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2002 SUZUKI ALTO

SERVICE MANUAL

RF410

SUZUKI
Caring for Customers

Part No. 99500M79G00-01E
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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: RF410

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.
RF410 Wiring Diagram Manual	99512M79G00-011

MARUTI UDYOG LIMITED
SERVICE DIVISION

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SECTION 0A

GENERAL INFORMATION

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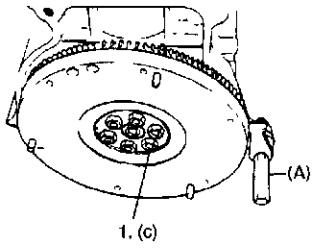
How To Use This Manual

1) There is a "TABLE OF CONTENTS" on the third page of this manual, whereby you can easily find the section that offers the infomation you need. Also, there is a CONTENTS on the first page of EACH SECTION, where the main items in that section are listed.
2) Each section of this manual has its own pagination. It is indicated at the top of each page along with the Section name.
3) The SPECIAL TOOL usage and TORQUE SPECIFICATION are given as shown in the figure.



1. Flywheel bolts or drive plate bolts for A/T vehicle

6) Install oil pump. Refer to "Oil pump'.
7) Install flywheel (for M/T vehicle) or drive platge (for A/T vehicle). Using special tool, lock flywheel or drive plate, and tighten flywheel or drive plate bolts to specified torque.

Special Tool
(A): 09924-17810

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

4) A number of abbreviations and symbols are used in the text. For their full explanations, refer to **"ABBREVIATIONS AND SYMBOLS MAY BE USED IN THIS MANUAL"** in this section.
5) The SI, metric and foot-pound systems are used as units in this manual.
6) DIAGNOSIS are included in each section as necessary.
7) At the end of each section, there are descriptions of SPECIAL TOOLS, REQUIRED SERVICE MATERIALS and TIGHTENING TORQUE SPECIFICATIONS that should be used for the servicing work described in that section.

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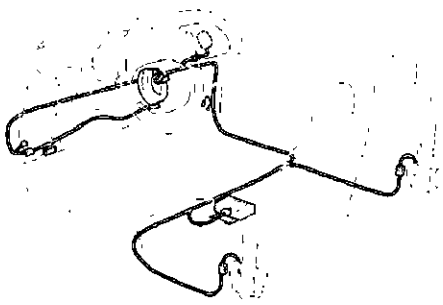


1. Air bag wire harness
2. Passenger air bag (inflator) module
3. SDM
4. Seat belt pretensioner
5. Contact coil
6. Driver air bag (inflator) module

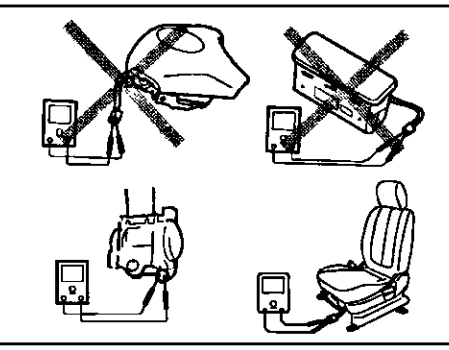
PRECAUTIONS

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 before-hand to avoid component damage or unintended air bag system activation.**

Diagnosis

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



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

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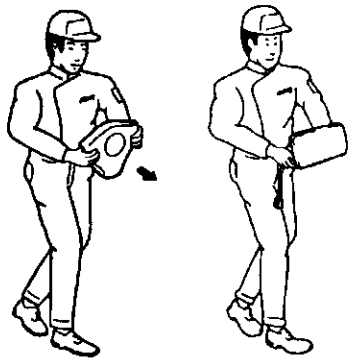
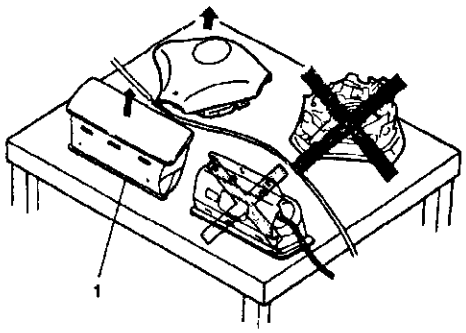
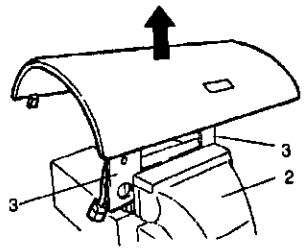
[A]



[B]





[A]:	ALWAYS CARRY AIR BAG (INFLATOR) MODULE WITH TRIM COVER (AIR BAG OPENING) AWAY FROM BODY.
[B]:	ALWAYS PLACE AIR BAG (INFLATOR) MODULE ON WORKBENCH WITH TRIM COVER (AIR BAG OPENING) UP, AWAY FROM LOOSE OBJECTS.
[C]:	ALWAYS PLACE WITH ITS FRONTAL SEAT COVER FACING UP, AWAY FROM LOOSE OBJECTS.

SERVICING AND HANDLING

WARNING:
Many of service procedures require disconnection of "AIR BAG" fuse and all air bag (inflator) module(s) from initiator circuit to avoid an accidental deployment. Driver, Passenger and Side Air Bag (Inflator) Modules

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

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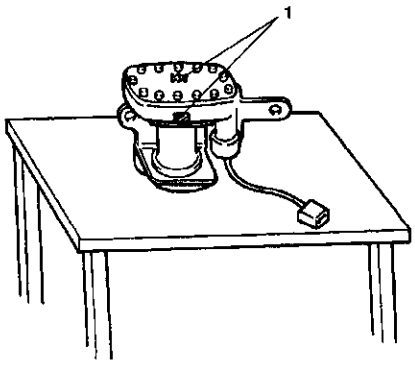
WARNING:
SDM

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



1 Exhaust hole

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 or to put a seat belt pretensioner on top of another. Otherwise, personal injury may result.**
- **Never dispose of live (inactivated) seat belt pretensioners (drive and passenger). If disposal is necessary, be sure to activate them according to activation procedures described in SECTION 10B before disposal.**
- **The seat belt pretensioner immediately after activation is very hot. Wait for at least half an hour to cool it off before proceeding the work.**
- **With many service procedures, gloves and safety glasses should be worn to prevent any possible irritation of the skin or eyes.**

- **Even when the accident was light enough not to cause air bags to activate, be sure to inspect system parts and other related parts according to instructions under "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, passenger and side), seat belt pretensioners (driver and passenger), side sensors or SDM, be careful not to drop it or apply an impact to it. If an excessive impact was applied, never attempt disassembly or repair but replace it with a new one.**
- **When grease, cleaning agent, oil, water, etc. has got onto air bag (inflator) modules (driver, passenger and side) or seat belt pretensioners (drive and passenger), wipe off immediately with a dry cloth.**

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- **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 temporarily disable air bag system referring to "DISABLING AIR BAG SYSTEM" in SECTION 10B.**
- **Never expose air bag system component parts directly to hot air (drying or baking the vehicle after painting) or flames.**
- **WARNING/CAUTION labels are attached on each part of air bag system components. Be sure to follow the instructions.**
- **After vehicle is completely repaired, perform "AIR BAG DIAGNOSTIC SYSTEM CHECK" in SECTION 10B.**

GENERAL PRECAUTIONS

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

WARNING:

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

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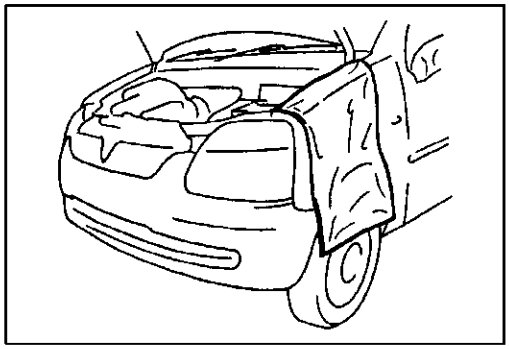
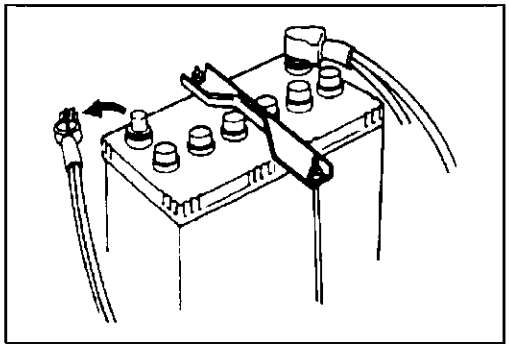
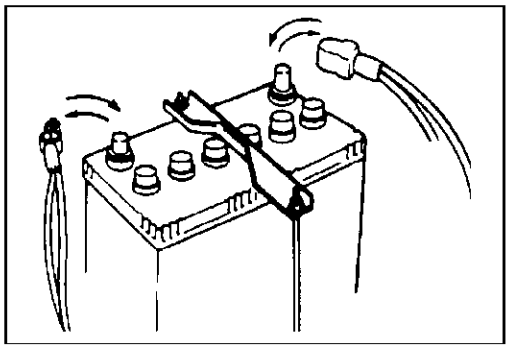


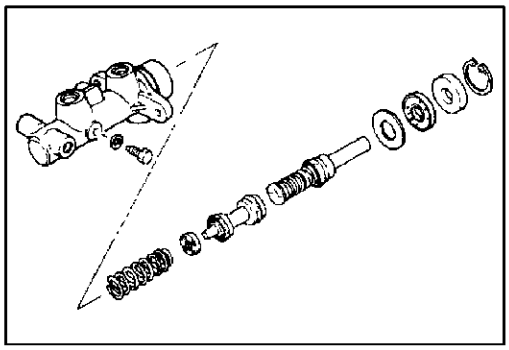
- Before starting any service work, cover fenders, seats and any other parts that are likely to get scratched or stained during servicing. Also, be aware that what you wear (e.g, buttons) may cause damage to the vehicle's finish.



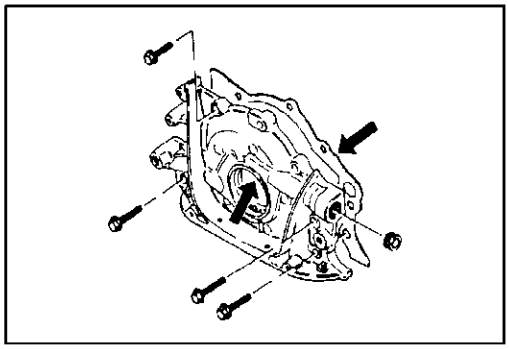
- When performing service to electrical parts that does not require use of battery power, disconnect the negative cable of the battery.



- 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.

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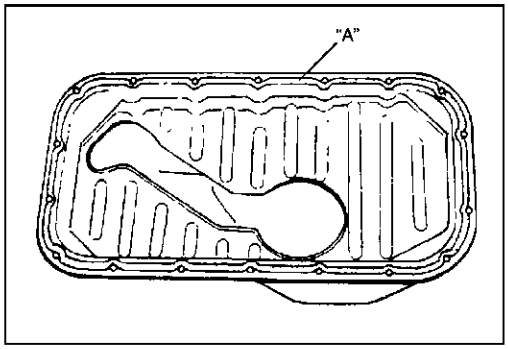
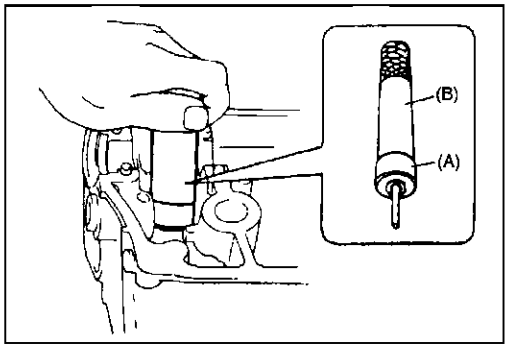


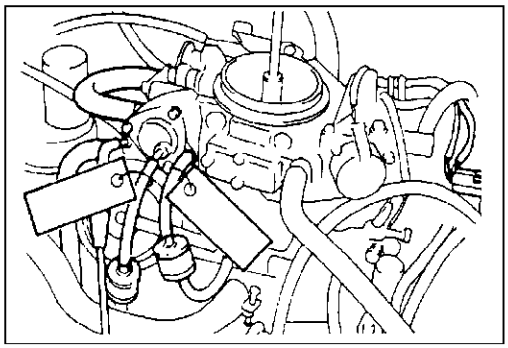
- Make sure that all parts used in reassembly are perfectly clean.
  When use of a certain type of lubricant, bond or sealant is specified, be sure to use the specified type.

  "A" : Sealant 99000-31150

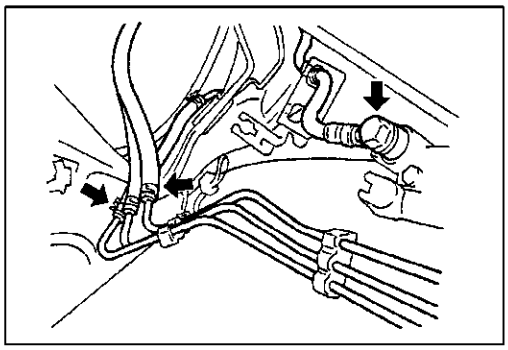


- Be sure to use special tools when instructed.

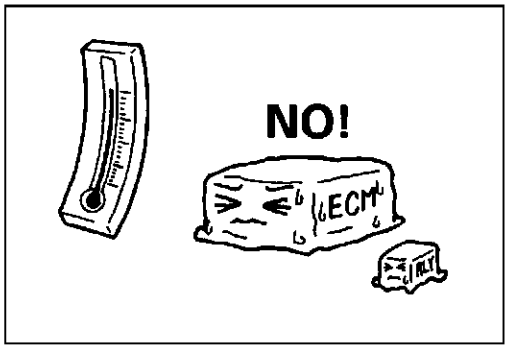
  Special Tool
  (A): 09917-98221
  (B): 09916-58210



- 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.

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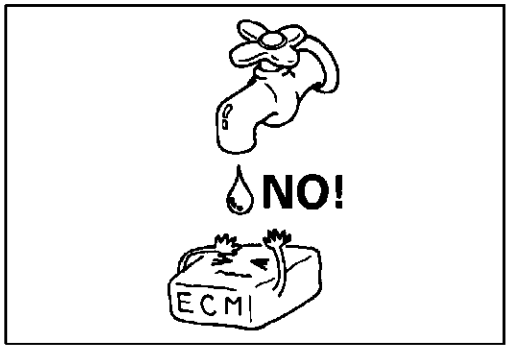
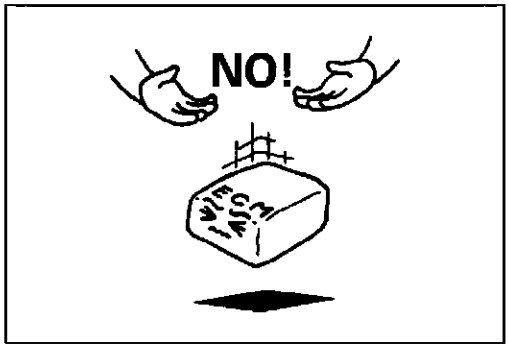


- Use care not to expose connectors and electrical parts to water which will be a cause of a trouble.



- 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.)

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.

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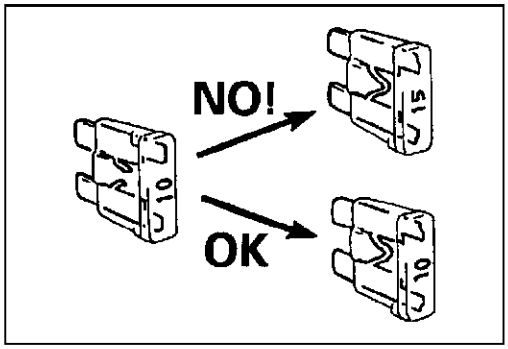
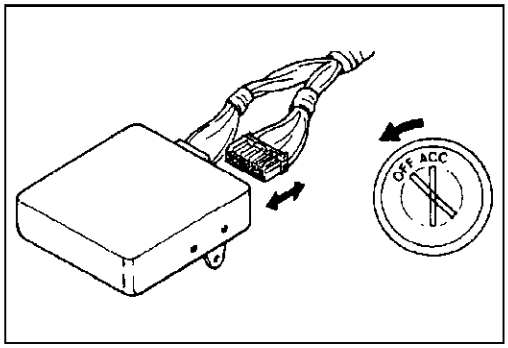
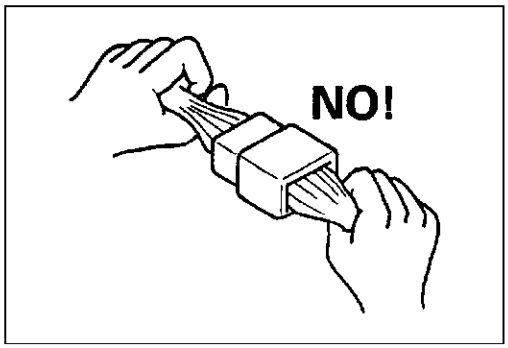


PRECAUTIONS FOR ELECTRICAL CIRCUIT SERVICE

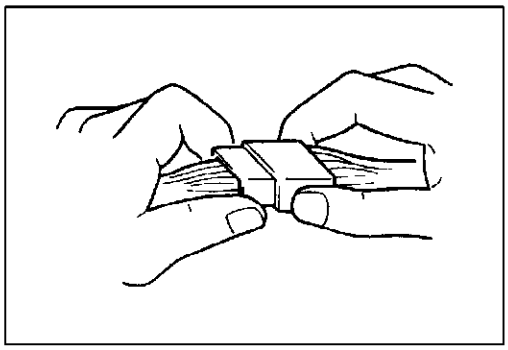
- When replacing a fuse, make sure to use a fuse of the specified capacity. Use of a fuse with a larger capacity will cause a damage to the electrical parts and a fire.



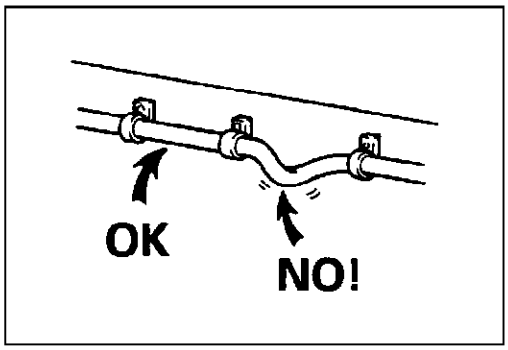
- When disconnecting and connecting coupler, make sure to turn ignition switch OFF, or electronic parts may get damaged.



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



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



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

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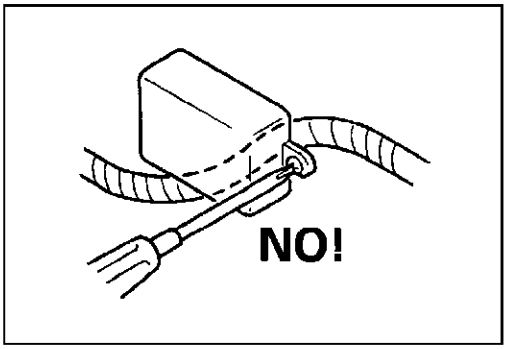
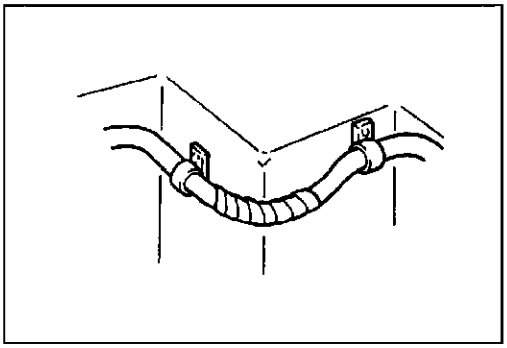
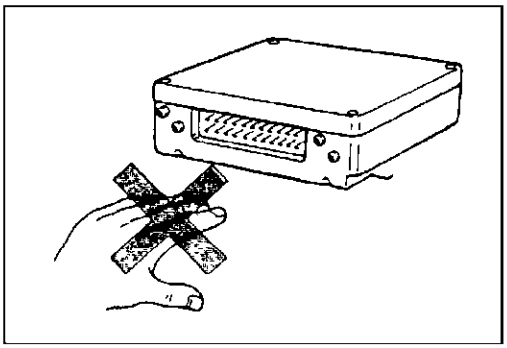


- When installing vehicle parts, be careful so that the wiring harness is not interfered with or caught by any other part.

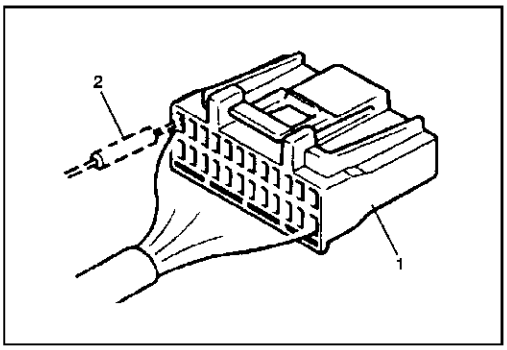


- To avoid damage to the harness, protect its part which may contact against a part forming a sharp angle by winding tape or the like around it.



- 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 dis-connected. Attempt to do it may cause damage to it.
- Never connect an ohmmeter to electronic control unit with its coupler connected to it. Attempt to do it may cause damage to electronic control unit and sensors.

- Be sure to use a specified voltmeter/ohmmeter. Otherwise, accurate measurements may not be obtained or personal injury may result. If not specified, use a voltmeter with high impedance (M Ω/V minimum) or a digital type voltmeter.



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

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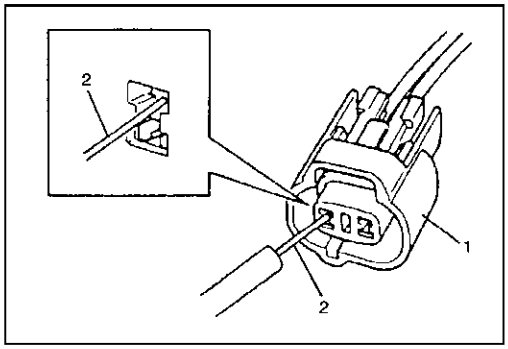
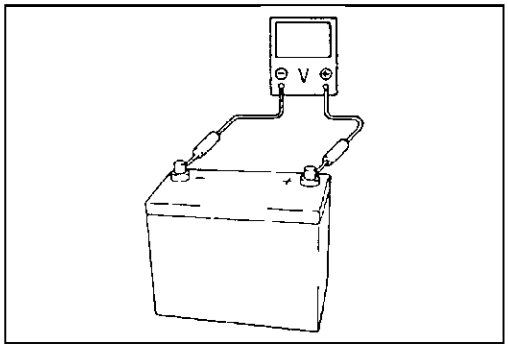


- **When connecting meter probe (2) from terminal side of coupler (1) because it can't be connected from harness side, use extra care not to bend male terminal of coupler of force its female terminal open for connection. In case of such coupler as shown connect probe as shown to avoid opening female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



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

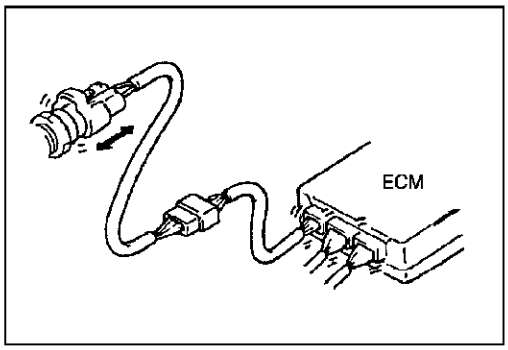
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

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

OPEN CIRCUIT CHECK

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

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



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

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

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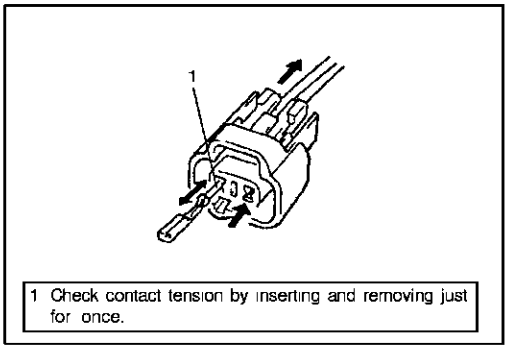
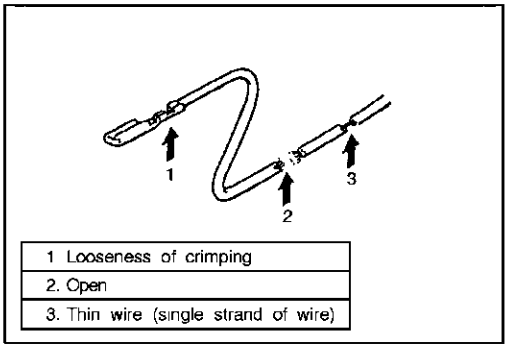


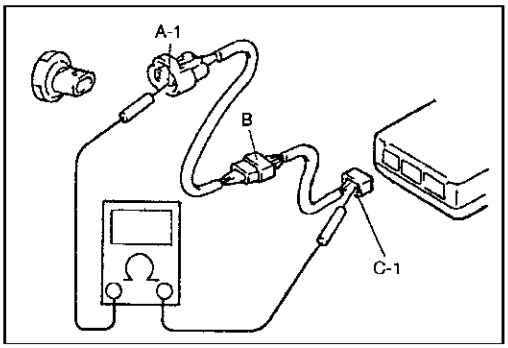
1 Check contact tension by inserting and removing just for once.

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.



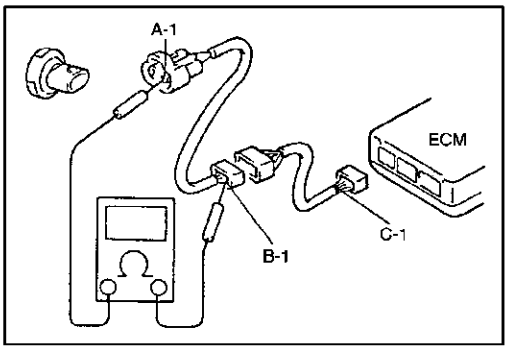
1 Looseness of crimping
2. Open
3. Thin wire (single strand of wire)

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



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.

