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 or 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 "Air Bag 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, that is air bag or inflator modules, SDM and/or seat belt with pretensioner, beforehand to avoid component damage or unintended activation.**

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: JIMNY (SN413) of and after the vehicle identification numbers below.

JSAFJA43V00140001
JSAFJB43V00140001
JSAFJB43V20140001
JSAFJB43V24140001
JSAFJB43V34140001
JS3JB43V□24140001
JS3JB43V□34140001

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.
JIMNY (SN413) WIRING DIAGRAM MANUAL	99512-81A20-015

SUZUKI MOTOR CORPORATION

TABLE OF CONTENTS

GENERAL INFORMATION	General Information	**0A**	**0A**
	Maintenance and Lubrication	**0B**	**0B**
HEATING AND AIR CONDITIONING	Heater and Ventilation	**1A**	**1A**
	Air Conditioning (Optional)	**1B**	**1B**
STEERING, SUSPENSION, WHEELS AND TIRES	Steering, Suspension, Wheels and Tires	**3**	**3**
	Front Wheel Alignment	**3A**	**3A**
	Steering Gear Box (Manual Type) and Linkage	**3B**	**3B**
	Power Steering (P/S) System (if equipped)	**3B1**	**3B1**
	Steering Wheel and Column	**3C**	**3C**
	Front Suspension	**3D**	**3D**
	Rear Suspension	**3E**	**3E**
	Wheels and Tires	**3F**	**3F**
DRIVE SHAFT AND PROPELLER SHAFT	Propeller Shafts	**4B**	**4B**
BRAKE SYSTEM	Brakes	**5**	**5**
	Antilock Brake System (ABS)	**5E**	**5E**
ENGINE	Engine General Information and Diagnosis	**6**	**6**
	Engine Mechanical (M13 Engine)	**6A1**	**6A1**
	Engine Cooling	**6B**	**6B**
	Engine Fuel	**6C**	**6C**
	Engine and Emission Control System	**6E**	**6E**
	Ignition System (Electronic Ignition System)	**6F**	**6F**
	Cranking System	**6G**	**6G**
	Charging System	**6H**	**6H**
	Exhaust System	**6K**	**6K**
TRANSMISSION, CLUTCH AND DIFFERENTIAL	Manual Transmission	**7A**	**7A**
	Automatic Transmission (4 A/T)	**7B**	**7B**
	Clutch	**7C**	**7C**
	Transfer	**7D**	**7D**
	Front Differential	**7E**	**7E**
	Rear Differential	**7F**	**7F**
ELECTRICAL SYSTEM	Body Electrical System	**8**	**8**
	Immobilizer Control System (if equipped)	**8G**	**8G**
BODY SERVICE		**9**	**9**
RESTRAINT SYSTEM	Restraint System	**10**	**10**
	Air Bag System	**10B**	**10B**

SECTION 0A

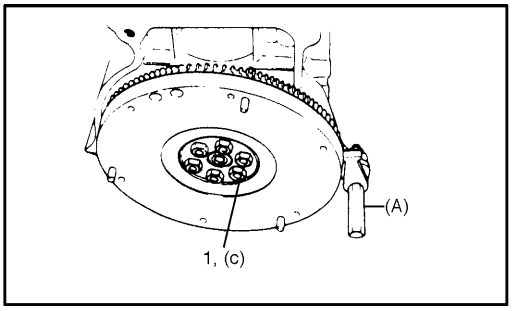
GENERAL INFORMATION

CONTENTS

How to Use This Manual 0A-2
Precautions 0A-3
Precaution for Vehicles Equipped with a Supplemental Restraint (Air Bag) System 0A-3
Diagnosis 0A-3
Servicing and handling 0A-4
General Precautions 0A-7
Precautions For Catalytic Converter 0A-10
Precautions For Electrical Circuit Service 0A-10
Electrical Circuit Inspection Procedure 0A-13
Open circuit check 0A-13
Short circuit check (wire harness to ground) 0A-15
Intermittent and Poor Connection 0A-15
Precaution For Installing Mobile Communication Equipment 0A-16
Identification Information 0A-17
Body Number 0A-17
Engine Identification Number 0A-17
Transmission Identification Number 0A-17
Warning, Caution and Information Labels 0A-18
Vehicle Lifting Points 0A-19
When Using Frame Contact Hoist 0A-19
When Using Floor Jack 0A-20
Abbreviations May Be Used In This Manual 0A-21
Abbreviations 0A-21
Fasteners Information 0A-24
Metric Fasteners 0A-24
Fastener Strength Identification 0A-24
Standard Tightening Torque 0A-24

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 figure.



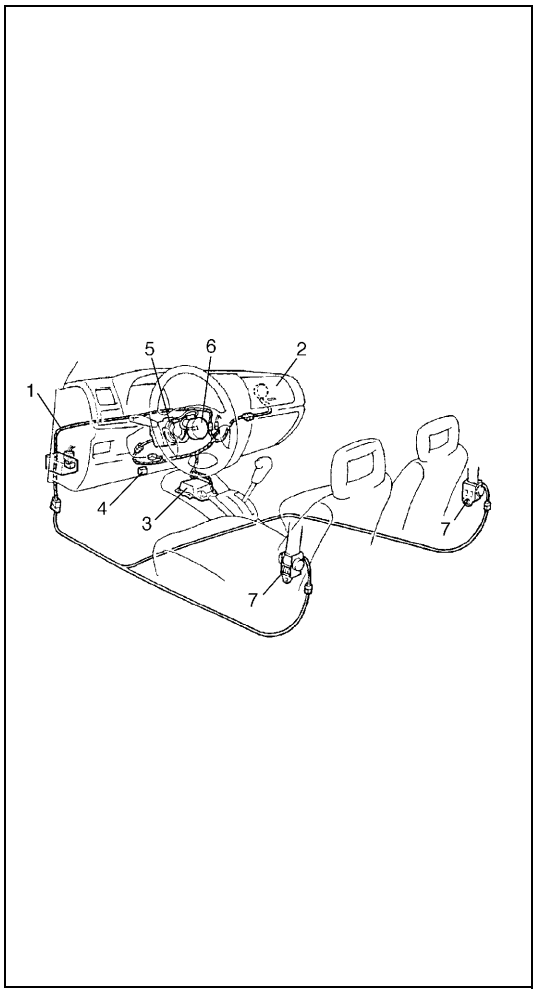
6) Install oil pump. Refer to "Oil pump" in this section.
7) Install flywheel (for M/T vehicle) or drive plate (for A/T vehicle). Using special tool, lock flywheel or drive plate, and tighten flywheel or drive plate bolts (1) to specified torque.

Special Tool
(A): 09924-17810
Tightening Torque
(c): 78 N·m (7.8 kg-m, 56.0 lb-ft)

4) A number of abbreviations are used in the text.
   For their full explanations, refer to **“Abbreviations 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 Specifications” that should be used for the servicing work described in that section.

Precautions

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



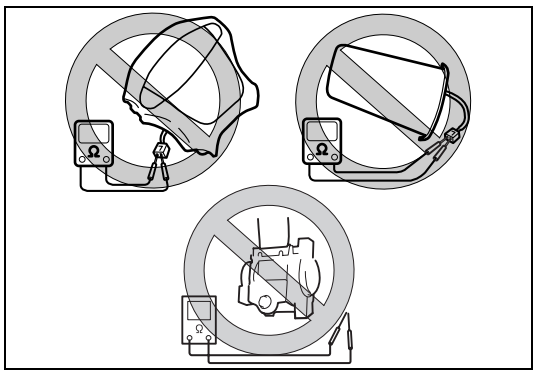
WARNING:

- **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 instrument panel wire harness and floor wire harness)	5. Contact coil
2. Passenger air bag (inflator) module	6. Driver air bag (inflator) module
3. SDM	7. Seat belt pretensioner (if equipped)
4. DLC	

Diagnosis

- When troubleshooting air bag system, be sure to follow “Air Bag Diagnostic System Check” 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.

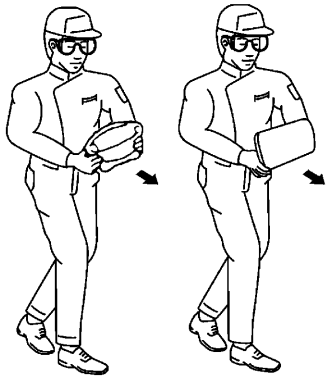


WARNING:

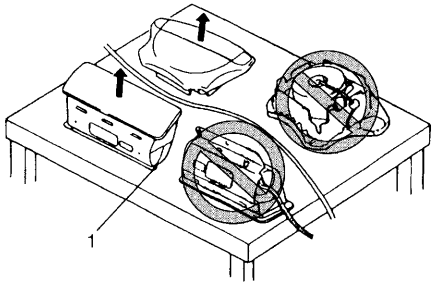
Never attempt to measure the resistance of the air bag (inflator) modules (driver and passenger) and seat belt pretensioners (driver and passenger). It is very dangerous as the electric current from the tester may deploy the air bag or activate the pretensioner.

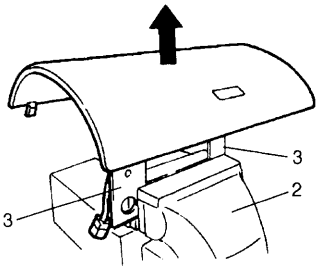
Servicing and handling

[A]



[B]





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 and Passenger Air Bag (Inflator) Modules

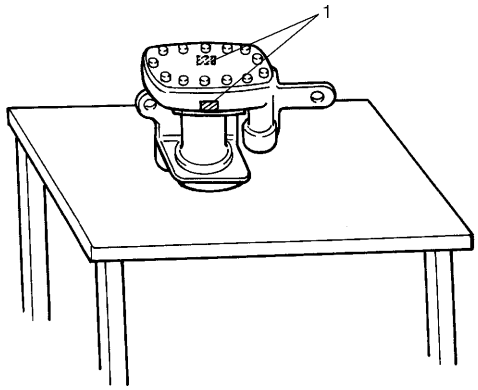
- **For handling and storage of a live air bag (inflator) module, select a place where the ambient temperature below 65°C (150°F), without high humidity and away from electric noise.**
- **When carrying a live air bag (inflator) module, make sure the bag opening is pointed away from you. In case of an 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). 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 and passenger). 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.

WARNING:

SDM

- **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, be sure not to lay it with its exhaust hole (1) provided side facing down. It is also prohibited to put something on its face with an exhaust hole (1) or to put a seat belt pretensioner on top of another. Otherwise, personal injury may result.**
- **Never dispose of live (inactivated) seat belt pretensioners (driver 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.**

CAUTION:

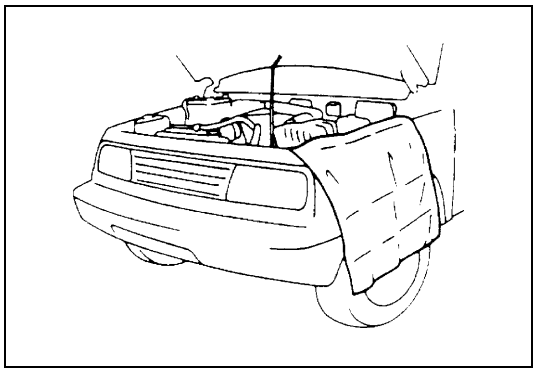
- **Even when the accident was light enough not to cause air bags to activate, be sure to inspect system parts and other related parts according to instructions under "Repair and Inspection Required after an Accident" in Section 10B.**
- **When servicing parts other than air bag system, if shocks may be applied to air bag system component parts, remove those parts beforehand.**
- **When handling the air bag (inflator) modules (driver and passenger), seat belt pretensioners (driver and passenger) or SDM, be careful not to drop it or apply an impact to it. If an excessive impact was applied (e.g., dropped from a height of 90 cm (3 feet) or more), 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 and passenger) or seat belt pretensioners (drive and passenger), wipe off immediately with a dry cloth.**
- **Air bag 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, 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 air bag (inflator) module connectors (driver and passenger) and seat belt pretensioner connectors (driver and passenger) 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

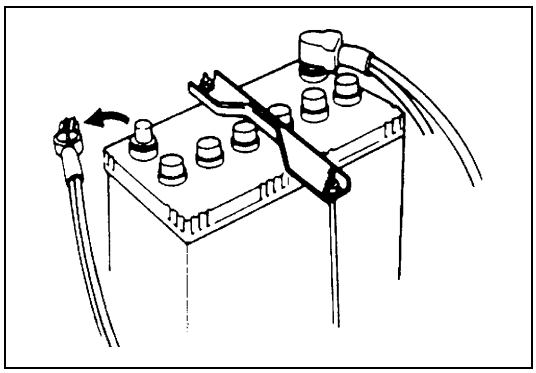
The WARNING and CAUTION below describe some general precautions that you should observe when servicing a vehicle. These general precautions apply to many of the service procedures described in this manual, and they will not necessarily be repeated with each procedure to which they apply.

WARNING:

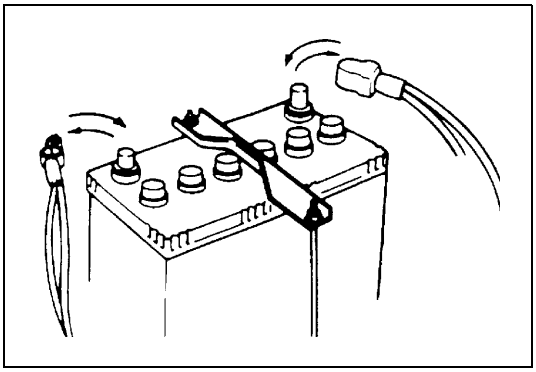
- **Whenever raising a vehicle for service, be sure to follow the instructions under "Vehicle Lifting Points" in this section.**
- **When it is necessary to do service work with the engine running, make sure that the parking brake is set fully and the transmission is in Neutral (for manual transmission 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, tailpipe, 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.**



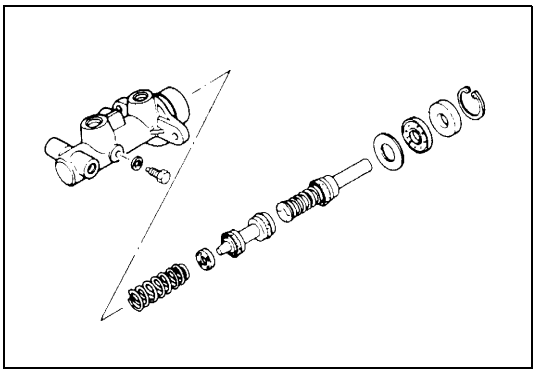
- **Before starting any service work, cover fenders, seats and any other parts that are likely to get scratched or stained during servicing. Also, be aware that what you wear (e.g, buttons) may cause damage to the vehicle's finish.**



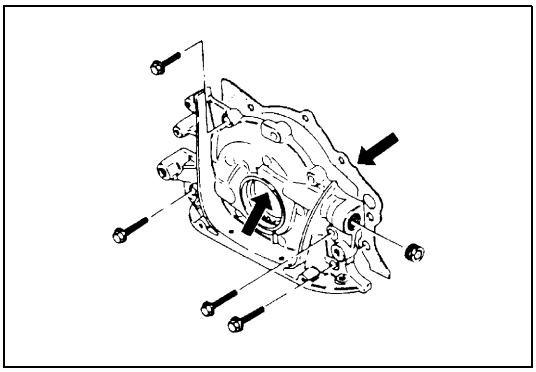
- **When performing service to electrical parts that does not require use of battery power, disconnect the negative cable of the battery.**



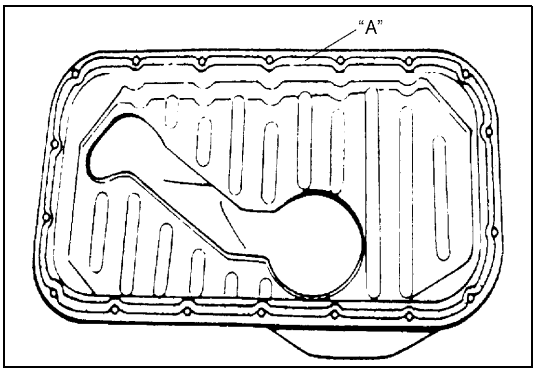
- **When removing the battery, be sure to disconnect the negative cable first and then the positive cable. When reconnecting the battery, connect the positive cable first and then the negative cable, and replace the terminal cover.**



- **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.**

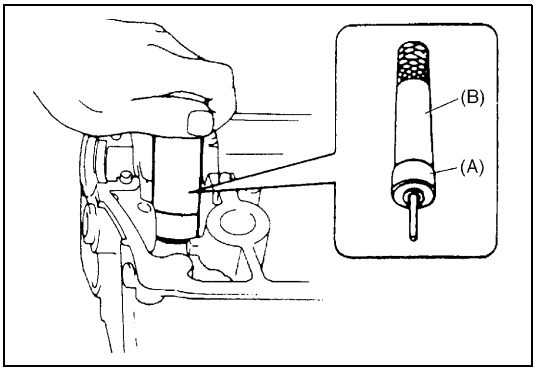


- **Whenever you use oil seals, gaskets, packing, O-rings, locking washers, split pins, self-locking nuts, and certain other parts as specified, be sure to use new ones. Also, before installing new gaskets, packing, etc., be sure to remove any residual material from the mating surfaces.**



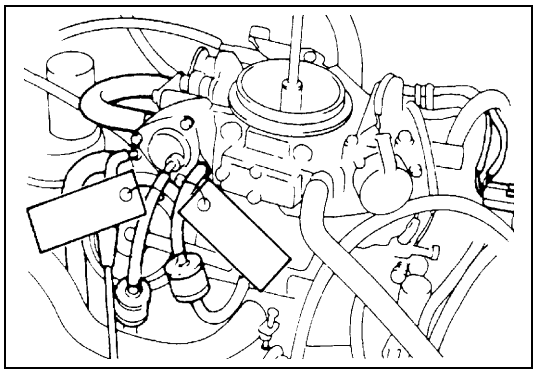
- **Make sure that all parts used in reassembly are perfectly clean.**
- **When use of a certain type of lubricant, bond or sealant is specified, be sure to use the specified type.**

"A": Sealant 99000-31150

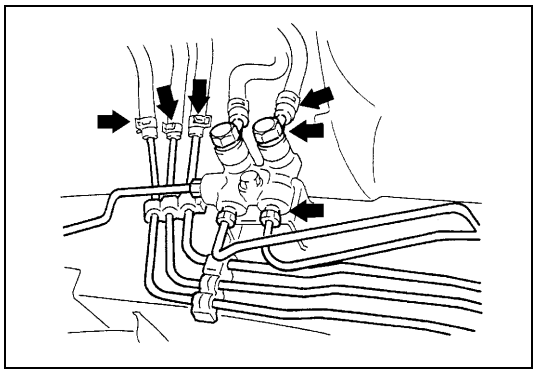


- **Be sure to use special tools when instructed.**

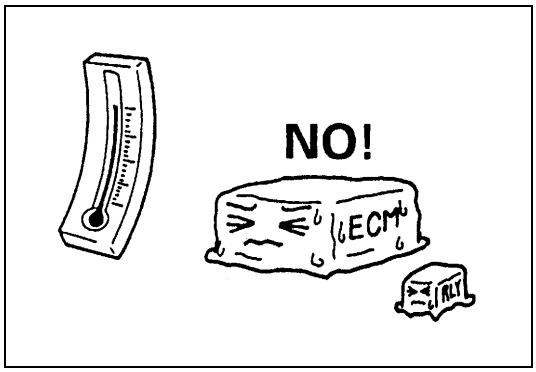
Special tool
(A): 09917-98221
(B): 09916-58210



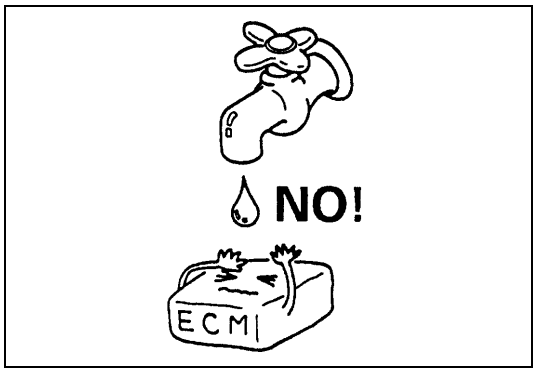
- When disconnecting vacuum hoses, attach a tag describing the correct installation positions so that the hoses can be reinstalled correctly.



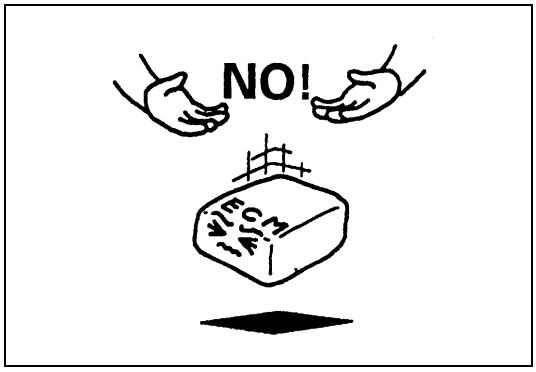
- After servicing fuel, oil, coolant, vacuum, exhaust or brake systems, check all lines related to the system for leaks.
- For vehicles equipped with fuel injection systems, never disconnect the fuel line between the fuel pump and injector without first releasing the fuel pressure, or fuel can be sprayed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



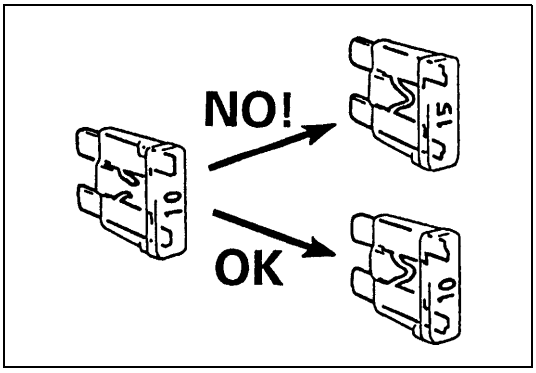
- Always be careful not to handle electrical parts (computer, relay, etc.) in a rough manner or drop them.

Precautions For Catalytic Converter

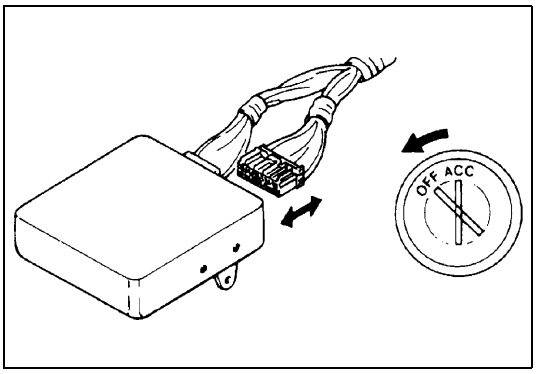
For vehicles equipped with a catalytic converter, use only unleaded gasoline and be careful not to let a large amount of unburned gasoline enter the converter or it can be damaged.

- **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.)**

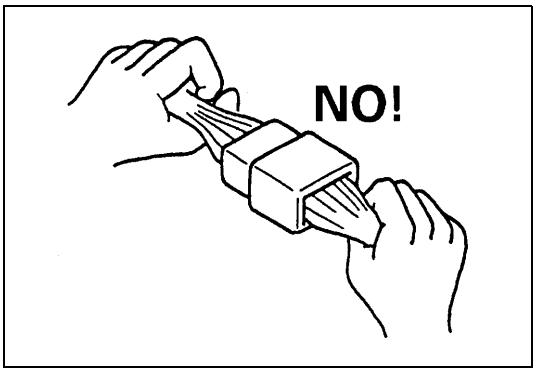
Precautions For Electrical Circuit Service



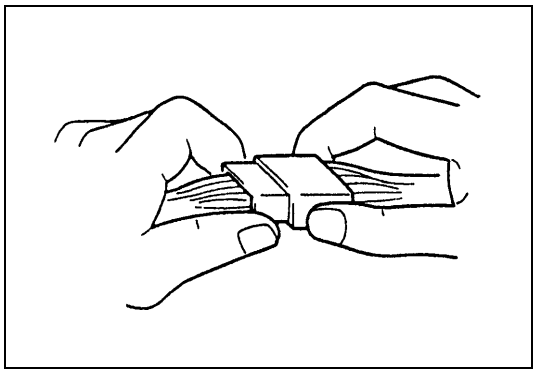
- **When replacing a fuse, make sure to use a fuse of the specified capacity. Use of a fuse with a larger capacity will cause a damage to the electrical parts and a fire.**



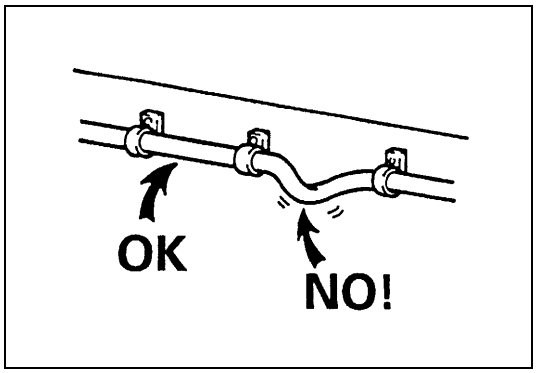
- **When disconnecting and connecting coupler, make sure to turn ignition switch OFF, or electronic parts may get damaged.**



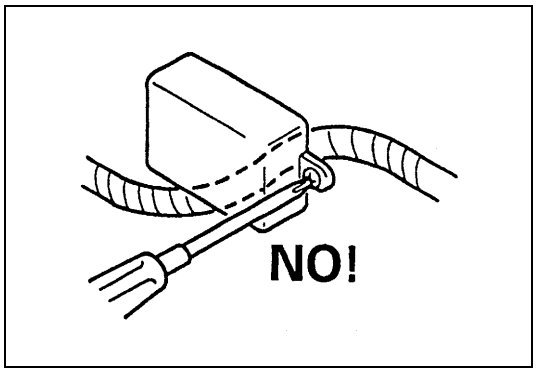
- **When disconnecting connectors, never pull the wiring harnesses. Unlock the connector lock first and then pull them apart by holding connectors themselves.**



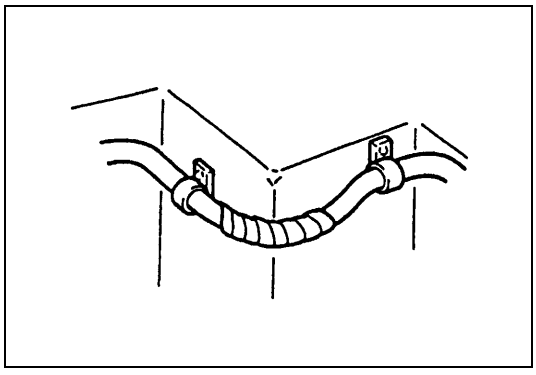
- **When connecting connectors, also hold connectors and push them together until they lock securely (a click is heard).**



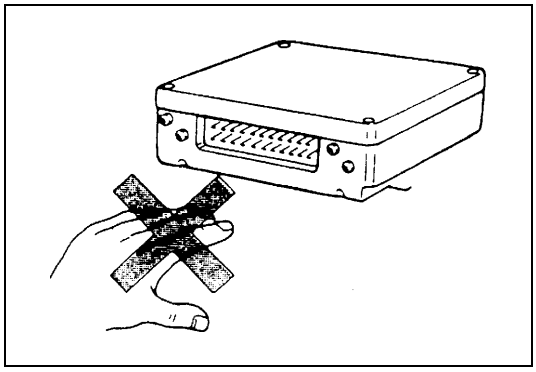
- **When installing the wiring harness, fix it with clamps so that no slack is left.**



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

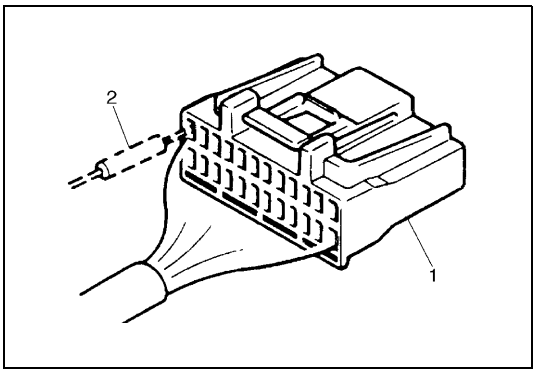


- **To avoid damage to the harness, protect its part which may contact against a part forming a sharp angle by winding tape or the like around it.**

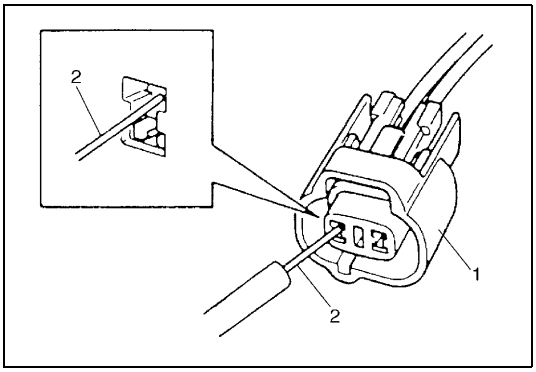


- **Be careful not to touch the electrical terminals of parts which use microcomputers (e.g. electronic control unit like as ECM, PCM, P/S controller, etc.). The static electricity from your body can damage these parts.**

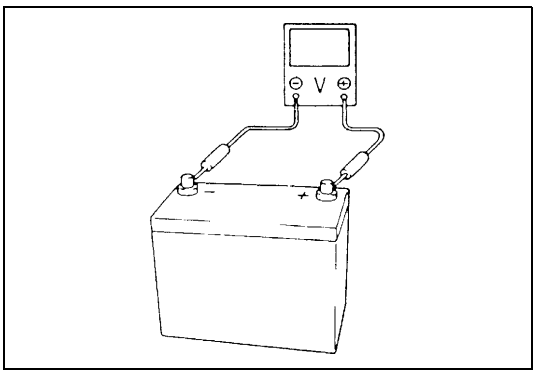
- **Never connect any tester (voltmeter, ohmmeter, or whatever) to electronic control unit when its coupler is disconnected. Attempt to do it may cause damage to it.**
- **Never connect an ohmmeter to electronic control unit with its coupler connected to it. Attempt to do it may cause damage to electronic control unit and sensors.**
- **Be sure to use a specified voltmeter / ohmmeter. Otherwise, accurate measurements may not be obtained or personal injury may result.**



- **When taking measurements at electrical connectors using a tester probe (2), be sure to insert the probe 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 to check for electrical system, check to make sure that battery voltage is 11V or higher. Such terminal voltage check at low battery voltage will lead to erroneous diagnosis.**

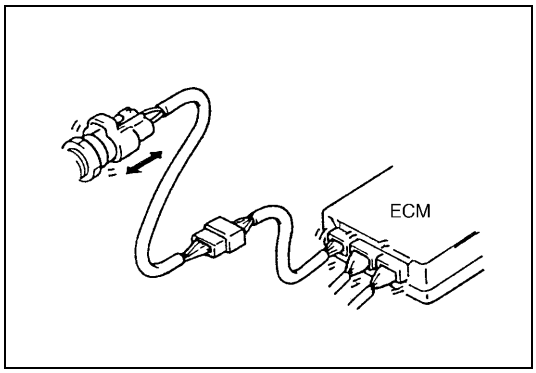
Electrical Circuit Inspection Procedure

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

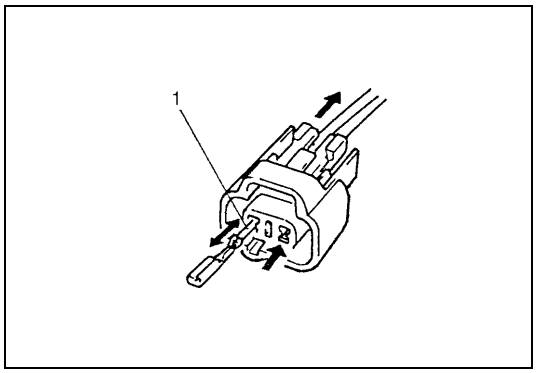
Possible causes for the open circuit are as follows. As the cause is in the connector or terminal in many cases, they need to be checked particularly carefully.

- 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



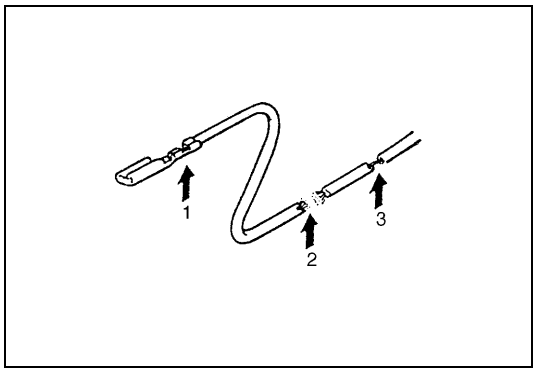
When checking system circuits including an electronic control unit such as ECM, TCM, ABS control module, etc., it is important to perform careful check, starting with items which are easier to check.

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.

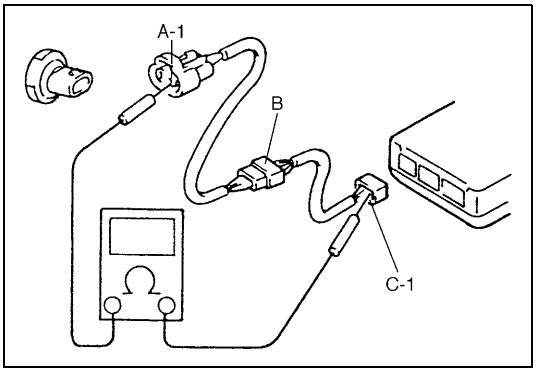
1. Check contact tension by inserting and removing just for once



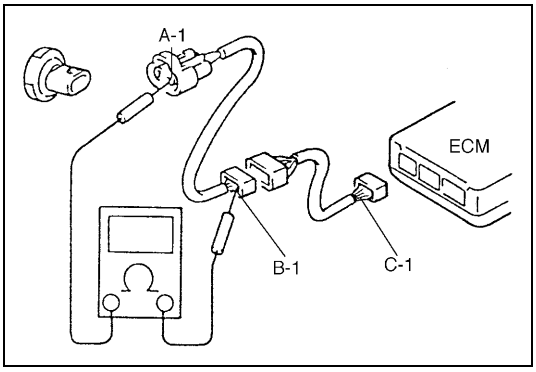
4) Using the following continuity check or voltage check procedure, check the wire harness for open circuit and poor connection with its terminals. Locate abnormality, if any.

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.

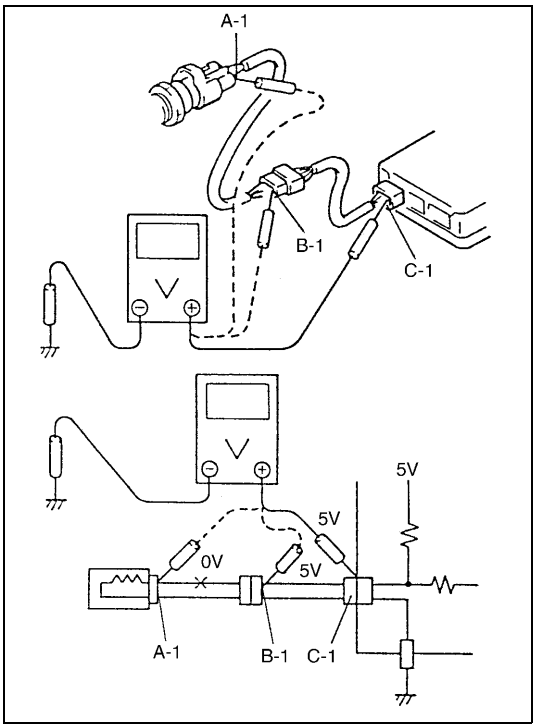


2) Disconnect the connector included in the circuit (connector-B in the figure) and measure resistance between terminals A-1 and B-1.
   If no continuity is indicated, that means that the circuit is open between terminals A-1 and B-1. If continuity is indicated, there is an open circuit between terminals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



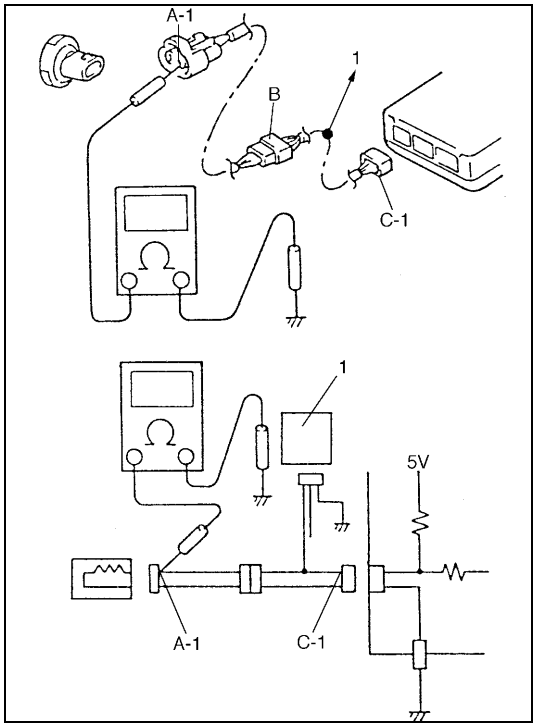
   a) If measurements were taken as shown in the figure at the left and results were as listed below, it means that the circuit is open between terminals B-1 and A-1.

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

   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. 5V
   B-1 and body ground: Approx. 5V
   A-1 and body ground: Approx. 3V (2V voltage drop)

Short circuit check (wire harness to ground)

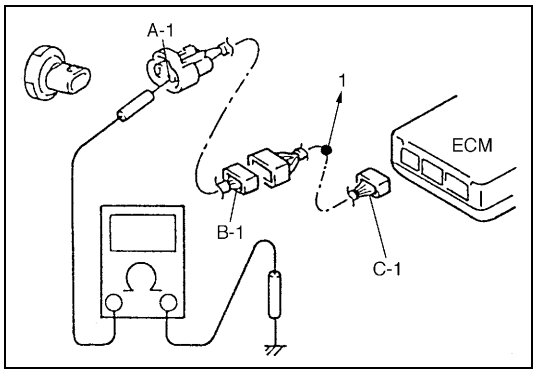


1) Disconnect negative cable from battery.
2) Disconnect connectors at both ends of the circuit to be checked.

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 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.

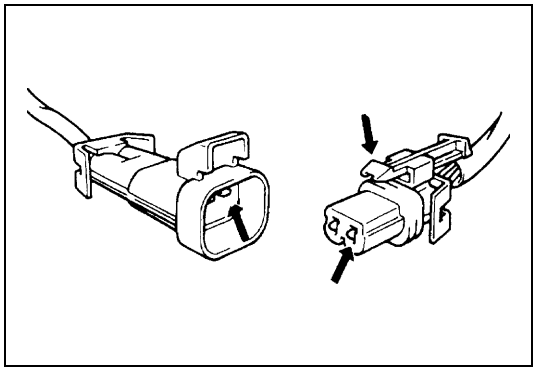


4) Disconnect the connector included in circuit (connector B) and measure resistance between A-1 and body ground.
   If continuity is indicated, it means that the circuit is shorted to the ground between terminals A-1 and B-1.

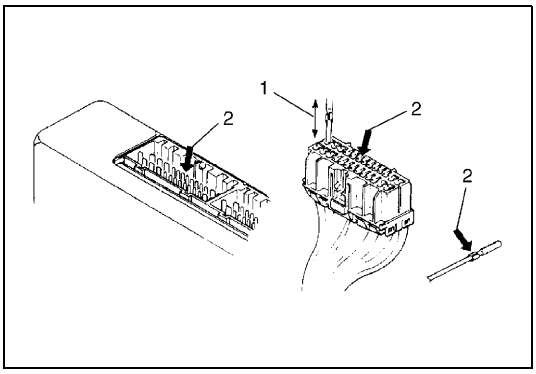
1. To other parts

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:

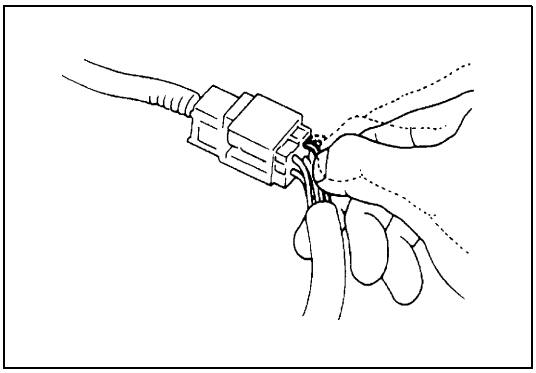


- Poor mating of connector halves, or terminals not fully seated in the connector body (backed out).
- Dirt or corrosion on the terminals. The terminals must be clean and free of any foreign material which could impede proper terminal contact. However, cleaning the terminal with a sand paper or the like 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.

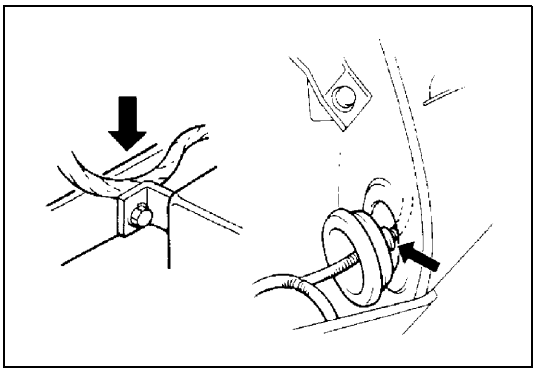


- Improperly formed or damaged terminals.
  Check each connector terminal in problem circuits carefully to ensure good contact tension by using the corresponding mating terminal.
  If contact tension is not enough, reform it to increase contact tension or replace.

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.

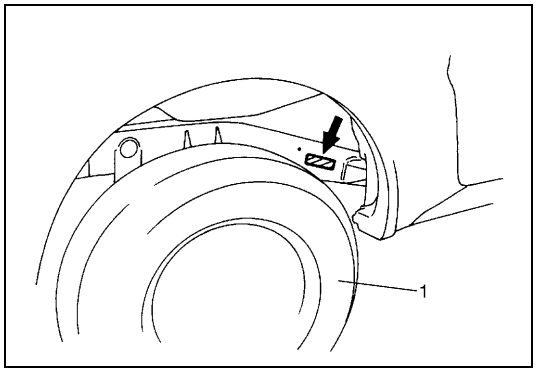
Precaution For Installing Mobile Communication Equipment

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.

Identification Information

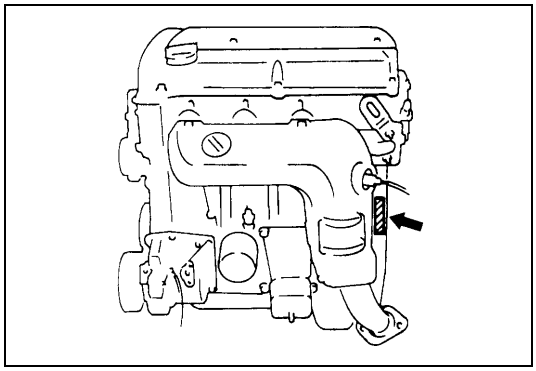
Body Number



The vehicle body number is punched on the chassis inside the tire housing on the right rear side.

1. Right rear tire

Engine Identification Number

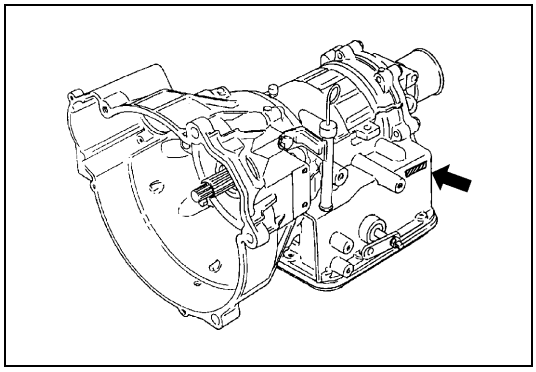


The number is punched on the cylinder block.

M 13- _____

- Serial number
- Engine displacement (13:1.3 L)
- Engine type (M)

Transmission Identification Number



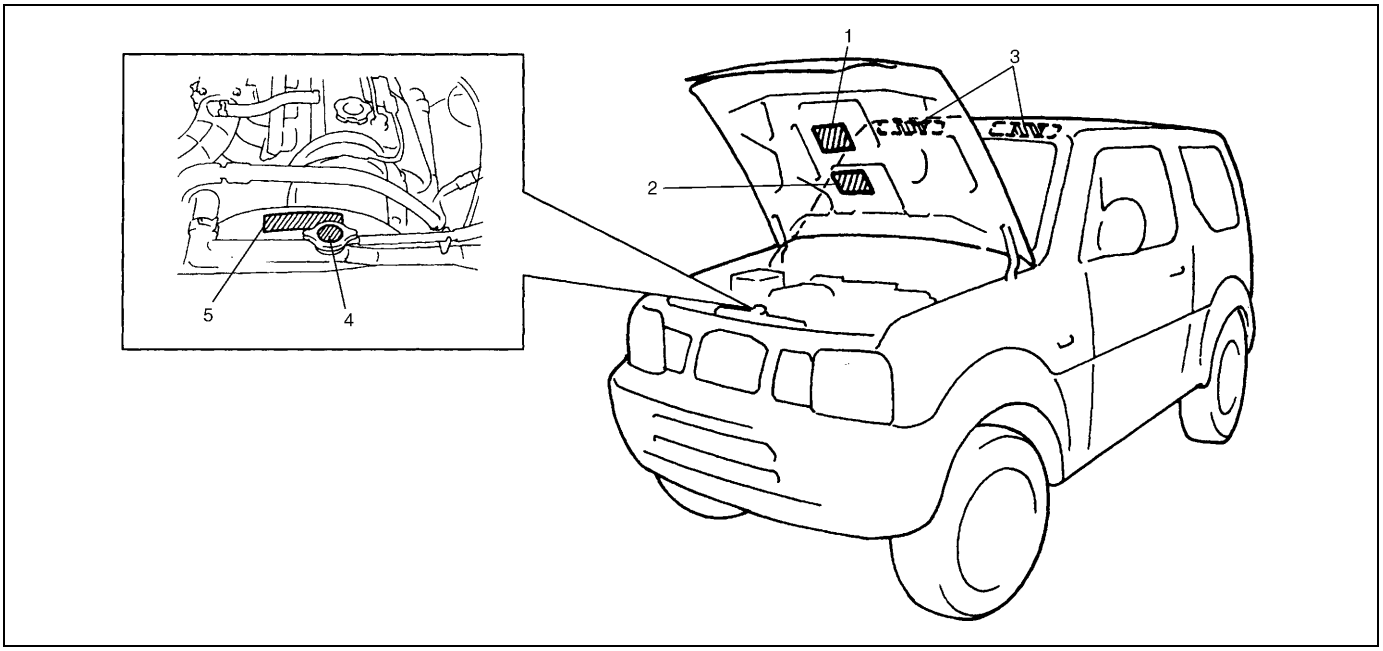
The automatic transmission identification number is located on the transmission case.

Warning, Caution and Information Labels

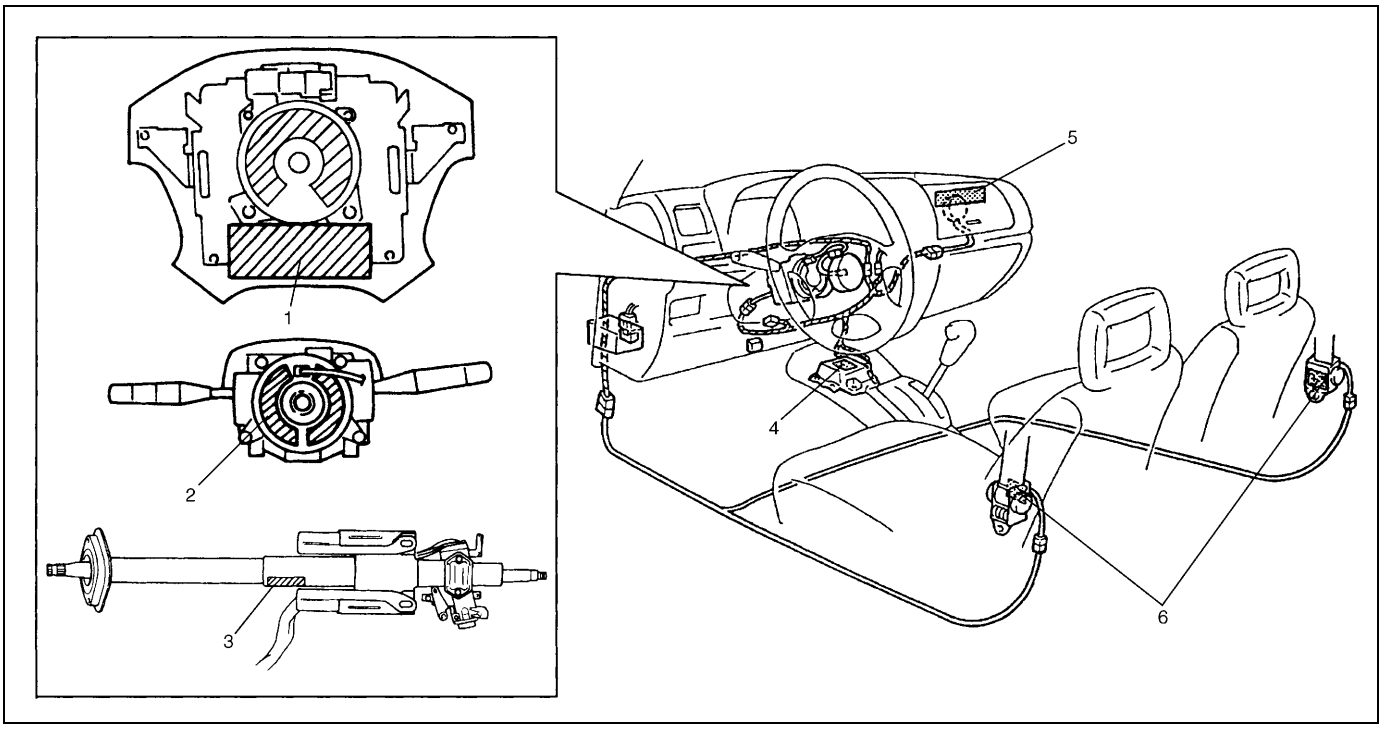
The figure below shows main labels among others that are attached to vehicle component parts.
When servicing and handling parts, refer to WARNING / CAUTION instructions printed on labels.
If any WARNING / CAUTION label is found stained or damaged, clean or replace it as necessary.

NOTE:

Air bag CAUTION / WARNING labels are attached on the vehicle equipped with air bag system only.



1. Emission control label (Australia only)	3. Air bag label on sun visor	5. Engine cooling fan label
2. Air bag label on engine hood	4. Radiator cap label	



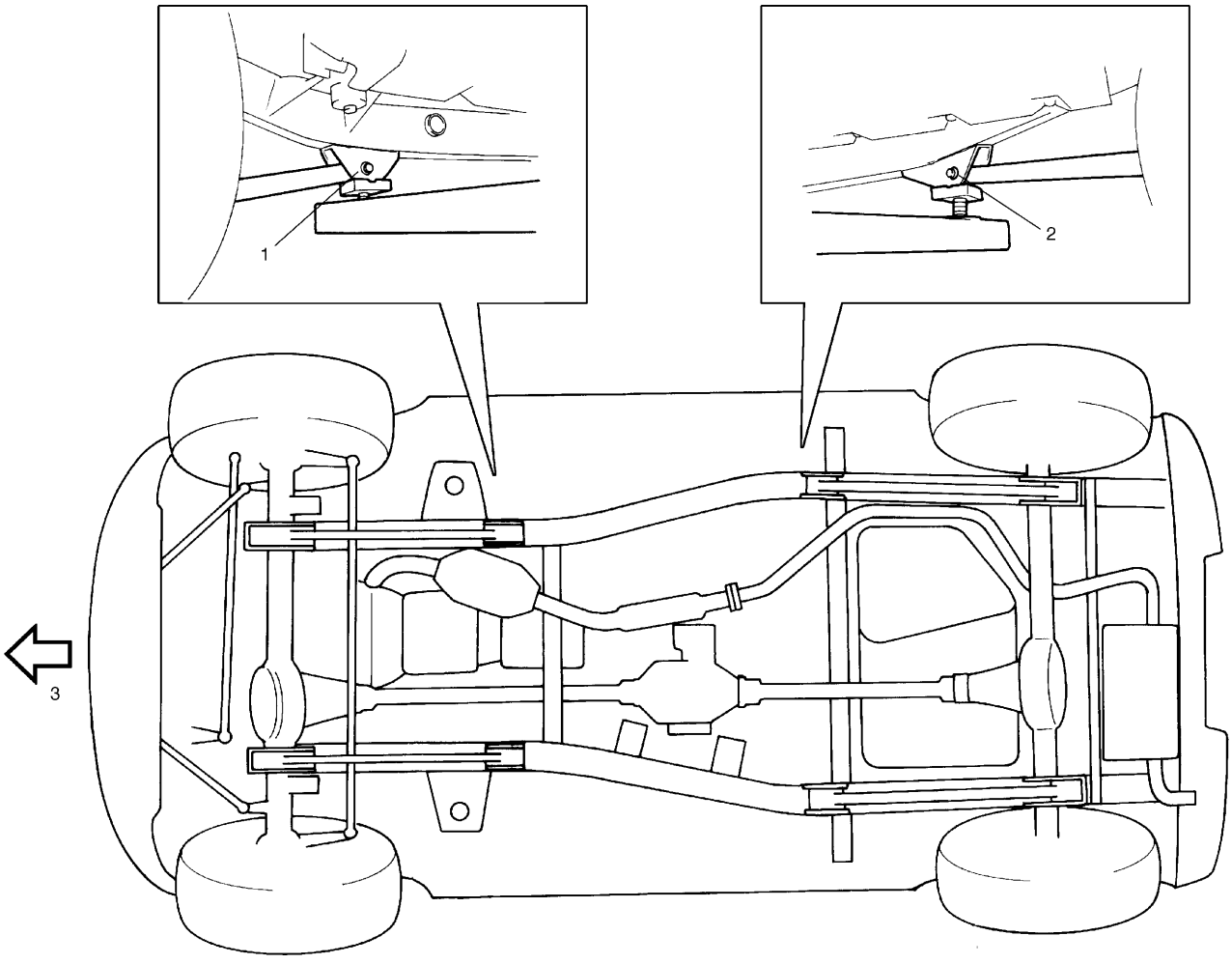
1. Air bag warning label on driver air bag (inflator) module	4. Air bag label on SDM
2. Air bag warning label on contact coil and combination switch assembly	5. Air bag label on passenger air bag (inflator) module
3. Air bag warning label on steering column	6. Seat belt pretensioner label on retractor

Vehicle Lifting Points

WARNING:

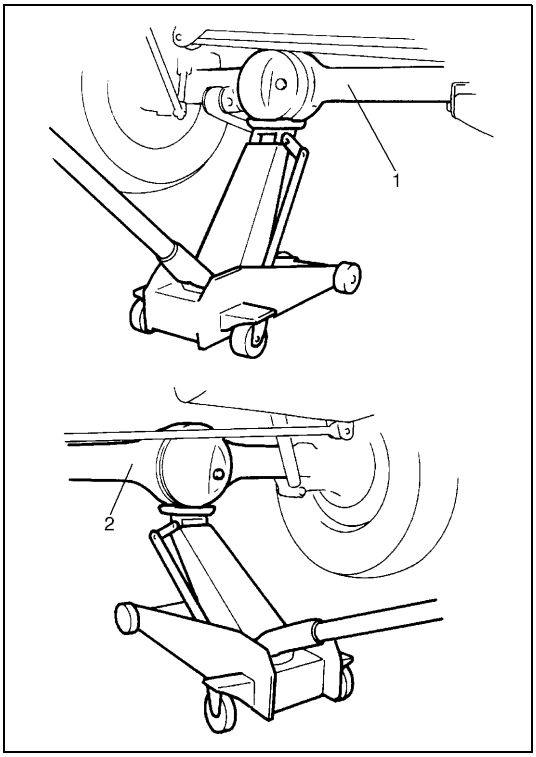
- **Before applying hoist to underbody, always take vehicle balance throughout service into consideration. Vehicle balance on hoist may change depending on what part to be removed.**
- **Before lifting up the vehicle, check to be sure that end of hoist arm is not in contact with brake pipe, fuel pipe, 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.	Front lifting point
2.	Rear lifting point
3.	Front

When Using Floor Jack



WARNING:

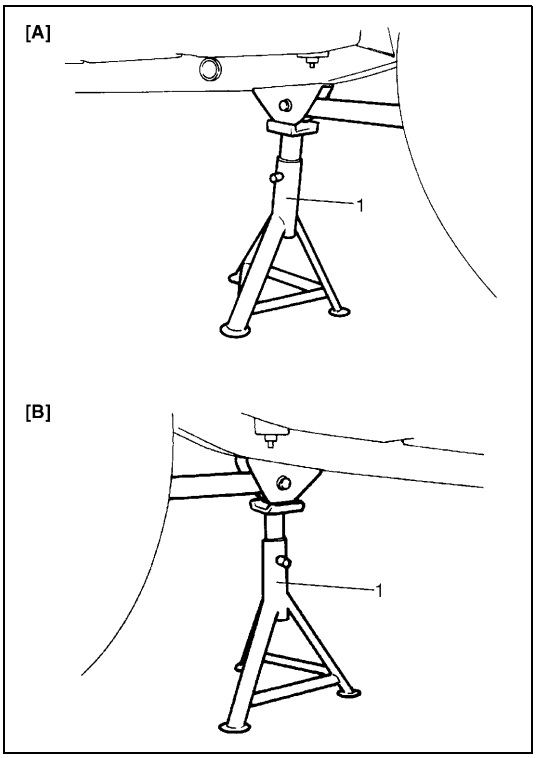
If the vehicle to be jacked up only at the front or rear end, be sure to block the wheels on ground in order to ensure safety.

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 center portion of the front axle housing (1) or rear axle housing (2).



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

[A]:	Front
[B]:	Rear

Abbreviations May Be Used In This Manual

Abbreviations

A	ABC	Anti-lock Brake System	E	EBCM	Electronic Brake Control Module, ABS Control Module
	ATDC	After Top Dead Center		ECM	Engine Control Module
	API	American Petroleum Institute		ECT Sensor	Engine Coolant Temperature Sensor (Water Temp. Sensor, WTS)
	ATF	Automatic Transmission Fluid		EGR	Exhaust Gas Recirculation
	ALR	Automatic Locking Retractor		EGRT Sensor	EGR Temperature Sensor (Recirculated Exhaust Gas Temp. Sensor, REGTS)
	AC	Alternating Current		EFE Heater	Early Fuel Evaporation Heater (Positive Temperature Coefficient, PTC Heater)
	A/T	Automatic Transmission		ELR	Emergency Locking Retractor
	A/C	Air Conditioning		EPS	Electronic Power Steering
	ABDC	After Bottom Dead Center		EVAP	Evaporative Emission
	A/F	Air Fuel Mixture Ratio		EVAP Canister	Evaporative Emission Canister (Charcoal Canister)
	A-ELR	Automatic-Emergency Locking Retractor	F	4WD	4 Wheel Drive
B	B+	Battery Positive Voltage	G	GEN	Generator
	BTDC	Before Top Dead Center		GND	Ground
	BBDC	Before Bottom Dead Center	H	HC	Hydrocarbons
C	CKT	Circuit		HO2S	Heated Oxygen Sensor
	CMP Sensor	Camshaft Position Sensor (Crank Angle Sensor, CAS)			
	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	I	IAC Valve	Idle Air Control Valve (Idle Speed Control Solenoid Valve, ISC Solenoid Valve)
	DLC	Data Link Connector (Assembly Line Diag. Link, ALDL, Serial Data Link, SDL)		IAT Sensor	Intake Air Temperature Sensor (Air temperature Sensor, ATS)
	DOHC	Double Over Head Camshaft		ICM	Immobilizer Control Module
	DOJ	Double Offset Joint		IG	Ignition
	DRL	Daytime Running Light		ISC Actuator	Idle Speed Control Actuator (Motor)
	DTC	Diagnostic Trouble Code (Diagnostic Code)			

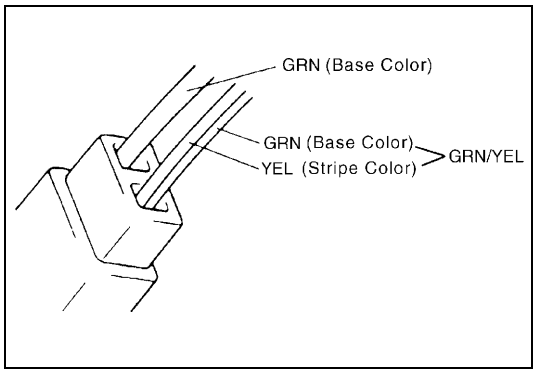
L	LH	Left Hand
	LSPV	Load Sensing Proportioning Valve
M	MAF Sensor	Mass Air Flow Sensor (Air Flow Sensor, AFS, Air Flow Meter, AFM)
	MAP Sensor	Manifold Absolute Pressure Sensor (Pressure Sensor, PS)
	Max	Maximum
	MFI	Multiport Fuel Injection (Multipoint Fuel Injection)
	Min	Minimum
	MIL	Malfunction Indicator Lamp (“CHECK ENGINE” 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
P	PNP	Park/Neutral Position
	P/S	Power Steering
	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
W	WU-OC	Warm Up Oxidation Catalytic Converter
	WU-TWC	Warm Up Three Way Catalytic Converter

SYMBOLS

SYMBOL	DEFINITION	SYMBOL	DEFINITION
	Tightening torque	1216	Apply SUZUKI BOND NO. 1216 99000-31160
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 SUZUKI SUPER GREASE A 99000-25010		
C	Apply SUZUKI SUPER GREASE C 99000-25030	1322	Apply THREAD LOCK 1322 99000-32110
E	Apply SUZUKI SUPER GREASE E 99000-25050	1333B	Apply THREAD LOCK 1333B 99000-32020
H	Apply SUZUKI SUPER GREASE H 99000-25120	1342	Apply THREAD LOCK 1342 99000-32050
I	Apply SUZUKI SUPER GREASE I 99000-25210		
1215	Apply SUZUKI BOND NO. 1215 99000-31110		Do not reuse
1207C	Apply SUZUKI BOND NO. 1207C 99000-31150		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).

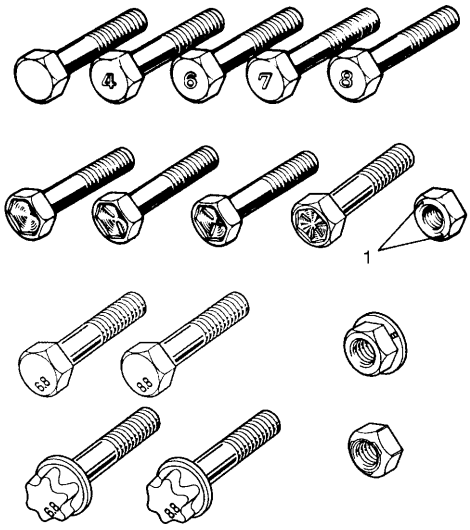
Fasteners Information

Metric Fasteners

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

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. Nuts strength identification

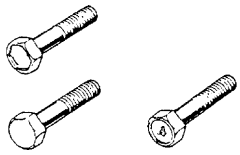
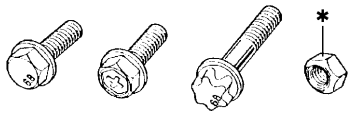
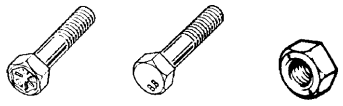
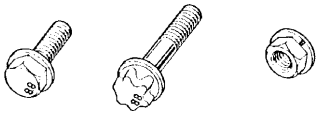
Standard Tightening Torque

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	An 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
	An 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
	An equivalent of 6.8 strength fastener without 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
	An 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
	An 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
	An equivalent of 8.8 strength fastener without 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 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 "Air Bag 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

Maintenance Schedule 0B-2
Maintenance Schedule Under Normal Driving Conditions 0B-2
Maintenance Recommended Under Severe Driving Conditions 0B-4
Maintenance Service..... 0B-5
Engine 0B-5
Drive Belt..... 0B-5
Valve Lash..... 0B-6
Engine Oil and Filter..... 0B-6
Engine Coolant..... 0B-8
Exhaust System 0B-8
Ignition System..... 0B-9
Spark Plugs 0B-9
Fuel System 0B-9
Air Cleaner Filter 0B-9
Fuel Lines and Connections..... 0B-10
Fuel Filter 0B-10
Fuel Tank 0B-10
Emission Control System 0B-10
Crankcase Ventilation Hoses and Connections 0B-10
PCV (Positive Crankcase Ventilation) Valve 0B-11
Fuel Evaporative Emission Control System 0B-11
Chassis and Body 0B-11
Clutch 0B-11
Brake Discs and Pads..... 0B-11
Brake Drums and Shoes 0B-12
Brake Hoses and Pipes..... 0B-12
Brake Fluid 0B-12
Parking Brake Lever and Cable 0B-13
Tires/Wheels 0B-13
Suspension System 0B-14
Propeller Shafts..... 0B-15
Manual Transmission Oil..... 0B-16
Automatic Transmission Fluid 0B-16
Transfer and Differential Oil 0B-17
Steering System..... 0B-18
Steering Knuckle Seal..... 0B-18
Power Steering (P/S) System (if equipped) 0B-19
All Hinges, Latches and Locks 0B-19
Final Inspection..... 0B-20
Recommended Fluids and Lubricants..... 0B-22

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		V-belt		I	R	I	R	I	R
		V-rib belt (Flat type)		–	–	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	Nickel spark plug	–	R	–	R	–	R
			Iridium spark plug	–	–	R	–	–	R
		Vehicle with HO2S	Nickel spark plug	–	–	R	–	–	R
			Iridium spark plug	–	–	–	R	–	–
	When leaded fuel is used, refer to “Maintenance Recommended Under Severe Driving Conditions” in this section.								
FUEL SYSTEM									
Air cleaner filter				I	I	R	I	I	R
Fuel lines and connections				–	I	–	I	–	I
Fuel filter				Replace every 210,000 km (126,000 miles).					
Fuel tank				–	–	I	–	–	I
EMISSION CONTROL SYSTEM									
Crankcase ventilation hoses and connections (Vehicle without HO2S)				–	–	I	–	–	I
✱PCV valve		Vehicle without HO2S		–	–	I	–	–	I
		Vehicle with HO2S		–	–	–	–	–	I
✱Fuel evaporative emission control system		Vehicle without HO2S		–	I	–	I	–	I
		Vehicle with HO2S		–	–	–	–	–	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.**
- **Nickel spark plug: BKR6E-11 (NGK) or K20PR-U11 (DENSO)**
- **Iridium spark plug: IFR5E11 (NGK) or SK16PR-A11 (DENSO)**

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
CHASSIS AND BODY							
Clutch (pedal height and travel)		–	I	–	I	–	I
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.					
Tires (wear, damage, rotation)		I	I	I	I	I	I
Wheel discs (damage)		I	I	I	I	I	I
Suspension system (tightness, damage, rattle, breakage)		–	I	–	I	–	I
Propeller shafts		–	–	I	–	–	I
Manual transmission oil (leakage, level) (I: 1st 15,000 km only)		I	–	R	–	–	R
Automatic transmission	Fluid level	–	I	–	I	–	I
	Fluid change	Replace every 165,000 km (99,000 miles).					
	Fluid hose	–	–	–	R	–	–
Transfer oil (leakage, level)		I	–	I	–	I	–
Differential oil (leakage, level) (R: 1st 15,000 km only)		R or I	–	I	–	I	–
Steering system (tightness, damage, breakage, rattle)		–	I	–	I	–	I
Power steering (if equipped)		I	I	I	I	I	I
All latches, hinges and locks		–	I	–	I	–	I

NOTE:

“R”: Replace or change

“I”: Inspect and correct, replace or lubricate 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 : Trailer towing (if admitted)

Severe Condition Code	Maintenance		Maintenance Operation	Maintenance Interval
– B C D – – – –	Drive belt (V-rib 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
– B – – – – – –	Exhaust pipe mountings		I	Every 15,000 km (9,000 miles) or 12 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	Nickel spark plug	R	Every 10,000 km (6,000 miles) or 8 months
		Iridium spark plug	R	Every 30,000 km (18,000 miles) or 24 months
– B C D – – – H	Wheel bearing		I	Every 15,000 km (9,000 miles) or 12 months
– B – – – – – –	Suspension bolts and nuts		T	Every 15,000 km (9,000 miles) or 12 months
– B – D E – – H	Propeller shafts		I	Every 15,000 km (9,000 miles) or 12 months
– B – – E – – H	Manual transmission, transfer and differential oil		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 mile) or 0 month
– B – – E – – H	Automatic transmission fluid		R	Every 30,000 km (18,000 miles) or 24 months
– B C D – – – –	Steering knuckle seal		I	Every 15,000 km (9,000 miles) or 12 months

NOTE:

- **“I”: Inspect and correct, replace or lubricate if necessary**
- **“R”: Replace or change**
- **“T”: Tighten to the specified torque**
- **✱1: Inspect or replace more frequently if necessary**

Maintenance Service

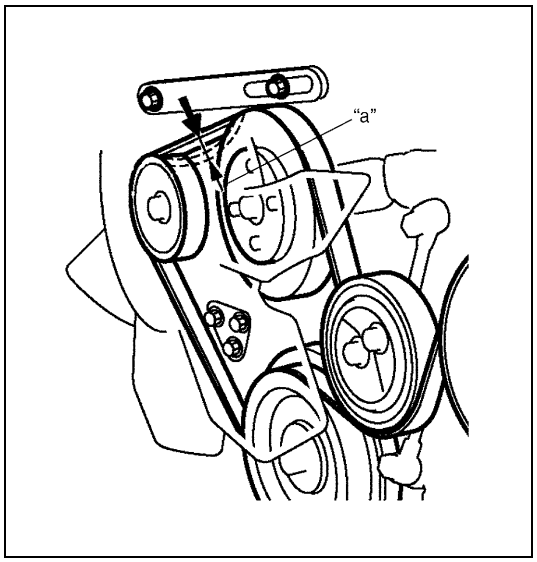
Engine

Drive Belt

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.).

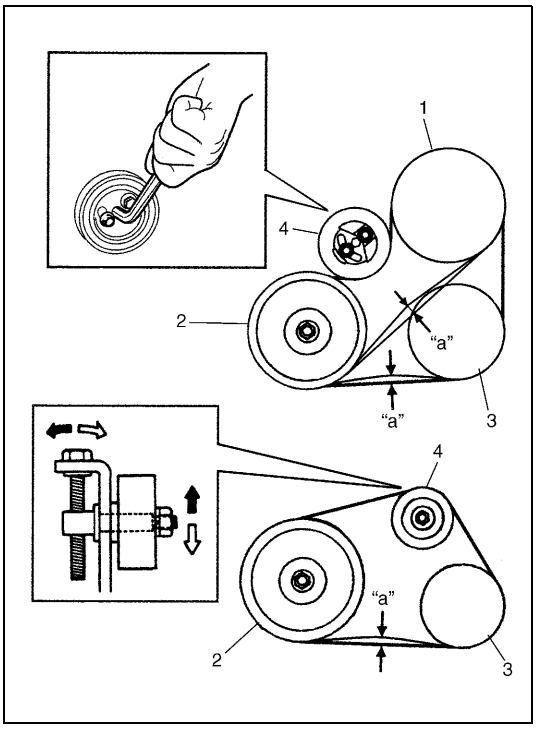
3) If belt is too tight or too loose, adjust it to specification by adjusting alternator position.
4) Tighten alternator adjusting bolts and pivot bolt.
5) Connect negative cable to battery.

REPLACEMENT

Replace belt. Refer to "Water Pump Belt and Cooling Fan" in Section 6B for replacement procedure of pump belt.

POWER STEERING PUMP AND/OR A/C COMPRESSOR DRIVE BELTS INSPECTION (IF EQUIPPED)

1) Disconnect negative cable at battery.
2) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If any defect exists, replace.



3) Check belt for tension.

Power steering pump and/or A/C compressor drive belt tension
"a": 6 – 9 mm (0.24 – 0.35 in.) deflection under 100 N (10 kg, 22 lb) pressure.

4) If belt tension is out of above specification, adjust it referring to "Compressor Drive Belt" in Section 1B or "Power Steering Belt Check" in Section 3B1.

1.	P/S pump pulley
2.	Camshaft pulley
3.	A/C compressor pulley (if equipped)
4.	Belt tension pulley

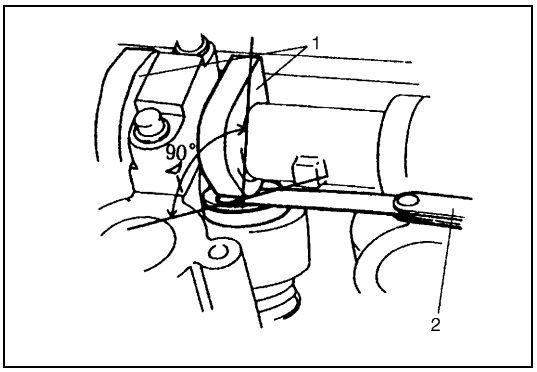
5) Connect negative cable to battery.

REPLACEMENT

Replace belt with new one referring to "Compressor Drive Belt" in Section 1B or "Power Steering Belt Check" in Section 3B1.

Valve Lash

INSPECTION



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

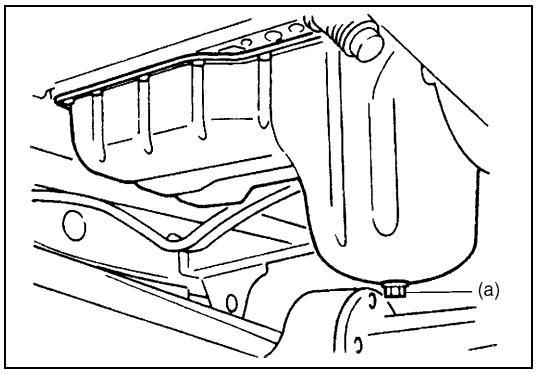
1.	Camshaft
2.	Thickness gauge

Engine Oil and Filter

CHANGE

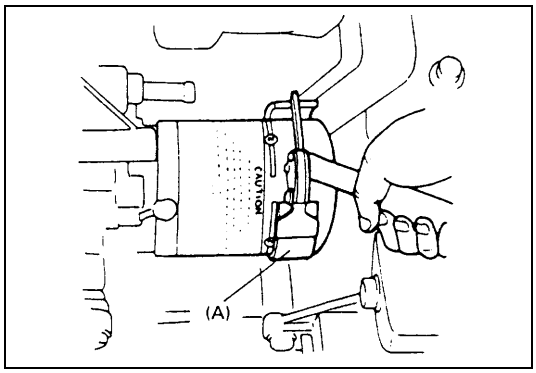
WARNING:
- **New and used engine oil can be hazardous. Be sure to read "WARNING" in General Precaution in Section 0A and observe what in written there.**
- **Step 1) – 7) outlined below must be performed with ENGINE NOT RUNNING. For step 8), be sure to have adequate ventilation while engine is running.**

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.



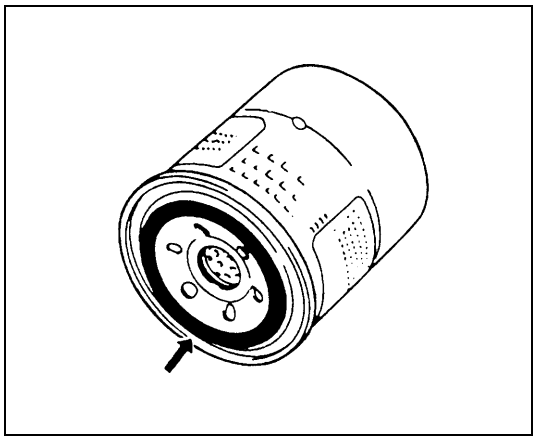
1) Drain engine oil by removing drain plug.
2) After draining oil, wipe drain plug clean. Reinstall drain plug, and tighten it securely as specified below.

Tightening torque
(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



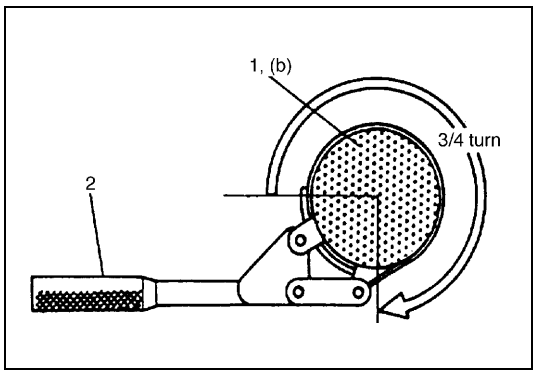
NOTE:

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.

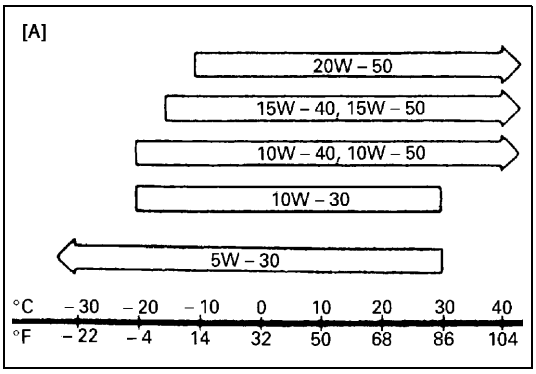
CAUTION:

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
(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 SE, SF, SG, SH, SJ or SL grade.
   Select the appropriate oil viscosity according to the proper engine oil viscosity chart [A].

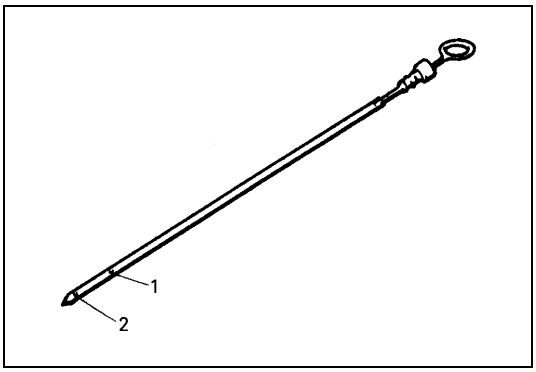
Engine oil specification

Oil pan capacity	About 3.8 liters (8.0/6.7 US/Imp pt.)
Oil filter capacity	About 0.2 liters (0.4/0.3 US/Imp pt.)
Others	About 0.3 liters (0.6/0.5 US/Imp pt.)
Total	About 4.3 liters (9.1/7.6 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 three minutes. Stop it and wait five 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

CHANGE

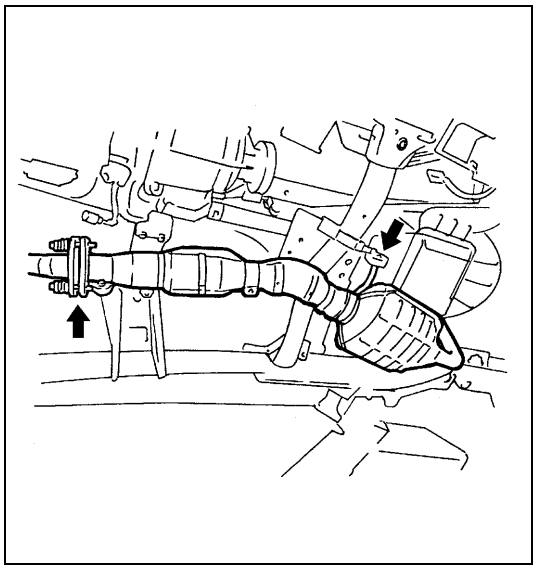
Change engine coolant referring to “Cooling System Flush and Refill” in Section 6B.

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.

Ignition System

Spark Plugs

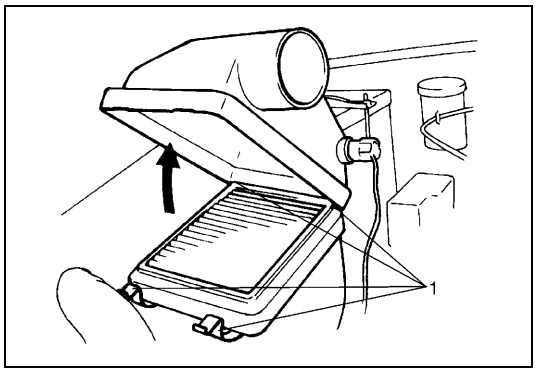
REPLACEMENT

Replace spark plugs with new ones referring to “Spark Plug” in Section 6F.

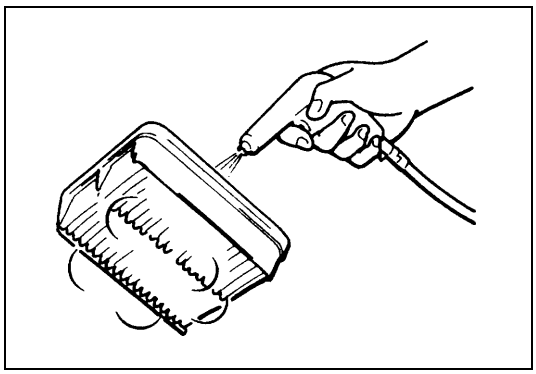
Fuel System

Air Cleaner Filter

INSPECTION



1) Remove air cleaner case clamps (1).
2) Take cleaner filter out of air cleaner case.
3) Check air cleaner filter for dirt. Replace excessively dirty filter.



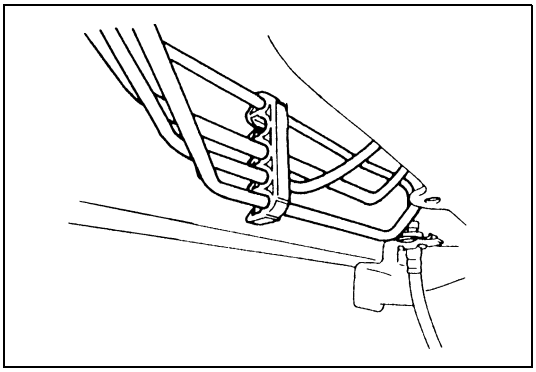
4) Blow off dust by compressed air from air outlet side of filter.
5) Install air cleaner filter into case.
6) Install air cleaner case cap and clamp it securely.

REPLACEMENT

Replace air cleaner filter with new one according to steps 1), 2) and 5), 6) of inspection procedure.

Fuel Lines and Connections

INSPECTION

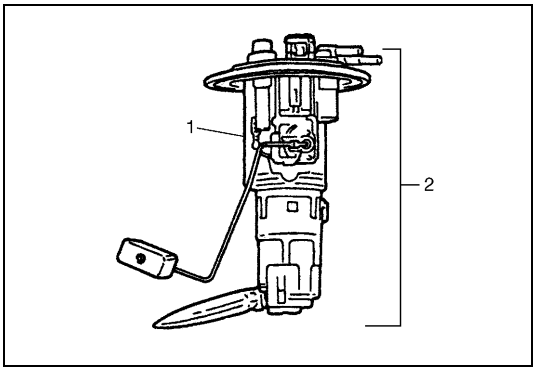


1) Visually inspect fuel lines and connections for evidence of fuel leakage, hose cracking and damage. Make sure all clamps are secure.
   Repair leaky joints, if any.
   Replace hoses that are suspected of being cracked.

Fuel Filter

REPLACEMENT

WARNING:
This work must be performed in a well ventilated area and away from any open flames (such as gas hot water heaters).



Fuel filter (1) is a part of fuel pump assembly (2) which is installed in fuel tank. Replace fuel filter with new one periodically, referring to “Fuel Pump Assembly (with Fuel Filter, Fuel Level Gauge and Fuel Cut Valve)” in Section 6C for proper procedure.

Fuel Tank

INSPECTION

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

Emission Control System

Crankcase Ventilation Hoses and Connections

INSPECTION

Refer to “PCV (Positive Crankcase Ventilation) Valve” in this section.

PCV (Positive Crankcase Ventilation) Valve

INSPECTION

Check crankcase ventilation hose and PCV hose for leaks, cracks or clog, and PCV valve for stick or clog. Refer to “PCV System” of Section 6E for PCV valve checking procedure.

Fuel Evaporative Emission Control System

INSPECTION

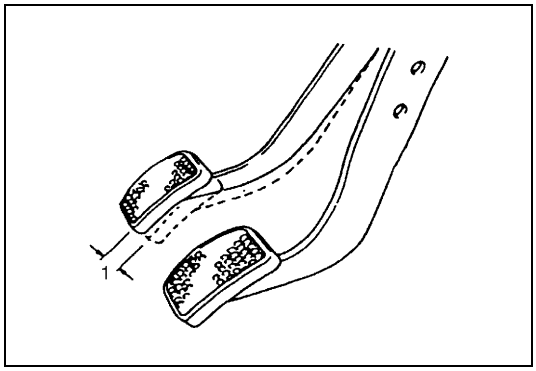
1) Visually inspect hoses for cracks, damage, or excessive bends. Inspect all clamps for damage and proper position.
2) Check EVAP canister for operation and clog, referring to “Evaporative Emission (EVAP) Control System” in Section 6E.

If a malfunction is found, repair or replace.

Chassis and Body

Clutch

INSPECTION

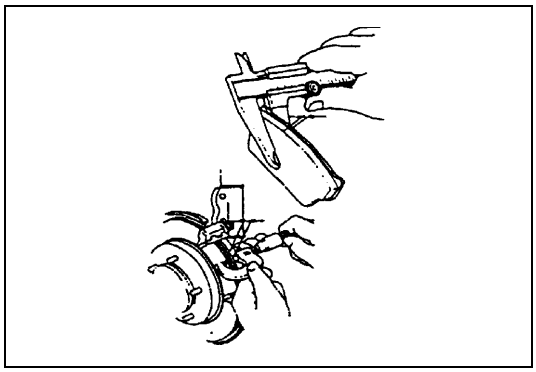


Check clutch pedal for height and free travel (1) referring to “Maintenance Service” in Section 7C. Adjust or correct if necessary.

Brake Discs and Pads

INSPECTION

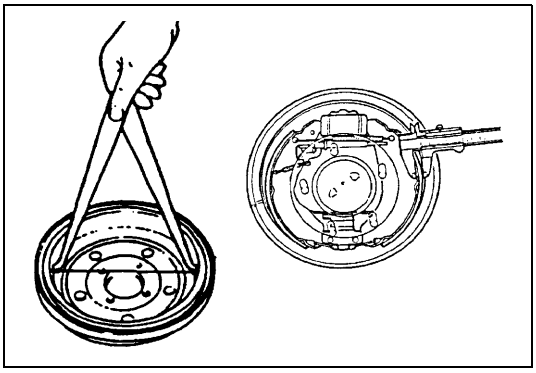
1) Remove wheel and caliper but don’t disconnect brake hose from caliper.



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

Brake Drums and Shoes

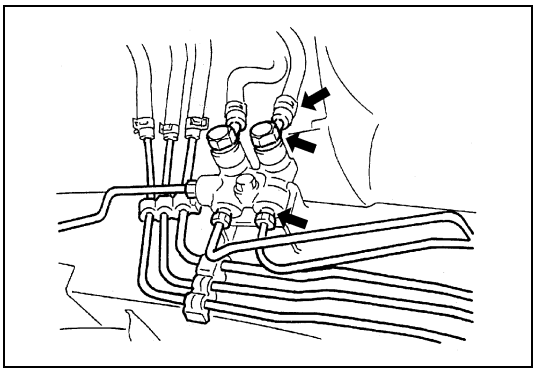
INSPECTION



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 “Brake Drum” in Section 5.

Brake Hoses and Pipes

INSPECTION



Check brake hoses and pipes for proper hookup, leaks, cracks, chafing and other damage.
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

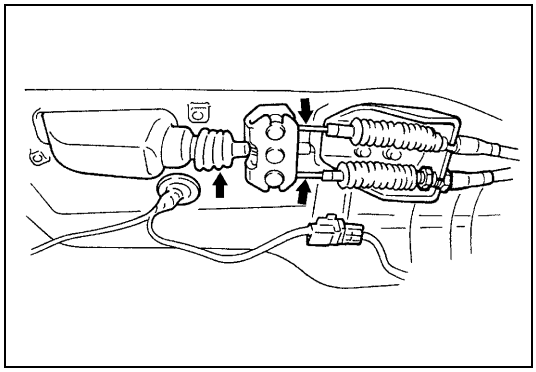
CHANGE

CAUTION:
Since brake system of this vehicle is factory-filled with glycol-base brake fluid, do not use or mix different type of fluid when refilling system; otherwise serious damage will occur. Do not use old or used brake fluid, or one taken from unsealed container.

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

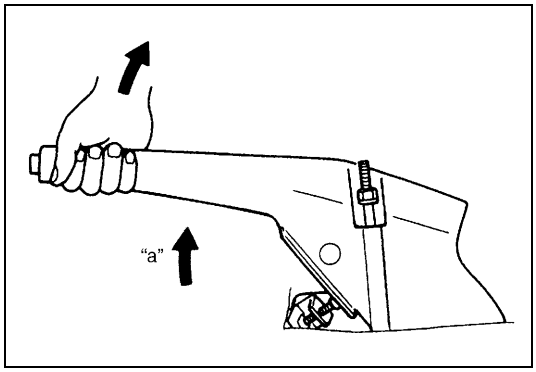
Parking Brake Lever and Cable

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.

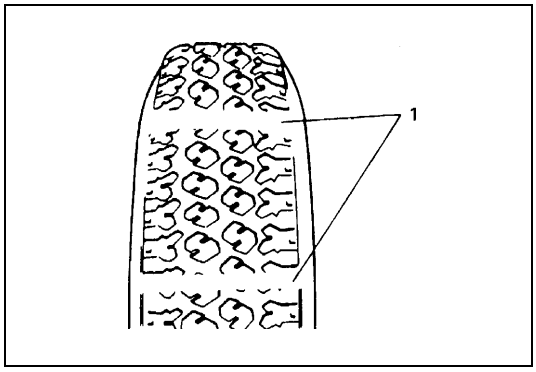


3) Check parking brake lever for proper operation and stroke, and adjust it if necessary.
For checking and adjusting procedures, refer to "Parking Brake Inspection and Adjustment" in Section 5.

Parking brake lever stroke
"a": 6 – 8 notches (with 200 N (20 kg, 44 lbs) of pull pressure)

Tires/Wheels

TIRE INSPECTION AND ROTATION



1) Check tires for uneven or excessive wear, or damage. If defective, replace.
Refer to "Irregular and/or Premature Wear" and "Wear Indicators" in Section 3 for details.

1. Wear indicator

2) Check inflating pressure of each tire and adjust pressure to specification as necessary.
Refer to "Inflation of Tires" in Section 3F for details.

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

Suspension System

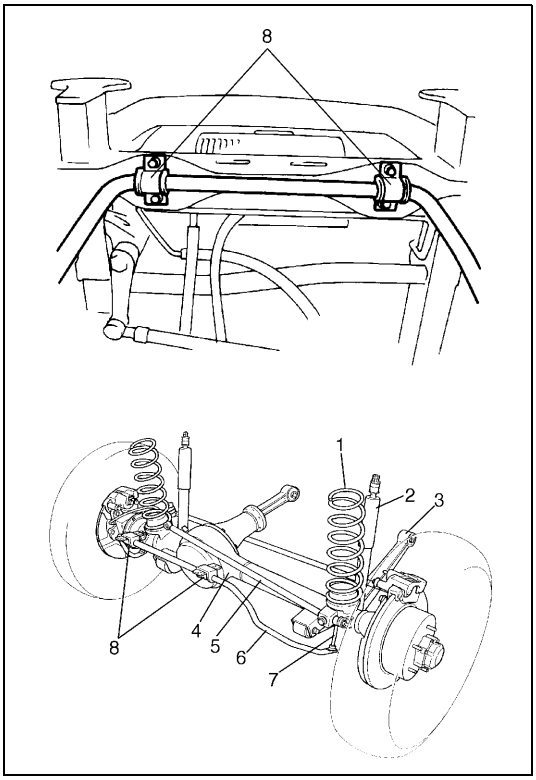
INSPECTION

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

NOTE:

For details of check points, refer to tables of “Tightening Torque Specification” in Section 3D and 3E.

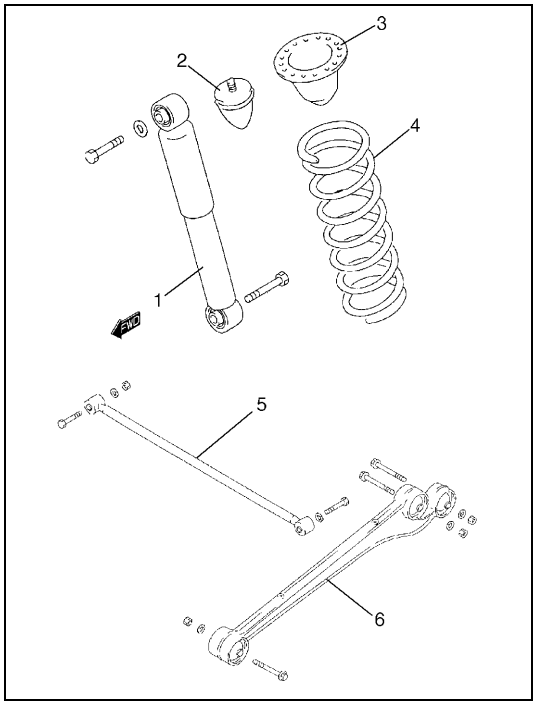
FRONT



1) Check stabilizer bar (6) for damage or deformation.
2) Check bushing (8) for damage, wear or deterioration.
3) Check coil spring (1), lateral rod (5) and leading arm (3) for deformation and damage.
4) Check lateral rod (5) and leading arm bushings for wear, damage and deterioration.
5) Inspect absorbers (2) for evidence of oil leakage, dents or any other damage on sleeves; and inspect anchor ends for deterioration.
6) Inspect for cracks or deformation in spring seat.
7) Inspect for deterioration of bump stopper.

4. Front axle housing
7. Ball joint

REAR



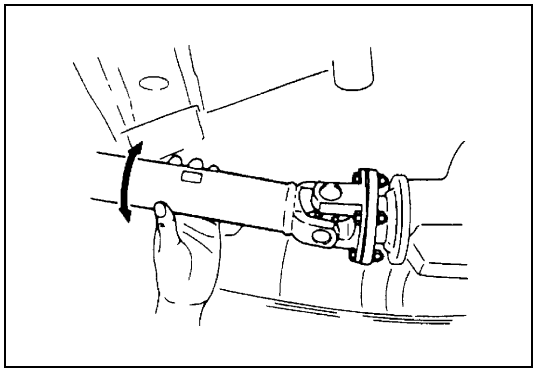
1) Check shock absorber (1) for damage, deformation, oil leakage and operation.
2) Check bushings for wear and damage.
3) Check coil spring (4), trailing arm (6) and lateral rod (5) for deformation and damage.
4) Check trailing arm (6) and lateral rod bushings and bump stopper (2) for wear, damage and deterioration.
5) Check other suspension parts for damage, loose or missing parts; also for parts showing signs of wear or lack of lubrication.

Replace any parts found defective in steps 1) to 5).

3. Spring seat

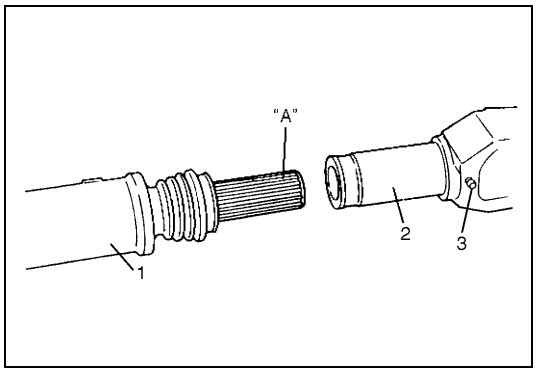
Propeller Shafts

INSPECTION



1) Check universal joint and spline of propeller shaft for rattle. If rattle is found, replace defective part with a new one.
2) Check propeller shaft (front & rear) flange yoke bolts for tightness, and retighten them as necessary.
   Refer to “Components” in Section 4B for tightening torque.

LUBRICATION



Grease splines of propeller shaft No.2 (1) and No.3 (2).

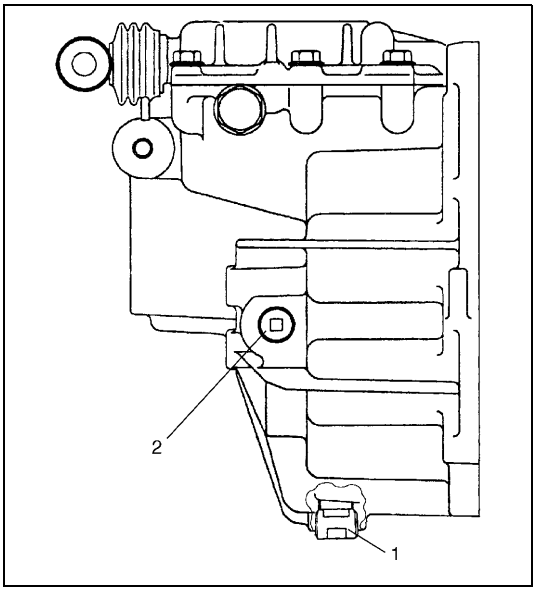
“A”: Chassis Grease

3. Nipple

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 level plug (2) of transmission.
4) 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.
5) Tighten level plug to specified torque.
   Refer to “Maintenance Service” in Section 7A for installation and tightening torque.

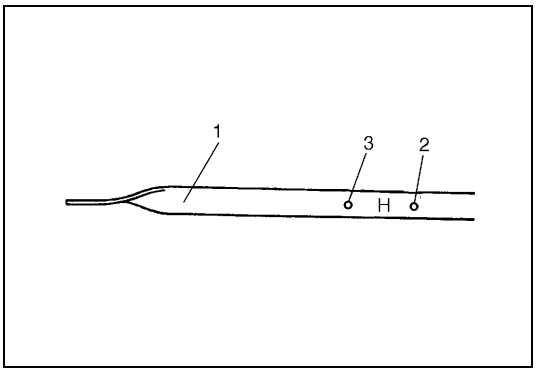
CHANGE

Change transmission oil with new specified oil referring to “Maintenance Service” in Section 7A.

Automatic Transmission Fluid

INSPECTION

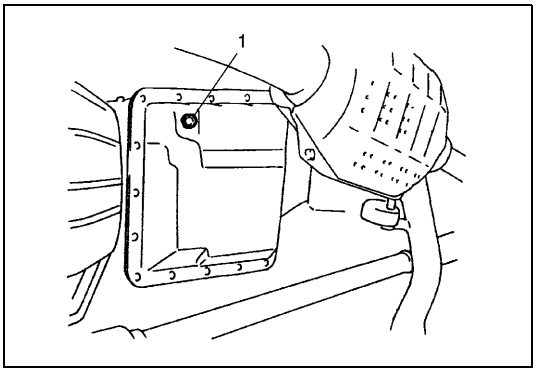
1) Inspect transmission case for evidence of fluid leakage. Repair leaky point, if any.
2) Make sure that vehicle is placed level for fluid level check.



3) Check fluid level.
   For fluid level checking procedure, refer to “Fluid Level Check” in Section 7B and be sure to perform it under specified conditions. If fluid level is low, replenish specified fluid.

1. Dipstick
2. “FULL HOT” mark
3. “LOW HOT” mark

CHANGE

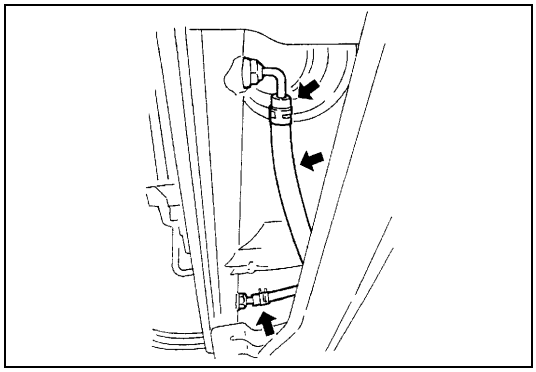


1) Inspect transmission case for evidence of fluid leakage. Repair leaky point, if any.
2) Make sure that vehicle is placed level for fluid level check.
3) Change fluid. For its procedure, refer to “Changing Fluid” in Section 7B.

CAUTION:
Use of specified fluid is absolutely necessary.

1. Drain plug

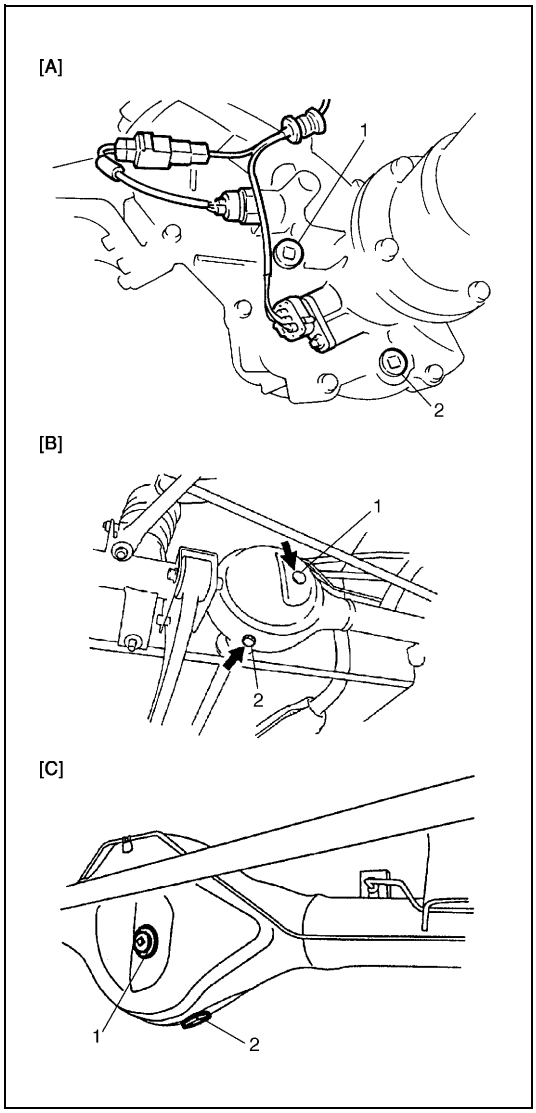
FLUID COOLER HOSE CHANGE



Replace inlet and outlet hoses of cooler hose and their clamps.
For replacement procedure, refer to “Oil Cooler Hoses” in Section 7B.

Transfer and Differential Oil

INSPECTION



1) Check transfer case and 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 and differentials (front and rear) 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.

[A] :	Transfer
[B] :	Front differential
[C] :	Rear differential
1.	Oil filler/level plug (Apply sealant for transfer)
2.	Drain plug (Apply sealant)

CAUTION:
Hypoid gear oil must be used for differential.

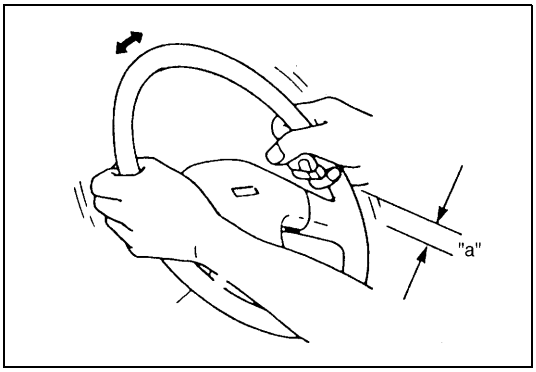
4) Tighten level plug to specified torque.
   Refer to “Oil Change” in Section 7D, 7E or 7F for tightening torque.

CHANGE

Change transfer oil and differentials oil with new specified oil referring to “Oil Change” in Section 7D, 7E or 7F.

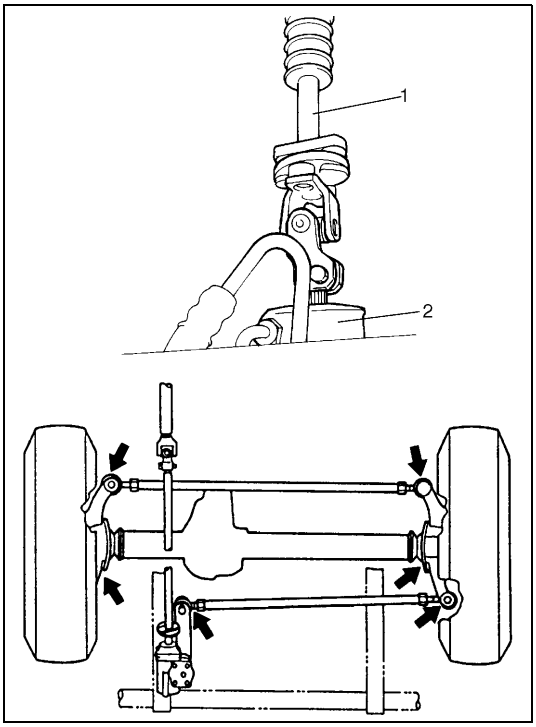
Steering System

INSPECTION



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

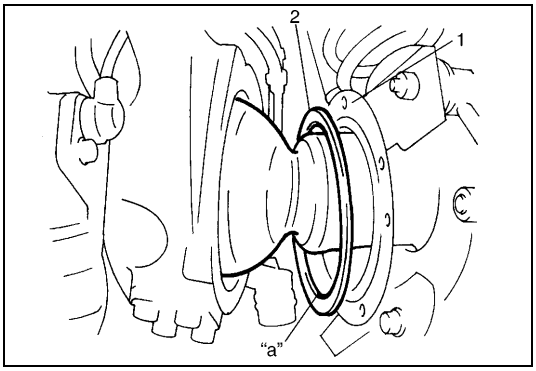
Steering wheel play
"a": 0 – 30 mm (0 – 1.2 in.)



2) Check universal joints of steering lower shaft (1) for rattle and damage. If rattle or damage is found, replace defective part with a new one.
3) Check steering linkage (including kingpin) for looseness and damage. Repair or replace defective part, if any.
4) Check bolts and nuts for tightness and retighten them as necessary. Repair or replace defective parts, if any.
   Refer to table of "Tightening Torque Specifications" in Section 3B (or 3B1) and 3C for particular check points.
5) Inspect steering gear box (2) for evidence of oil leakage. If leakage is found, check oil level in gear box.
6) Check boots of steering linkage for damage (leaks, detachment, tear, dent, etc.). If damage is found, replace defective boot with new one.
7) Check wheel alignment. Refer to "Preliminary Checks Prior to Adjusting Front Alignment" in Section 3A.

Steering Knuckle Seal

INSPECTION

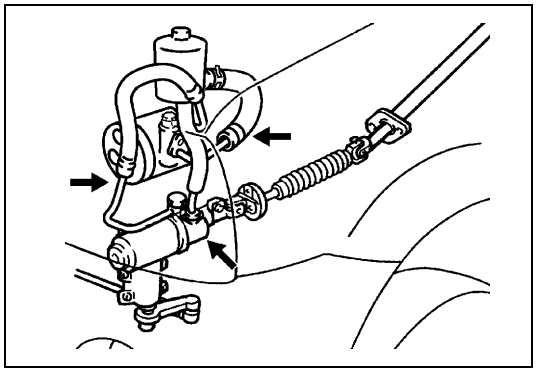


1) Remove knuckle seal cover (1).
2) Check knuckle seal (2) for wear, damage and deterioration. If defective, replace.
3) Apply grease to seal lip and install seal and seal cover.

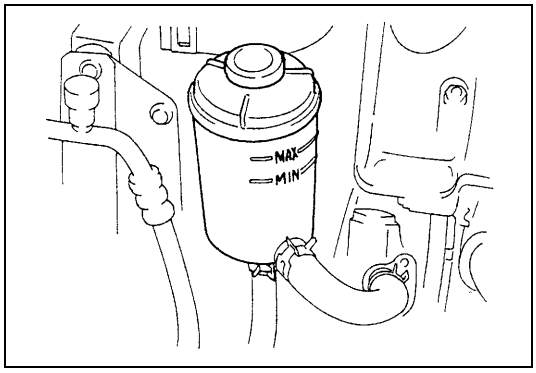
"a": Grease 99000-25010

Power Steering (P/S) System (if equipped)

INSPECTION



1) Visually check power steering system for fluid leakage and hose for damage and deterioration.
   Repair or replace defective parts, if any.



2) With engine stopped, check fluid level indicated on fluid tank or level gauge of tank cap, which should be between MAX and MIN marks. If it is lower than MIN, fill fluid up to MAX mark.

NOTE:

- **Be sure to use an equivalent of DEXRON®-II, DEXRON®-IIE or DEXRON®-III for P/S fluid.**
- **Fluid level should be checked when fluid is cool.**

3) Visually check pump drive belt for cracks and wear.
4) Check belt for tension, referring to “Drive Belt” in this section.
   If necessary, have belt adjusted or replaced.

All Hinges, Latches and Locks

DOORS INSPECTION

Check that each door of front 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 INSPECTION

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. Check hood latch bolt for tightness.

Tightening torque
Hood latch bolts
10 N·m (1.0 kg-m, 7.5 lb-ft)

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.
If “REPLACE BELT” label on front seat belt is visible, replace belt. Check that seat belt is securely locked.

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 SELECTOR LEVER (TRANSMISSION)

Check gear shift or selector 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 selector lever is shifted to.
With automatic transmission equipped vehicle, make sure that vehicle is at complete stop when shifting selector lever to “P” range position and release all brakes.

BRAKE

Foot Brake

Check the following:

- that brake pedal has proper travel,
- that brake works properly,
- that it is free from noise,
- that braking force is applied equally on all wheels,
- 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	SE, SF, SG, SH, SJ or SL (Refer to “Engine Oil and Oil Filter” in this section for engine oil viscosity.)
Engine coolant (Ethylene glycol base coolant)	“Antifreeze/Anticorrosion coolant”
Brake fluid	DOT 3
Manual transmission oil	Refer to “Maintenance Service” in Section 7A.
Transfer oil	Refer to “Oil Change” in Section 7D.
Differential oil (front & rear)	Refer to “Oil Change” in Section 7E and 7F.
Automatic transmission fluid	An equivalent of DEXRON®-IIE or DEXRON®-III
Power steering fluid	An equivalent of DEXRON®-II, DEXRON®-IIE or DEXRON®-III
Clutch linkage pivot points	Water resistance chassis grease (SUZUKI SUPER GREASE A 99000-25010)
Steering knuckle seal	
Door hinges	Engine oil or water resistance chassis grease
Hood latch assembly	
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 "Air Bag 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 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).**

NOTE:

The link mechanism of the heater varies depending on the specifications.

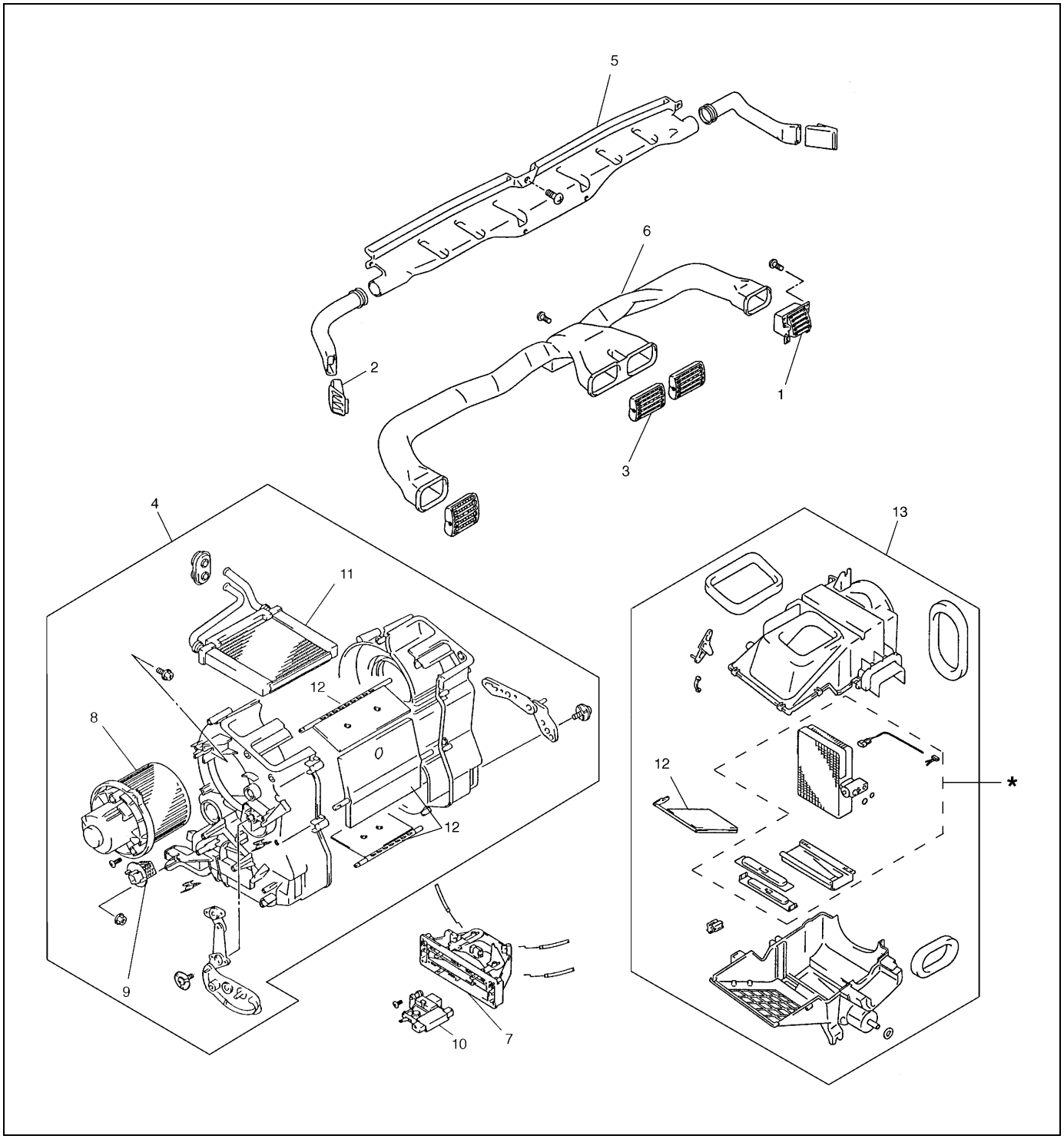
CONTENTS

General Description 1A-2
Diagnosis 1A-3
Diagnosis Table 1A-3
Wiring Circuit 1A-3
On Vehicle Service 1A-4
Heater Blower Motor 1A-4
Heater Blower Resistor 1A-5
Heater Control Lever Assembly 1A-5
Heater Blower Fan Switch 1A-7
Heater Unit/Boost Ventilation 1A-7

General Description

The heater, an in and out air selectable-type hot water heater, is so constructed that it is possible to assure an agreeable ventilation at all times by providing the ventilator air outlets at the center and both sides (right and left) of the instrument panel, the hot air outlet at a place close to the feet of front passengers, and the defroster air outlets at places, right and left, along the windshield glass.

The heater and ventilation consist of following parts.



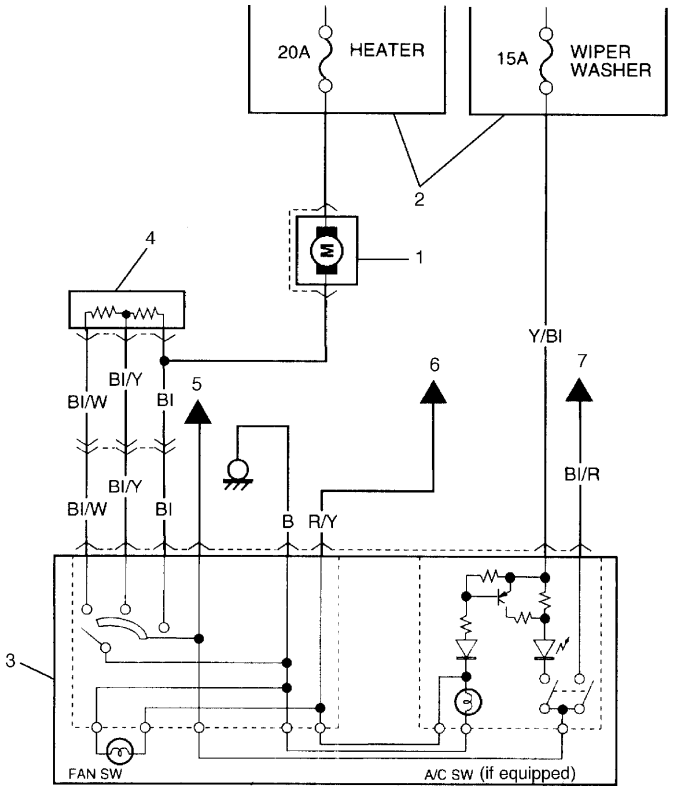
1. Side ventilator outlet	6. Ventilator duct	11. Heater core
2. Side defroster outlet	7. Control lever	12. Damper
3. Center ventilator outlet	8. Blower motor	13. Air inlet box (without air conditioning, without other parts marked *)/cooling unit (if equipped with air conditioning)
4. Heater unit	9. Blower resistor	
5. Defroster duct	10. Blower fan switch/Blower fan and A/C switch (if equipped with air conditioning)	

Diagnosis

Diagnosis Table

Condition	Possible Cause	Correction
Heater blower won't work even when its switch is ON.	Blower fuse blown	Replace fuse to check for short.
	Blower resistor faulty	Check resistor.
	Blower fan switch faulty	Check blower fan switch.
	Blower motor faulty	Replace motor.
	Wiring or grounding faulty	Repair as necessary.
Incorrect temperature output.	Control cables broken or binding	Check cables.
	Temperature control lever faulty	Check control lever.
	Control cable clamp position is faulty	Check and adjustment.
	Air damper broken	Repair damper.
	Air ducts clogged	Repair air ducts.
	Heater radiator leaking or clogged	Replace radiator.
	Heater hoses leaking or clogged	Replace hoses.
When mode control lever is changed, air outlet port is not changed.	Control cable broken or binding	Check cable.
	Mode control lever faulty	Check control lever.
	Control cable clamp position is faulty	Check and adjustment.
	Air damper broken	Repair damper.
	Air ducts leaking on clogged	Repair air ducts.

Wiring Circuit



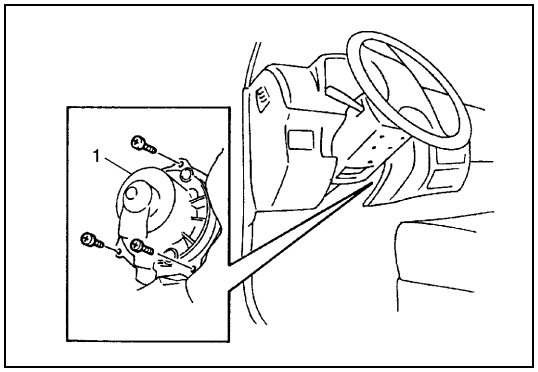
1. Heater motor	3. Heater blower motor switch	5. To ECM	7. To 4WD controller or A/C controller (if equipped)
2. Fuse box	4. Heater resister	6. To combination switch	

On Vehicle Service

Heater Blower Motor

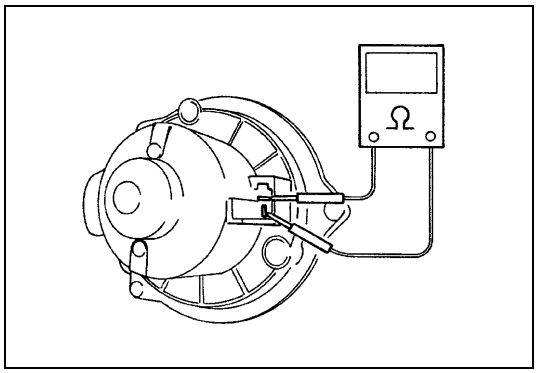
REMOVAL

1) Disconnect negative (–) cable at battery.
2) Disable air bag system, if equipped.
   Refer to “Disabling Air Bag System” in Section 10B.
3) Remove column hole cover.
4) Disconnect blower motor couplers.
5) Remove blower motor (1).

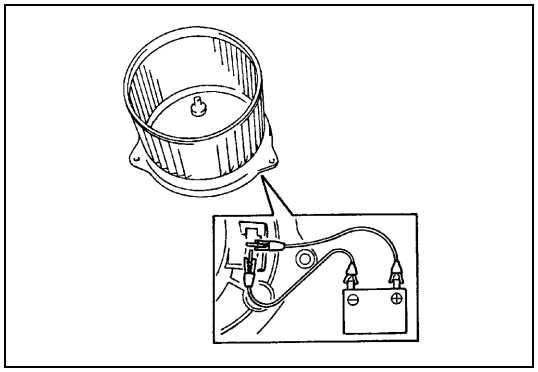


INSPECTION

Check continuity between two terminal as shown figure.
If check results are continuity, proceed to next operation check, If not replace.



Connect battery to blower motor as shown, then check that the blower motor operates smoothly.



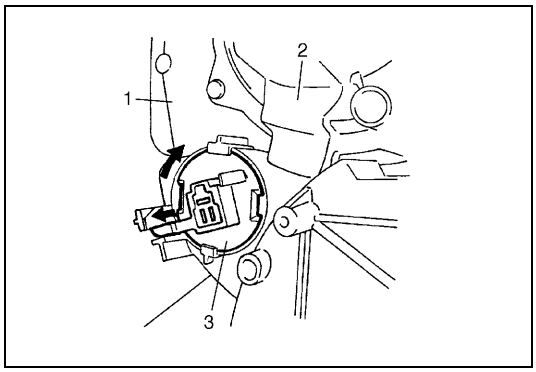
INSTALLATION

1) Reverse removal procedure for installation.
2) Enable air bag system, if equipped.
   Refer to “Enabling Air Bag System” in Section 10B.

Heater Blower Resistor

REMOVAL

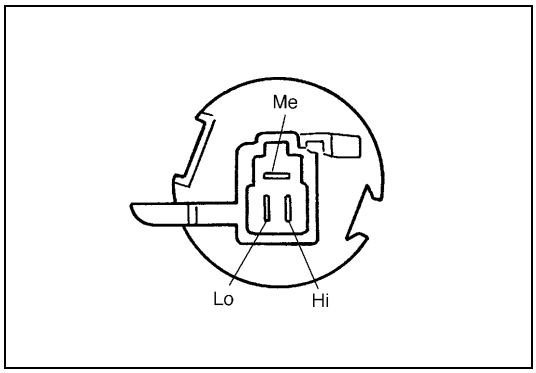
1) Disconnect negative (–) cable at battery.
2) Disable air bag system, if equipped.
   Refer to “Disabling Air Bag System” in Section 10B.
3) Disconnect resistor coupler.



4) Remove blower motor resistor (3) as shown figure.

1.	Heater unit
2.	Blower motor

INSPECTION



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

Heater blower resistor resistance
Me-Lo: approx. 2.4 Ω
Me-Hi: approx. 1.2 Ω

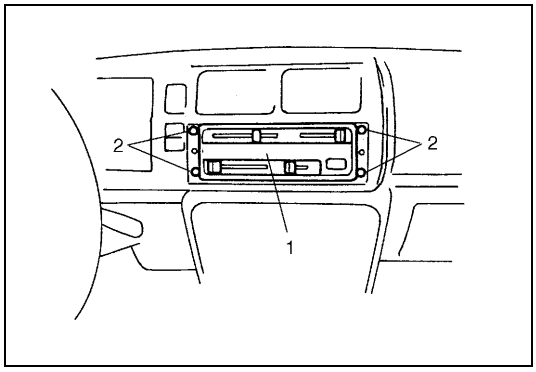
INSTALLATION

1) Reverse removal procedure for installation.
2) Enable air bag system, if equipped.
   Refer to “Enabling Air Bag System” in Section 10B.

Heater Control Lever Assembly

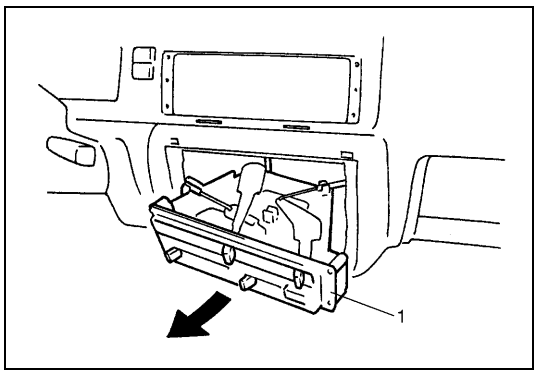
REMOVAL

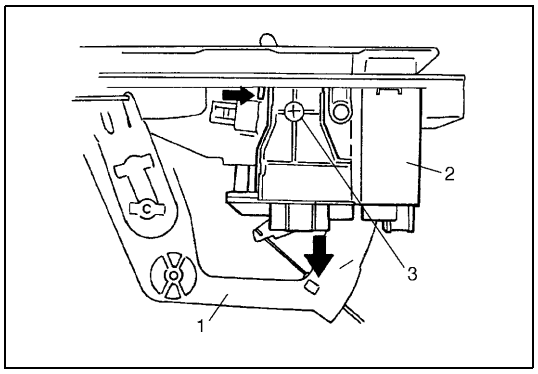
1) Disconnect negative (–) cable at battery.
2) Disable air bag system, if equipped.
   Refer to “Disabling Air Bag System” in Section 10B.



3) Remove meter cluster hood, ashtray, center garnish, instrument glove box and radio or accessory case (if equipped), Then remove mounting screws (2) from heater control lever assembly (1).

4) Disconnect blower fan switch coupler and A/C switch coupler (if equipped)
5) Disconnect each heater control cables.
6) Remove heater control lever assembly (1).

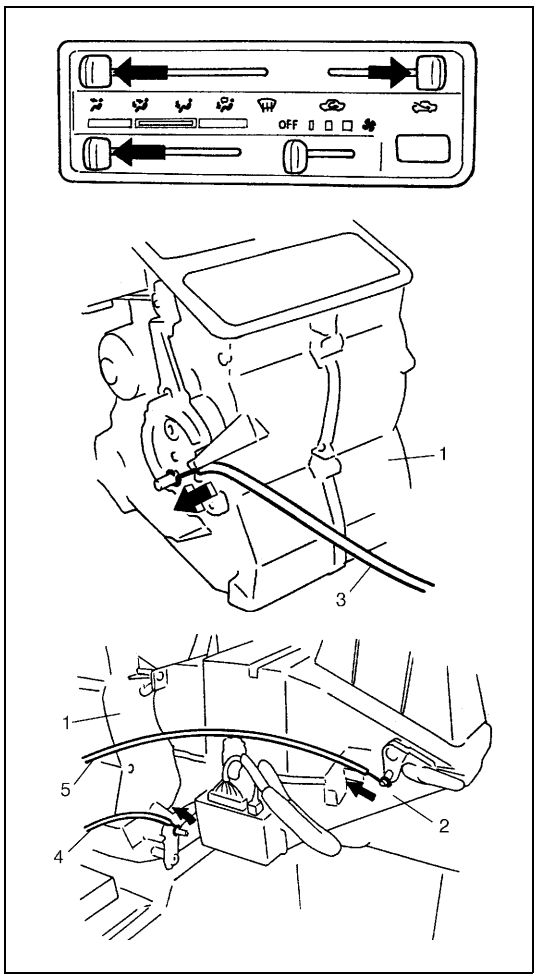




7) Remove blower fan switch screw (3).
8) Remove blower fan switch (2) as shown figure.

1.	Heater control lever assembly

INSTALLATION



1) Install in reverse order of removal procedure, adjustment the following items.
   - Move control lever fully in arrow direction
   - Push heater lever and air inlet box lever fully in arrow direction and fix cable with clamp in position as shown figure.

NOTE:

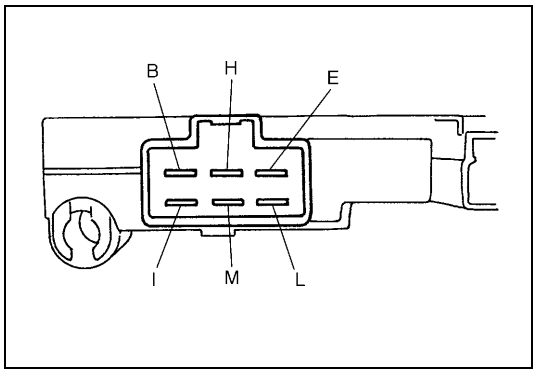
After installing control cables, be sure that control levers move smoothly and stop at proper position.

1.	Heater unit
2.	Air inlet box
3.	Mode control cable
4.	Temperature control cable
5.	Fresh air control cable

2) If equipped with air bag, enable air bag system. Refer to “Enabling Air Bag System” in Section 10B.

Heater Blower Fan Switch

INSPECTION



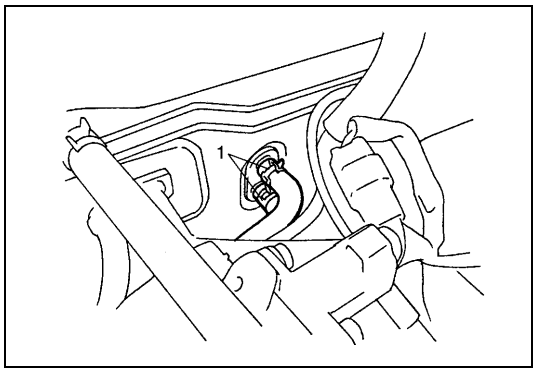
Check blower fan switch for each terminal-to-terminal continuity. For the detail refer to “Wiring Circuit” earlier in this section.

POSITION \ TERMINAL	B	E	I	L	M	H
OFF	○—⓪	○				
Lo	○—⓪	○	○	○		
M	○—⓪	○	○		○	
Hi	○—⓪	○	○			○

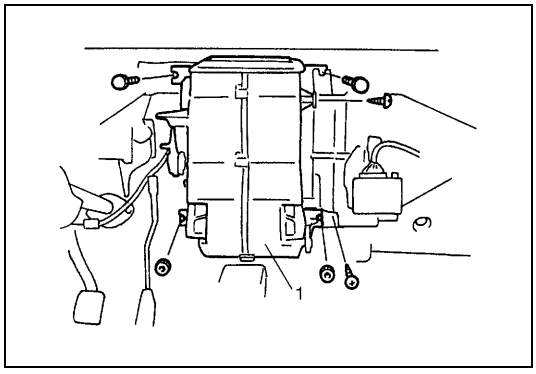
Heater Unit/Boost Ventilation

REMOVAL

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



3) Drain engine coolant and disconnect water hoses (1) from heater unit.
4) Remove instrument panel.

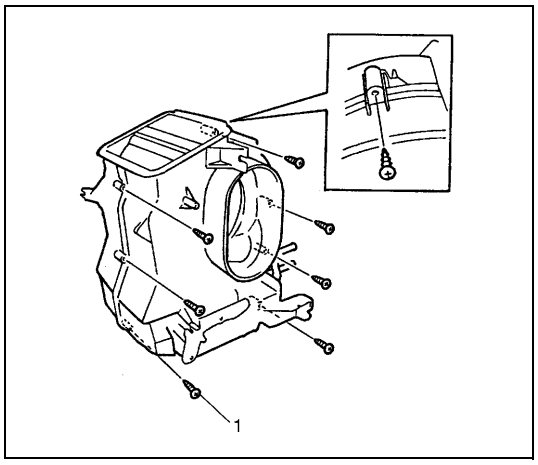


5) Remove bolts, nuts and screws as shown figure.
6) Remove heater unit (1).

INSTALLATION

Install heater unit by reversing removal procedure, noting the following items.

- When installing each part, be careful not to catch any cable or wiring harness.
- Adjust control cable (refer to heater control lever assembly in this section).
- Fill engine coolant to radiator.
- If equipped with air bag system, enable air bag system, Refer to “Enabling Air Bag System” in Section 10B.



CAUTION:

When the heater unit is disassembled and reassembled, locking force of the heater case lock may reduce. In such a case, tighten the heater case with a tapping screw of M4×L16 (1) as shown in the figure, or air may leak from its joint section.

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 "Air Bag 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 HFC-134a (R-134a) and the other using refrigerant CFC-12 (R-12).
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" in this section.
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.

NOTE:

For basic servicing method of the air conditioning system that is not described in this section, refer to AIR CONDITIONING BASIC MANUAL (Part number: 99520-02130).

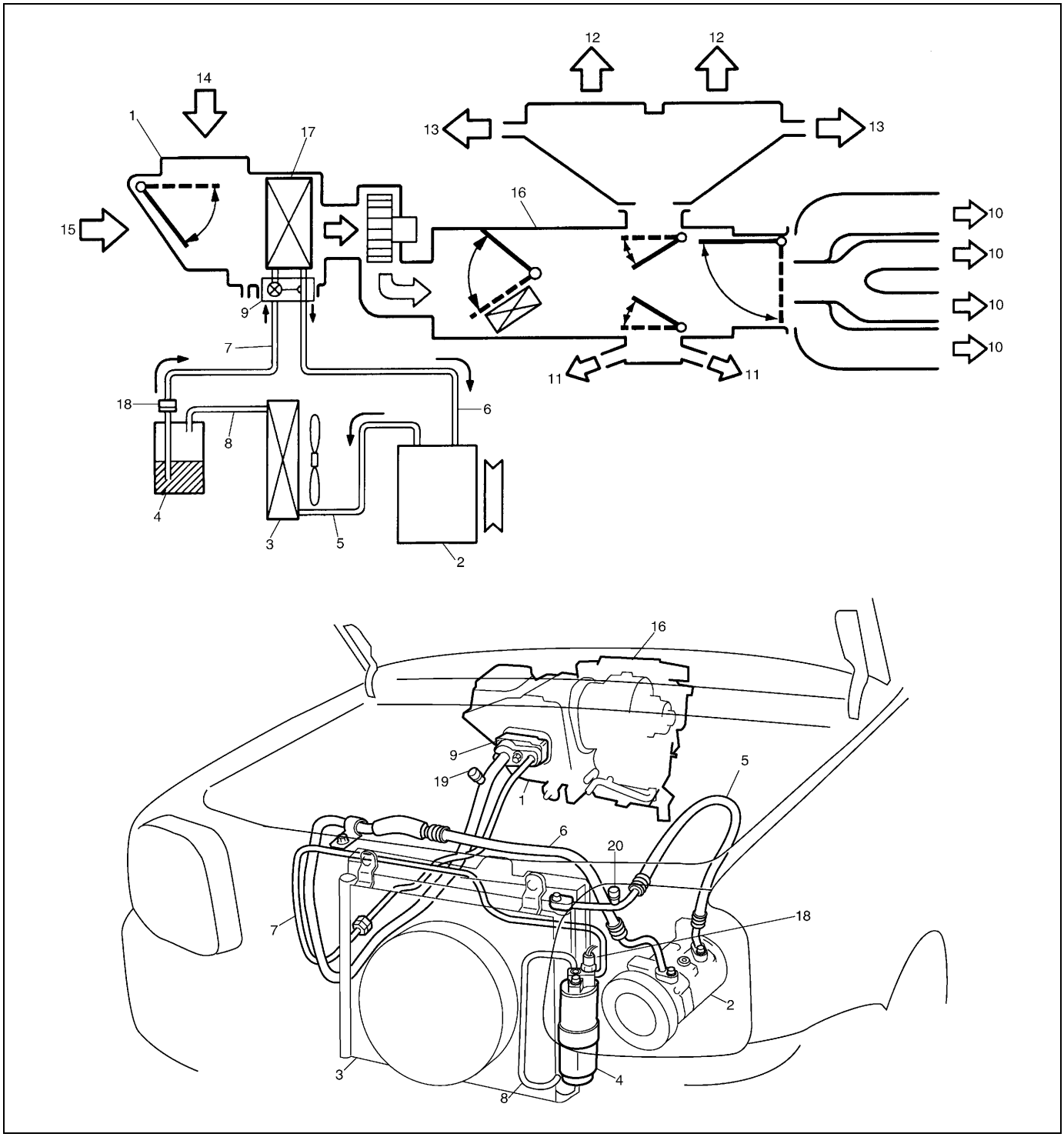
CONTENTS

General Description 1B-3
Major Components and Location 1B-3
Refrigerant Circulation 1B-4
Refrigerant Type 1B-4
Diagnosis 1B-5
General Diagnosis Table 1B-5
Abnormal Noise Diagnosis 1B-7
Abnormal noise from compressor 1B-7
Abnormal noise from magnetic clutch 1B-7
Abnormal noise from tubing 1B-7
Abnormal noise from condenser 1B-7
Abnormal noise from crankshaft pulley 1B-8
Abnormal noise from tension pulley 1B-8
Abnormal noise from A/C evaporator 1B-8
Abnormal noise from blower fan motor 1B-8
Quick Checking of Refrigerant Charge..... 1B-9
Performance Diagnosis..... 1B-10
Performance diagnosis table..... 1B-12
Detail diagnosis table (Ambient temperature at 30°C (86°F)) 1B-13
Compressor Drive Belt..... 1B-15
Electronical Diagnosis 1B-16
Wiring Diagram 1B-16
A/C System Inspection of ECM and ITS Circuits 1B-17
Refrigerant Recovery, Evacuating and Charging 1B-21
Operation Procedure for Refrigerant Charging 1B-21
Recovery..... 1B-22
Replenishing Compressor Oil 1B-22

Evacuating 1B-23
Evacuating procedure 1B-23
Charging 1B-25
Charging procedure 1B-25
Removing Manifold Gauge Set 1B-28
Leak Test 1B-28
On-Vehicle Service 1B-29
Service Precaution 1B-29
Refrigerant line 1B-29
Handling refrigerant HFC-134a (R-134a) 1B-30
Condenser Assembly 1B-31
Receiver / Dryer 1B-32
Condenser Cooling Fan Assembly 1B-33
Cooling Unit (Evaporator) 1B-34
A/C Evaporator Thermistor (A/C Evaporator Temperature Sensor) 1B-37
Expansion Valve 1B-37
Dual Pressure Switch 1B-38
A/C Switch 1B-39
Condenser Cooling Fan Motor Relay 1B-39
Compressor 1B-39
Magnet Clutch 1B-41
Lip Type Seal 1B-45
Tightening Torque Specification 1B-46
Required Service Materials 1B-47
Special Tools 1B-47

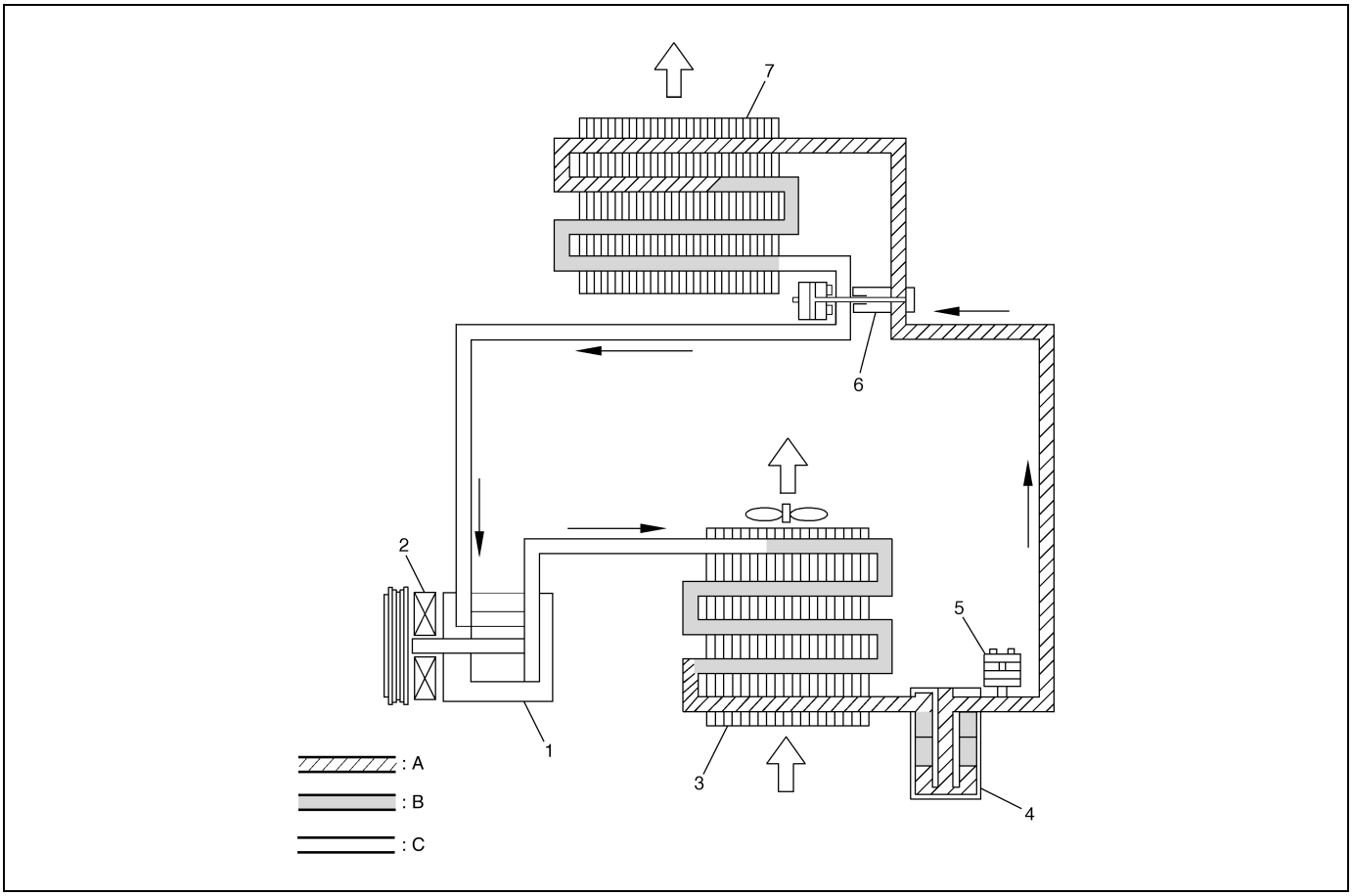
General Description

Major Components and Location



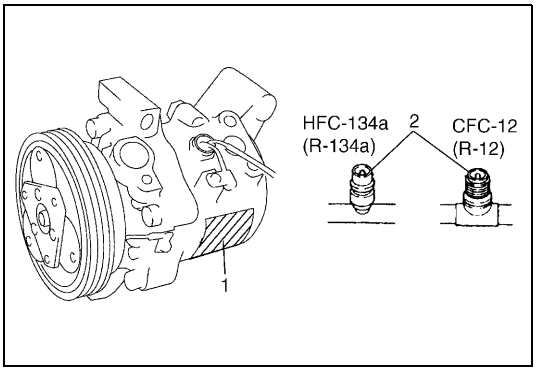
1. Cooling unit	6. Suction hose	11. Foot air	16. Heater unit
2. Compressor	7. Receiver / dryer outlet pipe	12. Defroster air	17. A/C evaporator
3. Condenser assembly	8. Condenser outlet pipe	13. Demister air	18. Dual pressure switch
4. Receiver / dryer	9. Expansion valve	14. Fresh air	19. Low pressure service (charge) valve
5. Discharge hose	10. Ventilation air	15. Recirculation air	20. High pressure service (charge) valve

Refrigerant Circulation



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

Refrigerant Type



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

Diagnosis

General Diagnosis Table

Condition	Possible Cause	Correction
Cool air won't come out (A/C system won't operative)	No refrigerant	Perform recover, evacuation and charging.
	Fuse blown	Check fuses in main and circuit fuse boxes, and check short circuit to ground.
	A/C switch faulty	Check A/C switch.
	Blower fan switch faulty	Check blower fan switch referring to Section 1A.
	A/C evaporator thermistor faulty	Check A/C evaporator thermistor.
	Dual pressure switch faulty	Check dual pressure switch.
	Wiring or grounding faulty	Repair as necessary.
	ECT sensor faulty	Check ECT sensor referring to Section 6E.
	ECM and its circuit faulty	Check ECM and its circuit referring to Section 6E.
	4WD controller faulty	Check 4WD controller referring to Section 3D.
Cool air won't come out (A/C compressor won't operative)	ECM faulty	Check ECM and its circuit referring to Section 6E.
	Magnet clutch faulty	Check magnet clutch.
	Compressor drive belt loosen or broken	Adjust or replace drive belt.
	Compressor faulty	Check compressor.
Cool air won't come out (A/C condenser cooling fan motor won't operative)	Fuse blown	Check "A/C" fuse in main fuse box, and check 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.
Cool air won't come out (Blower fan motor won't operative)	Fuse blown	Check fuses in main and circuit fuse boxes, and check short circuit to ground.
	Blower fan motor resistor faulty	Check blower fan motor resistor referring to Section 1A.
	Blower fan switch faulty	Check blower fan switch referring to Section 1A.
	Wiring or grounding faulty	Repair as necessary.
	Blower fan motor faulty	Check blower fan motor referring to Section 1A.

Condition	Possible Cause	Correction
Cool air won't come out or insufficient cooling (A/C system normal operative)	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 thermistor.
	A/C evaporator thermistor faulty	Check A/C evaporator thermistor.
	Expansion valve faulty	Check expansion valve.
	Receiver / dryer clogged	Check receiver / dryer.
	Compressor drive belt loosen or broken	Adjust or replace drive belt.
	Magnetic clutch faulty	Check magnetic clutch.
	Compressor faulty	Check compressor.
	Air in A/C system	Replace receiver / dryer, and perform evacuation and charging.
	Air leaking from cooling unit or air duct	Repair as necessary.
	Heater and ventilation system faulty	Check air inlet box (cooling unit), heater control lever assembly and heater unit referring to Section 1A.
	Blower fan motor faulty	Check blower fan motor referring to Section 1A.
	Excessive compressor oil existing in A/C system	Pull out compressor oil in A/C system circuit, and replace compressor.
Cool air won't 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 charging.
	Magnetic clutch faulty	Check magnetic clutch.
	Excessive charge of refrigerant	Check charge of refrigerant.
	Thermal switch faulty	Check thermal switch.
Cool air comes out only at high speed	Condenser clogged	Check A/C condenser.
	Insufficient charge of refrigerant	Check charge of refrigerant.
	Air in A/C system	Replace receiver / dryer, and perform evacuation and charging.
	Compressor drive belt loosen or broken	Adjust or replace drive belt.
	Compressor faulty	Check compressor.
Cool air won't come out only at high speed	Excessive charge of refrigerant	Check charge refrigerant.
	A/C evaporator frosted	Check A/C evaporator and A/C evaporator thermistor.
Insufficient velocity of cooled air	A/C evaporator clogged or frosted	Check A/C evaporator and A/C evaporator thermistor.
	Air leaking from cooling unit or air duct	Repair as necessary.
	Blower fan motor faulty	Check blower fan motor referring to Section 1A.
	Wiring or grounding faulty	Repair as necessary.

Abnormal Noise Diagnosis

There are various types of noise, ranging from those produced in the engine compartment to those from the passenger compartment, also from rumbling noises to whistling noises.

Abnormal noise from compressor

Condition	Possible Cause	Correction
During compressor operation, a rumbling noise is heard proportional to engine revolutions.	Inadequate clearance in piston area (piston or swash-plate).	Repair or replace compressor as necessary
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 belt.
	Loose compressor mounting bolts.	Retighten mounting bolts.
A loud rattle is heard at low engine rpm.	Loose compressor clutch plate bolt.	Retighten 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 clutch clearance (excessive).	Adjust clutch clearance.
	Worn clutch friction surface.	Replace magnet clutch assembly.
	Compressor oil leaked from lip type seal.	Replace lip type seal.
	Contaminating the friction surface.	Replace compressor body assembly.

Abnormal noise from tubing

Condition	Possible Cause	Correction
A droning noise is heard inside 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

Condition	Possible Cause	Correction
Considerable vibration in condenser.	Resonance from condenser bracket and body.	Firmly insert a silencer between condenser bracket and body.

Abnormal noise from crankshaft pulley

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

Abnormal noise from tension pulley

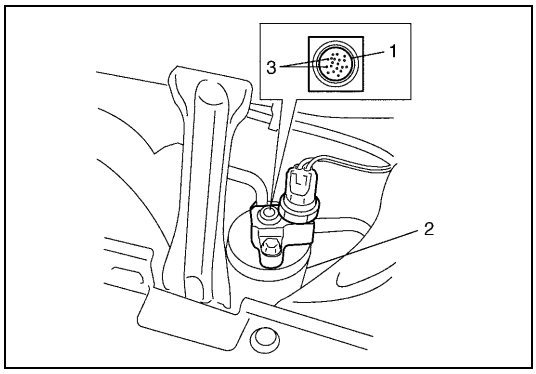
Condition	Possible Cause	Correction
Clattering noise is heard from pulley.	Worn or damaged bearing.	Replace tension pulley.
Pulley cranks upon contact.	Cracked or loose bracket.	Replace or retighten bracket.

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 fan motor

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



Quick Checking of Refrigerant Charge

The following procedure can be used for quickly checking whether the A/C system has a proper charge of refrigerant or not.
Run engine at fast idle, and operate A/C at its maximum cooling capacity for a few minutes. Then, look at the sight glass (1) on receiver / dryer (2) and compare what is observed with the symptoms listed in below.

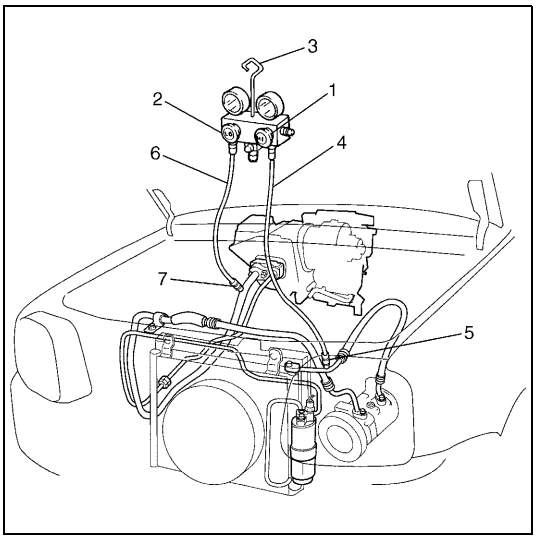
3. Bubbles

CHECKING REFRIGERANT CHARGE

Symptom	Charge of refrigerant condition	Correction
Bubbles observed in sight glass	Insufficient charge of refrigerant in system	Check system for leaks with a leak tester.
No bubbles observed in sight glass	No or insufficient charge of refrigerant in system	Refer to the items 3 and 4.
No temperature difference between compressor inlet and outlet	Empty or nearly empty system	Evacuate and charge system and then check it for leaks with a leak tester.
Noticeable temperature difference between compressor inlet and outlet	Proper or too much charge of refrigerant in system	Refer to the items 5 and 6.
When A/C is turned OFF, refrigerant in sight glass clears immediately and remains clear	Too much charge of refrigerant in system	Discharge excess refrigerant in order to obtain a specified charge.
When A/C is turned OFF, refrigerant in sight glass once produces bubbles and then clears	Proper charge of refrigerant in system	No correction needed because charge of refrigerant is normal.

Performance Diagnosis

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



2) Make sure that high pressure valve (1) and low pressure valve (2) of manifold gauge set (3) are firmly closed.
3) Connect high pressure charging hose (4) to high pressure service valve (5), and connect low pressure charging hose (6) to low pressure service valve (7).
4) Bleed the air in charging hoses (4), (6) by loosening their respective nuts on manifold gauge set (3), utilizing the refrigerant pressure. When a hissing sound is heard, immediately tighten nut.

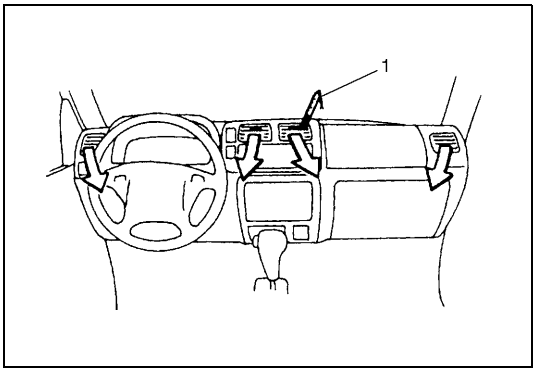
CAUTION:

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

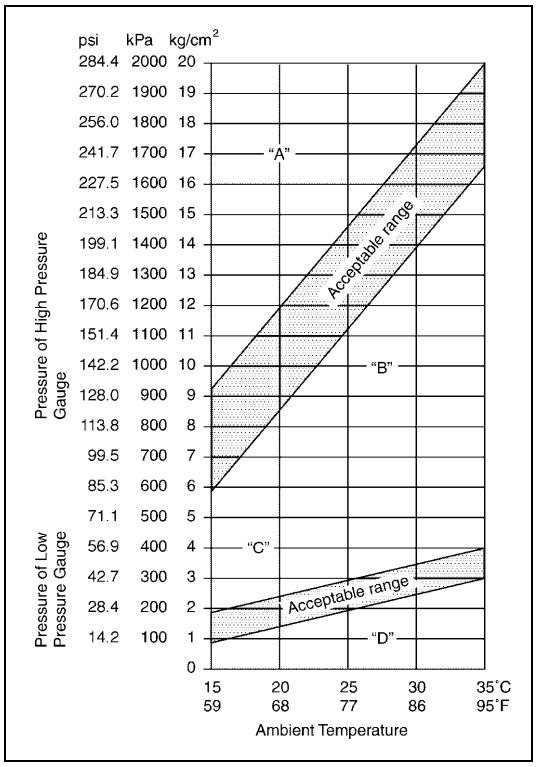
5) Warm up engine to normal operating temperature (engine coolant temperature at 80 – 90 °C (176 – 194 °F)) and keep it at specified idle speed. (Radiator cooling fan should not be working when checking pressure and temperature.)
6) Turn A/C switch ON, and set blower switch at “HI” (3rd position), temperature knob at “COOL” air outlet control knob at “FACE” and fresh / circulation control knob at “CIRCULATION”. (Confirm that A/C compressor and radiator / condenser cooling fan are working.)
   Keep all windows, doors and engine food open.

Performance diagnosis condition

Ambient temperature	**15 – 35 °C (59 – 95 °F)**
Engine rpm	**Keep to 1,500 rpm.**
Blower fan motor switch	**“H” (3rd position)**
Temperature control	**“Cool”**
Air outlet control	**“Face”**
Vehicle doors	**All open**
Air inlet door position	**Recirculation**



7) With dry bulb thermometer (1) inserted into center duct air outlet and another one set near evaporator air inlet, read temperature indicated on each thermometer.



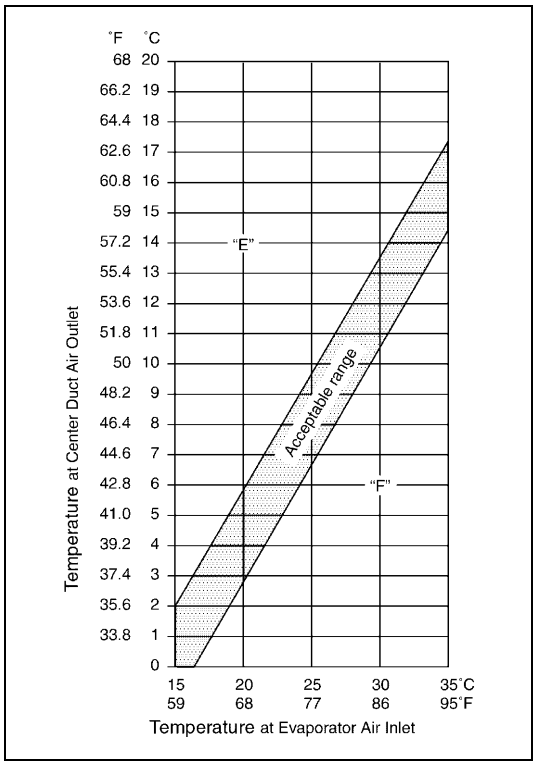
8) Check if each pressure on low side and on high side is within shaded range of the graph.
   If each gauge reading is out of specified pressure, correct defective part referring to "Performance Diagnosis Table" in this section.

NOTE:

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

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**



9) Check inlet port temperature-to-outlet port temperature relationship using graph.
   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 the graph.
   If crossing point is out of acceptable range, diagnose trouble referring to "Performance Diagnosis Table" in this section.

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 "Detail Diagnosis Table (Ambient Temperature At 30 °C (86 °F))" under "Performance Diagnosis" in this section.

HIGH PRESSURE GAUGE

Condition	Possible Cause	Correction
Pressure in higher than acceptable range ("A" area)	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 is lower than acceptable range ("B" area)	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 is higher than acceptable range ("C" area)	Expansion valve malfunction (valve opens too wide)	Check expansion valve
	Compressor malfunction (Insufficient compression)	Check compressor
Pressure is lower than acceptable range ("D" area)	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

CROSSING POINT OF CENTER VENTILATION LOUVER TEMPERATURE AND RECIRCULATION AIR INLET TEMPERATURE

Condition	Possible Cause	Correction
Crossing point is higher than acceptable range ("E" area)	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
Crossing point is lower than acceptable range ("F" area)	Insufficient air volume from center duct (Heater blower malfunction)	Check blower motor and fan
	Compressor malfunction	Check compressor

Detail 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 : 0.69 – 0.98 (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.

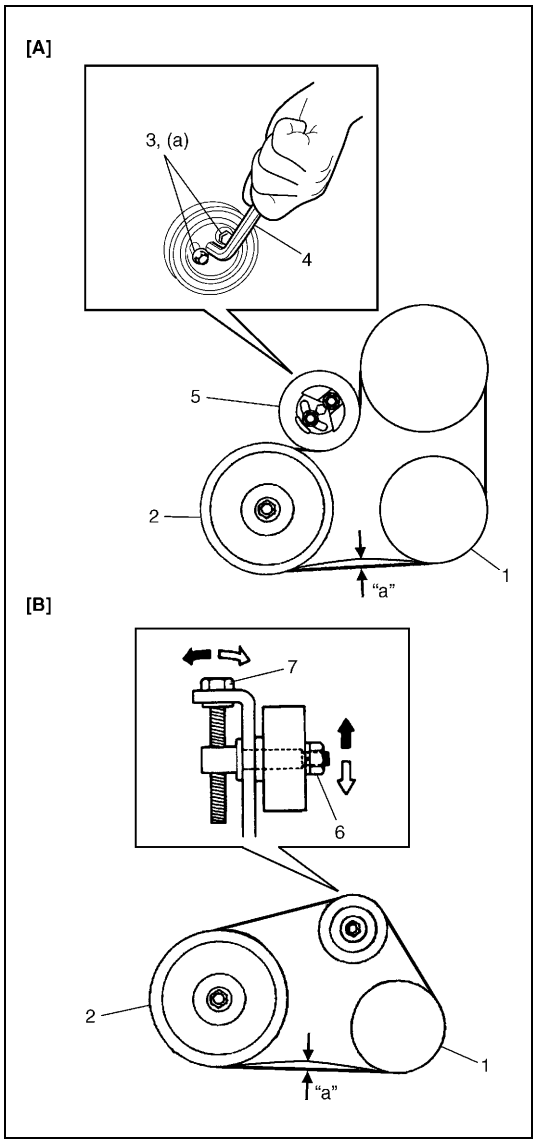
Condition			Possible Cause	Correction
MANIFOLD GAUGE MPa (kg/cm^2) (psi)		Detail		
Lo	Hi			
0.05 – 0.15 (0.5 – 1.5) (4.2 – 21.3)	**0.69 – 0.98 (7 – 10) (100 – 142)**	**Both low and high pressure sides indicate low readings. Continuous air bubbles are visible through sight glass. Output air is slightly 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.
0.35 – 0.45 (3.5 – 4.5) (50 – 64)	**1.96 – 2.45 (20 – 25) (285 – 355)**	**Pressure on both low and high pressure sides is high. 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.
		Pressure on both low and high pressure sides is high. 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)		**Pressure on both low and high pressure sides is high. Large amount of frost or dew on the low pressure side tubing.**	Faulty expansion valve. Refrigerant flow is not regulated properly.	Replace expansion valve.

Compressor Drive Belt

INSPECTION

- Check belt for wear and cracks, and replace as required.
- Check belt tension by measuring how much it deflects when pushed at intermediate point between compressor pulley (1) and crankshaft pulley (2) with about 100 N (10 kg, 22 lb) force.
  If belt tension is out of above specification, adjust belt tension according to the following procedures.

Deflection of compressor drive belt
"a" : 6 – 9 mm (0.24 – 0.35 in.)



ADJUSTMENT

For Vehicle With P/S

1) Loosen tension pulley bolts (3) and set hexagon wrench (4) to hexagon hole.
2) Turn tension pulley (5) counterclockwise by hexagon wrench in order to obtain above specified tension.
3) Tighten tension pulley bolts (3) to specified torque.

Tightening torque
Tension pulley bolts
(a) : 25N·m (2.5 kg-m, 18.0 lb-ft)

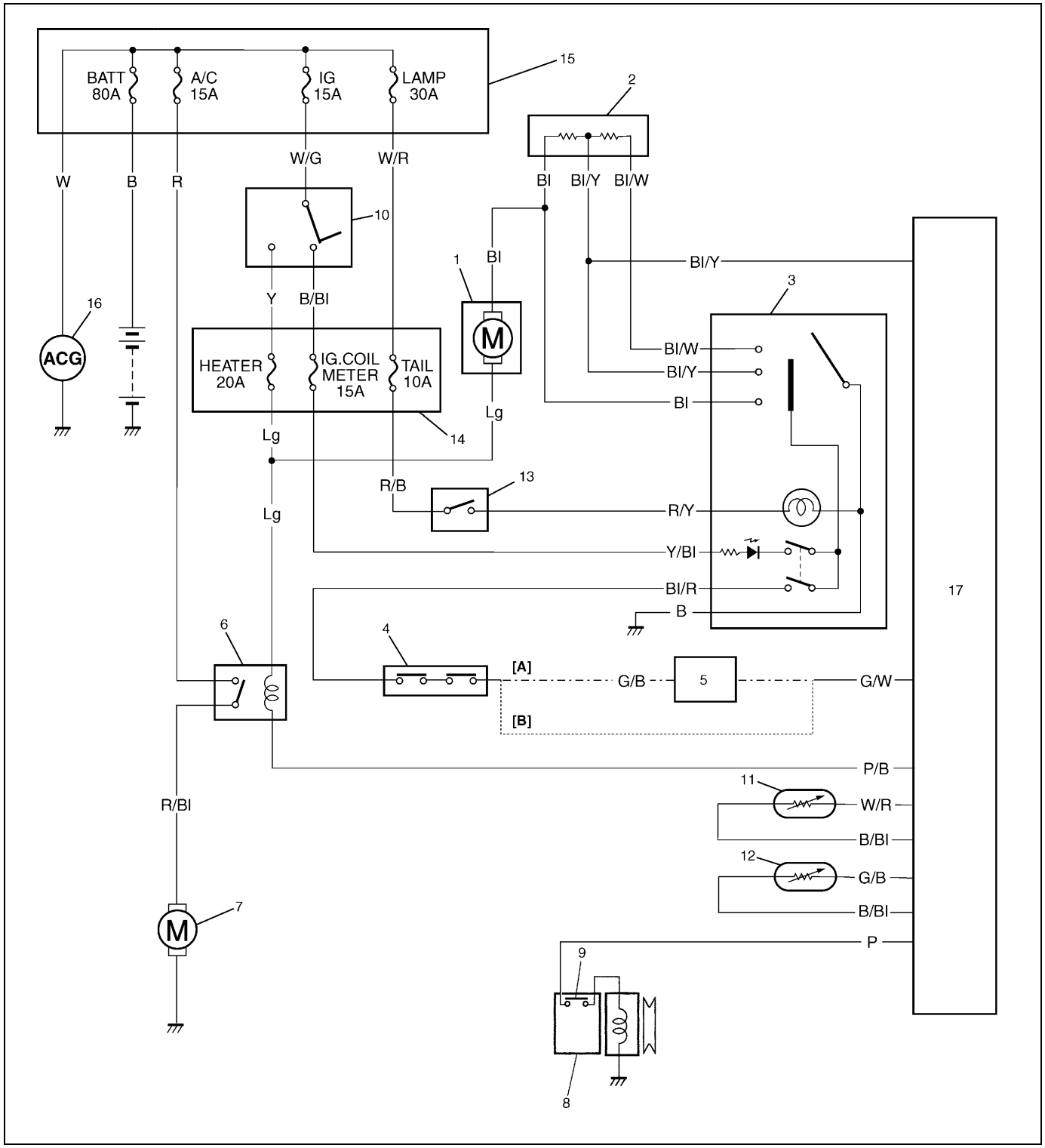
For Vehicle Without P/S

1) Loosen tension pulley tightening nut (6).
2) Adjust belt tension by tighten or loosen tension pulley adjusting bolt (7) in order to obtain above specified tension.
3) Tighten tension pulley tightening nut (6).

[A] : Vehicle with P/S
[B] : Vehicle without P/S

Electronical Diagnosis

Wiring Diagram



[A]: 4WD model	4. Dual pressure switch	9. Thermal switch	14. Circuit fuse box
[B]: 2WD model	5. 4WD controller	10. Ignition switch	15. Main fuse box
1. Blower fan motor	6. Condenser cooling fan motor relay	11. A/C evaporator thermistor	16. Generator
2. Blower fan motor resistor	7. Condenser cooling fan motor	12. ECT sensor	17. ECM
3. Blower fan motor switch and A/C switch	8. Compressor	13. Lighting switch	

A/C System Inspection of ECM and ITS Circuits

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

CAUTION:

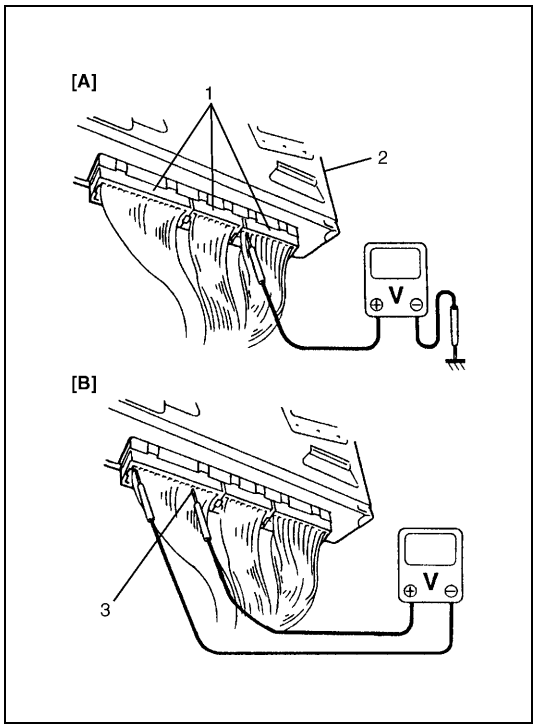
ECM cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM with couplers disconnected from ECM.

Voltage Check

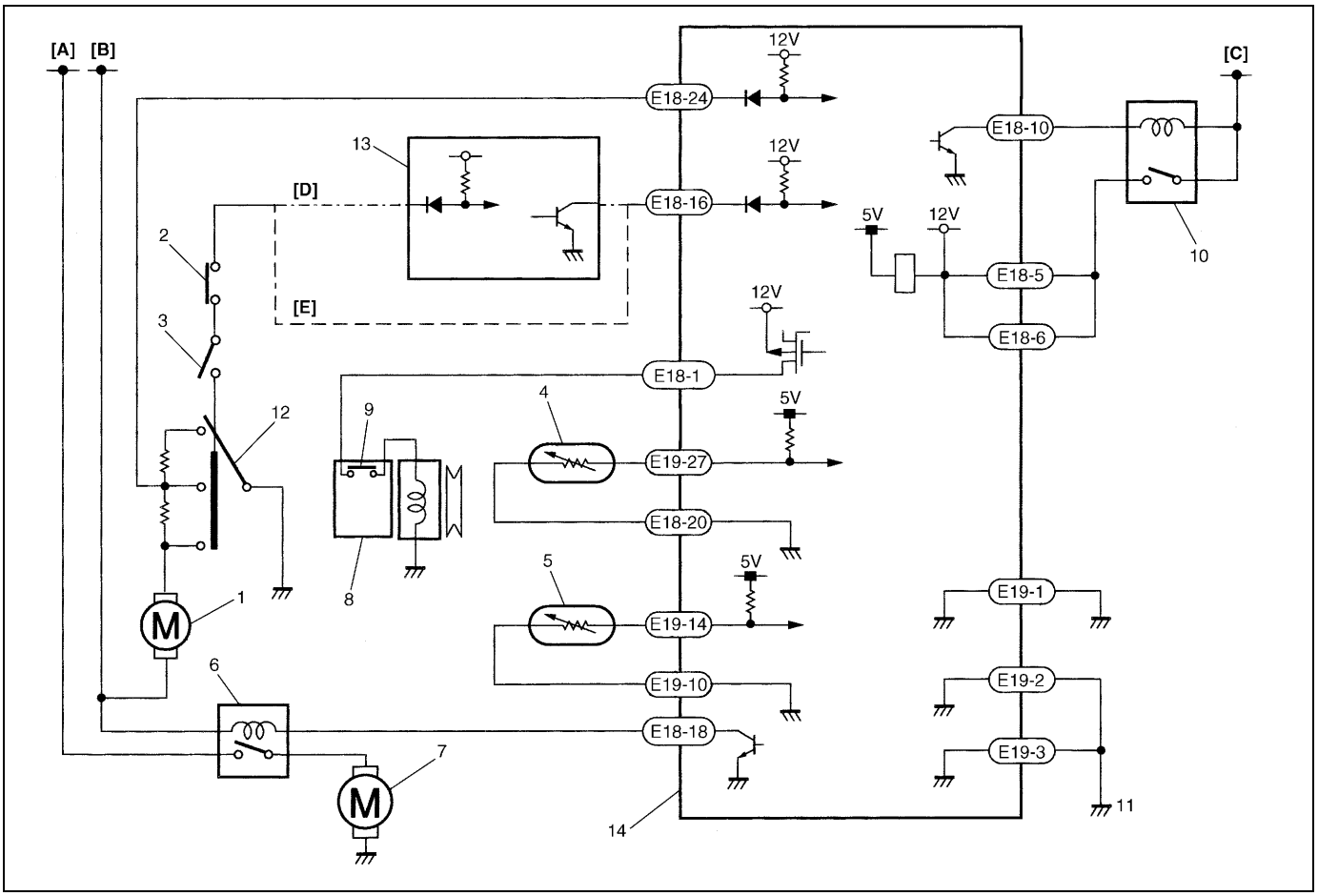
1) Remove ECM from vehicle by referring to “Engine Control Module” in Section 6E.
2) Connect ECM couplers (1) to ECM (2).
3) Check voltage at each terminal of couplers connected.

NOTE:

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

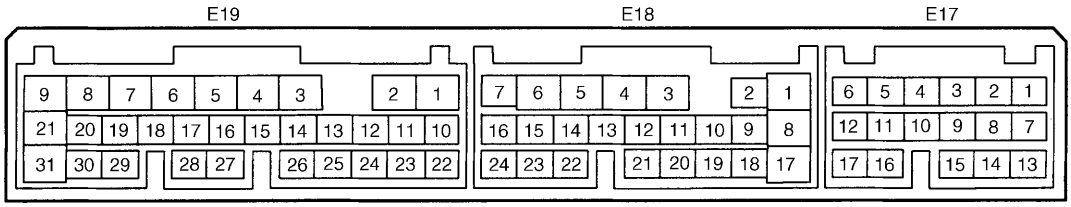


[A] :	Fig. A
[B] :	Fig. B
3.	E19-3



1. Blower fan motor	8. Compressor	[A]: To “A/C” fuse (25A) in main fuse box
2. Dual pressure switch	9. Thermal switch	[B]: To “HEATER” fuse (20A) in circuit fuse box
3. A/C switch	10. Main relay	[C]: To “FI” fuse (15A) in main fuse box
4. A/C evaporator thermistor	11. Engine earth	[D]: 4WD model
5. ECT sensor	12. Blower fan motor switch	[E]: 2WD model
6. Condenser cooling fan motor relay	13. 4WD controller	
7. Condenser cooling fan motor	14. ECM	

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
E18-1	P	Compressor magnet clutch output	Ground to engine (Fig B)	10 – 14 volt	Blower fan motor switch and A/C switch ON with engine running
				0 – 1 volts	Except the above-mentioned condition with engine running
E18-5	Bl/B	Main power supply for ECM	Ground to engine (Fig B)	10 – 14 volts	Ignition switch ON with engine stopped
E18-6	Bl/B	Main power supply for ECM	Ground to engine (Fig B)	10 – 14 volts	Ignition switch ON with engine stopped
E18-10	Bl	Main relay drive	Ground to engine (Fig B)	0.5 – 1.2 volt	Ignition switch ON with engine stopped
				0 volts	Ignition switch OFF
E18-16	G/W	A/C switch input	Ground to engine (Fig B)	12 – 15 volts	Blower fan motor switch or A/C switch OFF with engine running
				0 – 1 volt	Blower fan motor switch and A/C switch ON with engine running
				12 – 15 volts	Within several seconds after operate transfer lever between 2WD and 4WD with above condition
E18-18	P/B	Compressor cooling fan relay output	Ground to engine (Fig B)	0 – 1 volt	Blower fan motor switch and A/C switch ON or engine coolant temperature at more than 110 °C (230 °F) with engine running.
				12 – 15 volts	Except the above-mentioned condition with engine running
E18-20	B/Bl	Sensor ground for A/C evaporator	Ground to body (Fig A)	–0.5 – 0 volt	Engine running
E18-24	Bl/Y	Blower fan speed input	Ground to engine (Fig B)	0 – 1 volt	Blower fan motor switch 2nd or 3rd with engine running
				4 – 7 volts	Blower fan motor switch 1st with engine running
				12 – 15 volts	Blower fan motor switch and A/C switch OFF with engine running
E19-1	B	Main ground for ECM	Ground to engine (Fig A)	–0.5 – 1 volt	Engine running
E19-2	B/R	ECM ground for power circuit	Ground to engine (Fig A)	–0.5 – 1 volt	Engine running
E19-3	B/R	ECM ground for power circuit	Ground to engine (Fig A)	–0.5 – 1 volt	Engine running
E19-10	B/Bl	Sensor ground for ECT sensor	Ground to body (Fig A)	–0.5 – 1 volt	Engine running

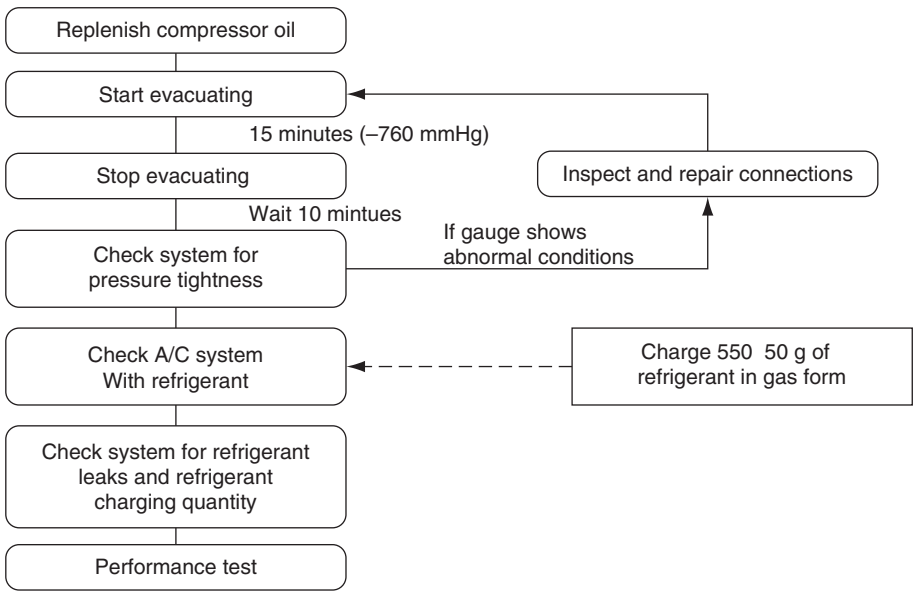
Terminal	Wire	Circuit	Measurement ground	Normal value	Condition
E19-14	G/B	ECT sensor input	Ground to engine (Fig B)	0.73 – 0.83 volts (315 – 355 Ω)	Engine coolant temperature at approximately 80 °C (176 °F) with engine running
				0.35 – 0.45 volts (145 – 165 Ω)	Engine coolant temperature at approximately 110 °C (230 °F) with engine running *If the temperature is more than 113 °C (235 °F), compressor should be stop (come back at less than 111 °C (232 °F)
E19-27	W/R	A/C evaporator thermistor temperature input	Ground to engine (Fig B)	2.0 – 2.3 volts (1800 – 2200 Ω)	Evaporator thermistor temperature at approximately 25 °C (77 °F) with engine running
				3.5 – 3.6 volts (6300 – 7000 Ω)	Evaporator thermistor temperature at approximately 0 °C (32 °F) with engine running *If the temperature is less than approximately 2.5 °C (36.5 °F), compressor cooling fan should be stop (come back at less than approximately 4 °C (39.2 °F)

Refrigerant Recovery, Evacuating and Charging

WARNING:

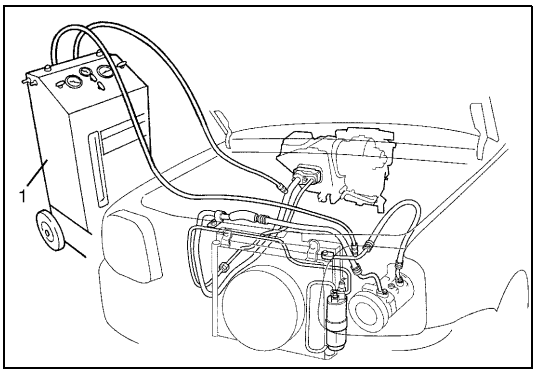
- **Your eyes should not be exposed to refrigerant (liquid).**
  Any liquid HFC-134a (R-134a) escaping by accident shows a temperature as low as approximately –6 °C (21 °F) below freezing point. Should liquid HFC-134a (R-134a) get into your eyes, it may cause a serious injury. To protect your eyes against such accident, it is necessary to always wear goggles. Should it occur that HFC-134a (R-134a) strikes your eyes(s), 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.**

Operation Procedure for Refrigerant Charging



Recovery

REFRIGERANT RECOVERY

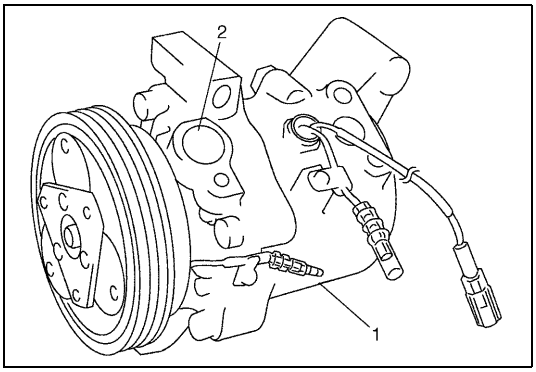


When evacuating A/C system, always recover refrigerant by using equipment (1) for refrigerant recovery and recycling. Discharging refrigerant HFC-134a (R-134a) into atmosphere would cause adverse effect to environments.

NOTE:

- **After recover 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



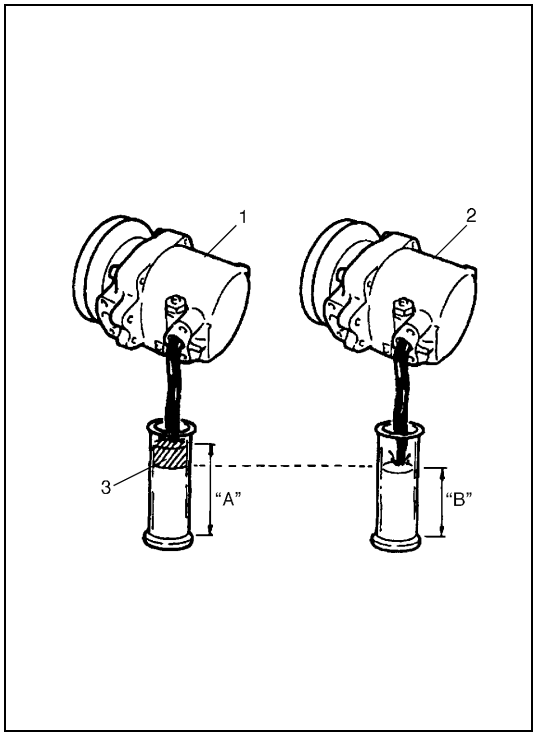
It is necessary to replenishing specified amount of compressor oil to compressor (1) from compressor suction side hole (2) before evacuating and charging refrigerant.

Compressor oil
99000-99088-00D0

WHEN CHARGING REFRIGERANT ONLY

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

WHEN REPLACING COMPRESSOR



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 new compressor 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

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 to be replenished
Evaporator	30 cm^3 (30 cc, 1.83 cu-in)
Condenser	30 cm^3 (30 cc, 1.83 cu-in)
Receiver / dryer	20 cm^3 (20 cc, 1.22 cu-in)
Hoses	10 cm^3 (10 cc, 0.61 cu-in) each
Pipes	10 cm^3 (10 cc, 0.61 cu-in) each

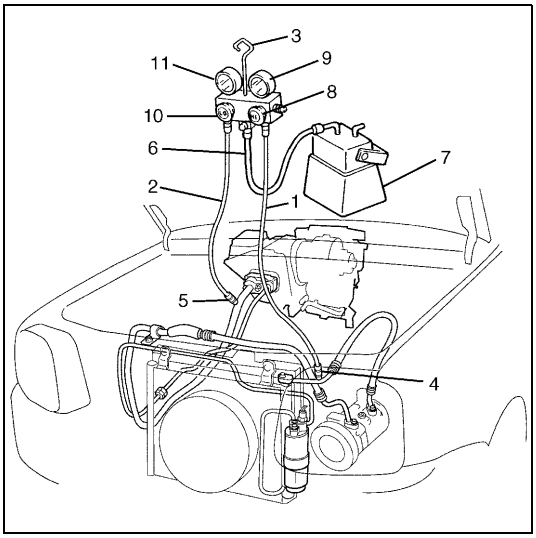
Evacuating

Evacuating procedure

Whenever opened (exposed to atmospheric air), A/C system must be evacuated by using a vacuum pump.

NOTE:

Do not evacuate before recovering refrigerant and replenishing compressor oil.



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 discharge hose
   Low charging hose (2) → Low pressure charging valve (5) on suction hose
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 (9) 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.

Charging

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.

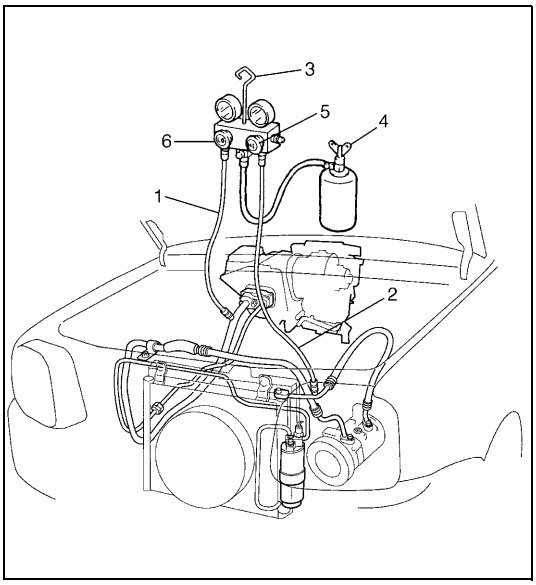
When charging refrigerant recovered by using the refrigerant and recycling equipment (when recycling refrigerant), follow the procedure described in the equipment manufacturer's instruction manual.

Charging procedure

The initial charging of the A/C system is performed from the high pressure side with the engine stopped.

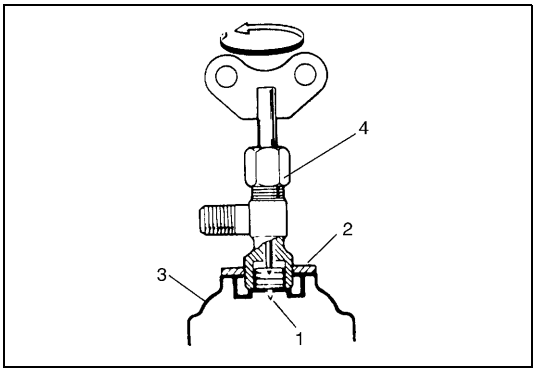
And next, this method must be followed by charging from the low pressure side with the engine running.

1) Check to make sure that hoses are routed properly after evacuating the system.

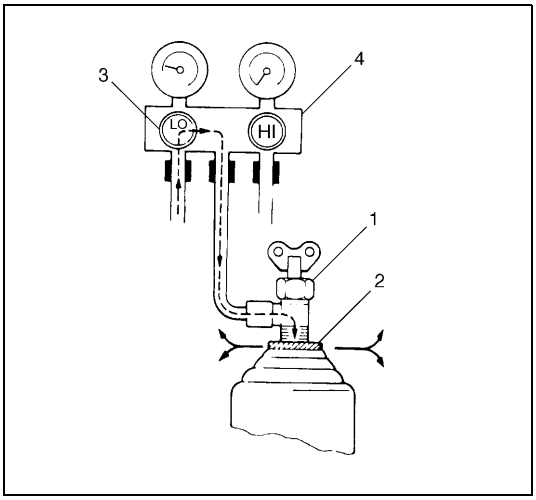


2) Connect Low charging hose (1) and High charging hose (2) of the manifold gauge set (3) in position. Thus open refrigerant container valve (4) to purge the charging line.
3) Open the high pressure side valve (5) and charge refrigerant to system.
4) After a while, open the low pressure side valve (6)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

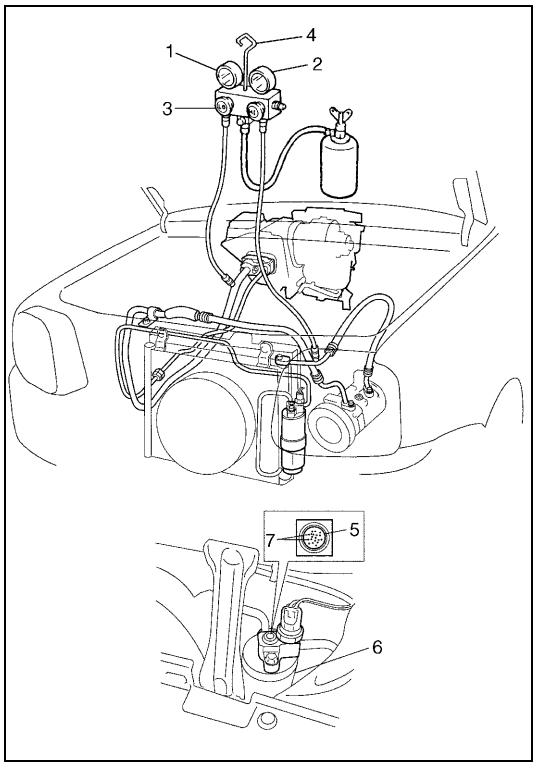
WARNING:
Make sure that high pressure side valve is closed securely.



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



   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 (500 – 600 g) of refrigerant or when low pressure gauge (1) and high pressure gauge (2) have indicated the following specified amount, close low pressure side valve (3) on manifold gauge set (4). At this time, look into the sight glass (5) of receiver / dryer (6) and check that there are no bubbles (7) in the sight glass, which means that the system is fully charged.

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

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.

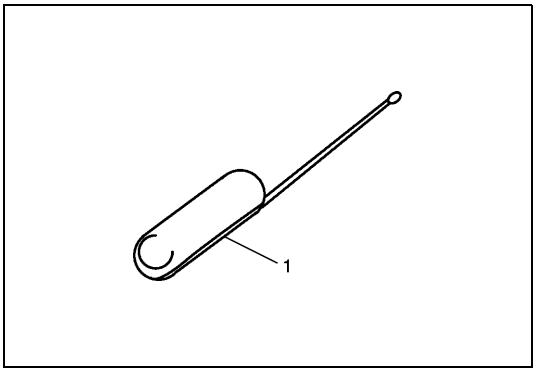
WARNING:
High pressure side is naturally under high pressure. So, care must be used to protect your eyes and skin.

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 DETECTOR



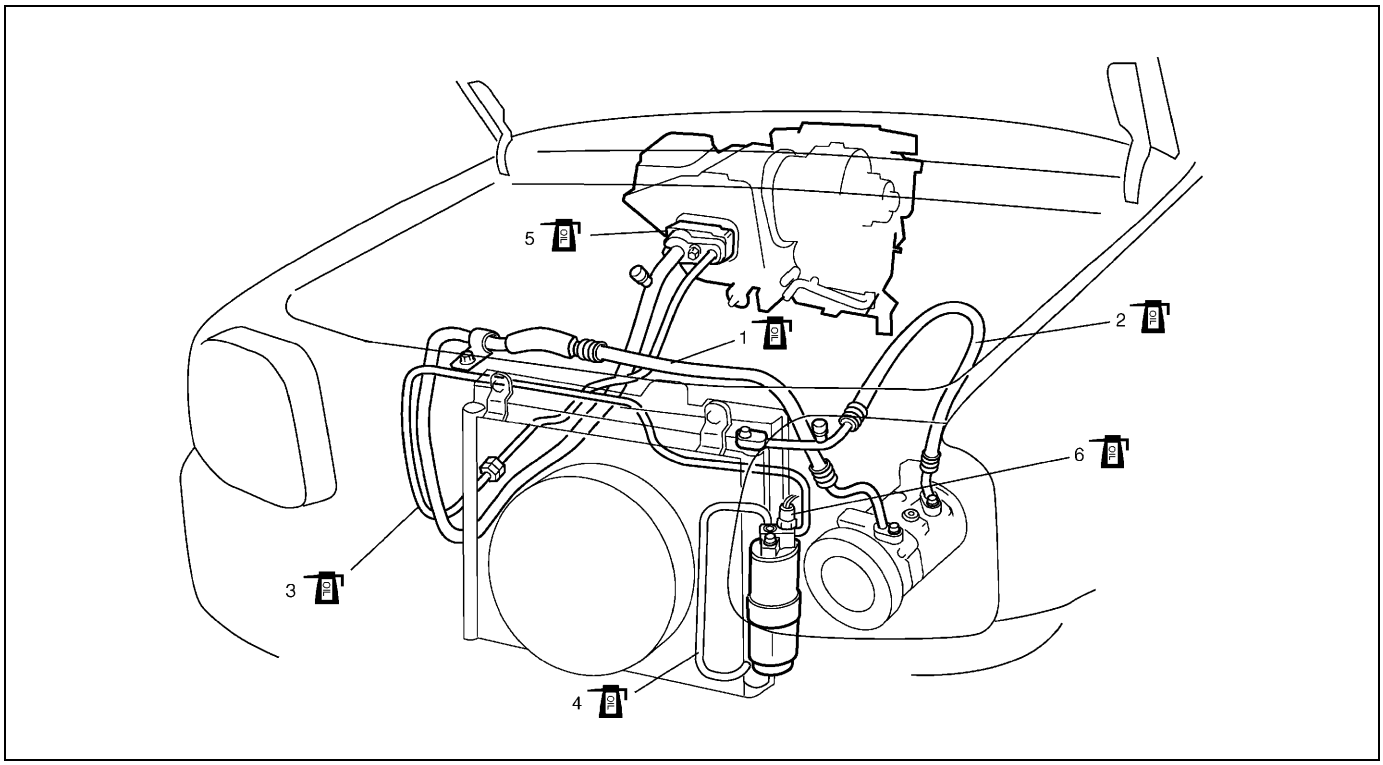
There are a number of fittings and places throughout the air conditioning system where a liquid leak detector solution may be used to pinpoint refrigerant leaks.
By merely applying the solution to the area in question with a swab, such as attached to the cap of a vial, bubbles will form within seconds if there is a leak.
For confined areas, such as sections of the evaporator and condenser, an electronic (refrigerant) leak detector (1) is more practical for determining leaks.

On-Vehicle Service

Service Precaution

When servicing air conditioning system, note the following instructions.

Refrigerant line



1. Suction hose: Apply compressor oil to O-ring.	4. Condenser outlet pipe: Apply compressor oil to O-ring.
2. Discharge hose: Apply compressor oil to O-ring.	5. Expansion valve: Apply compressor oil to O-ring.
3. Receiver / dryer outlet pipe: Apply compressor oil to O-ring.	6. Dual pressure switch: Apply compressor oil to O-ring.

- Never use heat for bending pipes. When bending a pipe, try to make its bending radius as slight 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 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.
- Tighten flared nuts by the following specified torque.

Tightening torque (Flared Nut Used for)
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)

- Route drain hose so that drained water does not make any contact to vehicle components.
- Before evacuating and charging refrigerant, replenish specified amount of compressor oil to compressor suction side by referring to “Replenishing Compressor Oil” in this section.

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

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.

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 HFC-134a (R-134a) and the other using refrigerant CFC-12 (R-12).
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" in this section. 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 service.Use of incorrect one will result in leakage of refrigerant, damage in parts or other faulty condition.

- 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.

Condenser Assembly

CAUTION:

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

INSPECTION

Check the following.

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

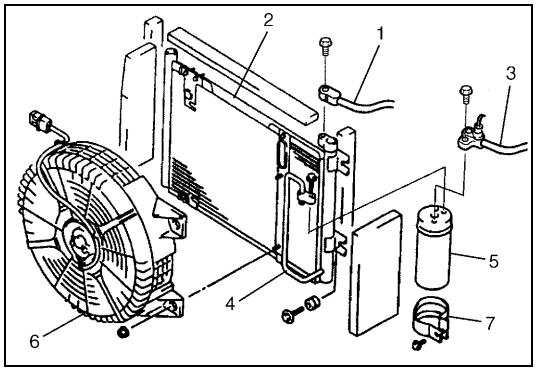
REMOVAL

1) Disconnect negative (–) cable at battery.
2) Recover refrigerant from A/C system by referring to “Recovery” 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” in Section 8.
4) Disconnect A/C condenser cooling fan motor and dual pressure switch connectors.
5) Remove radiator mounting bolts.



6) Disconnect discharge hose (1) from condenser (2).
7) Disconnect receiver / dryer outlet hose (3) and condenser outlet pipe (4) from receiver / dryer (5).
8) Remove condenser cooling fan assembly (6) from condenser (2).
9) Remove receiver / dryer (5) with its bracket (7) from condenser (2).
10) Remove condenser (2) from radiator.

INSTALLATION

Reverse removal procedure to install condenser, and then noting the following instructions.

- Replenish specified amount of compressor oil to compressor suction side by referring to “Replenishing Compressor Oil” in this section.
- Evacuate and charge refrigerant by referring to “Evacuating” and “Charging” in this section.

Receiver / Dryer

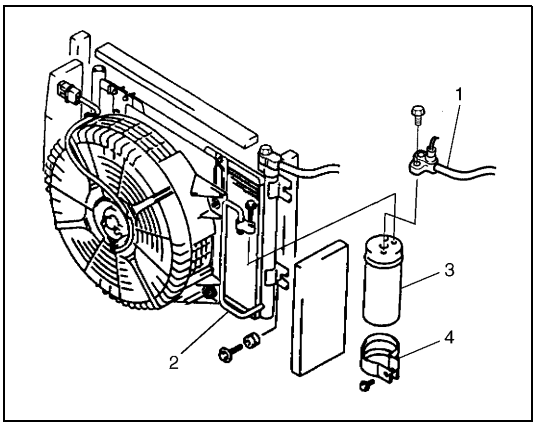
REMOVAL

1) Recover refrigerant from A/C system by referring to “Recovery” in this section.

NOTE:

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

2) Remove front bumper referring to “Front Bumper” in Section 8.



3) Disconnect receiver / dryer outlet hose (1) and condenser outlet pipe (2) from receiver / dryer (3).
4) Remove receiver / dryer (3) with its bracket (4).

INSTALLATION

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

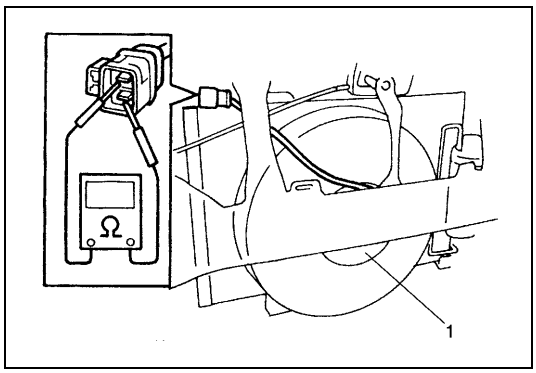
- Replenish specified amount of compressor oil to compressor suction side by referring to “Replenishing Compressor Oil” in this section.
- Evacuate and charge refrigerant by referring to “Evacuating” and “Charging” in this section.

Condenser Cooling Fan Assembly

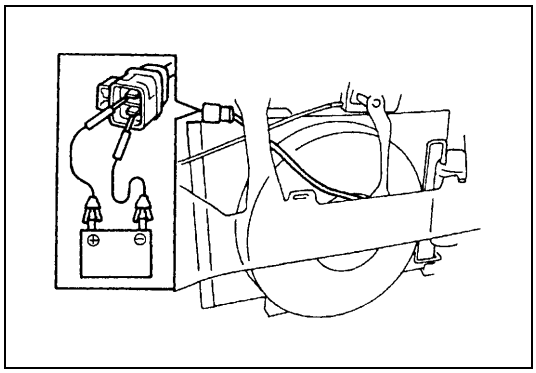
ASSEMBLY

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

INSPECTION



1) Check continuity between each two terminals about the condenser cooling fan motor (1).
   If check results are no continuity, replace condenser cooling fan motor.

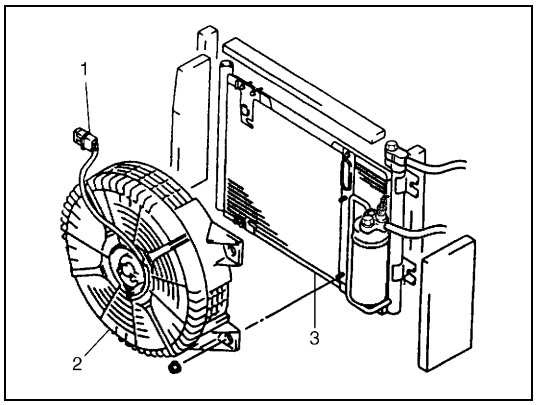


2) Connect battery to condenser cooling fan motor as shown in figure, then check that the condenser cooling fan motor operates smoothly.

Reference current of condenser cooling fan motor approximately 7.5 A at 12 V

REMOVAL

1) Remove front bumper.



2) Disconnect condenser cooling fan motor connector (1).
3) Remove radiator mounting bolts.
4) Remove condenser cooling fan assembly (2) from condenser (3).

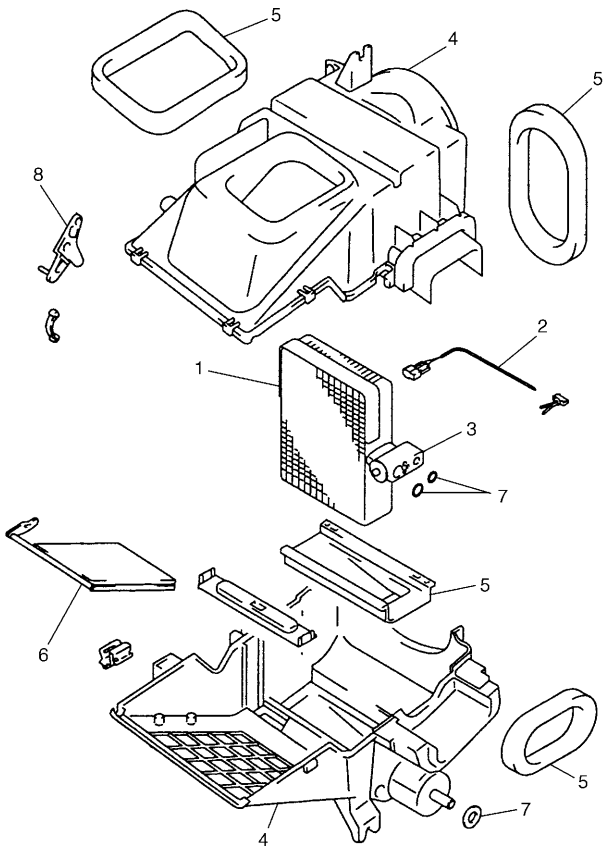
INSTALLATION

Reverse removal procedure for installation.

Cooling Unit (Evaporator)

CAUTION:

Be careful not to damage A/C evaporator fins. If A/C evaporator fin is bent, straighten A/C evaporator fin by using flat head screwdriver or pair of pliers.



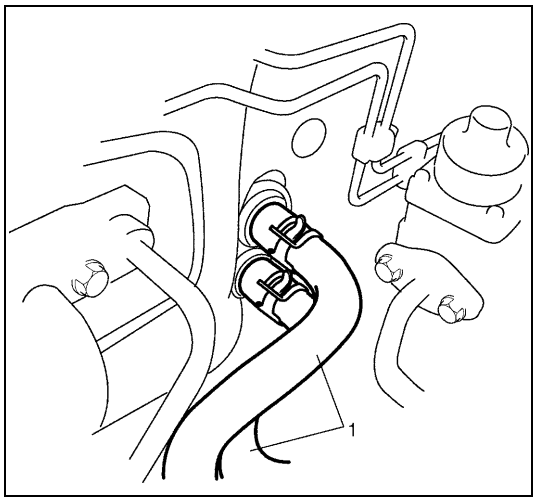
1. A/C evaporator	3. Expansion valve	5. Packing	7. O-ring
2. A/C evaporator thermistor (A/C evaporator temperature sensor)	4. Evaporator case	6. Air inlet door	8. Door link

REMOVAL

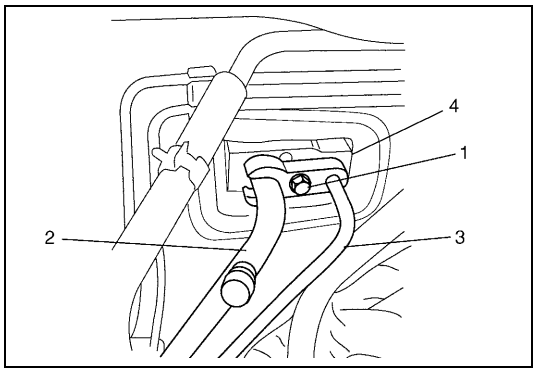
1) Disconnect negative (–) cable at battery.
2) Recover refrigerant from A/C system by referring to “Recovery” in this section.

NOTE:

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

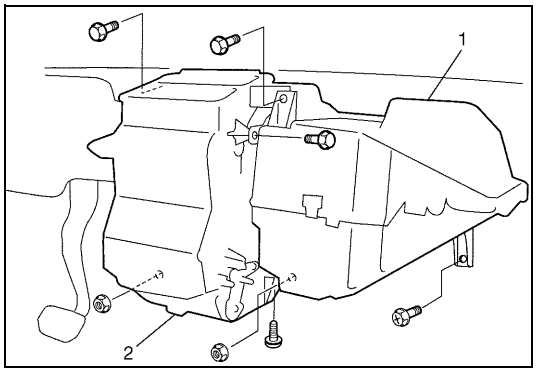


3) Drain engine coolant and disconnect heater hoses (1) from heater unit.
4) Disable air bag system referring to “Disabling Air Bag System” in Section 10B (if equipped).



5) Remove attaching bolt (1).
6) Disconnect suction hose (2) and receiver / dryer outlet pipe (3) from expansion valve (4).

7) Remove instrument panel referring to “Instrument Panel” in Section 9.



8) Remove cooling unit (1) with heater unit (2) from vehicle body.
9) Remove cooling unit (1) from heater unit (2).

INSPECTION

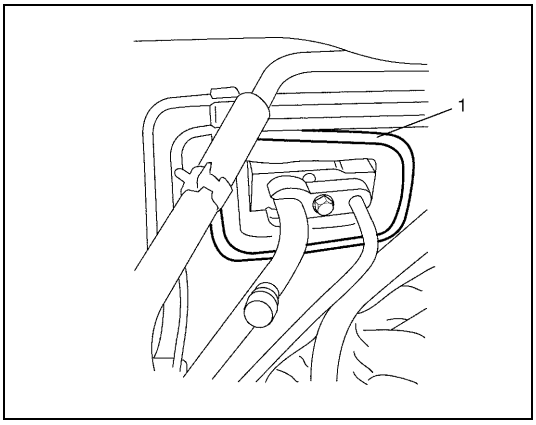
Check the following.

- Check 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.
- Check A/C evaporator fins for leakage and breakage.
  If any defects are found, repair or replace A/C evaporator.
- Check A/C evaporator fittings for leakage.
  If any defects are found, repair or replace A/C evaporator.

INSTALLATION

Reverse removal procedure to install cooling unit, and then noting the following instructions.

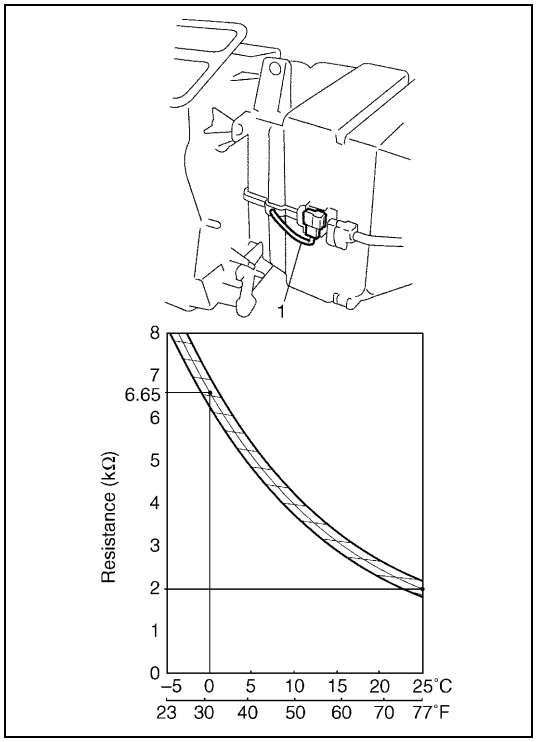
- If A/C evaporator thermistor removed, its should be reinstalled in original position.



- Install uniformly the packing (1) to installation hole.
- Replenish specified amount of compressor oil to compressor suction side by referring to “Replenishing Compressor Oil” in this section.
- Evacuate and charge refrigerant by referring to “Evacuating” and “Charging” in this section.
- Adjust mode control cable, temperature control cable and fresh air control cable by referring to “Heater Control Lever Assembly” in Section 1A.
- Enable air bag system referring to “Enable Air Bag System” in Section 10B. (if equipped)
- Fill engine coolant to radiator, referring to “Cooling System Flush and Refill” in Section 6B.

A/C Evaporator Thermistor (A/C Evaporator Temperature Sensor)

INSPECTION



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

A/C evaporator temperature sensor resistance

Sensor Temperature (°C (°F))	Resistance (kΩ)
0 (32)	6.4 – 7.0
25 (77)	1.8 – 2.2

NOTE:

When A/C evaporator thermistor (1) removed, its should be reinstalled in original position.

Expansion Valve

INSPECTION

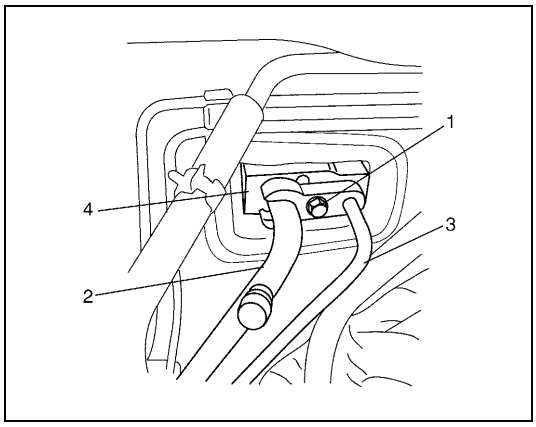
Refer to “Performance Diagnosis” in this section.

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Recover refrigerant from A/C system by referring to “Recover” in this section.

NOTE:

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



3) Remove attaching bolt (1).
4) Remove suction hose (2) and receiver dryer outlet pipe (3) from expansion valve (4).
5) Remove expansion valve (4).

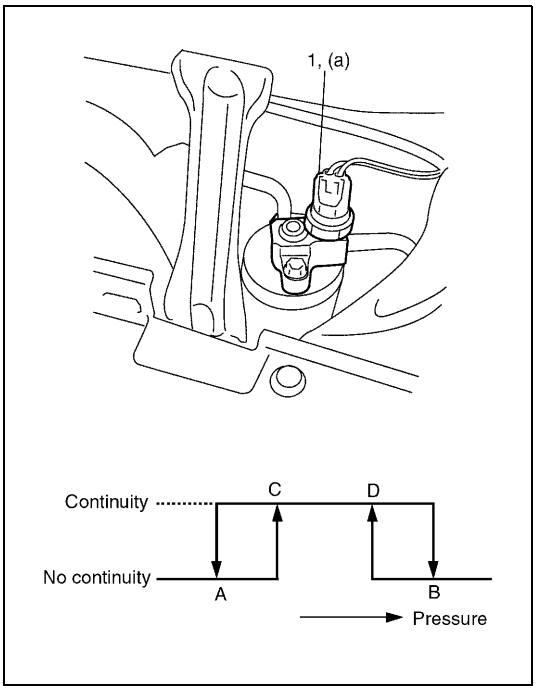
INSTALLATION

Reverse removal procedure for installation, and then note the following instructions.

- Replenish specified amount of compressor oil to compressor suction side by referring to “Replenishing Compressor Oil” in this section.
- Evacuate and charge refrigerant by referring to “Evacuation” and “Charging” in this section.

Dual Pressure Switch

INSPECTION



1) Check dual pressure switch (1) for continuity at normal temperature (approximately 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 switch for continuity at specified pressure as shown.

A : Approximately 195 kPa (1.95 kg/cm^2, 27.5 psi)

B : Approximately 3140 kPa (31.4 kg/cm^2, 446.5 psi)

C : Approximately 225 kPa (2.25 kg/cm^2, 32.0 psi)

D : Approximately 2550 kPa (25.5 kg/cm^2, 362.5 psi)

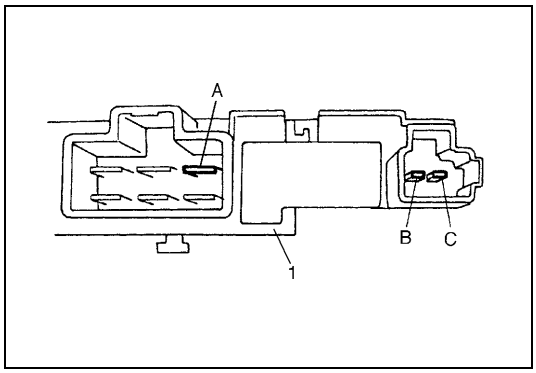
Tightening torque
Dual pressure switch
(a) : 10 N·m (1.0 kg-m, 7.0 lb-ft)

A/C Switch

REMOVAL AND INSTALLATION

Refer to “Heater Control Lever Assembly” in Section 1A.

INSPECTION

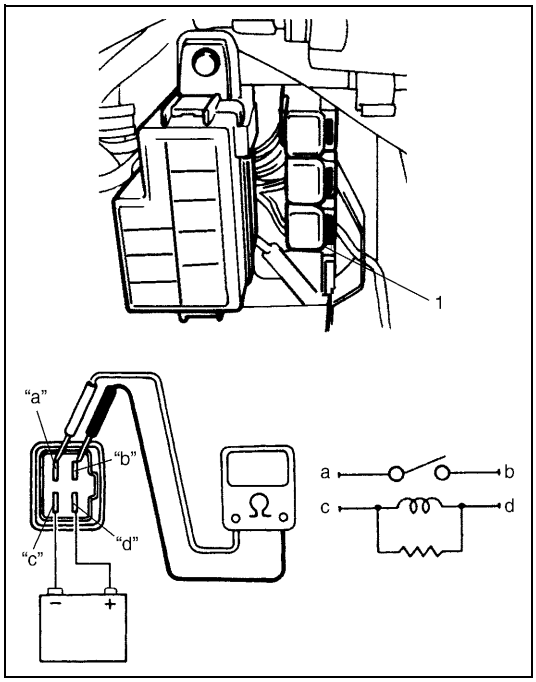


- Press A/C switch button and check if there is continuity between terminals “A” and “B”.
- With battery voltage (+) connected to terminal “C” and (–) to terminal “A”, press A/C Switch button and blower fan switch to “Hi” (3rd position).
  Check if indicator lamp lights.

1. Blower fan and A/C switch

Condenser Cooling Fan Motor Relay

INSPECTION



1) Disconnect negative (–) cable at battery.
2) Remove condenser cooling fan motor relay (1) from vehicle.
3) Check that there is no continuity between terminal “a” and “b”. If there is continuity, replace relay.
4) Check that there is continuity between terminals “a” and “b” when battery is connected to terminal “c” and “d”.
   If there is no continuity, replace relay.

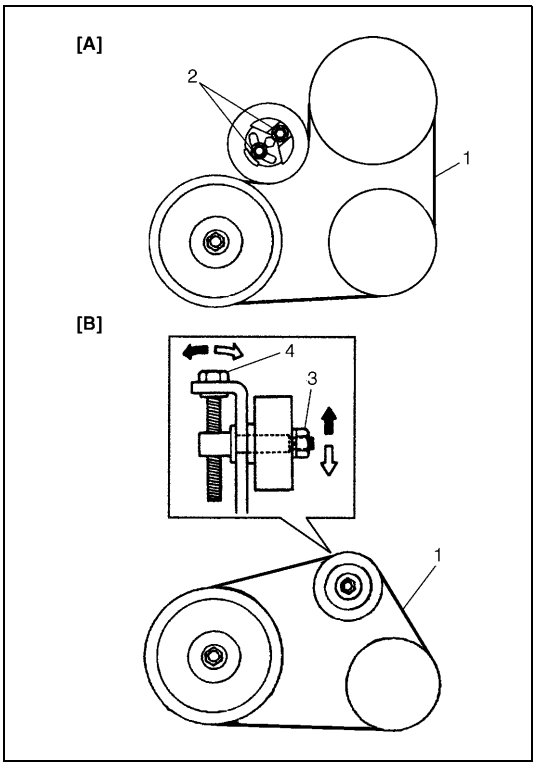
Compressor

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) Recover refrigerant from refrigeration system by referring to “Recovery” in this section.

NOTE:

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



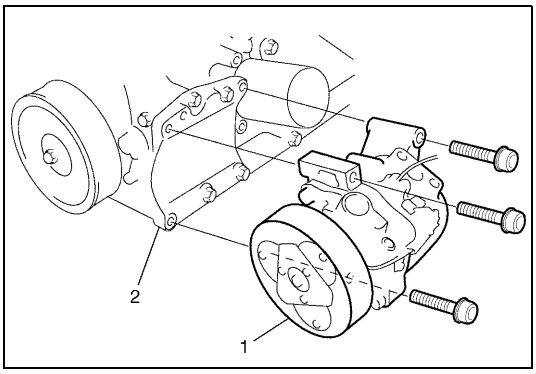
4) Remove compressor drive belt (1) as follows.
   For vehicle with P/S
   Loosen tension pulley bolts (2).
   For vehicle without P/S
   Loosen tension pulley tightening nut (3) and adjusting bolt (4).

[A] :	Vehicle with P/S
[B] :	Vehicle without P/S

5) Disconnect thermal switch connector.
6) Disconnect suction and discharge hoses from compressor.

NOTE:

Cap open fittings immediately to keep moisture out of system.



7) Remove compressor (1) from its bracket (2).

NOTE:

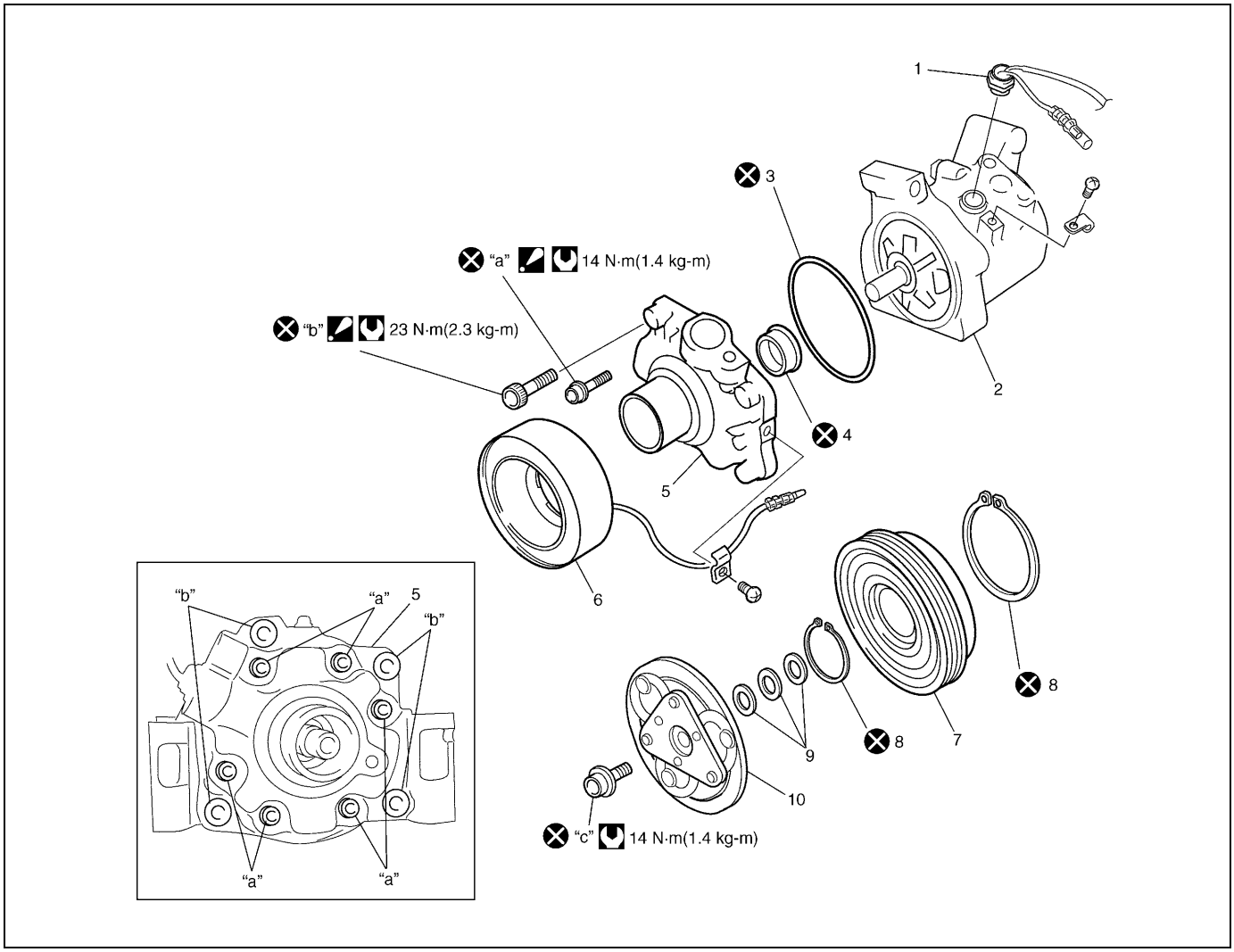
If compressor is replaced, drain oil from removed compressor. And then, measure its amount.

INSTALLATION

Reverse removal procedure for installation, and then noting the following instructions.

- Replenish specified amount of compressor oil to compressor suction side by referring to “Replenishing Compressor Oil” in this section.
- Evacuate and charge system by referring to “Recovery” in this section.
- Adjust drive belt tension by referring to “Compressor Drive Belt” in this section.

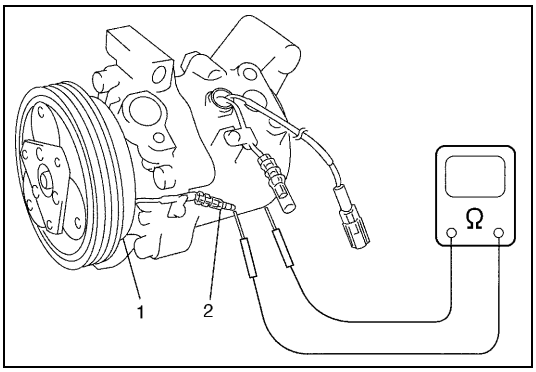
Magnet Clutch



1. Thermal switch	6. Magnet clutch coil	a. Front head bolt : Tighten bolt "a" first, and next "b".
2. Compressor body assembly	7. Compressor pulley	b. Front head bolt : Tighten bolt "a" first, and next "b".
3. O-ring	8. Circlip	c. Clutch plate bolt
4. Lip seal	9. Shim	Tightening torque
5. Front head	10. Clutch plate	Do not reuse.

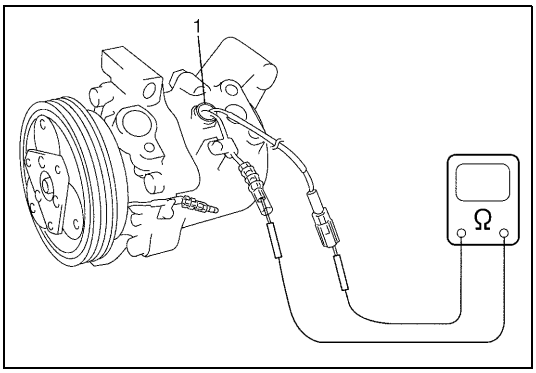
INSPECTION

- Check clutch plate and clutch pulley for leaks of compressor oil.
- Check clutch bearing of compressor pulley for noise, wear and grease leakage.



- Measure resistance of magnet clutch coil (1) between magnet clutch lead wire (2) and compressor body assembly.
  If measured resistance is not within tolerance, replace magnet clutch coil.

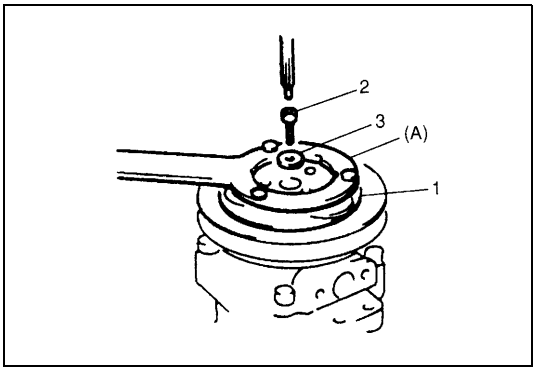
Magnet Clutch coil resistance
: 3.4 – 4.1 Ω at 20 °C (68 °F)



- Check thermal switch (1) for continuity using ohmmeter.
  If it is no continuity, replace thermal switch.

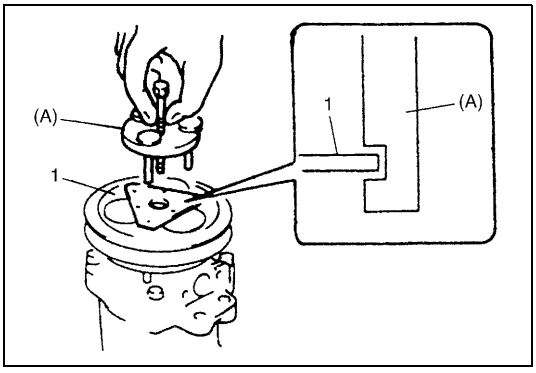
REMOVAL

1) Remove compressor from vehicle referring to “Compressor” in this section.



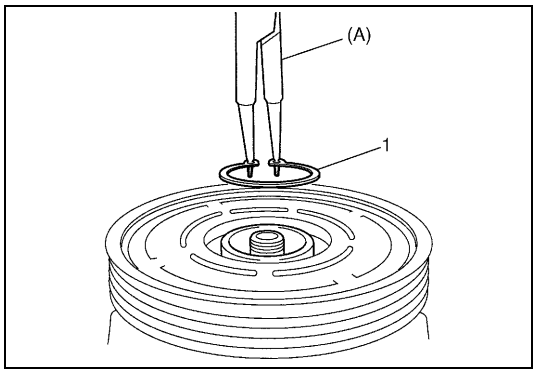
2) Fix clutch plate (1) with special tool, and remove clutch plate bolt (2) and washer (3).

Special tool
(A) : 09991-06020



3) Remove clutch plate (1) using special tool.

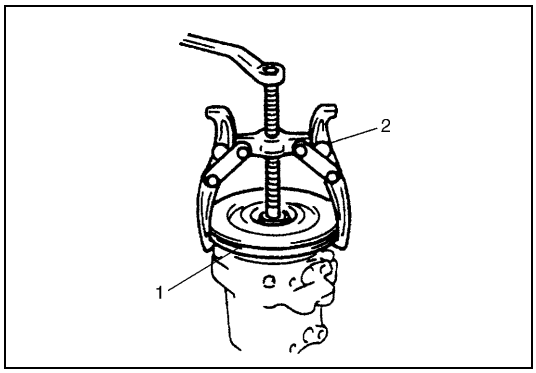
Special tool
(A) : 09991-06030



4) Remove circlip (1) using special tool.

Special tool
(A) : 09900-06107

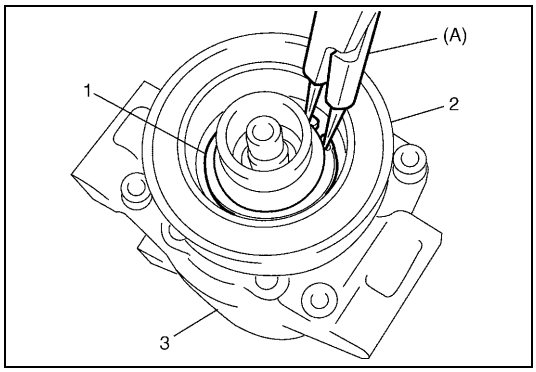
5) Remove magnet clutch lead wire clamp screw, and disconnect magnet clutch lead wire.



6) Remove magnet clutch pulley (1) by using a puller (2).

NOTE:

- **Be careful not to damage pulley part.**

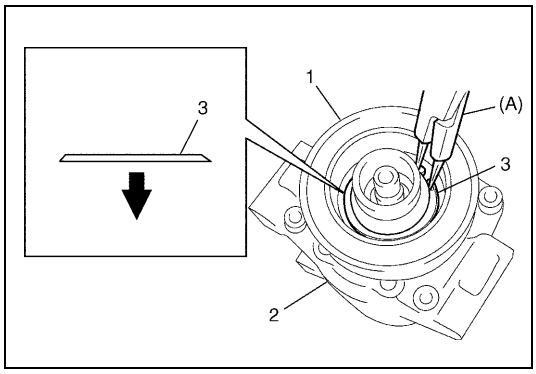


7) Remove snap ring (1) using special tool.

Special tool
(A) : 09900-06107

8) Remove magnet clutch coil (2) from compressor body assembly (3).

INSTALLATION



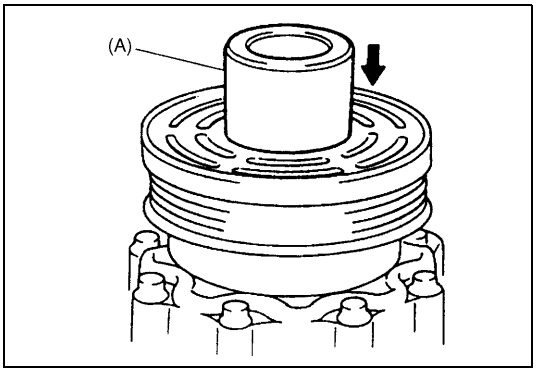
1) Install magnet clutch coil (1).

NOTE:

- **Protrusion on under side of magnet clutch coil (1) must match hole in compressor body assembly (2).**

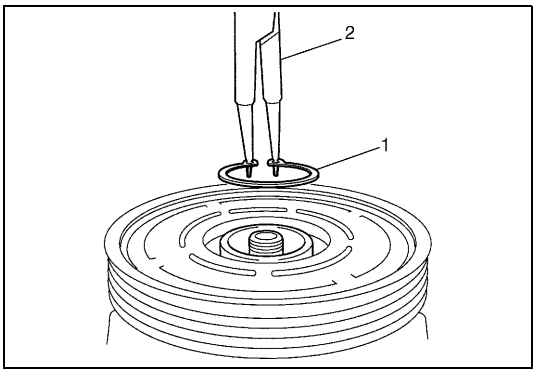
2) Install snap ring (3) to proper direction as show using special tool.

Special tool
(A) : 09900-06107



3) Install magnet clutch.
   a) Set magnet clutch squarely over clutch installation boss.
   b) Place special tool onto clutch bearing.
      Ensure that edge rests only on inner race of bearing.

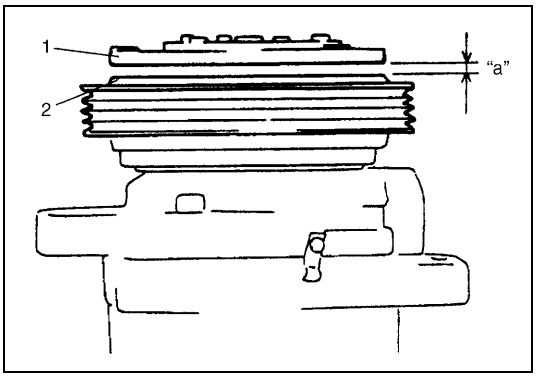
Special tool
(A) : 09991-06010



4) Install snap ring (1) using special tool.

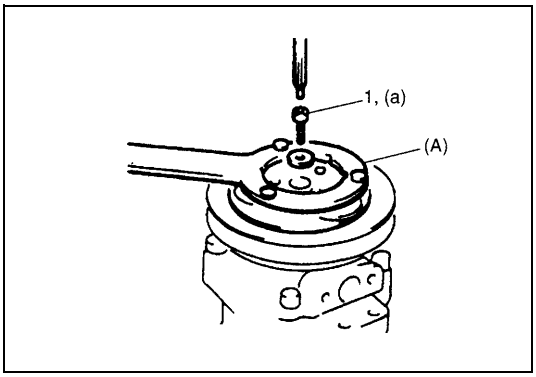
Special tool
(A) : 09900-06107

CAUTION:
Be careful not to scratch bearing seal.



5) Adjust clearance between clutch plate (1) and magnet clutch coil (2) by putting shim on compressor shaft.

Standard clearance between clutch plate and magnet clutch coil
"a" : 0.3 – 0.6 mm (0.012 – 0.024 in.)



6) Tighten new clutch plate bolt (1) as specified torque.

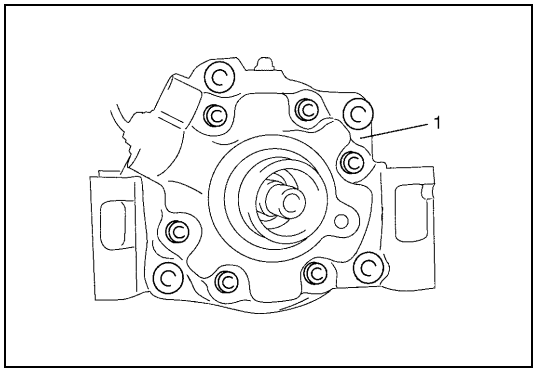
Tightening torque
Clutch plate bolt
(a) : 14 N·m (1.4 kg-m, 10.5 lb-ft)

Special tool
(A) : 09991-06020

Lip Type Seal

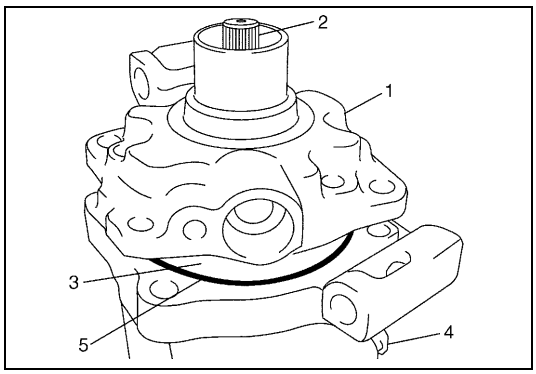
REMOVAL

1) Remove magnet clutch referring to “Magnet Clutch” in this section.



2) Remove front head mounting bolts (10 pcs).

1. Front head

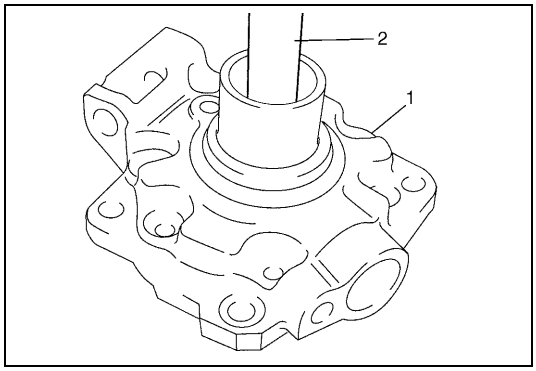


3) Remove front head (1) by pushing compressor shaft (2).

NOTE:

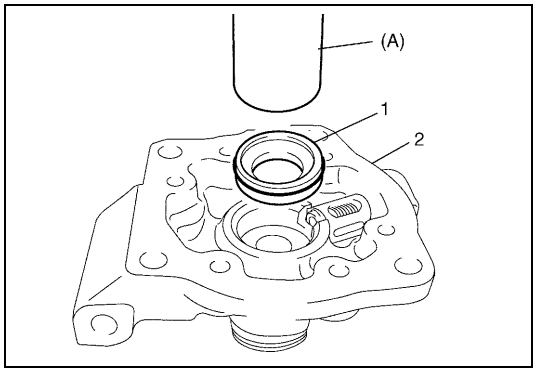
Be careful not to remove cylinder (3) from compressor body assembly (4).

4) Remove O-ring (5).



5) Remove lip type seal from front head (1) using bearing remover (2).

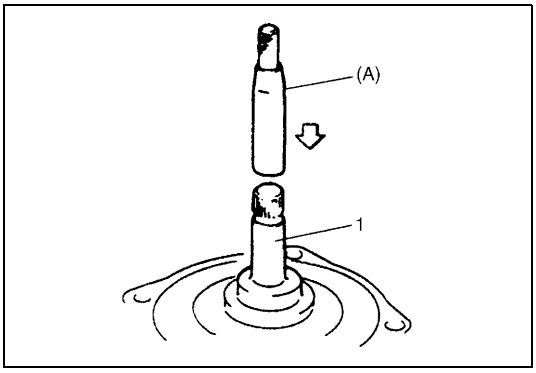
INSTALLATION



1) Press-fit lip type seal (1) into front head (2) using special tool.

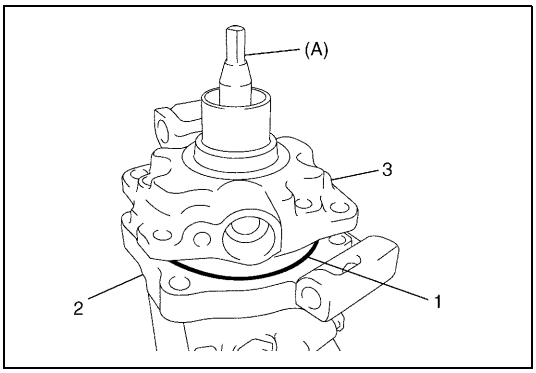
Special tool
(A) : 09991-06050

CAUTION:
Do not reuse lip seal (1) once removed from compressor.



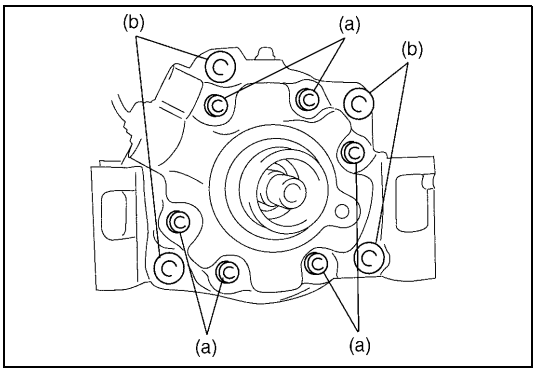
2) Coat special tool surface with compressor oil and place it on compressor shaft (1).

Special tool
(A) : 09991-06040



3) Install O-ring (1) to compressor body assembly (2).
4) Apply compressor oil to lip type seal and O-ring (1).
5) Install front head (3) to compressor body assembly (2).

Special tool
(A) : 09991-06040



6) Tighten new front head bolts to specified toque.

Tightening torque
Front heat bolts
(a) : 14 N·m (1.4 kg-m, 10.5 lb-ft)
(b) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

NOTE:

Tighten bolt (a) first, and next (b).

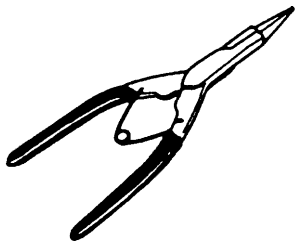
Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Tension pulley bolt (for vehicle with P/S)	25	2.5	18.0
Refrigerant 8 mm pipe (0.31 in.)	13	1.3	9.5
Refrigerant 12 mm pipe (0.47 in.)	23	2.3	16.6
Refrigerant 14.5 mm pipe (0.57 in.)	33	3.3	23.8
Dual pressure switch	10	1.0	7.0
Clutch plate bolt	14	1.4	10.5
Front head bolt (5 mm)	14	1.4	10.5
Front head bolt (8 mm)	23	2.3	16.6

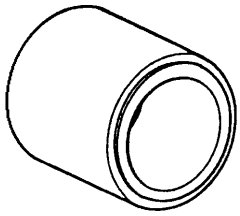
Required Service Materials

Material	Recommended SUZUKI product (Part Number)	Use
Compressor oil (Refrigerant oil)	COMPRESSOR OIL RS20 (150 cc) 99000-99088-00D0	• O-ring • Each component

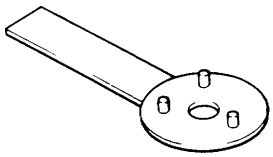
Special Tools



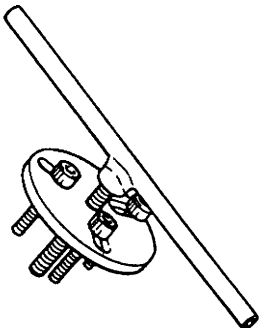
09900-06107
Snap ring pliers
(Open type)



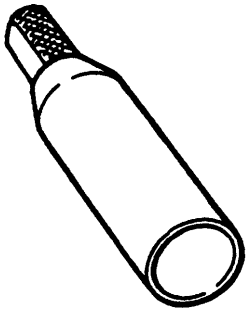
09991-06010
Magnet clutch pulley installer



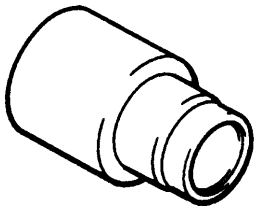
09991-06020
Armature plate spanner



09991-06030
Armature plate remover



09991-06040
Lip type seal protector



09991-06050
Lip type seal installer

SECTION 3

STEERING, SUSPENSION, WHEELS AND TIRES

DIAGNOSIS **3-1**
FRONT END ALIGNMENT . . . . . **Section 3A-1**
STEERING GEAR BOX AND LINKAGE . . . . . **Section 3B-1**
POWER STEERING SYSTEM (IF EQUIPPED) . . . . . **Section 3B1-1**
STEERING WHEEL, COLUMN AND SHAFT . . . . . **Section 3C-1**
FRONT SUSPENSION . . . . . **Section 3D-1**
REAR SUSPENSION . . . . . **Section 3E-1**
WHEELS AND TIRES . . . . . **Section 3F-1**

CONTENTS

General Diagnosis **3-2**
Diagnosis Table 3-2
Tire Diagnosis **3-5**
Irregular and/or Premature Wear 3-5
Wear Indicators 3-5
Radial Tire Waddle 3-5
Radial Tire Lead 3-7
Vibration Diagnosis **3-7**

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 inspections 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 wheel. Inspect for out-of-round tires, out-of-balance tires, bent rims, loose and/or rough wheel bearings.

Diagnosis Table

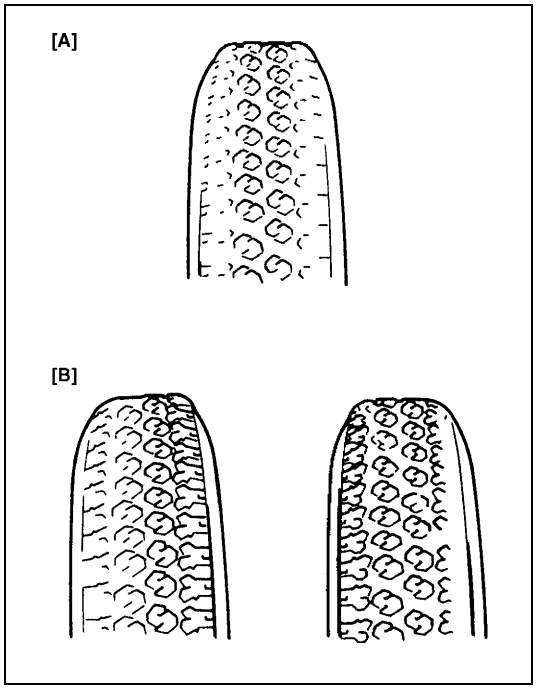
Condition	Possible Cause	Correction
Vehicle Pulls (Leads)	Mismatched or uneven tires	Replace tire.
	Tires not adequately inflated	Adjust tire pressure.
	Broken or sagging springs	Replace spring.
	Radial tire lateral force	Replace tire.
	Disturbed front wheel alignment	Check and adjust wheel alignment.
	Disturbed rear wheel alignment	Check and adjust wheel alignment.
	Brake dragging in one road wheel	Repair front brake.
	Loose, bent or broken front or rear suspension parts	Tighten or replace suspension part.
Abnormal or Excessive Tire Wear	Sagging or broken springs	Replace spring.
	Tire out of balance	Adjust balance or replace tire.
	Disturbed front wheel alignment	Check wheel alignment.
	Faulty shock absorber	Replace shock absorber.
	Hard driving	Replace tire.
	Overloaded vehicle	Replace tire.
	Not rotating tire	Replace or rotate tire.
	Worn or loose road wheel bearings	Replace wheel bearing.
	Wobbly wheel or tires	Replace wheel or tire.
	Tires not adequately inflated	Adjust the pressure.
Wheel Tramp	Blister or bump on tire	Replace tire.
	Improper shock absorber action	Replace shock absorber.

Condition	Possible Cause	Correction
Shimmy, Shake or Vibration	Tire or wheel out of balance	Balance wheels or replace tire and/or wheel.
	Loose wheel bearings	Replace wheel bearing.
	Loose wheel hub nuts	Retighten.
	Worn tie rod ends	Replace tie rod end.
	Worn king pin bearings or king pins	Replace king pin bearing and/or king pin.
	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 front wheel alignment	Check and adjust front wheel alignment.
	Loose or worn steering linkage	Tighten or replace steering linkage.
	Loose steering gear box bolts	Tighten box bolts.
	Worn steering knuckle oil seal	Replace.
Hard Steering	Bind in tie rod end ball studs or king pin bearings	Replace tie rod end or king pin bearing.
	Disturbed front wheel alignment	Check and adjust front wheel alignment.
	Steering gear box adjustment	Check and adjust steering gear box.
	Tire not adequately inflated	Inflate tires to proper pressure.
	Bind in steering column	Repair or replace.
	Low fluid level, loose drive belt or malfunction of power steering system (if equipped with P/S)	Check and correct.
Too Much Play in Steering	Wheel bearings worn	Replace wheel bearing.
	Steering gear box attachments loose	Tighten or repair.
	Steering gear box adjustments	Check and adjust steering gear box.
	Worn steering shaft joints	Replace joint.
	Worn tie rod ends drug rod ball joints	Replace tie rod end.
	Worn king pin bearings or king pin	Replace king pin bearing and/or king pin.
Poor Returnability	Bind in tie rod end ball studs	Replace tie rod end.
	Bind in king pin bearings	Replace king pin bearing.
	Bind in steering column	Repair or replace.
	Steering gear box needing lubricant	Check, repair or lubricate steering gear box.
	Disturbed front wheel alignment	Check and adjust front wheel alignment.
	Steering gear box not properly adjusted	Check and adjust steering gear box torque.
	Tires not adequately inflated	Adjust pressure.
Steering Noise (Rattle or Chuckle)	Loose bolts and nuts	Retighten.
	Broken or otherwise damaged wheel bearings	Replace wheel bearing.
	Worn or sticky tie rod ends	Replace tire rod end.
	Linkage joints needing grease	Lubricate or replace.

Condition	Possible Cause	Correction
Abnormal Noise, Front End	Worn, sticky or loose tie rod ends, drug rod ball joints, king pin bearings or axle shaft joints	Replace tie rod end, king pin bearing or axle shaft joint.
	Damaged shock absorbers or mountings	Replace or repair.
	Worn leading arm bushings	Replace.
	Worn stabilizer bar bushings	Replace.
	Worn lateral rod bushings	Replace.
	Loose stabilizer bar	Tighten bolts or replace bushes.
	Loose wheel nuts	Tighten wheel nuts.
	Loose suspension bolts or nuts	Tighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings	Replace wheel bearing.
	Broken suspension springs	Replace spring.
Wander or Poor Steering Stability	Mismatched or uneven tires	Replace tire or inflate tires to proper pressure.
	Loose king pin bearings and tie rod ends	Replace king pin bearing or tie rod end.
	Faulty shock absorbers or mounting	Replace absorber or repair mounting.
	Loose stabilizer bar	Tighten or replace stabilizer bar or bushes.
	Broken or sagging springs	Replace spring.
	Steering gear box not properly adjusted	Check or adjust steering gear box torque.
	Front wheel alignment	Check and adjust front wheel alignment.
Erratic Steering when Braking	Worn wheel bearings	Replace wheel bearing.
	Broken or sagging springs	Replace spring.
	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.
	Wheel tires are inflated unequally	Inflate tires to proper pressure.
	Defective wheel cylinders	Replace or repair wheel cylinder.
	Disturbed front wheel alignment	Check front wheel alignment
Ride Too Soft	Faulty shock absorber	Replace shock absorber.
Suspension bottoms	Overloaded	Check loading.
	Faulty shocks absorber	Replace shock absorber.
	Incorrect, broken or sagging springs	Replace spring.
Body Leans or Sways in Corners	Loose stabilizer bar	Tighten stabilizer bar bolts or replace bushes.
	Faulty shocks absorbers or mounting	Replace shock absorber or tighten mounting.
	Broken or sagging springs	Replace spring.
	Overloaded	Check loading.
Cupped Tires	Worn wheel bearings	Replace wheel bearing.
	Excessive tire or wheel run-out	Replace tire or wheel disc.
	Tire out of balance	Adjust tire balance.

Tire Diagnosis

Irregular and/or Premature Wear



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

If the following conditions are noted rotation is in order:

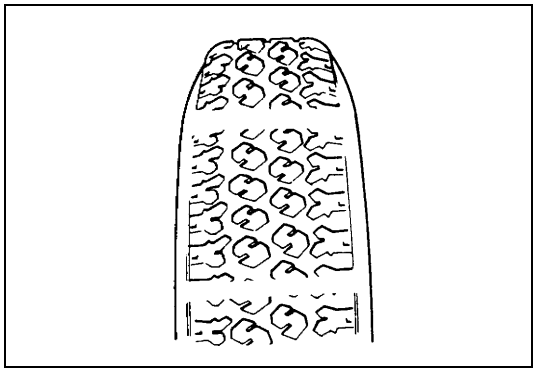
- Front tire wear is different from rear.
- Uneven wear exists across the tread of any tire.
- Left front and right front tire wear is unequal.
- Left rear and right rear tire wear is unequal.
- There is cupping, flat spotting, etc.

A wheel alignment check is in order if the following conditions are noted:

- Left front and right front tire wear is unequal.
- 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.

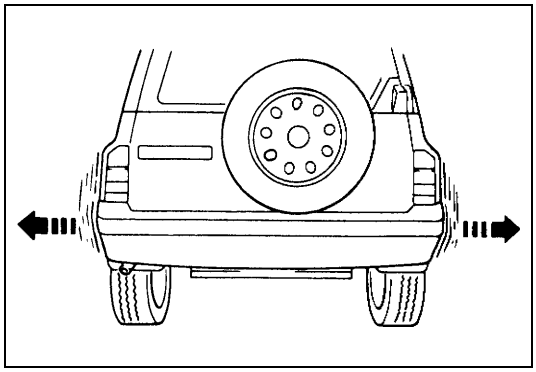
[A] :	Hard cornering, under inflation or lack of tire rotation
[B] :	Incorrect wheel alignment, tire construction not uniform or wheel heavy acceleration

Wear Indicators



The original equipment tires have built-in tread wear indicators to show when tires need replacement. These indicators will appear as 12 mm (0.47 inch) wide bands when the tire tread depth becomes 1.6 mm (0.063 inch). When the indicators appear in 3 or more grooves at 6 locations, tire replacement is recommended.

Radial Tire Waddle

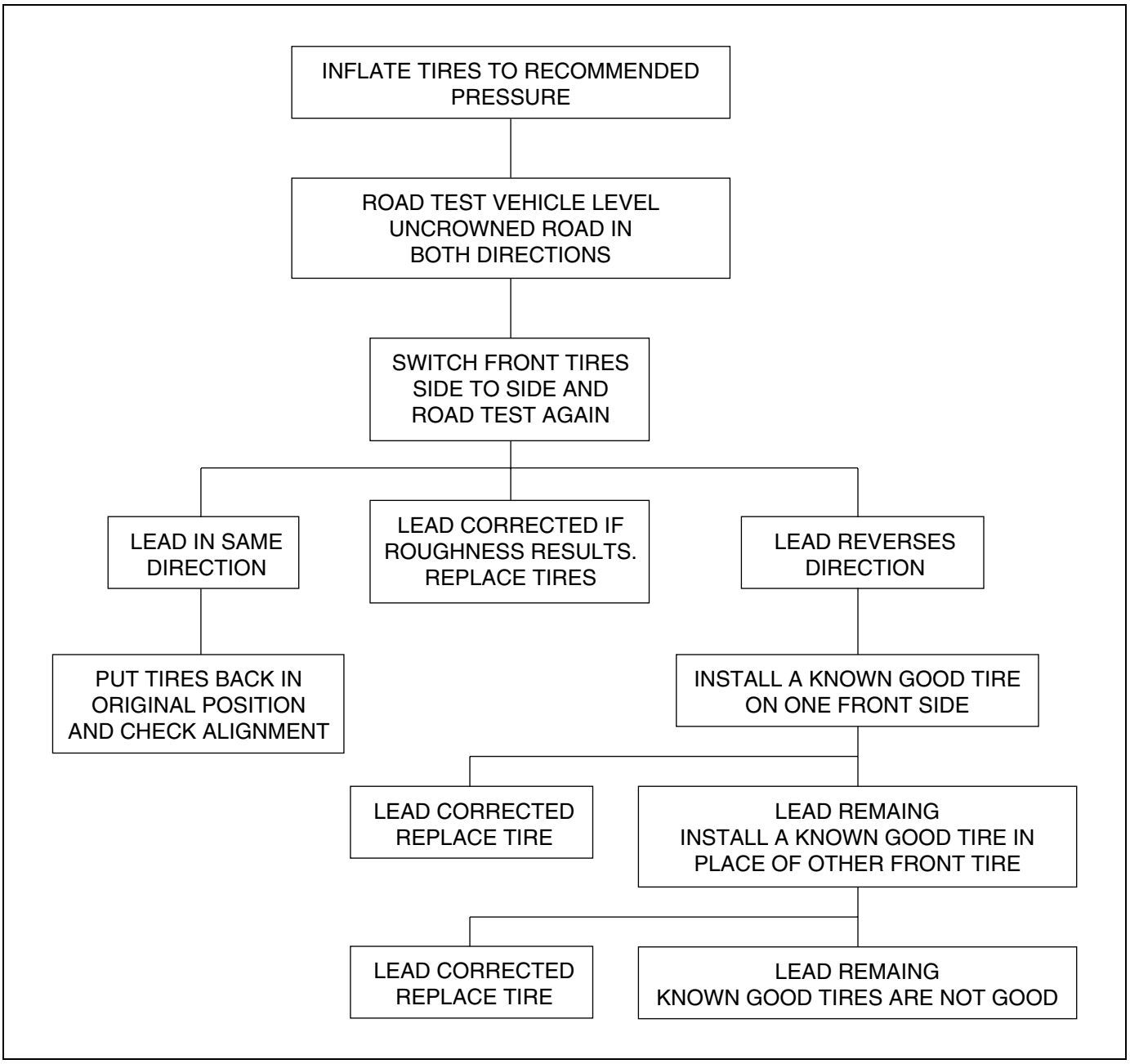


Waddle is side to side movement at the front and/or rear of the vehicle. It is caused by the steel belt not being straight within the tire. It is most noticeable at low speed, 5 to 30 mph. It is possible to road test a vehicle and tell on which end of the vehicle the faulty tire is located. If the waddle tire is on the rear, the rear end of the vehicle will shake from side to side or “waddle”. From the driver’s seat it feels as though someone is pushing on the side of the vehicle. If the faulty tire is on the front, the waddle 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 the vehicle. Waddle can be quickly diagnosed by using a Tire Problem Detector (TPD) and following the equipment manufacturer’s recommendations.

If a TPD is not available, the more time consuming method of substituting known good tire / wheel assemblies on the problem vehicle can be used as follows:

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 wadding end of vehicle. If wadding 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:

1) Incorrect alignment.
2) Uneven brake adjustment.
3) 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 above figure (Lead Diagnosis) should be used to make sure that front alignment is not mistaken for tire lead.

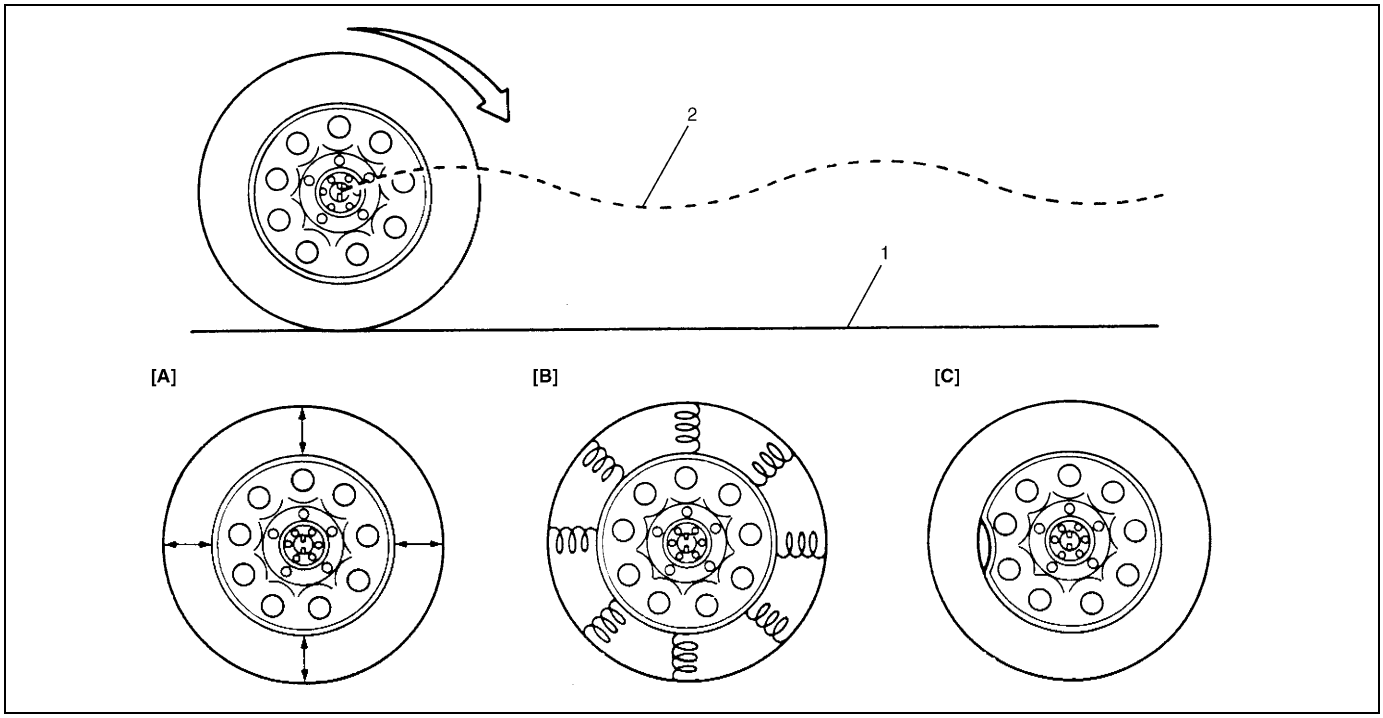
1) Part of the lead diagnosis procedure is different from the proper tire rotation pattern currently in the owner and service manuals. If a medium to high mileage tire is moved to the other side of the vehicle, be sure to check that ride roughness has not developed.
2) Rear tires will not cause lead.

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.

1) Tire runout.
2) Wheel runout.
3) 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] : Tire out of round	1. Smooth road
[B] : Tire stiffness variation	2. Suspension movement (loaded runout)
[C] : Rim bent or out of round	

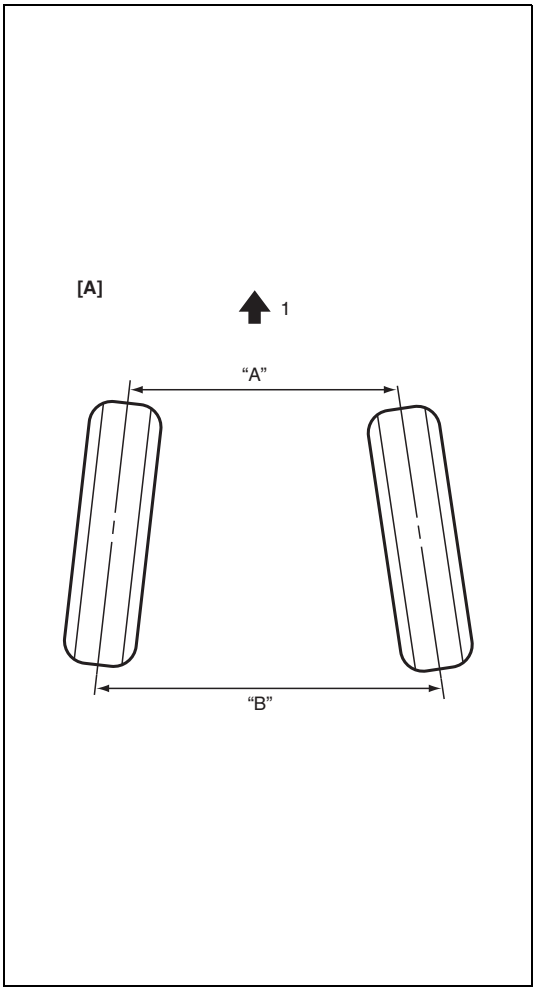
SECTION 3A

FRONT WHEEL ALIGNMENT

CONTENTS

General Description 3A-2
Toe Setting 3A-2
Camber 3A-2
Alignment Service Data (Reference) 3A-2
Diagnosis 3A-3
Diagnosis Table 3A-3
Preliminary Checks Prior To Adjusting Front Wheel Alignment 3A-3
Toe Adjustment 3A-3
Camber And Caster Check And Adjustment 3A-4
Steering Angle Check And Adjustment 3A-4
Side Slip(Reference) 3A-4

General Description



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 wheel 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).

Toe-in
"B" – "A" : 2 – 6 mm (0.08 – 0.24 in.)

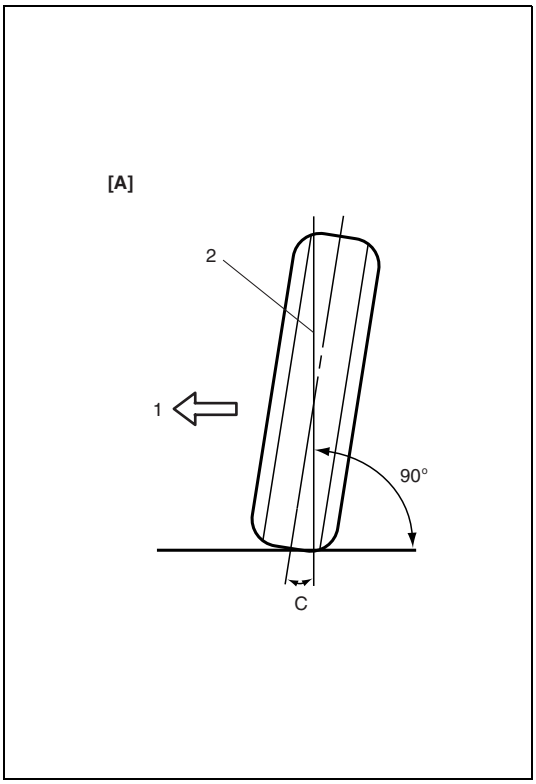
NOTE:

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

For adjusting toe setting, refer to "Toe Adjustment" in this section.

[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.

Camber
"C" : 0° 30' ± 1°

Alignment Service Data (Reference)

Caster
: 1° 55' ± 1°

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

Diagnosis

Diagnosis Table

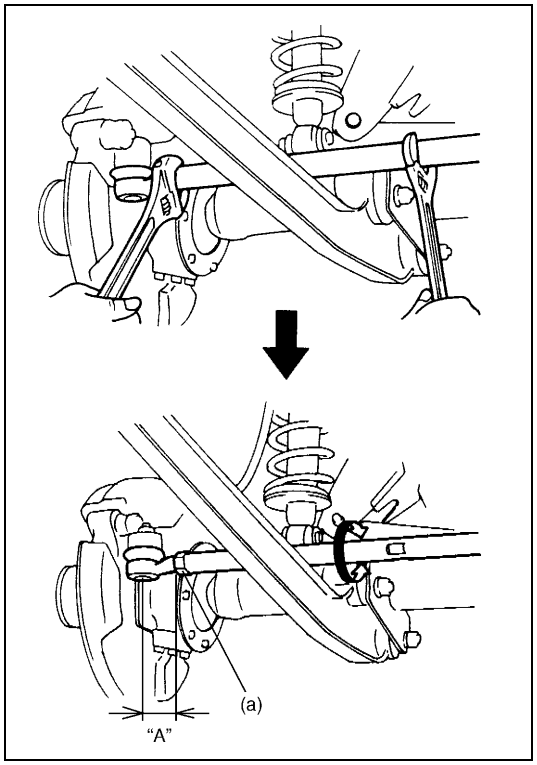
For the details, refer to “Diagnosis Table” in Section 3.

Preliminary Checks Prior To Adjusting Front Wheel 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. Section 3 of this manual contains a procedure for determining the presence of a tire lead problem. Before making any adjustment affecting toe setting, the following checks and inspections should be made to ensure correctness of alignment readings and alignment adjustments:

1) Check all tires for proper inflation pressures and approximately the same tread wear.
2) Check for loose of king pin bearings. Check tie rod ends; if excessive looseness is noted, it must be corrected before adjusting.
3) Check for run-out of wheels and tires.
4) Check vehicle trim heights; if out of limits and a correction is to be made, it must be made before adjusting toe.
5) Check for loose of suspension arms.
6) Check for loose or missing stabilizer bar attachments.
7) 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.
8) Consider condition of equipment being used to check alignment and follow manufacturer's instructions.
9) Regardless of equipment used to check alignment, vehicle must be on a level surface both fore and aft and transversely.

Toe Adjustment



Toe is adjusted by changing tie rod length. Loosen right and left tie rod end lock nuts first and then rotate tie rod to align toe-in to specification.

In this adjustment, right and left tie rod should become equal in length (“A”).

After adjustment, tighten lock nuts to specified torque.

Tightening torque
Tie rod end lock nuts
(a) : 65 N·m (6.5 kg-m, 47.0 lb-ft)

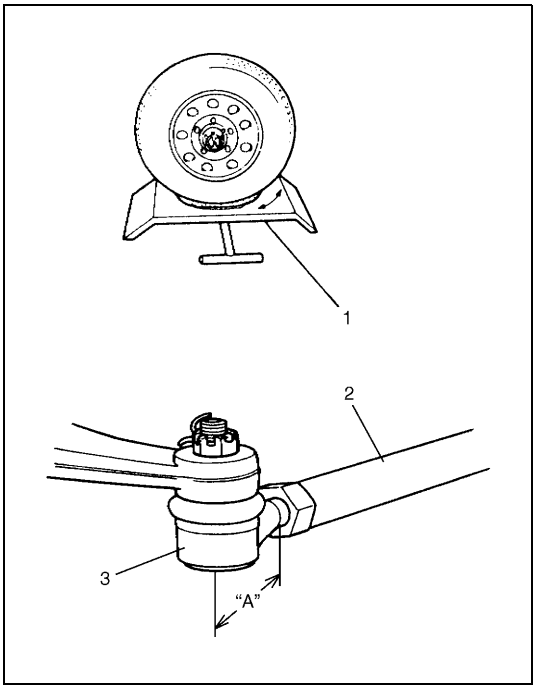
Camber And Caster Check And Adjustment

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 and axle housing, they should be replaced. If it is in vehicle body, repair it so as to attain specifications.

NOTE:

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

Steering Angle Check And Adjustment



When tie rod (2) or tie rod end (3) 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".

NOTE:

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

Steering angle
Inside : 35° ± 3°
Outside : 32° ± 3°

Side Slip(Reference)

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

Side slip limit
: Less than 3 mm/m (Less than 0.118 in/3 ft)

SECTION 3B

STEERING GEAR BOX (MANUAL TYPE) AND LINKAGE

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 "Air Bag 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 negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM)**

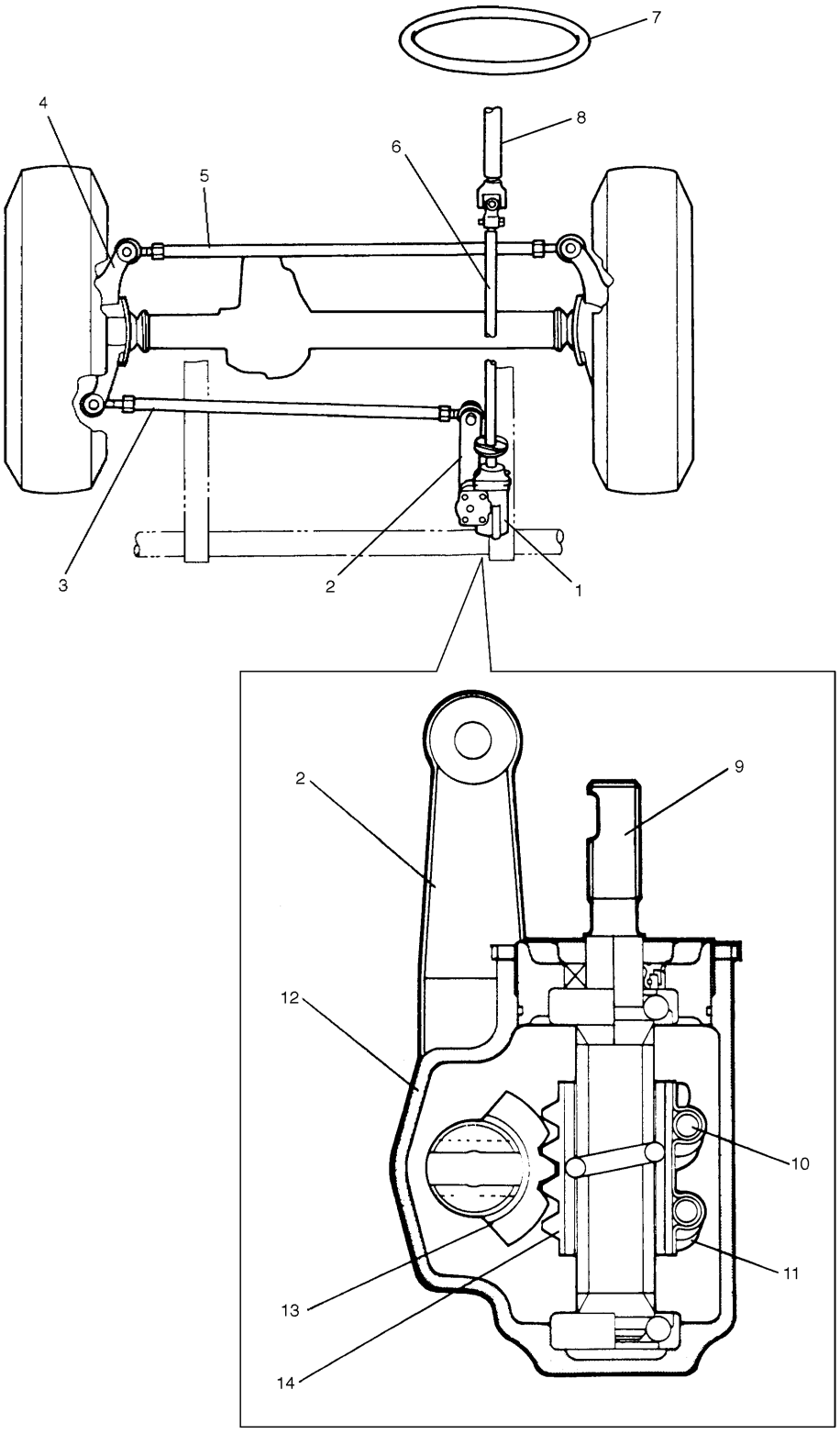
NOTE:

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 3B-2
Diagnosis 3B-3
Diagnosis Table 3B-3
Steering Wheel Play Check 3B-3
Tie Rod And Drag Rod Check..... 3B-3
Steering Gear Box Oil Level Check 3B-4
Adjustment of Worm Shaft Starting Torque . 3B-4
On-Vehicle Service 3B-6
Steering Gear Box 3B-6
Tie Rod And Drag Rod..... 3B-8
Tightening Torque Specifications 3B-10
Required Service Material 3B-10
Special Tools 3B-10

General Description



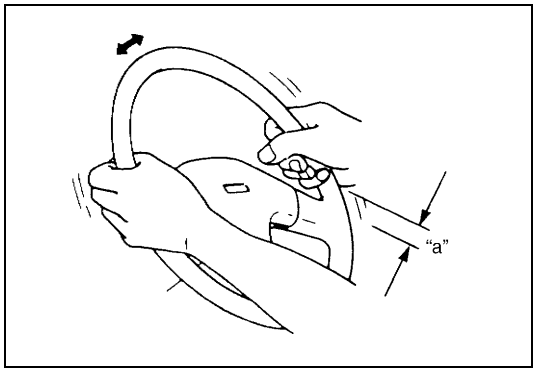
1. Steering gear box	5. Tie rod	9. Worm shaft	13. Sector shaft
2. Pitman arm	6. Steering lower shaft	10. Ball	14. Rack gear
3. Drag rod	7. Steering wheel	11. Ball nut	
4. Knuckle arm	8. Steering upper shaft	12. Gear case	

Diagnosis

Diagnosis Table

Refer to “Diagnosis Table” in Section 3.

Steering Wheel Play Check



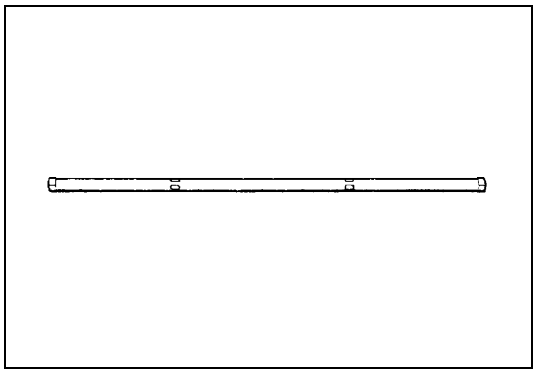
Check steering wheel for play and rattle, holding vehicle in straight forward condition on ground.

Steering wheel play
“a” : 10 – 30 mm (0.4 – 1.2 in.)

If play is not within specification, inspect for the following. If found defective, replace.

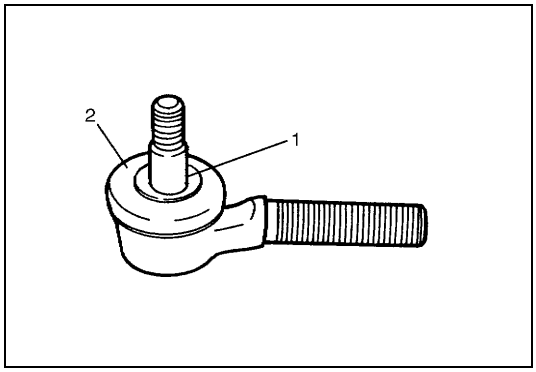
- Wear of tie rod end ball stud.
- Wear of king pin bearing
- Wear of steering shaft joint.
- Loosely install or joined parts.
- Wear of steering rack / sector gear.

Tie Rod And Drag Rod Check



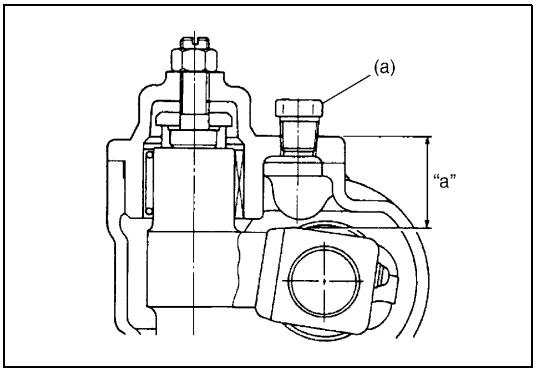
Inspect deformation or damage. Replace any defective part.

INSPECTION



1) Inspect for play in tie rod end ball joint (1). If found defective, replace.
2) Inspect boot (2) for tear. If even a small tear is noted, replace with new one.

Steering Gear Box Oil Level Check



Oil surface should be up to the level as shown in figure. If not, add prescribed gear oil, SAE 90.

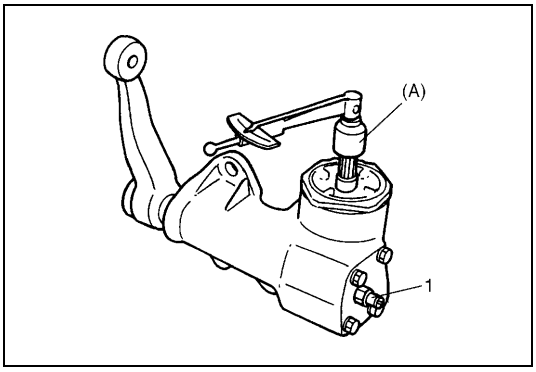
Steering gear box oil level
"a" : 23 mm (0.91 in.)

Apply sealant to thread parts of breathing plug and tighten breathing plug to specified torque.

(A) : Sealant 99000-31110

Tightening torque
Breathing plug
(a) : 4 N·m (0.4 kg-m, 3.0 lb-ft)

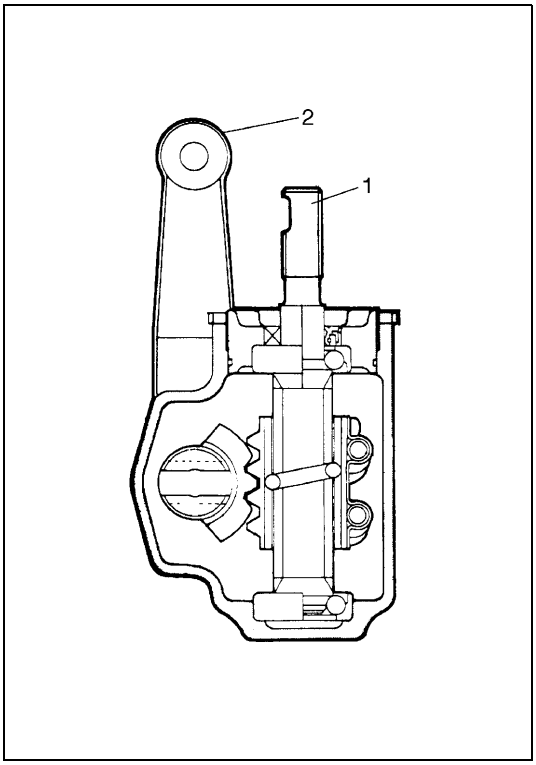
Adjustment of Worm Shaft Starting Torque



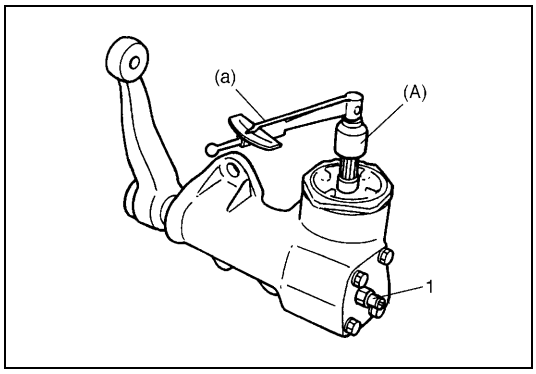
Steering gear box has adjusting bolt (1) which gives preload to sector shaft.

Special tool
(A) : 09944-18211

MAKE ADJUSTMENT ACCORDING TO FOLLOWING PROCEDURE.



1) Check worm shaft (1) to ensure that it is free from thrust play.
2) Position pitman arm (2) in nearly parallel with worm shaft (1) as shown. (With pitman arm (2) in this position, front wheels are in straightforward state.)

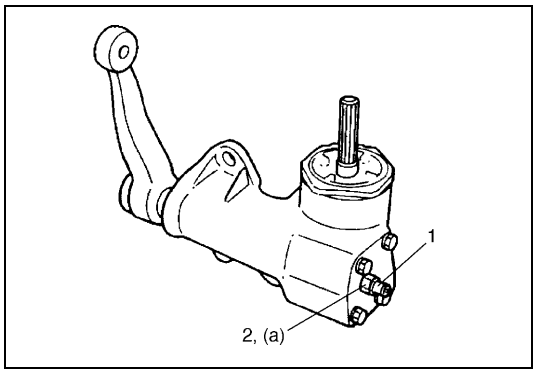


3) Measure worm shaft starting torque from its position in straight forward state as described in Step 2).

Starting Torque for Worm shaft
(a) : 50 – 100 N·cm (5.0-10.0 kg-cm, 0.4-0.7 lb-ft)

Special tool
(A) : 09944-18211

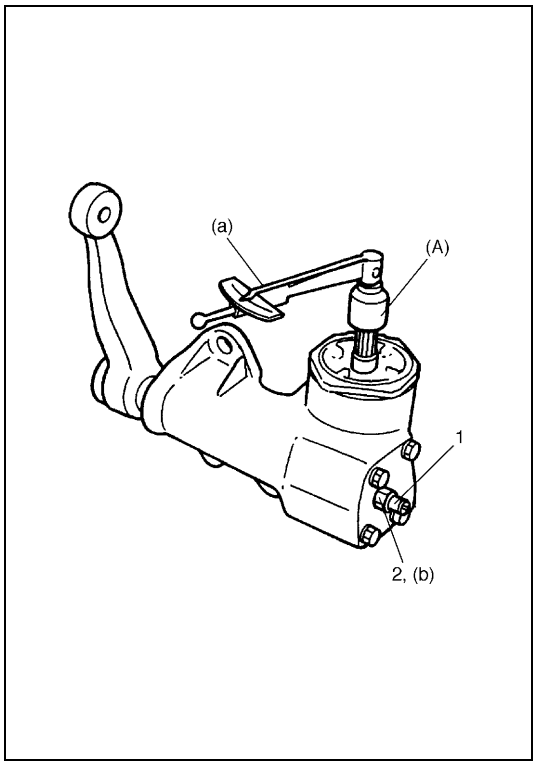
1. Adjusting bolt



If measured torque is not within specification, carry out adjustment with adjusting bolt (1) to meet specification and check to confirm it again.

Tightening torque
Steering gear box adjusting bolt lock nut
(a) : 30 N·m (3.0 kg-m, 22.0 lb-ft)

2. Lock nut



4) If worm shaft starting torque is checked all right, another check should be carried out on worm shaft operating torque in its entire operating range (by turning worm shaft all the way to the right and left).

Worm Shaft (Including sector shaft) Operating Torque
(a) : Under 120 N·cm (12.0 kg-cm, 10.9 lb-ft)

Special tool
(A) : 09944-18211

If measured torque does not conform to specification, readjust worm shaft starting torque in straightforward state by means of adjusting bolt (1), and then recheck worm shaft operating torque.

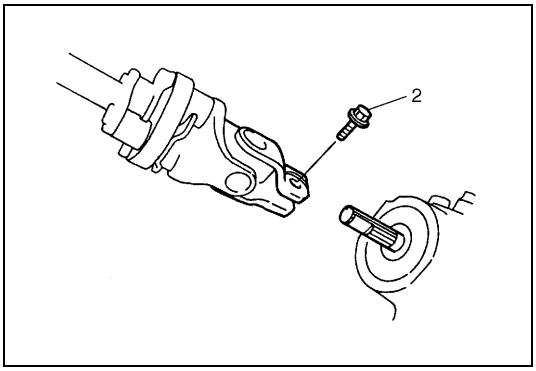
Tightening torque
Steering gear box adjusting bolt lock nut
(b) : 30 N·m (3.0 kg-m, 22.0 lb-ft)

If specified value is not attained even after readjustment, it is advisable to replace gear box with new gear box assembly.

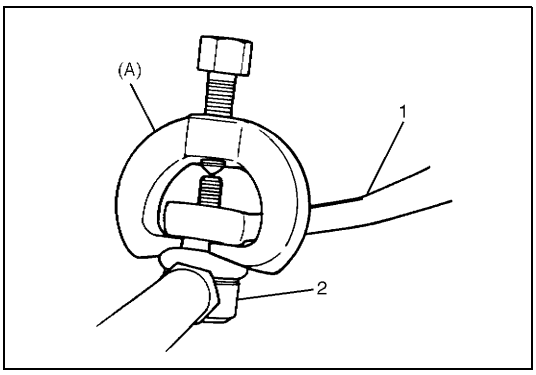
On-Vehicle Service

Steering Gear Box

REMOVAL



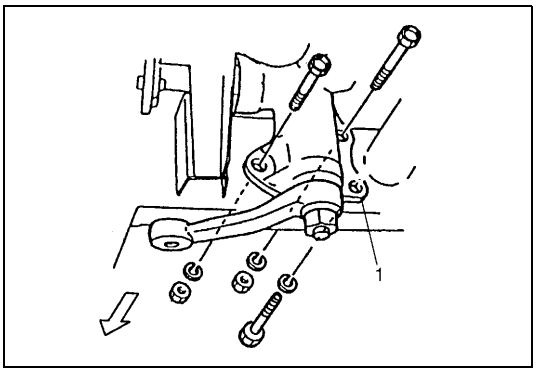
1) Remove steering lower shaft joint bolt (2).



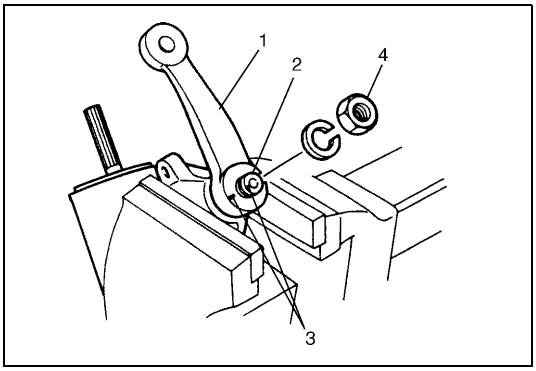
2) Remove drag rod end nut from pitman arm (1).
3) Disconnect drag rod end (2) from pitman arm (1), using special tool.

Special tool
(A) : 09913-65210

4) Remove radiator support member.



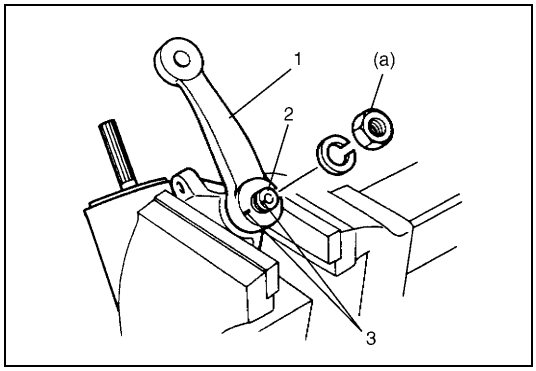
5) Remove steering gear box bolts, and remove steering gear box (1).



6) Remove pitman arm mounting nut (4).
7) Make match marks (3) on pitman arm (1) and sector shaft (2), for a guide during reinstallation.
8) Remove pitman arm (1) by using puller.

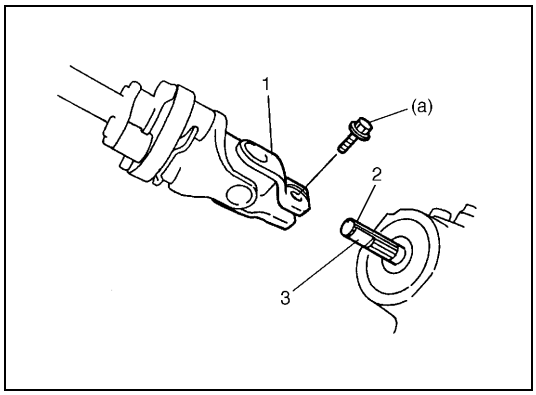
INSTALLATION

Reverse removal procedure to install steering gear box.



1) Install pitman arm (1) to sector shaft (2) of steering gear box with match marks (3) aligned as shown in figure and torque to specification.

Tightening torque
Pitman arm mounting nut
(a) : 135 N·m (13.5 kg-m, 98.0 lb-ft)

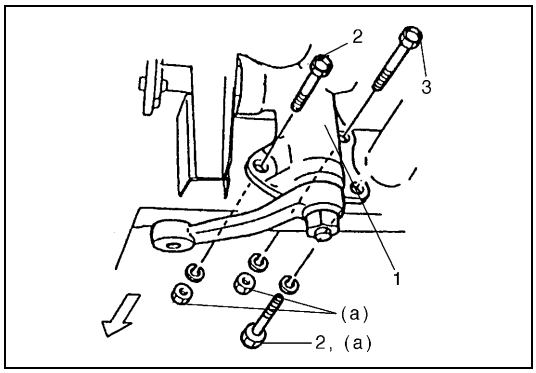


2) Install sector shaft (2) to steering lower shaft joint (1). Tighten joint bolt to specified torque.

NOTE:

Align flat part (3) of sector shaft with bolt hole of lower shaft joint as shown. Then insert sector shaft into lower shaft joint.

Tightening torque
Steering lower shaft joint bolt
(a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

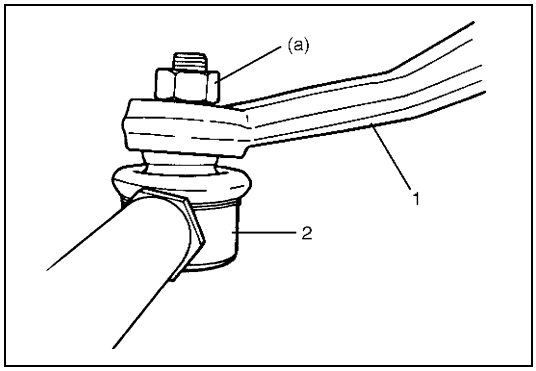


3) Install steering gear box mounting bolts (2), (3) with short bolt (3) positioned as shown in figure.
Tighten nuts and bolt to specified torque.

Tightening torque
Steering gear box mounting bolt and nuts
(a) : 80 N·m (8.0 kg-m, 58.0 lb-ft)

2. Steering gear box

4) Install radiator support member.



5) Connect drag rod (2) to pitman arm (1).
Tighten new drag rod end nut to specified torque.

NOTE:

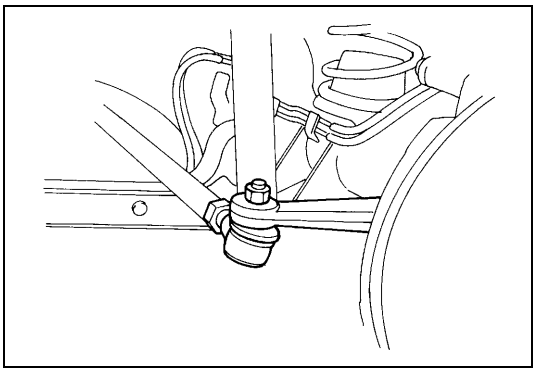
To prevent ball stud from being rotated while tightening tie rod end nut, tighten Nut (M12 × 1.25) to about 20 N·m (2.0 kg-m, 14.5 lb-ft) and remove it.
Then tighten new nut to specified torque.

Tightening torque
Drag rod end nut (pitman arm side)
(a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

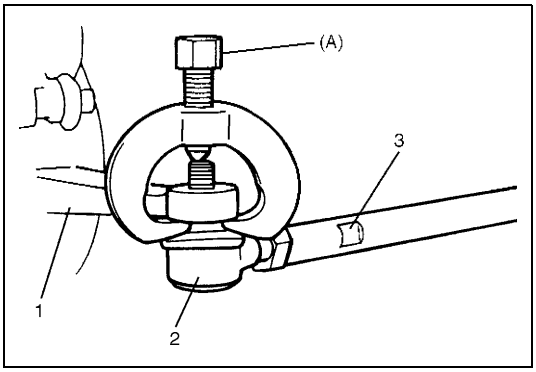
Tie Rod And Drag Rod

REMOVAL

1) Hoist vehicle and remove wheel (s).

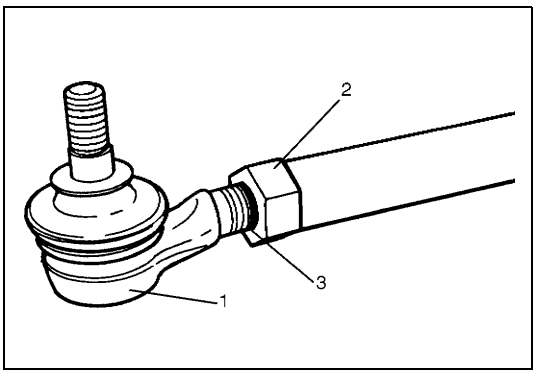


2) Remove tie rod end nut from steering knuckle.



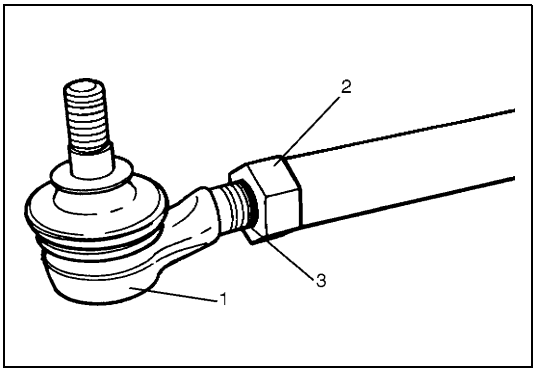
3) Mark (3) one end of tie rod before removing the rod as shown in figure to distinguish the correct installing direction easy.
4) Disconnect tie rod end (2) from knuckle (1), using special tool.

Special tool
(A) : 09913-65210

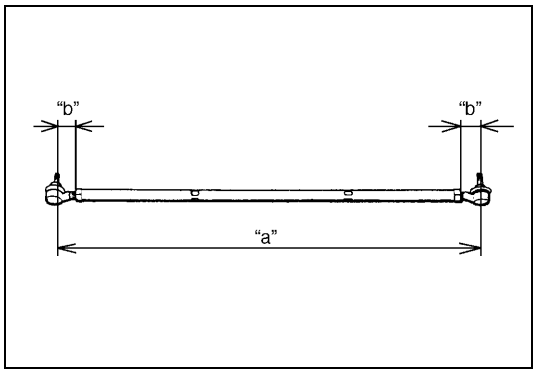


5) For ease of adjustment after installation, make marking (3) of tie rod end lock nut position on tie rod thread. Then loosen lock nut (2) and remove tie rod end (1) from tie rod.

INSTALLATION



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

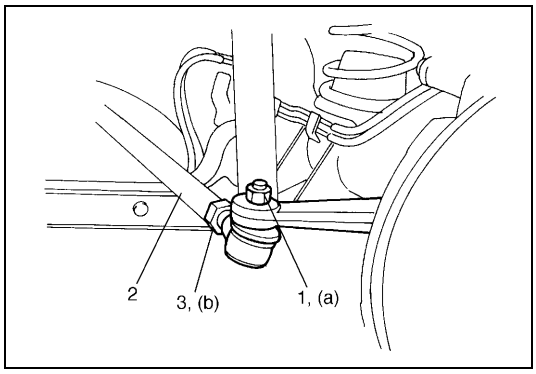


2) Adjust tie rod (and/or drag rod) length to the measurement shown in figure; then tighten tie rod end lock nuts temporarily by finger.

Tie rod and drag rod length
Tie rod length "a" : 1132 mm (44.6 in.)
Drag rod length "a" : 864.5 mm (34.0 in.)

NOTE:

Make the length "b" of right and left tie rod end the same.



3) Align lock nut (3) with mark on tie rod thread and connect tie rod end to knuckle and/or pitman arm. Tighten new nut (1) to specified torque.

NOTE:

To prevent ball stud from being rotated while tightening tie rod end nut (1), tighten Nut (M12 × 1.25) to about 20 N·m (2.0 kg-m, 14.5 lb-ft) and remove it.
Then tighten new nut (1) to specified torque.

Tightening torque
Tie rod end nut
(a) : 43 N·m (4.3 kg-m, 31.5 lb-ft)

4) Inspect for proper toe and steering angle (inside & outside). (Refer to "Preliminary Checks Prior To Adjusting Front Alignment" in Section 3A).
   Adjust tie rod (2) and drag rod length as required, if necessary.
5) After confirming proper toe, tighten tie rod end lock nut (3) to specified torque.

Tightening torque
Tie rod end lock nut
(b) : 65 N·m (6.5 kg-m, 47.0 lb-ft)

6) Tighten wheel nuts to specified torque and lower hoist.

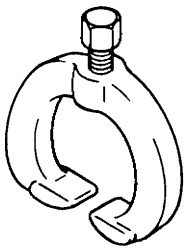
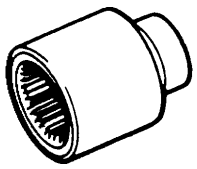
Tightening Torque Specifications

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Steering gear box oil plug	4	0.4	3.0
Steering gear box adjusting bolt lock nut	30	3.0	22.0
Pitman arm mounting nut	135	13.5	98.0
Steering shaft joint bolt	25	2.5	18.0
Steering gear box nuts and bolt	80	8.0	58.0
Tie rod end nut and drag rod end nut (knuckle side)	43	4.3	31.5
Wheel nut	95	9.5	69.0
Tie rod end lock nut	65	6.5	47.0
Drag rod end nut (pitman arm side)	50	5.0	36.5

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	• Thread of oil breathing plug

Special Tools

	
09913-65210 Tie-rod end remover	09944-18211 Pinion torque checking socket

SECTION 3B1

POWER STEERING (P/S) SYSTEM (If equipped)

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 "Air Bag 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 negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

NOTE:

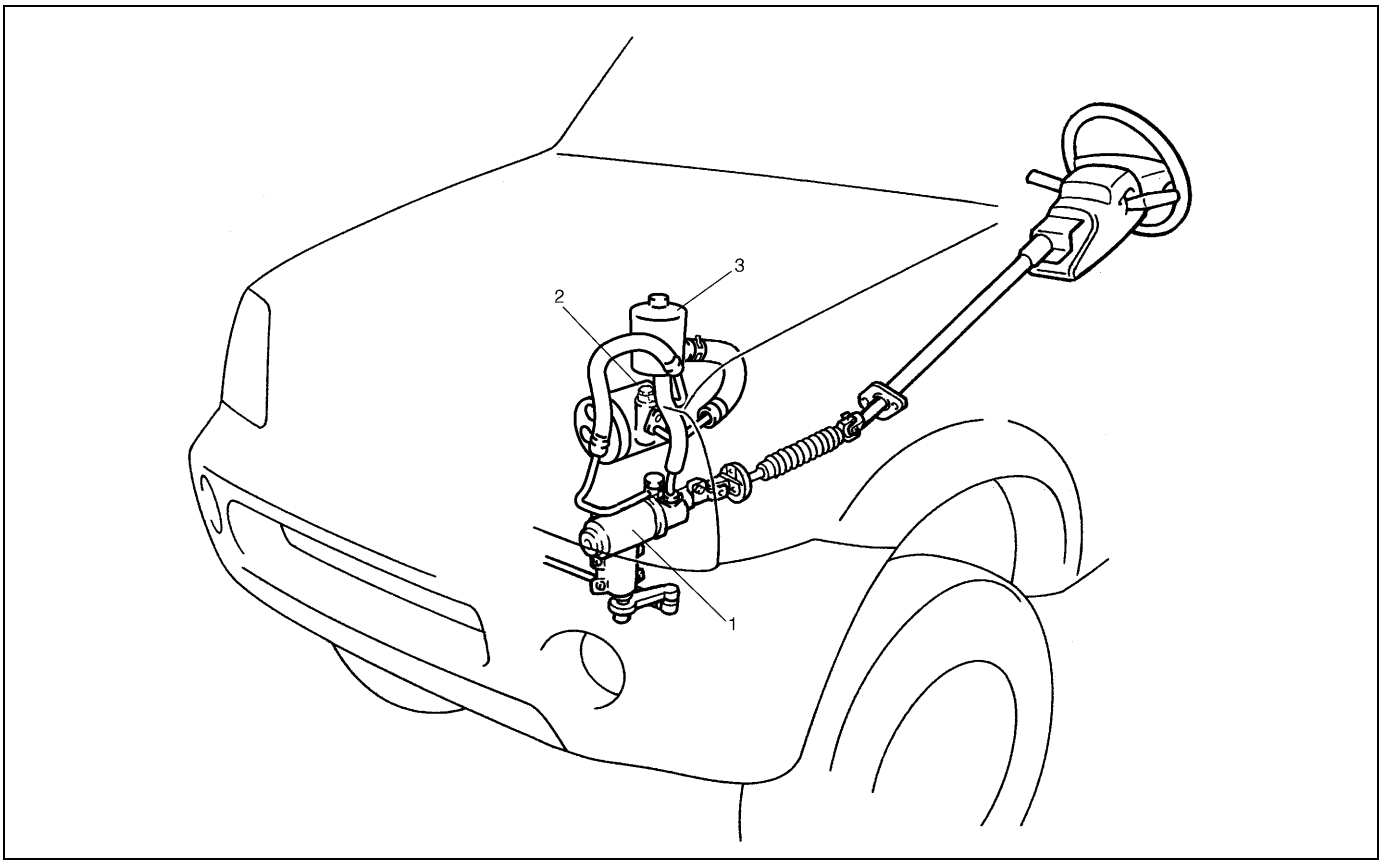
All steering gear fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a 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

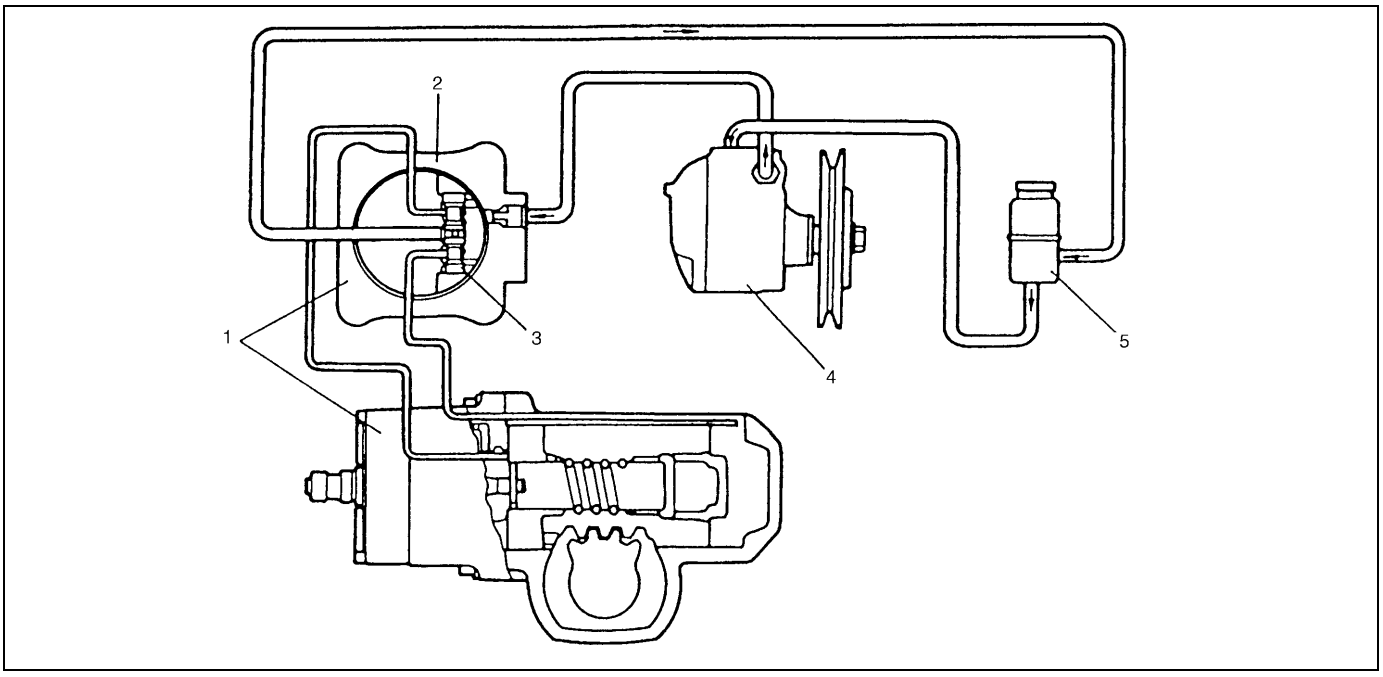
General Description 3B1-2
Diagnosis 3B1-3
Diagnosis Table 3B1-3
Steering Wheel Play Check 3B1-5
Steering Force Check 3B1-5
Power Steering Belt Check 3B1-6
Power Steering Belt Tension Adjustment 3B1-6
Power Steering Fluid Level Check 3B1-6
Idle-Up System Check 3B1-7
Power Steering Fluid Leakage Check 3B1-7
Air Bleeding Procedure 3B1-8
Hydraulic Pressure In P/S Circuit Check 3B1-10
On-Vehicle Service 3B1-12
Power Steering Belt 3B1-12
Power Steering (P/S) Pump 3B1-12
Power Steering (P/S) Gear Box 3B1-18
Tightening Torque Specifications 3B1-21
Required Service Materials 3B1-21
Special Tools 3B1-21

General Description

The power steering system in this vehicle reduces the driver's effort needed in turning the steering wheel by utilizing the hydraulic pressure generated by the power steering (P/S) pump which is driven by the engine. It is an integral type with the mechanical gear unit, hydraulic pressure cylinder unit and control valve unit all housed in the gear box.



1. Steering gear box	2. Power steering (P/S) pump	3. P/S fluid reservoir



1. Power steering gear box	3. Spool valve	5. P/S fluid reservoir
2. Control valve section	4. Power steering (P/S) pump	

Diagnosis

Diagnosis Table

Condition	Possible Cause	Correction
Steering wheel feels heavy (at low speed)	Fluid deteriorated, low viscosity, different type of fluid mixed	Change fluid.
	Pipes or hoses deformed, air entering through joint	Correct or replace.
	Insufficient air bleeding from piping	Bleed air.
	Belt worn, lacking in tension	Adjust belt tension or replace belt as necessary.
	Tire inflation pressure too low	Inflate tire.
	Wheel alignment out of adjustment	Adjust front wheel alignment.
	Steering wheel installed improperly (twisted)	Install steering wheel correctly.
	Hydraulic pressure failing to rise (See NOTE “A”.)	Replace P/S pump.
	Slow hydraulic pressure rise (See NOTE “A”.)	
Steering wheel feels heavy momentarily when turning it to the left or right.	Air drawn in due to insufficient amount of fluid	Add fluid and bleed air.
	Slipping belt	Adjust belt tension or replace belt as necessary.
No idle-up (See NOTE “B”.)	Defective pressure switch	Replace pressure switch (terminal set).

NOTE:

- **“A” : Be sure to warm up engine fully before performing this check. Pump vanes are sometimes hard to come out where temperature is low.**
- **“B” : Acceptable if idling speed does not drop.**

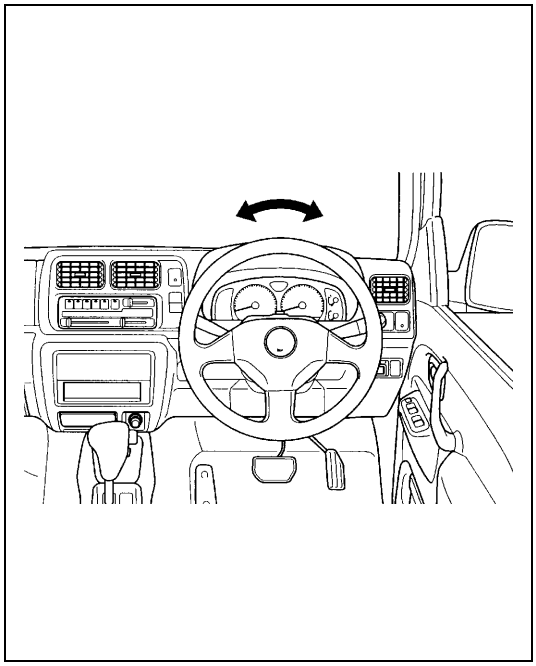
Condition	Possible Cause	Correction
Steering wheel returns slowly from turns. (See NOTE “C”.)	Dust or foreign object mixed in fluid	Change fluid.
	Deformed pipes or hoses	Correct or replace.
	Steering column installed improperly	Install correctly.
	Wheel alignment maladjusted	Adjust.
	Linkage or joints not operating smoothly	Correct.
Vehicle pulls to one side during straight driving.	Low or uneven tire inflation pressure	Inflate tire (s) as necessary.
	Wheel alignment maladjusted	Adjust.
	Defective spool valve	Replace gear box assembly.
Steering wheel play is large and vehicle wanders.	Loose steering shaft nut	Retighten.
	Loose linkage or joint	Retighten.
	Loose gear box fixing bolt	Retighten.
	Front wheel bearing worn	Replace.
Fluid leakage	Loose joints of hydraulic pressure pipes and hoses	Retighten.
	Deformed or damaged pipes or hoses	Correct or replace.
	Gear box	Replace gear box assembly.

Condition	Possible Cause	Correction
Abnormal noise (See NOTE "D".)	Air drawn in due to insufficient fluid	Replenish fluid.
	Air drawn in through pipe or hose joints	Retighten or replace.
	Belt slipping (loose)	Adjust.
	Worn belt	Replace.
	Loose steering linkage	Retighten.
	Loose gear box fixing bolt	Retighten.
	Loose pitman arm	Retighten.
	Pipes or hoses in contact with chassis	Correct.
	Defective pump vane	Replace pump assembly.
	Malfunction of flow control valve	Replace gear box assembly.
	Defective pump shaft bearing	Replace pump assembly.

NOTE:

- **"C" : Turn steering wheel 90° at 35 km/h (22 mile/h) and let it free. If it returns more than 60° then, it is normal.**
- **"D" : Some hissing noise may be heard through steering column when turning steering wheel with vehicle halted. It is from operation of the valve in the gear box and indicates nothing abnormal.**

Steering Wheel Play Check



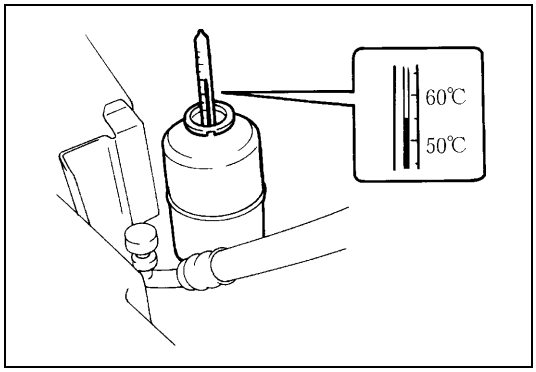
- With engine ON, check steering wheel play as follows. Move steering wheel to the right and left from its straight position and measure along its circumference how much it must be turned before tires start to move. It should be as specified below.

Steering wheel play
"a" : 30 mm (1.18 in.) or less

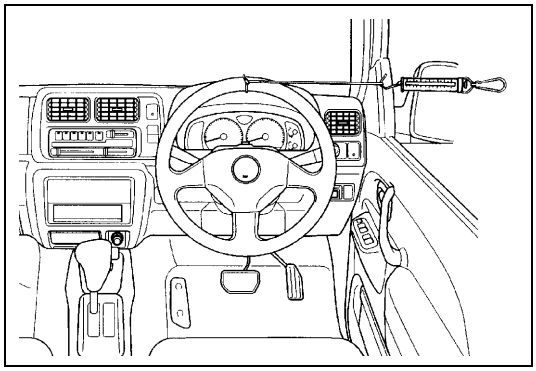
- Also, check steering wheel for looseness or rattle by trying to move it in its column direction and forward direction.

Steering Force Check

1) Place vehicle on level concreted road and set steering wheel at straight position.
2) Check that tire inflation pressure is as specified (Refer to tire placard).



3) Start engine and keep it running till power steering fluid is warmed to 50 to 60 °C (122 – 140 °F).

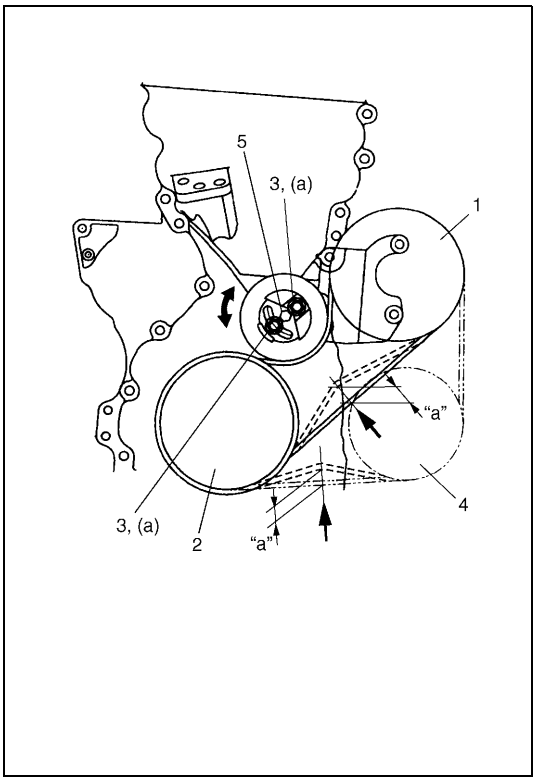


4) With engine running at idling speed, measure steering force by pulling spring balancer hooked on steering wheel in tangential direction.

Steering force
Less than 6.0 kg (13.2 lb)

Power Steering Belt Check

INSPECTION



- Check that belt is free from any damage and properly fitted in pulley groove.
- Check belt tension by measuring how much it deflects when pushed at mid-point between pulley with about 10 kg (22 lb) force.

Deflection of oil pump belt
"a" : 6 – 9 mm (0.25 – 0.35 in.)

Power Steering Belt Tension Adjustment

1) Loosen tension pulley bolts (3) and set hexagon wrench to hexagon hole (5).
2) Turn tension pulley counterclockwise by hexagon wrench in order to obtain above specification.
3) Tighten tension pulley bolts to specified torque.

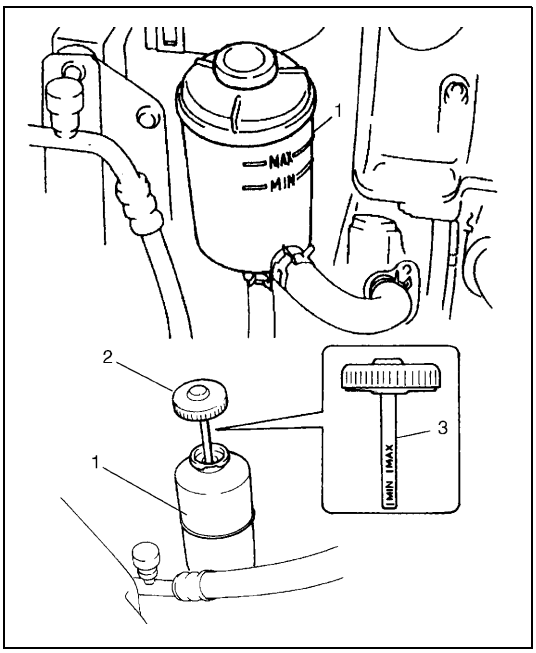
Tightening torque
Tension pulley bolts
(a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

1. P/S pump pulley	4. A/C compressor pulley (if equipped)
2. Crank pulley	

Power Steering Fluid Level Check

CAUTION:

- **Make sure to use an equivalent of DEXRON®-II, DEXRON®-IIE or DEXRON®-III for P/S fluid.**
- **Fluid level should be checked when fluid is cool before starting engine.**



With engine stopped check fluid level indicated on P/S fluid reservoir (1) or level gauge (3), which should be between MAX and MIN marks. If it is lower than lower limit (MIN), replenish fluid up to upper limit (MAX) mark.

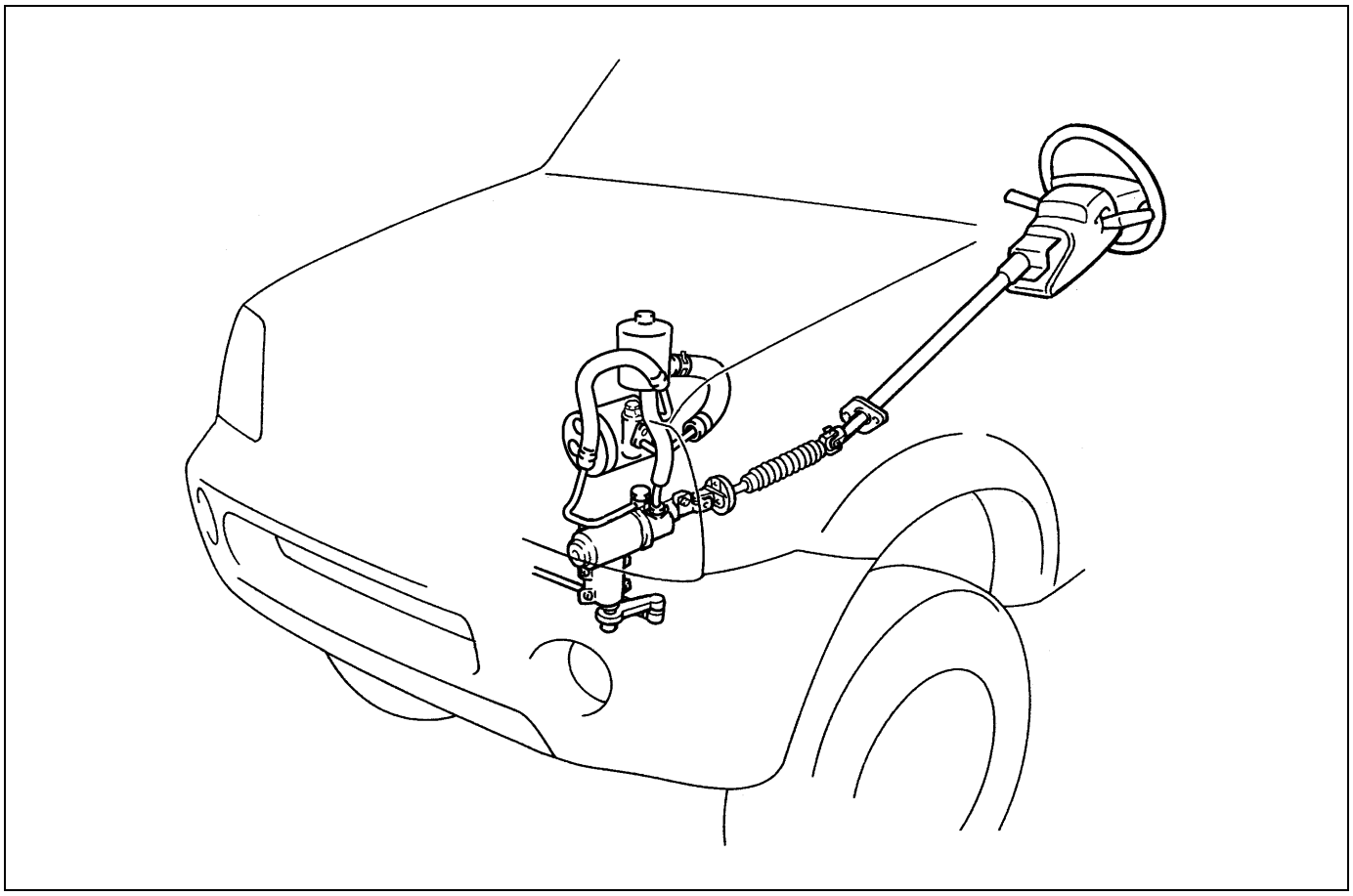
2. Cap

Idle-Up System Check

1) Warm up engine to normal operating temperature.
2) Turn A/C switch OFF, if equipped.
3) Turn steering wheel fully and check idle speed.
   Engine idle speed drops a little momentarily when steering wheel is turned fully but returns to its specified level immediately. If power steering pressure switch connector is connected, check the same with that connector disconnected. Momentary drop of engine idle speed should be less when it is connected than when disconnected.

Power Steering Fluid Leakage Check

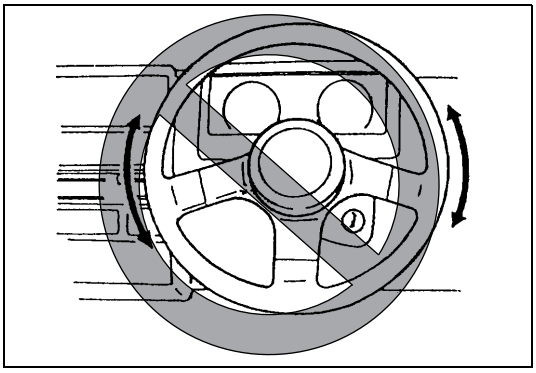
Start engine and turn steering wheel fully to the right and left so that maximum hydraulic pressure is applied to system. Then visually check gear box, P/S pump and P/S fluid reservoir respectively and each joint of hydraulic pressure piping for leakage. During this check, however, never keep steering wheel turned fully for longer than 10 seconds.



Air Bleeding Procedure

AIR BLEEDING FROM SYSTEM

CAUTION:
When air bleeding is not complete, it is indicated by foaming fluid on level gauge or humming noise from P/S pump.



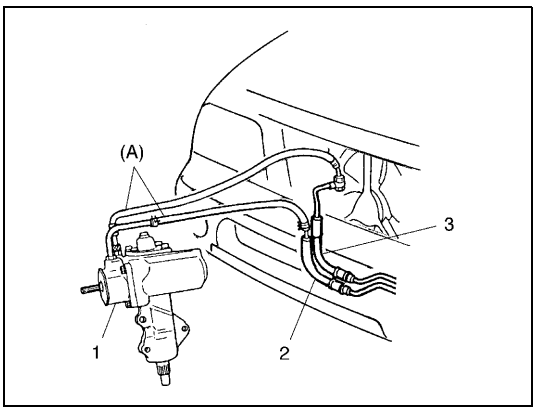
NOTE:
Bleed air from system when P/S system has been serviced in any way other than replacement of steering gear box (e.g., disconnection of piping, replacement of P/S pump). Never operate steering system while servicing. Or Air Bleeding from gear box must be performed.

1) Jack up the front end of vehicle and apply rigid rack.
2) Fill P/S fluid reservoir with fluid up to specified level.
3) With engine running at idling speed, add fluid up to specified level.
4) When fluid stops reducing, stop engine and leave P/S system as it is for about 10 minutes.
5) After running engine at idling speed for 1 minute, stop it.
6) As a final step, check to make sure that fluid is up to specified level.
7) Check steering condition and P/S system for fluid leakage.

AIR BLEEDING FROM GEAR BOX

NOTE:
Bleed air from gear box:
- **When steering gear box has been replaced with a new one.**
- **When entry of air into hydraulic circuit of steering gear box is suspected.**

1) Remove steering gear box from vehicle referring to “Power Steering (P/S) Gear Box” in this section.



2) Install special tool as shown.

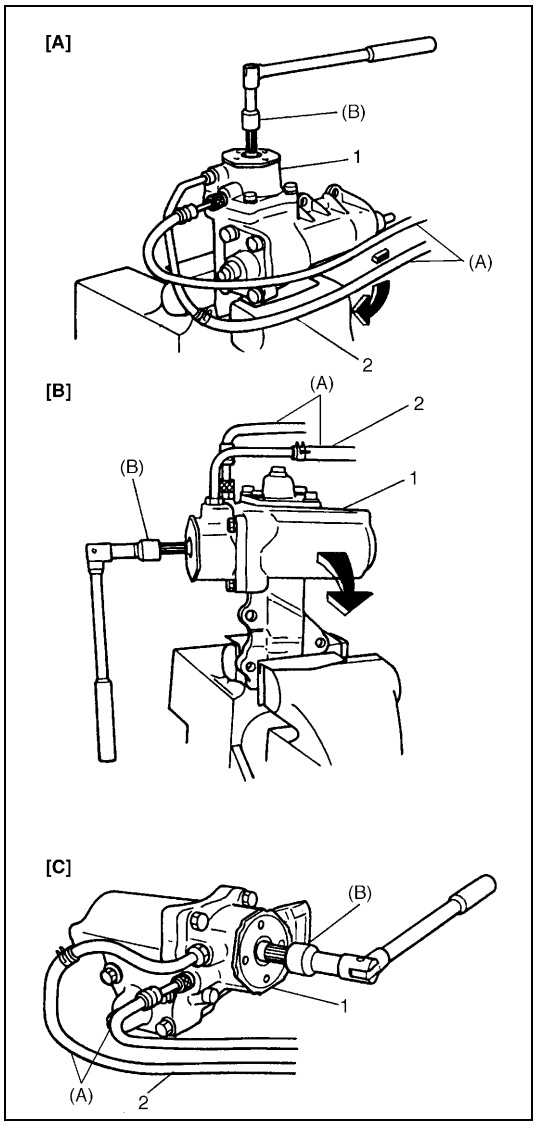
Special tool
(A) : 09945-35010

1. Steering gear box	3. High pressure hose / pipe
2. Low pressure hose / pipe	

3) After running engine at idling speed for 3 to 5 seconds, stop it and add fluid up to specified level. Repeat this step a few times.

NOTE:

Don't operate steering system for this step.



4) Set steering gear box (1) to state [A] as shown.
5) With engine running at idling speed, turn input shaft by using special tool in both directions as far as it locks till all foams are gone.

NOTE:

- **Add fluid into P/S fluid reservoir whenever its level lowers while servicing.**
- **Turn input shaft till it locks, return it a little and turn it again in the same direction till it locks. Repeat this some times.**

Special tool
(B) : 09944-18211

6) Perform Step 5) but with steering gear box in state [B] this time and then in state [C].

NOTE:

To change of state of gear box from [A] to [B] and from [B] to [C], turn gear box in arrow direction in figures [A] and [B].

7) Set input shaft at neutral position (straight position).

NOTE:

As input shaft makes 4 full turns from lock to lock, neutral position is obtained by turning it till it locks and turning it back by 2 full turns.

2. Vinyl tube (See-through tube)

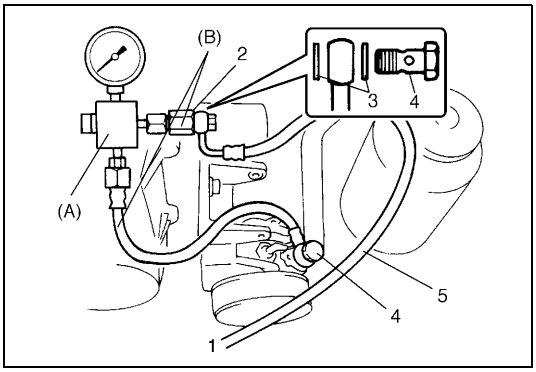
8) Remove (special) tools and install steering gear box to vehicle and P/S pipe / hose to steering gear box referring to "Power Steering (P/S) Gear Box" in this section.

NOTE:

- **Don't install pitman arm and steering lower shaft to steering gear box.**
  Installation of these parts will cause input shaft and/or sector shaft to turn, allowing air to enter gear box.
- **Plug up opening after pipe or hose disconnection.**

9) Bleed air in P/S system referring to "Air Bleeding Procedure" in this section.
10) Install pitman arm and steering lower shaft to steering gear box.

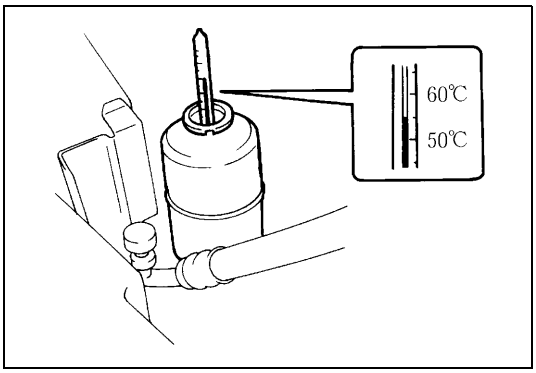
Hydraulic Pressure In P/S Circuit Check



1) Clean where pipe is connected thoroughly, then disconnect high pressure hose from high pressure pipe connector and connect oil pressure gauge (special tool) as shown.

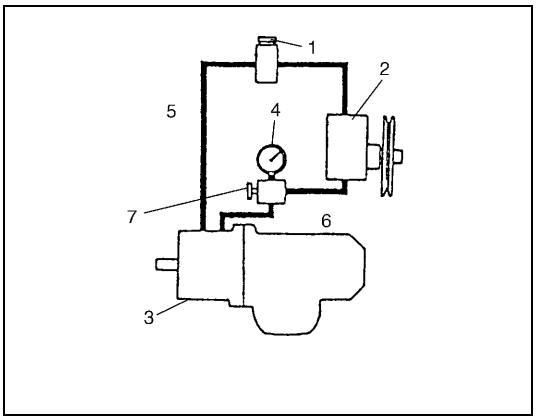
Special tool
(A) : 09915-77410
(B) : 09915-77420

1. To gear box	4. Union bolt
2. Attachment	5. Pressure hose
3. Washer	



2) Bleed air.

3) With engine running at idling speed, keep turning steering wheel to the right and left till fluid in P/S fluid reservoir is warmed to 50 to 60 °C (122 – 140 °F)

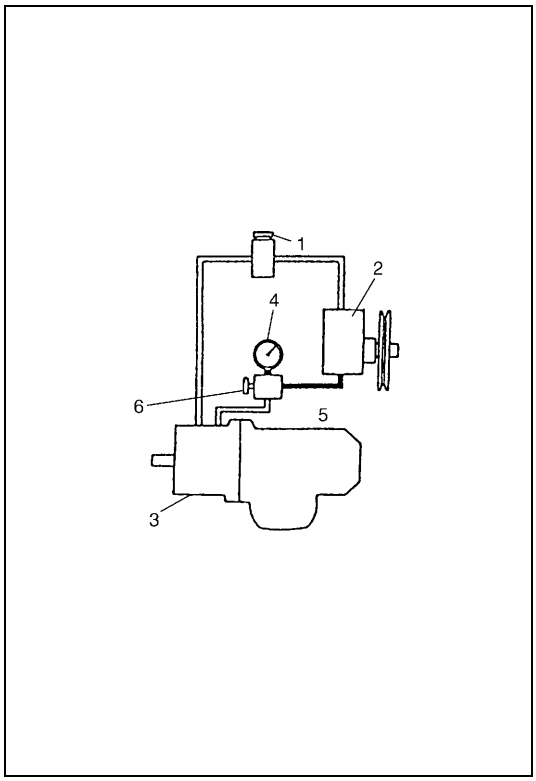


4) Back pressure check
With engine running at idling speed and hands off from steering wheel, check hydraulic pressure.

If back pressure exceeds 980 kPa (10 kg/cm^2, 142 psi), check control valve and pipes for obstruction.

Back pressure : 980 kPa (10 kg/cm^2, 142 psi)

1. P/S fluid reservoir	5. Low pressure side
2. P/S pump	6. High pressure side
3. Steering gear box	7. Valve (open)
4. Oil pump pressure gauge	



5) Relief pressure check

CAUTION:
- **Be sure not to keep gauge valve closed for longer than 10 seconds.**
- **Never keep steering wheel turned fully for longer than 10 seconds.**

a) Increase engine speed to about 1,500 to 1,600 rpm.
Close valve (6) gradually while watching pressure increase indicated on gauge (4) and take reading of relief pressure (maximum hydraulic pressure).

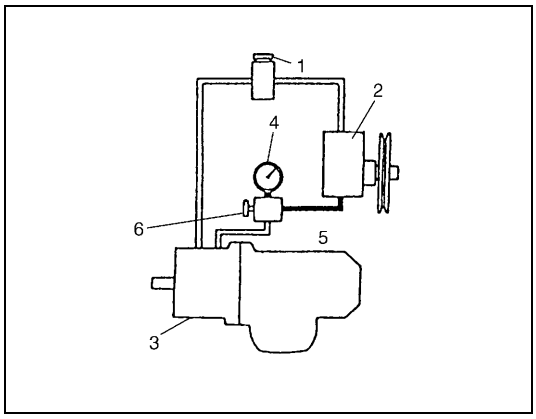
If higher than 8,400 kPa (85 kg/cm^2, 1208 psi), malfunction of relief valve.

If lower than 6,400 kPa (65 kg/cm^2, 925 psi), failure of P/S pump or settling of relief valve spring.

Relief pressure

6,400 – 8,400 kPa (65 – 85 kg/cm^2, 925 – 1208 psi)

1. P/S fluid reservoir	3. Steering gear box
2. P/S pump	5. High pressure side



b) Next, open gauge valve (6) fully and increase engine speed to about 1,500 to 1,600 r/min. Then turn steering wheel to the left or right fully and take reading of relief pressure.

If lower than 6,400 kPa (65 kg/cm^2, 1280 psi), failure in steering gear.

Relief pressure

6,400 – 8,400 kPa (65 – 85 kg/cm^2, 925 – 1208 psi)

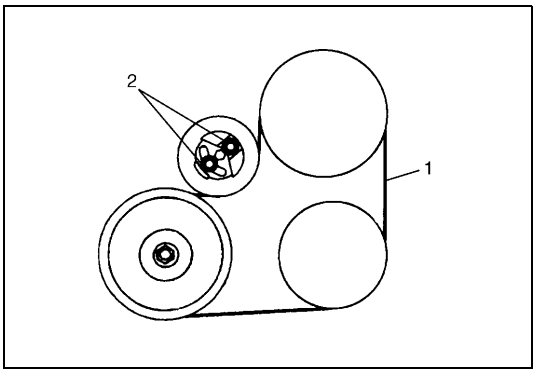
1. P/S fluid reservoir	4. Oil pressure gauge
2. P/S pump	5. High pressure side
3. Steering gear box	

On-Vehicle Service

Power Steering Belt

REMOVAL

1) Disconnect negative cable at battery.

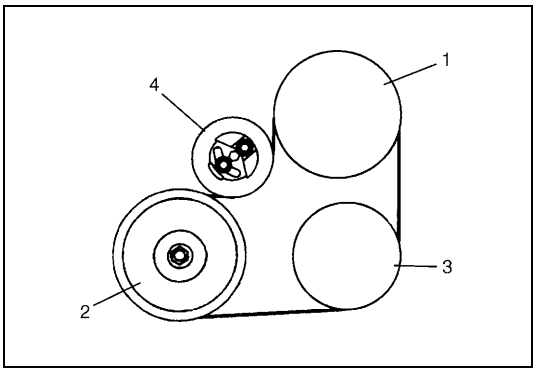


2) Loosen tension pulley bolts (2).
3) Remove power steering belt (1).

INSPECTION

- Check power steering belt for wear and cracks, and replace as required.

INSTLLATION

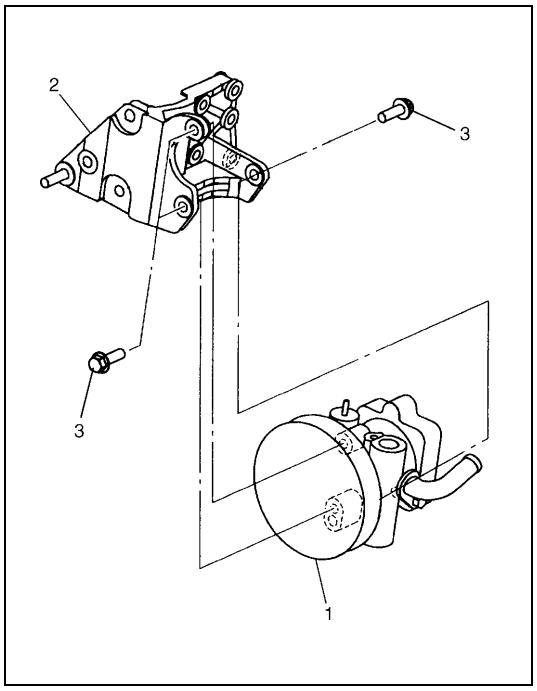


1) Install belt to power steering pump pulley (1), crankshaft pulley (2), A/C pulley (if equipped) (3) and tension pulley (4).
2) Adjust belt tension referring to “Power Steering Belt Check” in this section.

Power Steering (P/S) Pump

REMOVAL

1) Take out fluid in P/S fluid reservoir with syringe or such.
2) Remove P/S belt.
3) Disconnect high pressure hose and low pressure hose.
4) Disconnect pressure switch lead harness.



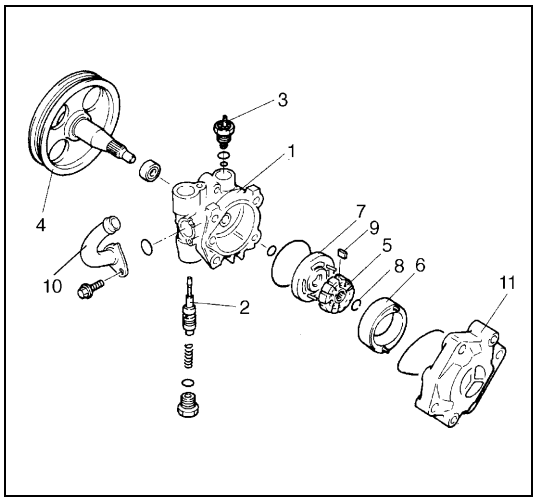
5) Remove P/S pump (1) removing 3 mounting bolts (3).

CAUTION:
- **Clean couplers at intake and discharge ports completely before disconnection.**
- **Plug ports of removed pump to prevent dust and any foreign object from entering.**

2. P/S pump bracket	

DISASSEMBLY

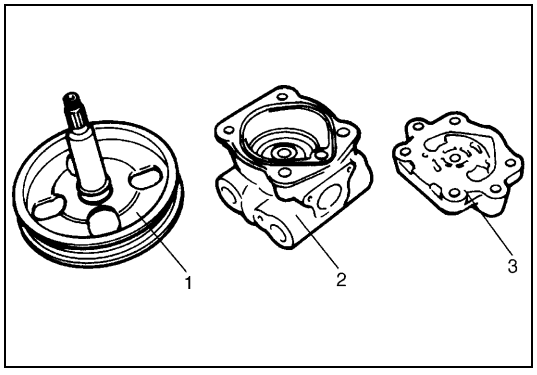
1) Clean its exterior thoroughly.
2) With aluminum plates placed on vise first, grip pump case with it.



3) Remove suction connector (10) and O-ring from pump body (1).
4) Remove power steering pressure switch (3) from pump body (1).
5) Remove relief valve (flow control valve) (2) and spring from pump body (1).
6) Remove pump cover (11), O-ring and cam ring (6) from pump body (1).
7) Remove vanes (9) from rotor (5).
8) Remove snap ring (8) from pump shaft (4) and pull out rotor (5) and pulley (shaft) (4).
9) Remove side plate (7) and O-ring from pump body (1).
10) Remove oil seal from pump body (1).

INSPECTION

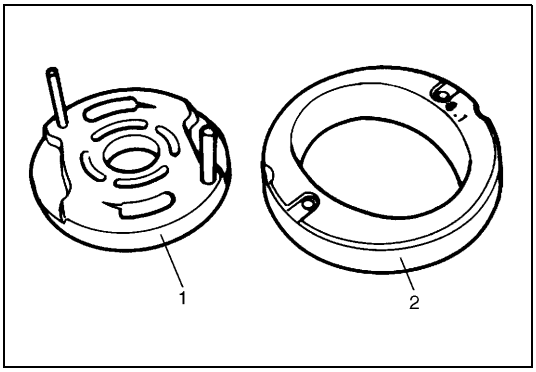
Pump body, cover and shaft



Check sliding surfaces of each part for wear and damage.
If any defect is found, replace pump assembly.

1. Pulley	3. Pump cover
2. Pump body	

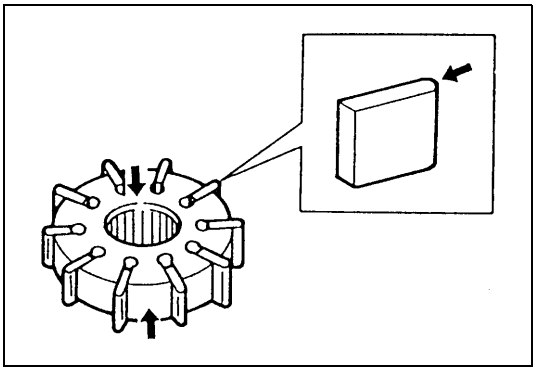
CAM RING AND SIDE PLATE



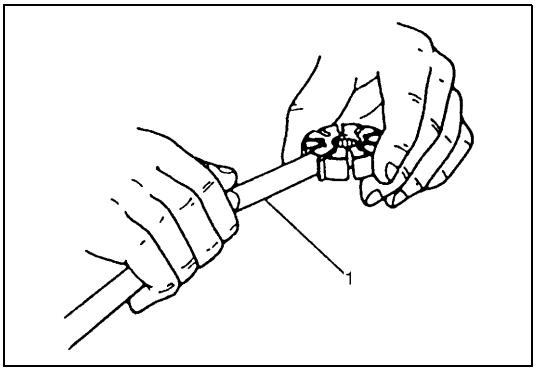
Check vane sliding surface of cam ring (2) for wear and damage. If any defect is found, replace pump assembly.

2. Side plate

ROTOR AND VANE



- Check sliding surfaces of rotor and vane for wear and damage.

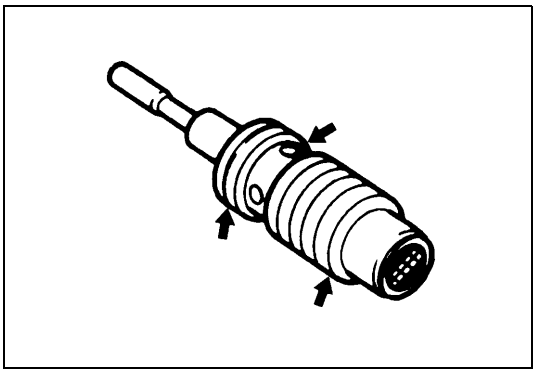


- Check clearance between rotor and vane.
  Replace pump assembly if any defect is found.

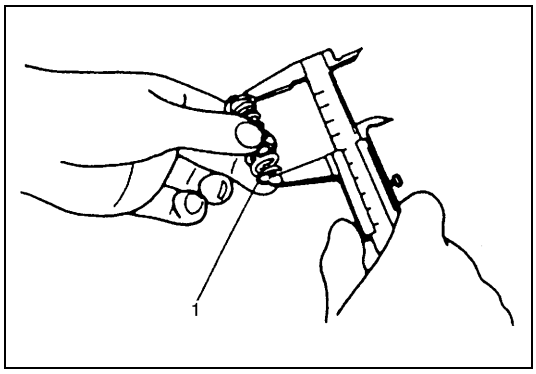
Clearance between rotor and vane
Standard : 0.01 mm (0.0004 in.)
Limit : 0.06 mm (0.0023 in.)

1. Thickness gauge

RELIEF VALVE (FLOW CONTROL VALVE) AND ITS SPRING



- Check fluid passage of relief valve and orifice of connector for obstruction (clogged).
- Check sliding surface of relief valve for wear and damage.

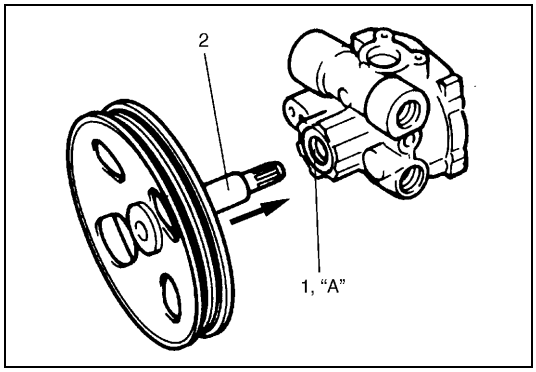


- Check free length of relief valve spring (1).
  Replace pump assembly if any defective is found.

Relief valve spring free length
Standard : 36.5 mm (1.44 in.)
Limit : 33.5 mm (1.32 in.)

ASSEMBLY

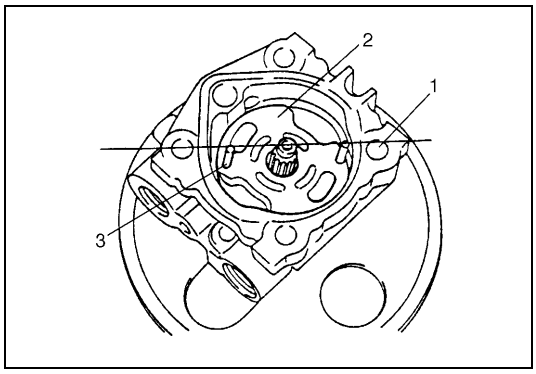
Reverse disassembly procedure for assembly, noting the following.



1) Apply power steering fluid to shaft (2) outer surface and grease to oil seal lip (1) and insert it from oil seal side.

"A" : Grease 99000-25010

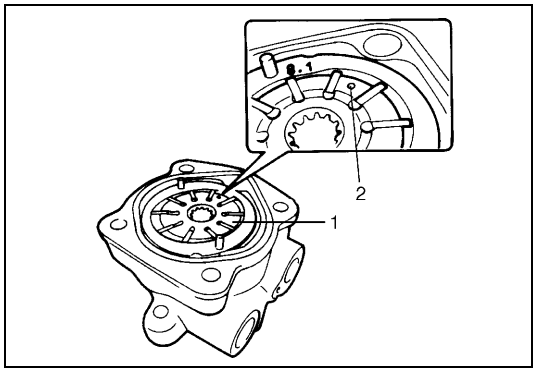
2) Apply power steering fluid to O-rings and fit them to pump body.



3) Install side plate (2) to pump body.

NOTE:

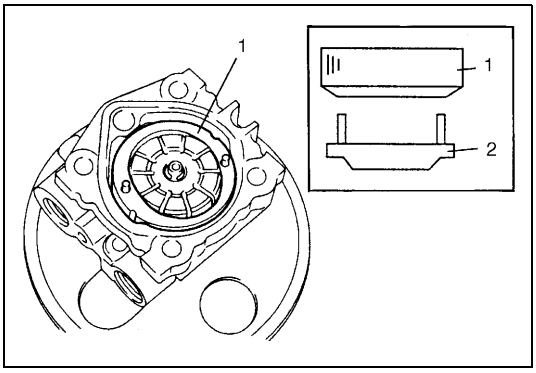
Carefully align the dowel pins (3) on the side plate (2) at bolt hole (1) as shown in figure.



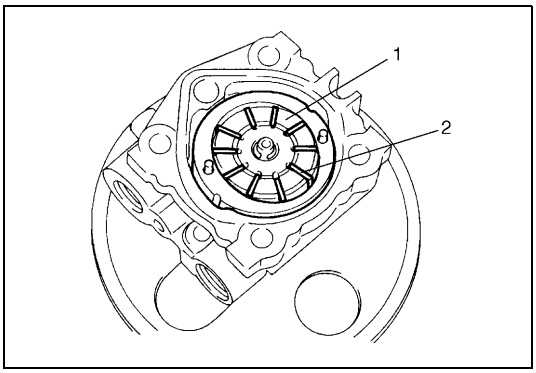
4) Apply power steering fluid to sliding surface of rotor (1).
5) Install rotor (1) to shaft, directing "dot" (2) marked side of rotor toward pump cover (facing up).
6) Install new snap ring to shaft, then make sure to fit snap ring into shaft groove securely.

NOTE:

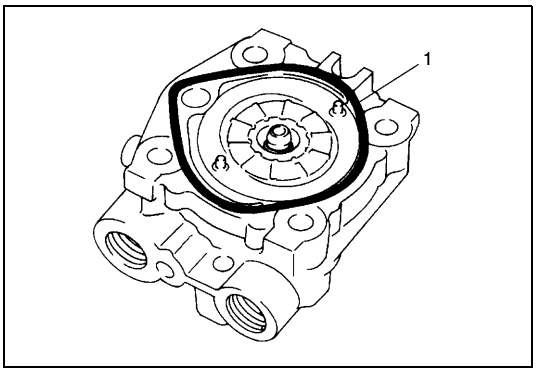
Never reuse the removed snap ring.



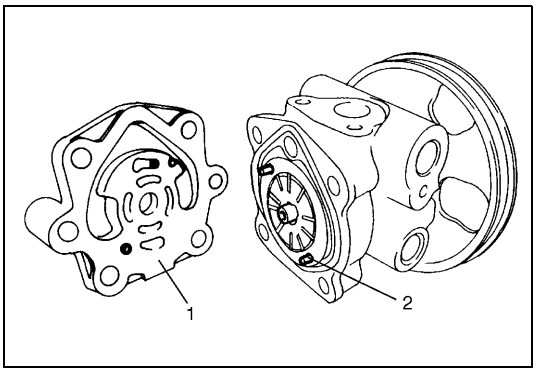
7) Apply power steering fluid to sliding surface of cam ring (1).
8) Install cam ring (1) to pump body. The tapered end of cam ring (1) should face the side plate (2).



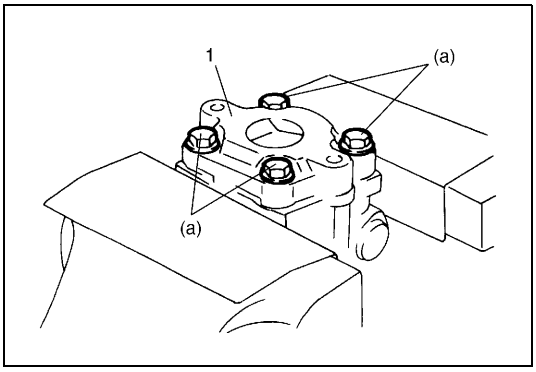
9) Apply power steering fluid to each vane (2).
10) Install vanes (10 pipes) (2) to rotor (1).



11) Apply power steering fluid to O-ring (1) and fit it to pump body.
12) Install O-ring (1) to pump body.



13) Apply power steering fluid to sliding surface of pump cover (1) and rotor.
14) Match the dowel pins (2) to the holes of the cover plate as shown and install pump cover to pump body.

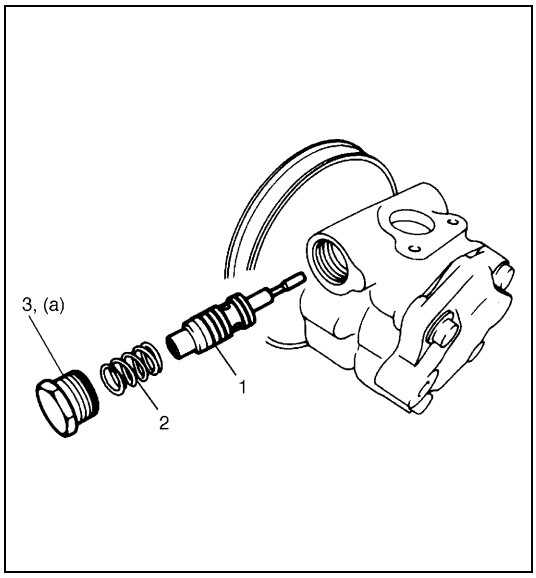


15) Tighten pump cover bolts to specified torque.

NOTE:

After installing pump cover (1), check to make sure that shaft can be turned by hand.

Tightening torque
Oil pump cover bolts
(a) : 28 N·m (2.8 kg-m, 20.0 lb-ft)



16) Apply power steering fluid to relief valve (flow control valve) (1).
17) Install relief valve (flow control valve) (1) to pump body.

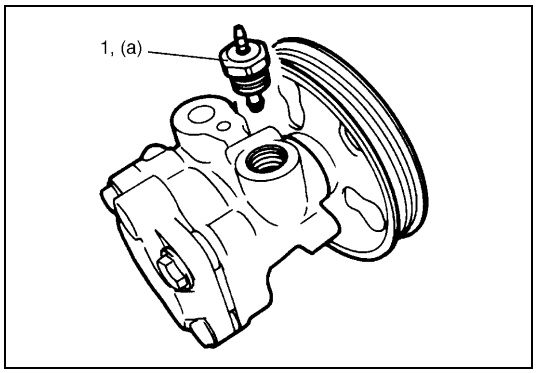
NOTE:

Check that relief valve (flow control valve) slides smoothly.

18) Apply power steering fluid to O-ring of plug (3).
19) Install O-ring to plug (3).
20) Tighten plug to specified torque.

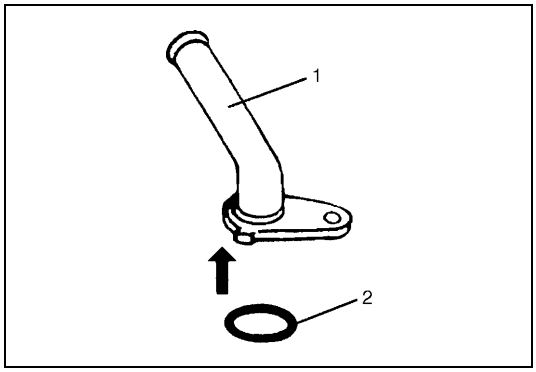
Tightening torque
Plug
(a) : 60 N·m (6.0 kg-m, 43.5 lb-ft)

2. Flow control valve spring

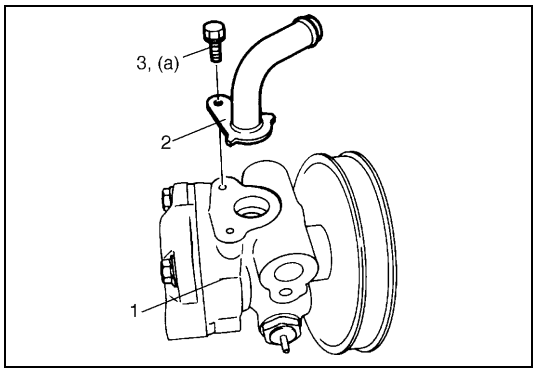


21) Apply power steering fluid to O-rings of pressure switch (1).
22) Install O-rings to pressure switch (1).
23) Install pressure switch (1) to pump body.

Tightening torque
Pressure switch
(a) : 28 N·m (2.8 kg-m, 20.0 lb-ft)



24) Apply power steering fluid to O-ring (2) of suction connector (1).
25) Install O-ring (2) to suction connector (1).



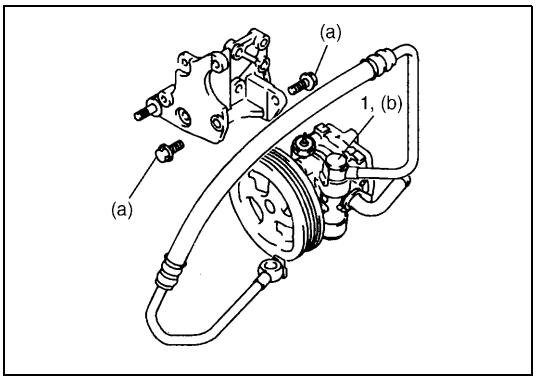
26) Install suction connector (2) to pump body as shown in figure. Tighten suction connector bolt (3) to specified torque.

Tightening torque
Suction connector bolt
(a) : 12 N·m (1.2 kg-m, 8.5 lb-ft)

1. P/S pump

INSTALLATION

CAUTION:
After installation, fill A/T fluid (an equivalent to DEXRON®-II, DEXRON®-IIE or DEXRON®-III) and be sure to bleed air referring to "Air Bleeding Procedure" in this section.



Install components in reverse order of removal procedure noting the following points.

- Tighten each bolt as specified below.

Tightening torque
Oil pump mounting bolts
(a) : 25 N·m (2.5 kg-m, 18.5 lb-ft)
Oil pump high pressure union bolt
(b) : 60 N·m (6.0 kg-m, 43.5 lb-ft)

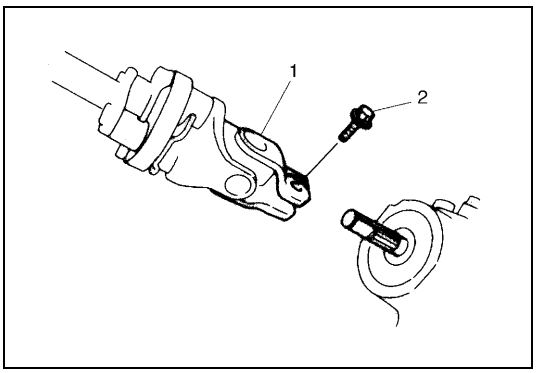
1. Union bolt

- Adjust P/S belt referring to "Power Steering Belt Check" in this section.
- Connect pressure switch terminal.

Power Steering (P/S) Gear Box

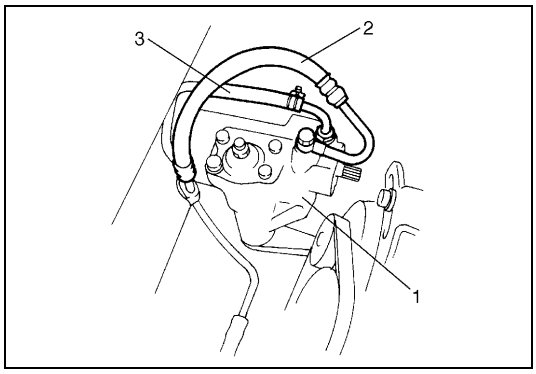
REMOVAL

1) Take out fluid in P/S fluid reservoir with syringe or such.
2) Turn steering wheel fully counterclockwise and loosen sector shaft nut of P/S gear box.
3) Return steering wheel to straightforward state and remove pitman arm from P/S gear box by using puller.
4) Remove radiator (for left-steering vehicle) referring to "Radiator" in Section 6B
5) Remove radiator support member.
6) Disconnect suction hose and return hose from P/S fluid reservoir, and remove P/S fluid reservoir assembly (for left-steering vehicle).



7) Remove steering lower shaft joint bolt (2).

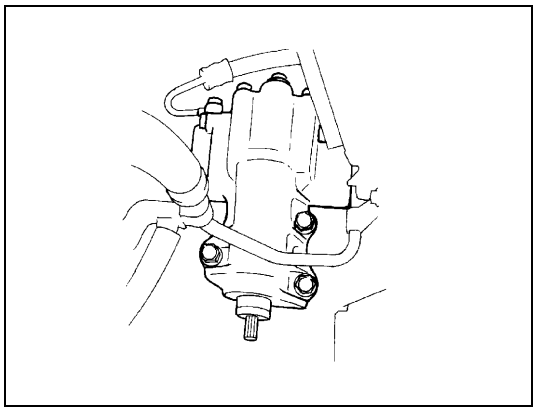
1. Steering lower shaft



8) Disconnect high pressure hose (2) and return hose (3) from gear box (1).

NOTE:

Plug up the section where hose disconnection.



9) Remove gear box assy from vehicle.

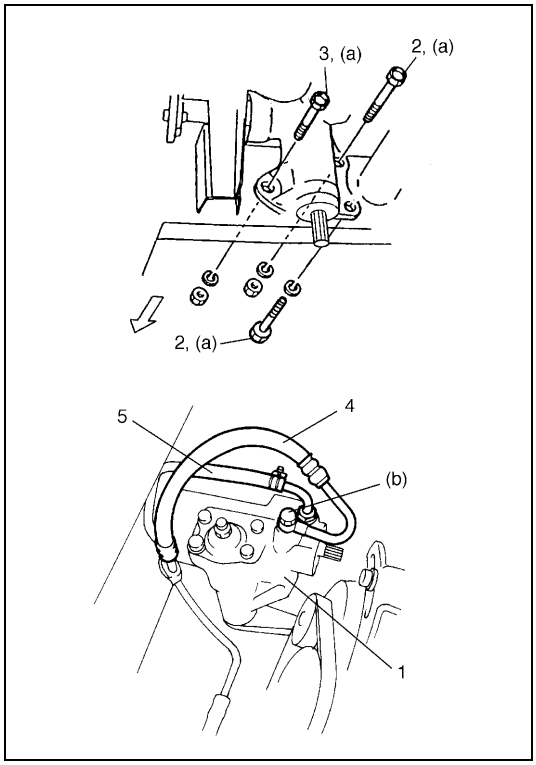
CAUTION:

Never turn gear box input shaft. Otherwise, air goes into gear box, which needs air bleeding for gear box.

NOTE:

- **Don't disassemble P/S gear box.**
- **For adjustment of worm shaft starting torque, refer to item "Adjustment of Worm Shaft Starting Torque" in Section 3B.**

INSTALLATION



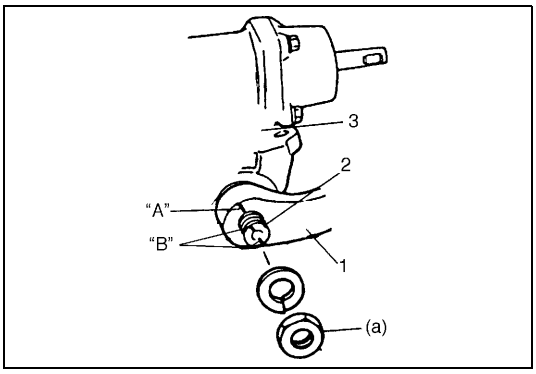
Reverse removal procedure to install P/S gear box noting the following points.

- Tightening torque specification.

Tightening torque
Power steering gear box mounting bolt and nuts
(a) : 80 N·m (8.0 kg-m, 58.0 lb-ft)
Gear box high pressure union bolt
(b) : 35 N·m (3.5 kg-m, 25.5 lb-ft)

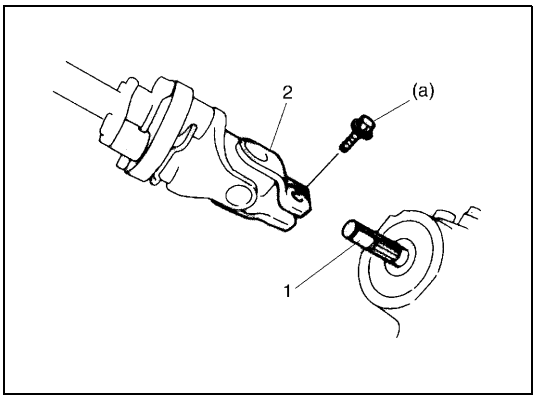
- Before servicing, set steering wheel and wheel / tire at straight position.

1. Steering gear box	4. High pressure hose
2. Bolt (long)	5. Return hose
3. Bolt (short)	



- Install pitman arm (1) to sector shaft (2) of P/S gear box (3) with match marks "A" and "B" aligned as shown in figure and torque to specification.

Tightening torque
Pitman arm mounting nut
(a) : 135 N·m (13.5 kg-m, 98.0 lb-ft)



- Install lower shaft by the following steps.

1) Align flat part of steering gear box worm shaft (1) with bolt hole in lower joint as shown. Then insert lower joint (2) onto worm shaft.
2) Be sure that front wheels and steering wheel are in straight-forward state and insert upper joint onto steering shaft.
3) Torque lower shaft joint bolt to specification.

Tightening torque
Steering shaft lower joint bolt
(a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

- Fill engine coolant to radiator.
- Bleed air in P/S circuit referring to "Air Bleeding Procedure" in this section.

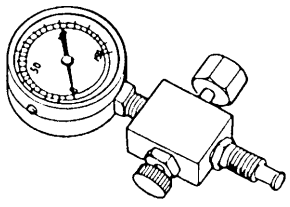
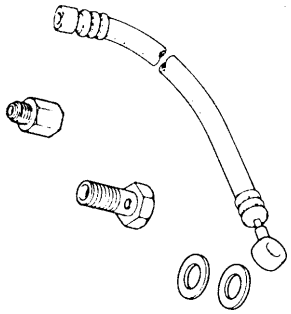
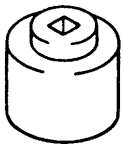
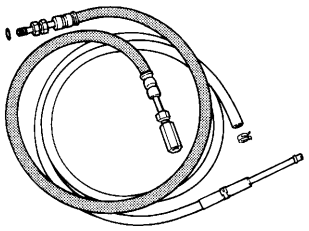
Tightening Torque Specifications

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Tension pulley bolt	25	2.5	18.0
Oil pump mounting bolt	25	2.5	18.5
Oil pump high pressure union bolt	60	6.0	43.5
Oil pump cover bolts	28	2.8	20.0
Pressure switch	28	2.8	20.0
Suction connector bolt	12	1.2	8.5
Power steering gear box mounting bolt and nuts	80	8.0	58.0
Gear box high pressure union bolt	35	3.5	25.5
Pitman arm mounting nut	135	13.5	98.0
Steering shaft joint bolt	25	2.5	18.5
Plug	60	6.0	43.5

Required Service Materials

Material	Recommended SUZUKI product (Part Number)	Use
Power steering fluid	An equivalent of DEXRON®-II, DEXRON®-IIE or DEXRON®-III.	• To fill P/S fluid reservoir • Parts lubrication when installing
Lithium grease	SUPER GREASE (A) (99000-25010)	• Oil seal lip of P/S pump pulley shaft

Special Tools

			
09915-77411 Oil pressure gauge	09915-77420 Oil pressure gauge attachment & hose set	09944-18211 Torque check socket	09945-35010 Air bleeding hose set

SECTION 3C

STEERING WHEEL AND COLUMN

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. 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.**
- **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

General Description 3C-2
Diagnosis 3C-3
Inspection and Repair Required After Accident 3C-3
On-Vehicle Service 3C-3
Service Precautions (For Vehicle with Air Bag System) 3C-3
Diagnosis and servicing 3C-3
Disabling air bag system 3C-3
Enabling air bag system 3C-3
Handling and storage 3C-3
Disposal 3C-3
Drive Air Bag (Inflator) Module (For Vehicle with Air Bag System) 3C-4
Steering Wheel 3C-5
Centering contact coil (for vehicle with air bag system) 3C-8
Combination Switch (For Vehicle without Air Bag System)/Contact Coil and Combination Switch Assembly (For Vehicle with Air Bag System) 3C-9
Steering Column Assembly 3C-11
Steering Lock Assembly (Ignition Switch) 3C-15
Steering Lower Shaft 3C-16
Checking Steering Column for Accident Damage 3C-18
Tightening Torque Specifications 3C-19
Required Service Material 3C-19
Special Tool 3C-19

General Description

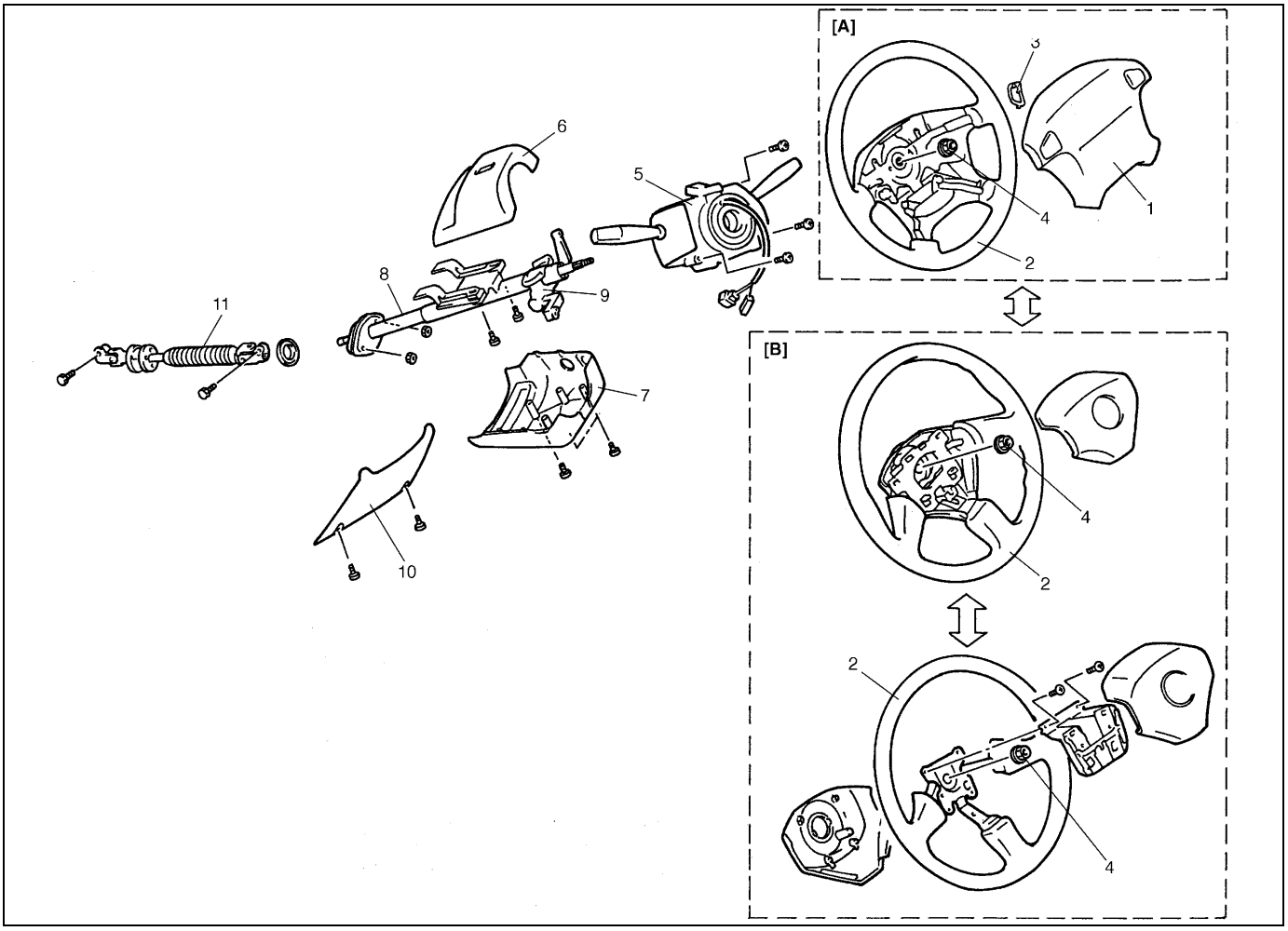
This double tube type steering column has the following three important features in addition to the steering function:

- The column is energy absorbing, designed to compress in a front-end collision.
- The ignition switch and lock are mounted conveniently on this column.
- With the column mounted lock, the ignition and steering operations can be locked to inhibit theft of the vehicle.

To insure the energy absorbing action, it is important that only the specified screws, bolts and nuts be used as designated and that they are tightened to the specified torque.

When the column assembly is removed from the vehicle, special care must be taken in handling it. Use of a steering wheel puller other than the one recommended in this manual or a sharp blow on the end of the steering shaft, leaning on the assembly, or dropping the assembly could shear the plastic shear pins which maintain column length and position.

The driver air bag (inflator) module is one of the supplemental restraint (air bag) system components and is mounted to the center of the steering wheel. During certain frontal crashes, the air bag system supplements the restraint of the driver's and passenger's seat belts by deploying the air bags.
The air bag (inflator) module should be handled with care to prevent accidental deployment. When servicing, be sure to observe all WARNINGS and CAUTIONS in this section and "Service Precautions" in Section 10B.



1. Driver air bag (inflator) module	6. Steering column upper cover	11. Steering lower shaft
2. Steering wheel	7. Steering column lower cover	[A] : For vehicle with air bag system
3. Steering wheel side cap	8. Steering column assembly	[B] : For vehicle without air bag system
4. Steering wheel nut	9. Steering lock assembly (ignition switch)	
5. Combination switch or contact coil and combination switch assembly	10. Steering column hole cover	

Diagnosis

For maintenance service of the steering wheel and column, refer to “Steering System Inspection” in Section 0B.
For diagnosis of the steering wheel and column, refer to “Diagnosis Table” in Section 3.
For diagnosis of the air bag system, refer to “Air Bag Diagnosis System Check Flow Table” in Section 10B.

Inspection and Repair Required After Accident

- For vehicle without air bag system
  After an accident, be sure to perform checks, inspections and repairs described under “Checking Steering Column for Accident Damage” in this section.
- For vehicle with air bag system
  After an accident, whether the air bag has been deployed or not, be sure to perform checks, inspections and repairs described under “Checking Steering Column for Accident Damage” in this section as well as “Repairs and Inspections Required after Accident” under “Diagnosis” in Section 10B.

On-Vehicle Service

Service Precautions (For Vehicle with Air Bag System)

Refer to “Service Precautions” in Section 10B.

Diagnosis and servicing

Refer to “Diagnosis and Servicing” in Section 10B.

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” in Section 10B.

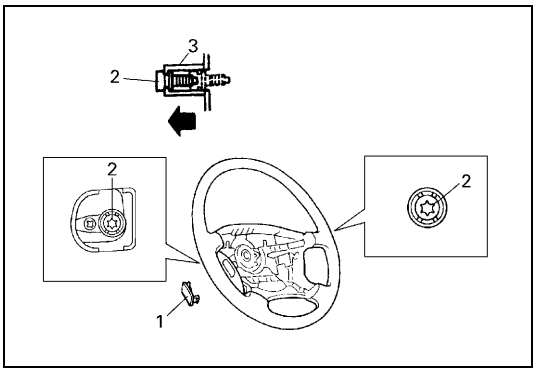
Drive Air Bag (Inflator) Module (For Vehicle with Air Bag System)

WARNING:

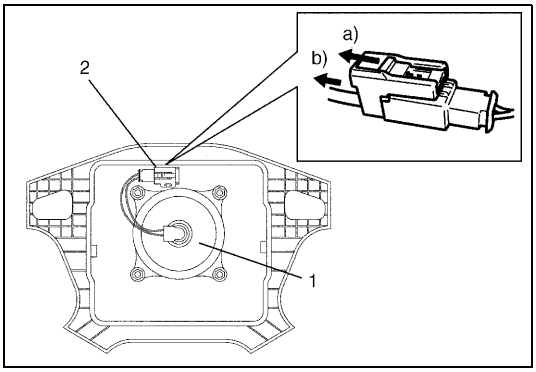
When handling an air bag (inflator) module, be sure to read "Service Precautions" given earlier in this section and observe each instruction. Failure to follow them could cause a damage to the air bag (inflator) module or result in personal injury.

REMOVAL

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

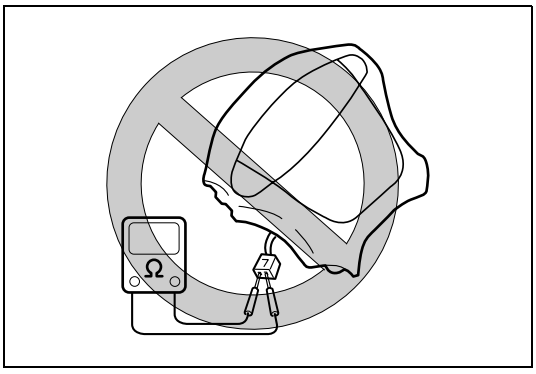


3) Remove steering wheel side cap (1) of left side.
4) Loosen 2 bolts (2) mounting driver air bag (inflator) module till it turns freely, pull them out and fix them to bolt clamps (3).



5) Remove driver air bag (inflator) module (1) from steering wheel.
6) Disconnect yellow connector (2) in order a) – b) as shown.

INSPECTION

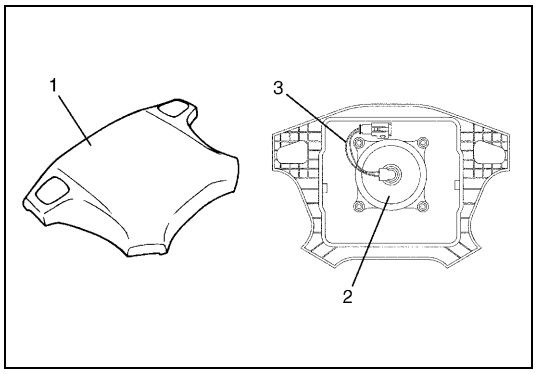


WARNING:

Never disassemble driver 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.

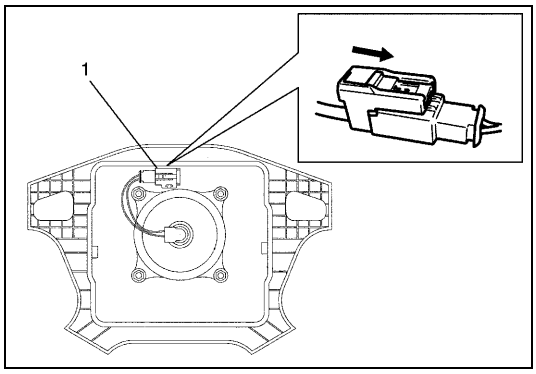


Check air bag (inflator) module visually and if any of the following is found, replace it with a new one.

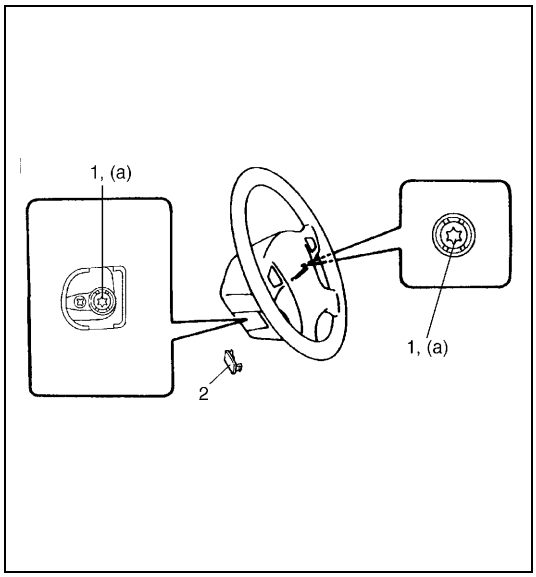
- Air bag being deployed
- Trim cover (1) (pad surface) being cracked
- Wire harness (3) or connector being damaged
- Air bag (inflator) module being damaged or having been exposed to strong impact (dropped)

2. Inflator case

INSTALLATION



1) Check that horn wire is connected to horn terminal securely.
2) Connect yellow connector (1) of driver air bag (inflator) module (3) pushing connector till it is locked.



3) Install driver air bag (inflator) module to steering wheel, taking care so that no part of wire harness is caught between them.
4) Make sure that clearance between module and steering wheel is uniform all the way.
5) Tighten driver air bag (inflator) module mounting bolts (1) to specified torque.

Tightening torque
Driver air bag (inflator) module mounting bolts
(a) : 9 N·m (0.9 kg-m, 6.5 lb-ft)

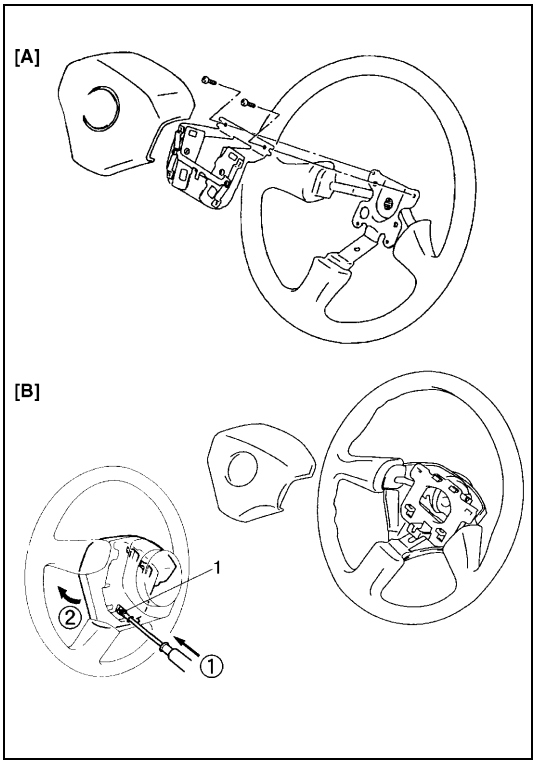
6) Install steering wheel side cap (2).
7) Connect negative battery cable.
8) Enable air bag system. Refer to “Enabling Air Bag System” under “Service Precautions” in Section 10B.

Steering Wheel

CAUTION:
For vehicle with air bag system
Removal of the steering wheel allows the contact coil to turn freely but do not turn the contact coil (on the combination switch) more than allowable number of turns (about two and a half turns from the center position clockwise or counterclockwise respectively), or coil will break.

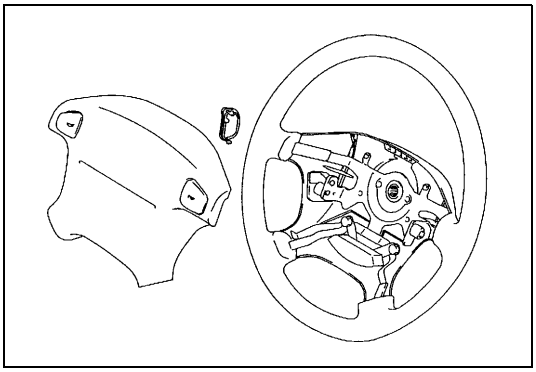
REMOVAL

1) Disconnect negative battery cable at battery terminal.



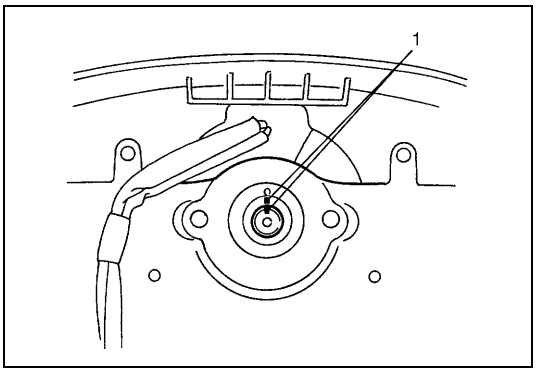
2) Remove steering wheel pad (for vehicle without air bag system) or driver air bag (inflator) module (for vehicle with air bag system) as follows.
   - Vehicle without air bag system for TYPE A
   a) Remove steering wheel pad.
   b) Disconnect horn connector.
   - Vehicle without air bag system for TYPE B
   a) As shown in the figure, while pushing the set spring (1) with a screwdriver or the like inserted in the hole of the steering wheel, pull the lower part of the pad forward and remove the steering wheel pad.

[A] : For TYPE A
[B] : For TYPE B

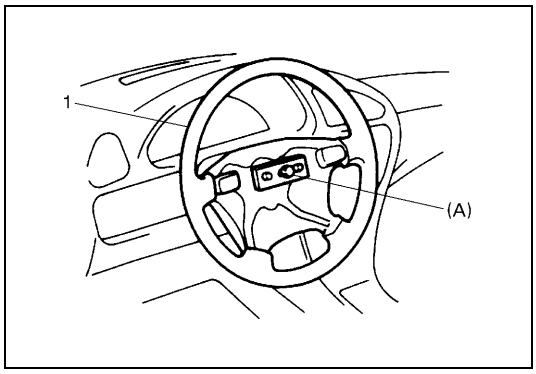


   - Vehicle with air bag system
   a) Remove driver air bag (inflator) module from steering wheel referring to “Driver Air Bag (Inflator) Module” in this section.

3) Remove steering shaft nut.



4) Make alignment marks (1) on steering wheel and shaft for a guide during reinstallation.



5) Remove steering wheel (1) with special tool.

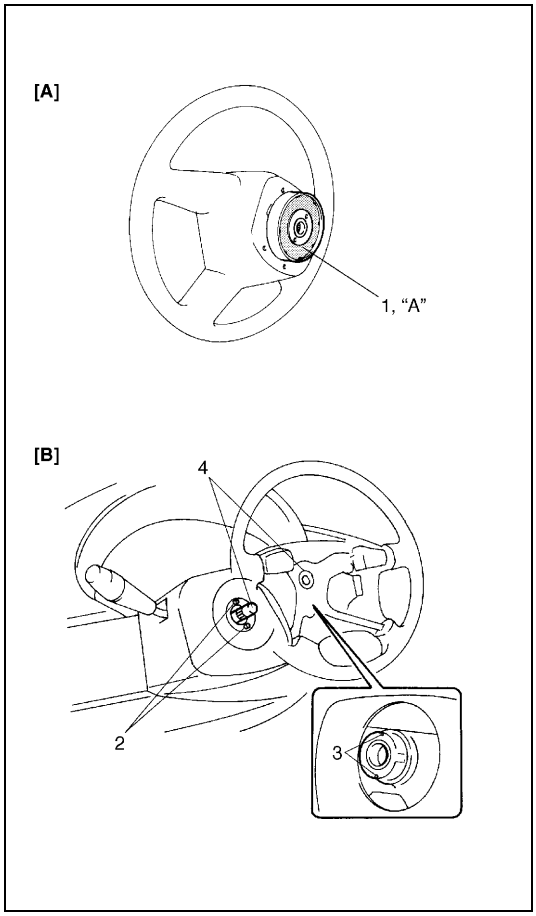
Special tool
(A) : 09944-36011

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.

INSTALLATION

1) Check that vehicle's front tires are at straight-ahead position. If equipped with air bag system, align contact coil to original position referring to "Centering Contact Coil" in this section.

CAUTION:
For vehicle with air bag system
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 as follows.
- For vehicle without air bag system

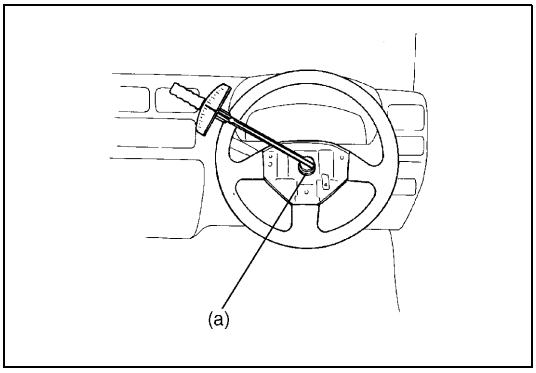
a) Apply grease to contact plate (1).

"A" : Grease 99000-25290

b) Install steering wheel onto shaft, aligning them by match marks.

- For vehicle with air bag system
  Install steering wheel to steering shaft with 2 lugs (2) on contact coil fitted in two grooves (3) in the back of steering wheel and also aligning marks (4) on steering wheel and steering shaft.

[A] : For vehicle without air bag system
[B] : For vehicle with air bag system



3) Tighten steering shaft nut to specified torque.

Tightening torque
Steering shaft nut (a) : 33 N·m (3.3 kg-m, 23.5 lb-ft)

NOTE:

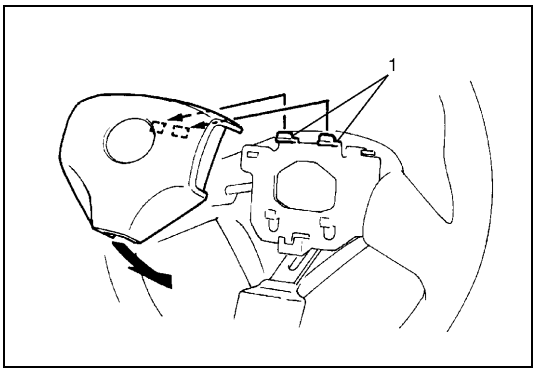
After installing the steering wheel, turn the steering wheel about 1 full rotation so that the cancel cam pin fits into the pin hole in the steering wheel and then check the turn signal lever for proper function.

4) Install steering wheel pad (for vehicle without air bag system) or driver air bag (inflator) module (for vehicle with air bag system) as follows.

• For vehicle without air bag system

– For TYPE A

a) Connect horn connector.
b) Install steering wheel pad.



– For TYPE B

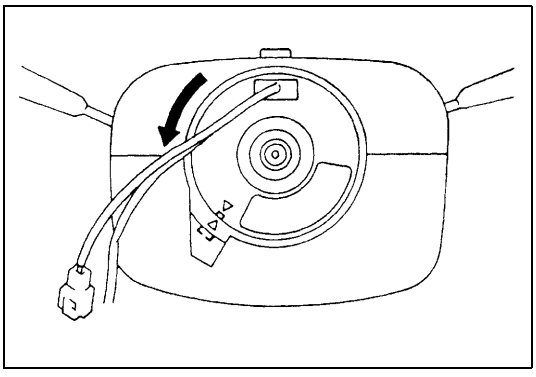
a) To install the pad, hook (1) the upper part of the pad to the pawl of the steering wheel and push in the lower part of the pad until it fits to the set spring securely.

• For vehicle with air bag system

a) Install driver air bag (inflator) module to steering wheel. Refer to “Driver Air Bag (Inflator) Module” in this section.

Centering contact coil (for vehicle with air bag system)

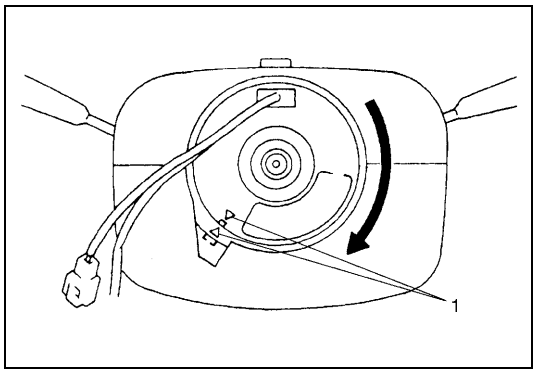
1) Check that vehicle’s wheels (front tires) are set at straight-ahead position.
2) Check that ignition switch is at “LOCK” position.



3) 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.



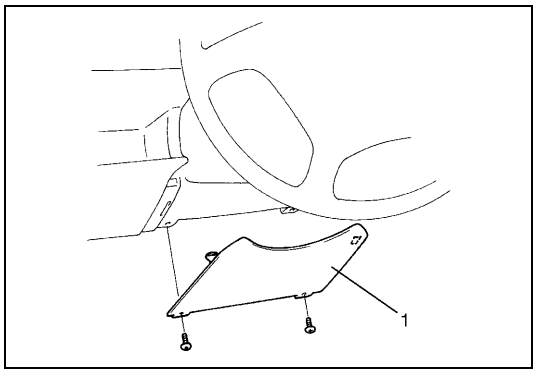
4) From the position where contact coil became unable to turn any further (it stopped), turn it back clockwise about two and a half rotations and align center mark with alignment mark (1).

Combination Switch (For Vehicle without Air Bag System)/Contact Coil and Combination Switch Assembly (For Vehicle with Air Bag System)

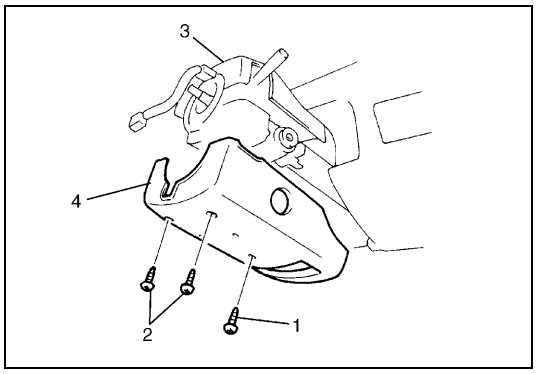
CAUTION:
For vehicle with air bag system
Do not turn contact coil (on combination switch) more than allowable number of turns (about two and a half turns from the center position clockwise or counter-clockwise respectively), or coil will break.

REMOVAL

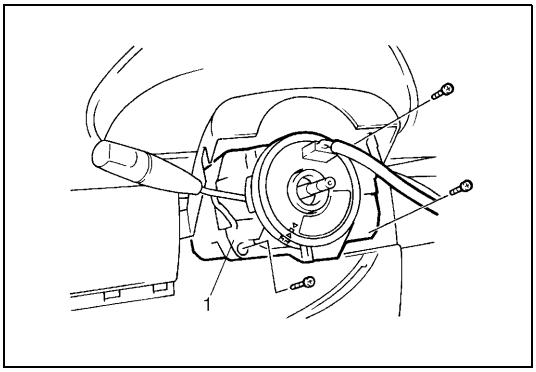
1) Remove steering wheel from steering column referring to "Steering Wheel" in this section.



2) Remove steering column hole cover (1).

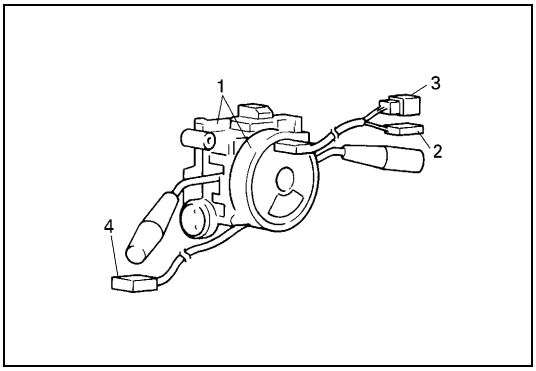


3) Remove steering column cover standard screw (1) and tapping screws (2).
4) Loosen steering column mounting bolts and nuts referring to "Steering Column" in this section.
5) Separate upper cover (3) and lower cover (4), then remove them.
6) Disconnect all connectors for combination switch/contact coil and combination switch assembly.



7) Remove combination switch/contact coil and combination switch assembly (1) from steering column.

INSPECTION

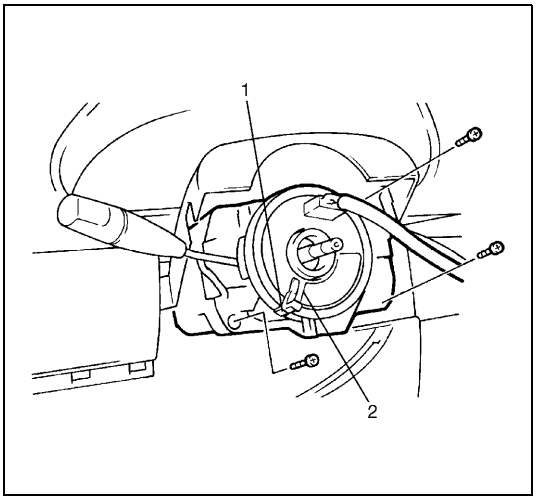


- For vehicle with air bag system
  Check contact coil and combination switch wire harness for any signs of scorching, melting or other damage. If it is damaged, replace.

1.	Contact coil and combination switch assembly
2.	To horn
3.	Connector to driver air bag (inflator) module
4.	Connector to air bag wire harness

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.



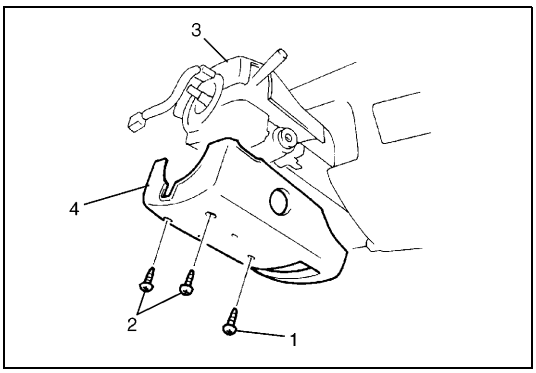
2) Install combination switch/contact coil and combination switch assembly to steering column.

NOTE:

For vehicle with air bag system

New contact coil and combination switch assembly is supplied with contact coil set and held at its center position with a lock pin (2) and seal (1). Remove this lock pin after installing contact coil and combination switch assembly to steering column.

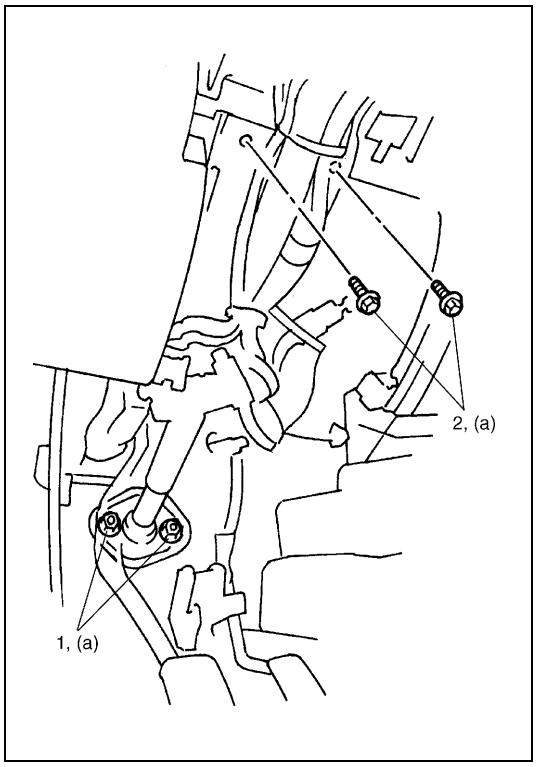
3) Connect all connectors that have been disconnected in "REMOVAL".



4) Install steering column upper (3) and lower cover (4), and then tighten steering column cover standard screw (1) and tapping screws (2).

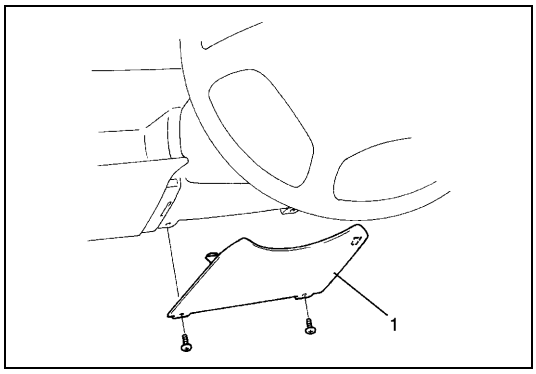
CAUTION:

When installing lower cover (3) and upper cover (2), be careful so that combination switch/contact coil and combination switch lead wirer is not caught between covers.



5) Tighten steering column mounting nuts and bolts by hand and then tighten mounting nuts (1) first, and then tighten mounting bolts (2).

Tightening torque
Steering column mounting bolts and nuts
(a) : 14 N·m (1.4 kg-m, 10.5 lb-ft)



6) Install steering column hole cover (1).
7) Install steering wheel to steering column referring to “Steering Wheel” in this section.

Steering Column Assembly

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.

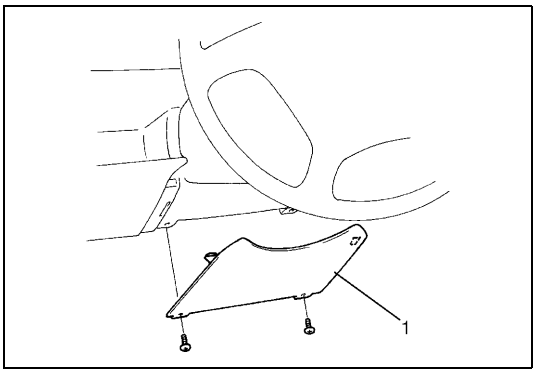
NOTE:

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.

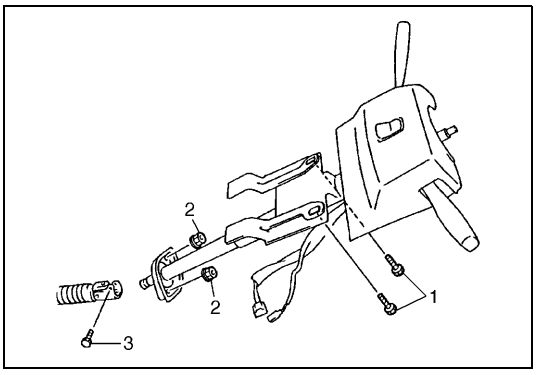
REMOVAL

WARNING:
For vehicle with air bag system
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.

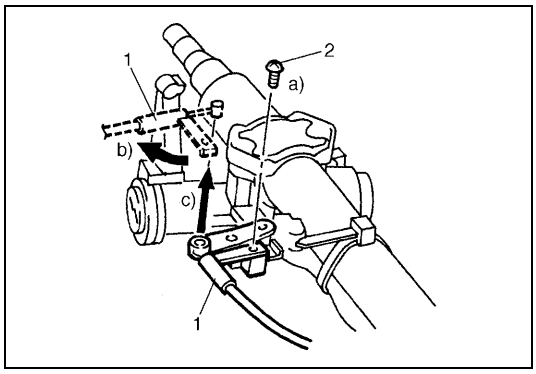
1) Disconnect negative battery cable at battery terminal.
2) For vehicle equipped with air bag system, disable air bag system referring to “Disabling Air Bag System” in Section 10B.
3) If necessary, remove steering wheel and combination switch assembly referring to “Steering Wheel” and “Combination switch/Contact Coil and Combination Switch Assembly” in this section.
   If not removing steering wheel and/or combination switch assembly, perform the following procedure.
   a) Turn steering wheel so that vehicle’s front tires are at straight ahead position.
   b) Turn ignition switch to “LOCK” position and remove key.



4) Remove steering column hole cover (1).
5) Disconnect all connectors of the following parts.
   • Combination switch/contact coil and combination switch assembly.
   • Ignition switch.
   • Immobilizer control system parts (if equipped).

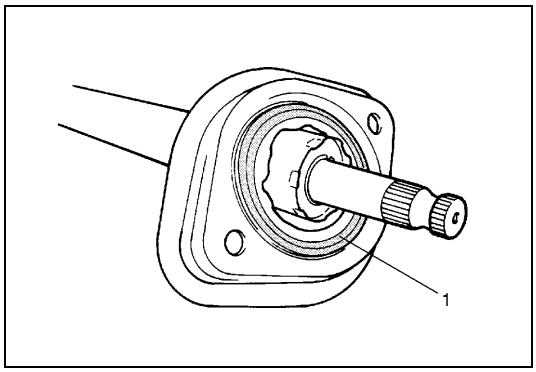


6) Remove joint bolt (steering column side) (3) and loosen joint bolt (steering gear box side).
7) Remove steering column mounting nuts (2) and bolts (1).



8) If equipped with shift (key) interlock cable (1), remove shift (key) interlock cable screw (2) and then disconnect its cable from ignition switch in order a) – c) as shown in the figure.

9) Remove steering column from vehicle.



10) Remove steering column seal (1) from steering column lower bracket.

