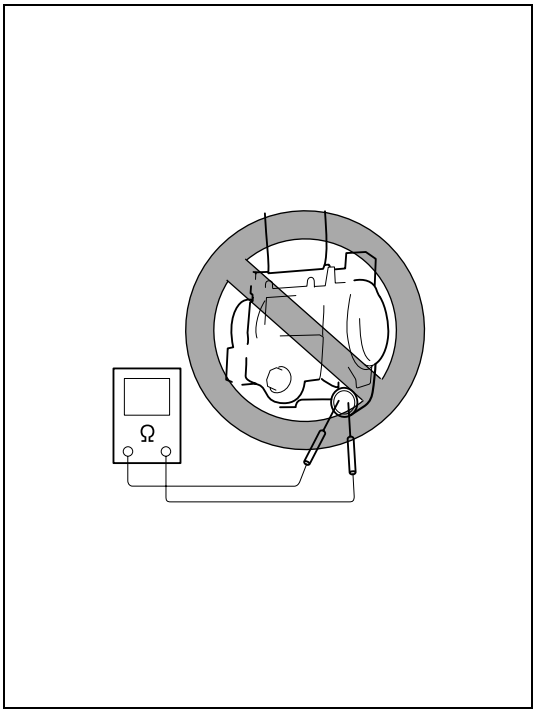
WARNING:

When placing a live air bag (inflator) module on bench or other surface, always face the bag up, away from the surface. The front seat back with the live side air bag (inflator) module must be placed with its frontal seat cover facing up.
It is also prohibited to place anything on top of the trim cover and stack air bag (inflator) modules.
This is necessary so that a free space is provided to allow the air bag to expand in the unlikely event of accidental deployment.
Otherwise, personal injury may result.

LIVE (INACTIVATED) SEAT BELT PRETENSIONER



Special care is necessary when handling and storing a live (inactivated) seat belt pretensioners.
Also, when the seat belt pretensioners activate, gas is generated and the seat belt (1) is retracted into the retractor assembly (2) quickly.
Note, therefore, that if they activate accidentally, the seat belt pretensioners and other object(s) around them may be thrown through the air.



WARNING:

Never attempt to measure the resistance of the seat belt pretensioners. It is very dangerous as the electric current from the tester may activate pretensioner.

- Never attempt to disassemble the seat belt pretensioners (retractor assembly).
- If any abnormality is found, be sure to replace it with new one as an assembly.
- When an abnormality is noted as existing in the live (inactivated) seat belt pretensioner, be sure to activate it before discarding it.
- When grease, cleaning agent oil, water, etc., got on the seat belt pretensioners (retractor assembly), wipe it off immediately with a dry cloth.
- If seat belt pretensioner was dropped from a height of 30 cm (1 ft) or more, it should be replaced with a new one as an assembly.

WARNING:

- **For handling and storage of a live seat belt pretensioner, select a place where the ambient temperature below 65°C (150°F), without high humidity and away from electric noise.**
- **Never carry the seat belt pretensioner by webbing.**
- **When placing live seat belt pretensioner on workbench or other surface, be sure not to put something on seat belt pretensioner.**

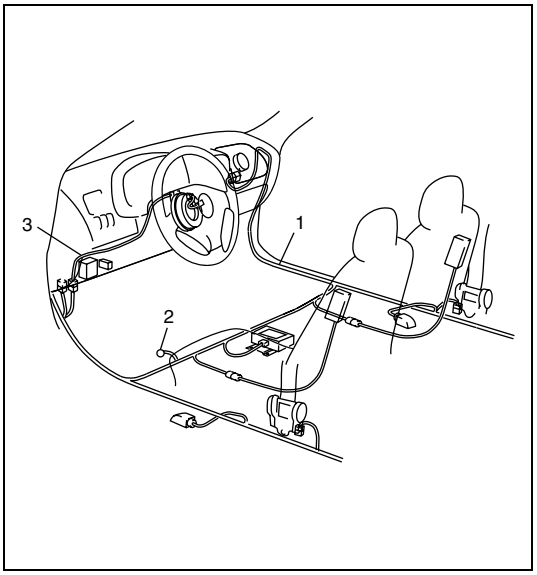
Otherwise, personal injury may result.

DEPLOYED AIR BAG (INFLATOR) MODULE AND ACTIVATED SEAT BELT PRETENSIONER

WARNING:

- **The air bag (inflator) module and seat belt pretensioner immediately after deployment/activation is very hot. Wait for at least 30 minutes to cool it off before proceeding the work.**
- **Do not apply water, oil, etc. to deployed air bag (inflator) module and to activated seat belt pretensioner.**
- **After an air bag (inflator) module has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by-products of the chemical reaction. As with many service procedures, gloves and safety glasses should be worn.**
- **Wash your hands with mild soap and water after completing the work.**

Refer to the procedure described under “Deployed Air Bag (Inflator) Module and Activated Seat Belt Pretensioner Disposal”.



AIR BAG WIRE HARNESS AND CONNECTOR IN FLOOR AND INSTRUMENT WIRE HARNESS

Air bag wire harness is included in floor harness (1) and instrument harness (3). The part of coupler side wire harness can be identified easily as it is covered with a yellow protection tube. Be very careful when handling it.

- When an open in air bag wire harness (in floor harness (1)) and (in instrument harness (3)), damaged wire harness, connector or terminal is found, replace wire harness, connectors and terminals as an assembly.
- When installing it, be careful so that the air bag wire harness (in floor harness (1) and in instrument harness (3)) is not caught or does not interfere with other parts.
- Make sure air bag system grounding point (2) are clean and grounds are securely fastened for optimum metal-to-metal contact. Poor grounding can cause intermittent problems that are difficult to diagnose.

DISPOSAL

Do not dispose of the live (undeployed) air bag (inflator) modules and the live (inactivated) seat belt pretensioners. When disposal is necessary, be sure to deploy/activate the air bag and seat belt pretensioner according to deployment/activation procedure described in “Air Bag (Inflator) Module and Seat Belt Pretensioner Disposal”.

WARNING:

Failure to follow proper air bag (inflator) module and seat belt pretensioner disposal procedures can result in air bag deployment and pretensioner activation which could cause personal injury. Undeployed air bag (inflator) module and inactivated seat belt pretensioner must not be disposed of through normal refuse channels.

The undeployed air bag (inflator) module and inactivated seat belt pretensioner contain substances that can cause severe illness or personal injury if the sealed container is damaged during disposal.

Repairs and Inspections Required after an Accident

CAUTION:

- **All air bag system components, including the electrical harness (component mounting points), must be inspected after an accident. If any components are damaged or bent, they must be replaced even if air bag system activation did not occur.**
- **Never use air bag system parts from another vehicle.**
- **Do not attempt to service the parts below. Service of these parts is by replacement only.**
  - **Driver/Passenger/Side air bag (inflator) module, Driver/Passenger seat belt pretensioner**
  - **SDM**
  - **Side sensors**
  - **Contact coil and combination switch assembly**
  - **Floor wire harness or instrument wire harness including air bag wire harness**
- **Proper operation of the air bag system requires that any repairs to the vehicle structure return it to its original production configuration.**

CAUTION:

After detecting one time of such collision as to meet deployment conditions, the SDM must not be used. Refer to "Air Bag Diagnostic System Check" when checking the SDM.

Accident with deployment/activation – component replacement

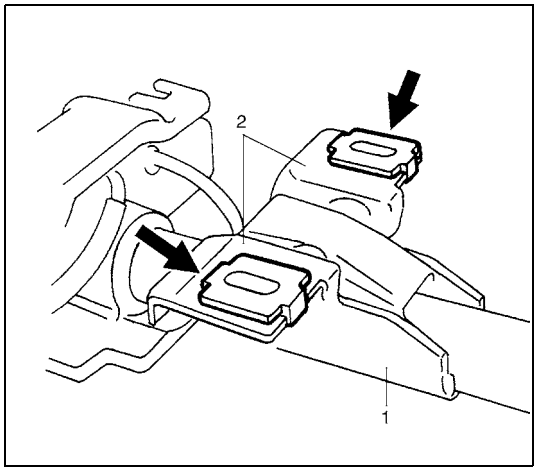
When driver and passenger air bag is deployed, the following components must be replaced.

- Driver and passenger air bag (inflator) modules
- Driver and passenger seat belt pretensioners
- SDM

When side air bag is deployed, the following components must be replaced.

- Applicable side air bag (inflator) module with seat back assembly
- Side sensor
- SDM

Accident with or without deployment/activation – component inspections



Certain air bag system components must be inspected after any crash, whether the air bag system activated or not.

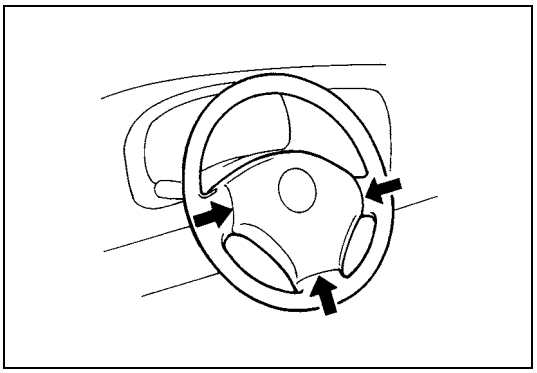
Those components are:

- Steering column (1) and shaft joints
  - Check for length, damage and bend according to "Checking Steering Column For Accident Damage" in Section 3C.

If any faulty condition is found in above checks, replace faulty part.

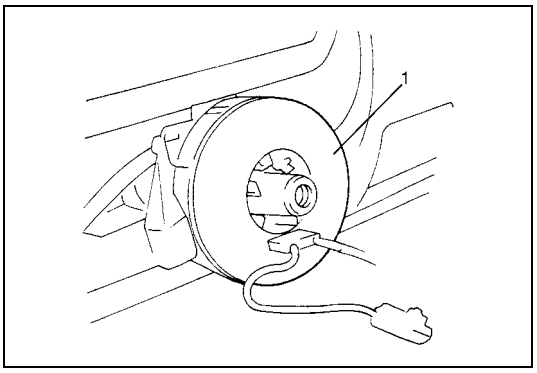
- Steering column bracket (2)
  - Check for damage and bent.