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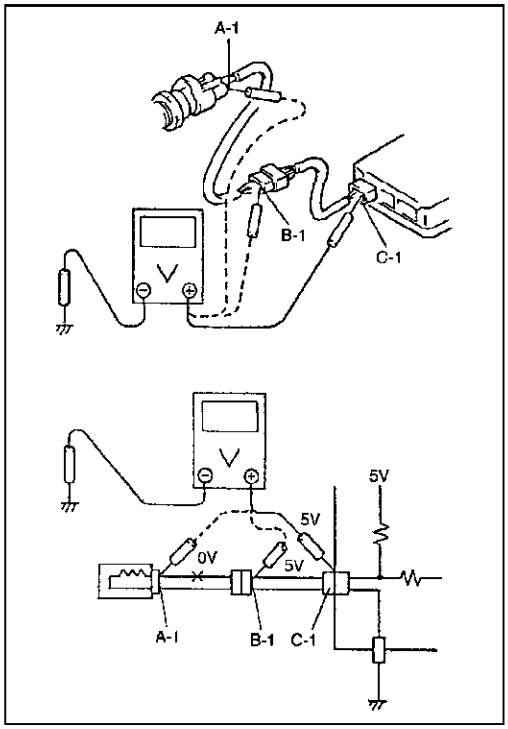
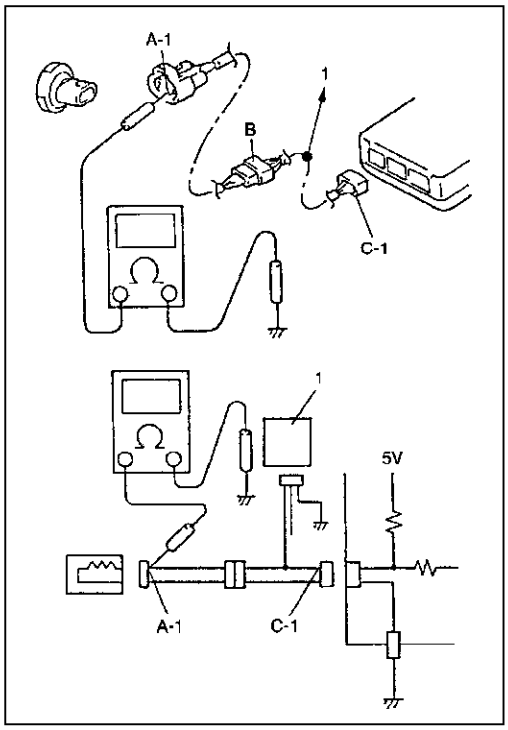


1) With all connectors connected and voltage applied to the circuit being checked, measure voltage between each terminal and body ground.
   a) If measurements were taken as shown in the figure and results were as listed below, it means that the circuit is open between terminals B-1 and A-1.

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

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

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

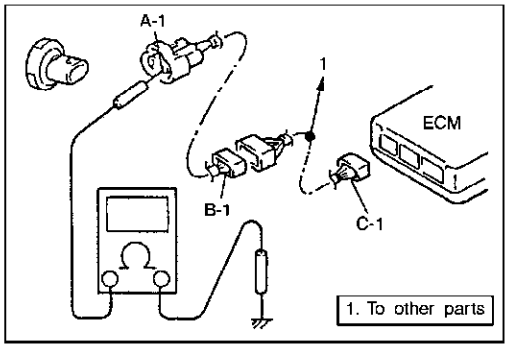


SHORT CIRCUIT CHECK (WIRE HARNESS TO GROUND)

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

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

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



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

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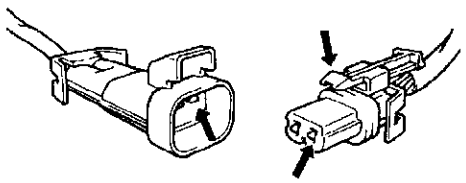
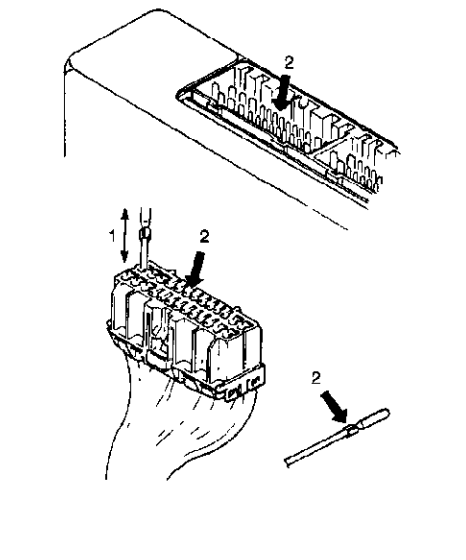


INTERMITTENT AND POOR CONNECTION

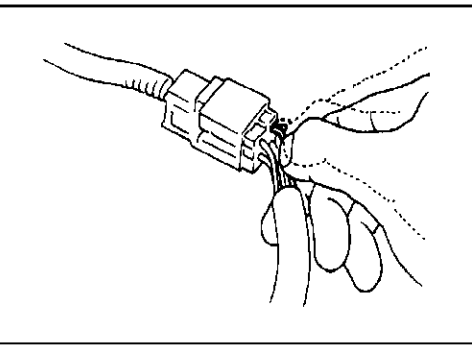
Most intermittent are caused by faulty electrical connections or wiring, although a sticking relay or solenoid can occasionally be at fault. When checking it for proper connection, perform careful check of suspect circuits for :

- 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.



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

- 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.



- 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.

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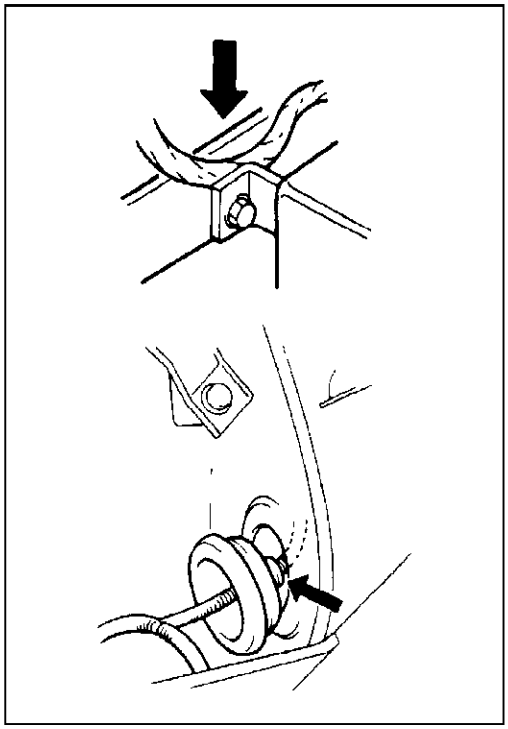

- Wire insulation which is rubbed through, causing an intermittent short as the bare area touches other wiring or parts of the vehicle.
- Wiring broken inside the insulation. This condition could cause continuity check to show a good circuit, but if only 1 or 2 strands of a multi-strand-type wire are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

If any abnormality is found, repair or replace.

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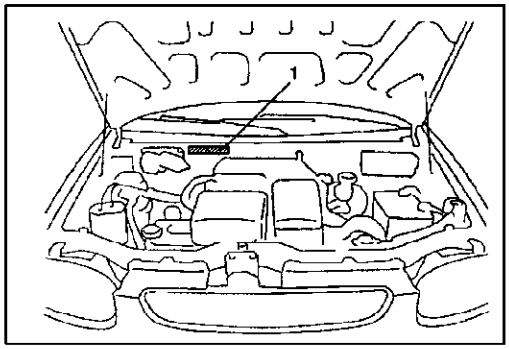
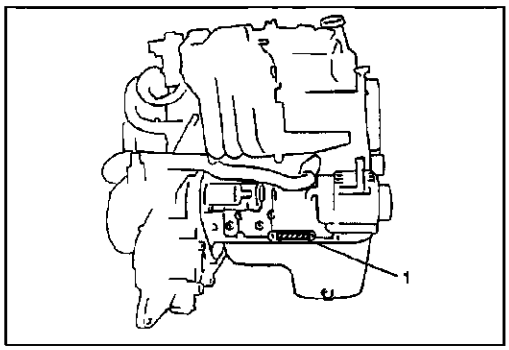


IDENTIFICATION INFORMATION

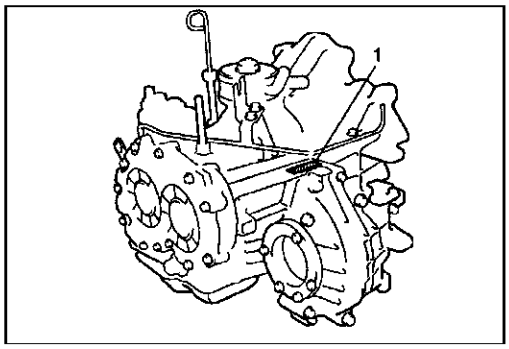
VEHICLE IDENTIFICATION NUMBER

The vehicle identification number (1) is punched on front dash panel in engine room.



ENGINE IDENTIFICATION NUMBER

The number (1) is punched on cylinder block.



TRANSMISSION IDENTIFICATION NUMBER

The automatic transmission identification number (1) is located on transmission case.

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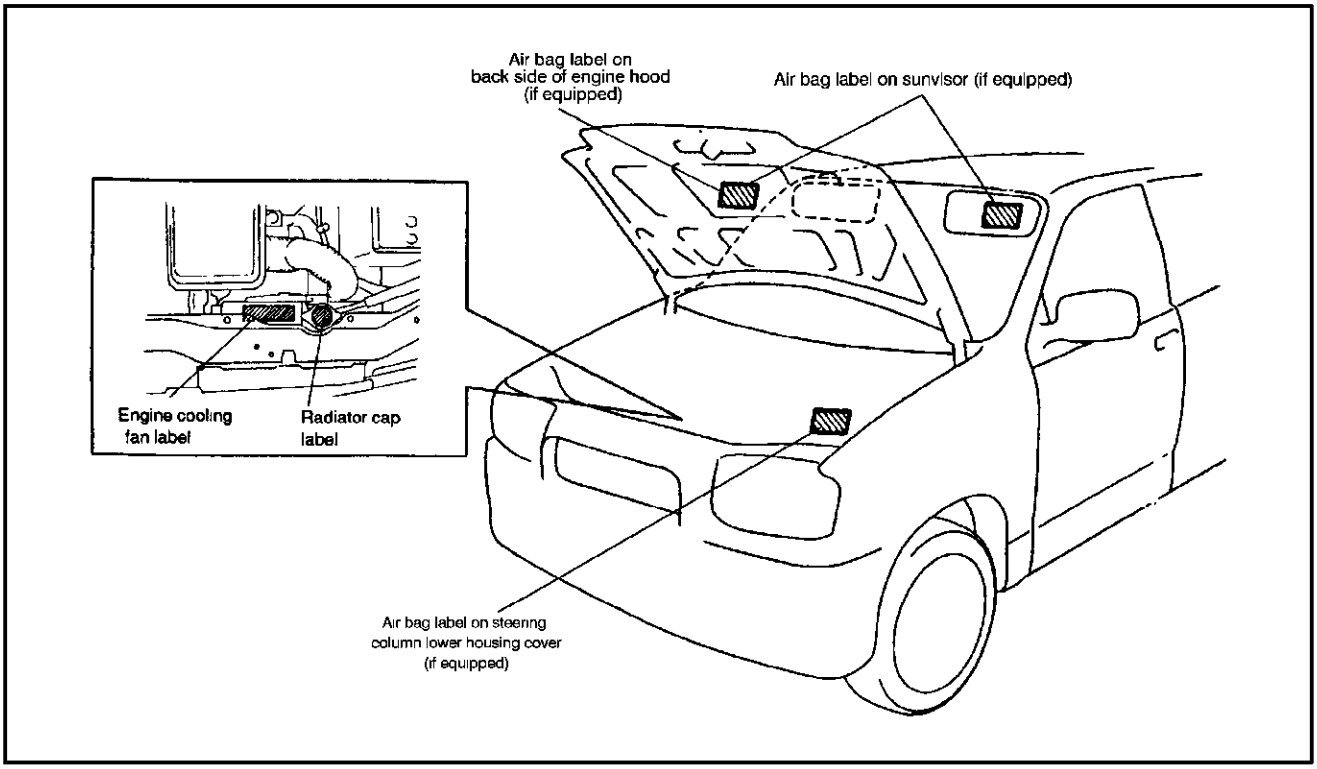
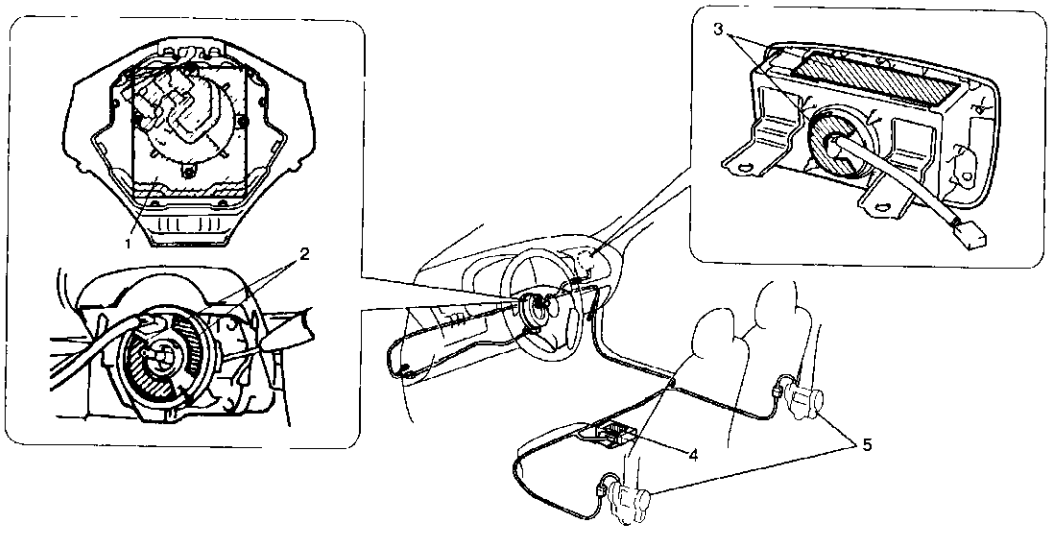
WARNING, CAUTION AND INFORMATION LABELS

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





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

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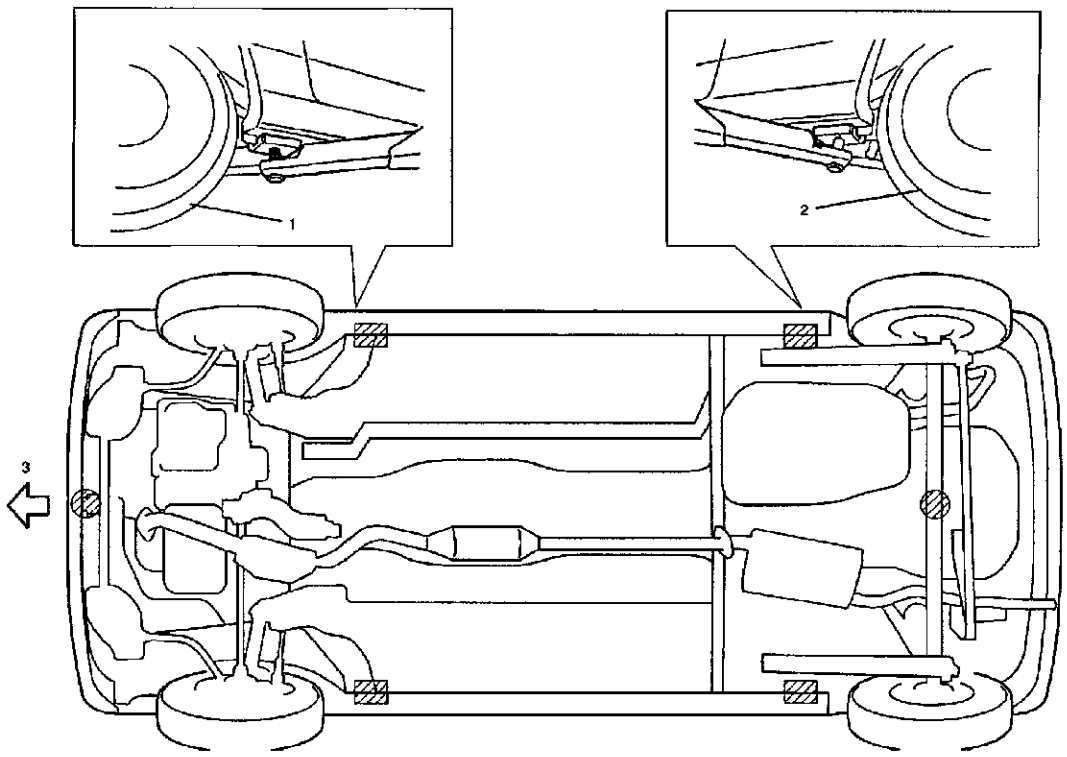
VEHICLE LIFTING POINTS

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 left tire	
2. Rear left tire	
3. Front	

	Support position for frame contact hoist and safety stand.
	Floor jack poistion

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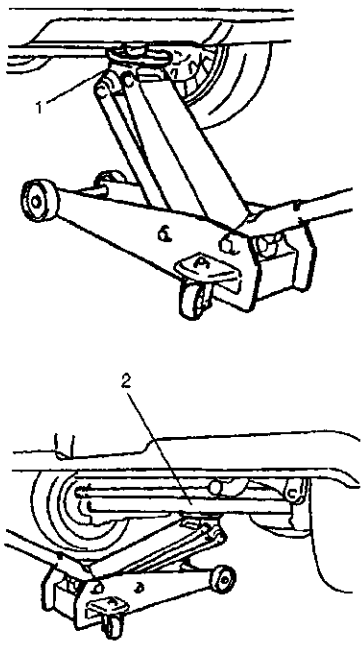
When using floor jack:

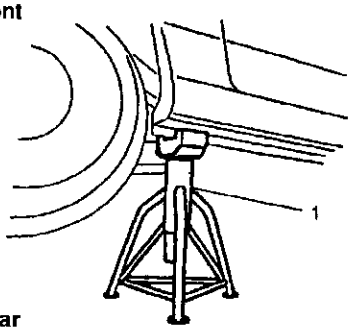


In raising front vehicle end off the floor by jacking, be sure to jack against the front bracket (1).
In raising rear vehicle end off the floor by jacking, be sure to apply jack against the center protion of rear axle (2).

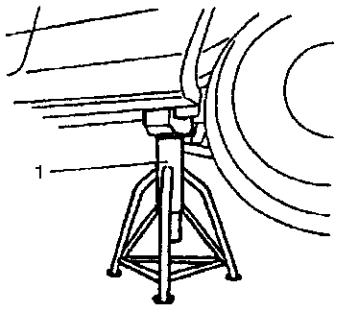
CAUTION:
- **Never apply jack against suspension parts (i.e., stabilizer, etc) or vehicle floor, or it may get deformed.**

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.

Front



Rear



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

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ABBREVIATIONS AND SYMBOLS MAY BE USED IN THIS MANUAL

ABBREVIATIONS

A

ABS	:	Anti-lock Brake System
ATDC	:	After Top Dead Center
API	:	American Petroleum Institute
ATF	:	Automatic Transmission Fluid,
ALR	:	Automatic Locking Retractor
AC	:	Alternating Current
A/T	:	Automatic Transmission
A/C	:	Air Conditioning
ABDC	:	After Bottom Dead Center
A/F	:	Air Fuel Mixture Ration
A-ELR	:	Automatic-Emergency Locking Retractor

B

B+	:	Battery Positive Voltage
BTDC	:	Before Top Dead Center
BBDC	:	Before Bottom Dead Center

C

CKT	:	Circuit
CMP sensor	:	Camshaft Position Sensor (Crandk 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
DLC	:	Data Link Connector (Assembly Line Diag. Link, ALDL, Serial Data Link, SDL)
DOHC	:	Double Over Head Camshaft
DOJ	:	Double Offset Joint
DRL	:	Daytime Running Light
DTC	:	Diagnostic Trouble Code (Diagnostic Code)

E

EBCM	:	Electronic Brake Control Module, ABS Control Module
ECM	:	Engine Control Module.
ECT sensor	:	Engine Coolant Temperature Sensor (Water Temp. Sensor, WTS)
EGR	:	Exhaust Gas Recirculation
EGRT Sensor	:	EGR Temperature Sensot (Recirculated Exhaust Gas Temp. Sensor, REGTS)
EFE Heater	:	Early Fuel Evaporation Heater (Positive Temperature Coefficient, PTC Heater)
ELR	:	Emergency Locking Retractor
EPS	:	Electronic Power Steering
EVAP	:	Evaporative Emission
EVAP Canister	:	Evaporative Emission Canister (Charcoal Canister)

F

4WD	:	4 Wheel Drive

G

GEN	:	Generator
GND	:	Ground

H

HC	:	Hydrocarbons
HO2S	:	Heated Oxygen Sensot

I

IAC Valve	:	Idle Air Control Valve (Idle Speed Control Solenoid Valve ISC Solenoid Valve)
IAT Sensor	:	Intake Air Temperature Sensor (Air temperature Sensor, ATS)
ICM	:	Immobilizer Control Modulr
IG	:	Ignition
ISC Actuator	:	Idle Speed Control Actuator (Motor)
ISO	:	International Standards Organization

J

JIS	:	Japanese Industrial Standard

L

LH	:	Left Hand
LSPV	:	Load Sensing Proportioning Valve

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M

- MAF Sensor: 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
- 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

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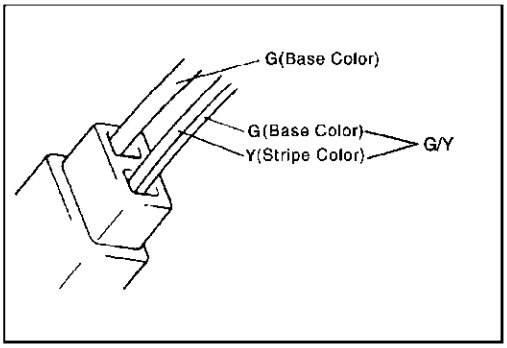
SYMBOLS

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. 1207C 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. “G”). The dual-colored wire uses two color symbols (i.e. “G/Y”). The first symbol represents the base color of the wire (“G” in the figure) and the second symbol represents the color of the stripe (“Y” in the figure).

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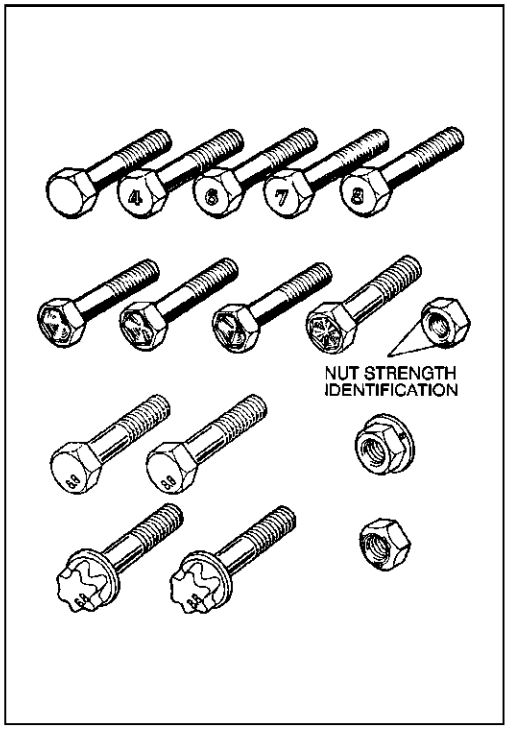
FASTENER INFORMATION

METRIC FASTENERS

Most of the fasteners used for this vehicle are metric. 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).

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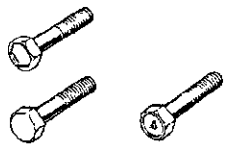
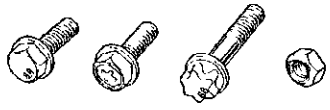
STANDARD TIGHTENING TORQUE

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:

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

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SECTION 0B

MAINTENANCE AND LUBRICATION

CONTENTS

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MAINTENANCE SCHEDULE

MAINTENANCE SCHEDULE UNDER NORMAL DRIVING CONDITIONS

Interval: This interval should be judged by odometer reading or months, whichever comes first.	This table includes services 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:						
	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
1. ENGINE							
1-1 Water pump drive belt (tension, wear)	V-rib belt	—	—	I	—	—	R
1-2 Camshaft timing belt		Replace every 100,000 km or 60,000 miles					
1-3 Valve lash (clearance)		—	I	—	I	—	I
1-4 Engine oil and Engine oil filter	SE,SF grade oil	Replace every 10,000 km (6,000 miles) or 8 months					
	SG,SH,SJ,SL grade oil	R	R	R	R	R	R
1-5 Engine coolant		—	R	—	R	—	R
1-6 Exhaust system (leakage, damage, tightness)		—	I	—	I	—	I
2. IGNITION SYSTEM							
2-1 Spark plugs		—	—	R	—	—	R
3. FUEL SYSTEM							
3-1 Air cleaner filter	Paved-road	I	I	R	I	I	R
	Dusty condition	Refer to "Severe Driving Condition" schedule					
3-2 Fuel lines (deterioration, leakage, damage)		—	I	—	I	—	I
3-3 Fuel filter		Replace every 105,000 Km or 63,000 miles					
3-4 Fuel tank		—	—	I	—	—	I
4. EMISSION CONTROL SYSTEM							
4-1 PCV (Positive Crankcase Ventilation) valve		—	—	—	—	—	I
4-2 Fuel evaporative emission control system		—	—	—	—	—	I
5. BRAKE							
5-1 Brake discs and pads (thickness, wear, damage)		I	I	I	I	I	I
Brake drums and shoes (wear, damage)		—	I	—	I	—	I
5-2. Brake hoses and pipes (leakage, damage, clamp)		—	I	—	I	—	I
5-3. Brake fluid		—	R	—	R	—	R
5-4. Brake lever and cable (damage, stroke, operation)		Inspect at first 15,000 km (9,000 miles) only					

NOTES:

- **"R": Replace or change**
- **"I": Inspect and correct or replace if necessary**
- **For Item 1-2 Camshaft timing belt: This belt may be replaced every 90,000 km (54,000 miles) according to customer's maintenance convenience.**
- **For Sweden, item 2-1, 4-1 and 4-2 should be performed by odometer reading only.**
- **For item 2-1 spark plug, replace every 50,000 km if the local law requires.**

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Interval: This interval should be judged by odometer reading or months, whichever comes first.	This table includes services 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:						
	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
6. CHASSIS AND BODY							
6-1 Clutch pedal (For manual transmission)		—	I	—	I	—	I
6-2 Tires/wheel discs (wear, damage, rotation)		I	I	I	I	I	I
6-3 Drive shaft boots (breakage, damage)		—	—	I	—	—	I
6-4 Suspension system (tightness, damage, rattle, breakage)		—	I	—	I	—	I
6-5 Steering system (tightness, damage, breakage, rattle)		—	I	—	I	—	I
6-6 Manual transmission oil (leakage, level) ("I": 1st 15,000km only)		I	—	R	—	—	R
6-7 Automatic transmission	Fluid level	—	I	—	I	—	I
	Fluid change	Replace every 165,000 km (99,000 miles)					
6-8 All latches, hinges and locks		—	I	—	I	—	I

NOTES:

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

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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 given in the chart below.