CAUTION:

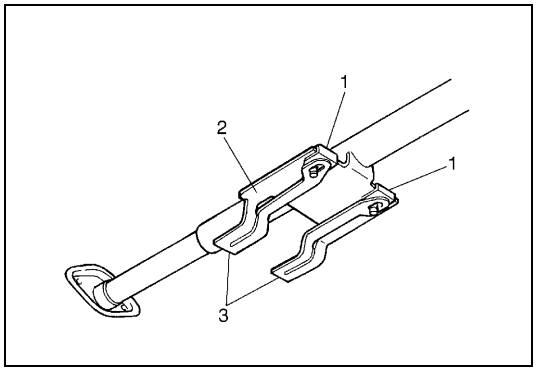
Don't separate double tube type steering column assembly into steering column and shaft. If column or shaft is defective, replace as and assembly.

INSPECTION

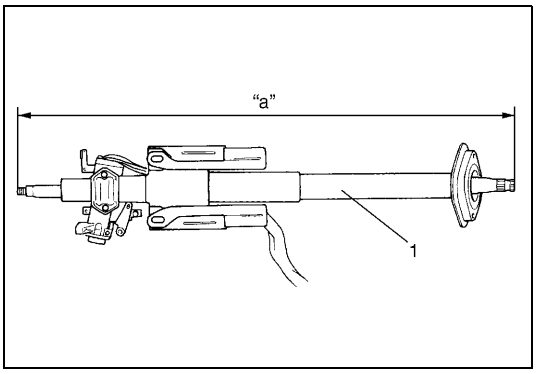
NOTE:

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



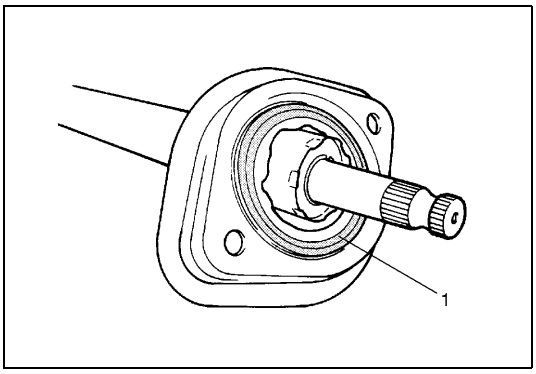
1) Check that two capsules (1) are attached to steering column bracket (2) securely. Check clearance between capsules and steering column bracket. Clearance should be 0.0 mm (0.0 in.) on both sides.
   If found loose or clearance, replace steering column assembly.
2) Check two plates (3) for any damages such as crack or breakage.
   If anything is found faulty, replace as steering column assembly.



3) Take measurement "a" as shown.
   If it is shorter than specified length, replace column assembly (1) with new one.

Steering column assembly length
"a" : 733.2 – 734.8 mm (28.87 – 28.93 in.)

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

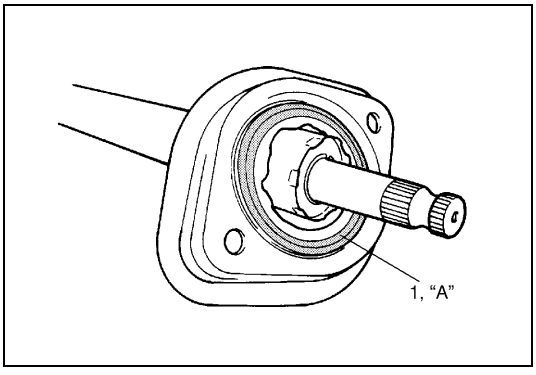


7) Check steering column lower seal (1) for breakage or deformation. If found defective, replace.

INSTALLATION

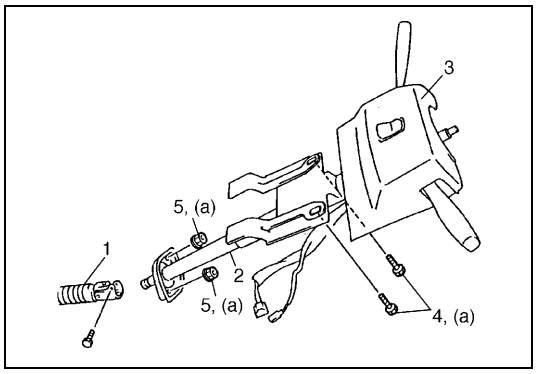
CAUTION:
After tightening steering column mounting bolts and nuts shaft joint bolts should be tightened.

1) Be sure that front wheels and steering wheel are in straight forward state.
2) If equipped, install shift (key) interlock cable to ignition switch.



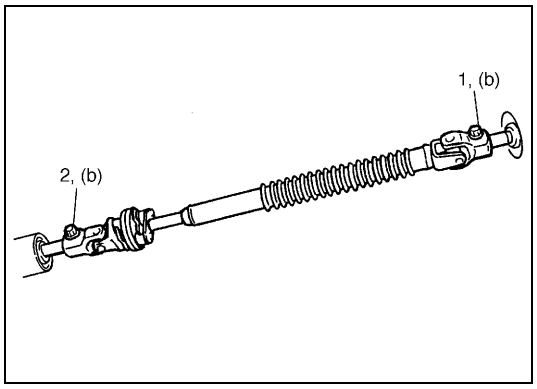
3) Apply sealant to the steering column lower bracket (shaded section in the figure) and fit the steering column seal (1) to the stepped part of the steering column lower bracket securely.

"A" : Sealant 99000-31090



4) Insert steering lower shaft (1) to steering shaft.
5) Put the steering column upper cover (3) on top of the steering column (2), if necessary and then tighten steering column mounting nuts (5) and bolts (4) by hand.
6) Tighten mounting nuts (5) first and then mounting bolts (4) to specified torque.

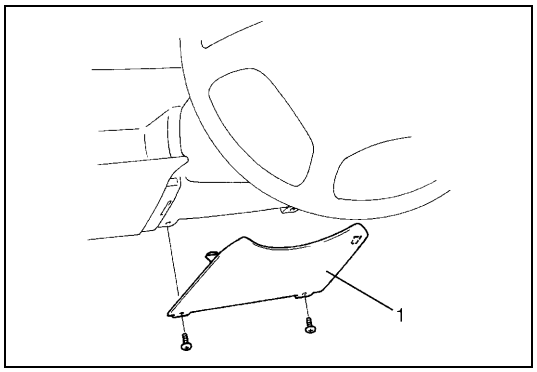
Tightening torque
Steering column mounting bolts and nuts
(a) : 14 N·m (1.4 kg-m, 10.5 lb-ft)



7) Tighten steering column side joint bolt (1) first, and then tighten steering gear box side joint bolt (2).

Tightening torque
Steering shaft joint bolts (b) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

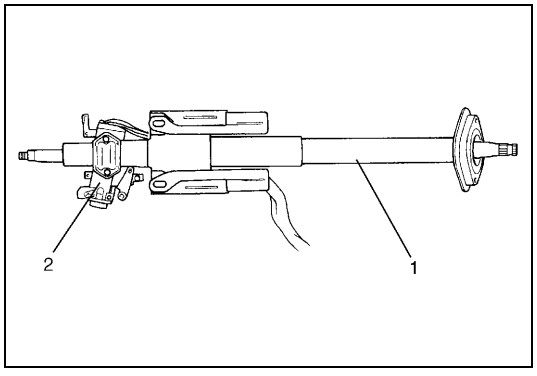
8) If combination switch is removed, install combination switch referring to “Combination Switch/Contact Coil and Combination Switch Assembly” in this section.
9) Connect all connectors that have been removed in “removal”.



10) Install steering column hole cover (1).
11) If steering wheel is removed, install steering wheel referring to “Steering Wheel” in this section.
12) If the vehicle equipped with air bag system, enable air bag system referring to “Enabling Air Bag System” in Section 10B.
13) Connect negative battery cable.

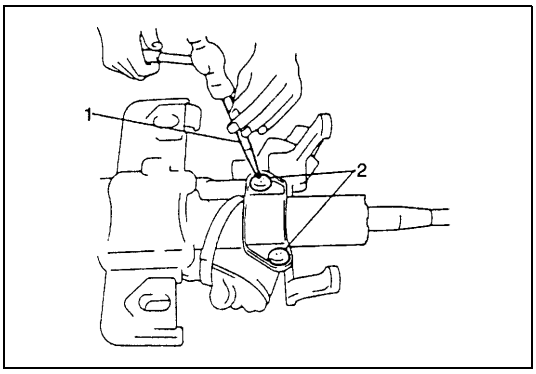
Steering Lock Assembly (Ignition Switch)

REMOVAL



1) Remove steering column (1) referring to “Steering Column” in this section.

2. Steering lock



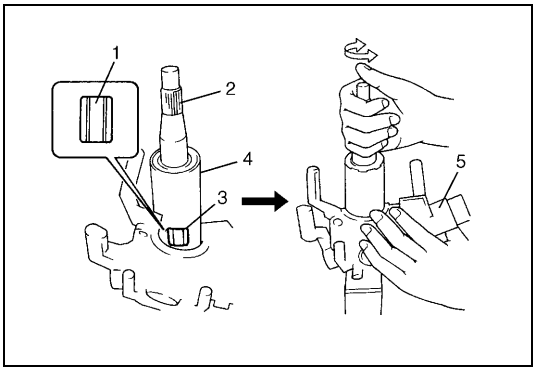
2) Loosen and remove steering lock mounting bolts (2) using center punch (1) as shown.

NOTE:

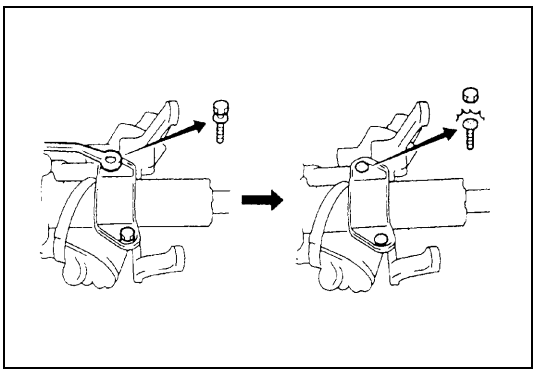
Use care not to damage aluminum part of steering lock body with center punch.

3) Turn ignition key to “ACC” or “ON” position and remove steering lock assembly from steering column.

INSTALLATION



1) Position oblong hole (1) of steering shaft in the center of hole (3) in column (4).
2) Turn ignition key to “ACC” or “ON” position and install steering lock assembly (5) onto column (4).
3) Now turn ignition key to “LOCK” position and pull it out.
4) Align hub on lock with oblong hole (1) of steering shaft and rotate shaft to assure that steering shaft (2) is locked.



5) Tighten new bolts until head of each bolt is broken off.
6) Turn ignition key to “ACC” or “ON” position and check to be sure that steering shaft rotates smoothly. Also check for lock operation.

7) Install steering column referring to “Steering Column” in this section.

Steering Lower Shaft

CAUTION:

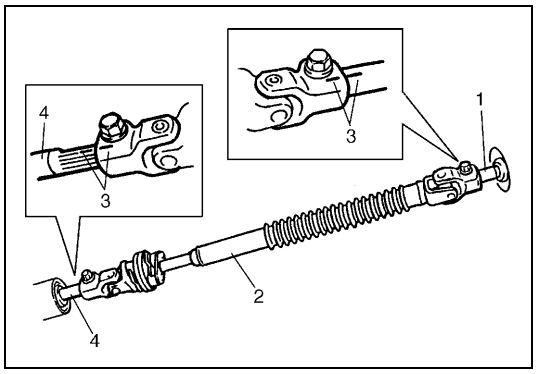
For vehicle with air bag system

Never turn steering wheel while steering shaft lower joint is removed.

Should it have been turned and contact coil (on combination switch) 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.

REMOVAL

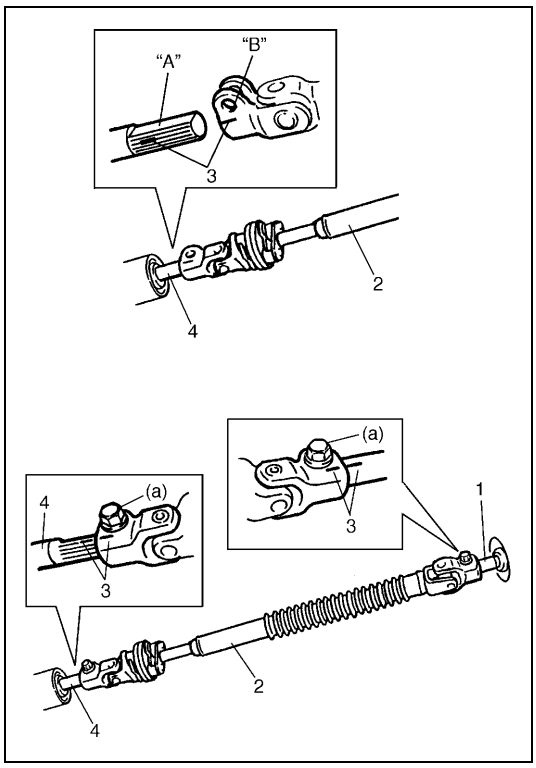
1) Turn steering wheel so that vehicle’s front tires are at straight-ahead position.
2) Turn ignition switch to “LOCK” position and remove key.



3) Make alignment marks (3) on lower shaft (2) and shaft (column side) (1) and lower shaft (2) and gear box shaft (gear box side) (4) for a guide during reinstallation.
4) Remove lower shaft joint bolts.
5) Remove steering lower shaft.

INSTALLATION

1) Be sure that front wheels and steering wheel are in straight forward state.
2) Insert lower shaft joint into shaft of steering column with matching marks (3).



3) Align flat part "A" of steering gear box shaft (4) with bolt hole "B" of lower shaft joint as shown. Then insert lower shaft joint into steering gear box shaft (4) with matching marks (3).
4) Tighten shaft joint bolt (column side) to specified torque first and then shaft joint bolt (gear box shaft side) to specified torque.

Tightening torque
Steering shaft joint bolts (a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

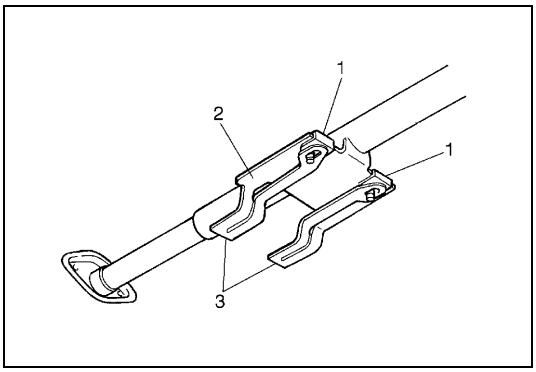
1. Steering column assembly
2. Steering lower shaft

Checking Steering Column for Accident Damage

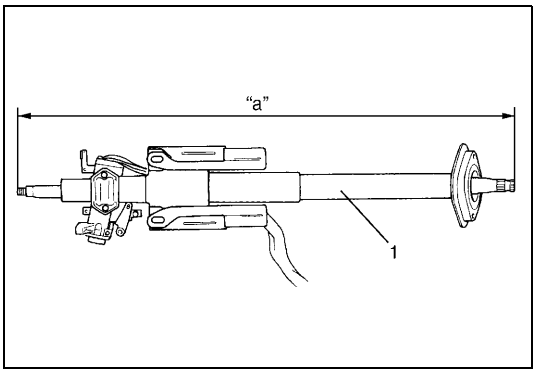
NOTE:

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

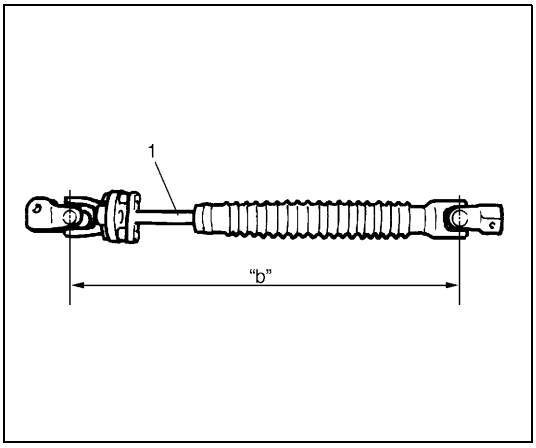


1) Check that two capsules (1) are attached to steering column bracket (2) securely. Check clearance between capsules (1) and steering column bracket (2). Clearance should be 0.0 mm (0.0 in.) on both sides.
   If found loose or clearance, replace steering column assembly.
2) Check two plates (3) for any damages such as crack or breakage.
   If anything is found faulty, replace as steering column assembly.



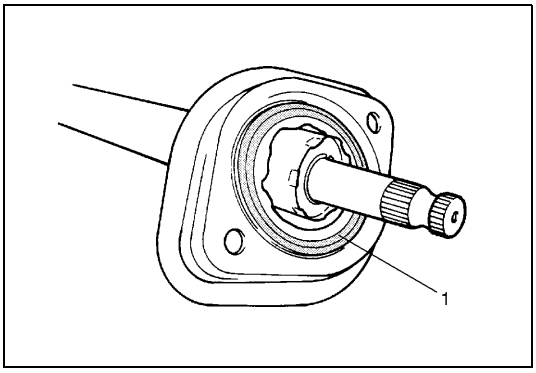
3) Take measurement "a" as shown.
   If it is shorter than specified length, replace column assembly (1) with new one.

Steering column assembly length
"a" : 733.2 – 734.8 mm (28.87 – 28.93 in.)



4) Check if steering lower shaft (1) is with in specified length.
   If it is out of specified length, replace it with new one.

Steering lower shaft length
"b" : 478.3 – 480.3 mm (18.83 – 18.91 in.)
(For LH steering vehicle without P/S system)
438.3 – 440.3 mm (17.26 – 17.33 in.)
(For RH steering vehicle without P/S system)
393.6 – 395.6 mm (15.50 – 15.57 in.)
(For LH steering vehicle with P/S system)
434.2 – 436.2 mm (17.09 – 17.17 in.)
(For RH steering vehicle with P/S system)



5) Check steering column lower seal (1) for breakage or deformation.
   If found defective, replace.

6) 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.
7) Check steering shaft for smooth rotation.
   If found defective, replace as column assembly.
8) Check steering shaft and column for bend, cracks or deformation.
   If found defective, replace.

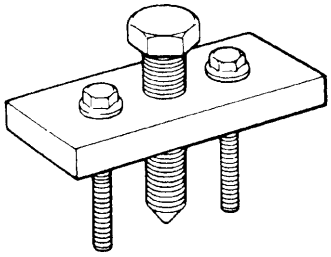
Tightening Torque Specifications

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Driver air bag (inflator) module bolts	9	0.9	6.5
Steering shaft nut	33	3.3	23.5
Steering column mounting bolts and nuts	14	1.4	10.5
Steering shaft joint bolts	25	2.5	18.0

Required Service Material

Material	Recommended SUZUKI product	Use
Water tight sealant	SEALING COMPOUND 366E (99000-31090)	• To apply to steering column seal.
Lithium grease	SUZUKI GREASE CE-T (99000-25290)	• Contact plate

Special Tool



09944-36011
Steering wheel remover

SECTION 3D

FRONT SUSPENSION

WARNING:

When hoisting vehicle, be sure to select the lifting point suitable for the service work referring to Section 0A.

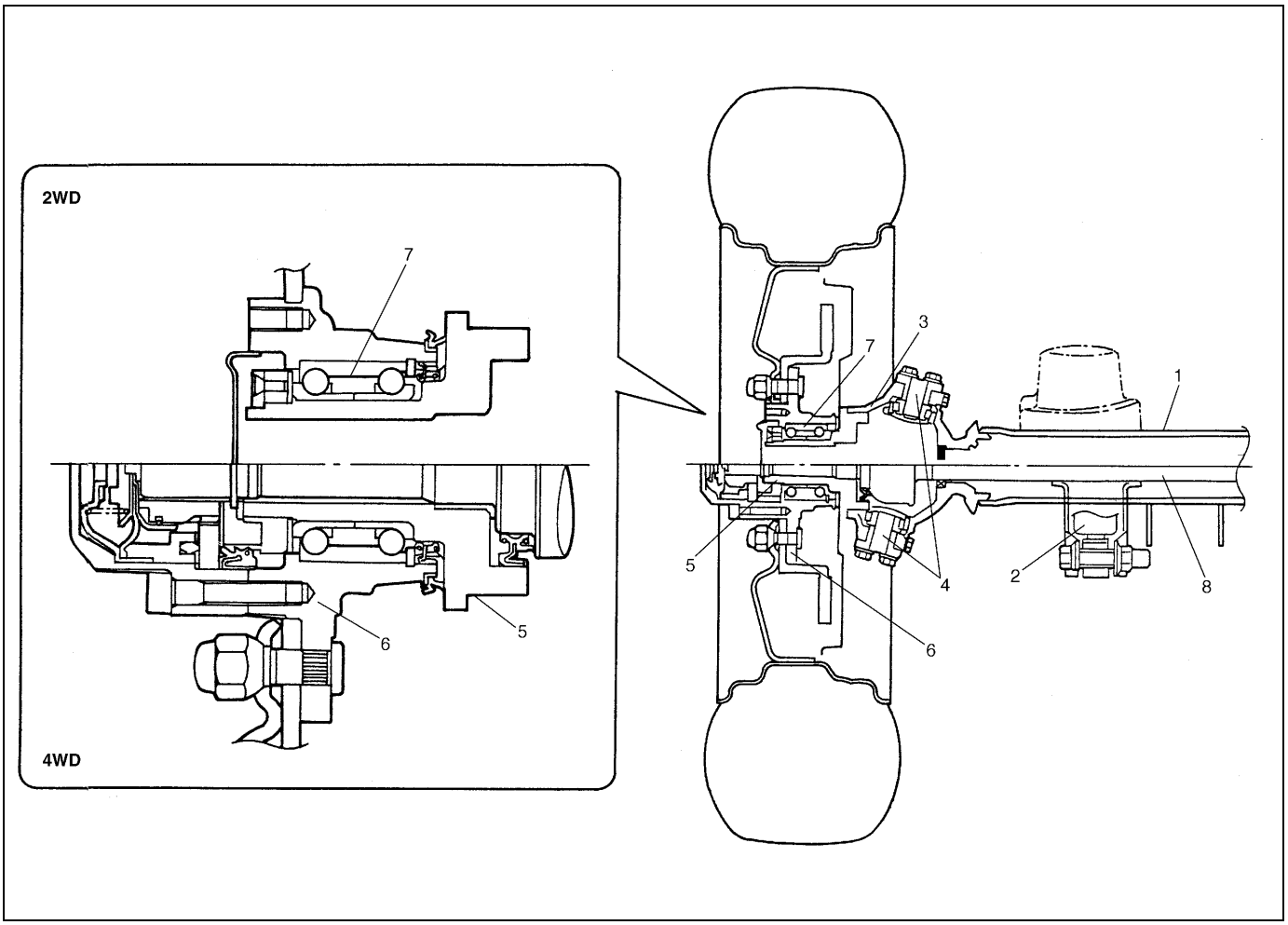
NOTE:

- **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 3D-2
4WD Control System 3D-2
Diagnosis 3D-8
Diagnosis Table 3D-8
4WD Controller and ITS Circuit Check 3D-10
4WD Control System Check 3D-11
Stabilizer bar / bushing check 3D-13
Shock Absorber and/or Coil Spring Check 3D-14
Leading Arm / Lateral Rod / Steering Knuckle Check 3D-14
Leading Arm Bushing / Lateral Rod Bushing Check 3D-15
Kingpin / Kingpin Bearing Check 3D-15
Barfield Joint Check 3D-15
Steering Knuckle Seal Check 3D-15
Wheel Disc, Nut and Bearing Check 3D-16
On-Vehicle Service 3D-17
Stabilizer Bar / Bushings 3D-17
Front Shock Absorber 3D-19
Coil Spring 3D-19
Bump Stopper and Spring Upper Seat 3D-21
Wheel Hub / Bearing / Oil Seal 3D-21
Steering Knuckle / Wheel Spindle 3D-28
Front Axle Shaft / Oil Seal / Kingpin Bearing Outer Race 3D-32
Steering Knuckle Seal 3D-34
Lateral Rod 3D-35
Leading Arm / Bushing 3D-36
Front Axle Housing 3D-38
Tightening Torque Specifications 3D-44
Required Service Material 3D-44
Special Tool 3D-45

General Description



1. Front axle housing	3. Steering knuckle	5. Wheel spindle	7. Wheel bearing
2. Shock absorber	4. Kingpin	6. Wheel hub	8. Front axle shaft (4WD)

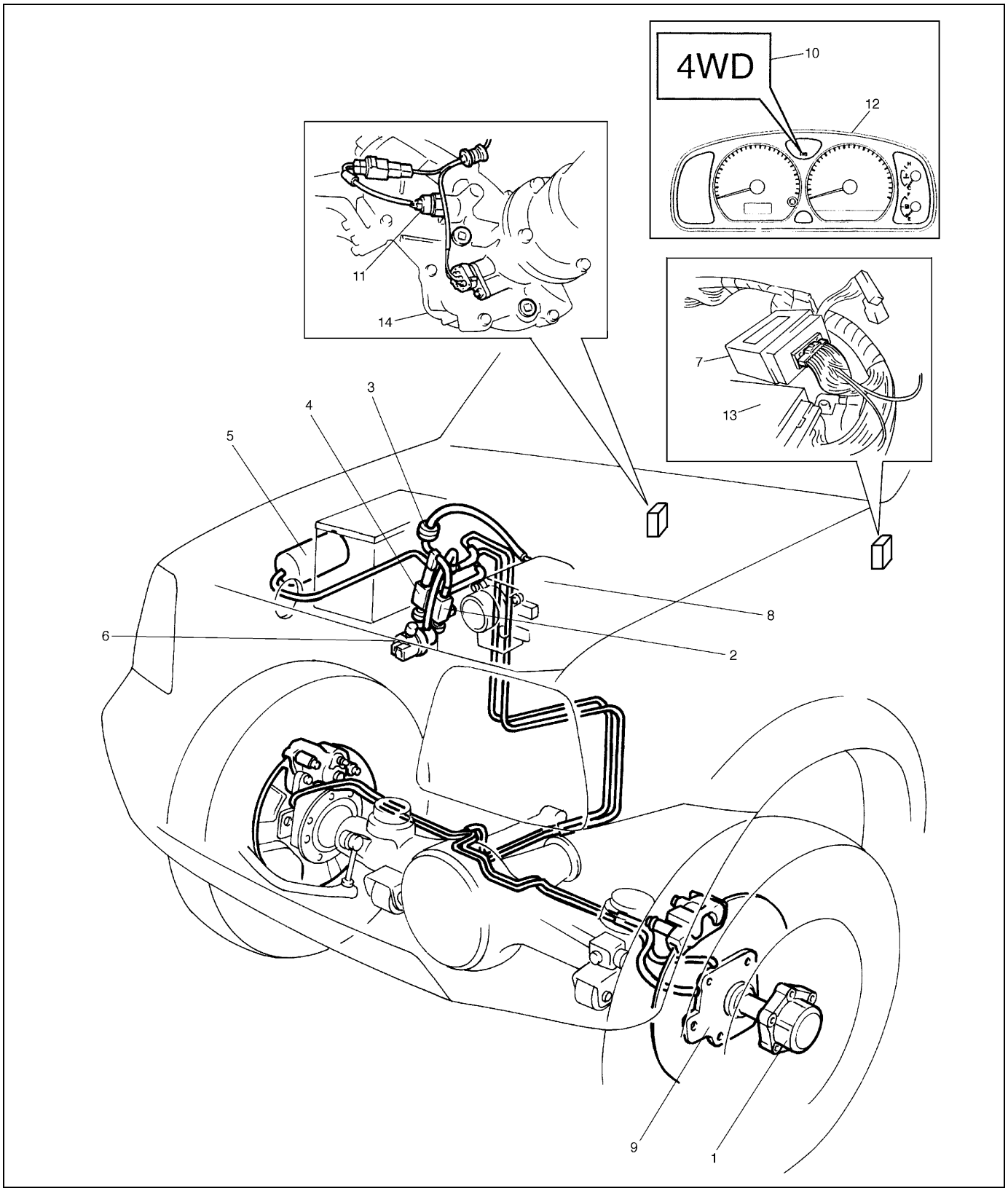
4WD Control System

The 4WD control system consists of a 4WD switch, a vacuum switch, a vacuum tank, two vacuum switching valves (VSV1 and VSV2) and air locking hub assemblies.

The 4WD controller controls locking or unlocking of the air locking hub according to operation of the transfer shift control lever.

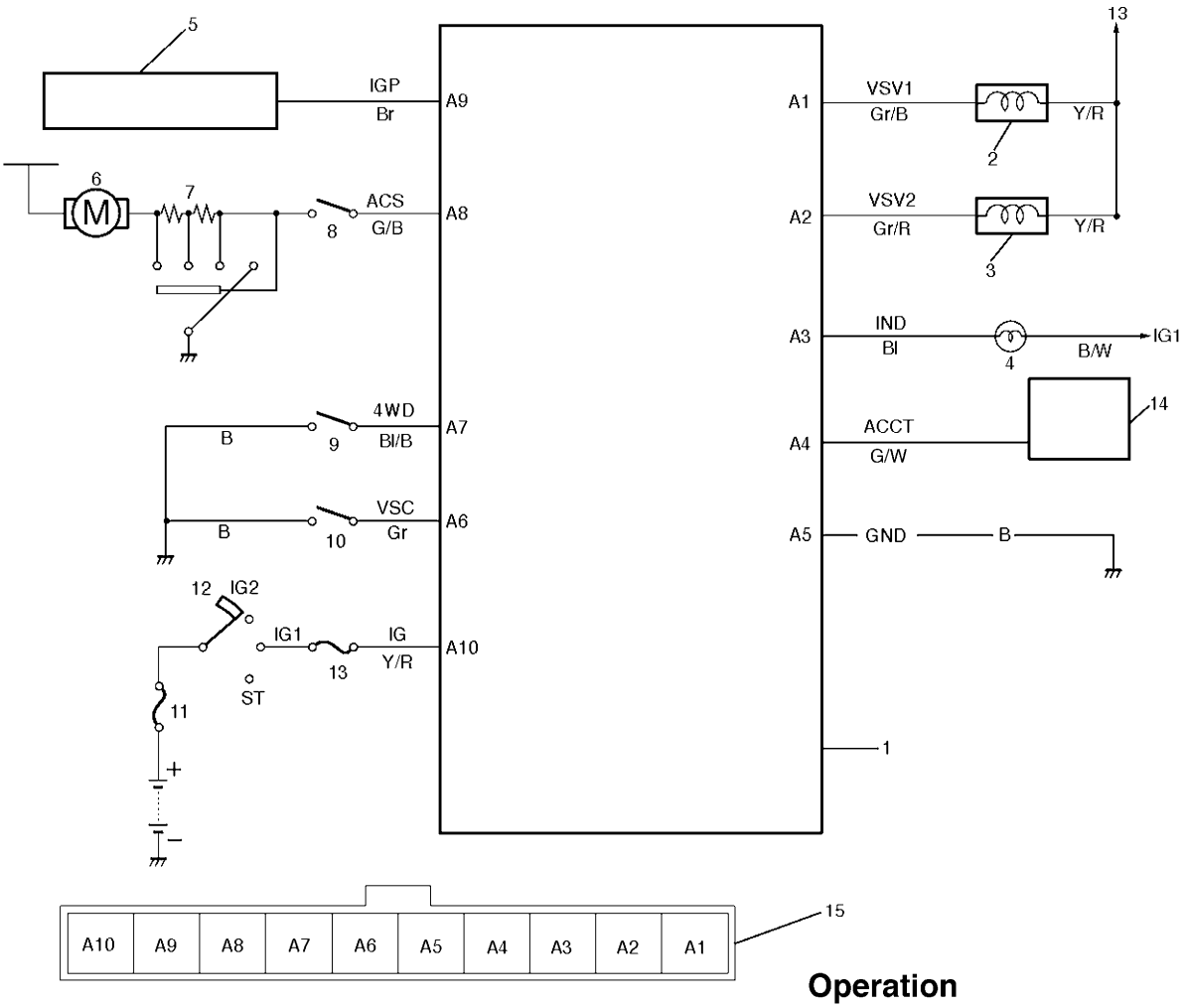
Vacuum generated in the intake manifold passes through the check valve and stored in the vacuum tank.

According to signals from the 4WD switch, the 4WD controller activates VSV1 (for unlocking) or VSV2 (for locking) to apply vacuum from the vacuum tank so that the front axle and the wheel hub are disengaged or engaged.

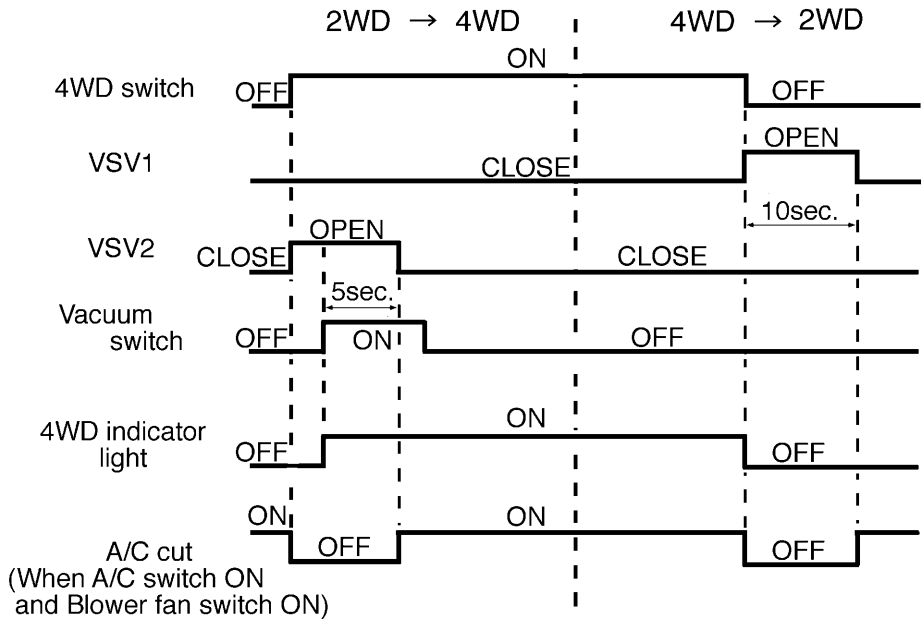


1. Air locking hub assembly	4. VSV2	7. 4WD controller	10. 4WD indicator light	13. ABS controller
2. VSV1	5. Vacuum accumulation tank	8. Intake manifold	11. 4WD switch	14. Transfer
3. Check valve	6. Vacuum switch	9. Wheel spindle	12. Combination meter	

SYSTEM CIRCUIT



Operation



1. 4WD controller	4. 4WD indicator lamp	7. Blower fan switch	10. Vacuum switch	13. IG fuse
2. VSV1	5. ECM	8. A/C switch (if equipped)	11. Main fuse	14. A/C controller (if equipped)
3. VSV2	6. Blower fan motor	9. 4WD switch	12. IG switch	15. Coupler of 4WD controller

Components and Functions

Component	Function
4WD switch	When the transfer shift lever is shifted to 4L or 4H position from 2H, this switch turns ON and cause the 4WD control system to turn ON.
4WD controller	When the 4WD switch turns on, the 4WD controller activates VSV2 to lock the air locking hubs and when it receives an “ON” signal from the vacuum switch, it makes VSV2 to complete operation within 5 seconds and causes the 4WD indicator light to light up. If vacuum in the vacuum circuit fails to reach the specified level due to a leakage in the vacuum circuit (when no “ON” signal is inputted from the vacuum switch), the 4WD controller stops operation of VSV2 in 15 seconds and makes the 4WD indicator light to flash to warn occurrence of a trouble. When the 4WD switch turns off, the 4WD controller activates VSV1 for 10 seconds to unlock the hubs and at the same time makes the 4WD indicator light turn off.
VSV1	VSV1 operates according to the signal from the 4WD controller. When it is activated, the port opens and vacuum in the intake manifold is applied through the vacuum circuit to unlock to the slide gear in the air locking hub. As a result, the air locking hubs are unlocked.
VSV2	VSV2 operates according to the signal from the 4WD controller. When it is activated, the port opens and vacuum in the intake manifold is applied through the vacuum circuit to lock to the slide gear in the air locking hub. As a result, the air locking hubs are locked.
Vacuum switch	When VSV2 receives the “ON” signal from 4WD switch, vacuum is applied through its circuit to the vacuum switch. The vacuum switch turns on when it detects vacuum exceeding 260 mmHg.
“4WD” indicator lamp	It lights up when 4WD control system is in the 4WD mode. It flashes to warn that locking hub operation has not completed (4WD control system fails to shift 4WD).

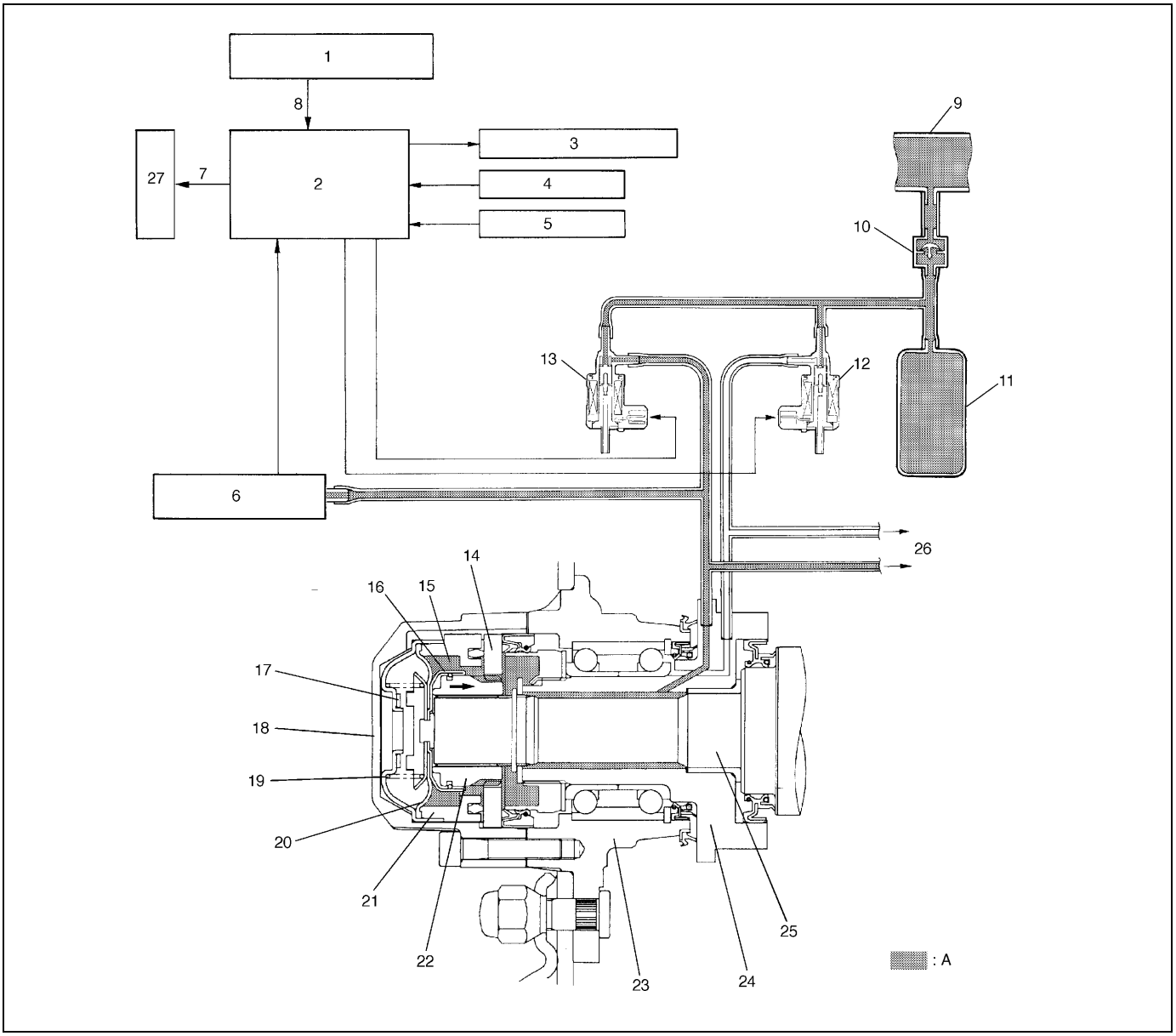
OPERATION

2WD → 4WD

When the transfer shift control lever is shifted from the 2WD (2H) position to the 4WD (4H or 4L) position, a 4WD "ON" signal is transmitted to the 4WD controller which then activates VSV2 to apply vacuum in the intake manifold to the chamber "B" in the hub housing.

When vacuum is applied, the slide gear is separated from the magnet, moves toward the center of the vehicle body and gets engaged with the outer gear. In this way, the front axle shaft and the front wheel hub rotate as one unit.

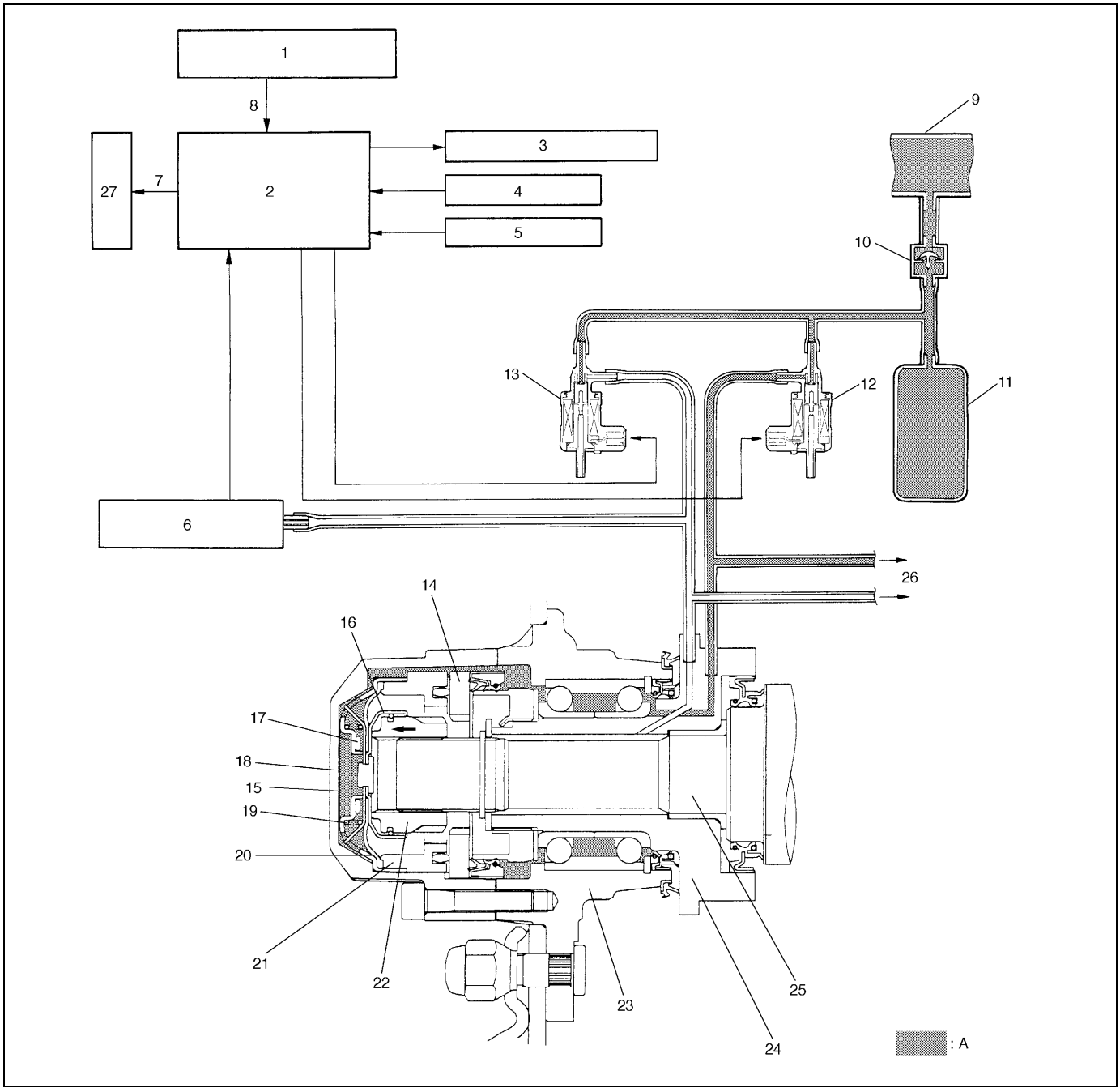
If vacuum in the circuit fails to reach 260 mmHg within 15 seconds after operation of VSV2 due to such trouble as a hole in the vacuum pipe, the slide gear does not operate and the 4WD indicator light flashes to warn that the hub is unlocked.



1. ECM	8. Engine speed signal	15. Chamber B	22. Slide gear
2. 4WD controller	9. Intake manifold	16. Piston A	23. Wheel hub
3. 4WD indicator lamp	10. Check valve	17. Magnet	24. Spindle
4. 4WD switch	11. Vacuum tank	18. Housing	25. Front axle shaft
5. A/C switch (if equipped)	12. VSV1	19. Spring	26. To opposite side
6. Vacuum switch	13. VSV2	20. Diaphragm	27. A/C controller
7. A/C cut signal (if equipped)	14. Outer gear	21. Sleeve	A: Vacuum circuit

4WD → 2WD

When the transfer shift control lever is shifted from the 4WD (4H or 4L) to the 2WD (2H) position, the 4WD controller activates VSV1 and the intake manifold vacuum is applied to the chamber “A” in the hub housing. As the slide gear is shifted to the wheel side by the vacuum force and disengaged from the outer gear, rotation of the front wheel hub is not transmitted to the front axle shaft.



1. EPI & A/C controller	8. Engine speed signal	15. Chamber A	22. Slide gear
2. 4WD controller	9. Intake manifold	16. Piston A	23. Wheel hub
3. 4WD indicator lamp	10. Check valve	17. Magnet	24. Spindle
4. 4WD switch	11. Vacuum tank	18. Housing	25. Front axle shaft
5. A/C switch (if equipped)	12. VSV1	19. Spring	26. To opposite side
6. Vacuum switch	13. VSV2	20. Diaphragm	27. A/C controller
7. A/C cut signal (if equipped)	14. Outer gear	21. Sleeve	A: Vacuum circuit

Diagnosis

Diagnosis Table

For description not found in the table below, refer to “Diagnosis Table” in Section 3.

4WD CONTROL SYSTEM

Condition	Possible Cause	Correction
4WD Indicator light flashing	• Hub locking procedure error	Shift transfer shift control lever 2WD → 4WD once again
	• Defective VSV2	Replace
	• Defective vacuum switch	Replace
	• Defective check valve or vacuum tank	Replace
	• Air leak from vacuum circuit	Check and repair
	• Clogged vacuum hose or pipe	Replace
	• Faulty 4WD controller	Check and replace
2WD/4WD switching error	• Defective air locking hub assembly	Replace
	• Abnormality in 4WD control system	Inspect referring to “4WD Control System Diagnostic Flow Table”
	• Air leakage from vacuum circuit	Check and replace
	• Clogged vacuum hose or pipe	Replace
	• Defective check valve or vacuum tank	Replace

4WD CONTROL SYSTEM DIAGNOSTIC FLOW TABLE

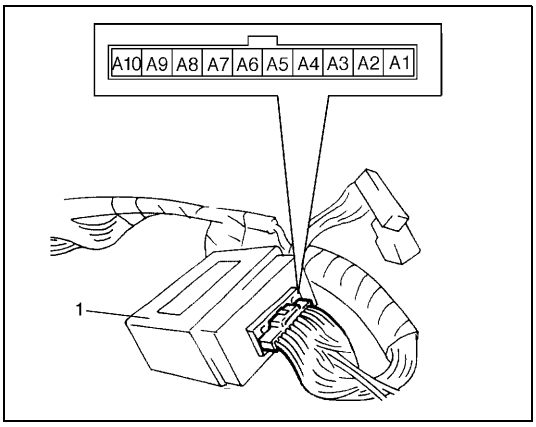
Before performing the trouble diagnosis, check that the air locking hub assemblies are in good condition and there is no air leakage from vacuum hoses and vacuum pipe. Refer to “4WD Control System Check” in this section for air leakage.

[NOTES ON SYSTEM CIRCUIT INSPECTION]

- Be sure to read “Precautions for Electrical Circuit Service” in Section 0A before circuit inspection and observe what is written there.
- For system circuit, refer to the figure of “System Circuit” in this section.

Step	Action	Yes	No
1	Check ground circuit. 1) Disconnect coupler from 4WD controller with ignition switch OFF. 2) Check for proper connection to 4WD controller at all terminals. 3) If OK, check continuity between A5 terminal and body ground. Is there continuity between A5 terminal and body ground?	Go to Step 2.	“B” wire is open.
2	Check power circuit. 1) Disconnect coupler from 4WD controller. 2) Turn ignition switch ON. 3) Check voltage between A10 terminal and ground. Is it 10 – 14 V?	Go to Step 3.	“Y/R” circuit is open or short.

Step	Action	Yes	No
3	Check 4WD switch circuit. 1) Connect coupler to 4WD controller. 2) Turn ignition switch ON and check voltage between A7 terminal and ground. **Transfer lever is in 2H : about 10 – 14 V** **Transfer lever is in 4L or 4H : about 0 V** Is check result satisfactory?	Go to Step 4.	Check 4WD switch (refer to "4WD Switch" in Section 7D), "Bl/B" and "B" circuits of 4WD switch. If OK, substitute a known-good 4WD controller and recheck.
4	Check VSV1 circuit. 1) Turn ignition switch ON. 2) Check voltage between A1 terminal and ground. Is it 10 – 14 V when transfer lever is in 4H or 4L range and about 0 V for 10 seconds after it is shifted to 2H range?	Go to Step 5.	Check VSV1 (refer to "4WD Control System Check" in this section), "Y/R" and "Gr/B" circuits of VSV1. If OK, substitute a known-good 4WD controller and recheck.
5	Check VSV2 circuit. 1) Turn ignition switch ON. 2) Check voltage between A2 terminal and ground. Is it 10 – 14 V when transfer lever is in 2H range and about 0 V for 5 seconds after it is shifted to 4H or 4L range?	Go to Step 6.	Check VSV2 (refer to "4WD Control System Check" in this section), "Y/R" and "Gr/R" circuits of VSV2. If OK, substitute a known-good 4WD controller and recheck.
6	Check vacuum switch circuit. 1) Turn ignition switch ON (stating engine). 2) Check voltage between A6 terminal and ground. Is it 10 – 14 V when transfer lever is in 2H range and about 0 V for 5 seconds after it is shifted to 4H or 4L range?	Go to Step 7.	Check vacuum switch (refer to "4WD Control System Check" in this section), "Gr" and "B" circuits of vacuum switch. If OK, substitute a known-good 4WD controller and recheck.
7	Check 4WD indicator light circuit. 1) Turn ignition switch ON. 2) Check voltage between A3 terminal and ground. Is it 10 – 14 V when transfer lever is in 2H range and about 0 V within 15 seconds after it is shifted to 4H or 4L range?	Substitute a known-good 4WD controller and recheck.	Check "Bl" circuit (including indicator light and combination meter refer to "Combination Meter" in Section 8). If OK, substitute a known-good 4WD controller and recheck.



4WD Controller and ITS Circuit Check

VOLTAGE CHECK

Check for input or output voltage of 4WD controller (1) (voltage between each circuit and body ground) with 4WD controller connector connected and ignition switch turned START (engine run).

CAUTION:

- **Disable air bag system (if equipped with Air Bag), refer to "Disabling Air Bag System" in Section 10B.**
- **This check must be carried out in a well-ventilated place.**

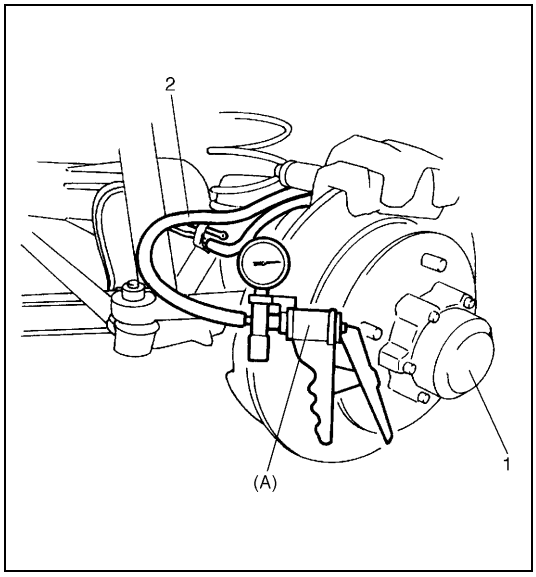
Terminal	Circuit	Wire Color	Normal Voltage	Condition
A1	VSV1	Gr/B	about 0 V	10 seconds after transfer shift control lever : 4WD → 2WD
			10 – 14 V	Transfer shift control lever: 4WD
A2	VSV2	Gr/R	*about 0 V	5 seconds after transfer shift control lever : 2WD → 4WD
			10 – 14 V	Transfer shift control lever: 2WD
A3	4WD indicator lamp	Bl	*about 0 V	Transfer shift control lever: 4WD
			10 – 14 V	Transfer shift control lever: 2WD
A4	A/C controller	G/W	*10 – 12 V	5 – 10 seconds after engine starts or transfer shift control lever switches.
			about 0 V	A/C switch and blower fan switch ON.
A5	Ground	B	about 0 V	any time
A6	Vacuum switch	Gr	*about 0 V	5 seconds after transfer shift control lever : 2WD → 4WD
			10 – 14 V	Other than above
A7	4WD switch	Bl/B	about 0 V	Transfer shift control lever: 4WD
			10 – 14 V	Transfer shift control lever: 2WD
A8	A/C switch	G/B	about 0 V	A/C switch ON and blower fan switch ON
			10 – 14 V	Other than above
A9	Ignition coil	Br	0 – 1 V	IG: ON
			Voltage varies according to engine speed.	
A10	Ignition switch	Y/R	10 – 14 V	IG: ON

* : With engine running

4WD Control System Check

AIR LOCKING HUB

1) Start engine and shift transfer shift control lever to 2H position.

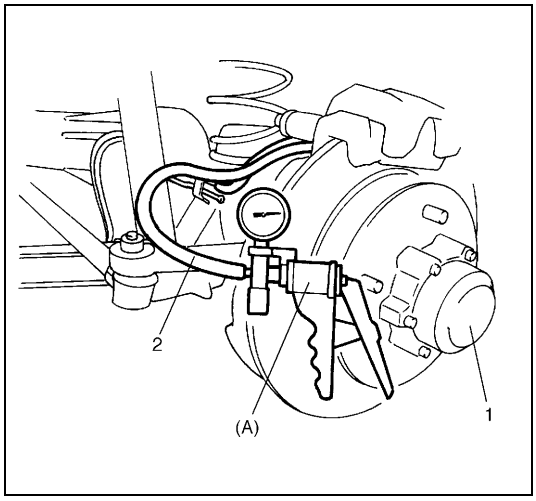


2) Connect vacuum pump gauge (special tool) to the spindle hose (2) which is disconnected from upper side pipe as shown. Apply vacuum and check operating sound from air locking hub (1).
   If there is not operating sound, replace air locking hub assembly.

Vacuum specification
More than 40 kPa (0.40 kg/cm^2, 5.70 Psi)

Special tool
(A) : 09917-47910

3) Connect hose, then start engine and shift transfer shift control lever to 4H or 4L position.

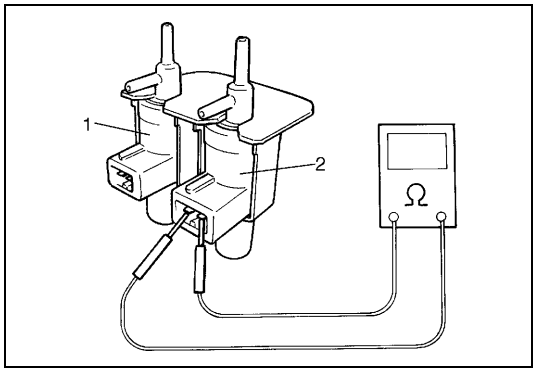


4) Connect vacuum pump gauge to the spindle hose (2) disconnected from lower side pipe.
   Apply vacuum and check operating sound from air locking hub (1).
   If there is no operating sound, replace air locking hub assembly.

Vacuum specification
More than 40 kPa (0.40 kg/cm^2, 5.70 Psi)

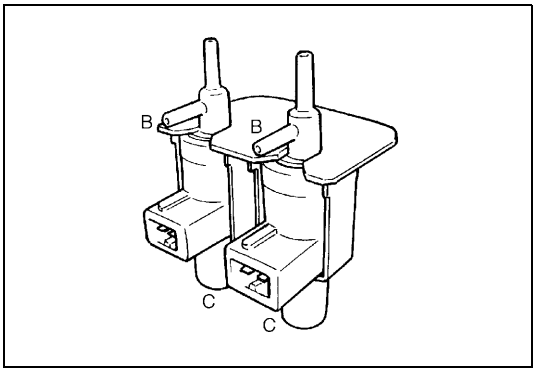
Special tool
(A) : 09917-47910

VSV1 AND VSV2

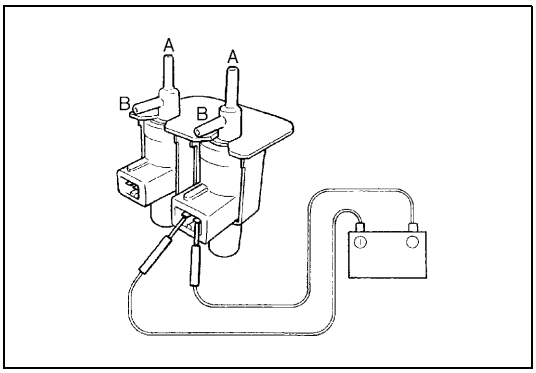


1) Disconnect coupler from VSV1 (1) (VSV2) (2) and check resistance between two terminals of VSV1 (1) (VSV2) (2).
   If resistance is out of specification, replace.

Resistance of VSV1 and VSV2
: 33 – 39 Ω

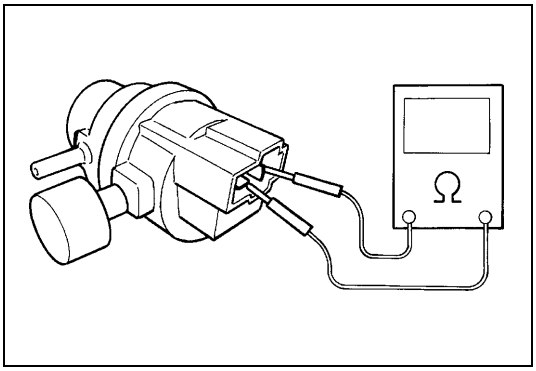


2) Blow air from B and check that air comes out of C.
   If found faulty, replace.



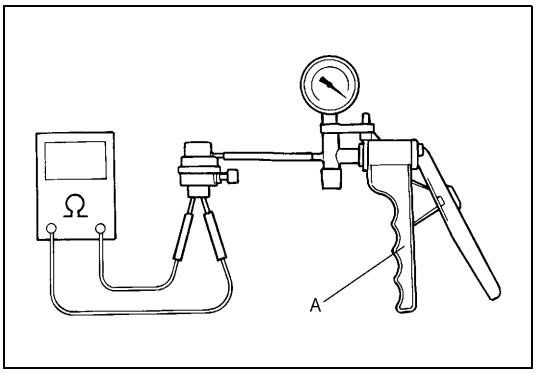
3) Connect 12 V-battery to VSV1 (VSV2) terminals and check continuity between A and B.
   Blow air from B and check that air comes out of A.
   If found faulty, replace.

VACUUM SWITCH



1) Disconnect coupler from vacuum switch and check resistance between two terminals of vacuum switch.
   If resistance is out of specification, replace.

Resistance of vacuum switch
: More than 1 MΩ



2) Connect vacuum pump gauge and apply vacuum more than 40 kPa (0.40 kg/cm^2, 5.70 Psi), then check resistance between terminals of vacuum switch.
   If resistance is out of specification, replace.

Vacuum switch resistance
: Less than 0.8 Ω

Special tool
(A) : 09917-47910

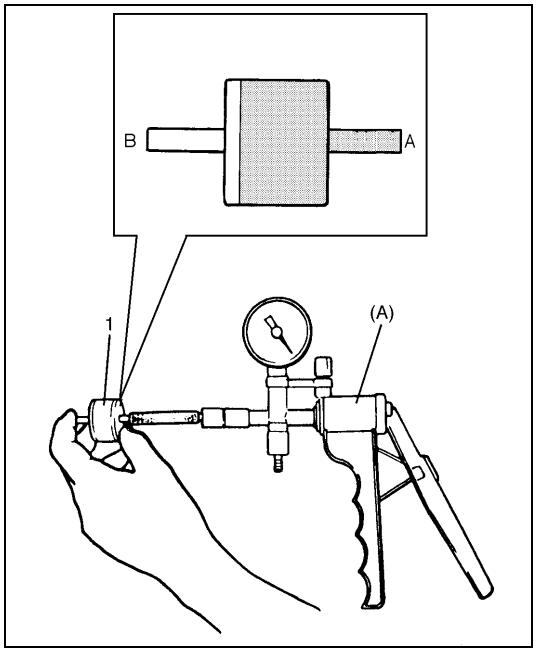
4WD SWITCH

Refer to “4WD Switch” in Section 7D.

VACUUM HOSE / PIPE

Inspect vacuum hoses for leaks or cracks, vacuum pipes for cracks, dents or corrosion. If defective, replace.

CHECK VALVE

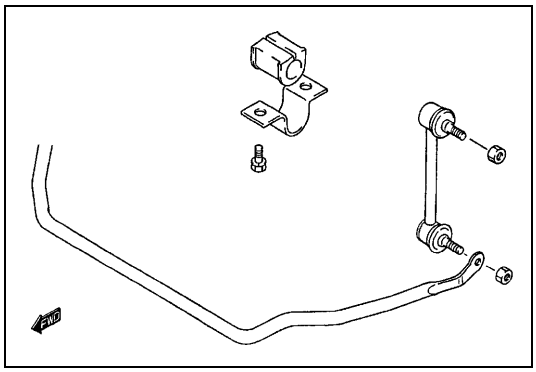


1) Remove check valve (1).
2) Close B side of check valve with finger as shown and apply –50 cmHg vacuum by means of vacuum pump. Then check that vacuum is applied. Apply vacuum to another side of check valve and check that vacuum is not applied.
   Replace if defective.

Special tool
(A) : 09917-47910

A :	Intake manifold side
B :	Vacuum switching valve side

Stabilizer bar / bushing check



BAR

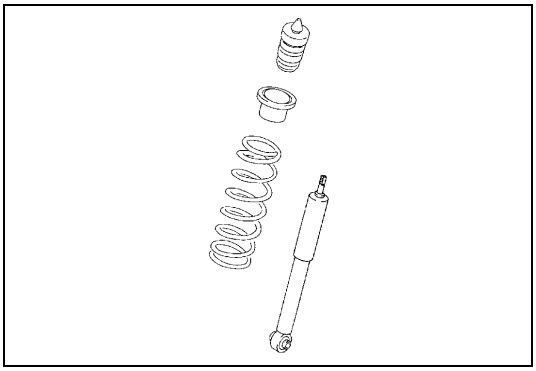
Inspect for damage or deformation. If defective, replace.

BUSHING

Inspect for damage, wear or deterioration. If defective, replace.

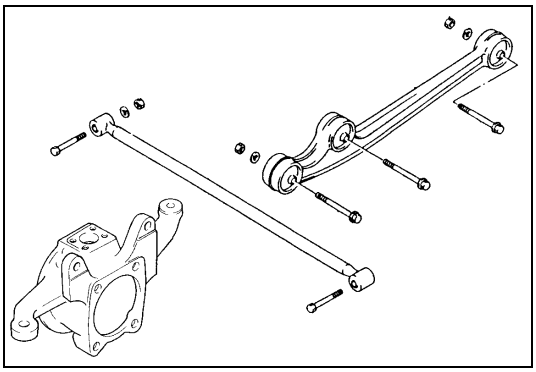
Shock Absorber and/or Coil Spring Check

1) Inspect shock absorber for oil leakage. If shock absorber is found faulty, replace it as an assembly unit, because it can not be disassembled.
2) Shock absorber function check
   Check and adjust tire pressures as specified.
   Bounce body three or four times continuously by pushing front end on the side with shock absorber to be checked. Apply the same amount of force at each push and note shock absorber resistance both when pushed and rebounding.
   Also, note how many times vehicle body rebounds before coming to stop after hands are off. Do the same for shock absorber on the other side.
   Compare shock absorber resistance and number of rebound on the right with those on the left.
   And they must be equal in both. With proper shock absorber, body should come to stop the moment hands are off or after only one or two small rebounds. If shock absorbers are suspected, compare them with known good vehicle or shock absorber.



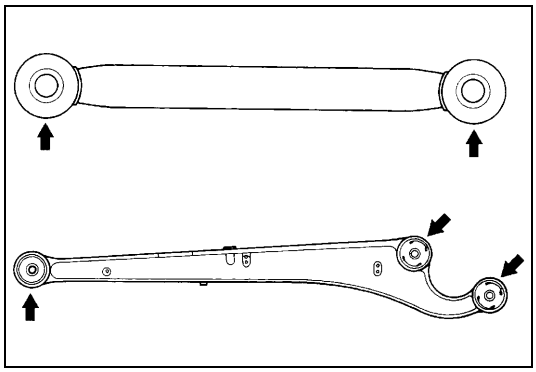
3) Inspect for damage or deformation.
4) Inspect for cracks or deformation in spring seat.
5) Inspect for deterioration of bump stopper.
6) Inspect shock absorber mount for wear, cracks or deformation.Replace any parts found defective in steps 2) – 6).

Leading Arm / Lateral Rod / Steering Knuckle Check



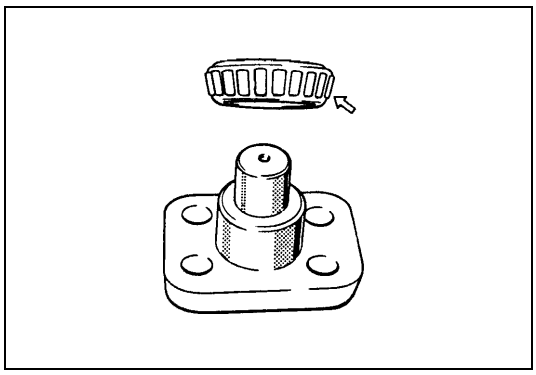
Inspect for cracks, deformation or damage.

Leading Arm Bushing / Lateral Rod Bushing Check



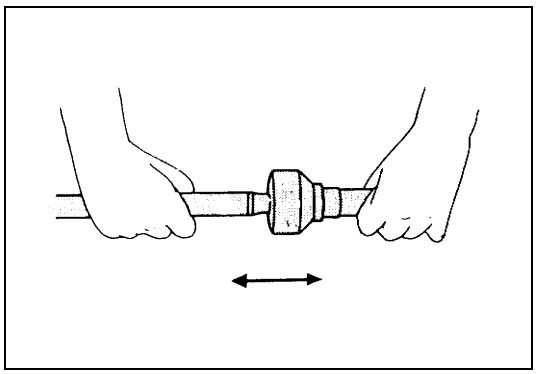
Inspect for damage, wear or deterioration.
If defective, replace.

Kingpin / Kingpin Bearing Check



1) Inspect for wear or deterioration.
2) Inspect for crack, damage or deformation of kingpin.
   If defective, replace.

Barfield Joint Check

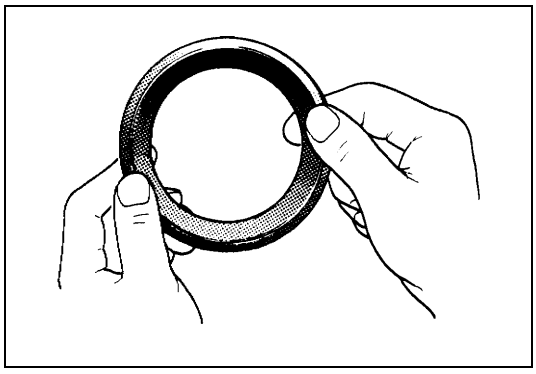


To be checked on this joint is its axial play, which shows up when a push-and-pull motion is given to live axle shaft and wheel spindle held in both hands, as shown in figure. There should be no play at all but a play of up to 1.5 mm (0.06 in.) is permissible. If play exceeds service limit, replace it.

Axial play in barfield joint

Standard	Service Limit
0 mm (no play)	1.5 mm (0.06 in.)

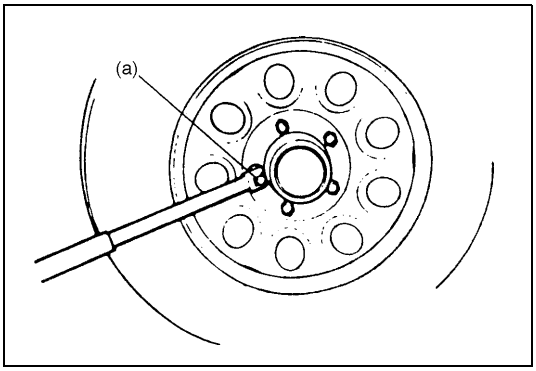
Steering Knuckle Seal Check



The knuckle seal used at the spherical sliding joint between the knuckle and the inner case accomplishes the additional purposes of keeping out road dust and of acting as the damper for the steering handwheel. As the wear of this seal advances, its damping effect decreases and thus make the front wheel develop a tendency to “shimmy” not only that road dust begins to creep into the sliding clearance to promote the wear of the spherical sliding surfaces.
Check the knuckle seal for wear or damage. If defective, replace with new one.

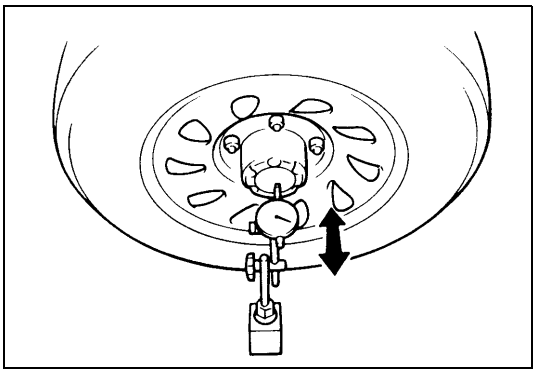
Wheel Disc, Nut and Bearing Check

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



2) Check wheel nuts for tightness and as necessary, retighten them to specification.

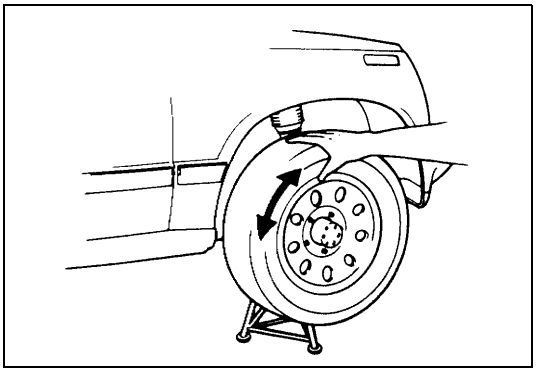
Tightening torque
Wheel nuts
(a) : 95 N·m (9.5 kg-m, 69.0 lb-ft)



3) Check wheel bearing for wear. After retightening lock nut to specified torque, apply dial gauge to wheel hub center and measure thrust play.

Wheel bearing thrust play limit
: 0.05 mm (0.002 in)

When measurement exceeds limit, replace bearing.



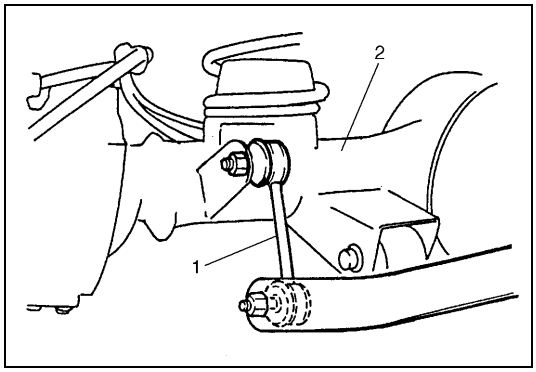
4) By rotating wheel actually, check wheel bearing for noise and smooth rotation. If defective, replace bearing.

On-Vehicle Service

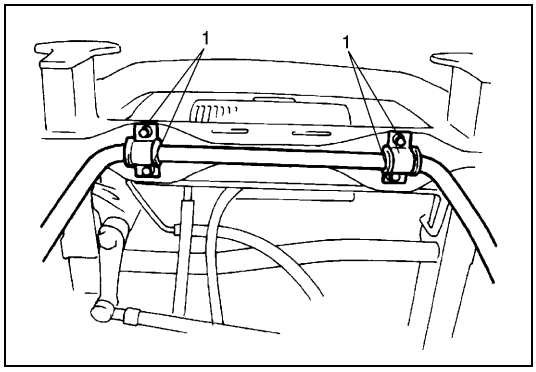
Stabilizer Bar / Bushings

REMOVAL

1) Hoist vehicle.
2) Remove front bumper.

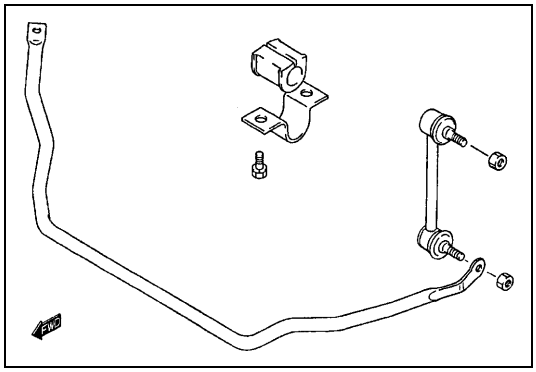


3) Disconnect stabilizer ball joints (right & left) (1) from front axle housing (2).

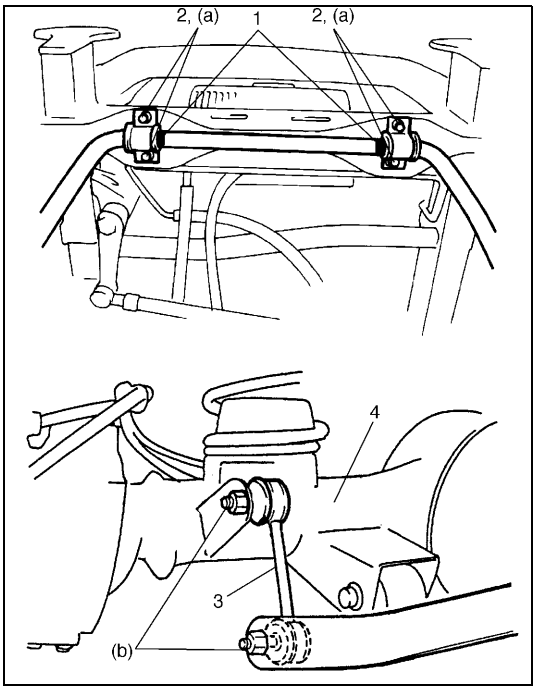


4) Remove stabilizer bar mount bush bracket bolts (1).
5) Remove stabilizer bar with its ball joint.
6) Disconnect stabilizer ball joints (right & left) from its bar.

INSTALLATION



1) Connect stabilizer ball joints (right & left) to its bar.



NOTE:

For correct installation of stabilizer bar, side-to-side, be sure that color paint (1) on stabilizer bar aligns with mount bush, both right and left, as shown.

2) When installing stabilizer, loosely assemble all components while insuring that stabilizer is centered, side-to-side.
3) Tighten stabilizer bracket bolts (2) and stabilizer ball joint nuts to specified torque.

NOTE:

Tighten stabilizer mount bracket bolts (2) with vehicle hoisted a little in non-load condition.

Tightening torque
Stabilizer mount bracket bolts
(a) : 20 N·m (2.0 kg-m, 14.5 lb-ft)
Stabilizer ball joint nuts
(b) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

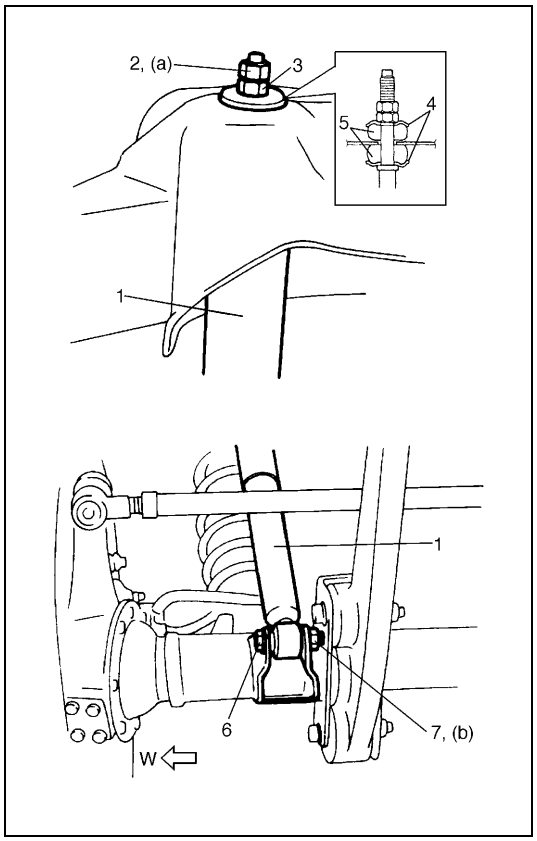
4) Install front bumper.
5) Lower hoist.

3. Stabilizer ball joint
4. Front axle housing

Front Shock Absorber

REMOVAL

1) Hoist vehicle.
2) Support front axle housing by using floor jack to prevent it from lowering, refer to “When Using Floor Jack” under “Vehicle Lifting Points” in Section 0A.



3) Remove shock absorber lower mounting bolt (6).
4) Remove shock absorber upper mounting lock nut (2) and absorber nut (3). Then remove shock absorber (1).

INSTALLATION

Install removed parts in reverse order of removal proceeded, noting the followings.

- As shown in figure, install washer (4) and bush (5) first and after tightening absorber nut (3) tighten lock nut (2) to specified torque.

Tightening torque
Shock absorber lock nut
(a) : 29 N·m (2.9 kg-m, 21.0 lb-ft)

- Install absorber lower mounting bolt (6) in proper direction as shown in the figure and tighten it with no load applied to axle housing.

Tightening torque
Shock absorber lower nut
(b) : 90 N·m (9.0 kg-m, 65.0 lb-ft)

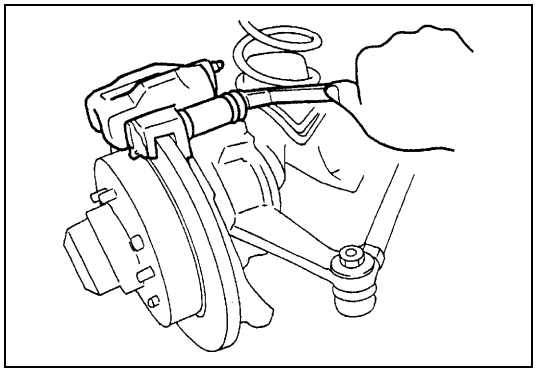
- Confirm front end (wheel) alignment referring to “Preliminary Checks Prior to Adjusting Front Alignment” in Section 3A.

W: Wheel side
7. Lower mounting nut

Coil Spring

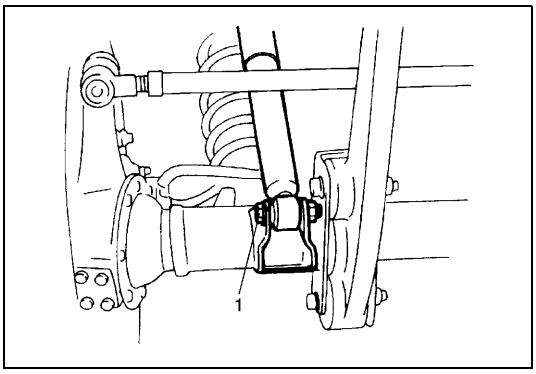
REMOVAL

1) Hoist vehicle and remove wheel.
2) Disconnect stabilizer ball joint from axle housing.



3) Remove brake caliper carrier bolts and suspend caliper.

CAUTION:
During removal, be careful not to damage brake flexible hose and wheel speed sensor harness (vehicle with ABS) and not to depress brake pedal.

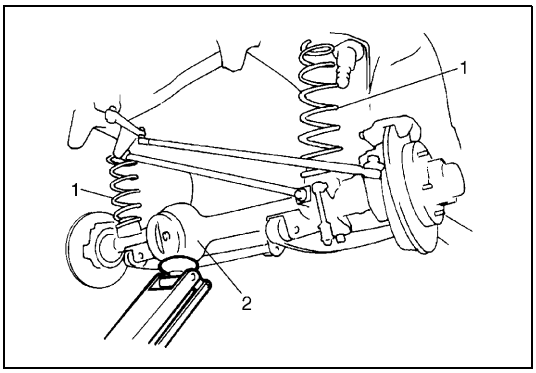


4) Support front axle housing by using floor jack.

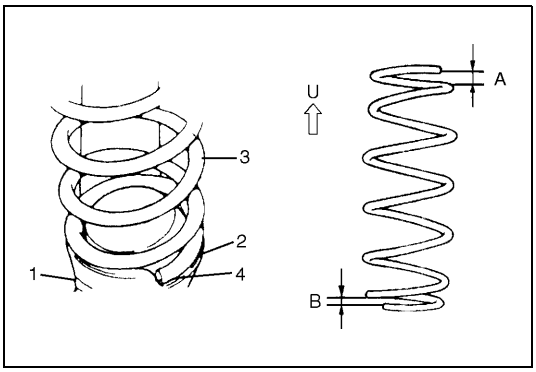
NOTE:

When supporting axle housing, it should be in non-load condition.

5) Remove shock absorber lower mounting bolt (1).



6) Lower front axle housing (2) gradually as far down as where coil spring (1) can be removed.
7) Remove coil spring (1).



INSTALLATION

Install removed parts in reverse order of removal procedures, noting the followings.

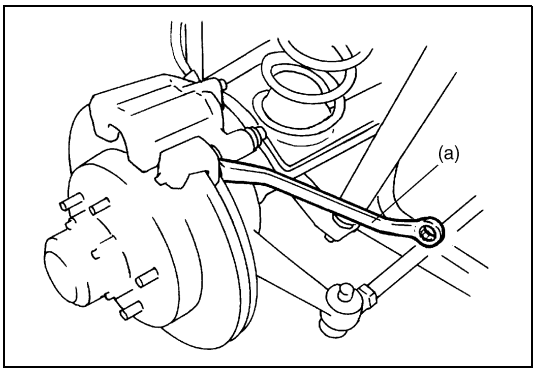
1) Install coil spring (3).

NOTE:

- **Make sure that coil spring direction as shown.**
- **When seating coil spring, mate spring end with stepped part (4) of lower spring seat (2).**

1.	Front axle housing
U :	Upper side
A :	Small
B :	Large

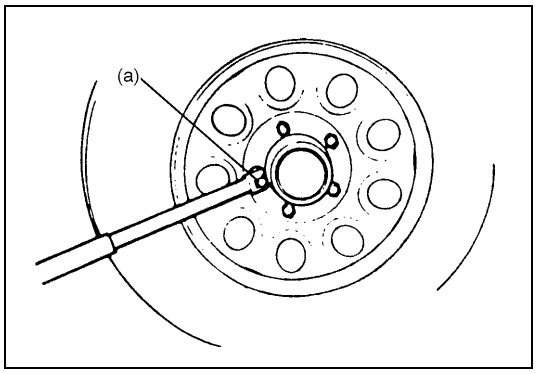
2) Install absorber lower mounting bolt, refer to “Front Shock Absorber” in this section.



3) Install caliper assembly and tighten caliper bolts to specified torque.

Tightening torque
Brake caliper carrier bolts
(a) : 85 N·m (8.5 kg-m, 61.5 lb-ft)

4) Connect stabilizer ball joint to axle housing and tighten nut referring to “Stabilizer Bar” in this section for tightening torque specification.



5) Install wheel and tighten wheel nuts to specified torque.

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

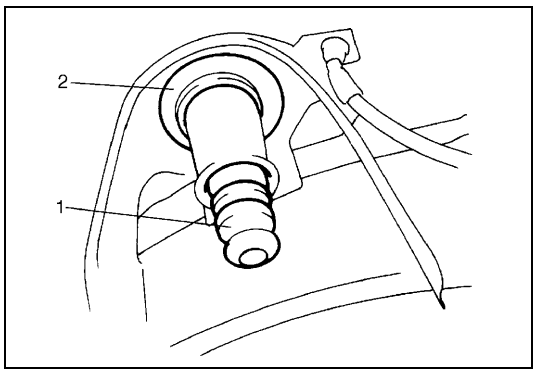
6) Lower hoist.
7) Confirm front end (wheel) alignment, referring to "Preliminary Checks Prior to Adjusting Front Alignment" in Section 3A.

Bump Stopper and Spring Upper Seat

REMOVAL

1) Remove coil spring, refer to "Coil Spring" in this section.
2) Remove bump stopper and spring upper seat.

INSTALLATION



1) Install bump stopper (1) and spring upper seat (2).

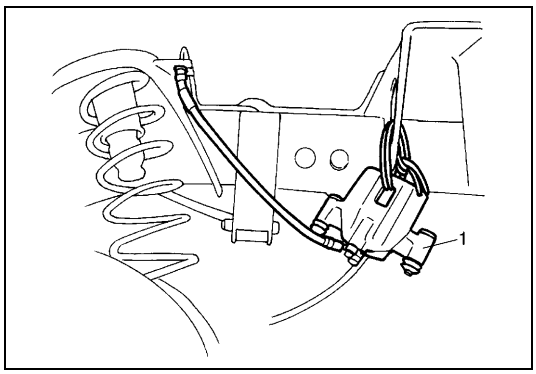
NOTE:
Before installing bump stopper (1), apply soap water on it.

2) Install coil spring, refer to "Coil Spring" in this section.

Wheel Hub / Bearing / Oil Seal

REMOVAL

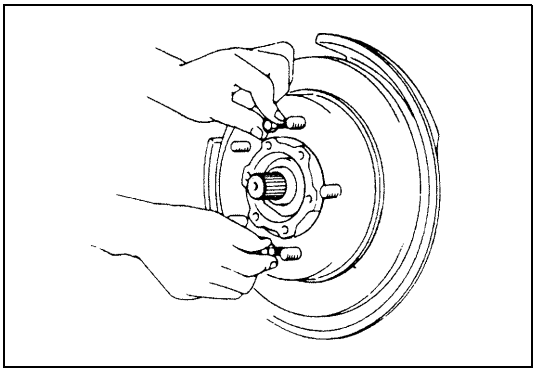
1) Hoist vehicle and remove wheel.



2) Remove brake caliper carrier bolts and suspend caliper (1).

CAUTION:
During removal, be careful not to damage brake flexible hose and not to depress brake pedal.

3) Remove ABS wheel sensor (if equipped with ABS).



4) Remove brake disc.

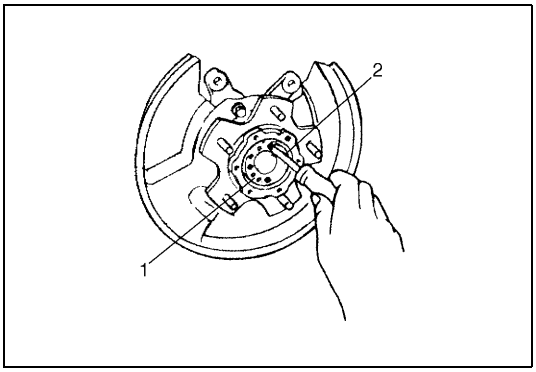
NOTE:

If brake disc can not be removed by hand, using 8 mm bolts.

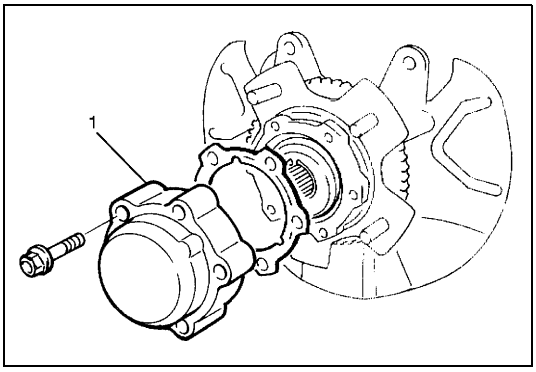
5) Remove front wheel bearing lock nut as follows.

For 2WD model :

a) Remove hub cap.

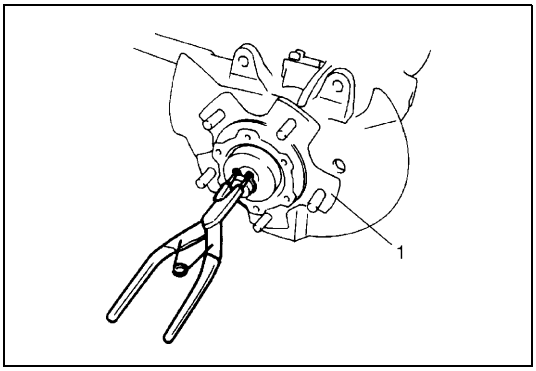


b) Remove front wheel bearing lock plate (1) by loosening 4 screws (2).



For 4WD model :

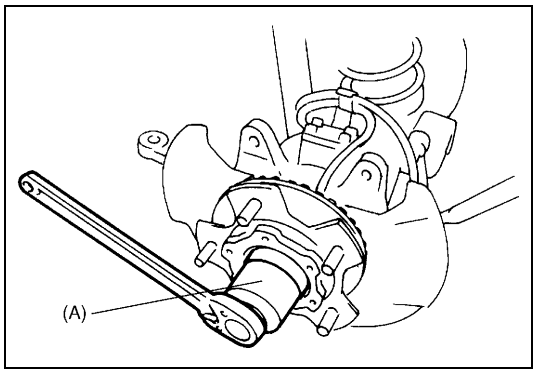
a) Remove air locking hub assembly (1).



b) Remove front axle shaft circlip and wheel spindle thrust washer.

c) Uncaulk front wheel bearing lock nut.

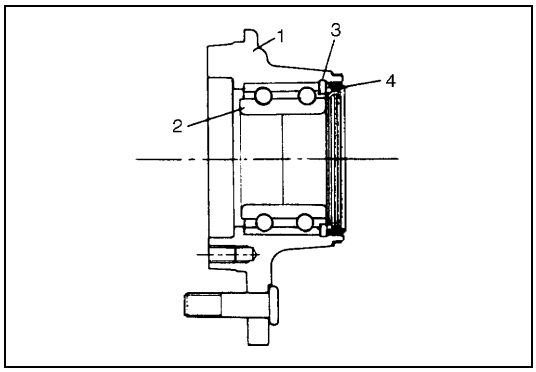
1. Wheel hub



6) Remove front wheel bearing lock nut by using special tool.

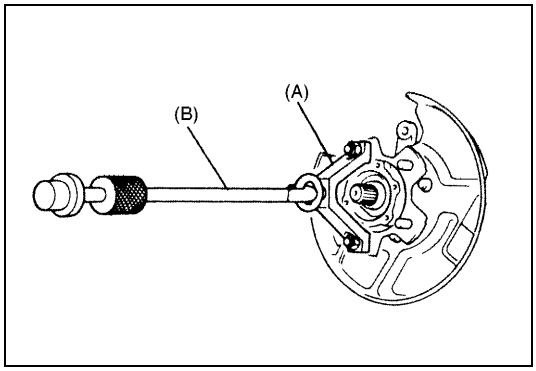
Special tool
(A) : 09944-77020 (For 4WD)
(A) : 09951-16050 (For 2WD)

7) Remove front wheel bearing washer.



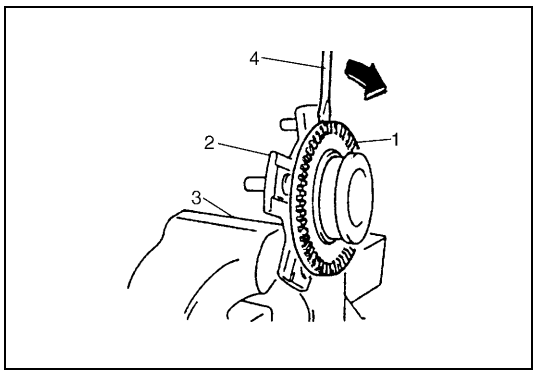
8) Remove wheel hub complete (1) with bearings (2) and oil seal (4).

3. Circlip



NOTE:
If wheel hub can not be removed by hand, use special tools as shown.

Special tool
(A) : 09943-35511 or 09943-35512
(B) : 09942-15510

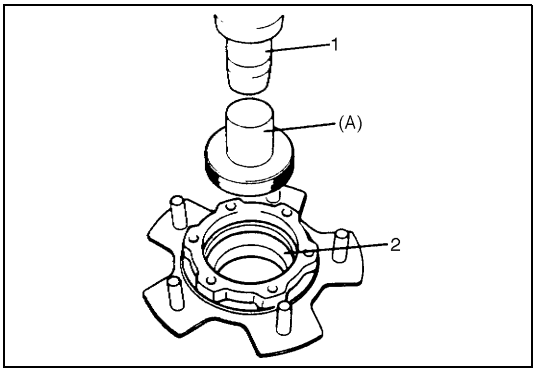


9) Remove sensor rotor from wheel hub as shown (if equipped with ABS).

CAUTION:
Pull out sensor rotor from wheel hub gradually and evenly.
Attempt to pull it out partially may cause it to be deformed.

1. Sensor rotor
2. Wheel hub
3. Vise
4. Flat end rod

10) Remove wheel bearing oil seal and circlip.

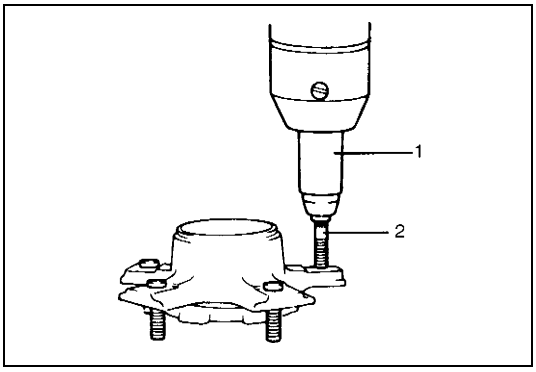


11) Using hydraulic press (1) and special tool remove wheel bearing (2).

Special tool
(A) : 09913-75520

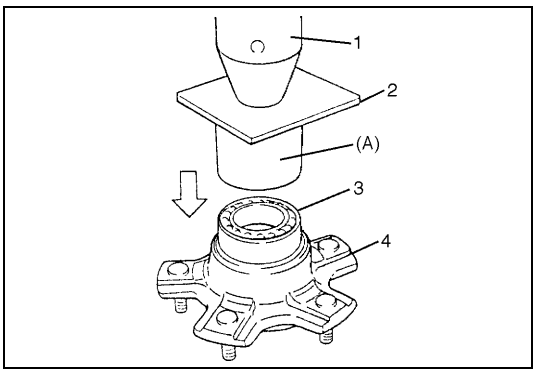
12) Remove hub bolts from hub.

INSTALLATION



1) Insert new stud in hub hole. Rotate stud slowly to assure serrations are aligned with those made by original bolt.

1.	Oil hydraulic press
2.	Hub bolt



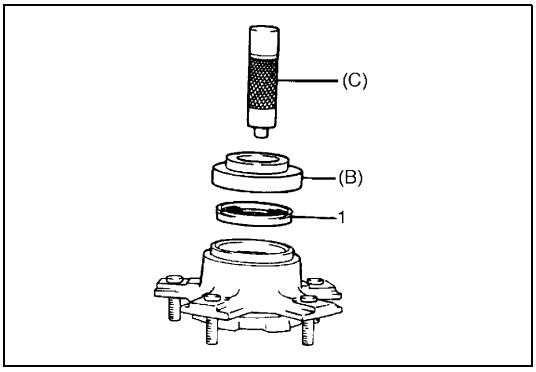
CAUTION:
Press-fit wheel bearing (3) vertically to hub (4).

2) Using special tool, press-fit wheel bearing (3) until its end contacts stepped surface of wheel hub (4).

Special tool
(A) : 09944-78210

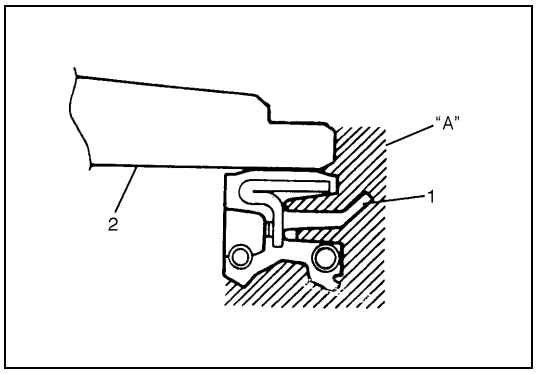
3) Install bearing circlip.

1.	Oil hydraulic press
2.	Steel plate



4) Drive in wheel bearing oil seal (1) by using special tools.

Special tool
(B) : 09944-66010
(C) : 09924-74510



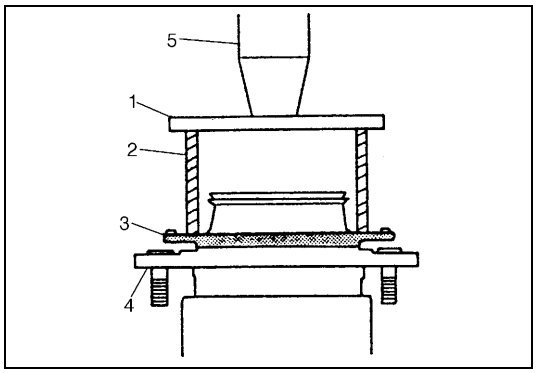
5) Apply lithium grease to lip portion and hollow of oil seal (1).

NOTE:

Amount of grease applied to hollow in oil seal (1) should be more than 60% of its vacant space.

"A" : Grease 99000-25010

2. Wheel hub

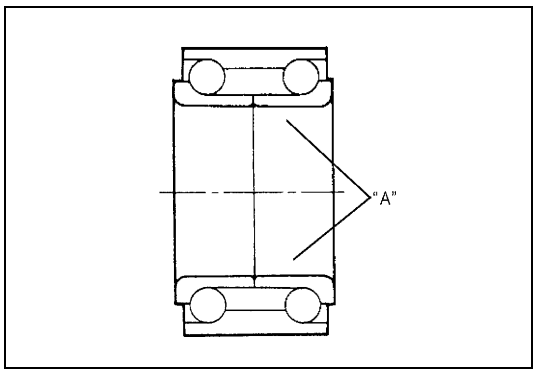


6) Install sensor rotor (3) as shown (if equipped with ABS).

NOTE:

- **Pipe (2) used here should have inner diameter of 90 mm (3.55 in.) – 96 mm (3.77 in.) and its outside should not contact teeth of sensor rotor (3).**
- **Use care not to insert wheel hub (4) diagonally.**

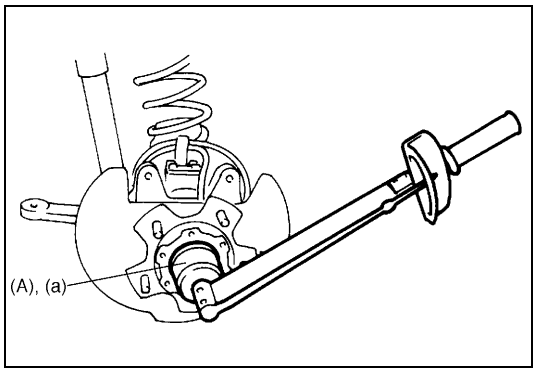
1. Steel plate
5. Hydraulic press



7) Apply lithium grease inside wheel bearing thin.

"A" : Grease 99000-25010

8) Install wheel hub complete with bearings and oil seal onto front wheel spindle.
9) Install bearing washer.



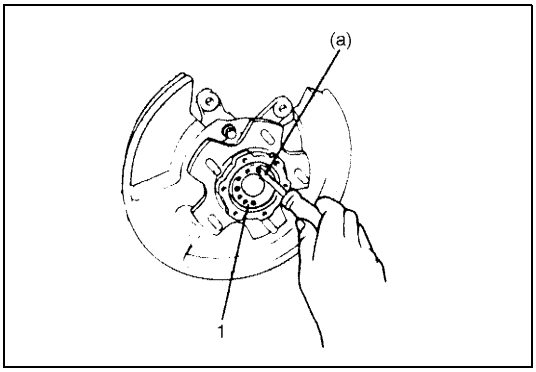
10) Tighten wheel bearing lock nut to specified torque while turning wheel hub by hand.

Special tool
(A) : 09944-77020 (For 4WD)
(A) : 09951-16050 (For 2WD)

Tightening torque
Wheel bearing lock nut
(a) : 220 N·m (22.0 kg-m, 160 lb-ft)

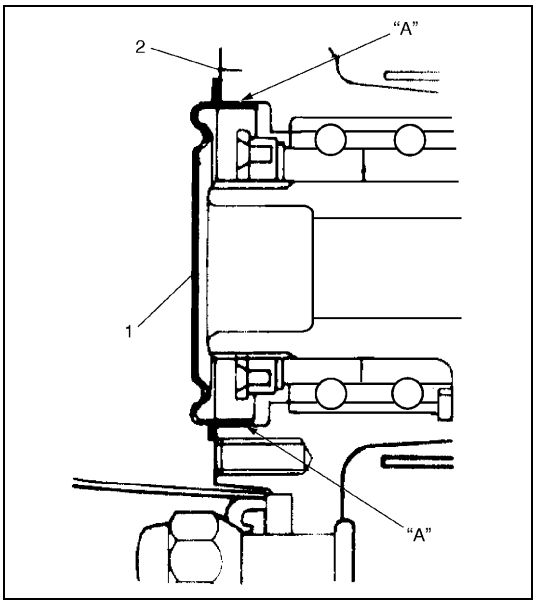
11) Install hub cap (for 2WD model) or air locking hub assembly (for 4WD model) as follows.

For 2WD model:



a) Using lock plate (1), lock bearing lock nut. If lock screw hole is not aligned with screw hole in lock nut, turn lock nut in tightening direction till they align.

Tightening torque
Wheel bearing lock washer screw
(a) : 1.5 N·m (0.15 kg-m, 1.0 lb-ft)

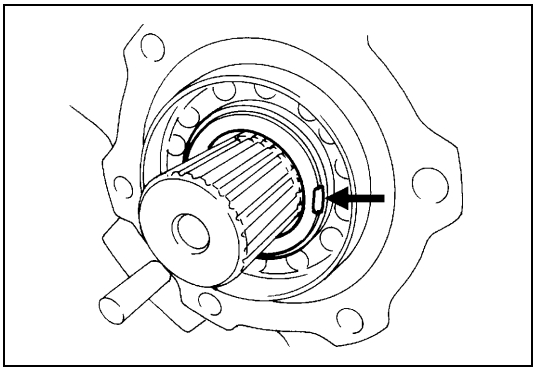


b) Remove grease, old sealant and dusts from mating surfaces of hub cap (1) and wheel hub (2) to clean, apply water tight sealant to hub cap mating surface evenly, and install hub cap (1) to wheel hub (2).

NOTE:

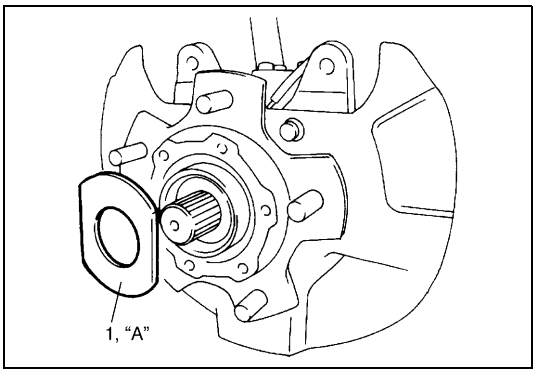
- **When installing hub cap (1), hammer lightly several locations on the collar of cap until collar comes closely into contact with wheel hub (2).**
- **If fitting part of cap is deformed or damaged or if it is fitted loosely, replace with new one.**

"A" : Sealant 99000-31090



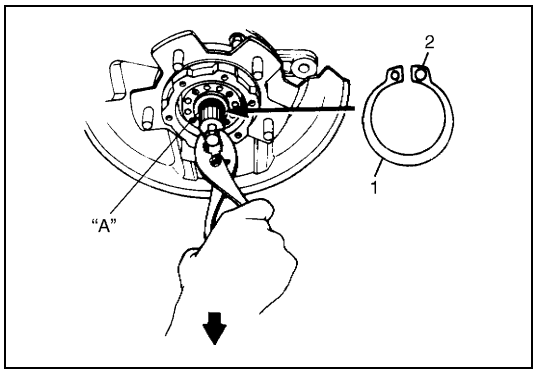
For 4WD model:

a) Caulk front wheel bearing lock nut at groove of spindle.



b) Apply lithium grease thinly to both surface, all around of front spindle thrust washer (1).

"A" : Grease 99000-25010

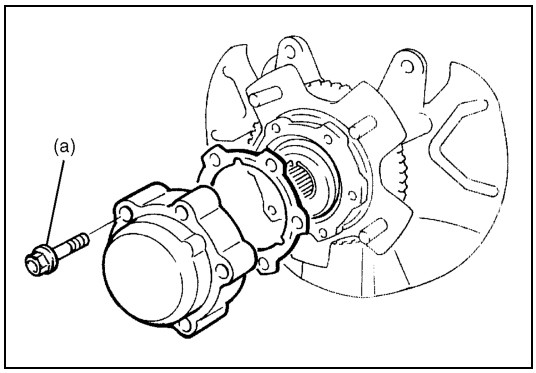


c) Install front axle shaft circlip (1) and apply thin coat of grease to spline part of axle shaft.

NOTE:

When installing circlip (1) to front axle shaft, utilize screw hole in axle shaft to pull it out and bring large diameter (2) of circlip at right as shown.

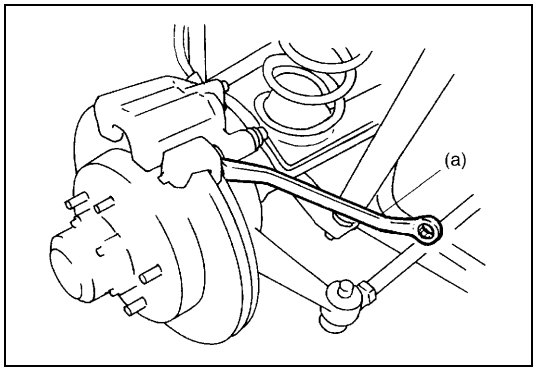
"A" : Grease 99000-25010



d) Clean mating surface of air locking hub and wheel hub. Install air locking hub assembly to wheel hub and tighten bolts to specified torque.

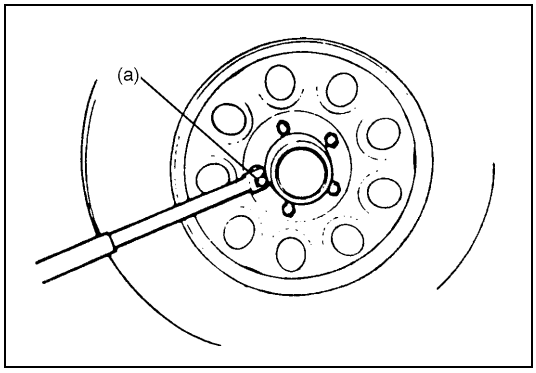
Tightening torque
Air locking hub bolts
(a) : 48 N·m (4.8 kg-m, 35.0 lb-ft)

12) Install ABS wheel sensor (if equipped with ABS).



13) Install brake disc and caliper assembly. Tighten carrier bolts to specified torque.

Tightening torque
Brake caliper carrier bolts
(a) : 85 N·m (8.5 kg-m, 61.5 lb-ft)



14) Install wheel and tighten wheel nuts specified torque.

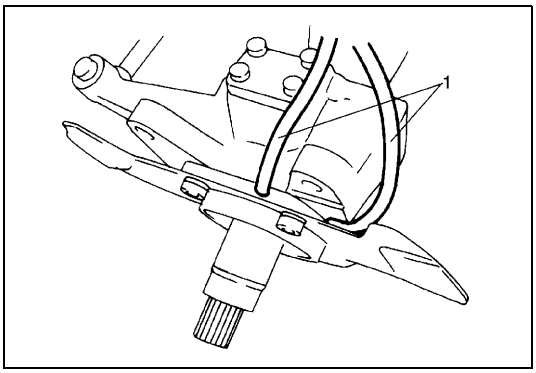
Tightening torque
Wheel nuts
(a) : 95 N·m (9.5 kg-m, 69.0 lb-ft)

15) Lower hoist.
16) For 4WD model:
Check air locking hub for air leakage, refer to "4WD System Check" in this section.

Steering Knuckle / Wheel Spindle

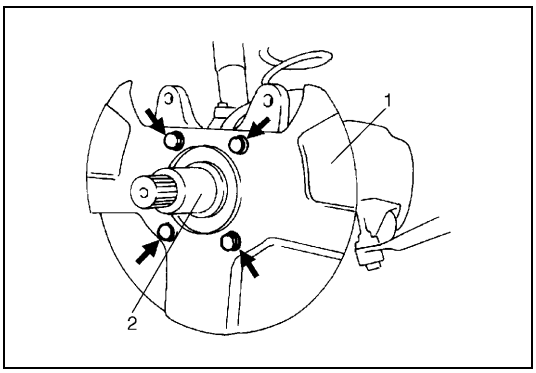
REMOVAL

1) Hoist vehicle and remove wheel.
2) Remove wheel hub assembly, refer to “Wheel Hub / Bearing / Oil Seal” in this section.

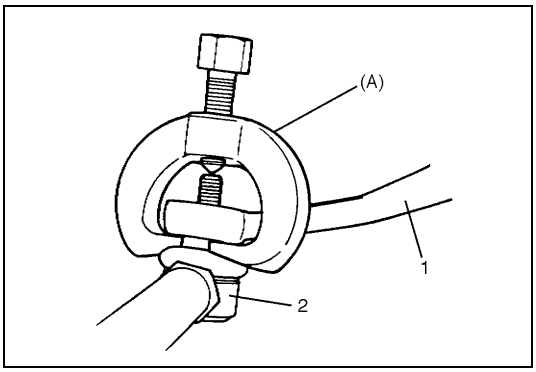


3) Disconnect spindle vacuum hoses (1) from wheel spindle (for 4WD).

CAUTION:
Give match mark to each spindle vacuum hoses before removing hose.

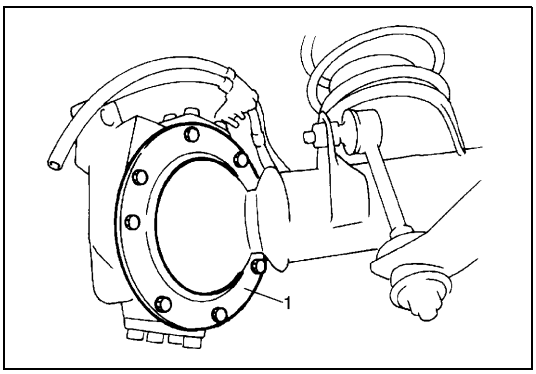


4) Remove disc dust cover (1) and wheel spindle (2).

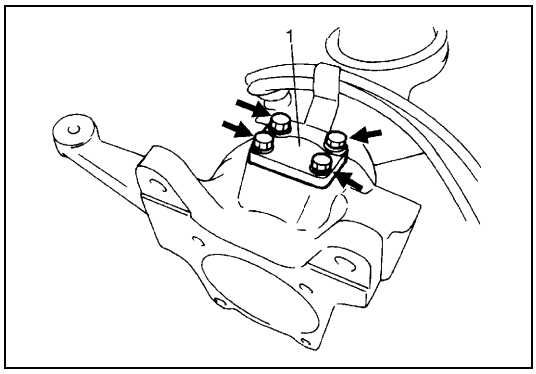


5) Remove tie rod end (and drag rod end) nut(s) and disconnect tie rod end (and drag rod end) (2) from steering knuckle (1) with special tool.

Special tool
(A) : 09913-65210



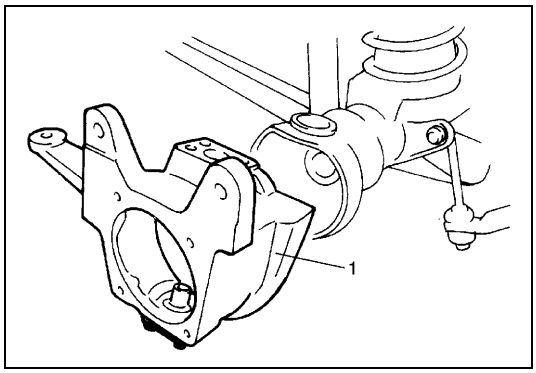
6) Remove knuckle seal cover bolts. Then remove knuckle seal cover (1), knuckle seal and knuckle seal retainer from knuckle.



7) Remove lower and upper kingpins (1).

NOTE:

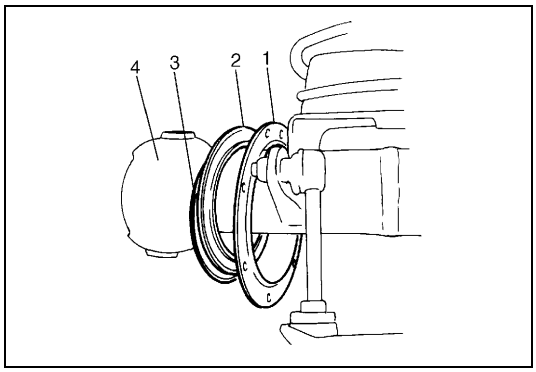
Upper and lower kingpins (1), when removed, must be marked off one from the other.



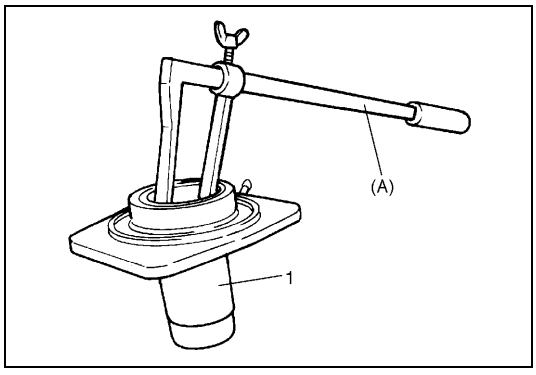
8) Remove steering knuckle (1).

NOTE:

- **When steering knuckle (1) is pulled, lower kingpin bearing sometimes falls off. So remove bearing while pulling off the knuckle gradually.**
- **Upper and lower kingpin bearings must be also marked off one from the other.**



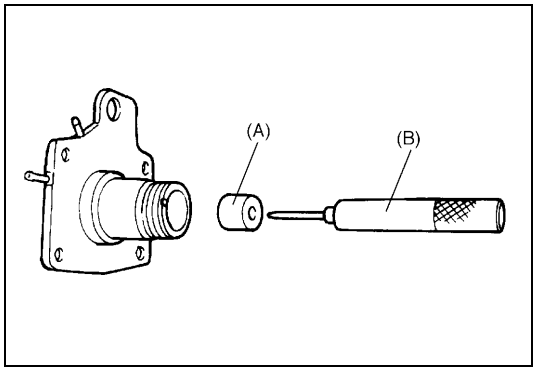
9) Remove knuckle seal cover (1), knuckle seal (2) and knuckle seal retainer (3) from front axle housing (4).



10) Remove spindle oil seal by using special tool.

Special tool
(A) : 09913-50121

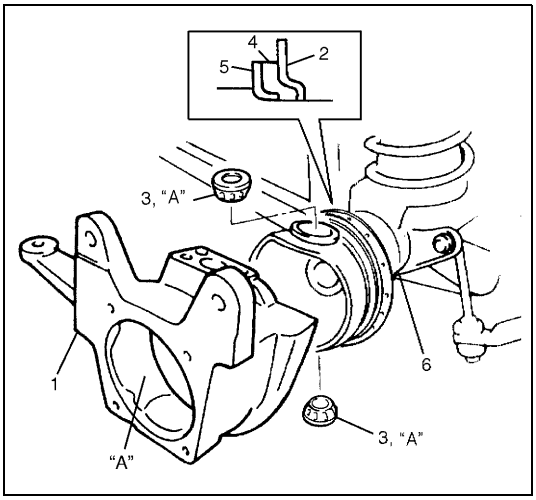
1. Wheel spindle



11) Remove spindle bushing by using special tools.

Special tool
(A) : 09917-88210
(B) : 09916-58210

INSTALLATION



1) Set knuckle seal cover (2), knuckle seal (4) and knuckle seal retainer (5) on front axle housing (6).
2) Apply grease within the knuckle (1). Amount of grease to be applied within the knuckle (1) is approximately 100 g (for 4WD).

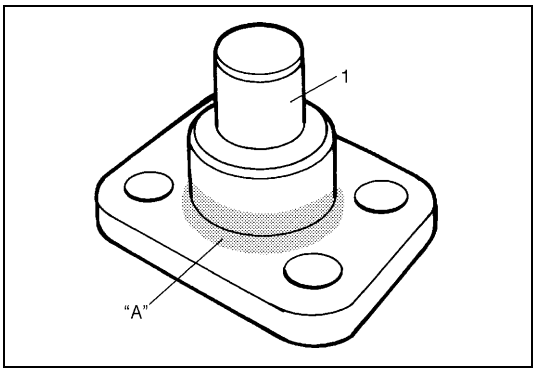
"A" : Grease 99000-25030

3) Apply grease to kingpin bearings (3) and install them to front axle housing (6).

NOTE:

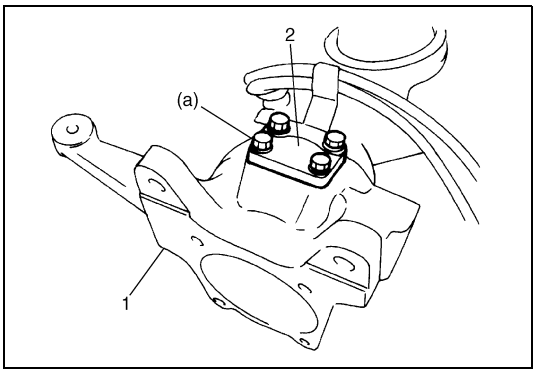
When reusing bearing (3), install bearing (3) with sealing at the top.

"A" : Grease 99000-25030



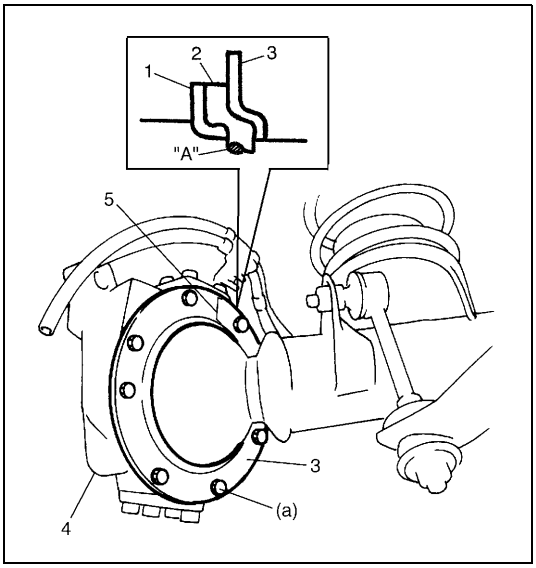
4) Apply sealant to indicated part of kingpin (1).

"A" : Sealant 99000-31090



5) Install steering knuckle (1) and king pins (2) and tighten kingpin bolts to specified torque.

Tightening torque
Kingpin bolts
(a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)



6) Apply grease to all around of knuckle seal lip.

"A" : Grease 99000-25010

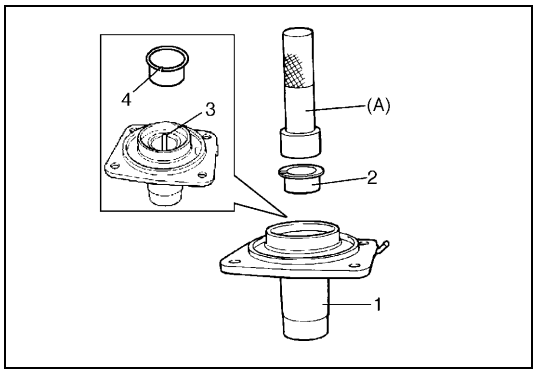
7) Install knuckle seal retainer (1), knuckle seal (2) and knuckle seal cover (3), tighten bolts to specified torque.

NOTE:

Install knuckle seal cover (3) and knuckle seal retainer (1) so that their split section comes at the top as shown in figure.

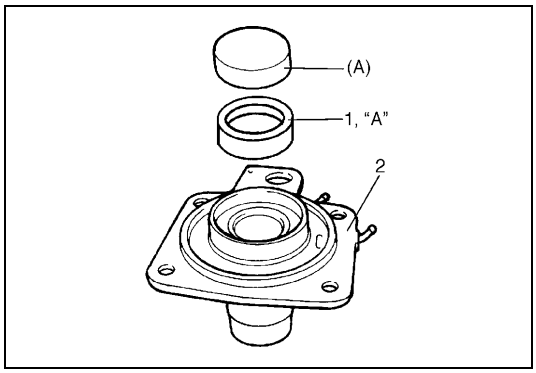
Tightening torque
Knuckle seal cover bolts
(a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)

4. Steering knuckle	5. Split part



8) Press-fit spindle bushing (2) to wheel spindle (1) by using special tool.
Set cut part (4) of spindle bushing (2) as shown in figure (opposite side of the groove (3) of wheel spindle).

Special tool
(A) : 09922-55131

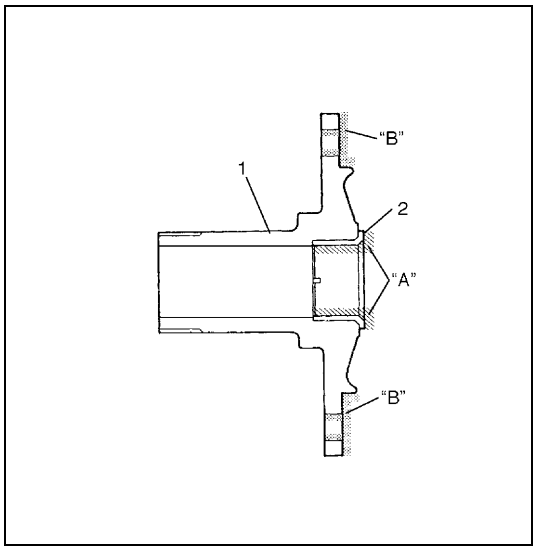


9) Press-fit spindle oil seal (1) until it becomes flush with wheel spindle (2) surface by using special tool, and then apply grease to its lip.

Special tool
(A) : 09944-66020

10) Apply grease to spindle oil seal lip.

"A" : Grease 99000-25010



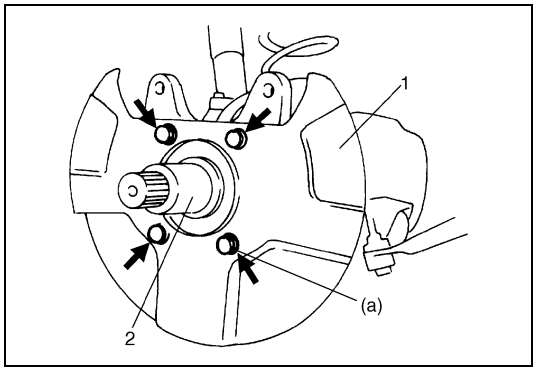
11) Apply grease to spindle bushing inside surface and flange (2).

"A" : Grease 99000-25010

CAUTION:
As this hole is a part of the passage of the vacuum that activates the air locking hub, if it is clogged with grease, the air locking hub cannot be locked or unlocked.
Therefore, be careful not to apply too much grease to avoid clogging the vacuum passage.

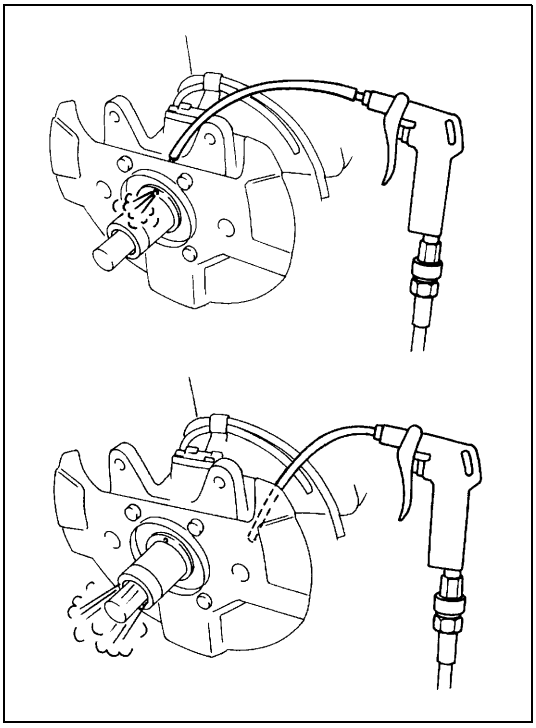
12) Install wheel spindle to knuckle, coat their mating surface with sealant.

"B" : Sealant 99000-31110 or 99000-31090



13) Install wheel spindle (1) and disc dust cover (2) to steering knuckle. Tighten wheel spindle bolts to specified torque.

Tightening torque
Wheel spindle bolts
(a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)



14) Blow air into pipes at the top and the front of wheel spindle and check that it comes out of the hole as shown in figure (for 4WD).

CAUTION:
As this hole is a part of the passage of the vacuum that activates the air locking hub, if it is clogged with grease, the air locking hub cannot be locked or unlocked.
Therefore, be careful not to apply too much grease to avoid clogging the vacuum passage.

15) Connect spindle vacuum hoses to wheel spindle (for 4WD).
16) Connect tie rod and drag rod to steering knuckle, refer to “Tie rod and Drag Rod” in Section 3B.
17) Install wheel hub assembly, refer to “Wheel Hub / Bearing / Oil Seal” in this section.
18) Install wheel and tighten wheel nuts to specified torque.

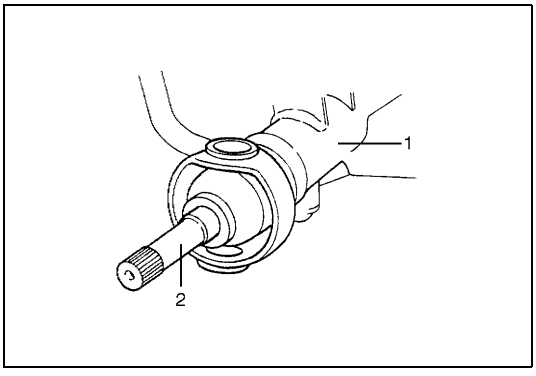
Tightening torque
Wheel nuts
: 95 N·m (9.5 kg-m, 69.0 lb-ft)

19) Lower hoist.

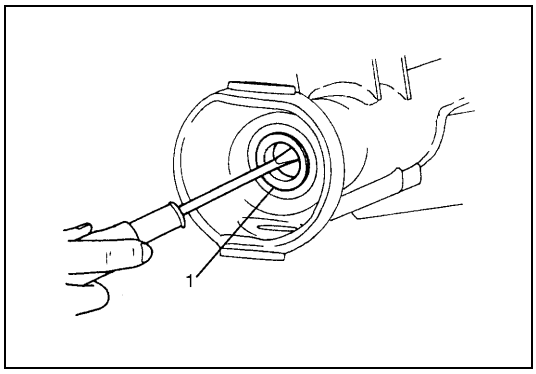
Front Axle Shaft / Oil Seal / Kingpin Bearing Outer Race

REMOVAL

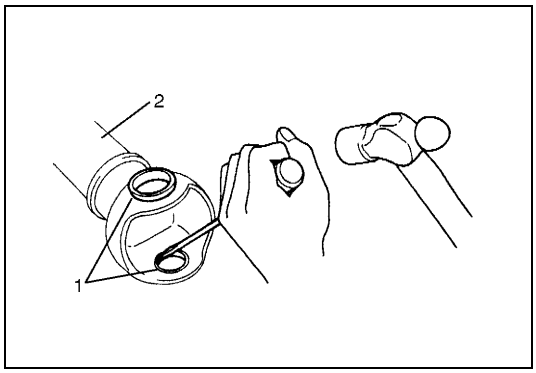
1) Hoist vehicle.
2) Drain differential gear oil from front axle housing by loosing drain plug (for 4WD).
3) Remove steering knuckle. For details, refer to “Steering Knuckle / Wheel Spindle” in this section.
4) Draw out axle shaft (2).



1. Front axle housing

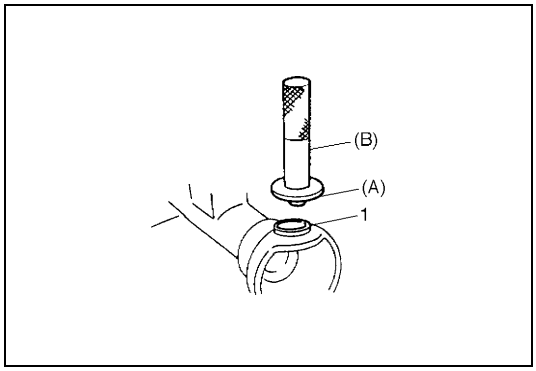


5) Remove oil seal (1) from axle housing (for 4WD).



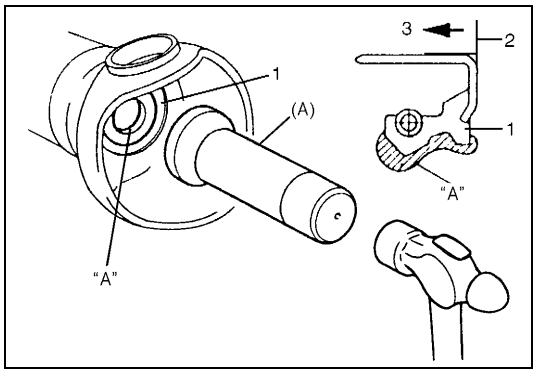
6) Drain out kingpin bearing outer race (1) from front axle housing (2).

INSTALLATION



1) Install kingpin bearing outer race (1) to front axle housing by using special tools.

Special tool
(A) : 09944-68510
(B) : 09924-74510



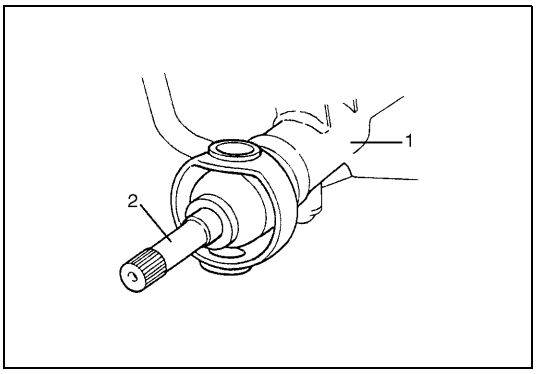
2) Press-fit oil seal (1) until it becomes flush with inner surface of front axle housing (2) by using special tool.

Special tool
(A) : 09951-76010

3) Apply grease to oil seal lip.

"A" : Grease 99000-25010

3. Body center



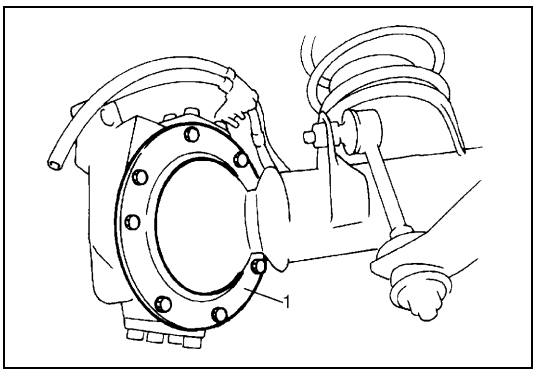
4) Install axle shaft (2) to front axle housing (1) (for 4WD).

5) Install knuckle to front axle housing. For details, refer to “Steering Knuckle / Wheel Spindle” in this section.
6) Refill front axle (differential) housing with new specified gear oil (for 4WD). Refer to “Maintenance Service” in Section 7E for refill.
7) After servicing, check that no oil leakage exists.

Steering Knuckle Seal

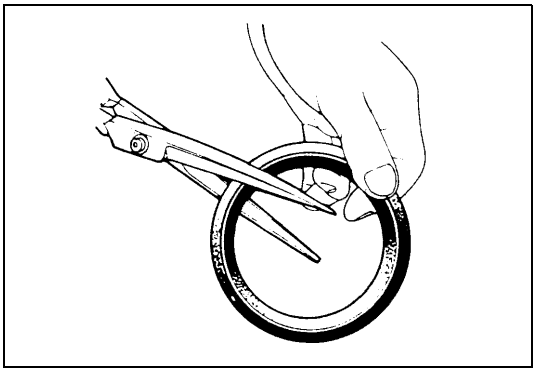
REMOVAL

1) Hoist vehicle.

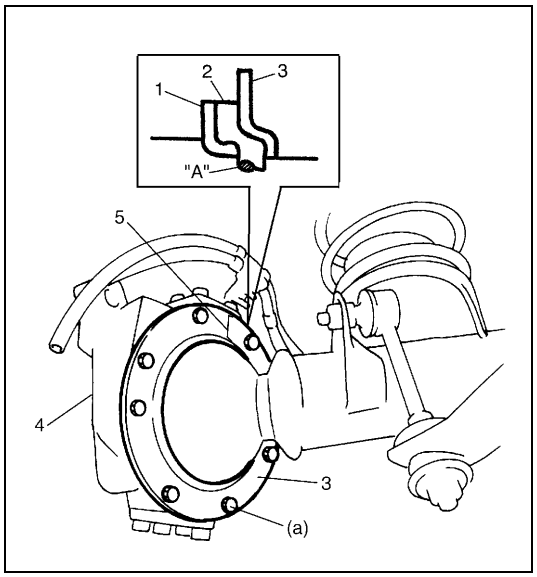


2) Remove knuckle seal cover bolts and seal cover (1).
3) Cut oil seal in place with scissors or knife, and take it off.

INSTALLATION



1) Cut replacement oil seal at one place with scissors or a knife.



2) Apply grease to oil seal lip.

"A" : Grease 99000-25010

3) Install oil seal retainer (1), oil seal (2) and oil seal cover (3) to steering knuckle (4).
Tighten bolts to specified Torque

NOTE:

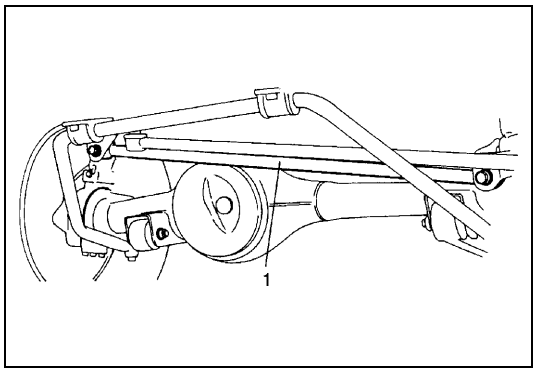
Install the seal (2) in oil seal retainer (1), bringing the split part (5) to top side and locating it about 30° off the matching face of oil seal retainer (1).

Tightening torque
Knuckle seal cover bolts
(a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)

Lateral Rod

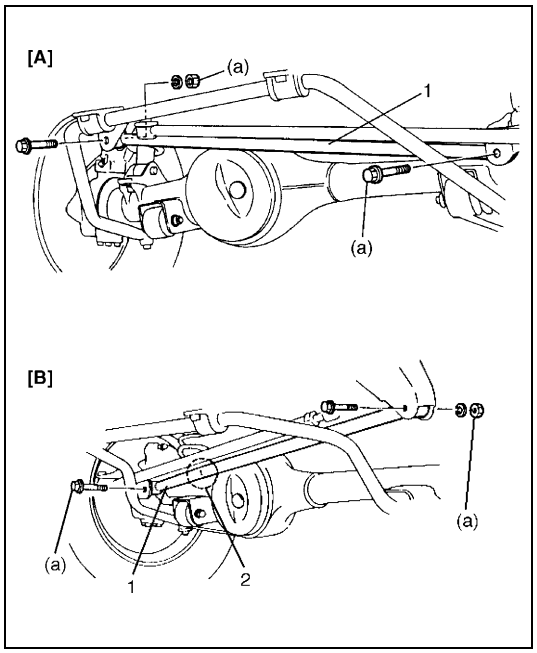
REMOVAL

1) Hoist vehicle.



2) Remove mounting bolts of lateral rod (1).
3) Remove lateral rod (1).

INSTALLATION



1) Install lateral rod (1) to vehicle body and front axle housing, referring to figure for proper installing direction of bolts.
Bolt and nut should not be tightened.

NOTE:

For left hand steering vehicle, install lateral rod with its bending point (2) placed to right side of vehicle.

2) Lower hoist and with vehicle in non-loaded condition, tighten bolt and nut of lateral rod to specified torque.

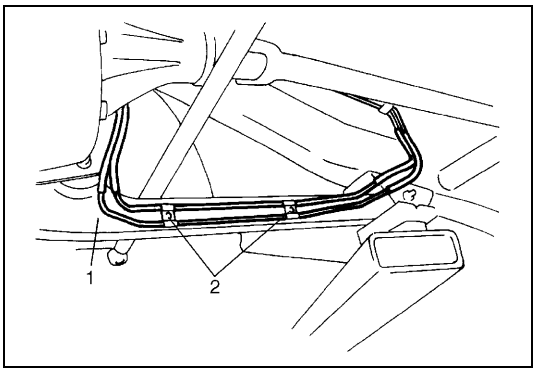
Tightening torque
Lateral rod bolt and nut
(a) : 90 N·m (9.0 kg-m, 65.0 lb-ft)

[A] :	Right hand steering vehicle
[B] :	Left hand steering vehicle

Leading Arm / Bushing

REMOVAL

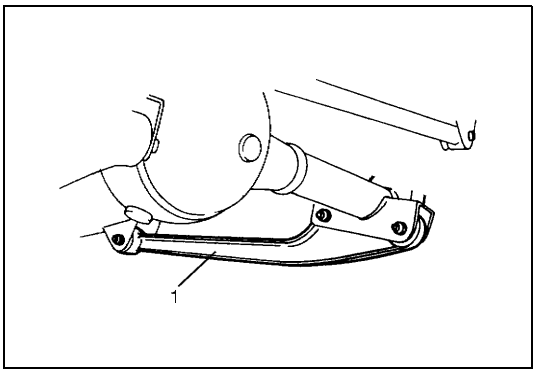
1) Hoist vehicle.



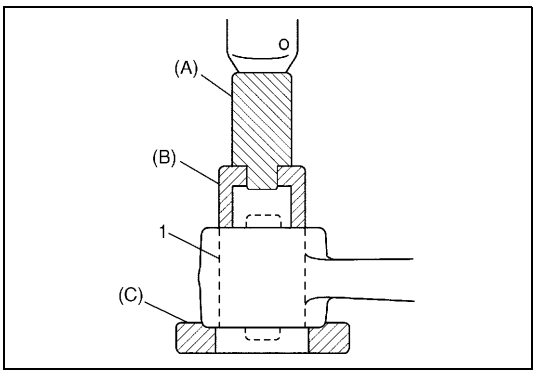
2) Remove air locking hub vacuum pipe clamp bolts (2) (for 4WD).

1. Leading arm (right side)

3) Support front axle housing by using floor jack.
4) Remove shock absorber lower mounting bolt, refer to “Front Shock Absorber” in this section.



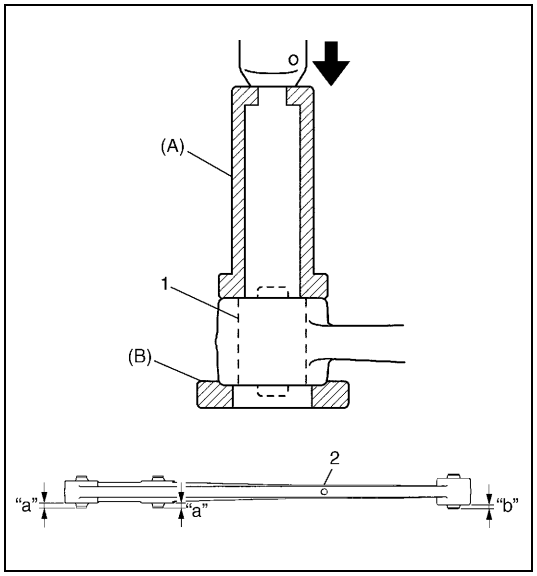
5) Remove mounting bolts and leading arm (1).



6) Remove bushings by using hydraulic press and special tools.

Special tool
(A) : 09924-74510
(B) : 09951-16030
(C) : 09951-26010

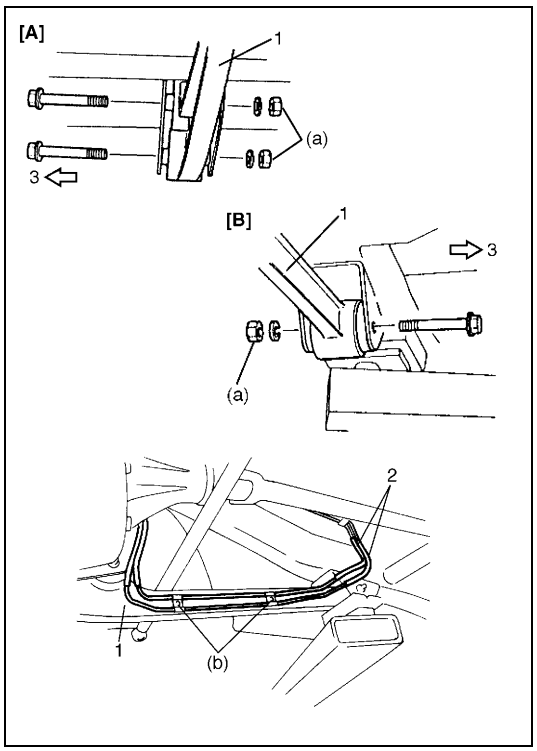
INSTALLATION



1) Install bushings (1) by using hydraulic press and special tools, noting the following point.
   - Install bushings (1) so that either face of bushing are aligned with housing edge of leading arm (2), also the length between the aligned side end of bushing and leading arm (2) are within specification below.

Special tool
(A) : 09913-85210
(B) : 09951-26010

Specification for leading arm bushing protrusion
"a" : 8.5 – 10.5 mm (0.33 – 0.41 in.)
"b" : 6.0 – 9.0 mm (0.24 – 0.35 in.)



2) Install leading arm (1) to vehicle body and axle housing, referring to figure for proper installing direction of bolts.
   Nuts should not be tightened.
3) Install shock absorber lower mounting bolt, refer to "Front Shock Absorber" in this section.
4) Install air locking hub vacuum pipe clamp bolts and tighten them to specified torque (for 4WD).

Tightening torque
Vacuum pipe clamp bolts
(b) : 5.5 N·m (0.55 kg-m, 4.0 lb-ft)

5) Lower hoist and with vehicle in non-loaded condition, tighten nuts of leading arm to specified torque.

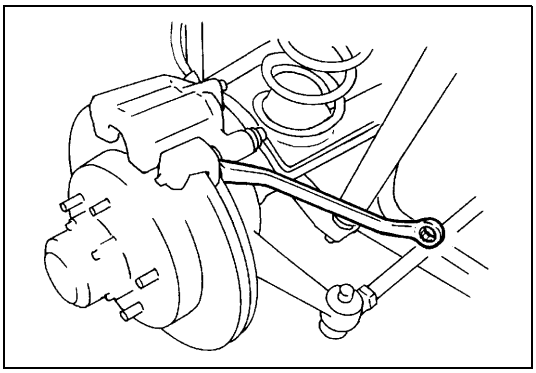
Tightening torque
Leading arm nuts
(a) : 90 N·m (9.0 kg-m, 65.0 lb-ft)

2.	Vacuum hose
3.	Body outside
[A] :	Front
[B] :	Rear

Front Axle Housing

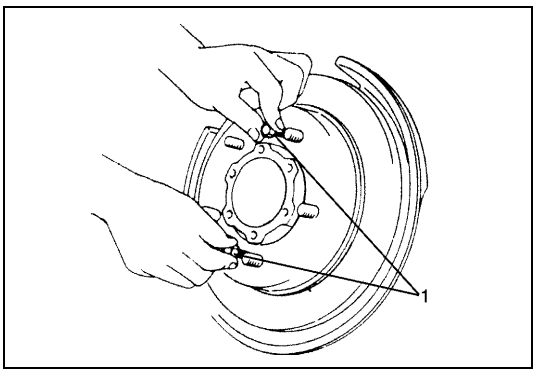
REMOVAL

1) Hoist vehicle.
2) Remove front wheels.
3) Drain front differential gear oil (for 4WD).



4) Remove caliper carrier bolts (R&L) and suspend caliper.

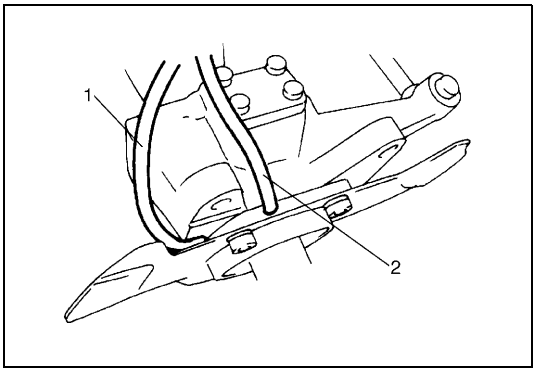
CAUTION:
During removal, be careful not to damage brake flexible hose and not to depress brake pedal.



5) Remove right and left brake disc.

NOTE:
If brake disc can not be removed by hand, use 8mm bolts (1).

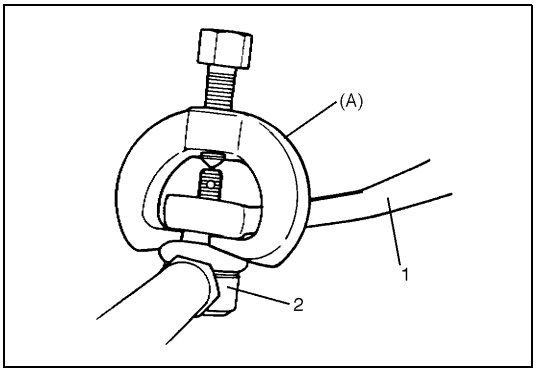
6) Remove wheel speed sensor (if equipped with ABS).



7) Disconnect spindle vacuum hoses from wheel spindle (for 4WD).

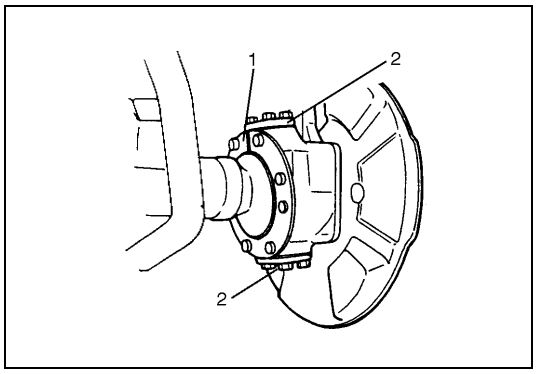
CAUTION:
Give match mark to spindle vacuum hose and wheel spindle before removal.

1.	Vacuum hose to lock
2.	Vacuum hose to unlock



8) Remove tie rod (and drag rod) end nuts and disconnect tie rod (and drag rod) ends (2) from knuckle arm (1) (R&L) with special tool.

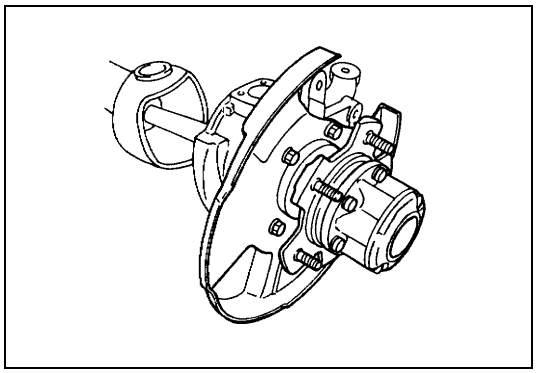
Special tool
(A) : 09913-65210



9) Remove knuckle seal cover bolts, take off knuckle seal cover (1), knuckle seal and knuckle seal retainer.
10) Remove upper and lower kingpins (2) from steering knuckle.

NOTE:

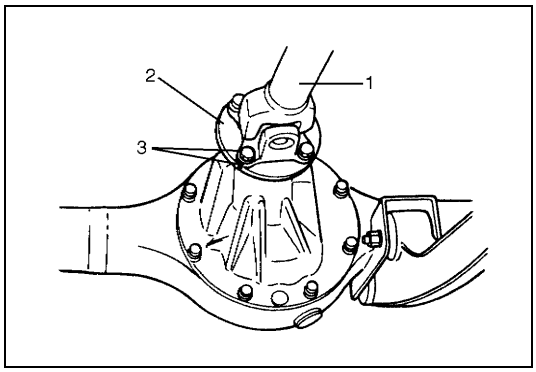
The removed upper and lower kingpins (2) must be kept separated so as to prevent an error when putting them back in their place in reassembly.



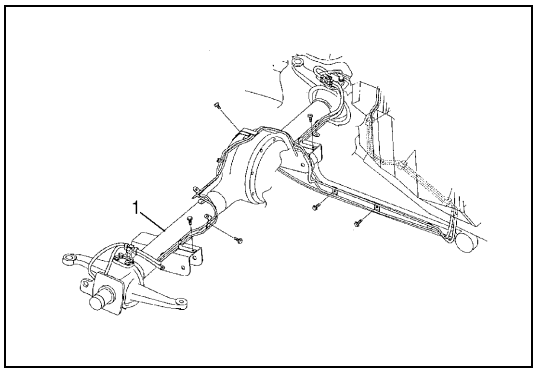
11) Remove knuckle with hub assembly from axle housing (for 2WD model) or draw out right and left axle shafts with knuckle and hub assembly (for 4WD model).

NOTE:

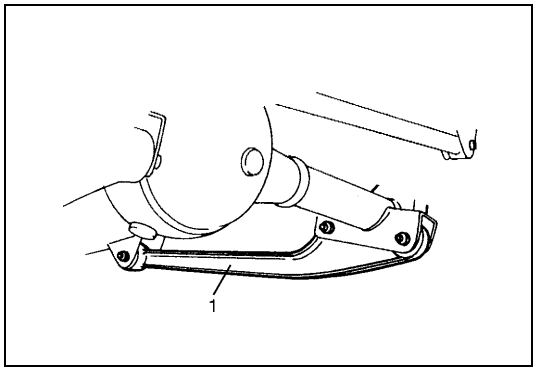
At this time, lower kingpin bearing sometimes falls off. So remove bearing while pulling off knuckle gradually.



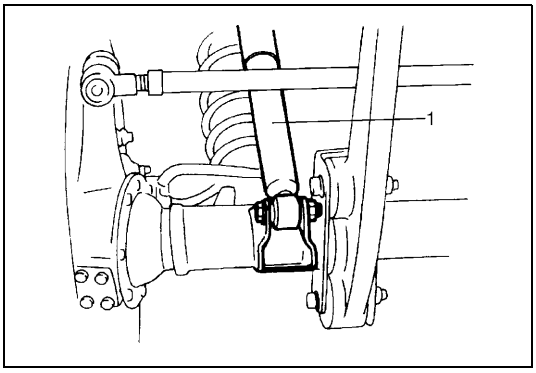
12) Before removing front propeller shaft (1), give match marks (3) on joint flange (2) and front propeller shaft as shown (for 4WD).
13) Remove front differential from front axle housing (for 4WD).



14) Remove air locking hub vacuum pipe from axle housing (1) (for 4WD).

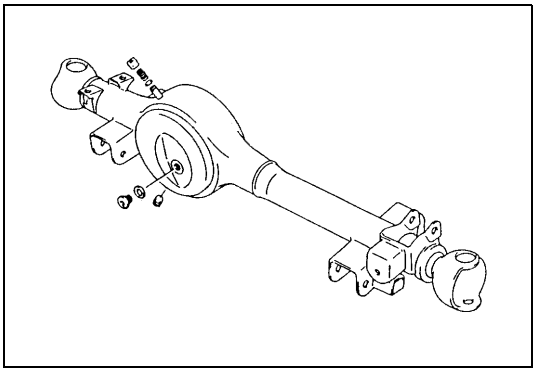


15) Support front axle housing by using floor jack.
16) Remove lateral rod, refer to “Lateral Rod” in this section.
17) Remove stabilizer bar, refer to “Stabilizer Bar / Bushings” in this section.
18) Loosen mounting nuts of leading arm (1) but don’t remove bolts.



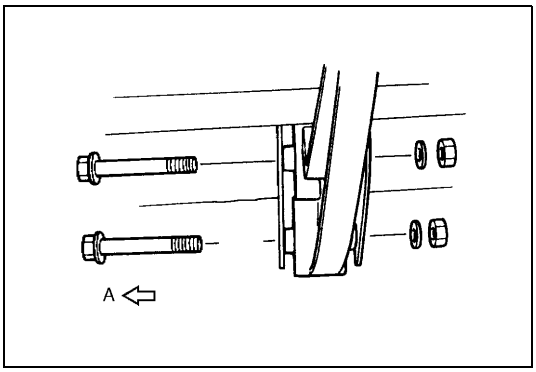
19) Lower floor jack until tension of suspension coil spring becomes a little loose and remove right and left sides lower mounting bolt of shock absorber (1).

20) Remove front mounting bolts of leading arm.
21) Lower front axle housing gradually.



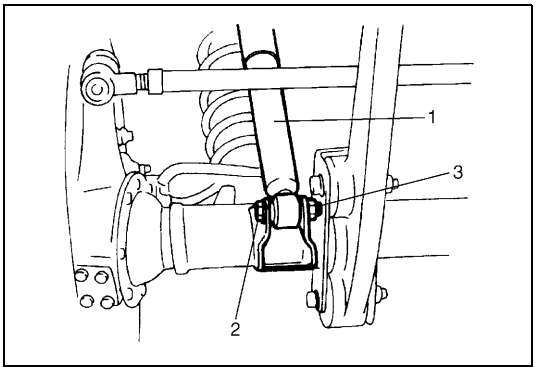
22) Remove axle housing.

INSTALLATION

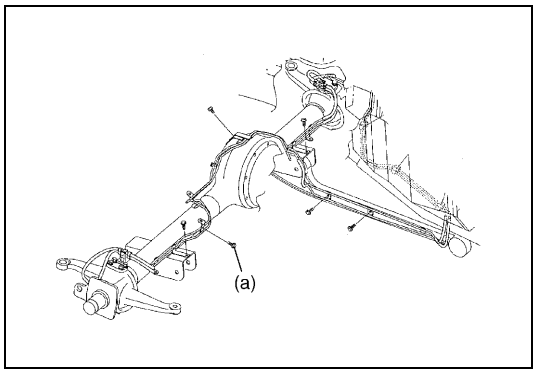


1) Place rear axle housing on floor jack. Then install leading arm front mounting bolts (right & left) in proper direction as shown. At this time, mount nuts but don't tighten them.

A : Body outside



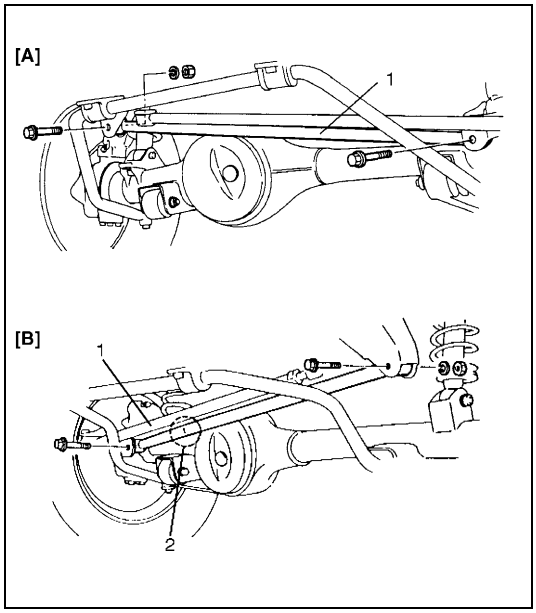
2) Install lower part of shock absorber (1) to right and left sides of axle housing and install bolts (2) in proper direction as shown in figure. At this time, mount nuts (3) but don't tighten them.



3) Install air locking hub vacuum pipe and tighten clamp bolts to specified torque (for 4WD).

Tightening torque
Vacuum pipe clamp bolts
(a) : 5.5 N·m (0.55 kg-m, 4.0 lb-ft)

4) Install stabilizer bar, refer to “Stabilizer Bar / Bushings” in this section.

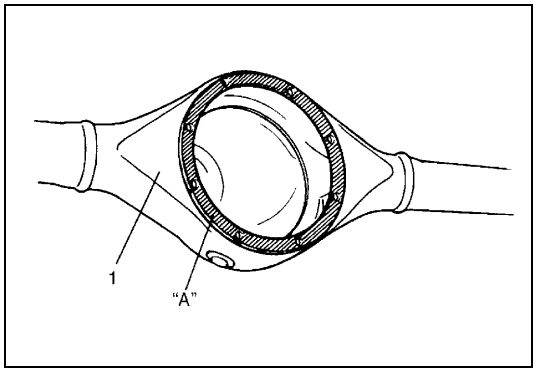


5) Install lateral rod (1) to vehicle body and axle housing.
Install bolts in proper direction as shown in figure.
At this time, mount bolt and nut but don't tighten them.

NOTE:

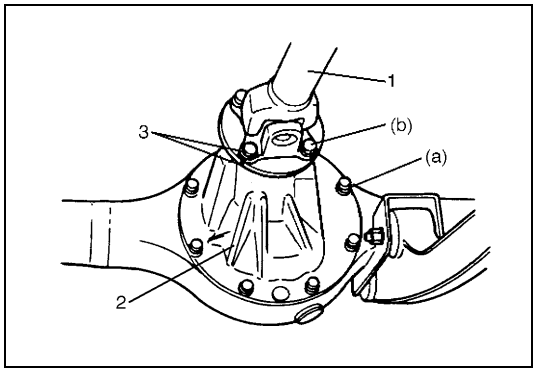
For left hand steering vehicle, install lateral rod with its bending point (2) placed to right side of vehicle.

[A] :	Right hand steering vehicle
[B] :	Left hand steering vehicle



6) Clean mating surfaces of axle housing (1) and differential carrier and apply sealant to housing side (for 4WD).

“A” : Sealant 99000-31110



7) Install differential carrier assembly (2) to axle housing and tighten carrier bolts to specified torque (for 4WD).

Tightening torque
Front differential carrier bolts
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

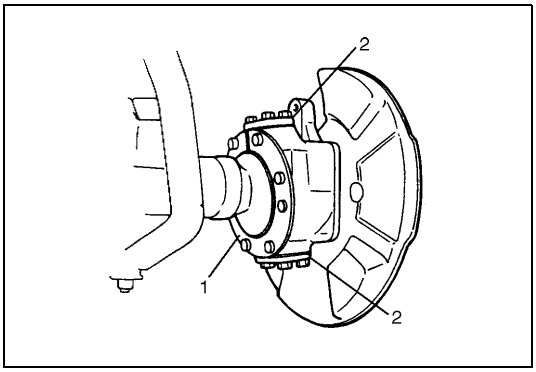
8) Install front propeller shaft (1) to joint flange aligning match marks (3) and torque flange bolts to specification (for 4WD).

Tightening torque
Front propeller shaft flange bolts
(b) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

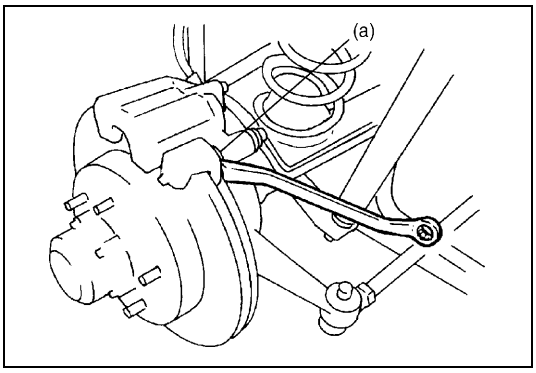
9) Install right and left axle shafts to axle housing (for 4WD). Install knuckle to axle housing (for 2WD).

NOTE:

Place knuckle seal and retainer in axle housing before installing axle shaft (knuckle), using care for installation direction of knuckle seal.



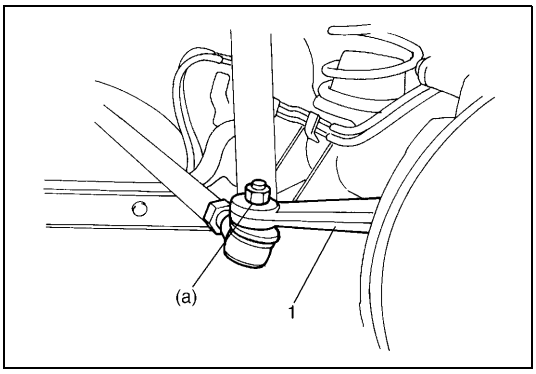
10) Install kingpins (2) and knuckle seal cover (1) to steering knuckle (R&L), refer to “Steering Knuckle / Wheel Spindle” in this section.



11) Install right and left brake disc and caliper assembly. Tighten carrier bolts to specified torque.

Tightening torque
Brake caliper carrier bolts
(a) : 85 N·m (8.5 kg-m, 61.5 lb-ft)

12) Connect spindle vacuum hoses to wheel spindle (for 4WD), while aligning the match mark.
13) Install ABS wheel sensor to steering knuckle (if equipped with ABS).



14) Install tie rod ends and drag rod end to knuckle arm (1) (R&L). Tighten new nuts to specified torque.

NOTE:

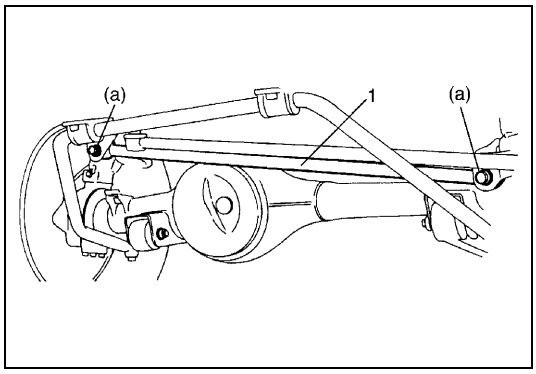
To prevent ball stud from being rotated while tightening tie rod end nut, tighten Nut (M12 x 1.25) to about 20 N·m (2.0 kg-m, 14.5 lb-ft) and remove it. Then tighten new nut to specified torque.

Tightening torque
Tie rod end nuts and drag rod end nut (Knuckle side)
(a) : 43 N·m (4.3 kg-m, 31.5 lb-ft)

15) Install wheels and tighten wheel nuts to specified torque.

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

16) Lower hoist.

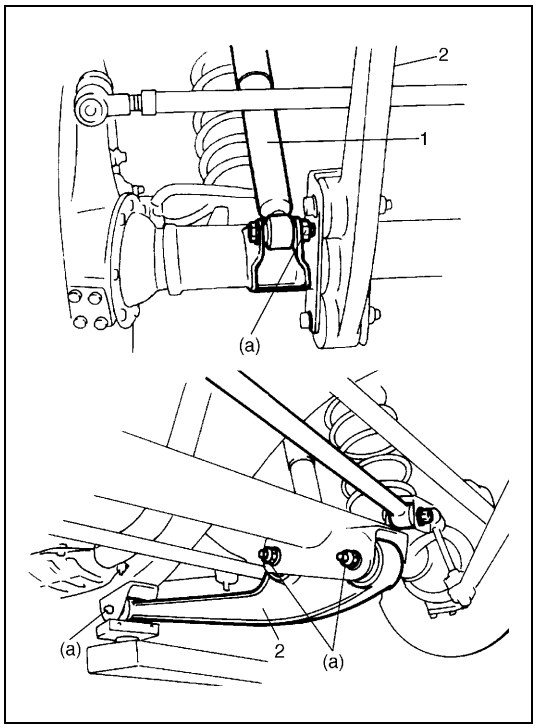


17) Tighten lateral rod (1) mounting bolt and nut to specified torque.

NOTE:

When tightening bolt and nut, be sure that vehicle is off hoist and in non loaded condition.

Tightening torque
Lateral rod bolt and nut
(a) : 90 N·m (9.0 kg-m, 65.0 lb-ft)



18) Tighten right and left shock absorber lower mounting nuts and leading arm mounting nuts to specified torque.

NOTE:

When tightening these nuts, be sure that vehicle is off hoist and in non loaded condition.

Tightening torque
Shock absorber lower nuts and leading arm nuts
(a) : 90 N·m (9.0 kg-m, 65.0 lb-ft)

1. Shock absorber
2. Leading arm

19) Refill front axle (differential) housing with new specified gear oil. Refer to “Maintenance Service” in Section 7E for refill.
20) Confirm front end (wheel) alignment referring to “Preliminary Checks Prior to Adjusting Front Alignment” in Section 3A.

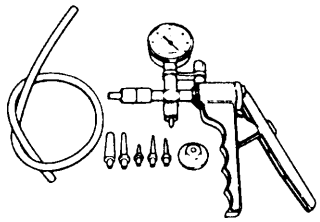
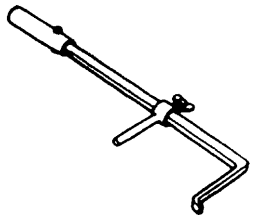
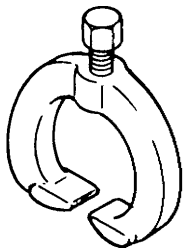
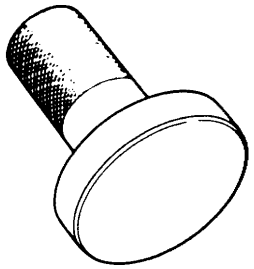
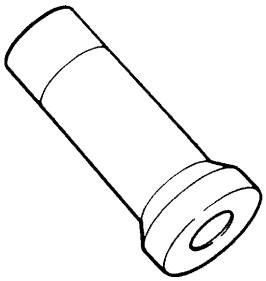
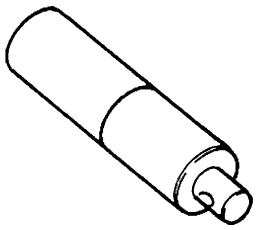
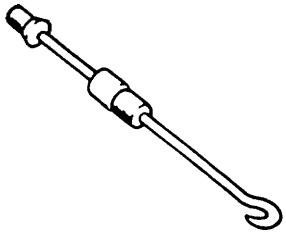
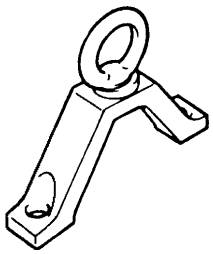
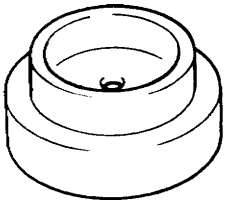
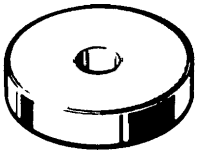
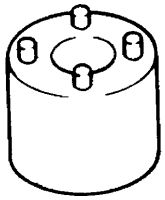
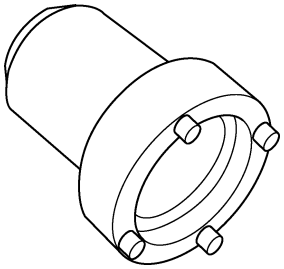
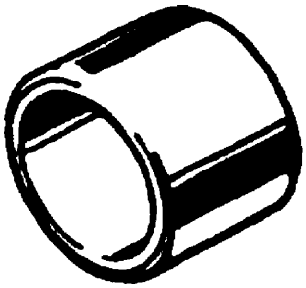
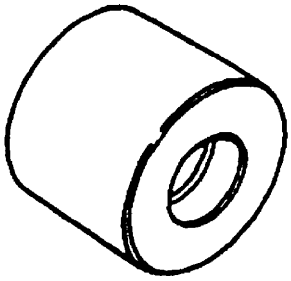
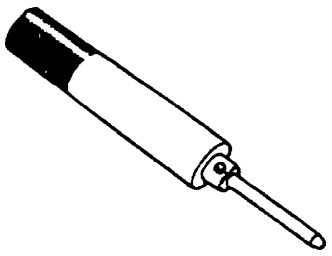
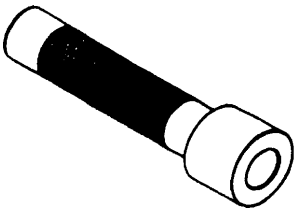
Tightening Torque Specifications

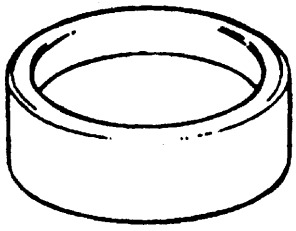
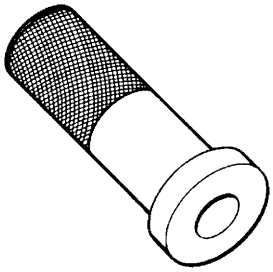
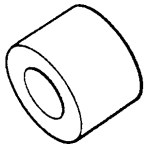
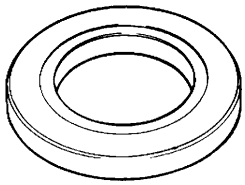
Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Stabilizer mount bracket bolt	20	2.0	14.5
Stabilizer ball joint nut	50	5.0	36.5
Shock absorber lock nut	29	2.9	21.0
Shock absorber lower nut	90	9.0	65.0
Brake caliper carrier bolt	85	8.5	61.5
Wheel bearing lock nut	220	22.0	160.0
Wheel bearing lock washer screw	1.5	0.15	1.0
Air locking hub bolt	48	4.8	35.0
Wheel spindle bolt	50	5.0	36.5
Kingpin bolt	25	2.5	18.0
Knuckle seal cover bolt	10	1.0	7.5
Tie-rod end nut	43	4.3	31.5
Drag-rod end nut (Knuckle side)			
Lateral rod bolt and nut	90	9.0	65.0
Leading arm nut			
Front differential carrier bolt	23	2.3	17.0
Front propeller shaft flange bolt	50	5.0	36.5
Wheel nut	95	9.5	69.0
Vacuum pipe clamp bolt	5.5	0.55	4.0

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Lithium grease	SUZUKI SUPER GREASE (A) (99000-25010)	• Knuckle seal / axle shaft oil seal • Recess of wheel spindles • Wheel hub oil seal • Wheel bearing • Spindle thrust washer • Spindle bush (inside and flange part) • Spindle oil seal
	SUZUKI SUPER GREASE (C) (99000-25030)	• Kingpin bearing • Axle shaft joint (for 4WD)
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	• Mating surfaces of wheel spindle and knuckle • Mating surface of differential carrier and axle housing
Sealing compound	SUZUKI SEALING COMPOUND 366E (99000-31090)	• Mating surface of wheel spindle and knuckle • Kingpin • Mating surfaces of hub cap and wheel hub

Special Tool

 09917-47910 Vacuum pump gauge	 09913-50121 Oil seal remover	 09913-65210 Tie rod end remover	 09913-75520 Bearing installer
 09951-76010 Bearing installer	 09924-74510 Bearing installer handle	 09942-15510 Sliding hammer	 09943-35511 or 09943-35512 Brake drum remover
 09944-66010 Wheel hub / knuckle oil seal installer	 09944-68510 Bearing installer attachment	 09951-16050 Wheel bearing tightening tool	 09944-77020 Ring nut wrench
 09944-78210 Bearing installer support	 09917-88210 Valve guide installer attachment	 09916-58210 Valve guide installer handle	 09922-55131 Bearing installer

			
09944-66020 Bearing installer	09913-85210 Oil seal installer	09951-16030 Bush remover	09951-26010 Bush remover plate

SECTION 3E

REAR SUSPENSION

WARNING:

When hoisting vehicle, be sure to select the lifting point suitable for the service work referring to Section 0A.

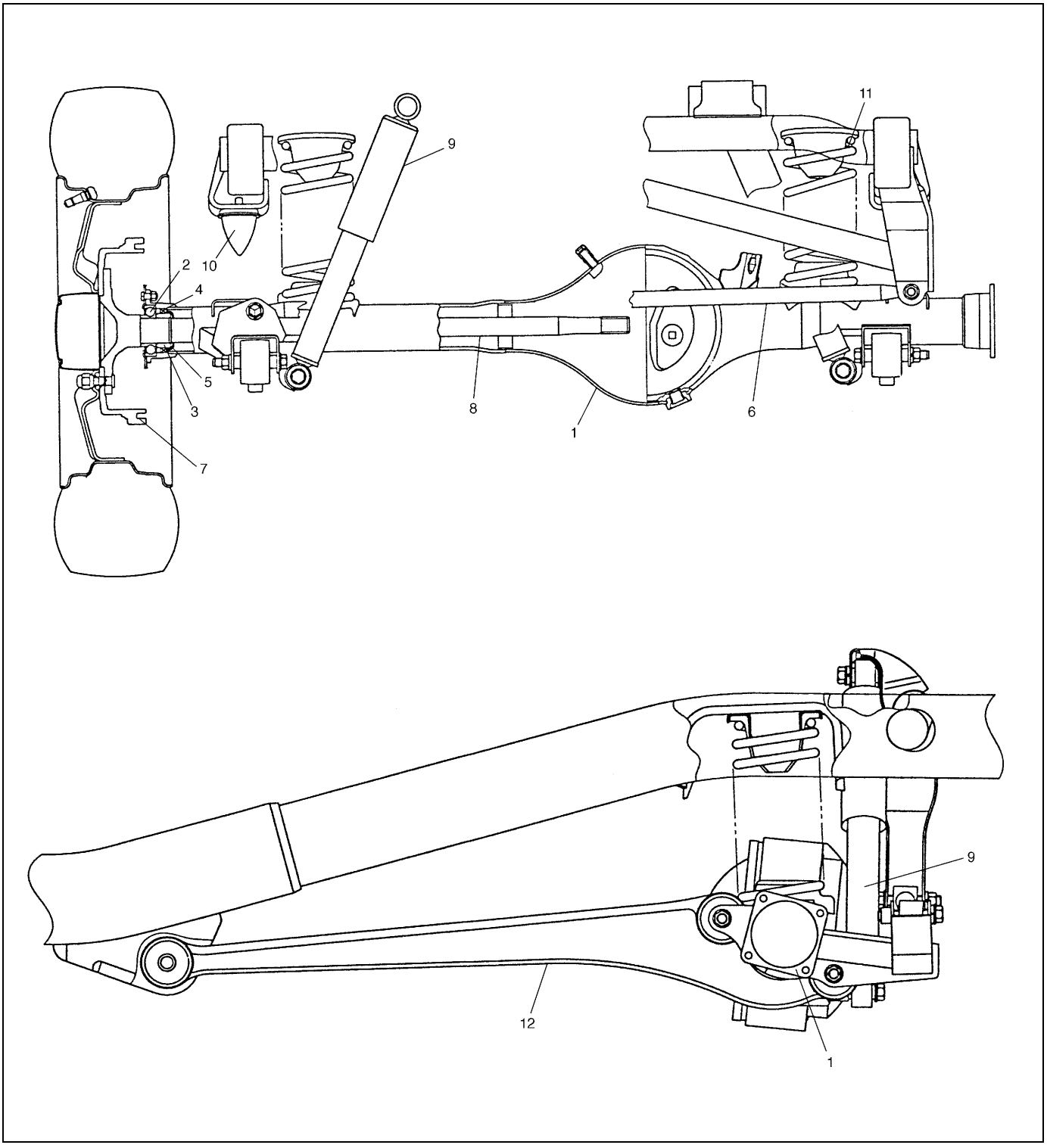
NOTE:

- **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 3E-2
Diagnosis 3E-3
Diagnosis Table 3E-3
Rear Shock Absorber Check 3E-3
Trailing Arm, Lateral Rod, Axle Housing and Coil Spring Check 3E-3
Trailing Arm and Lateral Rod Bush Check ... 3E-3
Rear Suspension Fasteners 3E-4
Bearing Retainer and Axle Shaft Oil Seal Check 3E-4
Bump Stopper and Spring Rubber Seat Check 3E-4
Wheel Disc, Nut and Bearing Check 3E-4
On-Vehicle Service 3E-5
Rear Shock Absorber 3E-5
Coil Spring 3E-6
Bump Stopper 3E-9
Lateral Rod 3E-9
Trailing Arm / Bushing 3E-10
Rear Axle Shaft and Wheel Bearing 3E-12
Rear Axle Shaft Inner Oil Seal 3E-17
Rear Axle Housing 3E-18
Tightening Torque Specifications 3E-22
Required Service Materials 3E-22
Special Tools 3E-23

General Description



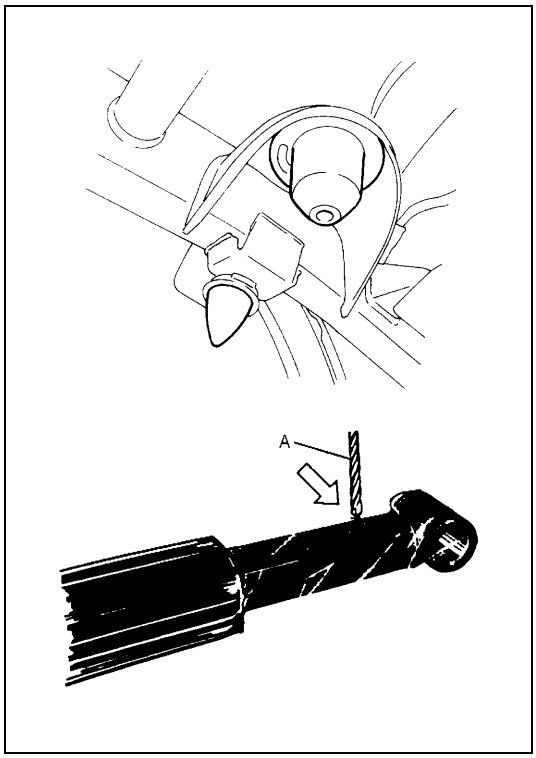
1. Rear axle housing	4. Bearing oil seal	7. Brake drum	10. Bump stopper
2. Rear wheel bearing	5. Oil seal protector	8. Rear axle shaft	11. Coil spring
3. Bearing retainer ring	6. Lateral rod	9. Shock absorber	12. Trailing arm

Diagnosis

Diagnosis Table

Refer to “Diagnosis Table” in Section 3.

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.

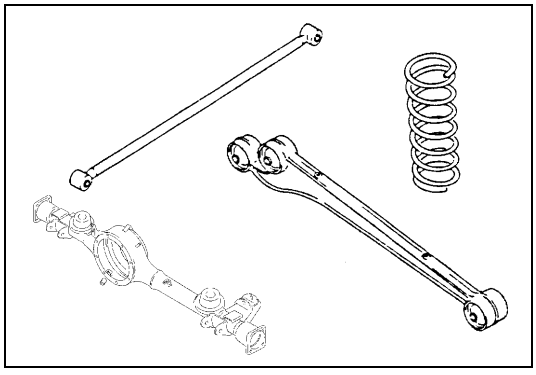
WARNING:

When handling rear shock absorber 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 in it where shown by an arrow in the 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.**

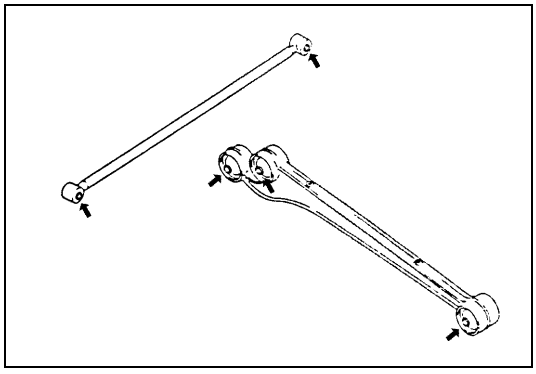
A : Drill hole with approximately 3 mm (0.12 in.) diameter.

Trailing Arm, Lateral Rod, Axle Housing and Coil Spring Check



Inspect for cracks, deformation or damage.
Replace any defective part.

Trailing Arm and Lateral Rod Bush Check

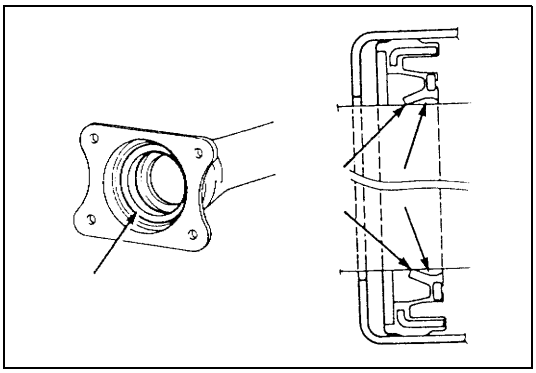


Inspect for wear and breakage. If found defective, replace.

Rear Suspension Fasteners

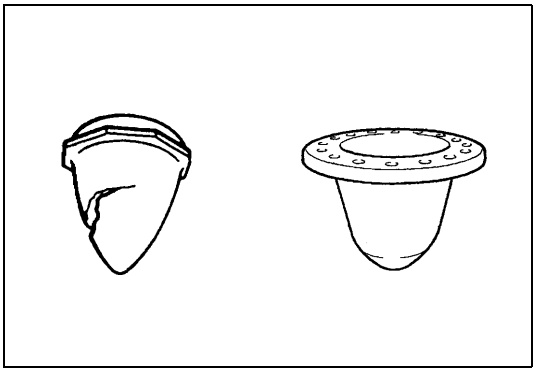
Check each bolt and nut fastening suspension parts for tightness. Tighten loose one, if any, to specified torque, referring to “Tightening Torque Specifications” of this section.

Bearing Retainer and Axle Shaft Oil Seal Check



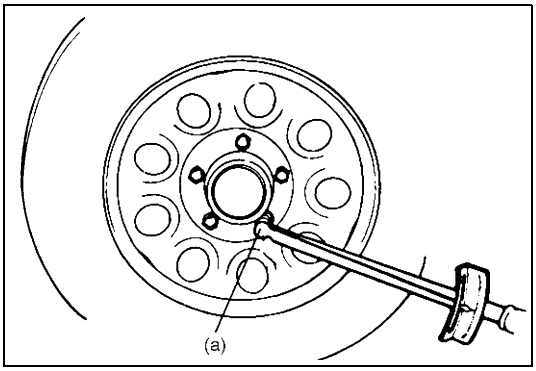
- When brake drum has been removed, check inside of brake drum for gear oil leakage.
- Also, check backside of brake back plate for oil leakage.If oil leakage is found, replace defective oil seal.
- Whenever it is possible to check oil seal during disassembly, check its lip for wear.
  If oil leakage or worn lip is found, replace defective oil seal.

Bump Stopper and Spring Rubber Seat Check



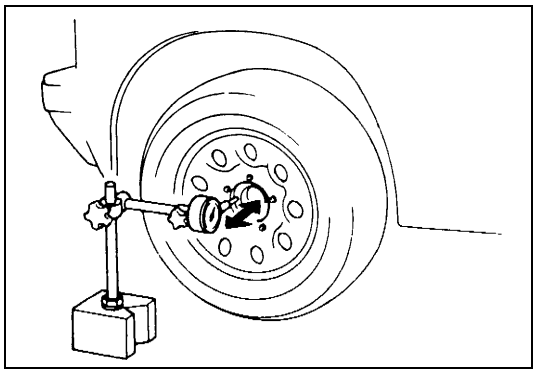
Inspect for wear and breakage. If found defective, replace.

Wheel Disc, Nut and Bearing Check



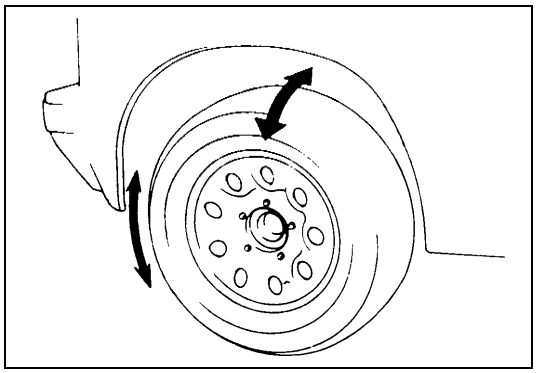
- Inspect each wheel disc for dents, distortion and cracks. A disc in badly damaged condition must be replaced.
- Check wheel hub nuts for tightness and, as necessary, retighten to specification.

Tightening torque
Wheel nuts
(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 after removing wheel center cap from wheel disc.
  When measurement exceeds limit, replace bearing.

Rear wheel bearing thrust play limit
: 0.8 mm (0.03 in.)



- By rotating wheel actually, check wheel bearing for noise and smooth rotation. If it is defective, replace bearing.

On-Vehicle Service

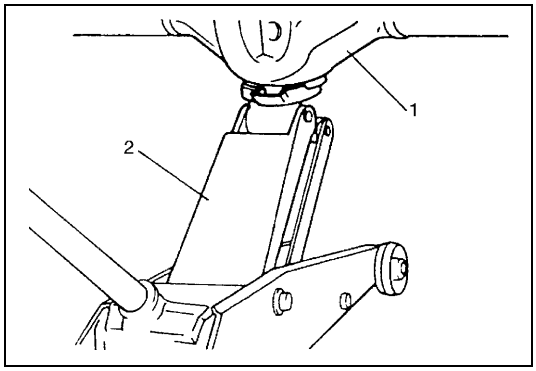
Rear Shock Absorber

WARNING:
When discarding shock absorber, be sure to refer to instructions in "Rear Shock Absorber Check" in this section for proper procedure as it is gas sealed type.

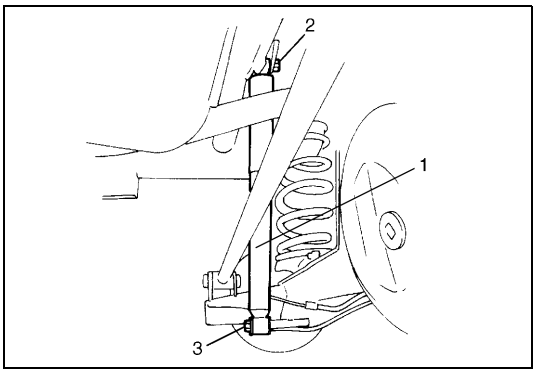
The shock absorber is non-adjustable, non-refillable, and cannot be disassembled. The only service the shock absorber requires is replacement when it has lost its resistance, is damaged, or leaking fluid.

REMOVAL

1) Hoist vehicle.

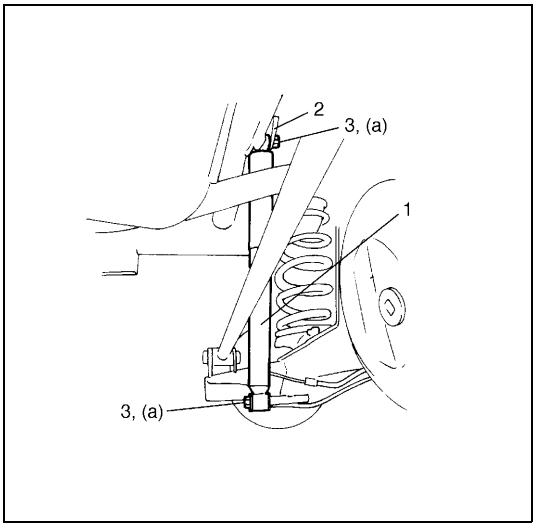


2) Support rear axle housing (1) by using floor jack (2) to prevent it from lowering.



3) Remove upper mounting bolt (2).
4) Remove lower mounting bolt (3).
5) Remove shock absorber (1).

INSTALLATION



1) Install shock absorber (1), refer to figure for proper installing direction of bush and washer (2).
   Tighten bolts (3) temporarily by hand.
2) Remove floor jack.
3) Lower hoist.
4) Tighten shock absorber bolts (3) to specified torque.

NOTE:

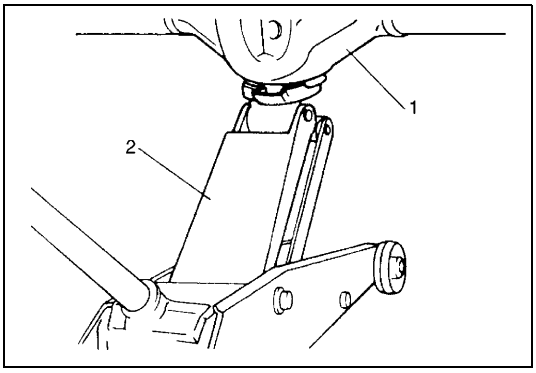
Tighten lower bolt with vehicle off hoist and in non-loaded condition.

Tightening torque
Shock absorber upper and lower bolts
(a) : 85 N·m (8.5 kg-m, 61.5 lb-ft)

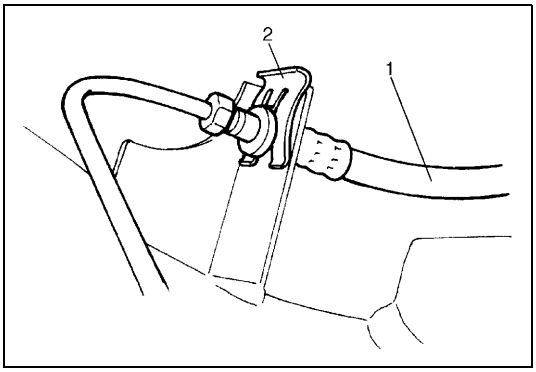
Coil Spring

REMOVAL

1) Hoist vehicle and remove wheel.

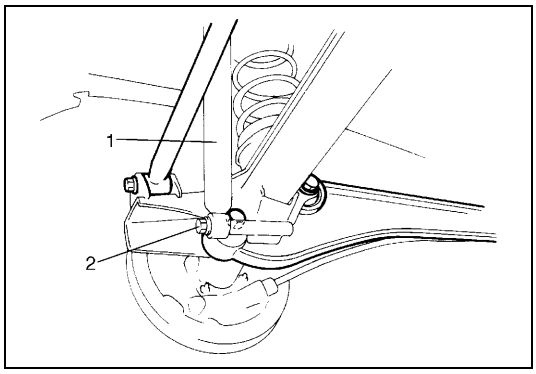


2) Support rear axle housing (1) by using floor jack (2).



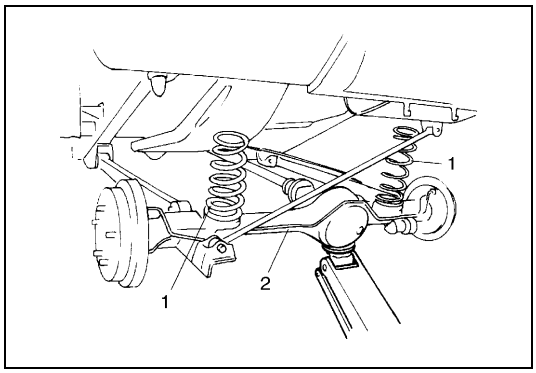
3) Remove brake flexible hose E-ring (2).

1. Brake flexible hose

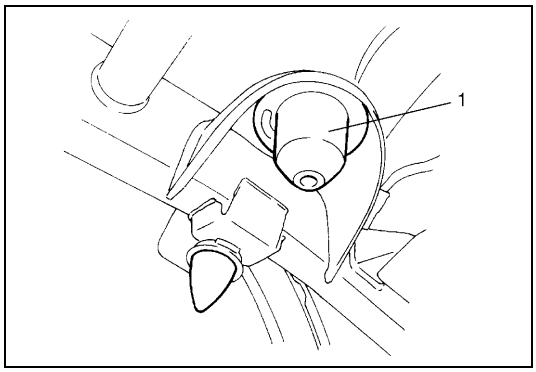


4) Remove shock absorber lower mounting bolt (2).

1. Shock absorber

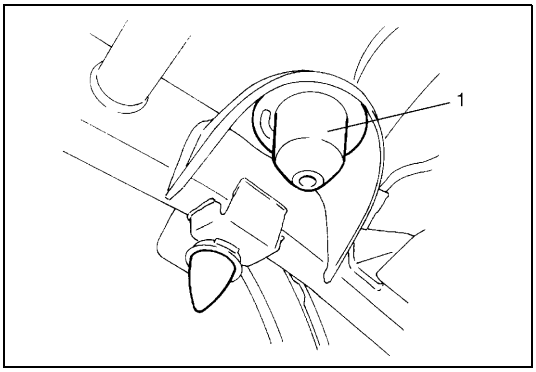


5) Lower rear axle housing (2) gradually as far down as where coil spring (1) can be removed.
6) Remove coil spring (1).



7) Remove spring rubber seat (1).

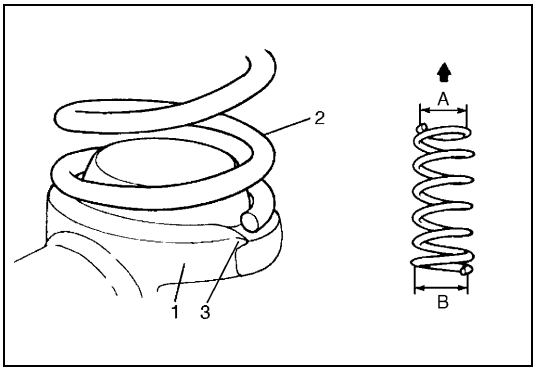
INSTALLATION



1) Install spring rubber seat (1).

NOTE:

Before installing spring rubber seat (1), apply soap water on it.



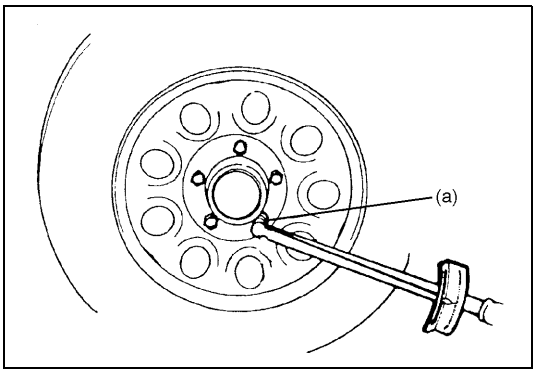
2) Install coil spring (2) on spring seat (1) of axle housing and then raise axle housing.

NOTE:

- **Upper and lower diameters of coil spring (2) are different.**
  Bring larger diameter end at bottom and set its open end in place on spring seat (1).
- **When seating coil spring (2), mate spring end with stepped part (3) of rear axle spring seat (1) as shown.**

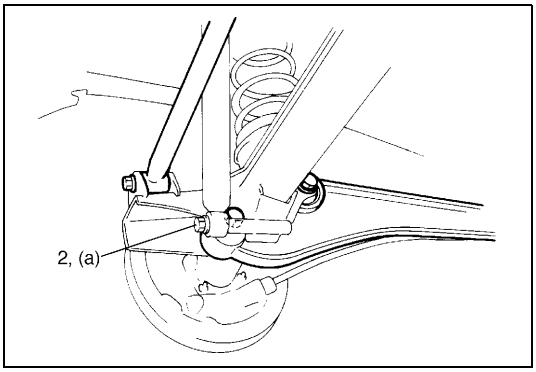
A :	Upper side (small dia.)
B :	Lower side (large dia.)

3) Install shock absorber lower mounting bolt.
   Tighten bolt temporarily by hand.
4) Install brake flexible hose E-ring.



5) Install wheel and tighten wheel nuts to specified torque.

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



6) Lower hoist and tighten absorber lower bolt (2) to specified torque.

Tightening torque
Shock absorber lower bolt
(a) : 85 N·m (8.5 kg-m, 61.5 lb-ft)

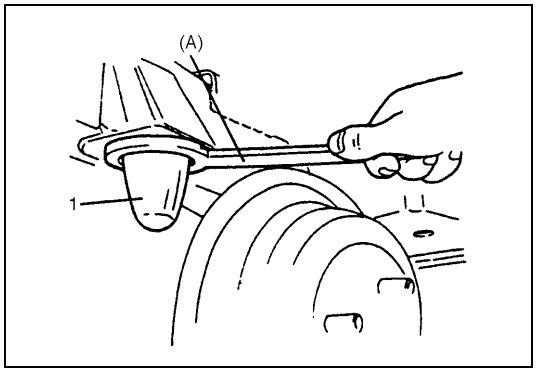
NOTE:

For tightening of lower bolt (2), refer to NOTE given under "Shock Absorber" in this section.

Bump Stopper

REMOVAL

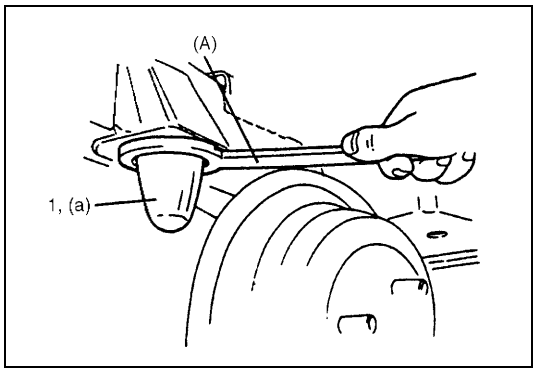
1) Hoist vehicle.
2) Remove wheel.



3) Remove bump stopper (1) by using special tool.

Special tool
(A) : 09941-66010

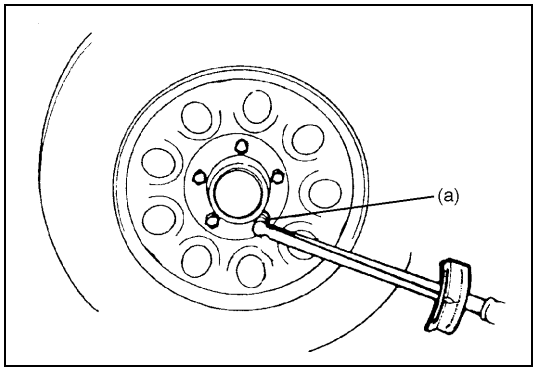
INSTALLATION



1) Tighten bump stopper (1) to specified torque by using special tool.

Special tool
(A) : 09941-66010

Tightening torque
Bump stopper
(a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)



2) Install wheel and tighten wheel nuts to specified torque.

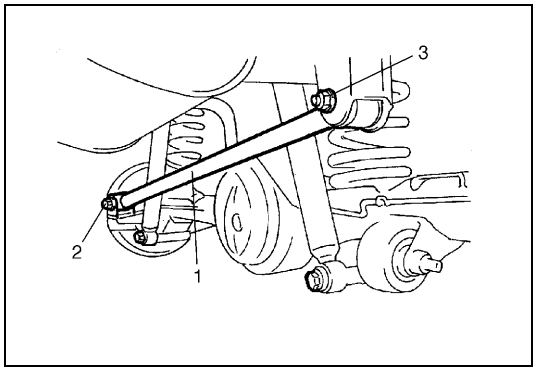
Tightening torque
Wheel nuts
(a) : 95 N·m (9.5 kg-m, 69.0 lb-ft)

3) Lower hoist.

Lateral Rod

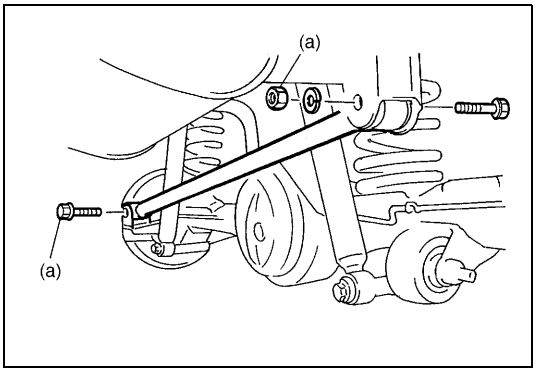
REMOVAL

1) Hoist vehicle.



2) Remove lateral rod mounting bolt (2) and nut (3).
3) Remove lateral rod (1).

INSTALLATION



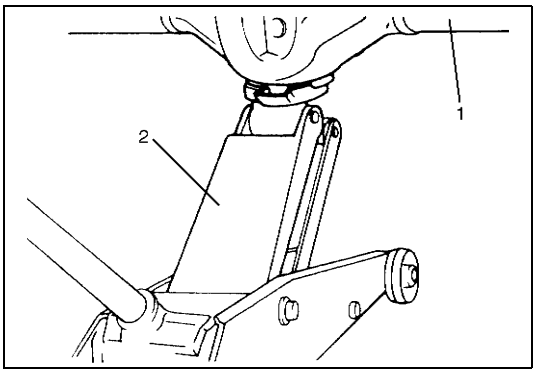
1) Install lateral rod to vehicle body and rear axle housing. Tighten bolt and nut temporarily by hand.
2) Lower hoist and with vehicle in non-loaded condition, tighten lateral rod bolt and nut to specified torque.

Tightening torque
Lateral rod bolt and nut
(a) : 90 N·m (9.0 kg-m, 65.0 lb-ft)

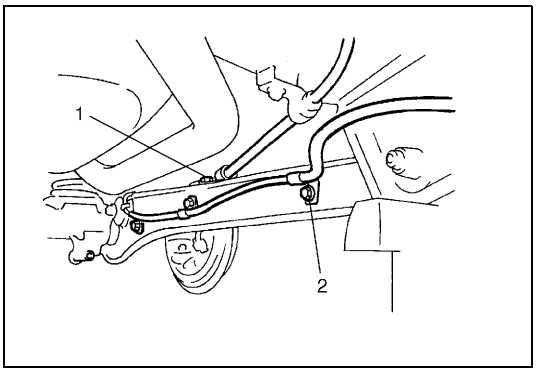
Trailing Arm / Bushing

REMOVAL

1) Hoist vehicle.

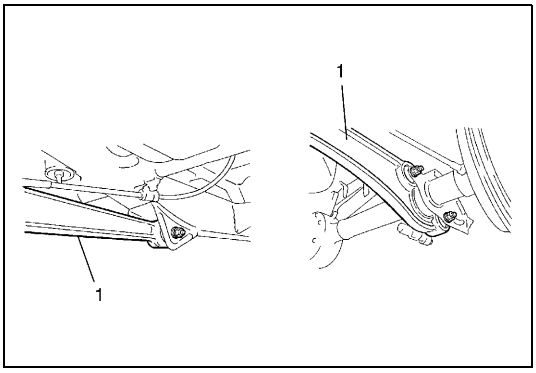


2) Support rear axle housing (1) by using floor jack (2).

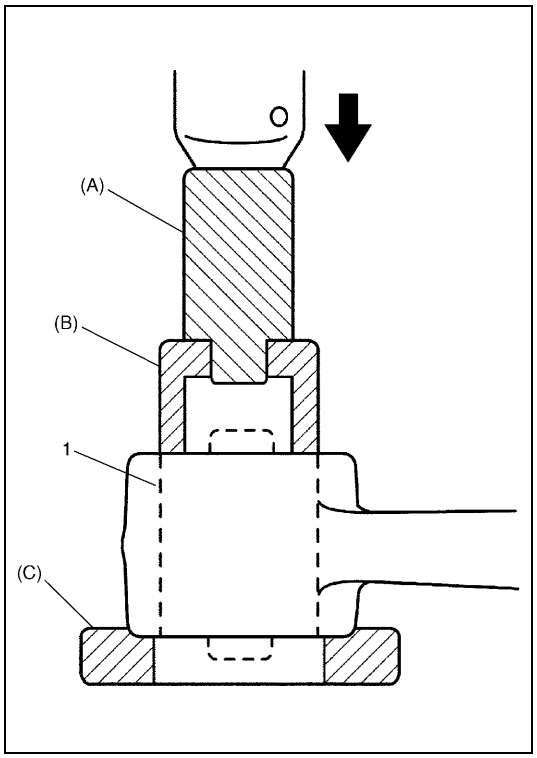


3) Disconnect parking brake cable clamp (1) from trailing arm.
4) Disconnect wheel speed sensor harness clamps (2) from trailing arm (if equipped with ABS).

5) Remove trailing arm mounting bolts.



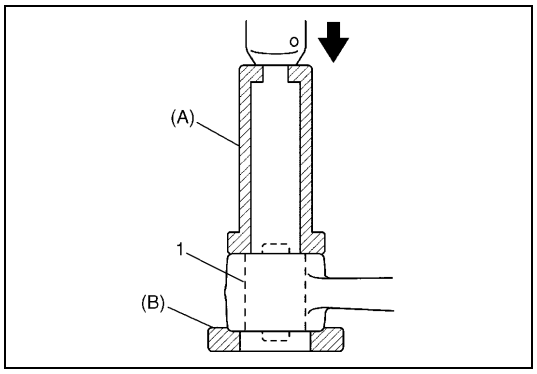
6) Remove trailing arm (1).



7) Remove bushings (1) by using hydraulic press and special tools.

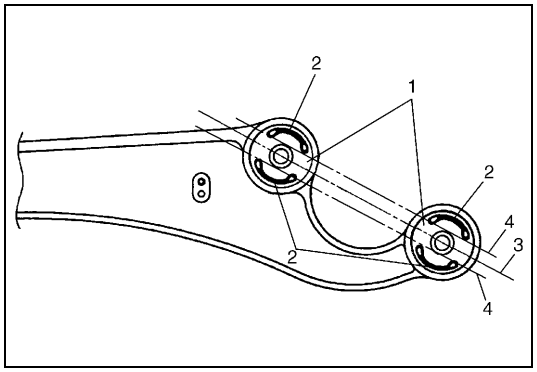
Special tool
(A) : 09924-74510
(B) : 09951-16030
(C) : 09951-26010

INSTALLATION



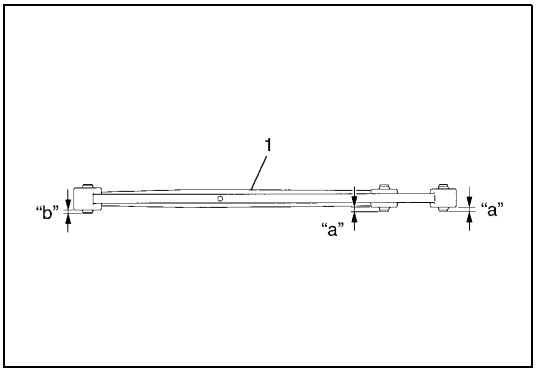
1) Install bushings (1) by using hydraulic press and special tools, noting the following points.

Special tool
(A) : 09913-85210
(B) : 09951-26010



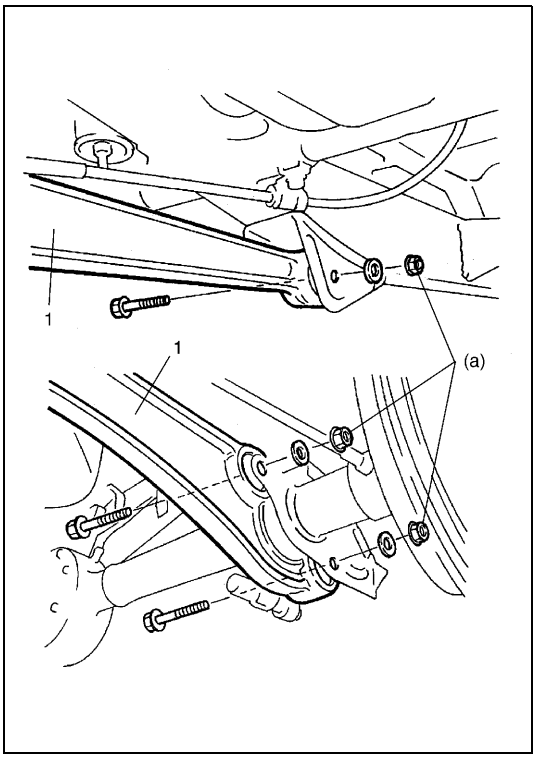
- For axle side bushings (1), install them so that center line and slit lines of them are parallel as shown figure.

2.	Slit
3.	Center line of bushings
4.	Slit line of bushings



- Install bushings so that either face of bushing are aligned with housing edge of leading arm, also the length between the aligned side end of bushing and trailing arm (1) are within specification below.

Specification for trailing arm bushing protrusion
"a" : 8.5 – 10.5 mm (0.33 – 0.41 in.)
"b" : 6.0 – 9.0 mm (0.24 – 0.35 in.)



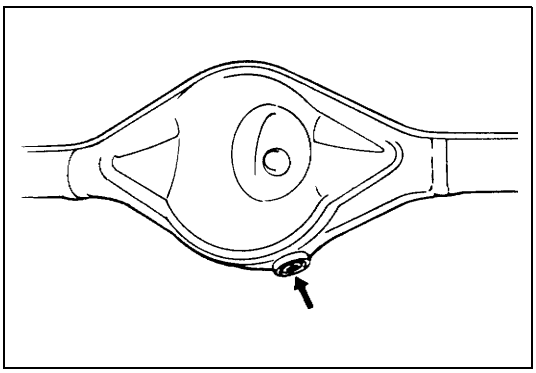
2) Install trailing arm (1) to vehicle body and rear axle housing, referring to figure for proper installing direction of bolts.
3) Remove floor jack.
4) Connect wheel speed sensor harness clamps to trailing arm (if equipped with ABS).
5) Connect parking brake cable clamp to trailing arm.
6) Lower hoist and with vehicle in non-loaded condition, tighten trailing arm nuts to specified torque.

Tightening torque
Trailing arm nuts
(a) : 90 N·m (9.0 kg-m, 65.0 lb-ft)

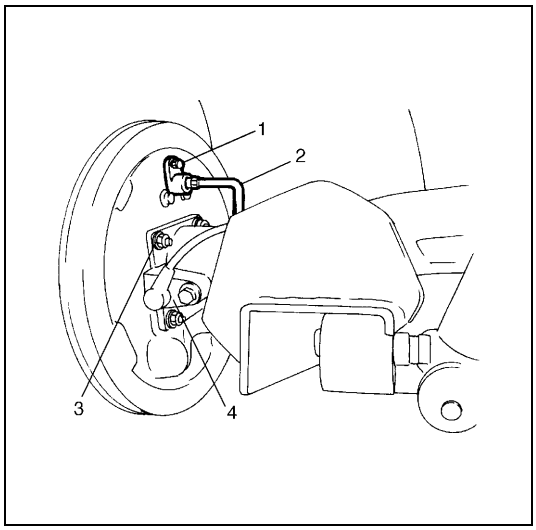
Rear Axle Shaft and Wheel Bearing

REMOVAL

1) Hoist vehicle and remove wheel.
2) Remove rear brake drum and disconnect parking brake cable from brake back plate. For details, refer to "Brake back plate" in Section 5.



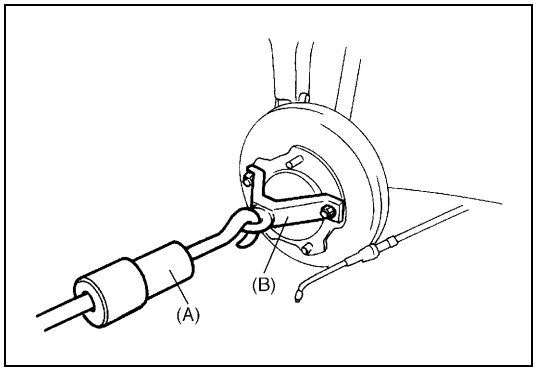
3) Drain gear oil from rear axle housing by loosening drain plug.



4) Remove wheel speed sensor (4) from rear axle housing (if equipped with ABS).

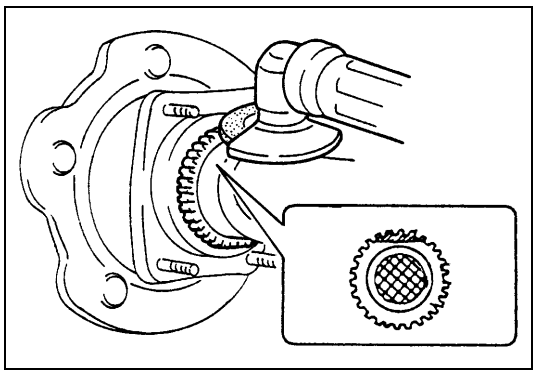
CAUTION:
- **Do not pull wire harness or twist more than necessary when removing rear wheel speed sensor (4).**
- **Do not cause damage to surface of rear wheel speed sensor (4) or pole piece and do not allow dust, etc. to enter its installation hole.**

5) Disconnect brake pipe(s) (2) from wheel cylinder and put wheel cylinder bleeder plug cap (1) onto pipe to prevent fluid from spilling.
6) Remove brake back plate nuts (3) from axle housing.

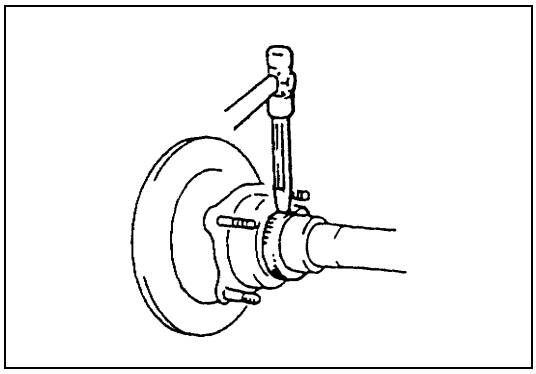


7) Using special tools indicated, draw out axle shaft with brake back plate.

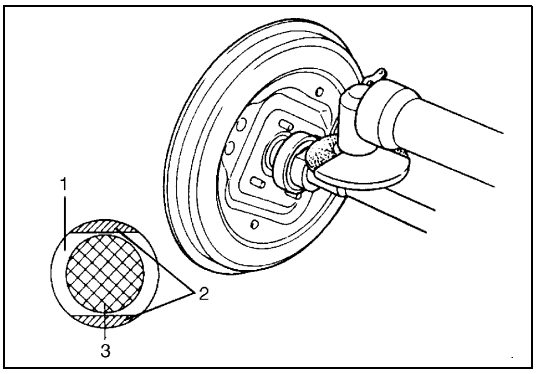
Special tool
(A) : 09942-15510
(B) : 09943-35511 or 09943-35512



8) If equipped with ABS, in order to remove sensor rotor from retainer ring, grind with a grinder one part of the sensor rotor as illustrated till it becomes thin.

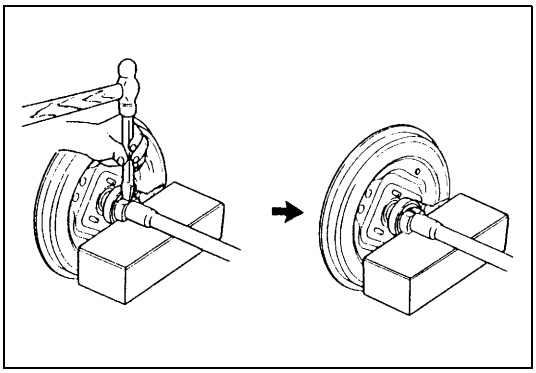


9) Break with a chisel the thin ground sensor rotor, and it can be removed (if equipped with ABS).

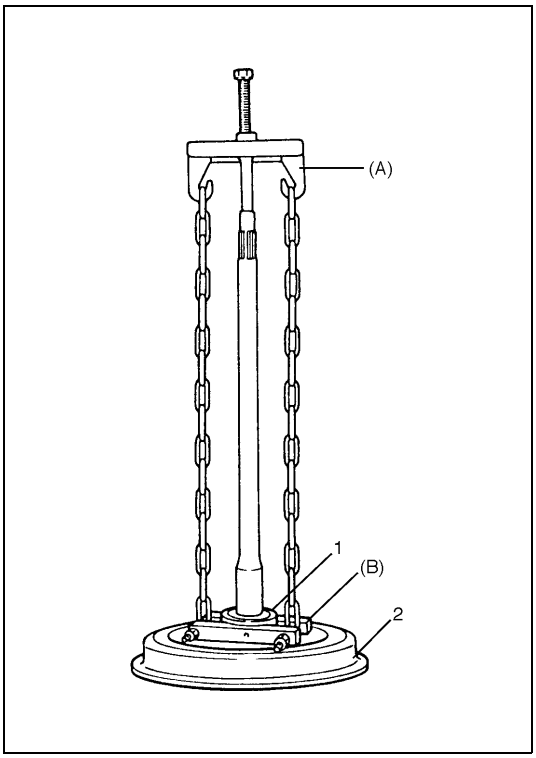


10) In order to remove the retainer ring (1) from the shaft (3), grind with a grinder (2) two parts of the bearing retainer ring (1) as illustrated till it becomes thin.

CAUTION:
Be careful not to go so far as to grind the shaft (3).

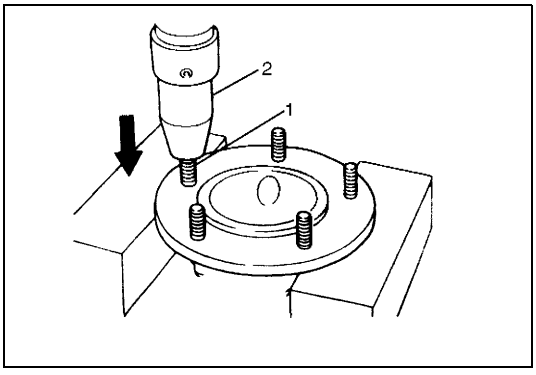


11) Break with a chisel the thin ground retainer ring, and it can be removed.

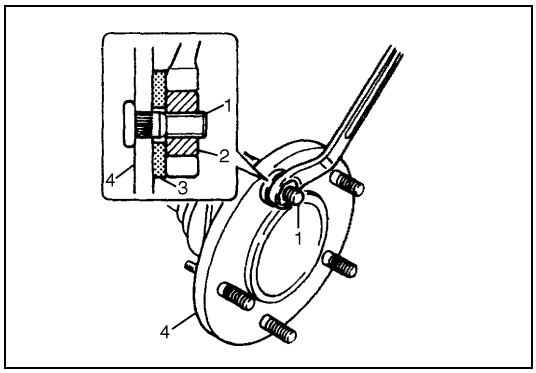


12) Using special tools, remove bearing (1) from shaft and then remove brake back plate (2).

Special tool
(A) : 09927-18411
(B) : 09921-57810



13) Remove stud bolt(s) (1) by using hydraulic press (2).

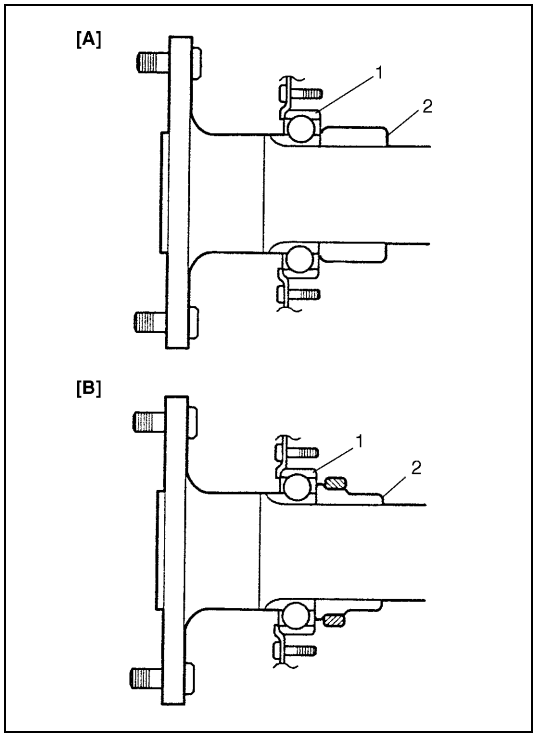


INSTALLATION

Install removed parts in reverse order of removal procedure, noting the following.

1) Aligning serrations between new stud bolt(s) (1) and flange, install new stud bolt(s) (1) by tightening nut (2) as shown.

3. Washer
4. Flange of axle shaft



2) Press-fit wheel bearing (1) and retainer ring (2) as shown.

NOTE:

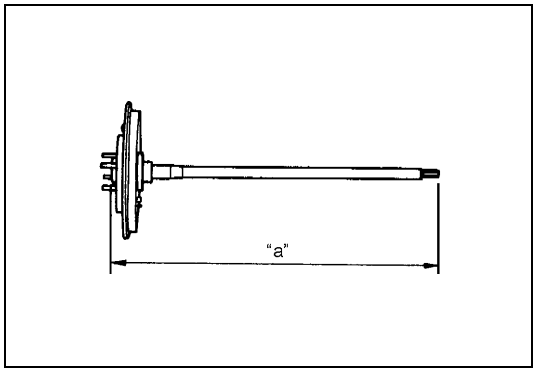
- **Use care not to cause any damage to outside of retainer ring (2).**
- **Refer to figure so that wheel bearing (1) is installed in proper direction.**

3) For vehicle with ABS, press-fit new sensor rotor as shown.

NOTE:

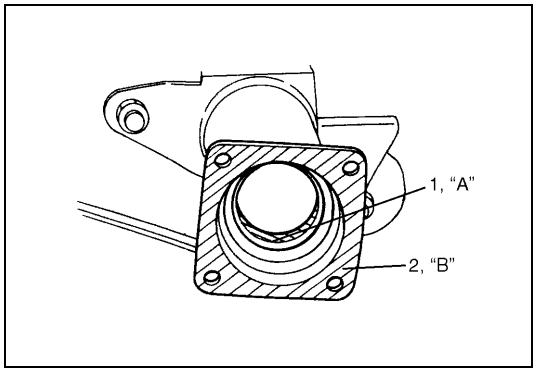
Use care not to cause any damage to outside of retainer ring (2).

[A]: Vehicle without ABS
[B]: Vehicle with ABS



4) Inspect axle shaft length.

Rear axle shaft length
"a" : 775.5 mm (30.5 in.) (left side),
559.5 mm (22.0 in.) (right side)



5) Apply grease to axle shaft oil seal lip (1) as shown.

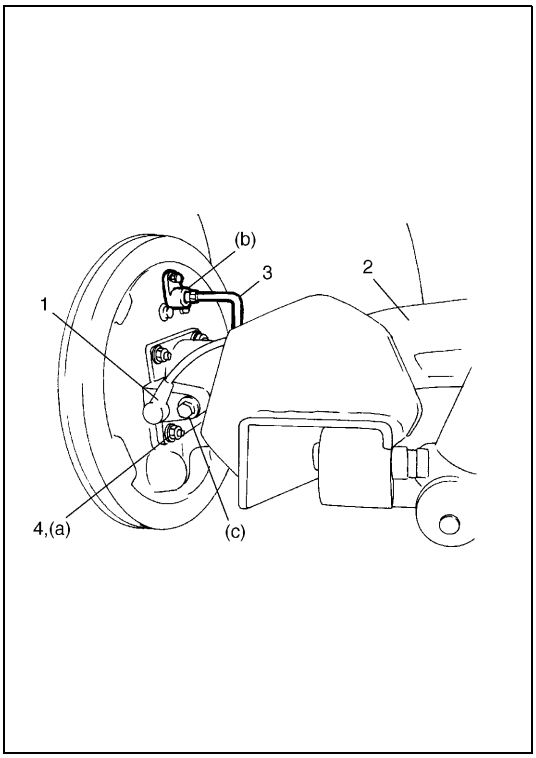
"A" : Grease 99000-25010

6) Apply sealant to mating surface of axle housing (2) with brake back plate.

NOTE:

Make sure to remove old sealant before applying it anew.

"B" : Sealant 99000-31110



7) Install rear axle shaft to rear axle housing (2) and tighten brake back plate nuts (4) to specified torque.

NOTE:

When installing rear axle shaft, be careful not to cause damage to oil seal lip in axle housing (2).

Tightening torque
Brake back plate nuts
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

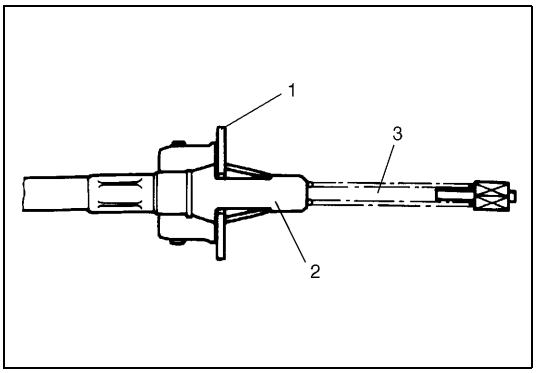
8) Connect brake pipe (3) to wheel cylinder and tighten brake pipe flare nut to specified torque.

Tightening torque
Brake pipe flare nut
(b) : 16 N·m (1.6 kg-m, 11.5 lb-ft)

9) Tighten wheel speed sensor bolt to specified torque (if equipped with ABS).

Tightening torque
Wheel speed sensor bolt
(c) : 10 N·m (1.0 kg-m, 7.5 lb-ft)

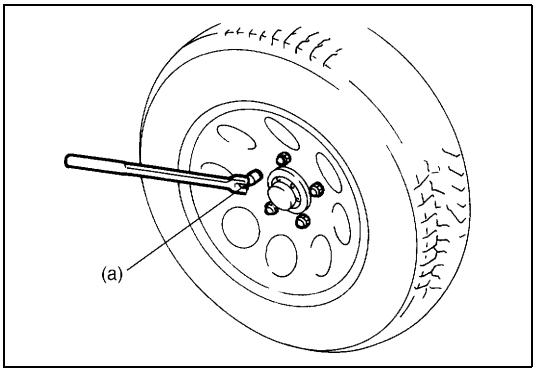
1. Wheel speed sensor



10) Install parking brake cable (3) to brake back plate (1).

2. Cable stopper ring

11) Install brake shoes, referring to “Brake Shoe” in Section 5.
12) Install brake drum. Refer to “Rear Brake Drum” in Section 5.
13) Refill differential housing with new specified gear oil. Refer to “Maintenance Service” in Section 7E for refill.
14) Fill reservoir with brake fluid and bleed brake system. (For bleeding operation, refer to “Bleeding Brakes” in Section 5.)



15) Install wheel and tighten wheel nuts to specified torque.

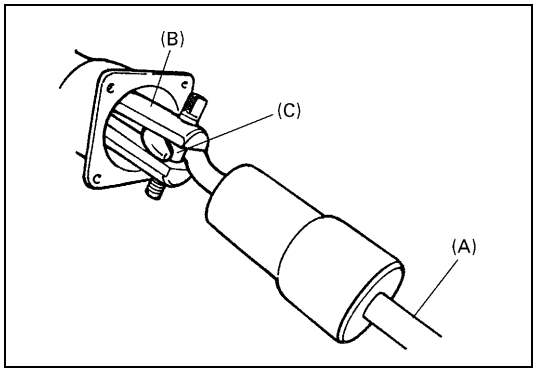
Tightening torque
Wheel nuts
(a) : 95 N·m (9.5 kg-m, 69.5 lb-ft)

16) Upon completion of all jobs, depress brake pedal with about 30 kg (66 lbs) load over ten times so as to obtain proper drum-to shoe clearance.
    Adjust parking brake cable. (For adjustment, refer to “Parking Brake Check and Adjustment” in Section 5.)
17) Tighten parking brake lever cover screws.
18) 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).
19) Check each installed part for oil leakage.

Rear Axle Shaft Inner Oil Seal

REMOVAL

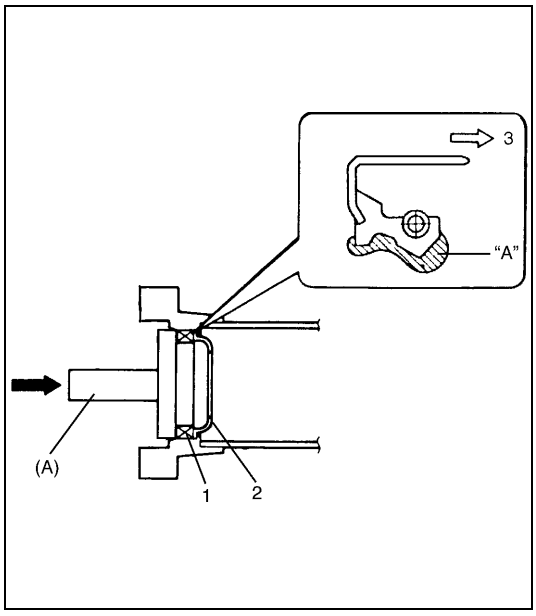
1) Remove rear axle shaft. For details, refer to “Rear Axle Shaft and Wheel Bearing” in this section.



2) Remove rear axle shaft inner oil seal by using special tools.

Special tool
(A) : 09942-15510
(B) : 09944-96010 (remover)
(C) : 09921-26010 (collar)

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 (1) is free from inclination as it is installed.**
- **Refer to figure so that oil seal (1) is installed in proper direction.**

Special tool
(A) : 09913-75520

“A” : Grease 99000-25010

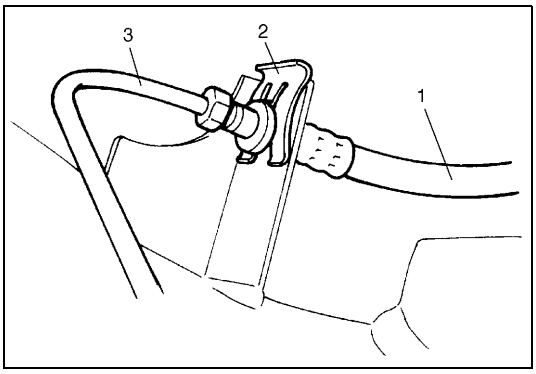
2) For procedure hereafter, refer to “Rear Axle Shaft and Wheel Bearing” in this section.

3. Differential side

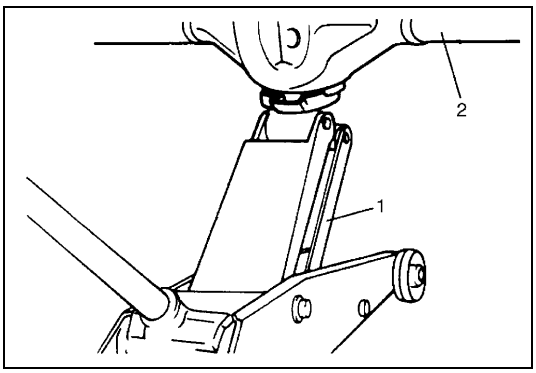
Rear Axle Housing

REMOVAL

1) Hoist vehicle and remove wheels.
2) Remove rear axle shaft, refer to “Rear Axle Shaft and Wheel Bearing” in this section.

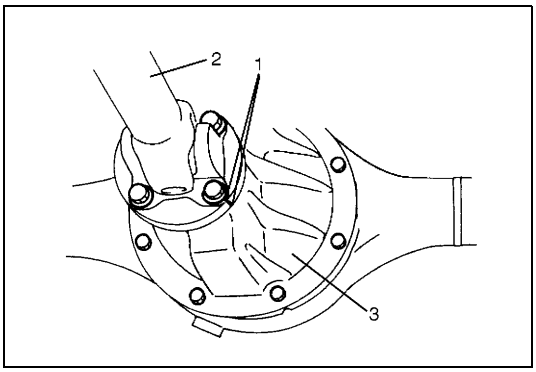


3) Disconnect brake pipe (3) from flexible hose (1) and remove E-ring (2).
4) Remove brake pipe clamps and pipes from axle housing.

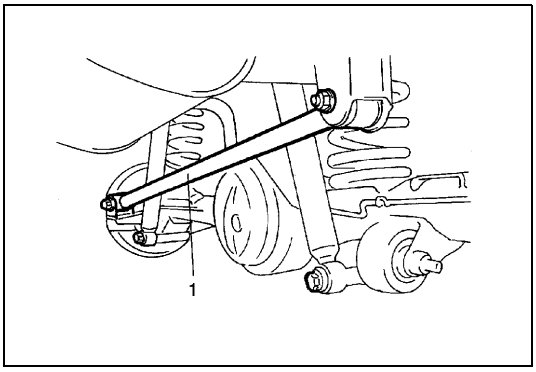


5) For jobs hereafter, support rear axle housing (2) by using floor jack (1) under axle housing (2).

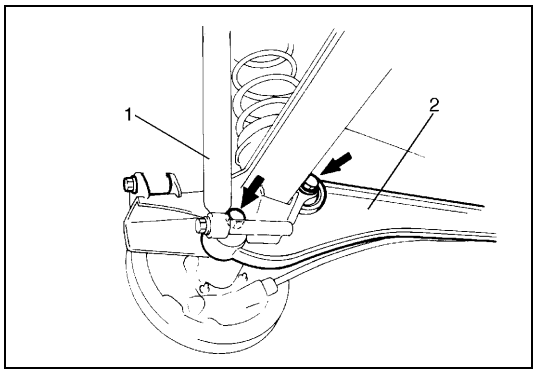
6) Remove LSPV stay from axle housing (if equipped with LSPV).



7) Before removing propeller shaft (2), give match marks (1) on joint flange and propeller shaft (2) as shown.
   Remove propeller shaft (2).
8) Remove differential carrier assembly (3).

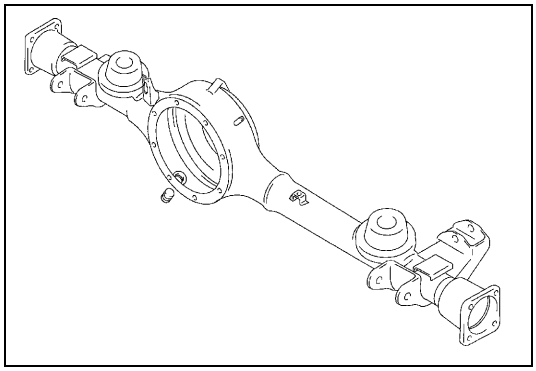


9) Remove lateral rod (1).



10) Loosen rear mounting nuts of trailing arm (2) but don't remove bolt.
11) Remove shock absorber (1) lower mounting bolt.

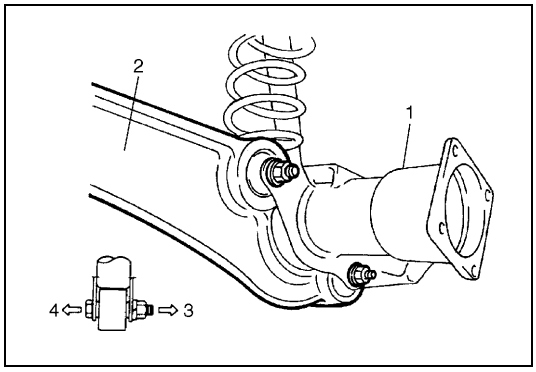
12) Lower floor jack until tension of suspension coil spring becomes a little loose and remove rear mount bolts of trailing arm.
13) Lower rear axle housing gradually.



14) Remove axle housing.

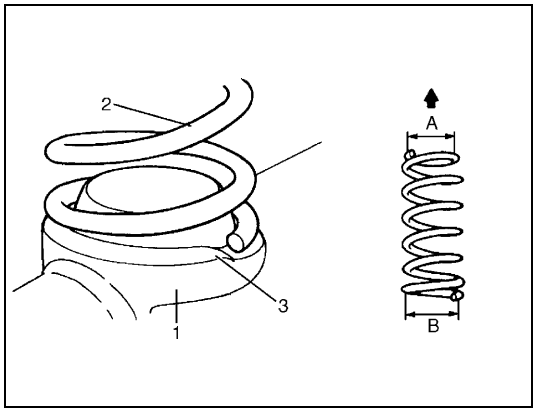
INSTALLATION

Install removed parts in reverse order of removal, noting the following.



1) Place rear axle housing (1) on floor jack. Then install trailing arm (2) rear mounting bolts (right & left) in proper direction as shown. At this time, mount nuts but don't tighten them.

3. Out side
4. Body center

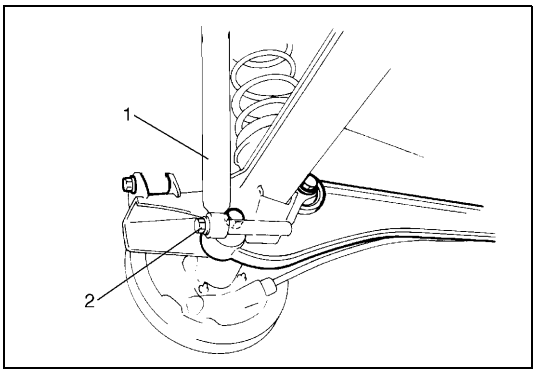


2) Install coil spring (2) (right & left) on spring seat (1) of axle housing and raise axle housing.

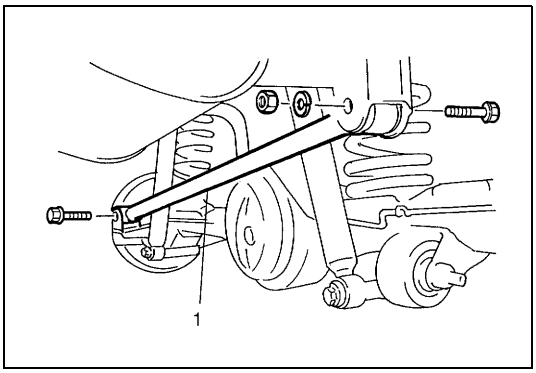
NOTE:

- **Upper and lower diameters of coil spring (2) are different. Bring larger diameter end at bottom and set its open end in place on spring seat (1).**
- **When seating coil spring (2), mate spring end with stepped part (3) of rear axle spring seat (1) as shown.**

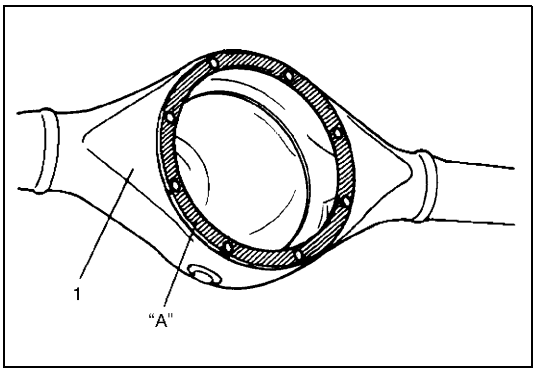
A: Upper side (small dia.)
B: Lower side (large dia.)



3) Install lower part of shock absorber (1) to right and left sides of axle housing and tighten bolts (2) temporarily by hand.

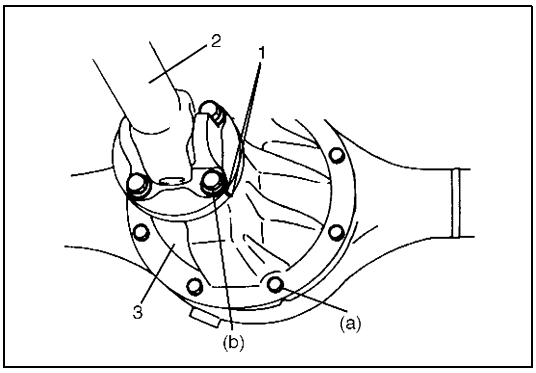


4) Install lateral rod (1) and install bolts in proper direction as shown.
   At this time, mount bolt and nut but don't tighten them.



5) Clean mating surfaces of axle housing (1) and differential carrier and apply sealant to housing side.

   "A" : Sealant 99000-31110



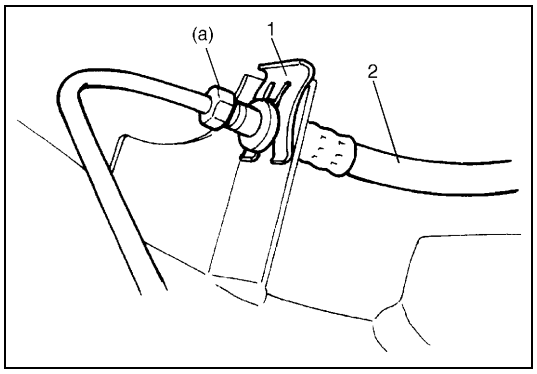
6) Install differential carrier assembly (3) to axle housing and tighten carrier bolts to specified torque.

   Tightening torque
   Rear differential carrier bolts
   (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

7) Install propeller shaft (2) to joint flange aligning match marks (1) and tighten flange bolts to specified torque.

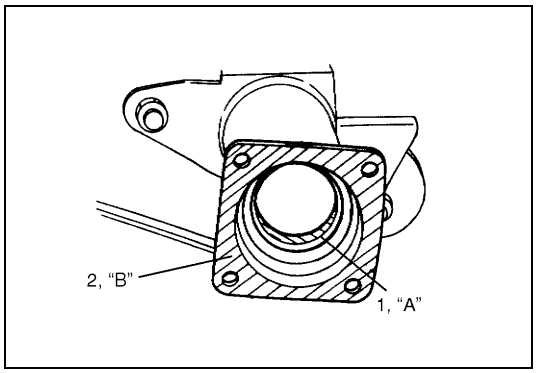
   Tightening torque
   Rear propeller shaft bolts
   (b) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

8) Install LSPV stay to axle housing and adjust LSPV stay position, referring to "LSPV Assembly Inspection and Adjustment" in Section 5 (if equipped with LSPV).
9) Remove floor jack from axle housing.
10) Connect brake pipes and parking brake cable onto axle housing and clamp them securely.
    For clamping positions, refer to "Rear Brake Hose / Pipe" and "Parking Brake Cable" in Section 5.



11) Connect brake flexible hose (2) to bracket on axle housing and secure it with E-ring (1).
12) Connect brake pipe to brake flexible hose and tighten brake pipe flare nut to specified torque.

Tightening torque
Brake pipe flare nut
(a) : 16 N·m (1.6 kg-m, 11.5 lb-ft)



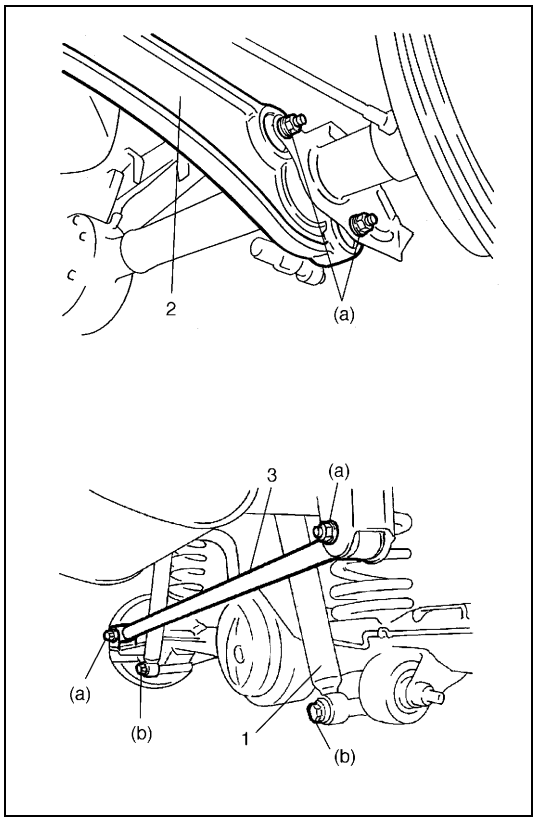
13) Clean mating surface of axle housing (2) (right & left) with brake back plate and apply sealant as shown.

"B" : Sealant 99000-31090

14) Apply grease to axle shaft oil seals lip (1) (right & left) as shown.

"A" : Grease 99000-25010

15) Install rear axle shafts, brake shoes, brake drums and wheels. For details, refer to "Rear Axle Shaft and Wheel Bearing" in this section.
16) Lower hoist.



17) Tighten right and left trailing arm nuts and shock absorber lower bolts to specified torque.
Tighten lateral rod bolt and nut to specified torque.

NOTE:

When tightening these bolts and nuts, be sure that vehicle is off hoist and in non loaded condition.

Tightening torque
Trailing arm nuts and lateral rod bolt and nut
(a) : 90 N·m (9.0 kg-m, 65.0 lb-ft)
Shock absorber lower bolts
(b) : 85 N·m (8.5 kg-m, 61.5 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). (For brake test, see Section 5.)
20) Check each installed part for oil leakage.

1. Shock absorber
2. Trailing arm
3. Lateral rod

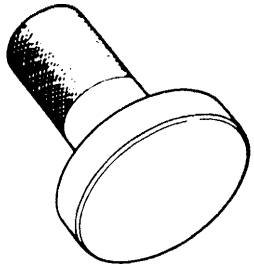
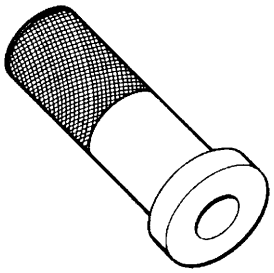
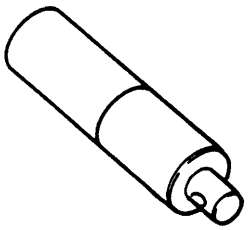
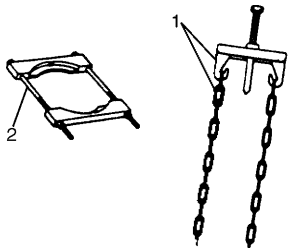
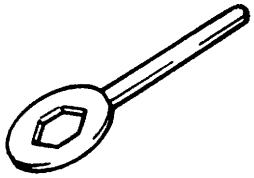
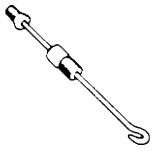
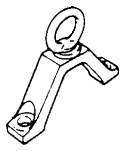
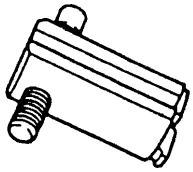
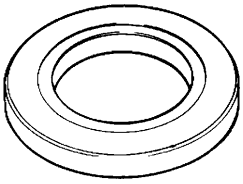
Tightening Torque Specifications

Fastening portion	Tightening torque		
	N•m	kg-m	lb-ft
Shock absorber upper and lower bolt	85	8.5	61.5
Bump stopper	50	5.0	36.5
Lateral rod bolt and nut	90	9.0	65.0
Trailing arm nut (Front and Rear)			
Brake back plate nut	23	2.3	17.0
Brake pipe flare nut	16	1.6	11.5
Rear differential carrier bolt	23	2.3	17.0
Rear propeller shaft bolt (Differential case side)	50	5.0	36.5
Rear propeller shaft bolt (Shaft No.3 transfer case side)	33	3.3	24.0
Wheel nut	95	9.5	69.0
Wheel speed sensor bolt and harness clamp bolt	10	1.0	7.5

Required Service Materials

Material	Recommended SUZUKI product (Part Number)	Use
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	Oil seal lip
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	• Joint seam of differential carrier and axle housing
Water tight sealant	SEALING COMPOUND 366E (99000-31090)	• To apply to mating surfaces of brake back plate and rear axle.
Gear oil	For gear oil information, refer to “Maintenance Service” in Section 7E of this manual.	Differential gear (Rear axle housing)

Special Tools

 09913-75520 Bearing installer	 09913-85210 Oil seal installer	 09924-74510 Bearing installer handle	 1) 09927-18411 Universal puller 2) 09921-57810 Bearing remover
 09941-66010 Bump stopper wrench	 09942-15510 Sliding hammer	 09943-35511 or 09943-35512 Brake drum remover	 09944-96010 Bearing outer race remover 09921-26010 Bearing outer race remover collar
 09951-16030 Bush remover	 09951-26010 Bush remover plate		

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 3F-2
- Tires 3F-2
- Wheels 3F-2
- Replacement Tires 3F-2
  - Replacement Wheels 3F-3
  - How To Measure Wheel Runout 3F-3
  - Metric Lug Nuts and Wheel Studs 3F-3

Diagnosis 3F-4
- Diagnosis Table 3F-4
- Balancing Wheels 3F-4
- General Balance Procedure 3F-4
  - Off-vehicle balancing 3F-4
  - On-vehicle balancing 3F-4

Maintenance and Minor Adjustments 3F-6
- Wheel and Tire 3F-6
  - Studs 3F-6
  - Matched tires and wheels (For vehicle equipped with steel wheels) 3F-6
- Inflation of Tires 3F-6
  - Tire placard 3F-7
  - Tire rotation 3F-7

On-Vehicle Service 3F-8
- Wheel 3F-8
- Tire 3F-9
  - Mounting and demounting 3F-9
  - Repair 3F-9

General Description

Tires

This vehicle is equipped with following tire.

Tire size
: 205/70 R15 or 175/80 R15

The tires are of tubeless type. The tires are designed to operate satisfactorily with loads up to the full rated load capacity when inflated to the recommended inflation pressure.
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.

Wheels

Standard equipment wheels are following steel wheels.

15 x 5 1/2 JJ

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.

WARNING:
Do not mix different types of tires on the same vehicle such as radial, bias and bias-belted tires except in emergencies, because vehicle handling may be seriously affected and may result in loss of control.

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.

The metric term for tire inflation pressure is the kilopascal (kPa). Tire pressures will usually be printed in both kPa and psi on the Tire Placard. Metric tire gauges are available from tool suppliers. The following chart, converts commonly used inflation pressures from kPa to psi.

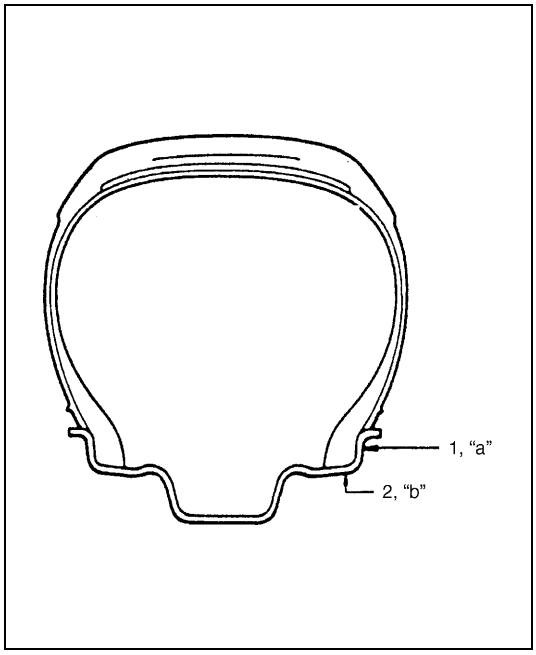
kPa	kgf/cm^2	psi
160	1.6	23
180	1.8	26
200	2.0	29
220	2.2	32
240	2.4	35
260	2.6	38
280	2.8	41
300	3.0	44
320	3.2	47
340	3.4	50

Replacement Wheels

Wheels must be replaced if they are bent, dented, have excessive lateral or radial runout, leak air through welds, have elongated bolt holes, if lug nuts won't stay tight, or if they are heavily rusted. Wheels with greater runout than shown in "How to Measure Wheel Runout" may cause objectional vibrations.

Wheels for replacement must be equivalent to the originally equipped wheels in load capacity, diameter, rim width, off-set and mounting configuration. A wheel of improper size or type may affect wheel and bearing life, brake cooling, speedometer / odometer calibration, ground clearance to the body and chassis.

How To Measure Wheel Runout

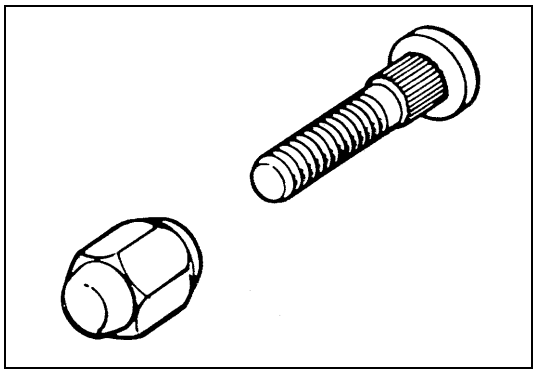


To measure the wheel runout, it is necessary to use accurate dial indicator. The tire may be on or off the wheel. The wheel should be installed to the wheel balancer of the like for proper measurement.Take measurements of both lateral runout (1) and radial runout (2) at both inside and outside of the rim flange. With dial indicator set in place securely, turn the wheel one full revolution slowly and record every reading of the indicator.

When the measured runout 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.

Lateral runout limit
"a" : 1.20 mm (0.047 in.)
Radial runout limit
"b" : 1.20 mm (0.047 in.)

Metric Lug Nuts and Wheel Studs



All models use metric lug nuts and wheel studs.

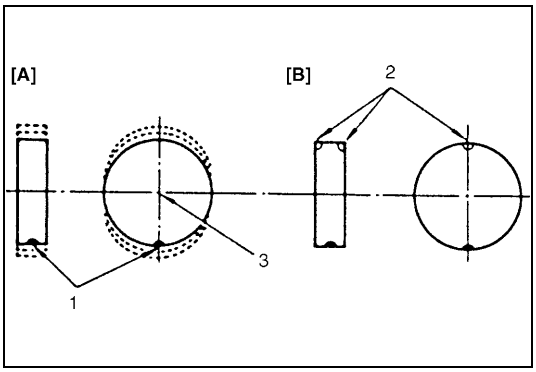
Metric lug nuts and wheel studs size
: M12 x 1.25

Diagnosis

Diagnosis Table

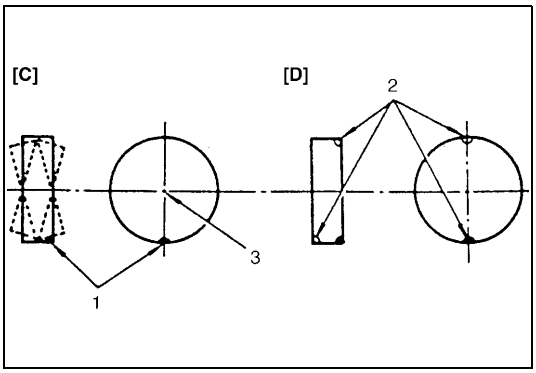
Refer to “Diagnosis Table” in Section 3.

Balancing Wheels



There are two types of wheel and tire balance: static and dynamic. Static balance, as shown in figure, is equal distribution of weight around wheel. Wheels that are statically unbalanced cause bouncing action called tramp. This condition will eventually cause uneven tire wear.

1. Heavy spot wheel tramp	[A] : Before correction
2. Balance weights addition point	[B] : Corrective weights
3. C/L of spindle	



Dynamic balance, as shown in left figure, is equal distribution of weight on each side of wheel centerline 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	[C] : Before correction
2. Balance weights addition point	[D] : Corrective weights
3. C/L of spindle	

General Balance Procedure

Deposits of mud, etc. must be cleaned from inside of rim.

WARNING:

Stones should be removed from tread in order to avoid operator injury during spin balancing and to obtain good balance.

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 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 35 mph (55 km/h) 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.

CAUTION:

For vehicle equipped with ABS, using on-vehicle balancing method with ignition switch ON may set malfunction diagnostic trouble code (DTC) of ABS even when system is in good condition.
Never turn ignition switch ON while spinning wheel.

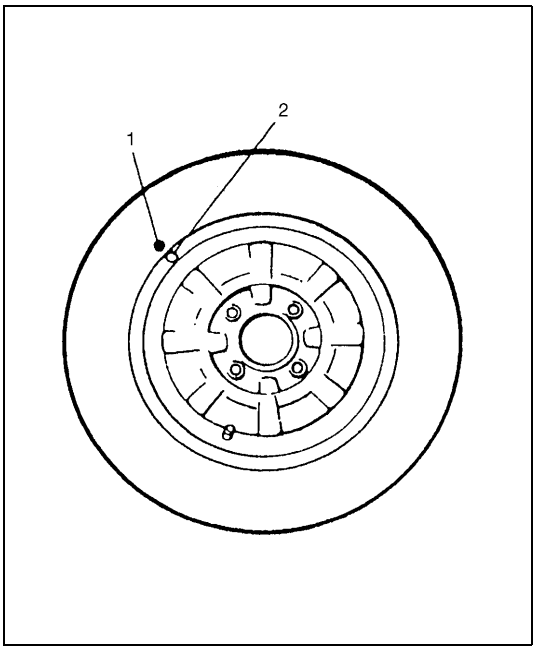
Maintenance and Minor Adjustments

Wheel and Tire

Wheel repairs that use welding, heating, or peening are not approved. All damaged wheels should be replaced.

Studs

If a broken stud is found, see Section 3E (rear) or Section 3D (front) for Note and Replacement procedure.



Matched tires and wheels (For vehicle equipped with steel wheels)

Tires and wheels are matchmounted 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 wash 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 rim’s paint dot should be aligned with the tire’s 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.

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 driver’s side door lock pillar.
It is normal for tire pressure 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:

1) Hard ride
2) Tire bruising or carcass damage
3) Rapid tread wear at center of tire

Unequal Pressure on Same Axle Can Cause:

1) Uneven braking
2) Steering lead
3) Reduced handling
4) Swerve on acceleration

Valve caps should be kept on valves to keep dust and water out.

Lower than Recommended Pressure Can Cause:

1) Tire squeal on turns
2) Hard steering
3) Rapid and uneven wear on the edges of the tread
4) Tire rim bruises and rupture
5) Tire cord breakage
6) High tire temperatures
7) Reduced handling
8) High fuel consumption

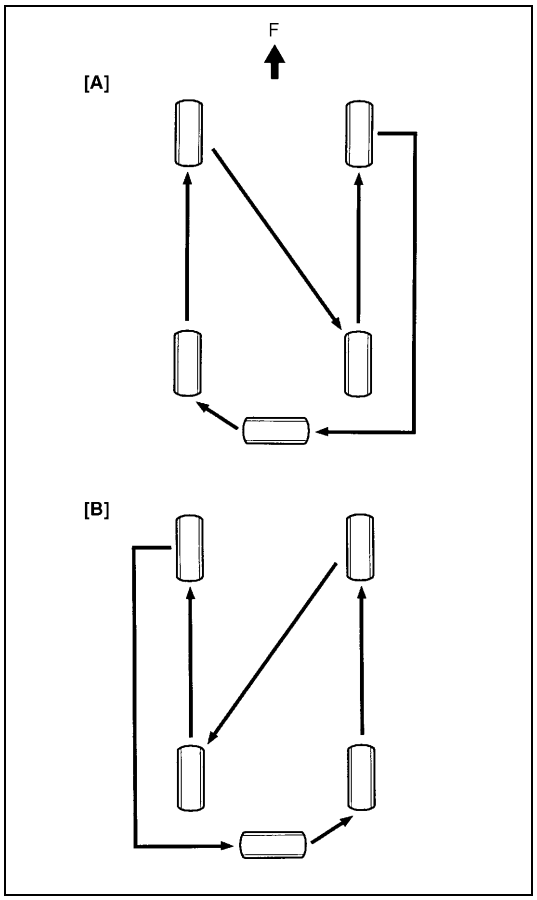
Tire placard

The tire placard is located on the driver's side door 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:

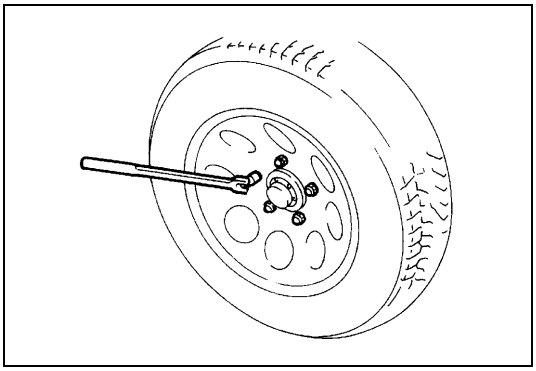
Due to their design, radial tires tend to wear faster in the shoulder area, particularly in front positions. This makes regular rotation especially necessary.

[A] :	RH steering vehicle
[B] :	LH steering vehicle
F :	Front

On-Vehicle Service

Wheel

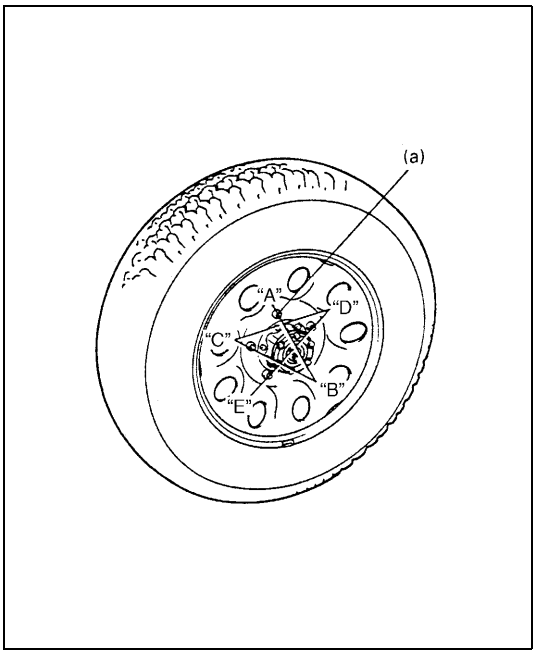
REMOVAL



1) Loosen wheel nuts by approximately 180° (half a rotation).
2) Hoist vehicle.
3) Remove 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



Wheel nuts must be tightened in sequence and to proper torque to avoid bending wheel or brake drum or disc as shown.

NOTE:
Before installing wheels, remove any build-up of corrosion on wheel mounting surface and brake drum or disc mounting surface by scraping and wire brushing. Installing wheels without good metal-to-metal contact at mounting surfaces can cause wheel nuts to loosen, which can later allow wheel to come off while vehicle is moving.

Tightening order
: "A"–"B"–"C"–"D"–"E"

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

Tire

Mounting and demounting

Use tire changing machine to mount or demount 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 wire brush or coarse steel wool to remove lubricants, old rubber and light rust. Before mounting or demounting tire, bead area should be well lubricated with approved tire lubricant.
After mounting, inflate to 240 kPa (35 psi) so that beads are completely seated. Then adjust pressure to specified shown on tire placard.

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 240 kPa (35 psi) pressure when inflating. If 240 kPa (35 psi) 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.

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 the tire manufacturer.

SECTION 4B

PROPELLER SHAFTS

NOTE:

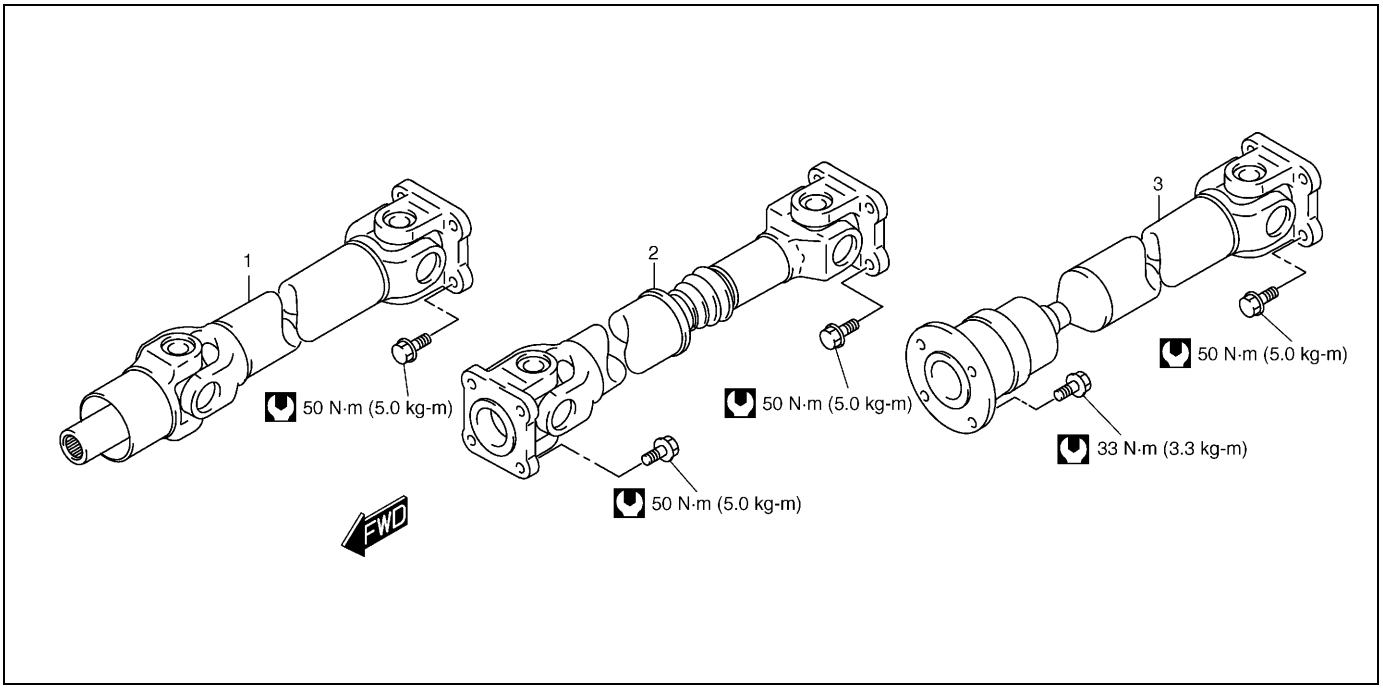
- **All propeller shaft fasteners are an important attaching part in that it could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not 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 propeller shaft part. Replace it with a new part, or damage to the part may result.**

CONTENTS

General Description 4B-2
Components 4B-2
Diagnosis 4B-2
Diagnosis Table 4B-2
Propeller Shaft Joint Check 4B-2
On-Vehicle Service 4B-3
Propeller Shafts 4B-3
Universal Joint 4B-5
Tightening Torque Specification 4B-7
Required Service Material 4B-7
Special Tool 4B-8

General Description

Components



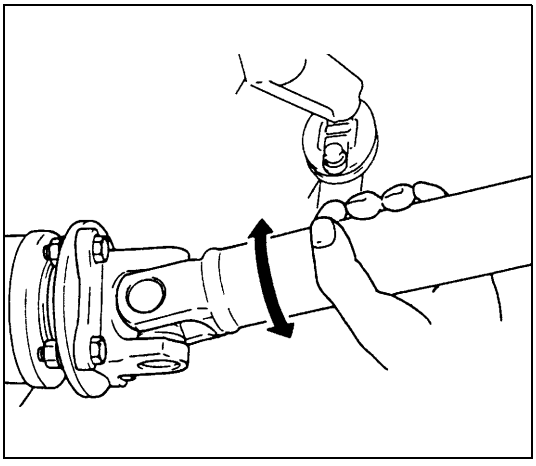
1.	Propeller shaft No.1
2.	Propeller shaft No.2
3.	Propeller shaft No.3
	Tightening Torque

Diagnosis

Diagnosis Table

Condition	Possible Cause	Correction
Abnormal noise	• Loose universal joint bolt. • Spider bearing worn out or stuck. • Wear spider.	Tighten universal joint bolt. Replace. Replace propeller shaft.
Vibration	• Performed propeller shaft.	Replace.

Propeller Shaft Joint Check



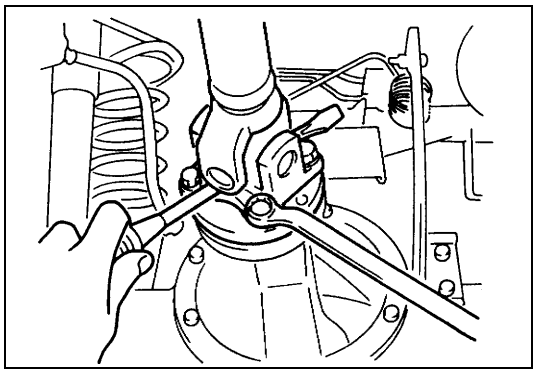
If universal joints are suspected of producing chattering or rattling noise, inspect them for wear. Check to see if cross spider rattles in yokes or if splines are worn down and replace defective propeller shaft with new one.

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).

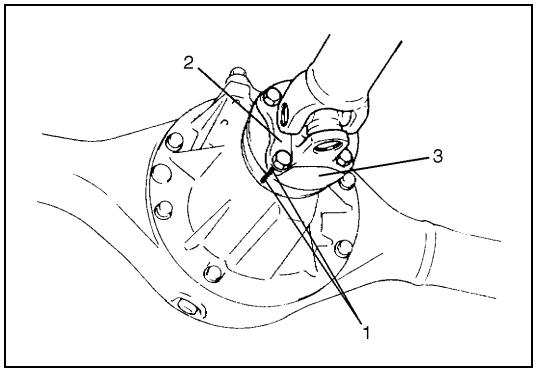
On-Vehicle Service

Propeller Shafts

REMOVAL

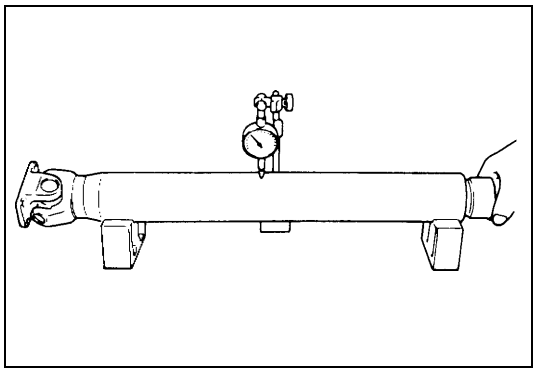


1) Hoist vehicle.
2) Drain transmission oil only when servicing propeller shaft No. 1.



3) Before removing propeller shaft (2), give match marks (1) on each joint flange (3) and propeller shaft (2) as shown.
4) Remove propeller shaft(s).

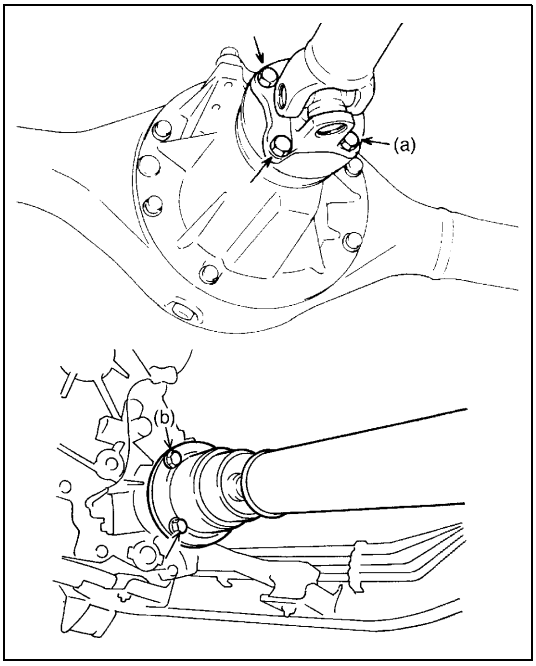
INSPECTION



Inspect propeller shaft and flange yoke for damage, and propeller shaft for runout.
If damage is found or shaft runout exceeds its limit, replace.

Propeller shaft runout limit : 0.8 mm (0.031 in.)

INSTALLATION



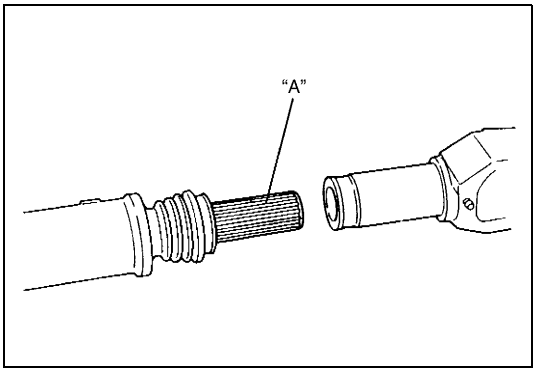
Install propeller shaft(s) reversing removal procedure noting following points :

- When installing propeller shaft, align the match marks. Otherwise, vibration may occur during driving.
- Use following specification to torque universal joint flange.

Tightening torque
Propeller shaft bolt (propeller shaft No.1, No.2 and No.3 rear differential side)
(a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)
Propeller shaft bolt (propeller shaft No.3 transfer case side)
(b) : 33 N·m (3.3 kg-m, 24 lb-ft)

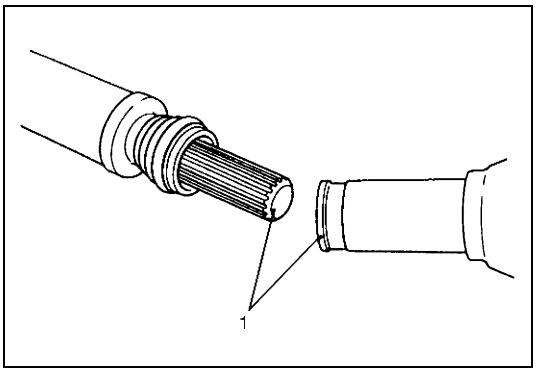
NOTE:

If transmission oil was drained for front propeller shaft removal, pour specified gear oil into transmission case to specified level.



- Grease splines of propeller shaft No. 2 and No. 3.

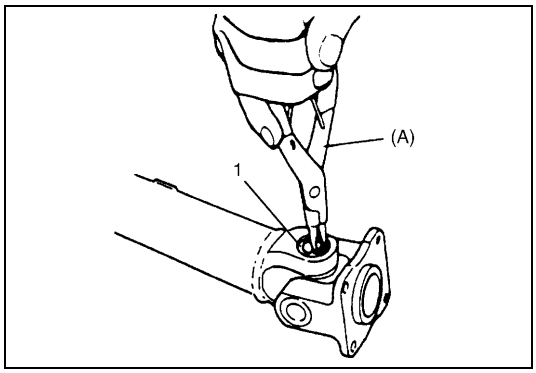
"A" : Chassis Grease 99000-25030



- Match marks (1) are provided on slip-on spline connections of propeller shaft No. 2 and No. 3. Inserting splined end into splined bore without regard to match marks can be a possible cause of noise or vibration of propeller shaft. Be sure to index marks.

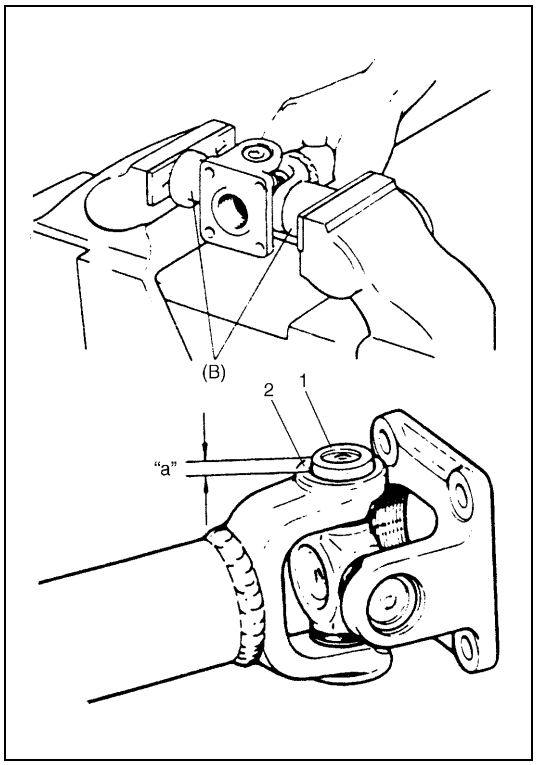
Universal Joint

DISASSEMBLY



1) Using special tool, remove 4 circlips (1).

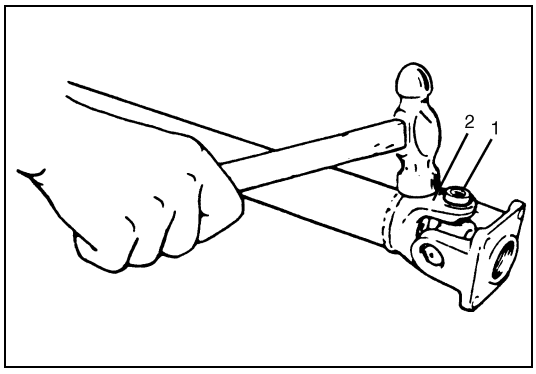
Special tool
(A) : 09900-06108



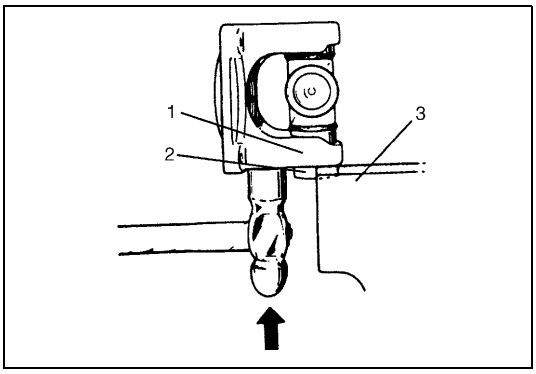
2) Apply penetrate lubricant between bearing race outer diameter and shaft yoke bore.
3) Using a set of special tool, push spider bearing race (1) out 3 – 4 mm (0.12 – 0.16 in.) from shaft yoke side face (2).

Special tool
(B) : 09926-48010

Pushed out value of bearing race from shaft yoke side face
"a" : 3 – 4 mm (0.12 – 0.16 in.)

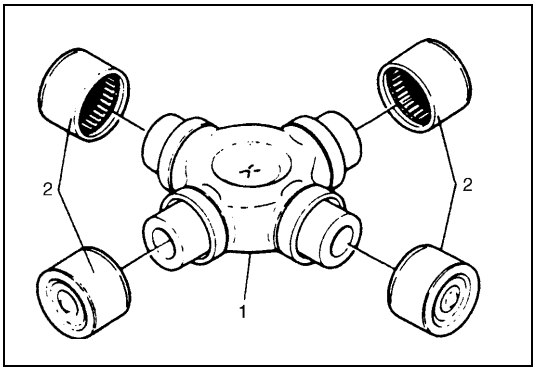


4) Tapping shaft yoke (2) with a hammer, remove bearing race (1) from shaft yoke (2) completely.
5) Take out bearing race (1) on the opposite side of shaft yoke (2) in the same way as shown.



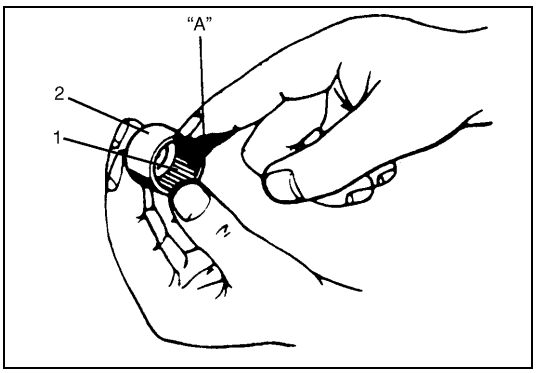
6) Push out bearing race (2) on flange yoke (1) in the same way as Step 2).
7) Holding bearing race (2) by a vise (3), tap flange yoke (1) and take out race.
8) Take out bearing race (2) on the opposite side of flange yoke (1) in the same way as Step 5) to Step 6).

REASSEMBLY



CAUTION:

Do not reuse spider (1), bearings (2) and circlips. Otherwise it may damage propeller shaft or cause abnormal vibration or noise.

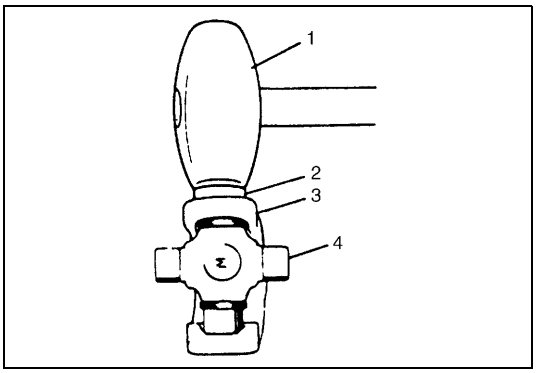


1) Apply grease to rollers (1) in bearing races (2).

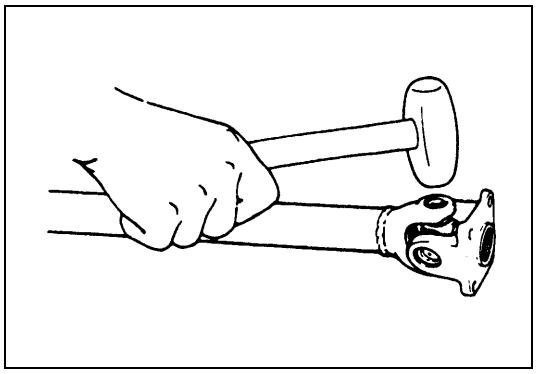
"A" : Grease 99000-25030

NOTE:

Make sure that rollers (1) in bearing race (2) are all in place.



2) With spider (4) inserted into bearing race (2) to prevent rollers in race from coming out, insert bearing race (2) into shaft yoke (3) until it is flush with side face of shaft yoke (3), tapping it by a copper hammer (1).



3) Insert bearing race into opposite side of shaft yoke until it is flush with side face of shaft yoke, tapping it by a copper hammer.
4) In the same way as Step 2) to Step 3), insert bearing races into flange yoke.
5) Using round bar of 22 – 24 mm (0.87 in. – 0.94 in.) in diameter and hammer, tap bearing races into shaft or flange yoke until circlips can be installed in its groove on yoke bores.
6) Install 4 circlips in each groove on shaft and flange yoke bores.

NOTE:

- **After reassembly, ensure that both shaft yoke and flange yoke move smoothly.**
- **Make sure that each circlip is fitted in groove securely.**

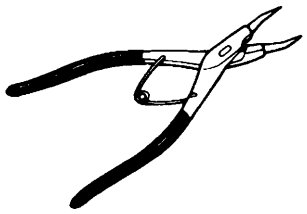
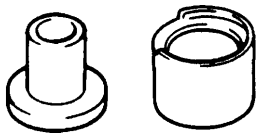
Tightening Torque Specification

Fastening portion	Tightening torque		
	N•m	kg-m	lb-ft
Propeller shaft bolt (propeller shaft No.1 No.2 and No.3 rear differential side)	50	5.0	36.5
Propeller shaft bolt (propeller shaft No.3 transfer case side)	33	3.3	24

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Lithium grease	SUPER GREASE C (99000-25030)	• To apply to spider bearing race and propeller shaft No.2 and No.3 splines.

Special Tool

	
09900-06108 Snap ring pliers (Closing type)	09926-48010 Universal joint disassembling tool set

SECTION 5

BRAKES

WARNING:

For lifting point of vehicle, refer to Section 0A.

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 "Air Bag 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 5-3
Diagnosis 5-4
Road Testing Brakes 5-4
Brake Fluid Leaks 5-4
Substandard or Contaminated Brake Fluid 5-4
Diagnosis Table 5-5
Brake Pedal Free Height Adjustment 5-8
Brake Pedal Play Check 5-8
Stop Light Switch Adjustment 5-8
Excessive Pedal Travel Check 5-9
Front Brake Disc Check 5-9
Front Brake Pad Check 5-9
Rear Brake Shoe Check 5-10
Master Cylinder and Brake Fluid Level Check 5-10
Rear Drum Brake Shoe Adjustment 5-11
Parking Brake Inspection and Adjustment ... 5-11
Booster Operation Check 5-12
Fluid Pressure Test (If Equipped with LSPV) 5-15
On-Vehicle Service 5-17
Air Bleeding of Brake System 5-17
Brake Hose and Pipe Inspection 5-18
Front Disc Brake 5-19
Brake pad 5-20
Caliper assembly 5-22
Brake Disc 5-26
Rear Brake 5-29
Brake drum 5-29
Brake shoe 5-32
Wheel Cylinder 5-33
Brake back plate 5-34
Master Cylinder 5-36
Master Cylinder Reservoir 5-36
Master Cylinder Assembly 5-37

Master Cylinder 5-38
Fill Reservoir 5-40
LSPV (Load Sensing Proportioning Valve) Assembly (If Equipped) 5-42
LSPV Assembly 5-43
P (Proportioning) Valve 5-44
Brake Booster 5-45
Inspection and adjustment 5-46
Brake Hose/Pipe 5-48
Front brake hose/pipe 5-48
Rear Brake Hose/Pipe 5-51
Parking Brake Lever/Cable 5-52
Parking brake lever 5-52
Parking Brake Cable 5-53
Tightening Torque Specifications 5-54
Required Service Material 5-54
Special Tool 5-55

General Description

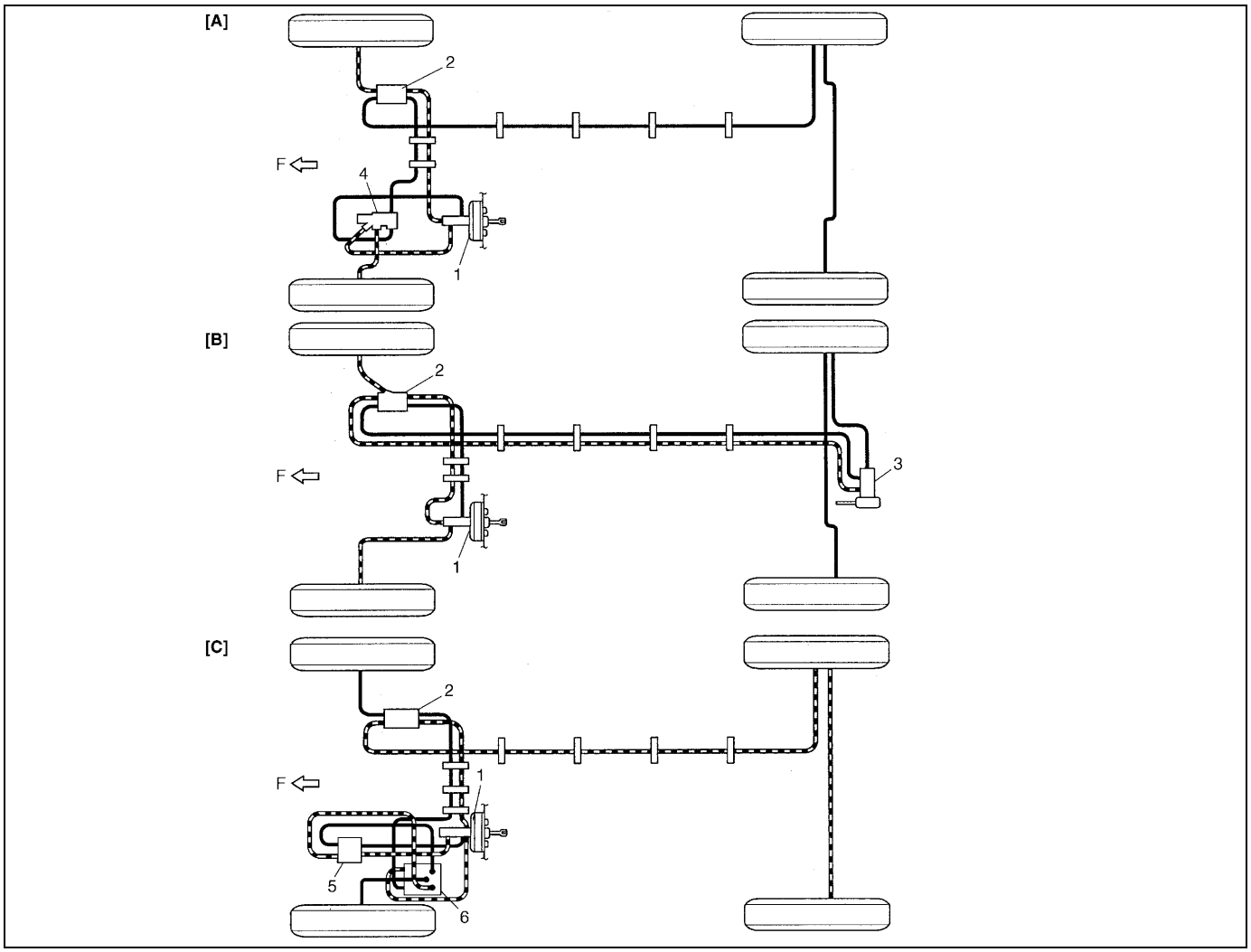
When the foot brake pedal is depressed, hydraulic pressure is developed in the master cylinder to actuate pistons (two in front and four in rear).
The master cylinder is a tandem master cylinder. Three (or two) brake pipes are connected to the master cylinder and they make two independent circuits. One connects front brakes (right and left) and the other connects rear brakes (right and left).
The load sensing proportioning valve (LSPV), the proportioning and bypass (P & B) valve or proportioning (P) valve is included in these circuits between the master cylinder and the rear brake.
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 wheel 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.

WARNING:

If any hydraulic component is removed or brake line disconnected, bleed the brake system. The torque values specified are for dry, unlubricated fasteners.



[A] : Vehicle without ABS, LSPV	1. Master cylinder	4. P & B valve	F: Forward
[B] : Vehicle with LSPV	2. 5-way joint (4-way joint)	5. P (Proportioning) valve	
[C] : Vehicle with ABS	3. LSPV (Load Sensing Proportioning valve)	6. Hydraulic Unit	

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 end 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 primary piston cups are swollen, then rubber parts have deteriorated. This deterioration may also be evidenced by swollen wheel cylinder piston cups on the drum brake wheels.

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.

If master cylinder piston seals are satisfactory, check for leakage or excessive heat conditions. If condition is not found, drain fluid, flush with brake fluid, refill and bleed the system.

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.

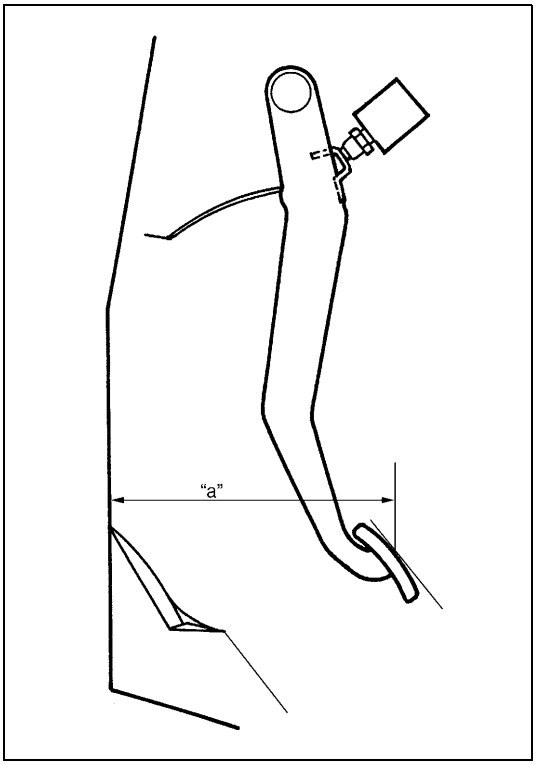
Diagnosis Table

Condition	Possible Cause	Correction
Not enough braking force	Brake oil leakage from brake lines	Locate leaking point and repair.
	Brake disc or pads stained with oil	Clean or replace.
	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 shoe linings	Replace.
	Defective wheel cylinders	Repair or replace.
	Malfunctioning caliper assembly	Repair or replace.
	Air in system	Bleed system.
	Maladjusted sensor spring length of LSPV	Check or adjust.
	Broken sensor spring of LSPV	Replace.
	Defective collar of LSPV	Replace.
	Malfunctioning ABS (Antilock brake system), if equipped	Check system and replace as necessary.
Brake pull (Brakes not working in unison)	Pad 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.
	Drum is out of round in some brakes	Replace.
	Wheel tires are inflated unequally	Inflate equally.
	Malfunctioning 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 tubes 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.
	Loose suspension parts	Caliper should slide. Check all suspension mountings.
	Loose calipers	Check and torque bolts to specifications.
Noise (high pitched squeak without brake applied)	Front lining worn out	Replace brake pads.
Rear brake locked prematurely	Maladjusted sensor spring length of LSPV	Check or adjust.
	Malfunctioning LSPV assembly	Replace assembly.
Brake locked (For vehicles equipped with ABS)	Malfunctioning ABS, if equipped	Check system and replace as necessary.

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 systems. Check warning light. Bleed system if required.
	Air in system (pedal soft/spongy)	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.
Dragging brakes (A very light drag is present in all disc brakes immediately after pedal is released)	Master cylinder pistons not returning correctly	Repair master cylinder.
	Restricted brake tubes or hoses	Check for soft hoses or damaged tubes and replace with new hoses and/or new brake tubes.
	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.
	Malfunctioning ABS, if equipped with ABS	Check system and replace as necessary.
Pedal pulsation (Pedal pulsates when depressed for braking.)	Damaged or loose wheel bearings	Replace wheel bearings.
	Distorted steering knuckle or rear axle shafts	Replace knuckle or rear axle shaft.
	Excessive disc lateral runout	Check per instructions. If not within specifications, replace or machine the disc.
	Parallelism not within specifications	Check per instructions. If not with specifications, replace or machine the 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 brake shoe.
	Worn or distorted shoe linings	Replace brake shoe (or pad).
	Loose front wheel bearings	Replace wheel bearing.
	Distorted backing plates or loose mounting bolts	Replace or retighten securing bolts.
Brake warning light turns on after engine start	Parking brake applied	Release parking brake and check that brake warning light 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 light circuit faulty	Repair circuit.

Condition	Possible Cause	Correction
Brake warning light 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.
	Faulty P & Differential valve (Differential switch)	Replace.
Brake warning light fails to turn on even when parking brake is applied	Bulb burnt out	Replace bulb.
	Brake warning light circuit open	Repair circuit.
ABS warning light does not turn on for 2 sec. after ignition switch has turned ON.	Bulb burnt out	Replace bulb.
	ABS warning light circuit open, if equipped with ABS (including check relay)	Check system referring to “TABLE-A” in Section 5E.
ABS warning light remains on after ignition switch has turned on for 2 sec.	Malfunctioning ABS, if equipped with ABS	Check system referring to “TABLE-B” in Section 5E.

Brake Pedal Free Height Adjustment

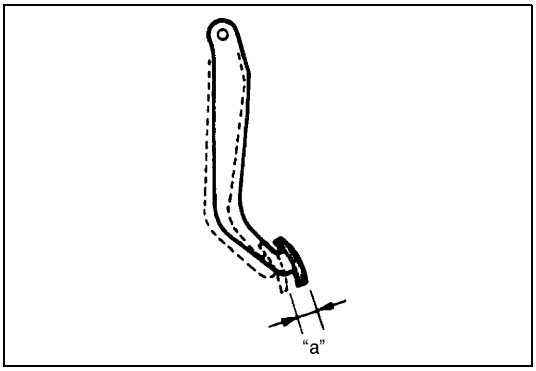


1) Check brake pedal free height.
   If it is not within specification, check and adjust following item 2) and 3).

   Brake pedal free height "a" from wall
   LH steering vehicle : 221 – 227 mm (8.70 – 8.94 in.)
   RH steering vehicle : 217 – 223 mm (8.54 – 8.78 in.)

2) Check measurement between booster mounting surface and center of clevis pin hole. When booster push rod clevis has been reinstalled, it is important that the measurement is adjusted. (Refer to "Brake Booster Inspection and Adjustment" in this section.)
3) Check stop light switch position. Adjust it if it is out of specification.

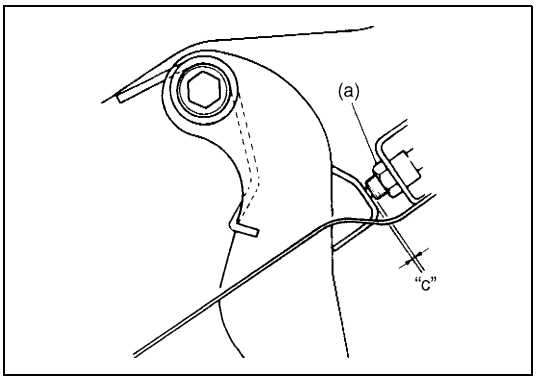
Brake Pedal Play Check



Pedal play should be within specification below.
If out of specification, check stop 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.

Brake pedal play "a" : 1 – 8 mm (0.04 – 0.31 in.)

Stop Light Switch Adjustment

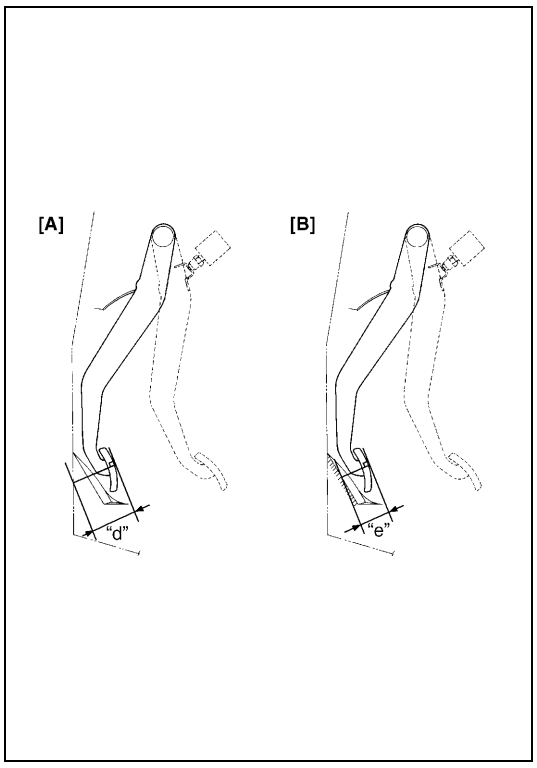


Adjustment should be made as follows when installing switch. Pull up brake pedal toward you and while holding it there, adjust switch position so that clearance between end of thread and brake pedal is specified. Then tighten lock nut to specified torque.

Clearance between brake pedal and stop light switch
"c" : 1.5 – 2.0 mm (0.06 – 0.08 in.)

Tightening torque
Stop light switch lock nut
(a) : 6.5 N·m (0.65 kg-m, 4.7 lb-ft)

Excessive Pedal Travel Check



1) Start engine.
2) Depress brake pedal a few times.
3) With brake pedal depressed with approximately 30 kg (66 lbs) load, measure brake pedal to wall clearance "d" or "e".

Clearance "d" or "e" between brake pedal and wall
LH steering vehicle clearance "d" : Over 55 mm (2.17 in.)
RH steering vehicle clearance "e" : Over 76 mm (2.99 in.)

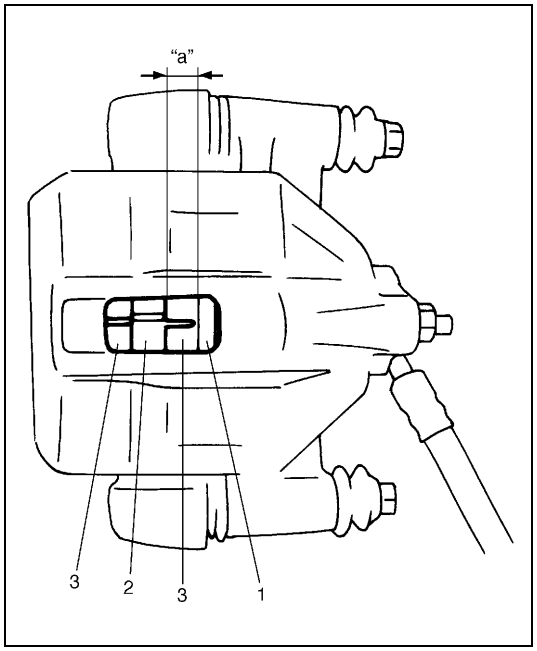
4) If clearance "d" or "e" is less than specification, the most possible cause is either rear brake shoes are worn out beyond limit or air is in lines.
   Should clearance "d" or "e" remain less than specification even after replacement of brake shoes and bleeding of system, other possible but infrequent 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 "Rear Brake" in this section. If defective, correct or replace.

[A]: LH steering vehicle
[B]: RH steering vehicle

Front Brake Disc Check

Refer to item "Front Disc Brake" in this section for inspection point and procedure.

Front Brake Pad Check



Inspect pad linings (3) periodically according to maintenance schedule whenever wheels are removed (for tire rotation or other reason). Take a look through each end (or hole) of caliper and check lining thickness of outside and inside pads. If lining is worn and its thickness ("a" in figure) is less than limit, all pads must be replaced at the same time.

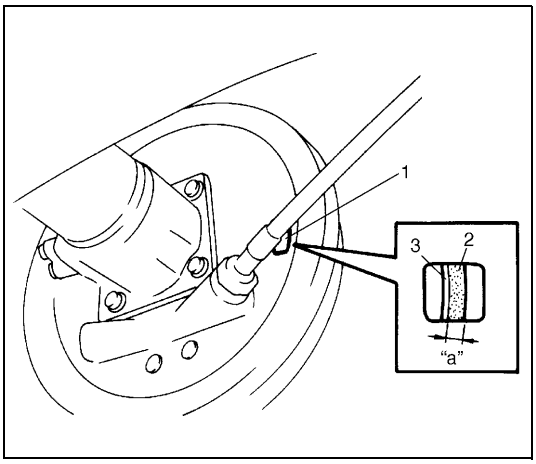
Front brake pad thickness "a" (lining thickness)
Limit : 2.0 mm (0.08 in.)

1. Pad rim
2. Disc

Rear Brake Shoe Check

Inspection should be carried out on following points after brake pedal travel (pedal to wall clearance) check, even when pedal travel is normal. Amount of brake shoe wear can be checked as follows.

1) Hoist vehicle.

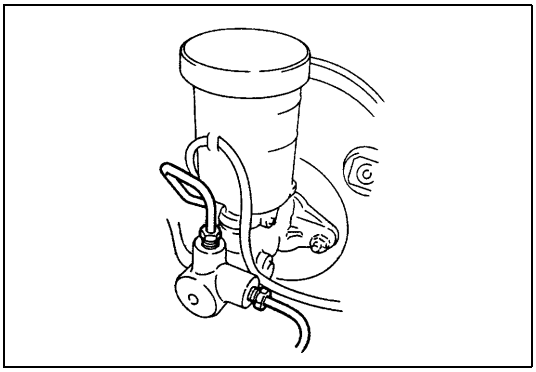


2) Remove rubber plug (1) from brake back plate.
3) Through hole of back plate, visually check for thickness of brake shoe lining (2). If lining thickness "a" is found less than limit, replace all shoes with new ones at the same time.

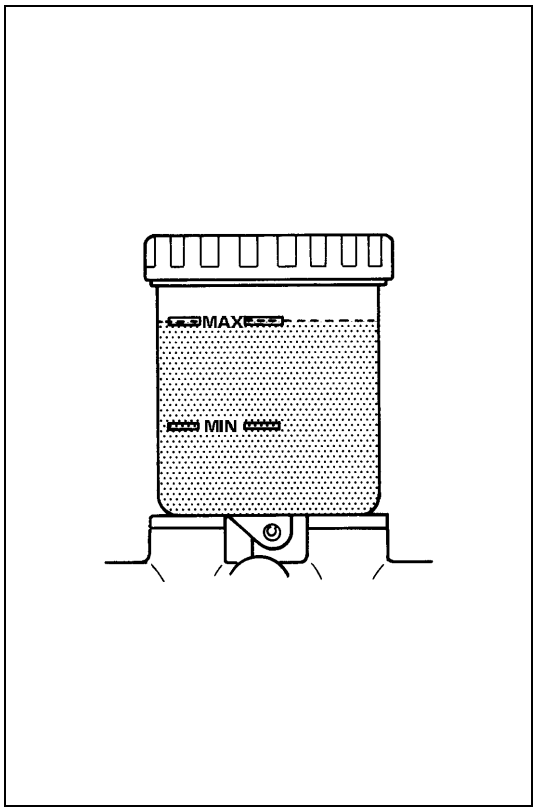
Rear brake shoe thickness "a" (lining thickness)
Limit : 1.0 mm (0.04 in.)

3. Brake shoe rim

Master Cylinder and Brake Fluid Level Check



1) Check master cylinder and reservoir for crack, damage and brake fluid leakage. If any faulty condition exists, correct or replace.
2) Check that brake fluid level is between MAX and MIN marks on reservoir.



NOTE:

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 brake warning lamp lights sometimes during driving, replenish fluid to MAX level.
When fluid decreases quickly, inspect brake system for leakage.
Correct leaky points and then refill to specified level.

CAUTION:

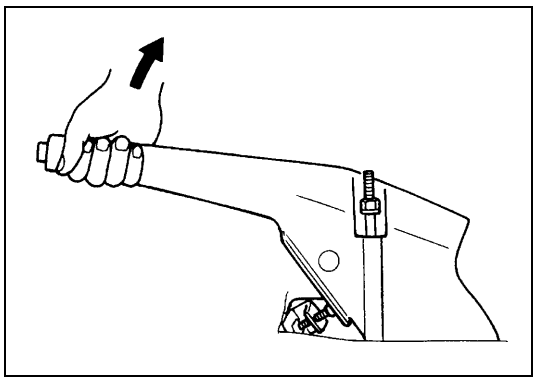
Do not use shock absorber fluid or any other fluid which contains mineral oil. Do not use a container which has been used for mineral oil or a container which is wet from water. Mineral oil will cause swelling and distortion of rubber parts in hydraulic brake system and water mixed into brake fluid will lower fluid boiling point. Keep all fluid containers capped to prevent contamination.

Rear Drum Brake Shoe Adjustment

Rear brake has self-adjusting mechanism but it does require adjustment for proper drum to shoe clearance when brake shoe has been replaced or brake drum has been removed for some other service.
Adjustment is automatically accomplished by depressing brake pedal about 30 times with approximately 30 kg (66 lbs) load after all parts are installed.
Then check brake drum for dragging and brake system for proper performance. After lowering vehicle from hoist, brake test should be performed.

Parking Brake Inspection and Adjustment

INSPECTION



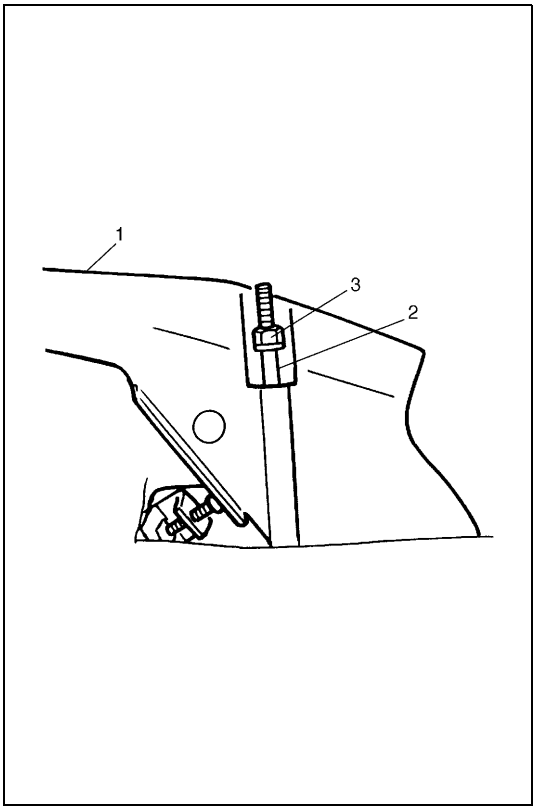
Hold center of parking brake lever grip and pull it up with 20 kg (44 lbs) force.
With parking brake lever pulled up as above, count ratchet notches.
There should be 6 to 8 notches.
Also, check if both right and left rear wheels are locked firmly. To count number of notches easily, listen to click sounds 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 by referring to adjustment procedure described on the following 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 following conditions before cable adjustment.

- **No air is trapped in brake system.**
- **Brake pedal travel is proper.**
- **Brake pedal has been depressed a few times with about 30 kg (66 lbs) load.**
- **Parking brake lever (1) has been pulled up a few times with about 20 kg force.**
- **Rear brake shoes are not worn beyond limit, and self adjusting mechanism operates properly.**

After confirming that above 5 conditions are all satisfied, adjust parking brake lever stroke by loosening or tightening adjusting nut (3) indicated in figure.

NOTE:

Check brake drum for dragging after adjustment.

Parking brake stroke (when lever is pulled up at 200 N (20 kg, 44 lbs) : 6 – 8 notches

2. Brake cable

Booster Operation Check

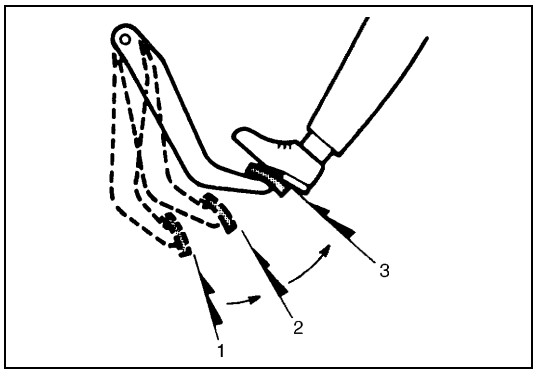
There are two ways to perform this inspection, with and without a tester. Ordinarily, it is possible to roughly determine its condition without using a tester.

NOTE:

For this check, make sure that no air is in hydraulic line.

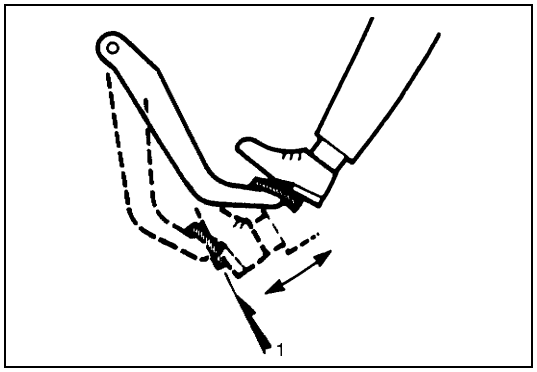
CHECK AIR TIGHTNESS

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.

1. 1st
2. 2nd
3. 3rd



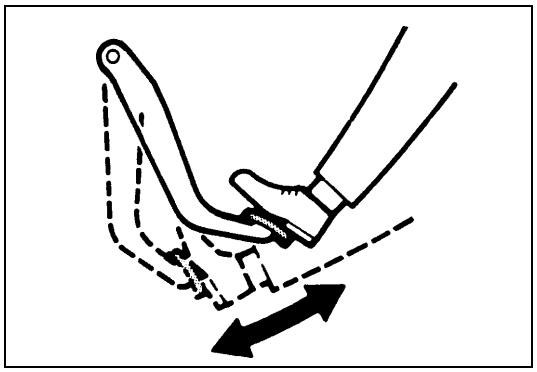
4) If pedal travel doesn't change, air tightness isn't obtained.

NOTE:

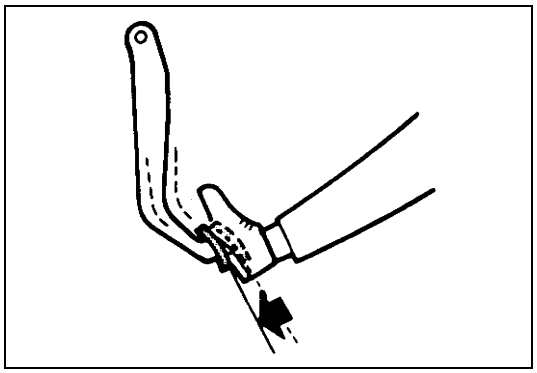
If defective, inspect vacuum lines and sealing parts, and replace any faulty part. When this has been done, repeat the entire test.

1. 1st, 2nd, 3rd

CHECK OPERATION

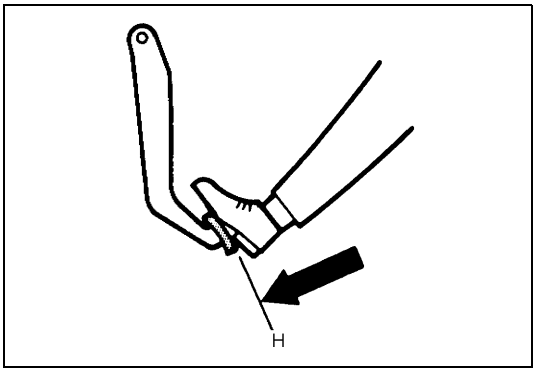


1) With engine stopped, depress brake pedal several times with the same load and make sure that pedal travel doesn't change.



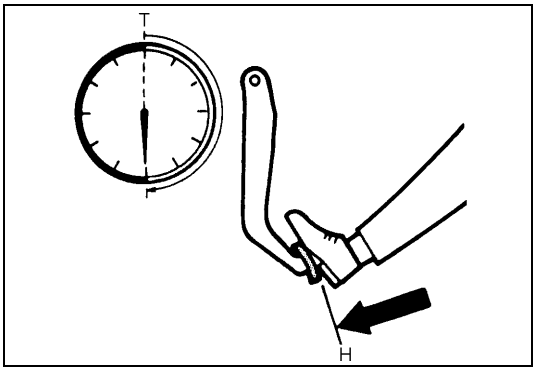
2) Start engine while depressing brake pedal. If pedal travel increases a little, operation is satisfactory. But no change in pedal travel indicates malfunction.

CHECK AIR TIGHTNESS UNDER LOAD



1) With engine running, depress brake pedal. Then stop engine while holding brake pedal depressed.

H : Hold



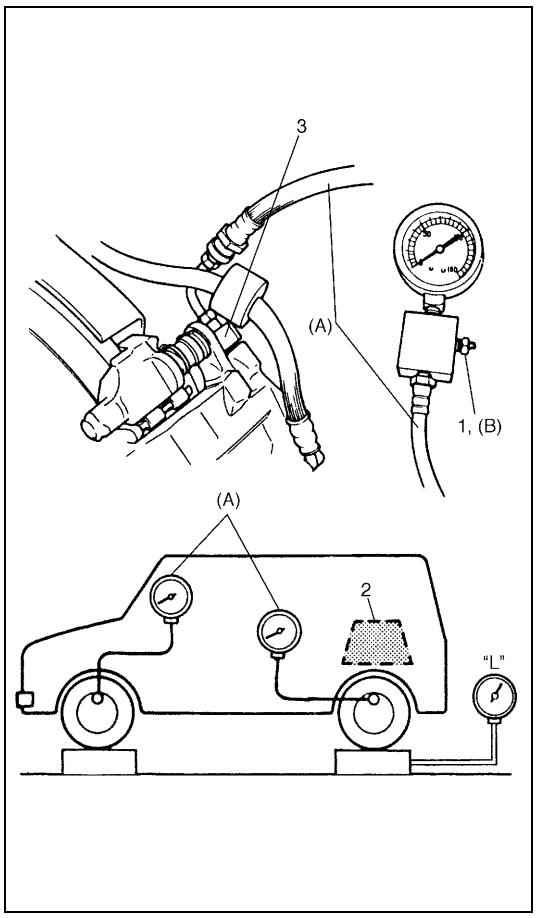
2) Hold brake pedal depressed for 30 seconds. If pedal height does not change, condition is good. But it isn't if pedal rises.

H : Hold
T : 30 seconds

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) Stop vehicle on level floor and place approximately about 140 kg (309 lbs) weight on rear housing so that rear axle weights 600 kg (1323 lb).

Rear axle weight
"L" : 600 kg (1323 lb)

2) Install special tool to front and rear brake.

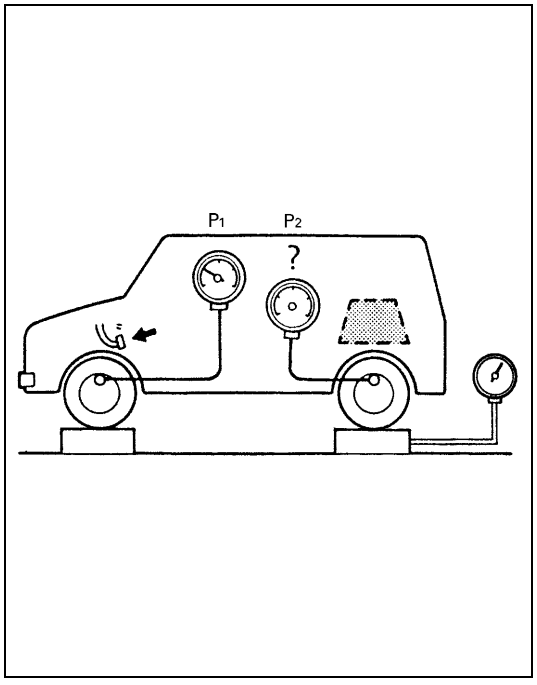
NOTE:

Special tool should be connected to bleeder plug hole of front (driver's side brake) and rear brakes.

Special tool
Front brake
(A) : 09956-02310
(B) : 55473-82030 (Use the air bleeder plug supplied as a spare part)

Rear brake
(A) : 09956-02310
(B) : 55473-82030 (Use the air bleeder plug supplied as a spare part)

1. Air bleeder plug
2. Weight
3. Attachment

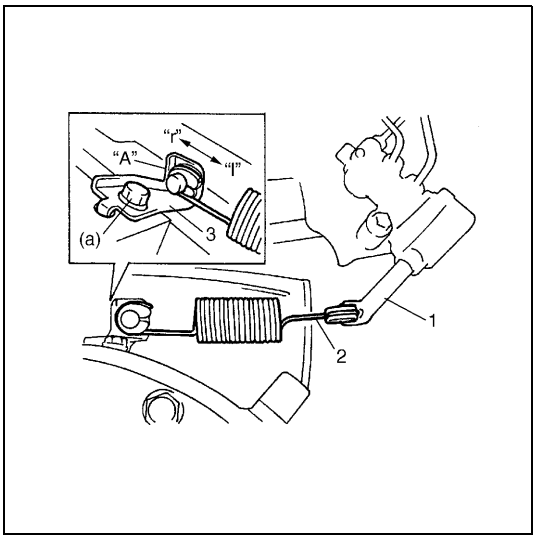


3) Depress brake pedal gradually till fluid pressure of front brake becomes as specified below and check corresponding pressure of rear brake. It should be within specification given below.

Front brake	Rear brake
5000 kPa 50 kg/cm^2 711 psi	3800 – 5100 kPa 38 – 51 kg/cm^2 540 – 725 psi

As done above, apply 100 kg/cm^2 pressure to front brake and check that rear brake pressure is within specification as given below.

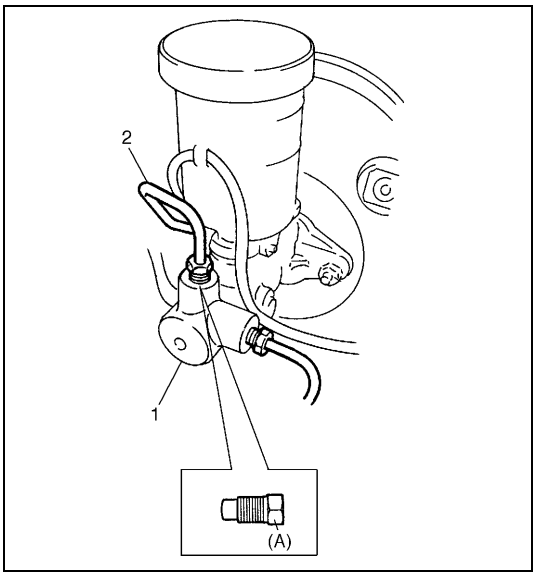
Front brake	Rear brake
10000 kPa 100 kg/cm^2 1422 psi	5100 – 6500 kPa 51 – 65 kg/cm^2 725 – 924 psi



4) If rear brake pressure is not within specification, adjust it by changing stay position as follows.
   - If rear brake pressure is higher than specification, move stay "A" to direction "l" and if it is lower, to direction "r".
   - Repeat steps 3) and 4) until rear brake pressure is within specification.
   - After adjustment, be sure to torque bolt to specification.

Tightening torque
LSPV adjust bolt
(a) : 25 N·m (2.5 kg-m, 18 lb-ft)

1. LSPV lever
2. LSPV spring
3. LSPV stay



5) Disconnect brake pipe (2) (connecting between master cylinder secondary side and 4-way joint) from master cylinder (1). Tighten plug (special tool) to master cylinder.
   Depress brake pedal. If rear brake pressure is 95 – 100 kg/cm^2 when front brake pressure is 100 kg/cm^2, it means that front fail-safe system functions properly.

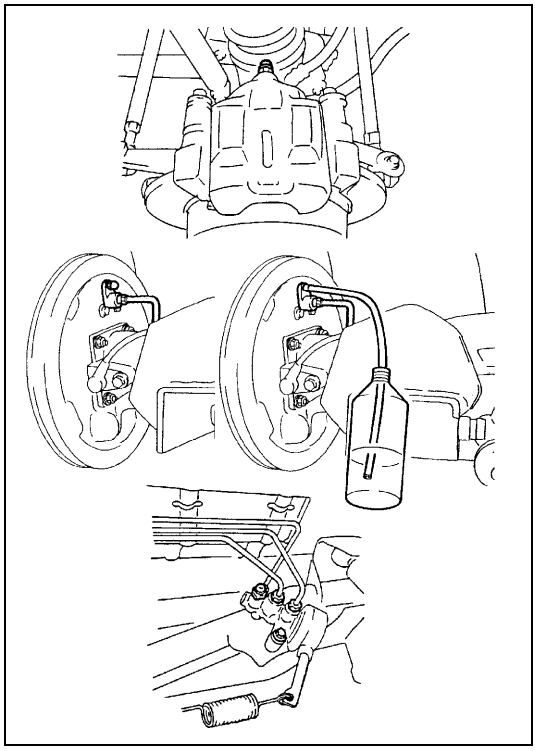
Front brake	Rear brake
10000 kPa	9500 – 10000 kPa
100 kg/cm^2	95 – 100 kg/cm^2
1422 psi	1350 – 1422 psi

Special tool
(A) : 09956-02210

On-Vehicle Service

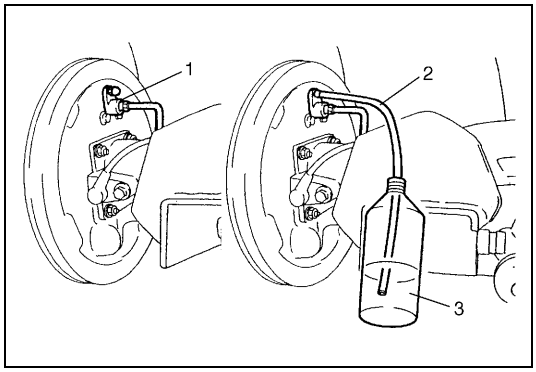
Air Bleeding of Brake System

CAUTION:
Brake fluid is extremely damaging to paint. If fluid should accidentally touch painted surface, immediately wipe fluid from paint and clean painted surface.

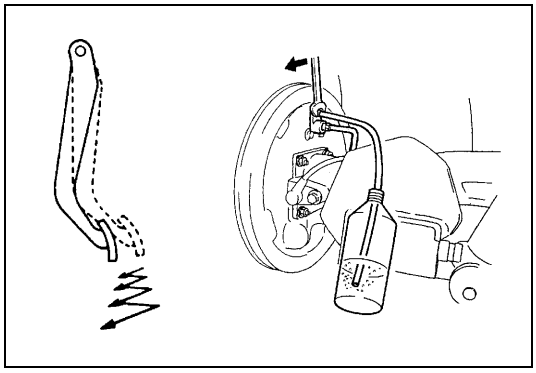


Bleeding operation is necessary to remove air whenever it entered hydraulic brake system.
Hydraulic lines of brake system consists of two separate lines, one for front wheel brakes and the other for rear wheel brakes. Air bleeding is necessary at right and left front wheel brakes, left rear wheel brake and LSPV (if equipped), i.e. 3 (4 for vehicle with LSPV) places in all.
Be sure to bleed air of brake system according to following procedure when its oil hydraulic circuit has been disconnected.

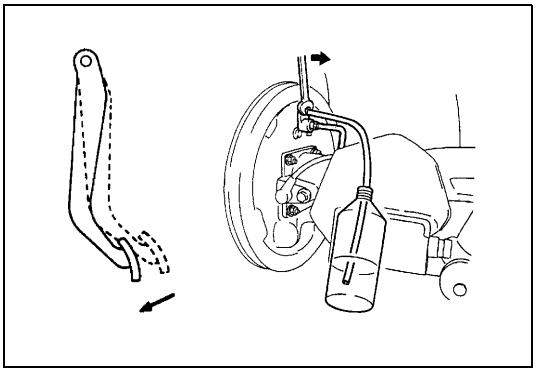
1) Fill master cylinder reservoir with brake fluid and keep at least one-half full of fluid during bleeding operation.



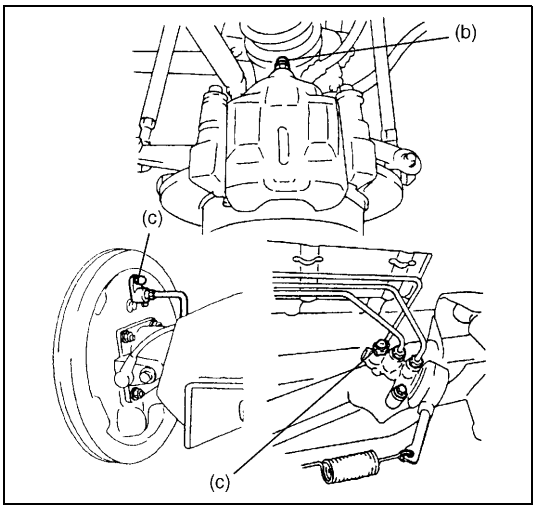
2) Remove bleeder plug cap (1).
   Attach a vinyl tube (2) to bleeder plug, and insert the other end into container (3).



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.

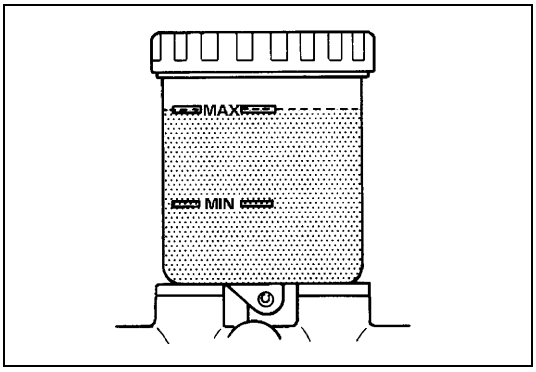


6) When bubbles stop, depress and hold brake pedal and tighten bleeder plug.

Tightening torque
Front caliper bleeder plug
(b) : 11 N·m (1.1 kg-m, 8.0 lb-ft)

Rear wheel cylinder and LSPV bleeder plug
(c) : 8 N·m (0.8 kg-m, 6.0 lb-ft)

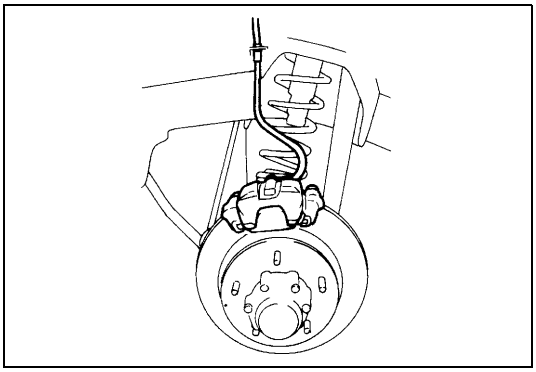
7) Then attach bleeder plug cap.
8) After completing bleeding operation, apply fluid pressure to pipe line and check for leakage.



9) Replenish fluid into reservoir up to specified level.
10) Check brake pedal for “sponginess”. If found spongy, repeat entire procedure of bleeding.

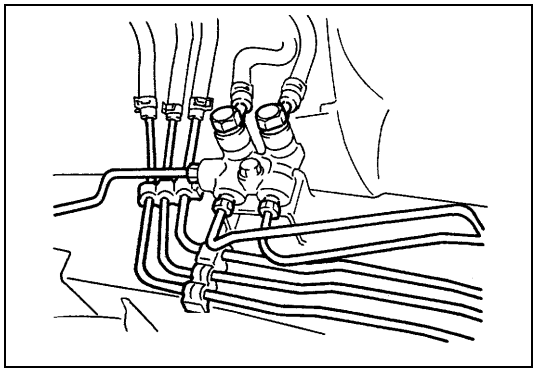
Brake Hose and Pipe Inspection

HOSE



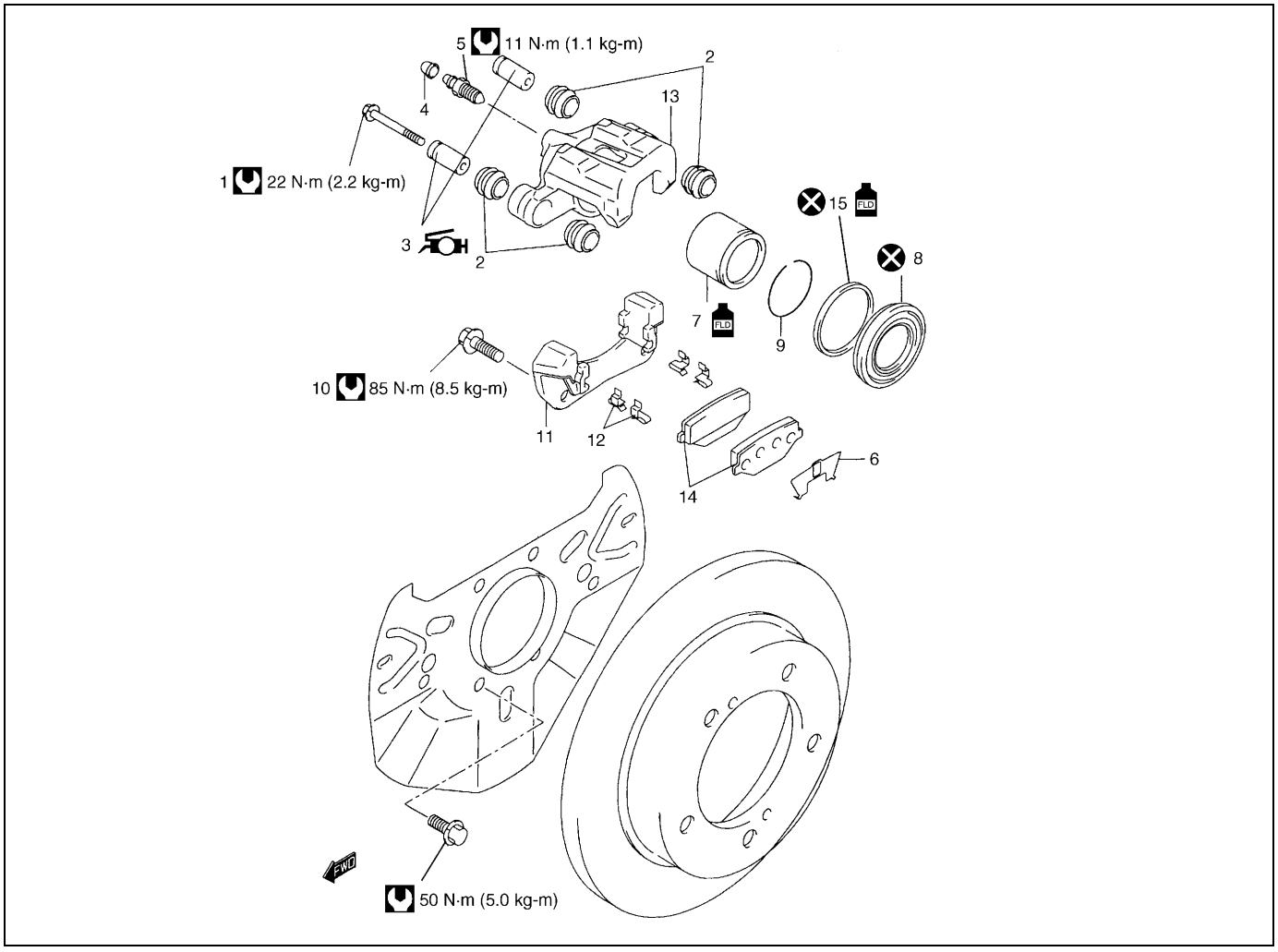
The brake hose assembly should be checked for road hazard damage, for cracks and chafing of the outer cover, for leaks and blisters. A light and mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, it is necessary to replace it.

PIPE



Inspect the tube for damage, cracks, dents and corrosion. If any defect is found, replace it.

Front Disc Brake

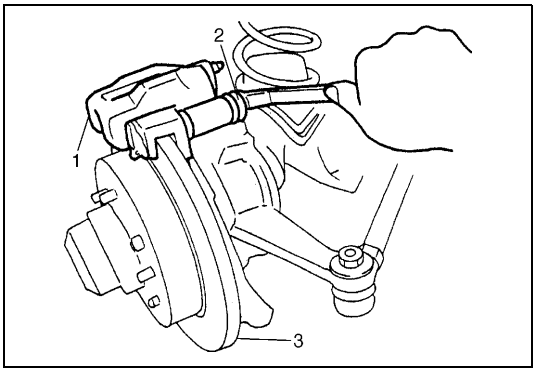


	1. Caliper pin bolt		10. Carrier bolt
	2. Boot		11. Brake caliper carrier
	3. Cylinder slide bush : Apply rubber grease to mating surface of caliper		12. Pad clip
	4. Bleeder plug cap		13. Disc brake caliper
	5. Bleeder plug		14. Disc brake pad
	6. Anti noise shim	FLD	15. Piston seal : Apply brake fluid to all around part of piston seal
FLD	7. Disc brake piston : Apply brake fluid to contact surface of cylinder		Tightening torque
	8. Cylinder boot		Do not reuse.
	9. Seat ring (boot ring)		

Brake pad

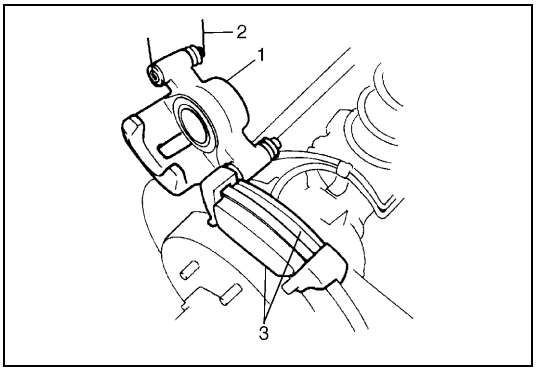
REMOVAL

1) Hoist vehicle and remove wheel.



2) Remove caliper pin bolts (2).

1.	Caliper
3.	Disc



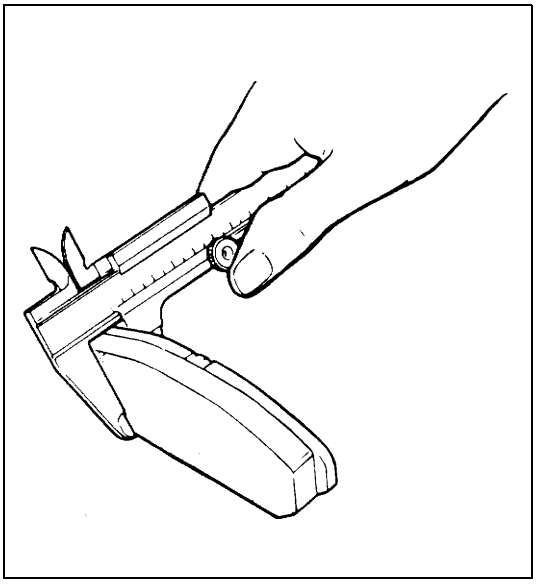
3) Remove caliper (1) from caliper carrier.

NOTE:

Hang removed caliper (1) 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 (3) removed.

4) Remove pads (3).

INSPECTION



Check pad lining for wear. When wear exceeds limit, replace with new one.

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.

Brake pad thickness (lining + pad rim)
Standard : 15 mm (0.59 in.)
Limit : 7 mm (0.28 in.)

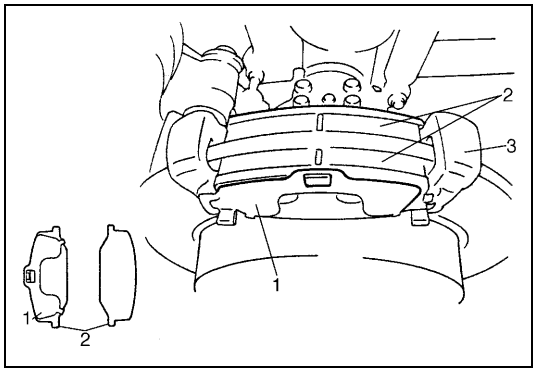
NOTE:

When pads are removed, visually inspect caliper for brake fluid leak. Correct leaky point, if any.

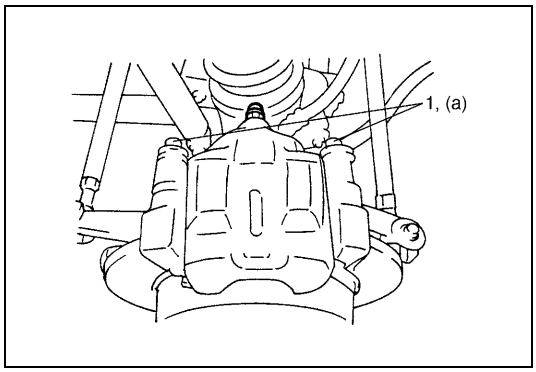
INSTALLATION

NOTE:

See NOTE at the beginning of this section.



1) Install pad shim (1) (to outside pad) and pads (2) to caliper carrier (3).

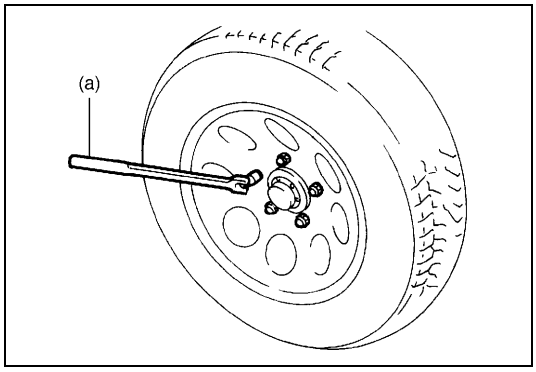


2) Install caliper and torque caliper pin bolts (1) to specification.

NOTE:

Make sure that boots are fit into groove securely.

Tightening torque
Brake caliper pin bolts
(a) : 22 N·m (2.2 kg-m, 16.0 lb-ft)



3) Install wheel and torque front wheel nuts to specification.

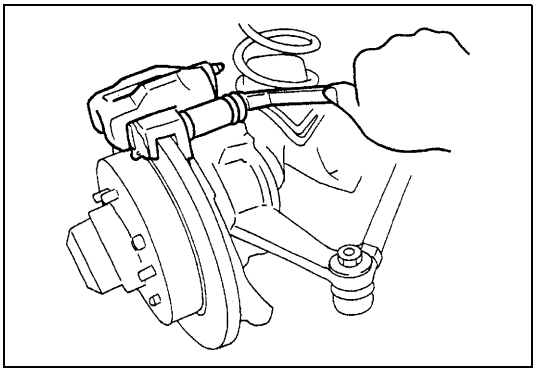
Tightening torque
Wheel nuts
(a) : 95 N·m (9.5 kg-m, 69.0 lb-ft)

4) Upon completion of installation, perform brake test.

Caliper assembly

REMOVAL

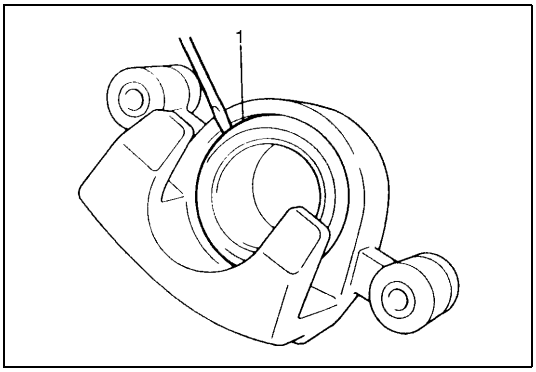
1) Hoist vehicle and remove wheel.
2) Remove brake flexible hose mounting bolt from caliper. As this will allow fluid to flow out of hose, have a container ready beforehand.



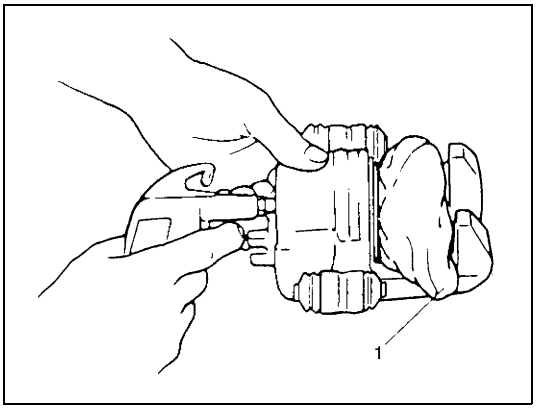
3) Remove caliper pin bolts.
4) Remove caliper from carrier.

DISASSEMBLY

1) Before disassembly, clean all around caliper with brake fluid.



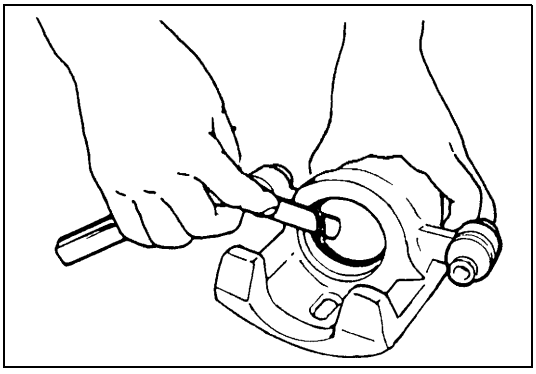
2) Remove piston set ring (1) and boot from caliper, pry off with a flat-bladed tool. Be careful not to damage boot.



3) Blow compressed air into cylinder through bolt hole where flexible hose was fitted. With this air pressure, piston can be pushed out of cylinder.

WARNING:

Do not apply too highly compressed air which will cause piston to jump out of cylinder. Place a cloth (1) to prevent piston from damage. It should be taken out gradually with moderately compressed air. Do not place your fingers in front of piston when using compressed air.



4) Remove piston seal using a thin blade like a thickness gauge, etc.

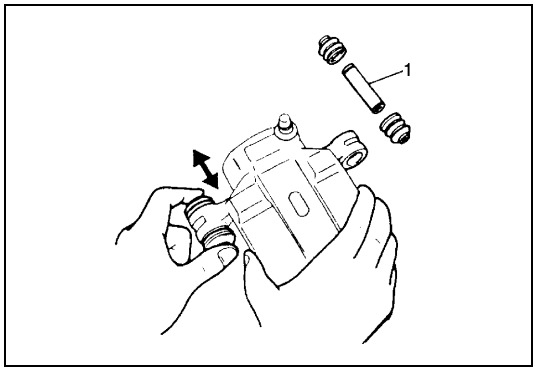
NOTE:

Be careful not to damage inside (bore side) of cylinder.

5) Remove bleeder plug and cap from caliper.

INSPECTION

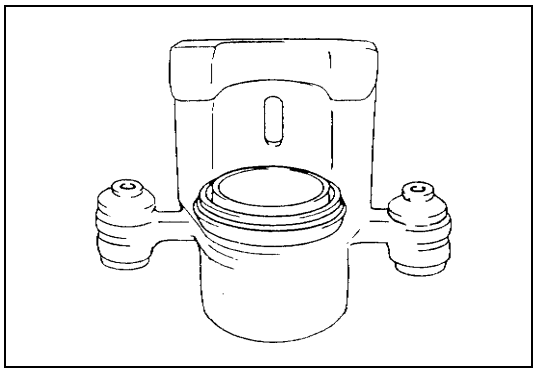
Cylinder Slide Bush



Check slide bush for smooth movement as shown.
If it is found faulty, correct or replace. Apply rubber grease to bush outer surface. Rubber grease should be the one whose viscosity is less affected by such low temperature as – 40 °C (– 40 °F).

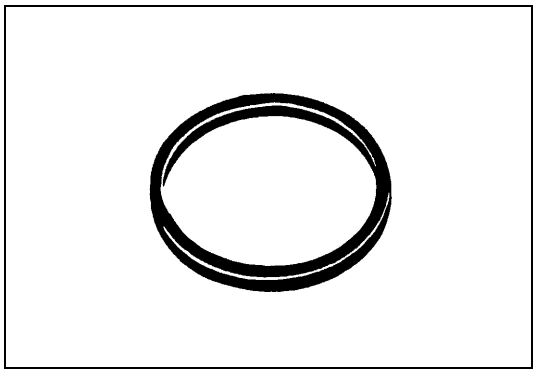
1. Apply rubber grease

Bush Dust Boot and Cylinder Boot



Check boots for breakage, crack and damage. If defective, replace.

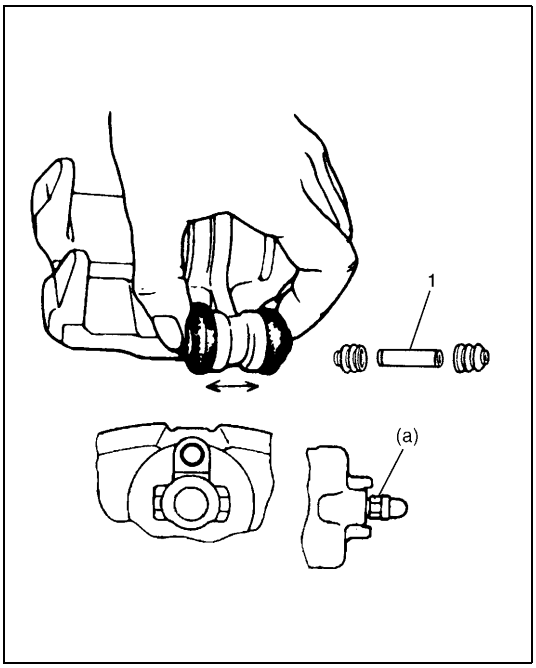
Piston Seal



Excessive or uneven wear of pad lining may indicate unsmooth return of the piston. In such a case, replace rubber seal.

ASSEMBLY

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.**



1) Check that slide bushes and boots for wear, corrosion, damage, movement or deterioration. If it is found faulty, correct or replace.
   Apply rubber grease to bush outer surface. And then make sure that each bush slides easily through each caliper bolt hole.

NOTE:

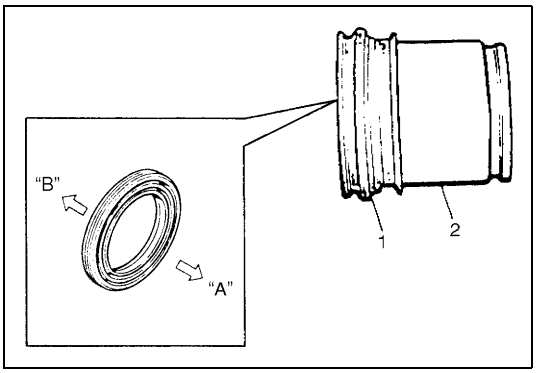
Where temperature gets as low as – 30 °C (– 22 °F) in cold weather, use rubber grease whose viscosity varies very little even at – 40 °C (– 40 °F).

2) Tighten bleeder plug to specified torque and install cap.

Tightening torque
Front caliper bleeder plug
(a) : 11 N·m (1.1 g-m, 8.0 lb-ft)

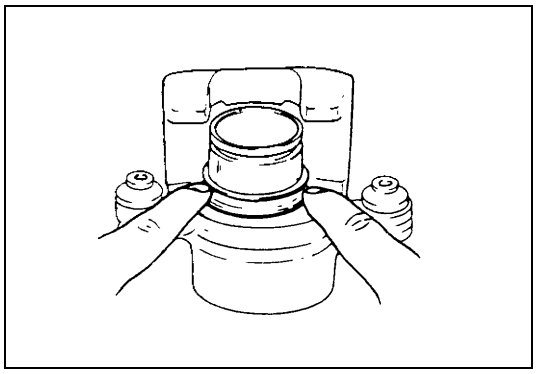
1. Apply rubber grease

3) 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. Fit piston seal into groove in cylinder taking care not to twist it.

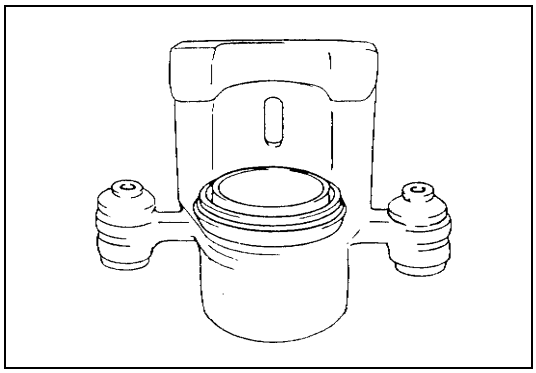


4) Before inserting piston (2) into cylinder, install new boot (1) onto piston (2) as shown.

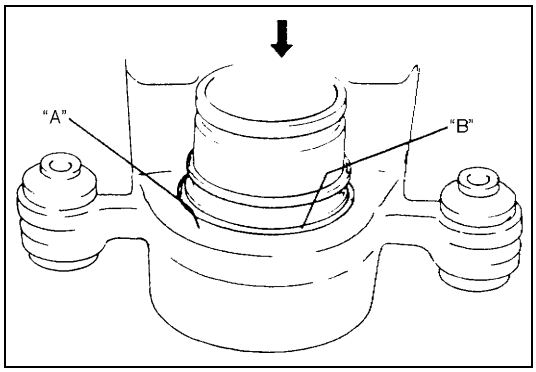
"A" : 2-grooved side directed inside
"B" : 3-grooved side directed outside



5) Fit boot as it is in figure into boot groove in cylinder with fingers.



6) Insert piston into cylinder by hand and fit boot in boot groove in piston.



7) To confirm that boot is fitted in its groove in cylinder properly, pull piston out of cylinder a little but do not take it all out.

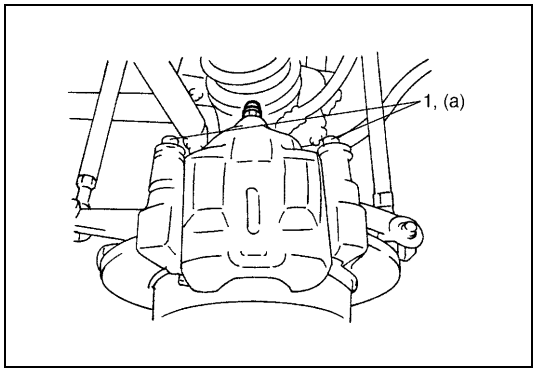
NOTE:

Boot's face "B" should be at the same level from cylinder's face "A" all around.

8) Insert piston into cylinder by hand.
9) Install piston set ring.

INSTALLATION

1) Install caliper to caliper carrier.

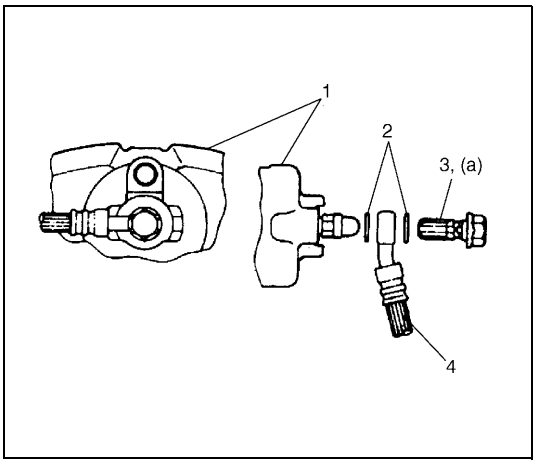


2) Torque caliper pin bolts (1) to specification.

NOTE:

Make sure that boots are fit into groove securely.

Tightening torque
Brake caliper pin bolts
(a) : 22 N·m (2.2 kg-m, 16.0 lb-ft)



3) Install brake flexible hose (4) as shown and torque hose mounting bolt (3) to specification.

Tightening torque
Front brake flexible hose bolt
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

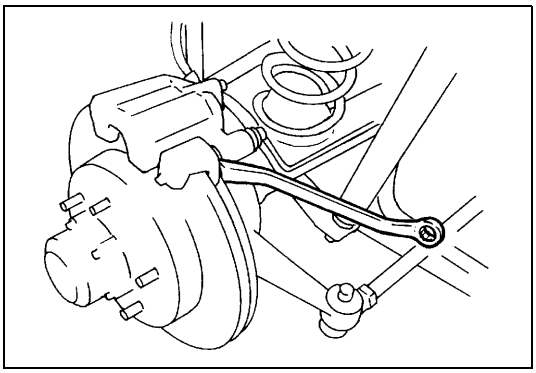
4) Install wheel and torque wheel nuts to specification.
5) After completing installation, fill reservoir with brake fluid and bleed brake system. Perform brake test and check each installed part for oil leakage.

1.	Brake caliper
2.	Washer

Brake Disc

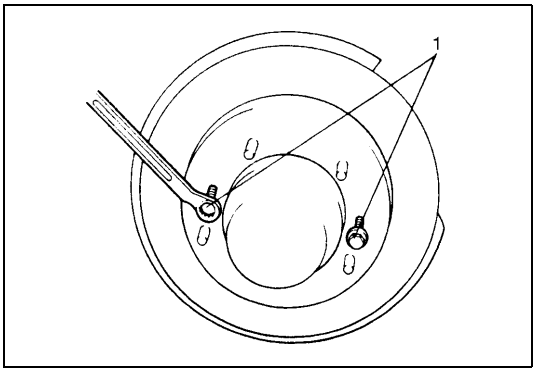
REMOVAL

1) Hoist vehicle and remove wheel.



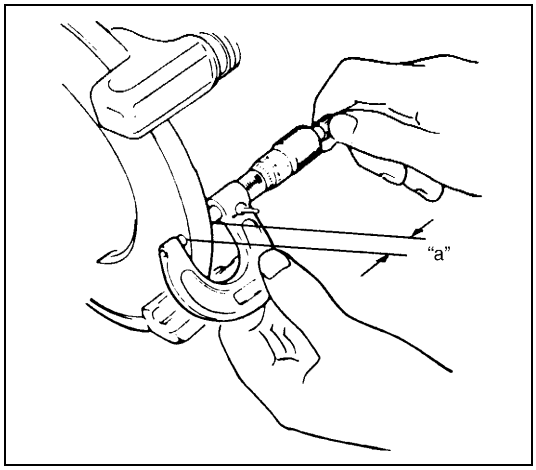
2) Remove caliper assembly by loosening carrier bolts (2 pcs).

CAUTION:
During removal, be careful not to damage brake flexible hose and not to depress brake pedal.



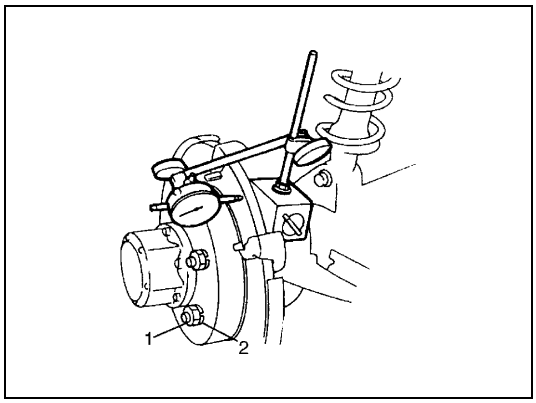
3) Pull brake disc off by using 8 mm bolts (1) (2 pcs).

INSPECTION



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.

Brake disc thickness "a"
Standard : 10 mm (0.394 in.)
Limit : 8.0 mm (0.315 in.)



Use wheel nuts (1) and suitable plain washers (2) to hold the disc securely against the hub, then mount a dial indicator as shown and measure the runout at 10 mm (0.39 in.) from the outer edge of the disc.

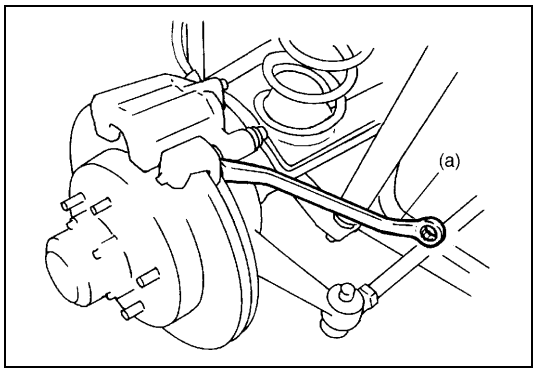
Disk deflection
Limit : 0.15 mm (0.006 in.)

NOTE:
Check front wheel bearing for looseness before measurement.

INSTALLATION

NOTE:
See NOTE at the beginning of this section.

1) Install disc to wheel hub.
2) Install caliper assembly to steering knuckle.

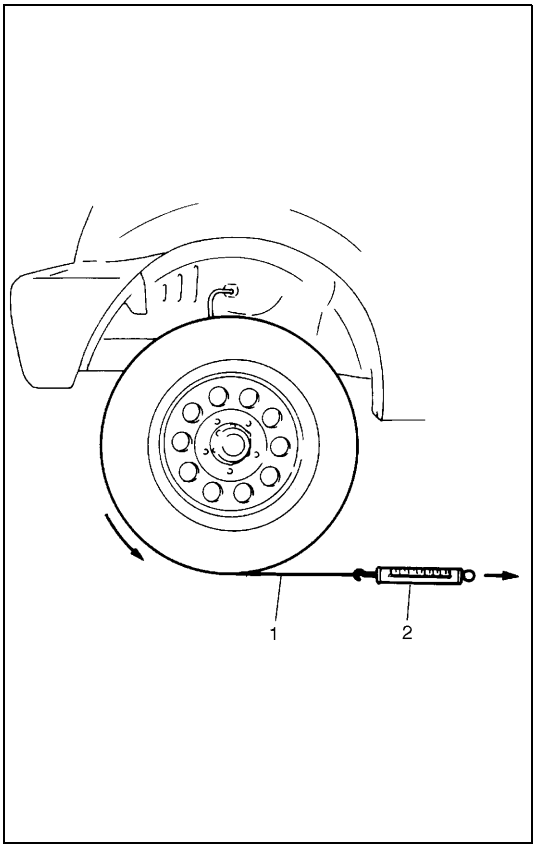


3) Torque caliper carrier bolts to specification.

Tightening torque
Brake caliper carrier bolts
(a) : 85 N·m (8.5 kg-m, 61.5 lb-ft)

4) Install wheel and torque front wheel nuts to specification.
5) Upon completion of installation, perform brake test.

CHECK FOR FRONT BRAKE AFTER INSTALLATION



Mount tires and make certain that they rotate smoothly, with a force of less than 3.0 kg (6.6 lb).

NOTE:

For above check the following must be observed.

- **Jack up front wheels, both right and left, off the ground.**
- **Shift transfer shift lever to 2H (rear wheel) position (if equipped) and start engine for a few seconds then stop.**
- **Side figure shows outer periphery of tire.**
- **Be careful not to depress brake pedal when checking tire for rotation.**

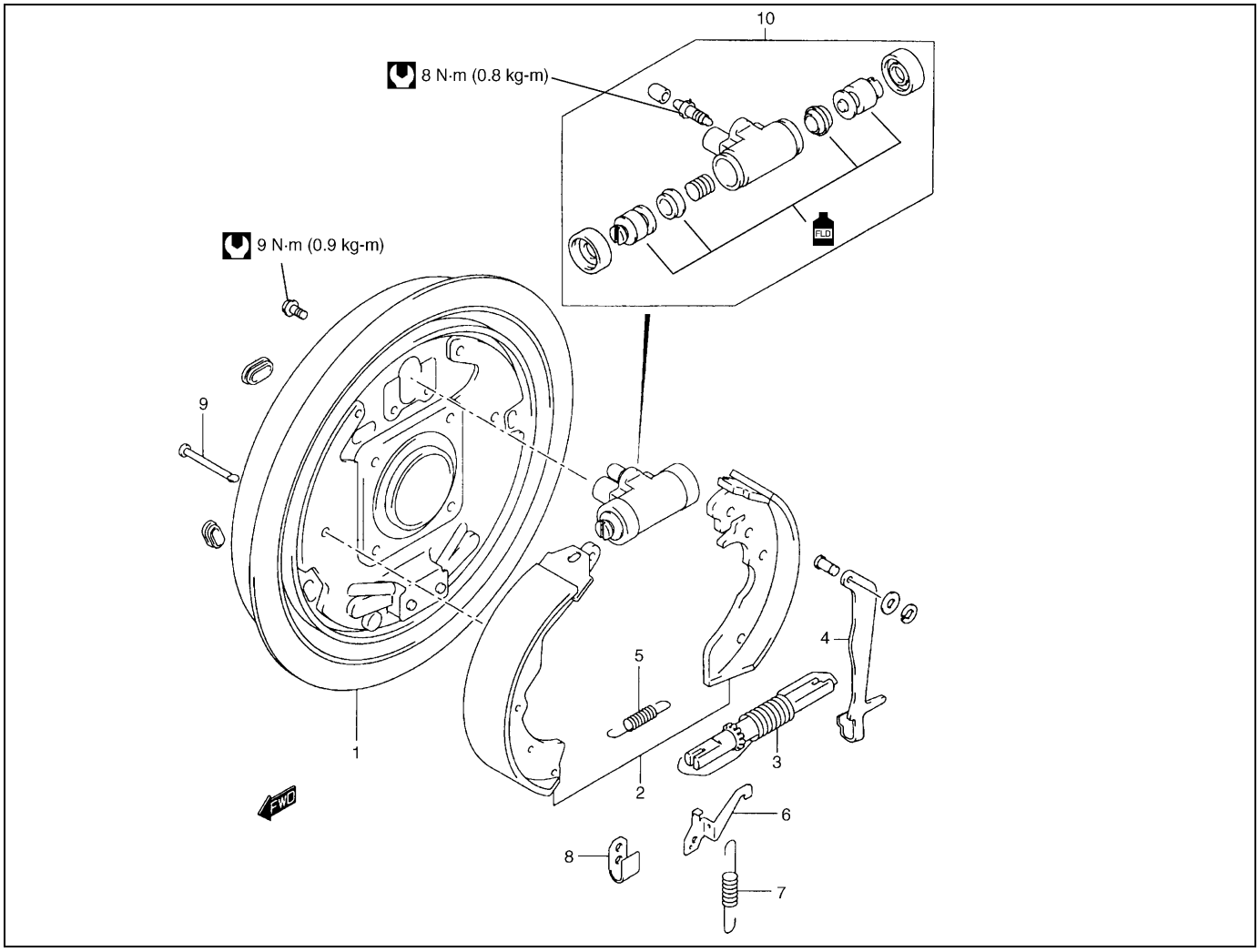
If tire rotation is heavy, check the following:

- Piston, piston seal and cylinder slide bush of caliper for installation.
- Wheel bearings for breakage.
- Disc for flatness (Improper flatness brings disc into contact with lining during rotation and makes rotation heavy).

To check this, measure disc deflection.

1.	String
2.	Spring measure

Rear Brake

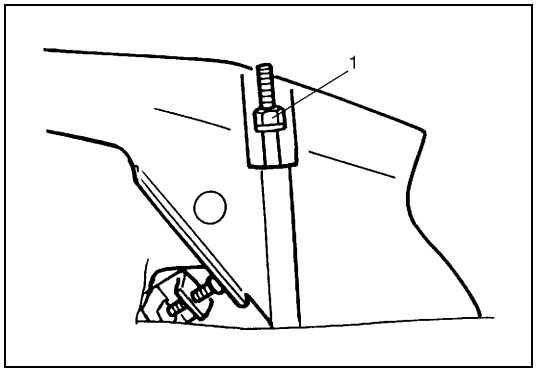


1. Brake back plate	5. Shoe return spring lower	9. Shoe hold down pin
2. Brake shoe	6. Adjuster lever	10. Wheel cylinder : Apply brake fluid to piston cap
3. Spring and rod assembly	7. Adjuster spring	Tightening torque
4. Parking brake shoe lever	8. Shoe hold down spring	

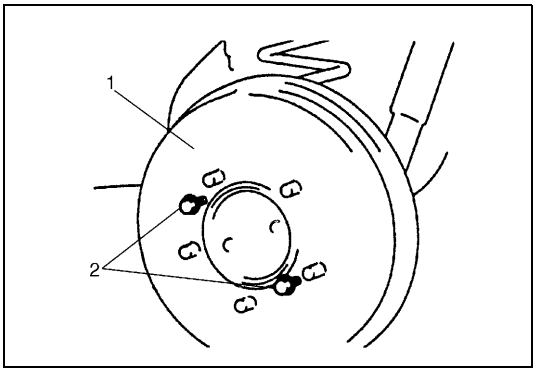
Brake drum

REMOVAL

1) Hoist vehicle and pull up parking brake lever.
2) Remove wheel.
3) Release parking brake lever.
4) Loosen parking brake cable adjusting nut (1).



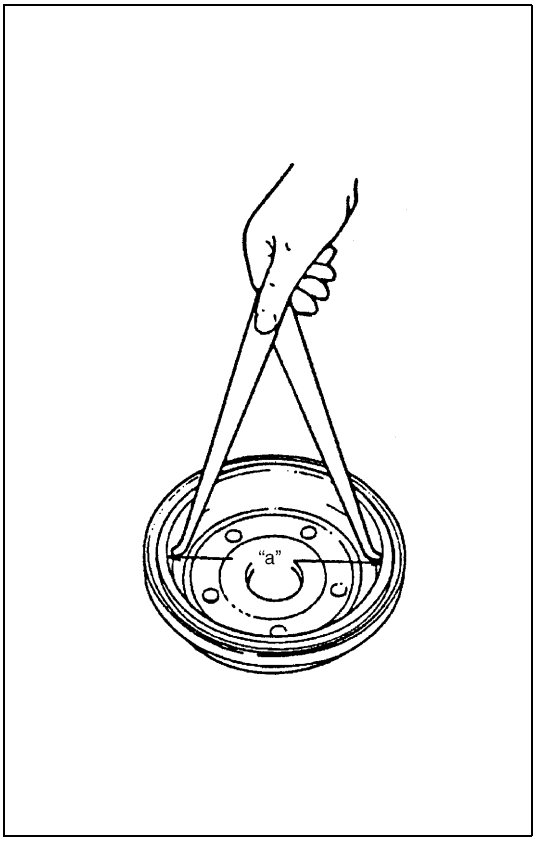
5) To increase clearance between brake shoe and brake drum, remove rubber plug from brake back plate and turn adjuster downward with flat-head screw driver.



6) Remove brake drum (1) off by using 8 mm bolts (2).

INSPECTION

Brake Drum



Inspect drum for cleanliness. Check wear of its braking surface by measuring its inside diameter.

Drum inner diameter "a"
Standard : 220 mm (8.66 in.)
Service Limit : 222 mm (8.74 in.)

Whenever brake drums are removed, they should be thoroughly cleaned and inspected for cracks, scores, deep grooves.

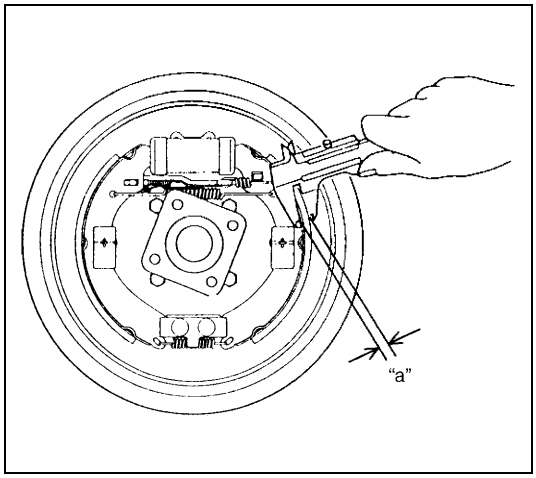
Cracked, scored, or grooved drum

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 not be turned.

NOTE:

When drum is removed, visually inspect wheel cylinder for brake fluid leakage. Correct leaky point, if any.

Brake Shoe



Where lining is worn out beyond service limit, replace shoe.
If one of brake linings is to service limit, all linings must be replaced at the same time.

Brake shoe thickness (lining + shoe rim) "a"
Standard (lining + rim) : 6.5 mm (0.26 in.)
Service limit : 3.0 mm (0.12 in.)

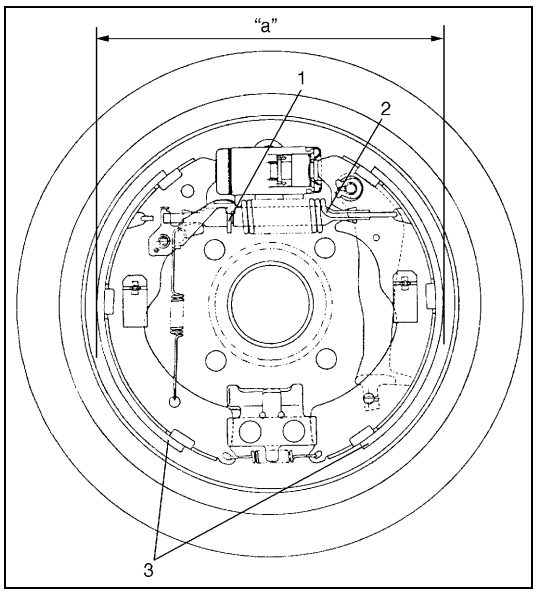
NOTE:

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.

INSTALLATION

NOTE:

See NOTE at the beginning of this section.

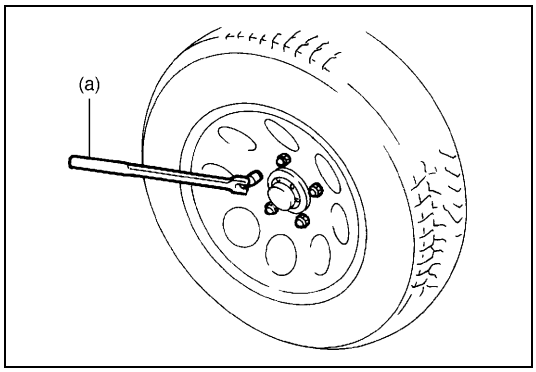


1) Before installing brake drum, check outer diameter of brake shoes. If it is not within value as specified below, adjust it to specification by turning adjuster (1).

Outer diameter of brake shoes
"a" : 219.4 - 219.7 mm (8.638 - 8.650 in.)

2. Spring and rod assembly
3. Brake shoes

2) Install brake drum after making sure that inside of brake drum and brake shoes are free from dirt and oil.
3) Upon completion of all jobs, depress brake pedal with about 30 kg (66 lbs) load about 30 times so as to obtain proper drum-to-shoe clearance.
   Adjust parking brake cable.



4) Install wheel and tighten wheel nuts to specified torque.

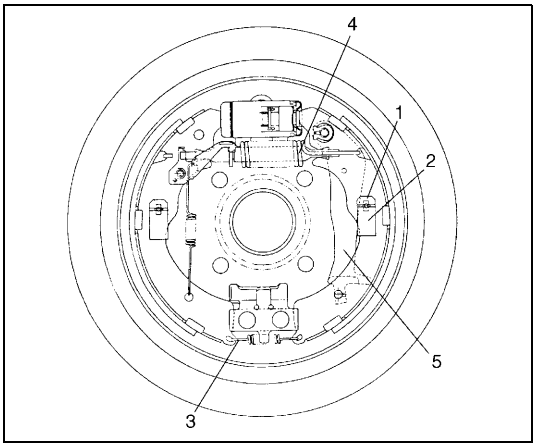
Tightening torque
Wheel nuts
(a) : 95 N·m (9.5 kg-m, 69.0 lb-ft)

5) 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 shoe

REMOVAL

1) Remove brake drum referring to “Brake Drum” in this section.

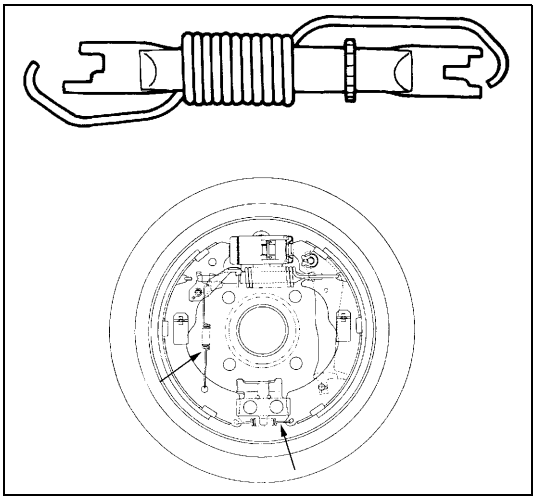


2) Remove shoe return spring lower (3), spring and rod assembly (4) and shoe hold down springs (2) by turning shoe hold down pins (1).

WARNING:
Use special care when installing brake shoe return spring. Failure in its proper installation may allow it to spring back and cause personal injury.

3) Remove parking brake shoe lever (5) from brake back plate.

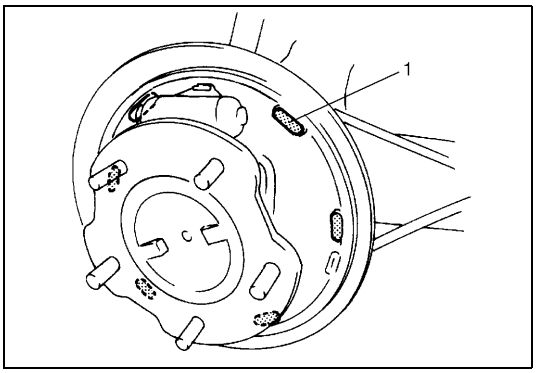
INSPECT



- Inspect lever for free movement against brake shoe web. If defective, correct or replace.
- Inspect ratchet or thread rod part for wear, sticking and corrosion.
- Inspect for damage or weakening.
- Inspect each part with arrow for rust. If found defective, replace.

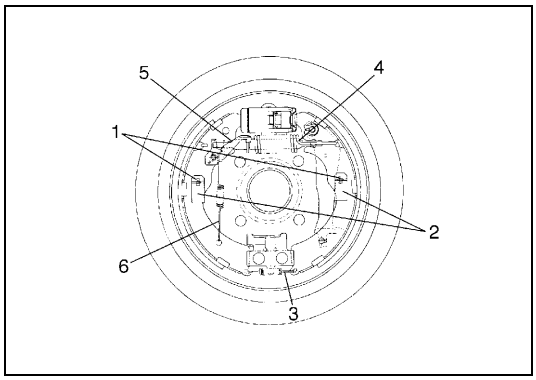
INSTALLATION

Assemble parts as shown in reverse order of removal.



1) Apply rubber grease to brake back plate and parking brake shoe lever as shown in the figure.

1. Apply rubber grease



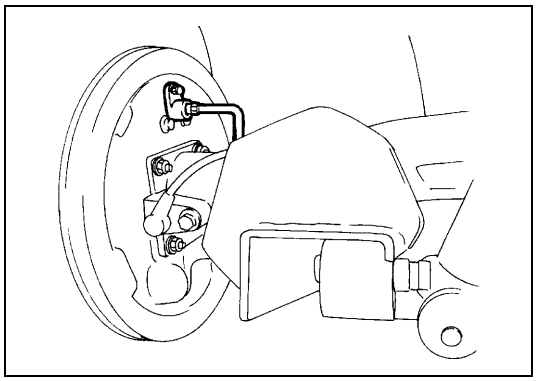
2) Install shoe hold down springs (2) by pushing them down in place and turning hold down pins (1).
3) Install shoe return spring and parking brake shoe lever spring.
4) For procedure hereafter, refer to “Brake Drum” in this section.

3.	Shoe return spring lower
4.	Spring and rod assembly
5.	Adjuster lever
6.	Adjuster spring

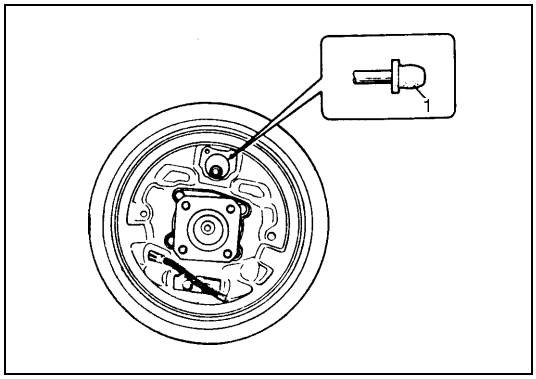
Wheel Cylinder

REMOVAL

1) Remove brake drum referring to “Brake Drum” in this section.
2) Remove brake shoe referring to “Brake Shoe” in this section.

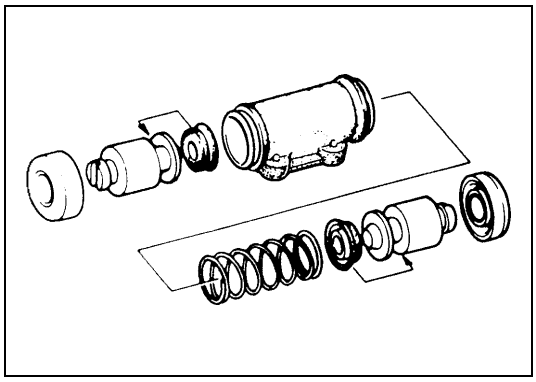


3) Loosen brake pipe flare nut (or nuts) but only within the extent that fluid does not leak.



4) Remove wheel cylinder mounting bolts. Disconnect brake pipe (or pipes) from wheel cylinder and put wheel cylinder breather plug cap (1) onto pipe to prevent fluid from spilling.

INSPECTION

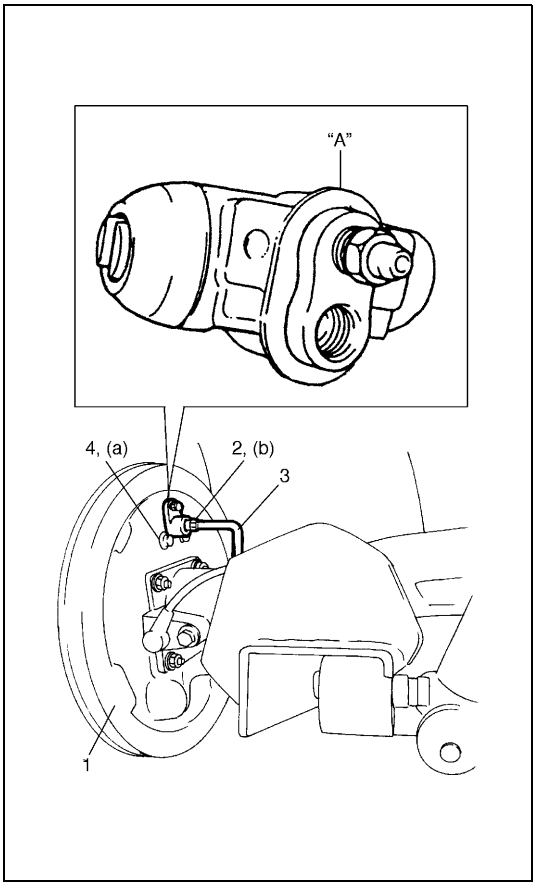


Inspect wheel cylinder disassembled parts for wear, cracks, corrosion or damage.

NOTE:

Clean wheel cylinder components with brake fluid.

INSTALLATION



1) Apply sealant to wheel cylinder. Then take off bleeder plug cap from brake pipe and connect pipe (for pipes) (3) to wheel cylinder just enough to prevent fluid from leaking.

"A" : Sealant 99000-31090

2) Tighten wheel cylinder to brake back plate (1) to specified torque.
3) Torque flare nut (or nuts) (2) of brake pipe which was connected in step 1) to specification.

Tightening torque
Wheel cylinder mounting bolts
(a) : 9 N·m (0.9 kg-m, 6.5 lb-ft)

Brake pipe flare nut
(b) : 16 N·m (1.6 kg-m, 11.5 lb-ft)

4. Wheel cylinder bolts

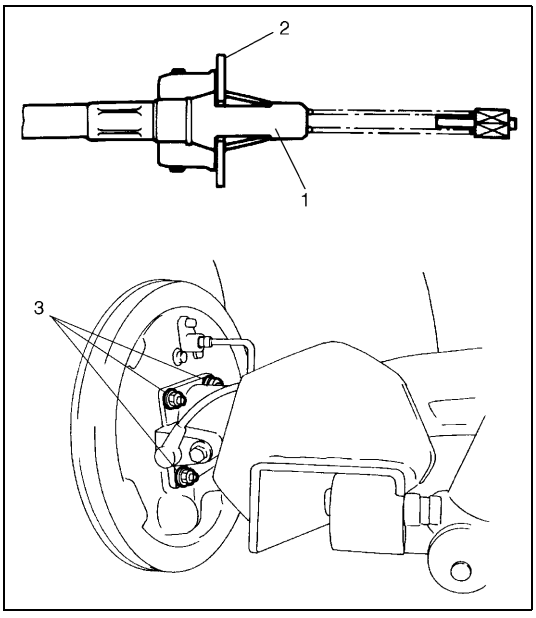
4) Install breather plug cap taken off from pipe back to breather plug.
5) For procedure hereafter, refer to "Brake Shoe" in this section.

NOTE:
Be sure to bleed brake system.

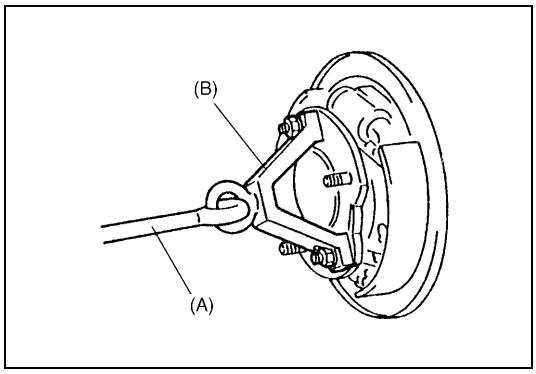
Brake back plate

REMOVAL

1) Remove brake drum referring to "Brake Drum" in this section.
2) Remove brake shoe referring to "Brake Shoe" in this section.
3) Remove wheel cylinder referring to "Wheel Cylinder" in this section.
4) Drain rear differential gear oil.

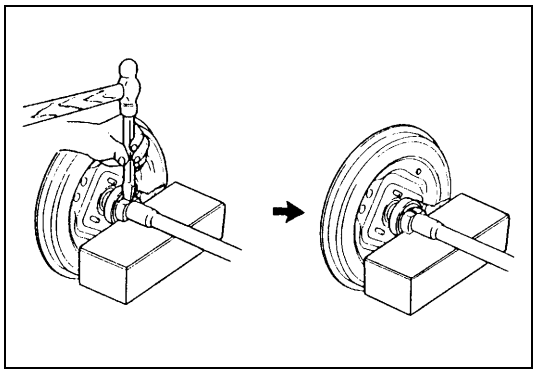


5) Remove cable from brake back plate (2) by squeezing parking brake cable stopper ring (1).
6) Remove brake back plate nuts (3) from rear axle housing.



7) Using special tools, draw out rear axle shaft with brake back plate.

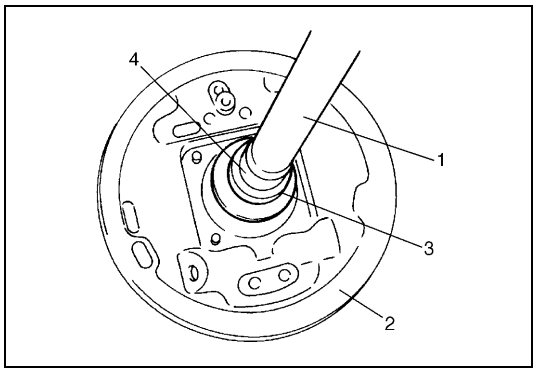
Special tool
(A) : 09943-35511
(B) : 09942-15510



8) Remove wheel bearing retainer and wheel sensor ring (if equipped with ABS), refer to “Rear Axle Shaft and Wheel Bearing” in Section 3E.
9) Remove brake back plate from axle shaft.

INSTALLATION

1) Install wheel cylinder, and tighten wheel cylinder bolts to specified torque. Refer to “Wheel Cylinder” in this section.



2) Install brake back plate (2) to axle shaft (1).
3) For installation procedure here after perform “Rear Axle Shaft and Wheel Bearing” in Section 3E.

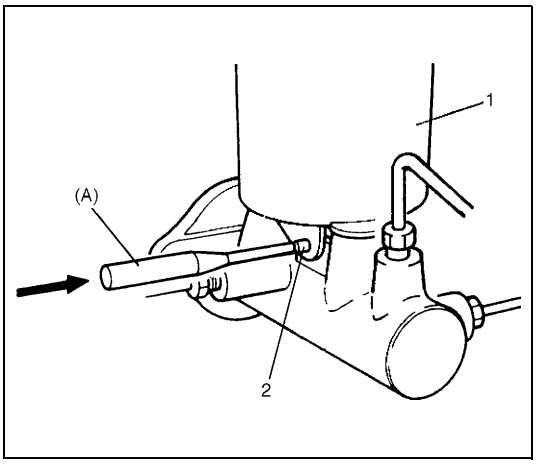
3.	Wheel bearing
4.	Retainer ring

Master Cylinder

Master Cylinder Reservoir

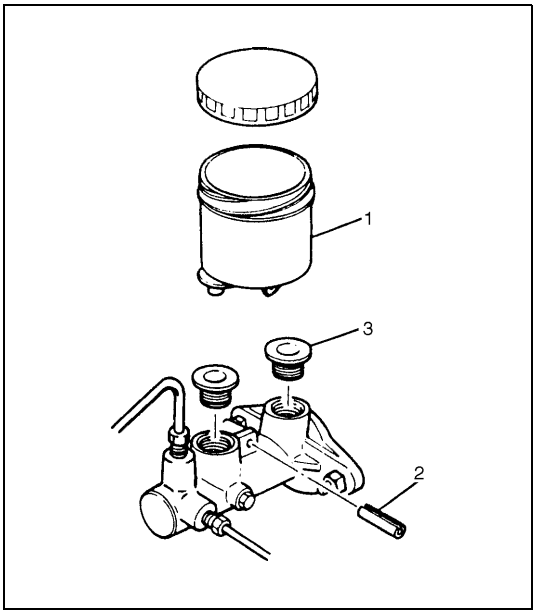
REMOVAL

1) Disconnect reservoir lead wire at coupler.



2) Clean outside of reservoir (1).
3) Take out fluid with syringe or such.
4) Remove reservoir connector pin (2) by using special tool.

Special tool
(A) : 09922-85811



Remove reservoir (1).

CAUTION:
Brake fluid is extremely damaging to paint.
Do not allow brake fluid to get on painted surfaces.

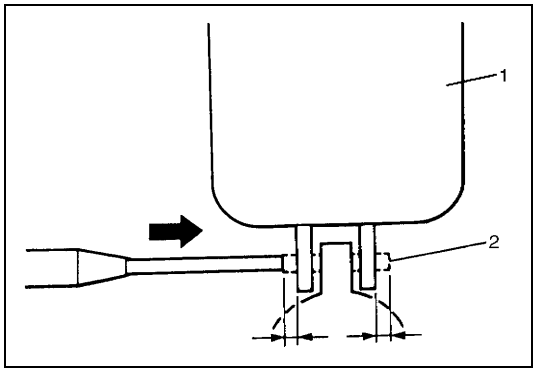
2.	Connector pin
3.	Grommets

INSTALLATION

NOTE:

See NOTE at the beginning of this section.

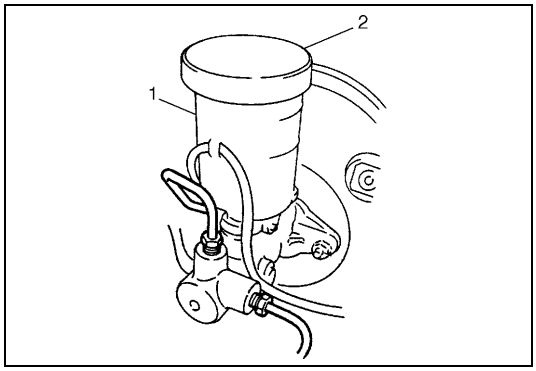
1) When using new grommets, lubricate them with the same fluid as the one to fill reservoir with. Then press-fit grommets to master cylinder. Grommets must be seated in place.



2) Install reservoir (1) and drive in reservoir pin (2).

NOTE:

Drive in reservoir pin (2) till both of its ends at the right and left of reservoir (1) become the same length.



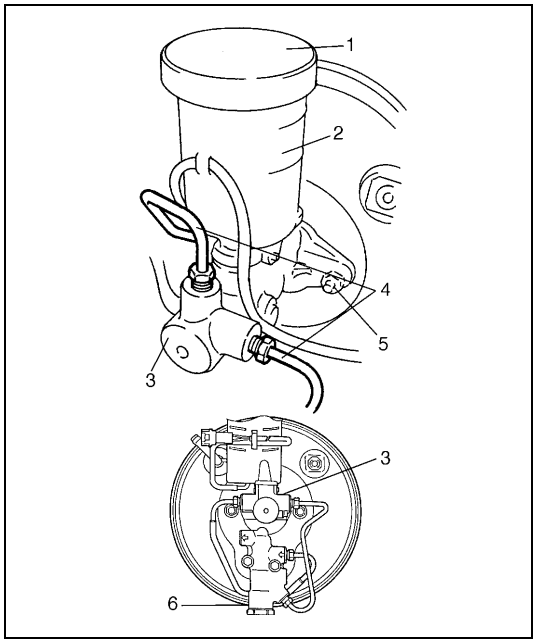
3) Connect reservoir lead wire.
4) Fill reservoir (1) with specified fluid.
5) Upon completion of installation, check for fluid leakage.

2. Cap

Master Cylinder Assembly

REMOVAL

1) Disconnect reservoir lead wire at coupler.



2) Clean around reservoir cap (1) and take out fluid with syringe or such.
3) Disconnect brake pipes (4) from master cylinder (3).

CAUTION:

Brake fluid is extremely damaging to paint.
Do not allow brake fluid to get on painted surfaces.

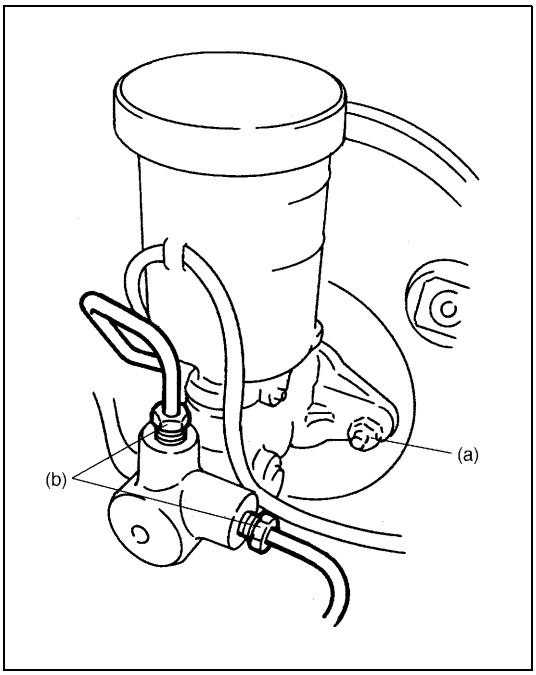
4) Remove master cylinder attaching nuts (5).
5) Remove master cylinder (3).
   For vehicle equipped with P & B valve (6), remove master cylinder (3) with P & B valve (6) and its bracket, then separate P & B valve (6) from master cylinder (3).

2. Reservoir

INSTALLATION

NOTE:

- **See NOTE at the beginning of this section.**
- **Check clearance between booster piston rod and primary.**



1) Install master cylinder as shown and torque attaching nuts to specification.

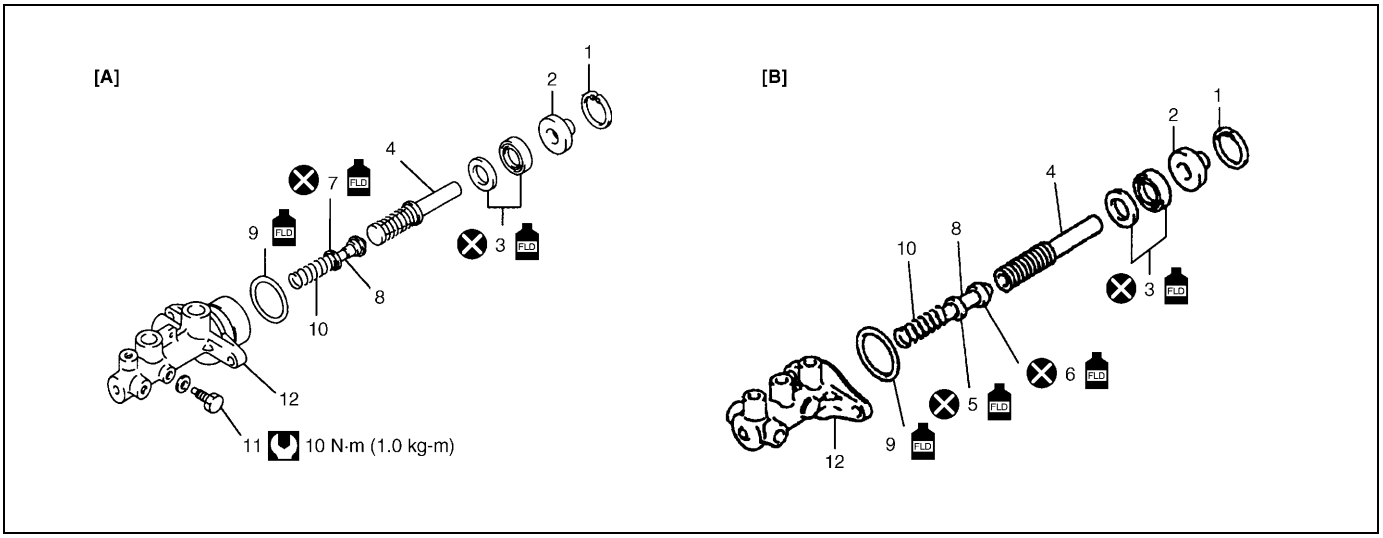
Tightening torque
Master cylinder nuts
(a) : 13 N·m (1.3 kg-m, 9.5 lb-ft)

2) Attach hydraulic lines and torque flare nuts to specification.

Tightening torque
Brake pipe flare nuts
(b) : 16 N·m (1.6 kg-m, 12.0 lb-ft)

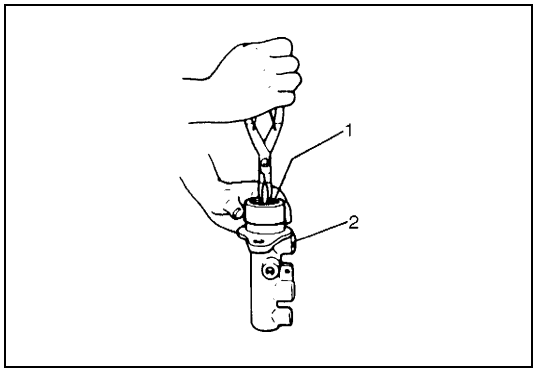
3) Connect reservoir lead wire.
4) Fill reservoir with specified brake fluid.
5) After installing, bleed air from system (refer to “Air Bleeding of Brake System” in this section) and check brake pedal height and play.
6) Perform brake test and check each installed part for fluid leakage.

Master Cylinder



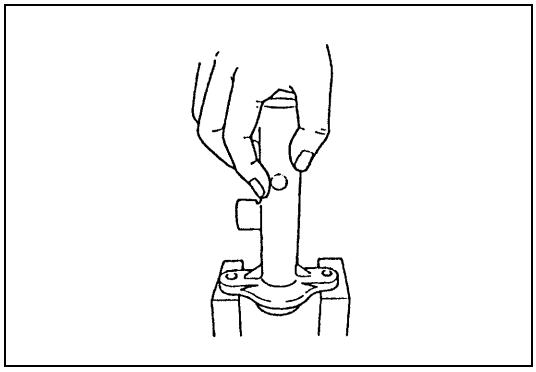
	[A] : For vehicle without ABS	FLD	7. Piston cup : Apply brake fluid confirm installing direction.
	[B] : For vehicle with ABS		8. Secondary piston
	1. Piston stopper circlip	FLD	9. Sealing : Apply brake fluid confirm installing direction.
	2. Piston stopper		10. Secondary piston return spring
FLD	3. Cylinder cup and plate : Apply brake fluid confirm installing direction.		11. Secondary piston stopper bolt
	4. Primary piston		12. Master cylinder body
FLD	5. Piston cup : Apply brake fluid confirm installing direction.		Tightening Torque
FLD	6. Secondary piston pressure cup : Apply brake fluid confirm installing direction.		Do not reuse

DISASSEMBLY

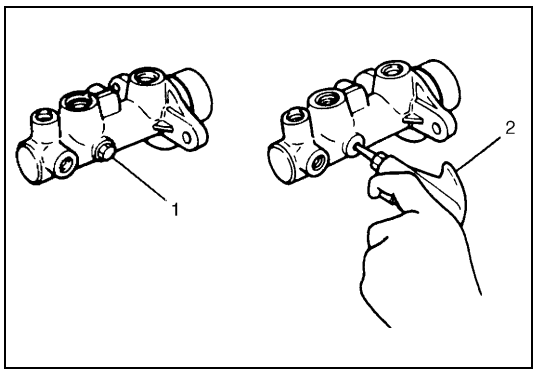


1) Remove circlip (1).
2) Remove primary piston.

2. Master cylinder

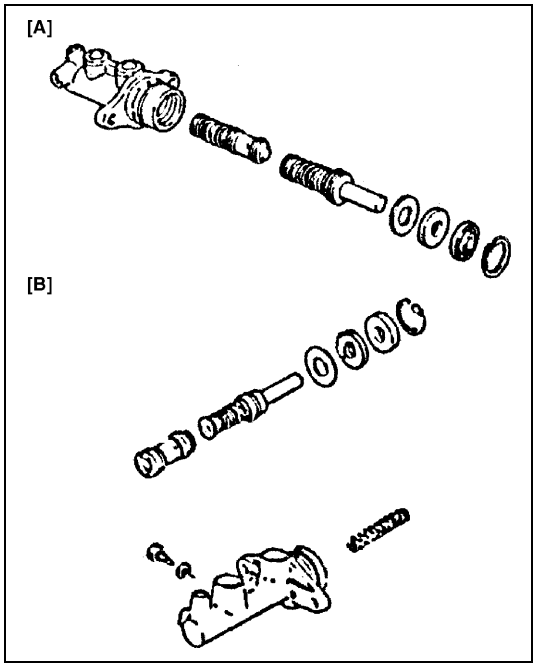


3) [For vehicle with ABS]
   Pull out primary piston assembly straight so as not to cause any damage to inside o cylinder wall.
   Pull out secondary piston assembly straight so as not to cause any damage to inside of cylinder wall and by tapping flange with a piece of wood or something soft.



4) [For vehicle without ABS]
   Remove piston stopper bolt (1). Then remove secondary piston by blowing compressed air (2) into hole from which piston stopper bolt was removed.
   Be cautions during removal as secondary piston jumps out.

INSPECTION



- Inspect all disassembled parts for wear or damage, and replace parts if necessary.

NOTE:

- **Wash disassembled parts with brake fluid.**
- **Do not reuse piston cups.**

- Inspect master cylinder bore for scoring or corrosion. It is best to replace corroded cylinder.
  Corrosion can be identified as pits or excessive roughness.

NOTE:

Polishing bore of master cylinder with cast aluminum body with anything abrasive is prohibited, as damage to cylinder bore may occur.

[A]: Vehicle equipped with ABS
[B]: Vehicle not equipped with ABS

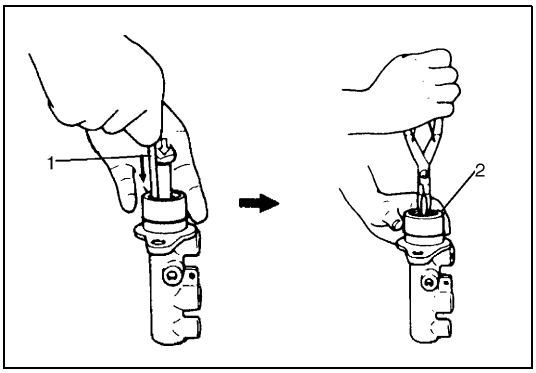
- Rinse cylinder in clean brake fluid. Shake excess rinsing fluid from cylinder. Do not use a cloth to dry cylinder, as lint from cloth cannot be kept from cylinder bore surfaces.