If any faulty condition is found in above checks, replace faulty part.



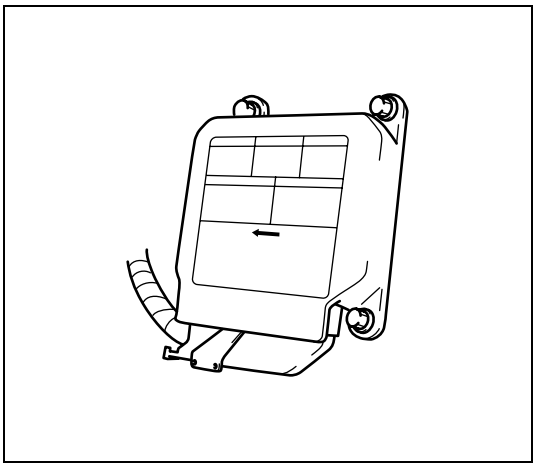
- Steering wheel and driver air bag (inflator) module
  - Check for damage or air bag (inflator) module fitness.
  - Check trim cover (pad surface) for cracks.
  - Check wire harness and connector for damage or tightness.

If any faulty condition is found in above checks, replace faulty part.



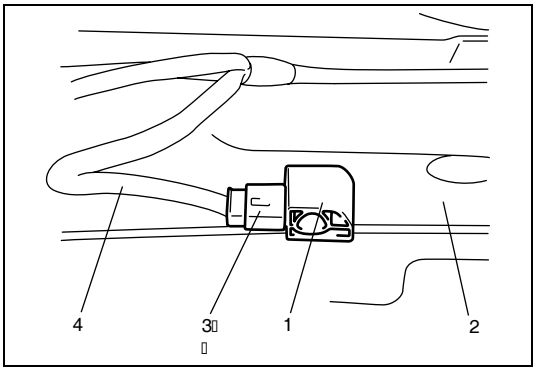
- Contact coil and combination switch assembly
  - Check wire harness and connectors for damage or tightness.
  - Check contact coil case for damage.

If any faulty condition is found in above checks, replace.



- SDM
  - Check for external damage such as deformation, scratch, crack, peeled paint, etc.
  - Check that SDM cannot be installed properly due to a cause in itself.
  - Check that connector or lead wire of SDM has a scorching, melting or damage.
  - Check SDM connector and terminals for tightness.
  - Check SDM sets a diagnostic trouble code (Refer to “Diagnostic Trouble Code (DTC) Check”.) and the diagnostic table leads to a malfunctioning SDM.

If any faulty condition is found in above checks, replace.

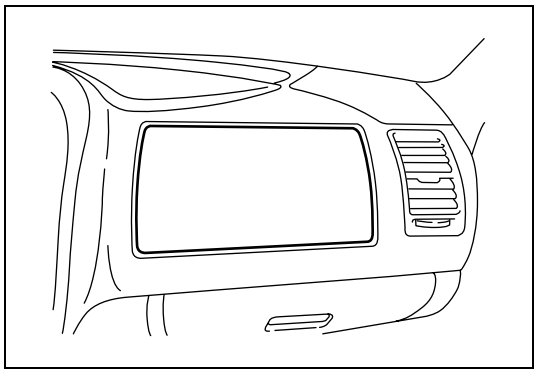


- Side sensors
  - Check sensor (1) and under body (2) for dents, cracks, deformation or rust.
  - Check sensor connector (sensor side and harness side) (3) or sensor lead wire (4) for damage, crack, scorching or melting.

If any faulty condition is found in above checks, replace.

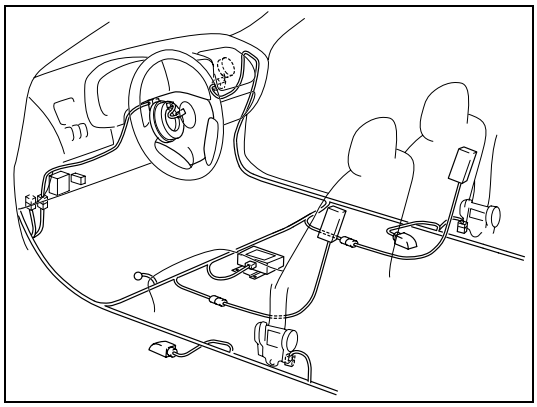
- Instrument panel member and reinforcement
  - Check for any distortion, bending, cracking or other damage.

If any faulty condition is found in above checks, replace.



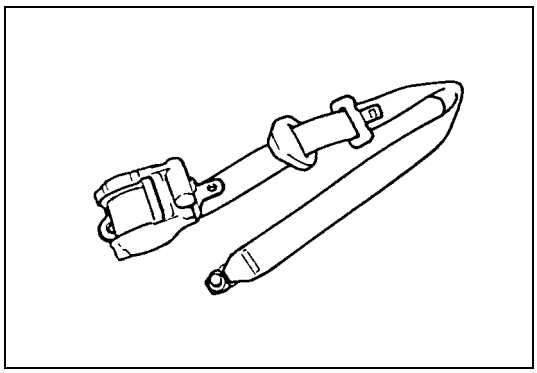
- Passenger air bag (inflator) module
  - Check for dents, cracks, damage or fitness.
  - Check trim cover for cracks or deformities.
  - Check harness and connector for damage or tightness.

If any faulty condition is found in above checks, replace.



- Air bag wire harness and connections
  - Check for damages, deformities or poor connections. (Refer to “Intermittents and Poor Connections”.)
  - Check wire harness clamps for tightness.

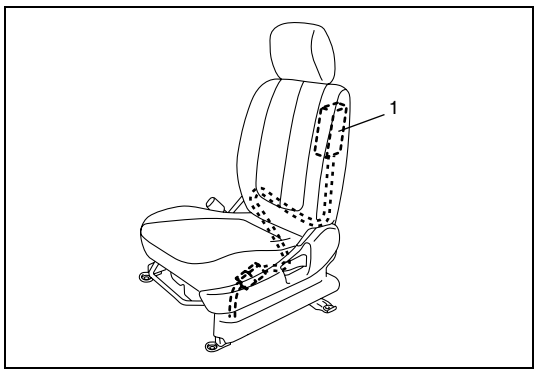
If any faulty condition is found, correct or replace.



- Seat belt pretensioner
  - Check for dents, cracks, damage or fitness.
  - Check connector for damage or tightness.

If any faulty condition is found in above checks, replace.

- Seat belts and mounting points
  - Refer to “Front Seat Belt Inspection” in Section 10.
- “AIR BAG” warning lamp
  - After vehicle is completely repaired, perform “Air Bag Diagnostic System Check”.



- Side air bag (inflator) module (1) (driver and passenger side)
  - Check front seat back for rent or damage.
  - Check wire harness and connector for damage or tightness.

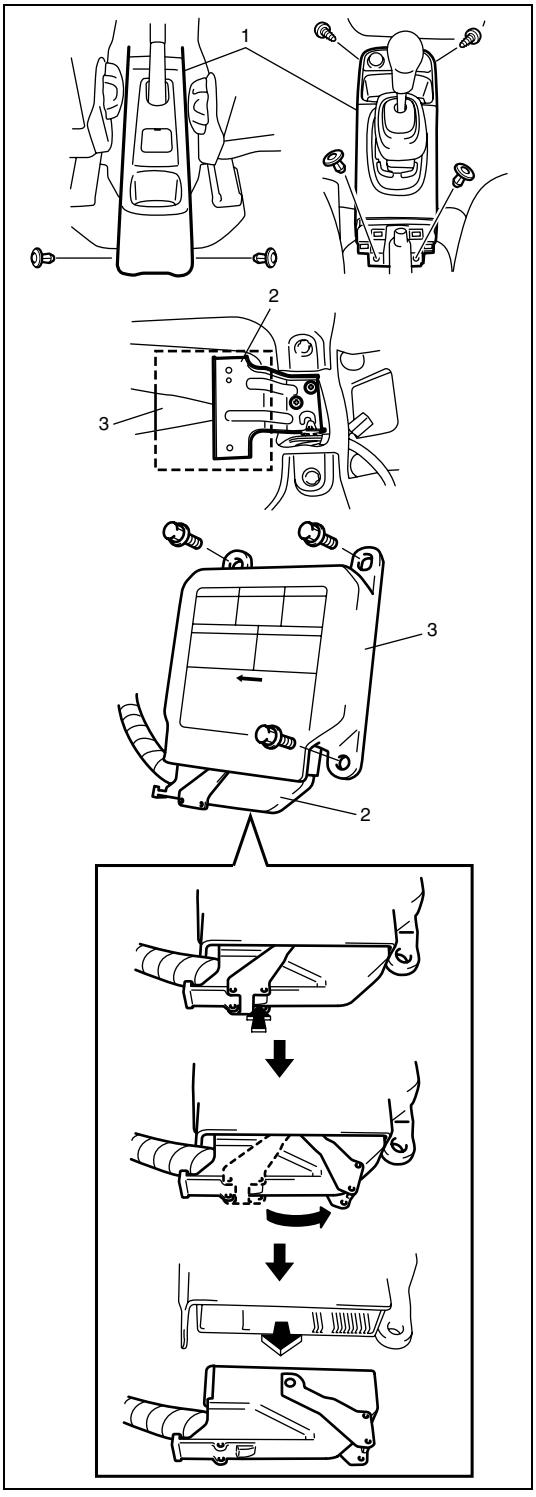
If any faulty condition is found in above checks, replace front seat back.

SDM Removal and Installation

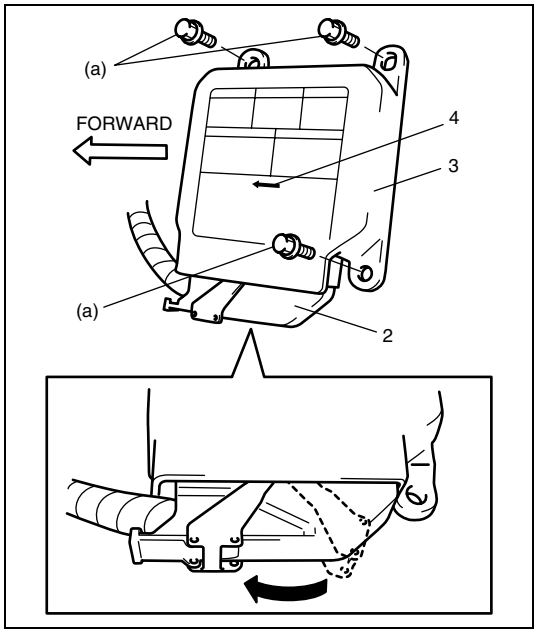
WARNING:

During service procedures, be very careful when handling a Sensing and Diagnostic Module (SDM).
Be sure to read "Service Precautions" before starting to work and observe every precaution during work. Neglecting them may result in personal injury or inactivation of the air bag system when necessary.