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 – – – – – – – –
G – – – – – – – –
H – Trailer towing

Severe Condition Code	Maintenance	Maintenance Operation	Maintenance Interval
– B C D – – – –	ITEM 1-1 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 – – H	ITEM 1-4 Engine oil and oil filter	R	Every 5,000 km (3,000 miles) or 4 months
A B C – E – – H	ITEM 2-1 Spark plugs	R	Every 10,000 km (6,000 miles) or 8 months
– – C – – – – –	ITEM 3-1 Air cleaner filter *1	I	Every 2,500 km (1,500 miles)
		R	Every 30,000 km (18,000 miles) or 24 months
– B C D – – – H	ITEM 6-2 Wheel bearings	I	Every 15,000 km (9,000 miles) or 12 months
– B – D E – – H	ITEM 6-3 Drive shaft boots	I	Every 15,000 km (9,000 miles) or 12 months
– B – – E – – H	ITEM 6-6 Manual transmission oil	I	First 15,000 Km (9,000 miles) or 12 months only
		R	Every 30,000 km (18,000 miles) or 24 months
– B – – E – – H	ITEM 6-7 Automatic transmission fluid	R	Every 30,000 km (18,000 miles) or 24 months

NOTES:

- **"R": Replace or change**
- **"I": Inspect and correct or replace if necessary**
- ***1: Inspect or replace more frequently if necessary.**

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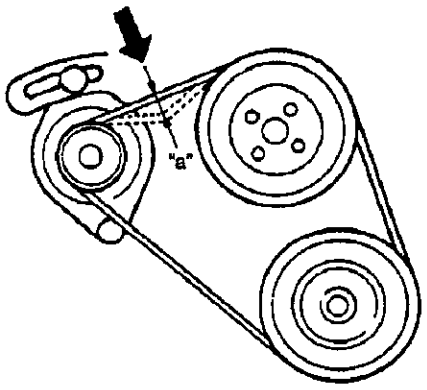
MAINTENANCE SERVICE

ENGINE

ITEM 1-1
Drive Belt Inspection and Replacement

WARNING:
Disconnect negative cable at battery before checking and replacing belt tension.

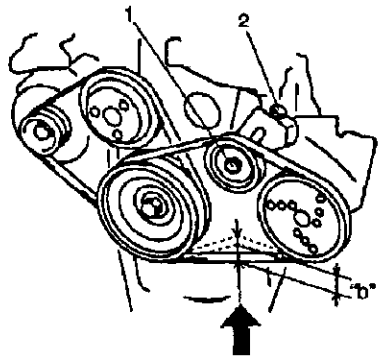


Water pump belt replacement

1) Disconnect negative cable from battery.
2) Inspect belt for cracks, cuts, deformation, wear and cleanliness. Replace if any defect exists.
3) Check pump belt for tension and adjust if it is out of specification.
   Water pump belt tension "a":
   12 – 15 mm (0.45 – 0.6 in.) deflection under 100N, 10 kg or 22 lb pressure
   NOTE:
   When replacing belt with a new one, adjust belt tension to 8 – 9 mm (0.3 – 0.35 in.).
4) Connect negative cable to battery.

Water pump belt replacement

Replace belt with new one referring to "Water Pump Belt Removal and Installation" in SECTION 6B.



A/C compressor drive belt inspection (If equipped)

1) Disconnect negative cable from battery.
2) Inspect belt for cracks, cuts, wear and deterioration.
   Replace if any defect exists.
3) Check belt for tension.
   A/C compressor drive belt tension "b":
   8 – 9 mm (0.31 – 0.35 in.) deflection under 100N, 10 kg or 22 lb pressure
3) If belt tension is out of above specification, adjust it as follows.
   a) Loosen tensioner bolt (1).
   b) Adjust belt tension to specification by turning adjusting bolt (2).
   c) Tighten tensioner bolt.
4) Connect negative cable to battery.

A/C compressor drive belt replacement

1) Disconnect negative cable from battery.
2) Loosen belt tension and replace belt with new one.
3) Adjust belt tension to specification.
4) Connect negative cable to battery.

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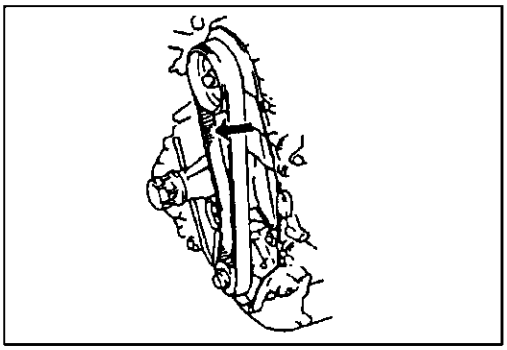
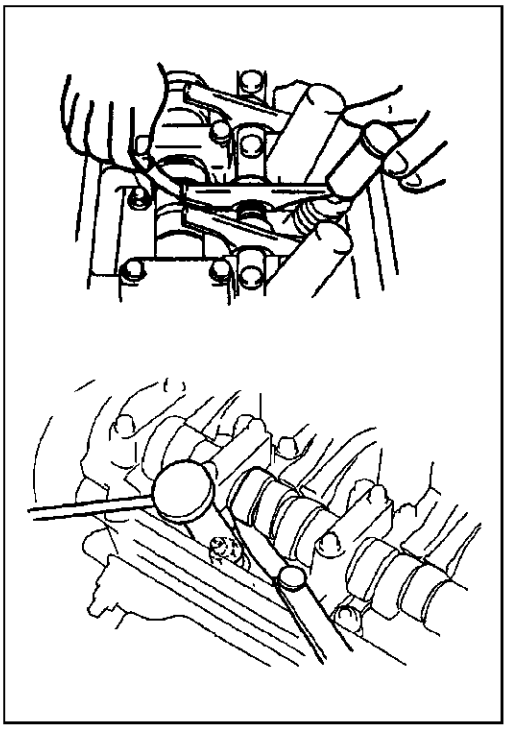


ITEM 1-2

Camshaft Timing Belt Replacement

Replace belt with new one. Refer to SECTION 6A for replace-ment procedure.

CAUTION:
- **Do not bent or twist timing belt.**
- **Do not allow timing belt to come into contact with oil, water, etc.**



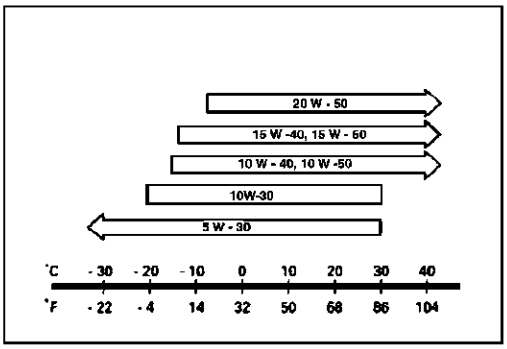
ITEM 1-3

Valve Lash Inspection

1) Remove cylinder head cover.
2) Inspect intake and exhaust valve lash and adjust as necessary. Refer to SECTION 6A for valve lash inspection and adjust-ment procedure.

Valve lash (clearance) specifica-tion		When cold (Coolant tem-perature is 15-25°C or 59-77°F)	When hot (Coolant temperature is 60-68°C or 140-154°F)
	Intake	0.13-0.17 mm (0.005-0.007 in)	0.15-0.19mm (0.006-0.007 in)
	Exhaust		0.14-0.18 mm (0.006-0.007 in)

3) Install cylinder head cover and tighten bolts to specification.



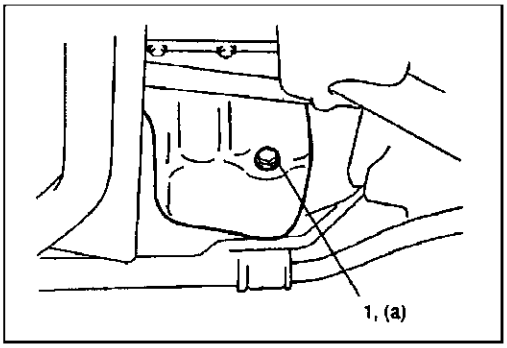
ITEM 1-4

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.

Use engine oil of SE, SF, SG, SH, SJ or SL grade.

Select the appropriate oil viscosity according to the left chart.



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 (1).
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, 36.0 lb-ft)

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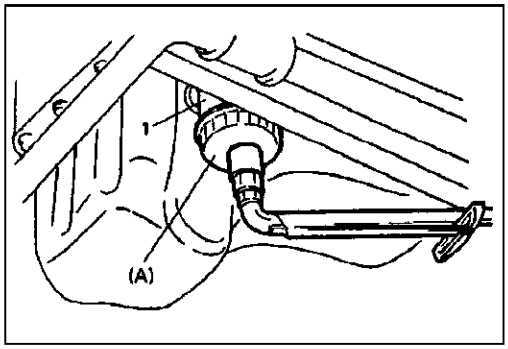
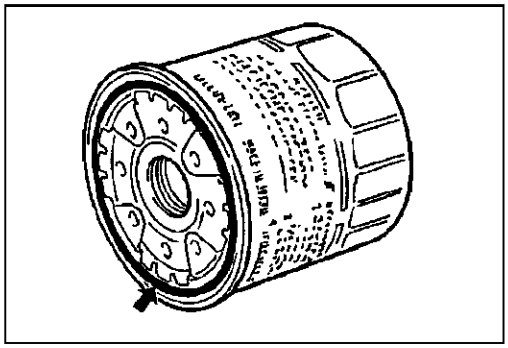
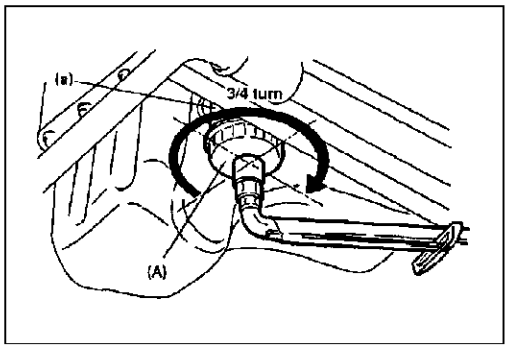


3) Loosen oil filter (1) by using oil filter wrench (Special tool).
Special Tool
(A): 09915-47340

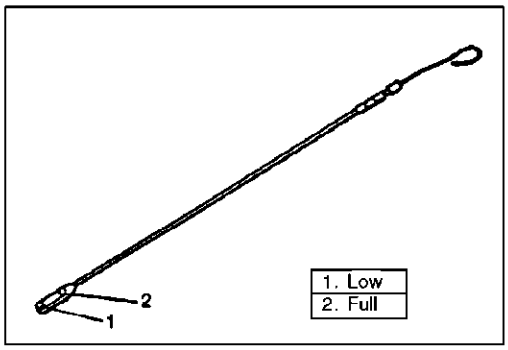


4) Apply engine oil to new oil filter "O" ring.
5) Screw new filter on oil filter stand by hand until filter "O" ring contacts mounting surface.

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



6) Tighten filter 3/4 turn from the point of contact with mounting surface using an oil filter wrench.
Special Tool
(A): 09915-47340
Tightening Torque (Reference)
(a): 14 N-m (1.4 kg-m, 10.5 lb-ft)



7) Replenish oil until oil level is bought to FULL level mark on dipstick (oil pan and oil filter capacity). Filler inlet is at the top of cylinder head cover.
8) Start engine and run it for three minutes. Stop it and wait another 5 minutes before checking oil level. Add oil, as necessary, to bring oil level to FULL level mark on dipstick.

Engine oil capacity

Oil pan capacity	about 3.5 liters (7.4/6.2 US/Imp pt.)
Oil filter capacity	about 0.2 liter (0.4/0.3 US/Imp pt.)
Others	about 0.3 liter (0.6/0.5 US/Imp pt.)
Total	about 4.0 liters (8.5/7.0 US/Imp pt.)

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

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

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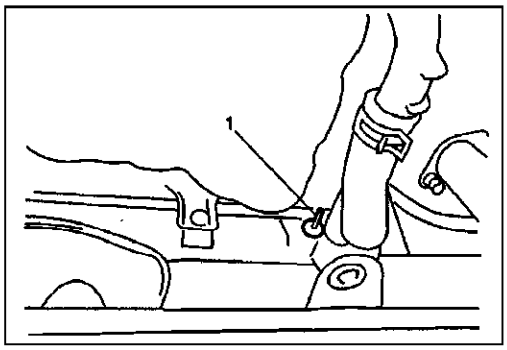
ITEM 1-5

Engine Coolant Change

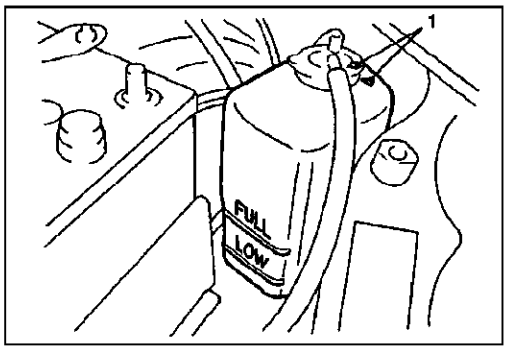
WARNING:
To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

CAUTION:
When changing engine coolant, use mixture of 50% water and 50% ethylene-glycol base coolant (Anti-Freeze/Anti-corrosion coolant) for the market where ambient temperature falls lower than –16°C (3°F) in winter and mixture of 70% water and 30% ethylene-glycol base coolant for the market where ambient temperature doesn't fall lower than –16°C (3°F).
Even in a market where no freezing temperature is anticipated, mixture of 70% water and 30% ethylene-glycol base coolant should be used for the purpose of corrosion protection and lubrication.

Refer to SECTION 6B of this manual for coolant capacity.



1) Remove radiator cap when engine is cool.
2) Loosen radiator drain plug (1) to drain coolant.
3) Remove reservoir and drain.
4) Tighten drain plug securely. Also install reservoir.



5) Slowly pour specified amount of coolant to the base of radiator filler neck, and run engine, with radiator cap removed, until radiator upper hose is hot. This drives out any air which may still be trapped within cooling system. Add coolant as necessary until coolant level reaches filler throat of radiator. Reinstall radiator cap.
6) Add coolant to reservoir so that its level aligns with FULL level line. Then, reinstall cap to reservoir aligning match marks (1) on the reservoir and cap.

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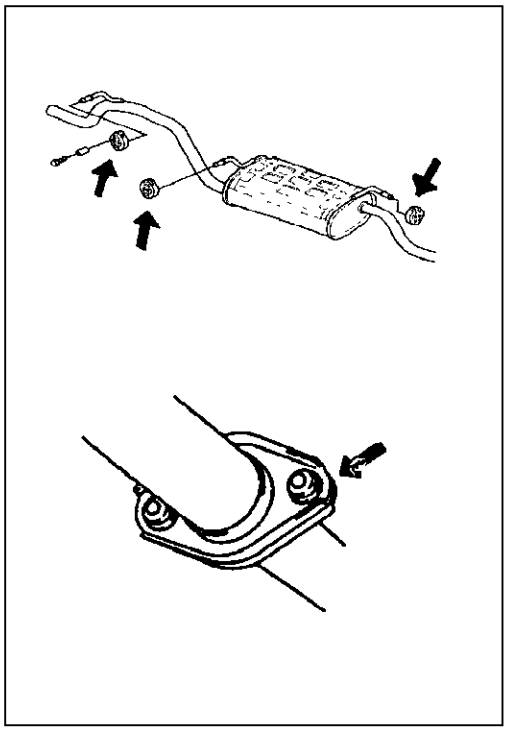
ITEM 1-6

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 vehicle is raised for other service, check exhaust system as follows:

- Check rubber mountings for damage and deterioration.
- Check exhaust system for leakage, loose connections, dents and damages.

  If bolts or nuts are loose, tighten them to specification.

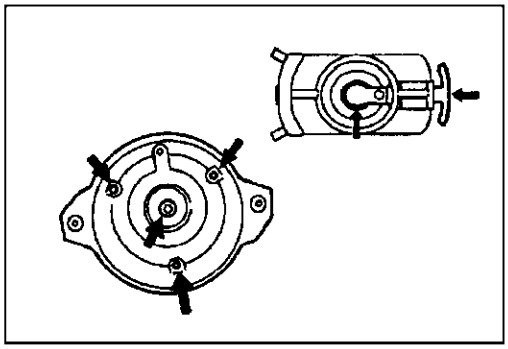
  Refer to SECTION 6K for torque specification of bolts and nuts.
- Check nearby body areas for damaged, missing or mispositioned parts, open seams, holes, loose connections or other defects which could permit exhaust fumes to seep into vehicle.
- Make sure that exhaust system components have enough clearance from underbody to avoid overheating and possible damage to floor carpet.
- Any defects should be fixed at once.

IGNITION SYSTEM

ITEM 2-1

Spark Plugs Replacement

Replace spark plugs with new ones referring to SECTION 6F1.



ITEM 2-2

Distributor Cap and Rotor Inspection

- Check distributor cap and rubber caps for cracks.
- Clean dusty and stained parts using a dry, soft cloth.
- Check center electrode and terminals for wear.
- Check rotor for cracks and its electrode for wear.

Repair or replace any component which is found to be in malcondition.

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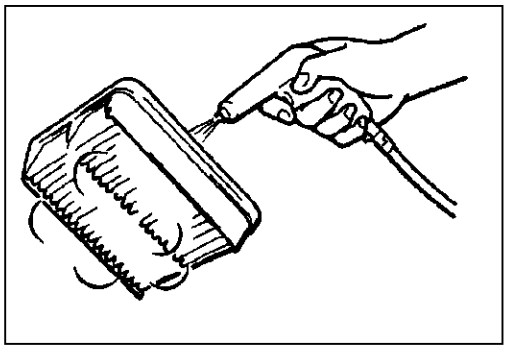


FUEL SYSTEM

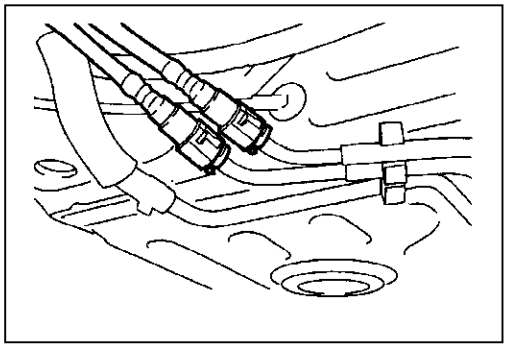
ITEM 3-1

Air Cleaner Filter Inspection

1) Unclamp air cleaner case clamps.
2) Take cleaner filter out of air cleaner case.
3) Visually check that air cleaner filter is not excessively dirty, damaged or oily.
4) Clean filter with compressed air from air outlet side of filter.
5) Install air cleaner filter into case referring to SECTION 6A.
6) Clamp case securely.

Air Cleaner Filter Replacement

Replace air cleaner filter with new one according to steps 1), 2), 5) and 6) of above Air Cleaner Filter Inspection.



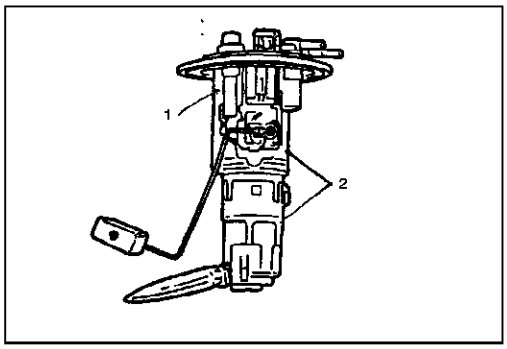
ITEM 3-2

Fuel Lines Inspection

Check fuel lines for loose connection, deterioration or damage which could cause leakage. Make sure all clamps are secure.

Replace any damaged or deteriorated parts.

There should be no sign of fuel leakage or moisture at any fuel connection.



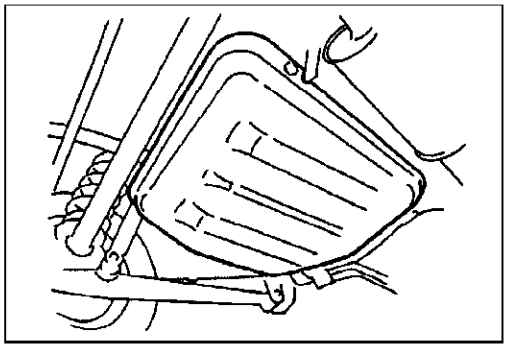
ITEM 3-3

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 installed in fuel pump assembly (2).

Replace fuel filter with new one, referring to SECTION 6C for removal and installation.



ITEM 3-4

Fuel Tank Inspection

Check fuel tank for damage, cracks, fuel leakage, corrosion and tank bolts looseness.

If a problem is found, repair or replace.

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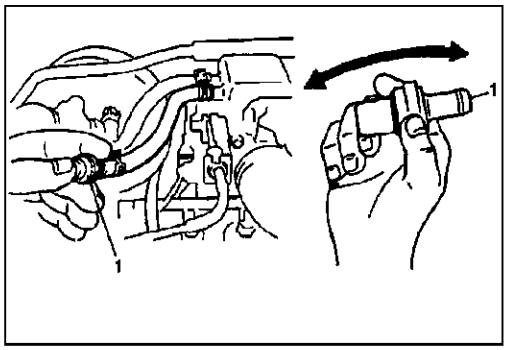
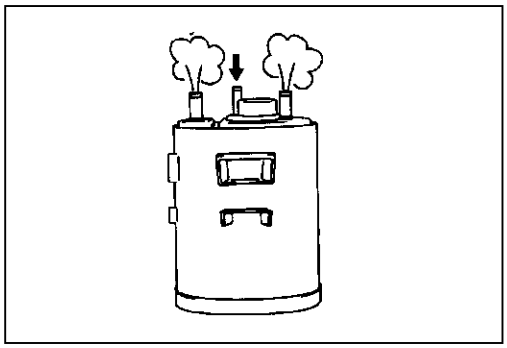


EMISSION CONTROL SYSTEM

ITEM 4-1

PCV (Positive Crankcase Ventilation) Valve Inspection

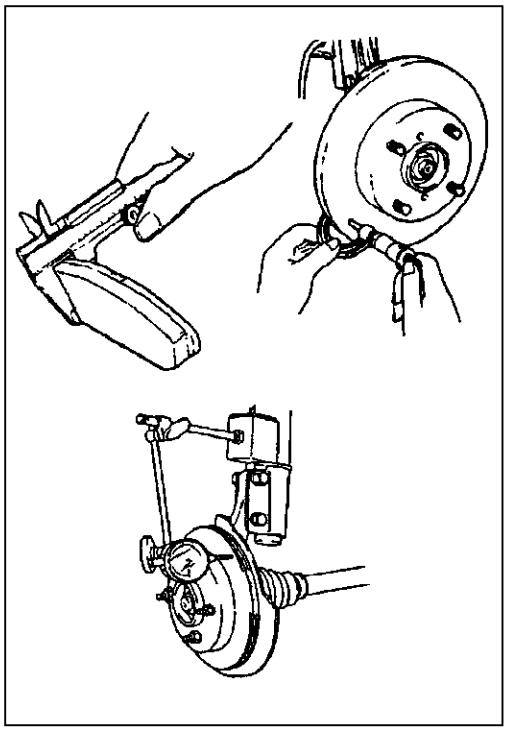
Check crankcase ventilation hoses and PCV hoses for leaks, cracks or clog, and PCV valve (1) for stick or clog. Refer to SECTION 6E1 for PCV valve checking procedure.



ITEM 4-2

Fuel Evaporative Emission Control System (if equipped)

Check EVAP (Evaporative Emission) canister and hoses for damage, clog and operation referring to SECTION 6E1.



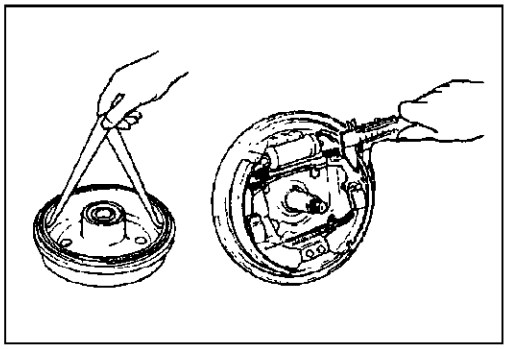
BRAKE

ITEM 5-1

Brake Discs, Pads, Drums and Shoes Inspection

Brake discs and pads

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 the details, refer to SECTION 5.
3) Install caliper and wheel.



Brake drums and shoes

1) Remove wheel and brake drum.
2) Check rear brake drums and brake linings for excessive wear and damage.

   At the same time, check wheel cylinders for leakage.

   Replace as necessary.

   For the details, refer to SECTION 5.
3) Install brake drum and wheel.

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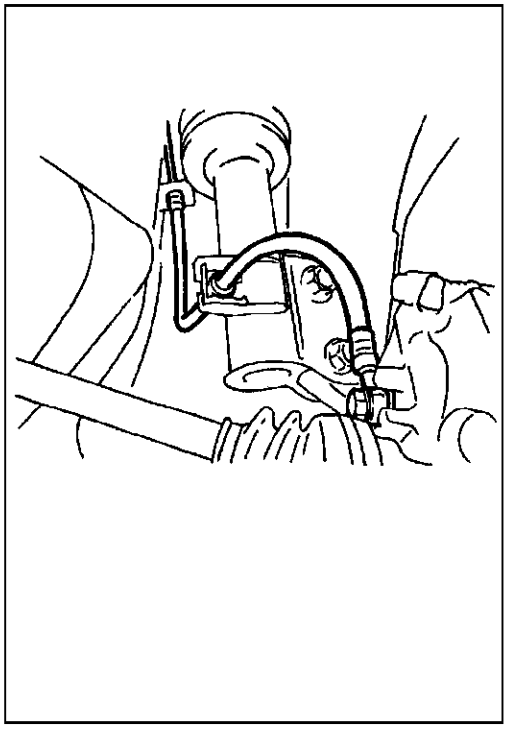

ITEM 5-2
Brake Hoses and Pipes Inspection

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

- Check brake hoses and pipes for proper hook-up, leaks, cracks, chafing, wear, corrosion, bends, twists and other damage.
  Replace any of these parts as necessary.
- Check all clamps for tightness and connections for leakage.
- Check that hoses and pipes are clear of sharp edges, moving parts.

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

ITEM 5-3
Brake Fluid Change

CAUTION:
Since brake system of this vehicle is factory-filled with brake fluid indicated on reservoir 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.

Change brake fluid as follows.

Drain existing fluid from brake system completely, fill system with specified fluid and carry out air purge operation.

For air purging procedure, refer to SECTION 5.

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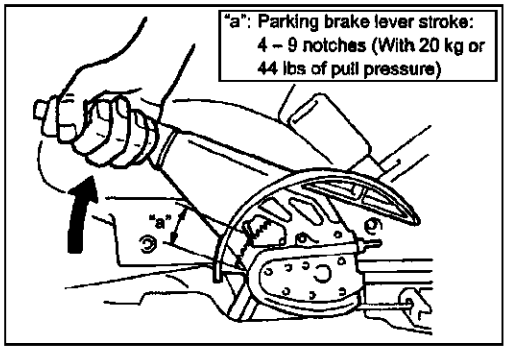
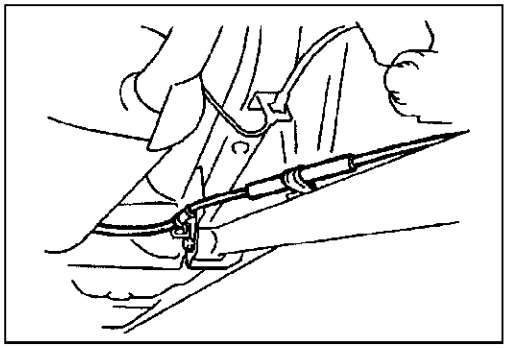


ITEM 5-4
Brake Lever and Cable Inspection
Parking brake lever

- Check tooth tip of each notch for damage or wear. If any damage or wear is found, replace parking lever.
- Check parking brake lever for proper operation and stroke, and adjust it if necessary.