ASSEMBLY

NOTE:

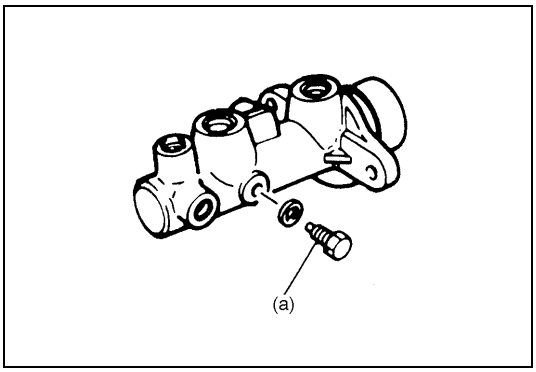
- **See NOTE at the beginning of this section.**
- **Before assembling, wash each part in fluid recommended to use for that vehicle.**

1) Install secondary piston assembly into cylinder.
2) Install primary piston in cylinder.
3) Depress, and install circlip (2).



1. Rod

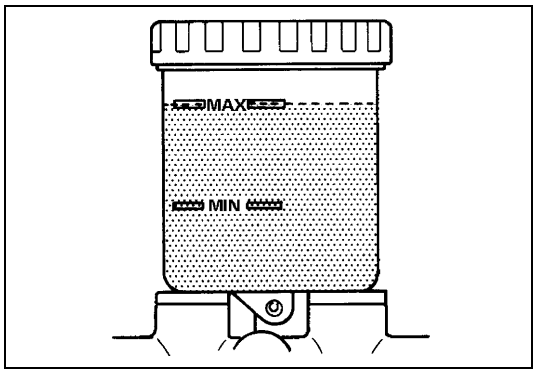
4) Install piston stopper bolt with pistons pushed in all the way and tighten it to specified torque (For vehicle without ABS).



Tightening torque
Piston stopper bolt
(a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)

Fill Reservoir

CAUTION:
Do not use shock absorber fluid or any other fluid which contains mineral oil. Do not use container which has been used for mineral oil or which is wet from water. Mineral oil will cause swelling and distortion of rubber parts in hydraulic brake system and water will mix with brake fluid, lowering fluid boiling point. Keep all fluid containers capped to prevent contamination.



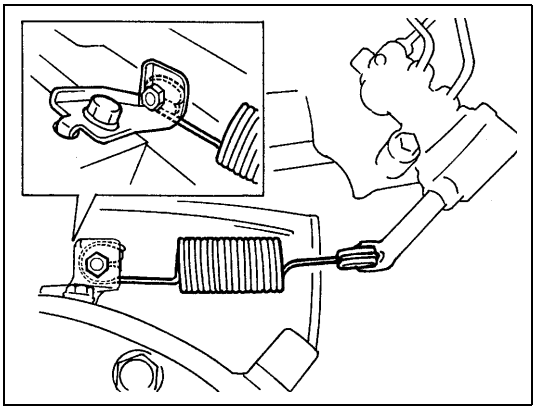
Fluid to fill reservoir with is indicated on reservoir cap of that vehicle with embossed letters or in owner's manual supplied with it. Add fluid up to MAX line.

LSPV (Load Sensing Proportioning Valve) Assembly (If Equipped)

CAUTION:
Brake fluid is extremely damaging to paint.
Do not allow brake fluid to get on painted surface.
LSPV assembly must not be disassembled.
Replace with new one if defective.

REMOVAL

1) Clean around reservoir cap and take out fluid with syringe or such.
2) Hoist vehicle.
3) Disconnect brake pipes from LSPV.
4) Remove LSPV assembly from vehicle.



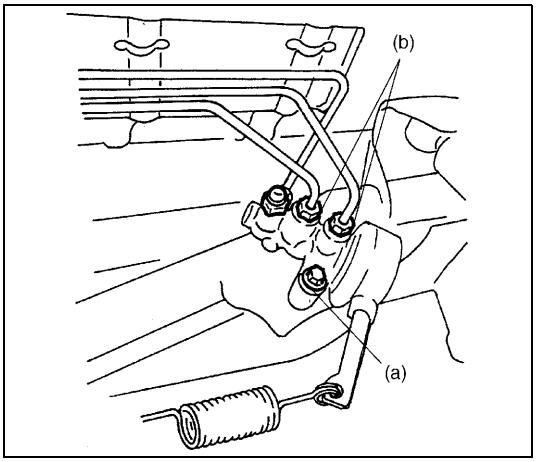
NOTE:
As shown in figure, LSPV assembly should be removed together with its spring and stay installed as they are.

5) Remove spring and stay from LSPV.

INSTALLATION

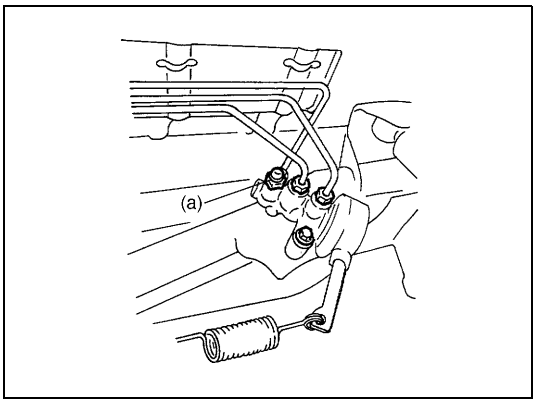
Install by reversing removal procedure, noting the following.

1) Torque each bolt and nut to specification as indicated respectively.



Tightening torque
LSPV bolts
(a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

Brake pipe flare nuts
(b) : 16 N·m (1.6 kg-m, 12.0 lb-ft)



2) Upon completion of installation, fill reservoir tank with specified fluid and bleed air from brake system.

NOTE:
Make sure to bleed air from LSPV bleeder without fail.

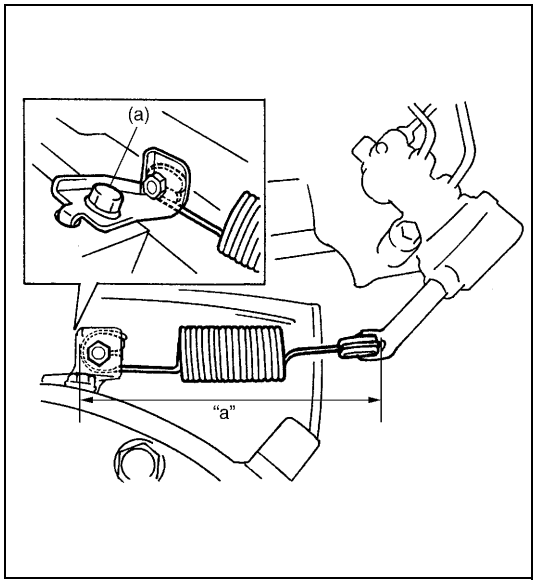
Tightening torque
LSPV bleeder plug
(a) : 8 N·m (8.0 kg-m, 6.0 lb-ft)

3) After bleeding air, check that LSPV is installed properly, referring to following INSPECTION & ADJUSTMENT.

LSPV Assembly

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.
   - Place it on level floor.
2) Push up LSPV lever with finger till it stops and measure length of coil spring ("a" in figure).



3) Spring length "a" should be as specified.

Spring length "a"
147 mm (5.79 in.)

4) If it isn't, adjust it to specification by changing stay position as shown in figure. After adjustment, tighten bolt to specified torque.

Tightening torque
LSPV adjust bolt
(a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

NOTE:

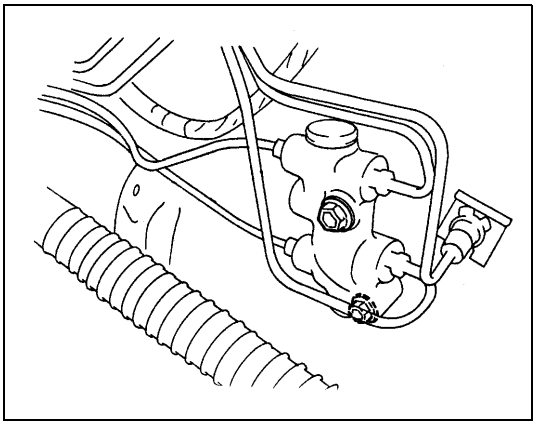
Check to make sure that LSPV body and brake pipe joints are free from fluid leakage. Replace defective parts, if any.

P (Proportioning) Valve

REMOVAL

CAUTION:
Do not allow brake fluid to get on painted surfaces.

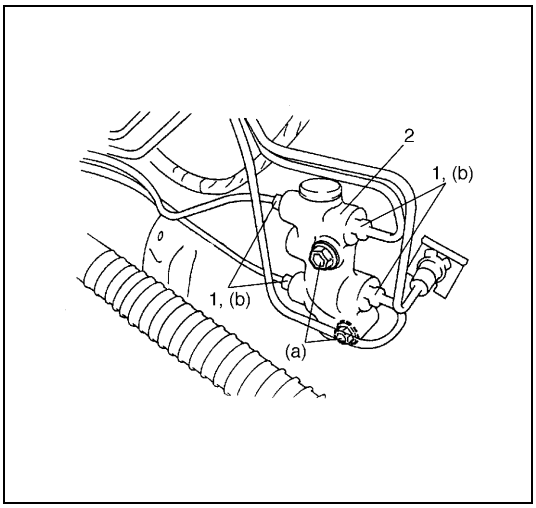
1) Clean around reservoir cap and take out fluid with syringe or such.



2) Disconnect brake pipes from P valve.
3) Remove P valve.

WARNING:
Never disassemble P valve assembly. If it is found faulty, replace it with new assembly.

INSTALLATION



1) Install P valve (2).

Tightening torque
P valve bolts
(a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

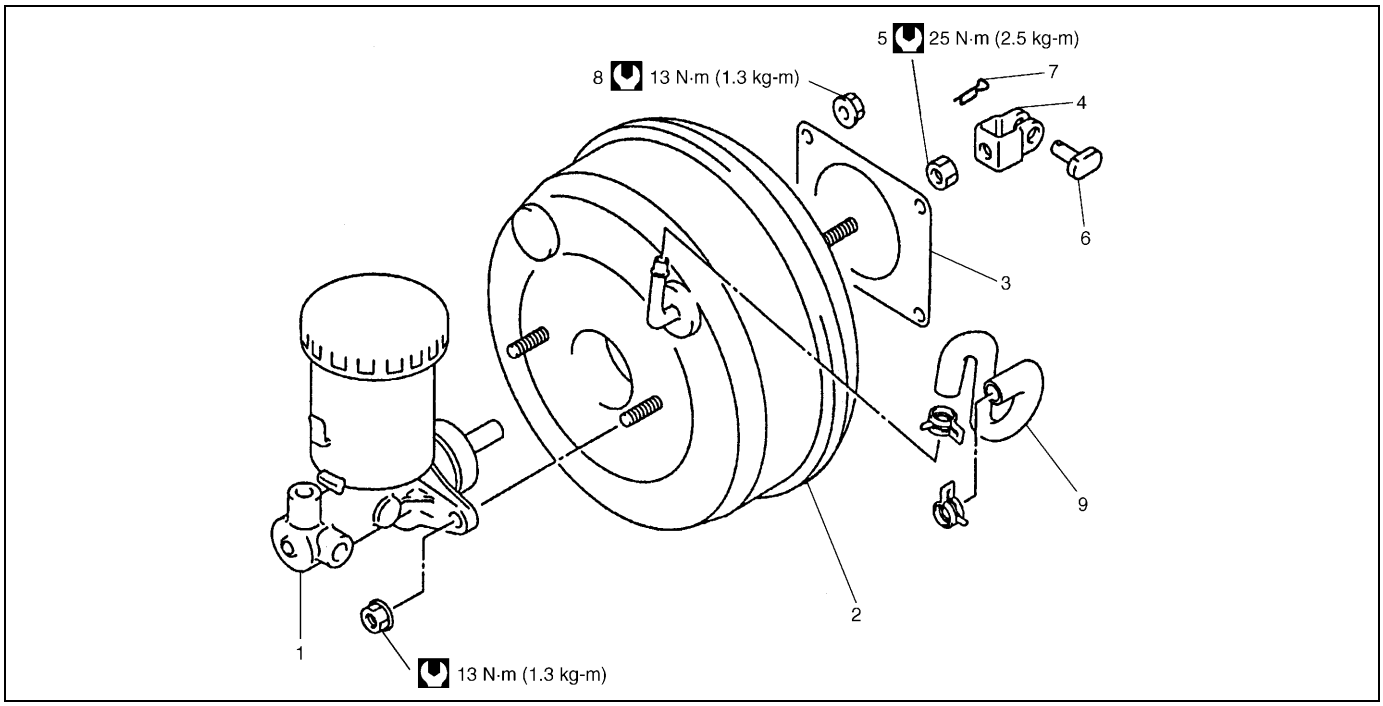
2) Tighten flare nuts to specified torque.

Tightening torque
Brake pipe flare nuts
(b) : 16 N·m (1.6 kg-m, 12.0 lb-ft)

3) Fill reservoir with specified brake fluid.
4) Bleed air from system.

1. Flare nuts

Brake Booster



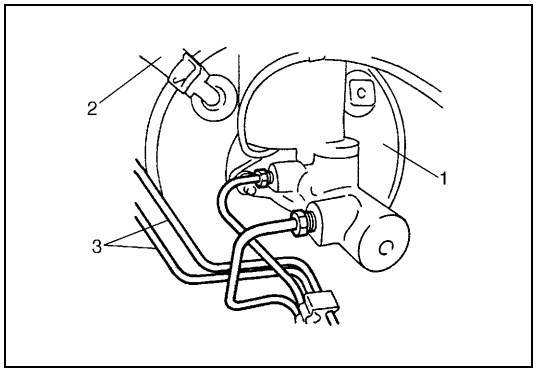
1. Brake master cylinder assembly	5. Nut	9. Brake vacuum hose
2. Brake booster assembly	6. Clevis pin	Tightening torque
3. Gasket	7. Clip	
4. Push rod clevis	8. Nut	

CAUTION:

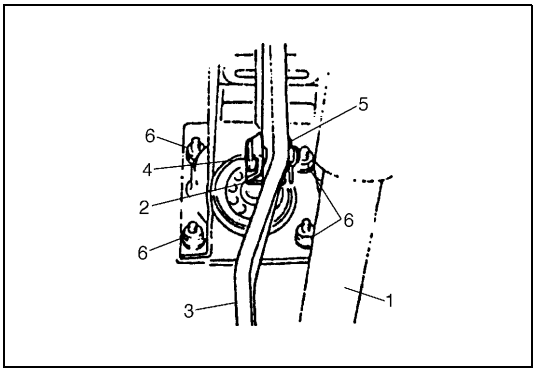
Never disassemble brake booster. Disassembly will spoil its original function. If faulty condition is found, replace it with new one.

REMOVAL

1) Remove master cylinder assembly, referring to “Maser Cylinder” in the section.



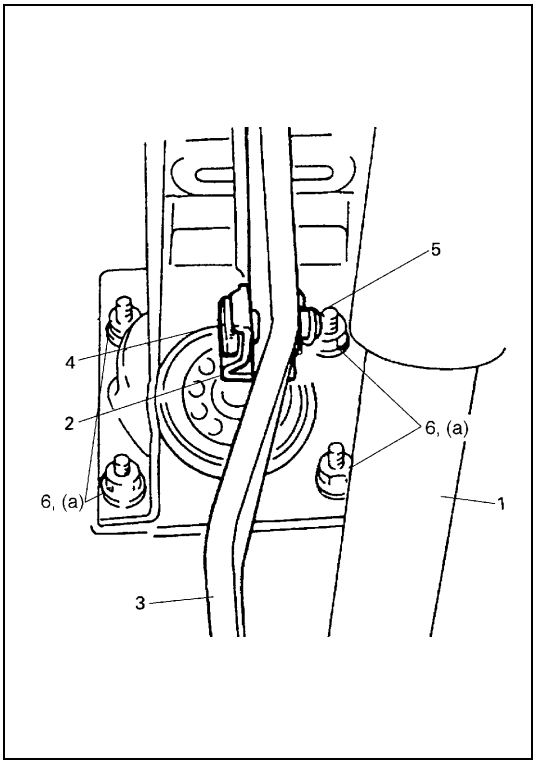
2) Disconnect brake vacuum hose (2) from booster (1).
3) Remove brake pipes (3).



4) Disconnect push rod clevis pin (4) from brake pedal arm (3).
5) Remove attaching nuts (6) and then booster as shown.

1.	Steering column
2.	Push rod clevis
5.	Clip

INSTALLATION



NOTE:

- **See NOTE at the beginning of this section.**
- **Check length of push rod clevis and adjust clearance between booster piston rod and master cylinder piston. Refer to "Brake Booster Inspection and Adjustment" in this section**
- **Apply silicone grease to master cylinder piston.**

1) Install booster to dash panel as shown, Then connect booster push rod clevis (2) to pedal arm (3) with clevis pin (4) and clip (5).
2) Tighter booster attaching nuts to the specified torque.

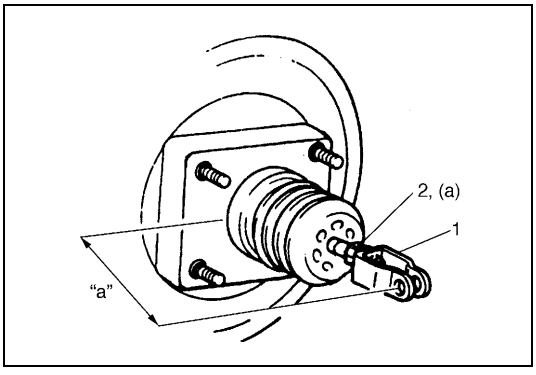
Tightening torque
Booster nuts
(a) : 13 N·m (1.3 kg-m, 9.5 lb-ft)

3) Connect brake vacuum hose to brake booster.
4) Install master cylinder, referring to "Master Cylinder" in this section.

1.	Steering column

Inspection and adjustment

INSTALLATION POSITION OF PUSH ROD

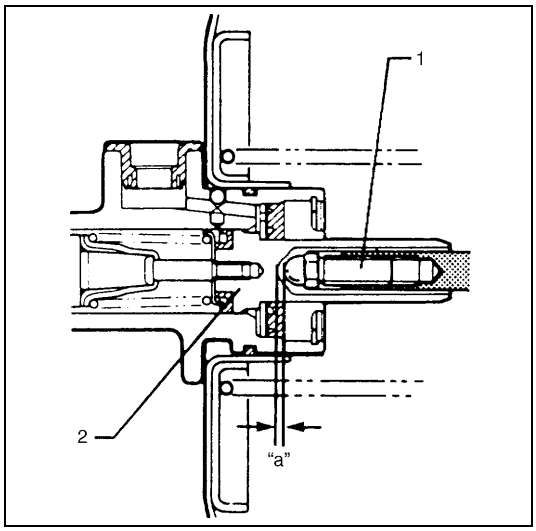


Install push rod clevis (1) so that measurement "a" is obtained and torque nut (2) to specification.

Tightening torque
Booster clevis nut
(a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

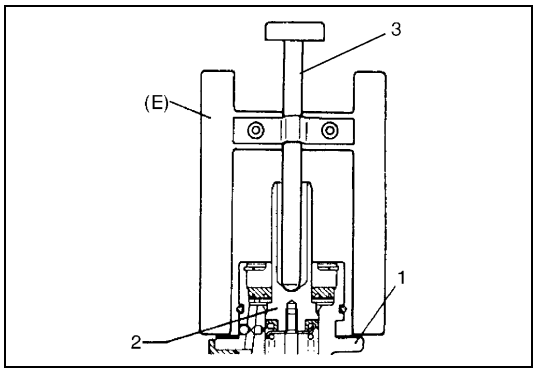
Distance "a" between center of booster clevis pin hole and booster surface
Standard : 126.1 – 127.1 mm (4.96 - 5.00 in.)

CLEARANCE BETWEEN BOOSTER PISTON ROD AND MASTER CYLINDER PISTON



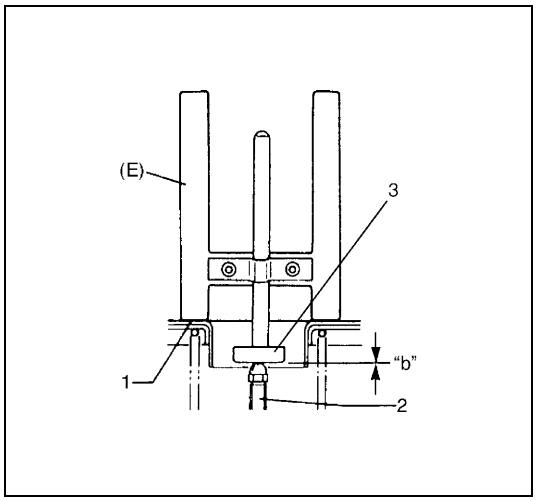
The length of booster piston rod (1) is adjusted to provide specified clearance "a" between piston rod end and master cylinder piston (2).

- 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.
- Remove piston (push) rod seal from booster, if equipped.



1) Set special tool (E) on master cylinder (1) and push pin (3) until contacts piston (2).

Special tool
(E): 09950-96010

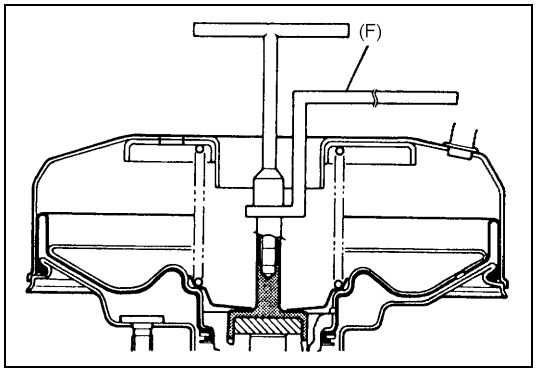


2) Turn special tool upside down and place it on booster (1). Adjust booster piston rod (2) length until rod end contacts pin head (3).

Special tool
(E): 09950-96010
Clearance "b" (between special tool and piston rod)
0 mm (0 in.)

NOTE:

Take measurement with booster set vertically or piston rod supported with screw driver or such so as to set rod at the center.



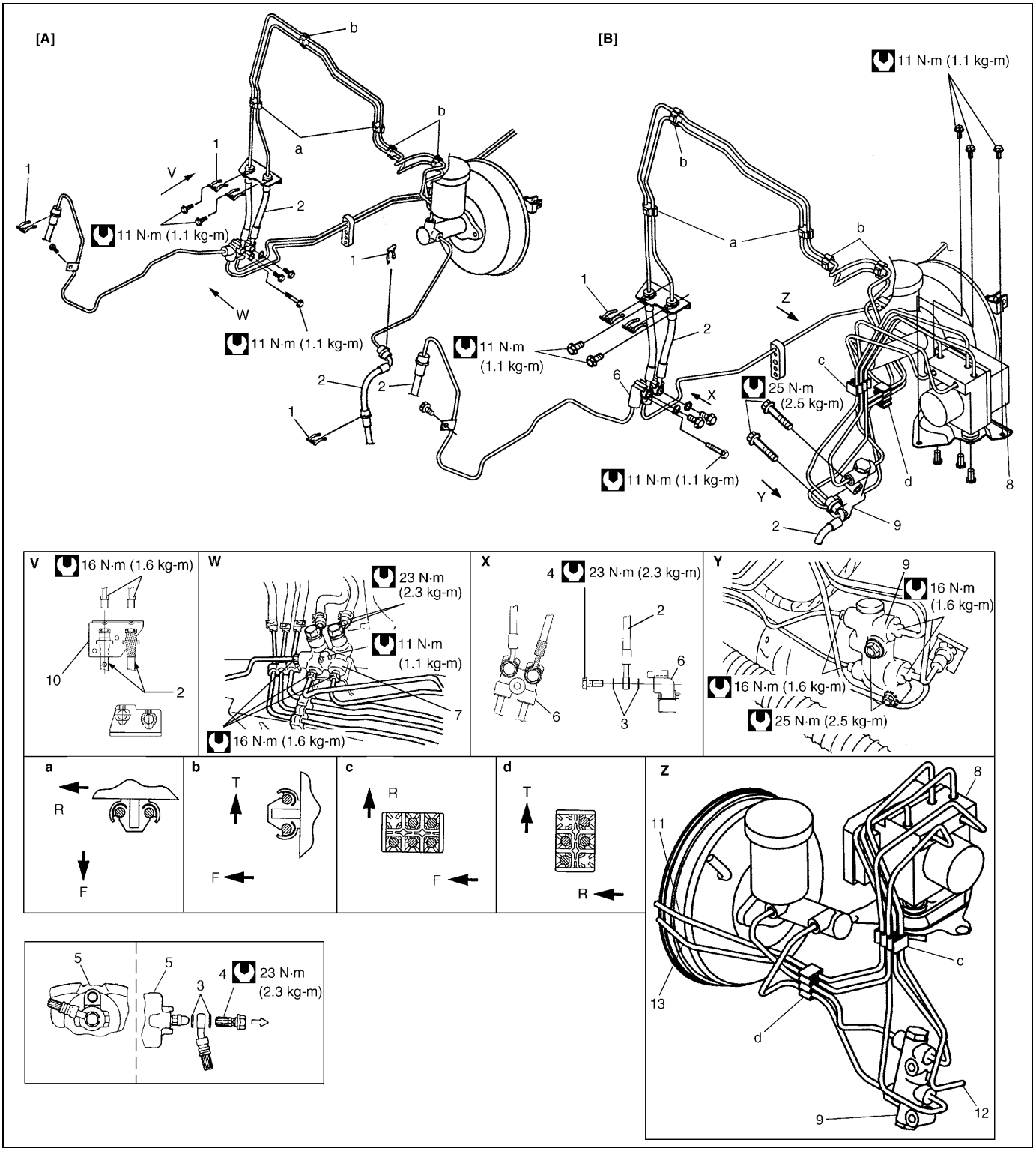
3) Adjust clearance by turning adjusting screw of piston rod.

Special tool
(F) : 09952-16010

Brake Hose/Pipe

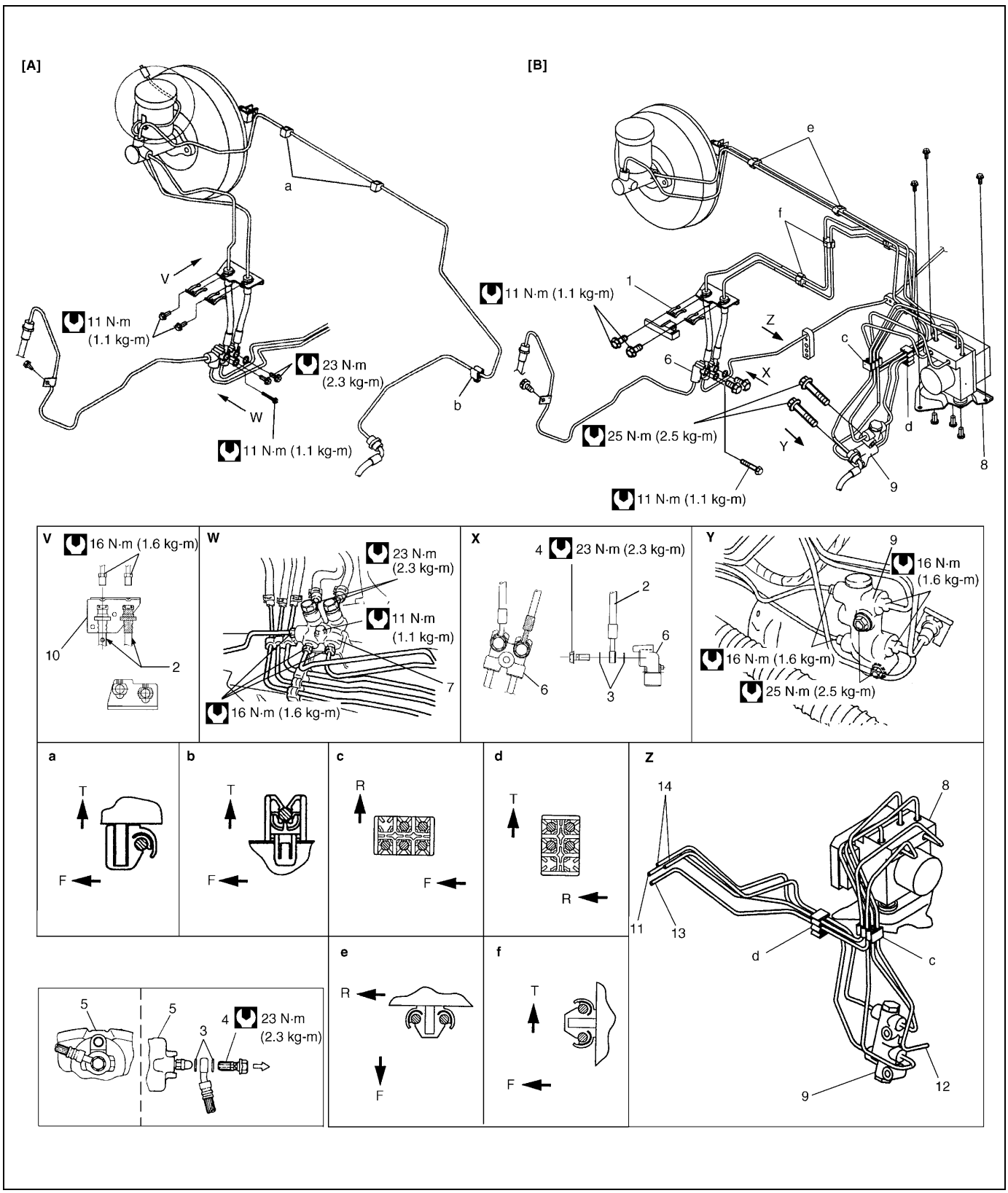
Front brake hose/pipe

For left-hand steering vehicle



[A] : For vehicle without ABS	X : View X	5. Brake caliper	12. To front left brake caliper
[B] : For vehicle with ABS	Y : View Y	6. 4 way joint	13. To rear brake
F : Front side	Z : View Z	7. 5 way joint	a-d: Clamp
R : Right side	1. E-ring	8. ABS hydraulic unit/control module assembly	Tightening torque
T : Top side	2. Flexible hose	9. P valve	
V : View V	3. Hose washer	10. Hose bracket	
W : View W	4. Hose bolt	11. To front right brake caliper	

For right-hand steering vehicle



[A] : For vehicle without ABS	X : View X	5. Brake caliper	12. To front left brake caliper
[B] : For vehicle with ABS	Y : View Y	6. 4 way joint	13. To rear brake
F : Front side	Z : View Z	7. 5 way joint	14. Front brake master cylinder
R : Right side	1. E-ring	8. ABS hydraulic unit	a-f: Clamp
T : Top side	2. Flexible hose	9. P valve	Tightening torque
V : View V	3. Hose washer	10. Hose bracket	
W : View W	4. Hose bolt	11. To front right brake caliper	

REMOVAL

1) Raise, suitably support vehicle. Remove wheel if necessary.
2) Clean dirt and foreign material from both hose end or pipe end fittings. Remove brake hose and pipe.

INSTALLATION

1) Install brake hose and pipe by reversing removal procedure, noting the following points.
   For installation, make sure that steering wheel is in straightforward position and hose has no twist or kink. Check to make sure that 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.
2) Perform brake test and check installed part for fluid leakage.

Rear Brake Hose/Pipe

REMOVAL

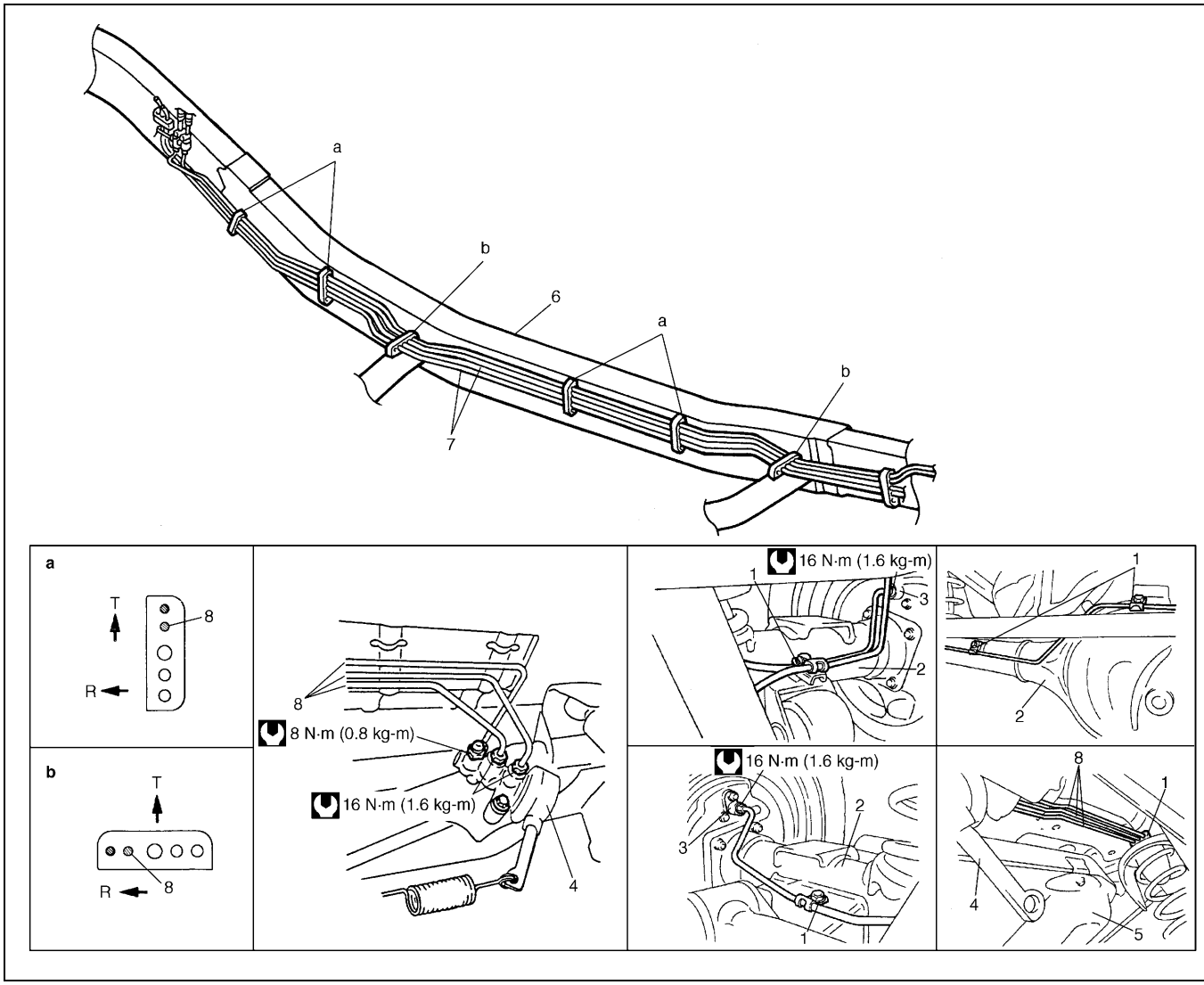
1) Raise, suitably support vehicle. Remove wheel if necessary.
2) Clean dirt and foreign material from both hose end or pipe end fittings. Remove brake hose and pipe.

INSTALLATION

1) Install brake hose and pipe by reversing removal procedure, noting the following points.
   Fill and maintain brake fluid level in reservoir. Bleed brake system.
2) Perform brake test and check each installed part for fluid leakage.

CAUTION:

- **Position clamps to white marks on two brake pipes.**
- **Be sure to obtain more than 3 mm (0.118 in.) clearance between axle housing and brake pipe.**
- **Install clamps properly referring to figure below and tighten bolts.**
- **When installing hose, make sure that it has no twist or kink.**



T : Top side	2. Rear axle housing	5. Fuel tank	8. Brake pipe (vehicle with LSPV)
R : Right side	3. Rear wheel cylinder	6. Chassis frame	a-b: Clamp
1. Clamp	4. LSPV (if equipped)	7. Fuel pipe	Tightening torque

Parking Brake Lever/Cable

Parking brake lever

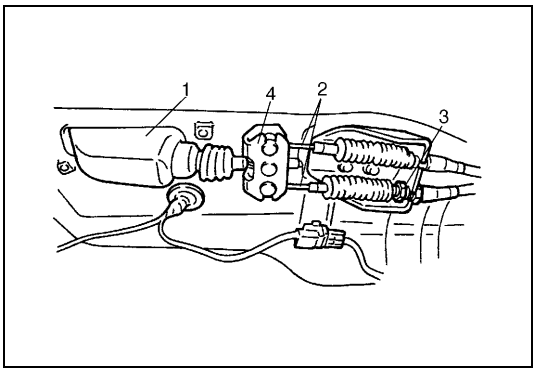
REMOVAL

1) Hoist vehicle and release parking brake lever.
2) Disconnect negative cable at battery.
3) Remove parking brake lever cover.
4) Disconnect lead wire of parking brake switch at coupler.

NOTE:

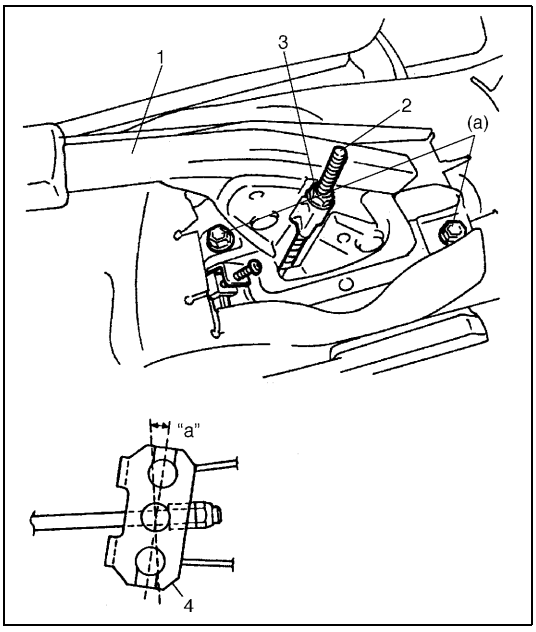
Don't disassemble parking brake lever switch. It must be removed and installed as a complete switch assembly.

5) Remove adjusting nut.



6) Loosen bracket nut (3) and disconnect parking brake cables (2) from equalizer (4).
7) Remove parking brake lever bolts and then remove parking brake lever assembly (1).

INSTALLATION



1) Install in reverse order of REMOVAL procedure.

Equalizer angle "a" : within 15 degrees

Tightening torque
Parking brake lever bolts
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

2) After all parts are installed, parking brake lever needs to be adjusted. Refer to "Parking Brake Inspection and Adjustment" in this section.
3) Check brake drum for dragging and brake system for proper performance.

1. Parking brake lever
2. Parking brake cable
3. Adjusting nut
4. Equalizer

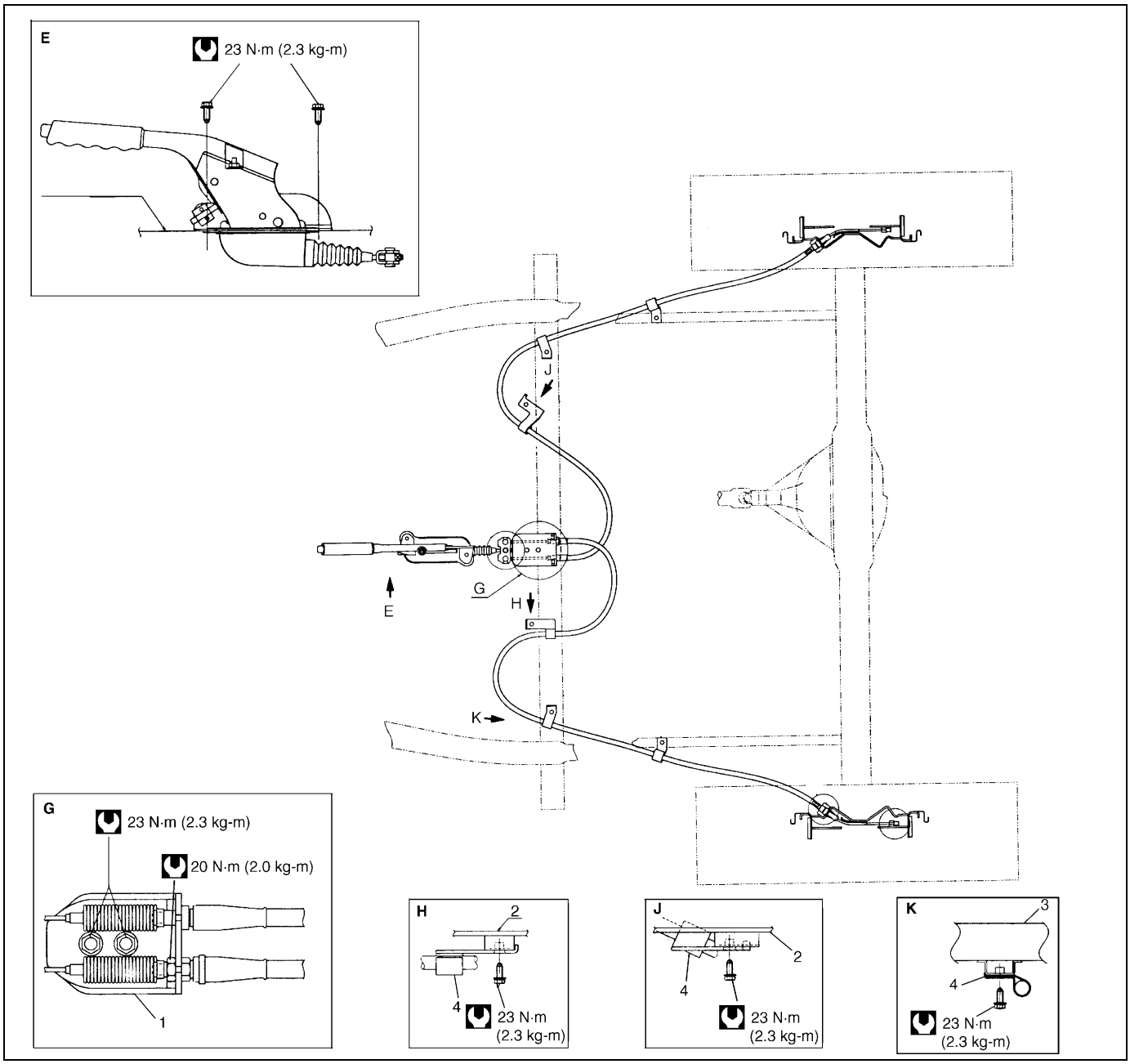
Parking Brake Cable

REMOVAL

1) Raise, suitably support vehicle and remove wheel if necessary.
2) Remove parking brake cable.

INSTALLATION

1) Install it by reversing removal procedure, noting the following points.
   - Install clamps properly referring to figure below.
   - Tighten bolts and nuts to specified torque.
2) Upon completion of installation, adjust cable. (Refer to “Parking Brake Inspection and Adjustment” in this section.) Then check brake drum for dragging and brake system for proper performance. After removing vehicle from hoist, brake test should be performed.



E : View E	J : View J	2. Floor	Tightening torque
G : View G	K : View K	3. Cross member	
H : View H	1. Bracket	4. Clamp	

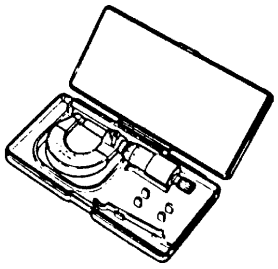
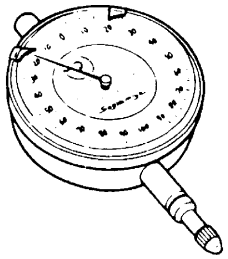
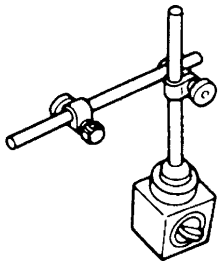
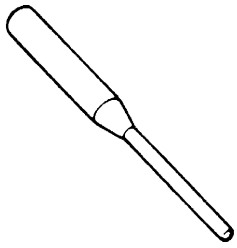
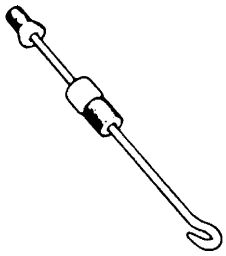
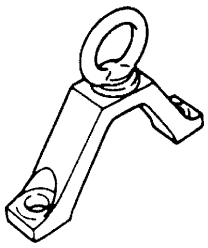
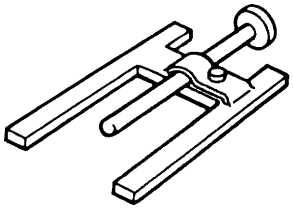
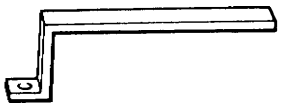
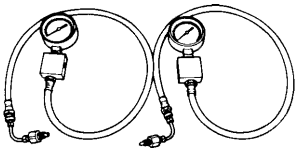
Tightening Torque Specifications

Fastening part		Tightening torque		
		N•m	kg-m	lb-ft
Brake caliper carrier bolt		85	8.5	61.5
Brake caliper pin bolt		22	2.2	16.0
Front brake flexible hose bolt		23	2.3	17.0
Rear brake back plate nut		23	2.3	17.0
Master cylinder nut		13	1.3	9.5
Booster nut		13	1.3	9.5
Brake pipe 5-way 4-way joint bolt		11	1.1	8.0
Brake pipe flare nut		16	1.6	12.0
LSPV bolt/P valve bolt		25	2.5	18.0
Brake bleeder plug	Front caliper	11	1.1	8.0
	Rear wheel cylinder, LSPV	8	0.8	6.0
Wheel nut		95	9.5	69.0
Hose bracket bolt		11	1.1	8.0
Booster clevis nut		25	2.5	18.0
Stop light switch lock nut		6.5	0.65	4.7
Parking brake lever bolt		23	2.3	17.0
Wheel cylinder mounting bolt		9	0.9	6.5
Piston stopper bolt		10	1.0	7.5
LSPV adjust bolt		25	2.5	18.0

Required Service Material

Material	Recommended SUZUKI products	Use
Brake fluid	Indicated on reservoir tank cap or described in owner's manual of vehicle	• To fill master cylinder reservoir. • To clean and apply to inner parts of master cylinder 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.
Sealant	SUZUKI BOND NO. 1215 99000-31110	• To apply to mating surfaces of brake back plate and rear axle housing. • To apply to mating surfaces of brake back plate and rear wheel bearing retainer.

Special Tool

 09900-20205 Micrometer (0 – 25 mm)	 09900-20602 Dial gauge (1/1000 mm)	 09900-20701 Magnetic stand	 09956-02210 Brake circuit plug
 09922-85811 Connector pin remover	 09942-15510 Sliding hammer	 09943-35511 Brake drum remover (Front wheel hub remover)	 09950-78220 Flare nut wrench (10 mm)
 09950-96010 Booster piston rod gauge	 09952-16010 Booster piston rod adjuster	 09956-02310 Fluid pressure gauge	

SECTION 5E

ANTILOCK BRAKE SYSTEM (ABS)

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 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 5E-2
- System Schematic 5E-3
- ABS Component Parts Location 5E-4
- ABS Control Module 5E-5
  - Self-diagnosis function 5E-5
  - Fail-safe function 5E-5

Diagnosis 5E-6
- Precaution in Diagnosing Troubles 5E-6
- ABS Diagnostic Flow Table 5E-6
- "ABS" Warning Lamp Check 5E-9
- Diagnostic Trouble Code (DTC) Check 5E-9
- DTC Check (Using SUZUKI Scan Tool) 5E-10
- Diagnostic Trouble Code (DTC) Clearance 5E-10
- Diagnostic Trouble Code (DTC) Table 5E-11
- System Circuit 5E-12
- Table – A "ABS" Warning Lamp Circuit Check – Lamp Does Not Come "ON" at Ignition Switch ON 5E-14
- Table – B "ABS" Warning Lamp Circuit Check – Lamp Comes "ON" Steady 5E-15
- Table – C "ABS" Warning Lamp Circuit Check – Lamp Flashes Continuously While Ignition Switch is ON 5E-16
- Table – D Code (DTC) is Not Outputted Even With Diag. Switch Terminal Connected to Ground. 5E-17
- DTC C1015 (DTC 15) – G Sensor Circuit 5E-18
- DTC C1016 (DTC 16) – Stop Lamp Circuit 5E-20
- DTC C1021 (DTC 21), DTC C1022 (DTC 22) – Right Front Wheel Speed Sensor Circuit 5E-21
- DTC C1025 (DTC 25), DTC C1026 (DTC 26) – Left Front Wheel Speed Sensor Circuit 5E-21
- DTC C1031 (DTC 31), DTC C1032 (DTC 32) – Right Rear Wheel Speed Sensor Circuit 5E-21
- DTC C1035 (DTC 35), DTC C1036 (DTC 36) – Left Rear Wheel Speed Sensor Circuit 5E-21
- DTC C1041 (DTC 41), DTC C1042 (DTC 42) – Right Front Solenoid Circuit 5E-24
- DTC C1045 (DTC 45), DTC C1046 (DTC 46) – Left Front Solenoid Circuit 5E-24
- DTC C1055 (DTC 55), DTC C1056 (DTC 56) – Rear Solenoid Circuit 5E-24
- DTC C1057 (DTC 57) – Power Source Circuit 5E-25
- DTC C1061 (DTC 61) – ABS Pump Motor Circuit 5E-26
- DTC C1063 (DTC 63) – ABS Fail Safe Circuit 5E-27
- DTC C1071 (DTC 71) – ABS Control Module 5E-28

On-Vehicle Service 5E-29
- Precaution 5E-29
- ABS Hydraulic Unit Operation Check 5E-29
- ABS Hydraulic Unit / Control Module Assembly 5E-30
- Front Wheel Speed Sensor 5E-32
- Front Wheel Sensor Ring 5E-35
- Rear Wheel Speed Sensor 5E-36
- Rear Wheel Sensor Ring 5E-38
- G Sensor 5E-39

Tightening Torque Specification 5E-40

Special Tool 5E-40

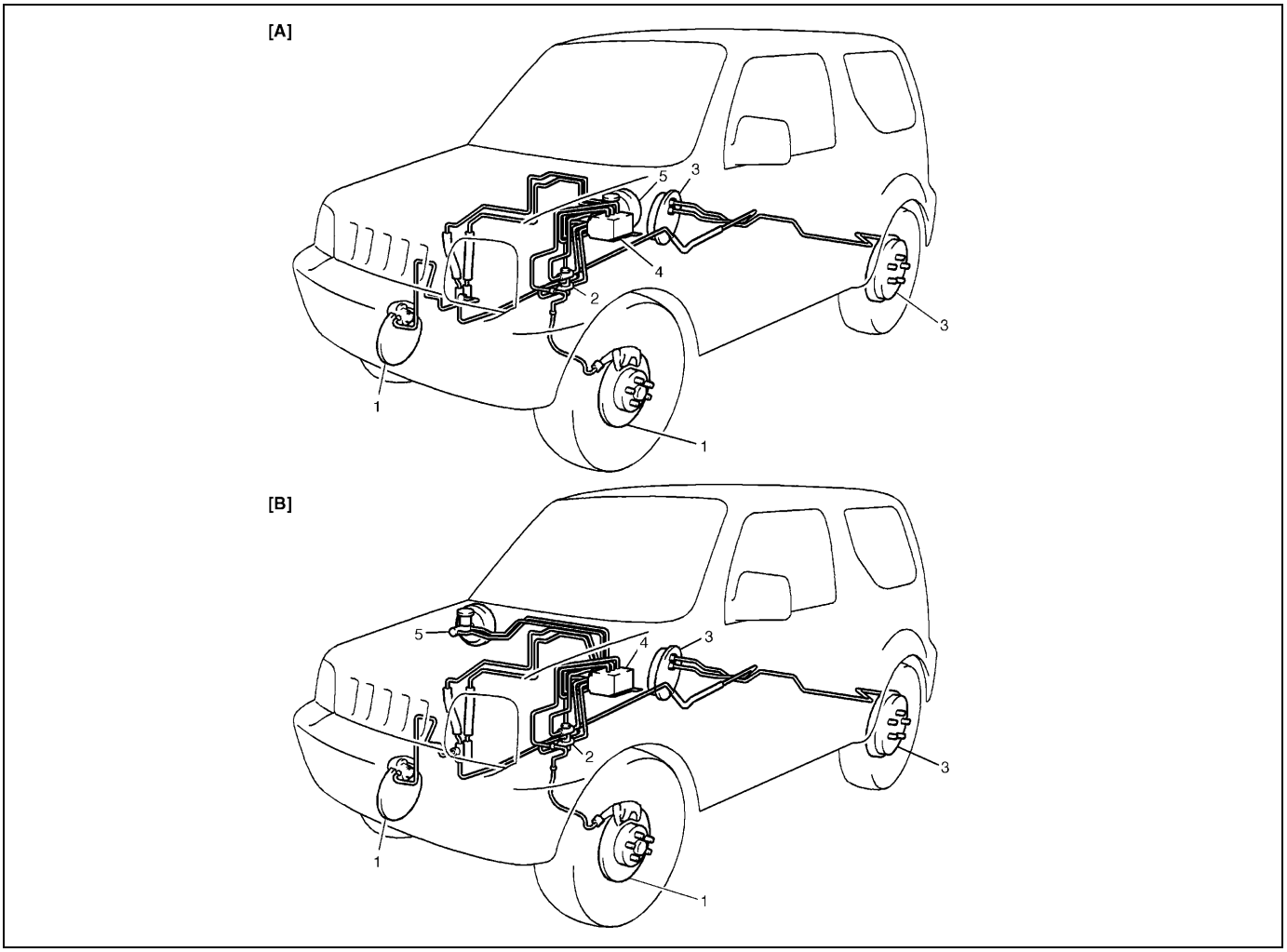
General Description

The ABS (Antilock Brake System) is a system to prevent each wheel to lock during hard braking or braking on a slippery road by controlling the fluid pressure from master cylinder to each brake (either brake caliper or wheel cylinder).

The ABS of this vehicle monitors all four wheels (four sensors) and controls all four wheels when the system is active.

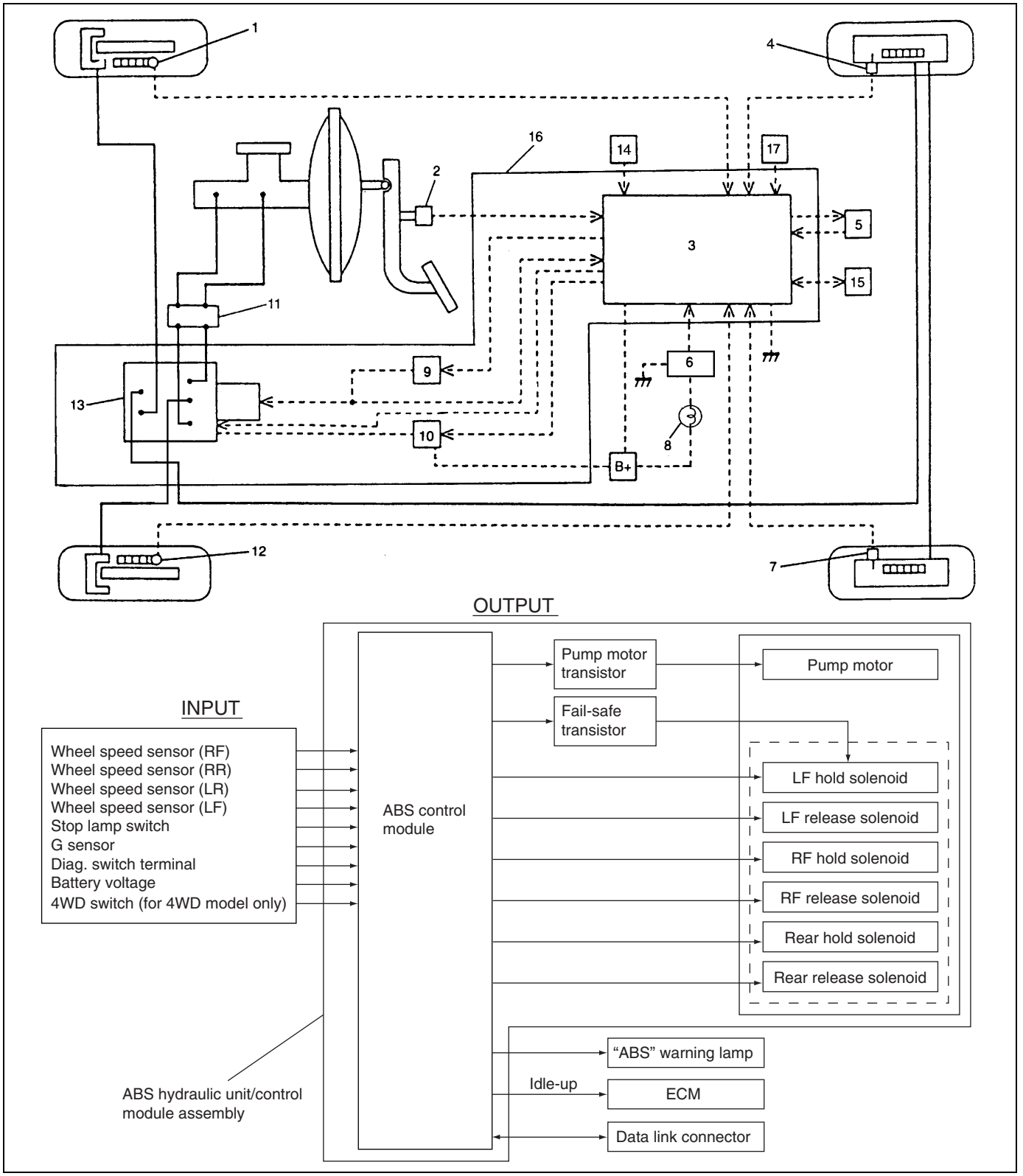
The component parts of this ABS includes following parts in addition to those of the conventional brake system.

- Wheel speed sensor senses revolution speed of each wheel and sends outputs to ABS control module.
- In this ABS, ABS hydraulic unit (actuator assembly), ABS control module, pump motor transistor and fail-safe transistor are combined as one component.
- ABS control module 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 operates according to signal from ABS control module and controls fluid pressure applied to wheel cylinder of each of 4 wheels.
- Fail-safe transistor which supplies power to solenoid valve in ABS hydraulic unit.
- Pump motor transistor supplies power to pump motor in ABS hydraulic unit.
- “ABS” warning lamp lights to inform abnormality when system fails to operate properly.
- G sensor which detects body deceleration speed.



1. Front disc brake	5. Brake master cylinder / booster
2. Proportioning valve	[A] : For LH steering vehicle
3. Rear drum brake	[B] : For RH steering vehicle
4. ABS hydraulic unit / control module assembly	

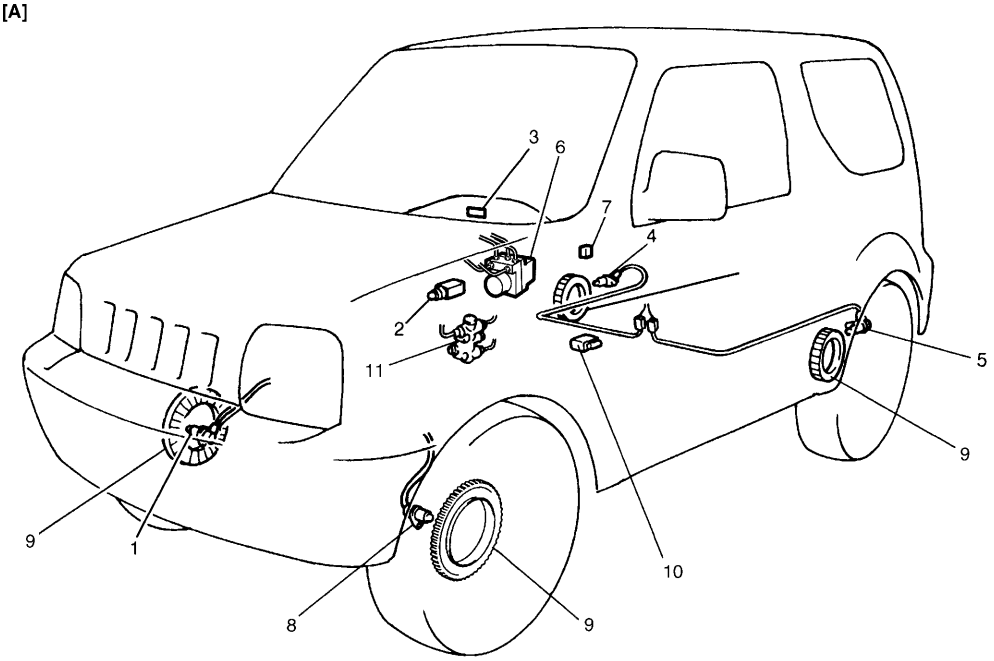
System Schematic



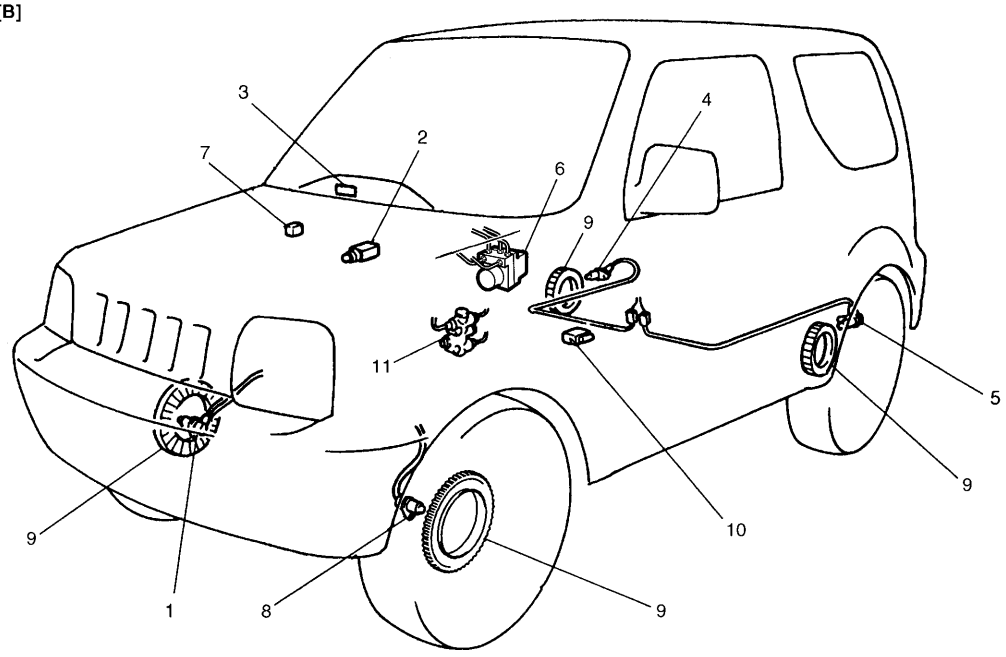
1. Wheel speed sensor (Right front)	7. Wheel speed sensor (Left rear)	13. ABS hydraulic unit
2. Stop lamp switch	8. "ABS" warning lamp	14. G sensor
3. ABS control module	9. ABS pump motor transistor	15. Data link connector
4. Wheel speed sensor (Right rear)	10. ABS solenoid valve transistor	16. ABS hydraulic unit / control module assembly
5. Monitor connector	11. Proportioning valve	17. 4WD switch (for 4WD model only)
6. ABS lamp driver module	12. Wheel speed sensor (Left front)	

ABS Component Parts Location

[A]



[B]



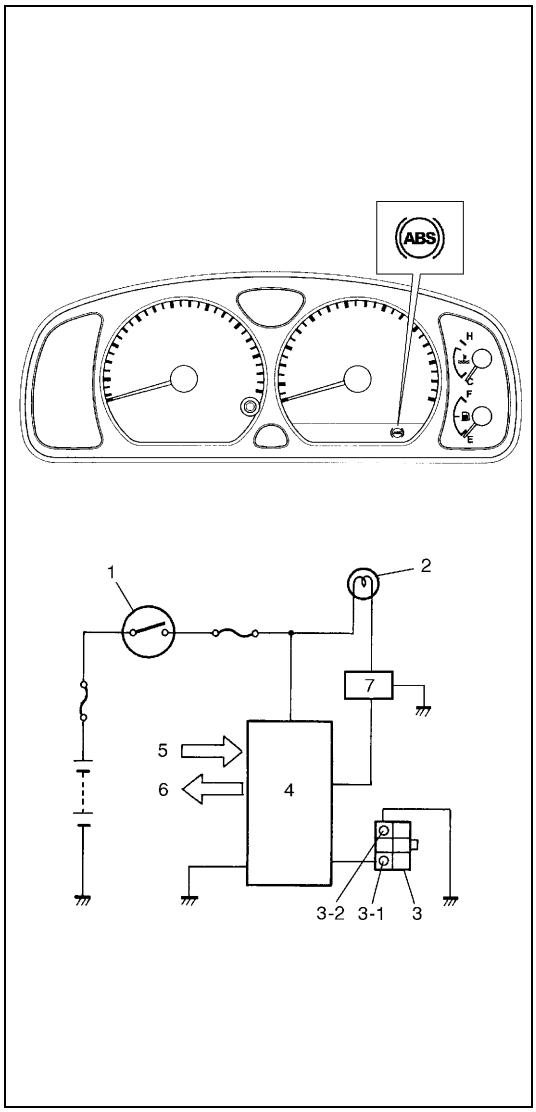
1. Wheel speed sensor (Right front)	6. ABS hydraulic unit / control module assembly	11. Proportioning valve
2. Stop lamp switch	7. Monitor connector	[A] : For LH steering vehicle
3. “ABS” warning lamp	8. Wheel speed sensor (Left front)	[B] : For RH steering vehicle
4. Wheel speed sensor (Right rear)	9. Wheel speed sensor ring	
5. Wheel speed sensor (Left rear)	10. G sensor	

ABS Control Module

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 as described below.

1) When ignition switch is turned ON, “ABS” warning lights for 2 seconds to check its bulb and 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 in ABS control module.
4) When Diag. switch terminal of monitor connector is grounded, the abnormal area is output as DTC.

SYSTEM CONDITION		DIAGNOSIS SWITCH TERMINAL	“ABS” WARNING LAMP
In good condition at present	No trouble in the past	Open	OFF
		Grounded	DTC 12
	Trouble occurred in the past	Open	OFF
		Grounded	History DTC
Abnormality exists at present	No trouble in the past	Open	ON
		Grounded	Current DTC
	Trouble occurred in the past	Open	ON
		Grounded	Current and history DTC

NOTE:

The current code and the history code are displayed without any classification.

For procedure to clear all DTC’s, refer to the item “Diagnostic Trouble Code (DTC) Clearance” in this section.

1. Ignition switch	4. ABS control module
2. “ABS” warning lamp	5. Sensed information
3. Monitor connector	6. Output
3-1. Diag. switch terminal	7. Lamp driver module
3-2. Ground terminal	

Fail-safe function

When an abnormality occurs (an abnormal DTC is detected), ABS control module turns OFF the fail-safe 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.

Diagnosis

To ensure that the trouble diagnosis is done accurately and smoothly, observe “Precautions 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 Electronic 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 diag. trouble code may be stored by mistake in the memory of ABS control module during inspection.

ABS Diagnostic Flow Table

Refer to the following for the details of each step.

Step	Action	Yes	No
1	Perform customer complaint analysis, problem symptom confirmation and diagnostic trouble code check record and clearance. Is there any trouble code?	Go to Step 2.	Go to Step 5.
2	Perform driving test. Is trouble symptom identified?	Go to Step 3.	Go to Step 6.
3	Check diagnostic trouble code. Is it malfunction code?	Go to Step 4.	Go to Step 5.
4	Inspect and repair referring to applicable diagnostic trouble code table in this section. Then perform final confirmation test after clearing diagnostic trouble code. Is trouble recur?	Go to Step 7.	End.
5	Inspect and repair referring to “Diagnosis Table” in Section 5. Then perform final confirmation test after clearing diagnostic trouble code. Is trouble recur?	Go to Step 7.	End.
6	Check for intermittent problems referring to “Intermittent and Poor Connection” in Section 0A and related circuit of trouble code recorded in Step 3. Then perform final confirmation test after clearing diagnostic trouble code. Is trouble recur?	Go to Step 7.	End.
7	Perform diagnostic trouble code check record and clearance. Is there any trouble code?	Go to Step 4.	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 the symptom is found, determine whether it is identified as a failure. (This step should be shared with the customer if possible.) When "ABS" warning lamp is not operating correctly, proceed to "Diagnostic Flow Table-A, B or C" in this section.

c) Diagnostic Trouble Code (DTC) Check, Record and Clearance

Perform "Diagnostic Trouble Code Check" procedure in this section, record it and then clear it referring to "Diagnostic Trouble Code 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 ABS 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 lamp) 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 “DTC Check” in this section.

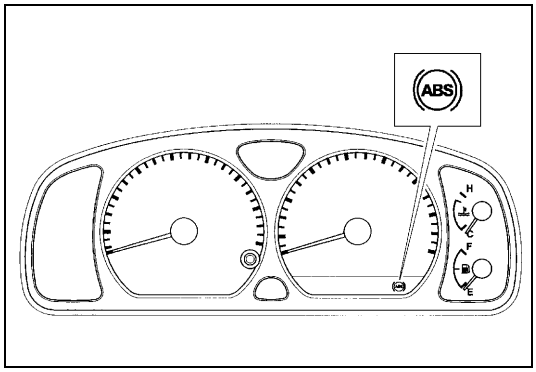
4) DIAGNOSTIC TROUBLE CODE FLOW TABLE
According to Diagnostic Flow Table for the diagnostic trouble code confirmed in Step 3, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ABS control module or other part and repair or replace faulty parts.

5) “DIAGNOSIS TABLE” IN SECTION 5
Check the parts or system suspected as a possible cause referring to “Diagnosis Table” in Section 5 and based on symptoms appearing on the vehicle (symptoms obtained through Step 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 Trouble in Section 0A and related circuit of trouble code recorded in Step 1)-c.

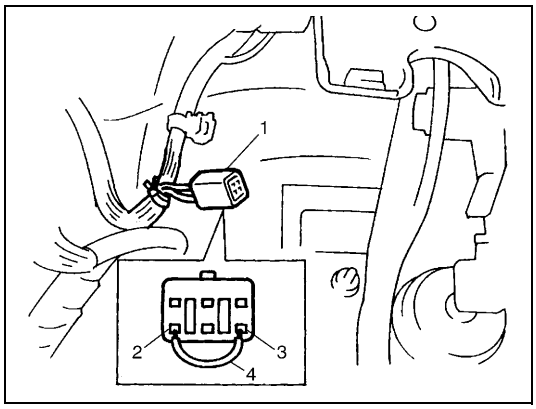
7) FINAL CONFIRMATION TEST
Confirm that the problem symptom has gone and the ABS is free from any abnormal conditions. If what has been repaired is related to the malfunction DTC, clear the DTC once and perform test driving and confirm that a normal code is indicated.

"ABS" Warning Lamp Check



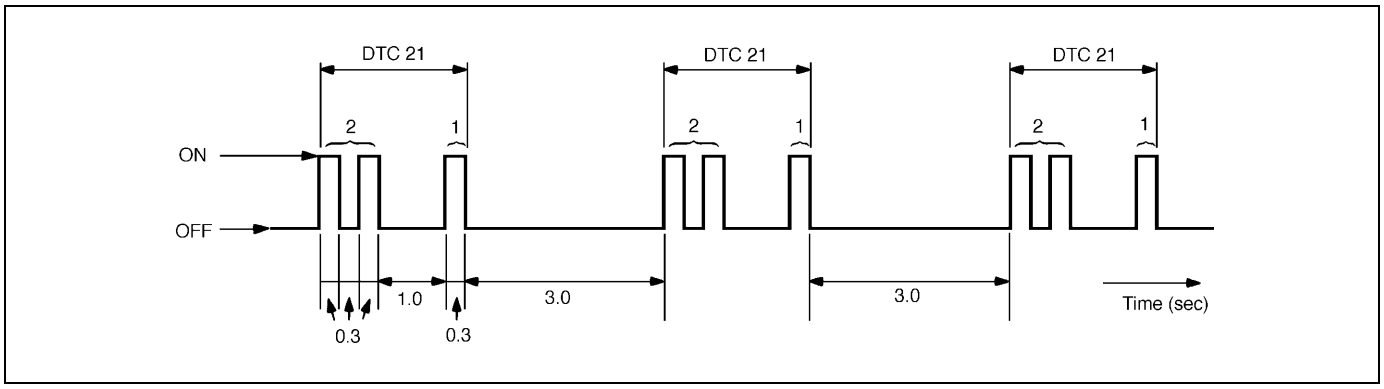
Turn ignition switch ON and check that "ABS" warning lamp comes ON for about 2 seconds and then goes OFF. If any faulty condition is found, advance to Diagnostic Flow Table-A, B or C.

Diagnostic Trouble Code (DTC) Check



1) Test drive vehicle at 40 km/h for more than a minute.
2) Stop vehicle and while IG switch OFF, connect diagnosis switch terminal (3) and ground terminal (2) of monitor connector (1) with service wire (4).
3) Turn IG switch ON, read the flashing "ABS" warning lamp which represents DTC as shown in example below and write it down. When more than 2 DTC's are stored in memory, flashing for each DTC is repeated three times starting with the smallest DTC number in increasing order.
   For details of DTC, refer to "DTC Table".

Example : When right front wheel speed sensor circuit opens (DTC 21)

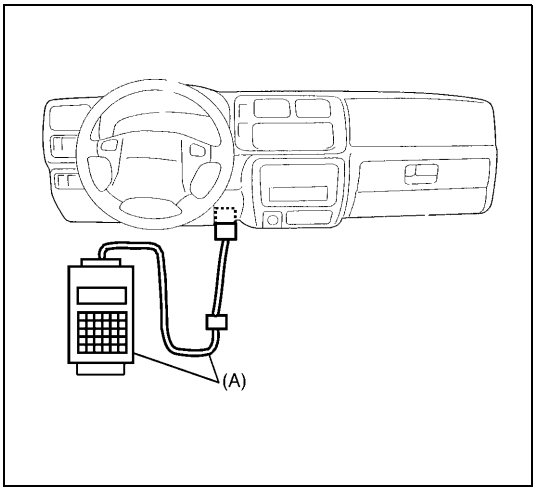


NOTE:

"ABS" warning lamp indicates only following DTCs, DTC 12 which means that no malfunction DTC is stored and history DTC which indicates history trouble area. When there is current trouble, "ABS" warning lamp remains ON and therefore DTC is not indicated.

4) After completing the check, turn ignition switch off, disconnect service wire from monitor connector.

DTC Check (Using SUZUKI Scan Tool)



1) Connect SUZUKI scan tool to data link connector after setting cartridge for ABS to it.

Special tool
(A) : SUZUKI scan tool

2) Turn ignition switch ON.
3) 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.
4) After completing the check, turn ignition switch off and disconnect SUZUKI scan tool from DLC.

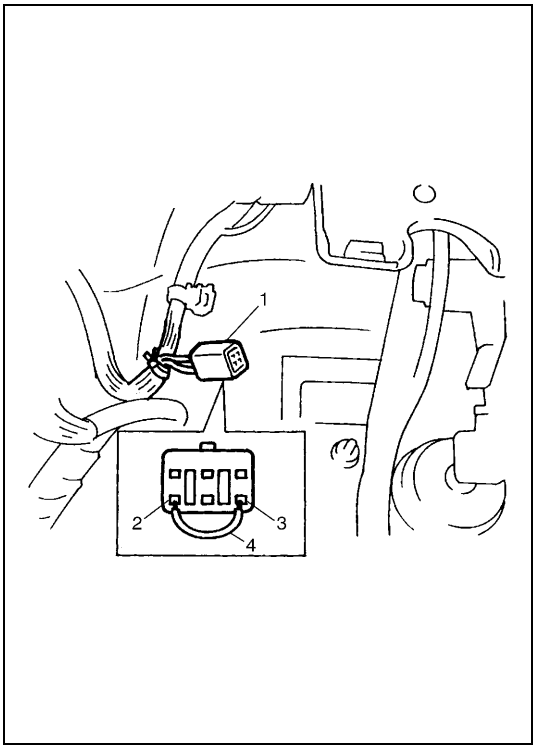
Diagnostic Trouble Code (DTC) Clearance

WARNING:

When preforming 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 DTC's by preforming the following procedure.

1) Turn ignition switch OFF.



2) Using service wire (4), connect diag. switch terminal (3) of monitor connector (1) to ground terminal (2).
3) With connection described in above step 2) maintained, turn ignition switch ON.
4) Repeat ON/OFF operation of service wire (4) at ground terminal (2) at least 5 times within 10 seconds.

NOTE:

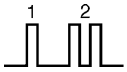
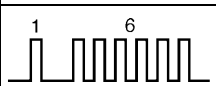
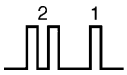
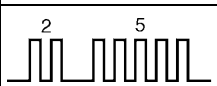
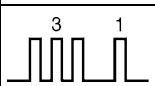
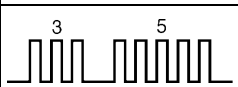
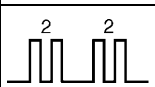
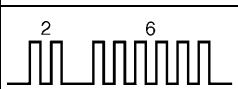
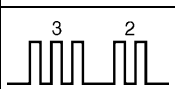
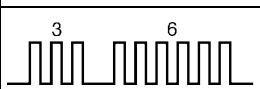
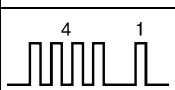
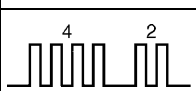
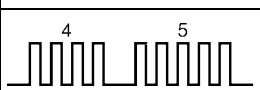
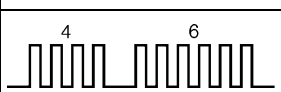
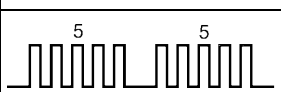
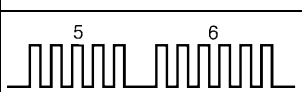
Service wire ON time must be for 0.1 second and more.

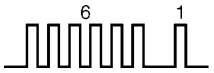
5) Turn ignition switch OFF and disconnect service wire (4) from monitor connector (1).
6) Perform "DRIVING TEST" (Step 2 of "ABS Diagnostic Flow Table") and "DTC CHECK" and confirm that normal DTC (DTC 12) is displayed.

NOTE:

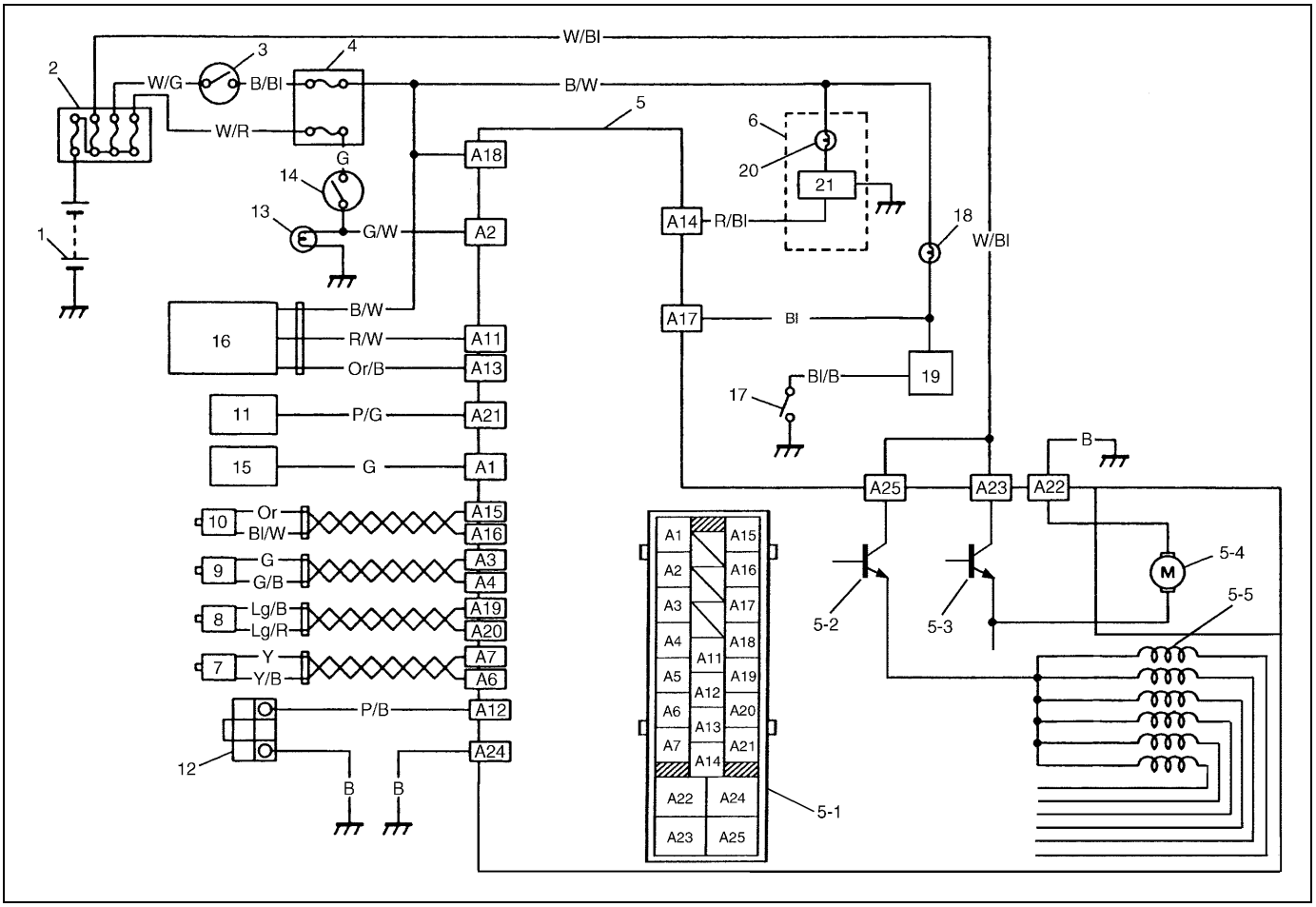
It is also possible to clear DTC by using SUZUKI scan tool. Refer to Cartridge Manual for procedure to clear DTC.

Diagnostic Trouble Code (DTC) Table

DTC (displayed on SUZUKI scan tool)	DTC (indicated by ABS warning lamp)	ABS warning light flashing pattern	DIAGNOSTIC ITEMS	
–	12		Normal	
C1015	15		G sensor circuit (for 4WD model only)	
C1016	16		Stop lamp switch circuit	
C1021	21		RF	Wheel speed sensor circuit and/or sensor ring
C1025	25		LF	
C1031	31		RR	
C1035	35		LR	
C1022	22		RF	
C1026	26		LF	
C1032	32		RR	
C1036	36		LR	
C1041	41		RF	Hold solenoid valve circuit
C1042	42			Release solenoid valve circuit
C1045	45		LF	Hold solenoid valve circuit
C1046	46			Release solenoid valve circuit
C1055	55		Rear	Hold solenoid valve circuit
C1056	56			Release solenoid valve circuit

DTC (displayed on SUZUKI scan tool)	DTC (indicated by ABS warning lamp)	ABS warning light flashing pattern	DIAGNOSTIC ITEMS
C1057	57		Power source
C1061	61		ABS pump motor circuit
C1063	63		ABS solenoid valve circuit
C1071	71		ABS control module

System Circuit

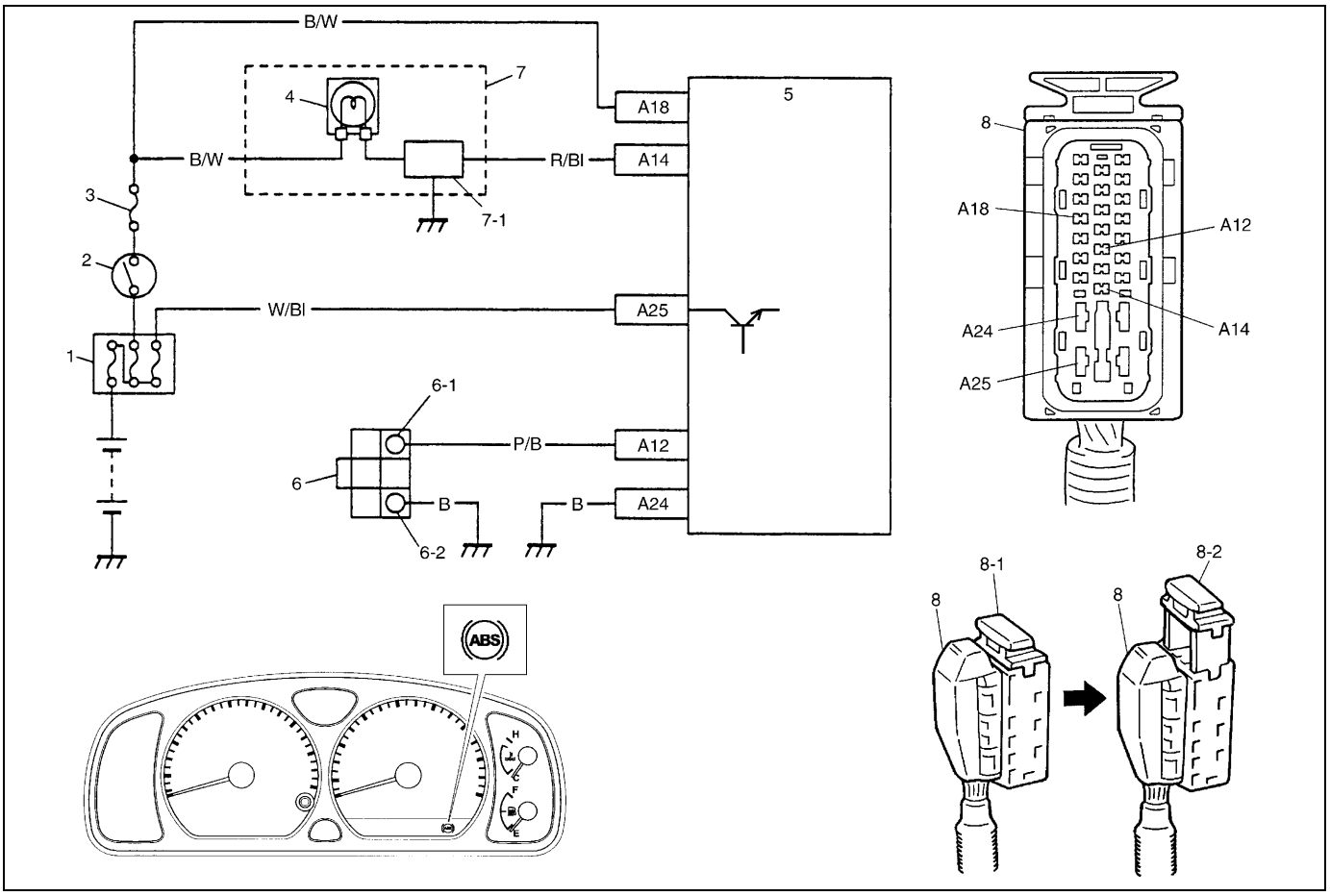


1. Battery	5-5. Solenoid valves	14. Stop lamp switch
2. Main fuses	6. Combination meter	15. ECM
3. Ignition switch	7. Right rear wheel speed sensor	16. G sensor
4. Circuit fuses	8. Left rear wheel speed sensor	17. 4WD switch (for 4WD model only)
5. ABS hydraulic unit / control module assembly	9. Right front wheel speed sensor	18. 4WD indicator lamp (for 4WD model only)
5-1. Terminal arrangement for ABS hydraulic unit / control module assembly	10. Left front wheel speed sensor	19. 4WD controller (for 4WD model only)
5-2. ABS fail-safe transistor	11. Data link connector	20. “ABS” warning lamp
5-3. ABS pump motor transistor	12. Monitor connector	21. ABS lamp driver module
5-4. Pump motor	13. Stop lamp	

TERMINAL	CIRCUIT
A1	Idle up signal
A2	Stop lamp switch
A3	Right front wheel speed sensor (+)
A4	Right front wheel speed sensor (–)
A5	–
A6	Right rear wheel speed sensor (–)
A7	Right rear wheel speed sensor (+)
A8	–
A9	–
A10	–
A11	G sensor signal
A12	Diagnosis switch terminal
A13	G sensor ground
A14	“ABS” warning lamp
A15	Left front wheel speed sensor (+)
A16	Left front wheel speed sensor (–)
A17	4WD switch (for 4WD model only)
A18	Ignition switch
A19	Left rear wheel speed sensor (+)
A20	Left rear wheel speed sensor (–)
A21	Data link connector
A22	Ground (for ABS pump motor)
A23	ABS pump motor power supply
A24	Ground (for ABS control module)
A25	Solenoid valve power supply

Wire color					
B :	Black	G/W :	Green / White	R/W :	Red / White
B/Bl :	Black / Blue	Lg/B :	Light green / Black	W/Bl :	White / Blue
B/W :	Black / White	Lg/R :	Light green / Red	W/G :	White / Green
B/Or :	Black / Orange	Or :	Orange	W/R :	White / Red
Bl :	Blue	Or/B :	Orange / Black	Y :	Yellow
Bl/W :	Blue / White	P/B :	Pink / Black	Y/B :	Yellow / Black
G :	Green	P/G :	Pink / Green		
G/B :	Green / Black	R/Bl :	Red / Blue		

Table – A "ABS" Warning Lamp Circuit Check – Lamp Does Not Come "ON" at Ignition Switch ON



1. Main fuse	6. Monitor connector (Blue)	8. ABS hydraulic unit / control module connector of harness
2. Ignition switch	6-1. Diag. switch terminal	8-1. Lock position
3. IG fuse	6-2. Diag. ground terminal	8-2. Unlock position
4. "ABS" warning lamp in combination meter	7. Combination meter	
5. ABS hydraulic unit / control module assembly	7-1. ABS lamp driver module	

CIRCUIT DESCRIPTION

Operation (ON / OFF) of the "ABS" warning lamp is controlled by the ABS control module and ABS lamp driver module.

If the Antilock brake system is in good condition, the ABS control module turns the "ABS" warning lamp ON at the ignition switch ON, keeps it ON for 2 seconds only and then turns it OFF. If an abnormality in the system is detected, the lamp is turned ON by ABS control module. Also, it is turned ON by ABS lamp driver module when the connector of the ABS control module was disconnected.

INSPECTION

Step	Action	Yes	No
1	1) Turn ignition switch ON. Do other warning lamp come ON?	Go to step 2.	Go to step 4.
2	1) Disconnect ABS hydraulic unit / control module connector. Does ABS warning lamp light with ignition switch ON?	Replace ABS hydraulic unit / control module assembly.	Go to step 3.

Step	Action	Yes	No
3	1) Remove combination meter. Is bulb of ABS warning lamp in good condition?	"R/Bl" circuit shorted to ground. If OK, replace ABS warning circuit (lamp driver module).	Replace bulb.
4	Is IG fuse in good condition?	Open in "B/W" wire to combination meter or poor connection.	Repair and replace.

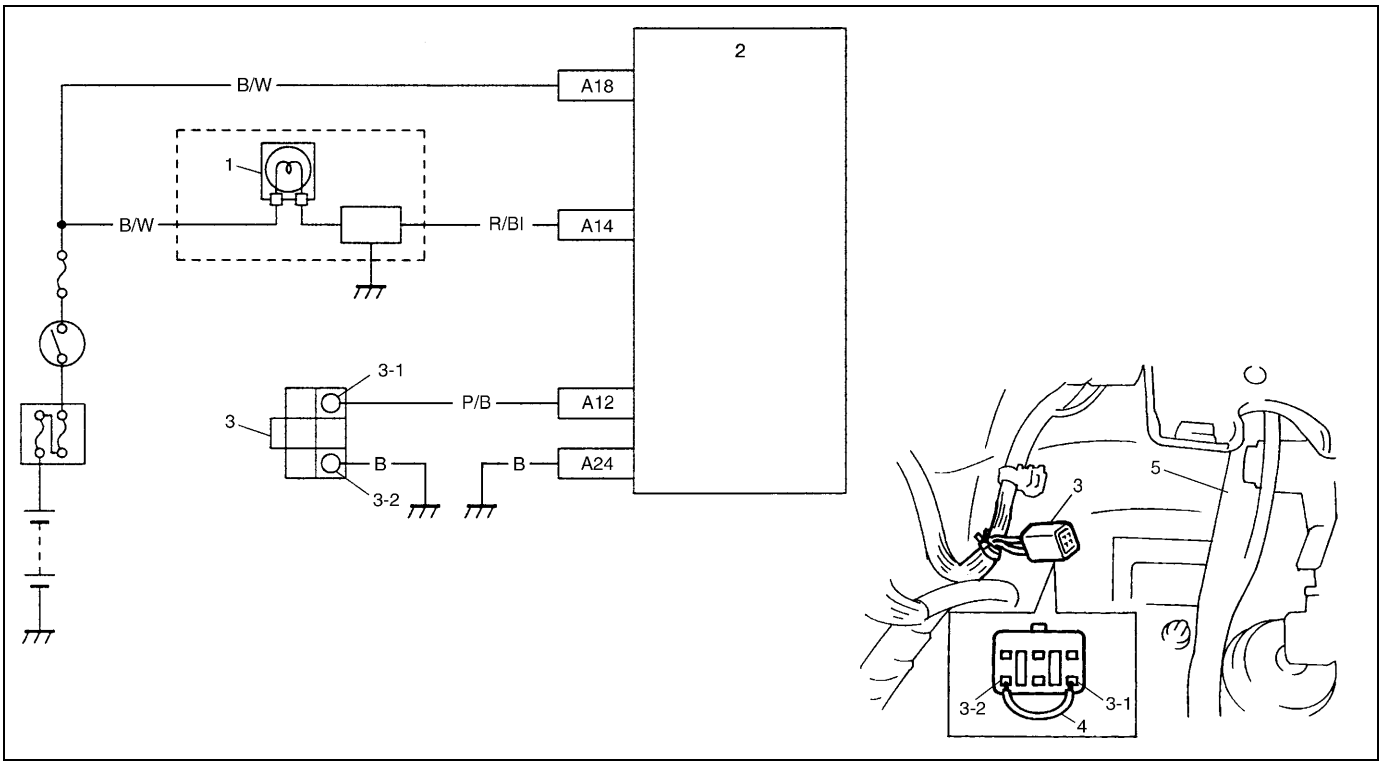
Table – B "ABS" Warning Lamp Circuit Check – Lamp Comes "ON" Steady

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 (including code No.12, NO CODES on SUZUKI scan tool) exists?	Go to step 2.	Go to step 3.
2	Is malfunction DTC (other than code No.12) exists at step 1?	Go to step 7 of ABS diagnostic flow table in this section.	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 "A14" and "A18". 3) If OK, turn ignition switch "ON" and measure voltage at terminal "A18" of connector. Is it 10 – 14 V?	Go to step 4.	"B/W" circuit open.
4	1) With ABS control module connector disconnected, turn ignition switch ON and light ABS warning lamp. 2) Connect terminal "A14" of disconnected connector to ground using service wire. Does "ABS warning lamp" turn off?	Go to step 5.	"R/Bl" circuit open. If wire and connection are OK, replace ABS lamp driver module.
5	1) Measure resistance from connector terminal "A24" to body ground. Is continuity indicated?	Substitute a known-good ABS hydraulic unit / control module assembly and recheck.	"B" circuit open.

Table – C "ABS" Warning Lamp Circuit Check – Lamp Flashes Continuously While Ignition Switch is ON



1. "ABS" warning lamp in combination meter	3-1. Diag. switch terminal	5. Pedal bracket
2. ABS hydraulic unit / control module assembly	3-2. Diag. ground terminal	
3. Monitor connector	4. Service wire	

CIRCUIT DESCRIPTION

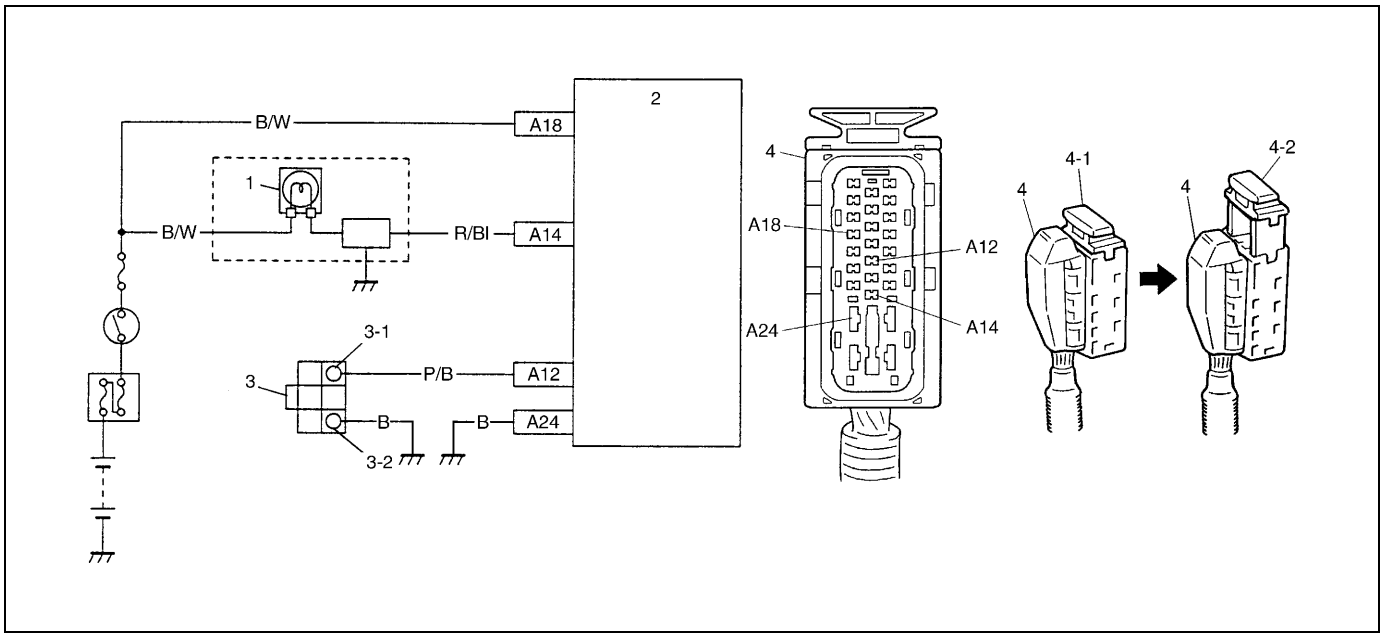
When the diag. switch terminal is shorted or connected to the ground with the ignition switch ON, the diag. trouble code (DTC) is indicated by flashing of the "ABS" warning lamp only in following cases.

- Normal DTC (12) is indicated if no malfunction DTC is detected in the ABS.
- A history malfunction DTC is indicated by flashing of the lamp if a current malfunction DTC is not detected at that point although a history malfunction DTC is stored in memory.

INSPECTION

Step	Action	Yes	No
1	Is diag. switch terminal connected to ground via service wire?	Go to step 3.	Go to step 2.
2	1) Ignition switch ON. 2) Measure voltage between diag. switch terminal and ground. Is it 10 – 14 V?	Substitute a known-good ABS hydraulic unit / control module assembly and recheck.	"P/B" wire circuit shorted to ground.
3	1) Ignition switch ON. 2) Does flashing of ABS warning lamp indicate DTC (DTC 12 or history DTC)?	Go to step 7 of "ABS diagnostic flow table" in this section.	Substitute a known-good ABS hydraulic unit / control module assembly and recheck.

Table – D Code (DTC) is Not Outputted Even With Diag. Switch Terminal Connected to Ground.



1. "ABS" warning lamp in combination meter	3-1. Diag. switch terminal	4-1. Lock position
2. ABS hydraulic unit / control module assembly	3-2. Diag. ground terminal	4-2. Unlock position
3. Monitor connector	4. ABS hydraulic unit / control module connector of harness	

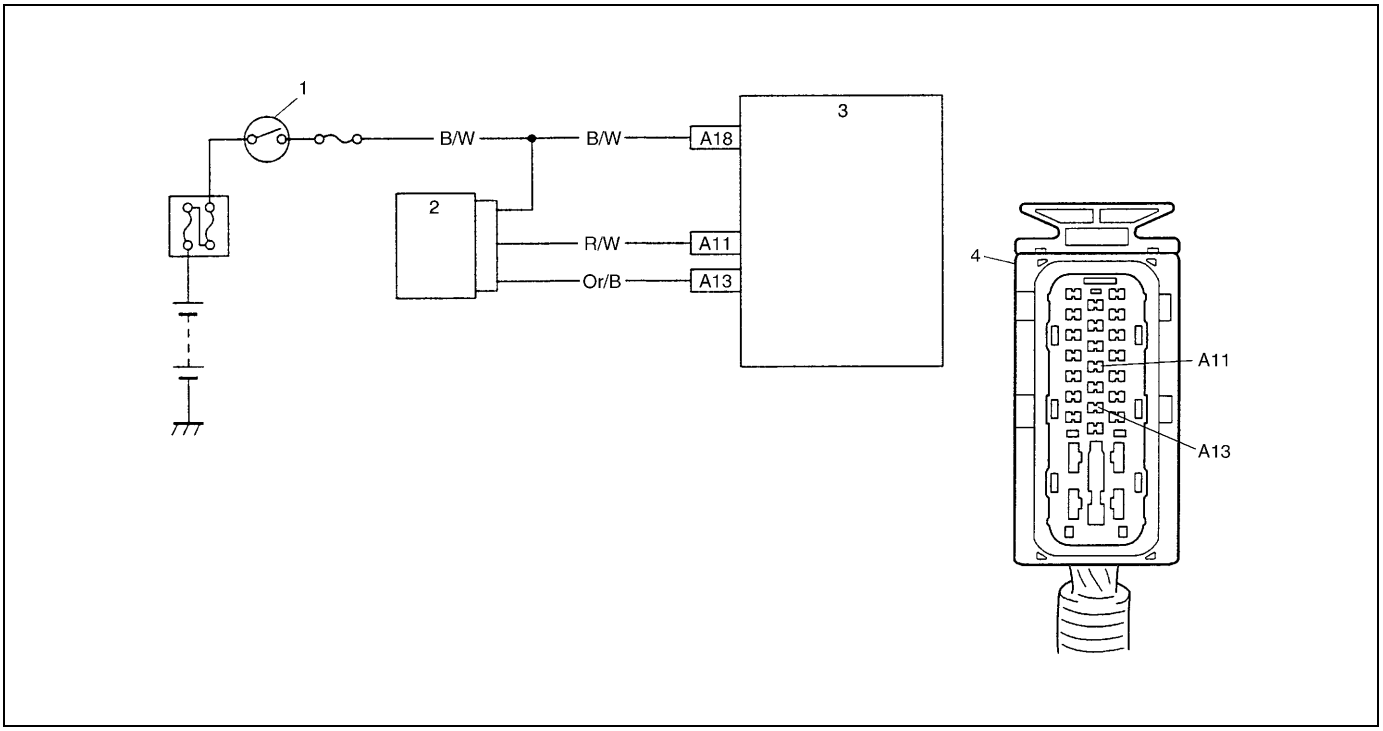
CIRCUIT DESCRIPTION

When the diag. switch terminal is connected to the ground with the ignition switch turned ON, the ABS control module outputs a diagnostic trouble code by flashing "ABS" warning lamp.

INSPECTION

Step	Action	Yes	No
1	Is it shorted diag. switch terminal and ground terminal by service wire properly?	Go to step 2.	Connect service wire securely.
2	1) Disconnect service wire. 2) Disconnect ABS hydraulic unit / control module connector. 3) Measure resistance between diag. switch terminal and connector terminal "A12". Is it infinite (∞)?	"P/B" circuit open.	Go to step 3.
3	1) Measure resistance between ground terminal of monitor connector and body ground. Is continuity indicated?	Go to step 4.	"B" circuit open or poor connection.
4	1) Check for proper connection to ABS hydraulic unit / control module at terminal "A12" and "A24". 2) If OK, then check "ABS" warning lamp circuit referring to TABLE A, B and C. Is it in good condition?	Substitute a known-good ABS hydraulic unit / control module assembly and recheck.	Repair "ABS" warning lamp circuit.

DTC C1015 (DTC 15) – G Sensor Circuit



1. Ignition switch	3. ABS hydraulic unit / control module assembly
2. G sensor	4. ABS hydraulic unit / control module connector of harness

DESCRIPTION

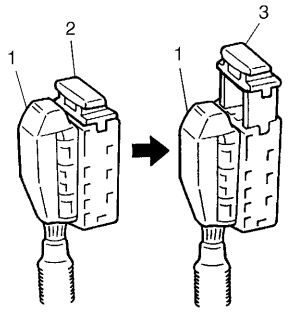
While a vehicle is at stop or running, if the potential difference between the sensor signal terminal “A11” and the sensor ground terminal “A13” is not within the specified voltage value, or if the signal voltage while at a stop does not vary from that while running, this DTC is set.

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.

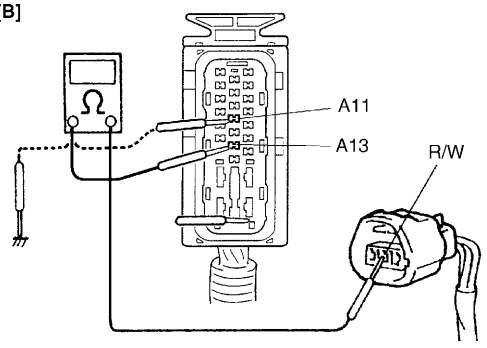
INSPECTION

Step	Action	Yes	No
1	Is G sensor installed floor securely?	Go to step 2.	Tighten sensor or bracket screw securely. If not, use new screw.
2	1) Ignition switch OFF. 2) Remove G sensor with bracket. 3) Check for proper connection to G sensor. 4) If OK, then check G sensor referring to "G Sensor" in this section. Is it in good condition?	Go to step 3.	Replace G sensor.
3	1) Disconnect connectors from ABS hydraulic unit / control module assembly (See [A]) and G sensor. 2) Check for proper connection to ABS control module at terminals "A11" and "A13". 3) If OK, then turn ignition switch ON and measure voltage between "B/W" terminal of sensor connector and body ground. Is it 10 – 14 V?	Go to step 4.	"B/W" circuit open.
4	Measure voltage between "R/W" terminal of sensor connector and body ground. Is it 0 V?	Go to step 5.	"R/W" circuit shorted to power circuit.
5	1) Ignition switch OFF. 2) Check that "R/W" circuit is free from open or short to ground and "Or/B" circuit. (See [B]) Is it in good condition?	"Or/B" circuit open. If circuit is OK, substitute a known-good ABS hydraulic unit / control module assembly.	"R/W" circuit open or shorted to ground or "Or/B" circuit.

[A]

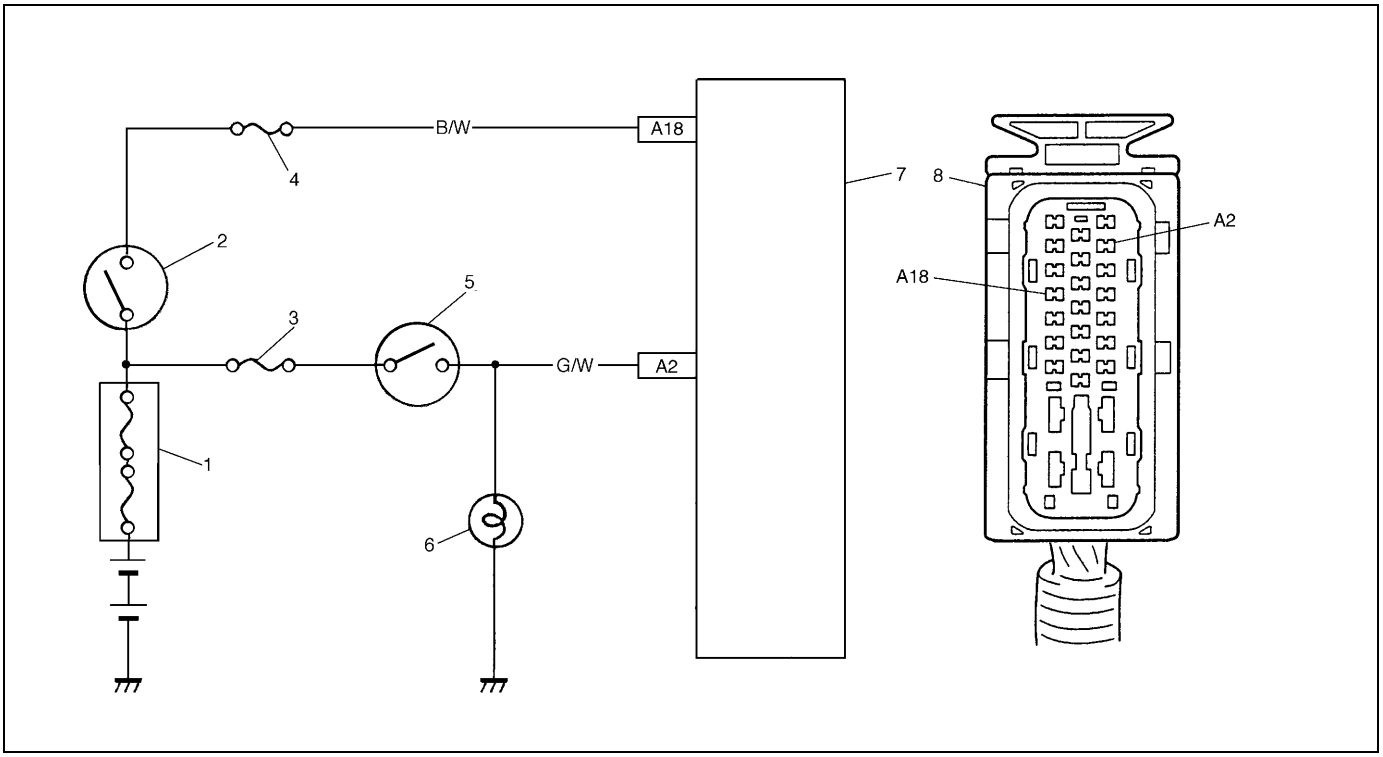


[B]



1. ABS hydraulic unit / control module connector
2. Lock position
3. Unlock position

DTC C1016 (DTC 16) – Stop Lamp Circuit



1. Main fuse	4. IG fuse	7. ABS hydraulic unit / control module assembly
2. Ignition switch	5. Stop lamp switch	8. ABS hydraulic unit / control module connector of harness
3. Tail stop fuse	6. Stop lamp	

DESCRIPTION

The ABS control module monitors the voltage at the stop lamp while the ignition switch is ON. When the voltage is without the specified range at terminal “A2”, a DTC will be set.

INSPECTION

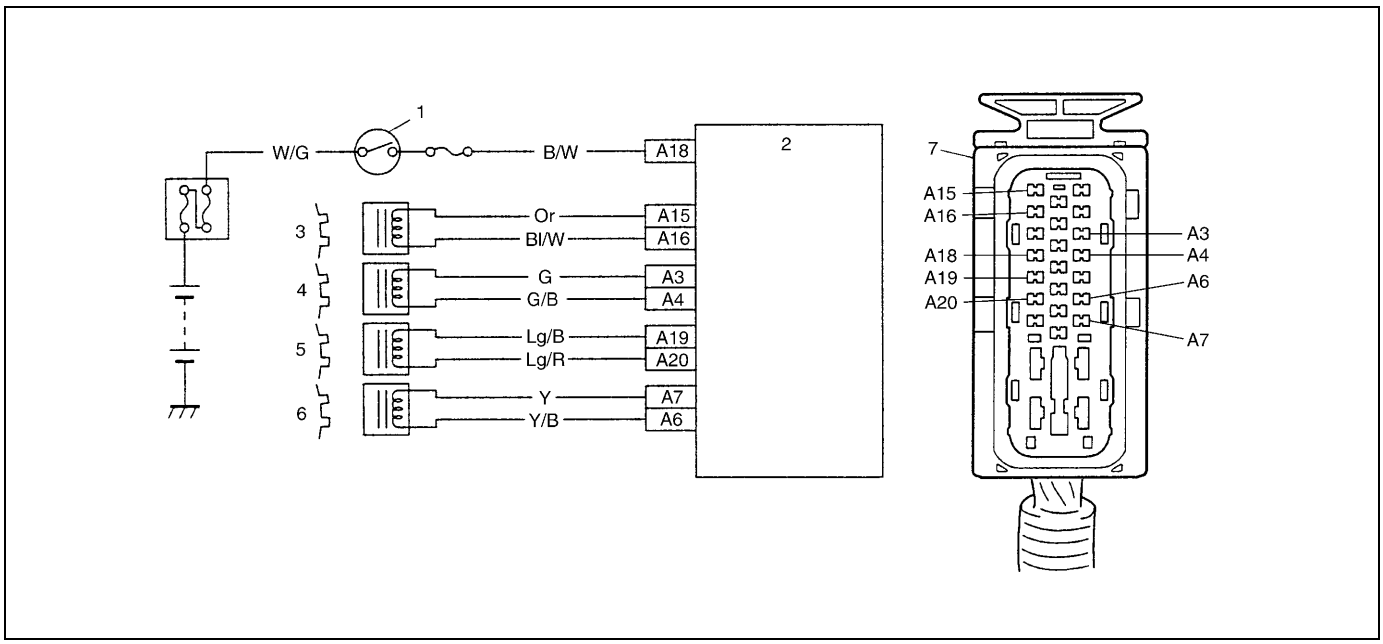
Step	Action	Yes	No
1	1) Turn IG switch OFF. 2) Disconnect connectors from ABS hydraulic unit / control module assembly. 3) Depress the brake pedal. 4) Measure the voltage between the stop lamp terminal “A2” and body ground. Is it 10 – 14 V?	Check for proper connection to ABS control module at terminal “A2”. If OK, substitute a known-good ABS control module and recheck.	“G/W” circuit open.

DTC C1021 (DTC 21), DTC C1022 (DTC 22) – Right Front Wheel Speed Sensor Circuit

DTC C1025 (DTC 25), DTC C1026 (DTC 26) – Left Front Wheel Speed Sensor Circuit

DTC C1031 (DTC 31), DTC C1032 (DTC 32) – Right Rear Wheel Speed Sensor Circuit

DTC C1035 (DTC 35), DTC C1036 (DTC 36) – Left Rear Wheel Speed Sensor Circuit



1. Ignition switch	4. Right front wheel speed sensor	7. ABS hydraulic unit / control module connector of harness
2. ABS hydraulic unit / control module assembly	5. Left rear wheel speed sensor	
3. Left front wheel speed sensor	6. Right rear wheel speed sensor	

DESCRIPTION

The ABS control module monitors the voltage at the positive (+) 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.

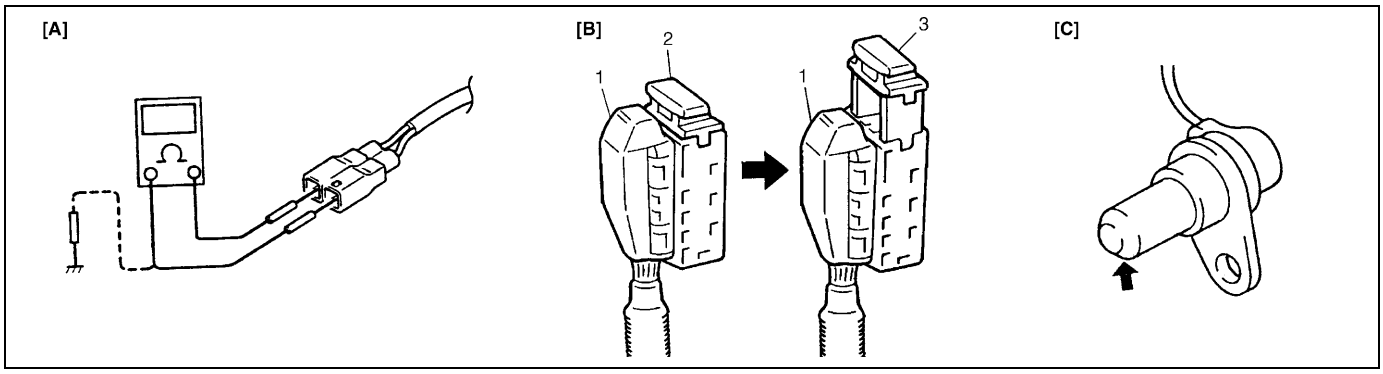
NOTE:

When the vehicle was operated in any of the following ways, one of these DTC's 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 DIAG. FLOW TABLE" in this section, check whether or not any abnormality exists.

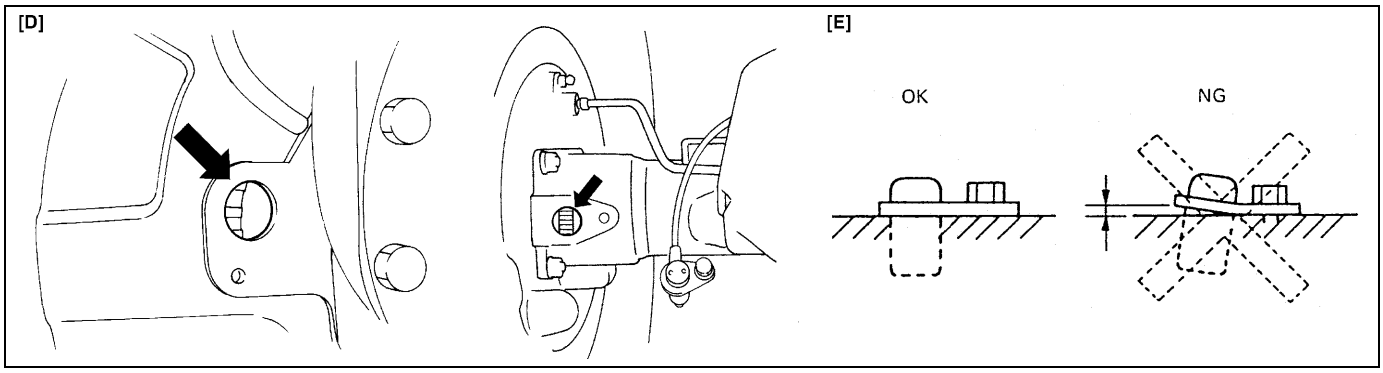
- **The vehicle was driven with parking brake pulled.**
- **The vehicle was driven with brake dragging.**
- **Wheel spin occurred while driving.**
- **Wheel(s) was turned while the vehicle was jacked up.**
- **The vehicle was stuck.**

INSPECTION

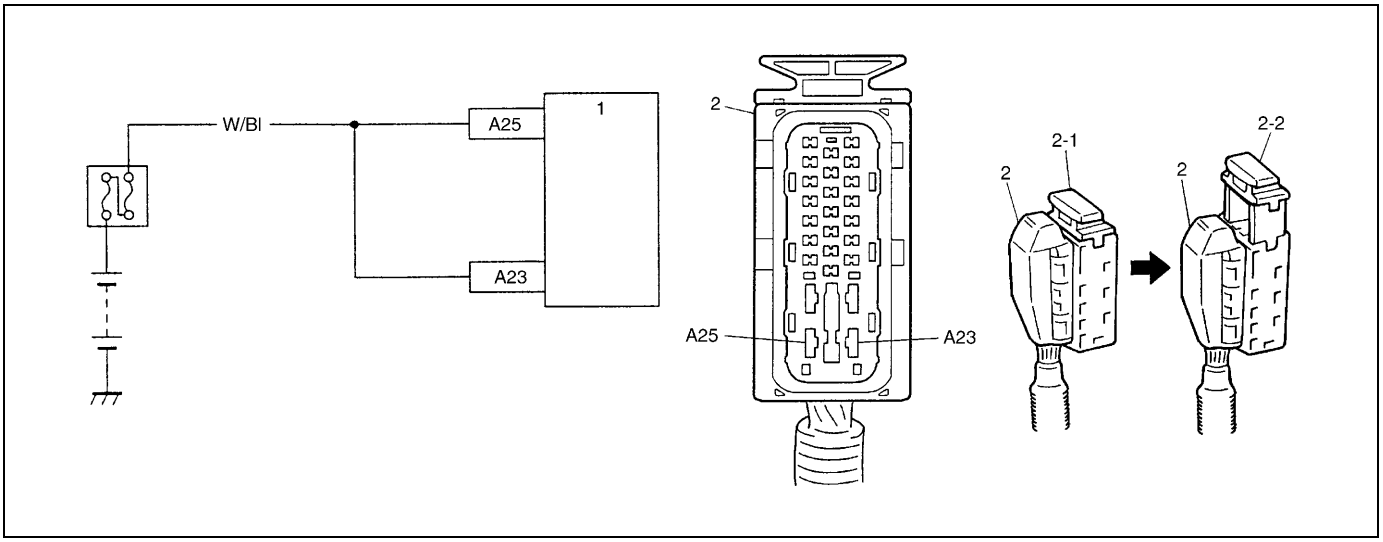
Step	Action	Yes	No
1	1) Disconnect the applicable sensor connector with ignition switch OFF. 2) Measure resistance between sensor terminals. Resistance of wheel speed sensor: 1.4 – 1.8 kΩ (at 20°C, 68°F) 3) Measure resistance between each terminal and body ground. Insulation resistance: 1MΩ or higher Were measured resistance values in step 2) and 3) as specified? (See [A])	Go to step 2.	Replace sensor.
2	1) Ignition switch OFF. 2) Disconnect connector from ABS hydraulic unit / control module assembly. (See [B]) 3) Check for proper connection to ABS hydraulic unit / control module assembly at each sensor terminal. 4) If OK, then turn ignition switch ON and measure voltage between sensor positive terminal of module connector and body ground. Is it 0V?	Go to step 3.	Sensor positive circuit shorted to power.
3	1) Ignition switch OFF. 2) Connect connector to sensor. 3) Measure resistance between sensor terminals at module connector. 4) Measure resistance between sensor positive terminal and negative terminal of module connector, between positive terminal and body ground. Are measured resistance values within each specified range described in above step 1?	Go to step 4.	Circuit open or shorted to ground.
4	1) Remove wheel speed sensor. 2) Check sensor for damage or foreign material being attached. Is it in good condition? (See [C])	Go to step 5.	Clean or replace sensor.
5	Check visually through wheel speed sensor installation hole for following. • Ring serration (teeth) neither missing or damaged. • No foreign material being attached. • Ring not being eccentric. • Wheel bearing free from excessive play. Are they in good condition? (See [D])	Go to step 6.	Clean, repair or replace.
6	1) Install sensor to knuckle or axle housing. 2) Tighten sensor bolt to specified torque and check that there is not any clearance between sensor and knuckle or axle housing. (See [E]) Replace sensor if any. Referring to “Front Wheel Speed Sensor” in this section, check output voltage or waveform of sensor. Is proper output voltage or waveform obtained?	Substitute a known-good ABS hydraulic unit / control module assembly and recheck.	Replace sensor and recheck.



1.	ABS hydraulic unit / control module connector
2.	Lock position
3.	Unlock position



DTC C1041 (DTC 41), DTC C1042 (DTC 42) – Right Front Solenoid Circuit
DTC C1045 (DTC 45), DTC C1046 (DTC 46) – Left Front Solenoid Circuit
DTC C1055 (DTC 55), DTC C1056 (DTC 56) – Rear Solenoid Circuit



1. ABS hydraulic unit / control module assembly	2-1. Lock position
2. ABS hydraulic unit / control module connector of harness	2-2. Unlock position

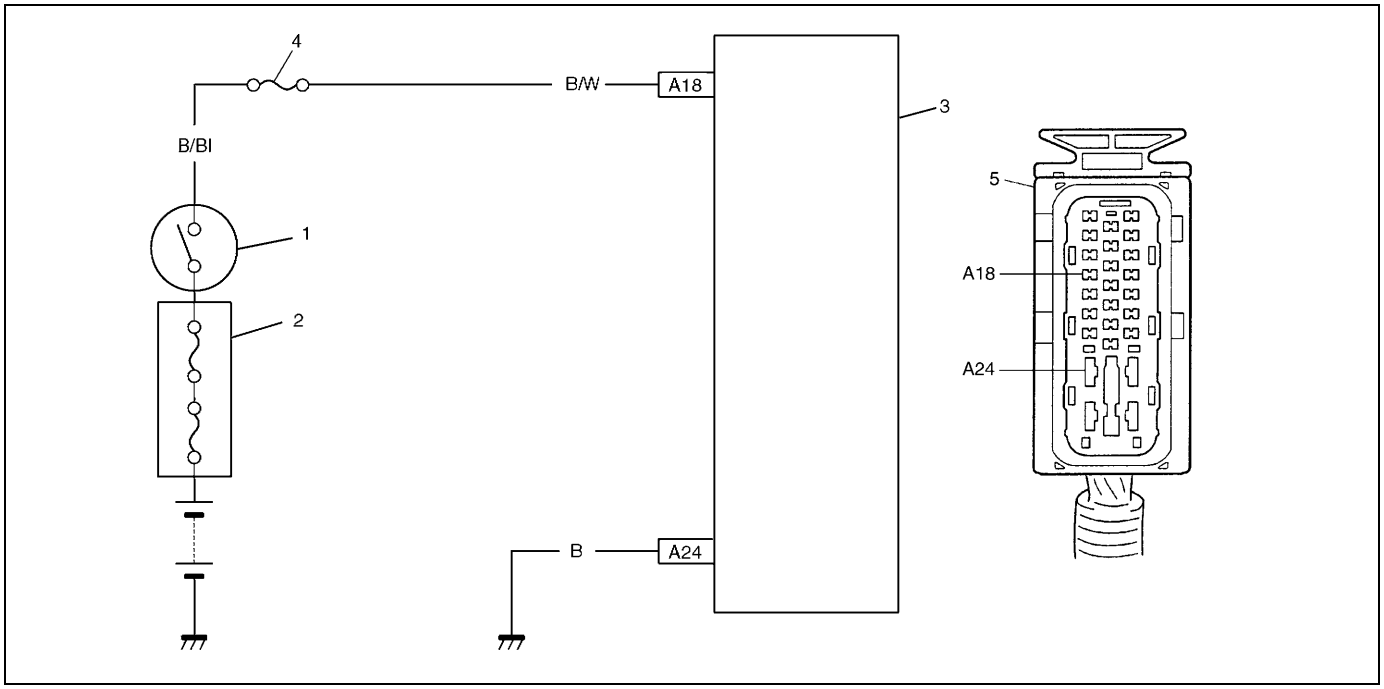
DESCRIPTION

The ABS control module monitors the voltage of the terminal of the solenoid circuit constantly with the ignition switch turned ON. It sets this DTC when the terminal voltage does not become low / high for the ON / OFF command to the solenoid or the voltage difference between solenoid circuit terminals exceeds the specified value with the solenoid turned OFF.

INSPECTION

Step	Action	Yes	No
1	1) Check solenoid referring to “ABS Hydraulic Unit Operation Check” in this section. Is it in good condition?	Check terminals “A25” and “A23” connection. If connections OK, substitute a known-good ABS hydraulic unit / control module assembly and recheck.	Go to step 2.
2	1) Ignition switch OFF. 2) Disconnect ABS hydraulic unit / control module connector. 3) Check for proper connection to ABS hydraulic unit / control module connector at terminal “A25”. 4) If OK, then measure voltage between terminal “A25” of module connector and body ground. Is it 10 – 14 V?	Substitute a known-good ABS hydraulic unit / control module assembly and recheck.	“W/Bl” circuit open.

DTC C1057 (DTC 57) – Power Source Circuit



1. Ignition switch	3. ABS hydraulic unit / control module assembly	5. ABS hydraulic unit / control module connector
2. Main fuse	4. Circuit fuse	

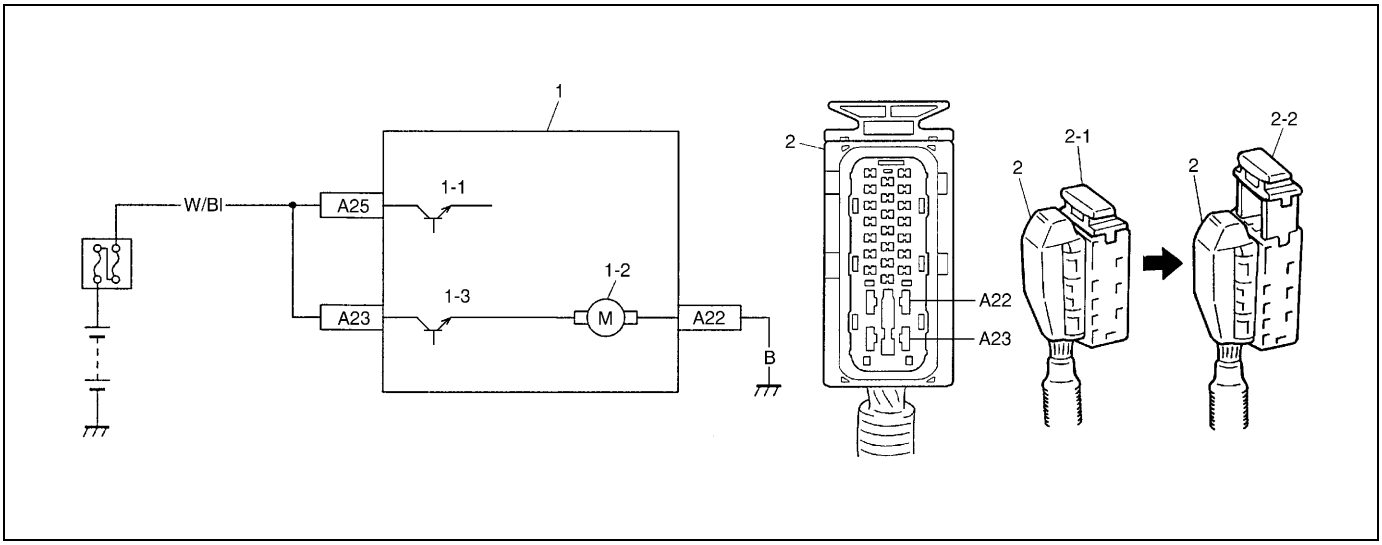
DESCRIPTION

The ABS control module monitors the power source voltage at terminal “A18”. When the power source voltage becomes extremely low, this DTC will be set. As soon as the voltage rises to the specified level, the set DTC will be cleared.

INSPECTION

Step	Action	Yes	No
1	Check battery voltage. Is it about 11 V or higher?	Go to step 2.	Check charging system referring to “Undercharged Battery” in Section 6H.
2	Check ABS main fuse, circuit fuse and connection. Is it in good condition?	Go to step 3.	Repair and/or replace fuse.
3	1) Ignition switch OFF. 2) Disconnect ABS hydraulic unit / control module connector. 3) Check proper connection to ABS hydraulic unit / control module connector at terminal “A18”. 4) If OK, then measure voltage between connector terminal “A18” and body ground. Is it 10 – 14 V?	Substitute a known-good ABS hydraulic unit / control module assembly and recheck.	“B/W” circuit open.

DTC C1061 (DTC 61) – ABS Pump Motor Circuit



1. ABS hydraulic unit / control module assembly	1-3. ABS fail safe transistor	2-2. Unlock position
1-1. ABS pump motor transistor	2. ABS hydraulic unit / control module connector of harness	
1-2. ABS pump motor	2-1. Lock position	

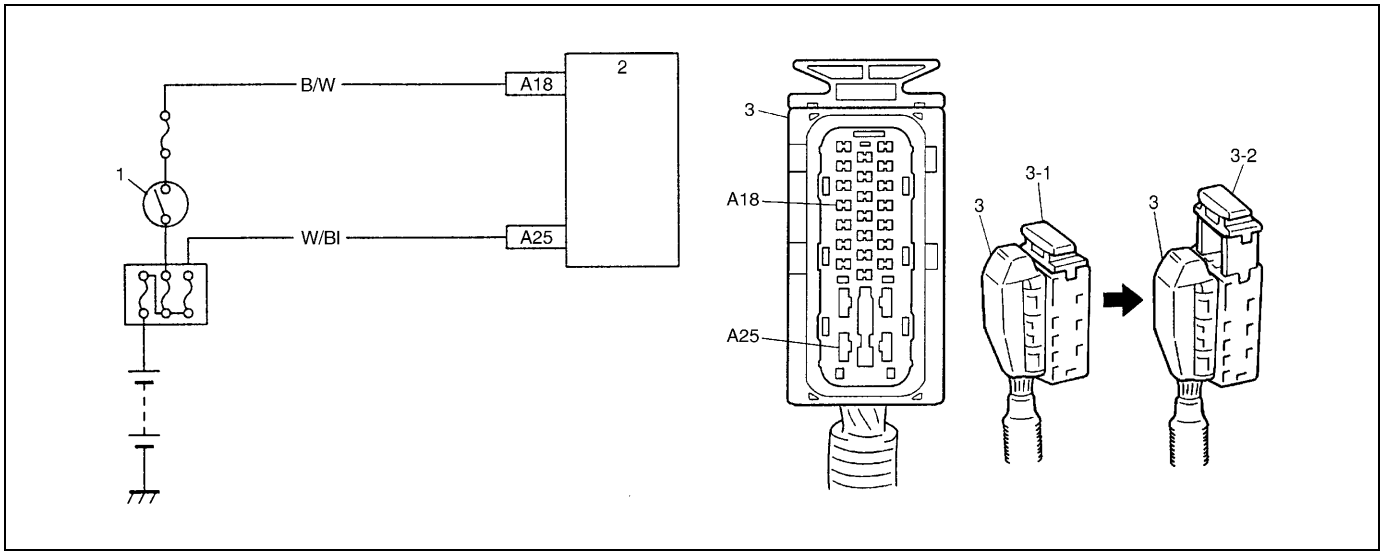
DESCRIPTION

The ABS control module monitors the voltage at the terminal “A23” of the pump motor circuit constantly with the ignition switch turned ON. It sets this DTC when the voltage at the terminal “A23” does not become high/low according to ON/OFF commands to the motor transistor of the module.

INSPECTION

Step	Action	Yes	No
1	1) Check pump motor referring to “ABS Hydraulic Unit Operation Check” in this section. Is it in good condition?	Check terminal “A23” connection. If connections OK, substitute a known-good ABS hydraulic unit / control module assembly and recheck.	Go to step 2.
2	1) Ignition switch OFF. 2) Disconnect ABS hydraulic unit / control module connector. 3) Check for proper connection to ABS hydraulic unit / control module connector at terminal “A23”. 4) If OK, then measure voltage between terminal “A23” of module connector and body ground. Is it 10 – 14V?	Go to step 3.	“W/Bl” circuit open.
3	Measure resistance between connector terminal “A22” of ABS hydraulic unit / control module assembly and body ground. Is it infinite (∞)?	“B” circuit open.	Substitute a known-good ABS hydraulic unit / control module assembly and recheck.

DTC C1063 (DTC 63) – ABS Fail Safe Circuit



1. Ignition switch	3-1. Lock position
2. ABS hydraulic unit / control module assembly	3-2. Unlock position
3. ABS hydraulic unit / control module connector of harness	

DESCRIPTION

The ABS control module monitors the voltage at the terminal of the solenoid circuit constantly with the ignition switch turned ON. Also, immediately after the ignition switch is turned “ON”, perform an initial check as follows. Switch the fail safe transistor in the order of ON → OFF → ON and check if the voltage at 6 solenoid circuit terminals changes to High → Low → High. If anything faulty is found in the initial check and when the voltage at all solenoid circuit terminals is low with the ignition switch turned ON and ABS not operated, this DTC will be set.

INSPECTION

Step	Action	Yes	No
1	Check battery voltage. Is it about 11 V or higher?	Go to step 2.	Check charging system referring to “Undercharged Battery” in Section 6H.
2	Check ABS main fuse and connection. Is it in good condition?	Go to step 3.	Repair and / or replace fuse.
3	1) Ignition switch OFF. 2) Disconnect ABS hydraulic unit / control module connector. 3) Check proper connection to ABS hydraulic unit / control module at terminal “A25”. 4) If OK, then measure voltage between connector terminal “A25” and body ground. Is it 10 – 14 V?	Substitute a known-good ABS hydraulic unit / control module assembly and recheck.	“W/Bl” circuit open or short to ground.

DTC C1071 (DTC 71) – ABS Control Module

DESCRIPTION

This DTC will be set when an internal fault is detected in the ABS control module.

INSPECTION

Step	Action	Yes	No
1	1) Ignition switch OFF. 2) Disconnect connectors from ABS control module. 3) Check for proper connection to ABS control module at all terminals. Are they in good condition?	Substitute a known-good ABS control module and recheck.	Repair or replace.

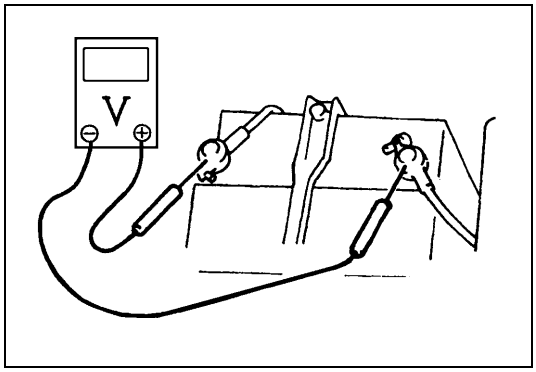
On-Vehicle Service

Precaution

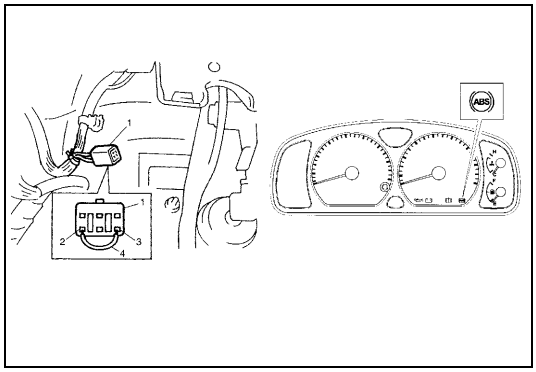
When connectors are connected to ABS hydraulic unit / control module assembly, do not disconnect connectors of sensors, fuse etc. and turn ignition switch ON. Then DTC will be set in ABS control module.

ABS Hydraulic Unit Operation Check

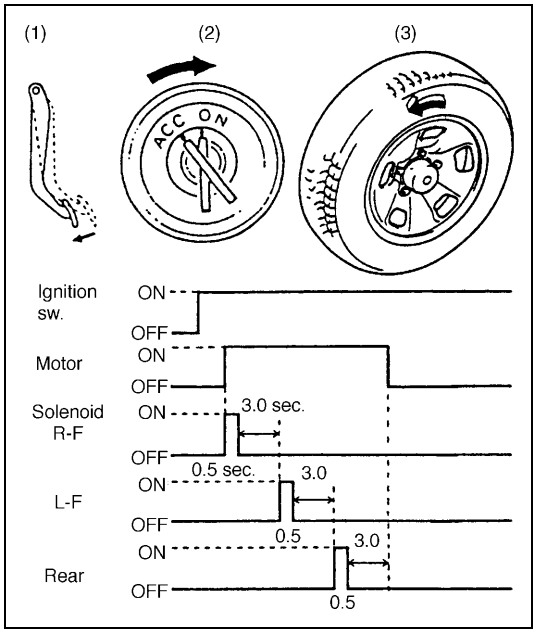
1) Check that basic brake system other than ABS is in good condition.



2) Check that battery voltage is 11 V or higher.
3) With ABS warning lamp, check that no abnormality is detected in ABS. Refer to “Diagnostic Trouble Code (DTC) Check” in this section.
4) Lift up vehicle.
5) Set transmission to neutral and release parking brake.
6) Turn each wheel gradually by hand to check if brake dragging occurs. If it does, correct.



7) With diag. switch terminal (3) of monitor connector (1) connected to ground terminal (2) by using service wire (4), turn ignition switch ON and check if ABS warning lamp indicates DTC 12.
   When other DTC’s appear on display, refer to “ABS Diagnostic Flow Table” in this section.
8) Turn ignition switch OFF.

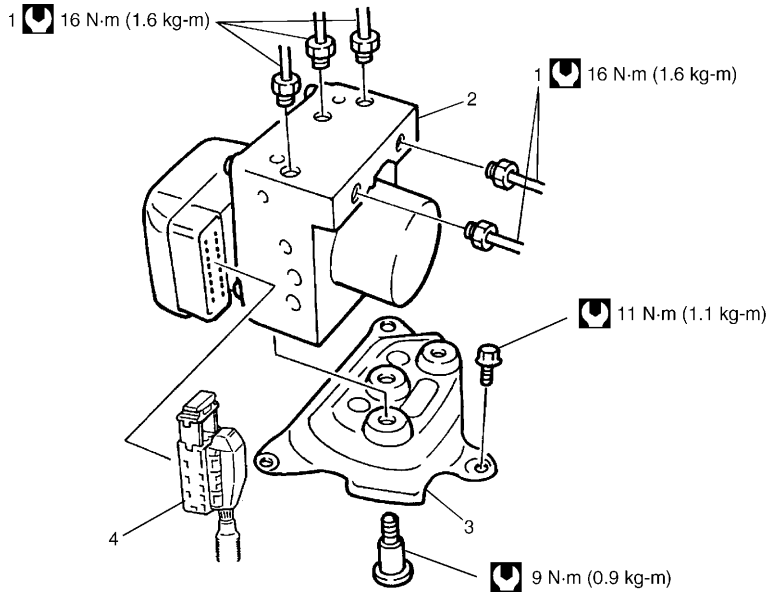


9) Perform following checks with help of another person.
   Brake pedal (1) should be depressed and then ignition switch (2) turned ON by one person and wheel (3) should be turned by another person’s hand. At this time, check that:
   - Operation sound of solenoid is heard and wheel turns only about 0.5 sec (Brake force is depressurized).
   - Operation sound of pump motor is heard and pulsation is felt at brake pedal.
10) If all 4-wheels cannot be checked during one ignition cycle (OFF → ON), repeat Steps 8) and 9) till all 4 wheels are checked.
    If a faulty condition is found in Steps 9) and 10), replace hydraulic unit.
11) Turn ignition switch OFF.
12) Remove service wire from monitor connector.

ABS Hydraulic Unit / Control Module Assembly

CAUTION:

Do not 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.



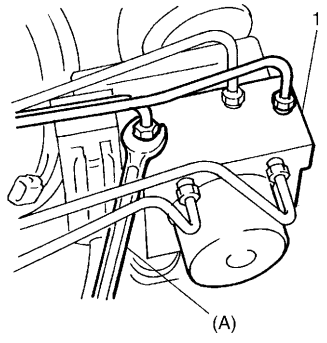
1. Brake pipe	3. Bracket	Tightening torque
2. ABS hydraulic unit / control module assembly	4. Connector	

HYDRAULIC UNIT INSPECTION

Check hydraulic unit for fluid leakage.
If any, repair or replace.

REMOVAL

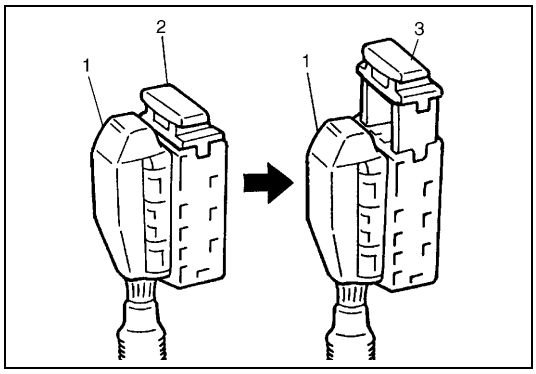
1) Disconnect negative cable at battery.
2) Using special tool, disconnect brake pipes from ABS hydraulic unit / control module assembly (1).



Special tool
(A) : 09950-78220

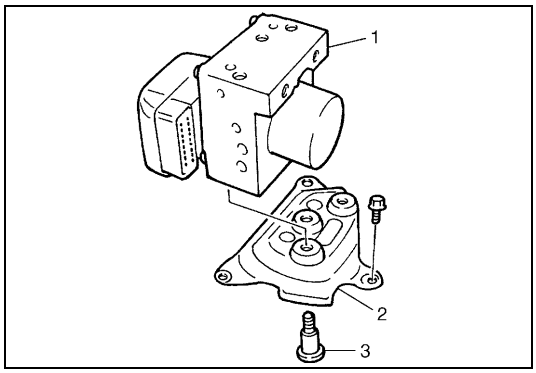
NOTE:

Put bleeder plug cap onto pipe to prevent fluid from spilling. Do not allow brake fluid to get on painted surfaces.



3) Disconnect ABS hydraulic unit / control module assembly connector (1) by pulling up lock.
4) Remove ABS hydraulic unit / control module assembly with its bracket.

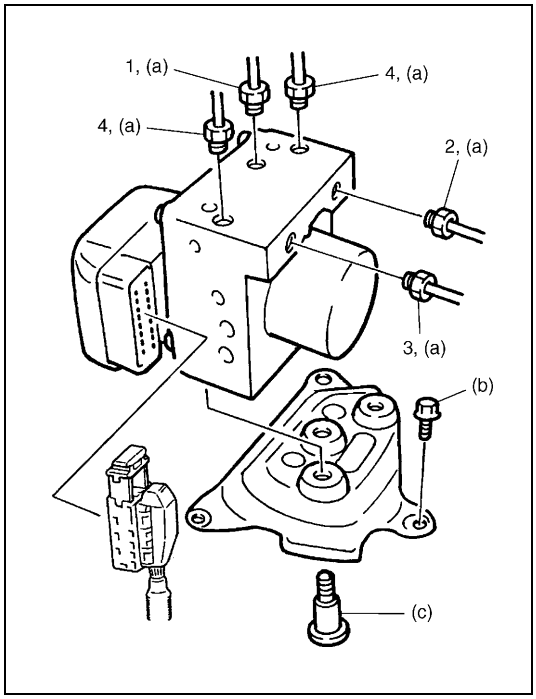
2. Lock position
3. Unlock position



5) Remove three bolts (3) and take out ABS hydraulic unit / control module assembly (1) from bracket (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



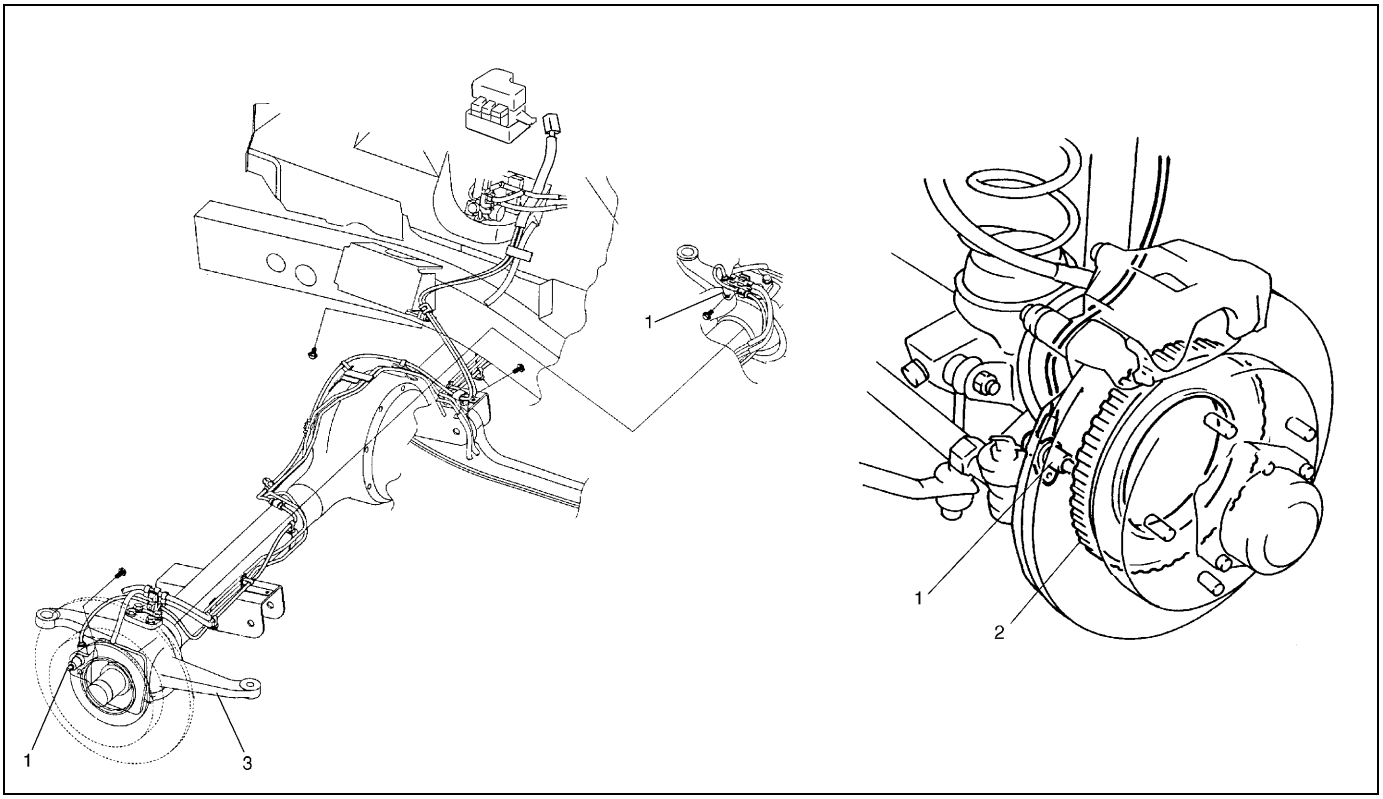
1) Install hydraulic unit by reversing removal procedure.

Tightening torque
Brake pipe flare nuts
(a) : 16 N·m (1.6 kg-m, 12.0 lb-ft)
ABS hydraulic unit / control module assembly bracket bolts
(b) : 11 N·m (1.1 kg-m, 8.0 lb-ft)
ABS hydraulic unit / control module assembly bolts
(c) : 9 N·m (0.9 kg-m, 6.5 lb-ft)

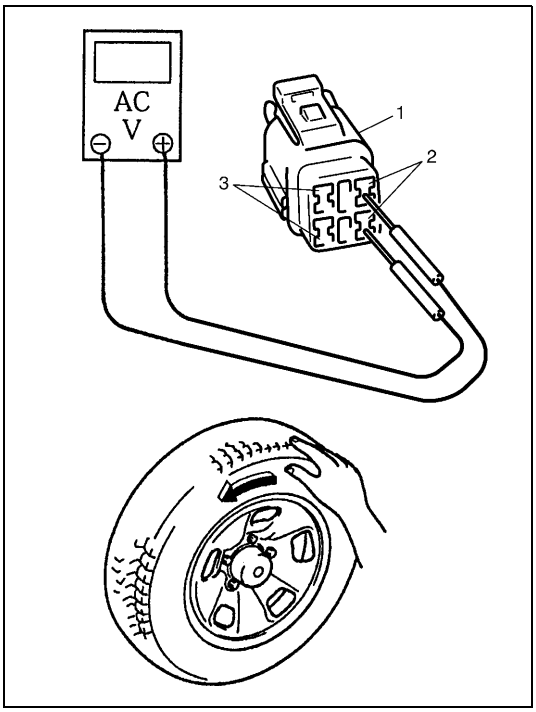
2) Bleed air from brake system referring to “Air Bleeding of Brake System” in Section 5.
3) Check each installed part for fluid leakage and perform hydraulic unit operation check.

1. To left front
2. To right front
3. To rear
4. From proportioning valve

Front Wheel Speed Sensor



1. Front wheel speed sensor	3. Knuckle
2. Sensor ring	



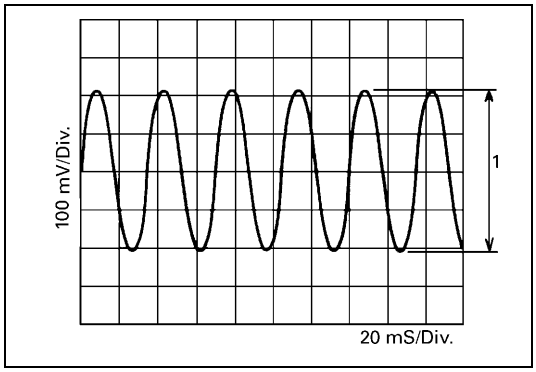
OUTPUT VOLTAGE INSPECTION

1) Turn ignition switch OFF.
2) Hoist vehicle a little.
3) Disconnect connector of wheel speed sensor.
4) Connect voltmeter between connector terminals.
5) While turning wheel 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
: 120 mV or more at 42 – 54 Hz

If measured voltage is not as specified, check sensor, rotor and their installation conditions.

1. Wheel speed sensor coupler
2. Right wheel sensor terminals
3. Left wheel sensor terminals



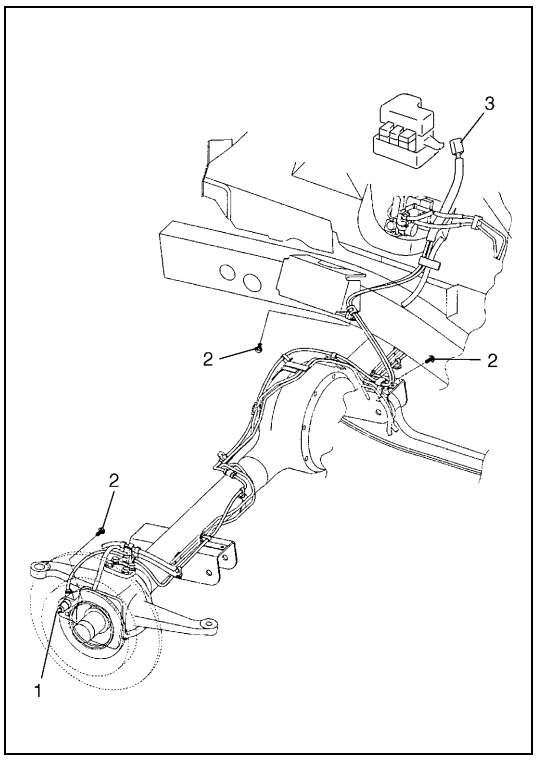
Reference

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
: 340 mV or more at 42 – 54 Hz

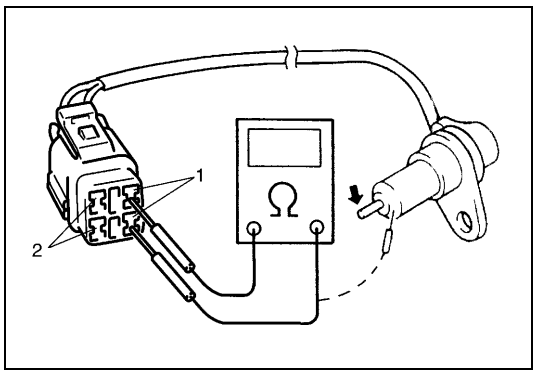
REMOVAL

1) Disconnect negative cable at battery.
2) Disconnect front wheel speed sensor coupler (3).
3) Hoist vehicle and remove wheel.
4) Remove harness clamp bolts (2) and front wheel speed sensor (1) 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.**

SENSOR INSPECTION



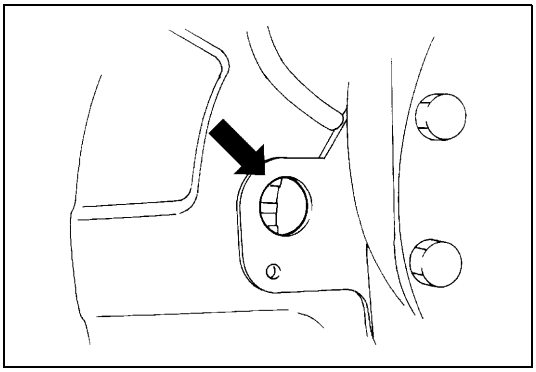
- Check sensor for damage.
- Check sensor for resistance.
  If any malfunction is found, replace.

Resistance between terminals of sensor
: 1.2 – 1.6 kΩ at 20 °C (68 °F)

Resistance between terminal and sensor body
: 1 MΩ or more

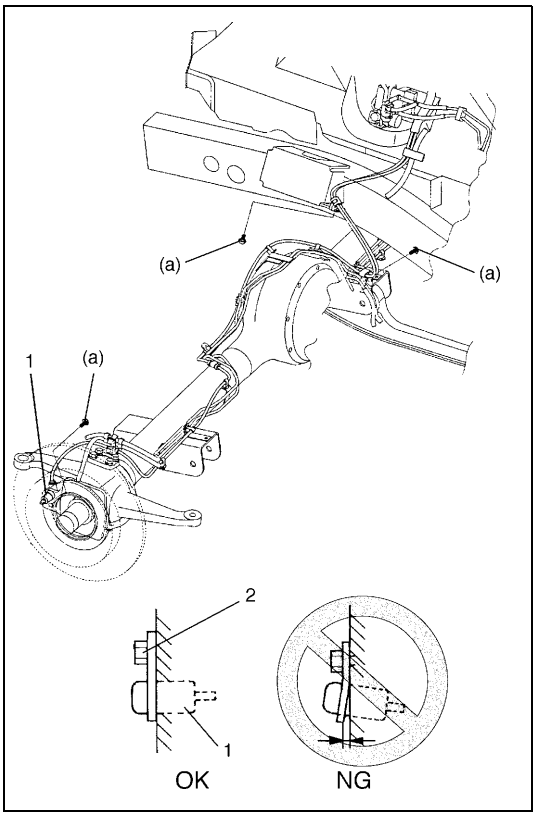
1.	Right wheel sensor terminals
2.	Left wheel sensor terminals

SENSOR RING INSPECTION



- Check ring teeth 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.

INSTALLATION



1) Check that no foreign material is attached to sensor (1) and ring.
2) Install it by reversing removal procedure.

Tightening torque
Front wheel speed sensor bolt and front wheel speed sensor harness clamp bolts
(a) : 10 N·m (1.0 kg-m, 7.2 lb-ft)

3) Check that there is no clearance between sensor and knuckle.

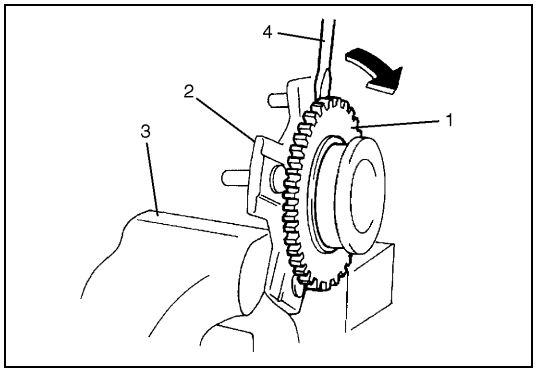
CAUTION:
Do not pull wire harness or twist more than necessary when installing front wheel speed sensor.

2. Bolt

Front Wheel Sensor Ring

REMOVAL

1) Remove wheel hub with sensor ring. Refer to “Wheel Hub / Bearing / Oil Seal” in Section 3D.



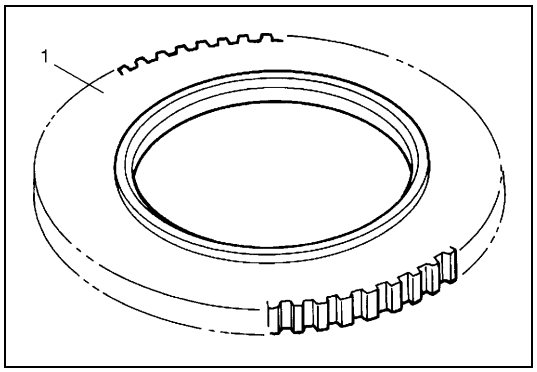
2) Remove sensor ring (1) from wheel hub (2) as shown.

CAUTION:

Pull out sensor ring (1) from wheel hub (2) gradually and evenly. Attempt to pull it out partially may cause it to be deformed.

3. Vise
4. Lever

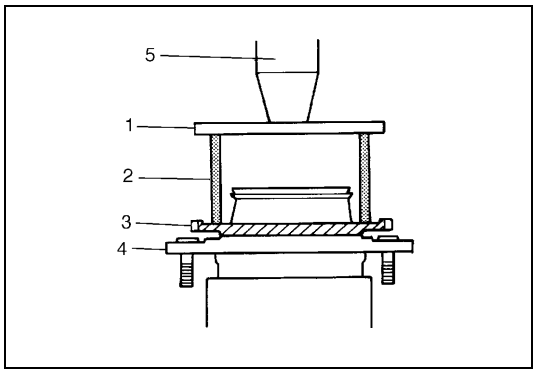
INSPECTION



- Check ring teeth for being missing, damaged or deformed.
- Check sensor ring (1) for being deformed.
- Check that no foreign material is attached.

If any malcondition is found, repair or replace.

INSTALLATION



1) Install sensor ring (3) as shown.

NOTE:

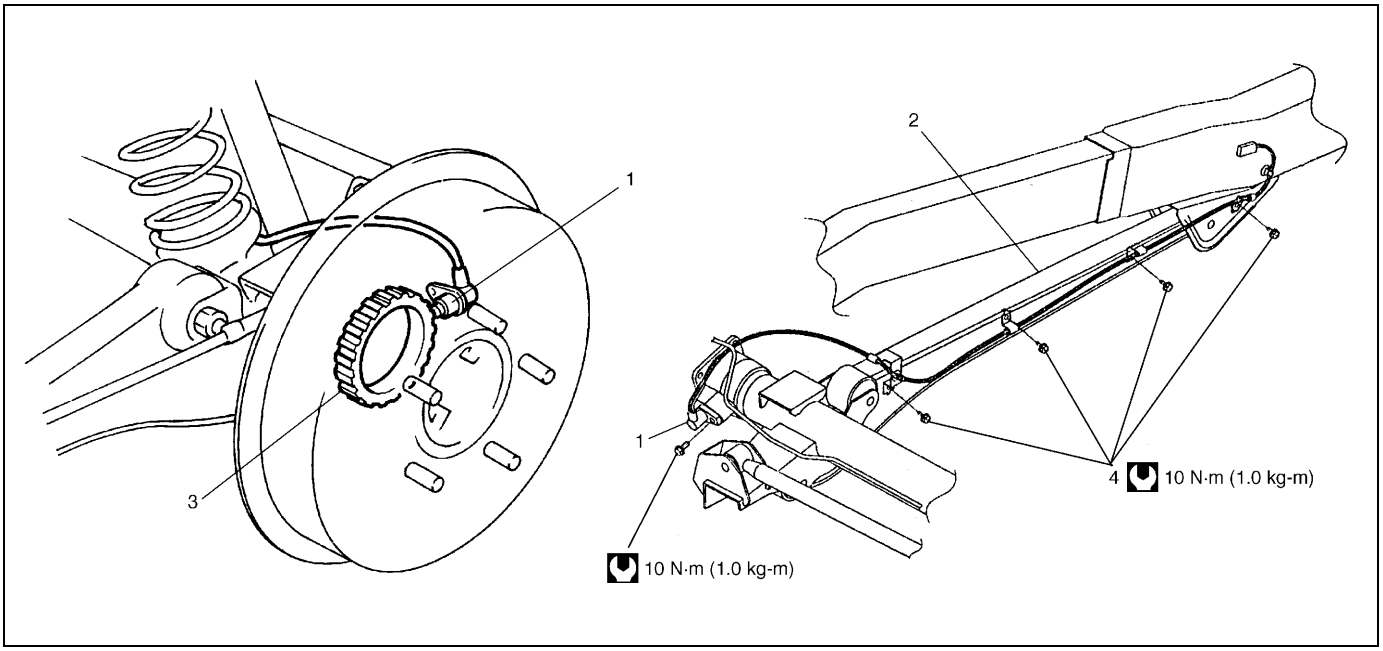
- **Pipe (2) used here should have inner diameter of 90 mm (3.55 in) – 96 mm (3.77 in) and its outside should not contact teeth of sensor ring.**
- **Use care not to insert wheel hub diagonally.**

1. Steel plate
4. Wheel hub
5. Hydraulic press

2) Install wheel hub, brake disc, brake caliper, locking hub and wheel.

Refer to “Wheel Hub / Bearing / Oil Seal” in Section 3D.

Rear Wheel Speed Sensor



1. Left rear wheel sensor	3. Sensor ring	Tightening torque
2. Trailing arm	4. Clamp bolt	

OUTPUT VOLTAGE INSPECTION

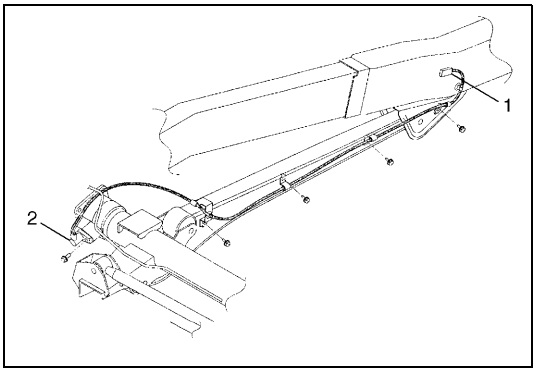
Check in the same procedure as that used of front wheel speed sensor check.

Output AC voltage at 1 to 1 1/3 rotation per second
: 100 mV or more at 38 – 49 Hz

Reference

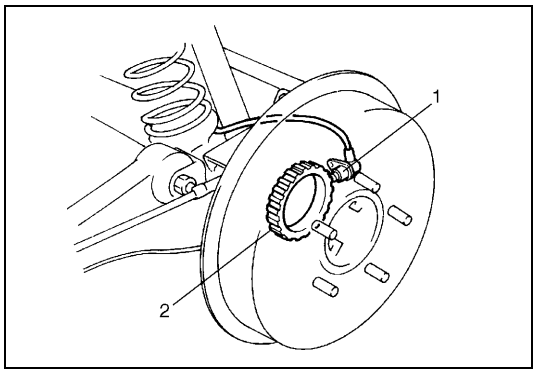
When using oscilloscope, peak-to-peak voltage at 1 to 1 1/3 rotation per second
: 280 mV or more at 38 – 49 Hz

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 from suspension frame.

2. Rear wheel sensor

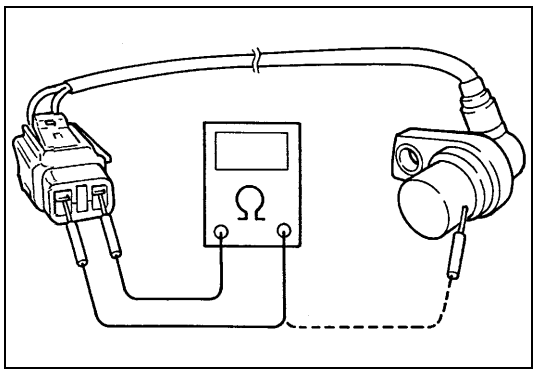


5) Remove rear wheel speed sensor (1) from rear axle housing.

CAUTION:
- **Do not pull wire harness when removing rear wheel speed sensor (1).**
- **Do not cause damage to surface of rear wheel speed sensor and do not allow dust, etc. to enter its installation hole.**

2. Rear wheel sensor ring

SENSOR INSPECTION



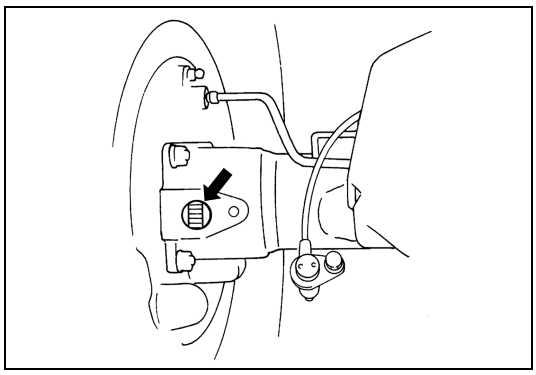
- Check sensor for damage.
- Check sensor for resistance.

Resistance between terminals of sensor
: 1.4 – 1.8 kΩ at 20 °C (68 °F)

Resistance between sensor terminal and sensor body
: 1 MΩ or more

If any malcondition is found, replace.

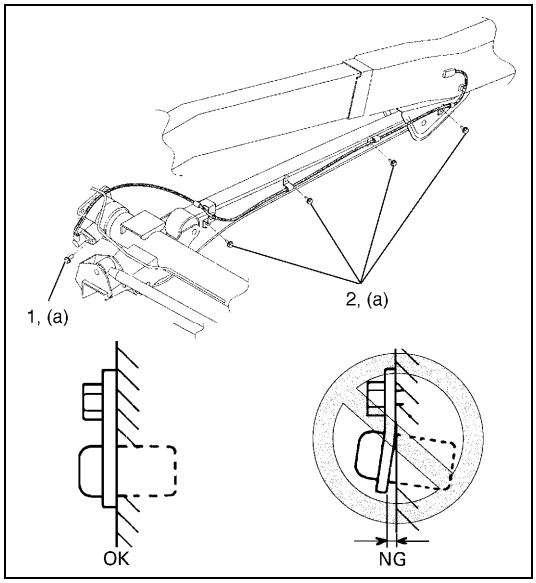
SENSOR RING INSPECTION



- Check ring teeth for being missing, damaged or deformed.
- Turn wheel 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.

INSTALLATION



1) Check that no foreign material is attached to sensor and ring.
2) Install it by reversing removal procedure.

Tightening torque
Rear wheel speed sensor bolt and rear wheel speed sensor harness clamp bolts
(a) : 10 N·m (1.0 kg-m, 7.2 lb-ft)

CAUTION:
Do not pull wire harness or twist more than necessary when installing rear wheel speed sensor.

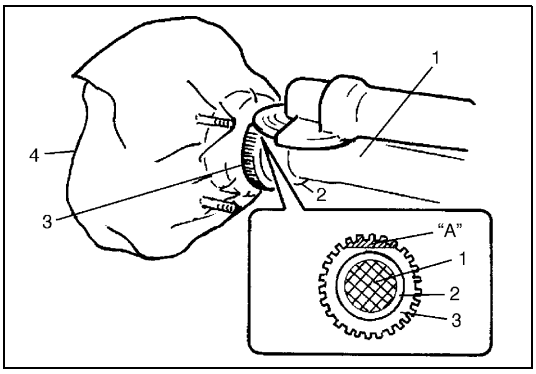
1. Sensor bolt
2. Clamp bolt

3) Check that there is no clearance between sensor and rear axle housing.

Rear Wheel Sensor Ring

REMOVAL

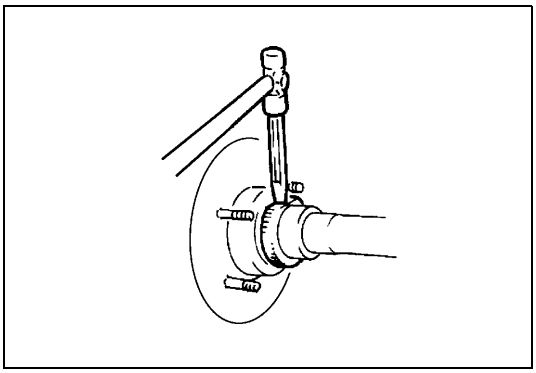
1) Remove rear axle shaft. Refer to “Rear Axle Shaft and Wheel Bearing” in Section 3E.



2) In order to remove sensor ring (3) from retainer ring (2), grind with a grinder one part of the sensor ring (3) as illustrated till it becomes thin.

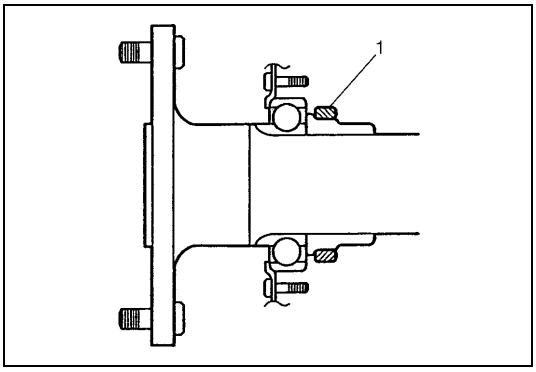
CAUTION:
- **Cover vinyl sheet (4) or the like over wheel bearing so that fine grains from grinding will not enter there.**
- **Be careful not to go so far as to grind the retainer ring (2).**

1.	Rear axle
“A”:	Grind with grinder



3) Break with a chisel the thin ground sensor ring, and it can be removed.

INSTALLATION



1) Press-fit sensor ring (1) as shown.

NOTE:

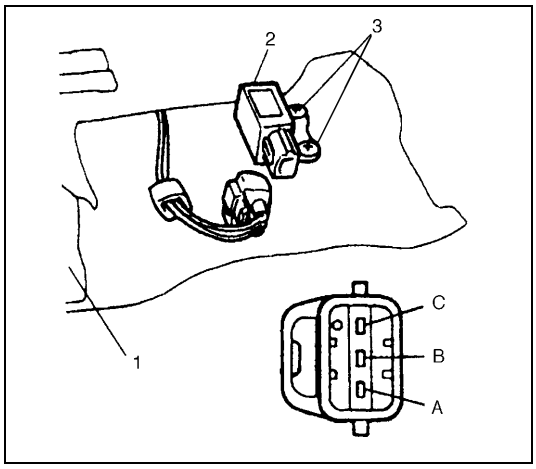
Use care not to cause any damage to outside of retainer ring.

2) Install rear axle shaft referring to “Rear Axle Shaft and Wheel Bearing” in Section 3E.
3) Install brake drum and wheel.
   Refer to “Brake Drum” in Section 5.

G Sensor

REMOVAL

1) Turn ignition switch “OFF” and disconnect battery negative cable.
2) Remove rear center console box.

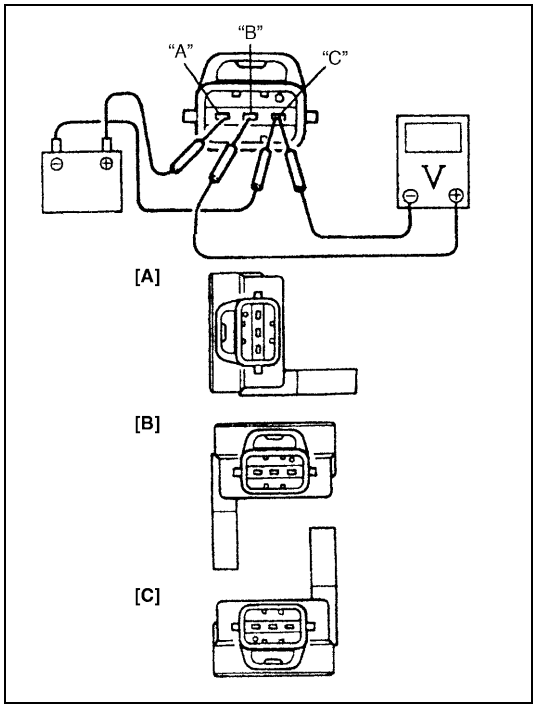


3) Disconnect connector from G sensor (2).
4) Remove G sensor (2) from floor.

CAUTION:
Sensor must not be dropped or shocked. It will affect its original performance.

1.	Parking brake lever assembly
3.	Bolt

INSPECTION

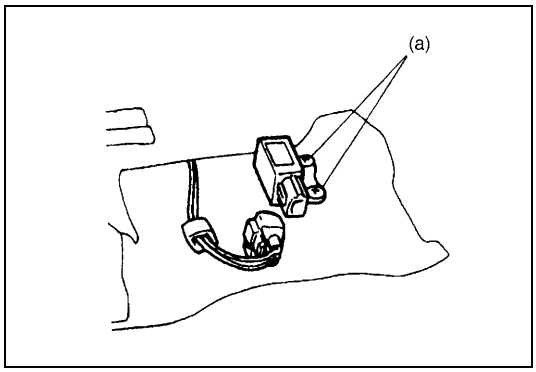


Connect positive cable of 12 volt battery to “A” terminal of sensor and ground cable to “C” terminal. Then using voltmeter, check voltage between “B” terminal and “C” terminal.
If measured voltage is not as specified, replace sensor with bracket.

G sensor specification
When placed horizontally : 2 – 3V
When placed upright with arrow upward : 3 – 4V
When placed upright with arrow downward : 1 – 2V

[A] :	Horizontal
[B] :	Upright with arrow upward
[C] :	Upright with arrow downward

INSTALLATION



1) Connect connector to sensor securely.
2) Install sensor onto floor so that arrow mark directs vehicle forward.

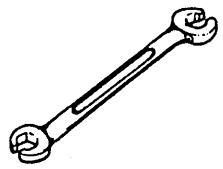
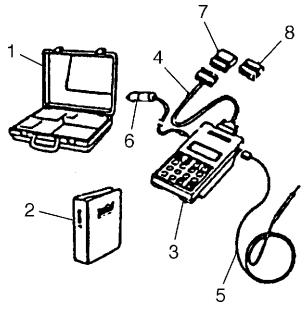
Tightening torque
G sensor bolts
(a) : 23 N·m (2.3 Kg-m, 17.0 lb-ft)

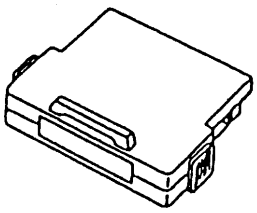
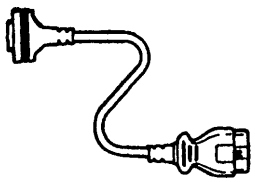
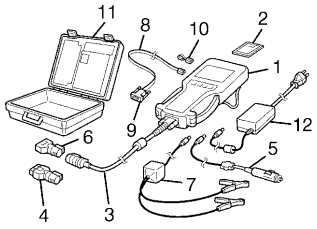
3) Install rear console box.

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Brake pipe flare nuts	16	1.6	11.6
ABS hydraulic unit / control module assembly bracket bolts	11	1.1	8.0
ABS hydraulic unit / control module assembly bolts	9	0.9	6.5
Front wheel speed sensor bolt	10	1.0	7.2
Front wheel speed sensor harness clamp bolts	10	1.0	7.2
Rear wheel speed sensor bolt	10	1.0	7.2
Rear wheel speed sensor harness clamp bolts	10	1.0	7.2
G sensor bolts	23	2.3	17.0

Special Tool

<table>
<tr>
<td> 
09950-78220
Flare nut wrench (10 mm)</td>
<td> 

09931-76011
Tech 1A kit (SUZUKI scan tool) See NOTE “A” below</td>
<td> 
Mass storage cartridge for Tech 1A</td>
<td> 
09931-76030
16/14 pin DLC cable for Tech 1A</td>
</tr>
<tr>
<td> 

Tech 2 kit (SUZUKI scan tool) See NOTE “B” below.</td>
<td></td>
<td></td>
<td></td>
</tr>
</table>

NOTE:

- **“A” : This kit includes the following items and substitutes for the Tech 2 kit.**
  1. Storage case, 2. Operator’s manual, 3. Tech 1A, 4. DLC cable, 5. Test lead / probe, 6. Power source cable, 7. DLC cable adaptor, 8. Self-test adaptor
- **“B” : This kit includes the following items and substitutes for the Tech 1A kit.**
  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 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 "Air Bag 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:

Whether the following systems (parts) are used in the particular vehicle or not depends on vehicle specifications. Be sure to bear this in mind when performing service work.

- **EGR valve**
- **Heated oxygen sensor(s) or CO adjusting resistor**
- **Three-way catalytic converter (TWC) and warm up three-way catalytic converter (WU-TWC)**

GENERAL INFORMATION AND ENGINE DIAGNOSIS 6-1
ENGINE MECHANICAL 6A1-1
ENGINE COOLING 6B-1
ENGINE FUEL 6C-1
ENGINE AND EMISSION CONTROL SYSTEM 6E-1
IGNITION SYSTEM 6F-1
CRANKING SYSTEM 6G-1
CHARGING SYSTEM 6H-1
EXHAUST SYSTEM 6K-1

CONTENTS

General Information 6-3
Statement on Cleanliness and Care 6-3
General Information on Engine Service 6-3
Precaution on fuel system service 6-4
Fuel pressure relief procedure 6-5
Fuel leakage check procedure 6-5
Engine Diagnosis 6-6
General Description 6-6
On-Board Diagnostic System (Vehicle with Immobilizer Indicator Lamp) 6-6
On-Board Diagnostic System (Vehicle without Immobilizer Indicator Lamp) 6-9
Precaution in Diagnosing Trouble 6-10
Engine Diagnostic Flow Table 6-11
Customer problem inspection form (example) 6-13
Malfunction indicator lamp (MIL) check 6-14
Diagnostic trouble code (DTC) check 6-14
Diagnostic trouble code (DTC) clearance 6-15

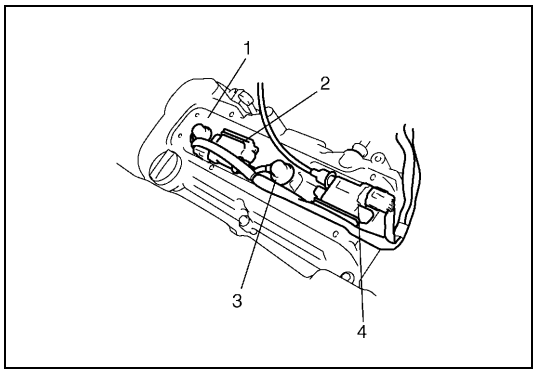
Diagnostic trouble code (DTC) table 6-16
Fail-safe table..... 6-19
Visual inspection 6-20
Engine basic inspection 6-21
Engine diagnosis table 6-23
Scan Tool Data 6-28
Scan tool data definitions 6-30
Inspection of ECM and Its Circuits 6-33
Component Location..... 6-42
Table A-1 Malfunction Indicator Lamp Circuit Check - Lamp Does Not Come “ON” at Ignition Switch ON (But Engine at Stop)..... 6-43
Table A-2 Malfunction Indicator Lamp Circuit Check - Lamp Remains “ON” after Engine Starts..... 6-44
Table A-3 Malfunction Indicator Lamp Circuit Check - Mil Flashes at Ignition Switch ON.... 6-45
Table A-4 Malfunction Indicator Lamp Circuit Check - MIL Does Not Flash, Just Remains ON or Just Remains OFF Even with Grounding Diagnosis Switch Terminal..... 6-45
Table A-5 ECM Power and Ground Circuit Check - MIL Doesn’t Light at Ignition Switch ON and Engine Doesn’t Start Though It Is Cranked Up..... 6-46
DTC P0105 (DTC No.11) Manifold Absolute Pressure (MAP) Circuit Malfunction..... 6-48
DTC P0110 (DTC No.18) Intake Air Temp. (IAT) Circuit Malfunction 6-51
DTC P0115 (DTC No.19) Engine Coolant Temperature (ECT) Circuit Malfunction 6-53
DTC P0120 (DTC No.13) Throttle Position Circuit Malfunction 6-55
DTC P0121 Throttle Position Circuit Range / Performance Problem..... 6-57
DTC P0130 (DTC No.14) Heated Oxygen Sensor (HO2S) Circuit Malfunction (Sensor-1)..... 6-59
DTC P0133 Heated Oxygen Sensor (HO2S) Circuit Slow Response (Sensor-1)..... 6-61
DTC P0135 (DTC No.14) Heated Oxygen Sensor (HO2S) Heater Circuit Malfunction (Sensor-1)..... 6-62
DTC P0136 Heated Oxygen Sensor (HO2S) Circuit Malfunction (Sensor-2) 6-64
DTC P0141 Heated Oxygen Sensor (HO2S) Heater Circuit Malfunction (Sensor-2)..... 6-66
DTC P0171 Fuel System Too Lean..... 6-68
DTC P0172 Fuel System Too Rich..... 6-68
DTC P0300 Random Misfire Detected (Misfire Detected at 2 or More Cylinders) 6-72
DTC P0301 Cylinder 1 Misfire Detected.....6-72
DTC P0302 Cylinder 2 Misfire Detected.....6-72
DTC P0303 Cylinder 3 Misfire Detected.....6-72
DTC P0304 Cylinder 4 Misfire Detected.....6-72
DTC P0325 (DTC No.17) Knock Sensor Circuit Malfunction 6-77
DTC P0335 (DTC No.23) Crankshaft Position (CKP) Sensor Circuit Malfunction 6-79
DTC P0340 (DTC No.15) Camshaft Position (CMP) Sensor Circuit Malfunction 6-82
DTC P0400 Exhaust Gas Recirculation Flow Malfunction 6-85
DTC P0420 Catalyst System Efficiency below Threshold.....6-88
DTC P0443 Purge Control Valve Circuit Malfunction 6-91
DTC P0481 A/C Condenser Fan Control Circuit Malfunction 6-92
DTC P0500 (DTC No.16) Vehicle Speed Sensor (VSS) Malfunction 6-94
DTC P0505 Idle Control System Malfunction 6-96
DTC P0601 Internal Control Module Memory Check Sum Error (DTC No.71).....6-98
DTC P1450 Barometric Pressure Sensor Low / High Input.....6-99
DTC P1451 Barometric Pressure Sensor Performance Problem.....6-99
DTC P1500 Engine Starter Signal Circuit Malfunction 6-101
DTC P1510 ECM Back-up Power Supply Malfunction 6-103
DTC P1570 (DTC No.21) ABS Signal Circuit Malfunction 6-104
DTC P1600 Serial Communication Problem Between ECM and TCM 6-105
DTC P1717 A/T Drive Range (Park / Neutral Position) Signal Circuit Malfunction 6-107
Table B-1 Fuel Injector Circuit Check 6-109
Table B-2 Fuel Pump and Its Circuit Check.....6-110
Table B-3 Fuel Pressure Check.....6-112
Table B-4 Idle Air Control System Check 6-114
Table B-5 A/C Signal Circuits Check (Vehicle with A/C) 6-117
Table B-6 Electric Load Signal Circuit Check.....6-119
TAble B-7 A/C Condenser Fan Control System Check.....6-121
Special Tool 6-123

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.

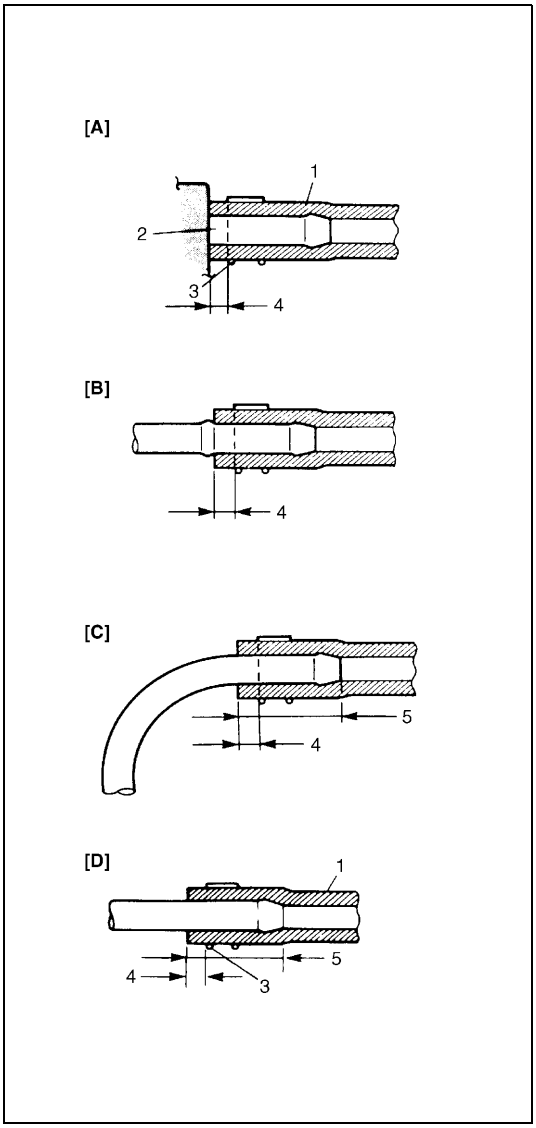
General Information on Engine Service

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 delivery pipe) 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.

[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 (0.1 2 – 0.27 in.) from hose end.
5.	20 to 30 mm (0.79 – 1.18 in.)

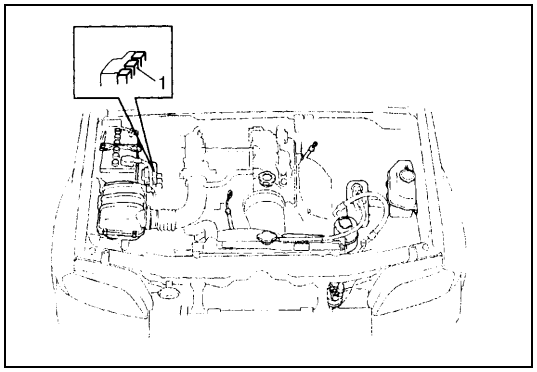
- When installing injector or fuel delivery pipe, lubricate its O-ring with spindle oil or gasoline.
- When connecting fuel pipe flare nut, first tighten flare nut by hand and then tighten it to specified torque.

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.

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 box cover.



3) Disconnect fuel pump relay (1) from its connector.
4) Remove fuel filler 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 its connector.

Fuel leakage check procedure

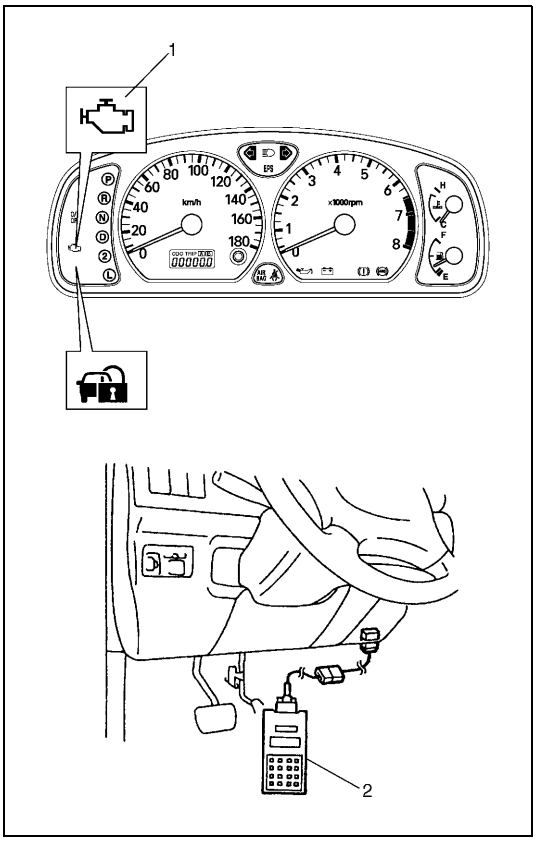
After performing any service on fuel system, check to make sure that there are no fuel leakages as follows.

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.

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 DIAGNOSTIC FLOW TABLE".
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 table.



On-Board Diagnostic System (Vehicle with Immobilizer Indicator Lamp)

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 bulb 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 generic scan tool. (Diagnostic information can be accessed by using a scan tool.)

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.

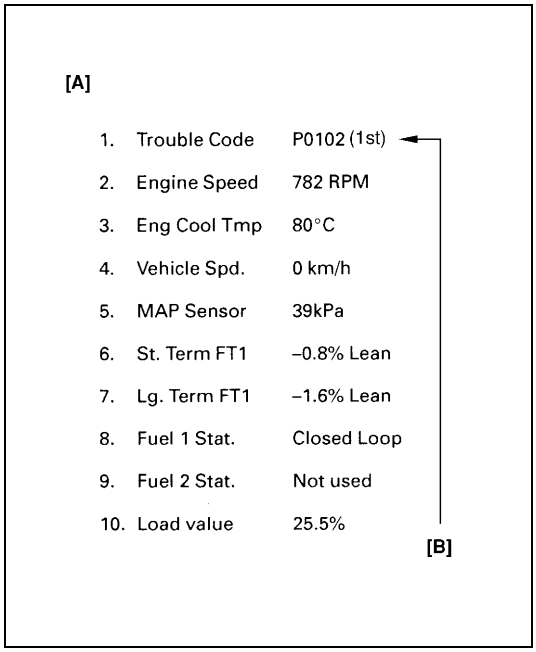
2 DRIVING CYCLES DETECTION LOGIC

The malfunction detected in the first driving cycle is stored in ECM memory (in the form of pending DTC and freeze frame data) 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 from 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.

[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 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”.)

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

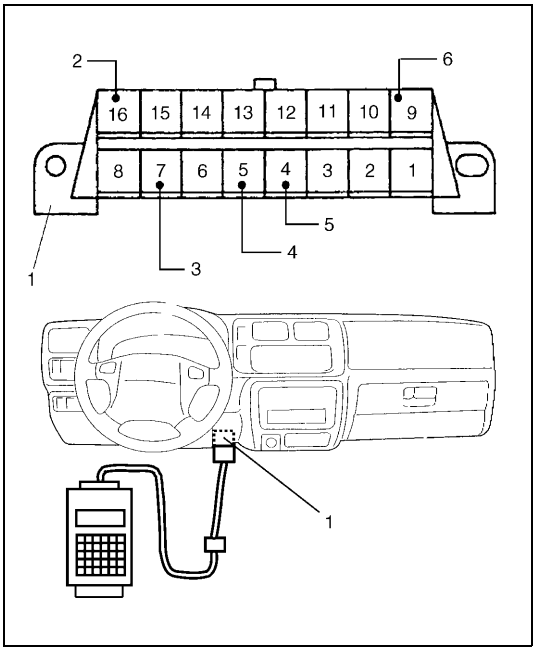
In the 2nd through the 4th frames, the freeze frame data of each malfunction is stored in the order as the malfunction is detected. These data are not updated.
Shown in the table below are examples of how freeze frame data are stored when two or more malfunctions are detected.

			FRAME			
			FRAME 1	FRAME 2	FRAME 3	FRAME4
			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	P0400 (EGR) detected	Data at P0400 detection	Data at P0400 detection	–	–
	2	P0171 (Fuel system) detected	Data at P0171 detection	Data at P0400 detection	Data at P0171 detection	–
	3	P0300 (Misfire) detected	Data at P0171 detection	Data at P0400 detection	Data at P0171 detection	Data at P0300 detection
	4	P0301 (Misfire) detected	Data at P0171 detection	Data at P0400 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).

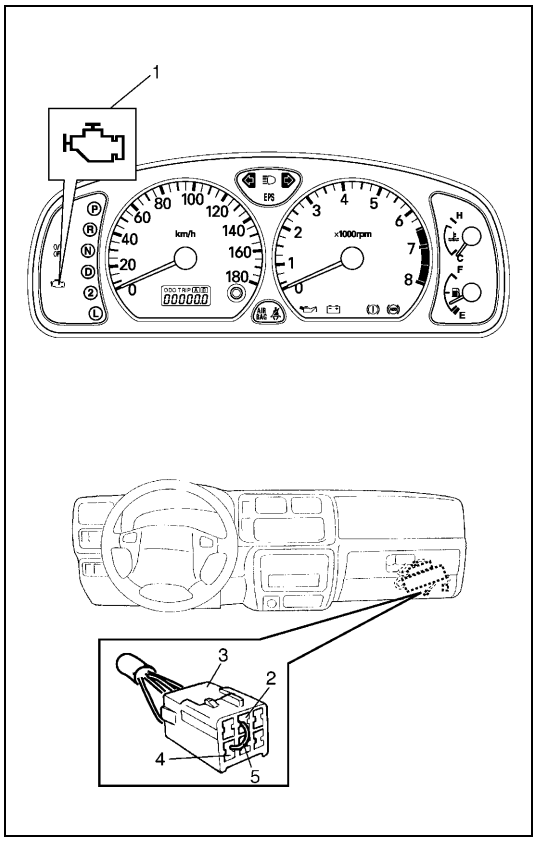
DATA LINK CONNECTOR (DLC)



DLC (1) is in compliance with SAEJ1962 in its installation position, the shape of connector and pin assignment.
Serial data line (K line of ISO 9141) (3) is used for SUZUKI scan tool or generic scan tool to communicate with ECM, TCM, 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+
4. ECM ground
5. Body ground

On-Board Diagnostic System (Vehicle without Immobilizer Indicator Lamp)



ECM diagnosis troubles which may occur in the area including the following parts when the ignition switch is ON and the engine is running, and indicates the result by turning on or flashing malfunction indicator lamp (1).

- Heated oxygen sensor (if equipped)
- ECT sensor
- TP sensor
- IAT sensor
- MAP sensor
- CMP sensor
- CKP sensor
- Knock sensor
- VSS
- CPU (Central Processing Unit) of ECM

ECM and malfunction indicator lamp (1) operate as follows.

- Malfunction indicator lamp (1) lights when the ignition switch is turned ON (but the engine at stop) with the diagnosis switch terminal ungrounded regardless of the condition of Engine and Emission Control system. This is only to check the malfunction indicator lamp (1) bulb and its circuit.
- If the above areas of Engine and Emission Control system is free from any trouble after the engine start (while engine is running), malfunction indicator lamp (1) turns OFF.
- When ECM detects a trouble which has occurred in the above areas, it makes malfunction indicator lamp (1) turn ON while the engine is running to warn the driver of such occurrence of trouble and at the same time it stores the trouble area in ECM back-up memory. (The memory is kept as it is even if the trouble was only temporary and disappeared immediately. And it is not erased unless the power to ECM is shut off for specified time below.)

  ECM also indicates trouble area in memory by means of flashing of malfunction indicator lamp (1) at the time of inspection. (i.e. when connecting diagnosis switch terminal (2) and ground terminal (4) of monitor connector (3) with a service wire (5) and ignition switch is turned ON.)

NOTE:

- **When a trouble occurs in the above areas and disappears soon while the diagnosis switch terminal is ungrounded and the engine is running, malfunction indicator lamp (1) lights and remains ON as long as the trouble exists but it turns OFF when the normal condition is restored.**
- **Time required to erase diagnostic trouble code memory thoroughly varies depending on ambient temperature as follows.**

AMBIENT TEMPERATURE	TIME TO CUT POWER TO ECM
Over 0 °C (32 °F)	60 sec. or longer
Under 0 °C (32 °F)	Not specifiable. Select a place with higher than 0 °C (32 °F) temperature.

Precaution in Diagnosing Trouble

- Don't disconnect couplers from ECM, battery cable at 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 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 (Vehicle with Immobilizer indicator lamp).
  If multiple 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 P0400 (EGR flow malfunction)
  – DTC P0171/P0172 (Fuel system too lean / too rich) and DTC P0400 (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 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 Diagnostic Flow Table

Refer to the following pages for the details of each step.

Step	Action	Yes	No
1	Customer Complaint Analysis 1) Perform customer complaint analysis referring to the 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 followings. Is there any DTC(s)?	Print DTC and freeze frame data or write them down and clear them by referring to “DTC Clearance” section. Go to Step 3.	Go to Step 4.
3	Visual Inspection 1) Perform visual inspection referring to the followings. Is there any faulty condition?	Repair or replace malfunction part. Go to Step 11.	Go to Step 5.
4	Visual Inspection 1) Perform visual inspection referring to the followings. Is there any faulty condition?		Go to Step 8.
5	Trouble Symptom Confirmation 1) Confirm trouble symptom referring to the 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 “DTC Check” 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 “DTC Check” section. Is there any DTC(s)?		Go to Step 10.
8	Engine Basic Inspection and Engine Diagnosis Table 1) Check and repair according to “Engine Basic Inspection” and “Engine Diagnosis Table” 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 the followings. Is there any faulty condition?	Repair or replace malfunction part(s). Go to Step 11.	Go to Step 11.
11	Final Confirmation Test 1) Clear DTC if any. 2) Perform final confirmation test referring to the 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 “DTC check” section. If DTC is indicated, print it and freeze frame data or write them down and then clear them by referring to “DTC clearance” 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 5.
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.

NOTE:

If only Automatic transmission DTCs (P0702-P1717) or Immobilizer DTCs (P1620-P1623) are indicated in this step, perform trouble diagnosis according to “Diagnosis” in Section 7B or Section 8G.

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” 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 section.

6. AND 7. RECHECKING AND RECORD OF DTC / FREEZE FRAME DATA

Refer to “DTC Check” section for checking procedure.

8. ENGINE BASIC INSPECTION AND ENGINE DIAGNOSIS TABLE

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 Diagnosis Table” 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. TROUBLESHOOTING FOR DTC (SEE EACH DTC DIAG. FLOW TABLE)

Based on the DTC indicated in Step 5 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:	

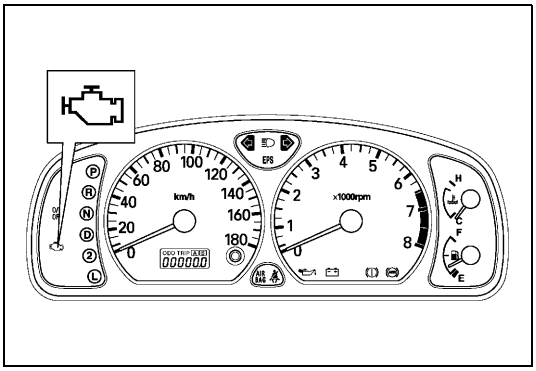
VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather Temperature Frequency Road	☐Fair ☐Cloudy ☐Rain ☐Snow ☐Always ☐Other_____ ☐Hot ☐Warm ☐Cool ☐Cold (°F/ °C) ☐Always ☐Always ☐Sometimes (times/ day, month) ☐Only once ☐Under certain condition ☐Urban ☐Suburb ☐Highway ☐Mountainous (☐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

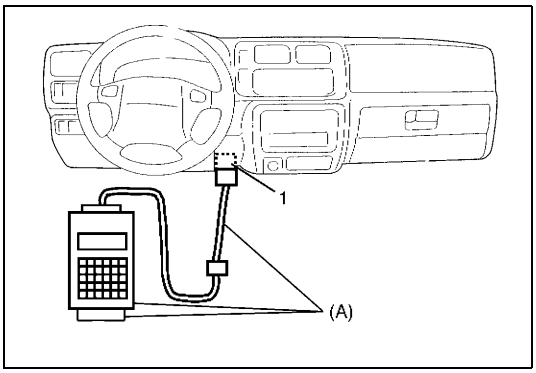


1) Turn ON ignition switch (but the engine at stop) and check that MIL lights.
   If MIL does not light up (or MIL dims), go to "Diagnostic Flow Table A-1" for troubleshooting.
   If MIL flushes, go to "Diagnostic Flow Table A-3" for trouble shooting (vehicle without immobilizer indicator lamp).
2) Start engine and check that MIL turns OFF.
   If MIL remains ON and no DTC is stored in ECM, go to "Diagnostic Flow Table A-2" for troubleshooting.

Diagnostic trouble code (DTC) check

[Using SUZUKI Scan Tool]

1) Prepare SUZUKI scan tool.



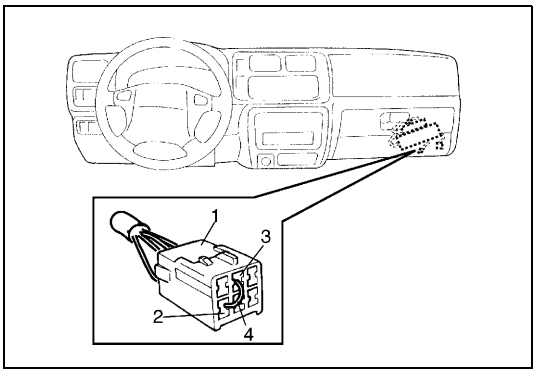
2) With ignition switch OFF, connect it to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

   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.

[Without Using SUZUKI Scan Tool] (Vehicle Without Immobilizer Indicator Lamp)

1) Check malfunction indicator lamp referring to "Malfunction Indicator Lamp Check" in this section.



2) With the ignition switch OFF position, connect diagnosis switch terminal (3) and ground terminal (2) in monitor connector (1) with service wire (4).
3) With the ignition switch ON position and leaving engine OFF, read DTC from flashing pattern of malfunction indicator lamp. Refer to "Diagnostic Trouble Code Table".
   If lamp does not flash or remains ON or OFF, go to "Diagnostic Flow Table A-4".

NOTE:

- **If abnormality or malfunction lies in two or more areas, malfunction indicator lamp indicates applicable codes three times each.**
  And flashing of these codes is repeated as long as diagnosis terminal is grounded and ignition switch is held at ON position.
- **Take a note of diagnostic trouble code indicated first.**

4) After completing the check, turn the ignition switch OFF position and disconnect service wire from monitor coupler.

Diagnostic trouble code (DTC) clearance

[Using SUZUKI Scan Tool]

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 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 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.**

[Without Using SUZUKI Scan Tool]

1) Turn the ignition switch OFF position.
2) Disconnect battery negative cable for specified time below to erase diagnostic trouble code stored in ECM memory and reconnect it.

Time required to erase DTC

Ambient temperature	Time to cut power to ECM
Over 0 °C (32 °F)	30 sec. or longer
Under 0 °C (32 °F)	Not specifiable. Select a place with higher than 0 °C (32 °F) temperature.

Diagnostic trouble code (DTC) table

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting :)	MIL (vehicle with immobilizer indicator lamp)	MIL (vehicle without immobilizer indicator lamp)
P0105 (No.11)	Manifold absolute pressure circuit malfunction	Low pressure-high vacuum-low voltage (or MAP sensor circuit shorted to ground) High pressure-low vacuum-high voltage (or MAP sensor circuit open)	1 driving cycle	1 driving cycle
P0110 (No.18)	Intake air temp. circuit malfunction	Intake air temp. circuit low input Intake air temp. circuit high input	1 driving cycle	1 driving cycle
P0115 (No.19)	Engine coolant temp. circuit malfunction	Engine coolant temp. circuit low input Engine coolant temp. circuit high input	1 driving cycle	1 driving cycle
P0120 (No.13)	Throttle position circuit malfunction	Throttle position circuit low input Throttle position circuit high input	1 driving cycle	1 driving cycle
P0121	Throttle position circuit performance problem	Poor performance of TP sensor	2 driving cycles	Not applicable
P0130 (No.14)	HO2S circuit malfunction (Sensor-1)	Min. output voltage of HO2S-higher than specification Max. output voltage of HO2S-lower than specification	2 driving cycles	1 driving cycle
P0133	HO2S circuit slow response (Sensor-1)	Response time of HO2S-1 output voltage between rich and lean is longer than specification.	2 driving cycles	Not applicable
P0135 (No.14)	HO2S heater circuit malfunction (Sensor-1)	Terminal voltage is lower than specification at heater OFF or it is higher at heater ON.	2 driving cycles	1 driving cycle
P0136	HO2S circuit malfunction (Sensor-2)	HO2S-2 voltage is higher than specification	2 driving cycles	Not applicable
P0141	HO2S heater circuit malfunction (Sensor-2)	Terminal voltage is lower than specification at heater OFF or it is higher at heater ON. (or heater circuit or short)	2 driving cycles	Not applicable
P0171	Fuel system too lean	Short term fuel trim or total fuel trim (short and long terms added) is larger than specification for specified time or longer. (fuel trim toward rich side is large.)	2 driving cycles	Not applicable
P0172	Fuel system too rich	Short term fuel trim or total fuel trim (short and long term added) is smaller than specification for specified time or longer. (fuel trim toward lean side is large.)	2 driving cycles	Not applicable
P0300 P0301 P0302 P0303 P0304	Random misfire detected Cylinder 1 misfire detected Cylinder 2 misfire detected Cylinder 3 misfire detected Cylinder 4 misfire detected	Misfire of such level as to cause damage to three way catalyst	MIL flashing during misfire detection	Not applicable
		Misfire of such level as to deteriorate emission but not to cause damage to three way catalyst	2 driving cycles	Not applicable
P0325 (No.17)	Knock sensor circuit malfunction	Knock sensor circuit low input Knock sensor circuit high input	1 driving cycle	1 driving cycle

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting :)	MIL (vehicle with immobilizer indicator lamp)	MIL (vehicle without immobilizer indicator lamp)
P0335 (No.23)	Crankshaft position sensor circuit malfunction	No signal for 2 sec. During engine cranking	1 driving cycle	1 driving cycle
P0340 (No.15)	Camshaft position sensor circuit malfunction	No signal during engine running	1 driving cycle	1 driving cycle
P0400	Exhaust gas recirculation flow malfunction detected	Excessive or insufficient EGR flow	2 driving cycles	Not applicable
P0420	Catalyst system efficiency below threshold	Output waveforms of HO2S-1 and HO2S-2 are similar. (Time from output voltage change of HO2S-1 to that of HO2S-2 is shorter than specification.)	2 driving cycles	Not applicable
P0443	Purge control valve circuit malfunction	Purge control valve circuit is open or shorted to ground	2 driving cycles	Not applicable
P0481	A/C condenser fan control circuit malfunction	A/C condenser fan relay terminal voltage is low when fan command is not outputted	2 driving cycles	Not applicable
P0500 (No.16)	Vehicle speed sensor malfunction	No signal while running in “D” range or during fuel cut at decelerating	2 driving cycles	1 driving cycle
P0505	Idle control system malfunction	No closed signal to IAC valve is detected	2 driving cycles	Not applicable
P0601 (No.71)	Internal control module memory check sum error	Data write error (or check sum error) when written into ECM	2 driving cycles	Not applicable
P1450	Barometric pressure sensor circuit malfunction	Barometric pressure is lower or higher than specification. (or sensor malfunction)	1 driving cycle	Not applicable
P1451	Barometric pressure sensor performance problem	Difference between manifold absolute pressure (MAP sensor value) and barometric pressure (barometric pressure sensor value) is larger than specification during cranking.	2 driving cycles	Not applicable
P1500	Starter signal circuit malfunction	Starter signal is not inputted from engine cranking till its start and after or it is always inputted	2 driving cycles	Not applicable
P1510	ECM backup power source malfunction	No backup power after starting engine	1 driving cycle	Not applicable
P1600	Serial communication problem between ECM and TCM	No signal or check sum error while engine running	1 driving cycle	Not applicable
P1717	AT D-range signal circuit malfunction	No “D” range (park / neutral position signal) is inputted while vehicle running	2 driving cycles	Not applicable
P1570	ABS signal circuit malfunction	ABS signal ON (low voltage) when engine start	Not applicable	1 driving cycle

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting :)	MIL
P0702	Transmission Control System Electrical	Refer to Section 7B. These DTCs can not be read on vehicle without Immobilizer indicator lamp (by ECM application of SUZUKI scan tool).	
P0705	Temperature Sensor Circuit Malfunction		
P0710	Transmission Temperature Sensor Circuit Malfunction		
P0715	Input / Turbine Speed Sensor Circuit Malfunction		
P0720	Output Shaft Speed Sensor Circuit Malfunction		
P0725	Engine Speed Input Circuit Malfunction		
P0730	Incorrect Gear Ratio		
P0743	Torque Converter Clutch Circuit Electrical		
P0753	Shift Solenoid A Electrical		
P0758	Shift Solenoid B Electrical		
P0763	Shift Solenoid C Electrical		
P0768	Shift Solenoid D Electrical		
P1700	Throttle Position Signal Input Malfunction		
P1702	Internal Control Module Memory Check Some Error		
P1709	Engine Coolant Temperature Signal Input Malfunction		
P1887	Transfer Signal		
P1620 (No.84)	ECU code not registered	Refer to Section 8G.	
P1621 (No.83)	No ECU code transmitted from Immobilizer Control Module		
P1622 (No.82)	Faulty in ECM		
P1623 (No.81)	ECU code not matched		

NOTE:

- **For ( ) marked No. in DTC column, it is used for vehicle without Immobilizer indicator lamp.**
- **DTC No.12 appears when none of the other codes is identified (vehicle without Immobilizer indicator lamp).**

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 (SYMPTOM)
P0105 (No.11)	Manifold absolute pressure sensor circuit malfunction	ECM uses value determined by throttle opening and engine speed.
P0110 (No.18)	Intake air temp. sensor circuit malfunction	ECM controls actuators assuming that intake air temperature is 20 °C (68 °F).
P0115 (No.19)	Engine coolant temp. sensor circuit malfunction	ECM controls actuators assuming that engine coolant temperature is 80 °C (176 °F).
P0120 (No.13)	Throttle position sensor circuit malfunction	ECM controls actuators assuming that throttle opening is 20°. (High idle speed)
P0335 (No.23)	Crankshaft position sensor circuit malfunction	ECM controls injection system sequential injection to synchronous injection. (Cranking for a few seconds to start engine)
P0340 (No.15)	Camshaft position sensor circuit malfunction	ECM controls injection system sequential injection to synchronous injection. (Cranking for a few seconds to start engine)
P0500 (No.16)	Vehicle speed sensor malfunction	ECM stops idle air control.
P1450	Barometric pressure sensor low / high input	ECM controls actuators assuming that barometric pressure is 100 kPa (760 mmHg).
P1570 (No.21)	ABS signal circuit malfunction	ECM controls actuators assuming that ABS signal is OFF.

Visual inspection

Visually check following parts and systems.

INSPECTION ITEM	REFERRING SECTION
• Engine oil – level, leakage	Section 0B
• Engine coolant – level, leakage	Section 0B
• Fuel – level, leakage	Section 0B
• A/T fluid – level, leakage	Section 0B
• Air cleaner element – dirt, clogging	Section 0B
• Battery – fluid level, corrosion of terminal	
• Water pump belt – tension, damage	Section 0B
• Throttle cable – play, installation	
• Vacuum hoses of air intake system – disconnection, looseness, deterioration, bend	Section 6E
• Connectors of electric wire harness – disconnection, friction	
• Fuses – burning	Section 8
• Parts – installation, bolt – looseness	
• Parts – deformation	
• Other parts that can be checked visually	
Also check following items at engine start, if possible	
• Malfunction indicator lamp – operation	Section 6
• Charge warning lamp – operation	Section 6H
• Engine oil pressure warning lamp – operation	Section 8 (Section 6 for pressure check)
• Engine coolant temp. meter – operation	Section 8
• Fuel level meter – operation	Section 8
• Tachometer, if equipped – operation	
• Abnormal air being inhaled from air intake system	
• Exhaust system – leakage of exhaust gas, noise	
• Other parts that can be checked visually	

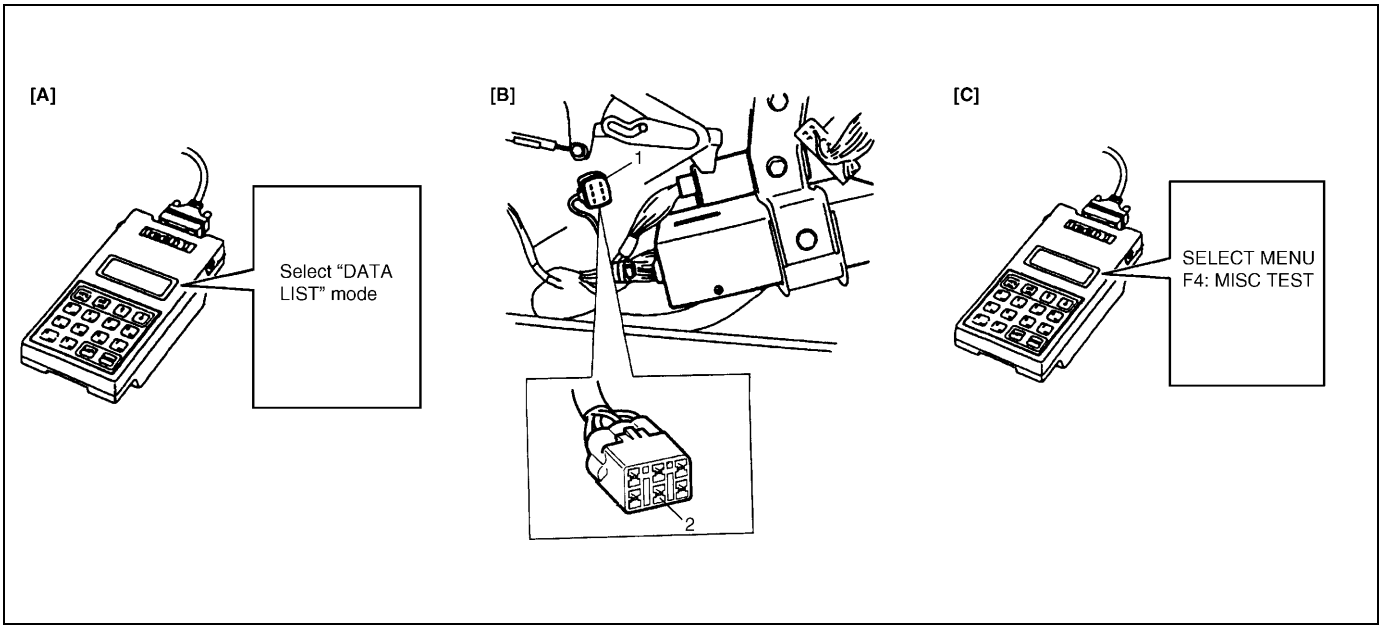
Engine basic inspection

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 Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
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 9.
5	Check idle speed as follows : 1) Warm up engine to normal operating temp. 2) Shift transmission to neutral position for M/T (“P” position for A/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 (700 – 800 r/min. for A/T vehicle)?	Go to Step 6.	Go to “Engine Diagnosis Table”.
6	Is SUZUKI scan tool available?	Go to Step 8.	Go to Step 7.
7	Check ignition timing as follows : 1) Connect test switch terminal (2) of monitor coupler (1) to ground. See Fig. 2. 2) Remove air cleaner bolt and crips and shift air cleaner position to observe ignition timing. 3) Using timing light (1), check initial ignition timing. See Fig. 4. Is it 5° ± 3° BTDC at specified idle speed?	Go to “Engine Diagnosis Table”.	Check ignition control related parts referring to Section 6F.
8	Check ignition timing as follows : 1) Select “MISC” mode on SUZUKI scan tool and fix ignition timing to initial one. See Fig. 3. 2) Remove air cleaner bolt and crips and shift air cleaner position to observe ignition timing. 3) Using timing light (1), check initial ignition timing. See Fig. 4. Is it 5° ± 3° BTDC at specified idle speed?	Go to “Engine Diagnosis Table”.	Check ignition control related parts referring to Section 6F.
9	Check immobilizer system malfunction as follows (if equipped) : 1) Check immobilizer indicator lamp or MIL (malfunction indicator lamp) for flashing. Is it flashing when ignition switch is turned to ON position?	Go to “Diagnosis” in Section 8G.	Go to Step 10.

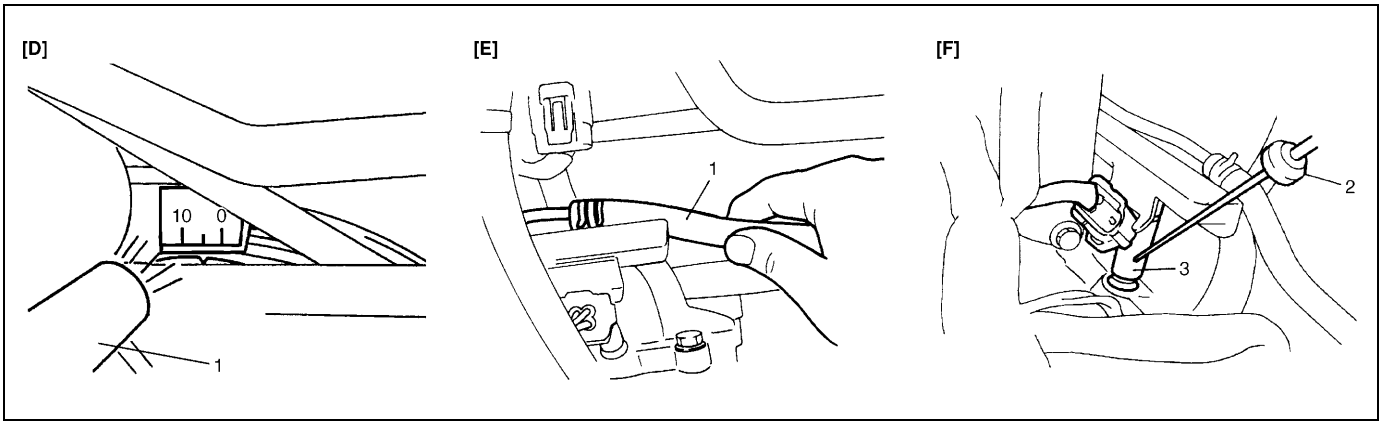
Step	Action	Yes	No
10	Check fuel supply as follows : 1) Check to make sure that enough fuel is filled in fuel tank. 2) Turn ON ignition switch for 2 seconds and then OFF. See Fig. 5. Is fuel return pressure (returning sounds) felt from fuel feed hose (1) when ignition switch is turned ON?	Go to Step 12.	Go to Step 11.
11	Check fuel pump for operating. 1) Was fuel pump operating sound heard from fuel filler for about 2 seconds after ignition switch ON and stop?	Go to “Diag. Flow Table B-3”.	Go to “Diag. Flow Table B-2”.
12	Check ignition spark as follows : 1) Disconnect injector couplers. 2) Remove spark plugs and connect them to high tension cords. 3) Ground spark plugs. 4) Crank engine and check if each spark plug sparks. Is it in good condition?	Go to Step 13.	Go to “Ignition Spark Test” in Section 6F.
13	Check fuel injector for operation as follows : 1) Install spark plugs and connect injector connectors. 2) Using sound scope (2), check operating sound of each injector (3) when cranking engine. See Fig. 6. Was injector operating sound heard from all injectors?	Go to “Engine Diagnosis Table”.	Go to “Diag. Flow Table B-1”.

[A] Fig. 1 for Step 5 / [B] Fig. 2 for Step 7 / [C] Fig. 3 for Step 8



[B] : When not using SUZUKI scan tool :
[C] : When using SUZUKI scan tool

[D] Fig. 4 for Step 7 or 8 / [E] Fig. 5 for Step 10 / [F] Fig. 6 for Step 13



Engine diagnosis table

Perform troubleshooting referring to following table when ECM has no DTC and no abnormality found in visual inspection and engine basic inspection previously.

Condition	Possible Cause	Reference Item
Hard Starting (Engine cranks OK)	• Faulty ignition coil	Ignition coil assembly in Section 6F.
	• Faulty CMP sensing rotor or CKP sensing rotor	CMP sensing rotor or CKP sensing rotor inspection in Section 6E.
	• Faulty idle air control system	Diagnostic Flow Table B-4
	• Faulty ECT sensor, TP sensor, CKP sensor, CMP sensor or MAP sensor	ECT sensor, TP sensor, CKP sensor, CMP sensor or MAP sensor in Section 6E.
	• Fuel pressure out of specification	Diagnostic Flow Table B-3
	• Faulty fuel injector	Diagnostic Flow Table B-1
	• Faulty ECM	Inspection of ECM and its circuit in this section.
	• Malfunctioning PCV system	PCV system in Section 6E.
	Low compression	Compression check in Section 6A1.
	• Improper valve lash	Valve lash in Section 6A1.
	• Improper valve timing	Timing chain and chain tensioner in Section 6A1.
	• Compression leak from valve seat	Valves and cylinder head in Section 6A1.
	• Sticky valve stem	Valves and cylinder head in Section 6A1.
	• Weak or damaged valve springs	Valves and cylinder head in Section 6A1.
	• Compression leak at cylinder head gasket	Valves and cylinder head in Section 6A1.
	• Sticking or damaged piston ring	Pistons, piston rings, connecting rods and cylinders in Section 6A1.
	• Worn piston, ring or cylinder	Pistons, piston rings, connecting rods and cylinders in Section 6A1.

Condition	Possible Cause	Reference Item
Engine has no power	Engine overheating	Refer to “Overheating” of this table.
	• Faulty ignition coil	Ignition coil assembly in Section 6F.
	• Faulty knock sensor	Knock sensor malfunction in this section.
	• Fuel pressure out of specification	Diagnostic Flow Table B-3
	• Faulty injector	Diagnostic Flow Table B-1
	• Faulty TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E.
	• Faulty ECM	Inspection of ECM and its circuit in this section.
	• Malfunctioning EGR valve (if equipped)	EGR system in Section 6E.
	• Maladjusted accelerator cable play	Accelerator cable adjustment in Section 6E.
	Low compression	Previously outlined.
	• Dragging brakes	Diagnosis table in Section 5.
	• Slipping clutch	Diagnosis table in Section 7C.
Improper engine idling or engine fails to idle	• Faulty ignition coil	Ignition coil assembly in Section 6F.
	Engine overheating	Refer to “Overheating” of this table.
	• Fuel pressure out of specification	Diagnostic Flow Table B-3
	• Faulty idle air control system	Diagnostic Flow Table B-4
	• Faulty evaporative emission control system	EVAP control system in Section 6E.
	• Faulty injector	Diagnostic Flow Table B-1
	• Faulty ECT sensor, TP sensor or MAP sensor	ECT sensor, TP sensor or MAP sensor in Section 6E.
	• Malfunctioning PCV system	PCV system in Section 6F.
	• Faulty ECM	Inspection of ECM and its circuit in this section.
	• Faulty EGR system (if equipped)	EGR system in Section 6E.
	Low compression	Previously outlined.
Engine hesitates (Momentary lack of response as the accelerator is depressed. Can occur at all vehicle speeds. Usually most severe when first trying to make the vehicle move, as from a stop sign.)	• Faulty ignition coil	Ignition coil assembly in Section 6F.
	Engine overheating	Refer to “Overheating” of this table.
	• Fuel pressure out of specification	Diagnostic Flow Table B-3
	• Faulty injector	Diagnostic Flow Table B-1
	• Faulty TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E.
	• Faulty ECM	Inspection of ECM and its circuit in this section.
	• Malfunctioning EGR valve (if equipped)	EGR system in Section 6E.
	Low compression	Previously outlined.
Surges (Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and down with no change in the accelerator pedal.)	• Faulty ignition coil or high-tension cord	Ignition coil assembly or high-tension cords in Section 6F.
	• Variable fuel pressure	Diagnostic Flow Table B-3
	• Faulty MAP sensor	MAP sensor in Section 6E.
	• Faulty injector	Diagnostic Flow Table B-1
	• Faulty ECM	Inspection of ECM and its circuit in this section.
	• Malfunctioning EGR valve (if equipped)	EGR system in Section 6E.

Condition	Possible Cause	Reference Item
Excessive detonation (The engine makes sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.)	Engine overheating	Refer to “Overheating” of this table.
	• Faulty spark plug	Spark plugs in Section 6F.
	• Clogged fuel filter and fuel lines	Diagnostic Flow Table B-3
	• Malfunctioning EGR valve (if equipped)	EGR system in Section 6E.
	• Poor performance of knock sensor, ECT sensor or MAP sensor	Knock sensor in this section, ECT sensor or MAP sensor in Section 6E.
	• Faulty injector	Diagnostic Flow Table B-1
	• Faulty ECM	Inspection of ECM and its circuit in this section.
	• Excessive combustion chamber deposits	Piston and cylinder head in Section 6A1.
Overheating	• Inoperative thermostat	Thermostat in Section 6B.
	• Faulty A/C condenser fan motor or its circuit	A/C condenser fan control system check in Section 6E.
	• Loose or slip water pump belt	ITEM1-1 Drive belt inspection and change in Section 0B.
	• Poor water pump performance	Water pump in Section 6B.
	• Clogged or leaky radiator	Radiator in Section 6B.
	• Improper engine oil grade	ITEM1-3 Engine oil and oil filter change 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.
	• Dragging brakes	Diagnosis Table in Section 5.
	• Slipping clutch	Diagnosis Table in Section 7C.
	• Blown cylinder head gasket	Valves and cylinder head in Section 6A1.
Poor gasoline mileage	• Faulty ignition coil	Ignition coil assembly in Section 6F.
	• Fuel pressure out of specification	Diagnostic Flow Table B-3
	• Faulty TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E.
	• Faulty injector	Diagnostic Flow Table B-1
	• Faulty ECM	Inspection of ECM and its circuit in this section.
	• Malfunctioning EGR valve (if equipped)	EGR system in Section 6E.
	• High idle speed	Refer to item “Improper Engine Idle Speed” previously outlined.
	Low compression	Previously outlined.
	• Poor valve seating	Valves and cylinder head in Section 6A1.
	• Dragging brakes	Diagnosis Table in Section 5.
	• Slipping clutch	Diagnosis Table in Section 7C.
	• Thermostat out of order	Thermostat in Section 6B.
	• Improper tire pressure	Refer to Section 3F.

Condition	Possible Cause	Reference Item
Excessive engine oil consumption	• Sticky piston ring	Pistons, piston rings, connecting rods and cylinders in Section 6A1.
	• Worn piston and cylinder	Pistons, piston rings, connecting rods and cylinders in Section 6A1.
	• Worn piston ring groove and ring	Pistons, piston rings, connecting rods and cylinders in Section 6A1.
	• Improper location of piston ring gap	Pistons, piston rings, connecting rods and cylinders in Section 6A1.
	• Worn or damaged valve stem seal	Valves and cylinder head in Section 6A1.
	• Worn valve stem	Valves and cylinder head in Section 6A1.
Low oil pressure	• Improper oil viscosity	ITEM1-3 Engine oil and oil filter change in Section 0B.
	• Malfunctioning oil pressure switch	Oil pressure switch in Section 8.
	• Clogged oil strainer	Oil pan and oil pump strainer in Section 6A1.
	• Functional deterioration of oil pump	Oil pump in Section 6A1.
	• Worn oil pump relief valve	Oil pump in Section 6A1.
	• Excessive clearance in various sliding parts	Refer to Section 6A1.
Engine noise See NOTE below.	• Improper valve lash	Valve lash in Section 6A1.
	• Worn valve stem and guide	Valves and cylinder head in Section 6A1.
	• Weak or broken valve spring	Valve springs in Section 6A1.
	• Warped or bent valve	Valves and cylinder head in Section 6A1.
	• Loose camshaft housing bolts	Camshaft in Section 6A1.
	• Worn piston, ring and cylinder bore	Pistons and cylinders in Section 6A1.
	• Worn crankpin bearing	Crankpin and connecting rod bearing in Section 6A1.
	• Worn crankpin	Crankpin and connecting rod bearing in Section 6A1.
	• Loose connecting rod nuts	Connecting rod in Section 6A1.
	• Low oil pressure	Previously outlined.
	• Worn crankshaft journal bearing	Main bearings, Crankshaft and cylinder block in Section 6A1.
	• Worn crankshaft journal	Main bearings, Crankshaft and cylinder block in Section 6A1.
	• Loose lower crankcase (bearing cap) bolts	Main bearings, Crankshaft and cylinder block in Section 6A1.
	• Excessive crankshaft thrust play	Main bearings, Crankshaft and cylinder block in Section 6A1.

NOTE:

Before checking the mechanical noise, make sure that :

- **Ignition timing is properly adjusted.**
- **Specified spark plug is used.**
- **Specified fuel is used.**

Condition	Possible Cause	Reference Item
Excessive hydrocarbon (HC) emission or Excessive carbon monoxide (CO) emission	• Faulty ignition coil	Ignition coil assembly in Section 6F.
	• Fuel pressure out of specification	Diagnostic Flow Table B-3
	• Lead contamination of three way catalytic converter	Maintenance in Section 6K.
	• Malfunctioning PCV system	PCV system in Section 6E.
	• Faulty EVAP control system	EVAP control system in Section 6E.
	• Closed loop system (A/F feed back compensation) fails – Faulty TP sensor – Faulty ECT sensor or MAP sensor – Faulty oxygen sensor	Check oxygen sensor output voltage. Refer to DTC P0130 (No.14) Table in this section.
	• Faulty injector	Diagnostic Flow Table B-1
	• Faulty ECM	Inspection of ECM and its circuit in this section.
	Low compression	Previously outlined.
Excessive nitrogen oxides (NOx) emission	• Fuel pressure out of specification	Diagnostic Flow Table B-3
	• Lead contamination of three way catalytic converter	Maintenance in Section 6K.
	• Closed loop system (A/F feed back compensation) fails – Faulty TP sensor – Faulty ECT sensor or MAP sensor – Faulty oxygen sensor	Check oxygen sensor output voltage Refer to DTC P0130 (No.14) Table in this section.
	• Faulty injector	Diagnostic Flow Table B-1
	• Faulty ECM	Inspection of ECM and its circuit in this section.
	• Faulty EGR system (if equipped)	EGR system in Section 6E.

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 below table 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.**
- **The triangle (Δ) marked data in the table below can not be read for vehicle without immobilizer indicator lamp at combination meter.**
- **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	CONDITION		REFERENCE VALUES
	✱	FUEL SYSTEM B1 (FUEL SYSTEM STATUS)	At specified idle speed after warming up		CLOSED (closed loop)
	✱	CALC LOAD (CALCULATED LOAD VALUE)	At specified idle speed with no load after warming up		3 – 9 %
			At 2500 r/min with no load after warming up		12 – 17 %
	✱	COOLANT TEMP. (ENGINE COOLANT TEMP.)	At specified idle speed after warming up		80 – 100 °C, 176 – 212 °F
	✱	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		– 15 – +15 %
	✱	MAP (INTAKE MANIFOLD ABSOLUTE PRESSURE)	At specified idle speed with no load after		30 – 37 kPa, 220 – 340 mmHg
	✱	ENGINE SPEED	At idling with no load after warming up		Desired idle speed ±50 r/min
	✱	VEHICLE SPEED	At stop		0 km/h, 0 MPH
	✱	IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER)	At specified idle speed with no load after warming up		5 – 16° BTDC
	✱	INTAKE AIR TEMP.	At specified idle speed after warming up		Ambient temp. : +15 °C (59 °F) –5 °C (23 °F)
	✱	MAF (MASS AIR FLOW RATE)	At specified idle speed with no load after warming up		1 – 4 gm/sec
	✱	THROTTLE POS (THROTTLE POSITION)	Ignition switch ON / engine stopped	Throttle valve fully closed	7 – 18 %
				Throttle valve fully open	70 – 90 %
	✱	O2S B1 S1 (HEATED OXYGEN SENSOR-1)	At specified idle speed after warming up		0.01 – 0.95 V

		SCAN TOOL DATA	CONDITION		REFERENCE VALUES	
Δ	✱	O2S B1 S2 (HEATED OXYGEN SENSOR-2)	When engine is running at 2000 r/min. for 3 min or longer after warming up.		0.01 – 0.95 V	
Δ	✱	PSP SW	No load to power steering.		OFF	
		DESIRED IDLE (DESIRED IDLE SPEED)	At idling with no load after warming up, M/T at neutral, A/T at "P" range		M/T	700 r/min
					A/T	750 r/min
		TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE)	Ignition switch ON / engine stopped	Throttle valve fully closed	More than 0.2 V	
				Throttle valve fully open	Less than 4.8 V	
		INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH)	At specified idle speed with no load after warming up		2.0 – 3.6 msec.	
			At 2500 r/min with no load after warming up		2.0 – 3.6 msec.	
		IAC FLOW DUTY (IDLE AIR CONTROL FLOW DUTY)	At idling with no load after warming up		5 – 25 %	
		TOTAL FT B1	At specified idle speed after warming up		– 35 – +35 %	
		BATTERY VOLTAGE	Ignition switch ON / engine stop		12 – 15 V	
		CANIST PRG DUTY (EVAP CANISTER PURGE FLOW DUTY)	–		0 – 100 %	
		CLOSED THROT POS (CLOSED THROTTLE POSITION)	Throttle valve at idle position		ON	
			Throttle valve opens larger than idle position		OFF	
		FUEL CUT	When engine is at fuel cut condition		ON	
			Other than fuel cut condition		OFF	
		A/C CONDENSER FAN	Ignition switch ON	A/C not operating	OFF	
				A/C operating	ON	
		ELECTRIC LOAD	Ignition switch ON / Headlight, small light, heater fan and rear window defogger all turned OFF		OFF	
			Ignition switch ON / Headlight, small light, heater fan or rear window defogger turned ON		ON	
		A/C SWITCH	Engine running after warming up, A/C not operating		OFF	
			Engine running after warming up, A/C operating		ON	
		PNP SIGNAL (PARK / NEUTRAL POSITION SIGNAL) A/T only	Ignition switch ON	Selector lever in "P" or "N" position	P/N Range	
				Selector lever in "R", "D", "2" or "L" position	D Range	
		EGR VALVE	At specified idle speed after warming up		0 %	
Δ		FUEL TANK LEVEL	–		0 – 100 %	
		BAROMETRIC PRESS	–		Display the barometric pressure	
		FUEL PUMP	Within 3 seconds after ignition switch ON or engine running		ON	
			Engine stop at ignition switch ON.		OFF	

		SCAN TOOL DATA	CONDITION		REFERENCE VALUES
		BRAKE SW	Ignition switch ON	Brake pedal is depressing	ON
				Brake pedal is releasing	OFF
		BLOWER FAN	Ignition switch ON	Blower fan switch ON	ON
				Blower fan switch OFF	OFF
		A/C MAG CLUTCH	Ignition switch ON	A/C operating	ON
				A/C not operating	OFF

Scan tool data definitions

FUEL SYSTEM (FUEL SYSTEM STATUS)

Air / fuel ratio feedback loop status displayed as either open or closed loop. Open indicates that ECM ignores feedback from the exhaust oxygen sensor.
Closed indicates final injection duration is corrected for oxygen sensor feedback.

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%.

COOLANT TEMP. (ENGINE COOLANT TEMPERATURE, °C, °F)

It is detected by engine coolant temp. sensor

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 implies an enleanment correction.

MAP (INTAKE MANIFOLD ABSOLUTE PRESSURE, kPa, inHg)

It is detected by manifold absolute pressure sensor and used (among other things) to compute engine load.

ENGINE SPEED (rpm)

It is computed by reference pulses from crankshaft position sensor.

VEHICLE SPEED (km/h, MPH)

It is computed based on pulse signals from vehicle speed sensor.

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.

INTAKE AIR TEMP. (°C, °F)

It is detected by intake air temp. sensor and used to determine the amount of air passing into the intake manifold as air density varies with temperature.

MAF (MASS AIR FLOW RATE, gm/s, lb/min)

It represents total mass of air entering intake manifold which is computed based on signals from MAP sensor, IAT sensor, TP sensor, etc.

THROTTLE POS (ABSOLUTE THROTTLE POSITION, %)

When throttle position sensor is fully closed position, throttle opening is indicated as 0% and 100% full open position.

OXYGEN SENSOR B1 S1 (HEATED OXYGEN SENSOR-1, V)

It indicates output voltage of HO2S-1 installed on exhaust manifold (pre-catalyst).

OXYGEN 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.

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.

TP SENSOR VOLT (THROTTLE POSITION SENSOR OUTPUT VOLTAGE, V)

The Throttle Position Sensor reading provides throttle valve opening information in the form of voltage.

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).

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).

TOTAL FUEL TRIM (%)

The value of Total Fuel Trim is obtained by putting values of short Term Fuel Trim and Long Term Fuel Trim together. This value indicates how much correction is necessary to keep the air / fuel mixture stoichiometrical.

BATTERY VOLTAGE (V)

This parameter indicates battery positive voltage inputted from main relay to ECM.

CANIST PURGE DUTY (EVAP CANISTER PURGE FLOW DUTY, %)

This parameter indicates valve ON (valve open) time rate within a certain set cycle of EVAP purge solenoid valve which controls the amount of EVAP purge.
0% means that the purge valve is completely closed while 100% is a fully open valve.

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.

FUEL CUT (ON / OFF)

ON : Fuel being cut (output signal to injector is stopped)
OFF : Fuel not being cut

A/C CONDENSER FAN (A/C CONDENSER FAN RELAY, ON / OFF)

ON : Command for condenser fan relay operation being output.
OFF : Command for relay operation not being output.

ELECTRIC LOAD (ON / OFF)

ON : Headlight, small light, heater fan or rear window defogger ON signal inputted.
OFF : Above electric loads all turned OFF.

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.

FUEL TANK LEVEL (%)

This parameter indicates approximate fuel level in the fuel tank. As the detectable range of the fuel level sensor is set as 0 to 100%, however, with some models whose fuel tank capacity is smaller, the indicated fuel level may be only 70% even when the fuel tank is full.

PNP SIGNAL (PARK / NEUTRAL POSITION SIGNAL, P/N RANGE or D RANGE)

It is detected by signal from TCM.
D range : A/T is in “R”, “D”, “2” or “L” range.
P/N range : A/T is in “P” or “N” range or the above signal is not inputted from TCM.

EGR VALVE (%)

This parameter indicates opening rate of EGR valve which controls the amount of EGR flow.

PSP SW

The Power Steering Pressure switch parameter displays ON when steering wheel is turned all the way to the right or left.

Inspection of ECM and Its Circuits

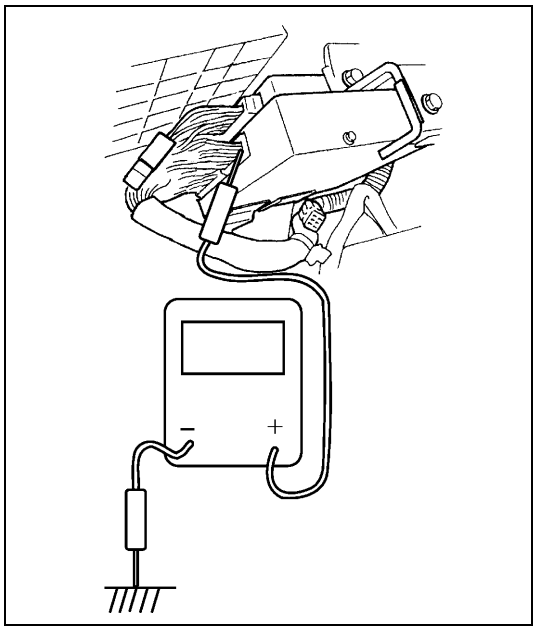
ECM and its circuits can be checked at ECM wiring connectors by measuring voltage and resistance.

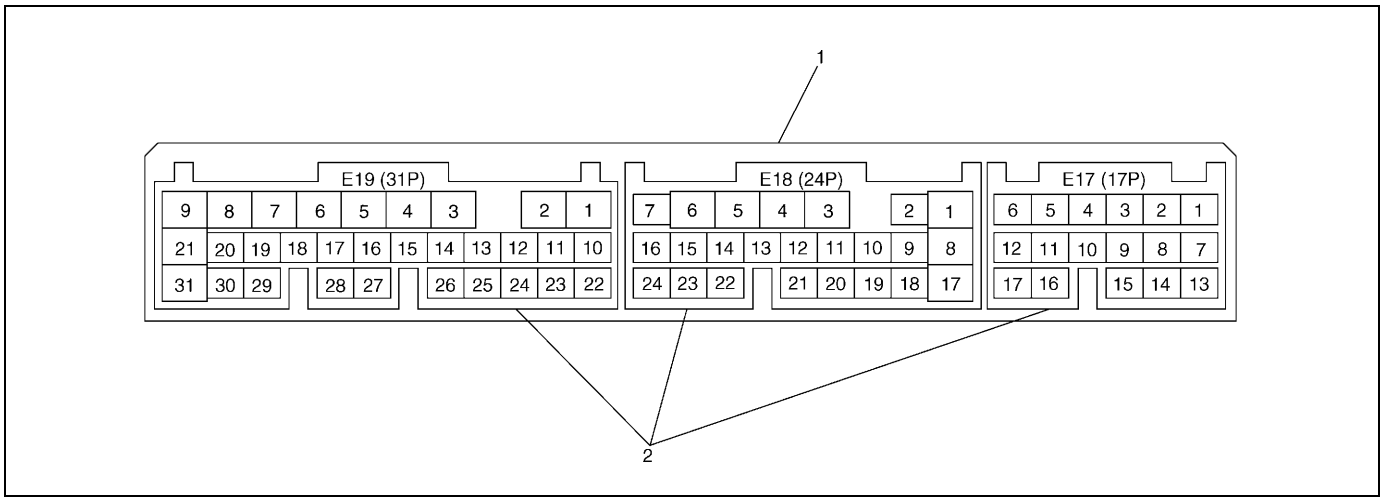
CAUTION:
ECM cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM with connector disconnected from it.

VOLTAGE CHECK

1) Remove ECM from body referring to Section 6E.
2) Check voltage at each terminal of connectors connected.

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





1. ECM
2. ECM connectors (Viewed from harness side)

ECM TERMINAL VOLTAGE VALUES TABLE

For TYPE A (See NOTE)

NOTE:

- **Type A is other than follows.**
- **Type B is left hand steering vehicle equipped with fasten seat belt light and EGR valve or right hand steering vehicle equipped with fasten seat belt light and immobilizer control system.**

TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
E19	1	Ground	–	–
	2	Ground	–	–
	3	Ground	–	–
	4	EVAP canister purge valve	10 – 14 V	Ignition switch ON
	5	Power steering pressure switch (if equipped)	0 – 1.3 V	While engine running at idle speed, turn steering wheel to right or left as far as it stops
			10 – 14 V	Ignition switch ON
	6	Idle air control valve	0 – 13 V	At specified idle speed after engine warmed up
	7	Heater of HO2S-1	10 – 14 V	Ignition switch ON
	8	Fuel injector NO.4	10 – 14 V	Ignition switch ON
	9	Fuel injector NO.1	10 – 14 V	Ignition switch ON
	10	Sensor ground	–	–
	11	Camshaft position sensor	0 – 0.8 V and 4 – 6 V	Ignition switch ON
	12	–	–	–
	13	Heater oxygen sensor-1	Refer to DTC P0130 diag. flow table	
		CO adjusting resistor (w/o HO2S)	0 – 5 V	Ignition switch ON position
	14	Engine coolant temp. sensor	0.55 - 0.95 V	Ignition switch ON Engine coolant temp. : 80 °C (176 °F)
	15	Intake air temp. sensor	2.0 – 2.7 V	Ignition switch ON Intake air temp. : 20 °C (68 °F)
	16	Throttle opening signal	0.2 – 1.0 V	Ignition switch ON position and throttle valve at idle position
			2.8 – 4.8 V	Ignition switch ON position and throttle valve fully open
	17	EGR valve (stepper motor coil 3, if equipped)	10 – 14 V	Ignition switch ON position leaving engine OFF
	18	EGR valve (stepper motor coil 1, if equipped)	10 – 14 V	Ignition switch ON position leaving engine OFF
	19	Ignition coil #2	–	–
	20	Ignition coil #1	–	–
	21	Fuel injector NO.2	10 – 14 V	Ignition switch ON
	22	Power source for sensors	4.75 – 5.25 V	Ignition switch ON
	23	Crankshaft position sensor	0 – 0.8 or 4 – 5 V	Ignition switch ON position
	24	–	–	–
	25	Knock sensor	About 2.5 V	At specified idle speed after engine warmed up

TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
E19	26	Manifold absolute pressure sensor	3.3 – 4.0 V	Ignition switch ON Barometric pressure : 100 kPa (760 mmHg)
	27	A/C evaporator temp. sensor	2.0 – 2.3 V	Ignition switch ON A/C evaporation temp. sensor at 25 °C (77 °F)
	28	EGR valve (stepper motor coil 4, if equipped)	10 – 14 V	Ignition switch ON position leaving engine OFF
	29	EGR valve (stepper motor coil 2, if equipped)	10 – 14 V	Ignition switch ON position leaving engine OFF
	30	–	–	–
	31	Fuel injector NO.3	10 – 14 V	Ignition switch ON

For TYPE B (See NOTE)

NOTE:

See NOTE in "ECM TERMINAL VOLTAGE VALUES TABLE" for applicable model.

TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
E19	1	Ground	–	–
	2	Ground	–	–
	3	Ground	–	–
	4	EVAP canister purge valve	10 – 14 V	Ignition switch ON
	5	Power steering pressure switch (if equipped)	0 – 1.3 V	While engine running at idle speed, turn steering wheel to right or left as far as it stops
			10 – 14 V	Ignition switch ON
	6	Idle air control valve	0 – 13 V	At specified idle speed after engine warmed up
	7	Heater of HO2S-1	10 – 14 V	Ignition switch ON
	8	Fuel injector NO.4	10 – 14 V	Ignition switch ON
	9	Fuel injector NO.1	10 – 14 V	Ignition switch ON
	10	Sensor ground	–	–
	11	Camshaft position sensor	0 – 0.8 V and 4 – 6 V	Ignition switch ON
	12	–	–	–
	13	Heater oxygen sensor-1	Refer to DTC P0130 diag. flow table	
		CO adjusting resistor (w/o HO2S)	0 – 5 V	Ignition switch ON position
	14	Engine coolant temp. sensor	0.55 - 0.95 V	Ignition switch ON Engine coolant temp. : 80 °C (176 °F)
	15	Intake air temp. sensor	2.0 – 2.7 V	Ignition switch ON Intake air temp. : 20 °C (68 °F)
	16	Throttle opening signal	0.2 – 1.0 V	Ignition switch ON position and throttle valve at idle position
			2.8 – 4.8 V	Ignition switch ON position and throttle valve fully open
	17	EGR valve (stepper motor coil 3, if equipped)	10 – 14 V	Ignition switch ON position leaving engine OFF

TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
E19	18	EGR valve (stepper motor coil 1, if equipped)	10 – 14 V	Ignition switch ON position leaving engine OFF
	19	Ignition coil #2	–	–
	20	Ignition coil #1	–	–
	21	Fuel injector NO.2	10 – 14 V	Ignition switch ON
	22	Power source for sensors	4.75 – 5.25 V	Ignition switch ON
	23	Crankshaft position sensor	0 – 0.8 or 4 – 5 V	Ignition switch ON position
	24	–	–	–
	25	Knock sensor	About 2.5 V	At specified idle speed after engine warmed up
	26	Manifold absolute pressure sensor	3.3 – 4.0 V	Ignition switch ON Barometric pressure : 100 kPa (760 mmHg)
	27	–	–	–
	28	EGR valve (stepper motor coil 4, if equipped)	10 – 14 V	Ignition switch ON position leaving engine OFF
	29	EGR valve (stepper motor coil 2, if equipped)	10 – 14 V	Ignition switch ON position leaving engine OFF
	30	–	–	–
	31	Fuel injector NO.3	10 – 14 V	Ignition switch ON

For TYPE A (See NOTE)

NOTE:

See NOTE in "ECM TERMINAL VOLTAGE VALUES TABLE" for applicable model.

TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
E18	1	A/C compressor clutch	0 V	Ignition switch ON
	2	Malfunction indicator lamp	10 – 14 V	Engine running
			0 – 1.0 V	Ignition switch ON leaving engine OFF
	3	Data link connector	10 – 14 V	Ignition switch ON
	4	Heater of HO2S-2 (if equipped)	10 – 14 V	Ignition switch ON
	5	Power source	10 – 14 V	Ignition switch ON
	6	Power source	10 – 14 V	Ignition switch ON
	7	Power source for buck-up	10 – 14 V	Ignition switch ON and OFF
	8	Immobilizer indicator lamp (with immobilizer indicator lamp)	10 – 14 V	Engine running
			0 – 1.0 V	Ignition switch ON leaving engine OFF
		Duty output terminal (without immobilizer indicator lamp)	0 – 1.0 V	Ignition switch ON
	9	–	–	–
	10	Main relay	10 – 14 V	Ignition switch OFF
			0.4 – 1.5 V	Ignition switch ON
	11	Tachometer	–	–
	12	Data link connector	4 – 5 V	Ignition switch ON
	13	Heated oxygen sensor-2	Refer to DTC P0130 diag. flow table	

TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
E18	14	Diag. Switch terminal (without immobilizer indicator lamp)	4 – 5 V	Ignition switch ON
	15	Test switch terminal (without immobilizer indicator lamp)	4 – 5 V	Ignition switch ON
	16	A/C (input) signal	10 – 14 V	Ignition switch ON A/C switch OFF
			0 – 2 V	Ignition switch ON A/C switch ON
	17	Lighting switch	10 – 14 V	Lighting switch ON
			0 – 1.3 V	Lighting switch OFF
	18	A/C condenser fan motor relay (if equipped)	0 – 1.0 V	A/C is operating
			10 – 14 V	A/C is not operating
	19	Fuel pump relay	0 – 1 V	For 2 seconds after ignition switch ON
			10 – 14 V	After the above time
	20	Sensor ground	–	–
	21	Throttle opening signal for TCM (A/T)	Indication deflection repeated 0 V and 10 – 14 V	Ignition switch ON
	22	Fuel level sensor (gauge) (with immobilizer indicator lamp)	0 – 2 V	Ignition switch ON Fuel tank fully filled
			4.5 – 7.5 V	Ignition switch ON Fuel tank emptied
	23	–	–	–
	24	Heater blower switch	0 – 2.0 V	Ignition switch ON and heater blower switch ON
			10 – 14 V	Ignition switch ON and heater blower switch OFF

For TYPE B (See NOTE)

NOTE:

See NOTE in "ECM TERMINAL VOLTAGE VALUES TABLE" for applicable model.

TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
E18	1	A/C compressor clutch	0 V	Ignition switch ON
	2	–	–	–
	3	–	–	–
	4	–	–	–
	5	Power source	10 – 14 V	Ignition switch ON
	6	Power source	10 – 14 V	Ignition switch ON
	7	Power source for buck-up	10 – 14 V	Ignition switch ON and OFF
	8	Immobilizer indicator lamp (with immobilizer indicator lamp)	10 – 14 V	Engine running
			0 – 1.0 V	Ignition switch ON leaving engine OFF
		Duty output terminal (without immobilizer indicator lamp)	0 – 1.0 V	Ignition switch ON

TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
E18	9	Ignition switch	10 – 14 V	Ignition switch ON
	10	Main relay	10 – 14 V	Ignition switch OFF
			0.4 – 1.5 V	Ignition switch ON
	11	Ignition switch	10 – 14 V	Ignition switch ON
	12	Rear defogger switch (if equipped)	10 – 14 V	Ignition switch ON and rear defogger switch ON
			0 – 1.3 V	Ignition switch ON and rear defogger switch OFF
	13	–	–	–
	14	Diag. Switch terminal (without immobilizer indicator lamp)	4 – 5 V	Ignition switch ON
	15	Test switch terminal (without immobilizer indicator lamp)	4 – 5 V	Ignition switch ON
	16	A/C (input) signal	10 – 14 V	Ignition switch ON A/C switch OFF
			0 – 2 V	Ignition switch ON A/C switch ON
	17	Lighting switch	10 – 14 V	Lighting switch ON
			0 – 1.3 V	Lighting switch OFF
	18	A/C condenser fan motor relay (if equipped)	0 – 1.0 V	A/C is operating
			10 – 14 V	A/C is not operating
	19	Fuel pump relay	0 – 1 V	For 2 seconds after ignition switch ON
			10 – 14 V	After the above time
	20	Engine start signal	6 – 14 V	While engine cranking
	21	Stop lamp switch	0 V	Ignition switch ON Stop lamp switch OFF
			10 – 14 V	Ignition switch ON Stop lamp switch ON
	22	Vehicle speed sensor	deflect between 0 – 1.6 and 4 – 14 V	Ignition switch ON and rear right wheel turned slowly with rear left wheel locked
	23	–	–	–
	24	–	–	–

For TYPE A (See NOTE)

NOTE:

See NOTE in "ECM TERMINAL VOLTAGE VALUES TABLE" for applicable model.

TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
E17	1	–	–	–
	2	R-range signal (A/T)	10 – 14 V	Ignition switch ON and shift select switch in R range
			0 – 1.3 V	Ignition switch ON and shift select switch in other than R range
	3	Blank	–	–

TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
E17	4	Blank	–	–
	5	Overdrive cut signal (A/T)	0 – 1.0 V	Ignition switch ON and ECT less than 60 °C
			10 – 14 V	Ignition switch ON and ECT more than 60 °C
	6	D-range idle up signal (A/T)	10 – 14 V	Ignition switch ON and shift select switch in other than P and N range
			0 – 1.6 V	Ignition switch ON and shift select switch in P and N range
	7	Stop lamp switch	0 V	Ignition switch ON Stop lamp switch OFF
			10 – 14 V	Ignition switch ON Stop lamp switch ON
	8	–	–	–
	9	Ignition switch	10 – 14 V	Ignition switch ON
	10	–	–	–
	11	Vehicle speed sensor	deflect between 0 – 1.6 and 4 – 14 V	Ignition switch ON and rear right wheel turned slowly with rear left wheel locked
	12	ABS signal (if equipped)	10 – 14 V	Ignition switch ON
	13	Engine start signal	6 – 14 V	While engine cranking
	14	–	–	–
	15	–	–	–
	16	Rear defogger switch (if equipped)	10 – 14 V	Ignition switch ON and rear defogger switch ON
			0 – 1.3 V	Ignition switch ON and rear defogger switch OFF
	17	A/T failure signal (with immobilizer indicator lamp) (A/T)	–	–

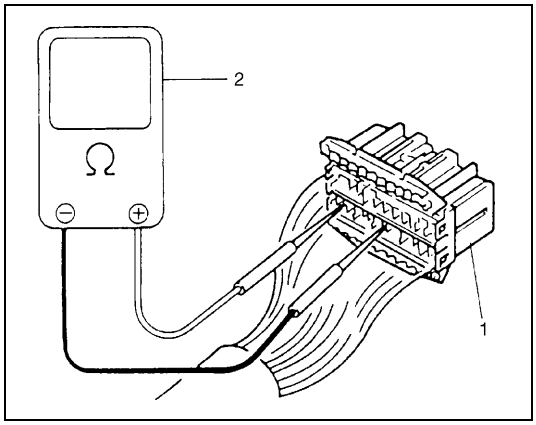
For TYPE B (See NOTE)

NOTE:
See NOTE in "ECM TERMINAL VOLTAGE VALUES TABLE" for applicable model.

TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
E17	1	A/C evaporator temp. sensor	2.0 – 2.3 V	Ignition switch ON A/C evaporator temp. sensor at 25 °C (77 °F)
	2	R-range signal (A/T)	10 – 14 V	Ignition switch ON and shift select switch in R range
			0 – 1.3 V	Ignition switch ON and shift select switch in other than R range
	3	Blank	–	–
	4	Blank	–	–

TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
E17	5	Overdrive cut signal (A/T)	0 – 1.0 V	Ignition switch ON and ECT less than 60° C
			10 – 14 V	Ignition switch ON and ECT more than 60 °C
	6	D-range idle up signal (A/T)	10 – 14 V	Ignition switch ON and shift select switch in other than P and N range
			0 – 1.6 V	Ignition switch ON and shift select switch in P and N range
	7	Data link connector	4 – 5 V	Ignition switch ON
	8	–	–	–
	9	Malfunction indicator lamp	10 – 14 V	Engine running
			0 – 1.0 V	Ignition switch ON leaving engine OFF
	10	–	–	–
	11	Data link connector	10 – 14 V	Ignition switch ON
	12	ABS signal (if equipped)	10 – 14 V	Ignition switch ON
	13	Heater blower switch	0 – 2.0 V	Ignition switch ON and heater blower switch ON
			10 – 14 V	Ignition switch ON and heater blower switch OFF
	14	Sensor ground	–	–
	15	Throttle opening signal for TCM (A/T)	Indication deflection repeated 0 V and 10 - 14 V	Ignition switch ON
	16	Tachometer	–	–
	17	–	–	–

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 terminal of couplers disconnected.

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).**

1. ECM coupler disconnected
2. Ohmmeter

TERMINALS	CIRCUIT	STANDARD RESISTANCE
E19-7 to E17-9 (For TYPE A) (See NOTE)	HO2S-1 heater	5 – 6.4 Ω
E19-7 to E18-11 (For TYPE B) (See NOTE)		
E18-4 to E17-9 (For TYPE A) (See NOTE)	HO2S-2 heater	11.7 – 14.3 Ω
E19-9 to E19-2	No.1 injector	12.0 – 13.0 Ω
E19-21 to E19-2	No.2 injector	12.0 – 13.0 Ω
E19-31 to E19-2	No.3 injector	12.0 – 13.0 Ω
E19-8 to E19-2	No.4 injector	12.0 – 13.0 Ω
E19-28 to E19-2	EGR valve (stepper motor coil 4)	20 – 24 Ω
E19-17 to E19-2	EGR valve (stepper motor coil 3)	20 – 24 Ω
E19-29 to E19-2	EGR valve (stepper motor coil 2)	20 – 24 Ω
E19-18 to E19-2	EGR valve (stepper motor coil 1)	20 – 24 Ω
E19-4 to E19-2	EVAP canister purge valve	30 – 34 Ω
E18-19 to E17-9 (For TYPE A) (See NOTE)	Fuel pump relay	70 – 110 Ω
E18-19 to E18-11 (For TYPE B) (See NOTE)		
E18-1 to Body ground	A/C compressor clutch	3 – 4.5 Ω
E18-18 to E19-2	A/C condenser fan control relay	70 – 110 Ω
E18-10 to E18-7	Main relay	70 – 110 Ω
E19-1 to Body ground	Ground	Continuity
E19-2 to Body ground	Ground	Continuity
E19-3 to Body ground	Ground	Continuity

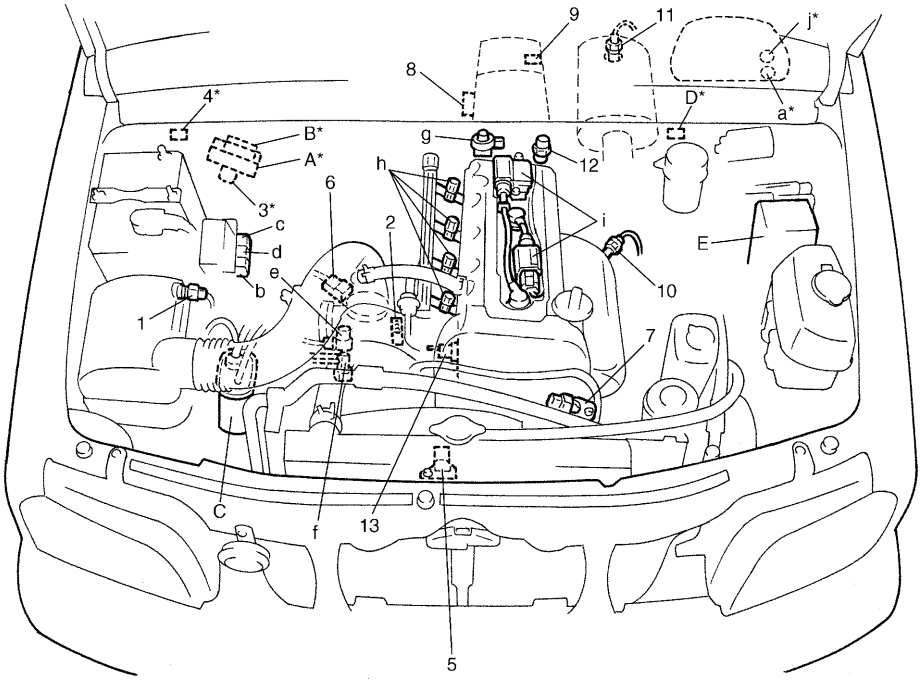
NOTE:
For TYPE A and TYPE B, refer to the NOTE in "ECM Terminal Voltage Values Table" for applicable model.

Component Location

NOTE:

The figure shows left-hand steering vehicle.

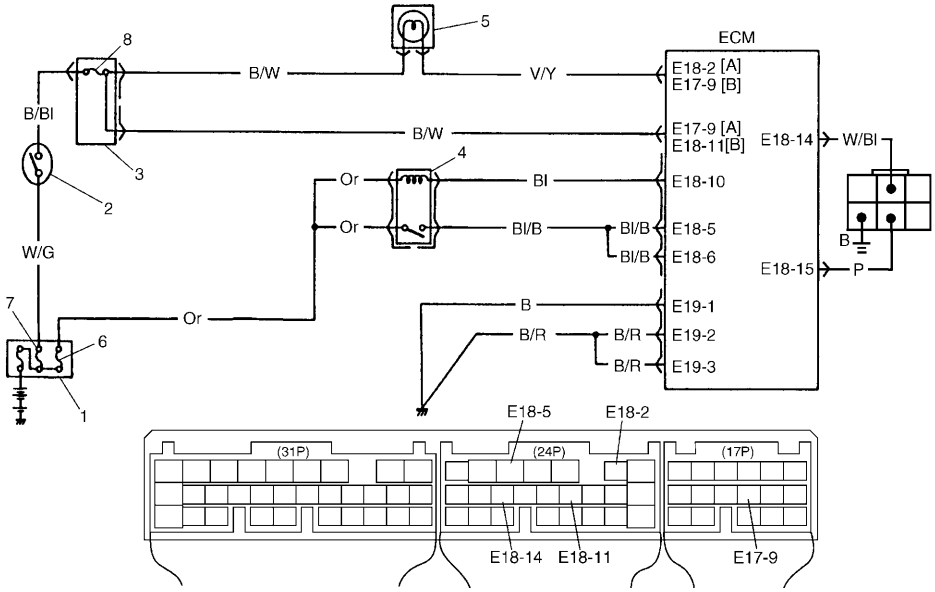
For right-hand steering vehicle, parts with (*) are installed at the other side.



1. IAT sensor	a : Immobilizer indicator lamp (if equipped)	A : ECM
2. TP sensor	b : A/C condenser fan motor relay (if equipped)	B : A/T control module
3. Monitor connector	c : Main relay	C : EVAP canister
4. CO adjusting resistor (if equipped)	d : Fuel pump relay	D : DLC
5. CKP sensor	e : IAC valve	E : ABS control module (if equipped)
6. MAP sensor	f : EVAP canister purge valve	
7. CMP sensor	g : EGR valve (if equipped)	
8. Transmission range switch	h : Fuel injector	
9. VSS	i : Ignition coil assemblies	
10. HO2S-1 (if equipped)	j : MIL	
11. HO2S-2 (if equipped)		
12. ECT sensor		
13. Knock sensor		

Table A-1 Malfunction Indicator Lamp Circuit Check - Lamp Does Not Come "ON" at Ignition Switch ON (But Engine at Stop)

CIRCUIT DESCRIPTION



1. Main fuse	4. Main relay	7. "IG" fuse	[A] : Case of TYPE A is shown (See NOTE)
2. Ignition switch	5. Malfunction indicator lamp in combination meter	8. "IG COIL METER" fuse	[B] : Case of TYPE B is shown (See NOTE)
3. Fuse box	6. "FI" fuse		

NOTE:

For TYPE A and TYPE B, refer to the NOTE in "ECM Terminal Voltage Values Table" for applicable model.

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.

INSPECTION

Step	Action	Yes	No
1	MIL Power Supply Check 1) Turn ignition switch ON. Do other indicator / warning lights in combination meter comes ON?	Go to Step 2.	"IG" fuse blown, main fuse blown, ignition switch malfunction, "B/W" circuit between "IG" fuse and combination meter or poor coupler connection at combination meter.

Step	Action	Yes	No
2	ECM Power and Ground Circuit Check Does engine start?	Go to Step 3.	Go to “Table A-5 ECM Power and Ground Circuit Check”. If engine is not cranked, go to “Diagnosis” in Section 8G.
3	MIL Circuit Check 1) Turn ignition switch OFF and disconnect connectors from ECM. 2) Check for proper connection to ECM at terminal E18-2 (Case of TYPE A) (See NOTE) or E17-9 (Case of TYPE B) (See NOTE). 3) If OK, then using service wire, ground terminal E18-2 (Case of TYPE A) (See NOTE) or E17-9 (Case of TYPE B) (See NOTE) in connector disconnected. Does MIL turn on at ignition switch ON?	Substitute a known-good ECM and recheck.	Bulb burned out, “V/Y” wire circuit open or “P” wire shorted to ground.

Table A-2 Malfunction Indicator Lamp Circuit Check - Lamp Remains “ON” after Engine Starts

WIRING DIAGRAM / CIRCUIT DESCRIPTION

Refer to table A-1.

INSPECTION

Step	Action	Yes	No
1	Diagnostic Trouble Code (DTC) check 1) Check DTC referring to DTC CHECK section. Is there any DTC(s)?	Go to Step 2 of “Engine Diag. Flow Table”.	Go to Step 2.
2	DTC check 1) Start engine and recheck DTC while engine running. Is there any DTC(s)?		Go to Step 3.
3	MIL Circuit check 1) Turn OFF ignition switch. 2) Disconnect connectors from ECM. Does MIL turn ON at ignition switch ON?	“V/Y” wire circuit shorted to ground.	Substitute a known-good ECM and recheck.

Table A-3 Malfunction Indicator Lamp Circuit Check - Mil Flashes at Ignition Switch ON

WIRING DIAGRAM / CIRCUIT DESCRIPTION

Refer to table A-1.

INSPECTION

Step	Action	Yes	No
1	MIL flashing pattern check : 1) With the ignition switch ON position, check MIL flashing pattern. Does MIL flashing pattern indicate DTC (diagnostic trouble code)?	Go to Step 2.	Go to “Diagnosis” in Section 8G.
2	Diagnosis switch terminal check : 1) With the ignition switch ON position, check voltage between E18-14 terminal of ECM coupler and ground. Is voltage 4 – 5 V?	Substitute a known-good ECM and recheck.	“W/Bl” wire (diagnosis switch terminal) shorted to ground circuit. If OK, substitute a known-good ECM and recheck.

Table A-4 Malfunction Indicator Lamp Circuit Check - MIL Does Not Flash, Just Remains ON or Just Remains OFF Even with Grounding Diagnosis Switch Terminal

WIRING DIAGRAM / CIRCUIT DESCRIPTION

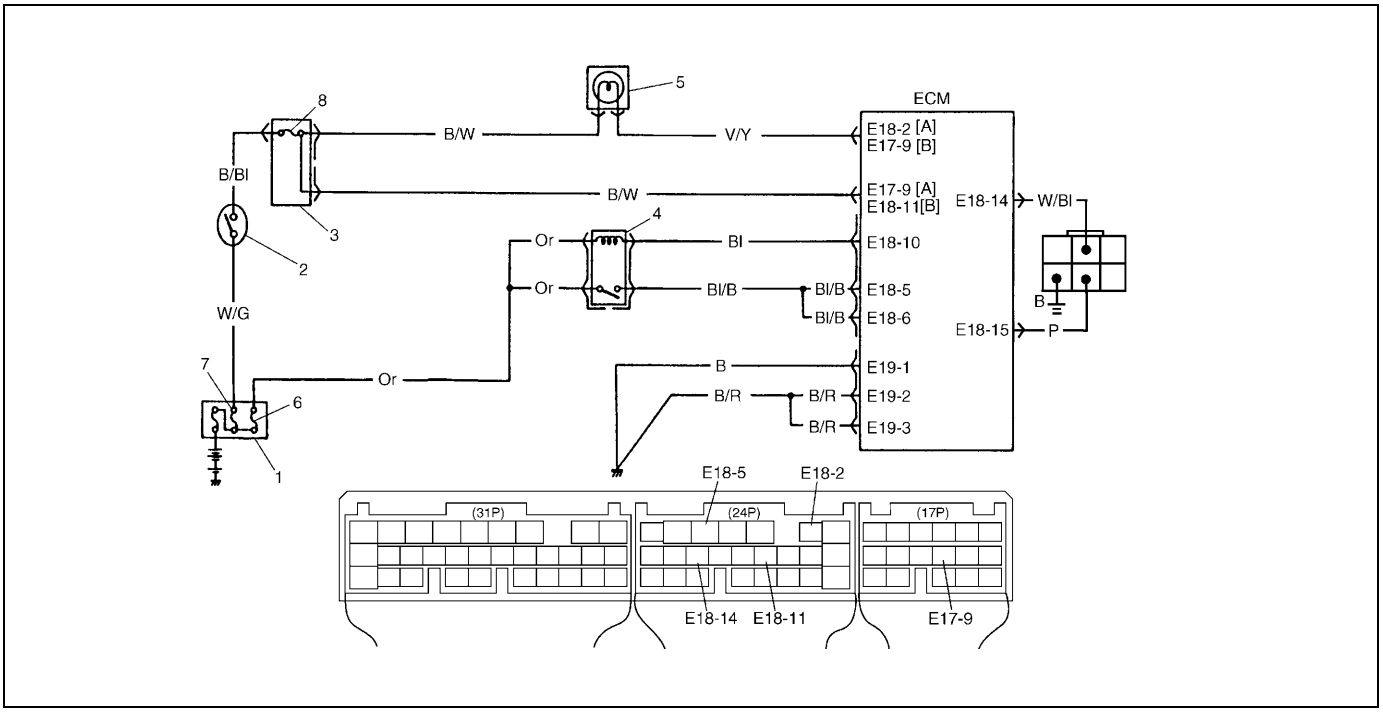
Refer to table A-1.

INSPECTION

Step	Action	Yes	No
1	MIL flashing pattern check : 1) With grounding diagnosis switch terminal and turn the ignition switch ON position, check voltage between E18-14 terminal of ECM connector and ground. Is voltage 0 – 1 V?	Go to Step 2.	“W/Bl” wire (diagnosis switch terminal), “B” wire of monitor connector open. If OK, substitute a known-good ECM and recheck.
2	Test switch terminal circuit check : 1) With the ignition switch ON position, check voltage between E18-15 terminal of ECM connector and ground. Is voltage 4 – 5 V?	Substitute a known-good ECM and recheck.	“P” wire (test switch terminal) shorted to ground circuit. If OK, substitute a known-good ECM and recheck.

Table A-5 ECM Power and Ground Circuit Check - MIL Doesn't Light at Ignition Switch ON and Engine Doesn't Start Though It Is Cranked Up

CIRCUIT DESCRIPTION



1. Main fuse	4. Main relay	7. "IG" fuse	[A] : Case of TYPE A is shown (See NOTE)
2. Ignition switch	5. Malfunction indicator lamp in combination meter	8. "IG COIL METER" fuse	[B] : Case of TYPE B is shown (See NOTE)
3. Fuse box	6. "FI" fuse		

NOTE:

For TYPE A and TYPE B, refer to the NOTE in "ECM Terminal Voltage Values Table" for applicable model.

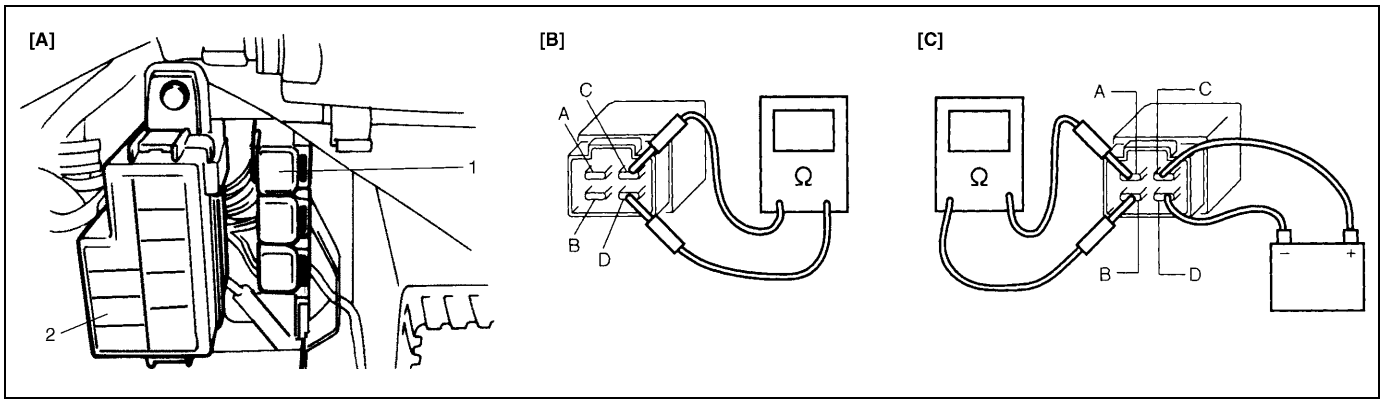
When the ignition switch tuned ON, the main relay turns ON (the contact point closes) and the main power is supplied to ECM.

INSPECTION

Step	Action	Yes	No
1	Main Relay Operating Sound Check Is operating sound of main relay heard at ignition switch ON?	Go to Step 5.	Go to Step 2.
2	Main Relay Check 1) Turn OFF ignition switch and remove main relay (1). 2) Check for proper connection to main relay (1) at terminal 3 and 4. 3) Check resistance between each two terminals. See Fig. 1 and 2. **Main relay resistance** **Between terminals A and B : Infinity** **Between terminals C and D : 70 – 110 Ω (at 20 °C, 68 °F)** 4) Check that there is continuity between terminals 1 and 2 when battery is connected to terminals 3 and 4. See Fig. 3. Is main relay in good condition?	Go to Step 3.	Replace main relay.

Step	Action	Yes	No
3	Fuse Check Is main “FI” fuse in good condition? See Fig. 1.	Go to Step 4.	Check for short in circuits connected to this fuse.
4	ECM Power Circuit Check 1) Turn OFF ignition switch, disconnect connectors from ECM and install main relay. 2) Check for proper connection to ECM at terminals E17-9 (Case of TYPE A) (See NOTE) or E18-11 (Case of TYPE B) (See NOTE), E18-10, E18-5 and E18-6. 3) If OK, then measure voltage between terminal E18-10 and ground, E17-9 (Case of TYPE A) (See NOTE) or E18-11 (Case of TYPE B) (See NOTE) and ground with ignition switch ON. Is each voltage 10 – 14 V?	Go to Step 5.	“B/W”, “Or” or “Bl/B” circuit open.
5	ECM Power Circuit Check 1) Using service wire, ground terminal E18-10 and measure voltage between terminal E18-5 and ground at ignition switch ON. Is it 10 – 14 V?	Check ground circuits “B” and “B/R” for open. If OK, then substitute a known-good ECM and recheck.	Go to Step 6.
6	Is operating sound of main relay heard in Step 1?	Go to Step 7.	“Bl/B” or “B/R” wire open.
7	Main Relay Check 1) Check main relay according to procedure in Step 2. Is main relay in good condition?	“Or” or “Bl/B” wire open.	Replace main relay.

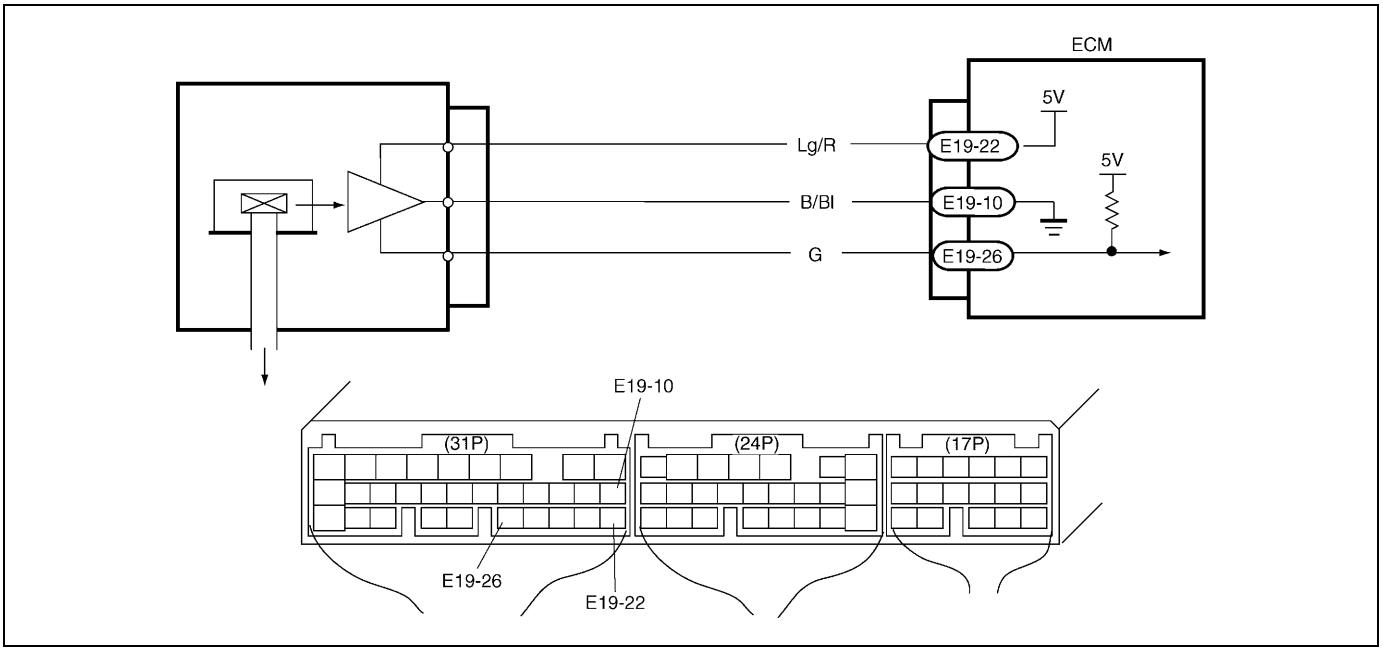
[A] Fig. 1 for Step 2 and 3 / [B] Fig. 2 for Step 2 / [C] Fig. 3 for Step 2



2. “F1” fuse

DTC P0105 (DTC No.11) Manifold Absolute Pressure (MAP) Circuit Malfunction

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
• MAP sensor signal is 0.19 V or lower. (Low pressure – High vacuums – Low voltage) • MAP sensor signal is 4.5 V or higher. (High pressure – Low vacuums – High voltage)	• "B/Bl" circuit open • "Lg/R" circuit open or shorted to ground • "G" circuit open or shorted to ground • MAP sensor malfunction • ECM malfunction

NOTE:

- **When DTC P0120 is indicated together, it is possible that "Lg/R" circuit is open.**
- **When DTC P0105 (No.11), P0110 (No.18) P0115 (No.19) P0120 (No.13) and P0460 are indicated together, it is possible that "B/Bl" circuit is open.**

DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

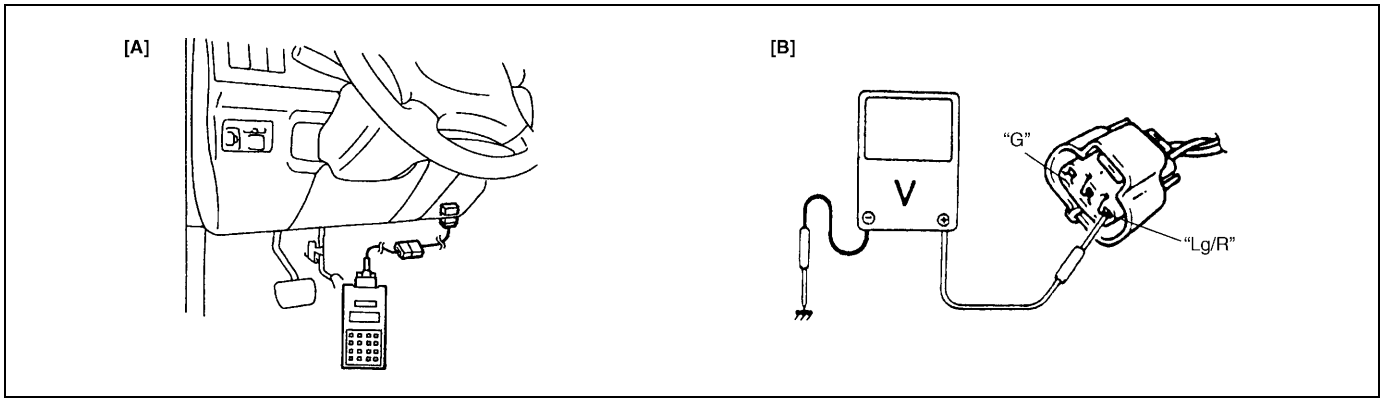
Step	Action	Yes	No
1	Was "Engine Diag. Flow Table" performed?	Go to Step 2.	Go to "Engine Diag. Flow Table".
2	Check MAP Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF. See Fig. 1. 2) Turn ignition switch ON. 3) Check intake manifold pressure. Is it 126 kPa (37.2 inHg) or 0 kPa (0 inHg)?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.

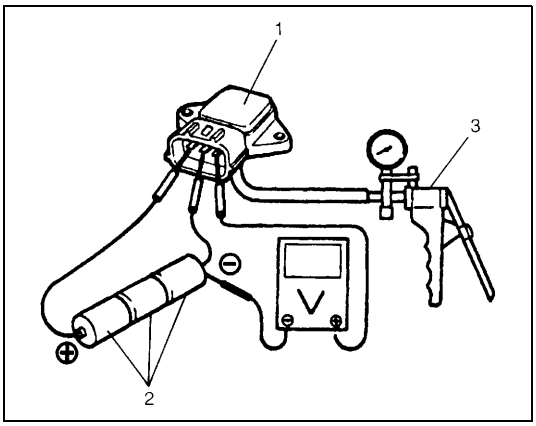
Step	Action	Yes	No
3	Check Wire Harness. 1) Disconnect MAP sensor connector with ignition switch OFF. 2) Check for proper connection of MAP sensor at "G" and "B/Bl" wire terminals. 3) If OK, then with ignition switch ON, check voltage at each of "Lg/R" and "G" wire terminals and body ground. See Fig. 2. Is voltage about 4 – 6 V at each terminal?	Go to Step 4.	"Lg/R" wire open or shorted to ground circuit or shorted to power circuit (See NOTE), "G" wire open or shorted to ground, poor E19-26 connection or E19-22 connection. If wire and connection are OK, confirm that MAP sensor is normal and then substitute a known-good ECM and recheck.
4	Check MAP sensor according to "MAP Sensor Individual Check" below. Is it in good condition?	"Lg/R" wire shorted to "G" wire, "B/Bl" wire open, poor E19-10 connection. If wire and connection are OK, substitute a known-good ECM and recheck.	Replace MAP sensor.

NOTE:

When battery voltage is applied to "Lg/R" wire, it is possible that MAP sensor is also faulty.

[A] Fig. 1 for Step 2 / [B] Fig. 2 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).

If check result is not satisfactory, replace MAP sensor (1).

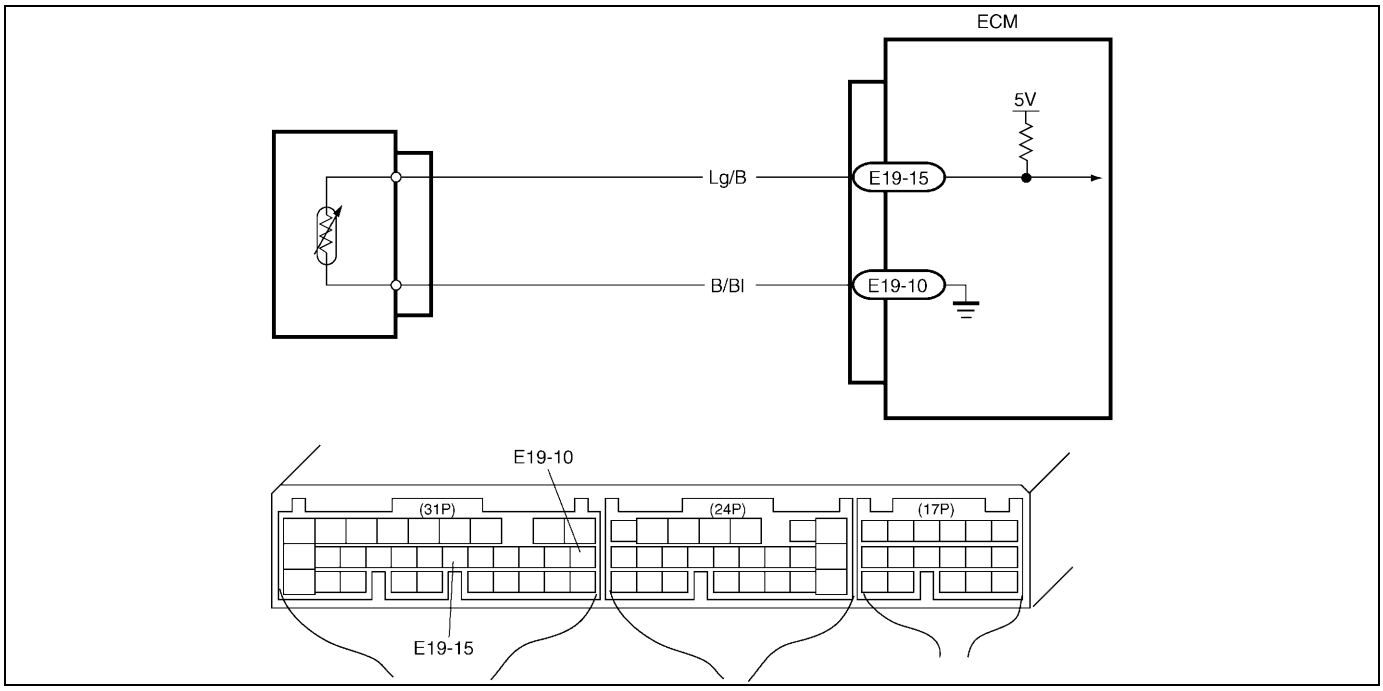
Output voltage (When input voltage is 4.5 – 5.5 V, ambient temp. 20 – 30 °C, 68 – 86 °F)

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

4) Install MAP sensor (1) securely.
5) Connect MAP sensor (1) connector securely.

DTC P0110 (DTC No.18) Intake Air Temp. (IAT) Circuit Malfunction

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
• Low intake air temperature (High voltage-High resistance) • High intake air temperature (Low voltage-Low resistance)	• "Lg/R" circuit open or shorted to power. • "B/Bl" circuit open • IAT sensor malfunction • ECM malfunction

NOTE:

- **When DTC P0105 (No.11), P0110 (No.18), P046, P0115 (No.19) and P0120 (No.13) are indicated together, it is possible that "B/Bl" circuit is open.**
- **Before inspecting, be sure to check that ambient temperature is higher than –40 °C (–40 °F).**

DTC CONFIRMATION PROCEDURE

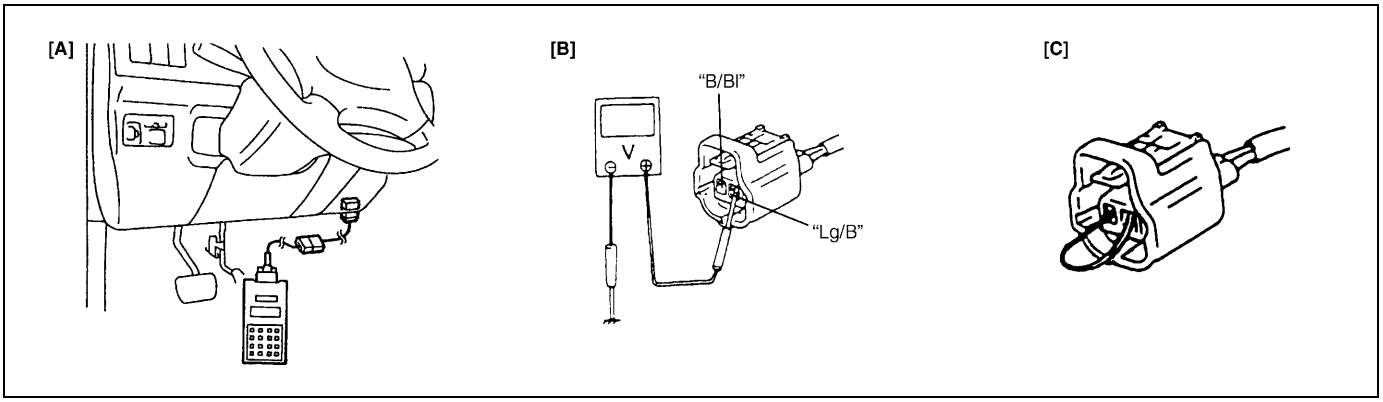
1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select "DTC" mode no scan tool and check DTC.

INSPECTION

Step	Action	Yes	No
1	Was "Engine Diag. Flow Table" performed?	Go to Step 2.	Go to "Engine Diag. Flow Table".
2	Check IAT Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF. See Fig. 1. 2) Turn ignition switch ON. 3) Check intake air temp. displayed on scan tool. Is –40 °C (–40 °F) or 119 °C (246 °F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.

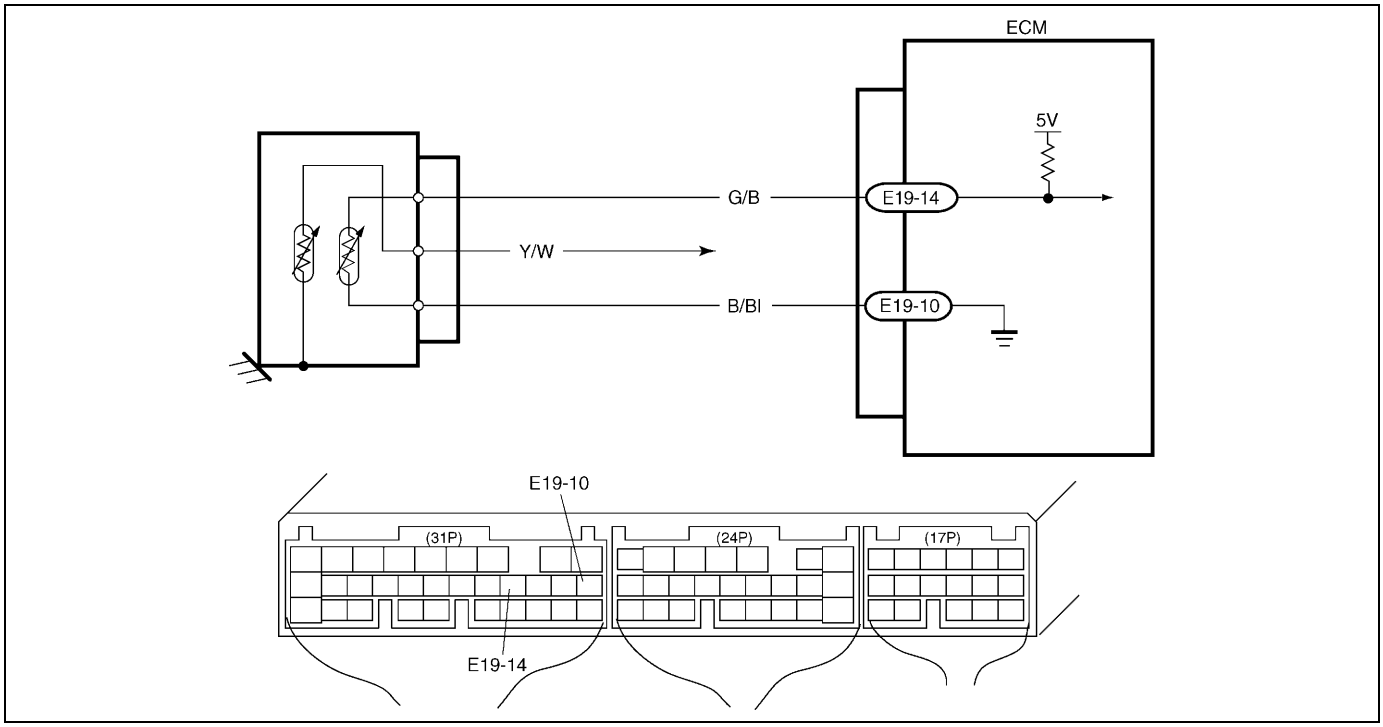
Step	Action	Yes	No
3	Check Wire Harness. 1) Disconnect IAT sensor connector with ignition switch OFF. 2) Check for proper connection to IAT sensor at “Lg/B” and “B/Bl” wire terminals. See Fig. 2. 3) If OK, then with ignition switch ON. Is voltage applied to “Lg/B” wire terminal about 4 – 6 V?	Go to Step 5.	“Lg/B” wire open or shorted to power, or poor E19-15 connection. If wire and connection are OK, substitute a known-good ECM and recheck.
4	Does scan tool indicate –40 °C (–40 °F) at Step 2.	Go to Step 6.	Go to Step 5.
5	Check Wire Harness 1) Check intake air temp. displayed on scan tool with ignition switch ON. Is –40 °C (–40 °F) indicated?	Replace IAT sensor.	“Lg/B” wire shorted to ground. If wire is OK, substitute a known-good ECM and recheck.
6	Check Wire Harness. 1) Using service wire, connect IAT sensor connector terminals. 2) Check intake air temp. displayed on scan tool with ignition switch ON. See Fig. 3. Is 119 °C (246 °F) indicated?	Replace IAT sensor.	“Lg/B” wire open or poor E19-10 connection. If wire and connection are OK, substitute a known-good ECM and recheck.

[A] Fig. 1 for Step 2 / [B] Fig. 2 for Step 3 / [C] Fig. 3 for Step 6



DTC P0115 (DTC No.19) Engine Coolant Temperature (ECT) Circuit Malfunction

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
• Low engine coolant temperature (High voltage-High resistance) • High engine coolant temperature (Low voltage-Low resistance)	• "G/B" circuit open or shorted to power • "B/Bl" circuit open • ECT sensor malfunction • ECM malfunction

NOTE:

- **When DTC P0105 (No.11), P0110 (No.18), P0115 (No.19), P0120 (No.13) and P0460 are indicated together, it is possible that "B/Bl" circuit is open.**
- **Before inspecting, be sure to check that coolant temp. meter in combination meter indicates normal operating temperature (Engine is not overheating).**
- **When this DTC and P1709 are stored together, also clear DTC stored in TCM after completion of repair.**

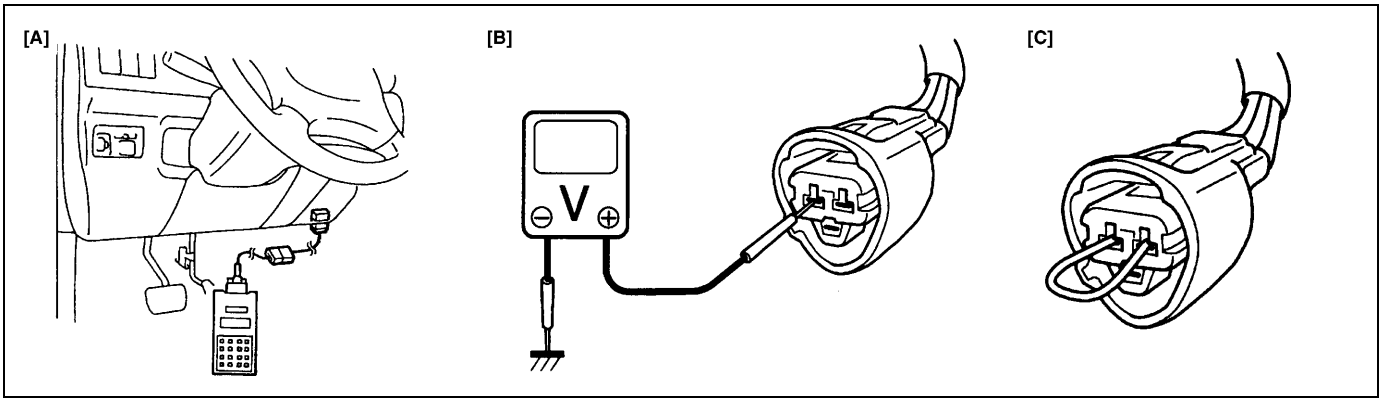
DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

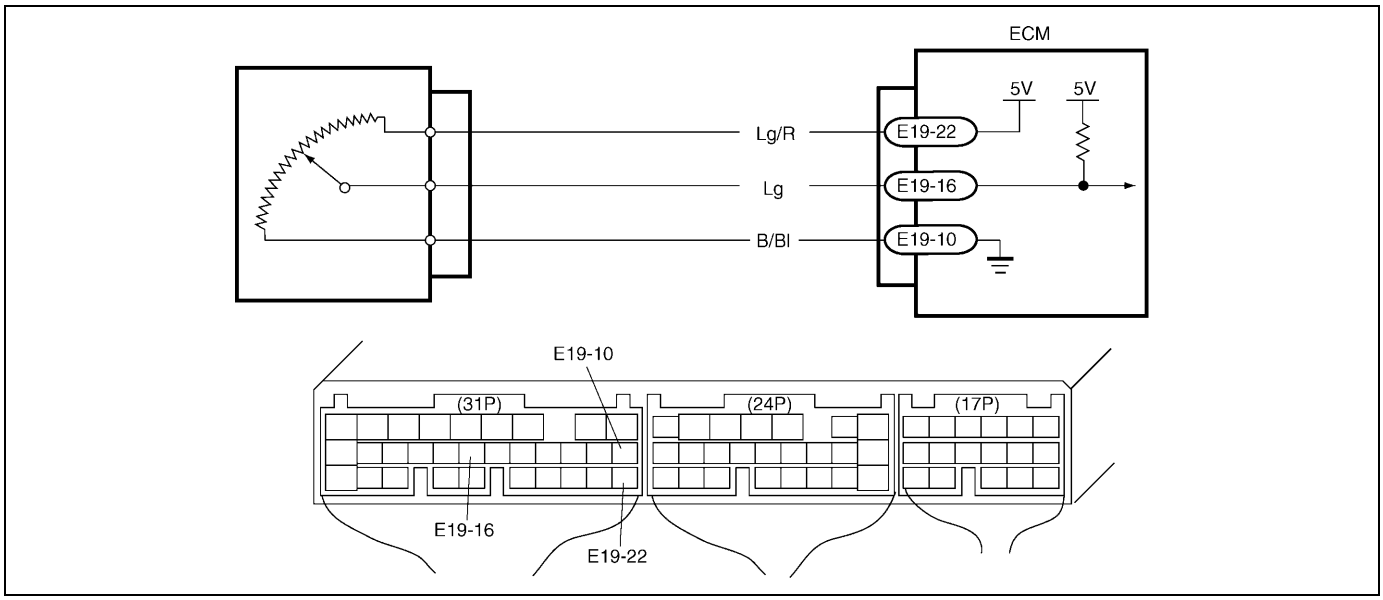
Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	Check ECT Sensor and Its Circuit. 1) Connect scan tool with ignition switch OFF. See Fig. 1. 2) Turn ignition switch ON. 3) Check engine coolant temp. displayed on scan tool. Is –40 °C (–40 °F) or 119 °C (246 °F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.
3	Check Wire Harness. 1) Disconnect ECT sensor connector. 2) Check engine coolant temp. displayed on scan tool. Is –40 °C (–40 °F) indicated?	Replace ECT sensor.	“G/B” wire shorted to ground. If wire is OK, substitute a known-good ECM and recheck.
4	Does scan tool indicate –40 °C (–40 °F) at Step 2.	Go to Step 6.	Go to Step 5.
5	Check Wire Harness. 1) Disconnect ECT sensor connector with ignition switch OFF. 2) Check for proper connection to ECT sensor at “B/Bl” and “G/B” wire terminals. See Fig. 2. 3) If OK, then with ignition switch ON. Is voltage applied to “B/Bl” wire terminal about 4 – 6 V?	Go to Step 4.	“G/B” wire open or shorted to power, or poor E19-14 connection. If wire and connection are OK, substitute a known-good ECM and recheck.
6	Check Wire Harness. 1) Using service wire, connect ECT sensor connector terminals. See Fig. 3. 2) Turn ignition switch ON and check engine coolant temp. displayed on scan tool. Is 119 °C (246 °F) indicated?	Replace ECT sensor.	“B/Bl” wire open or poor E19-10 connection. If wire and connection are OK, substitute a known-good ECM and recheck.

[A] Fig. 1 for Step 2 / [B] Fig. 2 for Step 5 / [C] Fig. 3 for Step 6



DTC P0120 (DTC No.13) Throttle Position Circuit Malfunction

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
• Signal voltage high • Signal voltage low	• "B/Bl" circuit open • "Lg" circuit open or shorted to ground • "B/Bl" circuit open or shorted to power or ground • TP sensor malfunction • ECM malfunction

NOTE:

- **When DTC P0105 (No.11), P0110 (No.18), P0115 (No.19), P0120 (No.13) and/or P0460 are indicated together, it is possible that "B/Bl" or "Lg/R" circuit is open.**
- **When this DTC and P1700 are stored together, also clear DTC stored in TCM after completion of repair.**

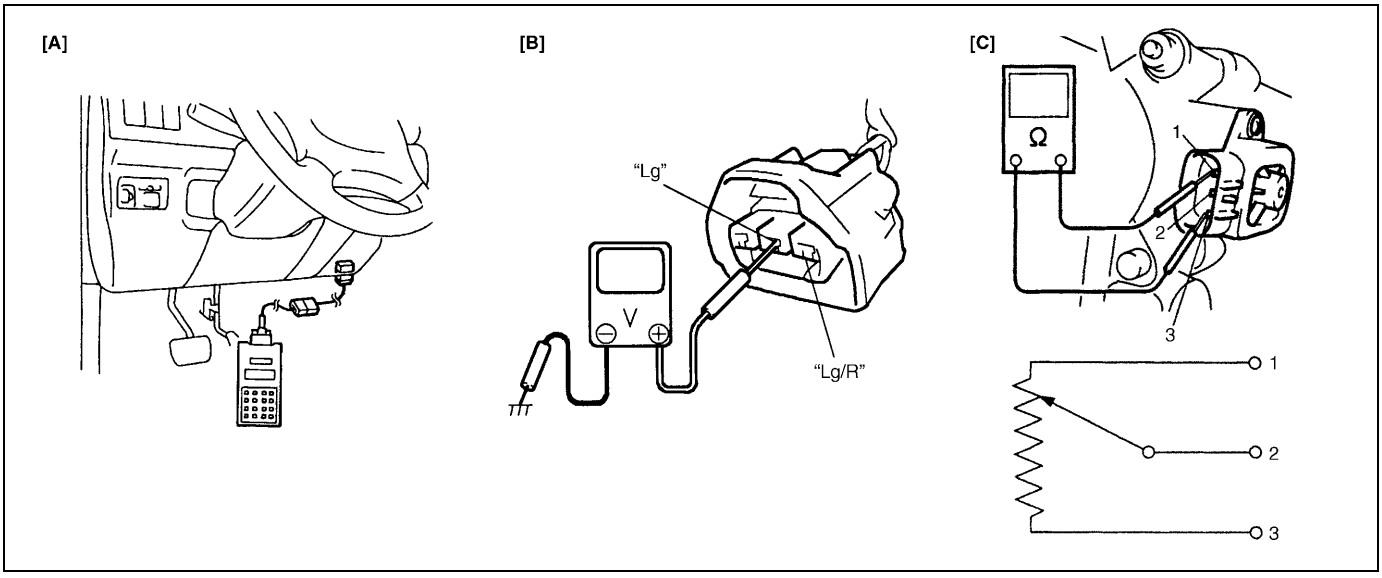
DTC CONFIRMATION PROCEDURE

1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	Check TP Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF and then turn ignition switch ON. See Fig. 1. 2) Check throttle valve opening percentage displayed on scan tool. Is it displayed 0% or 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 OFF. 2) Check for proper connection to TP sensor at “Lg/R”, “Lg” and “B/Bl” wire terminal. 3) If OK, then with ignition switch ON, check voltage at each of “Lg/R” and “Lg” wire terminals and body ground. See Fig. 2. Is voltage about 4 – 6 V at each terminal?	Go to Step 4.	“Lg/R” wire open, “Lg/R” wire shorted to ground circuit or power circuit or “B/Bl” wire, “Lg” wire open or shorted to ground circuit or poor E19-22 or E19-16 connection. If wire and connection are OK, substitute a known-good ECM and recheck.
4	Check TP Sensor. 1) Check resistance between terminals of TP sensor. See Fig. 3. **TP sensor resistance** **Between 1 and 3 : 4.0 – 6.0 kΩ** **Between 2 and 3 : Varying according to throttle valve opening (0.02 – 6.0 kΩ)** Are measured values within specifications?	“B/Bl” wire open or poor E19-10 connection. If wire and connection are OK, substitute a known-good ECM and recheck.	Replace TP sensor.

[A] Fig. 1 for Step 2 / [B] Fig. 2 for Step 3 / [C] Fig. 3 for Step 4



DTC P0121 Throttle Position Circuit Range / Performance Problem

WIRING DIAGRAM

Refer to DTC P0120 section.

CIRCUIT DESCRIPTION

DTC DETECTING CONDITION	POSSIBLE CAUSE
• After engine warmed up. • Difference between actual throttle opening (detected from TP sensor) and opening calculated by ECM (Obtained on the basis of engine speed and intake manifold pressure) in larger than specified value. ✱2 driving cycle detection logic, continuous monitoring	• TP sensor malfunction • High resistance in the circuit • 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, on a level road.**

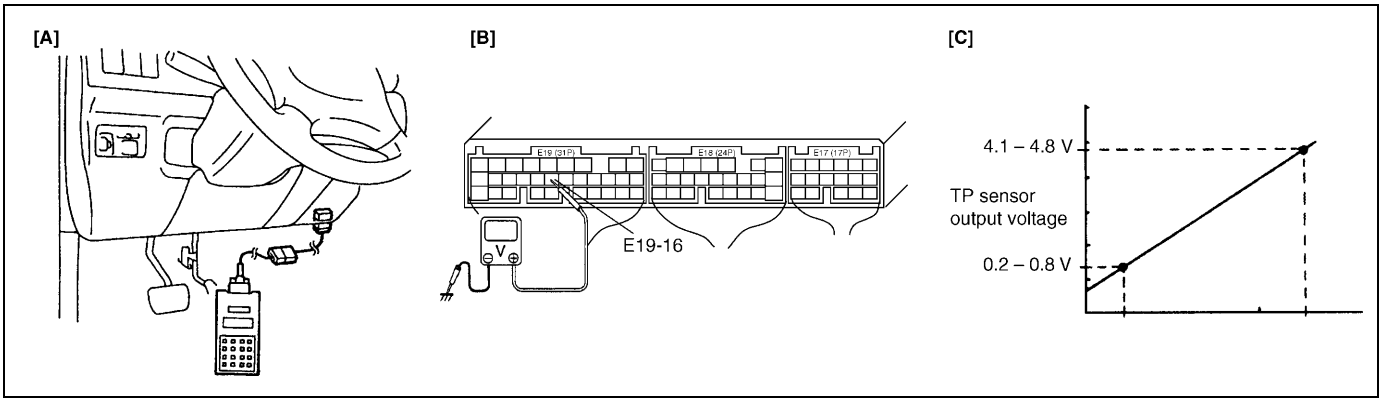
1) Turn ignition switch OFF. Clear DTC with ignition switch ON, check vehicle and environmental condition for :
   – Altitude (barometric pressure) : 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp. : –10 °C, 14 °F or higher
   – Intake air temp. : 70 °C, 158 °F or lower
   – Engine coolant temp. : 70 °C, 158 °F or higher
2) Warm up engine to normal operating temperature.
3) Increase vehicle speed to 30 – 40 mph, 50 – 60 km/h in 3rd gear or “D” range and hold throttle valve at that opening position for 1 min.
4) Stop vehicle.
5) Check DTC in “DTC” mode and pending DTC in “ON BOARD TEST” or “PENDING DTC” mode.

INSPECTION

Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	Is SUZUKI scan tool available?	Go to Step 3.	Go to Step 4.
3	Check TP Sensor and Its Circuit. 1) Turn ignition switch OFF and connect SUZUKI scan tool to DLC. See Fig. 1. 2) Turn ignition switch ON and check TP sensor output voltage when throttle valve is at idle position and fully opened. See Fig. 3. Dose voltage vary within specified value linearly as shown in figure?	Substitute a known-good ECM and recheck.	Go to Step 5.

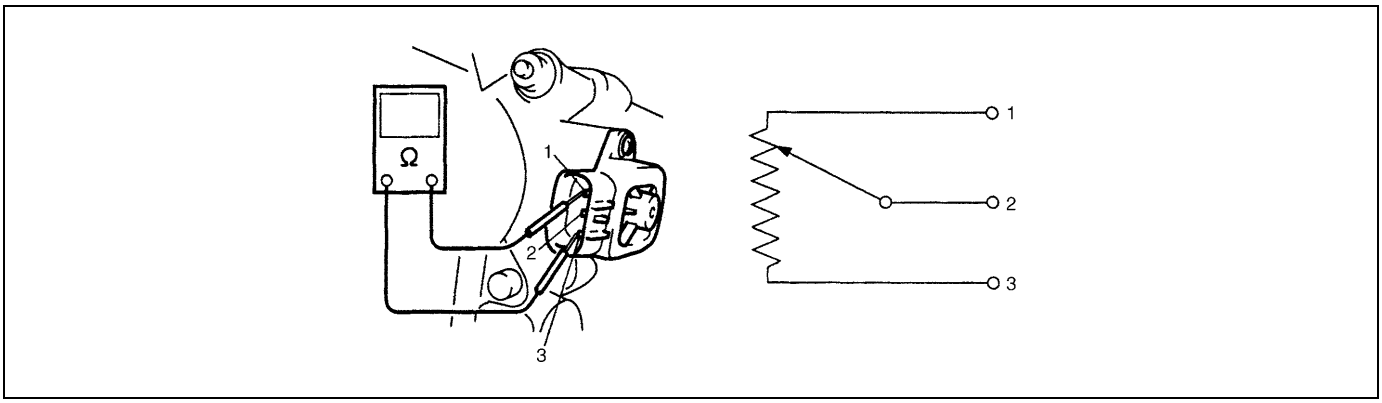
Step	Action	Yes	No
4	Check TP Sensor and its Circuit. 1) Turn ignition switch ON. 2) Check voltage at terminal E19-16 of ECM connector connected, when throttle valve is at idle position and fully opened. See Fig. 2 and 3. Dose voltage vary within specified value linearly as shown in figure?	If voltmeter was used, check terminal E19-16 for poor connection. If OK, substitute a known-good ECM and recheck.	Go to Step 5.
5	Check TP Sensor. 1) Turn ignition switch OFF. 2) Disconnect TP sensor connector. 3) Check for proper connection to TP sensor at each terminal. 4) If OK, then measure resistance between terminals and check if each measured value is as specified below. See Fig. 4. **TP sensor resistance** **Between 1 and 2 : 4.0 – 6.0 kΩ** **Between 1 and 3 : 0.02 – 6.0 kΩ, varying according to throttle valve opening.** Are measured values as specified?	High resistance in “Lg/R”, “Lg” or “B/Bl” circuit. If wire and connection are OK, substitute a known-good ECM and recheck.	Replace TP sensor.

[A] Fig. 1 for Step 3 / [B] Fig. 2 for Step 4 / [C] Fig. 3 for Step 3 and 4



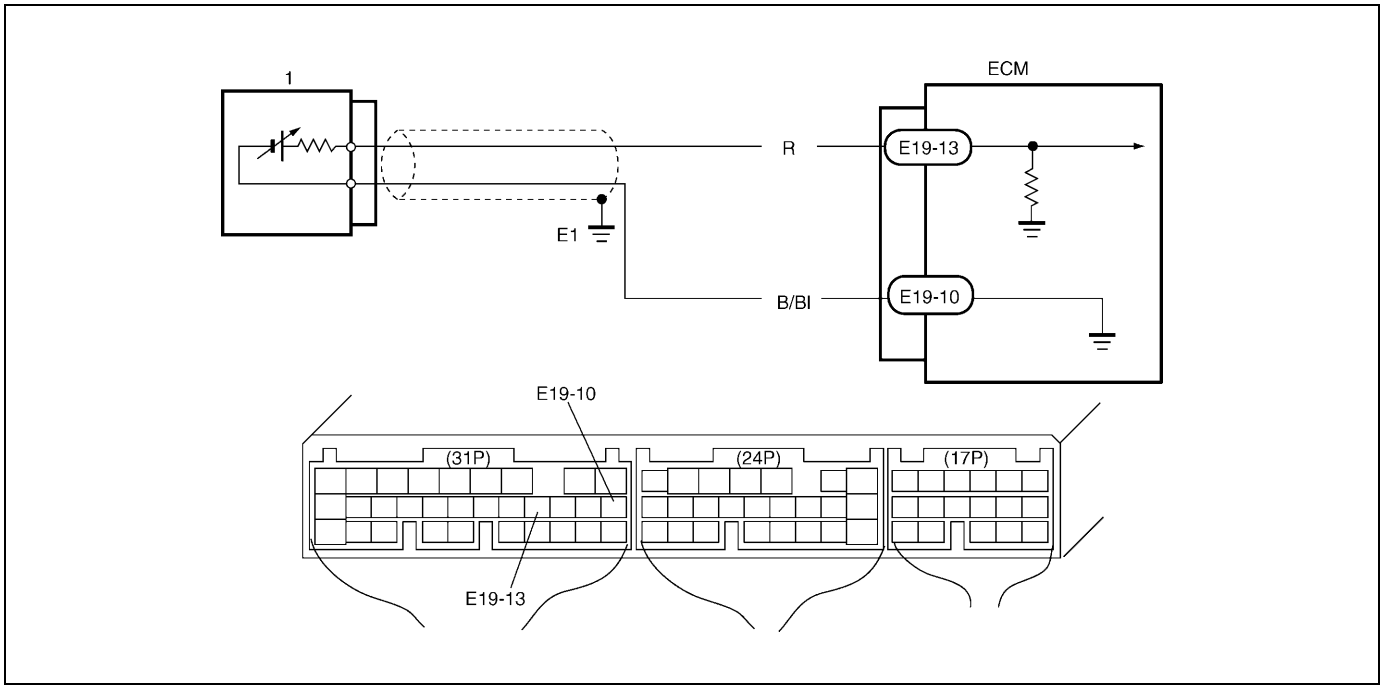
[A] : When using SUZUKI scan tool.
[B] : When not using SUZUKI scan tool.

Fig. 4 for Step 5



DTC P0130 (DTC No.14) Heated Oxygen Sensor (HO2S) Circuit Malfunction (Sensor-1)

CIRCUIT DESCRIPTION



1. Heated oxygen sensor-1 (HO2S-1)

DTC DETECTING CONDITION	POSSIBLE CAUSE
• When running at idle speed after engine warmed up and running at specified vehicle speed, HO2S-1 output voltage does not go below 0.3 V or over 0.6 V. ✱2 driving cycle detection logic, Monitoring once / 1 driving.	• Heated oxygen sensor-1 malfunction • "B/Bl" or "R" circuit open (poor connection) or short

DTC CONFIRMATION PROCEDURE

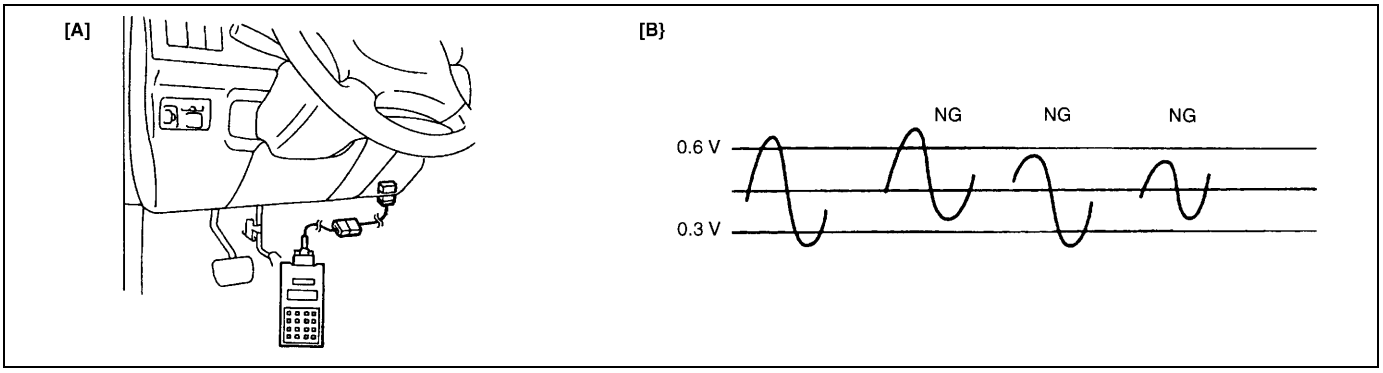
WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Turn ignition switch OFF. Clear DTC with ignition switch ON, check vehicle and environmental condition for :
   – Altitude (barometric pressure) : 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp. : –10 °C, 14 °F or higher
   – Intake air temp. : 70 °C, 158 °F or lower
2) Warm up engine to normal operating temperature.
3) Drive vehicle at 30 – 40 mph, 50 – 60 km/h for 2 min.
4) Stop vehicle and run engine at idle for 2 min.
5) Check DTC in "DTC" mode and pending DTC in "ON BOARD TEST" or "PENDING DTC" mode.

INSPECTION

Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is there DTC(s) other than HO2S-1 (DTC P0130)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	1) Connect scan tool to DLC with ignition switch OFF. See Fig. 1. 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). See Fig. 2. Does HO2S-1 output voltage deflect between 0.3 V and over 0.6 V repeatedly?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Check “R” and “B/Bl” wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-1.

[A] Fig. 1 for Step 3 / [B] Fig. 2 for Step 3



DTC P0133 Heated Oxygen Sensor (HO2S) Circuit Slow Response (Sensor-1)

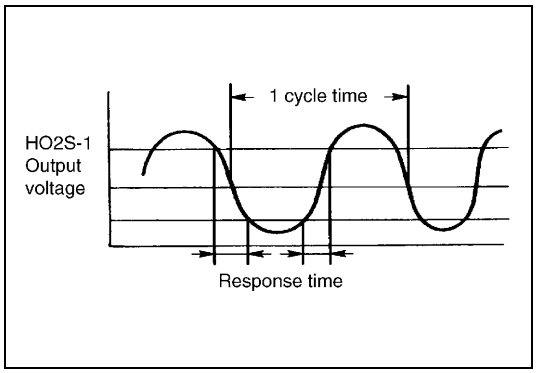
WIRING DIAGRAM

Refer to DTC P0130 section.

CIRCUIT DESCRIPTION

DTC DETECTING CONDITION	POSSIBLE CAUSE
• When running at specified idle speed after engine warmed up and running at specified vehicle speed, 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. See. Fig. 1 ✱2 driving cycle detection logic, Monitoring once / 1 driving.	• Heated oxygen sensor-1 malfunction

Fig. 1



DTC CONFIRMATION PROCEDURE

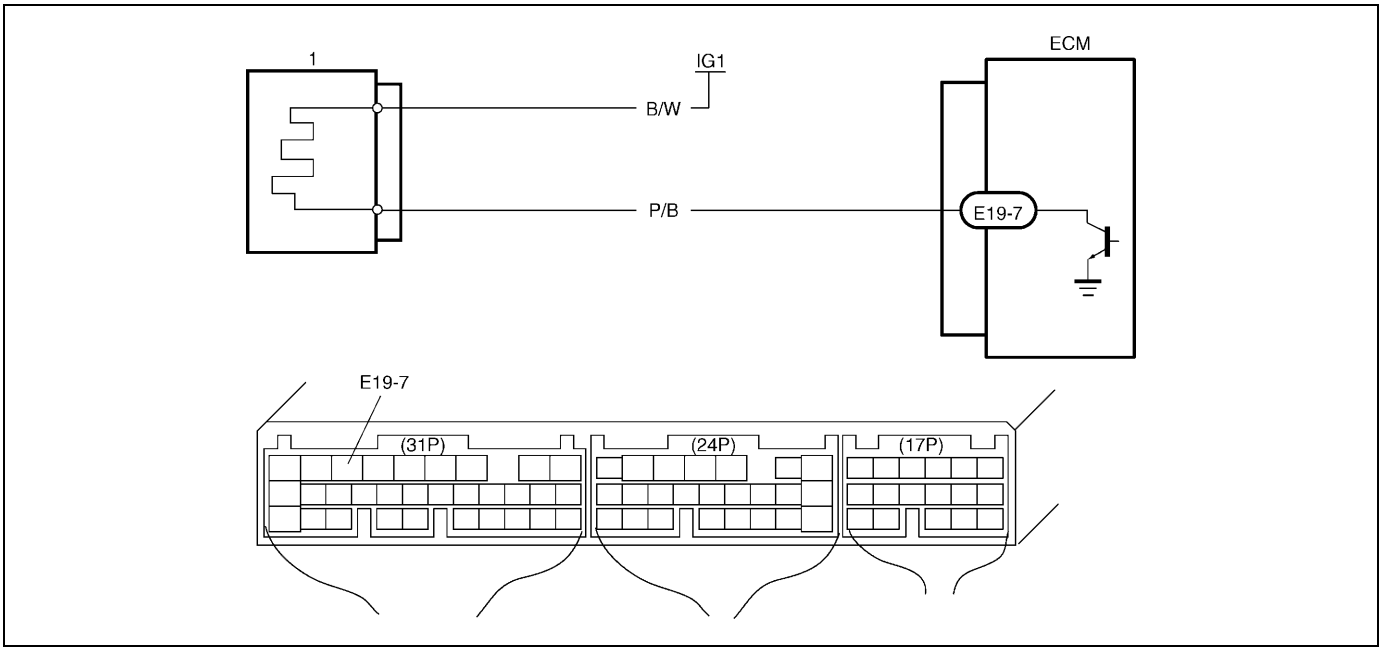
Refer to DTC P0130 section.

INSPECTION

Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	Is there DTC(s) other than HO2S-1 (DTC P0133)?	Go to applicable DTC Diag. Flow Table.	Replace HO2S-1.

DTC P0135 (DTC No.14) Heated Oxygen Sensor (HO2S) Heater Circuit Malfunction (Sensor-1)

CIRCUIT DESCRIPTION



1. Heated oxygen sensor-1 (HO2S-1) heater

DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B condition is met. A : • Low voltage at terminal E19-7 when engine is running at high load. B : • High voltage at terminal E19-7 when engine is running under condition other than above. ✱2 driving cycle detection logic, Continuous monitoring.	• HO2S-1 heater circuit open or shorted to ground • ECM malfunction

DTC CONFIRMATION PROCEDURE

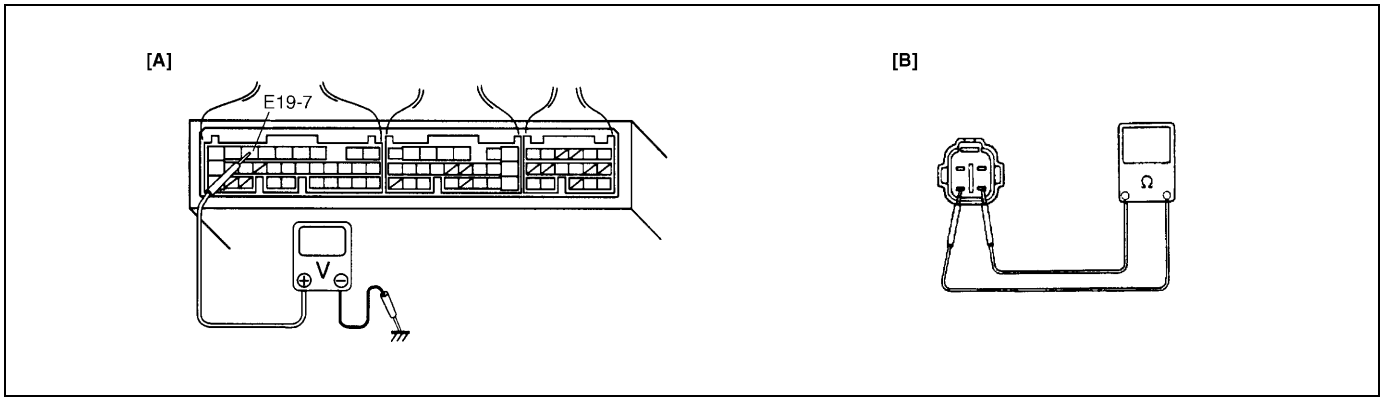
WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON, start engine and keep it at idle for 1 min.
3) Start vehicle and depress accelerator pedal fully for 5 sec. or longer.
4) Stop vehicle.
5) Check DTC in “DTC” mode and pending DTC in “ON BOARD TEST” or “PENDING DTC” mode.

INSPECTION

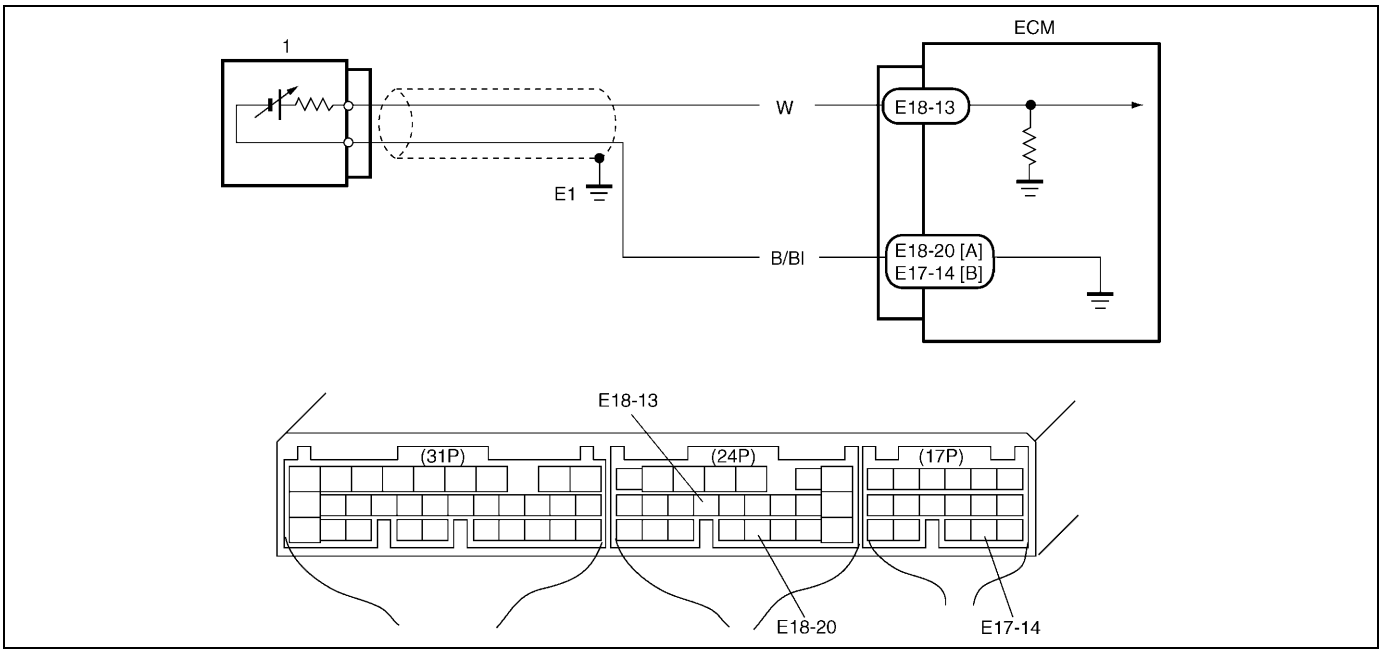
Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	Check Heater for Operation. 1) Check voltage at terminal E19-7. See Fig. 1. 2) Warm up engine to normal operating temperature. 3) Stop engine. 4) Turn ignition switch ON and Check voltage at terminal E19-7. See Fig. 1. Voltage should be over 10 V. 5) Start engine, run it at idle and check voltage at the same terminal. Voltage should be below 1.9 V. Are check results are specified?	Intermittent trouble Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check Heater of Sensor-1. 1) Disconnect HO2S-1 coupler with ignition switch OFF. 2) Check for proper connection to HO2S-1 at “B/W” and “P/B” wire terminals. 3) If OK, then check heater resistance. See Fig. 2. Is it 5 – 6.4 Ω at 20 °C, 68 °F?	“P/B” wire open or shorted to ground or poor connection at E19-7. If wire and connection are OK, substitute a known-good ECM and recheck.	Replace HO2S-1.

[A] Fig. 1 for Step 2 / [B] Fig. 2 for Step 3



DTC P0136 Heated Oxygen Sensor (HO2S) Circuit Malfunction (Sensor-2)

CIRCUIT DESCRIPTION



1. Heated oxygen sensor-2 (HO2S-2)	[A] : Case of TYPE A is shown (See NOTE)	[B] : Case of TYPE B is shown (See NOTE)

NOTE:

For TYPE A and TYPE B, refer to the NOTE in "ECM Terminal Voltage Values Table" for applicable model.

DTC DETECTING CONDITION	POSSIBLE CAUSE
Engine is warmed up and HO2S-2 voltage is 4.5 V or more. (circuit open) ✱2 driving cycle detection logic, monitoring once / 1 driving.	• Exhaust gas leakage • "W" or "B/Bl" circuit open or short • Heated oxygen sensor-2 malfunction • Fuel system malfunction

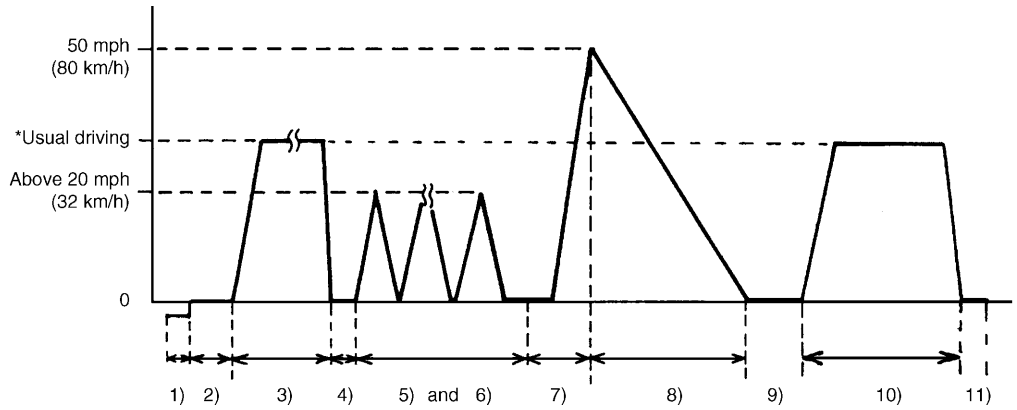
DTC CONFIRMATION PROCEDURE

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.**

1) Turn ignition switch OFF.
   Clear DTC with ignition switch ON, check vehicle and environmental condition for :
   – Altitude (barometric pressure) : 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp. : –10 °C, 14 °F or higher
   – Intake air temp. : 70 °C, 158 °F or lower
   – No exhaust gas leakage and loose connection
2) Warm up engine to normal operating temperature.
3) Drive vehicle under usual driving condition for 5 min. and check HO2S-2 output voltage and "short term fuel trim" with "Data List" mode on scan tool, and write it down.
4) Stop vehicle (don't turn ignition switch OFF).
5) Increase vehicle speed to higher than 20 mph, 32 km/h and then stop vehicle.

6) Repeat above steps 5) 4 times.
7) Increase vehicle speed to about 50 mph (80 km/h) in 3rd gear or 2 range.
8) Release accelerator pedal and with engine brake applied, keep vehicle coasting (fuel cut condition) for 10sec. or more.
9) Stop vehicle (don't turn ignition switch OFF) and run engine at idle for 2 min. After this step 9), if "Oxygen Sensor Monitoring TEST COMPLETED" is displayed in "READINESS TESTS" mode and DTC is not displayed in "DTC" mode, confirmation test is completed.
   If "TEST NOT COMPLTD" is still being displayed, proceed to next step 10).
10) Drive vehicle under usual driving condition for 10 min. (or vehicle is at a stop and run engine at idle for 10 min. or longer)
11) Stop vehicle (don't turn ignition switch OFF). Confirm test results according to "Test Result Confirmation Flow Table" in "DTC CONFIRMATION PROCEDURE" of DTC P0420.



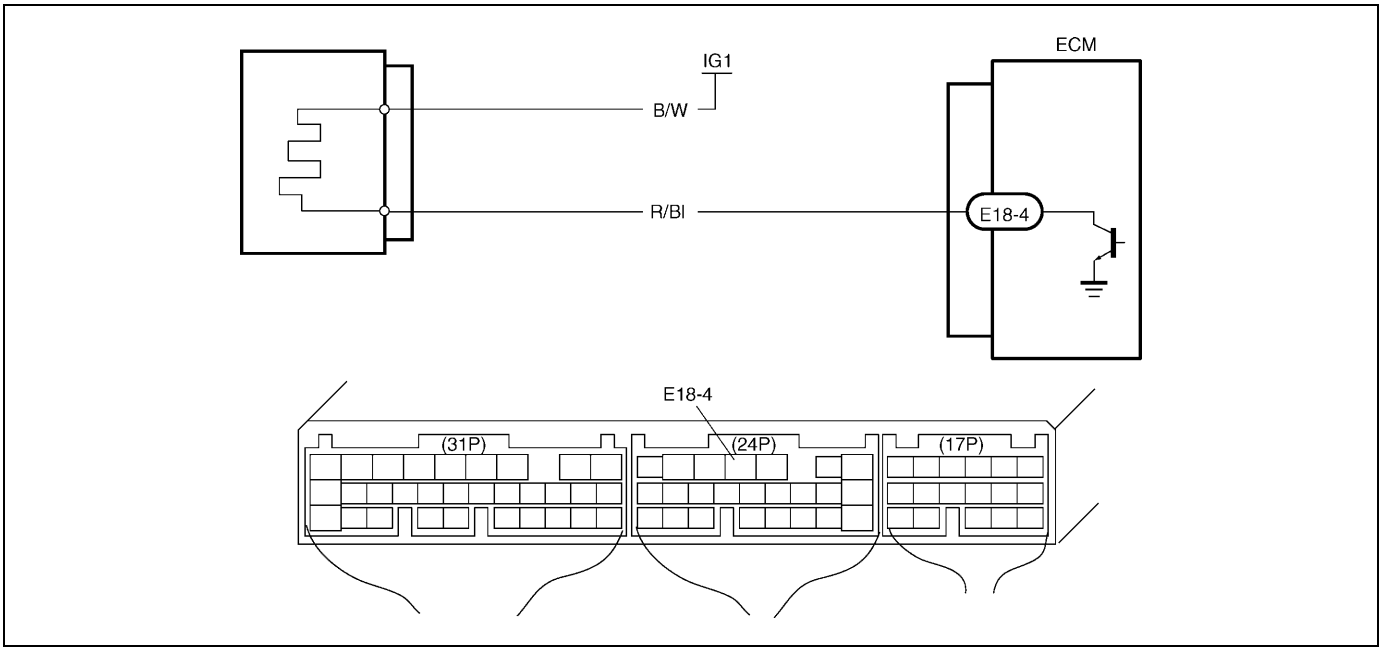
*Usual driving : Driving at 30 – 40 mph, 50 – 60 km/h including short stop according to traffic signal. (under driving condition other than high-load, high-engine speed, rapid accelerating and decelerating)

INSPECTION

Step	Action	Yes	No
1	Was "Engine Diag. Flow Table" performed?	Go to Step 2.	Go to "Engine Diag. Flow Table".
2	Check exhaust system for leakage, loose connection and damage. Is it good condition?	Go to Step 3.	Repair or replace.
3	Check HO2S-2 and Its Circuit. Was HO2S-2 output voltage indicated on scan tool in step 3) of DTC confirmation test less than 1.275 V?	Go to Step 4.	"B/Bl" or "W" circuit open or HO2S-2 malfunction.
4	Check Short Term Fuel Trim. Did short term fuel trim very within –20 – + 20% range in step 3) of DTC confirmation test?	Check "W" and "B/Bl" wire for open and short, and connection for poor connection. If wire and connection are OK, replace HO2S-2.	Check fuel system. Go to DTC P0171 / P0172 Diag. Flow Table.

DTC P0141 Heated Oxygen Sensor (HO2S) Heater Circuit Malfunction (Sensor-2)

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B condition it met. 1) Low voltage at terminal E18-4 for specified time after engine start or while engine running at high load. 2) High voltage at terminal E18-4 while engine running under other than above condition. ✱2 driving cycle detection logic, continuous monitoring.	• HO2S-2 heater circuit open or shorted to ground • ECM malfunction

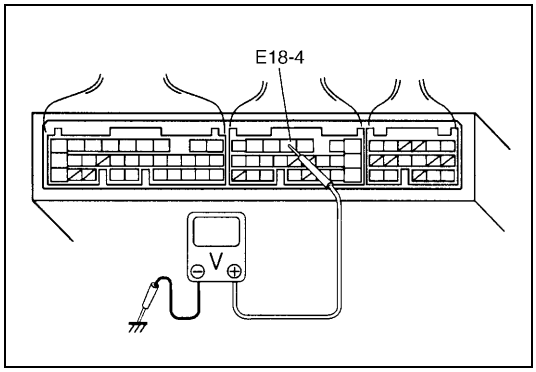
DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF once and then ON.
2) Clear DTC, start engine and warm up engine to normal operating temperature.
3) Keep it at 2000 r/min for 2 min.
4) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

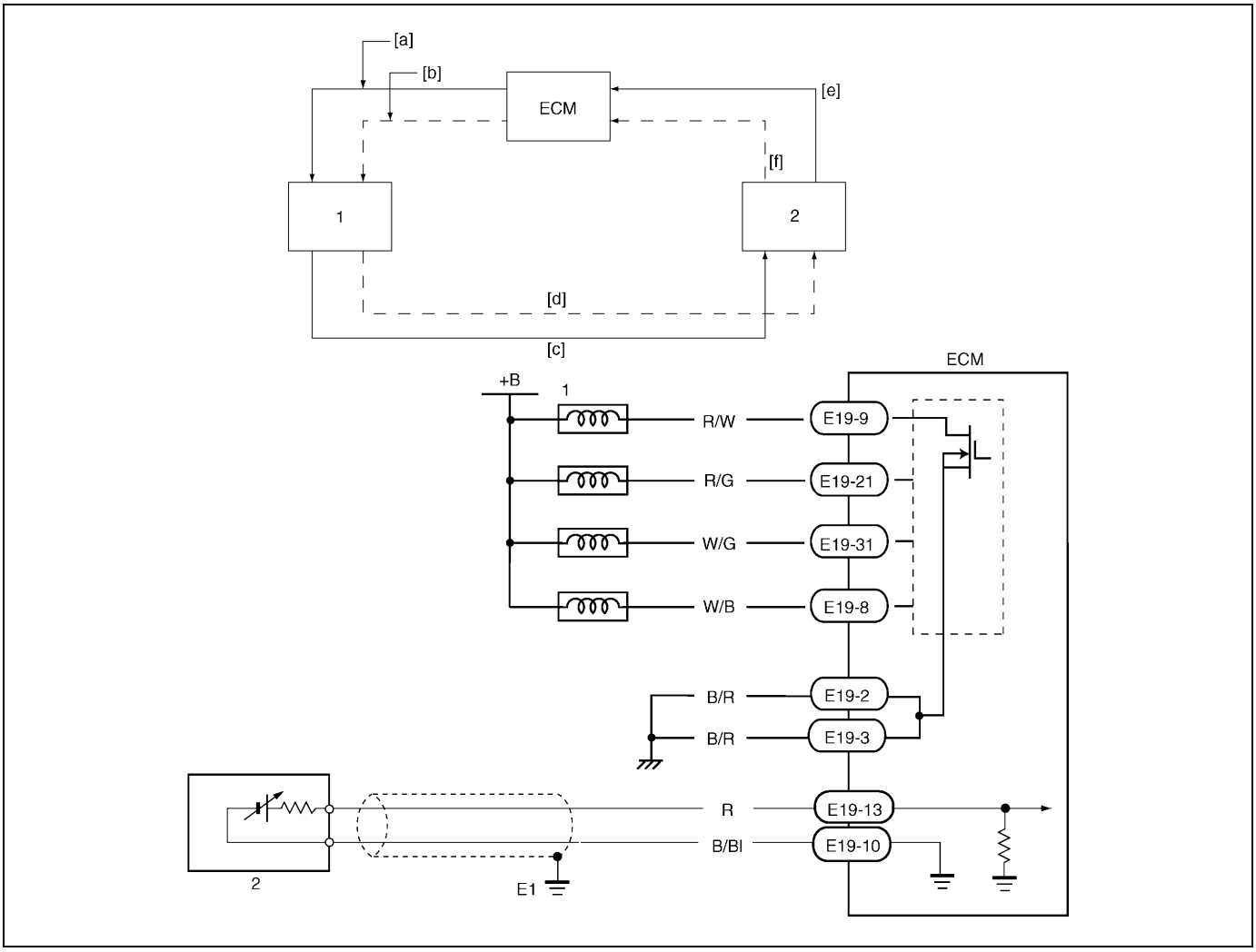
Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	Check HO2S-2 Heater and Its Circuit. 1) Warm up engine to normal operating temperature. 2) Stop engine. 3) Turn ignition switch ON and check voltage at terminal E18-4. See Fig. 1. Voltage should be over 10 V. 4) Start engine, run it at idle and check voltage at the same terminal after 1 min. from engine start. Voltage should be below 1.9 V. Are check result as specified?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check Heater or Sensor-2. 1) Disconnect HO2S-2 coupler with ignition switch OFF. 2) Check for proper connection to HO2S-2 at “B/W” and “R/Bl” wire terminals. 3) If OK, then check heater for resistance. Is it 11.7 – 14.3 Ω at 20 °C, 68 °F?	“R/Bl” wire open or shorted to ground or poor connection at E18-4. If wire and connection are OK, substitute a known-good ECM and recheck.	Replace HO2S-2.

Fig. 1 for Step 2



DTC P0171 Fuel System Too Lean
DTC P0172 Fuel System Too Rich

CIRCUIT DESCRIPTION



[a] : Signal to decrease amount of fuel injection	[d] : A/F mixture becomes richer (Oxygen concentration decreases)	1. Injector
[b] : Signal to increase amount of fuel injection	[e] : High voltage	2. Heated oxygen sensor-1 (HO2S-1)
[c] : A/F mixture becomes leaner (Oxygen concentration increases)	[f] : Low voltage	

DTC DETECTING CONDITION	POSSIBLE CAUSE
• When following condition occurs while engine running under closed loop condition. – Air / fuel ratio too lean (Total fuel trim (short and long terms added) is more than 30%) or – Air / fuel ratio too rich (Total fuel trim is less than –30%) ✱2 driving cycle detection logic, continuous monitoring.	• Vacuum leaks (air drawn in). • Exhaust gas leakage. • Heated oxygen sensor-1 circuit malfunction. • Fuel pressure out of specification. • Fuel injector malfunction (clogged or leakage). • MAP sensor poor performance. • ECT sensor poor performance. • IAT sensor poor performance. • TP sensor poor performance. • EVAP control system malfunction. • PCV valve 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.**

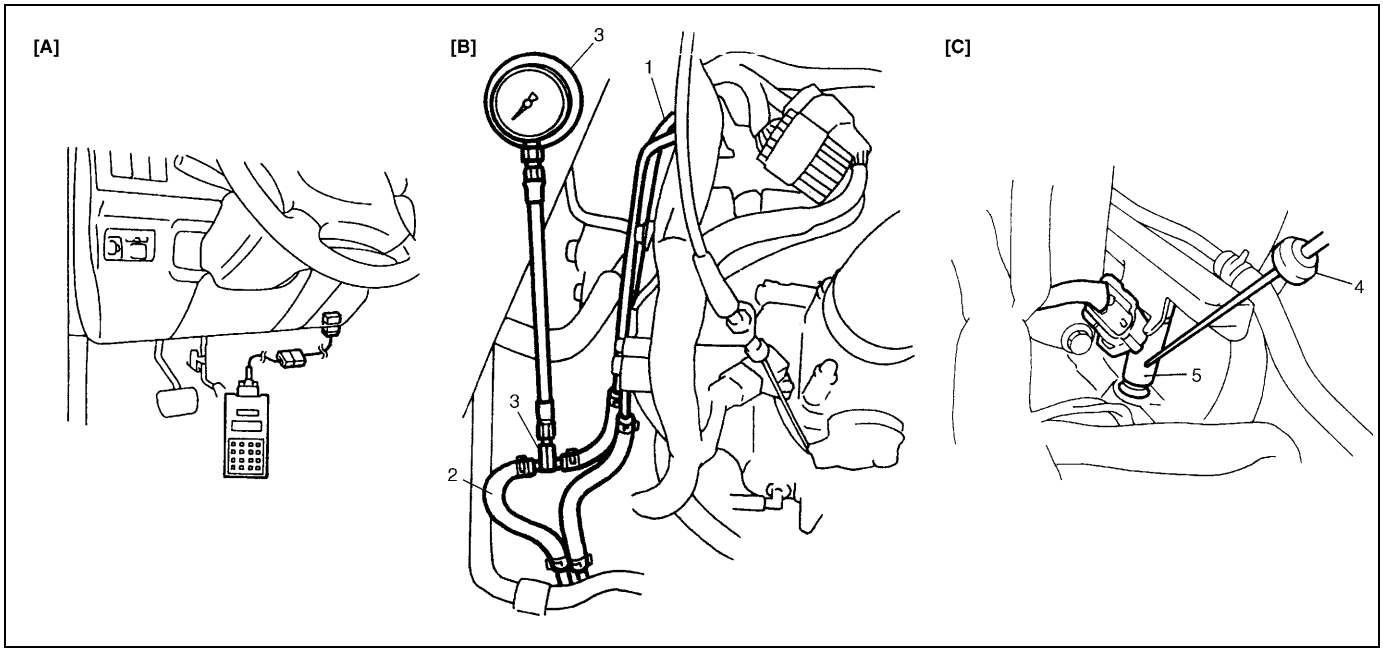
1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Check vehicle and environmental condition for :
   – Altitude (barometric pressure) : 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp. : –10 °C, 14 °F or higher
   – Intake air temp. : 70 °C, 158 °F or lower
4) Start engine and drive vehicle under usual driving condition (described in DTC confirmation procedure of DTC P0136) for 5 min. or longer and until engine is warmed up to normal operating temperature.
5) Keep vehicle speed at 30 – 40 mph, 50 – 60 km/h in 5th gear or “D” range for 5 min. or more.
6) Stop vehicle (do not turn ignition switch OFF).
7) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	Is there DTC(s) other than fuel system (DTC P0171 / P0172)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	Check HO2S-1 Output Voltage. 1) Connect scan tool to DLC with ignition switch OFF. See Fig. 1. 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 0.6 V repeatedly?	Go to Step 4.	Go to DTC P0130 Diag. Flow Table (HO2S-1 circuit check).
4	Check Fuel Pressure (Refer to Section 6E for details). 1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. See Fig. 2. 3) Check fuel pressure. **Fuel pressure specification** **With fuel pump operating and engine at stop :** **270 – 310 kPa, 2.7 – 3.1 kg/cm^2, 38.4 – 44.0 psi.** **At specified idle speed :** **210 – 260 kPa, 2.1 – 2.6 kg/cm^2, 29.8 – 37.0 psi.** Is measured value as specified?	Go to Step 5.	Go to Diag. Flow Table B-3 Fuel Pressure Check.

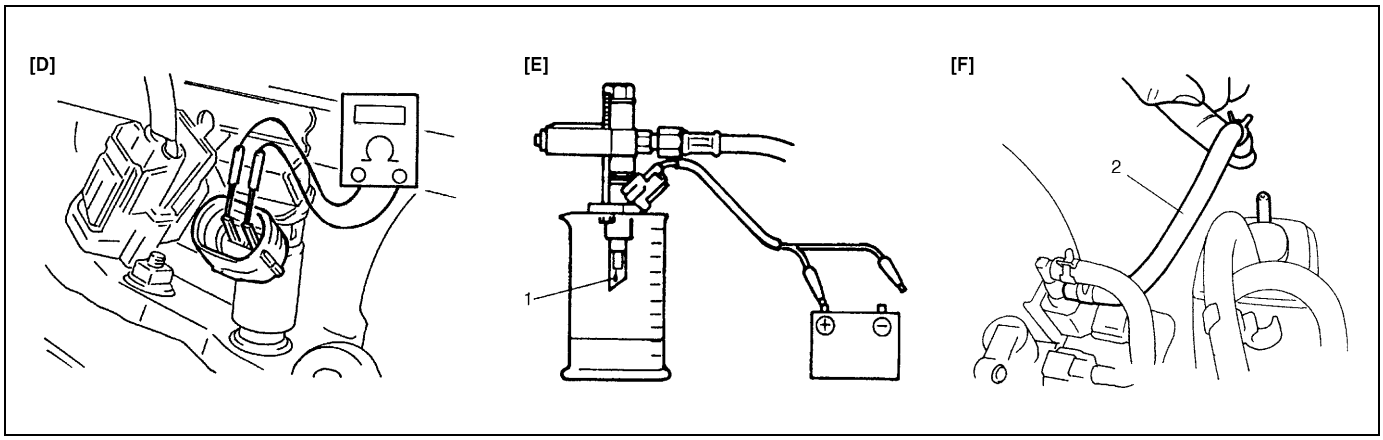
Step	Action	Yes	No
5	Check Fuel Injectors and Circuit. 1) Using sound scope (4) or such, check operating sound of each injector (5) when engine is running. Cycle of operating sound should vary according to engine speed. See Fig. 3. If no sound or an unusual sound is heard, check injector circuit (wire or coupler) or injector. 2) Turn ignition switch OFF and disconnect a fuel injector connector. 3) Check for proper connection to fuel injector at each terminal. 4) If OK, then check injector resistance. See Fig. 4. **Injector resistance** **11.3 – 13.8 ohm at 20 °C (68 °F)** 5) Carry out steps 1) and 3) on each injector. 6) Check each injector for injected fuel volume referring to Section 6E. See Fig. 5. **Injected fuel volume** **43 – 47 cc/15 sec (1.45/1.51 – 1.58/1.65 US/ Imp.oz/15 sec)** 7) Check each injector for fuel leakage after injector closed. **Fuel leakage** **Less than 1 drop / min. (1)** Is check result in step 1) and 3) to 7) satisfactory?	Go to Step 6.	Check injector circuit or replace fuel injector(s).
6	Check EVAP Canister Purge Valve. 1) Disconnect purge hose (2) from EVAP canister. 2) Place finger against the end of disconnected hose. 3) Check that vacuum is not felt there when engine is cool and running at idle. See Fig. 6. Is vacuum felt?	Check EVAP control system (See Section 6E).	Go to Step 7.
7	Check intake manifold absolute pressure sensor for performance (See step 4) of DTC P0105 (No.11) Diag. Flow Table). Is it in good condition?	Go to Step 8.	Repair or replace.
8	Check engine coolant temp. sensor for performance (See Section 6E). Is it in good condition?	Go to Step 9.	Replace engine coolant temp. sensor.
9	Check intake air temp. sensor for performance (See Section 6E). Is it in good condition?	Go to Step 10.	Replace intake air temp. sensor.
10	Check throttle position sensor for performance (See step 5) of DTC P0121 Diag. Flow Table). Is it in good condition?	Go to Step 11.	Replace throttle position sensor.
11	Check PCV valve for valve clogging (See Section 6E). Is it good condition?	Substitute a known-good ECM and recheck.	Replace PCV valve.

[A] Fig. 1 for Step 3 / [B] Fig. 2 for Step 4 / [C] Fig. 3 for Step 5

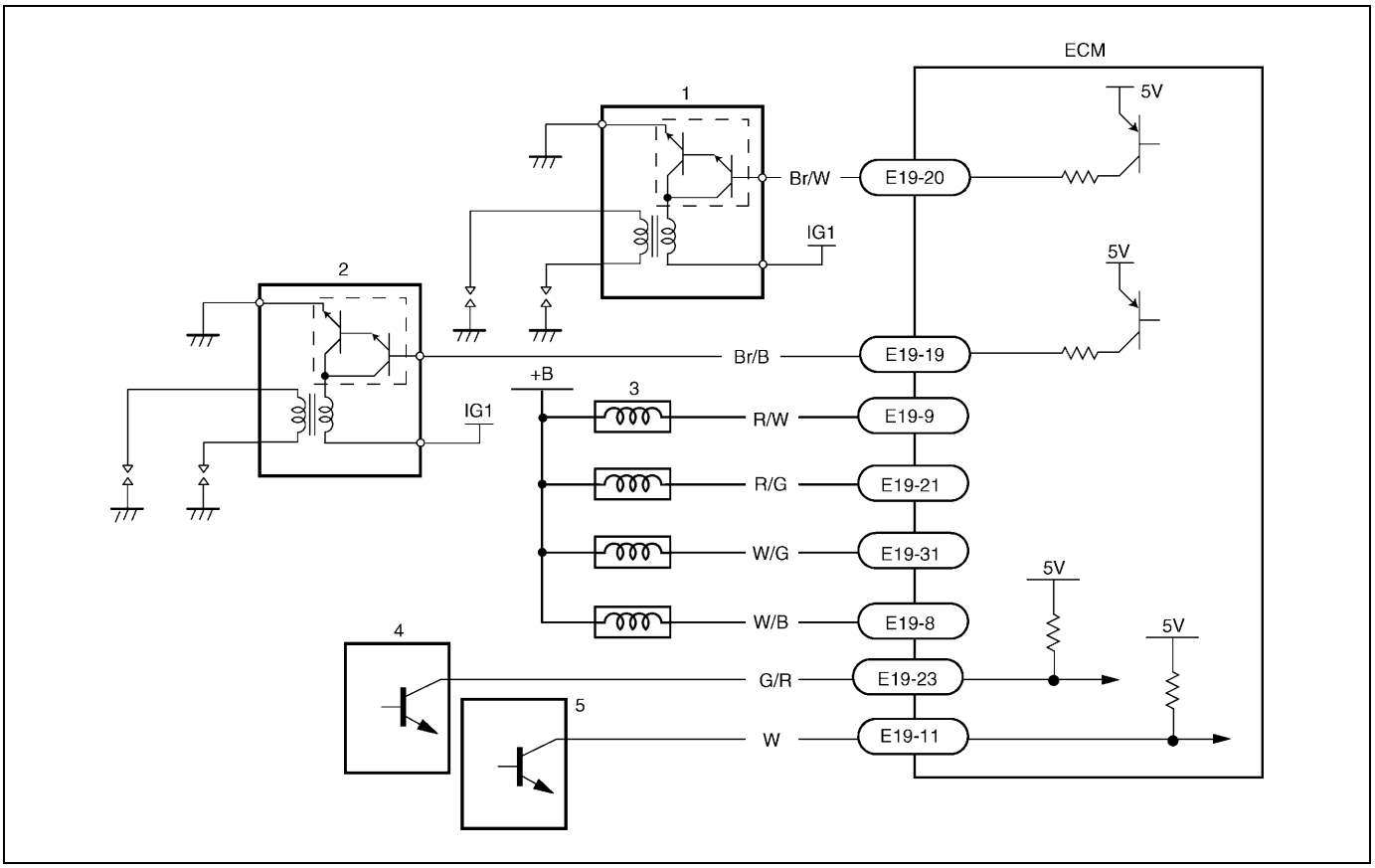


1.	Fuel delivery pipe
2.	Fuel feed hose
3.	Fuel pressure gauge & 3 way joint

[D] Fig. 4 for Step 5 / [E] Fig. 5 for Step 5 / [F] Fig. 6 for Step 6



DTC P0300 Random Misfire Detected (Misfire Detected at 2 or More Cylinders)
DTC P0301 Cylinder 1 Misfire Detected
DTC P0302 Cylinder 2 Misfire Detected
DTC P0303 Cylinder 3 Misfire Detected
DTC P0304 Cylinder 4 Misfire Detected



1.	Ignition coil assembly (for No.1 and No.4 cylinder)
2.	Ignition coil assembly (for No.2 and No.3 cylinder)
3.	Fuel injector
4.	CKP sensor
5.	CMP sensor

CIRCUIT DESCRIPTION

ECM monitors crankshaft revolution speed and engine speed via the crankshaft position sensor and cylinder No. via the camshaft position sensor. Then it calculates the change in the crankshaft revolution speed and from how many times such change occurred in every 200 or 1000 engine revolutions, it detects occurrence of misfire.

When ECM detects a misfire (misfire rate per 200 revolutions) which can cause overheat and damage to the three way catalytic converter, it makes the malfunction indicator lamp (MIL) flash as long as misfire occurs at that rate.

After that, however, when the misfire rate drops, MIL remains ON until it has been judged as normal 3 times under the same driving conditions.

Also, when ECM detects a misfire (misfire rate per 1000 revolutions) which will not cause damage to three way catalytic converter but can cause exhaust emission to be deteriorated, it makes MIL light according to the 2 driving cycle detection logic.

DTC DETECTING CONDITION	POSSIBLE CAUSE
• Engine under other than high revolution condition • Not on rough road • Engine speed changing rate (below specified value) • Manifold absolute pressure changing rate (below specified value) • Throttle opening changing rate (below specified value) • Misfire rate per 200 or 1000 engine revolutions (how much and how often crankshaft revolution speed changes) is higher than specified value	• Engine overheating • Vacuum leaks (air inhaling) from air intake system • Ignition system malfunction (spark plug(s), high-tension cord(s), ignition coil assembly) • Fuel pressure out of specification • Fuel injector malfunction (clogged or leakage) • Engine compression out of specification • Valve lash (clearance) out of specification • Manifold absolute pressure sensor malfunction • Engine coolant temp. sensor malfunction • PCV valve malfunction • EVAP control system malfunction • EGR system malfunction

DTC CONFIRMATION PROCEDURE

NOTE:

Among different types of random misfire, if misfire occurs at cylinders 1 and 4 or cylinders 3 and 2 simultaneously, it may not possible to reconfirm DTC by using the following DTC confirmation procedure. When diagnosing the trouble of DTC P0300 (Random misfire detected) of the engine which is apparently misfiring, even if DTC P0300 cannot be reconfirmed by using the following DTC confirmation procedure, proceed to the following Diag. Flow Table.

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) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Check vehicle and environmental condition for :
   – Altitude (barometric pressure) : 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp. : –10 °C, 14 °F or higher
   – Intake air temp. : 70 °C, 158 °F or lower
   – Engine coolant temp. : – 10 – 110 °C, 14 – 230 °F
4) Start engine and keep it at idle for 2 min. or more.
5) Check DTC in “DTC” mode and pending DTC in “ON BOARD TEST” or “PENDING DTC” mode.
6) If DTC is not detected at idle, consult usual driving based on information obtained in “Customer complaint analysis” and “Freeze frame data check”.

INSPECTION

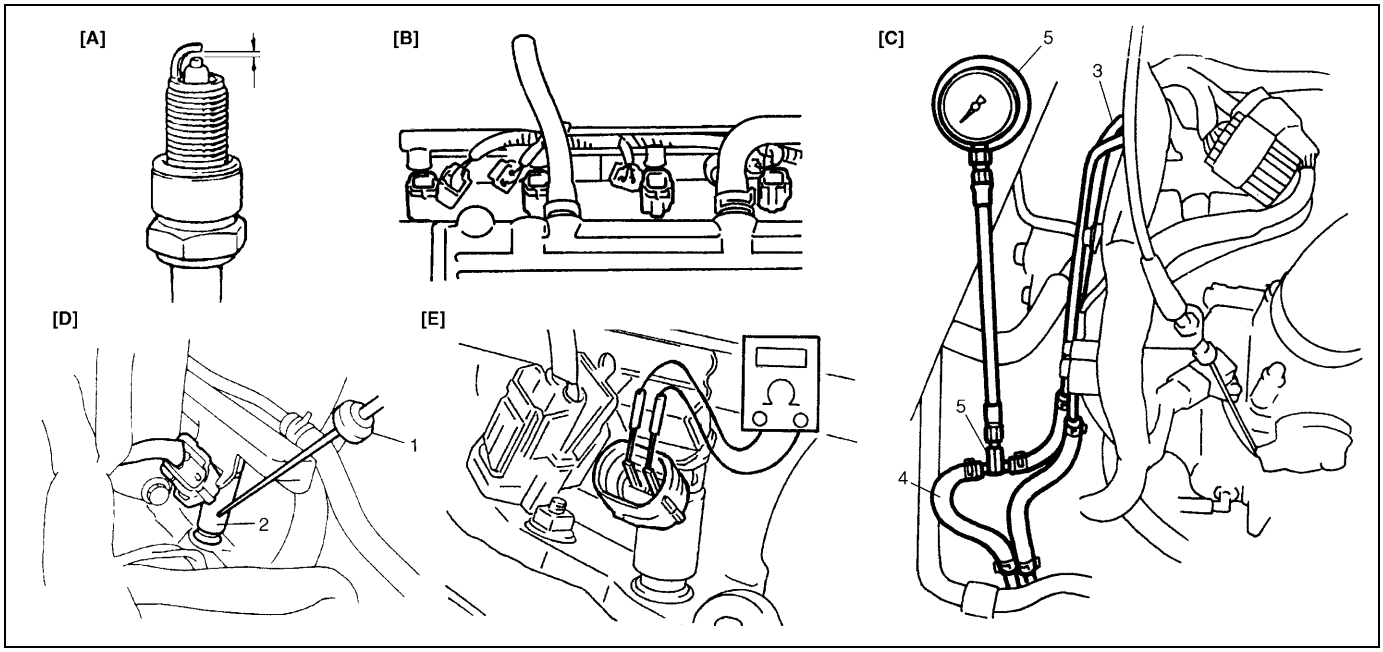
Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	Is there DTC other than Fuel system (DTC P0171/ P0172) and misfire (DTC P0300 – P0304)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.

Step	Action	Yes	No
3	Check Ignition System. 1) Remove spark plugs and check them for; • Air gap : 1.0 – 1.1 mm (0.040 – 0.043 in.) See Fig. 1. • Carbon deposits / Insulator damage / Plug type If abnormality is found, adjust, clean or replace by referring to Section 6F. (See CAUTION) 2) Disconnect all injector connectors. See Fig. 2. 3) Connect spark plugs to high tension cords and then ground spark plugs. 4) Crank engine and check that each spark plug sparks. Are above check results satisfactory?	Go to Step 4.	Check ignition system parts (Refer to Section 6F).
4	Check Fuel Pressure (Refer to Section 6E for details). 1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. See Fig. 3. 3) Check fuel pressure. **Fuel pressure specification** **With fuel pump operating and engine at stop :** **270 – 310 kPa, 2.7 – 3.1 kg/cm^2, 38.4 – 44.0 psi.** **At specified idle speed :** **210 – 260 kPa, 2.1 – 2.6 kg/cm^2, 29.8 – 37.0 psi.** Is measured value as specified?	Go to Step 5.	Go to Diag. Flow Table B-3 fuel pressure check.
5	Check Fuel Injectors and Circuit. 1) sing sound scope (1) or such, check operating sound of each injector (2) when engine is running. Cycle of operating sound should very according to engine speed. See Fig 4. If no sound or an unusual sound is heard, check injector circuit (wire or coupler) or injector. 2) Turn ignition switch OFF and disconnect a fuel injector connector. 3) Check for proper connection to fuel injector at each terminal. 4) If OK, then check injector resistance. See Fig. 5. **Injector resistance** **11.3 – 13.8 ohm at 20 °C (68 °F)** 5) Carry out steps 1) and 3) on each injector. 6) Check each injector for injected fuel volume referring to Section 6E. See Fig. 6. **Injected fuel volume** **43 – 47 cc/15 sec (1.45/1.51 – 1.58/1.65 US/Imp. oz/ 15 sec)** 7) Check each injector for fuel leakage after injector closed. **Fuel leakage** **Less than 1 drop/min.** Is check result in step 1) and 3) to 7) satisfactory?	Go to Step 6.	Check injector circuit or replace fuel injector(s).
6	Check PCV valve for clogging (See Section 6E). Is it in good condition?	Go to Step 7.	Replace PCV valve.

Step	Action	Yes	No
7	Check EVAP Canister Purge Valve for Closing. 1) Disconnect purge hose (1) from EVAP canister. 2) Place finger against the end of disconnected hose. 3) Check that vacuum is not felt there, when engine is cool and running at idle. See Fig. 7. Is vacuum felt?	Check EVAP control system (See Section 6E).	Go to Step 8.
8	Check manifold absolute pressure sensor for performance (See step 4) DTC P0105 Diag. Flow Table). Is it in good condition?	Go to Step 9.	Repair or replace.
9	Check engine coolant temp. sensor for performance (See Section 6E). Is it in good condition?	Go to Step 10.	Replace engine coolant temp. sensor.
10	Check parts or system which can cause engine rough idle or poor performance. • Engine compression (See Section 6A1). • Valve lash (See Section 6A1). • Valve timing (Timing belt installation. See 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.

CAUTION:
For iridium spark plugs, do not adjust air gap or clean.

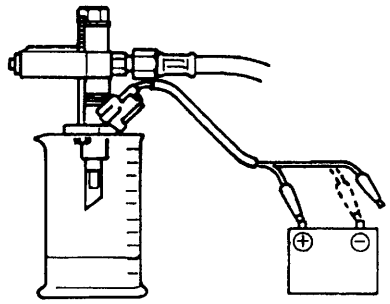
[A] Fig. 1 for Step 3 / [B] Fig. 2 for Step 3 / [C] Fig. 3 for Step 4 / [D] Fig. 4 for Step 5 / [E] Fig. 5 for Step 4



3. Fuel delivery pipe
4. Fuel feed hose
3. Fuel pressure gauge & 3 way joint

[F] Fig. 6 for Step 5 / [G] Fig. 7 for Step 7

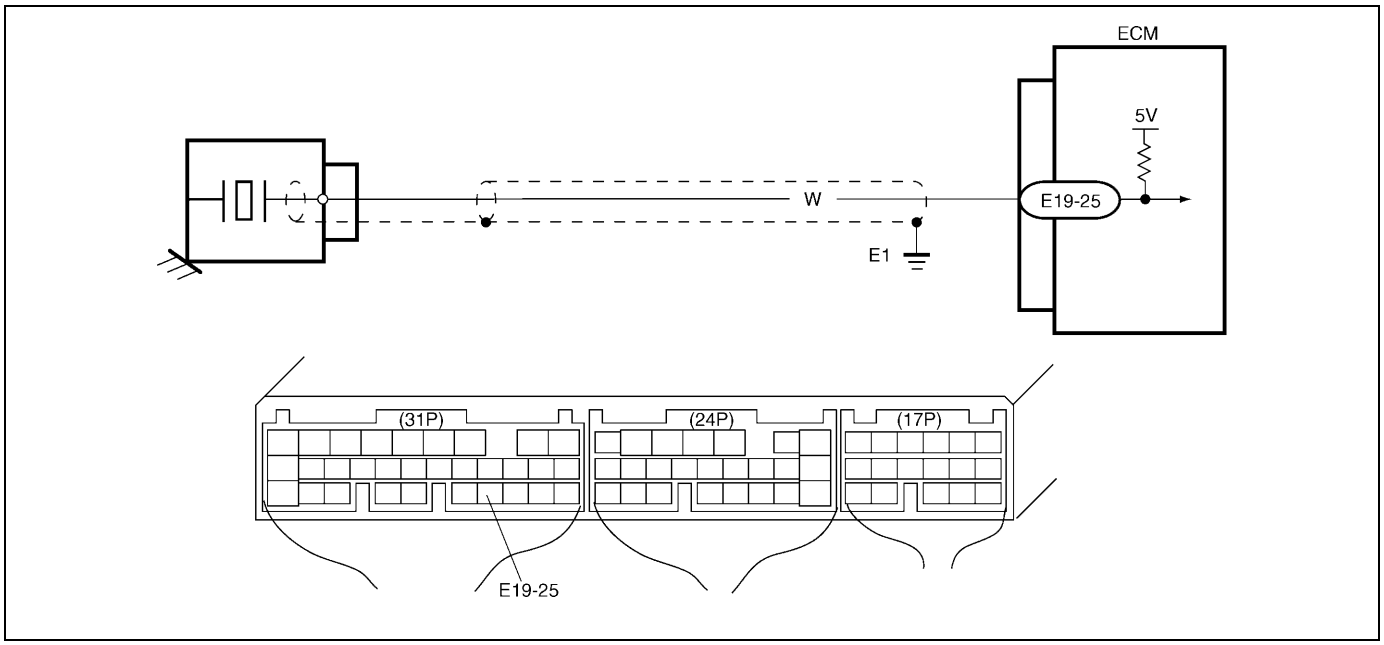
[F]



[G]

DTC P0325 (DTC No.17) Knock Sensor Circuit Malfunction

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
• Knock sensor voltage is 3.91 V or more • Knock sensor voltage is 1.23 V or less	• "W" circuit open or shorted to ground • Knock sensor malfunction • ECM malfunction

DTC CONFIRMATION PROCEDURE

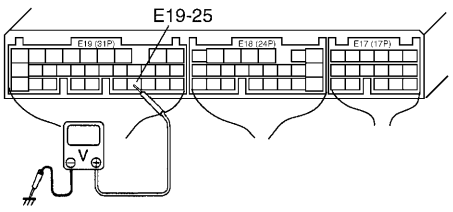
1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

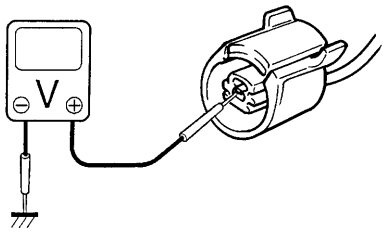
Step	Action	Yes	No
1	Was "Engine Diag. Flow Table" performed?	Go to Step 2.	Go to "Engine Diag. Flow Table".
2	1) With engine running, check voltage from "E19-25" terminal of ECM connector to body ground. See Fig. 1. 2) Is voltage about 1.25 – 3.75 V?	Knock sensor and its circuit are in good condition. Intermittent trouble or faulty ECM. Recheck, referring to "Intermittent Trouble" in Section 0A.	Go to Step 3.
3	1) Stop engine. 2) With ignition switch at OFF position, disconnect knock sensor connector. 3) With ignition switch at ON position, check voltage from "W" to body ground terminal of knock sensor connector. See Fig. 2. Is it 4 – 5 V?	Faulty knock sensor. Substitute a known-good knock sensor and recheck.	"W" wire open, shorted to ground circuit or poor "E19-25" connection. If wire and connection are OK, substitute a known-good ECM and recheck.

[A] Fig. 1 for Step 2 / [B] Fig. 2 for Step 3

[A]

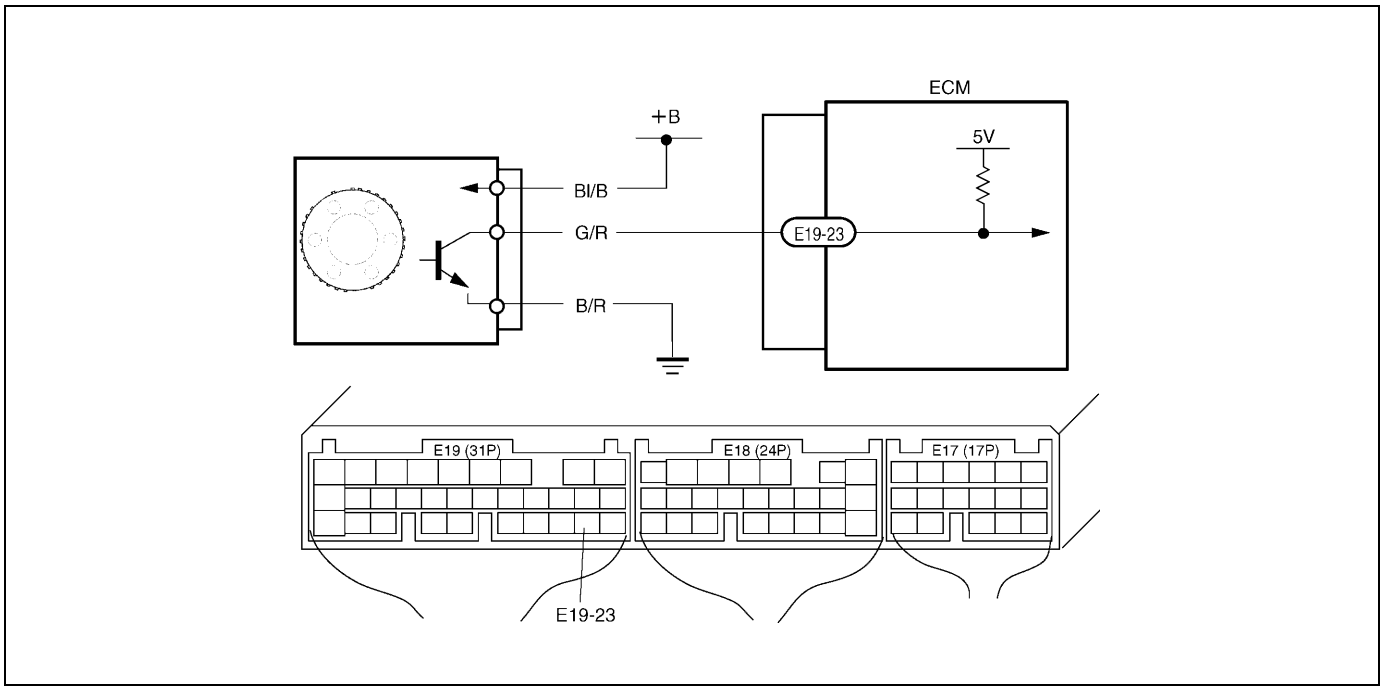


[B]



DTC P0335 (DTC No.23) Crankshaft Position (CKP) Sensor Circuit Malfunction

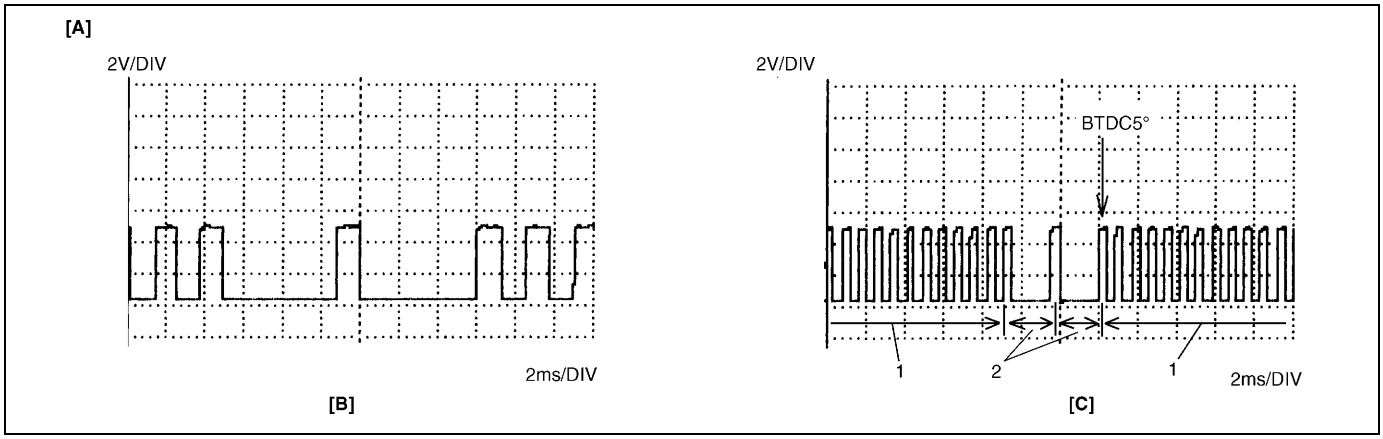
CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
• NO CKP sensor signal for 2 seconds at engine cranking.	• CKP sensor circuit open or short. • Signal teeth damaged. • CKP sensor malfunction, foreign material being attached or improper installation. • ECM malfunction.

REFERENCE

Connect oscilloscope between terminals E19-23 of ECM connector connected to ECM and body ground and check CKP sensor signal.



1. 10° signal	[A] : Oscilloscope Waveforms	[C] : Waveforms at 2000 rpm
2. 30° signal	[B] : Waveforms at idle speed	

DTC CONFIRMATION PROCEDURE

1) Clear DTC and crank engine for 2 sec.
2) Select “DTC” mode on scan tool and check DTC.

INSPECTION

Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
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 each terminal. 3) If OK, turn ignition switch ON and check for voltage at each terminal of sensor connector disconnected. See Fig. 1. Terminal “B+” : 10 – 14 V Terminal “Vout” : 4 – 5 V Terminal “GND” : 0 V Is check result satisfactory?	Go to Step 5.	Go to Step 4.
4	Was terminal “Vout” voltage out of specification in Step 3 check?	“G/R” wire open, short or poor connection. If wire and connection are OK, substitute a known-good ECM and recheck.	“Bl/B” or “B/R” wire open, short or poor connection.
5	Check Ground Circuit for Open. 1) Turn ignition switch OFF. 2) Check for continuity between “GND” terminal of CKP sensor connector and engine ground. Is continuity indicated?	Go to Step 6.	“B/R” wire open or poor ground connection.
6	Check CKP Sensor for Operation. 1) Remove CKP sensor from sensor case. 2) Remove metal particles on end face of CKP sensor, if any. 3) Connect each connector to ECM and CKP sensor. 4) Turn ignition switch ON. 5) Check for voltage at terminal E19-23 of connector connected to ECM by passing magnetic substance (iron) (1) while keeping approximately 1 mm (0.03 in.) gap with respect to end face of CKP sensor. See Fig. 2 and 3. Does voltage vary from low (0 – 1 V) to high (4 – 5 V) or from high to low?	Go to Step 7.	Replace CKP sensor.
7	Check signal rotor for the following. See Fig. 4. • 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 CKP sensor.

[A] Fig. 1 for Step 3 / [B] Fig. 2 for Step 6 / [C] Fig. 3 for Step 6

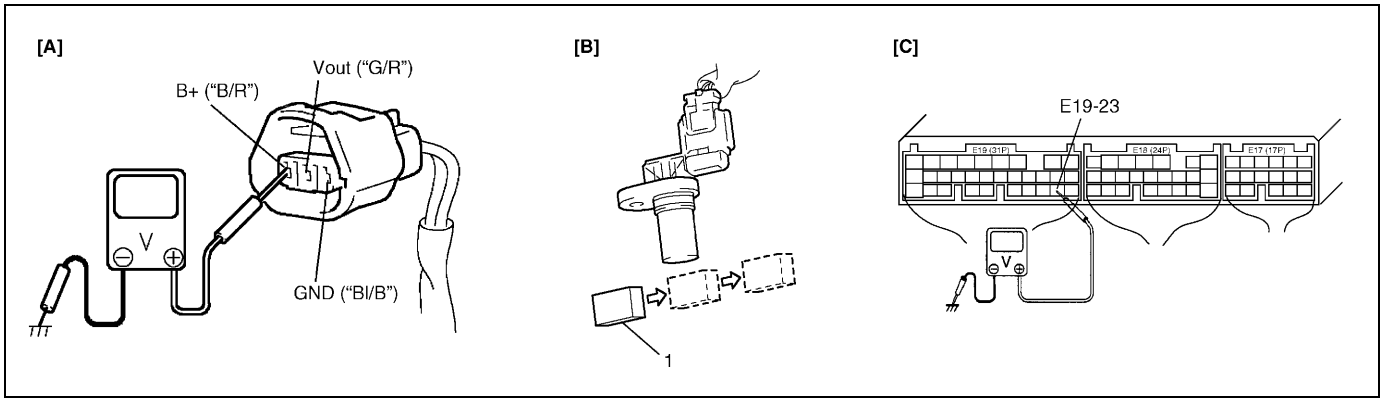
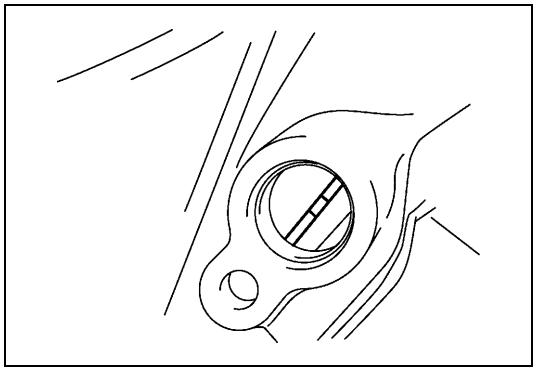
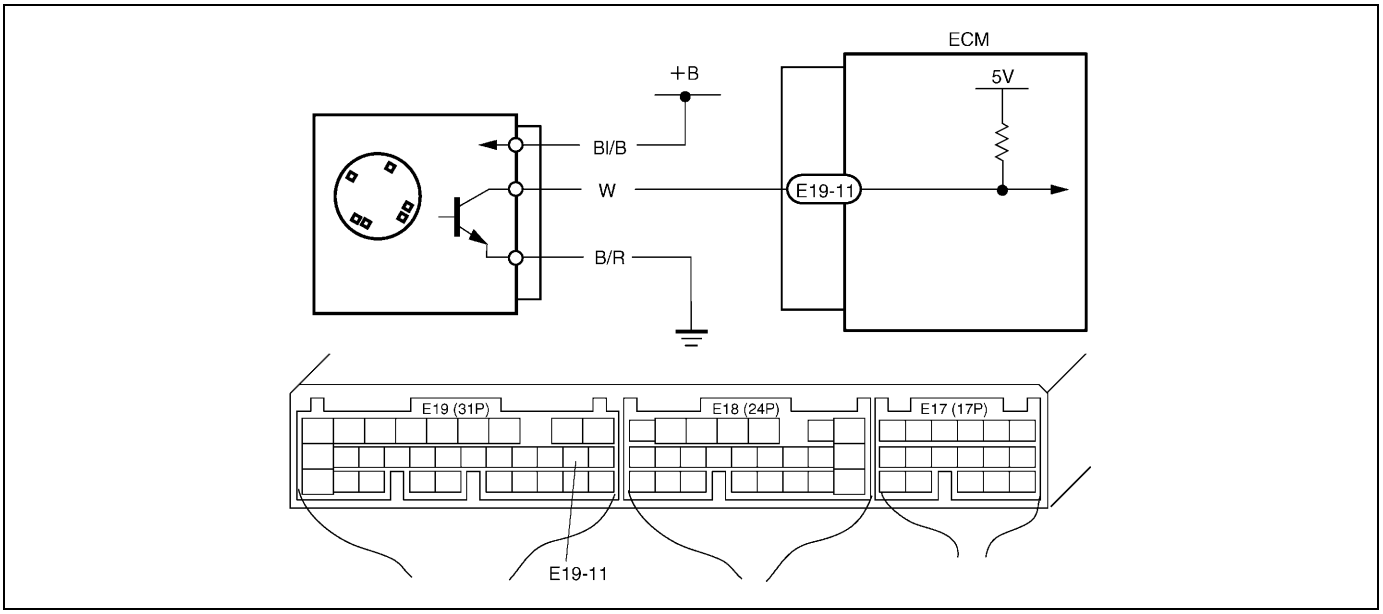


Fig. 4 for Step 7



DTC P0340 (DTC No.15) Camshaft Position (CMP) Sensor Circuit Malfunction

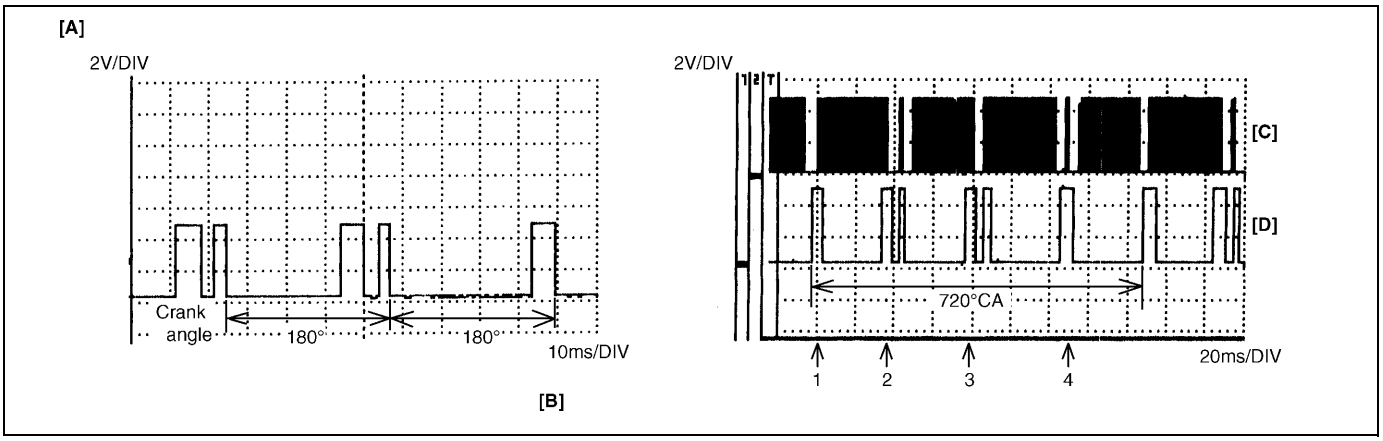
CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
• The number of CMP sensor signal pulses is incorrect during 8 revolution of crankshaft.	• CMP sensor circuit open or short. • Signal rotor teeth damaged. • CMP sensor malfunction, foreign material being attached or improper installation. • ECM malfunction. • CMP sensor phase lag.

REFERENCE

Connect oscilloscope between terminals E19-11 of ECM connector connected to ECM and body ground and check CMP sensor signal.



1. No.1 cylinder	3. No.3 cylinder	[A] : Oscilloscope Waveforms	[C] : CKP sensor waveform
2. No.2 cylinder	4. No.4 cylinder	[B] : Waveforms at specified idle speed	[D] : CMP sensor waveform

DTC CONFIRMATION PROCEDURE

1) Clear DTC.
2) Start engine and keep it at idle for 1 min.
3) Select “DTC” mode on scan tool and check DTC.

INSPECTION

Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
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 each terminal. 3) If OK, turn ignition switch ON and check for voltage at each terminal of sensor connector disconnected. See Fig. 1. Terminal “B+” : 10 – 14 V Terminal “Vout” : 4 – 5 V Terminal “GND” : 0 V Is check result satisfactory?	Go to Step 5.	Go to Step 4.
4	Was terminal “Vout” voltage out of specification in Step 3 check?	“W” wire open, short or poor connection. If wire and connection are OK, substitute a known-good ECM and recheck.	“Bl/B” or “B/R” wire open, short or poor connection.
5	Check Ground Circuit for Open. 1) Turn ignition switch OFF. 2) Check for continuity between “GND” terminal of CMP sensor connector and engine ground. Is continuity indicated?	Go to Step 6.	“B/R” wire open or poor ground connection.
6	Check CMP Sensor for Operation. 1) Remove CMP sensor from sensor case. 2) Remove metal particles on end face of CMP sensor, if any. 3) Connect each connector to ECM and CMP sensor. 4) Turn ignition switch ON. 5) Check for voltage at terminal E19-11 of connector connected to ECM by passing magnetic substance (iron) (1) while keeping approximately 1 mm (0.03 in.) gap with respect to end face of CMP sensor. See Fig. 2 and 3. Does voltage vary from low (0 – 1 V) to high (4 – 5 V) or from high to low?	Go to Step 7.	Replace CMP sensor.
7	Check signal rotor for the following. See Fig. 4. • 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 CMP sensor.

[A] Fig. 1 for Step 3 / [B] Fig. 2 for Step 6 / [C] Fig. 3 for Step 6

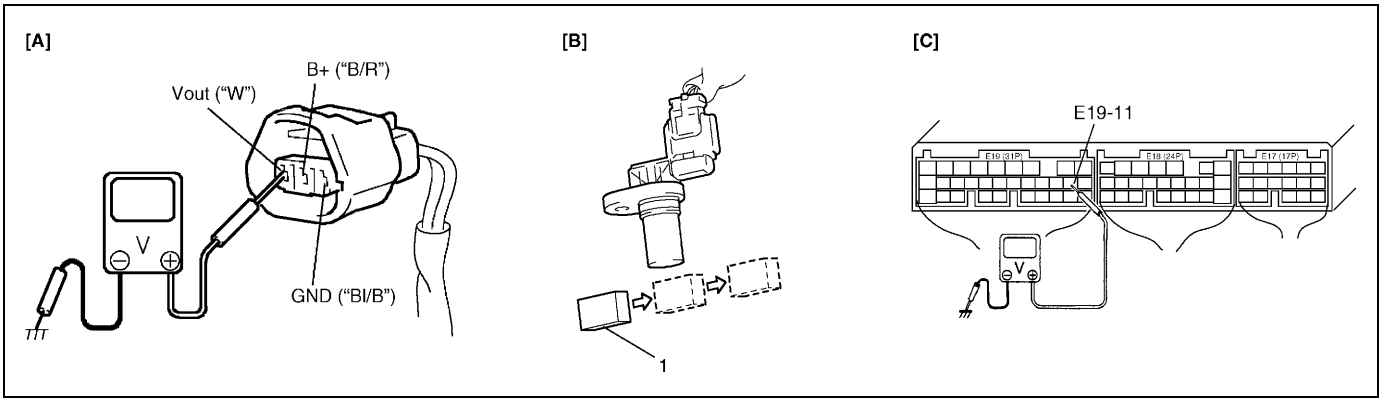
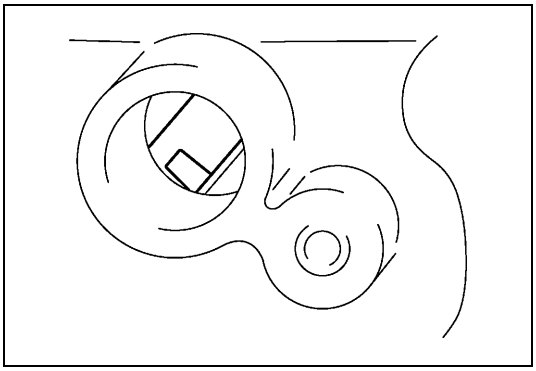
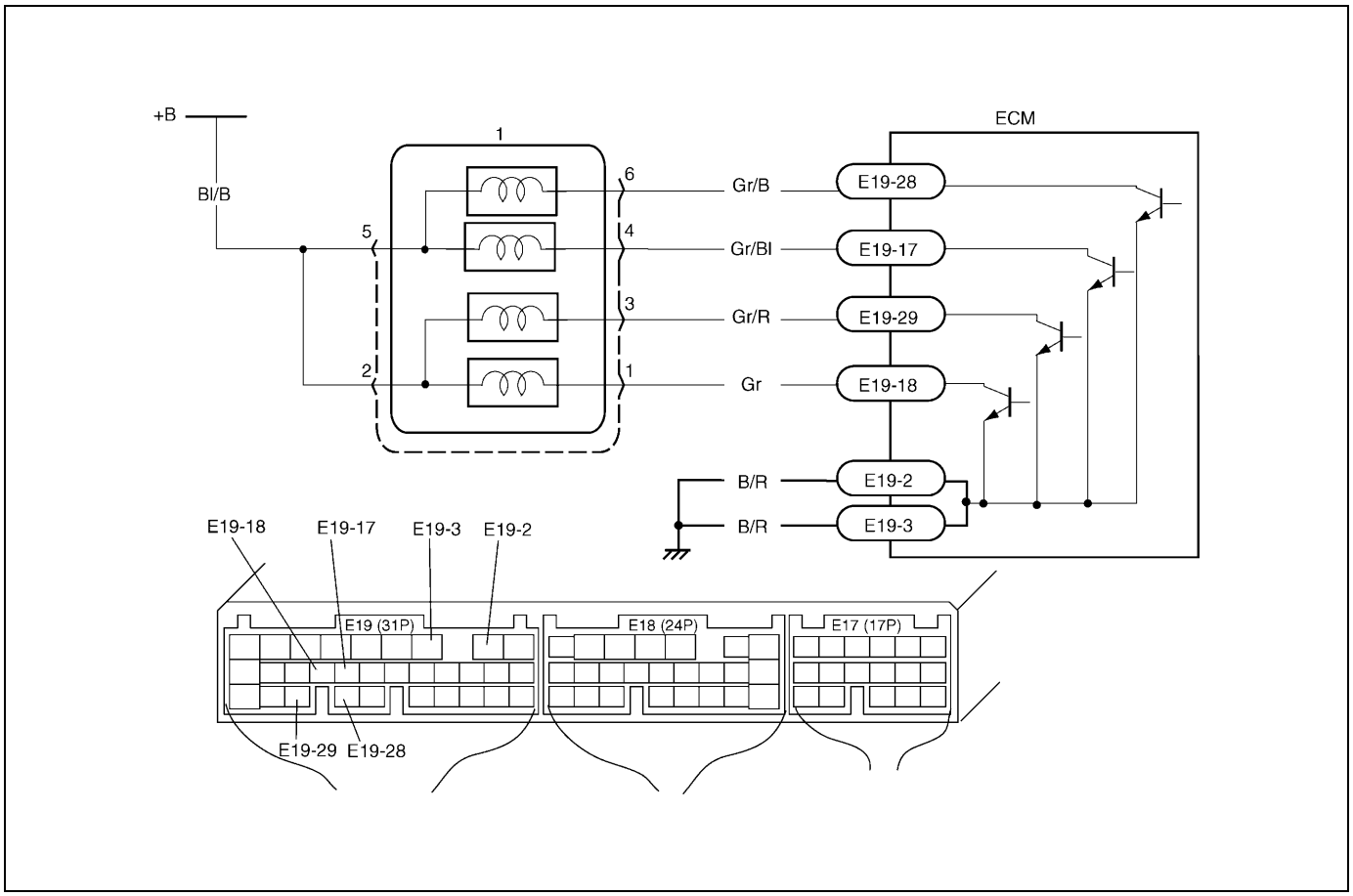


Fig. 4 for Step 7



DTC P0400 Exhaust Gas Recirculation Flow Malfunction

CIRCUIT DESCRIPTION



1. EGR valve

DTC DETECTING CONDITION	POSSIBLE CAUSE
• While running at specified vehicle speed after engine warm-up • During deceleration (engine speed high with closed throttle position ON) in which fuel cut is involved, difference in intake manifold absolute pressure between when EGR valve is opened at specified value and when it is closed is larger or smaller than specified value. ✱2 driving cycle detection logic, monitoring once / 1 driving	• EGR valve or its circuit • EGR passage • ECM

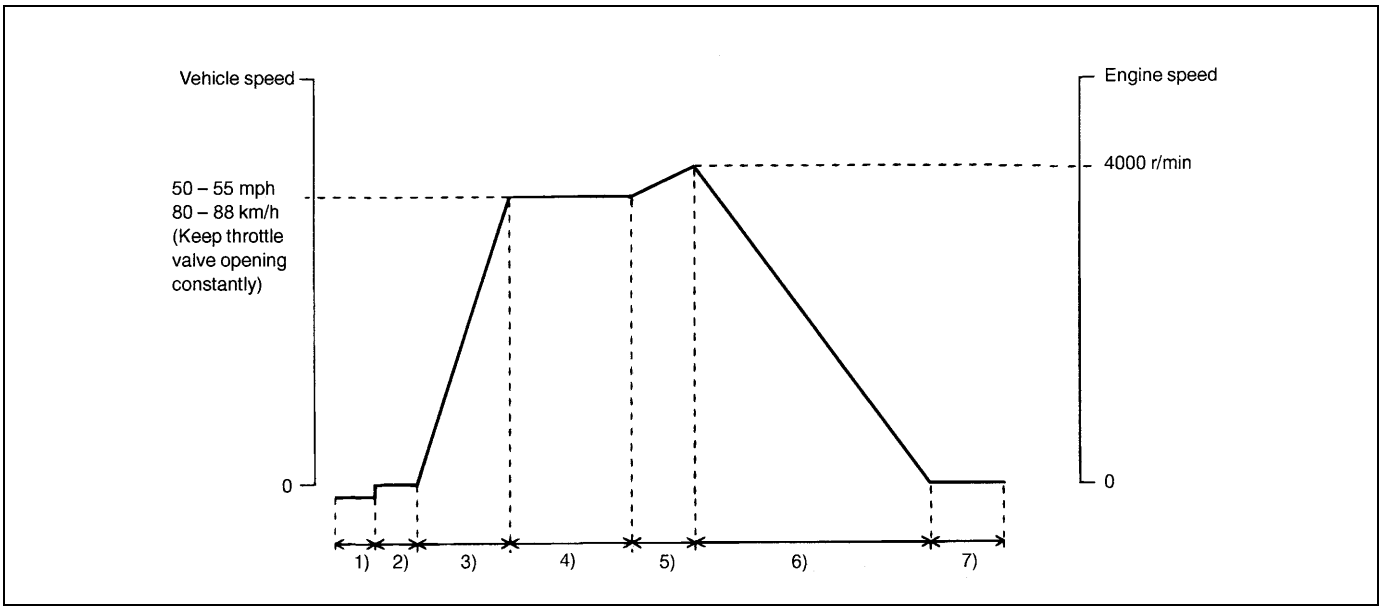
DTC CONFIRMATION PROCEDURE

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.**

1) Turn ignition switch OFF.
   Clear DTC with ignition switch ON, check vehicle and environmental condition for :
   – Altitude (barometric pressure) : 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp. : –10 °C, 14 °F or higher
   – Intake air temp. : 70 °C, 122 °F or lower

2) Start engine and warm it up to normal operating temperature (70 – 110 °C, 158 – 230 °F) and run it at idle for 5 min.
3) Increase vehicle speed to 50 – 55 mph, 80 – 88 km/h in 5th gear or in "D" range.
4) Hold throttle valve at that opening position for 2 min. or longer.
5) Increase engine speed to 4000 r/min. in 3rd gear or in "2" range.
6) Release accelerator pedal and with engine brake applied, keep vehicle coasting (fuel cut condition) till engine speed reaches 1500 r/min.
7) Stop vehicle (don't turn ignition switch OFF) and confirm test results according to following "Test Result Confirmation Flow Table."