Removal



1) Disconnect negative cable at battery.
2) Disable air bag system. Refer to "Disabling air bag system" in this section.
3) Remove front and rear center console boxes (1) by removing screws and clips.
4) Remove front center console box mounting bracket (2).
5) Disconnect SDM connector (2) from SDM (3).
6) Remove SDM (3) from vehicle.



Installation

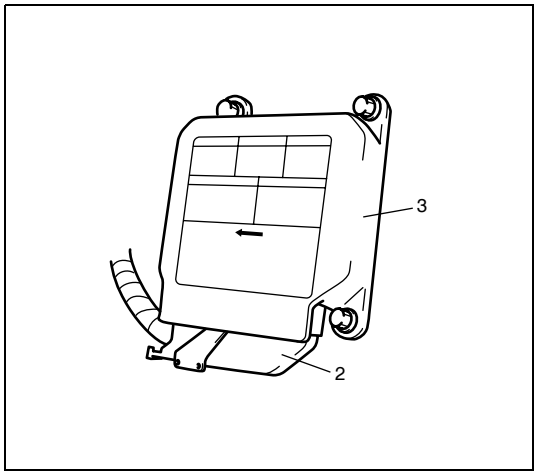
For installation, reverse removal procedure, nothing following points.

- Check none of the following conditions exists.
  - Bend, scratch, deformity in vehicle body mounted on SDM.
  - Foreign matters or rusts on mating surface of vehicle body mounted on SDM.
- Ensure that arrow (4) on the SDM (3) is pointing toward the front of the vehicle.
- Tighten SDM bolts to specified torque.

Tightening torque
SDM mounting bolt (a): 7 N·m (0.7 kg-m, 5.0 lb-ft)

- Connect SDM connector (2) to SDM (3) securely.
- Enable air bag system. Refer to “Enabling air bag system” in this section.

SDM Inspection



CAUTION:

- **Do not connect a tester whatever type it may be.**
- **Never repair or disassemble SDM (3).**
- **If SDM has been dropped, or if there are cracks, dents or other defects in the case or plate, replace it with a new one.**

- Check SDM (3) for dents, cracks or deformation.
- Check SDM connector (2) for damage, cracks or lock mechanism.
- Check SDM terminal for bent, corrosion or rust.

If any faulty condition is found in above checks, replace.

Side Sensor Removal and Installation

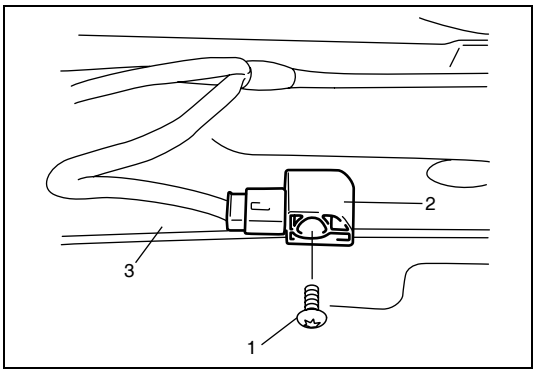
WARNING:

During service procedures, be very careful when handling a sensor.

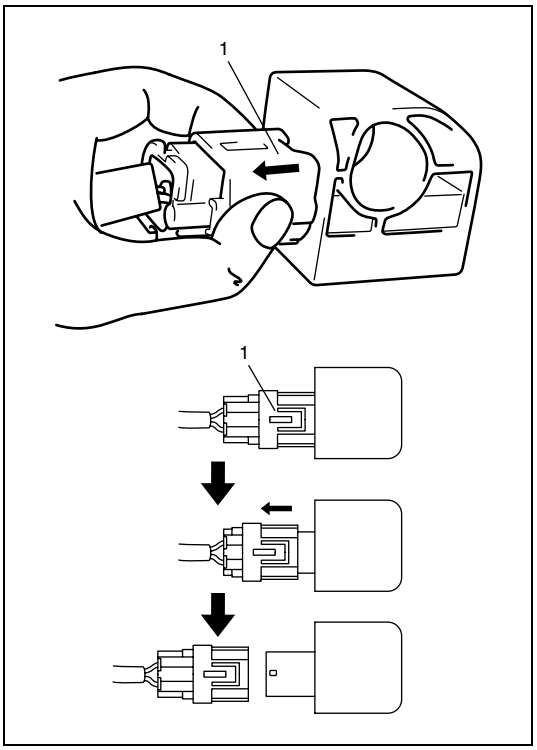
- **Never strike or jar a sensor.**
- **Under some circumstance, it could cause improper operation of the air bag system. A sensor bolt must be carefully torqued to assure proper operation.**

Removal

1) Disconnect negative cable at battery.
2) Disable air bag system. Refer to “Disabling air bag system” in this section.
3) Remove center pillar lower trim and side sill scuff.
4) Turn up floor carpet at front seat side.



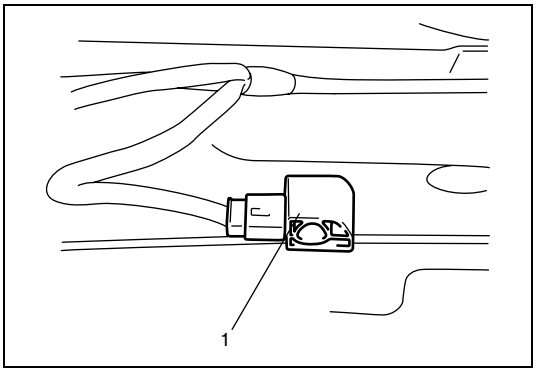
5) Remove side sensor bolt (1), and side sensor (2) from under body (3).



6) Disconnect side sensor connector sliding connector outer (1) as shown.

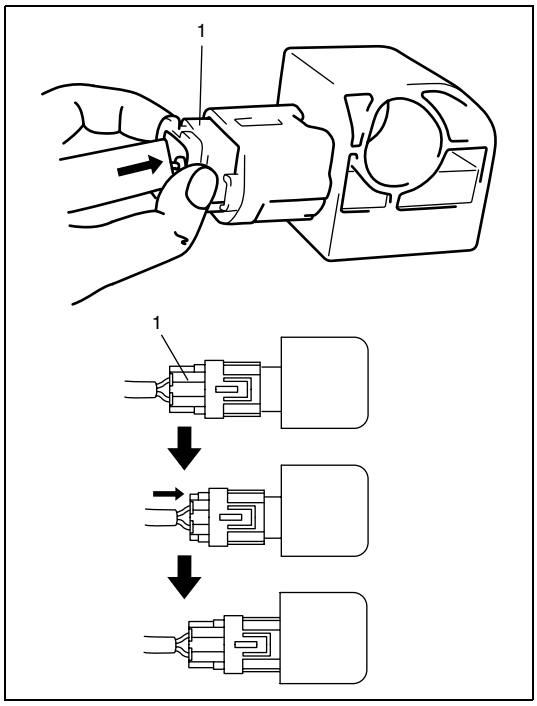
Installation

CAUTION:
Proper operation of side sensor requires sensor be rigidly attached to specified position.



1) Check that none of following faulty conditions exists.
   - Bend, deformity or rust of under body.
   - Foreign matter on mating surface of sensor.
2) Install side sensor (1) on under body (2) and tighten side sensor bolt (3) to specified torque.

Tightening torque
Side sensor bolt (a): 9 N·m (0.9 kg-m, 6.5 lb-ft)

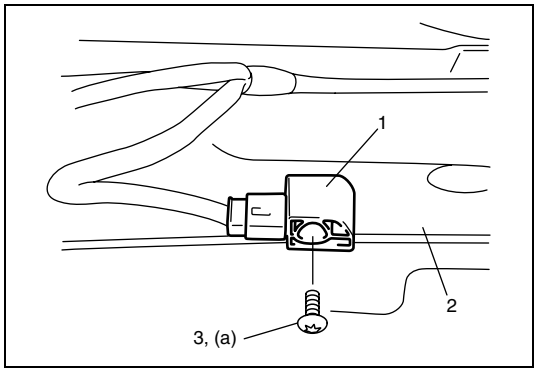


3) Connect side sensor connector pushing connector inner (1) as shown.

4) Connect negative cable at battery.
5) Enable air bag system. Refer to “Enabling air bag system” in this section.

Side Sensor Inspection

CAUTION:
- **Never disassemble side sensor.**
- **Sensor should be replaced when it was dropped from a height of 90 cm (3 ft) or more.**



- Check sensor (1) for dents, crack, deformation.
- Check sensor connector (sensor side and harness side), lock mechanism or sensor lead wire for damage, crack, scorching or melting.
- Check connector terminals for bent, corrosion or rust.

If any faulty condition is found in above checks, replace.

Seat Belt Pretensioner Removal and Installation

Refer to “Front Seat Belt Removal and Installation” in Section 10.

Seat Belt Pretensioner Inspection

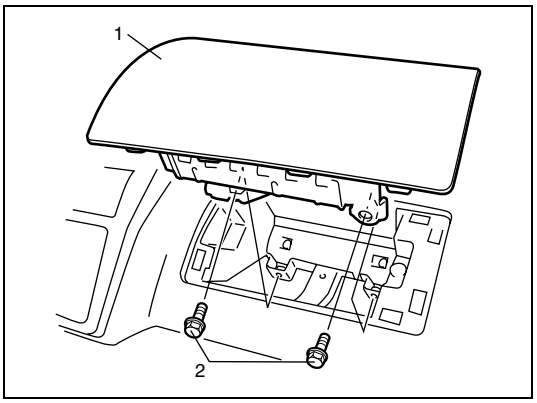
Refer to “Rear Seat Belt Inspection” in Section 10.