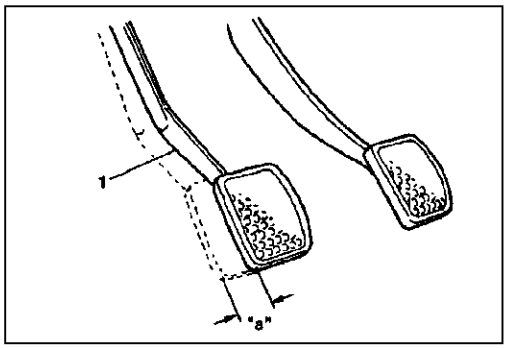
  For checking and adjusting procedures, refer to SECTION 5.



Parking brake cable

Inspect brake cable for damage and smooth movement.

Replace cable if it is in deteriorated condition.

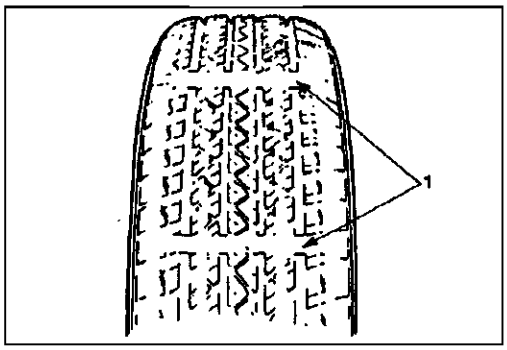


CHASSIS AND BODY

ITEM 6-1
Clutch Pedal Free Travel Inspection

Check clutch pedal (1) for height and free travel "a" referring to SECTION 7C.

Adjust or correct if necessary.



ITEM 6-2
Tire and Wheel Disc Inspection

[Tire inspection]

1) Check tire for uneven or excessive wear, or damage. If defective, replace.

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

   NOTE:

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

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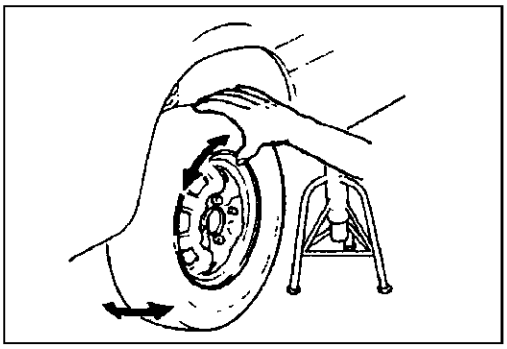
[Wheel disc inspection]

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

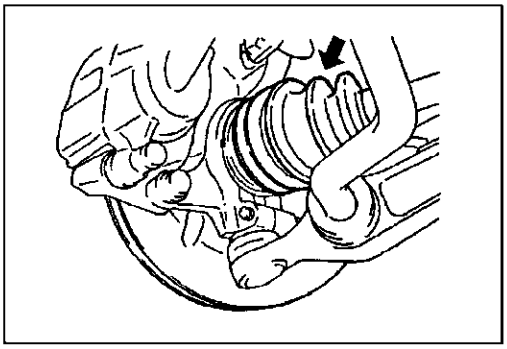
[Tire rotation]

Rotate tires referring to SECTION 3F.



Wheel Bearing Inspection

1) Check front wheel bearing for wear, damage, abnormal noise or rattles. For details, refer to SECTION 3D.
2) Check rear wheel bearing for wear, damage abnormal noise or rattle. For details, refer to SECTION 3E.

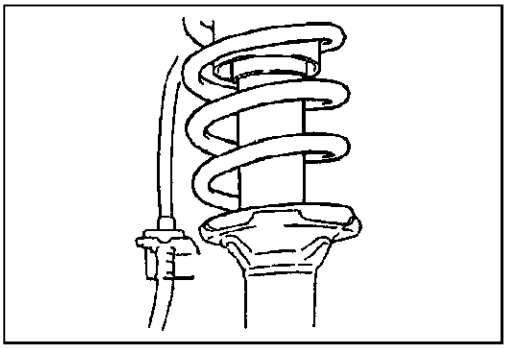


ITEM 6-3

Drive Shaft (Axle) Boot Inspection

Check drive shaft boots (wheel side and differential side) for leakage, detachment, tear or any other damage.

Replace boot as necessary.

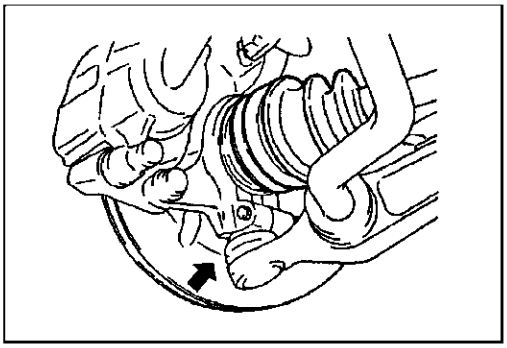


ITEM 6-4

Suspension System Inspection

- Inspect front strut and rear shock absorber for evidence of oil leakage, dents or any other damage on sleeves; and inspect anchor ends for deterioration.

  Replace defective parts, if any.



- Check front and rear suspension systems for damaged, loose or missing parts; also for parts showing signs of wear or lack of lubrication.

  Repair or replace defective parts, if any.
- Check front suspension arm ball joint stud dust seals (boots) for leakage, detachment, tear or any other damage.

  Replace defective boot, if any.

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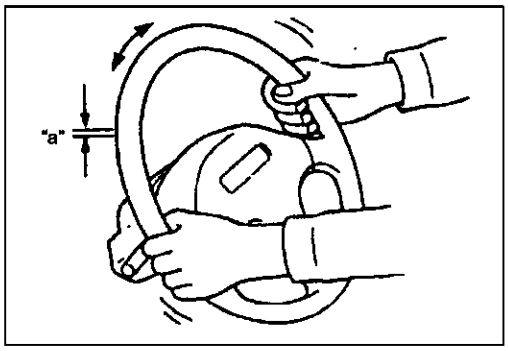
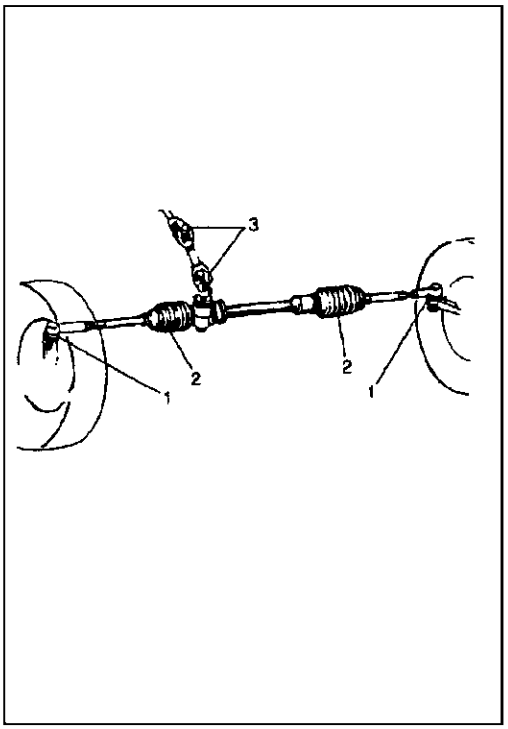


ITEM 6-5

Steering System Inspection

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

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



2) Check universal joints (3) of steering shaft for rattle and damage.If rattle or damage is found, replace it with a new one.
3) Check steering column and gear case mounting bolts and nuts for tightness and retighten them as necessary. Repair or replace defective parts, if any.
4) Check steering linkage for looseness and damage. Repair or replace defective parts, if any.
5) Check boots (1) and (2) of steering linkage and steering gear case for damage (leaks, detachment, tear, etc.). If damage is found, replace it with new one.
6) If equipped with power steering system, check also, in addition to above check items, that steering wheel can be turned fully to the right and left more lightly when engine is running at idle speed than when it is stopped. Repair, if found faulty.
7) Check wheel alignment. For the details of wheel alignment, refer to SECTION 3A.

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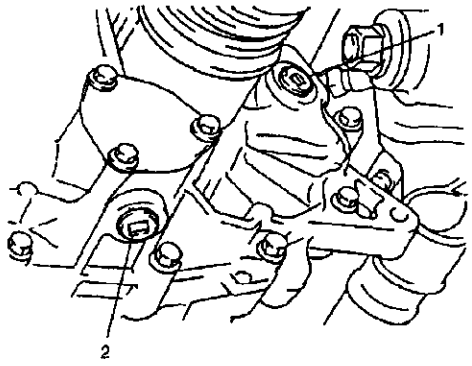


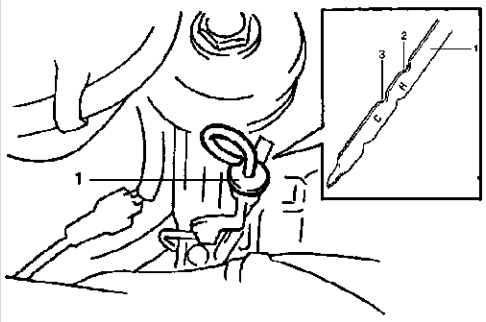
ITEM 6-6
Manual Transmission Oil Inspection and Change

Inspection

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

Change

1) Place the vehicle on level surface and drain oil by removing drain plug (2).
2) Apply sealant to drain plug after cleaning it and tighten drain plug to specified torque.
3) Pour specified oil up to level hole.
4) Tighten filler plug to specified torque.
   For recommended oil, its amount and tightening torque data, refer to On-Vehicle Service of SECTION 7A.



1. Fluid level gauge
2. FULL HOT mark
3. LOW HOT mark

ITEM 6-7
Automatic Transmission

Fluid level 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 SECTION 7B and be sure to perform it under specified conditions. If fluid level is low, replenish specified fluid.

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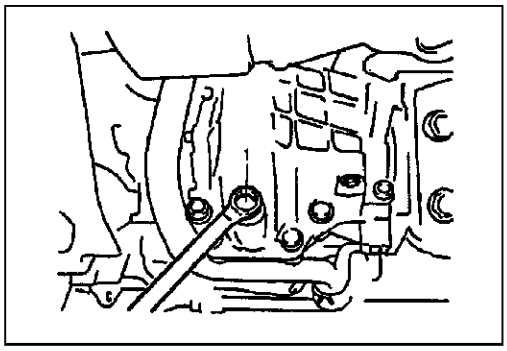
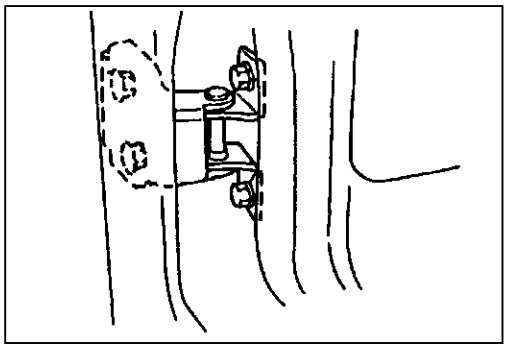


Fluid change

1) Perform steps 1) and 2) of above Fluid Level inspection.
2) Change fluid with new specified fluid. For its procedure, refer to SECTION 7B.



ITEM 6-8
All Latches, Hinges and Locks Inspection
Doors

Check that each door of front, rear and back doors opens and closes smoothly and locks securely when closed.

If any malfunction is found, lubricate hinge and latch or repair door lock system.

Engine hood

Check that secondary latch operates properly (check that secondary latch keeps hood from opening all the way even when pulling hood release handle inside vehicle.) Also check that hood opens and closes smoothly and properly and hood locks securely when closed.

If any malfunction is found, lubricate hinge and latch, or repair hood lock system.

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FINAL INSPECTION

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

Seats

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

Seat Belt

Inspect belt system including webbing, buckles, latch plates, retractors and anchors for damage or wear. Check that seat belt is securely locked.

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 and 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 and try to start.

Exhaust System Check

Check for leakage, cracks or loose supports.

Clutch (For Manual transmission)

Check for the following.

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

Gearshift or Select Lever (Transmission)

Check gear shift or select lever for smooth shifting to all positions and for good performance of transmission in any position.

With automatic transmission equipped vehicle, also check that shift indicator indicates properly according to which position select lever is shifted to.

Brake

[Foot brake]

Check the following;

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

[Parking brake and automatic transmission "P" (Park) mechanism]

Check that parking brake 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.

Make sure that vehicle is at complete stop when shifting select lever to "P" range position and release all brakes.

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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 fan switch lever to "HI" position and mode lever to defroster position for this check.

RECOMMENDED FLUIDS AND LUBRICANTS

Engine oil	SE, SF, SG, SH, SJ or SL (Refer to engine oil viscosity chart in item 1-4.)
Engine coolant (Ethylene glycol base coolant)	"Antifreeze/Anticorrosion coolant"
Brake fluid	DOT3 or SAE J1703
Manual transmission oil	API GL-4, SAE75W-90 (Refer to Section 7A for detail)
Automatic transmission fluid	An equivalent of DEXRON®-IIE or DEXRON®-III
Door hinges	Engine oil or water resistance chassis grease
Hood latch assembly	
Key lock cylinder	Spray lubricant

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SECTION 1A

HEATER (OPTIONAL) AND VENTILATION

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 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 Precauitons" under "On-Vehicle Service" in Section 10B before performing service on or around the air bag 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" postion 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).**

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Blower Fan Main Relay and Blower Fan Maximum Relay 1A-12
Ventilation Louver 1A-13

NOTE:

Although the figures in this section show only the right-hand steering vehicle, the same work procedure and data apply to the left-hand steering vehicle.

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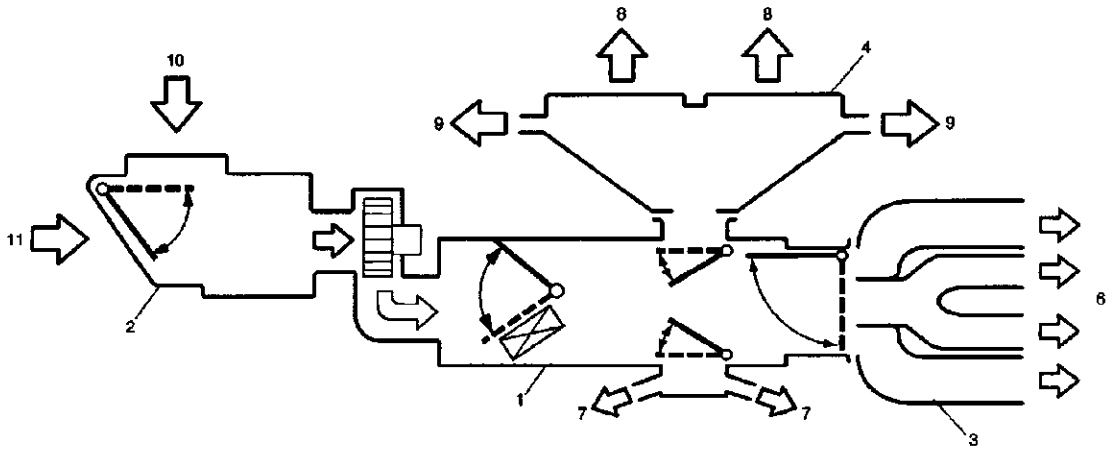
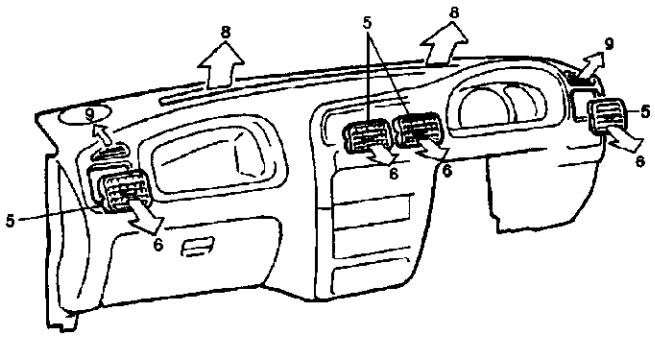
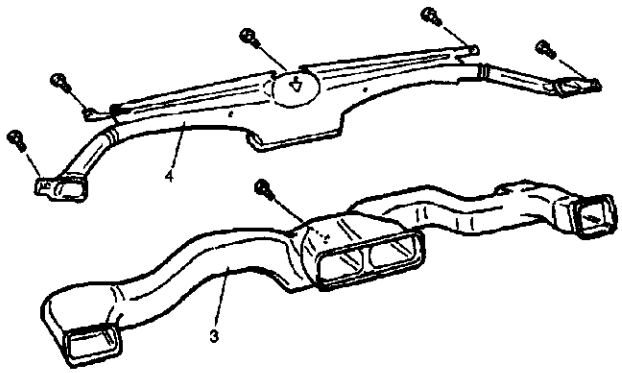
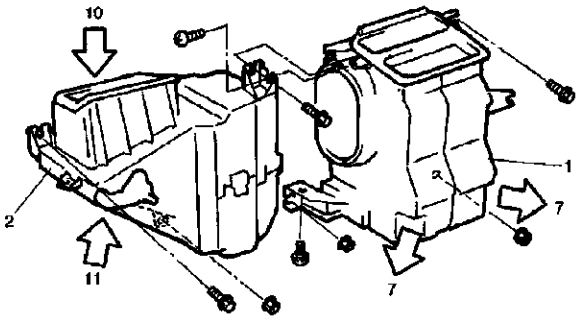
GENERAL DESCRIPTION

The heater and ventilation consist of the sollowing parts.









1. Heater unit	5. Ventilation louver	9. Demister air
2. Air inlet box	6. Ventilation air	10. Fresh air
3. Ventilator duct	7. Foot air	11. Recirculation air
4. Defroster nozzle	8. Defroster air	

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DIAGNOSIS

DIAGNOSIS TABLE

Trouble	Possible Cause	Remedy
Heater blower fan motor won't work even when its switch is operating position.	Fuse blown	Check "HEATER" fuse, main heater fuse and check for short circuit to ground.
	Blower main relay faulty	Check blower main relay.
	Blower fan motor resistor faulty	Check resistor.
	Blower fan motor switch faulty	Check blower fan switch.
	Blower fan motor faulty	Replace motor.
	Wiring or grounding faulty	Repair as necessary.
Heater blower fan won't work when its switch is maximum position.	Blower maximum relay faulty	Check blower maximum relay.
	Blower fan motor switch faulty	Check blower fan switch.
	Wiring or grounding faulty	Check wiring, grounding and repair as necessary.
Incorrect temperature output.	Control cables broken or binding	Check cables.
	Temperature control lever faulty	Check control lever.
	Position of control cable clamp is faulty	Check and adjust clamp position.
	Temperature door assembly broken	Repair temperature door assembly.
	Air ducts clogged	Repair air ducts.
	Heater core leaking or clogged	Replace core.
	Heater hoses leaking or colgged	Replace hoses.
	Thermostat faulty	Check thermostat by referring to SECTION 6B.
When mode control lever is changed, air outlet port is not changed or lever position disagree with air outlet port.	Control cables broken or binding	Check cable.
	Mode control lever faulty	Check control lever.
	Position of control cable clamp is faulty	Check and adjust clamp position.
	Air damper broken	Repair damper.
	Air ducts leaking or clogged	Repair air ducts.

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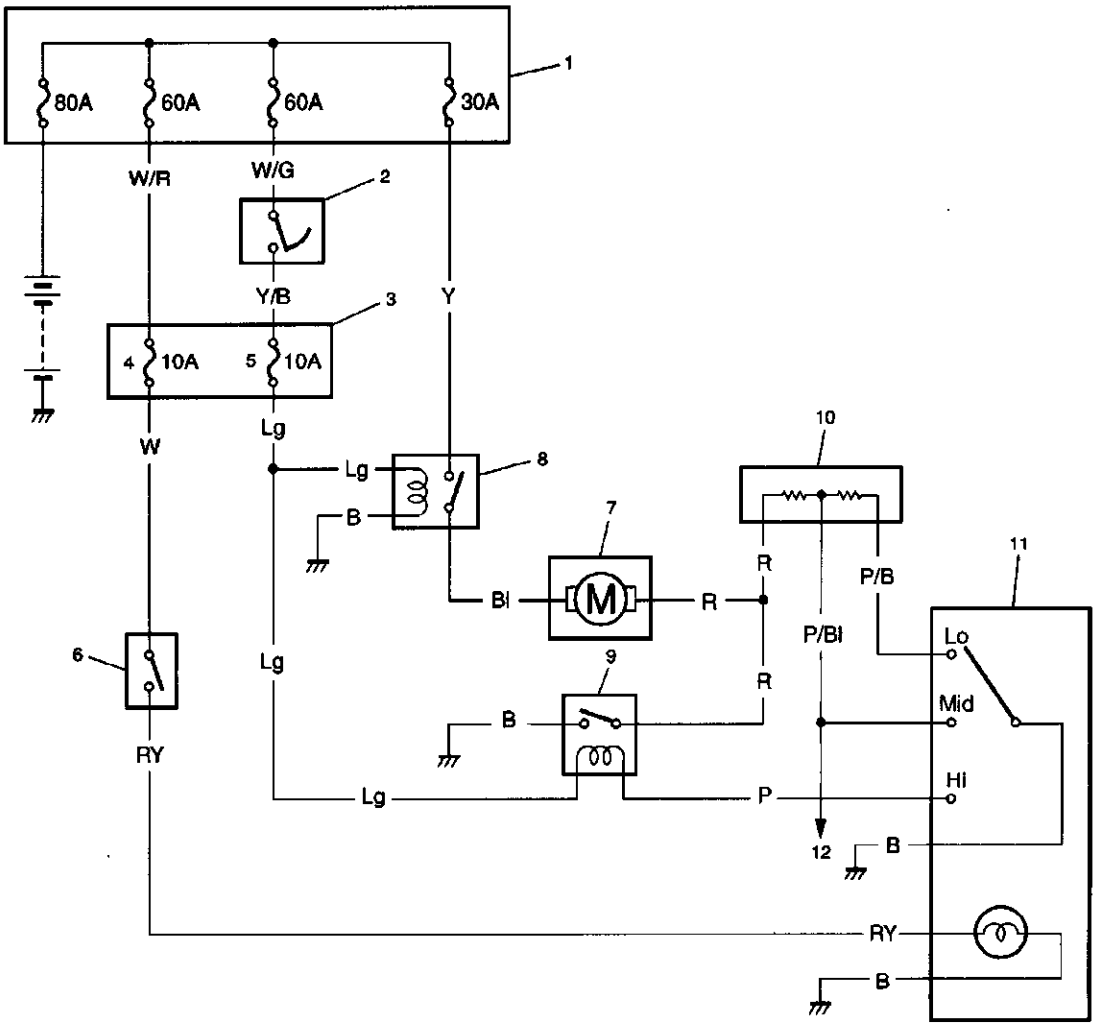
WIRING CIRCUIT



1. Main fuse box	7. Blower fan motor
2. Ignition switch	8. Blower fan main relay
3. Circuit fuse box	9. Blower fan maximum relay
4. "TAIL" fuse	10. Blower fan motor resistor
5. "HEATER" fuse	11. Blower fan switch
6. Lighting switch	12. To ECM (idle up signal)

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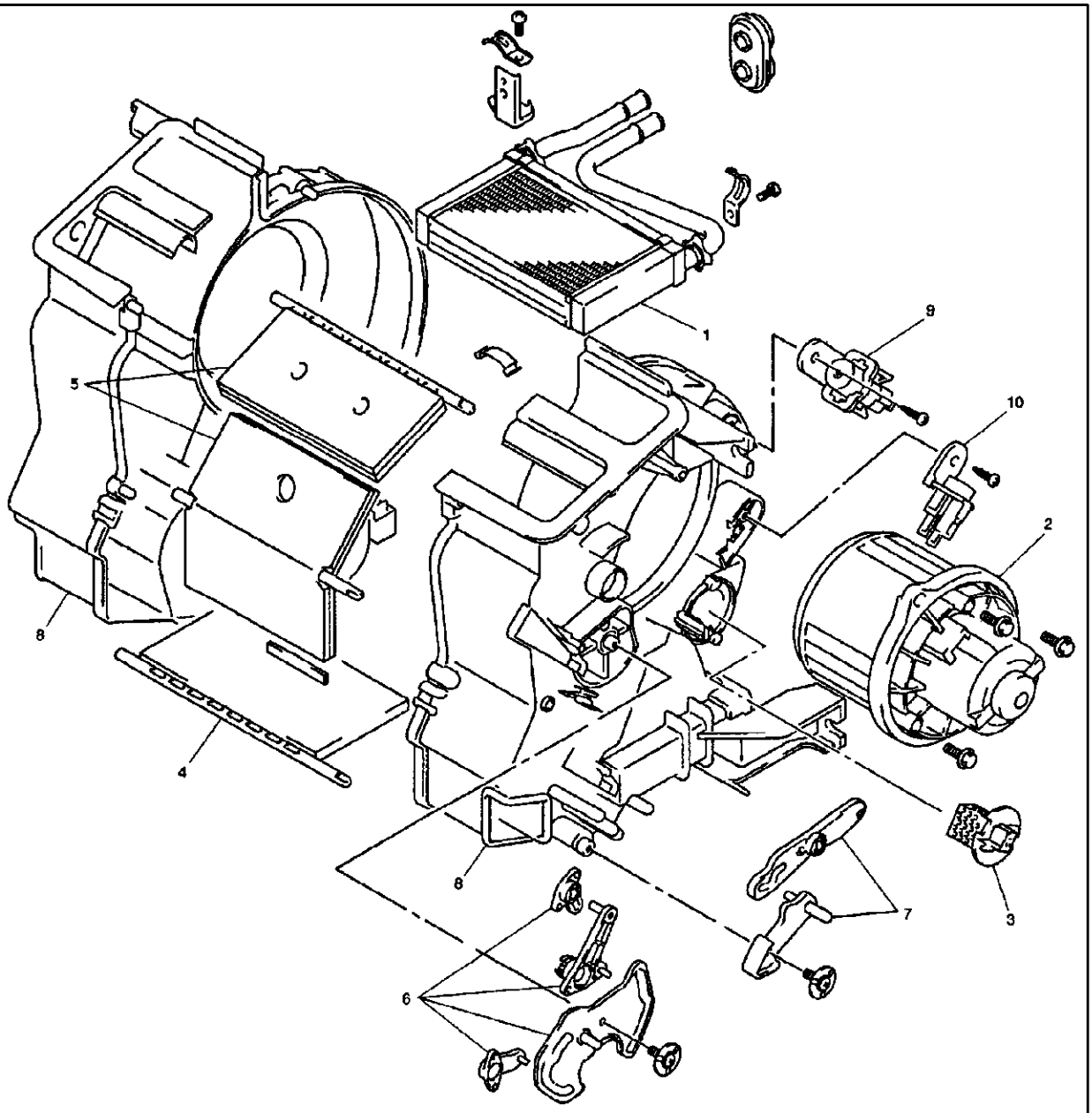
ON-VEHICLE SERVICE

HEATER UNIT



1. Heater core	6. Air outlet control lever assembly
2. Blower fan motor assembly	7. Temperature lever assembly
3. Blower fan motor resistor	8. Heater case
4. Temperature door assembly	9. Blower fan motor maximum relay
5. Air outlet control door assembly	10. Blower fan motor main relay

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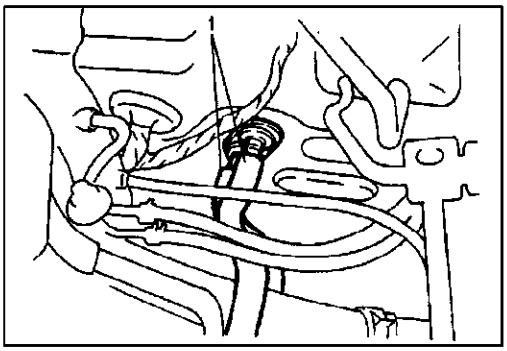
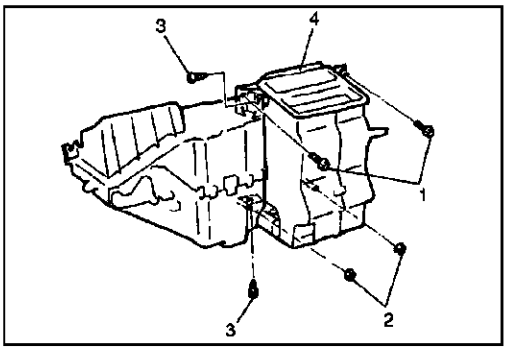


REMOVAL

1) Disconnect negative (–) cable at battery.
2) Drain engine coolant and disconnect heater hoses (1) from heater unit.
3) Remove instrument panel by referring to "INSTRUMENT PANEL" in SECTION 9.
4) Disconnect each couplers (blower motor, resistor, main relay, maximum relay) from heater unit.