Test Result Confirmation Flow Table

Step	Action	Yes	No
1	Check DTC in "DTC" mode and pending DTC in "ON BOARD TEST". Is DTC or pending DTC displayed?	Proceed to applicable DTC flow table.	Go to Step 2.
2	Set scan tool to "READINESS TESTS" mode and check if testing has been completed. Is test completed?	No DTC is detected. (Confirmation test is completed)	Repeat DTC confirmation procedure.

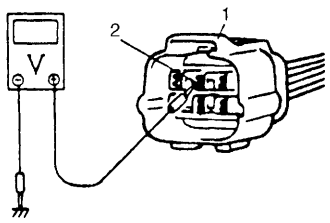
INSPECTION

Step	Action	Yes	No
1	Was "Engine Diag. Flow Table" performed?	Go to Step 2.	Go to "Engine Diag. Flow Table".
2	1) Turn ignition switch ON. 2) Does EGR stepper motor operation for 0.6 second after ignition switch OFF?	Go to Step 3.	Go to Step 6.
3	With ignition switch at OFF, check voltage between E19-28, 17, 29, 18 terminals of ECM and body ground. See Fig. 2. Is voltage about 0 V?	Go to Step 4.	Go to Step 8.

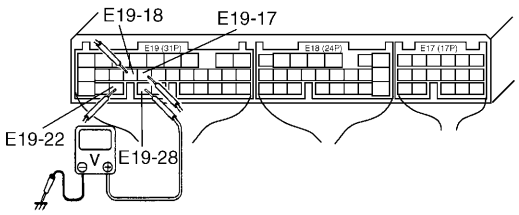
Step	Action	Yes	No
4	With ignition switch at ON, check voltage between E19-28, 17, 29, 18 terminals of ECM and body ground. See Fig. 2. Is voltage within 10 – 14 V?	Go to Step 5.	Go to Step 8.
5	Do you have SUZUKI scan tool?	Go to Step 6.	Stuck or faulty EGR valve or clogged EGR gas passage. If all above are OK, substitute a known-good ECM and recheck.
6	Check EGR system referring to “EGR System” in Section 6E. Is check result satisfactory?	Substitute a known-good ECM and recheck.	Stuck or faulty EGR valve or clogged EGR gas passage.
7	1) Disconnect EGR valve connector with ignition switch OFF. 2) Check voltage between “Bl/B” wire terminal (2) of EGR valve connector (1) and body ground with ignition switch ON. See Fig. 1. 3) Are they about 10 – 14 V?	Go to Step 3.	“Bl/B” wire open or short.
8	Check EGR valve referring to “EGR System” in Section 6E. Is it good condition?	EGR valve harness (“Gr/B”, “Gr/Bl”, “Gr/R” or “Gr” wire) open or short or poor connector connection (EGR valve connector, E19-28, 17, 29, 18) If wire harness and connection are OK, substitute a known-good ECM and recheck.	Faulty EGR valve.

[A] Fig. 1 for Step 7 / [B] Fig. 2 for Step 3 and 4

[A]

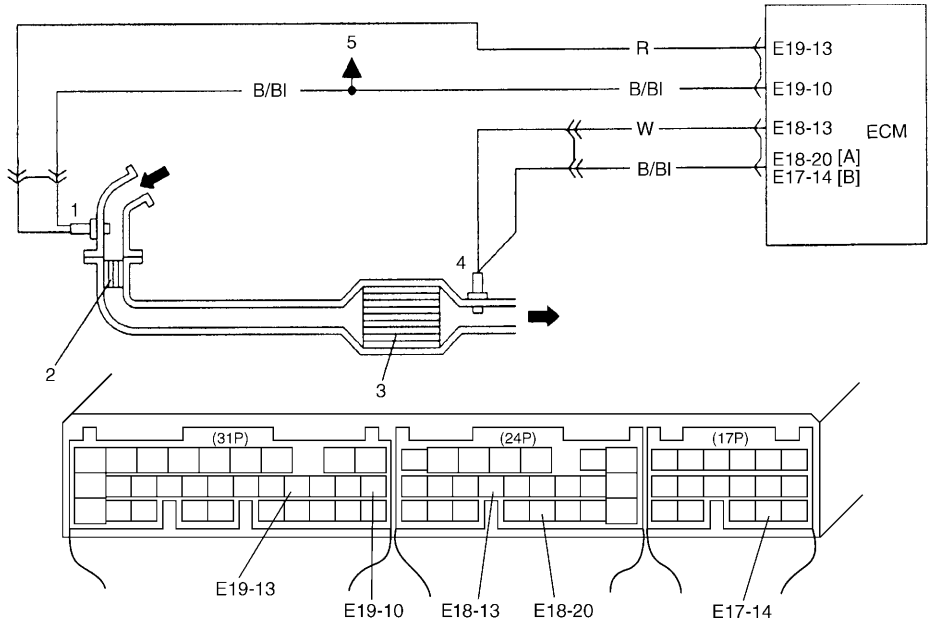


[B]



DTC P0420 Catalyst System Efficiency below Threshold

CIRCUIT DESCRIPTION



1. Heated oxygen sensor-1	3. Three way catalytic converter	5. To the sensor	[B] : Case of TYPE B is shown (See NOTE)
2. Warm up three way catalytic converter	4. Heated oxygen sensor-2	[A] : Case of TYPE A is shown (See NOTE)	

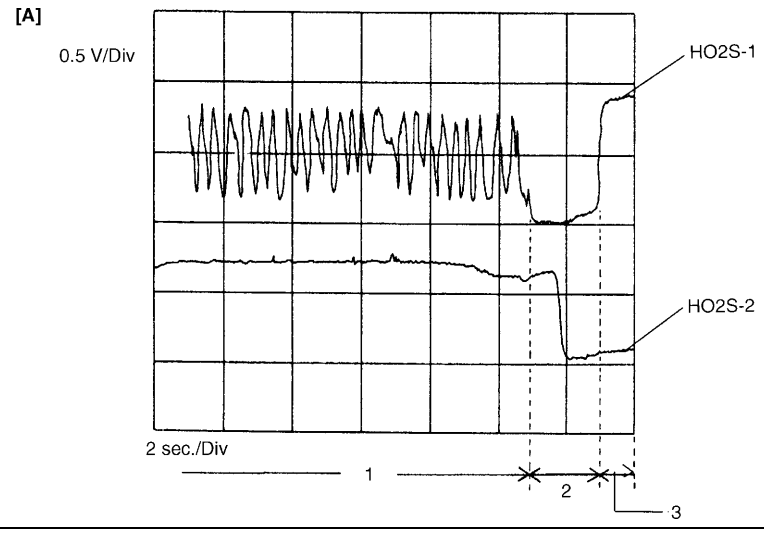
NOTE:

For TYPE A and TYPE B, refer to the NOTE in "ECM Terminal Voltage Values Table" for applicable model.

ECM monitors oxygen concentration in the exhaust gas which has passed the three way catalytic converter by HO2S-2.

When the catalyst is functioning properly, the variation cycle of HO2S-2 output voltage (oxygen concentration) is slower than that of HO2S-1 output voltage because of the amount of oxygen in the exhaust gas which has been stored in the catalyst.

REFERENCE



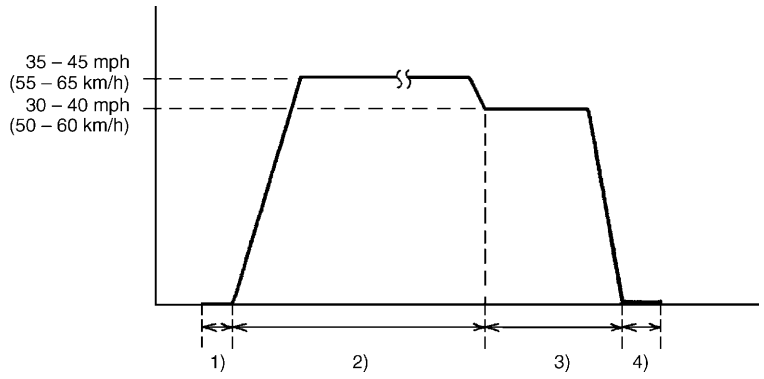
1. Engine running at closed loop condition	2. Fuel cut	3. Idle after fuel cut	[A] : Oscilloscope waveforms

DTC DETECTING CONDITION	POSSIBLE CAUSE
• 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 less than specified value. ✱2 driving cycle detection logic, monitoring once / 1 driving.	• Exhaust gas leak • Three way catalytic converter malfunction • Fuel system 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.**

1) Turn ignition switch OFF.
   Clear DTC with ignition switch ON, check vehicle and environmental condition for :
   – Altitude (barometric pressure) : 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)
   – Ambient temp. : –10 °C, 14 °F or higher
   – Intake air temp. : 70 °C, 158 °F or lower
   – Engine coolant temp. : 70 – 110 °C, 158 – 230 °F
2) Start engine and drive vehicle at 35 – 45 mph, 55 – 65 km/h for 8 min. or longer.
   While this driving, if “Catalyst Monitoring TEST COMPLETED” is displayed in “READINESS TESTS” mode and DTC is not displayed in “DTC” mode, confirmation test is completed.
   If “TEST NOT COMPLTD” is still being displayed, continue test driving.
3) Decrease vehicle speed at 30 – 40 mph, 50 – 60 km/h, and hold throttle valve at that opening position for 2 min. and confirm that short term fuel trim vary within – 20% – +20% range.
4) Stop vehicle (do not turn ignition switch OFF) and confirm test results according to following “Test Result Confirmation Flow Table”.



Test Result Confirmation Flow Table

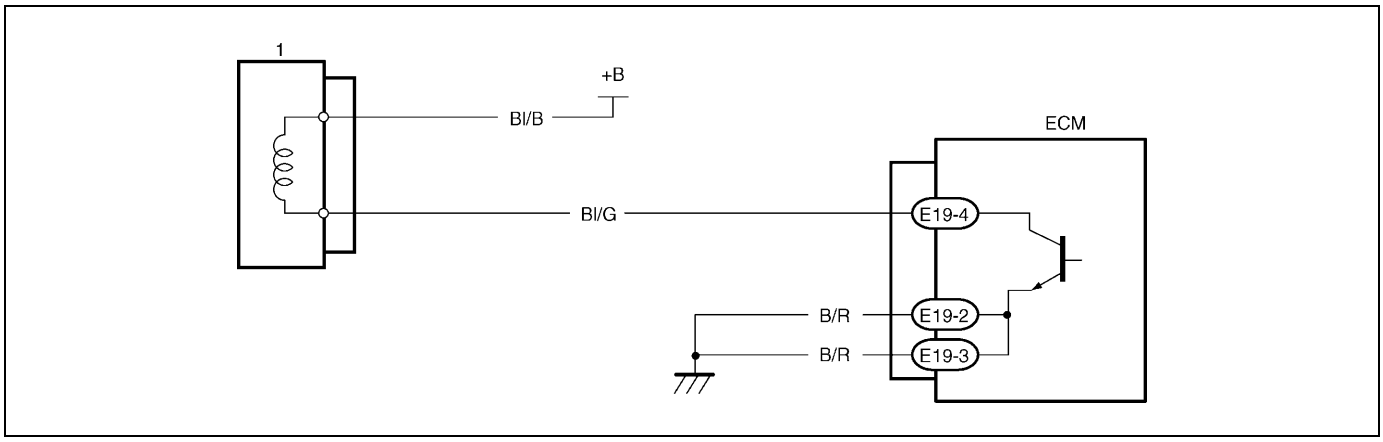
Step	Action	Yes	No
1	Check DTC in “DTC” mode and pending DTC in “ON BOARD TEST” or “PENDING DTC” mode. Is DTC or pending DTC displayed?	Proceed to applicable DTC Diag. Flow Table.	Go to Step 2.
2	Set scan tool to “READINESS TESTS” mode and check if testing has been completed. Is test completed?	No DTC is detected (confirmation test is completed).	Repeat DTC confirmation procedure.

INSPECTION

Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	Check Short Term Fuel Trim. Did short term fuel trim vary within –20 % – +20 % range in step 3) of DTC confirmation test?	Go to Step 3.	Check fuel system. Go to DTC P0171/P0172 Diag. Flow Table.
3	Check HO2S-2 for Output Voltage. Perform steps 1) through 9) of DTC confirmation procedure for DTC P0136 (HO2S-2 malfunction) and check output voltage of HO2S-2 then. Is over 0.6 V and below 0.3 V indicated?	Replace three way catalytic converter.	Check “W” and “B/Bl” wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-2.

DTC P0443 Purge Control Valve Circuit Malfunction

CIRCUIT DESCRIPTION



1. EVAP canister purge vale

DTC DETECTING CONDITION	POSSIBLE CAUSE
Canister Purge control valve circuit is opened or shorted.	• "Bl/G" circuit open or short • "Bl/B" circuit open or short • Canister purge valve malfunction

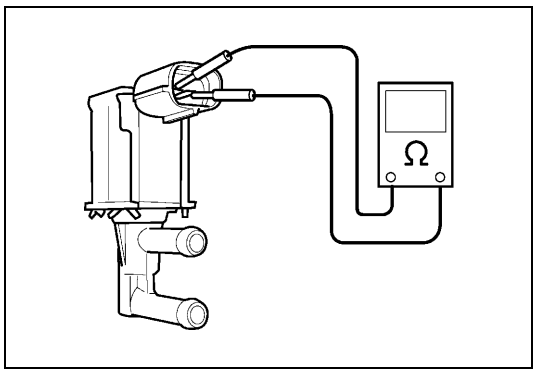
DTC CONFIRMATION PROCEDURE

1) Clear DTC with ignition switch ON.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

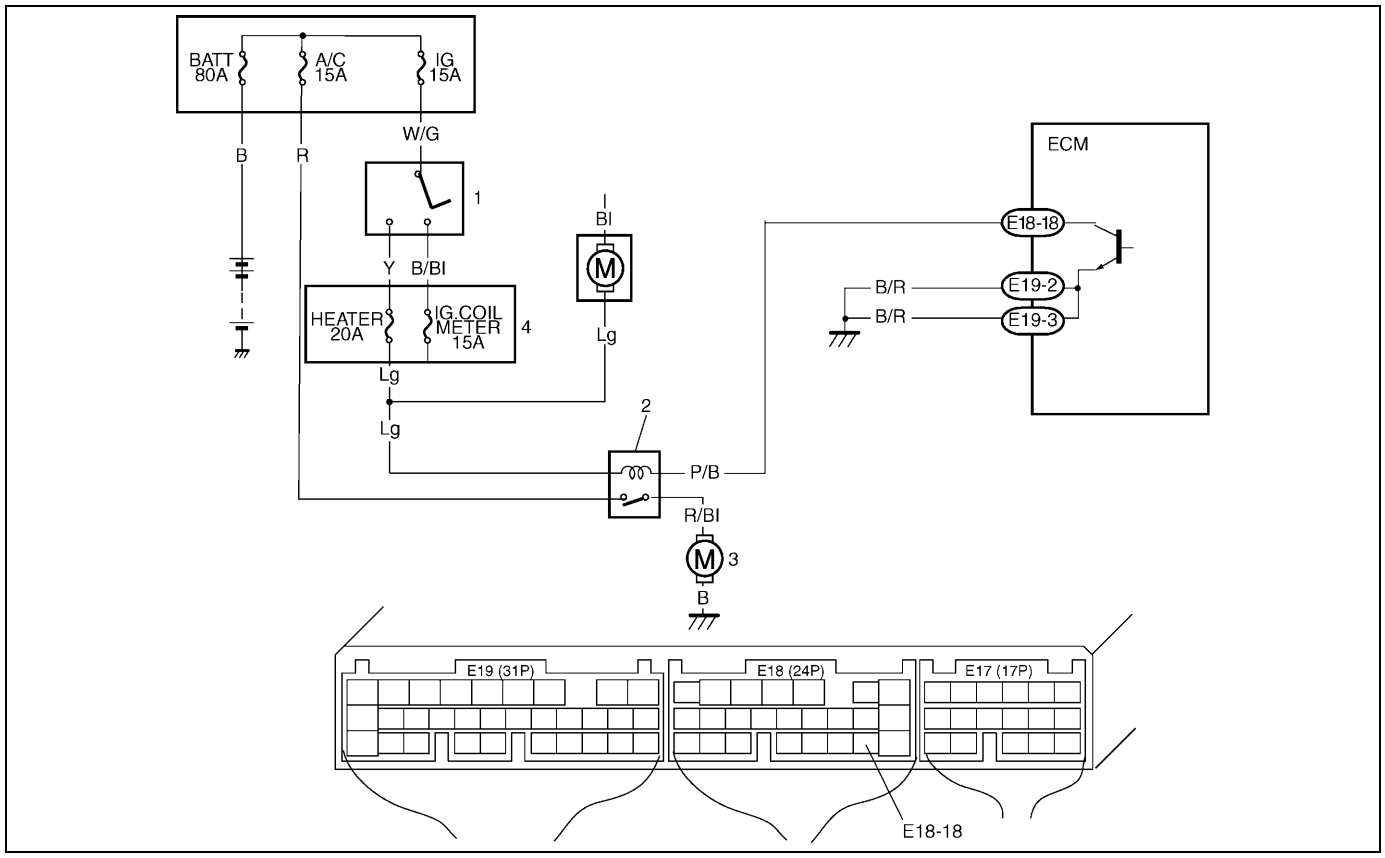
Step	Action	Yes	No
1	Was "Engine Diag. Flow Table" performed?	Go to Step 2	Go to "Engine Diag. Flow Table".
2	Check EVAP canister purge valve operation 1) With ignition switch OFF, disconnect coupler from canister purge valve. 2) Check resistance of EVAP canister purge valve. See Fig.1 **EVAP canister purge valve resistance** **Between two terminals : 30 – 34 Ω at 20 °C (68 °F)** **Between terminal and body : 1M Ω or higher** Is it as specified?	"Bl/G" circuit open or short.	Replace EVAP canister purge valve.

Fig. 1 for Step 2



DTC P0481 A/C Condenser Fan Control Circuit Malfunction

CIRCUIT DESCRIPTION



1. Ignition switch	3. A/C condenser fan relay	5. A/C condenser fan	7. Fuse box

DTC DETECTING CONDITION	POSSIBLE CAUSE
• Low voltage at terminal E18-18 when ECM doesn't output A/C ON signal to A/C amplifier or when engine coolant temp. is not 110 °C (230 °F) or more. ✱2 driving cycle detection logic, continuous monitoring.	• "P/B" or "Lg" circuit open or short • Condenser fan motor relay malfunction • ECM malfunction

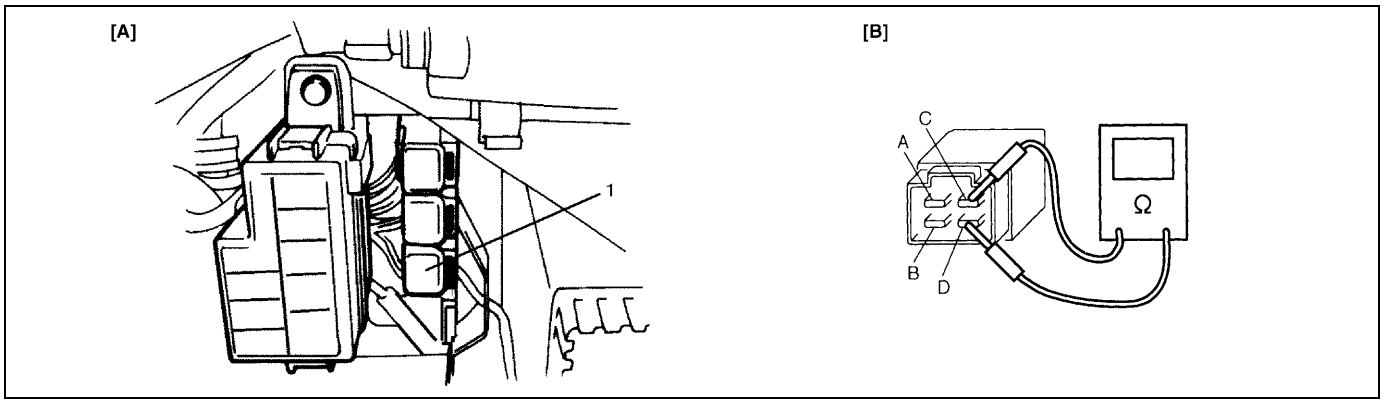
DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Start engine and then turn both A/C switch and heater blower switch ON for 2 sec or more.
4) Run engine at idle for 5 sec or more which A/C switch and heater blower switch OFF.
5) Check DTC and pending DTC.

INSPECTION

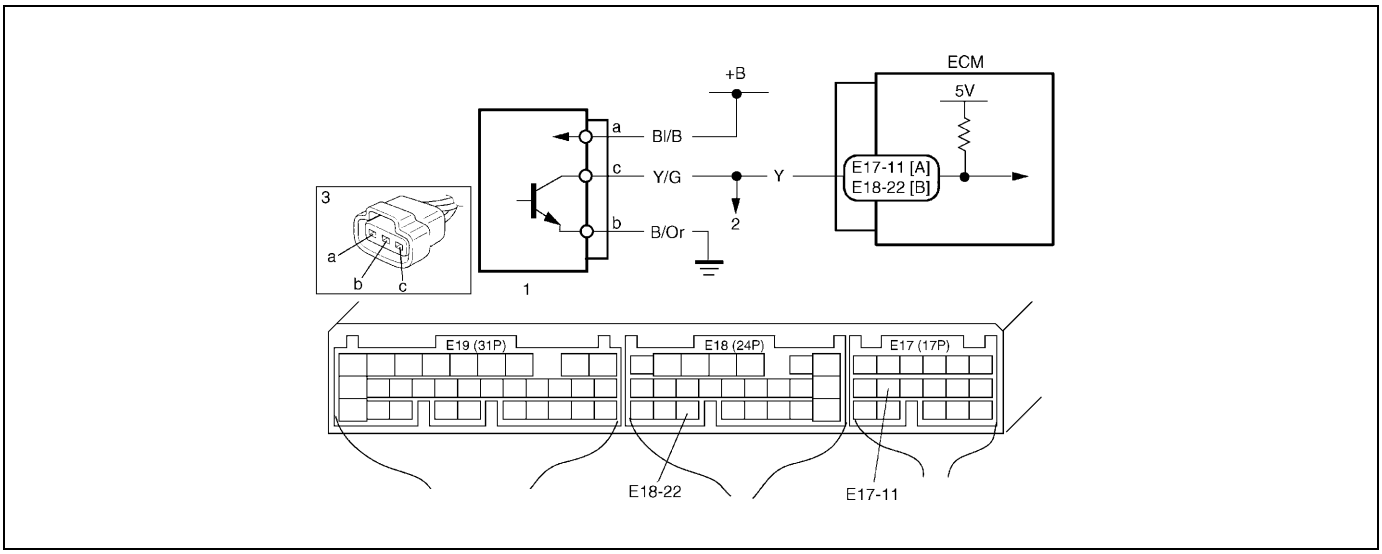
Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	Check A/C Condenser Fan Control Relay and its Circuit. 1) Turn ignition switch ON. 2) Check for voltage at terminal E18-18 of ECM connector connected, under following condition. When A/C switch turns OFF : 10 – 14 V Is voltage as specified?	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check A/C Condenser Fan Control Relay. 1) Turn ignition switch OFF and remove A/C condenser fan control relay (1). See Fig.1. 2) Check for proper connection to the relay at “P/B” and “Lg” wire terminals. 3) If OK, then measure resistance between terminals C and D. See Fig.2. Is it 70 - 110Ω?	“Lg” or “P/B” circuit open or short. If wires and connections are OK, substitute a known-good ECM and recheck.	Replace A/C condenser fan control relay.

[A] Fig. 1 for Step 3 / [B] Fig. 2 for Step 3



DTC P0500 (DTC No.16) Vehicle Speed Sensor (VSS) Malfunction

CIRCUIT DESCRIPTION



1. VSS	3. VSS connector	[B] : Case of TYPE B is shown (See NOTE)
2. Combination meter	[A] : Case of TYPE A is shown (See NOTE)	

NOTE:

For TYPE A and TYPE B, refer to the NOTE in "ECM Terminal Voltage Values Table" for applicable model.

DTC DETECTING CONDITION	POSSIBLE CAUSE
• VSS signal not inputted while vehicle running in "D" range or during fuel cut at deceleration. ✱2 driving cycle detection logic, continuous monitoring	• "B/Or" circuit open • "Y" or "Bl/B" circuit open or short • VSS malfunction • ECM malfunction • Speedometer malfunction

DTC CONFIRMATION PROCEDURE

WARNING:

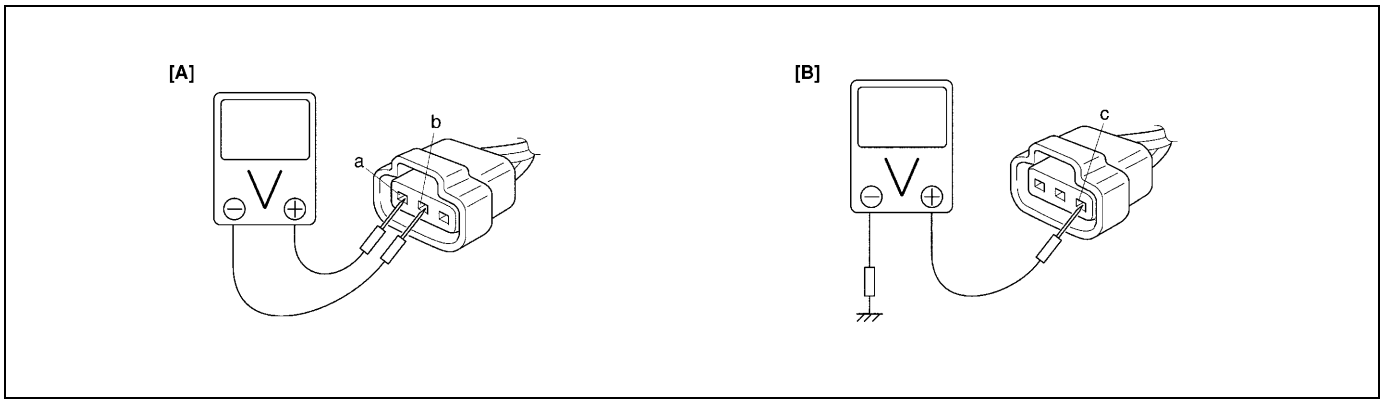
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Clear DTC and warm up engine to normal operating temperature.
2) Increase vehicle speed to 50 mph, 80 km/h in 3rd gear or "2" range while observing vehicle speed displayed on scan tool.
3) Release accelerator pedal and with engine brake applied, keep vehicle coasting (fuel cut condition) for 4 sec. or more.
4) Check pending DTC and DTC.

INSPECTION

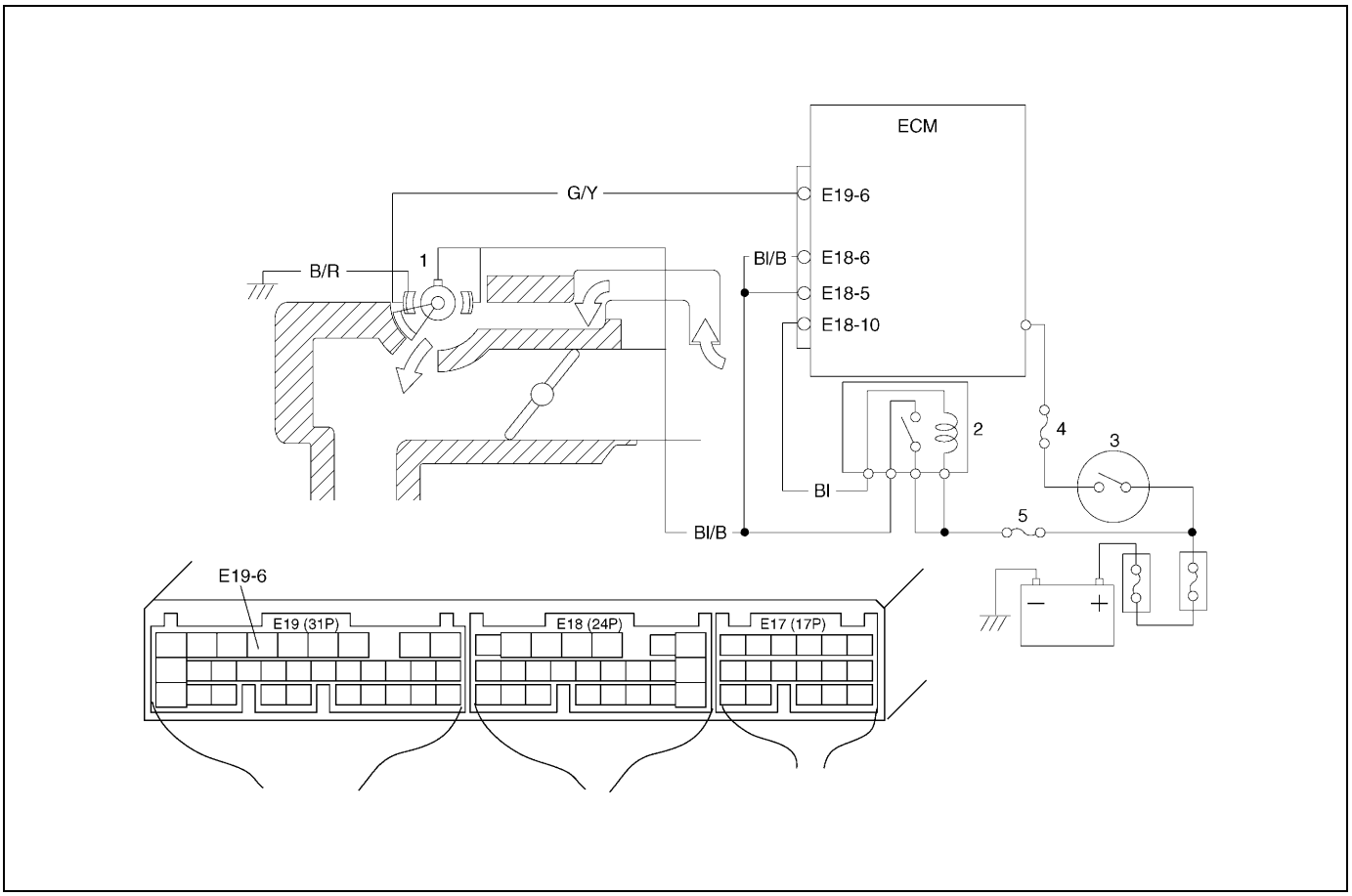
Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	Does speedometer indicate vehicle speed?	Go to Step 3.	Go to Step 5.
3	Check Vehicle Speed Signal. Is vehicle speed displayed on scan tool in step 2) and 3) of DTC confirmation procedure?	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 4.
4	1) Turn ignition switch to OFF position. 2) Disconnect combination meter connectors.Refer to Section 8. 3) Turn ignition switch to ON position, without running engine. 4) Measure voltage from terminal “c” of VSS connector to ground. See Fig.2. Is voltage within 4 – 5 V?	Faulty speedometer.	“Y” or “Y/G” wire open or short. Poor connection of ECM connector terminal. If OK, substitute a known-good ECM and recheck.
5	1) With ignition switch at OFF position, disconnect VSS connector. 2) Turn ignition switch to ON position, without running engine. 3) Measure voltage from terminal “a” to “b” of VSS connector. See Fig.1. Is voltage within 10 – 14 V?	Go to Step 6.	“Bl/B” or “B/Or” wire open or short.
6	1) Measure voltage from terminal “c” of VSS connector to ground. See Fig.2. Is voltage more than 4 V?	Go to Step 7.	“Y” or “Y/G” wire open or short. Poor connection of ECM connector terminal. If OK, substitute a known-good ECM and recheck.
7	1) Remove VSS. 2) Visually inspect VSS sensor signal rotor for damage. Was any damage found?	Faulty VSS signal rotor.	Poor connection of VSS connector terminal. If OK, substitute a known-good VSS and recheck.

[A] Fig. 1 for Step 5 / [B] Fig. 2 for Step 4 and Step 6



DTC P0505 Idle Control System Malfunction

CIRCUIT DESCRIPTION



1. IAC valve	3. Ignition switch	5. "FI" fuse
2. Main relay	4. "IG COIL METER" fuse	.

DTC DETECTING CONDITION	POSSIBLE CAUSE
• No closed signal to IAC valve is detected after engine start. ✱2 driving cycle detection logic, continuous monitoring.	• "Bl/B", "G/Y" or "B/R" circuit open or short • IAC valve malfunction • ECM malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Start engine and run it at idle for 1 min.
4) Check DTC and pending DTC.

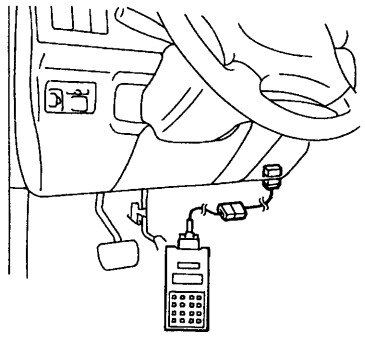
INSPECTION

Step	Action	Yes	No
1	Was "Engine Diag. Flow Table" performed?	Go to Step 2.	Go to "Engine Diag. Flow Table".
2	Is SUZUKI scan tool available?	Go to Step 3.	Go to Step 4.

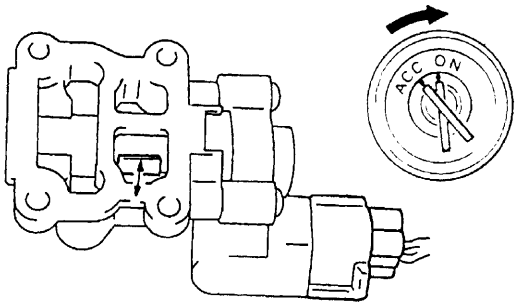
Step	Action	Yes	No
3	Check Idle Air Control System. 1) Connect SUZUKI scan tool to DLC with ignition switch OFF, set parking brake and block drive wheels. See Fig. 1. 2) Warm up engine to normal operating temperature. 3) Clear DTC and select “MISC TEST” mode on SUZUKI scan tool. Is it possible to control (increase and reduce) engine idle speed by using SUZUKI scan tool?	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 5.
4	Check Idle Air Control System. 1) Remove IAC valve from throttle boy referring to “IAC Valve” in Section 6E. 2) Check IAC valve for operation referring to “IAC Valve” in Section 6E. See Fig. 2. Is check result satisfactory?	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 5.
5	Check Wire Harness for Open and 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 ECM connector. 5) Check for proper connection to ECM at E19-6 terminal. 6) If OK, check “Bl/B”, “G/Y” and “B/R” circuit for open and short. Are they in good condition?	Replace IAC valve and recheck.	Repair or replace.

[A] Fig. 1 for Step 3 / [B] Fig. 2 for Step 4

[A]



[B]



DTC P0601 Internal Control Module Memory Check Sum Error (DTC No.71)

DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC P0601 : Data write error (or check sum error) when written into ECM ✱2 driving cycle detection logic, continuous monitoring.	ECM

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON and then turn ignition switch OFF.
3) Start engine and run it at idle if possible.
4) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

Substitute a known-good ECM and recheck.

DTC P1450 Barometric Pressure Sensor Low / High Input
DTC P1451 Barometric Pressure Sensor Performance Problem

WIRING DIAGRAM / CIRCUIT DESCRIPTION

Barometric pressure sensor is installed in ECM.

DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC P1450 : • Barometric pressure sensor voltage is 4.7 V or higher, or 1.6 V or lower	• ECM (barometric pressure sensor) malfunction
DTC P1451 : • Vehicle stopped • Engine cranking • Difference between barometric pressure and intake manifold absolute pressure is 26 kPa, 200 mmHg or more. • Difference between intake manifold absolute pressure at engine start and pressure after engine start is less than 1.3 kPa, 10 mmHg. ✱2 driving cycle detection logic, monitoring once / 1 driving.	• ECM (barometric pressure sensor) malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Turn ignition switch ON for 2 sec., crank engine for 2 sec. and run it at idle for 1 min.
4) Check pending DTC in “ON BOARD TEST” or “PENDING DTC” mode and DTC in “DTC” mode.

INSPECTION

DTC P1450 :

Substitute a known-good ECM and recheck.

DTC P1451 :

NOTE:

Note that atmospheric pressure varies depending on weather conditions as well as altitude. Take that into consideration when performing these check.

Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	1) Connect scan tool to DLC with ignition switch OFF. See Fig.1. 2) Turn ignition switch ON and select “DATA LIST” mode on scan tool. 3) Check manifold absolute pressure. Is it barometric pressure (approx. 100 kPa, 760 mmHg) at sea level?	Substitute a known-good ECM and recheck.	Go to Step 3.

Step	Action	Yes	No
3	Check MAP Sensor 1) Remove MAP sensor from intake manifold and connect vacuum pump gauge to MAP sensor. See Fig. 2. 2) Connect scan tool to DLC and turn ignition switch ON. 3) Check intake manifold absolute pressure displayed on scan tool for specified value. See Table 1. Is check result satisfactory?	Check air intake system for air being drawn in and engine compression. If OK, then substitute a known-good ECM and recheck.	Replace MAP sensor.

[A] Fig. 1 for Step 2 / [B] Fig. 2 for Step 3

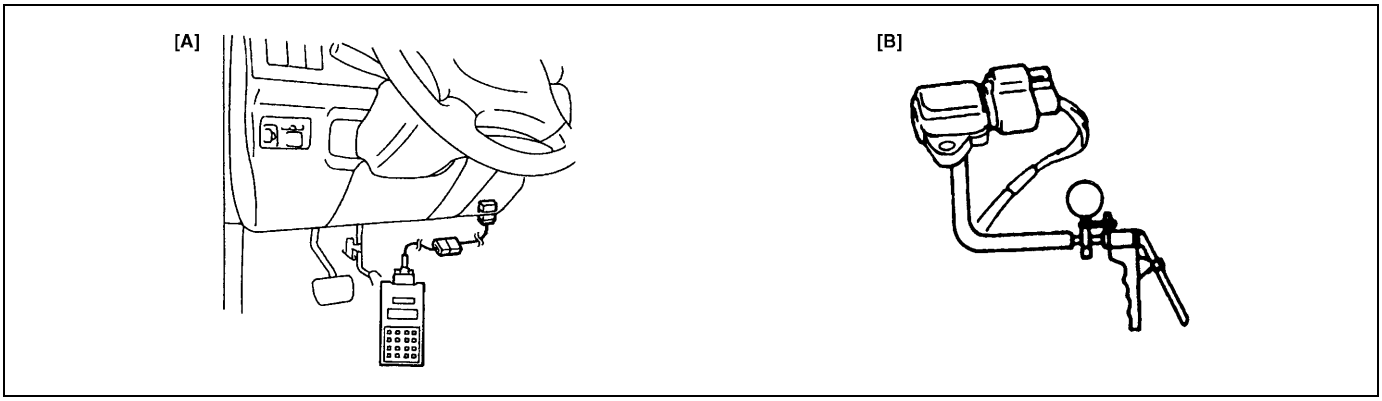
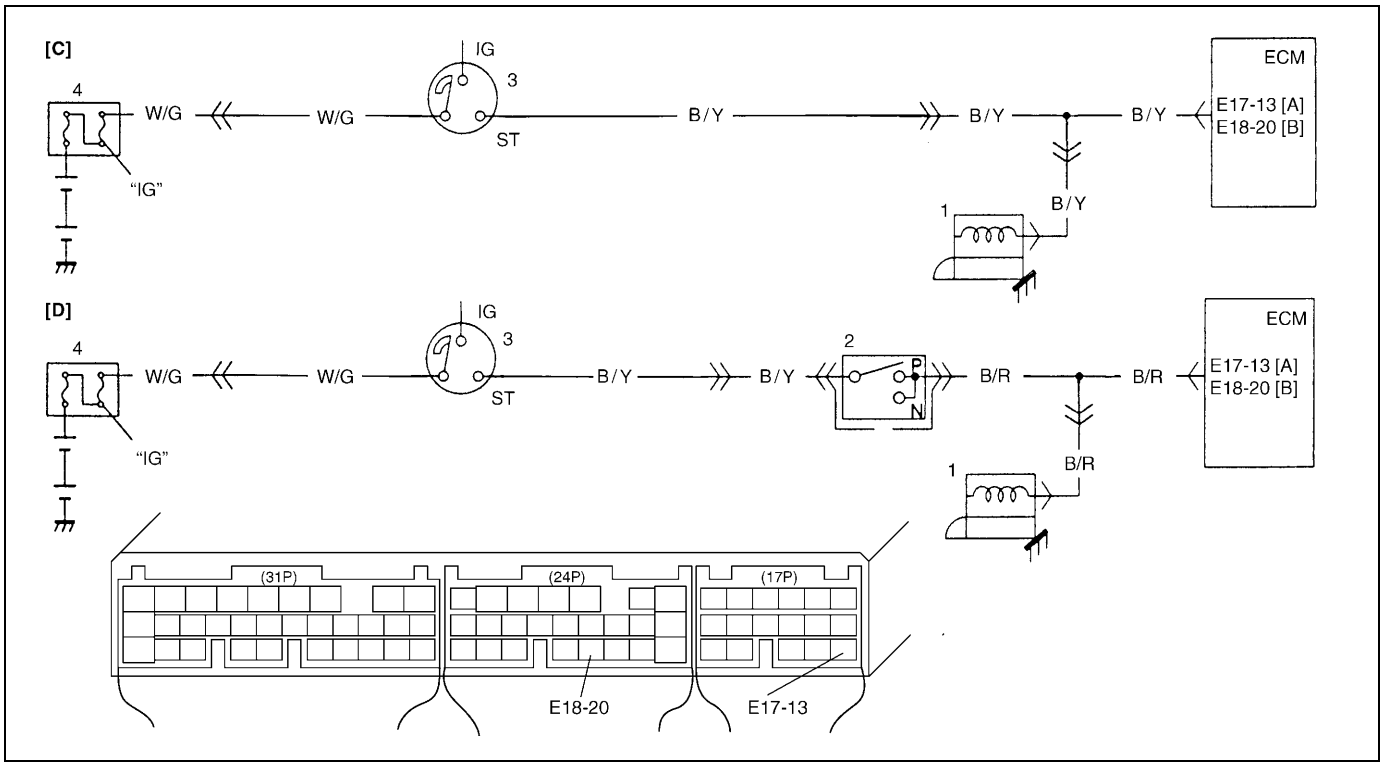


Table 1

Applying Vacuum	Displayed Value on Scan Tool
0	Barometric pressure (Approx. 100 kPa, 760 mmHg)
027 kPa 200 mmHg	Barometric pressure – 27 kPa (Approx. 73 kPa, 560 mmHg)
67 kPa 500 mmHg	Barometric pressure – 67 kPa (Approx. 33 kPa, 260 mmHg)

DTC P1500 Engine Starter Signal Circuit Malfunction

CIRCUIT DESCRIPTION



1. Starter	3. Ignition switch (starter switch)	[A] : Case of TYPE A is shown (See NOTE)	[C] : M/T vehicle
2. Transmission range sensor (switch)	4. Main fuse	[B] : Case of TYPE B is shown (See NOTE)	[D] : A/T vehicle

NOTE:

For TYPE A and TYPE B, refer to the NOTE in "ECM Terminal Voltage Values Table" for applicable model.

DTC DETECTING CONDITION	POSSIBLE CAUSE
• Low voltage at terminal E17-13 or E18-20 when cranking engine or • High voltage at terminal E17-13 or E18-20 after starting engine. ✱2 driving cycle detection logic, continuous monitoring.	• "B/Y" circuit open • ECM malfunction

DTC CONFIRMATION PROCEDURE

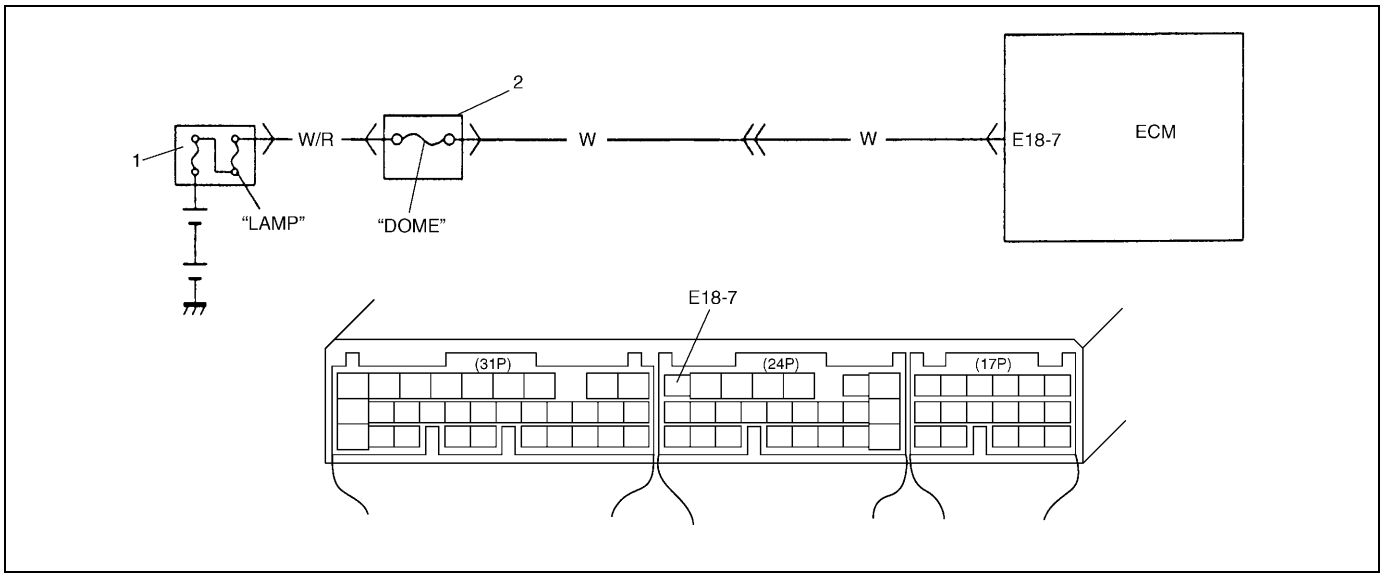
1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON, crank engine and run it at idle for 3 min.
3) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	Check for voltage at terminal E17-13 (Case of TYPE A) (See NOTE) or E18-20 (Case of TYPE B) (See NOTE) of ECM connector connected, under following condition. **Engine starter signal specification** **While engine cranking : 6 – 10 V** **After starting engine : 0 V** Is voltage as specified?	Poor E17-13 (Case of TYPE A) (See NOTE) or E18-20 (Case of TYPE B) (See NOTE) 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.	“B/Y” or “B/R” circuit open.

DTC P1510 ECM Back-up Power Supply Malfunction

CIRCUIT DESCRIPTION



1. Main fuse
2. Fuse box

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	POSSIBLE CAUSE
• Low voltage at terminal E18-7 after starting engine.	• "W" circuit open • ECM malfunction

DTC CONFIRMATION PROCEDURE

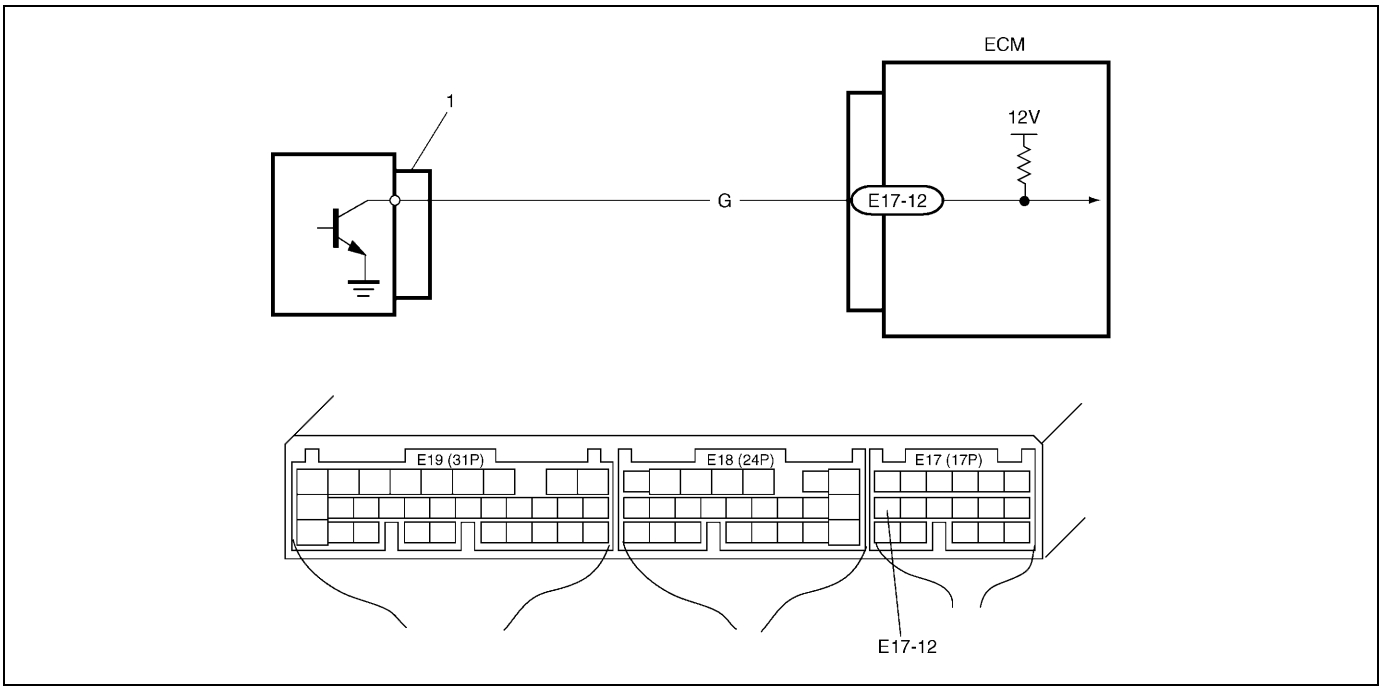
1) Clear DTC, start engine and run it at idle for 1 min.
2) Select "DTC" mode on scan tool and check DTC.

INSPECTION

Step	Action	Yes	No
1	Check for voltage at terminal E18-7 of ECM connector connected, under each condition, ignition switch OFF and engine running. Is it 10 – 14 V at each condition?	Poor E18-7 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.	"W" circuit open.

DTC P1570 (DTC No.21) ABS Signal Circuit Malfunction

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	POSSIBLE CAUSE
• ABS signal input is low when engine start.	• ABS signal circuit short to ground • ABS control module

DTC CONFIRMATION PROCEDURE

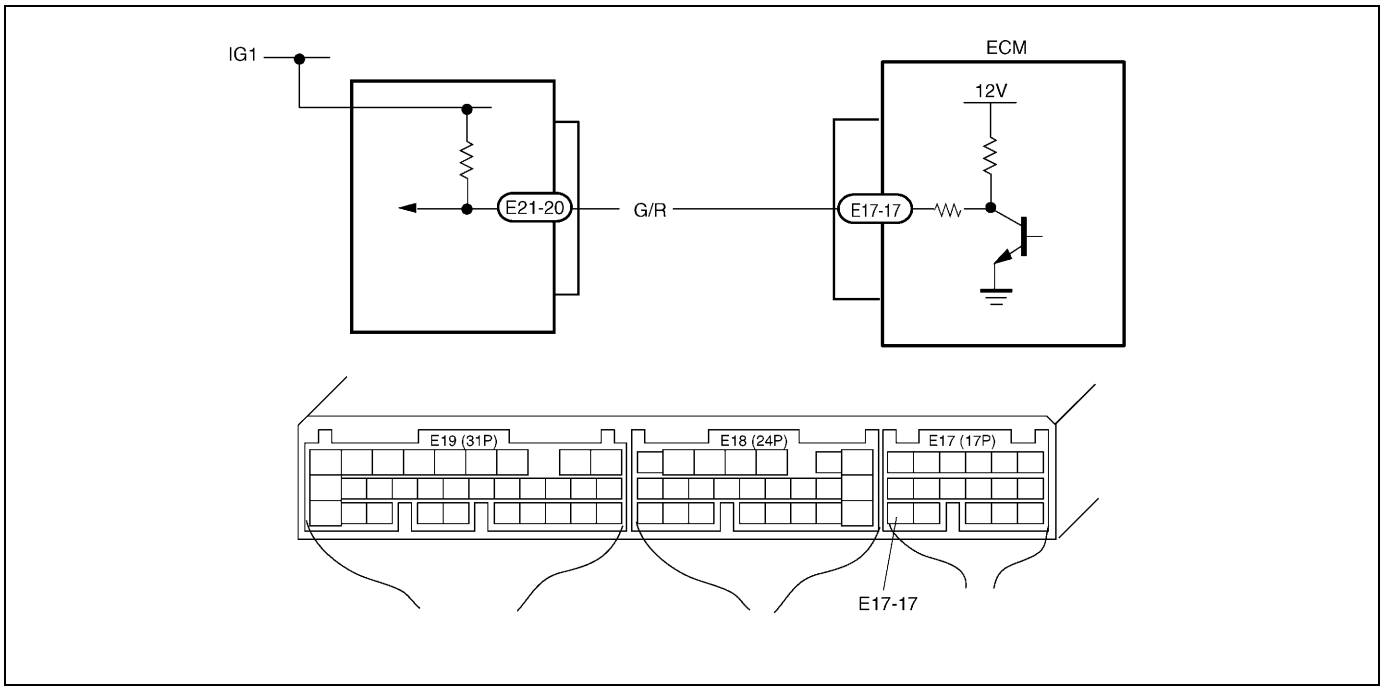
1) Clear DTC, start engine and keep it at idle for 1 min.
2) Select “DTC” mode on scan tool and check DTC.

INSPECTION

Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	1) With the ignition switch ON position, check voltage between E17-12 terminal of ECM coupler and ground. Is voltage within 10 – 14 V?	Intermittent trouble. If OK, substitute a known-good ECM and recheck.	Go to Step 3.
3	1) Check “G” wire for shorted to ground circuit. Is “G” wire in good condition?	Go to Step 4.	Repair or replace.
4	1) Disconnect coupler of ABS control module. 2) Clear DTC. 3) Start engine and check DTC. Is DTC P1570 (No.21) detected?	Substitute a known-good ECM and recheck.	Substitute a known-good ABS control module and recheck.

DTC P1600 Serial Communication Problem Between ECM and TCM

CIRCUIT DESCRIPTION



The serial data line is pulled up to about 12 V by ECM and TCM transmits information to ECM through it by controlling its grounding.
TCM constantly sends information while ignition switch is ON as to whether judgement was made or not with respect to all detectable DTCs as well as whether or not abnormality exists after judgement.

DTC DETECTING CONDITION	POSSIBLE CAUSE
No signal inputted from TCM to ECM or check sum error while engine running	• "G/R" circuit open or short • TCM power or ground circuit open. • TCM malfunction • ECM malfunction

DTC CONFIRMATION PROCEDURE

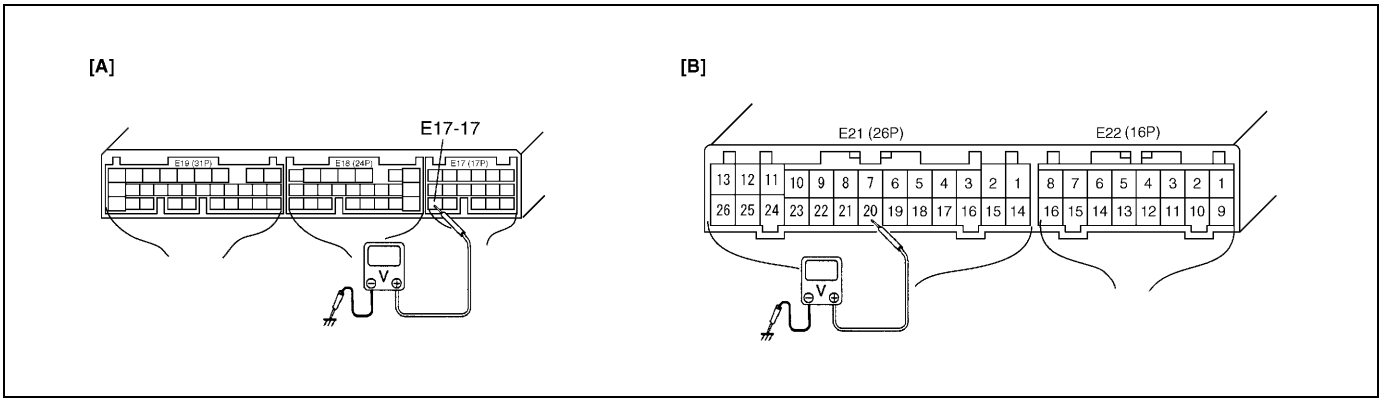
1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Start engine and run it at idle for 1 min.
4) Select "DTC" mode on scan tool and check DTC.

INSPECTION

Step	Action	Yes	No
1	Was "Engine Diag. Flow Table" performed?	Go to Step 2.	Go to "Engine Diag. Flow Table".
2	Check signal voltage. Check voltage between terminal E17-17 and body ground with ignition switch ON. See Fig. 1. Does it change between 0 – 12 V?	Intermittent trouble or faulty ECM or TCM. Check for intermittent trouble referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 3.

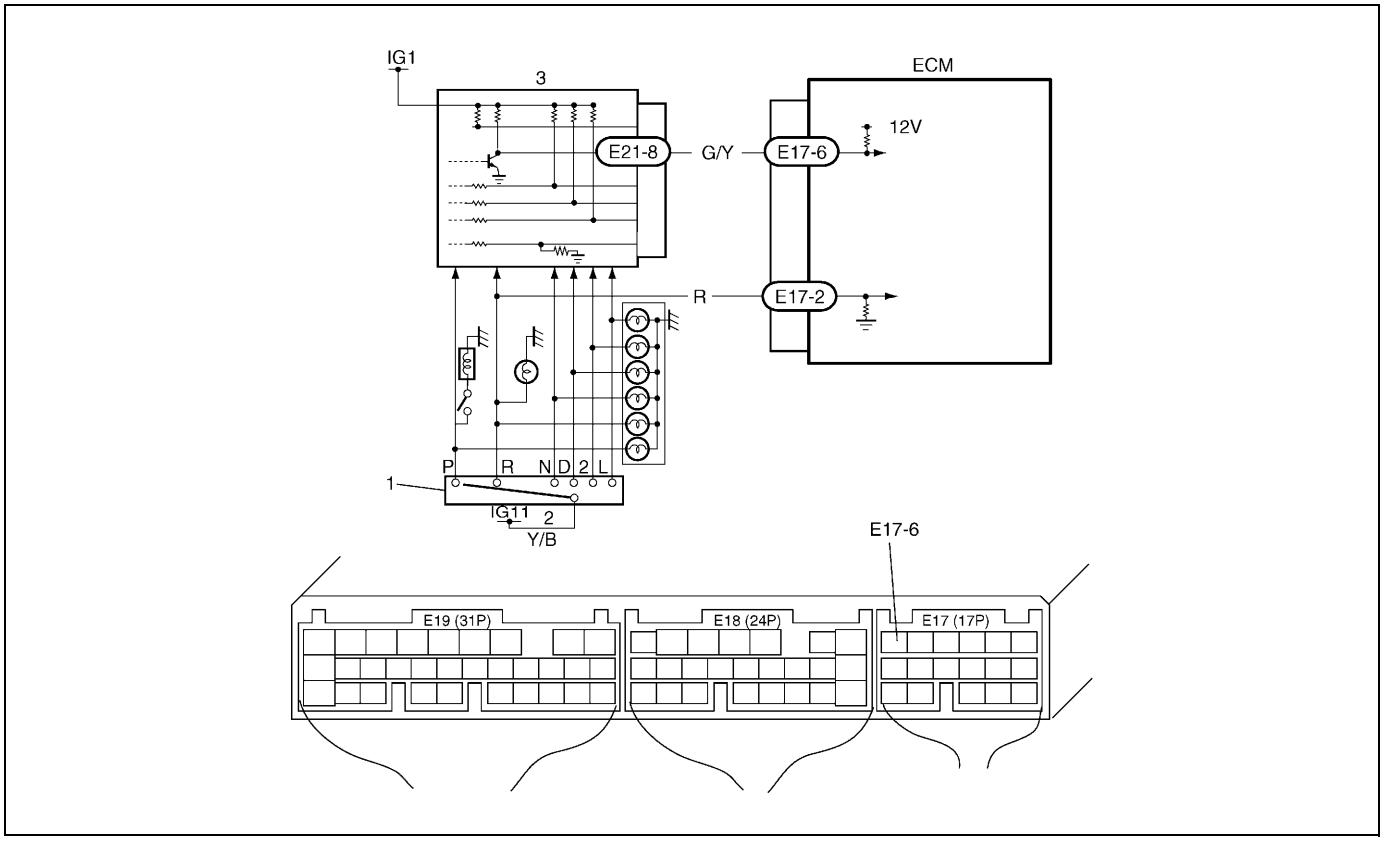
Step	Action	Yes	No
3	Is it about 12 V at Step 2?	"B/R" wire open, poor E21-11 connection or TCM power or ground circuit open. If wires and connections are OK, substitute a known-good TCM and recheck.	Go to Step 4.
4	Check signal circuit. 1) Disconnect TCM coupler with ignition switch OFF. 2) Check voltage between E21-20 terminal and body ground with ignition switch ON. See Fig. 2. Is it about 12 V?	Check TCM power and ground circuit for open. If OK, substitute a known-good TCM and recheck.	"B/R" wire shorted to ground or poor E17-17 terminal connection. If wire and connection are OK, substitute a known-good ECM and recheck.

[A] Fig. 1 for Step 2 / [B] Fig. 2 for Step 4



DTC P1717 A/T Drive Range (Park / Neutral Position) Signal Circuit Malfunction

CIRCUIT DESCRIPTION



1. Transmission range switch	2. From ignition switch	3. TCM

DTC DETECTING CONDITION	POSSIBLE CAUSE
• "D" range signal not inputted (Park / Neutral position signal inputted) to ECM while vehicle running ✱2 driving cycle detection logic, Continuous monitoring.	• "G/Y" circuit open • Transmission range switch malfunction • "R", "D", "2" or "L" range signal circuit open • TCM power or ground circuit open • TCM malfunction • ECM malfunction

DTC CONFIRMATION PROCEDURE

WARNING:

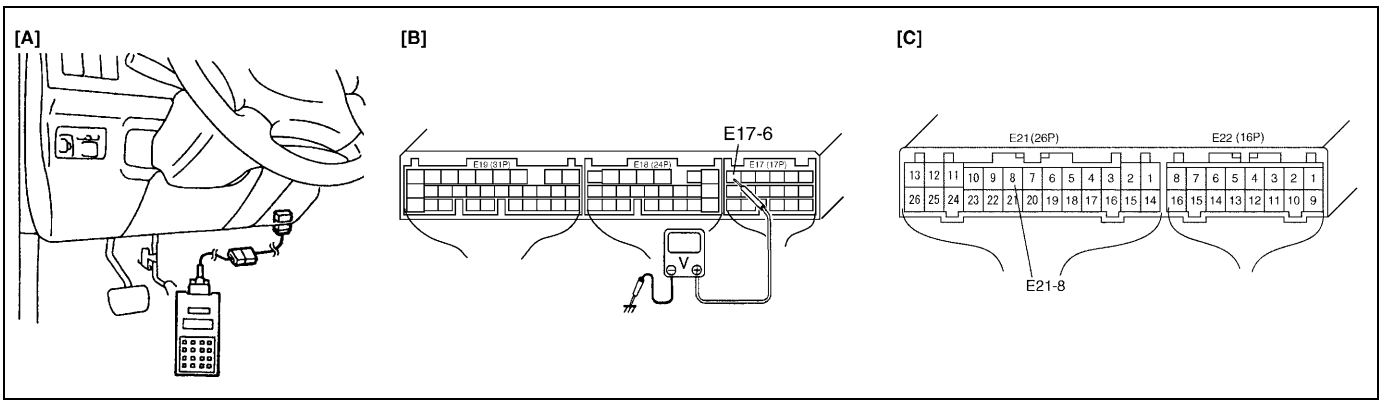
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Start engine and shift selector lever to "D" range.
4) Increase vehicle speed to higher than 20 mph, 32 km/h and then stop vehicle.
5) Repeat above step 4) 9 times.
6) Shift selector lever to "2" range and repeat above step 4) and 5).
7) Shift selector lever to "L" range and repeat above step 4) and 5).
8) Check DTC in "DTC" mode and pending DTC in "ON BOARD TEST" or "PENDING DTC" mode.

INSPECTION

Step	Action	Yes	No
1	Was “Engine Diag. Flow Table” performed?	Go to Step 2.	Go to “Engine Diag. Flow Table”.
2	Is SUZUKI scan tool available?	Go to Step 3.	Go to Step 4.
3	Check PNP signal (“D” range signal). 1) Connect SUZUKI scan tool to DLC with ignition switch OFF. See Fig. 1. 2) Turn ignition switch ON and check PNP signal (“P/N” or “D” range) on display when shifting selector lever to each range. Is “D” range on display (Is 0 – 1 V indicated) no matter which of “R”, “D”, “2” and “L” range positions selector lever may be at? See Table 1.	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 5.
4	Check PNP Signal (“D” range signal). 1) Turn ignition switch ON. 2) Check voltage at terminal E17-6 of ECM connector connected. See Fig. 2. Is “D” range on display (Is 0 – 1 V indicated) no matter which of “R”, “D”, “2” and “L” range positions selector lever may be at? See Table 1.	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 5.
5	Is “P/N” range on display (Is 10 – 14 V indicated) when selector lever is at one of “R”, “D”, “2” and “L” range positions only?	Check transmission range switch and circuits referring to Section 7B.	Go to Step 6.
6	Check PNP signal circuit. 1) Turn ignition switch OFF. 2) Disconnect TCM connectors. 3) Check for proper connection to TCM at terminal E21-5. 4) If OK, then check voltage at terminal E21-8 in TCM connector disconnected, with ignition switch ON. See Fig. 3 Is it 10 – 14 V?	“Y/B” circuit open, poor transmission range sensor connector connection, select cable maladjusted, transmission range sensor maladjusted or transmission range sensor malfunction. If all above are OK, substitute a known-good TCM and recheck.	“G/Y” circuit open or poor E17-6 connection. If wire and connection are OK, substitute a known-good ECM and recheck.

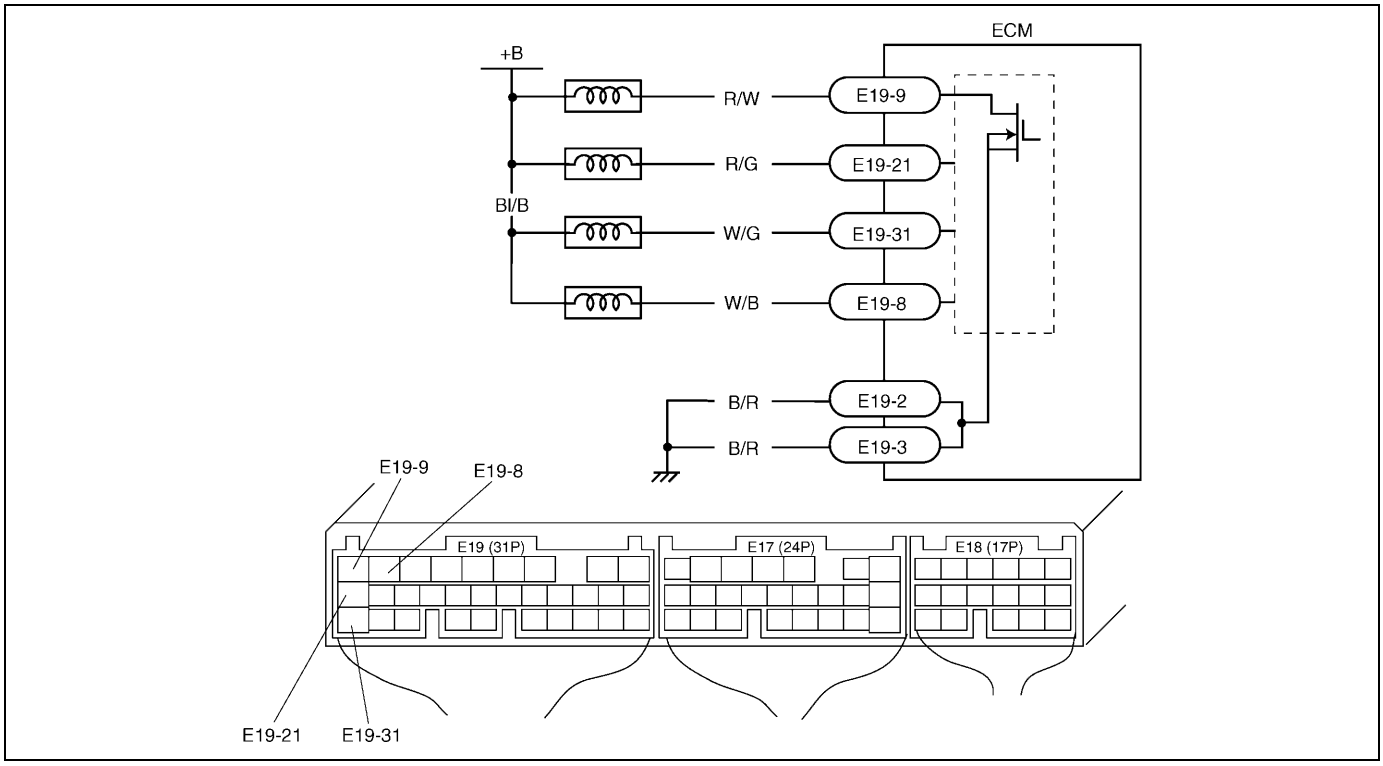
[A] Fig. 1 for Step 3 / [B] Fig. 2 for Step 4 / [C] Fig. 3 for Step 6



[D] Table 1 for Step 3 and 4

		Scan tool voltmeter	
		SUZUKI SCAN TOOL DISPLAY	VOLTAGE AT E17-6
Selector lever position	"P" and "N" range	P/N range	10 – 14V
	"R", "D", "2" and "L" range	D range	0 – 1V

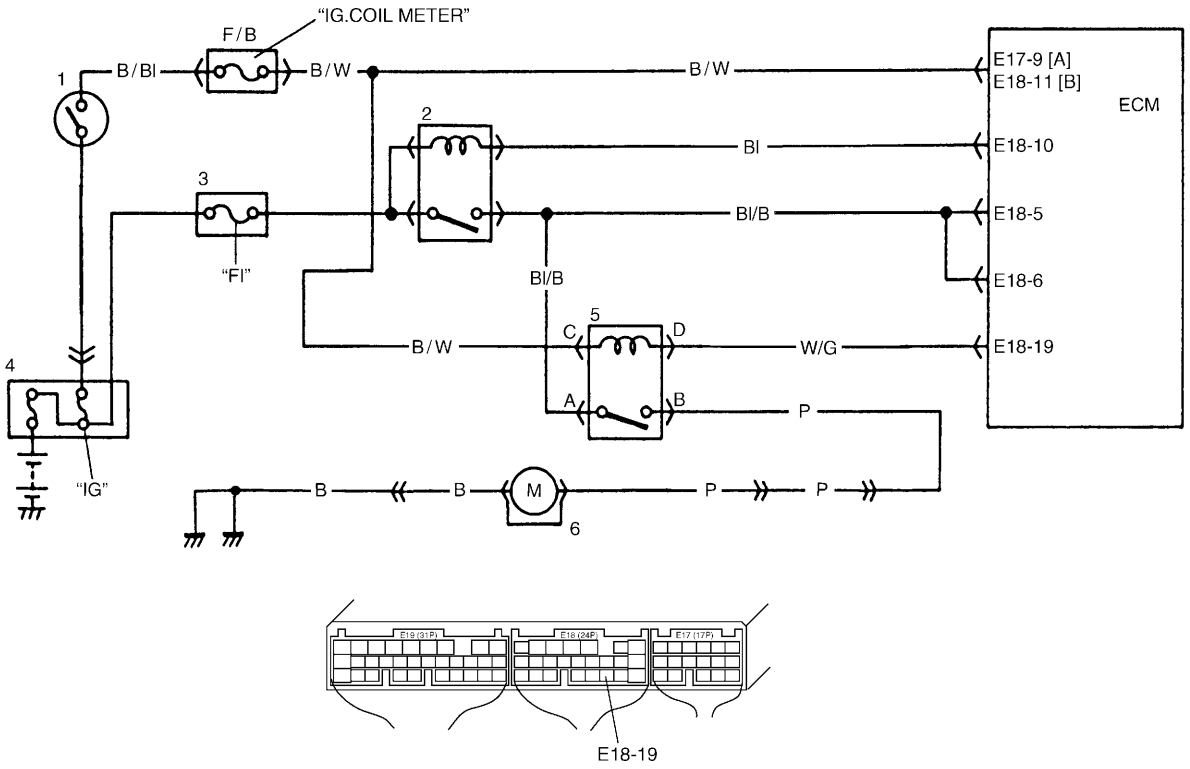
Table B-1 Fuel Injector Circuit Check



INSPECTION

Step	Action	Yes	No
1	Was "Engine Diag. Flow Table" performed?	Go to Step 2.	Go to "Engine Diag. Flow Table".
2	Check Injector for Operating Sound. Using sound scope, check each injector for operating sound at engine cranking. Do all 4 injector make operating sound?	Fuel injector circuit is in good condition.	Go to Step 3.
3	Dose none of 4 injectors make operating sound at Step 2?	Go to Step 4.	Check coupler connection and wire harness of injector not making operating sound and injector itself (Refer to Section 6E).
4	Check power circuit of injectors for open and short. Is it normal?	Check all 4 injectors for resistance respectively. If resistance is OK, substitute a known-good ECM and recheck.	Power circuit open or short.

Table B-2 Fuel Pump and Its Circuit Check



1. Ignition switch	3. Main relay	5. Fuel pump relay	[A] : Case of TYPE A is shown (See NOTE)
2. Main relay	4. Main fuse	6. Fuel pump	[B] : Case of TYPE B is shown (See NOTE)

NOTE:

For TYPE A and TYPE B, refer to the NOTE in "ECM Terminal Voltage Values Table" for applicable model.

INSPECTION

Step	Action	Yes	No
1	Was "Engine Diag. Flow Table" performed?	Go to Step 2.	Go to "Engine Diag. Flow Table".
2	Check Fuel Pump Control System for Operation. See Fig. 1. Is fuel pump heard to operate for 2 sec. after ignition switch ON?	Fuel pump circuit is in good condition.	Go to Step 3.
3	Check Fuel Pump for Operation. 1) Remove fuel pump relay from relay box with ignition switch OFF. 2) Check for proper connection to relay at each terminals. 3) If OK, using service wire, connect terminals "A" and "B" of relay connector. See Fig. 2 and CAUTION. Is fuel pump heard to operate at ignition switch ON?	Go to Step 4.	"P", "B" or "Bl/B" circuit open or fuel pump malfunction.

Step	Action	Yes	No
4	Check Fuel Pump Relay for Operation. 1) Check resistance between each two terminals of fuel pump relay. See Fig.3. **Fuel pump relay resistance** **Between terminals "A" and "B" : Infinity** **Between terminals "C" and "D": 100 – 150 Ω** 2) Check that there is continuity between terminals "A" and "B" when battery is connected to terminals "C" and "D". See Fig. 3. Is fuel pump relay in good condition?	"W/G" circuit open or poor E18-19 connection. If wire and connection are OK, substitute a known-good ECM and recheck.	Replace fuel pump relay.

CAUTION:

Check to make sure that connection is made between correct terminals. Wrong connection can cause damage to ECM, wire harness, etc.

[A] Fig. 1 for Step 2 / [B] Fig. 2 for Step 3 / [C] Fig. 3 for Step 4

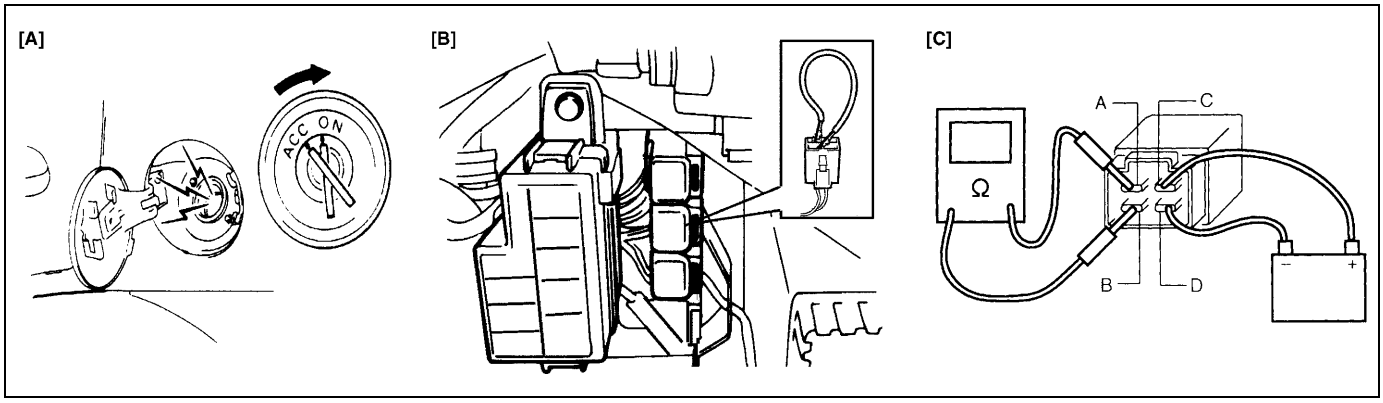
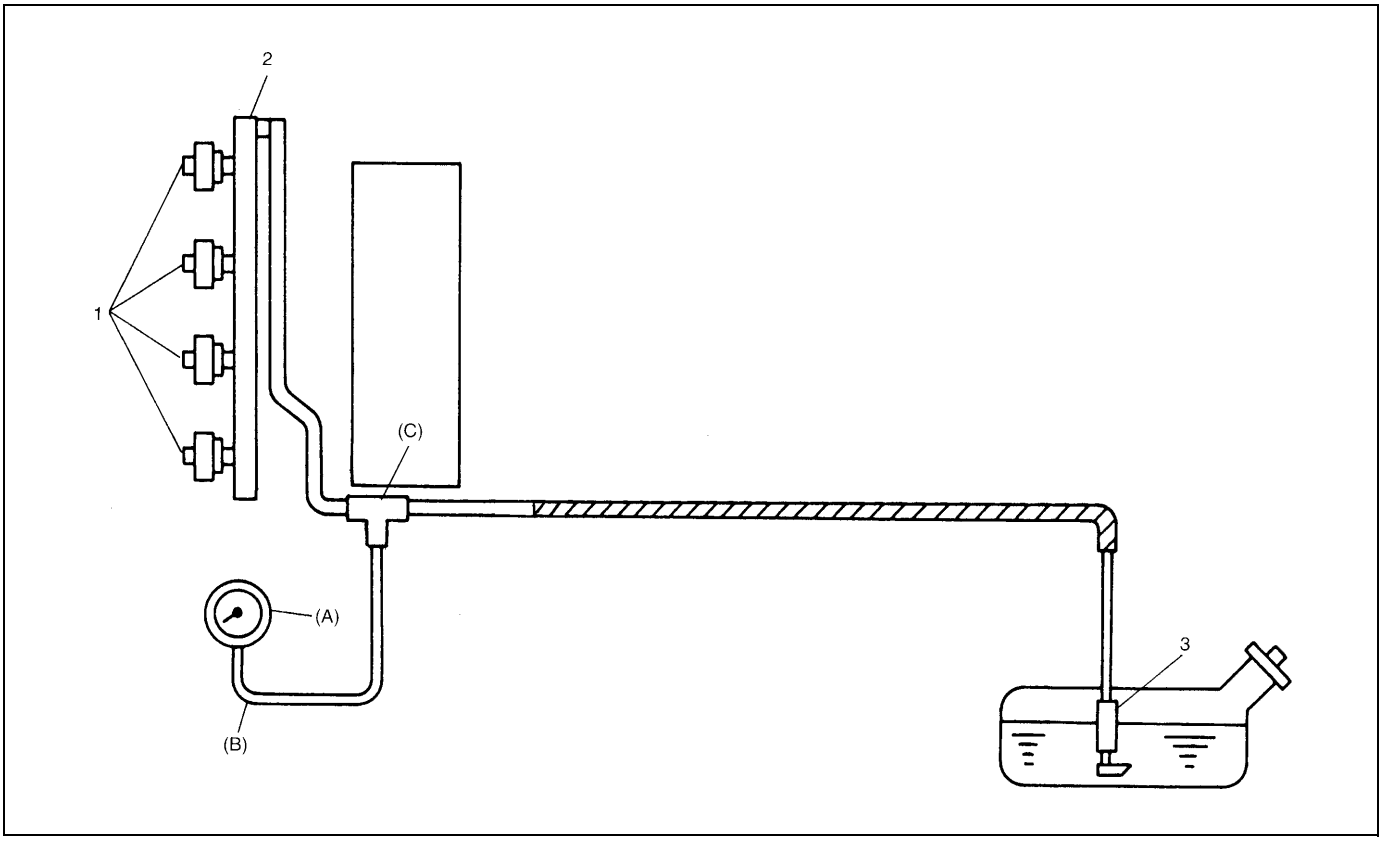


Table B-3 Fuel Pressure Check

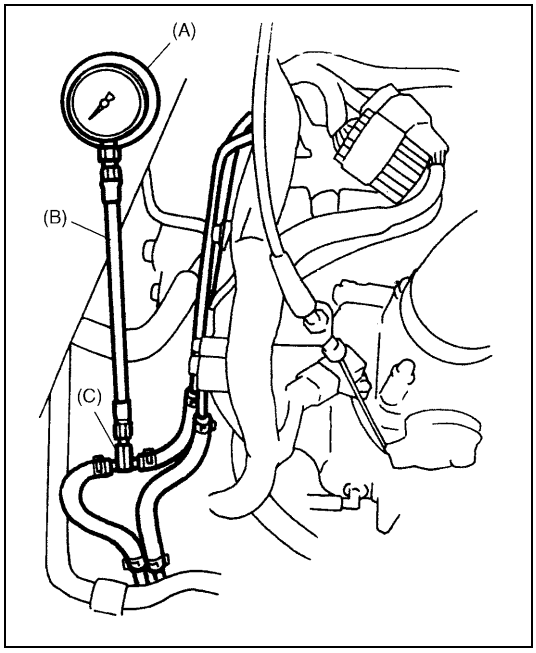


1. Injector	3. Fuel pump	(B) : Hose
2. Delivery pipe	(A) : Fuel pressure gauge	(C) : Attachment

INSPECTION

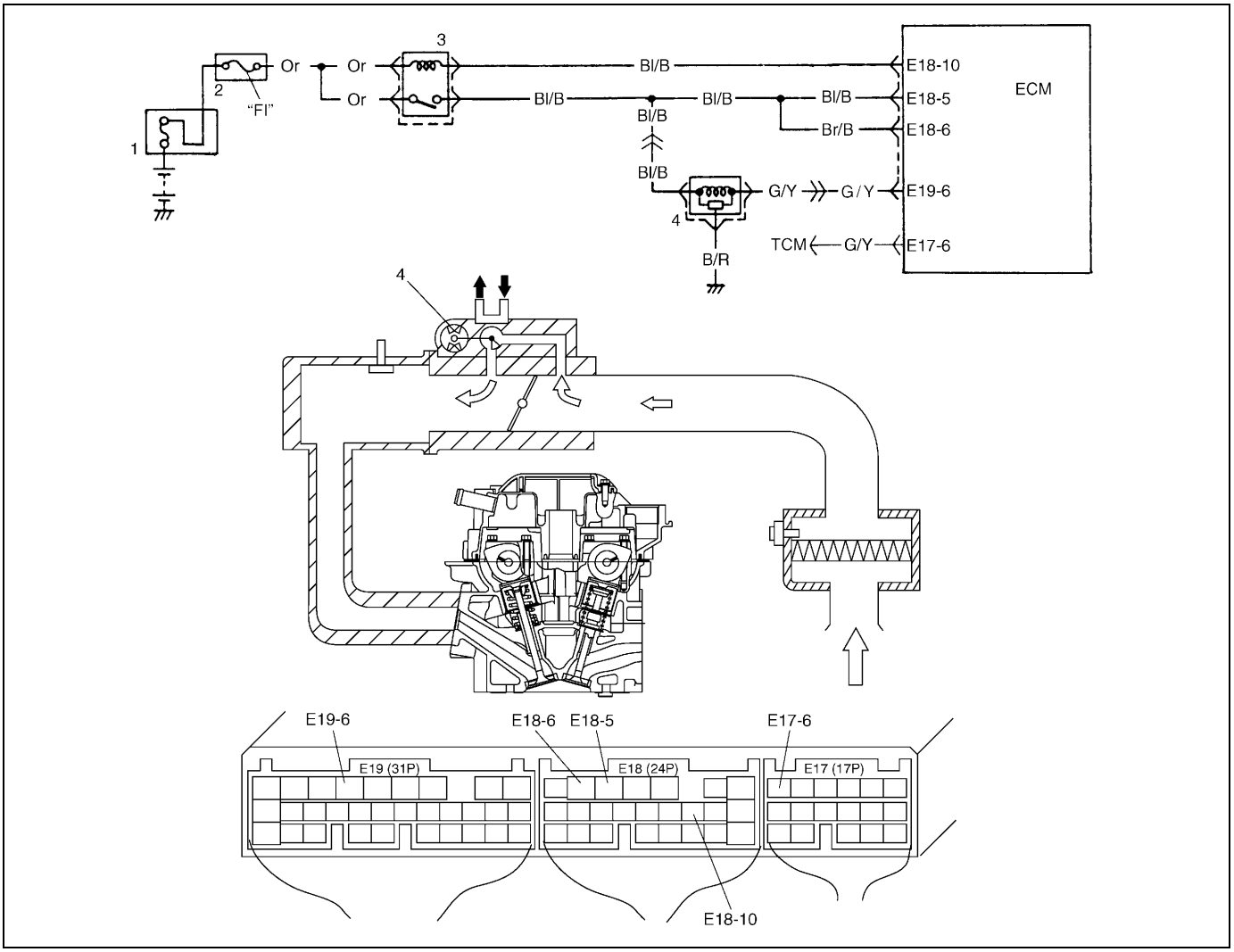
Step	Action	Yes	No
1	Check Fuel Pressure (Refer to Section 6E for details). 1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. See Fig.1. 3) Check fuel pressure by repeating ignition switch ON and OFF. Is fuel pressure then 270 – 310 kPa (2.7 - 3.1 kg/cm^2, 38.4 – 44.0 psi)?	Go to Step 2.	Go to Step 4.
2	Is 250 kPa (2.5 kg/cm^2, 35.6 psi) or higher fuel pressure retained for 1 minute after fuel pump is stopped at Step 1?	Normal fuel pressure.	Go to Step 3.
3	Is there fuel leakage from fuel feed line hose, pipe or their joint?	Fuel leakage from hose, pipe or joint.	Faulty fuel pressure regulator.
4	Was fuel pressure higher than spec. in Step 1?	Faulty fuel pressure regulator.	Clogged fuel filter, Restricted fuel feed hose or pipe, Faulty fuel pump or Fuel leakage from hose connection in fuel tank.

Fig. 1 for Step 1



Special tool
(A) : 09912-58441
(B) : 09912-58431
(C) : 09912-58490

Table B-4 Idle Air Control System Check



1. Main fuse	2. Fuse box	3. Main relay	4. IAC valve

INSPECTION

Step	Action	Yes	No
1	Check engine idle speed and IAC duty referring to "Idle Speed / IAC Duty Inspection" in Section 6E. 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 • Closed throttle position (TP sensor) • Stuck of PCV valve

Step	Action	Yes	No
3	Is engine idle speed kept specified speed even with headlight ON?	System is in good condition.	Check IAC system for operation referring to Step 3 or Step 4 of DTC P0505 Diag. Flow Table.
4	Was idle speed higher than specification in Step 1?	Go to Step 5.	Go to Step 8.
5	Check A/C (input) signal circuit referring to Step 1 of Table B-5 A/C Signal Circuit Check, if equipped. (A/C signal can be also checked by using SUZUKI scan tool.) Is it in good condition?	Go to Step 6.	Repair or replace A/C signal circuit or A/C system.
6	Check IAC system referring to Step 2 to Step 4 of DTC P0505 Diag. Flow Table. Is check result satisfactory?	Go to Step 7.	Go to Step 5 of DTC P0505 Diag. Flow Table.
7	Was IAC duty less than about 3% (or more than about 97% for OFF duty meter) in Step 1 of this table?	Check abnormal air inhaling from air intake system, PCV valve and EVAP canister purge control system.	Check TP sensor (closed throttle position) and ECT sensor for performance. If sensors are OK, substitute a known-good ECM.
8	Is SUZUKI scan tool available?	Go to Step 9.	Go to Step 10.
9	Check PNP signal (“D” range signal). 1) Connect SUZUKI scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON and check PNP signal (“P/N” and “D” range) on display when shifting selector lever to each range. See Table 1. Is check result satisfactory?	Go to Step 11.	Repair or replace.
10	Check PNP signal (“D” range signal). 1) Turn ignition switch ON. 2) Check voltage at terminal E17-6 of ECM connector connected. See Fig. 1 and Table 1. Is check result satisfactory?	Go to Step 11.	Repair or replace.
11	Check IAC system referring to Step 2 to Step 4 of DTC P0505 Diag. Flow Table. Is check result satisfactory?	Go to Step 12.	Go to Step 5 of DTC P0505 Diag. Flow Table.
12	Was IAC duty more than about 30% or ✱40% (or less than 70% or ✱60% for OFF duty meter) in Step 1 of this table? See NOTE.	Check parts or system which can cause engine low idle. • Accessory engine load • Clog of air passage • Etc.	Substitute a known-good ECM and recheck.

NOTE:

Duty value with (✱) are applicable to vehicle used at high altitude (higher than 2000 m or 6560 ft).

Fig. 1 for Step 10

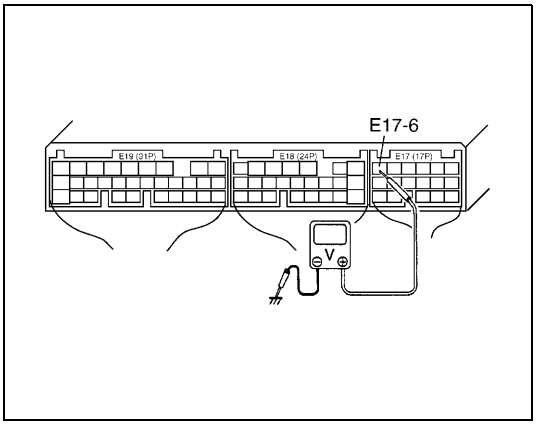
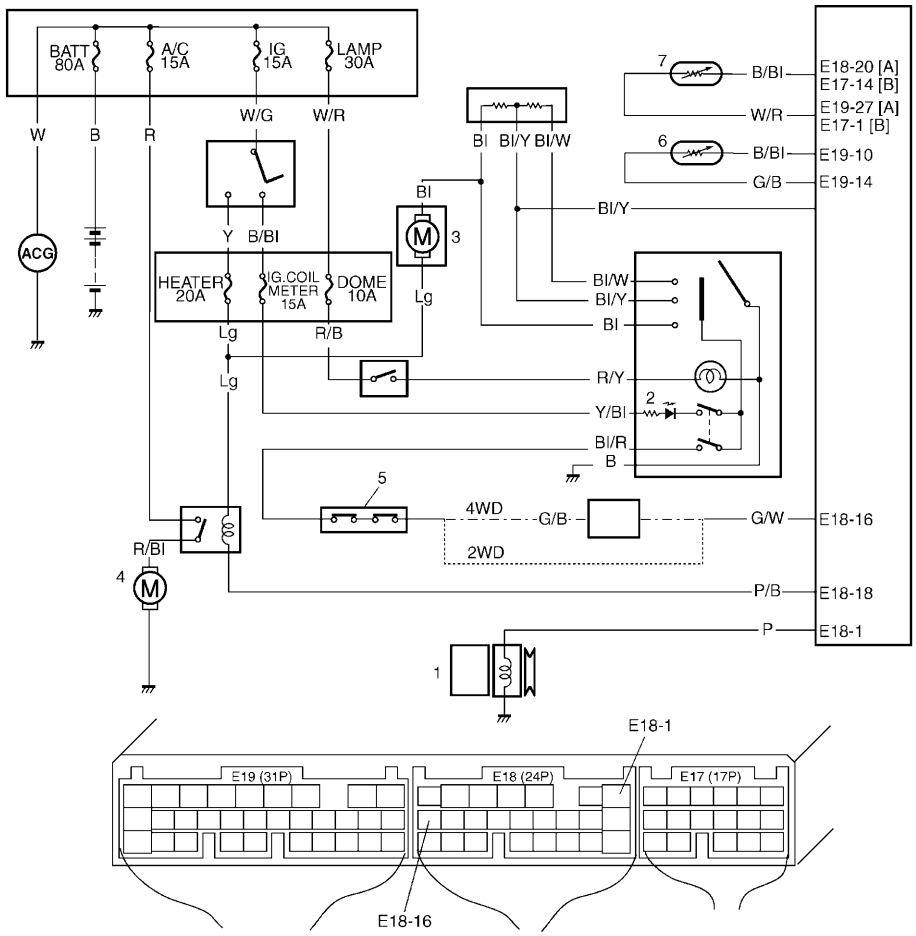


Table 1 for Step 9 and 10

		Scan tool or voltmeter	
		SUZUKI SCAN TOOL DISPLAY	VOLTAGE AT E17-6
Selector lever position	“P” and “N” range	P/N range	10 – 14V
	“R”, “D”, “2” and “L” range	D range	0 – 1V

Table B-5 A/C Signal Circuits Check (Vehicle with A/C)



1. A/C compressor magnet clutch	4. A/C condenser fan	7. Evaporator temp. sensor
2. A/C switch	5. Refrigerant pressure switch	[A] : Case of TYPE A is shown (See NOTE)
3. Blower fan	6. ECT sensor	[B] : Case of TYPE B is shown (See NOTE)

NOTE:

For TYPE A and TYPE B, refer to the NOTE in "ECM Terminal Voltage Values Table" for applicable model.

INSPECTION

Step	Action	Yes	No
1	Check evaporator temp. sensor. 1) Disconnect ECM connectors with ignition switch at OFF position. 2) Check resistance between E19-14 terminal and E19-10 terminal. Reference value (Refer to characteristic curve below) **ECT sensor resistance** **At 0°C 6.3 – 6.9 kΩ** **At 25°C 1.8 – 2.2 kΩ** Is it within specification?	Go to Step 2.	Faulty A/C evaporator thermistor or its circuit.
2	Check A/C switch circuit. 1) Check voltage at E18-16 terminal under each condition given below. **A/C switch signal specification** **Ignition switch ON A/C switch OFF** **: 10 – 14 V** **Ignition switch ON A/C switch ON** **: 0 – 1 V** Is check result satisfactory?	Go to Step 3.	"G/W" wire open or short Poor E18-16 terminal connection If wire and connection are OK, substitute a known-good ECM and recheck. Go to Step 3.
3	Check A/C compressor signal. 1) Check voltage at E18-1 terminal under each condition given below. See NOTE. **A/C compressor signal specification** **While engine running, A/C switch OFF** **: 0 V** **While engine running, A/C switch ON** **: 10 – 14 V** Is check result satisfactory?	A/C control system circuits are in good condition.	"P" wire open or short Poor E18-1 terminal connection If wire and connection are OK, substitute a known-good ECM and recheck.

NOTE:

When A/C evaporator thermistor temp. is below 2.5 °C (36.5 °F), A/C remain OFF (E18-1 terminal voltage become 0 – 1 V). This condition is not abnormal.

Fig. 1 for Step 1

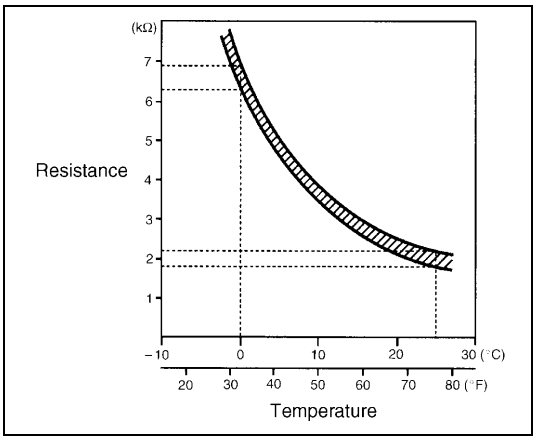
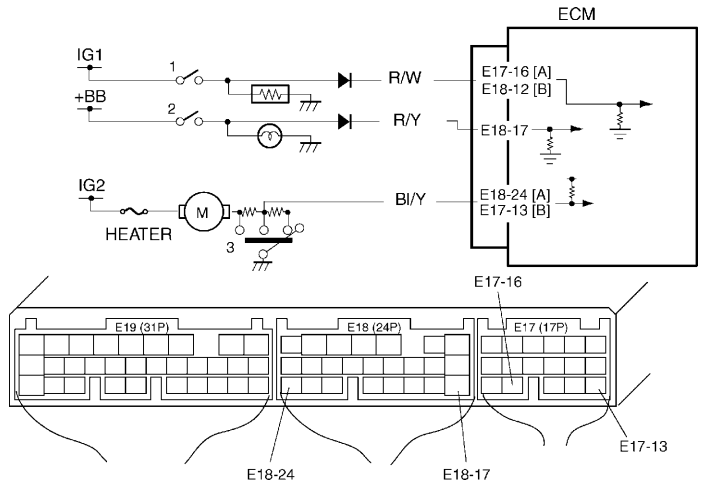


Table B-6 Electric Load Signal Circuit Check



1. Rear defogger switch	3. Blower fan switch	[B] : Case of TYPE B is shown (See NOTE)
2. Light switch	[A] : Case of TYPE A is shown (See NOTE)	

NOTE:

For TYPE A and TYPE B, refer to the NOTE in "ECM Terminal Voltage Values Table" for applicable model.

INSPECTION

Step	Action	Yes	No
1	Is SUZUKI scan tool available?	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. See Fig.1. 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.	"R/W", "R/Y" and/or "Bl/Y" 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 E17-16, E18-17 and E18-24 (Case of TYPE A) or E18-12, E18-17 and E17-13 (Case of TYPE B) (See NOTE) of ECM connector connected, under above each condition. See Fig. 2. and Table 1. Is each voltage as specified?	Electric load signal circuit is in good condition.	"R/W", "R/Y" and/or "Bl/Y" circuit open or short, Electric load diodes malfunction or Each electric load circuit malfunction.

[A] Fig. 1 for Step 2 / [B] Fig. 2 for Step 3

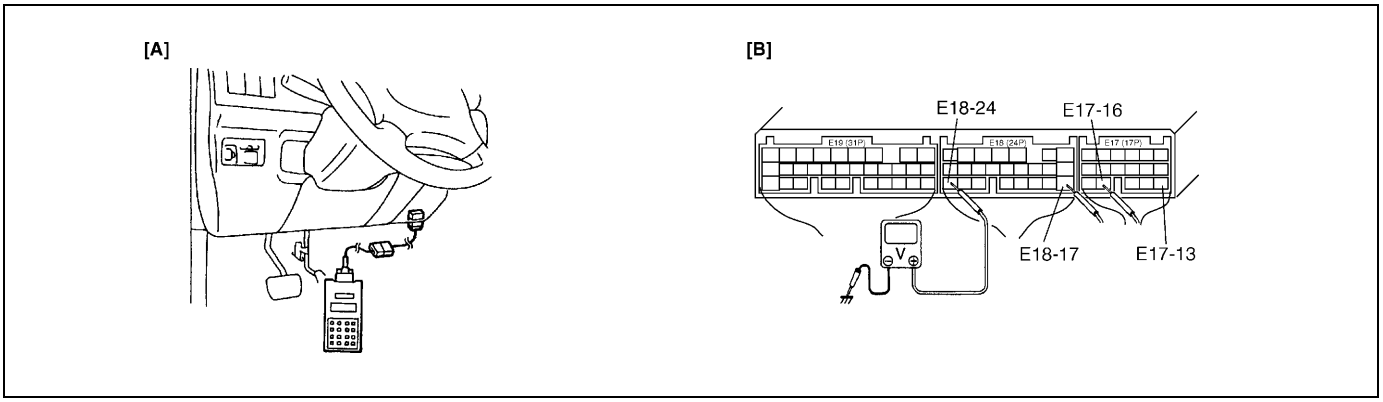
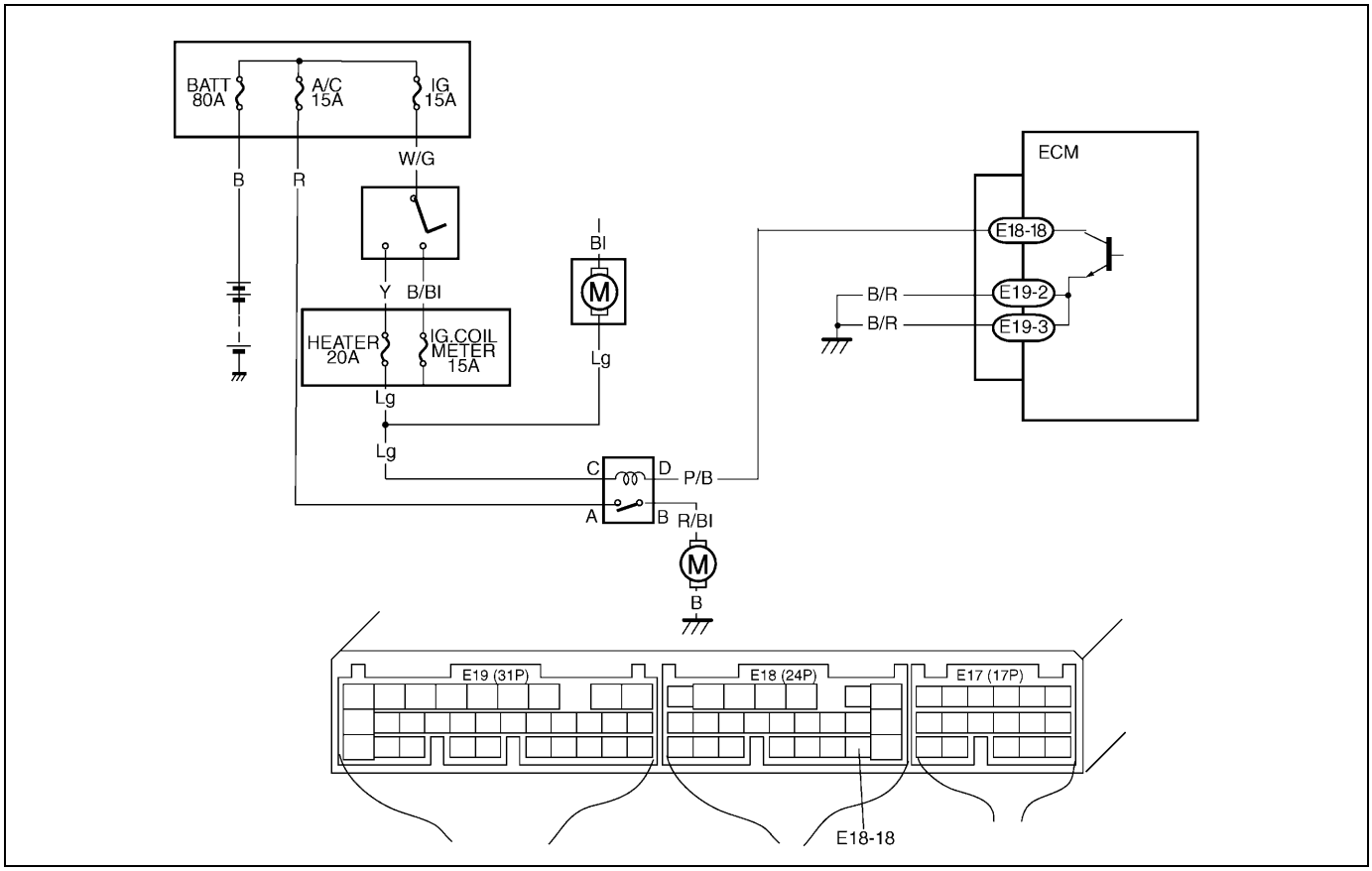


Table 1 for Step 2 and 3

		Scan tool or voltmeter		
		SUZUKI SCAN TOOL	VOLTAGE AT E18-17, E17-16 or E18-12	VOLTAGE AT E18-24 or E17-13
Ignition switch ON, Small light, heater blower fan and rear defogger all turned	OFF	OFF	0V	10 – 14V
	ON	ON	10 – 14V	0V

TAble B-7 A/C Condenser Fan Control System Check



INSPECTION

Step	Action	Yes	No
1	Check Fan Control System. 1) Connect scan tool to DLC with ignition switch OFF. See Fig. 1. 2) Start engine and select “DATA LIST” mode on scan tool. 3) Warm up engine until coolant temp. is 110 °C, 230 °F or higher and A/C switch turn OFF. (If engine coolant temp. does not rise, check engine cooling system or ECT sensor.) Is A/C condenser fan started when engine coolant temp. reached above temp.?	A/C condenser fan control system is in good condition.	Go to Step 2.
2	Check A/C Condenser Fan Relay and Its Circuit. 1) Check DTC and pending DTC with scan tool. Is DTC P0481 displayed?	Go to DTC P0481 Diag. Flow Table.	Go to Step 3.
3	Check A/C Condenser Fan Relay (1). 1) Turn ignition switch OFF and remove A/C condenser fan relay. 2) Check for proper connection to relay at terminals “A” and “B”. 3) If OK, check that there is continuity between “A” and “B” when battery is connected to terminals “C” and “D”. See Fig. 2. Is check result satisfactory?	Go to Step 4.	Replace A/C condenser fan relay.

Step	Action	Yes	No
4	Check A/C Condenser Fan (1). 1) Turn ignition switch OFF. 2) Disconnect fan motor connector (2). 3) Check for proper connection to motor at “R/Bl” and “B” terminals. 4) If OK, connect battery to motor and check for operation. See Fig. 3. Is it in good condition?	“R”, “R/Bl” or “B” circuit open.	Replace A/C condenser fan motor.

[A] Fig. 1 for Step 1 / [B] Fig. 2 for Step 3

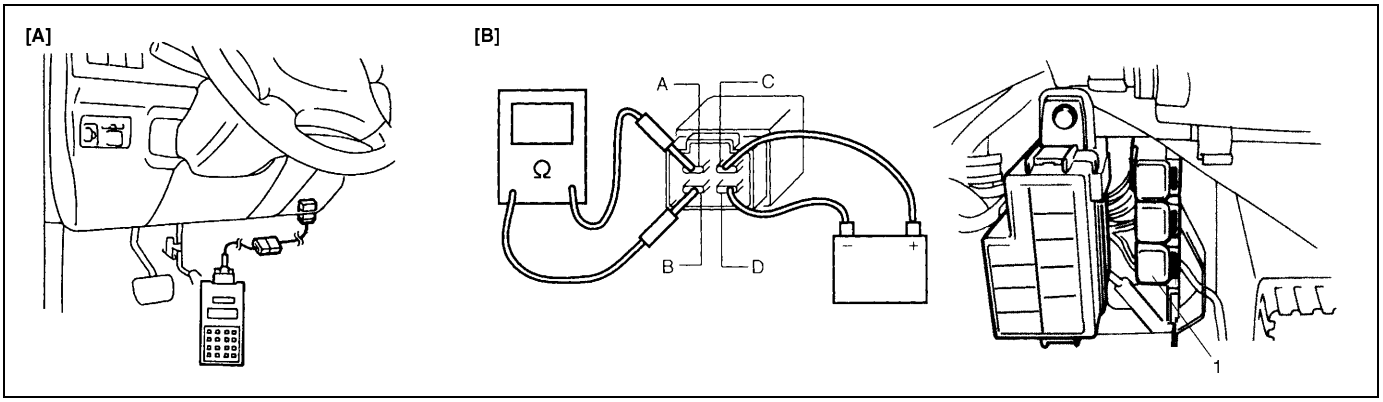
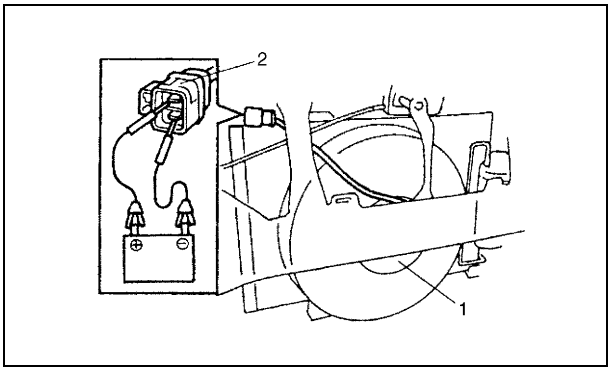
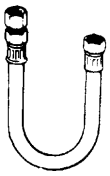
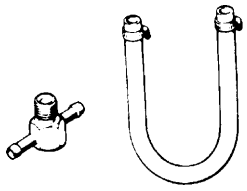
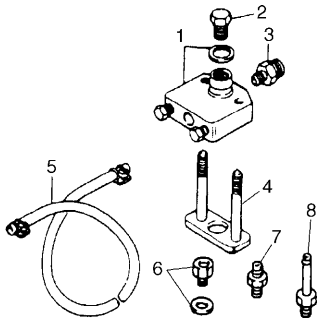
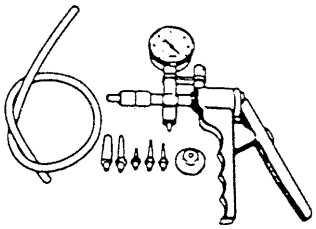
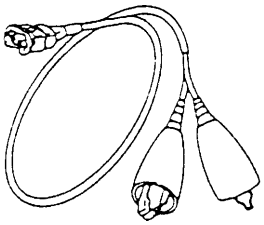
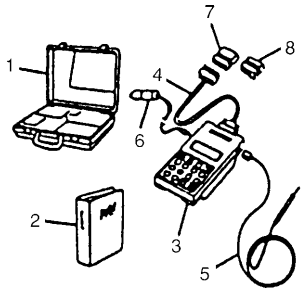
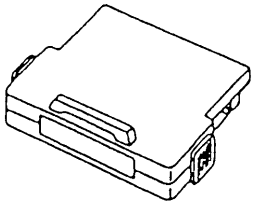
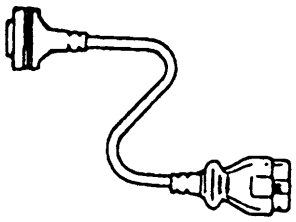
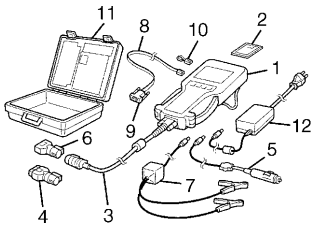


Fig. 3 for Step 4



Special Tool

 09912-58441 Pressure gauge	 09912-58431 Pressure hose	 09912-58490 3-way joint & hose	 09912-58421 Checking tool set (See NOTE “A”.)
 09912-57610 Checking tool plate	 09917-47010 Vacuum pump gauge	 09930-88530 Injector test lead	 09931-76011 SUZUKI scan tool (Tech 1A) kit (See NOTE “B”.)
 Mass storage cartridge	 09931-76030 16 / 14 pin DLC cable	 Tech 2 kit (SUZUKI scan tool) (See NOTE “C”.)	

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
- **“B” : This kit includes the following items and substitutes for the Tech 2 kit.**
  1. Storage case, 2. Operator’s manual, 3. Tech 1A, 4. DLC cable, 5. Test lead / probe, 6. Power source cable, 7. DLC cable adaptor, 8. Self–test adaptor
- **“C” : This kit includes the following items and substitutes for the Tech 1A kit.**
  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 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 "Air Bag 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 6A1-2
- Engine 6A1-2
- Engine Lubrication 6A1-3

Diagnosis 6A1-4
- Diagnosis Table 6A1-4
- Compression Check 6A1-4
- Engine Vacuum Check 6A1-6
- Oil Pressure Check 6A1-7
- Valve Lash (Clearance) 6A1-9

On-Vehicle Service 6A1-13
- Air Cleaner Element 6A1-13
- Air Cleaner Assembly 6A1-14
- Knock Sensor 6A1-14
- Cylinder Head Cover 6A1-15
- Throttle Body and Intake Manifold 6A1-18
- Exhaust Manifold 6A1-21
- Oil Pan and Oil Pump Strainer 6A1-24
- Timing Chain Cover 6A1-28
- Oil Pump 6A1-33
- Timing Chain and Chain Tensioner 6A1-37
- Camshaft, Tappet and Shim 6A1-42
- Valves and Cylinder Head 6A1-48
- Pistons, Piston Rings, Connecting Rods and Cylinders 6A1-62
- Engine Mountings 6A1-72

Unit Repair Overhaul 6A1-73
- Engine Assembly 6A1-73
- Main Bearings, Crankshaft and Cylinder Block 6A1-79

Required Service Material 6A1-93

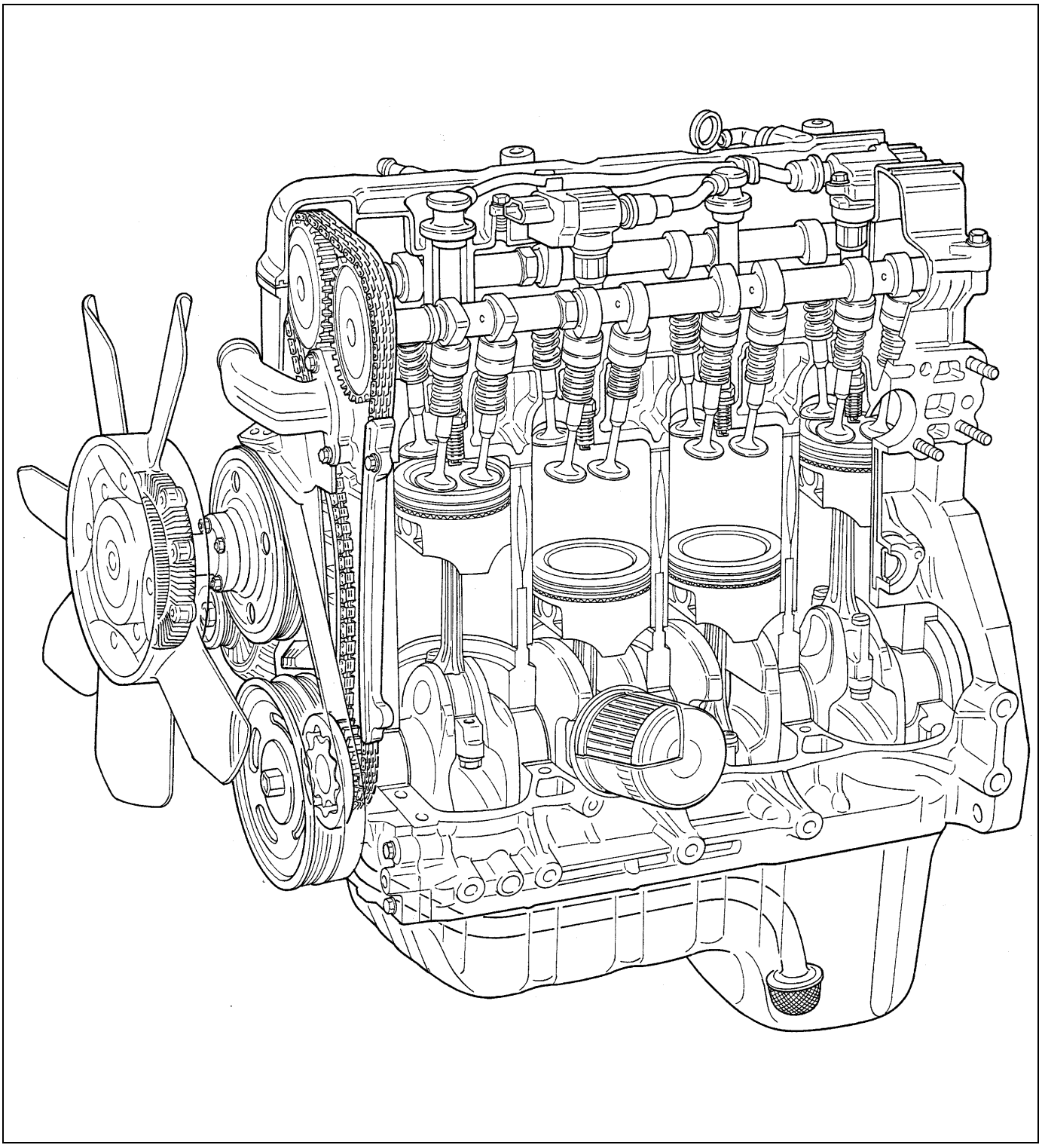
Tightening Torque Specification 6A1-93

Special Tool 6A1-94

General Description

Engine

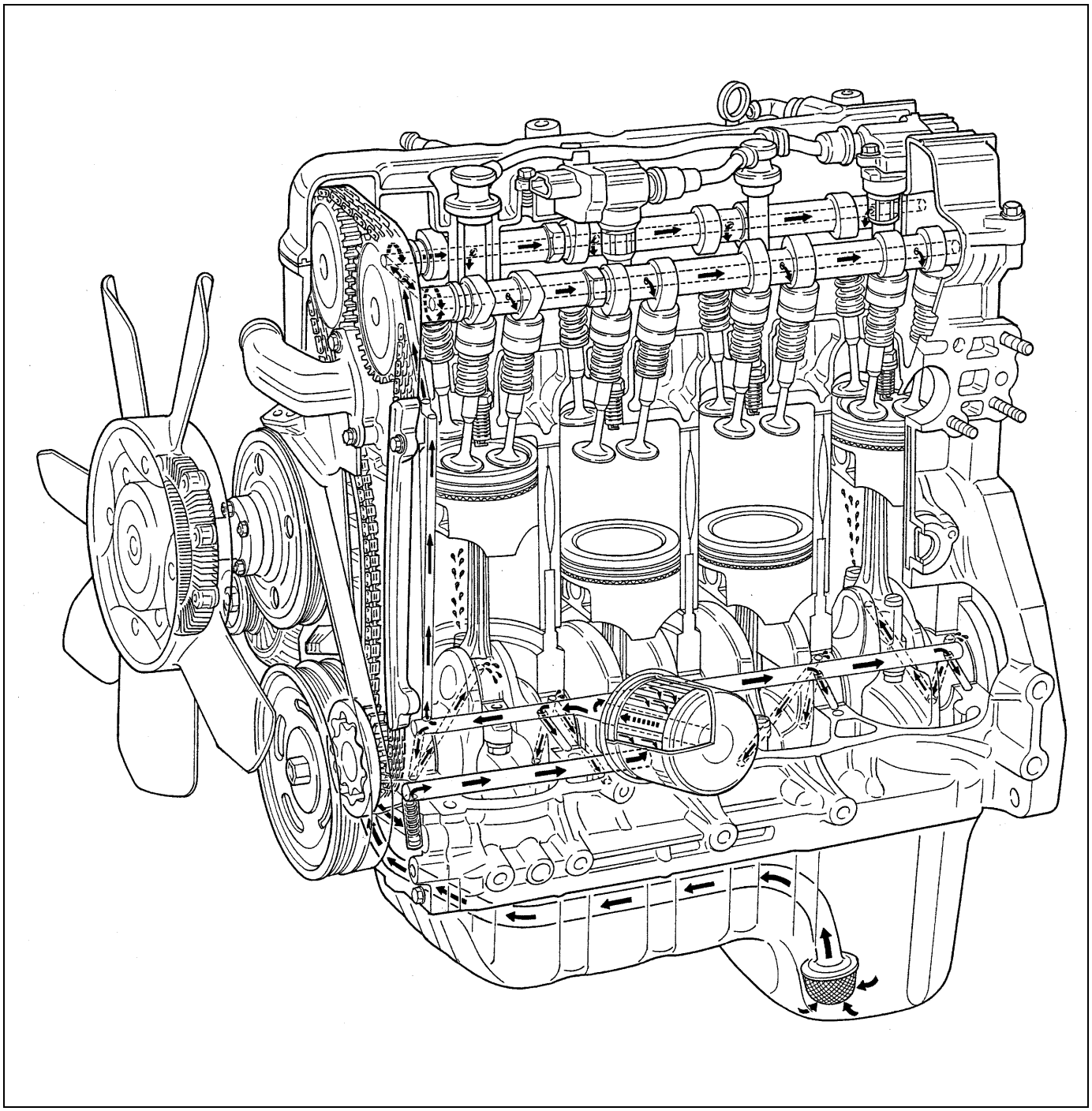
The engine is water-cooled, in line 4 cylinders, 4 stroke cycle gasoline unit with its DOHC (Double overhead camshaft) valve mechanism arranged for “V” type valve configuration and 16 valves (4 valves / one cylinder). The double overhead camshaft is mounted over the cylinder head; it is driven from crankshaft through timing chain, and no push rods are provided in the valve train system.



Engine Lubrication

The oil pump is of a trochoid type, and mounted under 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 400 kPa (4.0 kg/cm^2, 56.9 psi).



Diagnosis

Diagnosis Table

Refer to “Engine Diagnosis Table” in Section 6.

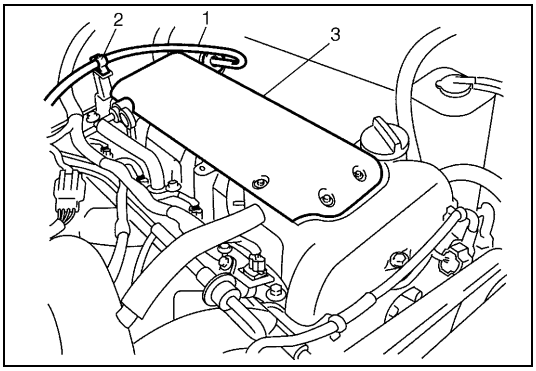
Compression Check

Check compression pressure on all 4 cylinders as follows:

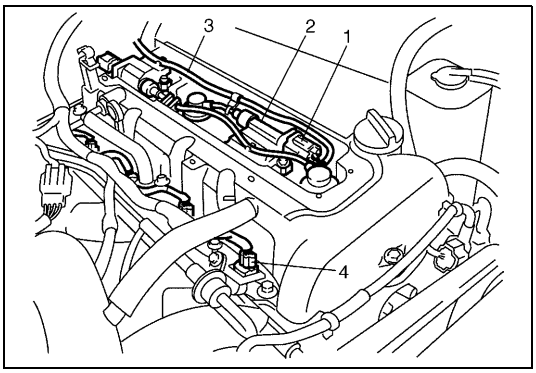
1) Warm up engine.
2) Stop engine after warming up.

NOTE:

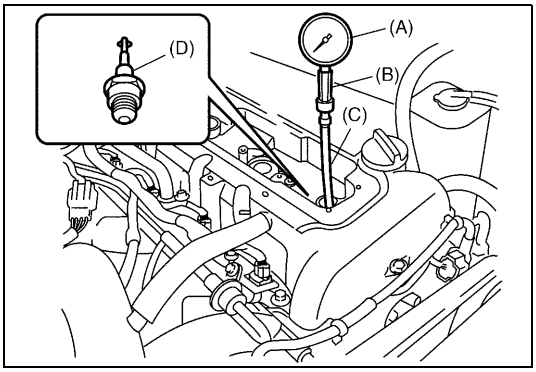
After warming up engine, place transmission gear shift lever in “Neutral” (shift selector lever to “P” range for A/T model), and set parking brake and block drive wheels.



3) Disconnect accelerator cable (1) from clamp (2) (For left hand steering vehicle only).
4) Remove cylinder head upper cover (3).

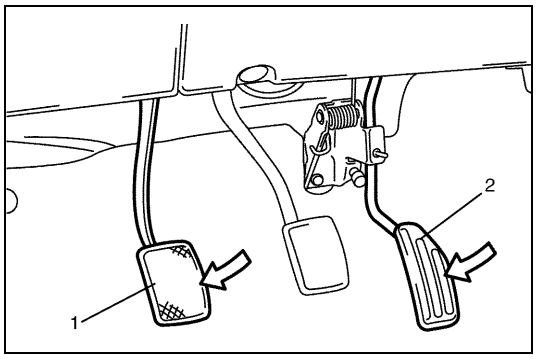


5) Disconnect ignition coil couplers (1).
6) Remove ignition coil assemblies (2) with high-tension cord (3).
7) Remove all spark plugs.
8) Disconnect fuel injector wires (4) at the coupler.



9) Install special tools (Compression gauge) into spark plug hole.

Special tool
(A) : 09915-64510-001
(B) : 09915-64510-002
(C) : 09915-64530
(D) : 09915-67010



10) 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.

11) Crank engine with fully charged battery, and read the highest pressure on compression gauge.

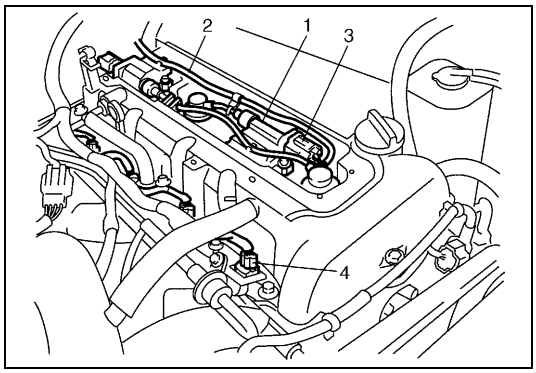
NOTE:

- **For measuring compression pressure, crank engine at least 250 rpm by using fully charged battery.**
- **If check results are below the limit valve, check installation condition for special tool.**

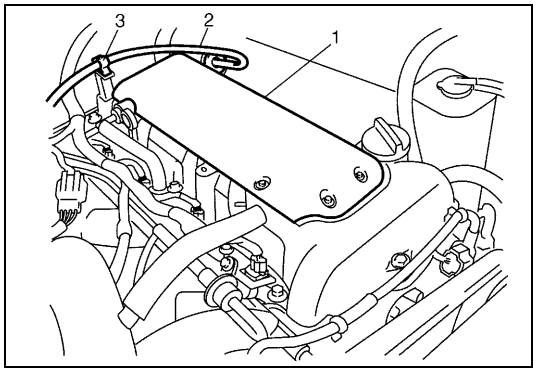
Compression pressure specification

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)**

12) Carry out Steps 9) through 11) on each cylinder to obtain 4 readings.



13) After checking, install spark plugs and ignition coil assemblies (1) with high-tension cord (2).
14) Connect ignition coil couplers (3).
15) Connect fuel injector wires (4) at the coupler.



16) Check cylinder head upper cover gasket for deterioration and then install it into groove of cylinder head upper cover (1) securely.
17) Install cylinder head upper cover with gasket on to cylinder head cover.
18) Connect accelerator cable (2) to clamp (3) (For left hand steering vehicle only).

Engine Vacuum Check

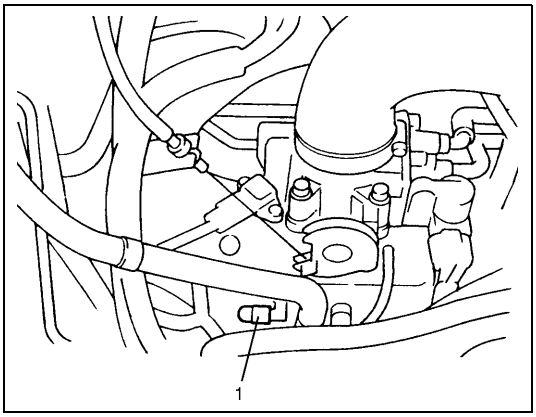
The engine vacuum that develops in the intake line is a good indicator of the condition of the engine. The vacuum checking procedure is as follows:

1) Warm up engine to normal operating temperature.

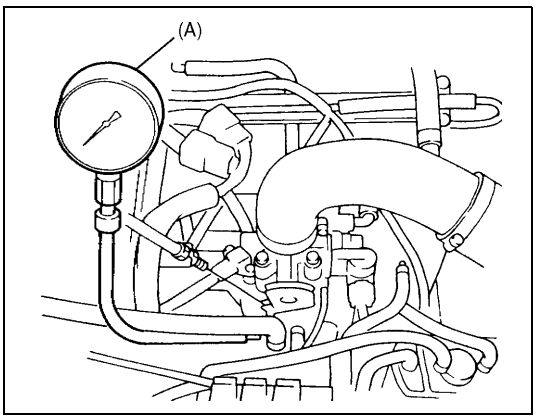
NOTE:

After warming up engine, be sure to place transmission 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 cap (1) from intake manifold.



4) Connect special tool (Vacuum gauge) to intake manifold.

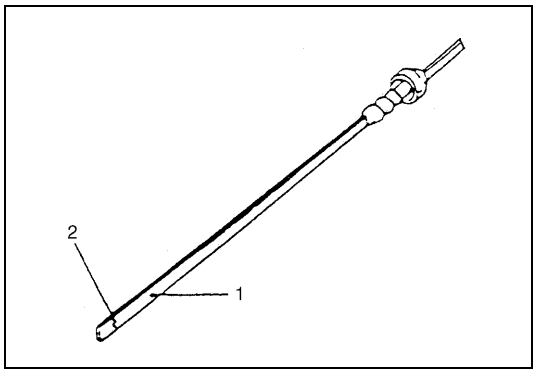
Special tool
(A) : 09915-67310

5) 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 cm Hg, 17.7 – 21.6 in. Hg)
at specified idle speed

6) After checking, disconnect special tool (Vacuum gauge) from intake manifold.
7) Install cap to intake manifold.

Oil Pressure Check



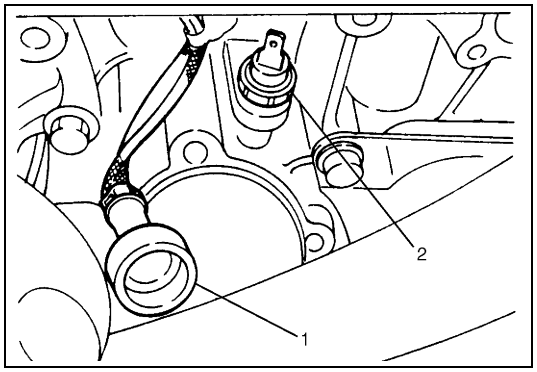
NOTE:

Prior to checking oil pressure, check the following items.

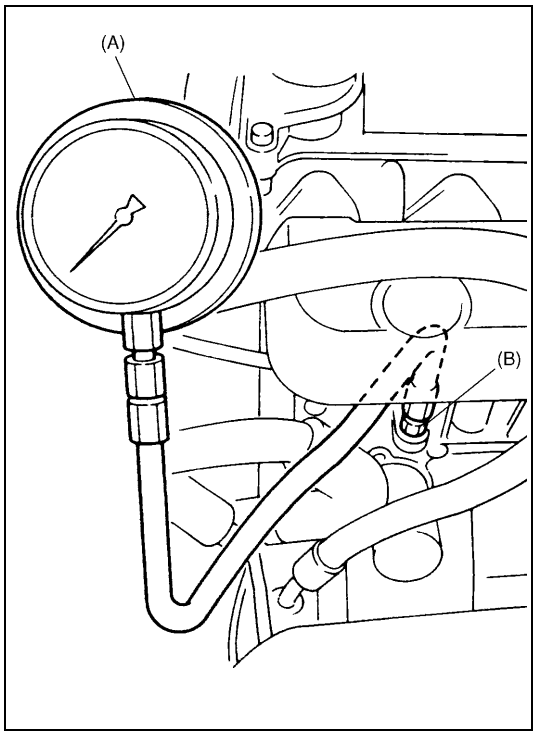
- Oil level in oil pan.
  If oil level is low, add oil up to Full level mark (hole) (1) on oil level gauge.

2. Low level mark (hole)

- Oil quality.
  If oil is discolored, or deteriorated, change it.
  For particular oil to be used, refer to the table in Section 0B.
- Oil leaks.
  If leak is found, repair it.



1) Disconnect oil pressure switch coupler (1) and remove oil pressure switch (2) from cylinder block.



2) Install special tools (Oil pressure gauge) to vacated threaded hole.

Special tool
(A) : 09915-77310
(B) : 09915-78211

3) Start engine and warm it up to normal operating temperature.

NOTE:

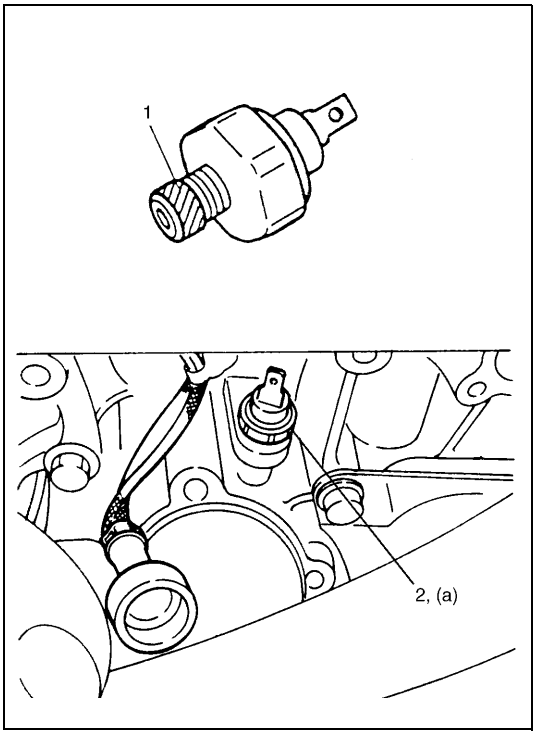
Be sure to place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake and block drive wheels.

4) After warming up, raise engine speed to 4,000 rpm and measure oil pressure.

Oil pressure specification

280 – 430 kPa (2.8 – 4.3 kg/cm^2, 39.8 – 61.1 psi) at 4,000 rpm

5) Stop engine and remove oil pressure gauge and attachment.



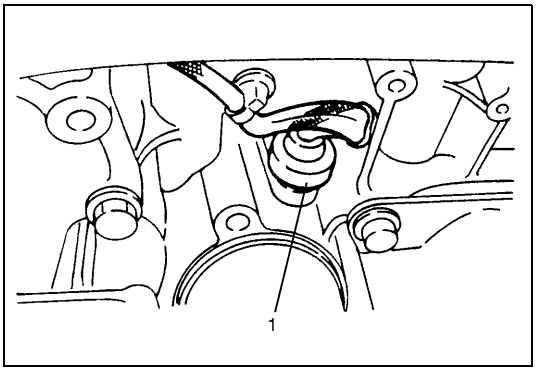
6) Before reinstalling oil pressure switch (2), be sure to wrap its screw threads with sealing tape (1) and tighten switch to specified torque.

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)

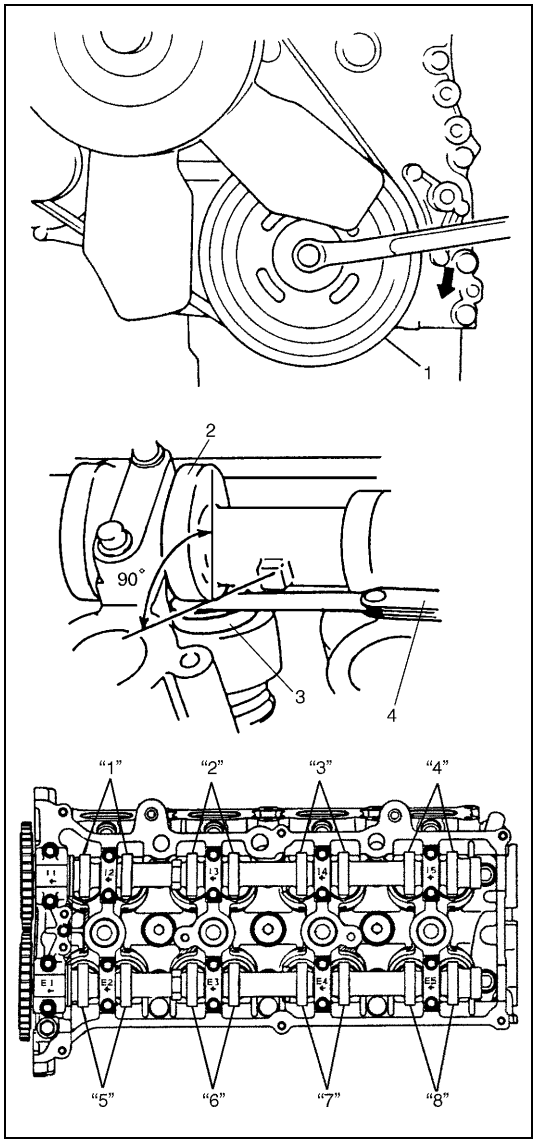
7) Start engine and check oil pressure switch for oil leakage. If oil leakage is found, repair it.



8) Connect oil pressure switch coupler (1).

Valve Lash (Clearance)

1) Remove negative cable at battery.
2) Remove cylinder head cover referring to “Cylinder Head Cover” in this section.

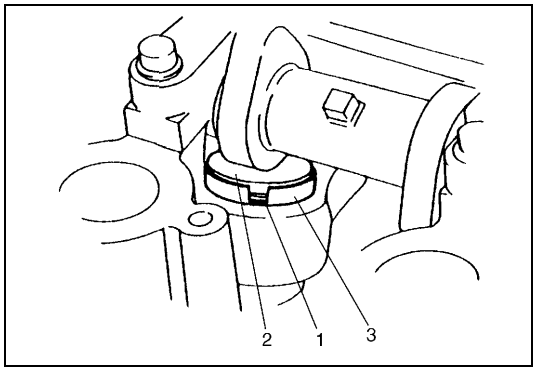


3) Using 17 mm wrench, turn crankshaft pulley (1) clockwise until cam lobes (2) become perpendicular to shim faces (3) at valves “1” and “7” as shown in figure.
4) Check valve lashes with thickness gauge (4) according to the following procedure.
   If valve lash is out of specification, record valve lash and adjust it to specification by replacing shim.
   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 are perpendicular to shim faces 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”.

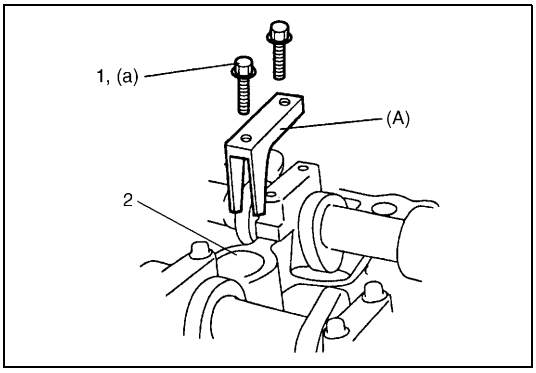
Valve clearance specification

	When cold (Coolant temperature is 15 – 25°C or 59 –77°F)	When hot (Coolant temperature is 60 – 68°C or 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.)**

REPLACEMENT OF SHIM



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.



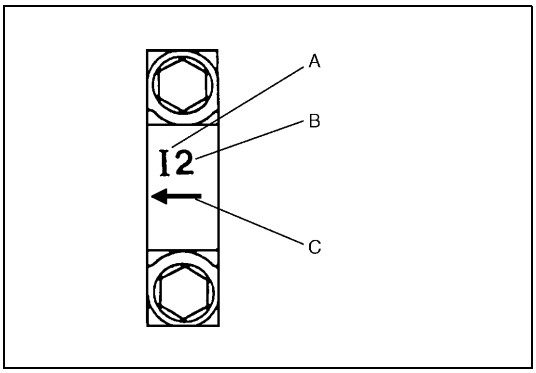
2) Lift valve by turning crankshaft and then remove camshaft housing bolts (1) where the shim to be replaced.

2. Plug hole

3) Install special tool with camshaft housing bolts as shown in figure.

Special tool
(A) : 09916-67020

Tightening torque
Camshaft housing bolts (for tightening of special tool)
(a) : 8 N·m (0.8 kg-m, 6.0 lb-ft)



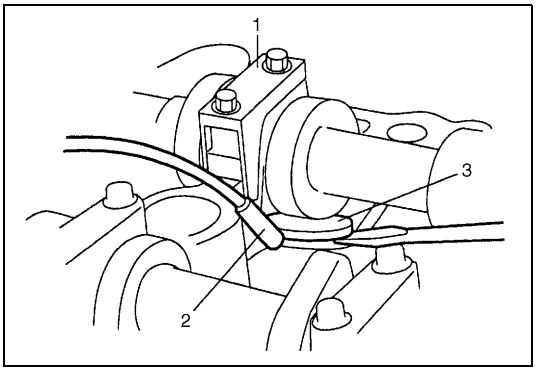
NOTE:

- **Check the special tools carved seal as shown, and then install special tool in accordance with the location of each camshaft housing.**
- **If special tool is holding down the shim, adjust special tool position so as not to hold down the shim by loosening camshaft housing bolt.**

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

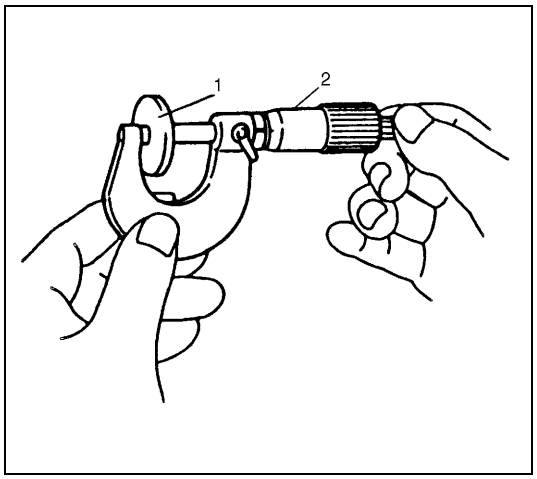
A: I : Intake side or E : Exhaust side
B: Position from timing chain side
C: Pointing to timing chain side



4) Turn camshaft by approximately 90° clockwise and remove shim (3).

WARNING:
Never put in the hand between camshaft and tappet.

1. Special tool
2. Magnet

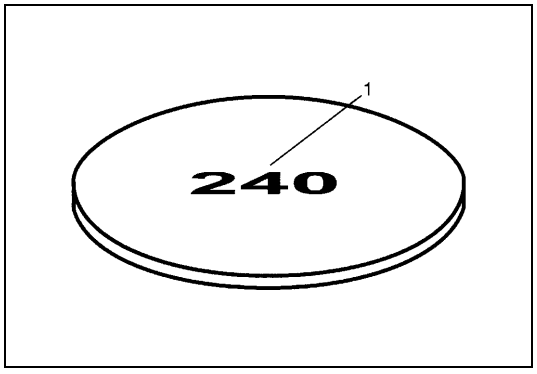


5) Using a micrometer (2), measure the thickness of the removed shim (1), and determine replacement shim by calculating the thickness of new shim with the following formula and table.

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

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.)

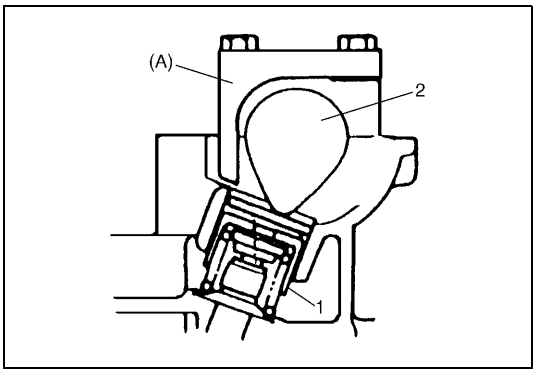


6) Select new shim No. (1) with a thickness as close as possible to calculated value.

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		

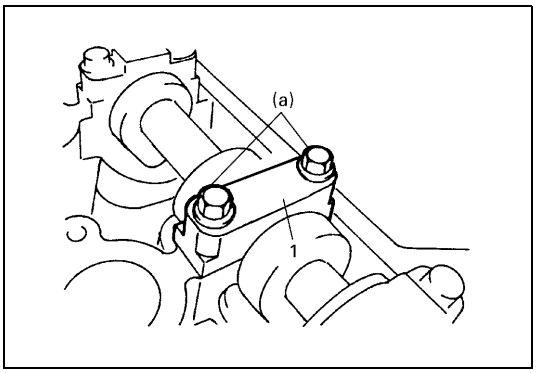
7) Install new shim facing shim No. side with tappet.



8) Lift valve by turning crankshaft counterclockwise (in opposite direction against above Step 4) and remove special tool.

Special tool
(A) : 09916-67020

1.	Tappet
2.	Camshaft



9) Install camshaft housing (1) and tighten them to specified torque.

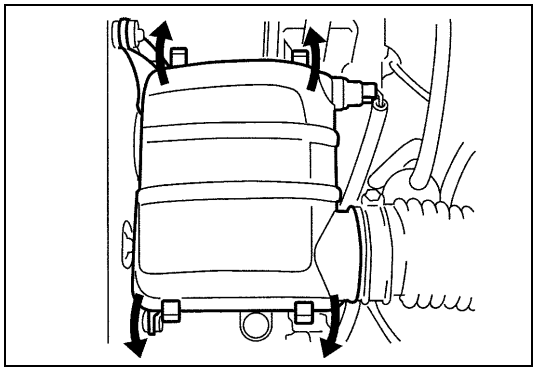
Tightening torque
Camshaft housing bolts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)

10) Check valve clearance again.
11) Install cylinder head cover, referring to “Cylinder Head Cover” in this section.

On-Vehicle Service

Air Cleaner Element

REMOVAL

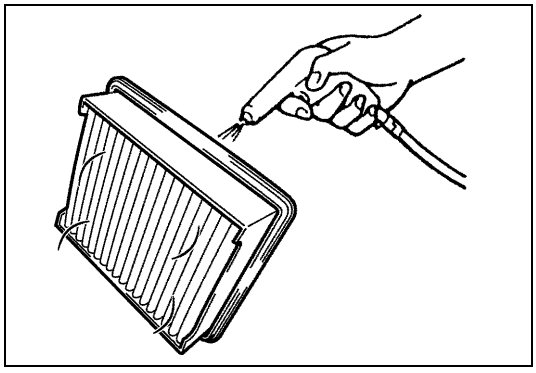


1) Open air cleaner case by unhooking its clamps.
2) Remove air cleaner element from case.

INSPECTION

Check air cleaner element for dirt. Replace excessively dirty element.

CLEANING



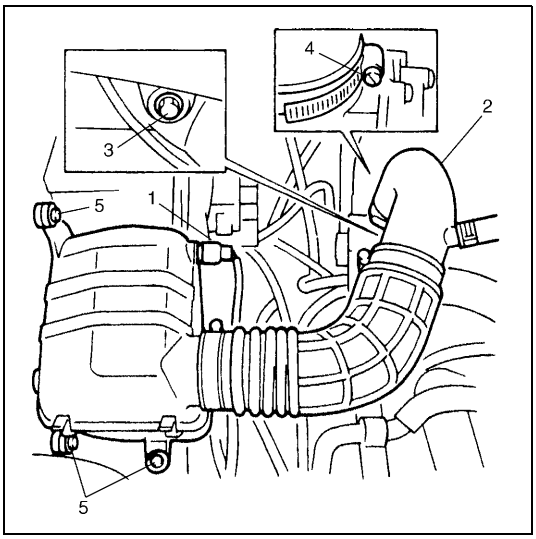
Blow off dust by compressed air from air outlet side of element.

INSTALLATION

Reverse removal procedure for installation.

Air Cleaner Assembly

REMOVAL



1) Disconnect negative cable at battery.
2) Disconnect IAT sensor coupler (1).
3) Disconnect breather hose from air cleaner outlet No.2 hose (2).
4) Remove air cleaner outlet No.2 hose fastening bolt (3).
5) Loosen air cleaner outlet No.2 hose clamp bolt (4).
6) Remove air cleaner case fastening bolts (5).
7) Remove air cleaner assembly with outlet hoses.

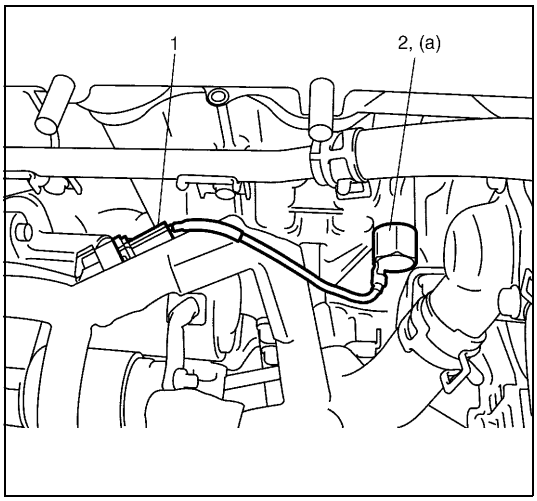
INSTALLATION

Reverse removal procedure for installation.

Knock Sensor

REMOVAL

1) Disconnect negative cable at battery.
2) Remove intake manifold referring to “Throttle Body and Intake Manifold” in this section.



3) Disconnect knock sensor connector (1).
4) Remove knock sensor (2) from cylinder block.

INSPECTION

Check sensor for damage.
If any faulty is found, replace.

INSTALLATION

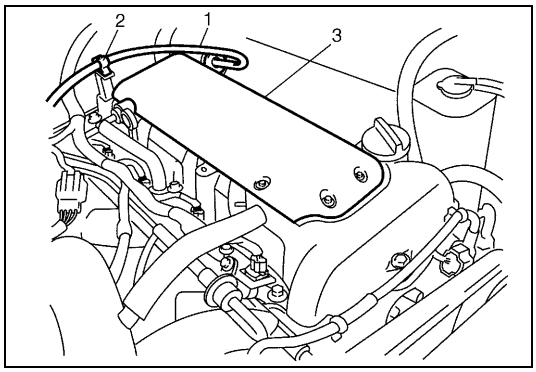
Reverse removal procedure for installation.

Tightening torque
Knock sensor (a) : 23 N·m (2.3 kg-m, 16.5 lb-ft)

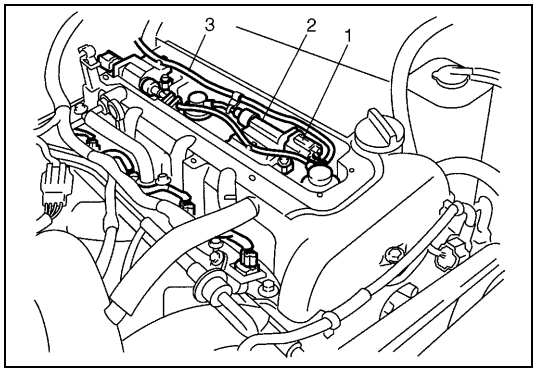
Cylinder Head Cover

REMOVAL

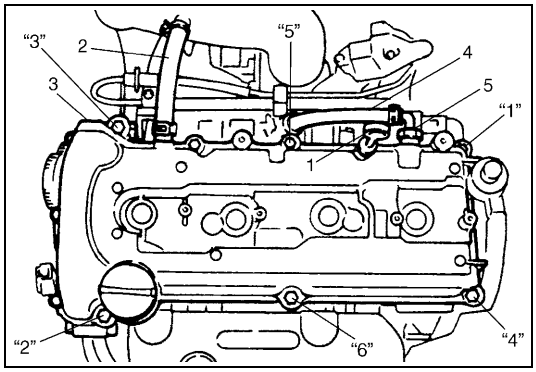
1) Disconnect negative cable at battery.



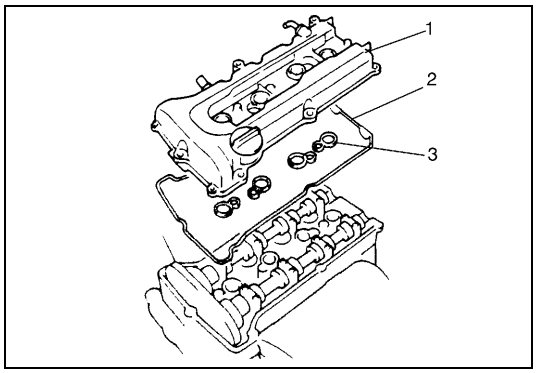
2) Disconnect accelerator cable (1) from clamp (2) (For left hand steering vehicle only).
3) Remove cylinder head upper cover (3).



4) Disconnect ignition coil couplers (1).
5) Remove ignition coil assemblies (2) with high-tension cord (3).

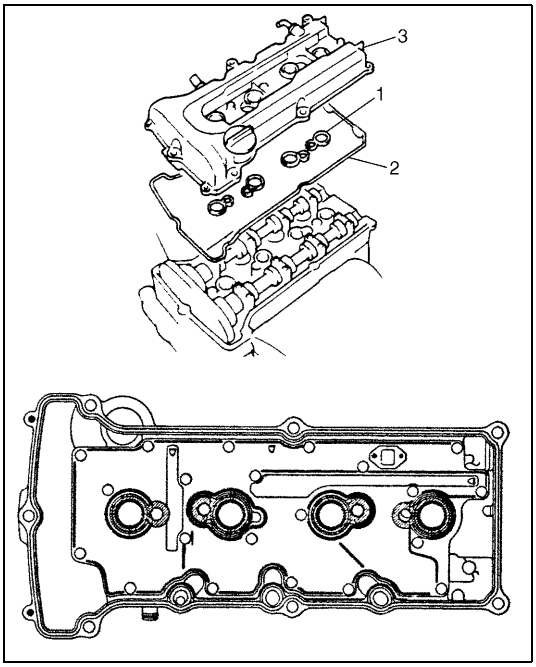


6) Remove oil level gauge (1).
7) Disconnect breather hose (2) from cylinder head cover (3) and PCV hose (4) from PCV valve (5).
8) Remove cylinder head cover mounting bolts in such order as indicated in figure.



9) Remove cylinder head cover (1) with cylinder head cover gasket (2) and spark plug hole gasket (3).

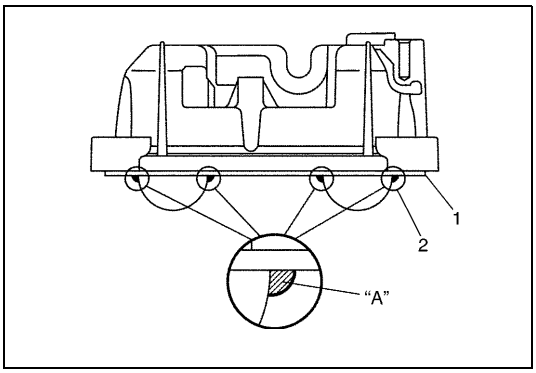
INSTALLATION



1) Install new spark plug hole gaskets (1) and new cylinder head cover gasket (2) to cylinder head cover (3) as shown in figure.

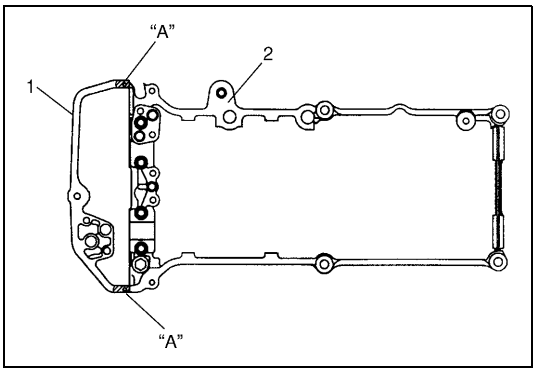
NOTE:

Be sure to check each of these parts for deterioration or any damage before installation and replace if found defective.



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 gasket (1) sealing surface area (2) as shown.

"A" : Sealant 99000-31150



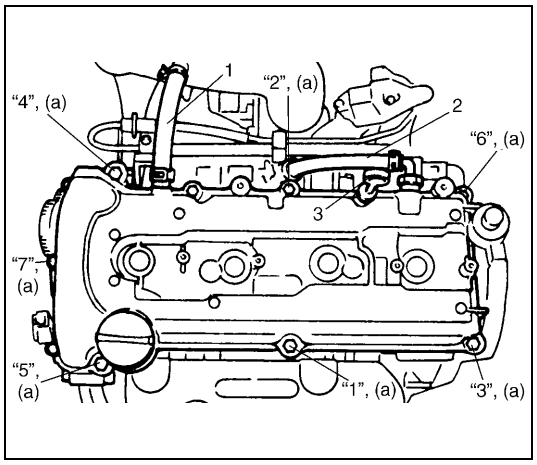
- Timing chain cover (1) and cylinder head (2) matching surface as shown.

"A" : Sealant 99000-31150

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.



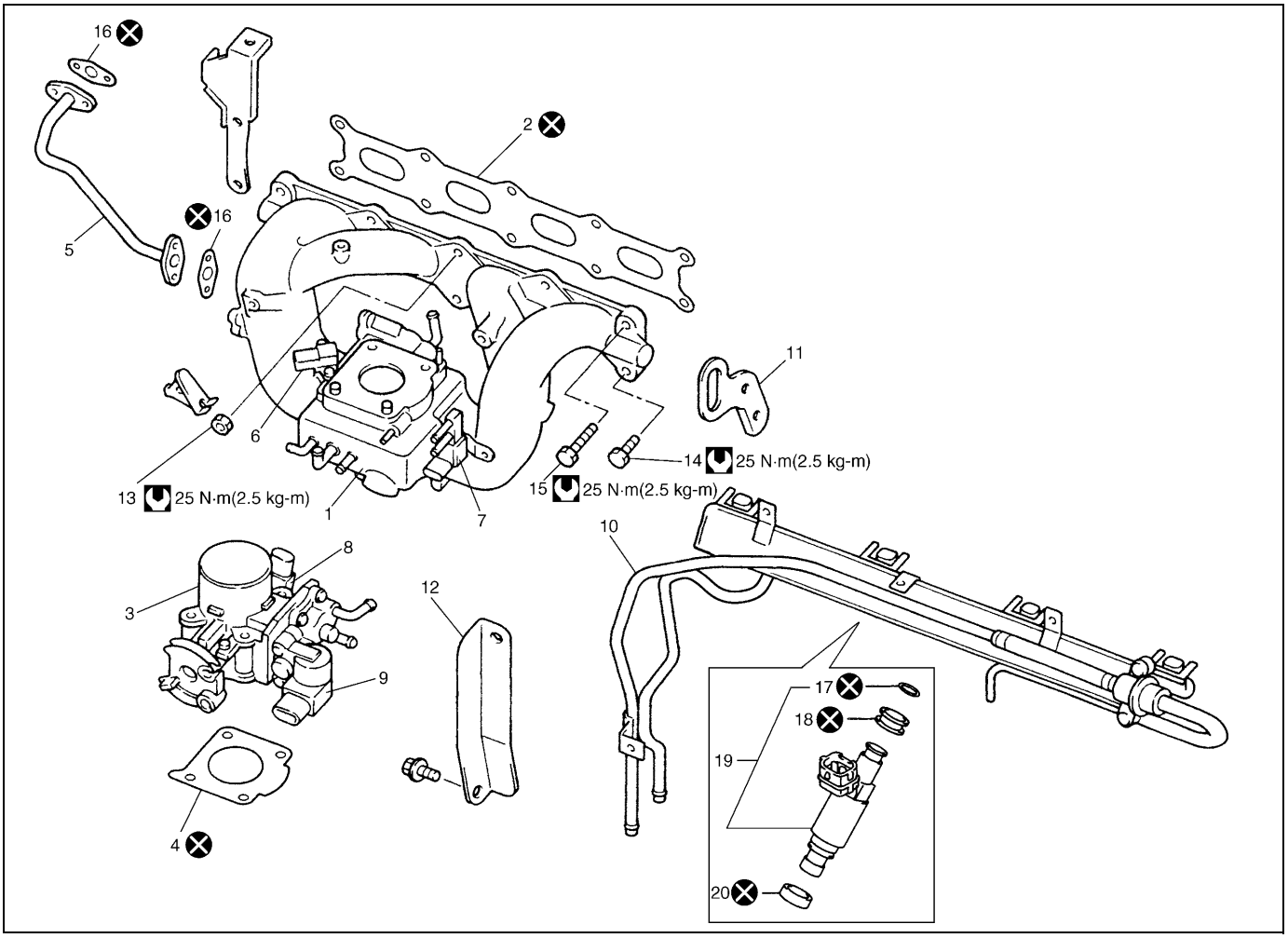
4) Tighten bolts in such order as indicated in figure a little at a time till they are tightened to specified torque.

Tightening torque
Cylinder head cover bolts (a) : 8 N·m (0.8 kg-m, 6.0 lb-ft)

5) Connect breather hose (1) and PCV hose (2).
6) Install oil level gauge (3).

7) Install ignition coil assemblies with high-tension cord.
8) Connect ignition coil couplers.
9) Install cylinder head upper cover.
10) Connect accelerator cable to clamp (For left hand steering vehicle only).
11) Connect negative cable at battery.

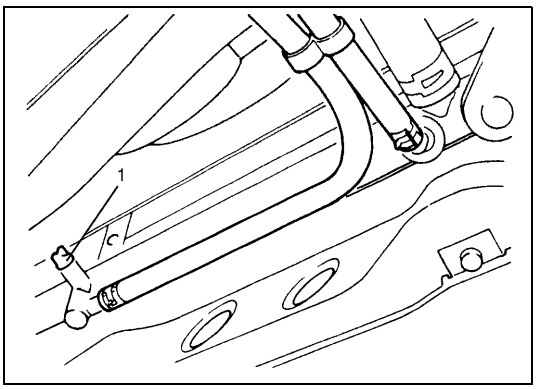
Throttle Body and Intake Manifold



1. Intake manifold	7. EVAP canister purge valve	13. Intake manifold mounting nut	19. Injector assembly
2. Intake manifold gasket	8. TP sensor	14. Intake manifold mounting bolt (short)	20. Cushion
3. Throttle body	9. IAC valve	15. Intake manifold mounting bolt (long)	Tightening torque
4. Gasket	10. Fuel delivery pipe	16. EGR pipe gasket	Do not reuse
5. EGR pipe	11. Engine hook	17. O-ring	
6. MAP sensor	12. Intake manifold stiffener	18. Grommet	

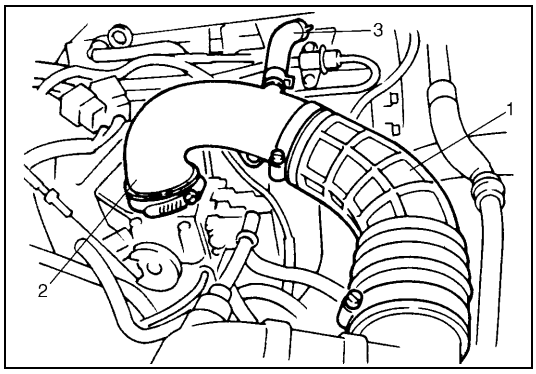
REMOVAL

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).

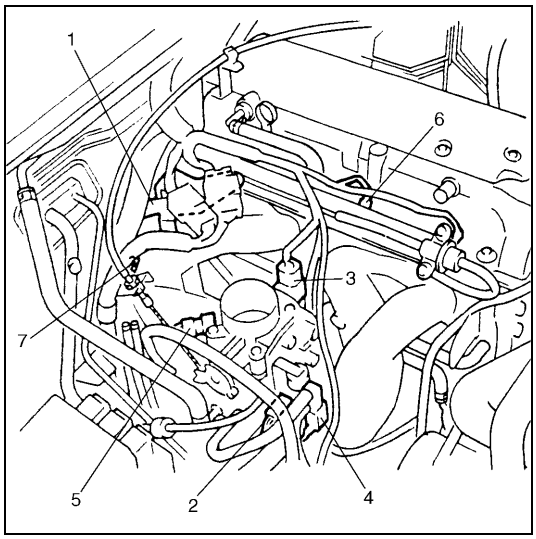


WARNING:

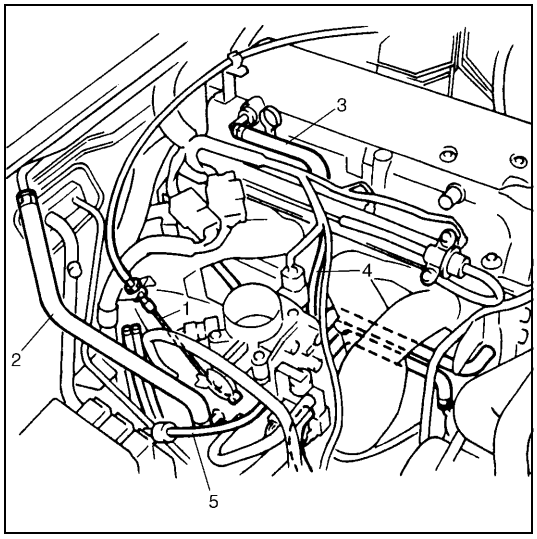
To help avoid danger of being burned, do not remove drain plug (1) and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.



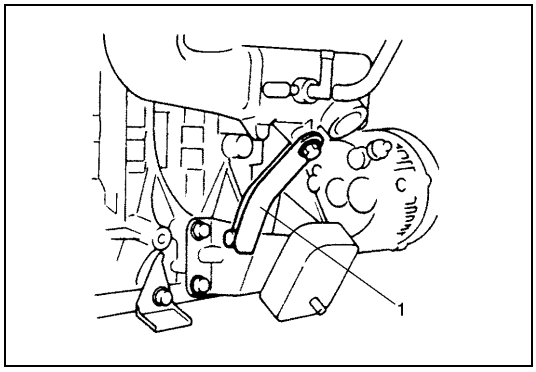
4) Remove air cleaner outlet No.1 (1) and No.2 (2) hoses and breather hose (3).



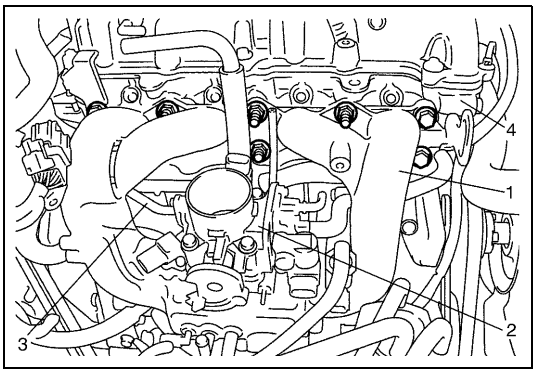
5) Remove intake manifold bracket (1) with main harness from intake manifold.
6) Disconnect the following electric lead wires:
   - IAC valve (2)
   - TP sensor (3)
   - EVAP canister purge valve (4)
   - MAP sensor (5)
   - Fuel injector wire harness at couplers (6)
   - Ground terminal (7) from intake manifold



7) Disconnect accelerator cable (1) from throttle body.
8) Disconnect the following hoses:
   - Brake booster hose (2) from intake manifold
   - PCV hose (3) from PCV valve
   - Fuel pressure regulator vacuum hose (4) from intake manifold
   - Canister purge hose from EVAP canister purge valve
   - Water hoses from throttle body
   - Vacuum hose (5) (to check valve) from throttle body
   - Fuel feed hose and return hose from each pipe
9) Remove fuel delivery pipe with fuel injectors from cylinder head and intake manifold.
10) Remove canister purge hose bracket.
11) Disconnect EGR pipe from EGR valve.



12) Remove intake manifold stiffener (1).

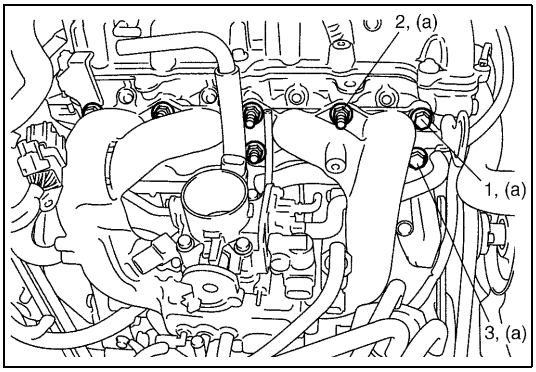


13) Remove intake manifold (1) with throttle body (2) and EGR pipe (3) from cylinder head (4), and then its gasket.

INSTALLATION

Reverse removal procedure for installation noting the followings.

- Use new intake manifold gasket and EGR pipe gasket.

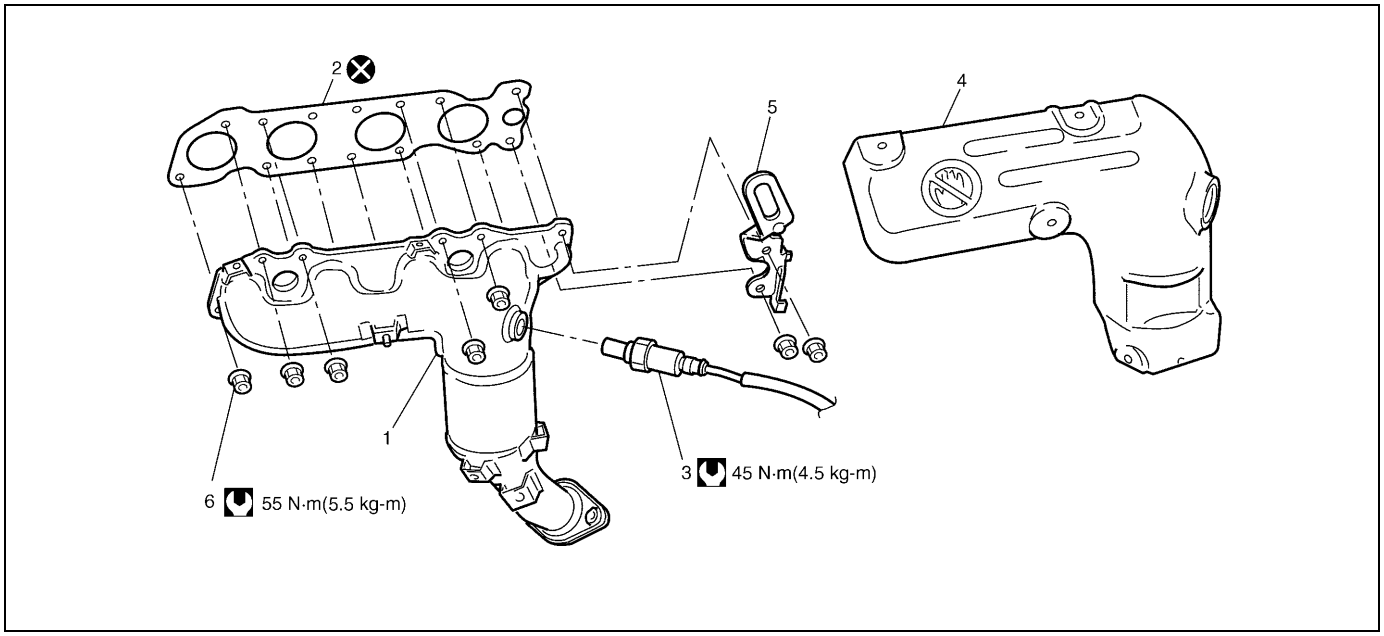


- Tighten long bolt (1), short bolt (3) and nuts (2) to specified torque.

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 6E.
- 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



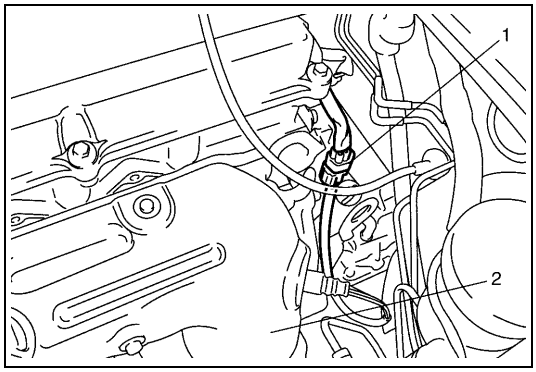
1. Exhaust manifold	4. Exhaust manifold cover	Tightening torque
2. Exhaust manifold gasket	5. Engine hook	Do not reuse.
3. Heated oxygen sensor (if equipped)	6. Exhaust manifold mounting nut	

WARNING:

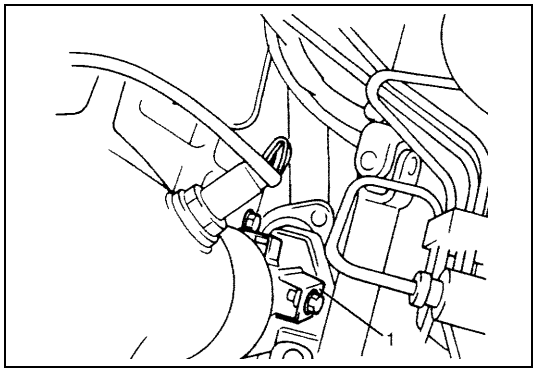
To avoid danger of being burned, do not service exhaust system while it is still hot. Service should be performed after system cools down.

REMOVAL

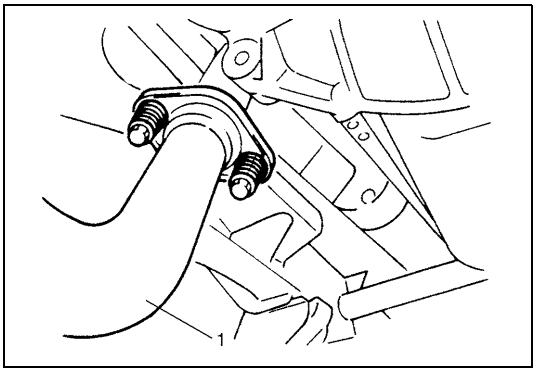
1) Disconnect negative cable at battery.



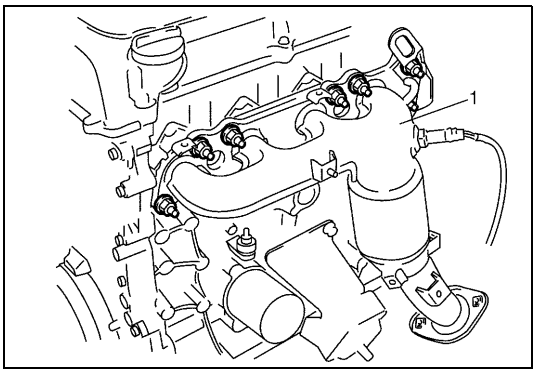
2) Disconnect heated oxygen sensor coupler (1) (if equipped) and detach it from its stay.
3) Remove exhaust manifold cover (2).



4) Remove exhaust manifold stiffener (1).

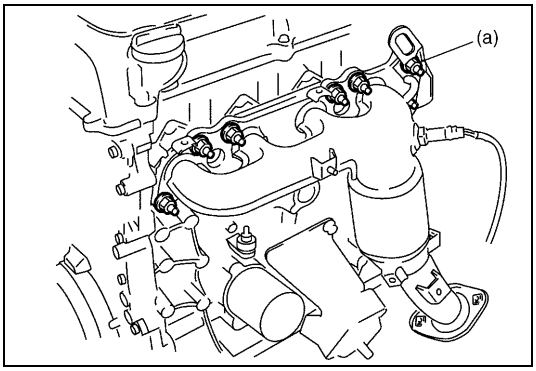


5) Disconnect exhaust pipe (1) from exhaust manifold.



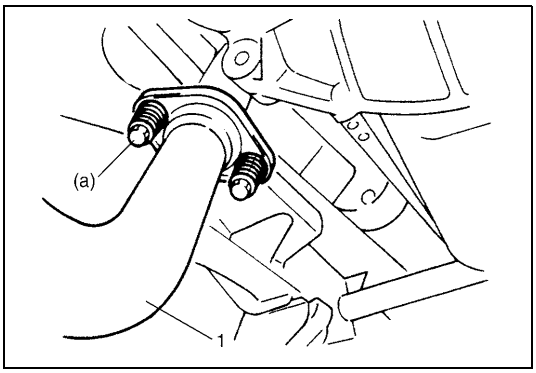
6) Remove exhaust manifold (1) and its gasket from cylinder head.

INSTALLATION



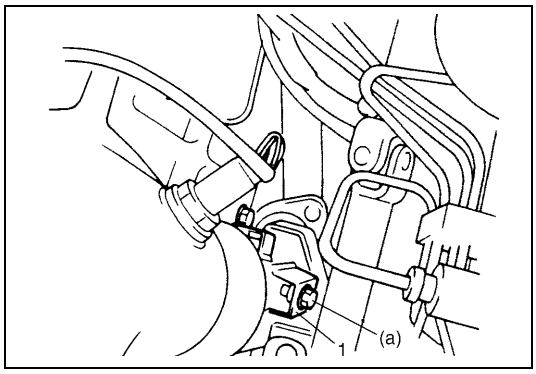
1) Install new gasket to cylinder head.
   Then install exhaust manifold.
   Tighten manifold nuts to specified torque.

Tightening torque
Exhaust manifold nuts (a) : 55 N·m (5.5 kg-m, 40.0 lb-ft)



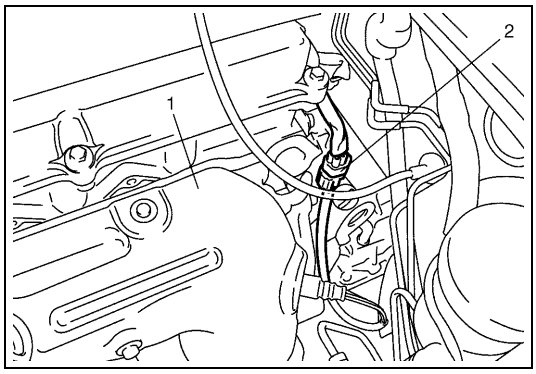
2) Install seal ring and install exhaust pipe (1) to exhaust manifold.
   Before installing seal ring, check it for deterioration or damage, and replace as necessary.
   Tighten pipe fasteners to specified torque.

Tightening torque
Exhaust pipe bolts (a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)



3) Install exhaust manifold stiffener (1).
   Tighten exhaust manifold stiffener bolts to specified torque.

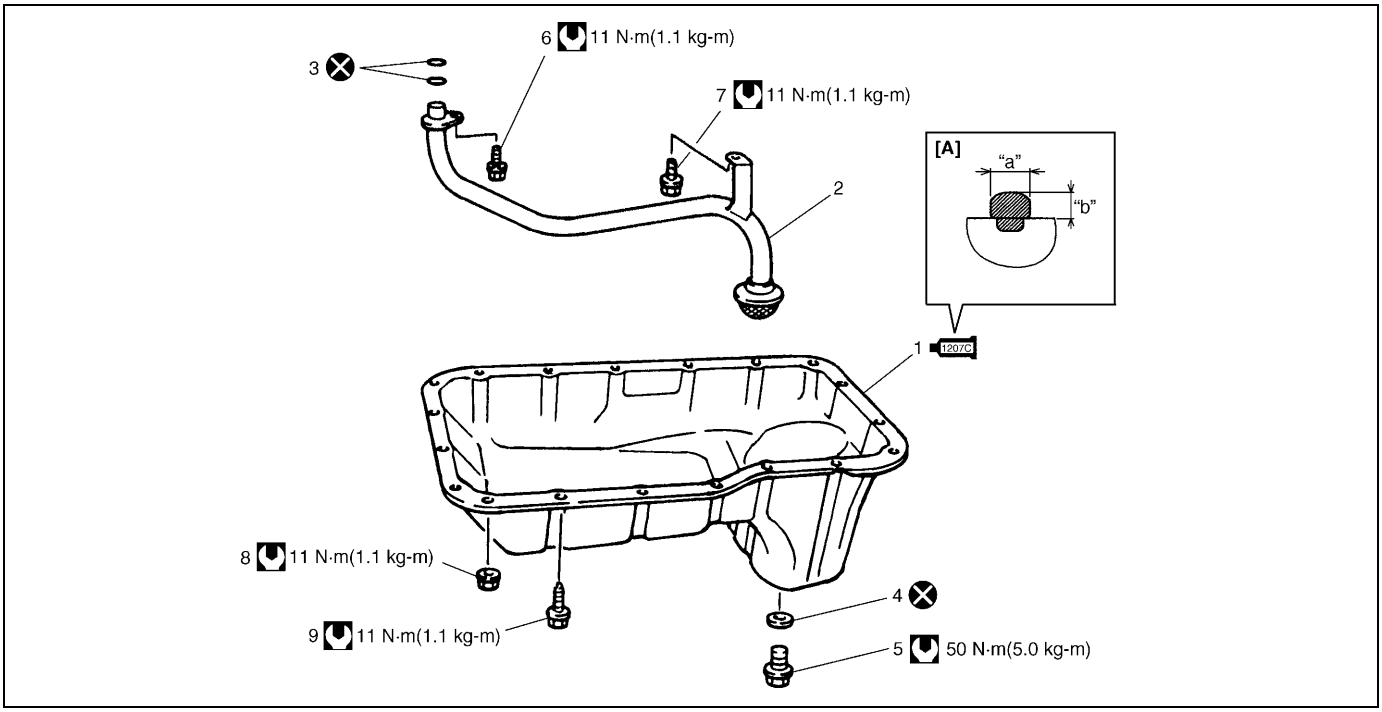
Tightening torque
Exhaust manifold stiffener bolts
(a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)



4) Install exhaust manifold cover (1).
5) Connect heated oxygen sensor coupler (2) and fit coupler to bracket securely (if equipped).

6) Connect negative cable at battery.
7) Check exhaust system for exhaust gas leakage.

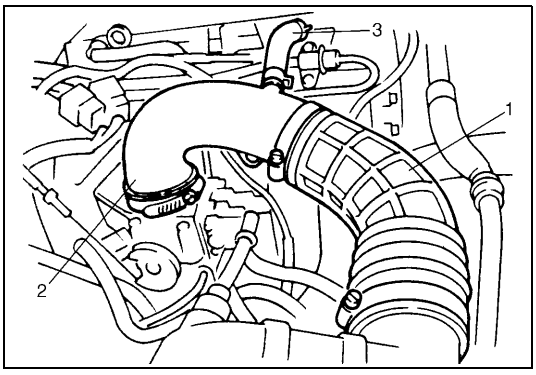
Oil Pan and Oil Pump Strainer



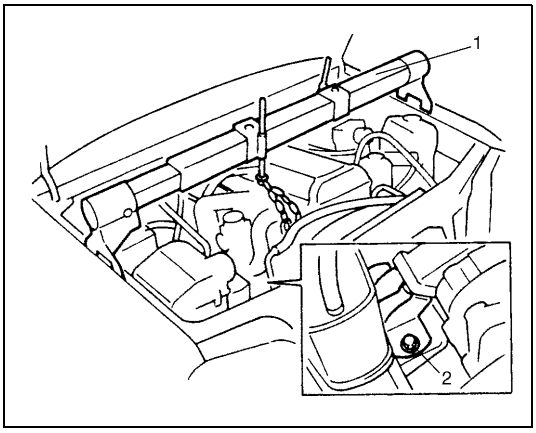
[A] : Sealant application amount	3. O-ring	8. Oil pan nut
"a" : 3 mm (0.12 in.)	4. Gasket	9. Oil pan bolt
"b" : 2 mm (0.08 in.)	5. Drain plug	Tightening torque
1207C 1. Oil pan : Apply sealant 99000-31150 to mating surface.	6. Strainer bolt	Do not reuse.
2. Strainer	7. Bracket bolt	

REMOVAL

1) Remove oil level gauge.



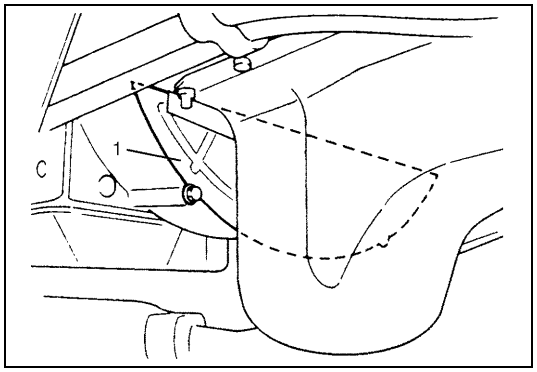
2) Remove air cleaner outlet No.1 (1) and No.2 (2) hoses and breather hose (3).



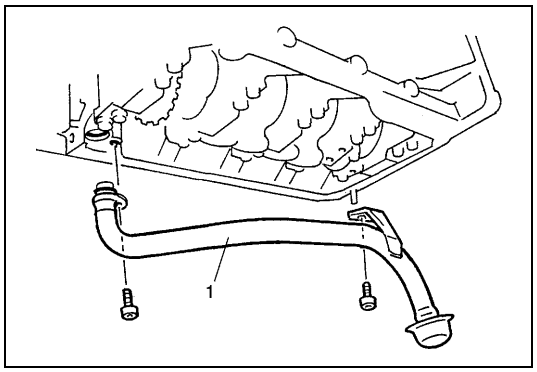
3) To facilitate and ensure removal of oil pan, increase clearance between engine and vehicle body according to the following procedure.
   a) Install support device (1).
   b) Loosen engine mounting bracket bolts (2), but do not remove them.
   c) Hoist engine 10 – 15 mm (0.4 – 0.6 in.).

CAUTION:
Do not hoist engine more than instructed above. That may cause trouble to engine or transmission.

4) Drain engine oil by removing drain plug.

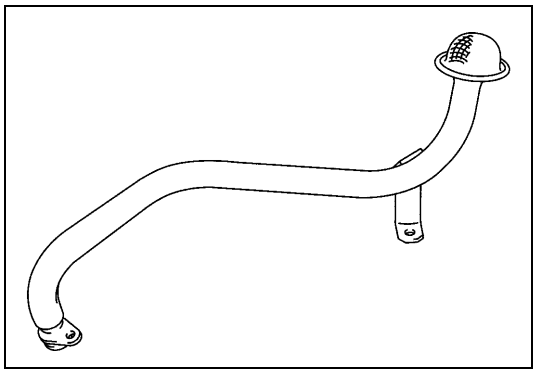


5) Remove clutch housing (torque converter housing for A/T vehicle) lower plate (1).

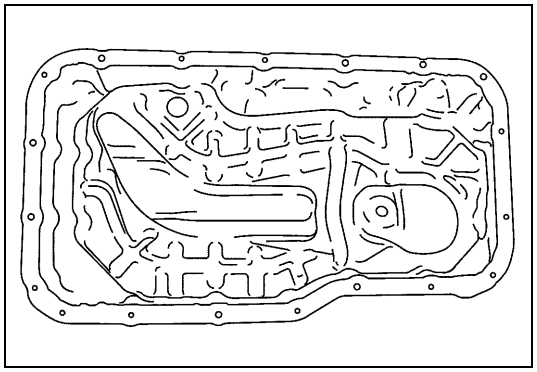


6) Remove oil pan and then oil pump strainer (1) from cylinder block.

CLEAN

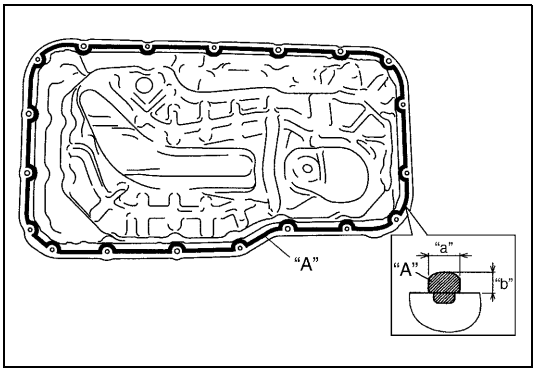


- Inside of oil pan and oil pump strainer screen.



- Clean sealing surface on oil pan and cylinder block.
  Remove oil, old sealant and dust from sealing surface.

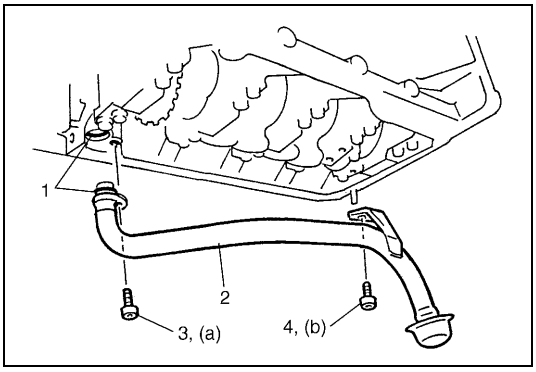
INSTALLATION



1) Apply sealant continuously to oil pan mating surface as shown in figure.

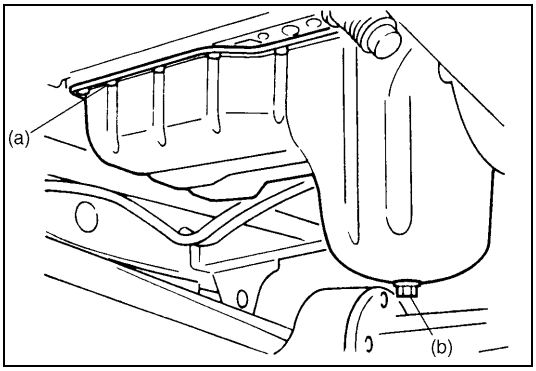
"A" sealant : 99000-31150

Sealant amount for oil pan
Width "a" : 3 mm, 0.12 in.
Height "b" : 2 mm, 0.08 in.



2) Install new O-rings (1) in the position as shown in figure and install oil pump strainer (2).
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)

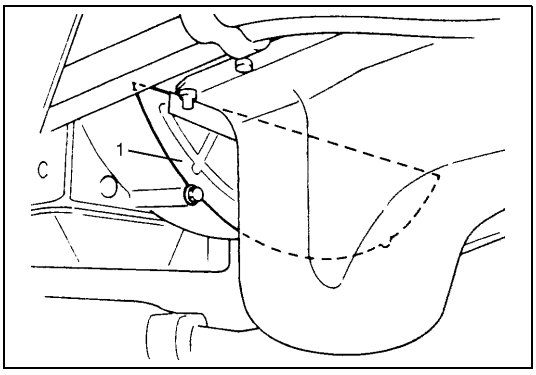


3) After fitting oil pan to cylinder block, run in securing bolts and start tightening at the center:
move wrench outward, tightening one bolt at a time. Tighten bolts and nuts to specified torque.

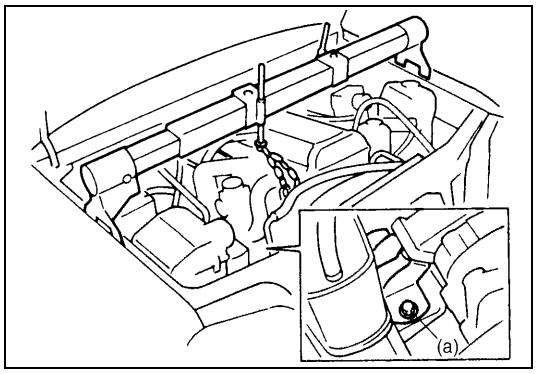
Tightening torque
Oil pan bolts and nuts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)

4) Install new gasket and drain plug to oil pan.
Tighten drain plug to specified torque.

Tightening torque
Oil pan drain plug (b) : 50 N·m (5.0 kg-m, 36.5 lb-ft)



5) Install clutch housing (torque converter housing for A/T vehicle) lower plate (1).

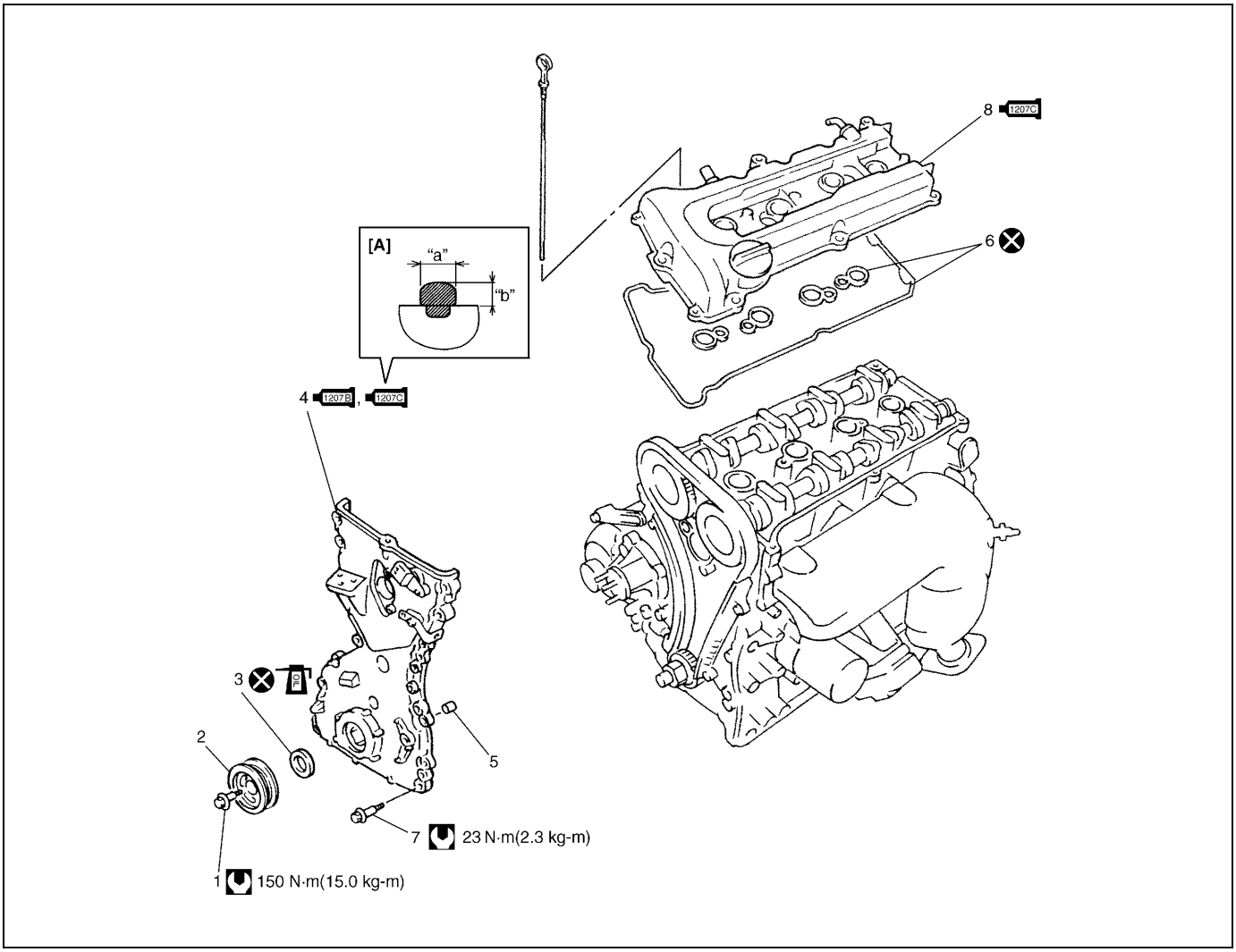


6) Lower engine and tighten engine mounting bracket bolts to specified torque.

Tightening torque
Engine mounting bracket bolts
(a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

7) Install oil level gauge.
8) Refill engine with engine oil referring to “Engine Oil and Filter Change” in Section 0B.
9) Verify that there is no engine oil leakage at each connection.

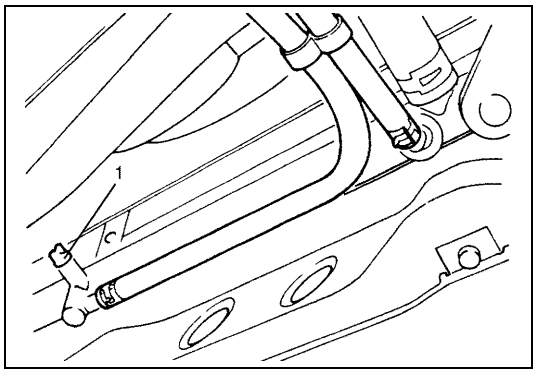
Timing Chain Cover



[A] : Sealant application amount	Oil 3. Oil seal : Apply engine oil to oil seal lip.	1207C 8. Cylinder head cover : Apply sealant 99000-31150 to the sealing point for timing chain cover mating surface and cylinder head gasket sealing point. Refer to "Cylinder Head Cover Installation".
"a" : 3 mm (0.12 in.)	4. Timing chain cover 1207B : Apply sealant 99000-31140 to the mating surface of cylinder and cylinder head. 1207C : Apply sealant 99000-31150 to the mating surface of timing chain cover referring to the figure of Step 1) in INSTALLATION.	Tightening torque
"b" : 2 mm (0.08 in.)	5. Pin	Do not reuse.
1. Crankshaft pulley bolt	6. Cylinder head cover gasket	
2. Crankshaft pulley	7. Timing chain cover mounting bolts	

REMOVAL

1) Disconnect negative cable at battery.
2) Remove A/C compressor and/or P/S pump belt (if equipped).
3) Remove generator belt.
4) Drain engine oil.

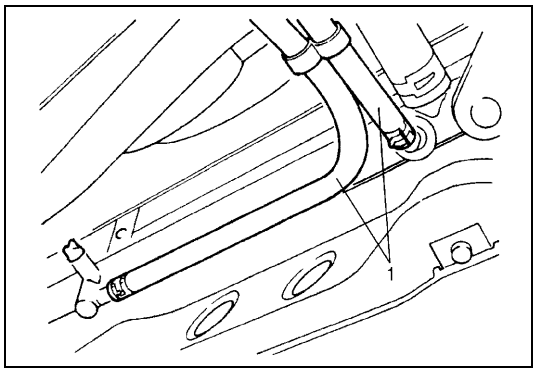


5) Drain coolant.

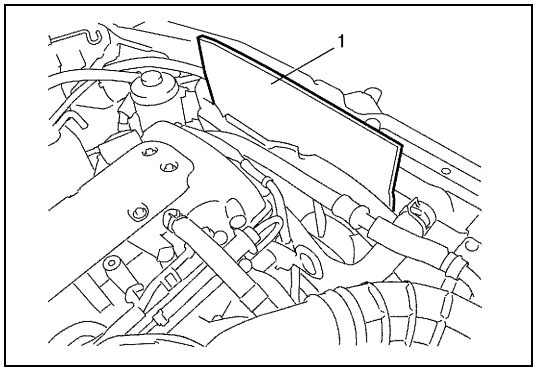
WARNING:

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.

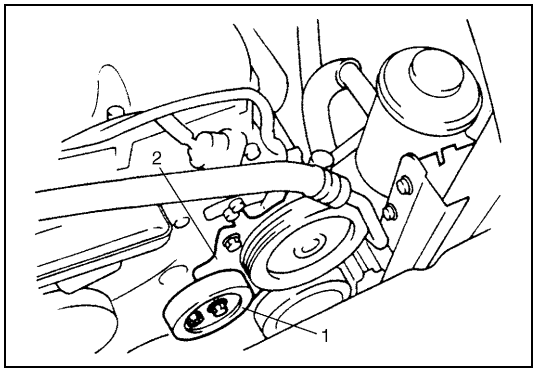
6) Disconnect radiator inlet and outlet hoses from each pipe.



7) Disconnect A/T fluid hoses (1) (vehicle with A/T) and release its clamps. Place some container under radiator to receive A/T fluid which will flow out when hose is disconnected.



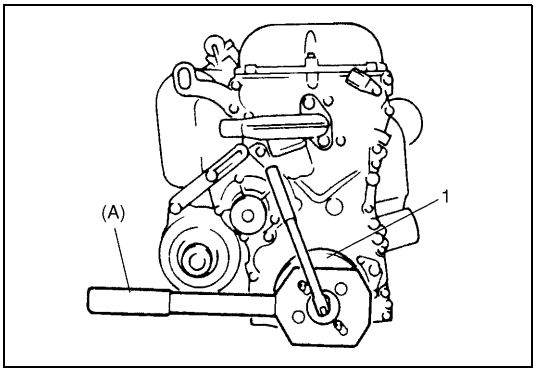
8) Remove fan shroud upper bolts and install board (1) or the like. This prevents damage to radiator fins when removing and installing radiator.
9) Remove radiator with cooling fan. Then remove water pump pulley. Refer to “Radiator” and “Water Pump Belt and Cooling Fan” in Section 6B.



10) Remove A/C compressor and/or P/S pump belt tension pulley (1) (if equipped).
11) With hose connected, detach P/S pump from its bracket and then remove P/S pump bracket (2) (if equipped) referring to “Power Steering Pump” in Section 3B1.

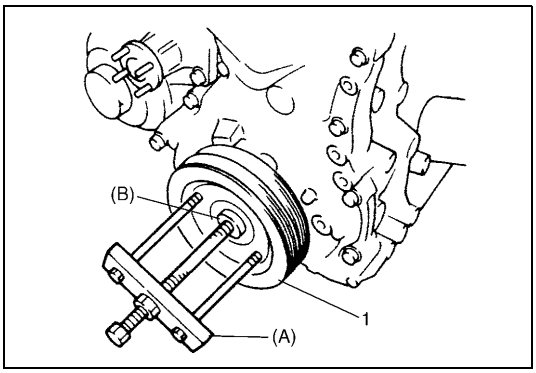
NOTE:

Suspend removed P/S pump at a place where no damage will be caused during removal and installation of timing chain cover.



12) Remove crankshaft pulley bolt.
To lock crankshaft pulley (1), use special tool with it as shown in figure.

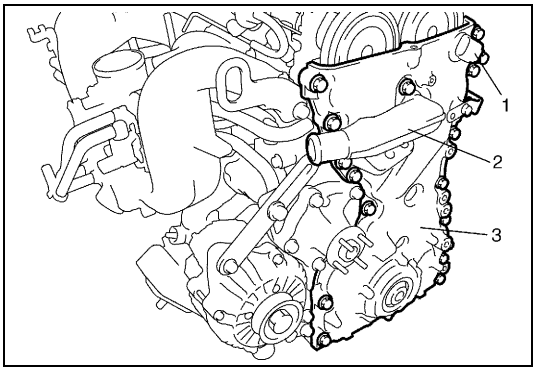
Special tool
(A) : 09917-68221



13) Remove crankshaft pulley (1).
If it is hard to remove, use special tools as shown in figure.
If bolts of special tool are too long, replace them with those of suitable length.

Special tool
(A) : 09944-36011
(B) : 09926-58010

14) Remove oil pan referring to “Oil Pan and Oil Pump Strainer” in this section.
15) Remove cylinder head cover referring to “Cylinder Head Cover” in this section.

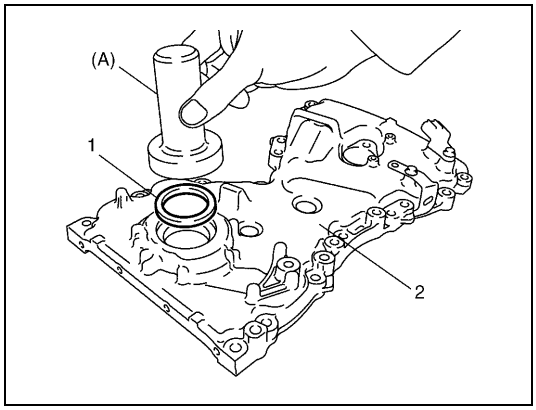


16) Disconnect CMP sensor coupler (1) and release its harness clamps.
17) Remove water outlet pipe (2).
18) Remove timing chain cover (3).

CLEANING

- Clean sealing surface on timing chain cover, cylinder block and cylinder head.
Remove oil, old sealant and dust from sealing surface.

INSPECTION



- Check oil seal (1) lip for fault or other damage.
  Replace as necessary.

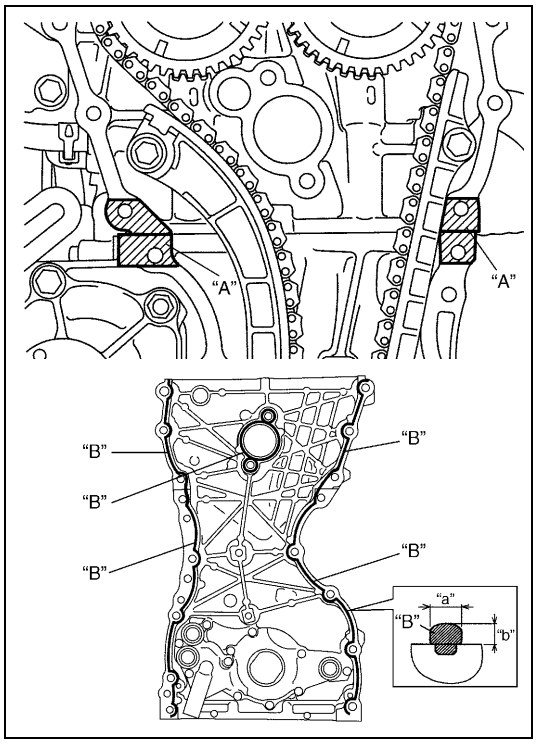
NOTE:

When installing new oil seal, tap it in until its surface is flash with edge of timing chain cover (2).
To install oil seal, use special tool (Bearing installer).

Special tool
(A) : 09913-75520

INSTALLATION

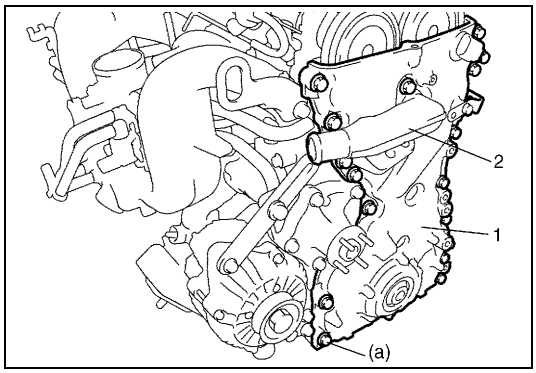
Reverse removal procedure to install timing chain cover, noting the following points.



1) 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 99000-31150

Sealant amount for timing chain cover
Width "a" : 3 mm, 0.12 in.
Height "b" : 2 mm, 0.08 in.

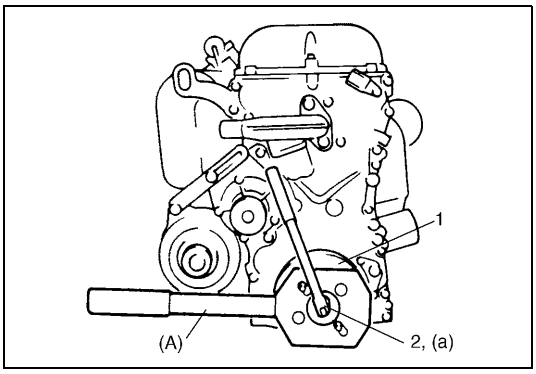


2) Apply engine oil to oil seal lip, then install timing chain cover (1) and water outlet pipe (2).
   Tighten bolts and nut to specified torque.

NOTE:

Before installing timing chain cover, check that pin is securely fitted.

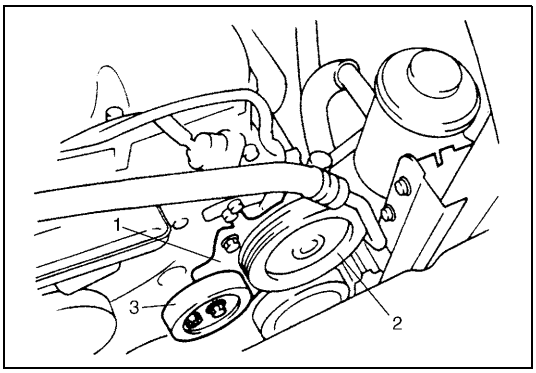
Tightening torque
Timing chain cover bolts and nut
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)



3) Install crankshaft pulley (1). Tighten bolt (2) to specified torque.
   To lock crankshaft pulley, use special tool with it as shown in figure.

Special tool
(A) : 09917-68221

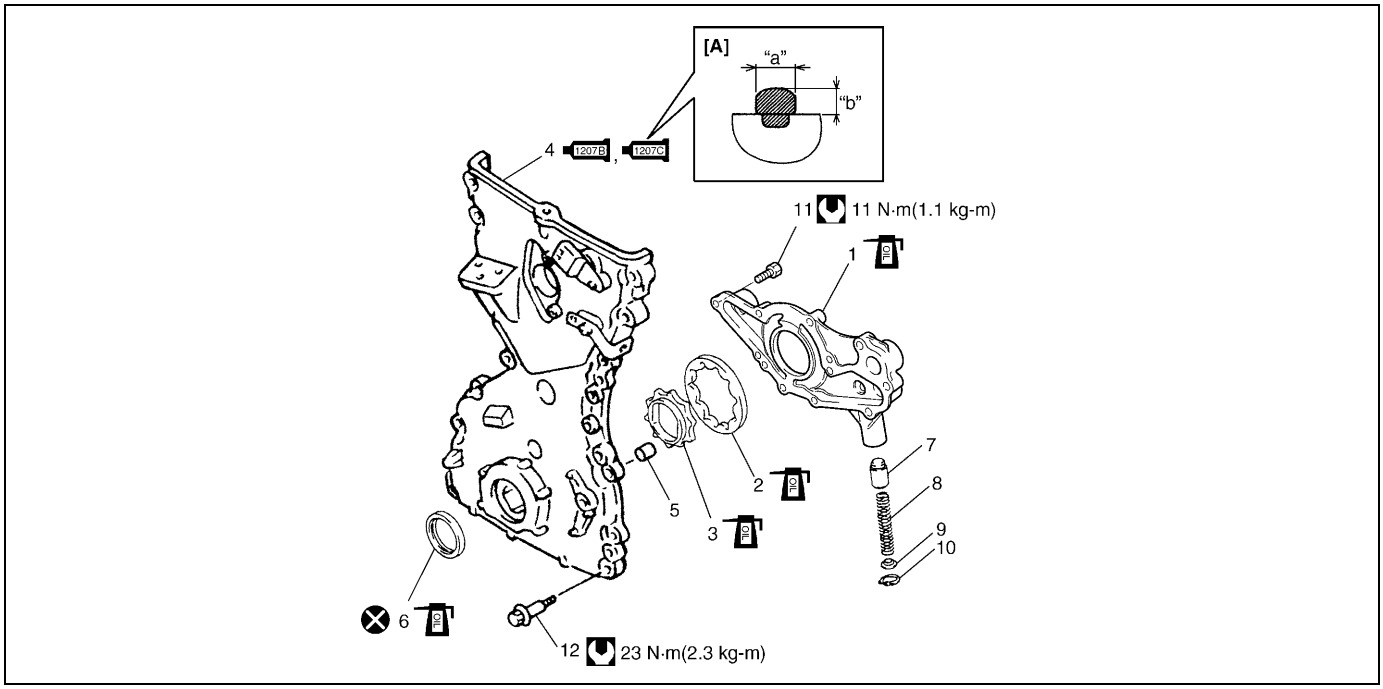
Tightening torque
Crankshaft pulley bolt (a) : 150 N·m (15.0 kg-m, 108.5 lb-ft)



4) Install P/S pump bracket (1), P/S pump (2) and A/C compressor and/or P/S pump belt tension pulley (3) (if equipped) referring to “Power Steering Pump” in Section 3B1.

5) Install cylinder head cover referring to “Cylinder Head Cover” in this section.
6) Install oil pan referring to “Oil Pan and Oil Pump Strainer” in this section.
7) Install radiator with cooling fan and connect A/T fluid hoses (vehicle with A/T), radiator inlet and outlet hoses referring to “Water Pump Belt and Cooling Fan” and “Radiator” in Section 6B.
8) Adjust generator belt tension referring to “Water Pump Belt Tension” in Section 6B for adjusting procedure.
9) Adjust A/C compressor and/or P/S pump belt tension (if equipped) referring to “Compressor Drive Belt” in Section 1B or “Power Steering Belt” in Section 3B1 for adjusting procedure.
10) Refill cooling system with coolant, engine with engine oil and A/T with specified A/T fluid (vehicle with A/T).
11) Verify that there is no coolant leakage, oil leakage and A/T fluid leakage (vehicle with A/T) at each connection.

Oil Pump

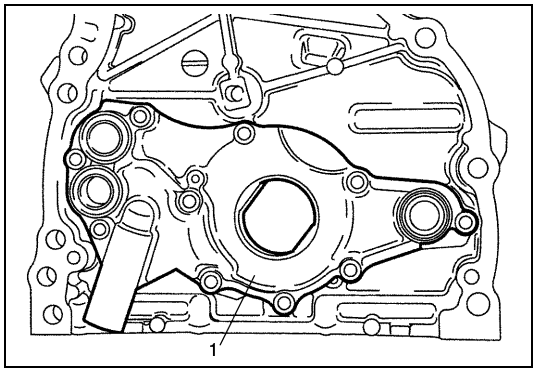


[A] : Sealant application amount	4. Timing chain cover 1207B : Apply sealant 99000-31140 to the mating surface of cylinder and cylinder head. 1207C : Apply sealant 99000-31150 to mating surface of timing chain cover referring to the figure of Step 1) in "Timing Chain Cover Installation".	10. Circlip
"a" : 3 mm (0.12 in.)	5. Pin	11. Oil pump mounting bolt
"b" : 2 mm (0.08 in.)	6. Oil seal	12. Timing chain cover mounting bolts
1. Rotor plate	7. Relief valve	Tightening torque
2. Outer rotor	8. Spring	Do not reuse.
3. Inner rotor	9. Retainer	Apply thin coat of engine oil to sliding surface of each parts.

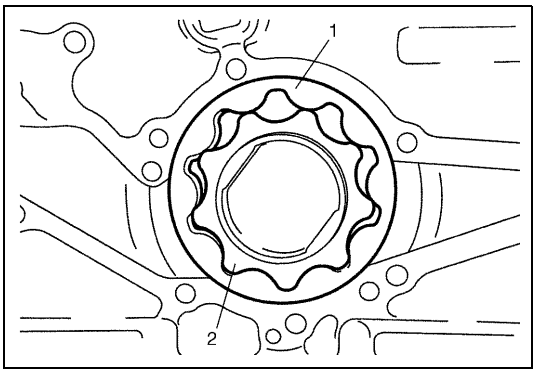
REMOVAL

1) Disconnect negative cable at battery.
2) Remove timing chain cover, referring to "Timing Chain Cover" in this section.

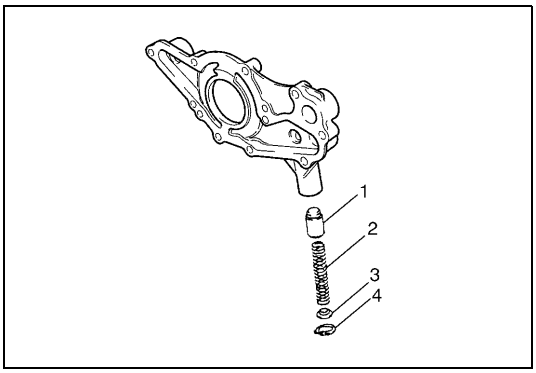
DISASSEMBLY



1) Remove rotor plate (1) by removing its mounting bolts.

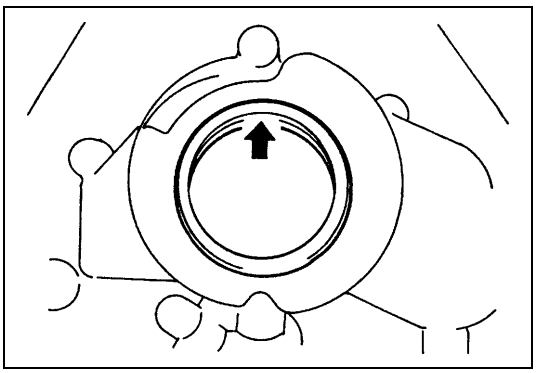


2) Remove outer rotor (1) and inner rotor (2).

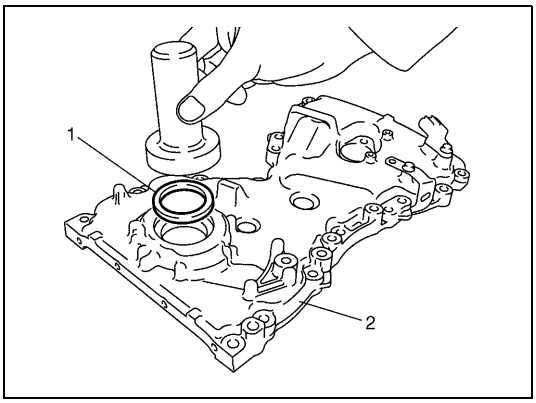


3) Remove relief valve (1), spring (2) and retainer (3) by removing circlip (4).

INSPECTION



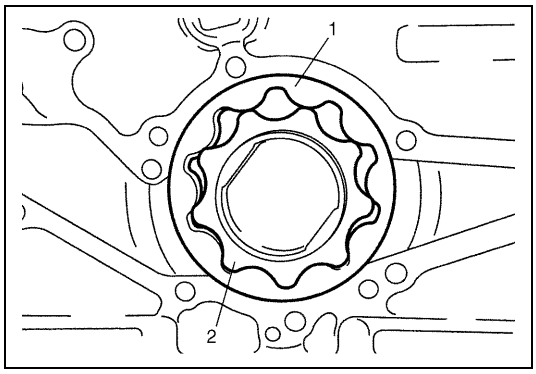
- Check oil seal lip for fault or other damage. Replace as necessary.



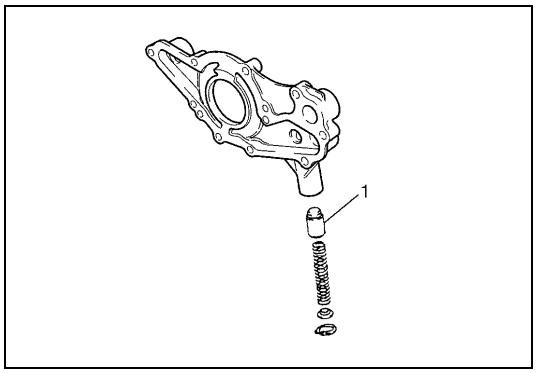
NOTE:

When installing new oil seal (1), press-fit it till its end face is flush with oil pump case (2) end face.

Special tool
(A) : 09913-75520



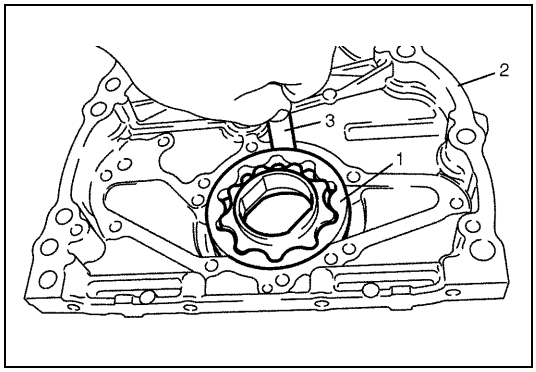
- Check outer (1) and inner rotors (2), rotor plate, and oil pump case for excessive wear or damage.



- Check relief valve (1) for excessive wear or damage and operates smoothly.

MEASUREMENT

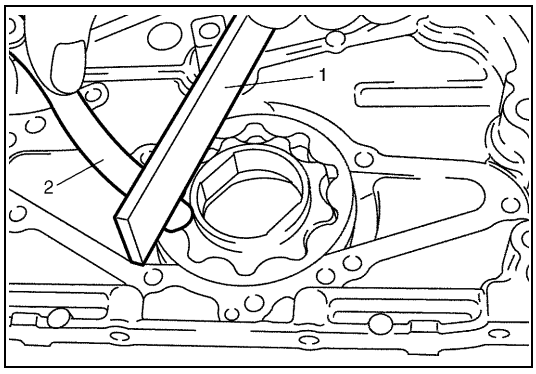
Radial clearance



Check radial clearance between outer rotor (1) and case (2), using thickness gauge (3).
If clearance exceeds its limit, replace outer rotor or case.

Limit on radial clearance between outer rotor and case for oil pump
0.310 mm (0.0122 in.)

Side clearance

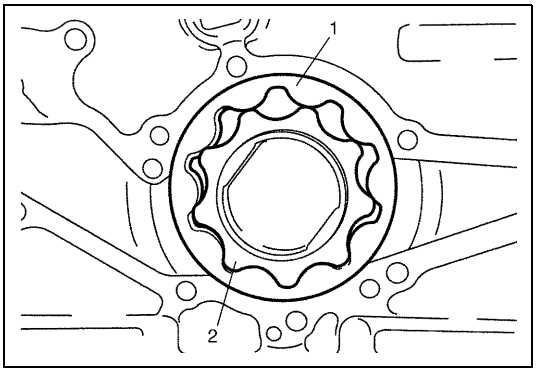


Using straight edge (1) and thickness gauge (2), measure side clearance.

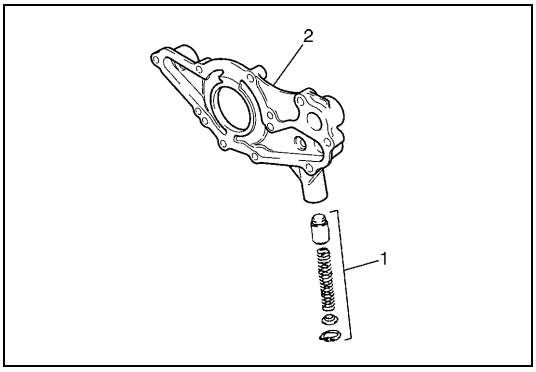
Limit on side clearance for oil pump inner rotor
0.15 mm (0.0059 in.)

ASSEMBLY

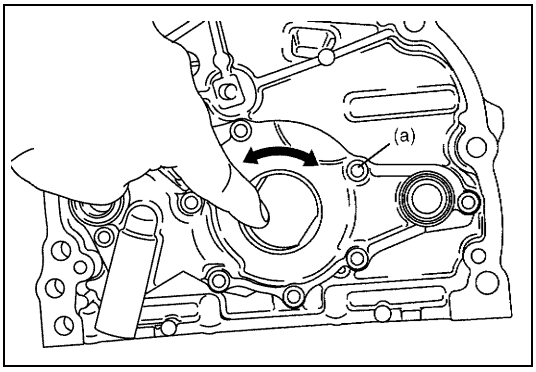
1) Wash, clean and then dry all disassembled parts.
2) Apply thin coat of engine oil to inner and outer rotors, oil seal lip portion, and inside surfaces of oil pump case and plate.



3) Install outer (1) and inner rotors (2) to oil pump case.



4) Install relief valve component (1) to rotor plate (2).



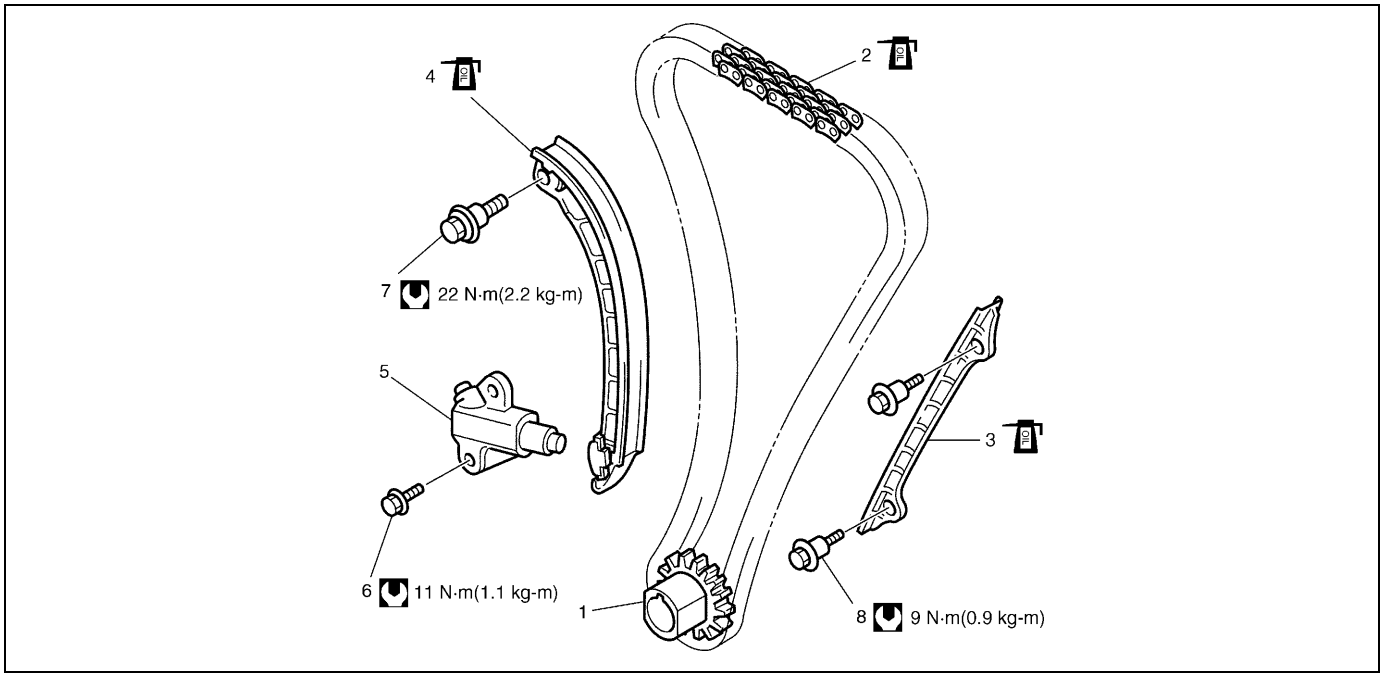
5) Install rotor plate and tighten all bolts to specified torque.
   After installing plate, check to be sure that rotors turn smoothly by hand (0.3 N·m (0.03 kg-m, 0.25 lb-ft) torque or below).

Tightening torque
Oil pump rotor plate bolts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)

INSTALLATION

For installation referring to “Timing Chain Cover” in this section.

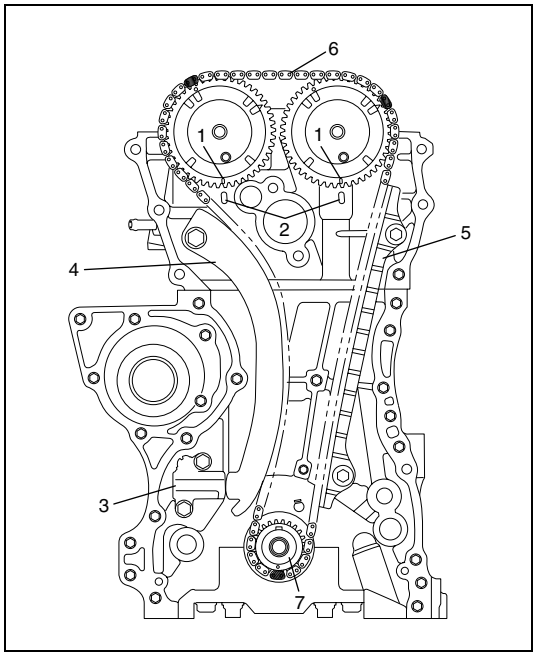
Timing Chain and Chain Tensioner



1. Crankshaft timing sprocket	5. Timing chain tensioner adjuster assembly	Tightening torque
2. Timing chain	6. Chain tensioner adjuster mounting bolt	Apply engine oil to sliding surface.
3. Timing chain No.1 guide	7. Chain tensioner mounting bolt	
4. Timing chain tensioner	8. Chain guide mounting bolt	

REMOVAL

1) Remove timing chain cover referring to “Timing Chain Cover”.

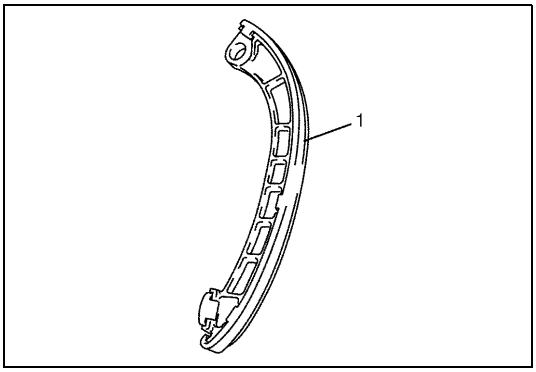


2) Align both intake and exhaust camshaft timing sprocket marks (1) with notches (2) of cylinder head respectively by turning crankshaft.
3) Remove timing chain tensioner adjuster assembly (3).
4) Remove timing chain tensioner (4).
5) Remove timing chain No.1 guide (5).
6) Remove timing chain (6) with crankshaft timing sprocket (7).

CAUTION:

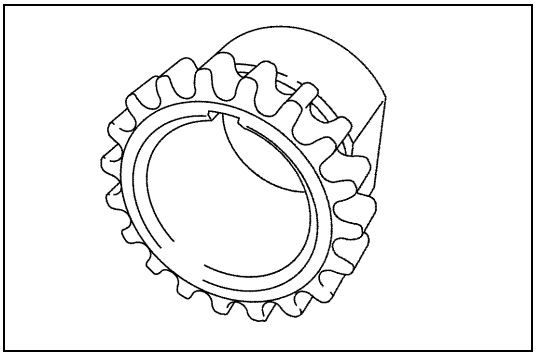
After timing chain is removed, never turn crankshaft and camshafts independently more than its allowable turning range described in “INSTALLATION” section.
If turned, interference may occur between piston and valves and valves themselves, and parts related to piston and valves may be damaged.

INSPECTION



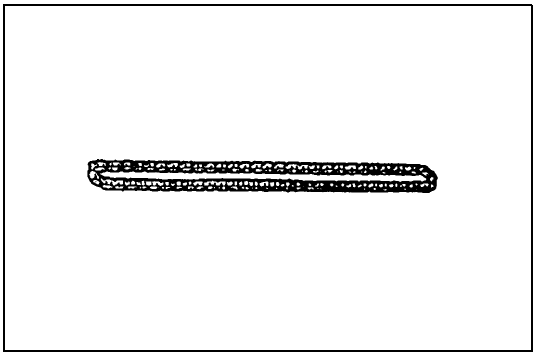
Timing chain tensioner

- Check shoe (1) for wear or damage.



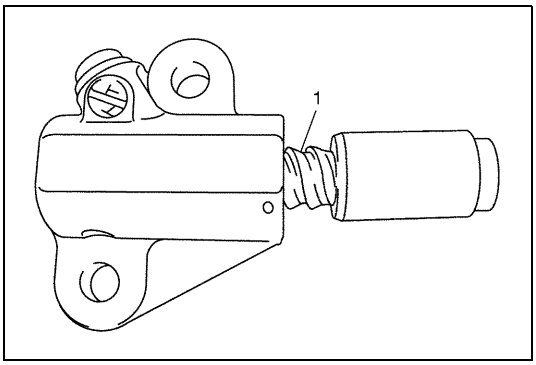
Crankshaft timing sprocket

- Check teeth of sprocket for wear or damage.



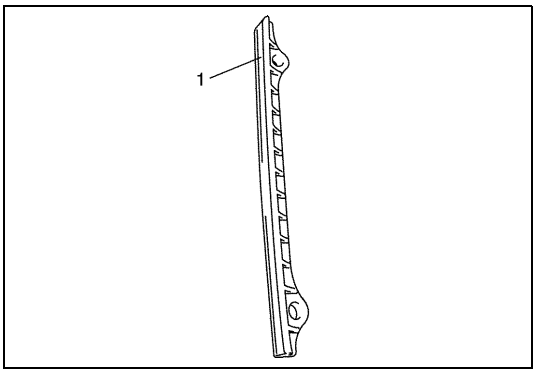
Timing chain

- Check timing chain for wear or damage.



Timing chain tensioner adjuster

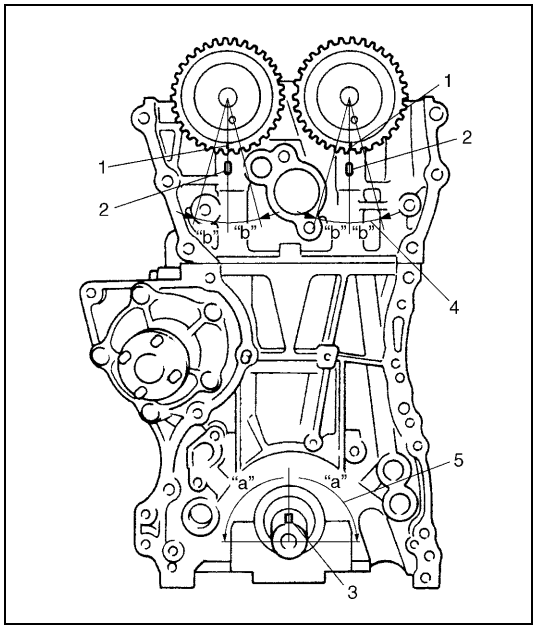
- Check that tooth surface (1) are free from damage.



Timing chain No.1 guide

- Check shoe (1) for wear or damage.

INSTALLATION



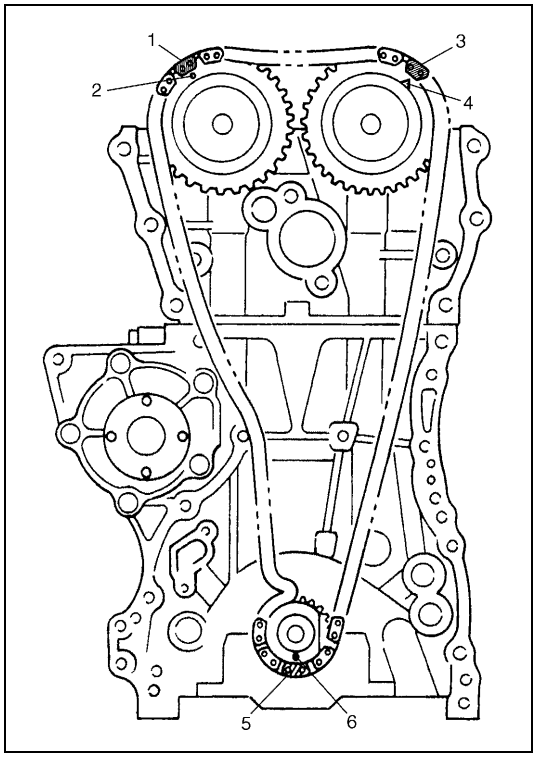
CAUTION:

After timing chain is removed, never turn crankshaft and camshafts independently more than such an extent ("a", "b") as shown in figure.

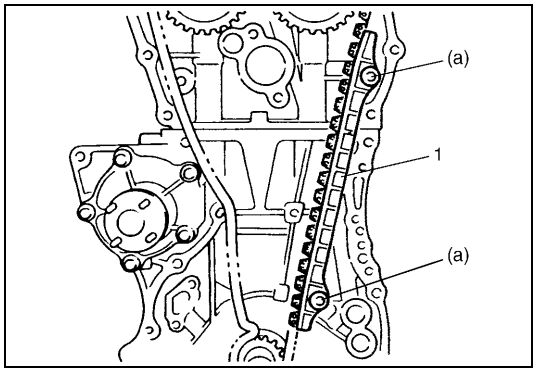
If turned, interference may occur between piston and valves and valves themselves, and parts related to piston and valves may be damaged.

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°	5. Crankshaft allowable turning range. By key on crankshaft, within 90° from top on both right and left.
"b" : 15°	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.

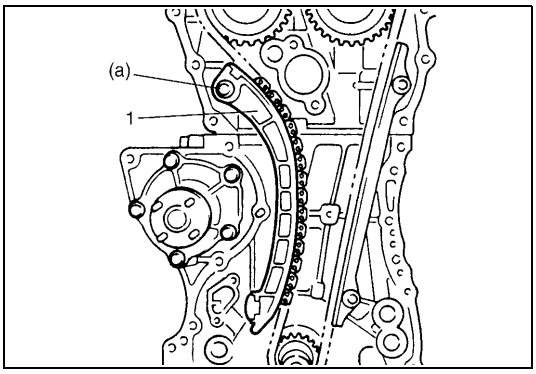


3) Install timing chain by aligning dark blue plate (1) of timing chain and mark (2) on camshaft timing sprocket and then aligning dark blue plate (3) and triangle mark (4) as shown in figure.
4) Fit crankshaft timing sprocket to timing chain by aligning gold plate (5) of timing chain and mark (6) on crankshaft timing sprocket. Then install crankshaft timing sprocket fitted with chain to crankshaft.



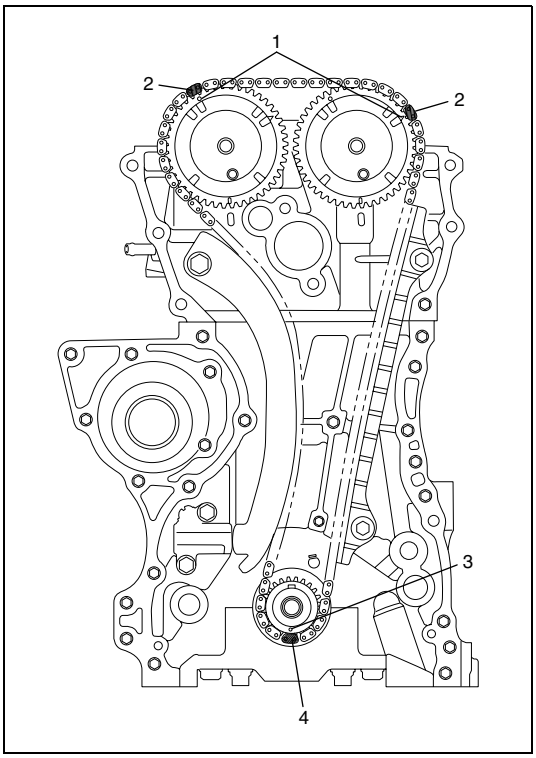
5) Apply engine oil to sliding surface of timing chain No.1 guide (1) and install it as shown in figure.
Tighten guide bolts to specified torque.

Tightening torque
Timing chain No.1 guide bolts
(a) : 9 N·m (0.9 kg-m, 6.5 lb-ft)

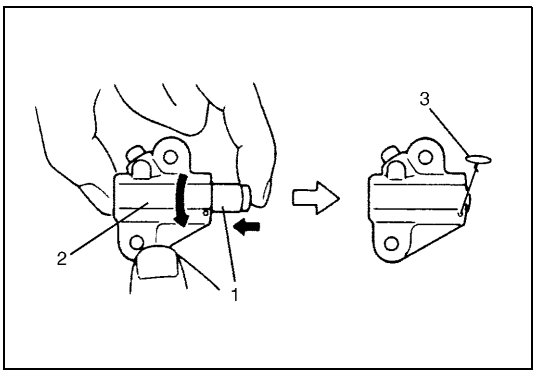


6) Apply engine oil to sliding surface of chain tensioner (1) and install chain tensioner and spacer.
Tighten tensioner bolt to specified torque

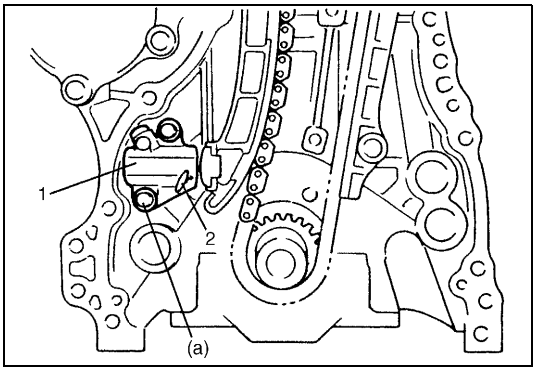
Tightening torque
Timing chain tensioner bolt
(a) : 22 N·m (2.2 kg-m, 16.0 lb-ft)



7) Check that match marks (1) on intake and exhaust camshaft timing sprockets are in match with dark blue plates (2) of timing chain and match mark (3) on crankshaft timing sprocket is in match with gold plate (4) of timing chain.

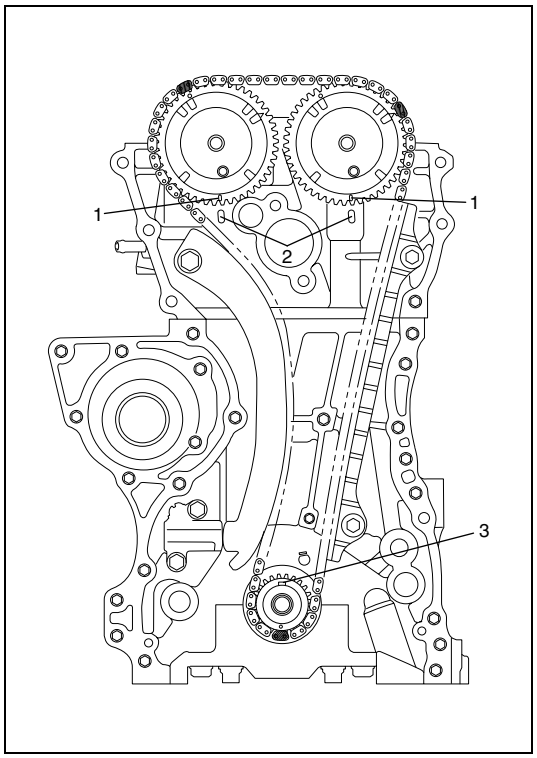


8) Screw in plunger (1) by turning timing chain tensioner adjuster (2) in arrow direction and install a retainer (3) (wire) to hold plunger in place.



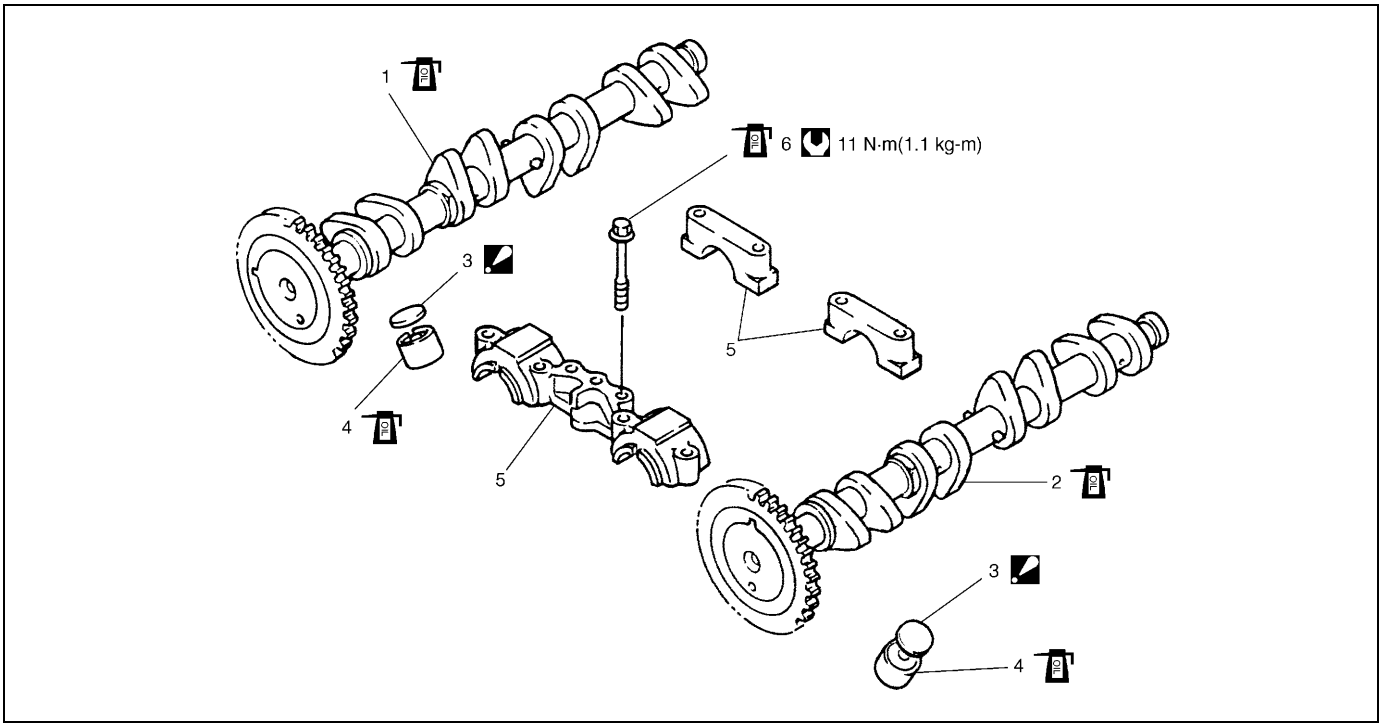
9) Install timing chain tensioner adjuster assembly (1) with a retainer (2).
Tighten adjuster bolts to specified torque and then remove a retainer from chain tensioner adjuster assembly.

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 on upside of crankshaft as shown in figure.
    If each mark of timing chain and each match mark are no matches, adjust each sprocket and timing chain.
11) Install timing chain cover referring to “Timing Chain Cover” in this section.
12) Perform Steps 3) to 8) of “INSTALLATION” of “Timing Chain Cover” in this section.

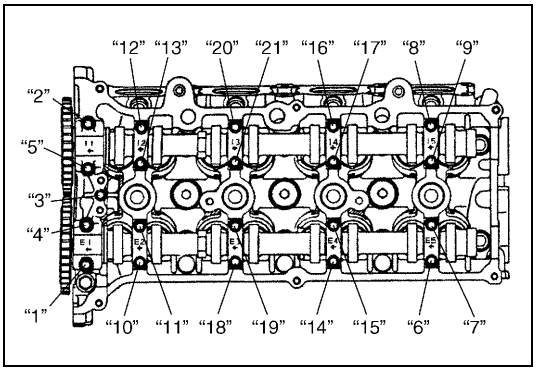
Camshaft, Tappet and Shim



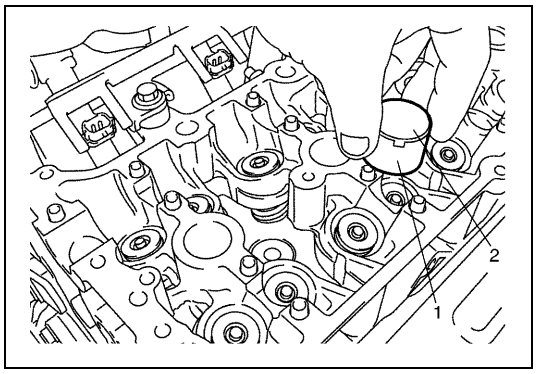
	1. Intake camshaft	4. Tappet	Tightening torque
	2. Exhaust camshaft	5. Camshaft housing	Apply engine oil to sliding surface of each part.
	3. Shim : Shim No. on it faces tappet side.	6. Camshaft housing bolt	

REMOVAL

1) Remove cylinder head cover and oil pan referring to “Cylinder Head Cover” and “Oil Pan and Oil Pump Strainer” in this section.
2) Remove timing chain cover referring to “Timing Chain Cover” in this section.
3) Remove timing chain referring to “Timing Chain and Chain Tensioner” in this section.



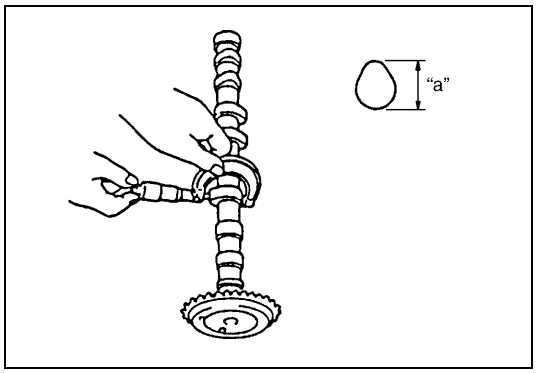
4) Loosen camshaft housing bolts in such order as indicated in figure and remove them.
5) Remove camshaft housings.
6) Remove intake and exhaust camshafts.



7) Remove tappets (1) with shims (2).

INSPECTION

Cam Wear

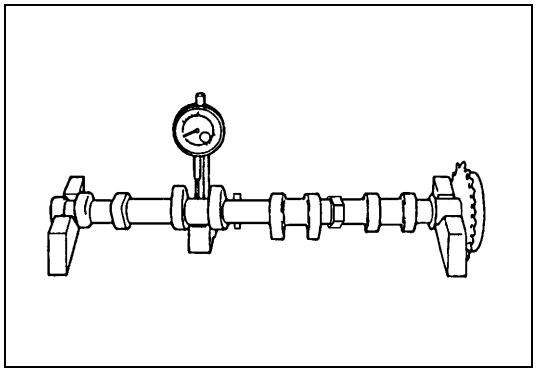


Using a micrometer, measure cam height "a". If measured height is below its limit, replace camshaft.

Cam height "a" of camshaft

	Standard	Limit
Intake cam	**44.919 – 45.079 mm (1.768 – 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.)**

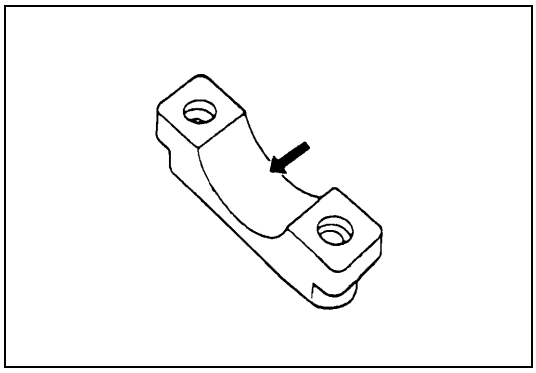
Camshaft Runout



Set camshaft between two "V" blocks, and measure its runout by using a dial gauge.
If measured runout exceeds below limit, replace camshaft.

Camshaft runout limit
0.10 mm (0.0039 in.)

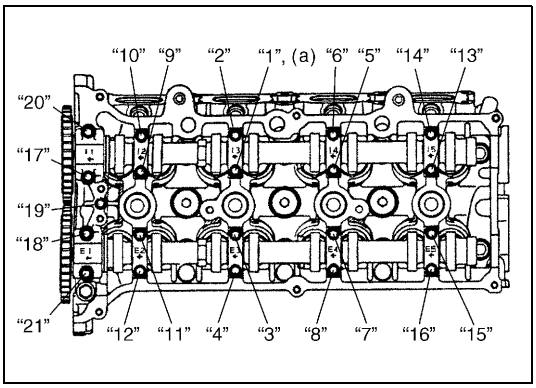
Camshaft Journal Wear



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 gauging 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 gauging plastic to full width of journal of camshaft (parallel to camshaft).
5) Install camshaft housing.



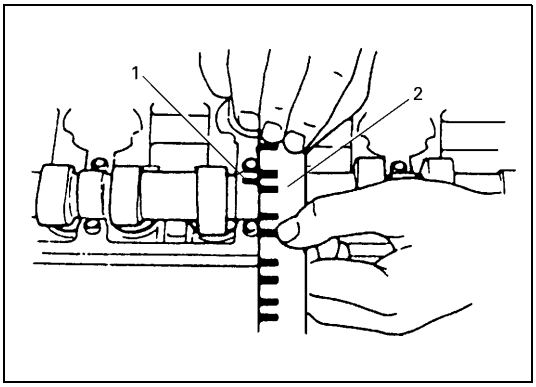
6) Tighten camshaft housing bolts in such order as indicated in figure a little at a time till they are tightened to specified torque.

NOTE:

Do not rotate camshaft while gauging plastic is installed.

Tightening torque

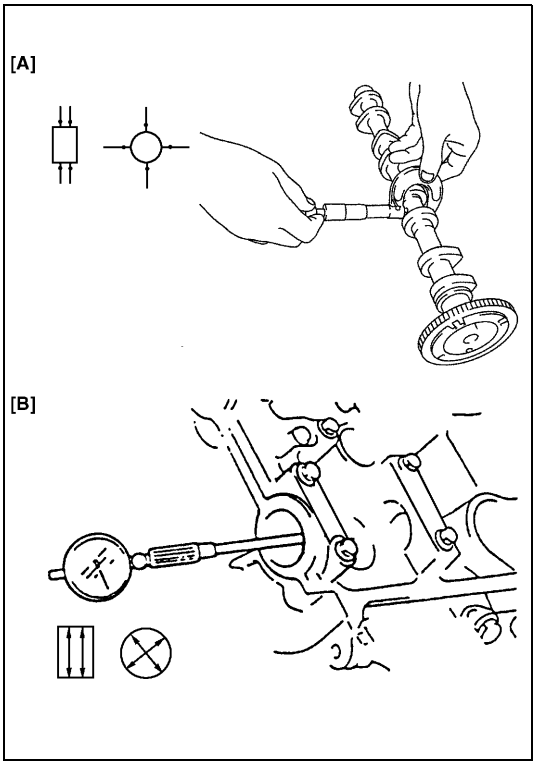
Camshaft housing bolts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)



7) Remove housing, and using scale (2) on gauging plastic (1) envelop, measure gauging plastic width at its widest point.

Camshaft journal clearance

Standard	Limit
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.

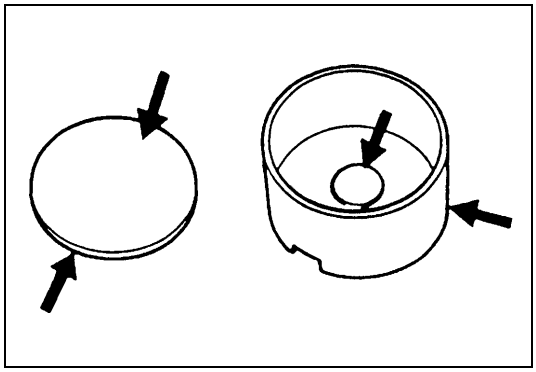
Camshaft journal outside diameter [A]

Item	Standard
No.1	26.934 – 26.955 mm (1.0604 – 1.0612 in.)
Other	22.934 – 22.955 mm (0.9029 – 0.9037 in.)

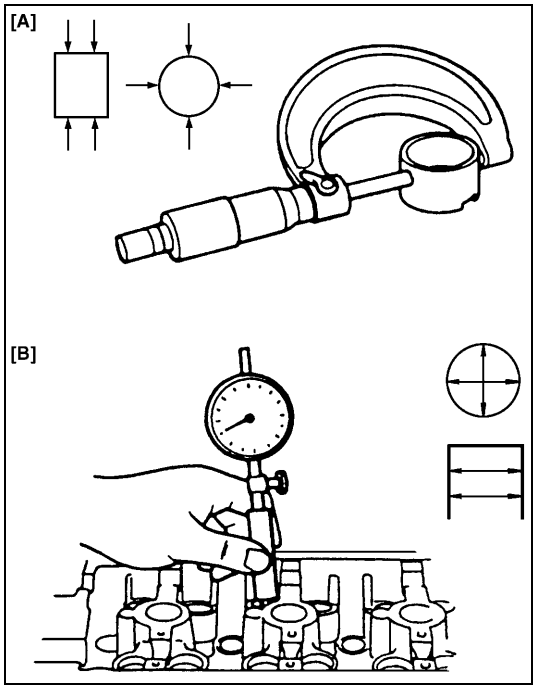
Camshaft journal bore diameter [B]

Item	Standard
No.1	27.000 – 27.021 mm (1.0630 – 1.0638 in.)
Other	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.



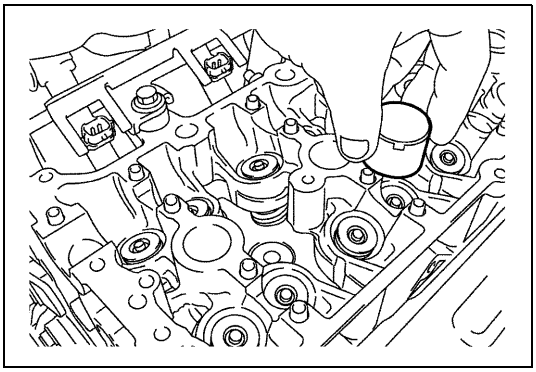
Measure cylinder head bore and tappet outside diameter to determine cylinder head-to-tappet clearance. If clearance exceeds limit, replace tappet or cylinder head.

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.)

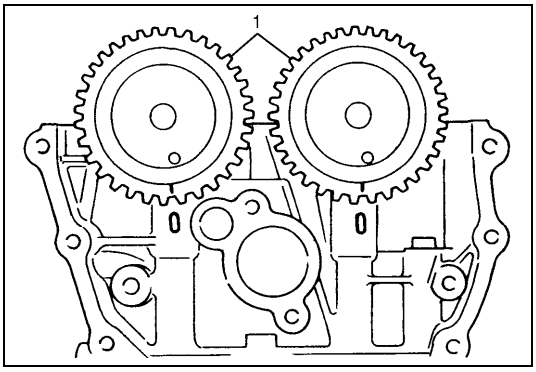
INSTALLATION



1) Install tappets and shims to cylinder head.
   Apply engine oil around tappet and then install it to cylinder head.

NOTE:

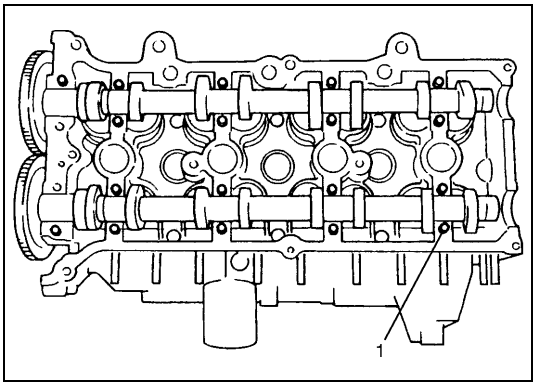
When installing shim, make sure to direct shim No. side toward tappet.



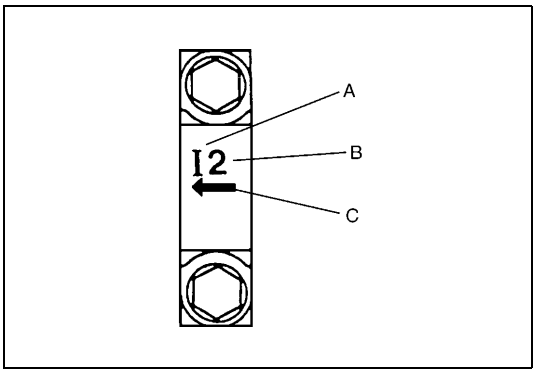
2) Install camshafts (1).
   Apply engine oil to sliding surface of each camshaft and camshaft journal then install them as shown in figure.

NOTE:

Before installing camshafts, turn crankshaft until key position faces upward. Refer to "Timing Chain and Chain Tensioner".

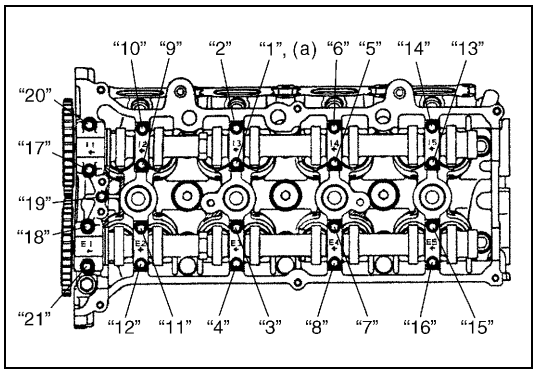


3) Install camshaft housing pins (1) as shown in figure.



4) 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

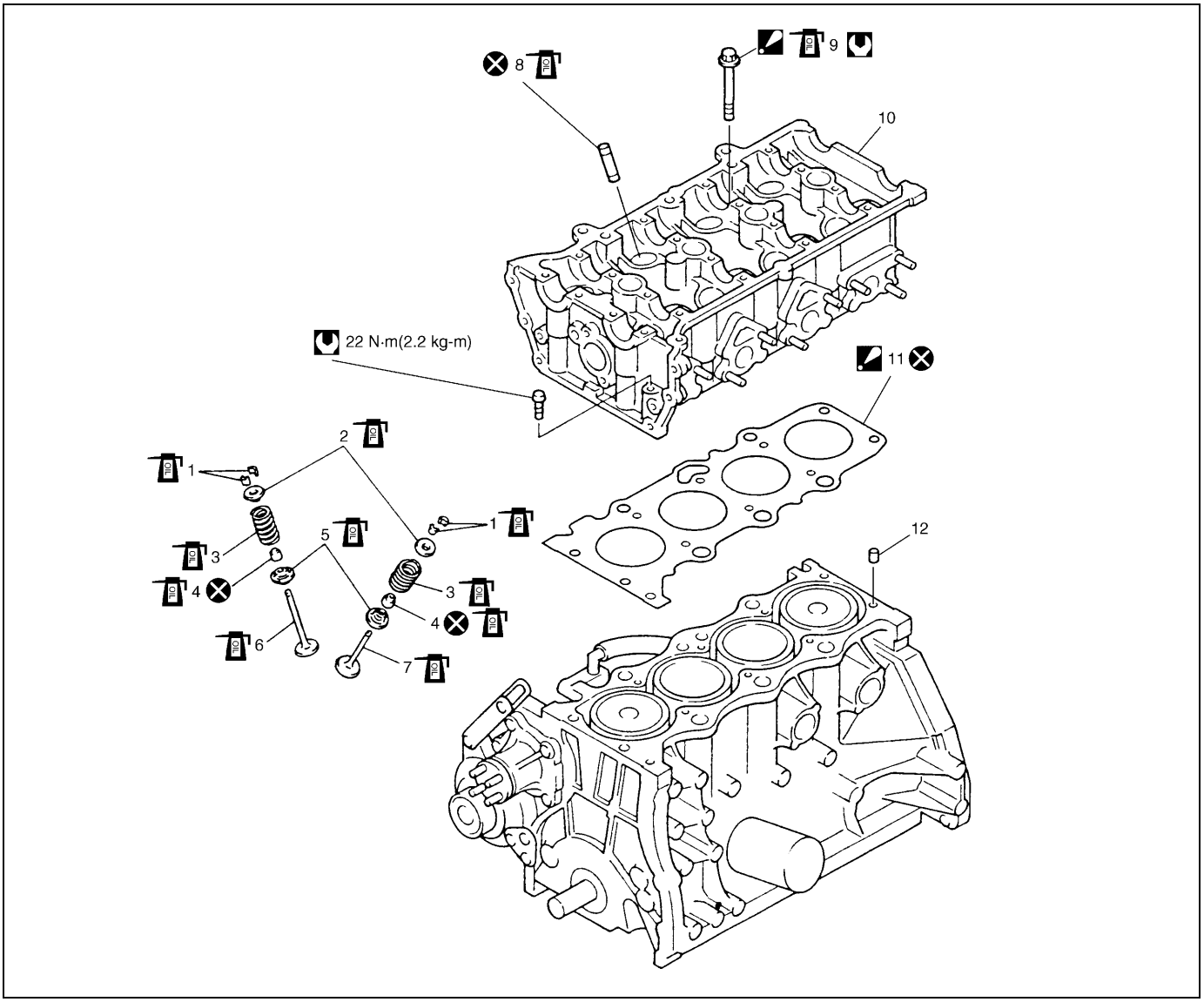


5) After applying engine oil to housing bolts, tighten them temporarily first. Then tighten them by the following numerical order in figure. Tighten a little at a time and evenly among bolts and repeat tightening sequence two or three times before they are tightened to specified torque.

Tightening torque
Camshaft housing bolts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)

6) Install timing chain with crankshaft sprocket referring to "Timing Chain and Chain Tensioner" in this section.
7) Install timing chain cover referring to "Timing Chain Cover" in this section.
8) Check valve lashes referring to "Valve Lash" in this section.
9) Install cylinder head cover and oil pan referring to "Cylinder Head Cover" and "Oil Pan and Oil Pump Strainer" in this section.
10) Install radiator with cooling fan and connect A/T fluid hoses (vehicle with A/T), radiator inlet and outlet hoses referring to "Water Pump Belt and Cooling Fan" and "Radiator" in Section 6B.
11) Adjust generator belt tension referring to "Water Pump Belt Tension" in Section 6B.
12) Adjust A/C compressor and/or P/S pump belt tension (if equipped) referring to "Compressor Drive Belt" in Section 1B or "Power Steering Belt" in Section 3B1.
13) Refill cooling system with coolant, engine with engine oil and A/T with specified A/T fluid (vehicle with A/T).
14) Verify that there is no coolant leakage, oil leakage and A/T fluid leakage (vehicle with A/T) at each connection.

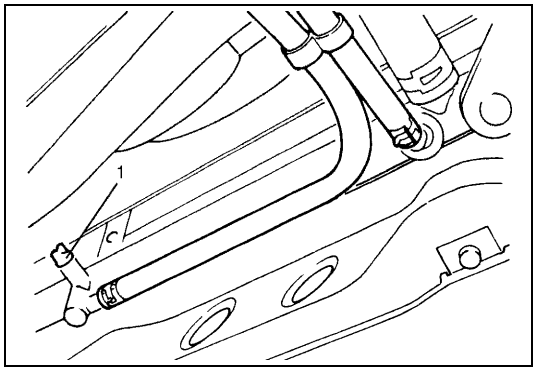
Valves and Cylinder Head



1. Valve cotters	6. Intake valve	11. Cylinder head gasket : "TOP" mark provided on gasket comes to crankshaft pulley side, facing up.
2. Valve spring retainer	7. Exhaust valve	12. Knock pin
3. Valve spring	8. Valve guide	Tightening torque
4. Valve stem seal	9. Cylinder head bolt 1) Tighten all bolts at 40 N·m (4.0 kg-m) 2) Turn all bolts to 60° 3) Then, turn all bolts to 60° once again	Do not reuse.
5. Valve spring seat	10. Cylinder head	Apply engine oil to sliding surface of each part.

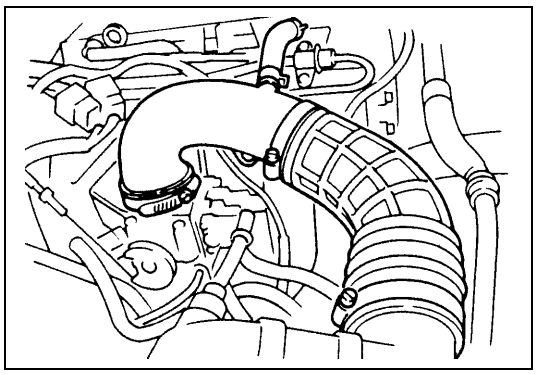
REMOVAL

1) Relieve fuel pressure referring to “Fuel Pressure Relief Procedure” in Section 6.
2) Disconnect negative cable at battery.
3) Drain engine oil.

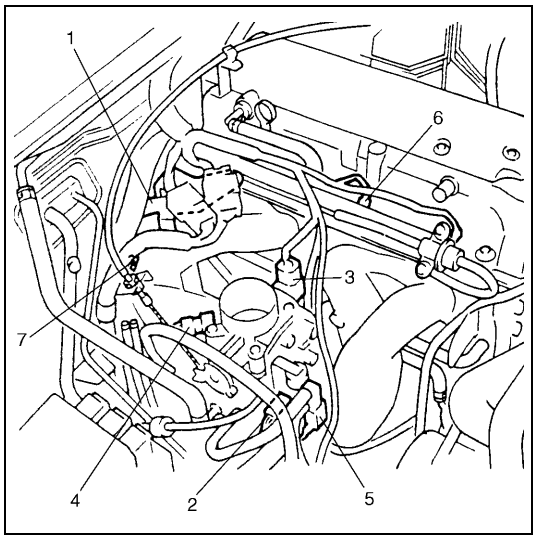


4) Drain coolant by loosening drain plug (1).

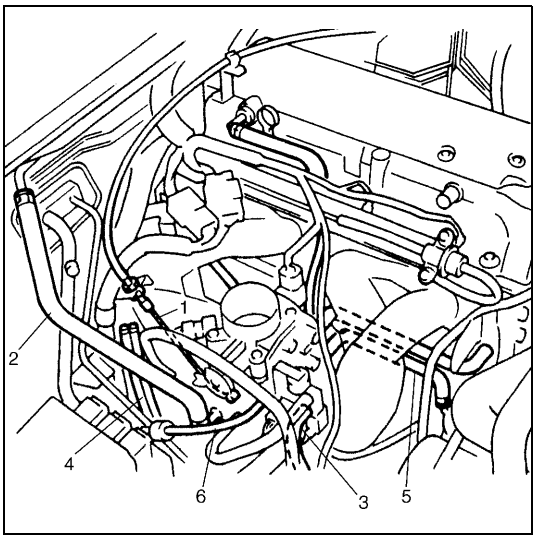
WARNING:
To help avoid danger of being burned, do not remove drain plug (1) and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.



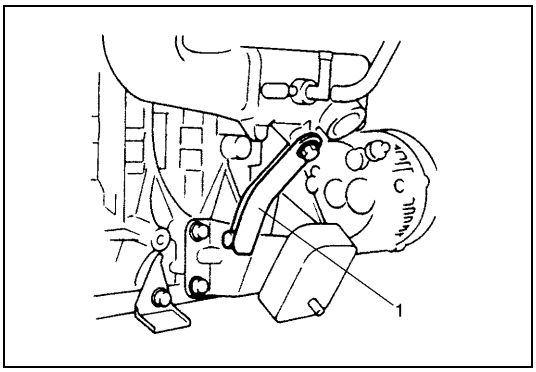
5) Remove air cleaner outlet No.1 and No.2 hoses and breather hose.



6) Remove intake manifold bracket (1) with main harness from intake manifold.
7) Disconnect the following electric lead wires:
   - EGR valve (if equipped)
   - IAC valve (2)
   - TP sensor (3)
   - MAP sensor (4)
   - CMP sensor
   - ECT sensor
   - EVAP canister purge valve (5)
   - Injectors (6)
   - Ignition coils
   - Heated oxygen sensor
   - Ground terminal (7) from intake manifold
   - Each wire harness clamps
8) Remove heated oxygen sensor bracket from cylinder head and detach heated oxygen sensor coupler from its bracket.

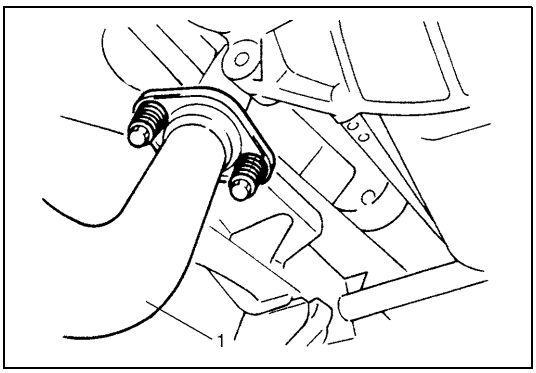


9) Disconnect accelerator cable (1) from throttle body.
10) Disconnect the following hoses:
    - Brake booster hose (2) from intake manifold
    - Canister purge hose (3) from EVAP canister purge valve
    - Fuel feed and return hoses (4) from each pipe
    - Water hose from thermostat case (5)
    - Heater inlet hose from its pipe
    - Vacuum hose (to check valve) (6)
11) Remove canister purge hose bracket from intake manifold.

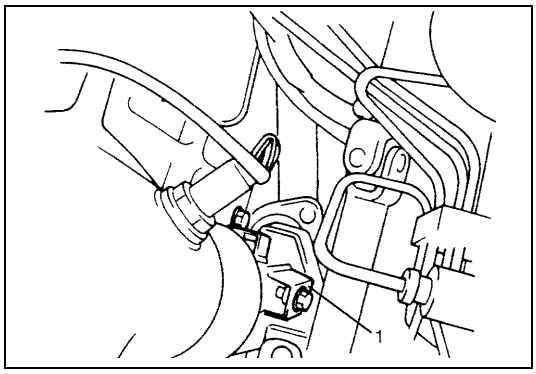


12) Remove intake manifold stiffener (1).

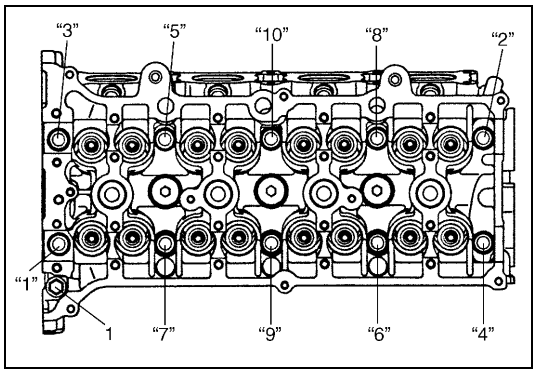
13) Remove oil pan referring to “Oil Pan and Oil Pump Strainer” in this section.
14) Remove cylinder head cover referring to “Cylinder Head Cover” in this section.
15) Remove timing chain cover referring to “Timing Chain Cover” in this section.
16) Remove timing chain referring to “Timing Chain and Chain Tensioner” in this section.
17) Remove intake and exhaust camshafts referring to “Camshaft, Tappet and Shim” in this section.



18) Disconnect exhaust pipe (1) from exhaust manifold.



19) Remove exhaust manifold stiffener (1).



20) Loosen cylinder head bolts in such order as indicated in figure by using a 12 corner socket wrenches and remove them.

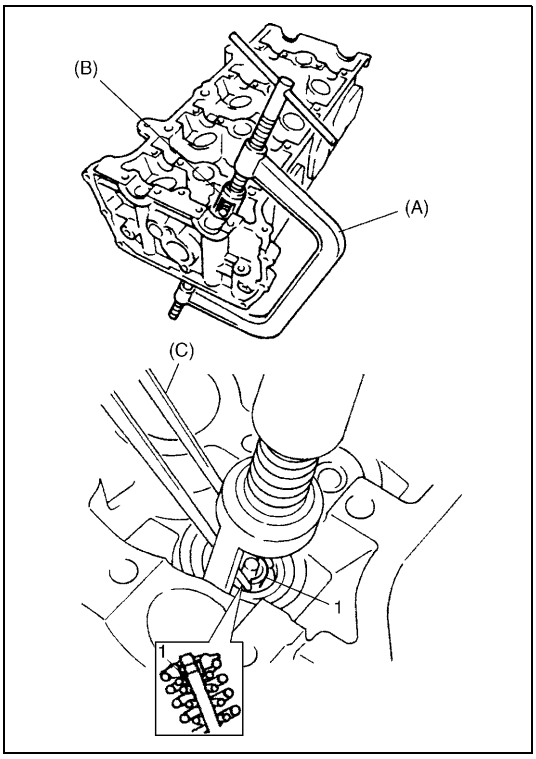
NOTE:

Don't forget to remove bolt (M8) (1) as shown in figure.

21) Check all around cylinder head for any other parts required to be removed or disconnected and remove or disconnect whatever necessary.
22) Remove cylinder head with intake manifold and exhaust manifold. Use lifting device, if necessary.

DISASSEMBLY

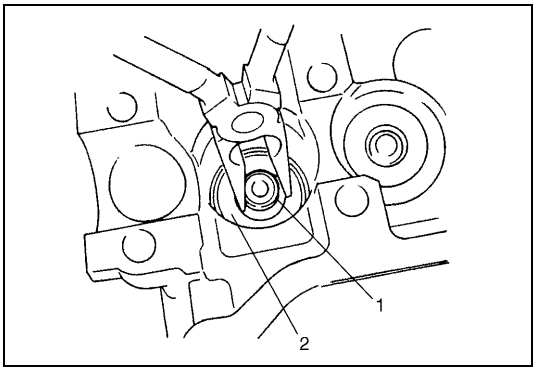
1) For ease in servicing cylinder head, remove intake manifold, injectors and exhaust manifold from cylinder head.



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

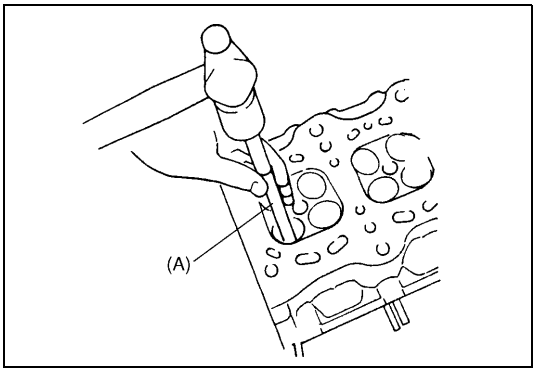
3) Release special tools and remove spring retainer and valve spring.
4) Remove valve from combustion chamber side.



5) Remove valve stem seal (1) from valve guide and then valve spring seat (2).

NOTE:

Do not reuse seal once disassembled. Be sure to use new 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

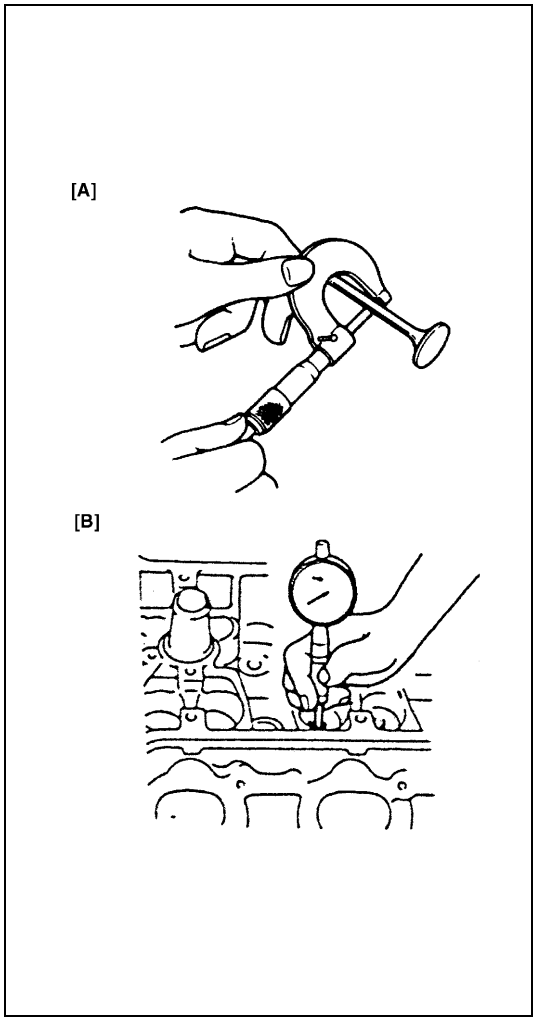
NOTE:

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.

INSPECTION

Valve Guides



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

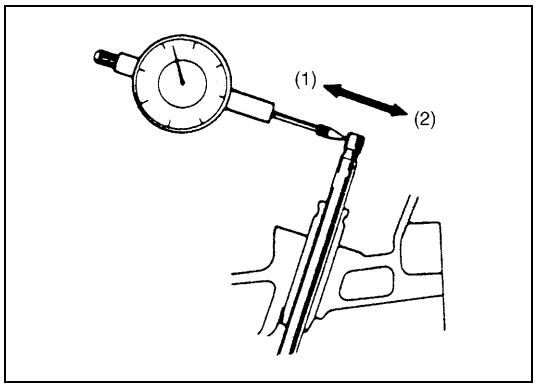
	Standard	Limit
In	**0.020 – 0.047 mm (0.0008 – 0.0019 in.)**	**0.07 mm (0.0028 in.)**
Ex	**0.045 – 0.072 mm (0.0018 – 0.0028 in.)**	**0.09 mm (0.0035 in.)**

Valve stem diameter [A]

	Standard
In	**5.465 – 5.480 mm (0.2152 – 0.2157 in.)**
Ex	**5.440 – 5.455 mm (0.2142 – 0.2148 in.)**

Valve guide bore [B]

	Standard
In and Ex	**5.485 – 5.510 mm (0.2159 – 0.2169 in.)**

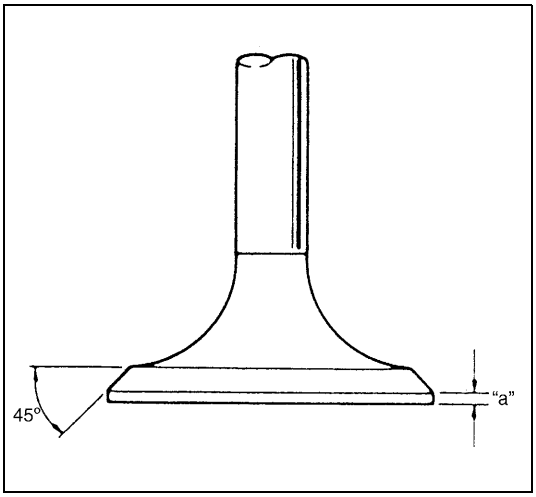


If bore gauge is not available, check end deflection of valve stem with a dial gauge instead.
Move stem end in directions (1) and (2) to measure end deflection.
If deflection exceeds its limit, replace valve stem and valve guide.

Valve stem end deflection limit
In: 0.14 mm (0.006 in.)
Ex: 0.18 mm (0.007 in.)

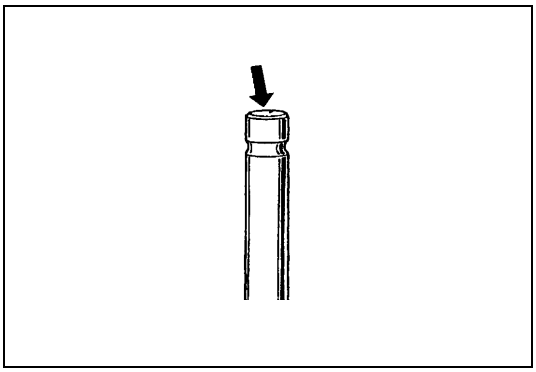
Valves

- Remove all carbon from valves.
- Inspect each valve for wear, burn or distortion at its face and stem end, as necessary, replace it.

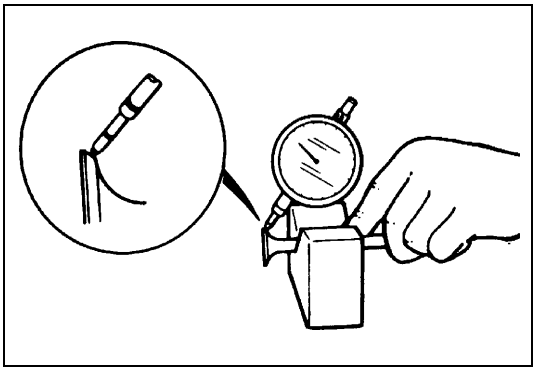


- Measure thickness "a" of valve head. If measured thickness exceeds limit, replace valve.

Valve head thickness "a" (In and Ex)
Standard : 1.22 – 1.55 mm (0.048 – 0.061 in.)
Limit : 0.9 mm (0.035 in.)

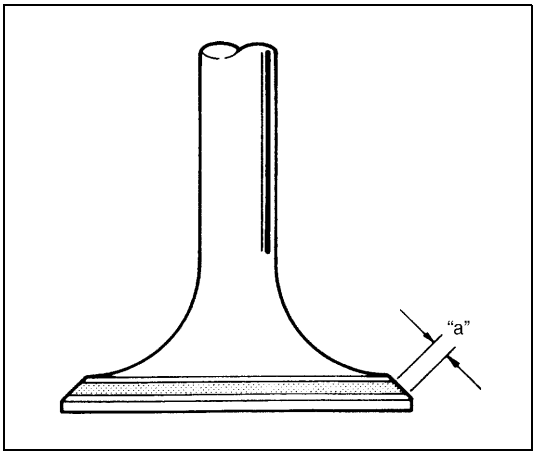


- Inspect valve stem end face for pitting and wear. If pitting or wear is found there, valve stem end may be resurfaced, but not too much to grind off its chamber. When it is worn out too much that its chamber is gone, replace valve.



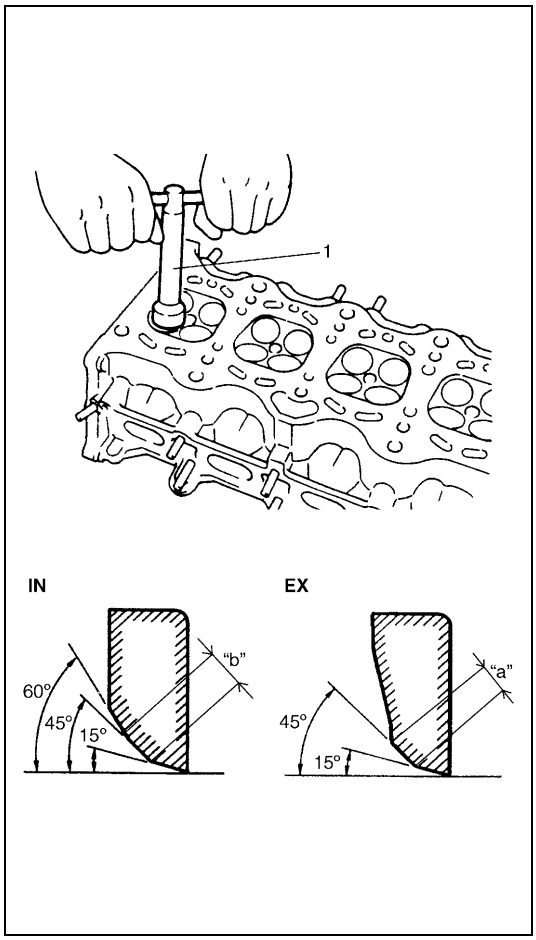
- Check each valve for radial runout with a dial gauge and "V" block. To check runout, rotate valve slowly. If runout exceeds its limit, replace valve.

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 : 1.1 – 1.3 mm (0.0433 – 0.0512 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 15° angle, and the second for making 45° angle. The second cut must be made to produce desired seat width.

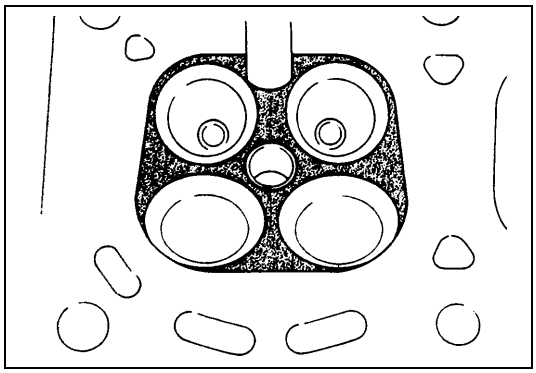
Seat width for exhaust valve seat
"a" : 1.1 – 1.3 mm (0.0433 – 0.0512 in.)

2) INTAKE VALVE SEAT: Use valve seat cutters 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" : 1.1 – 1.3 mm (0.0433 – 0.0512 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.

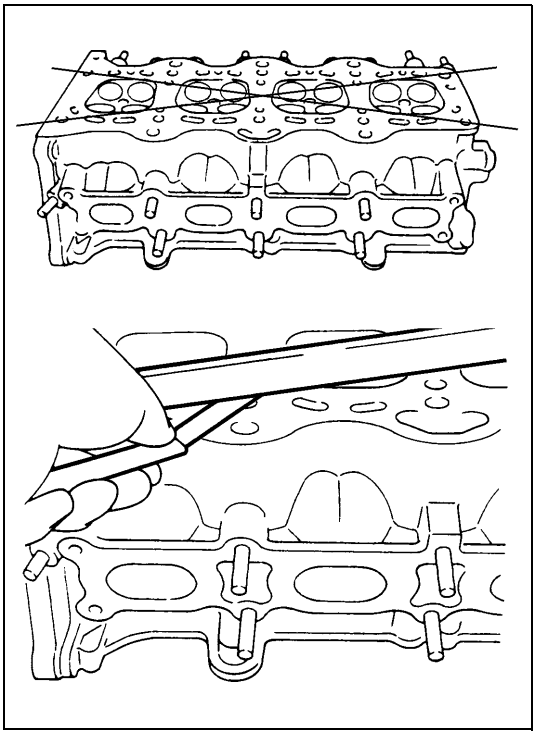
Cylinder Head



- Remove all carbon deposits from combustion chambers.

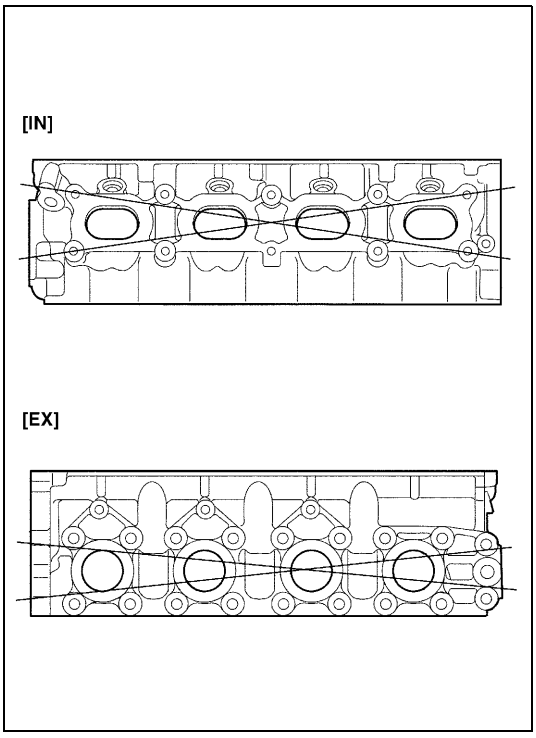
NOTE:

Do not use any sharp-edged tool to scrape off carbon deposits. Be careful not to scuff or nick metal surfaces when decarboning. 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 2 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.

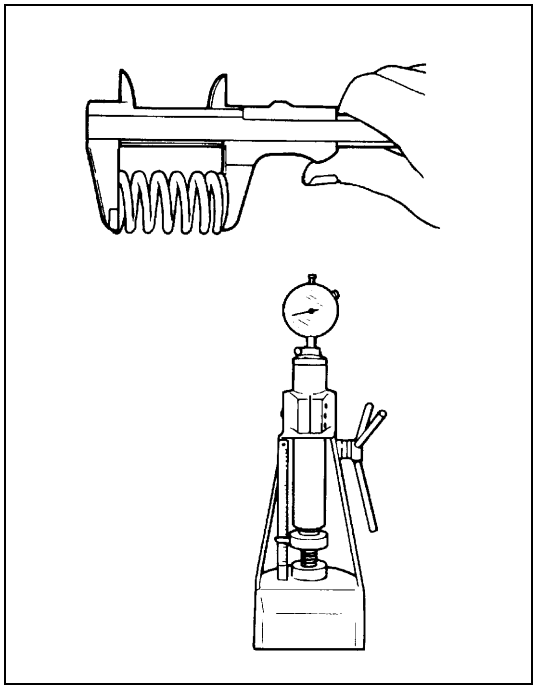
Limit of distortion for surface of cylinder head piston side
0.03 mm (0.001 in.)



- 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 surface of cylinder head intake and exhaust manifolds sides
0.05 mm (0.002 in.)

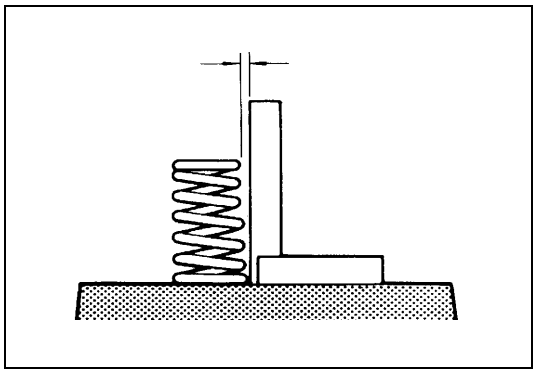
Valve Springs



- 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 (1.410 in.)

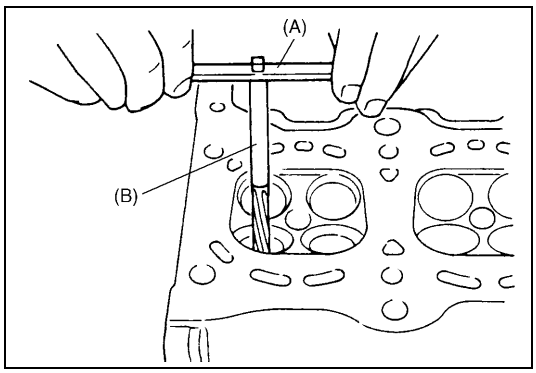
Valve spring preload
Standard : 107 – 125 N (10.7 – 12.5 kg) for 31.5 mm (23.6 – 27.6 lb / 1.240 in.)
Limit : 102 N (10.2 kg) for 31.5 mm (22.9 lb / 1.240 in.)



- Spring skewness:
  Use a square and surface plate to check each spring for skewness 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.

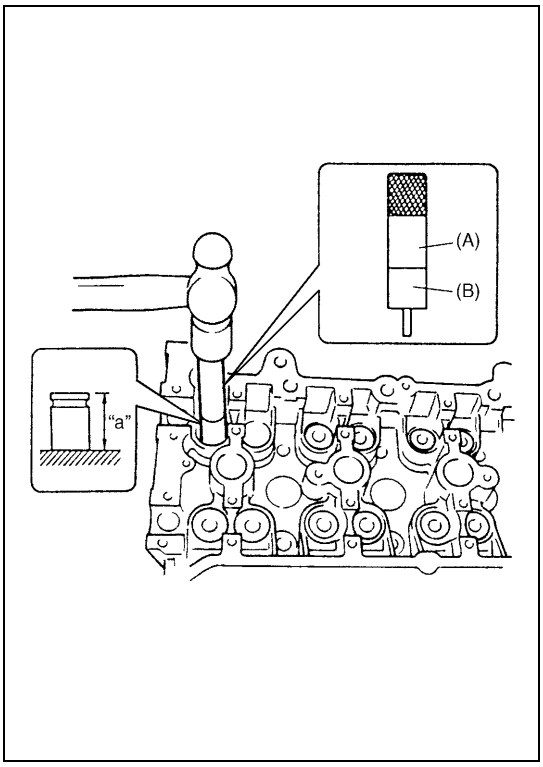
Valve spring skewness
Limit : 1.6 mm (0.063 in.)

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



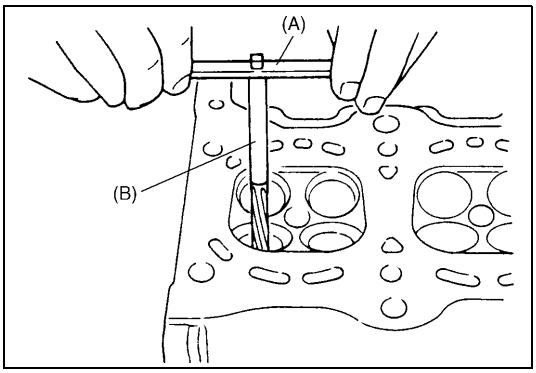
2) Install valve guide to cylinder head.
Heat cylinder head uniformly to a temperature of 80 to 100 °C (176 to 212 °F) so that head will not be distorted, and drive new valve guide into hole with special tools. Drive in new valve guide until special tool (Valve guide installer) contacts cylinder head.
After installing, make sure that valve guide protrudes by specified dimension "a" from cylinder head.

Special tool
(A) : 09916-58210
(B) : 09916-56011

NOTE:

- **Do not reuse once-disassembled valve guide. Make sure to install new valve guide.**
- **Intake and exhaust valve guides are identical.**

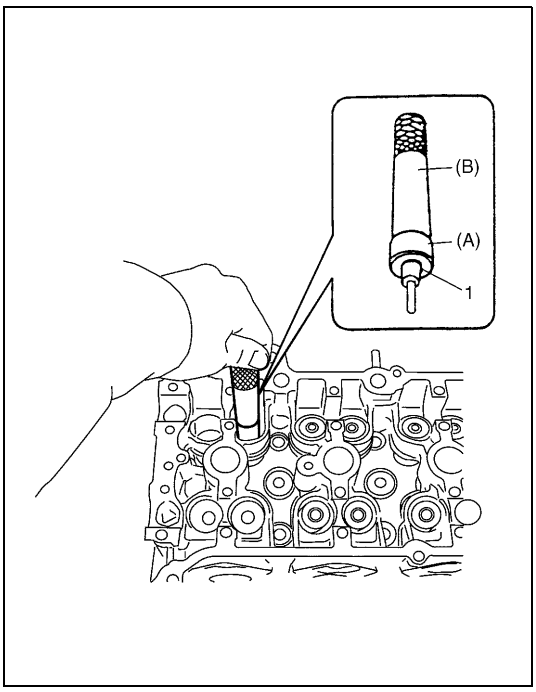
Specification for valve guide protrusion "a"
Intake and exhaust sides
: 11.3 mm (0.44 in.)



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.

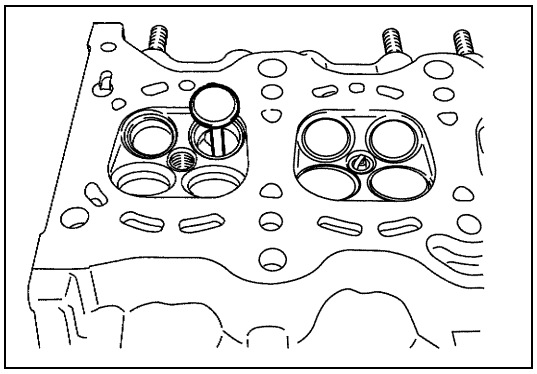


5) Install new valve stem seal (1) to valve guide.
After applying engine oil to seal and spindle of special tool (Valve guide installer handle), fit oil seal to spindle, and then install seal to valve guide by pushing special tool by hand.
After installing, check to be sure that seal is properly fixed to valve guide.

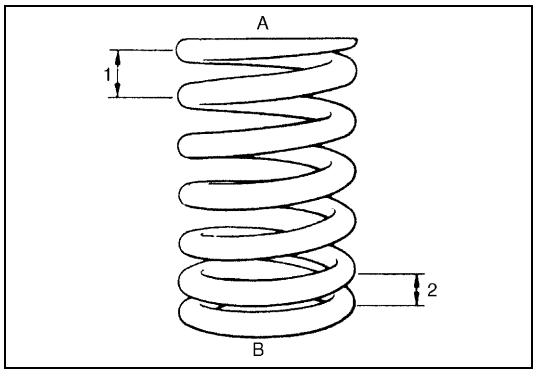
Special tool
(A) : 09917-98221
(B) : 09916-58210

NOTE:

- **Do not reuse once-disassembled seal. Be sure to install new seal.**
- **When installing, do not 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.**

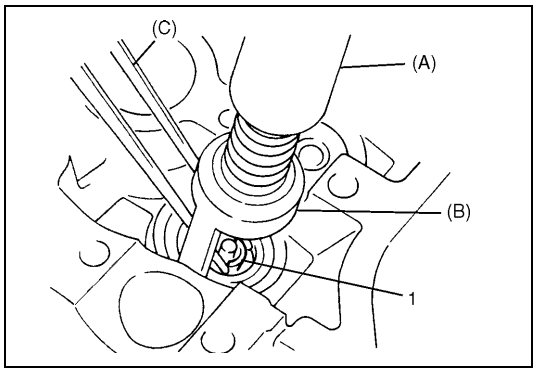


6) Install valve to valve guide
   Before installing valve to valve guide, apply engine oil to stem seal, valve guide bore and valve stem.



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

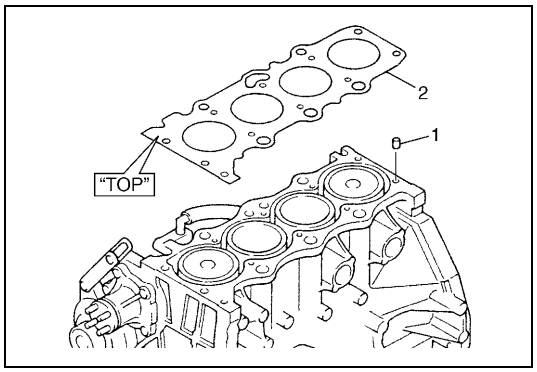
NOTE:

When compressing the valve spring, do not damage inside face of tappet installing hole.

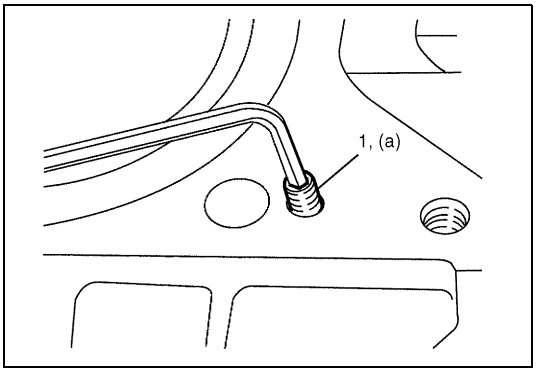
9) Install intake manifold, injectors and exhaust manifold to cylinder head.

INSTALLATION

1) Clean mating surface of cylinder head and cylinder block. Remove oil, old gasket and dust from mating surface.



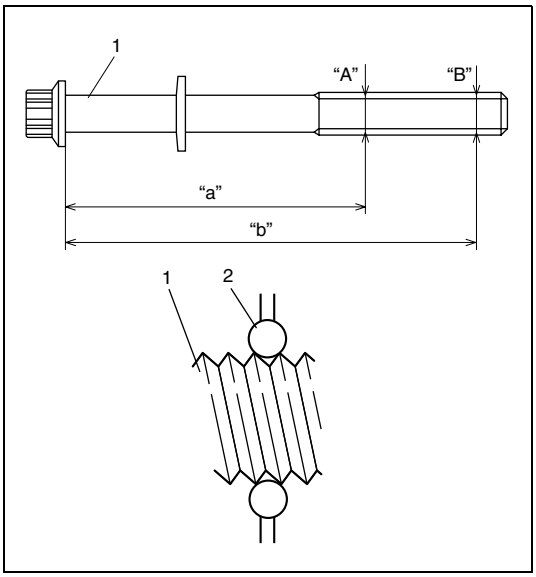
2) Install knock pins (1) to cylinder block.
3) Install new cylinder head gasket (2) to cylinder block."TOP" mark provided on gasket comes to crankshaft pulley side, facing up (toward cylinder head side).



4) Make sure that oil jet (venturi plug) (1) is installed and if it is, that it is not clogged.
   When installing it, be sure to tighten to 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 cylinder head bolts and tighten them gradually as follows.

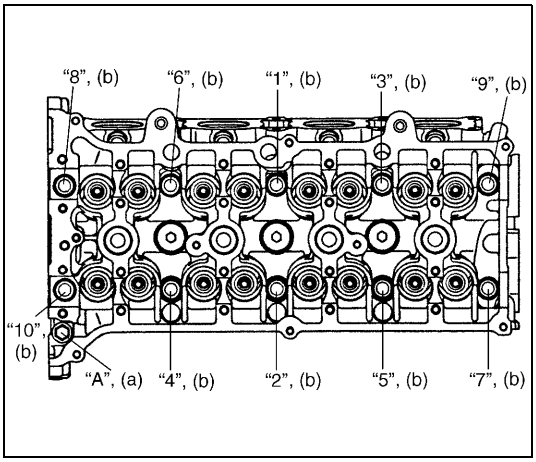


NOTE:

If cylinder head bolts are reused, check thread diameters of them for deformation according to the following and replace them with new ones if thread diameter difference exceeds limit.
Measure each thread diameter of cylinder head bolt (1) at "A" on 83.5 mm (2.81 in.) from seat side of flange bolt and "B" on 115 mm (4.53 in.) 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" : 83.5 mm (2.81 in.)
"b" : 115 mm (4.53 in.)

Cylinder head bolt diameter difference (deformation)
Limit ("A" – "B") : 0.1 mm (0.004 in.)



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) Retighten all bolts 60° according to numerical order in figure.
d) Repeat Step c).
e) Tighten bolt "A" to specified torque.

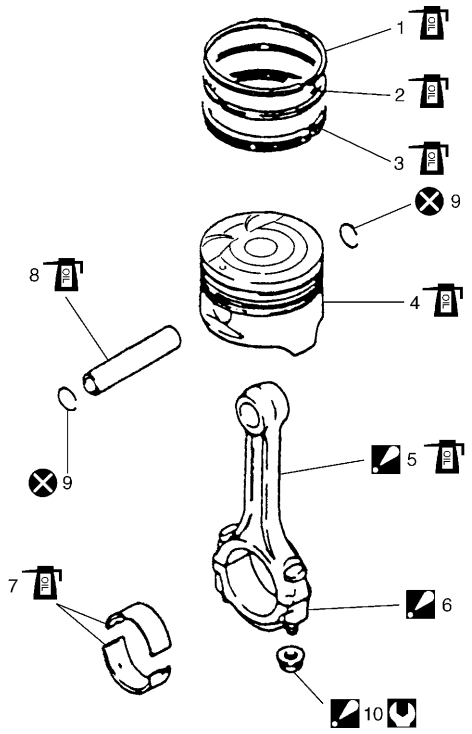
NOTE:

Be sure to tighten M8 bolt ("A") after securing the other bolt.

Tightening torque
Cylinder head bolt for M8 (a) : 22 N·m (2.2 kg-m, 16.0 lb-ft)
Cylinder head bolts for M10
(b) : 40 N·m (4.0 kg-m, 29.0 lb-ft) and extra tightening 60° twice

6) Install exhaust manifold stiffener and exhaust pipe referring to “Exhaust Manifold” in this section.
7) Install camshafts, timing chain and chain cover referring to “Camshaft, Tappet and Shim”, “Timing Chain and Chain Tensioner” and “Timing Chain Cover” in this section.
8) Install cylinder head cover and oil pan referring to “Cylinder Head Cover” and “Oil Pan and Oil Pump Strainer” in this section.
9) Install intake manifold stiffener and connect each hoses and electric lead wires securely.
10) Install air cleaner outlet hoses.
11) Install radiator with cooling fan and connect A/T fluid hoses (vehicle with A/T), radiator inlet and outlet hoses referring to “Water Pump Belt and Cooling Fan” and “Radiator” in Section 6B.
12) Adjust generator belt tension referring to “Water Pump Belt Tension” in Section 6B.
13) Adjust A/C compressor and/or P/S pump belt tension (if equipped) referring to “Compressor Drive Belt” in Section 1B or “Power Steering Belt” in Section 3B1.
14) Adjust accelerator cable play referring to “Accelerator Cable Adjustment” in Section 6E.
15) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
16) Refill cooling system with coolant, engine with engine oil and A/T with specified A/T fluid (vehicle with A/T).
17) Connect negative cable at battery.
18) Verify that there is no fuel leakage, coolant leakage, oil leakage, A/T fluid leakage (vehicle with A/T) and exhaust gas leakage at each connection.

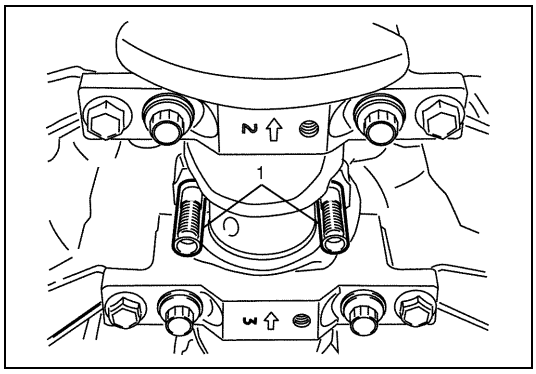
Pistons, Piston Rings, Connecting Rods and Cylinders



	1. Top ring		8. Piston pin
	2. 2nd ring		9. Piston pin circlip
	3. Oil ring		10. Bearing cap nut 1) Tighten all nuts to 15 N·m (1.5 kg-m) 2) Turn all nuts to 45° 3) Then, turn all nuts to 45° once again
	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.
	7. Connecting rod bearing		

REMOVAL

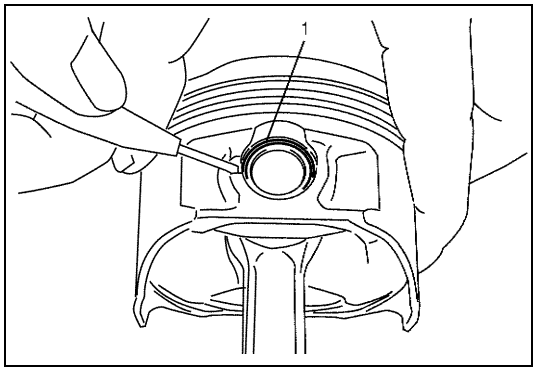
1) Relieve fuel pressure referring to “Fuel Pressure Relief Procedure” in Section 6.
2) Disconnect negative cable at battery.
3) Drain engine oil.
4) Drain coolant.
5) Remove cylinder head referring to “Valves and Cylinder Head” in this section.
6) Mark cylinder number on all pistons, connecting rods and connecting rod caps using silver pencil or quick drying paint.
7) Remove rod bearing caps.



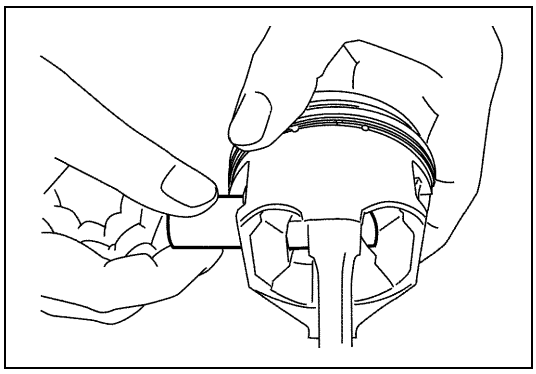
8) Install guide hose (1) over threads of rod bolts.
   This prevents damage to bearing journal and rod bolt threads when removing connecting rod.
9) Decarbon top of cylinder bore before removing piston from cylinder.
10) Push piston and connecting rod assembly out through the top of cylinder bore.

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.



- Ease out piston pin circlips (1), as shown.



- Force piston pin out.

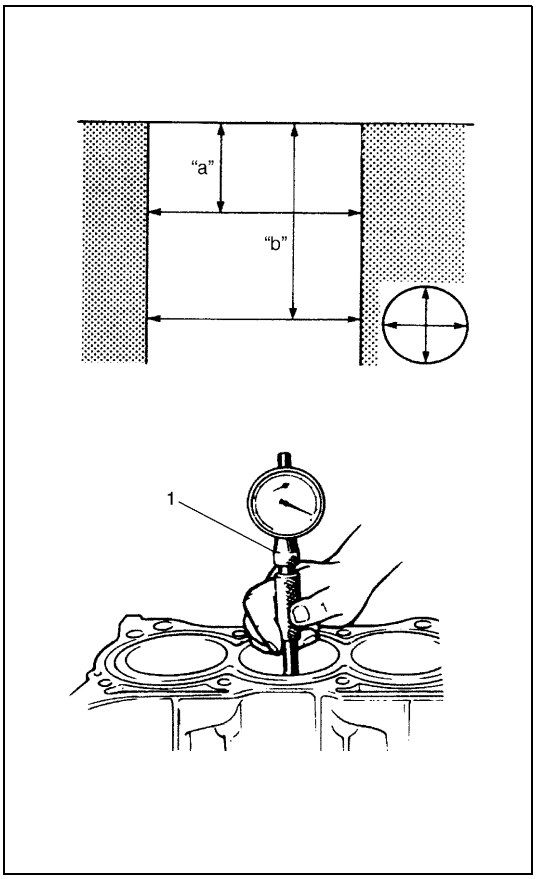
CLEANING

Decarbon piston head and ring grooves, using a suitable tool.

INSPECTION

Cylinder

- 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.



- 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.

Limit on cylinder bore diameter
78.114 mm (3.073 in.)

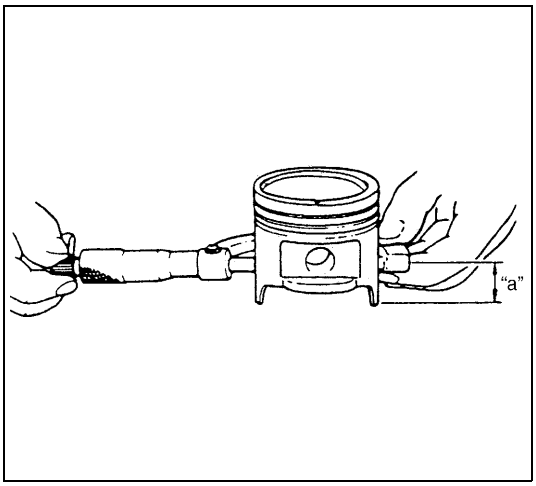
Limit on taper and out-of-round for cylinder
0.10 mm (0.004 in.)

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.

"a" : 50 mm (1.96 in.)
"b" : 95 mm (3.74 in.)

Pistons

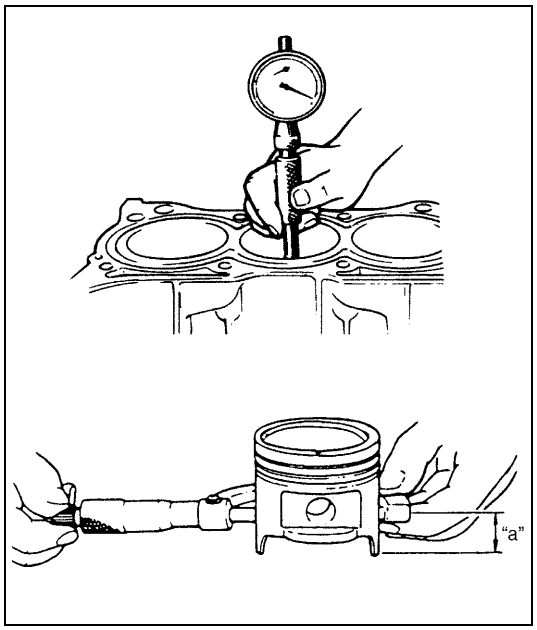


- Inspect piston for faults, cracks or other damaged.
  Damaged or faulty piston should be replaced.
- Piston diameter:
  As indicated in figure, piston diameter should be measured at a position 19.5 mm (0.77 in.) from piston skirt end in the direction perpendicular to piston pin.

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.)



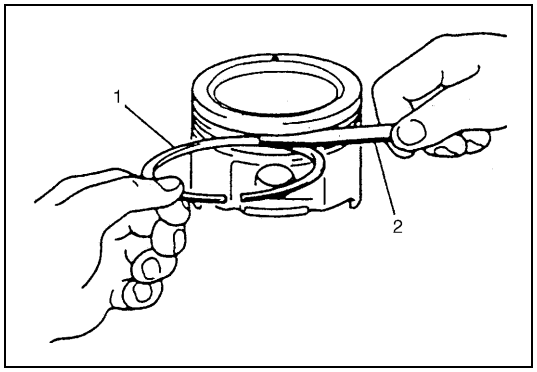
- Piston clearance:
  Measure cylinder bore diameter and piston diameter to find their difference which is piston clearance. Piston clearance should be within specification as given below. If it is out of specification, rebore cylinder and use oversize piston.

Piston clearance
Standard : 0.032 – 0.061 mm (0.0013 – 0.0024 in.)
Limit : 0.161 mm (0.0063 in.)

NOTE:

Cylinder bore diameters used here are measured in thrust direction at two positions.

"a" : 19.5 mm (0.77 in.)

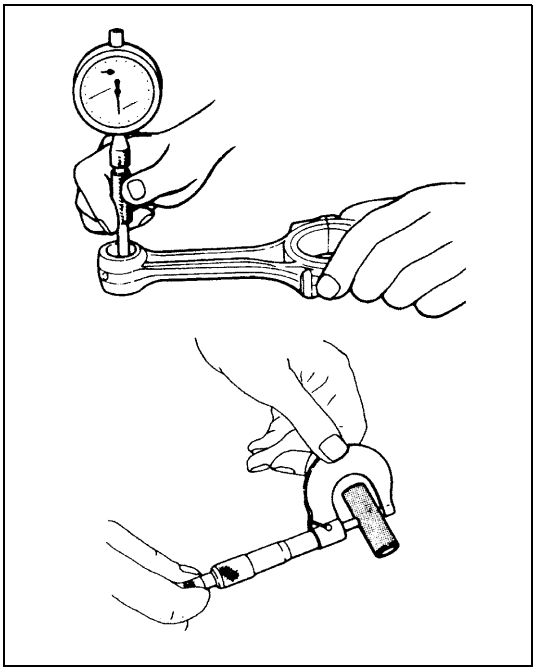


- Ring groove clearance:
  Before checking, piston grooves must be clean, dry and free of carbon deposits.
  Fit new piston ring (1) into piston groove, and measure clearance between ring and ring land by using thickness gauge (2).
  If clearance is out of limit, replace piston.

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

- 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
0.003 – 0.014 mm (0.0001 – 0.0006 in.)

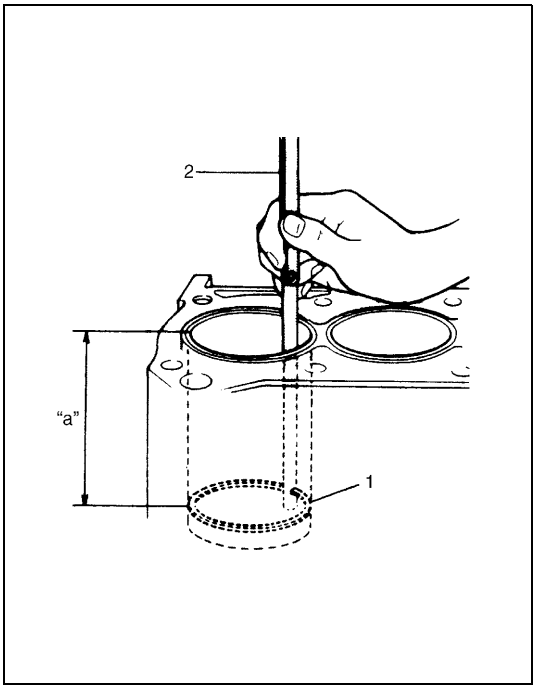
Piston pin clearance in piston
0.006 – 0.017 mm (0.00024 – 0.00067 in.)

Small-end bore for connecting rod
20.003 – 20.011 mm (0.7875 – 0.7878 in.)

Piston pin diameter
19.997 – 20.000 mm (0.7873 – 0.7874 in.)

Piston bore
20.006 – 20.014 mm (0.7876 – 0.7880 in.)

Piston Rings



To measure end gap, insert piston ring (1) into cylinder bore and then measure the gap by using thickness gauge (2).
If measured gap is out of specification, replace ring.

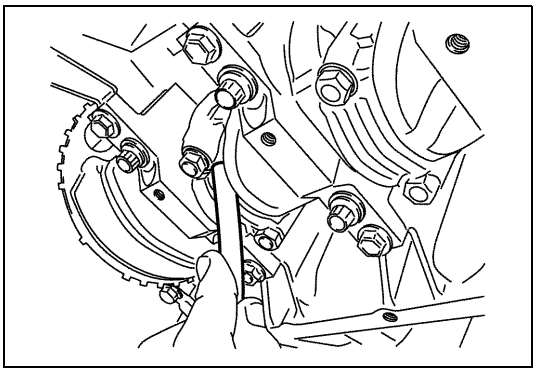
NOTE:
Decarbon and clean top of cylinder bore before inserting piston ring.

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 (0.0039 in.)
Oil ring	0.20 – 0.70 mm (0.0079 – 0.0276 in.)	1.5 mm (0.059 in.)

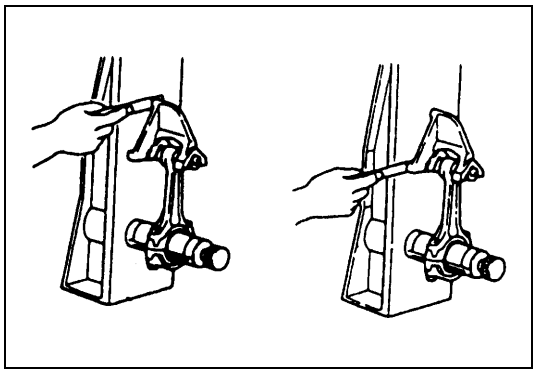
"a" : 120 mm (4.72 in.)

Connecting Rod



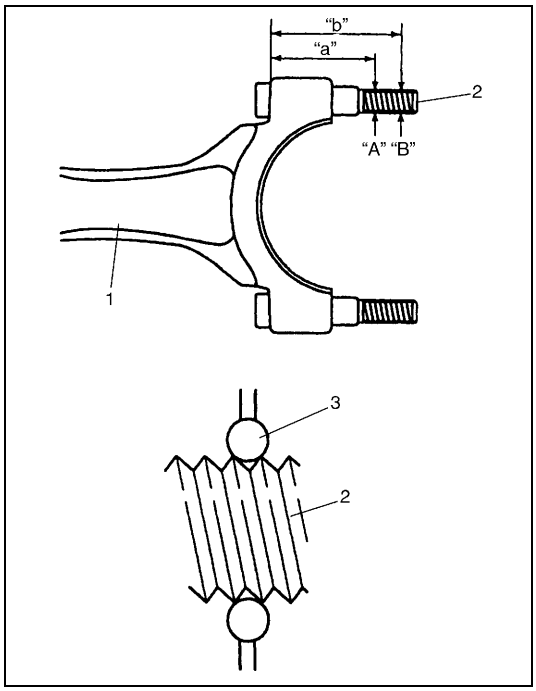
- Big-end side clearance:
  Check big-end of connecting rod for side clearance, with rod fitted and connected to its crank pin in the normal manner. If measured clearance is found to exceed its limit, replace connecting rod.

Side clearance for connecting rod big-end
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 limit is exceeded, replace it.

Connecting rod alignment
Limit on bow : 0.05 mm (0.0020 in.)
Limit on twist : 0.10 mm (0.0039 in.)

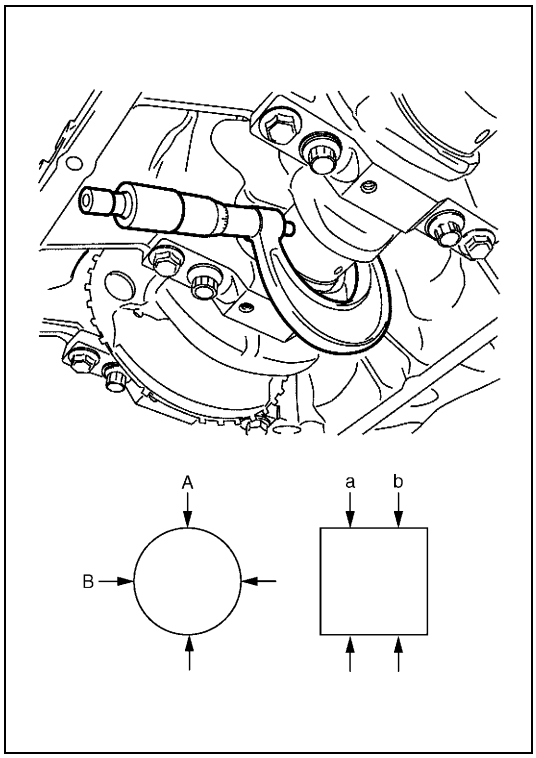


- Connecting rod bolt diameter (Plastic deformation tightening bolt)
  Measure connecting rod (1) bolt (2) for diameter "A" on 32 mm (1.25 in.) from bolt mounting surface and diameter "B" on 40 mm (1.57 in.) from bolt mounting surface by using a micrometer (3).
  Calculate difference in diameters ("A" – "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

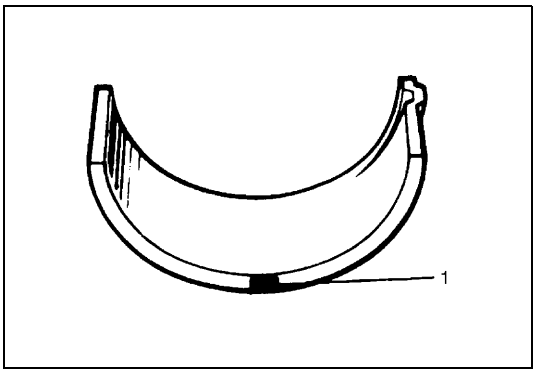


- Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged or out-of-round or taper is out of limit, replace crankshaft or regrind crank pin to undersize and use undersize bearing.

Crank pin diameter

Connecting rod bearing size	Crank pin diameter
Standard	41.982 – 42.000 mm (1.6528 – 1.6535 in.)
0.25 mm (0.0098 in.) undersize	41.732 – 41.750 mm (1.6430 – 1.6437 in.)

Out-of-round : A – B
Taper : a – b
Crank pin taper and out-of-round
Limit : 0.01 mm (0.0004 in.)

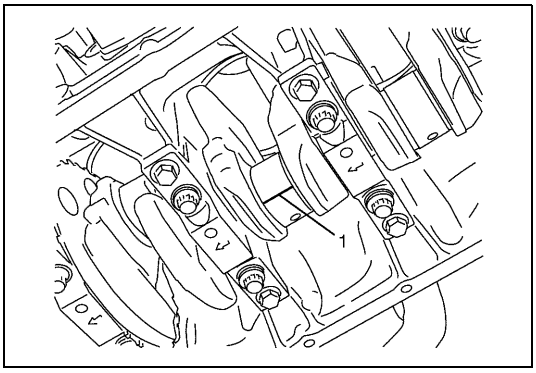


- Rod bearing :
  Inspect bearing shells for signs of fusion, pitting, burn or flaking and observe contact pattern. Bearing shells found in defective condition must be replaced.
  Two kinds of rod bearing are available; standard size bearing and 0.25 mm (0.0098 in.) undersize bearing. For identification 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.

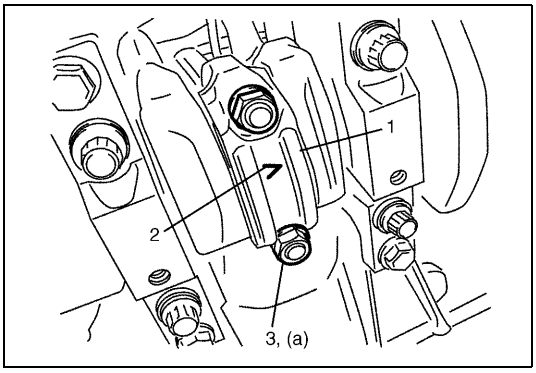
1. Red paint

- Rod bearing clearance:

1) Before checking bearing clearance, clean bearing and crank pin.
2) Install bearing in connecting rod and bearing cap.

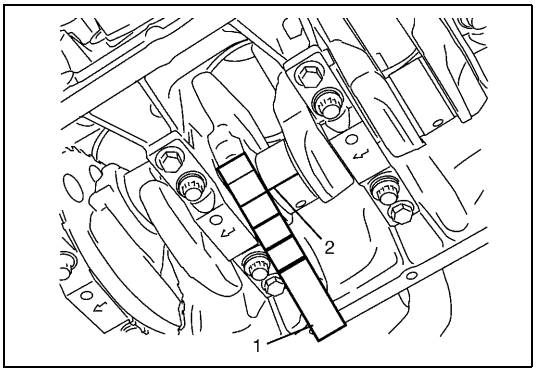


3) Place a piece of gauging plastic (1) to full width of crank pin as contacted by bearing (parallel to crankshaft), avoiding oil hole.



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).

Tightening torque
Connecting rod bearing cap nuts
(a) : 15 N·m (1.5 kg-m, 11.0 lb-ft) and extra tightening 45° twice



5) Remove cap and using a scale (1) on gauging plastic (2) envelope, measure gauging plastic width at the widest point (clearance).
   If clearance exceeds its limit, use a new standard size bearing and remeasure clearance.

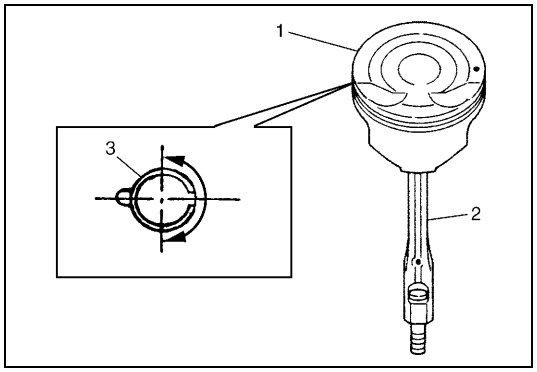
Connecting rod bearing clearance
Standard : 0.029 – 0.047 mm (0.0011 – 0.0019 in.)
Limit : 0.065 mm (0.0026 in.)

6) If clearance can not be brought to within its limit even by using a new standard size bearing, regrind crankpin to undersize and use 0.25 mm undersize bearing.

NOTE:

After checking the rod bearing clearance, make sure to check connecting rod bolt diameter.
Refer to "Inspection" of "Connecting Rod".

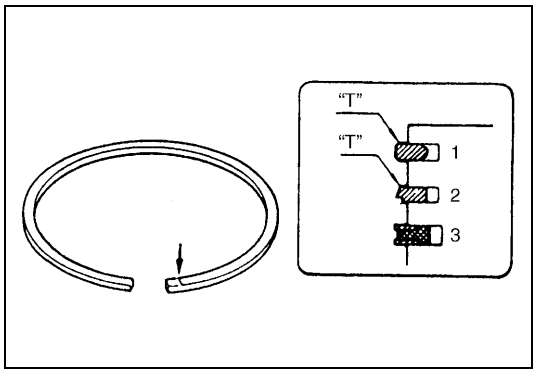
ASSEMBLY



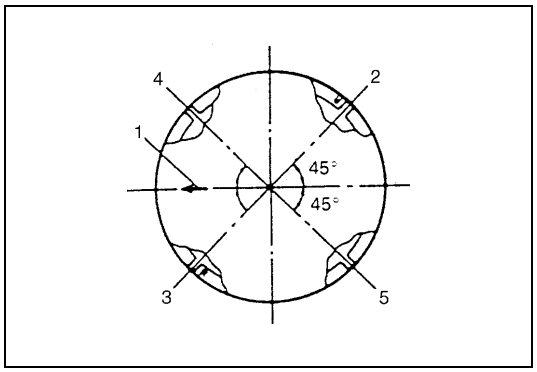
1) Install piston pin to piston (1) and connecting rod (2):
   a) After applying engine oil to piston pin and piston pin holes in piston and connecting rod.
   b) Fit connecting rod as shown in figure.
   c) Insert piston pin to piston and connecting rod.
   d) Install piston pin circlips (3).

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.



2) 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.



3) After installing three rings (1st, 2nd and oil rings), distribute their end gaps as shown in figure.

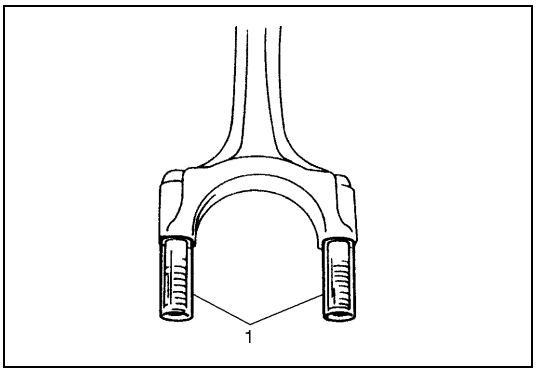
1. Arrow mark
2. 1st ring end gap
3. 2nd ring end gap and oil ring spacer gap
4. Oil ring upper rail gap
5. Oil ring lower rail gap

INSTALLATION

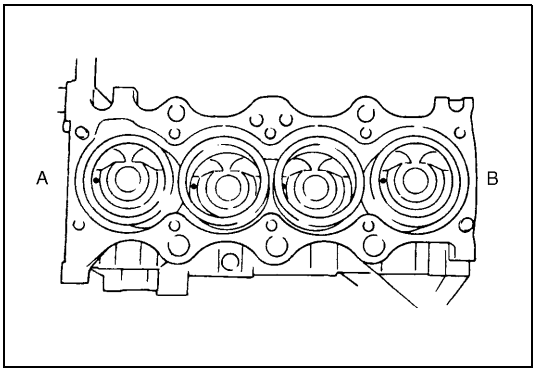
1) Apply engine oil to pistons, rings, cylinder walls, connecting rod bearings and crankpins.

NOTE:

Do not apply oil between connecting rod and bearing or between bearing cap and bearing.

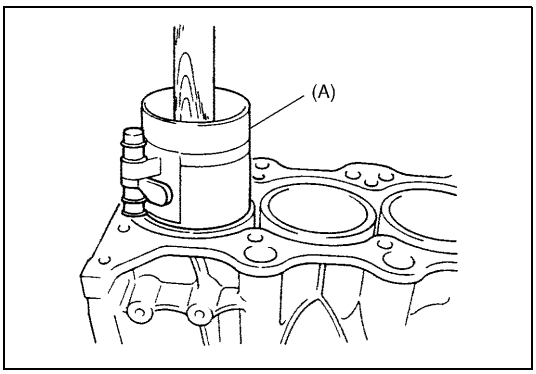


2) Install guide hoses (1) over connecting rod bolts.
These guide hoses protect crank pin and threads of rod bolt from damage during installation of connecting rod and piston assembly.



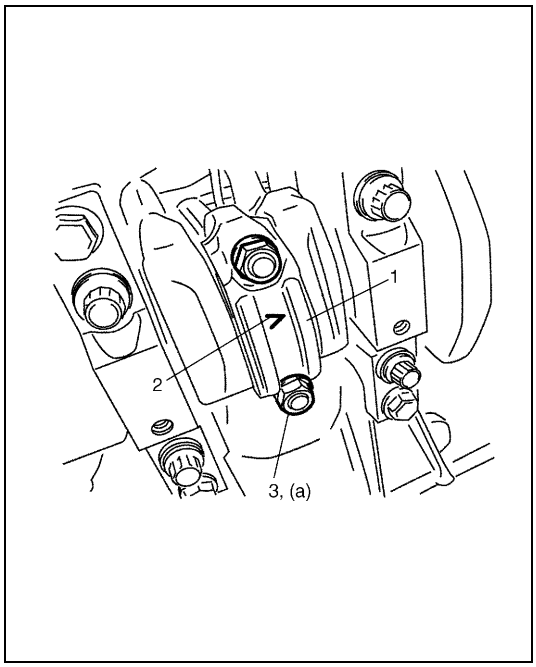
3) When installing piston and connecting rod assembly into cylinder bore, point front mark on piston head to crankshaft pulley side.

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.

NOTE:

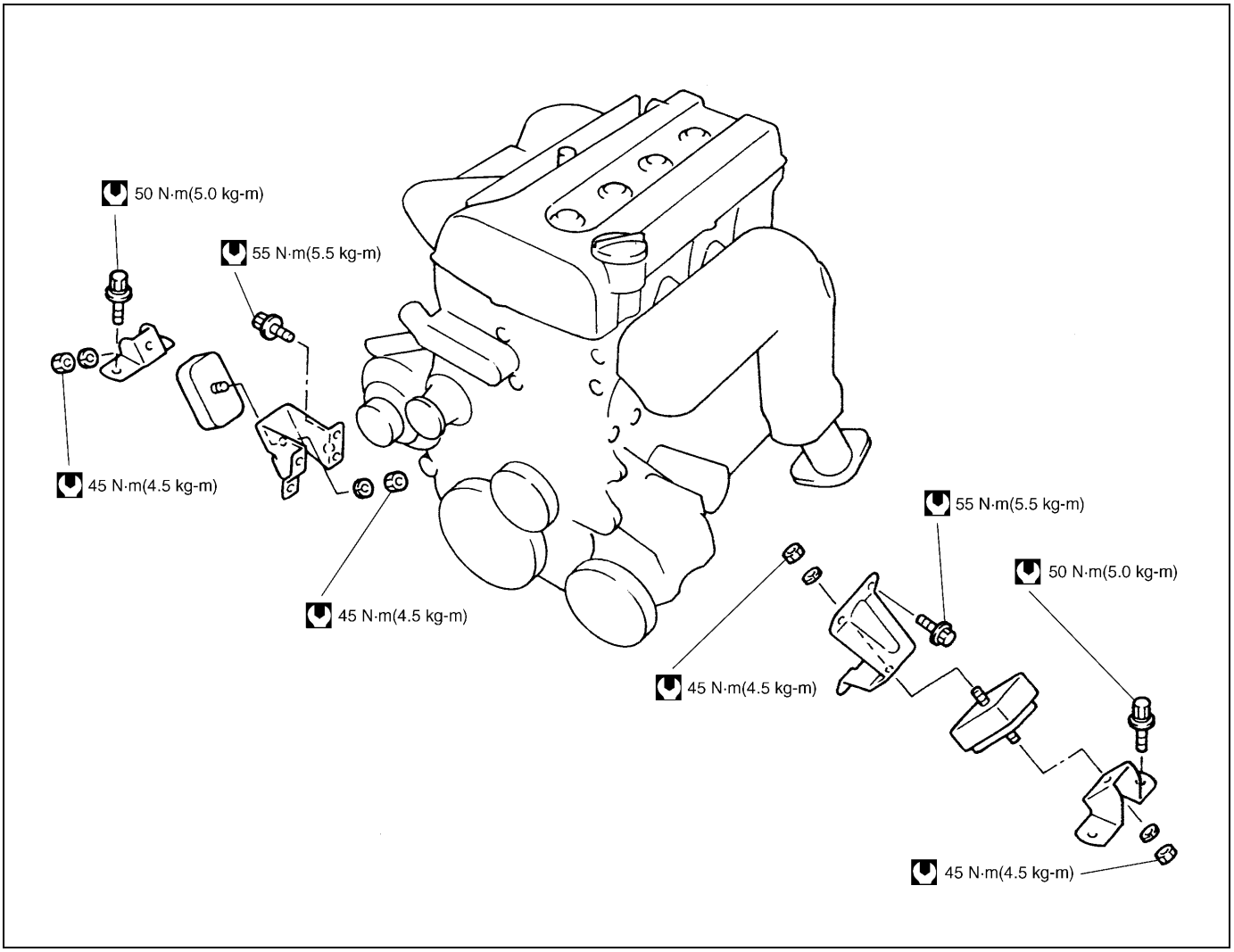
Before installing bearing cap, make sure to check connecting rod bolt diameter.
Refer to "Inspection" of "Connecting Rod" in this section.

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).

Tightening torque
Connecting rod bearing cap nuts
(a) : 15 N·m (1.5 kg-m, 11.0 lb-ft) and extra tightening 45° twice.

6) Reverse removal procedure for installation as previously outlined.
7) Adjust generator belt tension referring to "Water Pump Belt Tension" in Section 6B.
8) Adjust A/C compressor and/or P/S pump belt tension (if equipped) referring to "Compressor Drive Belt" in Section 1B or "Power Steering Belt" in Section 3B1.
9) Adjust accelerator cable play referring to "Accelerator Cable Adjustment" in Section 6E.
10) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
11) Refill cooling system with coolant engine with engine oil and A/T with specified A/T fluid (vehicle with A/T).
12) Connect negative cable at battery.
13) Verify that there is no fuel leakage, coolant leakage, oil leakage, A/T fluid leakage (vehicle with A/T) and exhaust gas leakage at each connection.

Engine Mountings



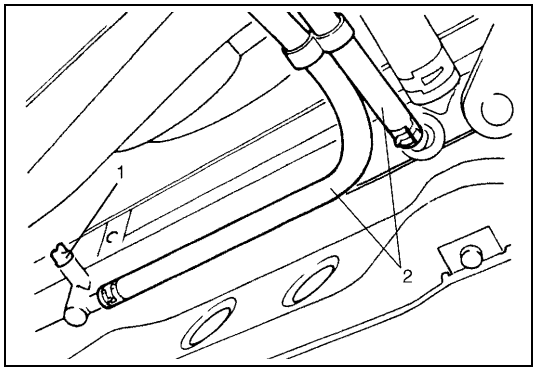
Tightening torque

Unit Repair Overhaul

Engine Assembly

REMOVAL

1) Relieve fuel pressure referring to “Fuel Pressure Relief Procedure” in Section 6.
2) Disconnect negative cable at battery.
3) Remove engine hood after disconnecting windshield washer hose.
4) Remove A/C compressor and/or P/S pump belt (if equipped).
5) Remove generator belt.
6) Drain engine oil.

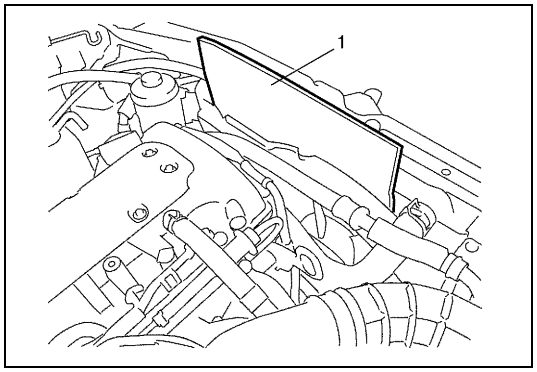


7) Drain coolant.

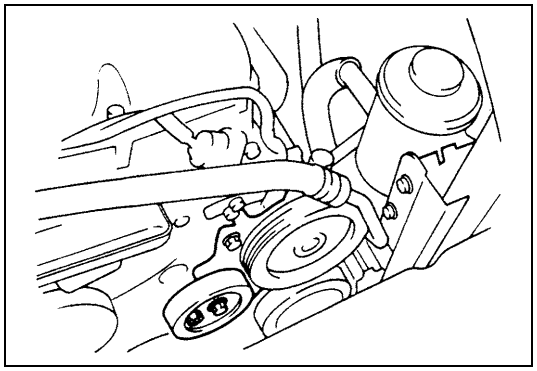
WARNING:

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.

8) Disconnect radiator inlet and outlet hoses from each pipe.
9) Disconnect A/T fluid hoses (2) (vehicle with A/T) and release its clamps. Place some container under radiator to receive A/T fluid which will flow out when hose is disconnected.



10) Remove fan shroud upper bolts and install board (1) or the like. This prevents damage to radiator fins when removing and installing radiator.
11) Remove radiator with cooling fan referring to Section 6B. Then remove water pump pulley.



12) With hose connected, detach P/S pump from its bracket (if equipped) referring to “Power Steering Pump” in Section 3B1.

NOTE:

Suspend removed P/S pump at a place where no damage will be caused during removal and installation of engine assembly.

13) If vehicle equipped with A/C compressor, work of right hand steering vehicle differs from its of left hand steering vehicle. Each work is as follows.

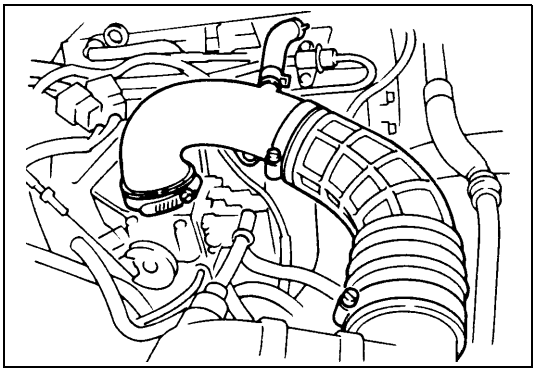
a) For right hand steering vehicle:
With hose connected, detach A/C compressor from its bracket.

NOTE:

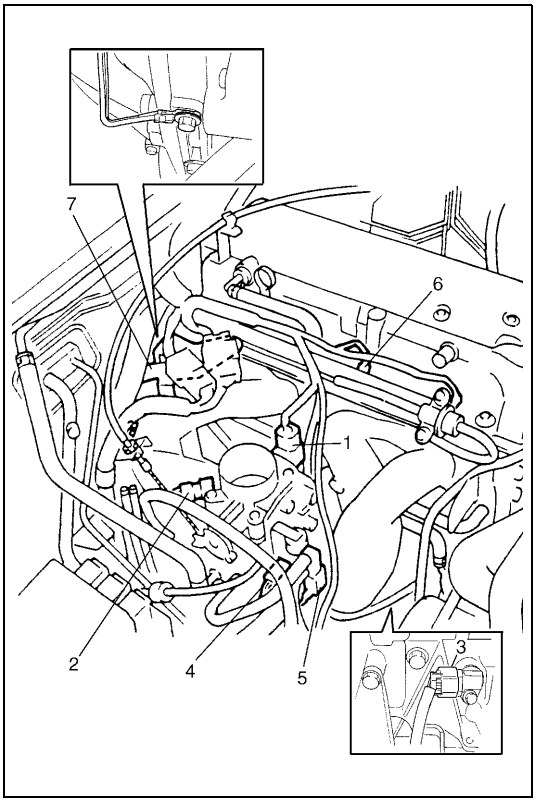
Suspend removed A/C compressor at a place where no damage will be caused during removal and installation of engine assembly.

b) For left hand steering vehicle:
i) Recover refrigerant from refrigeration system using recovery and recycling equipment.
ii) Disconnect magnet clutch lead wire.
iii) Remove suction pipe and disconnect discharge pipe from A/C compressor.
iv) Remove A/C compressor from its bracket.

When servicing above steps, refer to “Compressor” in Section 1B.



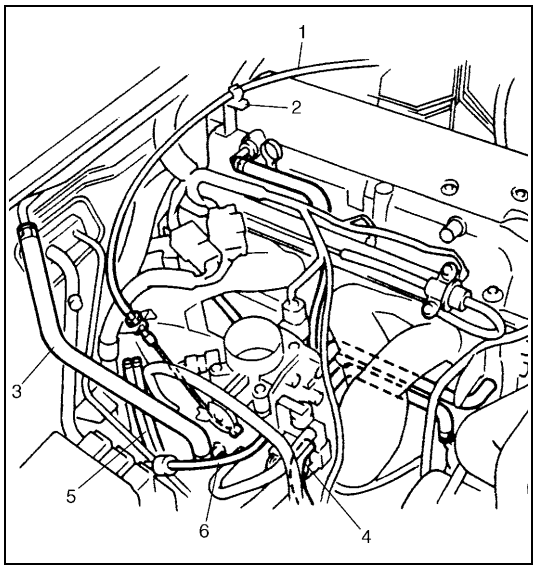
14) Remove air cleaner outlet No.1 and No.2 hoses.



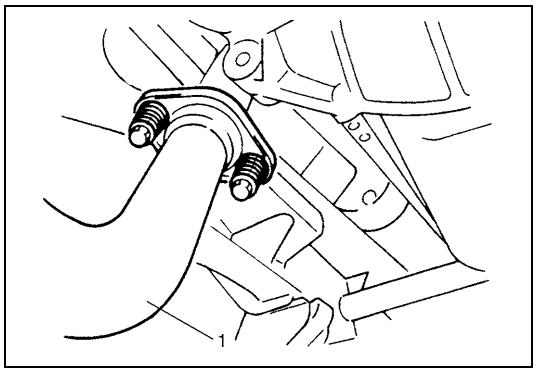
15) Disconnect the following electric lead wires:
- TP sensor (1)
- MAP sensor (2)
- CKP sensor (if equipped) (3)
- CMP sensor
- ECT sensor
- Heated oxygen sensor
- EGR valve (if equipped)
- IAC valve (4)
- EVAP canister purge valve (5)
- Injectors (6)
- Ignition coils
- Generator
- Starting motor
- Oil pressure switch
- Ground terminal from intake manifold and cylinder block
- Each wire harness clamps

16) Remove intake manifold bracket (7) with main harness from intake manifold.
17) Remove starting motor referring to “Dismounting” in Section 6G.

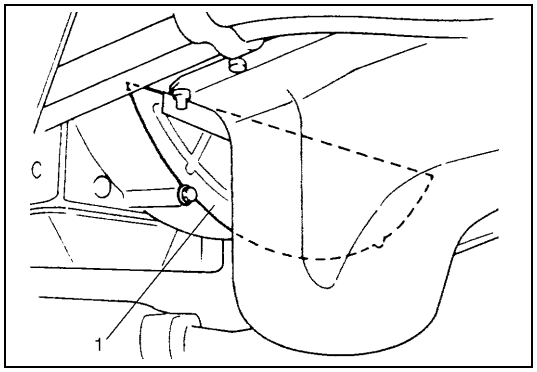
18) Remove heated oxygen sensor bracket from cylinder head and detach No.1 heated oxygen sensor coupler from its bracket.



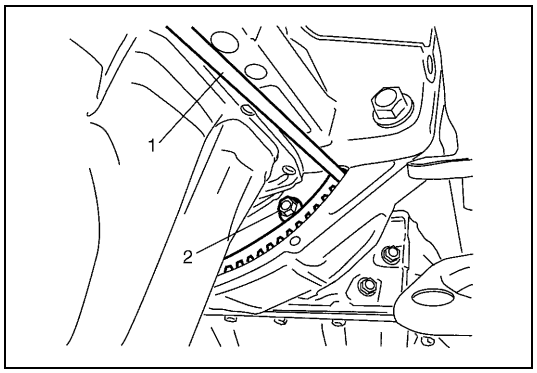
19) Release accelerator cable (1) from clamp (2) (for left hand steering vehicle only) and disconnect accelerator cable from throttle body.
20) Remove canister purge hose bracket from intake manifold.
21) Disconnect the following hoses:
    - Brake booster hose (3) from intake manifold
    - Canister purge hose (4) from EVAP canister purge valve
    - Fuel feed and return hoses (5) from each pipe
    - Heater inlet and outlet hoses from each pipe
    - Vacuum hose (6) (to check valve)



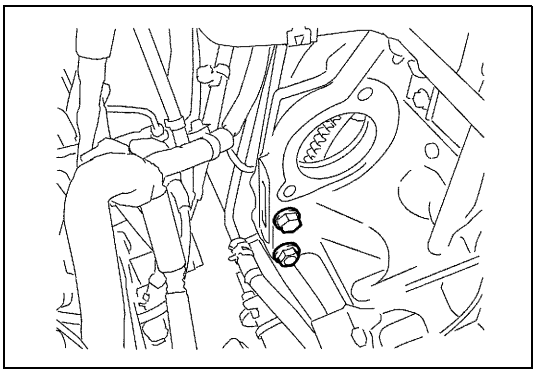
22) Disconnect exhaust pipe (1) from exhaust manifold.



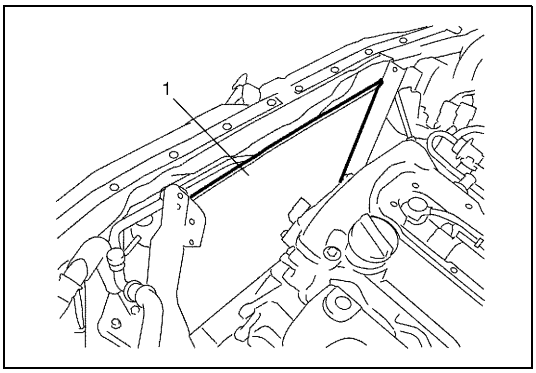
23) Remove clutch housing (torque converter housing for A/T) lower plate (1).



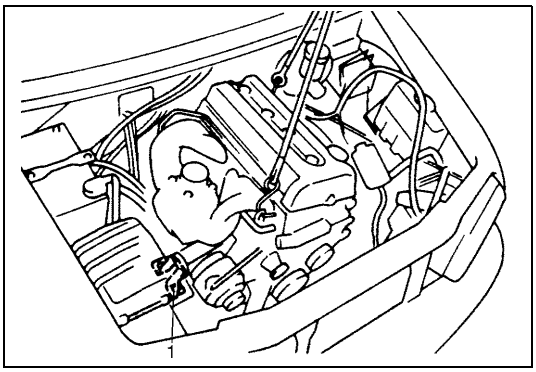
24) With drive plate locked by using a proper size rod (1) or the like, remove torque converter bolts (2) (vehicle with A/T).
25) Support transmission. For A/T vehicle, do not jack under A/T oil pan to support transmission.



26) Remove bolts and nuts fastening cylinder block and transmission.

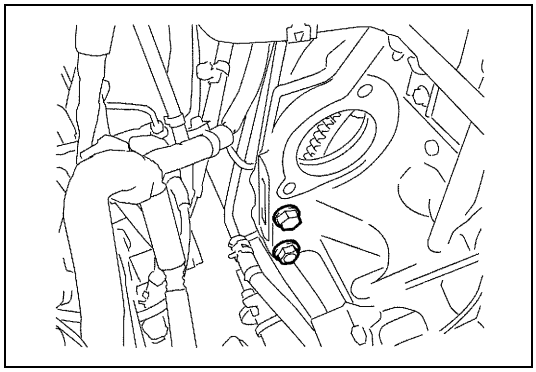


27) Install board (1) or the like on A/C condenser. This prevents damage to condenser fins when lifting and lowering engine assembly.

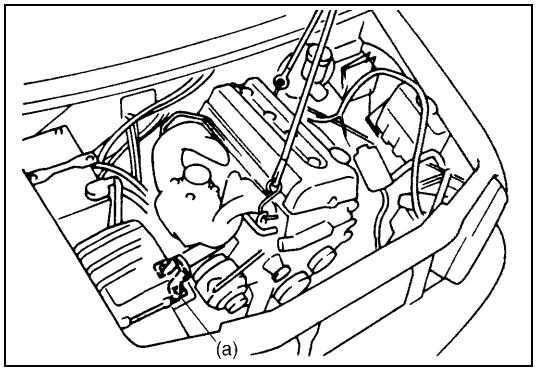


28) Install lifting device.
29) Remove right and left engine mounting bracket bolts (1).
30) Before lifting engine, check to ensure all hoses, electric wires and cables are disconnected from engine.
31) Remove engine assembly from chassis and transmission by lifting a little, sliding toward front side, and then carefully hoist engine assembly.

INSTALLATION

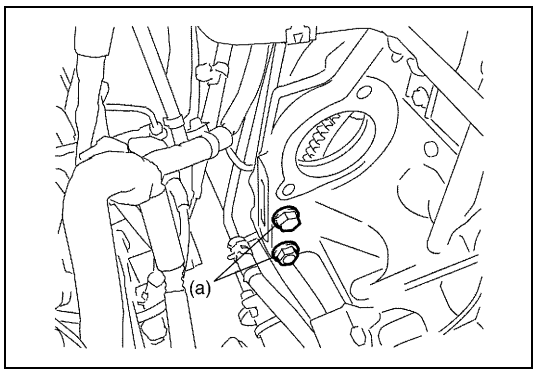


1) Lower engine assembly into engine compartment.
   Connect engine to transmission.
   Hard-tighten bolts and nuts fastening cylinder block and transmission.



2) Tighten right and left engine mounting bracket bolts to specified torque.

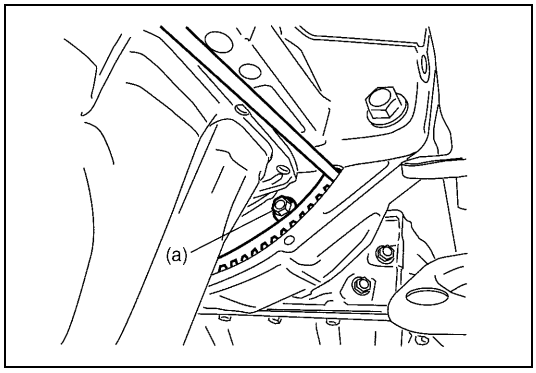
Tightening torque
Engine mounting bracket bolts
(a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)



3) Tighten bolts and nuts fastening cylinder block and transmission to specified torque.

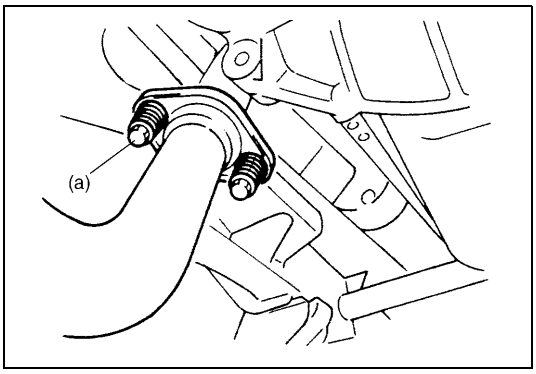
Tightening torque
Vehicle with M/T
Cylinder block and transmission fastening bolts and nuts
(a) : 94 N·m (9.4 kg-m, 68.0 lb-ft)
Vehicle with A/T
Cylinder block and transmission fastening bolts and nuts
(a) : 80 N·m (8.0 kg-m, 58.0 lb-ft)

4) Remove lifting device.



5) Reverse removal procedure for installation, noting the following points.
- Tighten torque converter bolts to specified torque (vehicle with A/T).

Tightening torque
Torque converter bolts (a) : 20 N·m (2.0 kg-m, 14.5 lb-ft)

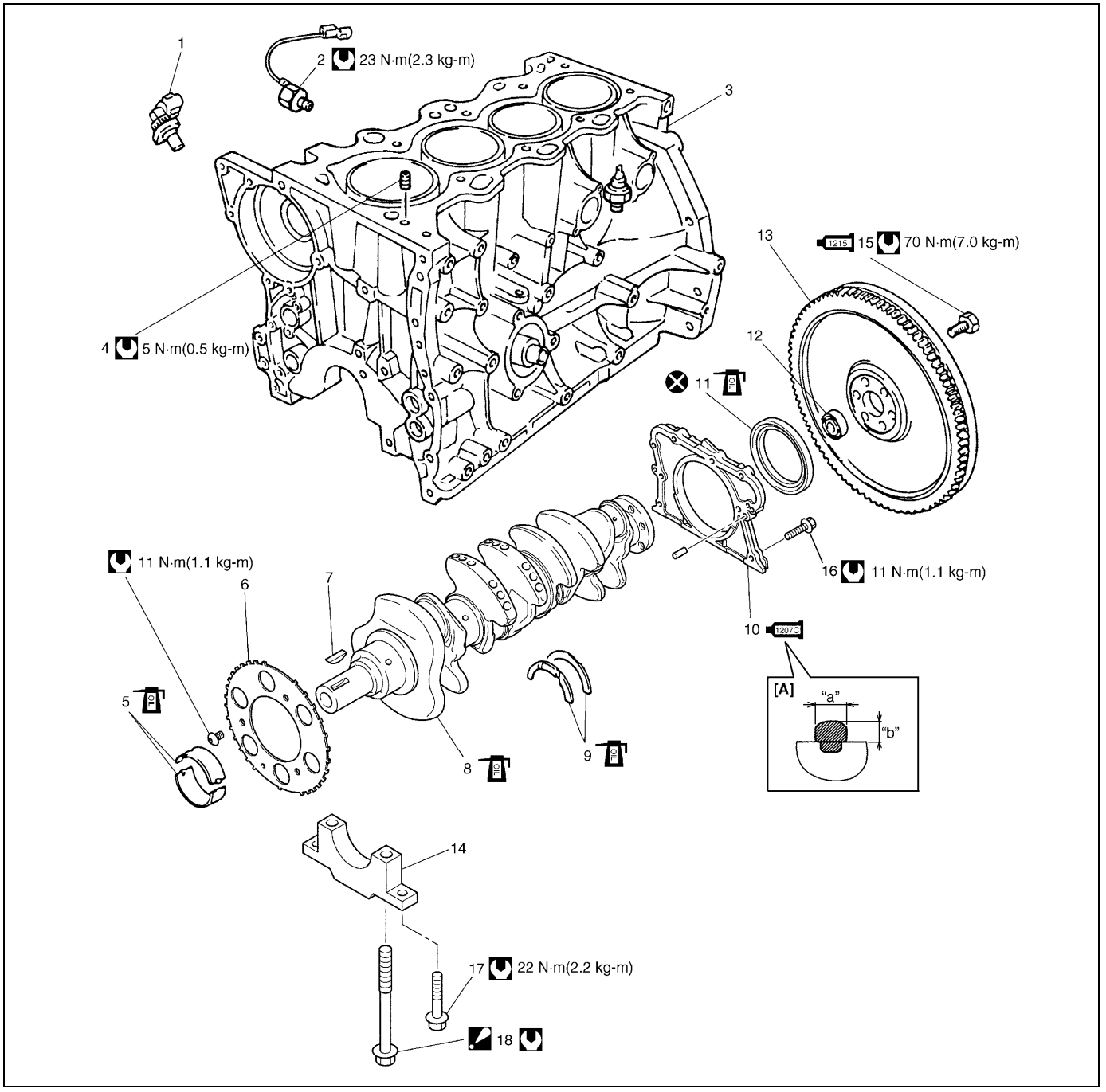


- Install seal ring and exhaust pipe to exhaust manifold. Tighten pipe fasteners to specified torque.

Tightening torque
Exhaust pipe bolts (a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

6) Reverse disconnected hoses, cables and electric wires for connection.
7) Install air cleaner outlet hoses.
8) Install radiator with cooling fan and connect A/T fluid hoses (vehicle with A/T), radiator inlet and outlet hoses referring to “Water Pump Belt and Cooling Fan” and “Radiator” in Section 6B.
9) Adjust generator belt tension referring to “Water Pump Belt Tension” in Section 6B.
10) Adjust A/C compressor and/or P/S pump belt tension (if equipped) referring to “Compressor Drive Belt” in Section 1B or “Power Steering Belt” in Section 3B1.
11) Adjust accelerator cable play referring to “Accelerator Cable Adjustment” in Section 6E.
12) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
13) Refill cooling system with coolant engine with engine oil and A/T with specified A/T fluid (vehicle with A/T).
14) Connect negative cable at battery.
15) Verify that there is no fuel leakage, coolant leakage, oil leakage, A/T fluid leakage (vehicle with A/T) and exhaust gas leakage at each connection.

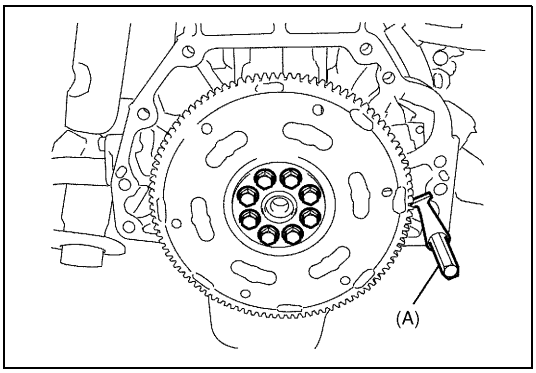
Main Bearings, Crankshaft and Cylinder Block



Tightening torque	4. Venturi plug	12. Input shaft bearing
Do not reuse.	5. Main bearing	13. Flywheel
Apply engine oil to inside / sliding surface.	6. Sensor plate	14. Main bearing cap
"a" : 3 mm (0.12 in.)	7. Crankshaft timing sprocket key	1215 15. Flywheel mounting bolt : Apply sealant 99000-31110 to thread part.
"b" : 2 mm (0.08 in.)	8. Crankshaft	16. Rear oil seal housing mounting bolt
1. CKP sensor (if equipped)	9. Thrust bearing	17. Main bearing cap No.2 bolt
2. Knock sensor	1207C 10. Rear oil seal housing : Apply specified amount [A] of sealant 99000-31150 to mating surface.	18. Main bearing cap No.1 bolt 1) Tighten all bolts to 50 N·m (5.0 kg-m) 2) Then, turn all bolts to 60°
3. Cylinder block	11. Rear oil seal	

REMOVAL

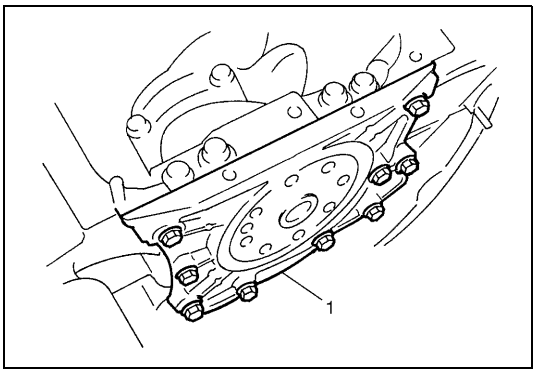
1) Remove engine assembly from vehicle as previously outlined.



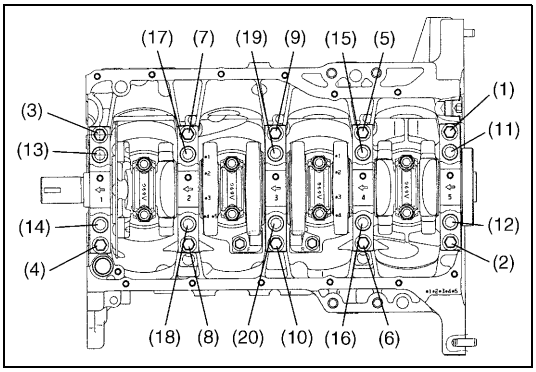
2) Remove clutch cover, clutch disc and flywheel (drive plate for A/T) by using special tool.

Special tool
(A) : 09924-17810

3) Remove the following parts from engine as previously outlined.
- Oil pan and oil pump strainer
- Intake manifold and exhaust manifold
- Cylinder head cover
- Timing chain cover
- Timing chain guide, chain tensioner adjuster, chain tensioner, timing chain and crankshaft timing sprocket
- Camshaft, tappet and shim
- Cylinder head assembly
- Piston and connecting rod



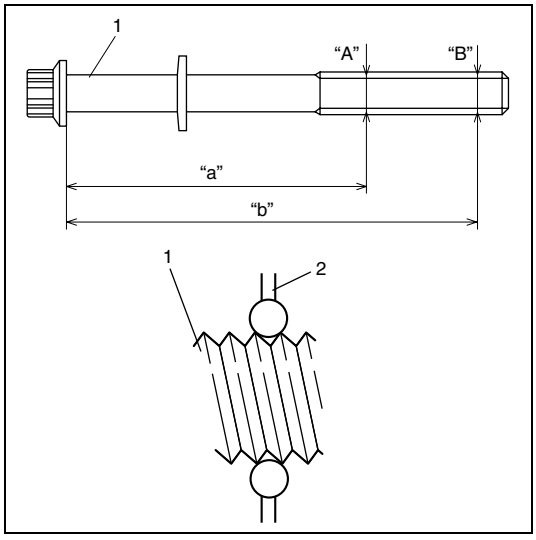
4) Remove rear oil seal housing (1).



5) Loosen bearing cap No.1 and No.2 bolts in such order as indicated in figure and remove them.
6) Remove crankshaft from cylinder block.

INSPECTION

Main bearing cap No.1 bolt



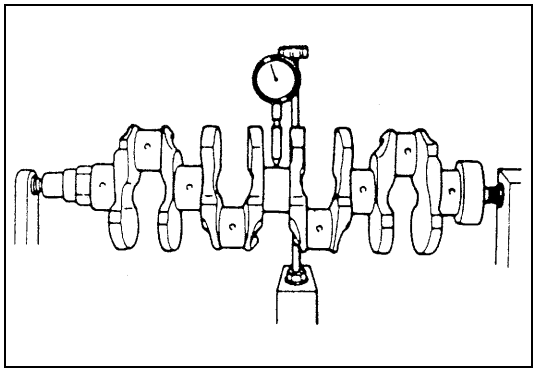
Measure each thread diameter of bearing cap No.1 bolts (1) at "A" on 60 mm (2.36 in.) from seat side of flange bolt and "B" on 90 mm (3.54 in.) from seat side of flange bolt by using a micrometer (2).
Calculate difference in diameters ("A" – "B").
If it exceeds limit, replace with new one.

Bearing cap No.1 bolt diameter measurement points
"a" : 60 mm (2.36 in.)
"b" : 90 mm (3.54 in.)

Bearing cap No.1 bolt diameter difference
Limit ("A" – "B") : 0.2 mm (0.008 in.)

Crankshaft

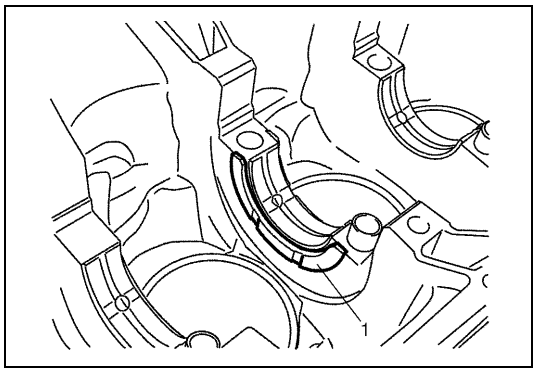
Crankshaft runout



Using a dial gauge, measure runout at center journal. Rotate crankshaft slowly. If runout exceeds its limit, replace crankshaft.

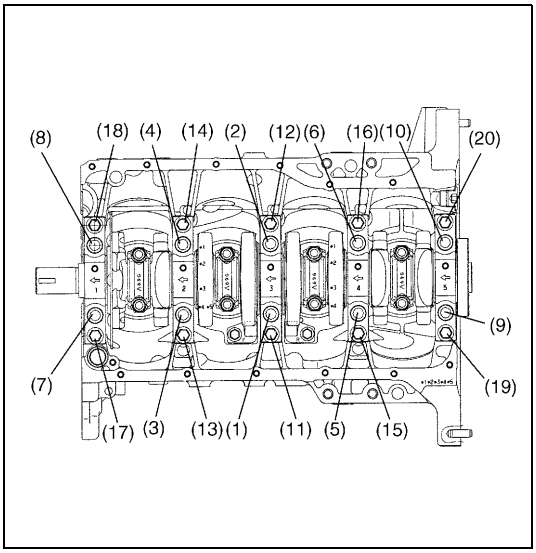
Crankshaft runout
Limit : 0.04 mm (0.0016 in.)

Crankshaft thrust play



Measure this play with crankshaft set in cylinder block in the normal manner, that is with thrust bearing (1) and journal bearing caps installed.

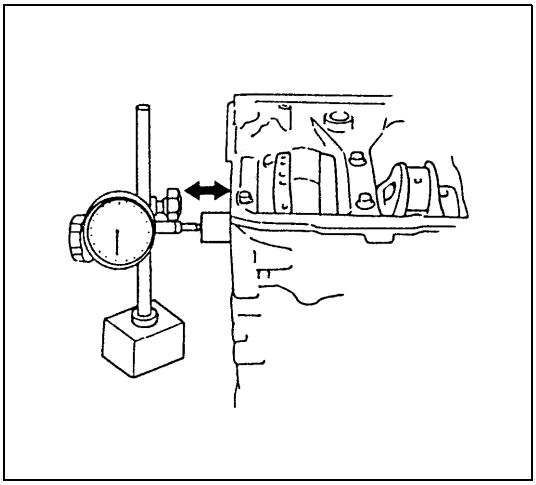
Thickness of crankshaft thrust bearing
Standard : 2.500 mm (0.0984 in.)
Oversize (0.125 mm (0.0049 in.)) : 2.563 mm (0.1009 in.)



Tighten bearing cap No.1 bolts (1) – (10) and No.2 bolts (11) – (20) gradually as follows.

1) Tighten bolts (1) – (10) to 30 N·m (3.0 kg-m, 22.0 lb-ft) according to numerical order in figure.
2) In the same manner as in Step 1), tighten them to 50 N·m (5.0 kg-m, 36.5 lb-ft).
3) In the same manner as in step 1), retighten them to 60°.
4) Tighten bolts (11) – (20) to 22 N·m (2.2 kg-m, 16.0 lb-ft) according to numerical order in figure.

Tightening torque
Crankshaft bearing cap No.1 bolts (1) – (10) :
50 N·m (5.0 kg-m, 36.5 lb-ft) and extra tightening 60°
Crankshaft bearing cap No.2 bolts (11) – (20) :
22 N·m (2.2 kg-m, 16.0 lb-ft)



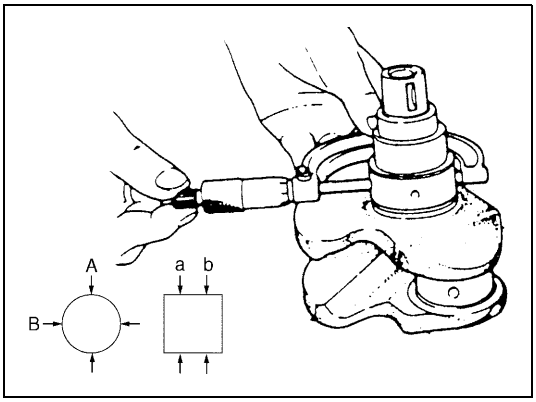
Use a dial gauge to read displacement in axial (thrust) direction of crankshaft.
If its limit is exceeded, replace thrust bearing with new standard one or oversize one to obtain standard thrust play.

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, check for thread deformation of each bearing cap No.1 bolt according to previous mentioned "Main Bearing Cap No.1 Bolt" once again.

Out-of-round and taper of journals



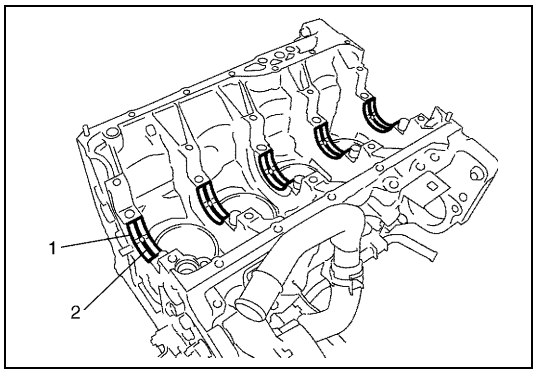
An unevenly worn crankshaft journal shows up as a difference in diameter at a cross section or along its length (or both). This difference, if any, is determined by taking micrometer readings. If any one of journals is badly damaged or if amount of uneven wear in the sense explained above exceeds its 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.

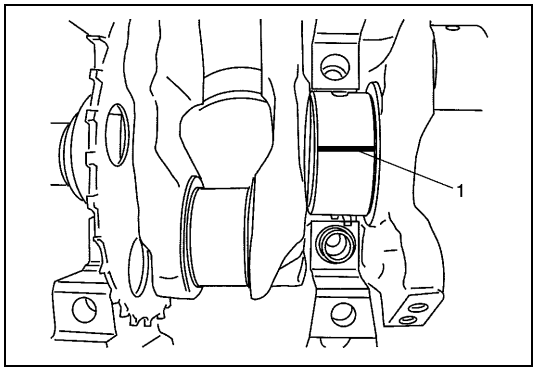
Visual inspection

Check bearings for pitting, scratches, wear or damage.
If any malcondition is found, replace both upper and lower halves.
Do not replace either half without replacing the other half.

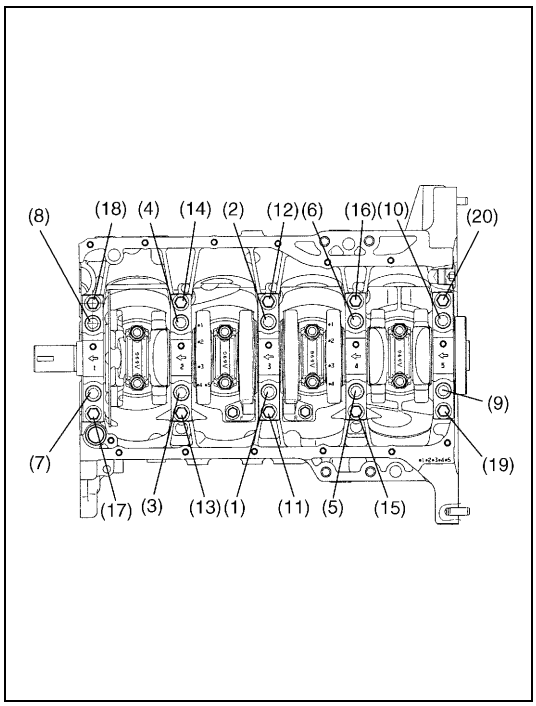
Main bearing clearance

Check clearance by using gauging plastic according to the following procedure.

1) Remove bearing caps.
2) Clean bearings and main journals.



3) Place a piece of gauging plastic (1) the full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.

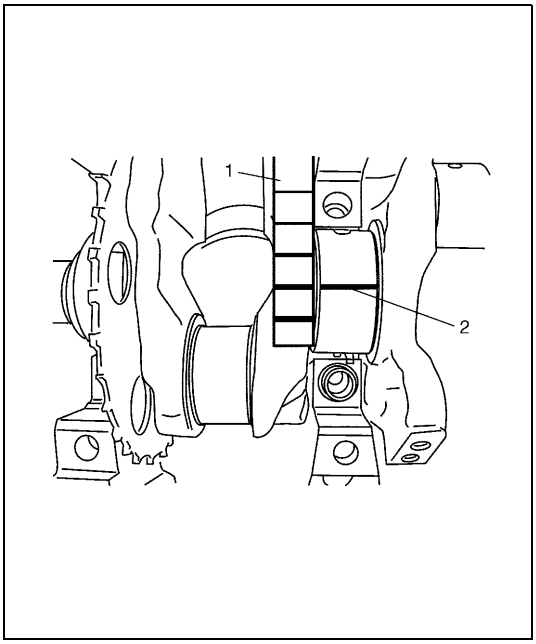


4) Tighten bearing cap No.1 bolts (1) – (10) and No.2 bolts (11) – (20) gradually as follows.
   a) Tighten bolts (1) – (10) to 30 N·m (3.0 kg-m, 22.0 lb-ft) according to numerical order in figure.
   b) In the same manner as in Step a), tighten them to 50 N·m (5.0 kg-m, 36.5 lb-ft).
   c) In the same manner as in step a), retighten them to 60°.
   d) Tighten bolts (11) – (20) to 22 N·m (2.2 kg-m, 16.0 lb-ft) according to numerical order in figure.

Tightening torque
Crankshaft bearing No.1 bolts (1) – (10) :
50 N·m (5.0 kg-m, 36.5 lb-ft) and extra tightening 60°
Crankshaft bearing No.2 bolts (11) – (20) :
22 N·m (2.2 kg-m, 16.0 lb-ft)

NOTE:

Do not rotate crankshaft while gauging plastic is installed.



5) Remove bearing caps and using scale (1) on gauging plastic (2) envelop, measure gauging 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 undersize bearing.
   After selecting new bearing, recheck clearance.

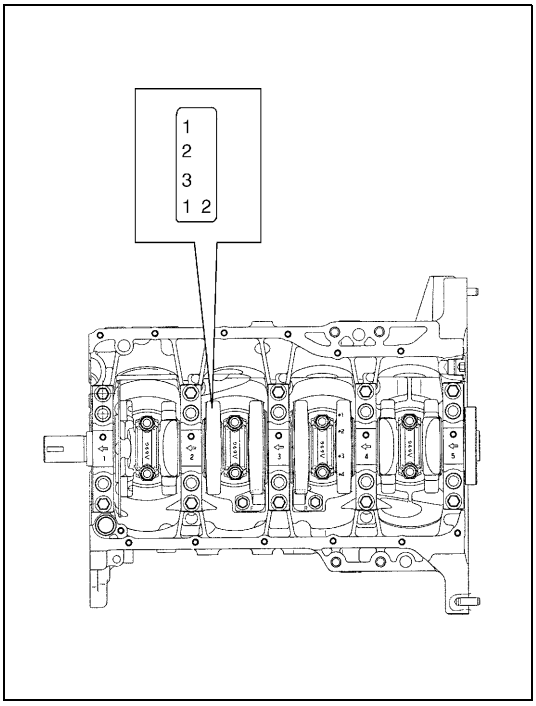
Main bearing clearance
Standard : 0.025 – 0.045 mm (0.0010 – 0.0018 in.)
Limit : 0.065 mm (0.0026 in.)

NOTE:

After checking the bearing clearance, check for thread deformation of each bearing cap No.1 bolt according to previous mentioned Step 4) once again.

Selection of main bearings

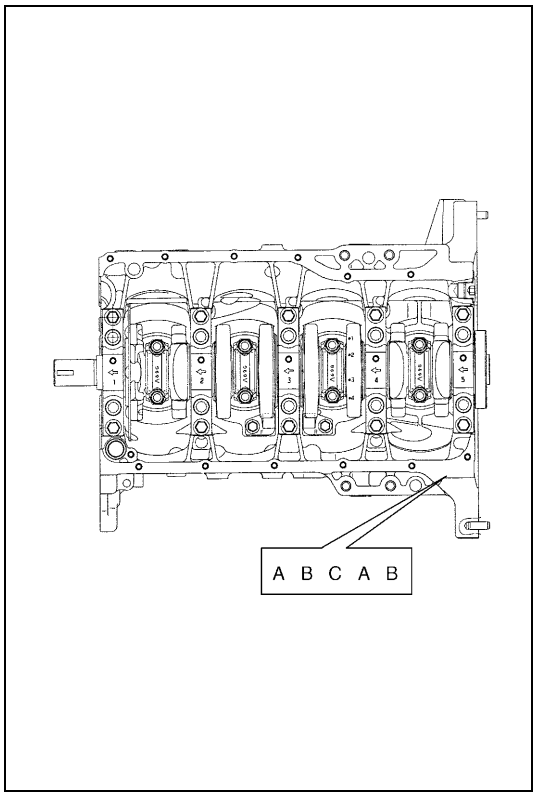
STANDARD BEARING:
If bearing is in malcondition, or bearing clearance is out of specification, select a new standard bearing according to the following procedure and install it.



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

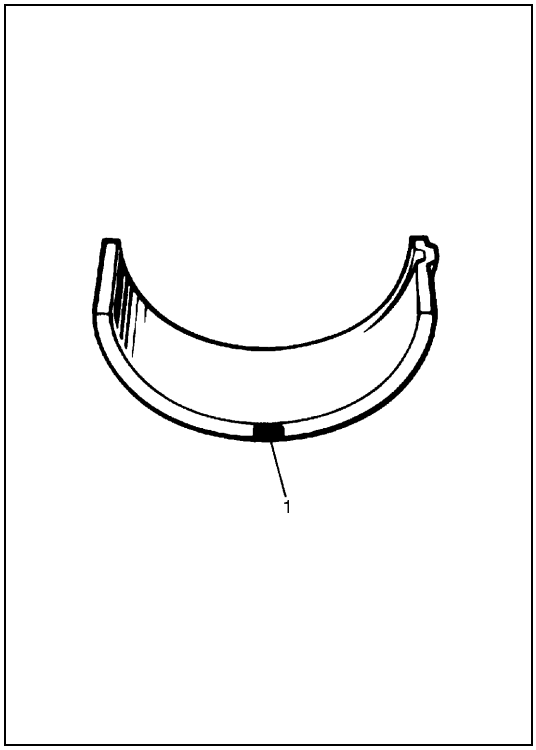
Stamped numbers	Journal diameter
1	**44.994 – 45.000 mm (1.7714 – 1.7717 in.)**
2	**44.988 – 44.994 mm (1.7712 – 1.7714 in.)**
3	**44.982 – 44.988 mm (1.7709 – 1.7712 in.)**



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”) represent the following cap bore diameters.
Stamped alphabets on cylinder block represent bearing cap bore diameter marked with an arrow in figure respectively. For example, stamped “A” indicates that corresponding bearing cap bore diameter is 49.000 – 49.006 mm (1.9291 – 1.9294 in.).

Crankshaft bearing cap bore

Stamped alphabet	Bearing cap bore diameter (without bearing)
A	**49.000 – 49.006 mm (1.9291 – 1.9294 in.)**
B	**49.006 – 49.012 mm (1.9294 – 1.9296 in.)**
C	**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 center of bearings.
Each color indicates the following thickness.

Standard size of crankshaft main bearing

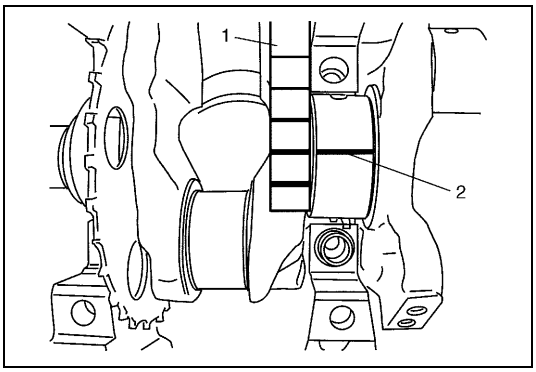
Color painted	Bearing thickness
Pink	**1.990 – 1.994 mm (0.0783 – 0.0785 in.)**
Purple	**1.993 – 1.997 mm (0.0785 – 0.0786 in.)**
Brown	**1.996 – 2.000 mm (0.0786 – 0.0787 in.)**
Green	**1.999 – 2.003 mm (0.0787 – 0.0789 in.)**
Black	**2.002 – 2.006 mm (0.0788 – 0.0790 in.)**

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.

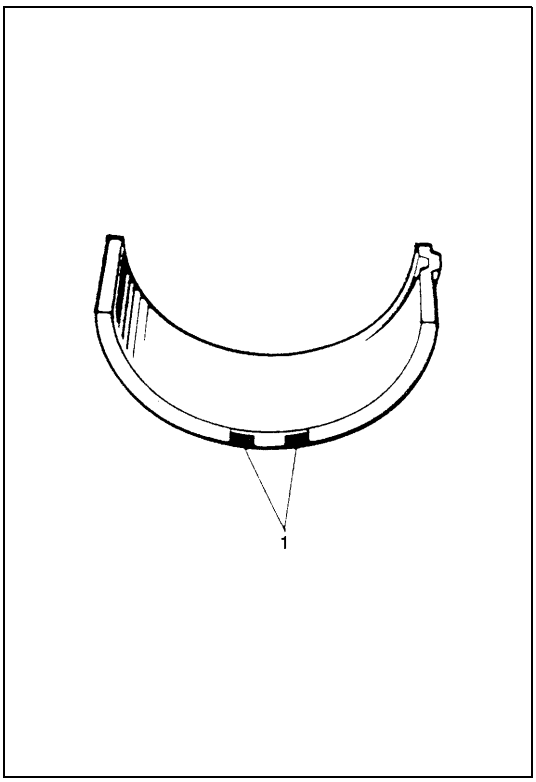
Specification of standard crankshaft main bearing

		Number stamped on crank web No.2 (Journal diameter)		
		1	2	3
Alphabet stamped on cylinder block (Cap bore dia.)	A	Pink	Purple	Brown
	B	Purple	Brown	Green
	C	Brown	Green	Black
		New standard bearing to be installed.		



5) Using scale (1) on gauging 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):



- 0.25 mm undersize bearing is available, in five kinds varying in thickness.
To distinguish them, each bearing is painted in the following colors at the center of bearing.
Each color represents the following thickness.

Undersize of crankshaft main bearing

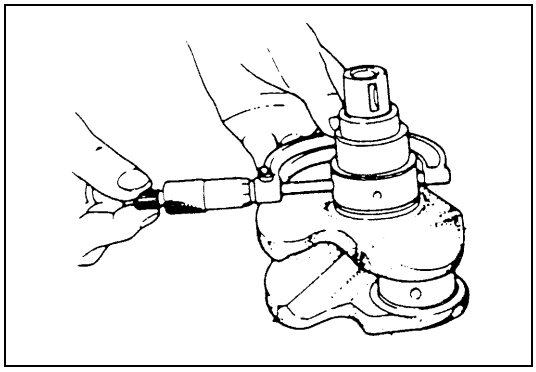
Color painted	Bearing thickness
Red and Pink	2.115 – 2.119 mm (0.0833 – 0.0834 in.)
Red and Purple	2.118 – 2.122 mm (0.0834 – 0.0835 in.)
Red and Brown	2.121 – 2.125 mm (0.0835 – 0.0837 in.)
Red and Green	2.124 – 2.128 mm (0.0836 – 0.0838 in.)
Red and Black	2.127 – 2.131 mm (0.0837 – 0.0839 in.)

1. Paint

- If necessary, regrind crankshaft journal and select undersize bearing to use with it as follows.

a) Regrind journal to the following finished diameter.

Finished diameter
44.732 – 44.750 mm (1.7611 – 1.7618 in.)

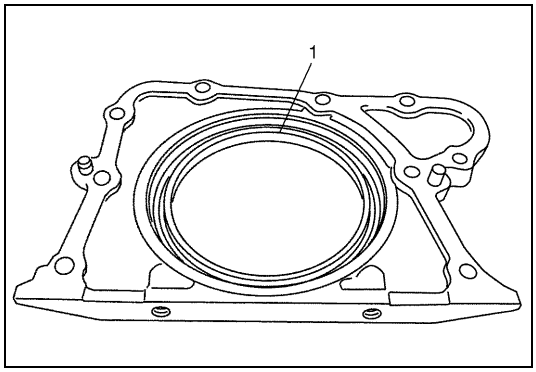


1) Using micrometer, measure reground journal diameter. Measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.
2) Using journal diameter measured above and alphabets stamped on cylinder block, select an undersize bearing by referring to table given below.
   Check bearing clearance with newly selected undersize bearing.

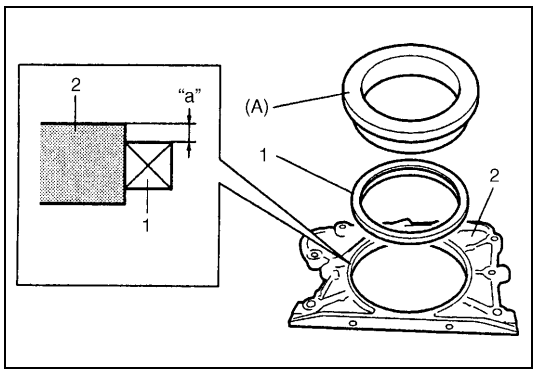
Specification of undersize crankshaft main bearing

		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	Red and Pink	Red and Purple	Red and Brown
	B	Red and Purple	Red and Brown	Red and Green
	C	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.

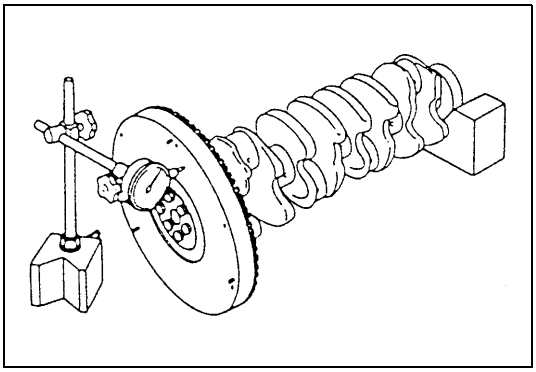


For oil seal installation, press-fit rear oil seal (1) to oil seal housing (2) by using special tool as shown in the figure.

Special tool
(A) : 09911-97820

Crank rear oil seal installing position
"a" : 3 mm (0.12 in.)

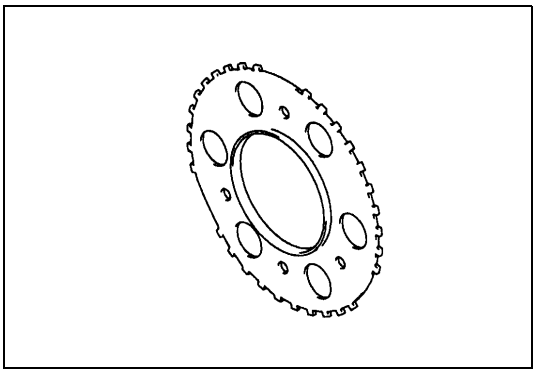
Flywheel



- If ring gear is damaged, cracked or worn, replace flywheel.
- If the surface contacting clutch disc is damaged, or excessively worn, replace flywheel.
- Check flywheel for face runout with a dial gauge.
  If runout exceeds its limit, replace flywheel.

Flywheel runout
Limit : 0.2 mm (0.0079 in.)

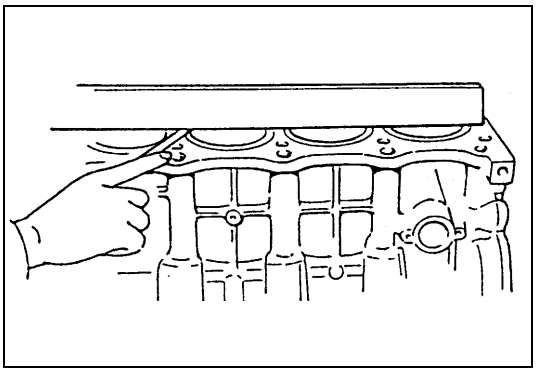
Sensor Plate



- 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.

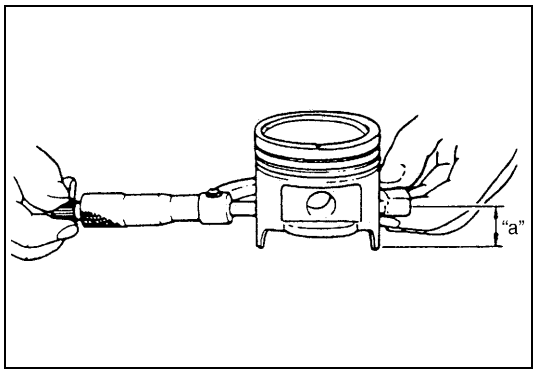
Cylinder block flatness
Limit : 0.05 mm (0.0020 in.)

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) Calculate cylinder bore diameter to be rebored as follows.
   D = A + B – C
   D : Cylinder bore diameter to be rebored.
   A : Piston diameter as measured.
   B : Piston clearance = 0.02 –0.04 mm (0.0008 – 0.0016 in.)
   C : Allowance for honing = 0.02 mm (0.0008 in.)
5) Rebore and hone cylinder to calculated dimension.

NOTE:

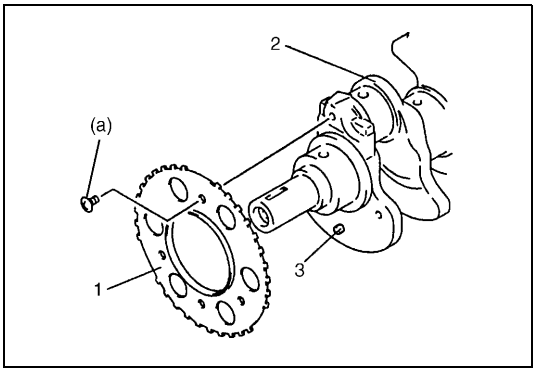
Before reboring, install all main bearing caps in place and tighten to specification to avoid distortion of bearing bores.

6) Measure piston clearance after honing.

INSTALLATION

NOTE:

- **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.**

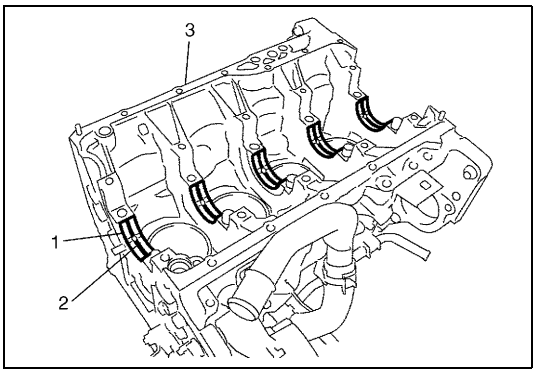


1) Install sensor plate (1) to crankshaft (2) and tighten bolts to specified torque.

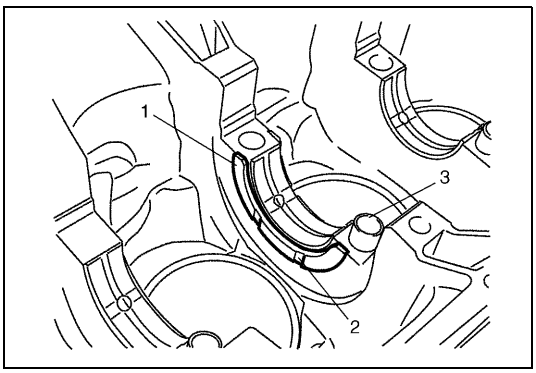
NOTE:

When installing sensor plate, align spring pin (3) on crankshaft and hole of sensor plate.

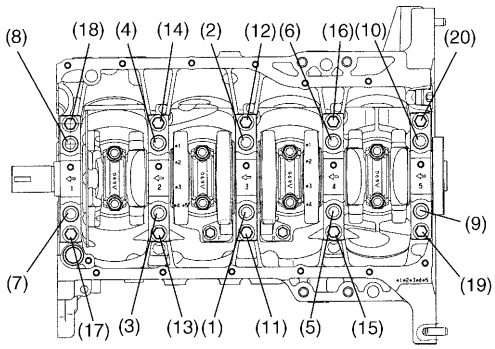
Tightening torque
Sensor plate bolts (a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)



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 bearing cap No.1 bolts ((1) – (10)) and bearing cap No.2 bolts ((11) – (20)), tighten them gradually as follows.

NOTE:

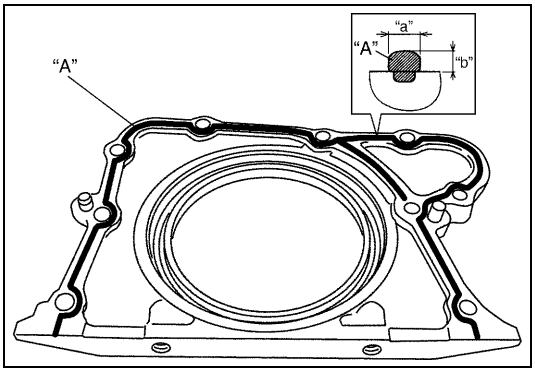
- **If bearing cap No.1 bolts are reused, check thread diameters of them for deformation according to previous mentioned "Main Bearing Cap No.1 Bolt" and replace them with new ones if thread diameter exceeds limit.**

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 22 N·m (2.2 kg-m, 16.0 lb-ft) according to numerical order as shown.

Tightening torque
Crankshaft bearing cap No.1 bolts (1) – (10)
: 50 N·m (5.0 kg-m, 36.5 lb-ft) and extra tightening 60°
Crankshaft bearing cap No.2 bolts (11) – (20)
: 22 N·m (2.2 kg-m, 16.0 lb-ft)

NOTE:

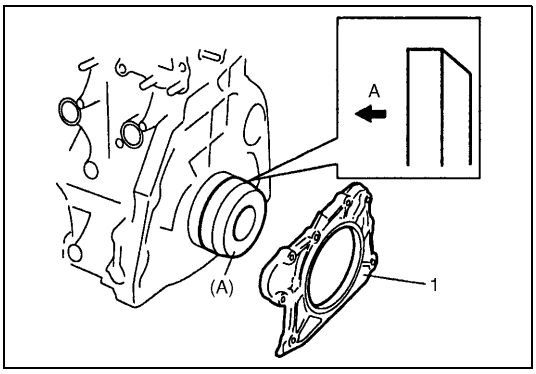
After tightening cap bolts, check to be sure that crankshaft rotates smoothly when turning it by 12 N·m (1.2 kg-m, 9.0 lb-ft) torque or below.



7) Apply sealant to mating surface of rear oil seal housing (1).

"A" : Sealant 99000-31150

Sealant amount for rear oil seal housing
Width "a" : 3 mm, 0.12 in.
Height "b" : 2 mm, 0.08 in.

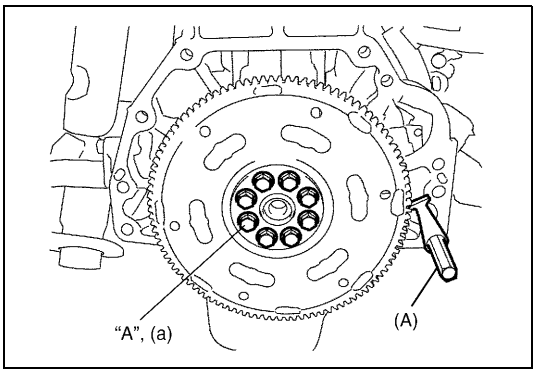


8) Install rear oil seal housing (1) and tighten bolts to specified torque by using special tool.

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



9) Install flywheel (drive plate for A/T).
Using special tool, lock flywheel or drive plate, and tighten flywheel or drive plate bolts applied with sealant to specification.