Passenger Air Bag (Inflator) Module Removal and Installation

WARNING:

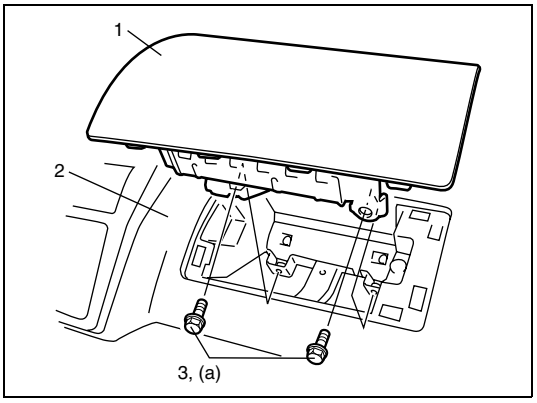
- **Never attempt to disassemble or repair the passenger air bag (inflator) module. If any abnormality is found, be sure to replace it with new one as an assembly.**
- **Be sure to read "Service Precautions" before starting to work and observe every precaution during work. Neglecting them may result in personal injury or undeployment of the air bag when necessary.**

Removal



1) Disconnect negative cable at battery.
2) Disable air bag system. Refer to "Disabling air bag system" in this section.
3) Remove passenger air bag (inflator) module (1) attaching bolts (2) then remove passenger air bag (inflator) module (1) from instrument panel member.

Installation

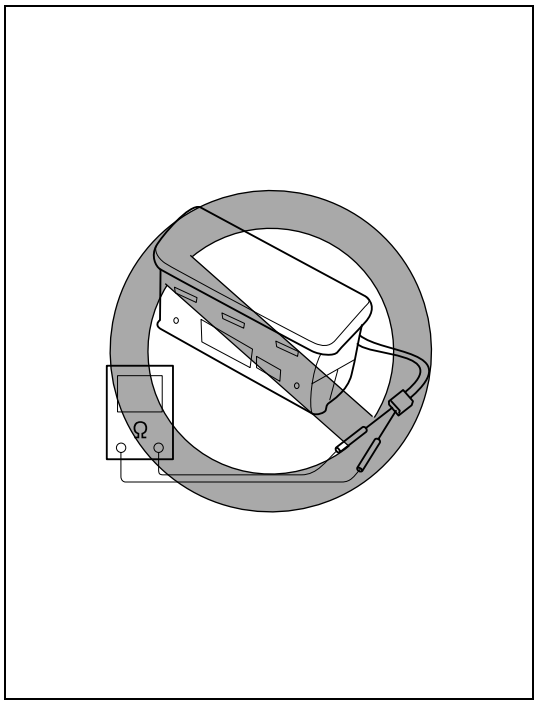


1) Install passenger air bag (inflator) module (1) to instrument panel (2).
2) Tighten passenger air bag (inflator) module attaching bolts (3) to specified torque.

Tightening torque
Passenger air bag (inflator) module mounting bolt
(a): 23 N·m (2.3 kg-m, 16.5 lb-ft)

3) Connect negative cable to battery.
4) Enable air bag system. Refer to "Enabling air bag system" in this section.

Passenger Air Bag (Inflator) Module Inspection



WARNING:

Never measure resistance of passenger air bag (inflator) module or disassemble it. Otherwise personal injury may result.

CAUTION:

If air bag (Inflator) module was dropped from a height or 90 cm (3 ft) or more, it should be replaced.

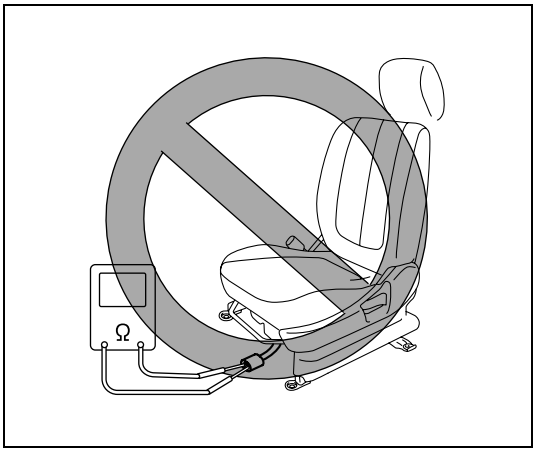
Check air bag (inflator) module appearance visually for following symptoms and if any one of them is applicable, replace with a new one.

- Air bag has deployed.
- There is a crack in trim cover (pad surface).
- Wire harness or connector is damaged.
- Air bag (inflator) module is damaged or a strong impact was applied to it.

Side Air Bag (Inflator) Module (If Equipped) Inspection

WARNING:

Be sure to read "Service Precautions" before starting to work and observe every precaution during work. Neglecting them may result in personal injury or undeployment of the air bag when necessary.



WARNING:

Never measure resistance of side air bag (inflator) module or disassemble it. Otherwise personal injury may result.

Check air bag (inflator) module appearance visually for following symptoms and if any one of them is applicable, replace with a new one.

- Air bag has deployed.
- There is a rent or damage in front seat back.
- Wire harness or connector is damaged or clamp for tightness.

Driver Air Bag (Inflator) Module Removal and Installation

Refer to "Driver Air Bag (Inflator) Module Removal and Installation" in Section 3C.

Driver Air Bag (Inflator) Module Inspection

Refer to "Driver Air Bag (Inflator) Module Inspection" in Section 3C.

Contact Coil Assembly

Refer to "Contact Coil Cable Assembly Removal and Installation" in Section 3C.

Contact Coil Assembly Inspection

Refer to "Contact Coil Cable Assembly Inspection" in Section 3C.

Air Bag (Inflator) Module and Seat Belt Pretensioner Disposal

WARNING:

Failure to follow proper air bag (inflator) module and seat belt pretensioner disposal procedures can result in air bag deployment and pretensioner activation which may cause personal injury.
Do not dispose of live (undeployed) air bag (inflator) modules and seat belt pretensioners. Because undeployed air bag (inflator) module/inactivated seat belt pretensioner must not be disposed of through normal refuse channels.
Undeployed air bag (inflator) module and inactivated seat belt pretensioner contain substances that can cause severe illness or personal injury if sealed container is damaged during disposal.

Air bag (inflator) module/seat belt pretensioner can be deployed/activated inside or outside of vehicle. Deployment/Activation method used depends upon final disposition of vehicle. Review the following instructions in order to determine which will work best in a given situation.

Deployment/Activation Outside of Vehicle:
When you intend to return the vehicle to service, deploy the air bag (inflator) module(s) or activate seat belt pretensioner(s) outside of the vehicle.

Deployment/Activation Inside of Vehicle:
When the vehicle will be destroyed, or salvaged for component parts, deploy the air bag modules and/or activate seat belt pretensioners installed on vehicle.

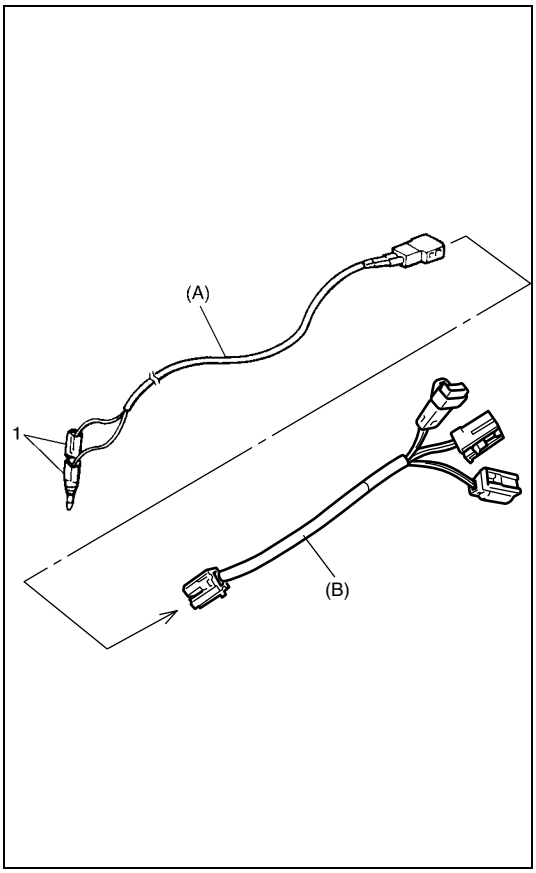
WARNING:

The following precautions must be observed for this work. Failure to observe any of them may result in personal injury.

- **Procedure should be followed strictly as described here.**
- **Be sure to read "Service Precautions" beforehand.**
- **To avoid accidental deployment/activation, this work should be performed by no more than one person.**
- **Since smoke is produced when air bag (inflator) module is deployed and pretensioner is activated, select well-ventilated area.**
- **Air bag (inflator) module and seat belt pretensioner will immediately deploy/activate when 12 volts vehicle battery is connected to it. Wear safety glasses throughout this entire deployment/activation and disposal procedure.**
- **Wear suitable ear protection when deploying air bag (inflator) module/activating seat belt pretensioner. Also, advise those who are in area close to deployment/activation site to wear suitable ear protection.**
- **Do not deploy/activate two or more air bag system components (air bag (inflator) modules and seat belt pretensioners) at the same time.**
- **Never connect deployment harness to any 12 volts vehicle battery before connecting deployment harness to air bag (inflator) module and seat belt pretensioner. Deployment harness shall remain shorted and not be connected to 12 volts vehicle battery till you are ready to deploy air bag (inflator) module or activate seat belt pretensioner.**

Deployment/Activation Outside of Vehicle

When you intend to return the vehicle to service, deploy the air bag (inflator) module(s) or activate seat belt pretensioner(s) outside of the vehicle.



1) Turn ignition switch to "LOCK" position and remove key.
2) Wear safety glasses during this deployment/activation procedure.
3) Check that there is no open, short or damage in special tools (deployment harness (A) and adapter cable (B)). If any faulty is found, do not use it and be sure to use new deployment harness (A).