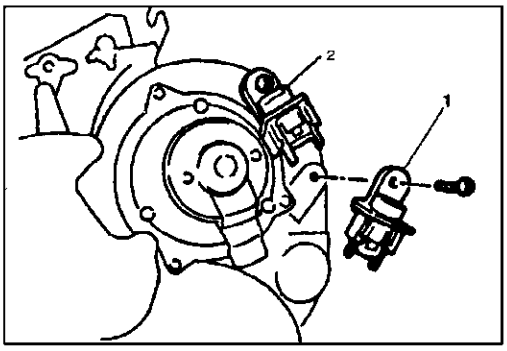


5) Remove bolts (1), nuts (2) and screws (3) as shown.
6) Remove heater unit (4) from vehicle.

INSTALLATION

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

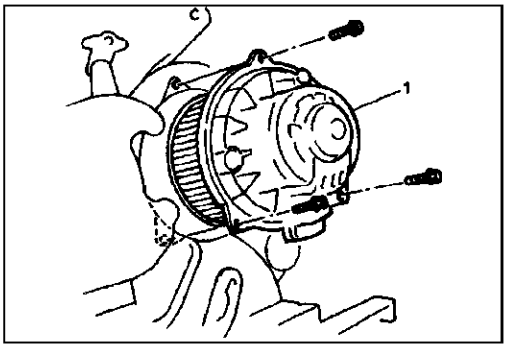
- When installing each part, be careful not to catch any cable or wiring harness.
- Adjust heater control cable by referring to "HEATER CONTROL LEVER ASSEMBLY" in this section.
- Fill engine coolant to radiator.



BLOWER FAN MOTOR

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Remove steering column hole cover.
3) If necessary remove clutch pedal from vehicle by referring to "CLUTCH PEDAL AND CLUTCH PEDAL BRACKET" in SECTION 7C.
4) Remove blower fan main relay (1) and/or maximum relay (2).



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

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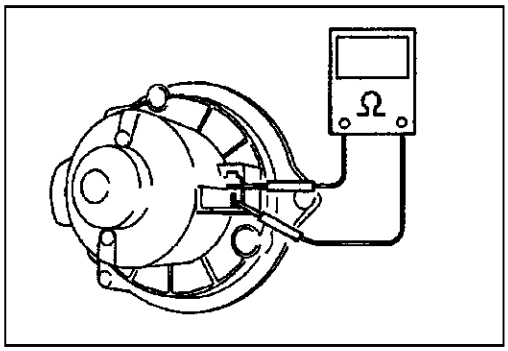
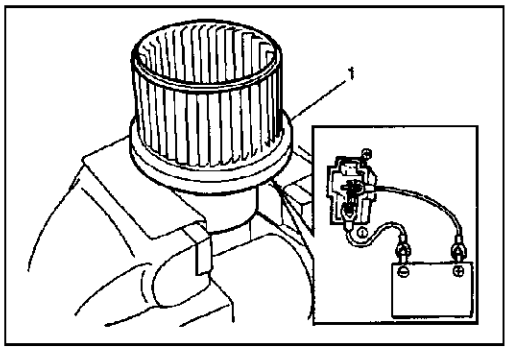


INSPECTION

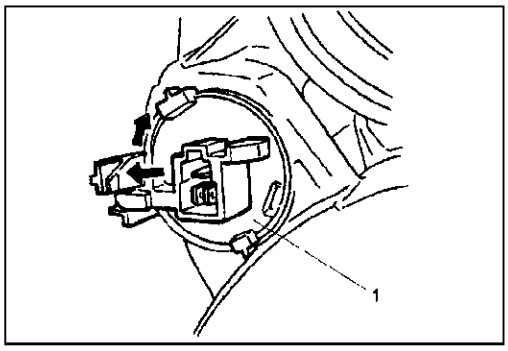
1) Check motor coil for continuity between two terminal as shown in figure.
   If there are no continuity, replace blower fan motor.



2) Check motor for operation and current.
   a) Fix blower fan motor (1) using soft-jawed vise.
   b) Connect battery positive (+) terminal to blower fan motor positive (+) terminal and negative (–) terminal to blower fan motor negative (–) terminal.
   c) Check that there is smoothly operates and no noise.
   d) Check that ammeter indicates specified current.
      If current is out of specification, replace blower fan motor.
      Specified current: 17A maximum at 12V

INSTALLATION

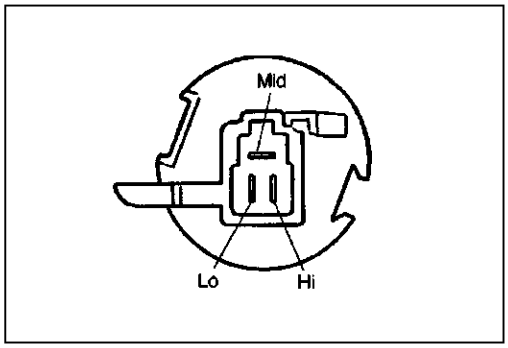
Reverse removal procedure for installation.



BLOWER FAN MOTOR RESISTOR

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Disconnect blower fan motor resistor coupler.
3) Remove blower fan motor resistor (1) as shown in figure.



INSPECTION

Measure each terminal-to-terminal resistance on resistor

Resistance Mid – Lo : 1.5 – 3.0 Ω at 25°C (77°F)
Mid – Hi : 0.5 – 1.5 Ω at 25°C (77°F)

If measured resistance is out of specification, replace blower motor resistor.

INSTALLATION

Reverse removal procedure for installation.

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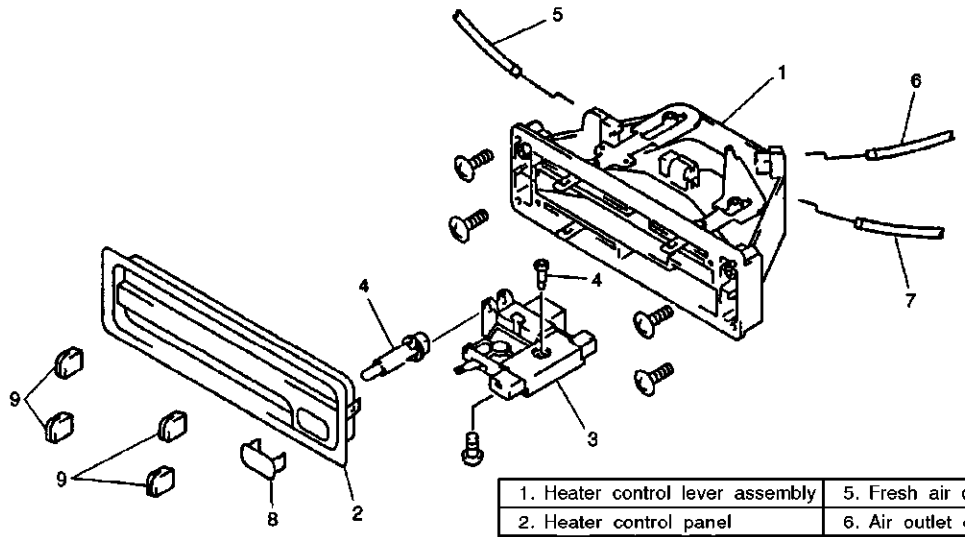
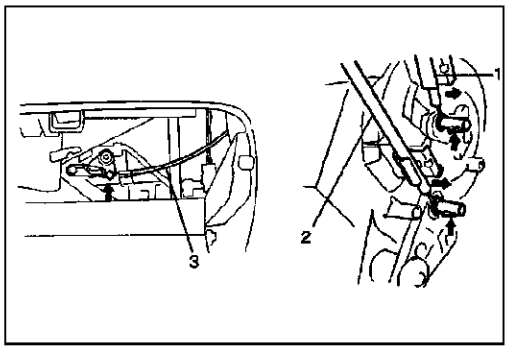
HEATER CONTROL LEVER ASSEMBLY



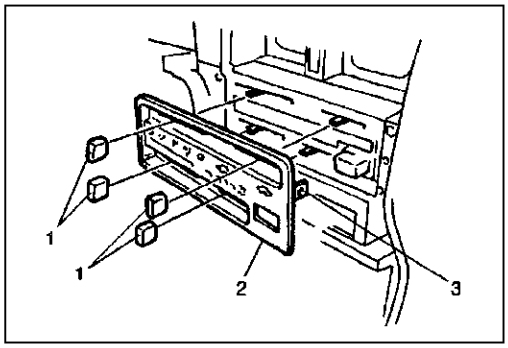
1. Heater control lever assembly	5. Fresh air control cable
2. Heater control panel	6. Air outlet control cable
3. Blower fan switch and A/C switch (if equipped)	7. Temperature control cable
4. Bulb	8. A/C switch plug (if equipped)
	9. Knob

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Remove steering column hole cover.
3) Remove ashtray, center garnish, meter cluster panel, instrument glove box and radio or accessory case (if equipped).



4) Disconnect air outlet control (1), temperature control (2) and fresh air control (3) cables.
5) Disconnect blower fan switch coupler and A/C switch coupler (if equipped) respectively.



6) Remove knobs (1) from each levers.
7) Remove heater control panel (2) by unlocking the lock part (3).

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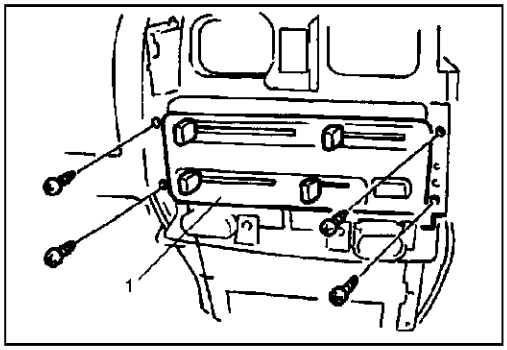
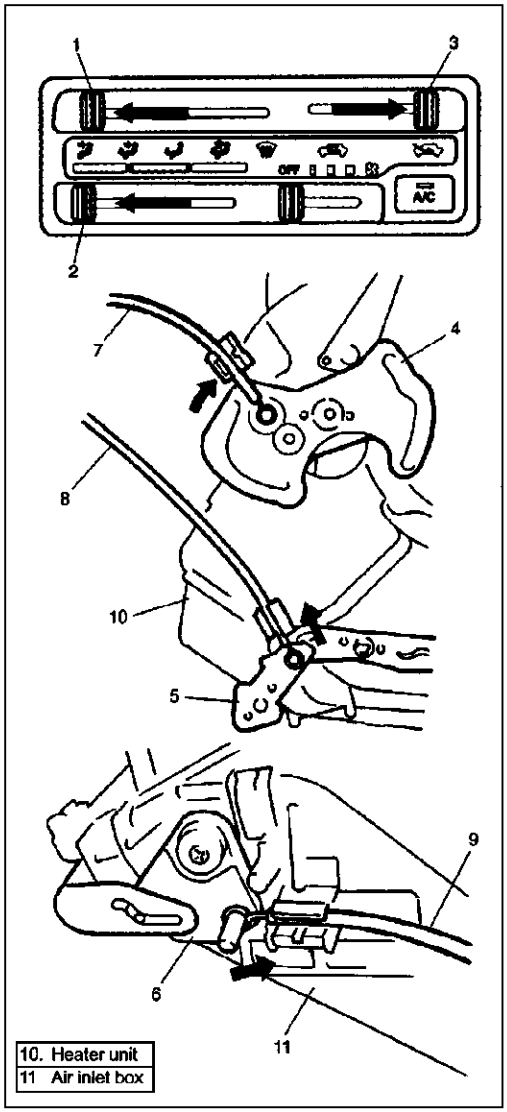


8) Remove heater control lever assembly (1).
9) Remove blower fan switch by referring to "BLOWER FAN SWITCH" in this section.



10. Heater unit
11 Air inlet box

INSTALLATION

1) Reverse removal procedure for installation.
2) Adjust cable as follows.
   a) Move air outlet control lever (1), temperature control lever (2) and fresh air control lever (3) fully in arrow direction as shown in figure.
   b) Push air outlet lever (4), temperature lever (5) and door link (6) fully in arrow direction and fix air outlet control cable (7), temperature control cable (8) and fresh air control cable (9) with clamp in position as shown in figure.

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

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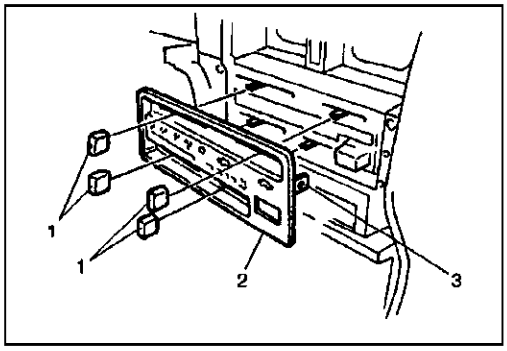
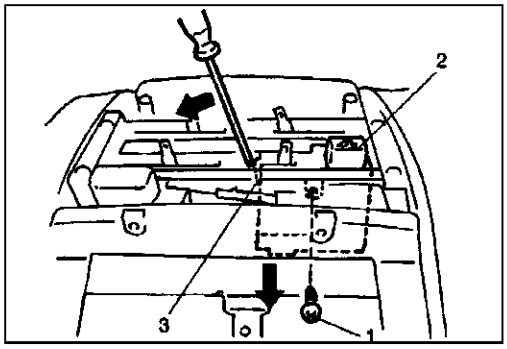


BLOWER FAN SWITCH

REMOVAL

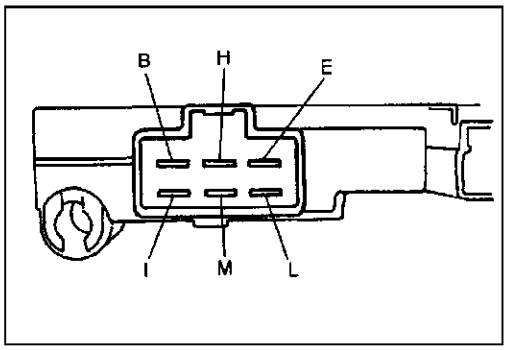
1) Disconnect negative (–) cable at battery.
2) Remove steering hole cover.
3) Remove ashtray, center garnish, meter cluster panel and radio or accessory case (if equipped).
4) Remove knobs (1) from each levers.
5) Remove heater control panel (2) by unlocking the lock part (3).
6) Disconnect blower fan switch coupler.



7) Loosen blower fan switch screw (1) and then remove blower fan switch (2) from heater control lever assembly by unlocking the lock part (3) as shown in figure.

INSTALLATION

Reverse removal procedure for installation.



INSPECTION

Check blower fan switch for each terminal-to-terminal continuity.
For the detail, refer to "WIRING CIRCUIT" in this section.

TERMINAL / SWITCH POSITION	B	I	E	L	M	H
OFF	○ (M)	○				
Lo	○ (M)	○	○	○		
Mid	○ (M)	○	○		○	
Hi	○ (M)	○	○			○

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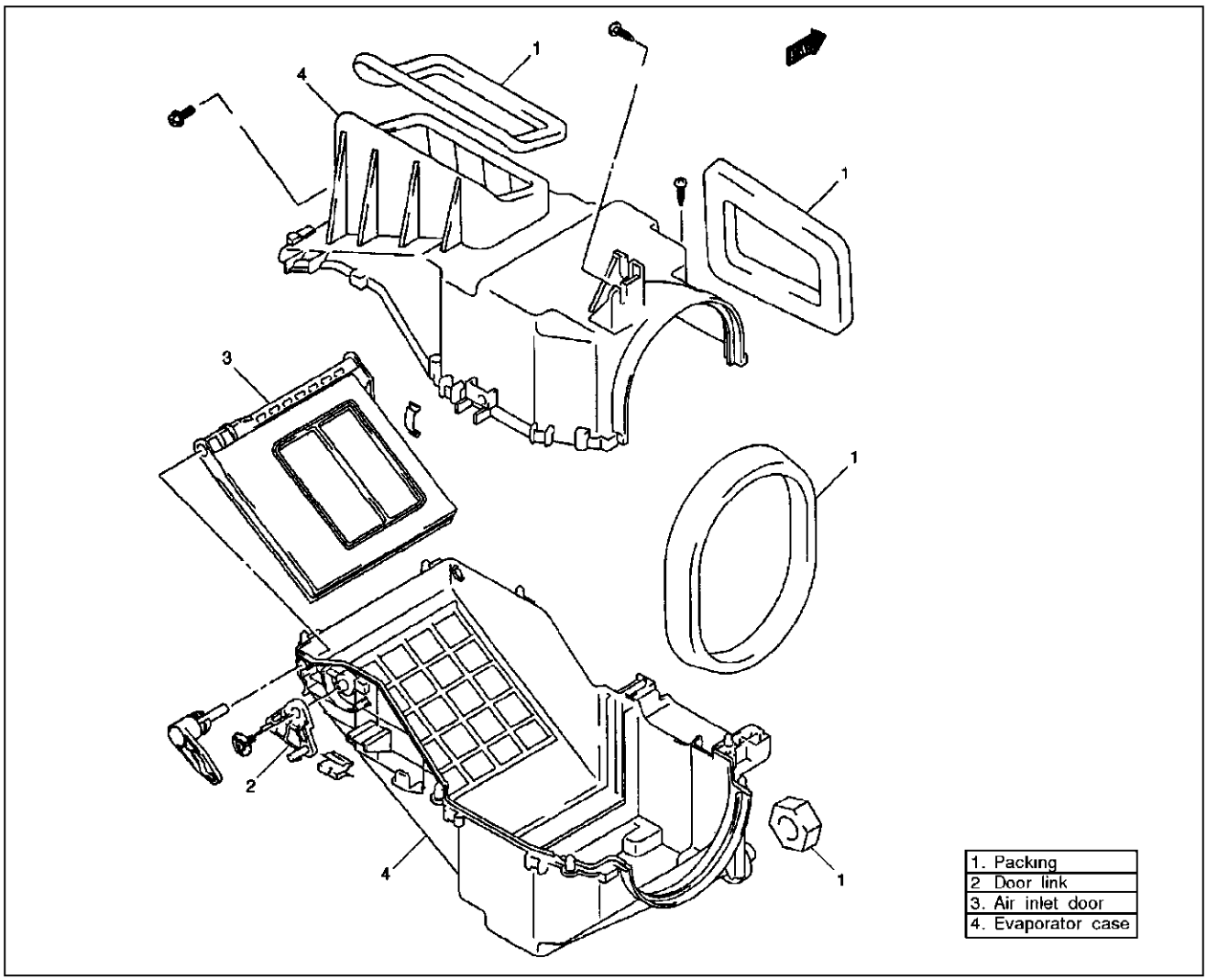
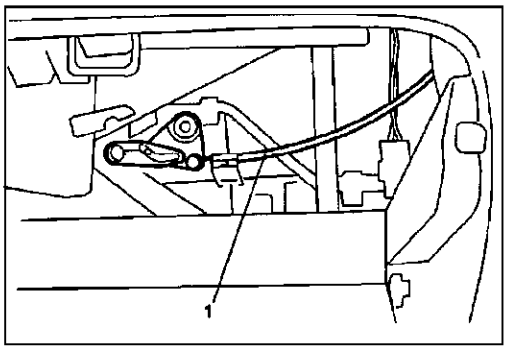
AIR INLET BOX



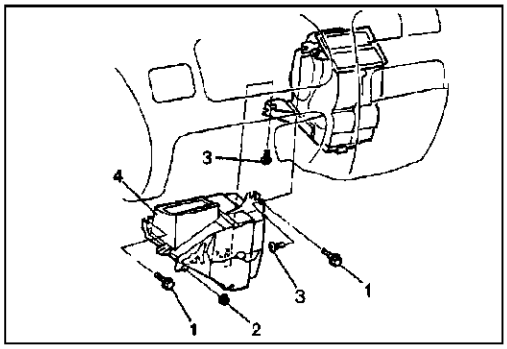
1. Packing
2. Door link
3. Air inlet door
4. Evaporator case



REMOVAL

NOTE:
If vehicle is equipped with air conditioning, refer to "COOLING UNIT" in Section 1B.

1) Remove glove box.
2) Remove fresh air control cable (1).



3) Remove air inlet box mounting bolts (1), nut (2), screws (3) and drain hose.
4) Remove air inlet box (4).

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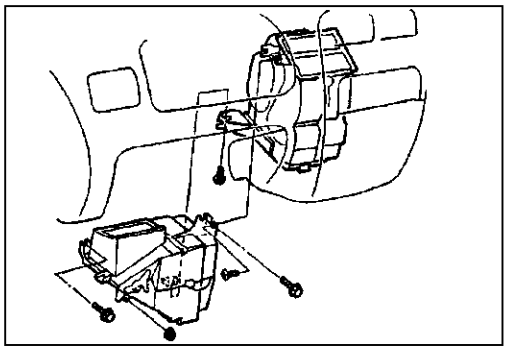
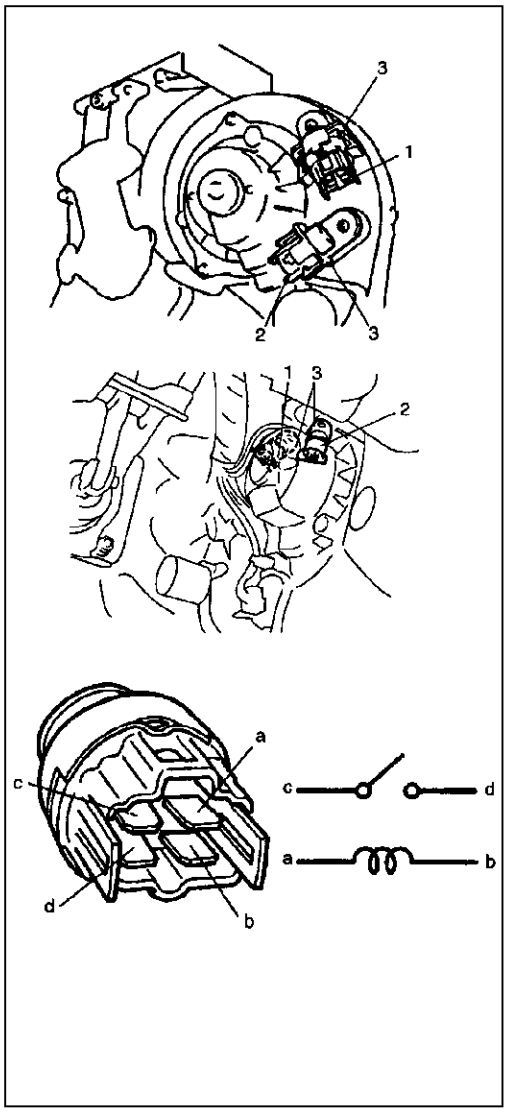


INSTALLATION

NOTE:
If vehicle is equipped with air conditioning, refer to "COOLING UNIT" in Section 1B.
Reverse removal procedure for installation, noting the following instruction.

- Adjust fresh air control cable, refer to "HEATER CONTROL LEVER ASSEMBLY" in this section.
- Install cutting part of drain hose downward.



BLOWER FAN MAIN RELAY AND BLOWER FAN MAXIMUM RELAY

INSPECTION

1) Disconnect negative (–) cable at battery.
2) Remove steering column hole cover.
3) Disconnect blower fan maximum relay (1) and blower fan main relay (2) couplers.
4) Remove blower fan maximum relay and blower fan main relay from its housing (3).
5) Check that there is no continuity between terminal "c" and "d". If there is continuity, replace relay.
6) Check relay function as follows:
   a) Connect battery positive (+) terminal to terminal "b" of relay.
   b) Connect battery negative (–) terminal "a" of relay.
   c) Check continuity between terminal "c" and "d".

   If there is no continuity when relay is connected to the battery, replace relay.

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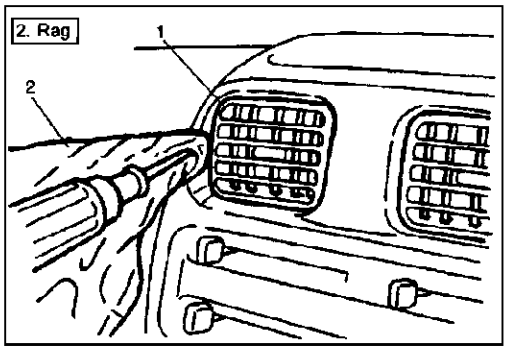
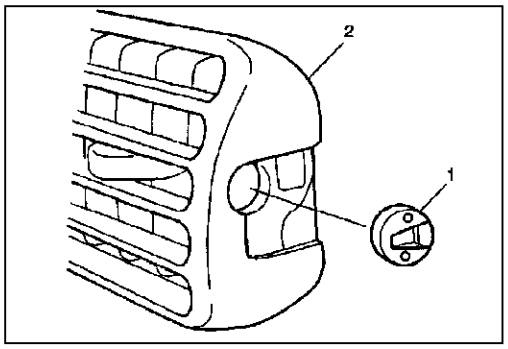


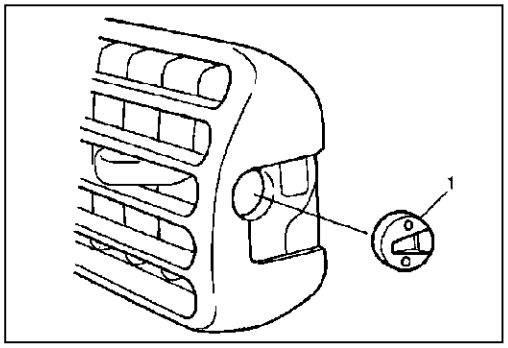
VENTILATION LOUVER

REMOVAL

1) Remove ventilation louver (1) as shown in figure.