"A" : Sealant 1215 99000-31110

Special tool
(A) : 09924-17810

Tightening torque
Flywheel or drive plate bolts
(a) : 70 N·m (7.0 kg-m, 51.0 lb-ft)

10) Install the following parts to engine as previously outlined.
- Piston and connecting rod
- Cylinder head assembly
- Camshaft, tappet and shim
- Timing chain guide, chain tensioner adjuster, chain tensioner, timing chain and crankshaft timing sprocket
- Timing chain cover
- Cylinder head cover
- Intake manifold and exhaust manifold
- Oil pan and oil pump strainer

11) Install clutch to flywheel (vehicle with M/T) referring to "Clutch Cover, Clutch Disc, Flywheel and Release Bearing" in Section 7C.
12) Install engine assembly to vehicle referring to "Engine Assembly" in this section.

Required Service Material

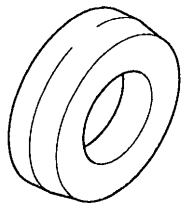
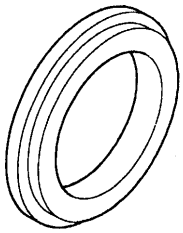
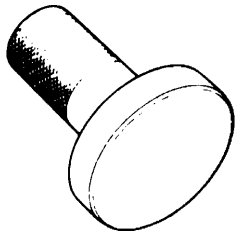
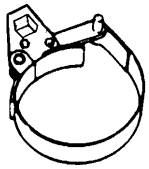
Material	Recommended SUZUKI product (Part Number)	Use
Sealant	SUZUKI BOND NO. 1207C (99000-31150)	• To apply to mating surface of cylinder block and oil pan. • To apply to mating surface of cylinder block and timing chain cover. • To apply to sealing surface of cylinder head cover. • To apply to mating surface to rear oil seal housing.
	SUZUKI BOND NO. 1207B (99000-31140)	• To apply to mating surface of cylinder block, cylinder head and timing chain cover.
	SUZUKI BOND NO. 1215 (99000-31110)	• To flywheel (M/T) or drive plate (A/T) bolts.

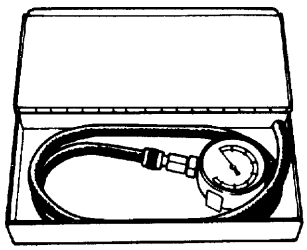
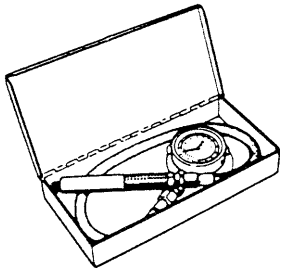
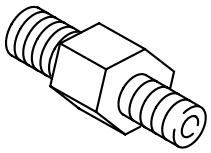
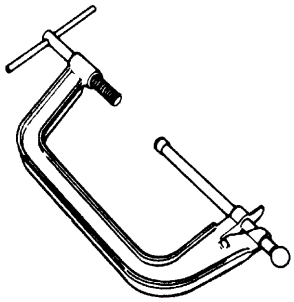
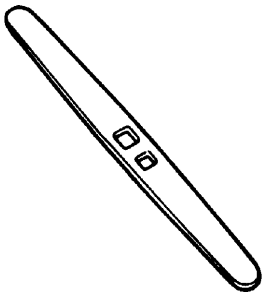
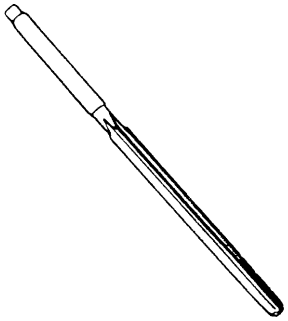
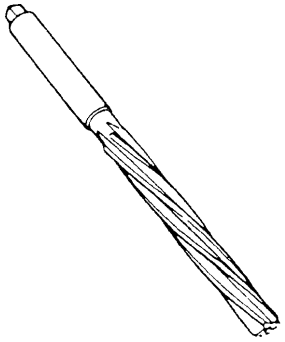
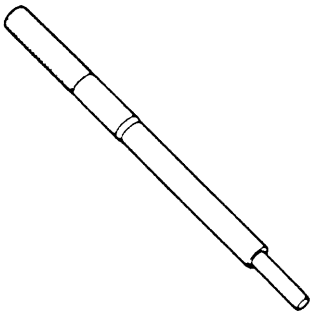
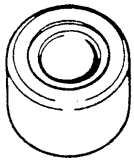
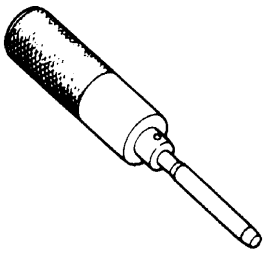
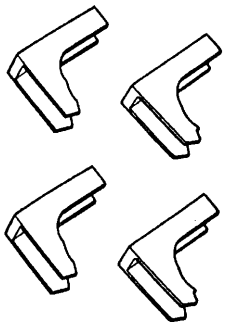
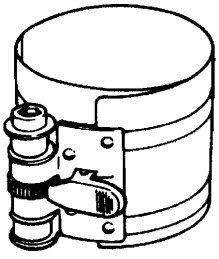
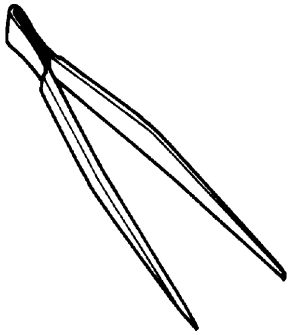
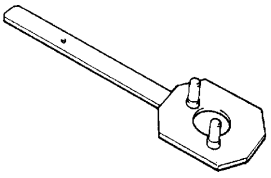
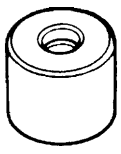
Tightening Torque Specification

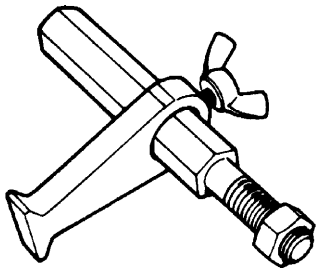
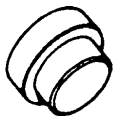
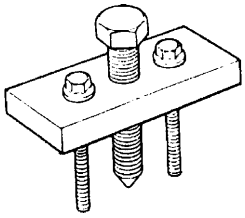
Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Oil pressure switch	14.0	1.4	10.5
Camshaft housing bolts (for replacement of shim)	8.0	0.8	6.0
Camshaft housing bolts	11.0	1.1	8.0
Cylinder head cover bolts	8.0	0.8	6.0
Intake manifold bolts and nuts	25.0	2.5	18.0
Exhaust manifold bolts and nuts	55.0	5.5	40.0
Exhaust pipe bolts	50.0	5.0	36.5
Exhaust manifold stiffener bolts	50.0	5.0	36.5
Oil pump strainer bolt	11.0	1.1	8.0
Oil pump strainer bracket bolt	11.0	1.1	8.0
Oil pan bolts and nuts	11.0	1.1	8.0
Oil pan drain plug	50.0	5.0	36.5
Timing chain cover bolts and nut	23.0	2.3	17.0
Crankshaft pulley bolt	150.0	15.0	108.5
Oil pump rotor plate bolts	11.0	1.1	8.0
Timing chain No.1 guide bolts	9.0	0.9	6.5
Timing chain tensioner adjuster bolts	11.0	1.1	8.0
Venturi plug	5.0	0.5	3.5
Cylinder head bolt for M8	22.0	2.2	16.0
Cylinder head bolts for M10	a) Tighten 40 N·m b) Turn 60° c) Turn 60°	a) Tighten 4.0 kg-m b) Turn 60° c) Turn 60°	a) Tighten 29.0 lb-ft b) Turn 60° c) Turn 60°
Connecting rod bearing cap nuts	a) Tighten 15 N·m b) Turn 45° c) Turn 45°	a) Tighten 1.5 kg-m b) Turn 45° c) Turn 45°	a) Tighten 11.0 lb-ft b) Turn 45° c) Turn 45°
Engine mounting bolts	50.0	5.0	36.5

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Crankshaft bearing cap No.1 bolts (for inspection of crankshaft thrust play)	50.0	5.0	36.5
Crankshaft bearing cap No.2 bolts	22.0	2.2	16.0
Sensor plate bolts	11.0	1.1	8.0
Crankshaft bearing cap No.1 bolts	a) Tighten 50 N·m b) Turn 60°	a) Tighten 5.0 kg-m b) Turn 60°	a) Tighten 36.5 lb-ft b) Turn 60°
Rear oil seal housing bolts	11.0	1.1	8.0
Flywheel or drive plate bolts	70.0	7.0	51.0
Torque converter bolts	20.0	2.0	14.5
Timing chain tensioner bolt	22.0	2.2	16.0
Knock sensor	23.0	2.3	16.5
Cylinder block and transmission fastening bolts and nuts (vehicle with M/T)	94.0	9.4	68.0
Cylinder block and transmission fastening bolts and nuts (vehicle with A/T)	80.0	8.0	58.0

Special Tool

 09911-97720 Oil seal guide	 09911-97820 Oil seal installer	 09913-75520 Bearing installer	 09915-47330 Oil filter wrench
 09915-64510-001 Compression gauge	 09915-64510-002 Connector	 09915-64530 Hose	 09915-67010 Attachment

 09915-67310 Vacuum gauge	 09915-77310 Oil pressure gauge	 09915-78211 Oil pressure gauge attachment	 09916-14510 Valve lifter
 09916-14521 Valve lifter 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 attachment	 09916-58210 Valve guide installer handle	 09916-67020 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

SECTION 6B

ENGINE COOLING

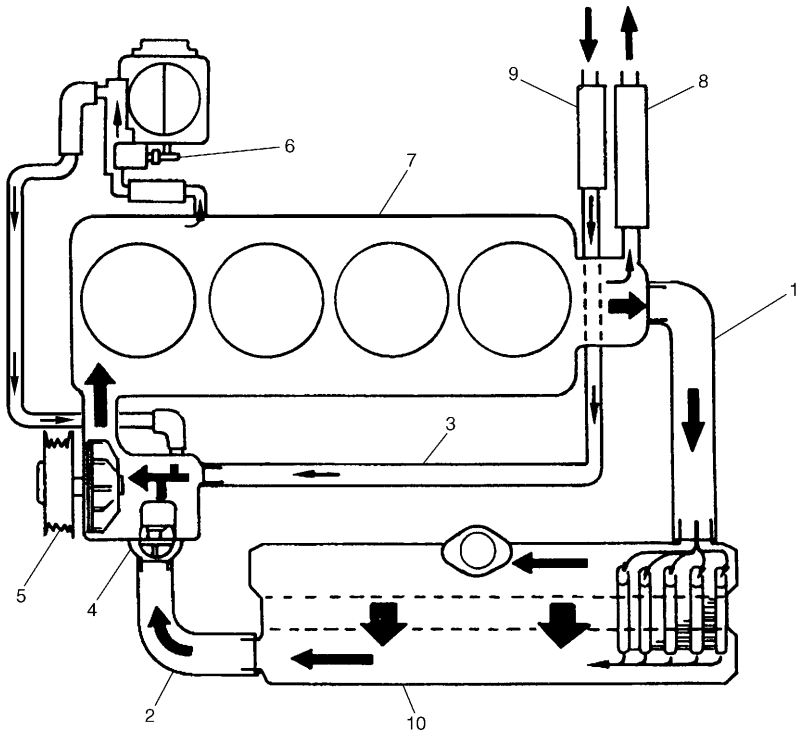
CONTENTS

General Description 6B-2
Cooling System Circulation 6B-2
Radiator Cap 6B-3
Coolant Reservoir 6B-3
Water Pump 6B-4
Thermostat 6B-4
Cooling Fan Clutch 6B-4
Coolant (Water) Temperature Gauge 6B-4
Diagnosis 6B-5
Maintenance 6B-6
Coolant 6B-6
Coolant Level 6B-7
Cooling System Service 6B-7
Cooling System Flush and Refill 6B-8
Water Pump Belt Tension 6B-9
On-Vehicle Service 6B-10
Cooling System Component 6B-10
Coolant Draining 6B-11
Cooling Water Pipes or Hoses 6B-11
Thermostat 6B-11
Water Pump Belt and Cooling Fan 6B-13
Radiator 6B-14
Water Pump 6B-15
Required Service Material 6B-17
Tightening Torque Specification 6B-17

General Description

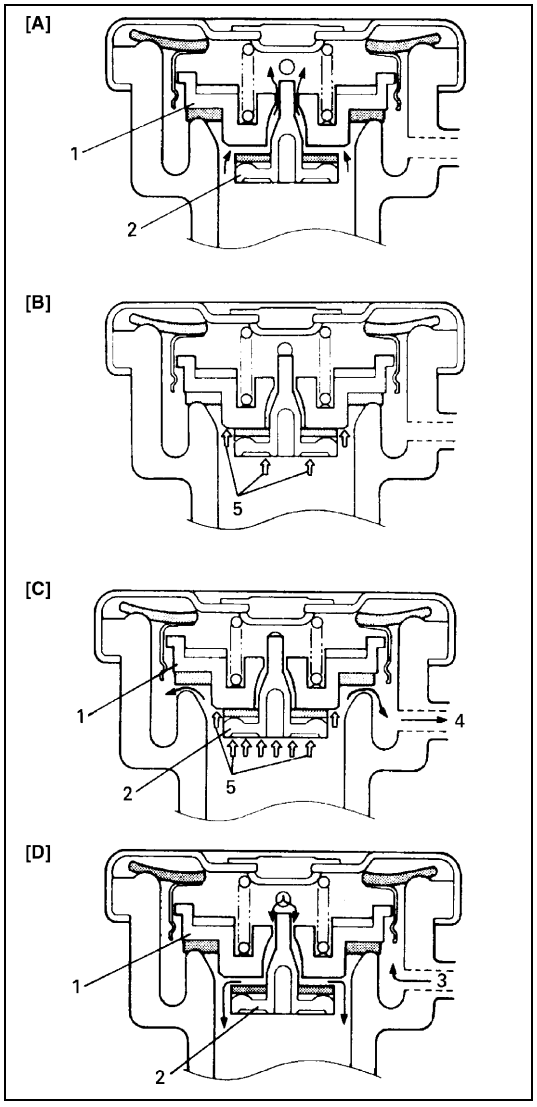
The cooling system consists of the radiator cap, radiator, reservoir, hoses, water pump, cooling fan & clutch, thermostat. The radiator is of tube-and-fin type.

Cooling System Circulation



1. Radiator inlet hose	5. Water pump	9. Heater outlet hose
2. Radiator outlet hose	6. Fast idle control plunger of throttle body	10. Radiator
3. Water inlet pipe	7. Cylinder block/cylinder head	
4. Thermostat	8. Heater inlet hose	

Radiator Cap



A pressure-vent cap is used on the radiator. The cap contains a pressure valve (1) and ventilation valve (2).
The cap has its face marked 1.1, which means that its pressure valve opens at 1.1 kg/cm^2 (15.6 psi, 110 kPa).

NOTE:

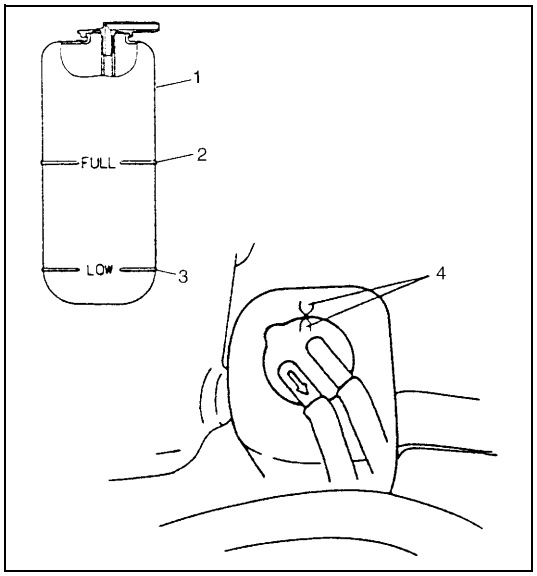
Do not remove radiator cap to check engine coolant level; check coolant visually at the see-through coolant reservoir.
Coolant should be added only to reservoir as necessary.

WARNING:

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 or causing a serious fire.

[A]: At air bleed	3. From reservoir
[B]: At valves closed	4. To reservoir
[C]: At pressure relief	5. Pressure in radiator
[D]: At vacuum relief	

Coolant Reservoir

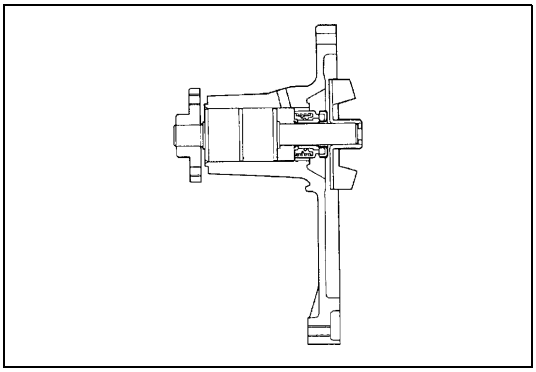


A “see-through” plastic reservoir (1) is connected to the radiator by a hose.
Coolant level should be between “FULL” level mark (2) and “LOW” level mark (3) on the reservoir.
Coolant should be added only to the reservoir as necessary.

NOTE:

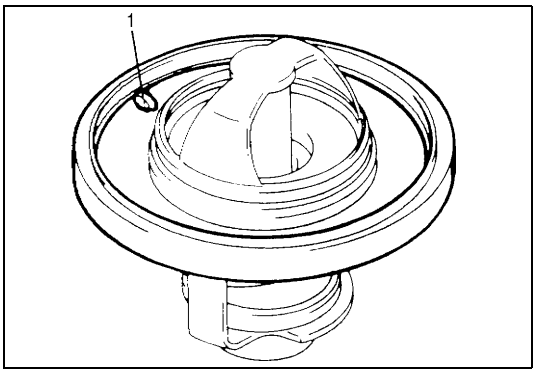
When installing reservoir cap, set arrow marks (4) on the reservoir and cap as the figure.

Water Pump



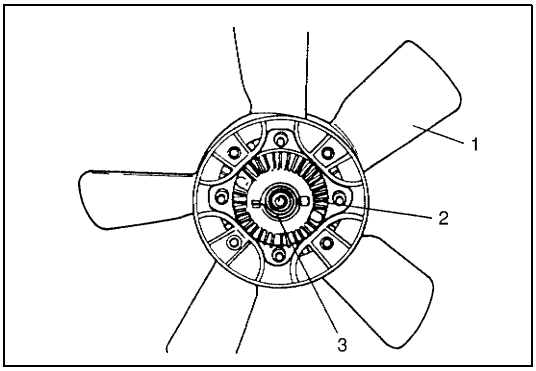
The centrifugal type water pump is used in the cooling system.
The pump impeller is supported by a totally sealed bearing.
The water pump can not be disassembled.

Thermostat



A wax pellet type thermostat is used in the cooling system.
The temperature at which the valve begins to open is stamped on thermostat.
In the top portion of the thermostat, an air bleed valve (1) is provided; this valve is for venting out the gas or air, if any, that is accumulated in the circuit.

Cooling Fan Clutch



Fluid is enclosed in the cooling fan clutch (2) and at its center front, there is a bimetal (3) whose thermal reaction and the engine speed control the cooling fan speed.

NOTE:

Do not disassemble clutch assembly.

WARNING:

Keep hands, tools, and clothing away from engine cooling fan (1) to help prevent personal injury.

Coolant (Water) Temperature Gauge

A water temp. gauge is located at intake manifold.
This gauge activates a temp. meter in the instrument cluster.
When installing, wind sealing tape on gauge thread and tighten it.

Diagnosis

Condition	Possible Cause	Correction
Engine overheats	• 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.
	• Defective cooling fan clutch	Check and replace as necessary.
	• Plugged radiator	Check and replace radiator as necessary.
	• Faulty radiator cap	Replace.
	• Maladjusted ignition timing	Check system related parts.
	• Dragging brakes	Adjust brake.
	• Slipping clutch	Adjust or replace.

Maintenance

Coolant

The coolant recovery system is standard. The coolant in the radiator expands with heat, and the overflow is collected in the reservoir.
When the system cools down, the coolant is drawn back into the radiator.
The cooling system has been filled at the factory with a quality coolant that is either 50/50 mixture of water and anti-freeze / anti-corrosion coolant (ethylene glycol antifreeze).
The 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).

Anti-freeze proportioning table

Freezing temperature	**°C**	**– 16**	**– 36**
	°F	**3**	**– 33**
Anti-freeze / Anti-corrosion coolant concentration	**%**	**30**	**50**
Ratio of compound to cooling water	**ltr.**	**1.35/3.15**	**2.25/2.25**
	US pt.	**2.85/6.65**	**4.75/4.75**
	Imp pt.	**2.37/5.53**	**3.95/3.95**

Coolant capacity

Engine radiator and heater	**5.2 liters (11.0/9.2 US/Imp. pt.)**
Reservoir	**0.7 liters (1.5/1.2 US/Imp. pt.)**
Total	**5.9 liters (12.5/10.5 US/Imp. pt.)**

NOTE:

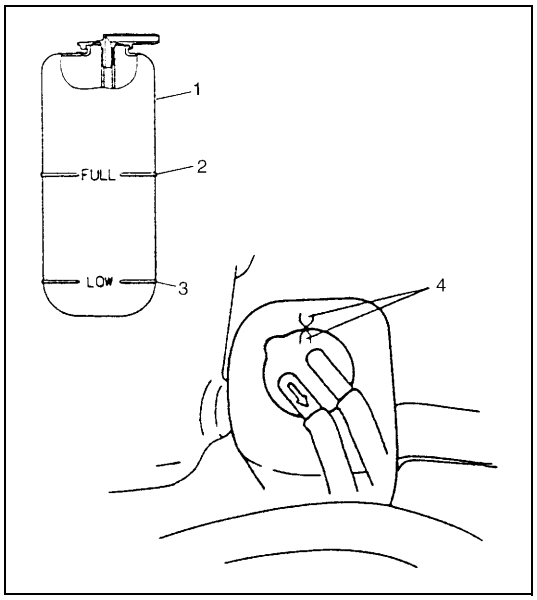
- **Alcohol or methanol base coolant or plain water alone should not be used in cooling system at any time as damage to cooling system could occur.**
- **Even in a market where no freezing temperature is anticipated, mixture of 70% water and 30% ethylene glycol antifreeze (Antifreeze / Anticorrosion coolant) should be used for the purpose of corrosion protection and lubrication.**

Coolant Level

WARNING:
To help avoid danger of being burned:
- **Do not remove reservoir cap while coolant is "boiling", and**
- **Do not remove radiator cap while engine and radiator are still hot.**

Scalding fluid and steam can be blown out under pressure if either cap is taken off too soon.

To check level, look at "see-through" reservoir.
It is not necessary to remove radiator cap to check coolant level.



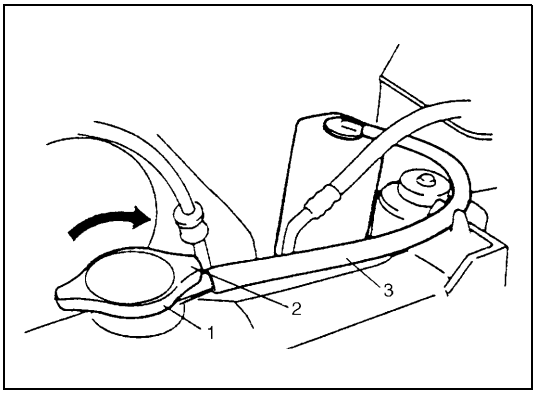
When engine is cool, check coolant level in reservoir (1).
A normal coolant level should be between "FULL" (2) and "LOW" (3) marks on reservoir (1).
If coolant level is below "LOW" mark, remove reservoir cap and add proper coolant to reservoir to bring coolant level up to "FULL" mark. Then, reinstall cap.

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.**
- **When installing reservoir cap, set arrow marks (4) on the reservoir and cap as the figure.**

Cooling System 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.

Cooling system should be serviced as follows.
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, check system and radiator cap for proper pressure holding capacity 1.1 kg/cm^2 (15.6 psi, 110 kPa). If replacement of cap is required, use proper cap specified for this vehicle.



NOTE:

After installing radiator cap (1) to radiator, make sure that its ear (2) is aligned with reservoir hose (3) as shown in figure.
If not, turn cap more to align its ear with hose.

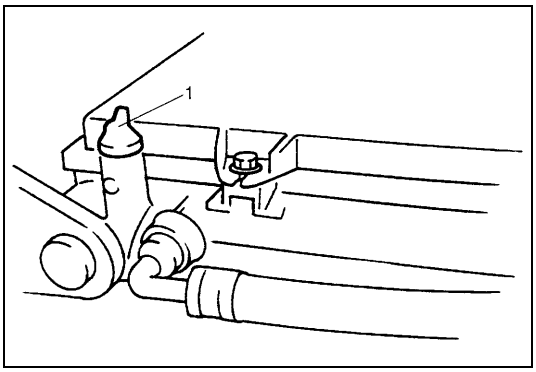
5) Tighten hose clamps and inspect all hoses.
   Replace hoses whenever cracked, swollen or otherwise deteriorated.
6) Clean frontal area of radiator core.

Cooling System Flush and Refill

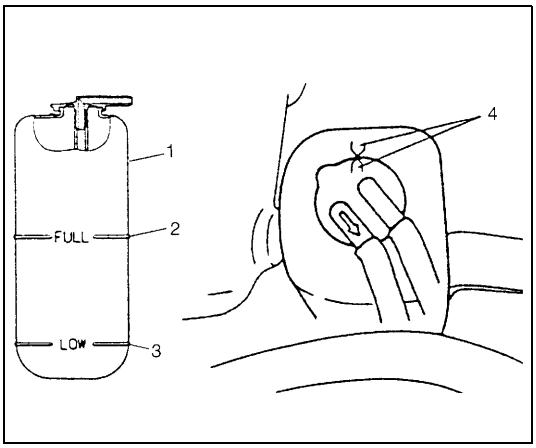
WARNING:

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.

1) Remove radiator cap when engine is cool:
   Turn cap slowly to the left until it reaches a “stop” (Do not press down while turning it).
   Wait until pressure is relieved (indicated by a hissing sound) then press down on cap and continue to turn it to the left.
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 open radiator drain plug (1) to drain coolant.
4) Close drain plug. 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) Drain system and then close radiator drain plug tightly.



7) Disconnect hose from water reservoir (1). Remove reservoir and pour out any fluid. Scrub and clean inside of reservoir with soap and water. Flush it well with clean water and drain. Reinstall reservoir and hose.
8) Add 50/50 mixture of good quality ethylene glycol antifreeze and water to radiator and reservoir.
   Fill radiator to the base of radiator filler neck and reservoir to “FULL” level mark (2). Reinstall reservoir cap setting the arrow marks (4) on the reservoir and cap as the figure.

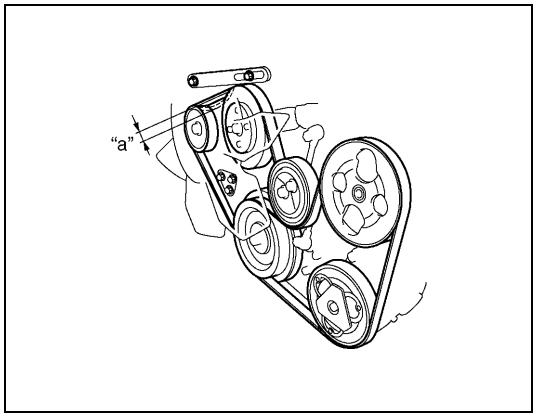
3. LOW level mark

9) Run engine, with radiator cap removed, until radiator upper hose is hot.
10) With engine idling, add coolant to radiator until level reaches the bottom of filler neck. Install radiator cap, making sure that the ear of cap lines up with reservoir hose.

Water Pump Belt Tension

WARNING:
Disconnect negative cable at battery before checking and adjusting belt tension.

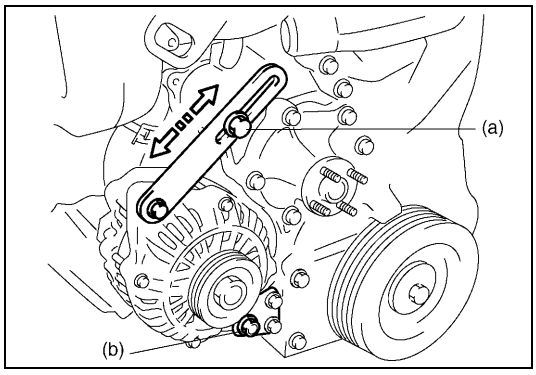
1) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If it is necessary to replace belt, refer to "Water Pump Belt and Cooling Fan" in this section.



2) Check belt for tension. Belt is in proper tension when it deflects 4.5 to 5.5 mm (0.18 – 0.22 in.) under thumb pressure (about 10 kg or 22 lb.).

Water pump 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 and pivot bolts as specified torque.

Tightening torque
Generator adjusting bolt (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)
Generator pivot bolts (b) : 50 N·m (5.0 kg-m, 36.0 lb-ft)

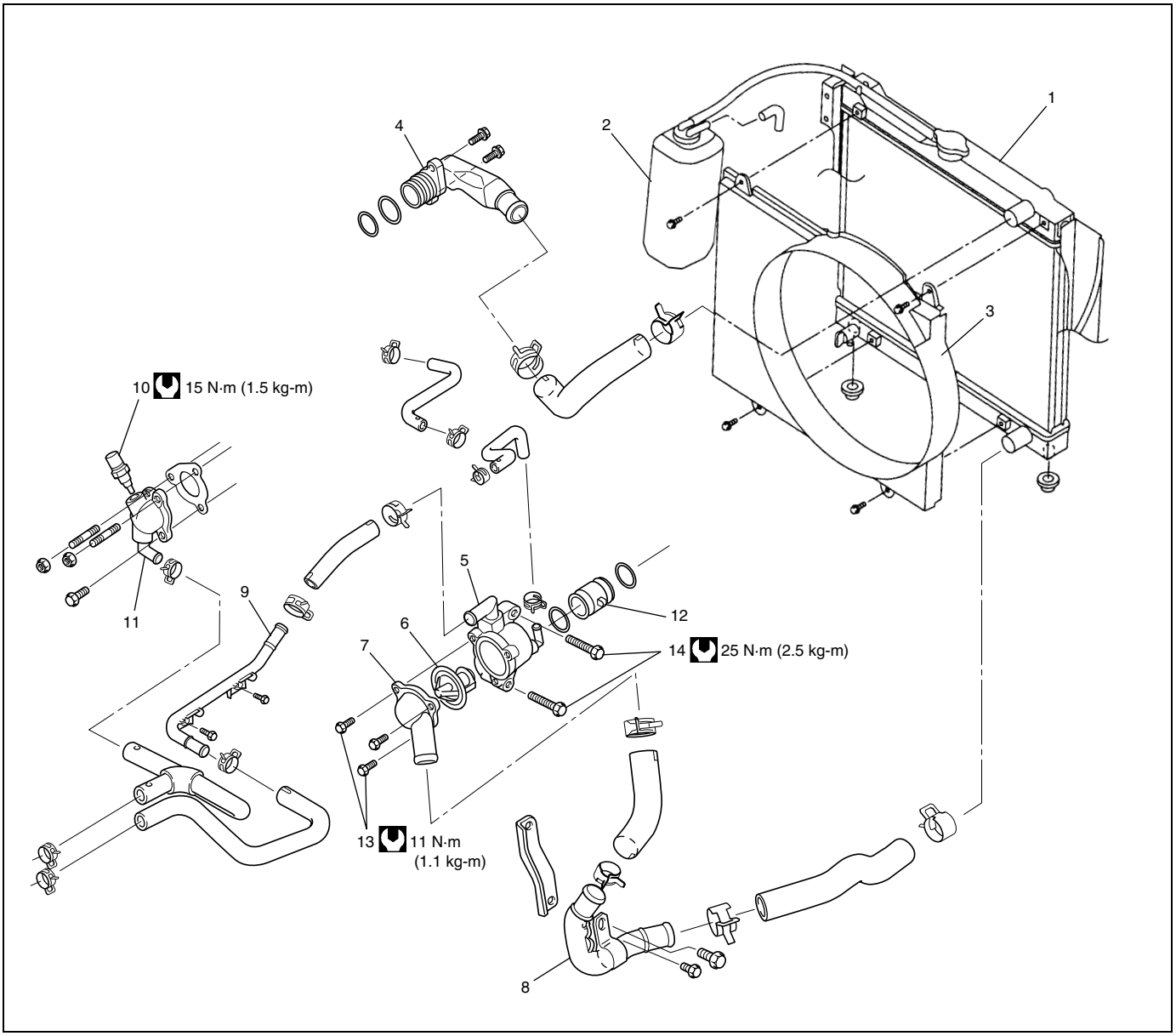
5) Connect negative cable at battery terminal.

On-Vehicle Service

CAUTION:

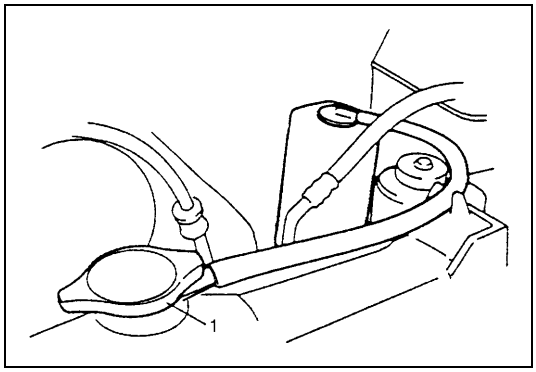
- **Check to make sure that engine coolant temperature is cold before removing any part of cooling system.**
- **Disconnect negative cable at battery before removing any part.**

Cooling System Component



1. Radiator	6. Thermostat	11. Water outlet cap
2. Reservoir	7. Thermostat cap	12. Thermostat case outlet pipe
3. Cooling fan shroud	8. Radiator outlet pipe	13. Thermostat cap bolt
4. Water outlet pipe	9. Heater pipe	14. Thermostat case bolt
5. Thermostat case	10. ECT sensor	Tightening Torque

Coolant Draining



1) Remove radiator cap (1).
2) Loosen drain plug on radiator to drain coolant.
3) After draining coolant, be sure to tighten drain plug securely.
4) Fill cooling system. Refer to “Coolant” in this section.

Cooling Water Pipes or Hoses

REMOVAL

1) Drain cooling system.
2) To remove water pipes or hoses, loosen screw on each pipe or hose clip and pull hose end off.

INSTALLATION

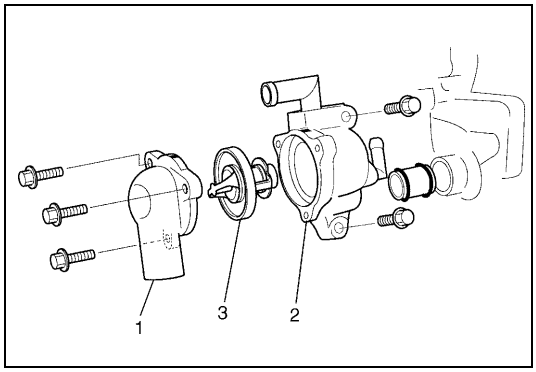
Install removed parts in reverse order of removal procedure, noting the following.

- Tighten each clamp bolt securely.
- Refill cooling system with proper coolant, referring to description on “Coolant” and “Cooling System Flush and Refill” in this section.

Thermostat

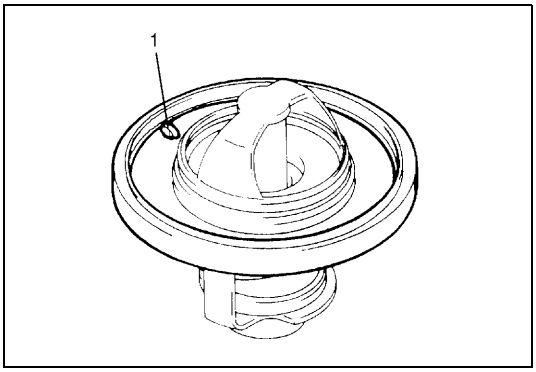
REMOVAL

1) Drain cooling system and tighten drain plug.
2) Remove intake manifold, referring to “Throttle Body and Intake Manifold” in Section 6A1.

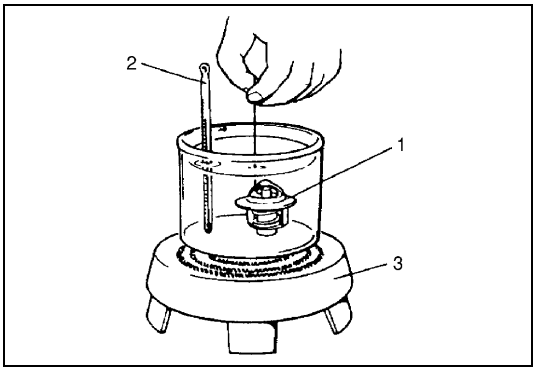


3) Disconnect thermostat cap (1) from thermostat case (2).
4) Remove thermostat (3).

INSPECTION



1) Make sure that air bleed valve (1) of thermostat is clear. Should this valve be clogged, engine would tend to overheat.
2) Check valve seat for some foreign matters being stuck which prevent valve from seating tight.



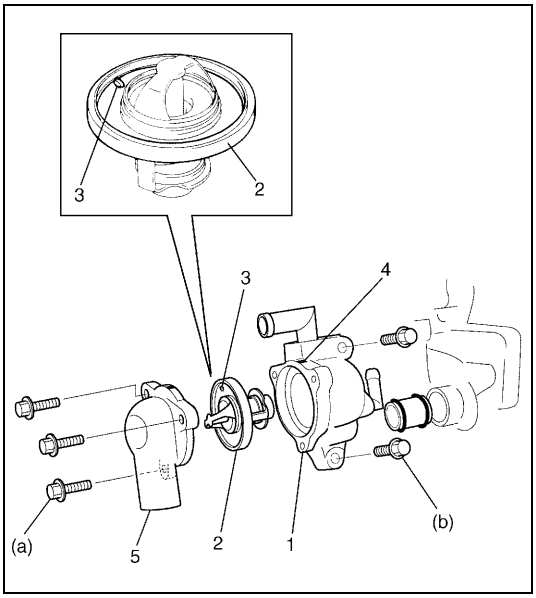
3) Check thermostatic movement of wax pellet as follows:
   a) Immerse thermostat (1) in water, and heat water gradually.
   b) Check that valve starts to open at specification temp.
   c) If valve starts to open at a temperature substantially below or above, thermostat unit should be replaced with a new one.
      Such a unit, if re-used, will bring about overcooling or overheating tendency.

Thermostat functional specification

Temp. at which valve begins to open	**80 – 84 °C (176 – 183 °F)**
Temp. at which valve becomes fully open	**93 – 97 °C (199 – 207 °F)**
Valve lift	**More than 8 mm at 95 °C (203 °F)**

2. Thermometer
3. Heater

INSTALLATION



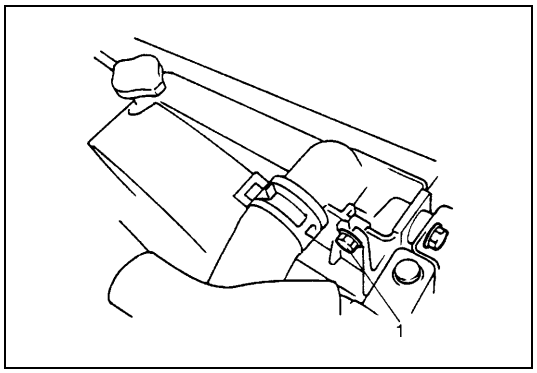
1) When positioning the thermostat (2) on the thermostat case (1), be sure to align its air breather valve (3) with mark (4).
2) Install thermostat cap (5) to thermostat case with align air bleed valve and mark.
   Then, tighten mounting bolts to specified torque.

Tightening torque
Thermostat cap bolts
(a) : 11 N·m (1.1 kg-m, 8.0 lb-ft)
Thermostat case bolts
(b) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

3) Install intake manifold by referring to “Throttle Body and Intake Manifold” in Section 6A1.
4) Fill the cooling system.

Water Pump Belt and Cooling Fan

REMOVAL



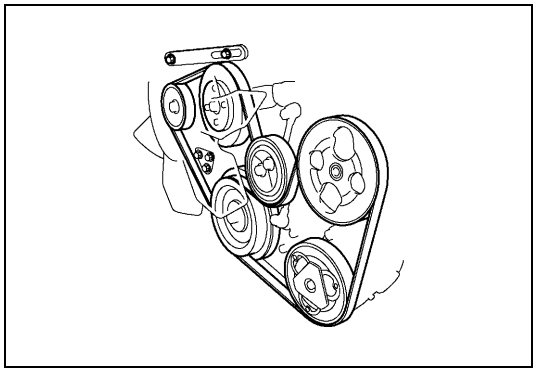
1) Remove radiator shroud securing bolts (1).
2) Remove radiator by referring to “Radiator” in this section.

3) Loosen water pump drive belt tension.
4) Remove cooling fan by removing securing nuts.
   Remove power steering and/or compressor drive belt before removing water pump belt.
5) Remove pump belt.

INSTALLATION

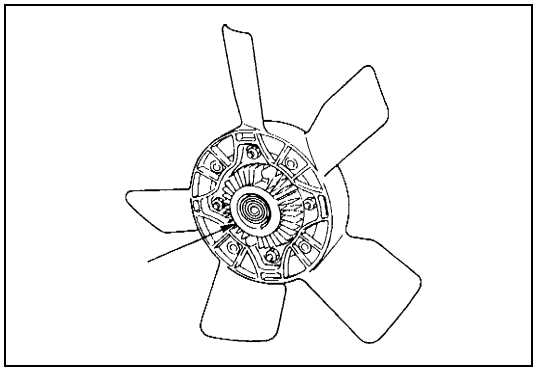
Once cooling fan or water pump belt has been removed, make sure to tighten bolts and nuts securely in reinstallation and adjust pump belt tension to specification. For specified tension, refer to “Water Pump Belt Tension” in this section.

WATER PUMP BELT TENSION INSPECTION



1) Check belt tension. It should be within specification. Refer to “Water Pump Belt Tension” in this section.
2) If tension is out of specification, adjust it.
   For its adjustment, refer to “Water Pump Belt Tension” in this section.
   After adjustment, be sure to tighten bolts.

COOLING FAN CLUTCH INSPECTION

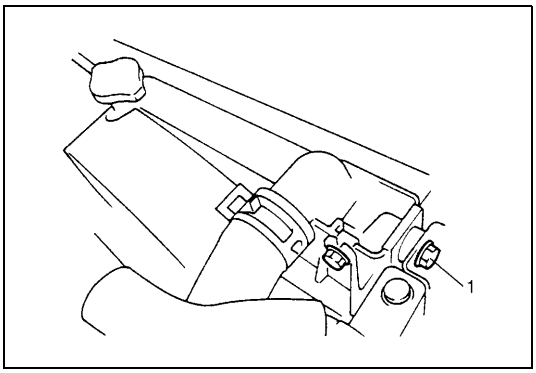


Inspect fluid coupling for oil leakage.
If necessary, replace fan clutch assembly. Do not disassemble clutch assembly.

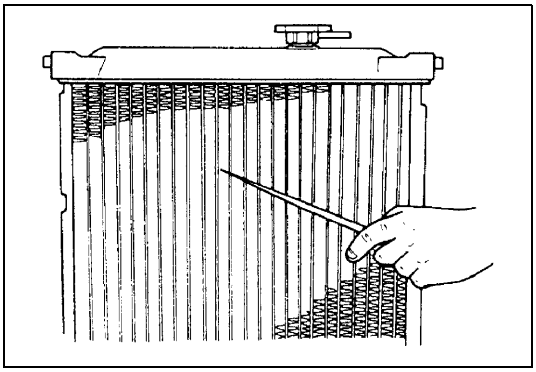
Radiator

REMOVAL

1) Drain cooling system.
2) Remove radiator shroud.
3) Disconnect water hoses from radiator.
4) With automatic transmission (A/T) vehicle, disconnect additional two fluid hoses from radiator.
   Place some container under radiator to receive A/T fluid which will flow out when hose is disconnected.
5) Install radiator protection board to between radiator and cooling fan.
6) Remove radiator after removing two bolts (1).



INSPECTION



If the water side of the radiator is found excessively rusted or covered with scales, clean it by flushing with the radiator cleaner compound.
This flushing should be carried out at regular intervals for scale or rust formation advances with time even where a recommended type of coolant is used. Periodical flushing will prove more economical.
Inspect the radiator cores and straighten the flattened or bent fins, if any. Clean the cores, removing road grimes and trashes.
Excessive rust or scale formation on the wet side of the radiator lowers the cooling efficiency.
Flattened or bent fins obstruct the flow of air through the core to impede heat dissipation.

Radiator flushing interval recommended
Two years

INSTALLATION

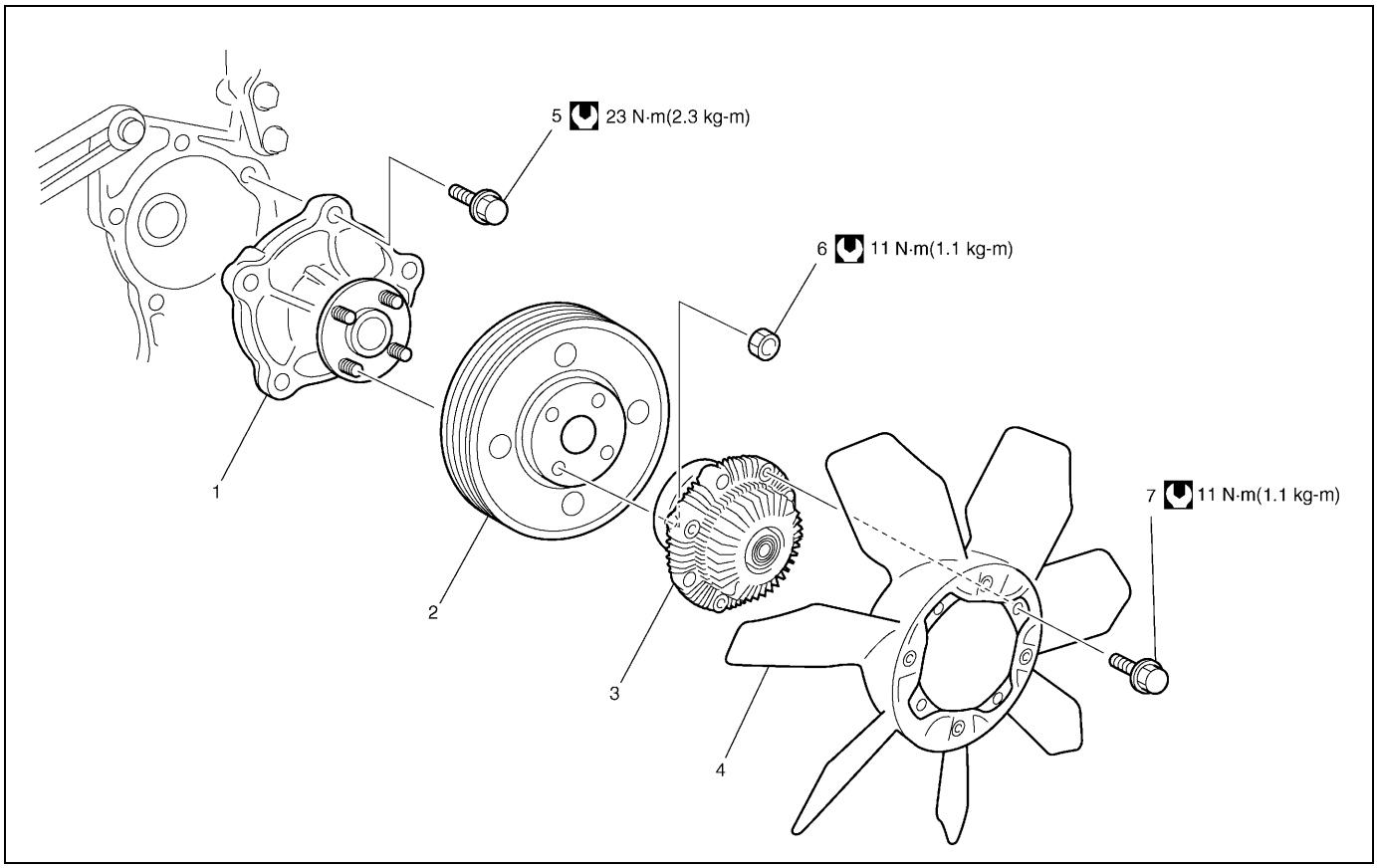
Reverse removal procedures.

NOTE:

- **Refill cooling system with proper coolant referring to "Coolant" and "Cooling System Flush and Refill" in this section.**
- **With automatic transmission vehicle, fill A/T fluid up to specified level. For procedure to check A/T fluid and its level, refer to "Changing Fluid" in Section 7B.**
- **After installation, check each joint for leakage.**

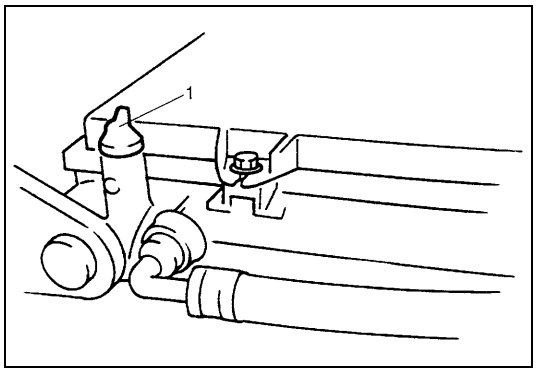
Water Pump

COMPONENTS



1. Water pump	4. Radiator cooling fan	7. Radiator cooling fan mounting bolt
2. Water pump pulley	5. Water pump mounting bolts	Tightening Torque
3. Radiator cooling fan clutch	6. Water pump pulley and fan clutch mounting nuts	

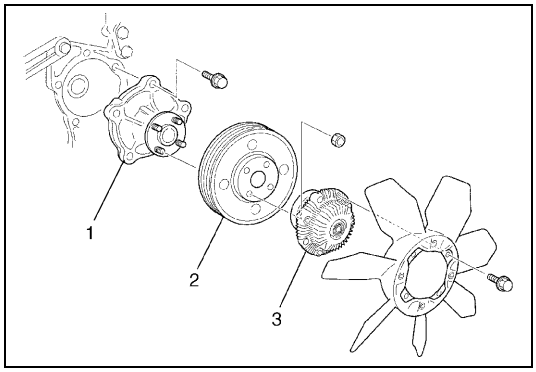
REMOVAL



1) Drain cooling system.
   Refer to Step 6) of “Cooling System Flush and Refill” in this section.

1. Drain plug

2) Remove the radiator shroud.
3) Remove radiator referring to “Radiator” in this section.

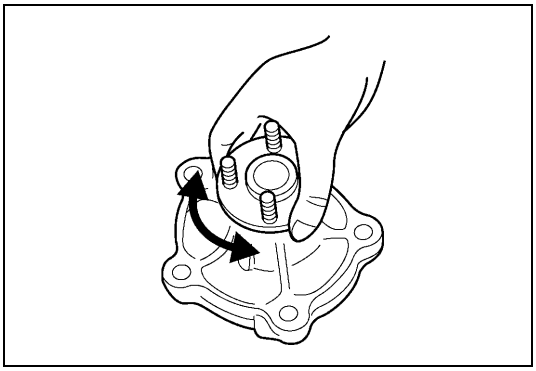


4) Loosen water pump drive belt tension.
   Then remove water pump pulley (2) with fan clutch (3) and pump drive belt.
5) Remove water pump assembly (1).

INSPECTION

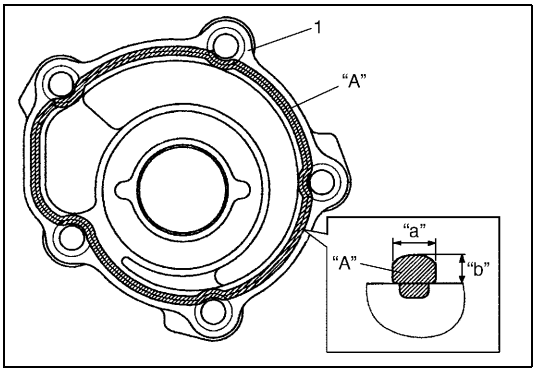
NOTE:

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 an abnormal noise, replace it.

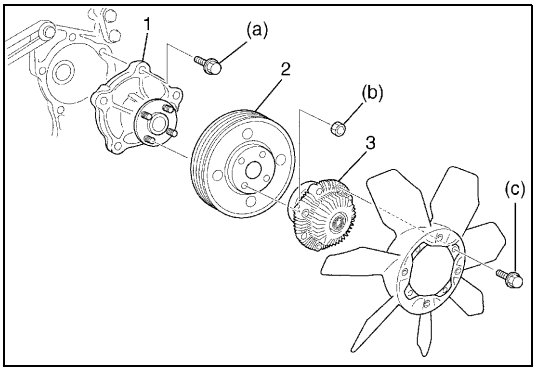
INSTALLATION



1) Apply sealant to water pump (1).

"A" : Sealant 99000-31150

Sealant quantity for mating surface of water pump
Width "a" : 3mm (0.12 in.)
Height "b" : 2mm (0.08 in.)



2) Install water pump (1) to cylinder block.

Tightening torque
Water pump bolts (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

3) Install water pump pulley (2) with fan clutch (3).

Tightening torque
Water pump pulley nuts (b) : 11 N·m (1.1 kg-m, 8.0 lb-ft)
Fan clutch bolts (c) : 11 N·m (1.1 kg-m, 8.0 lb-ft)

4) Install water pump drive belt, cooling fan and radiator shroud.
5) Adjust water pump belt tension.
   Refer to "Water Pump Belt Tension" in this section.
6) Connect negative cable at battery.
7) Fill the cooling system.

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 water pump mating surface.

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Water pump bolt	23	2.3	17.0
Thermostat cap bolt	11	1.1	8.0
Thermostat case bolt	25	2.5	18.0
Fun clutch bolt	11	1.1	8.0

SECTION 6C

ENGINE FUEL

CONTENTS

General Description 6C-2
Fuel System 6C-2
Fuel Tank 6C-2
Fuel Pump Assembly 6C-3
Fuel Filler Cap 6C-3
On-Vehicle Service 6C-4
Fuel Lines 6C-4
Fuel Filler Cap 6C-4
Fuel Tank 6C-4
Fuel Pump Assembly 6C-7
Tightening Torque Specification 6C-10
Special Tool 6C-10

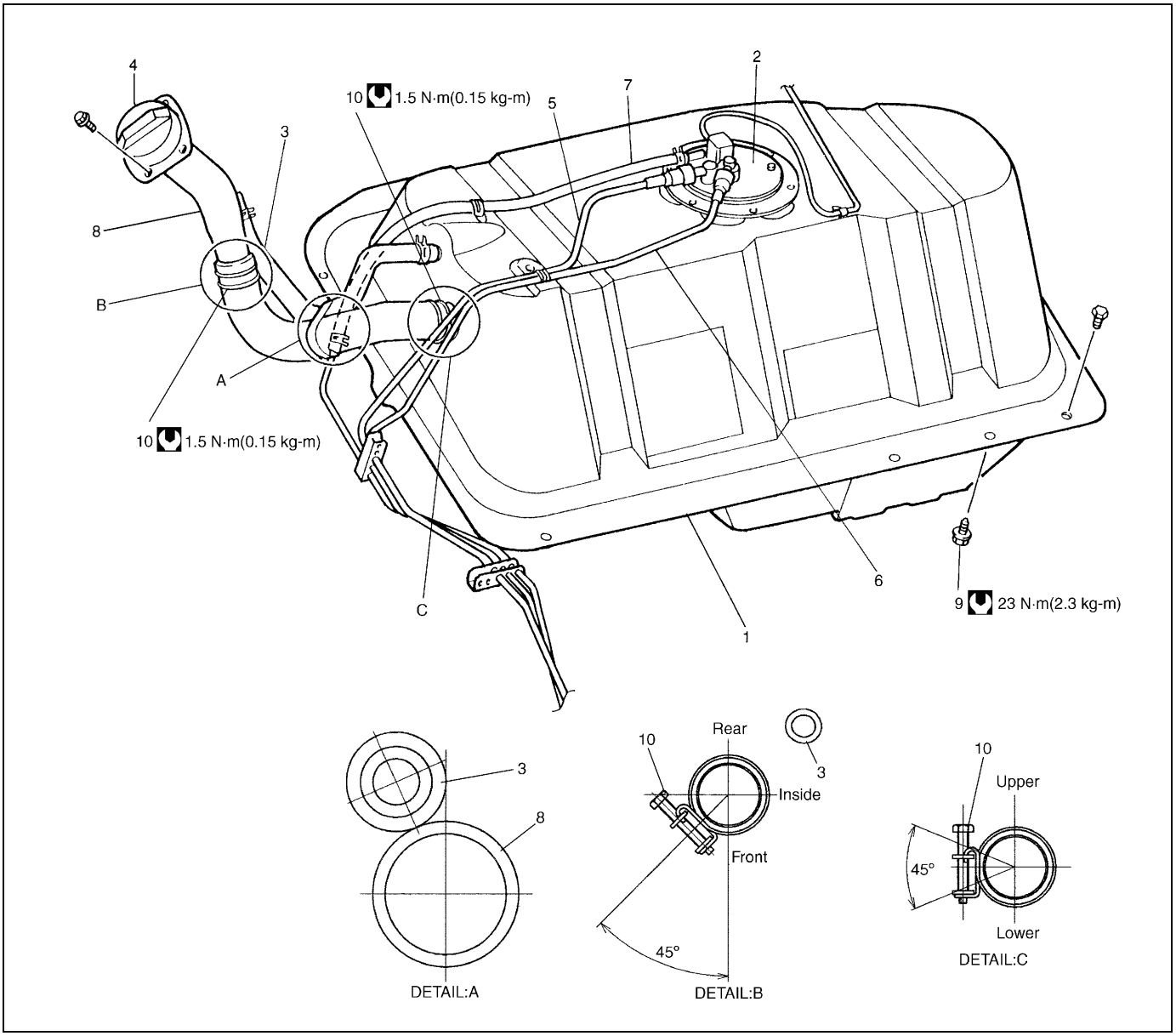
CAUTION:

For vehicles with a catalytic converter, be sure to use 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.

General Description

Fuel System

The main components of the fuel system are fuel tank, fuel pump assembly with fuel filter and fuel level gauge and fuel cut valve, fuel feed line, fuel return line and fuel vapor line.
For the details of fuel flow and fuel vapor flow, refer to “Fuel Delivery System” and “Emission Control System” in Section 6E.

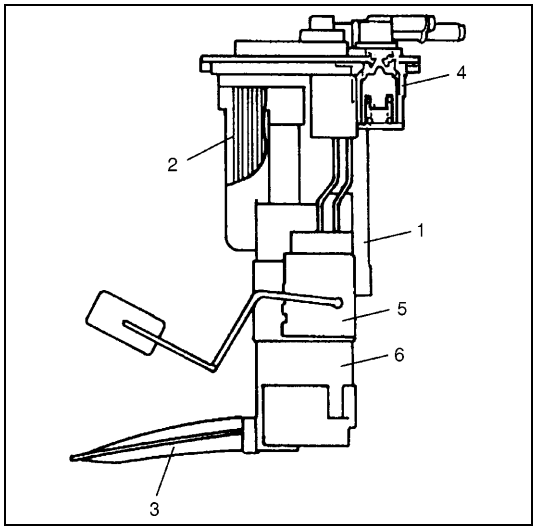


1. Fuel tank	4. Fuel filler cap	7. Fuel vapor line	10. Fuel filler hose clamp
2. Fuel pump assembly	5. Fuel feed line	8. Fuel filler neck	Tightening torque
3. Breather hose	6. Fuel return line	9. Fuel tank mounting bolt	

Fuel Tank

The fuel tank is located under the rear section of the vehicle. The fuel pump assembly is installed in fuel tank. Whenever servicing the fuel pump assembly, the fuel tank must be removed from the vehicle.

Fuel Pump Assembly



The fuel pump assembly (1) consists of fuel pump (6), fuel filter (2), fuel level gauge (5) and fuel cut valve (4).

3. Suction filter

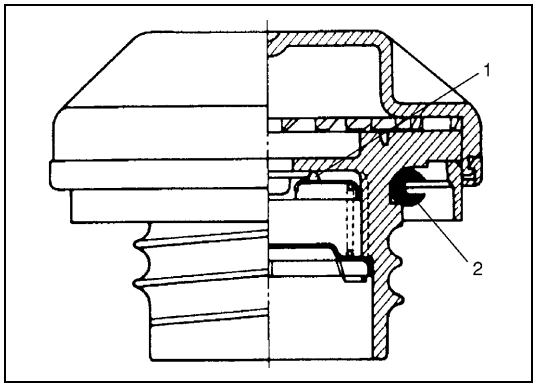
FUEL PUMP

For structure and operation of the fuel pump, refer to “Fuel Delivery System” in Section 6E.

FUEL CUT VALVE

The fuel cut valve consists of a float and a spring. It allows only the fuel vapor to flow into the canister and prevents the fuel from flowing into the canister.

Fuel Filler Cap



The fuel tank filler neck has a vacuum cap.
A ratchet tightening device on the threaded fuel filler cap reduces the chances of incorrect installation, which would prevent sealing fuel vapors.
After the gasket (2) on fuel filler cap and the filler neck flange contact, the ratchet produces a loud clicking noise, indicating the seal has been set.
This cap has a vacuum relief valve (1) inside.
The vacuum relief valve opens to relieve the vacuum created in the fuel tank.

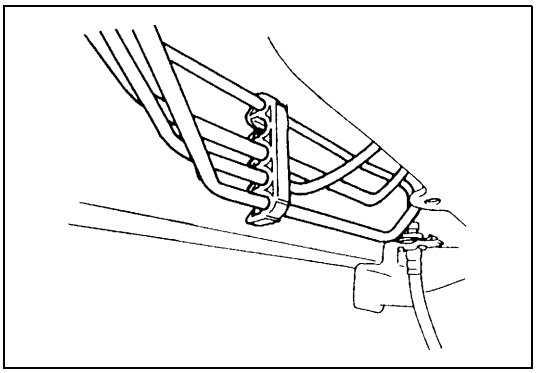
On-Vehicle Service

Before work, refer to “Precaution on Fuel System Service” in Section 6.

Fuel Lines

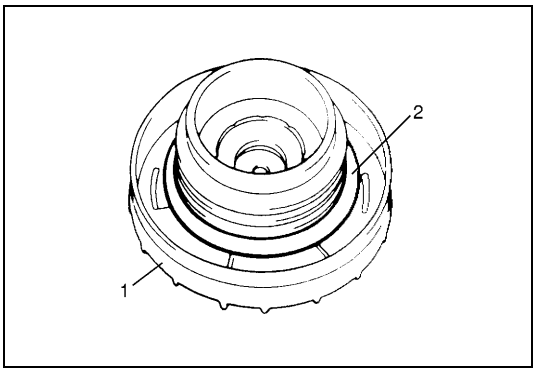
Due to the fact that fuel feed line is under high pressure, use special care when servicing it.

INSPECTION



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 Filler Cap



Remove cap (1) and check gasket (2) for even filler neck imprint and deterioration or any damage. If gasket 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.

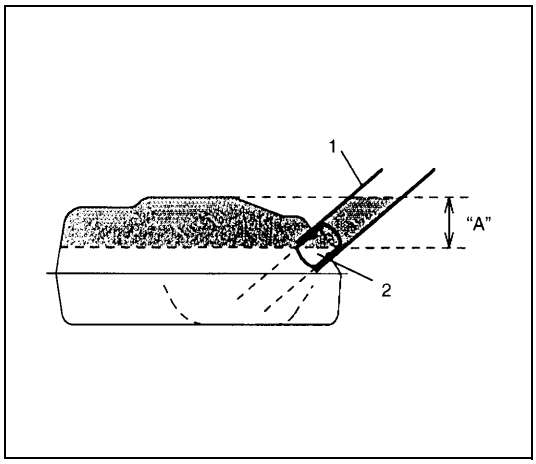
Fuel Tank

REMOVAL

WARNING:

- **Before starting the following procedure, be sure to observe “Precaution on Fuel System Service” in Section 6.**
- **Keep fuel tank horizontally and stably when removing it. Fuel may come out if tank is tilted. Also, fuel tank may drop and cause personal injury.**

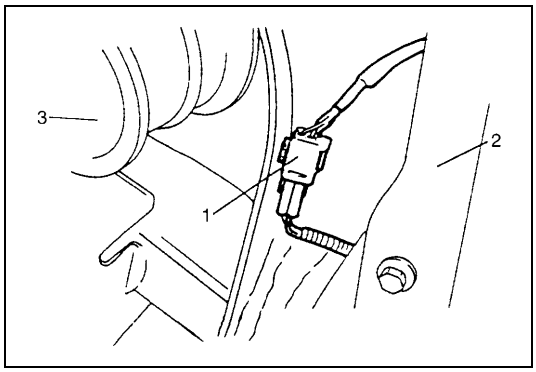
1) Relieve fuel pressure in fuel feed line referring to “Fuel Pressure Relief Procedure” in Section 6.
2) Disconnect negative cable at battery.
3) Remove fuel filler cap.



4) Insert hose of a hand operated pump into fuel filler hose (1) and drain fuel in space "A" in the figure (drain fuel through it till fuel stops).

CAUTION:
Do not force hose of a hand operated pump into fuel tank. Doing so can damage inlet valve (2).

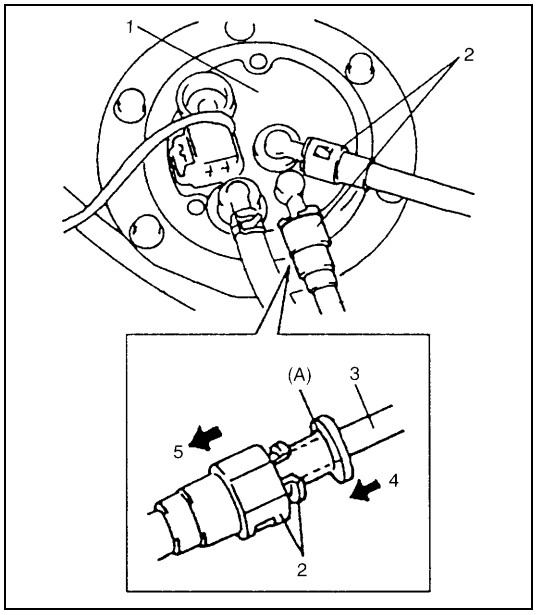
5) Hoist vehicle.
6) Remove exhaust center pipe referring to "Components" in Section 6K and rear propeller shaft referring to "Propeller Shafts" in Section 4B.



7) Disconnect coupler (1) for fuel pump assembly.
The coupler is close by left rear suspension coil spring (3).

2. Fuel tank	

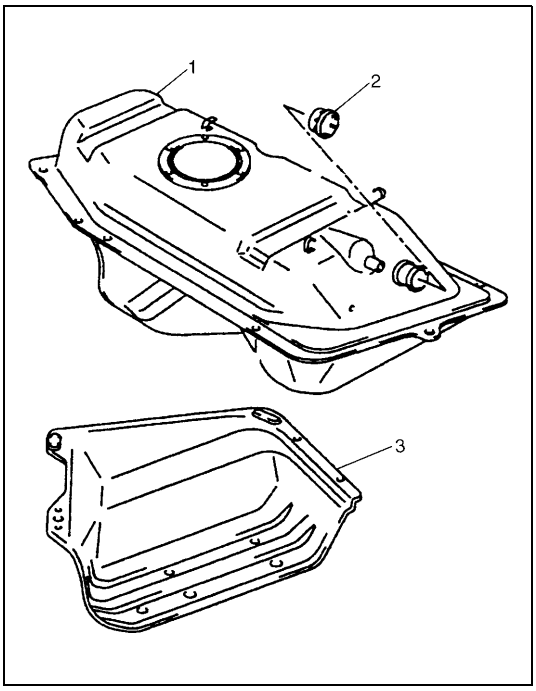
8) Remove fuel tank filler hose protector.
Disconnect filler hose and breather hose from fuel filler neck.
9) Disconnect fuel vapor hose from pipe.
10) With fuel tank supported on a jack, remove fuel tank bolts.



11) Lower fuel tank a little and hold it. Unclamp fuel hoses and disconnect them from fuel pump assembly (1).
When disconnecting joints of fuel feed line and return line from pipe, unlock joint by inserting special tool between pipe (3) and joint lock first.

Special tool
(A) : 09919-47020

2. Quick joint	5. Disconnect joint
4. Insert special tool	



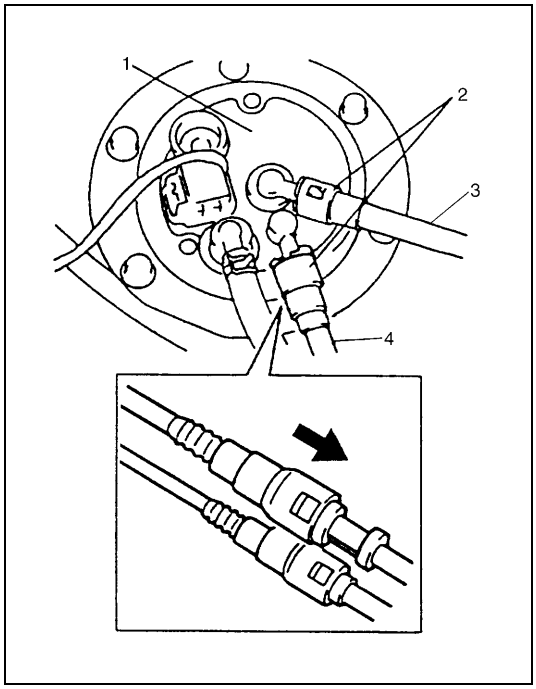
12) Remove fuel tank (1) from vehicle. Remove fuel tank protector (3) and inlet valve (2) as necessary.

FUEL TANK PURGING PROCEDURE

CAUTION:
This purging procedure will not remove all fuel vapor. Do not attempt any repair on tank where heat or flame is required, as an explosion resulting in personal injury could occur.

The following procedure is used for purging the fuel tank.

1) After removing fuel tank, remove all hoses and fuel pump assembly from fuel tank.
2) Drain all remaining fuel from tank.
3) Move 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.



INSTALLATION

1) Install fuel pump (1) assembly to fuel tank. Refer to “Fuel Pump Assembly” in this section. Install protector to fuel tank.
2) Install inlet valve to fuel tank.
   If deformed or damaged in any other way, replace with a new one.
3) Connect fuel filler and breather hoses to fuel tank and vapor hose to fuel pump assembly. Clamp them securely.
4) Lift up fuel tank on jack.
   Connect fuel feed hose (4) and return hose (3) to pipes as shown in figure and clamp them securely.

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.

2. Quick joint

5) Install fuel tank to vehicle and connect wire harness coupler.
6) Connect fuel filler hose and breather hose to fuel filler neck. Connect fuel vapor hose to pipe. Clamp them securely.
7) Install fuel filler hose protector.

Fuel Pump Assembly

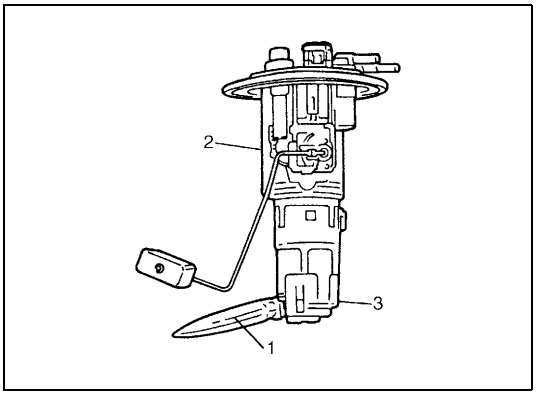
WARNING:

Before starting the following procedure, be sure to observe “Precaution on Fuel System Service” in Section 6.

REMOVAL

1) Remove fuel tank from vehicle. Refer to “Fuel Tank” in this section.
2) Disconnect wire harness coupler and fuel vapor hose from fuel pump assembly.
3) Remove fuel pump assembly from fuel tank by removing bolts.

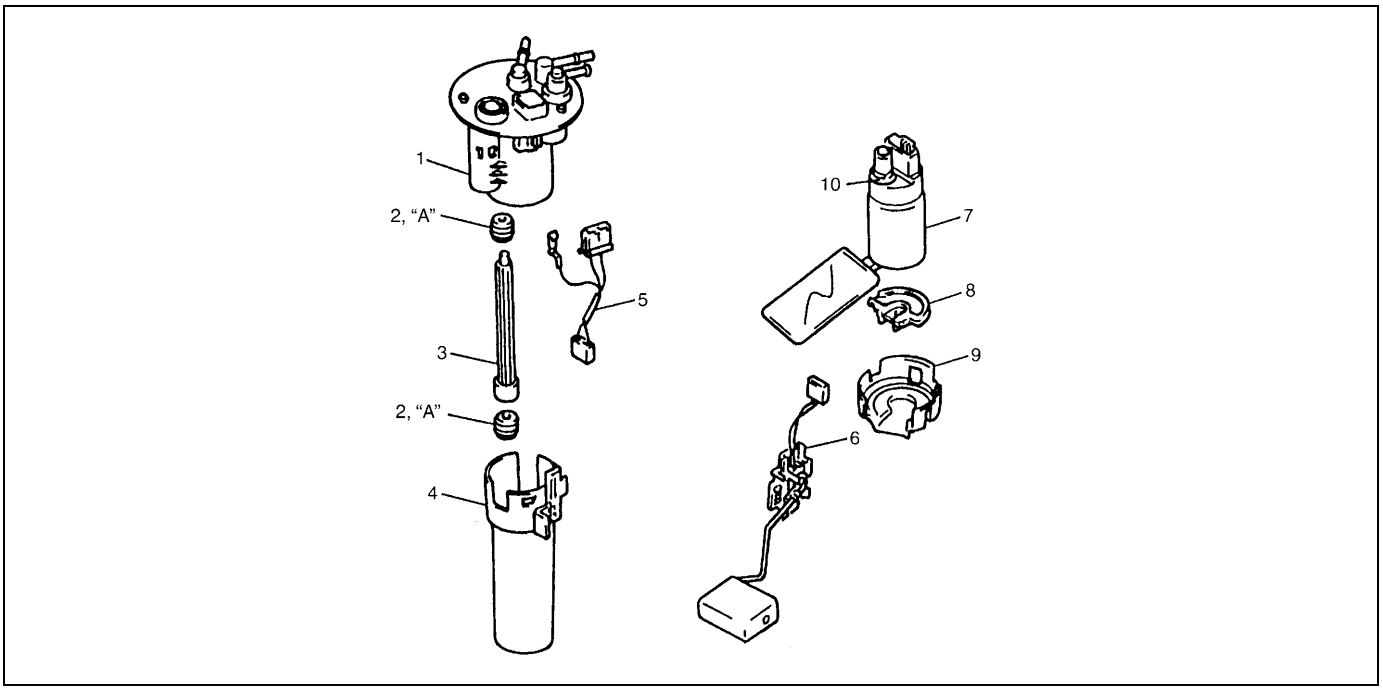
INSPECTION



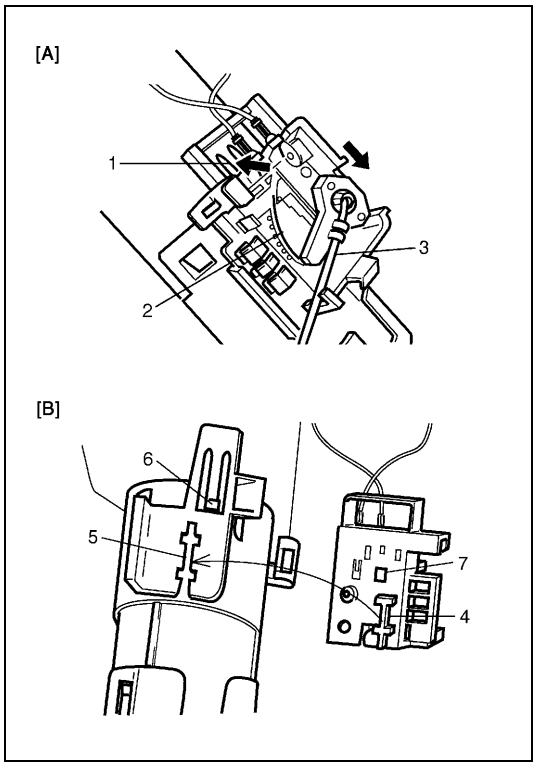
Check fuel pump assembly for damage.
Check fuel suction filter (1) for evidence of dirt and contamination. If present, replace or clean and check for presence of dirt in fuel tank.
For inspection of fuel pump itself, refer to “Table B – 3 Fuel Pressure Check” in Section 6.
For inspection of fuel level gauge, refer to “Fuel Meter / Fuel Gauge Unit” in Section 8.

2.	Fuel filter & bracket assembly
3.	Fuel pump motor & level gauge assembly

DISASSEMBLY / REASSEMBLY



“A” : Apply oil	4. Housing	8. Cushion
1. Bracket sub assembly (including fuel filter)	5. Lead wire	9. Bracket
2. Grommet	6. Fuel level gauge	10. Spacer
3. Tube	7. Fuel pump	



CAUTION:

- **While removing fuel level gauge, do not contact resistor plate (2) or deform arm (3). It may cause fuel level gauge to fail.**
- **When removing grommet from fuel tube or bracket sub assembly, be very careful not to cause damage to grommet installed section (sealed section in bore). Should it be damaged, replace it with new one, or fuel will leak from that part.**

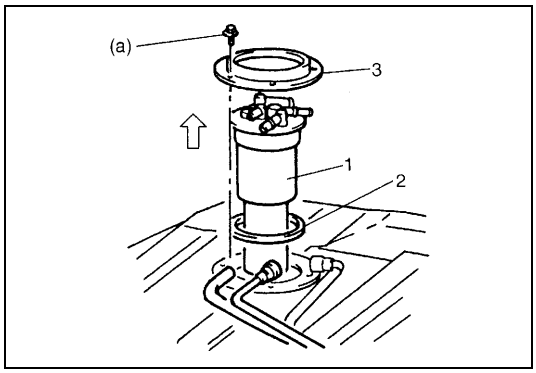
NOTE:

- **When removing fuel level gauge, press snap-fit part (1) and slide it in the arrow direction as shown in figure.**
- **When installing fuel level gauge to housing, fit protrusion (4) of fuel level gauge in groove (5) in housing and slide it up till lug (6) fits in window (7) securely. Refer to figure shown.**

[A] : Removal
[B] : Installation

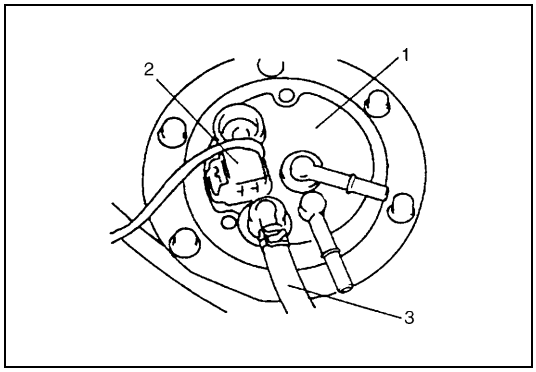
INSTALLATION

1) Clean mating surfaces of fuel pump assembly and fuel tank.



2) Install new gasket (2) and plate (3) to fuel pump assembly (1) then install fuel pump assembly to fuel tank.

Tightening torque
Fuel pump assembly bolts (a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)



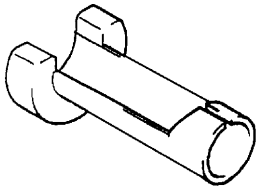
3) Connect wire harness coupler (2) and fuel vapor hose (3) to fuel pump assembly (1).

4) Install fuel tank to vehicle. Refer to “Fuel Tank” in this section.

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Fuel pump assembly bolt	10	1.0	7.5

Special Tool



09919-47020
Quick joint remover

SECTION 6E

ENGINE AND EMISSION CONTROL 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 "Air Bag 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:

Whether following systems (parts) are used in the particular vehicle or not depends on specifications. Be sure to bear this in mind when performing service work.

- **EGR valve**
- **Heated oxygen sensor (s) or CO adjusting resistor**
- **Three way catalytic converter (TWC) and warm up three-way catalytic converter (WU-TWC)**

CONTENTS

General Description 6E-3
Air Intake System 6E-5
Fuel Delivery System 6E-6
Fuel pump 6E-6
Electronic Control System 6E-7
Engine & emission control input / output table 6E-8
On-Vehicle Service 6E-15
Accelerator cable adjustment 6E-15
Idle speed / idle air control (IAC) duty inspection 6E-15
Idle mixture inspection / adjustment (vehicle without heated oxygen sensor) 6E-17
Air Intake System 6E-18
Throttle body 6E-18
Idle air control valve (IAC valve) 6E-21
Fuel Delivery System 6E-22
Fuel pressure inspection 6E-22
Fuel pump 6E-23
Fuel pressure regulator 6E-24
Fuel injector 6E-25
Electronic Control System 6E-29
Engine control module (ECM) 6E-29
Manifold absolute pressure sensor (MAP sensor) 6E-29
Throttle position sensor (TP sensor) 6E-30
Intake air temperature sensor (IAT sensor) 6E-31
Engine coolant temperature sensor (ECT sensor) 6E-32
Heated oxygen sensor (Sensor-1 and sensor-2) 6E-33
Camshaft position sensor 6E-34
Crankshaft position sensor 6E-35
Vehicle speed sensor (VSS) 6E-36
Fuel level sensor (GAUGE) 6E-36
Knock sensor 6E-36
Main relay, fuel pump relay and A/C condenser fan control relay 6E-36
Fuel cut operation 6E-37
A/C condenser fan control system 6E-37
A/C condenser fan 6E-37
Output signals of throttle valve opening and engine coolant temp. (Vehicle with A/T only) 6E-38
Emission Control System 6E-38

EGR system (If equipped)..... 6E-38
Evaporative emission (EVAP) control system..... 6E-39
PCV system 6E-41

Special Tools 6E-42
Tightening Torque Specifications..... 6E-43

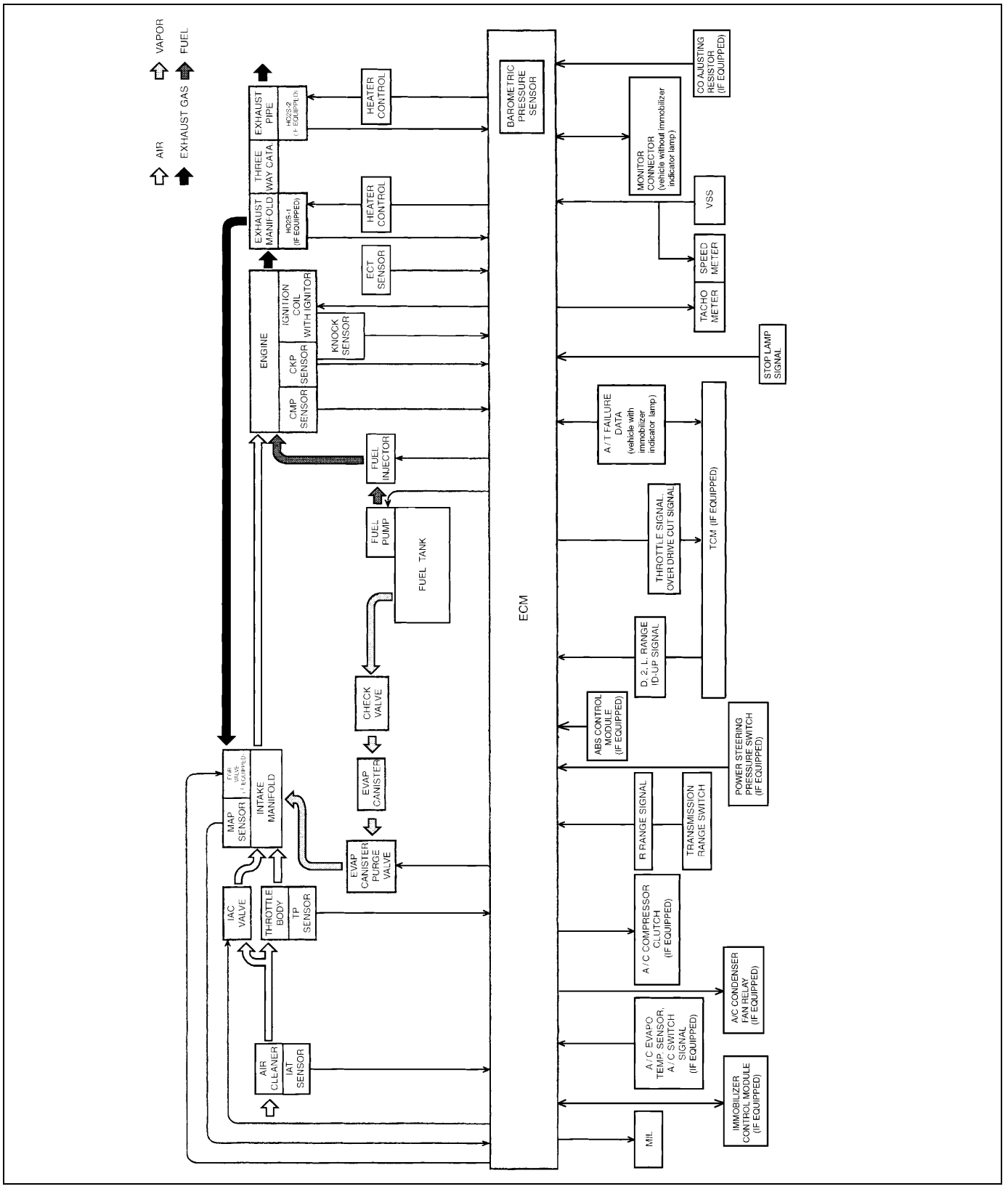
General Description

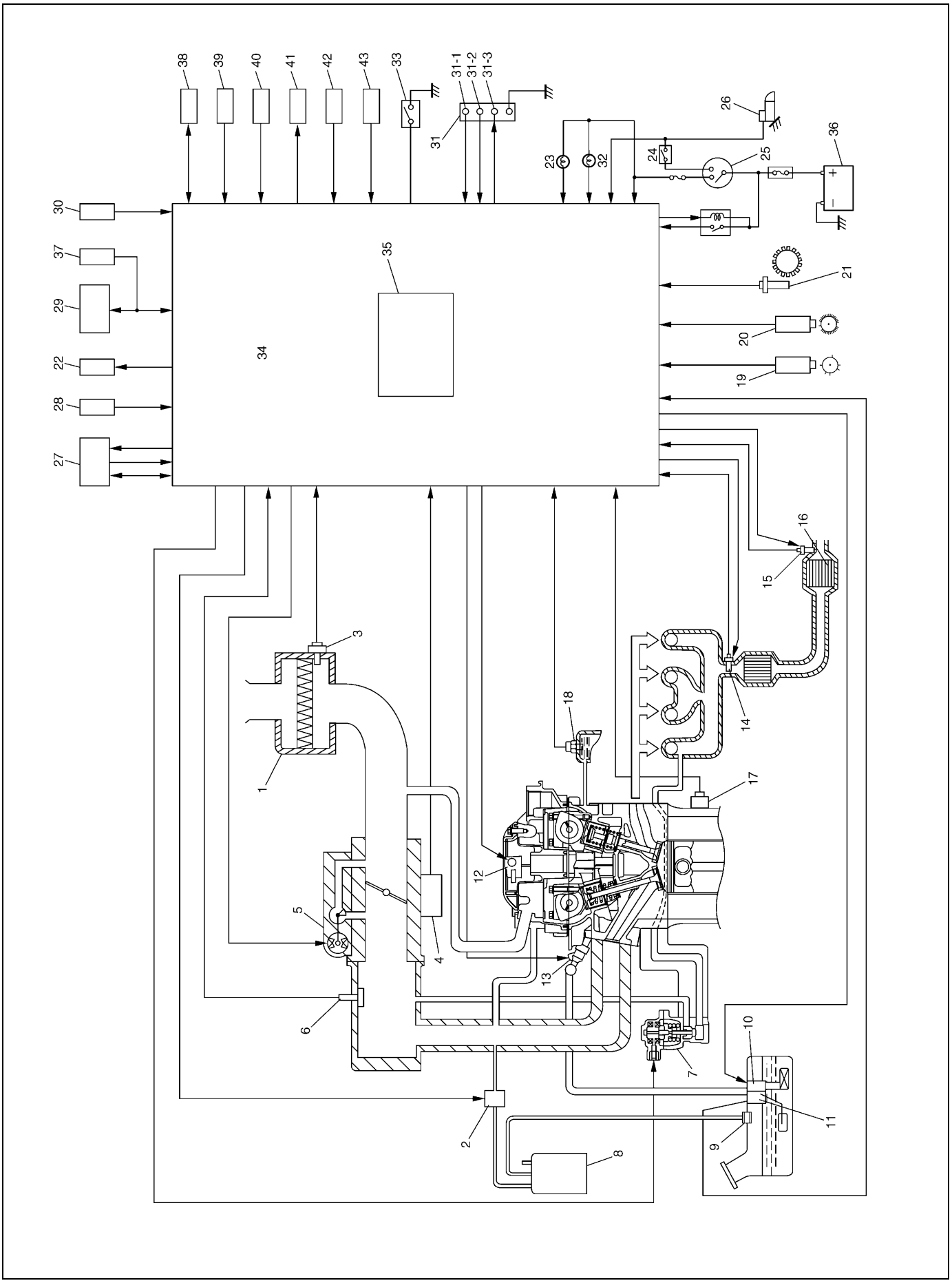
The engine and emission control system is divided into 4 major sub-systems: air intake system, fuel delivery system, electronic control system and emission control system.

Air intake system includes air cleaner, throttle body, IAC valve and intake manifold.

Fuel delivery system includes fuel pump, delivery pipe, fuel pressure regulator, etc. Electronic control system includes ECM, various sensors and controlled devices.

Emission control system includes EGR, EVAP and PCV system.




38
39
40
41
42
43
33
31-1
31-2
31-3
31
26
36
23
32
24
25
30
37
29
22
28
27
34
35
21
20
19
16
15
3
1
18
14
17
12
5
4
13
6
10
7
11
2
9
8

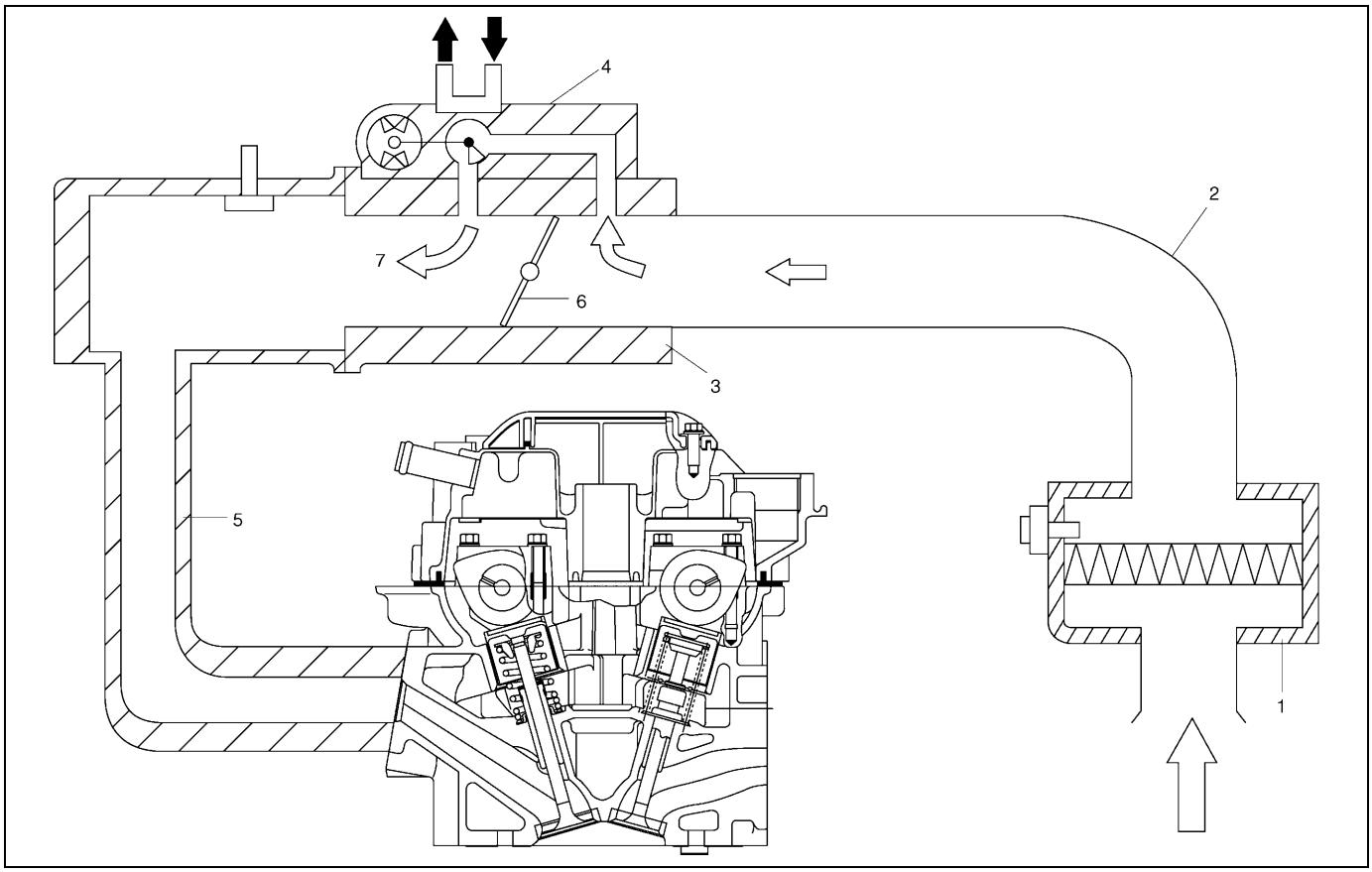
1. Air Cleaner	17. Knock sensor	31-2. Test switch terminal (vehicle w/o immobilizer indicator lamp)
2. EVAP canister purge valve	18. ECT sensor	31-3. Duty output terminal (vehicle w/o immobilizer indicator lamp)
3. IAT sensor	19. CMP sensor	32. Immobilizer indicator lamp (if equipped)
4. TP sensor	20. CKP sensor	33. Stop lamp switch
5. IAC valve	21. VSS	34. ECM
6. MAP sensor	22. A/C condenser fan (if equipped)	35. Barometric pressure sensor (vehicle with immobilizer indicator lamp)
7. EGR valve (if equipped)	23. Malfunction indicator lamp in combination meter	36. Battery
8. EVAP canister	24. Park/Neutral position switch in TR switch (A/T)	37. Immobilizer control module (if equipped)
9. Tank pressure control valve (built-in fuel pump)	25. Ignition switch	38. ABS control module (if equipped)
10. Fuel pump	26. Starter magnetic switch	39. CO adjusting resistor (if equipped)
11. Fuel level sensor	27. TCM (A/T)	40. Power steering pressure switch (if equipped)
12. Ignition coil assembly	28. Transmission range switch (A/T)	41. A/C compressor clutch (if equipped)
13. Fuel injector	29. DLC	42. A/C EVAP TEMP. sensor (if equipped)
14. Heated Oxygen Sensor (HO2S)-1 (if equipped)	30. Electric load	43. A/C switch (if equipped)
15. Heated Oxygen Sensor (HO2S)-2 (if equipped)	31. Monitor connector (if equipped)	
16. Three way catalytic convertor (if equipped)	31-1. Diagnosis switch terminal (vehicle w/o immobilizer indicator lamp)	

Air Intake System

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).

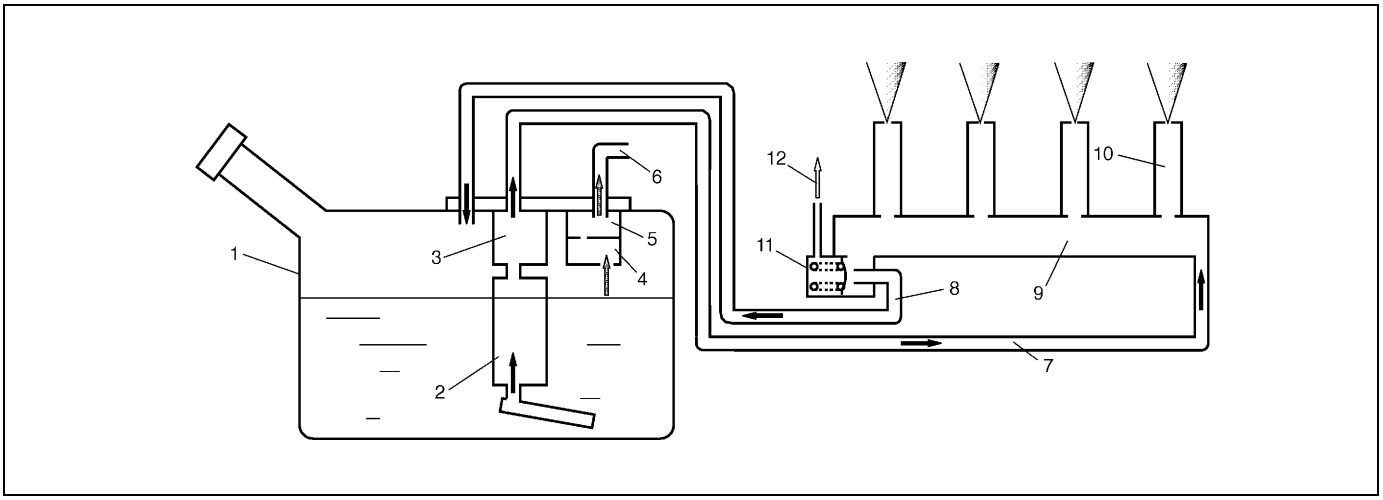
The air (by the amount corresponding to the throttle valve (6) opening and engine speed) is filtered by the air cleaner (1), passes through the throttle body (3), is distributed by the intake manifold (5) and finally drawn into each combustion chamber.

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).



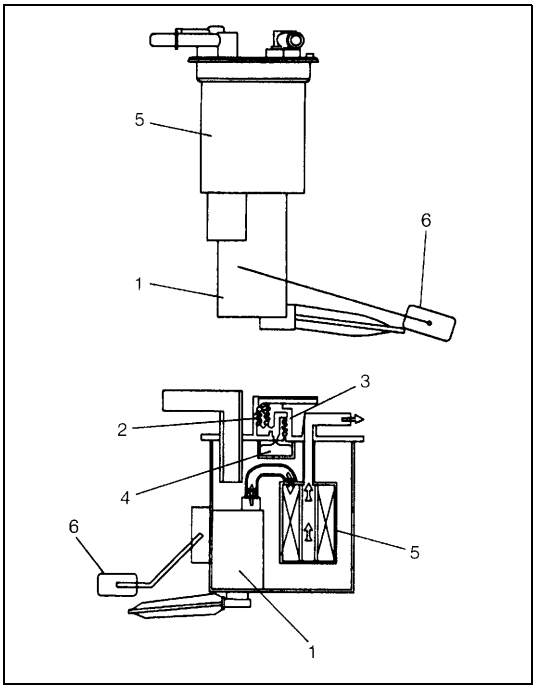
Fuel Delivery System

The fuel delivery system consists of the fuel tank (1), fuel pump (2), fuel filter (3), fuel pressure regulator (11), delivery pipe (9) and fuel injectors (10).
The fuel in the fuel tank is pumped up by the fuel pump, filtered by the fuel filter and fed under pressure to each injector through the delivery pipe.
As the fuel pressure applied to the injector (the fuel pressure in the fuel feed line) is always kept a certain amount higher than the pressure in the intake manifold by the fuel pressure regulator, the fuel is injected into the intake port of the cylinder head when the injector open according to the injection signal from ECM.
The fuel relieved by the fuel pressure regulator returns through the fuel return line (8) to the fuel tank.



4. Fuel cut valve	6. To EVAP canister	12. To intake manifold (vacuum passage)
5. Fuel tank pressure control valve	7. Fuel feed line	

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) is included and a fuel level gauge (6) is attached.

Electronic Control System

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.

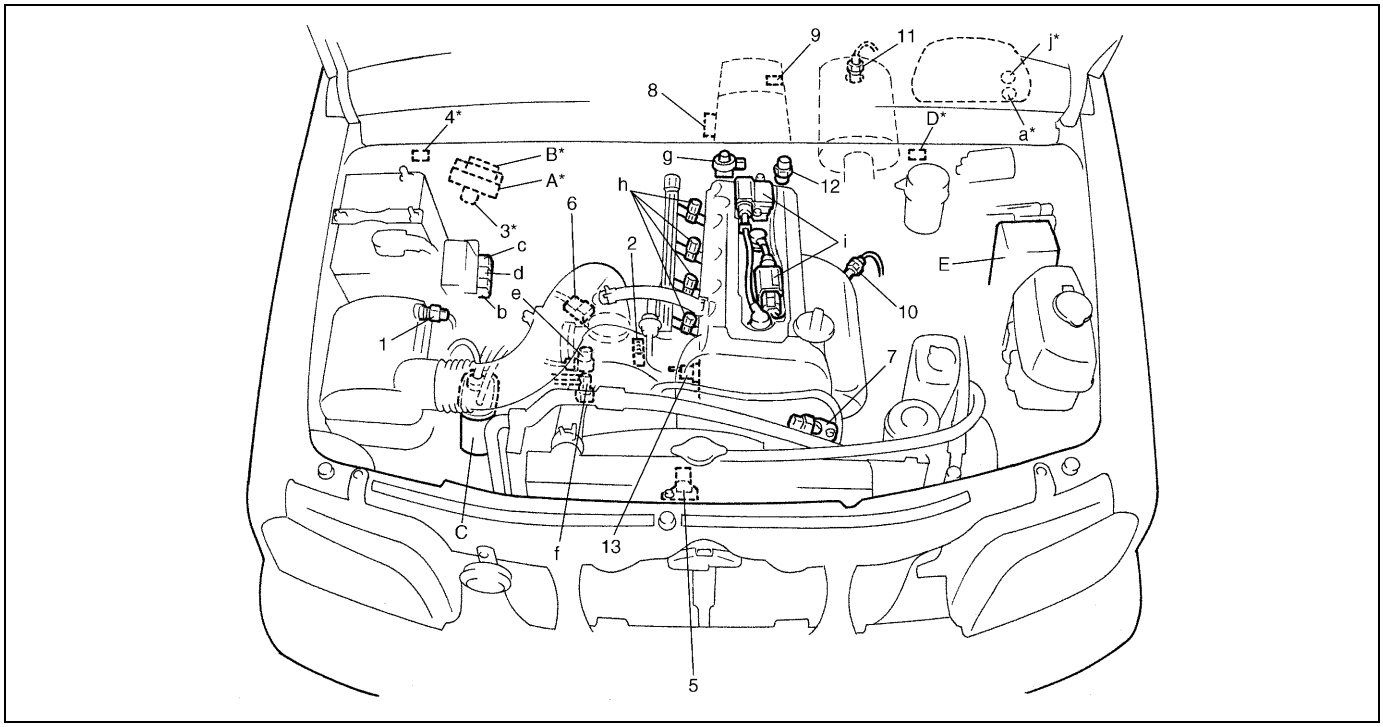
Functionally, it is divided into the following sub systems:

- Fuel injection control system
- Idle speed control system
- Fuel pump control system
- A/C control system (if equipped)
- A/C condenser fan control system
- EGR system (if equipped)
- Evaporative emission control system
- Oxygen sensor heater control system
- Ignition control system

Also, with A/T model, ECM sends throttle valve opening signal and over drive cut signal to transmission control module to control A/T.

NOTE:

The figure shows left-hand steering vehicle. For right-hand steering vehicle, parts with (*) are installed at the other side.



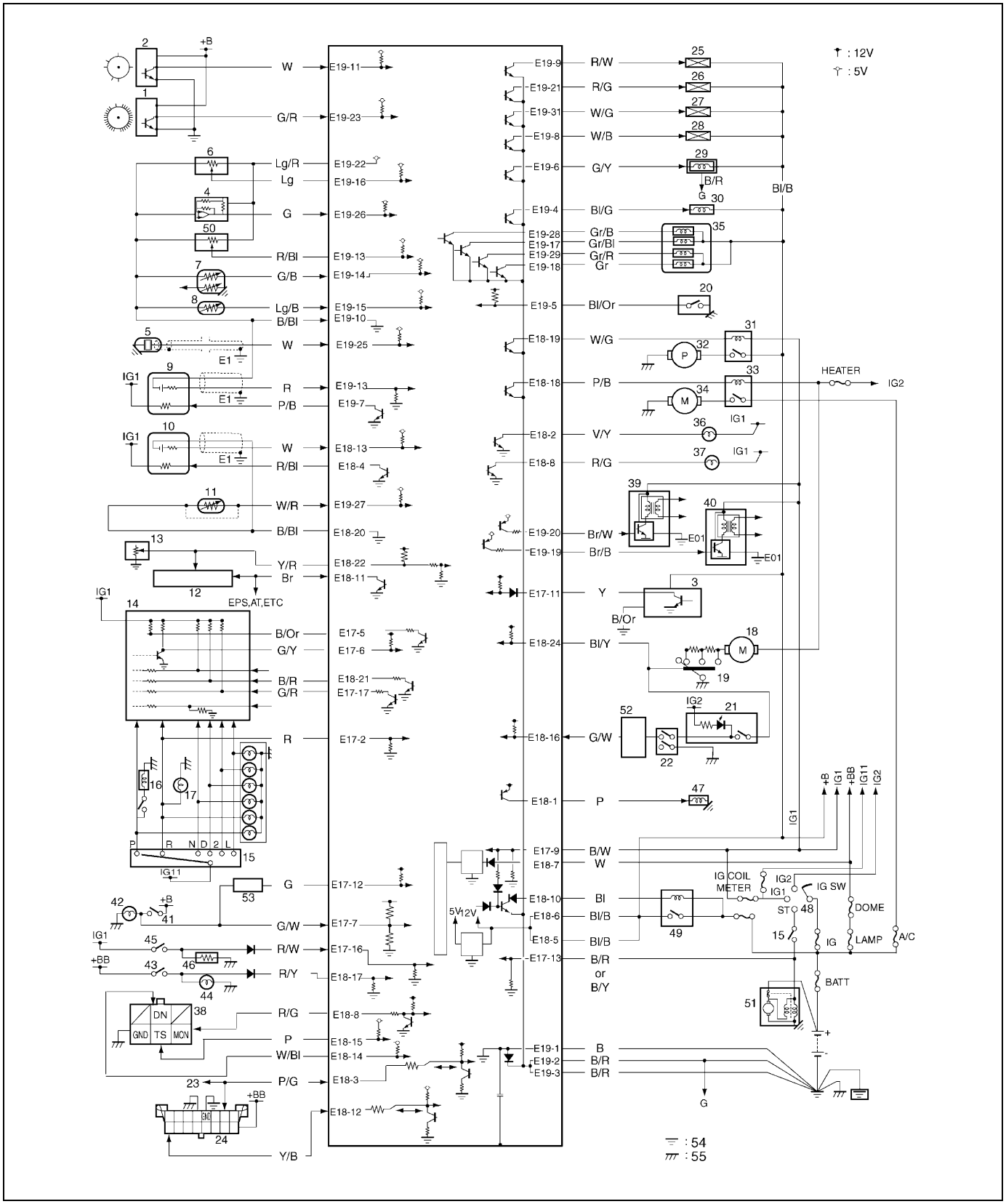
1. IAT sensor	a : Immobilizer indicator lamp (if equipped)	A : ECM
2. TP sensor	b : A/C condenser fan motor relay (if equipped)	B : A/T control module
3. Monitor connector	c : Main relay	C : EVAP canister
4. CO adjusting resistor (if equipped)	d : Fuel pump relay	D : DLC
5. CKP sensor	e : IAC valve	E : ABS control module (if equipped)
6. MAP sensor	f : EVAP canister purge valve	
7. CMP sensor	g : EGR valve (if equipped)	
8. Transmission range switch	h : Fuel injector	
9. VSS	i : Ignition coil assemblies	
10. HO2S-1 (if equipped)	J : MIL	
11. HO2S-2 (if equipped)		
12. ECT sensor		
13. Knock sensor		

Engine & 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 (IF EQUIPPED)	EVAP CANISTER PURGE VALVE	A/C COMPRESSOR CLUTCH	A/C CONDENSER FAN RELAY	MIL	MAIN RELAY	TRANSMISSION CONTROL MODULE
SIGNAL FROM SENSOR, SWITCH AND CONTROL MODULE	DIAGNOSIS SWITCH TERMINAL (VEHICLE WITHOUT IMMOBILIZER INDICATOR LAMP)										○		
	BAROMETRIC PRESSURE SENSOR (VEHICLE WITH IMMOBILIZER INDICATOR LAMP)		○		○						○		○
	STOP LAMP SWITCH				○								
	STARTER SWITCH	○	○		○				○		○		
	IGNITION SWITCH	○	○	○	○	○	○	○	○	○		○	○
	LIGHTING SWITCH				○								
	REAR DEFOGGER SWITCH (IF EQUIPPED)				○								
	BLOWER SWITCH				○								
	A/C SWITCH (IF EQUIPPED)				○				○	○			
	A/C EVAPORATOR TEMP. SENSOR (IF EQUIPPED)				○				○				
	VSS				○				○	○	○		○
	HEATED OXYGEN SENSOR-1 (IF EQUIPPED)		○					○			○		
	HEATED OXYGEN SENSOR-2 (IF EQUIPPED)	For detecting deterioration of three way catalytic converter									○		
	IAT SENSOR		○		○	○	○	○	○		○		
	ECT SENSOR		○	○	○	○	○	○	○	○	○		○
	TP SENSOR		○		○	○			○		○		○
	MAP SENSOR		○	○	○	○	○	○	○		○		
	CMP SENSOR	○	○	○	○	○	○	○	○		○		
	CKP SENSOR	○	○	○	○	○	○	○	○		○		
	TEST SWITCH TERMINAL (VEHICLE WITHOUT IMMOBILIZER INDICATOR LAMP)					○							
	KNOCK SENSOR					○					○		

ECM INPUT / OUTPUT CIRCUIT DIAGRAM

For TYPE A (See NOTE)



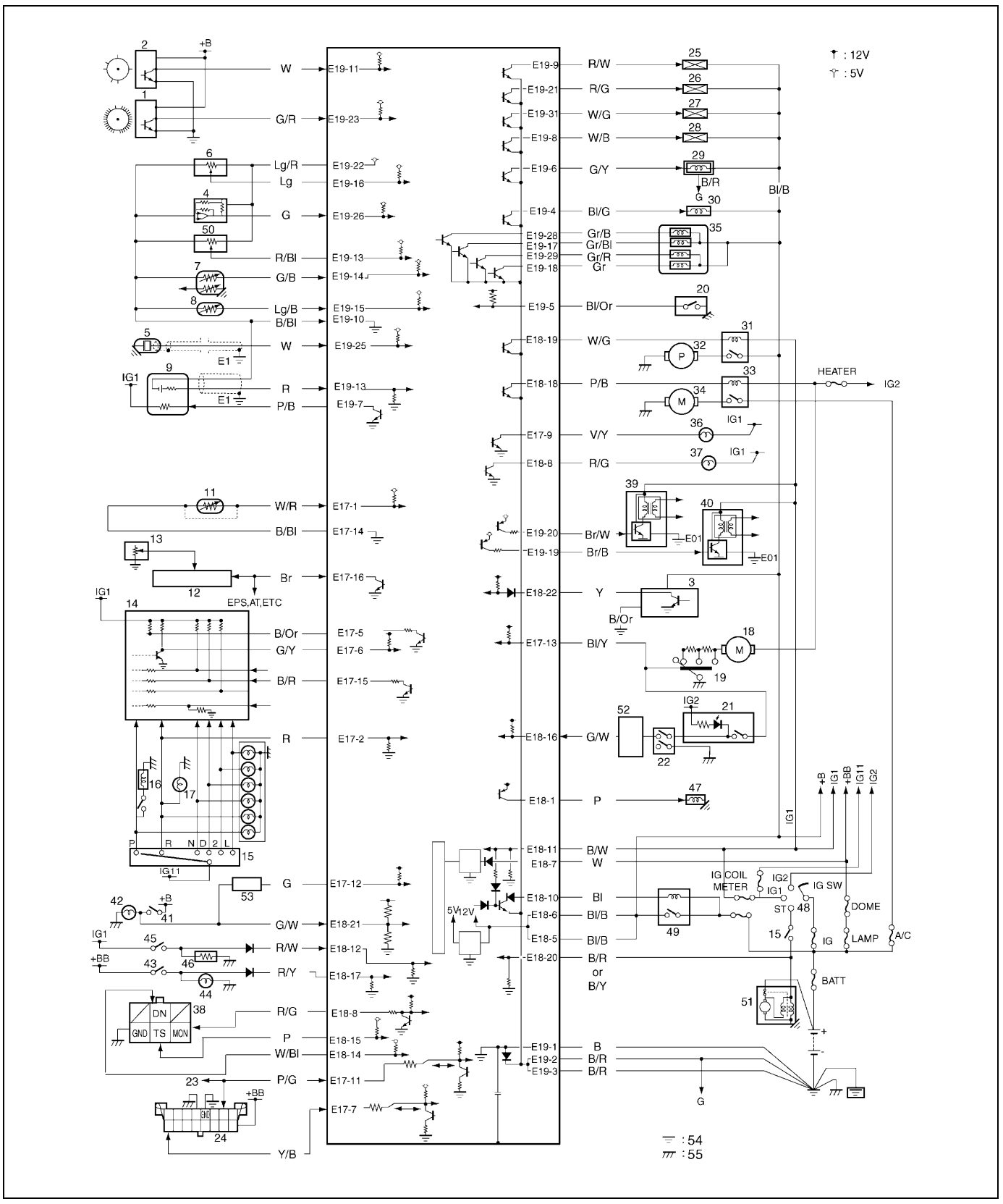
NOTE:

Type A is other than follows.

Type B is left hand steering vehicle equipped with fasten seat belt light and EGR valve or right hand steering vehicle equipped with fasten seat belt light and immobilizer control system.

1. CKP sensor	20. Power steering pressure switch (if equipped)	39. Ignition coil assembly (for No.1 and No.4 spark plugs)
2. CMP sensor	21. A/C switch	40. Ignition coil assembly (for No.2 and No.3 spark plugs)
3. VSS	22. A/C refrigerant pressure switch (if equipped)	41. Stop lamp switch
4. MAP sensor	23. Immobilizer control module (if equipped)	42. Stop lamp
5. Knock sensor	24. Data link connector	43. Lighting switch
6. TP sensor	25. Injector No.1	44. Position lamp
7. ECT sensor	26. Injector No.2	45. Rear defogger switch (if equipped)
8. IAT sensor	27. Injector No.3	46. Rear defogger (if equipped)
9. Heated oxygen sensor-1 (if equipped)	28. Injector No.4	47. A/C compressor clutch (if equipped)
10. Heated oxygen sensor-2 (if equipped)	29. IAC valve	48. Ignition switch
11. A/C evaporator temp. sensor (if equipped)	30. EVAP canister purge valve	49. Main relay
12. Speedometer	31. Fuel pump relay	50. CO adjusting register (if equipped)
13. Fuel level sensor	32. Fuel pump	51. Starting motor
14. TCM (A/T)	33. A/C condenser fan relay (if equipped)	52. 4WD controller (4WD)
15. Transmission range switch (A/T)	34. A/C condenser fan motor (if equipped)	53. ABS control module (if equipped)
16. Shift lock solenoid (A/T, if equipped)	35. EGR valve (if equipped)	54. Engine ground
17. Backup lamp	36. Malfunction indicator lamp	55. Body ground
18. Heater fan motor	37. Immobilizer indicator lamp (if equipped)	
19. Heater fan switch	38. Monitor connector (vehicle without immobilizer indicator lamp)	

For TYPE B (See NOTE)



NOTE:

See NOTE in “ECM INPUT / OUTPUT CIRCUIT DIAGRAM” for applicable model.

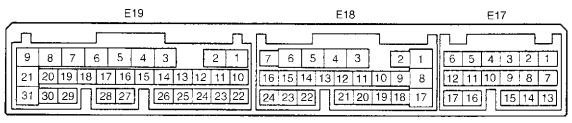
1. CKP sensor	20. Power steering pressure switch (if equipped)	39. Ignition coil assembly (for No.1 and No.4 spark plugs)
2. CMP sensor	21. A/C switch	40. Ignition coil assembly (for No.2 and No.3 spark plugs)
3. VSS	22. A/C refrigerant pressure switch (if equipped)	41. Stop lamp switch
4. MAP sensor	23. Immobilizer control module (if equipped)	42. Stop lamp
5. Knock sensor	24. Data link connector	43. Lighting switch
6. TP sensor	25. Injector No.1	44. Position lamp
7. ECT sensor	26. Injector No.2	45. Rear defogger switch (if equipped)
8. IAT sensor	27. Injector No.3	46. Rear defogger (if equipped)
9. Heated oxygen sensor-1 (if equipped)	28. Injector No.4	47. A/C compressor clutch (if equipped)
10. Heated oxygen sensor-2 (if equipped)	29. IAC valve	48. Ignition switch
11. A/C evaporator temp. sensor (if equipped)	30. EVAP canister purge valve	49. Main relay
12. Speedometer	31. Fuel pump relay	50. CO adjusting register (if equipped)
13. Fuel level sensor	32. Fuel pump	51. Starting motor
14. TCM (A/T)	33. A/C condenser fan relay (if equipped)	52. 4WD controller (4WD)
15. Transmission range switch (A/T)	34. A/C condenser fan motor (if equipped)	53. ABS control module (if equipped)
16. Shift lock solenoid (A/T, if equipped)	35. EGR valve (if equipped)	54. Engine ground
17. Backup lamp	36. Malfunction indicator lamp	55. Body ground
18. Heater fan motor	37. Immobilizer indicator lamp (if equipped)	
19. Heater fan switch	38. Monitor connector (vehicle without immobilizer indicator lamp)	

ECM TERMINAL ARRANGEMENT TABLE

For TYPE A (See NOTE)

CONNECTOR	TERMINAL	WIRE COLOR	CIRCUIT
E19	1	B	Ground for ECM
	2	B/R	Ground for drive circuit
	3	B/R	Ground for drive circuit
	4	Bl/G	Canister purge valve
	5	Bl/Or	Power steering pressure switch (if equipped)
	6	G/Y	IAC valve
	7	P/B	Heater of HO2S-1 (if equipped)
	8	W/B	No.4 fuel injector
	9	R/W	No.1 fuel injector
	10	B/Bl	Ground for sensor circuit
	11	W	CMP sensor
	12	–	–
	13	R R/Bl	Heated oxygen sensor-1 (if equipped) CO adjusting resistor (w/o HO2S)
	14	G/B	ECT sensor
	15	Lg/B	IAT sensor
	16	Lg	TP sensor
	17	Gr/Bl	EGR valve (stepper motor coil 3, if equipped)
	18	Gr	EGR valve (stepper motor coil 1, if equipped)
	19	Br/B	IG coil assembly for No.2 and 3 spark plugs
	20	Br/W	IG coil assembly for No.1 and 4 spark plugs
	21	R/G	No.2 fuel injector
	22	Lg/R	Power supply for sensor
	23	G/R	CKP sensor
	24	–	–
	25	W	Knock sensor
	26	G	MAP sensor
	27	W/R	A/C evaporator temp. sensor
	28	Gr/B	EGR valve (stepper motor coil 4, if equipped)
	29	Gr/R	EGR valve (stepper motor coil 2, if equipped)
	30	–	–
	31	W/G	No.3 fuel injector
E18	1	P	A/C compressor clutch (if equipped)
	2	V/Y	Malfunction indicator lamp
	3	P/G	Data link connector (12 V)
	4	R/Bl	Heater of HO2S-2 (if equipped)
	5	Bl/B	Power source
	6	Bl/B	Power source

CONNECTOR	TERMINAL	WIRE COLOR	CIRCUIT
E18	7	W	Backup power source
	8	R/G	Immobilizer indicator lamp (if equipped)
			Duty output terminal (vehicle without immobilizer indicator lamp)
	9	–	–
	10	Bl	Main relay
	11	Br	Tachometer
	12	Y/B	Data link connector (5 V)
	13	W	Heated oxygen sensor-2 (if equipped)
	14	W/Bl	Diagnosis switch terminal (vehicle without immobilizer indicator lamp)
	15	P	Test switch terminal (vehicle without immobilizer indicator lamp)
	16	G/W	A/C SW signal (if equipped)
	17	R/Y	Lighting switch
	18	P/B	A/C condenser fan relay (if equipped)
	19	W/G	Fuel pump relay
	20	B/Bl	Ground for sensor
	21	B/R	Throttle opening signal output for A/T (A/T)
	22	Y/R	Fuel level gauge (vehicle with immobilizer indicator lamp)
	23	–	–
	24	Bl/Y	Heater blower switch
E17	1	–	–
	2	R	R-range signal (A/T)
	3	–	–
	4	–	–
	5	B/Or	Overdrive cut signal (A/T)
	6	G/Y	D-range idle-up signal (A/T)
	7	G/W	Stop lamp switch
	8	–	–
	9	B/W	Ignition switch
	10	–	–
	11	Y	Vehicle speed sensor
	12	G	ABS signal (if equipped)
	13	B/Y (M/T) B/R (A/T)	Engine start signal
	14	–	–
	15	–	–
	16	R/W	Rear defogger switch (if equipped)
	17	G/R	A/T failure signal (A/T) (vehicle with immobilizer indicator lamp)



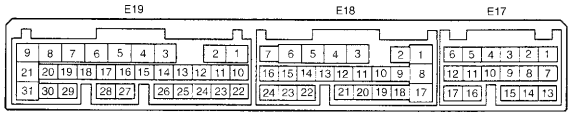
NOTE:

See NOTE in "ECM INPUT / OUTPUT CIRCUIT DIAGRAM" for applicable model.

For TYPE B (See NOTE)

CONNEC-TOR	TERMINAL	WIRE COLOR	CIRCUIT
E19	1	B	Ground for ECM
	2	B/R	Ground for drive circuit
	3	B/R	Ground for drive circuit
	4	Bl/G	Canister purge valve
	5	Bl/Or	Power steering pressure switch (if equipped)
	6	G/Y	IAC valve
	7	P/B	Heater of HO2S-1 (if equipped)
	8	W/B	No.4 fuel injector
	9	R/W	No.1 fuel injector
	10	B/Bl	Ground for sensor circuit
	11	W	CMP sensor
	12	–	–
	13	R R/Bl	Heated oxygen sensor-1 (if equipped) CO adjusting resistor (w/o HO2S)
	14	G/B	ECT sensor
	15	Lg/B	IAT sensor
	16	Lg	TP sensor
	17	Gr/Bl	EGR valve (stepper motor coil 3, if equipped)
	18	Gr	EGR valve (stepper motor coil 1, if equipped)
	19	Br/B	IG coil assembly for No.2 and 3 spark plugs
	20	Br/W	IG coil assembly for No.1 and 4 spark plugs
	21	R/G	No.2 fuel injector
	22	Lg/R	Power supply for sensor
	23	G/R	CKP sensor
	24	–	–
	25	W	Knock sensor
	26	G	MAP sensor
	27	–	–
	28	Gr/B	EGR valve (stepper motor coil 4, if equipped)
	29	Gr/R	EGR valve (stepper motor coil 2, if equipped)
	30	–	–
	31	W/G	No.3 fuel injector
E18	1	P	A/C compressor clutch (if equipped)
	2	–	–
	3	–	–
	4	R/Bl	Heater of HO2S-2 (if equipped)
	5	Bl/B	Power source
	6	Bl/B	Power source

CONNEC-TOR	TERMINAL	WIRE COLOR	CIRCUIT
E18	7	W	Backup power source
	8	R/G	Immobilizer indicator lamp (if equipped)
			Duty output terminal (vehicle without immobilizer indicator lamp)
	9	–	–
	10	Bl	Main relay
	11	B/W	Ignition switch
	12	R/W	Rear defogger switch
	13	–	–
	14	W/Bl	Diagnosis switch terminal (vehicle without immobilizer indicator lamp)
	15	P	Test switch terminal (vehicle without immobilizer indicator lamp)
	16	G/W	A/C SW signal (if equipped)
	17	R/Y	Lighting switch
	18	P/B	A/C condenser fan relay (if equipped)
	19	W/G	Fuel pump relay
	20	B/Y (M/T) B/R (A/T)	Engine start signal
	21	G/W	Stop lamp switch
	22	Y	Vehicle speed sensor
	23	–	–
	24	–	–
E17	1	W/R	A/C evaporator temp. sensor
	2	R	R-range signal (A/T)
	3	–	–
	4	–	–
	5	B/Or	Overdrive cut signal (A/T)
	6	G/Y	D-range idle-up signal (A/T)
	7	Y/B	Data link connector
	8	–	–
	9	V/Y	Malfunction indicator lamp
	10	–	–
	11	P/G	Data link connector (12 V)
	12	G	ABS signal (if equipped)
	13	Bl/Y	Heater blower switch
	14	B/Bl	Ground for sensor
	15	B/R	Throttle opening sensor
	16	Br	Tachometer
	17	–	–

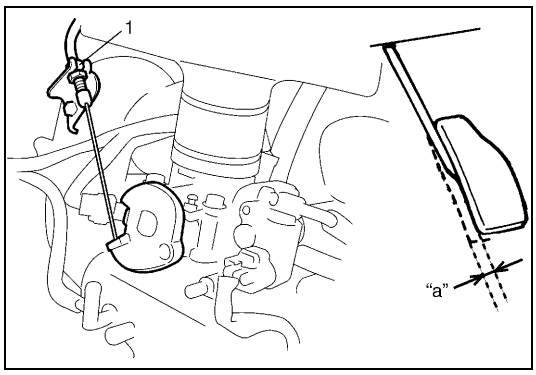


NOTE:

See NOTE in "ECM INPUT / OUTPUT CIRCUIT DIAGRAM" for applicable model.

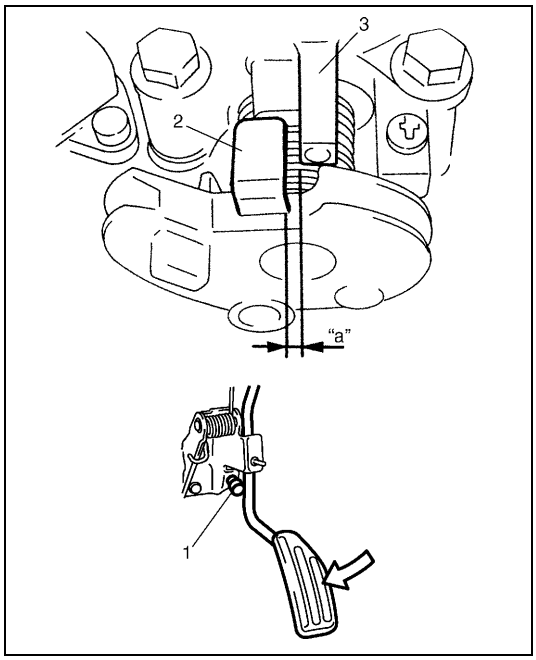
On-Vehicle Service

Accelerator cable adjustment



1) With throttle valve closed, check accelerator pedal play which should be within following specification.
   If measured value is out of specification, adjust it to specification with cable adjusting nut (1).

Accelerator pedal play
"a" : 2 – 7 mm (0.08 – 0.27 in.)



2) With accelerator pedal depressed fully, check clearance between throttle lever (2) and lever stopper (3) (throttle body) which should be within following specification.
   If measured value is out of specification, adjust it to specification by changing height of pedal stopper bolt (1).

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

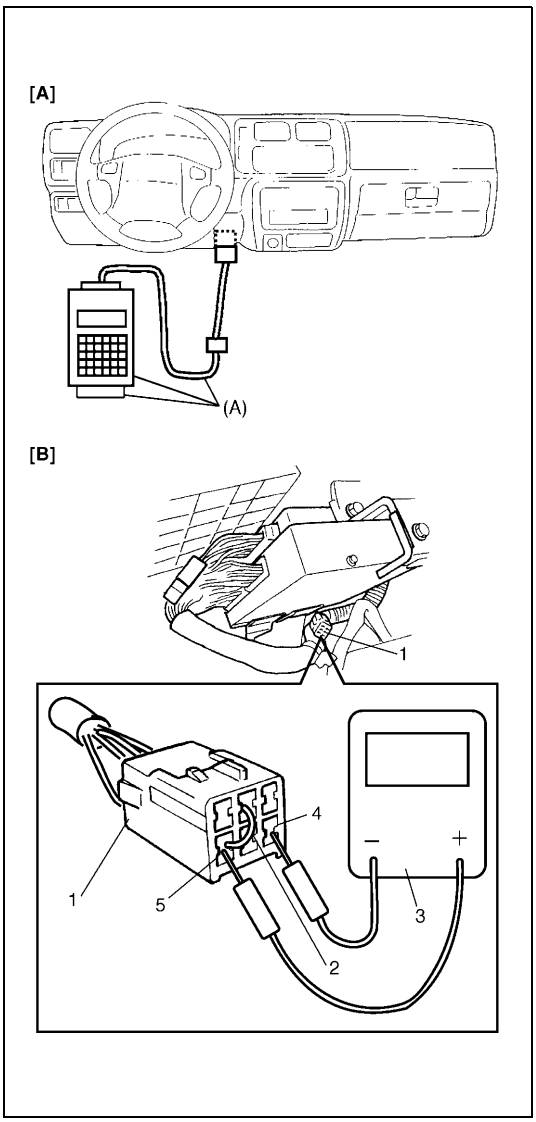
Before idle speed / IAC duty check, make sure of the following.

- 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 and adjusted 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 SUZUKI scan tool to DLC with ignition switch OFF, if it is available.
2) Warm up engine to normal operating temperature.
3) Check engine idle speed and "IAC duty" as follows:
   a) When using SUZUKI scan tool:
      i) Select "Data List" mode on scan tool to check "IAC duty".

(A) : SUZUKI scan tool

   b) When using duty meter (3) (Vehicle without immobilizer indicator lamp):

NOTE:

IAC duty can be checked using monitor connector only for vehicle not equipped with immobilizer indicator lamp.

      i) Set tachometer.
      ii) Using service wire (2), ground "Diag. switch terminal" in monitor connector (1) and connect duty meter between "Duty output terminal (4)" and "Ground terminal (5)" of monitor connector (1).

[A] : When using SUZUKI scan tool
[B] : When using duty meter (Vehicle without immobilizer indicator lamp)

4) If duty and/or idle speed is out of specifications, inspect idle air control system referring to "Diagnostic Flow Table B-4 Idle Air Control System Check" in Section 6.

Engine idle speed and IAC duty

	A/C OFF	A/C ON
M/T vehicle	**700 ± 50 r/min (rpm) 5 – 25 %**	**900 ± 50 r/min (rpm)**
A/T vehicle at P/N range	**750 ± 50 r/min (rpm) 5 – 25 %**	**900 ± 50 r/min (rpm)**

NOTE:

Above duty values are ON duty (low voltage rate) meter indications.

5) Remove service wire from monitor connector.
6) Check that specified engine idle speed is obtained with A/C ON if vehicle is equipped with A/C.
   If not, check A/C ON signal circuit and idle air control system.

Idle mixture inspection / adjustment (vehicle without heated oxygen sensor)

All vehicles not equipped with heated oxygen sensor are shipped with their CO % factory adjusted as follows.

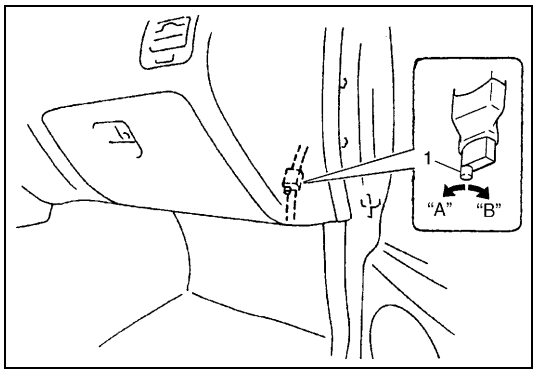
Engine idle mixture (CO %)
0.5 – 1.5 % at specified idle speed

Idle mixture adjustment should never be changed from the original factory setting. However, if during diagnosis, the check indicates idle mixture to be the cause of a driver performance complaint or emission failure, the idle mixture can be adjusted using the following procedures.

NOTE:

For this inspection and adjustment, exhaust gas tester (CO meter) and engine tachometer are necessary.

1) Check idle speed according to “Idle Speed / Idle Air Control (IAC) Duty Inspection” in this section.
2) Using exhaust gas tester, check that idle mixture CO % is within above specification. If it is out of specification, adjust it to specification by turning resistor knob.



NOTE:

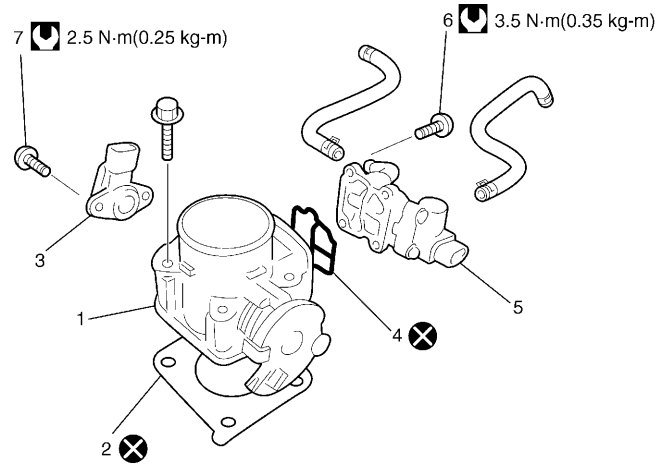
CO adjusting resistor knob to “A” increases CO % (A/F mixture becomes rich) and turning it to “B” decreases CO % (A/F mixture becomes lean).

1. CO adjusting resistor

3) If idle mixture has been adjusted, confirm that idle speed is within specification.

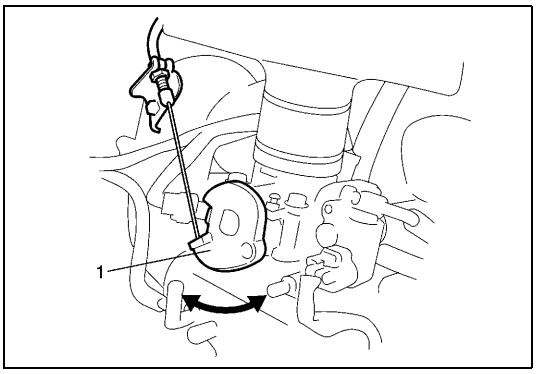
Air Intake System

Throttle body



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

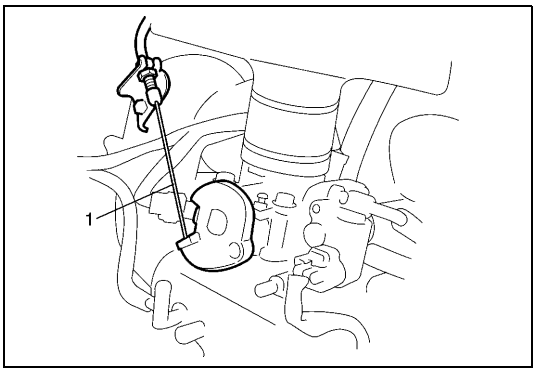
ON-VEHICLE INSPECTION



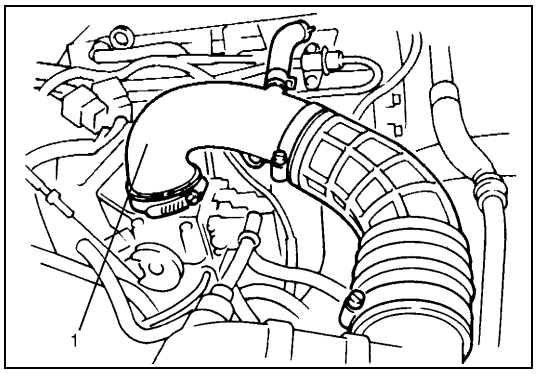
- Check that throttle valve lever (1) moves smoothly.

REMOVAL

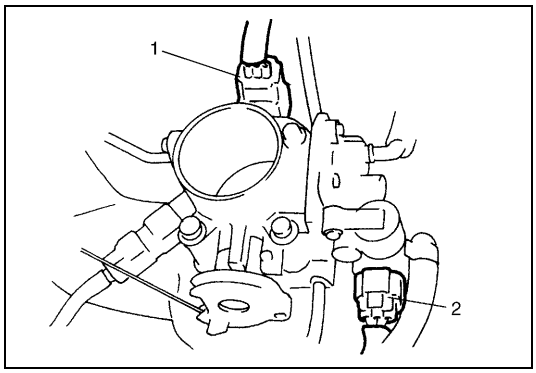
1) Disconnect negative cable at battery.
2) Drain cooling system.



3) Disconnect accelerator cable (1) from throttle valve lever.



4) Disconnect air cleaner outlet NO.2 hose (1) from throttle body.



5) Disconnect electric connector from TP sensor (1) and IAC valve (2).
6) Remove throttle body from intake manifold.
7) Disconnect engine coolant hoses from throttle body.

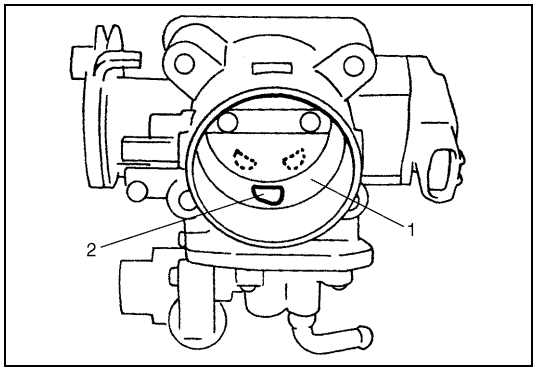
DISASSEMBLY

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.

1) Remove TP sensor and IAC valve from throttle body.

CLEANING



Clean throttle body bore (1) and idle air passage (2) by blowing compressed air.

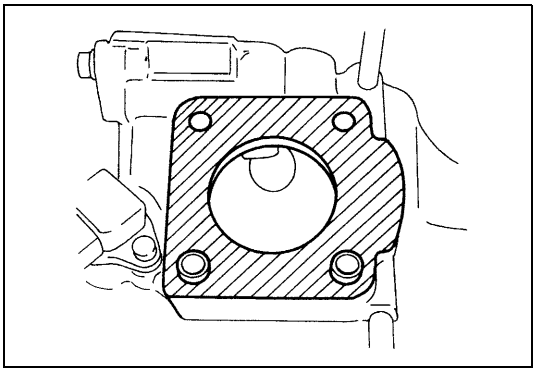
NOTE:

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.

REASSEMBLY

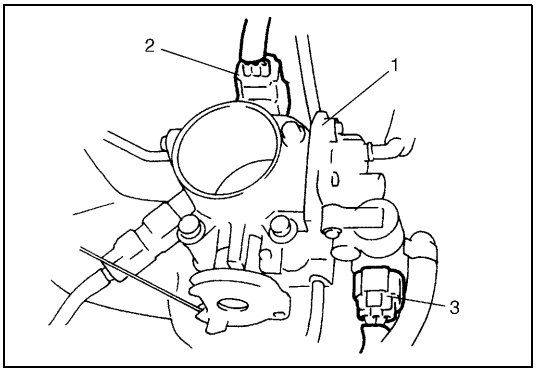
1) Install IAC valve to throttle body referring to “Idle Air Control Valve” in this section.
2) Install TP sensor to throttle body referring to “Throttle Position Sensor” in this section for installation.

INSTALLATION

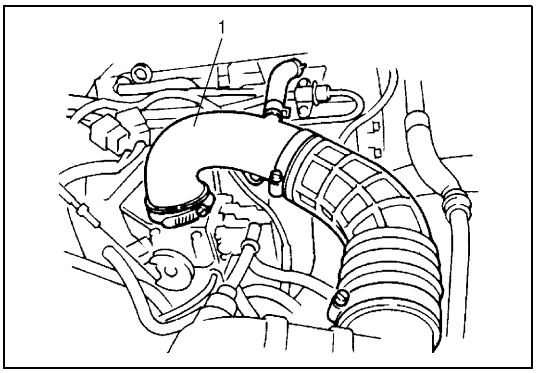


1) Clean mating surfaces and install throttle body gasket to intake manifold.
   Use new gasket.

2) Connect engine coolant hoses.



3) Install throttle body (1) to intake manifold.
4) Connect connectors to TP sensor (2) and IAC valve (3) securely.



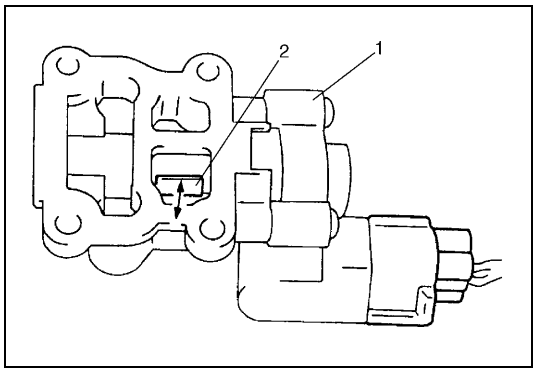
5) Install air cleaner outlet No.2 hose (1) and pipe.
6) Connect accelerator cable and adjust cable play to specification.
7) Refill cooling system.
8) Connect negative cable at battery.

Idle air control valve (IAC valve)

REMOVAL

1) Remove throttle body from intake manifold referring to "Throttle Body" in this section for removal.
2) Remove IAC valve from throttle body.

INSPECTION

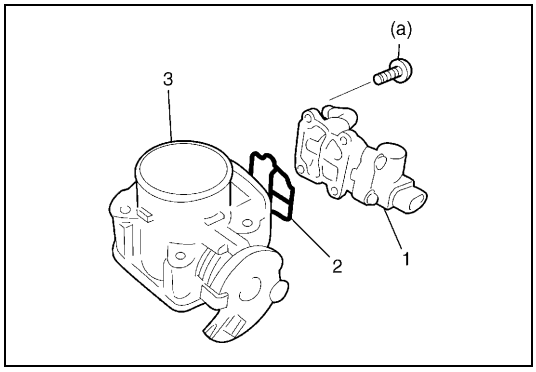


1) Connect each connector to IAC valve (1), TP sensor and IAT sensor.
2) Check that rotary valve (2) of IAC valve opens and closes once and then stops in about 60 ms as soon as ignition switch is turned ON.

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, perform this operation check 3 times or more continuously.**
  If rotary 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.

INSTALLATION



1) Install new O-ring (2) to IAC valve (1).
2) Install IAC valve (1) to throttle body (3).
   Tighten IAC valve screws to specified torque.

Tightening torque
IAC valve screws (a) : 3.5 N·m (0.35 kg-m, 2.5 lb-ft)

3) Install throttle body to intake manifold referring to "Throttle Body" in this section for installation.

Fuel Delivery System

Fuel pressure inspection

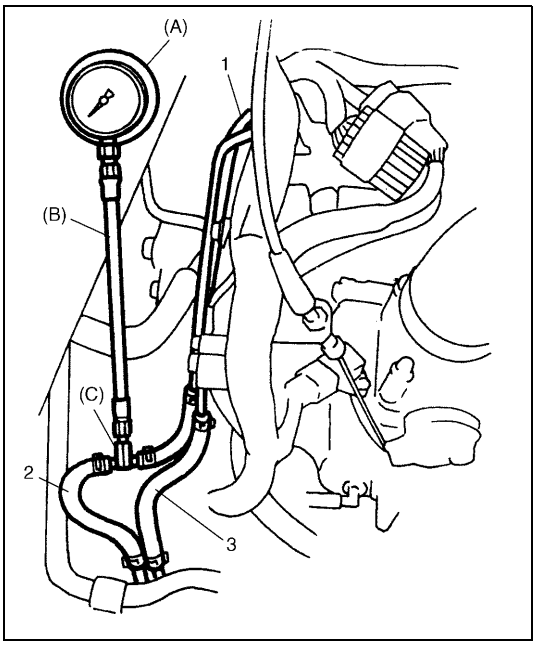
WARNING:

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 (1) and fuel feed hose (2) 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

3. Fuel return pipe

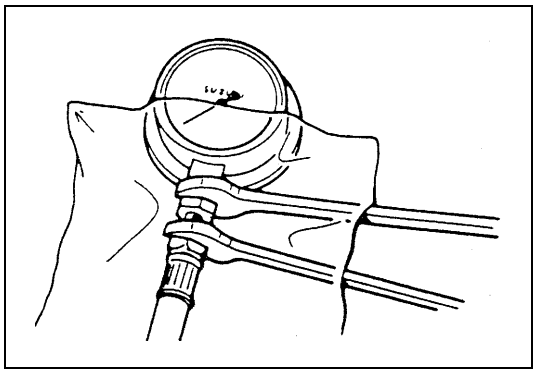
4) Check that battery voltage is above 11 V.

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	210 – 260 kPa 2.1 – 2.6 kg/cm^2, 29.8 – 37.0 psi
With 1 min. after engine (fuel pump) stop (Pressure reduces as time passes)	over 200 kPa 2.0 kg/cm^2, 28.4 psi

6) Start engine and warm it up to normal operating temperature.
7) Measure fuel pressure at idling.
   If measured pressure doesn't satisfy specification, refer to "Diagnostic Flow Table B-3" 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.
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

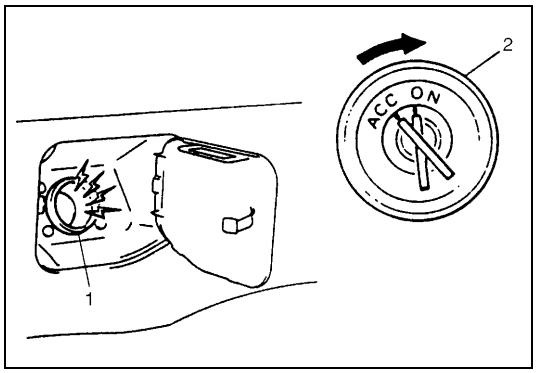
ON-VEHICLE INSPECTION

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.

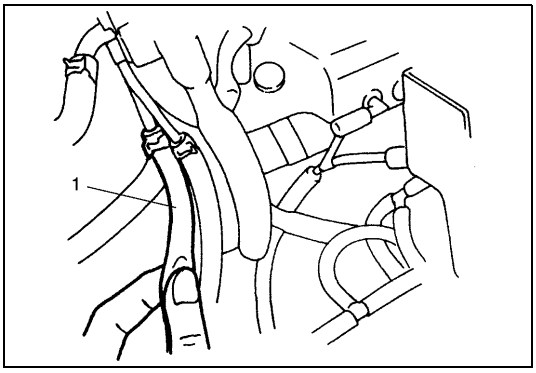
NOTE:

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 (2). Then fuel pump operating sound should be heard from fuel filler (1) for about 2 seconds and stop. Be sure to reinstall fuel filler cap after checking.
   If above check result is not satisfactory, advance to "Diagnostic Flow Table B-2" in Section 6.

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 2 seconds after ignition switch ON.
   If fuel pressure is not felt, advance to “Diagnostic Flow Table B-3” in Section 6.

REMOVAL

Remove fuel tank from body according to procedure described in “Fuel Tank” of Section 6C and remove fuel pump from fuel tank.

INSPECTION

Check fuel pump filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in 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” of Section 6C.

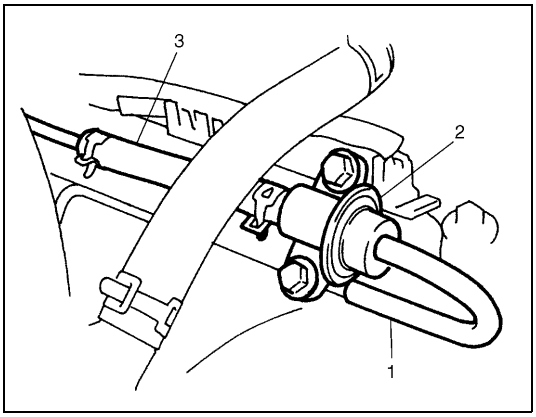
Fuel pressure regulator

ON-VEHICLE INSPECTION

Perform fuel pressure inspection according to procedure described in “Fuel Pressure Inspection” of this section.

REMOVAL

1) Relieve fuel pressure according to procedure described on “Fuel Pressure Relief Procedure” in Section 6.
2) Disconnect battery negative cable from battery.



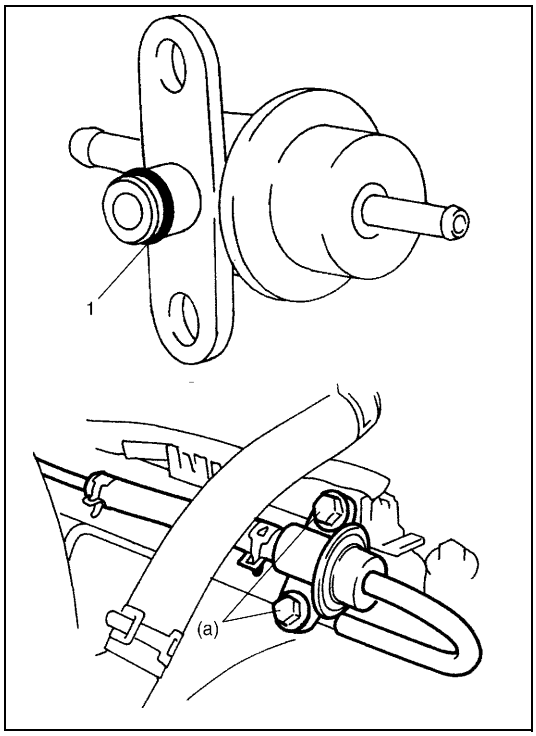
3) Disconnect vacuum hose (1) from fuel pressure regulator (2).
4) Remove fuel pressure regulator from fuel delivery pipe.

CAUTION:
A small amount of fuel may be released when it is from delivery pipe.
Place a shop cloth under delivery pipe so that released fuel is absorbed in it.

5) Disconnect fuel return hose (3) from fuel pressure regulator.

INSTALLATION

For installation, reverse removal procedure and note following precautions.



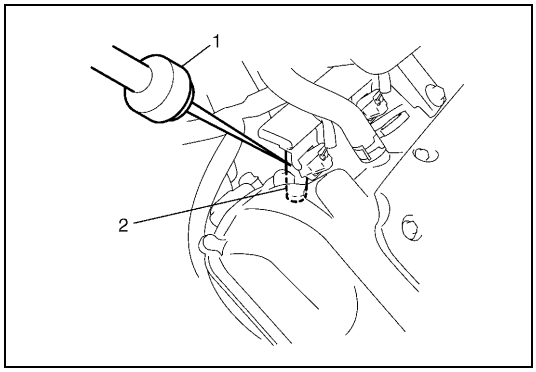
- Use new O-ring (1).
- Apply thin coat of gasoline to O-ring to facilitate installation.
- Tighten fuel pressure regulator bolts to specified torque.

Tightening torque
Fuel pressure regulator bolts
(a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)

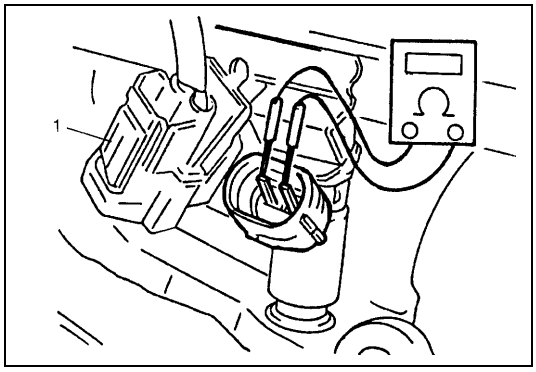
- With engine “OFF” and the ignition switch ON position, check for fuel leaks around fuel line connection.

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).



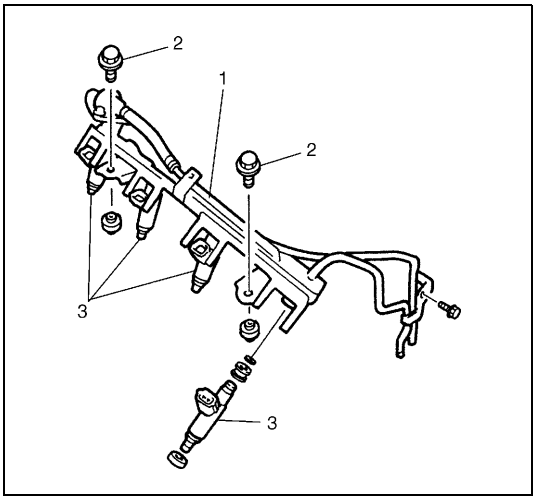
2) Disconnect connector (1) from injector, connect ohmmeter between terminals of injector and check resistance.
   If resistance is out of specification, replace.

Resistance of injector
11.3 – 13.8 Ω at 20 °C, 68 °F

3) Connect connector (1) to injector securely.

REMOVAL

1) Relieve fuel pressure according to procedure described in "Fuel Pressure Relief Procedure" in Section 6.
2) Disconnect battery negative cable at battery.
3) Disconnect fuel injector couplers and release wire harness from clamps.
4) Remove clamp bolt for fuel feed pipe and return pipe.

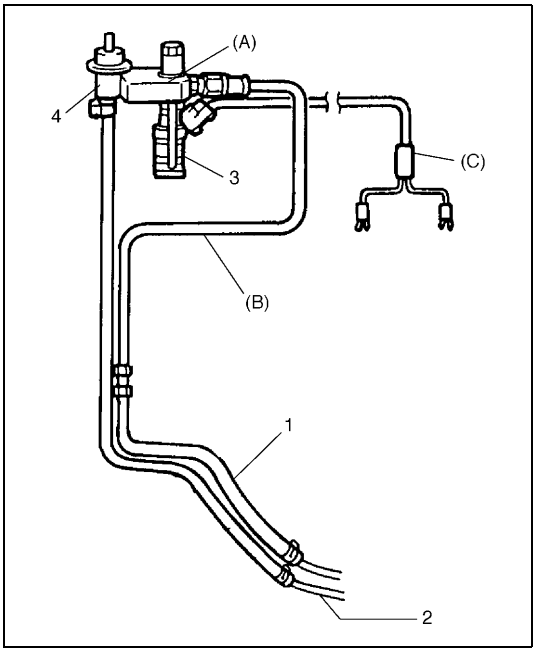


5) Remove fuel delivery pipe bolts (2).
6) Remove fuel injector(s) (3).

CAUTION:
A small amount of fuel may come out after removal of fuel injectors, cover them with shop cloth.

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 (3) and fuel pressure regulator (4) to special tool (injector checking tool).

Special tool
(A) : 09912-58421

2) Connect special tools (hose and attachment) to fuel feed hose (1) of vehicle.

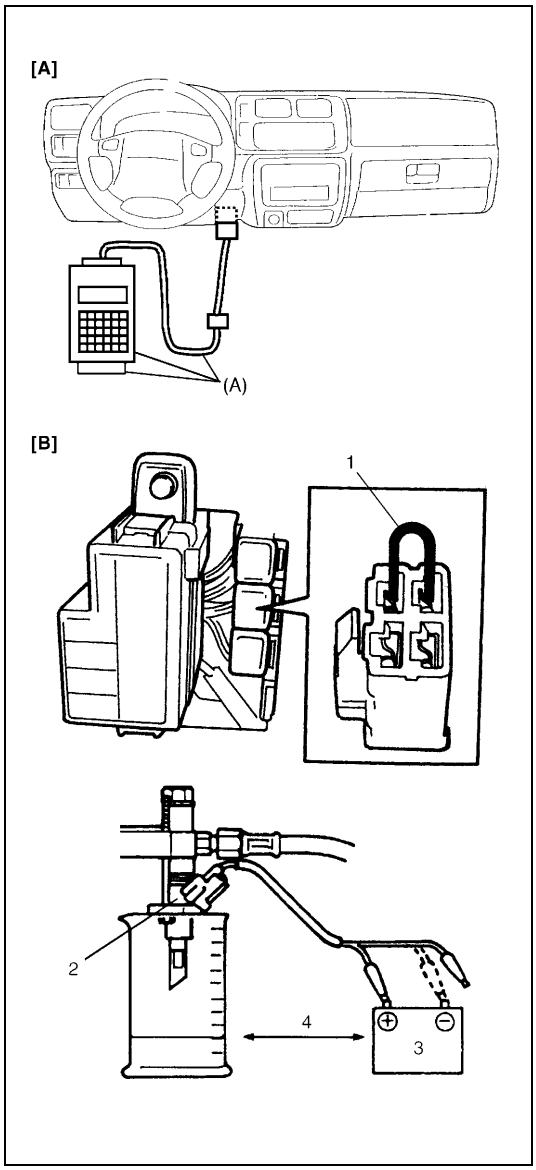
Special tool
(B) : 09912-58432

3) Connect special tool (test lead) to injector.

Special tool
(C) : 09930-88530

2. Fuel return line

4) Install suitable vinyl tube onto injector nozzle to prevent fuel from splashing out when injecting.



5) Put graduated cylinder under injector as shown.
6) Operate fuel pump and apply fuel pressure to injector as follows:
   a) When using SUZUKI scan tool :
      i) Connect SUZUKI scan tool to DLC with ignition switch OFF.
      ii) Turn ignition switch ON, clear DTC and select “MISC TEST” mode on SUZUKI scan tool.
      iii) Turn fuel pump ON by using SUZUKI scan tool.

   (A) : SUZUKI scan tool

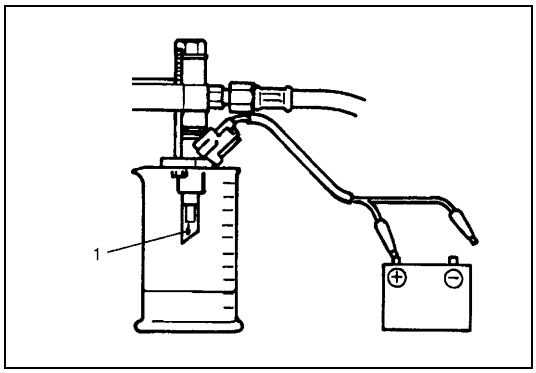
   b) Without using SUZUKI scan tool :
      i) Remove fuel pump relay from connector.
      ii) Connect two terminals of relay connector using service wire (1) as shown in figure.

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.
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.

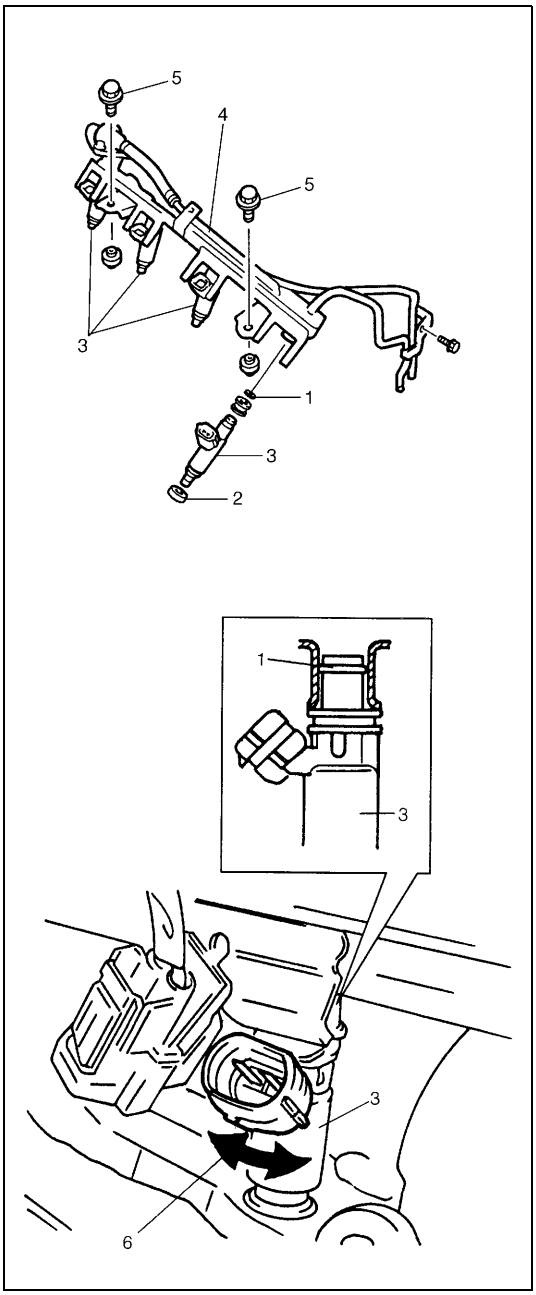
Injected fuel volume
43 – 47 cc/15 sec. (1.45/1.51 – 1.58/1.65 US/Imp. oz/15 sec.)

4.	Keep as far apart as possible
[A] :	When using SUZUKI scan tool
[B] :	Without using SUZUKI scan tool



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 (1)
Less than 1 drop/min.



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 intake manifold.
  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).
- After installation, with engine “OFF” and ignition switch “ON”, check for fuel leaks around fuel line connection.

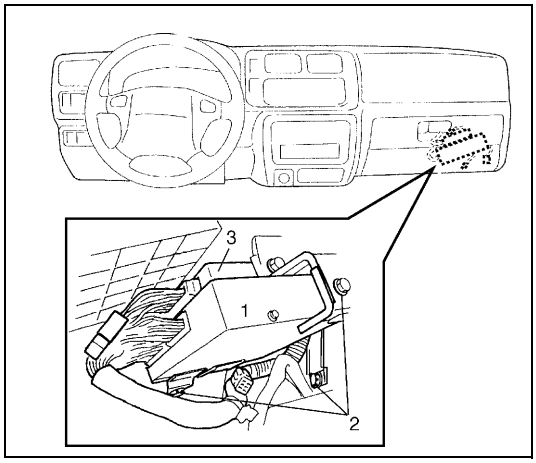
Electronic Control System

Engine control module (ECM)

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, refer to “Disabling Air Bag System” in Section 10B if equipped.
3) Remove glove box.



4) Disconnect ECM (1) and TCM (3) (if equipped) connectors.
5) Loosen 2 nuts (2) and remove ECM and TCM (if equipped).

INSTALLATION

1) Reverse removal procedure noting the following:
   • Connect connectors to ECM and TCM (if equipped) securely.

Manifold absolute pressure sensor (MAP sensor)

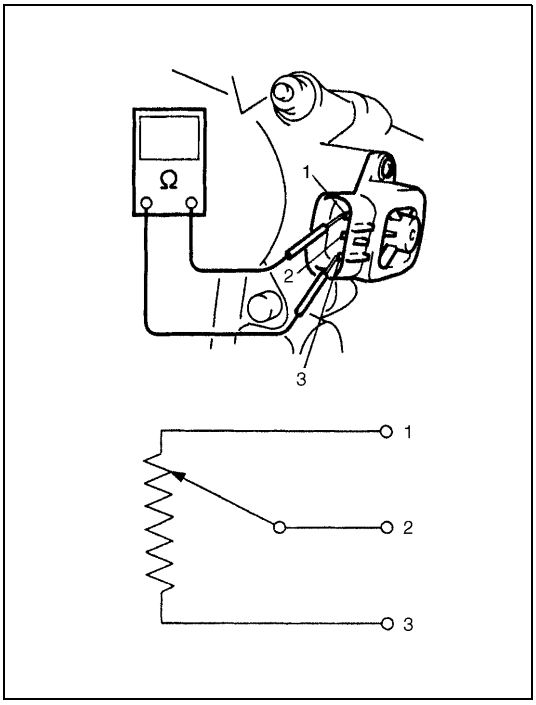
INSPECTION

Check MAP sensor referring to “MAP Sensor Individual Check” in DTC P0105 (No.11) Flow Table of Section 6. If malfunction is found, replace.

Throttle position sensor (TP sensor)

INSPECTION

1) Disconnect negative cable at battery and connector from TP sensor.



2) 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	20.0 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.

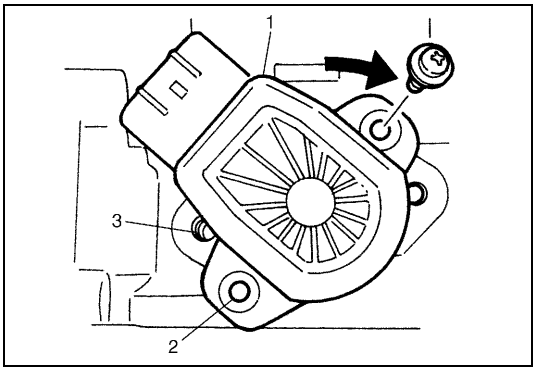
1. Reference voltage terminal
2. Output voltage terminal
3. Ground terminal

3) Connect TP sensor connector securely.
4) Connect negative cable to battery.

REMOVAL

1) Remove throttle body from intake manifold referring to “Throttle Body” in this section for removal.
2) 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) and turn TP sensor clockwise so that those holes align.

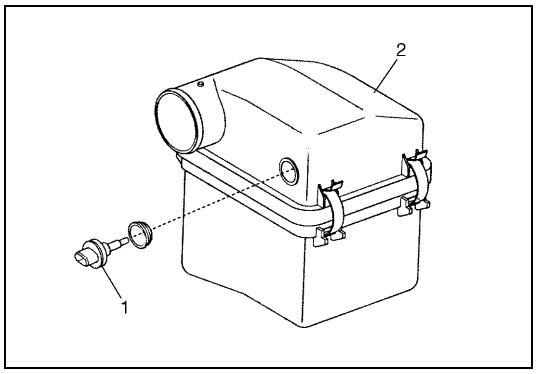
Tightening torque
TP sensor screws (a) : 2.5 N·m (0.25 kg-m, 1.8 lb-ft)

2) Connect connector to TP sensor securely.
3) Connect battery negative cable to battery.

Intake air temperature sensor (IAT sensor)

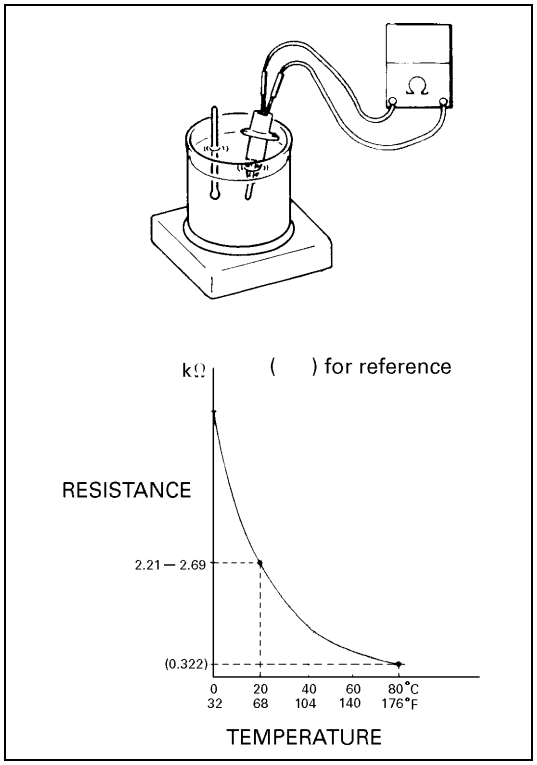
REMOVAL

1) Disconnect battery negative cable at battery.
2) Disconnect connector from IAT sensor (1).
3) Remove IAT sensor (1) from air cleaner case (2).



INSPECTION

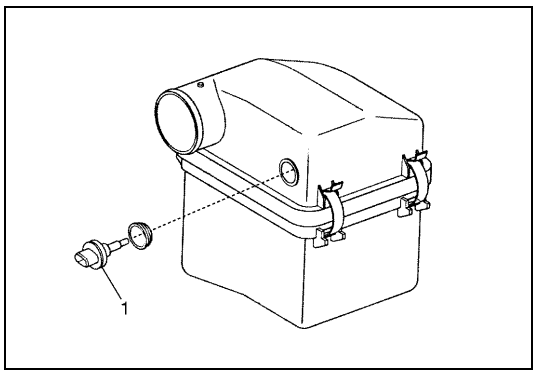
Immerse temperature sensing part of IAT sensor in water (or ice) and measure resistance between sensor terminals while heating water gradually.
If measured resistance doesn't show such characteristic as shown in left figure, replace IAT sensor.



INSTALLATION

Reverse removal procedure noting the following.

- Clean mating surfaces of IAT sensor and air cleaner case.
- Connect IAT sensor connector (1) securely.



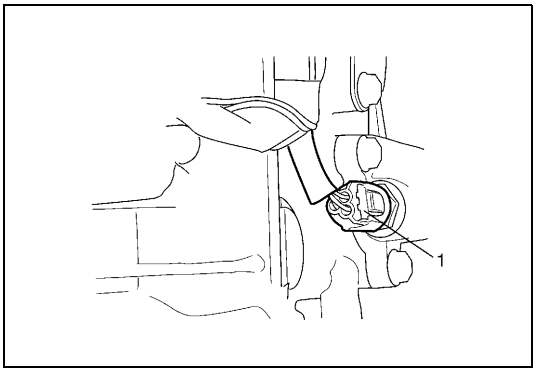
Engine coolant temperature sensor (ECT sensor)

REMOVAL

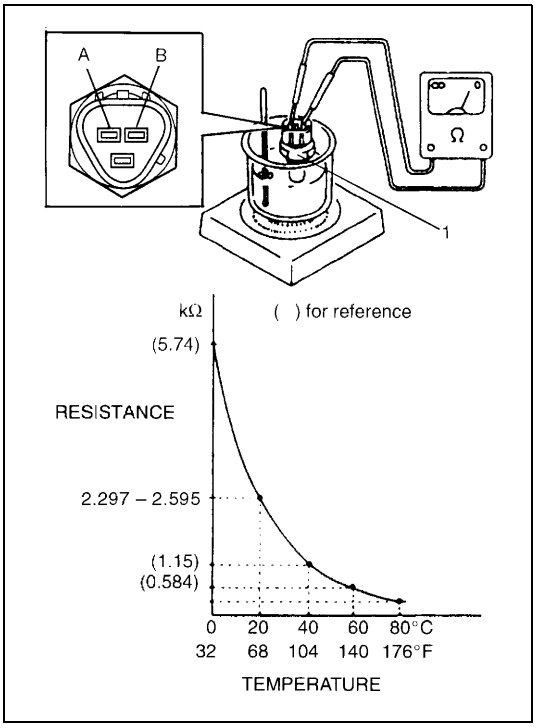
1) Disconnect battery negative cable at battery.
2) Drain coolant referring to Step 6) of “Cooling System Flush and Refill” in Section 6B.

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) Disconnect connector from ECT sensor.
4) Remove ECT sensor (1) from water outlet cap.



INSPECTION

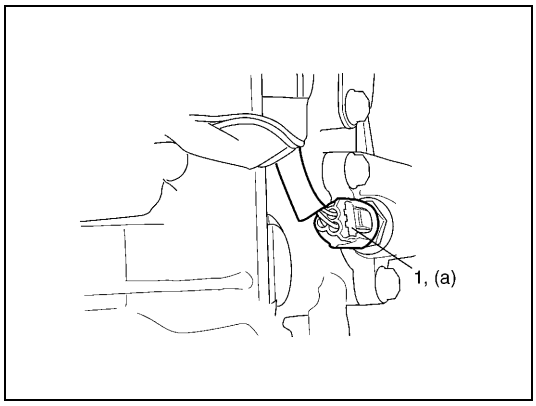


Immerse temperature sensing part of ECT sensor (1) in water (or ice) and measure resistance between terminal “A” and “B” while heating water gradually.
If measured resistance doesn’t show such characteristic as shown in left figure, replace ECT sensor (1).

INSTALLATION

Reverse removal procedure noting the following:

- Clean mating surfaces of ECT sensor (1) and water outlet cap.
- Check O-ring for damage and replace if necessary.



- Tighten ECT sensor (1) to specified torque.

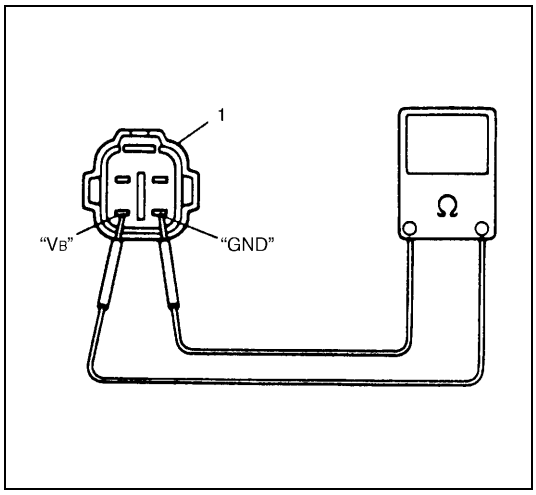
Tightening torque
ECT sensor (a) : 15 N·m (1.5 kg-m, 11.5 lb-ft)

- Connect connector to ECT sensor (1) securely.
- Refill coolant referring to “Cooling System Flush and Refill” in Section 6B.

Heated oxygen sensor (Sensor-1 and sensor-2)

OXYGEN SENSOR HEATER 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

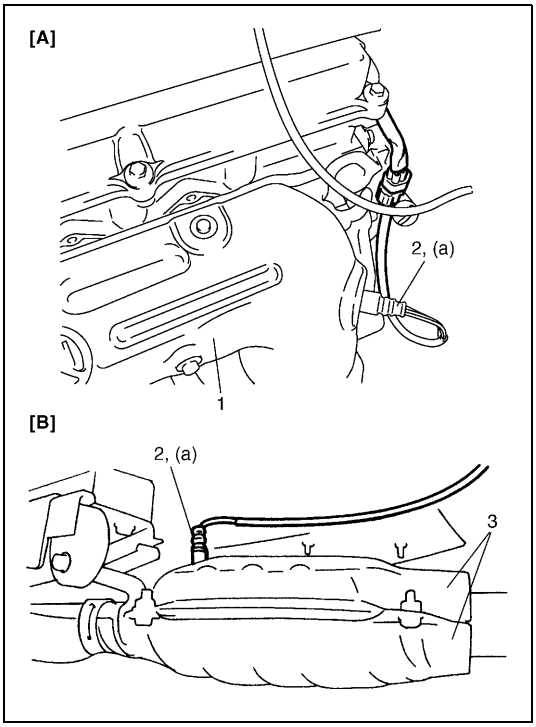
1. Viewed from terminal side

3) Connect sensor connector securely.

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 sensor-1, remove exhaust manifold cover (1) and disconnect connector of heated oxygen sensor and release its wire harness from clamps.
3) For sensor-2, disconnect connector of heated oxygen sensor and release its wire harness from clamp. Hoist vehicle and then remove exhaust No.1 pipe covers (3).
4) Remove heated oxygen sensor (2) from exhaust manifold or exhaust No.1 pipe.

[A] : HO2S-1
[B] : HO2S-2

INSTALLATION

Reverse removal procedure noting the following.

- Tighten heated oxygen sensor (2) to specified torque.

Tightening torque
Heated oxygen sensor (a) : 45 N·m (4.5 kg-m, 32.5 lb-ft)

- Connect connector of heated oxygen sensor (2) and clamp wire harness securely.
- After installing heated oxygen sensor (2), start engine and check that no exhaust gas leakage exists.

Camshaft position sensor

INSPECTION

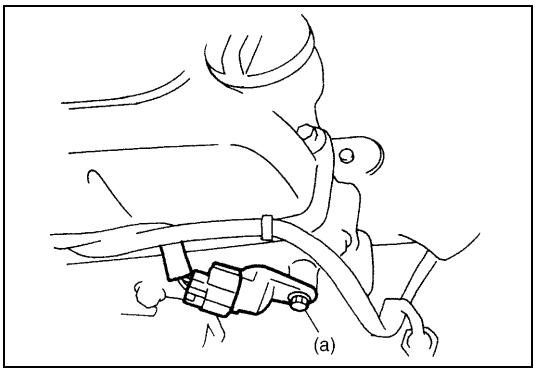
Check camshaft position sensor referring to “DTC P0340 (No. 15) Diag. Flow Table” in Section 6. If malfunction is found, replace.

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 tooth are free from any metal particles and damage.



3) Install camshaft position sensor to sensor case.

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.

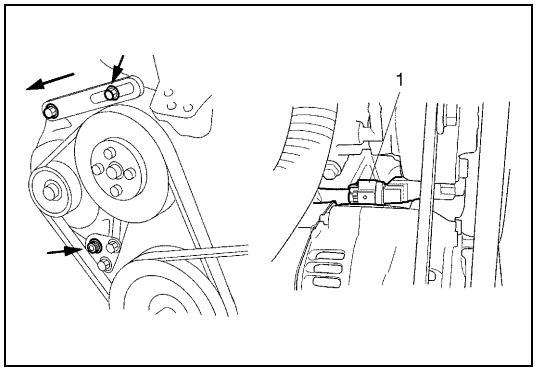
Crankshaft position sensor

INSPECTION

Check crankshaft position sensor referring to step 2 and 6 of "DTC P0335 (No.23) Flow Table" in Section 6. If malfunction is found, replace.

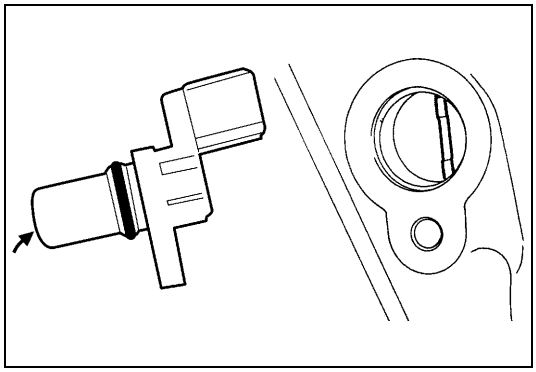
REMOVAL

1) Disconnect negative cable at battery.
2) Remove generator drive belt, loosen pivot bolt and move generator outward.
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 tooth is 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 Belt Tension" in Section 6B.
5) Connect negative cable to battery.



Vehicle speed sensor (VSS)

INSPECTION

Check vehicle speed sensor referring to step 7 of “DTC P0500 (No.16) Flow Table” in Section 6. If malfunction is found, replace.

Fuel level sensor (GAUGE)

INSPECTION

Refer to “Fuel Meter / Fuel Gauge Unit” in Section 8.

REMOVAL / INSTALLATION

Refer to “Fuel Pump Assembly” in Section 6C.

Knock sensor

INSPECTION

Check knock sensor referring to “DTC P0325 (No.17) Flow Table” in Section 6. If malfunction is found, replace.

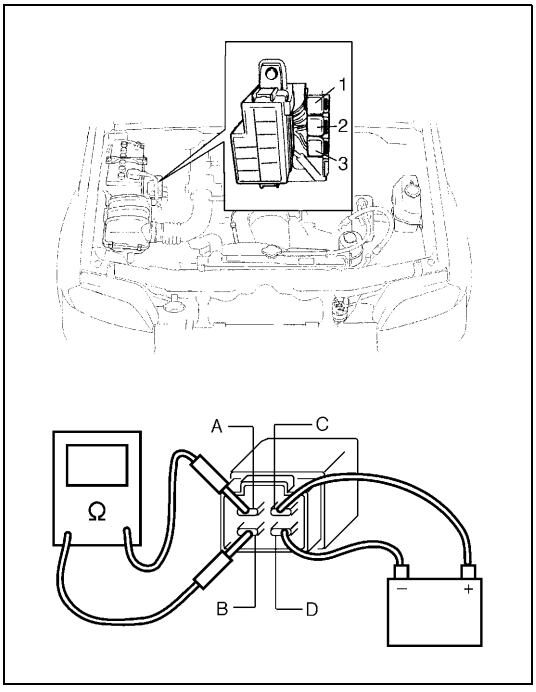
REMOVAL / INSTALLATION

Refer to “Knock Sensor” in Section 6A1.

Main relay, fuel pump relay and A/C condenser fan control relay

INSPECTION

1) Disconnect negative cable at battery.
2) Remove main relay (1), fuel pump relay (2) and A/C condenser fan control relay (3) from vehicle.
3) Check that there is no continuity between terminal “A” and “B”. If there is continuity, replace relay.
4) Connect battery positive (+) terminal to terminal “C” of relay.
   Connect battery negative (–) terminal “D” of relay.
   Check continuity between terminal “A” and “B”.
   If there is no continuity when relay is connected to the battery, replace relay.



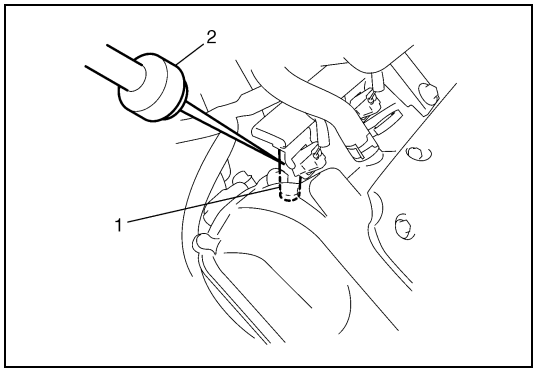
Fuel cut operation

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.

A/C condenser fan control system

SYSTEM INSPECTION

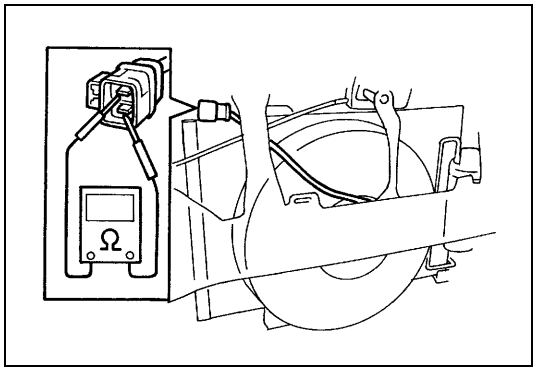
WARNING:

Keep hands, tools, and clothing away from A/C condenser 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.

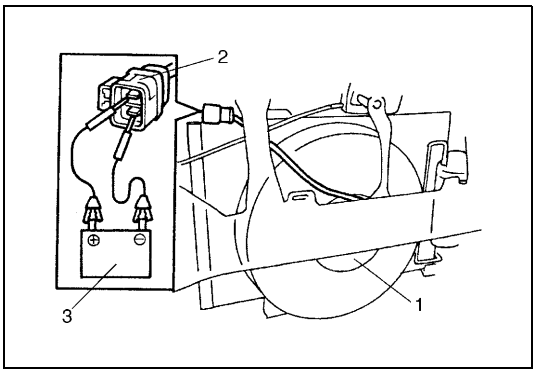
Check system for operation referring to "Flow Table B-7" in Section 6.
If A/C condenser fan fails to operate properly, check relay, A/C condenser fan and electrical circuit.

A/C condenser fan

INSPECTION



1) Check continuity between each two terminals.
   If there is no continuity, replace A/C condenser fan motor.



2) Connect battery (3) to A/C condenser fan motor coupler (2) as shown in figure, then check that the A/C condenser fan motor (1) operates smoothly.
If A/C condenser fan motor does not operate smoothly, replace motor.

Reference current data of A/C condenser fan motor
Approx. 6.7 – 8.3 A at 12 V

Output signals of throttle valve opening and engine coolant temp. (Vehicle with A/T only)

THROTTLE VALVE OPENING SIGNAL INSPECTION

Check throttle valve opening (throttle position) signal referring to step 1 of "DTC P1700 (No.32 or 33) Flow Table" in Section 7B.
If check result is not satisfactory, check each wire harness, circuit connections and TP sensor.

ENGINE COOLANT TEMP. SIGNAL INSPECTION

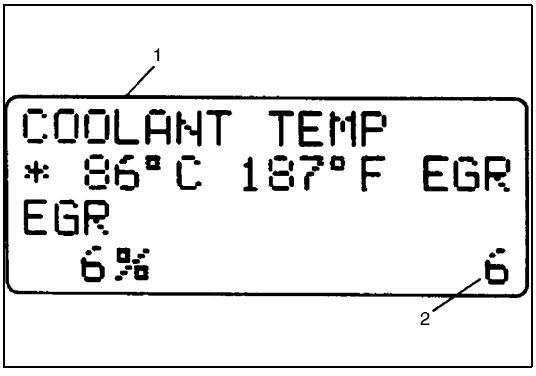
Check engine coolant temp. signal referring to step 1 of "DTC P1709 (No.51) Flow Table" in Section 7B.
If check result is not satisfactory, check each wire harness, circuit connection and ECT sensor.

Emission Control System

EGR system (If equipped)

SYSTEM INSPECTION (USING SUZUKI SCAN TOOL)

1) Connect SUZUKI scan tool to DLC with ignition switch OFF.
2) Turn ignition switch ON and then select "DATA LIST" mode on scan tool.
3) Make sure that vehicle condition is as following.
   - Vehicle speed = 0 km/h (0 KPH)
   - Engine speed ≤ 3000 rpm
4) Clear DTC by using "CLEAR INFO" mode.



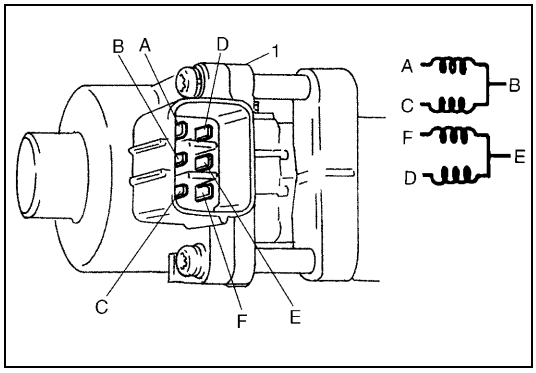
5) With engine idling (without depressing accelerator pedal), open EGR valve by using "STEP EGR" mode in "MISC TEST" menu.
In this state, according as EGR valve opening increases engine idle speed drops. If not, possible cause is clogged EGR gas passage, stuck or faulty EGR valve, poor performance of ECT sensor or TP sensor or DTC and/or pending DTC is (are) stored in ECM memory.

1. SUZUKI scan tool display
2. EGR valve opening (0: Close, 100: Full Open)

REMOVAL

1) Disconnect negative cable at battery.
2) Disconnect EGR valve connector.
3) Remove EGR pipe.
4) Remove EGR valve and gasket from cylinder head.

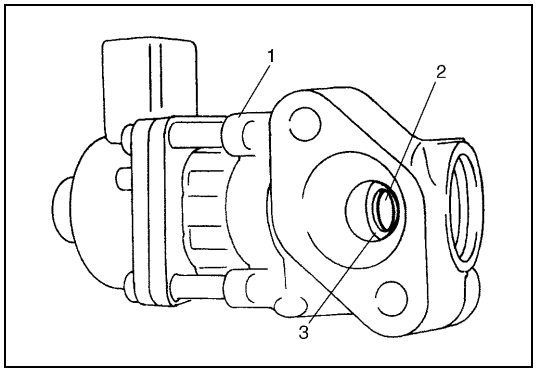
INSPECTION



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 (1) gas passage.

NOTE:

Do not use any sharp-edged tool to remove carbon.
Be careful not to damage or bend EGR valve, valve seat and rod.

3) Inspect valve (2), valve seat (3) and rod for fault, cracks, bend or other damage.
   If found faulty, replace EGR valve assembly.

INSTALLATION

Reverse removal procedure noting following.

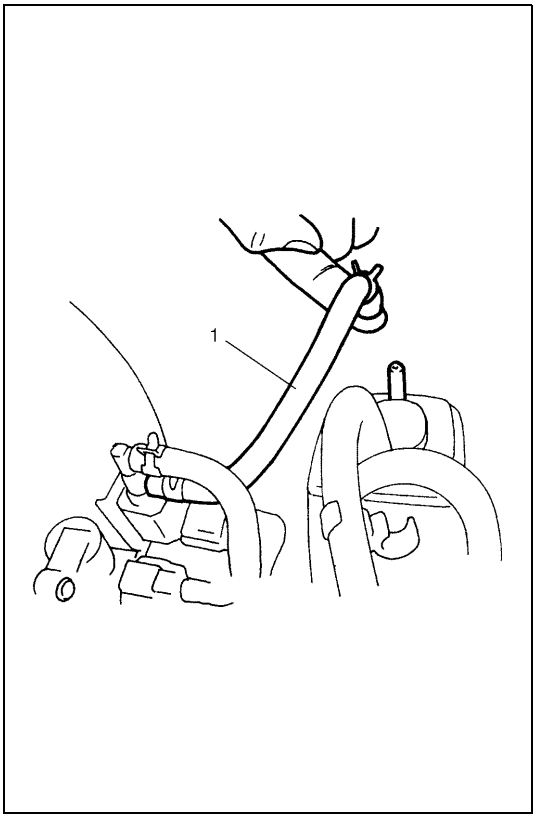
- Clean mating surface of valve and cylinder head.
- Use new gaskets.

Evaporative emission (EVAP) control system

EVAP CANISTER PURGE 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) 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.
3) Connect purge hose to EVAP canister and warm up engine to normal operating temperature.
4) Turn ignition switch OFF.
5) Restart engine and run it at 2000 r/min. for 2 min. or more.
6) Disconnect purge hose from EVAP canister.
7) Also check that vacuum is felt when engine is running at 3000 r/min.

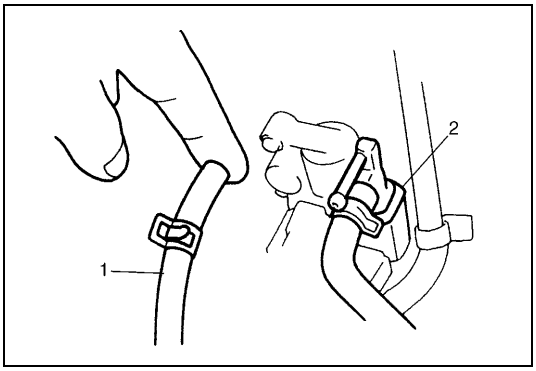
NOTE:

ECM detects a change in the purge fuel vapor concentration and sometimes stops purging for several seconds but this is nothing abnormal.

8) If vacuum is not felt in Step 7), run engine at idle for 8 min. or more and then repeat check in Step 7).

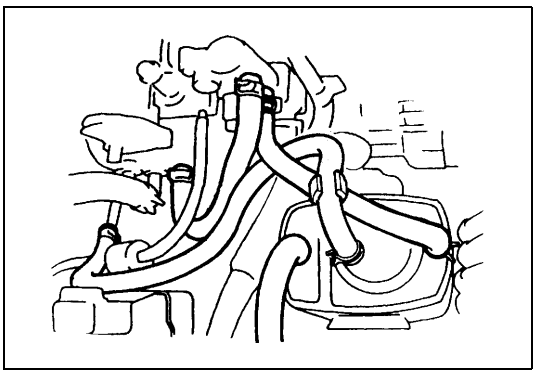
If check result is not satisfactory in Steps 2) and 8), check vacuum passage, hoses, EVAP canister purge valve, wire harness and ECM.

VACUUM PASSAGE INSPECTION



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 INSPECTION



Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

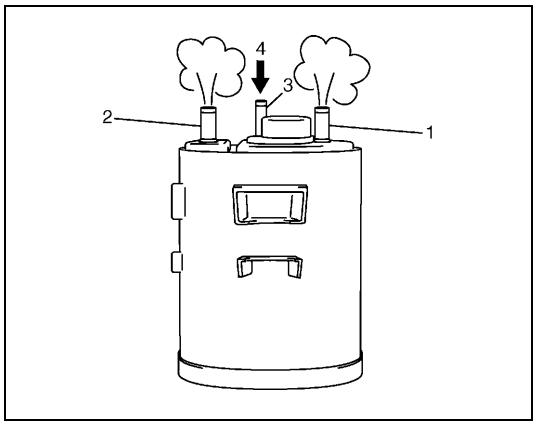
EVAP CANISTER PURGE VALVE INSPECTION

Check EVAP canister purge valve referring to step 2 of “DTC P0443 Flow Table” in Section 6.
If found malfunction, replace.

EVAP CANISTER INSPECTION

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

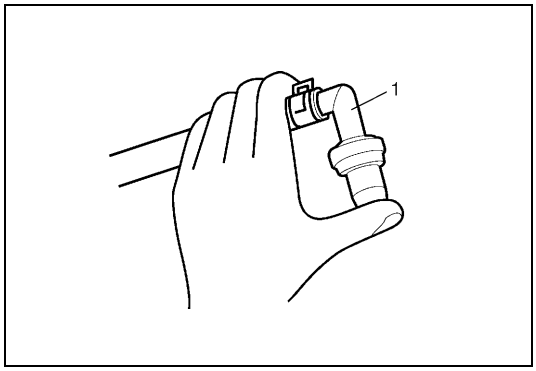
NOTE:
Be sure to check that there is no obstruction in PCV valve or its hoses before checking IAC duty, for obstructed PCV valve or hose hampers its accurate adjustment.

PCV HOSE INSPECTION

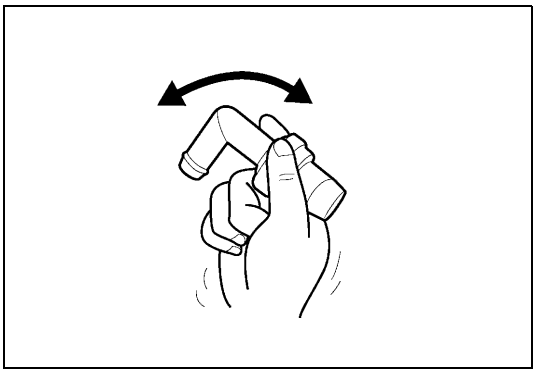
Check hoses for connection, leakage, clog and deterioration.
Replace as necessary.

PCV VALVE INSPECTION

1) Disconnect PCV valve (1) from cylinder head cover and install plug to head cover hole.
2) Run engine at idle.

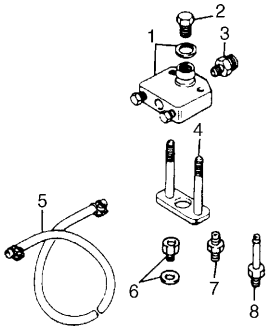
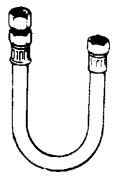
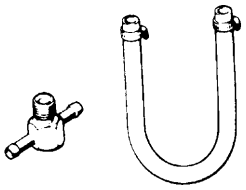
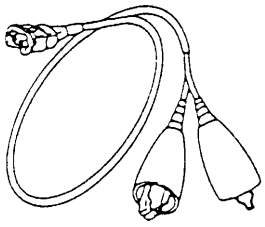
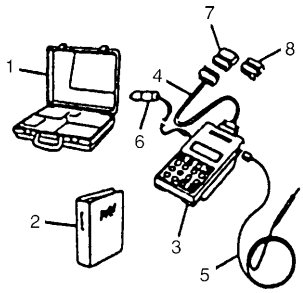
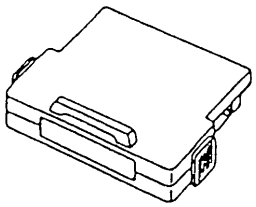


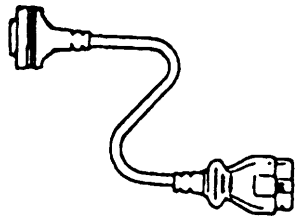
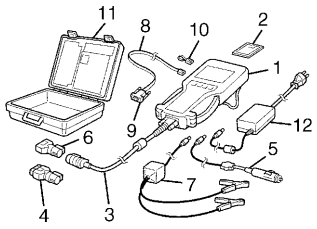
3) Place your finger over end of PCV valve (1) to check for vacuum. If there is no vacuum, check for clogged valve. Replace as necessary.



4) After checking vacuum, stop engine and remove PCV valve (1).
   Shake valve and listen for the rattle of check needle inside the valve. If valve does not the rattle, replace valve.
5) After checking, remove plug and install PCV valve (1).

Special Tools

 09912-57610 Checking tool plate	 09912-58421 Checking tool set (See NOTE “A”.)	 09912-58432 Pressure hose	 09912-58442 Pressure gauge
 09912-58490 3-way joint & hose	 09930-88530 Injector test lead	 09931-76011 SUZUKI scan tool (Tech 1A) kit (See NOTE “B”.)	 Mass storage cartridge

	
09931-76030 16/14 pin DLC cable	Tech 2 kit (SUZUKI scan tool) (See NOTE “C”.)

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 and substitutes for the Tech 2 kit.**
  1. Storage case, 2. Operator’s manual, 3. Tech 1A, 4. DLC cable (14/26 pin, 09931-76040), 5. Test lead / probe, 6. Power source cable, 7. DLC cable adaptor, 8. Self-test adaptor
- **“C”: This kit includes the following items and substitutes for the Tech 1A kit.**
  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

Tightening Torque Specifications

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-1 and -2	45	4.5	32.5
Camshaft position sensor	10	1.0	7.5
Fuel pressure regulator bolt	10	1.0	7.5

SECTION 6F

IGNITION SYSTEM (ELECTRONIC IGNITION 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 "Air Bag 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 6F-2
Diagnosis 6F-3
On-Vehicle Service 6F-5
Ignition Spark Test 6F-5
High-tension Cords 6F-5
Spark Plugs 6F-6
Ignition Coil Assembly (Including Ignitor) 6F-7
Crankshaft Position Sensor (CKP Sensor) ... 6F-8
Ignition Timing 6F-8
Special Tools 6F-10
Tightening Torque Specification 6F-10

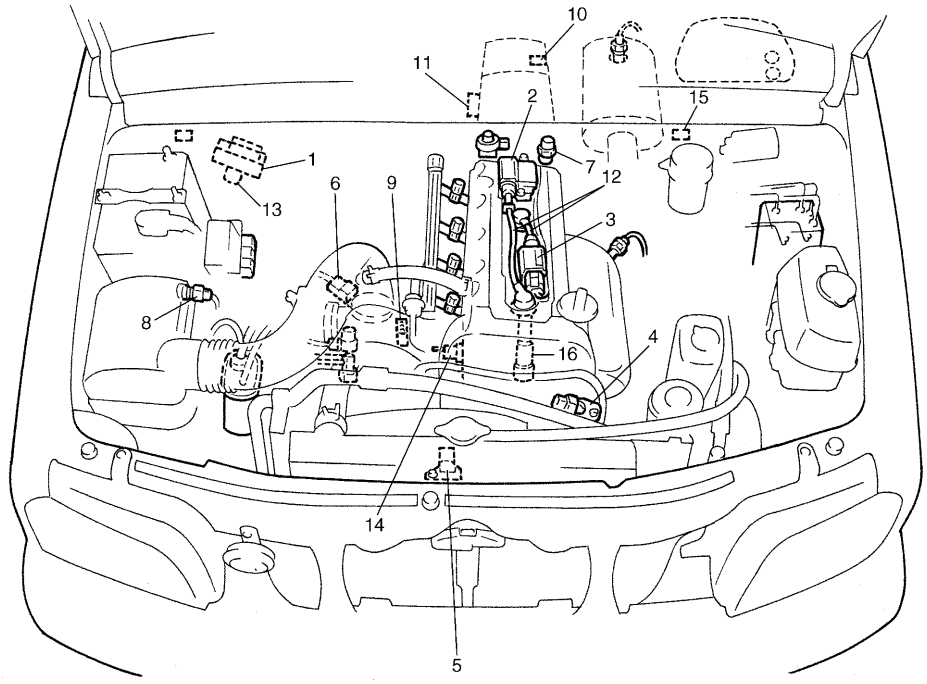
General Description

The ignition system is an electronic (distributorless) ignition system. It consists of the parts as described below and has an electronic ignition control system.

- 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 ignitor)
  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 adjust initial ignition timing automatically.
- TP sensor, ECT sensor, MAP sensor and other sensors/switches
  Refer to “Electronic Control System” in Section 6E for details.

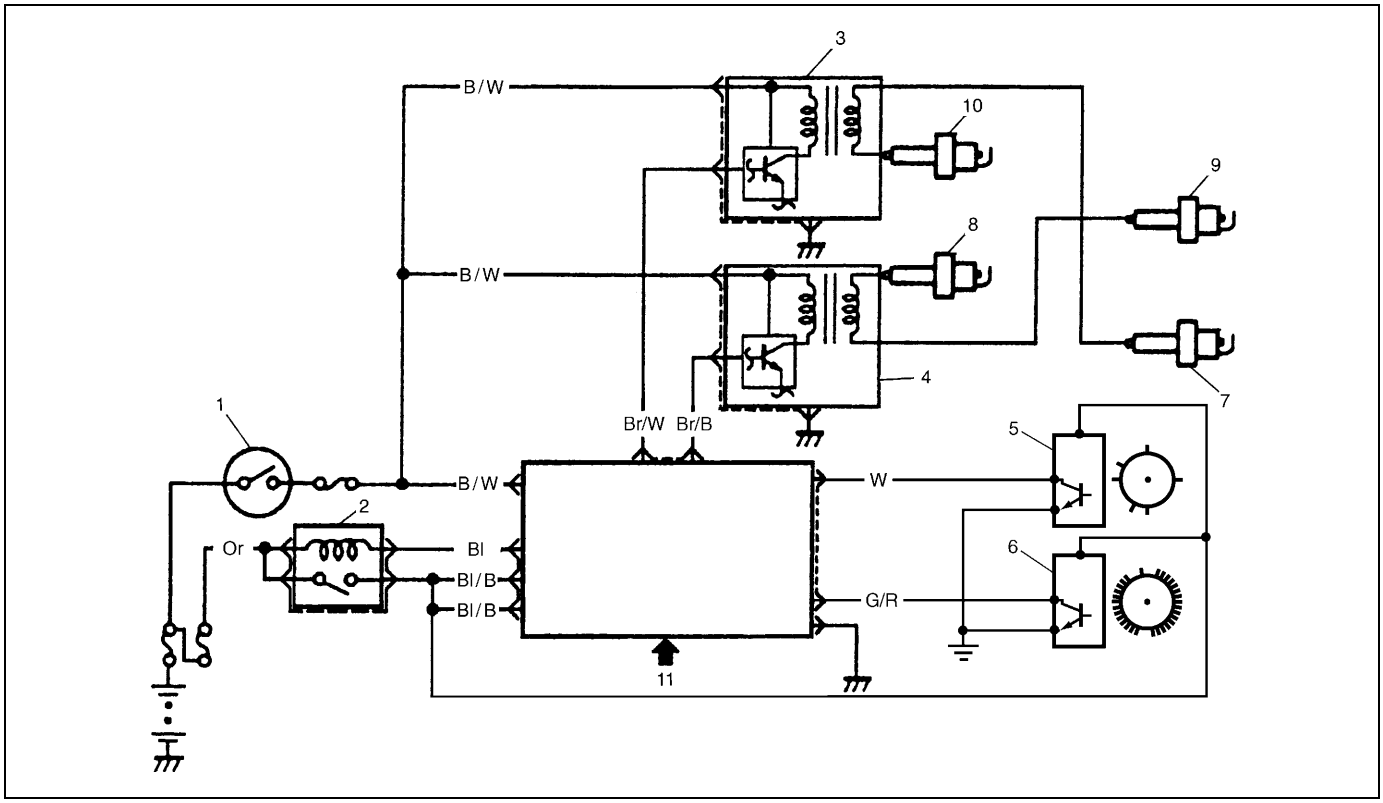
Although this ignition system does not have a distributor, it has two ignition coil assemblies (one is for No.1 and No.4 spark plugs and the other is for No.2 and No.3 spark plugs). When an ignition signal is sent from ECM to the ignitor in the ignition coil assembly for No.1 and No.4 spark plugs, a 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.

SYSTEM COMPONENTS



1. ECM	7. ECT sensor	13. Monitor connector
2. Ignition coil assembly for No.1 and No.4 spark plugs	8. IAT sensor	14. Knock sensor
3. Ignition coil assembly for No.2 and No.3 spark plugs	9. TP sensor	15. DLC
4. CMP sensor	10. VSS	16. Spark plugs
5. CKP sensor	11. Transmission range switch (A/T)	
6. MAP sensor	12. High-tension cords	

SYSTEM WIRING 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, IAT sensor, TP sensor, Knock sensor, VSS, Park/ Neutral position signal, Electric load signal, Engine start signal, Test switch terminal)
6. CKP sensor	

Diagnosis

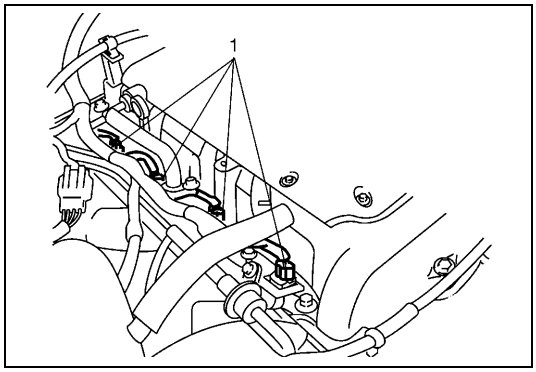
Condition	Possible Cause	Correction
Engine cranks, but will not start or hard to start (No spark)	Blown fuse for ignition coil	Replace.
	Loose connection or disconnection of lead wire or high-tension cord(s)	Connect securely.
	Faulty high-tension cord(s)	Replace.
	Faulty spark plug(s)	Adjust, clean or replace.
	Faulty ignition coil	Replace ignition coil assembly.
	Faulty CKP sensor or CKP sensor plate	Clean, tighten or replace.
	Faulty 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 ECM	Replace.

IGNITION SYSTEM DIAGNOSTIC FLOW TABLE

Step	Action	Yes	No
1	Was “Engine Diagnostic Flow Table” in Section 6 performed?	Go to Step 2.	Go to “Engine Diag. Flow Table” in Section 6.
2	Ignition Spark Test 1) Check all spark plugs for condition and type referring to “Spark Plugs” section. 2) If OK, perform ignition spark test, referring to “Ignition Spark Test” 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 Diag. Flow Table in Section 6.	Go to Step 4.
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” 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” 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 and 6 of “DTC P0335 (No.23) CKP Sensor Circuit Malfunction” 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” section. Is check result satisfactory?	System is in good condition.	Check CKP sensor, CKP sensor plate and input signals related to this system.

On-Vehicle Service

Ignition Spark Test

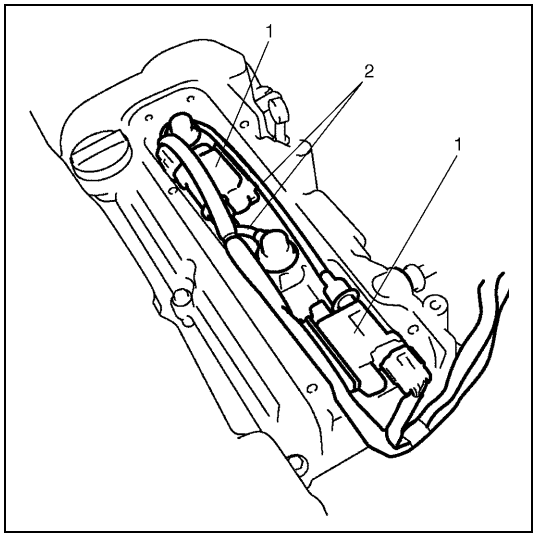


1) Disconnect all injector connectors (1) from injectors.

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.

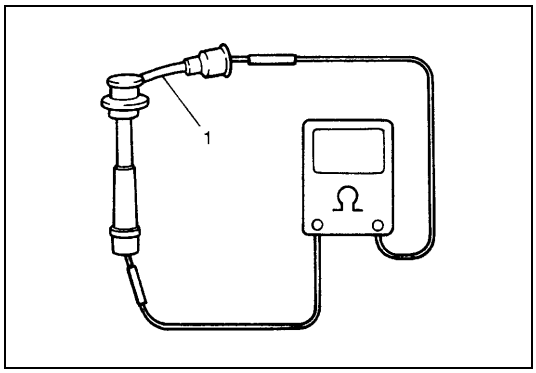
2) Remove cylinder head upper cover.
3) Remove spark plug and check it for condition and type referring to "Spark Plugs" in this section.
4) If OK, connect ignition coil connector to ignition coil assembly and connect spark plug to ignition coil assembly or high-tension cord. Ground spark plug.
5) Crank engine and check if each spark plug sparks.
6) If no spark is emitted, inspect the related parts as described under "Diagnosis" earlier in this section.

High-tension Cords



1) Remove cylinder head upper cover and disconnect high-tension cords (2) from ignition coil assemblies (1) while gripping each cap.
2) Pull out high-tension cords from spark plugs while gripping each cap.

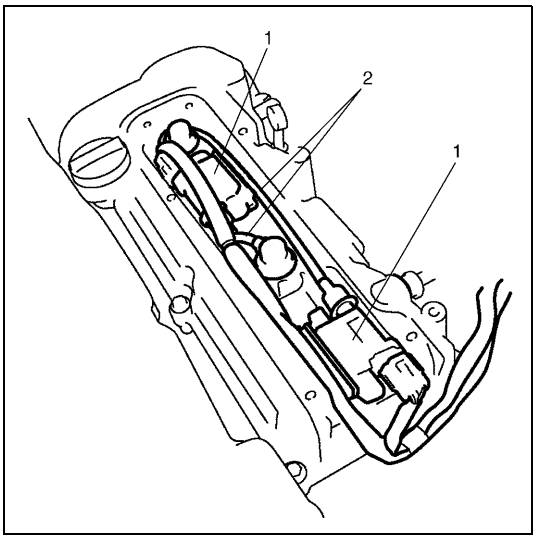
CAUTION:
- **Removal of high-tension cords together with clamps will be recommended so as not to damage their inside wire (resistive conductor).**
- **For the same reason, pull out each connection by gripping cap portion.**



3) Measure resistance of high-tension cord (1) by using ohmmeter.

High-tension cord resistance
4 – 10 kΩ/m (1.2 – 3.0 kΩ/ft)

4) If resistance exceeds specification, replace high-tension cord(s).

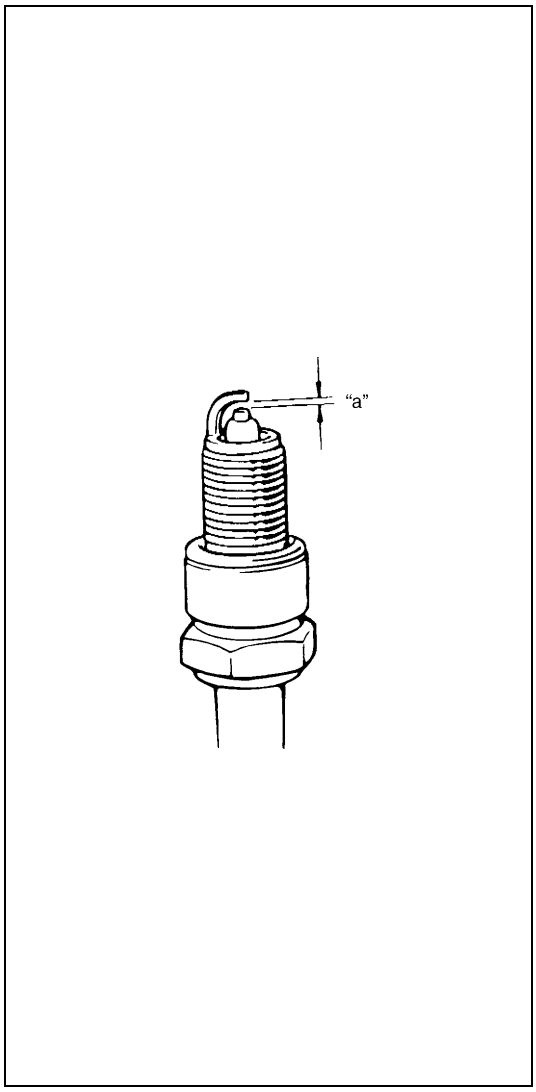


5) Install high-tension cords (2) to spark plugs and ignition coil assemblies (1) while gripping each cap.

CAUTION:
- **Never attempt to use metal conductor high-tension cords as replacing parts.**
- **Insert each cap portion fully when installing high-tension cords.**

Spark Plugs

1) Pull out high-tension cords by gripping their caps and then remove ignition coil assemblies referring to “Ignition Coil Assembly” in this section.
2) Remove spark plugs.
3) Inspect them for:
   - Electrode wear
   - Carbon deposits
   - Insulator damage



4) If any abnormality is found, adjust air gap, clean with spark plug cleaner or replace them with specified new plugs.
   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 : BKR6E-11, IFR5E11
DENSO : K20PR-U11, SK16PR-A11

NOTE:

NGK IFR5E11 or DENSO SK16PR-A11 is highly recommended for better engine starting performance under – 25°C (– 13°F).

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.

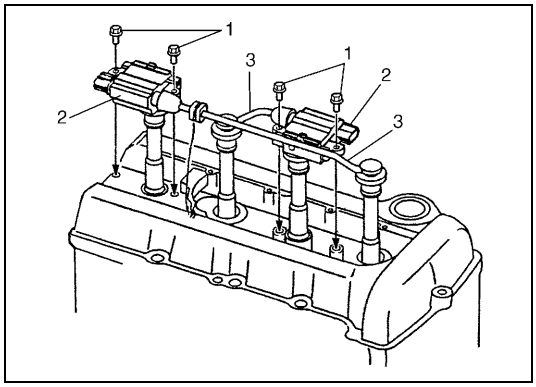
5) Install spark plugs and torque them to specification.

Tightening torque
Spark plug : 25 N·m (2.5 kg-m, 18.0 lb-ft)

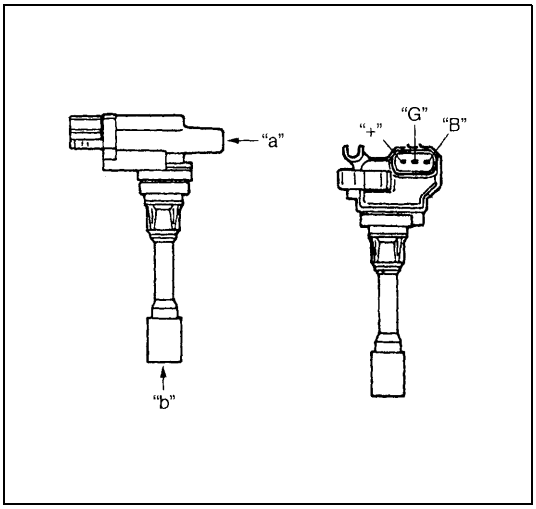
6) Install ignition coil assemblies referring to "Ignition Coil Assembly" in this section.
7) Install high-tension cords securely by gripping their caps.

Ignition Coil Assembly (Including Ignitor)

1) Disconnect negative cable at battery.
2) Remove cylinder head upper cover.
3) Disconnect ignition coil connector.



4) Disconnect high-tension cord (3) from ignition coil assembly (2).
5) Remove ignition coil bolts (1) and then pull out ignition coil assembly.



6) Measure resistance between terminals as follows by using analog type ohmmeter.
   If check result is not satisfactory, replace ignition coil assembly.

   Secondary coil resistance
   "a" – "b" : 7.5 – 14 kΩ (at 20°C, 68°F)

7) Install ignition coil assembly.
8) Tighten ignition coil bolts, and then connect ignition coil coupler.
9) Install high-tension cord to ignition coil assembly while gripping its cap.
10) Install cylinder head upper cover.

Crankshaft Position Sensor (CKP Sensor)

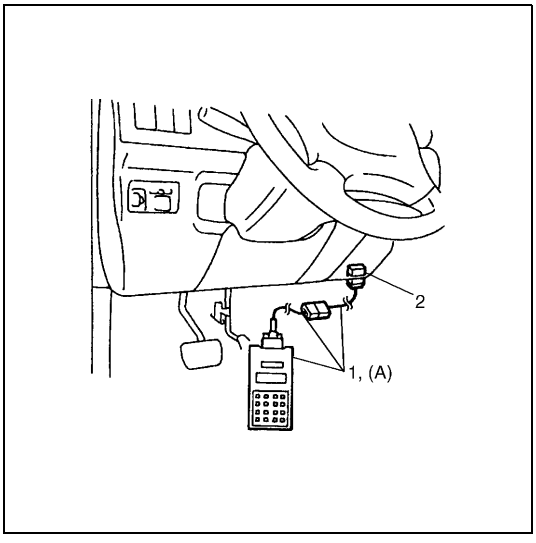
Refer to "Crankshaft Position Sensor" in Section 6E for removal, inspection and installation.

Ignition Timing

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.**

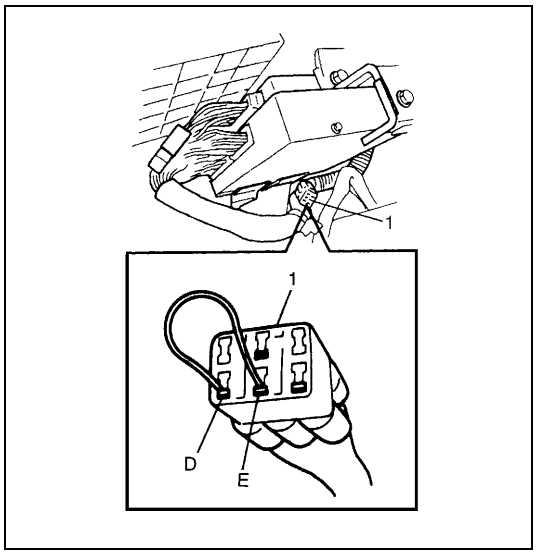
INSPECTION



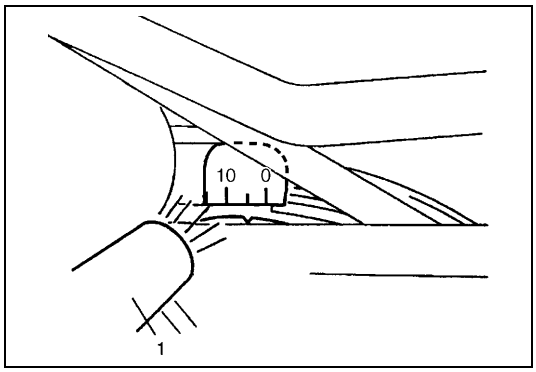
1) When using SUZUKI scan tool (1), connect SUZUKI scan tool to DLC (2) with ignition switch OFF.

   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.
   (Refer to "Idle Speed/Idle Air Control Duty Inspection" in Section 6E.)



5) Fix ignition timing to initial one as follows.
   a) When using SUZUKI scan tool:
      Select “MISC” mode on SUZUKI scan tool and fix ignition timing to initial one.
   b) Without using SUZUKI scan tool: (vehicle without immobilizer indicator lamp)
      Disconnect scan tool from DLC, and connect D and E terminals of monitor connector (1) or E to body ground by using service wire so that ignition timing is fixed on initial one.



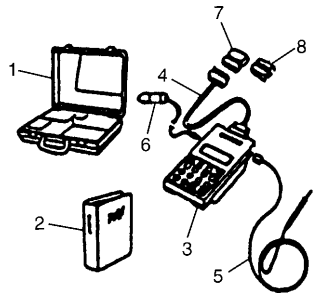
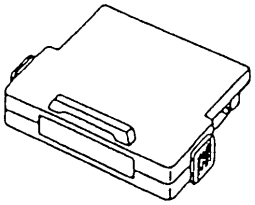
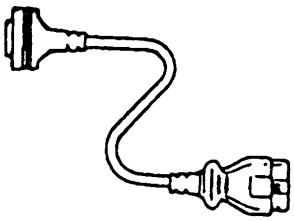
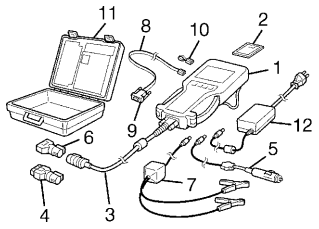
6) Using timing light (1), check that ignition timing is within specification.

Initial ignition timing (test switch terminal grounded or fixed with SUZUKI 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
   - Test switch signal circuit
   - VSS
   - Timing chain cover installation
8) After checking Initial Ignition Timing, release ignition timing fixation by using SUZUKI scan tool or disconnect service wire from monitor connector.
9) With engine idling (test switch terminal ungrounded, throttle opening at closed position and car stopped), check that ignition timing is about 7°–17° BTDC. (Constant variation within a few degrees from 7°–17° 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, test switch terminal circuit and ECM.

Special Tools

			
09931-76011 Tech 1A kit (SUZUKI scan tool) (See NOTE “A”.)	Mass storage cartridge for Tech 1A	09931-76030 16/14 pin DLC adapter for Tech 1A	Tech 2 kit (SUZUKI scan tool) (See NOTE “B”.)

NOTE:

- **“A” : This kit includes the following items and substitutes for the Tech 2 kit.**
  1. Storage case, 2. Operator’s manual, 3. Tech 1A, 4. DLC cable (14/26 pin, 09931-76040),
  5. Test lead/probe, 6. Power source cable, 7. DLC cable adaptor, 8. Self-test adaptor
- **“B” : This kit includes the following items and substitutes for the Tech 1A kit.**
  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

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Spark plug	25	2.5	18.0

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 "Air Bag 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:

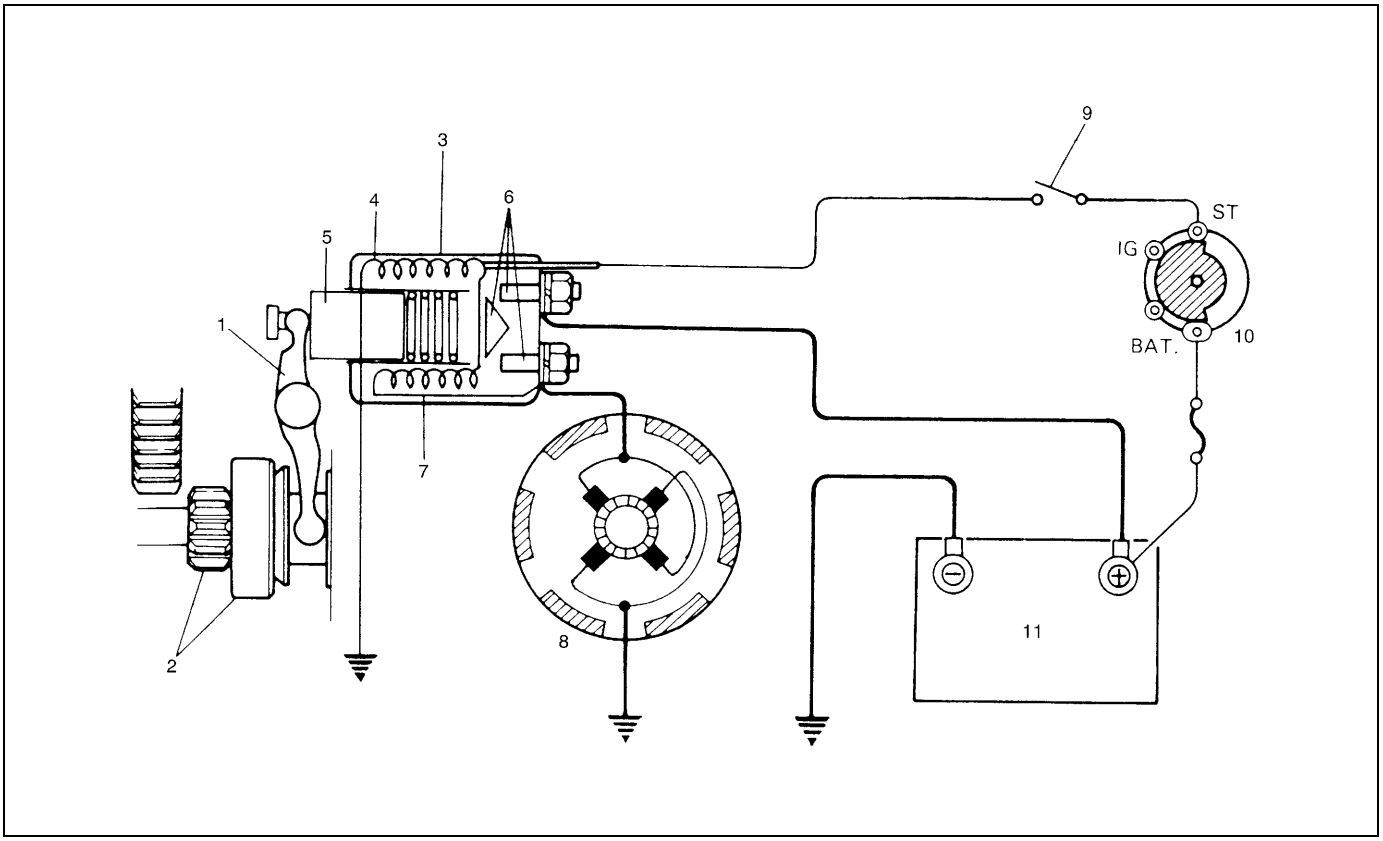
Starting motor varies depending on specifications, etc. Therefore, be sure to check model and specification of vehicle being serviced before replacing parts.

CONTENTS

General Description 6G-2
Cranking Circuit 6G-2
Diagnosis 6G-2
Diagnosis Table 6G-2
Performance Test 6G-4
On-Vehicle Service 6G-5
Starting Motor 6G-5
Specifications 6G-7

General Description

Cranking Circuit



1. Pinion drive lever	5. Plunger	9. A/T: Transmission range switch (shift lever switch)
2. Pinion & Over-running clutch	6. Magnetic switch contacts	10. Ignition & Starter switch
3. Magnetic switch	7. Pull-in coil	11. Battery
4. Hold-in coil	8. Starting motor	

Diagnosis

Diagnosis Table

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

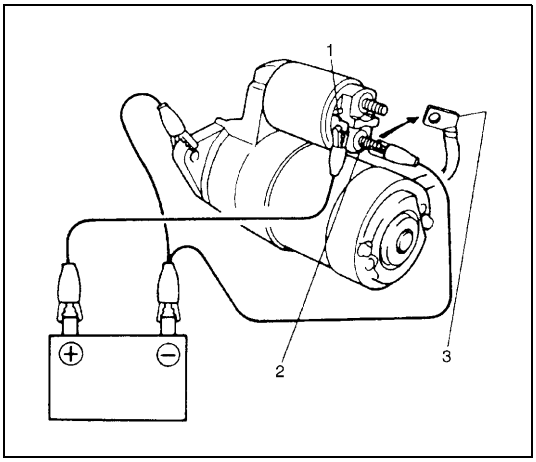
Condition	Possible Cause	Correction
Motor not running (No operating sound of magnetic switch)	Shift lever switch is not in P or N, or not adjusted (A/T)	Shift in P or N, or adjust switch.
	Battery run down	Recharge battery.
	Battery voltage too low due to battery deterioration	Replace battery.
	Poor 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 (M/T) or drive plate (A/T).
Noise	Abnormally worn bush	Replace bush.
	Worn pinion or worn teeth of ring gear	Replace pinion or flywheel (M/T) or drive plate (A/T).
	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.

Condition	Possible Cause	Correction
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.

Performance Test

CAUTION:
Each test must be performed within 3 – 5 seconds to avoid coil from burning.

PULL-IN TEST

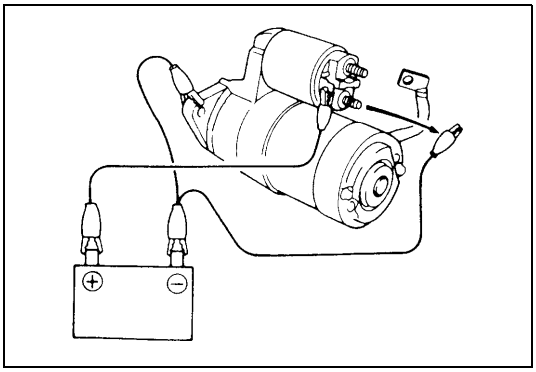


Connect battery to magnetic switch as shown.
Check that plunger and pinion move outward.
If plunger and pinion don't move, replace magnetic switch.

NOTE:
Before testing, disconnect lead wire from terminal M.

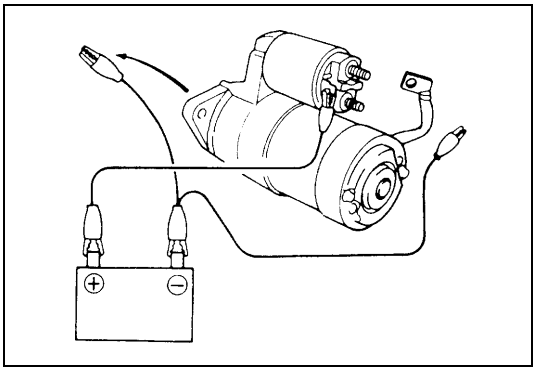
1.	Terminal "S"
2.	Terminal "M"
3.	Lead wire (switch to motor)

HOLD-IN TEST

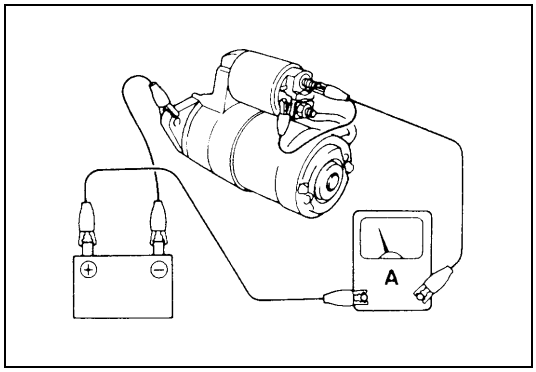


While connected as above with plunger out, disconnect negative lead from terminal "M".
Check that plunger and pinion remain out.
If plunger and pinion return inward, replace magnetic switch.

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.



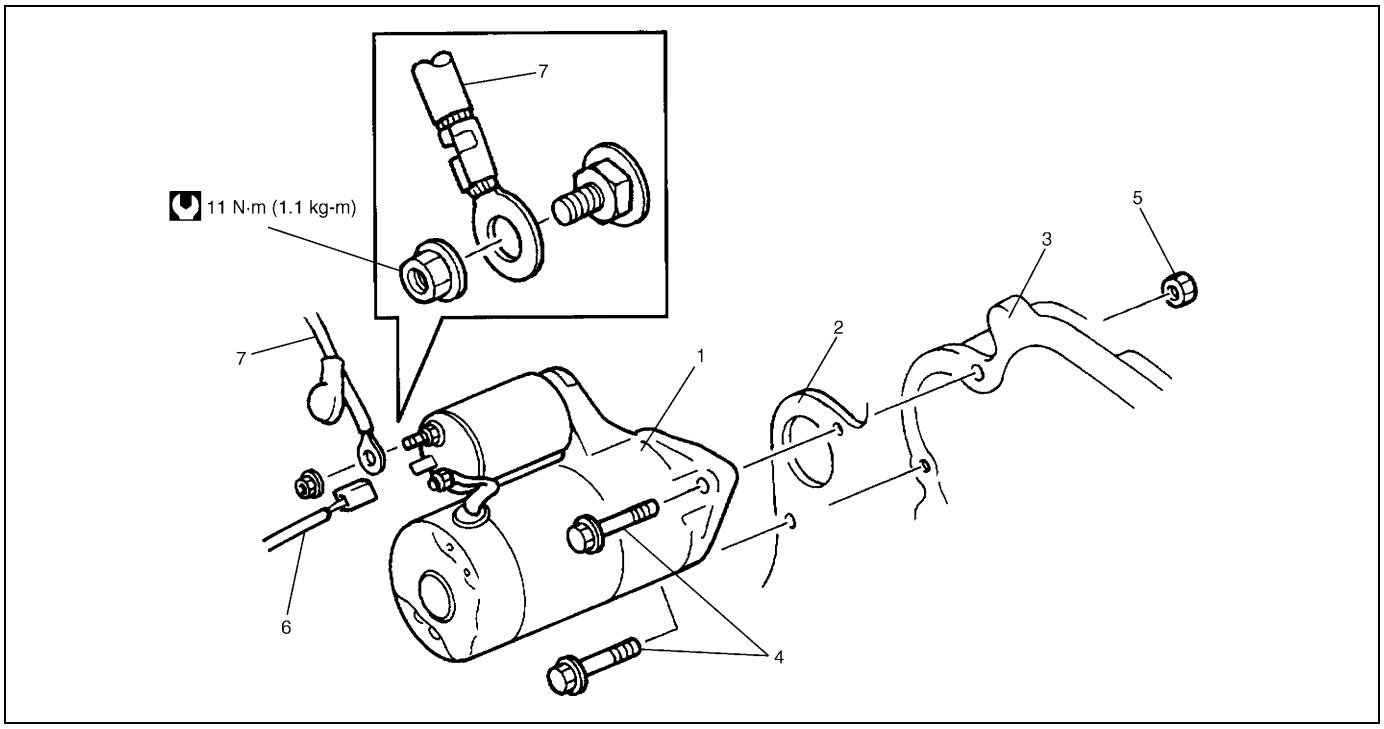
NO-LOAD PERFORMANCE TEST

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)
: 90 A MAX. at 11 V

On-Vehicle Service

Starting Motor



1. Starting motor	3. Transmission case	5. Starting motor mounting nut	7. Battery cable
2. Clutch housing upper plate	4. Starting motor mounting bolt	6. Magnetic switch lead wire	Tightening Torque

DISMOUNTING

1) Disconnect negative (–) battery lead at battery.
2) Disconnect magnetic switch lead wire (6) and battery cable (7) from starting motor terminals.
3) Remove starting motor mount bolts (4) and nut (5).
4) Remove starting motor (1).

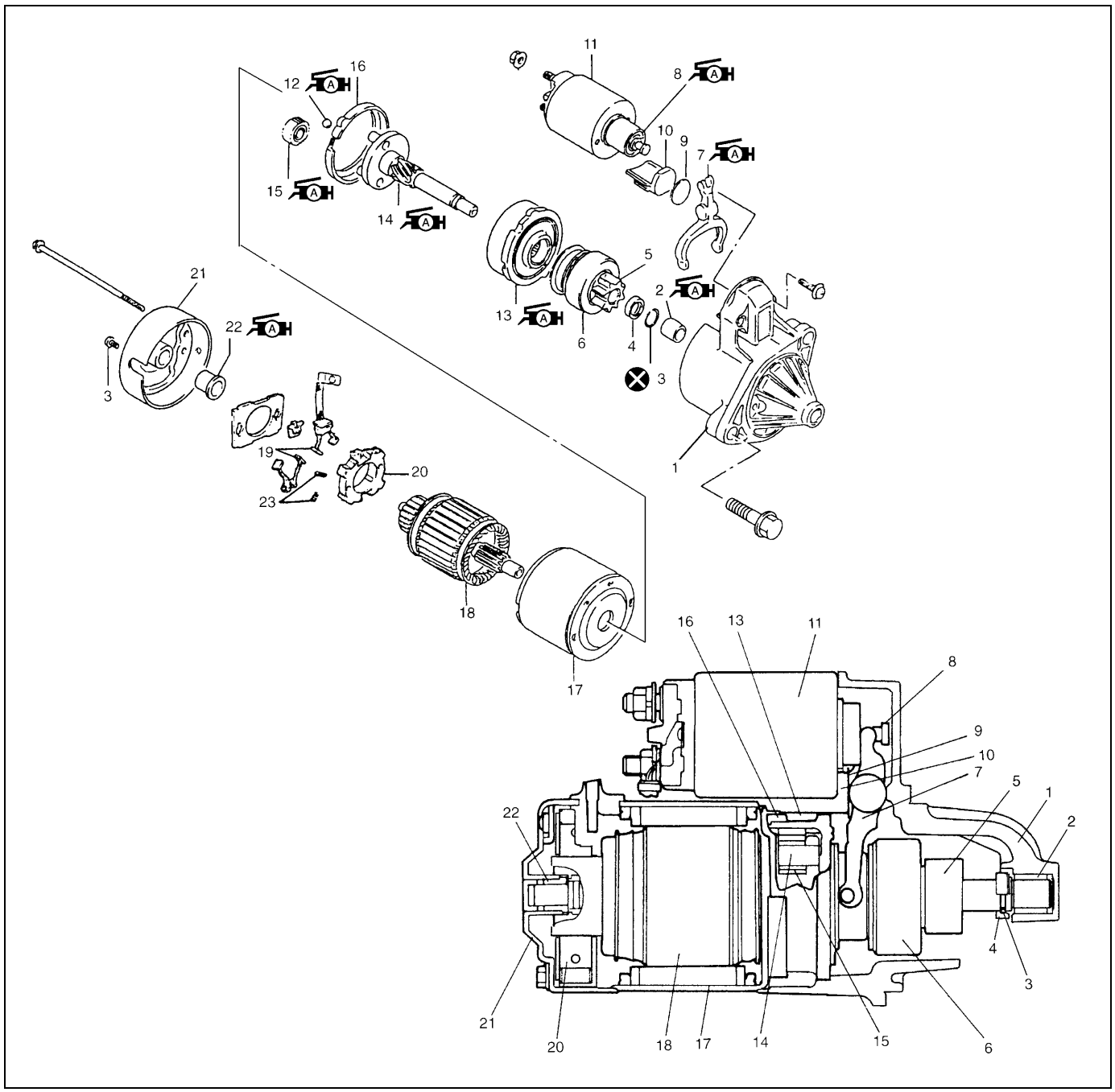
REMOUNTING

Reverse the dismounting procedure.

DISASSEMBLY AND REASSEMBLY

NOTE:

- **Make sure to apply grease before assembly, where are indicated "A" in the figure below.**
- **Spare parts have been lubricated.**



1. Front housing	6. Over-running clutch	11. Magnetic switch	16. Packing	21. Rear bracket
2. Bush	7. Lever	12. Ball	17. Yoke	22. Rear bush
3. Snap ring	8. Plunger	13. Internal gear	18. Armature	23. Brush spring
4. Pinion stop ring	9. Plate	14. Planetary carrier shaft	19. Brush	Apply grease (99000-25010)
5. Pinion gear	10. Seal rubber	15. Planetary gear	20. Brush holder	Do not reuse.

Specifications

Voltage			12 volts	
Output			0.9 kW	1.2 kW
Rating			30 seconds	
Direction of rotation			Clockwise as viewed from pinion side	
Brush length			12.3 mm (0.48 in.)	12.3 mm (0.48 in.)
Number of pinion teeth			8	
Performance		Condition	Guarantee	
Around at 20° C (68 °F)	No load characteristic	11.0 V	90 A maximum 2,800 rpm minimum	90 A maximum 2,500 rpm minimum
	Load characteristic	8.0 V 200 A	4.8 N·m (0.48 kg-m, 3.5 lb-ft) minimum 1,260 rpm minimum	–
		7.5 V 300 A	–	10.5 N·m (1.05 kg-m, 7.6 lb-ft) minimum 880 rpm minimum
	Locked rotor current	3.5 V	550 A maximum 12.2 N·m (1.22 kg-m, 8.8 lb-ft) minimum	–
		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	

SECTION 6H

CHARGING SYSTEM

WARNING:

For vehicles equipped with Supplemental Restraint (Air Bag) System

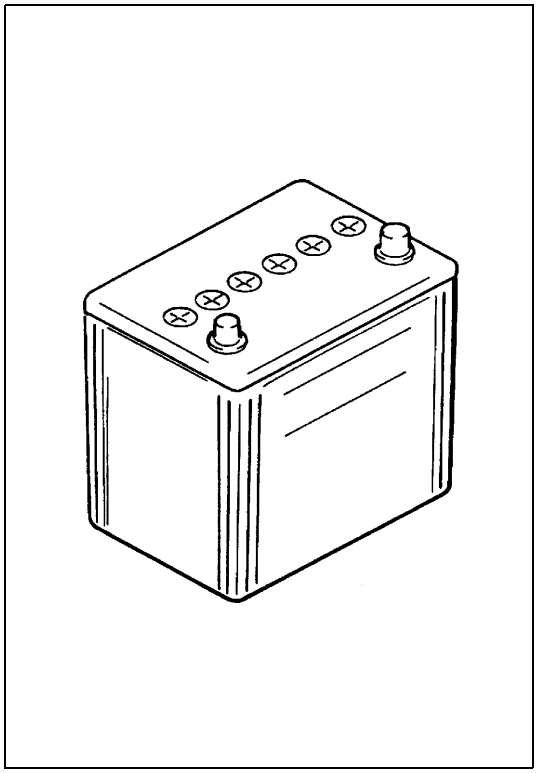
- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near 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 6H-2
Battery 6H-2
Generator 6H-4
Diagnosis 6H-6
Battery 6H-6
Generator 6H-7
On-Vehicle Service 6H-9
Battery 6H-9
Jump starting in case of emergency 6H-9
Dismounting 6H-11
Handling 6H-11
Remounting 6H-11
Generator 6H-11
Generator belt 6H-11
Unit Repair Overhaul 6H-12
Generator 6H-12
Dismounting 6H-12
Remounting 6H-13
Disassembly and reassembly 6H-13
Inspection 6H-14
Specifications 6H-17
Battery 6H-17
Generator 6H-17
Tightening Torque Specification 6H-17

General Description

Battery



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

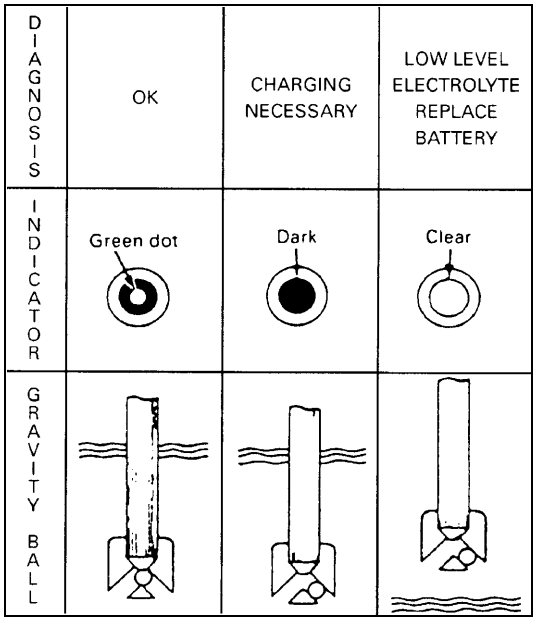
The battery carrier should be in good condition so that it will support the battery securely and keep it level.
Before installing the battery, the battery carrier and hold-down clamp should be clean and free from corrosion and make certain there are no parts in carrier.
To prevent the battery from shaking 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 in 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 which is 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 2,000 to 3,000 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.

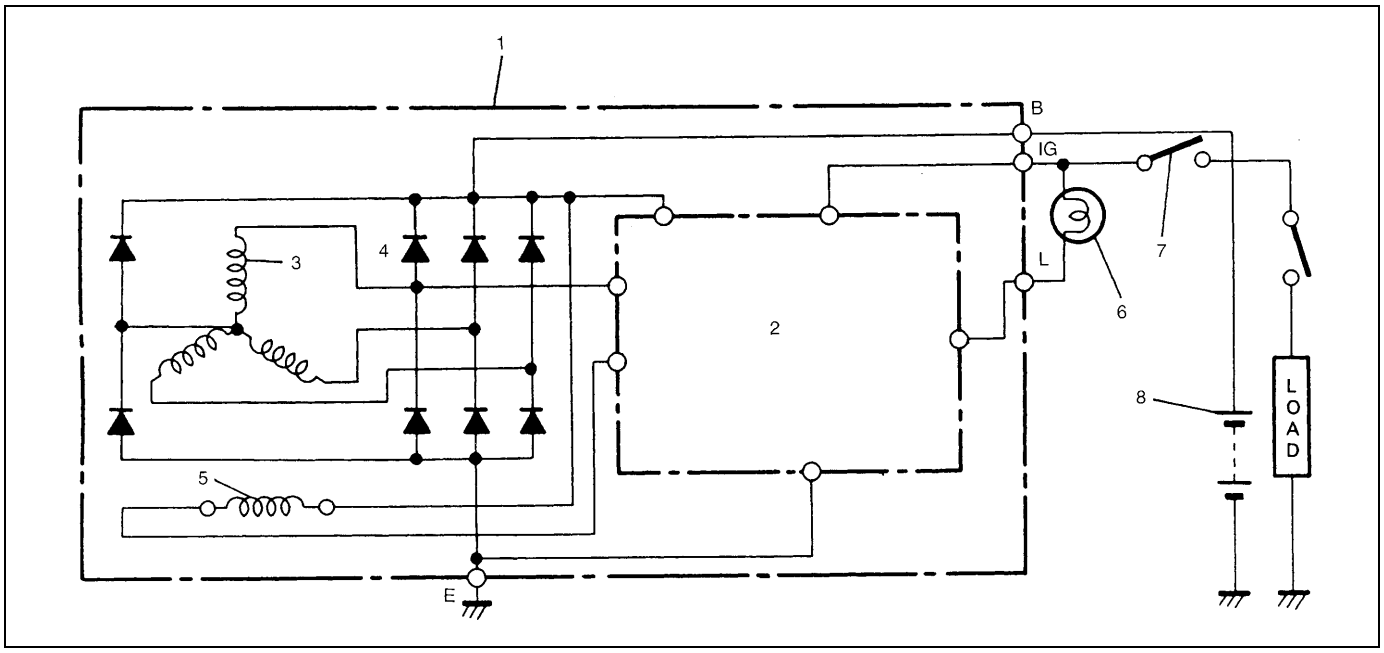
2) Keep the battery cable connections clean.
   The cable connections, particularly at the positive (+) terminal post, tend to become corroded. The product of corrosion, or rust, on the mating faces of conductors resists the flow of current.
   Clean the terminals and fittings periodically to ensure 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

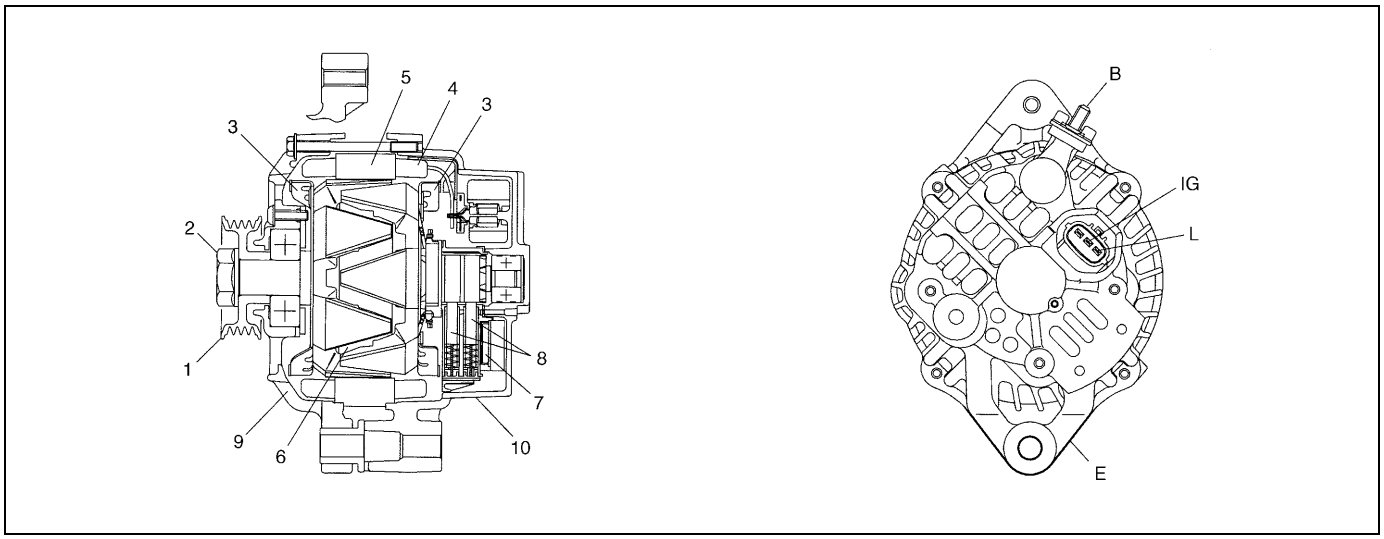
The generator is a small and high performance type with an IC regulator incorporated.
The internal components are connected electrically as shown below figure.

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.
- A condenser mounted in the rear housing suppresses radio noise.



1. Generator with regulator assembly	3. Stator coil	5. Field coil (rotor coil)	7. Main switch
2. I.C. regulator	4. Diode	6. Charge indicator light	8. Battery



1. Pulley	5. Stator core	9. Front housing	IG: Ignition terminal
2. Pulley nut	6. Field coil	10. Rear housing	L: Lamp terminal
3. Rotor fan	7. Regulator	B: Generator output (Battery terminal)	
4. Stator coil	8. Brush	E: Ground	

Diagnosis

Battery

COMMON CAUSES OF FAILURE

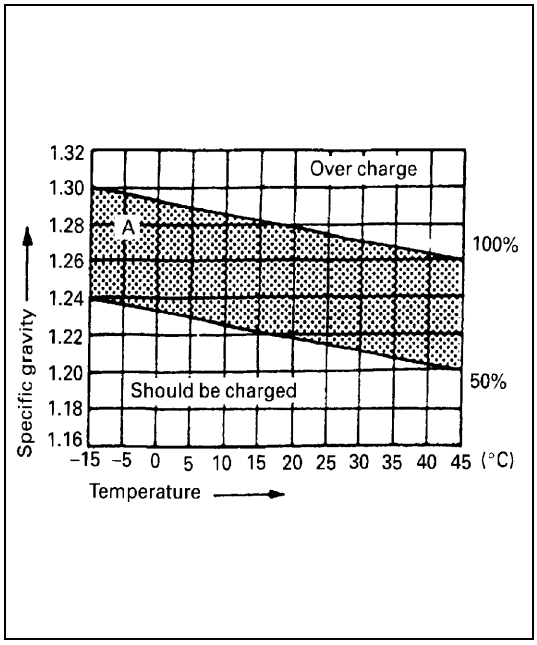
A battery is not designed to last indefinitely; however, with proper care, it will provide many years of service. If the battery performs satisfactorily during test but fails to operate properly for no apparent reason, the followings are some factors that may point to the cause of trouble:

- Accessories left on overnight or for an extended period without the generator operating.
- Slow average driving speeds for short periods.
- Electrical load exceeding generator output particularly with addition of after market equipment.
- Defects in charging system such as high resistance, slipping drive belt, loose generator output terminal, faulty generator or voltage regulator. Refer to “Generator” in this “Diagnosis” section.
- Battery abuse, including failure to keep battery cable terminals clean and tight or loose battery hold down.
- Mechanical problems in electrical system such as shorted or pinched wires.

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.

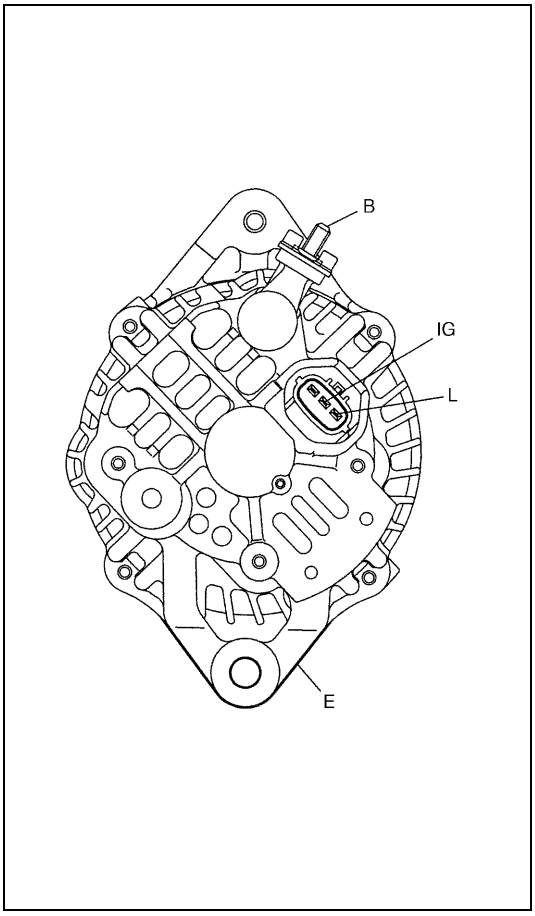
How to use the temperature-corrected state-of-charge graph

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



CAUTION:

- **Do not mistake polarities of IG terminal and L terminal.**
- **Do not make a short circuit between IG and L terminals. Always connect these terminals through a lamp.**
- **Do not connect any load between L and E.**
- **When connecting a charger or a booster battery to vehicle battery, refer to this section describing battery charging.**

B:	Generator output (Battery terminal)
E:	Ground
IG:	Ignition terminal
L:	Lamp terminal

Trouble in charging system will show up as one or more of 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 a loose drive pulley, loose mounting bolts, worn or dirty bearings, defective diode, or defective stator.

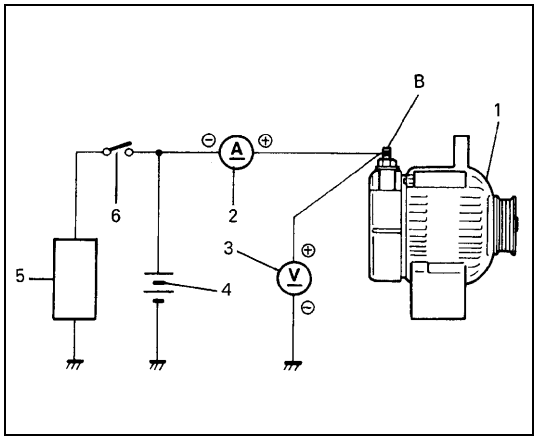
FAULTY INDICATOR LAMP OPERATION

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.

UNDERCHARGED BATTERY

This condition, as evidenced by slow cranking or indicator clear with red dot 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.

1) Make sure that undercharged condition has not been caused by accessories left on for extended period of time.
2) Check drive belt for proper tension.
3) If battery defect is suspected, refer to BATTERY section.
4) Inspect wiring for defects. Check all connections for tightness and cleanliness, battery cable connections at battery, starting motor and ignition ground cable.



5) Connect voltmeter and ammeter as shown in the figure.

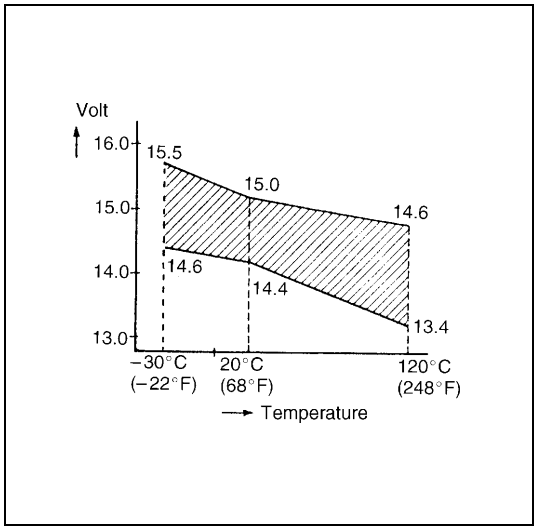
NOTE:

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

6) Measure current and voltage.

No-load Check



1) Run engine from idling up to 2,000 rpm and read meters.

NOTE:

Turn off switches of all accessories (wiper, heater etc.).

Standard current
10 A maximum
Standard voltage
14.4 – 15.0 V (at 20 °C, 68 °F)

NOTE:

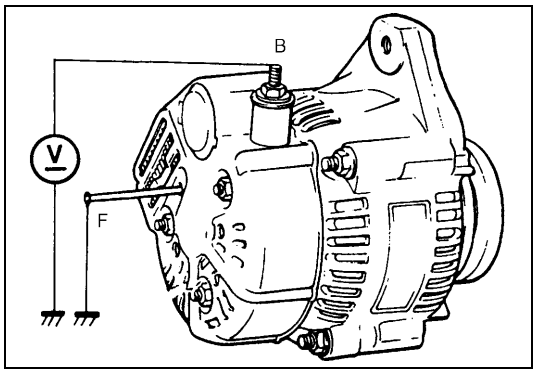
Consideration should be taken that voltage will differ somewhat with regulator case temperature as shown in the graph.

Higher Voltage

If voltage is higher than standard value, check ground of brushes. If brushes are not grounded, replace IC regulator.

Lower Voltage

If voltage is below or in standard value, increase engine speed up to 2,000 – 2,500 rpm soon after starting engine, and read maximum value on ammeter immediately.
If current is less than 49 A, repair or replace generator.

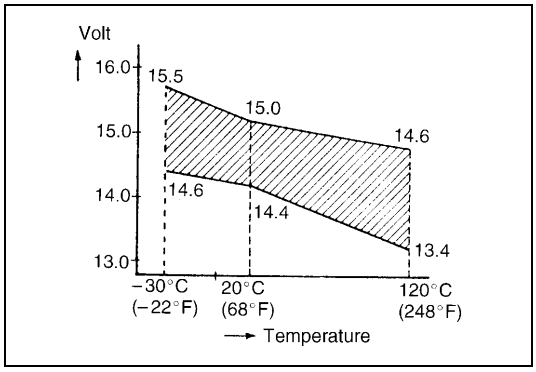


2) Ground F terminal and start engine, then measure voltage at B terminal as shown in left figure.
   - Voltage is higher than standard value
     It is considered that generator itself is good but IC regulator has been damaged, replace IC regulator.
   - Voltage is lower than standard value
     Generator itself has problem, check the generator.

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 section.
2) If obvious overcharged 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, proceed to disassembly section of generator service.
4) Check ground of brushes. If brushes are not grounded, replace IC regulator. Then check field coil for grounds and shorts, referring to “INSPECTION” section.

On-Vehicle Service

Battery

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.**

1) Set parking brake and place automatic transmission in PARK (NEUTRAL on manual transmission). 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.

WARNING:

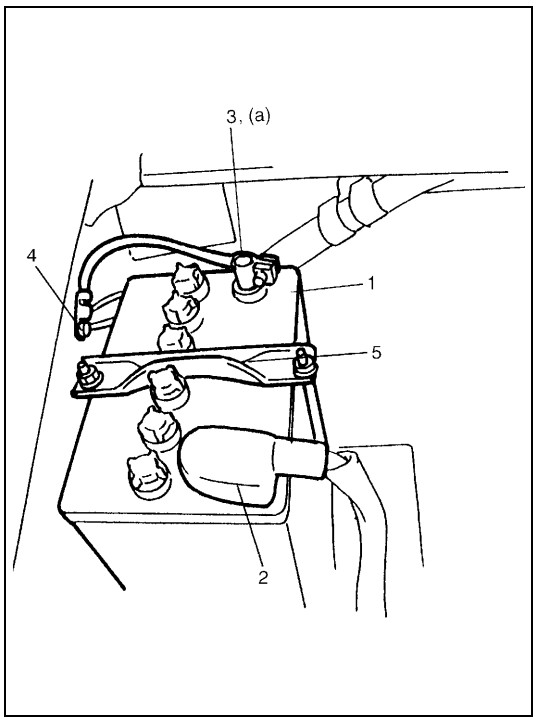
Do not connect negative cable directly to negative terminal of dead battery.

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.



Dismounting

1) Disconnect negative cable (3).
2) Disconnect positive cable (2).
3) Remove retainer (5).
4) Remove battery (1).

4. Body ground 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

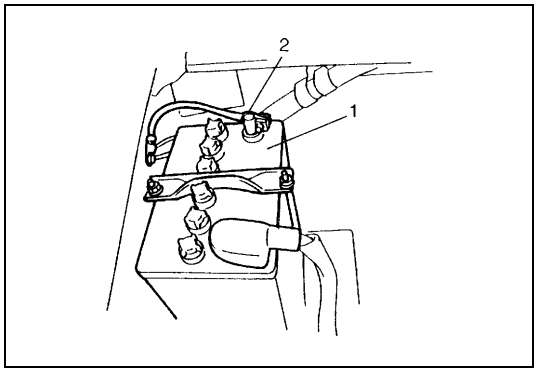
Generator belt

Refer to “Water Pump Belt and Cooling Fan” in Section 6B.

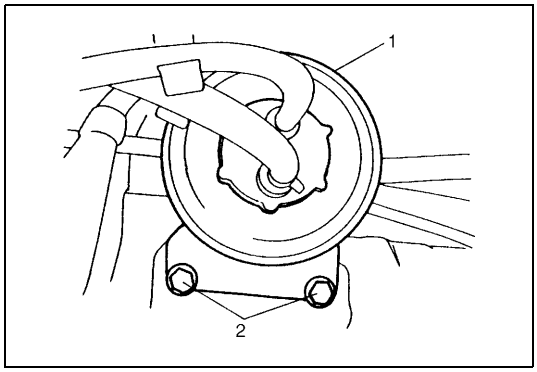
Unit Repair Overhaul

Generator

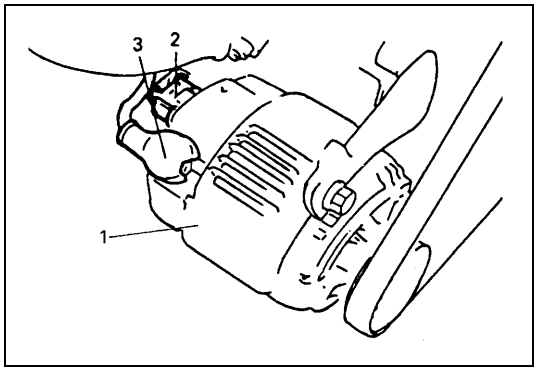
Dismounting



1) Disconnect negative (–) cable (2) at battery (1).

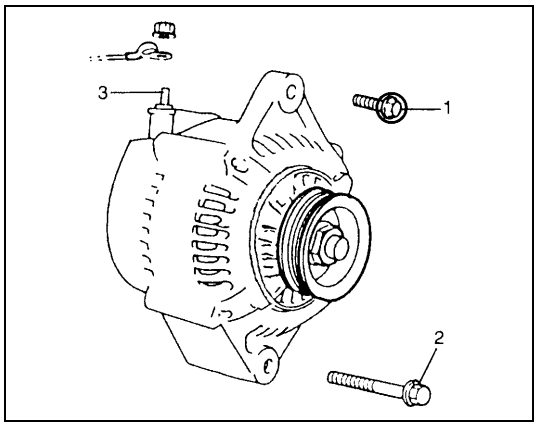


2) Remove bolts (2) and then canister (1) together with its bracket.



3) Disconnect “B” terminal wire (3) and coupler (2) from generator (1).

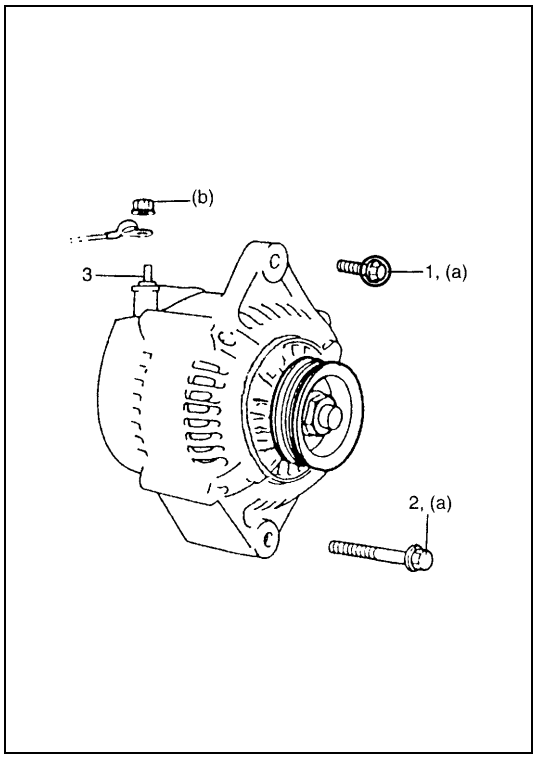
4) Remove generator belt. Refer to “Water Pump Belt and Cooling Fan” in Section 6B.



5) Remove generator.

1.	Generator adjusting bolt
2.	Generator pivot bolt
3.	“B” terminal

Remounting



1) Mount generator on the generator bracket.
2) Tighten generator bolts.

Tightening torque
Generator pivot bolt
(a) : 23 N·m (2.3 kg-m, 16.5 lb-ft)
(b) : 50 N·m (5.0 kg-m, 36.0 lb-ft)

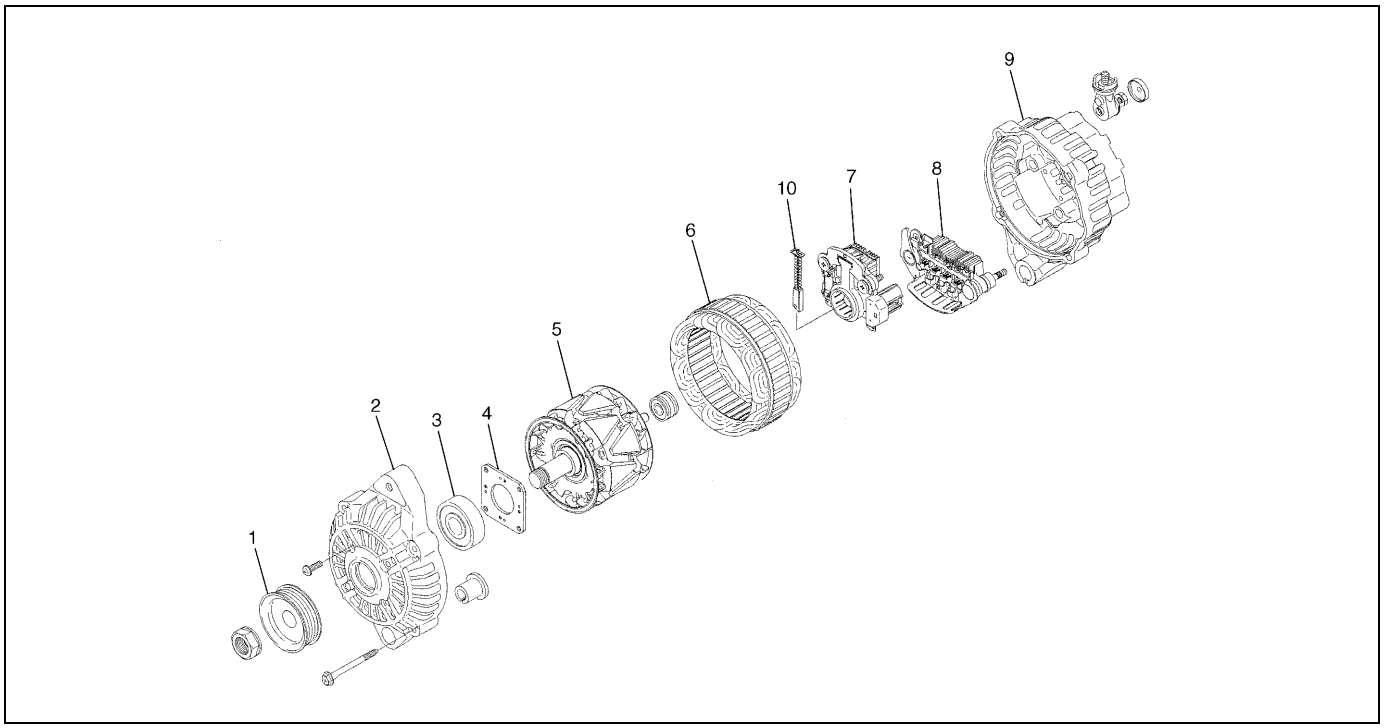
3) Install generator (cooling fan) belt. Refer to “Water Pump Belt and Cooling Fan” in Section 6B.
4) Connect “B” terminal wire (3) and coupler to generator.

Tightening torque
“B” terminal outer nut of generator
(b) : 8.0 N·m (0.8 kg-m, 6.0 lb-ft)

1.	Upper generator bolt (Short)
2.	Lower generator bolt (Long)

5) Install canister.
6) Connect negative (–) cable at battery.

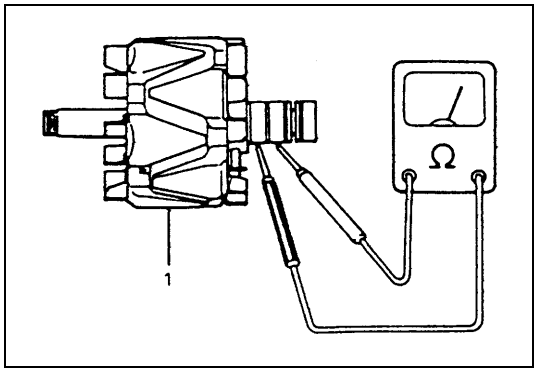
Disassembly and reassembly



1. Pulley	5. Rotor	9. Rear housing
2. Front housing	6. Stator	10. Brush
3. Bearing	7. IC regulator	
4. Retainer	8. Rectifier	

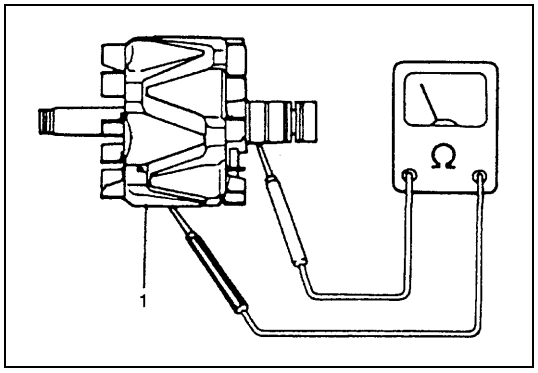
Inspection

Rotor

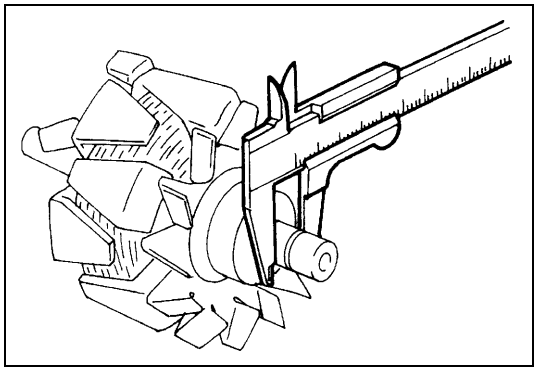


1) Using ohmmeter, check for continuity between slip rings of rotor (1). If there is no continuity, replace rotor.

Standard resistance between slip rings of rotor
1.8 – 2.1 Ω

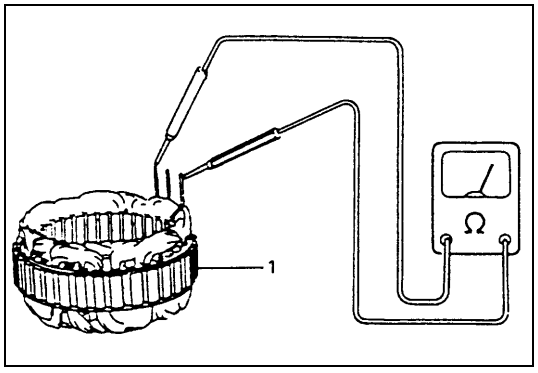


2) Using ohmmeter, check that there is no continuity between slip ring and rotor core. If there is continuity, replace rotor.
3) Check slip rings for roughness or scoring. If rough or scored, replace rotor (1).



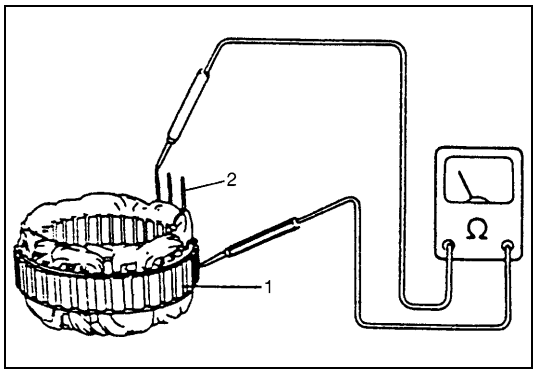
4) Check slip rings for roughness or scoring. If rough or scored, replace rotor.
Using a vernier caliper, measure the slip ring diameter.
If the diameter is less than minimum, replace the rotor.

Slip ring diameter
Standard : 14.4 mm (0.567 in.)
Limit : 14.0 mm (0.551 in.)



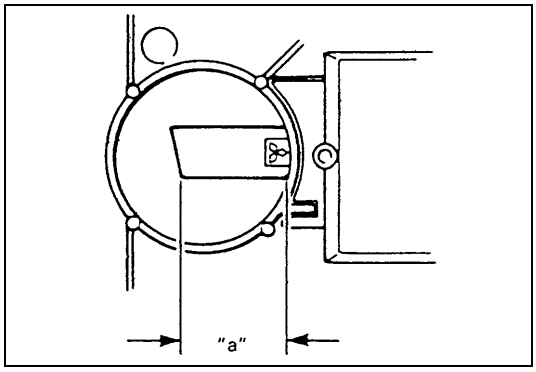
Stator

1) Using ohmmeter, check all leads for continuity.
If there is no continuity, replace stator (1).



2) Using ohmmeter, check that there is no continuity between coil leads (2) and stator core. If there is continuity, replace stator (1).

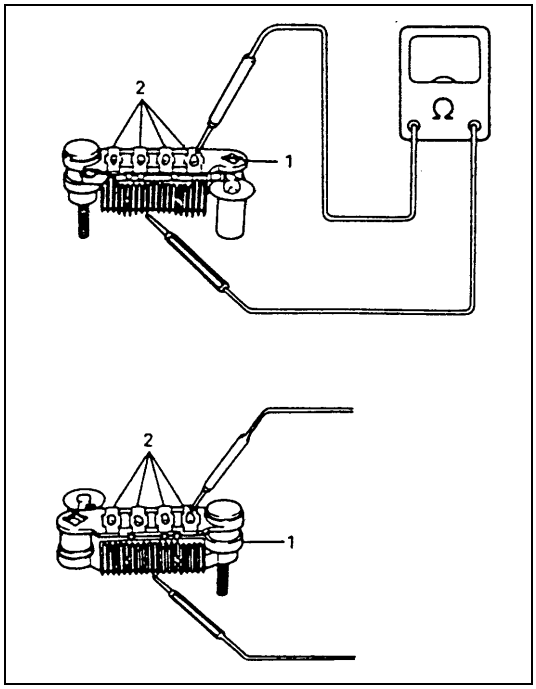
Brush and Brush Holder



Check each brush for wear by measuring its length.
If brush is found worn down to service limit, replace brush.

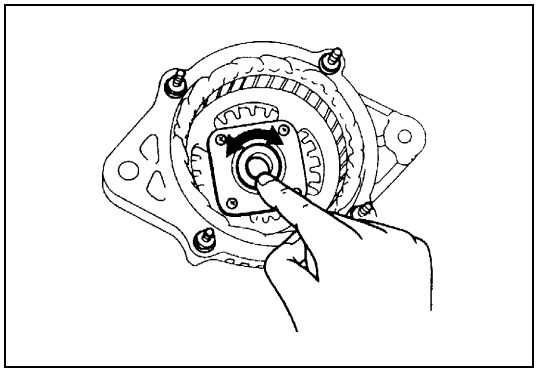
Brush length "a"
Standard : 16 mm (0.63 in.)
Service limit : 2 mm (0.08 in.)

Rectifier



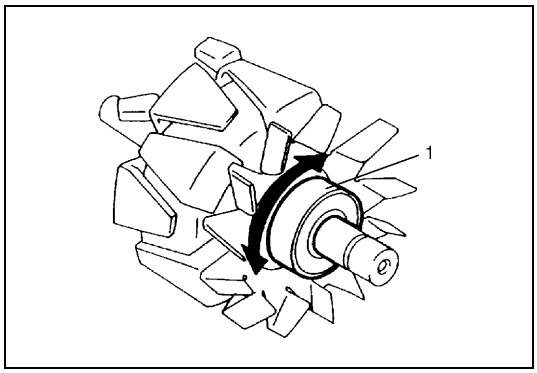
1) Using ohmmeter, check continuity between each of upper and lower rectifier bodies and each diode lead (2).
Check both directions by reversing probes of ohmmeter and there should be only one-way continuity in each case.
If check result is not satisfactory, replace rectifier (1).

Drive End Bearing



Check that the bearing is not rough or worn.

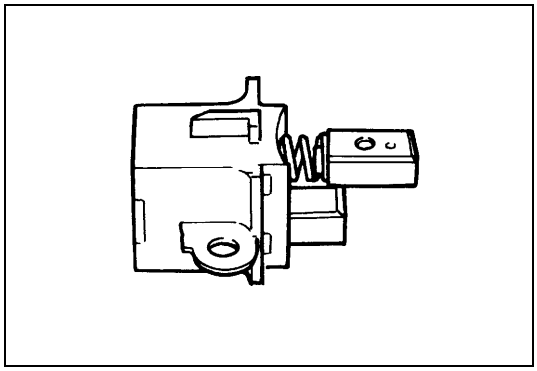
End Housing Bearing



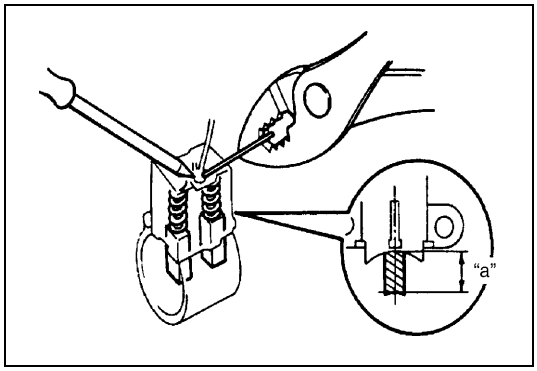
Check that the bearing is not rough or worn.
When removal is necessary, use bearing puller to remove end housing bearing (1).

CAUTION:
Be careful not to distort cooling fan blade while applying puller.

Replace Brush



1) Unsolder and remove the brush and spring.
2) Run the wire of a new brush through the spring and the hole in the brush holder, and insert the spring and brush into the brush holder.



3) Solder the brush wire to the brush holder at specified exposed length.

Exposed brush length
"a" : 10.5 mm (0.413 in.)

4) Check that the brush moves smoothly in the brush holder.
5) Cut off the excess wire.
6) Apply insulation paint to the soldered area.

Specifications

Battery

55B24R TYPE

Rated capacity	36 AH/5HR, 12 Volts
Electrolyte	3.1 L (6.55/5.46 US/Imp pt)
Electrolyte S.G.	1.28 when fully charged at 20 °C (68 °F)

38B20R TYPE

Rated capacity	28 AH/5HR, 12 Volts
Electrolyte	2.1 L (4.44/3.70 US/Imp pt)
Electrolyte S.G.	1.28 when fully charged at 20 °C (68 °F)

Generator

Type	70 A type
Rated voltage	12 V
Nominal output	70 A
Permissible max. speed	18,000 r/min.
No-load speed	1,300 r/min (rpm)
Setting voltage	14.4 to 15.0 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
Generator mounting bolts	23	2.3	16.5
“B” terminal inner nut	4.2	0.42	3.0
“B” terminal outer nut	8	0.8	6.0
Pulley nut	118	11.8	85.5
Rear end frame nuts	4.5	0.45	3.5
Rear end cover nuts			
Rectifier “B” bolt	3.9	0.39	3.0
Stator stud bolts	8.8	0.88	6.5
Drive end bearing plate screws	2.6	0.26	2.0
Rectifier screws	2.0	0.20	1.5
Regulator and brush holder screws			
Terminal plate bolt	3.8	0.38	3.0

SECTION 6K

EXHAUST SYSTEM

CONTENTS

General Description 6K-1
Maintenance 6K-1
On-Vehicle Service 6K-2
Exhaust Manifold 6K-2
Exhaust Pipe..... 6K-2

NOTE:

Whether following parts are used in the particular vehicle or not depends on specification. Be sure to bear this in mind when performing service work.

- **Three-Way Catalytic Converter (TWC)**

General Description

The exhaust system of this vehicle consists of the exhaust manifold, exhaust center pipe, muffler, seals, etc. The catalytic converter is an emission control device added to the exhaust system to lower the level of Hydrocarbon (HC), Carbon Monoxide (CO) and Oxides of Nitrogen (NOx) pollutants in the exhaust gas. The catalyst in the catalytic converter is of “Three way” type.

CAUTION:

Be sure to use UNLEADED FUEL for the catalytic converter equipped vehicle. Use of LEADED FUEL will affect performance of the catalytic converter adversely to a great extent.

Maintenance

WARNING:

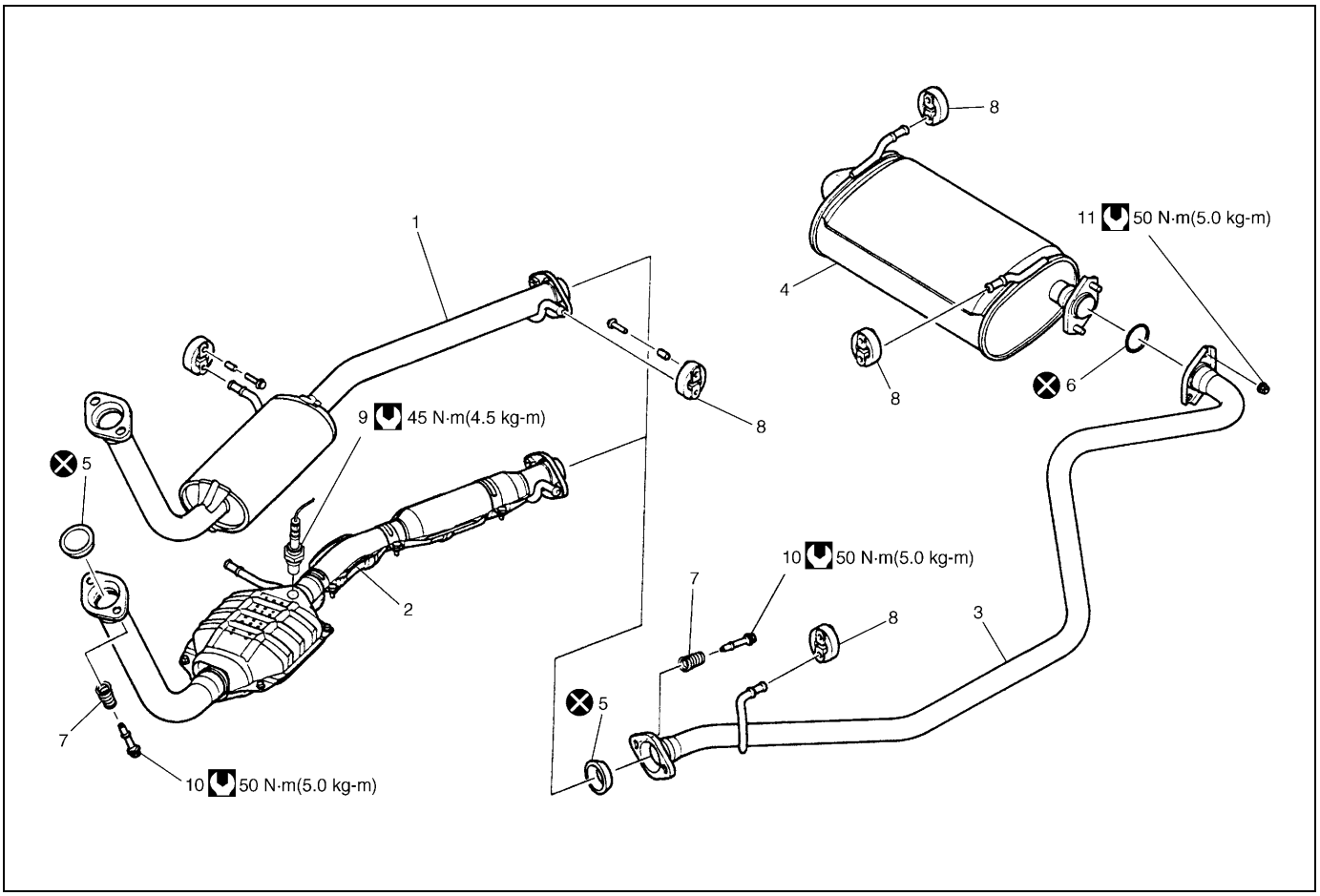
To avoid danger of being burned, do not touch exhaust system when system is hot.
Any service on exhaust system should be performed when system is cool.

At every interval of periodic maintenance service, and when vehicle is raised for other service, check exhaust system as follows:

- Check rubber mountings 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. Refer to “Components” in this section.
- Check nearby body areas for damaged, missing, or mispositioned part, open seam, hole, loose 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

COMPONENTS



1. Exhaust pipe (Vehicle without TWC)	6. Gasket	11. Mounting nuts
2. Exhaust pipe (Vehicle with TWC)	7. Spring	Tightening torque
3. Exhaust center pipe	8. Mounting	Do not reuse.
4. Muffler	9. Oxygen sensor	
5. Seal ring	10. Mounting bolts	

Exhaust Manifold

REMOVAL AND INSTALLATION

Refer to “Exhaust Manifold” in Section 6A1 for removal and installation procedures of exhaust manifold.

INSPECTION

Check seals for deterioration or damage.

Exhaust Pipe

REMOVAL AND INSTALLATION

For replacement of exhaust pipe, exhaust center pipe, muffler or any parts used to mount or connect them, be sure to hoist vehicle and observe WARNING under “Maintenance” and the following.

CAUTION:

Exhaust pipe with three way catalytic converter should not be exposed to any impulse. Do not drop it or hit it against something.

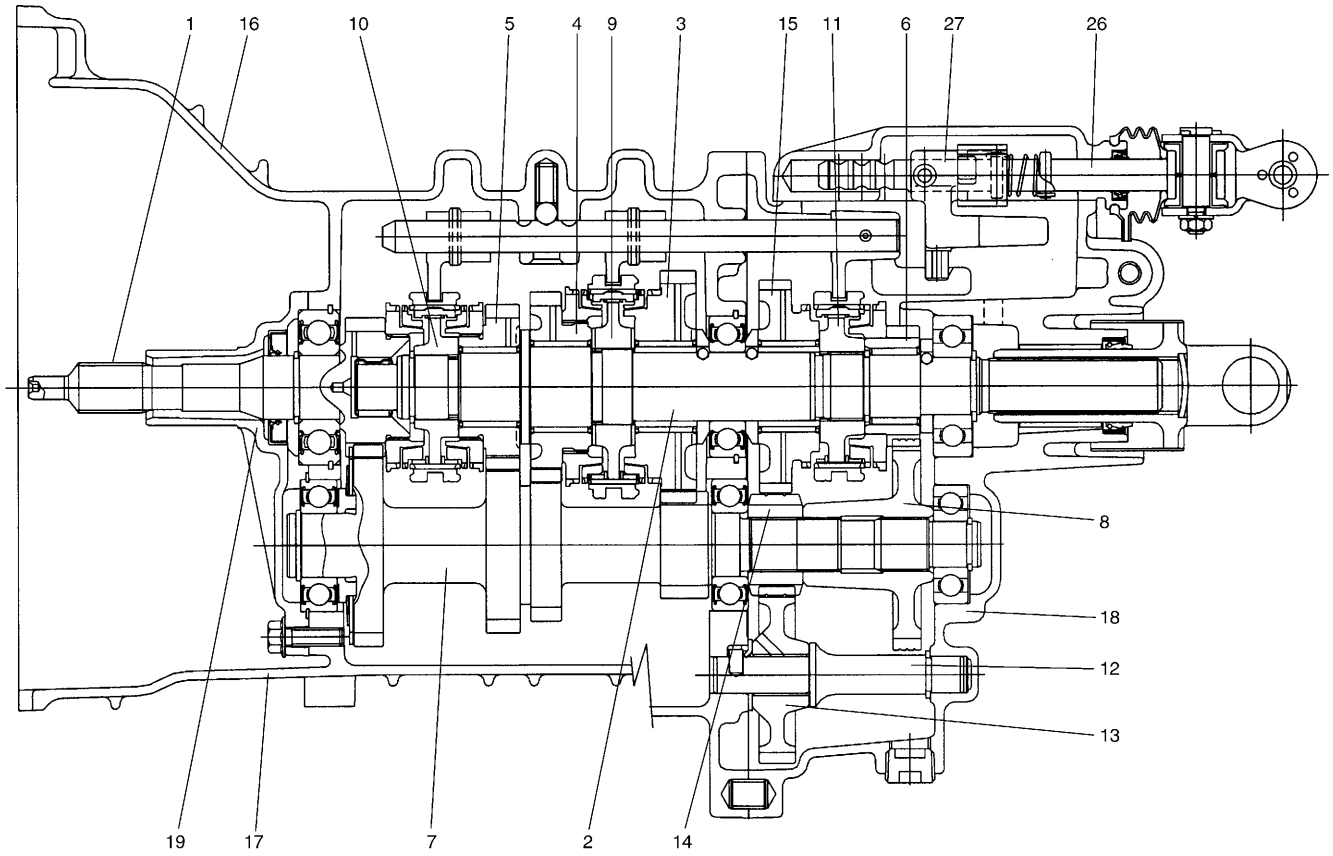
SECTION 7A

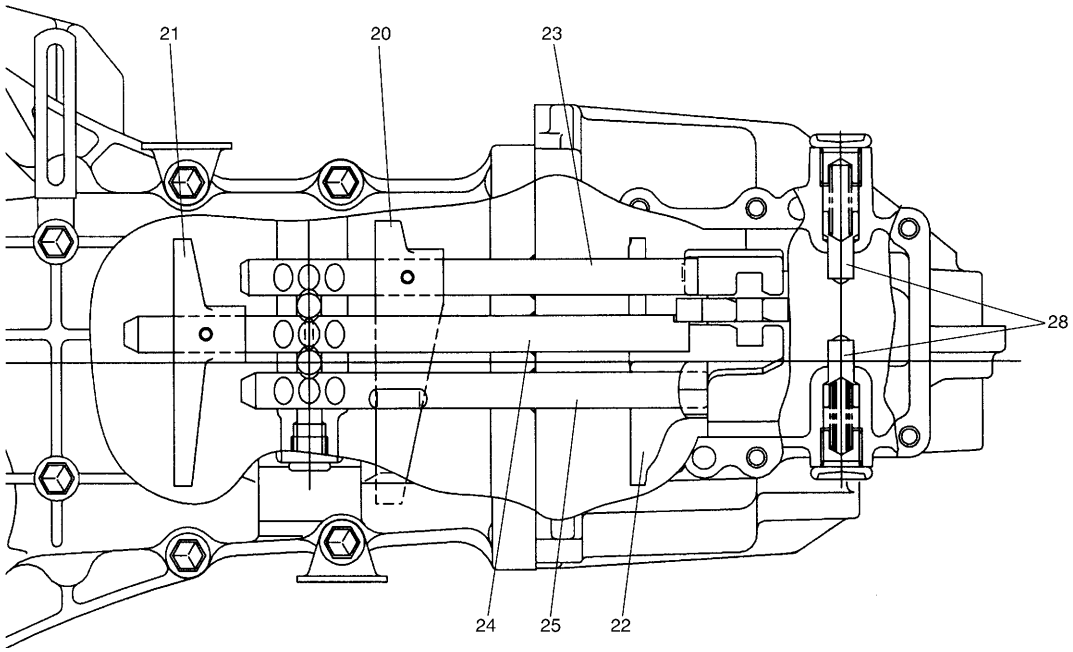
MANUAL TRANSMISSION

CONTENTS

General Description 7A-2
On-Vehicle Service 7A-3
Maintenance Service 7A-3
Oil change 7A-3
Rear Gear Shift Control 7A-4
Unit Repair Overhaul 7A-7
Dismounting Unit 7A-7
Remounting Unit 7A-8
Disassembling Unit 7A-9
Front gear shift control 7A-10
Extension case 7A-10
Transmission case 7A-10
Countershaft 7A-11
Input shaft and main shaft 7A-12
Shift shafts and forks 7A-14
Assembling Unit 7A-19
Main shaft and input shaft 7A-19
Countershaft and reverse idle gear 7A-23
Shift shafts and forks 7A-25
Transmission lower case and upper case 7A-26
Extension case 7A-27
Input shaft bearing retainer 7A-28
Clutch release bearing 7A-28
Input shaft 7A-29
Front gear shift control 7A-29
Tightening Torque Specification 7A-30
Required Service Material 7A-31
Special Tool 7A-32

General Description





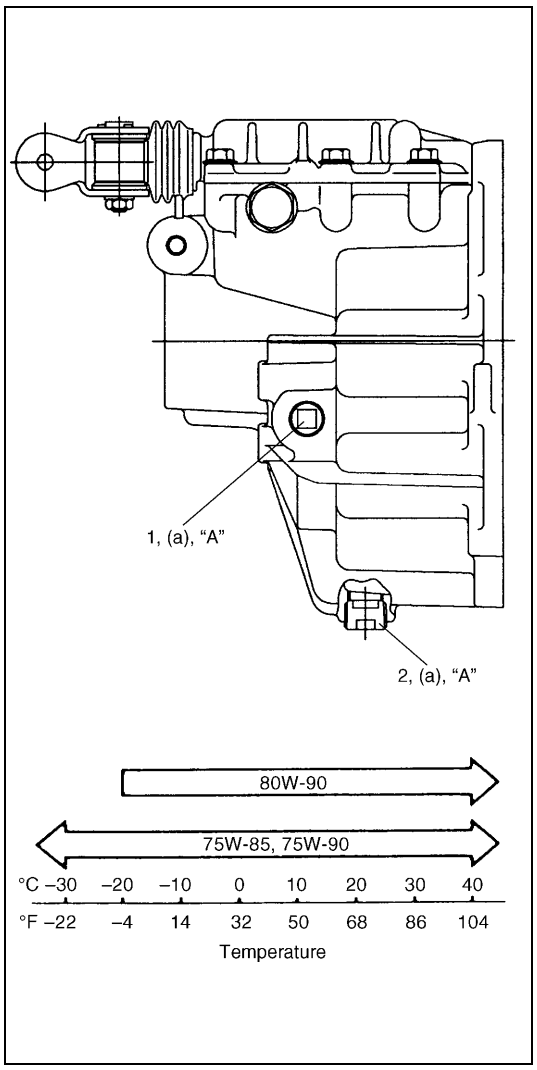
1. Input shaft	8. Countershaft 5th gear	15. Main shaft reverse gear	22. Reverse gear shift fork
2. Main shaft	9. Low speed synchronizer hub	16. Upper case	23. Low speed gear shift shaft
3. Main shaft low gear	10. High speed synchronizer hub	17. Lower case	24. High speed gear shift shaft
4. Main shaft 2nd gear	11. 5th speed synchronizer hub	18. Extension case	25. Reverse gear shift shaft
5. Main shaft 3rd gear	12. Reverse gear shaft	19. Input shaft bearing retainer	26. Gear shift front shaft
6. Main shaft 5th gear	13. Reverse idle gear	20. Low speed gear shift fork	27. Gear shift front arm
7. Countershaft	14. Countershaft reverse gear	21. High speed gear shift fork	28. Select guide pin

On-Vehicle Service

Maintenance Service

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 and pour new specified oil as shown below by specified amount (roughly up to level hole).

NOTE:

- **It is highly recommended to use SAE 75W-90 gear oil.**
- **Whenever vehicle is hoisted for any service work other than oil change, also be sure to check for oil leakage.**
- **If water or rust is mixed in drained oil, be sure to check boot of transmission.**

Transmission oil
API GL-4
For SAE classification, refer to viscosity chart in the figure.

Transmission oil capacity
1.3 liters (2.75/2.29 US/Imp. pt)

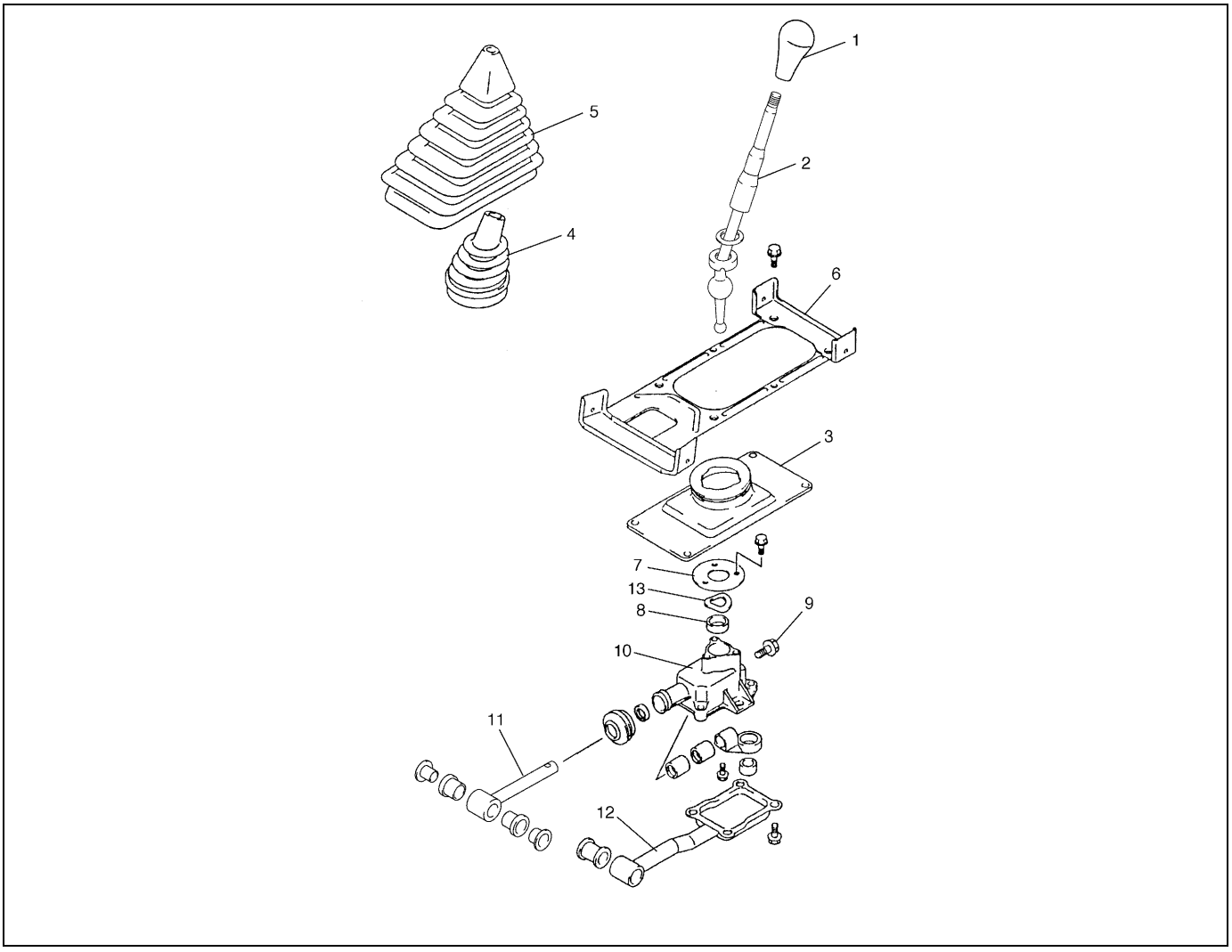
4) Torque drain plug (2) and level / filler plug (1) as specified below after applying sealant to its thread.

CAUTION:
Transmission oil must not be poured through gear shift control lever part.

"A" : Sealant 99000-31110

Tightening torque
Transmission oil filler and drain plugs
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

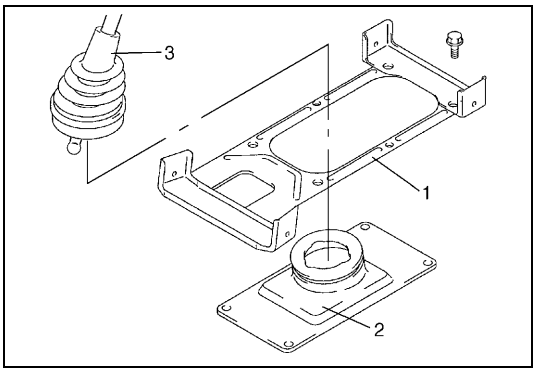
Rear Gear Shift Control



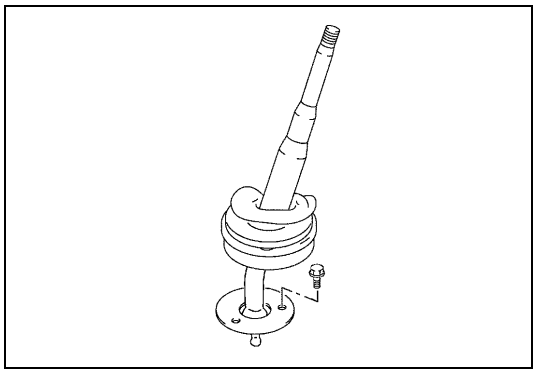
1. Gear shift knob	5. Gear shift lever boot No.3	9. Gear control select bolt	13. Gear shift control seat spring
2. Gear shift lever	6. Gear shift lever boot cover	10. Gear shift lever case	
3. Gear shift lever boot No.1	7. Gear shift lever plate	11. Gear shift rear shaft	
4. Gear shift lever boot No.2	8. Gear shift control lower seat	12. Extension rod	

REMOVAL

1) Remove shift knob and remove center console box with shift lever boot No.3

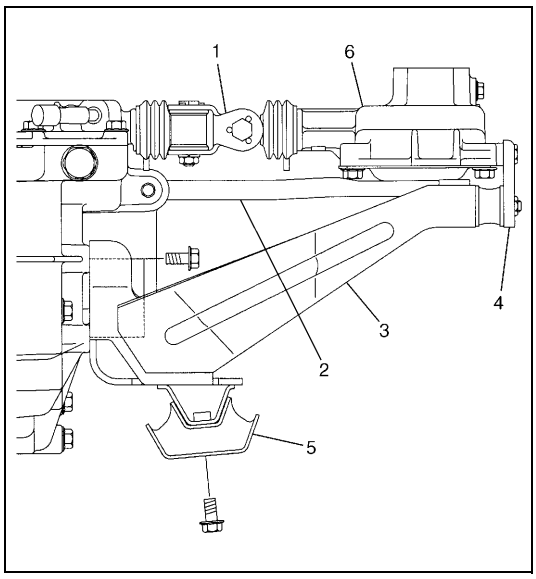


2) Pull out shift lever boot No.2 (3) and remove shift lever boot cover (1) and shift lever boot No.1 (2).



3) Remove 3 bolts, and then remove shift lever case plate, shim, spring and shift lever.

4) Hoist vehicle and drain transmission oil.
5) Remove exhaust No.1 pipe, refer to “Component” in Section 6K.
6) Remove propeller shaft No.1 (and No.2, if equipped for 4WD), refer to “Propeller Shafts” in Section 4B.



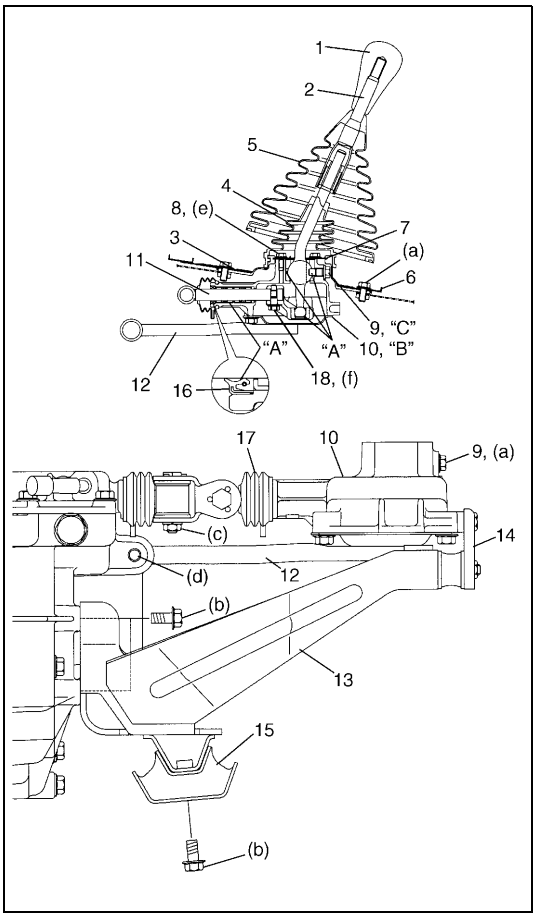
7) Remove gear shift control joint bolt and extension rod bolt.
8) Apply transmission jack and remove rear mounting bracket (3) with gear shift case mounting bracket (4) and engine rear mounting (5).
9) Remove rear gear shift control assembly (6).

1.	Gear shift control joint
2.	Extension rod

INSPECTION

- Check that gear shift control lever moves smoothly without abnormal noise.
- Check bushes and boot for damage and deterioration.

INSTALLATION



Install in reverse order of removal procedure noting following points.

"A" : Grease 99000-25010
"B" : Sealant 99000-31110
"C" : Cement 99000-32110

- Press fit oil seal, referring to figure for installing direction.
- Make breather of boot face downward as shown in figure.
- Torque bolts to specifications, as given below.

Tightening torque
Gear shift control boot cover bolts
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)
Transmission rear mounting bolts
(b) : 25 N·m (2.5 kg-m, 18.0 lb-ft)
Control shaft joint nuts
(c) : 18 N·m (1.8 kg-m, 13.0 lb-ft)
Extension rod joint bolt
(d) : 35 N·m (3.5 kg-m, 25.5 lb-ft)
Gear shift lever plate bolts
(e) : 5.5 N·m (0.55 kg-m, 4.0 lb-ft)
Gear shift rear arm bolt
(f) : 34 N·m (3.4 kg-m, 24.5 lb-ft)

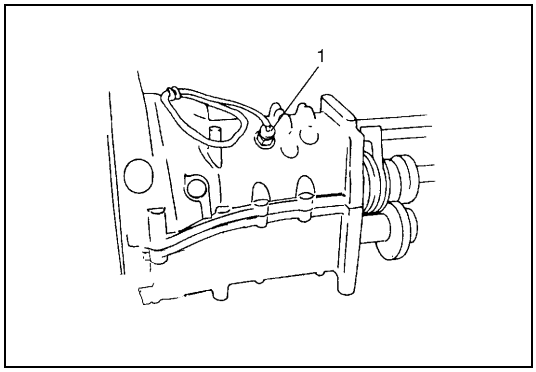
- When installing propeller shaft(s), refer to "Propeller Shafts" in Section 4B.
- When installing exhaust No.1 pipe, refer to "Component" in Section 6K.
- After connecting clutch cable, adjust clutch pedal free travel, refer to "Maintenance Service" in Section 7C.

1. Gear shift knob	10. Gear shift lever case
2. Gear shift lever	11. Gear shift rear shaft
3. Gear shift lever boot No.1	12. Extension rod
4. Gear shift lever boot No.2	13. Rear mounting bracket
5. Gear shift lever boot No.3	14. Gear shift case mounting bracket
6. Gear shift lever boot cover	15. Engine rear mounting
7. Gear shift lever plate	16. Oil seal
8. Gear shift lever plate bolt	17. Boot
9. Gear control select bolt	18. Gear shift rear arm bolt

Unit Repair Overhaul

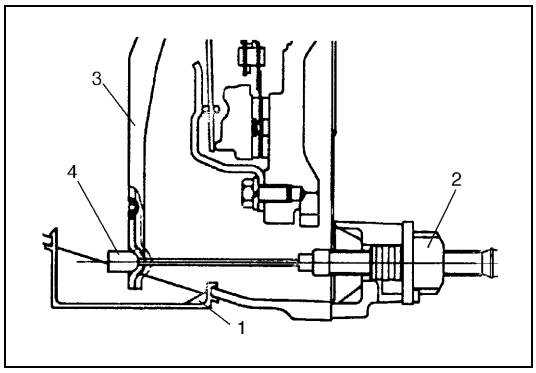
Dismounting Unit

1) Disconnect negative cable at battery.
2) Remove shift lever and rear gear shift control assembly, refer to “Rear Gear Shift Control Removal” in this section.



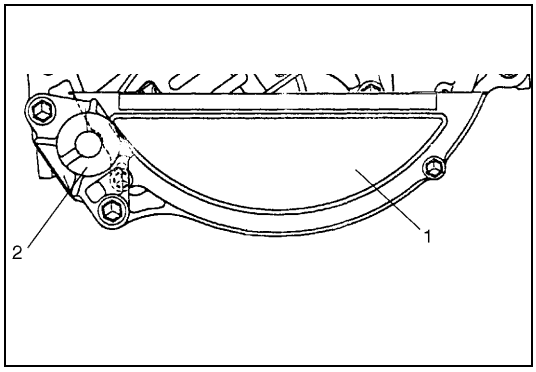
3) Disconnect back up lamp switch lead wire at coupler respectively.
4) Remove starting motor from transmission case, refer to “Starting Motor” of Section 6G.

1. Back up lamp switch

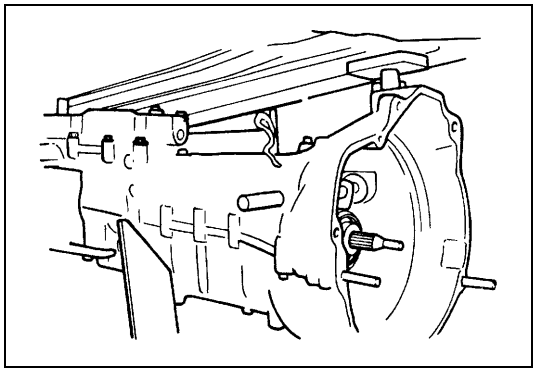


5) Remove clutch housing cap (1) and disconnect clutch cable (4) from clutch release fork (3).

2. Clutch cable nut

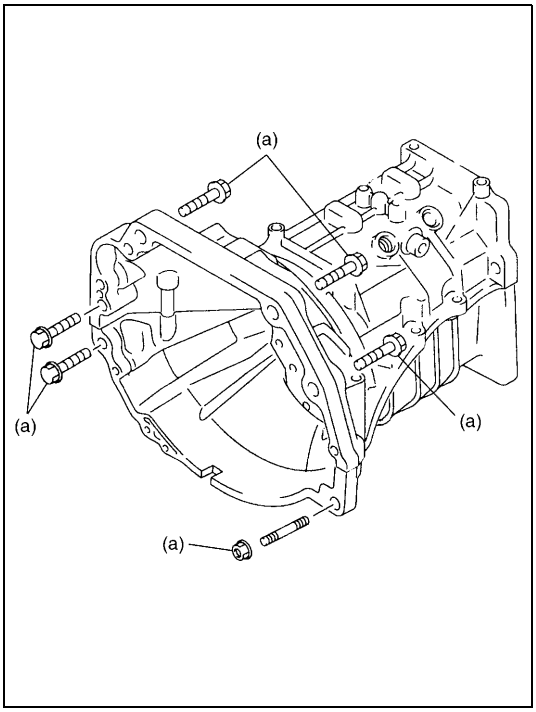


6) Remove clutch cable bracket (2) and clutch housing lower plate (1) from transmission case.



7) Remove bolts and nuts fastening engine cylinder block and transmission case and separate transmission from engine.
8) Take down transmission.
9) Remove clutch cover, disc and flywheel referring to “Clutch Cover, Clutch Disc, Flywheel and Release Bearing” in Section 7C.

Remounting Unit



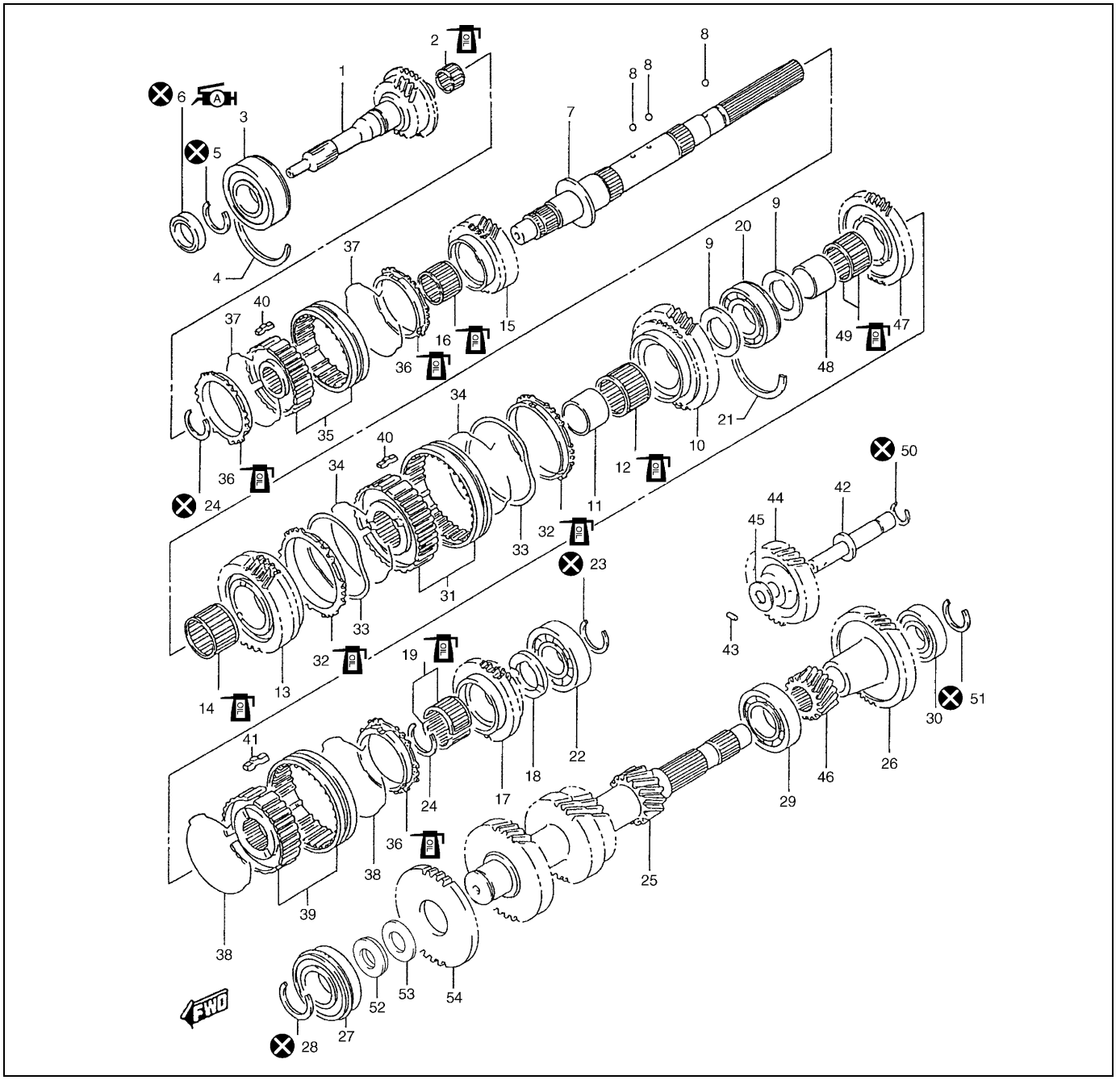
For remounting, reverse dismounting procedure.

- When installing flywheel, clutch cover and disc, refer to “Clutch Cover, Clutch Disc, Flywheel and Release Bearing” in Section 7C.
  Use specified torques as given below.

Tightening torque
Transmission to engine bolts and nut
(a) : 94 N·m (9.4 kg-m, 68.0 lb-ft)

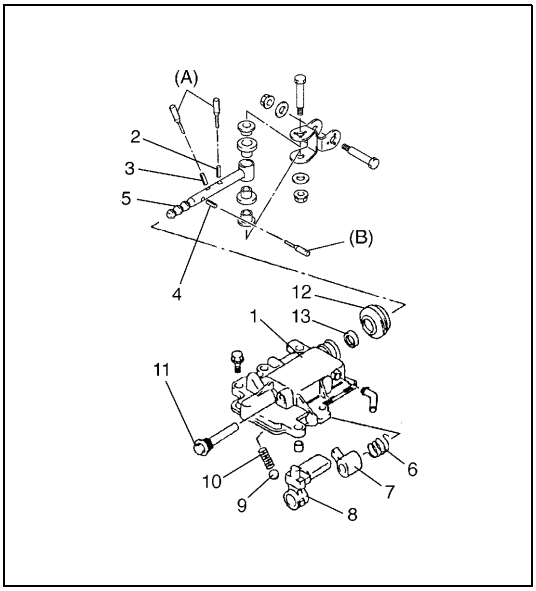
- For tightening torques not mentioned above, refer to “Tightening Torque Specification” at the end of this section.
- Connecting clutch cable, refer to “Maintenance Service” in Section 7C in this manual for details.
- When installing starting motor, refer to “Starting Motor” in Section 6G.
- When installing rear gear shift control assembly and shift lever, refer to “Rear Gear Shift Control” in this section.
- Pour transmission oil according to “Maintenance Service” in this section.

Disassembling Unit



1. Input shaft	15. 3rd gear	30. Rear bearing	45. Washer
2. Input shaft bearing	16. 3rd gear needle bearing	31. Low speed synchronizer hub assembly	46. Countershaft reverse gear
3. Front bearing	17. 5th gear	32. Low speed synchronizer ring	47. Main shaft reverse gear
4. C-ring	18. 5th gear washer	33. Low speed synchronizer spring	48. Gear bush
5. Circlip	19. 5th gear needle bearing	34. Synchronizer spring	49. Needle bearing
6. Oil seal : Apply grease 99000-25010 to oil seal lip	20. Main shaft bearing	35. High speed synchronizer hub assembly	50. Snap ring
	21. C-ring	36. High speed synchronizer ring	51. Circlip
7. Main shaft	22. Main shaft rear bearing	37. Synchronizer spring	52. Friction gear retainer
8. Main shaft washer ball	23. Circlip	38. Synchronizer spring	53. Friction spring
9. Main shaft bearing washer	24. Circlip	39. 5th speed synchronizer hub assembly	54. Friction gear
10. Low gear	25. Countershaft	40. Synchronizer key	Do not reuse.
11. Gear bush	26. Countershaft 5th gear	41. Synchronizer key	Apply transmission oil.
12. Needle bearing	27. Front bearing	42. Reverse gear shaft	
13. 2nd gear	28. Circlip	43. Pin	
14. Needle bearing	29. Center bearing	44. Reverse idle gear	

Front gear shift control



1) Remove gear shift lever front case (1).
2) Remove reverse gear shift limit bolt (11).
3) Remove shift front arm pin (4), shift limit spring pin (2) and shift limit yoke pin (3) by using special tools.

Special tool
(A) : 09922-85811
(B) : 09925-78210

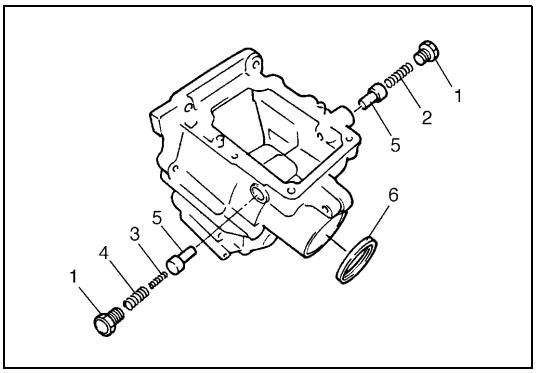
4) Pull out gear shift shaft (5), and then remove limit spring (6), limit yoke (7) and shift front arm (8).

NOTE:

Ball (9) and spring (10) will jump out when disconnecting gear shift shaft.

5) Remove boot (12) and oil seal (13).

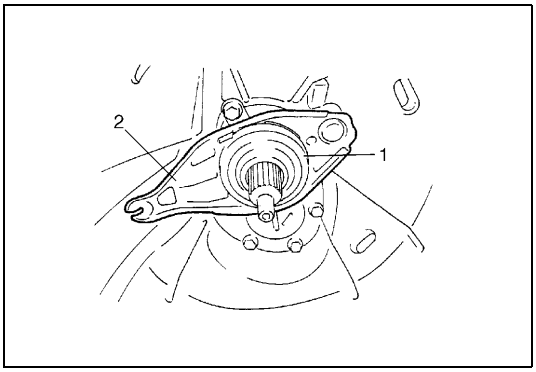
Extension case



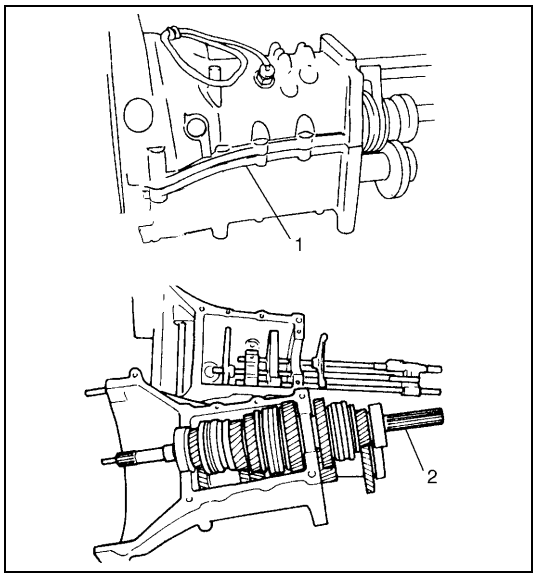
1) Remove select return spring bolts (1), return springs and select guide pins (5).
2) Remove bolts securing extension case to transmission case, and then take off extension case.
3) Remove extension case seal (6) as necessary.

2. Low select return spring	4. Reverse select return spring (outer)
3. Reverse select return spring (inner)	

Transmission case



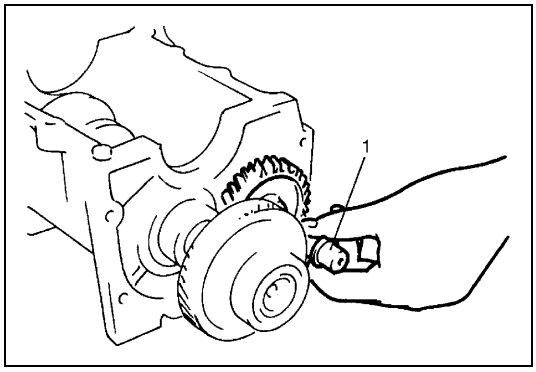
1) Remove clutch release bearing (1) and release fork (2).
2) Remove input shaft bearing retainer bolts and pull out retainer.
3) Take out oil seal from input shaft bearing retainer as necessary.



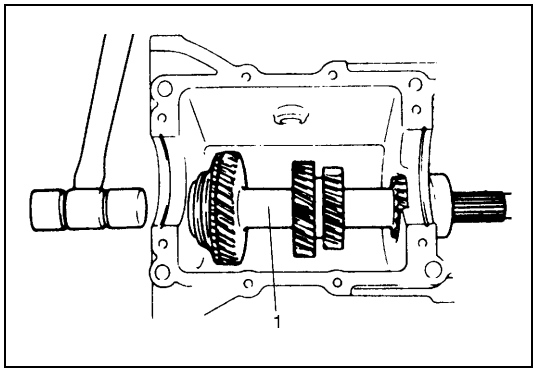
4) Remove bolts fastening upper and lower cases together, separate the two, and take out main shaft assembly (2).
Using a screwdriver or the like can be used to pry two cases apart, as shown. In such a case, do not stick screwdriver too far into between two mating faces, or faces may get damaged.

1. Pry Point

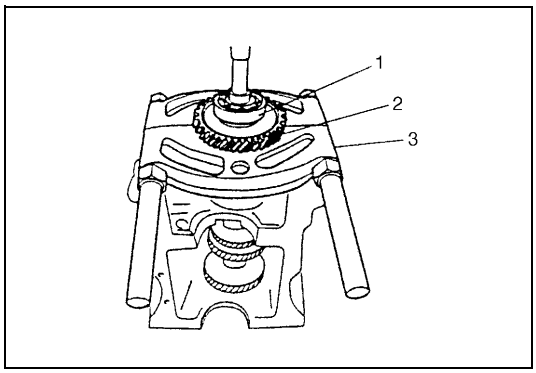
Countershaft



1) Remove reverse idle gear shaft (1) with gear.

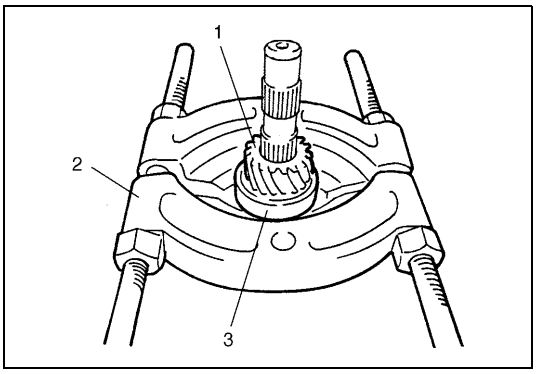


2) Remove outside circlip of countershaft front bearing.
3) Using plastic hammer, drive countershaft (1) rearward.

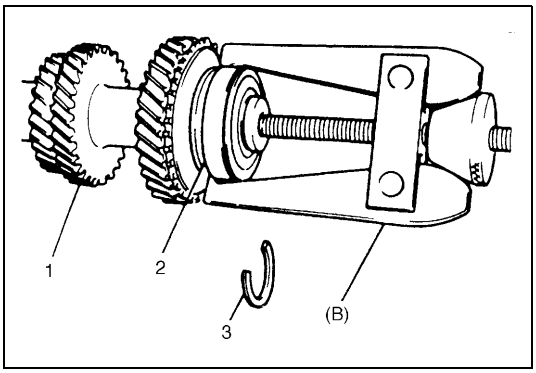


CAUTION:
Be sure to set flat face of puller against 5th gear so as not to cause damage to teeth.

4) Remove countershaft rear bearing (1) and 5th gear (2) with puller (3) and hydraulic press.



5) Remove countershaft reverse gear (1) and center bearing (3) with puller (2) and hydraulic press.
6) Remove countershaft from lower case.

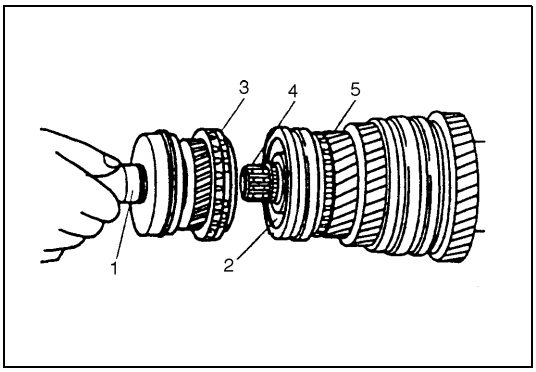


7) Remove circlip (3) of countershaft front bearing (2) and pull out bearing by using special tool.

Special tool
(B) : 09913-60910

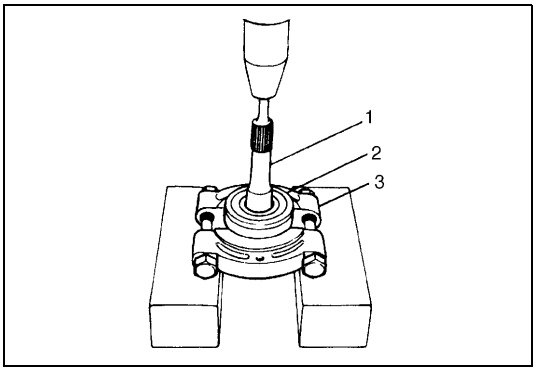
1. Countershaft	

Input shaft and main shaft



1) Take out input shaft (1) by hand, taking care not to let high-speed synchronizer ring (3) fall off.

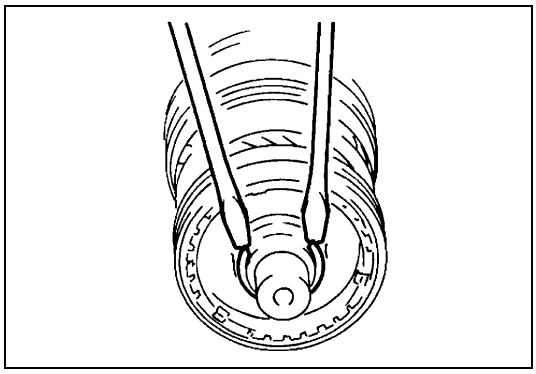
2. Main shaft	5. 3rd gear
4. Bearing	



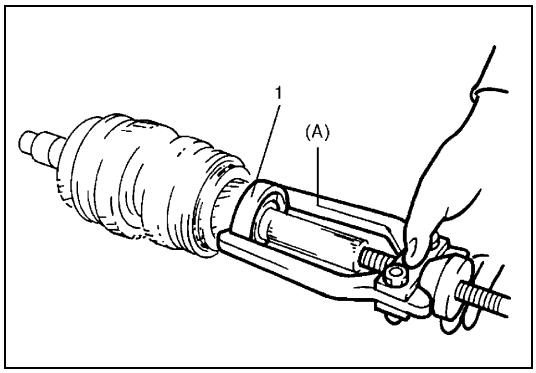
2) Remove circlip of input shaft (1) and pull out bearing (2) with puller (3) and hydraulic press as necessary.

NOTE:

Sealed bearing must not be washed. Replace it with new one when required.

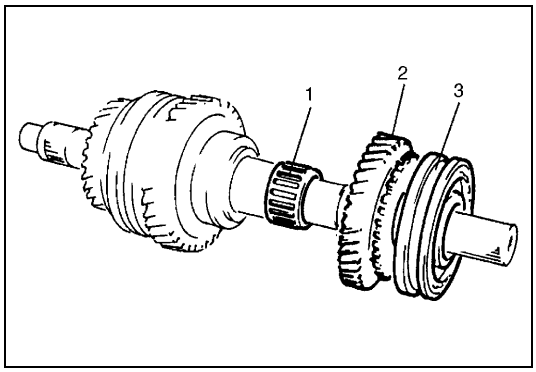


3) Remove circlip retaining hub of high-speed synchronizer sleeve, and slide off sleeve hub, third driven gear and needle bearing from main shaft.

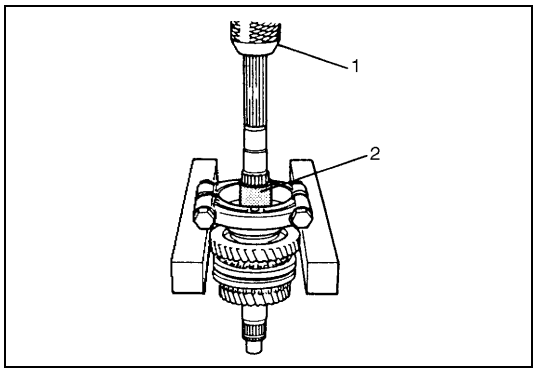


4) Remove circlip retaining rear bearing (1) on main shaft. Remove main shaft bearing using special tool.

Special tool
(A) : 09913-65135



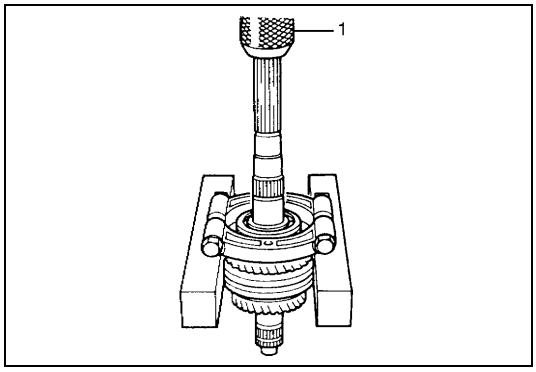
5) From main shaft, take off 5th gear washer, ball, 5th gear, 5th speed synchronizer ring and 5th gear needle bearing (1).
6) Remove circlip retaining the 5th speed synchronizer hub (3) on main shaft.
7) Remove 5th speed synchronizer hub, reverse gear (2) and reverse gear needle bearing.



NOTE:

During this removal, watch out for a ball which may fall off. It must not be lost. Also, ball bearing should not be removed together with washer and bush.

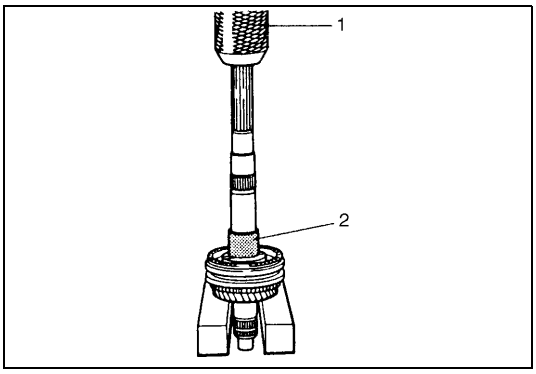
8) Remove bearing washer and reverse gear bush (2) on main shaft by using hydraulic press (1).



NOTE:

In the state as shown, there is a ball in washer which is located under bearing. Be sure to prevent it from falling off and getting lost.

9) Remove ball and main shaft (center) bearing by using hydraulic press (1).



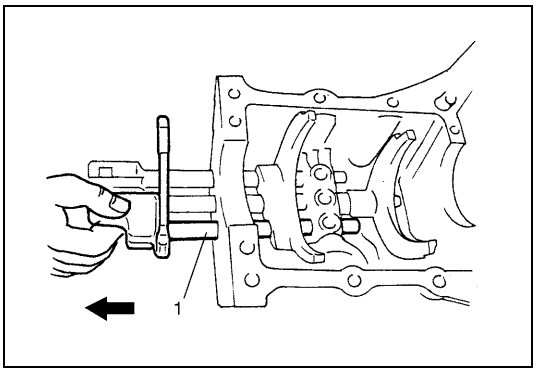
10) Remove bearing washer, ball, low gear, low synchronizer, ring, needle bearing and low gear bush (2) on main shaft.
11) Remove low speed synchronizer sleeve and hub assembly, 2nd gear and 2nd synchronizer ring all together by using hydraulic press (1).

NOTE:

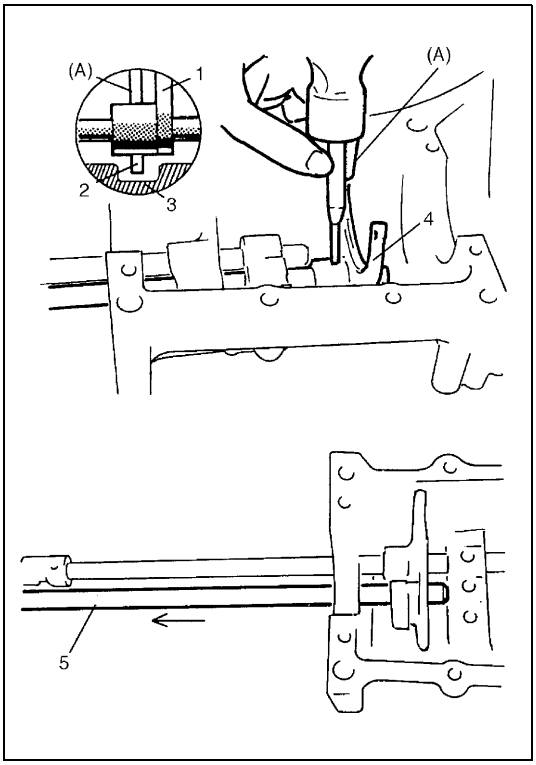
If bush can't be pulled out by hand, pull off sleeve and hub together by using press.

12) Remove sleeve from hub and then take off synchronizer keys and springs.

Shift shafts and forks



1) Pull out reverse gear shift shaft (1). As this shaft comes out, locating ball and spring will jump out of hole; do not let them fly away.



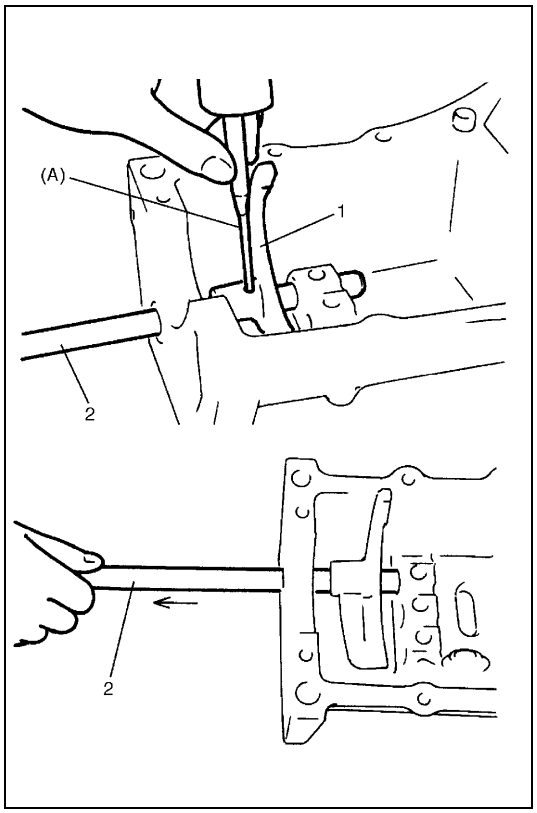
CAUTION:

When removing yoke pin, be sure not to drive it out so far as to contact case. Or it will cause damage to case.

2) Using special tool, drive out yoke pin on high speed gear shift fork (4), and pull out shift shaft (5).
As in above case, be careful not to let locating ball, interlock ball and spring fly away.

Special tool
(A) : 09922-85811

1. Fork	3. Transmission case
2. Spring pin	

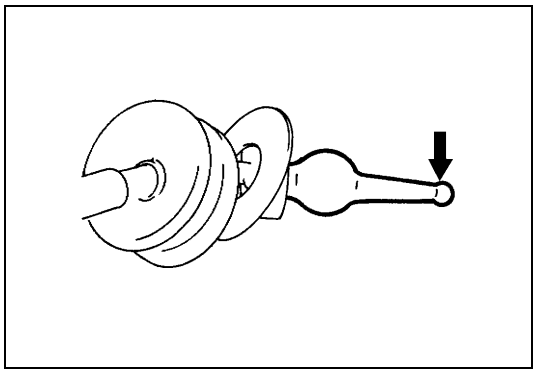


3) Drive yoke pin out of low speed gear shift fork (1) and pull out fork shaft (2) and fork.

Special tool
(A) : 09922-85811

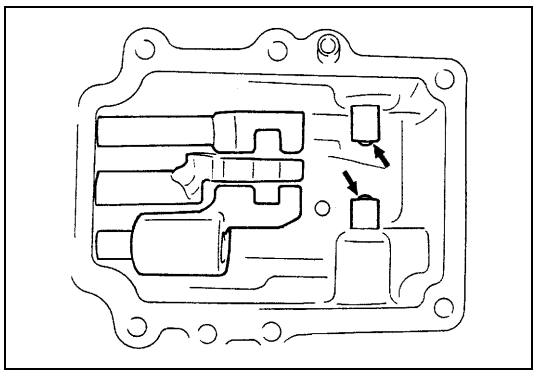
INSPECTION

Gear Shift Lever

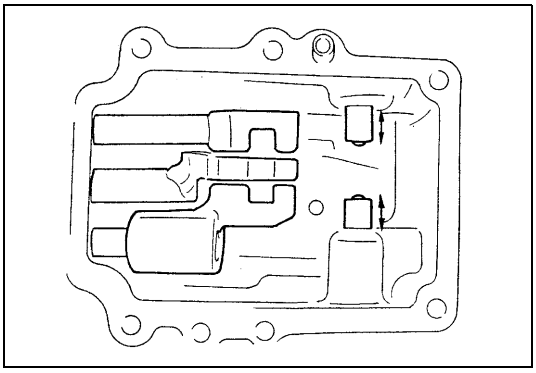


Check lower end of gear shift lever where gear shift fork shaft contact for wear and any kind of damage. Worn or damaged gear shift lever must be replaced with a new one.

Reverse & Low Speed Select Guide Pins

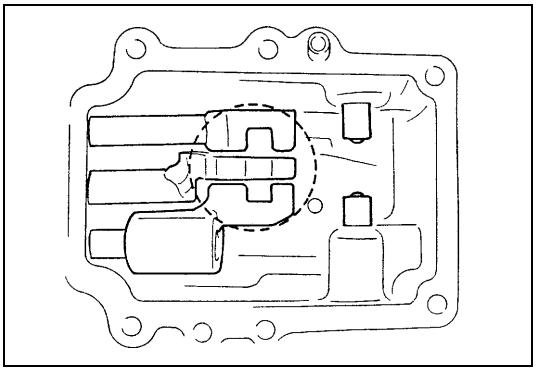


Check both select guide pins where gear shift front arm contacts for stepped wear. Replace worn select guide pin.



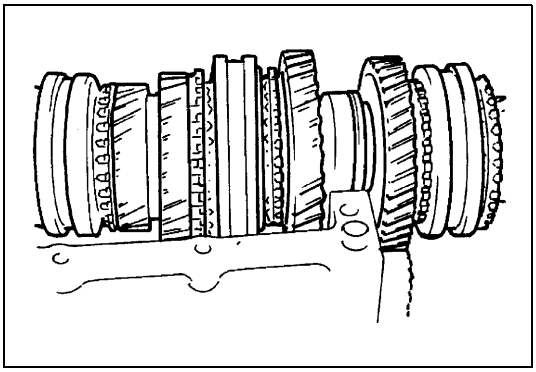
Move shaft and check low speed select guide pin for smooth movement without rattle. If found defective, replace it and apply grease to pin.

Gear Shift Fork Shaft



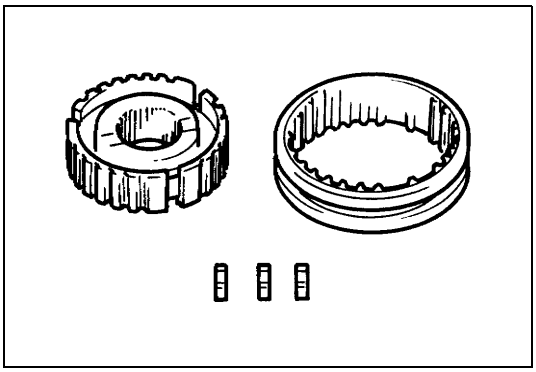
Visually check each gear shift fork shaft (High, Low and Reverse) where gear shift front arm contacts for wear. Worn shaft must be replaced.

Gears



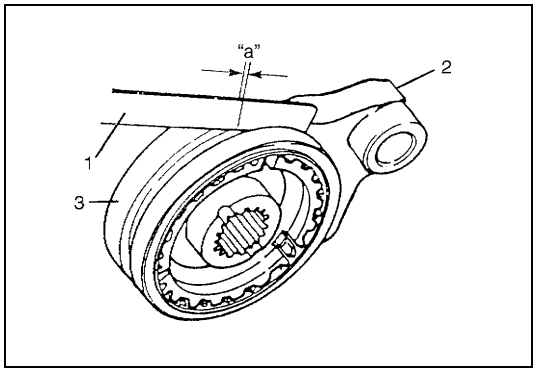
Check each part for wear, damage or discoloration. Replace if found defective.

Synchronizer Hubs, Sleeves and Keys



Check each part for wear or damage. Replace if found defective.

Shift Forks and Sleeves

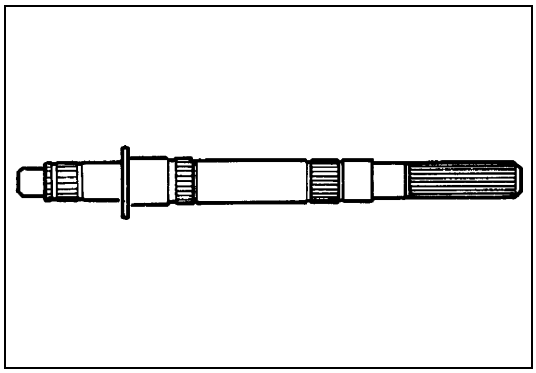


Check contact surfaces for wear or damage.
Measure clearance between fork and sleeve.

Clearance "a" between fork and sleeve
Service limit : 1.0 mm (0.039 in.)

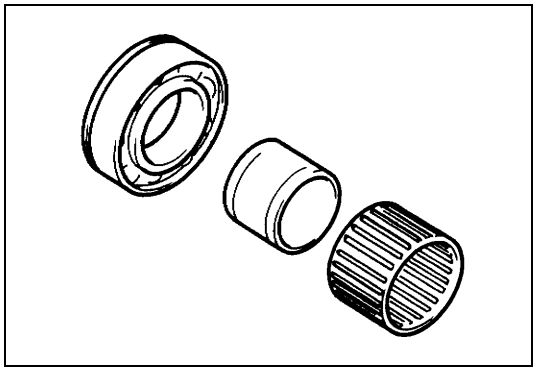
1. Thickness gauge	3. Sleeve
2. Shift fork	

Main Shaft



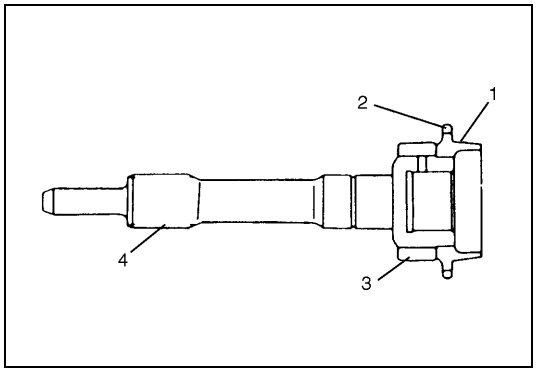
Check each part of shaft for wear, discoloration or damage. Replace shaft if any part is found defective.

Bearings and Bushes



Check each part for wear, damage or discoloration. With ball bearing, check that it rotates smoothly and it does not make noise.
Replace if found defective.

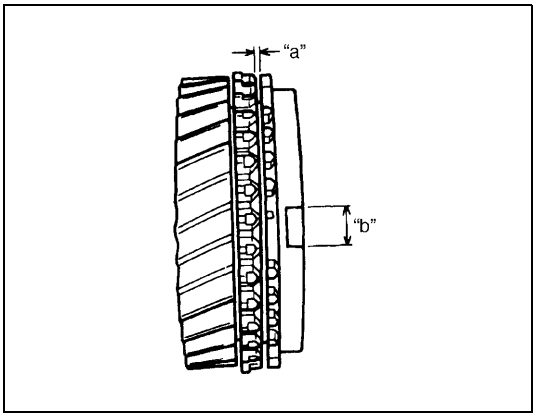
Input Shaft



Inspect cone (1) and toothed ring (2) for wear and damage.

Inspect gear teeth (3) and splines (4) for wear and damage.
If any part of input shaft inspected as above is found excessively worn or badly damaged, replace shaft.

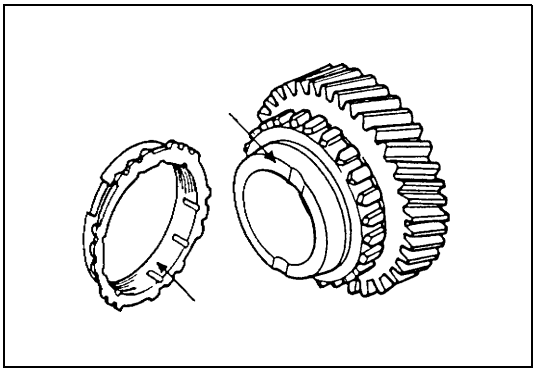
Combination of Gear and Synchronizer Ring



Check clearance "a" between synchronizer ring and gear, key slot width "b" in synchronizer ring and each chamfered tooth of gear and synchronizer ring and replace with new one, if necessary. Also, check gear tooth.

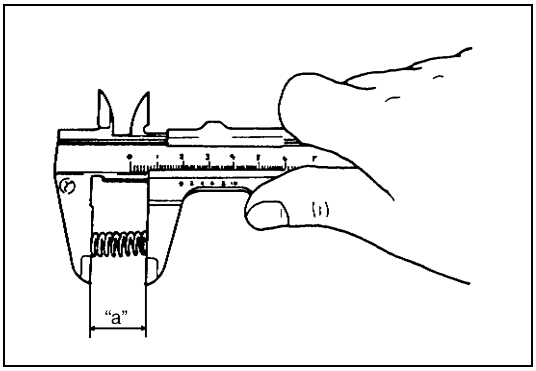
Clearance "a" between synchronizer ring and gear
Standard : 1.0 – 1.4 mm (0.039 – 0.055 in.)
Service limit : 0.5 mm (0.019 in.)

Key slot width "b"
Standard : 10.1 mm (0.397 in.)
Service limit : 10.4 mm (0.409 in.)



Inspect external cone (of gear) and internal cone (of ring) for abnormal wear. Be sure that contact patterns on these surfaces indicate uniform full-face contact, and that surfaces are free from any wavy wear. A badly worn member must be replaced.
Proper synchronizing action on gear shifting can be expected only when ring-to-gear clearance and condition of cone surfaces, among other things, are satisfactory.

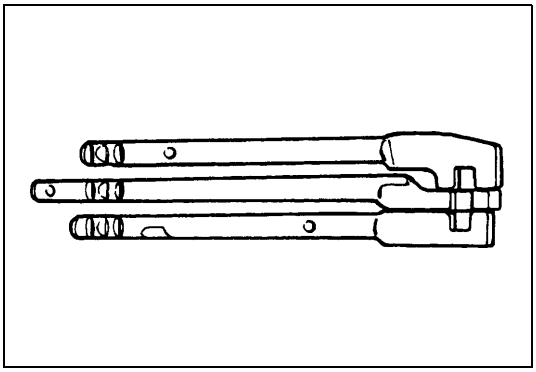
Fork Shaft Locating Springs



If "gears slipping out of mesh" has been complained, check these springs for strength by measuring their free length, and replace them if their free lengths are less than service limit.

Fork shaft spring free length "a"
Standard : 25.0 mm (0.984 in.)
Service limit : 23.0 mm (0.906 in.)

Gear Shift Shafts



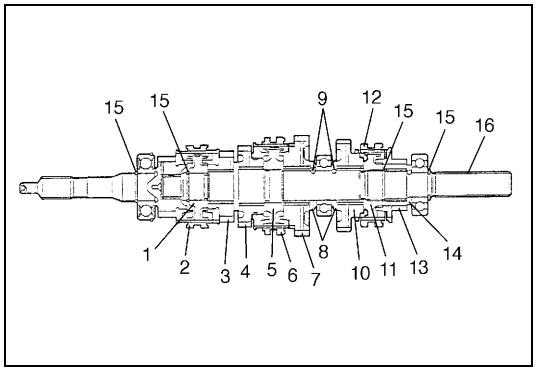
Check the part of shaft as indicated in figure for uneven wear. Replace shaft if uneven wear is noted.

Assembling Unit

NOTE:

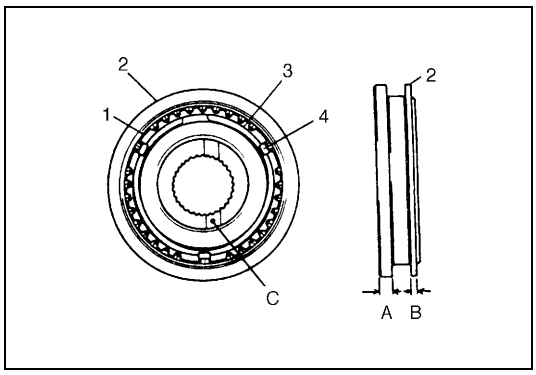
- **Before installation, wash each part and apply specified gear oil to sliding faces of bearing and gear.**
- **Use new circlips on shaft for reinstallation. Don't reuse used circlips.**
- **Tighten each fastening bolt and nut according to "Tightening Torque Specification" in this section.**

Main shaft and input shaft



Install each parts by reversing respective removal procedures. Be careful for installing direction of each washer, gear, synchronizer hub and sleeve.
Refer to figure. Make sure to install each ball on main shaft.

1. High speed synchronizer hub	9. Ball
2. High speed synchronizer sleeve	10. Reverse gear
3. 3rd gear	11. 5th speed synchronizer hub
4. 2nd gear	12. 5th speed synchronizer sleeve
5. Low speed synchronizer hub	13. 5th gear
6. Low speed synchronizer sleeve	14. 5th gear washer
7. Low gear	15. Circlip
8. Washer	16. Main shaft

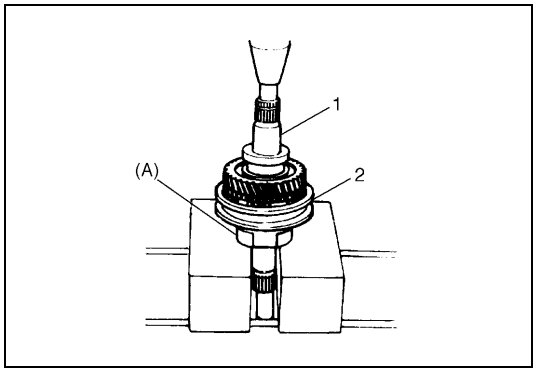


1) Fit sleeve (2) to low speed hub (1), place 3 synchronizer keys (4) in it and set synchronizer springs (3).
   Refer to figure for proper installing direction of hub, sleeve and springs. Synchronizer key has no specific direction for installation.

NOTE:

When installing each synchronizer spring, insert its hooked end to hub hole and put it toward right.

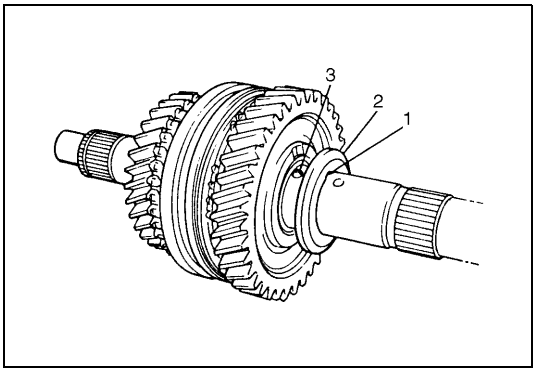
A : Thick (2nd gear side)
B : Thin (Low gear side)
C : Punch mark (Low gear side)



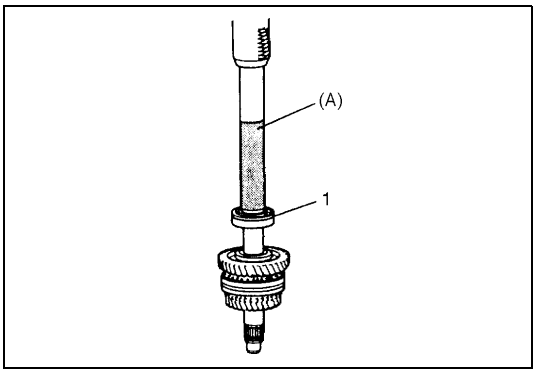
2) Install needle bearing, 2nd gear and 2nd synchronizer ring to main shaft (1).
3) Press-fit hub and sleeve assembly onto main shaft with press.

Special tool
(A) : 09927-08210

2. Low speed sleeve and hub assembly



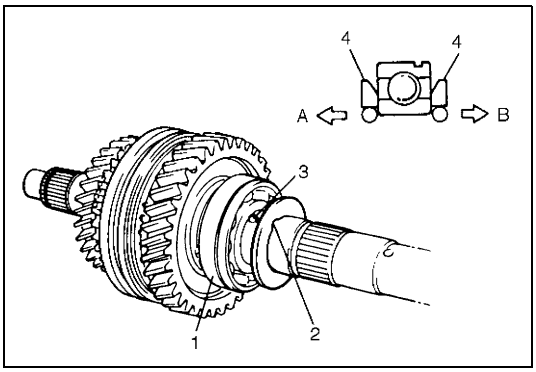
4) Install low gear bush, needle bearing, synchronizer ring, low gear, ball (3) and washer onto main shaft.
Fit ball into hole in shaft and install washer so that its slot (1) comes over ball.
To direct washer correctly, bring its circumference chamfered side (2) to main shaft center bearing.



5) Press-fit center bearing with bearing installer (special tool) using care for its installing direction.

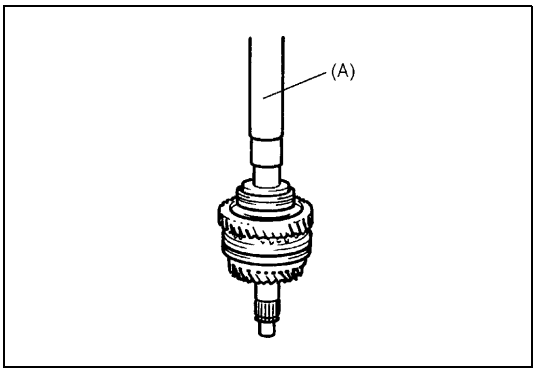
Special tool
(A) : 09925-18011

1. Ring groove



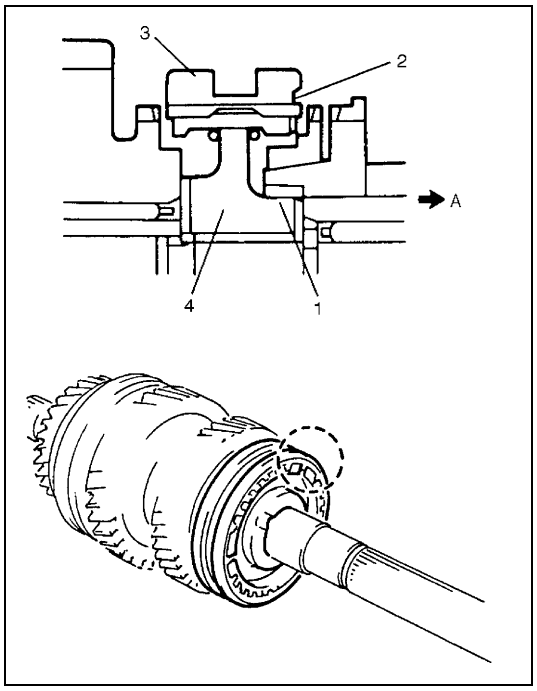
6) Install ball (3) and washer (4).
As figure shows, install washer so that its circumference chamfered side faces center bearing (1) and its slot (2) comes over ball.

A : Input shaft side
B : Rear bearing side



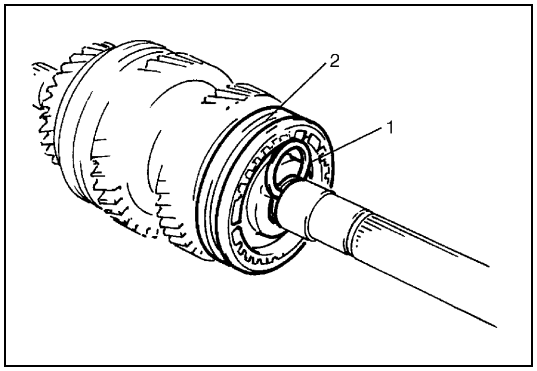
7) Press-fit reverse gear bush, preventing ball installed in step 6) from coming off.

Special tool
(A) : 09925-18011



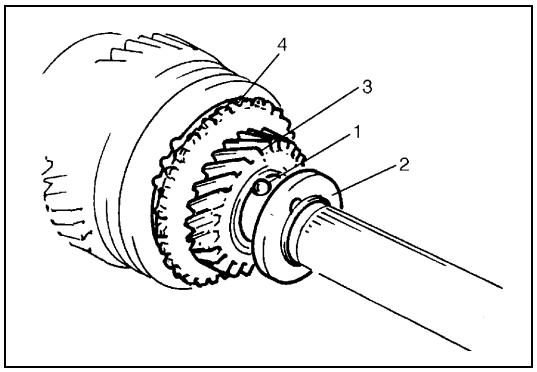
8) Install reverse gear bearing, reverse gear and 5th speed synchronizer hub (4) and sleeve (3). For proper direction, make sure to install hub so that the side whose inside boss (1) is smaller in diameter and longer is directed to main shaft rear bearing, and sleeve so that the side whose inside is stepped is also directed to main shaft rear bearing.

2. Stepped sleeve
A : Rear bearing side

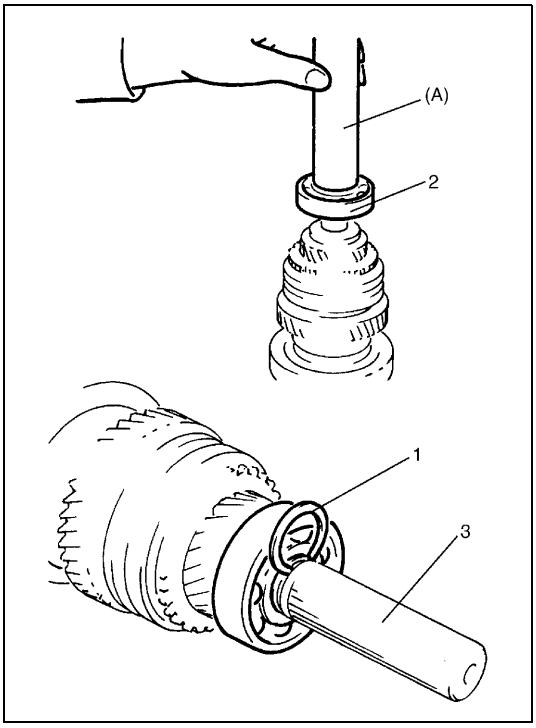


9) Fit 5th speed synchronizer hub circlip (1) into groove in main shaft.

2. 5th speed synchronizer hub and sleeve assembly

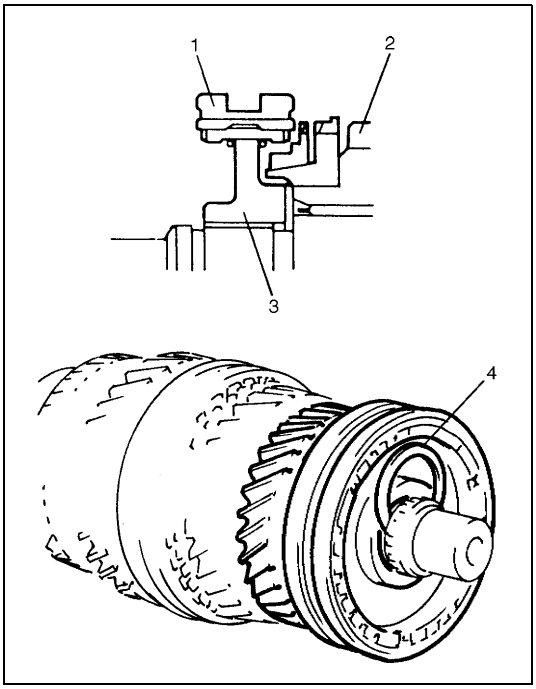


10) Install 5th gear bearing, 5th gear synchronizer ring (4) and 5th gear (3). Then install ball (1) and washer (2), making oil groove of washer face 5th gear.

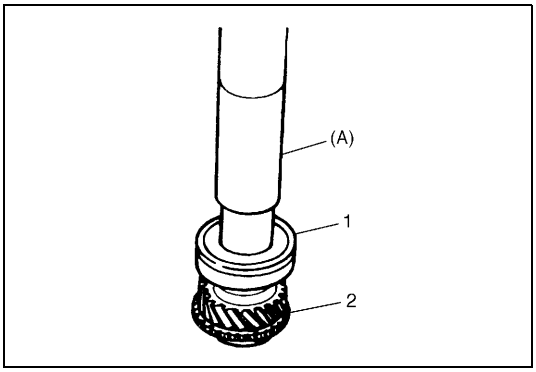


11) Press-fit main shaft rear bearing (2) and fit circlip (1) into groove in main shaft (3).

Special tool
(A) : 09925-18011



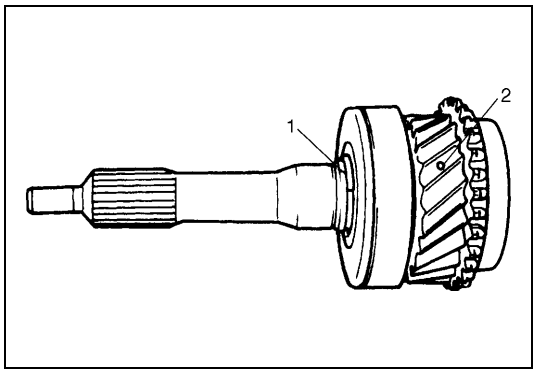
12) Install 3rd gear bearing, 3rd gear (2), high speed synchronizer ring, hub (3) and sleeve (1). When installing hub, direct the side with larger outer diameter boss to 3rd gear side. Then fit circlip (4) into groove in main shaft.



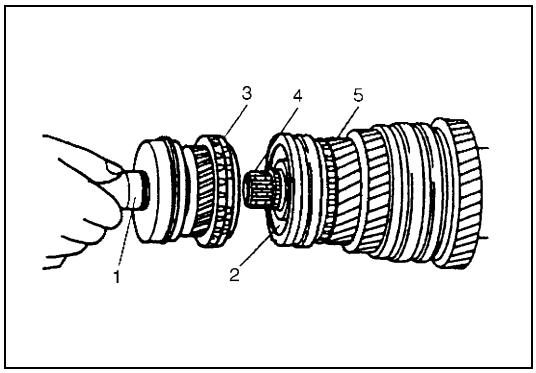
13) When installing bearing (1), bring it so that its groove for C-ring is in the rear and press-fit with special tool and hydraulic press.

Special tool
(A) : 09925-18011

2. Input shaft



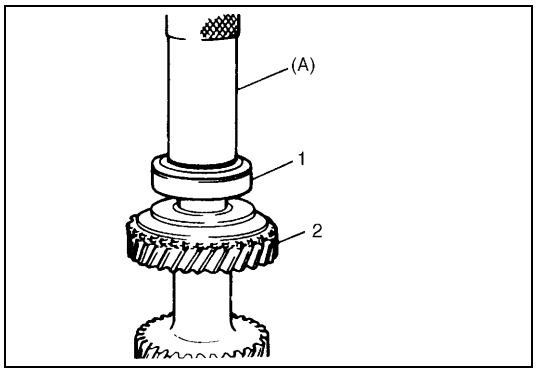
14) After fitting circlip (1), air-blow lubrication oil hole (2).



15) Install synchronizer ring (3), needle bearing and input shaft (1).

2. Main shaft
4. Bearing
5. 3rd gear

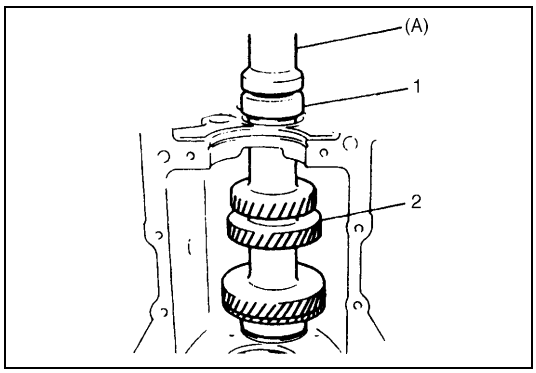
Countershaft and reverse idle gear



1) Press-fit front bearing (1) and fit circlip.

Special tool
(A) : 09913-84510

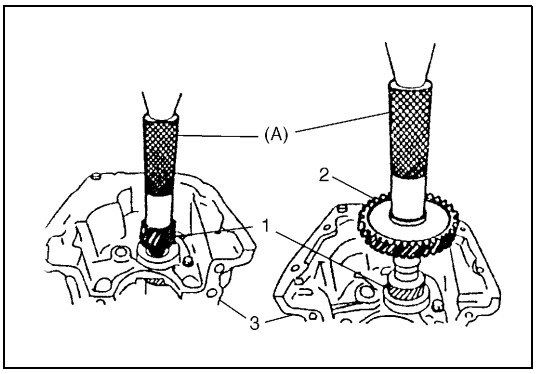
2. Countershaft



2) With shaft inserted into case, install center bearing (1) on it and then press-fit shaft by using special tool and hammer. Meanwhile case should be supported on wood blocks.

Special tool
(A) : 09925-18011

2. Countershaft



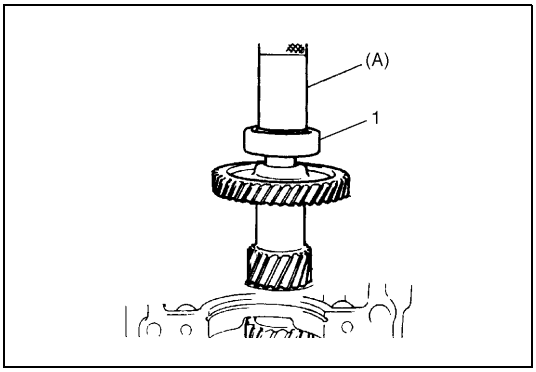
3) Press-fit reverse gear (1) and then 5th gear (2).

NOTE:

When press-fitting, hold countershaft with its front end set on wood blocks.

Special tool
(A) : 09913-80113

3. Lower case

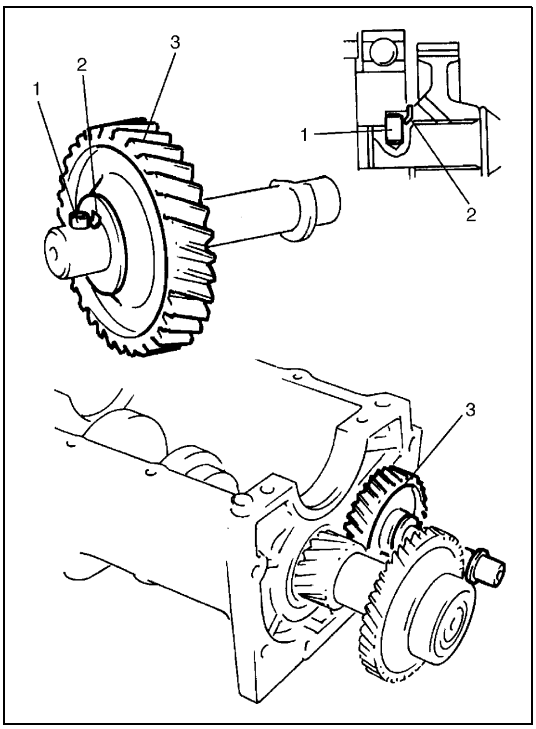


4) After press-fitting countershaft rear bearing (1), make sure to fit circlip securely.

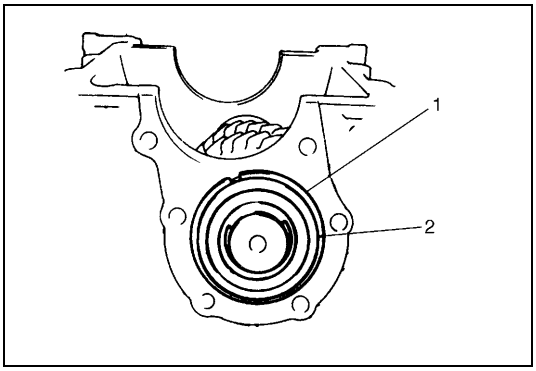
NOTE:

When press-fitting, hold countershaft with its front end set on wood blocks.

Special tool
(A) : 09913-80113



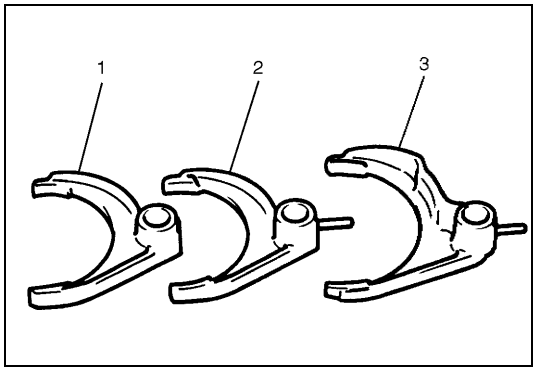
5) Install reverse idle gear (3) and washer onto reverse gear shaft and pin (1) into it.
Install above as assembled into lower case with pin and washer tongue (2) aligned as shown.



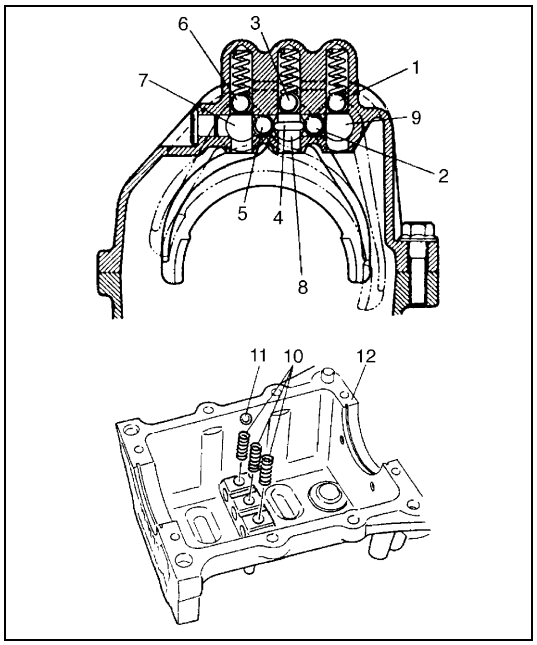
6) Fit circlip (1) around bearing and check that circlip just contacts with case surface.

2. Front bearing

Shift shafts and forks



1.	High speed gear shift fork
2.	Reverse gear shift fork
3.	Low speed gear shift fork

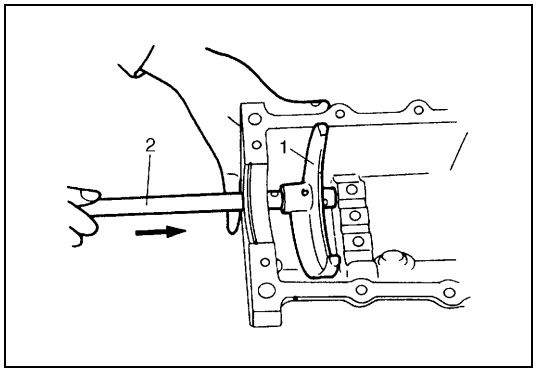


Note that 3 shift shafts individually have a locating ball and locating spring, and that 2 interlock balls and an interlock roller are used between shafts as shown.

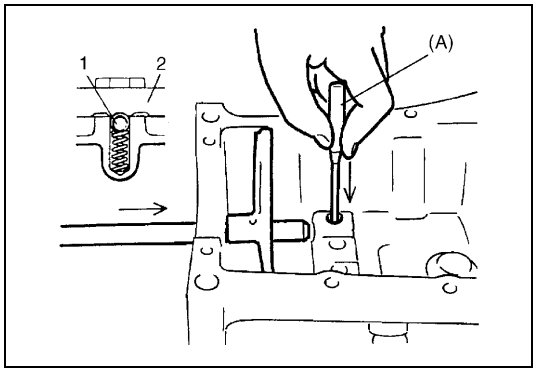
Install low, high and reverse shafts in that order.

1) Install 3 locating springs into 3 holes in upper case. Fit locating ball on top of locating spring in hole.

1.	Locating ball	7.	Reverse gear shift shaft
2.	Interlock ball	8.	High speed gear shift shaft
3.	Locating ball	9.	Low speed gear shift shaft
4.	Interlock roller	10.	Locating spring
5.	Interlock ball	11.	Locating ball
6.	Locating ball	12.	Upper case



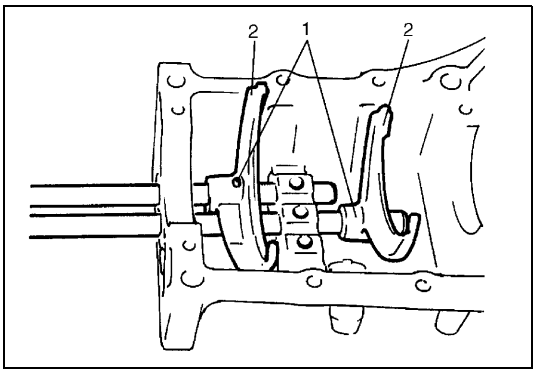
2) Insert low speed gear shift shaft (2) into upper case and low speed shift fork (1) in the direction as shown.



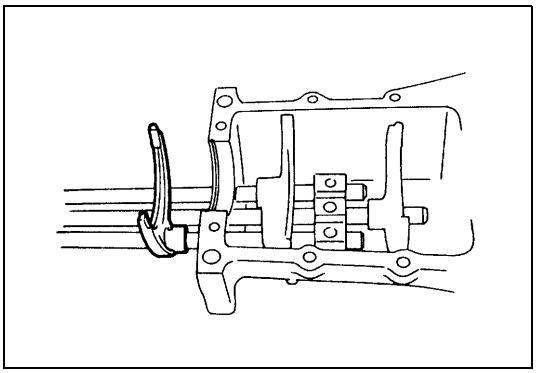
3) Push down low speed gear shift shaft locating ball (1) to pass shaft over it and keep inserting shaft until locating ball fits in center slot of 3 continuous slots in shaft.
Drive shift yoke pin into fork and shaft.

Special tool
(A) : 09922-85811

2.	Shift shaft

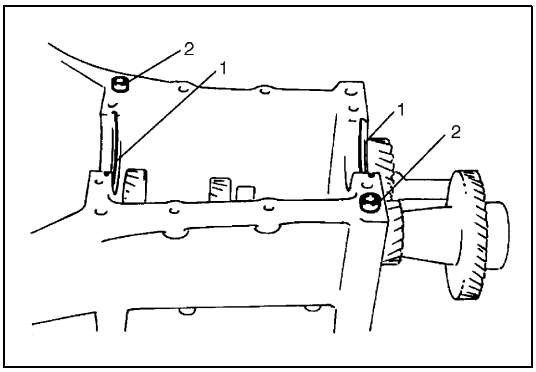


4) Install interlock ball and locating ball in upper case.
   After installing interlock roller in high speed gear shift shaft and insert shaft into upper case as described in 2) and 3).
   Fork (2) should installed in such direction as shown. Then drive shift yoke pin (1) until it becomes flush with outer surface of fork.

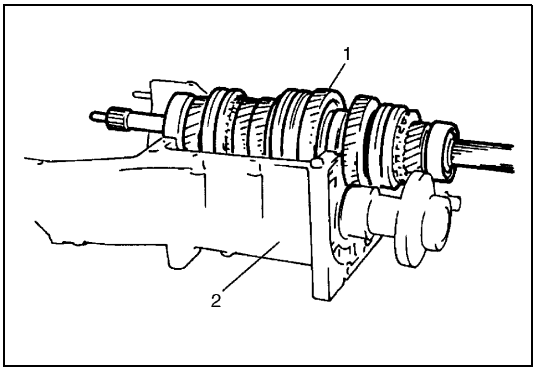


5) Install interlock ball and locating ball into upper case. Then insert reverse gear shift shaft into upper case as described in 2) and 3).

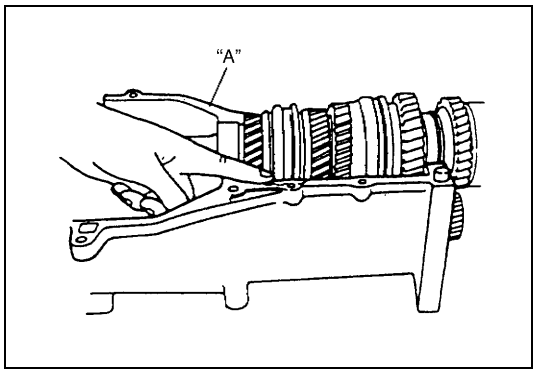
Transmission lower case and upper case



1) With countershaft assembly, reverse idle gear and reverse gear shaft installed in lower case, check that bearing stopper rings (1) are fitted in both sides of lower case as shown.
   Also check for 2 knock pins (2).

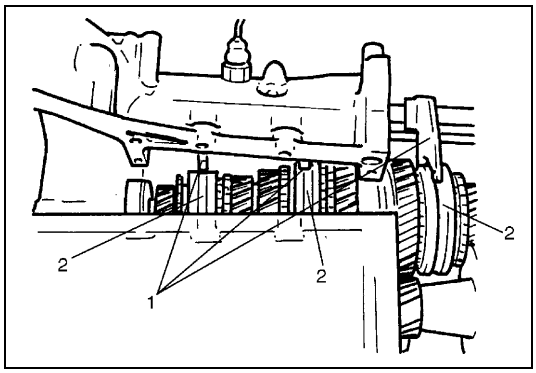


2) Make sure that mating surfaces of both lower and upper cases are clean.
3) Install main shaft and input shaft assembly (1) in lower case (2).



4) Uniformly apply sealant to mating surface of lower case.

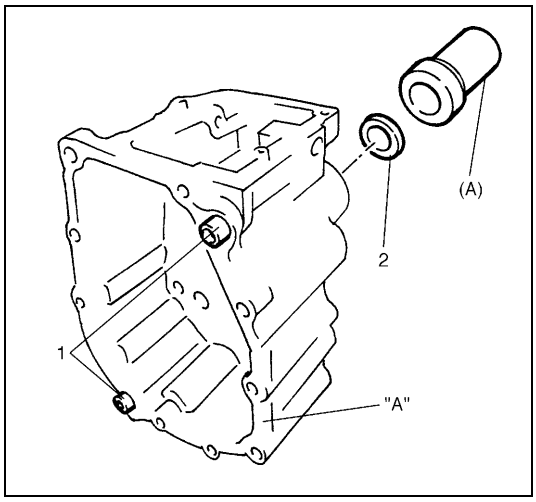
"A" : Sealant 99000-31110



5) Install upper case to lower case by matching 3 shift forks (1) with 3 grooves in synchronizer sleeve (2) on main shaft respectively.
6) Tighten case bolts to specification.

Tightening torque
Transmission case bolts :
23 N·m (2.3 kg-m, 17.0 lb-ft)

Extension case



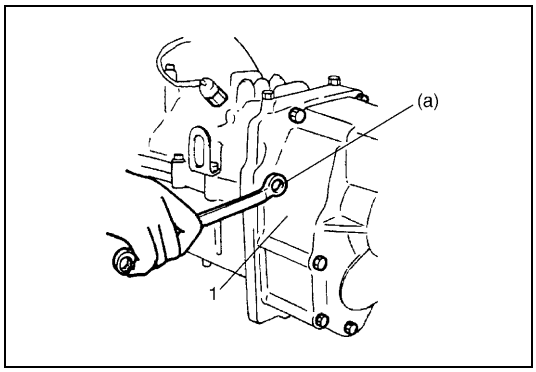
1) Check knock pins (1) are fitted.
2) Install extension case seal (2) so that end surface of oil seal becomes flush with that case. Apply grease to extension case seal lip.

Grease 99000-25010

Special tool
(A) : 09913-85210

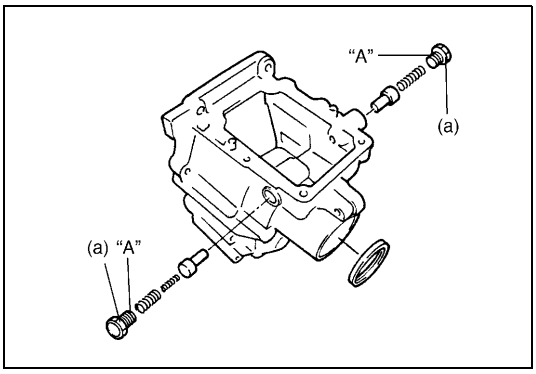
3) Clean surface of extension case to mate with transmission case and uniformly apply sealant.

"A" : Sealant 99000-31110



4) Make sure that 3 shift shafts are in neutral position.
5) Install extension case (1) to transmission case.
6) Tighten case bolts to specification.

Tightening torque
Extension case bolts
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

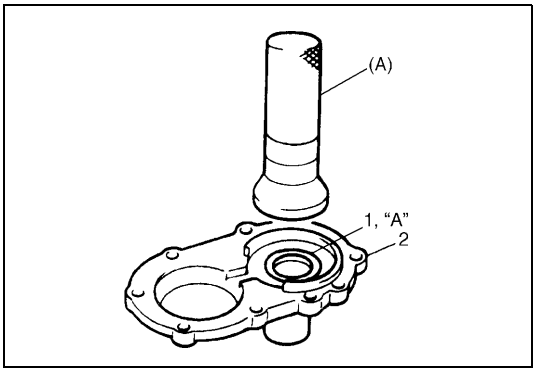


7) Install select guide pins, low select return spring and reverse select return springs (outer and inner).
8) Apply thread lock to thread of select return spring bolt.
   And tighten select return spring bolt to extension case to specified torque.

Tightening torque
Select return spring bolts
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

"A" : Cement 99000-32110

Input shaft bearing retainer



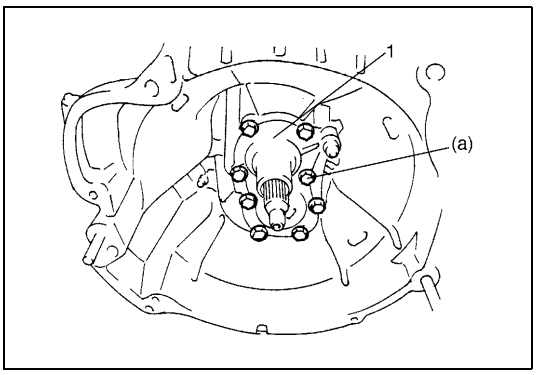
1) Install new oil seal (1) with special tool and hammer up to case surface, apply grease to oil seal lip.

Special tool
(A) : 09951-16080

"A" : Grease 99000-25010

2) Clean surface of retainer (2) to mate with transmission case and uniformly apply sealant.

Sealant 99000-31110



3) Tighten retainer bolts to specification.

Tightening torque
Input shaft bearing retainer bolts
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

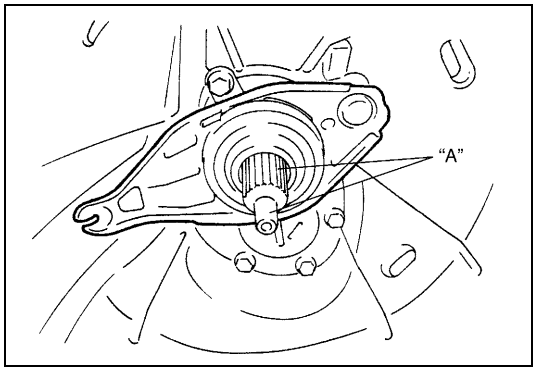
4) Check transmission input shaft for easy rotation by hand.
5) Check each select and shift shaft for operation.

1. Input shaft bearing retainer

Clutch release bearing

Before installing bearing, apply grease to inner surface of clutch release bearing. For detail, refer to "Clutch Cover, Clutch Disc, Flywheel and Release Bearing" in Section 7C.

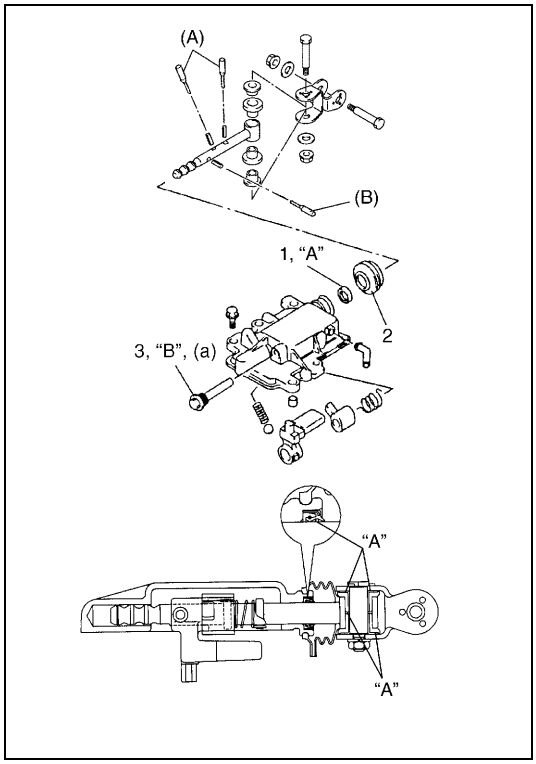
Input shaft



Before remounting transmission assembly to engine and vehicle, apply grease to input shaft.

"A" : Grease 99000-25210

Front gear shift control



1) Clean all parts thoroughly, inspect them and replace with new ones as required.
2) Assemble component parts by reversing removal procedure.

Special tool
(A) : 09922-85811
(B) : 09925-78210

- Apply grease to lip portion of oil seal. Refer to the figure for installing direction.

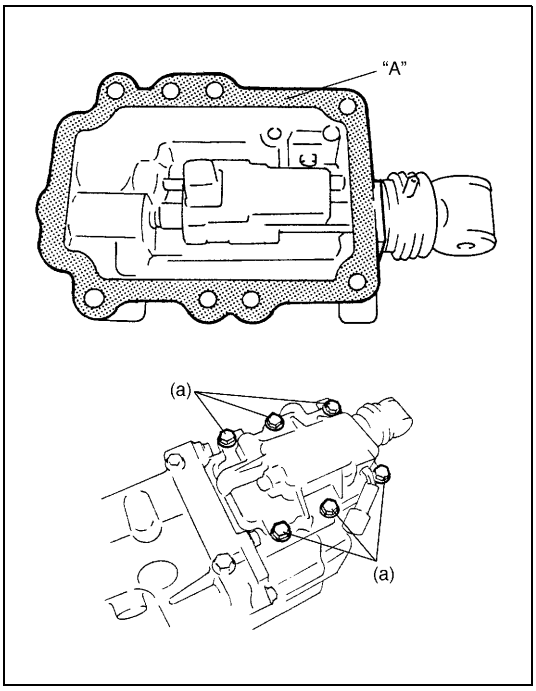
"A" : Grease 99000-25010

- Install boot in such direction that breather faces downward.
- Apply thread lock cement to reverse gear shift limit bolt and tighten it to specified torque.

"B" : Cement 99000-32110

Tightening torque
Reverse gear shift limit bolt
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

1.	Oil seal
2.	Boot
3.	Reverse gear shift limit bolt



3) When installing gear shift lever front case to extension case, clean joint faces, and then apply sealant to joint faces.

"A" : Sealant 99000-31110

Tightening torque
Gear shift lever front case bolts
(a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

Tightening Torque Specification

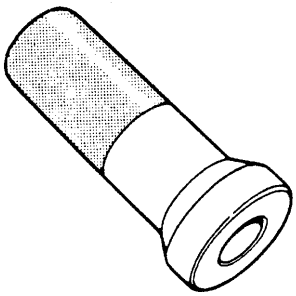
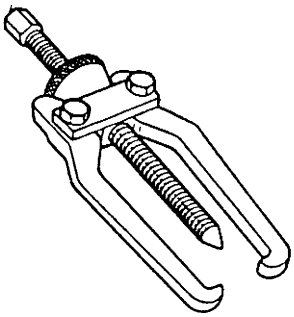
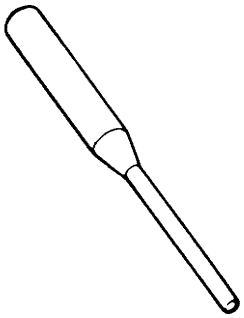
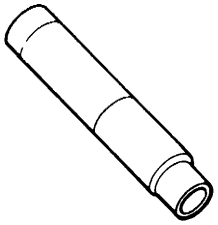
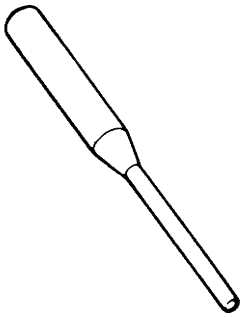
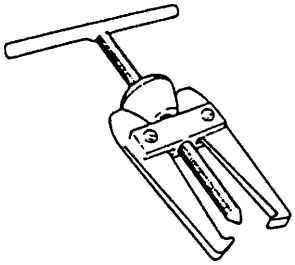
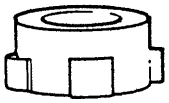
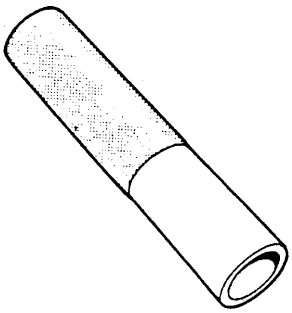
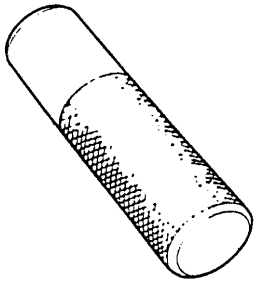
Be sure to torque each bolt and nut according to specification given below, whenever loosened.
If specified torque for particular bolt or nut is not included in the list, refer to Section 0A.

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Gear shift control boot cover bolts	23	2.3	17.0
Gear shift lever plate bolts	5.5	0.55	4.0
Extension rod joint bolt	35	3.5	25.5
Control shaft joint nuts	18	1.8	13.0
Select return spring bolts	23	2.3	17.0
Gear shift lever front case bolts	23	2.3	17.0
Transmission case bolts	23	2.3	17.0
Extension case bolts	23	2.3	17.0
Transmission oil filler and drain plugs	23	2.3	17.0
Input shaft bearing retainer bolts	23	2.3	17.0
Reverse gear shift limit bolt	23	2.3	17.0
Transmission to engine bolts and nuts	94	9.4	68.0
Transmission rear mounting bolts	25	2.5	18.0
Gear shift rear arm bolt	34	3.4	24.5

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Oil seal lips • Gear shift control lever • Gear shift control shaft bushes
	SUZUKI SUPER GREASE I (99000-25210)	• Input shaft spline front end
Sealant	SUZUKI BOND NO.1215 (99000-31110)	• Oil drain and filler plug • Mating surface of transmission case • Mating surface of extension case • Mating surface of input shaft bearing retainer • Mating surface of gear shift lever case
Thread lock cement	THREAD LOCK CEMENT 1322 (99000-32110)	• Reverse gear shift limit bolt • Gear shift rear arm bolt

Special Tool

 09951-16080 Bearing installer	 09913-65135 Bearing puller	 09922-85811 Spring pin remover	 09925-18011 Bearing installer
 09925-78210 Spring pin remover	 09913-60910 Bearing puller	 09927-08210 Shaft remover	 09913-80113 Bearing installer
 09913-84510 Bearing installer			

SECTION 7B

AUTOMATIC TRANSMISSION (4 A/T)

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 "Air Bag 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 7B-3
- Electronic Shift Control System 7B-6
- Transmission Control Module (TCM) 7B-7
  - Throttle position sensor 7B-8
  - Output shaft speed sensor 7B-8
  - Input shaft speed sensor 7B-8
  - Transmission range sensor (Shift switch) 7B-8
  - O/D off switch 7B-9
  - Fail safe function 7B-10
  - Automatic gear shift diagram 7B-12

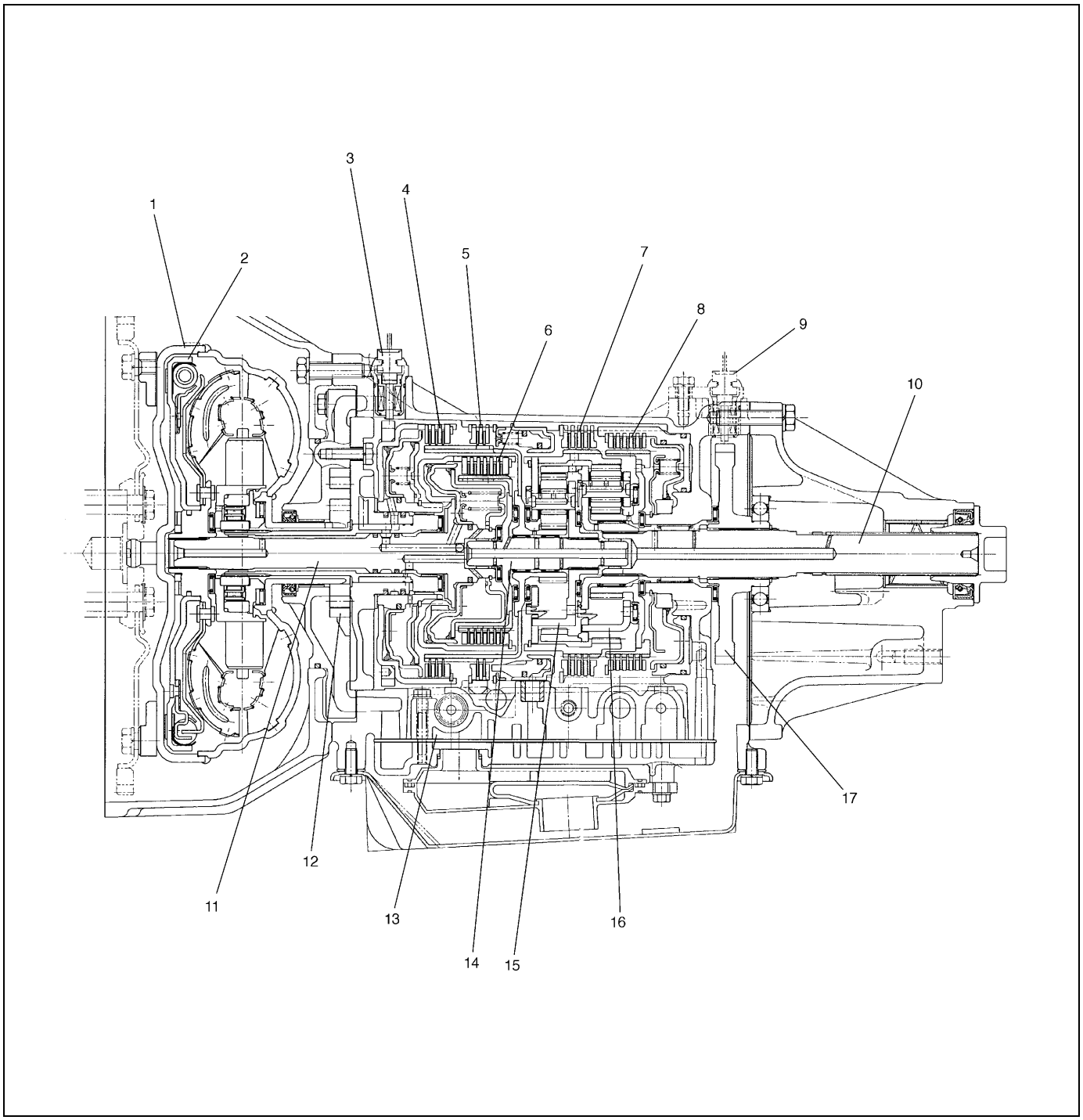
Diagnosis 7B-13
- Automatic Transmission Diagnostic Flow Table 7B-13
- Trouble Diagnosis Table 7B-18
- Stall Test 7B-20
- Time Lag Test 7B-21
- Line Pressure Test 7B-22
- Engine Brake Test 7B-23
- "P" Range Test 7B-23
- Electronic Control System Diagnosis 7B-24
  - Precautions in diagnosing troubles 7B-24
- Diagnostic Trouble Code(s) Check 7B-25
- Diagnostic Trouble Code(s) Clearance 7B-27
- Diagnostic Trouble Code (DTC) Table 7B-28
- TCM Power and Ground Circuit Check 7B-30
- DTC P0715/DTC No.14 Input / Turbine Speed Sensor Circuit 7B-31
- DTC P0730/DTC No. 18 Incorrect Gear Ratio 7B-33
- DTC P0753/DTC No.21/22 Shift Solenoid-A (No.1) Electrical 7B-35
- DTC P0758/DTC No.23/24 Shift Solenoid-B (No.2) Electrical 7B-35
- DTC P0763/DTC No.43/44 Shift Solenoid-C (No.3) Electrical 7B-35
- DTC P0768/DTC No.45/46 Shift Solenoid-D (No.4) Electrical 7B-35
- DTC P0743/DTC No.25/26 TCC (Lock-Up Clutch) Circuit Electrical 7B-35
- DTC P0741/DTC No.29 TCC (Lock-Up) Circuit Performance or Stuck OFF 7B-37
- DTC P0720/DTC No. 31 Output Shaft Speed Sensor Circuit 7B-38
- DTC P1700/DTC No.32/33 Throttle Position Signal Input Malfunction 7B-41
- DTC P0705/DTC No.34 Transmission Range Sensor (Switch) Circuit Malfunction 7B-43
- DTC P0725/DTC No.35 Engine Speed Input Circuit 7B-45
- DTC P0710/DTC No.36/38 Transmission Fluid Temperature Sensor Circuit 7B-47
- DTC P1709/DTC No.51 Engine Coolant Temperature Signal Circuit 7B-49
- DTC P0702/P1702/DTC No.52 Transmission Control System Electrical or Internal Malfunction of TCM 7B-50
- DTC P1887/DTC No.57 Vehicle Speed Sensor (VSS) Signal Circuit 7B-51
- Scan Tool Data 7B-52
- Inspection of TCM and Its Circuits 7B-56

On-Vehicle Service 7B-58
- Maintenance Service 7B-58

Fluid level check 7B-58
Fluid change 7B-59
Oil cooler hoses 7B-60
Selector Lever 7B-61
Transmission Range Sensor (Shift Switch) 7B-62
Selector Rod 7B-64
Output Shaft Speed Sensor 7B-65
Input Shaft Speed Sensor 7B-66
Vehicle Speed Sensor 7B-67
Throttle Position Sensor 7B-67
Engine Coolant Temperature (ECT) Sensor 7B-67
O/D Off Switch 7B-68
Shift Solenoid Valves and Transmission Fluid Temperature Sensor 7B-68
Shift solenoid valves and lock-up solenoid valve 7B-69
Transmission fluid temperature sensor ... 7B-70
Extension Case Oil Seal 7B-71
Transmission Control Module (TCM) 7B-71
Learning Control Memory Initialization 7B-72
Interlock Cable (if equipped) 7B-72
Unit Repair Overhaul 7B-75
Unit Dismounting 7B-76
Unit Remounting 7B-77
Unit Disassembly 7B-77
Disassembly of Subassembly 7B-86
Oil pump 7B-86
Front clutch (C1 clutch) 7B-89
Rear clutch (C2 clutch) 7B-94
Planetary set 7B-99
Valve body 7B-101
Output shaft assembly 7B-107
Unit Assembly 7B-108
Tightening Torque Specification 7B-120
Special Tool 7B-121
Required Service Material 7B-122

General Description

This automatic transmission is a full automatic type with 3-speed plus overdrive (O/D).
The torque converter is a 3-element, 1-step and 2-phase type. The gear shift device consists of 2 sets of planetary gear units, 2 sets of disc type clutches and 3 sets of disc type brakes. The gear shift is done by selecting one of 6 positions (“P”, “R”, “N”, “D”, “2” and “L”) by means of the select lever installed on the floor. On the shift knob, there is an overdrive (O/D) cut switch which allows shift-up to the overdrive mode and shift-down from the overdrive mode.