Special tool
(A): 09932-75030
(B): 09932-78331

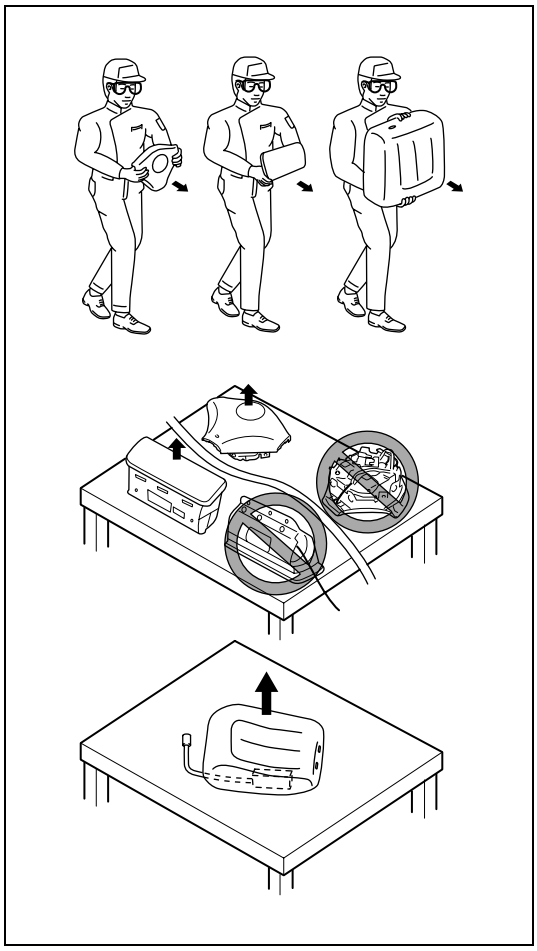
NOTE:

If faulty of seat belt pretensioner connector of adapter cable (B) is found, replace it to spare connector (special tool).

4) Short two deployment harness leads (1) together by fully seating one banana plug into the other.

WARNING:

Deployment harness (A) shall remain shorted and not be connected to 12 volts vehicle battery till you are ready to deploy air bag module or activate seat belt pretensioner.



5) Remove air bag (inflator) module(s) or seat belt pretensioner(s) from vehicle referring to “Driver Air Bag (Inflator) Module Removal and Installation” in Section 3C, “Passenger Air Bag (Inflator) Module Removal and Installation” in this section, “Front Seat Belt Removal and Installation” in Section 10 and “Front Seat Removal and Installation” in Section 9.

WARNING:

- **For handing and storage of live air bag (inflator) module, select place where ambient temperature below 65°C (150°F), without high humidity and away from electric noise.**
- **Always carry live air bag (inflator) module with trim cover away from you.**
- **When storing live air bag (inflator) module or when leaving live air bag (inflator) module unattended on bench or other surface, always face trim cover up and away from surface. Front seat back with live air bag (inflator) module must be placed with its frontal seat cover facing up. This is necessary so that free space is provided to allow air bag (inflator) module to expand in the unlikely event of accidental deployment.**

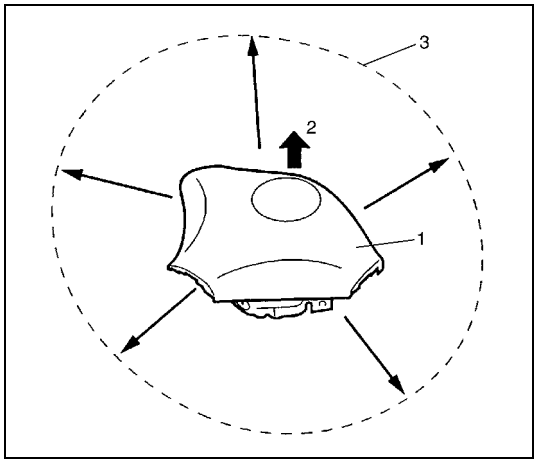
Failure to follow procedures may result in personal injury.

WARNING:

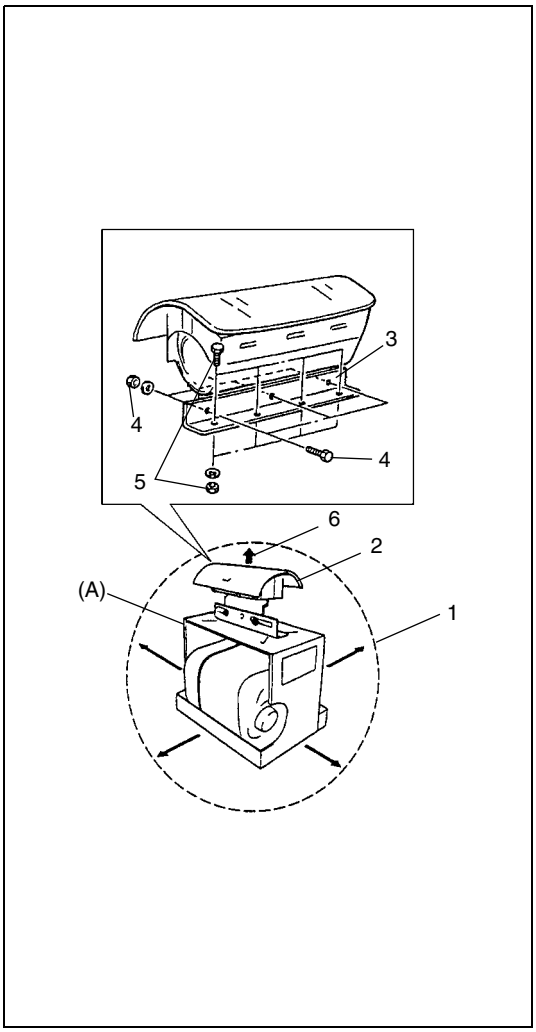
- **For handling and storage of a live seat belt pretensioner, select a place where the ambient temperature below 65°C (150°F), without high humidity and away from electric noise.**
- **Never carry the seat belt pretensioner by webbing.**
- **When placing live seat belt pretensioner on workbench or other surface, be sure not to put something on seat belt pretensioner.**

Otherwise, personal injury may result.

6) Set air bag (inflator) module or seat belt pretensioner as follows.



- For driver air bag (inflator) module
  i) Clear space (3) on ground about 185 cm (6 ft) in diameter where driver air bag (inflator) module (1) for deployment. Paved, outdoor location where there is no activity is preferred. If outdoor location is not available, space on shop floor where there is no activity and provide sufficient ventilation. Ensure no loose or flammable objects are within deployment area.
  ii) Place driver air bag (inflator) module (1) with its vinyl trim cover facing up (2) on ground in step i).



- For passenger air bag (inflator) module
  i) Clear space (1) on ground about 185 cm (6 ft) in diameter where passenger air bag (inflator) module for deployment. Paved, outdoor location where there is no activity is preferred. If outdoor location is not available, space on shop floor where there is no activity and provide sufficient ventilation. Ensure no loose or flammable objects are within deployment area.
  ii) Place deployment fixture (A) on ground in step i).

Special tool
(A): 09932-75041

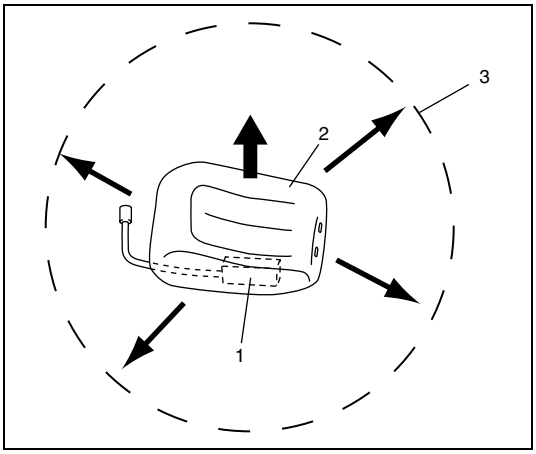
  iii) Fill plastic reservoir in deployment fixture (A) with water or sand. This is necessary to provide sufficient stabilization of fixture during deployment.
  iv) Attach passenger air bag (inflator) module (2) in deployment fixture (A) using mounting attachment (3), hold-down bolts & nuts (4) and M8 bolts & nuts (5).

NOTE:

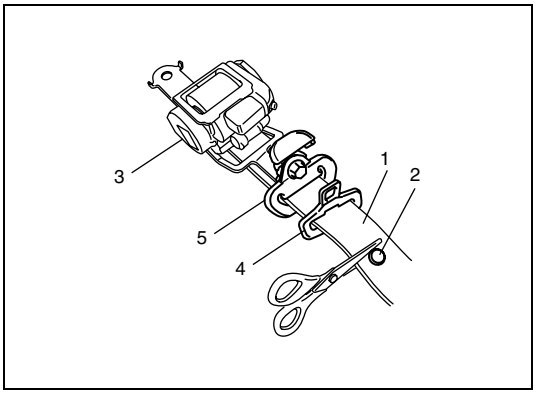
Make sure that deploying direction (6) faces as shown in figure against mounting attachment (3).

CAUTION:

Be sure to use M8 size and 7T strength bolts and nut (5) for fixing passenger air bag (inflator) module (2) to mounting attachment (3).



- For side air bag (inflator) module
  i) Clear space (3) on ground about 185 cm (6 ft) in diameter where side air bag (inflator) module (1) for deployment. Paved, outdoor location where there is no activity is preferred. If outdoor location is not available, space on shop floor where there is no activity and provide sufficient ventilation. Ensure no loose or flammable objects are within deployment area.
  ii) Place front seat back (2) with side air bag (inflator) module (1) with its frontal seat cover facing up on ground in step i).

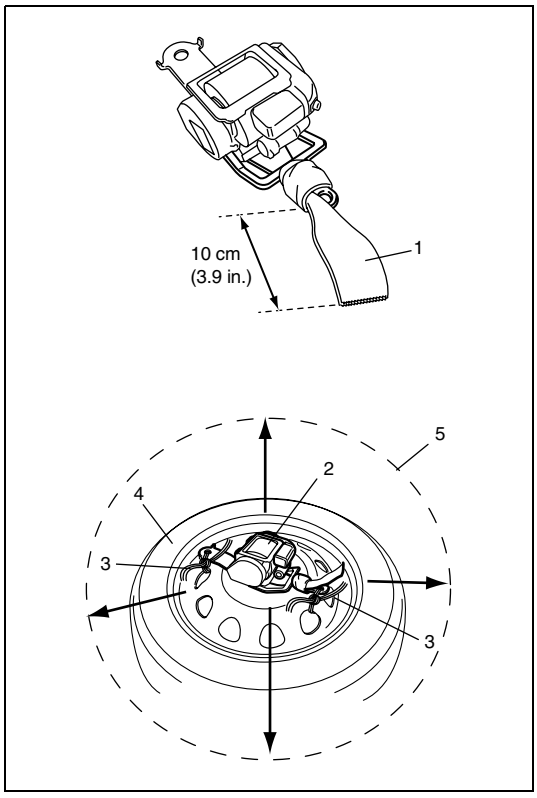


- For seat belt pretensioner
  i) Cut webbing (1) at tongue plate stopper (2) of seat belt pretensioner (3) side as shown.