2) Remove ventilation louver holder (1) from ventilation louver (2).



INSTALLATION

Reverse removal procedure for installation, and then note installation direction of ventilation louver holder (1) as shown.

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SECTION 1B

AIR CONDITIONING (OPTIONAL)

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

- **Service on and around the air bag system componenets and 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 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).**

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).

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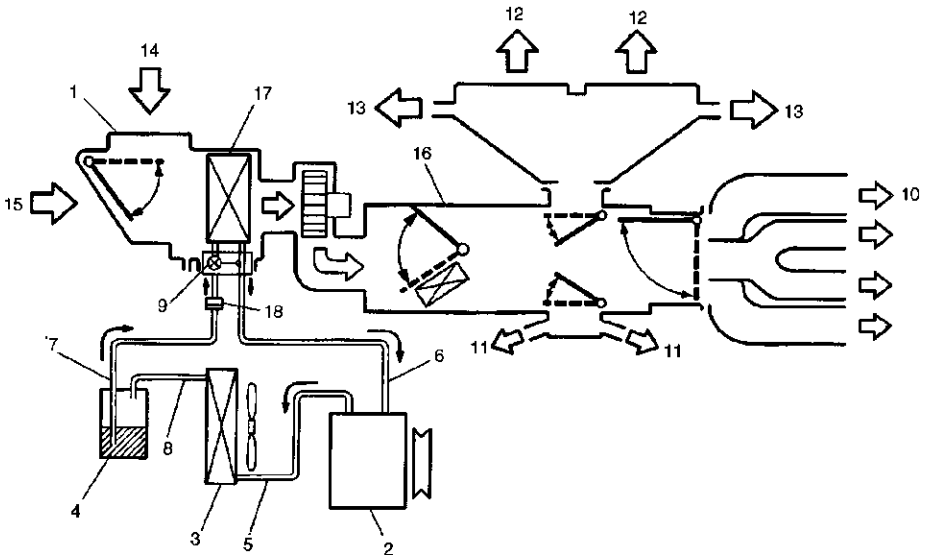
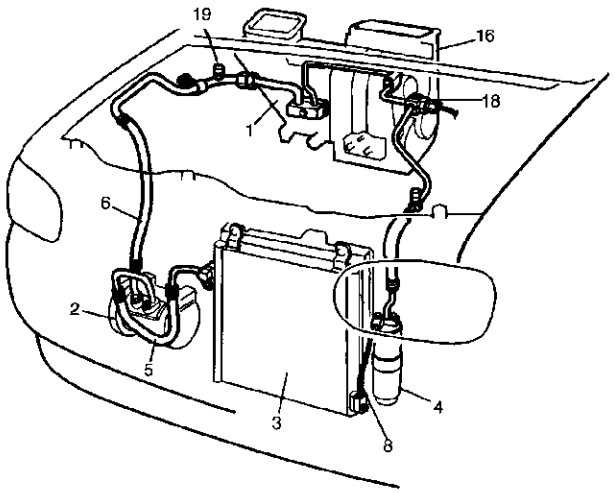
GENERAL DESCRIPTION

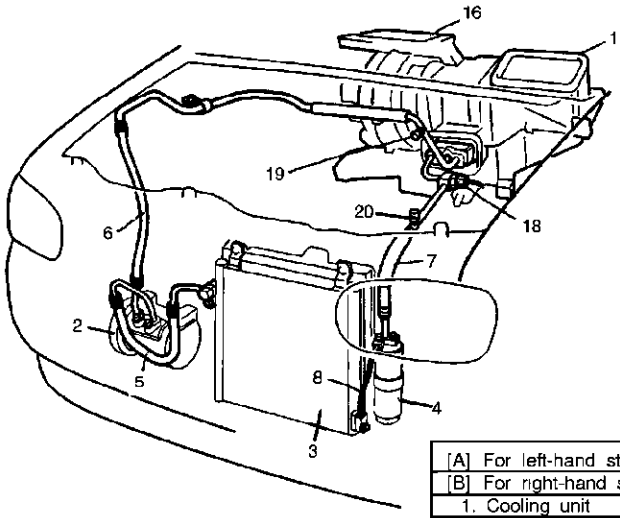
MAJOR COMPONENTS AND LOCATION



[A]



[B]



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

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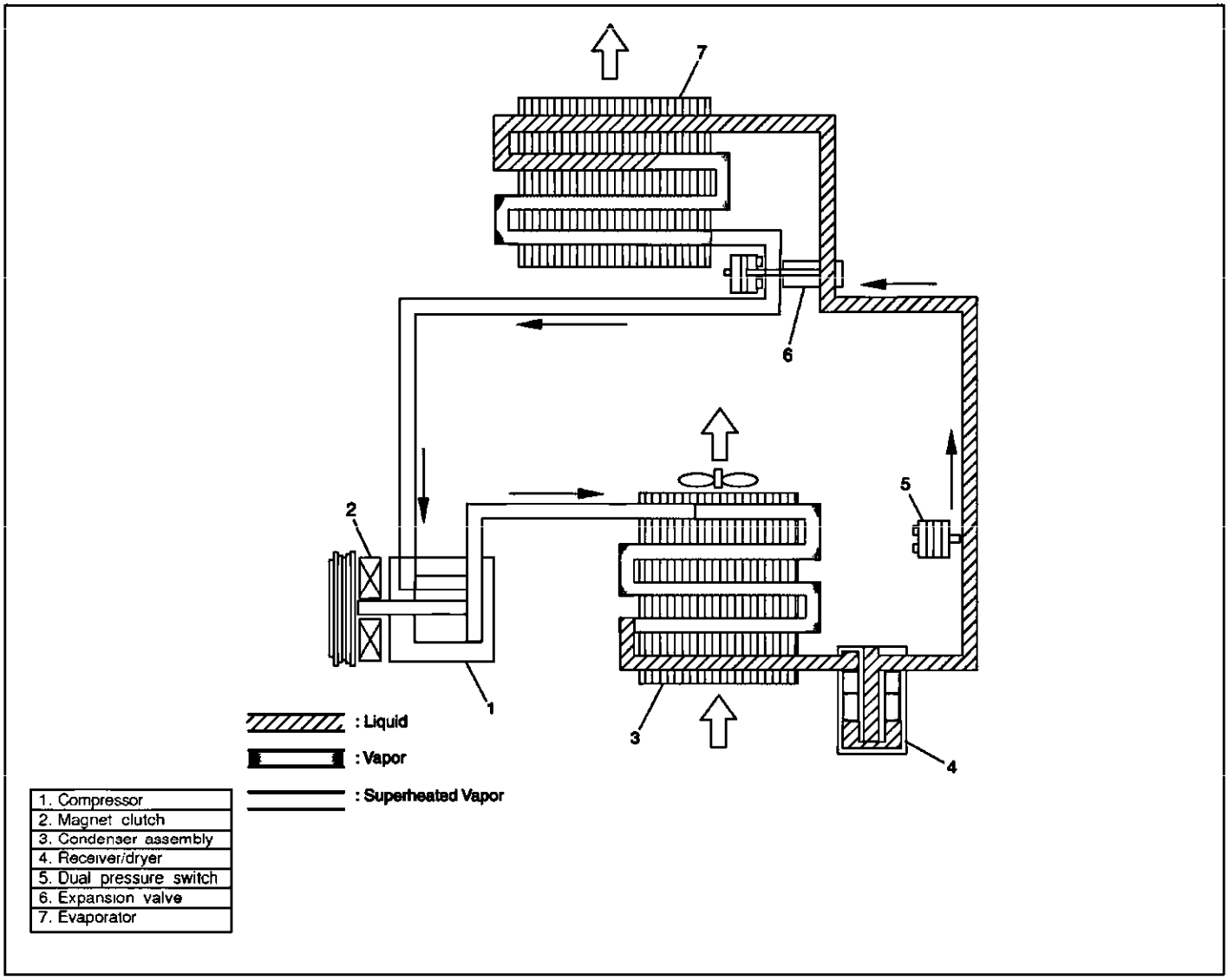
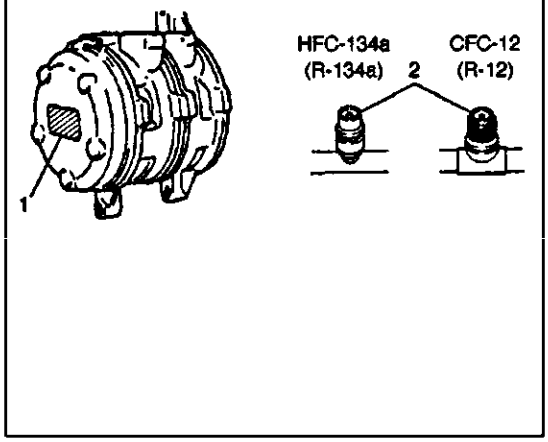
REFRIGERANT CIRCULATION



1. Compressor
2. Magnet clutch
3. Condenser assembly
4. Receiver/dryer
5. Dual pressure switch
6. Expansion valve
7. Evaporator



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).

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DIAGNOSIS

GENERAL DIAGNOSIS TABLE

Condition	Possible Cause	Correction
Cool air does not come out	**A/C system inoperative**	
	• No refrigerant	• Perform recover, evacuation and charging.
	• Fuse blown	• Check "HEATER" fuse in circuit fuse box and main fuses, 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 (A/C evaporator tempertaure sensor) faulty	• Check A/C evaporator thermistor (A/C evaporator temperature sensor).
	• Dual pressure switch faulty	• Check dual pressure switch.
	• Wiring or grounding faulty	• Repair as necessary.
	• ECT sensor faulty	• Check ECT sensor referring to SECTION 6E1.
	• ECM (PCM) and its circuit faulty	• Check ECM (PCM) and its circuit referring to SECTION 6E1.
	Compressor inoperative (does not rotate)	
	• Fuse blown	• Check "HEATER" fuse in circuit fuse box and main fuses, and check short circuit to ground.
	• Compressor relay faulty	• Check A/C compressor relay.
	• ECM (PCM) faulty	• Check ECM (PCM) and its circuit referring to SECTION 6E1.
	• Magnet clutch faulty	• Check magnet clutch.
	• Compressor drive belt loosen or broken	• Adjust or replace drive belt.
	• Compressor faulty	• Check compressor.
	A/C condensor cooling fan motor inoperative	
	• Fuse blown	• Check main fuses, and check short circuit to ground.
	• Wiring or grounding faulty	• Repair as necessary.
	• Radiator/condenser cooling fan motor relay faulty	• Check radiator/condenser cooling fan motor relay.
	• Radiator/condenser cooling fan motor faulty	• Check radiator/condenser cooling fan motor.
	Blower fan motor inoperative	
	• Fuse blown	• Check "HEATER" fuse in circuit fuse box and main fuses, 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.
	• Blower fan motor main relay and/or blower fan motor maximum relay faulty	• Check blower fan motor main relay and/or blower fan motor maximum relay referring to SECTION 1A.

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

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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. • Loose compressor clutch plate bolt.	• Adjust drive belt tension, or replace belt. • Retighten mounting bolts.
• A loud rattle is heard at low engine rpm.	• Loose compressor mounting bolts.	• 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). • Worn clutch friction surface. • Compressor oil leaked from shaft seal, contaminating the friction surface.	• Adjust clutch clearance. • Replace magnet clutch assembly. • 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. • Resonance caused by pulsation from variations in refrigerant pressure.	• Reposition clamps or increase the number of clamps. • 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.

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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. • Pulley cranks upon contact.	• Worn or damaged bearing. • Cracked or loose bracket.	• Replace tension pulley. • 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. • Fluttering noise or large droning noise is heard from blower fan motor.	• Worn or damaged motor brushes or commutator. • Leaves or other debris introduced from fresh air inlet to blower fan motor.	• Repair or replace blower fan motor. • Remove debris and make sure that the screen at fresh air inlet is intact.

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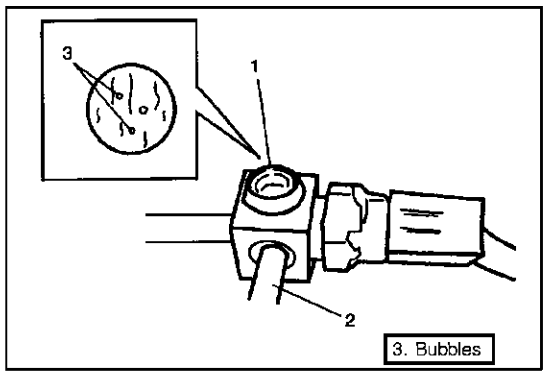

QUICKLY CHECKING OF REFRIGERANT CHARGE

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 outlet pipe (2) and compare what is observed with the symptoms listed in below.

CHECKING REFRIGERANT CHARGE

Item No.	Symptom	Charge of refrigerant condition	Correction
1	Bubbles observed in sight glass	Insufficient charge of refrigerant in system	Check system for leaks with a leak tester.
2	No bubbles observed in sight glass	No or insufficient charge of refrigerant in system	Refer to the items 3 and 4.
3	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.
4	Noticeable temperature difference between compressor inlet and outlet	Proper or too much charge of refrigerant in system	Refer to the items 5 and 6.
5	When A/C is turned OFF, refrigerant in sight glass clears immediately and remains clear	Too much charge of refrigerant in system	Discharge excess charge of refrigerant to adjust it to a specified charge.
6	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.

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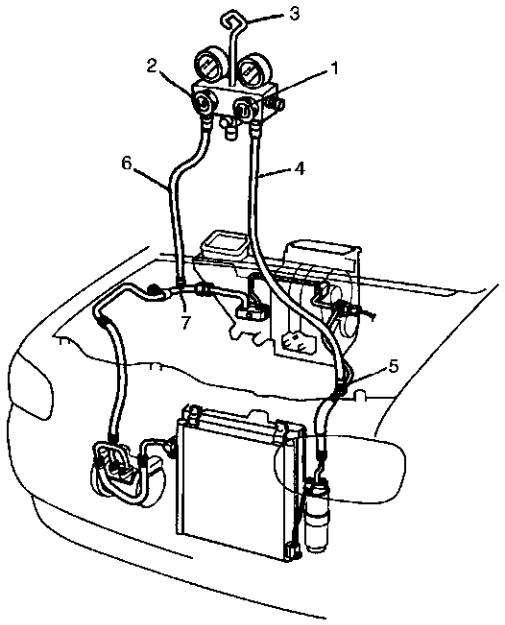
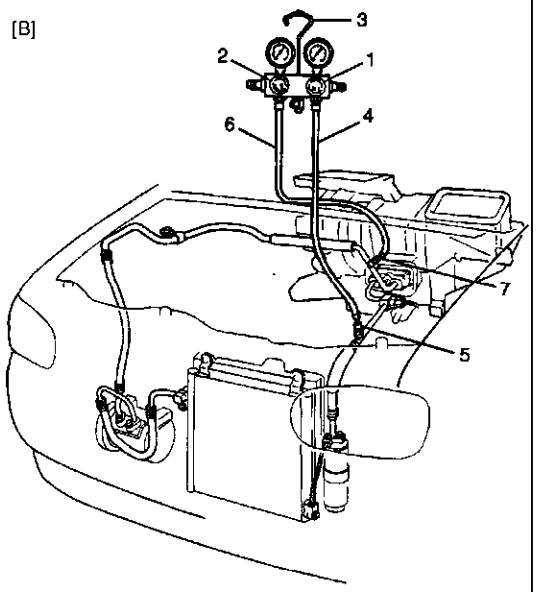
[A]



[B]



[A]: For left-hand steering vehicle
[B]: For right-hand steering vehicle

PERFORMANCE DIAGNOSIS

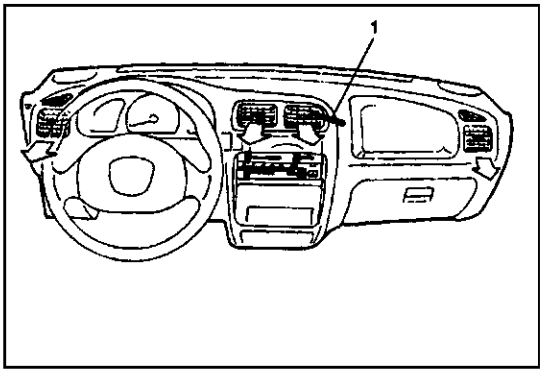
1) Confirm that vehicle and environmental conditions are as follows.
   - Vehicle is not exposed to direct sun.
   - Ambient temperature is within 15° – 35°C.
2) Make sure that high pressure valve (1) and low pressure valve (2) of manifold gauge set (3) are firmly closed.
3) Connect high pressure charging 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) 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 hood open.

Ambient temperature	15° – 35°C
Engine rpm	Keep to 1,500 rpm.
Blower fan motor switch	"HI" (3rd position)
Temperature control	"COOL"
Air outlet control	"FACE"
Vehicle doors	All open
Air inlet door position	Recirculation



7) With about 20 mm of dry bulb thermometer (1) inserted into center duct air outlet and another one set near evaporator air inlet, read temperature indicated on each thermometer.

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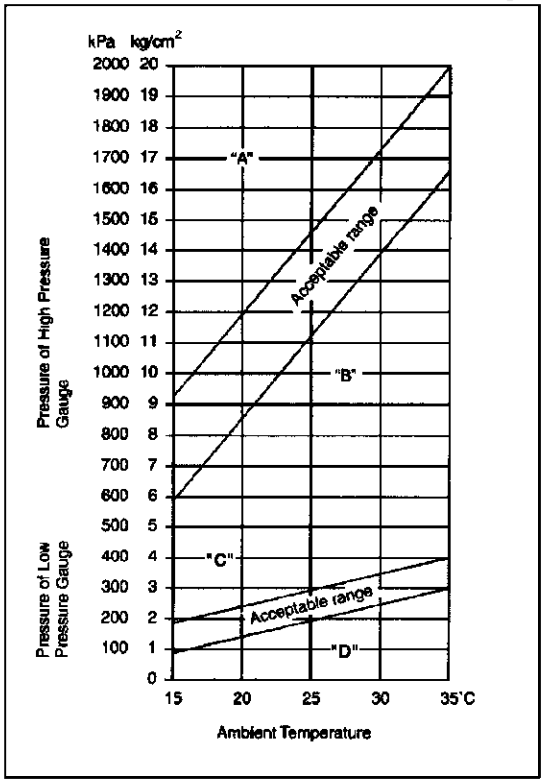


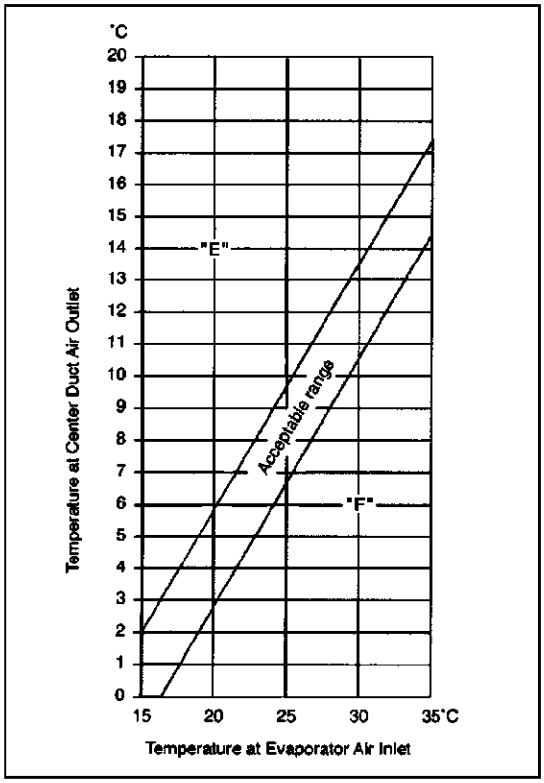
8) Check for each pressure of low side and high side if it is within shaded range of graph.

If each gauge reading is out of specified pressure, correct defective part referring to "PERFORMANCE DIAGNOSIS TABLE".

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

Example:

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



9) Check inlet port temperature-to-outlet port temperature relationship using graph.

For example, if evaporator inlet port temperature is 25°C and center duct air outlet temperature is 8°C, their crossing point is within acceptable range as shown in graph.

If crossing point is out of acceptable range, diagnose trouble referring to "PERFORMANCE DIAGNOSIS TABLE" on next page.

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PERFORMANCE DIAGNOSIS TABLE

	TESTING RESULTS	POSSIBLE CAUSE	REMEDY
HIGH PRESSURE GAUGE	Pressure high ("A" area of high side graph)	• Refrigerant overcharged • Expansion valve frozen or clogged • Clogged refrigerant passage of high side • Radiator/condenser cooling fan malfunction (Insufficient cooling of condenser) • Dirty or bent condenser fins (Insufficient cooling of condenser) • Compressor malfunction (Insufficient oil etc.) • Engine overheat	• Recharge • Check expansion valve • Clean or replace • Check radiator condenser cooling fan • Clean or repair • Check compressor • Check engine cooling system referring to SECTION 6B.
	Pressure low ("B" area of high side graph)	• Insufficient refrigerant (Insufficient charge or leakage) • Expansion valve malfunction (valve opens too wide) • Compressor malfunction (Insufficient compression)	• Check for leakage, repair if necessary and recharge • Check expansion valve • Check compressor
LOW PRESSURE GAUGE	Pressure high ("C" area of low side graph)	• Expansion valve malfunction (valve opens too wide) • Compressor malfunction (Insufficient compression)	• Check expansion valve • Check compressor
	Pressure low ("D" area of low side graph)	• Insufficient refrigerant (Insufficient charge or leakage) • Expansion valve malfunction (valve opens too narrow) • Clogged refrigerant passage (crashed pipe)	• Check for leakage, repair if necessary and recharge • Check expansion valve • Repair or replace
THERMOMETER AT CENTER DUCT	Outlet air temperature at center duct is high (Crossing point is in area "E")	• Insufficient or excessive charge of refrigerant • Dirty or bent A/C evaporator fins • Air leakage from cooling (heater) unit or air duct • Malfunctioning, switchover function of door in cooling (heater) unit • Compressor malfunction	• Check refrigerant pressure • Clean or repair • Repair or replace • Repair or replace • Check compressor
	Outlet air temperature at center duct is low (Crossing point is in area "F")	• Insufficient air volume from center duct (Heater blower malfunction) • Compressor malfunction	• Check blower fan motor and fan • Check compressor

NOTE:
If ambient temperature is approximately 30°C (86°F), it is possible to diagnose A/C system in detail referring to next page table.

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DETAIL DIAGNOSIS TABLE (AMBIENT TEMPERATURE AT 30°C)

MANIFOLD GAUGE	MPa (kg/cm²)	CONDITION	CAUSE	CORRECTION
Lo	Hi			
0.23 – 0.35 (2.3 – 3.5)	1.4 – 1.75 (14 – 17.5)	Normal condition.	———	———
Negative pressure	0.5 – 0.6 (5 – 6)	• 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) ↕ Abnormal: Negative pressure	Normal: 1.4 – 1.75 (14 – 17.5) ↕ Abnormal: 0.69-0.98 (7-10)	• During A/C operation, the low pressure side sometimes indicates negative pressure, and sometimes normal pressure. Also high pressure side reading fluctuates between the abnormal and normal pressure.	• Expansion valve is frozen due to moisture in the system, and temporarily shuts off the refrigeration cycle	• Replace expansion valve. • Replace receiver/dryer. • Evacuate A/C system and recharge with fresh refrigerant.
0.05 – 0.15 (0.5 – 1.5)	0.69 – 0.98 (7 – 10)	• 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 a gas 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)		• 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)	1.96 – 2.45 (20 – 25)	• High pressure reading on both low and high pressure sides. • Air bubbles are not visible even when engine rpm is lowered.	• Overcharged A/C system. • Faulty condenser cooling operation. • Faulty radiator/ condenser cooling fan operation	• Adjust refrigerant to specified amount. • Clean condenser. • Inspect and repair radiator/ condenser cooling fan.
		• High pressure reading on both low and high pressure sides. • Low pressure side tubing is not cold when touched. • Air bubbles are visible through sight glass.	• Presence of air in A/C system. (Improperly evacuated)	• Replace receiver/dryer. • Inspect quantity of compressor oil and presence of contaminants in oil. • Evacuate system and recharge with freshrefrigerant.
0.45 – 0.55 (4.5 – 5.5)		• High pressure reading on both low and high pressure sides. • Large amount of frost or dew on the low pressure side tubing.	• Faulty expansion valve. • Refrigerant flow is not regulated properly.	• Replace expansion valve.

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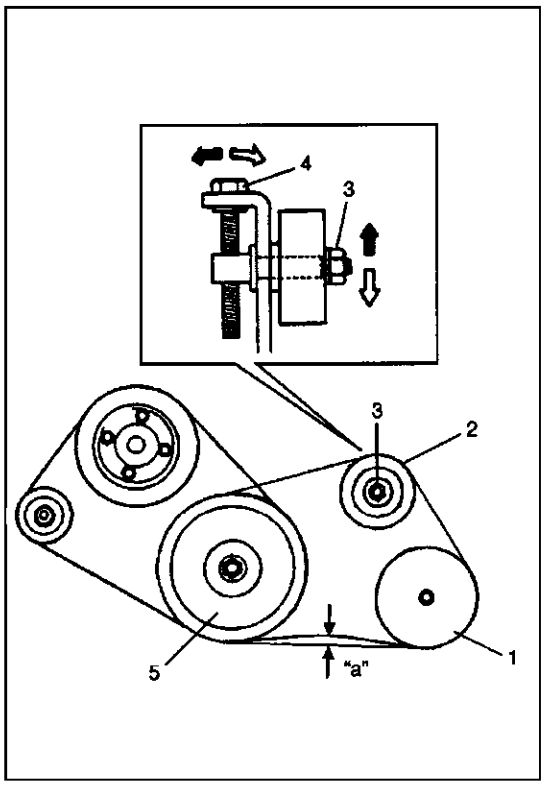

COMPRESSOR DRIVE BELT INSPECTION

1) Check belt for wear and cracks, and replace as required.
2) Check belt tension by measuring how much it deflects when pushed at intermediate point between compressor pulley (1) and tension pulley (2) with about 100 N (10 kg) force.

   "a" : 8 – 9 mm as deflection/100N (10 kg)

   If belt tension is without above specification, adjust belt tension by according to the following procedures.