1. Torque converter	7. Reverse brake	13. Valve body
2. Torque converter clutch (Lock-up clutch)	8. 1st and 2nd brake	14. Intermediate shaft
3. Input shaft speed sensor (Turbine rev. sensor)	9. Output shaft speed sensor (A/T vehicle speed sensor)	15. Front carrier
4. Front clutch (C1)	10. Output shaft	16. Rear carrier
5. Overdrive brake	11. Input shaft	17. Parking gear
6. Rear clutch (C2)	12. Oil pump	

Item			Specifications		
Torque converter	Type Stall torque ratio		3-element, 1-step, 2-phase type More than 1.7		
Oil pump	Type Drive system		Internal gear type oil pump Engine driven		
Gear change device	Type		Forward 4-step, reverse 1-step planetary gear type		
	Shift position		“P” range “R” range “N” range “D” range (O/D ON) “D” range (O/D OFF) “2” range “L” range	Gear in neutral, output shaft fixed, engine start Reverse Gear in neutral, engine start Forward 1st ↔ 2nd ↔ 3rd ↔ 4th (O/D) automatic gear change Forward 1st ↔ 2nd ↔ 3rd ← 4th automatic gear change Forward 1st ↔ 2nd ← 3rd automatic gear change Forward 1st ← 2nd reduction, and fixed at 1st gear	
	Gear ratio	1st	2.962	Number of teeth	Front sun gear : 21 Rear sun gear : 34 Front pinion gear : 19 Rear pinion gear : 16 Front internal gear : 59 Rear internal gear : 66
		2nd	1.515		
		3rd	1.000		
		4th (overdrive gear)	0.737		
		Reverse (reverse gear)	2.809		
	Control elements		Wet type multi-disc clutch ... 2 sets Wet type multi-disc brake ... 3 sets		
	Final gear reduction ratio (Differential)		3.909		
Lubrication	Lubrication system		Force feed system by oil pump		
Cooling	Cooling system		Radiator assisted cooling (water-cooled)		
Fluid used			Equivalent of DEXRON®-IIE or DEXRON®-III		

FUNCTIONS

NOTE:

For operation of each part, refer to "Table of Component Operation" in this section.

PART NAME	FUNCTION
Front clutch	Meshes input shaft and front sun gear.
Rear clutch	Meshes input shaft and front internal gear and front carrier.
Overdrive brake	Fixes front sun gear.
1st & 2nd brake	Fixes rear sun gear.
Reverse brake	Fixes front carrier and rear internal gear.

TABLE OF COMPONENT OPERATION

Selector position / Gear position \ Part		Front clutch	Rear clutch	Overdrive brake	1st & 2nd brake	Reverse brake
P		○	×	×	×	×
R		○	×	×	×	○
N		○	×	×	×	×
D	1st	○	×	×	○	×
	2nd	×	○	×	○	×
	3rd	○	○	×	×	×
	4th(O/D)	×	○	○	×	×
2	1st	○	×	×	○	×
	2nd	×	○	×	○	×
L	1st	○	×	×	○	×

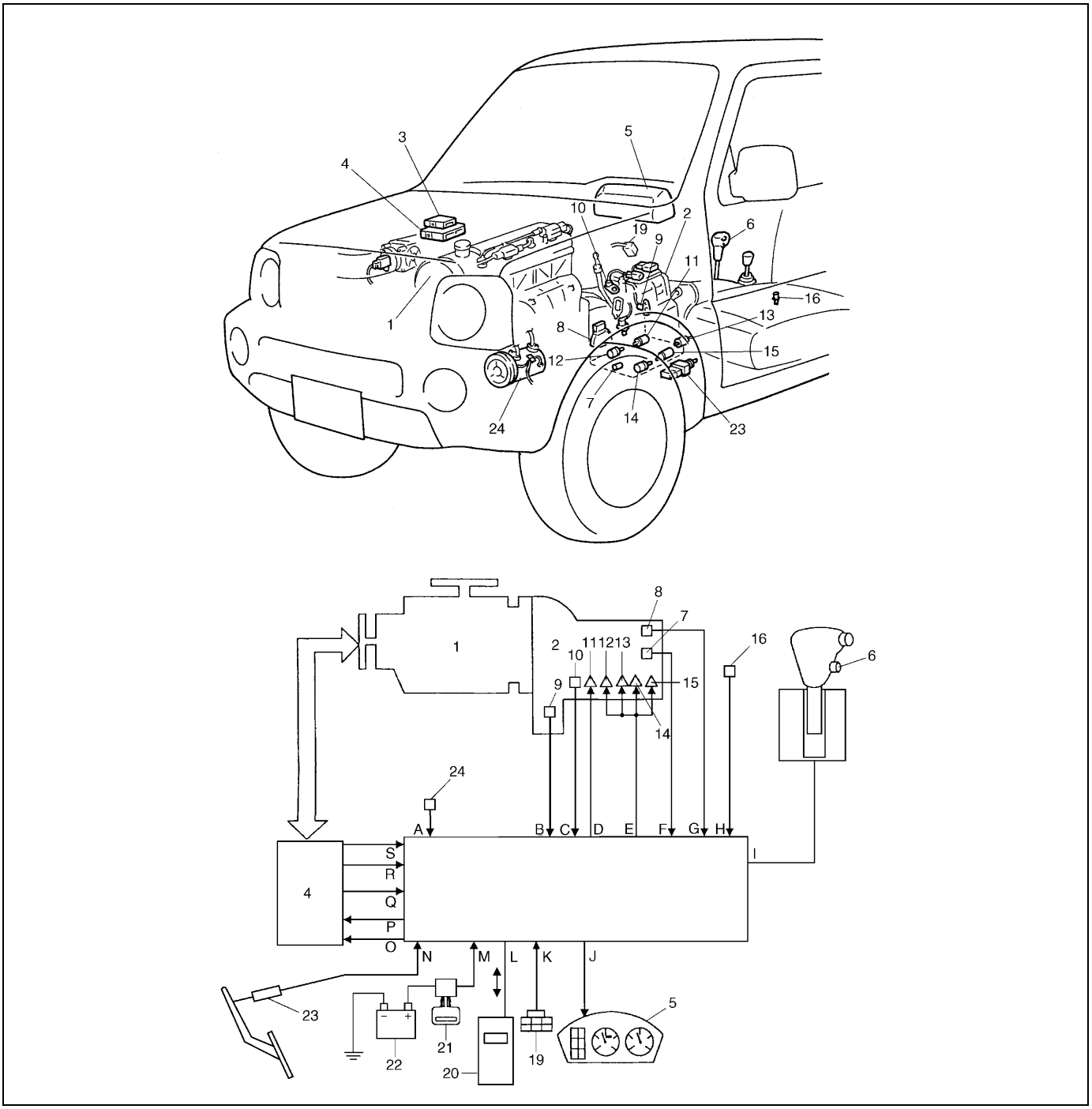
○ :Operating × :Not operating

TABLE OF SHIFT SOLENOID VALVE OPERATION

Range & Gear	Shift Solenoid Valve			
	A (No.1)	B (No.2)	C (No.3)	D (No.4)
[P] , [N]	×	○	×	×
1st gear of O/D, [D] , [2] , [L]	×	○	○	×
2st gear of O/D, [D] , [2] , [L]	○	×	○	×
3st gear of O/D, [D] ([2] , [L])	×	×	×	×
4st gear of O/D	○	×	×	○
[R]	×	×	×	×

○ :Operating × :Not operating

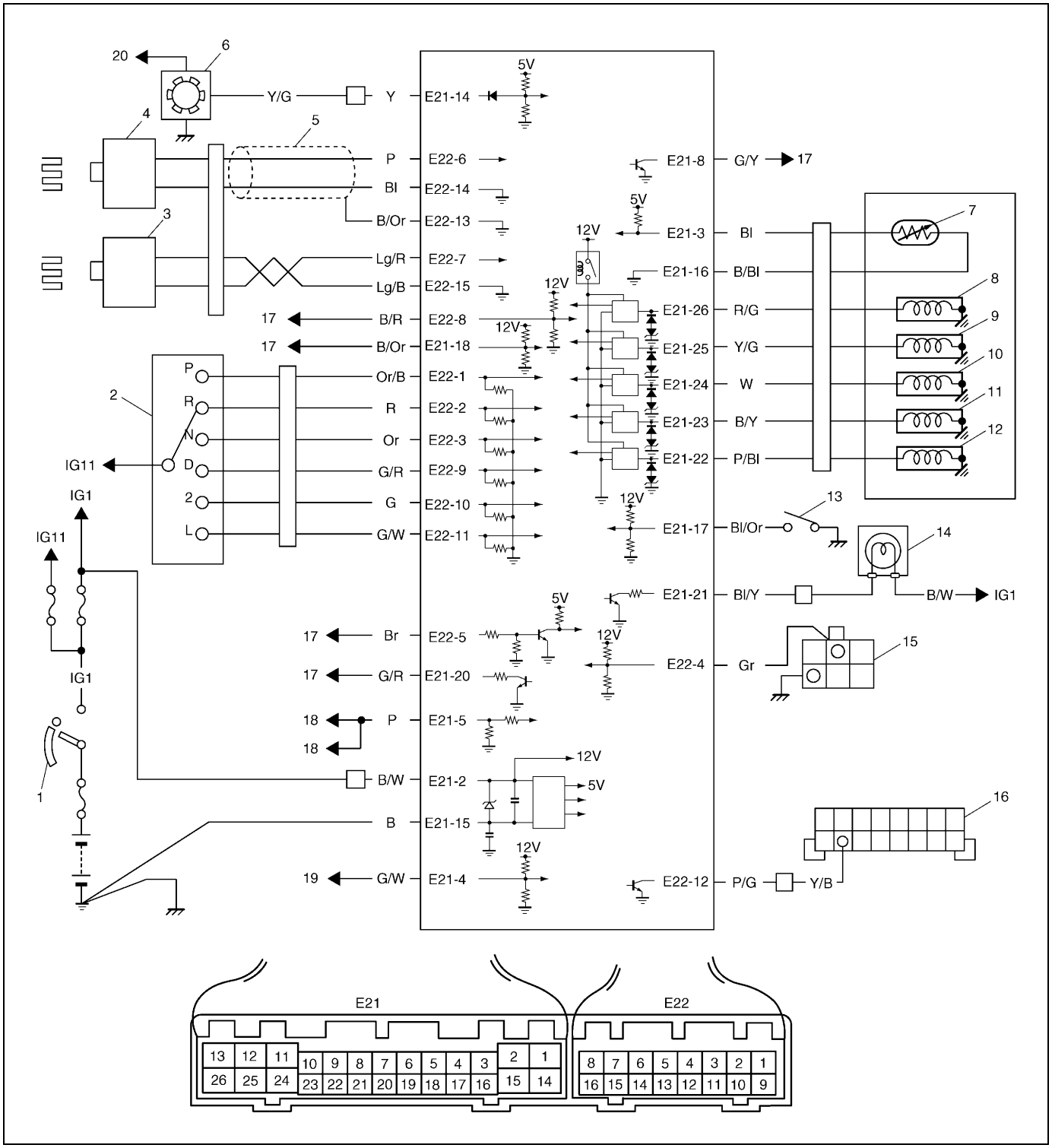
Electronic Shift Control System



1. Engine	16. Vehicle speed sensor (VSS)	G. Range signal
2. Transmission	17. Blank	H. Vehicle speed signal
3. TCM	18. Blank	I. O/D OFF signal
4. ECM	19. Monitor connector No.2	J. O/D OFF lamp signal
5. Combination meter (O/D OFF lamp)	20. SUZUKI scan tool	K. Diagnosis switch signal
6. O/D off switch	21. Ignition switch	L. SUZUKI scan tool
7. Transmission fluid temp. sensor (A/T fluid temp. sensor)	22. Battery	M. Power supply
8. Transmission range sensor (Shift switch)	23. Brake light switch	N. Brake signal
9. Output shaft speed sensor (A/T VSS)	24. A/C compressor	O. A/T failure signal
10. Input shaft speed sensor (Turbine rev. sensor)	A. A/C on signal	P. Idle up signal
11. TCC solenoid (Lock-up solenoid)	B. A/T output shaft speed signal	Q. Throttle signal
12. Shift solenoid-A (Shift solenoid No.1)	C. Turbine speed signal	R. Engine coolant temp. signal
13. Shift solenoid-B (Shift solenoid No.2)	D. TCC (lock-up) control signal	S. Engine speed (rev.) signal
14. Shift solenoid-C (Shift solenoid No.3)	E. Shift control signal	
15. Shift solenoid-D (Shift solenoid No.4)	F. A/T fluid temp. signal	

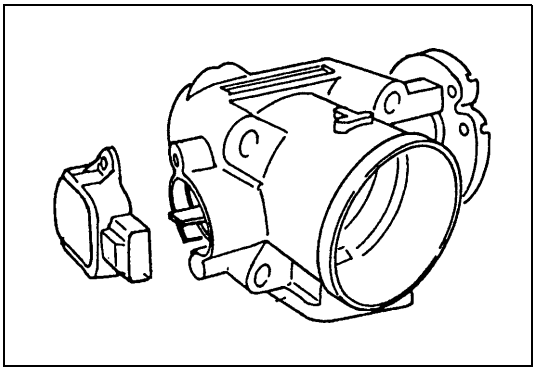
Transmission Control Module (TCM)

The TCM is an electronic circuit component that controls gear shift, TCC lock-up and idle-up according to the signal from each sensor. It is a microcomputer consisting of an IC, transistor, diode, etc. It is installed behind glove box.



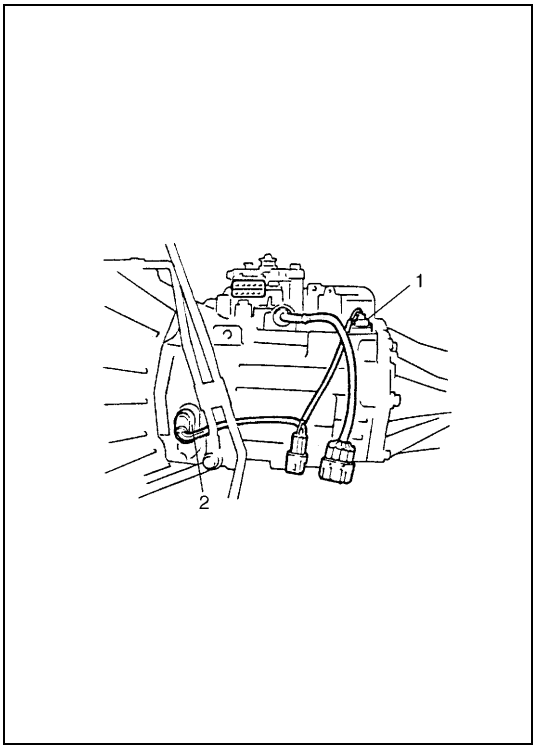
1. Ignition switch	8. Shift solenoid-A (Shift solenoid No.1)	15. Monitor connector No.2
2. Transmission range sensor (Shift switch)	9. Shift solenoid-B (Shift solenoid No.2)	16. DLC
3. Input shaft speed sensor (Turbine rev. sensor)	10. Shift solenoid-C (Shift solenoid No.3)	17. To ECM
4. Output shaft speed sensor (A/T VSS)	11. Shift solenoid-D (Shift solenoid No.4)	18. To A/C
5. Shield wire	12. TCC solenoid (Lock-up solenoid)	19. To brake lamp switch
6. Vehicle speed sensor (VSS)	13. “O/D” cut switch	20. To main relay
7. Transmission fluid temperature sensor (A/T fluid temp. sensor)	14. “O/D OFF” lamp (in combination meter)	21. Terminal arrangement of TCM coupler (Viewed from harness side)

Throttle position sensor



This sensor is installed to the throttle valve shaft. Throttle valve opening signal is transmitted from TP sensor to ECM as voltage signal. The signal is converted to duty signal in ECM and it is sent to TCM.

Output shaft speed sensor



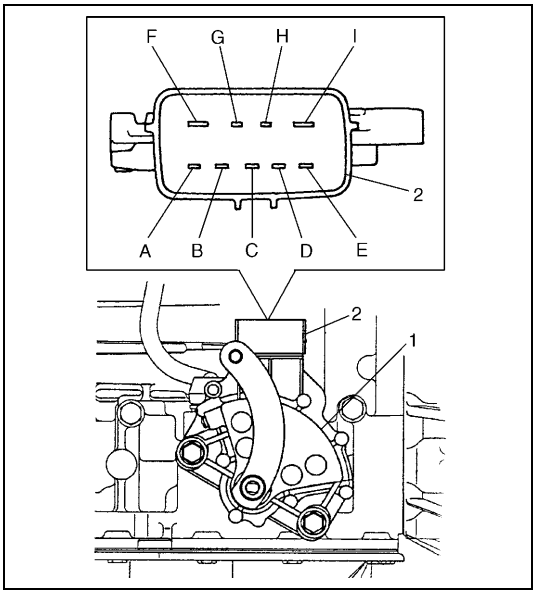
This sensor is a pulse generator type that detects revolution of the counter driven gear (vehicle speed) in the transmission case.
The pulse generator is a noncontact sensor consisting of a permanent magnet, coil and gears.
As the Output shaft turns, the magneflux from the permanent magnet varies and a voltage of the frequency corresponding to the rotor revolution occurs in the coil. This voltage is inputted to the TCM where TCM judges the output shaft revolution or the vehicle speed.

Input shaft speed sensor

This sensor is a pulse generator type that detects revolution of torque converter's turbine shaft in the transmission case.
The principle of operation is the same as the output shaft speed sensor.

1. Output shaft speed sensor
2. Input shaft speed sensor

Transmission range sensor (Shift switch)

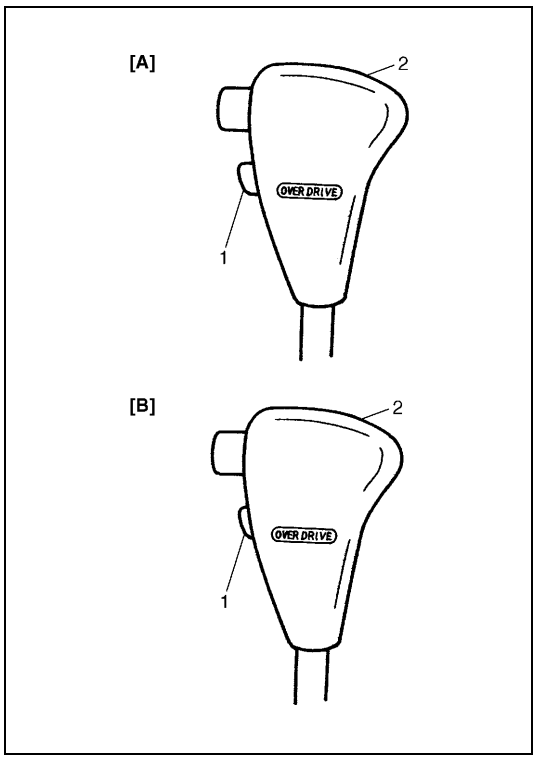


A transmission range sensor (1) is provided so that the engine can be started only when the shift lever is in the "P" or "N" position.

Switch Position \ Terminal No	B	A	H	C	E	D	G	I	F
P			○			○		○	○
R			○		○				
N			○				○	○	○
D			○	○					
2		○	○						
L	○		○						

2. Transmission range sensor coupler

O/D off switch



The gear shift up or shift down to and from the O/D gear can be selected with this switch.

O/D off switch (1)	O/D OFF indicator light
ON	ON
OFF	OFF

2. Shift lever
[A]: O/D off switch ON
[B]: O/D off switch OFF

Fail safe function

This function is provided by the safe mechanism that assures safe driveability even when the solenoid valve, sensor or its circuit fails.
The table below shows the fail safe function for each fail condition of sensor, solenoid or its circuit.

Area	Detecting condition	Fail safe function
Input/Turbine speed sensor circuit (DTC P0715)	Input shaft speed sensor signal voltage is too high or too low.	• When vehicle running and in shift change by automatic electronic control, gear is fixed to gear which is going to be selected and lock-up function is turned OFF. • When vehicle running and in no shift change, gear is fixed to gear right before the trouble occurred and lock-up function is turned OFF. • When vehicle is at stop after or during detecting trouble, or in shift change by manual operation while running, gear is fixed as the followings and lock-up function is turned OFF. "P" range → P, "R" range → R, "N" range → N, "D" range → 3rd, "2" range → 2nd, "L" range → 1st
Output shaft speed sensor circuit (DTC P0720)	Output shaft speed sensor signal voltage is too high or too low.	
Shift solenoid (DTC P0753) (DTC P0758) (DTC P0763) (DTC P0768)	• Solenoid output voltage is too high although TCM orders solenoid to turn off. • Solenoid output voltage is too low although TCM orders solenoid to turn on.	• When select lever is "P", "R", "N", "D" or "2" range, A/T power relay is turned OFF and gear is fixed as follows : "P" range → P, "R" range → R, "N" range → N, "D"/"2" range → 3rd • When select lever is "L" range, gear is fixed to pre programmed gear position of several patterns as follows : – Malfunction of No.1 solenoid → 2nd or 3rd – Malfunction of No.2 solenoid → 1st or 3rd – Malfunction of No.3 solenoid → 3rd – Malfunction of No.4 solenoid → 3rd – Malfunction of 2 or more solenoids → 3rd
TCC circuit (DTC P0743)		Lock-up function is turned OFF.
A/T hardware itself (DTC P0730)	Difference in detected revolution between input shaft speed sensor and output shaft speed sensor is too wide.	"P" range → P, "R" range → R, "N" range → N, "D"/"2"/"L" range → To be controlled as follows : 1) When detecting trouble at first, gear is selected well-suited gear calculated with parameters of each sensor's rev. number and gear position just when the trouble occurred. Lock-up function is turned OFF. 2) If A/T can transmit driving force under the above condition, gear is fixed the selected gear until ignition switch is turned OFF. 3) If A/T can not transmit driving force under the above condition, after once vehicle stop, gear which can transmit drive force is searched one by one until gear is found out. After gear is found out, position of gear is held until ignition switch is turned OFF.

Area	Detecting condition	Fail safe function
Transmission range sensor circuit (DTC P0705)	No transmission range sensor signal is inputted or two or more transmission range sensor signals are inputted at the same time.	• When vehicle running, shift range position is fixed to shift range position right before the trouble occurred until vehicle stop and lock-up function is turned OFF. • When vehicle is at stop after or during detecting the trouble, gear is fixed as the followings and lock-up function is turned OFF. – When 2 adjoining gear position signals are inputted. "P", "R" range → R, "R", "N" range → R, "N", "D" range → D, "D", "2" range → D, "2", "L" range → 2nd – When 2 or more signals excepting above or no signal are inputted. "P" range → P, "R" range → R, "N" range → N, "D"/"2"/"L" range → 3rd
Transmission fluid temperature sensor circuit (DTC P0710)	• A/T fluid temp. signal input voltage is too low. • A/T fluid temp. signal input voltage does not go down although standard value of engine rev. signal is inputted.	• When detecting circuit open, TCM control as fluid temperature is 100°C (212°F). • Lock-up function is turned OFF.
Engine speed input circuit (DTC P0725)	Inputted engine rev. signal is too low or too high.	• Engine rev. is processed as 4000 rpm. • No compensation or judgement for gear shift control, for which engine rev. is considered, is processed. • Lock-up function is turned OFF.
Engine coolant temp. signal circuit (DTC P1709)	O/D off signal from ECM require O/D off although A/T fluid temp. is normal operating temp. and engine rev. is standard.	O/D off signal from ECM is not used even though engine coolant temperature is low.
Throttle position signal circuit (DTC P1700)	No or abnormal throttle opening signal is inputted	• Scheduling of automatic gear shift is performed as throttle valve opening is 0%. • Control of automatic gear shift (i.e. control of oil pressure) is performed as throttle valve opening is 100%. • Coast down shifting is performed when brake is applied and engine rev. is less than 1,500 rpm. • Lock-up function is turned OFF.

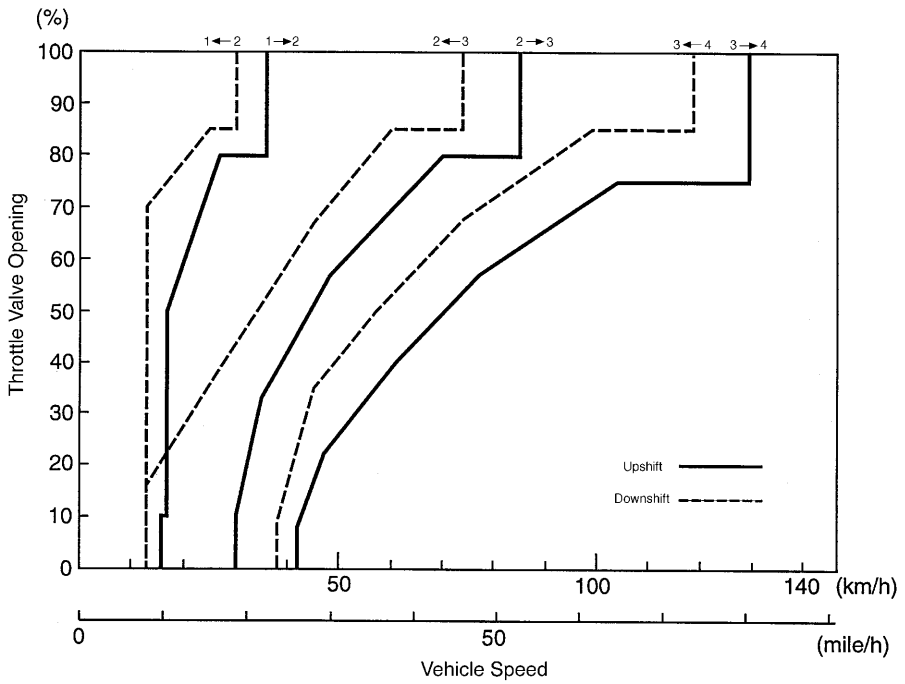
Automatic gear shift diagram

Automatic shift schedule as a result of shift control is shown below.

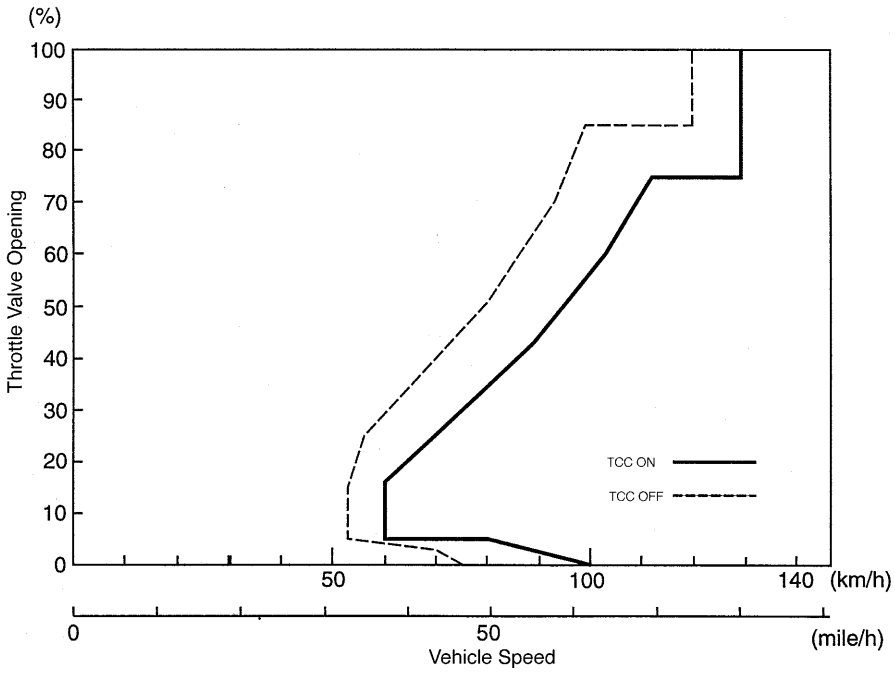
	Shift					
Throttle opening	1 → 2	2 → 3	3 → 4	4 → 3	3 → 2	2 → 1
Full throttle	36 (22)	85 (53)	127	118 (73)	74 (46)	30 (19)
Closed throttle	16 (10)	30 (19)	43 (27)	38 (24)	13 (8)	13 (8)

Gear Shift Diagram [A] and TCC lock-up diagram [B]

[A]



[B]



Diagnosis

This vehicle is equipped with an electronic transmission control system, which controls the automatic shift up and shift down timing, etc. suitably to vehicle driving conditions.
When diagnosing a trouble in the transmission including this system, follow “Automatic Transmission Diagnostic Flow Chart” given below to obtain correct result smoothly.

Automatic Transmission Diagnostic Flow Table

NOTE:

For the details of each step, refer to the following.

Step	Action	Yes	No
1	Customer Complaint Analysis 1) Perform customer complaint analysis referring to the following page. Was customer complaint analysis performed according to instruction on the following page?	Go to Step 2.	Perform customer complaint analysis.
2	Diagnostic Trouble Code (DTC) Check, Record and Clearance 1) Check for DTC referring to the following page. Is there any DTC(s)?	Print DTC or write it down and clear it by referring to “DTC Clearance” in this section. Go to Step 3.	Go to Step 4.
3	Visual Inspection 1) Perform visual inspection referring to the following page. Is there any faulty condition?	Repair or replace malfunction part. Go to Step 11.	Go to Step 5.
4	Visual Inspection 1) Perform visual inspection referring to the following page. Is there any faulty condition?		Go to Step 8.
5	Trouble Symptom Confirmation 1) Confirm trouble symptom referring to the following page. Is trouble symptom identified?	Go to Step 6.	Go to Step 7.
6	Rechecking and Record of DTC. 1) Recheck for DTC referring to “DTC Check” in this section. Is there any DTC(s)?	Go to Step 9.	Go to Step 8.
7	Rechecking and Record of DTC. 1) Recheck for DTC referring to “DTC Check” in this section. Is there any DTC(s)?	Go to Step 9.	Go to Step 10.

Step	Action	Yes	No
8	Automatic Transmission Basic Check and Trouble Diagnosis Table 1) Check and repair according to “A/T BASIC CHECK AND TROUBLE DIAGNOSIS TABLE” in this section. Are check and repair complete?	Go to Step 11.	Check and repair malfunction part(s). Go to Step 11.
9	Troubleshooting for DTC 1) Check and repair according to applicable DTC Diagnostic Flow Table. Are check and repair complete?		
10	Check for Intermittent Problems 1) Check for intermittent problems referring to the following page. Is there any faulty condition?	Repair or replace malfunction part(s). Go to Step 11.	Go to Step 11.
11	Final Confirmation Test 1) Clear DTC if any. 2) Perform final confirmation test referring to the following page. 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 a questionnaire form as shown below will facilitate collecting information to the point required for proper analysis and diagnosis.

CUSTOMER QUESTIONNAIRE (EXAMPLE)

User name:	Model:	VIN:	
Date of issue:	Date Reg.	Date of problem:	Mileage:
DESCRIPTION OF PROBLEM			
Engine does not start		Engine stops	
Vehicle does not move (forward, rearward)		Transmission does not shift (1st, 2nd, 3rd, 4th, Rev) gear	
No lock-up (TCC clutch operation)		Automatic shift does not occur	
Shift point too high or too low		Transmission slipping in (1st, 2nd, 3rd, 4th, Rev) gear	
Excessive gear change shock		Other	
VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS			
Environmental Condition			
Weather	fair/cloudy/rain/snow/always/other( )		
Temperature	hot/warm/cool/cold/( ) °C/always		
Frequency	always/sometimes (times/ day, month)/only once		
Road	urban/suburb/highway/mountainous (uphill/downhill)/tarmacadam/gravel/other( )		
Vehicle Condition			
Transmission range	(P, R, N, D, 2, L) range/(→) range		
Transmission temp.	cold/warming up phase/warmed up		
Vehicle	at stop/during driving (constant speed/accelerating/decelerating/right hand corner/left hand corner)/other ( )/speed (km/h)		
Engine	Speed (r/min)/throttle opening (idle/about %/full)		
Brake	Apply/Not apply		
"O/D OFF" switch	ON/OFF		
MALFUNCTION INDICATOR LAMP ("O/D OFF" LIGHT) FUNCTION			
always ON/sometimes ON/not on			
Diagnostic trouble code indicated/not indicated			
Diagnostic trouble code recorded			

NOTE:

The above form is a standard sample. It should be modified according to conditions characteristic of each market.

2. DIAGNOSTIC TROUBLE CODE (DTC) CHECK, RECORD AND CLEAR

DTCs are indicated by the malfunction indicator lamp. Refer to “Diagnostic Trouble Code(s) Check” in this section. When a DTC is indicated by this lamp, it means existence of a malfunction in the system represented by that code but whether it still exists (current) or it occurred in the past and has gone (history) is unknown. To know it, clear this DTC once (Refer to “How to Clear Diagnostic Trouble Code(s)” in this section.), perform “Test Drive” and/or “Problem Symptom Confirmation” in this section and then check DTC again as described in “Diagnostic Trouble Code(s) Check” in this section. Attempt to diagnose the trouble based on the DTC recorded in this step or failure to clear the DTC in this step may mislead the diagnosis or make diagnosing difficult. Even after checking the DTC with the SUZUKI scan tool, diagnosis should be performed according to this flow chart to check TCM for proper self-diagnosis function.

3 and 4. VISUAL INSPECTION

As a preliminary step, perform visual check of the following items that support proper function of the automatic transmission.

INSPECTION ITEM	REFERRING SECTION
• Engine oil ----- level, leakage	Section 0B
• Engine coolant ----- level, leakage	Section 0B
• A/T fluid ----- level, leakage, color	Section 0B
• Battery ----- fluid level, corrosion of terminal	
• A/T fluid hoses ----- disconnection, looseness, deterioration	
• Connectors of electric wire harness ----- disconnection, friction	Section 8
• Fuses ----- burning	Section 8
• Parts ----- installation, bolt ----- looseness	
• Parts ----- deformation	
• Other parts that can be checked visually	
Also add following items at engine start.	
• Indicator, warning lights in combination meter ----- ON (indicating abnormality in system) or OFF	Section 8
• Other parts that can be checked visually	

5. TROUBLE SYMPTOM CONFIRMATION

Check if what the customer claimed in CUSTOMER COMPLAINT ANALYSIS 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.)

When the symptom is not actually found, possibility is:

- The symptom occurs under certain conditions.
  ----- Retry with the vehicle under different conditions.
- The trouble occurred only temporarily and normal operation has been restored.
  ----- Perform “Diagnostic Trouble Code Check” and if the diagnostic trouble code is indicated, inspect according to the flow table for that DTC.

6 and 7. RECHECKING AND RECORD OF DTC

Refer to “DTC Check” in this section.

8. AUTOMATIC TRANSMISSION BASIC CHECK AND TROUBLE DIAGNOSIS TABLE

Perform basic automatic transmission check according to the list below first. When the end of the list has been reached, check the part of system suspected as a possible cause referring to “Trouble Diagnosis Table” and based on symptoms appearing on vehicle (symptoms obtained through steps of customer complaint analysis, trouble symptom confirmation and/or A/T basic check) and repair or replace faulty parts, if any.

AUTOMATIC TRANSMISSION BASIC CHECK LIST

1) Power Supply Voltage Check
   Check that the battery voltage is within 10 – 14 V at engine stop.
2) A/T Fluid Check
   Check A/T fluid level and quality.
3) STALL TEST
   Perform stall test. Refer to “Stall Test” in this section for details.
4) LINE PRESSURE TEST
   Perform line pressure test. Refer to “Line Pressure Test” in this section.
5) ROAD TEST
   Perform road test to understand correctly the trouble area.
6) Electrical Harness and Coupler Check
   Check the connection of the harness coupler. Check for the loose connection of the harness, loose connection of the terminals.

9. DIAGNOSTIC TROUBLE CODE FLOW TABLE

Based on the DTC indicated in STEP 6 and STEP 7 and referring to “DTC Check”, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, TCM 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 automatic transmission 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 a normal code is indicated.

Trouble Diagnosis Table

NOTE:

For the inspection of throttle position sensor, refer to TP SENSOR in Section 6E.

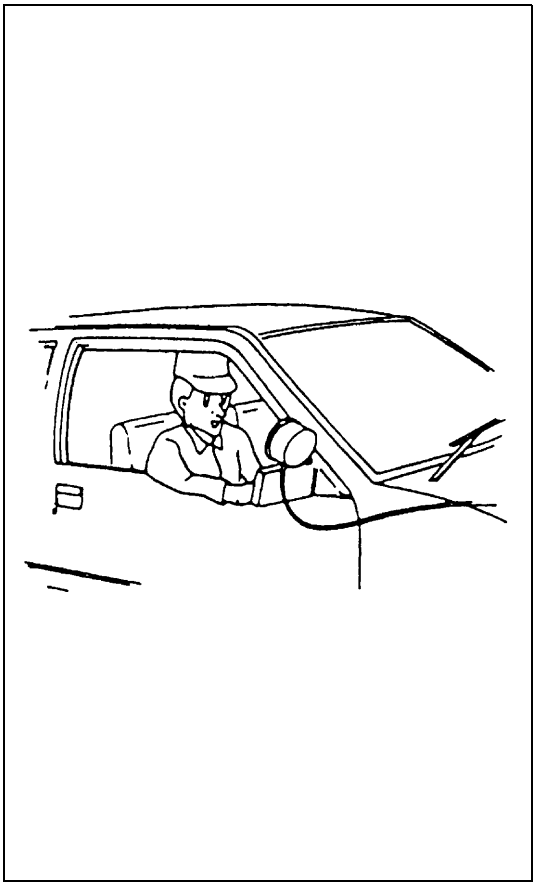
Condition		Possible Cause	Correction
No up-shift	1st → 2nd 2nd → 3rd	• A/T output shaft speed sensor or its circuit faulty	Inspect A/T output shaft speed sensor.
		• Shift solenoid-A (No.1) (1st → 2nd, 2nd → 3rd), -B (No.2) (1st → 2nd), -C (No.3) (2nd → 3rd) or its circuit faulty	Repair or replace.
		• TCM faulty	Replace TCM.
	3rd → 4th	• Transmission temp. sensor or its circuit faulty	Inspect Transmission fluid temp. sensor.
		• A/T output shaft speed sensor or its circuit faulty	Inspect A/T output shaft speed sensor.
		• Shift solenoid-A (No.1), -D (No.4) or its circuit faulty	Repair or replace.
		• O/D OFF switch and/or "O/D OFF" indicator light circuit faulty	Refer to "O/D Off Switch" in this section and/or inspect its circuit.
		• Engine coolant temp. sensor or its circuit faulty	Refer to ECT sensor in Section 6E.
		• TCM faulty	Replace TCM.
No down-shift	4th → 3rd 3rd → 2nd 2nd →1st	• Shift solenoid-A (No.1) (4th → 3rd, 3rd → 2nd, 2nd → 1st), -B (No.2) (2nd → 1st), -C (No.3) (3rd → 2nd), -D (No.4) (4th → 3rd) or its circuit faulty	Repair or replace.
		• Throttle position sensor or its circuit faulty	Inspect TP sensor.
		• TCM faulty	Replace TCM.
Shift point too high or too low		• Throttle position sensor, A/T output shaft speed sensor or its circuit faulty	Inspect TP sensor and/or A/T output shaft speed sensor.
Vehicle does not move		• Shift solenoid -A (No.1), -B (No.2), -C (No.3) or its circuit faulty	Repair or replace.
Excessive slip		• Shift solenoid -A (No.1) to -D (No.4) or its circuit faulty	Repair or replace.
Excessive shock at N → D or N → R		• Shift solenoid -B (No.2), -C (No.3) or its circuit faulty • ECM (ISC)	Repair or replace. Inspect ECM
No lock-up or No lock-up OFF		• TCC (lock-up) solenoid valve or its circuit faulty	Repair or replace.
		• Throttle position sensor or its circuit faulty	Refer to throttle position sensor in Section 6E.
		• Engine coolant temp. sensor or its circuit faulty	Refer to ECT sensor in Section 6E.
		• Brake light switch circuit faulty	Repair or replace.
		• ECM faulty	Inspect ECM.
Vehicle does not move at any range		• Manual valve faulty	Clean or replace.
		• Primary regulator valve faulty	Clean or replace.

Condition		Possible Cause	Correction
No gear change	**1st ↔ 2nd**	• Shift solenoid-A (No.1) and/or -B (No.2) stuck	Clean or replace.
		• Signal valve faulty	Clean or replace.
	2nd ↔ 3rd	• Shift solenoid -A (No.1), -C (No.3) and/or fail valve No.1 stuck	Clean or replace.
	3rd ↔ 4th	• Shift solenoid-A (No.1), -D (No.4) and/or fail valve No.2 stuck	Clean or replace.
Harsh engagement	**P, N → R**	• Rear clutch accumulator faulty	Clean or replace.
	N → D	• 1st & 2nd brake accumulator faulty	Clean or replace.
	1st → 2nd at D range or 2 range	• Rear clutch accumulator faulty	Clean or replace.
	2nd → 3rd at D range	• Front clutch accumulator faulty	Clean or replace.
	3rd → 4th at D range	• Overdrive brake accumulator faulty	Clean or replace.
	All gear change	• Primary regulator valve faulty	Clean or replace.
Excessive slip (low line pressure)		• Primary regulator valve faulty	Clean or replace.
Vehicle does not move at	**1st and 3rd gear**	• Front clutch faulty	Repair or replace.
	Reverse gear	• Reverse brake faulty	Repair or replace.
	2nd, 3rd, 4th and reverse gear	• Rear clutch faulty	Repair or replace.
	1st and 2nd gear	• 1st & 2nd brake faulty	Repair or replace.
	4th gear	• Overdrive brake faulty	Repair or replace.
	Any forward and reverse gear	• Parking lock pawl faulty	Repair or replace.
Shock or engine stalls when starting off and stopping		• Torque converter clutch faulty	Inspect and replace as necessary.
No up-shift	**1st → 2nd**	• Rear clutch faulty	Repair or replace.
	2nd → 3rd	• Front clutch faulty	Repair or replace.
	3rd → 4th	• Overdrive brake faulty	Repair or replace.
No engine braking	**2nd or 3rd gear**	• Front or rear clutch or 1st & 2nd brake faulty	Repair or replace
	L range 1st gear	• Front clutch or 1st & 2nd brake faulty	Repair or replace.
No lock-up		• Torque converter clutch faulty	Inspect and replace as necessary.
		• Lock-up control valve faulty	Clean or replace.
		• Lock-up solenoid faulty	Clean or replace.
		• Secondary regulator valve faulty	Clean or replace.
		• Signal valve faulty	Clean or replace.
No lock-up OFF		• TCC (lock-up) solenoid faulty	Clean or replace.
		• Lock-up control valve faulty	Clean or replace.

Stall Test

This test is to check overall performance of automatic transmission and engine by measuring stall speed at “D” and “R” ranges. Be sure to perform this test only when transmission fluid is at normal operating temperature and its level is between FULL and LOW marks.

CAUTION:
- **Do not run engine at stall more than 5 seconds continuously, for fluid temperature may rise excessively high.**
- **After performing stall test, be sure to leave engine running at idle for longer than 30 seconds before another stall test.**



1) Apply parking brake and block wheels.
2) Install tachometer.
3) Start engine with select lever shifted to “P”.
4) Depress brake pedal fully.
5) Shift select lever to “D” and depress accelerator pedal fully while watching tachometer. Read engine rpm quickly when it has become constant (stall speed).
6) Release accelerator pedal immediately after stall speed is checked.
7) In the same way, check stall speed in “R” range.
8) Stall speed should be within following specification.

Engine stall speed
Standard : 2,550 – 2,850 rpm

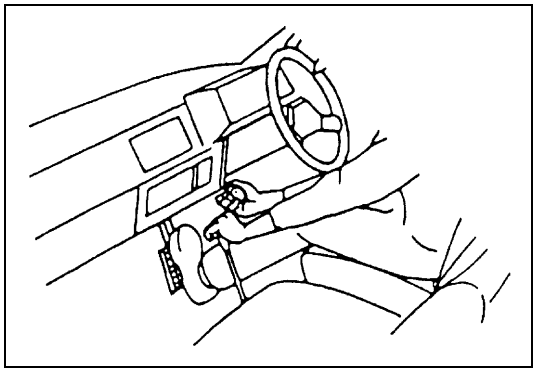
Troubleshooting

Test result	Possible cause
Lower than standard level	• Lack of engine output • Defective torque converter
Higher than standard level in “D” range	• Malfunctioning 1st & 2nd brake • Malfunctioning rear clutch • Malfunctioning stator one-way clutch
Higher than standard level in “R” range	• Low line pressure • Malfunctioning front clutch • Malfunctioning reverse brake • Malfunctioning stator one-way clutch

Time Lag Test

This test is to check conditions of clutch, reverse brake and fluid pressure. “Time lag” means time elapsed since select lever is shifted with engine idling till shock is felt.

1) With chocks placed in front and behind front and rear wheels respectively, depress brake pedal.
2) Start engine.



3) With stop watch ready, shift select lever from “N” to “D” range and measure time from that moment till shock is felt.
4) Similarly measure time lag by shifting select lever from “N” to “R” range.

Gear shifting time lag
“N” → “D” : Less than 1.0 sec.
“N” → “R” : Less than 1.4 sec.

NOTE:

- **When repeating this test, be sure to wait at least minute after select lever is shifted back to “N” range.**
- **Engine should be warmed up fully for this test.**

Troubleshooting

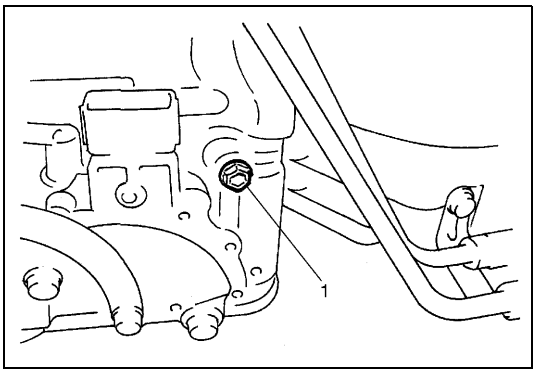
Test result	Possible cause
When “N” → “D” time lag exceeds specification.	• Low line pressure • Worn front clutch • Worn 1st & 2nd brake
When “N” → “R” time lag exceeds specification.	• Low line pressure • Worn front clutch • Worn reverse brake

Line Pressure Test

Purpose of this test is to check operating conditions of each part by measuring fluid pressure in fluid pressure line.
Line pressure test requires following conditions.

- Automatic fluid is at normal operating temperature (70 – 80 °C /158 – 176 °F).
- Fluid is filled to proper level (between FULL and LOW on dipstick).

1) Apply parking brake securely and place chocks against wheels.



2) Remove fluid pressure check hole plug bolt (1).
3) Attach oil pressure gauge to fluid pressure check hole in transmission case.

Special tool
(A) : 09925-37810

CAUTION:
After attaching oil pressure gauge, check that no fluid leakage exists.

4) Depress foot brake fully, run engine at idle and stall then check fluid pressure in “D” or “R” range.

CAUTION:
Do not continue running engine at stall speed longer than 5 seconds.

Automatic transmission line pressure

	“D” range	“R” range
At idle speed	**8.2 – 9.6 kg/cm^2 116.6 – 136.5 psi**	**13.0 – 16.0 kg/cm^2 184.9 – 227.5 psi**
At stall speed	**8.2 – 9.6 kg/cm^2 116.6 – 136.5 psi**	**13.0 – 16.0 kg/cm^2 184.9 – 227.5 psi**

Troubleshooting

Test result	Possible cause
Line pressure higher than standard level in each range	• Malfunctioning regulator valve
Line pressure lower than standard level in each rang	• Malfunctioning regulator valve • Defective oil pump
Line pressure lower than standard level only in “D” range	• Fluid leakage from “D” range pressure circuit • Fluid leakage from 1st & 2nd brake • Fluid leakage from front clutch
Line pressure lower than standard level only in “R” range	• Fluid leakage from “R” range pressure circuit • Fluid leakage from front clutch • Fluid leakage from reverse brake

Engine Brake Test

WARNING:
Before test, make sure that there is no vehicle behind so as to prevent rear-end collision.

1) While driving vehicle in 3rd gear of “D” range, shift select lever down to “2” range and check if engine brake operates.
2) In the same way as in Step 1), check engine brake for operation when select lever is shifted down to “L” range.
3) Engine brake should operate in above test.

Troubleshooting

Test result	Possible cause
Fails to operate when shifted down to “2” range	• Defective shift switch
Fails to operate when shifted down to “L” range	• 1st & 2nd brake defective • Defective A/T

“P” Range Test

1) Stop vehicle on a slope, shift select lever to “P” range and at the same time apply parking brake.
2) After stopping engine, depress brake pedal and release parking brake.
3) Then, release brake pedal gradually and check that vehicle remains stationary.
4) Depress brake pedal and shift select lever to “N” range.
5) Then, release brake pedal gradually and check that vehicle moves.

WARNING:
Before test, check that no one is around vehicle or down on a slope and keep watchful for safety during test.

Troubleshooting

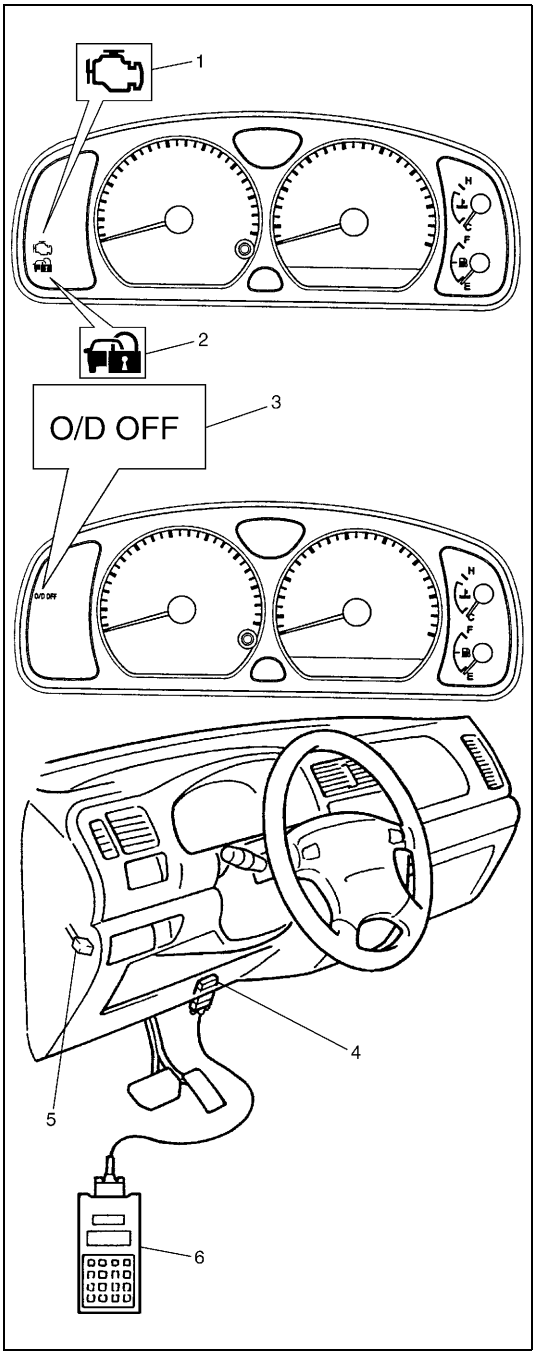
Test result	Possible cause
Vehicle moves at “P” range or remains stationary at “N” range	Defective parking lock pawl or spring

Electronic Control System Diagnosis

TCM has on-board diagnostic system (a system self-diagnosis function).
Investigate where the trouble is by referring to “Diagnostic Flow Table” and “Diagnostic Trouble Code Table” on later pages.

Precautions in diagnosing troubles

[PRECAUTIONS IN IDENTIFYING DIAGNOSTIC TROUBLE CODE]

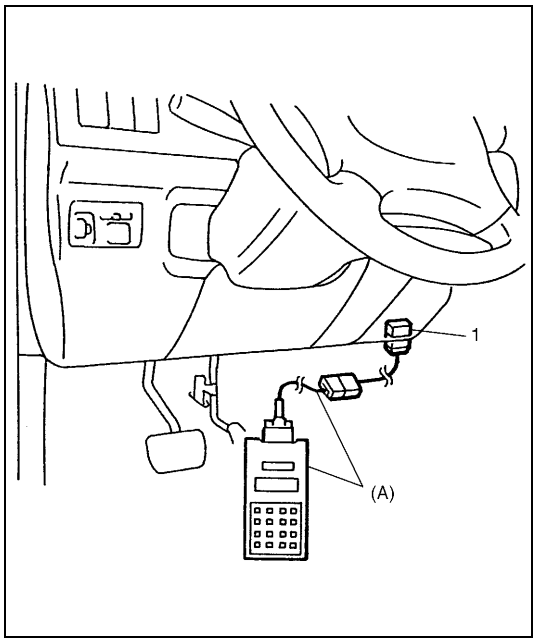


- For vehicle equipped with immobilizer indicator lamp (2) (which comes on when turning on ignition switch leaving engine OFF), malfunction indicator lamp (MIL) (1) comes on when TCM detests malfunction of automatic transmission system.
  But MIL does not come on in case of DTC P1887.
- For vehicle equipped without immobilizer indicator lamp (2), malfunction indicator lamp (MIL) (1) does not come on although TCM detests malfunction of automatic transmission system.
- Using SUZUKI scan tool (Tech-1) (6), diagnostic trouble code (DTC) stored in TCM memory can be checked and cleared as well.
  Before its use, be sure to read Operator’s (instruction) Manual supplied with it carefully to have good understanding of its functions and usage.
- Not using scan tool, the DTC stored in TCM memory also can be checked and cleared.
  DTC stored in the TCM memory is outputted by flashing of “O/D OFF” lamp (3) with diagnosis switch terminal of monitor connector No.2 (5) grounded.
  If no DTC is stored in TCM memory, DTC No.12 is outputted repeatedly.
  If no DTC is stored in TCM memory, they are outputted starting from smallest code number in increasing order.
  After all DTCs are outputted, all DTCs are outputted repeatedly.
- Be sure to read “Precautions for Electrical Circuit Service” in Section 0A before inspection and observe what is written there.
- When replacing TCM with used one, learning control memory in TCM should be initialized after the replacement referring to “Learning Control Memory Initialization” in this section.

4. Data link connector (DLC)

Diagnostic Trouble Code(s) Check

[Check DTC with SUZUKI scan tool]

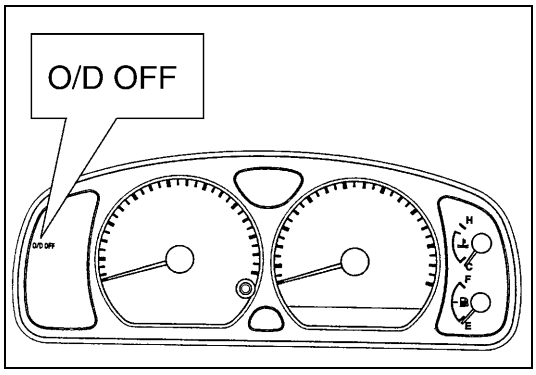


1) Turn ignition switch OFF.
2) After setting cartridge to connect SUZUKI scan tool to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

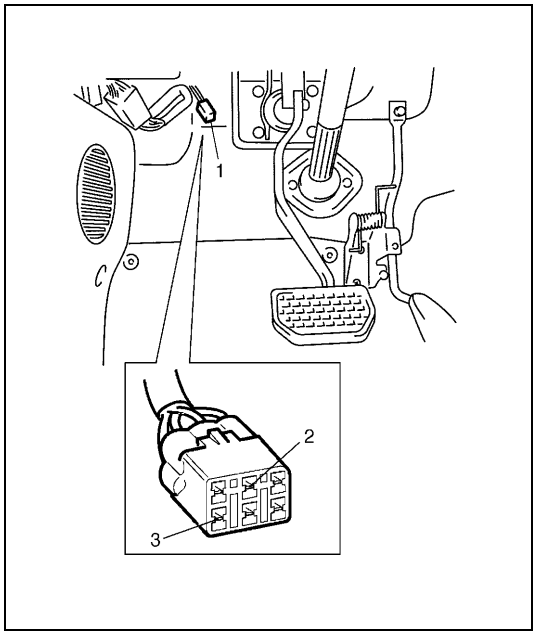
Special tool
(A) : SUZUKI scan tool

3) Turn ignition switch 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.
5) After completing the check, turn ignition switch OFF and disconnect SUZUKI scan tool from data link connector (DLC).

[Check DTC without SUZUKI scan tool]

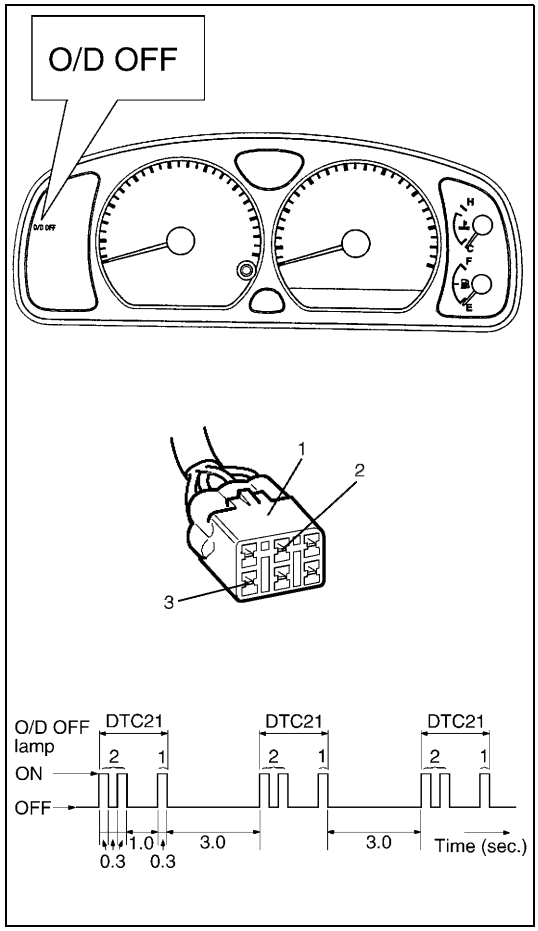


1) Turn ignition switch ON and make sure that O/D OFF light is OFF in combination meter (O/D off switch OFF).



2) Turn ignition switch OFF.
3) Using service wire, ground diagnosis switch terminal (2) of monitor connector No.2 (1).

3. Ground terminal



4) Read DTC from flashing pattern of O/D OFF lamp.

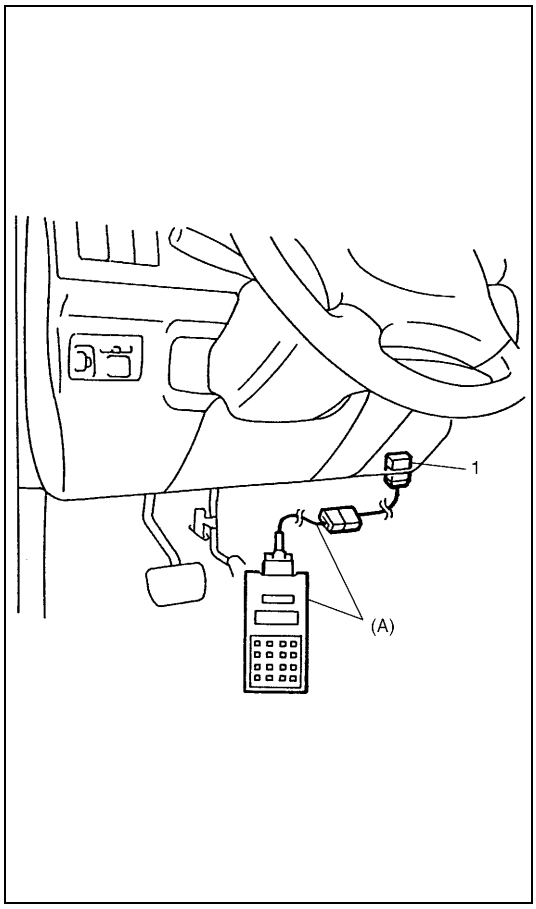
5) After completing the DTC check, turn ignition switch OFF and disconnect service wire from monitor connector No.2 (1).

2.	Diagnosis switch terminal
3.	Ground terminal

Diagnostic Trouble Code(s) Clearance

[Clear DTC with SUZUKI scan tool]

1) Turn ignition switch OFF.



2) After setting cartridge to SUZUKI scan tool connect it to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

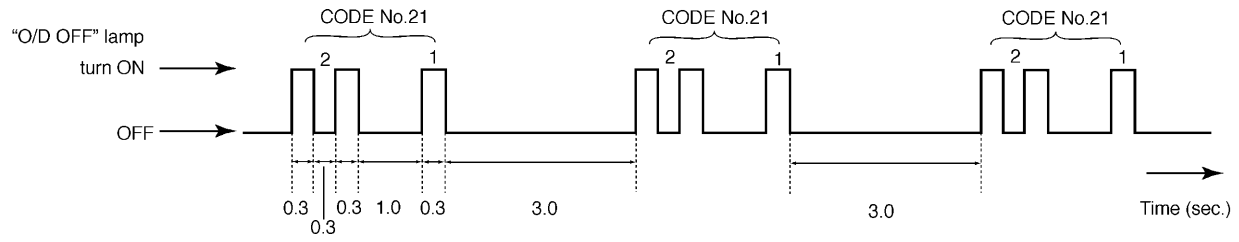
Special tool
(A) : SUZUKI scan tool

3) Turn ignition switch ON.
4) 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 OFF and disconnect SUZUKI scan tool from data link connector (DTC).

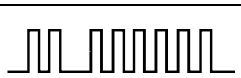
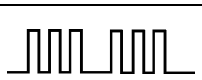
[Clear DTC without SUZUKI scan tool]

1) Turn ignition switch ON.
2) Using service wire ground diagnosis switch terminal of monitor connector No.2 five times within 10 seconds.
3) Perform "DTC Check" and confirm that only DTC 12 (normal DTC) is displayed. If not repeat step 1) and 2) and check again.

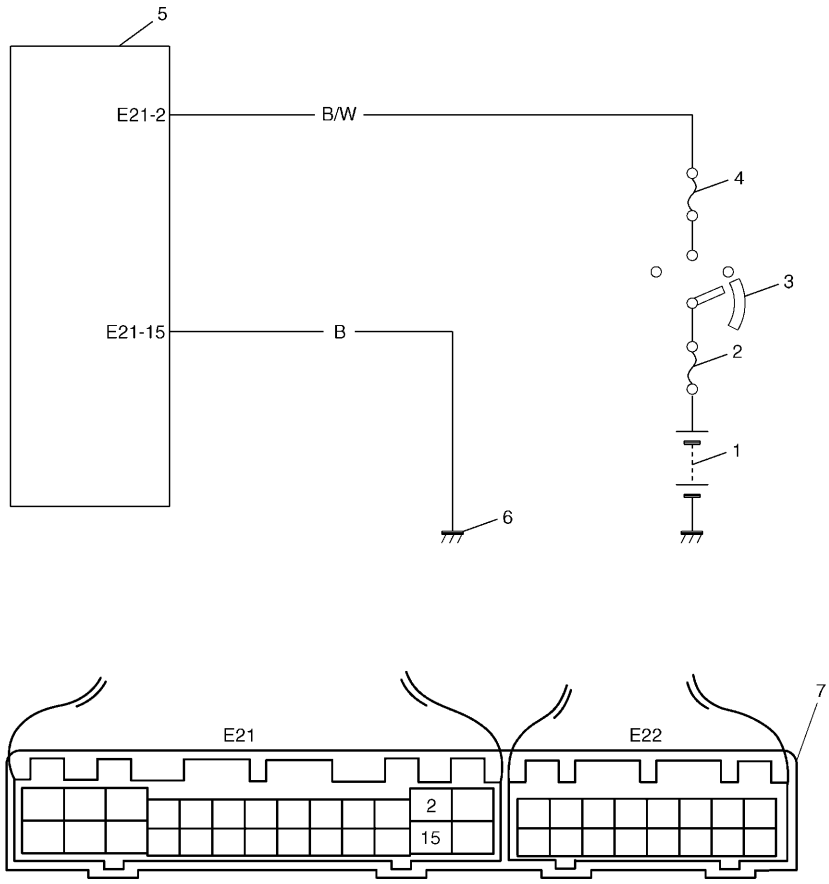
Diagnostic Trouble Code (DTC) Table



DTC NO.		"O/D OFF" Light Flashing Pattern of DTC (Not using scan tool)	DETECTING ITEMS	MIL	
Using scan tool	Not using scan tool			Vehicle equipped with immobilizer indicator lamp	Vehicle equipped without immobilizer indicator lamp
–	12		Normal	–	–
P0715	14		Input/Turbine speed sensor circuit	1 driving cycle	Not applicable
P0730	18		Incorrect gear ratio	2 driving cycles	Not applicable
P0753	21		Shift solenoid-A electrical	1 driving cycle	Not applicable
	22				
P0758	23		Shift solenoid-B electrical	1 driving cycle	Not applicable
	24				
P0763	43		Shift solenoid-C electrical	1 driving cycle	Not applicable
	44				
P0768	45		Shift solenoid-D electrical	1 driving cycle	Not applicable
	46				

DTC NO.		"O/D OFF" Light Flashing Pattern of DTC (Not using scan tool)	DETECTING ITEMS	MIL	
Using scan tool	Not using scan tool			Vehicle equipped with immobilizer indicator lamp	Vehicle equipped without immobilizer indicator lamp
P0743	25		Torque converter clutch (lock-up clutch) circuit electrical	1 driving cycle	Not applicable
	26				
P0741	29		Torque converter clutch (lock-up clutch) circuit performance or stuck off	2 driving cycles	Not applicable
P0720	31		Output shaft speed sensor circuit	1 driving cycle	Not applicable
P1700	32		Throttle position signal input malfunction	1 driving cycle	Not applicable
	33				
P0705	34		Transmission range sensor circuit malfunction	1 driving cycle	Not applicable
P0725	35		Engine speed input circuit	2 driving cycles	Not applicable
P0710	36		Transmission fluid temperature sensor circuit	2 driving cycles	Not applicable
	38				
P1709	51		Engine coolant temperature signal circuit	1 driving cycle	Not applicable
P0702	52		Transmission control system electrical	1 driving cycle	Not applicable
P1702			Internal malfunction of TCM		
P1887	57		VSS signal circuit	Not applicable	Not applicable

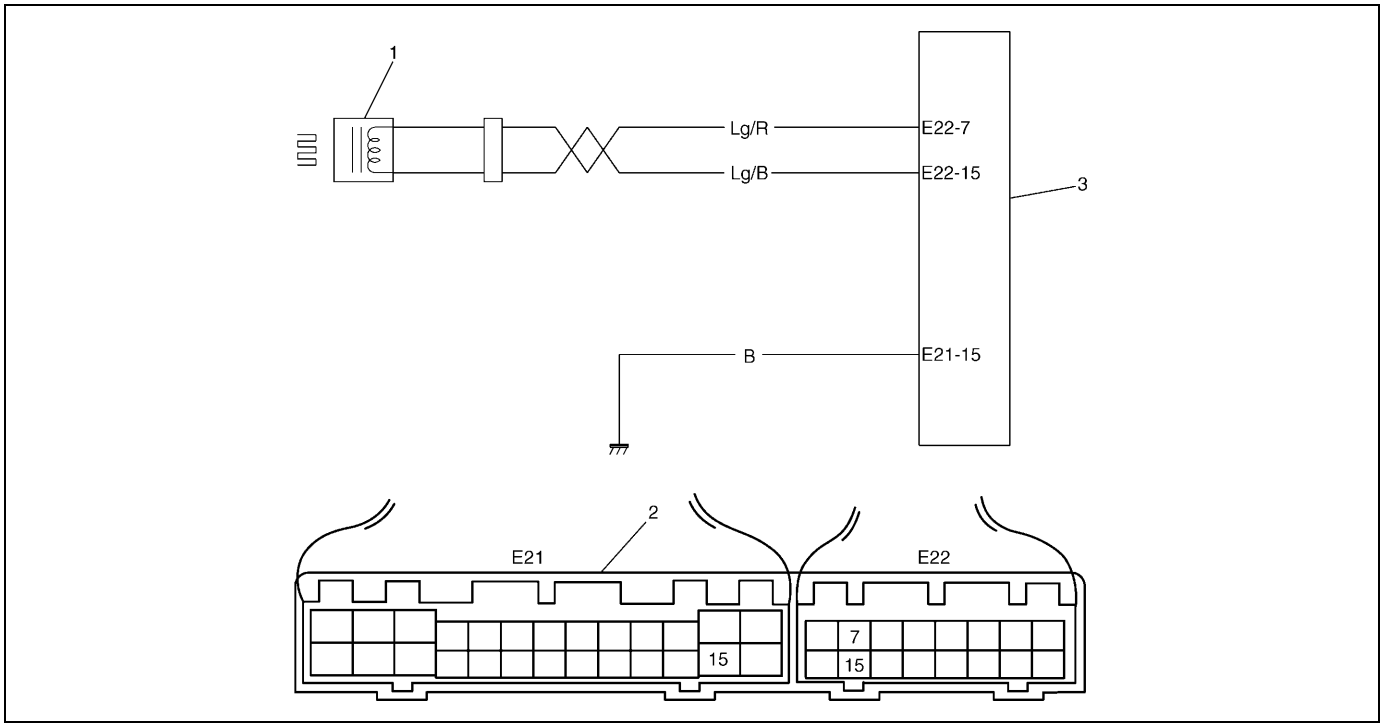
TCM Power and Ground Circuit Check



1. Battery	4. Circuit fuse (IG)	7. Terminal arrangement of TCM coupler (Viewed from harness side)
2. Main fuse	5. TCM	
3. Ignition switch	6. Ground	

Step	Action	Yes	No
1	Check voltage between terminal “E21-2” of TCM coupler and body ground with ignition switch ON. Is it 10 – 14 V?	Go to Step 2.	“B/W” wire open.
2	Check voltage between terminal “E21-15” of TCM coupler and body ground with ignition switch ON. Is it about 0 V?	Poor “E21-2” or “E21-15” connection. If all above are OK, substitute a known-good TCM and recheck.	“B” wire open.

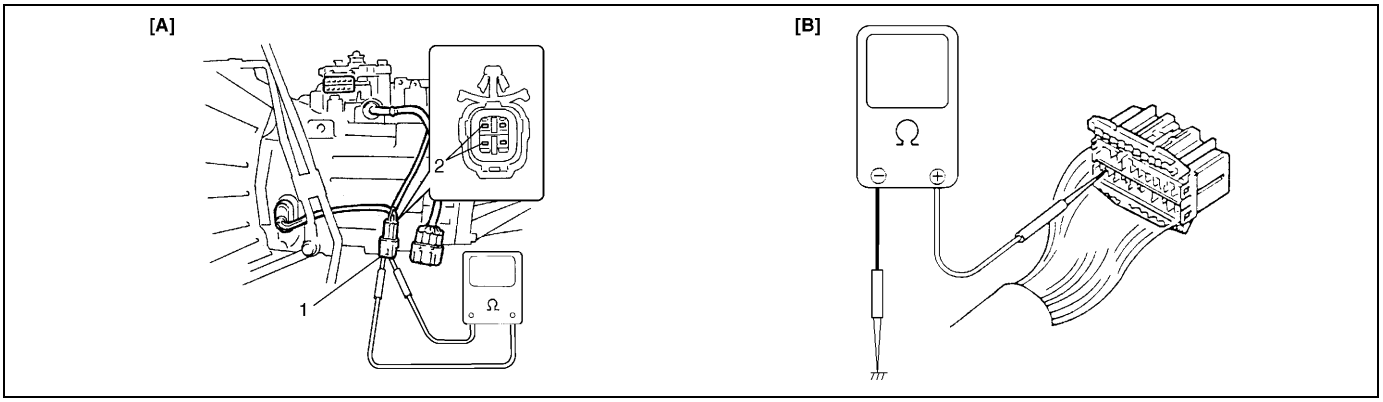
DTC P0715/DTC No.14 Input / Turbine Speed Sensor Circuit



1. Input shaft speed sensor	2. Terminal arrangement of TCM coupler (viewed from harness side)	3. TCM

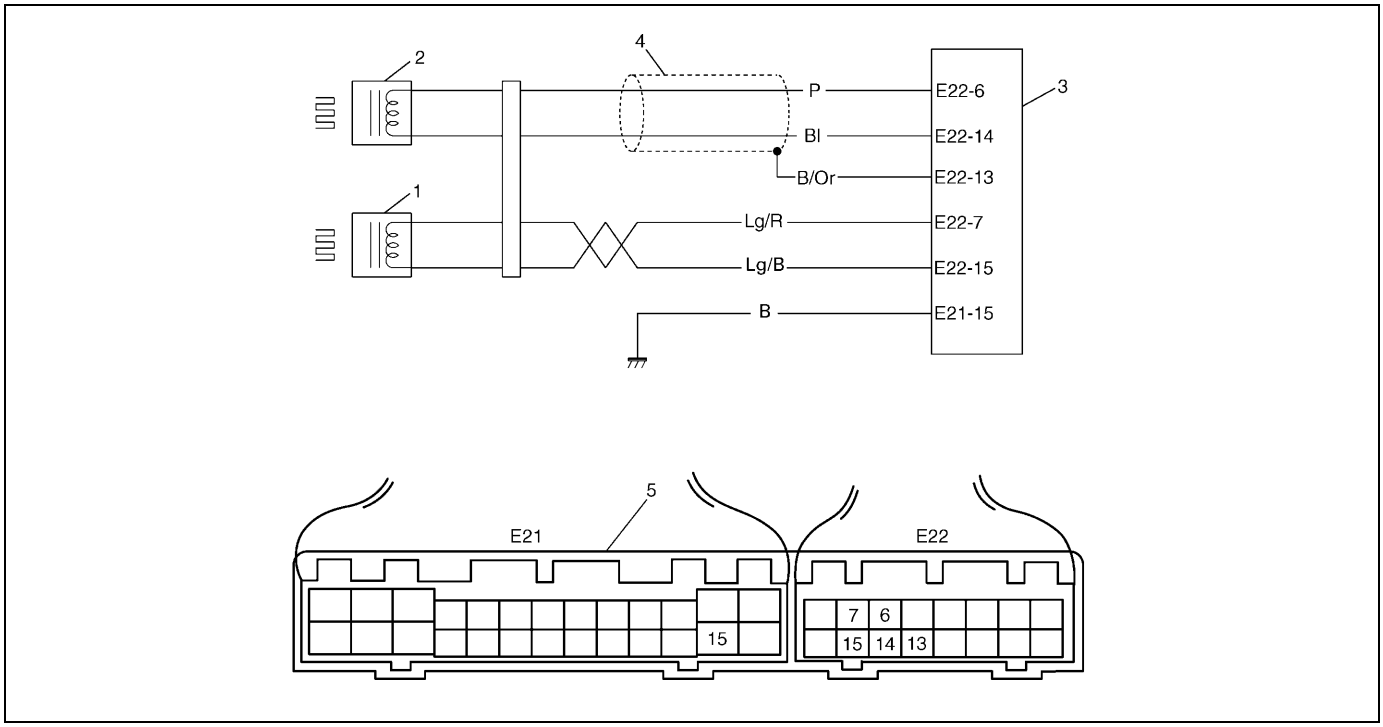
DTC DETECTING CONDITION
Input shaft speed sensor signal voltage is too high or too low.

Step	Action	Yes	No
1	Was “Automatic Transmission Diagnostic Flow Chart” performed?	Go to Step 2.	Go to “Automatic Transmission Diagnostic Flow Chart”.
2	1) Turn ignition switch OFF and disconnect output shaft speed sensor – input shaft speed sensor coupler. 2) Measure resistance between terminals of the disconnected sensor side coupler. Is it 160 – 200 Ω? See figure.	Go to Step 3.	Replace input shaft speed sensor.
3	1) Connect output shaft speed sensor – input shaft speed sensor coupler then disconnect TCM couplers. 2) Measure resistance between terminal “E22-7” and “E22-15” of disconnected harness side coupler. Is it 160 – 200 Ω?	Go to Step 4.	“Lg/R” or “Lg/B” wire open or shorted each other.
4	1) Turn ignition switch OFF and connect input shaft speed sensor coupler then disconnect TCM couplers. 2) Measure resistance between terminal “E22-7” of disconnected harness side coupler and body ground then terminal “E22-15” of disconnected harness side coupler and body ground. Are they about 0 Ω? See figure.	Short in between “Lg/R” wire and ground or “Lg/B” wire and ground.	Poor connection of terminal “E22-7” or “E22-15” of TCM. If all the above are in good condition, substitute a known-good TCM and recheck.



[A]: Fig. for Step 2
[B]: Fig. for Step 4
1. Input shaft speed sensor coupler
2. Input shaft speed sensor terminal

DTC P0730/DTC No. 18 Incorrect Gear Ratio



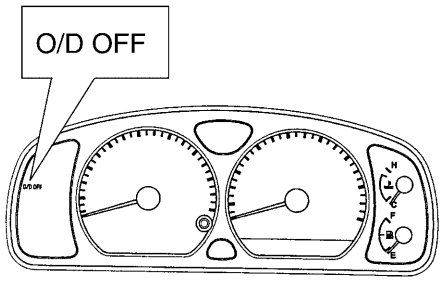
1. Input shaft speed sensor	4. Shield wire
2. Output shaft speed sensor	5. Terminal arrangement of TCM coupler (viewed from harness side)
3. TCM	

DTC DETECTING CONDITION
Difference in detected revolution between input shaft speed sensor and output shaft speed sensor is too wide.

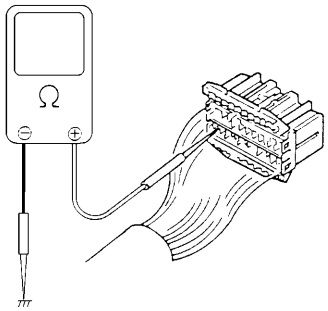
Step	Action	Yes	No
1	Check if DTC P0730/DTC No.18 displayed with DTC P0715/DTC No.14 or DTC P0720/DTC No.31. Is DTC P0730/DTC No.18 displayed with DTC P0715/DTC No.14 or DTC P0720/DTC No.31? See figure.	Inspect according to DTC P0715/DTC No.14 or DTC P0720/DTC No.31 flow table first.	Go to Step 2.
2	1) Turn ignition switch OFF and disconnect TCM couplers. 2) Measure resistance between terminal “E22-13” of the disconnected harness side coupler and body ground. Is it about 0 Ω? See figure.	Short in between shield portion or “B/Or” wire and ground.	Go to Step 3.

Step	Action	Yes	No
3	Check input shaft speed sensor and output shaft speed sensor referring to each item in this section. Are they OK? See figure.	• Broken wire in shield portion or broken “B/Or” wire, or shorted to power source circuit. • Malfunction of A/T itself (clutch slipping, etc.) If all the above are in good condition, substitute a known-good TCM and recheck.	Inspect and replace referring to each item in this section.

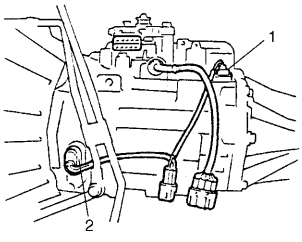
[A]



[B]

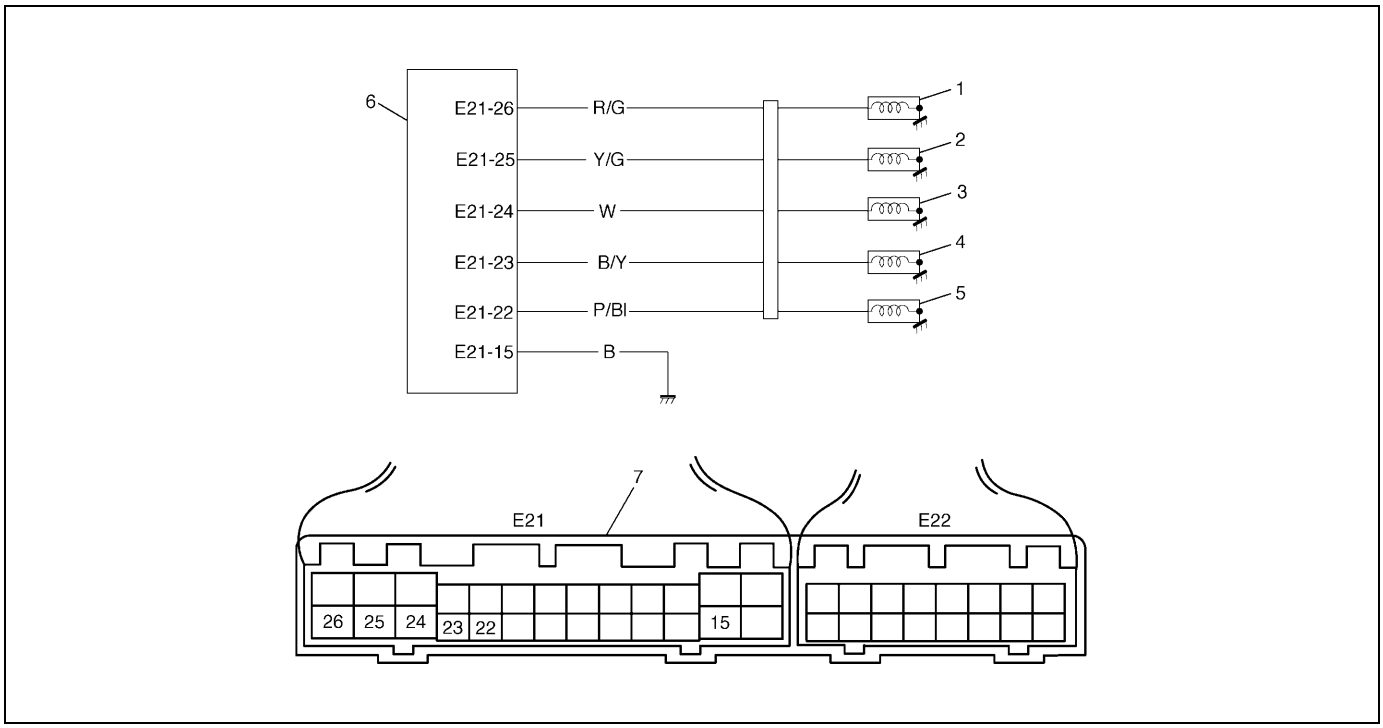


[C]



[A]: Fig. for Step 1
[B]: Fig. for Step 2
[C]: Fig. for Step 3
1. Output shaft speed sensor
2. Input shaft speed sensor

DTC P0753/DTC No.21/22 Shift Solenoid-A (No.1) Electrical
DTC P0758/DTC No.23/24 Shift Solenoid-B (No.2) Electrical
DTC P0763/DTC No.43/44 Shift Solenoid-C (No.3) Electrical
DTC P0768/DTC No.45/46 Shift Solenoid-D (No.4) Electrical
DTC P0743/DTC No.25/26 TCC (Lock-Up Clutch) Circuit Electrical



1. Shift solenoid-A (No.1)	4. Shift solenoid-D (No.4)	7. Terminal arrangement of TCM coupler (viewed from harness side)
2. Shift solenoid-B (No.2)	5. TCC (lock-up) solenoid	
3. Shift solenoid-C (No.3)	6. TCM	

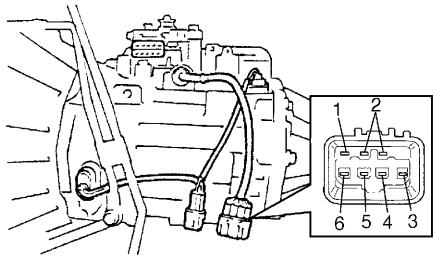
DTC DETECTING CONDITION
• Solenoid output voltage is too high although TCM orders solenoid to turn OFF.
• Solenoid output voltage is too low although TCM orders solenoid to turn ON.

Step	Action	Yes	No
1	1) Turn ignition switch OFF and disconnect solenoid coupler. 2) Measure the resistance between each solenoid terminal of the solenoid side coupler and transmission ground. Is it 11 – 15 Ω? See figure.	Go to Step 2.	• Solenoid lead wire open or shorted to ground. • Malfunction of solenoid.
2	Is DTC No.22, 24, 44, 46 or 26?	Go to Step 4.	Go to Step 3.
3	Is DTC No.21, 23, 43, 45 or 25?	Go to Step 6.	Go to Step 5. (When DTC is P0753, P0758, P0763, P0768 or P0743.)

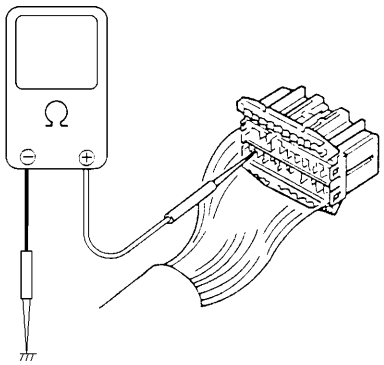
Step	Action	Yes	No
4	1) Disconnect TCM couplers. 2) Measure the resistance between terminal "E21-26", "E21-25", "E21-24", "E21-23" or "E21-22" of the disconnected harness side TCM coupler and body ground. Is it about 0 Ω? See figure.	"R/G", "Y/G", "W", "B/Y" or "P/Bl" wire shorted to ground.	Substitute a known-good TCM and recheck.
5	1) Disconnect TCM couplers. 2) Measure the resistance between terminal "E21-26", "E21-25", "E21-24", "E21-23" or "E21-22" of the disconnected harness side TCM coupler and body ground. Is it about 0 Ω? See figure.	"R/G", "Y/G", "W", "B/Y" or "P/Bl" wire shorted to ground.	Go to Step 6.
6	1) Connect solenoid coupler then disconnect TCM couplers. 2) Measure the resistance between each solenoid terminal of the disconnected harness side TCM coupler and body ground. Is it 11 – 15 Ω?	Go to Step 7.	"R/G", "Y/G", "W", "B/Y" or "P/Bl" wire open or poor connection of shift solenoid coupler.
7	Turn ignition switch ON then measure voltage between terminal "E21-26", "E21-25", "E21-24", "E21-23" or "E21-22" of the disconnected harness side TCM coupler and body ground. Is it about 0 V?	Poor connection at terminal "E21-26", "E21-25", "E21-24", "E21-23" or "E21-22" of TCM. If all the above are in good condition, substitute a known-good TCM and recheck.	"R/G", "Y/G", "W", "B/Y" or "P/Bl" wire or shift solenoid lead wire shorted to power source circuit.

Solenoid	Terminal Number	Lead Wire Color	Terminal Number of Shift Solenoid Coupler (shift solenoid side)
Shift solenoid-A (No.1)	E21-26	R/G	3
Shift solenoid-B (No.2)	E21-25	Y/G	4
Shift solenoid-C (No.3)	E21-24	W	5
Shift solenoid-D (No.4)	E21-23	B/Y	6
TCC (lock-up) solenoid	E21-22	P/Bl	1

[A]



[B]



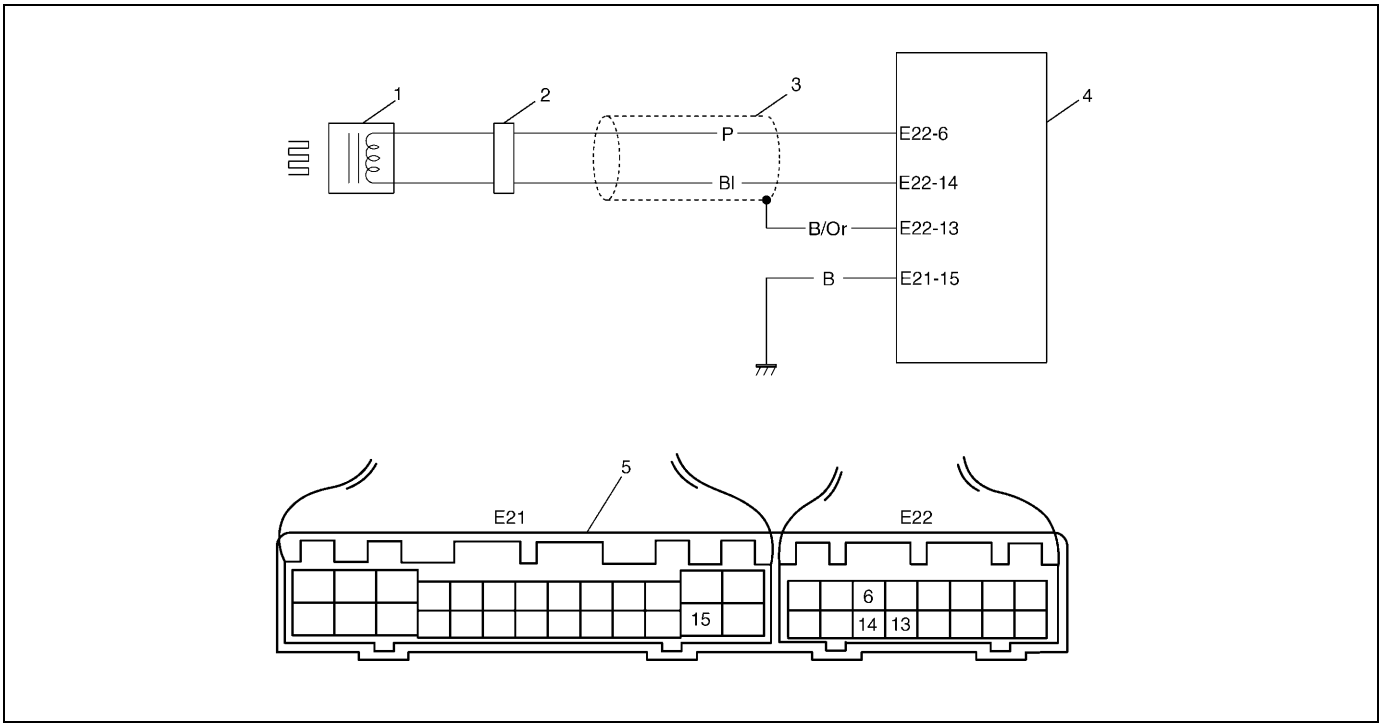
[A]: Fig. for Step 1/5	2. Transmission fluid temp. sensor terminal	5. Shift solenoid-C (No.3) terminal
[B]: Fig. for Step 4	3. Shift solenoid-A (No.1) terminal	6. Shift solenoid-D (No.4) terminal
1. TCC (lock-up) solenoid terminal	4. Shift solenoid-B (No.2) terminal	

DTC P0741/DTC No.29 TCC (Lock-Up) Circuit Performance or Stuck OFF

DTC DETECTING CONDITION
• Difference between turbine rev. and engine rev. is too close even though TCM ordered TCC solenoid to turn OFF. • Difference between turbine rev. and engine rev. is too wide even though TCM ordered TCC solenoid to turn ON.

Step	Action	Yes	No
1	Was “Automatic Transmission Diagnostic Flow Chart” performed?	Go to Step 2.	Go to “Automatic Transmission Diagnostic Flow Chart”.
2	Check TCC (lock-up) solenoid referring to “Shift Solenoid Valve and TCC (Lock-Up) Solenoid Valve Inspection” in this section. Is it in good condition?	Go to Step 3.	Replace TCC (lock-up) solenoid.
3	Check valve body for fluid passage clog, or lock-up control valve, secondary regulator valve or signal valve stuck, referring to “Transmission Unit Repair Overhaul” in this section. Are they in good condition?	Go to Step 4.	Faulty valve body.
4	Substitute a known-good torque converter and recheck. Is it OK?	Torque converter malfunction.	Overhaul and repair automatic transmission.

DTC P0720/DTC No. 31 Output Shaft Speed Sensor Circuit

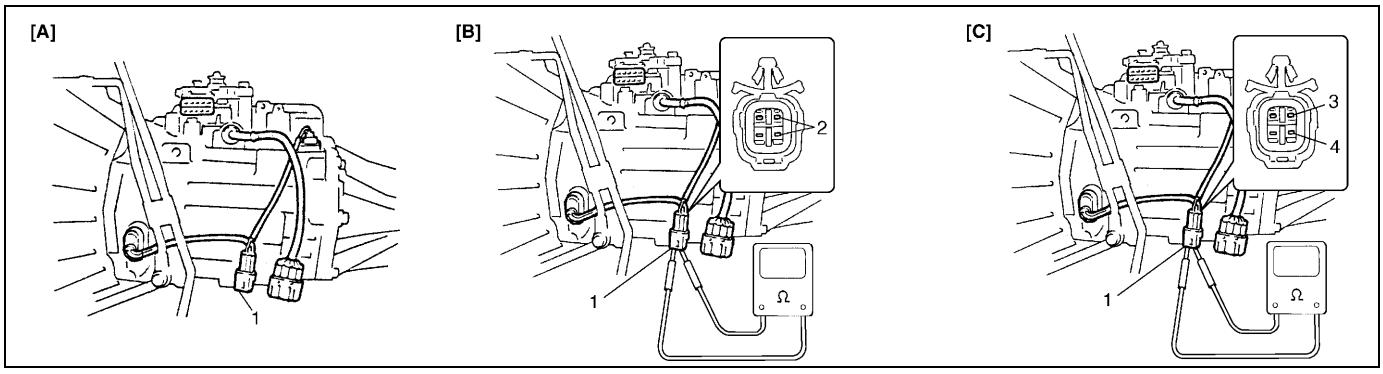


1. Output shaft speed sensor (A/T VSS)	4. TCM
2. Coupler	5. Terminal arrangement of TCM coupler (viewed from harness side)
3. Shield wire	

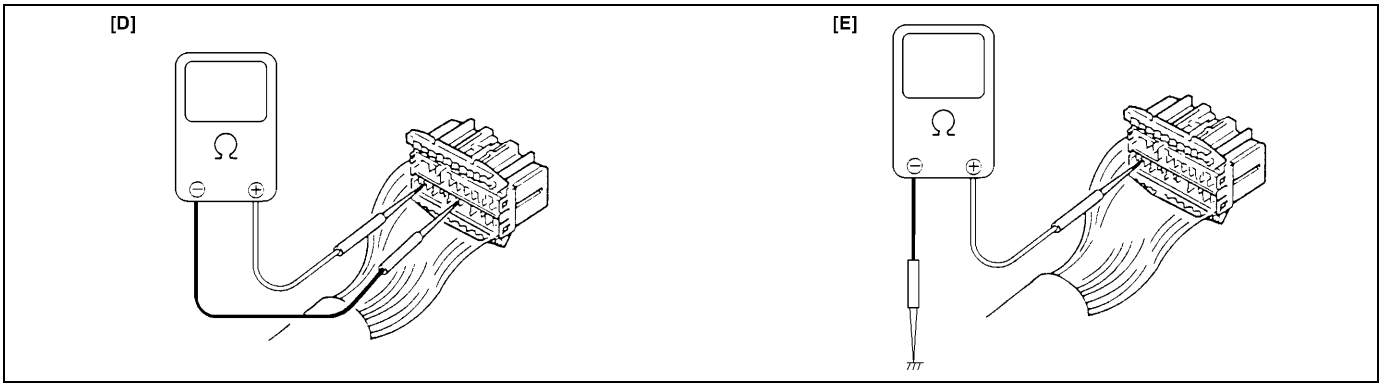
DTC DETECTING CONDITION
Output shaft speed sensor signal voltage is too high or too low.

Step	Action	Yes	No
1	1) Turn ignition switch OFF and disconnect output shaft speed sensor – input shaft speed sensor coupler (1). See figure. 2) Measure resistance between terminals of disconnected sensor side coupler. Is it 160 – 200 Ω? See figure.	Go to Step 2.	Replace output shaft speed sensor.
2	1) Connect output shaft speed sensor coupler then disconnect TCM couplers. 2) Measure resistance between terminal “E22-6” and “E22-14” of disconnected harness side coupler. Is it 160 – 200 Ω? See figure.	Go to Step 3.	“P” or “Bl” wire open or shorted each other.

Step	Action	Yes	No
3	1) Turn ignition switch OFF and disconnect output shaft speed sensor – input shaft speed sensor coupler. See figure. 2) Measure resistance between terminal “3” of disconnected sensor side coupler and body ground then terminal “4” of disconnected sensor side coupler and body ground. Is it about 0 Ω? See figure.	Replace output shaft speed sensor.	Go to Step 4.
4	1) Turn ignition switch OFF and connect output shaft speed sensor coupler then disconnect TCM couplers. 2) Measure resistance between terminal “E22-6” of disconnected harness side coupler and body ground then terminal “E22-14” of disconnected harness side coupler and body ground. Is it about 0 Ω? See figure.	“P” or “Bl” wire shorted to ground.	Go to Step 5.
5	Measure resistance between terminal “E22-6” and “E22-13” of disconnected harness side coupler then terminal “E22-14” and “E22-13” of disconnected harness side coupler. Is it about 0 Ω? See figure.	“P” wire or “B” wire shorted to shield portion.	Poor connection of terminal “E22-6” or “E22-14” of the TCM. If all the above are in good condition, substitute a known-good TCM and recheck.

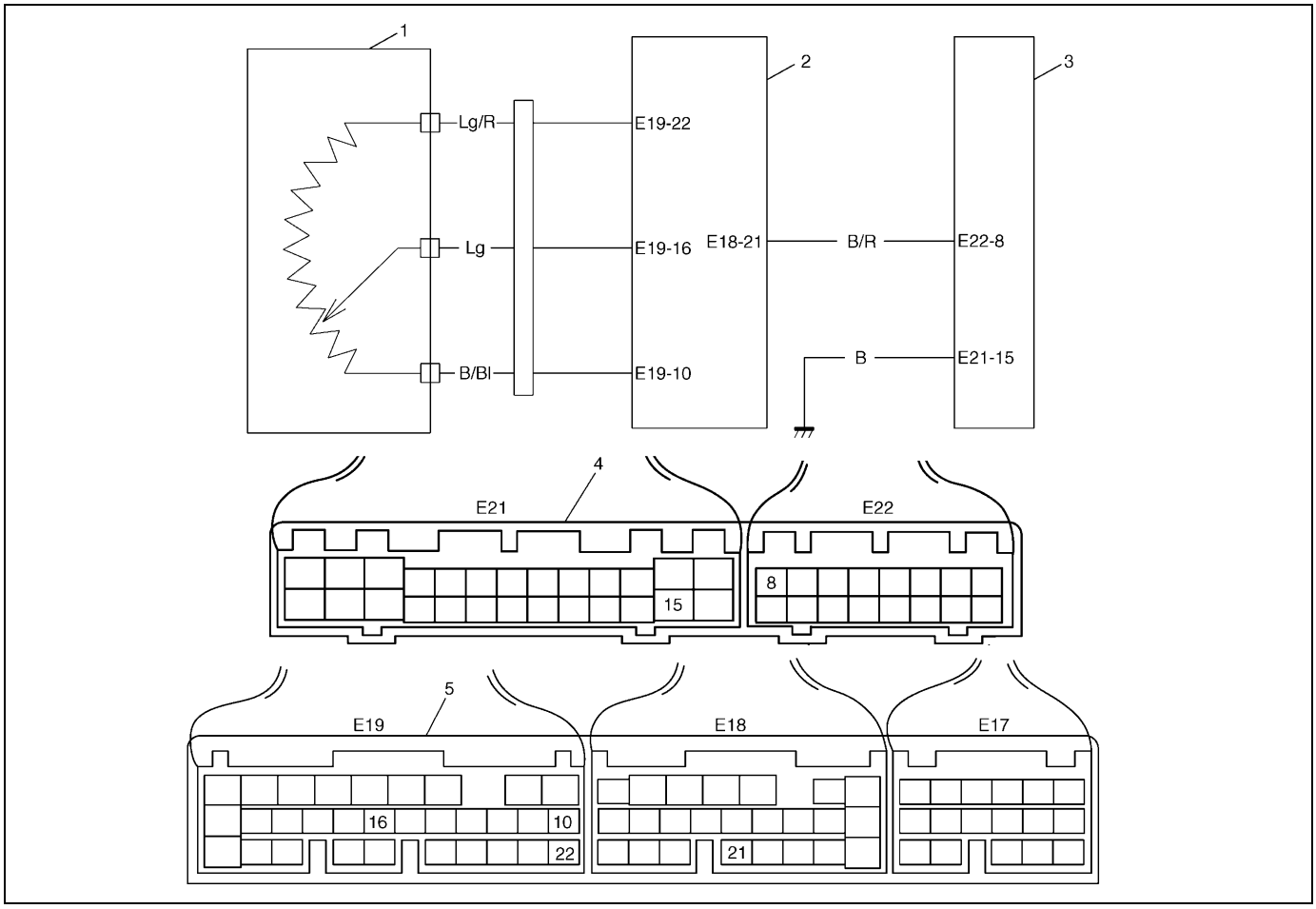


[A]: Fig. for Step 1/3	1. Output shaft speed sensor – input shaft speed sensor coupler	4. Terminal “4”
[B]: Fig. for Step 1	2. Output shaft speed sensor terminals	
[C]: Fig. for Step 3	3. Terminal “3”	



[D]: Fig. for Step 2/5
[E]: Fig. for Step 4

DTC P1700/DTC No.32/33 Throttle Position Signal Input Malfunction



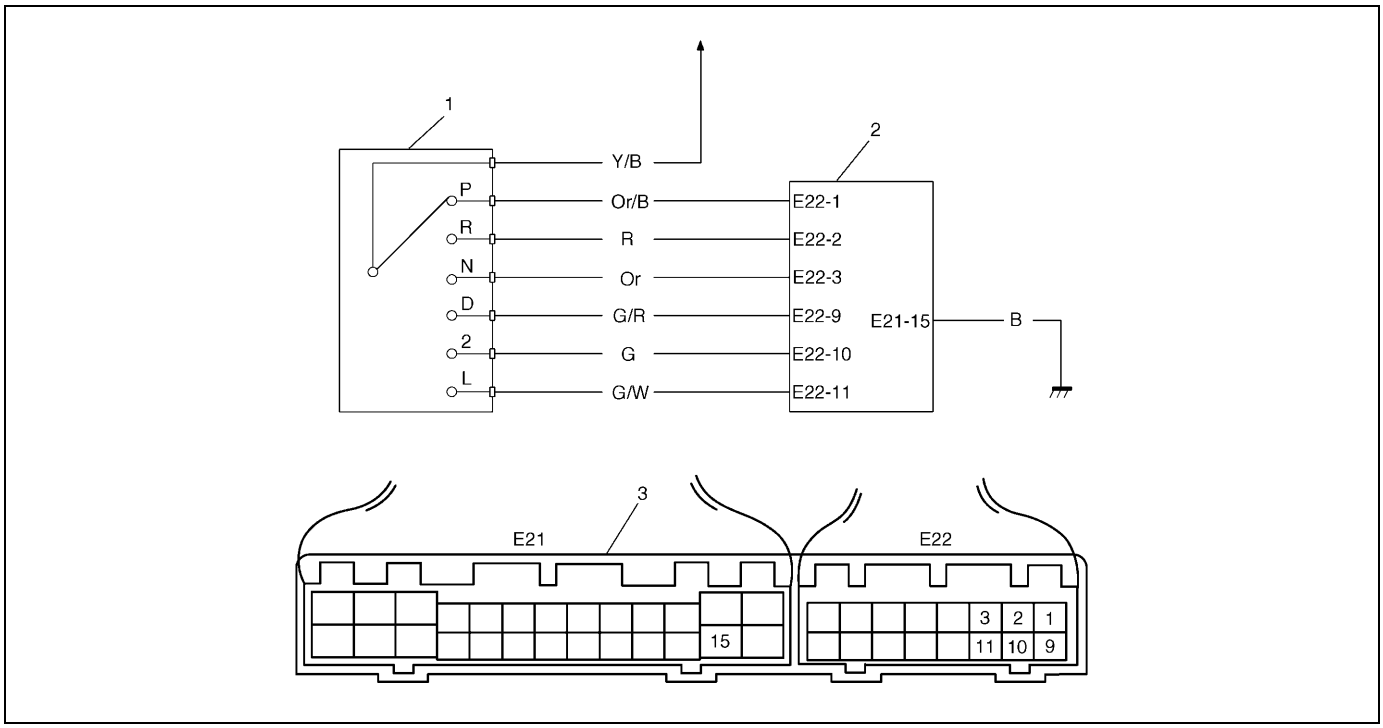
1. Throttle position (TP) sensor	4. TCM coupler (viewed from harness side)
2. ECM	5. Terminal arrangement of ECM coupler (viewed from harness side)
3. TCM	

DTC DETECTING CONDITION
NO or abnormal throttle opening signal is input.

Step	Action	Yes	No
1	Check DTC of “Engine Diagnosis” referring to Section 6. Is there DTC related to throttle position sensor detected?	Inspect and repair referring to DTC flow table of “Engine Diagnosis” in Section 6.	Go to Step 2.
2	Is DTC No.33?	Go to Step 4.	Go to Step 3.
3	Is DTC No.32?	Go to Step 5.	Go to Step 6. (When DTC is P1700.)
4	1) Turn ignition switch OFF and disconnect ECM couplers. 2) Turn ignition switch ON and check voltage between terminal “E18-21” of disconnected harness side ECM coupler and body ground. Is it 10 – 14 V?	Poor connection of terminal “E18-21” of ECM coupler. If connection is OK, substitute a known-good ECM and recheck.	“B/R” wire open or poor connection of terminal “E22-8” of TCM coupler. If wire and connection are OK, substitute a known-good TCM and recheck.

Step	Action	Yes	No
5	1) Turn ignition switch OFF and disconnect ECM couplers. 2) Turn ignition switch ON and check voltage between terminal “E18-21” of disconnected harness side ECM coupler and body ground. Is it 10 – 14 V?	Go to Step 7.	Substitute a known-good TCM and recheck.
6	1) Check for proper connection of terminal “E18-21” of ECM coupler. 2) If OK, turn ignition switch OFF and disconnect ECM couplers. 3) Turn ignition switch ON and check voltage between terminal “E18-21” of disconnected harness side ECM coupler and body ground. Is it 10 – 14 V?	Go to Step 7.	“B/R” wire open or poor connection of terminal “E22-8” of TCM coupler. If wire and connection are OK, substitute a known-good TCM and recheck.
7	1) Turn ignition switch OFF and disconnect TCM couplers. 2) Check resistance between terminal “E22-8” of disconnected harness side TCM coupler and body ground. Is it infinity?	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A. If no trouble found, substitute a known-good ECM and recheck.	“B/R” wire shorted to ground.

DTC P0705/DTC No.34 Transmission Range Sensor (Switch) Circuit Malfunction

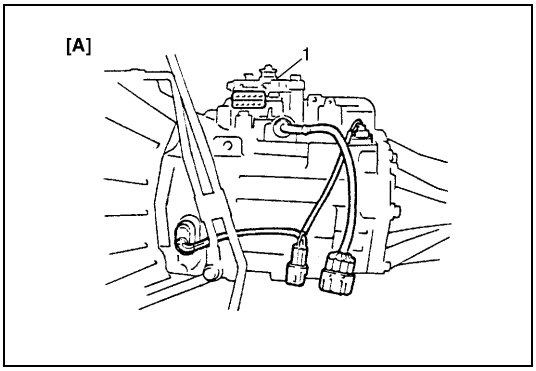


1. Transmission range sensor (switch)	3. Terminal arrangement of TCM coupler (viewed from harness side)
2. TCM	

DTC DETECTING CONDITION
No transmission range sensor signal is input or two or more transmission range sensor signals are input at the same time.

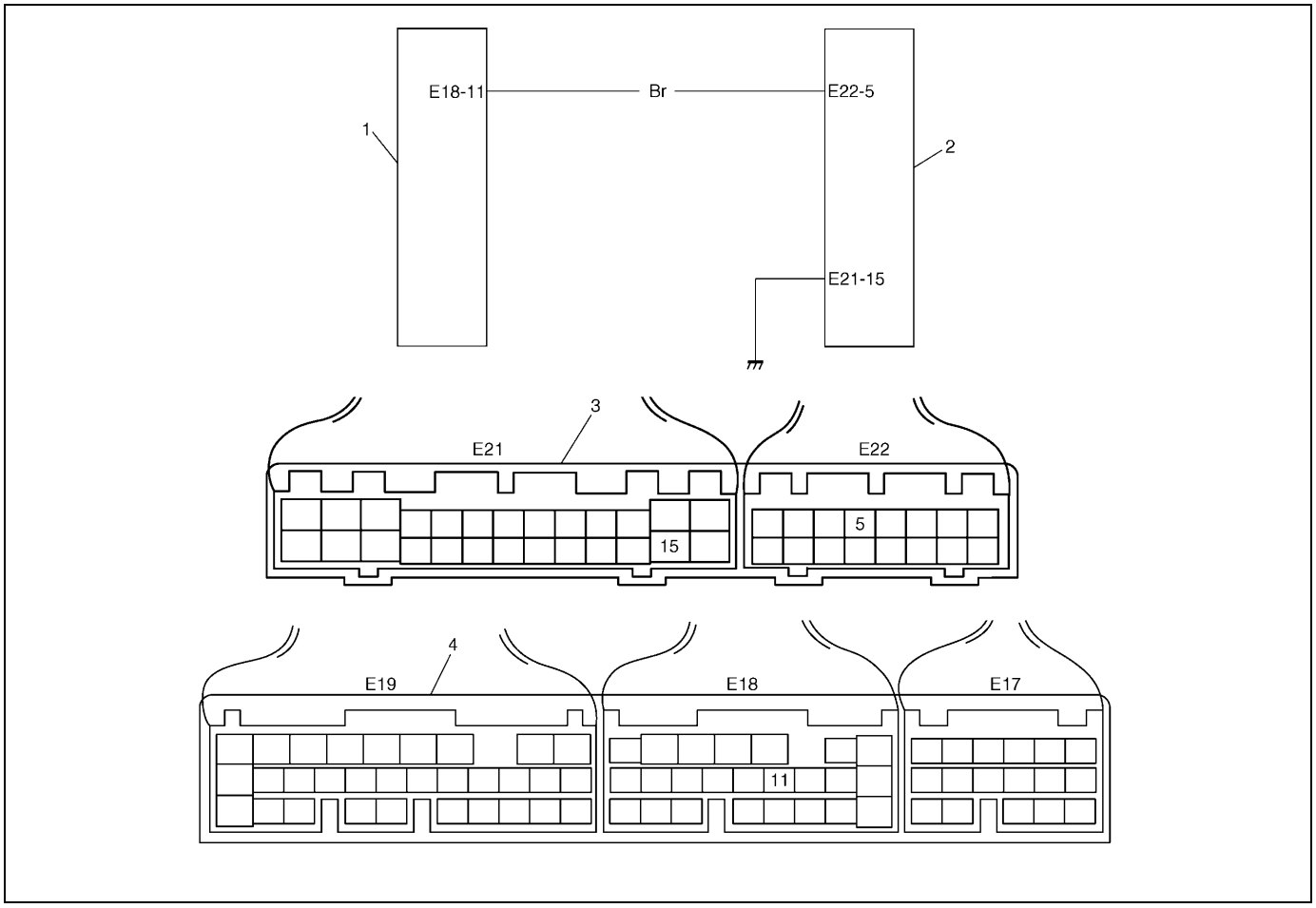
Step	Action	Yes	No
1	1) Turn ignition switch OFF, disconnect TCM coupler. 2) Turn ignition switch ON, check voltage between terminal “E22-1” and “E21-15” of disconnected harness side TCM coupler. Is it 10 – 14 V at “P” range and 0 V at the other range?	Go to Step 2.	Go to Step 7.
2	While ignition switch ON, check voltage between terminal “E22-2” and “E21-15” of disconnected harness side TCM coupler. Is it 10 – 14 V at “R” range and 0 V at the other range?	Go to Step 3.	Go to Step 7.
3	While ignition switch ON, check voltage between terminal “E22-3” and “E21-15” of disconnected harness side TCM coupler. Is it 10 – 14 V at “N” range and 0 V at the other range?	Go to Step 4.	Go to Step 7.

Step	Action	Yes	No
4	While ignition switch ON, check voltage between terminal “E22-9” and “E21-15” of disconnected harness side TCM coupler. Is it 10 – 14 V at “D” range and 0 V at the other range?	Go to Step 5.	Go to Step 7.
5	While ignition switch ON, check voltage between terminal “E22-10” and “E21-15” of disconnected harness side TCM coupler. Is it 10 – 14 V at “2” range and 0 V at the other range?	Go to Step 6.	Go to Step 7.
6	While ignition switch ON, check voltage between terminal “E22-11” and “E21-15” of disconnected harness side TCM coupler. Is it 10 – 14 V at “L” range and 0 V at the other range?	Intermittent trouble or faulty TCM. Check for intermittent trouble referring to “Intermittent and Poor Connection” in Section 0B.	Go to Step 7.
7	Check transmission range sensor referring in this section. Is it OK? See figure.	Transmission range sensor wire shorted. If wire harnesses are OK, substitute a known-good TCM and recheck.	Replace transmission range sensor.



[A]: Fig. for Step 7
1. Transmission range sensor

DTC P0725/DTC No.35 Engine Speed Input Circuit

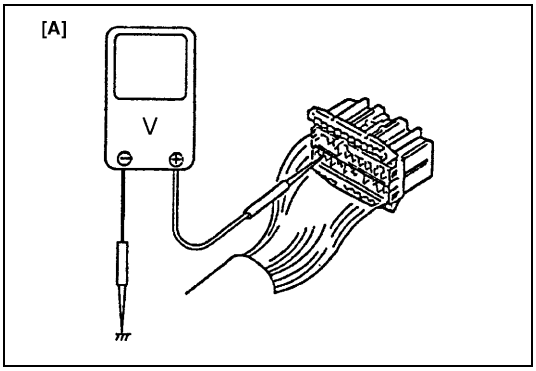


1. ECM	3. Terminal arrangement of TCM coupler (viewed from harness side)
2. TCM	4. Terminal arrangement of ECM coupler (viewed from harness side)

DTC DETECTING CONDITION
Input engine rev. signal voltage is too low or too high.

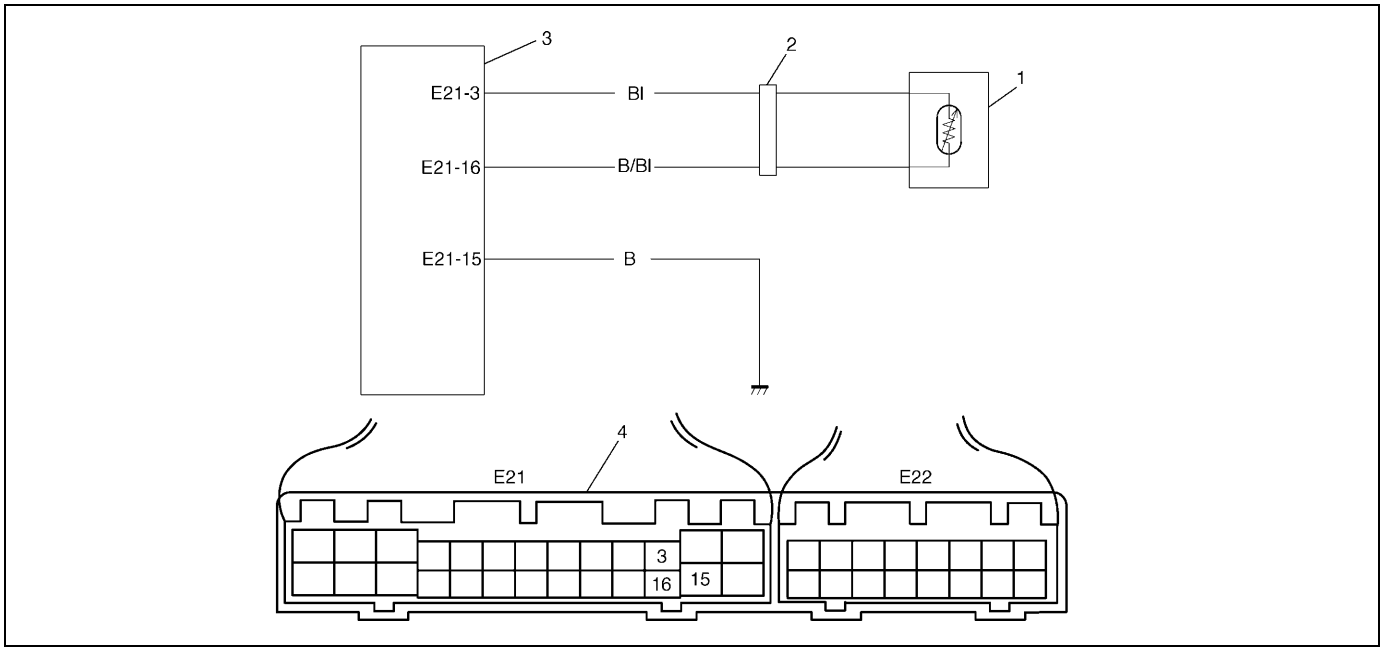
Step	Action	Yes	No
1	Check DTC of “Engine Diagnosis” referring to Section 6. Is there DTC related to engine speed sensor?	Inspect and repair referring to DTC flow table of “Engine Diagnosis” in Section 6.	Go to Step 2.
2	1) Turn ignition switch OFF and disconnect ECM or TCM couplers. 2) Measure resistance between terminal “E18-11” and “E22-5” of disconnected harness side coupler. Is it about 0 Ω?	Go to Step 3.	“Br” wire open.
3	Measure resistance between terminal “E22-5” of disconnected harness side coupler and body ground. See figure. Is it infinity?	Go to Step 4.	“Br” wire shorted to ground.

Step	Action	Yes	No
4	1) Turn ignition switch OFF and connect ECM couplers. 2) Turn ignition switch ON and measure voltage between terminal “E22-5” of disconnected harness side TCM coupler and body ground. Is it 10 – 14 V?	Intermittent trouble or faulty ECM or TCM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A. If no trouble found, substitute a known-good ECM or TCM and recheck.	“Br” wire is shorted to power circuit or faulty ECM. If “Br” wire is OK, substitute a known-good ECM and recheck.



[A]: Fig. for Step 3

DTC P0710/DTC No.36/38 Transmission Fluid Temperature Sensor Circuit



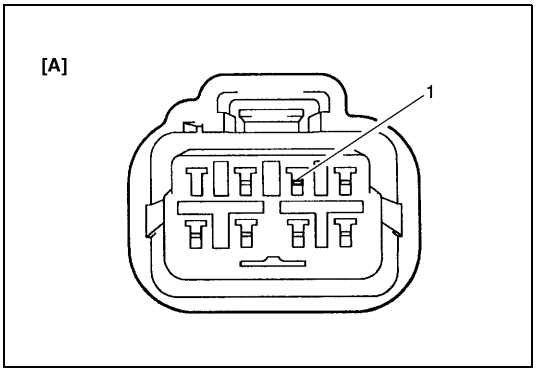
1. Transmission fluid temperature sensor	3. TCM
2. Coupler	4. Terminal arrangement of TCM coupler (viewed from harness side)

DTC DETECTING CONDITION

- Transmission fluid temperature signal input voltage is too low.
- Transmission fluid temperature signal input voltage does not go down although standard value of engine rev. signal is input.

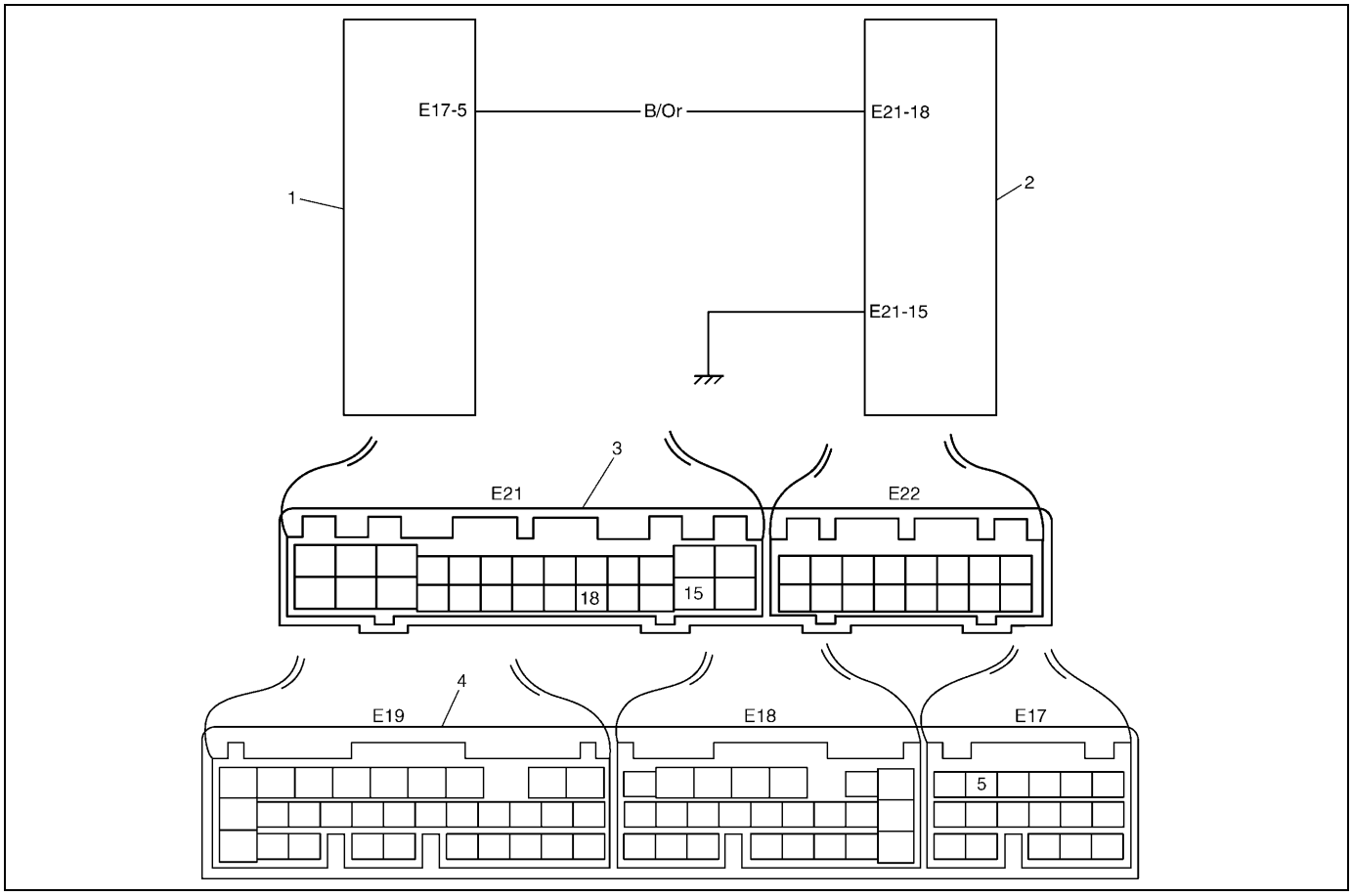
Step	Action	Yes	No
1	1) Turn ignition switch OFF and disconnect sensor wire harness coupler. 2) Measure resistance between “BI” wire and “B/BI” wire terminal of sensor harness side coupler. Is it infinity or 0 Ω?	Faulty transmission temperature sensor. Replace transmission temperature sensor.	Go to Step 2.
2	Is DTC No.36?	Go to Step 4.	Go to Step 3.
3	Is DTC No.38?	Go to Step 5.	Go to Step 6. (When DTC is P0710.)
4	1) Turn ignition switch OFF and connect sensor wire harness coupler. 2) Disconnect TCM couplers. 3) Measure the resistance between terminal “E21-3” and “E21-16” of disconnected harness side coupler. Is it about 0 Ω?	“BI” and “B/BI” wire shorted each other.	Substitute a known-good TCM and recheck.
5	1) Turn ignition switch OFF and connect sensor wire harness coupler. 2) Disconnect TCM couplers. 3) Measure the resistance between terminal “E21-3” and “E21-16” of disconnected harness side coupler. Is it infinity?	“BI” or “B/BI” wire open or poor connection of solenoid wire harness coupler.	Go to Step 7.

Step	Action	Yes	No
6	1) Turn ignition switch OFF and connect sensor wire harness coupler. 2) Disconnect TCM couplers. 3) Measure the resistance between terminal "E21-3" and "E21-16" of disconnected harness side coupler. Is it about 0 Ω or infinity?	"Bl" or "B/Bl" wire open, shorted each other or poor connection of solenoid wire harness coupler.	Go to Step 7.
7	1) Turn ignition switch OFF and connect TCM couplers. 2) Disconnect solenoid wire harness coupler. 3) Turn ignition switch ON then measure voltage between "Bl" wire terminal of disconnected harness side coupler and engine ground. See figure. Is it 4 – 6 V?	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If no trouble found, substitute a known-good TCM and recheck.	"Bl" wire shorted to power circuit or poor connection of terminal "E21-3". If wire and connection are OK, substitute a known-good TCM.



[A]: Fig. for Step 7
1. "Bl" wire terminal

DTC P1709/DTC No.51 Engine Coolant Temperature Signal Circuit

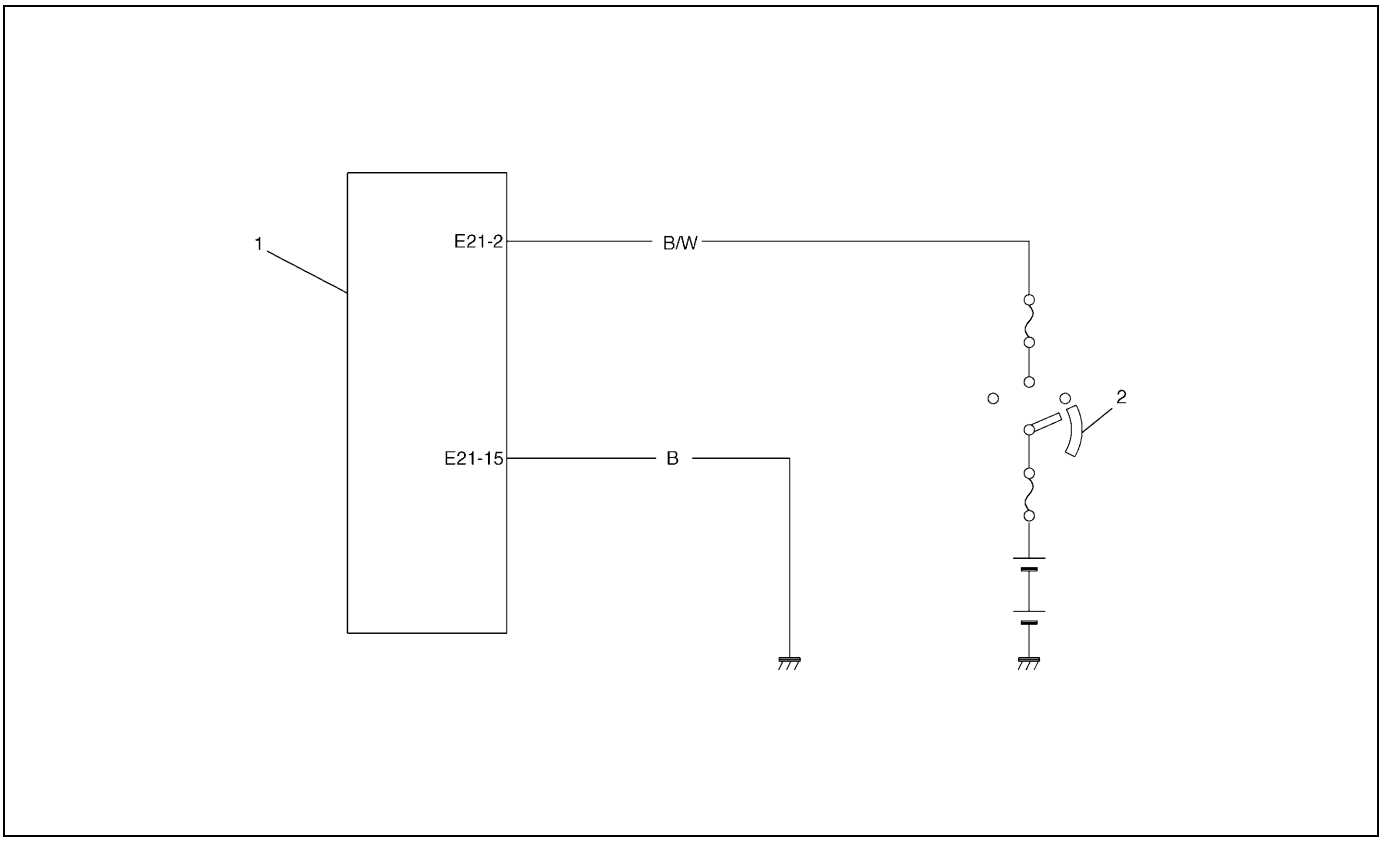


1. ECM	4. Terminal arrangement of TCM coupler (viewed from harness side)
2. TCM	5. Terminal arrangement of ECM coupler (viewed from harness side)

DTC DETECTING CONDITION
• O/D off signal from ECM require O/D off although A/T fluid temperature is normal operating temperature and engine rev. is standard.

Step	Action	Yes	No
1	Check DTC of “Engine Diagnosis” referring to Section 6. Is any DTC detected?	Inspect and repair referring to DTC flow table of “Engine Diagnosis” in Section 6.	Go to Step 2.
2	1) Turn ignition switch OFF and disconnect TCM and ECM couplers. 2) Measure resistance between terminal “E21-18” of disconnected harness side TCM coupler and body ground. Is it infinity?	Go to Step 3.	“B/Or” wire shorted to ground.
3	1) Turn ignition switch OFF and connect TCM couplers. 2) Turn ignition switch ON and check voltage between terminal “E21-18” and body ground. Is it 0 V?	Substitute a known-good TCM and recheck.	Substitute a know-good ECM and recheck.

DTC P0702/P1702/DTC No.52 Transmission Control System Electrical or Internal Malfunction of TCM

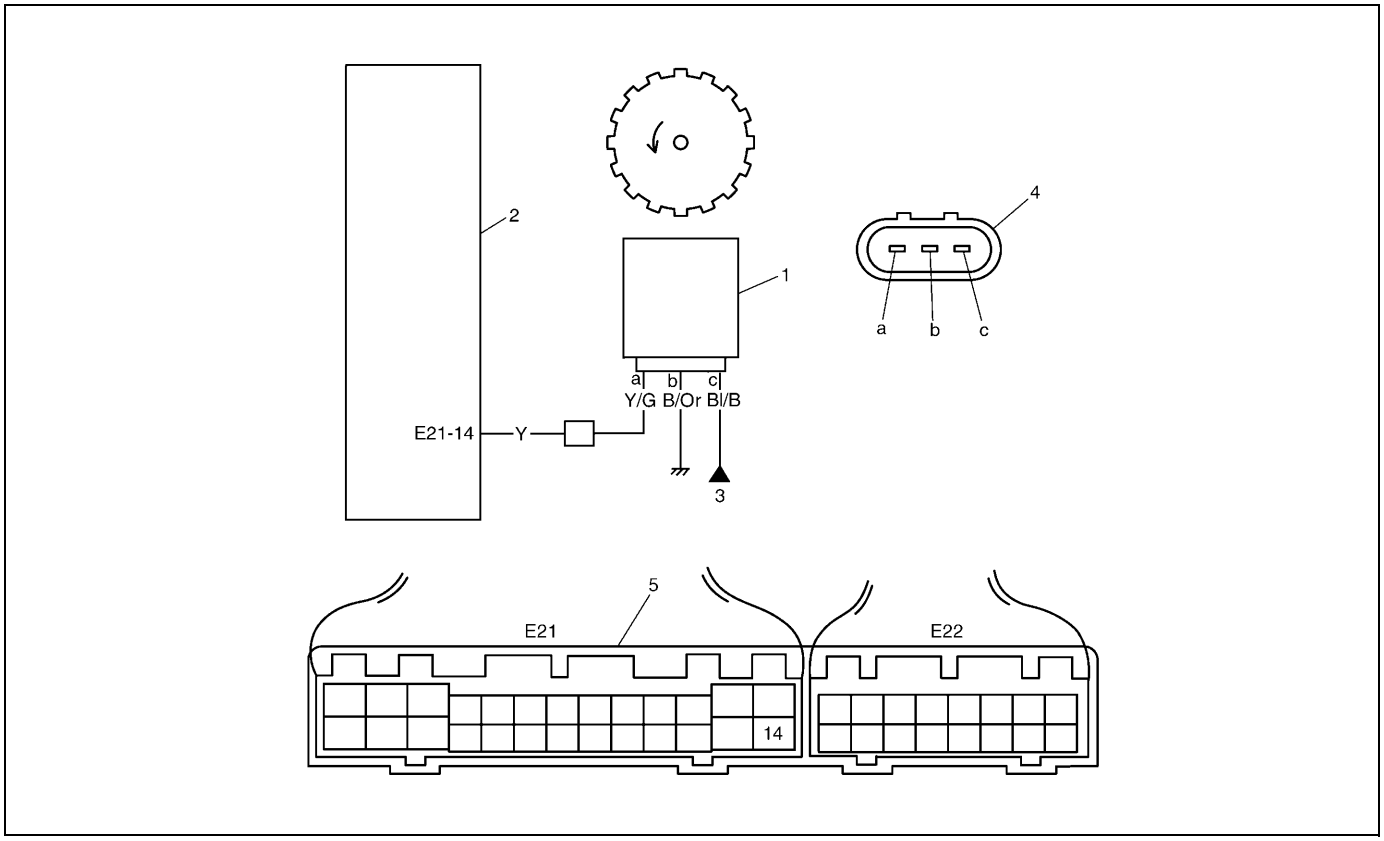


1. TCM
2. Ignition switch

DTC DETECTING CONDITION
• Relay output voltage is too high although TCM orders the relay to turn OFF or relay output voltage is too low although TCM orders the relay to turn on. • Calculation of current data stored in TCM is not correct comparing with pre-stored checking data in TCM.

Step	Action	Yes	No
1	1) Turn ignition switch ON. 2) Erase all DTCs referring to “DTC Clearance” in this section. 3) Turn ignition switch OFF. 4) Turn ignition switch ON once again and check for any DTC. Is it DTC P1702/DTC No.52 or DTC P0702/DTC No.52?	Replace TCM.	Could be a temporary malfunction of the TCM.

DTC P1887/DTC No.57 Vehicle Speed Sensor (VSS) Signal Circuit



1. VSS	3. Power supply from main relay	5. Terminal arrangement of TCM coupler (Viewed from harness side)
2. TCM	4. VSS terminal	

DTC DETECTING CONDITION
Difference in detected vehicle speed between output shaft speed sensor and VSS is too wide.

Step	Action	Yes	No
1	Confirm if DTC P0720/DTC No.31 is detected together. Is DTC P0720/DTC No.31 detected?	Inspect and repair referring to DTC flow table of “Output Shaft Speed Sensor” in this section.	Go to Step 2.
2	1) Turn ignition switch OFF and disconnect VSS coupler. 2) Turn ignition switch ON and measure voltage between “Bl/B” wire terminal and “B/Or” wire terminal of disconnected harness side coupler. Is it 10 – 14V?	Go to Step 3.	“Bl/B” or “B/Or” wire open or shorted.
3	Measure voltage between “Y/G” wire terminal of disconnected harness side coupler and engine ground. Is it 3 V or more?	Go to Step 4.	“Y/G” or “Y” wire open or shorted to ground.

Step	Action	Yes	No
4	1) Remove VSS referring to Section 7D. 2) Check VSS rotor referring to Section 7D. Is it in good condition?	Intermittent trouble or faulty TCM. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A. If no trouble found, substitute a known-good TCM and recheck.	Replace VSS rotor.

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, judgement as normal as abnormal should not be made by checking with those data alone.
Also, condition in the below table that can be cases where the automatic transmission or actuator is not operating in the condition as indicated by the scan tool.

NOTE:

The following scan tool data related to automatic transmission can be checked only by communicating with TCM.

SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
GEAR POSITION	Ignition switch ON and vehicle at stop.	Selector lever is in “P” position.	P or N
		Selector lever is in “R” position.	R
		Selector lever is in “N” position.	P or N
		Selector lever is in “D” position.	1
		Selector lever is in “2” position.	1
		Selector lever is in “L” position.	1
REQUIRED GEAR	Ignition switch ON and vehicle at stop.	Selector lever is in “P” position.	P or N
		Selector lever is in “R” position.	R
		Selector lever is in “N” position.	P or N
		Selector lever is in “D” position.	1
		Selector lever is in “2” position.	1
		Selector lever is in “L” position.	1
INPUT SHAFT REV	Ignition switch ON and engine stop.		0 RPM
	At 60 km/h (37.5 mile/h) constant speed, T/F “2H” range, O/D off switch ON, 20% or less throttle opening and 3rd gear (“D” range).		2650 RPM (displayed in increments of 50 rpm)
OUTPUT SHAFT REV	At vehicle stop.		0 RPM
	At 60 km/h (37.5 mile/h) constant speed, T/F “2H” range, O/D off switch ON, 20% or less throttle opening and 3rd gear (“D” range).		2650 RPM (displayed in increments of 50 rpm)
BATTERY VOLT.	Ignition switch ON and engine stop.		Battery voltage is displayed 8 – 16 V

SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
ATF TEMP.	After driving at 60 km/h (37.5 mile/h) for 15 minutes or more, and A/T fluid temperature around sensor reaches 70 – 80 °C (158 – 176 °F).		70 – 80 °C, 158 – 176 °F
SHIFT SOL #1 DUTY	Ignition switch ON, vehicle is at stop and selector lever is in “P” position.		0 %
	While on shifting from 1st gear to 2nd gear.		0 – 100 %
SHIFT SOL #2 DUTY	Ignition switch ON, vehicle is at stop and selector lever is in “P” position.		100 %
	While on shifting from 1st gear to 2nd gear.		0 – 100 %
SHIFT SOL #3 DUTY	Ignition switch ON, vehicle is at stop and selector lever is in “P” position.		0 %
	While on shifting from 2nd gear to 3rd gear.		0 – 100 %
SHIFT SOL #4 DUTY	Ignition switch ON, vehicle is at stop and selector lever is in “P” position.		0 %
	While on shifting from 3rd gear to 4th gear.		0 – 100 %
TCC SOL DUTY	At 5 km/h (3 mile/h) constant speed, O/D off switch ON, closed throttle and 1st gear.		0 %
	At 60 km/h (37.5 mile/h) constant speed, T/F “2H” range, O/D off switch OFF, 5% to 16% throttle opening and 4th gear (“D” range).		100 %
ENGINE SPEED	At engine idle speed.		Engine idle speed is displayed
VEHICLE SPEED	At vehicle stop.		0 km/h, 0 MPH
O/D OFF SWITCH (CON)	Ignition switch ON and normal engine coolant temperature.	O/D off switch OFF.	OFF
		O/D off switch ON.	ON
O/D OFF SWITCH (MON)	Ignition switch ON.	O/D off switch OFF.	OFF
		O/D off switch ON.	ON
TRANS. RANGE	Ignition switch ON.	Selector lever is in “P” position.	P
		Selector lever is in “R” position.	R
		Selector lever is in “N” position.	N
		Selector lever is in “D” position.	D
		Selector lever is in “2” position.	2
		Selector lever is in “L” position.	L
D RANGE SIGNAL	Ignition switch ON.	Selector lever is in “P” position.	OFF
		Selector lever is in “R” position.	ON
		Selector lever is in “N” position.	OFF
		Selector lever is in “D” position.	ON
		Selector lever is in “2” position.	ON
		Selector lever is in “L” position.	ON
THROTTLE POSITION	Ignition switch ON.	Accelerator pedal is released.	0 %
		Accelerator pedal is depressed.	0 – 100 % (Varies depending on depressed value)
COOLANT TEMP.	Engine coolant temperature is 60 °C (140 °F) or more and engine running.		HIGH
	Engine coolant temperature is below 60 °C (140 °F) and engine running.		LOW

SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
A/C SWITCH	Ignition switch ON and air conditioner switch OFF.		OFF
BRAKE SWITCH	Ignition switch ON.	Brake pedal is depressed.	ON
		Brake pedal is released.	OFF

SCAN TOOL DATA DEFINITIONS:

GEAR POSITION

Current gear position computed by throttle position coming from ECM and vehicle speed.

REQUIRED GEAR

Gear position to which TCM is going to shift according to calculation by throttle position coming from ECM and vehicle speed.

INPUT SHAFT REVOLUTION (RPM)

Input shaft revolution computed by reference pulses coming from input shaft speed sensor on transmission case.

OUTPUT SHAFT REVOLUTION (RPM)

Output shaft revolution computed by reference pulses coming from output shaft speed sensor on transmission case.

BATTERY VOLTAGE (V)

Battery voltage read by TCM as analog input signal by TCM.

ATF TEMPERATURE (°C, °F)

ATF temperature decided by signal from transmission fluid temperature sensor installed on valve body.

SHIFT SOLENOID #1 DUTY

Electricity duty ratio of duty pulse signal applied to shift solenoid valve-A (No.1) by TCM.

SHIFT SOLENOID #2 DUTY

Electricity duty ratio of duty pulse signal applied to shift solenoid valve-B (No.2) by TCM.

SHIFT SOLENOID #3 DUTY

Electricity duty ratio of duty pulse signal applied to shift solenoid valve-C (No.3) by TCM.

SHIFT SOLENOID #4 DUTY

Electricity duty ratio of duty pulse signal applied to shift solenoid valve-D (No.4) by TCM.

TCC SOLENOID DUTY

Electricity duty ratio of duty pulse signal applied to TCC solenoid valve by TCM.

ENGINE SPEED (RPM)

Engine speed computed by reference pulse from crankshaft position sensor.

VEHICLE SPEED (KPH/MPH)

Vehicle speed computed by reference pulse signals coming from vehicle speed sensor on transfer case.

O/D OFF SWITCH CONTROL
Condition which TCM controls automatic transmission if shift to O/D is permitted or not.
ON : Shift to O/D is permitted.
OFF : Shift to O/D is not permitted.

O/D OFF SWITCH MONITOR
Input signal from O/D off switch on selector knob.
ON : O/D off switch ON.
OFF : O/D off switch OFF.

TRANSMISSION RANGE
Transmission range detected by signal fed from transmission range sensor.

D RANGE SIGNAL
ON : Signal which TCM require ECM to increase idle speed.
OFF : Signal which TCM does not require ECM to increase idle speed.

THROTTLE POSITION (%)
Throttle opening ratio computed by duty pulse signal from ECM.

COOLANT TEMPERATURE
Signal from ECM whether engine coolant temperature is more than 50 °C (122 °F) or not.

A/C SIGNAL
ON : Signal which inform that air conditioner compressor is turned ON.
OFF : Signal which inform that air conditioner compressor is not turned ON.

BRAKE SWITCH
Input signal from brake light switch on pedal bracket.
ON : Brake pedal depressed.
OFF : Brake pedal released.

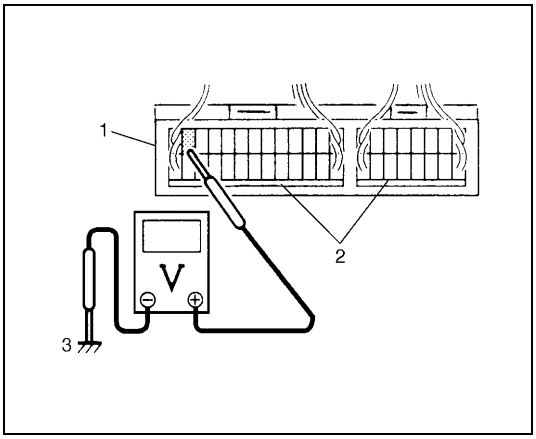
Inspection of TCM and Its Circuits

TCM and its circuits can be checked at TCM wiring couplers by measuring voltage and resistance.

CAUTION:

TCM cannot be checked by itself, it is strictly prohibited to connect voltmeter or ohmmeter to TCM with coupler disconnected from it.

VOLTAGE CHECK



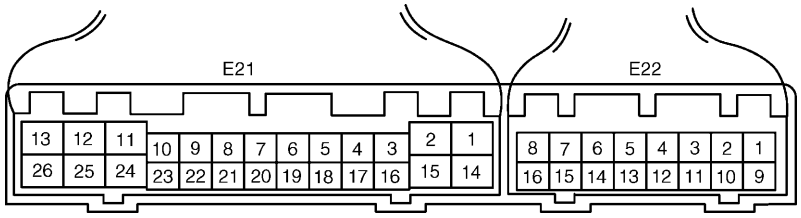
1) Remove TCM (1) from vehicle referring to “Transmission Control Module Removal” in this section.
2) Connect TCM couplers (2) to TCM.
3) Check voltage at each terminal of couplers connected.

NOTE:

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

3. Body ground

Terminal arrangement of TCM coupler (Viewed from harness side)



TERMINAL		CIRCUIT	STANDARD VOLTAGE	CONDITION
E21	2	IG power source	10 – 14 V	IG switch ON
	3	Transmission fluid temperature sensor	0.2 – 0.4 V	IG switch ON, fluid temperature 80 °C (176 °F)
	4	Brake switch	10 – 14 V	IG switch ON, brake pedal depressed
	5	A/C compressor	0 – 2 V	A/C OFF
			10 – 14 V	A/C ON
	8	D-range idle up signal	10 – 14 V	Select lever at “P” or “N” range
			0 – 1 V	Select lever other than “P” and “N” range
	14	Vehicle speed sensor	–	–
	15	Ground	0 – 1 V	IG switch ON
	16	Transmission fluid temperature sensor ground	0 – 1 V	IG switch ON
	17	O/D off switch	0 – 1 V	IG switch ON, O/D off switch ON
			10 – 14 V	IG switch ON, O/D off switch OFF
	18	Engine coolant temperature signal	10 – 14 V	IG switch ON, normal operating temperature of engine fluid
	20	A/T failure serial data	0 – 1 V	IG switch ON
	21	O/D OFF lamp	10 – 14 V	IG switch ON, O/D off switch OFF
			0 – 1 V	IG switch ON, O/D off switch ON
	22	Lock-up solenoid	0 – 1 V	IG switch ON, select lever at “P” range
	23	Shift solenoid-D (No.4)	0 – 1 V	IG switch ON, select lever at “P” range
	24	Shift solenoid-C (No.3)	0 – 1 V	IG switch ON, select lever at “P” range
			10 – 14 V	IG switch ON, select lever at “L” range
	25	Shift solenoid-B (No.2)	0 – 1 V	IG switch ON, select lever at “R” range
			10 – 14 V	IG switch ON, select lever at “P” range
	26	Shift solenoid-A (No.1)	0 – 1 V	IG switch ON, select lever at “P” range
E22	1	Transmission range sensor – “P” range	10 – 14 V	IG switch ON, select lever at “P” range
			0 – 1 V	IG switch ON, select lever other than “P” range
	2	Transmission range sensor – “R” range	10 – 14 V	IG switch ON, select lever at “R” range
			0 – 1 V	IG switch ON, select lever other than “R” range
	3	Transmission range sensor – “N” range	10 – 14 V	IG switch ON, select lever at “N” range
			0 – 1 V	IG switch ON, select lever other than “N” range
	4	Diagnosis switch	10 – 14 V	IG switch ON, diagnosis switch terminal not grounded
	5	Engine speed signal	0 – 1 V	IG switch ON, leaving engine OFF
	6	Output shaft speed sensor (+)	–	–
	7	Input shaft speed sensor (+)	–	–
	8	Throttle opening signal	–	–
	9	Transmission range sensor – “D” range	10 – 14 V	IG switch ON, select lever at “D” range
			0 – 1 V	IG switch ON, select lever other than “D” range
	10	Transmission range sensor – “2” range	10 – 14 V	IG switch ON, select lever at “2” range
			0 – 1 V	IG switch ON, select lever other than “2” range
	11	Transmission range sensor – “L” range	10 – 14 V	IG switch ON, select lever at “L” range
			0 – 1 V	IG switch ON, select lever other than “L” range
	12	Serial data link (SUZUKI scan tool)	10 – 14 V	IG switch ON
	13	Output shaft speed sensor shield	–	–
	14	Output shaft speed sensor (–)	–	–
	15	Input shaft speed sensor (–)	–	–

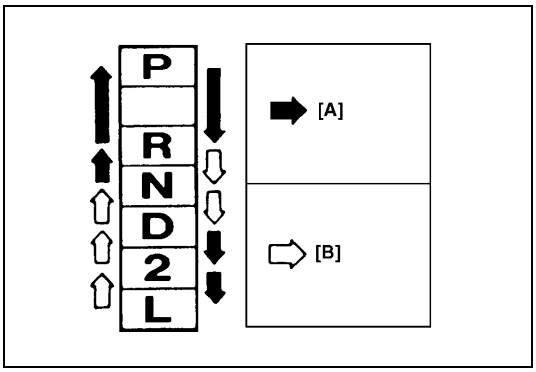
On-Vehicle Service

Maintenance Service

Fluid level check

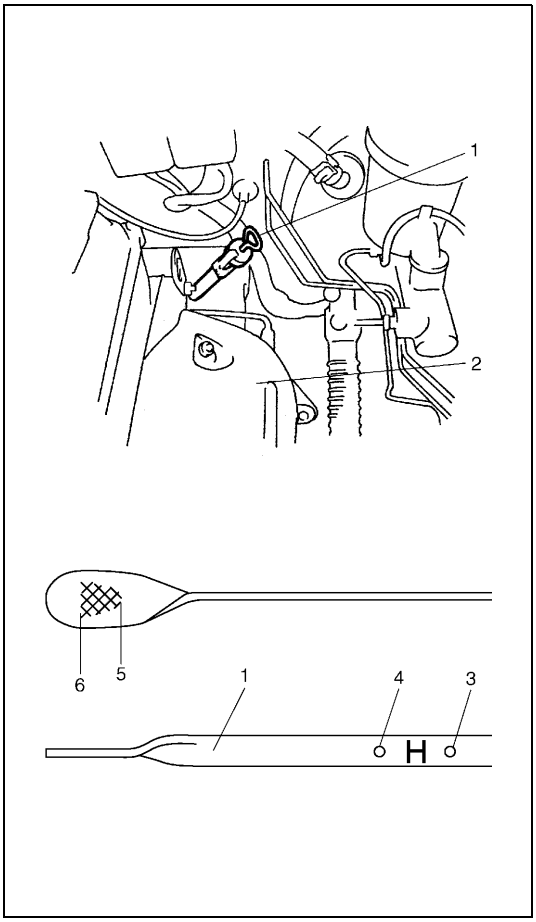
LEVEL CHECK AT NORMAL OPERATING TEMPERATURE

1) Stop vehicle and place it level.
2) Apply parking brake and place chocks against wheels.
3) With selector at P position, start engine.
4) Warm up engine till fluid temperature reaches normal operating temperature (70 – 80 °C/158 – 176 °F). As a guide to check fluid temperature, warm up engine to normal operating temperature.



5) Keep engine idling and shift selector slowly to L and back to P position.
6) With engine idling, pull out dipstick, wipe it off with a clean cloth and put it back into place.

[A] :	Shift the selector lever with its button pushed in.
[B] :	Shift the selector lever without pushing its button.



7) Pull out dipstick (1) again and check fluid level indicated on it. Fluid level should be between FULL HOT and LOW HOT. If it is below LOW HOT, add an equivalent of DEXRON®-IIE or DEXRON®-III, up to FULL HOT.

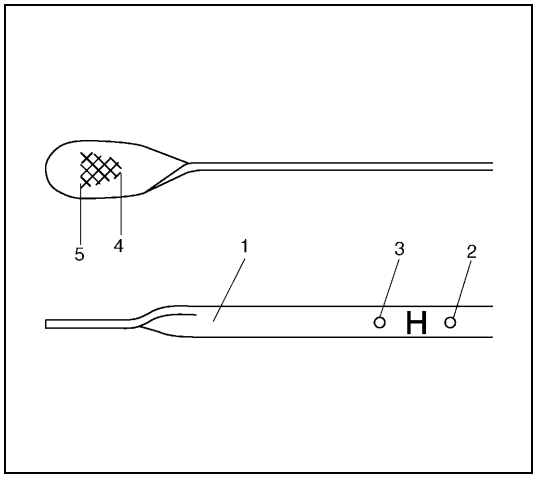
Automatic transaxle fluid

An equivalent of DEXRON®-III or DEXRON®-IIE

NOTE:

- **DO NOT RACE ENGINE while checking fluid level, even after the engine start.**
- **DO NOT OVERFILL. Overfilling can cause foaming and loss of fluid through breather. Then slippage and transmission failure can result.**
- **Bringing the level from LOW HOT to FULL HOT requires 0.13 liters (0.27/0.23 US/Imp. pt).**
- **If vehicle was driven under high load such as pulling a trailer, fluid level should be checked about half an hour after it is stopped.**

2.	Exhaust manifold cover
3.	“FULL HOT” mark
4.	“LOW HOT” mark
5.	“FULL COLD” line
6.	“LOW COLD” line

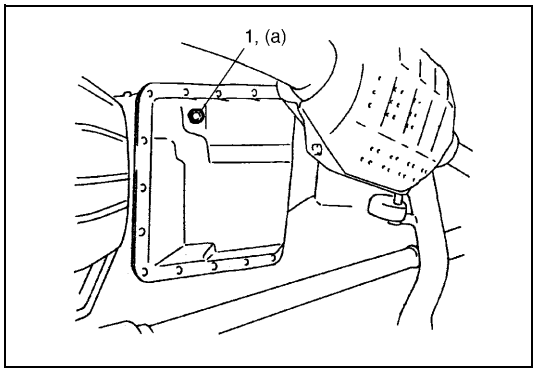


LEVEL CHECK AT ROOM TEMPERATURE

The fluid level check at room temperature (20 – 30 °C/68 – 86 °F) performed after repair or fluid change before test driving is just preparation for level check of normal operating temperature. The checking procedure itself is the same as that described previously. If the fluid level is between FULL COLD and LOW COLD, proceed to test drive. And when the fluid temperature has reached the normal operating temperature, check fluid level again and adjust it as necessary.

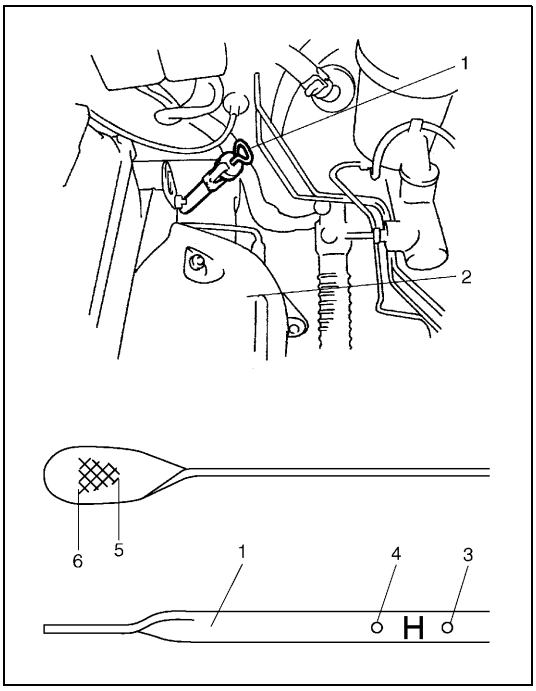
1. Dipstick	4. “FULL COLD” line
2. “FULL HOT” mark	5. “LOW COLD” line
3. “LOW HOT” mark	

Fluid change



1) Lift up vehicle.
2) When engine has cooled down, remove drain plug (1) from oil pan and drain A/T fluid.
3) Install drain plug.

Tightening torque
A/T fluid drain plug
(a) : 22 N·m (2.2 kg-m, 16.0 lb-ft)



4) Lower vehicle and fill proper amount of an equivalent of DEXRON®-IIE or DEXRON®-III.
5) Check fluid level according to procedure described under LEVEL CHECK AT NORMAL OPERATING TEMPERATURE.

Automatic transaxle fluid

An equivalent of DEXRON®-III or DEXRON®-IIE

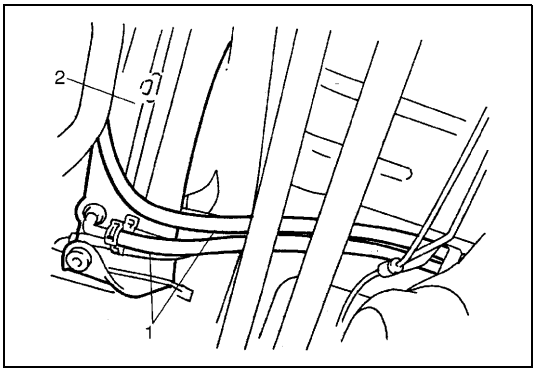
Automatic transaxle fluid capacity
When draining from drain plug hole :
1.0 liters (2.11/1.76 US/Imp. pt.)
When overhauling :
3.7 liters (7.82/6.51 US/Imp. pt.)

1. Dipstick	4. “LOW HOT” mark
2. Exhaust manifold cover	5. “FULL COLD” line
3. “FULL HOT” mark	6. “LOW COLD” line

Oil cooler hoses

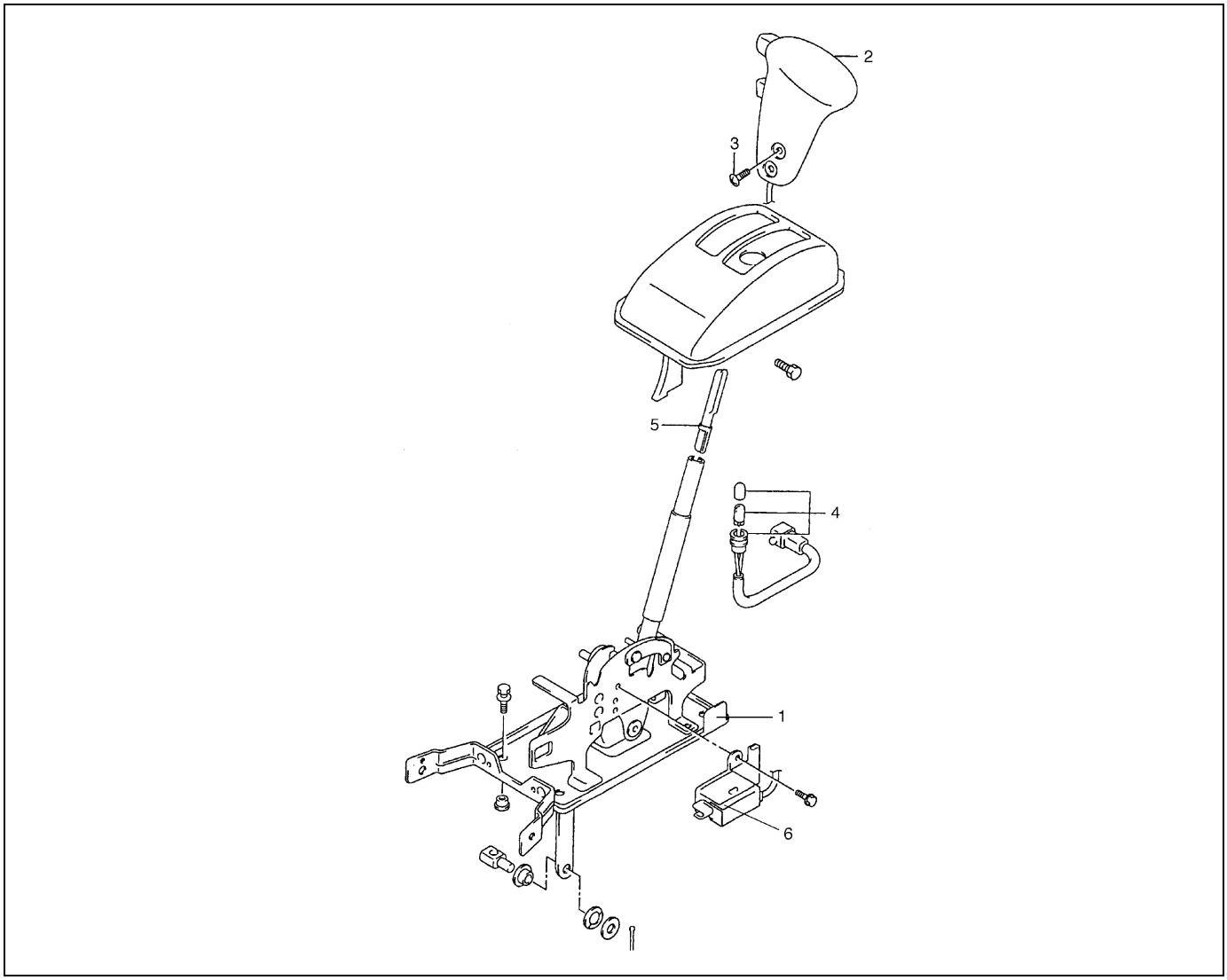
The rubber hoses for the oil cooler should be checked at specified interval. When replacing them, be sure to note the following.

- Replace clamps at the same time
- Insert hose as far as its limit mark
- Clamp clamps securely

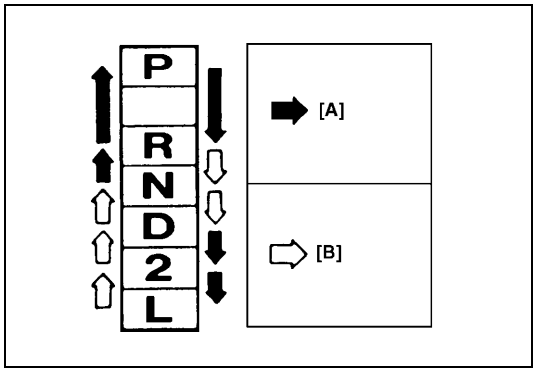


1. Oil cooler hose	
2. Radiator	

Selector Lever



1. Selector lever assembly	4. Illumination lamp assembly
2. Selector lever knob assembly	5. Selector lever guide
3. Screw	6. Shift lock solenoid (if equipped)



INSPECTION

Check selector lever for smooth and clear cut movement and position indicator for correct indication.
For operation of selector lever, refer to the figure.

[A] :	Shift the selector lever with its button pushed in.
[B] :	Shift the selector lever without pushing its button.

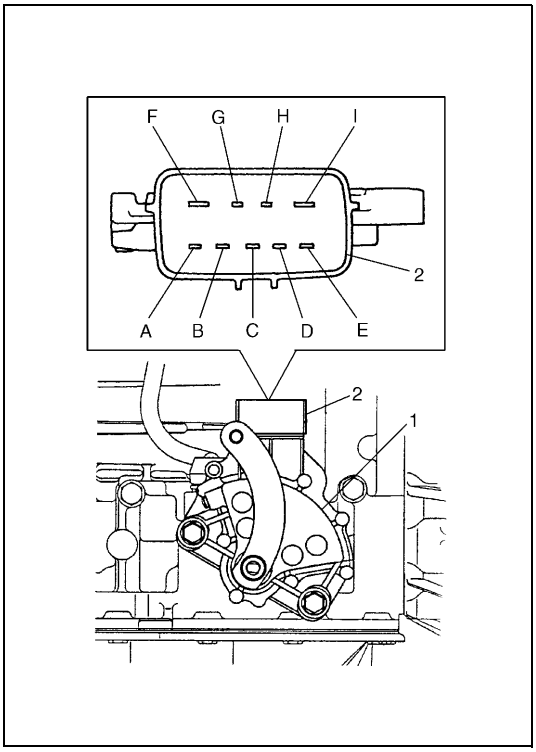
Transmission Range Sensor (Shift Switch)

REMOVAL

1) Block wheels and turn selector lever to “N” range.
2) Disconnect transmission range sensor coupler and remove selector rod from shift control shaft lever.
3) Remove shift control shaft lever and then transmission range sensor.

CAUTION:
Do not overhaul transmission range sensor.

INSPECTION

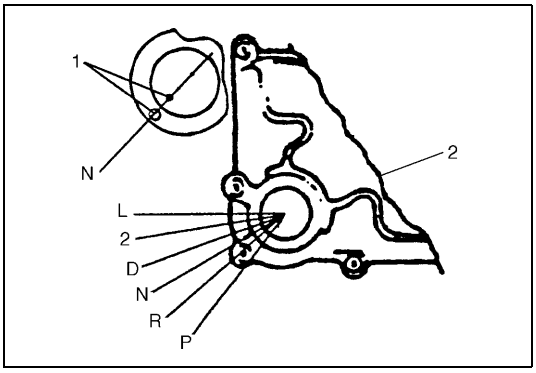


1) Disconnect transmission range sensor coupler (2).
2) Check that continuity exists at terminals shown below by moving selector lever.

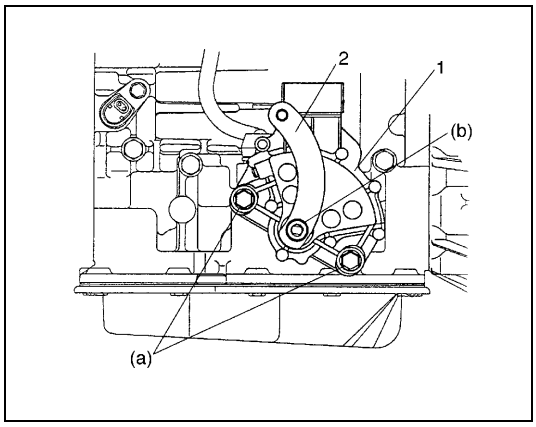
Sensor Position \ Terminal No	B	A	H	C	E	D	G	I	F
P			○			○		○	○
R			○		○				
N			○				○	○	○
D			○	○					
2		○	○						
L	○		○						

1. Transmission range sensor

INSTALLATION



1) Using flat tip screwdriver, turn transmission range sensor (2) to align match marks (transmission range sensor “N” range) (1). Turn shift control shaft to “N” range (to have the automatic transmission to “N” range).



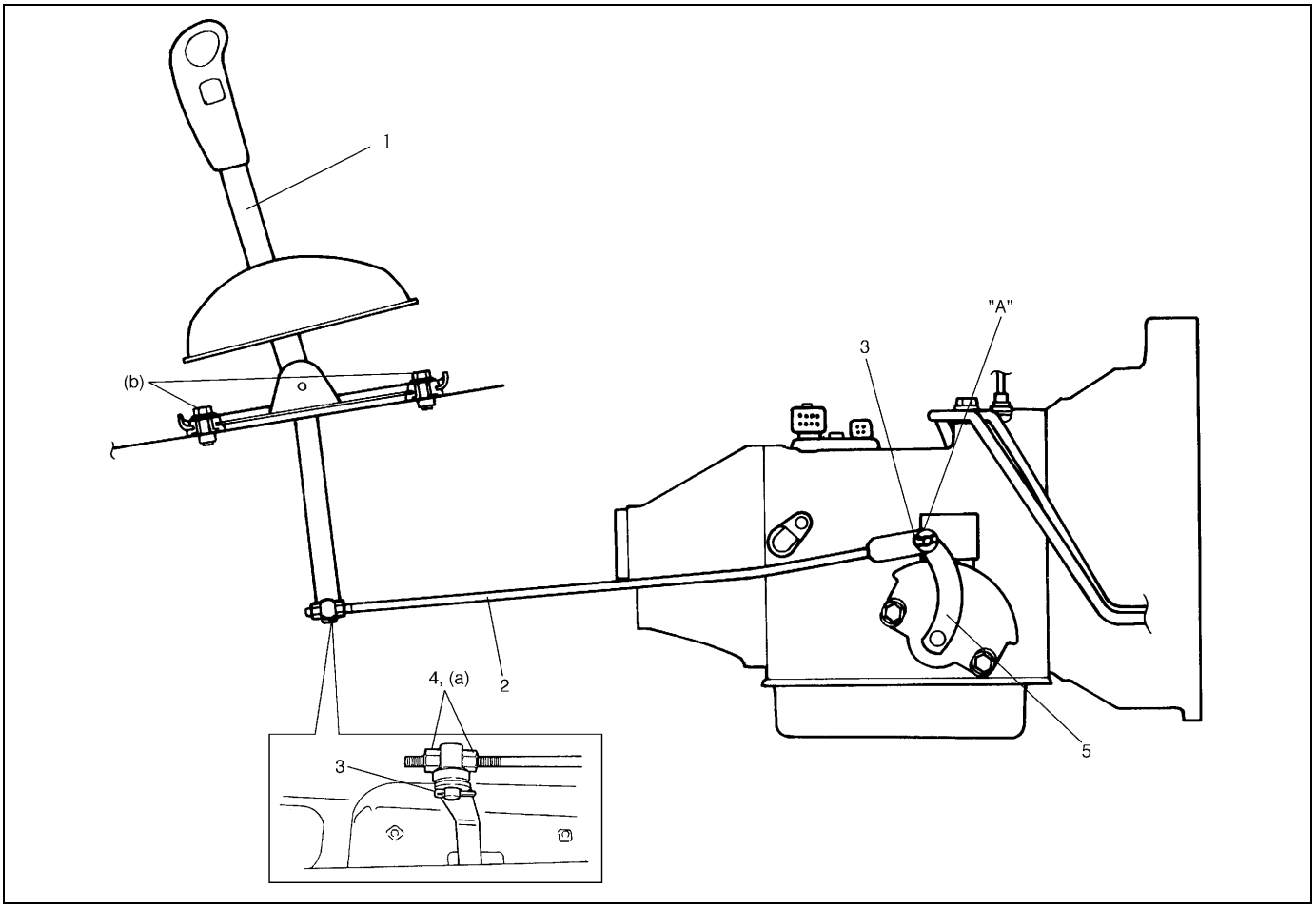
2) Install transmission range sensor (1) to transmission case and then lever to shift control shaft after setting them in “N” position as shown in figure. Tighten bolts and nut to specification.

Tightening torque
Transmission range sensor bolt
(a) : 18 N·m (1.8 kg-m, 13.0 lb-ft)
Shift control shaft nut
(b) : 13 N·m (1.3 kg-m, 9.5 lb-ft)

1. Shift control shaft lever

3) Shift selector lever to “N” position and connect selector rod to shift control shaft lever.
4) Move selector lever in cabin to each range and check the continuity of each terminal of transmission range sensor referring to “Transmission Range Sensor Inspection” in this section.
5) Connect transmission range sensor coupler.
6) Check that the engine can only be started in “N” and “P” range, but can not in “D”, “2”, “L” or “R” range. Also, check that backup lights come ON at “R” range.

Selector Rod



1. Selector lever assembly	4. Selector rod nut
2. Selector rod	5. Shift control shaft lever
3. Clip	

REMOVAL

1) Hoist vehicle.
2) Remove clips on both ends of selector rod.
3) Remove selector rod from transmission and selector lever assembly.

INSTALLATION

Install selector rod by reversing removal procedure.
The important steps in installation are as follows.

- Apply grease to shift control shaft lever pin.

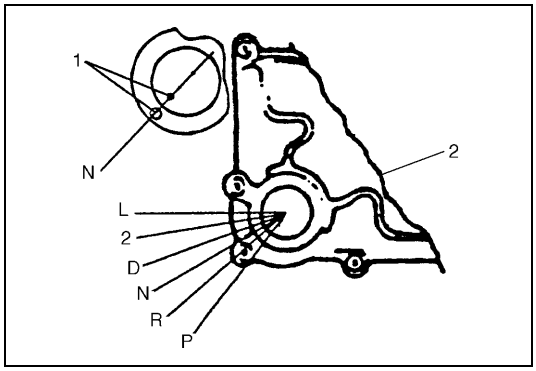
"A" : Grease 99000-32020

- Tighten bolts and nut in the figure to specified torque.

Tightening torque
Selector rod nut
(a) : 7 N·m (0.7 kg-m, 5.0 lb-ft)
Selector lever assembly bolts
(b) : 18 N·m (1.8 kg-m, 13.0 lb-ft)

- Adjusting procedure is as follows.

ADJUSTMENT

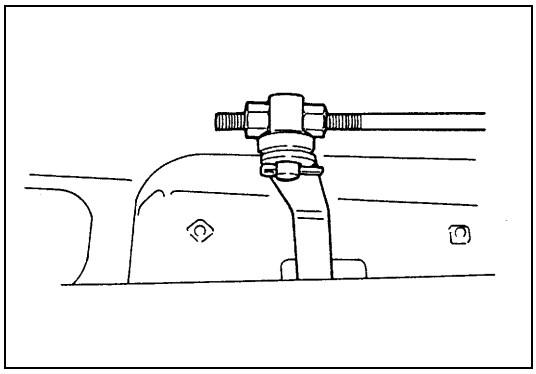


1) Before tightening rod end nut, shift selector lever to N range.
2) Also shift control shaft lever to N range by aligning match marks (1).

NOTE:

Make sure that nuts and rod joint have clearance under above conditions.

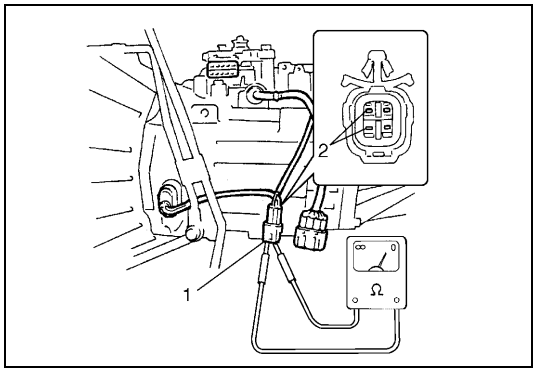
2. Transmission range sensor



3) Turn nuts by hand till it contacts control shift lever joint. Then tighten them with wrench.
4) After selector rod was installed, check for the following.
   - Push vehicle with selector lever shifted to P range. Vehicle should not move.
   - Vehicle can not be driven in N range.
   - Vehicle can be driven in D, 2 and L ranges.
   - Vehicle can be backed in R range.

Output Shaft Speed Sensor

INSPECTION

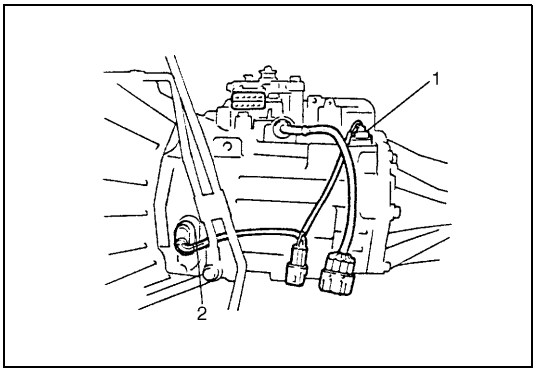


1) Disconnect negative cable at battery.
2) Disconnect output shaft speed sensor – input shaft speed sensor coupler (1).
3) Check resistance between output shaft speed sensor terminals (2).

Output shaft speed sensor resistance
Standard : 160 – 200 Ω at 20 °C (68 °F)

REMOVAL

1) Disconnect negative cable at battery.
2) Disconnect output shaft speed sensor – input shaft speed sensor coupler.



3) Remove output shaft speed sensor – input shaft speed sensor (2) by removing its bolt.

1. Output shaft speed sensor

INSTALLATION

1) Apply A/T fluid to output shaft speed sensor O-ring.
2) Install output shaft speed sensor to A/T case and tighten bolt to specified torque.

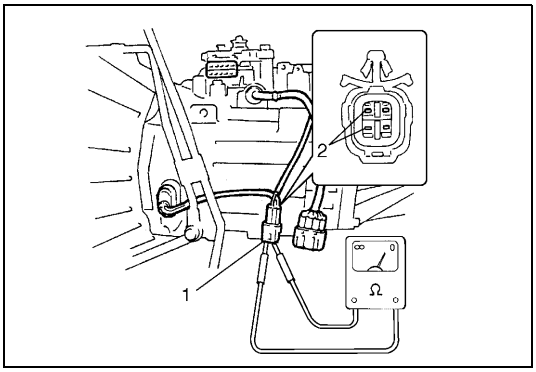
Tightening torque
Output shaft speed sensor bolt : 8 N·m (0.8 kg-m, 6.0 lb-ft)

3) Connect output shaft speed sensor – input shaft speed sensor coupler.
4) Connect negative cable to battery.

Input Shaft Speed Sensor

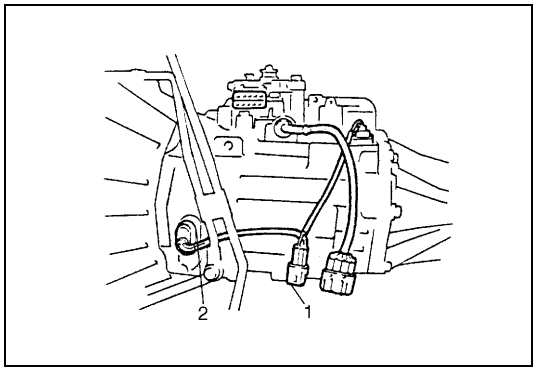
INSPECTION

1) Disconnect negative cable at battery.



2) Disconnect output shaft speed sensor – input shaft speed sensor coupler (1).
3) Check resistance between input shaft speed sensor terminals (2).

Input shaft speed sensor resistance
Standard : 160 – 200 Ω at 20 °C (68 °F)



REMOVAL

1) Disconnect negative cable at battery.
2) Disconnect output shaft speed sensor – input shaft speed sensor coupler (1).
3) Remove input shaft speed sensor (2) by removing its bolt.

INSTALLATION

1) Apply A/T fluid to input shaft speed sensor O-ring.
2) Install input shaft speed sensor to A/T case and tighten bolt to specified torque.

Tightening torque
Input shaft speed sensor bolt : 8 N·m (0.8 kg-m, 6.0 lb-ft)

3) Connect output shaft speed sensor – input shaft speed sensor coupler.
4) Connect negative cable to battery.

Vehicle Speed Sensor

Refer to Step 7 of “DTC P0500/DTC No.16 Flow Table” in Section 6 for inspection.

Throttle Position Sensor

INSPECTION

Check throttle position sensor referring to Section 6E.

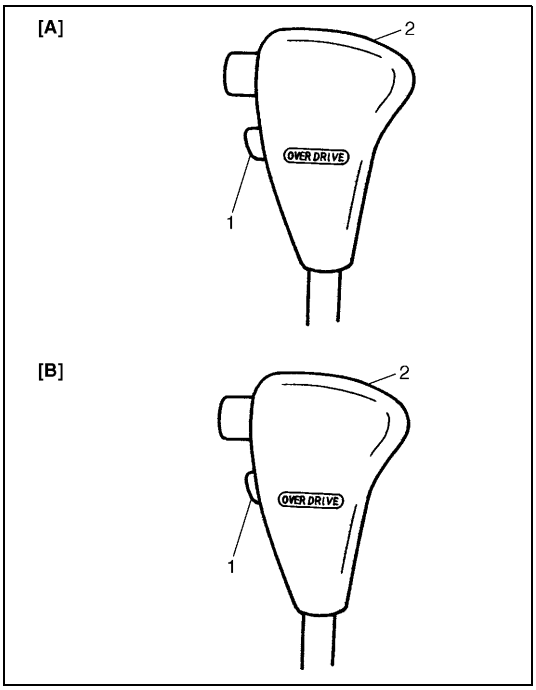
Engine Coolant Temperature (ECT) Sensor

INSPECTION

Check engine coolant temp. sensor referring to Section 6E.

O/D Off Switch

INSPECTION



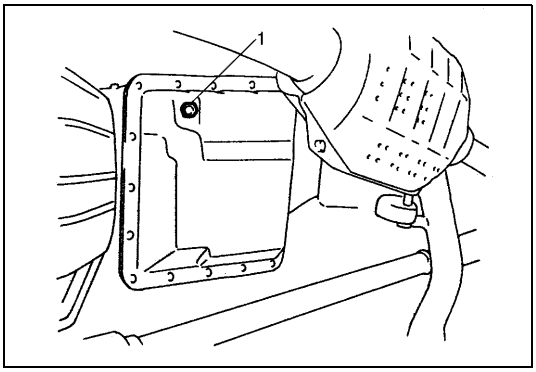
1) Remove console box.
2) Disconnect O/D off switch coupler.
3) Check continuity between O/D off switch terminals.

O/D off switch (1)	ON	OFF
Continuity	Continuity	No continuity

2. Shift lever
[A]: O/D off switch ON
[B]: O/D off switch OFF

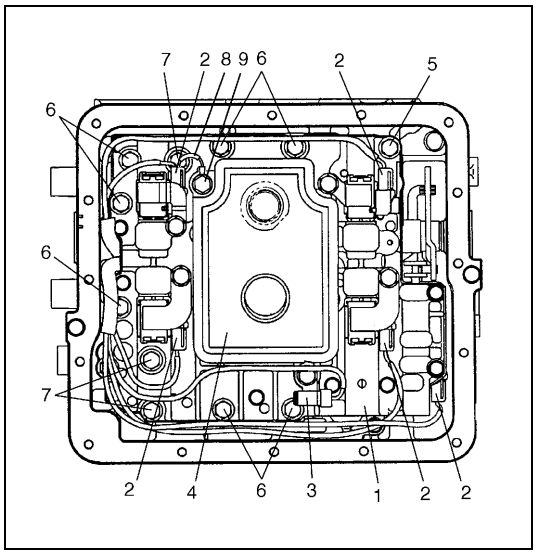
Shift Solenoid Valves and Transmission Fluid Temperature Sensor

REMOVAL



1) Disconnect negative cable from battery.
2) Drain A/T fluid.
3) Remove A/T oil pan.
4) Disconnect transmission fluid temperature sensor coupler.

1. Drain plug

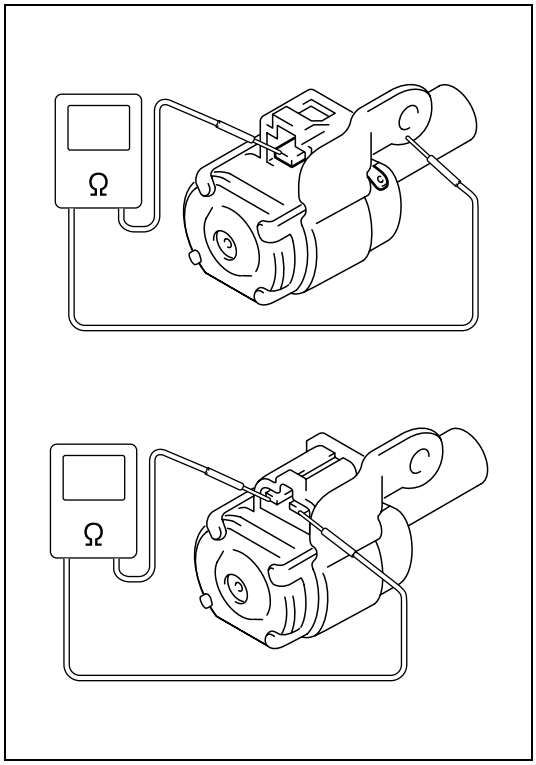


5) Remove one of oil strainer bolts (9) and ground wire (8) for shift solenoid valve No.1.
6) Disconnect shift solenoid and transmission fluid temperature sensor (3) couplers (2).
7) Remove shift solenoid valves (No.1, No.3 and No.4) and lock-up solenoid valve.
8) Remove valve body assembly (1).
9) Remove shift solenoid valve No.2.

4. Oil strainer assembly
5. Bolt A
6. Bolt B
7. Bolt C

Shift solenoid valves and lock-up solenoid valve

INSPECTION



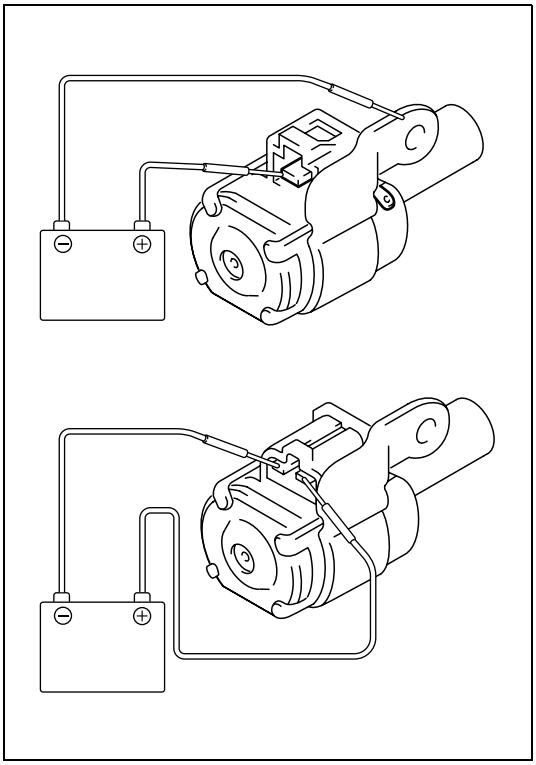
Resistance Check

- Shift solenoid No.1, No.2, No.3, No.4 and lock-up solenoid. Check resistance between terminals or terminal and solenoid body.

Shift solenoid valves and lock-up solenoid valve resistance
Standard : 11.5 – 12.5 Ω

1. Shift solenoid or lock-up solenoid

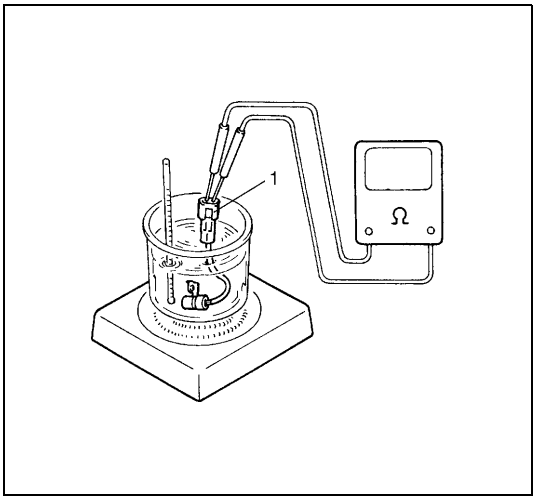
Operation check



Shift solenoid valves No.1, No.2, No.3, No.4 and lock-up solenoid When solenoids is connected to the battery (2) as shown in figure, check that the solenoid actuates with a click sound.

1. Shift solenoid or lock-up solenoid

Transmission fluid temperature sensor



INSPECTION

Warm up transmission fluid temperature sensor. Thus make sure its resistance decrease with the increase of temperature.

Transmission fluid temperature sensor resistance

Temperature	Resistance
20 °C (68 °F)	2.5 Ω
40 °C (104 °F)	1.2 Ω
60 °C (140 °F)	0.6 Ω
80 °C (176 °F)	0.3 Ω

1. Transmission fluid temperature sensor coupler

INSTALLATION

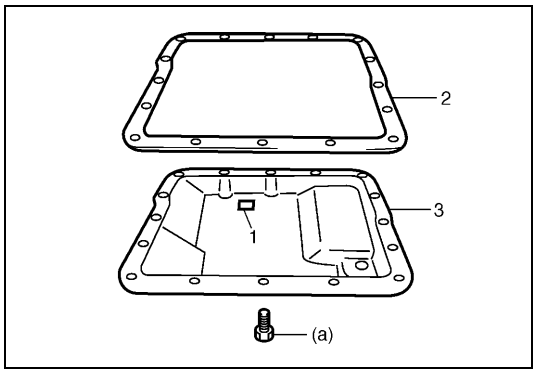
Reverse removal procedure for installation noting following points.

- Tighten solenoid valve bolts and valve body assembly bolts to specification referring to “Unit Assembly” in this section.

Tightening torque
Solenoid valve bolts : 8 N·m (0.8 kg-m, 6.0 lb-ft)

Tightening torque
Valve body bolts
: 10 N·m (1.0 kg-m, 7.5 lb-ft)

- Make sure that slot of manual valve is fitted to pin of manual valve lever.



- Clean mating surface of A/T oil pan (3) and A/T case and install new gasket (2) to A/T oil pan.
  Tighten bolts to specification

Tightening torque
A/T oil pan bolts
(a) : 7.5 N·m (0.75 kg-m, 5.5 lb-ft)

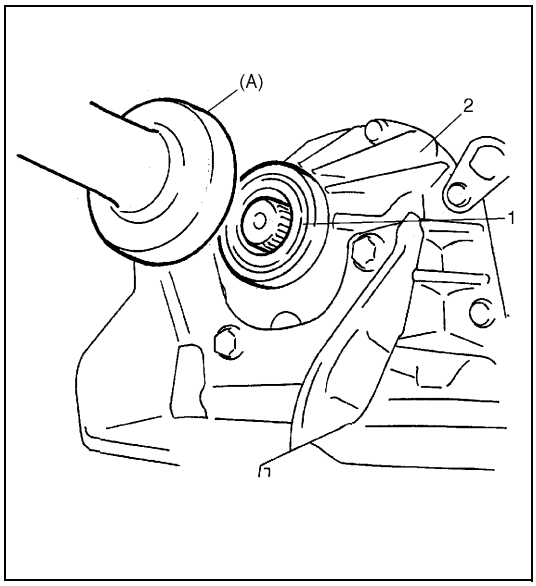
1. Magnet

- Refill A/T fluid referring to “Maintenance Service” in this section and verify that there is no A/T fluid leakage.

Extension Case Oil Seal

REPLACEMENT

1) Lift up vehicle and drain transmission oil.
2) Remove propeller shaft No.1 and No.2.
   Refer to “Propeller Shafts” in Section 4B for procedure.



3) Remove extension case (2) oil seal (1) by using screwdriver or like.
4) Install new extension case oil seal by using special tool.

NOTE:

For oil seal installation, press-fit oil seal so that transmission case end face is flush with oil seal end face.

Special tool
(A): 09913-75520

5) Install propeller shafts referring to “Propeller shafts” in Section 4B.
6) Refill A/T fluid referring to “Maintenance Service” in this section.

Transmission Control Module (TCM)

CAUTION:

TCM and ECM consist of highly precise parts, so when handling it (or them), be careful not to expose to excessive shock.

REMOVAL

Remove ECM and separate TCM from ECM bracket.
Refer to “Electronic Control System” in Section 6E for ECM removal.

INSTALLATION

Reverse removal procedure noting the following.

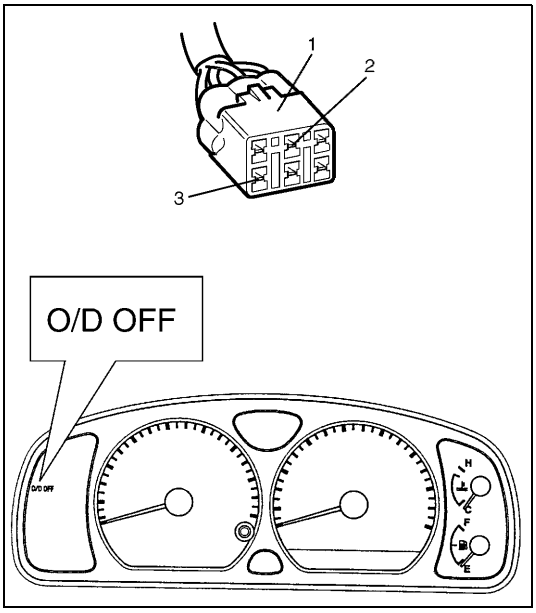
- Connect ECM and TCM couplers securely.
- If the vehicle is equipped with air bag system, be sure to enable air bag system after TCM and ECM are back in place. Refer to “Enabling Air Bag System” in Section 10B.

Learning Control Memory Initialization

Initialization of learning control memory in TCM should be made upon replacement of parts as explained below.

- Automatic transmission assembly replacement with new or used one
- Any A/T brake component parts replacement such as discs, plates and flange with new or used one(s)
- Any A/T clutch component parts replacement such as discs, plates and flange with new or used one(s)
- Replacement of TCM with used one

1) Turn ignition switch to “ON” position. (Do not start engine.)
2) Bring diagnosis switch terminal (2) of monitor coupler (1) in contact with ground terminal (3) using service wire.
3) Repeat shifting selector lever from “D” to “2” position and vice versa for 3 times within 10 seconds to complete memory initialization.
4) Confirm initialization by DTC set in system referring to “DTC Check” in this section.
   DTC No.12: completion of initialization is confirmed
   DTC No.52: initialization is failed
5) If you failed initialization, repeat steps 1) to 3).



NOTE:

- **“O/D OFF” lamp continues to turn on while initialization.**
- **DTCs which might have been set in system other than No.12 and 52 are also erased by initialization.**

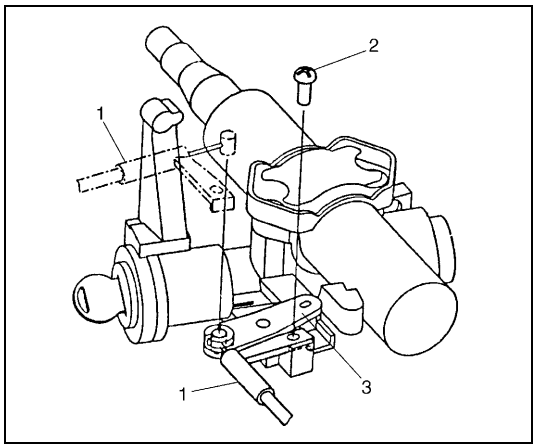
Interlock Cable (if equipped)

NOTE:

Don’t bend interlock cable excessively when removing and installing it, or system will not operate correctly.

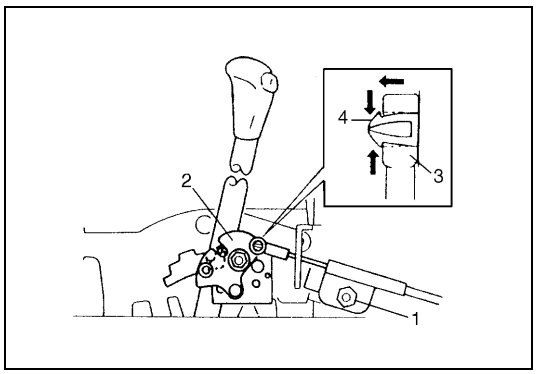
REMOVAL

1) Disconnect negative cable at battery and disable air bag system, referring to “Disabling Air Bag System” in Section 10B.
2) Remove steering upper and lower cover.



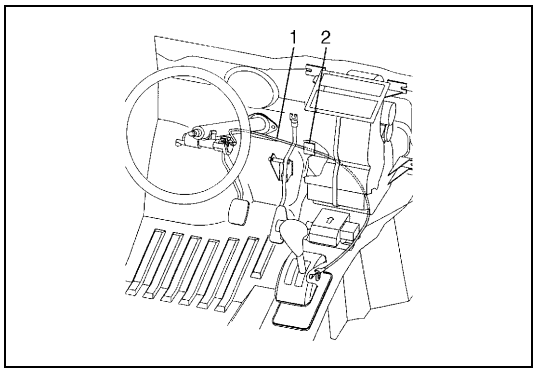
3) Remove interlock cable (1) clamp screw (2) located at ignition switch and disconnect interlock cable from key cylinder cam (3) with ignition switch turned at “ACC” position. And then turn ignition switch to “LOCK” position.

4) Remove parking brake cover and console box.



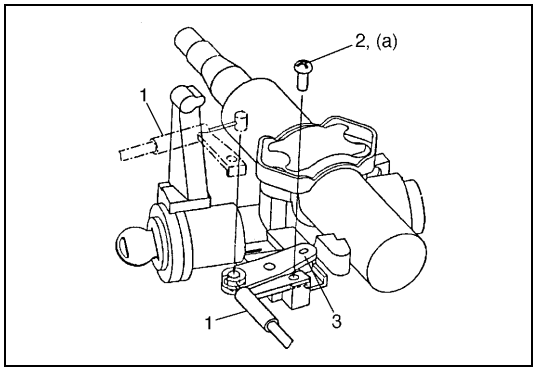
5) Remove cable bracket nut (1) and detach cable end (3) from key release cam (2) while pressing claws of release cam boss (4).
   At this time, be careful not to cause damage to its claws.
6) Remove interlock cable.

INSTALLATION



1) Install interlock cable (1) as shown in figure.

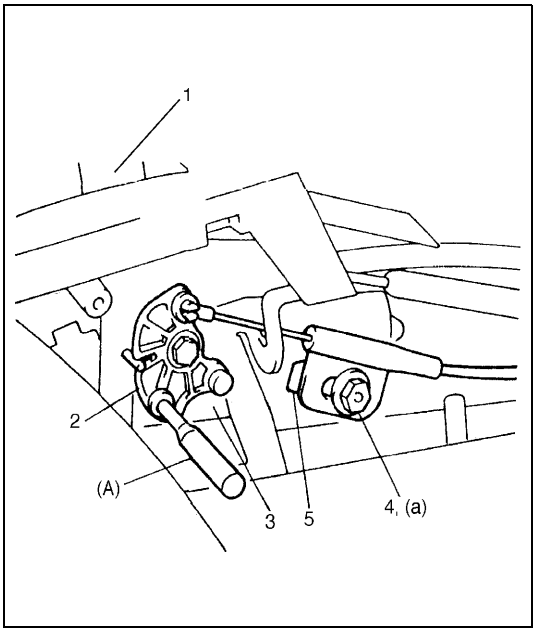
2. Tape



2) Connect cable (1) end to steering lock and tighten cable clamp screw (2) securely.

Tightening torque
Interlock cable screw
(a) : 2.2 N·m (0.22 kg-m, 1.6 lb-ft)

3. Key cylinder cam



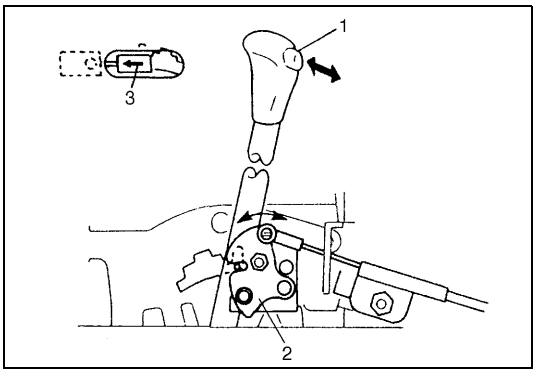
3) Shift selector lever (1) to “P” position and with lock plate manually moved toward front side of vehicle, push knob button of selector lever.
4) Under above condition, fix key release cam (2) inserting special tool into holes on cam and selector bracket (3).

Special tool
(A) : 09925-78210 (6 mm)

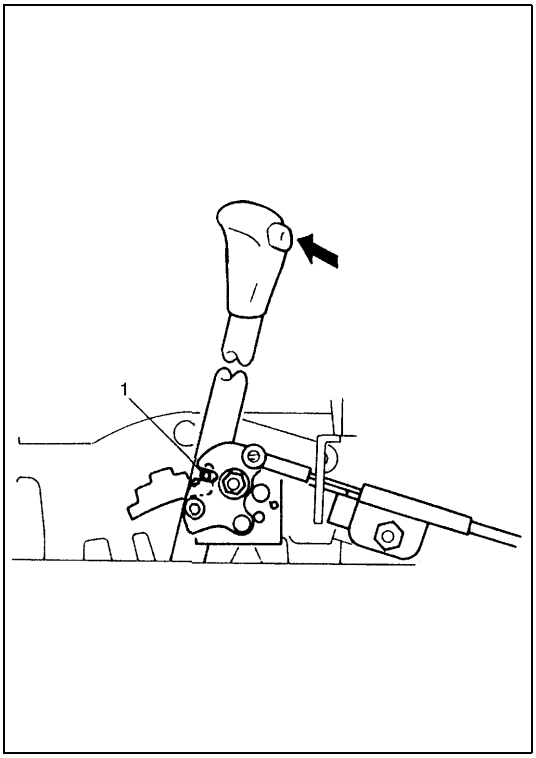
5) Connect cable end to key release cam.
6) With cable bracket pushed in arrow direction by spring force, tighten cable bracket nut (4).

Tightening torque
Interlock cable bracket nut
(a) : 13 N·m (1.3 kg-m, 9.5 lb-ft)

5. Leaf spring



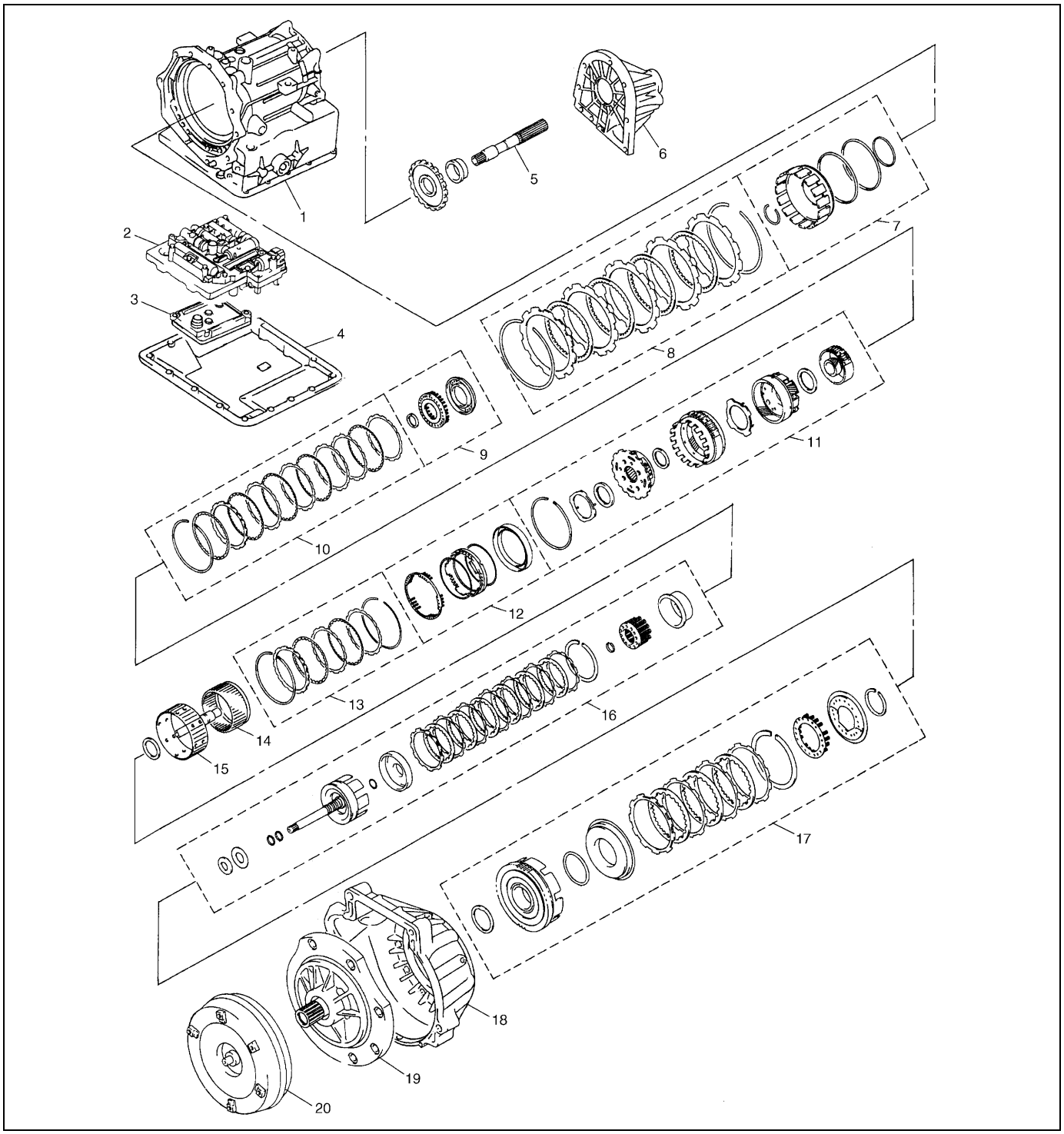
7) Remove special tool. Then with lock plate of shift lock solenoid (3) manually moved toward front side of vehicle, check that key release cam (2) moves smoothly by operating knob button (1) of selector lever.



8) With selector lever set at “P” position, turn ignition key to “ACC” position and then check for following conditions.
   - With knob button released, ignition key can be turned from “ACC” position to “LOCK” position.
   - With knob button pressed, ignition key cannot be turned from “ACC” position to “LOCK” position.
9) Install steering upper and lower cover.
10) Connect negative cable at battery and enable air bag system, referring to “Enabling Air Bag System” in Section 10B.

1. Detent pin position when knob button is pressed at “P” position

Unit Repair Overhaul



1. Transmission case	6. Extension case	11. Planetary gear assembly	16. C2 (Rear clutch) assembly
2. Valve body assembly	7. B2 (reverse brake) piston assembly	12. B0 (O/D brake) piston assembly	17. C1 (front clutch) assembly
3. Oil strainer	8. B2 brake assembly	13. B0 brake assembly	18. Torque converter housing
4. A/T oil pan	9. B1 (1st & 2nd brake) piston assembly	14. Front planetary sun gear	19. Oil pump assembly
5. Output shaft	10. B1 brake assembly	15. Intermediate shaft	20. Torque converter

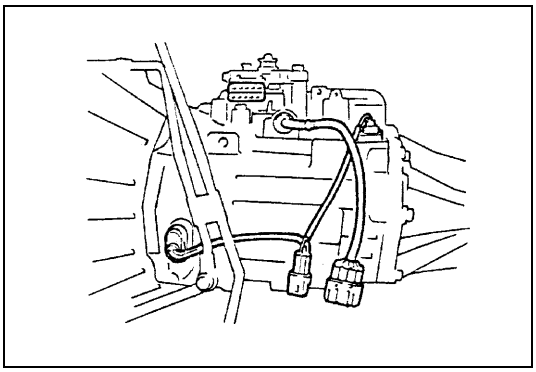
NOTE:

When transmission is replaced, or when any A/T clutch or brake component parts such as discs, plates and flange are replaced with new or used one(s), learning control memory of TCM should be initialized after those replacement referring to "Learning Control Memory Initialization" in this section.

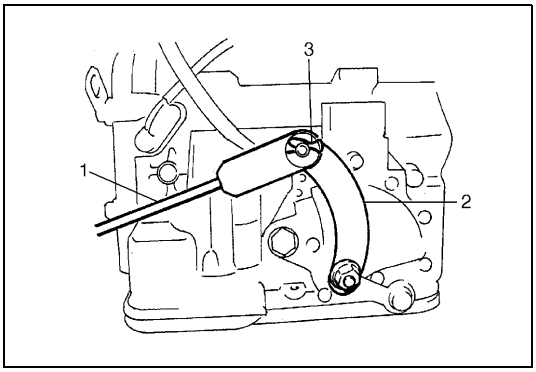
Unit Dismounting

NOTE:

If automatic transmission is overhauled later on, draining A/T fluid at this point will facilitate work.



1) Remove following parts.
   - Propeller shafts No.1 and No.2 (refer to “Propeller shafts” in Section 4B)
   - Exhaust pipe (refer to “Component” in Section 6K)
   - Negative cable from battery
2) Disconnect couplers. (2 couplers from wire harness and 1 from shift switch)

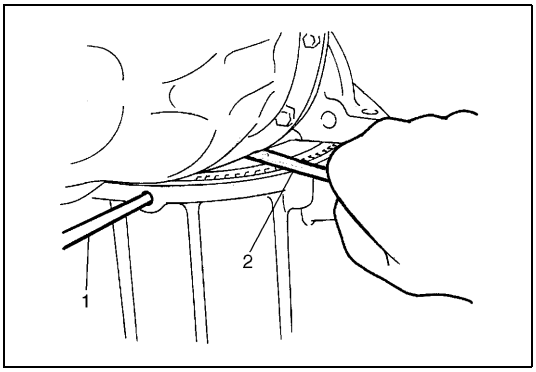


3) Remove selector rod (1) from shift control shaft lever (2) by removing pin (3).
4) Remove oil cooler hoses from pipes.

NOTE:

To avoid leakage of transmission fluid, plug open ends of oil cooler pipes and hoses right after they are disconnected.

5) Remove torque converter housing lower plate.

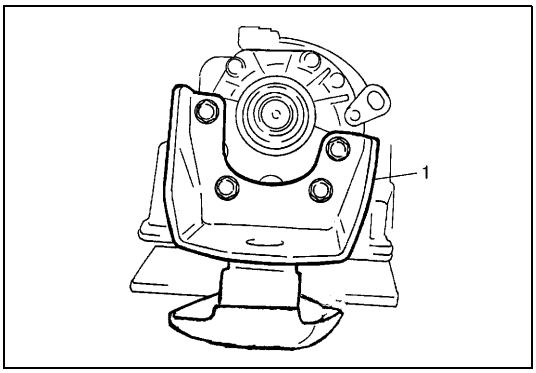


6) Remove drive plate bolts.
   To lock drive plate, engage a flat screwdriver (1) with drive plate gear.

2. Wrench

7) Remove starting motor.

8) With transmission held up on jack, remove engine to transmission bolts and nuts.



9) Remove transmission rear mounting bracket (1).
10) Move transmission to the rear a little and lower it including torque converter.

WARNING:

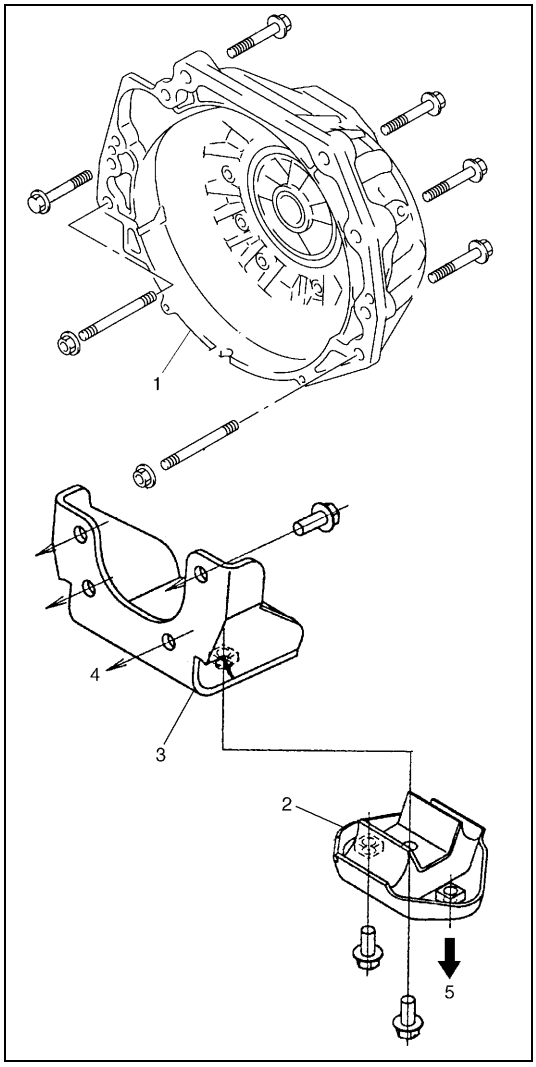
Be sure to keep transmission horizontal throughout the work. Should it be tilted, torque converter may fall off and cause personal injury and A/T fluid may flow out.

Unit Remounting

WARNING:

When moving transmission assembly with torque converter equipped in it, be sure to keep it horizontal. Tilting it with its front facing down may allow converter to fall off. Whereby an injury may result.

For remounting, reverse dismounting procedure. Use specified torque as given below and left.



Tightening torque	N·m	kg-m	lb-ft
Exhaust pipe to manifold bolts	50	5.0	36.5
Muffler to exhaust pipe bolts	50	5.0	36.5
Universal joint flange bolts and nuts	50	5.0	36.5
Drive plate bolts	19	1.9	14.0
Engine to transmission bolts and nuts	80	8.0	58.0
Rear mounting bracket to transmission bolt	25	2.5	18.0
Rear mounting to bracket bolt	25	2.5	18.0
Frame to rear mounting bolts	25	2.5	18.0

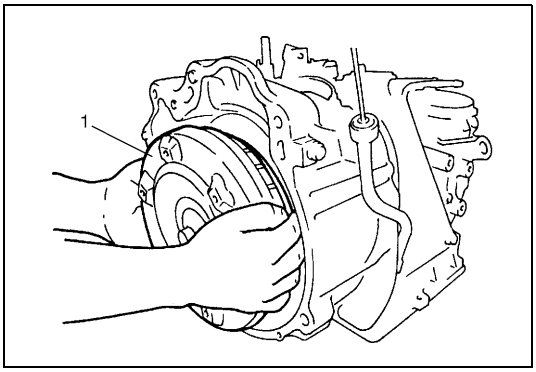
- Clamp wiring harness and hoses securely.
- Refer to “Selector Rod” in this section for adjusting procedure of selector rod.
- Follow fluid level check procedure in “Maintenance Service” in this section for refilling automatic transmission fluid, its level adjusting and fluid specification.
- Connect battery, and confirm that engine and transmission function acceptably.
- When remounting drive plate, use specified bolts.

1. Torque converter housing
2. Transmission rear mounting
3. Transmission rear mounting bracket
4. To transmission
5. To frame

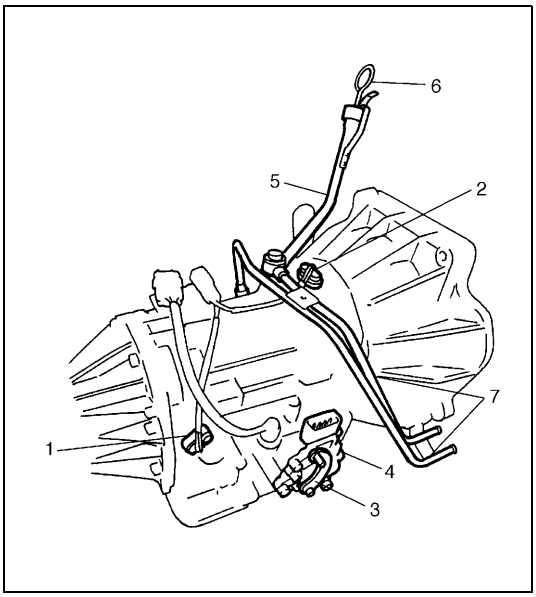
Unit Disassembly

CAUTION:

- **Thoroughly clean transmission exterior before overhauling it.**
- **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 torque converter (1).

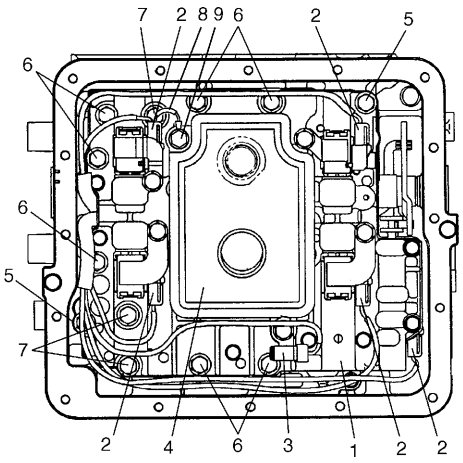


2) Remove following parts.
- Battery ground cable (if still attached)
- Output shaft speed sensor (1) and input shaft speed sensor (2)
- Shift control shaft lever (3) and transmission range sensor (4)
- A/T fluid level gauge (6) and filler tube (5)
- Oil cooler pipes (7)

3) Remove oil pan and oil pan gasket.

NOTE:

For removal of oil pan, do not turn transmission over as this will contaminate valve body with foreign matters in the bottom of oil pan.
When removing oil pan, tap around it lightly with a plastic hammer. Do not force it off by using a screwdriver or the like.



4) Remove one of oil strainer bolts (9) and ground wire (8) of shift solenoid valve No.1.
   Disconnect couplers (2) from solenoid valves, and transmission fluid temperature sensor.
   Remove transmission fluid temperature sensor (3) and oil strainer assembly (4).
5) Remove valve body assembly (1).

CAUTION:

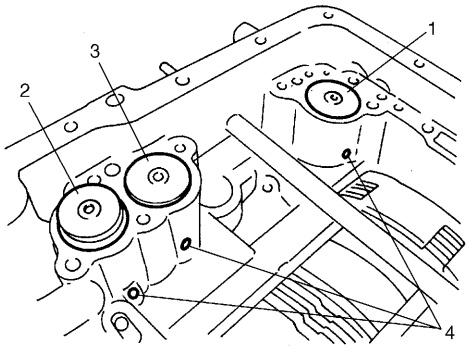
Be careful not to let manual valve fall off when removing valve body assembly.

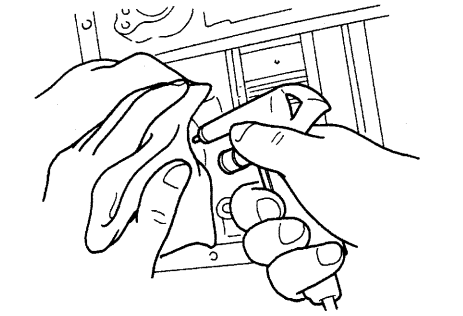
NOTE:

There are three kinds of bolts fixing valve body assembly (1).

5.	Bolt A
6.	Bolt B
7.	Bolt C

6) Remove solenoid harness assembly.

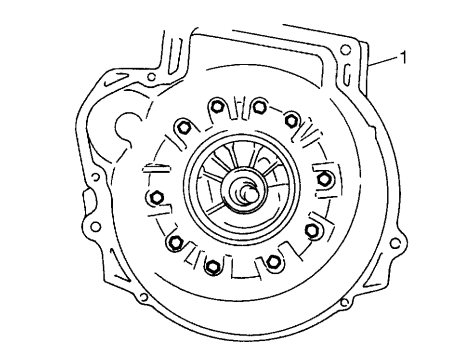




7) Remove accumulator pistons and springs.
   To remove C1 (1), C2 (2) and B1 (3) accumulator pistons and springs, position a rag on pistons to catch each piston.
   To remove pistons, force low-pressure compressed air (1 kg/cm^2, 15 psi, 100 kPa, max) into hole (4) as shown in figure, and pop each piston into the rag.
   To remove B0 accumulator piston and spring, remove snap ring and accumulator spacer, then remove spring and piston.

NOTE:

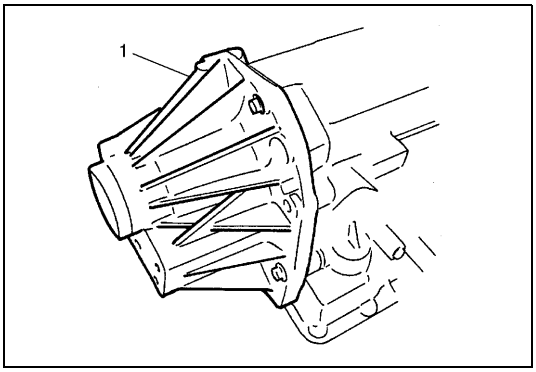
Do not push accumulator pistons with fingers or anything before removing them. Pushing them may cause compressed fluid in accumulator to spew out of hole and get to your face and clothes.



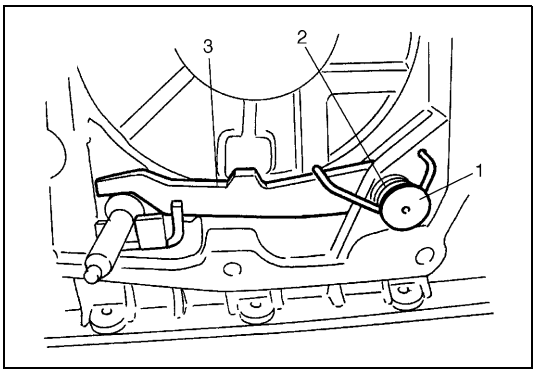
8) Remove torque converter housing (1).
   a) Remove housing bolts.
   b) Remove housing while tapping around it lightly with a plastic hammer.

NOTE:

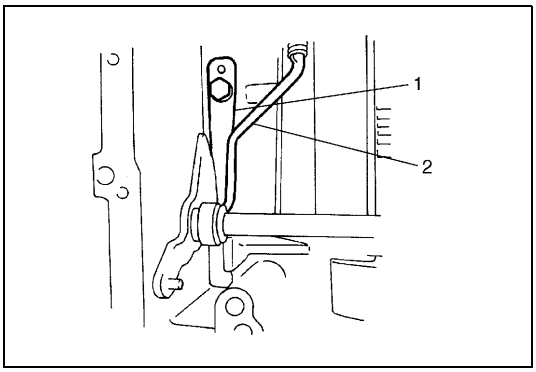
Never reuse housing bolts.



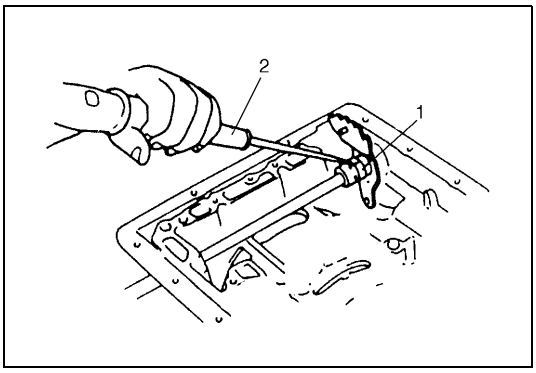
9) Remove extension case (1) and disconnect output shaft assembly.
Remove thrust bearing from transmission case.



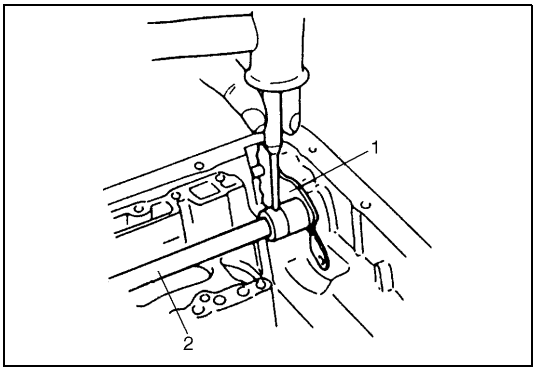
10) Remove parking pawl shaft (1), spring (2) and then parking pawl (3).



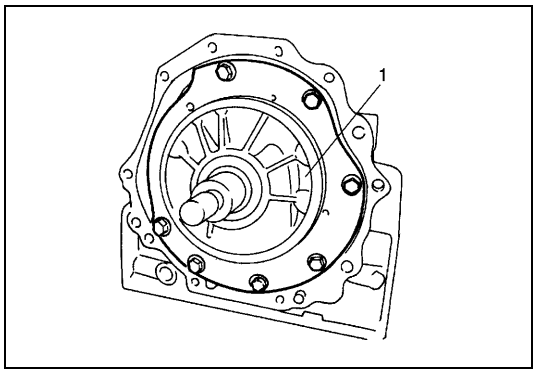
11) Remove detent spring (1) and parking rod (2).



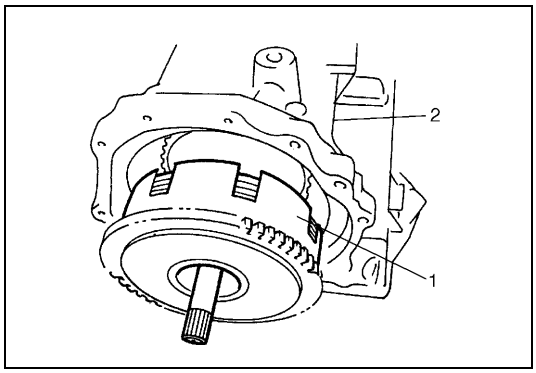
12) Remove manual shift shaft as follows, if necessary.
a) Remove sleeve cover (1) by using caulking tool (2).



b) Using a punch, drive out manual shift lever pin, pull out manual shift shaft (2) and remove manual shift lever (1). Then remove sleeve cover from manual shift lever.
Remove oil seal from both sides of transmission case and replace as necessary.

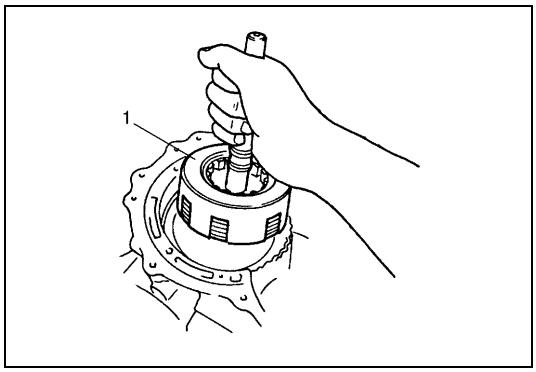


13) Remove oil pump (1).

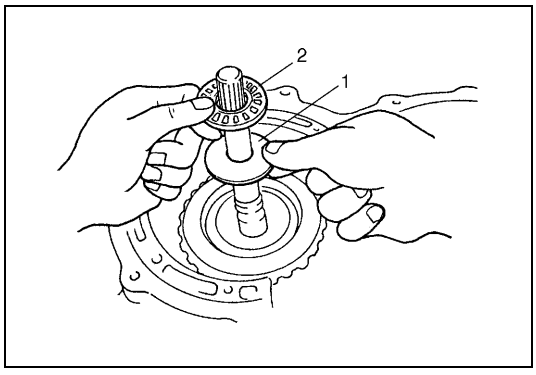


14) Remove front disc clutch assembly (1).

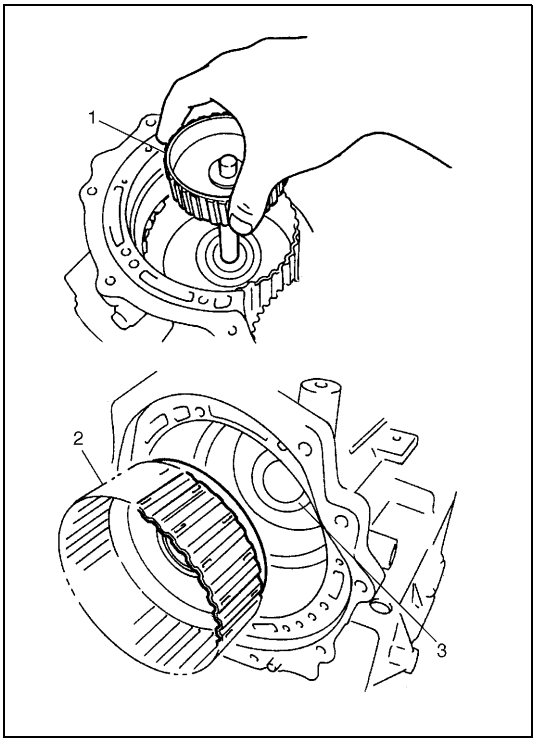
2. Transmission case



15) Remove rear disc clutch assembly (1).

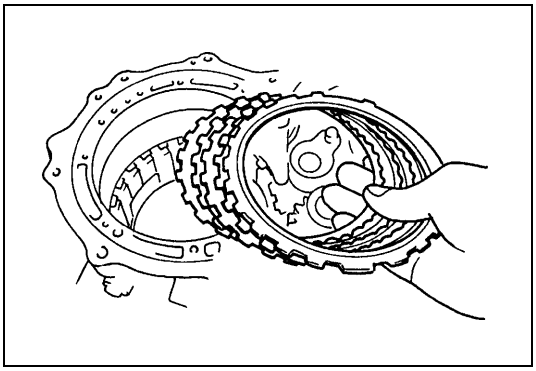


16) Remove thrust bearing race (1) and thrust needle roller bearing (2).

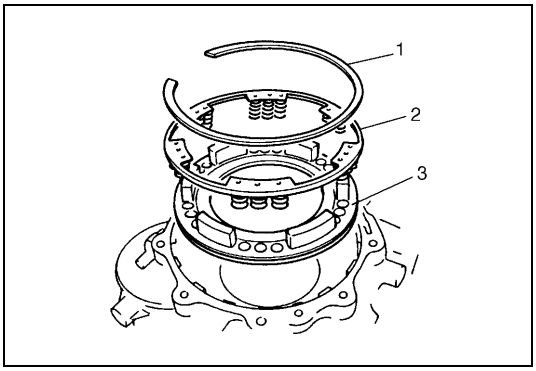


17) Remove intermediate shaft assembly (1) and front sun gear (2).

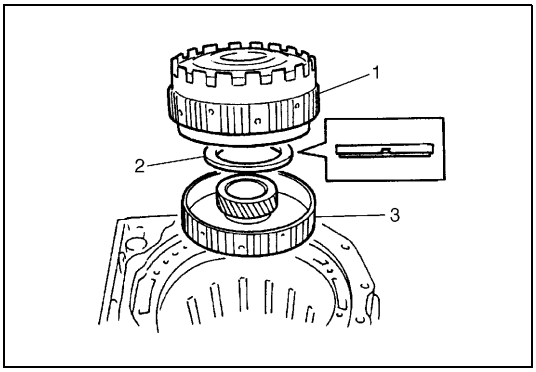
3. Thrust bearing



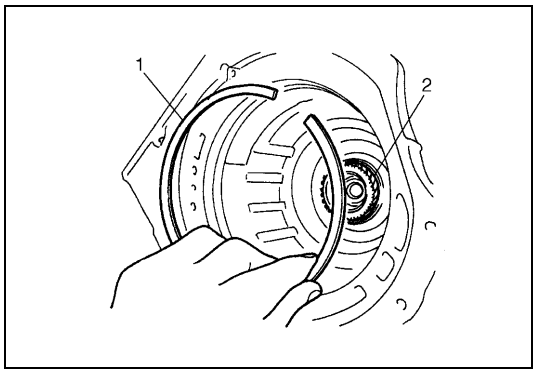
18) Remove B0 brake snap ring, brake flanges, brake discs and brake plates.



19) Remove snap ring (1) then remove B0 brake piston return spring subassembly (2) and B0 brake piston (3) & drum assembly.

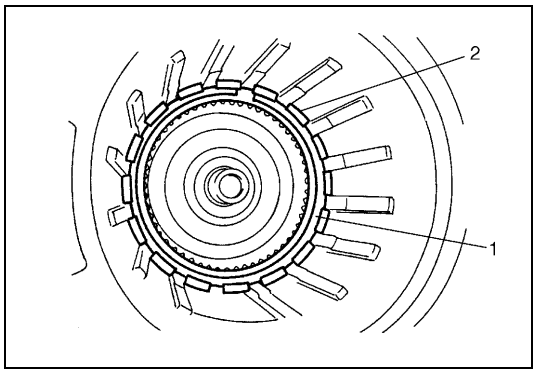


20) Remove planetary carrier assembly (1), thrust needle bearing (2) and rear sun gear (3).



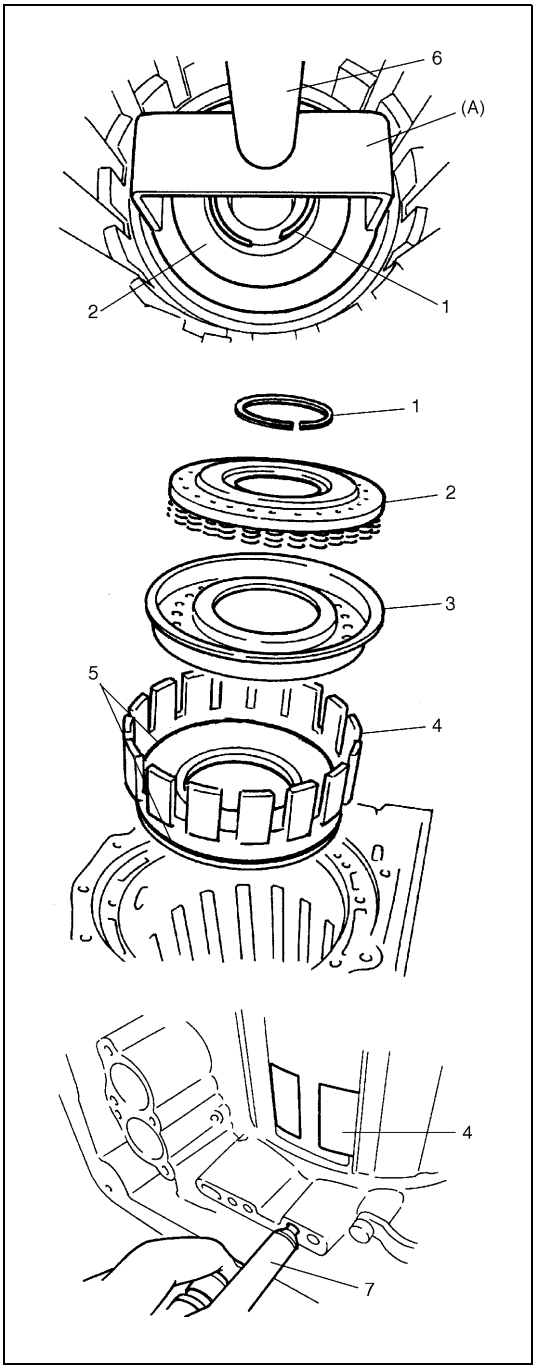
21) Remove B2 brake snap ring (1), brake flange, brake discs, brake plates and cushion plate.

2. Rear sun gear



22) Remove B1 brake snap ring (1), brake flange, brake discs and brake plates.

2. B2 brake piston



23) Use hydraulic press (6) and special tool to compress B1 & B2 brake return spring seat (2), then remove snap ring (1).

Special tool
(A) : 09926-96010

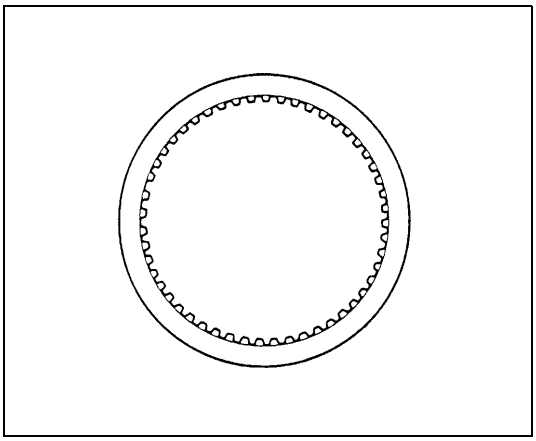
NOTE:

Do not compress wave spring more than necessary.

24) Remove spring seat and B1 brake piston (3) from B2 brake piston (4).
25) Remove B2 brake piston.
To remove B2 brake piston, force low-pressure compress air (1 kg/cm^2, 15 psi, 100 kPa max) into hole shown in figure, and pop out piston into a rag.

5. O-ring
7. Air gun

INSPECTION



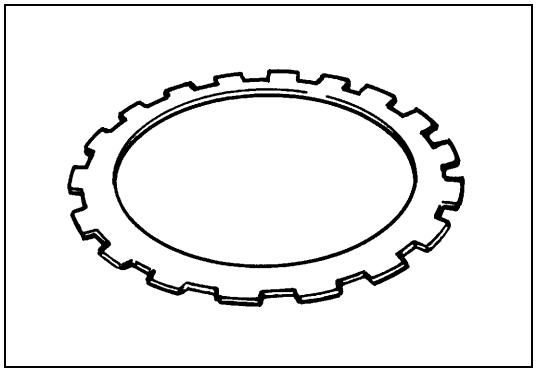
Clutch and Brake Discs

Dry and inspect them for pitting, burn flaking, wear, glazing, cracking, charring and chips or metal particles imbedded in lining. If discs show any of the above conditions, replacement is required.

NOTE:

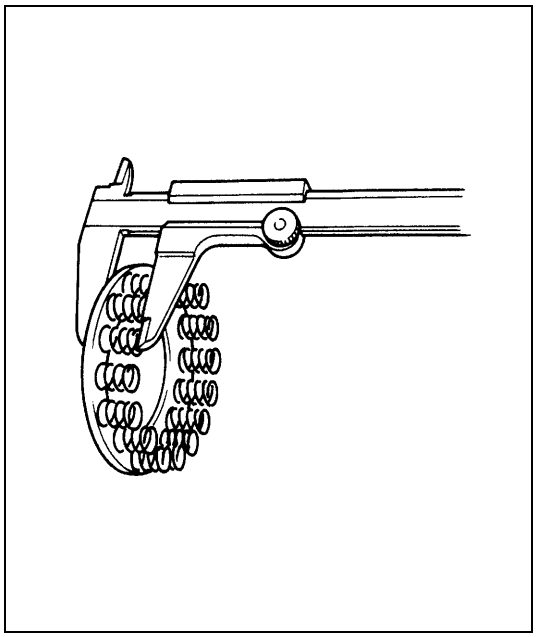
- **If disc lining is exfoliated or discolored, replace all discs.**
- **Before assembling new discs, soak them in A/T fluid for at least two hours.**

Clutch and Brake Plates and Flanges



Dry plates and check for discoloration. If plate surface is smooth and even color smear is indicated, the plate should be reused. If severe heat spot discoloration or surface scuffing is indicated, the plate must be replaced.

Brake Piston Return Spring Subassembly



Measure height of B1 & B2 and B0 brake piston return springs.

Brake piston return spring height
Standard :
15.62 mm (6.15 in.) (B1 & B2 return spring assembly)
15.19 mm (5.98 in.) (B0 return spring assembly)

NOTE:

- **Do not apply excessive force when measuring spring height.**
- **Perform measurement at several points.**

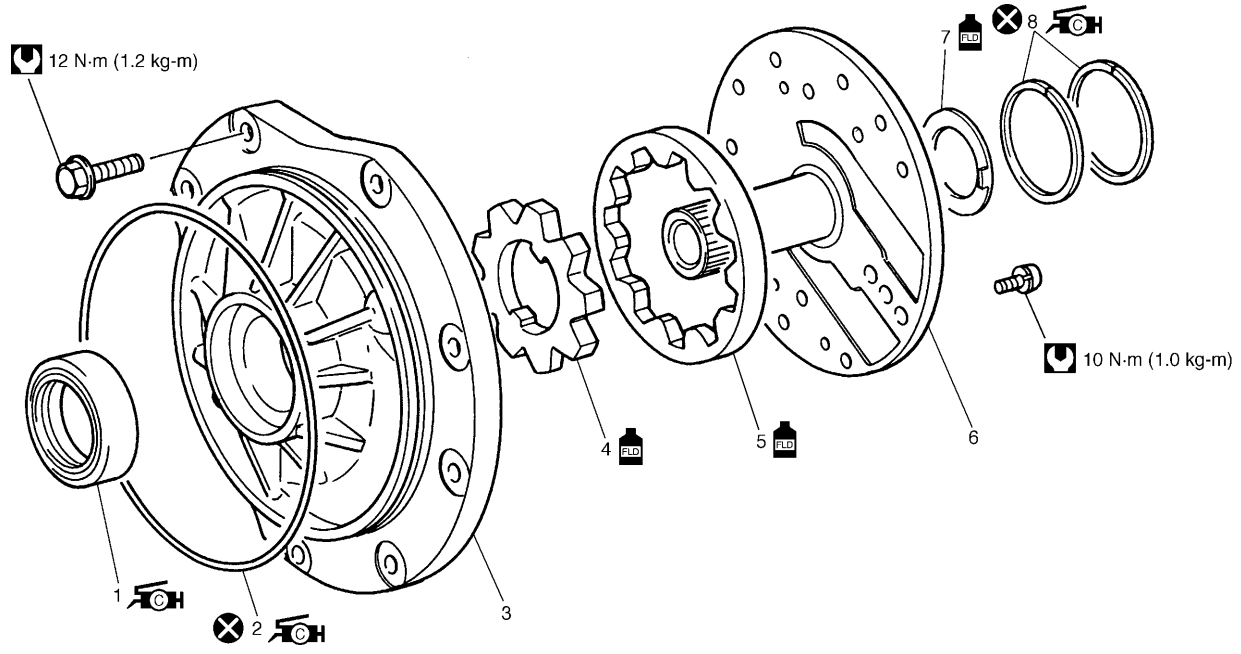
Evidence of extreme heat or burning in the area of clutch may have caused springs to take a heat set and would require their replacement.

Disassembly of Subassembly

CAUTION:

- **Keep component parts in group for each subassembly and avoid mixing them up.**
- **Clean all parts with cleaning solvent thoroughly and air dry them.**
- **Use kerosene or automatic transmission fluid as cleaning solvent.**
- **Do not use wiping cloths or rags to clean or dry parts.**
- **All oil passages should be blown out and checked to make sure that they are not obstructed.**
- **Keep face and eyes away from solvent spray while air blowing parts.**
- **Check mating surface for irregularities and remove them, if any, and clean it again.**
- **Soak new clutch discs and brake discs in transmission fluid for at least 2 hours before assembly.**
- **Replace all gaskets and O-rings with new ones.**
- **Apply automatic transmission fluid to all O-rings.**
- **When installing seal ring, be careful so that it is not expanded excessively, extruded or caught.**
- **Replace oil seals that are removed and apply grease to their lips.**
- **Before installing, be sure to apply automatic transmission fluid to sliding, rolling and thrusting surface of all component part. Also after installation, make sure to check each part for proper operation.**
- **Always use torque wrench when tightening bolts.**

Oil pump



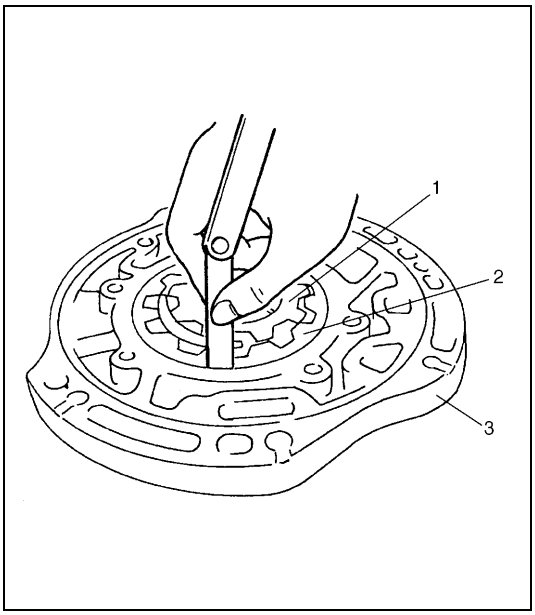
C	1. Oil seal : Apply grease 99000-25030 to oil seal lip.		7. Clutch drum thrust washer
C	2. D-ring : Apply grease 99000-25030 to all over surface.	C	8. Clutch drum oil seal ring : Apply grease 99000-25030 to all over surface.
	3. Oil pump body	FLD	Apply automatic transmission fluid.
	4. Oil pump drive gear		Tightening torque
	5. Oil pump driven gear		Do not reuse.
	6. Stator shaft assembly		

DISASSEMBLY

1) Remove D-ring from pump body.
2) Remove 2 oil seal rings and clutch drum thrust washer.
3) Remove 11 bolts.
4) Separate pump body from stator shaft assembly.
5) Remove oil seal from pump body.

INSPECTION

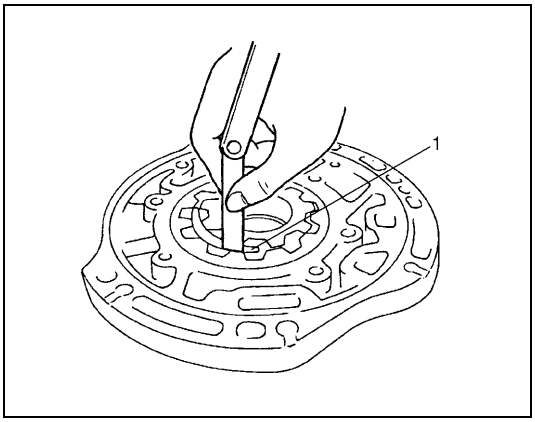
1) Inspect pump body oil seal.
   Check for wear, damage or cracks.
   Replace oil seal if necessary and apply grease to its lip portion slightly when it is installed.



2) Check body clearance of driven gear.
   Push driven gear (2) to one side of body (3). Using a feeler gauge, measure clearance between driven gear and body.
   If clearance exceeds its standard value, replace oil pump assembly.

Clearance between drive gear and body
Standard : 0.08 – 0.15 mm (0.0027 – 0.0059 in.)
Limit : 0.30 mm (0.018 in.)

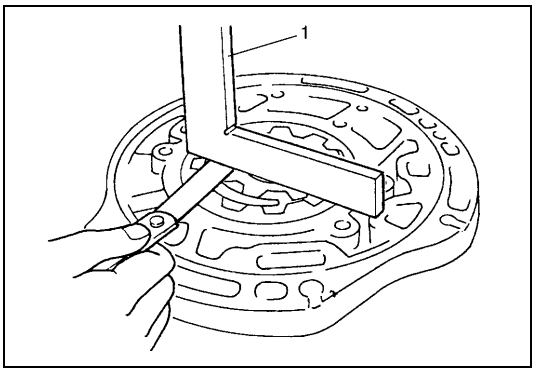
1. Oil pump drive gear



3) Check tip clearance of both drive and driven gears.
   Measure radial clearance between gear tooth and crescent.
   If clearance exceeds its standard value, replace oil pump assembly.

Radial clearance between oil pump gear tooth and oil pump body
Standard : 0.13 – 0.20 mm (0.0051 – 0.0079 in.)
Limit : 0.30 mm (0.018 in.)

1. Pump body crescent portion

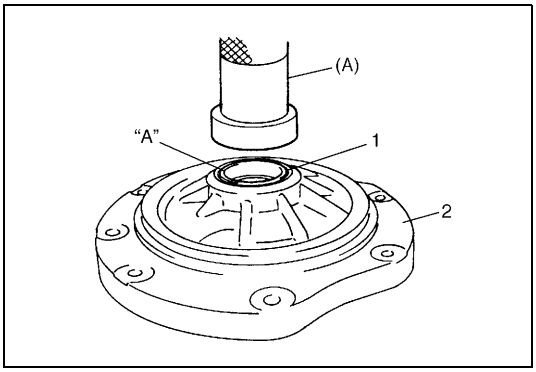


4) Check side clearance of both gears.
   Using a straightedge and a feeler gauge, measure side clearance between gear and pump body.
   If clearance exceeds its standard value, replace oil pump assembly.

Side clearance between gear and oil pump body
Standard : 0.02 – 0.04 mm (0.0008 – 0.0019 in.)

1. Straightedge (Press it down while measuring)

ASSEMBLY

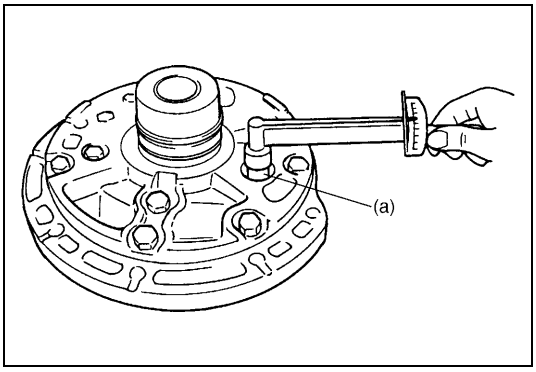


1) Install pump body oil seal (1).
   Use special tool and hammer to install it, and then apply grease to its lip portion.

   Special tool
   (A) : 09913-85210

   "A": Grease 99000-25030

2) Install driven gear and drive gear to pump body (2) after applying A/T fluid to gears.

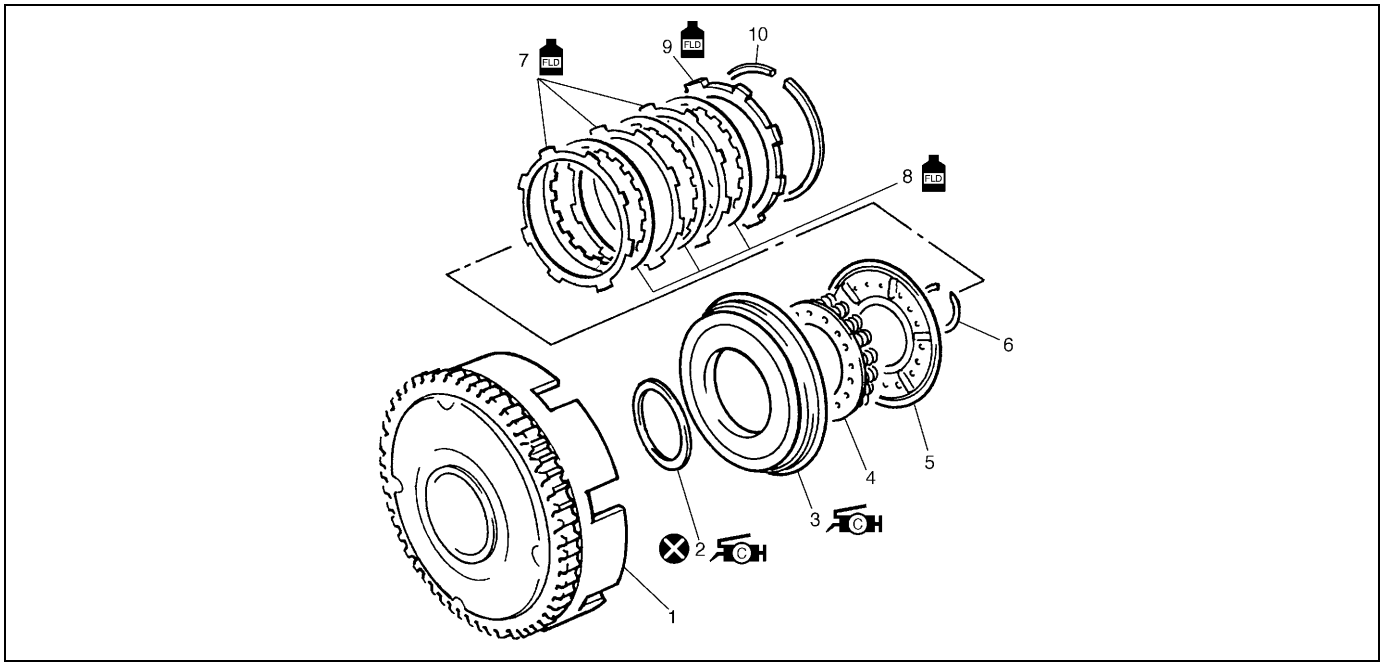


3) Install stator shaft assembly to pump body and tighten 11 pump cover bolts to specification.

   Tightening torque
   Oil pump cover bolts (a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)

4) Install 2 new oil seal rings to stator shaft.
5) Apply grease to 2 oil seal rings.
6) Install D-ring applied with grease and make sure that it is not twisted or extruded.
7) Check drive gear for smooth rotation.

Front clutch (C1 clutch)

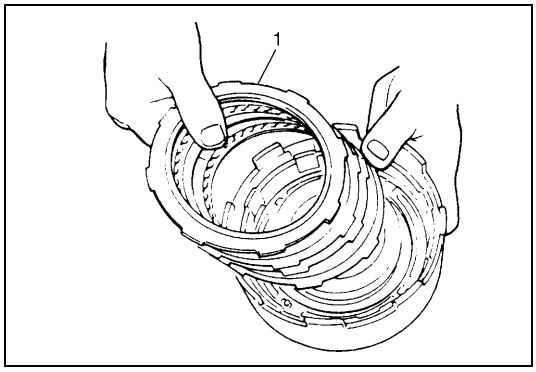


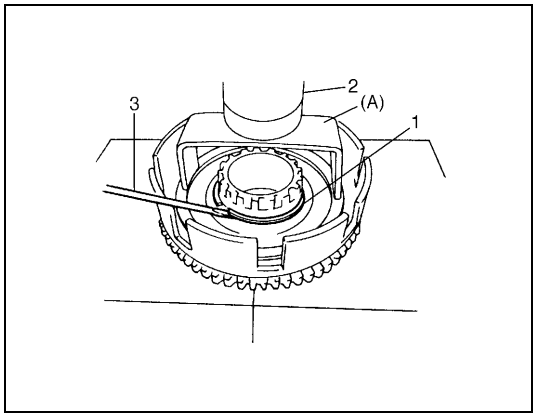
	1. Front clutch No.1 drum	7. Clutch plate
C	2. D-ring : Apply grease 99000-25030 to all over surface.	8. Clutch disc
C	3. Front clutch piston : Apply grease 99000-25030 to the lip of the piston.	9. Clutch flange
	4. Front clutch return spring seat	10. Snap ring
	5. Front clutch balancer	FLD Apply automatic transmission fluid.
	6. Shaft snap ring	Do not reuse.

DISASSEMBLY

1) Remove snap ring.

2) Remove flange (1), discs and plates.

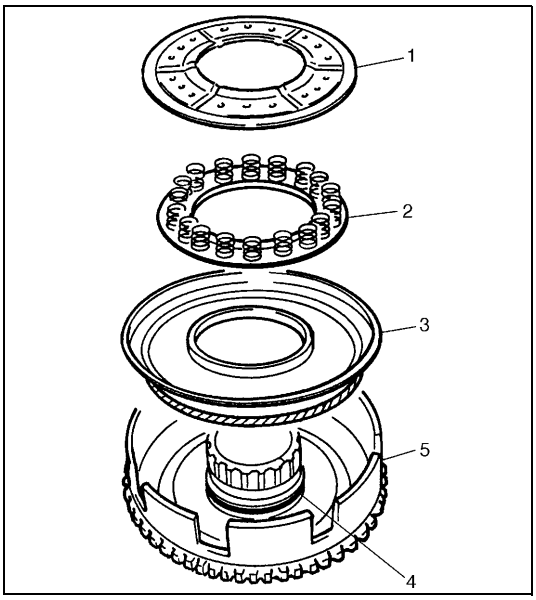




3) Remove shaft snap ring (1).
Compress piston return springs and remove shaft snap ring. Place special tool (clutch spring compressor) on spring seat and compress spring with a press (2), and then remove shaft snap ring, using a screwdriver (3).

CAUTION:
Do not push down return spring more than necessary.

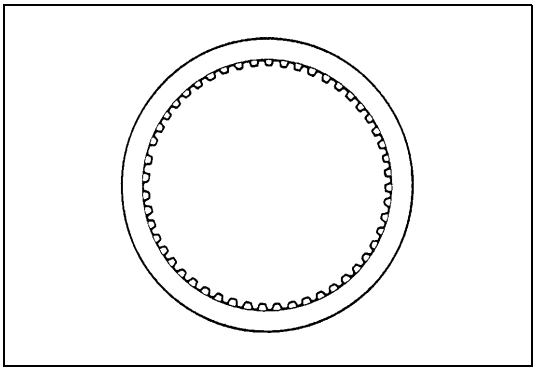
Special tool
(A) : 09926-96010



4) Remove front clutch balancer (1) and front clutch return spring seat (2).
5) Remove front clutch piston (3).
   Blow compressed air through input shaft oil hole to remove piston. If piston does not pop out, take it out with long nose pliers.
6) Remove D-ring (4) from front clutch No.1 drum (5).

INSPECTION

Clutch Discs, Plates and Flange

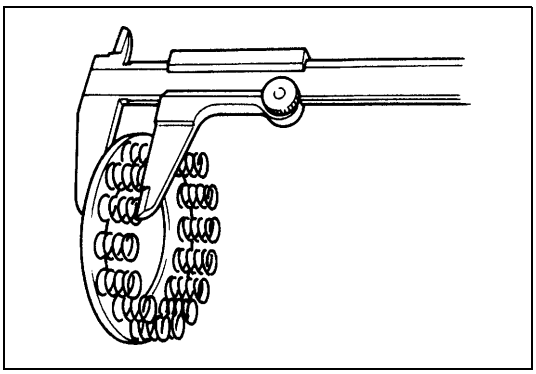


Check that sliding surfaces of discs, plates and flanges are not worn or burnt. If necessary, replace.

NOTE:

- **If disc lining is exfoliated or discolored, replace all discs.**
- **Before assembling new discs, soak them in A/T fluid for at least two hours.**

Front Clutch Return Spring Seat



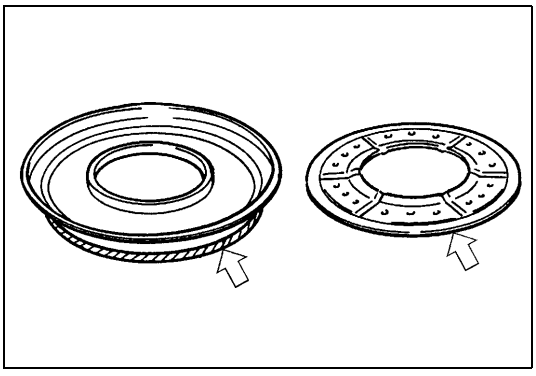
Measure height of front clutch return spring.

Height of front clutch return spring
14.85 mm (0.585 in.)

NOTE:

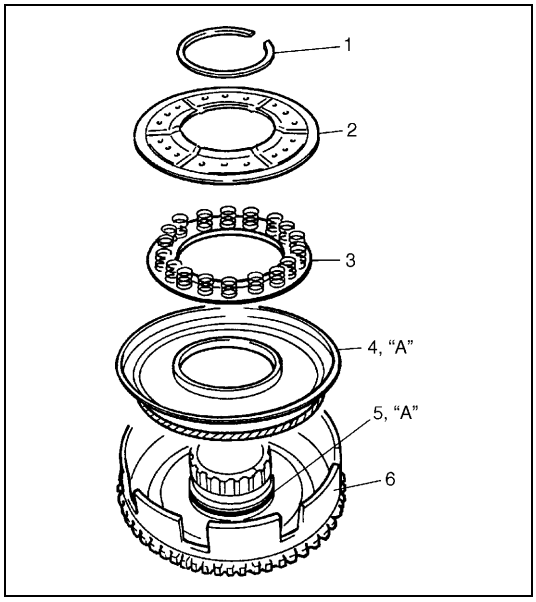
- **Do not apply excessive force when measuring spring height.**
- **Perform measurement at several points.**

Front Clutch Piston Lip and Front Clutch Balancer Lip



Check each lip for wear, deformation, cut, and/or hardening. If necessary, replace.

ASSEMBLY



1) Install new D-ring (5) to front clutch No.1 drum.
   Apply grease to D-ring and fit it to drum.

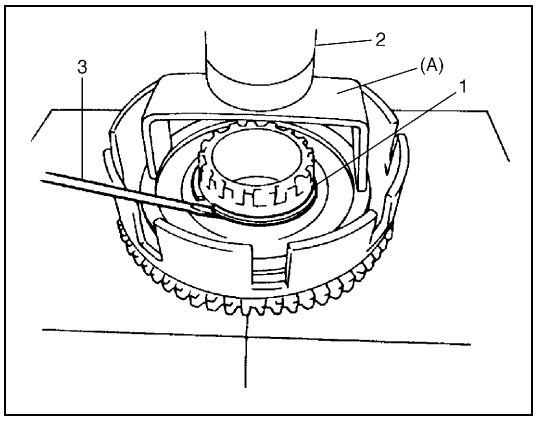
"A" : Grease 99000-25030

2) Install piston (4) into front clutch No.1 drum (6).
   Use care that the piston lip does not get twisted or caught.
   Apply grease to the lip of the piston.

"A" : Grease 99000-25030

3) Install front clutch return spring (3) seat and front clutch balancer (2).

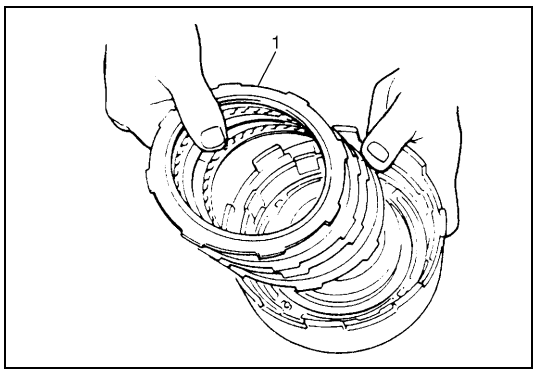
1. Snap ring



4) Install shaft snap ring (1).
   Compress return springs and install shaft snap ring in groove by using a screwdriver (3).
   Place special tool (clutch spring compressor) on spring seat and compress springs with a press (2).

CAUTION:
Do not compress return spring more than necessary.

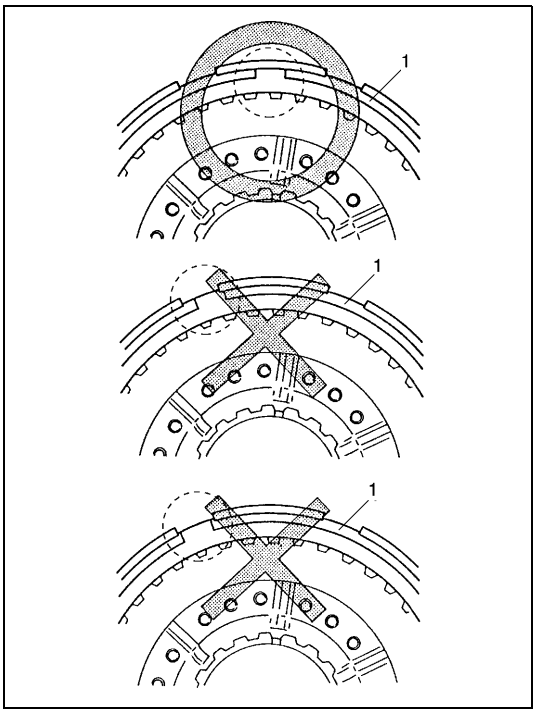
Special tool
(A) : 09926-96010



5) Install discs, plates and flange (1) in following order.
   1) Plate → 2) Disc → 3) Plate → 4) Disc → 5) Plate → 6) Disc → 7) Flange

NOTE:

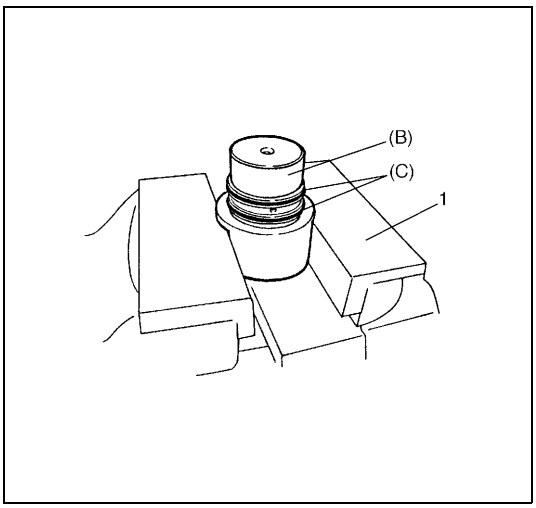
Before assembly, new discs should be soaked in automatic transmission fluid for at least 2 hours.



6) Install snap ring (1).

NOTE:

Make sure that the ends of the snap ring do not come to the opening of the front clutch No.1 drum.

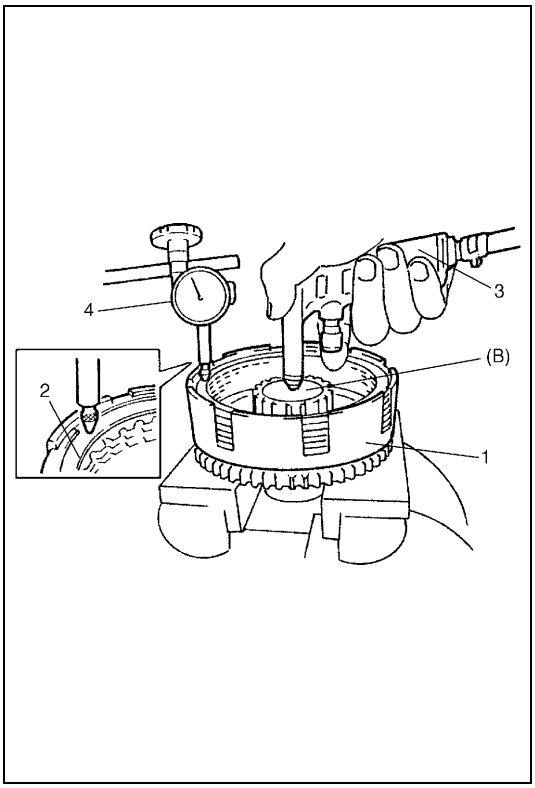


7) Place special tool (B) on soft jawed vise (1) and install 2 oil seal rings on special tool.

Special tool
(B) : 09926-26030
SUZUKI GENUINE PARTS
(C) : Clutch oil seal set 22860-81AT0

NOTE:

- **Clutch oil seal set has two oil seal rings in a set.**
- **Do not use the oil seal rings removed from oil pump assembly. It is not necessary to remove oil seal rings from special tool once installed.**



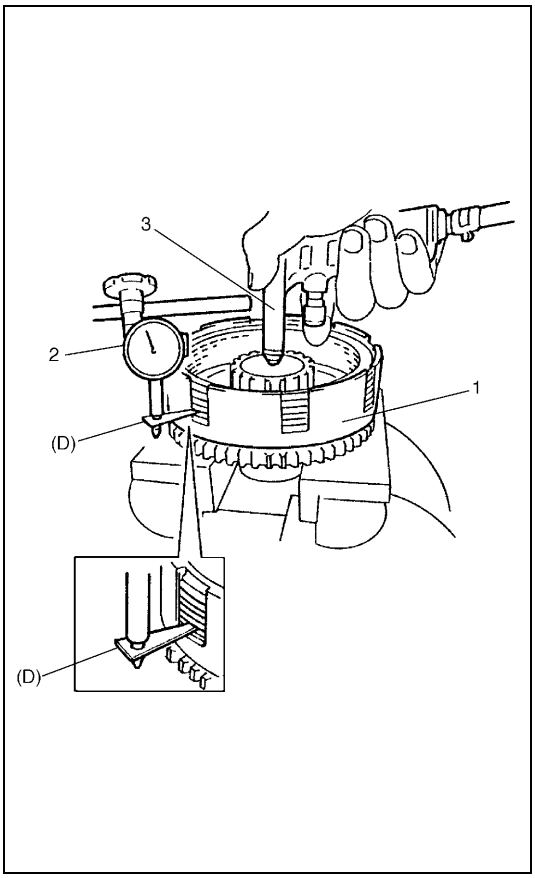
8) Place front clutch assembly (1) on special tool (B).
9) Set dial gauge (4) on the top of clutch flange (2) and measure clearance by blowing compressed air (4 kg/cm^2, psi) as shown in figure.

Front clutch disc clearance
0.65 – 1.20 mm (0.026 – 0.047 in.)

If the clearance is out of specification, use clutch flange of different, thickness to match the clearance to specification. Follow 5 types of clutch flanges are available as spare parts.

Available clutch flange thickness
2.750 mm (0.108 in.)
2.875 mm (0.113 in.)
3.000 mm (0.118 in.)
3.125 mm (0.123 in.)
3.250 mm (0.128 in.)
3.375 mm (0.133 in.)
3.500 mm (0.138 in.)

3. Air gun



10) Attach special tool (D) to dial gauge (2) and set them on the lowest clutch plate.

Special tool
(D) : 09952-06010

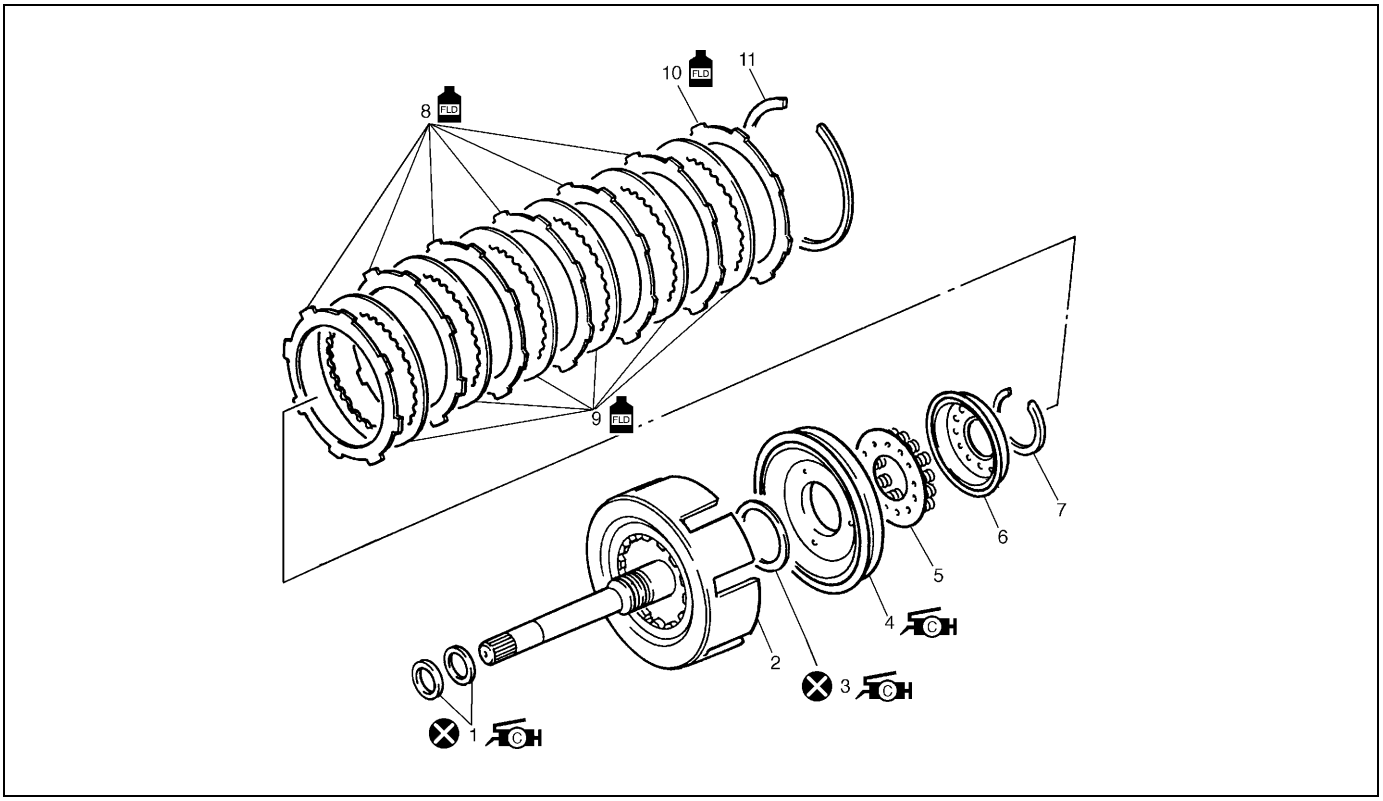
Measure piston stroke by blowing compressed air (4 kg/cm^2, 56.9 psi) as shown in figure.
If the piston stroke is out of specification, use clutch flange of different thickness to match the piston stroke to specification. Following 7 types of clutch flanges are available as spare parts.

Front clutch piston stroke
0.95 – 1.20 mm (0.037 – 0.047 in.)

Available clutch flange thickness
2.750 mm (0.108 in.)
2.875 mm (0.113 in.)
3.000 mm (0.118 in.)
3.125 mm (0.123 in.)
3.250 mm (0.128 in.)
3.375 mm (0.133 in.)
3.500 mm (0.138 in.)

1. Front clutch assembly
3. Air gun

Rear clutch (C2 clutch)

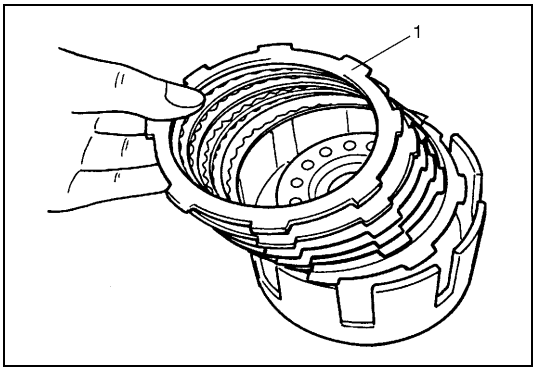


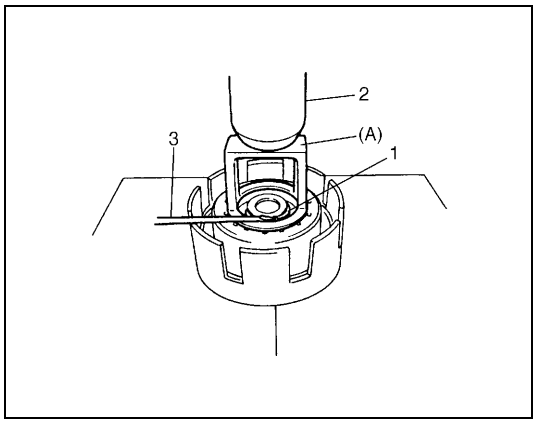
C H	1. Input shaft oil seal ring : Apply grease 99000-25030 to all over surface.		8. Clutch plate
	2. Input shaft subassembly		9. Clutch disc
C H	3. D-ring : Apply grease 99000-25030 to all over surface.		10. Clutch flange
C H	4. Rear clutch piston : Apply grease 99000-25030 to the lip of the piston.		11. Snap ring
	5. Rear clutch return spring seat	FLD	Apply automatic transmission fluid.
	6. Rear clutch balancer		Do not reuse.
	7. Shaft snap ring		

DISASSEMBLY

1) Remove snap ring.

2) Remove flange (1), discs and plates.

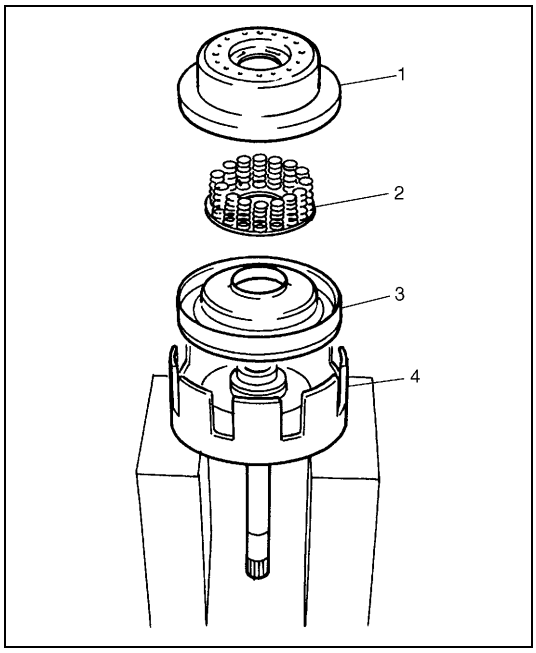




3) Remove shaft snap ring (1).
   Compress piston return springs and remove shaft snap ring. Place special tool (clutch spring compressor) on spring seat and compress spring with a press (2), and then remove shaft snap ring, using a screwdriver (3).

CAUTION:
Do not push down return spring more than necessary.

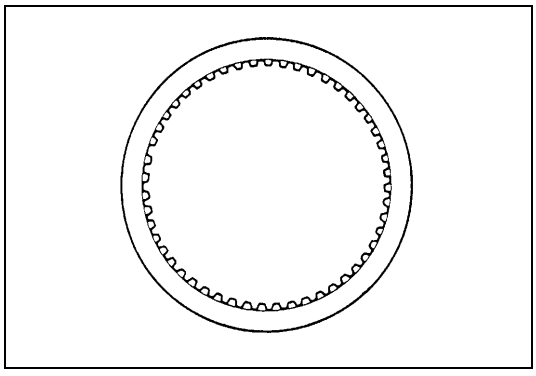
Special tool
(A) : 09926-96020



4) Remove rear clutch balancer (1) and rear clutch return spring seat (2).
5) Remove rear clutch piston (3).
   If piston does not pop out, blow compressed air through input shaft oil hole to remove piston.
6) Remove D-ring, and oil seals from input shaft subassembly (4).

INSPECTION

Clutch Discs, Plates and Flange

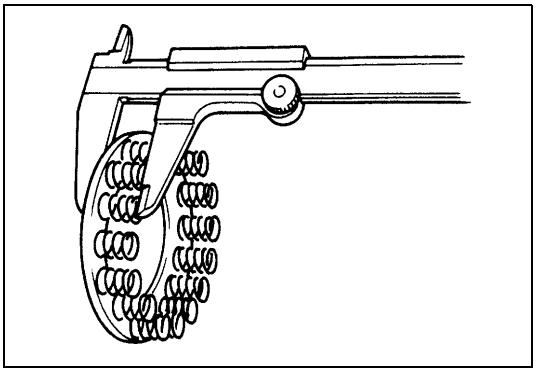


Check that sliding surfaces of discs, plates and flanges are not worn or burnt. If necessary, replace.

NOTE:

- **If disc lining is exfoliated or discolored, replace all discs.**
- **Before assembling new discs, soak them in A/T fluid for at least two hours.**

Rear Clutch Return Spring Seat



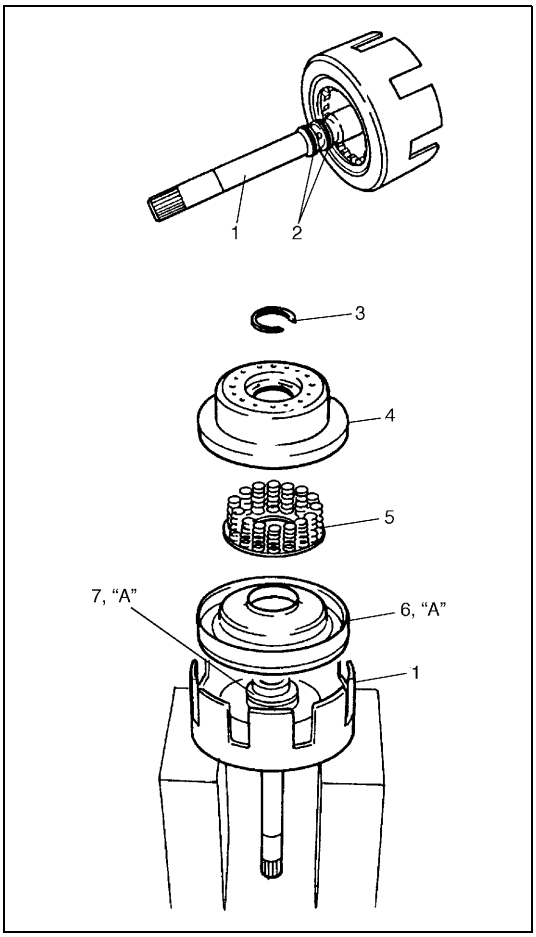
Measure height of overdrive clutch return spring.

Height of overdrive clutch return spring
28.14 mm (1.108 in.)

NOTE:

- **Do not apply excessive force when measuring spring height.**
- **Perform measurement at several points.**

ASSEMBLY



1) Install new D-ring (7) and oil seals (2) to input shaft subassembly.
   Apply grease to D-ring and fit it to input shaft subassembly (1).

"A" : Grease 99000-25030

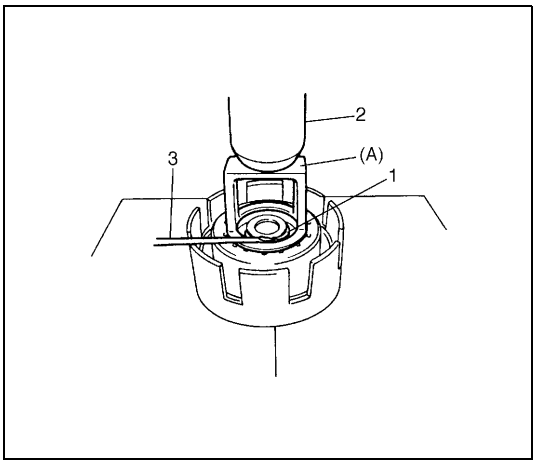
2) Install piston (6) into input shaft subassembly.
   Apply grease to the lip of the piston.

"A" : Grease 99000-25030

Use care that the lip does not get twisted or caught.

3) Install rear clutch return spring seat (5) and rear clutch balancer (4).

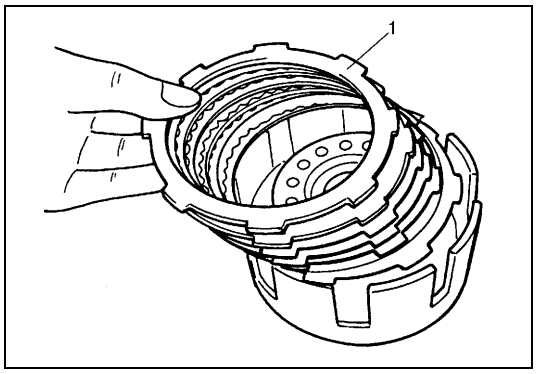
3. Snap ring



4) Install shaft snap ring (1).
   Compress return springs and install shaft snap rings in groove by using a screwdriver (3).
   Place special tool (clutch spring compressor) on spring seat and compress springs with a press (2).

CAUTION:
Do not compress return spring more than necessary.

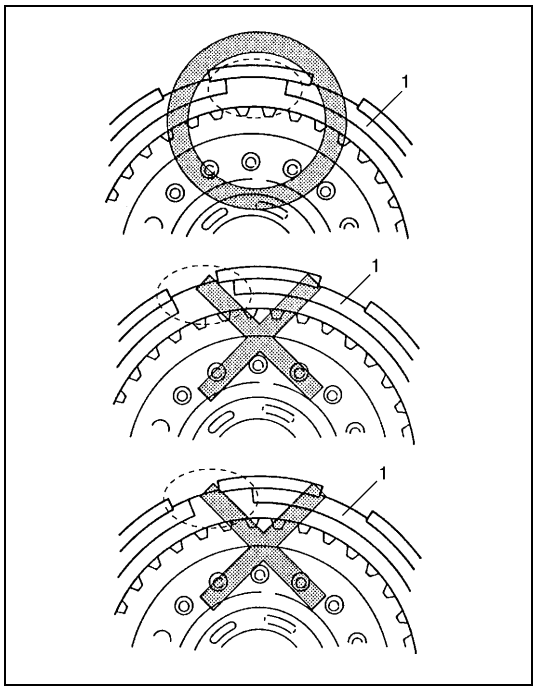
Special tool
(A) : 09926-96020



5) Install discs, plates and flange (1) in following order.
   1) Plate → 2) Disc → 3) Plate → 4) Disc → 5) Plate → 6) Disc → 7) Plate → 8) Disc → 9) Plate → 10) Disc → 11) Plate → 12) Disc → 13) Flange

NOTE:

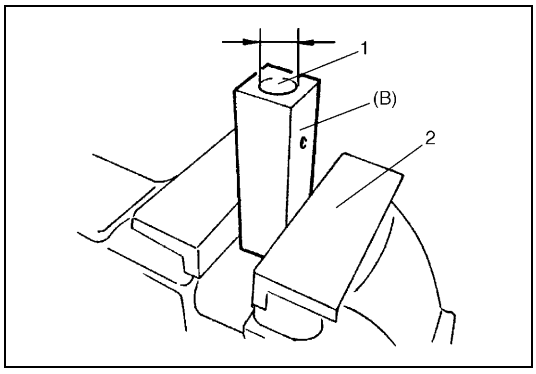
Before assembly, new discs should be soaked in automatic transmission fluid for at least 2 hours



6) Install snap ring (1).

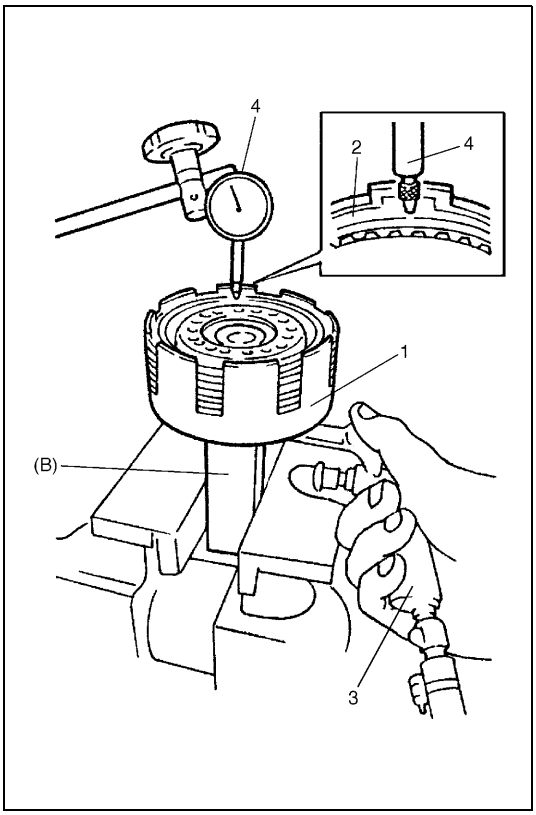
NOTE:

Make sure that the ends of the snap ring do not come to the opening of the input shaft subassembly.



7) Place special tool (B) on soft jawed vise (2) with wider opening (1) facing up.

Special tool
(B) : 09926-26040



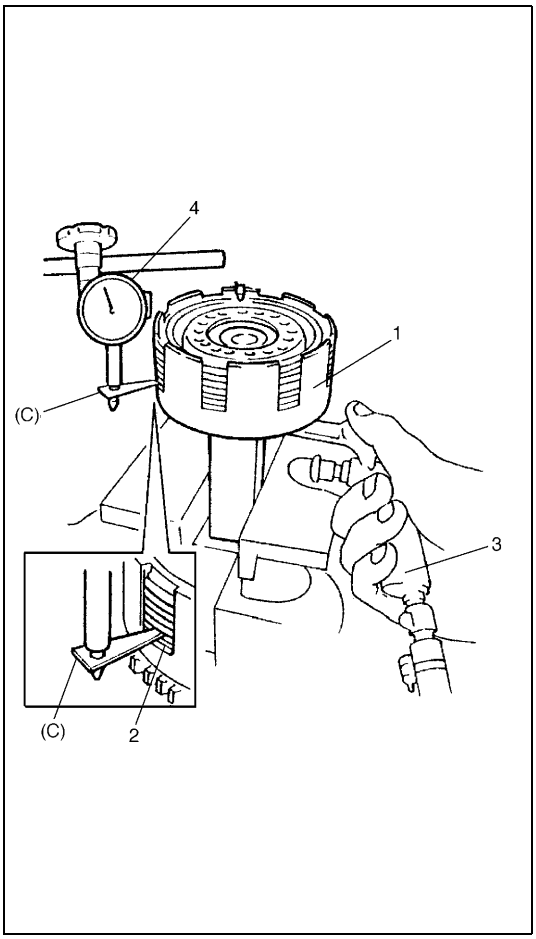
8) Place rear clutch assembly (1) on special tool (B).
9) Set dial gauge (4) on the top of clutch flange (2) and measure clearance by blowing compressed air (4 kg/cm^2, psi) as shown in figure.

Rear clutch disc clearance
: 1.10 – 1.85 mm (0.051 – 0.073 in.)

If the clearance is out of specification, use clutch flange of different thickness to match the clearance to specification. Follow 5 types of clutch flanges are available as spare parts.

Available clutch flange thickness
2.750 mm (0.108 in.)
2.900 mm (0.114 in.)
3.050 mm (0.120 in.)
3.200 mm (0.126 in.)
3.350 mm (0.132 in.)
3.500 mm (0.138 in.)
3.650 mm (0.144 in.)

3. Air gun



10) Attach special tool (C) to dial gauge (4) and set them on the lowest clutch plate (2).

Special tool
(C) : 09952-06010

Measure piston stroke by blowing compressed air (4 kg/cm^2, psi) as shown in figure.

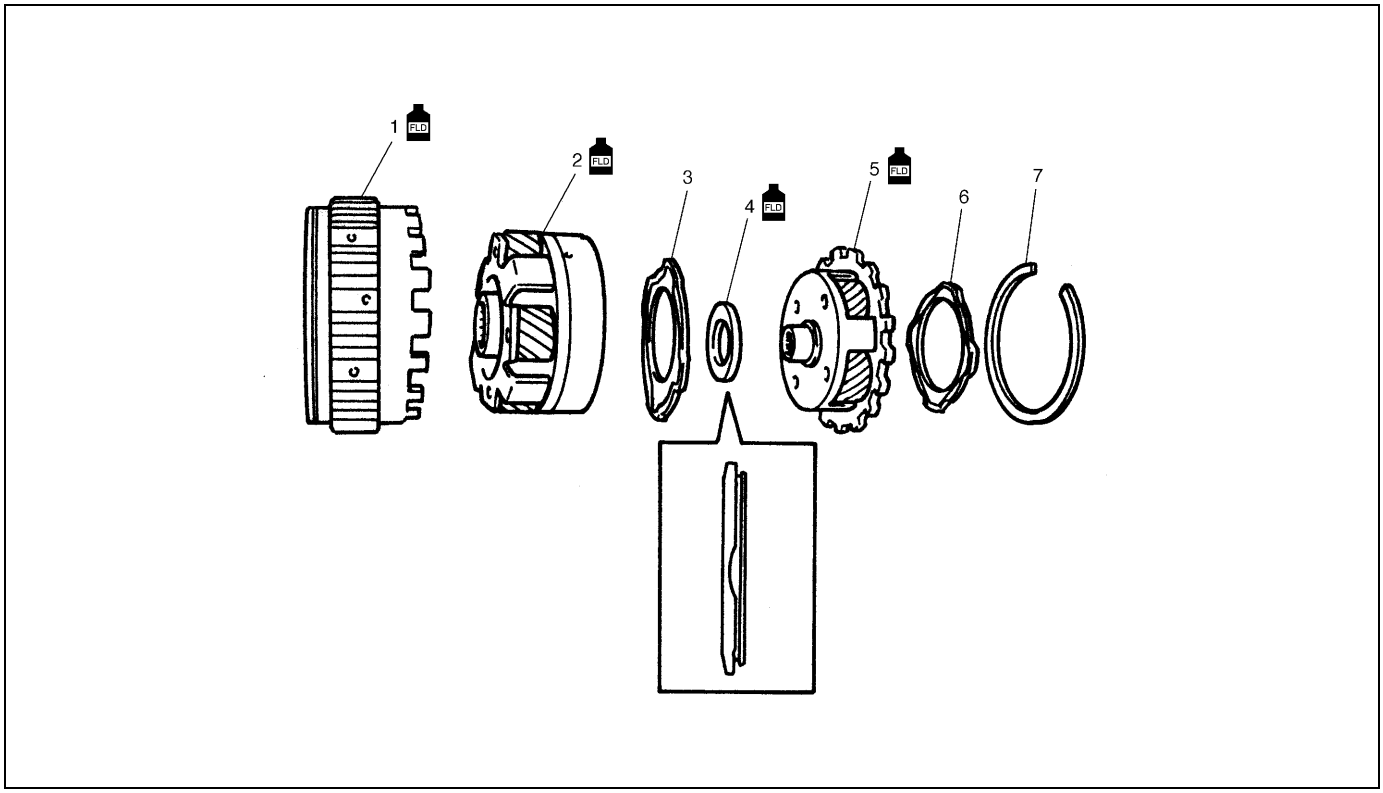
Rear clutch piston stroke
: 1.60 – 1.85 mm (0.063 – 0.073 in.)

If the piston stroke is out of specification, use clutch flange of different thickness to match the piston stroke within specification. Following 7 types of clutch flanges are available as spare parts.

Available clutch flange thickness
2.750 mm (0.108 in.)
2.900 mm (0.114 in.)
3.050 mm (0.120 in.)
3.200 mm (0.126 in.)
3.350 mm (0.132 in.)
3.500 mm (0.138 in.)
3.650 mm (0.144 in.)

1. Rear clutch assembly
3. Air gun

Planetary set



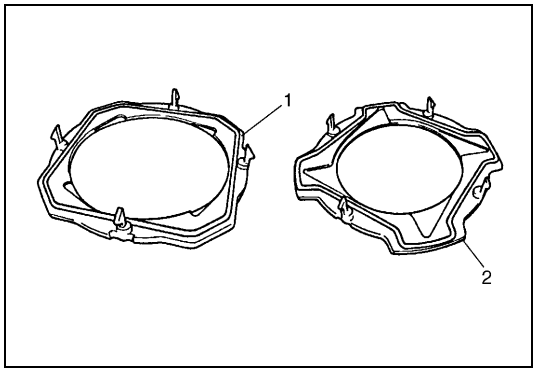
1. Rear ring gear	4. Thrust needle roller bearing	7. Snap ring
2. Rear carrier assembly	5. Front carrier assembly	FLD Apply automatic transmission fluid.
3. Planetary oil receiver No.2	6. Planetary oil receiver No.1	

DISASSEMBLY

1) Remove snap ring.
   Remove front carrier assembly.
2) Remove planetary oil receiver No.1 from rear carrier assembly.
3) Remove rear carrier assembly.
4) Remove needle roller bearing and planetary oil receiver No.2 from planetary gear assembly No.2.

INSPECTION

Planetary Oil Receiver No.1 and No.2



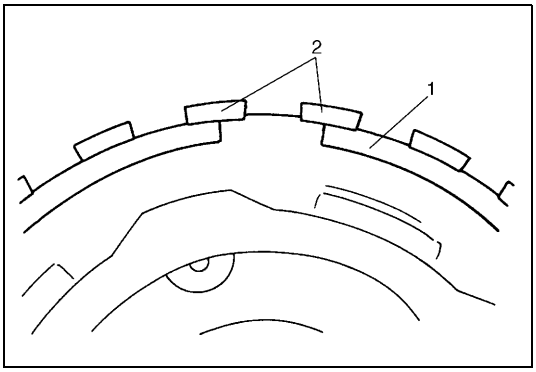
Inspect the seal and the claw for deterioration, damage or cut. If found faulty, replace.

1. Planetary oil receiver No.1
2. Planetary oil receiver No.2

ASSEMBLY

Reverse removal procedure for installation noting following points.

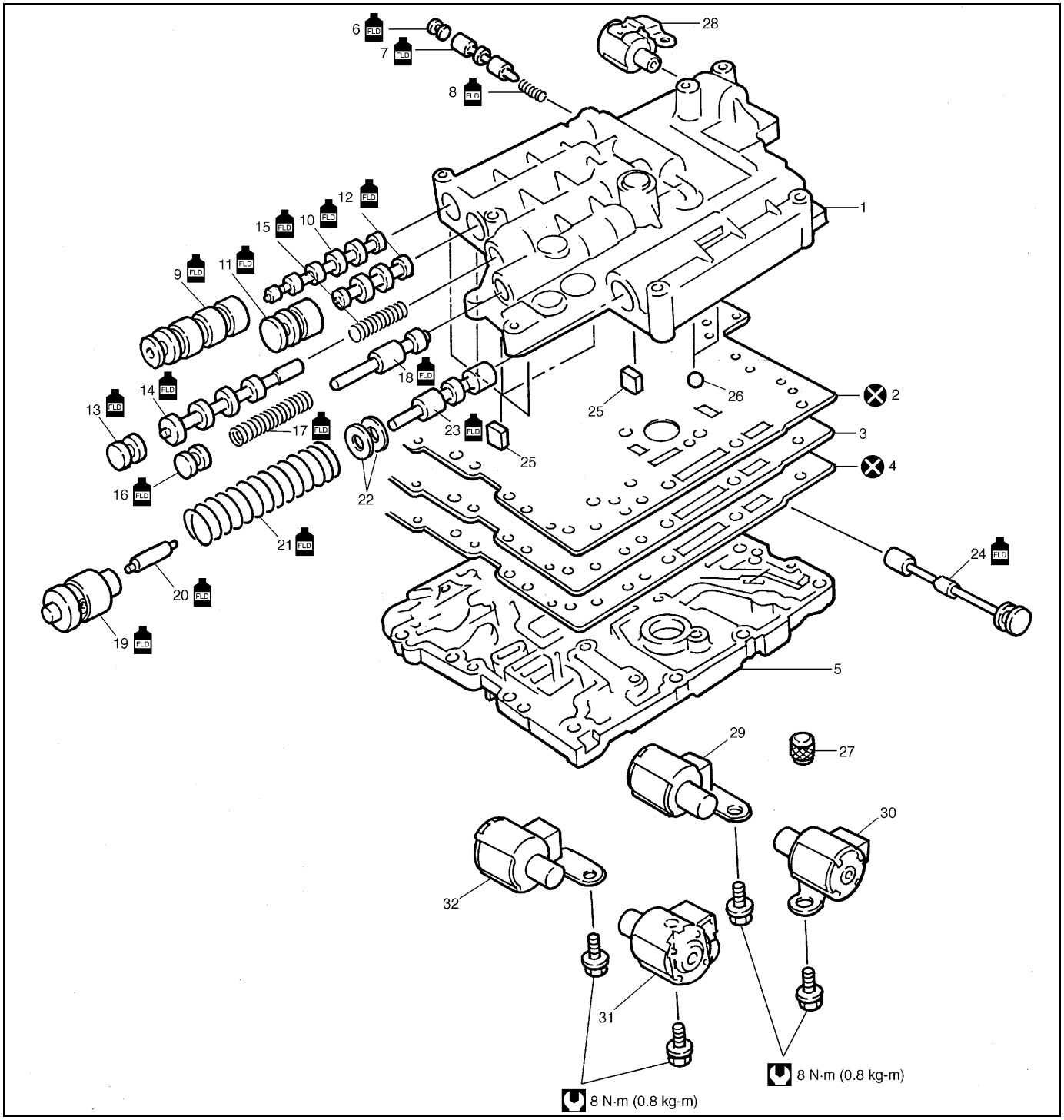
- Note the direction of needle roller bearing.
- Take care not to break the claw of oil receiver.
- Oil receiver has installation position.
  Make sure that all claws are aligned with holes before inserting them.



- Note the location of the ends of the snap ring (1).

2. Planetary ring gear No.2

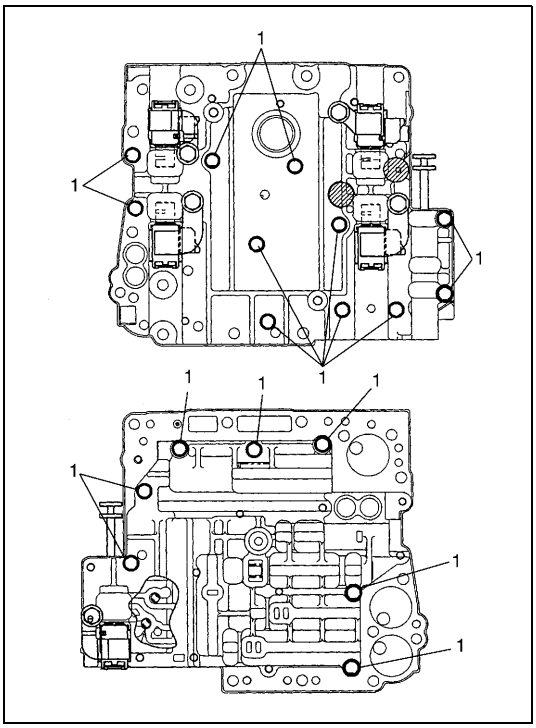
Valve body



1. Upper valve body	13. Plug	25. Key
2. Gasket for upper valve body	14. Lock-up control valve	26. Steel ball
3. Valve body plate	15. Lock-up control valve spring	27. Oil strainer
4. Gasket for lower valve body	16. Plug	28. Shift solenoid valve No.2
5. Lower valve body	17. Secondary regulator valve spring	29. Shift solenoid valve No.4
6. Plug	18. Secondary regulator valve	30. Shift solenoid valve No.3
7. Signal valve	19. Primary regulator valve sleeve	31. Shift solenoid valve No.1
8. Signal valve spring	20. Primary regulator valve plunger	32. Lock-up solenoid valve
9. Fail valve No.1 sleeve	21. Primary regulator valve spring	FLD Apply automatic transmission fluid.
10. Fail valve No.1	22. Washer plate	Do not reuse.
11. Fail valve No.2 sleeve	23. Primary regulator valve	Tightening torque
12. Fail valve No.2	24. Manual valve	

DISASSEMBLY

Valve Body Assembly

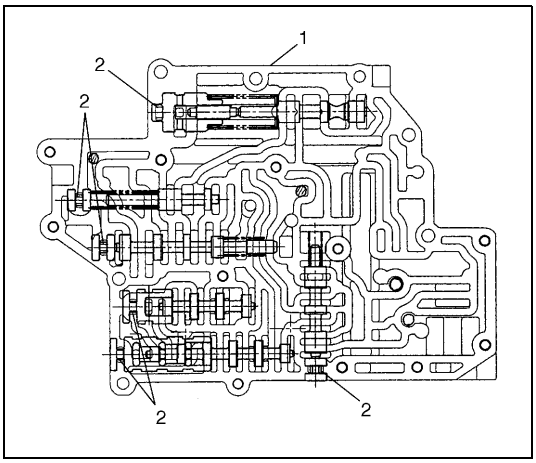


1) Remove manual valve.
2) Remove 18 bolts (1) from lower valve body.

NOTE:

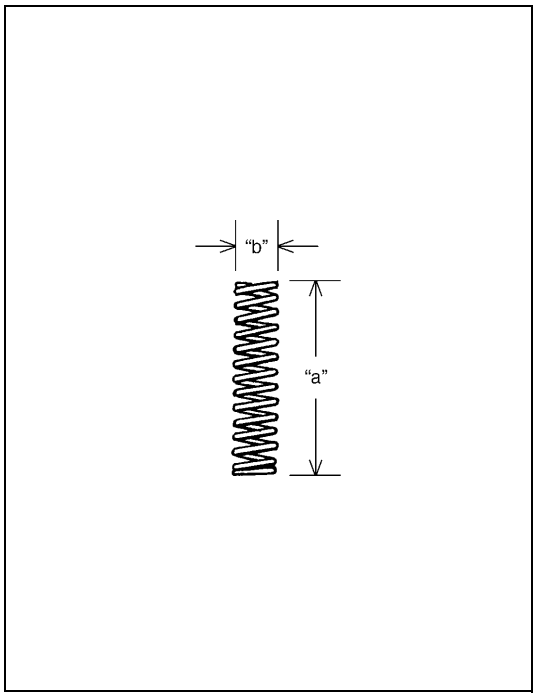
- **There are 4 different kinds of bolt fixing upper and lower valve body. Do not mix them up and remember where they belong to.**
- **When separating lower and upper valve body, be careful not to let the steel ball to fall off.**

Upper Valve Body



1) Remove shift solenoid No.2.
2) Remove sleeves, springs, washers, plunger and valves by removing keys (2).
3) Remove oil strainer.

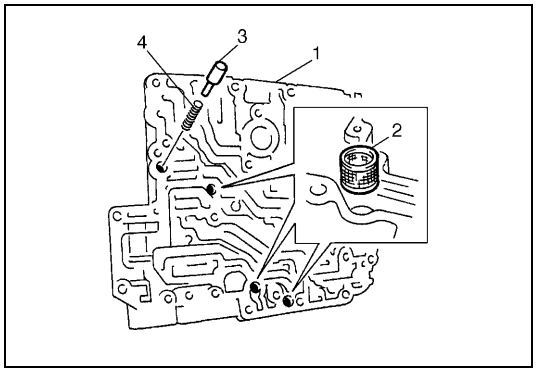
1. Upper valve body



Valve spring dimensions (Reference)

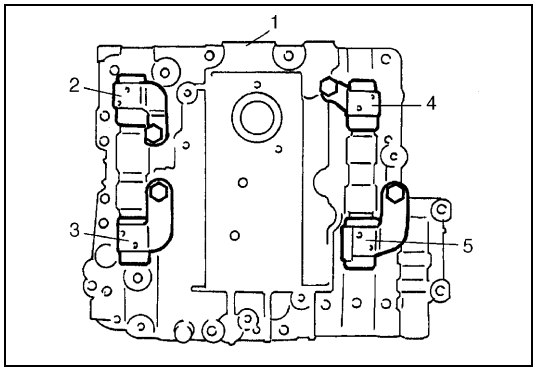
Spring	Color of Paint	Free length "a"	Outside diameter "b"
Primary regulator valve	Yellow	66.9 mm (2.633 in.)	16.0 mm (0.630 in.)
Signal valve	Blue	20.5 mm (0.807 in.)	6.2 mm (0.244 in.)
Lock-up control valve	–	29.5 mm (1.161 in.)	8.8 mm (0.346 in.)
Second-ary regu-lator valve	Blue	38.7 mm (1.524 in.)	8.8 mm (0.346 in.

Lower Valve Body



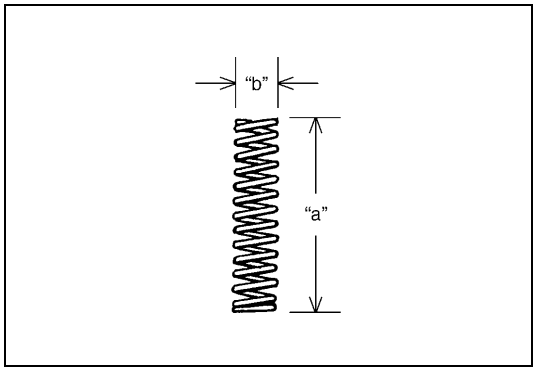
1) Remove oil strainer (2), bypass valve (3) and spring (4).

1. Lower valve body



2) Remove solenoid valves.

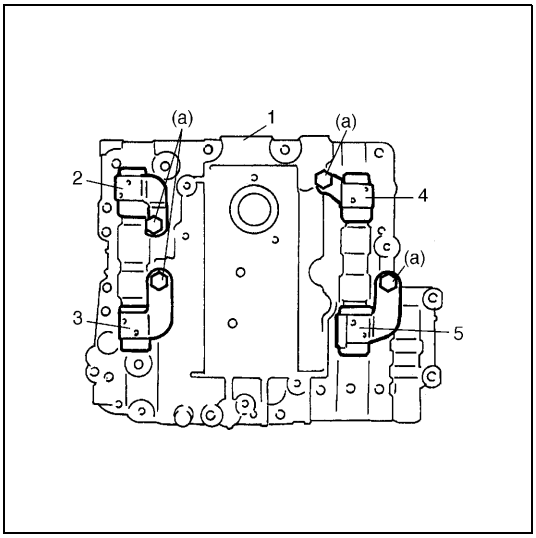
1. Lower valve body
2. Solenoid valve No.1
3. Lock-up control valve
4. Solenoid valve No.3
5. Solenoid valve No.4



Cooler bypass valve spring dimensions (reference)
Free length "a" : 22.8 mm (8.98 in.)
Outside diameter "b" : 8.0 mm (0.31 in.)

ASSEMBLY

Lower Valve Body



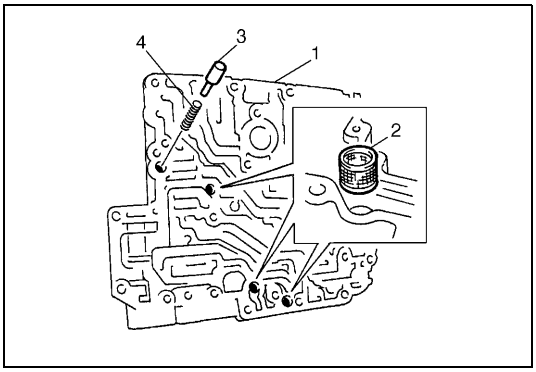
1) Install solenoid valves.

Tightening torque
Solenoid valve bolt
(a) : 8 N·m (0.8 kg-m, 6.0 lb-ft)

NOTE:

Solenoid valve No.1 and No.2 are the same solenoid valve.

1.	Lower valve body
2.	Solenoid valve No.1
3.	Lock-up solenoid valve
4.	Solenoid valve No.3
5.	Solenoid valve No.4



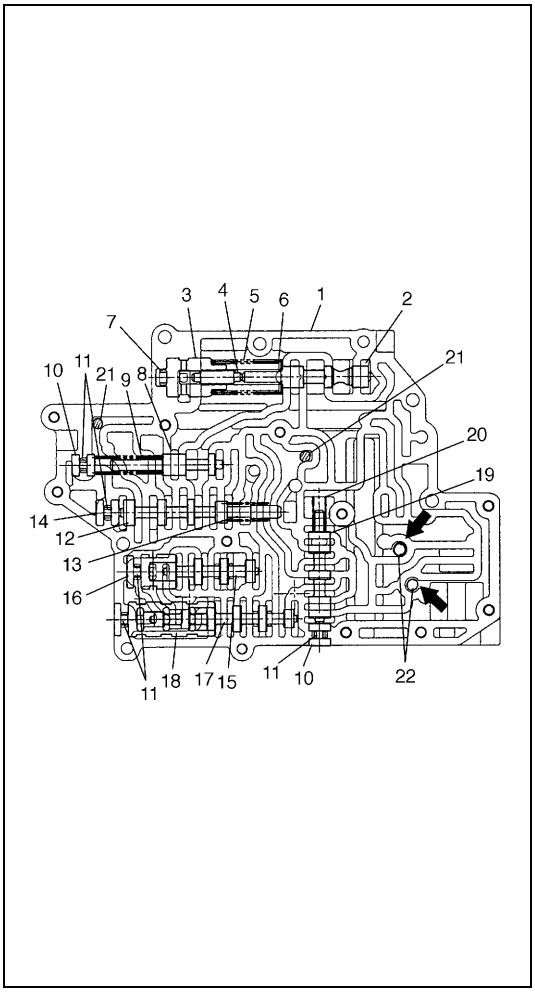
2) Insert oil strainers (2) and bypass valve (3) to lower valve body (1).

NOTE:

Clean oil strainer before installing.

4.	Spring

Upper Valve Body



1) Apply A/T fluid to each valve, plate washer, spring, plunger, sleeve and key.
   Insert valves, plate washers, springs, sleeves and plunger referring to “Valve Body” in this section and hold them with keys as shown in the figure.

NOTE:

- **Note the location of the key shown in picture.**
- **Each compression spring has an identification color paint.**
- **Note the direction of each valve.**

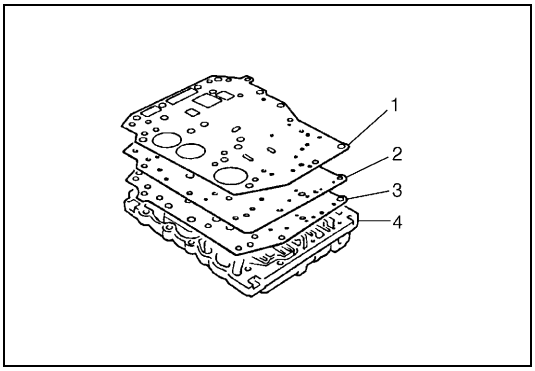
2) Install solenoid valve No.2.

Tightening torque
Solenoid valve bolt: 8 N·m (0.8 kg-m, 6.0 lb-ft)

3) Install oil strainer and steel ball.

1. Upper valve body	12. Lock-up control valve
2. Primary regulator valve	13. Compression spring
3. Primary regulator valve sleeve	14. Plug
4. Primary regulator valve plunger	15. Fail valve No.2
5. Compression spring (yellow-painted)	16. Fail valve No.2 sleeve
6. Plate washer	17. Fail valve No.1
7. Key	18. Fail valve No.1 sleeve
8. Secondary regulator valve	19. Signal valve
9. Compression spring (blue-painted)	20. Compression spring (blue-painted)
10. Plug	21. Oil strainer
11. Key	22. Steel ball

Valve Body Assembly

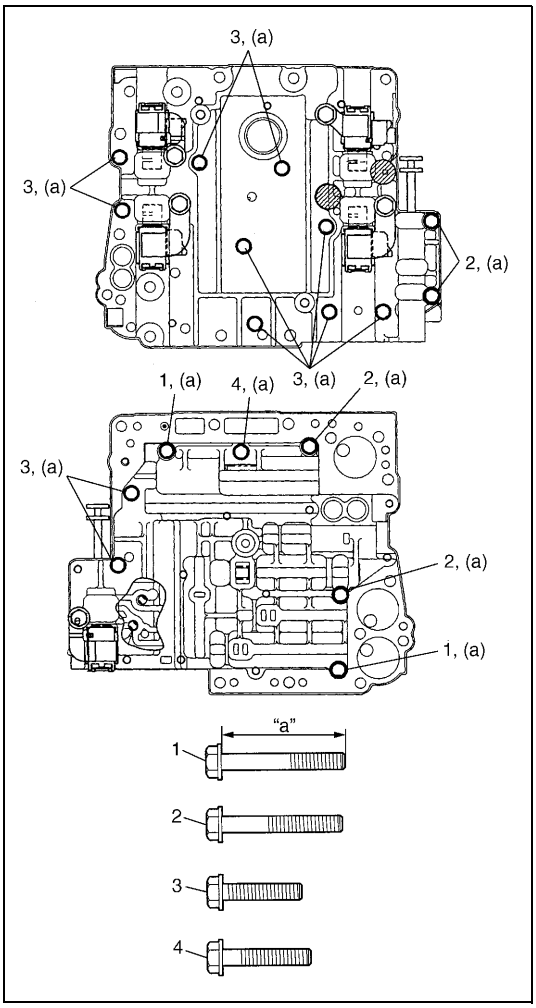


1) Install gasket for upper valve body, valve body plate (2) and gasket for lower valve body to upper valve body (4).

NOTE:

Make sure that steel balls and oil strainers are installed at proper location. Refer to “Upper Valve Body Assembly” for steel ball location.

1. Gasket (for lower valve body)	
3. Gasket (for upper valve body)	



2) Assemble upper valve body with gaskets and plate to lower valve body. Make sure that bypass valve is installed to lower valve body before assembly.

Tightening torque
Valve body assembly bolts (a) : 5.5 N·m (0.55 kg-m, 4.0 lb-ft)

NOTE:

There are four kinds of bolts fixing upper and lower valve body. Refer to the table below for the bolt specifications.

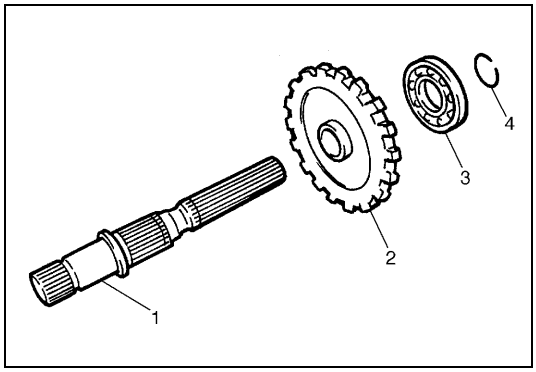
Bolt	Length "a"	Pieces
A	41.0 mm (1.61 in.)	2
B	38.0 mm (1.50 in.)	4
C	23.0 mm (0.91 in.)	11
D	29.5 mm (1.16 in.)	1

1. Bolt A	3. Bolt C
2. Bolt B	4. Bolt D

3) Install manual valve to valve body assembly.

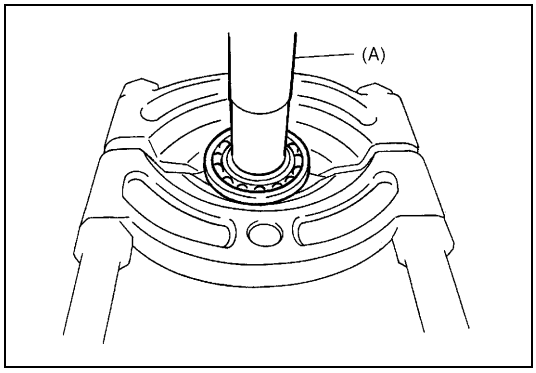
Output shaft assembly

DISASSEMBLY



1) Remove circlip (4) and pull out output shaft (1) from parking gear assembly (2).

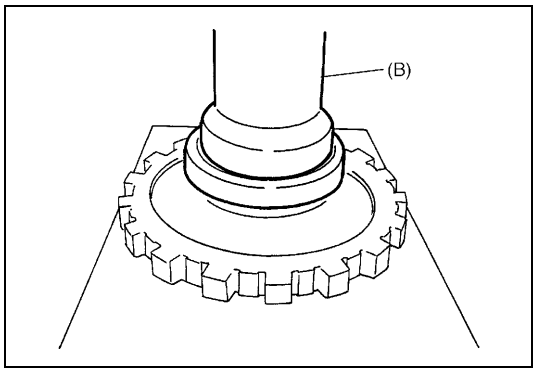
3. Bearing



2) Pull out bearing from parking gear by using puller and hydraulic press.

Special tool
(A) : 09913-80112

ASSEMBLY



Reverse disassembly procedure noting following point.

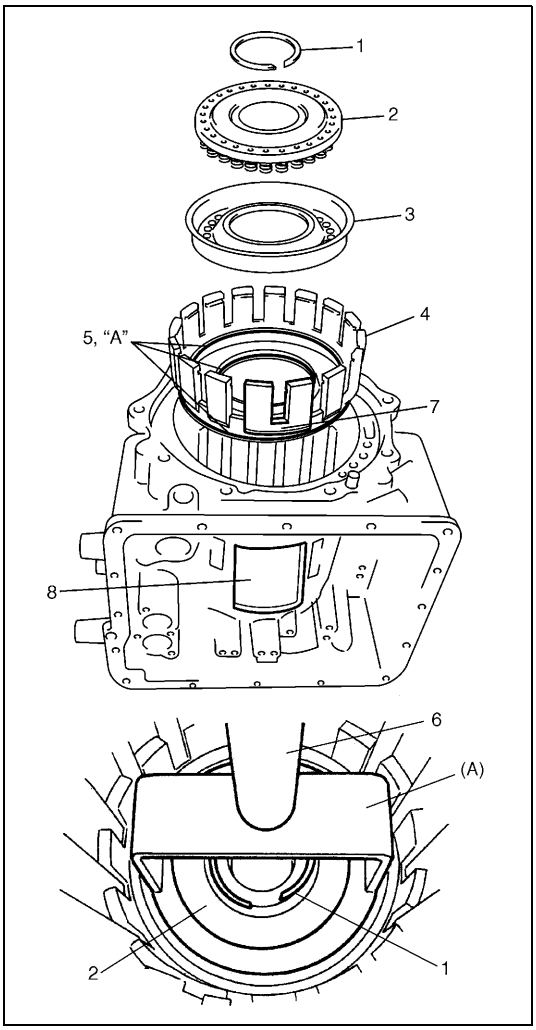
- Press-fit bearing by using press and special tool

Special tool
(B) : 09913-76010

Unit Assembly

CAUTION:

- **Automatic transmission consists of highly precise parts. As even a flaw in a small part may cause oil leakage or decrease in function, check each part carefully before installation.**
- **Clean all parts with compressed air. Never use wiping cloths or rags.**
- **Before assembling new clutch discs and brake discs, soak them in automatic transmission fluid for at least 2 hours.**
- **Be sure to use new gaskets and O-rings.**
- **Lubricate O-rings with automatic transmission fluid.**
- **Apply automatic transmission fluid on sliding or rotating surfaces of the parts before assembly.**
- **Use yellow petrolatum grease or Suzuki Super Grease C to retain parts in place.**
- **Be sure to install thrust bearings and races in correct direction and position.**
- **Make sure that snap ring ends are not aligned with one of cutouts and are installed in groove correctly.**
- **Do not use adhesive cements on gaskets and similar parts.**
- **Be sure to torque each bolt and nut to specification.**



1) Install new O-rings (5) (inside and outside) to B2 brake piston (4), and apply grease to them.

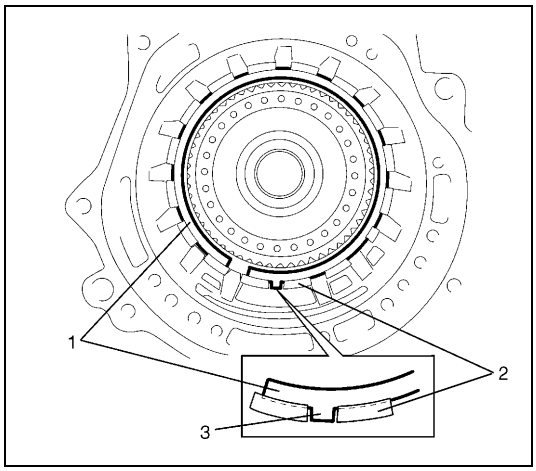
"A": Grease: 99000-25030

2) Install B2 brake piston with two fingers, which have mounded part (7) between them, aligned with transmission case hole (8) as shown in figure.
3) Install B1 brake piston (3) and B1 and B2 return spring assembly (2) to transmission case.
4) Install snap ring (1) by compressing return spring assembly through B2 brake piston seat with hydraulic press (6) and special tool.

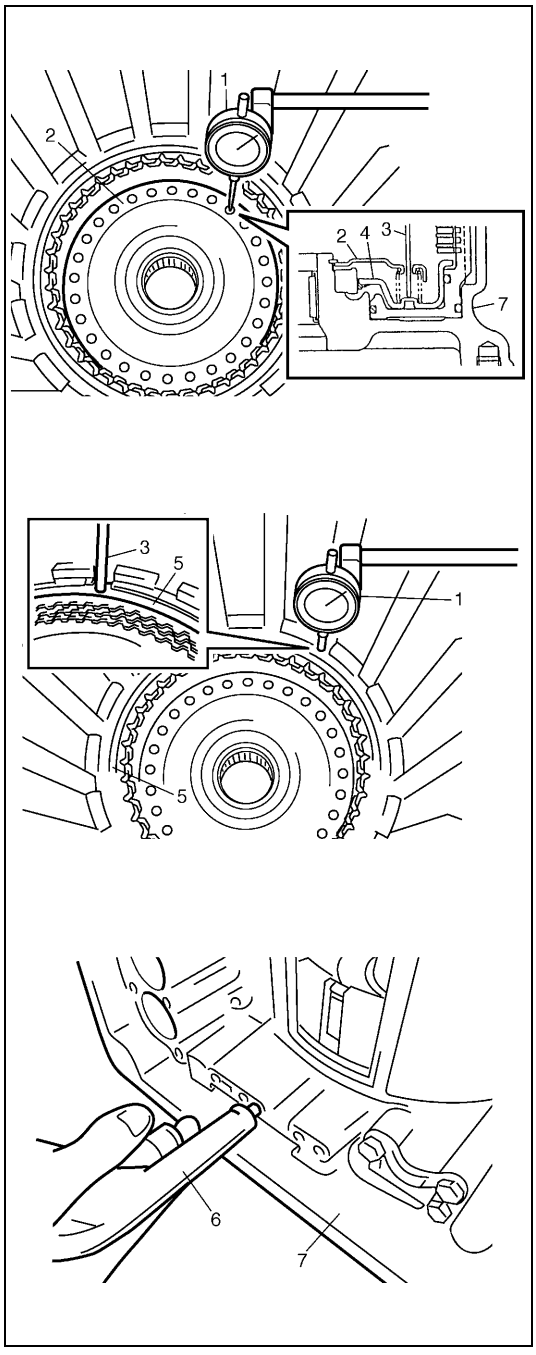
NOTE:

Don't compress B1 & B2 return spring assembly more than necessary or it may get damaged.

Special tool
(A): 09926-96010



5) Install B1 brake discs, plates and flange to B2 brake piston (2) in following order.
   1) Plate → 2) Disc → 3) Plate → 4) Disc → 5) Plate → 6) Disc → 7) Plate → 8) Disc → 9) Plate → 10) Disc → 11) Flange
6) Install snap ring (1) to B2 brake piston (2) with antirotation protrusion (3) aligned with gap between two fingers having mounded part.



7) Measure B1 brake stroke and clearance in following manner.

B1 Brake Stroke:

Set the dial gauge (1) to 1st & 2nd brake (B1 brake) piston through B1 brake spring seat (2) hole as shown. Blow compressed air into hole shown in figure. Then measure the difference as the compressed air is blown in.

B1 brake piston stroke
Standard : 1.75 – 2.00 mm (0.0689 – 0.0787 in.)

B1 Brake Clearance:

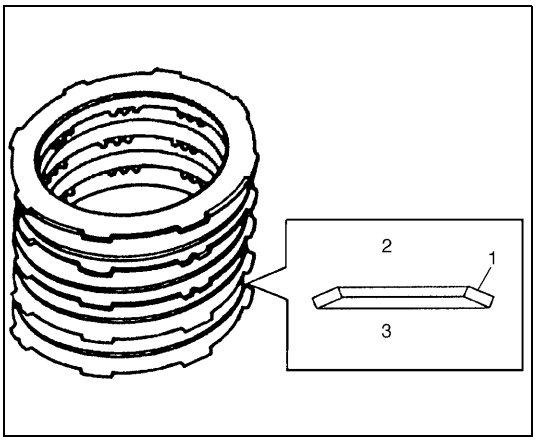
Blow compressed air into the hole shown in figure.
Measure the difference.

B1 brake disc clearance
Standard : 1.30 – 2.00 mm (0.0512 – 0.0787 in.)

If the measured value(s) is (are) out of specification, select the flange from table below and repeat this step until the measured values are within specification.

Available flange thickness
2.875 mm (0.113 in.)
3.050 mm (0.120 in.)
3.225 mm (0.127 in.)
3.400 mm (0.134 in.)
3.575 mm (0.141 in.)

3.	Tip of dial gauge
4.	B1 brake piston
5.	Brake flange
6.	Air gun
7.	Transmission case



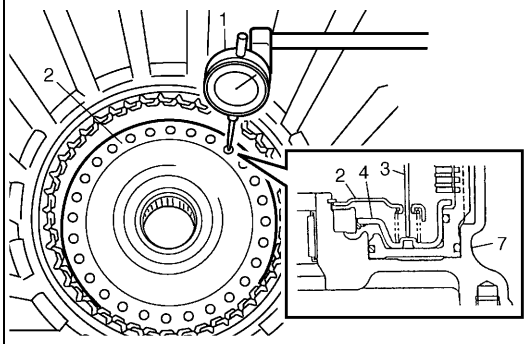
8) Install B2 brake discs, plates and flange in following order.
   1) Plate → 2) Cushion plate → 3) Plate → 4) Disc →
   5) Plate (thick) → 6) Disc → 7) Plate (thick) → 8) Disc →
   9) Flange

NOTE:

Cushion plate (1) has installing direction as shown in figure.

2.	Front
3.	Rear

9) Hold above parts with snap ring.



10) Measure B2 brake stroke and clearance in following manner.

B2 Brake Stroke:

Set the dial gauge (1) to reverse brake (B2 brake) piston through B1 brake spring seat (2) hole as shown. Blow compressed air into hole shown in figure. Then measure the difference as the compressed air is blown in.

B2 brake piston stroke
Standard : 2.22 – 2.47 mm (0.0874 – 0.0972 in.)

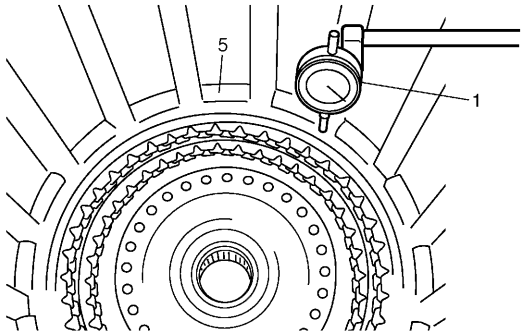
B2 Brake Clearance:

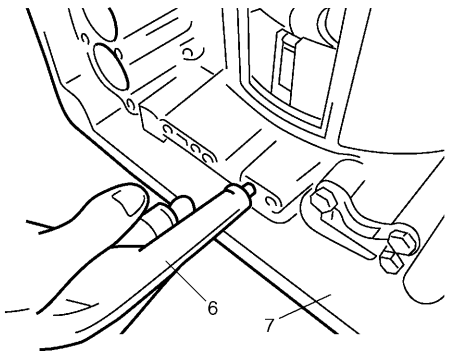
Blow compressed air into the hole shown in figure.
Measure the difference.

B2 brake disc clearance
Standard : 0.60 – 1.70 mm (0.0236 - 0.0669 in.)

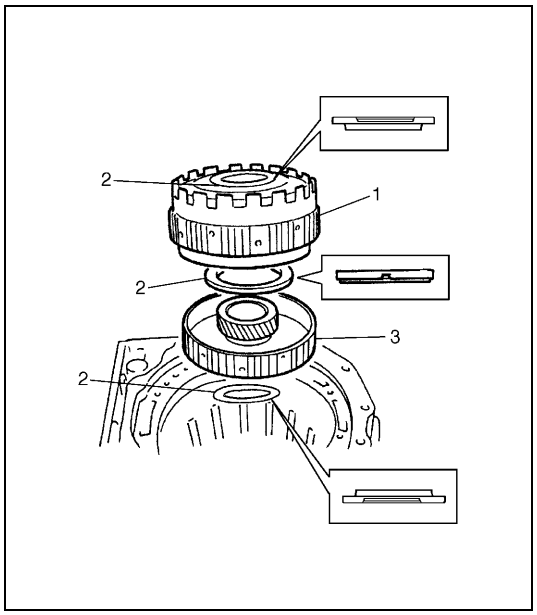
If the measured value(s) is (are) out of specification, select the flange from table below and repeat this step until the measured values are within specification.

Available flange thickness
2.36 mm (0.093 in.)
2.54 mm (0.100 in.)
2.72 mm (0.107 in.)
2.90 mm (0.114 in.)

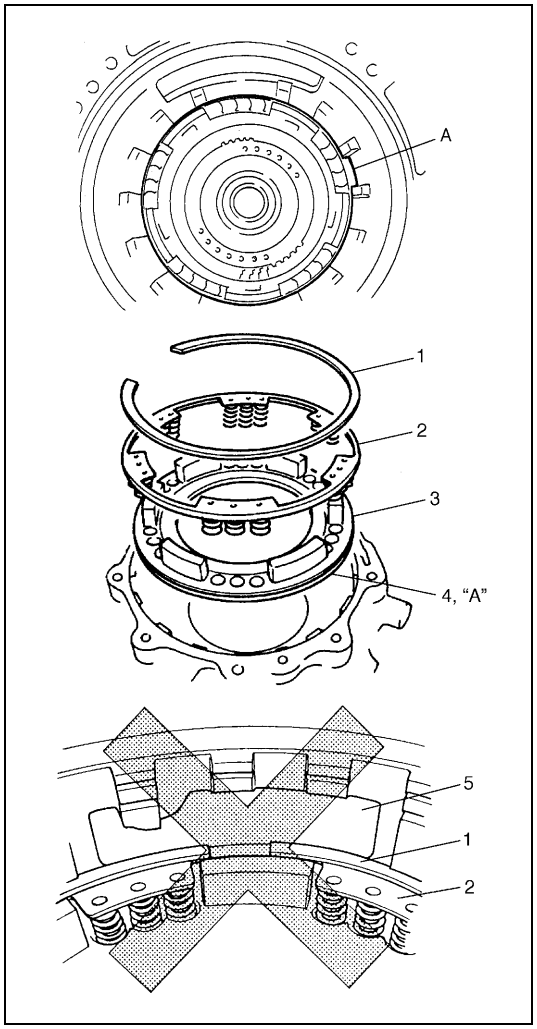




3.	Tip of dial gauge
4.	B1 brake piston
5.	Brake flange
6.	Air gun
7.	Transmission case



11) Install thrust needle roller bearing (2) and rear sun gear (3). Turn rear sun gear right and left to match the brake discs and the spline of rear sun gear.
12) Install thrust needle roller bearing and planetary set (1). Turn planetary set right and left to match the gears of the rear sun gear and the gears of the planetary set.



13) Install new inner and outer O-rings (4) to B0 brake piston and apply grease to them.

"A": Grease 99000-25030

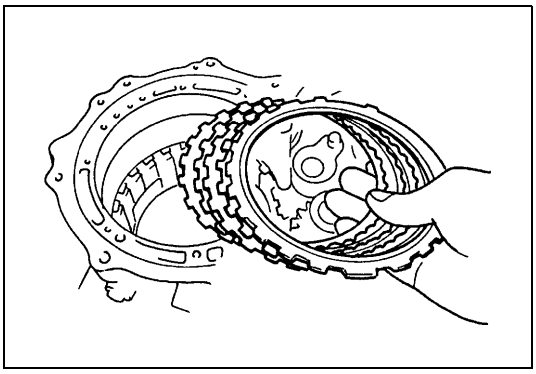
Install brake piston to B0 brake drum.

14) Install B0 brake piston & drum assembly to transmission case, in such way that the edge A comes at the position as shown in figure. Make sure that the O-rings are not twisted or caught.
15) Place B0 brake piston return spring subassembly (2) on piston. Make sure that each spring fits the holes on the piston.
16) Push down return spring subassembly and install snap ring (1).

CAUTION:

Check that the opening of snap ring does not face the cored-hole (5) of the transmission case.

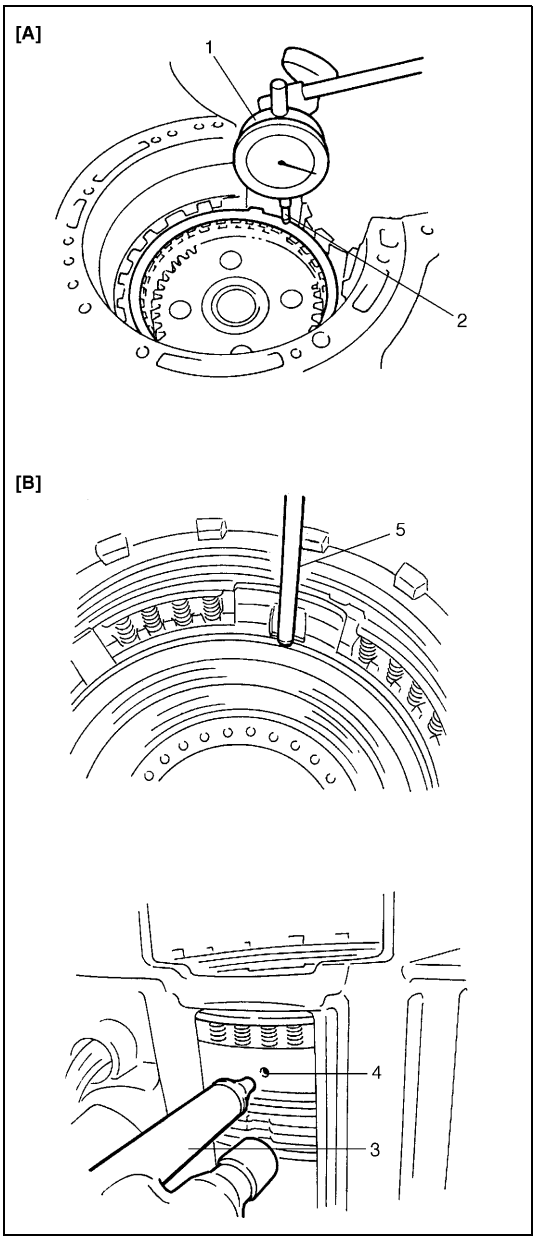
3. B0 brake piston



17) Install B0 brake discs, plates and flange in following order.
1) Plate → 2) Disc → 3) Plate → 4) Disc → 5) Flange

NOTE:

The flat surface of B0 flange must face to B0 disc.



18) Inspect B0 brake piston stroke and clearance by blowing compressed air into hole shown in figure.
Make sure that the obtained piston stroke and clearance satisfy the standard value.

B0 brake clearance:

Set dial gauge (1) to the top of B0 brake flange and blow compressed air into the hole shown in figure.

B0 brake disc clearance
Standard : 0.50 – 1.05 mm (0.0197 – 0.0413 in.)

B0 piston stroke:

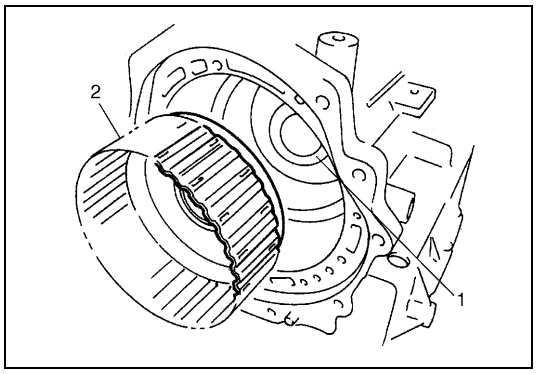
Set dial gauge to the step of B0 brake piston as shown in figure. Blow compressed air into the hole shown in figure and measure the value for piston stroke.

B0 brake piston stroke
Standard : 0.70 – 1.05 mm (0.0275 – 0.0413 in.)

If the measured value(s) is (are) out of specification, select the flange from table below and repeat this step until the measured values are within specification.

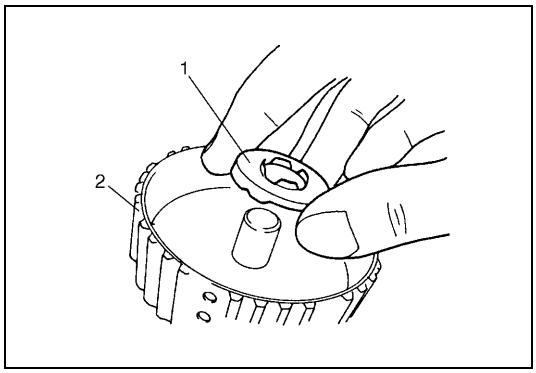
Available flange thickness
2.35 mm (0.093 in.)
2.60 mm (0.102 in.)
2.85 mm (0.112 in.)
3.10 mm (0.122 in.)

2.	Tip of dial gauge on B0 brake flange
3.	Air gun
4.	Blow compressed air into this hole
5.	Tip of dial gauge on B0 brake piston
[A]:	Clearance
[B]:	Piston stroke

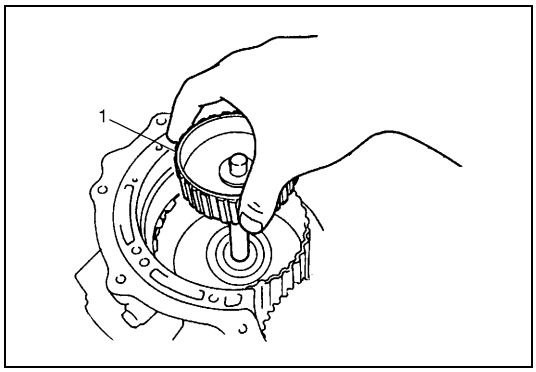


19) Install front sun gear (2) to planetary set.

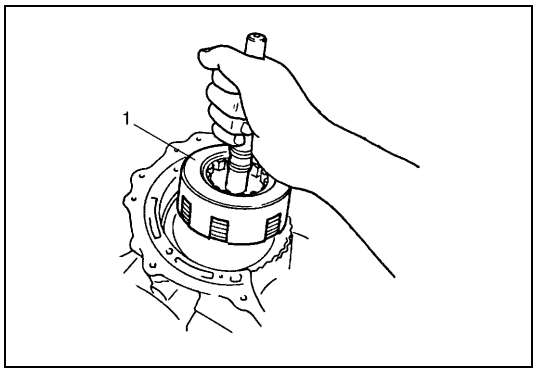
1. Needle roller bearing



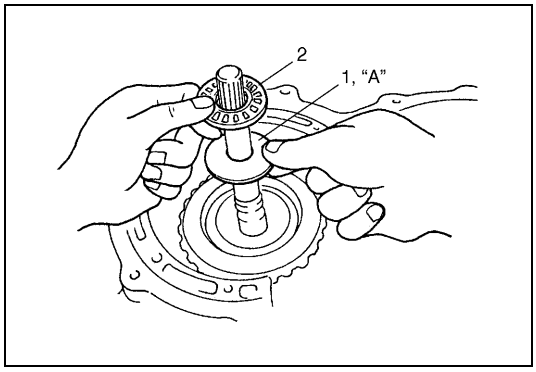
20) Install thrust needle roller bearing (1) to intermediate shaft (2).



21) Install intermediate shaft (1) to transmission case.

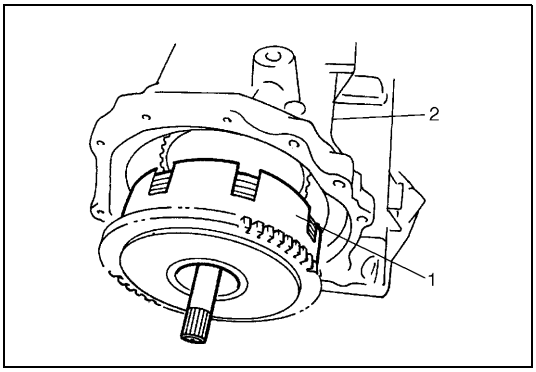


22) Install rear disc clutch assembly (1) by turning it right and left to match the clutch disc of rear disc clutch assembly and the spline of intermediate shaft.



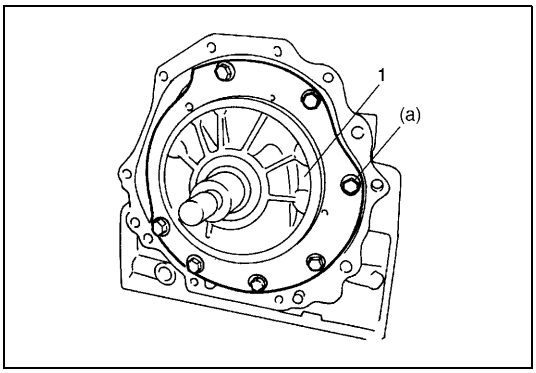
23) Install thrust bearing race (1) and thrust needle roller bearing (2).

“A”: Grease 99000-25030



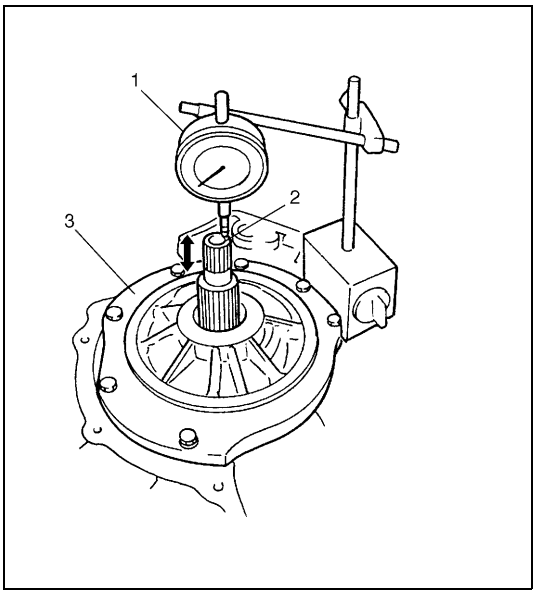
24) Install front disc clutch assembly (1) by turning it right and left to match the clutch disc of front disc clutch assembly and the spline of follow shaft.

2. Transmission case



25) Install gasket to transmission case and install oil pump assembly (1) to transmission case.

Tightening torque
Oil pump assembly bolts
(a) : 12 N·m (1.2 kg-m, 8.5 lb-ft)



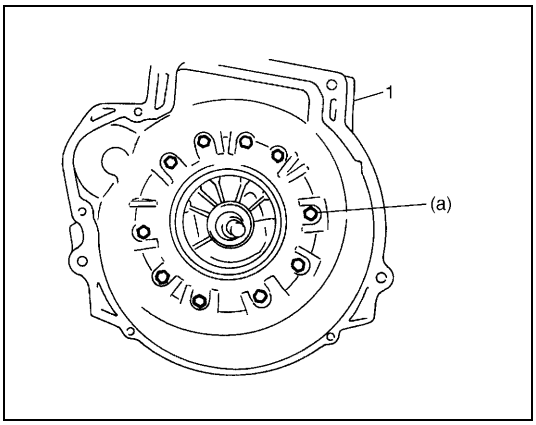
26) Measure input shaft end play.
Set dial gauge (1) as shown in figure and measure the play of the input shaft.

Input shaft end play
Standard : 0.3 – 0.9 mm (0.012 – 0.036 in.)

If the obtained value is out of standard value, select thrust bearing race (installed in step 22) of different thickness shown in table below and adjust the play.

Available thrust bearing race thickness
1.3 mm (0.051 in.)
1.7 mm (0.067 in.)
2.1 mm (0.083 in.)

2. Input shaft end
3. Oil pump



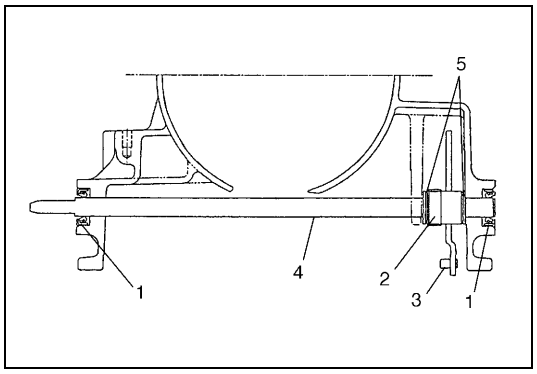
27) Apply grease to oil pump D-ring.
Install new gasket to transmission case and install torque converter housing (1).

Tightening torque
Torque converter housing bolt
(a) : 19 N·m (1.9 kg-m, 14.0 lb-ft)

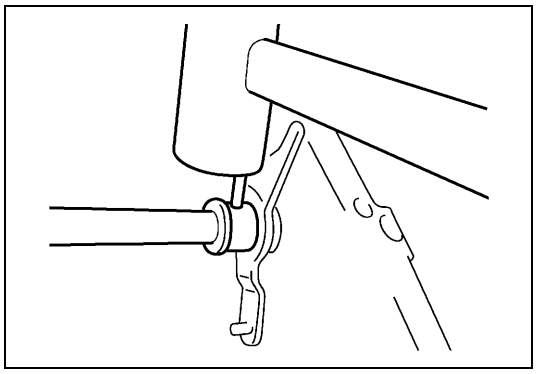
Grease 99000-25030

NOTE:

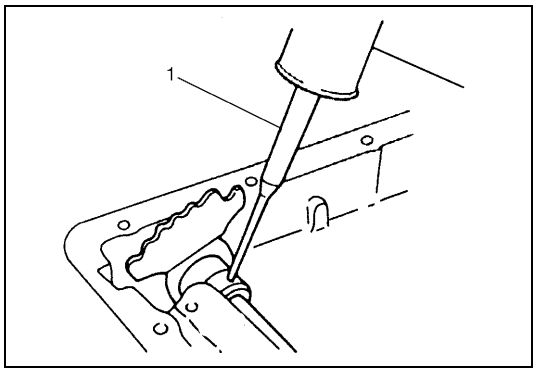
Use new bolts.



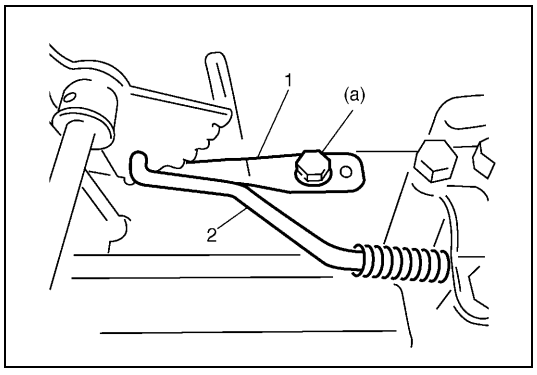
28) Apply grease to lip of new oil seal (1) and drive in oil seal till it contacts with transmission case.
29) After installing new sleeve cover (2) and washers (5) to manual shift lever (3), install manual shift shaft (4) and manual shift lever to transmission case.



30) Align hole in manual shift shaft with that in manual shift lever and drive in new manual shift lever pin through sleeve cover.

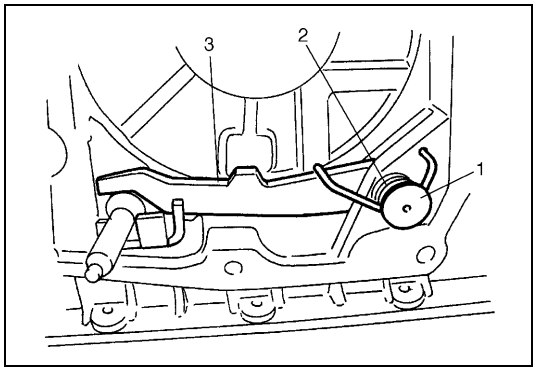


31) Turn sleeve cover by 90° and caulk securely with pin punch (1). Then check that manual shift shaft turns smoothly.

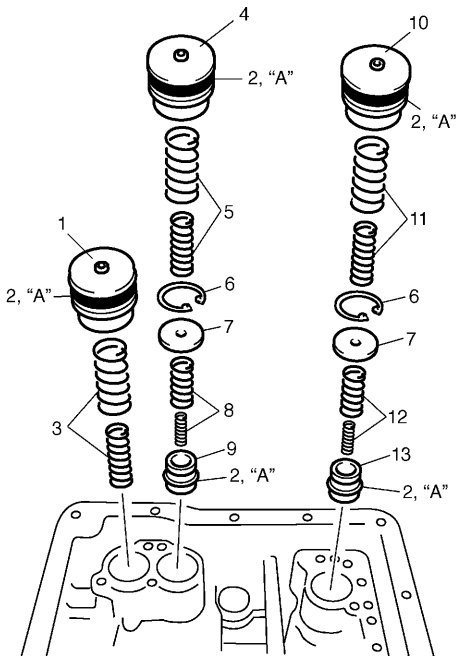


32) Install detent spring (1) and parking rod (2) as shown in figure.

Tightening torque
Detent spring assembly bolt
(a) : 15 N·m (1.5 kg-m, 11.0 lb-ft)



33) Install parking pawl (3), spring (2) and parking pawl shaft (1) as shown in figure.



34) Install O-rings to each accumulator piston and apply grease or ATF to them.

"A" : Grease 99000-25030

35) Install B0 accumulator piston, compression spring gray paint and accumulator spacer.
Hold them with snap ring.

NOTE:

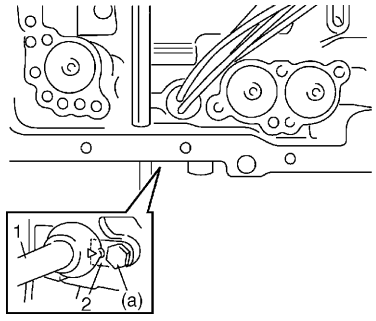
- **Make sure that the snap ring is fitted to the groove of B1-B0 accumulator cylinder.**
- **Make sure that the O-ring is not twisted or caught when installing.**

36) Install B1 accumulator spring (with light blue paint) and accumulator piston.

NOTE:

Make sure that the O-ring is not twisted or caught when installing.

1.	C2 accumulator piston (large)
2.	O-ring
3.	C2 accumulator spring (with pink paint)
4.	B1 accumulator piston (with 1 groove)
5.	B1 accumulator spring (with light blue paint)
6.	Snap ring
7.	Accumulator spacer
8.	B0 accumulator spring (with white paint)
9.	B0 accumulator piston
10.	C1 accumulator piston (with 2 grooves)
11.	C1 accumulator spring
12.	C2 accumulator spring (with orange paint)
13.	C2 accumulator piston (small)



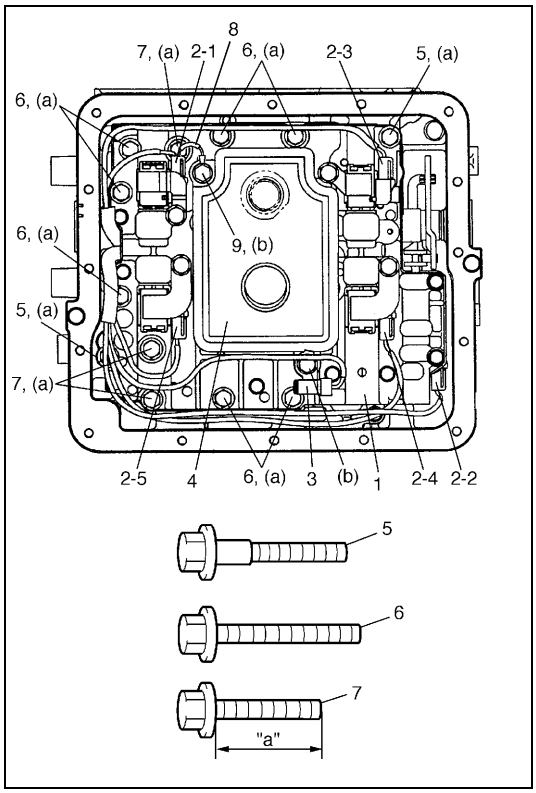
37) Install wire-to-solenoid assembly (1).
Fix it with sleeve lock plate (2) and a bolt.

NOTE:

- **Apply grease to O-ring of wire-to-solenoid assembly.**
- **Match the arrow mark on wire-to-solenoid assembly with the sleeve lock plate.**

Tightening torque
Wire-to-solenoid assembly bolt
(a) : 8.0 N·m (0.8 kg-m, 6.0 lb-ft)

Grease 99000-25030



38) Install valve body (1) to transmission case.
First match the pin of the manual valve lever to the slot of the manual valve.

NOTE:

Connect shift solenoid No.2 coupler (green) before tightening bolts.

Tightening torque
Valve body bolts
(a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)

Bolt	Length “a”	Pieces
A	25 mm (0.98 in.)	2
B	25 mm (0.98 in.)	7
C	20 mm (0.79 in.)	3

3. Transmission fluid temp. sensor	7. Bolt C
4. Oil strainer assembly	8. Ground wire
5. Bolt A	9. Oil strainer bolt
6. Bolt B	

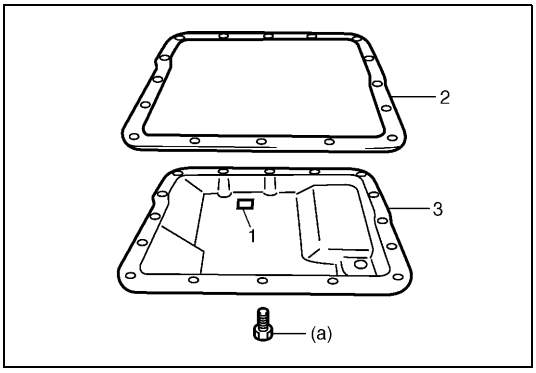
39) Connect couplers of wire-to-solenoid to solenoid valves.

Solenoid Valve	Color
No.1	Natural
No.2	Green
No.3	Natural
No.4	Black
Lock-up	Black

2-1. Shift solenoid No.1 coupler
2-2. Shift solenoid No.2 coupler
2-3. Shift solenoid No.3 coupler
2-4. Shift solenoid No.4 coupler
2-5. Lock-up solenoid coupler

40) Install O-ring to oil strainer assembly.
41) Install oil strainer assembly with ground wire for shift solenoid valve No.1 to the top of valve body assembly.
Connect transmission fluid temperature sensor coupler.
Fix transmission fluid temperature sensor and oil strainer assembly with bolts.

Tightening torque
Oil strainer bolts
(b) : 8 N·m (0.8 kg-m, 6 lb-ft)



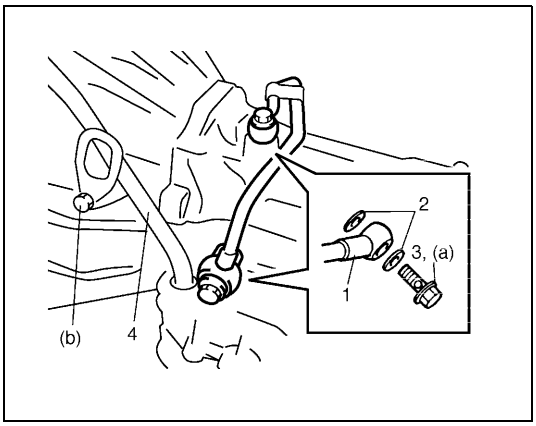
42) Install magnet (1) in oil pan.

NOTE:

If metal particles are attached to the magnet, clean them before installing.

43) Install gasket (2) to transmission case and install oil pan (3).

Tightening torque
A/T oil pan bolts
(a) : 7.5 N·m (0.75 kg-m, 5.5 lb-ft)

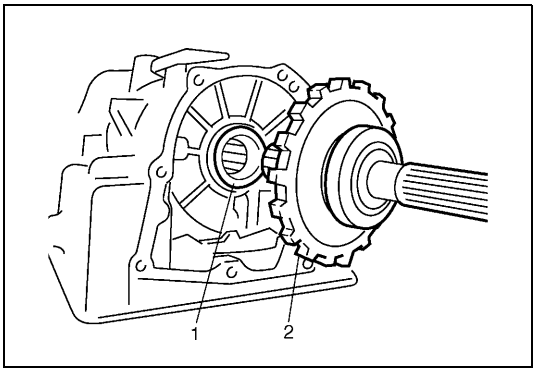


44) Install oil cooler pipe (1) with new gaskets (2).

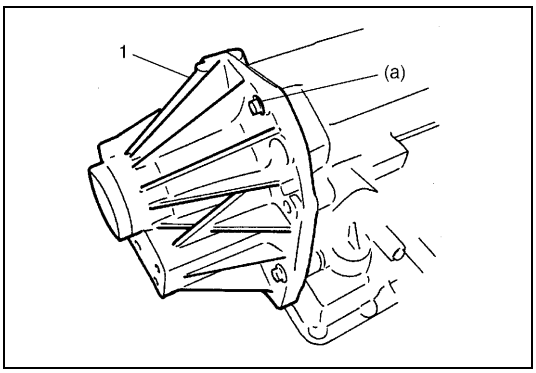
Tightening torque
Oil cooler pipe union bolts
(a) : 36 N·m (3.6 kg-m, 26.0 lb-ft)
Transmission hook bolt
(b) : 19 N·m (1.9 kg-m, 13.5 lb-ft)
Oil cooler pipe bracket bolt: 6 N·m (0.6 kg-m, 4.5 lb-ft)

45) Install A/T fluid filler tube (4) and level gauge.

3. Union bolt



46) Apply grease to thrust bearing (1) and install it to transmission case.
47) Install output shaft assembly (2) to transmission case.

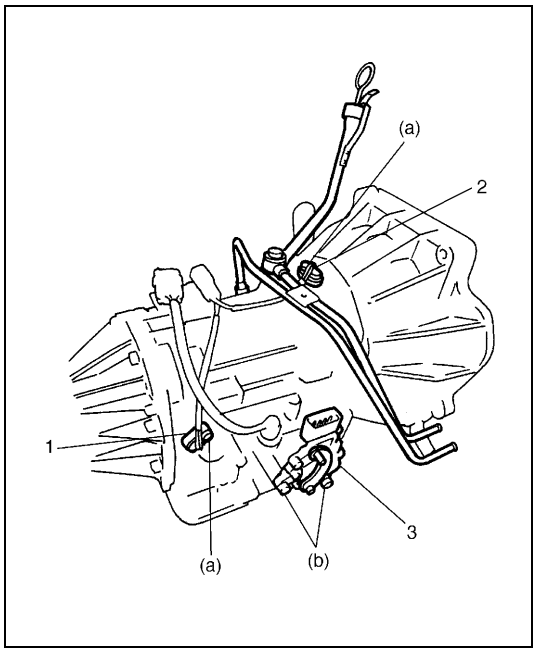


48) Install extension case (1).

Tightening torque
Extension case bolt
(a) : 17 N·m (1.7 kg-m, 12.5 lb-ft)

NOTE:

Use new bolts.

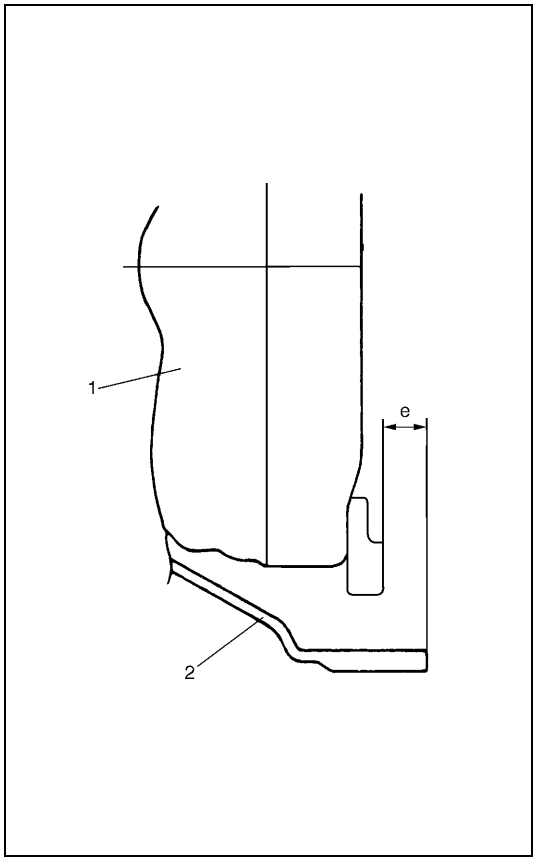


49) Install output shaft speed sensor (1) and input shaft speed sensor (2).
Apply grease to O-ring of each sensor.

Tightening torque
Output shaft speed sensor and input shaft speed sensor bolt
(a) : 8 N·m (0.8 kg-m, 6.0 lb-ft)

50) Install transmission range sensor (3).
Install it temporarily so that the adjustment can be done after installing A/T assembly back to the vehicle.

Tightening torque
Transmission range sensor bolt
(b) : 18 N·m (1.8 kg-m, 13.0 lb-ft)



51) Install torque converter (1) to input shaft.
- Install torque converter, using care not to damage oil seal of oil pump.
- After installing torque converter, check that distance “e” is within specification.

Torque converter installing position
Distance “e” : More than 20.0 mm (0.787 in.)

- Check torque converter for smooth rotation.
- Apply grease around cup at the center of torque converter.

Grease 99000-25010

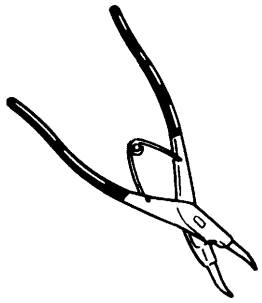
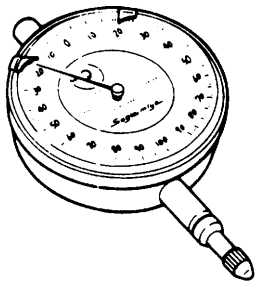
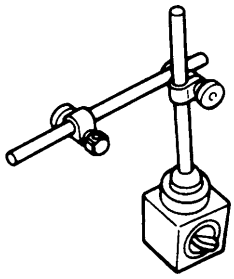
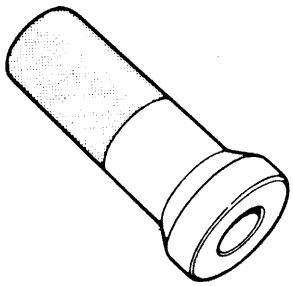
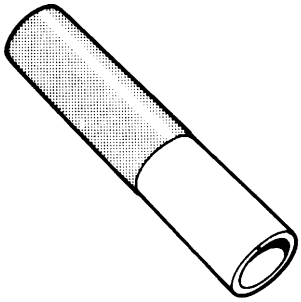
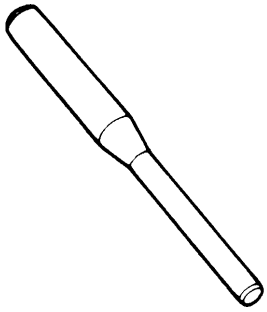
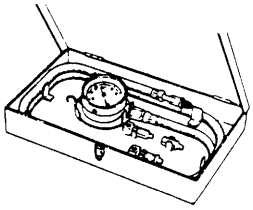
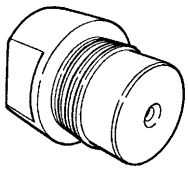
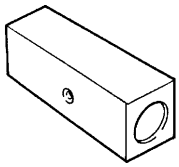
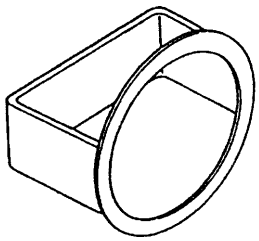
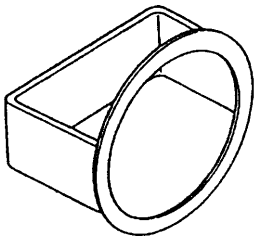
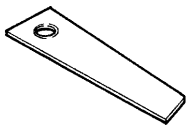
CAUTION:
- **Before installing converter, make sure that its pump hub portion is free from nicks, burrs or damage which may cause oil seal to leak.**
- **Be very careful not to drop converter on oil pump gear. Damage in gear, should it occur, may cause a critical trouble.**

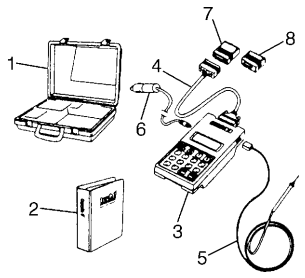
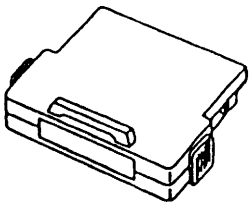
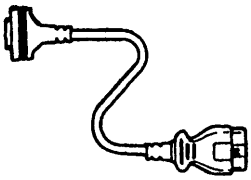
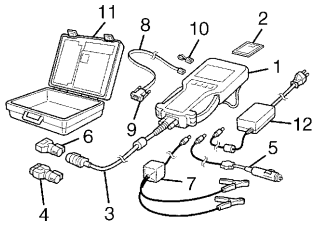
2. Torque converter housing

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
A/T fluid drain plug	22.0	2.2	16.0
Transmission range sensor bolts	18.0	1.8	13.0
Output shaft speed sensor bolt	8.0	0.8	6.0
Input shaft speed sensor bolt	8.0	0.8	6.0
Selector rod nut	7.0	0.7	5.0
A/T oil pan bolts	7.5	0.75	5.5
Oil strainer bolts	8.0	0.8	6.0
Selector lever assembly bolt	18.0	1.8	13.0
Shift control shaft nut	13.0	1.3	9.5
Solenoid valve bolts	8.0	0.8	6.0
Interlock cable screw	2.2	0.22	1.6
Interlock cable bracket nut	13.0	1.3	9.5
Drive plate bolts	19.0	1.9	14.0
Rear mounting to bracket blot	25.0	2.5	18.0
Rear mounting bracket to transmission bolts	25.0	2.5	18.0
Frame to rear mounting bolts	25.0	2.5	18.0
Engine to transmission bolts and nuts	80.0	8.0	58.0
Universal joint flange bolts and nuts	50.0	5.0	36.5
Exhaust pipe to manifold bolts	50.0	5.0	36.5
Muffler to exhaust pipe bolts	50.0	5.0	36.5
Detent spring assembly bolt	15.0	1.5	11.0
Oil pump assembly bolts	12.0	1.2	8.5
Torque converter housing bolts	19.0	1.9	14.0
Wire-to-solenoid assembly bolt	8.0	0.8	6.0
Valve body assembly bolts	5.5	0.55	4.0
Valve body bolts	10.0	1.0	7.5
Oil cooler pipe union bolts	36.0	3.6	26.0
Oil cooler pipe bracket bolt	6.0	0.6	4.5
Extension case bolts	17.0	1.7	12.5
Oil pump cover bolts	10.0	1.0	7.5

Special Tool

 09900-06108 Snap ring plier (Closing type)	 09900-20606 Dial gauge	 09900-20701 Magnetic stand	 09913-76010 Bearing installer
 09913-80112 Bearing installer	 09925-78210 Spring pin remover (6 mm)	 09925-37810 Oil pressure gauge	 09926-26030 Clutch clearance checking base No.1
 09926-26040 Clutch clearance checking base No.2	 09926-96010 Clutch spring compressor	 09926-96020 Clutch spring compressor	 09952-06010 Dial gauge plate No.1

			
09931-76011 Tech 1A kit (SUZUKI scan tool) (See NOTE “A”.)	Mass storage cartridge for Tech 1A	09931-76030 16/14 pin DLC cable for Tech 1A	Tech 2 kit (SUZUKI scan tool) (See NOTE “B”.)

NOTE:

- **“A”: This kit includes the following items and substitutes for the Tech 2 kit.**
  1. Storage case, 2. Operator’s manual, 3. Tech 1A, 4. DLC cable (14/26 pin, 09931-76040), 5. Test lead/probe, 6. Power source cable, 7. DLC cable adaptor, 8. Self-test adaptor
- **“B”: This kit includes the following items and substitutes for the Tech 1A kit.**
  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

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Automatic transmission fluid	An equivalent of DEXRON®-IIE or DEXRONR®-III	• Automatic transmission • Parts lubrication when installing
Lithium grease	SUZUKI SUPER GREASE C (99000-25030)	• Retaining parts in place when assembling • Oil seal lips • Oil pump D-ring
	SUZUKI SUPER GREASE A (99000-25010)	• Rod ends • Converter center cup

SECTION 7C

CLUTCH

CONTENTS

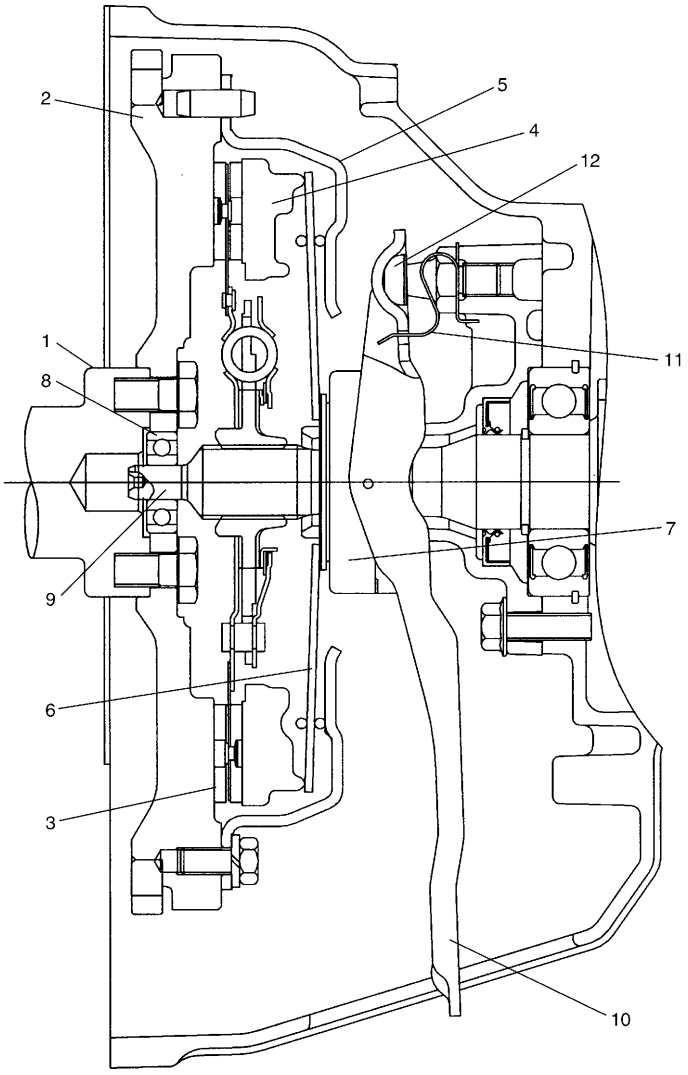
General Description **7C-2**
Diagnosis **7C-3**
On-Vehicle Service **7C-4**
Maintenance Service 7C-4
Clutch pedal height 7C-4
Clutch pedal free travel 7C-4
Clutch cable routing 7C-5
Clutch Cable 7C-6
Unit Repair Overhaul **7C-7**
Clutch Cover, Clutch Disc, Flywheel and Release Bearing 7C-7
Tightening Torque Specification **7C-13**
Required Service Material **7C-13**
Special Tool **7C-13**

General Description

The clutch is a diaphragm-spring clutch of a dry single disc type. The diaphragm spring is of a taperingfinger type, which is a solid ring in the outer diameter part, with a series of tapering fingers pointing inward. The disc, carrying three torsional coil springs, is slidably mounted on the transmission input shaft with a serration fit.

The clutch cover is secured to the flywheel, and carries the diaphragm spring in such a way that the peripheral edge 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 push on the tips of the tapering 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	7. Release bearing
2. Flywheel	8. Input shaft bearing
3. Clutch disc	9. Input shaft
4. Pressure plate	10. Release fork
5. Clutch cover	11. Release fork return spring
6. Diaphragm spring	12. Clutch release fork support

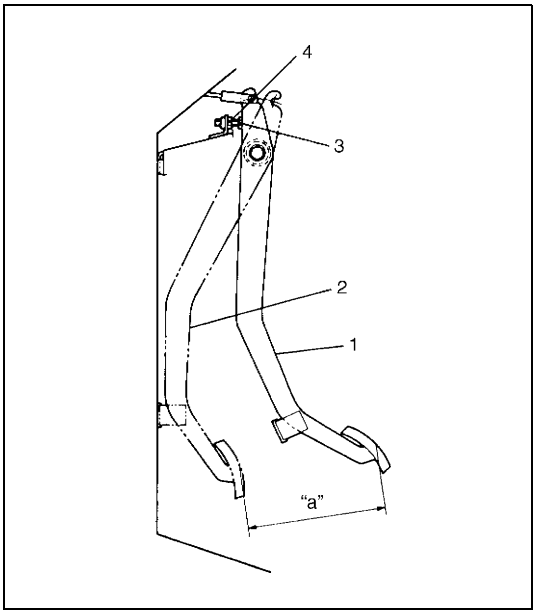
Diagnosis

Condition	Possible Cause	Correction
Slipping clutch	Loss of clearance at the tip of release fork	Adjust as prescribed.
	Clutch facings dirty with oil	Replace.
	Clutch facings excessively worn	Replace.
	Weakened diaphragm spring	Replace.
	Distorted pressure plate or flywheel surface	Replace.
	Improper clutch pedal free travel	Adjust and, as necessary, replace clutch facings.
Dragging clutch	Improper clutch pedal free travel	Adjust free travel.
	Weakened diaphragm spring, or worn spring tip	Replace.
	Damaged or worn splines of transmission input shaft	Replace.
	Front input shaft bearing worn or broken	Replace.
	Excessively wobbly clutch disc	Replace.
	Clutch facings broken or dirty with oil	Replace.
Clutch vibration	Glazed clutch facings	Repair or replace.
	Clutch facings dirty with oil	Replace.
	Wobbly clutch disc, or poor facing contact	Replace.
	Weakened torsion springs in clutch disc	Replace.
	Clutch disc rivets loose	Replace the disc.
	Distorted pressure plate or flywheel surface	Replace.
	Weakened engine mounting or loosened mounting bolt or nut	Retighten or replace.
Noisy clutch	Worn or broken release bearing	Replace.
	Front input shaft bearing worn down	Replace.
	Excessive rattle of clutch disc hub	Replace the disc.
	Cracked clutch disc	Replace.
	Pressure plate and diaphragm spring rattling	Replace.
Grabbing clutch	Clutch facings soaked with oil	Replace.
	Excessively worn clutch facings	Replace.
	Rivet heads showing out of the facing	Replace.
	Weakened torsion springs	Replace.

On-Vehicle Service

Maintenance Service

Clutch pedal height

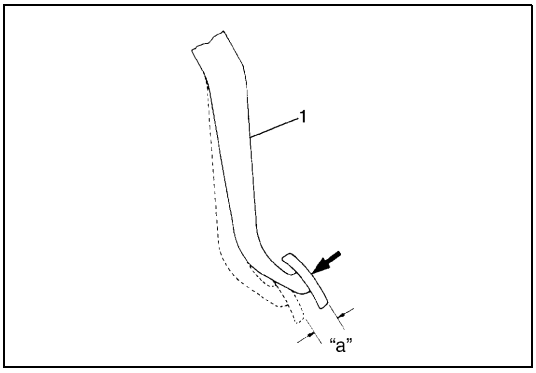


Check that clutch pedal height is within "a" range as illustrated.
If clutch pedal height is out of specification, adjust it by turning pedal stopper bolt.
Be sure to tighten lock nut (4) after adjustment.

Clutch pedal height
"a": 140 mm (5.51 in.)

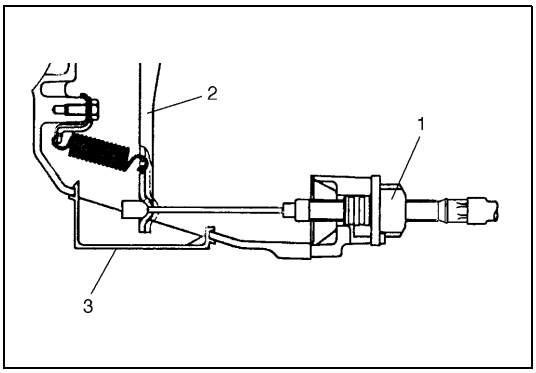
1.	Clutch pedal free position
2.	Fully depressed position
3.	Clutch pedal stopper bolt

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.

Clutch pedal free travel
"a": 10 – 20 mm (0.4 – 0.8 in.)



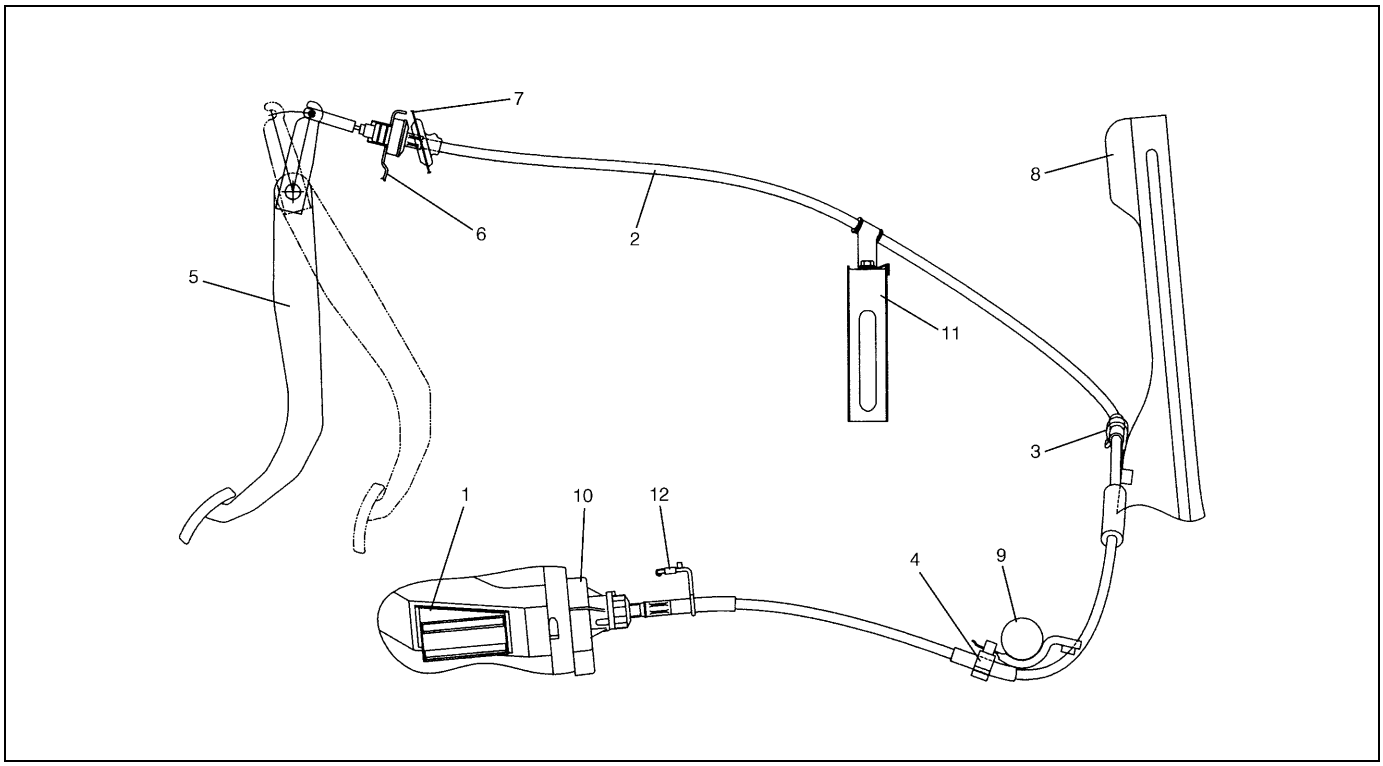
2) If free travel is out of specification, adjust it with clutch cable adjust nut (1).

Release fork free travel
: 2 – 4mm (0.08 – 0.16 in.)

2.	Release fork
3.	Cap

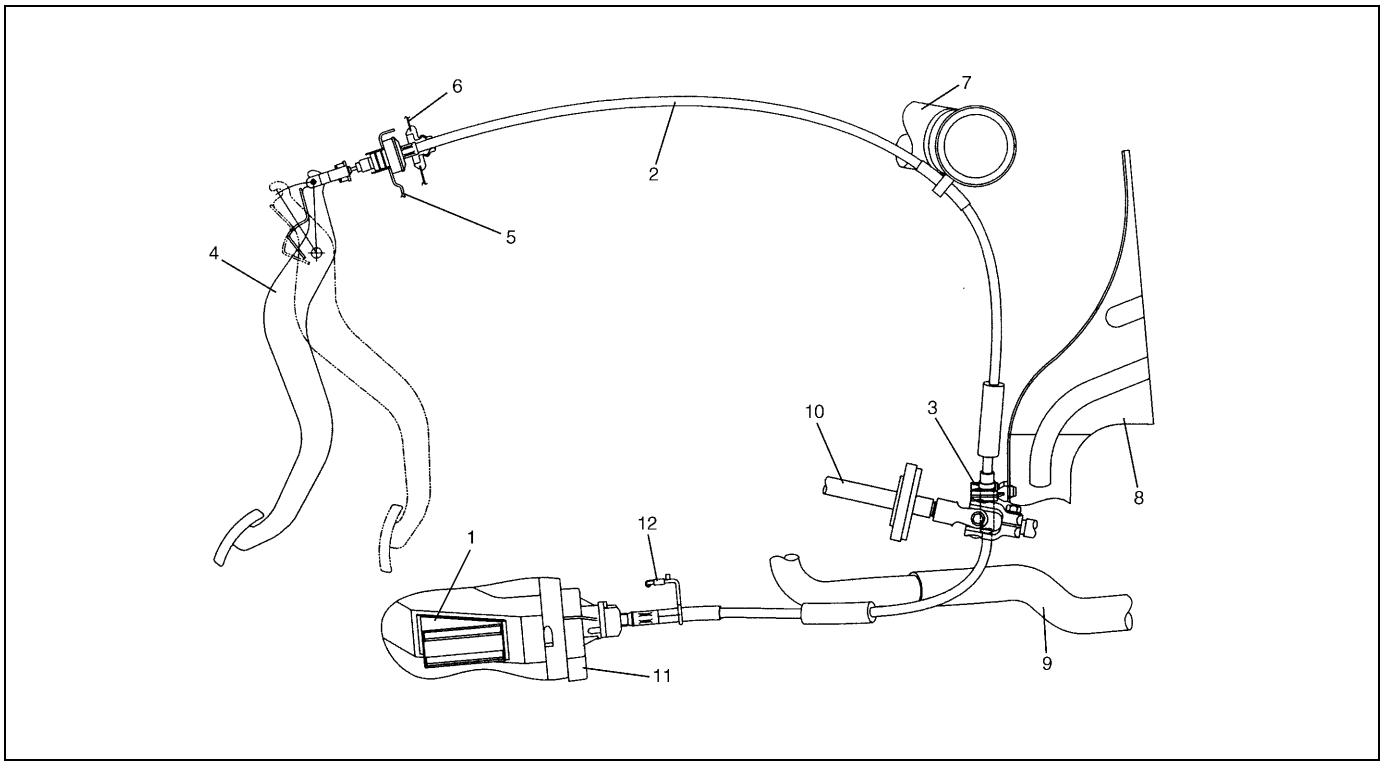
Clutch cable routing

1) For left-hand side steering vehicle.



1. Clutch housing cap	4. Clutch cable clamp No.2	7. Dash panel	10. Clutch cable bracket
2. Clutch cable	5. Clutch pedal	8. Radiator stay	11. Air cleaner bracket
3. Clutch cable clamp No.1	6. Pedal bracket	9. Cross member	12. Clutch cable clamp No.3

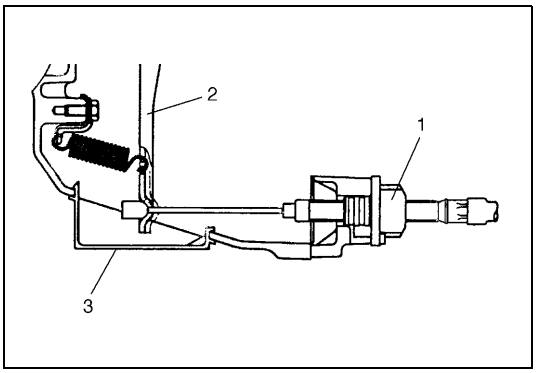
2) For right-hand side steering vehicle.



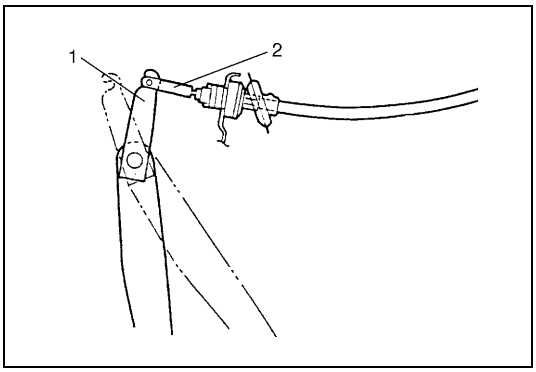
1. Clutch housing cap	4. Clutch pedal	7. Air cleaner outlet hose	10. Steering lower shaft
2. Clutch cable	5. Pedal bracket	8. Radiator stay	11. Clutch cable bracket
3. Clutch cable clamp No.1	6. Dash panel	9. Radiator outlet hose	12. Clutch cable clamp No.2

Clutch Cable

REMOVAL



1) Remove clutch housing cap (3).
2) Loosen clutch cable adjust nut (1) and disconnect clutch cable from release fork (2).



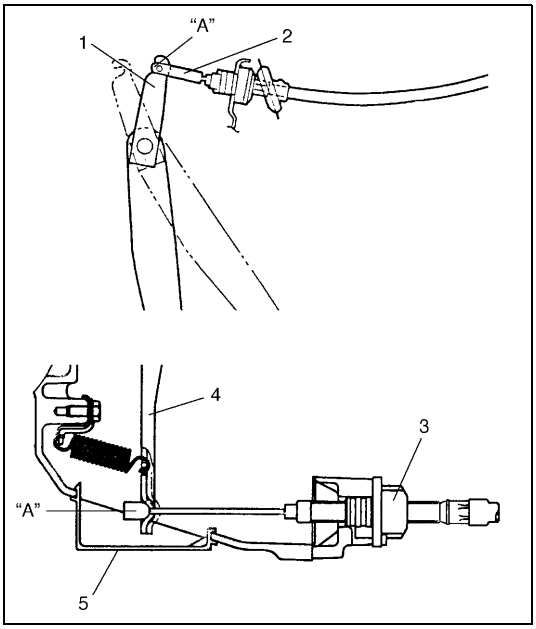
3) Disconnect cable hook (2) at clutch pedal shaft arm (1), then take off cable.

INSPECTION

Inspect clutch cable and replace it for any of following conditions.

- Excessive cable friction
- Frayed cable
- Bent or kinked cable
- Worn end

INSTALLATION



1) Before installing cable, apply grease to cable end hook (2) and release fork (4) as shown figure.

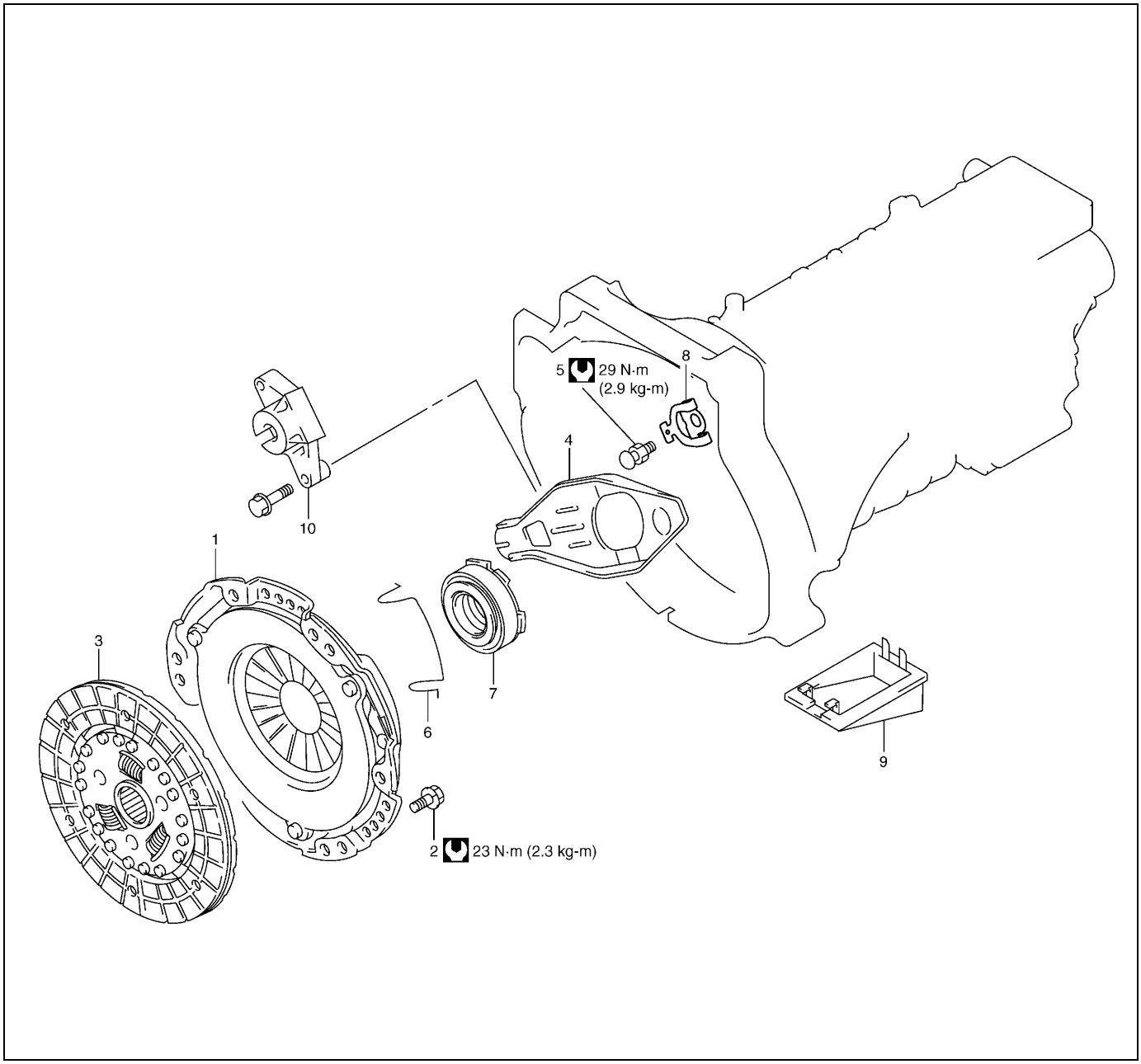
"A" : Grease 99000-25010

2) Screw in clutch cable adjust nut (3) and adjust free travel of pedal to specification by turning nut.
3) Check clutch for proper function with engine running.

1.	Clutch pedal shaft arm
5.	Cap

Unit Repair Overhaul

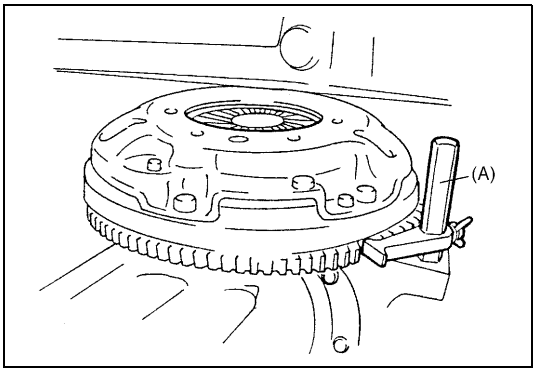
Clutch Cover, Clutch Disc, Flywheel and Release Bearing



1. Clutch cover	5. Clutch release fork support	9. Clutch housing cap
2. Bolt	6. Release bearing clip	10. Clutch cable bracket
3. Clutch disc	7. Release bearing	Tightening torque
4. Release fork	8. Release fork return spring	

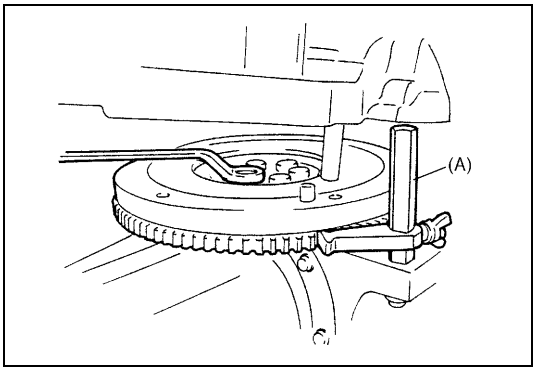
REMOVAL

1) Removal of clutch presupposes that the transmission has been separated from engine according to the method outlined in “Dismounting of Transmission” of Section 7A.



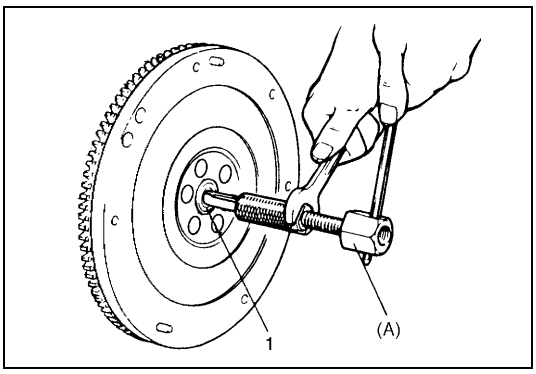
2) Hold flywheel stationary with special tool and remove bolts securing clutch cover to flywheel, and take off clutch cover and disc.

Special tool
(A): 09924-17810



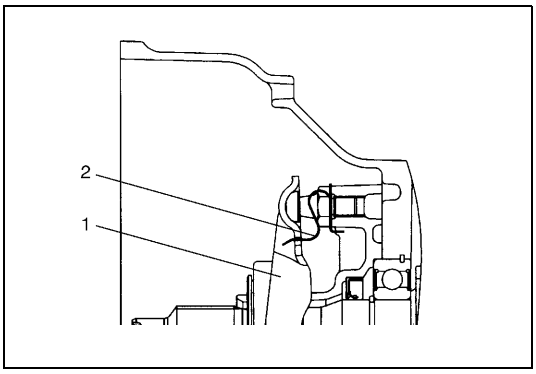
3) Hold flywheel stationary with special tool and remove bolts securing flywheel to crank shaft, and take off flywheel.

Special tool
(A): 09924-17810

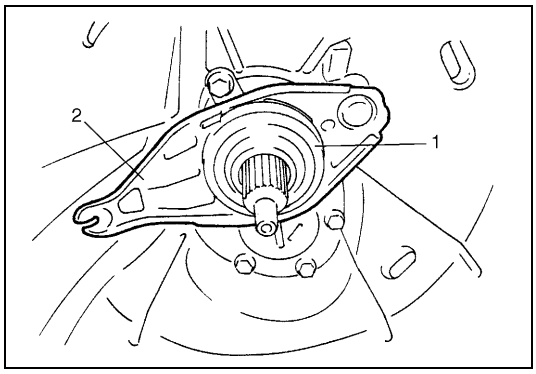


4) Use special tool for pulling out of input shaft bearing (1).

Special tool
(A): 09921-26020



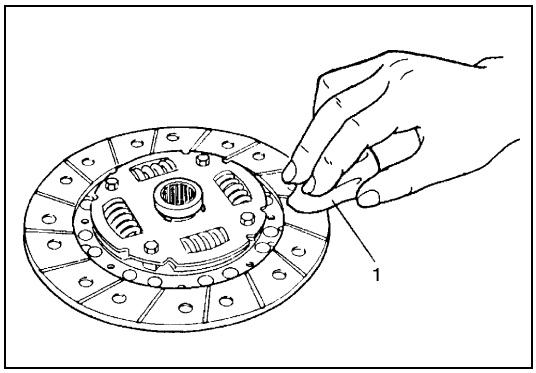
5) Detach clutch release fork (1) from clutch release fork return spring (2).



6) Remove release bearing (1) and clutch release fork (2).

INSPECTION

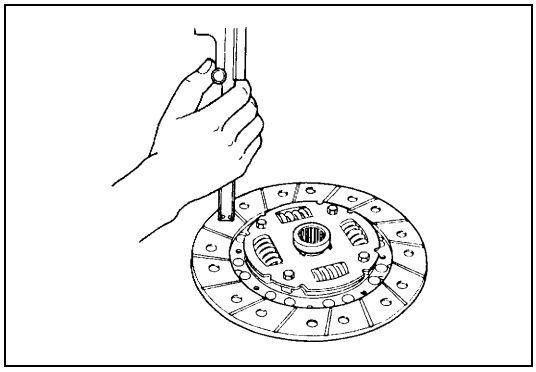
Clutch Disc Facing Surface Condition



A burnt or glazed facing can be reconditioned by grinding it with No. 120 – 200 sandpaper. If surface is in bad condition beyond repair, replace whole clutch disc assembly.

1. Sandpaper

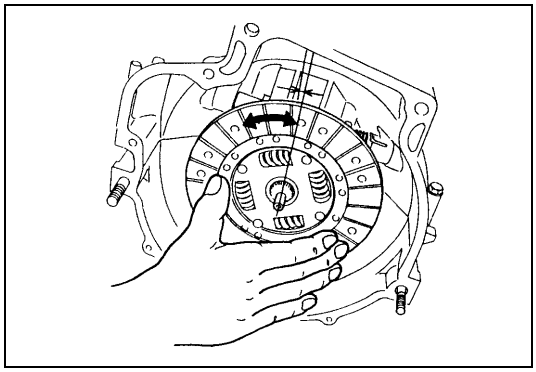
Clutch Facing Wear



Check wear of facing by measuring depth of each rivet head depression, i.e. distance between rivet head and facing surface. If depressing is found to have reached service limit at any of the holes, replace clutch disc assembly.

Rivet head depth of clutch disc
Standard: 1.2 mm (0.05 in.)
Service limit: 0.5 mm (0.02 in.)