NOTE:

Hold seat belt pretensioner (3) vertically in the same condition as it is installed. Otherwise, webbing can't be pulled out.

  ii) Remove tongue plate (4) and shoulder anchor (5) from webbing.



iii) Tie webbing (1) tightly at 10 cm (3.9 in.) from cutting edge as shown.
iv) Tie seat belt pretensioner (2) with wire harness (3) to wheel-installed tire (4) as shown.

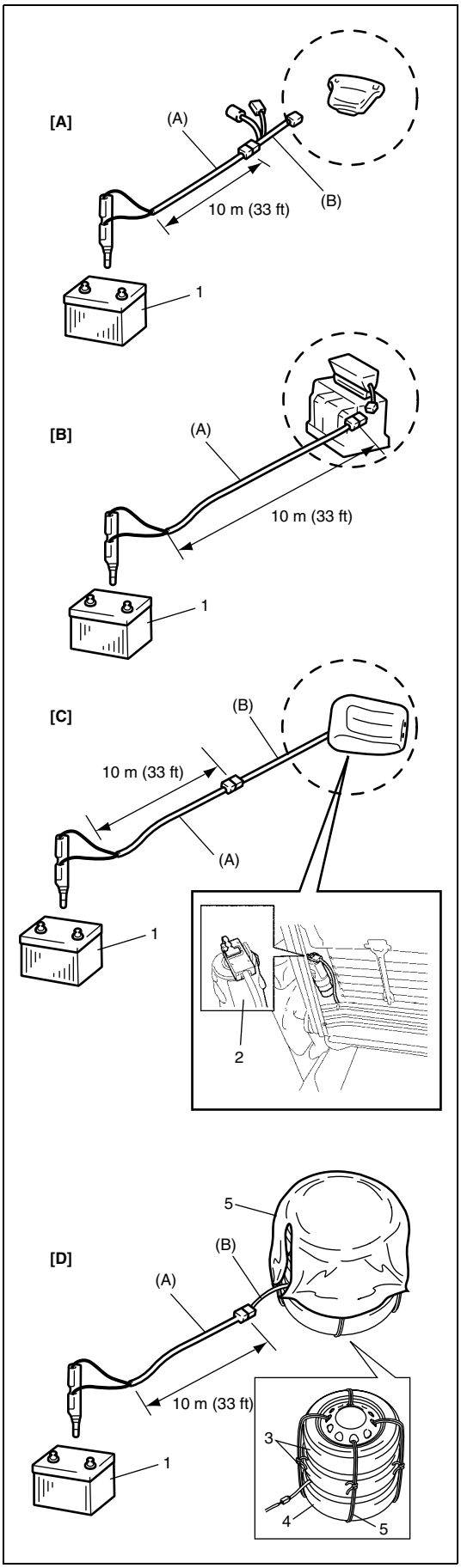
Wire harness specification:

Stripped wire harness section 1.25 mm^2 (0.0019 in.^{2}) or more (Stripped wire harness diameter 1.25 mm (0.05 in.) or more)

NOTE:

Wind wire harness (3) around at least 3 times.

v) Clear space (5) on ground about 185 cm (6 ft) in diameter where seat belt pretensioner (2) is to be activated. Paved, outdoor location where there is no activity is preferred. If outdoor location is not available, space on shop floor where there is no activity and provide sufficient ventilation. Ensure no loose or flammable objects are within activation area.
vi) Place wheel-installed tire (4) with seat belt pretensioner (2) on ground in step v).



7) Stretch deployment harness (A) from air bag (inflator) module or seat belt pretensioner to its full length 10 m (33 ft).

Special tool
(A): 09932-75030

8) Place 12 volts vehicle battery (1) near shorted end of deployment harness (A).
9) Verify that area around air bag (inflator) module or seat belt pretensioner is clear of all people and loose or flammable objects.
10) Connect adapter cable (B) as follows.

Special tool
(B): 09932-78331

- For driver air bag (inflator) module:
  Verify that driver air bag (inflator) module is resting with its vinyl trim cover facing up, and connect adapter cable (B) to driver air bag (inflator) module.
- For passenger air bag (inflator) module:
  Verify that passenger air bag (inflator) module is firmly and properly secured on deployment fixture (special tool), and connect adapter cable (B) to passenger air bag (inflator) module.
- For side air bag (inflator) module:
  Verify that front seat back with side air bag (inflator) module (2) resting with its frontal seat cover facing up, and connect adapter cable (B) to side air bag (inflator) module.
- For seat belt pretensioner:
  Connect adapter cable (B) to seat belt pretensioner.

11) Connect adapter cable (B) to deployment harness (A) connector and lock connectors with lock slider.
12) For seat belt pretensioner
  a) Pile 2 wheel-installed tires (3) on top of tire with seat belt pretensioner (4), and tie them with wire harness (5) as shown.

Wire harness specification:

Stripped wire harness section 1.25 mm^2 (0.0019 $in.^2$) or more (Stripped wire harness diameter 1.25 mm (0.05 in.) or more)

NOTE:

Wind wire harness around at least 2 times.

  b) Drape blanket (6) over those tires.

[A]:	For driver air bag (inflator) module
[B]:	For passenger air bag (inflator) module
[C]:	For side air bag (inflator) module
[D]:	For seat belt pretensioner

13) Notify all people in immediate area that you intend to deploy/ activate air bag (inflator) module or seat belt pretensioner.

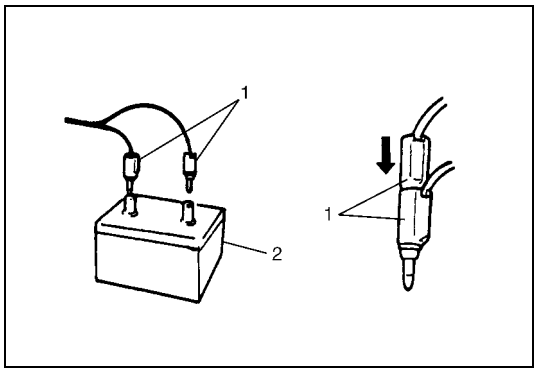
NOTE:

- **When air bag (inflator) module deploys and seat belt pretensioner activates, rapid gas expansion will create substantial report. Wear suitable ear protection. Notify all people in immediate area that you intend to deploy air bag (inflator) module or activate seat belt pretensioner and suitable ear protection should be worn.**
- **When driver air bag (inflator) module deploys, driver air bag (inflator) module may jump about 30 cm (1 ft) vertically. This is normal reaction to force of rapid gas expansion inside of drive air bag (inflator) module.**
- **After air bag (inflator) module has been deployed, surface of air bag (inflator) may contain powdery residue. This powder consists primarily of cornstarch (used to lubricate bag (inflator) as it inflates) and byproducts of chemical reaction.**

WARNING:

- **Do not place deployed air bag (inflator) module and activated seat belt pretensioner near any flammable objects.**
- **Do not apply water, oil, etc. to deployed air bag (inflator) module and activated seat belt pretensioner.**
- **Wait for about 30 minutes before touching any metal surface of air bag (inflater) module or seat belt pretensioner module. Disregarding these precautions may cause fire or personal injury.**

Failure to follow procedures may result in fire or personal injury.

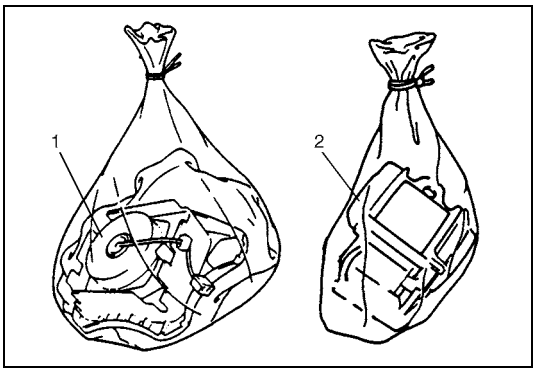


14) Separate two banana plugs (1) on deployment harness.
15) Connect deployment harness to 12 volts vehicle battery (2). This will immediately deploy or activate air bag (inflator) module or seat belt pretensioner.
16) Disconnect deployment harness from 12 volts vehicle battery (2) and short two deployment harness leads together by fully seating one banana plug into the other.

17) In the unlikely event that air bag (inflator) module or seat belt pretensioner did not deploy/activate after following these procedures, proceed immediately with Step 23) through 26). If air bag (inflator) module or seat belt pretensioner did deploy or activate, proceed with Steps 18) through 22).
18) Put on pair of shop gloves to protect your hands from possible irritation and heat when handling deployed air bag (inflator) module or activated seat belt pretensioner.
19) Disconnect adapter cable (special tool) from air bag (inflator) module or seat belt pretensioner as soon as possible. This will prevent adapter cable (special tool) from damage due to possible contact with hot air bag (inflator) module or hot seat belt pretensioner.
20) Check adapter cable connector as follows.
    - For air bag (inflator) module:
      Air bag (inflator) module connector of adapter cable (special tool) are designed to be reused. However they should be inspected for damage after deployment and replaced if necessary.
    - For seat belt pretensioner:
      Seat belt pretensioner connector of adapter cable (special tool) must be replaced to spare connector (special tool).

NOTE:

Do not reuse seat belt pretensioner connector of adapter cable (special tool) because it will be destroyed by shock when seat belt pretensioner is activated.



21) Dispose of deployed air bag (inflator) module (1) or activated seat belt pretensioner (2) through normal refuse channels after it has cooled for at least 30 minutes and tightly seal air bag (inflator) module (1) or seat belt pretensioner (2) in strong vinyl bag. (Refer to “Deployed Air Bag (Inflator) Module and Activated Seat Belt Pretensioner Disposal” in detail.)
22) Wash your hands with mild soap and water afterward.