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

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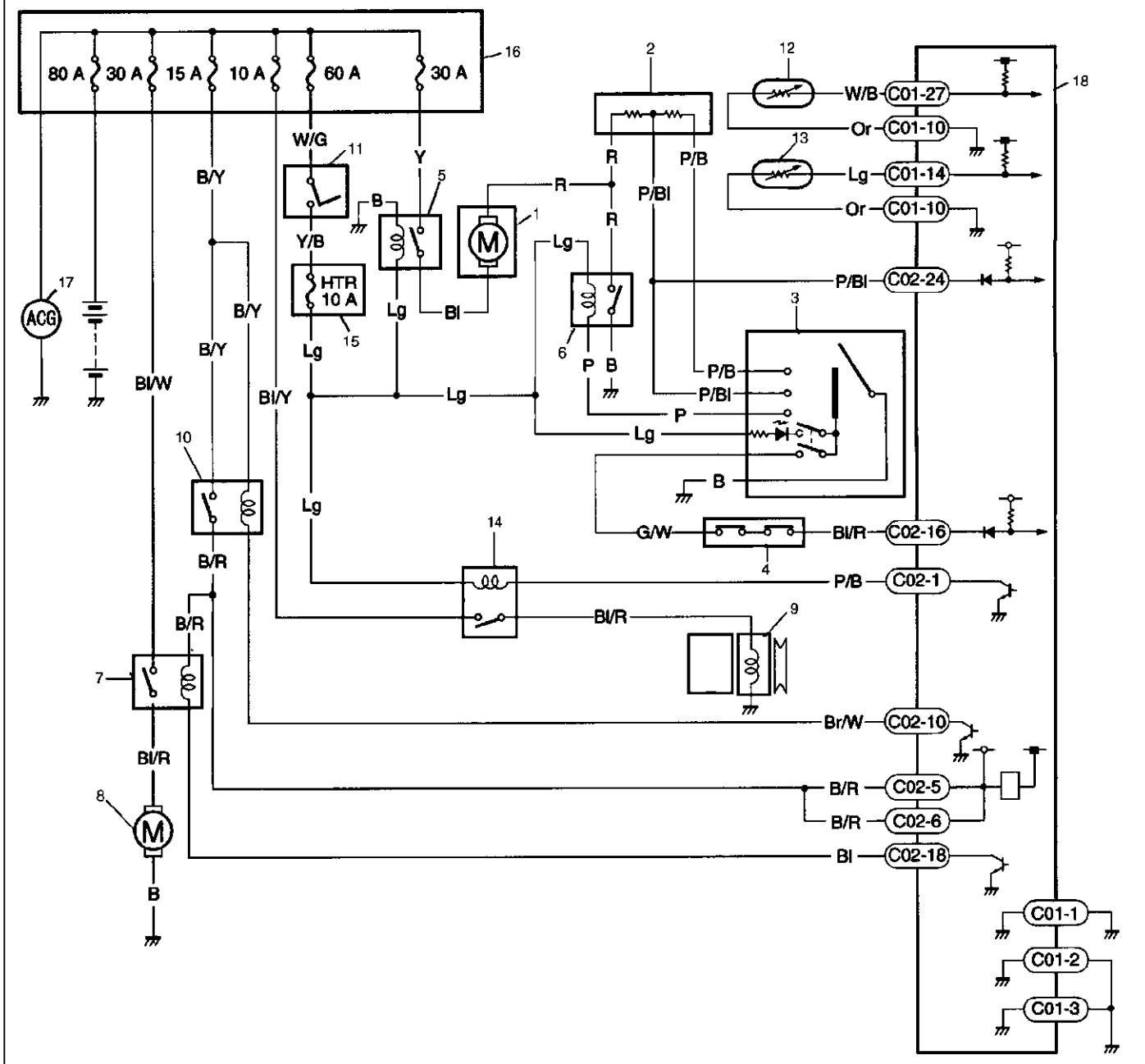
ELECTRONICAL DIAGNOSIS

WIRING DIAGRAM



-O-:12V	
-■-:5V	

1. Blower fan motor	10. Main relay
2. Blower fan motor resistor	11. Ignition switch
3. Blower fan motor switch and A/C switch	12. A/C evaporator thermistor (A/C evaporator temperature sensor)
4. Dual pressure switch	13. ECT sensor
5. Blower fan motor main relay	14. Compressor relay
6. Blower fan motor maximum relay	15. Circuit fuse box
7. Radiator/condenser cooling fan relay	16. Main fuse box
8. Radiator/condenser cooling fan motor	17. Generator
9. Compressor	18. ECM (PCM)

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Fig.A

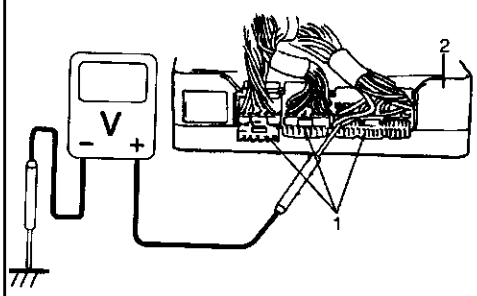
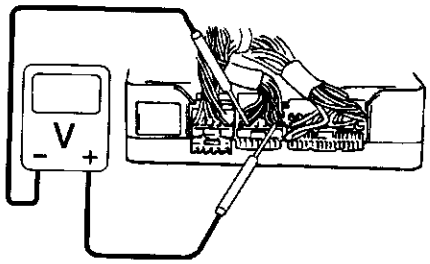


Fig.B



A/C SYSTEM INSPECTION OF ECM (PCM) AND ITS CIRCUITS

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

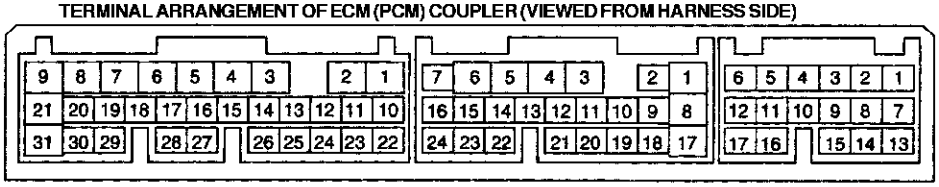
CAUTION:
ECM (PCM) cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM (PCM) with couplers disconnected from it.

Voltage Check

1) Remove ECM (PCM) from vehicle by referring to "ECM (PCM) REMOVAL AND INSTALLATION" in SECTION 6E1.
2) Connect ECM (PCM) couplers (1) to ECM (2).
3) Check voltage at each terminal of couplers connected.

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

TERMINAL ARRANGEMENT OF ECM (PCM) COUPLER (VIEWED FROM HARNESS SIDE)



C01 C02 C03

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ECM VOLTAGE VALUES TABLE FOR RELATION OF A/C CONTROL

Terminal	Wire	Circuit	Measurement ground	Normal value	Condition
C01-01	B/Or	ECM (PCM) main ground	Ground to body (Fig A)	– 0.5 – 0 volt	Engine running
C02-05	B/R	Main power supply for ECM (PCM)	Ground to engine (Fig B)	10 – 14 volts	Ignition switch ON with engine stopped
C01-02	B	ECM (PCM) ground for power circuit	Ground to body (Fig A)	– 0.5 – 0 volt	Engine running
C02-06	B/R	Power supply for ECM (PCM) power circuit	Ground to engine (Fig B)	10 – 14 volts	Ignition switch ON with engine stopped
C02-10	Br/W	Main relay drive	Ground to engine (Fig B)	0.5 – 1.2 volt	Ignition switch ON with engine stopped
				10 – 14 volts	Ignition switch OFF
C02-18	Bl	Radiator/condenser 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 98°C (208°F) with engine running
				12 – 15 volts	Except the above-mentioned with engine running
C01-03	B	ECM (PCM) ground for power circuit	Ground to body (Fig A)	– 0.5 – 0 volts	Engine running
C02-24	P/Bl	Blower fan speed input	Ground to engine (Fig B)	0 – 1 volt	Blower fan motor switch middle or high position with engine running
				4 – 8 volts	Blower fan motor switch low position with engine running
				12 – 15 volts	Blower fan motor switch OFF with engine running
C02-16	Bl/R	A/C switch input	Ground to engine (Fig B)	0 – 1 volts	Blower fan motor switch and A/C switch ON with engine running
				12 – 15 volt	Blower fan motor switch or A/C switch OFF with engine running
C01-10	Or	Sensor ground for A/C evaporator thermistor (A/C evaporator temperature sensor)	Ground to body (Fig A)	– 0.5 – 0 volt	Engine running
C01-27	W/B	A/C evaporator thermistor temperature (A/C evaporator temperature sensor) input	Ground to engine (Fig B)	About 2.13 volts (2000Ω)	A/C evaporator thermistor (A/C evaporator temperature sensor) at approximately 25°C (77°F) with engine running
				About 3.41 volts (5800Ω)	A/C evaporator thermistor temperature at approximately 2.5°C (35.6°F) with engine running *If the temperature is less than approximately 2°C, in this case compressor and radiator condenser fan should be stop (come back at more than approximately 4°C (less than 5374W, 3.33 V)
C01-14	Lg	ECT sensor input	Ground to engine (Fig B)	About 0.78 volts (335Ω)	Engine coolant temperature at approximately 80°C (176°F) with engine running
				About 0.40 volts (157Ω)	Engine coolant temperature at approximately 110°C (230°F) with engine running *If the temperature is more than 110°C (142Ω), in this case compressor should be stop come back at less than 108°C (more than 164Ω, 0.42 V)
C01-10	Or	Sensor ground for ECT sensor	Ground to body (Fig A)	– 0.5 – 0 volt	Engine running
C02-01	P/B	Compressor magnet clutch relay output	Ground to engine (Fig B)	0 – 1 volt	Blower fan motor switch and A/C switch ON with engine running at A/C evaporator thermistor (A/C evaporator temperature sensor) temperature input more than approximately 3.5°C (less than 3.00 V (4064Ω) and/or ECT sensor input less than 108°C (more than 0.43 V (149Ω)
				12 – 15 volts	Except the above-mentioned with engine running

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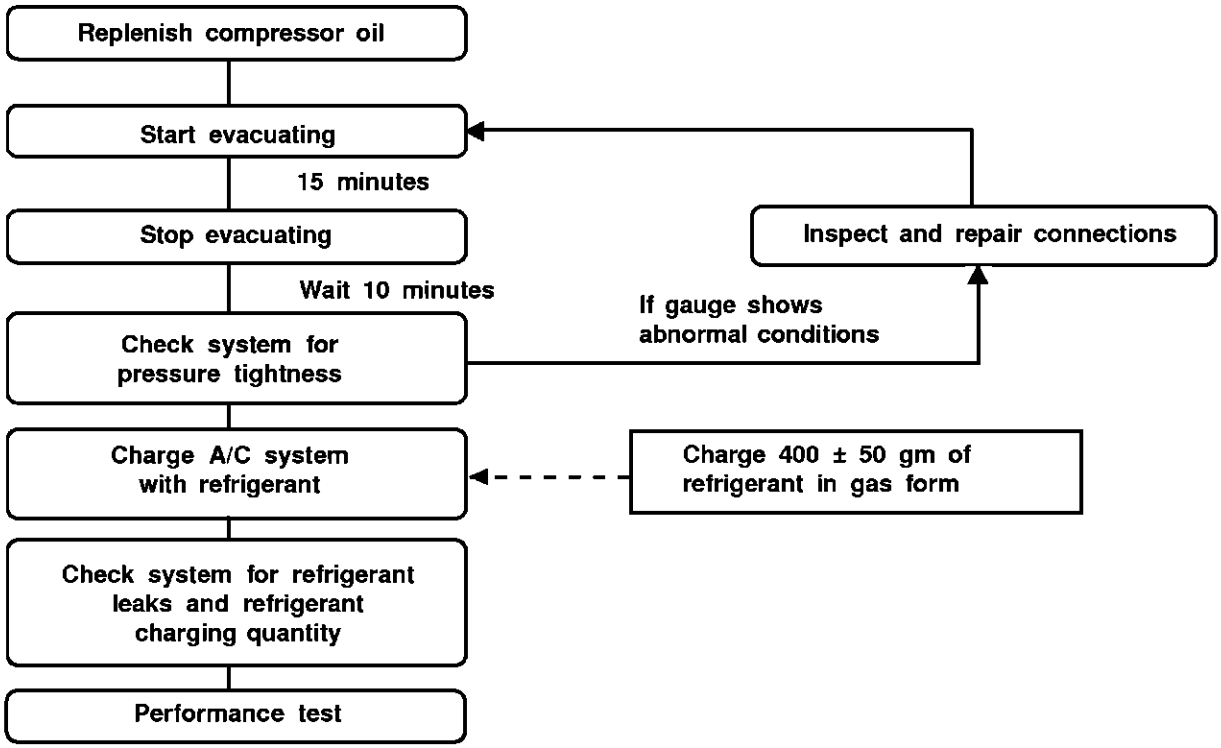
REFRIGERANT RECOVERY, EVACUATING AND CHARGING

WARNING:

- **Your eyes should not be exposed to refrigerant (liquid).**
  Any liquid Refrigerant-134a escaping by accident shows a temperature as low as approximately –6°C 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



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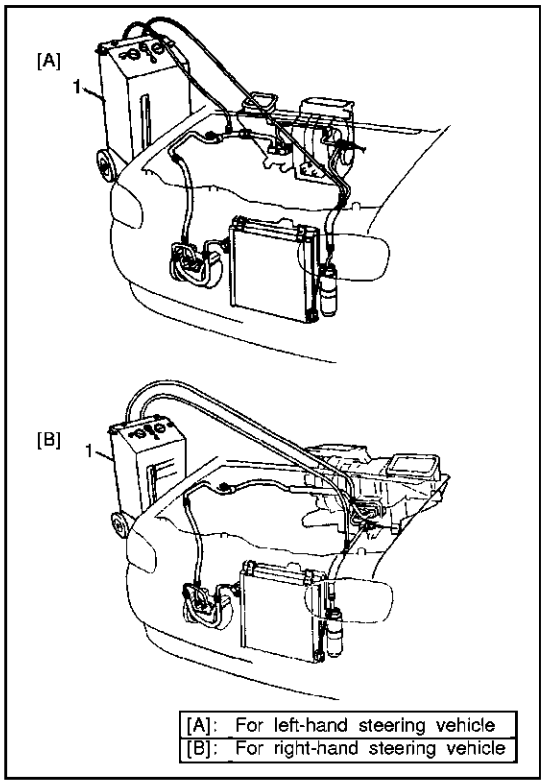


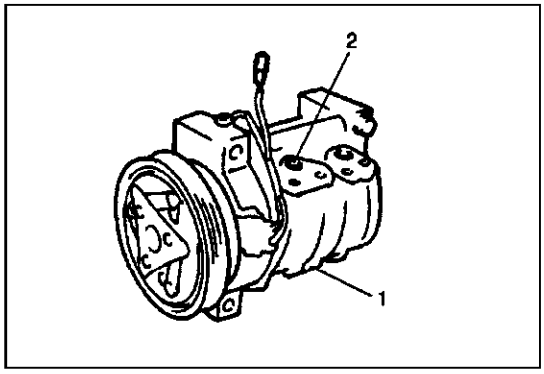
RECOVERY

REFRIGERANT RECOVERY

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

NOTE:

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



REPLENISHING COMPRESSOR OIL

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

When charging refrigerant only

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

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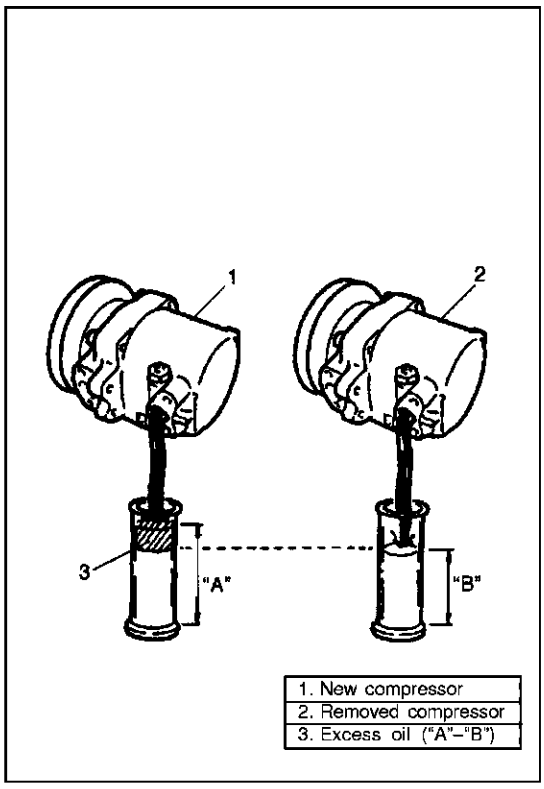

When replacing compressor

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 it by the amount calculated as follows.

"C" = "A" – "B"

"C": Amount of oil to be drained

"A": Amount of oil sealed in a new compressor

"B": Amount of oil remaining in removed compressor

NOTE:

- **Compressor assembly supplied from factory is filled up with the following amount of oil.**
- **Oil amount in compressor: 100 – 115 cm^3 (100 – 115 cc)**

When replacing other part

Replenish the following amount of oil to compressor.

Replaced part	Amount of compressor oil to be replenished
Evaporator	25 cc
Condenser	15 cc
Receiver/dryer	20 cc
Hoses	10 cc each
Pipes	10 cc each

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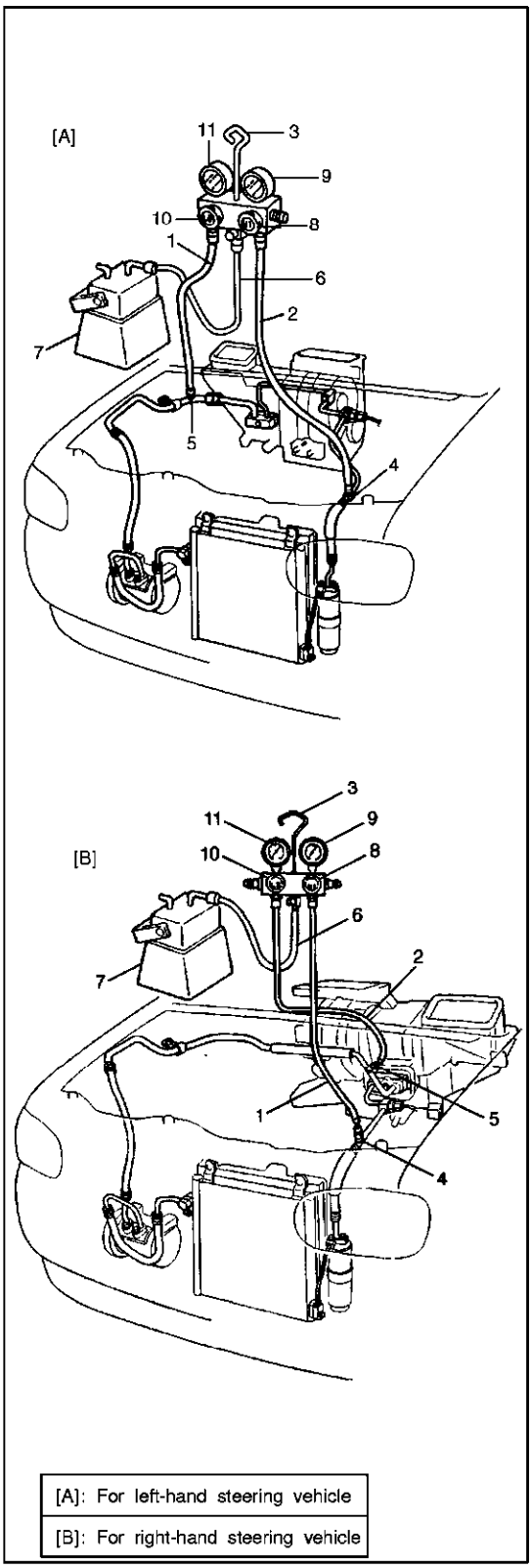

[A]: For left-hand steering vehicle
[B]: For right-hand steering vehicle

EVACUATING

EVACUATING PROCEDURE

1) Whenever opened (exposed to atmospheric air), air conditioning system must be evacuated by using a vacuum pump. The A/C system should be attached with a manifold gauge set, and should be evacuated for approximately 15 minutes.

   NOTE:

   Do not evacuate before recovering refrigerant in system.

2) 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 receiver/dryer outlet pipe

   Low charging hose (2) ➔ Low pressure charging valve (5) on suction pipe

3) Attach center charging hose (6) of manifold gauge set (3) to vacuum pump (7).

4) 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.

5) Approximately 10 minutes later, low pressure gauge (11) indicate -100Kpa (-1.0Kg/cm^2, -760mmHg, -14.2 psi) providing no leakage exists.

   NOTE:

   - **If the system does not indicate -100Kpa (-1.0Kg/cm^2,-760mmHg, -14.2 psi) , 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.**

6) Evacuation should be carried out for a total of at least 15 minutes.

7) Continue evacuation until low pressure gauge (9) indicates -100Kpa (-1.0Kg/cm^2, -760mmHg, -14.2 psi), and then close both valves (8), (10).

8) Stop vacuum pump (7). Disconnect center charging hose (6) from pump inlet. Now, the system is ready for charging.

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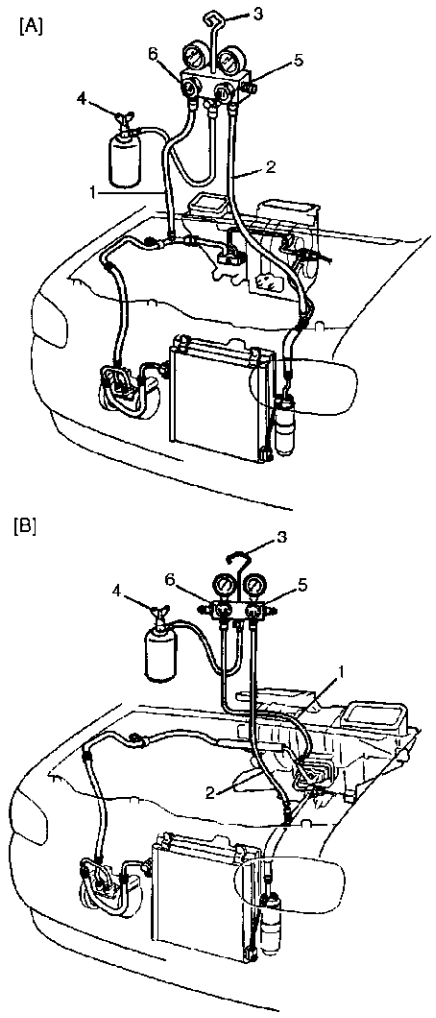
CHARGING

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 from 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 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.



[A]: For left-hand steering vehicle
[B]: For right-hand steering vehicle

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).

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

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

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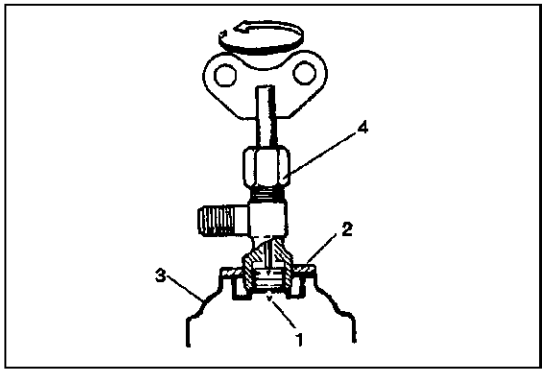
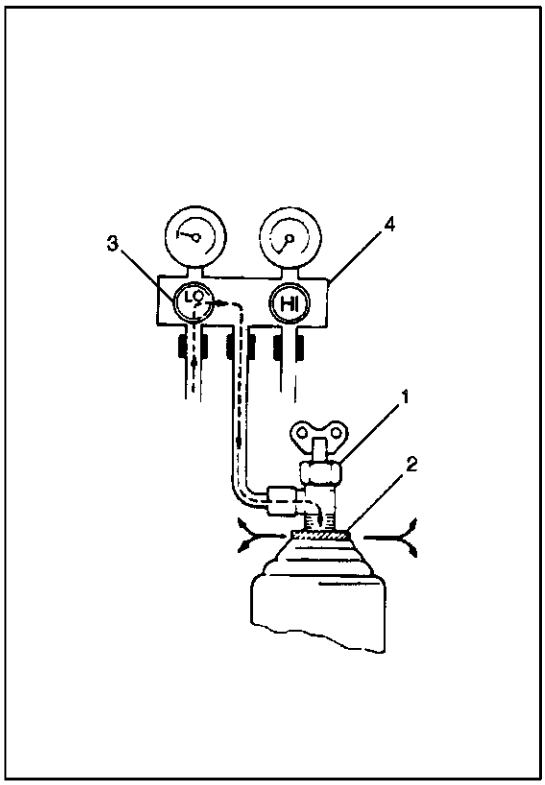
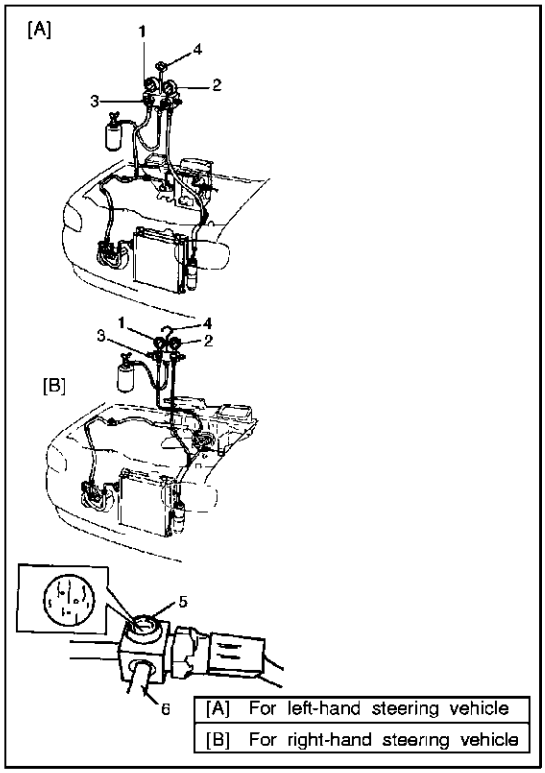


7) When refrigerant container (3) is emptied, use the following procedure to replace it with a new refrigerant container (3).
   a) Close low pressure valve.
   b) Replace empty container (3) with a refrigerant container which has been charged with refrigerant. When using refrigerant container tap valve (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 (350 – 450 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) of manifold gauge set (4). At this time, look into the sight glass (5) of receiver/ dryer outlet pipe (6) and check that there are no bubbles (7) in it, which means that the system is fully charged.