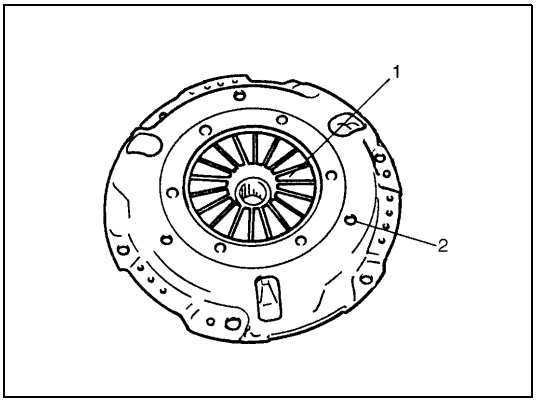
Backlash in Disc Serration Fit



Check backlash by turning disc back and forth as mounted on transmission input shaft. Replace disc assembly if backlash is noted to exceed service limit. Backlash here is a circular displacement as measured with a dial indicator.

Backlash limit in serration fit of clutch disc
: 0.8 mm (0.03 in.)

Clutch Cover

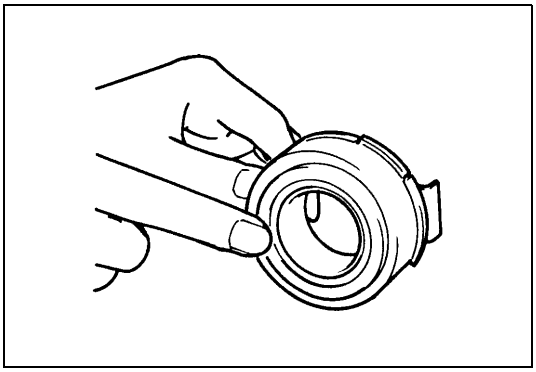


Inspect clutch cover for evidence of diaphragm spring rivets getting loose. If rivets are loose or are getting loose, replace cover assembly as such cover makes rattling noise when clutch pedal is depressed.

Inspect tips of tapering fingers for wear. If tips are worn excessively, replace cover assembly.

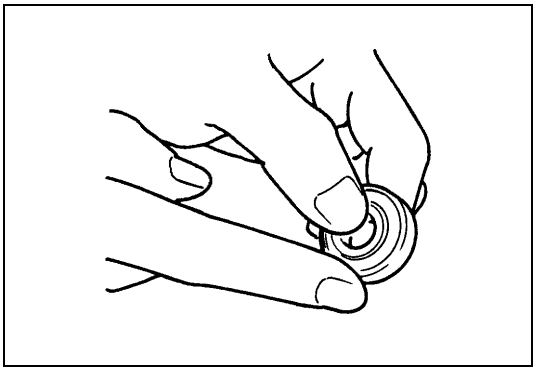
1. Spring wear
2. Rivet

Release Bearing



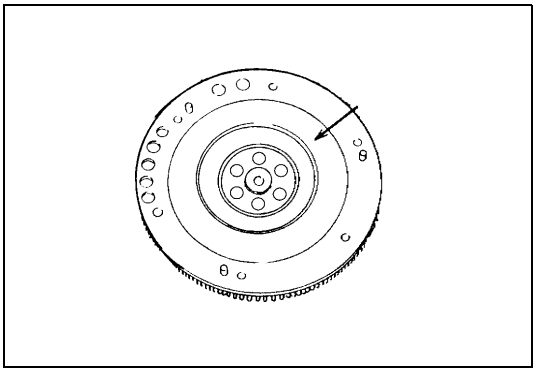
Replace release bearing if it sticks, rattles or makes abnormal noise when spun and turned by hand.

Input Shaft Bearing



Replace input shaft bearing if it sticks, rattles or makes abnormal noise when spun and turned by hand.

Flywheel

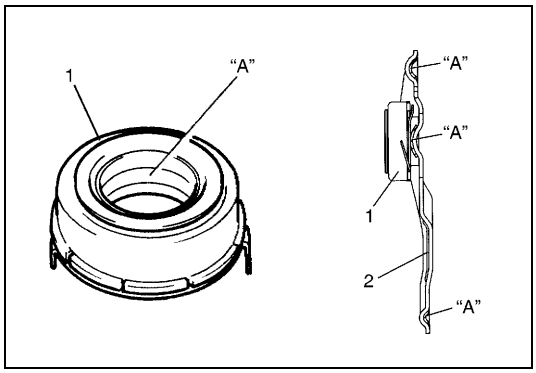


Check surface contacting clutch disc for any wear or damage.

INSTALLATION

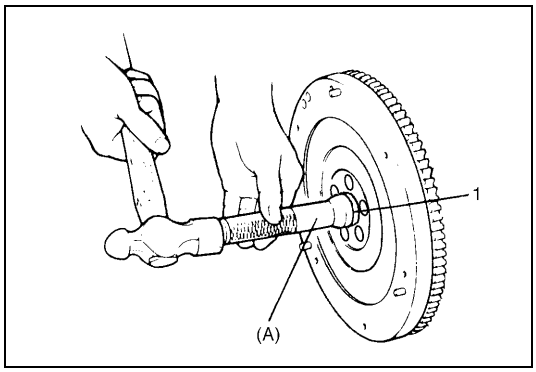
NOTE:

- **Before installing flywheel, clutch disc and clutch cover, hoist vehicle and lift transmission by jack up to transmission installation position.**
- **Before assembling, make sure that flywheel surface and pressure plate surface have been cleaned and dried thoroughly.**



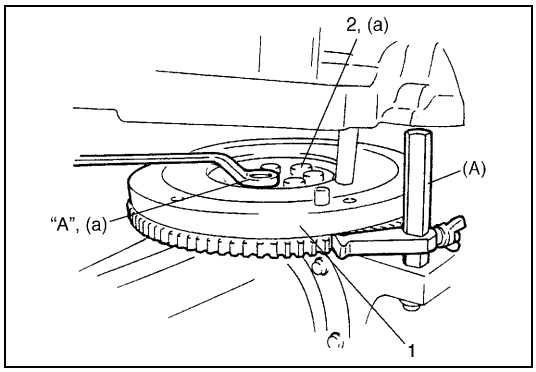
1) Before installing retainer, apply grease to release bearing (1) inner surface and release fork (2).

"A": Grease 99000-25010



2) Install input shaft bearing (1) to flywheel using special tool.

Special tool
(A): 09925-98210

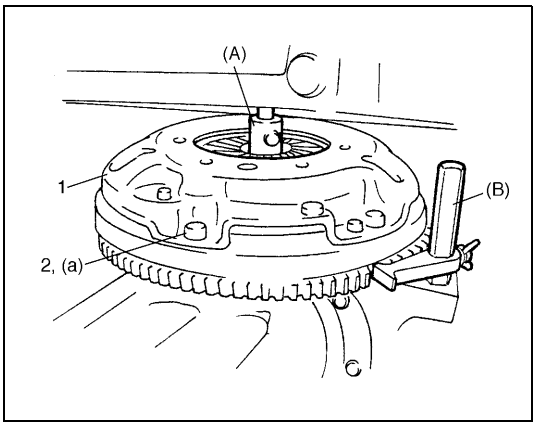


3) Install flywheel (1) to crankshaft and tighten bolts (2) applied with sealant at thread part to specification.

Special tool
(A): 09924-17810

"A": Sealant 99000-31110

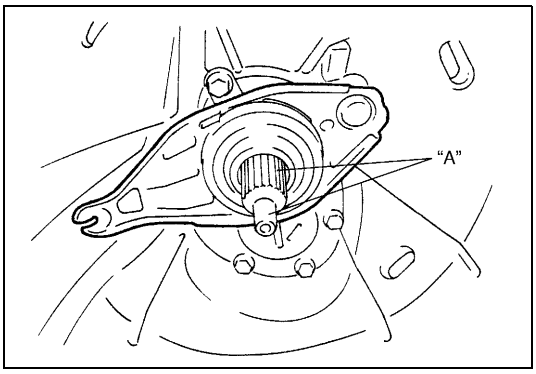
Tightening torque
Flywheel bolts
(a): 76 N·m (7.6 kg-m, 55.0 lb-ft)



4) Using special tool, install clutch disc and clutch cover (1). Tighten clutch cover bolts (2) to specification using special tool.

Special tool
(A): 09923-36320
(B): 09924-17810

Tightening torque
Clutch cover bolts
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



5) Slightly apply grease to input shaft. Then join transmission with engine. Refer to "Remounting" of Section 7A.

"A": Grease 99000-25210

NOTE:

Turn crankshaft with wrench from front while inserting transmission input shaft to clutch disc until splines mesh.

Tightening Torque Specification

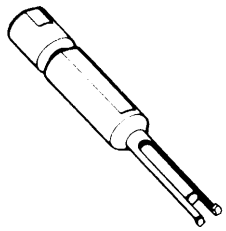
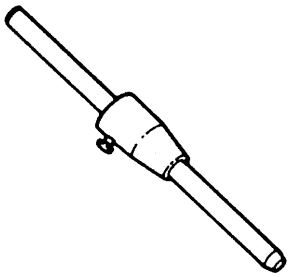
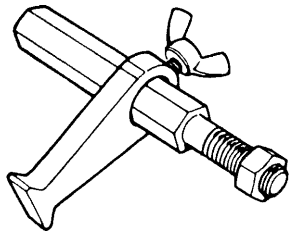
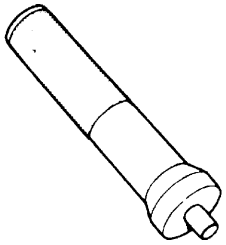
Be sure to torque each nut or bolt, if loosened, to specification given below. If specified tightening torque for particular bolt or nut is not included here, refer to Section 0A of this manual.

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Flywheel bolts	76	7.6	55.0
Clutch cover bolts	23	2.3	17.0
Clutch release fork support	29	2.9	21.0

Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Cable junction with pedal shaft arm. • Release fork. • Inside of release bearing.
	SUZUKI SUPER GREASE I (99000-25210)	• Input shaft spline and front end.
Sealant	SUZUKI BOND No. 1215 (99000-31110)	• Flywheel bolts.

Special Tool

			
09921-26020 Bearing remover (for input shaft bearing)	09923-36320 Clutch center guide	09924-17810 Flywheel holder	09925-98210 Input shaft bearing installer

SECTION 7D

TRANSFER

NOTE:

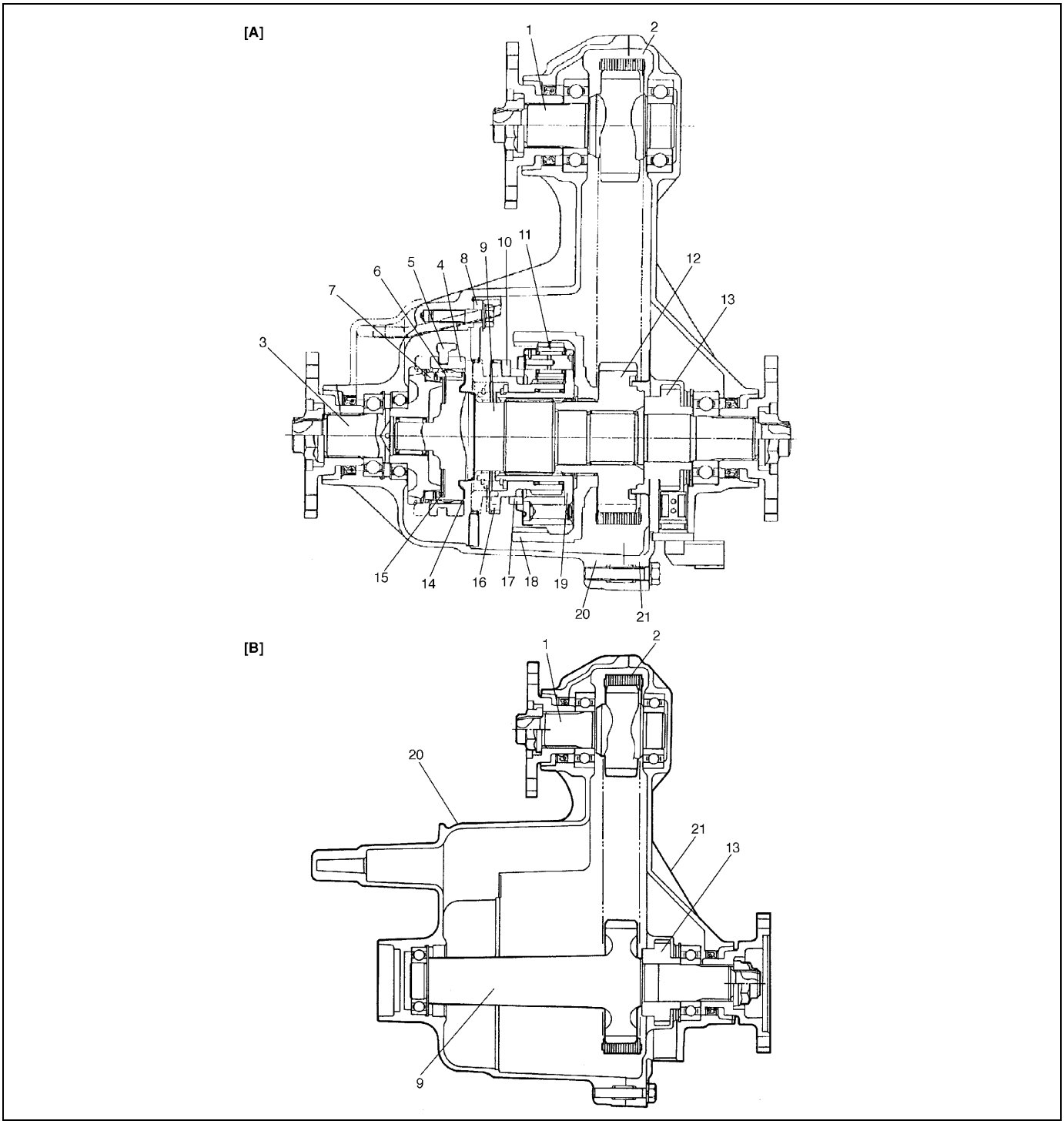
When servicing 2WD vehicles, use the same procedure described in this section but refer to the parts diagram of 2WD vehicles on page 7D-2 to check their differences from 4WD vehicles.

CONTENTS

General Description 7D-2
Planetary Gear Unit 7D-3
Planetary Gear Operation 7D-3
Gear Shift Control 7D-4
Diagnosis 7D-5
On-Vehicle Service 7D-6
Oil Change 7D-6
4WD Switch 7D-6
Unit Repair Overhaul 7D-8
Tightening Torque Specification 7D-24
Required Service Material 7D-24
Special Tool 7D-25

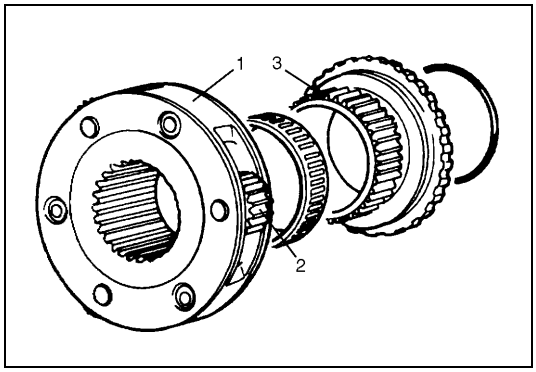
General Description

The transfer consists of an input shaft, drive chain, output front shaft for 4WD model, output rear shaft and their accompanying gears, hubs, sleeves, synchronizer ring, shift shaft, etc. For 4WD model, the planetary gear unit installed at the center of the output rear shaft selects the Lo range or the Hi range and the sleeve on the output front shaft side selects the 2WD or 4WD.



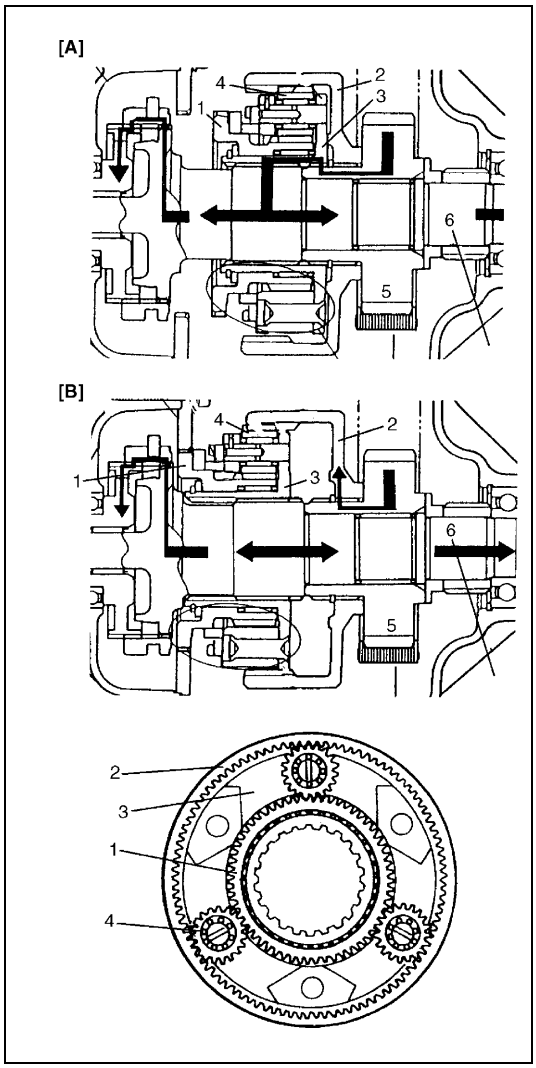
1. Input shaft	9. Output rear shaft	17. Shift fork spacer for 4WD model
2. Drive chain	10. Hi-Lo shift fork for 4WD model	18. Ring gear for 4WD model
3. Output front shaft for 4WD model	11. Pinion gear for 4WD model	19. Planetary carrier for 4WD model
4. Sleeve for 4WD model	12. Sprocket gear for 4WD model	20. Front case
5. 2-4 shift fork for 4WD model	13. Speedometer sensor rotor	21. Rear case
6. Synchronizer key for 4WD model	14. Key retainer for 4WD model	[A] : 4WD model
7. Synchronizer ring for 4WD model	15. Key spring for 4WD model	[B] : 2WD model
8. Lock-up plate for 4WD model	16. Sun gear for 4WD model	

Planetary Gear Unit



The planetary gear unit consists of a planetary carrier (1), 3 pinion gears (2) and a sun gear (3). As the Hi-Lo shift fork moves this planetary gear unit, the gear is selected in the 4H↔N↔4L pattern.

Planetary Gear Operation



4H range

As the sprocket output gear (5) and the output rear shaft (6) are engaged through the planetary carrier (3) serration, they turn as one unit.

L range

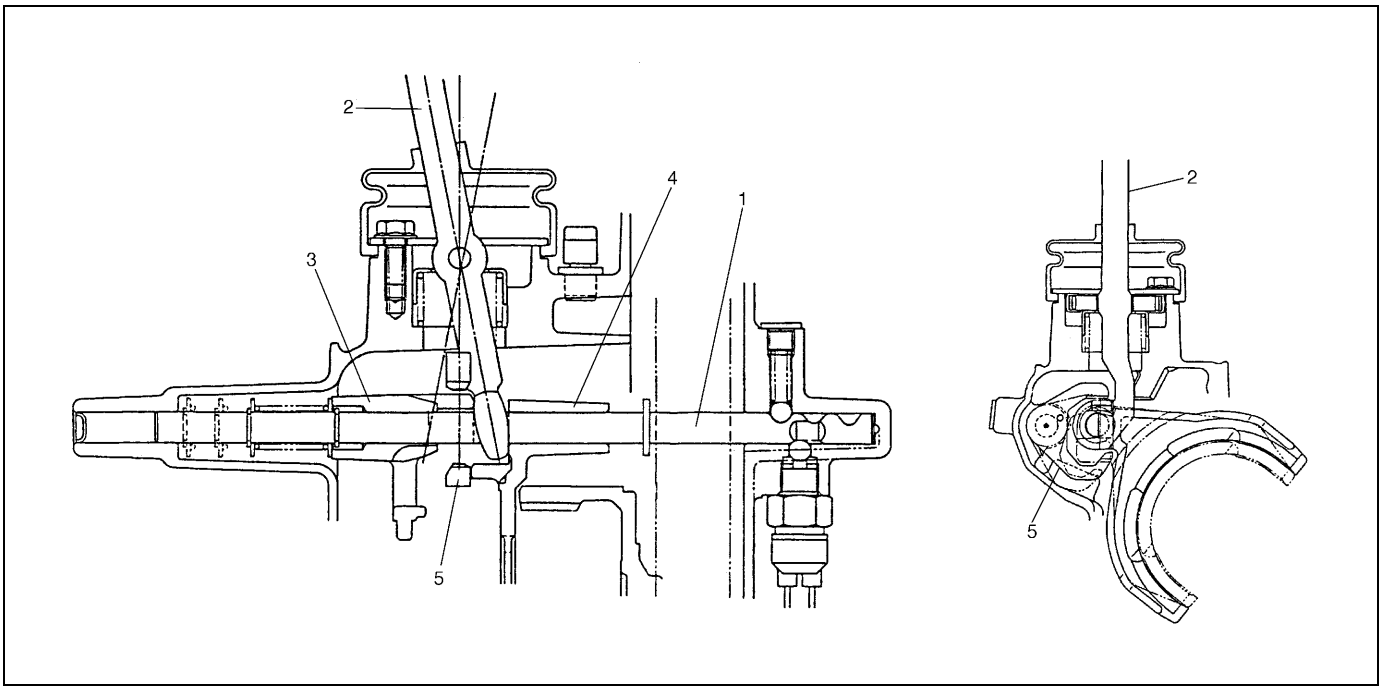
As the sun gear (1) is engaged with the lock-up plate and fixed, rotation of the sprocket output gear is transmitted through the ring gear (2), planetary pinion (4) and planetary carrier while being reduced and causes the output rear shaft to turn.

[A]: 4H range
[B]: 4L range

Gear Shift Control

The gear is shifted to the 2H, 4H or 4L shift position by using the shift lever provided inside of the vehicle. The control mechanism consists of a shift lever, shift shaft, interlock block, shift fork, etc.

The shift lever is installed directly to the transfer case. To shift the shift control lever between 2H and 4H positions, move it in the shift shaft direction. To shift it from the 4H position to the 4L position, push it down at the 4H position and then move it in the shift shaft direction.



1. Shift shaft	2. Shift lever	3. 2-4 shift fork	4. Hi-Lo shift fork	5. Interlock block

Control Mechanism

The shift lever fitted through the shift shaft and fixed to it with a pin. Also, the 2-4 shift fork to shift the gear in the 2H↔4H pattern and the Hi-Lo shift fork in the 4H↔4L pattern are fitted so that they can slide on the shift shaft. The interlock block cannot move in the shaft direction of the shift shaft as its movement is restricted by the interlock pin installed to the transfer case, but it can turn within the range of the groove in the interlock block. Interlock block can be turned by pushing shift control lever downward at 4H shift position, it restricts 2-4 shift fork movement and enable Hi-Lo shift fork to side forward, causes 4L shift position.

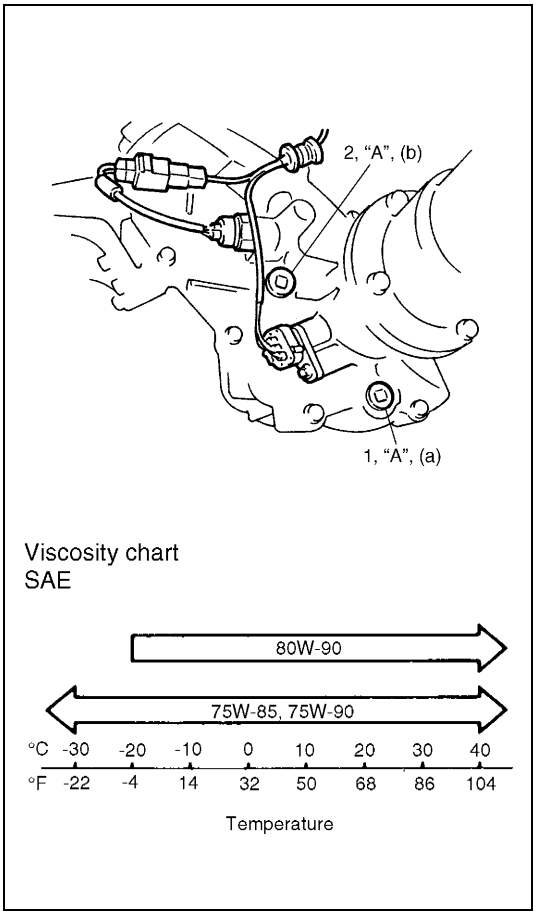
Diagnosis

Condition	Possible Cause	Correction
Gear slipping out of mesh	• Worn shift fork shaft	Replace.
	• Worn shift fork or sleeve	Replace.
	• Weak or damaged locating spring	Replace.
	• Worn bearings on input shaft or output shaft	Replace.
	• Worn chamfered tooth on sleeve or gear	Replace sleeve and gear.
	• Worn synchronizer ring	Replace.
Gears refusing to disengage	• Distorted shift shaft or shift fork	Replace.
	• Weakened or broken synchronizer spring	Replace.
Hard shifting	• Inadequate or insufficient lubricant	Replenish.
	• Worn chamfered tooth on sleeve or gear	Replace sleeve and gear.
	• 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 chamfered tooth on sleeve or gear	Replace.

On-Vehicle Service

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 (1) after applying sealant to its thread and fill new specified oil as shown below by specified amount (roughly up to level hole).

"A" : Sealant 99000-31110

Tightening torque
Oil drain plug (a) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

NOTE:

- **It is highly recommended to use SAE 75W-90 gear oil.**
- **Whenever vehicle is hoisted for any other service work than oil change, also be sure to check for oil leakage.**

Gear oil :
API GL-4
For SAE classification, refer to viscosity chart in the figure.
Oil capacity for 4WD model : 0.9 liters (1.9/1.6 US/Imp. pt)
Oil capacity for 2WD model : 1.34 liters (2.8/2.4 US/Imp. pt)

4) Torque level/filler plug (2) as specified below after applying sealant to its thread.

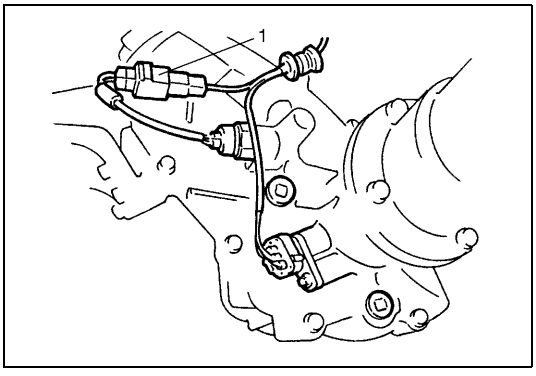
"A" : Sealant 99000-31110

Tightening torque
Oil level/filler plug (b) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

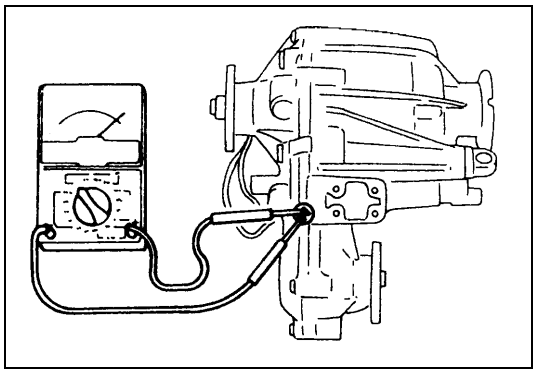
4WD Switch

Inspection

1) Hoist vehicle.



2) Disconnect 4WD switch coupler (1).



3) Check continuity between two terminals of 4WD switch.

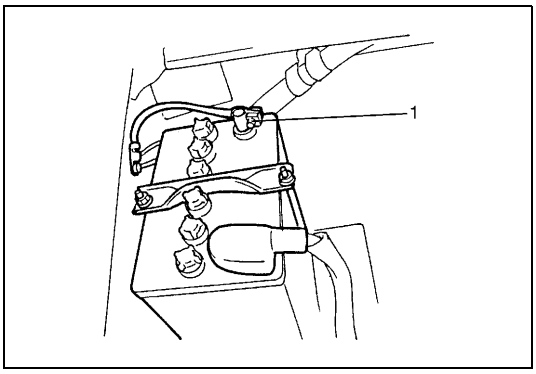
Transfer position	
2H	Not continuity
4H, 4L	Continuity

4) Connect 4WD switch coupler.

Unit Repair Overhaul

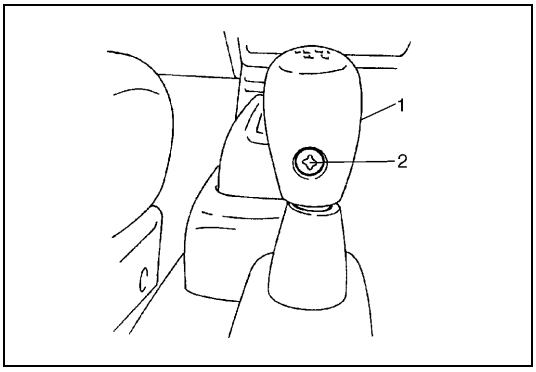
DISMOUNTING

In Engine Room



1) Disconnect negative cable (1) at battery.

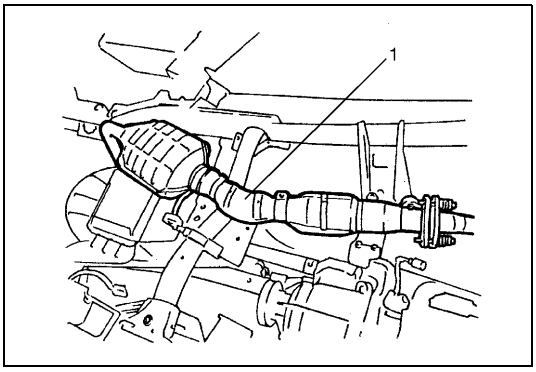
In Cabin



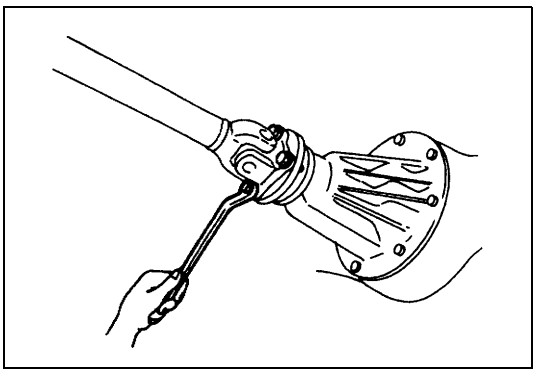
1) Remove transfer shift knob (1) by removing screw (2).

On Lift

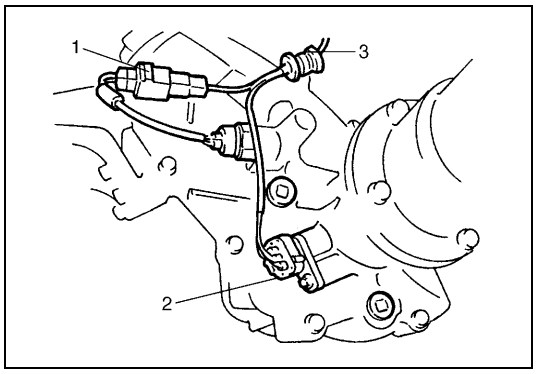
1) Drain transfer oil referring to “Oil Change” in this section.



2) Remove exhaust pipe (1).

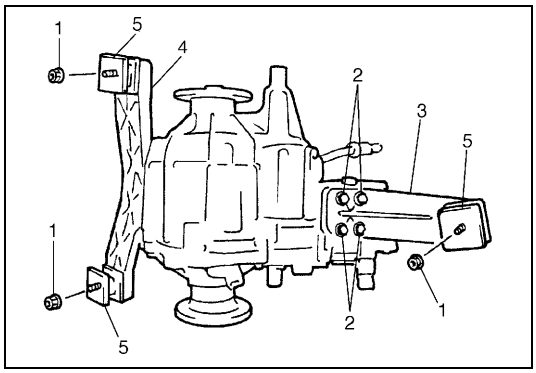


3) Give match marks on each joint flange and propeller shaft.
4) Remove securing bolts from each flange connection, sever 3 propeller shafts from transfer gear box and suspend propeller shafts with a wire hook or like.



5) Disconnect 4WD switch wire at coupler (1) and unclamp harness. Disconnect speed sensor coupler.

2.	Speed sensor
3.	Clamp

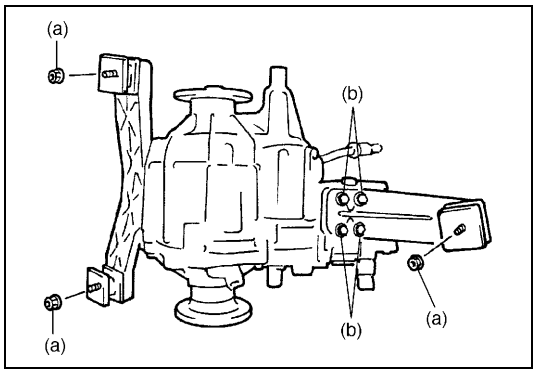


6) With transfer supported on jack, remove 3 mounting nuts (1) and 4 bolts (2).
7) Remove transfer with mountings from body.
8) Remove mounting from transfer.

3.	Mounting right bracket
4.	Mounting left bracket
5.	Mounting

REMOUNTING

For remounting, reverse dismounting procedure, noting following.

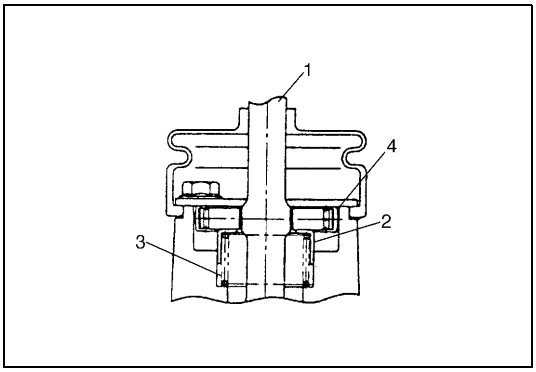


- Use specified torques as given below.

Tightening torque
Transfer mounting nut
(a) : 30 N·m (3.0 kg-m, 22.0 lb-ft)
Transfer mounting bracket bolt
(b) : 23 N·m (2.3 kg-m, 17.0 lb-ft)

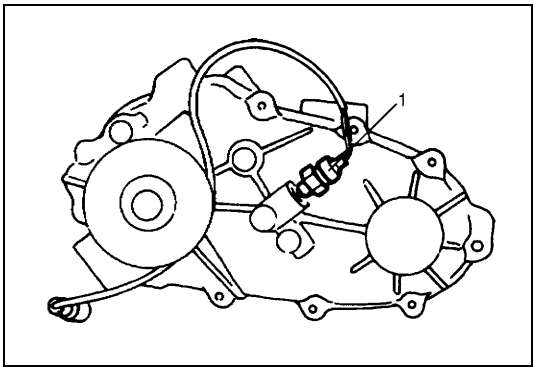
- Set each clamp for wiring securely.
- Connect couplers to speed sensor and 4WD switch securely.
- Pour gear oil to transfer as specified.
- When installing propeller shafts, align the each match marks. For tightening torque of flange bolts, refer to “Propeller shafts” in Section 4B.
- Install exhaust pipe to “Component” in Section 6K.
- Install shift knob.
- Connect battery.

DISASSEMBLY

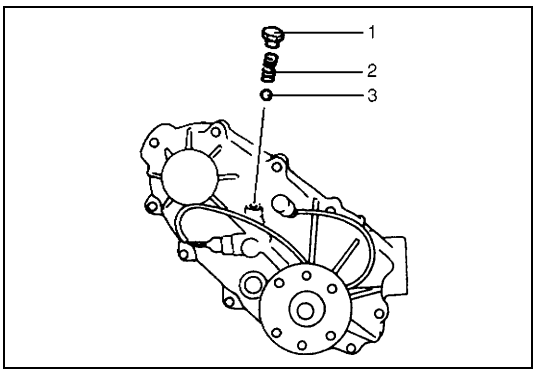


1) Remove boot and then plate, bush (4) and spring (3). Disconnect gear shift control lever (1).

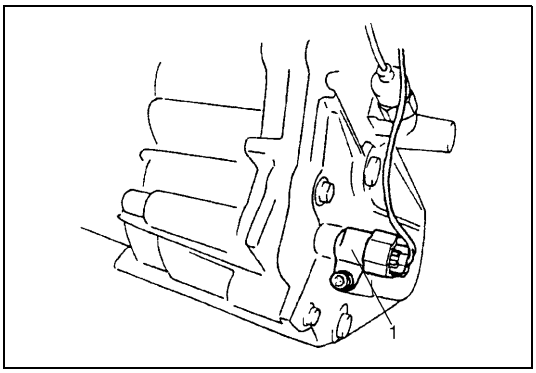
2. Cap



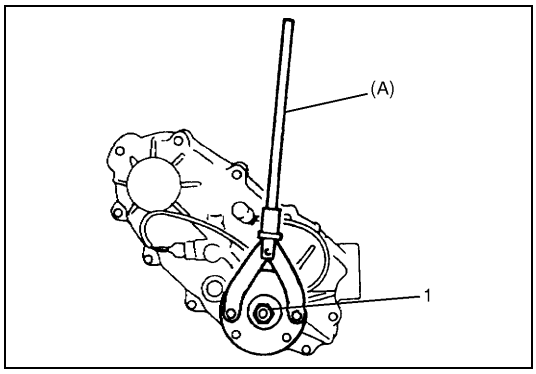
2) Remove 4WD switch (1) and take out steel ball.



3) Remove locating spring bolt (1) and take out locating spring (2) and steel ball (3).

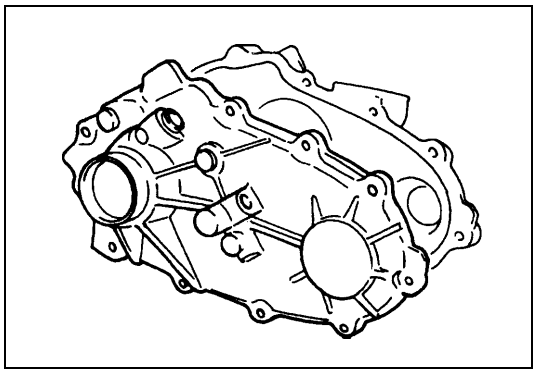


4) Remove vehicle speed sensor (1).



5) Remove rear output side flange. To lock flange, use special tool. With flange locked, remove flange nut (1).

Special tool
(A) : 09930-40113

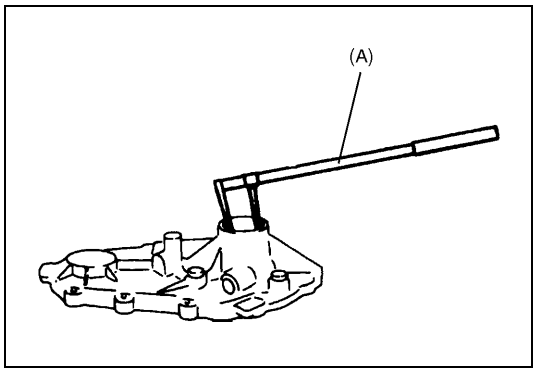


6) Remove 11 rear case bolts and then separate case by using special tool.

NOTE:

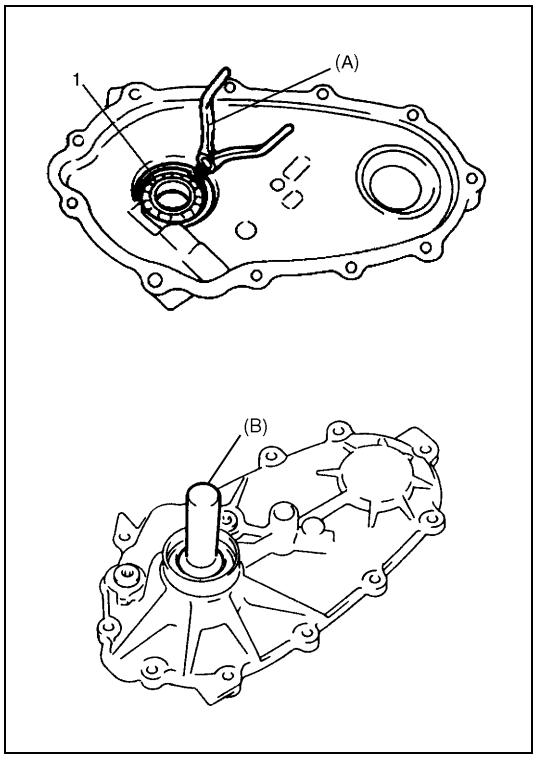
To separate case, use special tool at 2 points in turn and make opening wider evenly.

Special tool
09912-34501



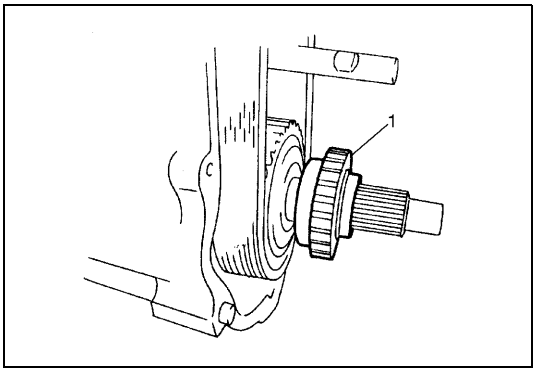
7) Remove oil seal from rear case by using special tool.

Special tool
(A) : 09913-50121

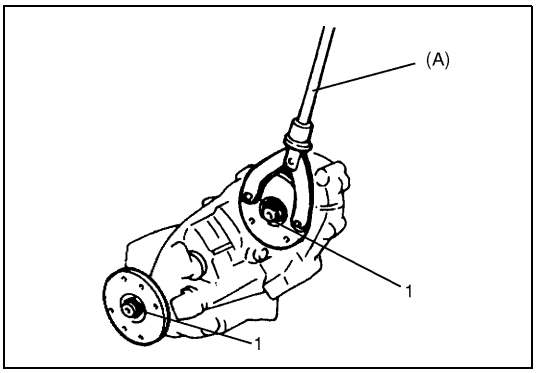


8) Remove circlip (1) by using special tool and then remove bearing by using special tool.

Special tool
(A) : 09900-06108
(B) : 09913-75830

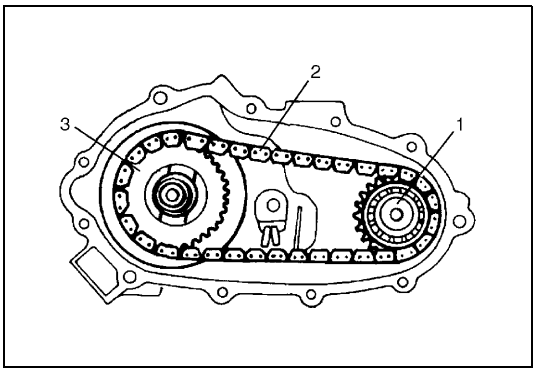


9) Pull out speedometer sensor rotor (1).

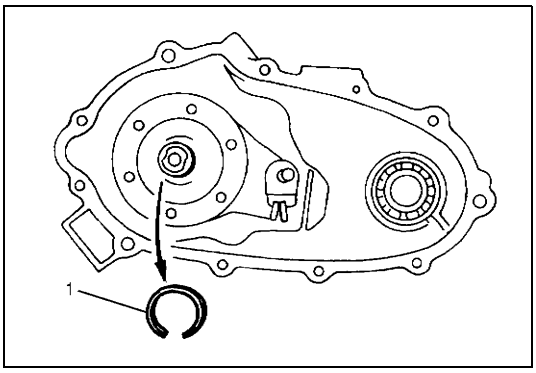


10) Remove flanges. To lock flange, use special tool. With flange locked, remove flange nut (1).

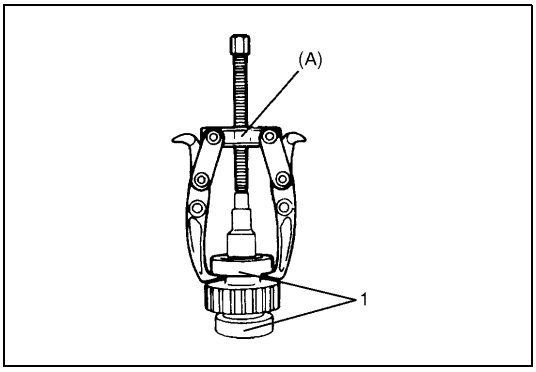
Special tool
(A) : 09930-40113



11) Remove drive chain (2), input shaft (1) and ring and sprocket gear assembly (3) as an assembly.

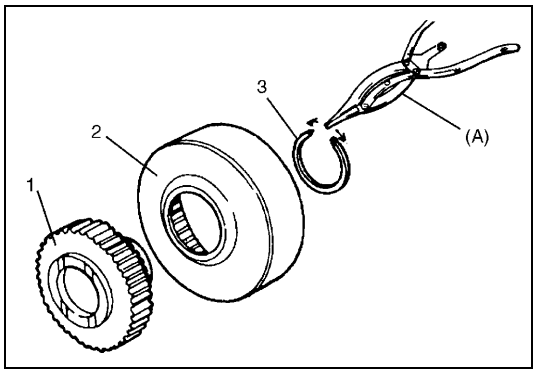


12) Remove needle roller bearing (1).



13) Pull out bearings (1) from input shaft by using special tool.

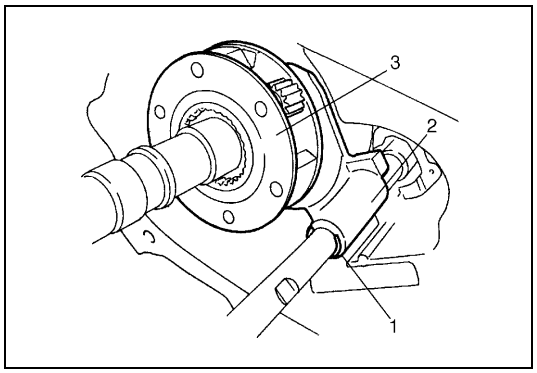
Special tool
(A) : 09913-65135



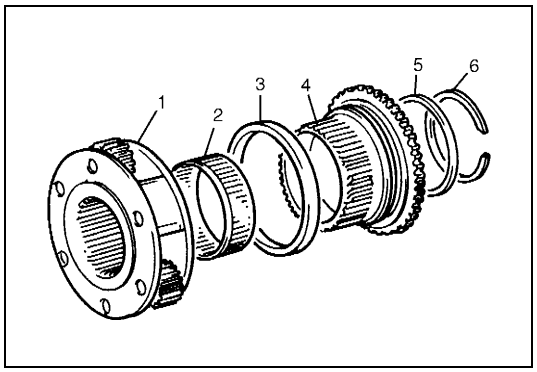
14) Disassemble ring and sprocket gear assembly by removing circlip (3).

Special tool
(A) : 09920-76010

1.	Sprocket gear
2.	Ring gear

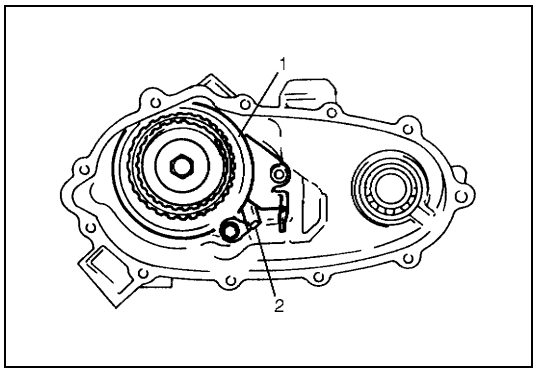


15) Remove snap ring (1) and pull out Hi-Lo shift fork (2) and planetary gear assembly (3) as an assembly.

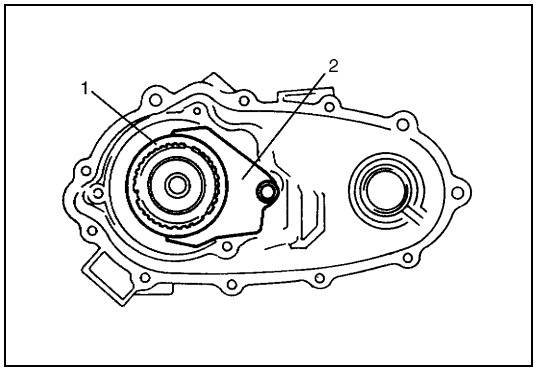


16) Disassemble planetary gear unit by removing circlip (6).

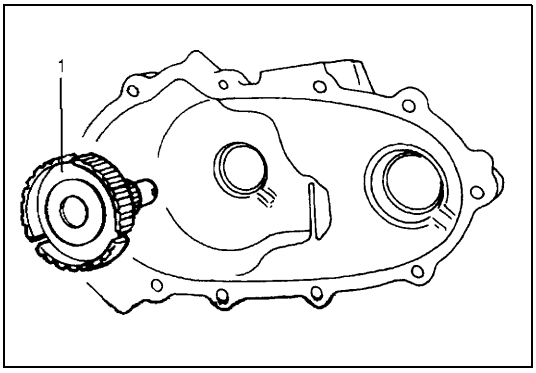
1.	Planetary gear assembly
2.	Needle roller bearing
3.	Shift fork spacer
4.	Planetary sun gear
5.	Thrust washer



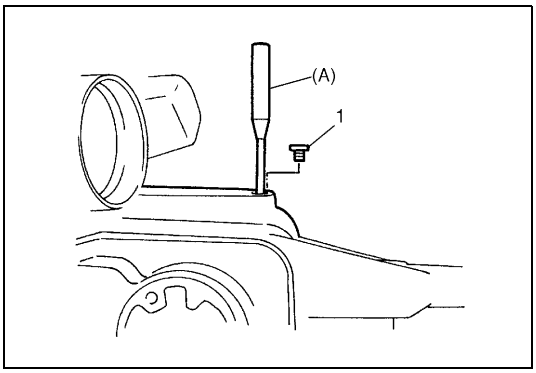
17) Remove lock up plate (1) and oil gutter (2) by removing 3 bolts.



18) Remove output rear shaft, shift shaft, reduction clutch sleeve (1) and 2-4 shift fork (2) as an assembly.
Disassemble shift shaft by removing snap ring as necessary.
19) Remove synchronizer ring.

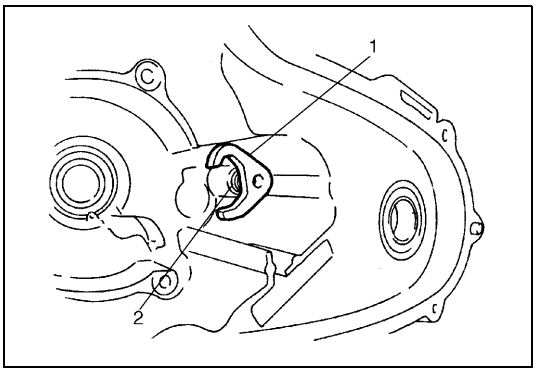


20) Remove output front shaft (1).

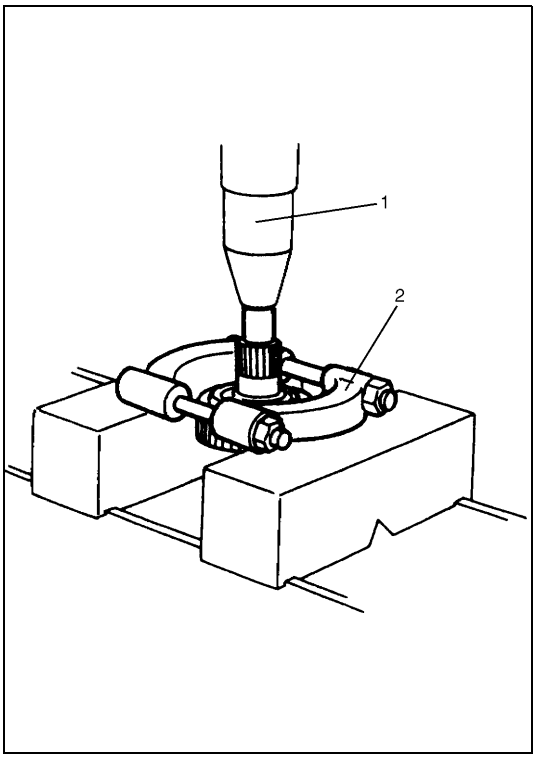


21) Remove screw (1) and drive out pin with special tool.

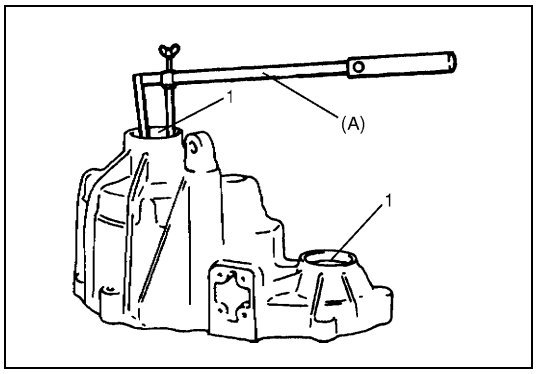
Special tool
(A) : 09922-85811



22) Remove interlock block (1) and return spring (2).

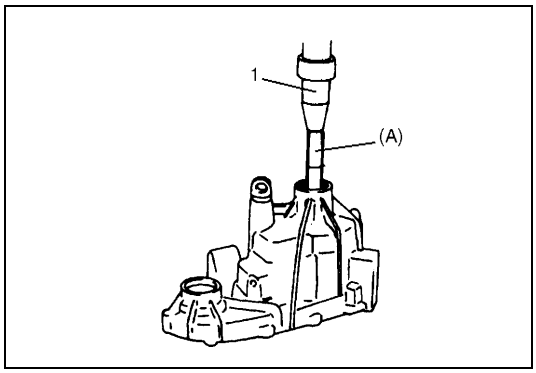


23) By using bearing puller (2) and hydraulic press (1), remove bearing from output front shaft.



24) By using special tool, remove oil seals (1) from front case.

Special tool
(A) : 09913-50121

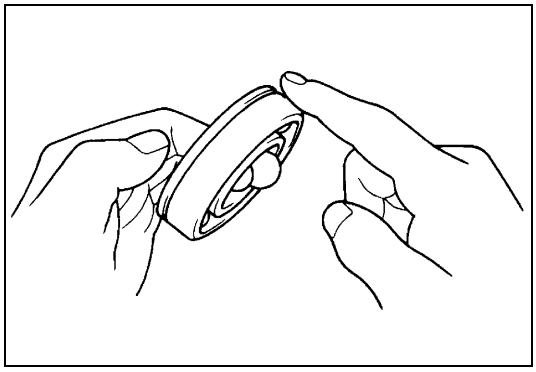


25) Remove circlip and then, remove bearing from front case.

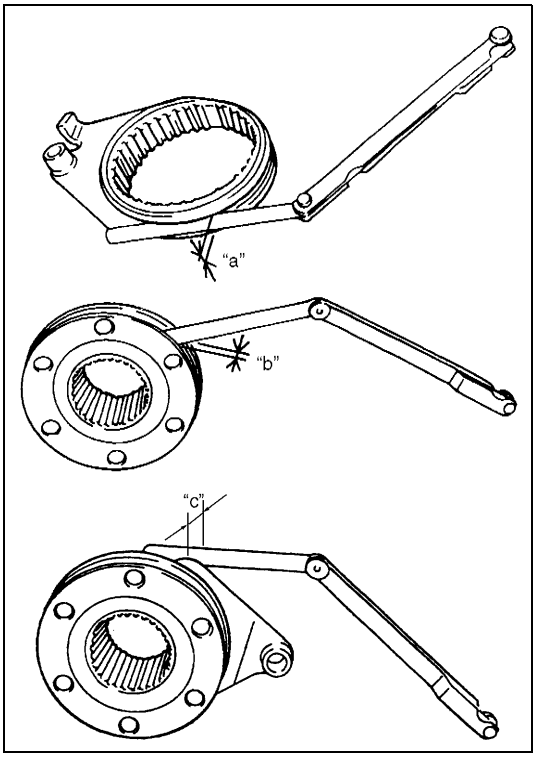
Special tool
(A) : 09913-75830

1. Hydraulic press

INSPECTION



- Check each bearing for smooth rotation.
  If found abnormal, replace.
- Check needle bearing and bearing contacting surface for damage. Replace as required.



- Check gear tooth surface and shift mechanism in the same manner as with transmission.
  Correct or replace as necessary.

Especially for following parts, measure each clearance

Clearance Between Sleeve and 2-4 Shift Fork "a":
Service Limit 1.0 mm (0.039 in.)

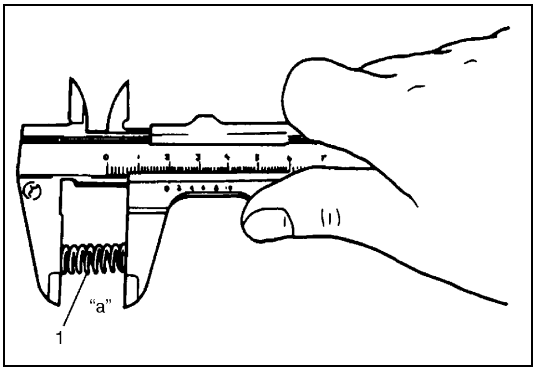
If clearance exceeds service limit, replace sleeve and 2-4 shift fork.

Thrust Clearance Between Pinion gear and carrier "b":
Standard 0.15 – 0.55 mm (0.0059 – 0.021 in)

If clearance is out of standard value, replace planetary carrier subassembly.

Clearance Between Planetary Gear Unit and Hi-Lo Shift Fork "c" :
Service Limit 1.0 mm (0.039 in).

If clearance exceeds service limit, replace planetary sun gear, shift fork spacer and Hi-Lo shift fork.

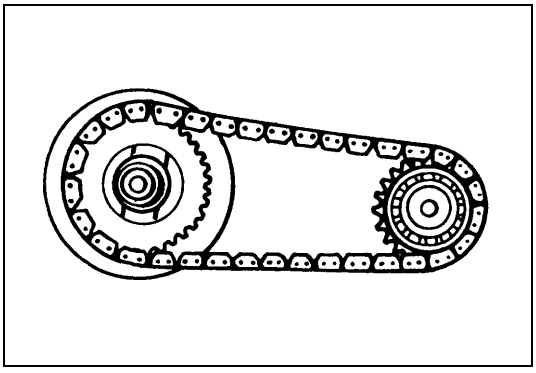


- Check each spring for distortion or breakage and change it with new one as necessary.
  Especially for locating springs, measure each free length and replace if it is below service limit

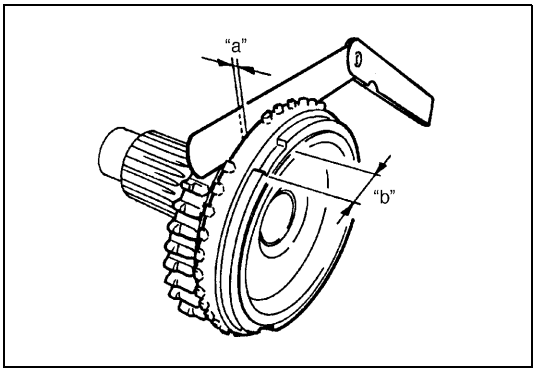
Locating spring free length "a":

Standard	**23.7 mm (0.933 in.)**
Service limit	**22.0 mm (0.866 in.)**

1. Locating spring



- Check drive chain and sprockets for abnormal wear or damage. Replace as required.
- Check oil seal for leakage and its lip for excessive hardness. If either is found, replace.
  Also, check corresponding surface of shaft where oil seal lip contacts. Correct or replace as necessary.

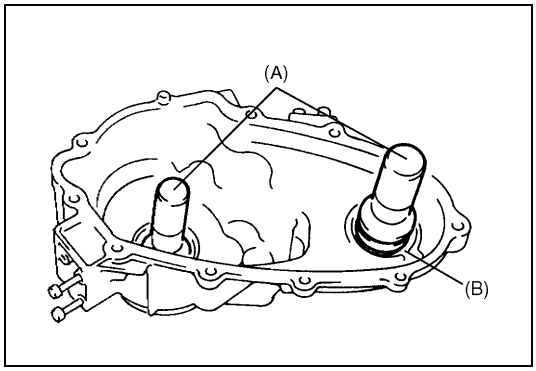


- Check clearance "a" between synchronizer ring and output front shaft, key slot width "b" in synchronizer ring and each chamfered tooth of gear and synchronizer ring and synchronizer ring and replace with new one, if necessary. Also, check gear tooth.

Clearance "a" between synchronizer ring and output front shaft
Standard : 0.85 – 1.55 mm (0.035 – 0.061 in.)
Service limit : 0.75 mm (0.030in.)

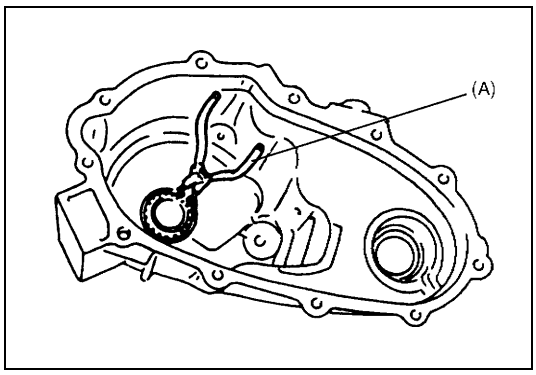
Slot width "b"
Standard : 12.3 mm (0.484 in.)
Service limit : 12.6 mm (0.496 in.)

ASSEMBLY



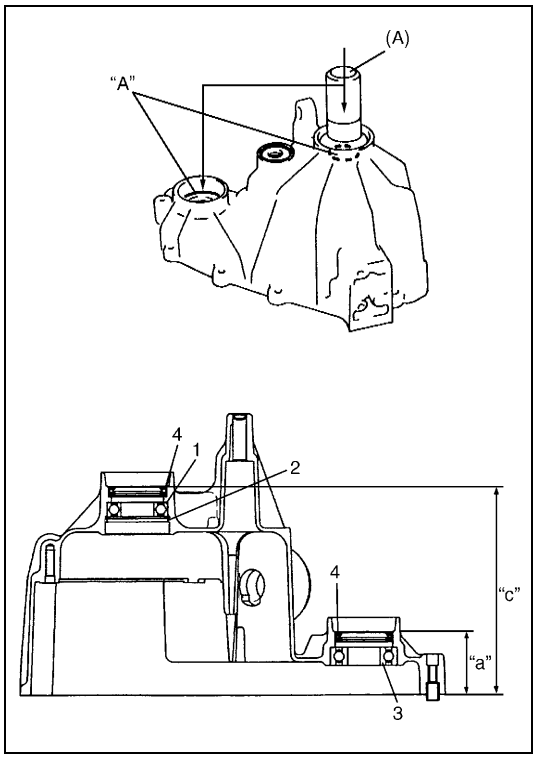
1) Install bearing to front case by using special tool and press.

Special tool
(A) : 09913-75810
(B) : 09944-66020



2) Fix output front shaft with circlip by using special tool.

Special tool
(A) : 09900-06108



3) By using special tool and hummer, install oil seal to front case. Apply grease to each oil seal lip.

Special tool
(A) : 09913-75810

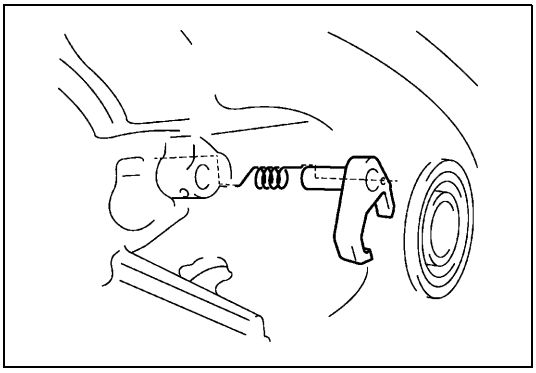
NOTE:

Refer to figure below for each oil seal installation position

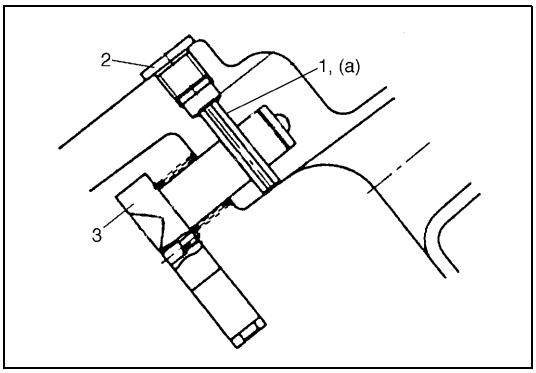
"A" : Grease 99000-25010

Transfer front case oil seal installing position
"a" : 53.2 – 54.2 mm (2.1 – 2.13 in)
"c" : 179.3 – 180.3 mm (7.06 – 7.10 in)

1.	Output front bearing
2.	Circlip
3.	Input bearing
4.	Oil seal



4) Install interlock block and spring as shown in figure.

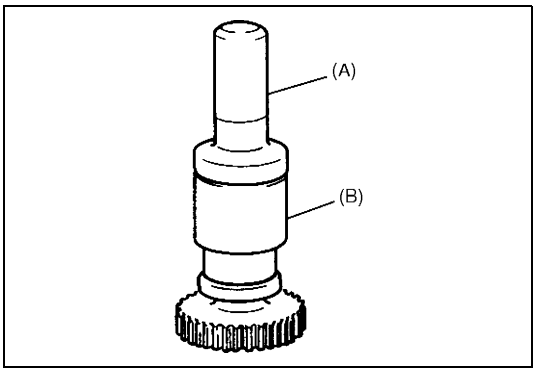


5) Drive in pin (1) a little with special tool and tighten screw (2).

Special tool
09922-85811

Tightening torque
Interlock block pin screw
(a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

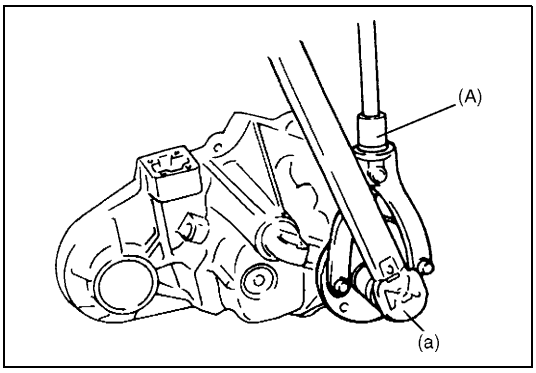
3. Interlock block



6) By using special tools and hydraulic press, install bearing to output shaft.

Special tool
(A) : 09913-75520
(B) : 09940-53111

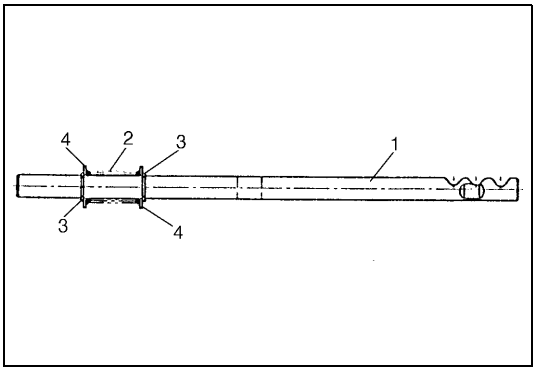
7) Install output front shaft to front case.



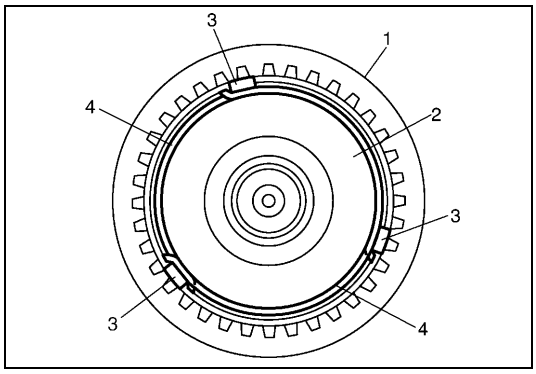
8) Install flange, tighten flange nut and caulk nut.

Special tool
(A) : 09930-40113

Tightening torque
Flange nut (a) : 130 N·m (13.0 kg-m, 94 lb-ft)



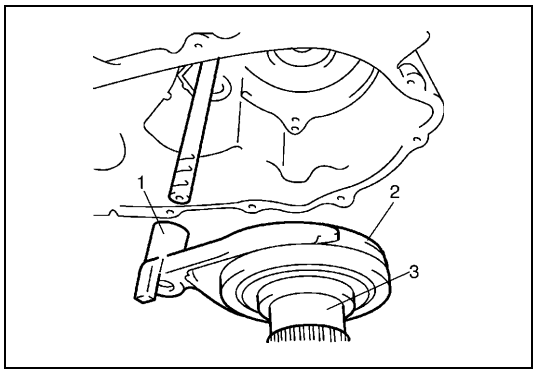
9) Install shift shaft (1) to front case with spring (2), washers (4) and snap rings (3) installed as shown in figure.



10) Assemble output rear shaft (2), sleeve (1), keys (3) and key springs (4) as shown in figure. Sleeve has specific installing direction.

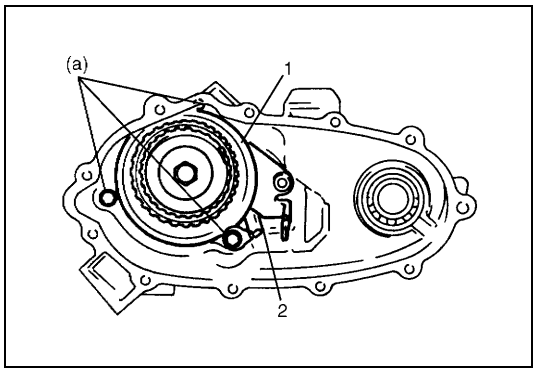
NOTE:

Install key springs, deviating their openings so that they are not in line with each other.



11) Install output rear shaft (3) and 2-4 shift fork (1) as an assembly.

2. Sleeve

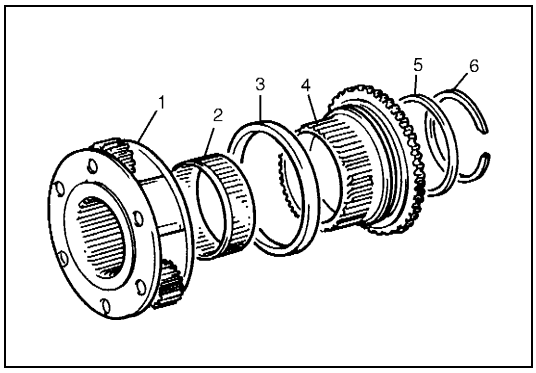


12) Install lock up plate (1) and oil gutter (2) and tighten 3 bolts.

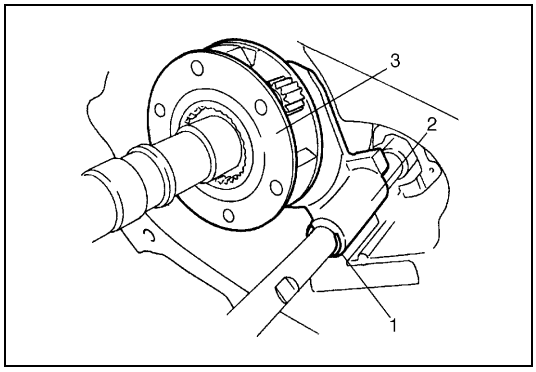
Tightening torque
Lock up plate bolts (a) : 28 N·m (2.8 kg-m, 20.5 lb-ft)

NOTE:

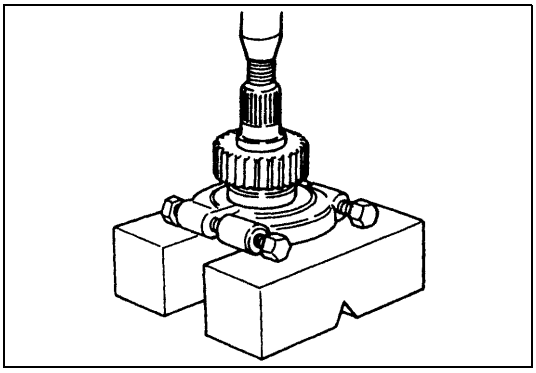
Chamfer of lock up plate must face to rear side.



13) Assemble planetary gear assembly (1), shift fork spacer (3), needle roller bearing (2), planetary sun gear (4) and thrust washer (5) and secure then with circlip (6).



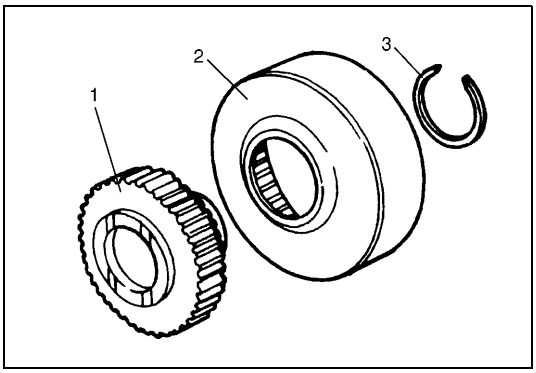
14) Install planetary gear unit (3) and Hi-Lo shift fork (2) to output rear shaft as an assembly. Fit snap ring (1) to shift shaft.



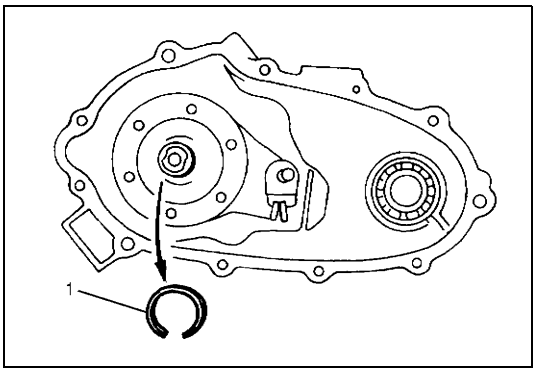
15) Install bearing to input shaft by using bearing puller and hydraulic press.

NOTE:

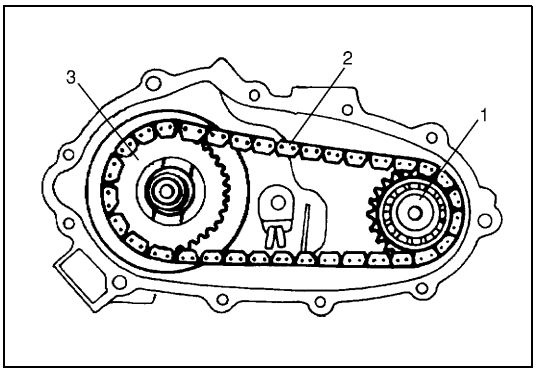
Fit bearing puller at inner race of bearing.



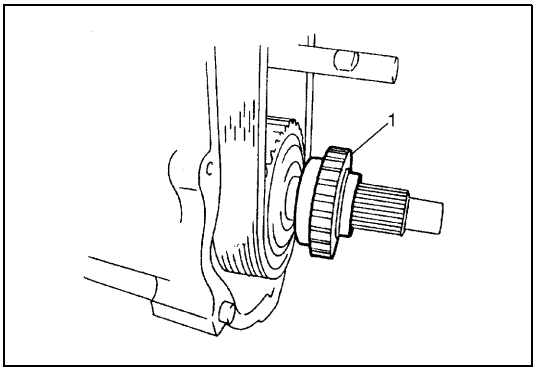
16) Assemble ring gear (2) and sprocket gear (1) and secure them with circlip (3).



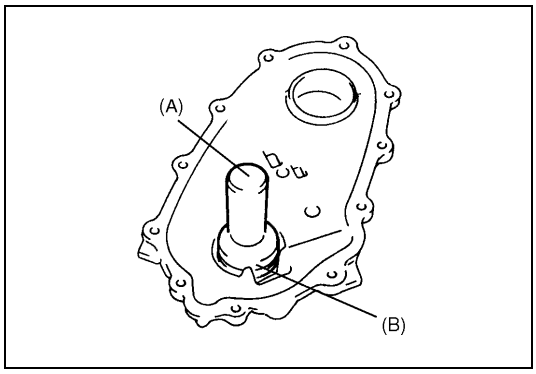
17) Fit needle roller bearing (1) to output shaft.



18) Install input shaft (1), sprocket gear assembly (3) and drive chain (2) to front case as an assembly.

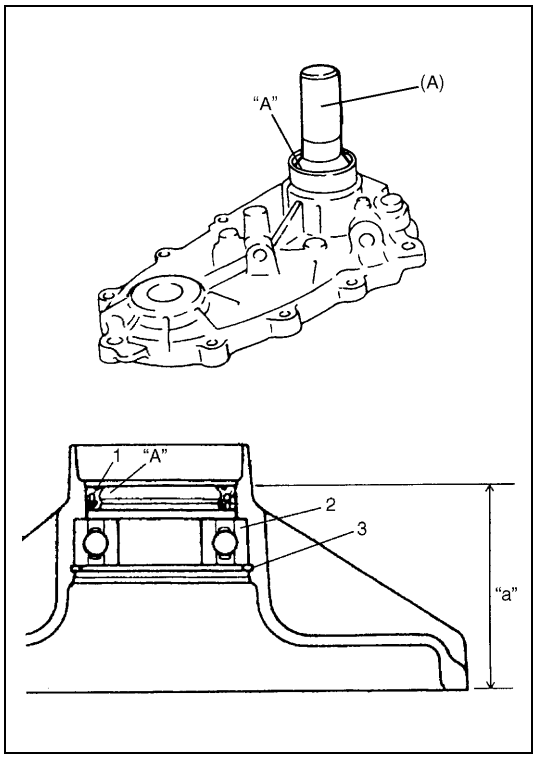


19) Install speedometer sensor rotor (1) to output shaft.



20) Install bearing to rear case by using special tool and press and fix it with circlip.

Special tool
(A) : 09913-75810
(B) : 09944-66020



21) By using special tool and hammer, install oil seal (1) to rear case. Apply grease to oil seal lip.

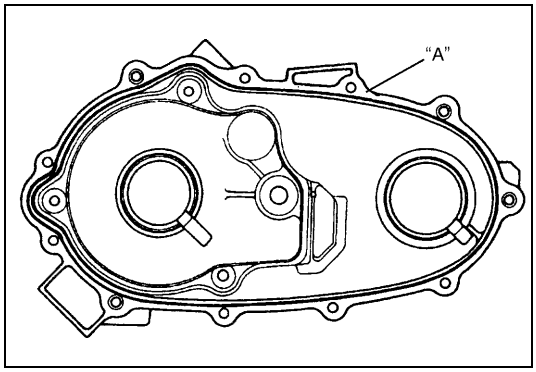
NOTE:
Refer to figure for oil seal installation position.

Special tool
(A) : 09913-75810

"A" : Grease 99000-25010

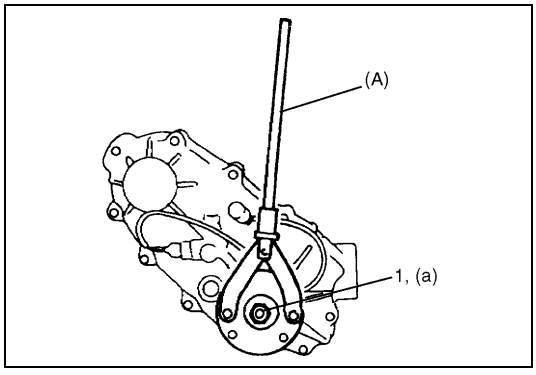
Transfer rear case oil seal installing position
"a" : 69.35 ± 0.5 mm (2.730 ± 0.020 in.)

2.	Bearing
3.	Circlip



22) After cleaning mating surfaces of both cases, coat mating surface of front case with sealant evenly and put it over rear case.

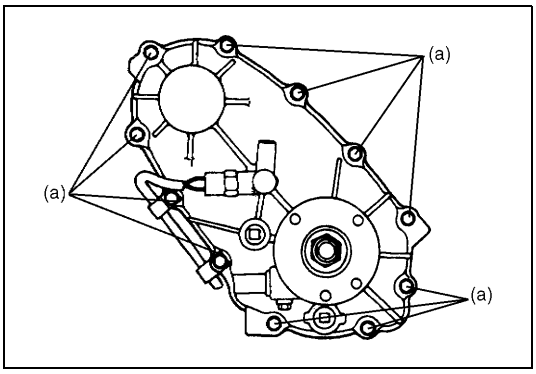
"A" : Sealant 99000-31110



23) Align front case and rear case, then install flange, tighten flange nut (1) and calk it.

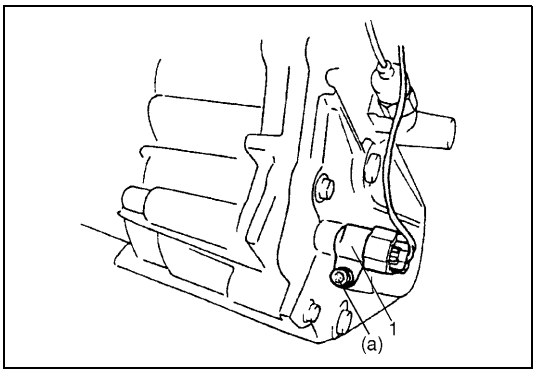
Special tool
(A) : 09930-40113

Tightening torque
Flange nut (a) : 130 N·m (13.0 kg-m, 94.0 lb-ft)



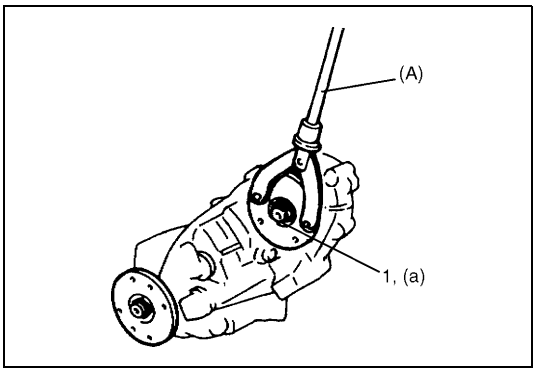
24) Tighten 11 case bolts.

Tightening torque
Transfer case bolt (a) : 18 N·m (1.8 kg-m, 13.0 lb-ft)



25) Install speed sensor (1).

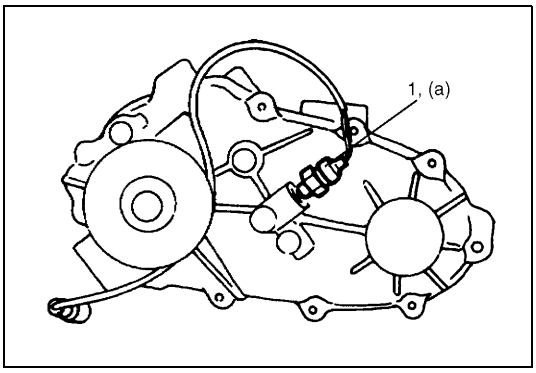
Tightening torque
Speed sensor bolt (a) : 10 N·m (1.0 kg-m, 7.5 lb-ft)



26) Install input flange, tighten flange nut (1) and calk it.

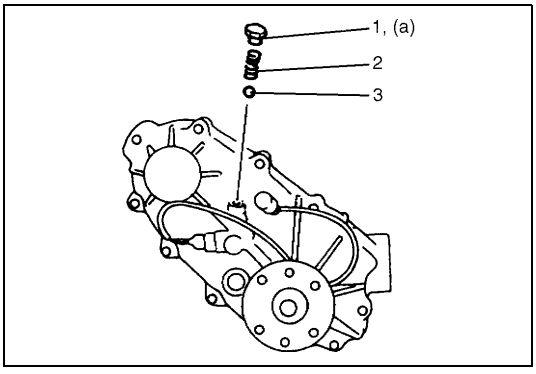
Special tool
(A): 09930-40113

Tightening torque
Flange nut (a) : 130 N·m (13.0 kg-m, 94.0 lb-ft)



27) Install steel ball and 4WD switch (1).

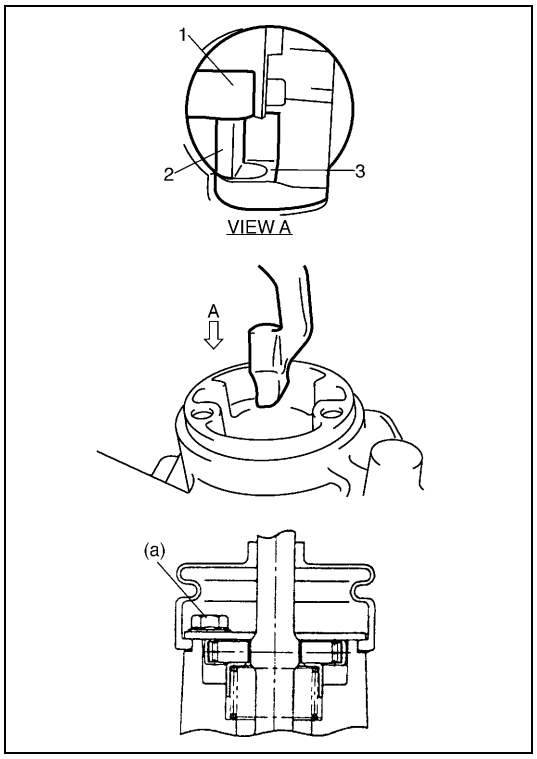
Tightening torque
4WD switch (a) : 19 N·m (1.9 kg-m, 14.0 lb-ft)



28) Install steel ball (3), locating spring (2) and locating spring bolt (1).

Tightening torque
Locating spring bolt (a) : 25 N·m (2.5 kg-m, 18.0 lb-ft)

29) Install shift and select arm and fix it spring pin.



30) Set shift shaft (2), 2-4 shift fork and Hi-Lo shift fork (3) position as shown in figure. (2H shift position).
31) Install transfer shift control lever through spring and cover and fit boot to front case after tightening bolts.

Tightening torque
Shift control lever bolts (a) : 18 N·m (1.8 kg-m, 13.0 lb-ft)

1. Interlock block

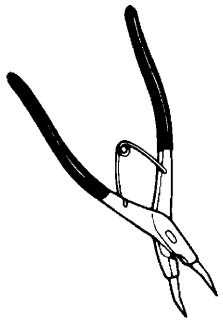
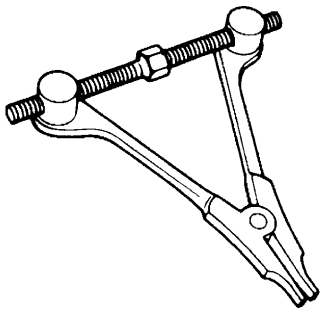
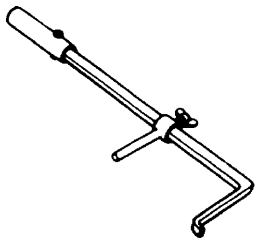
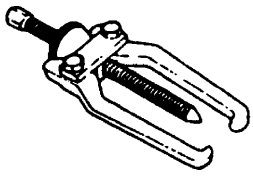
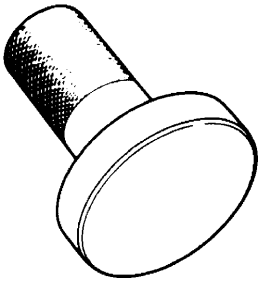
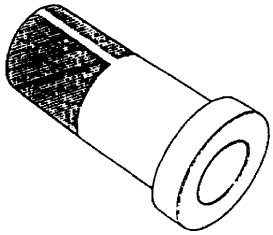
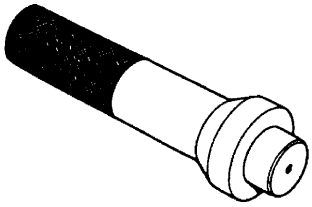
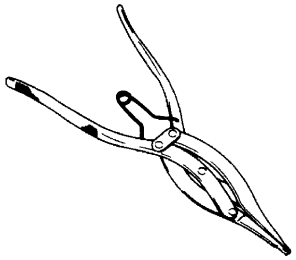
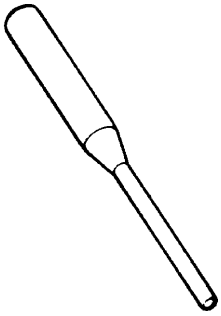
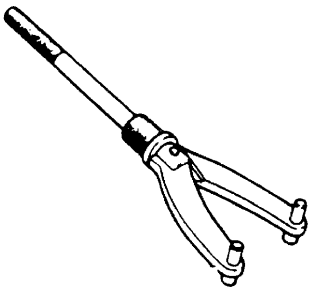
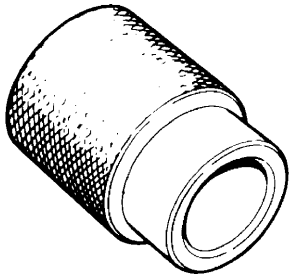
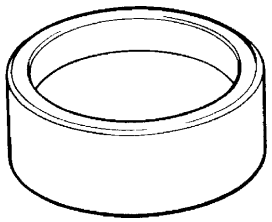
Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Oil filler/level and drain plug	23	2.3	17.0
Transfer mounting nut	30	3.0	22.0
Transfer mounting bracket bolt	23	2.3	17.0
Propeller shaft bolt	50	5.0	36.5
Flange nut	130	13.0	94.0
Lock up plate bolt	28	2.8	20.5
Interlock bolt	23	2.3	17.0
Transfer case bolt	18	1.8	13.0
4WD switch	19	1.9	14.0
Locating spring bolt	25	2.5	18.0
Shift control lever bolt	18	1.8	13.0
Speed sensor bolt	10	1.0	7.5
Interlock block pin screw	25	2.5	18.0

Required Service Material

Material	Recommended SUZUKI products (Part Number)	Use
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	Oil seal lip
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	• Oil filter and level plug • Oil drain plug • Mating surface of front case

Special Tool

 09900-06108 Snap ring plier (Closing type)	 09912-34510 Separator	 09913-50121 Oil seal remover	 09913-65135 Bearing puller
 09913-75520 Bearing installer	 09913-75810 Bearing installer	 09913-75830 Bearing installer	 09920-76010 Snap ring plier (Opening type)
 09922-85811 Pin remover	 09930-40113 Flange holder	 09940-53111 Differential side bearing installer	 09944-66020 Bearing installer

SECTION 7E

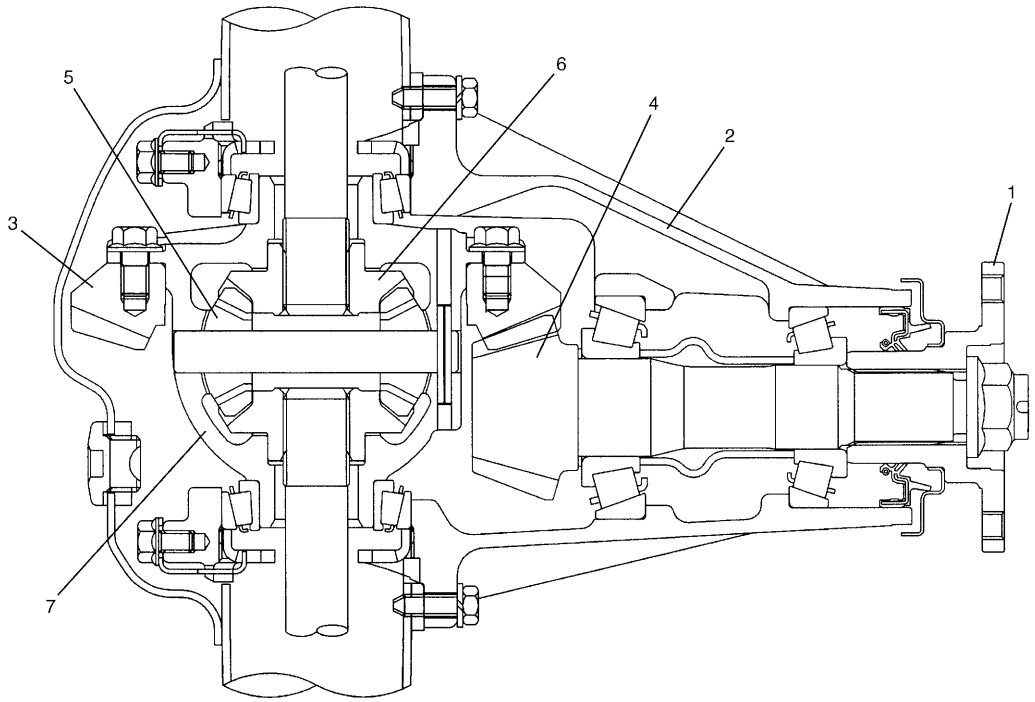
FRONT DIFFERENTIAL

CONTENTS

General Description **7E-2**
Diagnosis **7E-3**
On-Vehicle Service **7E-4**
Oil Change 7E-4
Unit Repair Overhaul **7E-5**
Differential Unit 7E-6
Tightening Torque Specifications **7E-23**
Required Service Materials **7E-23**
Special Tools **7E-24**

General Description

The front 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	

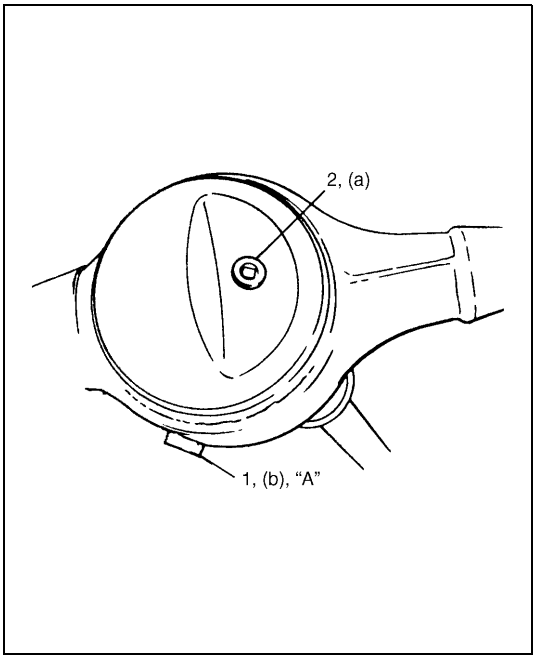
Diagnosis

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) or axle bearing(s)	Replace.
Oil leakage	Clogged breather plug	Clean.
	Worn or damaged oil seal	Replace.
	Excessive oil	Adjust oil level.
	Loose differential carrier bolts	Replace or retighten

On-Vehicle Service

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) Apply sealant to drain plug thread.

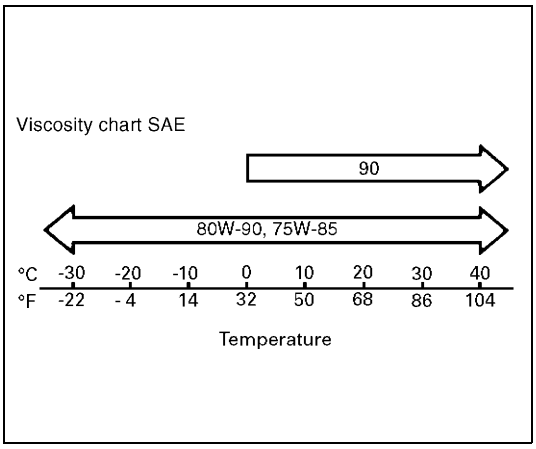
"A" : Sealant 99000-31110

5) Tighten drain plug to specified torque.

Tightening torque
Front differential oil drain plug
(b) : 27 N·m (2.7 kg-m, 19.5 lb-ft)

6) Pour proper amount of new differential oil as specified below roughly up to level hole.
7) Install new gasket to level/filler plug and tighten level/filler plug to specified torque.

Tightening torque
Front differential oil level/filler plug
(a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)



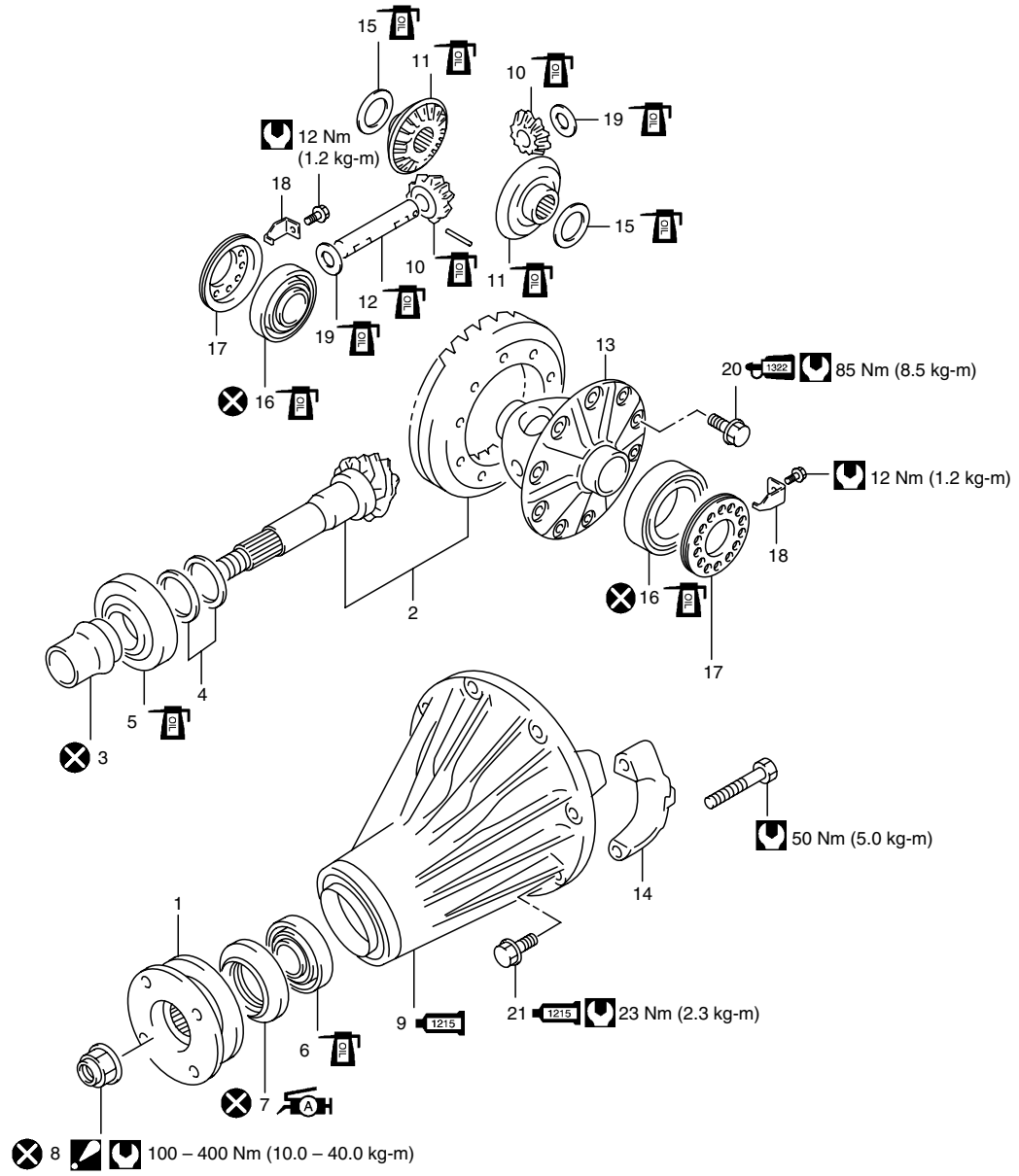
NOTE:

- **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
: 1.35 liters (2.9/2.3 US/Imp. pt)

Unit Repair Overhaul

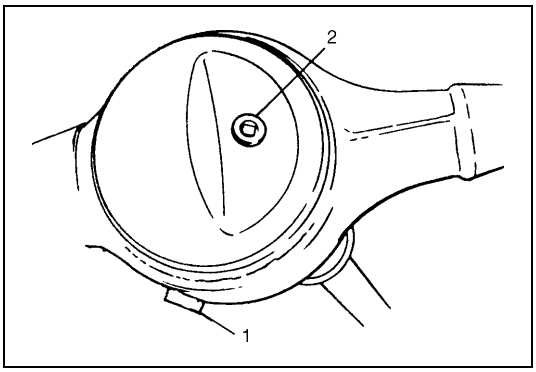


	1.	Companion flange	9.	Differential carrier : Apply sealant 99000-31110 to mating face with axle housing.	17.	Differential side bearing adjuster
	2.	Drive bevel / Hypoid gear set	10.	Differential pinion	18.	Lock plate
	3.	Drive bevel pinion spacer	11.	Differential gear	19.	Pinion washer
	4.	Shim	12.	Pinion shaft	20.	Drive bevel gear bolt : Apply thread lock cement 99000-32110 to thread.
	5.	Drive bevel pinion rear bearing	13.	Differential case	21.	Differential carrier bolt : Apply sealant 99000-31110 to thread.
	6.	Drive bevel pinion front bearing	14.	Differential side bearing cap		Do not reuse.
	7.	Oil seal : Apply grease 99500-25010 to oil seal lip.	15.	Thrust washer		Tightening torque
	8.	Flange nut : After tightening nut so as rotational torque of drive bevel pinion to be in specified torque, caulk nut securely.	16.	Differential side bearing		Apply differential oil.

Differential Unit

DISMOUNTING

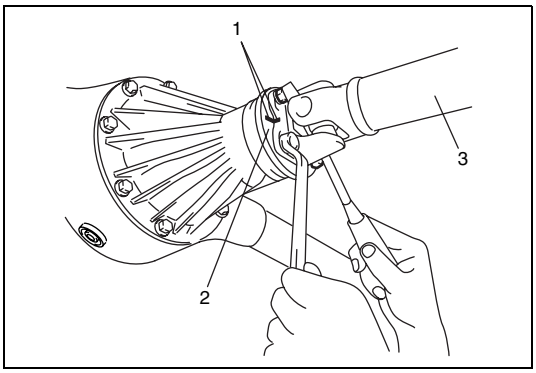
1) Lift up vehicle and remove wheels.



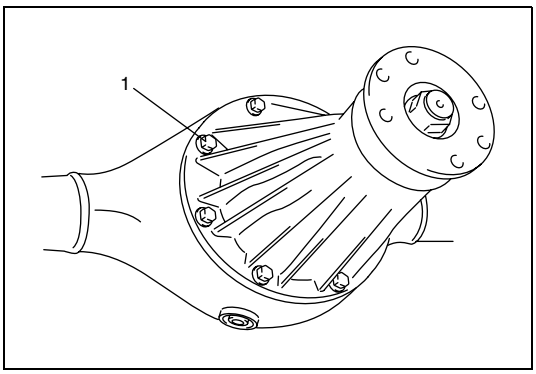
2) Drain differential oil from front axle housing referring to “Oil Change” in this section.

1.	Drain plug
2.	Level/Filler plug

3) Remove front axle shafts referring to “Front Axle Shaft / Oil Seal / Kingpin Bearing Outer Race” or “Front Axle Housing” in Section 3D.



4) Before removing propeller shaft, give match marks (1) on companion flange (2) and propeller shaft (3) as shown.

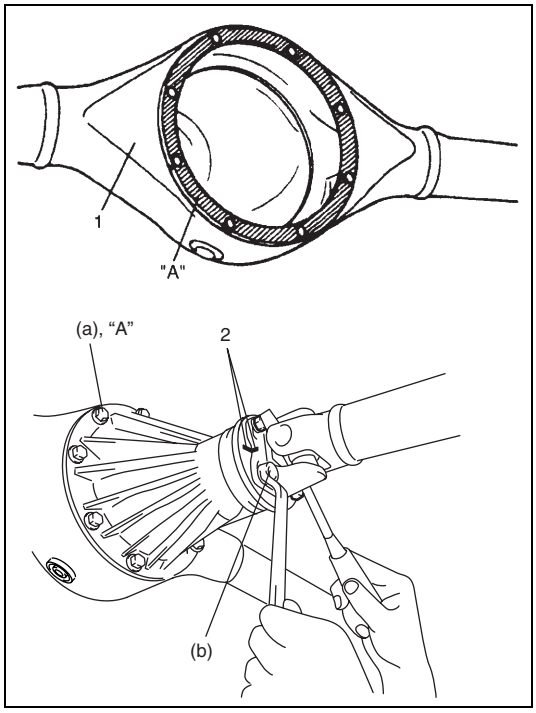


5) Remove differential carrier bolts (1) and differential assembly.

REMOUNTING

Reverse removal procedure for installation, noting the following.

Front Differential



- Clean mating surface of front 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) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

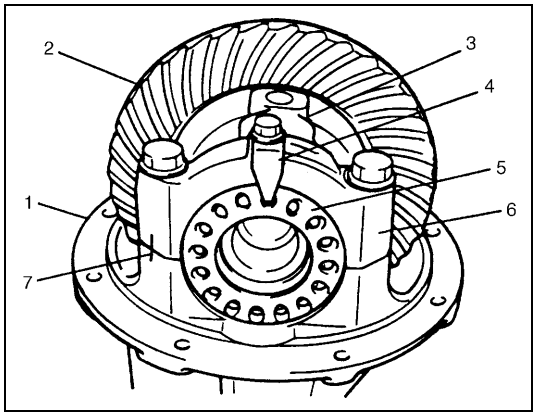
Front Axle Shaft

For installation of front axle shaft, refer to "Front Axle Shaft / Oil Seal / Kingpin Bearing Outer Race" or "Front Axle Housing" in Section 3D.

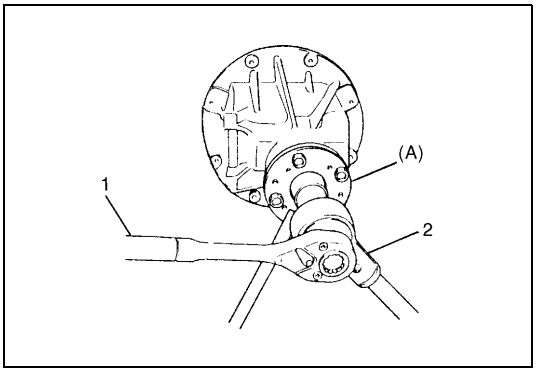
Differential Gear Oil

Refill differential housing with new specified differential oil. Refer to "Oil Change" in this section.

DISASSEMBLY

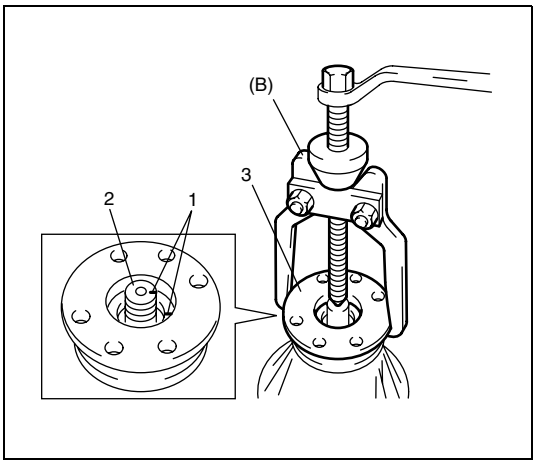


1) Put match marks (7) on differential side bearing caps (6) and differential carrier (1).
2) Remove differential side bearing lock plates (4) and differential side bearing caps by removing their bolts and then remove bearing adjusters (5), side bearing outer races and drive bevel gear (2) with differential case (3).



3) Hold companion flange with special tool and then remove flange nut by using power wrench (2) and socket wrench (1).

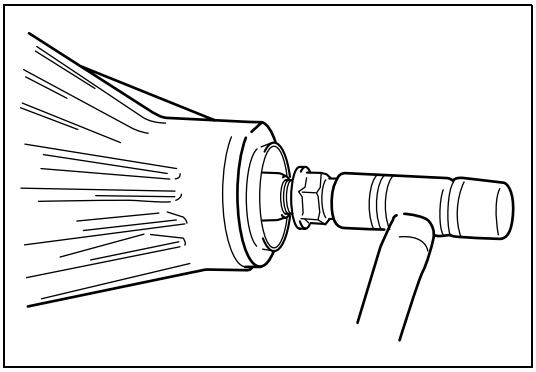
Special tool
(A) : 09922-66020



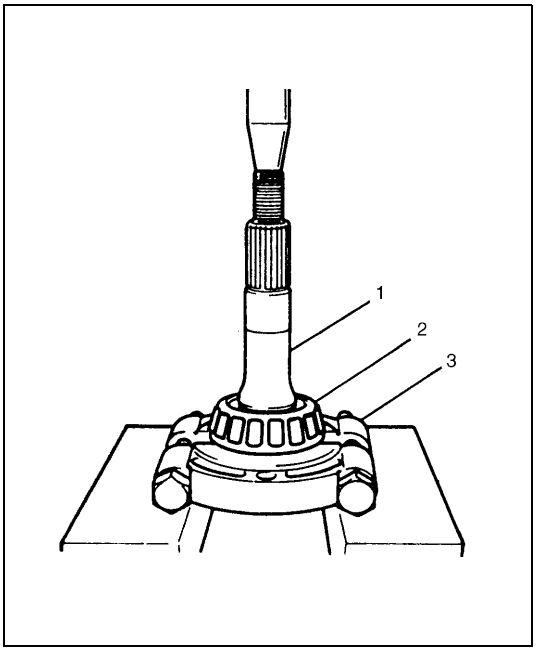
CAUTION:
Do not make mating mark on the coupling surface of the flange to prevent propeller shaft from generating vibration.

4) Make mating marks (1) on drive bevel pinion (2) and companion flange (3).
5) Remove companion flange from drive bevel pinion by using special tool if it is hard to remove.

Special tool
(B) : 09913-65135

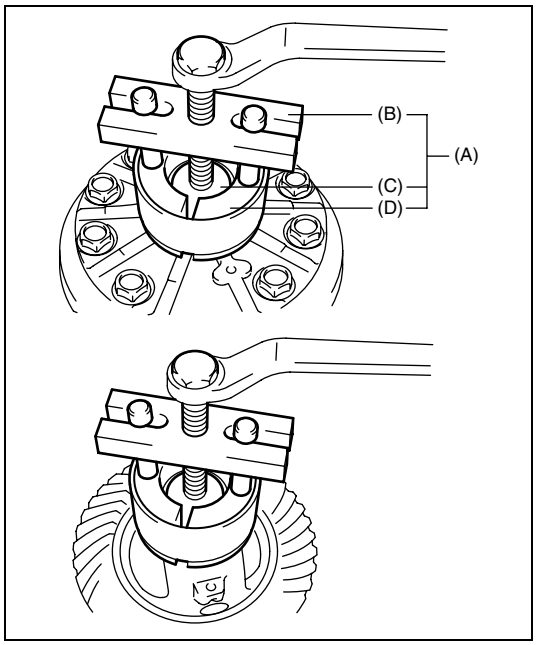


6) Remove drive bevel pinion with rear bearing, and spacer from differential carrier.
If it is hard to remove, screw an used nut into pinion and hammer on that nut with a plastic hammer but never directly on drive bevel pinion.



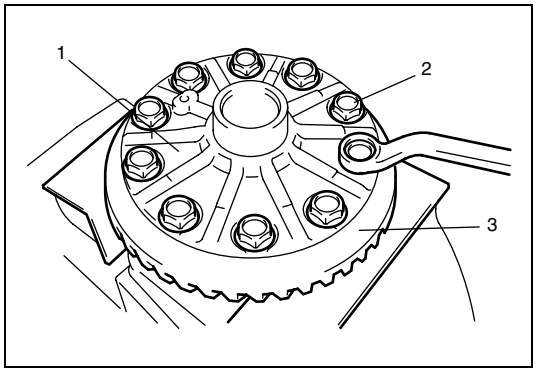
7) Remove drive bevel pinion rear bearing (2) by using bearing puller (3) and hydraulic press.

1. Drive bevel pinion

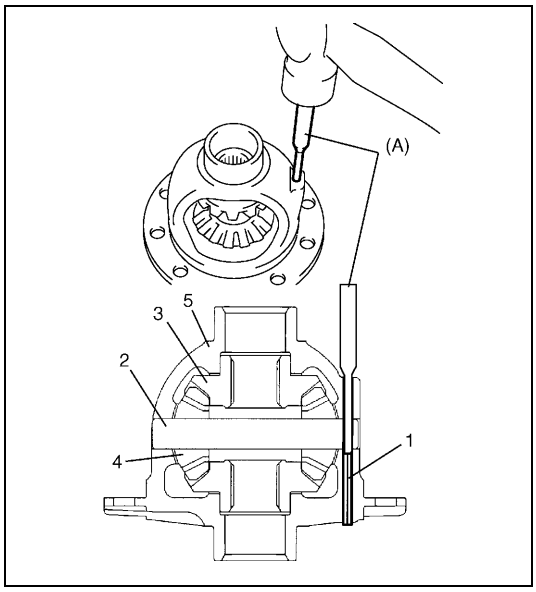


8) Using special tools, remove differential side bearings.

Special tool
(A) : 09926-37610
(B) : 09926-37610-001
(C) : 09926-37610-003
(D) : 09926-37610-002



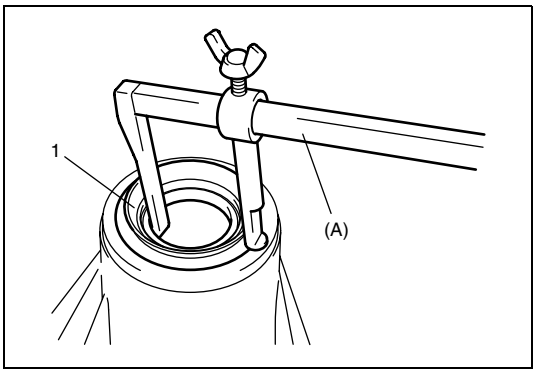
9) Hold differential case (1) with soft jawed vise.
10) Remove drive bevel gear bolts (2).
11) Remove drive bevel gear (3) from differential case.



12) Push spring pin (1) out of pinion shaft with special tool and hammer.

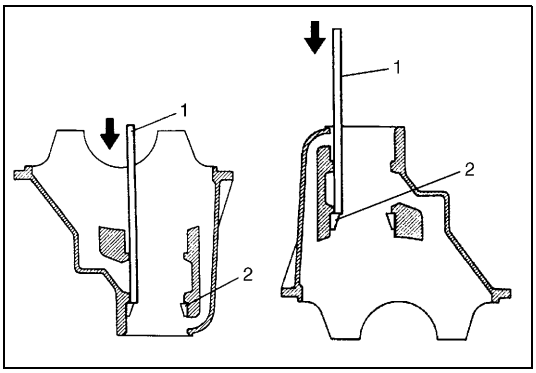
Special tool
(A) : 09922-85811

13) Remove pinion shaft (2), differential gears (3), pinions (4) and washers from differential case (5).



14) Remove oil seal (1) by using special tool.

Special tool
(A) : 09913-50121



15) Drive out bevel pinion bearing outer races (2) in differential carrier by hammering metal stick (1) applied to them.

INSPECTION

- Check companion flange for wear or damage.
- Check bearings for wear or discoloration.
- Check differential carrier for cracks.
- Check drive bevel pinion and bevel gear for wear or cracks.
- Check differential gears, pinion gears and pinion shaft for wear or damage.
- Check side gear spline for wear or damage.

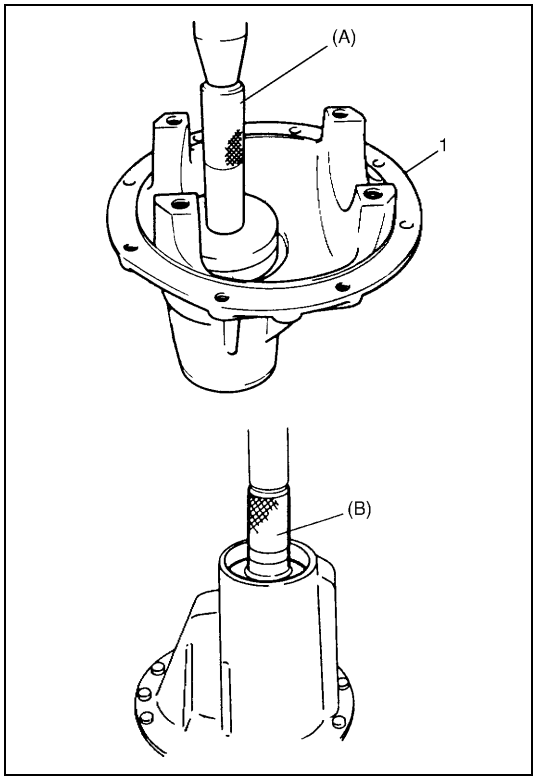
ADJUSTMENT AND REASSEMBLY

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.

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 and outer race assembly.**

Drive Bevel Pinion Bearing Outer Race



CAUTION:
Perform press-fitting carefully so as not to tilt outer race.

Install drive bevel pinion bearing outer races using special tools as shown.

Special tool
(A) : 09913-75510
(B) : 09913-75520

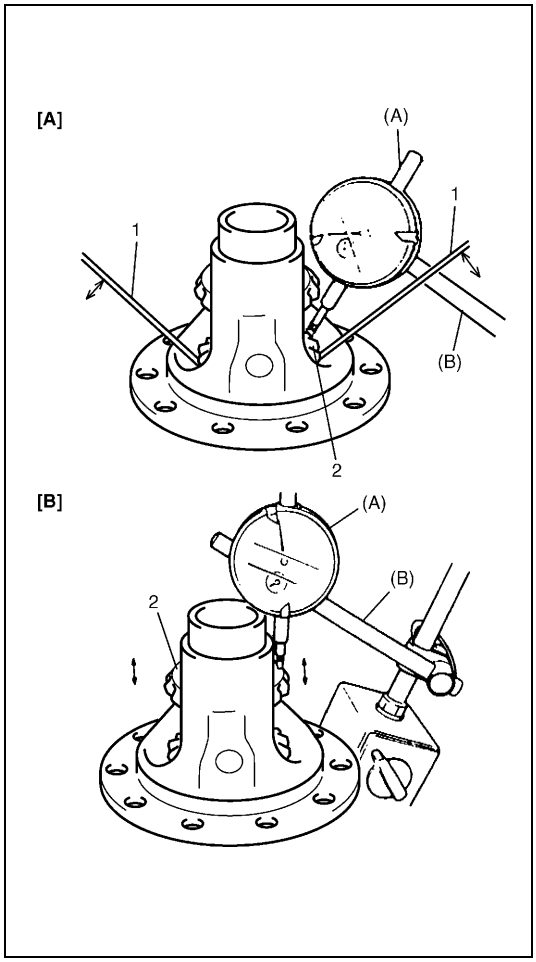
1. Differential carrier

Differential Case Assembly

1) Assemble differential case assembly.
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.)



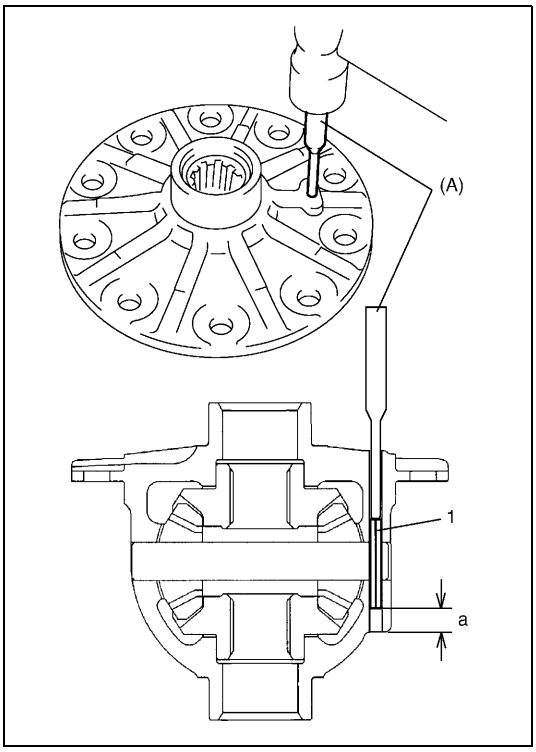
[A] : Right side
[B] : Left side

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.

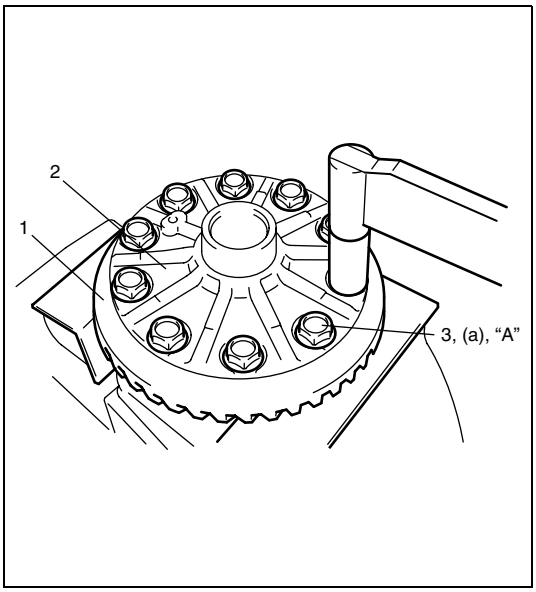
Available side washer thickness
0.9, 1.0, 1.1 and 1.2 mm (0.035, 0.039, 0.043 and 0.047 in.)



4) Drive spring pin (1) in pinion shaft till depth come to value shown below.

Special tool
(A) : 09922-85811

Spring pin installing depth
"a" : 8.5 – 9.5 mm (0.335 – 0.374 in.)



5) Put drive bevel gear (1) on differential case (2).
6) Hold differential case (2) with soft jawed vise.

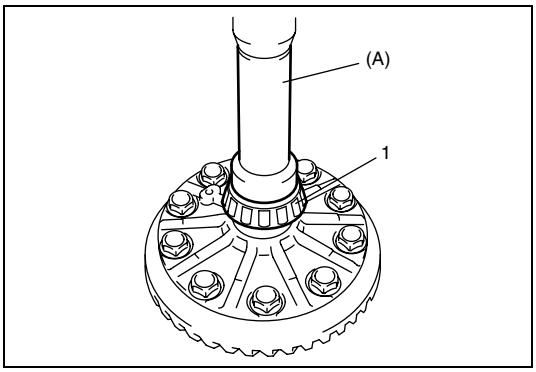
CAUTION:
Use specified bolts. Use of any other bolts than specified may cause loosening of bolts and damage to drive bevel gear.

7) Apply thread lock cement to drive bevel gear bolt (3).

"A" : Cement 99000-32110

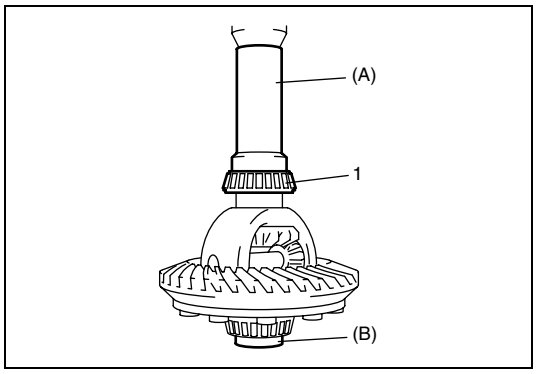
8) Tighten drive bevel gear bolt to specified torque.

Tightening torque
Drive bevel gear bolts
(a) : 85 N·m (8.5 kg-m, 61.5 lb-ft)



9) Install right differential side bearing (1) to differential case by using special tool and hydraulic press.

Special tool
(A) : 09913-76010

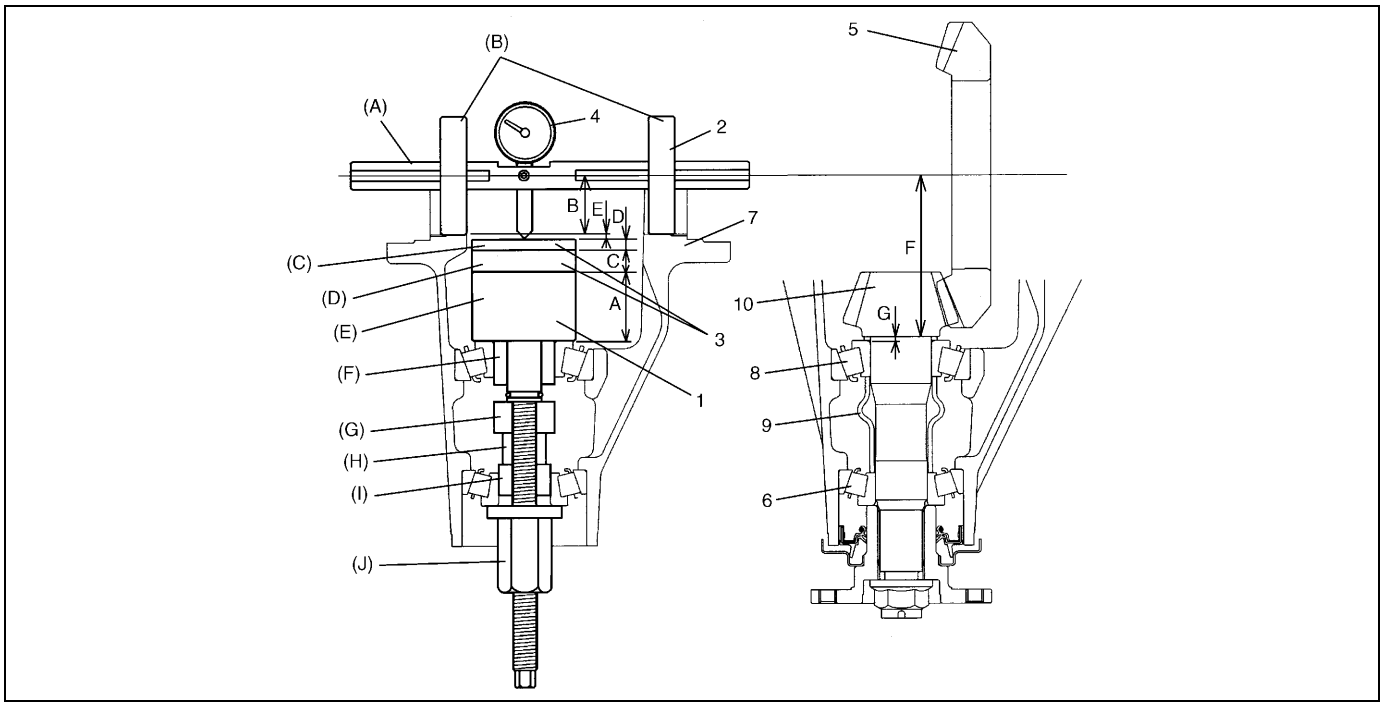


10) Install left differential side bearing (1) to differential case by using special tools and hydraulic press.

Special tool
(A) : 09913-76010
(B) : 09926-37610-003

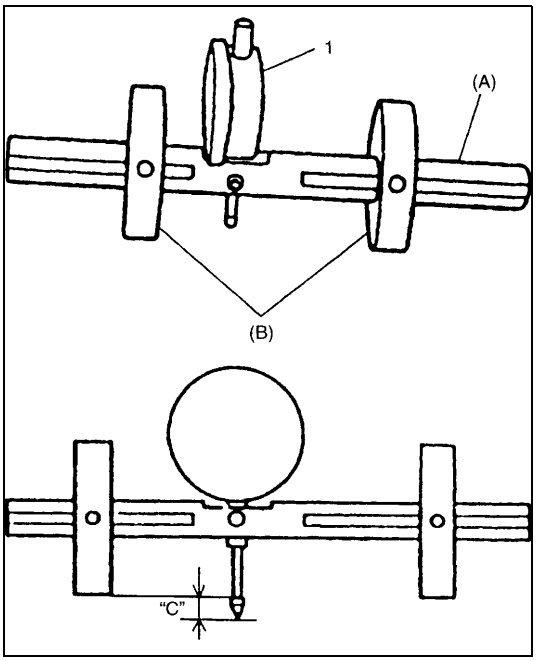
Differential Carrier and Drive Bevel Pinion

To engage drive bevel pinion and gear correctly, it is prerequired to install drive bevel pinion to differential carrier properly by using adjusting shim.



A: Dummy height of pinion form dummy (= 40 mm/1.575 in.)	F: Drive bevel pinion mounting distance (= 94 mm/3.701 in.)	5. Drive bevel gear
B: Radius of bearing form dummy with dummy shaft (= 34 mm/1.339 in.)	G: Shim thickness for mounting distance adjustment (= E)	6. Front bearing
C: Block dummy thickness (= 14 mm/0.5512 in.)	1. Pinion form dummy	7. Differential carrier
D: Block dummy thickness (= 6 mm/0.2362 in.)	2. Bearing form dummy with dummy shaft	8. Rear bearing
A+B+C+D: Mounting distance adjusting dummy total size (= 94 mm/ 3.701 in.)	3. Block dummy	9. Spacer
E: Measured dimension	4. Dial gauge	10. Drive bevel pinion

Special tool
(A) : 09922-76120
(B) : 09922-76220
(C) : 09922-76520
(D) : 09922-76550
(E) : 09922-76140
(F) : 09922-76410
(G) : 09922-76310
(H) : 09922-76340
(I) : 09922-76320
(J) : 09922-76150

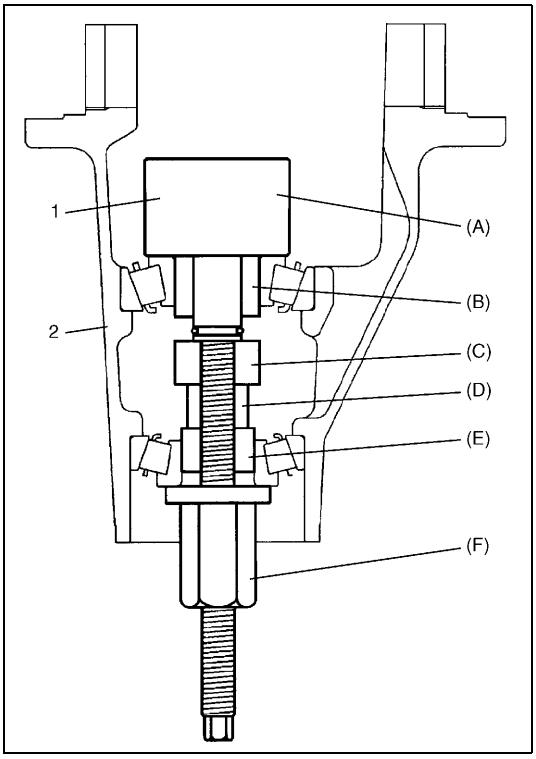


1) Assemble bearing form dummy with dummy shaft using special tools.

Special tool
(A) : 09922-76120
(B) : 09922-76220

2) Install dial gauge (1) to bearing form dummy with dummy shaft as shown in figure.

Dial gauge rod tip set distance
"c" : 2 – 3 mm (0.079 – 0.118 in.)

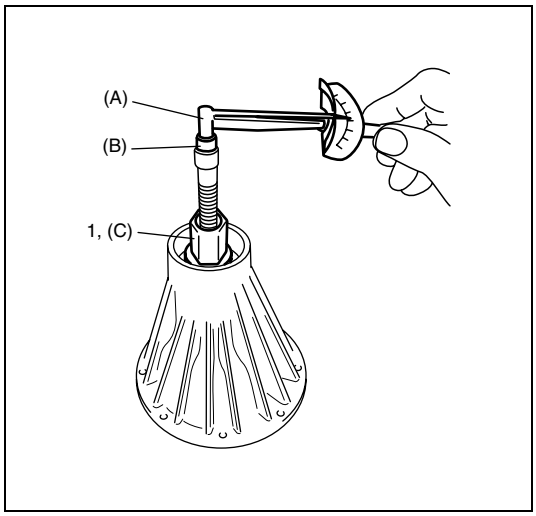


NOTE:

This installation requires no spacer or oil seal.

3) Apply differential oil to drive bevel pinion front and rear bearings.
4) Install pinion form dummy (1), the other special tools and drive bevel pinion bearings to differential carrier (2).

Special tool
(A) : 09922-76140
(B) : 09922-76410
(C) : 09922-76310
(D) : 09922-76340
(E) : 09922-76320
(F) : 09922-76150



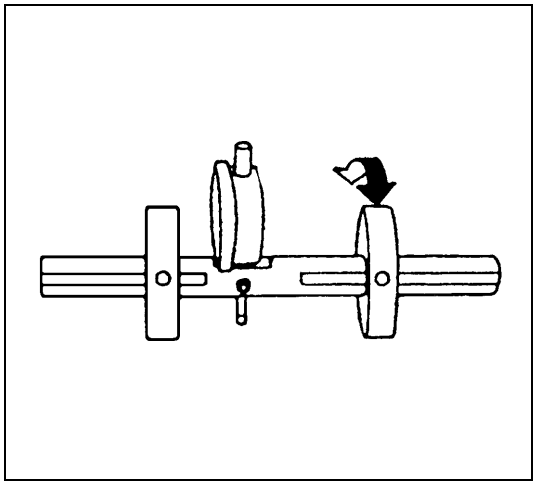
NOTE:

Before taking measurement, check for rotation by hand more than 15 revolutions.

5) Tighten special tool (1) so that specified bearing preload is obtained.

Special tool
(A) : 09900-23107
(B) : 09915-24550
(C) : 09922-76150

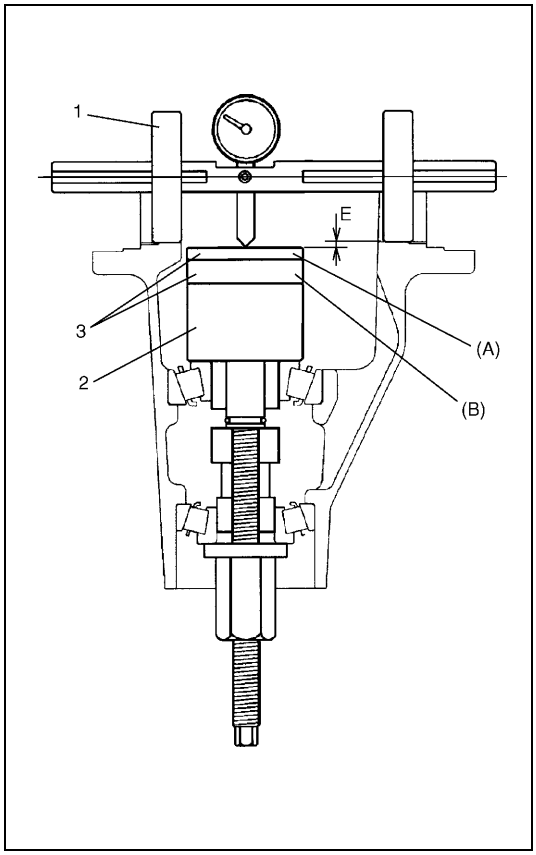
Drive bevel pinion bearing preload (at 50 rpm)
: 0.9 – 1.7 N·m (9.0 – 17.0 kg-cm, 7.8 – 14.7 lb-in.)



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 zero adjustment.**
- **It is desirable that short pointer indicates beyond 2 mm when long one is at zero.**

6) Set dial gauge to bearing form dummy with dummy shaft and make zero adjustment on surface plate.



7) Put block dummies (3) on pinion form dummy (2).

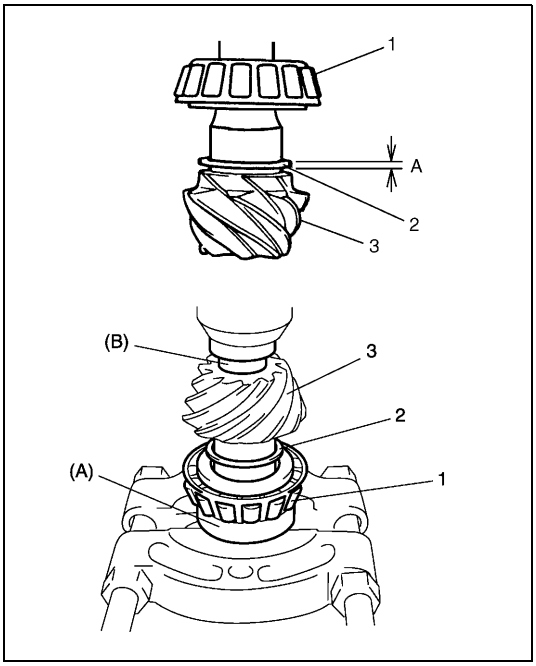
Special tool
(A) : 09922-76520
(B) : 09922-76550

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 zero position, pointer turns counterclockwise.**
- **Measured value may exceed 1 mm. Therefore, it is also necessary to know reading of short pointer.**

8) Place zero-adjusted bearing form dummy with dummy shaft (1) and dial gauge set on block dummies (3) and take measurement between zero position and extended dial gauge measuring tip.
9) Obtain adjusting shim thickness by using measured value by dial gauge in the following equation.

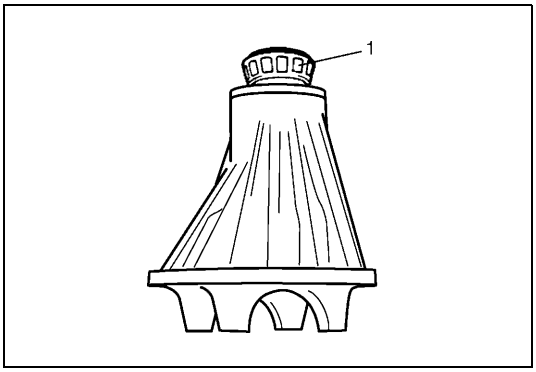
Necessary shim thickness	=	Dial gauge measured value E



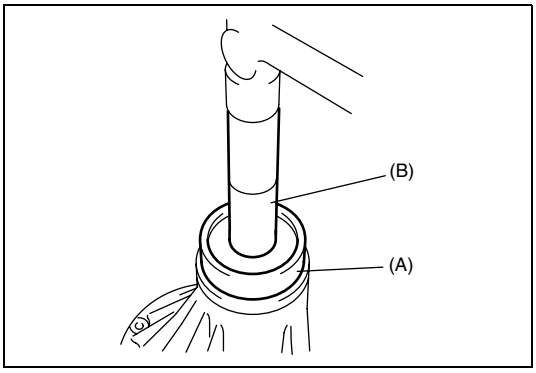
10) Select adjusting shim(s) (2) closest to measured value from among following available sizes.
11) Put shim(s) in place and press-fit drive bevel pinion rear bearing (1) to drive bevel pinion (3) by using special tools and hydraulic press.

Special tool
(A) : 09924-07730
(B) : 09926-37610-003

Available shim thickness
: 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.)



12) Apply differential oil to drive bevel pinion front bearing (1).
13) Install drive bevel pinion front bearing in differential carrier.

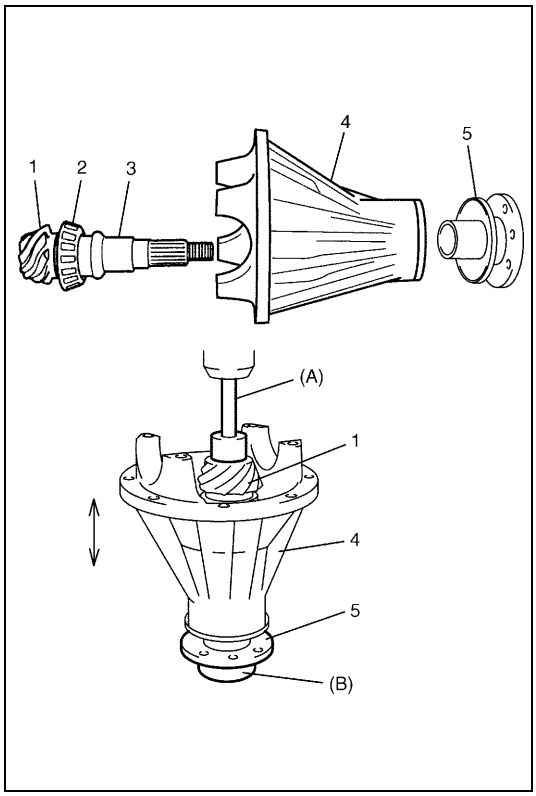


14) Apply grease to oil seal lip.

Grease 99000-25010

15) Install oil seal in differential carrier by using special tool.

Special tool
(A) : 09944-66010
(B) : 09924-74510



CAUTION:

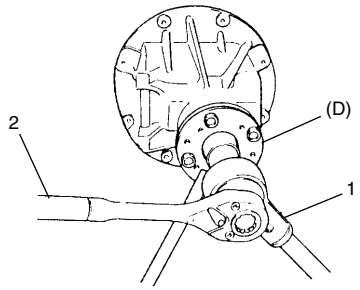
- **Use new drive bevel pinion spacer, otherwise bearings may be damaged.**
- **Take care not to give press force to drive bevel pinion spacer, otherwise spacer and bearings may be damaged.**

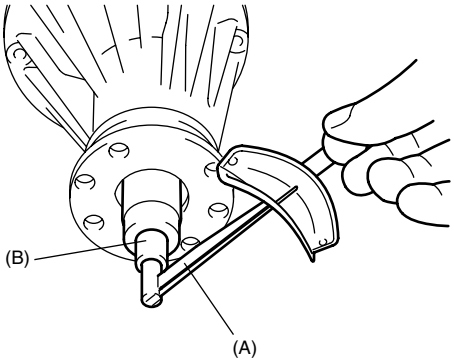
16) Apply differential oil to drive bevel pinion rear bearing (2).
17) Install drive bevel pinion (1), spacer (3) and companion flange (5) into differential carrier (4).
18) Until bearing axial clearance come to 1 – 2 mm (0.039 – 0.079 in.), press-fit drive bevel pinion (1) to companion flange (5) by using special tools and hydraulic press.

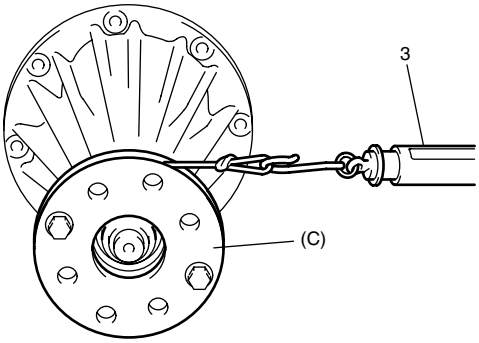
NOTE:

Bearing axial clearance can be confirmed by shaking differential carrier (4) in the direction shown in figure.

Special tool
(A) : 09925-58210
(B) : 09951-46010







NOTE:

- **Before taking measurement, check for smooth rotation by hand.**
- **Preload of drive bevel pinion bearings is adjusted by tightening flange nut to deform drive bevel pinion spacer.**
  Therefore, be sure to use a new spacer for adjustment and tighten flange nut step by step and check for preload by measuring starting torque as often as tightening to prevent over crushing of spacer.
  If preload exceeds specification given below during adjustment, replace spacer and repeat preload adjustment procedure. Attempt to decrease preload by loosening flange nut will not do.
- **For measuring preload of drive bevel pinion bearings, turn drive bevel pinion at about 50 rpm is required.**
- **Make a record preload of drive bevel pinion bearings because the preload is used for checking composite preload of drive bevel pinion bearings and differential side bearings.**

19) Tighten flange nut gradually with special tools so that preload of drive bevel pinion is in specification.

Tightening torque
Flange nut
: 100 – 400 N·m (10 – 40 kg-m, 72 – 289 lb-ft)

Preload of drive bevel pinion bearings / Starting torque of drive bevel pinion when measuring by torque wrench
: 0.9 – 1.7 N·m (9.0 – 17.0 kg-cm, 7.8 – 14.7 lb-in.)

Preload of drive bevel pinion bearings / Starting torque of drive bevel pinion when measuring by spring balance
: 18 – 34 N (1.8 – 3.4 kg, 4.0 – 7.5 lb)

Special tool
(A) : 09900-23107
(B) : 09915-24550
(C) : 09922-75222
(D) : 09922-66020

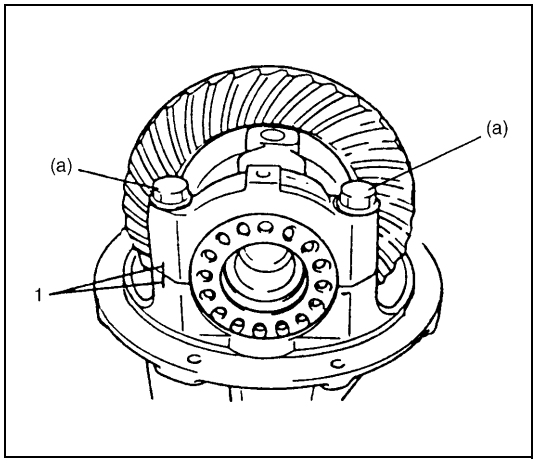
1. Power wrench (4 – 10 magnification)
2. Socket wrench
3. Spring balance

Differential Assembly

1) Place differential side bearing outer races on their respective bearings. Used left and right outer races are not interchangeable.
2) Install differential case assembly in differential carrier.
3) Install differential side bearing adjusters on their respective carrier, making sure adjuster are threaded properly.

NOTE:

Screw in each adjuster till it contacts bearing outer race so that outer race is prevented from inclining.



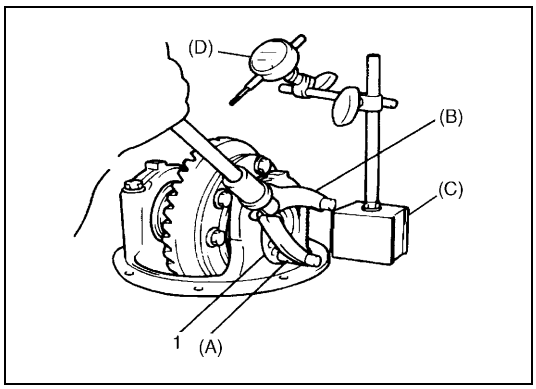
4) Align match marks (1) on differential side bearing cap and carrier. Screw in two side bearing cap bolts two or three turns and press down bearing cap by hand.

NOTE:

If bearing cap does not fit tightly on carrier, side bearing adjuster is not threaded properly. Reinstall adjuster.

5) Tighten bearing cap bolts to provisional torque.

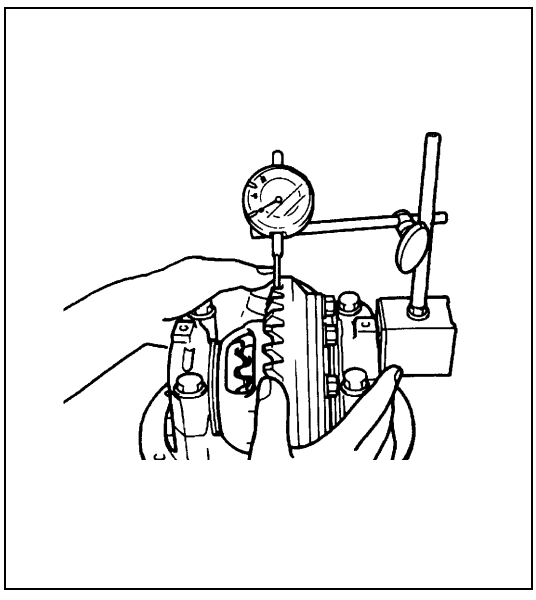
Tightening torque
Bearing cap bolts
(a) : 15 N·m (1.5 kg-m, 11.0 lb-ft)



6) Tighten both differential side bearing adjusters (1) so as to obtain specified gear backlash and at the same time, obtain preload of differential side bearing.

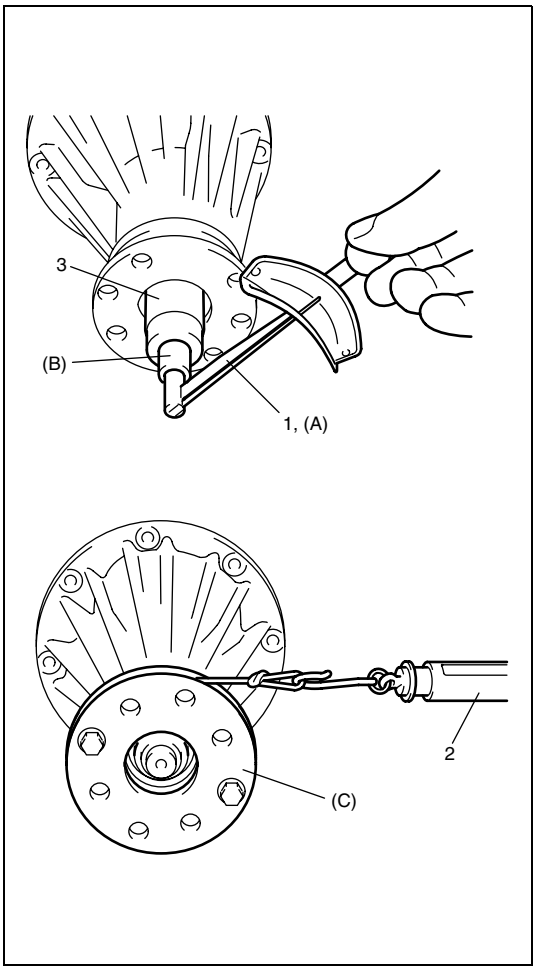
Special tool
(A) : 09930-40120
(B) : 09930-40113
(C) : 09900-20701
(D) : 09900-20607

Bevel gear backlash : 0.10 – 0.20 mm (0.0039 – 0.0078 in.)



NOTE:

- **Be sure to apply measuring tip of dial gauge at right angles to convex side of tooth.**
- **Measure at least 4 points on drive bevel gear periphery.**
- **As a practical measure following would be recommended to obtain specified backlash and differential side bearing preload at the same time.**
  - **– To increase or decrease backlash for adjustment, displace drive bevel gear toward or away from drive bevel pinion by running in one adjuster and running out the other adjuster by equal amount.**
  - **– Tighten both adjusters further by one notch at a time.**



7) Measure composite preload of drive bevel pinion bearings and differential side bearings with torque wrench (1) or spring balance (2).
8) Calculate preload of differential side bearings by using the following equation.

Preload of differential side bearings	=	Composite preload	–	Preload of drive bevel pinion bearings

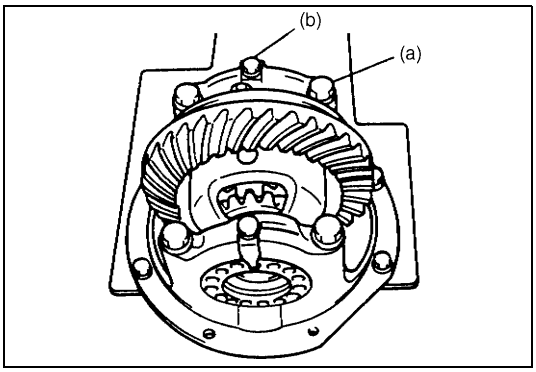
If preload of differential side bearings is specification shown below, adjust preload by tightening or loosening side bearing adjusters.

Preload of differential side bearings / Starting torque of drive bevel pinion when measuring by torque wrench
: 0.2 – 0.3 N·m (2.0 – 3.0 kg-cm, 1.7 – 2.6 lb-in.)

Preload of differential side bearings / Starting torque of drive bevel pinion when measuring by spring balance
: 4.0 – 6.0 N (0.4 – 0.6 kg, 0.9 – 1.3 lb)

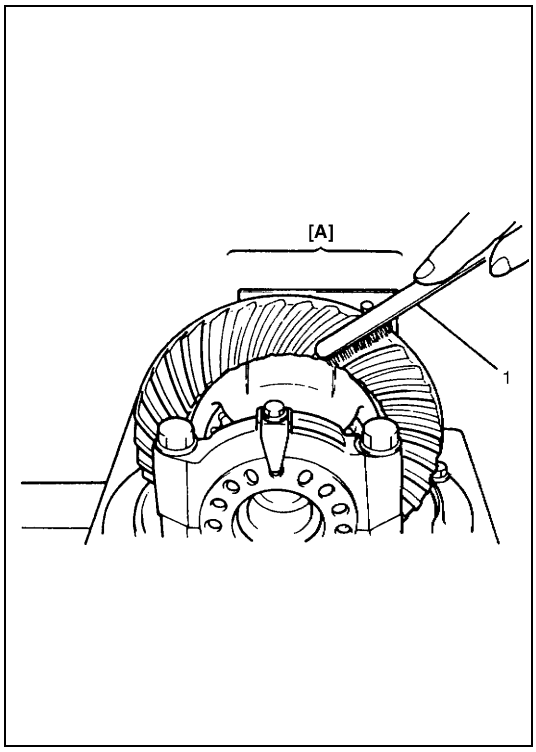
Special tool
(A) : 09900-23107
(B) : 09915-24550
(C) : 09922-75222

3. Socket



9) Torque bearing cap bolts to specified torque and install bearing lock plates.

Tightening torque
Bearing cap bolts
(a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)
Lock plate bolts
(b) : 11.5 N·m (1.15 kg-m, 8.5 lb-ft)



10) As final step, check gear tooth contact as follows.

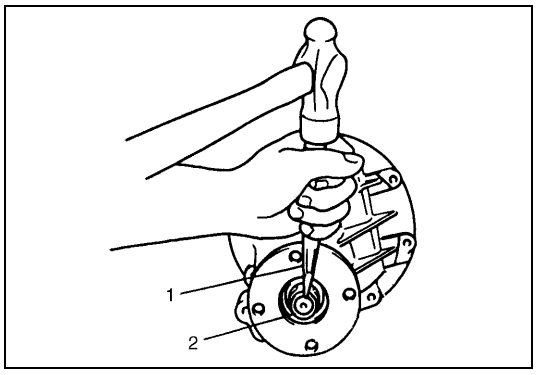
CAUTION:
When applying red lead paste to teeth, be sure to paint tooth surfaces uniformly.
The paste must not be too dry or too fluid.

a) After cleaning tooth surface of about 10 teeth in [A] range, paint them with gear marking compound evenly by using brush (1) or sponge etc.

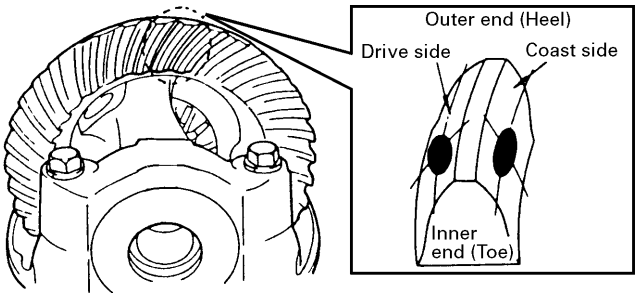
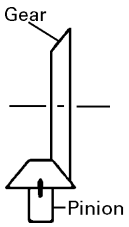
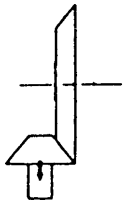
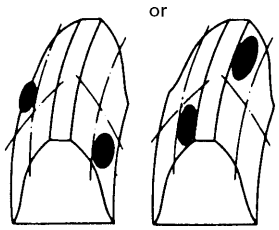
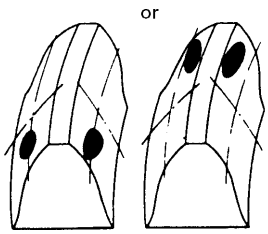
NOTE:

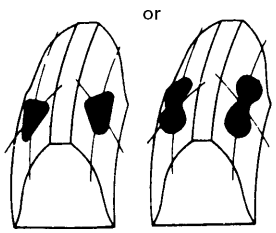
Be careful not to turn drive bevel gear more than one full revolution, for it will hinder accurate check.

b) Turn gear to bring its painted part in mesh with drive 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 following chart. If contact pattern is not normal, readjust or replace as necessary according to instruction in chart.



11) Upon completion of gear tooth contact check, caulk flange nut (2) with caulking tool (1) and hammer.

TOOTH CONTACT PATTERN	DIAGNOSIS AND REMEDY
	NORMAL
	HIGH CONTACT Pinion is positioned too fat 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 carrier is too much or too little. The remedy is to replace the carrier with a new one.
	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.

TOOTH CONTACT PATTERN	DIAGNOSIS AND REMEDY
	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 differential case.

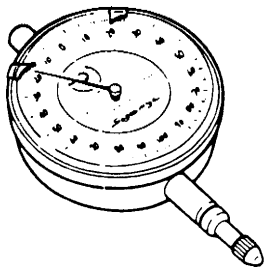
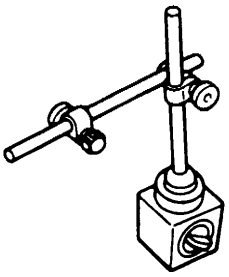
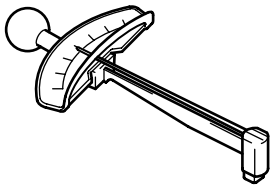
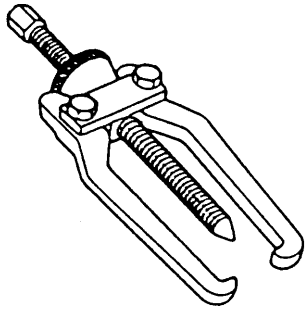
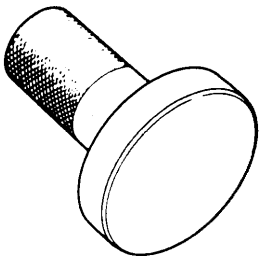
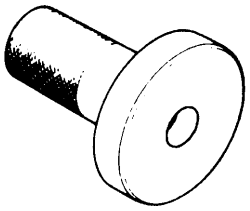
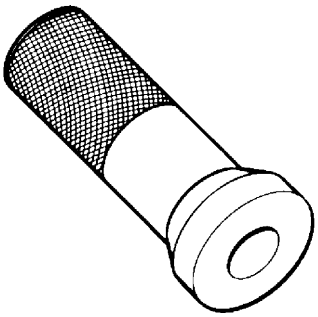
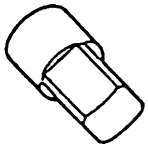
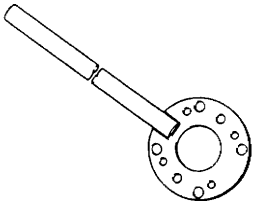
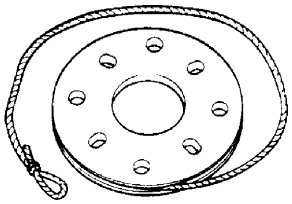
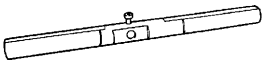
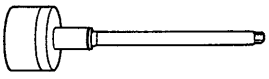
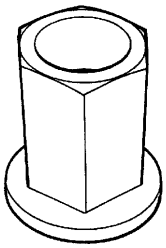
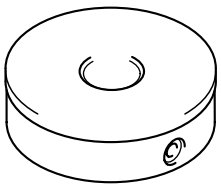
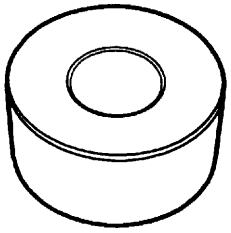
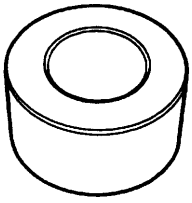
Tightening Torque Specifications

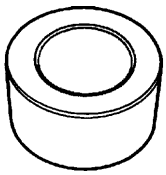
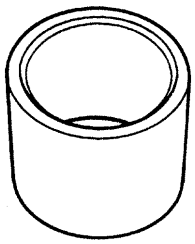
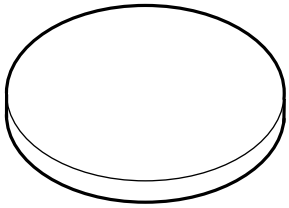
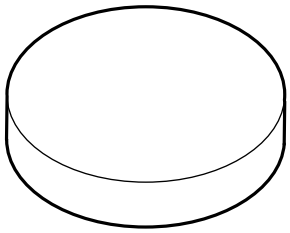
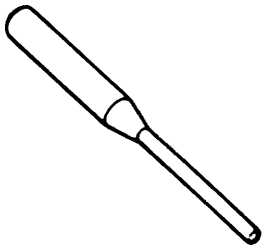
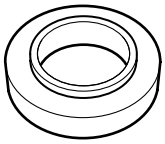
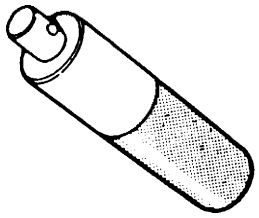
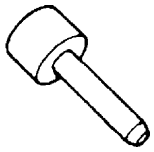
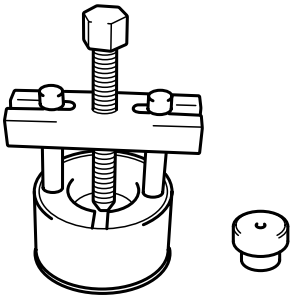
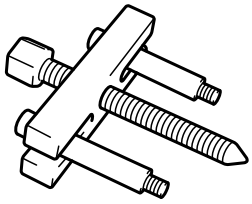
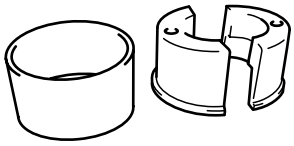
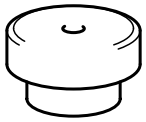
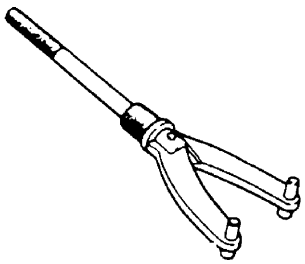
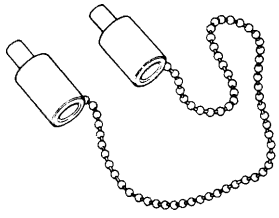
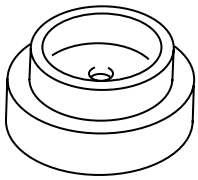
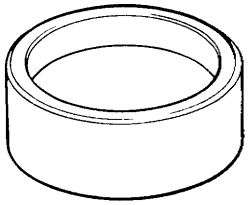
Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Front differential oil drain plug	27	2.7	19.5
Front differential oil level/filler plug	50	5.0	36.5
Differential carrier bolts	23	2.3	17.0
Propeller shaft bolts	50	5.0	36.5
Drive bevel gear bolts	85	8.5	61.5
Flange nut	100 – 400	10 – 40	72 – 289
Bearing cap bolts	50	5.0	36.5
Lock plate bolts	11.5	1.15	8.5

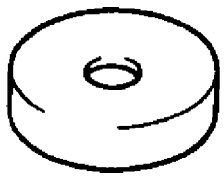
Required Service Materials

Material	Recommended SUZUKI 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 lip
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	• Front differential drain plug • Mating surface of differential carrier • Mating surface of front axle housing • Differential carrier bolts

Special Tools

 09900-20607 Dial gauge	 09900-20701 Magnetic stand	 09900-23107 Torque wrench	 09913-65135 Bearing puller
 09913-75510 Bearing installer	 09913-75520 Bearing installer	 09913-76010 Bearing installer	 09915-24550 Adapter socket
 09922-66020 Flange holder	 09922-75222 Preload adjuster	 09922-76120 Dummy shaft	 09922-76140 Bevel pinion shaft
 09922-76150 Bevel pinion nut	 09922-76220 Bearing gear dummy	 09922-76310 Rear collar	 09922-76320 Rear collar

 09922-76340 Rear collar	 09922-76410 Front collar	 09922-76520 Gauge block	 09922-76550 Gauge block
 09922-85811 Spring pin remover	 09924-07730 Bearing installer	 09924-74510 Installer attachment	 09925-58210 Oil seal installer
 09926-37610 Bearing remover See NOTE 1.	 09926-37610-001 Bearing puller See NOTE 2.	 09926-37610-002 Bearing puller attachment See NOTE 2.	 09926-37610-003 Bearing remover attachment See NOTE 2.
 09930-40113 Rotor holder	 09930-40120 Attachment	 09944-66010 Oil seal installer	 09944-66020 Bearing installer



09951-46010
Oil seal installer

NOTE:

- **"1" : This tool consists of Bearing Puller with 09926-37610-001, Bearing Puller Attachment with 09926-37610-002 and Bearing Remover Attachment with 09926-37610-003.**
- **"2" : This tool is constituent of Bearing Remover with 09926-37610.**

SECTION 7F

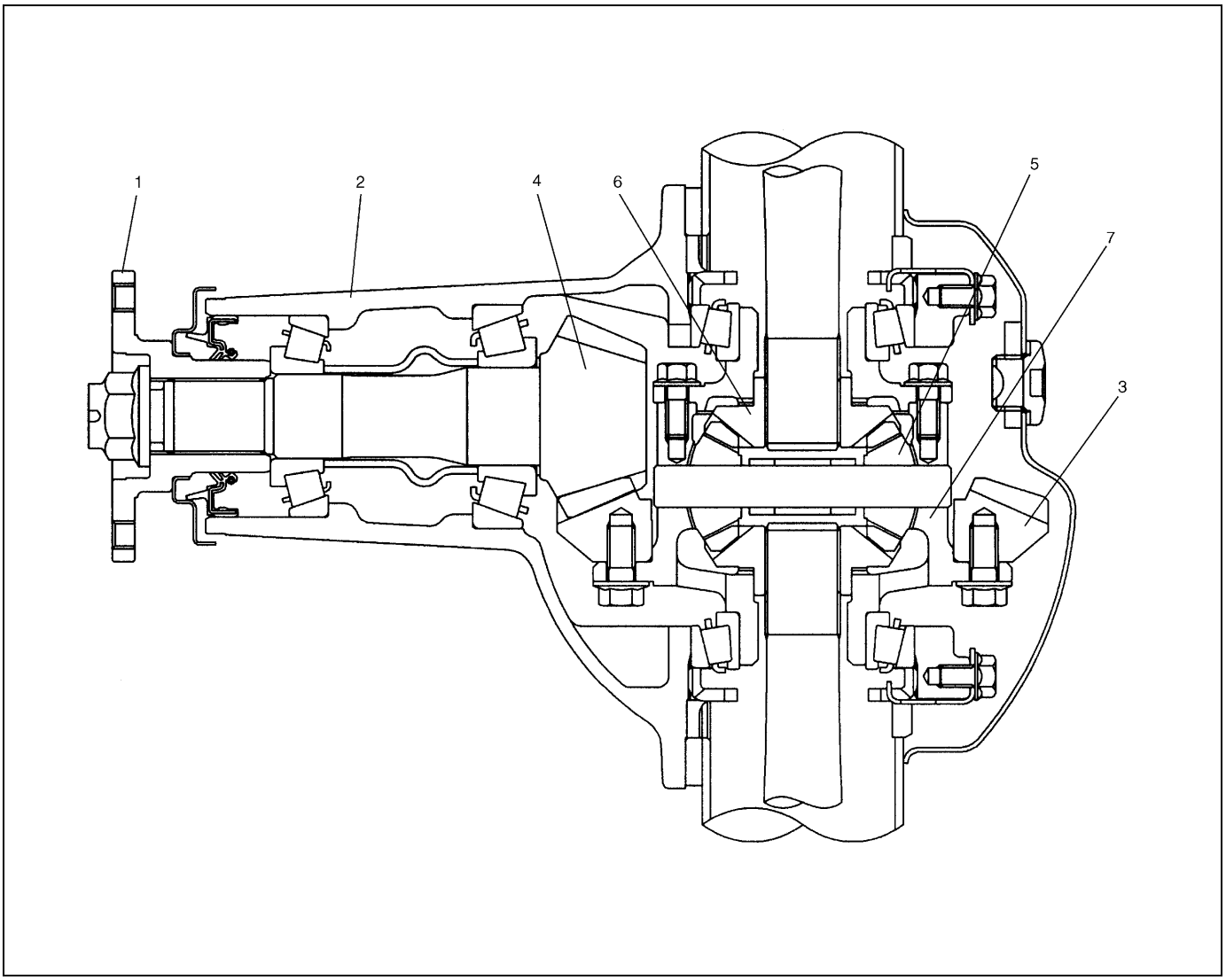
REAR DIFFERENTIAL

CONTENTS

General Description 7F-2
Diagnosis 7F-3
On-vehicle Service 7F-4
Oil Change 7F-4
Unit Repair Overhaul 7F-5
Differential Unit 7F-6
Tightening Torque Specification 7F-25
Required Service Material 7F-25
Special Tool 7F-25

General Description

The rear differential assembly 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	

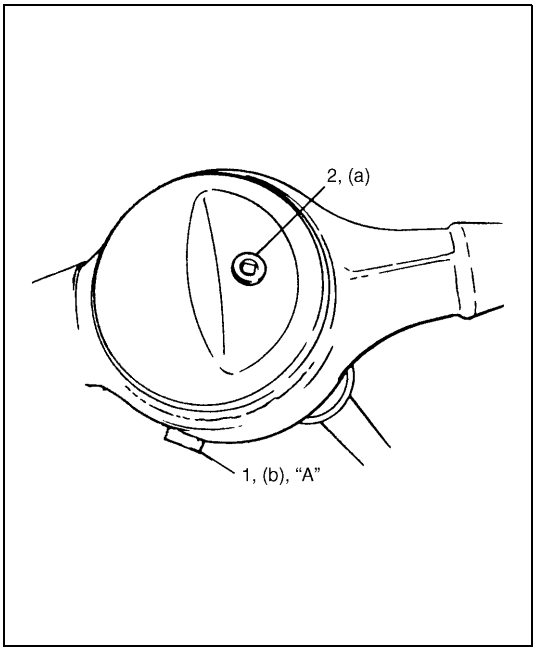
Diagnosis

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) or axle bearing(s)	Replace.
Oil leakage	Clogged breather plug	Clean.
	Worn or damaged oil seal	Replace.
	Excessive oil	Adjust oil level.
	Loose differential carrier bolts	Replace or retighten.

On-vehicle Service

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) Apply sealant to drain plug thread.

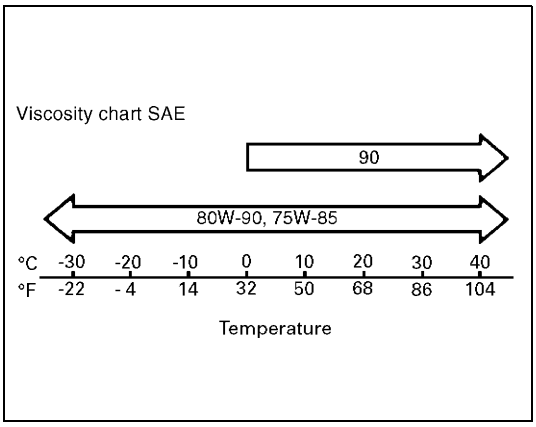
"A" : Sealant 99000-31110

5) Tighten drain plug to specified torque.

Tightening torque
Rear differential oil drain plug
(b) : 27 N·m (2.7 kg-m, 19.5 lb-ft)

6) Pour proper amount of new differential oil as specified below roughly up to level hole.
7) Install new gasket to level/filler plug and tighten level/filler plug to specified torque.

Tightening torque
Rear differential oil level/filler plug
(a) : 50 N·m (5.0 kg-m, 36.5 lb-ft)



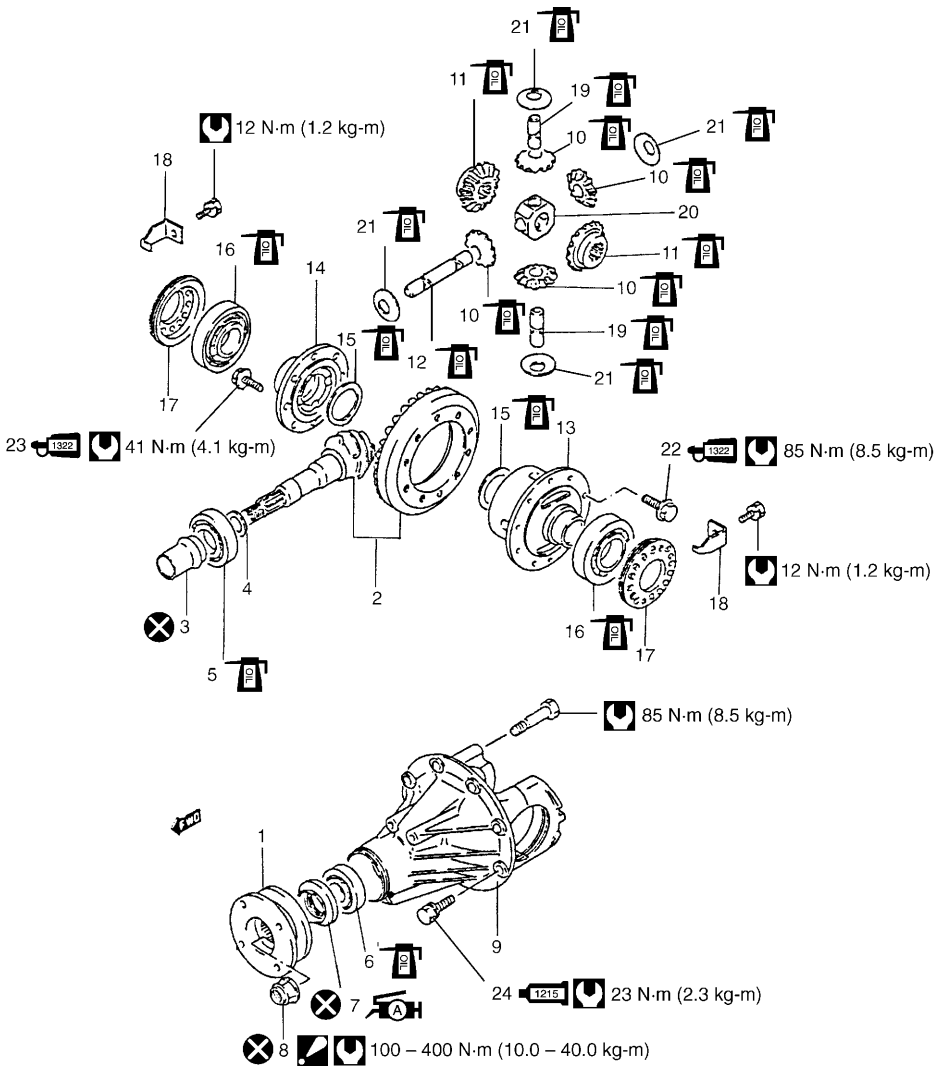
NOTE:

- **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
: 1.5 liters (3.2/2.6 US/Imp. pt)

Unit Repair Overhaul

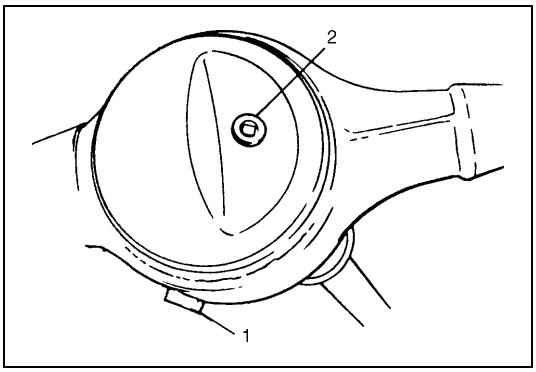


	1. Companion flange	10. Differential pinion		19. Pinion shaft No.2
	2. Drive bevel/Hypoid gear set	11. Differential gear		20. Pinion joint
	3. Drive bevel pinion spacer	12. Pinion shaft No.1		21. Pinion washer
	4. Shim	13. Differential left case	1322	22. Drive bevel gear bolt : Apply thread lock cement 99000-32110 to thread.
	5. Drive bevel pinion rear bearing	14. Differential right case	1322	23. Differential case bolt : Apply thread lock cement 99000-32110 to thread.
	6. Drive bevel pinion front bearing	15. Thrust washer	1215	24. Differential carrier bolt : Apply sealant 99000-31110 to thread.
A/H	7. Oil seal : Apply grease 99500-25010 to oil seal lip.	16. Differential side bearing		Do not reuse.
	8. Flange nut : After tightening nut so as rotational torque of drive bevel pinion to be in specified torque, caulk nut securely.	17. Differential side bearing adjuster		Tightening torque
1215	9. Differential carrier assembly : Apply sealant 99000-31110 to mating face with axle housing.	18. Lock plate	OIL	Apply differential oil.

Differential Unit

DISMOUNTING

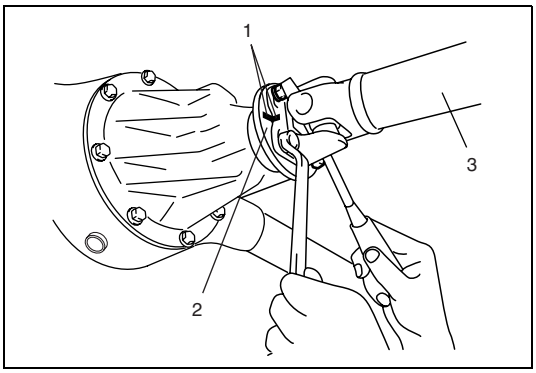
1) Lift up vehicle and remove wheels.



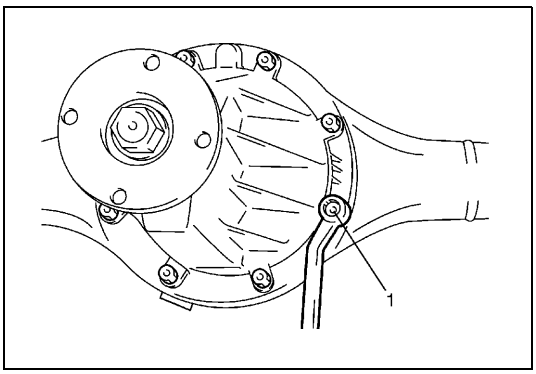
2) Drain differential oil from rear axle housing referring to “Oil Change” in this section.

1. Drain plug
2. Level/Filler plug

3) Remove rear brake drums and pull out right and left rear axle shaft referring to “Rear Axle Shaft and Wheel Bearing” in Section 3E.



4) Before removing propeller shaft, give match marks (1) on companion flange (2) and propeller shaft (3) as shown.

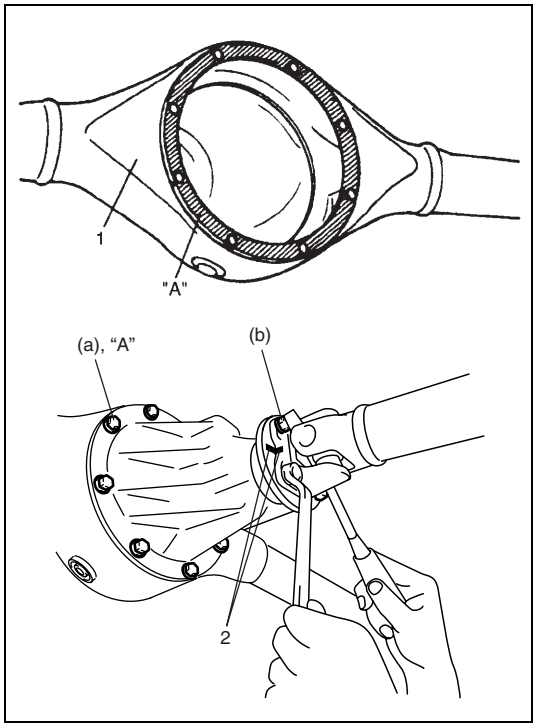


5) Remove differential carrier bolts (1) and differential assembly.

REMOUNTING

Reverse removal procedure for installation, noting the following.

Rear Differential



- Clean mating surface of rear 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) : 50 N·m (5.0 kg-m, 36.5 lb-ft)

Rear Axle Shaft

For installation of rear axle shafts, refer to "Rear Axle Shaft and Wheel Bearing" in Section 3E.

Rear Brake Drum

For installation of rear brake drums, refer to "Rear Axle Shaft and Wheel Bearing" in Section 3E.

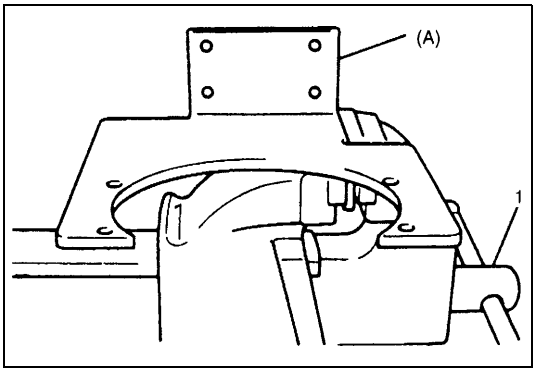
Differential Gear Oil

Refill differential housing with new specified differential oil. Refer to "Oil Change" in this section.

Brake Circuit Air Purging

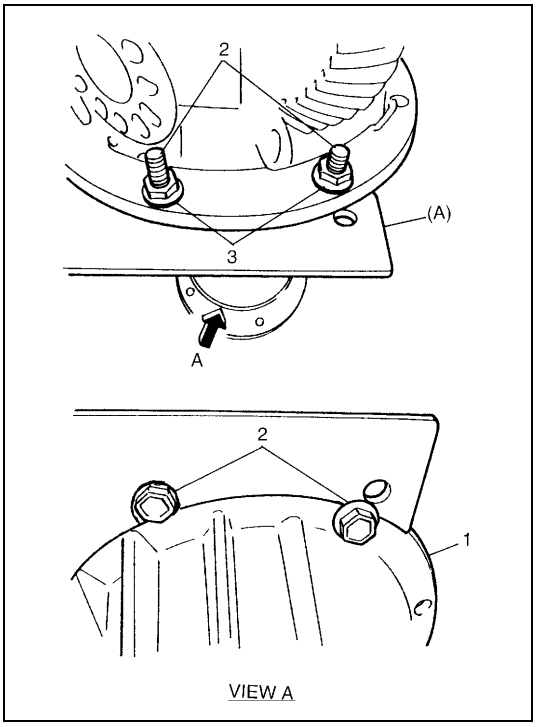
Make sure to purge air out of brake circuit. Refer to "Bleeding Brakes" in Section 5.
Then ensure that joint seam of pipe is free from oil leak.

DISASSEMBLY



1) Set special tool on vise (1) securely.

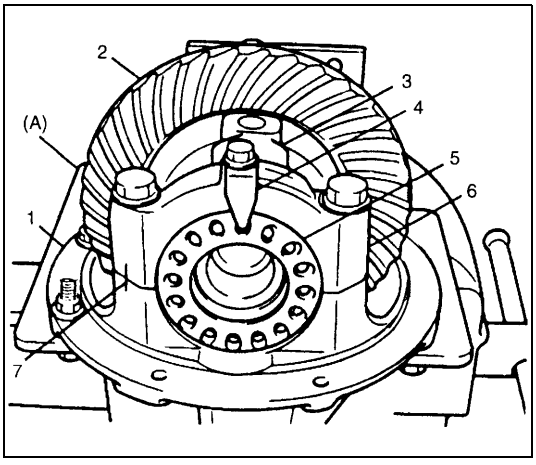
Special tool
(A) : 09944-76010



2) Using 2 bolts and nuts, set differential assembly onto special tool.

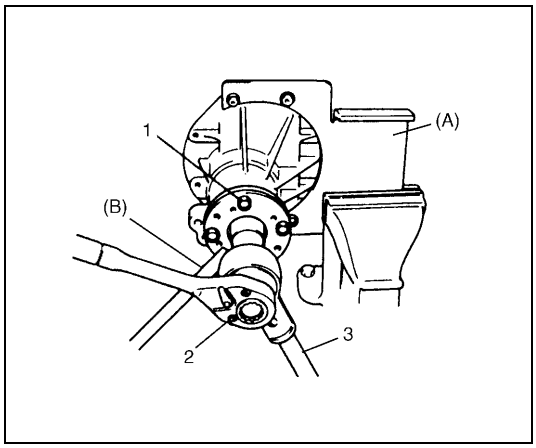
Special tool
(A) : 09944-76010

1. Differential carrier



3) Put match marks (7) on differential side bearing caps and differential carrier (1).
4) Remove differential side bearing lock plates (4) and differential side bearing caps (6) by removing their bolts and then remove bearing adjusters (5), side bearing outer races and drive bevel gear (2) with differential case (3).

Special tool
(A) : 09944-76010



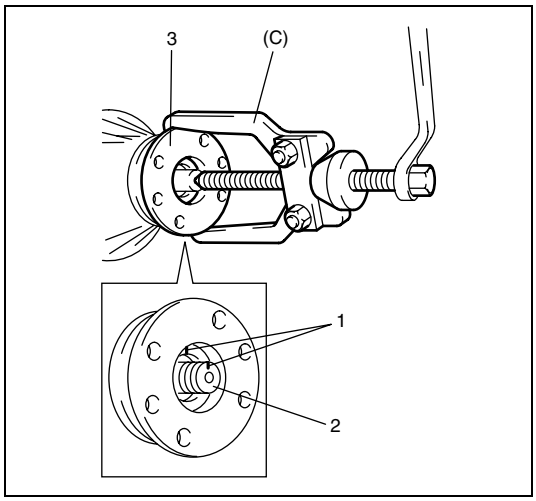
5) Turn differential assembly together with special tool (A) by 90 degrees and grip it with vise again.

Special tool
(A) : 09944-76010

6) Hold companion flange with special tool and then remove flange nut by using power wrench (3) and socket wrench (2).

Special tool
(B) : 09922-66020

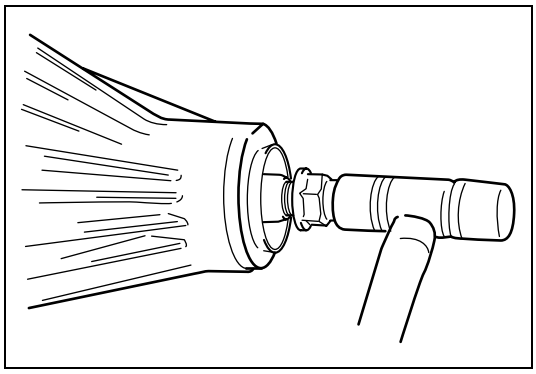
1. Bolt and nut



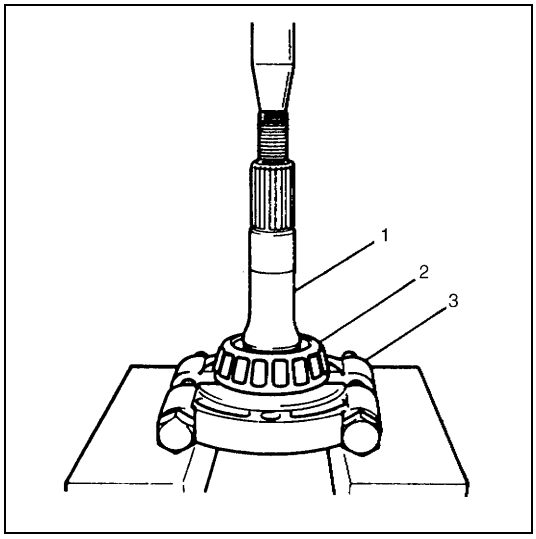
CAUTION:
Do not make mating mark on the coupling surface of the flange to prevent propeller shaft from generating vibration.

7) Make mating marks (1) on drive bevel pinion (2) and companion flange (3).
8) Remove companion flange from drive bevel pinion using special tool.

Special tool
(C) : 09913-65135

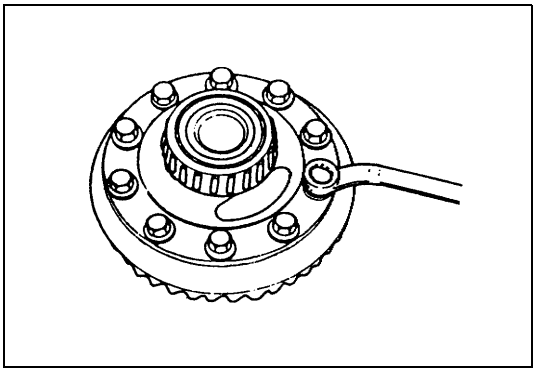


9) Remove drive bevel pinion with rear bearing, and spacer from differential carrier.
If it is hard to remove, screw an used nut into pinion and hammer on that nut with a plastic hammer but never directly on drive bevel pinion.

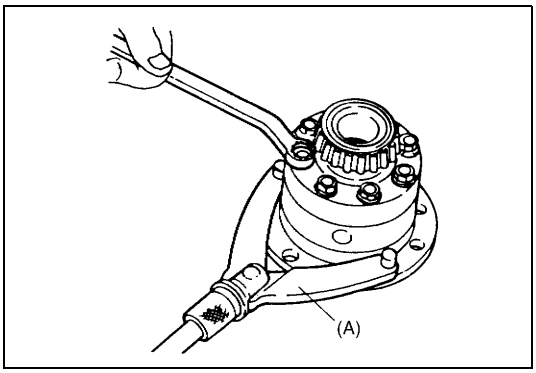


10) Remove drive bevel pinion rear bearing (2) by using bearing puller (3) and hydraulic press.

1. Drive bevel pinon

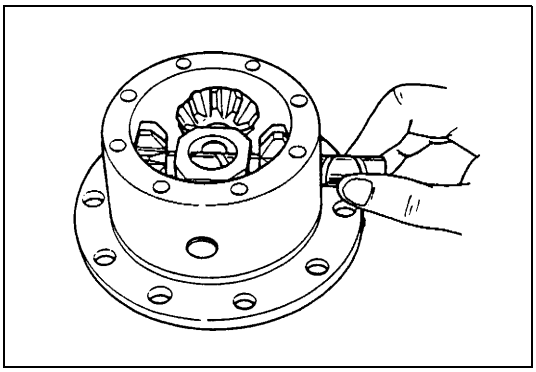


11) Remove 10 bolts securing bevel gear to differential case, and separate gear from case.

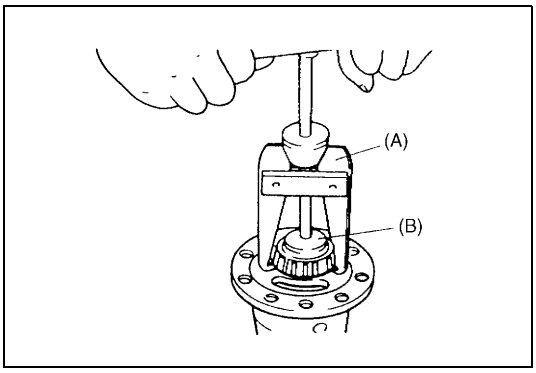


12) There are 8 bolts fastening two differential case halves together. Remove these bolts to sever right-hand case half from left-hand one, and take off right-hand one.

Special tool
(A) : 09930-40113

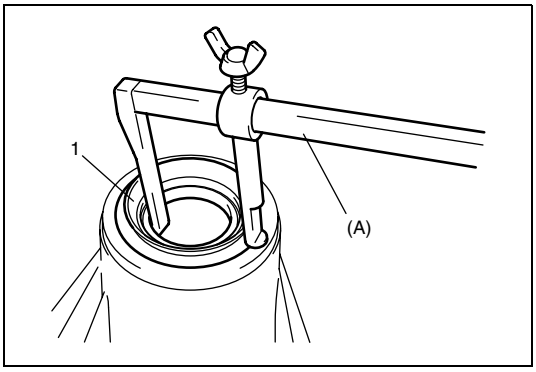


13) Remove differential pinion shafts side gears, differential pinions and thrust washers.



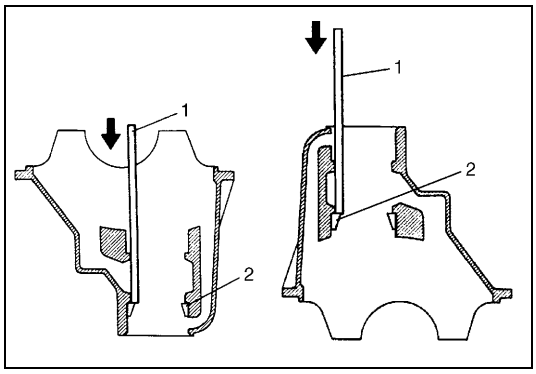
14) Using special tools, extract side bearing from each differential case half.

Special tool
(A) : 09913-60910
(B) : 09913-85230



15) Remove oil seal (1) from differential carrier by using special tool.

Special tool
(A) : 09913-50121



16) Drive out drive bevel pinion bearing outer races in differential carrier by hammering metal stick applied to them.

INSPECTION

- Check companion flange for wear or damage.
- Check bearings for wear or discoloration.
- Check differential carrier for cracks.
- Check drive bevel pinion and bevel gear for wear or cracks.
- Check differential gears, pinion gears and pinion shaft for wear or damage.
- Check side gear spline for wear or damage.

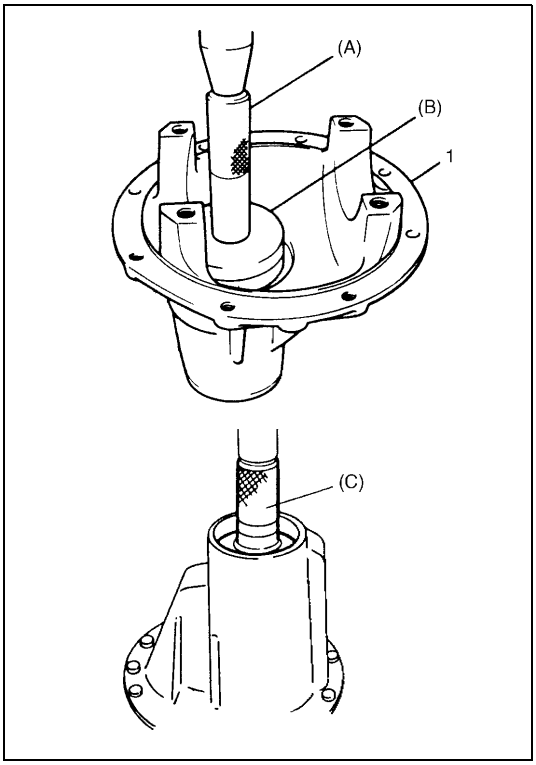
ADJUSTMENT AND REASSEMBLY

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.

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 and outer race assembly.**

Drive Bevel Pinion Bearing Outer Race



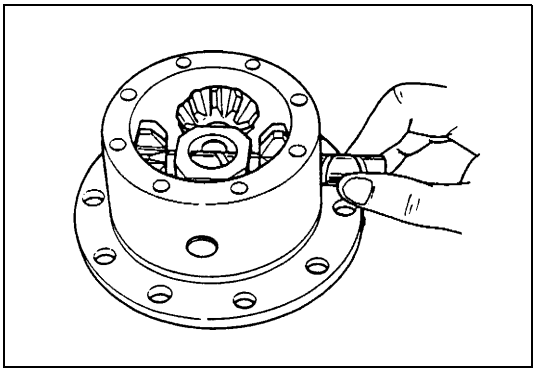
CAUTION:
Perform press-fitting carefully so as not to tilt outer race.

Install bevel pinion bearing outer races using special tools and hydraulic press.

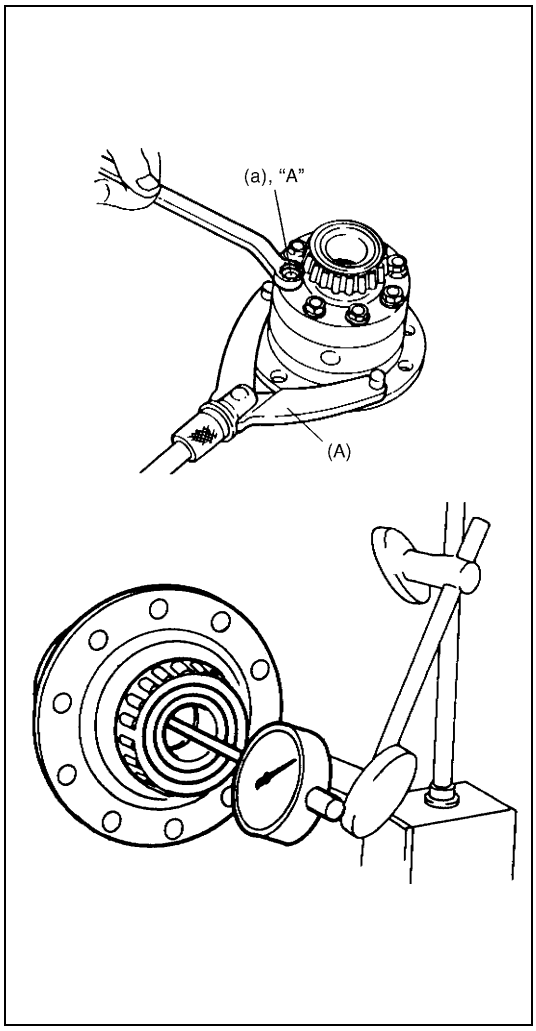
Special tool
(A) : 09924-74510
(B) : 09926-68310
(C) : 09913-75510

1. Differential carrier

Differential Case Assembly



1) Install differential side gears, pinions, thrust washers and pinion shafts in differential case.



2) To check thrust play of differential side gear fasten together two case halves by tightening securing bolts to prescribed torque. By comparing thrust play reading, taken as shown in figure, against thrust play indicated below, increase or decrease total thickness of thrust washers, which are located in two places, that is, on the inner side of each case half.

Special tool
(A) : 09930-40113

Tightening torque
Differential case bolts
(a) : 41 N·m (4.1 kg-m, 30.0 lb-ft)

Differential side gear thrust play
Standard : 0.12 – 0.37 mm (0.005 – 0.014 in.)

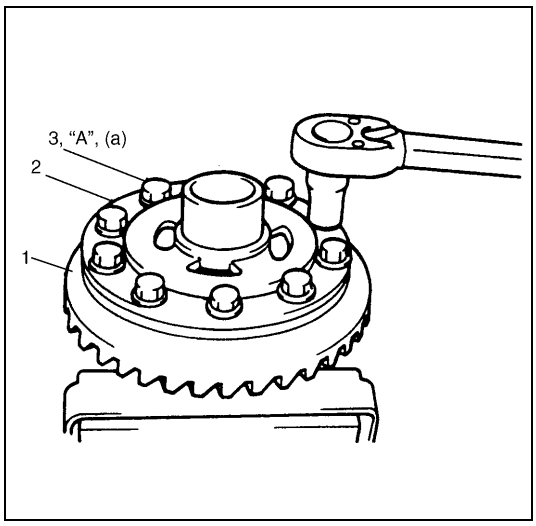
Available differential gear thrust washer thickness
: 0.6, 0.7 and 0.8 mm (0.024, 0.028 and 0.032 in.)

3) Remove differential case bolts again.
4) Apply thread lock cement to differential case bolts.

"A" : Cement 99000-32110

5) Retighten differential case bolts to specified torque.

Tightening torque
Differential case bolts
(a) : 41 N·m (4.1 kg-m, 30.0 lb-ft)

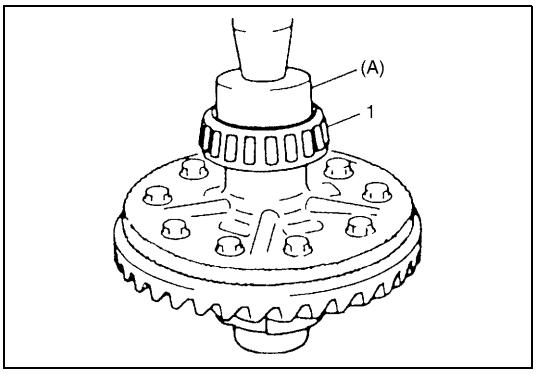


CAUTION:
Use specified bolts. Use of any other bolts than specified may cause loosening of bolts and damage to drive bevel gear.

6) Put drive bevel gear (1) on differential case (2) and fasten them with 10 bolts (3) by tightening them to specified torque. Use thread lock cement for 10 bolts.

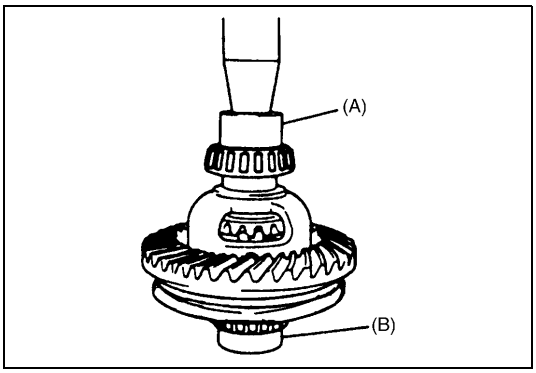
"A" : Cement 99000-32110

Tightening torque
Drive bevel gear bolts
(a) : 85 N·m (8.5 kg-m, 61.5 lb-ft)



7) Press-fit differential side bearing (1) with special tool and hydraulic press.

Special tool
(A) : 09944-66020



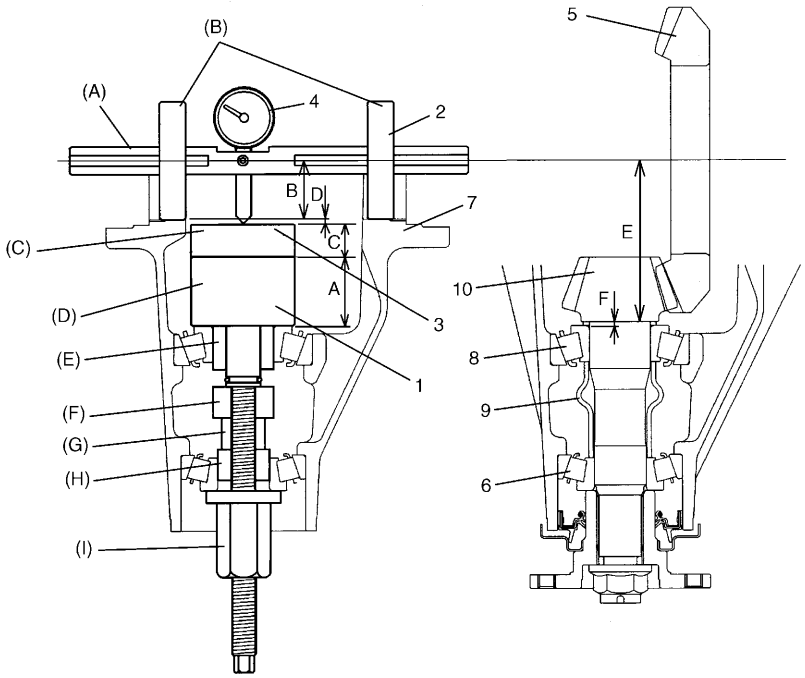
8) Hold bearing press-fitted in previous step with holder and press-fit differential side bearing on the other side.

NOTE:
Be sure to use bearing holder for the purpose of protecting lower bearing.

Special tool
(A) : 09944-66020
(B) : 09951-16060

Differential Carrier and Drive Bevel Pinion

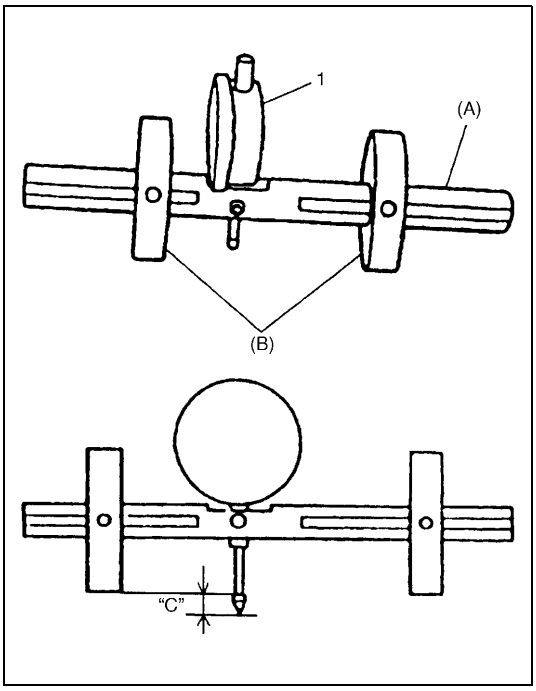
To engage drive bevel pinion and gear correctly, it is prerequired to install drive bevel pinion to differential carrier properly by using adjusting shim.



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 (= 40 mm/1.575 in.)	1. Pinion form dummy	7. Differential carrier
C : Block dummy thickness (= 14 mm/0.5512 in.)	2. Bearing form dummy with dummy shaft	8. Rear bearing
A+B+C : Mounting distance adjusting dummy total size (= 94 mm/3.701 in.)	3. Block dummy	9. Spacer
D : Measured dimension	4. Dial gauge	10. Drive bevel pinion
E : Drive bevel pinion mounting distance (= 94 mm/1.575 in.)	5. Drive bevel gear	

Special tool

(A) : 09922-76120
(B) : 09922-76240
(C) : 09922-76550
(D) : 09922-76140
(E) : 09922-76410
(F) : 09922-76310
(G) : 09922-76340
(H) : 09922-76320
(I) : 09922-76150

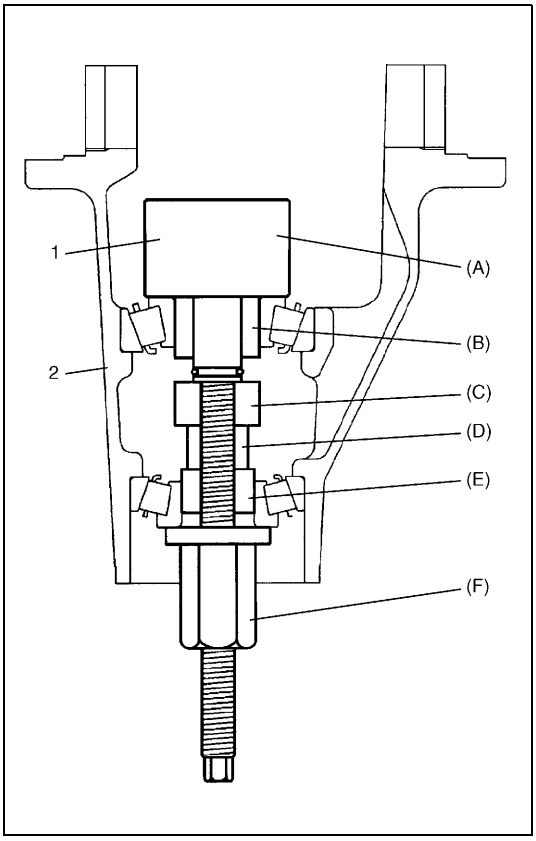


1) Assemble bearing form dummy with dummy shaft using special tools.

Special tool
(A) : 09922-76120
(B) : 09922-76240

2) Install dial gauge (1) to bearing form dummy with dummy shaft as shown in figure.

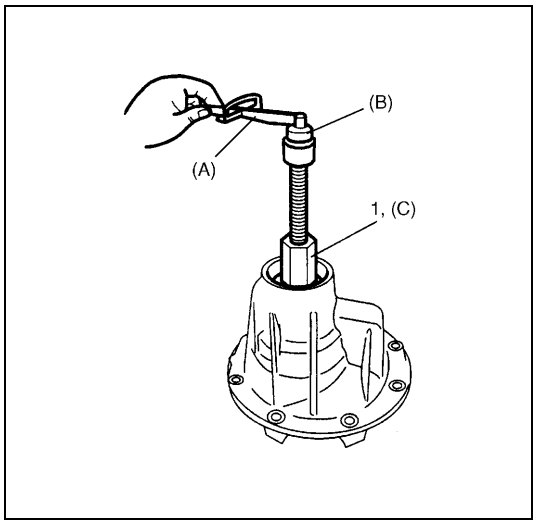
Dial gauge rod tip set distance
"C" : 2 – 3 mm (0.079 – 0.118 in.)



NOTE:
This installation requires no spacer or oil seal.

3) Apply differential oil to drive bevel pinion front and rear bearings.
4) Install pinion form dummy (1), the other special tools and drive bevel pinion bearings to differential carrier (2).

Special tool
(A) : 09922-76140
(B) : 09922-76410
(C) : 09922-76310
(D) : 09922-76340
(E) : 09922-76320
(F) : 09922-76150



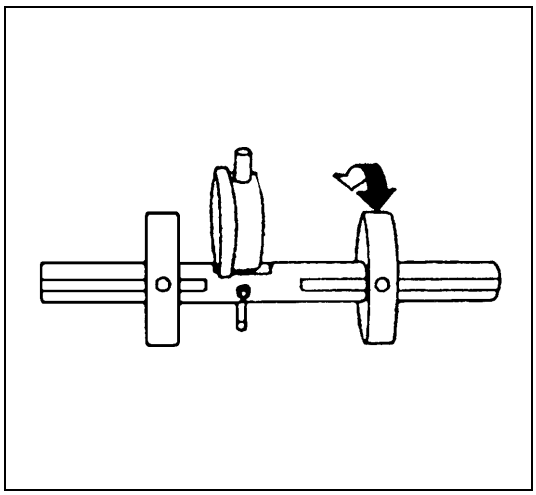
NOTE:

Before taking measurement, check for rotation by hand more than 15 revolutions.

5) Tighten special tool (1) so that specified bearing preload is obtained.

Special tool
(A) : 09900-23107
(B) : 09915-24550
(C) : 09922-76150

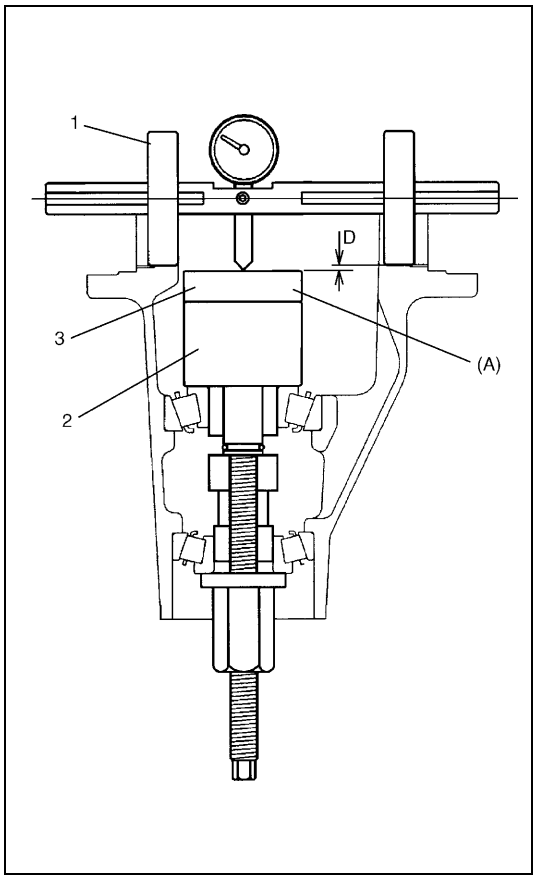
Drive bevel pinion bearing preload at 50 rpm
: 0.9 – 1.7 N·m (9.0 – 17.0 kg-cm, 7.8 – 14.7 lb-in.)



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 zero adjustment.**
- **It is desirable that short pointer indicates beyond 2 mm when long one is at zero.**

6) Set dial gauge to bearing form dummy with dummy shaft and make zero adjustment on surface plate.



7) Put block dummy (3) on pinion form dummy (2).

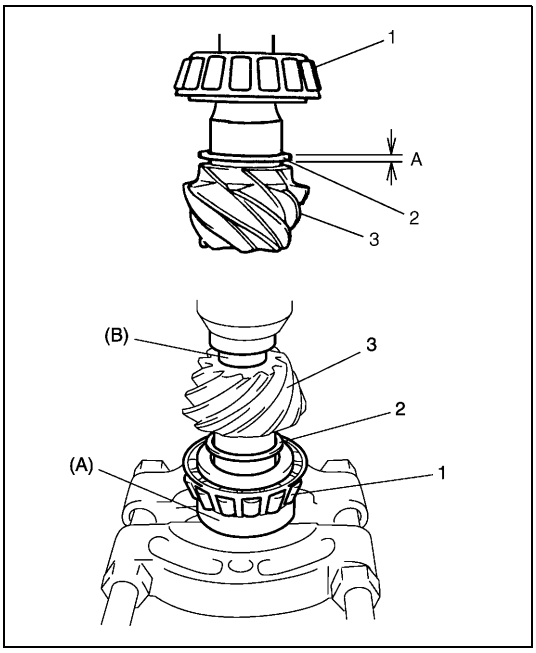
Special tool
(A) : 09922-76550

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 zero position, pointer turns counterclockwise.**
- **Measured value may exceed 1 mm. Therefore, it is also necessary to know reading of short pointer.**

8) 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.
9) Obtain adjusting shim thickness by using measured value by dial gauge in the following equation.

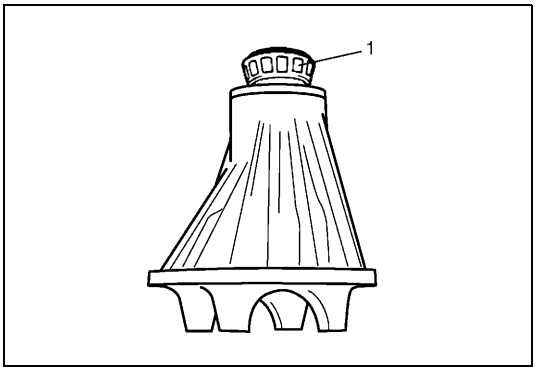
Necessary shim thickness	=	Dial gauge measured value D



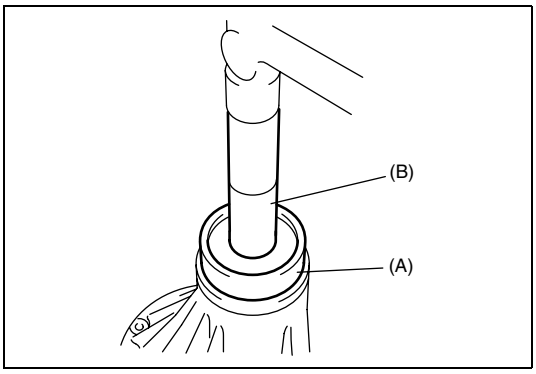
10) Select adjusting shim(s) (2) closest to measured value from among following available sizes.
11) Put shim(s) in place and press-fit drive bevel pinion rear bearing (1) to drive bevel pinion (3) by using special tools and hydraulic press.

Special tool
(A) : 09924-07730
(B) : 09926-37610-003

Available shim thickness
: 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.)



12) Apply differential oil to drive bevel pinion front bearing (1).
13) Install drive bevel pinion front bearing in differential carrier.

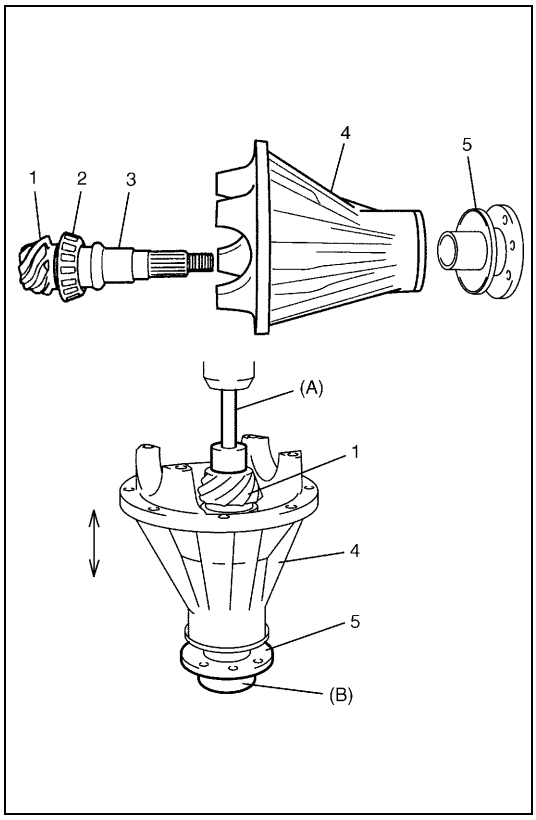


14) Apply grease to oil seal lip.

Grease 99000-25010

15) Install oil seal in differential carrier by using special tool.

Special tool
(A) : 09944-66010
(B) : 09924-74510



CAUTION:

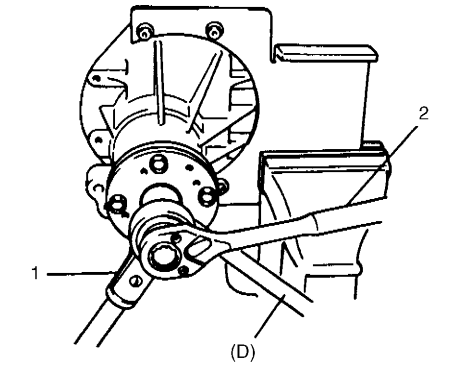
- **Use new drive bevel pinion spacer, otherwise bearings may be damaged.**
- **Take care not to give press force to drive bevel pinion spacer, otherwise spacer and bearings may be damaged.**

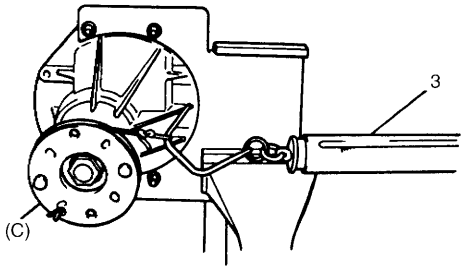
16) Apply differential oil to drive bevel pinion rear bearing (2).
17) Install drive bevel pinion (1), spacer (3) and companion flange (5) into differential carrier (4).
18) Until bearing axial clearance come to 1 – 2 mm (0.039 – 0.079 in.), press-fit drive bevel pinion (1) to companion flange (5) by using special tools and hydraulic press.

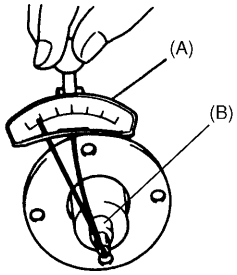
NOTE:

Bearing axial clearance can be confirmed by shaking differential carrier (4) in the direction shown in figure.

Special tool
(A) : 09925-58210
(B) : 09951-46010







NOTE:

- **Before taking measurement, check for smooth rotation by hand.**
- **Preload of drive bevel pinion bearings is adjusted by tightening flange nut to deform drive bevel pinion spacer.**
  Therefore, be sure to use a new spacer for adjustment and tighten flange nut step by step and check for preload by measuring starting torque as often as tightening to prevent over crushing of spacer.
  If preload exceeds specification given below during adjustment, replace spacer and repeat preload adjustment procedure. Attempt to decrease preload by loosening flange nut will not do.
- **For measuring preload of drive bevel pinion bearings, turn drive bevel pinion at about 50 rpm is required.**
- **Make a record preload of drive bevel pinion bearings because the preload is used for checking composite preload of drive bevel pinion bearings and differential side bearings.**

19) Tighten flange nut gradually with special tools so that preload of drive bevel pinion is in specification.

Tightening torque
Flange nut
: 100 – 400 N·m (10 – 40 kg-m, 72 – 289 lb-ft)

Preload of drive bevel pinion bearings/Starting torque of drive bevel pinion when measuring by torque wrench
: 0.9 – 1.7 N·m (9.0 – 17.0 kg-cm, 7.8 – 14.7 lb-in.)

Preload of drive bevel pinion bearings/Starting torque of drive bevel pinion when measuring by spring balance
: 18 – 34 N (1.8 – 3.4 kg, 4.0 – 7.5 lb)

Special tool
(A) : 09900-23107
(B) : 09915-24550
(C) : 09922-75222
(D) : 09922-66020

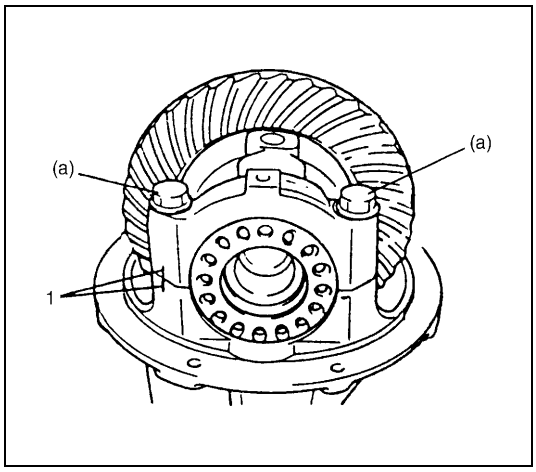
1. Power wrench (4 – 10 magnification)
2. Socket wrench
3. Spring balance

Differential Assembly

1) Place differential side bearing outer races on their respective bearings.
   Used left and right outer races are not interchangeable.
2) Install differential case assembly in differential carrier.
3) Install differential side bearing adjusters on their respective carrier, making sure adjuster are threaded properly.

NOTE:

Screw in each adjuster till it contacts bearing outer race so that outer race is prevented from including.



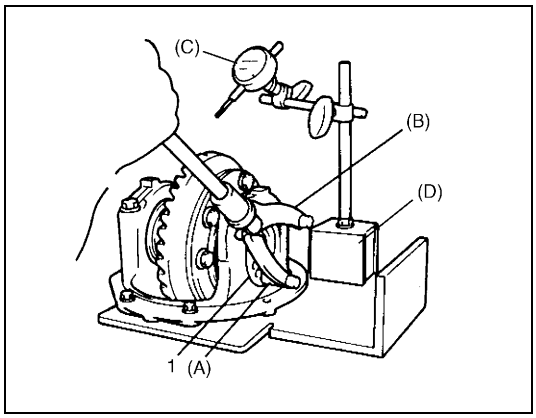
4) Align match marks (1) on differential side bearing cap and carrier. Screw in two side bearing cap bolts two or three turns and press down bearing cap by hand.

NOTE:

If bearing cap does not fit tightly on carrier, side bearing adjuster is not threaded properly. Reinstall adjuster.

5) Tighten bearing cap bolts to provisional torque.

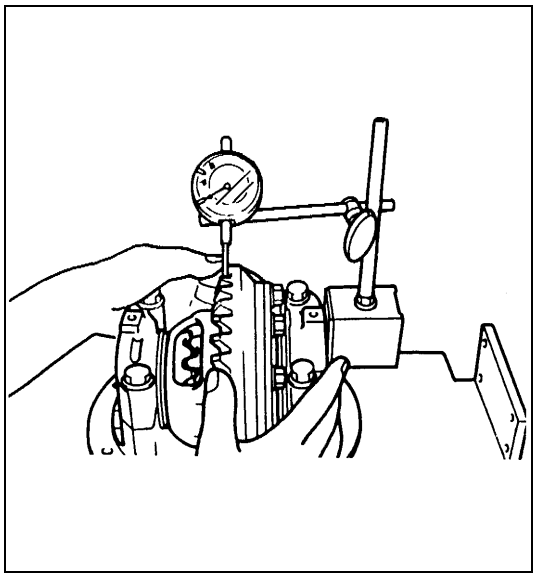
Tightening torque
Bearing cap bolts
(a) : 15 N·m (1.5 kg-m, 11.0 lb-ft)



6) Tighten both differential side bearing adjusters (1) so as to obtain specified gear backlash and at the same time, obtain preload of differential side bearing.

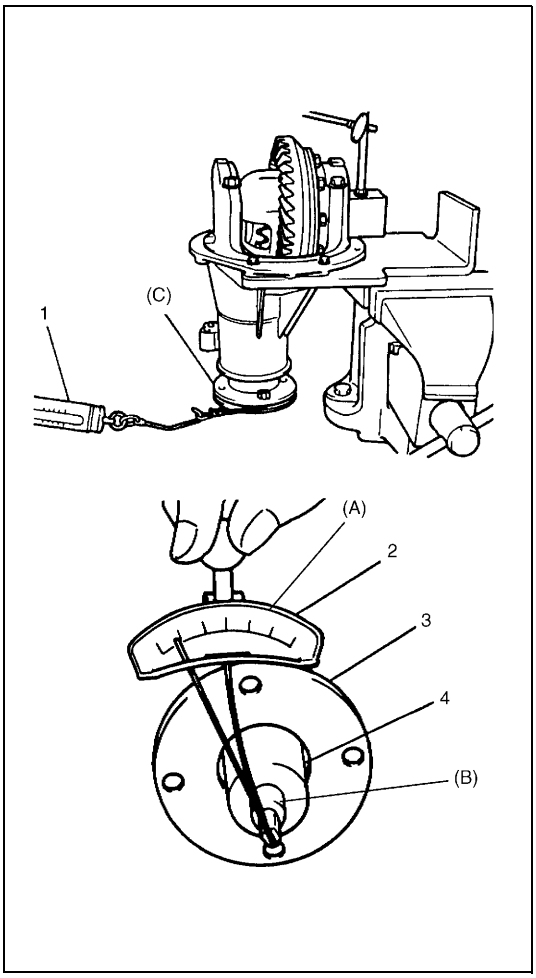
Special tool
(A) : 09930-40120
(B) : 09930-40113
(C) : 09900-20607
(D) : 09900-20701

Bevel gear backlash
: 0.10 – 0.20 mm (0.0039 – 0.0078 in.)



NOTE:

- **Be sure to apply measuring tip of dial gauge at right angles to convex side of tooth.**
- **Measure at least 4 points on drive bevel gear periphery.**
- **As a practical measure following would be recommended to obtain specified backlash and differential side bearing preload at the same time.**
  - **– To increase or decrease backlash for adjustment, displace drive bevel gear toward or away from drive bevel pinion by running in one adjuster and running out the other adjuster by equal amount.**
  - **– Tighten both adjusters further by one notch at a time.**



7) Measure composite preload of drive bevel pinion bearings and differential side bearings with torque wrench (2) or spring balance (1).
8) Calculate preload of differential side bearings by using the following equation.

Preload of differential side bearings	=	Composite preload	–	Preload of drive bevel pinion bearings

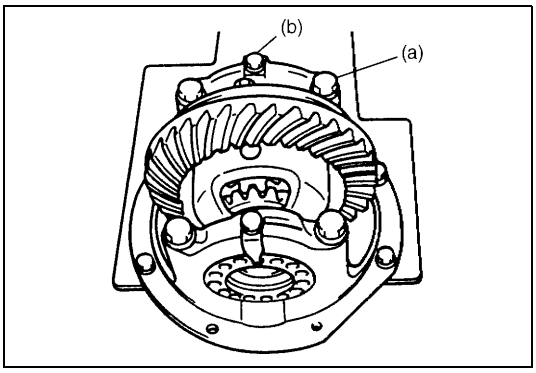
If preload of differential side bearings is specification shown below, adjust preload by tightening or loosening side bearing adjusters.

Preload of differential side bearings/Starting torque of drive pinion when measuring by torque wrench
: 0.2 – 0.3 N·m (2.0 – 3.0 kg-cm, 1.7 – 2.6 lb-in.)

Preload of differential side bearings/Starting torque of drive pinion when measuring by spring balance
: 4.0 – 6.0 N (0.4 – 0.6 kg, 0.9 – 1.3 lb)

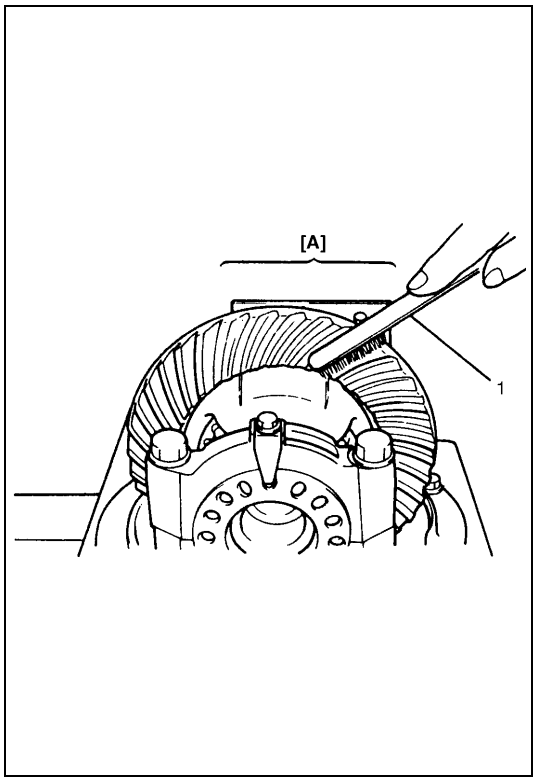
Special tool
(A) : 09900-23107
(B) : 09915-24550
(C) : 09922-75222

3. Companion flange
4. Socket



9) Torque bearing cap bolts to specified torque and install bearing lock plates.

Tightening torque
Bearing cap bolts
(a) : 85 N·m (8.5 kg-m, 61.5 lb-ft)
Lock plate bolts
(b) : 11.5 N·m (1.15 kg-m, 8.5 lb-ft)



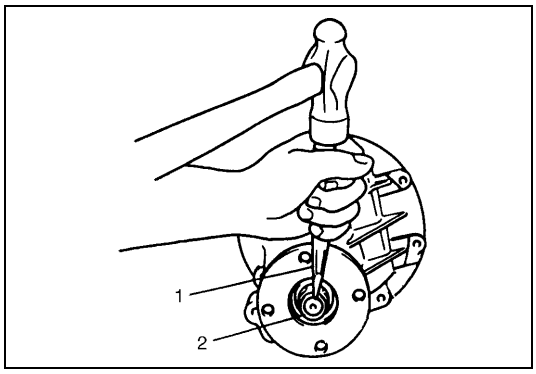
10) As final step, check gear tooth contact as follows.

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.

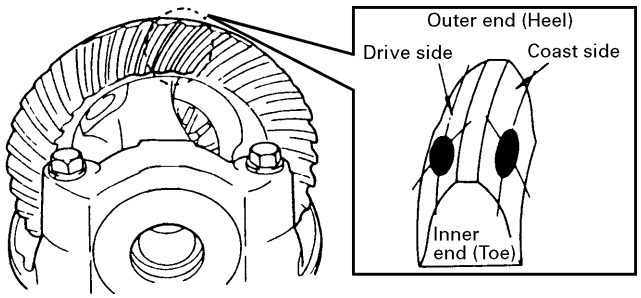
a) After cleaning tooth surface of about 10 teeth in [A] range, paint them with gear marking compound evenly by using brush (1) or sponge etc.

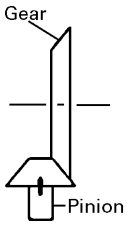
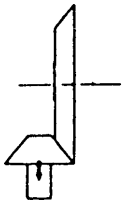
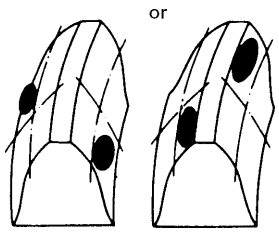
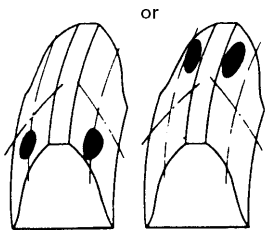
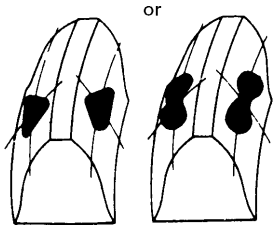
NOTE:
Be careful not to turn drive bevel gear more than one full revolution, for it will hinder accurate check.

b) Turn gear to bring its painted part in mesh with drive 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 following chart. If contact pattern is not normal, readjust or replace as necessary according to instruction in chart.



11) Upon completion of gear tooth contact check, caulk flange nut (2) with caulking tool (1) and hammer.

TOOTH CONTACT PATTERN	DIAGNOSIS AND REMEDY
	NORMAL

TOOTH CONTACT PATTERN	DIAGNOSIS AND REMEDY
	HIGH CONTACT Pinion is positioned too fat 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 carrier is too much or too little. The remedy is to replace the carrier with a new one.
	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.

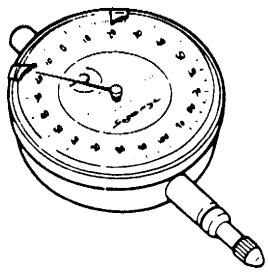
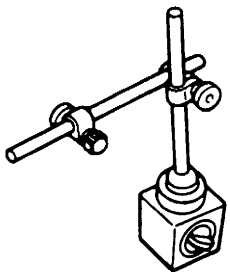
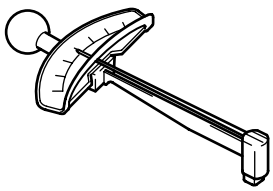
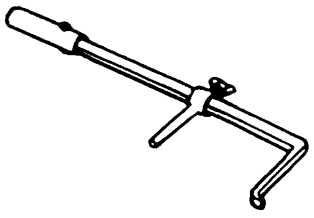
Tightening Torque Specification

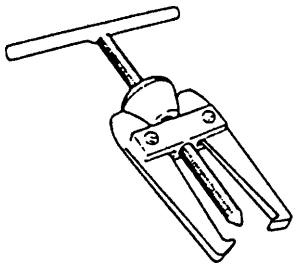
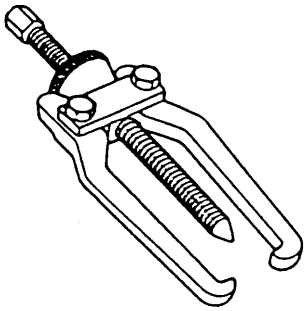
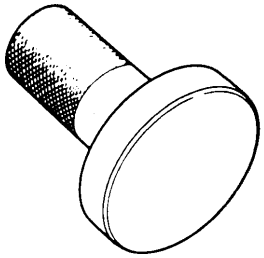
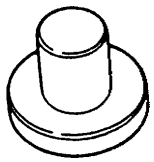
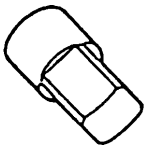
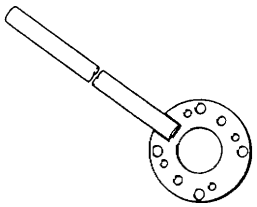
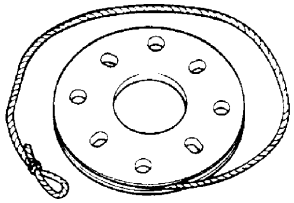
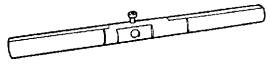
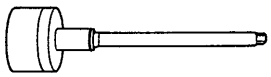
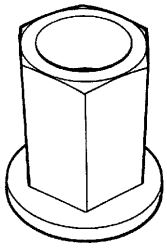
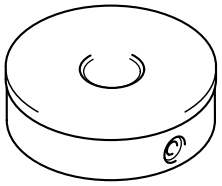
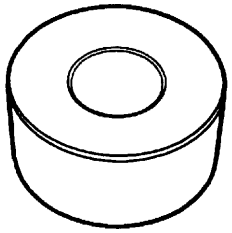
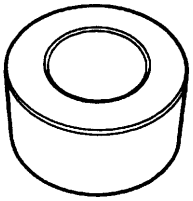
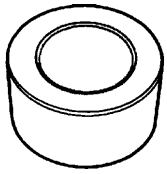
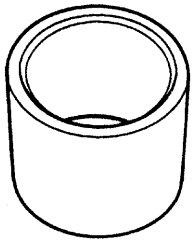
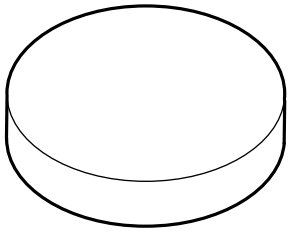
Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Rear differential oil drain plug	27	2.7	19.5
Rear differential oil level/filler plug	50	5.0	36.5
Differential carrier bolts	23	2.3	17.0
Propeller shaft bolts	50	5.0	36.5
Differential case bolts	41	4.1	30.0
Drive bevel gear bolts	85	8.5	61.5
Flange nut	100 – 400	10 – 40	72 – 289
Bearing cap bolts	85	8.5	61.5
Lock plate bolts	11.5	1.15	8.5

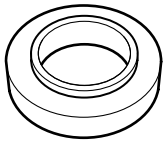
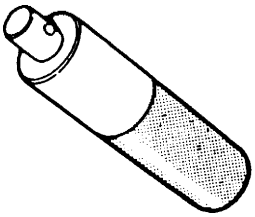
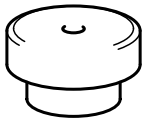
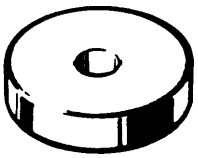
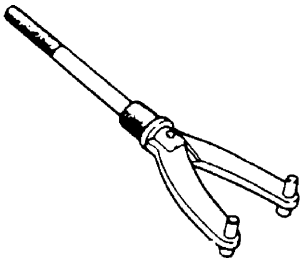
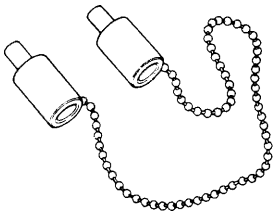
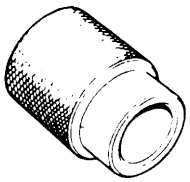
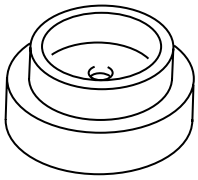
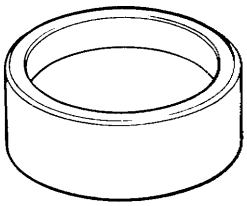
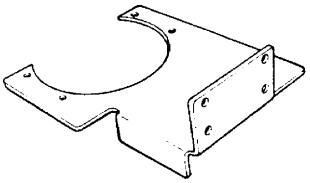
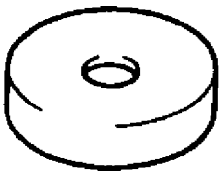
Required Service Material

Material	Recommended SUZUKI product (Part Number)	Use
Thread lock cement	THREAD LOCK CEMENT 1322 (99000-32110)	• Drive bevel gear bolts • Differential case bolts
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	Oil seal lip
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	• Rear differential drain plug • Mating surface of differential carrier • Mating surface of rear axle housing • Differential carrier bolts

Special Tool

			
09900-20607 Dial gauge	09900-20701 Magnetic stand	09900-23107 Torque wrench	09913-50121 Oil seal remover

 09913-60910 Bearing puller	 09913-65135 Bearing puller	 09913-75510 Bearing installer	 09913-85230 Bearing removing jig
 09915-24550 Adapter socket	 09922-66020 Flange holder	 09922-75222 Preload adjuster	 09922-76120 Dummy shaft
 09922-76140 Bevel pinion shaft	 09922-76150 Bevel pinion nut	 09922-76230 Bearing gear dummy	 09922-76310 Rear collar
 09922-76320 Rear collar	 09922-76340 Rear collar	 09922-76410 Front collar	 09922-76550 Gauge block

 09924-07730 Bearing installer	 09924-74510 Installer attachment	 09925-58210 Oil seal installer	 09926-37610-003 Bearing remover attachment
 09926-68310 Bearing installer	 09930-40113 Rotor holder	 09930-40120 Attachment	 09940-53111 Bearing installer
 09944-66010 Oil seal installer	 09944-66020 Bearing installer	 09944-76010 Differential carrier holder	 09951-16060 Bush remover
 09951-46010 Oil seal installer			

SECTION 8

BODY ELECTRICAL SYSTEM

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 "Air Bag 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 8-3
- Headlight 8-3
- Headlights with Leveling System (If Equipped) 8-3
- Rear Fog Light (If Equipped) 8-3
- Turn Signal and Hazard Warning Lights 8-4
- Clearance, Tail and License Plate Lights 8-4
- Back-up Light 8-4
- Brake Lights 8-5
- Tachometer and ECM 8-5
- Speedometer and VSS 8-5
- Fuel Meter and Fuel Gauge Unit 8-5
- Engine Coolant Temp. (ECT) Meter and ECT Sensor 8-5
- Oil Pressure Light 8-6
- Brake and Parking Brake Warning Light 8-6
- Seat Belt Warning Light 8-6
- Rear Window Defogger (If Equipped) 8-7
- Front Wiper and Washer 8-7
- Rear wiper and washer (If equipped) 8-7
- Power Window Control System (If Equipped) 8-7
- Power Door Lock System (If Equipped) 8-8
- Power Door Lock System with Keyless Entry System (If Equipped) 8-8
- Power Door Mirror Control System 8-9
- Door Mirror Heater (If Equipped) 8-9
- Front Seat Heater (If Equipped) 8-9
- Cigarette Lighter 8-9
- Interior Lights 8-10

On-Vehicle Service 8-11
- Headlight 8-11
  - Headlight switch 8-11
  - Headlight 8-12
  - Bulb replacement 8-12
  - Headlight aiming adjustment with screen 8-13
- Headlights with Leveling System (If Equipped) 8-14
  - Leveling switch 8-14
  - Leveling actuator 8-14
- Turn Signal and Hazard Warning Lights System 8-14
  - Turn signal and hazard warning lights system circuit inspection 8-14
  - Turn signal light switch 8-16
  - Hazard switch 8-16
- Stop (Brake) Lamp 8-16
  - Stop (brake) lamp switch 8-16
- Rear Fog Light (If Equipped) 8-17
  - Rear fog light switch 8-17
- Ignition Switch 8-17
- Combination Meter 8-18
- Fuel Meter/Fuel Gauge Unit 8-19
  - Fuel level meter 8-19
  - Fuel sender gauge 8-20
- Engine Coolant Temperature Meter and Sensor Unit 8-20
  - Engine coolant temperature meter 8-20
  - Engine coolant temperature sensor 8-21
- Oil Pressure Warning Light 8-21
  - Oil pressure switch 8-21
- Brake and Parking Brake Warning Light 8-22
  - Brake fluid level switch 8-22

Parking brake switch 8-22
Seat Belt Warning Light (If Equipped)..... 8-22
Seat belt switch 8-22
Rear Window Defogger..... 8-22
Defogger switch 8-22
Defogger wire..... 8-23
Wiper and Washer 8-24
Front wiper/washer switch..... 8-25
Wiper motor..... 8-28
Washer pump..... 8-29
Rear Wiper and Washer 8-30
Wiper and washer switch 8-30
Rear wiper motor..... 8-30
Rear wiper intermittent relay 8-31
Power Window Control System
(If Equipped) 8-33
Breaker..... 8-33
Power window main switch 8-33
Power Door Lock System (If Equipped)..... 8-34
Power door lock system component
location..... 8-34
Power door lock system operation
inspection..... 8-35
Power door lock system circuit
inspection..... 8-35
Driver side key cylinder switch 8-36
Power door lock actuator 8-37
Power Door Lock System with Keyless
Entry System (If Equipped).....8-38
Power door lock system with keyless
entry system component location 8-38
System Description.....8-38
Change of signal mode.....8-39
Keyless entry system operation
inspection.....8-39
Keyless entry system circuit inspection 8-40
Transmitter.....8-41
Driver side key cylinder switch.....8-42
Power door lock actuator 8-42
Door switch 8-42
Power Door Mirror Control System
(If Equipped) 8-43
Mirror switch.....8-43
Door mirror actuator.....8-43
Door Mirror Heater (If Equipped) 8-44
Mirror heater switch 8-44
Mirror heater (if equipped) 8-44
Front Seat Heater (If Equipped).....8-45
Seat heater switch (driver and
passenger side) 8-45
Seat heater wire.....8-45

Diagnosis

Headlight

Condition	Possible Cause	Correction
Headlights do not light up	Bulb blown	Check bulb.
	Headlight switch faulty	Check headlight switch.
	Headlight R and L fuses blown	After checking short circuit replace fuse.
	Wiring or grounding faulty	Repair circuit.
Only one headlight does not light up	Bulb blown	Check bulb.
	Headlight R or L fuse blown	After checking short circuit replace fuse.
	Headlight switch faulty	Check headlight switch.
	Wiring or grounding faulty	Repair circuit.
Only one beam (“Hi” or “Lo”) does not light	Bulb burnt out	Replace bulb.
	Lighting or dimmer switch faulty	Check switch.

Headlights with Leveling System (If Equipped)

Condition	Possible Cause	Correction
Both headlights do not move	“WIPER WASHER” fuse blown	After checking short circuit, replace fuse.
	Leveling switch faulty	Check switch or replace it as necessary.
	Supply voltage too low	Recharge or replace battery.
One of headlights (either Right or Left) does not move	Socket, wiring or grounding faulty	Repair as necessary.
	Actuator faulty	Replace actuator.
	Vehicle body around headlight deformed	Repair body.
	Headlight assembly itself deformed	Replace headlight assembly.

Rear Fog Light (If Equipped)

Condition	Possible Cause	Correction
Rear fog light does not come on	“FOG” or “REAR FOG” fuse blown	After checking short circuit, replace fuse.
	Rear fog light switch faulty	Check fog light switch.
	Lighting switch faulty	Check switch.
	Wiring or grounding faulty	Repair as necessary.
	Bulb blown	Replace.

Turn Signal and Hazard Warning Lights

Condition	Possible Cause	Correction
Flash rate high or one side only flashes	Bulb blown on “flash rate high”-side	Replace bulb.
	Incorrect bulb	Replace bulb.
	Turn signal/hazard warning relay faulty	Check system referring to “Turn Signal and Hazard Warning Lights System” in this section.
	Wiring or grounding faulty	
Flash rate low	Supply voltage low	Check charging system.
	Turn signal/hazard relay faulty	Check system referring to “Turn Signal and Hazard Warning Lights System” in this section.
One side only flashes	Turn signal switch faulty	Check system referring to “Turn Signal and Hazard Warning Lights System” in this section.
	Turn signal and hazard warning relay faulty	
	Wiring or grounding faulty	
No flashing	“HAZARD” and/or “METER” fuse(s) blown	After checking short circuit, replace fuse.
	Turn signal/hazard relay faulty	Check system referring to “Turn Signal and Hazard Warning Lights System” in this section.
	Combination switch or hazard switch faulty	
	Wiring or grounding faulty	

Clearance, Tail and License Plate Lights

Condition	Possible Cause	Correction
All lights do not light up	Bulb(s) blown	Check bulb.
	“TAIL” fuse blown	After checking short circuit, replace fuse.
	Wiring or grounding faulty	Repair circuit.
Some lights do not light up	Bulb(s) blown	Check bulb.
	Wiring or grounding faulty	Repair circuit.

Back-up Light

Condition	Possible Cause	Correction
Back-up lights do not light up	Bulb(s) blown	Check bulb.
	“BACK” fuse blown	After checking short circuit, replace fuse.
	Back-up light switch faulty	Check switch.
	Wiring or grounding faulty	Repair circuit.
Back-up lights stay on	Back-up light switch faulty	Check or replace switch.
	Wiring or grounding faulty	Repair circuit.

Brake Lights

Condition	Possible Cause	Correction
Brake lights do not light up	Bulb(s) blown	Check bulb.
	"STOP" fuse blown	After checking short circuit, replace fuse.
	Brake light switch faulty	Check switch.
	Wiring or grounding faulty	Repair circuit.
Brake lights stay on	Brake light switch faulty	Check, adjust or replace switch.
	Wiring or grounding faulty	Repair circuit.

Tachometer and ECM

Condition	Possible Cause	Correction
Tachometer shows no operation	"METER" fuse blown	After checking short circuit, replace fuse.
	Wiring or grounding faulty	Repair circuit.
	Tachometer faulty	Replace tachometer.
	ECM or other controller faulty	Check ECM and other controller.

Speedometer and VSS

Condition	Possible Cause	Correction
Speedometer shows no operation	"METER" fuse blown	After checking short circuit, replace fuse.
	VSS faulty	Check VSS.
	Wiring or grounding faulty	Repair.
	Speedometer faulty	Replace speedometer.

Fuel Meter and Fuel Gauge Unit

Condition	Possible Cause	Correction
Fuel meter shows no operation	"METER" fuse blown	After checking short circuit, replace fuse.
	Fuel gauge unit	Check fuel gauge unit.
	Fuel meter	Check fuel meter.
	Wiring or grounding	Repair circuit.

Engine Coolant Temp. (ECT) Meter and ECT Sensor

Condition	Possible Cause	Correction
Engine coolant temp. meter shows no operation	"METER" fuse blown	After checking short circuit, replace fuse.
	ECT meter faulty	Check ECT meter.
	ECT sensor faulty	Check ECT sensor.
	Wiring or grounding faulty	Repair circuit.

Oil Pressure Light

Condition	Possible Cause	Correction
Oil pressure warning light does not light up when ignition switch is on at engine off	Bulb in combination meter blown	Check bulb.
	"METER" fuse blown	After checking short circuit, replace fuse.
	Combination meter wiring circuit faulty	Check combination meter wiring circuit.
	Oil pressure switch faulty	Check oil pressure switch.
	Wiring or grounding faulty	Repair circuit.

Brake and Parking Brake Warning Light

Condition	Possible Cause	Correction
Brake warning light does not light up when fluid low level	Bulb in combination meter blown	Check bulb.
	"METER" fuse blown	After checking short circuit, replace fuse.
	Combination meter wiring circuit faulty	Check combination meter wiring circuit.
	Brake fluid level switch faulty	Check brake fluid level switch.
	Wiring or grounding faulty	Repair circuit.
Brake warning light does not light up when cranking (when ignition switch at ST position)	Ignition switch faulty	Check ignition switch.
	Combination meter wiring circuit faulty	Check combination meter wiring circuit.
	Wiring or grounding faulty	Repair circuit.
Brake warning light does not light up when parking brake pull up	Bulb in combination meter blown	Check bulb.
	"METER" fuse blown	After checking short circuit, replace fuse.
	Combination meter wiring circuit faulty	Check combination meter wiring circuit.
	Parking brake switch faulty	Check parking brake switch.
	Wiring or grounding faulty	Repair circuit.

Seat Belt Warning Light

Condition	Possible Cause	Correction
Seat belt warning light does not light up	Bulb in combination meter blown	Check bulb.
	Seat belt switch faulty	Check seat belt switch.
	"METER" fuse blown	After checking short circuit, replace fuse.
	Wiring or grounding faulty	Repair circuit.

Rear Window Defogger (If Equipped)

Condition	Possible Cause	Correction
Defogger does not operate	"REAR DEFG" fuse blown	After checking short circuit, replace fuse.
	Defogger wire faulty	Check heat wire.
	Rear window defogger switch faulty	Check switch.
	Wiring or grounding faulty	Repair circuit.

Front Wiper and Washer
Rear wiper and washer (If equipped)

Condition	Possible Cause	Correction
Wiper malfunctions or does not return to its original position	"WIPER-WASHER" fuse blown	After checking short circuit, replace fuse.
	Wiper motor faulty	Check wiper motor.
	Rear wiper intermittent relay faulty	Check relay.
	Wiper switch faulty	Check wiper switch.
	Wiring or grounding faulty	Repair circuit.
Washer malfunctions	Washer hose or nozzle clogged	Clean or repair clogged hose or nozzle.
	"WIPER-WASHER" fuse blown	After checking short circuit, replace fuse.
	Washer motor faulty	Check washer motor.
	Rear wiper intermittent relay faulty	Check relay.
	Wiper switch faulty	Check wiper switch.
	Wiring or grounding faulty	Repair circuit.

Power Window Control System (If Equipped)

Condition	Possible Cause	Correction
All power windows do not operate	"POWER WINDOW" fuse blown	After checking short circuit, replace fuse.
	Ignition (main) switch faulty	Check ignition (main) switch.
	Power window switch faulty	Check power window switch.
	Wiring or grounding faulty	Repair circuit.
Only one power window does not operate	Wiring and/or coupler faulty	Check wiring and/or coupler.
	Power window switch (main or sub) faulty	Check power window switch.
	Window actuator faulty	Check window actuator.
	Grounding faulty	Repair.

Power Door Lock System (If Equipped)

Condition	Possible Cause	Correction
All are not locked/ unlocked by only driver side key cylinder switch	"D/L" fuse blown	After checking short circuit, replace fuse.
	Driver side key cylinder switch faulty	Check system referring to "Power Door Lock System" in this section.
	Power door lock controller faulty	
	Wiring or ground faulty	
Only one door is not locked/unlocked	Power door lock actuator faulty	Check system referring to "Power Door Lock System" in this section.
	Wiring or grounding faulty	

Power Door Lock System with Keyless Entry System (If Equipped)

Condition	Possible Cause	Correction
All are not locked/ unlocked by only driver side key cylinder switch	"D/L" fuse blown	After checking short circuit, replace fuse.
	Driver side key cylinder switch faulty	Check system referring to "Power Door Lock System" in this section.
	Power door lock controller faulty	
	Wiring or ground faulty	
Only one door is not locked/unlocked	Power door lock actuator faulty	Check system referring to "Power Door Lock System" in this section.
	Wiring or grounding faulty	
All doors are not locked/unlocked by only keyless entry transmitter	Transmitter battery dead	Replace battery.
	Transmitter faulty	Replace transmitter.
	Code registration error	Perform code registration.
	Door switch faulty	Check system referring to "Power Door Lock System" in this section.
	Key remainder switch (in ignition switch) faulty	
	Power door lock controller faulty	
	Wiring or grounding faulty	
Turn signal lights are not flashed when doors are locked/ unlocked by transmitter	Keyless entry system is in interior light signal mode	Change signal mode referring to "Change of Signal Mode" in this section, if necessary.
	Turn signal and hazard warning system faulty	Check system referring to "Turn Signal and Hazard Warning Light System" in this section.
	Power door lock controller faulty	Check system referring "Power Door Lock System With Keyless Entry System" in this section.
	Wiring or grounding faulty	
Interior light does not turn ON when interior light switch is at DOOR position and doors are unlocked by transmitter	Power door lock controller faulty	Check system referring to "Power Door Lock System With Keyless Entry System" in this section.
	Wiring or grounding faulty	

Power Door Mirror Control System

Condition	Possible Cause	Correction
All power mirrors do not operate	"CIGAR" fuse blown	After checking short circuit, replace fuse.
	Power door mirror switch faulty	Check switch.
	Wiring or grounding faulty	Repair as necessary.
One power mirror does not operate	Power door mirror switch faulty	Check switch.
	Actuator (power door mirror motor) faulty	Check actuator.
	Wiring or grounding faulty	Repair as necessary.

Door Mirror Heater (If Equipped)

Condition	Possible Cause	Correction
All door mirrors mist when rear defogger switch is ON	"Cigar" fuse blown	After checking short circuit, replace fuse.
	Rear defogger switch faulty	Check switch.
	Door mirror heater relay faulty	Check relay
	Wiring or grounding faulty	Repair circuit.
One door mirror mists when rear defogger switch is ON	Mirror heater faulty	Check actuator.
	Wiring or grounding faulty	Repair circuit.

Front Seat Heater (If Equipped)

Condition	Possible Cause	Correction
Both seat back and cushion do not become hot although seat heater switch is ON	"Heater" and/or "Seat Heater" fuse(s) blown	After checking short circuit, replace fuse.
	Seat heater switch faulty	Check switch.
	Wiring or grounding faulty	Repair circuit.
Only seat back does not become hot although seat heater switch is ON	Seat heater circuit in seat back faulty	Check seat heater.
	Wiring or grounding faulty	Repair circuit.
Only seat cushion does not become hot although seat heater switch is ON	Seat heater circuit in seat back and/or seat cushion faulty	Check seat heater.
	Wiring or grounding faulty	Repair circuit.

Cigarette Lighter

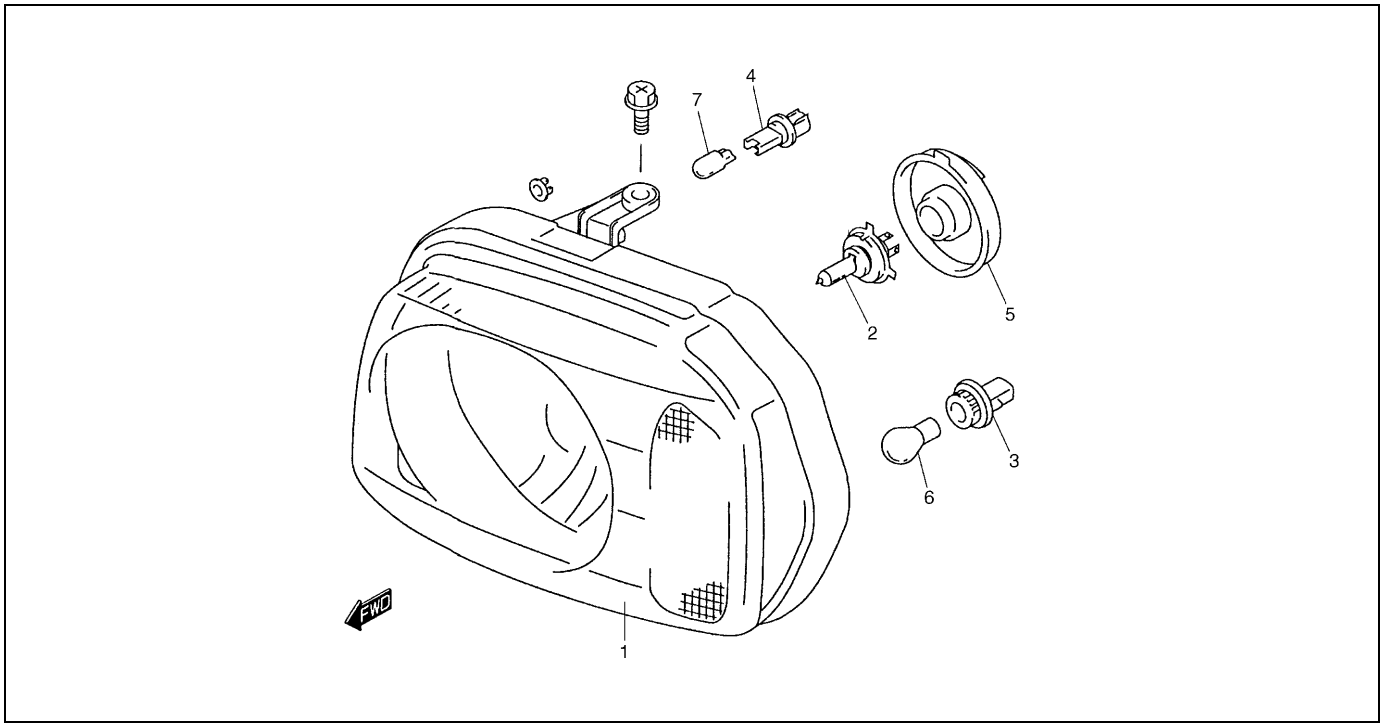
Condition	Possible Cause	Correction
Cigarette lighter shows no operation	"CIGAR" fuse blown	After checking short circuit, replace fuse.
	Ignition switch faulty	Check ignition switch.
	Cigarette lighter faulty	Check cigarette lighter.
	Wiring or grounding faulty	Repair circuit.

Interior Lights

Condition	Possible Cause	Correction
Interior lights do not light up	Bulbs blown	Replace.
	“Dome” fuse blown	After checking short circuit, replace fuse.
	Interior light switch faulty	Check switch.
	Door switch faulty	Check switch.
	Wiring or grounding	Repair.
One of interior light does not light up	Bulb blown	Replace.
	Interior light switch faulty	Check switch.
	Door switch faulty	Check switch.
	Wiring or grounding	Repair.

On-Vehicle Service

Headlight

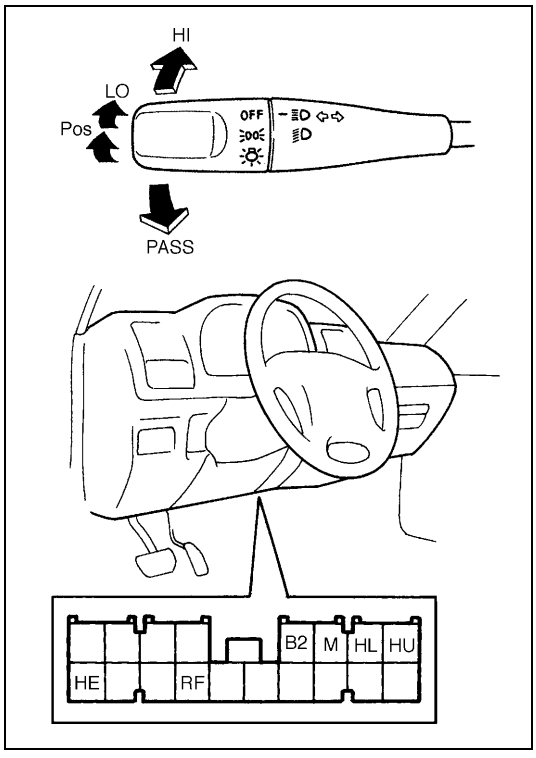


1. Headlight assembly	3. Turn signal light socket	5. Socket cover	7. Position light bulb
2. Halogen bulb	4. Position light socket	6. Turn signal light bulb	

Headlight switch

INSPECTION

1) Disconnect negative (–) cable at battery.
2) Disconnect combination switch lead wire couplers from junction/fuse block.
3) Use a circuit tester to check the continuity at each switch position shown below.



Switch Position \ Terminal / Wire Color	HE	HU	HL	RF
	B	R	R/W	Br/Y
Passing	○—○			
Low Beam			○—○	
Main (High) Beam		○—		—○

Switch Position \ Terminal / Wire Color	HE	RF	B2	M
	B	Br/Y	W	R/Y
OFF				
☼			○—○	
☀	○—○		○—	—○

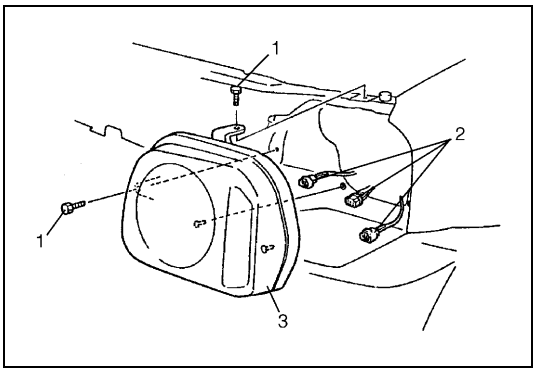
REMOVAL AND INSTALLATION

Refer to “Combination Switch/Contact Coil and Combination Switch Assembly” in Section 3C for details.

Headlight

REMOVAL

1) Disconnect negative cable at battery.
2) Remove front bumper.



3) Remove headlight mounting bolts (1).
4) Detach headlight assembly from vehicle.
5) Disconnect couplers (2) from headlight assembly.
6) Remove headlight assembly (3).

INSTALLATION

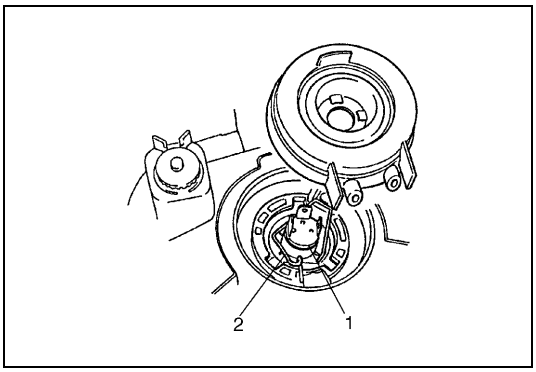
Reverse removal procedure for installation.

Bulb replacement

WARNING:

- **To avoid danger of being burned, don't touch when the bulb is hot.**
- **Don't touch glass surface of bulb, to avoid deteriorate as the case may be unclear when bulb light on at dirty condition.**

1) Disconnect negative (–) cable at battery.
2) Disconnect harness from bulb.

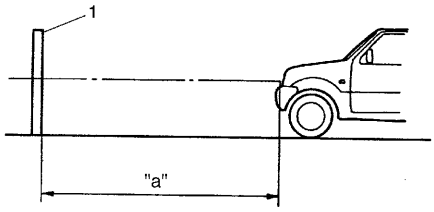


3) Remove socket cover and bulb (1).

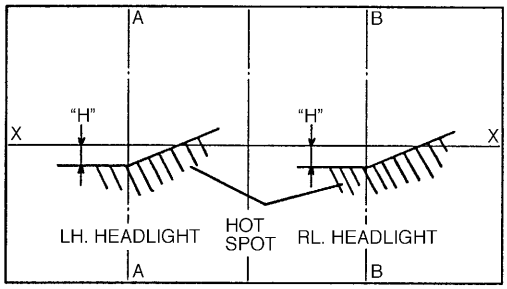
2. Spring

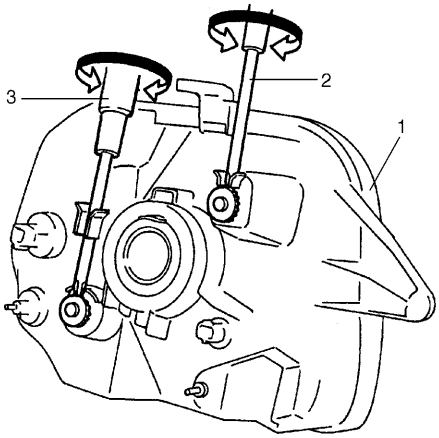
4) Replace bulb and assemble all removed parts.

Headlight aiming adjustment with screen



[A]





NOTE:

- **Unless otherwise obligated by local regulations, adjust headlight aiming according to following procedure.**
- **After replacing headlight, be sure to adjust aiming.**

1) Before adjustment, make sure the following.
   a) Place vehicle on a flat surface in front of screen (1) ahead of headlight surface.

   Distance between screen and headlight
   "a" : 10 m (32.8 ft.)

   b) Adjust air pressure of all tires to a specified value respectively.
   c) Bounce vehicle body up and down by hand to stabilize suspension.
   d) Carry out with one driver aboard.

   Driver's weight : 75 kg (165 lb)

   e) Turn headlight leveling switch to "0" position.

2) Check to see if hot spot (high intensity zone) of each low beam axis falls as illustrated.

   Hot spot specification
   "H" : Approx. 130 mm (5.15 in.)

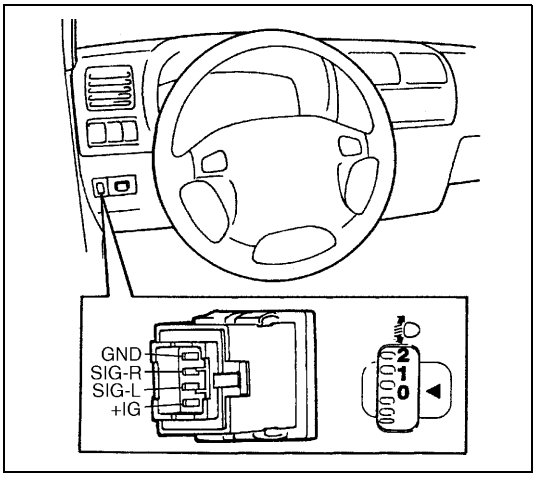
3) If headlight aiming is not set properly, align it to specification by adjusting aiming screw and aiming gear.

1.	Headlight assembly
2.	Aiming (for right/left adjustment)
3.	Aiming (for up/down adjustment)
[A] :	The illustration shows LH steering vehicle. And RH steering vehicle is symmetrical
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

Headlights with Leveling System (If Equipped)

Leveling switch

INSPECTION



Check for resistance between terminals at each switch position as shown below. If check result is not as specified, replace.

Position	Terminals	Resistance (KΩ)
–	+IG and GND	3.7 – 5.6
0	• SIG-R and GND • SIG-L and GND	4.0 – 4.5
1		3.4 – 3.8
2		2.8 – 3.2
3		2.2 – 2.5
4		1.6 – 1.8

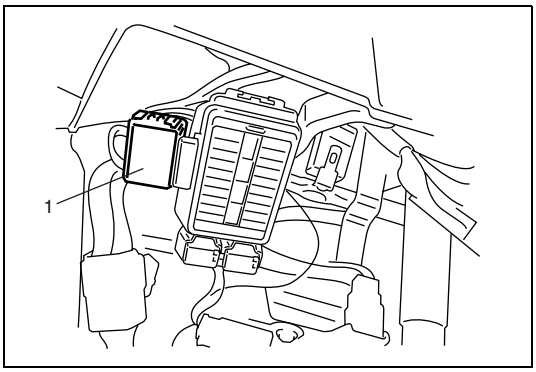
Leveling actuator

INSPECTION

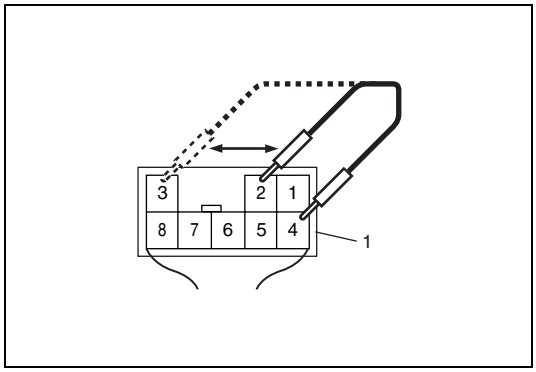
All headlight system couplers connected including leveling actuator and switch, and at Ignition switch ON, listen to the leveling actuator sound on both actuators according to the movement of the leveling switch. If no sound is heard with the movement of the leveling switch, replace headlight assembly.

Turn Signal and Hazard Warning Lights System

Turn signal and hazard warning lights system circuit inspection



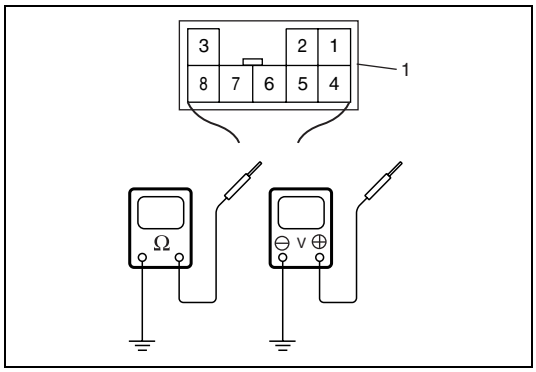
1) Disconnect negative (–) cable from battery.
2) Disconnect turn signal and hazard warning relay (1) connector “G34”.



3) Connect negative (–) cable to battery.

4) Confirm that right or left side turn signal light turn on when connect “G34-4” terminal to “G34-2” or “G34-3” terminal with service wire.
If turn signal light does not turn on, check bulb or repair applicable circuit.

1. Turn signal and hazard warning relay connector “G34” viewed from harness side



5) Check that voltage and continuity between the following terminals and body ground are specifications under each condition.
If check result is not as specified, repair applicable circuit.
If check result is OK, replace turn signal and hazard warning relay and recheck.

1. Turn signal and hazard warning relay connector “G34” viewed from harness side

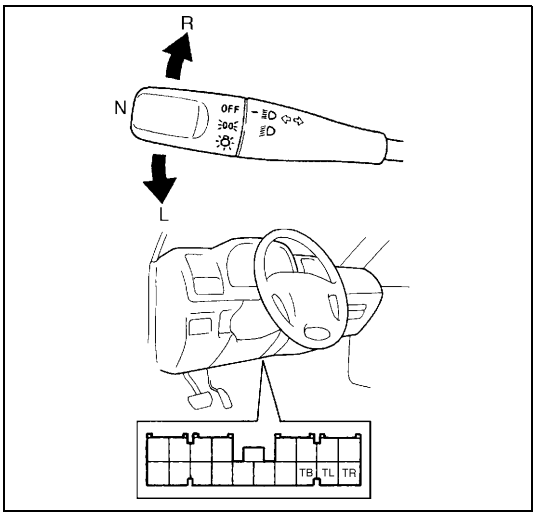
Turn signal and hazard warning lights system circuit check

Terminal	Wire	Circuit	Specification	Condition
G34-1	BLK/RED	Ignition switch circuit	10 – 14 V	Ignition switch is ON position.
			0 – 1 V	Ignition switch is ON position.
G34-4	WHT/BLU	Power supply for turn signal and hazard warning lights	10 – 14 V	–
G34-5	GRN/YEL	Right side turn signal light switch circuit	Continuity	Turn signal light switch is R position.
			No continuity	Turn signal light switch is N or L position.
G34-6	GRN/RED	Left side turn signal light switch circuit	Continuity	Turn signal light switch is L position.
			No continuity	Turn signal light switch is N or R position.
G34-7	BLK	Ground	0 – 1 V	–
G34-8	YEL/BLU	Hazard warning switch and keyless entry system (if equipped) circuits	Continuity	Hazard warning switch is ON position.
				Approx. 1.2 sec. after pushing UNLOCK button on transmitter.
				Approx. 0.6 sec. after pushing LOCK button on transmitter.
			No continuity	Hazard warning switch is OFF position.

Turn signal light switch

INSPECTION

1) Disconnect negative cable at battery.
2) Disconnect combination switch lead wire coupler.
3) Use a circuit tester to check the continuity at each switch position shown below.



Switch Position \ Terminal / Wire Color	TL	TB	TR
	G/R	G	G/Y
L	○—○		
N			
R		○—○	

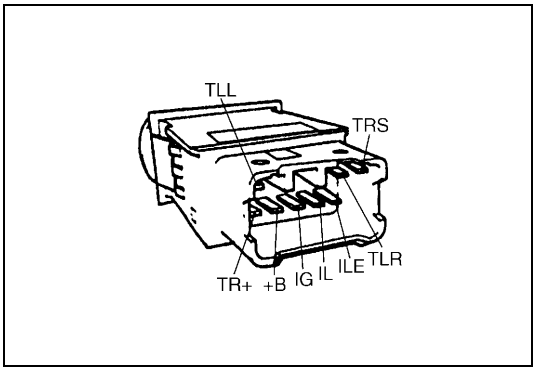
[A] : LH steering vehicle shown

REMOVAL AND INSTALLATION

Refer to “Combination Switch/Contact Coil and Combination Switch Assembly” in Section 3C for details.

Hazard switch

INSPECTION



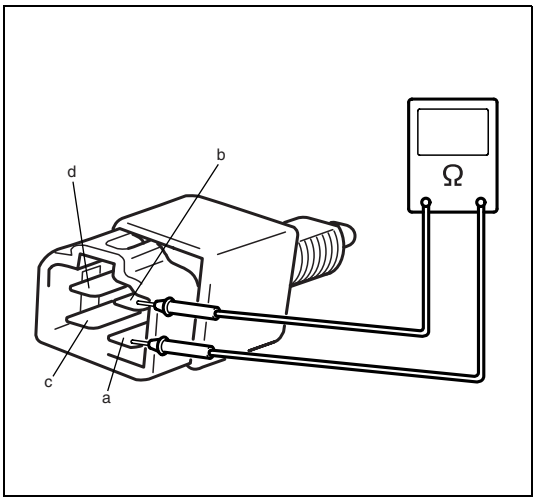
Check continuity between terminals at each switch position shown below.

Hazard SW \ Terminal	+B	TR+	IG	TRS	TLL	TLR	IL	ILE
OFF		○—○					○—○	
ON	○—○						○—○	

Stop (Brake) Lamp

Stop (brake) lamp switch

INSPECTION



Check stop lamp (brake) switch for continuity as shown below.
If check result is not as specified, replace switch.

Type 1 (Connector color: black):

Shaft (1) \ Terminal	a	b	c	d
FREE	○	○	○	○
PUSH				

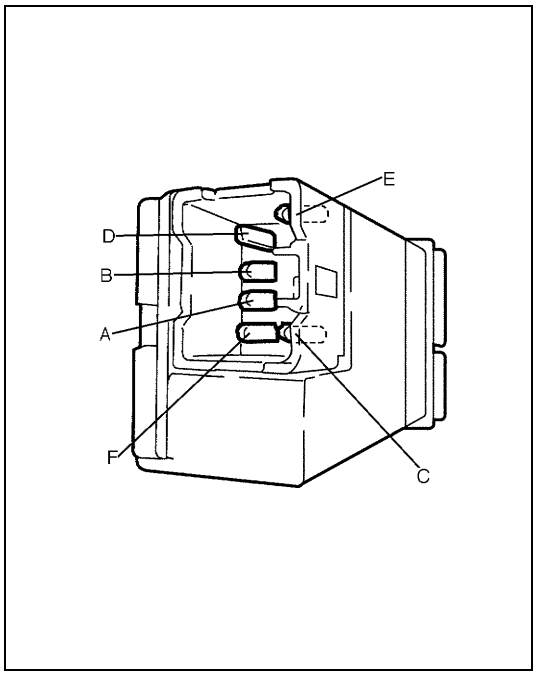
Type 2 (Connector color: blue):

Shaft (1) \ Terminal	a	b	c	d
FREE	○—○		○—○	
PUSH				

Rear Fog Light (If Equipped)

Rear fog light switch

INSPECTION



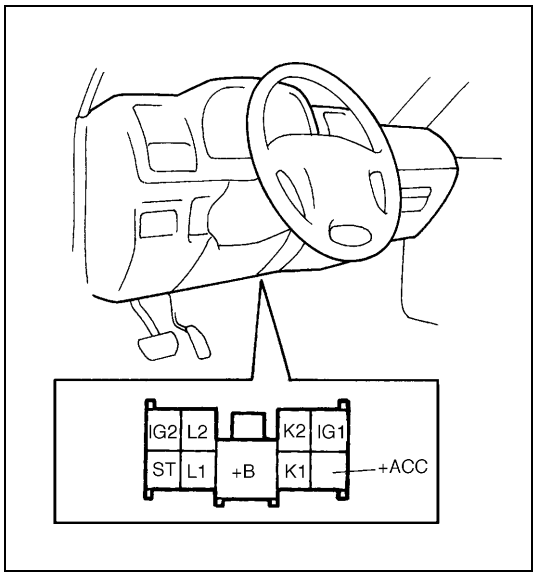
Use a circuit tester to check switch for continuity between terminals shown below.

RR FOG SW \ TERMINAL / OFF SW		A	B	C	D	E	F
FREE	FREE		○		○	○	○
	PUSH		○	○	○	○	○
PUSH	FREE	○	○		○		○
	PUSH		○	○	○	○	○
RETURN	FREE	○	○		○		○
	PUSH		○	○	○	○	○

Ignition Switch

INSPECTION

1) Disconnect negative cable at battery.
2) Disconnect ignition switch lead wire coupler.
3) Use a circuit tester to check the continuity at each switch position. If any continuity is not obtained, replace ignition switch.



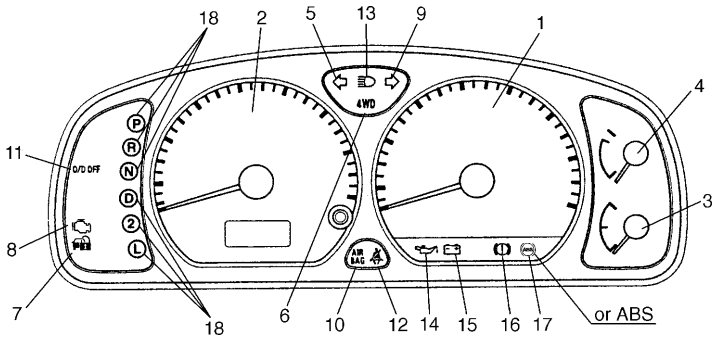
Key Position \ Terminal / Wire Color		+B1	+ACC	IG1	IG2	ST	L1	L2	K1	K2
		W/G	Bl	B/W	Y/B	B/Y	B	B	G	G
OUT	LOCK	○								
IN	ACC	○	○							
	ON	○	○	○	○				○	○
	START	○		○		○	○	○		

ACC : Accessory

REMOVAL AND INSTALLATION

Refer to “Steering Lock Assembly (Ignition Switch)” in Section 3C for details.

Combination Meter

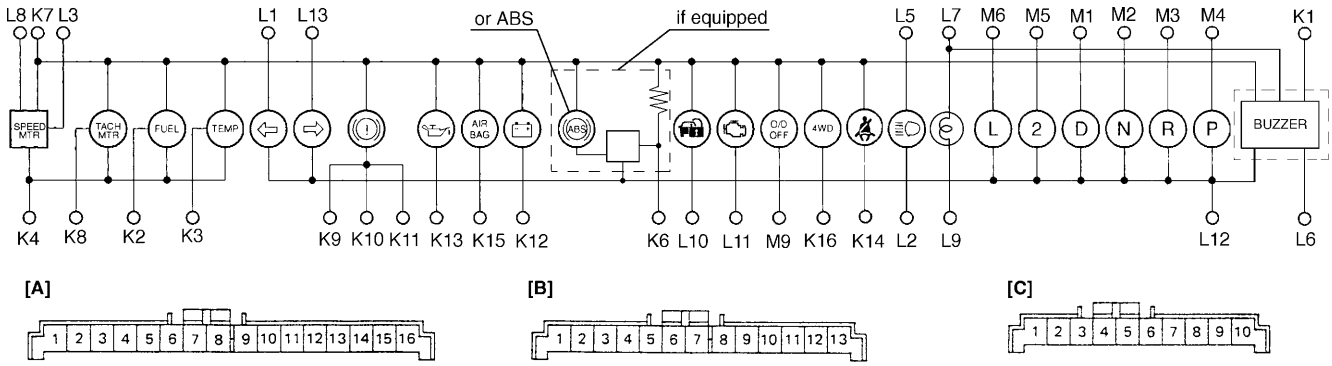


1. Tachometer	7. Immobilizer warning light (if equipped)	13. High beam light
2. Speedometer	8. CHECK ENGINE light	14. Oil pressure warning light
3. Fuel lever meter	9. Turn signal pilot light (RH)	15. Charge warning light
4. Water temperature meter	10. AIR BAG warning light (if equipped)	16. Brake warning light
5. Turn signal pilot light (LH)	11. O/D OFF light (A/T vehicle only)	17. ABS warning light (if equipped)
6. 4WD indicator (if equipped)	12. Fasten seat belt light (if equipped)	18. Shift position indicator (A/T vehicle, if equipped)

COMBINATION METER INTERNAL CIRCUITS AND COUPLERS

NOTE:

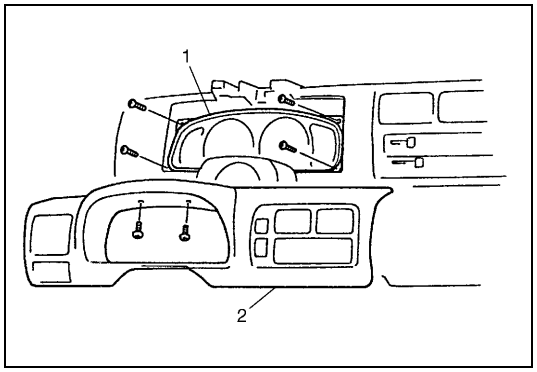
Terminal arrangement of coupler viewed from harness side.



[A] : Connector K		[B] : Connector L		[C] : Connector M	
1. To ignition switch	Bl/G	1. To combination switch (turn L)	G/R	1. To transmission range switch (A/T vehicle, if equipped)	G/R
2. To fuel level gauge	Y/R	2. To combination switch (dimmer sw)	R	2. To transmission range switch (A/T vehicle, if equipped)	Or
3. To ECT sensor	Y/W	3. To VSS	Y/G	3. To transmission range switch (A/T vehicle, if equipped)	R
4. To ground	B/Or	4. Blank	–	4. To transmission range switch (A/T vehicle, if equipped)	Or/B
5. Blank	–	5. To main fuse	W/Bl	5. To transmission range switch (A/T vehicle, if equipped)	G
6. To ABS control module (if equipped)	R/Bl	6. To door switch	B/Y	6. To transmission range switch (A/T vehicle, if equipped)	G/W
7. To ignition switch	B/W	7. To combination switch (dimmer sw)	R/Y	7. Blank	–
8. To ECM	Br	8. To main fuse	W	8. Blank	–
9. To ignition switch	V/R	9. To ground	B	9. To TCM (A/T vehicle, if equipped)	Bl/Y
10. To brake fluid level switch	R/B	10. To ECM (if equipped)	R/G	10. Blank	–
11. To parking brake switch	R/G	11. To ECM	V/Y		
12. To alternator	W/R	12. To ground	B		
13. To oil pressure switch	Y/B or Y/Bl	13. To combination switch (turn R)	G/Y		
14. To seat belt switch (if equipped)	Lg				
15. To SDM (if equipped)	Bl				
16. To 4WD control module (if equipped)	Bl				

REMOVAL

1) Disconnect negative cable at battery.
2) Loosen steering column mounting bolts and nuts referring to “Steering Column Assembly” in Section 3C.



3) Remove meter cluster panel (2). Make sure to disconnect all couplers of switches and wires of cigarette lighter on meter cluster panel (2).
4) Disconnect couplers from combination meter (1).
5) Remove combination meter (1).

INSTALLATION

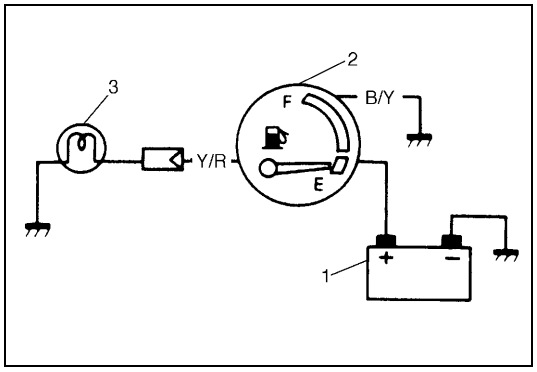
Reverse removal procedure for installation.

Fuel Meter/Fuel Gauge Unit

Fuel level meter

INSPECTION

1) Disconnect Y/R lead wire going to gauge unit.
2) Use a bulb (12 V 3.4 W) (3) in position to ground lead wire as illustrated.

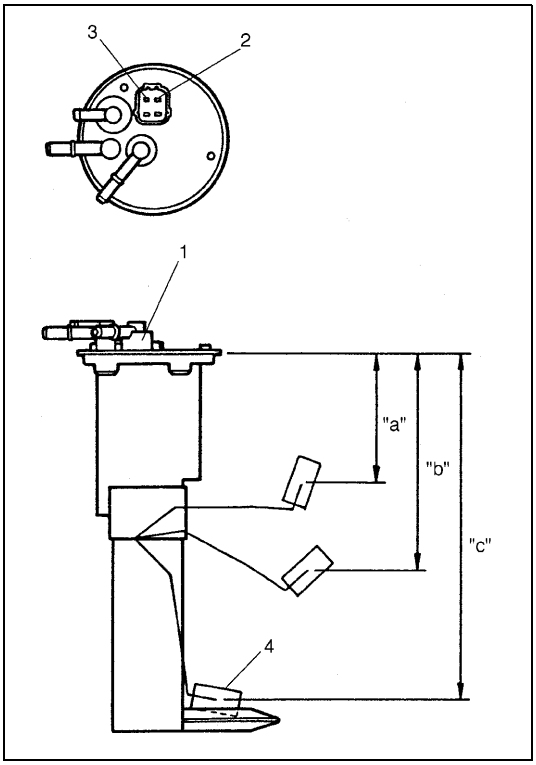


1.	Battery
2.	Fuel meter

3) Turn ignition switch ON.
   Make sure that bulb is lighted with meter pointer fluctuating several seconds thereafter. If meter is faulty, replace.

Fuel sender gauge

INSPECTION



1) Remove fuel pump assembly (1) referring to “Fuel Pump Assembly” in Section 6C.
2) Use an ohmmeter to confirm that resistance of sender gauge unit changes with change of float position. If the measured value is out of specification, replace.

Fuel sender gauge specification

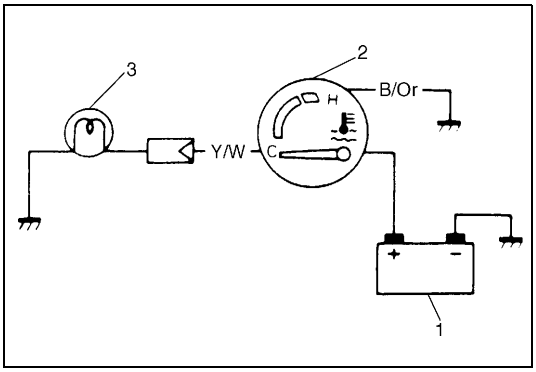
Float Position		Resistance (Ω)
Full Upper “a”	91.4 mm (4.03 in.)	2 – 4
Middle (1/2) “d”	154.8 mm (6.20 in.)	29.5 – 35.5
Full Lower “c”	263.5 mm (8.60 in.)	119 – 121

2. Fuel level gauge “+” terminal
3. Fuel level gauge “–” terminal
4. Float

Engine Coolant Temperature Meter and Sensor Unit

Engine coolant temperature meter

INSPECTION



1) Disconnect Y/W lead wire going to sender gauge installed to thermostat case.
2) Use a bulb (12 V 3.4 W) (3) in position to ground wire as illustrated.

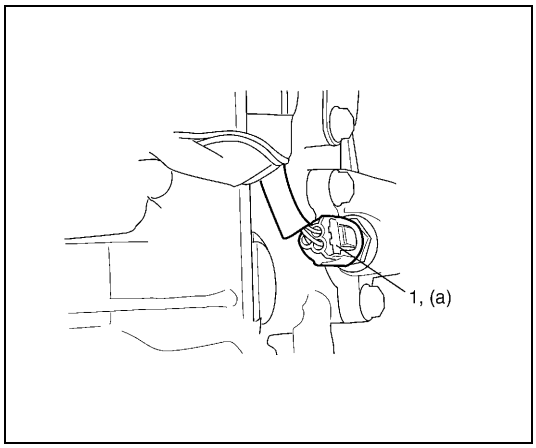
1. Battery
2. Engine coolant temperature meter

3) Turn main switch ON. Confirm that bulb is lighted with meter pointer fluctuating several seconds thereafter.
   If not, replace.

Engine coolant temperature sensor

REMOVAL

1) Disconnect negative cable at battery.
2) Drain cooling system.



3) Disconnect coupler from ECT sensor (1).
4) Remove ECT sensor from intake manifold.

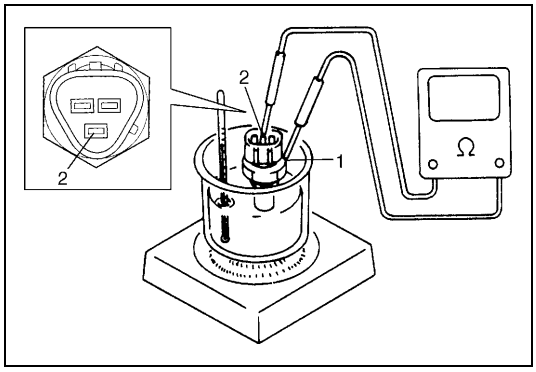
INSTALLATION

Reverse removal procedure for installation noting the following points.

- Clean mating surface of sensor and intake manifold.
- Check O-ring for damage and replace if necessary.
- Tighten ECT sensor to specified torque.

Tightening torque
ECT sensor (a) : 15 N·m (1.5 kg-m, 11.0 lb-ft)

INSPECTION



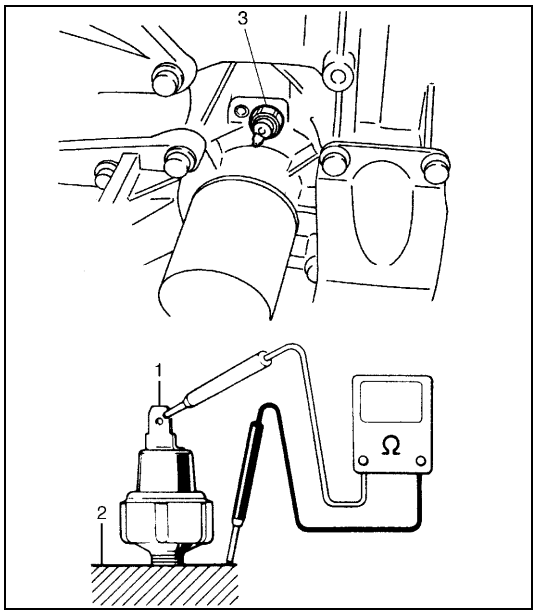
1) Warm up ECT sensor (1) observing resistance between sensor terminal (2) and sensor unit (1). Resistance should be decreased with increase of its temperature.
2) Check resistance between sensor terminal (2) and sensor unit (1) as shown. If check result is not as specified, replace sensor.

ECT sensor specification
Temperature : 50 °C (122 °F)
Resistance : 136 – 216 Ω

Oil Pressure Warning Light

Oil pressure switch

INSPECTION



Use an ohmmeter to check switch continuity.

Oil pressure switch specification
During Engine Running : No continuity (∞ Ω)
At Engine Stop : Continuity (0 Ω)

1.	To wiring harness
2.	Cylinder block
3.	Oil pressure switch

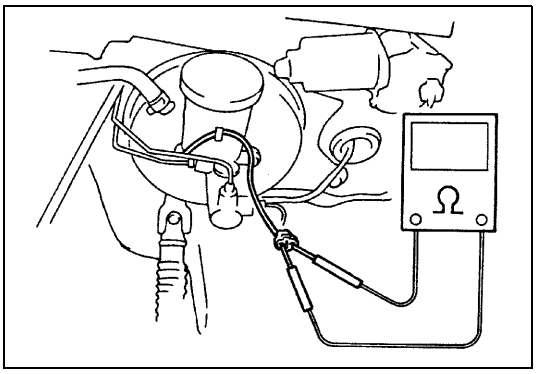
REMOVAL AND INSTALLATION

Refer to “Oil Pressure Check” in Section 6A1.

Brake and Parking Brake Warning Light

Brake fluid level switch

INSPECTION

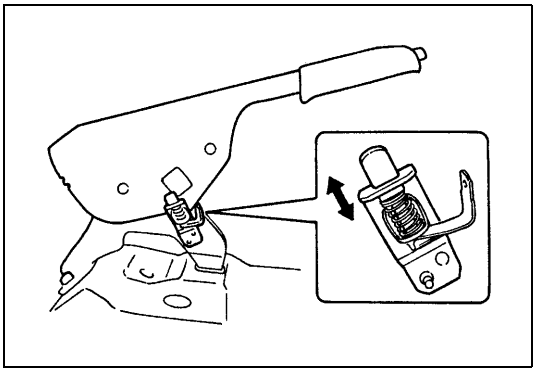


Use an ohmmeter to check switch for continuity.
If found defective, replace switch.

Brake fluid level switch specification
OFF position (float up) : No continuity
ON position (float down) : Continuity

Parking brake switch

INSPECTION



Use an ohmmeter to check switch for continuity.
If found defective, replace switch.

Parking brake switch specification
OFF position (parking brake released) : No continuity
ON position (parking brake lever pulled up) : Continuity

Seat Belt Warning Light (If Equipped)

Seat belt switch

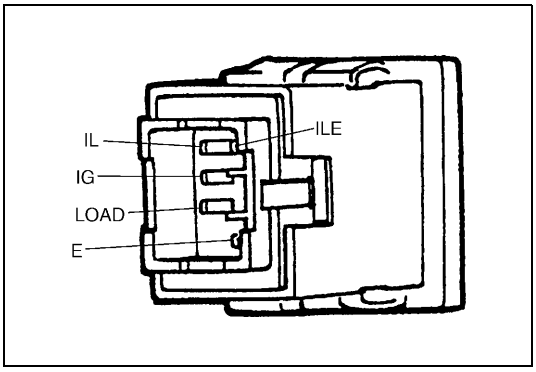
INSPECTION

Refer to “Front Seat Belt without Pretensioner” in Section 10A for inspection.

Rear Window Defogger

Defogger switch

INSPECTION

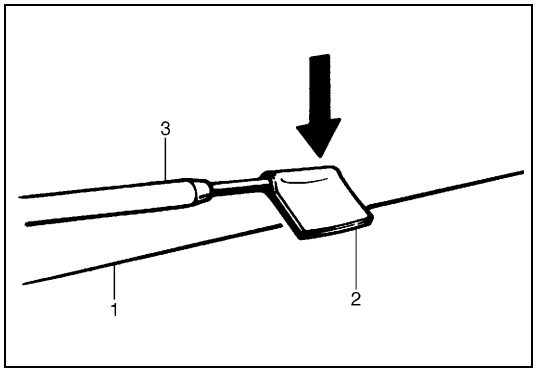


Use a circuit tester to check defogger switch for continuity.
If switch has no continuity between terminals, replace.

Terminal / Defogger SW	IG	E	LOAD	IL	ILE
OFF		○—○	○—○	○—○	
ON	○—○	○—○	○—○	○—○	

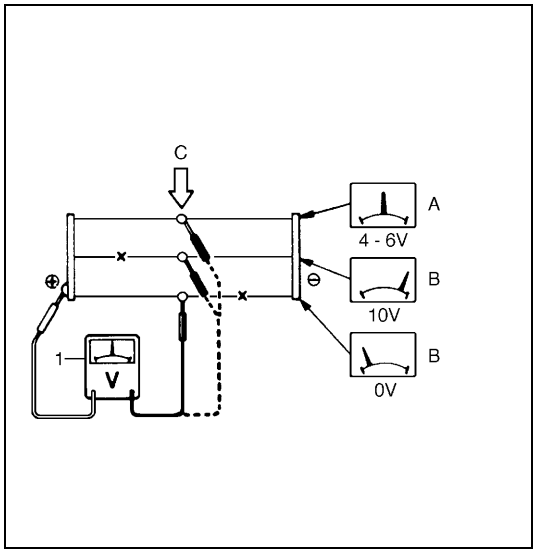
Defogger wire

INSPECTION



NOTE:

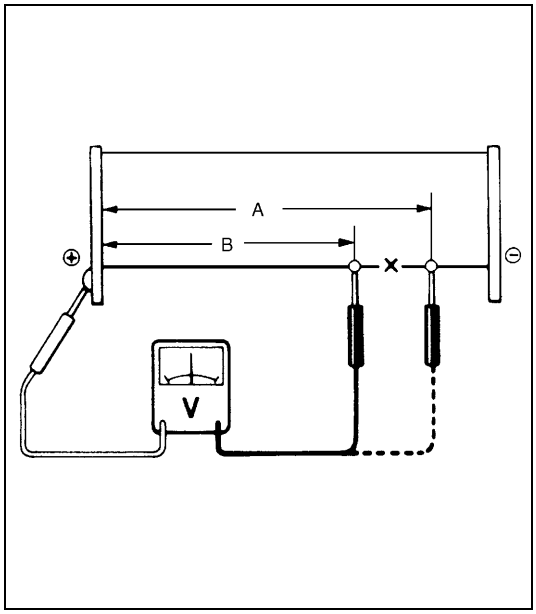
- **When cleaning rear window glass, use a dry cloth to wipe it along heat wire (1) direction.**
- **When cleaning glass, do not use detergent or abrasive-containing glass cleaner.**
- **When measuring wire voltage, use a tester with negative probe (3) wrapped with a tin foil (2) which should be held down on wire by finger pressure.**



1) Check defogger wire damage as follows.
   a) Turn main switch ON.
   b) Turn defogger switch ON.
   c) Use a voltmeter (1) to check voltage at the center of each heat wire, as shown.
      If measured voltage is 10 V, wire must be damaged between its center and positive end. If voltage is zero, wire must be damaged between its center and ground.

Voltage	Criteria
Approx. 5 V	Good (No break in wire)
Approx. 10 V or 0 V	Broken wire

A. Good
B. Broken wire
C. At center

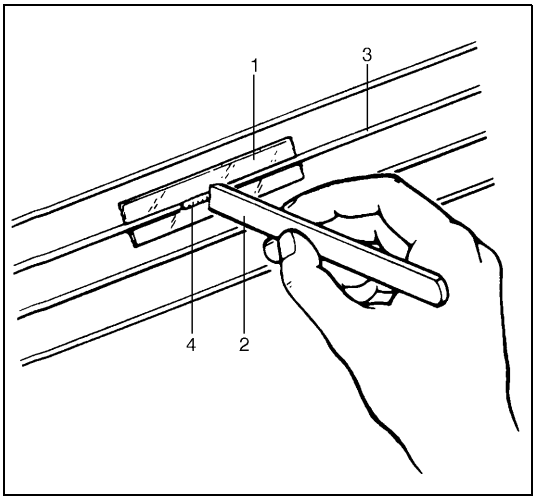


2) Locate damage in defogger wire as follows.
   a) Touch voltmeter positive (+) lead to heat wire positive terminal end.
   b) Touch voltmeter negative (–) lead with a foil strip to heat wire positive terminal end, then move it along wire to the negative terminal end.
   c) The place where voltmeter fluctuates from zero to several volts is where there is damage.

NOTE:

If heat wire is free from damage, voltmeter should indicate 12 V at heat wire positive terminal end and its indication should decrease gradually toward zero at the other terminal (ground).

A. Several volts
B. 0 volt

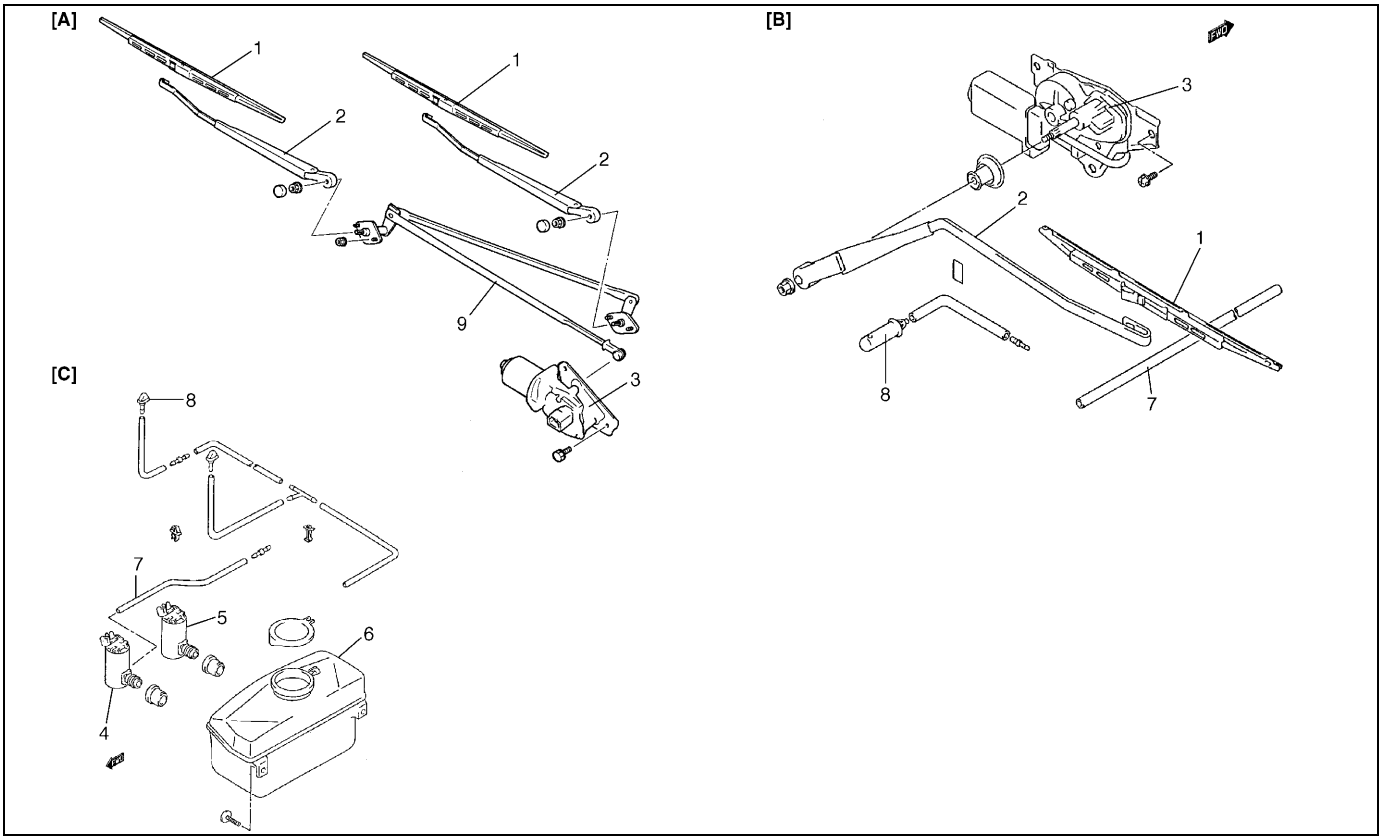


REPAIR

1) Use white gasoline for cleaning.
2) Apply masking tape (1) at both upper and lower sides of heat wire to be repaired.
3) Apply commercially-available repair agent (4) with a fine-tip brush.
4) Two to three minutes later, remove masking tapes previously applied.
5) Leave repaired heat wire as it is for at least 24 hours before operating defogger again.

2.	Wood spatula
3.	Broken wire

Wiper and Washer

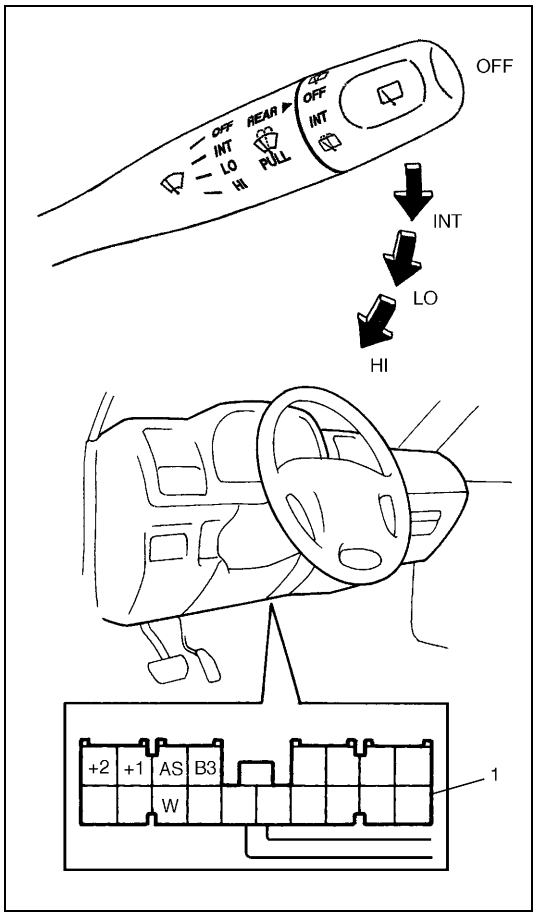


[A] : Front wiper	1. Wiper blade	4. Front washer pump	7. Washer hose
[B] : Rear wiper	2. Wiper arm	5. Rear washer pump	8. Washer nozzle
[C] : Washer	3. Wiper motor	6. Washer tank	9. Wiper link

Front wiper/washer switch

INSPECTION

1) Disconnect negative cable at battery.
2) Disconnect combination switch lead wire coupler.
3) Use a circuit tester to check the continuity at each switch position as shown below.



Wiper SW \ Terminal / Wire Color	B3	+2	+1	As
	Y/Bl	Bl/R	Bl	Bl/W
OFF			○—○	○—○
INT			○—○	○—○
LO	○—	——	—○	
HI	○—	—○		

Washer SW \ Terminal / Wire Color	B3	W
	Y/Bl	Bl/B
OFF		
ON	○—	—○

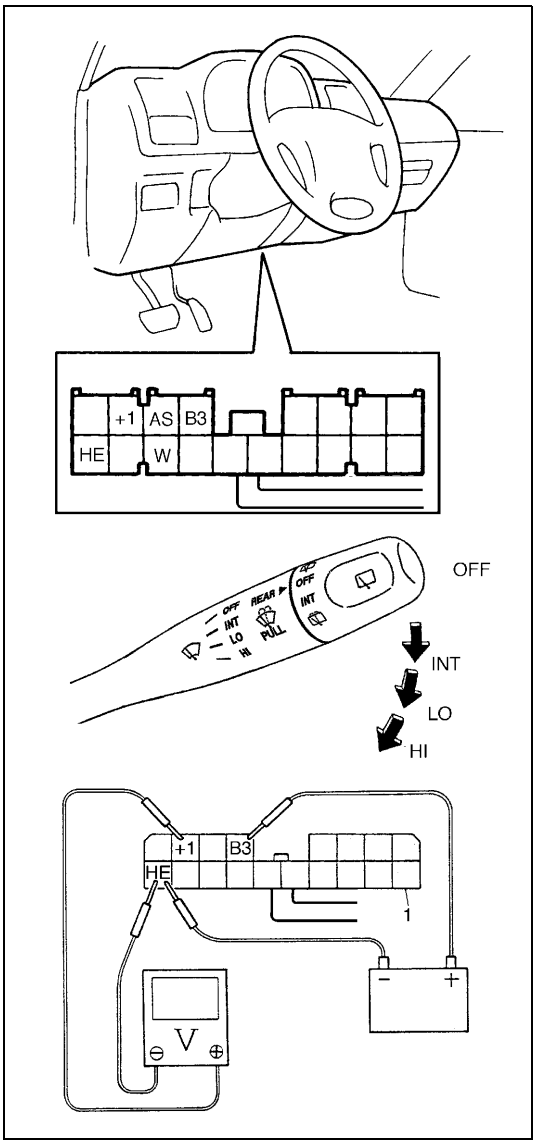
REMOVAL AND INSTALLATION

Refer to “Combination Switch/Contact Coil and Combination Switch Assembly” in Section 3C for details.

1. Combination switch lead wire coupler terminal viewed from terminal side

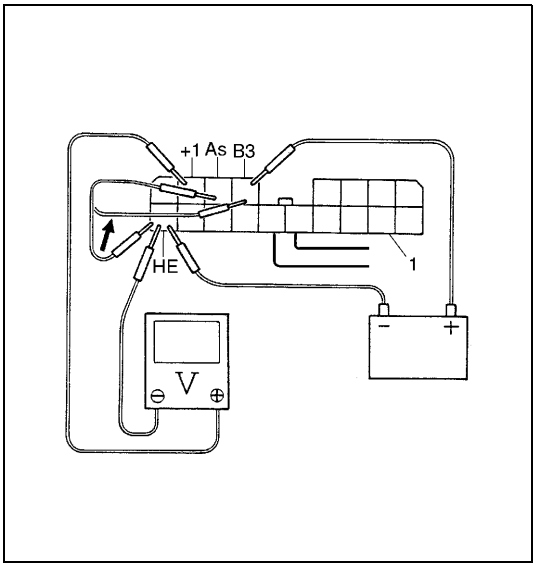
Intermittent Wiper Relay Circuit

1) Disconnect negative cable at battery.
2) Disconnect combination switch lead wire coupler.



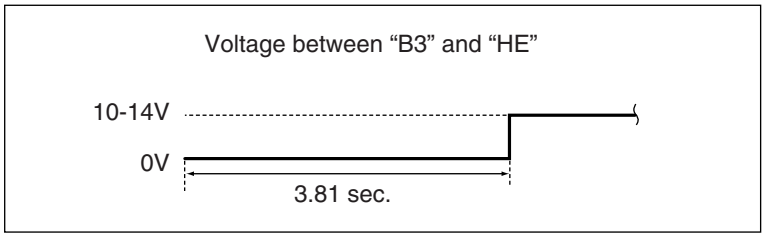
3) Turn the front wiper switch to INT position.
4) Connect battery positive terminal to terminal “B3” and battery negative terminal to terminal “HE”.
5) Connect voltmeter positive lead to terminal “+1” and negative lead to terminal “HE”.
   Check that the voltmeter indicates the battery voltage (10 – 14 V).

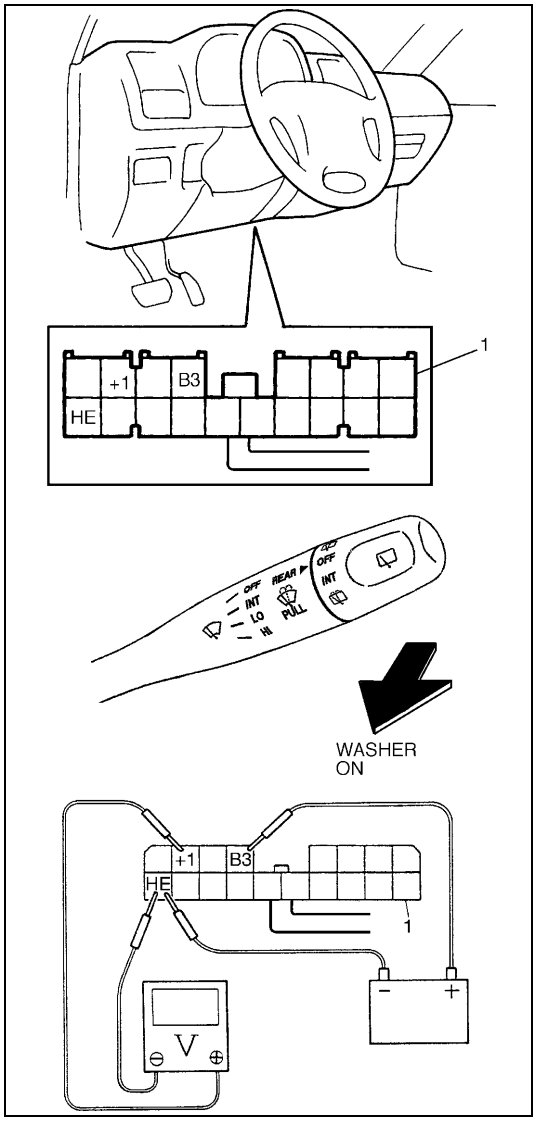
1. Combination switch lead wire coupler terminal viewed from terminal side



6) Connect terminal “As” and terminal “B3” by a jumper wire. Then connect terminal “B3” end to terminal “HE”.
   Observe the voltmeter voltage drops to 0 V right after connecting the jumper wire from terminal “B3” to “HE”. Then the voltage rises to battery voltage (10 – 14 V) within the time shown below.

1. Combination switch lead wire coupler terminal viewed from terminal side

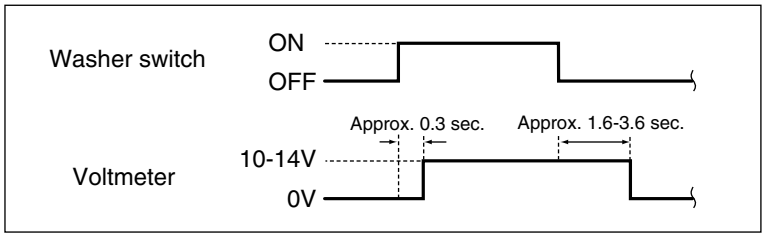




Washer Linked Operation

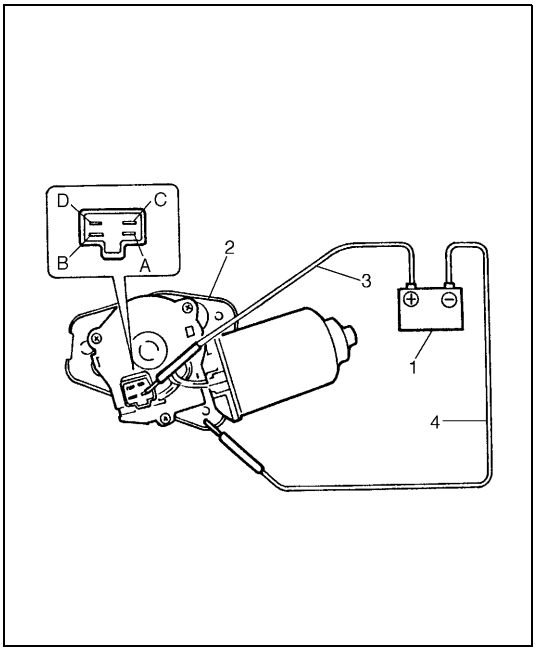
1) Disconnect negative cable at battery.
2) Disconnect combination switch lead wire coupler.
3) Make sure that front wiper switch is at OFF position.
4) Connect battery positive terminal to terminal “B3” and battery negative terminal to terminal “HE”.
5) Connect voltmeter positive lead to terminal “+1” and negative lead to terminal “HE”.
6) Push washer switch check that voltage changes as shown in the table.

1. Combination switch lead wire coupler terminal viewed from terminal side



Wiper motor

INSPECTION



Motor operation (low speed)

1) Connect battery (1) positive (+) terminal to terminal “A” and its negative (–) terminal to bracket.
2) Check wiper motor rotates at specified speed below.
   If check result is out of specification, replace.

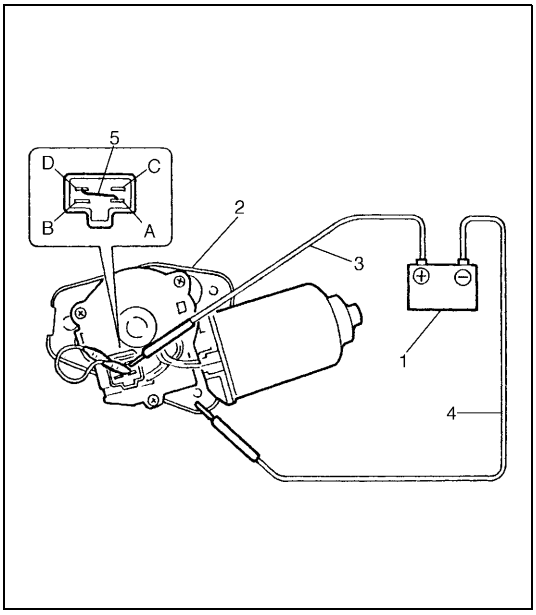
Specification: 44 – 52 r/min (rpm)

Motor operation (high speed)

1) Connect battery positive (+) terminal to terminal “B” and its negative (–) terminal to bracket.
2) Check wiper motor rotates at specified speed below.
   If check result is out of specification, replace.

Specification: 64 – 78 r/min (rpm)

2. Wiper motor
3. “+” -Red lead
4. “–” -Black lead



Automatic stop operation

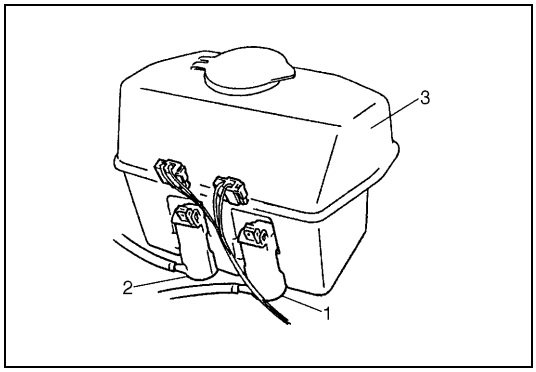
1) Connect battery (1) positive (+) terminal to terminal “A” and its negative (–) terminal to bracket and let the motor turn.
2) Disconnect terminal “A” from battery positive (+) terminal, and let the motor stop.
3) Connect terminal “A” and “D” with a jumper wire (5), and connect terminal “C” to battery positive (+) terminal. Observe the motor turns once again then stops at a original stop position.
4) Repeat Step 1) to 3) several times and check that the motor stops at the original stop position every time.
   If check result is not satisfied, replace.

2. Wiper motor
3. “+” -Red lead
4. “–” -Black lead

Washer pump

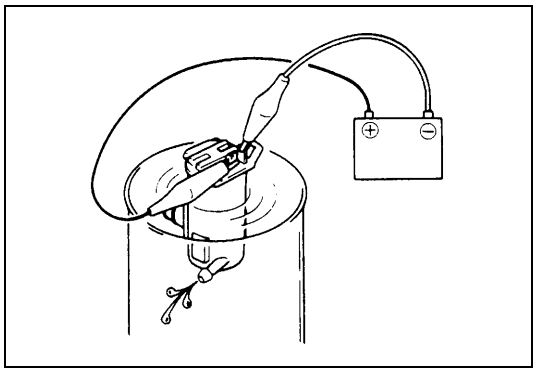
REMOVAL

1) Disconnect battery (–) cable.
2) Remove washer tank fitting screws.
3) Disconnect pump lead wire coupler(s) and hose(s).
4) Remove washer tank (3).
5) Remove pump from tank.



1.	Front washer pump
2.	Rear washer pump

INSPECTION



Connect battery (+) and (–) terminals to pump (+) and (–) terminals respectively to check pumping rate.
Check for both front and rear washer pump.

Pumping Rate
Front washer pump
: more than 1.0 l/min (2.1 US pt./min, 1.76 Imp pt./min)
Rear washer pump
: more than 1.0 l/min (2.1 US pt./min, 1.76 Imp pt./min)

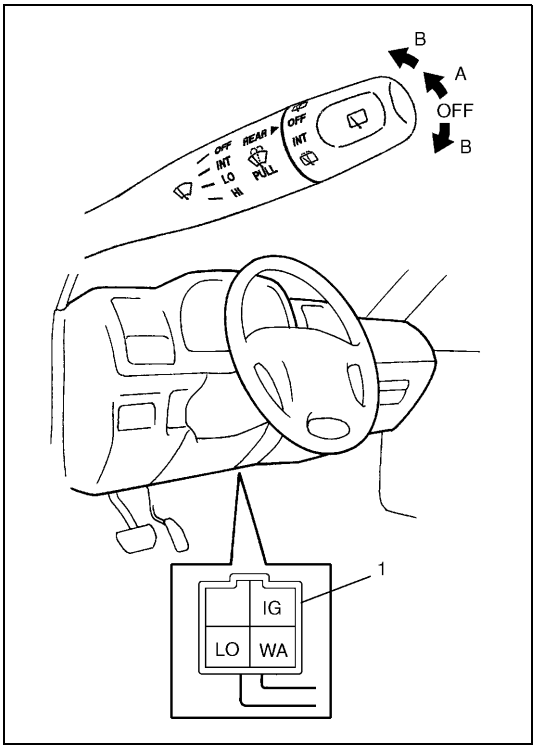
INSPECTION

Reverse removal procedure for installation.

Rear Wiper and Washer

Wiper and washer switch

INSPECTION



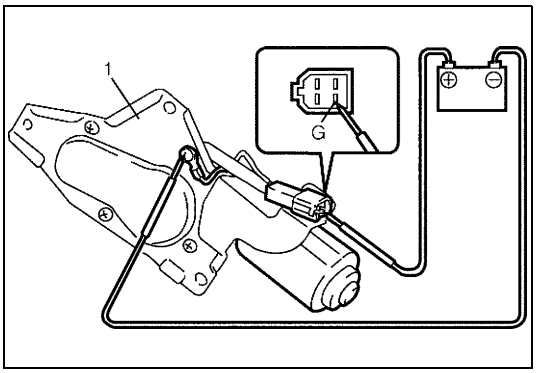
Check for continuity between terminals at each switch position.

Terminal / Wire Color / Position	IG	LO	WA
	B	W	Bl
OFF			
WIPER INT (A)	○—○		
WIPER and WASHER ON (B)	○—○	○—○	

1. Combination switch lead wire coupler viewed from terminal side

Rear wiper motor

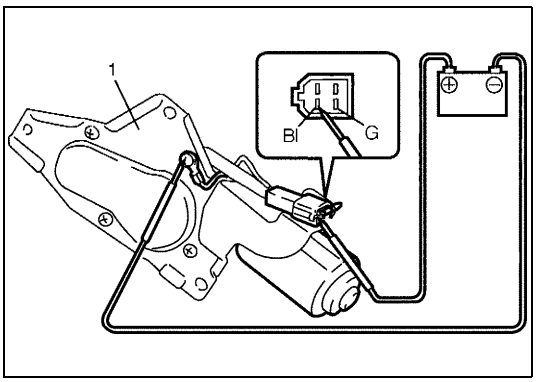
INSPECTION



Motor operation

1) Use a 12 V battery positive (+) terminal to terminal “G” and it negative (–) terminal to wiper bracket (1).
2) Check wiper motor rotates at specified speed below.
   If check result is out of specification, replace.

Specification : 35 – 45 r/min (rpm)



Automatic stop operation

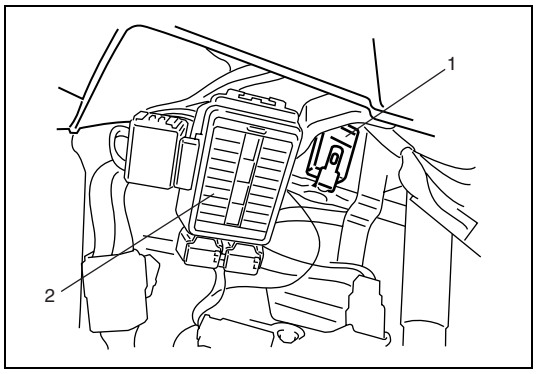
1) Connect battery positive (+) terminal to terminal “G” and battery (–) terminal to wiper bracket (1) and let the motor turn.
2) Disconnect terminal “G” from battery and let the motor stop.
3) Connect terminal “Bl” to battery positive (+) terminal. Observe the wiper motor turns once again, then stops at a original stop position.
4) Repeat Step 1) to 3) several times, and inspect if the motor stops at the original stop condition every time.
   If check result is not satisfied, replace.

Rear wiper intermittent relay

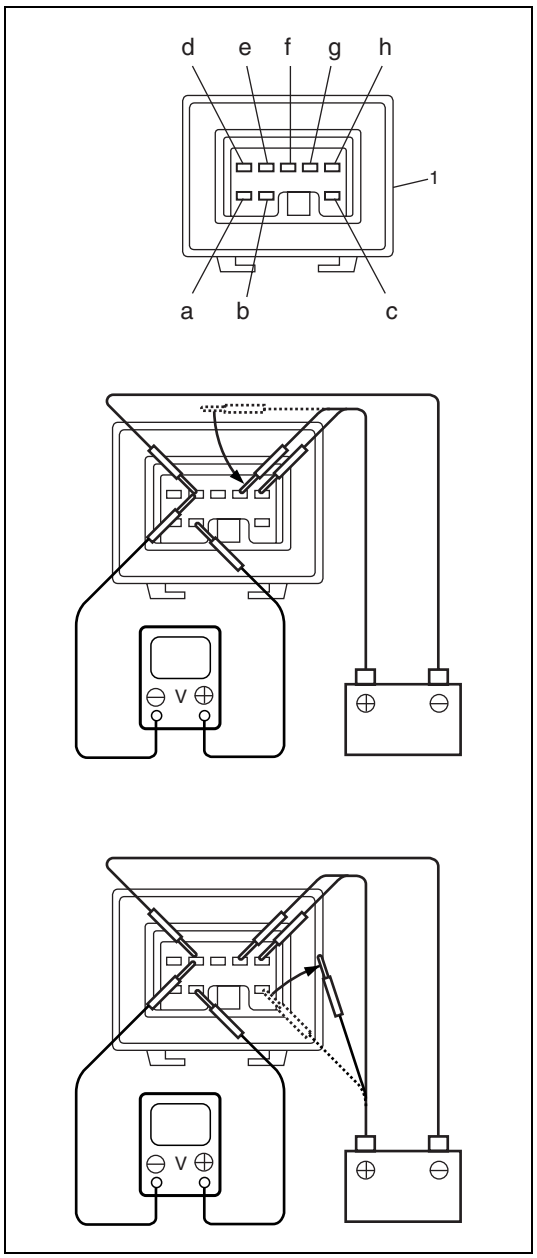
INSPECTION

1) Disconnect negative (–) cable from battery.

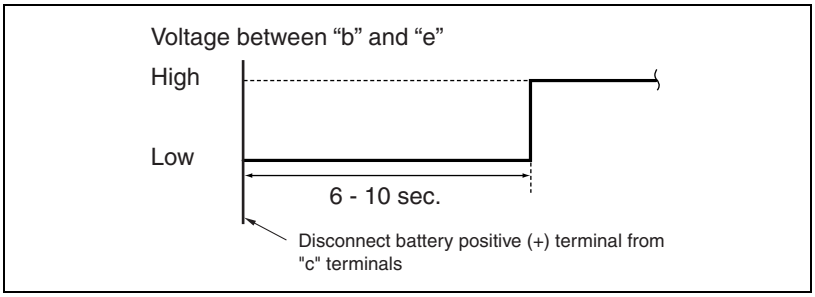
2) Remove rear wiper intermittent relay (1) from vehicle.



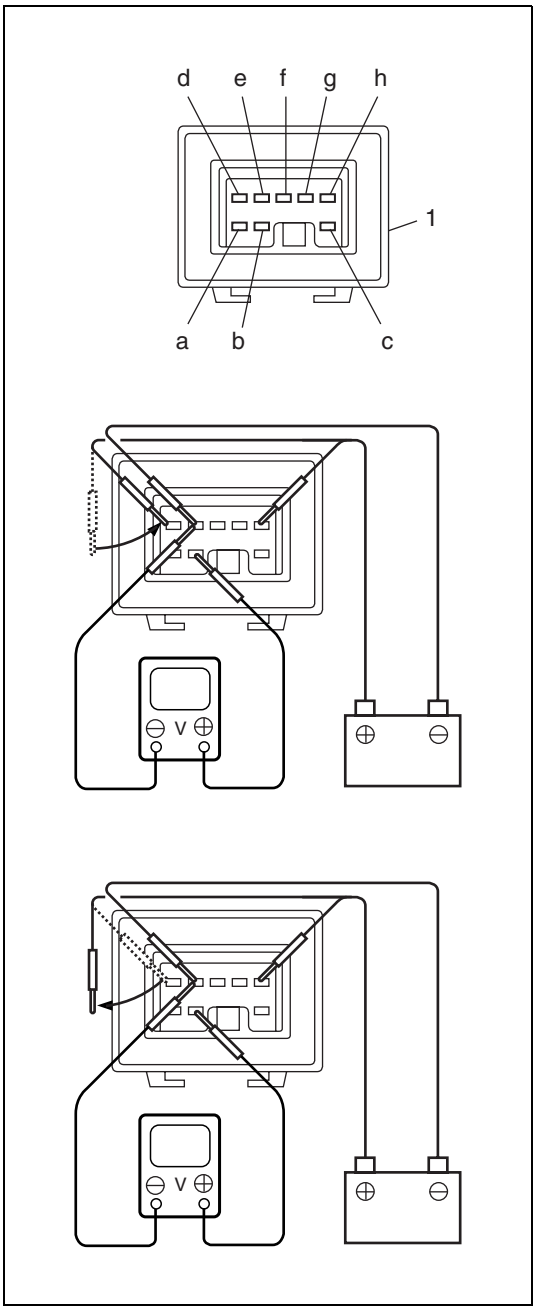
2. Circuit fuse box



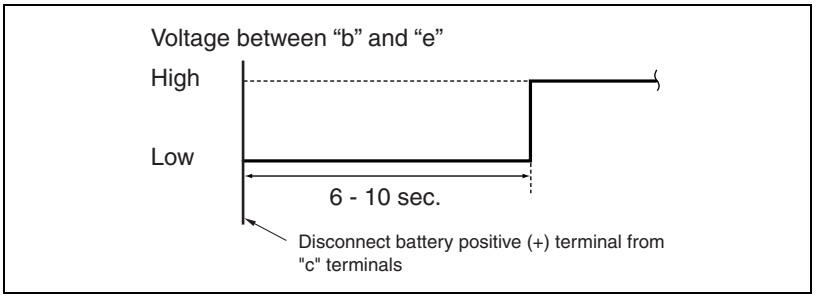
3) Check INT circuit as follows.
   a) Connect battery positive (+) terminal to “h” terminal and battery negative (–) terminal to “e” terminal.
   b) Check that voltage between “b” terminal and “e” terminal changes from 0 V to battery voltage when connecting battery positive (+) terminal to “g” terminal.
      If check result is not satisfied, replace relay.
   c) Connect battery positive (+) terminal to “c” terminal.
   d) Check that voltage between “b” terminal.
      If check result is not satisfied, replace relay.



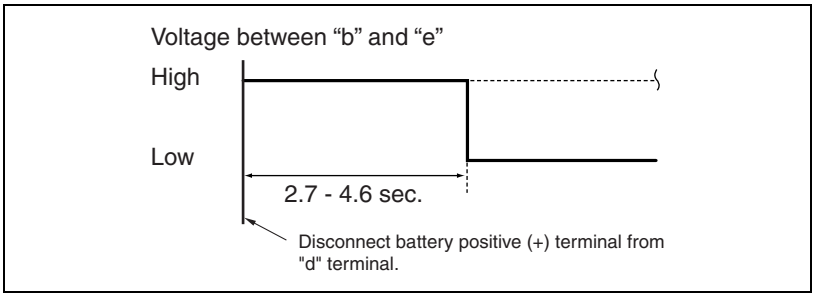
1. Rear wiper intermittent relay



4) Check WIPER AND WASH circuit as follows.
   a) Connect battery positive (+) terminal to “h” terminal and battery negative (–) terminal to “e” terminal.
   b) Check that voltage between “b” terminal and “e” terminal changes as below figure when connecting battery positive (+) terminal from “d”.
      If check result is not satisfied, replace relay.



   c) Check that voltage between “b” terminal and “e” terminal changes as below figure when disconnecting battery positive (+) terminal from “d”.
      If check result is not satisfied, replace relay.

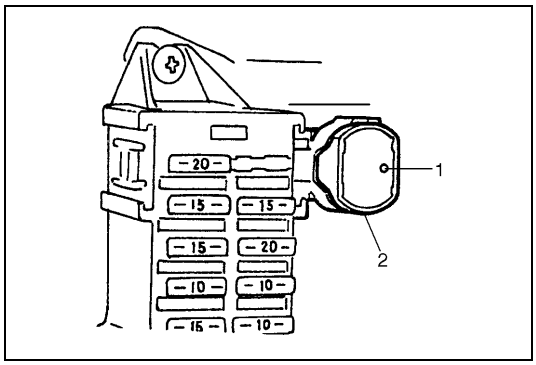


1. Rear wiper intermittent relay

Power Window Control System (If Equipped)

Breaker

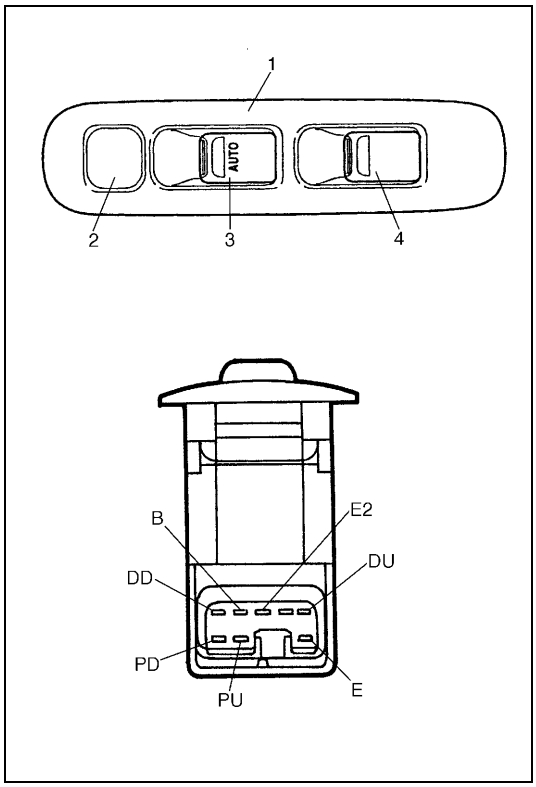
INSPECTION



- When the breaker (2) has worked, insert a pin in the hole (1) indicated in the figure and push it until a click is heard.
  If the system fails to operate properly, replace the breaker.

Power window main switch

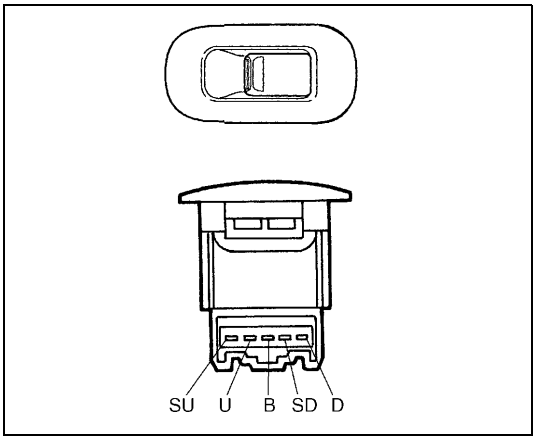
INSPECTION



Inspect switch continuity between terminals.

Switch Position			Driver Side Window Switch				Passeger Side Window Switch			
Terminal			B	E	DU	DD	B	E	PU	PD
Window Lock Switch	OFF	UP	○	○	○		○	○	○	
		OFF		○	○			○	○	
				○		○		○		○
		DOWN	○			○	○			○
				○	○			○	○	
	ON	UP	○	○		○	○		○	
		OFF		○	○				○	○
				○		○				
		DOWN	○			○	○			○

1.	Power window main switch
2.	Power window lock switch
3.	Driver side window switch
4.	Passenger side window switch



Power window sub switch

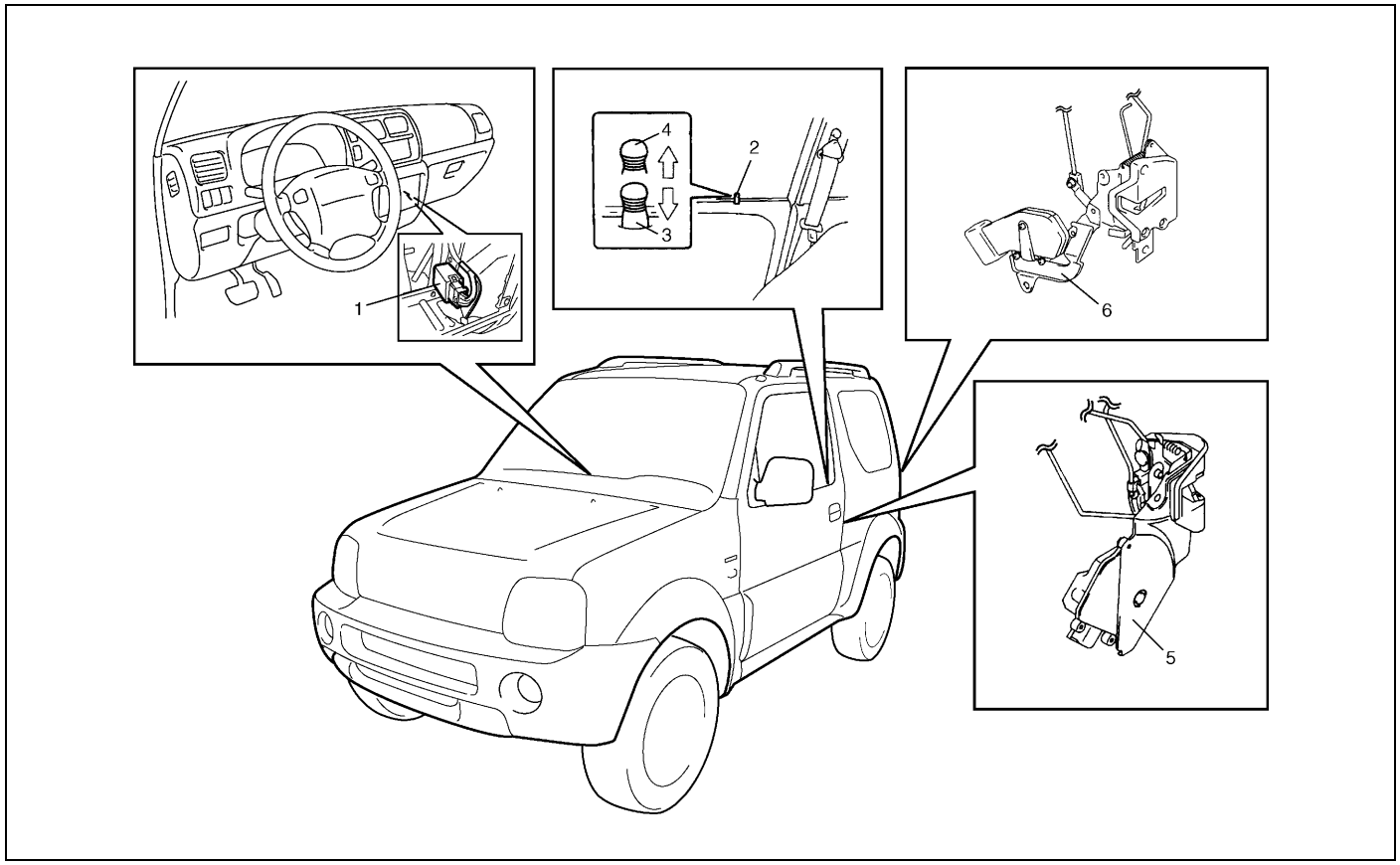
INSPECTION

Inspect switch continuity between terminal.

Switch Position \ Terminal	B	SD	SU	D	U
UP	○	○		○	○
OFF		○	○	○	○
DOWN	○		○	○	

Power Door Lock System (If Equipped)

Power door lock system component location



1. Power door lock controller	3. LOCK position	5. Front door actuator
2. Driver side door knob switch	4. UNLOCK position	6. Back door actuator

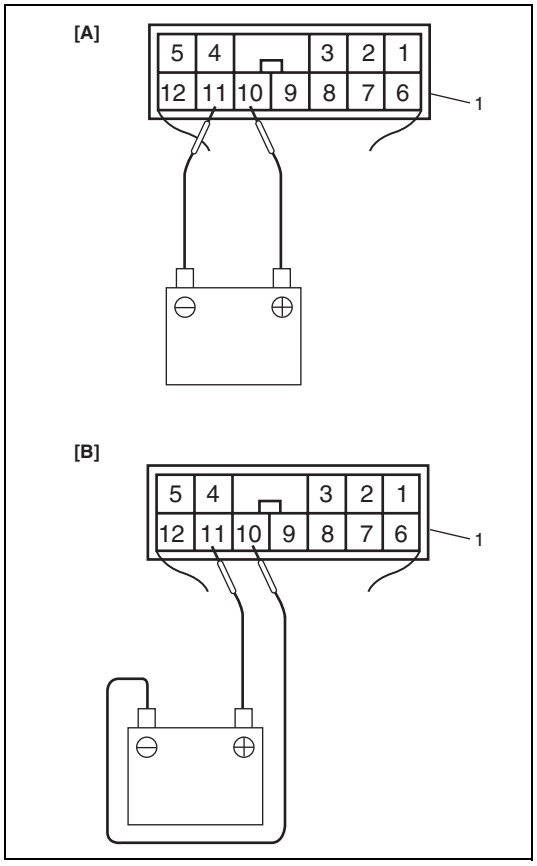
Power door lock system operation inspection

1) Check the following operation:
   a) When the driver side key cylinder is turned LOCK, check all doors lock.
   b) When the driver side door key cylinder is turned UNLOCK, check all doors unlock.

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.



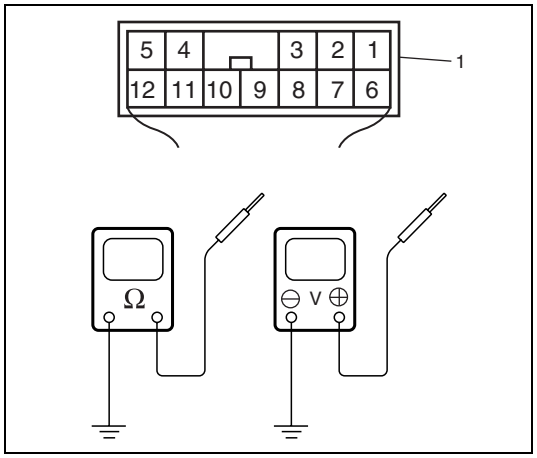
2) Disconnect door lock controller coupler (1).
3) Confirm that all doors are unlocked. Connect battery positive (+) and negative (–) terminals to door lock controller coupler terminals and check power door lock operation as follows.
   If it does not operate as specified, repair applicable circuit or check actuator. If it operates as specified, go to next step.

Power door lock operation for vehicle:

Step	TERMINAL		OPERATION
	G10-10	G10-11	
1	⊕	⊖	UNLOCK ⟶ LOCK
2	⊖	⊕	LOCK ⟶ UNLOCK

[A] : Step 1: Lock operation check
[B] : Step 2: Unlock operation check

1. Power door lock controller coupler “G10” viewed from harness side

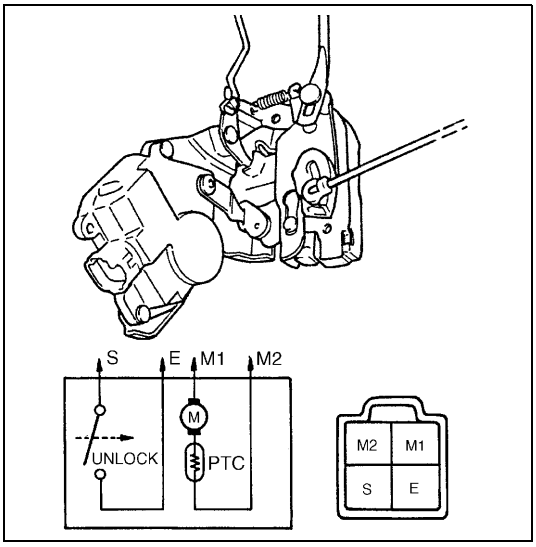


4) Connect negative (–) cable to battery.
5) Check that the voltage and continuity between the following terminals and body ground are specifications under each conditions.
   If check result is not as specified, repair circuit.
   If check result is OK, recheck power door lock system as follows.
   a) Substitute a known-good door lock controller.
   b) Recheck power door lock system circuit.

1 : Power door lock controller coupler “G10” viewed from harness side

Power door lock system circuit check

Terminal	Wire	Circuit	Specification	Condition
G10-7	WHT/GRN	Main power supply	10 – 14 V	–
G10-8	BLU/RED	Driver side door knob switch lock signal circuit	Continuity	Driver side door knob switch is lock position.
			No continuity	Driver side door knob switch is unlock position.
G10-9	BRN/YEL	Driver side door knob switch unlock signal circuit	Continuity	Driver side door knob switch is unlock position.
			No continuity	Driver side door knob switch is lock position.
G10-12	BLK	Ground	0 – 1 V	–



Driver side key cylinder switch

INSPECTION

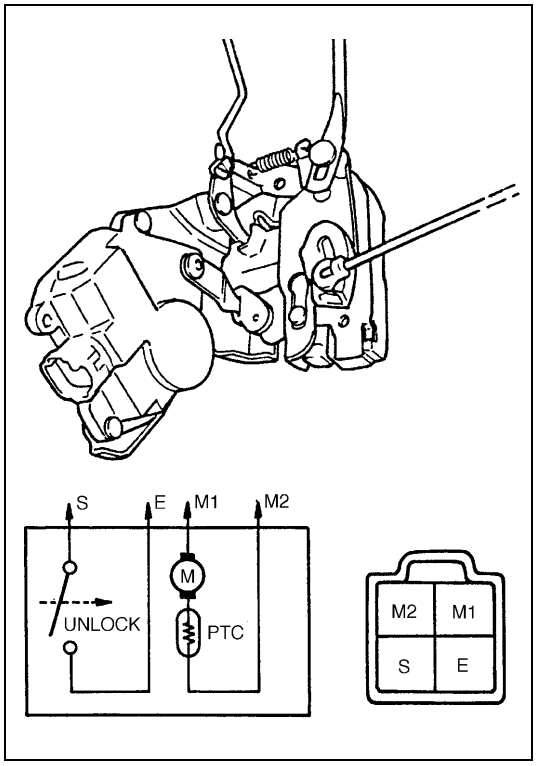
Inspect continuity at terminals according to the key action.

Key \ Terminal	S	E
LOCK		
UNLOCK	○	○

Power door lock actuator

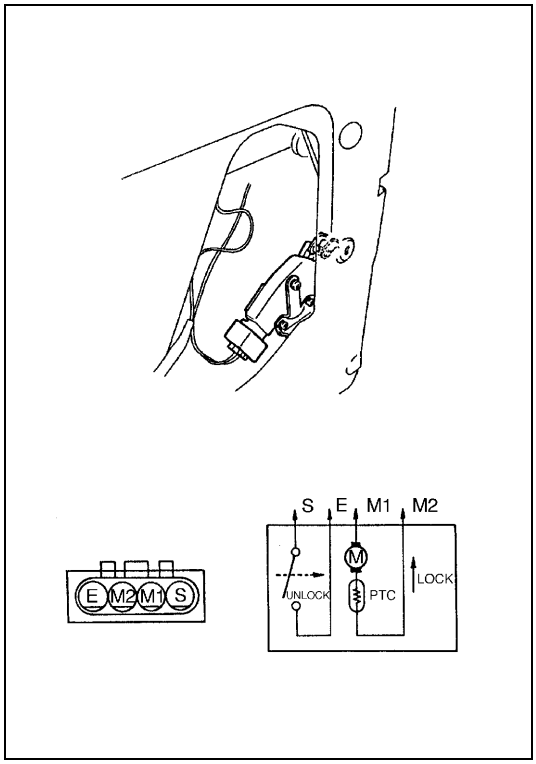
INSPECTION

1) Disconnect power door lock actuator coupler.
2) Connect 12 V battery positive and negative terminals to the door lock actuator terminals shown below.
   If it does not follow the table's operation, replace the faulty door lock actuator.



Front Door

Operation / Terminal	UNLOCK		LOCK	
	R	L	R	L
M1	⊕	⊖	⊖	⊕
M2	⊖	⊕	⊕	⊖

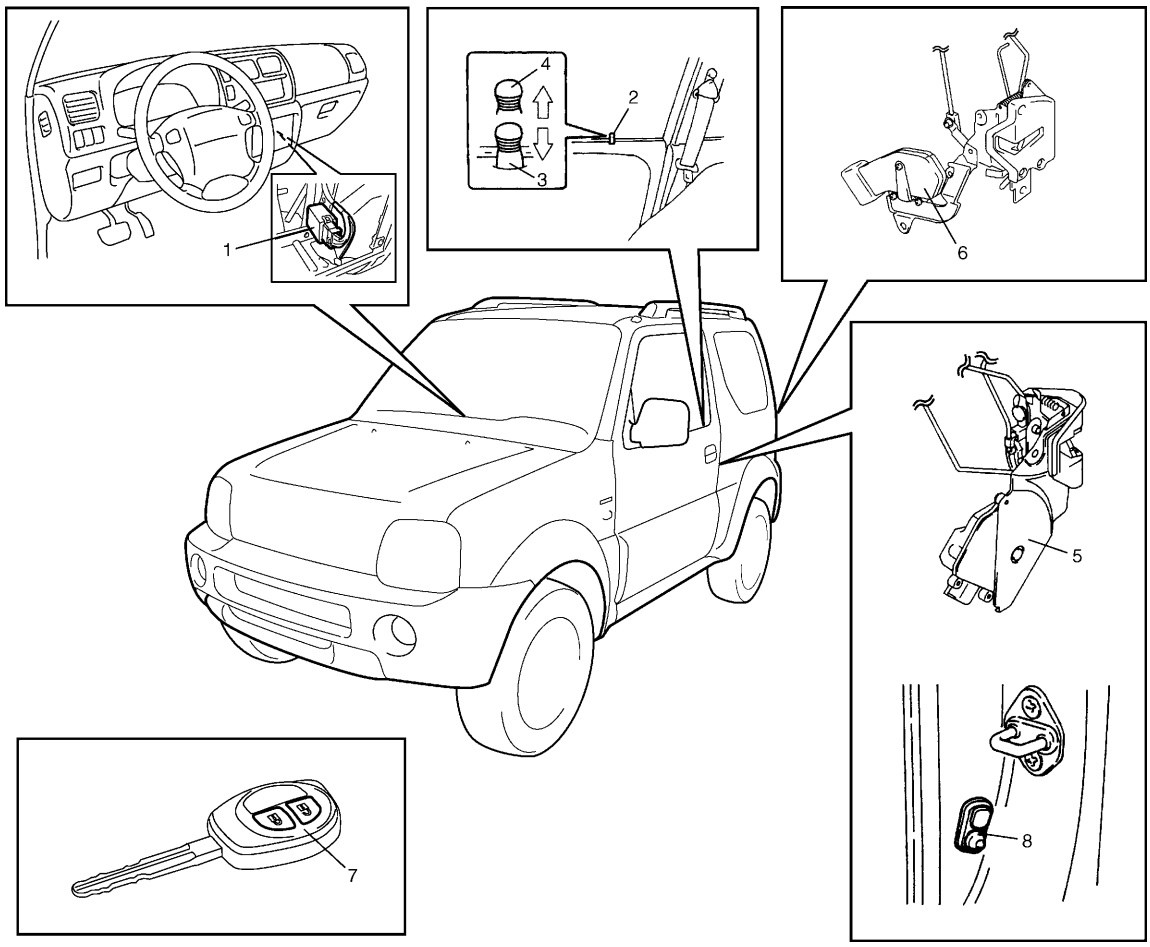


Back Door

Operation / Terminal	UNLOCK	LOCK
M1	⊖	⊕
M2	⊕	⊖

Power Door Lock System with Keyless Entry System (If Equipped)

Power door lock system with keyless entry system component location



1. Power door lock controller	4. UNLOCK position	7. Transmitter
2. Driver side door knob switch	5. Front door actuator	8. Door switch
3. LOCK position	6. Back door actuator	

System Description

The keyless entry system has the following signal modes in order to feed back the signal when the controller received 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 about 15 seconds.
Interior light signal mode	The interior light flashes twice.	The interior light turns on about 15 seconds.

NOTE:

- **These signal modes are able to change referring to “Change of Signal Mode” in this section.**
- **The initial condition is the hazard warning light signal mode.**

Change of signal mode

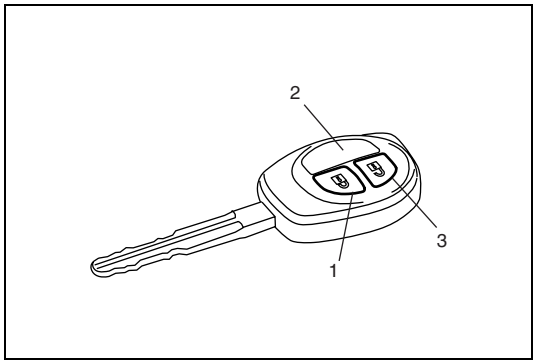
1) Confirm that all doors are closed and ignition key is out of ignition switch.
2) Perform the following procedures within 15 seconds.
   a) Insert ignition key to ignition switch and pull out ignition key from ignition switch.
   b) Repeat step a) two times.
   c) Insert ignition key to ignition switch, and then push “LOCK” button on transmitter more than five times.
3) Confirm that 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 good condition referring to “Power Door Lock System Operation Inspection” in this section.
2) Confirm that turn signal and hazard warning light system is good condition referring to “Turn Signal and Hazard Warning Light System” in this section.
3) Check transmitter battery for dead. If battery is dead, replace battery referring to “Replacement of Transmitter Battery” under “Transmitter” in this section.
4) Confirm that all doors are closed and unlocked.



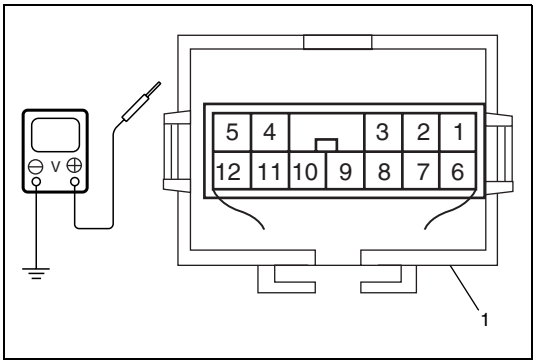
5) Check the following operation:
   a) When pushing “LOCK” button (1) on transmitter (2), check all doors lock and hazard warning lights flash once.
   b) When pushing “UNLOCK” button (3) on transmitter (2), check all doors unlock and hazard warning lights flash twice and interior light turn on about 15 seconds with the interior light switch in the middle position.

If check result is not satisfied, 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.



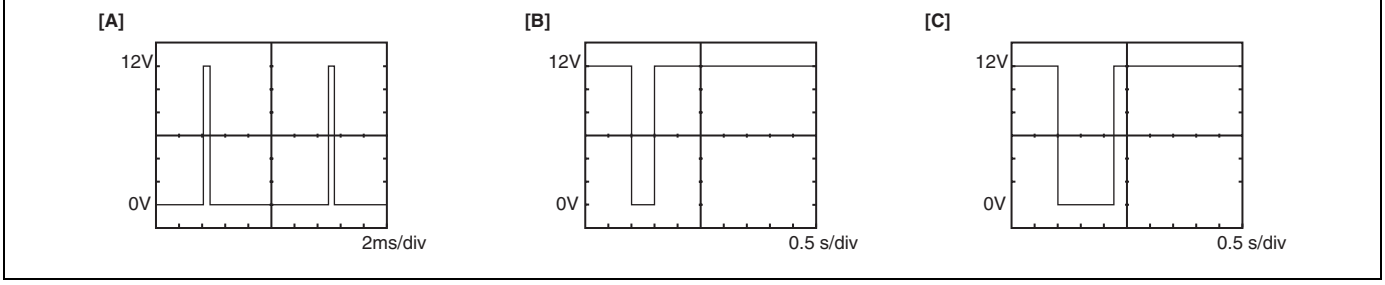
Check that the voltage and continuity between the following terminals and body ground are specifications under each conditions.
If check result is not as specified, check applicable circuit.
If circuit is normal, recheck keyless entry system circuit as follows.

1) Substitute a known-good door lock controller.
2) Register key code referring to "Code Registration Procedure" under "Transmitter" in this section.
3) Recheck keyless entry system circuit.

1. Door lock controller

Keyless entry system circuit check

Terminal	Wire	Circuit	Specification	Condition
G10-2	BLU/GRN	Key remainder circuit	10 – 14 V	Ignition key is in ignition switch.
			0 – 1 V	Ignition key is not in ignition.
G10-4	BLK/RED	Door switch & interior light circuit	0 – 1 V	Driver side, passenger side, rear driver side, rear passenger side or back door is open.
			10 – 14 V	All doors are close.
			Figure "A"	Fulfill the following conditions. • All door is close. • Interior light switch is middle position. • 15 seconds after pushing "UNLOCK" button on transmitter.
G10-5	YEL/BLU	Hazard warning signal circuit	Figure "B"	Push "LOCK" button on transmitter.
			Figure "C"	Push "UNLOCK" button on transmitter.

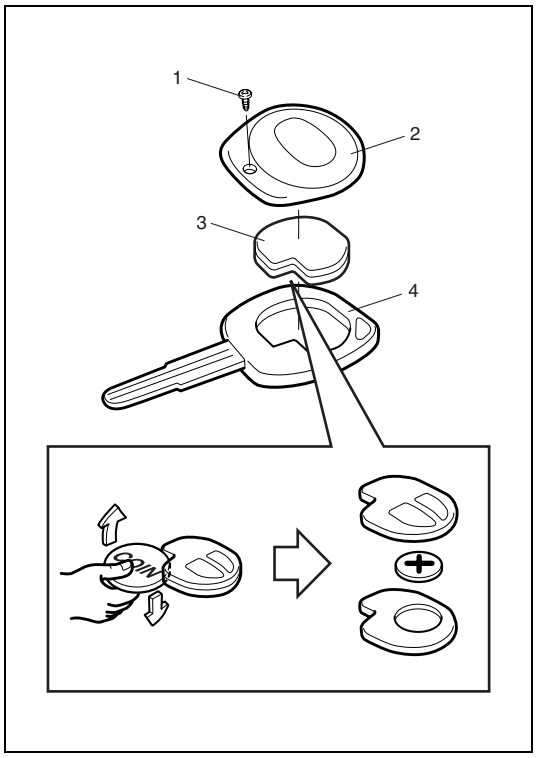


[A] : Figure "A"
[B] : Figure "B"
[C] : Figure "C"

Transmitter

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).
3) Put edge of coin or flat blade screwdriver in slot of transmitter (3) and by pry it open.
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.

CAUTION:

Use care not to allow grease or dirt to be attached on the printed circuit board and the battery.

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.**

CODE REGISTRATION PROCEDURE

If transmitter or door lock controller replace new one, register key code as follows.

1) Confirm that the vehicle is the following conditions.
   - All doors are closed.
   - Ignition key is out of ignition switch.
   - Driver side door is unlocked.
2) Disconnect negative (-) cable from battery.
3) After 30 seconds, perform the following procedure within 60 seconds.
   a) Connect negative (-) cable to battery.
   b) Operate driver side door knob switch from lock to unlock.
   c) Push "LOCK" button on transmitter and confirm that are operated from lock to unlock.
   d) Push driver side door knob switch to lock position.
   e) Push "LOCK" button on transmitter twice and confirm that all doors are operated from unlock to lock. With this, code registration is completed.

NOTE:

- **Two transmitter codes can be registered.**
- **When a new transmitter code is registered, the oldest one will be cleared.**

Driver side key cylinder switch

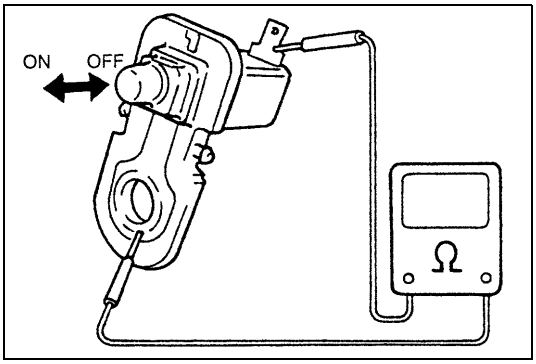
Refer to “Driver Side Key Cylinder Switch” under “Power Door Lock System (If Equipped)” in this section.

Power door lock actuator

Refer to “Power Door Lock Actuator” under “Power Door Lock System (If Equipped)” in this section.

Door switch

INSPECTION



Remove door switch from body and check switch for continuity. if found defective, replace switch.

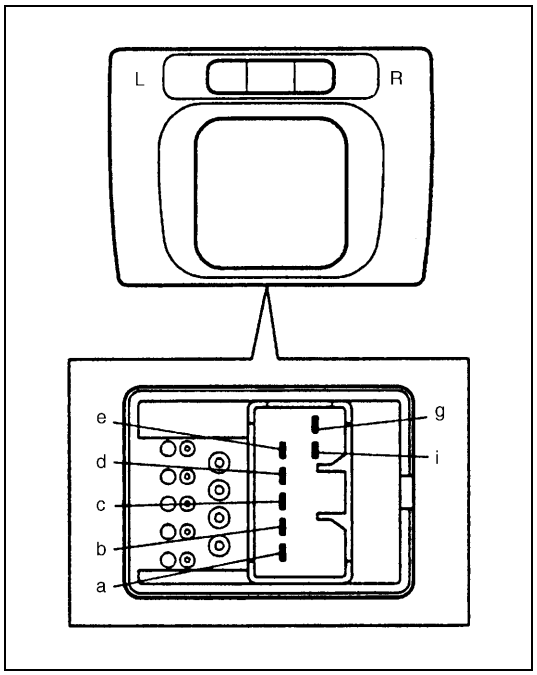
OFF position (Door closed)	No continuity
ON position (Door open)	Continuity

Power Door Mirror Control System (If Equipped)

Mirror switch

INSPECTION

1) Remove mirror switch from instrument panel.
2) Check continuity at each switch position by using a circuit test. If any continuity is not obtained, replace mirror switch.

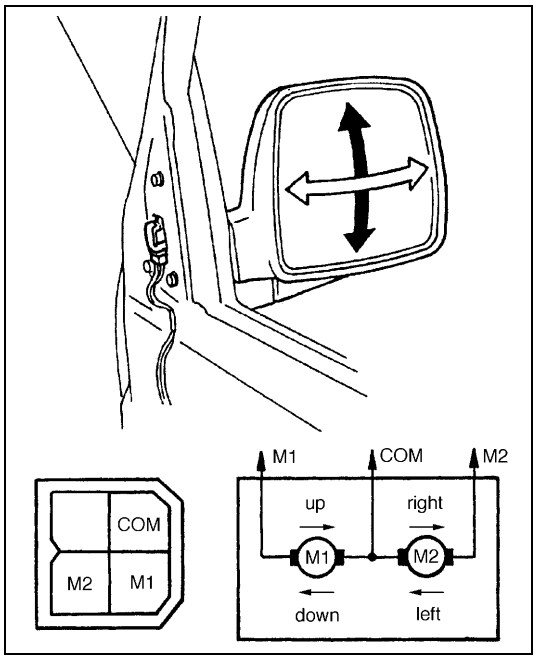


L / R	a	b	c	d / e	g / f
UP	○	○	○		○
DOWN	○	○	○		○
LEFT	○	○	○	○	
RIGHT	○	○	○	○	

Door mirror actuator

INSPECTION

1) Remove front door inner garnish from front door.
2) Disconnect door mirror coupler.
3) Check that door mirror operates properly when battery voltage is applied to connector terminals.
   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.



Terminal / Operation	COM	M1	M2
Up	⊖	⊕	
Down	⊕	⊖	
Left	⊖		⊕
Right	⊕		⊖

NOTE:

When installing door mirror to door, be careful not to pinch harness between door and door mirror.

Door Mirror Heater (If Equipped)

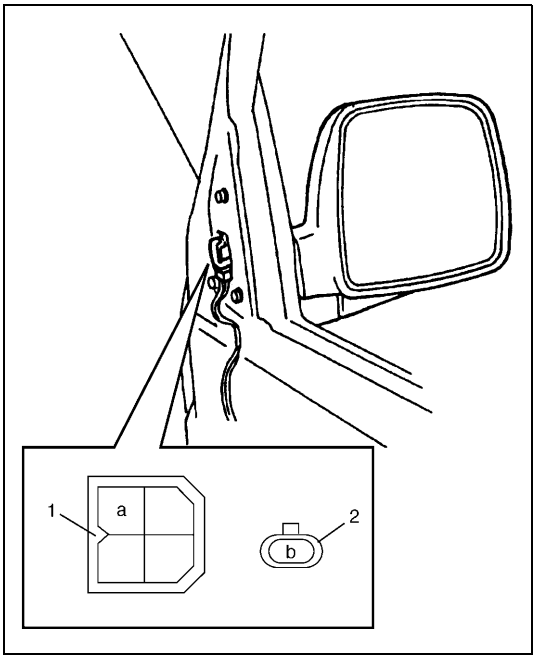
Mirror heater switch

INSPECTION

Door mirror heater is operated by rear defogger switch. Check rear defogger switch referring to “Rear Defogger Switch” in this section.

Mirror heater (if equipped)

INSPECTION

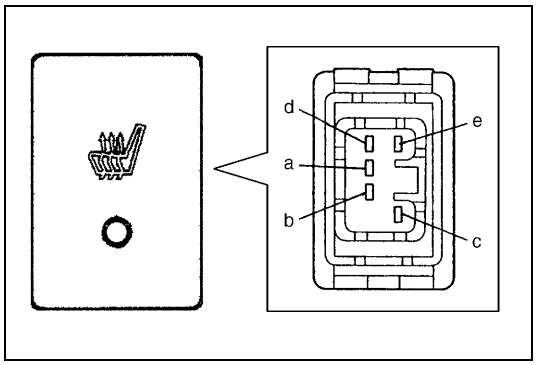


1) Remove door inner garnish from front door.
2) Disconnect door mirror coupler (1) and door mirror heater coupler (2).
3) Check for continuity between terminals “a” and “b”.
   if not continuity, replace outside mirror.

Front Seat Heater (If Equipped)

Seat heater switch (driver and passenger side)

INSPECTION

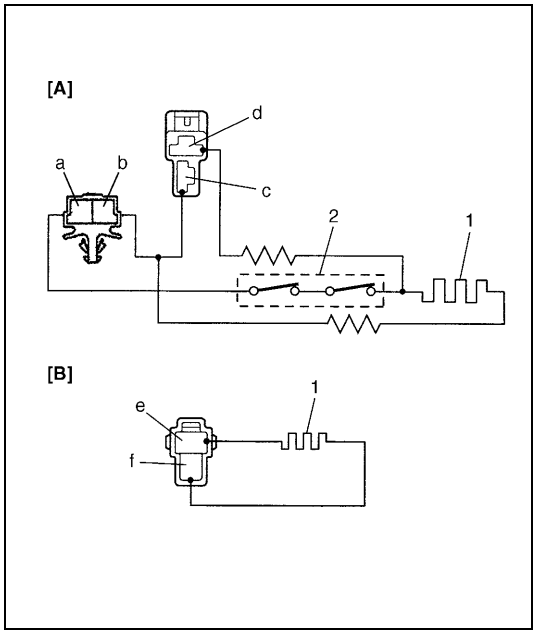


1) Remove seat heater switch from instrument panel.
2) Check for continuity between terminals at each switch position as show below. If check result is not as specified, replace switch.

Position \ Terminal	a	b	c	d	e
FREE		○	○	○	○
PUSH	○	○	○	○	○

Seat heater wire

INSPECTION



1) Confirm that seat heater switch is OFF position.
2) Disconnect two couplers of seat heater under the seat cushion.
3) Check for continuity between terminals as show below. If not continuity, replace faulty seat heater.

Seat heater circuit in seat back
Between “a” and “b”
Between “b” and “c”
Between “b” and “d”

Seat heater circuit in seat cushion
Between “e” and “f”

[A]:	Seat heater circuit in seat back
[B]:	Seat heater circuit in seat cushion
1.	Heater wire
2.	Thermostat

SECTION 8G

IMMOBILIZER CONTROL SYSTEM (IF EQUIPPED)

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 "Air Bag 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:

Whether the immobilizer indicator lamp is used in the particular vehicle or not depends on vehicle specifications. If there is an heated oxygen sensor (sensor 2) on exhaust pipe, the vehicle is equipped with immobilizer indicator lamp and if there isn't, it is not equipped with immobilizer indicator lamp. For details of heated oxygen sensor (sensor 2), refer to Section 6E in this manual.

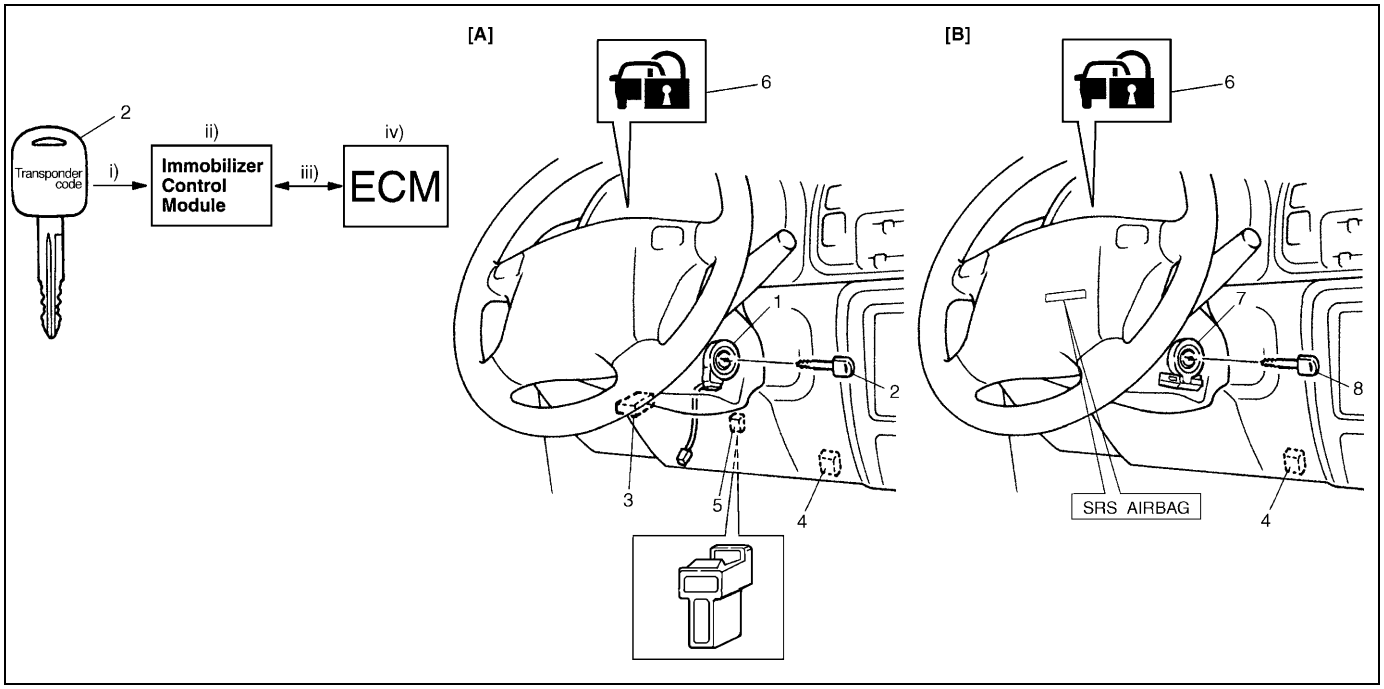
CONTENTS

General Description 8G-3
System and Location 8G-3
Immobilizer Control Module 8G-5
ECM 8G-5
On-Board Diagnostic System (Self-Diagnosis Function) 8G-5
Diagnosis 8G-8
Precautions in Diagnosing Troubles 8G-8
Precautions in identifying diagnostic trouble code 8G-8
Diagnostic Flow Table 8G-9
Diagnostic Trouble Code (DTC) Check (Immobilizer Control Module) 8G-11
[Vehicle not equipped with air bag system] 8G-11
[Vehicle equipped with air bag system] 8G-12
Diagnostic Trouble Code (DTC) Check (ECM) 8G-12
[Not using SUZUKI scan tool] (Except for vehicle equipped with immobilizer indicator lamp) 8G-12
[Using SUZUKI scan tool] 8G-13
Diagnostic Trouble Code Table 8G-14
Immobilizer control module 8G-14
Table A DTC is Not Output From Diagnostic Output Terminal (For Vehicle Not Equipped with Air Bag System) 8G-16
Table B Immobilizer Indicator Lamp Check For Vehicle Equipped with Immobilizer Indicator Lamp (Immobilizer Indicator Lamp Does Not Light at Ignition Switch ON) 8G-17
Table C Immobilizer Indicator Lamp Check for Vehicle Equipped with Immobilizer Indicator Lamp (Immobilizer Indicator Lamp Remains on After Engine Starts) 8G-18
Table D DTC is Not Output From Immobilizer Control Module (For Vehicle Equipped with Air Bag System) 8G-19

DTC11/32 Transponder Code Not Matched 8G-21
DTC31 Transponder Code Not Registered..... 8G-21
DTC12 Fault in Immobilizer Control Module 8G-21
DTC13 No Transponder Code Transmitted or Coil Antenna Opened / Shorted..... 8G-22
DTC21 ECM / Immobilizer Control Module Code Not Matched (Immobilizer Control Module Side)..... 8G-25
DTC81 ECM / Immobilizer Control Module Code Not Matched (P1623) (ECM Side).... 8G-25
DTC84 ECM / Immobilizer Control Module Code Not Registered (P1620)..... 8G-25
DTC82 (P1622) Fault in ECM..... 8G-25
DTC22 Ignition Switch Circuit Open / Short 8G-26
DTC23 No ECM / Immobilizer Control Module Code Transmitted From ECM or DLC Circuit Opened / Shorted 8G-28
DTC83 (P1621) No ECM / Immobilizer Control Module Code Transmitted From Immobilizer Control Module or DLC Circuit Opened / Shorted 8G-28
Inspection of ECM, Immobilizer Control Module and Its Circuit..... 8G-30
On-Vehicle Service 8G-33
Precautions in Handling Immobilizer Control System 8G-33
Immobilizer Control Module..... 8G-34
Coil Antenna (Vehicle not equipped with air bag system) 8G-34
How to Register Ignition Key..... 8G-36
Procedure After Immobilizer Control Module Replacement..... 8G-37
Procedure After ECM Replacement 8G-38
Special Tools 8G-39

General Description

System and Location



4. Data link connector (DLC)	6. Immobilizer indicator lamp (if equipped)
5. Immobilizer diagnostic coupler	

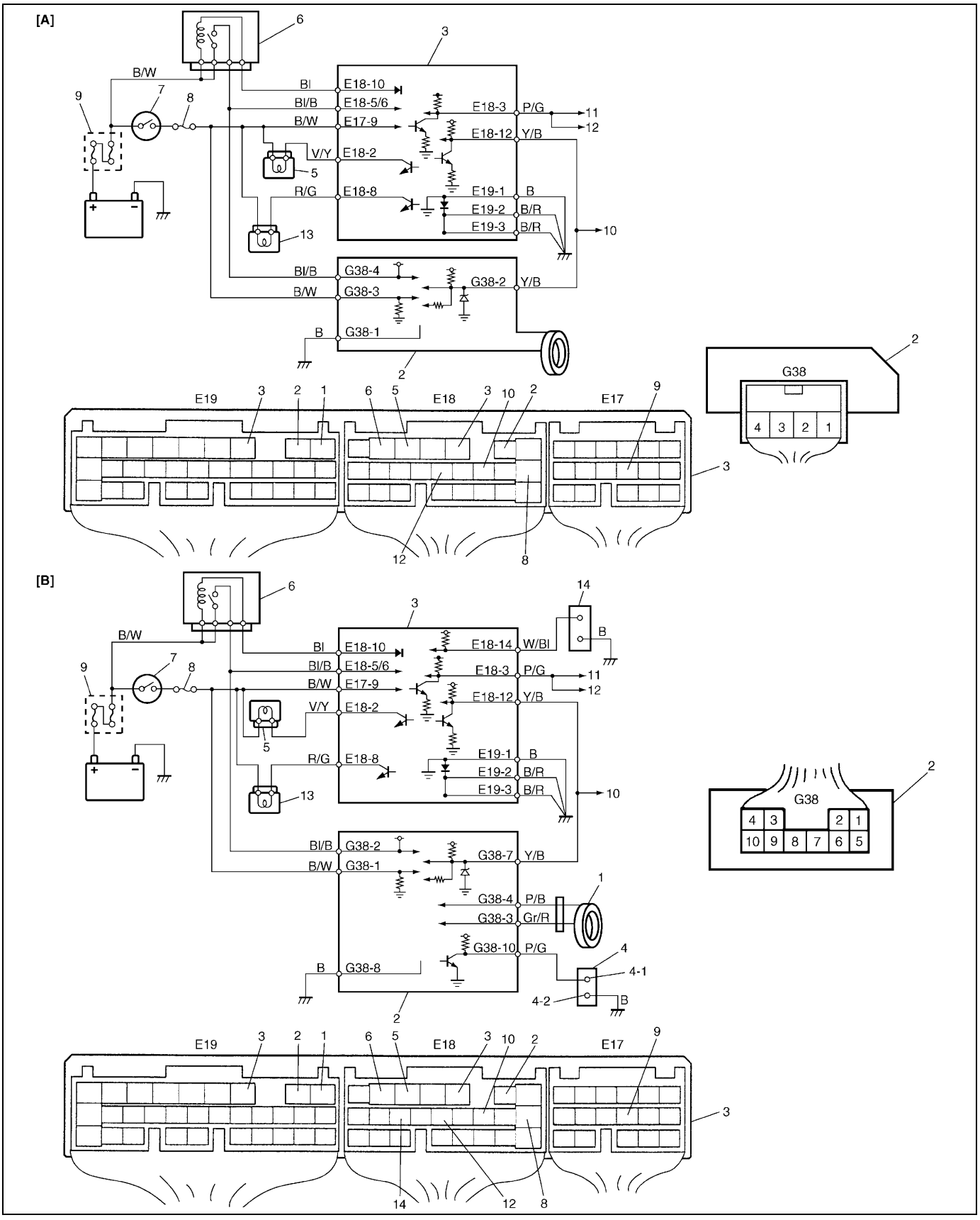
The immobilizer control system designed to prevent vehicle burglar consists of following components.

Vehicle not equipped with air bag system [A]
- Engine control module (ECM)
- Immobilizer control module (3)
- Ignition key with built-in transponder (Knob color: Black) (2)
- Coil antenna (1)

Vehicle equipped with air bag system [B]
- Engine control module (ECM)
- Immobilizer control module with coil antenna (7)
- Ignition key with built-in transponder (Knob color: Dark gray) (8)

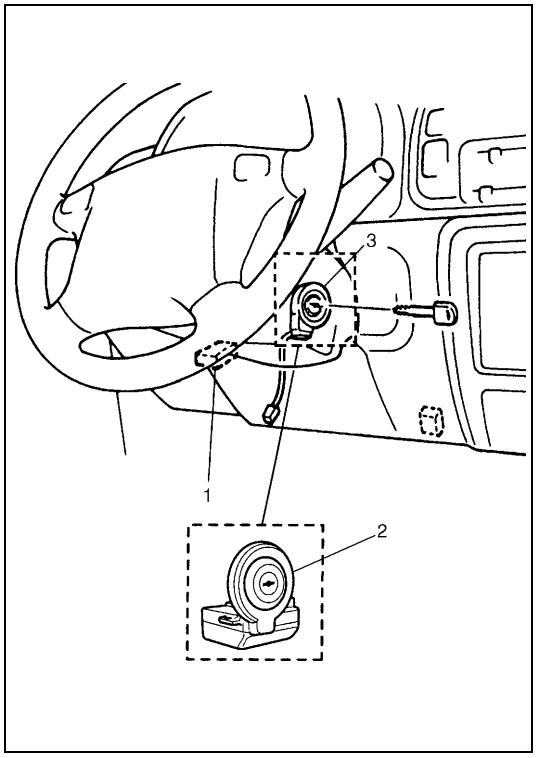
Operation of this system is as follows.

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 to the steering lock assembly.
ii) Immobilizer Control Module compares the Transponder code read in (1) 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.



1. Coil antenna	5. Malfunction indicator lamp	11. To #7-pin in data link connector
2. Immobilizer Control Module	6. Main relay	12. To ABS control module SDM and TCM
3. ECM	7. Ignition switch	13. Immobilizer indicator lamp (if equipped)
4. Immobilizer diagnostic coupler	8. Fuse	14. Monitor coupler (Vehicle not equipped with immobilizer indicator lamp)
4-1. Diagnostic output terminal	9. Main fuse	[A] : Vehicle equipped with air bag system
4-2. Ground terminal	10. To #9-pin in data link connector	[B] : Vehicle not equipped with air bag system

Immobilizer Control Module



Immobilizer Control Module is installed to the steering lock assembly or the underside of the instrument panel at the driver's seat side.
As main functions, Immobilizer Control Module checks matching not only between the Transponder Code transmitted from the ignition key and that registered in Immobilizer Control Module (Up to 4 different Transponder codes can be registered.) but also between the ECM / Immobilizer Control Module code transmitted from ECM and that registered in Immobilizer Control Module. In addition, it has an on-board diagnostic system (self-diagnosis function) which is described in "On-Board Diagnostic System (Self-Diagnosis Function)" in this section.

1.	Immobilizer Control Module (Vehicle not equipped with air bag system)
2.	Immobilizer Control Module (Vehicle equipped with air bag system)
3.	Coil antenna (Vehicle not equipped with air bag system)

ECM

As main functions, ECM not only checks matching of ECM / Immobilizer Control Module code but also has an on-board diagnostic system (self-diagnosis function) as described in "On-Board Diagnostic System (Self-Diagnosis Function)" in this section.
For installation position of ECM, refer to "Engine Control Module" in Section 6E.

On-Board Diagnostic System (Self-Diagnosis Function)

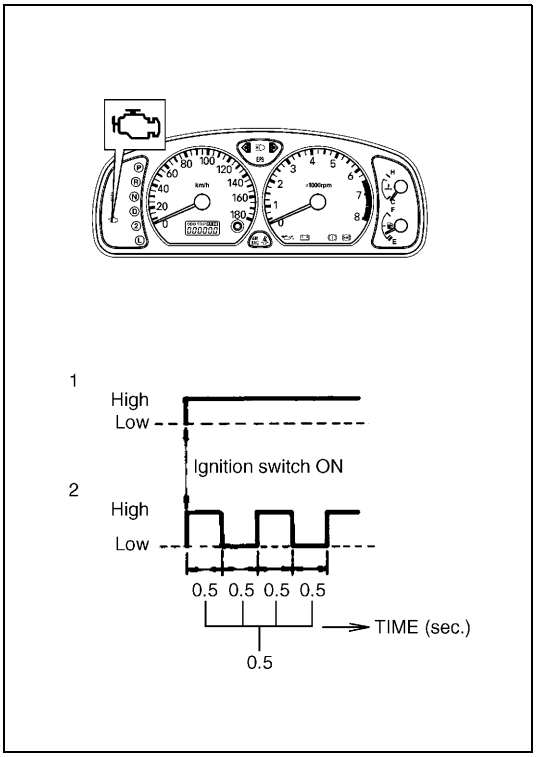
Immobilizer Control Module and ECM diagnose troubles which may occur in the area including the following parts when the ignition switch is ON.

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



<Vehicle not equipped with immobilizer indicator lamp>

With the diagnosis switch terminal of monitor coupler for ECM not grounded, the ignition switch turned ON (but the engine at stop) and regardless of the condition of the electronic fuel injection system, ECM indicates whether a trouble has occurred in the immobilizer control system or not by causing the malfunction indicator lamp to flash or turn ON.

Malfunction indicator lamp is ON:

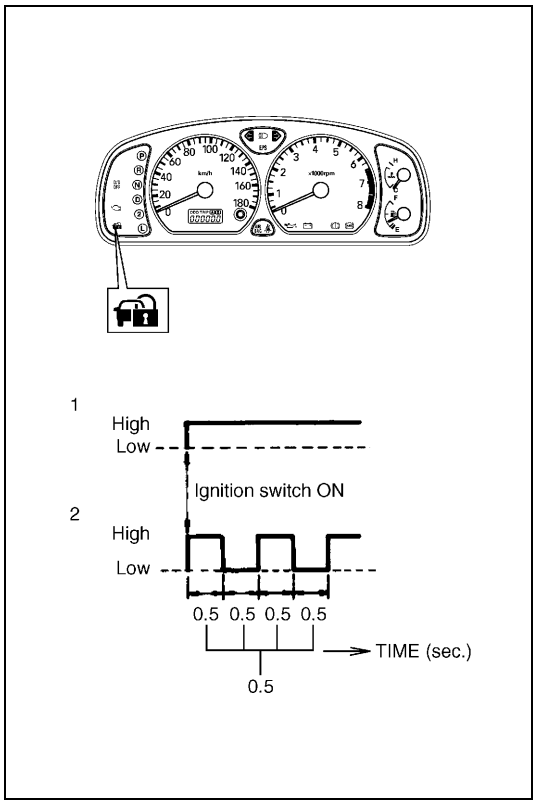
No trouble exists in the immobilizer control system.

Malfunction 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 malfunction indicator lamp stays ON and if the diagnosis result is "abnormal" (2), it immediately changes to flashing but if the result if "normal" (1), it remains ON. Diagnosis takes about 3 seconds at maximum



<Vehicle equipped with immobilizer indicator lamp>

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" (2), it immediately changes to flashing but if the result if "normal" (1), it remains ON. Diagnosis takes about 3 seconds at maximum.

When ECM and Immobilizer Control Module detects a trouble which has occurred in the above areas, it stores DTC corresponding to the exact trouble area in ECM and Immobilizer Control Module memory.

DTCs stored in memory of each controller (Immobilizer Control Module and ECM) can be read by using the procedure described in "Diagnostic Trouble Code Check (Immobilizer Control Module)" and "Diagnostic Trouble Code Check (ECM)" in this section.

Diagnosis

Precautions in Diagnosing Troubles

Precautions in identifying diagnostic trouble code

ECM

<Vehicle not equipped with immobilizer indicator lamp>

- Before identifying diagnostic trouble code indicated by malfunction indicator lamp or 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.
- If abnormality or malfunction lies in two or more areas, malfunction indicator lamp indicates applicable codes three times each.
  And flashing of these codes is repeated as long as diagnosis terminal is grounded and ignition switch is held at ON position.
- When ECM detects a trouble in both engine and emission control system and immobilizer control system, malfunction indicator lamp indicates trouble codes of both systems alternately while the ignition switch is turned ON and the diagnosis terminal is grounded.
- Take a note of diagnostic trouble code indicated first.

<Vehicle equipped with immobilizer indicator lamp>

- 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 are cases where output of diagnostic output terminal, malfunction indicator lamp and/or Suzuki scan tool indicate a diagnostic trouble code representing a trouble which occurred only temporarily and has gone. In such case, it may occur that good parts are replaced unnecessarily. To prevent such accident, be sure to follow instructions given below when checking by using "Diagnostic Flow Table".
  - 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 output of diagnostic output terminal, malfunction indicator lamp and/or 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 malfunction indicator lamp, output of diagnostic output terminal and/or Suzuki scan tool indicate.

Only when they indicate trouble code again, substitute a known-good ECM or Immobilizer Control Module and check again.

If they indicate not 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.

Diagnostic Flow Table

Vehicle Not Equipped With Immobilizer Indicator Lamp

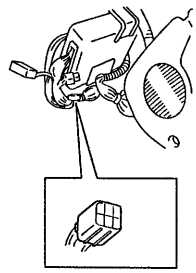
Step	Action	Yes	No
1	1) Make sure that diagnosis switch terminal in monitor coupler is not grounded by service wire. See Fig. 1. 2) Check malfunction indicator lamp while ignition switch is ON (but without starting engine). See Fig. 2. Does malfunction indicator lamp flash?	Go to Step 3.	If malfunction indicator lamp remains ON, go to Step 2. If malfunction indicator lamp remains OFF, go to "Malfunction Indicator Lamp Check" in Section 6.
2	1) Using service wire (2), ground diagnosis switch terminal in monitor coupler (1). See Fig. 3. Does malfunction indicator lamp flash?	Immobilizer control system is in good condition.	Go to "Malfunction Indicator Lamp Check" in Section 6.
3	Does malfunction indicator lamp flash as Fig. 4?	Go to Step 4.	Go to "Malfunction Indicator Lamp Check" in Section 6.
4	1) Check DTC stored in immobilizer control module referring to "Diagnostic Trouble Code Check (Immobilizer Control Module)" in this section. Is there any DTC(s)?	Go to flow table for DTC No.	Go to Step 5.
5	1) Check DTC stored in ECM referring to "Diagnostic Trouble Code Check (ECM)" in this section. Is there any DTC(s)?	Go to flow table for DTC No.	Substitute a known-good ECM and recheck. See NOTE.

NOTE:

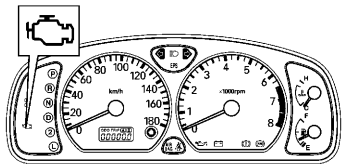
After replacing with a known-good ECM, register ECM / Immobilizer Control Module code in ECM by performing procedure described in "Procedure after ECM Replacement" in this section.

[A] Fig. 1 for step 1 / [B] Fig. 2 for step 1 / [C] Fig. 3 for step 2 and step 5

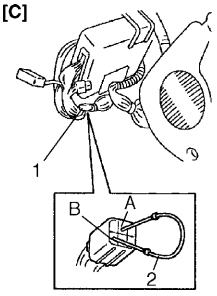
[A]



[B]

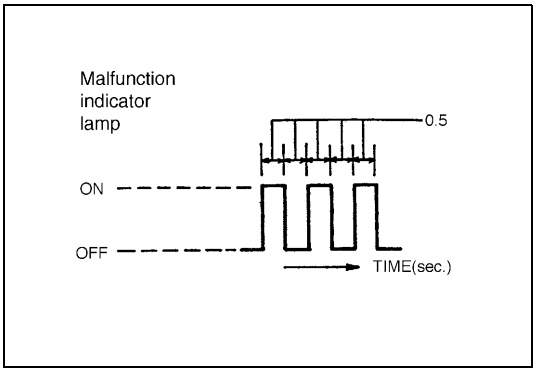


[C]



A :	Diagnosis switch terminal
B :	Ground terminal

Fig. 4 for step 3



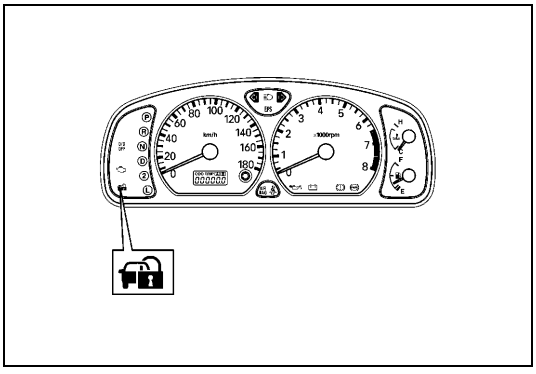
Vehicle Equipped with Immobilizer Indicator Lamp

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 "Immobilizer Indicator Lamp Check" in this section.
2	1) Check DTC stored in ECM referring to "Diagnostic Trouble Code Check (ECM)" in this section. Is there any DTC(s)?	Go to "Immobilizer Indicator Lamp Check" in this section.	Immobilizer control system is in good condition.
3	1) Check DTC stored in immobilizer control module referring to "Diagnostic Trouble Code Check (Immobilizer Control Module)" 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 "Diagnostic Trouble Code Check (ECM)" 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.

NOTE:

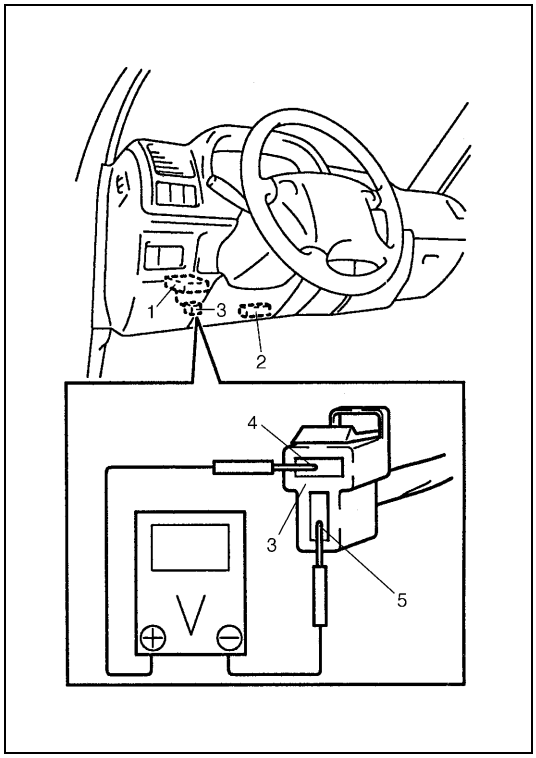
After replacing with a known-good ECM, register ECM / Immobilizer Control Module code in ECM by performing procedure described in "Procedure after ECM Replacement" in this section.

Fig. 1 for step 1



Diagnostic Trouble Code (DTC) Check (Immobilizer Control Module)

[Vehicle not equipped with air bag system]

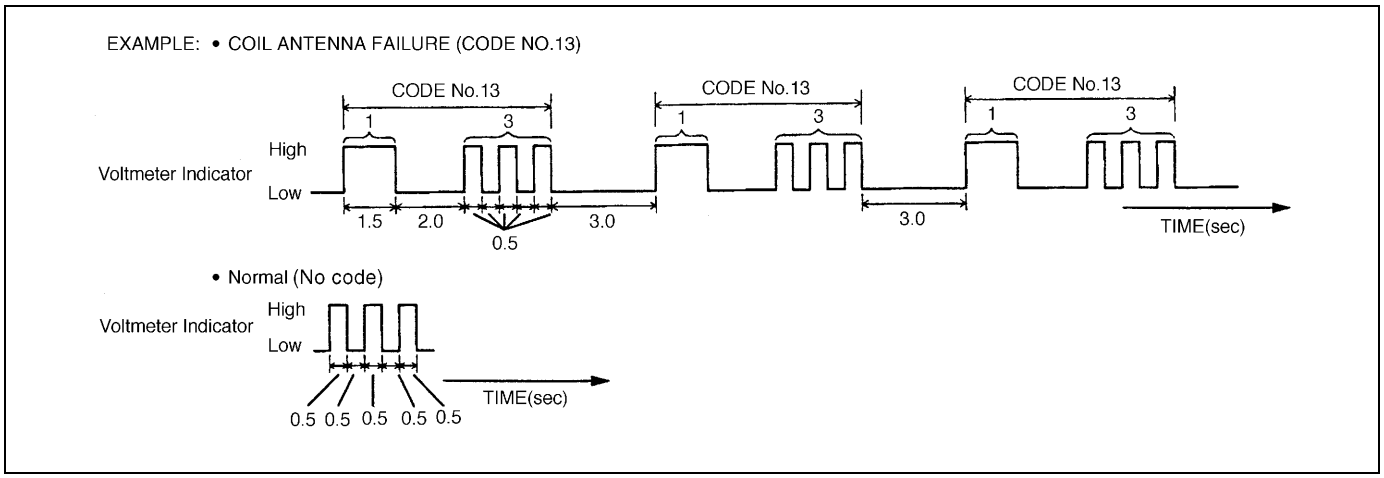


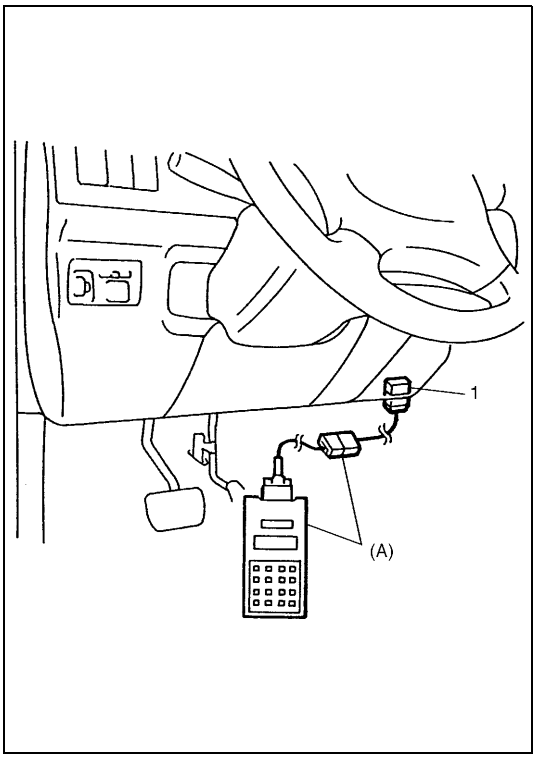
1) Using analog type voltmeter, connect positive probe to diagnostic output terminal (4) and negative probe to ground terminal (5) of immobilizer diagnostic coupler (3) with ignition switch turned ON.
2) Read deflection of voltmeter indicator which represents DTC as shown in example below and write it down. For details of DTC, refer to Immobilizer Control Module side in “Diagnostic Trouble Code Table”.
   If voltmeter indicator does not deflect, go to “Diagnostic Flow Table A”.

NOTE:

If abnormality or malfunction lies in two or more areas, voltmeter indicator lamp indicates applicable codes three times each.

1.	Immobilizer control module
2.	DLC (Data link connector)





[Vehicle equipped with air bag system]

1) Turn ignition switch OFF.
2) After setting cartridge 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. Refer to Suzuki scan tool operator's manual for further details.
   If communication between Suzuki scan tool and immobilizer control module is not possible, go to "Diagnostic Flow Table D".

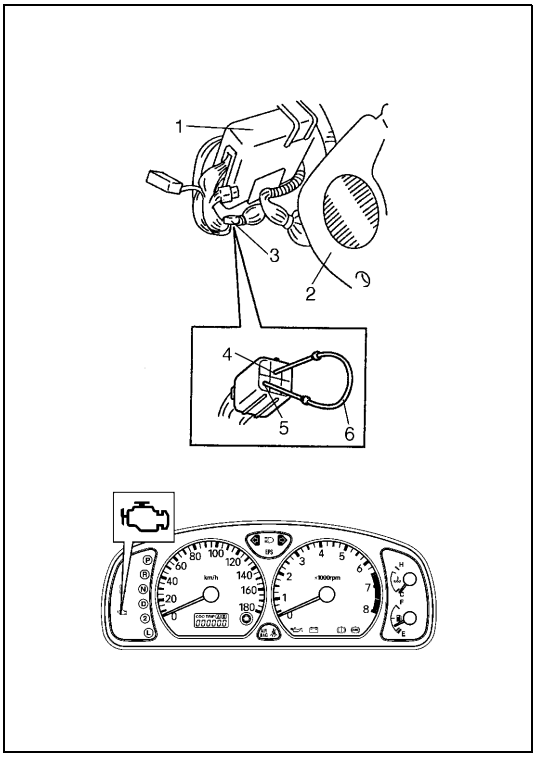
NOTE:

When reading DTC stored in immobilizer control module using Suzuki scan tool, select "BCM" from the applications menu and "IMMOBILIZER" from the select system menu displayed on Suzuki scan tool.

5) After completing the check, turn ignition switch OFF and disconnect Suzuki scan tool from data link connector (DLC).