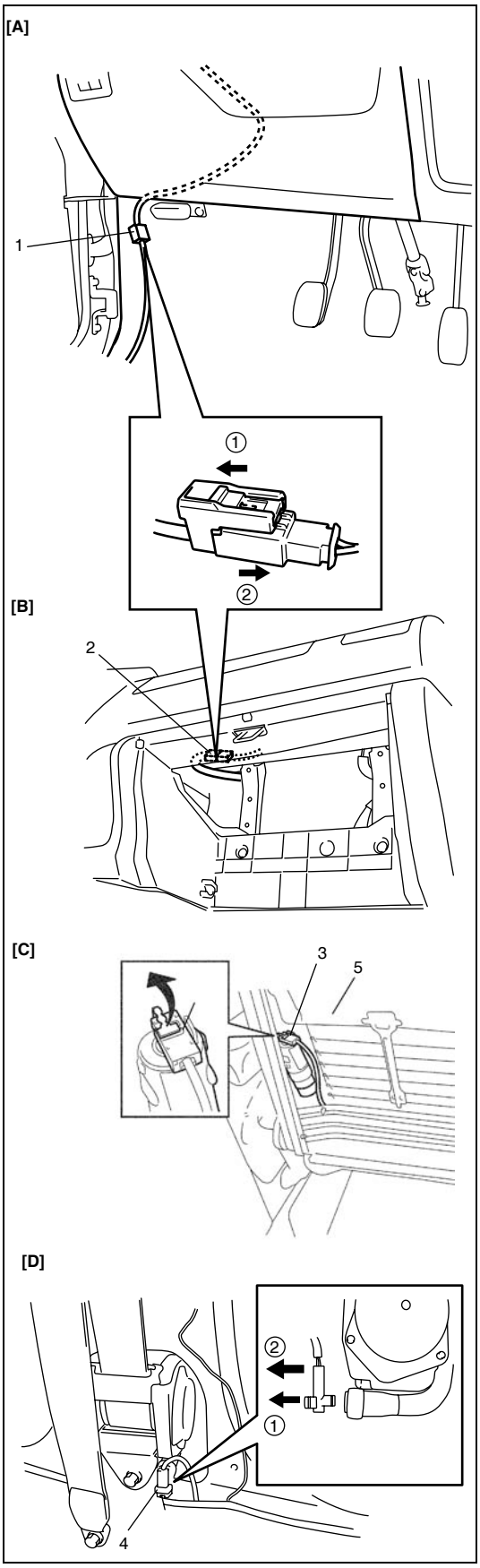
NOTE:

Remaining steps are to be followed in the unlikely event that air bag (inflator) module did not deploy or seat belt pretensioner did not activate.

23) Ensure that deployment harness has been disconnected from 12 volts vehicle battery and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
24) Disconnect deployment harness and adapter cable from air bag (inflator) module or seat belt pretensioner.

25) Temporarily store undeployed air bag (inflator) module or unactivated seat belt pretensioner referring to “Service Precautions” for details.
26) Contact your local distributor for further assistance.

Deployment/Activation Inside of Vehicle

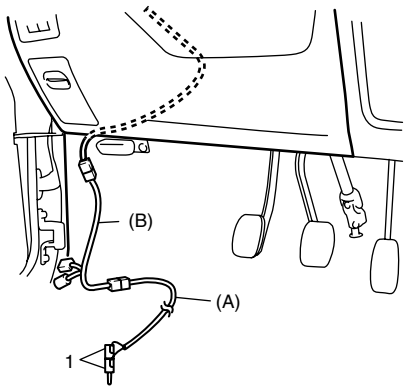


When the vehicle will be destroyed, or salvaged for component parts, deploy the air bag modules and/or activate seat belt pretensioners installed on vehicle.

1) Turn ignition switch to “LOCK” position, remove key and put on safety glasses.
2) Remove all loose objects from front seats and instrument panel.
3) Disconnect air bag (inflator) module or seat belt pretensioner connector as follows.
   - For driver air bag (inflator) module:
     Disconnect contact coil connector (1) located near base of steering column.
   - For passenger air bag (inflator) module:
     Remove glove box from instrument panel and disconnect passenger air bag (inflator) module connector (2).
   - For side air bag (inflator) module:
     To turn over driver and passenger side back trims (5) and disconnect side air bag (inflator) module connectors (3).
   - For seat belt pretensioner:
     Remove both side (driver and passenger side) center pillar lower trims and disconnect seat belt pretensioner connectors (4).
4) Confirm that each air bag (inflator) module and/or seat belt pretensioner is securely mounted.

[A]:	Driver air bag (inflator) module
[B]:	Passenger air bag (inflator) module
[C]:	Side air bag (inflator) module
[D]:	Seat belt pretensioner

[A]



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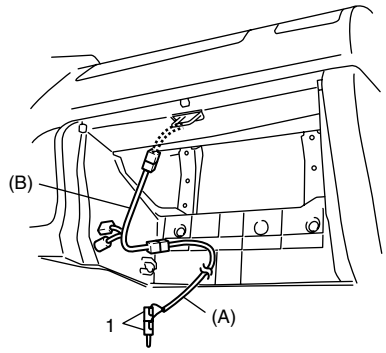
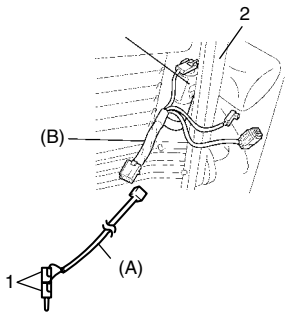


[C]



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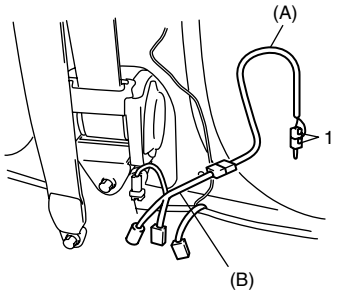


5) Check that there is no open, short or damage in special tools (deployment harness (A) and adapter cable (B)). If any faulty condition is found, do not use it and be sure to use new deployment harness (A) and/or adapter cable (B). And connect adapter cable (B) to deployment harness (A) and lock connectors with lock slider.

NOTE:

If faulty of seat belt pretensioner connector of adapter cable (B) is found, replace it to spare connector (special tool).

Special tool
(A): 09932-75030
(B): 09932-78331

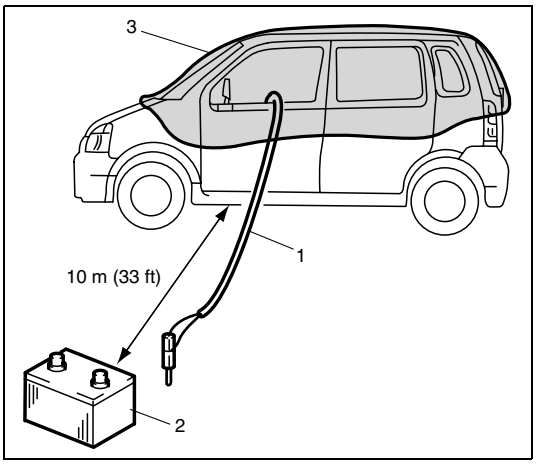
6) Short two deployment harness leads (1) together by fully seating one banana plug into the other.

WARNING:

Deployment harness (A) shall remain shorted and not be connected to 12 volts vehicle battery until you are ready to deploy air bag (inflator) module or activate seat belt pretensioner.

7) Connect adapter cable (B) in series with deployment harness (A) to air bag (inflator) module or seat belt pretensioner as follows.
- For air bag (inflator) module:
  Connect adapter cable (B) in series with deployment harness (A) and push adapter cable (B) connector to air bag (inflator) module connector (driver, passenger or side of driver and passenger) till click can be heard.
- For side air bag (inflator) module:
  Connect adapter cable (B) deployment harness (A) and lock connector with lock lever.
- For seat belt pretensioner:
  Connect adapter cable (B) in series with deployment harness (A) to seat belt pretensioner and lock connector with lock part.

[A]:	For driver air bag (inflator) module
[B]:	For passenger air bag (inflator) module
[C]:	For side air bag (inflator) module
[D]:	For seat belt pretensioner
2.	Seat back assembly



8) Route deployment harness (1) out of vehicle.
9) Verify that inside of vehicle and area surrounding vehicle are clear of all people and loose or flammable objects.
10) Stretch deployment harness (1) to its full length 10 m (33 ft).
11) Place 12 volts vehicle battery (2) near shorted end of deployment harness (1).
12) Completely cover windshield area and front door window openings with drop cloth, a blanket or any similar item (3). This reduces possibility of injury due to possible fragmentation of vehicle's glass or interior.
13) Notify all people in immediate area that you intend to deploy air bag (inflator) module or activate seat belt pretensioner.

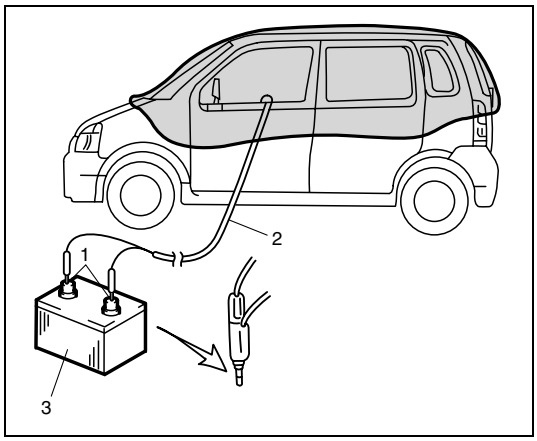
NOTE:

- **When air bag (inflator) module deploys or seat belt pretensioner activates, rapid gas expansion will create substantial report. Wear suitable ear protection. Notify all people in immediate area that you intend to deploy air bag (inflator) module or to activate seat belt pretensioner and suitable ear protection should be worn.**
- **After air bag (inflator) module has been deployed, surface of air bag may contain powdery residue. This powder consists primarily of cornstarch (used to lubricate air bag (inflator) module as it inflates) and by-products of chemical reaction.**

WARNING:

- **Do not place deployed air bag (inflator) module and activated seat belt pretensioner near any flammable objects.**
- **Do not apply water, oil, etc. to deployed air bag (inflator) module and activated seat belt pretensioner.**
- **Wait for about 30 minutes before touching any metal surface of air bag (inflater) module or seat belt pretensioner module. Disregarding these precautions may cause fire or personal injury.**

Failure to follow procedures may result in fire or personal injury.



14) Separate two banana plugs (1) on deployment harness (2).
15) Connect deployment harness (2) to 12 volts vehicle battery (3). This will immediately deploy or activate air bag (inflator) module or seat belt pretensioner.
16) Disconnect deployment harness (2) from 12 volts vehicle battery (3) and short two deployment harness leads together by fully seating one banana plug into the other.
17) Repeat Steps 2) through 16) to deploy/activate air bag (inflator) modules and seat belt pretensioners which has not been deployed/activated, if any.
18) In the unlikely event that air bag (inflator) module and seat belt pretensioner after following these procedures, proceed immediately with Step 24) through 26). If air bag (inflator) module and seat belt pretensioner did deploy/activate, proceed with Steps 19) through 23).
19) Carefully remove drop cloth from vehicle and clean off any fragments or discard it entirely.
20) Put on pair of shop gloves to protect your hands from possible irritation and heat when handling deployed air bag (inflator) module and activated seat belt pretensioner.
21) Disconnect adapter cable (special tool) from air bag (inflator) module or seat belt pretensioner as soon as possible. This will prevent adapter cable (special tool) from damage due to possible contact with hot air bag (inflator) module or hot seat belt pretensioner.
22) Check adapter cable connector as follows.
    - For air bag (inflator) module:
      Air bag (inflator) module connector of adapter cable (special tool) are designed to be reused. However they should be inspected for damage after deployment and replaced if necessary.
    - For seat belt pretensioner:
      Seat belt pretensioner connector of adapter cable (special tool) must be replaced to spare connector (special tool).

    NOTE:

    Do not reuse seat belt pretensioner connector of adapter cable (special tool) because it will be destroyed by shock when seat belt pretensioner is activated.

23) With air bag (inflator) modules deployed and seat belt pretensioners activated, vehicle may be scrapped in the same manner as non-air bag system/seat belt pretensioner equipped vehicle.

NOTE:

Remaining steps are to be followed in the unlikely event that air bag (inflator) module did not deploy or seat belt pretensioner did not activate.

24) Remove undeployed air bag (inflator) module(s) and/or inactivated seat belt pretensioner(s) from vehicle. For driver air bag (inflator) module, refer to “Driver Air Bag (Inflator) Module Removal and Installation” in Section 3C. For passenger air bag (inflator) module, refer to “Passenger Air Bag (Inflator) Module Removal and Installation” in this section. For seat belt pretensioner, refer to “Front Seat Belt Removal and Installation” in Section 10.
25) Temporarily store undeployed air bag (inflator) module and/or unactivated seat belt pretensioner referring to “Service Precautions” for details.
26) Contact your local distributor for further assistance.

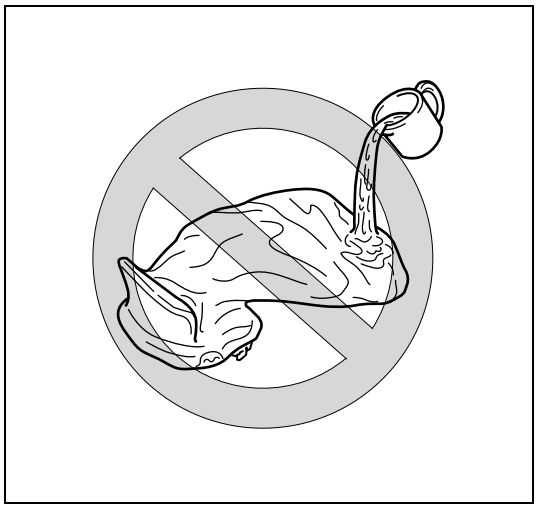
Deployed Air Bag (Inflator) Module and Activated Seat Belt Pretensioner Disposal

WARNING:

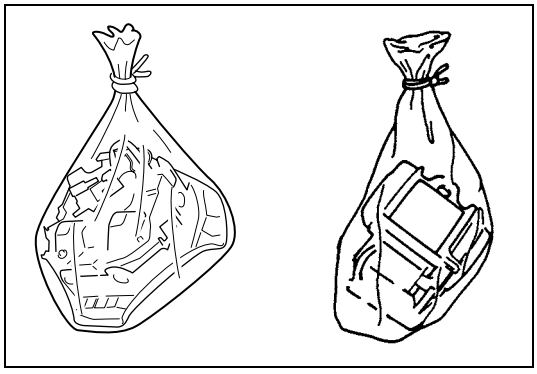
Failure to follow proper air bag (inflator) module and seat belt pretensioner disposal procedures can result in air bag deployment and pretensioner activation which may cause personal injury. Undeployed air bag (inflator) module and inactivated seat belt pretensioner must not be disposed of through normal refuse channels.

Undeployed air bag (inflator) module and inactivated seat belt pretensioner contains substances that can cause severe illness or personal injury if sealed container is damaged during disposal.

Deployed air bag (inflator) module and activated seat belt pretensioner can be disposed of through normal refuse channels just like any other parts. For their disposal, however, following points should be noted.



- Air bag (inflator) module and seat belt pretensioner immediately after deployment/activation is very hot. Wait for 30 minutes to cool it off before handling it.
- Never apply water, oil, etc. to deployed air bag (inflator) module and activated seat belt pretensioner to cool it off and be careful so that water, oil etc. does not get on deployed air bag (inflator) module and activated seat belt pretensioner.
- After air bag (inflator) module has been deployed, surface of air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate air bag (inflator) module as it inflates) and by-products of chemical reaction. As with many service procedures, you should wear gloves and safety glasses.



- When disposing of deployed air bag (inflator) module and activated seat belt pretensioner, be sure to seal it in a vinyl bag.
- When air bag (inflator) module and seat belt pretensioner have been deployed/activated inside of vehicle which is going to be scrapped, leave them as installed to vehicle.
- Be sure to wash your hands with mild soap and water after handling it.

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
SDM mounting bolt	7	0.7	5.0
Passenger air bag (inflator) module bolt	23	2.3	16.5
Side sensor bolt	9	0.9	6.5

Special Tool

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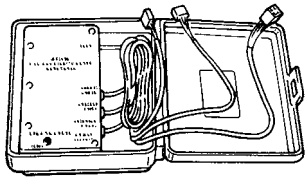
<td> 
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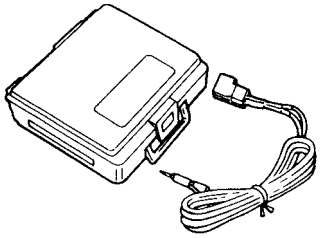
<td> 
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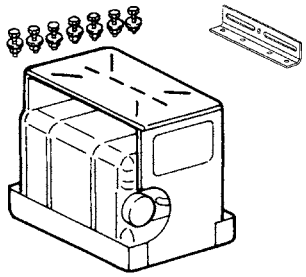
<td> 
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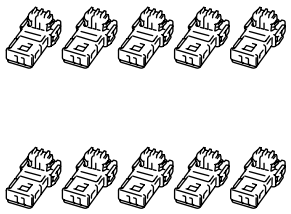
<td> 
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Spare connector
(See NOTE "C".)</td>
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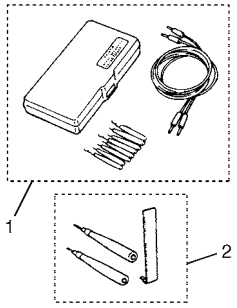
<td> 
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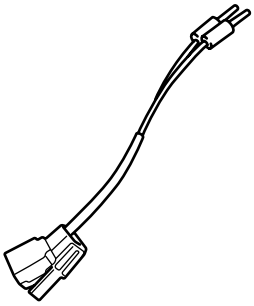
Connector test adapter set (See NOTE "D".)</td>
<td> 
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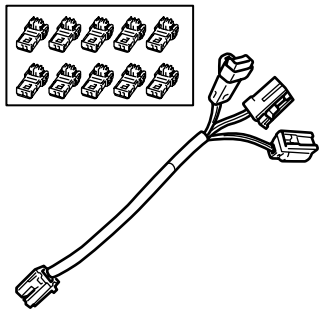
<td> 
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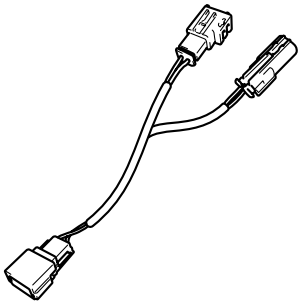
<td> 
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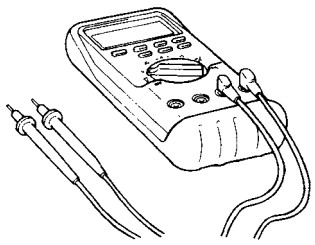
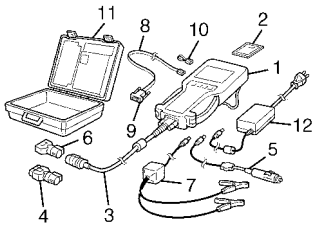
<td> 
Digital multimeter
(See NOTE "A" and WARNING.)</td>
<td> 
Tech 2 kit (Suzuki Scan Tool)
(See NOTE "B".)</td>
<td></td>
<td></td>
</tr>
</table>

WARNING:

Be sure to use the specified digital multimeter. Otherwise, air bag (inflator) module deployment or personal injury may result.

NOTE:

- **"A": Digital multimeter specification: Maximum test current is 10 mA or less at minimum range of resistance measurement.**
- **"B": This kit includes the following items.**
  1. Tech 2, 2. PCMCIA card, 3. DLC cable, 4. SAE 16/19 adapter, 5. Cigarette cable, 6. DLC loopback adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loopback connector, 11. Storage case, 12. Power supply
- **"C": These connectors are spares for adapter cable (09932-78331).**
- **"D": This set includes the following items.**
  1. Connector test adapter kit (09932-75020), 2. Connector test adapter & shorting bar release tool (09932-76020)

Prepared by
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