Diagnostic Trouble Code (DTC) Check (ECM)

[Not using SUZUKI scan tool] (Except for vehicle equipped with immobilizer indicator lamp)



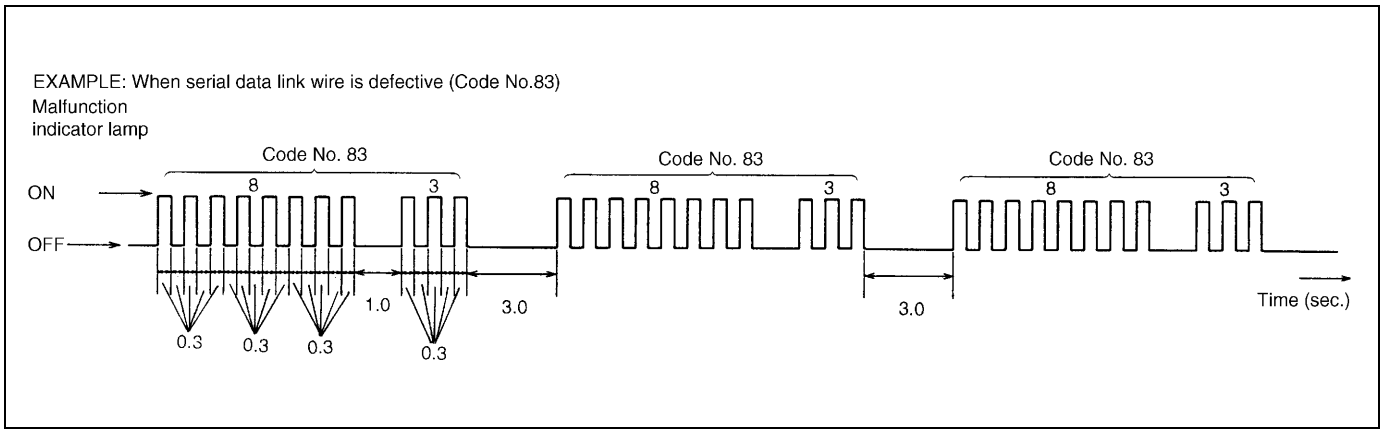
1) Using service wire (6), ground diagnostic switch terminal in monitor coupler (3).

1. ECM
2. Dash side trim
4. To diagnostic switch
5. To ground terminal

2) Read DTC from flashing pattern of malfunction indicator lamp as shown in example below and write it down. For details of DTC, refer to ECM side in "Diagnostic Trouble Code Table".
   If lamp remains ON, go to "Malfunction Indicator Lamp Check" in Section 6.

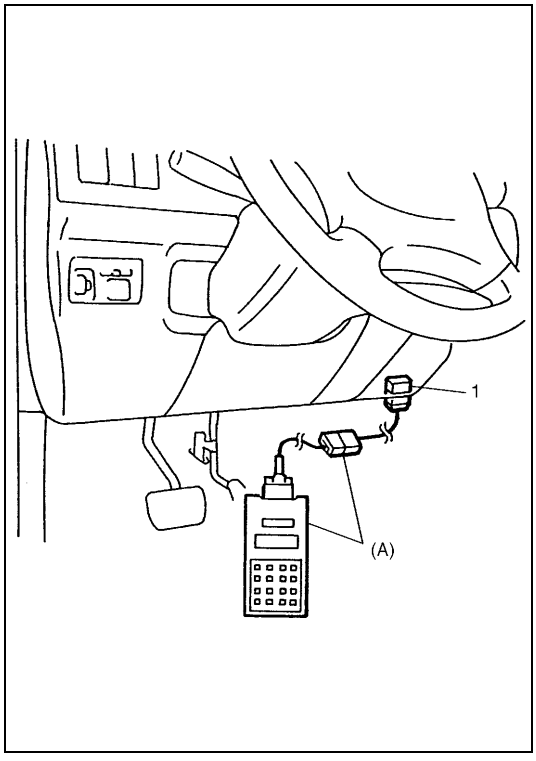
NOTE:

If abnormality or malfunction lies in two or more areas, malfunction indicator lamp indicates applicable codes three times each.
And flashing of these codes is repeated as long as diagnosis terminal is grounded and ignition switch is held at ON position.



3) After completing the check, turn ignition switch OFF and disconnect service wire from monitor coupler.

[Using SUZUKI scan tool]



1) Turn ignition switch OFF.
2) After setting cartridge 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. Refer to Suzuki scan tool operator's manual for further details.
   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.

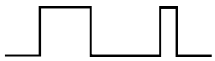
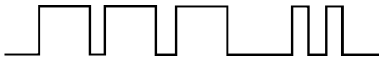
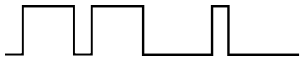
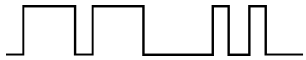
NOTE:

- **When reading DTC stored in ECM using Suzuki scan tool, select "ECM" from the applications menu and "SUZUKI mode" from the communication mode menu displayed on Suzuki scan tool.**
- **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 Suzuki mode of ECM application.**

5) After completing the check, turn ignition switch OFF and disconnect Suzuki scan tool from data link connector (DLC).

Diagnostic Trouble Code Table

Immobilizer control module

DTC (indicated on Suzuki scan tool)	DTC (indicated by voltmeter indicator)	VOLTMETER INDICATION	DIAGNOSTIC AREA	DIAGNOSIS
NO DTC	–		Normal (No code)	This code appears when none of the other codes are identified.
11	11		Transponder code	Diagnose trouble according to “Diagnostic Flow Table” corresponding to each code No.
31	31			
*32	*32			
12	12		Immobilizer Control Module	
13	13		Coil antenna or ignition key with built-in transponder	
21	21		ECM / Immobilizer Control Module code	
22	22		Ignition switch circuit	
23	23		Serial data link circuit	

NOTE:

The DTC with asterisk (*) in DTC column is for vehicle equipped with air bag system.

ECM

To learn how to read diagnostic trouble code (DTC) from flashing of malfunction indicator lamp, refer to “Diagnostic Trouble Code Table” in Section 6.

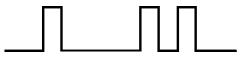
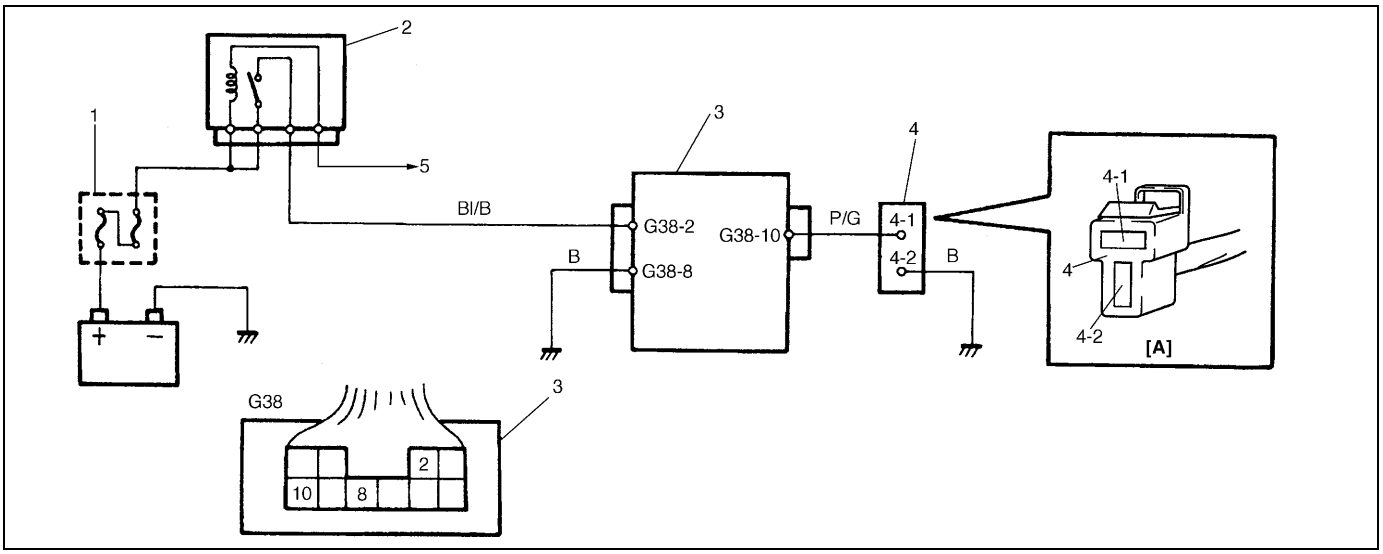
DTC (indicated on Suzuki scan tool)	DTC (indicated by MIL)	Malfunction Indicator lamp (MIL) flashing pattern	DIAGNOSTIC AREA	DIAGNOSIS
NO DTC	12		Normal	This code appears when it is confirmed that none of other trouble codes is set for immobilizer control system or engine and emission control system.
P1623	81		ECM / Immobilizer Control Module code	Diagnose trouble according to “Diagnostic Flow Table” corresponding to each code No.
P1620	84			
P1622	82		ECM	
P1621	83		Serial data link wire	

Table A DTC is Not Output From Diagnostic Output Terminal (For Vehicle Not Equipped with Air Bag System)



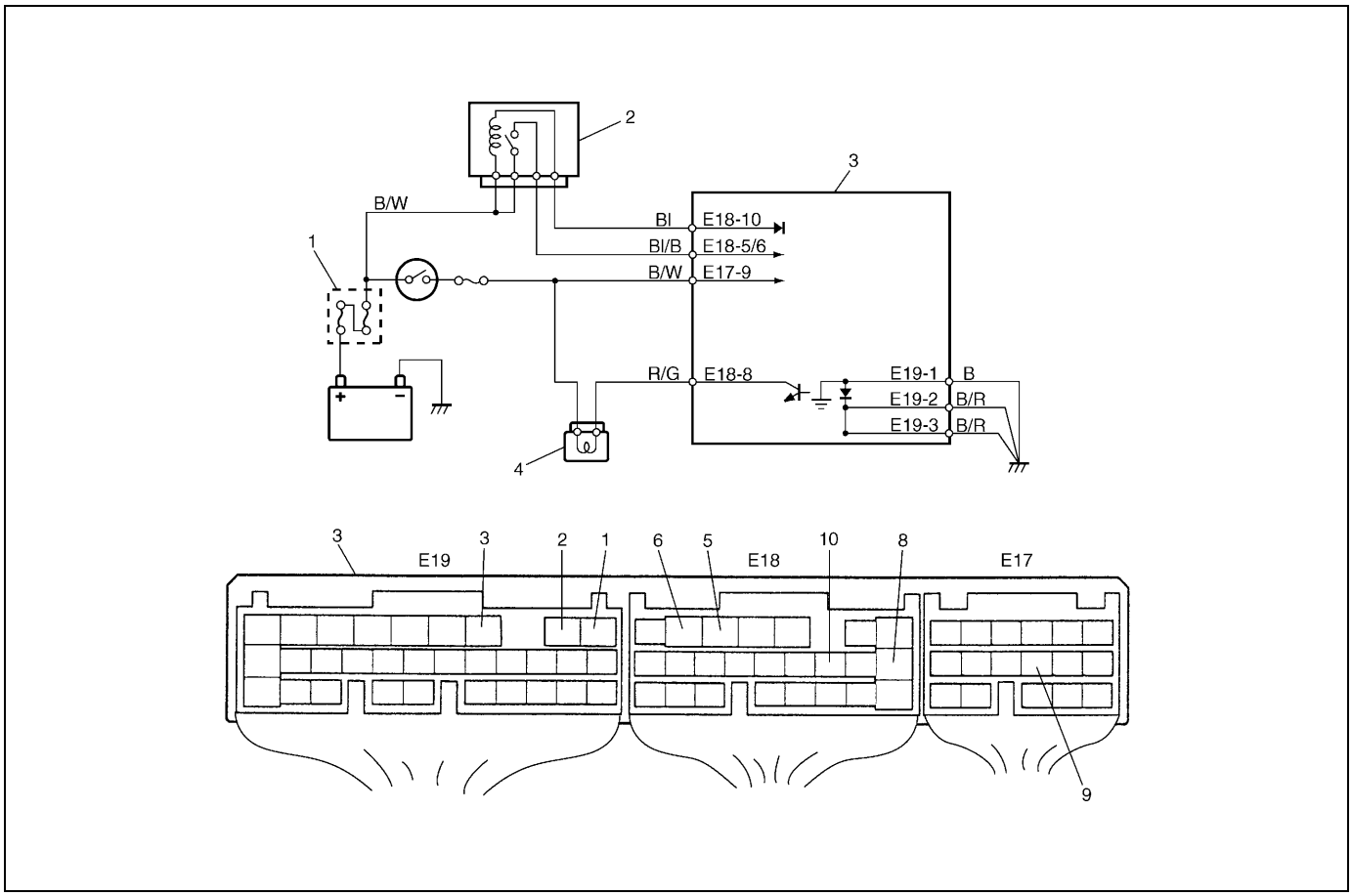
1. Main fuse	4. Immobilizer diagnostic coupler (Vehicle not equipped with immobilizer indicator lamp)	5. To ECM
2. Main relay	4-1. Ground terminal	[A] : In cabin
3. Immobilizer Control Module	4-2. Diagnostic output terminal	

Step	Action	Yes	No
1	Check voltage between G38-2 terminal and body ground with ignition switch turned ON. Is it 10 – 14V?	Go to Step 2.	"Bl/B" wire open.
2	1) Connect voltmeter between G38-10 terminal and body ground. 2) Does voltmeter indicator deflect?	Go to Step 3.	Poor G38-2, G38-10 or G38-8 connection. "B" wire of G38-8 terminal open. "P/G" wire between G38-10 terminal and diagnostic output terminal of immobilizer diagnostic coupler short. If wire and connections are OK, substitute a known-good Immobilizer Control Module and recheck. See NOTE.
3	1) Connect voltmeter between diagnostic output terminal of immobilizer diagnostic coupler and body ground. 2) Is it possible to read DTC by checking deflection of voltmeter indicator?	"B" wire of ground terminal for immobilizer diagnostic coupler open.	"P/G" wire between G38-10 terminal and diagnostic output terminal of immobilizer diagnostic coupler 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.

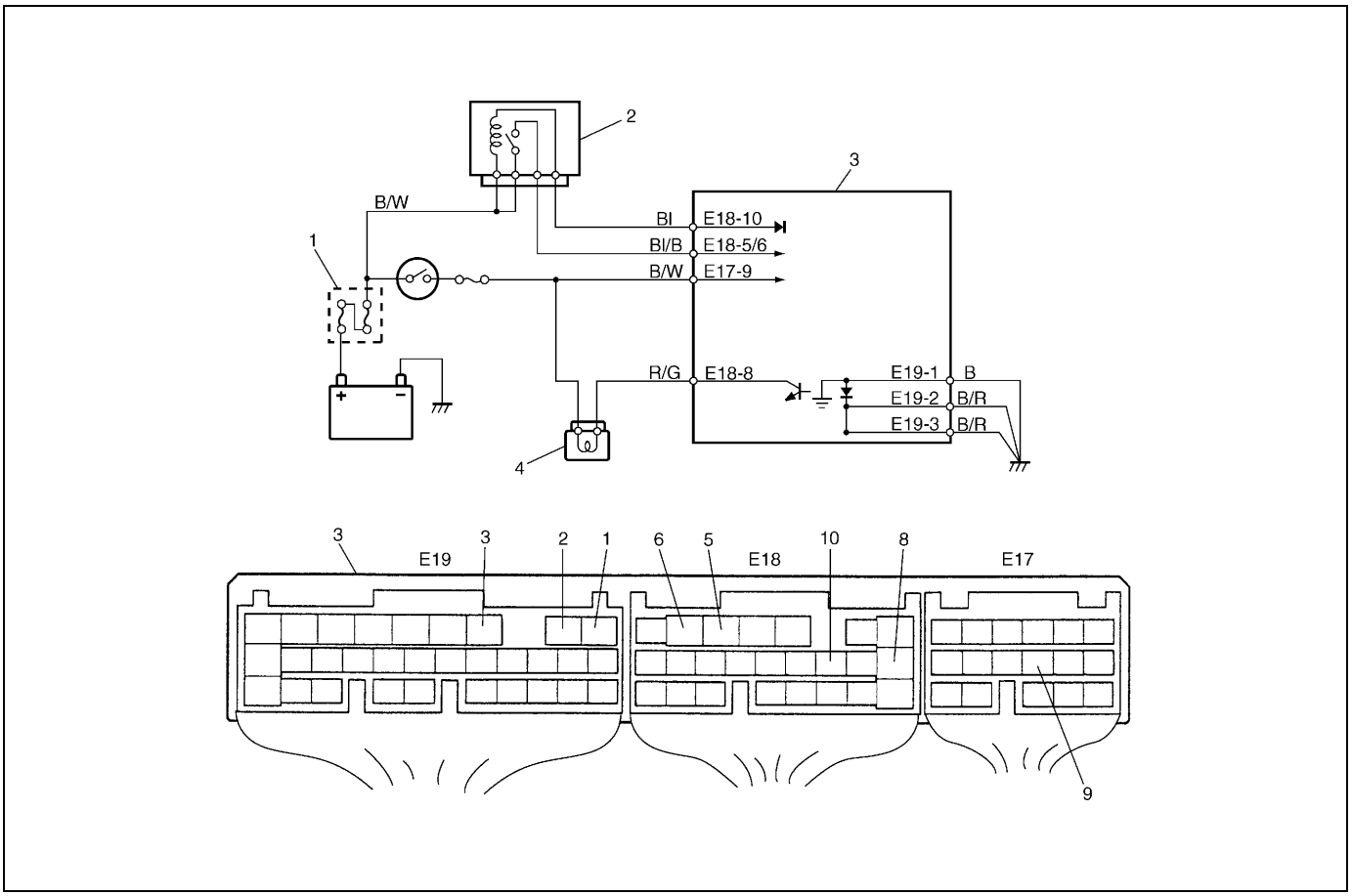
Table B Immobilizer Indicator Lamp Check For Vehicle Equipped with Immobilizer Indicator Lamp (Immobilizer Indicator Lamp Does Not Light at Ignition Switch ON)



1. Main fuse	2. Main relay	3. ECM	4. Immobilizer indicator lamp

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, "B/W" 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 E18-8. 3) If OK, then using service wire, ground terminal E18-8 in connector disconnected. Does immobilizer indicator lamp turn on at ignition switch ON?	Substitute a known-good ECM and recheck.	Bulb burned out or "Bl" wire circuit open.

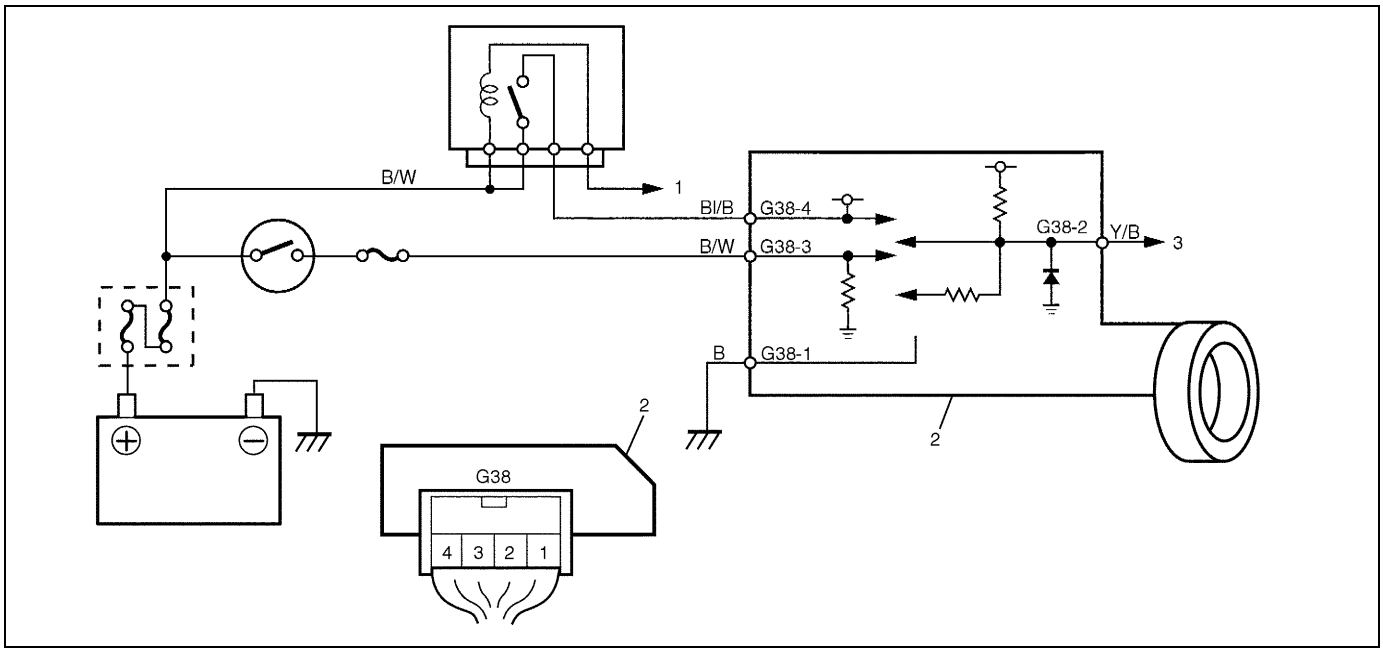
Table C Immobilizer Indicator Lamp Check for Vehicle Equipped with Immobilizer Indicator Lamp (Immobilizer Indicator Lamp Remains on After Engine Starts)



1. Main fuse	2. Main relay	3. ECM	4. Immobilizer indicator lamp

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect couplers from ECM. Does immobilizer indicator lamp turn ON at ignition switch ON?	"R/G" wire shorted to ground circuit.	Substitute a known-good ECM and recheck.

Table D DTC is Not Output From Immobilizer Control Module (For Vehicle Equipped with Air Bag System)



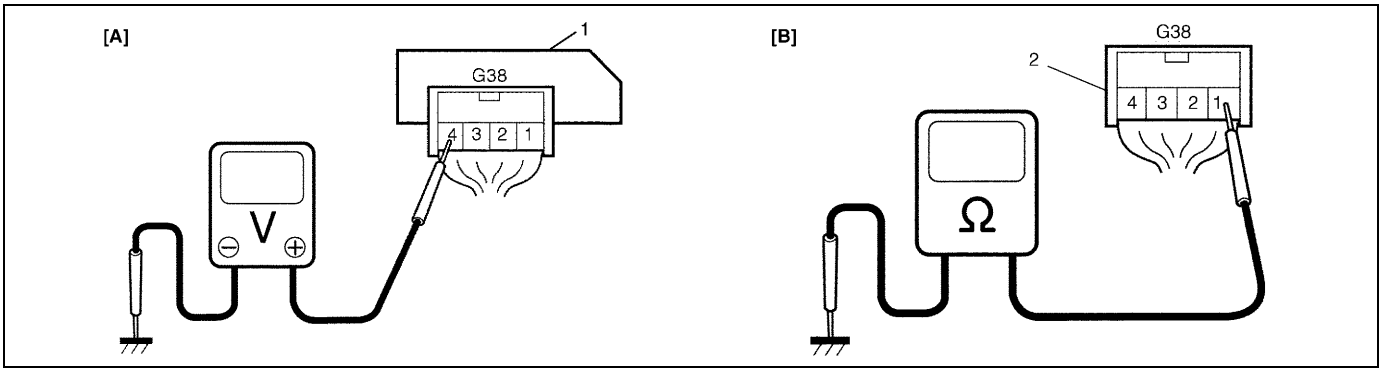
1. To ECM	2. Immobilizer control module	3. To #9-pin in DLC

Step	Action	Yes	No
1	Check voltage between G38-4 terminal and body ground with ignition switch turned ON. See Fig 1. Is it 10 – 14 V?	Go to Step 2.	"Bl/B" wire open or short to ground.
2	1) Disconnect coupler at immobilizer control module. 2) Is there continuity between coupler terminal G38-1 and body ground? See Fig 2.	Poor "G38-4" or "G38-1" connection Poor #9-pin connection in DLC Serial data line "Y/B" open or short to ground If connections and line are OK, substitute a known-good Immobilizer Control Module and recheck. See NOTE.	"B" 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



1.	Immobilizer control module
2.	Immobilizer control module coupler

DTC11/32 Transponder Code Not Matched

DESCRIPTION:

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.

INSPECTION:

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

DESCRIPTION:

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.

INSPECTION:

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

DESCRIPTION:

This DTC is set when an internal fault is detected in Immobilizer Control Module.

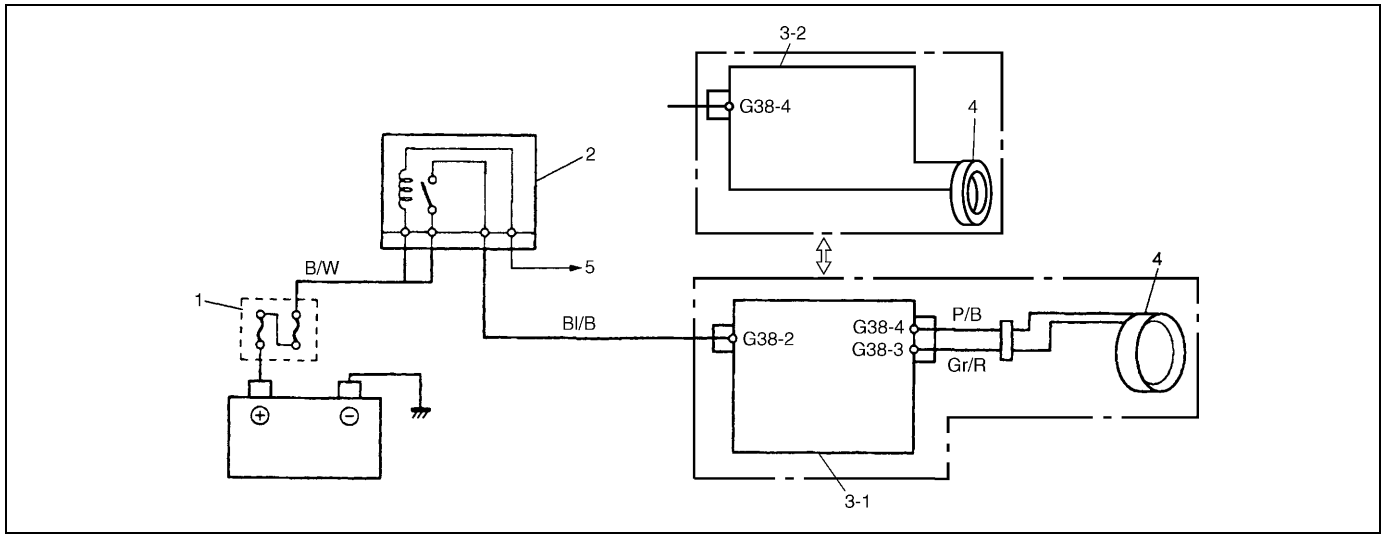
INSPECTION:

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.	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



1. Main fuse	3-1. Immobilizer Control Module (Vehicle not equipped with air bag system)	4. Coil antenna
2. Main relay	3-2. Immobilizer Control Module (Vehicle equipped with air bag system)	5. To ECM

DESCRIPTION:

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.

INSPECTION:

Vehicle not equipped with air bag system

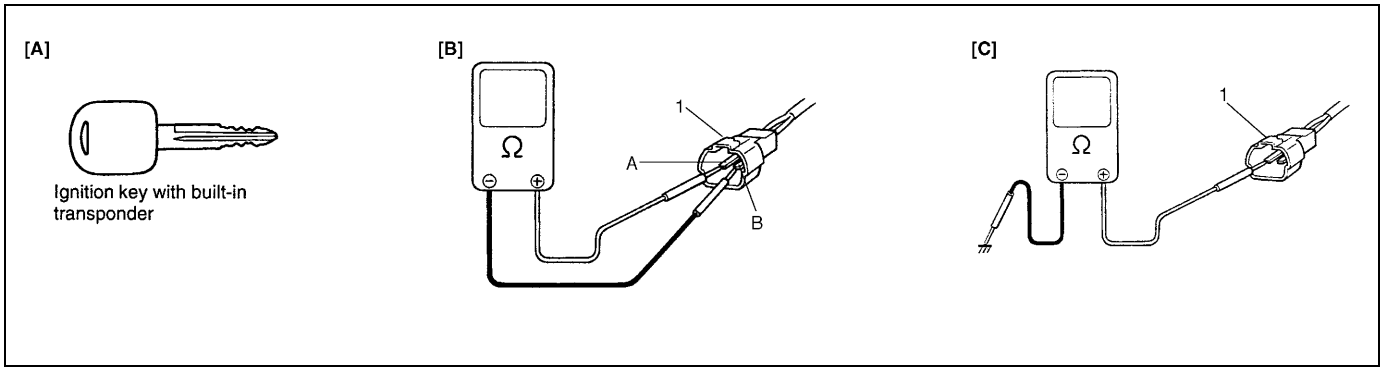
Step	Action	Yes	No
1	Check that knob shape and color for ignition key are as shown below. • Knob color: Black • Knob shape: the same as shown in Fig.1. Is it the original one?	Go to Step 2.	Replace ignition key with original one and follow “Diagnostic Flow Table” again.
2	1) Disconnect coil antenna coupler (1) with ignition switch turned OFF. 2) Is there continuity between coil antenna coupler terminals A and B? (See Fig. 2)	Go to Step 3.	Coil antenna open.
3	Measure resistance between terminals of coil antenna coupler (1) and body ground. (See Fig. 3) Is it ∞ (infinity) Ω?	Go to Step 4.	Coil antenna shorted to ground.

Step	Action	Yes	No
4	1) With coil antenna coupler disconnected, disconnect Immobilizer Control Module coupler. 2) Measure resistance between coil antenna terminals of Immobilizer Control Module coupler (1). (See Fig. 4) Is it ∞ (infinity) Ω?	Go to Step 5.	"P/B" wire shorted to "Gr/R" wire.
5	Measure resistance between terminal G38-4 of Immobilizer Control Module coupler (1) and body ground. (See Fig. 5) Is it ∞ (infinity) Ω?	Go to Step 6.	"P/B" wire shorted to ground.
6	Measure resistance between terminal G38-3 of Immobilizer Control Module coupler (1) and body ground. (See Fig. 6) Is it ∞ (infinity) Ω?	Go to Step 7.	"Gr/R" wire shorted to ground.
7	1) Connect coil antenna coupler. 2) Is there continuity between Immobilizer Control Module coupler (1) terminals G38-4 and G38-3? (See Fig. 7)	Go to Step 8.	"P/B" or "Gr/R" wire open Poor coil antenna-to-coupler
8	1) If connections are OK, connect Immobilizer Control Module coupler and substitute a known-good coil antenna. 2) Is DTC 13 also indicated with ignition switch turned ON?	Go to Step 9.	Faulty coil antenna.
9	Is DTC 13 still indicated even when another ignition key (with built-in transponder) for that vehicle used?	Substitute a known-good Immobilizer Control Module and recheck. See NOTE.	Faulty transponder.

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



[D] Fig. 4 for step 4 / [E] Fig. 5 for step 5 / [F] Fig. 6 for step 6

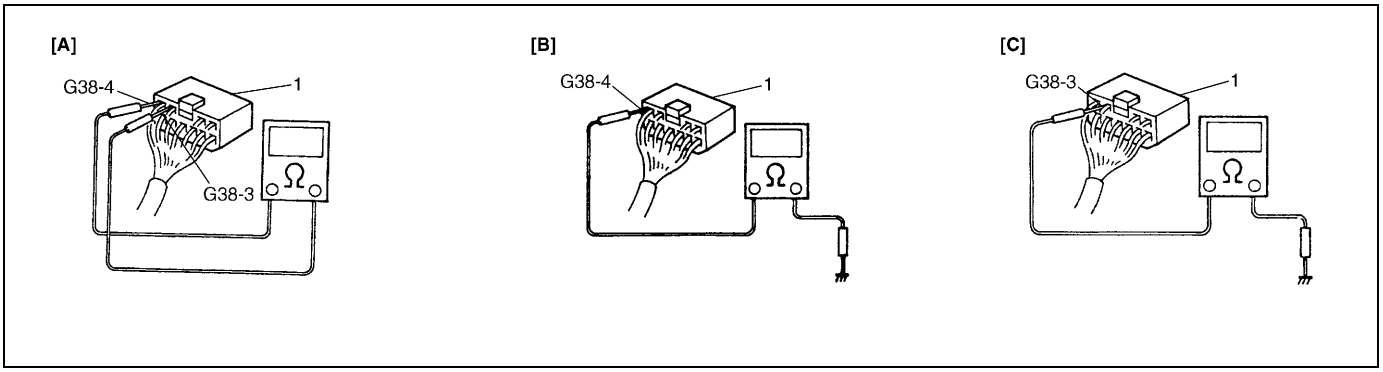
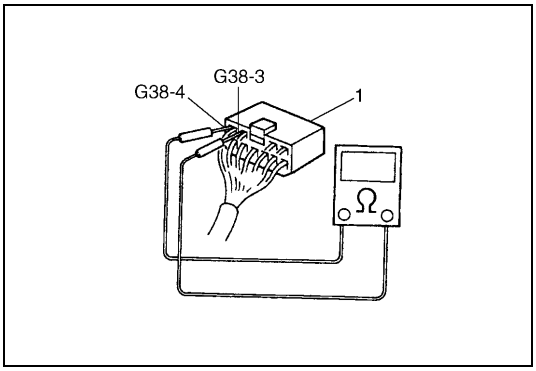


Fig. 7 for step 7



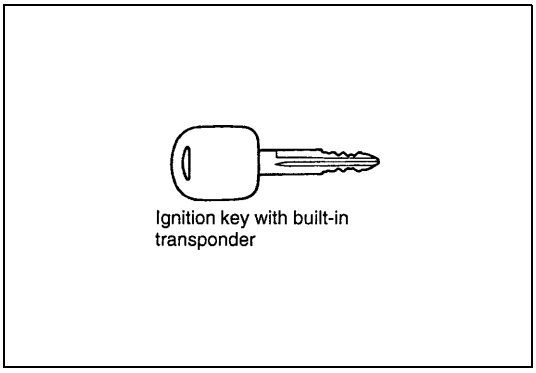
Vehicle Equipped with Air Bag System

Step	Action	Yes	No
1	Check that knob shape and color for ignition key are as shown below. • Knob color: Dark gray • Knob shape: the same as shown in Fig.1. Is it the original one?	Substitute a known-good Immobilizer Control Module and recheck. See NOTE.	Replace ignition key with original one and follow “Diagnostic Flow Table” 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.

Fig. 1 for step 1



DTC21 ECM / Immobilizer Control Module Code Not Matched (Immobilizer Control Module Side)

DTC81 ECM / Immobilizer Control Module Code Not Matched (P1623) (ECM Side)

DTC84 ECM / Immobilizer Control Module Code Not Registered (P1620)

DESCRIPTION:

- 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.
- DTC81 (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.
- DTC84 (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.

INSPECTION:

Perform procedure described in “Procedure After ECM Replacement” in this section.

DTC82 (P1622) Fault in ECM

DESCRIPTION:

This DTC is set when an internal fault is detected in ECM.

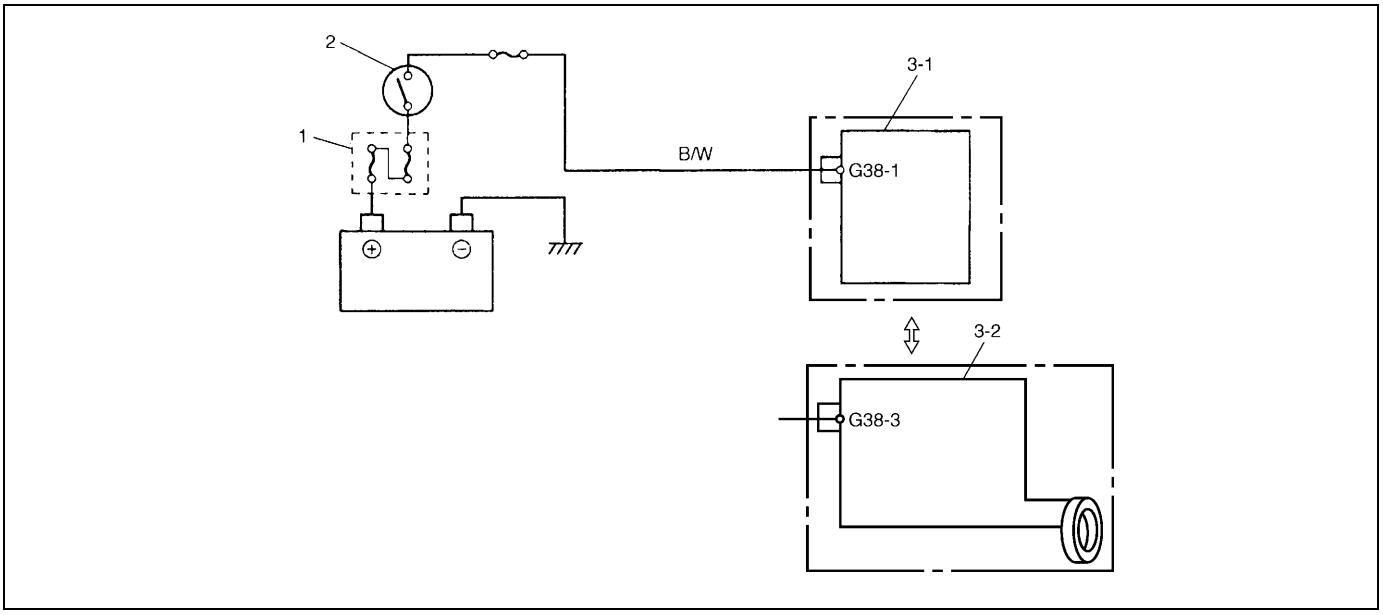
INSPECTION:

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.	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



1. Main fuse	2. Ignition switch	3-1. Immobilizer Control Module (Vehicle not equipped with air bag system)	3-2. Immobilizer Control Module (Vehicle equipped with air bag system)

DESCRIPTION:

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.

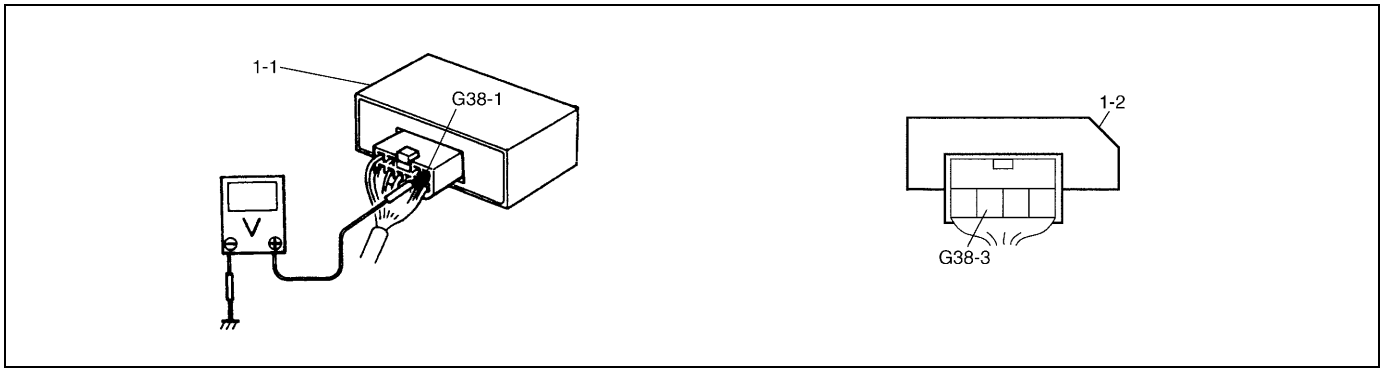
INSPECTION:

Step	Action	Yes	No
1	Check voltage between Immobilizer Control Module coupler terminal shown below and body ground with ignition switch turned ON. (See Fig.1) • Terminal for vehicle without air bag system: “G38-1” • Terminal for vehicle with air bag system: “G38-3” Is it 10 – 14V?	<Vehicle without air bag system> Poor G38-1 terminal connection <Vehicle with air bag system> Poor G38-3 terminal connection If connection is OK, substitute a known-good Immobilizer Control Module and recheck. See NOTE.	“B/W” wire open or short.

NOTE:

After replacing with a know-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.

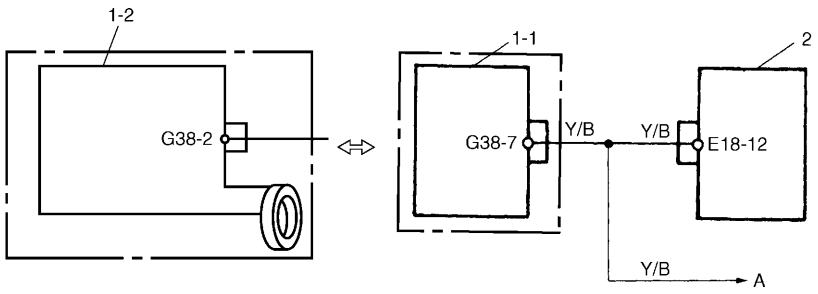
Fig. 1 for step 1



1-1.	Immobilizer Control Module (Vehicle not equipped with air bag system)
1- 2.	Immobilizer Control Module (Vehicle equipped with air bag system)

DTC23 No ECM / Immobilizer Control Module Code Transmitted From ECM or DLC Circuit Opened / Shorted

DTC83 (P1621) No ECM / Immobilizer Control Module Code Transmitted From Immobilizer Control Module or DLC Circuit Opened / Shorted



1-1. Immobilizer Control Module (Vehicle not equipped with air bag system)	1-2. Immobilizer Control Module (Vehicle equipped with air bag system)	2. ECM	A. To data link connector (DLC)

DESCRIPTION:

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 DTC83.

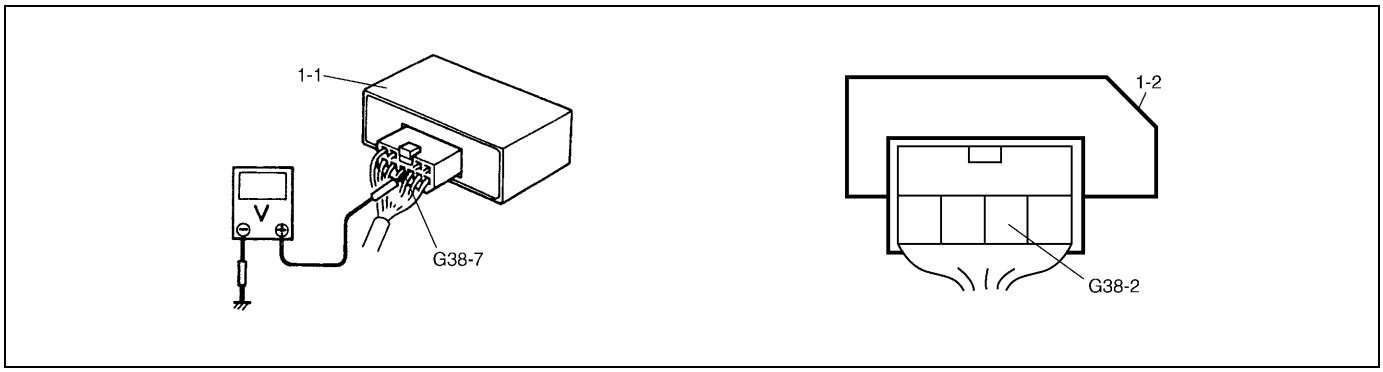
INSPECTION:

Step	Action	Yes	No
1	Check voltage between Immobilizer Control Module coupler terminal shown below and body ground with ignition switch turned ON. (See Fig. 1) • Terminal for vehicle without air bag system: “G38-7” • Terminal for vehicle with air bag system: “G38-2” Is it 4 – 5V?	Go to Step 2.	“Y/B” wire short.
2	1) Disconnect ECM coupler with ignition switch turned OFF. 2) Is there continuity between Immobilizer Control Module coupler terminal shown below and serial data link terminal (E18-12) of ECM coupler? (For positions of Data link connector terminal of ECM coupler, refer to “System and Location” in this section.) • Terminal for vehicle without air bag system: “G38-7” • Terminal for vehicle with air bag system: “G38-2”	<Vehicle without air bag system> Poor G38-7 terminal connection or poor data link connector terminal connection (ECM) <Vehicle with air bag system> Poor G38-2 terminal connection 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.	“Y/B” wire between Immobilizer Control Module and ECM open.

NOTE:

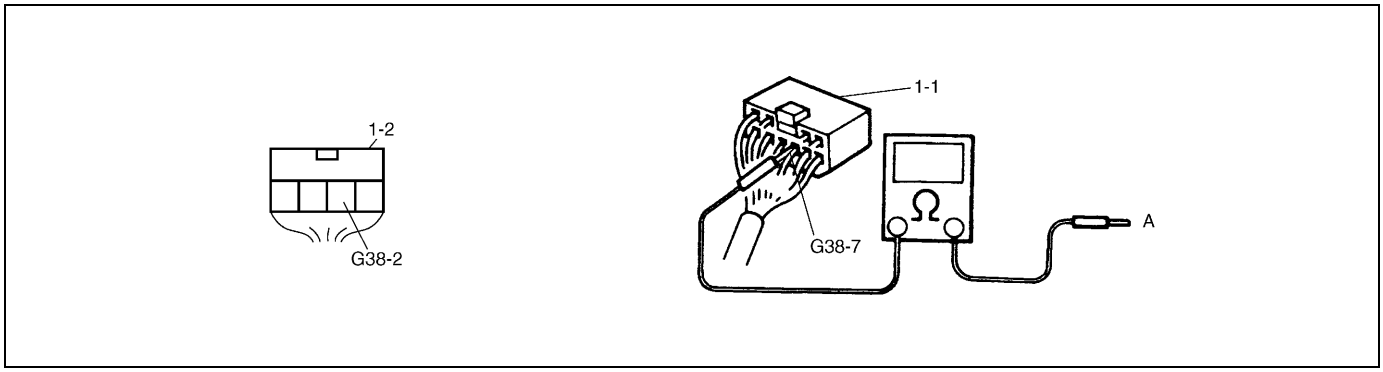
- **After replacing with a known-good ECM, register ECM / Immobilizer Control Module code in ECM by performing procedure described in "Procedure After ECM Replacement" in this section.**
- **After replacing with a known-good Immobilizer Control Module, register ECM / Immobilizer Control Module code in 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 this section.**

Fig. 1 for step 1



1-1.	Immobilizer Control Module (Vehicle not equipped with air bag system)
1-2.	Immobilizer Control Module (Vehicle equipped with air bag system)

Fig. 2 for step 2



1-1.	Immobilizer Control Module coupler disconnected (Vehicle not equipped with air bag system)
1-2.	Immobilizer Control Module coupler disconnected (Vehicle equipped with air bag system)
A.	Connect to serial data link terminal (E18-12) 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 “Inspection of ECM and Its Circuits” in Section 6.

CAUTION:

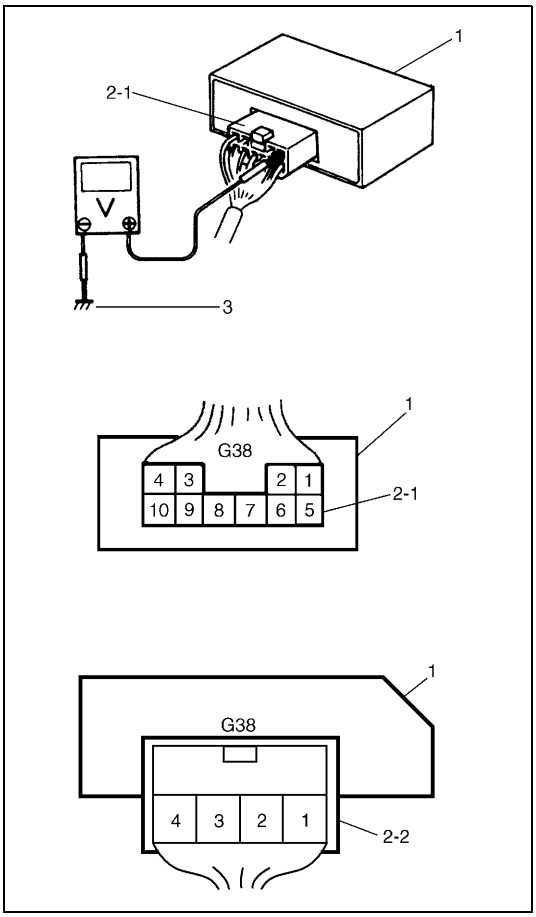
Immobilizer Control Module cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to Immobilizer Control Module with coupler disconnected from it.

Voltage Check

1) Remove Immobilizer Control Module, referring to “Immobilizer Control Module” for removal 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
2-1.	Immobilizer Control Module coupler (Vehicle not equipped with air bag system)
2-2.	Immobilizer Control Module coupler (Vehicle equipped with air bag system)
3.	Body ground

<Vehicle not equipped with air bag system>

TERMINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
G38-1	Ignition signal	10 – 14V	Ignition switch ON
		0 – 0.8V	Ignition switch OFF
G38-2	Power source	10 – 14V	Ignition switch ON
G38-3	Coil antenna 2	0V	Ignition switch ON
G38-4	Coil antenna 1	0V	Ignition switch ON
G38-5 G38-6	Blank	–	–
G38-7	Data link connector (Serial data terminal)	4 – 5V	Ignition switch ON
G38-8	Ground	–	–
G38-9	Blank	–	–
G38-10	Diagnosis output	0 – 14V	Ignition switch ON
		0V	Ignition switch OFF

NOTE:

When measuring voltage at G38-4 and G38-3 terminals with ignition switch turned ON, be sure to turn ignition switch ON before connecting positive probe of voltmeter to G38-4 or G38-3 terminal. If it is not turned ON first, DTC13 (Diagnostic Trouble Code 13) may be indicated.

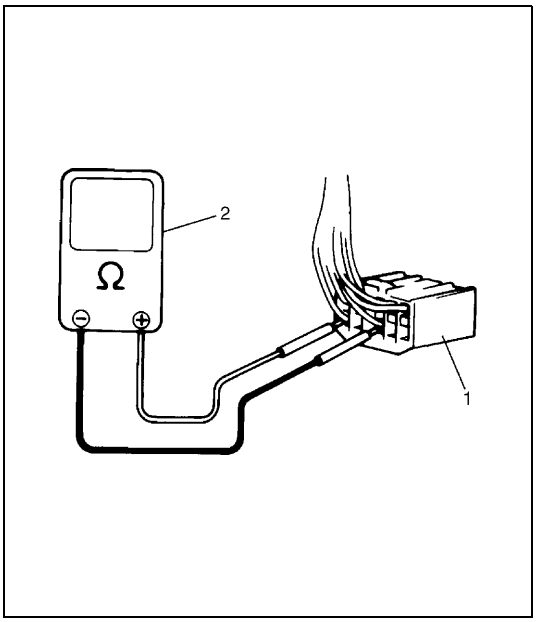
<Vehicle equipped with air bag system>

TERMINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
G38-1	Ground	–	–
G38-2	Data link connector (Serial data terminal)	4 – 5V	Ignition switch ON
G38-3	Ignition signal	10 – 14V	Ignition switch ON
		0 – 0.8V	Ignition switch OFF
G38-4	Power source	10 – 14V	Ignition switch ON

Resistance Check (Vehicle Not Equipped with Air Bag System)

1) Disconnect Immobilizer Control Module couplers from Immobilizer Control Module with ignition switch OFF.

CAUTION:
Never touch terminals of Immobilizer Control Module itself or connect voltmeter or ohmmeter.



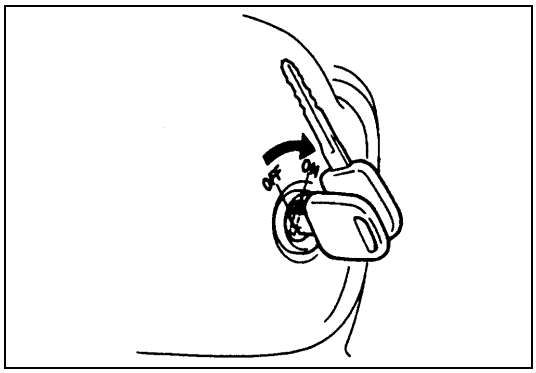
2) Check resistance between each terminal of couplers disconnected (1).

CAUTION:
- **Be sure to connect ohmmeter (2) 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).**

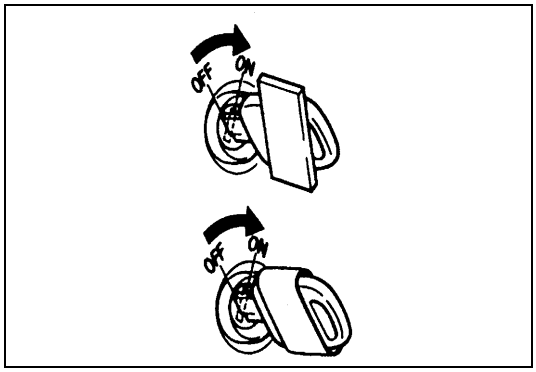
TERMINAL	CIRCUIT	NORMAL RESISTANCE	CONDITION
G38-4 – G38-3	Coil antenna	Continuity	–

On-Vehicle Service

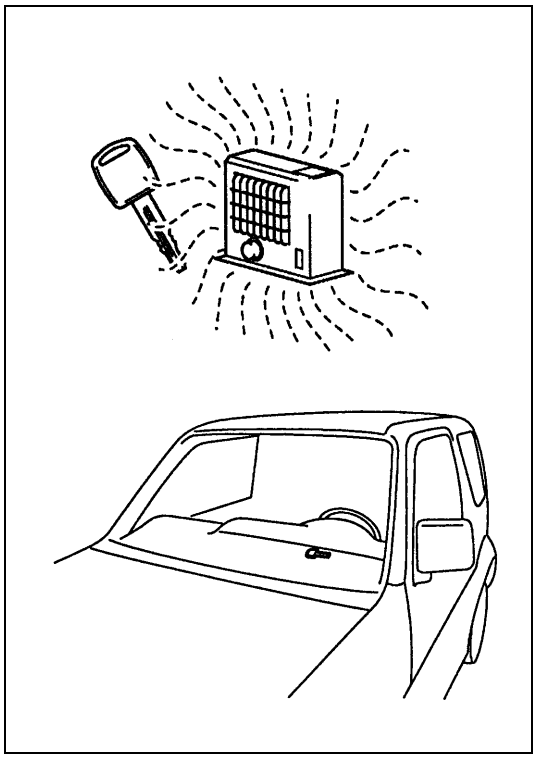
Precautions in Handling Immobilizer Control System



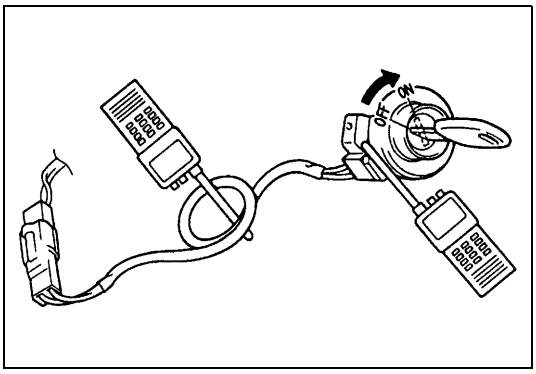
- Don't turn ON ignition switch with ignition key for immobilizer control system put together with another one or placed quite close to another one. Or the system may detect abnormal condition and prevent engine from starting.



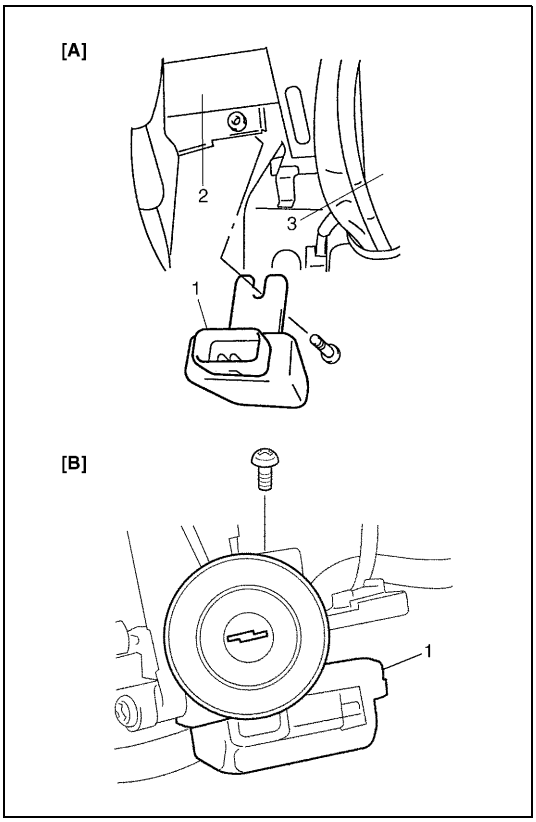
- Do not turn ON ignition switch by using ignition key with any type of metal wound around its grip or in contact with it. Or the system may detect abnormal condition and prevent engine from starting.



- 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 coil antenna or its harness to Immobilizer Control Module. Or the system may detect abnormal condition and prevent engine from starting.



Immobilizer Control Module

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Remove steering column hole cover.
3) [Vehicle equipped with air bag system]
   Remove steering column mounting bolts, then remove steering column upper and lower cover.
4) Disconnect coupler at Immobilizer Control Module.
5) Remove immobilizer control module (1).

2.	Steering support member
3.	Steering shaft
[A] :	For vehicle not equipped with air bag system
[B] :	For vehicle equipped with air bag system

INSTALLATION

Reverse removal procedure for installation.

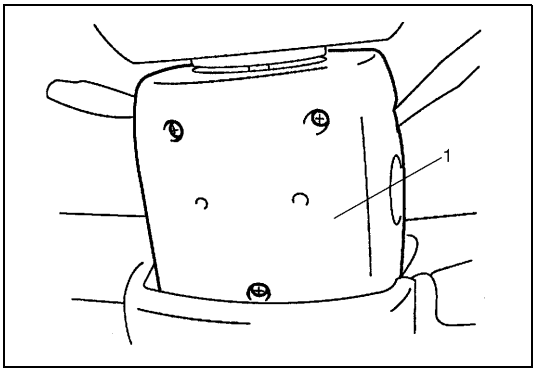
NOTE:

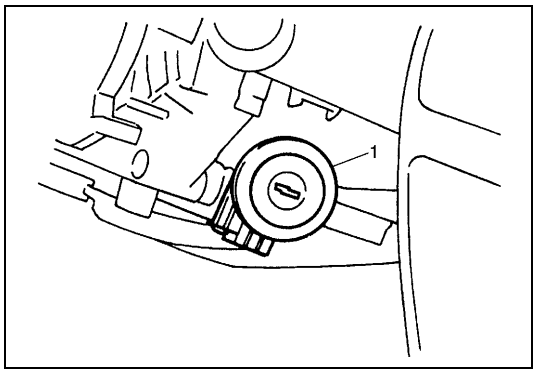
After replacing Immobilizer Control Module, be sure to register Transponder code and ECM / Immobilizer Control Module code in Immobilizer Control Module and ECM / Immobilizer Control Module code in ECM by performing procedure described in "Procedure After Immobilizer Control Module Replacement" in this section.

Coil Antenna (Vehicle not equipped with air bag system)

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Remove steering column hole cover.
3) Remove steering column upper and lower cover (1).





4) Remove coil antenna (1).

INSTALLATION

For installation, reverse removal procedure.

How to Register Ignition Key

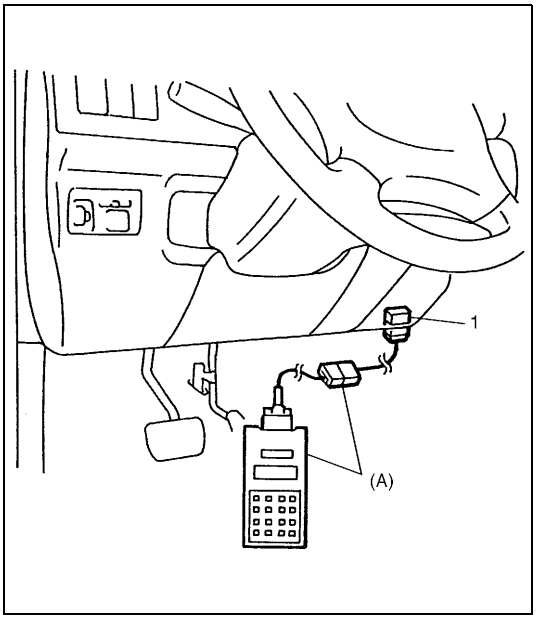
Register the ignition key with a built-in transponder in Immobilizer Control Module by using the following procedure.

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 with / without air bag system is as shown below. The ignition key with wrong knob color cannot be registered.

- **Knob color of ignition key for vehicle with air bag system: Dark gray**
- **Knob color of ignition key for vehicle without air bag system: Black**

1) Prepare SUZUKI scan tool and cartridge for immobilizer control system.

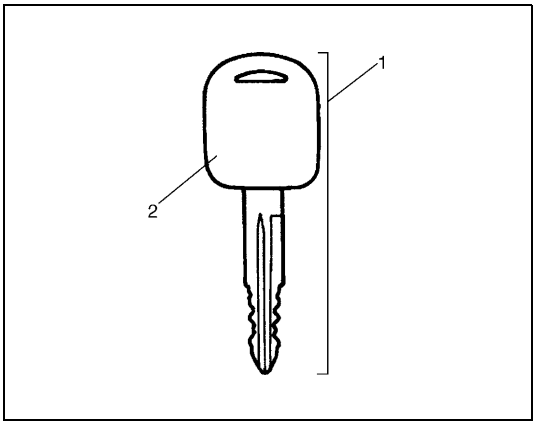


2) With ignition switch OFF, connect SUZUKI scan tool to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

(A) : SUZUKI scan tool

NOTE:

For operation procedure of SUZUKI scan tool, refer to SUZUKI scan tool operator's manual.



3) Prepare ignition key with a built-in transponder (1). And then turn ignition switch ON by using it.

2. Key knob

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 executing the "CLR. TRANS COD (CLEAR TP CODE)" command in the SELECT MODE menu by using SUZUKI scan tool.

NOTE:

When "CLR. TRANS COD (CLEAR TP CODE)" command is executed with the malfunction indicator lamp (if not equipped with immobilizer indicator lamp) ON or 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 by executing "ENT. TRANS COD (ENT. TP CODE)" command in SELECT MODE menu.
6) Make sure that following indicator lamp lights when ignition switch is turned OFF once and then turned ON.
   - Vehicle not equipped with immobilizer indicator lamp : malfunction indicator lamp (MIL).
   - Vehicle equipped with immobilizer indicator lamp : immobilizer indicator lamp.
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 same Transponder code for ignition key with a built-in transponder as the one 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 with / without air bag system is as shown below. The ignition key with wrong knob color cannot be registered.

- **Knob color of ignition key for vehicle with air bag system: Dark gray**
- **Knob color of ignition key for vehicle without air bag system: Black**

1) Perform steps 1) and 2) described in "How To Register Ignition Key" in this section.
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 by executing "CLR. TRANS COD (CLEAR TP CODE)" command in SELECT MODE menu.

NOTE:

When "CLR. TRANS COD (CLEAR TP CODE)" command is executed with the malfunction indicator lamp (if not equipped with immobilizer indicator lamp) ON or 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 by executing "ENT. TRANS COD (ENT. TP CODE)" command in SELECT MODE menu.
5) Using SUZUKI scan tool, register ECM / Immobilizer Control Module code in both Immobilizer Control Module and ECM by executing "RECORD ECU (RECORD ECM/PCM/ICM)" command in SELECT MODE menu.
6) Make sure that following indicator lamp lights when ignition switch is turned OFF once and then turned ON.
   - Vehicle not equipped with immobilizer indicator lamp : malfunction indicator lamp (MIL).
   - Vehicle equipped with immobilizer indicator lamp : immobilizer indicator lamp.
7) If any other Transponder code for ignition key with a built-in transponder 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 same Transponder code for ignition key with a built-in transponder as the one 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.

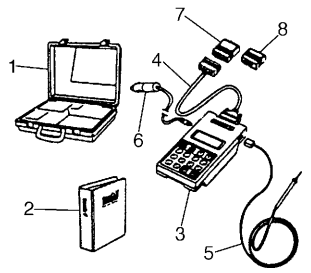
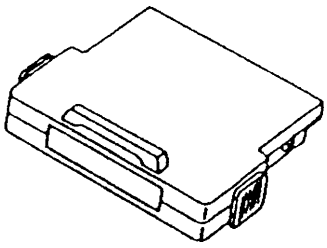
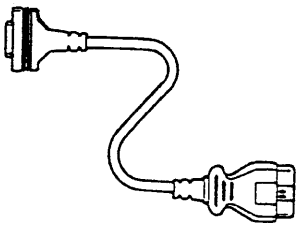
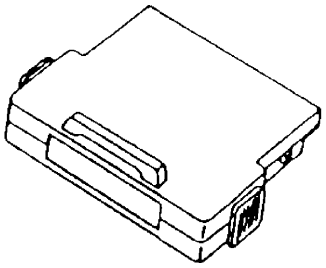
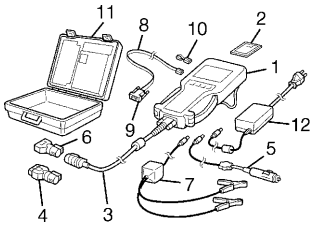
1) Perform steps 1) and 2) described in "How To Register Ignition Key" in this section. And then turn ignition switch ON.
2) Using SUZUKI scan tool, register ECM / Immobilizer Control Module code in ECM by executing "RECORD ECU (RECORD ECM / ICM)" command in SELECT MODE menu.

NOTE:

For operation procedure of SUZUKI scan tool, refer to SUZUKI scan tool operator's manual.

3) Make sure that following indicator lamp lights when ignition switch is turned OFF once and then turned ON.
   - Vehicle not equipped with immobilizer indicator lamp : malfunction indicator lamp (MIL).
   - Vehicle equipped with immobilizer indicator lamp : immobilizer indicator lamp.

Special Tools

 09931-76011 Tech 1A kit (SUZUKI scan tool) See NOTE “A” below.	 Immobilizer cartridge of version 1.1 or more	 09931-76030 16/14 pin DLC cable	 Mass storage cartridge of version 1.5 or more
 Tech 2 kit (SUZUKI scan tool) See NOTE “B” below.			

NOTE:

- **“A” : This kit includes the following items and substitutes for the Tech 2 kit.**
  1. Storage case, 2. Operator’s manual, 3. Tech 1A, 4. DLC cable, 5. Test lead/probe, 6. Power source cable, 7. DLC cable adaptor, 8. Self-test adaptor
- **“B” : This kit includes the following items and substitutes for the Tech 1 kit.**
  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 "Air Bag 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).**
- **When servicing vehicle body, if shock may be applied to air bag system component parts, remove those parts beforehand. (Refer to Section 10B.)**

NOTE:

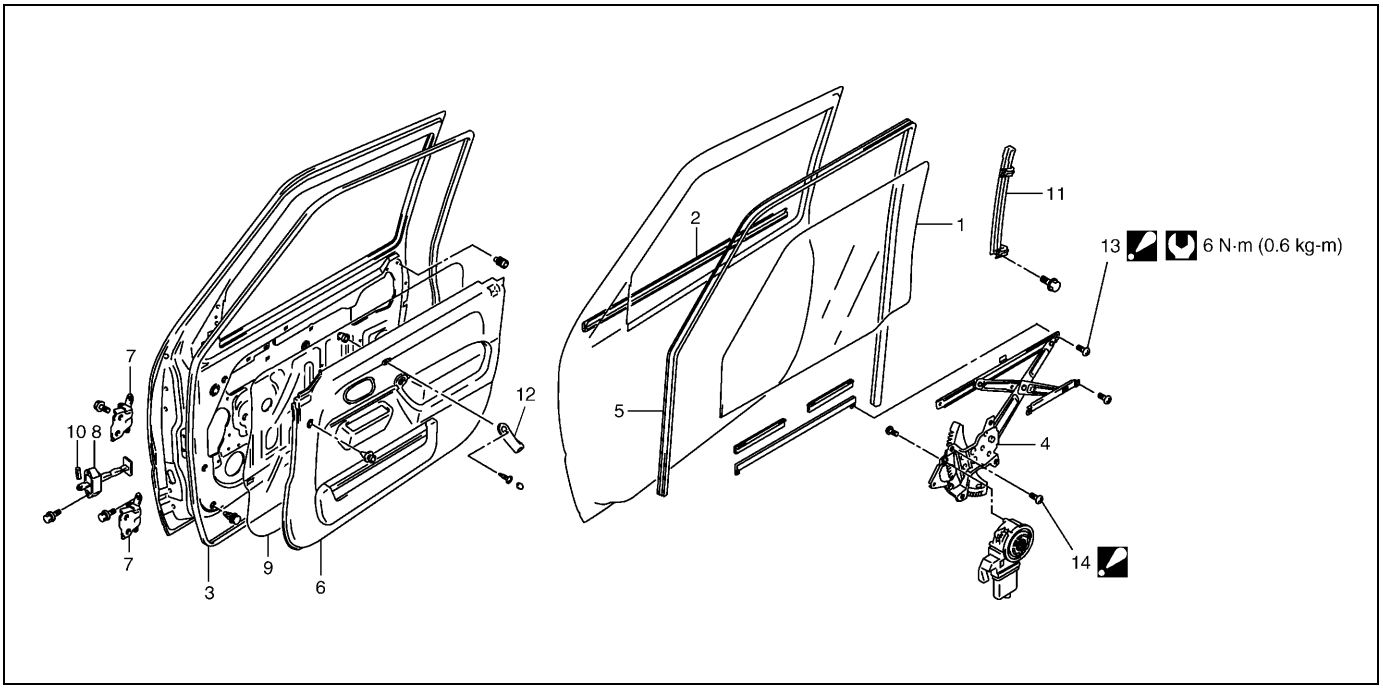
Fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number of with an equivalent part if replacement becomes necessary.
Do not use a replacement 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 and Windows 9-2
Front Door Glass 9-2
Front Door Window Regulator 9-5
Windowshield 9-6
Quarter Window 9-11
Back Door Glass 9-12
Body Structure 9-13
Front Door Assembly 9-13
Back Door Assembly 9-15
Under Body Dimensions 9-17
Body Dimensions 9-19
Instrumentation and Driver Information 9-22
Instrument Panel 9-22
Seats 9-23
Front Seat 9-23
Rear Seat 9-24
Paint and Coatings 9-25
Anti-Corrosion Treatment 9-25
Metal Replacement Parts Finishing 9-26
Security and Locks 9-34
Front Door Lock Assembly 9-34
Back Door Lock Assembly 9-36
Exterior and Interior Trim 9-37
Splash Guard 9-37
Roof Rail (If Equipped) 9-37
Tightening Torque Specification 9-38

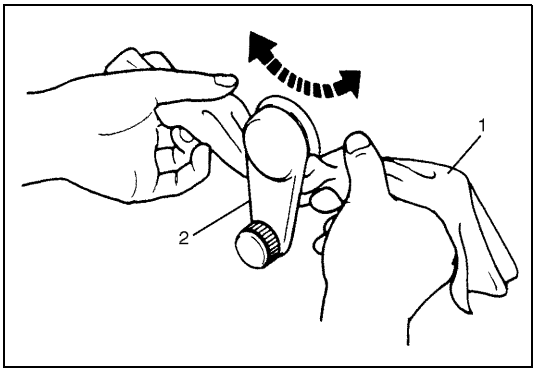
Glass and Windows

Front Door Glass

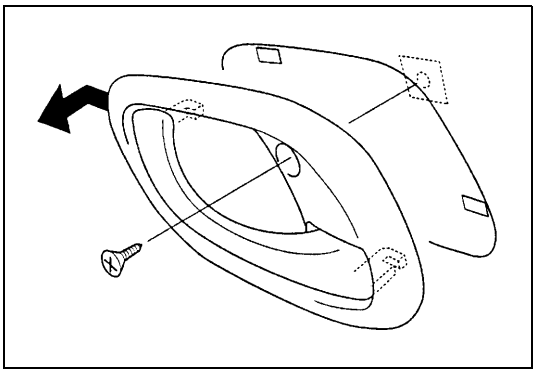


1. Door glass	6. Door trim		11. Door sash
2. Out side weatherstrip	7. Door hinge		12. Door grip
3. Opening weatherstrip	8. Door open stopper		13. Door glass attaching screw : Tighten rear screw first, and then tighten front screw.
4. Window regulator	9. Door sealing cover		14. Window regulator mounting screw : Tighten proper procedure referring to “Front Door Window Regulator”.
5. Glass run	10. Door open stopper pin		Tightening torque

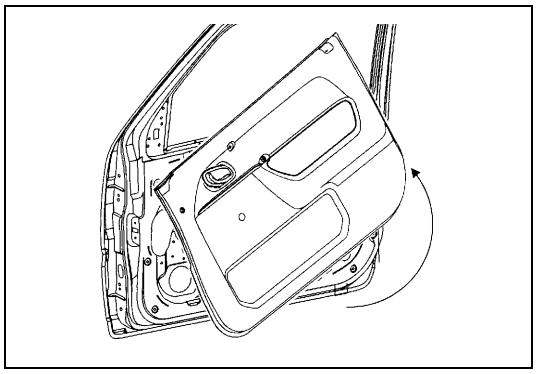
REMOVAL



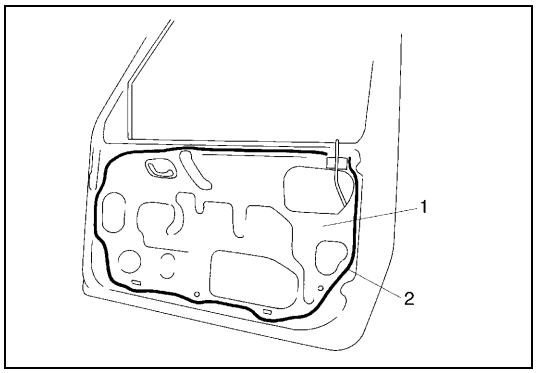
1) Remove window regulator handle (2) (if equipped).
   For its removal, pull off snap by using a cloth (1) as shown in the figure.



2) Remove inside handle bezel.
3) Remove door inner garnish.
4) Remove inside lock knob and door grip fitting screw.

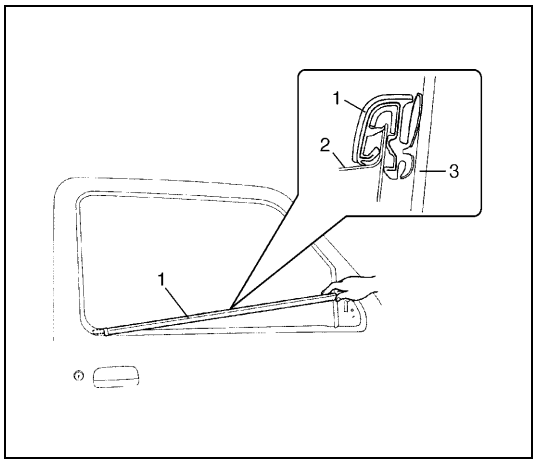


5) Remove door trim.
With inside handle bezel tilted as shown in figure, turn door trim 90° counterclockwise to remove it.
And disconnect power window switch lead wire at coupler (if equipped).



6) Remove door sealing cover (1).

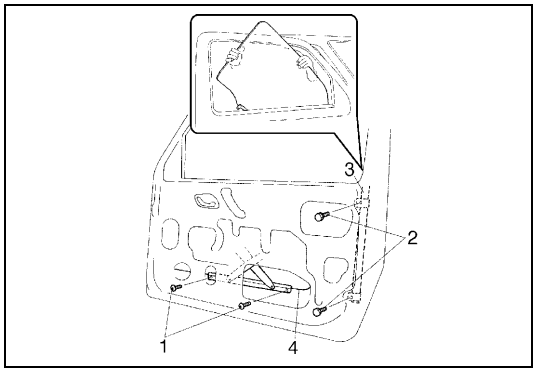
2. Adhesive



7) Remove door mirror.
8) Remove door outside weatherstrip (1).
Lower window all the way down. Then, use a tape-wrapped putty knife (or screwdriver) to pry off weatherstrip.

CAUTION:
Use a tape-wrapped putty knife (or screwdriver) to pry off weatherstrip. Use of an unwrapped tool will cause damage to painting.

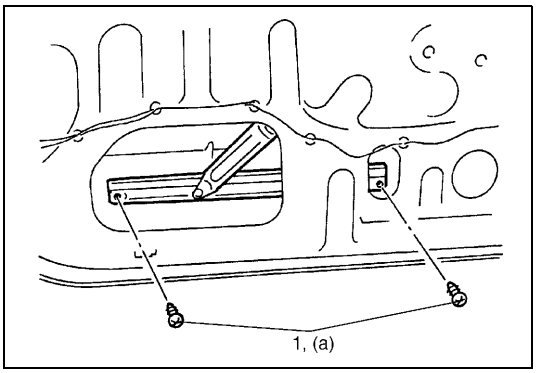
2. Door panel
3. Door glass



9) Remove door sash (3) mounting bolts (2).
10) Remove glass attaching screws (1).
11) Take out door glass (4).

INSTALLATION

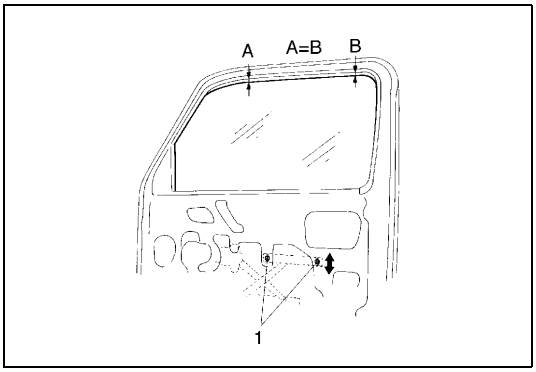
Reverse removal procedure to install door glass noting following points:



- Tighten glass attaching screws (1) to specified torque. Tighten rear screw first, then front screw.

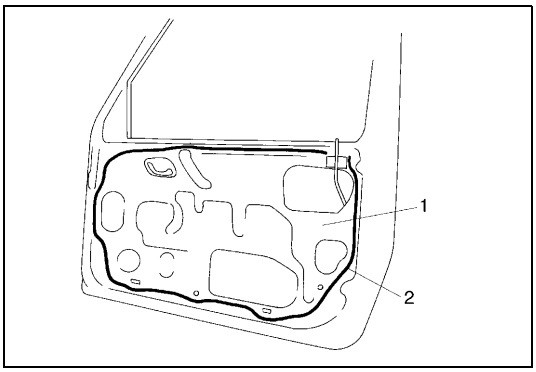
Tightening torque
Front door glass attaching screws
(a): 6 N·m (0.6 kg-m, 4.3 lb-ft)

- When window becomes hard to raise and lower, adjust screws to correct tilted glass as shown in figure.

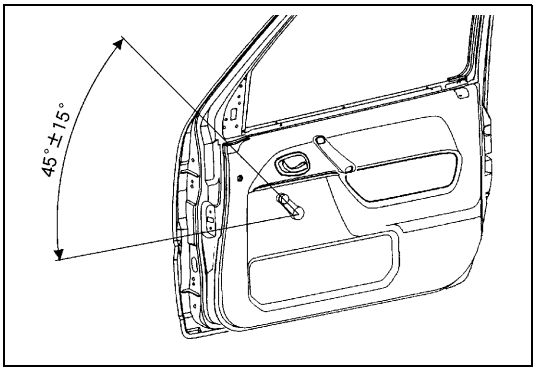


- Adjust equalizer of window regulator so that measurement A and B are equal.

1. Screws



- Secure door sealing cover (1) with adhesive (2).

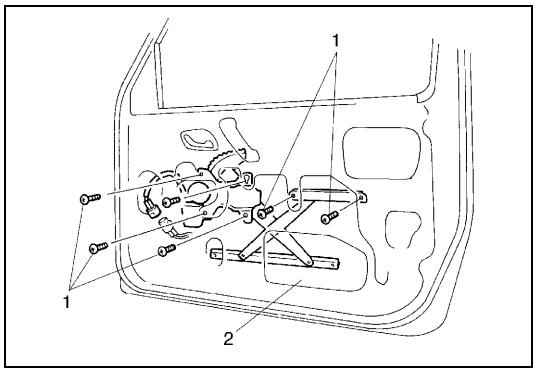


- Install door window regulator handle so that it has a 45° angle when glass is fully closed, as shown in the figure.

Front Door Window Regulator

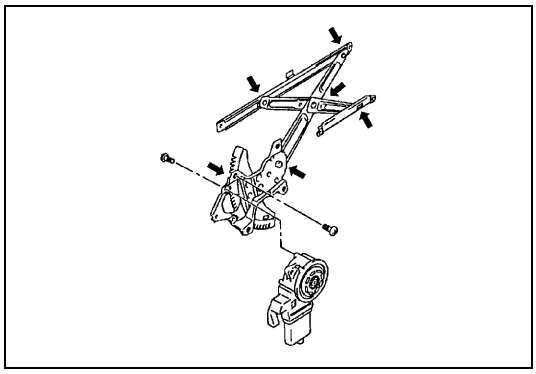
REMOVAL

1) Remove door glass, referring to steps 1) to 11) of "REMOVAL" under "Front Door Glass" in this section.
2) Disconnect power window motor lead wire at coupler and loosen clamp.



3) Loosen regulator mounting screws (1) and take out regulator through hole (2) as shown in the figure.

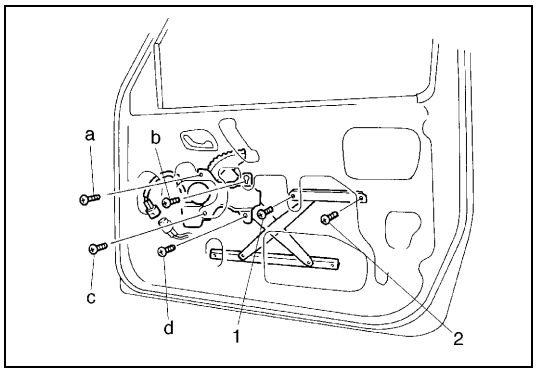
INSPECTION



1) Check regulator sliding and rotating parts for greasing.
2) Check rollers for wear and damage.
3) Check wire for damage.

INSTALLATION

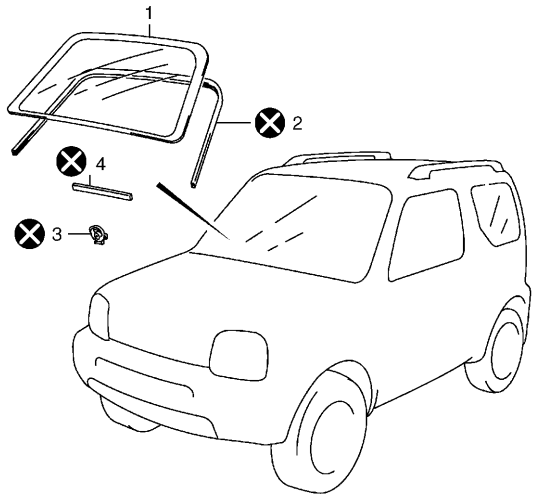
Reverse removal procedure to install window regulator noting following point.



- Tighten screws according to the order (a, b, c, d , 1, 2) shown in the figure.
- 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, make a fine adjustment with the screws. Refer to "Front Door Glass" in this section.

Windowshield

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 the follow the proper procedure.



1. Windshield glass	3. Stopper	⊗ Do not reuse.
2. Windshield molding	4. Spacer	

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 following property.

Glass adhesive shearing strength

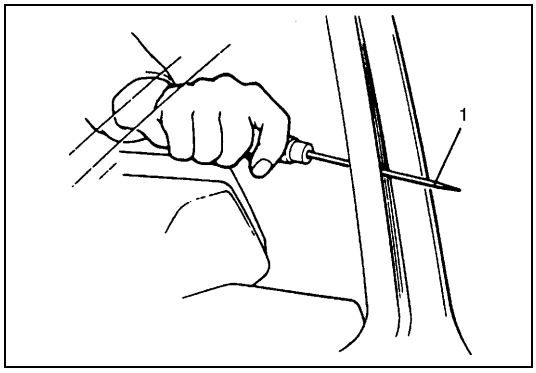
: 40 kg/cm^2 (569 lb/in^2) or more

Adhesive materials and tools required for removal and installation.

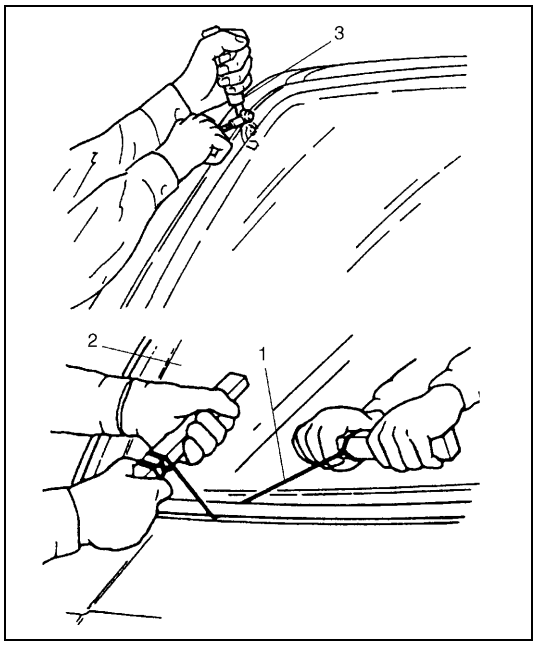
- One component urethane adhesive and primers used in combination (For one sheet of windshield).
  - Adhesive (470 g (15.7 oz.))
  - Primer for glass (30 g (1.0 oz.))
  - Primer for body (30 g (1.0 oz.))
  - Primer for molding (30 g (1.0 oz.))
- Eyeleteer
- Piano string
- Windshield knife
- Brush for 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, sunvisor, and front pillar trims (right & left).
5) If necessary, remove instrument panel. Refer to “Instrument Panel” in this section.
6) If necessary, remove head lining.
7) Remove (or cut) windshield molding all around until windshield edge comes out.



8) Drill hole with eyeleteer (1) through adhesive and let piano string through it.

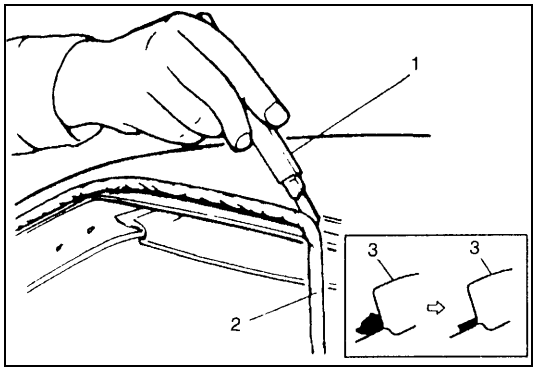


9) Cut adhesive all around windshield (2) with piano string (1). When using tool to cut adhesive, be careful not to cause damage to windshield. Use wire to cut adhesive along lower part of windshield.

NOTE:

Use piano string as close to glass as possible so as to prevent damage to body and instrument panel.

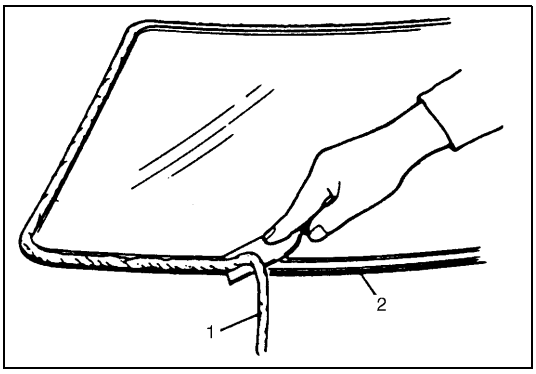
3. Windshield knife



10) Using knife (1), smoothen adhesive (2) remaining on body (3) side so that it is 1 to 2 mm thick all around.

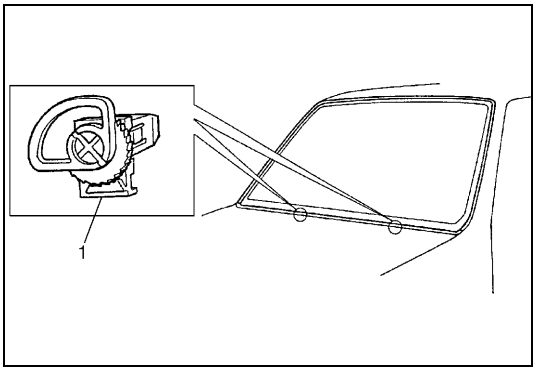
NOTE:

Before using knife, clean knife with alcohol or the like to remove oil.

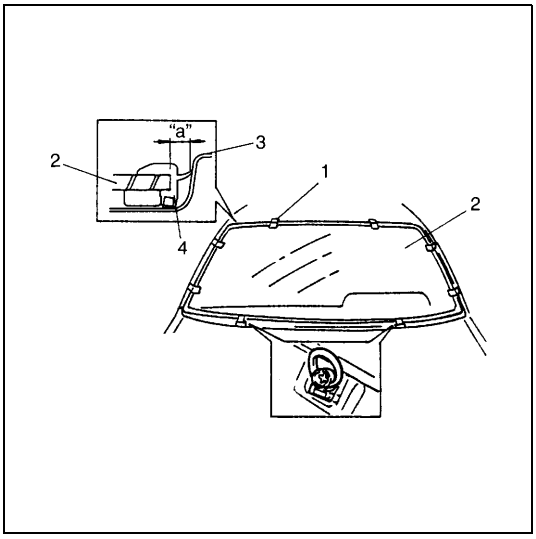


11) When reusing windshield, remove the adhesive (1) from the windshield using care not to damage primer coated surface (2).

INSTALLATION



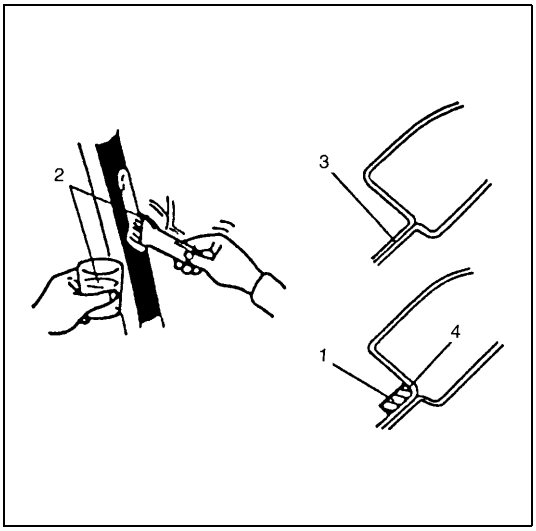
1) Using cleaning solvent, clean windshield edge where windshield glass is to be adhered. (Let it dry for more than 10 minutes.)
2) Install new glass stoppers (1) (2pcs) to lower side of windshield.



3) To determine installing position of glass (2) to body (3), position glass against body so that clearance between upper end of glass and body is about 5 mm (0.197 in.) and clearances between each side end (right & left) of glass and body are even. Place glass so that lug of fastener is matched with cut in body and fit fastener. Then mark mating marks (1) on glass and body as shown.
   Upper clearance can be adjusted by moving stoppers position.

Windshield clearance
"a": Approx. 5 mm (0.197 in.)

4. Molding

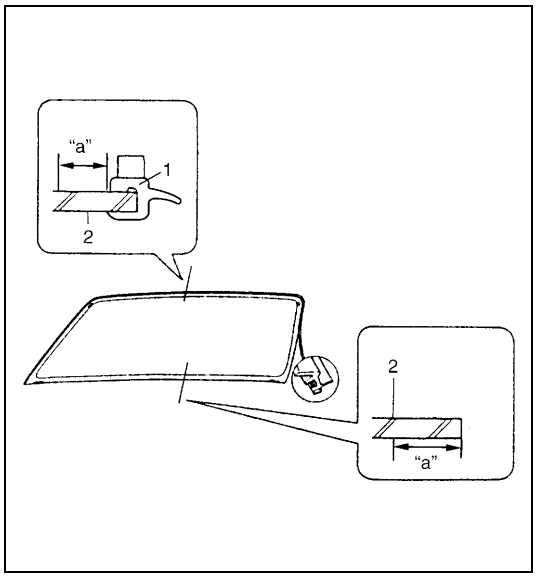


4) Clean contact surfaces of old adhesive (4), paint or bare metal thoroughly.
   If surfaces of paint or bare metal come out, apply primer (2) for body with caution not to apply primer to surface of adhesive remaining on body.

NOTE:

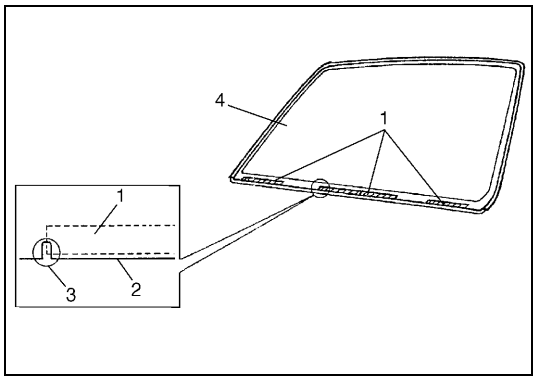
- **Be sure to refer to primer maker's instruction for proper handling and drying time.**
- **Do not touch body and old adhesive surfaces where glass is to be adhered.**

1. Do not apply primer
3. 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 more than 10 minutes.

Cleaning area for distance from the edge of glass or molding
"a": 30 – 50 mm (1.18 – 1.97 in.)



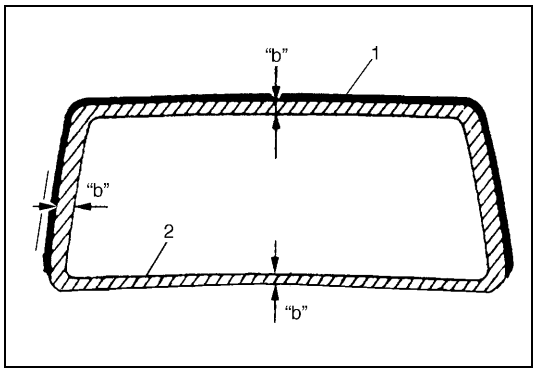
7) Install new spacer (1) to glass (4).

2. Ceramic printing
3. Cutting section of ceramic printing

8) Using new brush, apply sufficient amount of primer for glass along glass surface to be adhered to body.

NOTE:

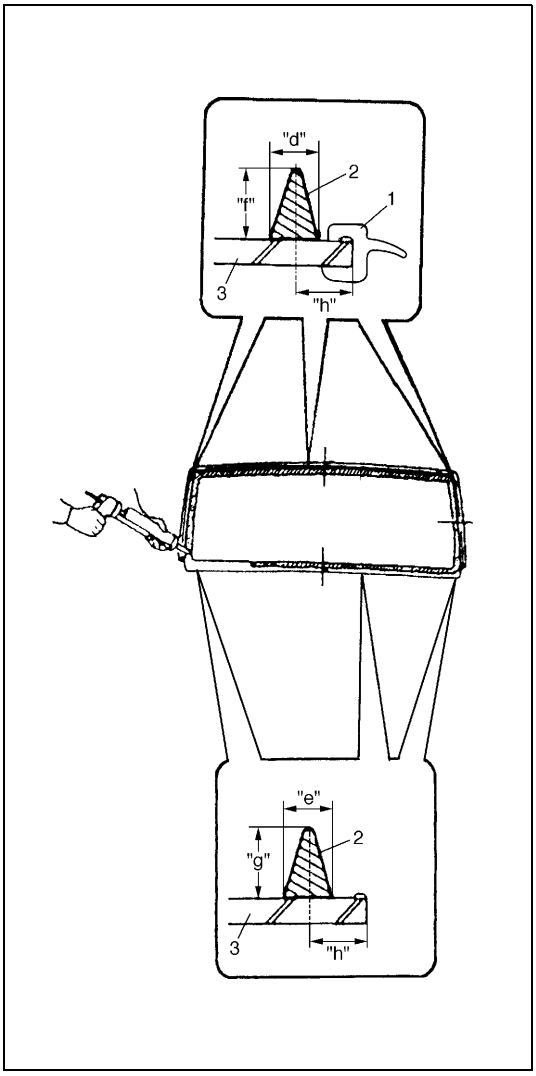
- **Be sure to refer to maker's instruction for proper handling and drying time.**
- **Do not apply primer on outside of ceramic coated surface.**
- **Do not touch primer coated surface.**
- **Width "b": 15 mm (0.59 in.)**



9) Apply primer for molding (1) along molding surface all around as shown in figure.

Width applied primer for windshield
"b": 15 mm (0.59 in.)

2. Fastener



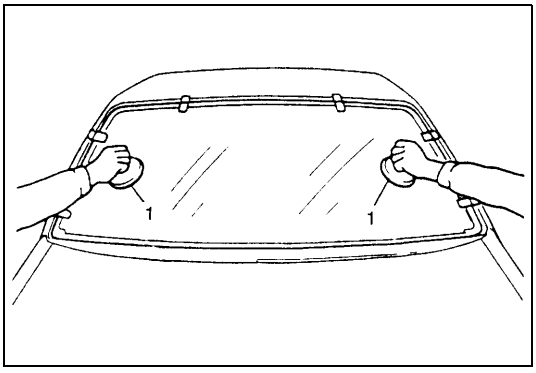
10) Apply adhesive referring to the figure.

NOTE:

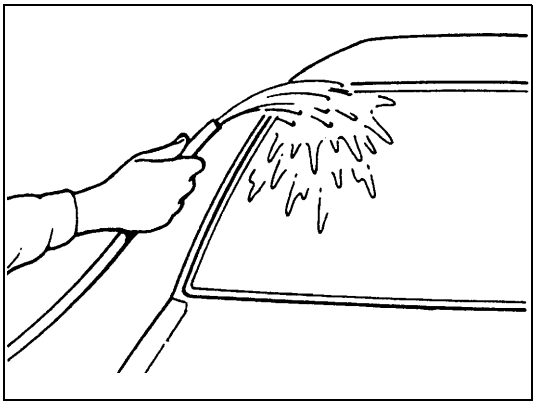
- **Start from bottom side of glass.**
- **Be careful not to damage primer.**
- **Height of adhesive applied to lower side should be higher than that of other three sides.**
- **Upper, right and left sides**
- **Press glass against body quickly after adhesive is applied.**
- **Use of rubber sucker grip is helpful to hold and carry glass after adhesive 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.**

Adhesive amount specifications and position for windshield
Width "d": Approx. 8 mm (0.31 in.)
Width "e": Approx. 9 mm (0.35 in.)
Height "f": Approx. 15 mm (0.59 in.)
Height "g": Approx. 17 mm (0.67 in.)
Distance "h": Approx. 10.5 mm (0.41 in.)

1.	Molding
2.	Adhesive
3.	Glass



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:

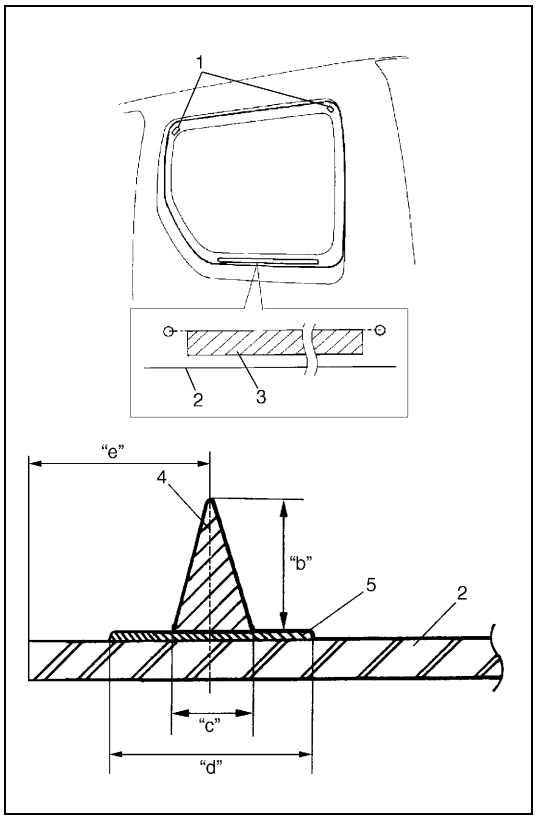
Upon completion of installation, note the following.

- **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

Refer to "Windshield" section as removal and installation procedures are basically the same. However, note the following.



NOTE:

- **Observe following precautions when applying adhesive (4) along glass edge.**
  - **– Adhesive should be applied evenly especially in height.**
  - **– Be careful not to damage primer (5).**
  - **– Press glass (2) against body quickly after adhesive is applied.**

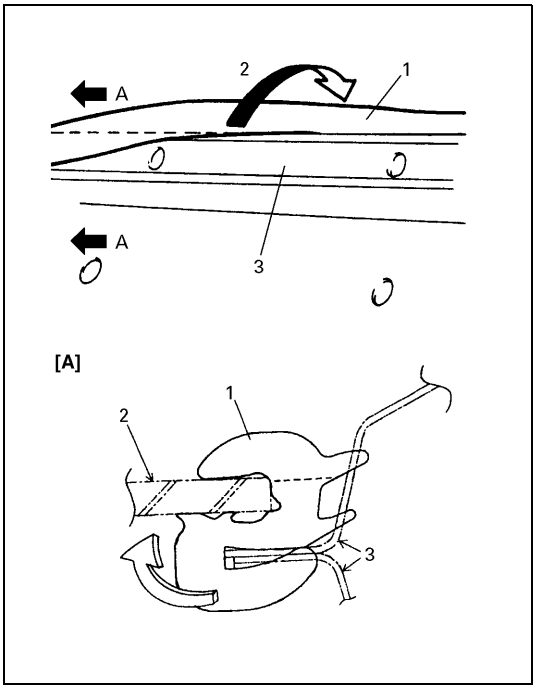
Adhesive amount specification and position for quarter window
Height "b": 15 mm (0.59 in.)
Width "d": 15 mm (0.59 in.)
Width "c": 6 mm (0.23 in.)
Distance "e": 17 mm (0.67 in.) for glass lower section and rear section
Distance "e": 12 mm (0.47 in.) for glass upper section.
Distance "e": 14 mm (0.55 in.) for glass front section.

1.	Pin
3.	Double face tape

Back Door Glass

REMOVAL

1) Remover rear wiper arm.
2) Disconnect rear defogger coupler.



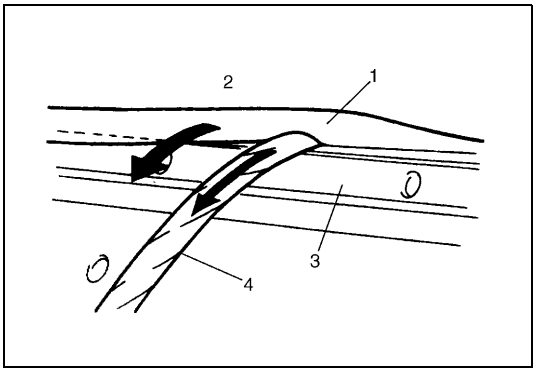
3) As rear window shield is fixed by means of back door window weatherstrip (1), remove glass (2) and weatherstrip together by removing end of weatherstrip little by little while pushing the entire glass from inside toward outside as shown in figure.

NOTE:

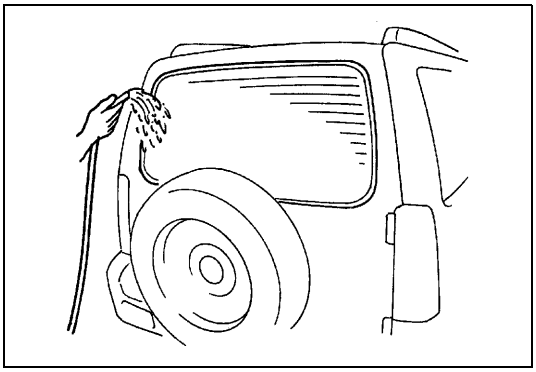
Do not apply an excessive force to glass locally.

3.	Back door panel
[A]:	Viewed A

INSTALLATION



1) Install weatherstrip (1) to glass (2).
2) Pass string (4) through outer groove of weatherstrip (groove where back door panel (3) fits in) so that weatherstrip can be installed to back door.
3) Apply soap water to outer edge of back door panel and install glass and weatherstrip together to back door by pulling the string little by little.
4) Connect rear defogger coupler.
5) Install rear wiper arm.



6) Check for water leakage by running water from hose over window. If leakage is found, complete the installation of leaky point. If water still leaks even after that, remove glass and start installation procedure all over again.

NOTE:

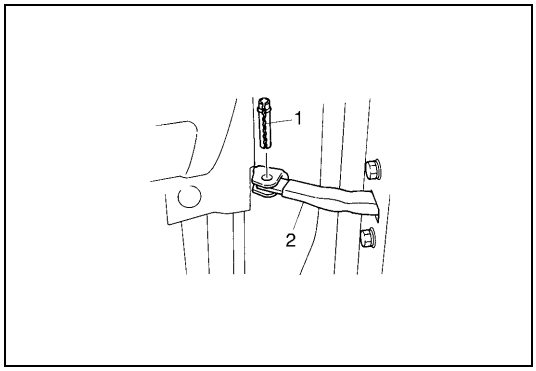
Do not use high pressure water.

Body Structure

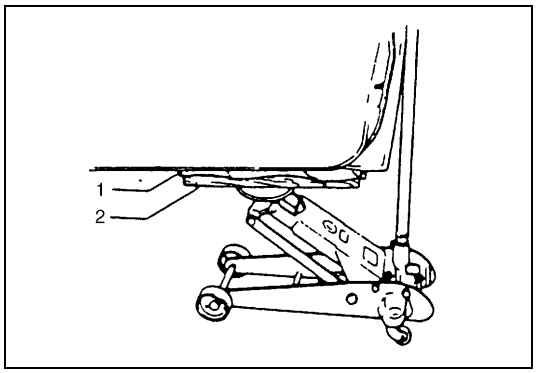
Front Door Assembly

REMOVAL

1) Remove front fender.
2) Disconnect door harness lead wires at each coupler.
3) Remove stopper pin (1).

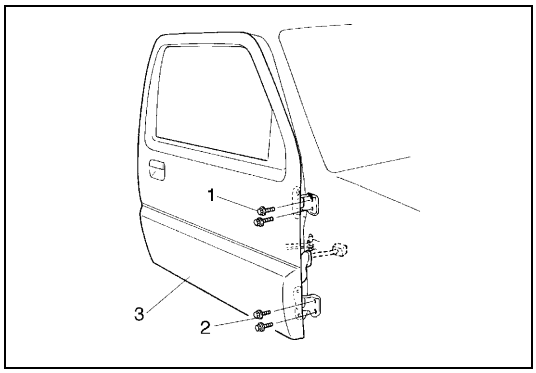


2. Door open stopper



4) Support door panel using a jack with a piece of wood placed between jack and panel, as shown.

1. Rags
2. Wooden piece

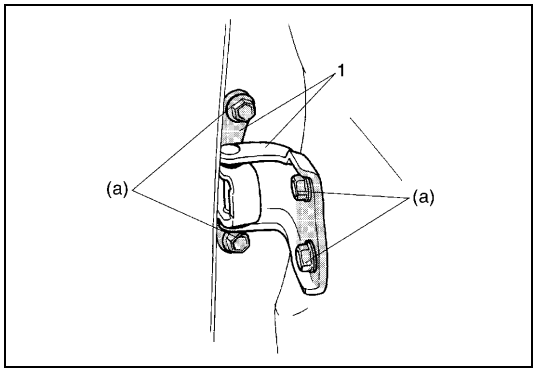


5) Remove door assembly (3) by loosening hinge mounting bolts.

1. Upper hinge mounting bolts
2. Lower hinge mounting bolt

INSTALLATION

Reverse removal procedure to install door assembly noting following points.

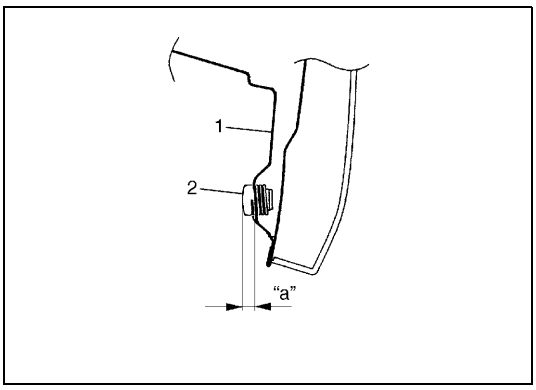


NOTE:

When replacing door, coat replacement door inside (1) with wax for proper anticorrosion treatment.
Refer to "Undercoating / Anti-Corrosion Compound Application Area" in this section.

- Tighten door hinge bolts to specified torque.

Tightening torque
Front door hinge bolts (a): 27 N·m (2.7 kg-m, 19.5 lb-ft)

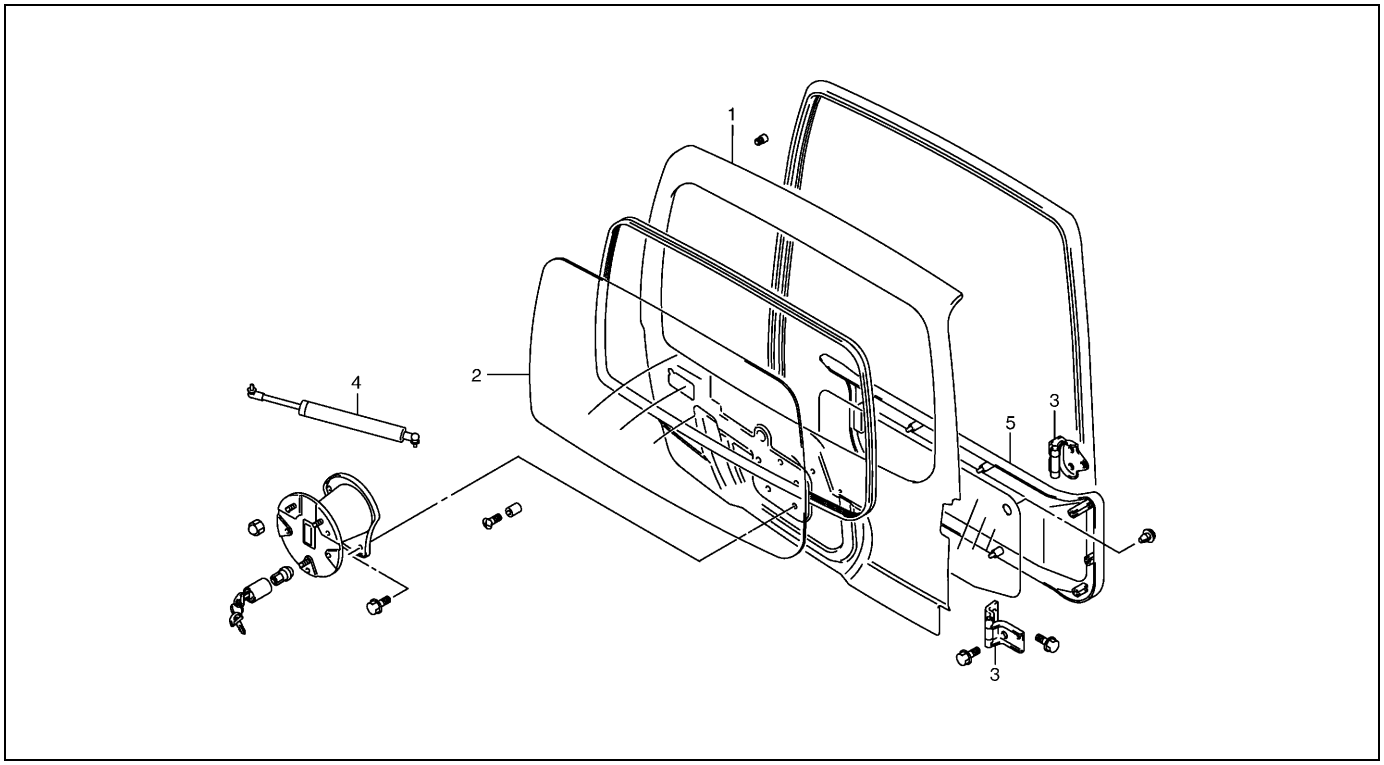


- Adjust door latch striker position by referring to "Front Door Lock Assembly" in this section so that door is positioned correctly.
- Adjust front door cushion (2) so that door (1) contacts body when closed as shown in the figure.

Front door cushion position
"a": 7 mm (0.3 in.)

- After installation, open and close the door to check looseness. Replace door open stopper pin when there is looseness.
- When weatherstrip is hardened, water leak may develop. In such case, replace it with new one.

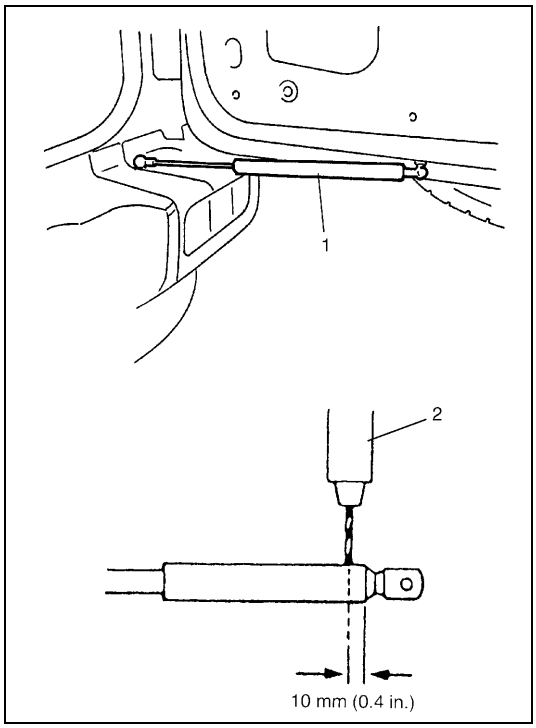
Back Door Assembly



1. Back door panel assy	3. Back door hinge	5. Back door trim
2. Back door window glass	4. Back door balancer unit	

REMOVAL

1) Remove back door trim, and door sealing cover, refer to steps 1) to 3) of “REMOVAL” under “Back Door Lock Assembly” in this section.
2) Remove wire harness connector inside the back door.
3) Remove back door balancer (1) (first at its door-side and next at its body-side), as shown.



WARNING:

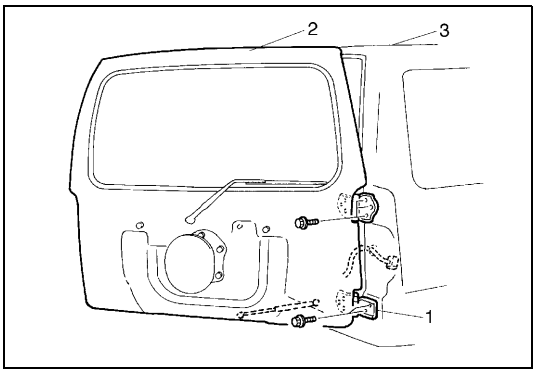
Handling of Back Door Balancer (Damper)

- **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.**
- **Do not disassemble balancer (1) because its cylinder is filled with gas.**

Discarding of Back Door Balancer

- **The gas itself in balancer is harmless but it may issue out of the hole together with chips generated by the drill (2). Therefore, be sure to wear goggle when drilling.**
- **Using a 2 to 3 mm (0.08 to 0.12 in.) drill (2), make a hole to remove gas inside as shown before discarding.**

4) Remove combination lamp.

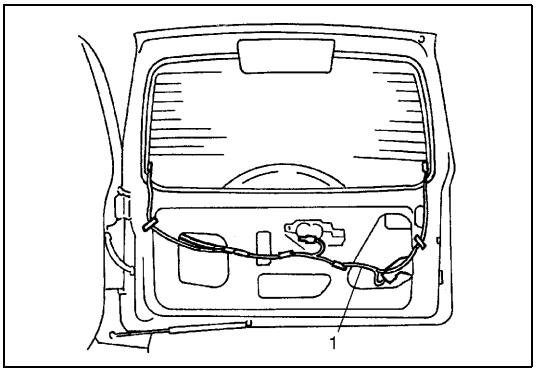


5) Remove door hinge bolts and door (2).

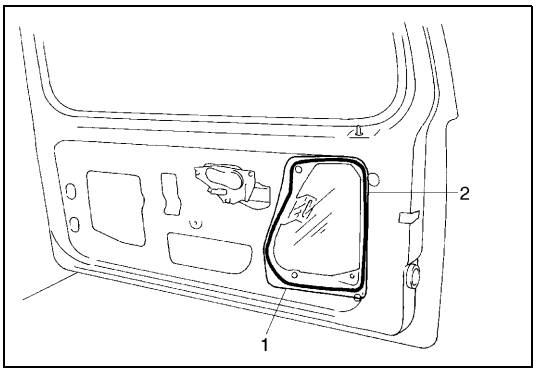
1.	Back door hinge
3.	Body

INSTALLATION

Reverse removal procedure to install back door noting following points.



- Secure wiring harness (1).



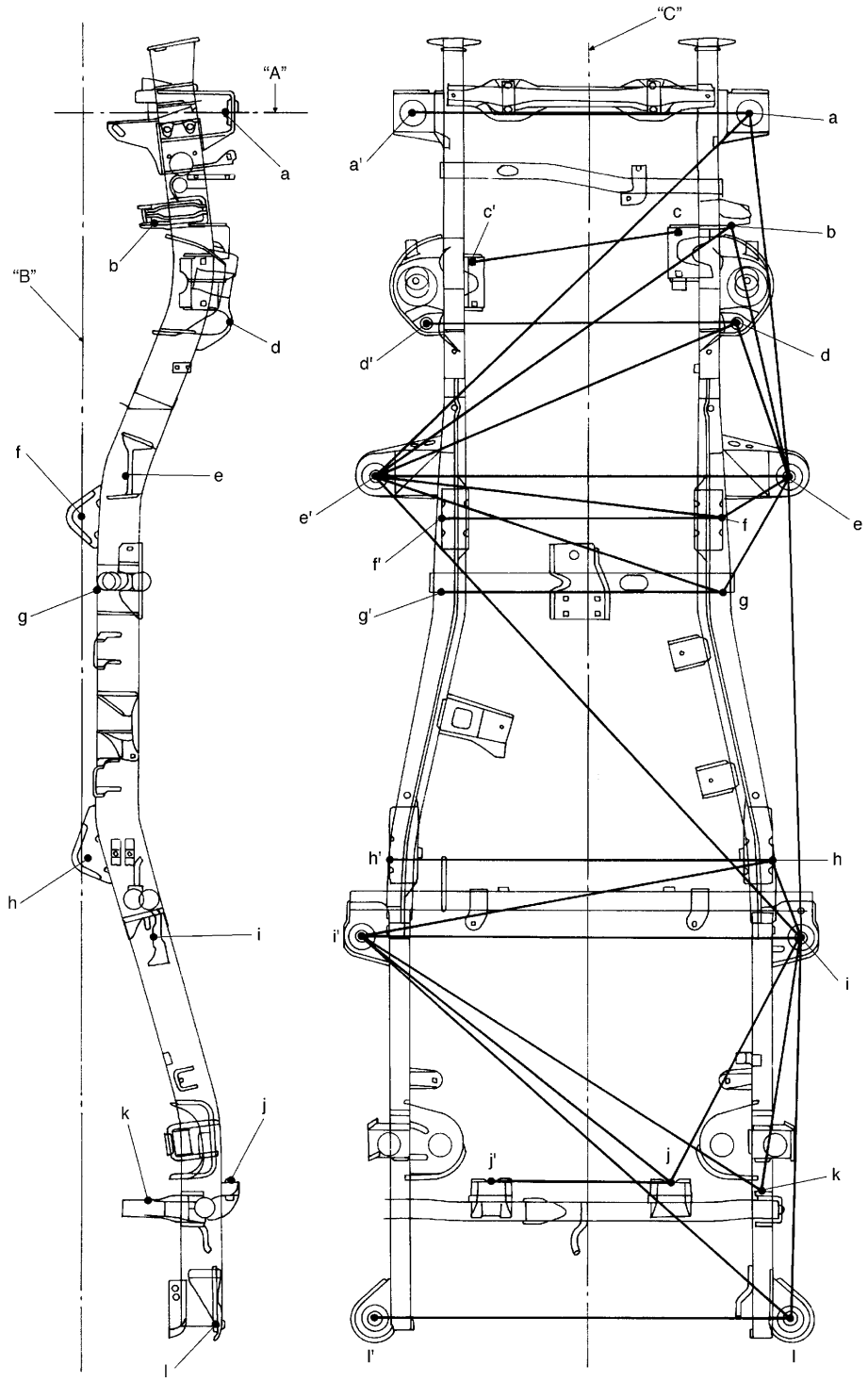
- Secure door sealing cover (1).

NOTE:

Use adhesive (2) to seal sealing cover to back door.

- Adjust door latch striker position by referring “Back Door Lock Assembly” in this section so that door is positioned correctly.
- Adjust door cushion so that door contacts body when closed.

Under Body Dimensions



a, a'. 1st mounting installation hole	f, f'. Front suspension arm installation hole	k. Lateral rod front section installation hole
b. Lateral rod rear section installation hole	g, g'. Zig hole	l, l'. 4th mounting installation hole
c, c'. Engine mounting installation hole	h, h'. Rear suspension arm installation hole	"A": Standard line
d, d'. Front shook absorber installation	i, i'. 3rd mounting installation hole	"B": Standard line
e, e'. 2nd mounting installation	j, j'. Rear shock absorber installation hole	"C": Standard line

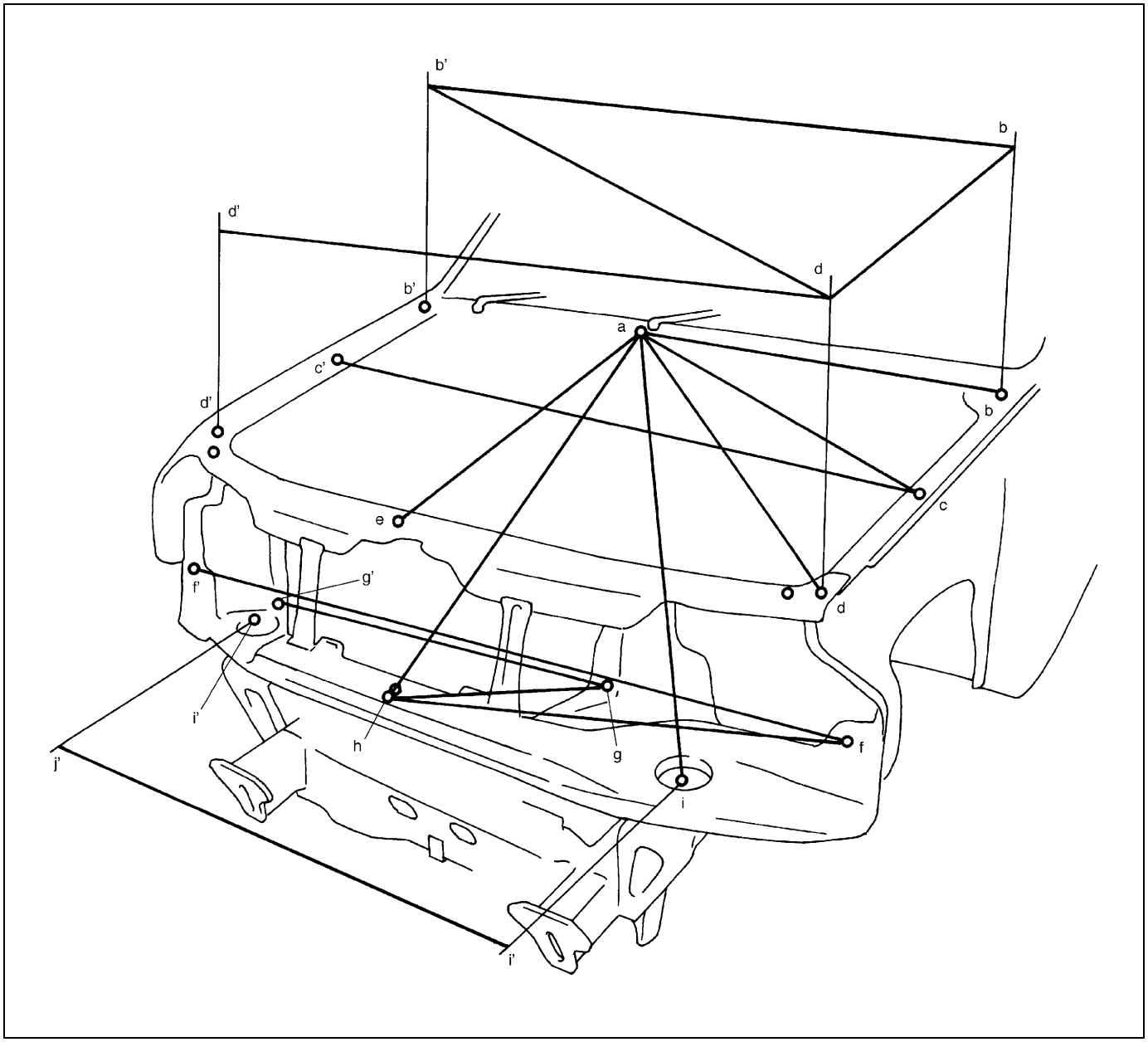
Projection Dimension

Measurement Position	Length from line "A" mm (in.)	Length from line "B" mm (in.)	Length from line "C" mm (in.)
a	0 (0)	368 (14.49)	425 (16.73)
b	285 (11.22)	156 (6.14)	397 (15.63)
c	302 (11.89)	335 (13.19)	241 (9.49)
d	532 (20.94)	368 (14.49)	390 (15.35)
e	920 (36.22)	113 (4.45)	520 (20.47)
f	1025 (40.35)	0 (0)	356 (14.02)
g	1215 (47.83)	36 (1.42)	355 (13.98)
h	1900 (74.80)	16 (0.63)	481 (18.94)
i	2098 (82.60)	182 (7.17)	553 (21.78)
j	2719 (107.05)	370 (14.57)	226 (8.90)
k	2765 (108.86)	101 (3.98)	481 (18.94)
l	3065 (120.67)	325 (12.80)	523 (20.59)

Measurement Dimension

Measurement Position	Length mm (in.)	Measurement Position	Length mm (in.)
a – a'	850 (33.46)	g – e'	927 (36.50)
a – e'	1343 (52.87)	g – g'	710 (27.95)
a – e	960 (37.80)	h – h'	962 (37.87)
b – e'	117 (4.61)	h – i'	1066 (41.97)
b – e	649 (25.55)	h – i	268 (10.55)
c – c'	515 (20.28)	i – i'	1106 (43.54)
d – d'	780 (30.71)	i – j	727 (28.62)
d – e'	1022 (40.24)	i – k	676 (26.61)
d – e	482 (18.98)	i – e	978 (38.50)
e – e'	1040 (40.94)	j – i'	1014 (39.92)
e – f	225 (8.86)	k – i'	1233 (48.54)
e – g	347 (13.66)	j – j'	452 (17.80)
e – i	1181 (46.50)	l – i	1454 (57.24)
f – e'	889 (35.00)	l – i'	1064 (41.90)

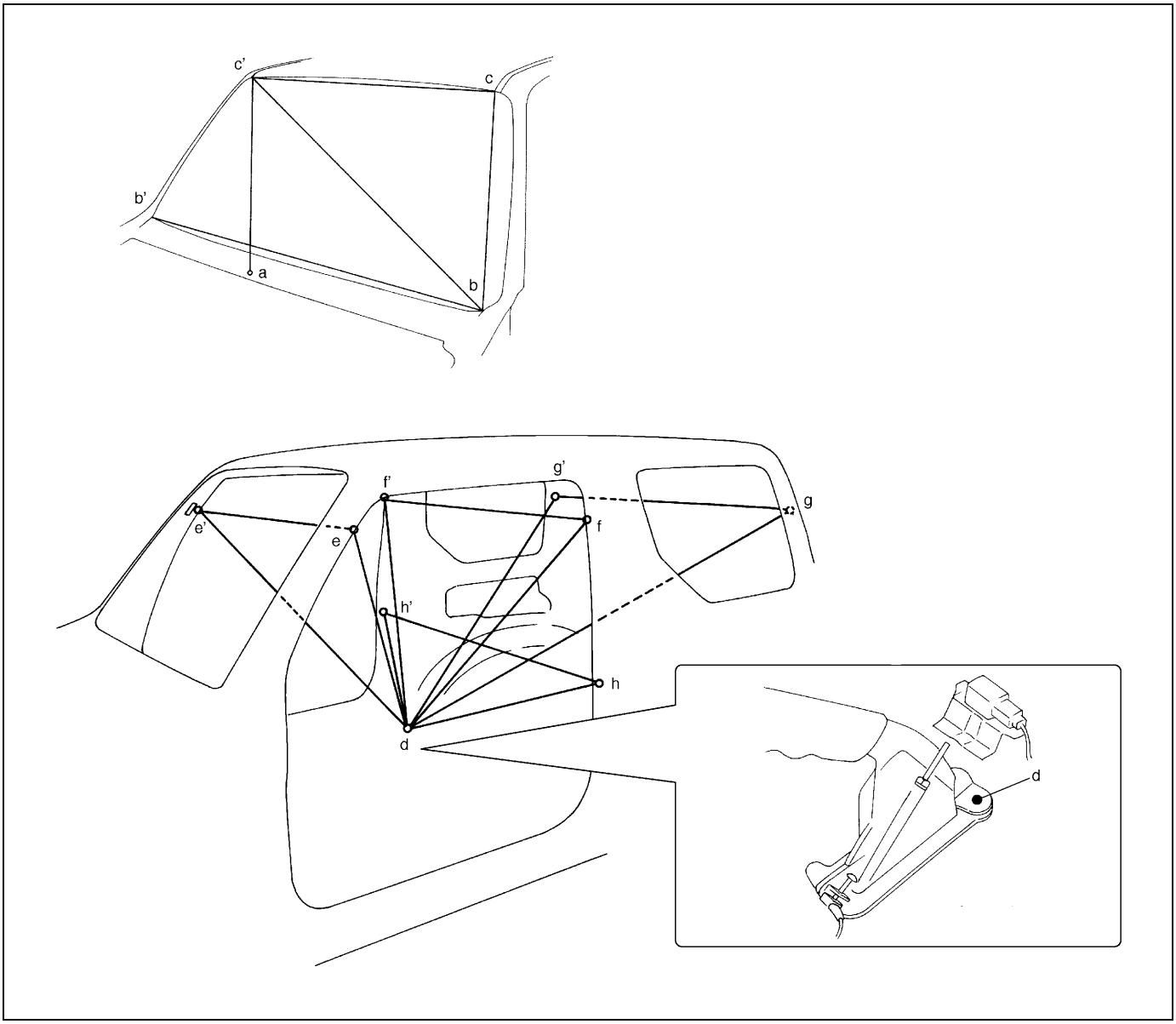
Body Dimensions



a. Garnish installation clip hole	d, d'. Front fender installation hole	g, g'. Headlight installation hole
b, b'. Front fender installation hole	e. Hood cushion installation hole	h. Front bumper installation clip hole
c, c'. Front fender installation hole	f, f'. Headlight installation resin nut hole	i, i'. 1st mounting installation hole

Measurement Dimension

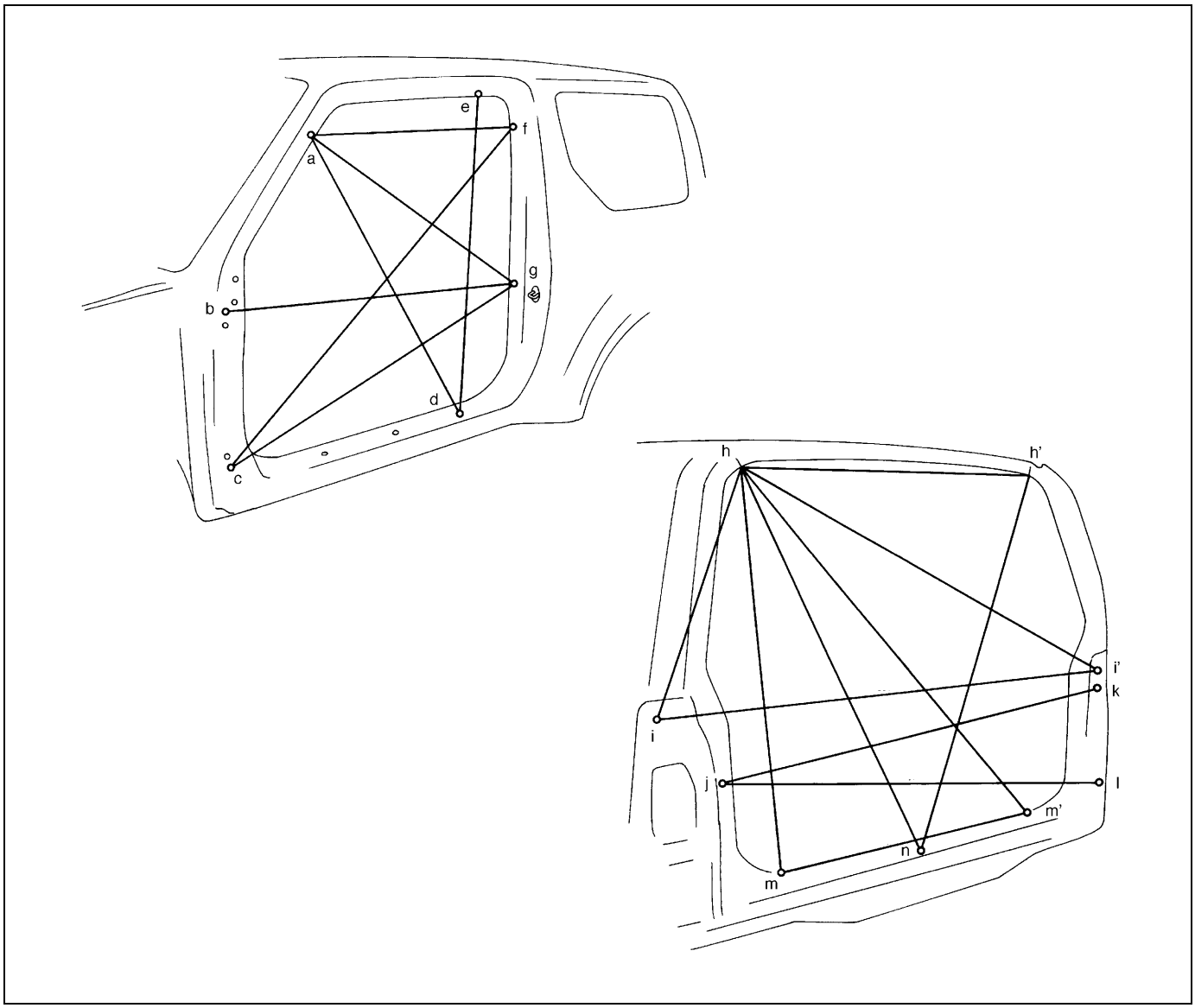
Measurement Position	Length mm (in.)	Measurement Position	Length mm (in.)
a – b	660 (25.98)	c – c'	1222 (48.11)
a – c	664 (26.14)	d – b'	1166 (45.90)
a – d	833 (32.80)	d – d'	1393 (54.84)
a – i'	890 (35.04)	f – f'	1266 (49.84)
a – h	837 (32.95)	f – h	661 (26.02)
a – e	667 (26.26)	g – g'	654 (25.75)
b – b'	1266 (49.84)	g – h	351 (13.82)
b – d	681 (26.81)	i – i'	850 (33.46)



a. Garnish installation clip hole	d. Parking brake rear installation hole	g, g'. Rear seat belt upper installation hole
b, b'. Front end of front windshield upper installation section	e, e'. Body outer panel clipping section	h, h'. Body outer panel ϕ8 zig hole
c, c'. Front end of front windshield lower installation section	f, f'. Body outer panel clipping section	

Measurement Dimension

Measurement Position	Length mm (in.)	Measurement Position	Length mm (in.)
a – c'	902 (35.51)	d – g	1479 (58.23)
b – b'	1190 (46.85)	d – g'	1514 (59.61)
b – c	620 (24.41)	d – h	718 (28.27)
b – c'	1240 (48.82)	d – h'	795 (31.30)
c – c'	969 (38.15)	e – e'	1102 (43.39)
d – e	1179 (46.42)	f – f'	1127 (44.37)
d – e'	1221 (48.07)	g – g'	1103 (43.43)
d – f	1063 (41.85)	h – h'	1254 (49.37)
d – f'	1111 (43.74)		



a. Body outer panel clipping section	f. Body outer panel clipping section	k. Back door upper hinge in upper installation hole
b. Front door upper hinge in upper installation hole	g. Body outer panel ϕ8 zig hole	l. Back door lower hinge in lower installation hole
c. Front door lower hinge in lower installation hole	h, h'. Rear end of roof panel upper installation section	m, m'. Rear end of piller outer panel inside installation section
d. Side sil scuff installation hole (rear end)	i, i'. Combination lamp upper installation hole	n. Rear bumper installation hole
e. Body outer panel ϕ8 zig hole	j. Back door striker upper installation hole	

Measurement Dimension

Measurement Position	Length mm (in.)	Measurement Position	Length mm (in.)
a – d	1094 (43.07)	h – i'	1186 (46.69)
a – f	683 (26.89)	h – m	896 (35.28)
a – g	861 (33.90)	h – m'	1224 (48.19)
b – g	1099 (43.27)	h – n	1024 (40.31)
c – f	1428 (56.22)	i – i'	1297 (51.06)
c – g	1162 (45.75)	j – k	1136 (44.72)
d – e	1074 (42.28)	j – l	1160 (45.67)
h – h'	867 (34.13)	m – m'	804 (31.65)
h – i	540 (21.26)	n – n'	1033 (40.67)

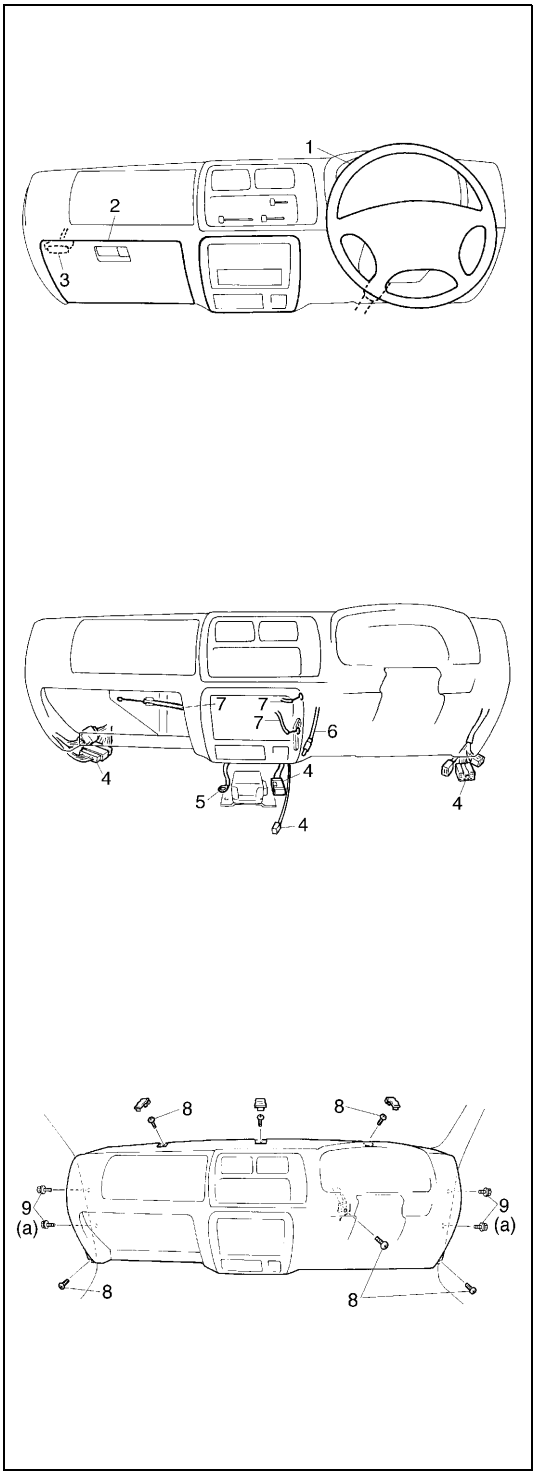
Instrumentation and Driver Information

Instrument Panel

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 glove box (2) and column hole cover.
4) Disconnect wires and cables from heater unit and air inlet box assembly.
5) Remove steering column assembly (1). Refer to “Steering Column Assembly” in Section 3C.
6) Disconnect speedometer connector and remove speedometer assembly.
7) Remove engine hood opener (3).
8) Disconnect couplers (4) which need to be disconnected for removal for instrument panel.
9) Remove instrument panel mounting screws (8).
10) Remove instrument panel mounting bolt (9).
11) Remove instrument panel.

CAUTION:
For vehicle with Air Bag, instrument panel could not be removed with SDM coupler connected.
Use are not to damage Air Bag harness.

5.	Body ground
6.	Antenna wire
7.	Heater control cable

INSTALLATION

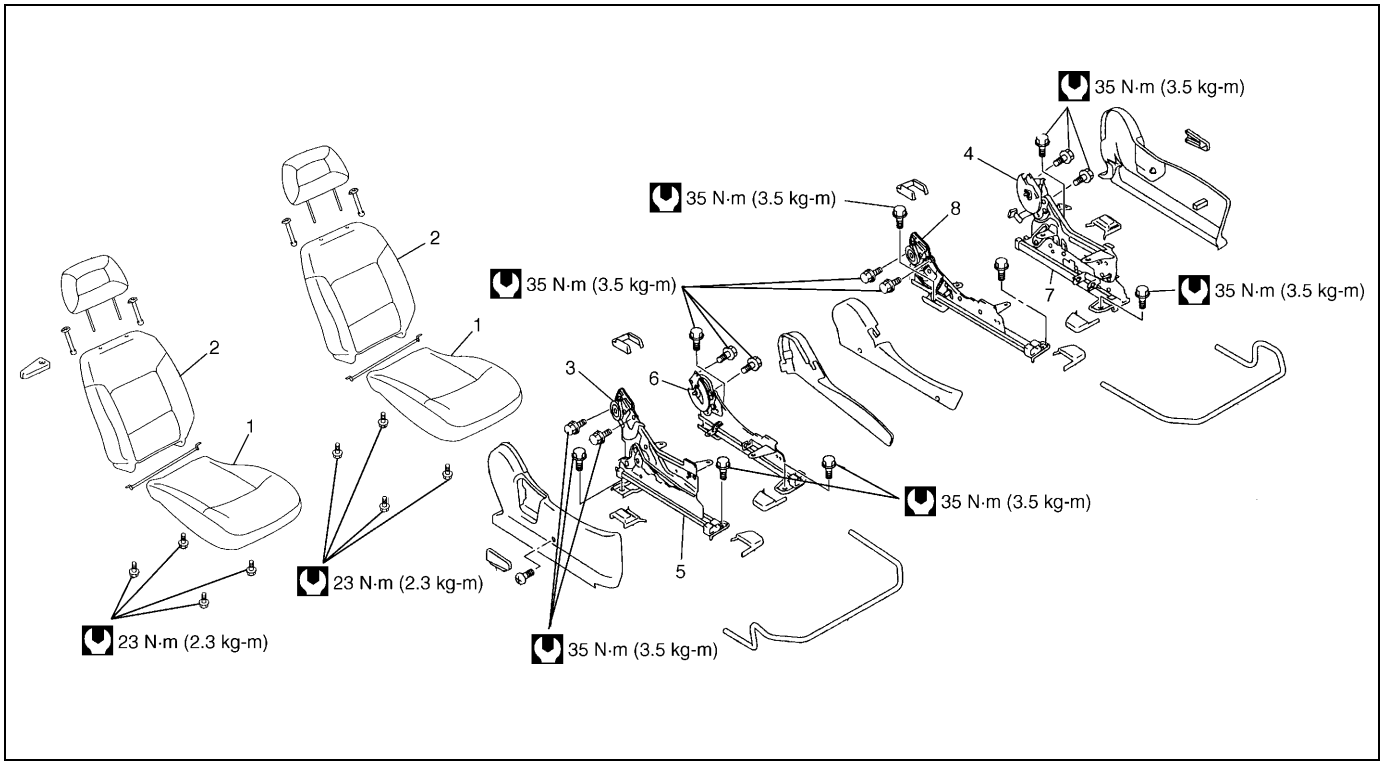
1) Install instrument panel by reversing removal procedure, noting the following items.
   - Tighten instrument panel mounting bolts to specified torque.

   Tightening torque
   Instrument panel mounting bolts
   (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

   - When installing each part, be careful not to catch any cable or wiring harness.
   - When installing steering column assembly, refer to “Steering Column Assembly” in Section 3C.
2) Adjust control cables. (Refer to Step 1) of “INSTALLATION” under “Heater Control Lever Assembly” in Section 1A.)
3) Enable air bag system if equipped. Refer to “Enabling Air Bag System” in Section 10B.

Seats

Front Seat



1. Seat cushion	4. Reclining assembly (LH side)	7. Seat adjuster (LH outside)
2. Seat back	5. Seat adjuster (RH outside)	8. Seat adjuster (LH inside)
3. Reclining assembly (RH side)	6. Seat adjuster (RH inside)	Tightening torque

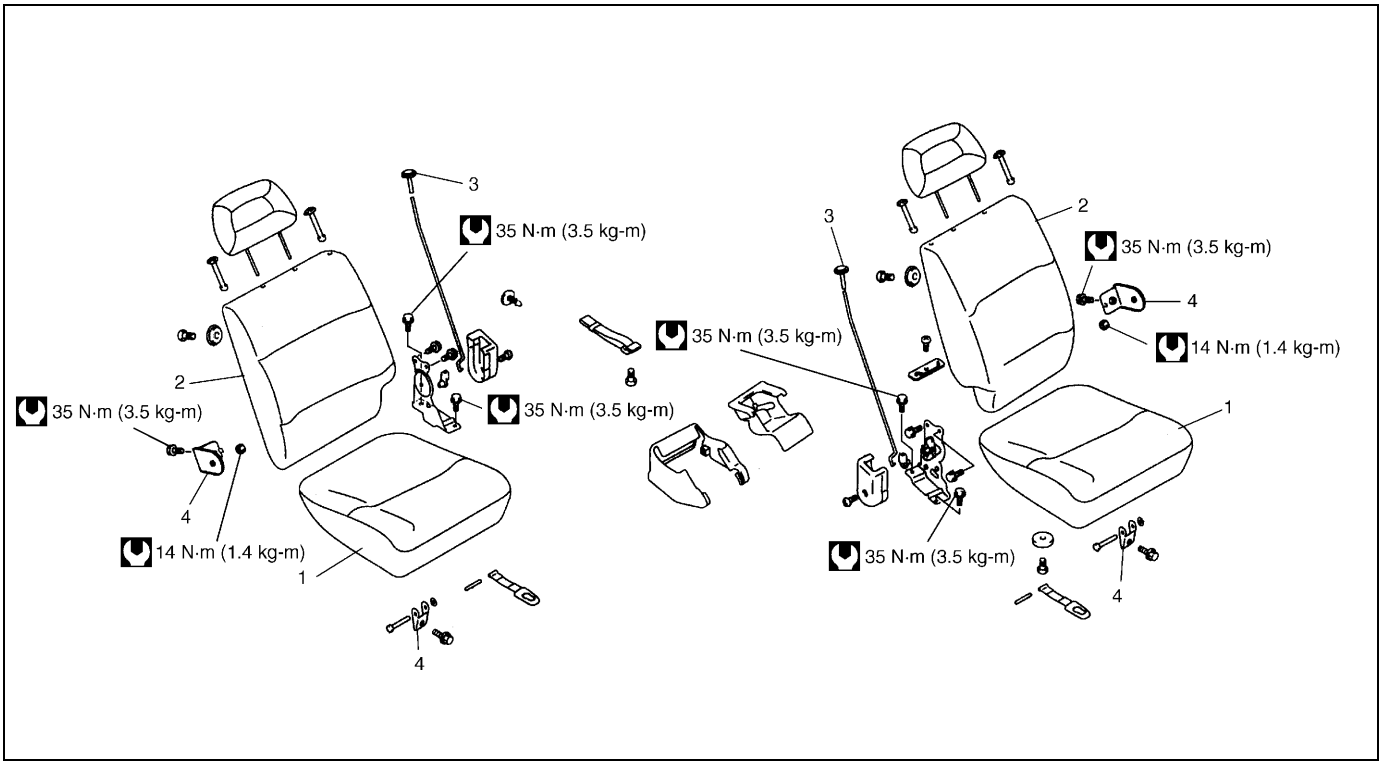
REMOVAL

1) Remove four mounting bolt to remove seat cushion.
2) Remove four mounting bolts to remove seat back.
3) Disassemble and repair seat as necessary.

INSTALLATION

Reverse removal procedure to install front seat.
Torque to specifications, as shown.

Rear Seat



1. Seat cushion	3. Seat auto lock release handle	Tightening torque
2. Seat back	4. Seat hinge male	

REMOVAL

1) Remove four mounting bolt to remove seat cushion.
2) Remove four mounting 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.

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:

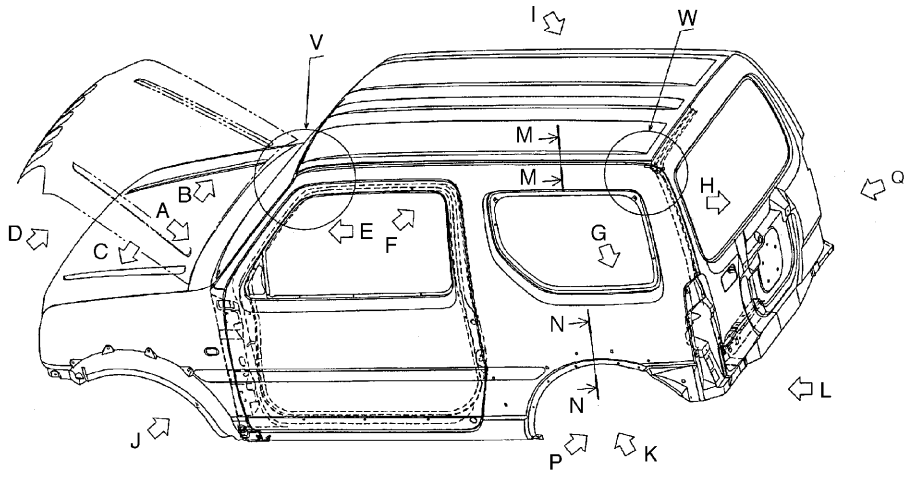
1) Clean and prepare the metal surface.
2) Apply primer.
3) Apply sealer (all joints sealed originally).
4) Apply color in areas where color is required such as hem flanges, exposed joints and under body components.
5) Apply anticorrosion compound (penetrative wax).
6) Apply undercoating (rust proof material).

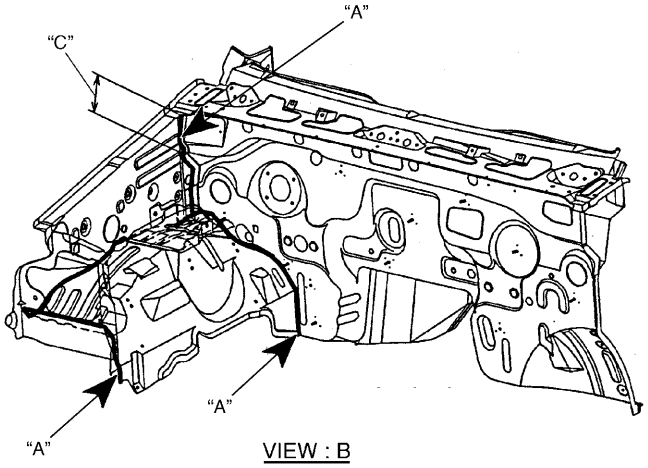
When the welding or heating operation causes the original galvanization or other anticorrosive materials to be burnt, the interior and under-body panel surfaces must be cleaned.
Removal of residues of the burning should be carried out carefully when the relevant place has box type construction or has shape which limits the access to the interior surfaces. In general, the following method can be used satisfactorily for the removal of those residues.
Scrape the accessible places. If a standard putty knife or scraper does not fit to the relevant place, consider to use a more flexible scraper to a place narrowly enclosed by sheet metals.
A jet of compressed air can remove most residues, and is effective to limited areas.
However, this type of operation absolutely requires eye protection.

Metal Replacement Parts Finishing

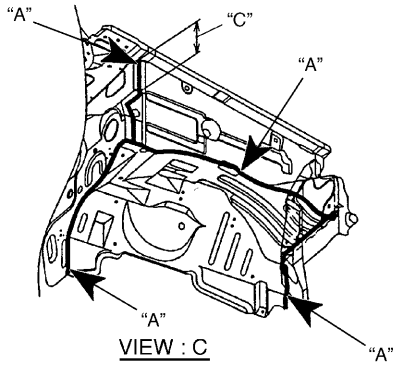
1) The metal service replacement parts (or assemblies) are coated with electro-deposition primer.
   For the proper adhesion of a paint, the following finish process (refinish steps) becomes necessary.
   a) Use wax or grease-removing solvent to clean the part.
   b) Use a wet or dry sand-paper (No. 400) to polish the panel lightly. DO not polish it forcibly to produce any scratch. Clean the part again.
   c) If factory-applied primer coating is cut through to the bare metal, apply metal conditioner to the bare metal exposed to open air. As for method of use of the metal conditioner, follow directions on the container.
   d) Apply primer-surfacer to the part completely dry before starting sand-paper polishing. As for drying time, follow directions advised on the primer-surfacer container.
   e) Use a wet or dry sand-paper (No. 400) and water to polish the panel lightly.
   f) Wash the part again.
   g) Apply color, coating to the part.
   h) Different paints demand different drying methods. Hence, follow directions advised on the pertinent paint container.
   i) When lacquer coating (quick-drying paint coating) is applied, dry coated surface and polish it with compound.
      In the case of the melamine or acrylic coating, compound polishing can be omitted after drying.
   j) If the case of lacquer coating, wax should not be applied to coated surface until the surface has dried completely (for approx. two months).
2) Before replacing exterior parts or assemblies, check paint conditions of all the covered or hidden interior surfaces. If any rust scale is found at these places, proceed as follows:
   a) Use a proper wire brush, adhesive or liquid rust removing agent to remove rust. As for the method of use, follow directions advised for respective materials.
   b) If necessary, wash parts with detergent, rinse, and dry them.
   c) Before installing exterior body parts, apply anticorrosive compound to all cleaner surfaces of exterior body parts. Also, apply anticorrosive compound to inner surfaces of exterior body parts to be installed.

SEALANT APPLICATION AREA

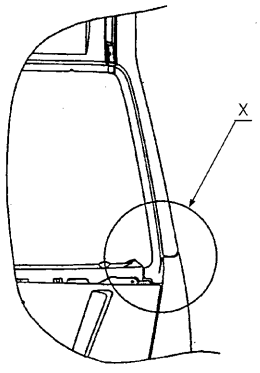




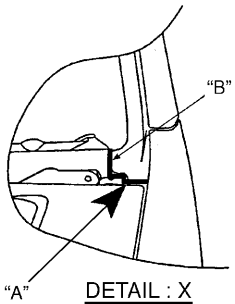
VIEW : B



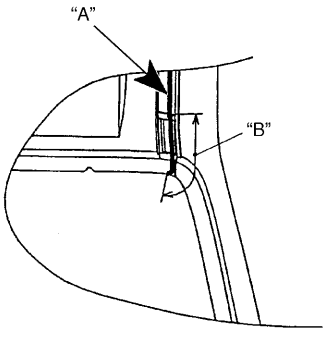
VIEW : C



VIEW : A

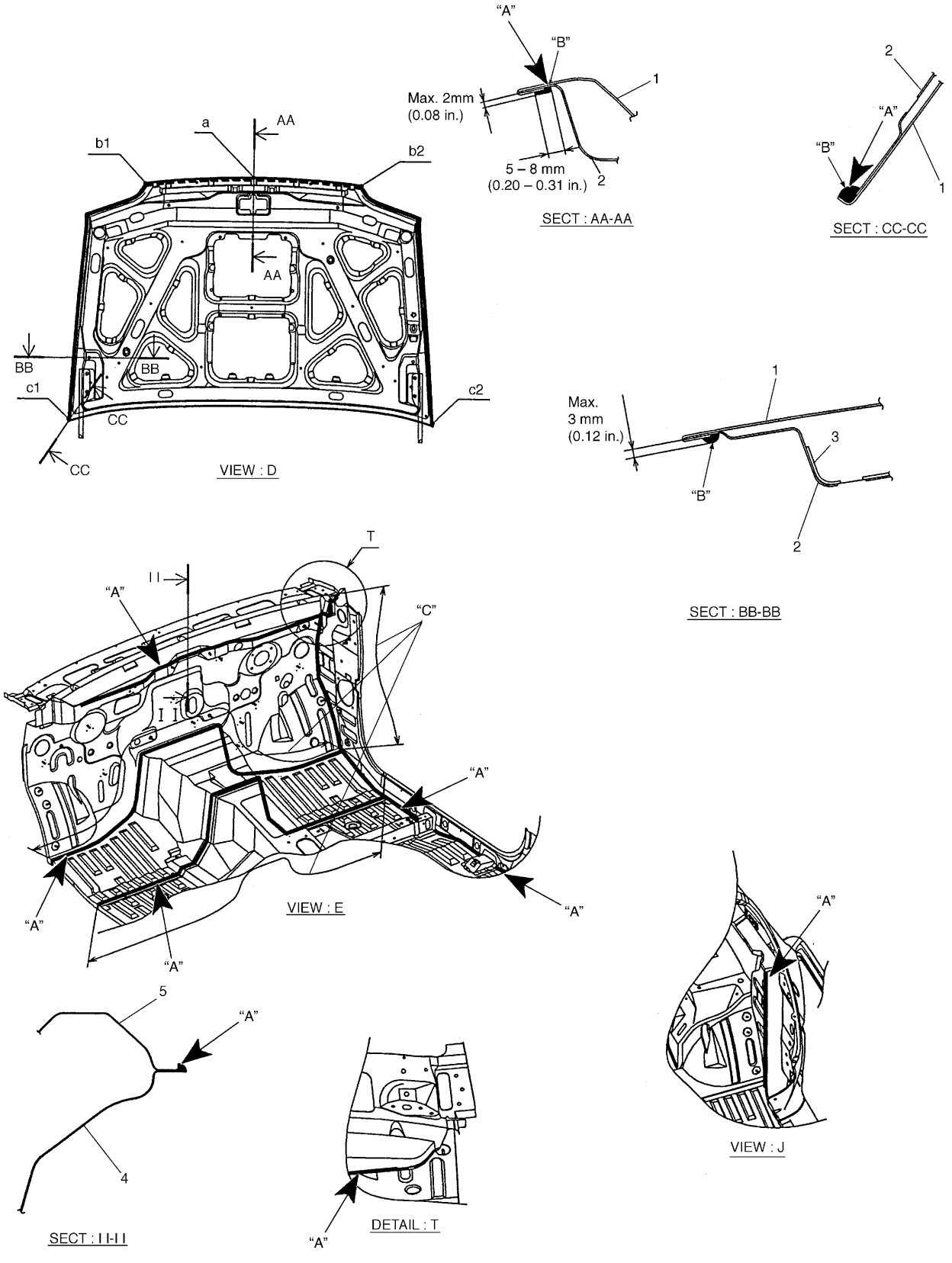


DETAIL : X

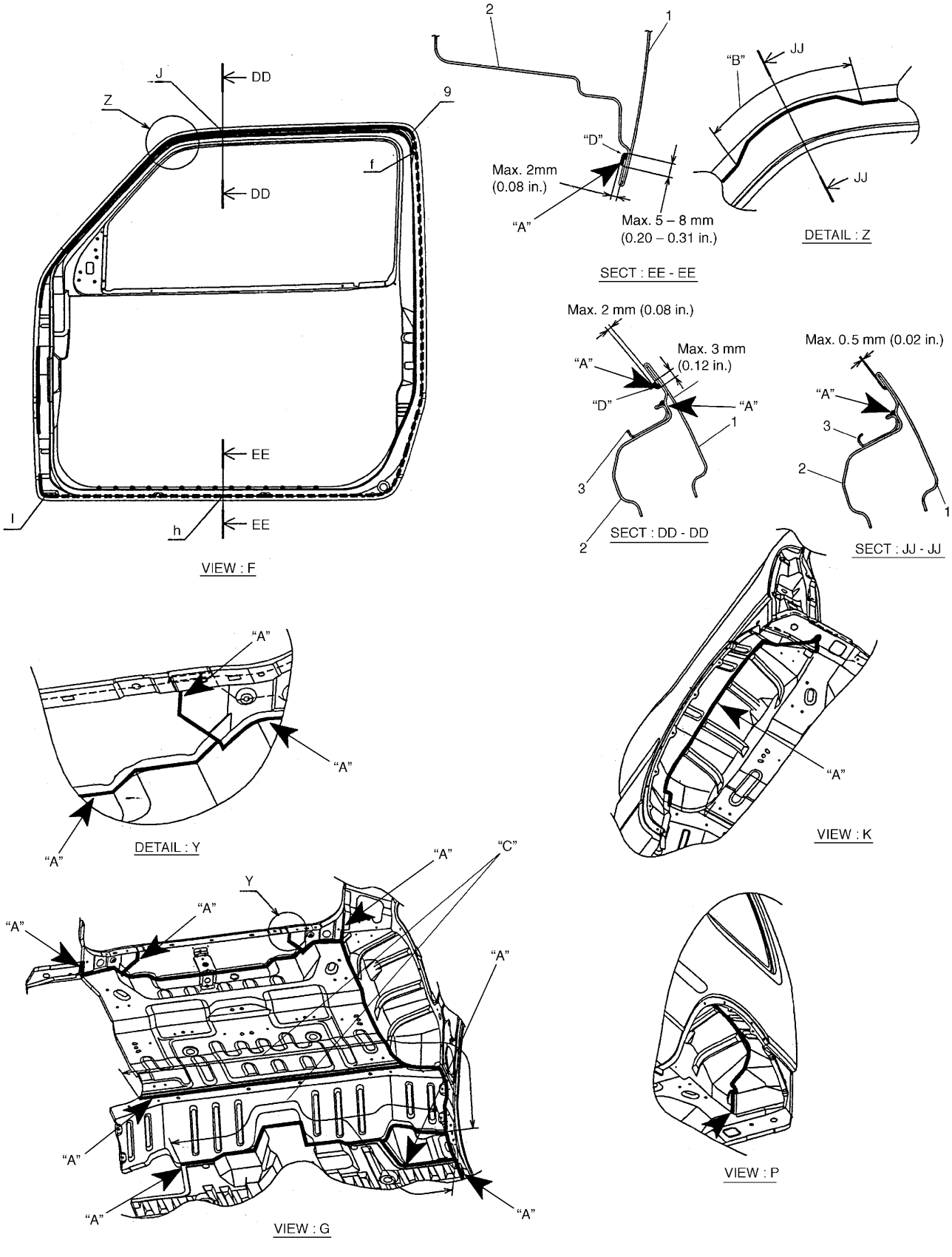


DETAIL : V

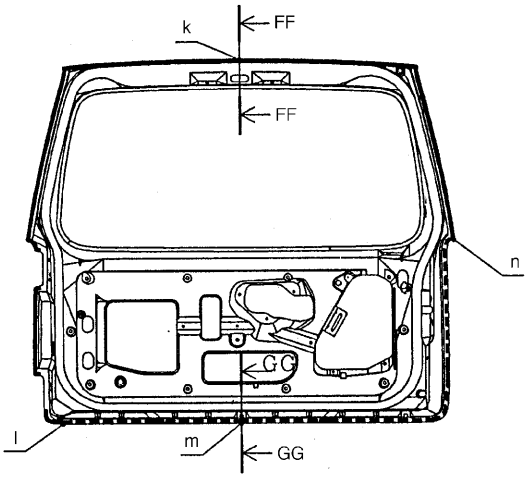
"A":	Apply sealant to painted area.
"B":	Wipe off excess sealant after application.
"C":	Smooth out sealant with a brush in one direction.



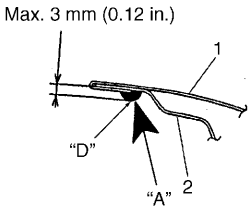
"A": Apply sealant to painted area.	1. Hood outer panel	4. Dash panel
"B": Make sure that the sealant covers completely the end of flange.	2. Hood inner panel	5. Cowl top panel
"C": Smooth out sealant with a brush in one direction.	3. Hood hinge reinforcement	



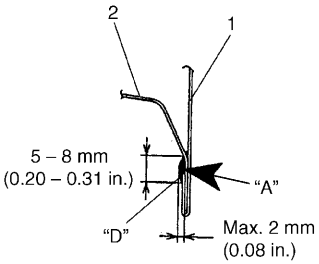
"A": Apply sealant to painted area.	1. Front door outer panel
"B": Wipe off excess sealant after application.	2. Front door inner panel
"C": Smooth out sealant with a brush in one direction.	3. Door weatherstrip rail
"D": Make sure that the sealant covers completely the end of flange.	



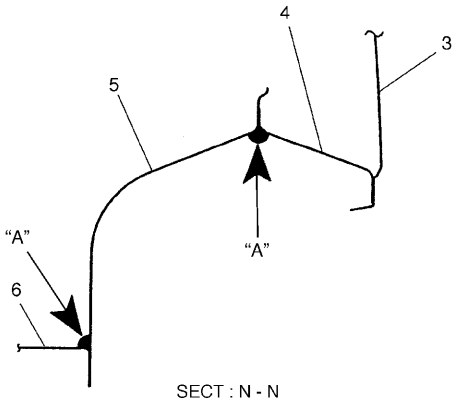
VIEW : H



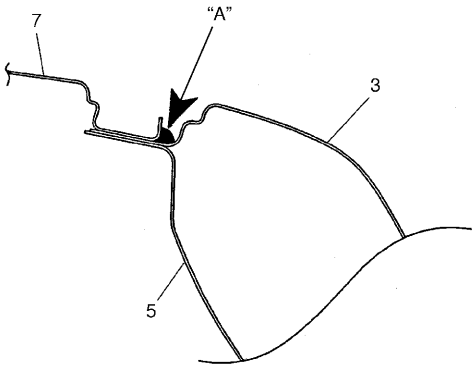
SECT : FF - FF



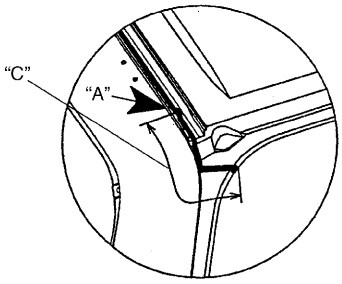
SECT : GG - GG



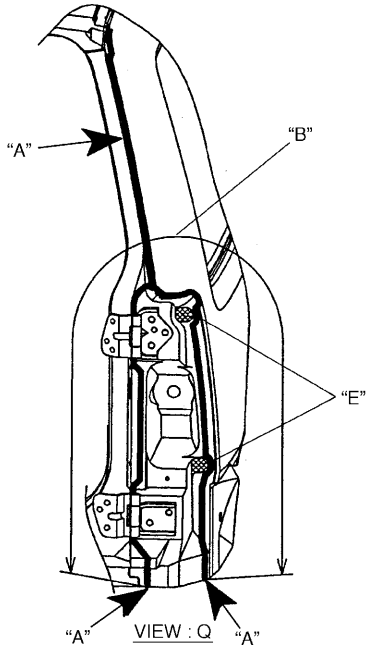
SECT : N - N



SECT : M - M

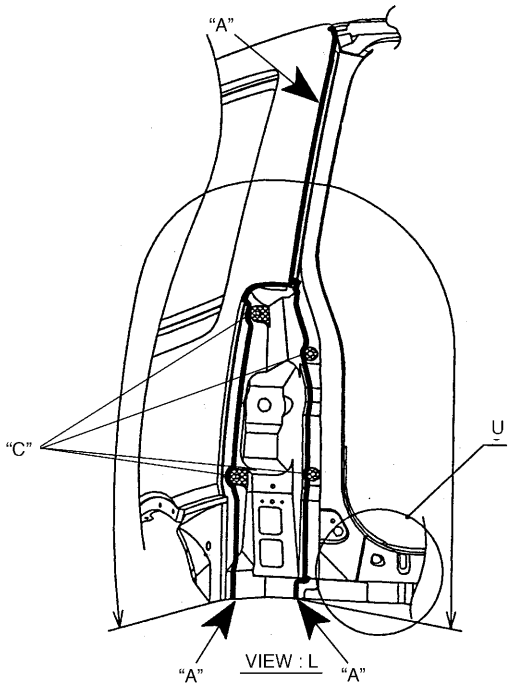


DETAIL : W

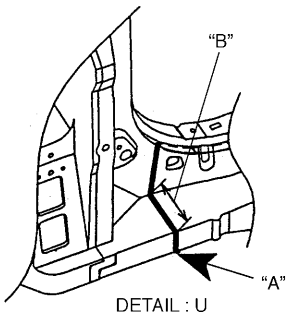


VIEW : Q

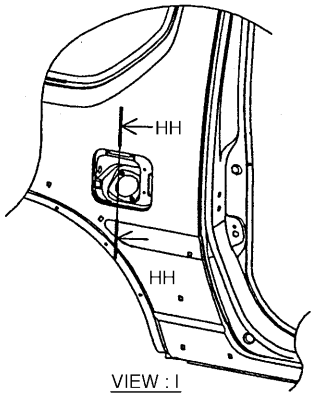
"A": Apply sealant to painted area.	1. Back door outer panel	6. Rear floor panel
"B": Smooth out sealant with a brush in one direction.	2. Back door inner panel	7. Roof panel
"C": Wipe off excess sealant after application.	3. Side body outer panel	
"D": Make sure that the sealant covers completely the end of flange.	4. Rear wheel housing outer panel	
"E": Do not sealant to this area.	5. Rear quarter inner panel	



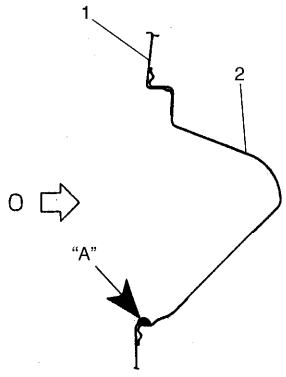
VIEW : L



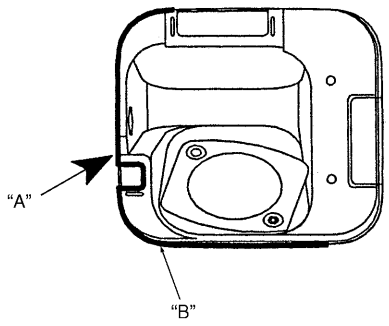
DETAIL : U



VIEW : I



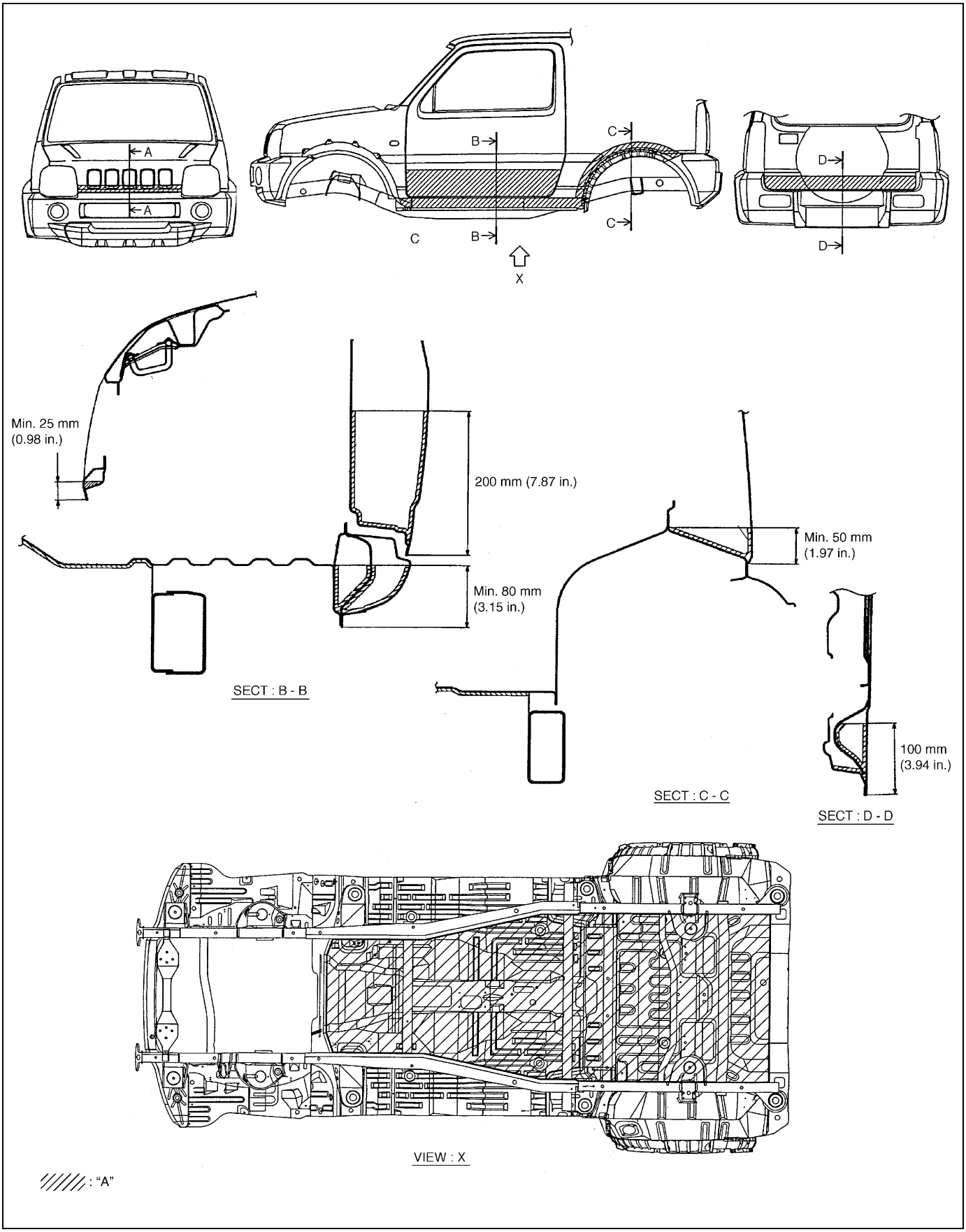
SECT : HH - HH



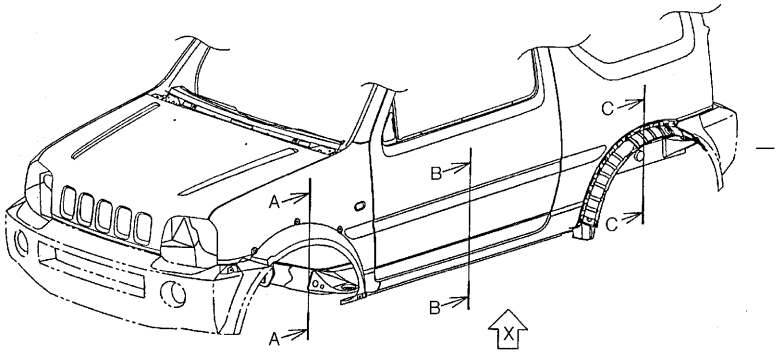
VIEW : O

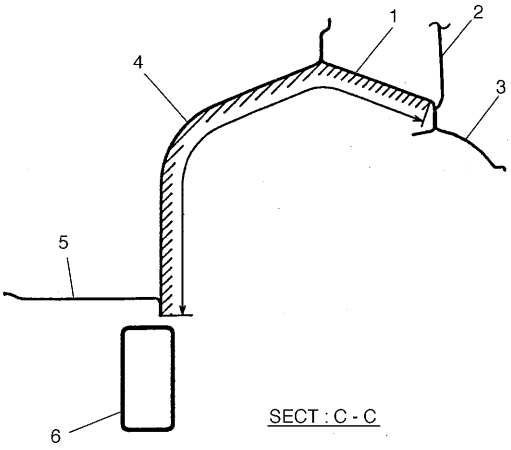
"A": Apply sealant to painted area.	1. Side body outer panel
"B": Smooth out sealant with a brush in one direction.	2. Fuel inlet box
"C": Do not sealant to this area.	

UNDER COATING / ANTI-CORROSION COMPOUND APPLICATION AREA

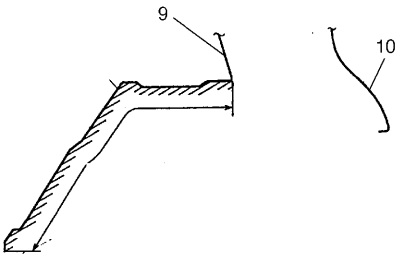


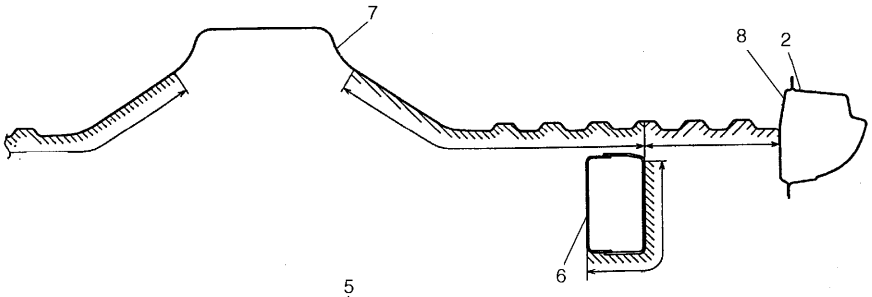
"A": Apply rustproof wax to shaded area (Over 50 μm)

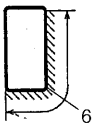




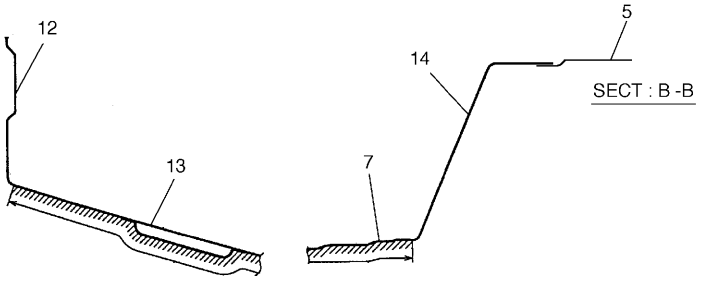
SECT : C - C





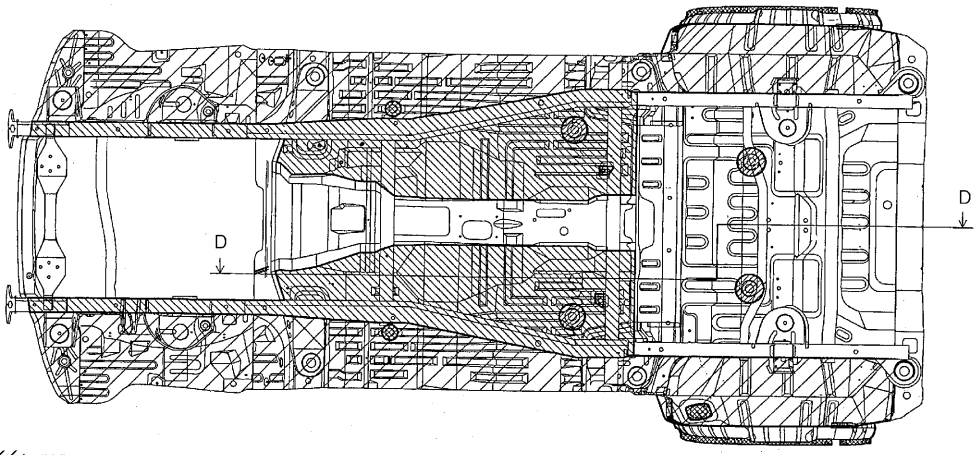


SECT : A - A



SECT : B -B

SECT : D - D

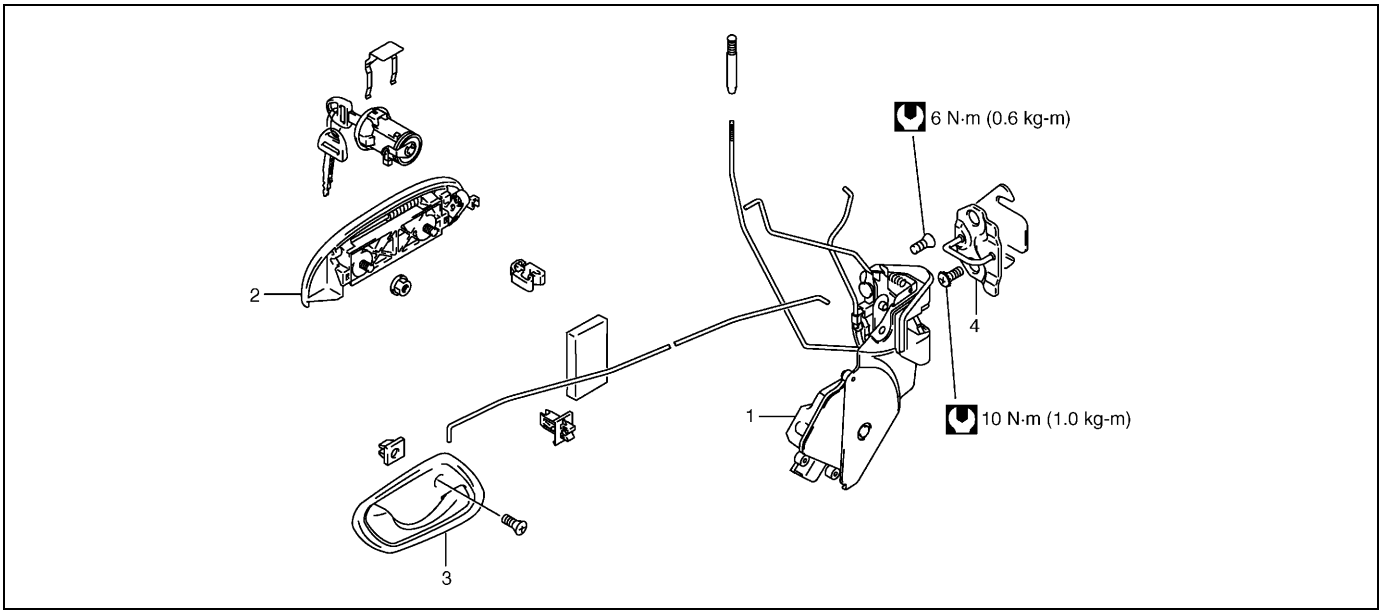


: "A"

"A": Apply undercoating to shaded area (Over 400 μm)	5. Rear floor	10. Front fender
1. Rear wheel housing	6. Frame	11. Front wheel housing
2. Side body outer	7. Main floor	12. Dash panel
3. Rear splash guard holder	8. Side sill inner	13. Tunnel front
4. Rear quarter inner	9. Front fender apron	14. Center floor

Security and Locks

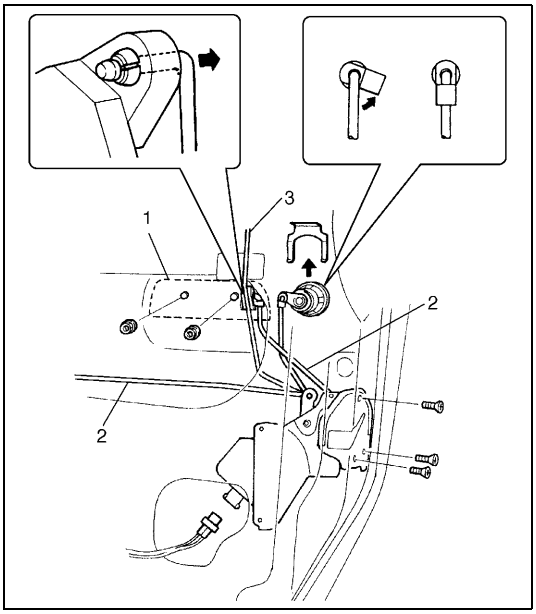
Front Door Lock Assembly



1. Door latch	3. Inside handle bezel	Tightening torque
2. Outside handle	4. Latch striker	

REMOVAL

1) Raise window all the way up.
2) Remove door trim and door sealing cover, refer to steps 1) to 6) of “REMOVAL” under “Front Door Glass” in this section.
3) Remove door sash.

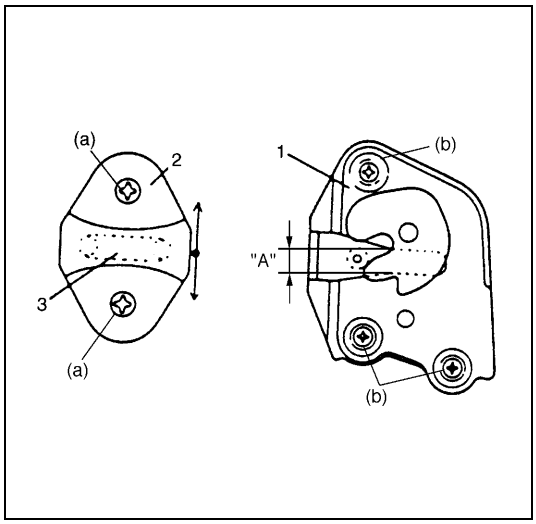


4) Remove door opening control rods (2).
5) Disconnect control rod (3).
6) Disconnect door lock motor lead wire.
7) Remove lock assembly.

1. Out side door handle

INSTALLATION

To install front door lock, reverse removal procedure, noting following.



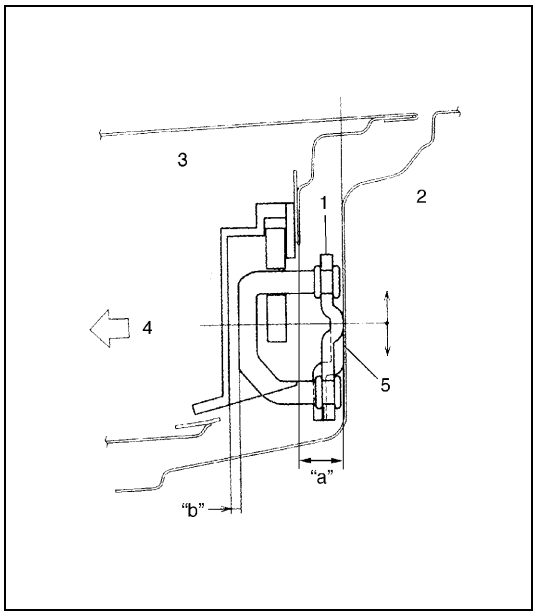
- Door latch striker (2).
  Move door latch striker up or down so its center aligns with the center of groove “A” on the door, as shown.

NOTE:

Striker should be moved vertically and placed level. Do not adjust door lock.

Tightening torque
Door latch striker screw (a): 10 N·m (1.0 kg-m, 7.2 lb-ft)
Door latch screw (b): 6 N·m (0.6 kg-m, 4.3 lb-ft)

1. Door latch
2. Shaft



- Move door latch striker (1) sideways to adjust door (3) surface flush with body (2) surface, as shown.
  In order to correctly obtain door latch striker position in the fore-and-aft direction, increase or decrease number of shims (5) inserted between body and striker to adjust it.

Dimension between door surface and body surface “a”: 13.3 – 14.8 mm (0.52 – 0.58 in.)
Dimension between door latch and door latch striker “b”: 3.2 – 5.2 mm (0.13 – 0.2 in.)

NOTE:

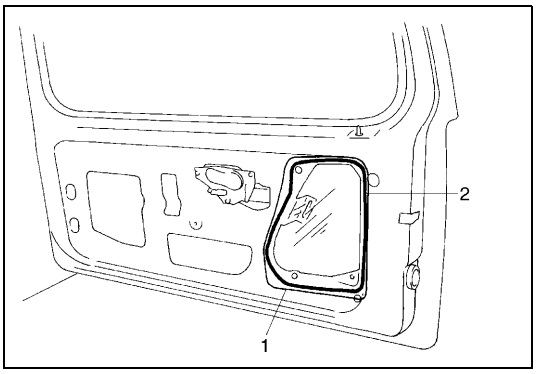
Apply oil or grease to striker joints periodically.

4. Front side

Back Door Lock Assembly

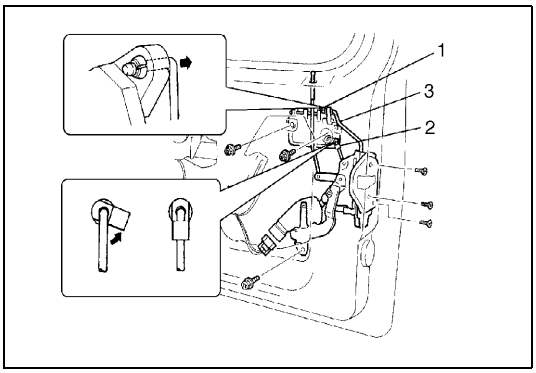
REMOVAL

1) Remove inside lock knob.
2) Remove door trim.



3) Remove door sealing cover (1).

2. Adhesive

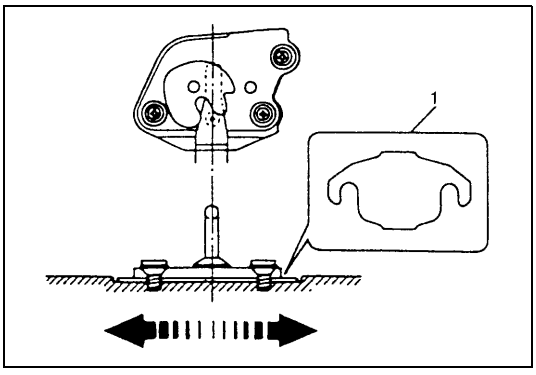


4) Remove door lock control rod (2).
5) Disconnect control rod (3).
6) Disconnect door lock motor lead wire.
7) Remove lock assembly.

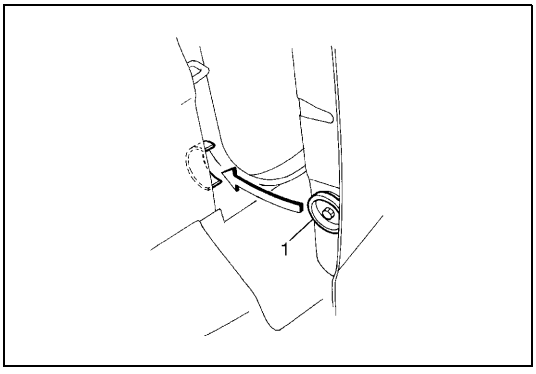
1. Outside door handle

INSTALLATION

Reverse removal procedure to install back door lock assembly noting following points.



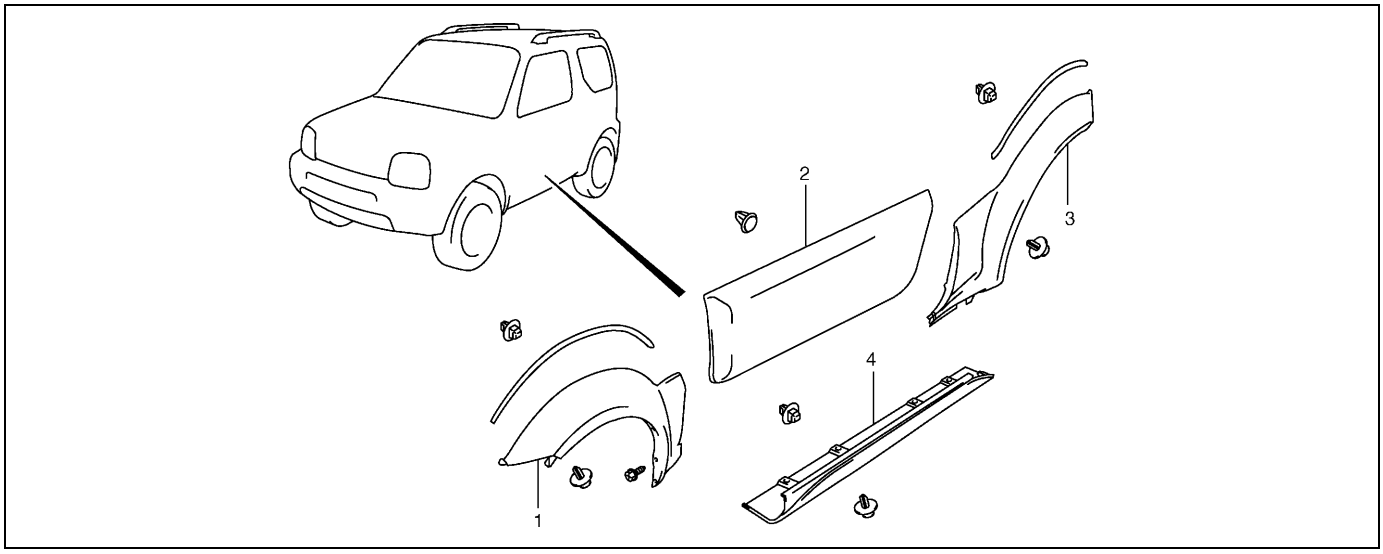
- Door latch striker.
  Adjust door latch striker so that its center aligns with the center of groove in door latch base.
  To adjust door latch and striker with each other, insert proper number of shims (1) below the bottom of striker, as shown.



- Door rubber cushion.
  Move rubber cushion (1) installed at the left side of back door to align it with its guide.

Exterior and Interior Trim

Splash Guard

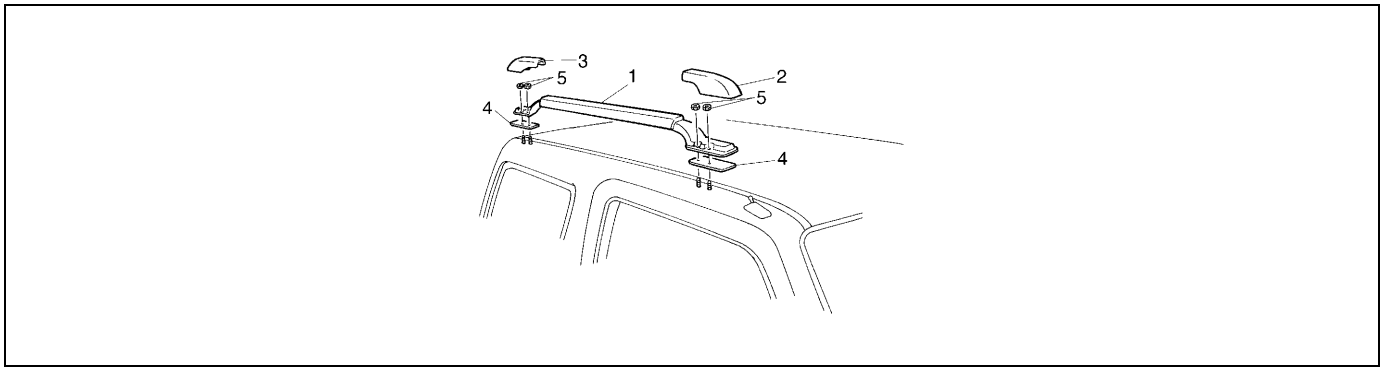


1. Fender splash guard	3. Rear splash guard
2. Front door splash guard	4. Side sill splash guard

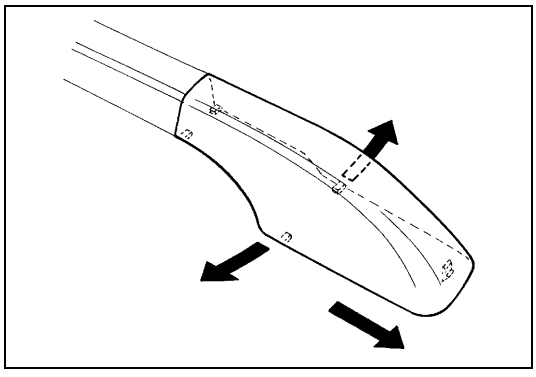
REMOVAL AND INSTALLATION

Remove and install as shown in figure.

Roof Rail (If Equipped)



1. Roof rail assembly	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 assembly.

INSTALLATION

Reverse removal procedure for installation.
Confirm that each roof rail fixing nut is tightened securely.

Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Front door glass attaching screw	6	0.6	4.3
Front door hinge bolt	27	2.7	19.5
Door latch striker screw	10	1.0	7.2
Door latch screw	6	0.6	4.3

SECTION 10

RESTRAINT 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 "Air Bag 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).**

NOTE:

To determine if the vehicle is equipped with seat belt pretensioner, refer to Owner's Manual.

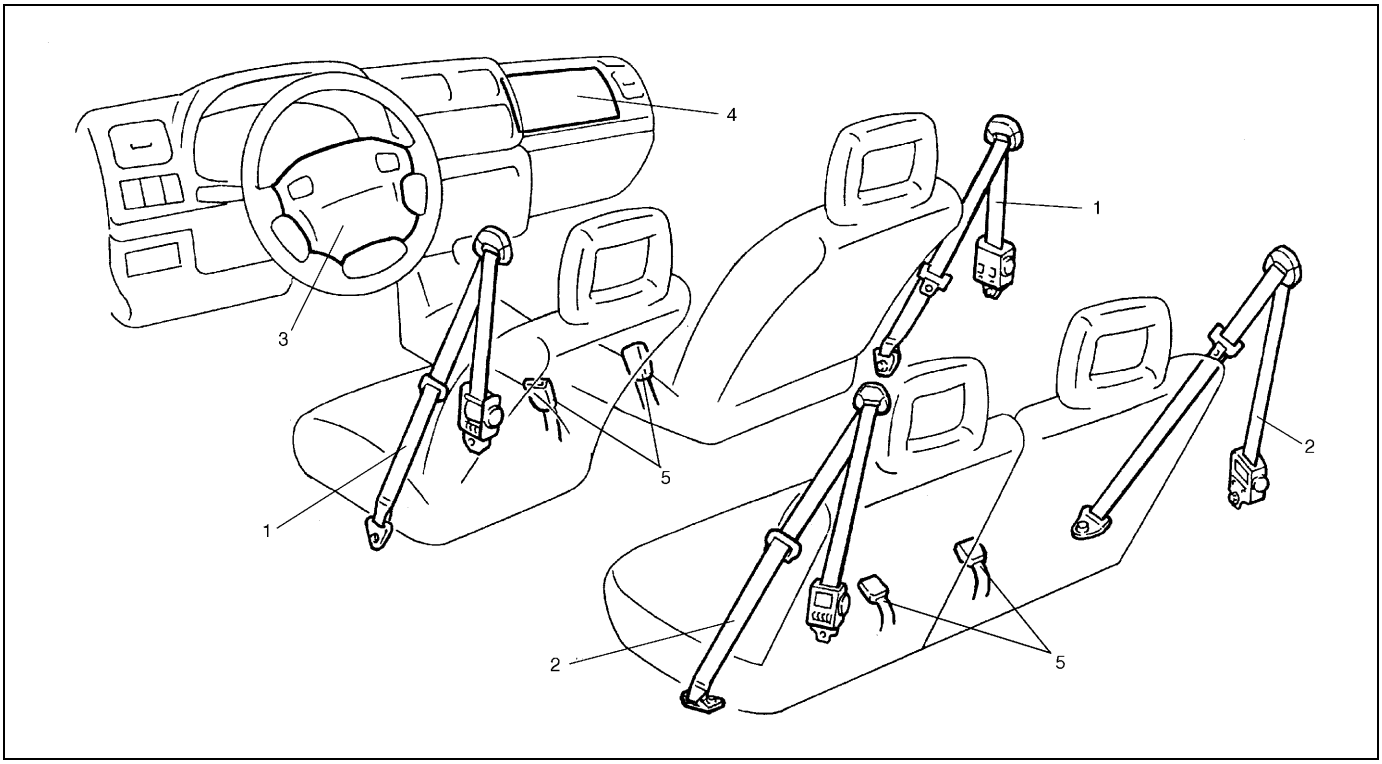
CONTENTS

General Description 10-2
Seat Belt Pretensioner (If Equipped) 10-3
Diagnosis 10-3
Inspection and Repair Required after Accident 10-3
On-Vehicle Service 10-4
Service Precautions 10-4
Service and diagnosis 10-4
Disabling air bag system for vehicle with air bag system 10-4
Enabling air bag system for vehicle with air bag system 10-4
Handling and storage for vehicle with air bag system 10-4
Disposal for vehicle with air bag system 10-4
Front Seat Belt without Pretensioner 10-5
Front Seat Belt with Pretensioner 10-6
Rear Seat Belt 10-8
Tightening Torque Specifications 10-8

General Description

There are three types of restraint system used for this vehicle.

	Type 1	Type 2	Type 3
Front seat belt	Seat belt with ELR	Seat belt with ELR	Seat belt with ELR
Rear seat belt	Seat belt with A-ELR	Seat belt with A-ELR	Seat belt with A-ELR
Supplemental restraint system	–	Driver and front passenger air bags	Driver and front passenger air bags
	–	–	Driver and front passenger pretensioners



1. Front seat belt	3. Driver side air bag (inflator) module (if equipped)	5. Front seat belt buckle
2. Rear seat belt	4. Passenger air bag (inflator) module (if equipped)	6. Rear seat belt buckle

Seat Belt with ELR

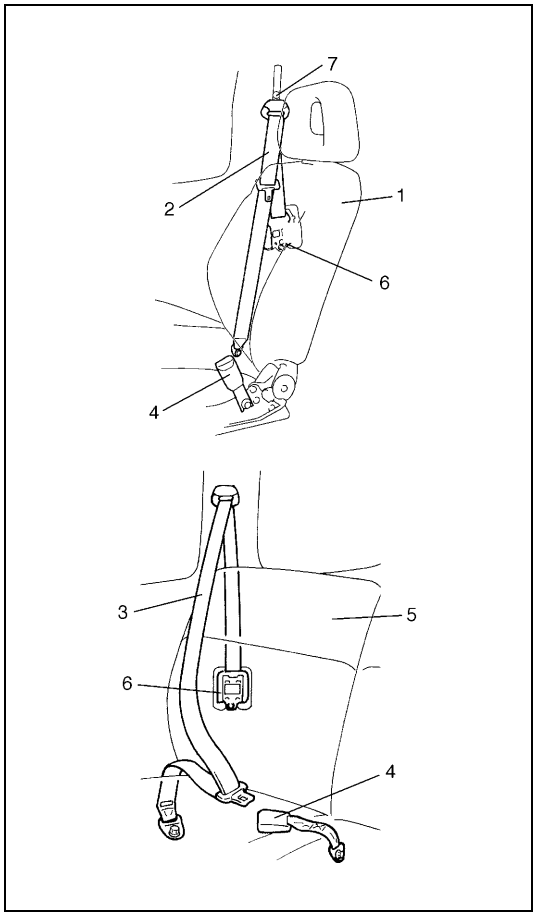
The seat belt with emergency locking retractor (ELR) is designed so that it locks immediately to prevent the webbing from being pulled out of the retractor any further when any of the following items is detected as exceeding each set value.

- 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 Pretensioner (If Equipped)



Some seat belts of the driver and front passenger seats are provided with a pretensioner as an optional function unit. The pretensioner is incorporated in retractor assembly (6) and controlled by SDM as one of air bag system components. It will be activated to takes up the sag of the seat belt at the same time as the air bag deployment when an impact at the front of vehicle exceeds the specified value.

When servicing seat belt 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 retractor assembly if pretensioner has been activated. Replace it with a new one as an assembly.

1.	Front seat
2.	Front seat belt
3.	Rear seat belt
4.	Buckle
5.	Rear seat
7.	Shoulder adjuster

Diagnosis

Diagnose air bag system including in seat belt pretensioner referring 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, inspections and repairs described on “Repairs and Inspections Required after Accident” in Section 10B.

On-Vehicle Service

Service Precautions

Service and diagnosis

WARNING:
If seat belt replacement is necessary, replace buckle and seat belt 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 seat belt 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, start to tighten the bolt by hand 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” of “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 referring 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 for vehicle with air bag system

Refer to “Disabling Air Bag System” in Section 10B.

Enabling air bag system for vehicle with air bag system

Refer to “Enabling Air Bag System” in Section 10B.

Handling and storage for vehicle with air bag system

Refer to “Handling and Storage” in Section 10B.

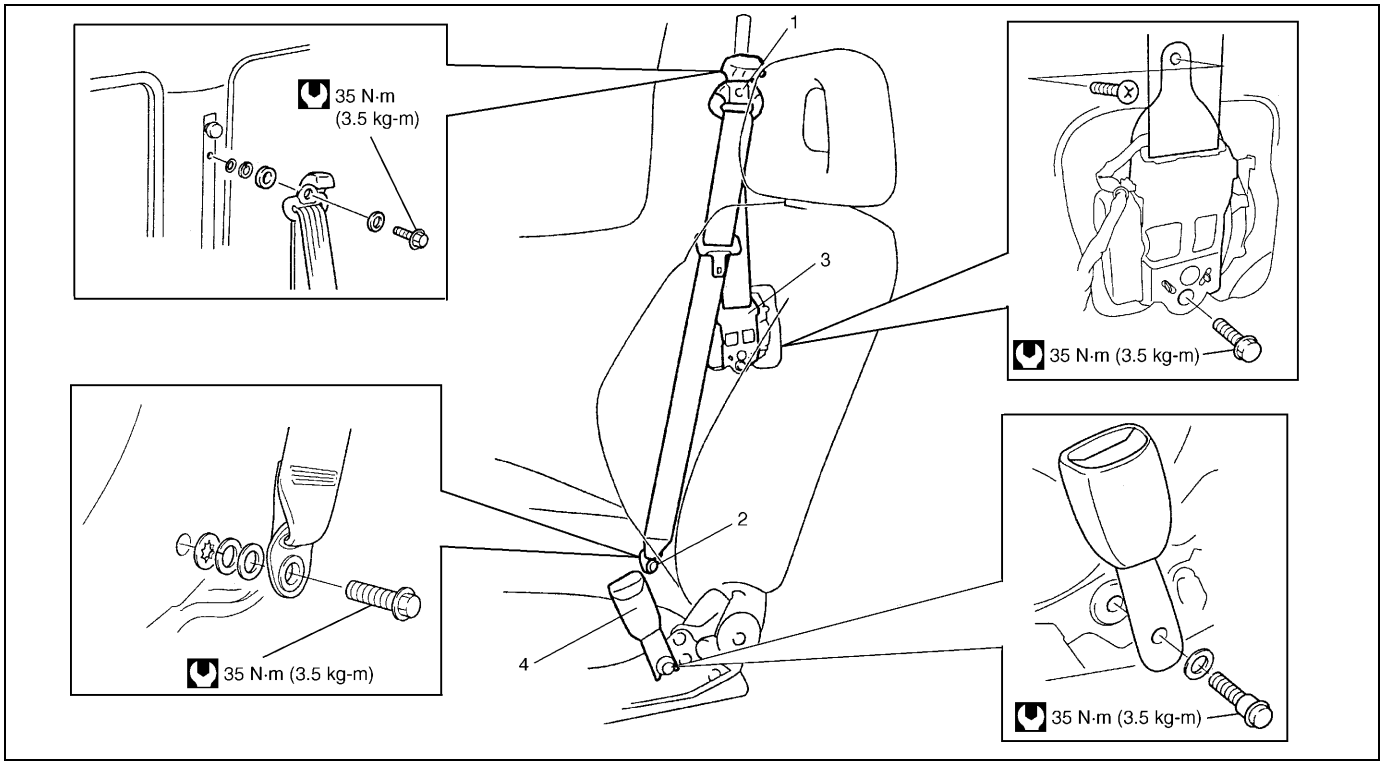
Disposal for vehicle with air bag system

Refer to “Disposal” in Section 10B.

Front Seat Belt without Pretensioner

WARNING:

Be sure to read "Service Precautions" before starting to work and observe every precaution during work.



1. Upper anchor	3. Retractor assembly	Tightening torque
2. Lower anchor	4. Buckle	

INSPECTION BEFORE REMOVAL

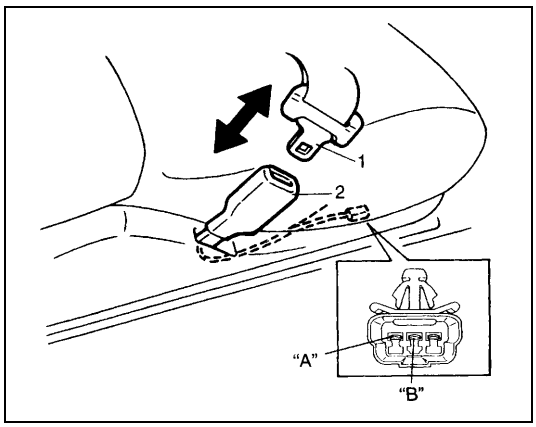
Seat belts and attaching parts can affect the vital components and systems of a vehicle.
Therefore, they should be inspected carefully and replaced with genuine parts only.

Anchor Bolt

Anchor bolts should be torqued to specification.

Belt Latch

It should be secure when latched.



Warning System (if equipped)

Check driver's seat belt strap switch for continuity by ohmmeter.

Seat belt strap switch specification
Without inserted buckle tongue to buckle catch :
Terminal "A" and "B" : Continuity
With inserted buckle tongue to buckle catch :
Terminal "A" and "B" : No continuity (∞ Ω)

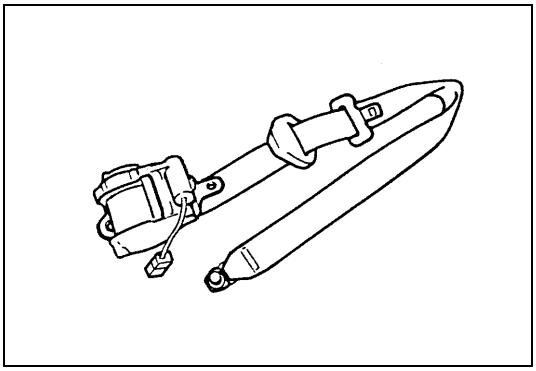
1. Buckle tongue
2. Buckle catch

REMOVAL

Refer to the component figure to remove front seat belts.

INSPECTION

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 should pass the above inspection and should lock webbing even when tilted (approx. 15°) toward the fore and aft or right and left directions.

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 seat belt anchor bolts to specified torque referring to previous figure.

Front Seat Belt with Pretensioner

WARNING:

- **Do not 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 this section, 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.**

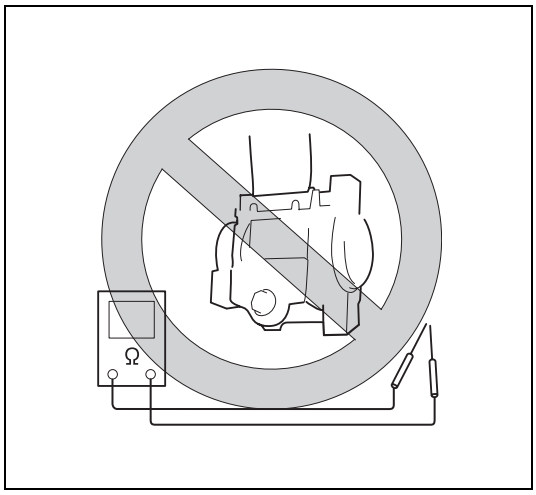
INSPECTION BEFORE REMOVAL

When checking seat belt with pretensioner, refer to "Inspection before Removal" under "Front Seat Belt without Pretensioner" in this section.

REMOVAL

1) Disconnect negative battery cable from battery.
2) Disable air bag system referring to “Disabling Air Bag System” in Section 10B.
3) Disconnect Yellow connector for seat belt pretensioner.
4) Remove front seat belts from vehicle referring to “Front Seat Belt without Pretensioner” in this section.

INSPECTION



When checking seat belt with pretensioner, use the following check items in addition to those specified for seat belt without pretensioner described in “Inspection” under “Front Seat Belt without Pretensioner” in this section.

WARNING:

Do not measure resistance of pretensioner or disassemble it. Otherwise, personal injury may result.

CAUTION:

If seat belt pretensioner (retractor assembly) was dropped from a height of 90 cm (3 ft) or more, it should be replaced.

Check retractor assembly with seat belt pretensioner appearance visually for the following symptoms and if any one of them is applicable, replace it with a new one as an assembly.

- Seat belt 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.

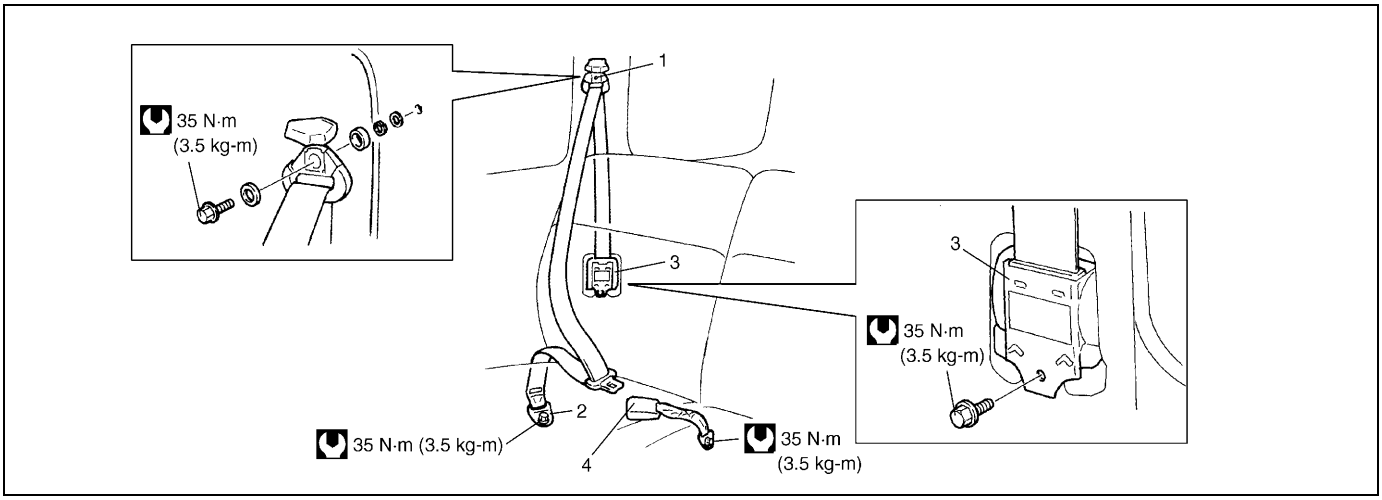
INSTALLATION

1) Install front seat belts to vehicle referring to “Front Seat Belt without Pretensioner” in this secton.
2) Connect Yellow connector for seat belt pretensioner securely.
3) Connect negative battery cable to battery.
4) Enable air bag system referring to “Enabling Air Bag System” in Section 10B.

Rear Seat Belt

WARNING:

Be sure to read "Service Precautions" in this section before starting to work and observe every precaution during work.



1. Upper anchor	3. Retractor assembly
2. Lower anchor	4. Buckle

INSPECTION BEFORE REMOVAL

Check the rear seat belt in the same way as when inspecting front seat belt without pretensioner referring to "Inspection before Removal" under "Front Seat Belt without Pretensioner" in this section.

REMOVAL

Refer to the component figure to remove rear seat belts.

INSPECTION

Check the rear seat belt in the same way as when inspecting front seat belt without pretensioner referring to "Inspection" under "Front Seat Belt without Pretensioner" in this secton.

INSTALLATION

Install the rear seat belt observing the same precautions as when installing front seat belt without pretensioner referring to "Front Seat Belt without Pretensioner" in this section.

- Be sure to tighten seat belt anchor bolts to specified torque as shown in the figure.

Tightening Torque Specifications

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
Upper and lower anchor bolt	35	3.5	25.5
Retractor assembly bolt	35	3.5	25.5
Buckle bolt	35	3.5	25.5

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:

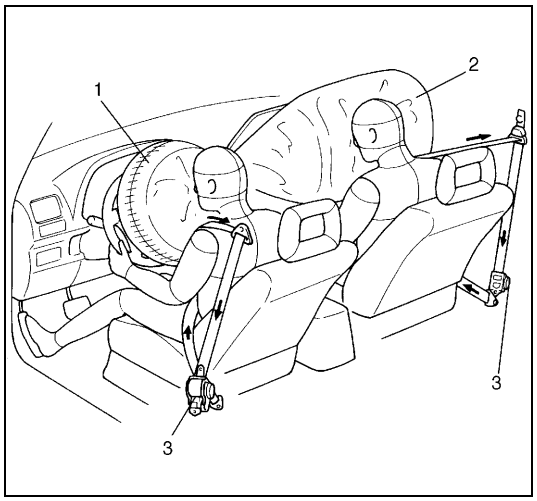
When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) 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 10B-3
System Components and Wiring Location View and Connectors 10B-4
System Wiring Diagram 10B-5
Diagnosis 10B-6
Diagnostic Trouble Code (DTC) 10B-6
Use of Special Tool 10B-6
Intermittents and Poor Connections 10B-8
Air Bag Diagnostic System Check 10B-9
Air Bag Diagnostic System Check Flow Table 10B-10
DTC Check 10B-11
DTC Clearance 10B-12
DTC Table 10B-13
"AIR BAG" Warning Lamp Circuit Trouble Diagnosis Table 10B-15
"AIR BAG" warning lamp comes on steady 10B-16
"AIR BAG" warning lamp does not come on 10B-17
"AIR BAG" warning lamp flashes 10B-19
"AIR BAG" warning lamp can not indicate flashing 10B-20
SDM Serial Data Circuit Toruble Diagnosis Table 10B-21
DTC B1015 – Passenger Air Bag Initiator Circuit Resistance High 10B-23
DTC B1016 – Passenger Air Bag Initiator Circuit Resistance Low 10B-23
DTC B1018 – Passenger Air Bag Initiator Circuit Short to Ground 10B-23
DTC B1019 – Passenger Air Bag Initiator Circuit Short to Power Circuit 10B-23
DTC B1021 – Driver Air Bag Initiator Circuit Resistance High 10B-28
DTC B1022 – Driver Air Bag Initiator Circuit Resistance Low 10B-28
DTC B1024 – Driver Air Bag Initiator Circuit Short to Ground 10B-28
DTC B1025 – Driver Air Bag Initiator Circuit Short to Power Circuit 10B-28
DTC B1032 – Power Source Voltage Low 10B-35
DTC B1041 – Driver Pretensioner Initiator Circuit Resistance High 10B-37
DTC B1042 – Driver Pretensioner Initiator Circuit Resistance Low 10B-37

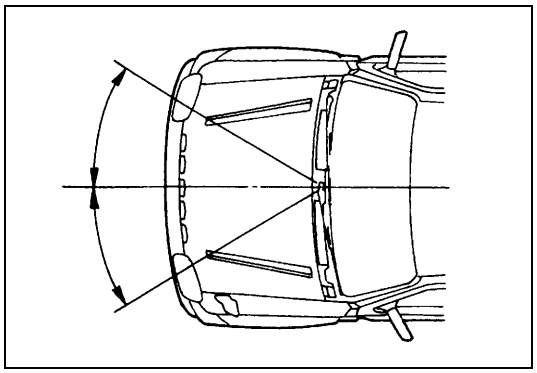
DTC B1043 – Driver Pretensioner Initiator Circuit Short to Ground 10B-37
DTC B1044 – Driver Pretensioner Initiator Circuit Short to Power Circuit 10B-37
DTC B1045 – Passenger Pretensioner Initiator Circuit Resistance High 10B-37
DTC B1046 – Passenger Pretensioner Initiator Circuit Resistance Low 10B-37
DTC B1047 – Passenger Pretensioner Initiator Circuit Short to Ground 10B-37
DTC B1048 – Passenger Pretensioner Initiator Circuit Short to Power Circuit 10B-37
DTC B1051 – Frontal Crash Detected (System Activation Command Outputted) 10B-46
DTC B1071 – Internal SDM Fault 10B-47
DTC B1013 – System Specifications Different from SDM Specifications 10B-47
On-vehicle Service 10B-48
Service Precautions 10B-48
Service and diagnosis 10B-48
Disabling air bag system 10B-49
Enabling air bag system 10B-49
Handling and storage 10B-50
Disposal 10B-54
Air bag wire harness and connector in instrument panel harness, floor harness and pretensioner harness 10B-54
Repairs and Inspections Required after an Accident 10B-55
Accident with Deployment/Activation - Component Replacement 10B-55
Accident with or without Deployment/ Activation - Component Inspections 10B-55
SDM 10B-58
Passenger Air Bag (Inflator) Module 10B-59
Driver Air Bag (Inflator) Module 10B-60
Contact Coil and Combination Switch Assembly 10B-60
Seat Belt Pretensioner 10B-60
Air Bag (Inflator) Module and Seat Belt Pretensioner Disposal 10B-61
Deployment/Activation Outside of Vehicle 10B-62
Deployment/Activation Inside Vehicle 10B-69
Deployed Air Bag (Inflator) Module and Activated Seat Belt Pretensioner Disposal 10B-73
Tightening Torque Specification 10B-74
Special Tool 10B-74

General Description



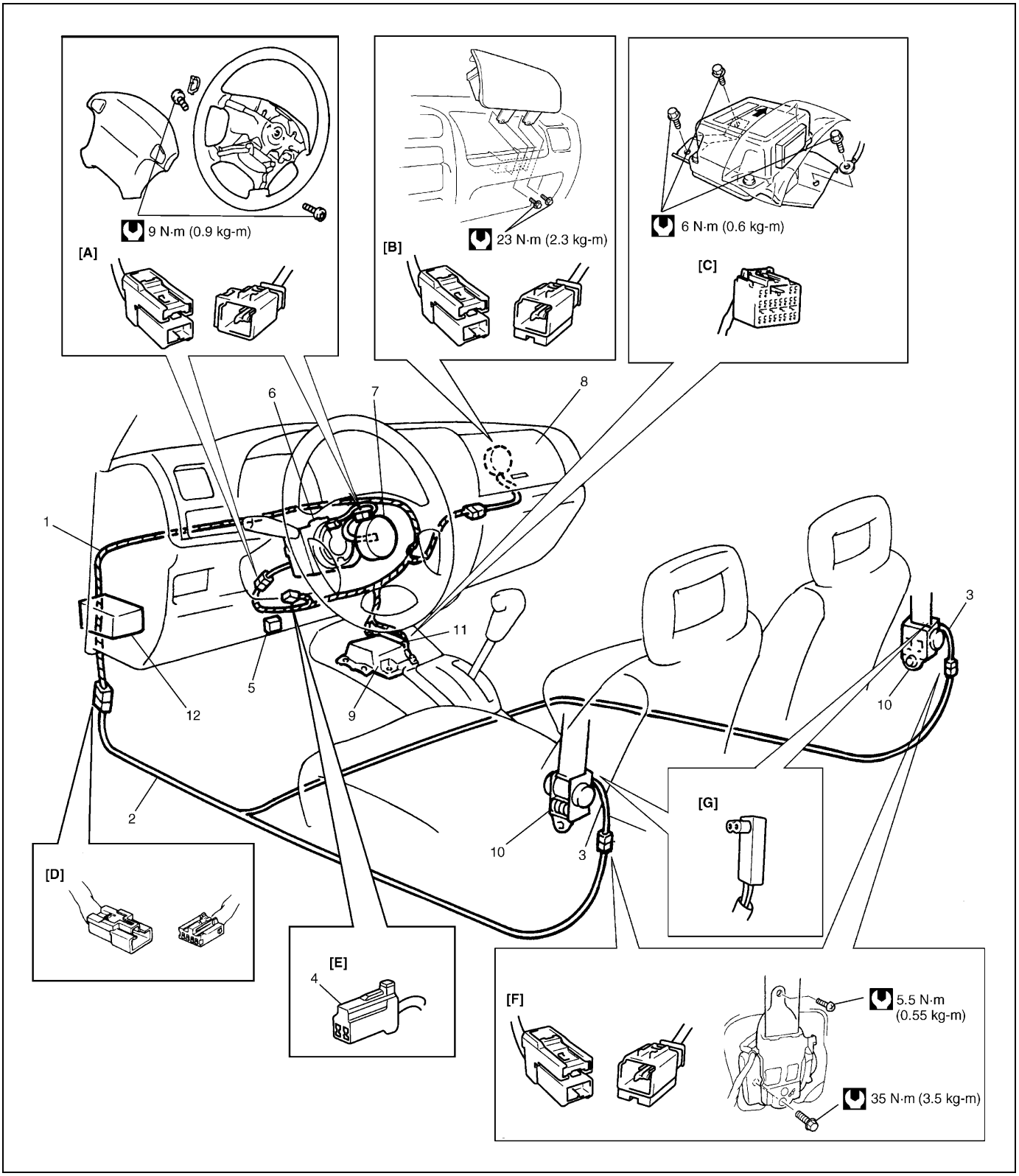
With the air bag system which includes air bags for both the driver's and passenger's sides as well as the seat belt pretensioners, the sag of the seat belt is taken up (for seat belt with pretensioner), the driver air bag (inflator) module is deployed from the center of the steering column and the passenger 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.

1. Driver side air bag
2. Passenger side air bag
3. Seat belt pretensioner



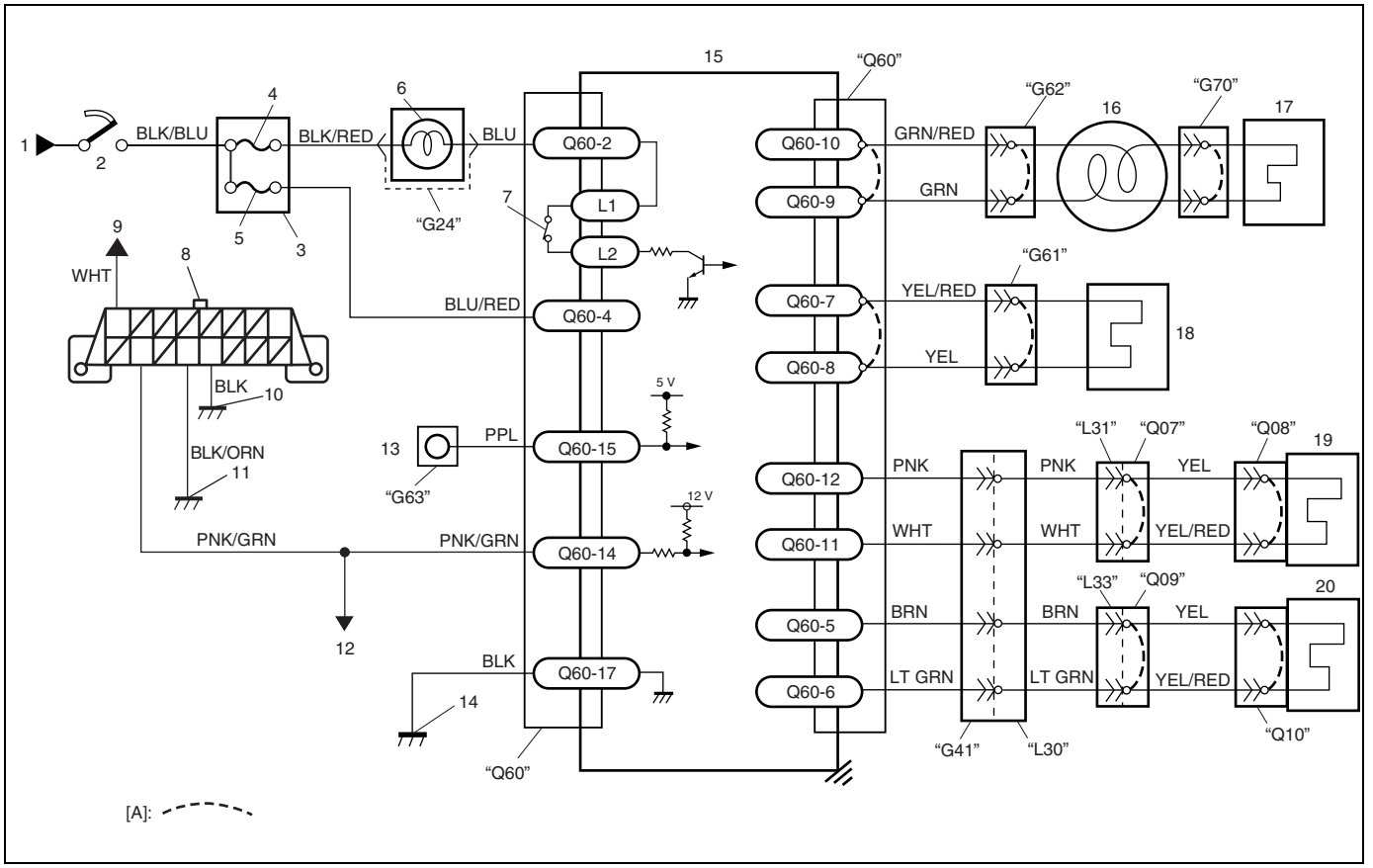
The air bag system is designed to activate only in severe frontal collisions. It is not designed to activate in rear impacts, side impacts, rollovers, or minor frontal collisions, since it would offer no protection in those types of accidents.

System Components and Wiring Location View and Connectors



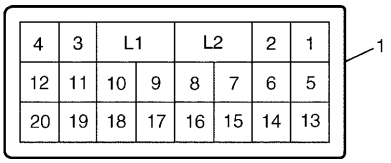
[A] : Connector “G62”, “G70”	1. Air bag harness in instrument panel harness	8. Passenger air bag (inflator) module
[B] : Connector “G61”	2. Air bag harness in floor harness	9. SDM
[C] : Connector “Q60”	3. Air bag harness in seat belt pretensioner harness	10. Seat belt pretensioner (retractor assembly)
[D] : Connector “L30”	4. “Air bag” monitor coupler	11. Ground for air bag system
[E] : Connector “G63”	5. DLC	12. “AIR BAG” fuse in circuit fuse box
[F] : Connector “Q07”, “Q09”	6. Contact coil assembly	
[G] : Connector “Q08”, “Q10”	7. Driver air bag (inflator) module	

System Wiring Diagram



[A] : Shorting bar	7. Connection detection pin	14. Ground for air bag system
1. To main fuse box	8. Data link connector (DLC)	15. SDM
2. Ignition switch	9. To circuit fuse box	16. Contact coil assembly
3. Circuit fuse box	10. Ground on body	17. Driver air bag (inflator) module
4. "METER" fuse	11. Ground on engine block	18. Passenger air bag (inflator) module
5. "AIR BAG" fuse	12. To ECM, TCM and ABS control module (if equipped)	19. Driver seat belt pretensioner
6. "AIR BAG" warning lamp in combination meter	13. "AIR BAG" monitor coupler	20. Passenger seat belt pretensioner

TERMINAL ARRANGEMENT OF SDM CONNECTOR "Q60" VIEWED FROM HARNESS SIDE



1. SDM connector "Q60"

SDM connector “Q60” terminal description

TERMINAL	CIRCUIT		TERMINAL	CIRCUIT	
Q60-1	–		Q60-11	Driver pretensioner	Low
Q60-2	“AIR BAG” warning lamp		Q60-12		High
Q60-3	–		Q60-13	–	
Q60-4	Ignition switch (power source)		Q60-14	Data link connector (DLC)	
Q60-5	Passenger pretensioner	High	Q60-15	Diagnosis switch	
Q60-6		Low	Q60-16	–	
Q60-7	Passenger air bag (inflator)	High	Q60-17	Ground	
Q60-8	module	Low	Q60-18	–	
Q60-9	Driver air bag (inflator)	Low	Q60-19	–	
Q60-10	module	High	Q60-20	–	

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)

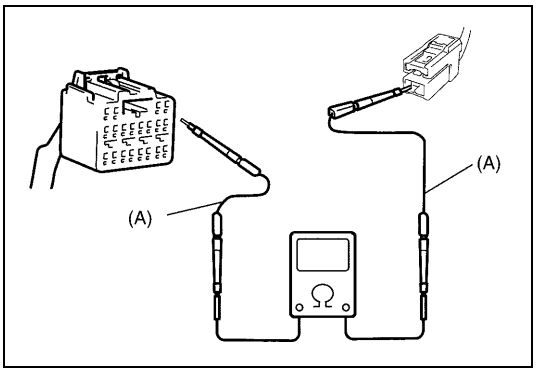
The “Air Bag Diagnostic System Check” must always be the starting point of any air bag system diagnosis. The “Air Bag Diagnostic System Check” checks for proper “AIR BAG” warning lamp operation and checks for air bag diagnostic trouble codes using on-board diagnosis function or SUZUKI scan tool.

Use of Special Tool

WARNING:

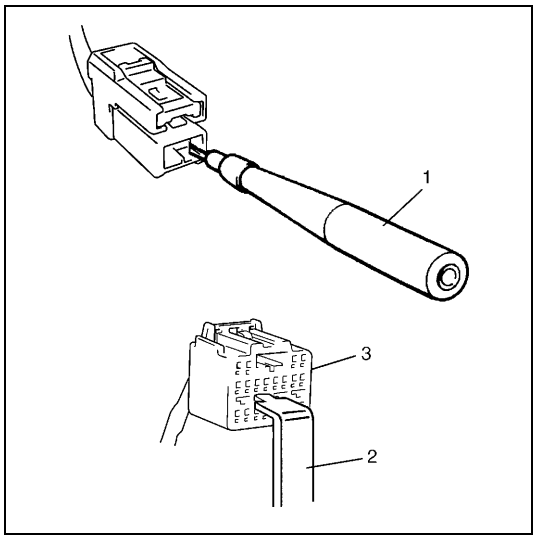
To avoid deployment when troubleshooting the air bag system, do not use electrical test equipment such as a battery powered or AC powered voltmeter, ohmmeter, etc., or any type of electrical equipment other than that specified in this manual. Do not use a non-powered probe type tester. Instructions in 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, Adapter cable, Connector Test Adapter Kit and the Digital Multimeter.



Special tool
(A) : 09932-76010 (Connector Test Adapter Kit)

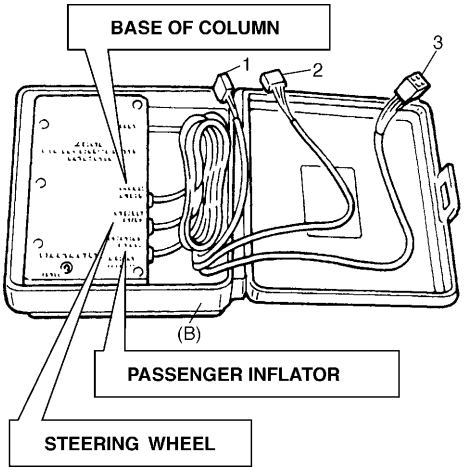
This must be used whenever a diagnostic procedure requests checking or probing a terminal.
Using the appropriate adapter in the special tool will ensure that no damage to the terminal will occur from the multimeter probe, such as spreading or bending.



The adapter (1) will also give an idea of whether contact tension is sufficient, helping to find an open or intermittent open due to poor terminal contact.

An SDM short bar release tool (2) is included in the connector test adapter kit.

Inserting it into the SDM connector (3) will release the shorting bar.



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 the 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 for passenger air bag (inflator) module.
- Each of driver and passenger seat belt pretensioners when it is connected to air bag harness connector for driver and passenger seat belt pretensioners.

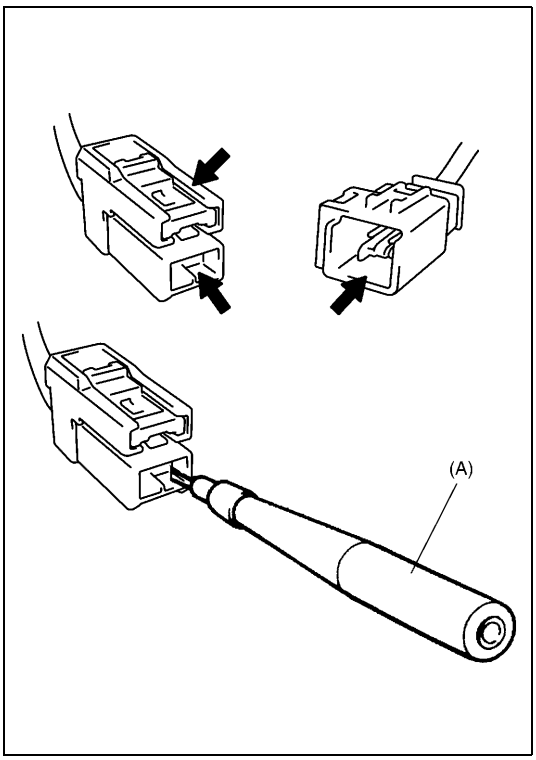
Another connector ("BASE OF COLUMN") is used to substitute the load of the driver air bag (inflator) module and the contact coil assembly when it is connected at the base of the column to the air bag wire harness.
The third connector ("PASSENGER INFLATOR") is not used.

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, passenger air bag (inflator) module and driver and passenger seat belt pretensioners
3. Not used

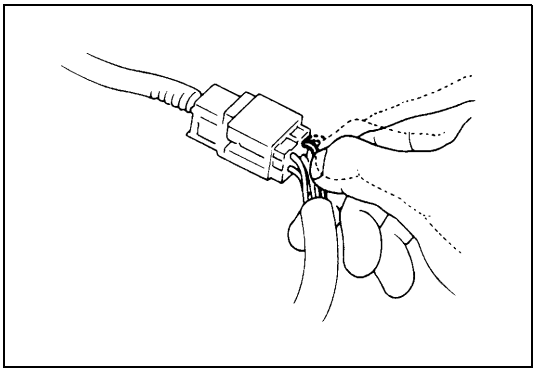
Intermittents and Poor Connections

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:

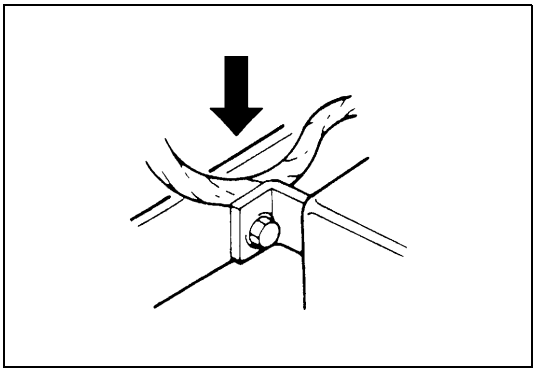


- Poor mating of connector halves, or terminals not fully seated in the connector body (backed out).
- Dirt or corrosion on the terminals. The terminals must be clean and free of any foreign material which could impede proper terminal contact.
  However, cleaning the terminal with a sand paper or the 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” in this section.
   (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” in this section.
   (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

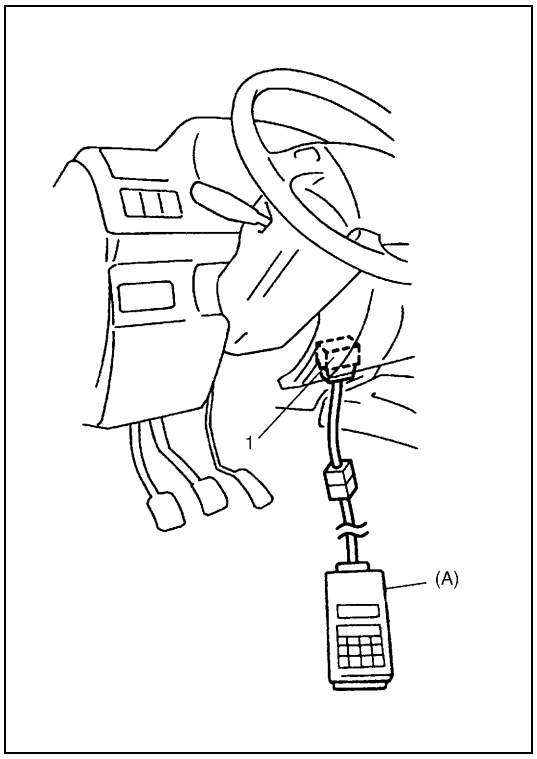
STEP 1 : Check that “AIR BAG” warning lamp lights.
STEP 2 : Check that “AIR BAG” warning lamp lights.
STEP 3 : Check diagnosis switch circuit.
STEP 4 : Check that “AIR BAG” warning lamp flashes 6 times after ignition switch is turned ON.
STEP 6 : Check that history codes are in SDM memory. (using SUZUKI scan tool)
STEP 7 : Check that history codes are in SDM memory. (using monitor coupler)
STEP 9 : Check that current code is in SDM memory. (using SUZUKI scan tool)
STEP 10 : Check that current code is in SDM memory. (using monitor coupler)

Air Bag Diagnostic System Check Flow Table

Step	Action	Yes	No
1	1) Make sure that battery voltage is about 11V or higher. 2) Note “AIR BAG” warning lamp as ignition switch is turned to ON position. Does “AIR BAG” warning lamp come ON?	Go to step 2.	Proceed to ““AIR BAG” Warning Lamp Does Not Come On” in this section.
2	Does “AIR BAG” warning lamp come ON steady?	Proceed to ““AIR BAG” Warning Lamp Comes On Steady” in this section.	Go to step 3.
3	Does “AIR BAG” warning lamp keep flashing (indicating DTC) when ignition switch is ON?	Proceed to ““AIR BAG” Warning Lamp Flashes” in this section.	Go to step 4.
4	Does “AIR BAG” warning lamp turn OFF after flashing 6 times?	Go to step 5.	Go to step 8.
5	Do you have SUZUKI scan tool?	Go to step 6.	Go to step 7.
6	1) Check DTC referring to “Using SUZUKI Scan Tool” under “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 “Intermittent and Poor Connections” in this section. Then clear DTC referring to “DTC Clearance” in this section, and repeat this table.
7	1) Check DTC referring to “Not Using SUZUKI Scan Tool” under “DTC Check” in this section. Is flashing pattern No. 12 indicated on “AIR BAG” warning lamp?	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 “Intermittent and Poor Connections” in this section. Then clear DTC referring to “DTC Clearance” in this section, and repeat this table.
8	Do you have SUZUKI scan tool?	Go to step 9.	Go to step 10.
9	1) Check DTC referring to “Using SUZUKI Scan Tool” under “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 corresponding DTC flow table.
10	1) Check DTC referring to “Not Using SUZUKI Scan Tool” under “DTC Check” in this section. Is flashing pattern No. 12 indicated on “AIR BAG” warning lamp?	Substitute a known-good SDM and recheck.	Check and repair according to corresponding DTC flow table.

DTC Check

Using SUZUKI Scan Tool



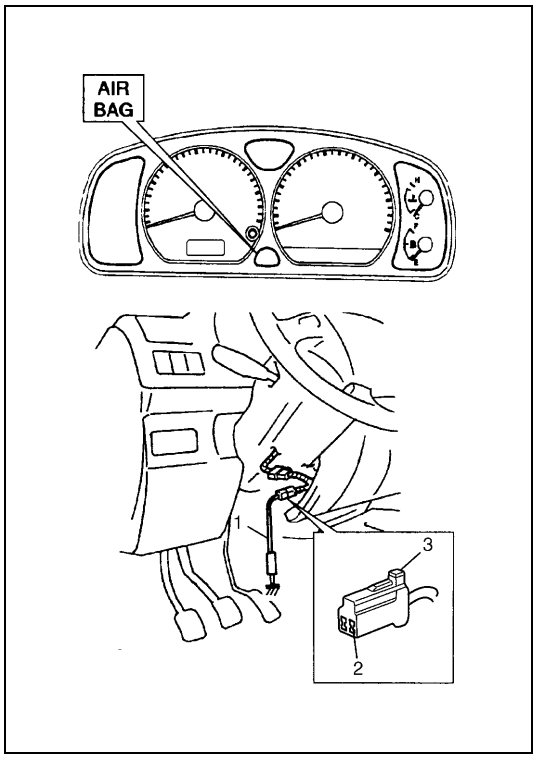
1) Turn ignition switch to OFF position.
2) After setting SUZUKI scan tool, connect it to data link connector (DLC) located on underside of instrument panel at driver's seat side.

Special tool
(A) : SUZUKI scan tool

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 referring to SUZUKI scan tool operator's manual for further details.
   If communication between scan tool and SDM is not possible, proceed to "SDM Serial Data Circuit Trouble Diagnosis Table" in this section.
5) After completing the check, turn ignition switch to OFF position and disconnect SUZUKI scan tool from data link connector (DLC).

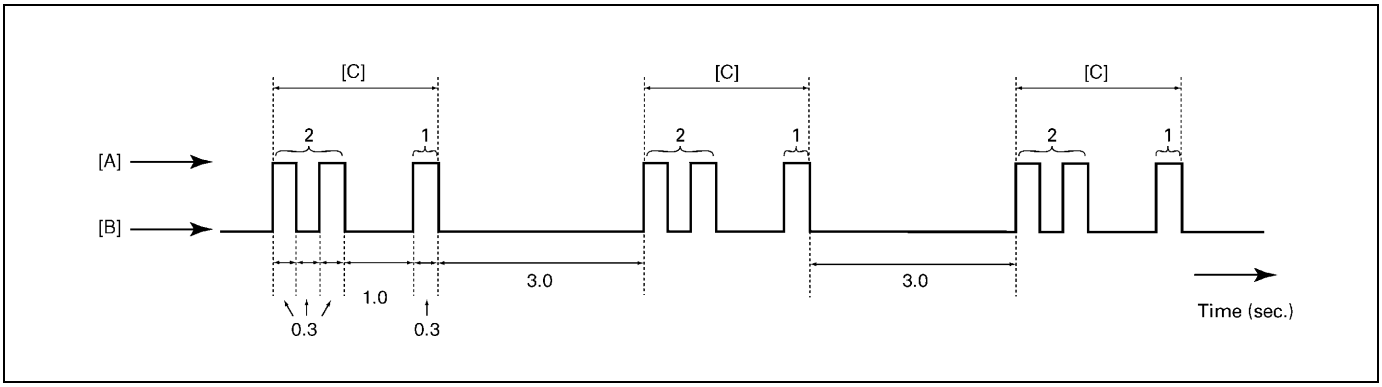
1. Data link connector (DLC)

Not Using SUZUKI Scan Tool



1) Check that "AIR BAG" warning lamp comes ON when ignition switch is turned to ON position.
   If it does not come "ON", proceed to ""AIR BAG" Warning Lamp Does Not Come On" in this section.
2) Using service wire (1), ground diagnosis switch terminal (2) in monitor coupler (3).
3) Read DTC from flashing pattern of "AIR BAG" warning lamp referring to "DTC TABLE" in this section.
   If lamp does not indicate DTC, proceed to ""AIR BAG" Warning Lamp Can Not Indicate Flashing" in this section.
4) After completing the check, turn ignition switch to OFF position and disconnect service wire from "AIR BAG" monitor coupler.

EXAMPLE : When driver air bag initiator circuit resistance high (DTC B1021) is set



[A] : "AIR BAG" warning lamp is turned ON
[B] : "AIR BAG" warning lamp is turned OFF
[C] : Code No.21

DTC Clearance

Using SUZUKI Scan Tool

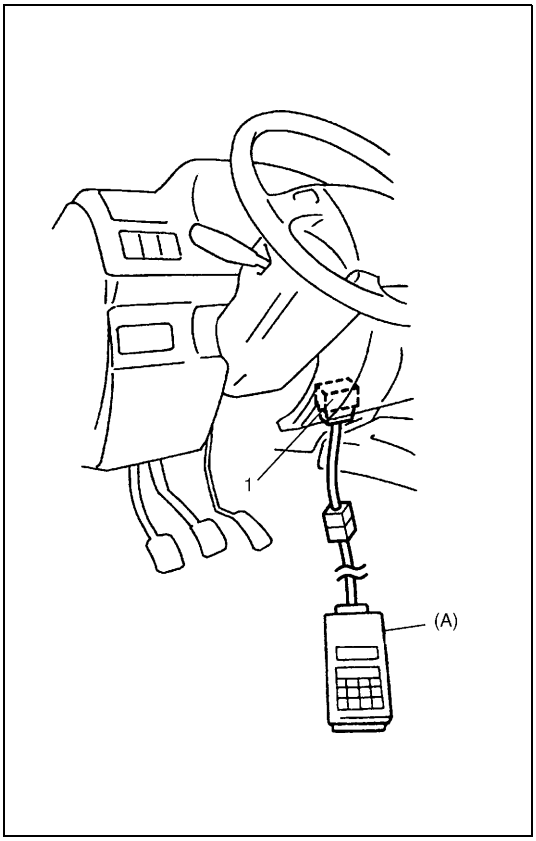
1) Turn ignition switch to OFF position.
2) Connect SUZUKI scan tool to data link connector (DLC) in the same manner as when making this connection for DTC check.

Special tool
(A) : SUZUKI scan tool

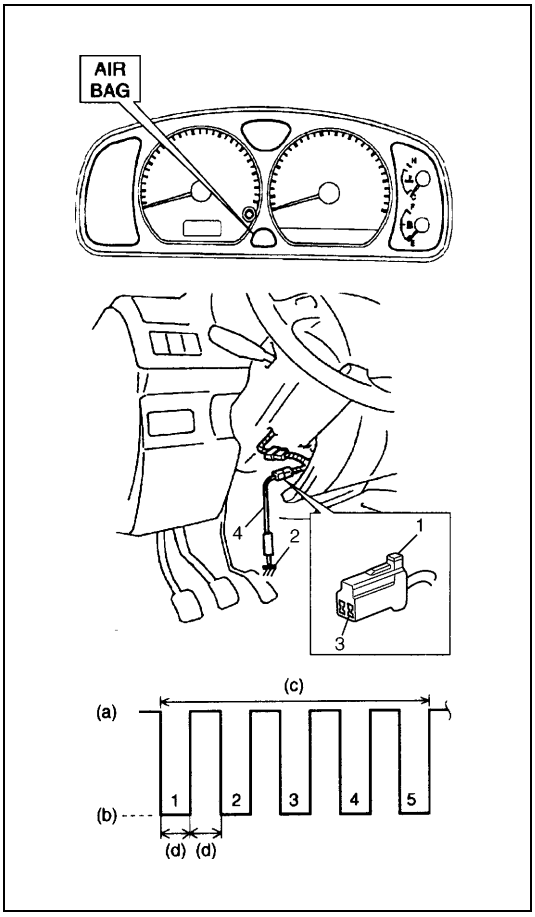
3) Turn ignition switch to ON position.
4) Erase DTC according to instructions displayed on SUZUKI scan tool.
   Refer to SUZUKI scan tool operator's manual for further details.
5) After completing the check, turn ignition switch to OFF position and disconnect SUZUKI scan tool from DLC.
6) Perform "DTC Check" in this section, and confirm that normal DTC ("NO CODES") is displayed and not malfunction DTC.

NOTE:

If DTC B1051 or DTC B1071 is stored in SDM, it is not possible to clear DTC.



1. Data link connector (DLC)



Not Using SUZUKI Scan Tool

1) Turn ignition switch to ON position and wait about 6 seconds or more.
2) Using service wire, repeat shorting and opening between diagnosis switch terminal on "AIR BAG" monitor coupler and body ground 5 times at about 1 second intervals.
3) Perform "DTC Check" in this section, and confirm that normal DTC (DTC 12) is displayed and not malfunction DTC.

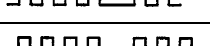
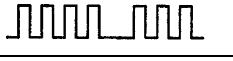
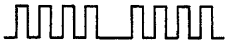
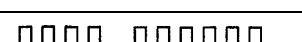
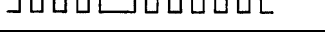
NOTE:

If DTC B1051 or DTC B1071 is stored in SDM, it is not possible to clear DTC.

1. "AIR BAG" monitor coupler	(a) Open
2. Body ground	(b) Short
3. Diagnosis switch terminal	(c) About 10 seconds
4. Service wire	(d) 1 sec.

DTC Table

DTC	"AIR BAG" warning lamp flashing pattern		Diagnosis		
	NO.	MODE			
–	12		Normal		–
B1015	15		Passenger air bag circuit	Resistance high	Diagnose trouble according to diagnostic flow table corresponding to each code No.
B1016	16			Resistance low	
B1018	18			Short to ground	
B1019	19			Short to power circuit	
B1021	21		Driver air bag circuit	Resistance high	
B1022	22			Resistance low	
B1024	24			Short to ground	
B1025	25			Short to power circuit	
B1032	32		Power source voltage	Too low	

DTC	"AIR BAG" warning lamp flashing pattern		Diagnosis		
	NO.	MODE			
B1041	41		Driver pretensioner circuit	Resistance high	Diagnose trouble according to diagnostic flow table corresponding to each code No.
B1042	42			Resistance low	
B1043	43			Short to ground	
B1044	44			Short to power circuit	
B1045	45		Passenger pretensioner circuit	Resistance high	
B1046	46			Resistance low	
B1047	47			Short to ground	
B1048	48			Short to power circuit	
B1051	51		SDM	Frontal crash detected	
B1071	71		SDM	Internal fault	
B1013	13			Specifications different between air bag system and SDM	

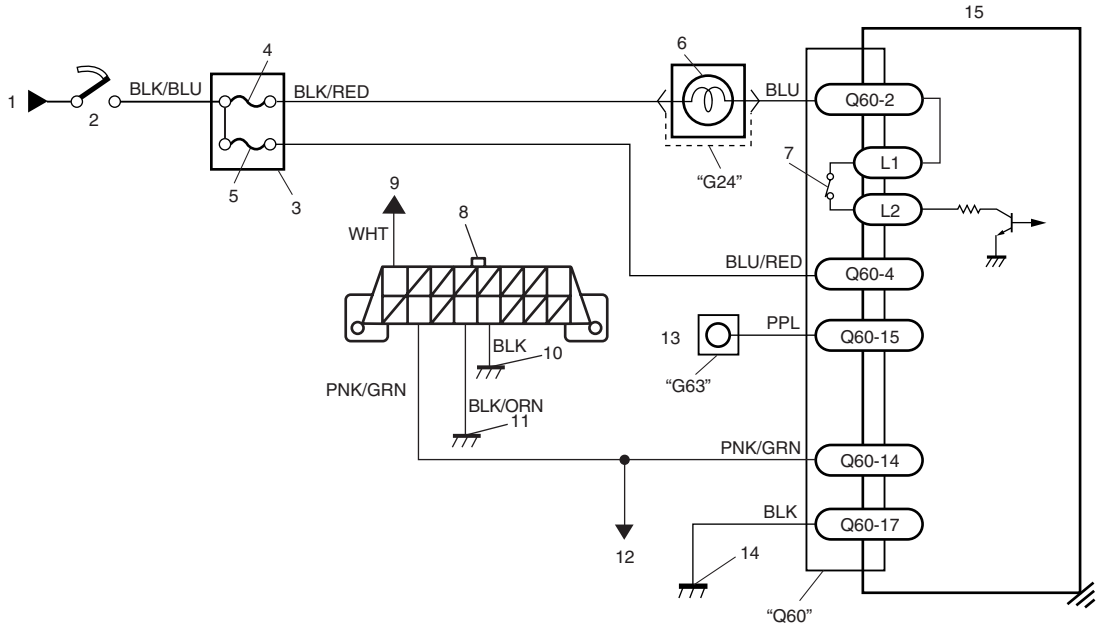
NOTE:

- **When 2 or more codes are indicated, the lowest numbered code will appear first.**
- **Current DTC and history DTC can be identified by lighting and flashing of "AIR BAG" warning lamp as follows. However, if a multiple number of DTC's are set an even one of them is a current DTC, "AIR BAG" warning lamp remains on after ignition switch is turned ON. Therefore, it is not possible to identify any of them as to whether it is a current one or a history one. (But use of SUZUKI scan tool will make identification possible.)**

	Current DTC is set. (Abnormality exists at present.)	**History DTC is set only. (Faulty condition occurred once in the past but normal condition is restored at present.)**
"AIR BAG" warning lamp after ignition switch ON	**Flashing 6 times and turns on.**	**Flashing 6 times and turns off.**
"AIR BAG" warning lamp when grounding diagnosis switch	**Current DTC is displayed.**	**History DTC is displayed.**

“AIR BAG” Warning Lamp Circuit Trouble Diagnosis Table

WIRING DIAGRAM



1. From main fuse	6. “AIR BAG” warning lamp in combination meter	11. Ground on engine block
2. Ignition switch	7. Connection detection pin	12. To ECM, TCM and ABS control module (if equipped)
3. Circuit fuse box	8. Data link connector	13. “AIR BAG” monitor coupler
4. “METER” fuse	9. To circuit fuse box	14. Ground for air bag system
5. “AIR BAG” fuse	10. Ground on body	15. SDM

CAUTION:

- **Be sure to perform “Air Bag Diagnostic System Check” in this section before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a specified digital multimeter described in “Special Tool” in this section along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to “Intermittent 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.**

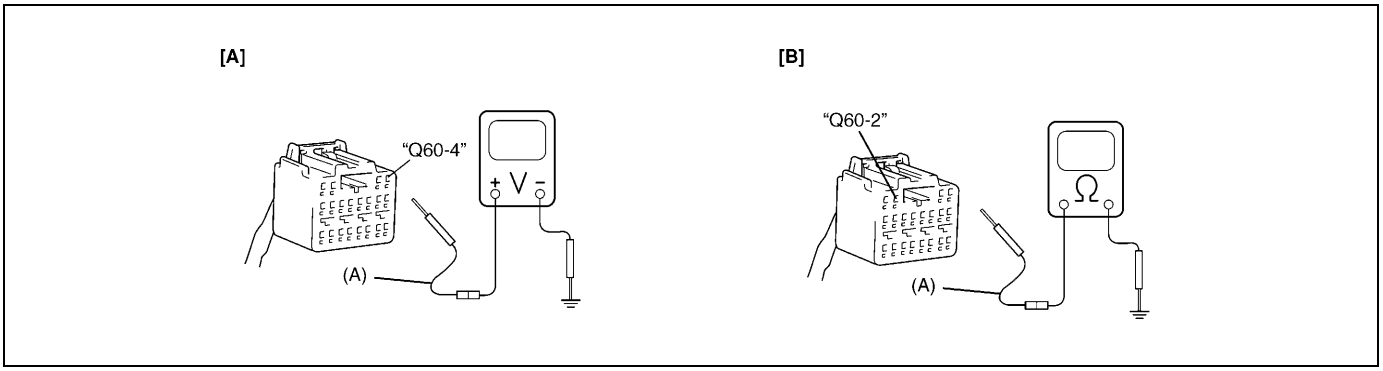
"AIR BAG" warning lamp comes on steady

TABLE TEST DESCRIPTION

STEP 1 : Check "AIR BAG" fuse.
STEP 2 : Check power source circuit.
STEP 3 : Check "AIR BAG" warning lamp circuit.

DIAGNOSTIC FLOW TABLE

Step	Action	Yes	No
1	1) Ignition switch OFF. 2) Remove and inspect "AIR BAG" fuse. Is fuse good?	Go to step 2.	"BLU/RED" wire short to ground. After repair, replace "AIR BAG" fuse.
2	1) Disconnect SDM connector "Q60". 2) Check proper connection to SDM at terminal "Q60-4". 3) If OK then check voltage between "Q60-4" terminal of SDM connector and body ground with ignition switch ON. Is it 8 V or more?	Go to step 3.	"BLU/RED" wire (between "AIR BAG" fuse and SDM connector) open "BLK/BLU" wire (between ignition switch and "AIR BAG" fuse) open or short to ground.
3	1) Disconnect 16-pin combination meter connector "G24" from combination meter referring to "Combination Meter" in Section 8. 2) Check resistance between "Q60-2" terminal of SDM connector and body ground. Is resistance 1 MΩ or more?	Substitute a known-good SDM and recheck.	"BLU" wire (between combination meter and SDM connector) short to ground.



[A] : Fig. for STEP 2
[B] : Fig. for STEP 3

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" in this section to confirm that the trouble has been corrected.**

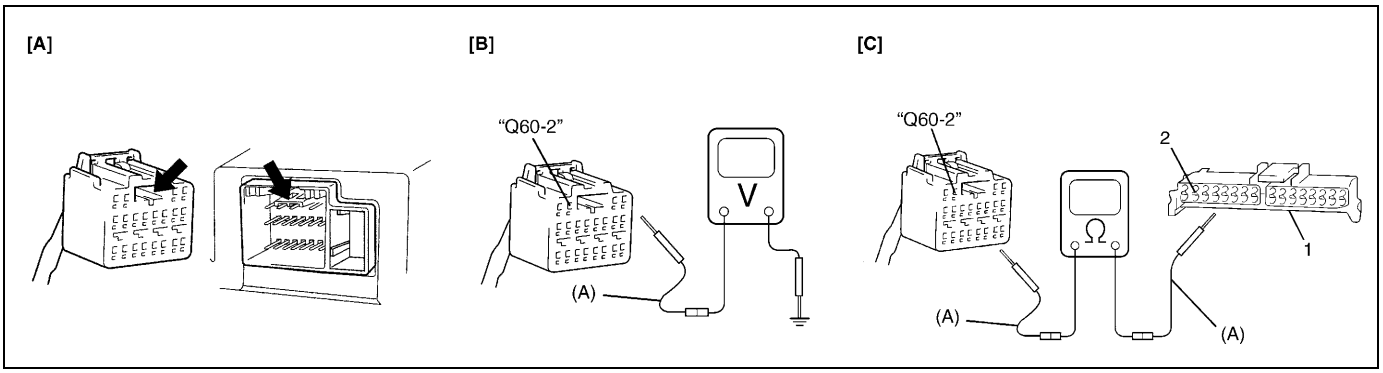
"AIR BAG" warning lamp does not come on

TABLE TEST DESCRIPTON

STEP 1 : Check combination meter power feed circuit.
STEP 2 : Check electrical connection check mechanism in SDM connector.
STEP 3 : Check "AIR BAG" warning lamp circuit.
STEP 4 : Check "AIR BAG" bulb and combination meter.
STEP 5 : Check open in "AIR BAG" warning lamp circuit.
STEP 6 : Check short from "AIR BAG" warning lamp circuit to power circuit.

DIAGNOSTIC FLOW TABLE

Step	Action	Yes	No
1	1) Set parking brake. 2) Note combination meter when ignition switch is turned ON. Does the "BRAKE" indicator (warning lamp) come ON?	Go to step 2.	"BLK/BLU", "BLK/RED" wire or "METER" fuse open or short to ground
2	1) Disconnect SDM connector "Q60". 2) Check electrical connection check mechanism. (Connection detecting pin and "L1" and "L2" terminals for dents, cracks or damages.) Is it in good condition?	Go to step 3.	Repair electrical connection check mechanism.
3	1) Check proper connection to SDM at terminal "Q60-2". 2) If OK, check voltage from "Q60-2" terminal of SDM connector to body ground with ignition switch ON. Is it 8 V or more?	Substitute a known-good SDM and recheck.	Go to step 4.
4	1) Turn ignition switch OFF. 2) Remove and inspect "AIR BAG" warning lamp bulb and combination meter referring to "Combination Meter" in section 8. Are there in good condition?	Go to step 5.	Replace bulb "AIR BAG" warning lamp bulb or combination meter.
5	1) Check proper connection to combination meter at "BLU" terminal for "AIR BAG" warning lamp and to SDM at terminal "Q60-2". 2) If OK, check resistance between "BLU" wire terminal of combination meter connector "G24" (16-pin connector) and "Q60-2" terminal of SDM connector. Is resistance 1 Ω or less?	Go to step 6.	Repair high resistance or open in "BLU" wire circuit (between combination meter and SDM).
6	1) Measure voltage from "Q60-2" terminal of SDM connector to body ground with ignition switch ON. Is it 0 V or more?	Repair short from "BLU" wire circuit (between combination meter and SDM) to power circuit.	Substitute a known-good SDM and recheck.



[A] : Fig. for STEP 2	1. 16-pin connector (for combination meter connector "G24")
[B] : Fig. for STEP 3 and 6	2. "BLU" wire terminal
[C] : Fig. for STEP 5	

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" in this section to confirm that the trouble has been corrected.**

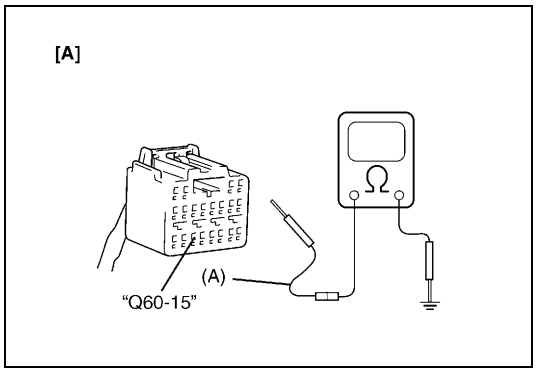
“AIR BAG” warning lamp flashes

TABLE TEST DESCRIPTON

STEP 1 : Check “AIR BAG” monitor coupler.
STEP 2 : Check diagnosis switch circuit for air bag system.

DIAGNOSTIC FLOW TABLE

Step	Action	Yes	No
1	1) Check “AIR BAG” monitor coupler “G63”. Is it connected diagnosis switch terminal and ground terminal in “AIR BAG” monitor coupler by service wire?	Remove service wire.	Go to step 2.
2	1) With ignition switch OFF, disconnect SDM connector “Q60”. 2) Measure resistance between “Q60-15” terminal of SDM connector and body ground. Is resistance 1 MΩ or more?	Substitute a known-good SDM and recheck.	Repair short from “PPL” wire circuit to ground.



[A] : Fig. for STEP 2

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” in this section to confirm that the trouble has been corrected.**

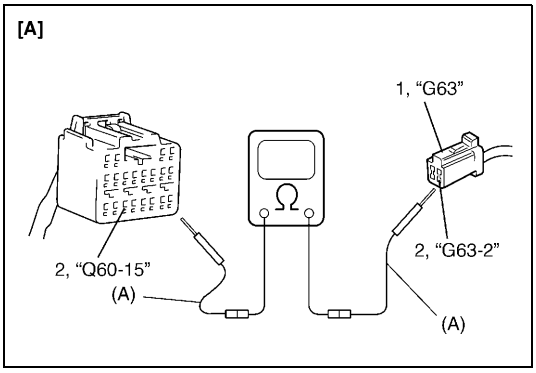
“AIR BAG” warning lamp can not indicate flashing

TABLE TEST DESCRIPTON

STEP 1 : Check “AIR BAG” monitor coupler.
STEP 2 : Check diagnosis switch circuit for air bag system.

DIAGNOSTIC FLOW TABLE

Step	Action	Yes	No
1	1) Inspect connection between diagnostic switch terminal on “AIR BAG” monitor coupler “G63” and body ground by service wire. Is it securely connected between them by service wire?	Go to step 2.	Properly connection diagnostic switch terminal on “AIR BAG” monitor coupler and body ground by service wire.
2	1) Disconnect SDM connector “Q60” from SDM. 2) Check for proper connection at “PPL” wire (“Q60-15” terminal of SDM connector and “G63-2” terminal of “AIR BAG” monitor coupler) terminals. 3) If OK then measure resistance between “Q60-15” terminal and “G63-2” terminal. Is resistance 1 Ω or more?	Check “PPL” wire terminals. If OK then “PPL” wire circuit high resistance or open.	Substitute a known good SDM and recheck.



[A] : Fig. for STEP 2
1. “AIR BAG” monitor coupler
2. “PPL” wire terminal

Special tool
(A) : 09932-76010

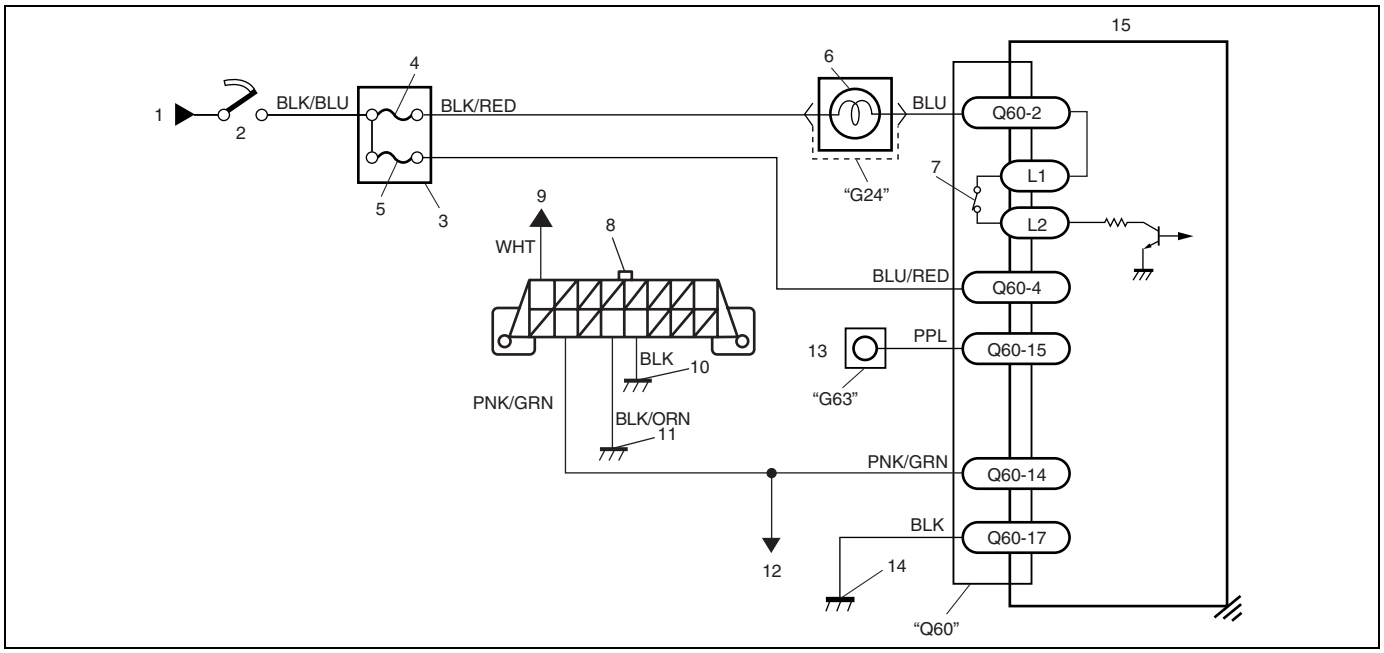
NOTE:

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” in this section to confirm that the trouble has been corrected.**

SDM Serial Data Circuit Toruble Diagnosis Table

WIRING DIAGRAM



1. From main fuse	6. "AIR BAG" warning lamp in combination meter	11. Ground on engine block
2. Ignition switch	7. Connection detection pin	12. To ECM, TCM and ABS control module (if equipped)
3. Circuit fuse box	8. Data link connector (DLC)	13. "AIR BAG" monitor coupler
4. "METER" fuse	9. To circuit fuse box	14. Ground for air bag system
5. "AIR BAG" fuse	10. Ground on body	15. SDM

CAUTION:

- **Be sure to perform "Air Bag Diagnostic System Check" in this section before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a specified digital multimeter described in "Special Tool" in this section along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to "Intermittent 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.**

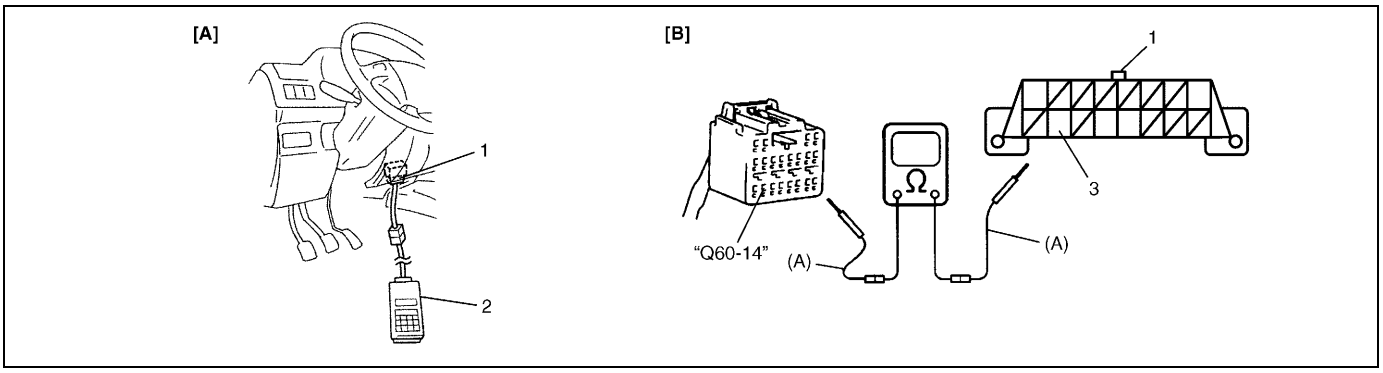
TABLE TEST DESCRIPTION

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 "PNK/GRN" circuit in air bag harness.

DIAGNOSTIC FLOW TABLE

Step	Action	Yes	No
1	1) Make sure that SUZUKI scan tool is free from malfunction for air bag system is used. 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, TCM (if equipped) 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 (“PNK/GRN” wire circuit) used by all controllers or short to ground or power circuit which has occurred some-where in serial data circuit (“PNK/GRN” wire circuit).
3	1) With ignition switch OFF, disconnect SDM connector “Q60”. 2) Check proper connection at “Q60-14” (“PNK/GRN” wire) terminal of SDM connector. 3) If OK, then check resistance between “PNK/GRN” wire terminal of DLC and “Q60-14” (“PNK/GRN” wire) terminal of SDM connector. Is resistance 1 Ω or less?	Substitute a known-good SDM and recheck.	Repair high resistance or open in “PNK/GRN” wire circuit.



[A] : Fig. for STEP 1	1. DLC	3. “PNK/GRN” wire terminal
[B] : Fig. for STEP 3	2. SUZUKI scan tool	

Special tool
(A) : 09932-76010

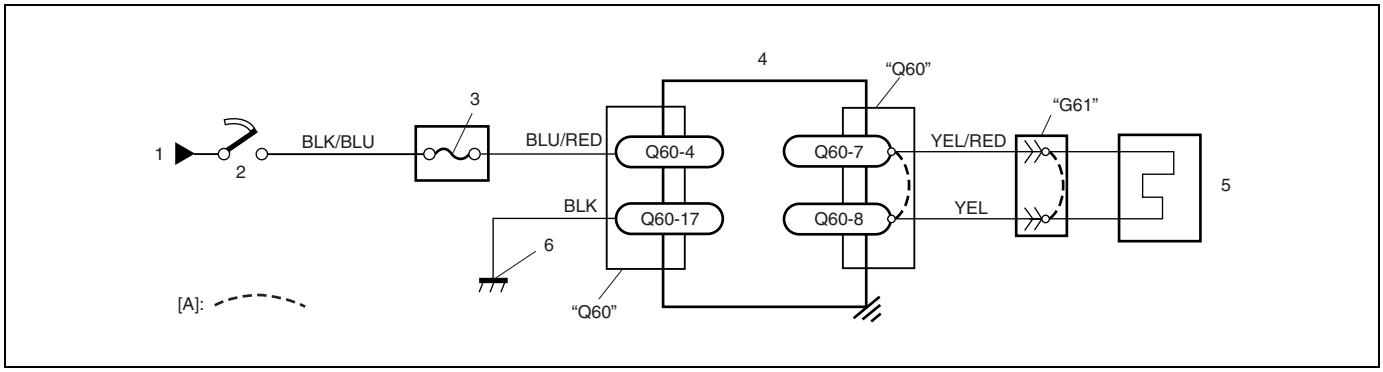
NOTE:

Upon completion of inspection and repair work, perform following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Repeat “Air Bag Diagnostic System Check” in this section 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



1. From main fuse	3. "AIR BAG" fuse	5. Passenger air bag (inflator) module	[A] : Shorting bar
2. Ignition switch	4. SDM	6. Ground for air bag system	

CAUTION:

- **Be sure to perform "Air Bag Diagnostic System Check" in this section before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a specified digital multimeter described in "Special Tool" in this section along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to "Intermittent 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 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

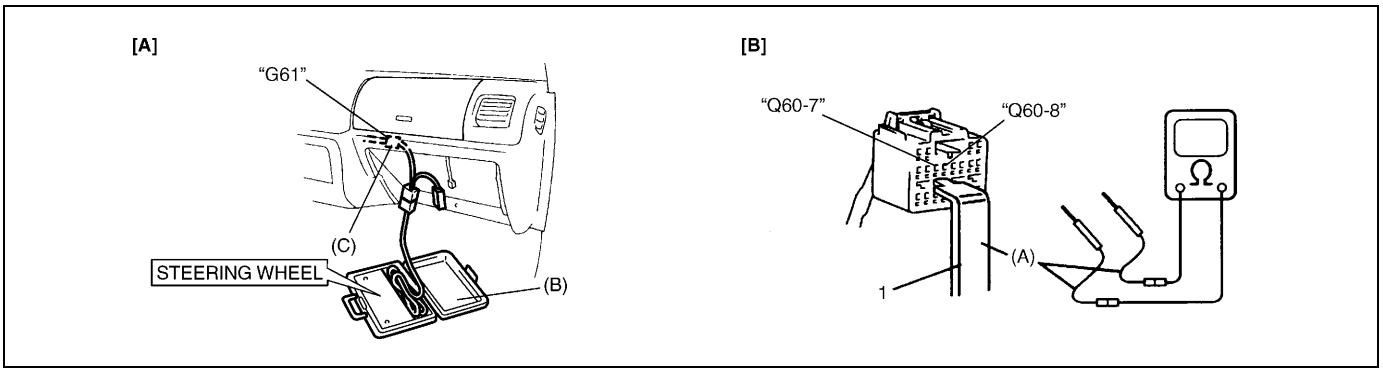
DTC B1015, B1016, B1018 and B1019 :

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 B1018 and B1019 only.

DIAGNOSTIC FLOW TABLE

DTC B1015 : PASSENGER AIR BAG INITIATOR CIRCUIT RESISTANCE HIGH

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector “G61” behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in “G61” connector. 3) If OK then connect special tools (B) and (C) to passenger air bag (inflator) module connector “G61”. With ignition switch ON, does DTC B1015 still exist?	Go to step 2.	Ignition switch OFF. Replace passenger air bag (inflator) module referring to “Passenger Air Bag (Inflator) Module” in this section.
2	1) With ignition switch OFF, disconnect SDM connector “Q60”. 2) Check proper connection to SDM at terminals “Q60-7” and “Q60-8”. 3) If OK, release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 4) Measure resistance between “Q60-7” and “Q60-8” terminals with special tools (B) and (C) connected to “G61” connector. Is resistance 4.5 Ω or less?	Substitute a known-good SDM and recheck.	Repair high resistance or open in “YEL/RED” or “YEL” 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

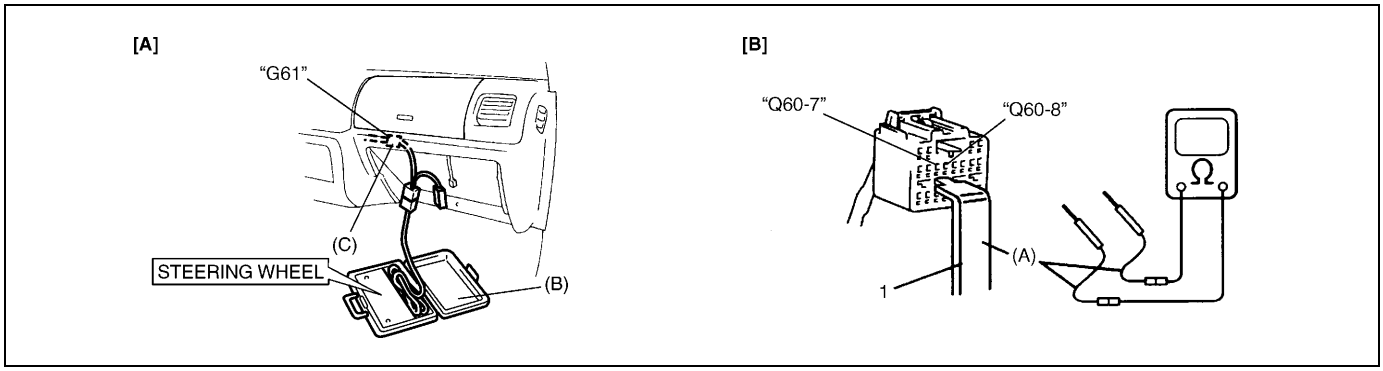
NOTE:

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 referring to “DTC Clearance” in this section, if any.**
- **Repeat “Air Bag Diagnostic System Check” in this section to confirm that the trouble has been corrected.**

DTC B1016 : PASSENGER AIR BAG INITIATOR CIRCUIT RESISTANCE LOW

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector “G61” behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in “G61” connector. 3) If OK then connect special tools (B) and (C) to passenger air bag (inflator) module connector “G61”. With ignition switch ON, does DTC B1016 still exist?	Go to step 2.	Ignition switch OFF. Replace passenger air bag (inflator) module referring to “Passenger Air Bag (Inflator) Module” in this section.
2	1) With ignition switch OFF, disconnect SDM connector “Q60”. 2) Check proper connection to SDM at terminals “Q60-7” and “Q60-8”. 3) If OK, release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 4) Measure resistance between “Q60-7” and “Q60-8” terminals with special tools (B) and (C) connected to “G61” connector. Is resistance 1.4 Ω or more?	Substitute a known-good SDM and recheck.	Repair short from “YEL/RED” wire circuit to “YEL” wire circuit or from “YEL/RED” or “YEL” 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

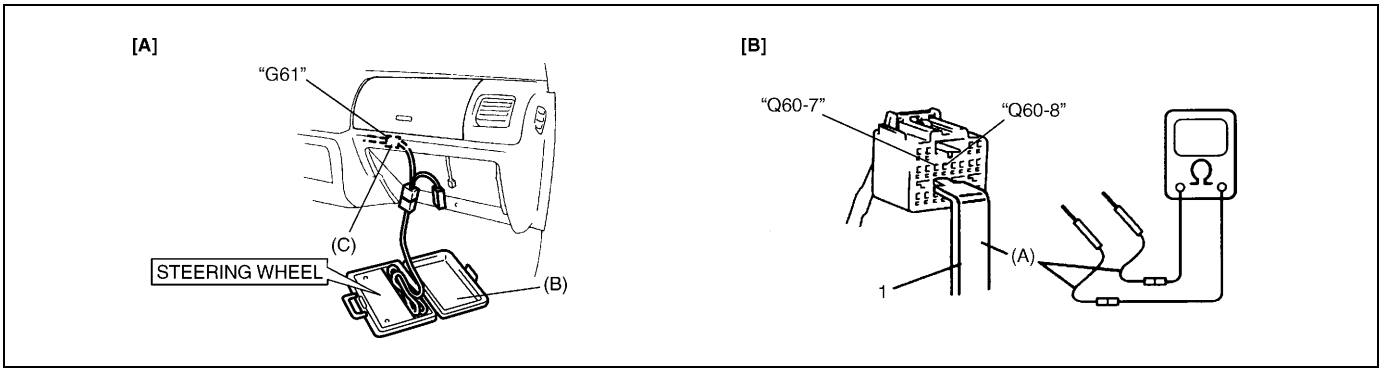
NOTE:

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 referring to “DTC Clearance” in this section, if any.**
- **Repeat “Air Bag Diagnostic System Check” in this section to confirm that the trouble has been corrected.**

DTC B1018 : PASSENGER AIR BAG INITIATOR CIRCUIT SHORT TO GROUND

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector “G61” behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in “G61” connector. 3) If OK then connect special tools (B) and (C) to passenger air bag (inflator) module connector “G61”. With ignition switch ON, does DTC B1018 still exist?	Go to step 2.	Ignition switch OFF. Replace passenger air bag (inflator) module referring to “Passenger Air Bag (Inflator) Module” in this section.
2	1) With ignition switch OFF, disconnect special tools (B) and (C) from “G61” connector and SDM connector “Q60” from SDM respectively. 2) Release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 3) Measure resistance between “Q60-7” terminals and body ground. Is resistance 1 MΩ or more?	Go to step 3.	Repair short from “YEL/RED” wire circuit to ground.
3	1) Measure resistance between “Q60-8” terminal and body ground. Is resistance 1 MΩ or more?	Substitute a known-good SDM and recheck.	Repair short from “YEL” 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

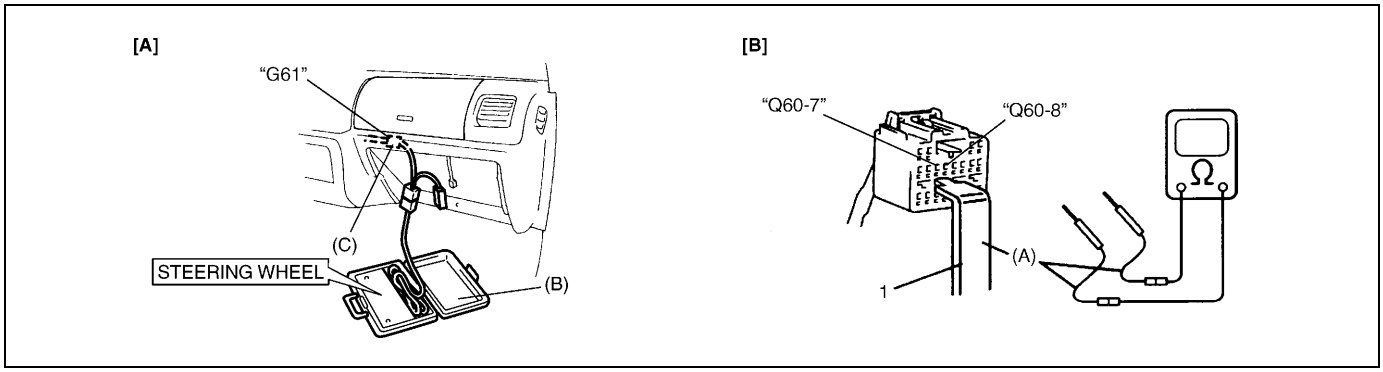
NOTE:

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 referring to “DTC Clearance” in this section, if any.**
- **Repeat “Air Bag Diagnostic System Check” in this section to confirm that the trouble has been corrected.**

DTC B1019 : PASSENGER AIR BAG INITIATOR CIRCUIT SHORT TO POWER CIRCUIT

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector “G61” behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in “G61” connector. 3) If OK then connect special tools (B) and (C) to passenger air bag (inflator) module connector “G61”. With ignition switch ON, does DTC B1019 still exist?	Go to step 2.	Ignition switch OFF. Replace passenger air bag (inflator) module referring to “Passenger Air Bag (Inflator) Module” in this section.
2	1) With ignition switch OFF, disconnect special tools (B) and (C) from “G61” connector and SDM connector “Q60” from SDM respectively. 2) Release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 3) Measure voltage from “Q60-7” terminal to body ground. With ignition switch ON, is voltage 1 V or less?	Go to step 3.	Repair short from “YEL/RED” wire circuit to power circuit.
3	1) Measure voltage from “Q60-8” terminal to body ground. With ignition switch ON, is voltage 1 V or less?	Substitute a known-good SDM and recheck.	Repair short from “YEL” 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

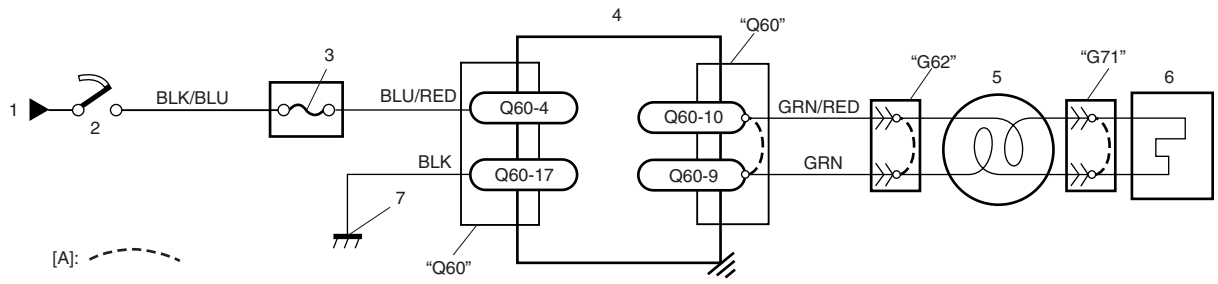
NOTE:

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 referring to “DTC Clearance” in this section, if any.**
- **Repeat “Air Bag Diagnostic System Check” in this section 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



1. From main fuse	4. SDM	7. Ground for air bag system
2. Ignition switch	5. Contact coil assembly	[A] : Shorting bar
3. "AIR BAG" fuse	6. Driver air bag (inflator) module	

CAUTION:

- **Be sure to perform "Air Bag Diagnostic System Check" in this section before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a specified digital multimeter described in "Special Tool" in this section along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to "Intermittent 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 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

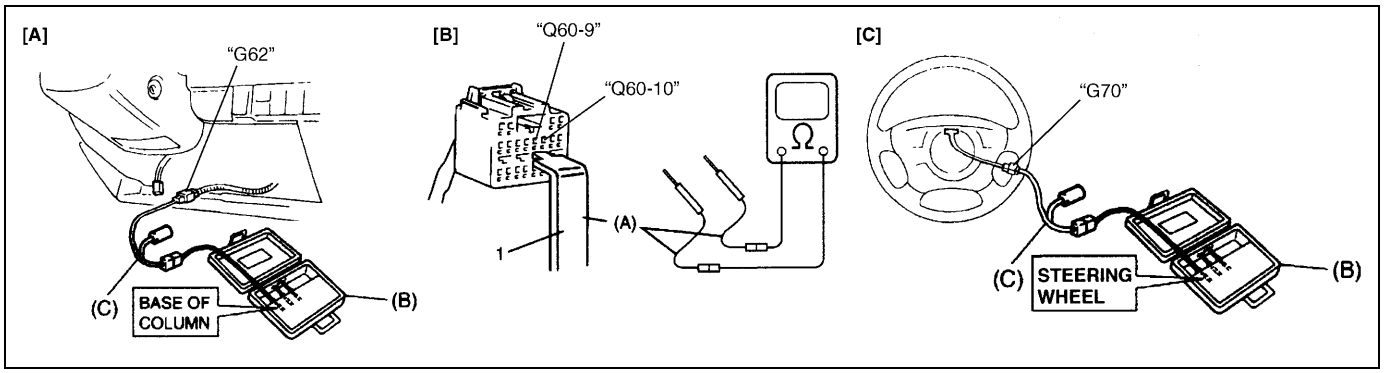
DTC B1021, B1022, B1024 and B1025 :

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 : DRIVER AIR BAG INITIATOR CIRCUIT RESISTANCE HIGH

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect contact coil connector “G62” located near the base of the steering column. 2) Check proper connection to contact coil at terminals in connect coil connector “G62”. 3) If OK then connect special tools (B) and (C) to contact coil connector “G62”. With ignition switch ON, does DTC B1021 still exist?	Go to step 2.	Go to step 3.
2	1) With ignition switch OFF, disconnect SDM connector “Q60”. 2) Check proper connection to SDM at terminals “Q60-9” and “Q60-10”. 3) If OK, release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 4) Measure resistance between “Q60-9” and “Q60-10” terminals with connected special tools (B) and (C) to “G62” connector. Is resistance 4.5 Ω or less?	Substitute a known-good SDM and recheck.	Repair high resistance or open in “GRN” or “GRN/RED” wire circuit.
3	1) With ignition switch OFF, disconnect special tools (B) and (C) from “G62” connector then reconnect contact coil connector “G62” located near the base of the steering column as it was. 2) Remove driver air bag (inflator) module from steering wheel referring to “Driver Air Bag (Inflator) Module” in Section 3C. 3) Check proper connection to driver air bag (inflator) module at terminals in “G70” connector. 4) If OK then connect special tools (B) and (C) to “G70” connector. With ignition switch ON, does DTC B1021 still exist?	Ignition switch OFF. Replace contact coil assembly referring to “Combination Switch/Contact Coil and Combination Switch Assembly” in Section 3C.	Ignition switch OFF. Replace driver air bag (inflator) module referring to “Steering Wheel and Driver Air Bag (Inflator) Module” 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

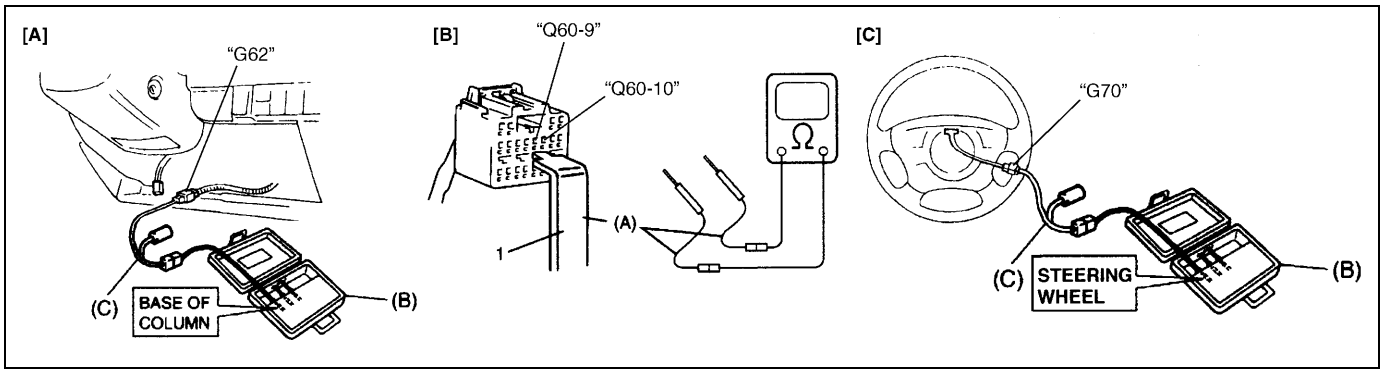
NOTE:

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 referring to "DTC Clearance" in this section, if any.**
- **Repeat "Air Bag Diagnostic System Check" in this section to confirm that the trouble has been corrected.**

DTC B1022 : DRIVER AIR BAG INITIATOR CIRCUIT RESISTANCE LOW

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect contact coil connector "G62" located near the base of the steering column. 2) Check proper connection to contact coil at terminals in "G62" connector. 3) If OK then connect special tools (B) and (C) to contact coil connector "G62". With ignition switch ON, does DTC B1022 still exist?	Go to step 2.	Go to step 3.
2	1) With ignition switch OFF, disconnect SDM connector "Q60". 2) Check proper connection to SDM at terminals "Q60-9" and "Q60-10". 3) If OK, release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 4) Measure resistance between "Q60-9" and "Q60-10" terminals with connected special tools (B) and (C) to "G62" connector. Is resistance 1.7 Ω or more?	Substitute a known-good SDM and recheck.	Repair short from "GRN" wire circuit to "GRN/RED" wire circuit or from "GRN" or "GRN/RED" wire circuit to other wire circuit.
3	1) With ignition switch OFF, disconnect special tools (B) and (C) from "G62" connector then reconnect contact coil connector "G62" located near the base of the steering column as it was. 2) Remove driver air bag (inflator) module from steering wheel referring to "Driver Air Bag (Inflator) Module" in Section 3C. 3) Check proper connection to driver air bag (inflator) module at terminals in "G70" connector. 4) If OK then connect special tools (B) and (C) to "G70" connector. With ignition switch ON, does DTC B1022 still exist?	Ignition switch OFF. Replace contact coil assembly referring to "Combination Switch/ Contact Coil and Combination Switch Assembly" in Section 3C.	Ignition switch OFF. Replace driver air bag (inflator) module referring to "Driver Air Bag (Inflator) Module" 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

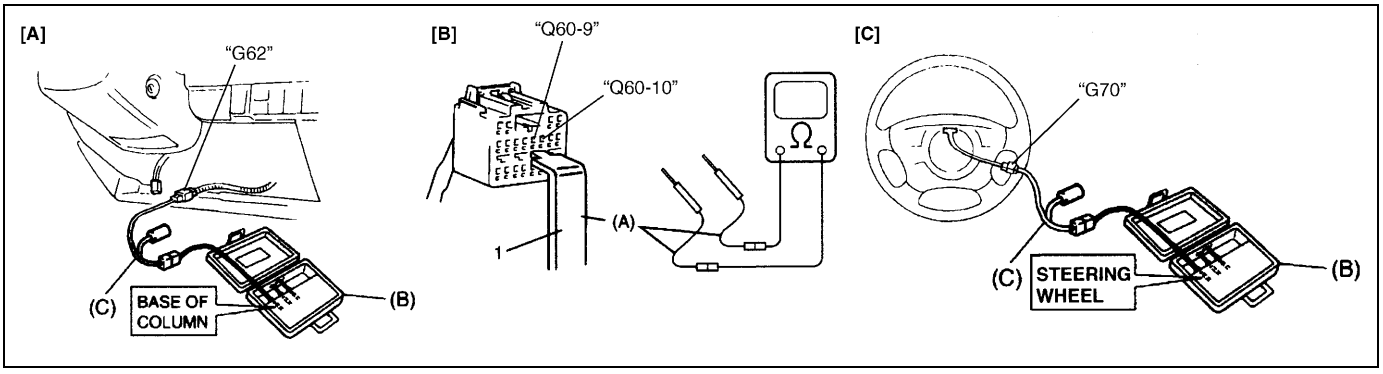
NOTE:

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 referring to "DTC Clearance" in this section, if any.**
- **Repeat "Air Bag Diagnostic System Check" in this section to confirm that the trouble has been corrected.**

DTC B1024 : DRIVER AIR BAG INITIATOR CIRCUIT SHORT TO GROUND

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect contact coil connector “G62” located near the base of the steering column. 2) Check proper connection to contact coil at terminals in “G62” connector. 3) If OK then connect special tools (B) and (C) to contact coil connector “G62”. With ignition switch ON, does DTC B1024 still exist?	Go to step 2.	Go to step 3.
2	1) With ignition switch OFF, disconnect special tools (B) and (C) from “G62” connector and SDM connector “G62” from SDM respectively. 2) Release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 3) Measure resistance between “Q60-9” terminal and body ground and between “Q60-10” terminal and body ground. Are they 1 MΩ or more?	Substitute a known-good SDM and recheck.	Repair short from “GRN” or “GRN/RED” wire circuit to ground.
3	1) With ignition switch OFF, disconnect special tools (B) and (C) from “G62” connector then reconnect contact coil connector “G62” located near the base of the steering column as it was. 2) Remove driver air bag (inflator) module from steering wheel referring to “Driver Air Bag (Inflator) Module” in Section 3C. 3) Check proper connection to driver air bag (inflator) module at terminals in “G70” connector. 4) If OK then connect special tools (B) and (C) to “G70” connector. With ignition switch ON, does DTC B1024 still exist?	Ignition switch OFF. Replace contact coil assembly referring to “Combination Switch/ Contact Coil and Combination Switch Assembly” in Section 3C.	Ignition switch OFF. Replace driver air bag (inflator) module referring to “Driver Air Bag (Inflator) Module” 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

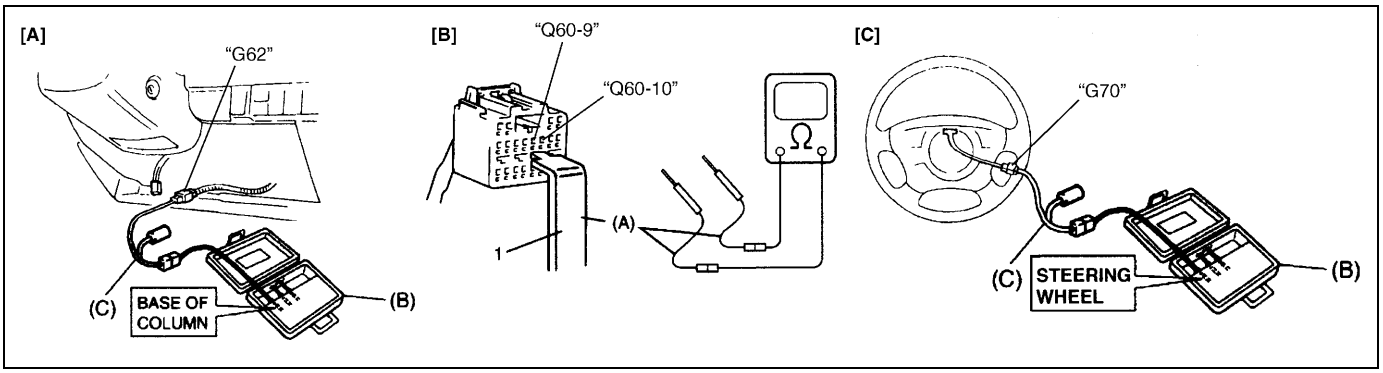
NOTE:

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 referring to "DTC Clearance" in this section, if any.**
- **Repeat "Air Bag Diagnostic System Check" in this section to confirm that the trouble has been corrected.**

DTC B1025 : DRIVER AIR BAG INITIATOR CIRCUIT SHORT TO POWER CIRCUIT

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect contact coil connector "G62" located near the base of the steering column. 2) Check proper connection to contact coil at terminals in contact coil connector "G62". 3) If OK then connect special tools (B) and (C) to contact coil connector "G62". With ignition switch ON, does DTC B1025 still exist?	Go to step 2.	Go to step 3.
2	1) With ignition switch OFF, disconnect special tools (B) and (C) from "G62" connector and SDM connector "Q60" from SDM respectively. 2) Release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 3) Measure voltage from "Q60-9" terminal to body ground and from "Q60-10" terminal to body ground. With ignition switch ON, are they 1 V or less?	Substitute a known-good SDM and recheck.	Repair short from "GRN" or "GRN/RED" wire circuit to power circuit.
3	1) With ignition switch OFF, disconnect special tools (B) and (C) from "G62" connector then reconnect contact coil connector "G62" located near the base of the steering column as it was. 2) Remove driver air bag (inflator) module from steering wheel referring to "Driver Air Bag (Inflator) Module" in Section 3C. 3) Check proper connection to driver air bag (inflator) module at terminals in "G70" connector. 4) If OK then connect special tools (B) and (C) to "G70" connector. With ignition switch ON, does DTC B1025 still exist?	Ignition switch OFF. Replace contact coil assembly referring to "Combination Switch/ Contact Coil and Combination Switch Assembly" in Section 3C.	Ignition switch OFF. Replace driver air bag (inflator) module referring to "Driver Air Bag (Inflator) Module" 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

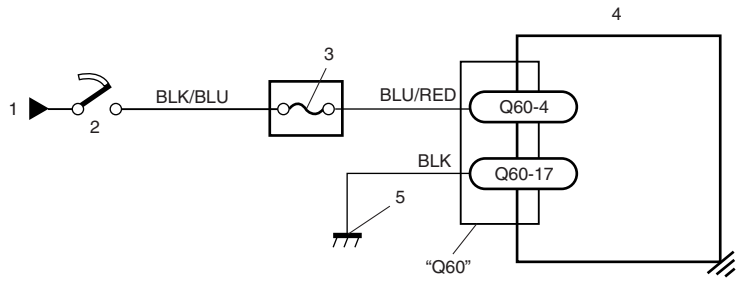
NOTE:

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 referring to "DTC Clearance" in this section, if any.**
- **Repeat "Air Bag Diagnostic System Check" in this section to confirm that the trouble has been corrected.**

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" in this section before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a specified digital multimeter described in "Special Tool" in this section along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to "Intermittent 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 SET WHEN :

The power source voltage is below specified value for specified time.

TABLE TEST DESCRIPTION :

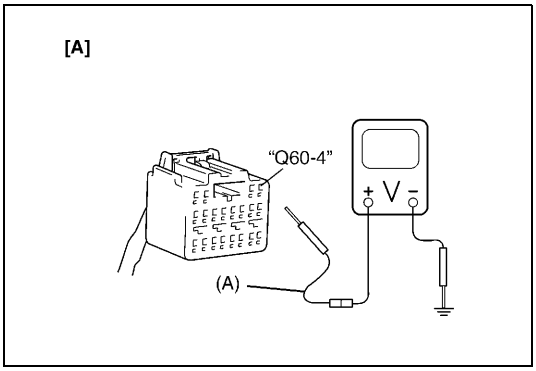
STEP 1 : Check if voltage on battery is within normal range.
STEP 2 : Check "AIR BAG" fuse.
STEP 3 : Check if battery applied to SDM is within normal range.
STEP 4 : Check if DTC B1032 still exists.

DIAGNOSTIC FLOW TABLE

DTC B1032 : POWER SOURCE VOLTAGE LOW

Step	Action	Yes	No
1	1) Measure voltage on battery. Is voltage 11 V or more?	Go to step 2.	Check Charging System and repair as necessary referring to "Diagnosis" in Section 6H.
2	1) Ignition switch OFF. 2) Remove and inspect "AIR BAG" fuse. Is fuse good?	Go to step 3.	"BLU/RED" wire short to ground. After repair, replace "AIR BAG" fuse.

Step	Action	Yes	No
3	1) With ignition switch OFF, disconnect SDM connector “Q60”. 2) Check proper connection to SDM at “Q60-4” terminal. 3) If OK then ignition switch ON, and then check voltage from “Q60-4” terminal on SDM connector to body ground. Is voltage 8 V or more?	Go to step 4.	Possibly faulty points are as follows. Check each of them and repair as necessary. • Circuit from battery to “Q60” connector. • Charging System (Refer to “Diagnosis” in Section 6H.)
4	1) With ignition switch OFF, reconnect SDM connector. With ignition switch ON, does DTC B1032 still exist?	Substitute a known-good SDM and recheck.	Check Charging System and repair as necessary referring to “Diagnosis” in Section 6H.



[A] : Fig. for STEP 3

Special tool
(A) : 09932-76010

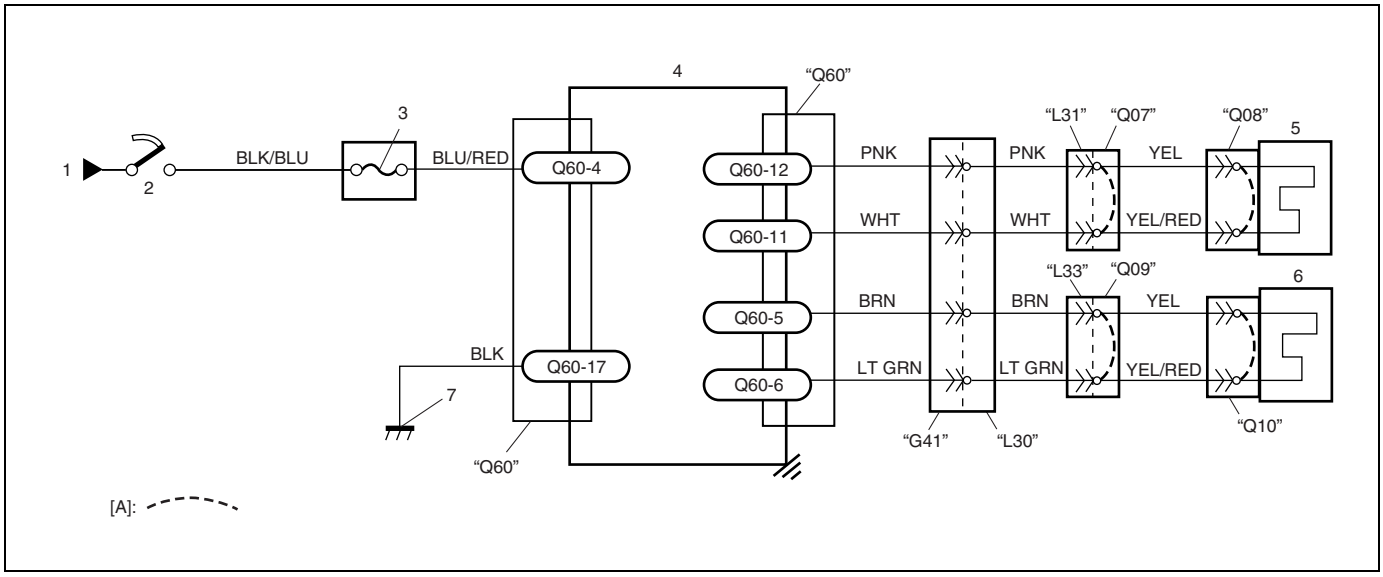
NOTE:

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 referring to “DTC Clearance” in this section, if any.**
- **Repeat “Air Bag Diagnostic System Check” in this section 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



1. From main fuse	4. SDM	7. Ground for air bag system
2. Ignition switch	5. Driver seat belt pretensioner	[A] : Shorting bar
3. "AIR BAG" fuse	6. Passenger seat belt pretensioner	

CAUTION:

- **Be sure to perform "Air Bag Diagnostic System Check" in this section before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a specified digital multimeter described in "Special Tool" in this section along with a correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is required, refer to "Intermittent 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 SET WHEN

DTC B1041 and B1045 :

The resistance of driver or passenger seat belt pretensioner initiator circuit is above a specified value for specified time.

DTC B1042 and B1046 :

The resistance of driver or passenger seat belt pretensioner initiator circuit is below a specified value for specified time.

DTC B1043 and B1047 :

The voltage measured at driver or passenger seat belt pretensioner initiator circuit is below a specified value for specified time.

DTC B1044 and 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 and B1048 :

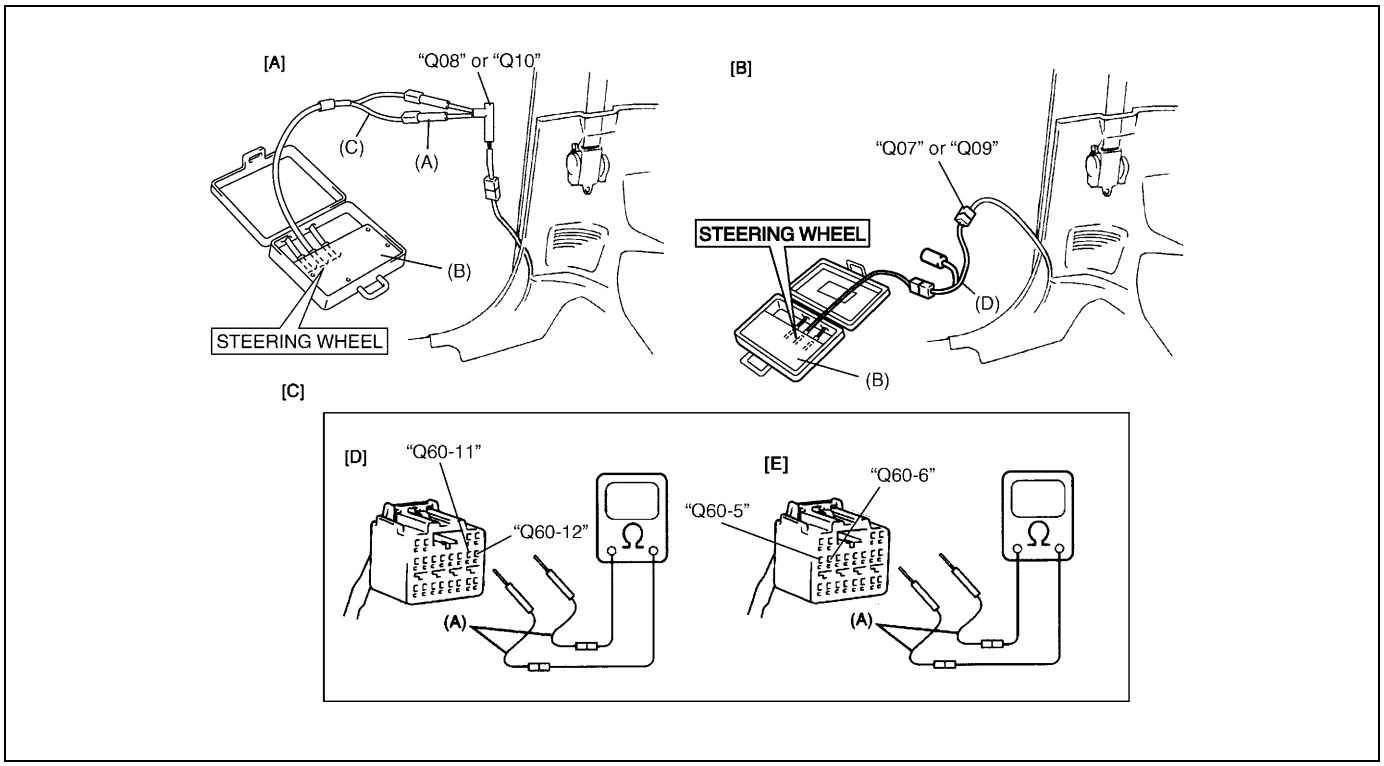
STEP 1 : Check whether malfunction is in seat belt pretensioner.
STEP 2 : Check seat belt pretensioner initiator circuit in seat belt pretensioner harness.
STEP 3 : Check seat belt pretensioner initiator circuit in air bag harness.

DIAGNOSTIC FLOW TABLE

DTC B1041 : DRIVER PRETENSIONER INITIATOR CIRCUIT RESISTANCE HIGH
DTC B1045 : PASSENGER PRETENSIONER INITIATOR CIRCUIT RESISTANCE HIGH

Step	Action	Yes	No
1	1) With ignition switch OFF, remove quarter lower trim of applicable side. 2) Disconnect connector “Q08” or “Q10” connector from seat belt pretensioner. 3) Check proper connection to applicable seat belt pretensioner at terminals in “Q08” or “Q10” connector. 4) If OK then connect special tools (A), (B) and (C) to “Q08” or “Q10” connector. With ignition switch ON, does DTC B1041 or B1045 still exist?	Go to step 2.	Ignition switch OFF, and replace seat belt pretensioner referring “Front Seat Belt” in Section 10.
2	1) With ignition switch OFF, disconnect special tools (A), (B) and (C) from “Q08” or “Q10” connector. 2) Disconnect connector “Q07” or “Q09” from air bag wire harness in floor harness. 3) Check proper connection to air bag wire harness at terminals in “Q07” or “Q09” connector. 4) If OK then connect special tools (B) and (D) to “Q07” or “Q09” connector. With ignition switch ON, does DTC B1041 or B1045 still exist?	Go to step 3.	Repair high resistance or open in “YEL” or “YEL/RED” wire circuit.

Step	Action	Yes	No
3	1) With ignition switch OFF, disconnect SDM connector “Q60”. 2) Check proper connection between “Q60-11” and “Q60-12” or “Q60-6” and “Q60-5”. 3) If OK, measure resistance with connected special tools (B) and (D). • DTC B1041 : between “Q60-12” and “Q60-11” terminals • DTC B1045 : between “Q60-5” and “Q60-6” terminals. Is resistance 4.5 Ω or less?	Substitute a known-good SDM and recheck.	DTC B1041 : Repair high resistance or open in “PNK” or “WHT” wire circuit. DTC B1045 : Repair high resistance or open in “BRN” or “LT GRN” wire circuit.



[A] : Fig. for STEP 1	[C] : Fig. for STEP 3	[E] : For DTC B1045
[B] : Fig. for STEP 2 and 3	[D] : For DTC B1041	

Special tool
(A) : 09932-76010
(B) : 09932-75010
(C) : 09932-78310
(D) : 09932-78340

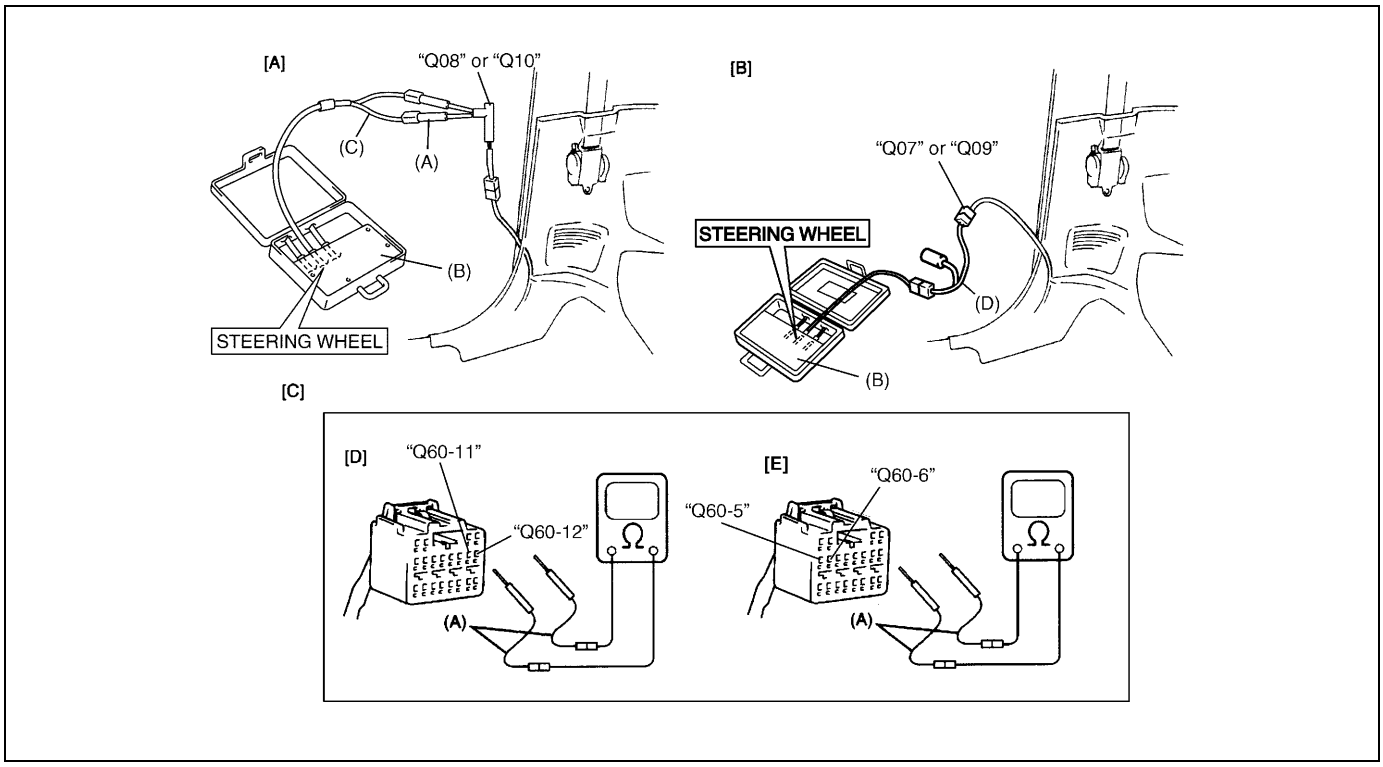
NOTE:

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 referring to “DTC Clearance” in this section, if any.**
- **Repeat “Air Bag Diagnostic System Check” in this section to confirm that the trouble has been corrected.**

DTC B1042 : DRIVER PRETENSIONER INITIATOR CIRCUIT RESISTANCE LOW
DTC B1046 : PASSENGER PRETENSIONER INITIATOR CIRCUIT RESISTANCE LOW

Step	Action	Yes	No
1	1) With ignition switch OFF, remove quarter lower trim of applicable side. 2) Disconnect connector “Q08” or “Q10” connector from seat belt pretensioner. 3) Check proper connection to applicable seat belt pretensioner at terminals in “Q08” or “Q10” connector. 4) If OK then connect special tools (A), (B) and (C) to “Q08” or “Q10” connector. With ignition switch ON, does DTC B1042 or B1046 still exist?	Go to step 2.	Ignition switch OFF, and replace seat belt pretensioner referring “Front Seat Belt” in Section 10.
2	1) With ignition switch OFF, disconnect special tools (A), (B) and (C) from “Q08” or “Q10” connector. 2) Disconnect connector “Q07” or “Q09” from air bag wire harness in floor harness. 3) Check proper connection to air bag wire harness at terminals in “Q07” or “Q09” connector. 4) If OK then connect special tools (B) and (D) to “Q07” or “Q09” connector. With ignition switch ON, does DTC B1042 or B1046 still exist?	Go to step 3.	Repair short from “YEL” wire circuit to “YEL/RED” wire circuit or from “YEL” or “YEL/RED” wire circuit to other wire circuit.
3	1) With ignition switch OFF, disconnect SDM connector “Q60”. 2) Check proper connection between “Q60-11” and “Q60-12” or “Q60-6” and “Q60-5”. 3) If OK, measure resistance with connected special tools (B) and (D). • DTC B1042 : between “Q60-11” and “Q60-12” terminals • DTC B1046 : between “Q60-5” and “Q60-6” terminals. Is resistance 1.4 Ω or more?	Substitute a known-good SDM and recheck.	DTC B1042 : Repair short from “PNK” wire circuit to “WHT” wire circuit or from “PNK” or “WHT” wire circuit to other wire circuit. DTC B1046 : Repair short from “BRN” wire circuit to “LT GRN” wire circuit or from “BRN” or “LT GRN” wire circuit to other wire circuit.



[A] : Fig. for STEP 1	[C] : Fig. for STEP 3	[E] : For DTC B1046
[B] : Fig. for STEP 2 and 3	[D] : For DTC B1042	

Special tool
(A) : 09932-76010
(B) : 09932-75010
(C) : 09932-78310
(D) : 09932-78340

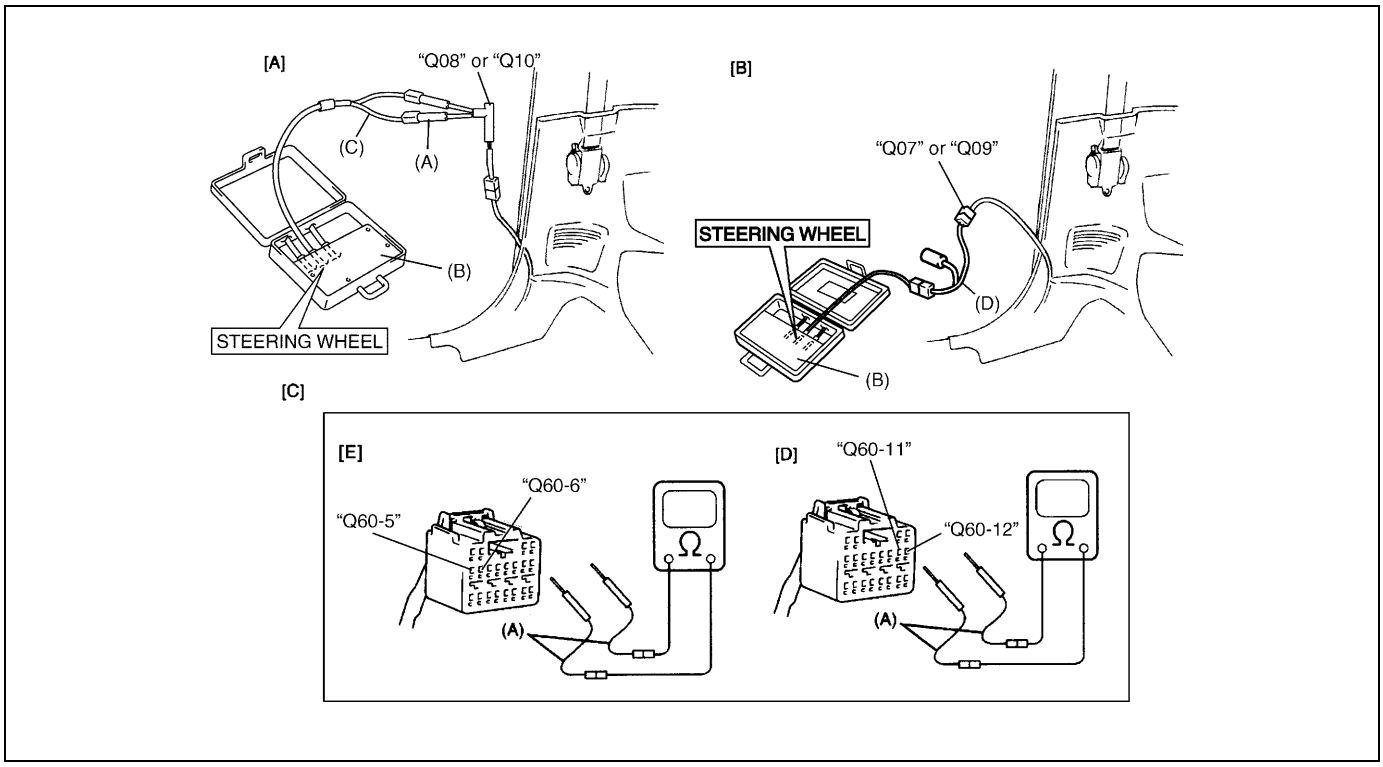
NOTE:

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 referring to "DTC Clearance" in this section, if any.**
- **Repeat "Air Bag Diagnostic System Check" in this section to confirm that the trouble has been corrected.**

DTC B1043 : DRIVER PRETENSIONER INITIATOR CIRCUIT SHORT TO GROUND
DTC B1047 : PASSENGER PRETENSIONER INITIATOR CIRCUIT SHORT TO GROUND

Step	Action	Yes	No
1	1) With ignition switch OFF, remove quarter lower trim of applicable side. 2) Disconnect connector “Q08” or “Q10” connector from seat belt pretensioner. 3) Check proper connection to applicable seat belt pretensioner at terminals in “Q08” or “Q10” connector. 4) If OK then connect special tools (A), (B) and (C) to “Q08” or “Q10” connector. With ignition switch ON, does DTC B1043 or B1047 still exist?	Go to step 2.	Ignition switch OFF, and replace seat belt pretensioner referring “Front Seat Belt” in Section 10.
2	1) With ignition switch OFF, disconnect special tools (A), (B) and (C) from “Q08” or “Q10” connector. 2) Disconnect connector “Q07” or “Q09” from air bag wire harness in floor harness. 3) Check proper connection to air bag wire harness at terminals in “Q07” or “Q09” connector. 4) If OK then connect special tools (B) and (D) to “Q07” or “Q09” connector. With ignition switch ON, does DTC B1043 or B1047 still exist?	Go to step 3.	Repair short “YEL” or “YEL/RED” wire circuit to ground.
3	1) With ignition switch OFF, disconnect special tools (A) and (D) from seat belt pretensioner wire harness connector “Q07” or “Q09”. 2) Disconnect SDM connector “Q60” from SDM. 3) Measure resistance. • DTC B1043 : between “Q60-11” terminal and body ground, and between “Q60-12” terminal and body ground. • DTC B1047 : between “Q60-5” terminal and body ground, and between “Q60-6” terminal and body ground. Is resistance 1 MΩ or more?	Substitute a known-good SDM and recheck.	DTC B1043 : Repair short “WHT” or “PNK” wire circuit to ground. DTC B1047 : Repair short from “BRN” or “LT GRN” wire circuit to ground.



[A] : Fig. for STEP 1	[C] : Fig. for STEP 3	[E] : For DTC B1047
[B] : Fig. for STEP 2 and 3	[D] : For DTC B1043	

Special tool
(A) : 09932-76010
(B) : 09932-75010
(C) : 09932-78310
(D) : 09932-78340

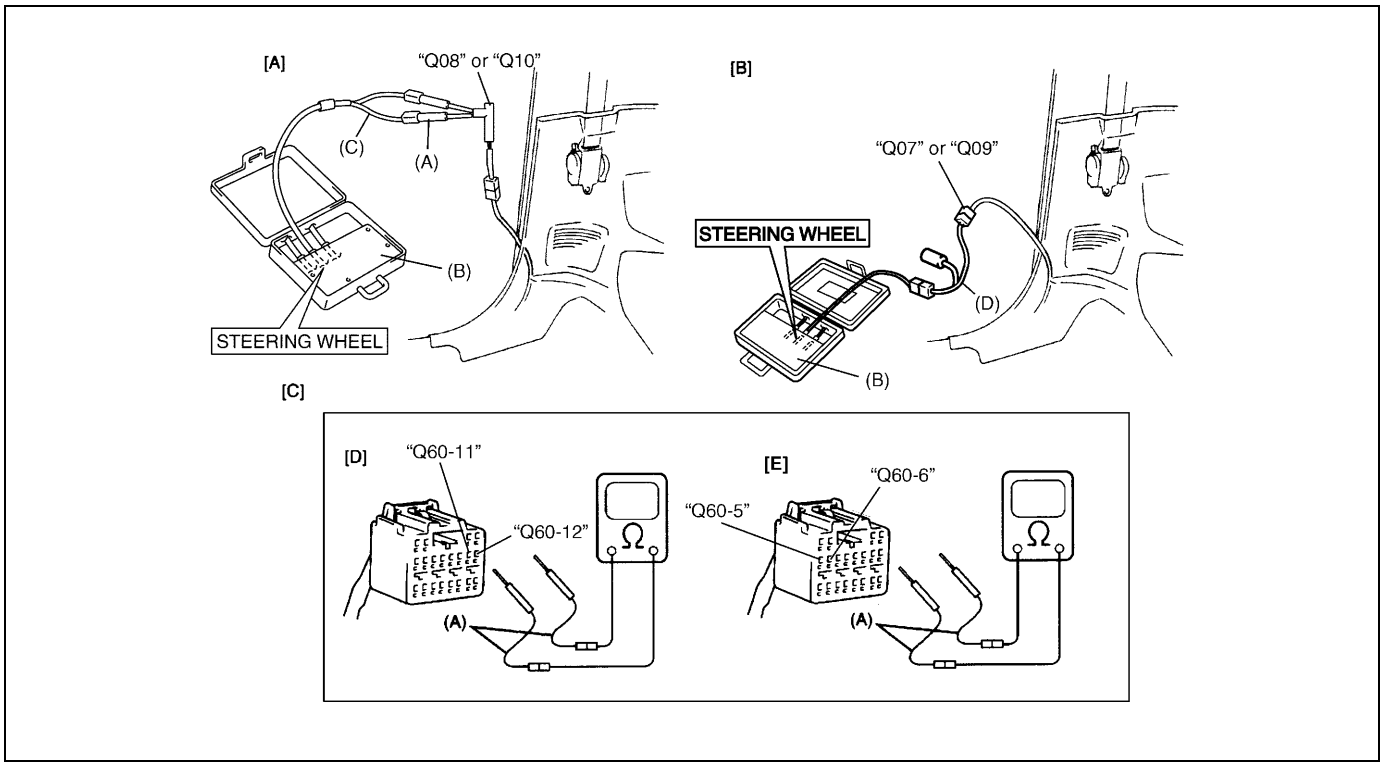
NOTE:

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 referring to "DTC Clearance" in this section, if any.**
- **Repeat "Air Bag Diagnostic System Check" in this section to confirm that the trouble has been corrected.**

DTC B1044 : DRIVER PRETENSIONER INITIATOR CIRCUIT TO POWER CIRCUIT
DTC B1048 : PASSENGER PRETENSIONER INITIATOR CIRCUIT TO POWER CIRCUIT

Step	Action	Yes	No
1	1) With ignition switch OFF, remove quarter lower trim of applicable side. 2) Disconnect connector “Q08” or “Q10” connector from seat belt pretensioner. 3) Check proper connection to applicable seat belt pretensioner at terminals in “Q08” or “Q10” connector. 4) If OK then connect special tools (A), (B) and (C) to “Q08” or “Q10” connector. With ignition switch ON, does DTC B1044 or B1048 still exist?	Go to step 2.	Ignition switch OFF, and replace seat belt pretensioner referring “Front Seat Belt” in Section 10.
2	1) With ignition switch OFF, disconnect special tools (A), (B) and (C) from “Q08” or “Q10” connector. 2) Disconnect connector “Q07” or “Q09” from air bag wire harness in floor harness. 3) Check proper connection to air bag wire harness at terminals in “Q07” or “Q09” connector. 4) If OK then connect special tools (B) and (D) to “Q07” or “Q09” connector. With ignition switch ON, does DTC B1044 or B1048 still exist?	Go to step 3.	Repair short “YEL” or “YEL/RED” wire circuit to power circuit.
3	1) With ignition switch OFF, disconnect special tools (A) and (D) from seat belt pretensioner wire harness connector “Q07” or “Q09”. 2) Disconnect SDM connector “Q60” from SDM. 3) Measure voltage. • DTC B1044 : between “Q60-11” terminal and body ground, and between “Q60-12” terminal and body ground. • DTC B1048 : between “Q60-5” terminal and body ground, and between “Q60-6” terminal and body ground. With ignition switch ON, is voltage 1 V or less?	Substitute a known-good SDM and recheck.	DTC B1044 : Repair short “WHT” or “PNK” wire circuit to power circuit. DTC B1048 : Repair short from “BRN” or “LT GRN” wire circuit to power circuit.



[A] : Fig. for STEP 1	[C] : Fig. for STEP 3	[E] : For DTC B1048
[B] : Fig. for STEP 2 and 3	[D] : For DTC B1044	

Special tool
(A) : 09932-76010
(B) : 09932-75010
(C) : 09932-78310
(D) : 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 referring to "DTC Clearance" in this section, if any.**
- **Repeat "Air Bag Diagnostic System Check" in this section to confirm that the trouble has been corrected.**

DTC B1051 – Frontal Crash Detected (System Activation Command Outputted)

CAUTION:
Be sure to perform "Air Bag Diagnostic System Check" in this section before starting diagnosis according to flow table.

DTC WILL 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.

Step	Action	Yes	No
1	1) Ignition switch OFF. Has air bag (inflator) module deployed?	Replace components and perform inspections as directed in "Repairs and Inspections Required after an Accident" in this section.	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" in this section.	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.**
- **Repeat "Air Bag Diagnostic System Check" in this section to confirm that the trouble has been corrected.**

DTC B1071 – Internal SDM Fault

DTC WILL SET WHEN

An internal SDM fault is detected by SDM.

CAUTION:
Be sure to perform "Air Bag Diagnostic System Check" in this section before starting diagnosis according to the following diagnostic procedures.

NOTE:
DTC B1071 can never be cleared once it has been set.

1) Ignition switch OFF.
2) Replace SDM referring to "SDM" in this section.
3) Repeat "Air Bag Diagnostic System Check" in this section.

DTC B1013 – System Specifications Different from SDM Specifications

DTC WILL SET WHEN

Specifications of the air bag system differ from those of SDM.

CAUTION:
Be sure to perform "Air Bag Diagnostic System Check" in this section before starting diagnosis according to the following diagnostic procedures.

1) Ignition switch OFF.
2) Replace SDM referring to "SDM" in this section.
3) Repeat "Air Bag Diagnostic System Check" in this section.

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:

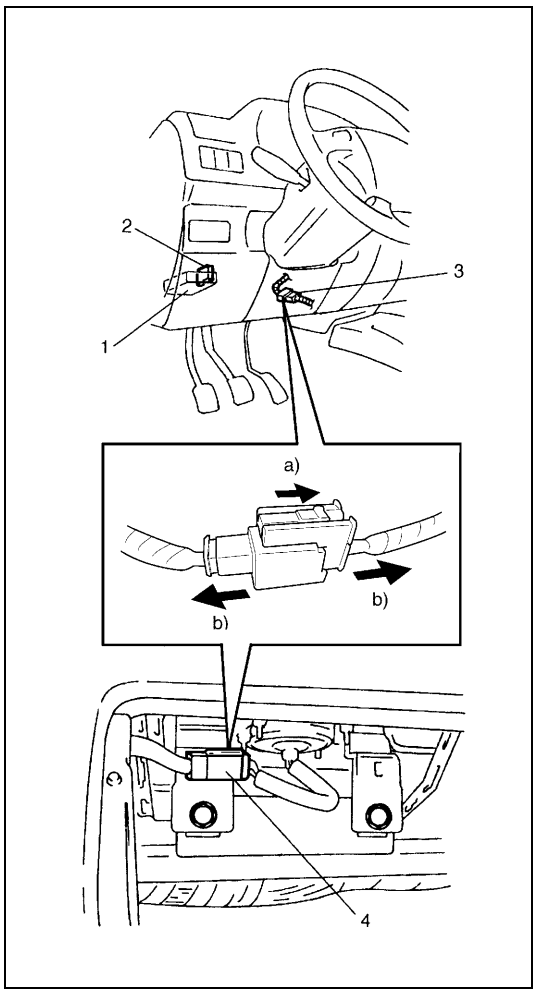
- **If the air bag system and another vehicle system both need repair, Suzuki recommends that the air bag system be repaired first, to help avoid unintended air bag system activation.**
- **Do not modify the steering wheel, dashboard or any other on or around air bag system components. Modifications 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 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 and passenger), seat belt pretensioners (driver and passenger) or SDM, be careful not to drop it or apply an impact to it. If an excessive impact was applied (e.g., dropped from a height of 90 cm (3 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 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, disable the air bag system temporarily referring to “Disabling Air Bag System” in this section.
Failure to follow procedures could result in possible air bag system activation, personal injury or unneeded air bag system repairs.

Disabling air bag system

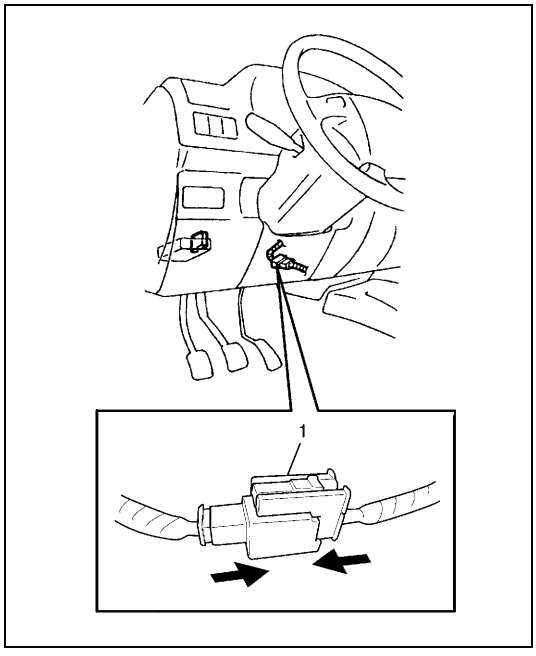


1) Turn steering wheel so that vehicle's wheels (front tires) and pointing straight ahead.
2) Turn ignition switch to "LOCK" position and remove key.
3) Remove "AIR BAG" fuse (2) from fuse box (1).
4) Disconnect Yellow connector (3) of contact coil and combination switch assembly.
   a) Release locking of lock slider.
   b) After unlocked, disconnect connector.
5) 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.
   b) After unlocked, disconnect connector.

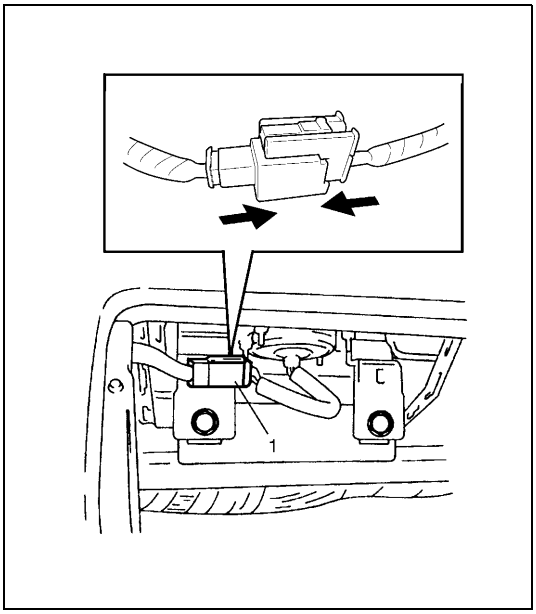
NOTE:

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



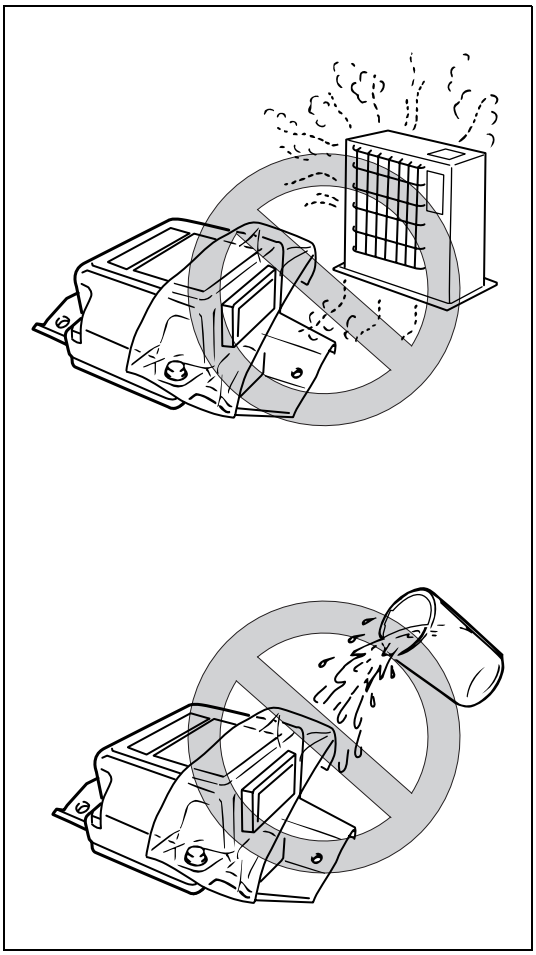
1) Turn ignition switch to "LOCK" position and remove key.
2) Connect Yellow connector (1) of contact coil and combination switch assembly, by pushing connector till click is heard from it.



3) Connect Yellow connector (1) of passenger air bag (inflator) module by pushing connector till click is heard from it.
4) Install glove box.
5) Install “AIR BAG” fuse to fuse box.
6) 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” in this section.

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.

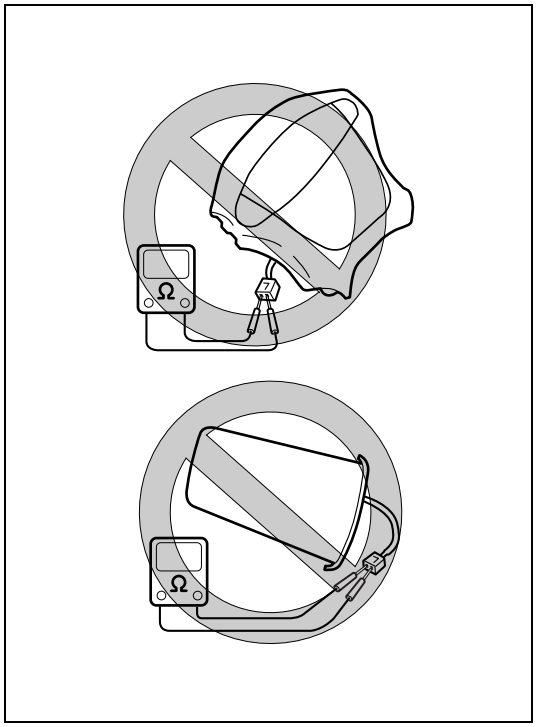
CAUTION:

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” in this section 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 was dropped from a height of 90 cm (3 ft) or more or if it is found to be damaged or deformed, 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

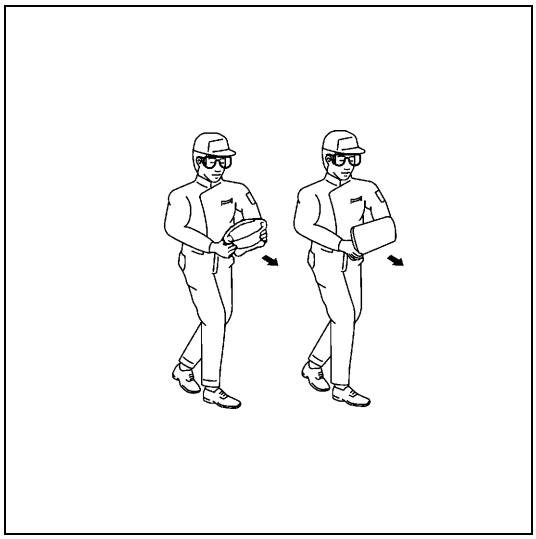
Special care is necessary when handling and storing a live (undeployed) air bag (inflator) modules.
The rapid gas generation produced during deployment of the air bag could cause the air bag (inflator) module, or an object in front of the air bag (inflator) module, to be thrown through the air in the unlikely event of an accidental deployment.



WARNING:

Never attempt to measure the resistance of the air bag (inflator) modules (driver and passenger). It is very dangerous as the electric current from the tester may deploy the air bag.

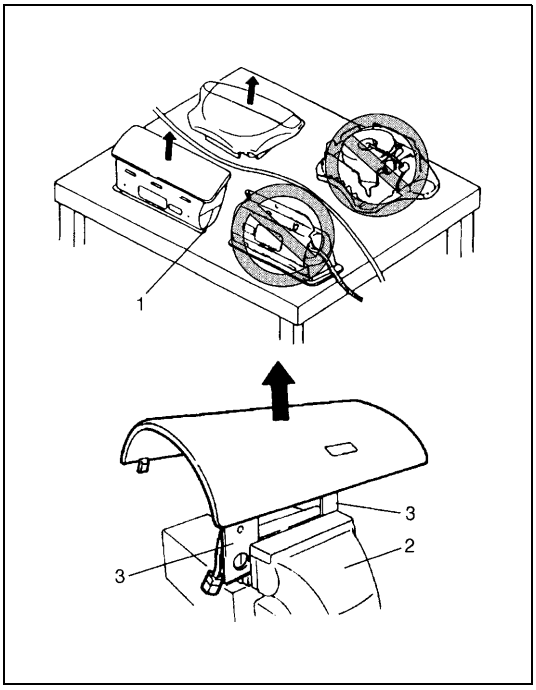
- Never attempt disassembly of the air bag (inflator) modules.
- If any abnormality is found, be sure to replace it with new one as an assembly.
- When an abnormality is noted as existing in the live (undeployed) air bag (inflator) module, be sure to deploy it before discarding it.
- When grease, cleaning agent, oil, water, etc., got on the air bag (inflator) modules (driver 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.**

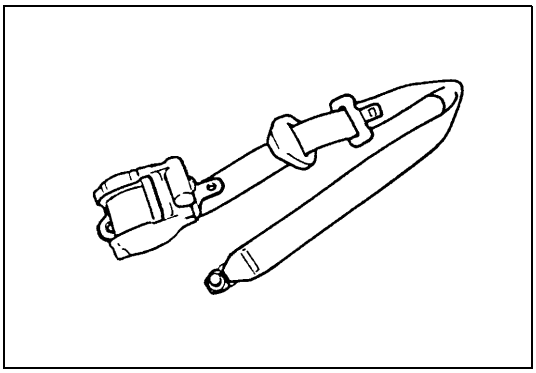
Otherwise, personal injury may result.



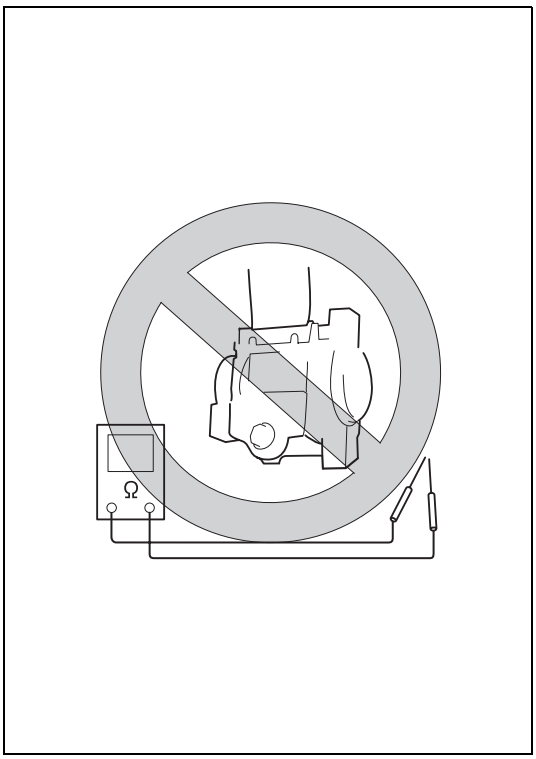
WARNING:

When placing a live air bag (inflator) module on bench or other surface, always face the bag up, away from the surface. 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).
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



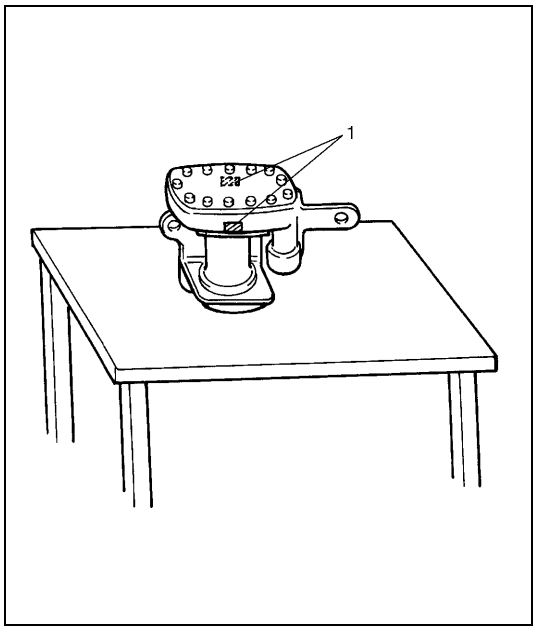
Special care is necessary when handling and storing a live (inactivated) seat belt pretensioners.
Also, when the seat belt pretensioners activate, gas is generated and the seat belt is retracted into the retractor assembly quickly.
Note, therefore, that if they activate accidentally, the seat belt pretensioners 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 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 seat belt pretensioner, select a place where the ambient temperature below 65°C (150°F), without high humidity and away from electric noise.**
- **Do not carry the seat belt pretensioner by webbing.**
- **When placing a live seat belt pretensioner on the workbench or other surface, be sure not to lay it with its exhaust hole (1) provided side facing down. It is also prohibited to put something on its face with an exhaust hole (1) or to put a seat belt pretensioner on top of another.**

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 activate 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” in this section.

Disposal

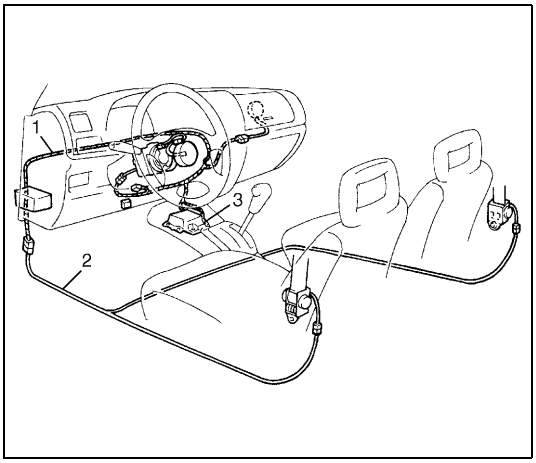
Do not dispose of the live (undeployed) air bag (inflator) modules and the live (inactivated) seat belt pretensioners. When disposal is necessary, be sure to deploy/activate the air bag and seat belt pretensioner according to deployment/activation procedure described in “Air Bag (Inflator) Module and Seat Belt Pretensioner Disposal” in this section.

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.

Air bag wire harness and connector in instrument panel harness, floor harness and pretensioner harness



Air bag wire harness (1) is included in instrument panel harness, floor harness and pretensioner harness. The air bag wire harness (1) 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 (1), 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 (1) is not caught or does not interfere with other parts.
- Make sure all air bag system grounding point (2) is clean and ground is securely fastened for optimum metal-to-metal contact. Poor grounding can cause intermittent problems that are difficult to diagnose.

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 air bag (inflator) module, Driver/Passenger seat belt pretensioner**
  - **– SDM**
  - **– Contact coil and combination switch assembly**
  - **– Air bag wire harness in instrument panel harness, floor harness and pretensioner 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" in this section when checking the SDM.

Accident with Deployment/Activation - Component Replacement

The following components must be replaced.

- Driver and passenger air bag (inflator) modules
- Driver and passenger seat belt pretensioners
- 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.

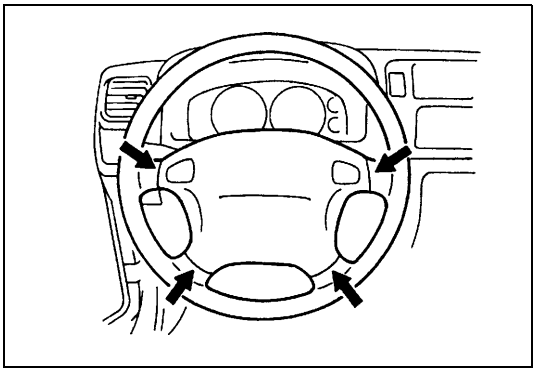
Those components are :

- Steering column 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.

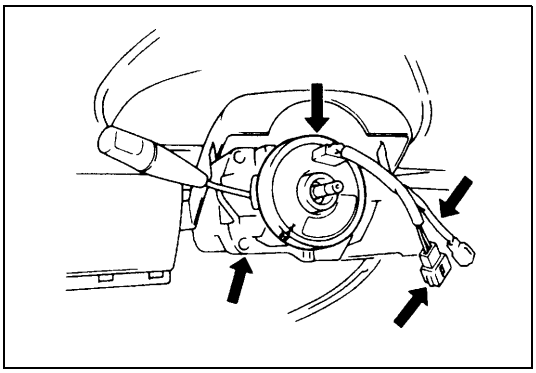
- Steering column bracket and capsules
  - – Check for damage and bent.

If any faulty condition is found in above checks, replace faulty part.



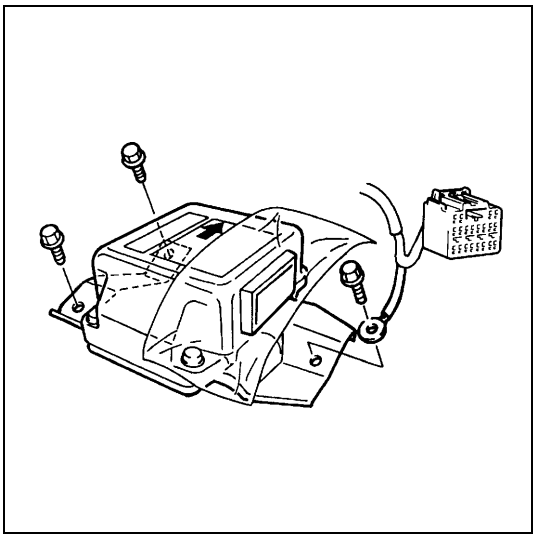
- Steering wheel and driver air bag (inflator) module
  - Check for damage or air bag (inflator) module fitness.
  - Check trim cover (pad surface) for cracks.
  - Check wire harness and connector for damage or tightness.

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.

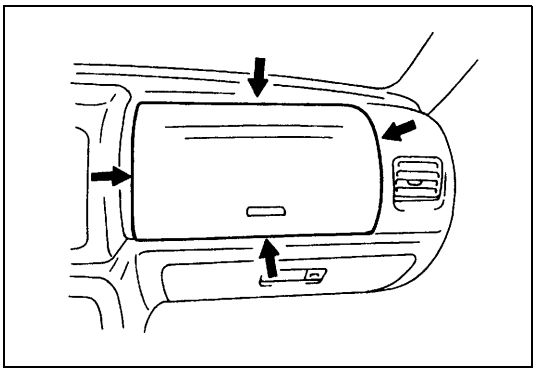


- SDM and SDM plate
  - Check for external damage such as deformation, scratch, crack, peeled paint, etc.
  - Check that SDM cannot be installed properly due to a cause in itself. (There is a gap between SDM and SDM plate, or it cannot be fixed securely.)
  - Check that connector or lead wire of SDM has a scorching, melting or damage.
  - Check that connector is connected securely or locked.
  - Check SDM connector and terminals for tightness.
  - Check SDM sets a diagnostic trouble code referring to “DTC Check” in this section, and the diagnostic table leads to a malfunctioning SDM.

If any faulty condition is found in above checks, replace.

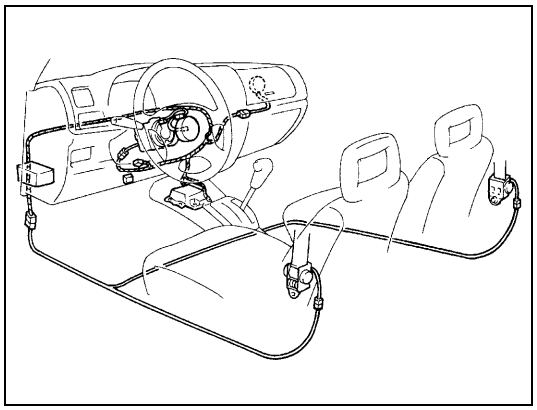
- Instrument panel member and reinforcement
  - Check for any distortion, bending, cracking or other damage.

If any faulty condition is found in above checks, replace.



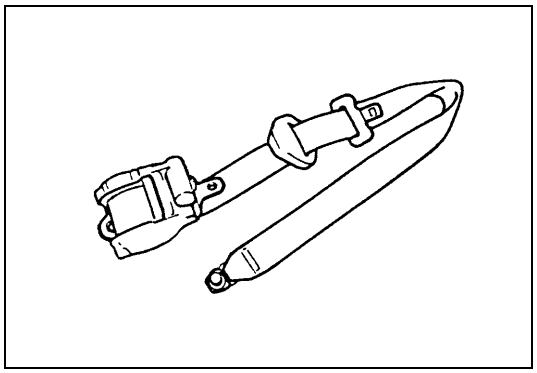
- Passenger air bag (inflator) module
  - Check for dents, cracks, damage or fitness.
  - Check trim cover for cracks or deformities.
  - Check harness and connector for damage or tightness.

If any faulty condition is found in above checks, replace.



- Air bag wire harness and connections
  - Check for damages, deformities or poor connections referring to “Intermittents and Poor Connections” in this section.
  - 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 harness and 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” in Section 10.
- “AIR BAG” warning lamp
  - After vehicle is completely repaired, perform “Air Bag Diagnostic System Check” in this section.

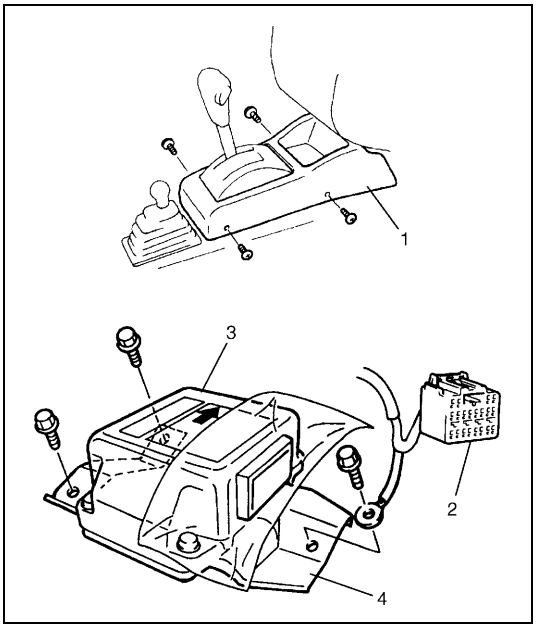
SDM

WARNING:

During service procedures, be very careful when handling a Sensing and Diagnostic Module (SDM).
Be sure to read "Service Precautions" in this section 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 referring to "Disabling Air Bag System" in this section.

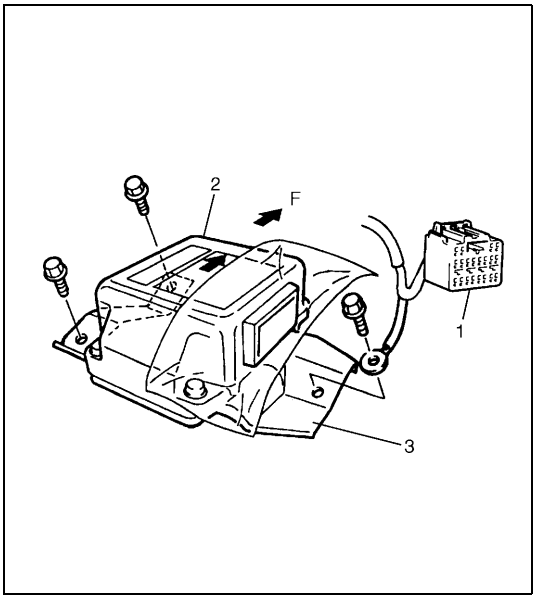


3) Remove center console box (1) by removing screws.
4) Disconnect SDM connector (2) from SDM (3).
5) Remove SDM (3) with SDM plate (4) as an assembly from vehicle.

CAUTION:

Do not separate SDM (3) and SDM plate (4).

INSPECTION



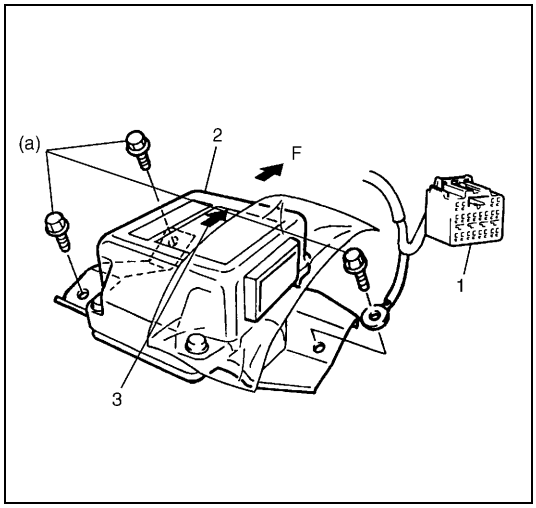
CAUTION:

- **Do not connect a tester whatever type it may be.**
- **Never repair or disassemble SDM (3).**
- **If SDM has been dropped from a height of 90 cm (3 ft) or more, or if there are cracks, dents or other defects in the case or plate, replace it with a new one.**

- Check SDM (2) and SDM plate (3) for dents, cracks or deformation.
- Check SDM connector (1) for damage, cracks or lock mechanism.
- Check SDM terminal for bent, corrosion or rust.

If any faulty condition is found in above checks, replace.

F : Forward



INSTALLATION

For installation, reverse removal procedure noting the following points.

- Ensure that arrow (3) on the SDM (2) is pointing toward the front of the vehicle.
- Tighten SDM bolts to specified torque.

Tightening torque
SDM mounting bolt (a) : 6 N·m (0.6 kg-m, 4.5 lb-ft)

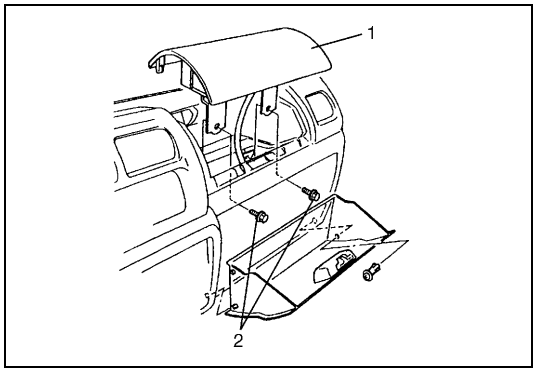
- Connect SDM connector (1) to SDM (2) securely.
- Enable air bag system referring to “Enabling Air Bag System” in this section.

F : Forward

Passenger Air Bag (Inflator) Module

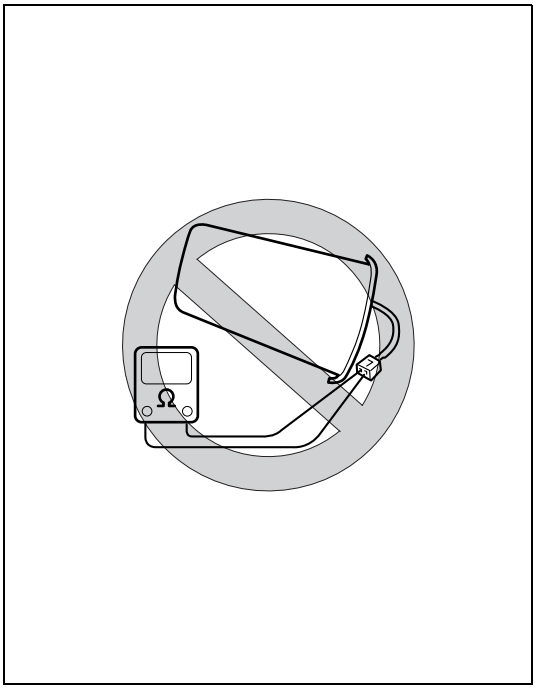
WARNING:

- **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” in this section 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 referring to “Disabling Air Bag System” in this section.
3) Remove passenger air bag (inflator) module attaching bolts (2) and passenger air bag (inflator) module (1) from vehicle.



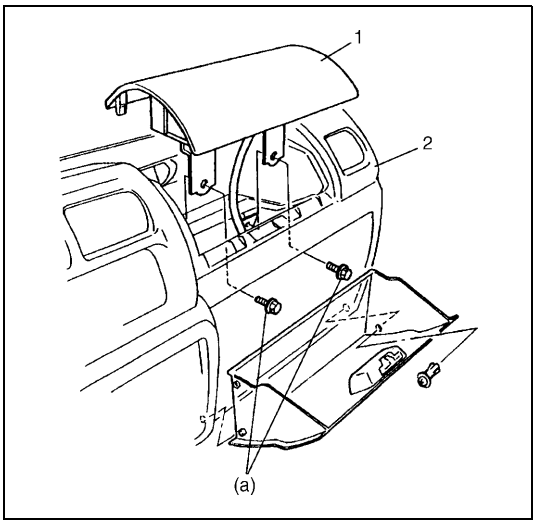
INSPECTION

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 the 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.



INSTALLATION

1) Install passenger air bag (inflator) module (1) to instrument panel (2).
2) Tighten passenger air bag (inflator) module attaching bolts 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.

Driver Air Bag (Inflator) Module

Refer to “Driver Air Bag (Inflator) Module” in Section 3C for removal, inspection and installation.

Contact Coil and Combination Switch Assembly

Refer to “Contact Coil and Combination Switch Assembly” in Section 3C for removal, inspection and installation.

Seat Belt Pretensioner

Refer to “Front Seat Belt” in Section 10 for removal, inspection and installation.

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:

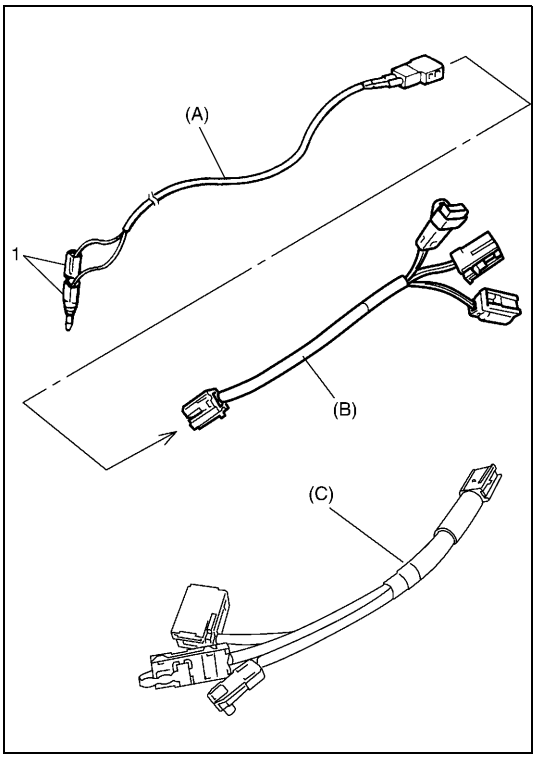
The following precautions must be observed for this work. Failure to observe any of them may result in personal injury.

- **Procedure should be followed strictly as described here.**
- **Be sure to read “Service Precautions” in this section 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), adapter cable (B) and adapter cable (C)). If any faulty is found, do not use it and be sure to use new special tool.

Special tool
(A) : 09932-75031
(B) : 09932-78332
(C) : 09932-78320

NOTE:

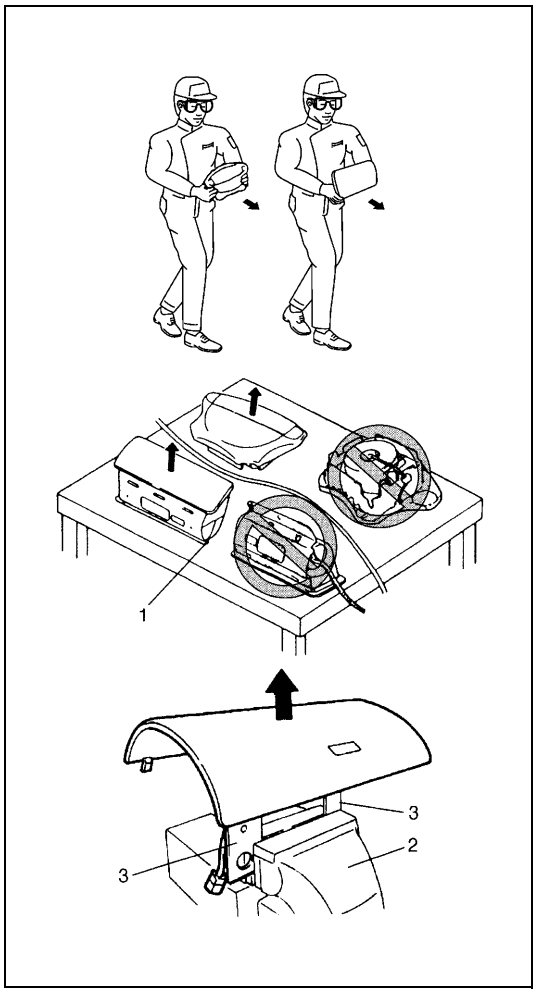
If faulty seat belt pretensioner connector of adapter cable (C) is found, replace it to spare connector (special tool).

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.

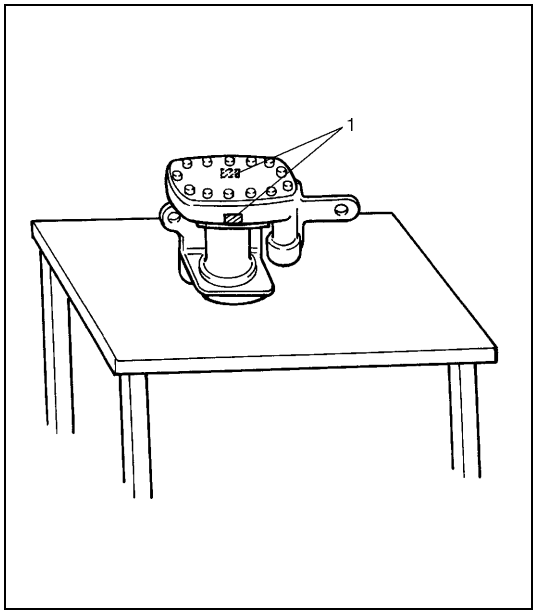
5) Remove applicable air bag (inflator) module or seat belt pretensioner as follows.
   - For driver air bag (inflator) module
     Remove driver air bag (inflator) module referring to “Driver Air Bag (Inflator) Module” in Section 3C.
   - For passenger air bag (inflator) module
     Remove passenger air bag (inflator) module referring to “Passenger Air Bag (inflator) Module” in this section.
   - For seat belt pretensioner
     Remove seat belt referring to “Front Seat Belt with Pretensioner” in Section 10.



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. As the live passenger air bag (inflator) module must be placed with its bag (trim cover) facing up, place it on the work bench with a slit (1) or use the work bench vise (2) to hold it securely at its lower mounting bracket (3). It is also prohibited to place anything on top of the trim cover and stack air bag (inflator) modules. 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.

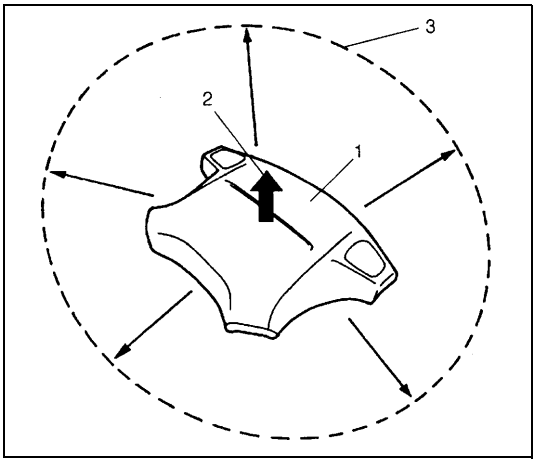


WARNING:

- **For handing 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.**
- **Do not carry the seat belt pretensioner by webbing.**
- **When placing a live seat belt pretensioner on the workbench or other surface, be sure not to lay it with its exhaust hole (1) provided side facing down. It is also prohibited to put something on its face with an exhaust hole (1) or to put a seat belt pretensioner on top of another.**

Otherwise, personal injury may result.

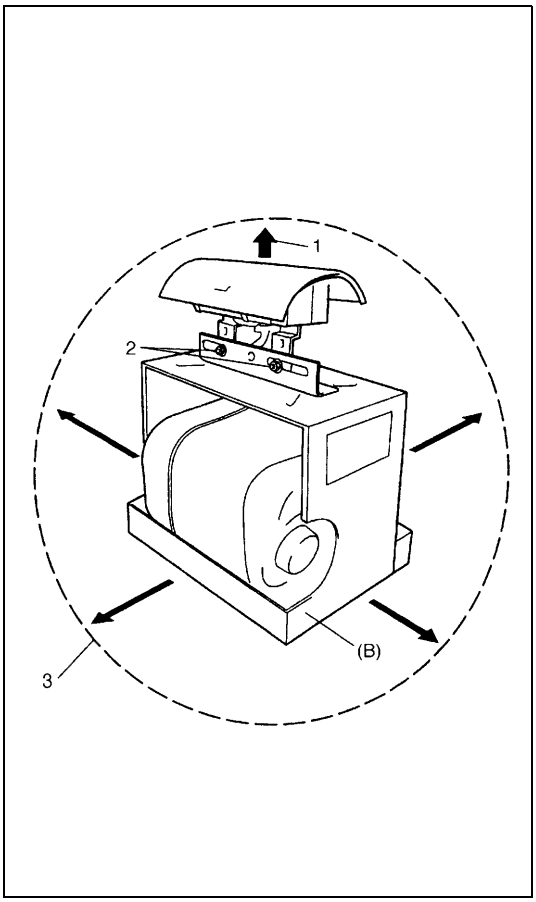
6) Set air bag (inflator) module or seat belt pretensioner as follows.



• For driver air bag (inflator) module

a) 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.

b) Place driver air bag (inflator) module (1) with its vinyl trim cover facing up (2) on ground in step a).



• For passenger air bag (inflator) module

a) Clear space (3) on ground about 185 cm (6 ft) in diameter where passenger 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.

b) Place deployment fixture (A) on ground in step a).

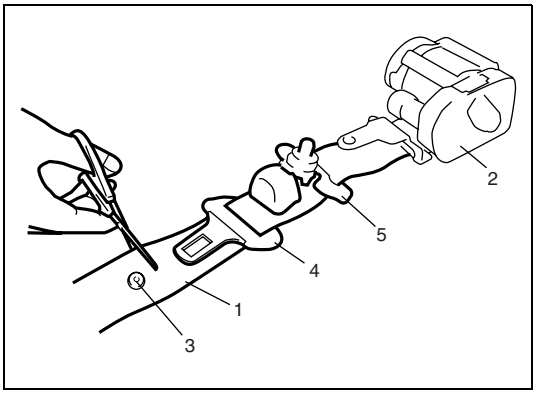
Special tool
(A) : 09932-75041

c) Fill plastic reservoir in deployment fixture (A) with water or sand. This is necessary to provide sufficient stabilization of fixture during deployment.

d) Attach passenger air bag (inflator) module (1) in deployment fixture (A) securely using mounting attachment, hold-down bolts & nuts and M8 bolts & nuts (2).

CAUTION:

Be sure to use M8 size and 7T strength bolt for fixing passenger air bag (inflator) module (1) to deployment fixture (A).



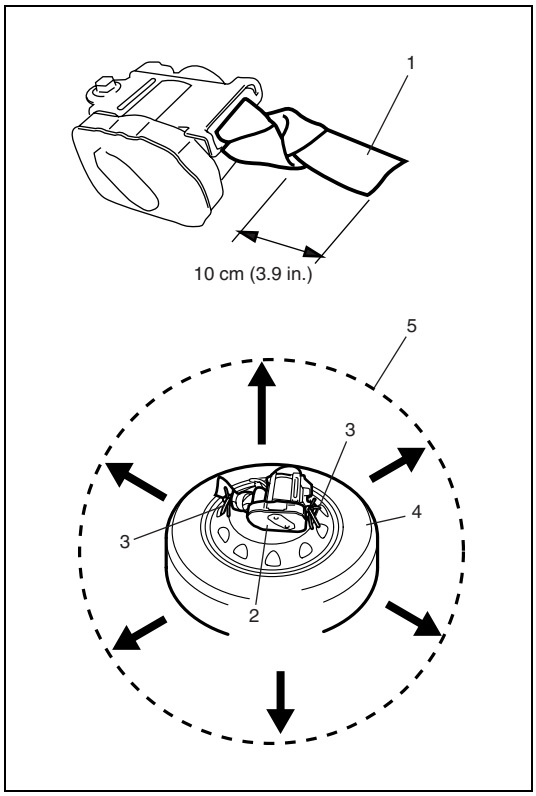
• For seat belt pretensioner

a) Cut webbing (1) at tongue plate stopper (3) of seat belt pretensioner (2) side as shown.

NOTE:

Hold seat belt pretensioner (2) vertically in the same condition as it is installed. Otherwise, webbing can't be pulled out.

b) Remove tongue plate (4) and shoulder anchor (5) from webbing.



c) Tie webbing (1) tightly at 10 cm (3.9 in.) from cutting edge as shown.
d) Tie seat belt pretensioner (2) with wire harness (3) to wheel-installed tire (4) as shown.

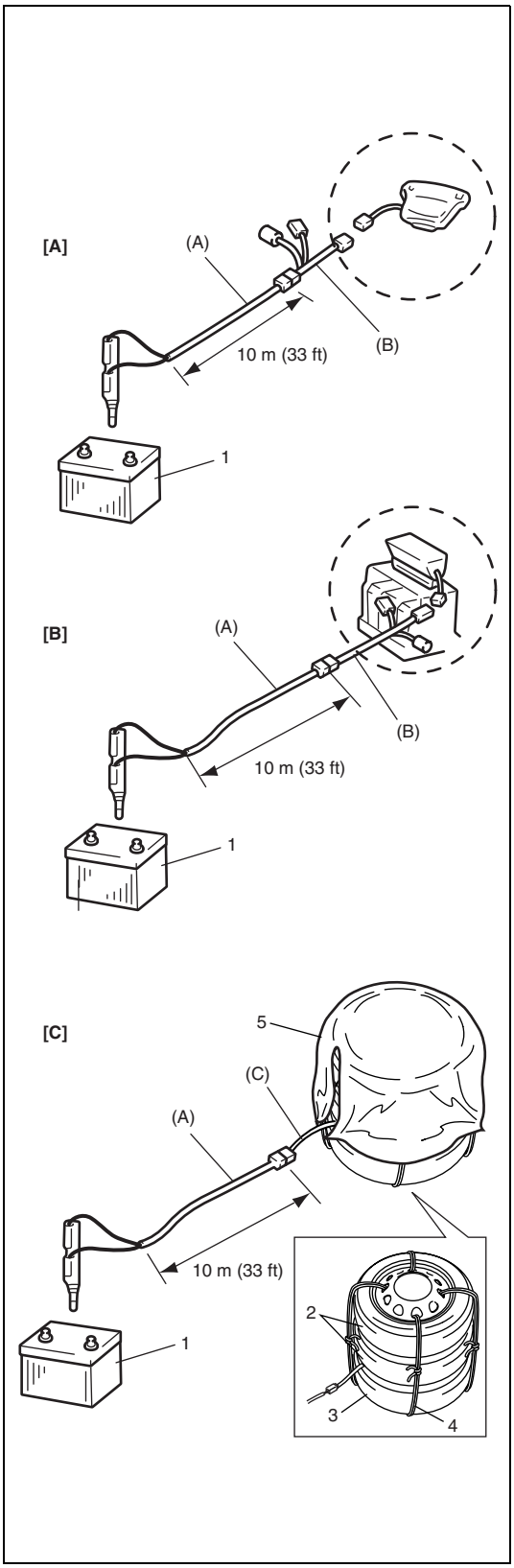
Wire harness specification:

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.

e) 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.
f) Place wheel-installed tire (4) with seat belt pretensioner (2) on ground in step e).



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) : 09932-75031

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) or (C) as follows.

Special tool
(B) : 09932-78332
(C) : 09932-78320

- 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 seat belt pretensioner

a) Connect adapter cable (C) to seat belt pretensioner.
b) Pile 2 wheel-installed tires (2) on top of tire with seat belt pretensioner (3), and tie them with wire harness (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 around at least 2 times.

c) Drape blanket (5) over those tires.

11) Connect adapter cable (B) or (C) to deployment harness (A) connector and lock connectors with lock lever.

[A] :	For driver air bag (inflator) module
[B] :	For passenger air bag (inflator) module
[C] :	For seat belt pretensioner

12) Notify all people in immediate area that you intend to deploy/ activate air bag (inflator) module or seat belt pretensioner.

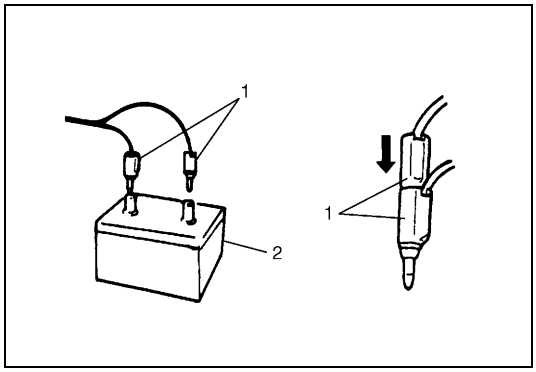
NOTE:

- **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.

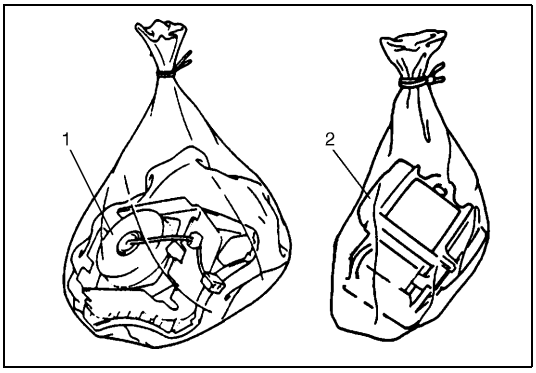


13) Separate two banana plugs (1) on deployment harness.
14) Connect deployment harness to 12 volts vehicle battery (2). This will immediately deploy or activate air bag (inflator) module or seat belt pretensioner.
15) Disconnect deployment harness from 12 volts vehicle battery (2) and short two deployment harness leads together by fully seating one banana plug into the other.

16) After confirming that air bag (inflator) module deployed and/or seat belt pretensioner activated, proceed to Step (7) through Step 21). In the unlikely event that air bag (inflator) module did not deploy or seat belt pretensioner did not activate, proceed to Step 22) through Step 25).
17) 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.
18) 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.
19) 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. Replace it with new adapter cable (special tool), if necessary.
    - For seat belt pretentioner
      Seat belt pretensioner connector of adapter cable (special tool) should be inspected for damage when seat belt pretensioner is activated. Replace it with spare connector (special tool), if necessary.

NOTE:

Do not reuse faulty seat belt pretensioner connector of adapter cable (special tool) because it can be destroyed by shock when seat belt pretensioner is activated.



20) 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.)
21) 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.

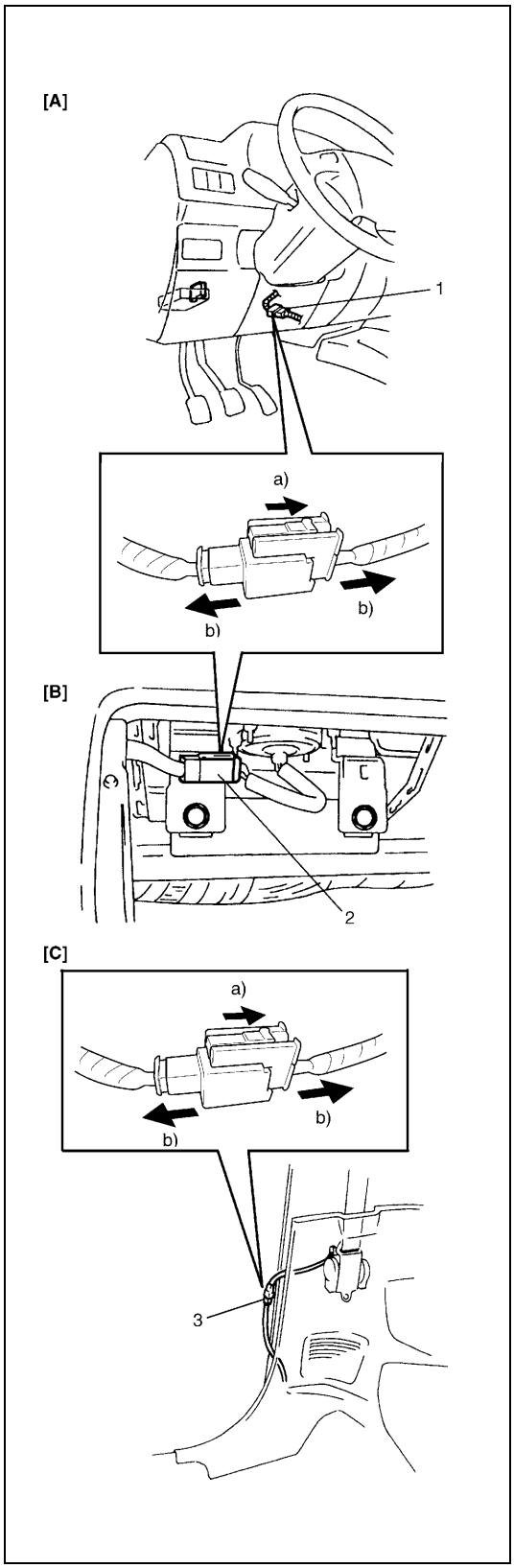
22) Ensure that deployment harness has been disconnected from 12 volts vehicle battery and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
23) Disconnect deployment harness and adapter cable from air bag (inflator) module or seat belt pretensioner.

24) Temporarily store undeployed air bag (inflator) module or unactivated seat belt pretensioner referring to “Service Precautions” for details.
25) Contact your local distributor for further assistance.

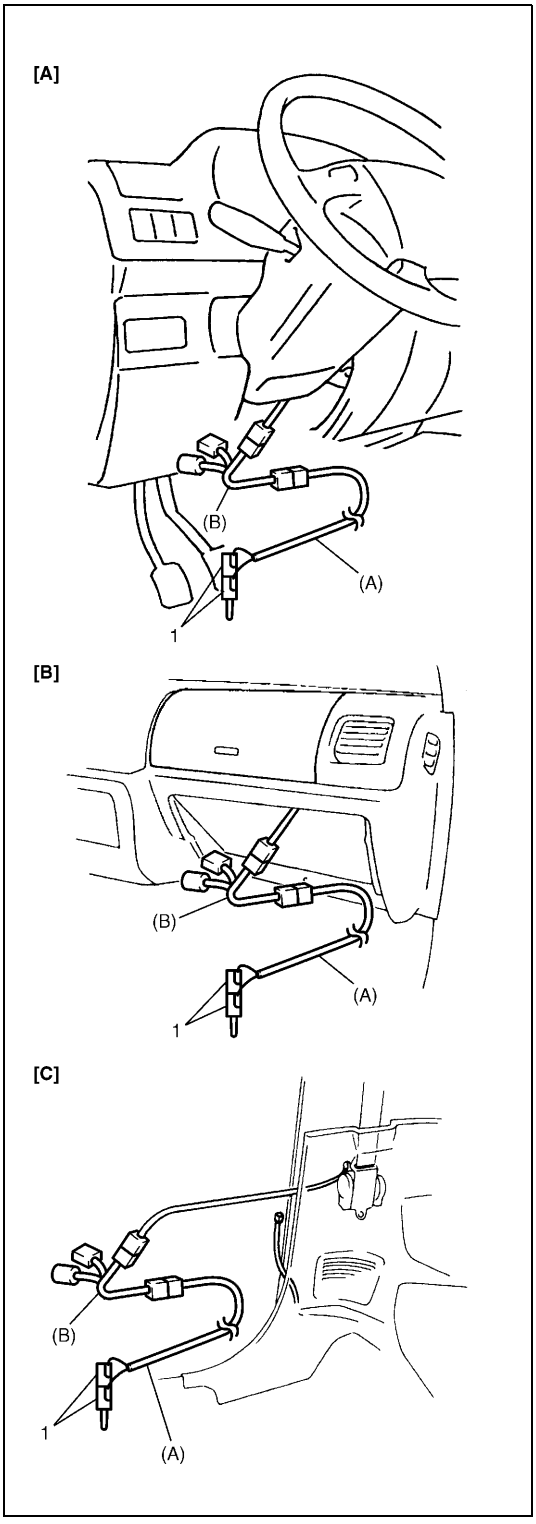
Deployment/Activation Inside Vehicle

When the vehicle will be destroyed, or salvaged for component parts, deploy the air bag modules and 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 seat belt pretensioner
     Remove both side (driver and passenger side) quarter lower trims and disconnect seat belt pretensioner connectors (3).
4) Confirm that each air bag (inflator) module and seat belt pretensioner is securely mounted.



[A] :	Driver air bag (inflator) module
[B] :	Passenger air bag (inflator) module
[C] :	Seat belt pretensioner



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 (2).

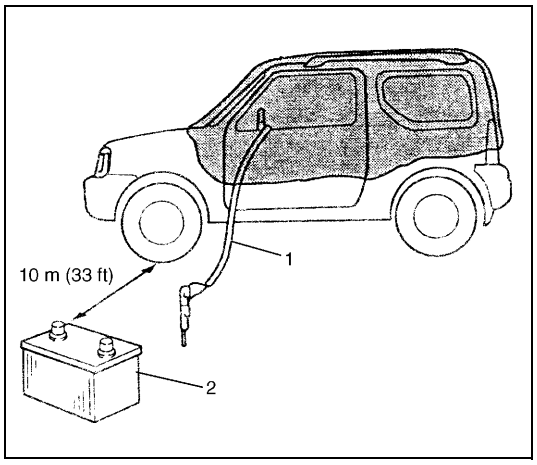
Special tool
(A) : 09932-75031
(B) : 09932-78332

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 seat belt pretensioner
  Connect adapter cable (B) in series with deployment harness (A) to seat belt pretensioner and lock connector with lock part.

[A] :	Driver air bag (inflator) module
[B] :	Passenger air bag (inflator) module
[C] :	Seat belt pretensioner



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.

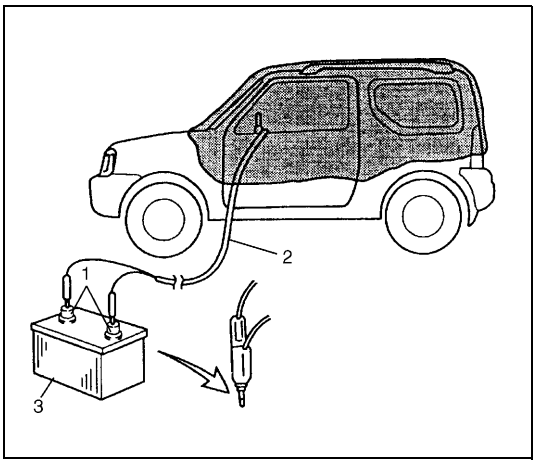
NOTE:

- **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 Step 3) through Step 16) to deploy/activate air bag (inflator) modules and seat belt pretensioners which has not been deployed/activated, if any.
18) After confirming that air bag (inflator) module and seat belt pretensioner deployed and/or activated, proceed to Step 19) through Step 23). In the unlikely event that air bag (inflator) module did not deploy or seat belt pretensioner did not activate, proceed to Step 24) through Step 26).
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.
    Adapter cable connector (special tool) are designed to be reused. However they should be inspected for damage after deployment and replaced if necessary.
23) Scrap the vehicle in the same manner as the vehicle without air bag system.

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 as follows.
    - For driver air bag (inflator) module
      Remove driver air bag (inflator) module referring to “Driver Air Bag (Inflator) Module” in Section 3C.
    - For passenger air bag (inflator) module
      Remove passenger air bag (inflator) module referring to “Passenger Air Bag (Inflator) Module” in this section.

- For seat belt pretensioner
  Remove seat belt referring to “Front Seat Belt with Pretensioner” in Section 10.

25) Temporarily store undeployed air bag (inflator) module and/or unactivated seat belt pretensioner referring to “Service Precautions” in this section.
26) Contact your local distributor for further assistance.

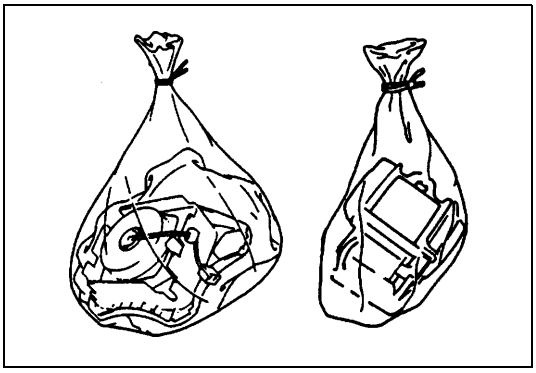
Deployed Air Bag (Inflator) Module and Activated Seat Belt Pretensioner Disposal

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. The undeployed air bag (inflator) module and the inactivated seat belt pretensioner must not be disposed of through normal refuse channels.
The undeployed air bag (inflator) module and the inactivated seat belt pretensioner contains substances that can cause severe illness or personal injury if the sealed container is damaged during disposal.

Deployed air bag (inflator) module and the activated seat belt pretensioner can be disposed of through normal refuse channels just like any other parts. For their disposal, however, the following points should be noted.

- The air bag (inflator) module and the 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 the activated seat belt pretensioner to cool it off and be careful so that water, oil etc. does not get on the deployed air bag (inflator) module and the activated seat belt pretensioner.
- After the 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, you should wear gloves and safety glasses.

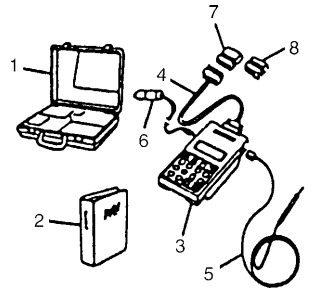
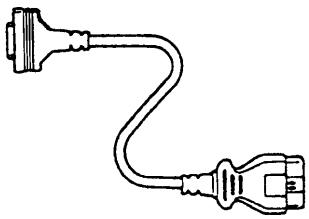
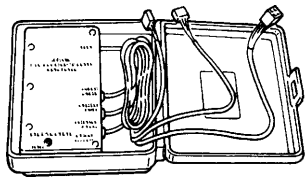
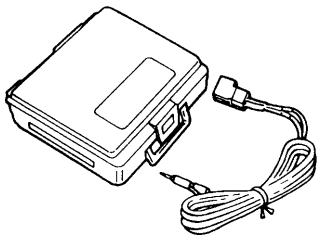
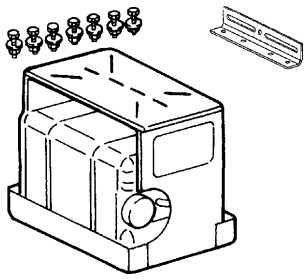
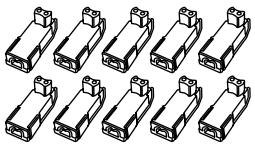
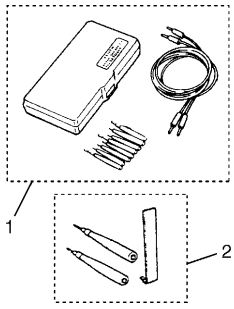
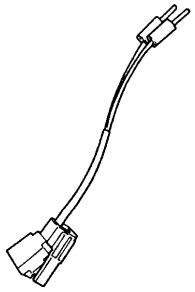


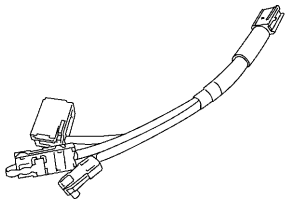
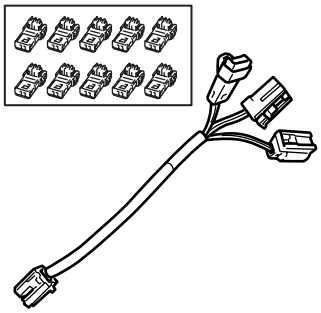
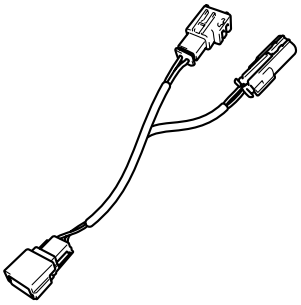
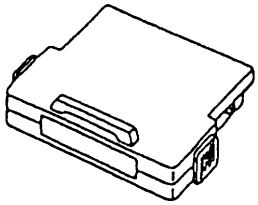
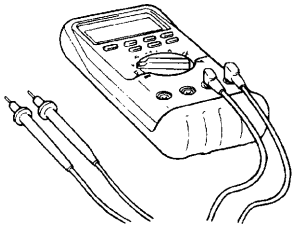
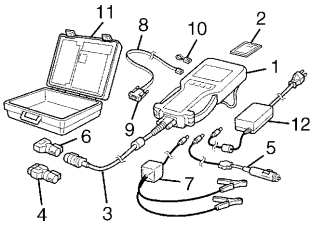
- When disposing of the deployed air bag (inflator) module and the activated seat belt pretensioner, be sure to seal it in a vinyl bag.
- When air bag (inflator) module and seat belt pretensioner have been deployed/activated inside the vehicle which is going to be scrapped, leave them as installed to the 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	6	0.6	4.5
Passenger air bag (inflator) module bolt	23	2.3	16.5

Special Tool

			
09931-76011 Tech 1A kit (SUZUKI scan tool) (See NOTE “A”.)	09931-76030 16/14 pin DLC cable for Tech 1A	09932-75010 Air bag driver/passenger load tool	09932-75031 Air bag deployment harness
			
09932-75041 Passenger air bag (inflator) module deployment fixture	09932-75420 Spare connector (See NOTE “E”.)	09932-76010 Connector test adapter set (See NOTE “D”.)	09932-78310 Adapter cable

			
09932-78320 Adapter cable	09932-78332 Adapter cable	09932-78340 Adapter cable	Mass storage cartridge for Tech 1A
			
Digital multimeter (See NOTE “B” and WARNING.)	Tech 2 kit (SUZUKI scan tool) (See NOTE “C”.)		

WARNING:

Be sure to use the specified digital multimeter. Otherwise, air bag (inflator) module deployment or personal injury may result.

NOTE:

- **“A” : This kit includes the following items and substitutes for the Tech 2 kit.**
  1. Storage case, 2. Operator’s manual, 3. Tech 1A, 4. DLC cable, 5. Test lead/probe, 6. Power source cable, 7. DLC cable adapter, 8. Self-test adapter
- **“B” : Digital multimeter specification : Maximum test current is 10 mA or less at minimum range of resistance measurement.**
- **“C” : This kit includes the following items and substitutes for the Tech 1A kit.**
  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
- **“D” : This set includes the following items.**
  1. Connector test adapter kit (09932-75020), 2. Connector test adapter & shorting bar release tool (09932-76020)
- **“E” : These connector are spare connector for adaptor cable (09932-78320).**

Prepared by
SUZUKI MOTOR CORPORATION

1st Ed. January, 2002

Printed in Japan

Printing: January, 2002 XXXX