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

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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.**

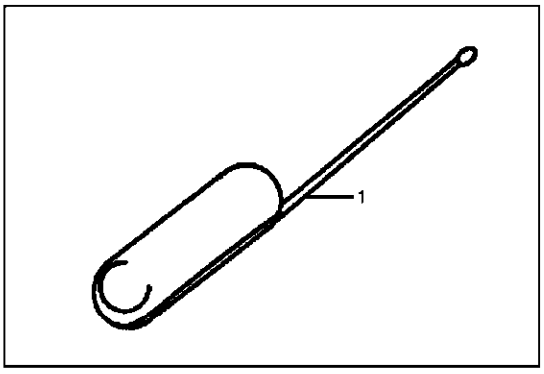
5) Put caps on service valves.

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.



Special Tool

(A): 09990-86011

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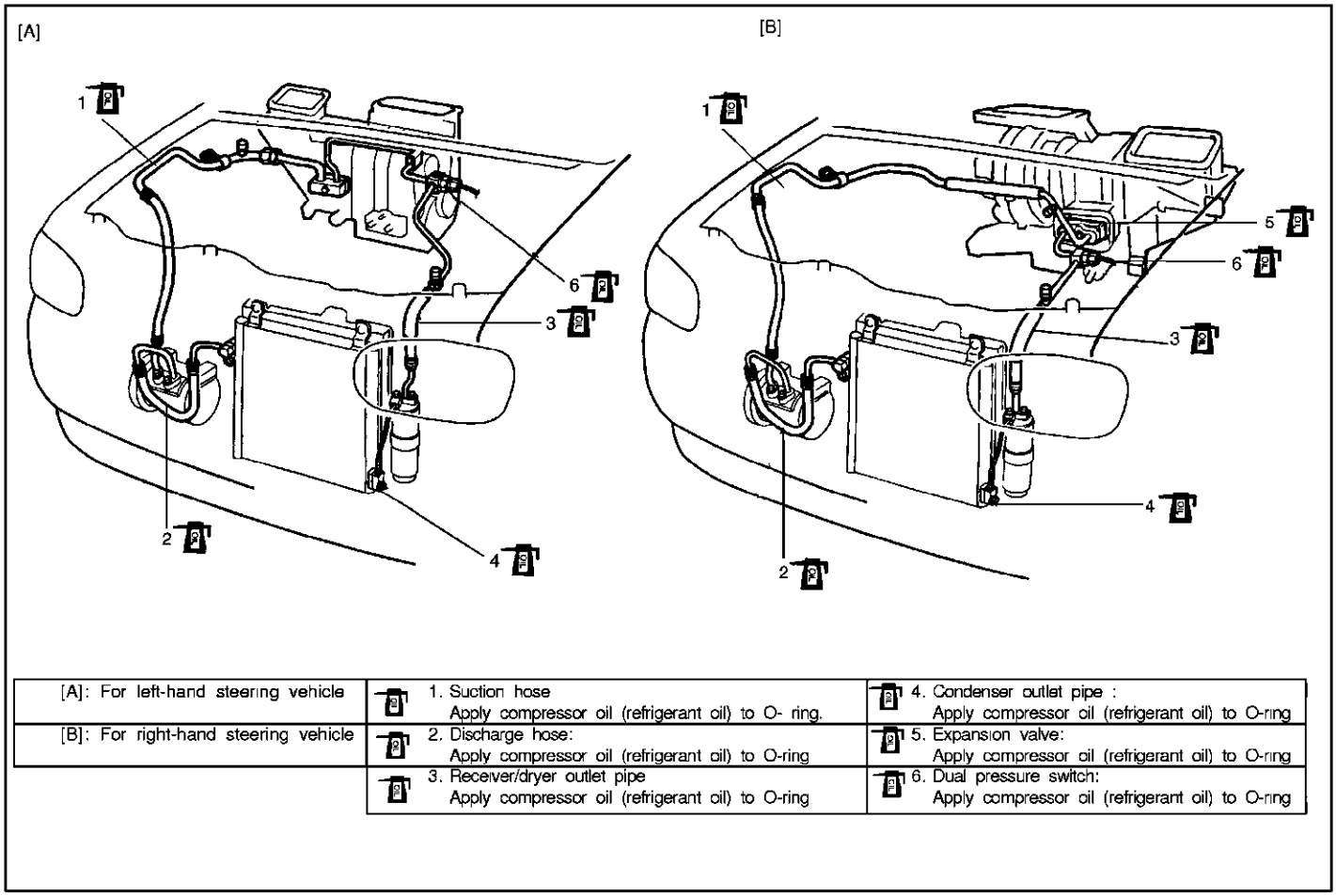
ON-VEHICLE SERVICE

SERVICE PRECAUTION

When servicing air conditioning system, note the following instructions.

REFRIGERANT LINE



[A]: For left-hand steering vehicle	1. Suction hose Apply compressor oil (refrigerant oil) to O- ring.	4. Condenser outlet pipe : Apply compressor oil (refrigerant oil) to O-ring
[B]: For right-hand steering vehicle	2. Discharge hose: Apply compressor oil (refrigerant oil) to O-ring	5. Expansion valve: Apply compressor oil (refrigerant oil) to O-ring
	3. Receiver/dryer outlet pipe Apply compressor oil (refrigerant oil) to O-ring	6. Dual pressure switch: Apply compressor oil (refrigerant 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 (refrigerant oil) to seats of coupling nuts and O-ring.
- When tightening or loosening a fitting, use two wrenches, one for turning and the other for support.
- 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.
- If pipes or hoses are replaced, replenish specified amount of compressor oil to compressor suction-side by referring to “REPLENISHING COMPRESSOR OIL” in this section.

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HANDLING REFRIGERANT HFC-134a (R-134a)

- Always wear goggles to protect your eyes.
- Avoid you direct contact to liquid refrigerant.
- Do not heat refrigerant container higher than 40°C.
- 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.

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.**

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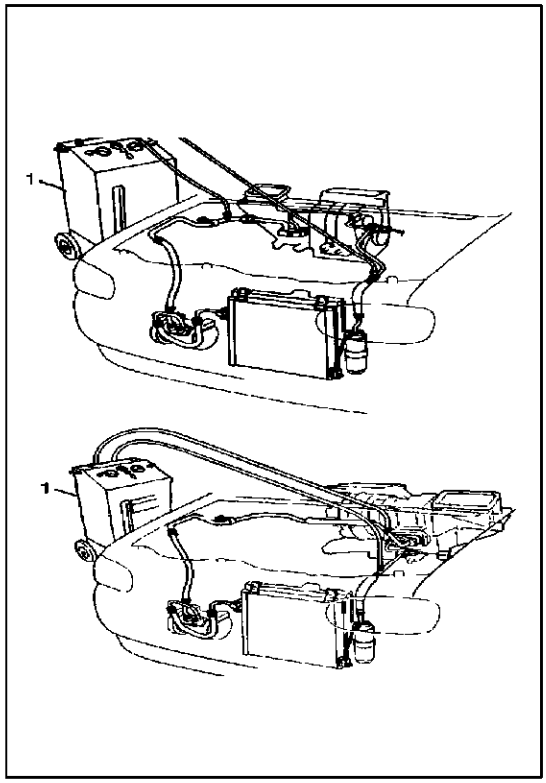
CONDENSER ASSEMBLY

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 9.
4) Disconnect discharge hose (1) from condenser (2) and remove its bracket from condenser (2).
5) Disconnect receiver/dryer outlet hose (3) from receiver/dryer (4).
6) Remove left side head lamp with disconnect related connectors.
7) Disconnect condenser outlet pipe (5) from receiver/dryer (4).
8) Loosen radiator mounting bolt (6).
9) Loosen condenser mounting bolt (7).
10) Remove condenser assembly (2).

INSTALLATION

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

- If condenser is replaced, 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 headlight aiming by referring to "HEADLIGHT AIMING WITH SCREEN" under "HEADLIGHT" in SECTION 8.

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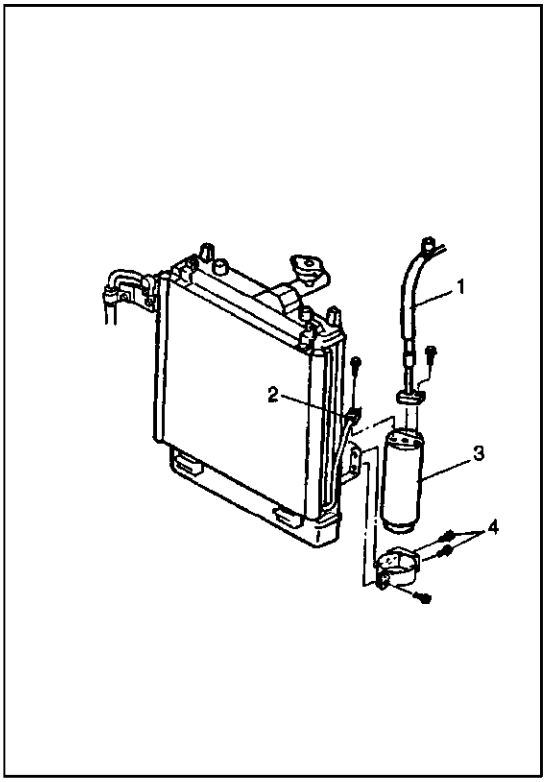


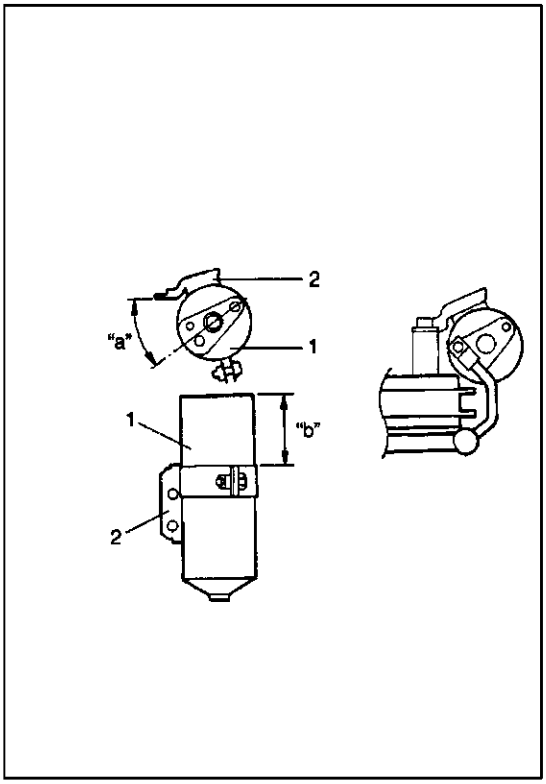
RECEIVER/DRYER

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



INSTALLATION

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

- If receiver/dryer is replaced, 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.
- Install receiver/dryer (1) to its bracket (2) as shown in figure.

Angle "a": 35°
Length "b": 54 – 55 mm (2.13 – 2.17 in.)

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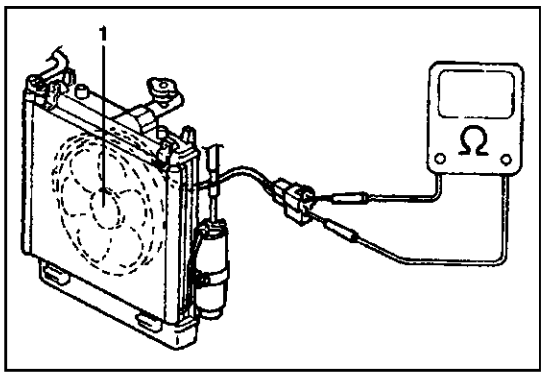


RADIATOR/CONDENSER COOLING FAN MOTOR

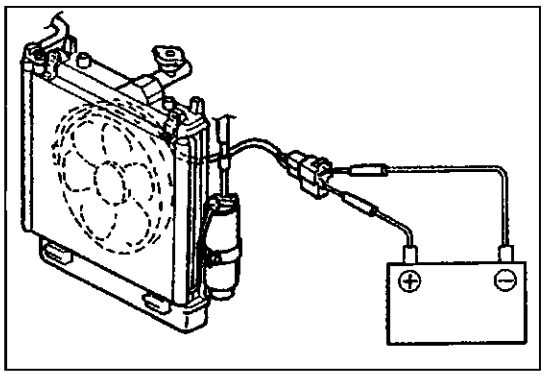
REMOVAL AND INSTALLATION

For details, refer to "RADIATOR AND FAN" in SECTION 6B.

INSPECTION

1) Check continuity between each two terminals about the radiator/condenser cooling fan motor (1).

   If check results are no continuity, replace radiator/condenser cooling fan motor.



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

   Reference current : approximately 8.0 – 12.0 A at 12 V

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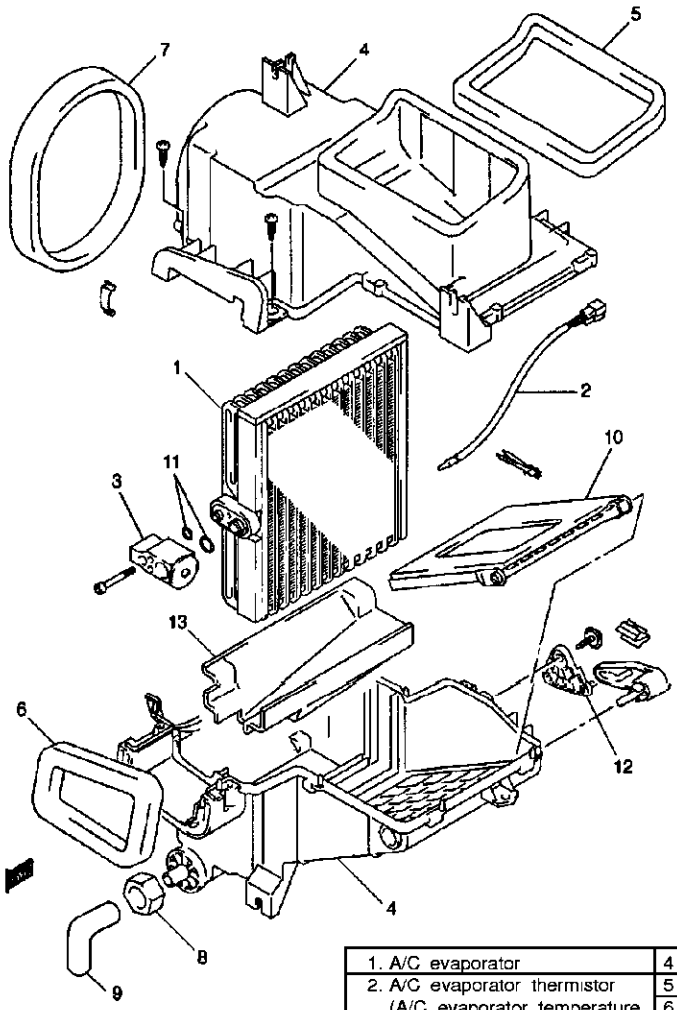
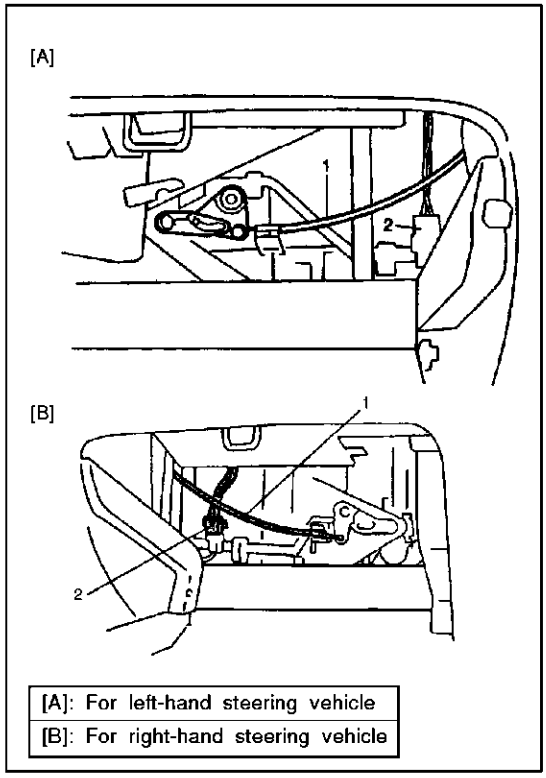
COOLING UNIT (EVAPORATOR)



1. A/C evaporator	4. Evaporator case	9. Drain hose
2. A/C evaporator thermistor (A/C evaporator temperature sensor)	5. Cooling unit packing	10. Air inlet door
	6. Dash packing	11. O-ring
	7. Packing	12. Door link
3. Expansion valve	8. Drain packing	13. Lower packing



[A]: For left-hand steering vehicle
[B]: For right-hand steering vehicle

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 glove box.
4) Remove fresh air control cable (1) and disconnect A/C evaporator (A/C evaporator temperature sensor) thermistor coupler (2).

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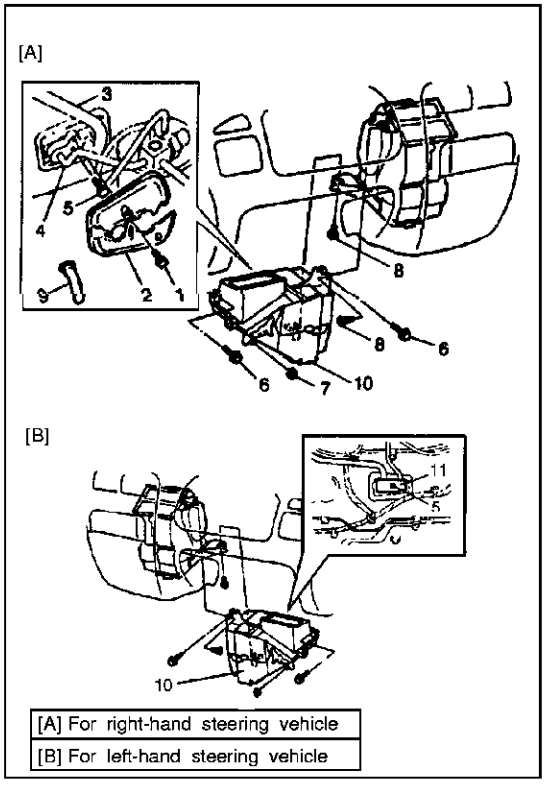
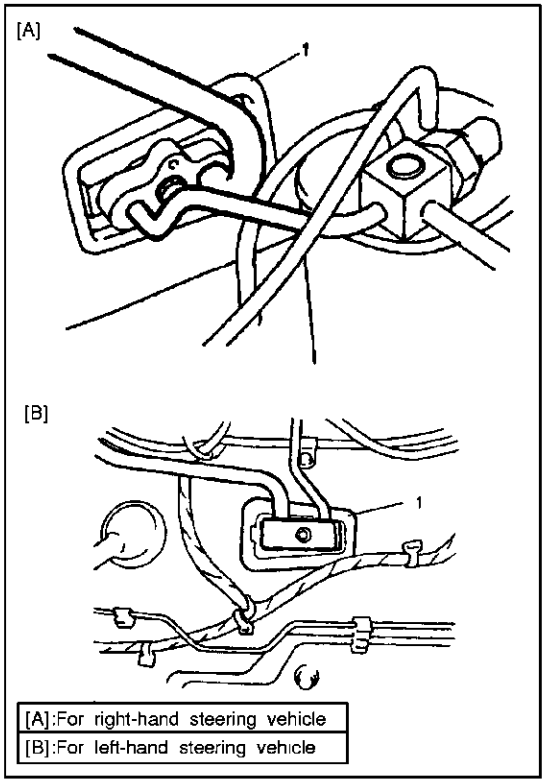


[A] For right-hand steering vehicle
[B] For left-hand steering vehicle

5) Remove attaching bolt (1) and cover (2).
6) Disconnect suction hose (3) and receiver/dryer outlet hose (4) by removing attaching bolt (5).
7) Remove cooling unit mounting bolts (6), nut (7) and screws (8).
8) Remove drain hose (9).
9) Remove cooling unit (10).



[A]:For right-hand steering vehicle
[B]:For left-hand steering vehicle

INSTALLATION

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

- If cooling unit or evaporator is replaced, replenish specified amount of compressor oil to compressor suction side by referring to "REPLENISHING COMPRESSOR OIL" in this section.
- Install uniformly the packing (1) to installation hole.

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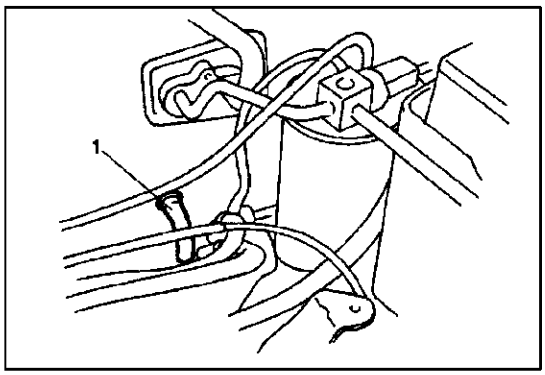

- Evacuate and charge refrigerant by referring to "EVACUATING" and "CHARGING" in this section.
- Adjust fresh air control cable, refer to "HEATER CONTROL LEVER ASSEMBLY" in SECTION 1A.
- Install the cutting part of drain hose (1) downward as shown in figure.
- If A/C evaporator thermistor (A/C evaporator temperature sensor) removed, its should be reinstalled in original position.

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.

NOTE:

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

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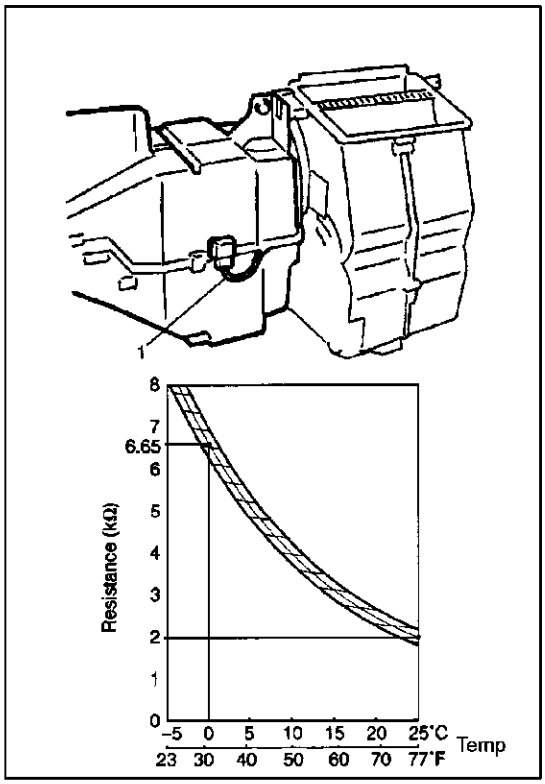


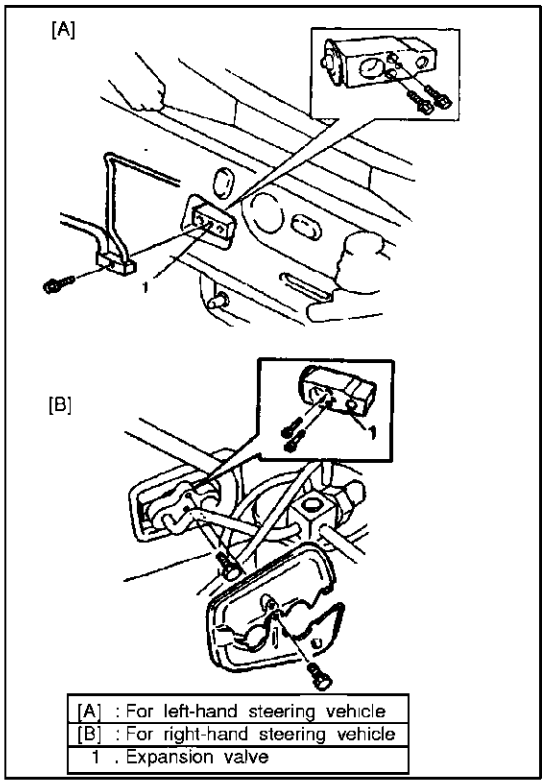
A/C EVAPORATOR THERMISTOR (A/C EVAPORATOR TEMPERATURE SENSOR)

Check resistance between terminals for A/C evaporator thermistor (1).

Sensor Temperature (°C)	Resistance (kΩ)
0	6.3 – 7.0
25	1.8 – 2.2

If check results are not as specified, replace thermistor.

NOTE:
When A/C evaporator thermistor removed, it should be re-installed in original position.

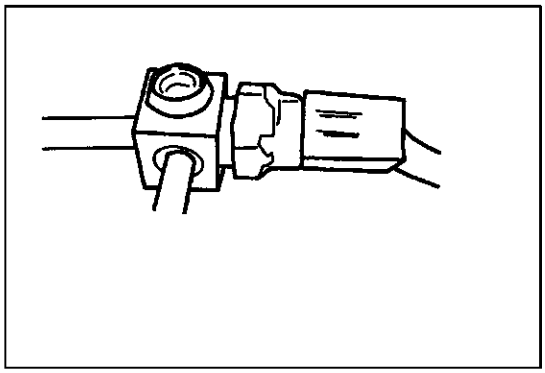


[A] : For left-hand steering vehicle
[B] : For right-hand steering vehicle
1 . Expansion valve

EXPANSION VALVE

INSPECTION

Refer to "PERFORMANCE DIAGNOSIS" in this section.



DUAL PRESSURE SWITCH

INSPECTION

1) Check dual pressure switch (1) for continuity at normal temperature (approximately 25°C) 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.

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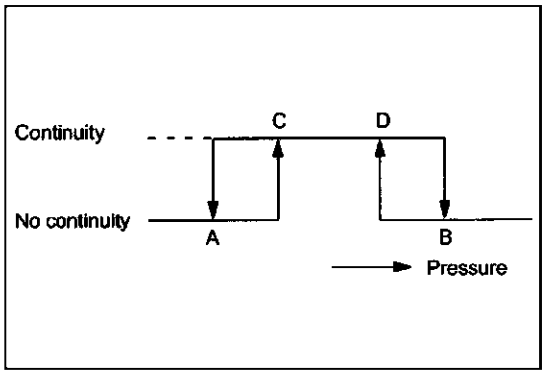


2) Check switch for continuity at specified pressure as shown.

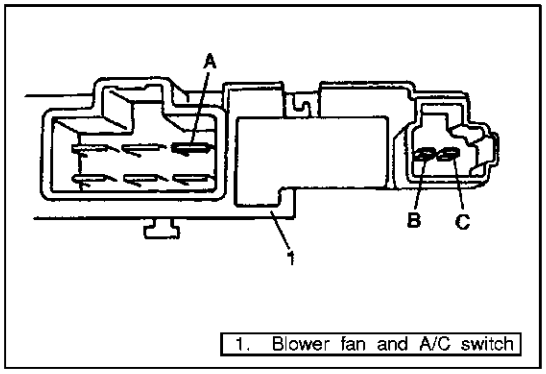
A: Approximately 200 kPa (2.0 kg/cm²)
B: Approximately 3200 kPa (32 kg/cm²)
C: Approximately 230 kPa (2.3 kg/cm²)
D: Approximately 2600 kPa (26 kg/cm²)

Tightening torque for dual pressure switch
11 N-m (1.1 kg-m, 8.0 lb-ft)

A/C SWITCH

REMOVAL AND INSTALLATION

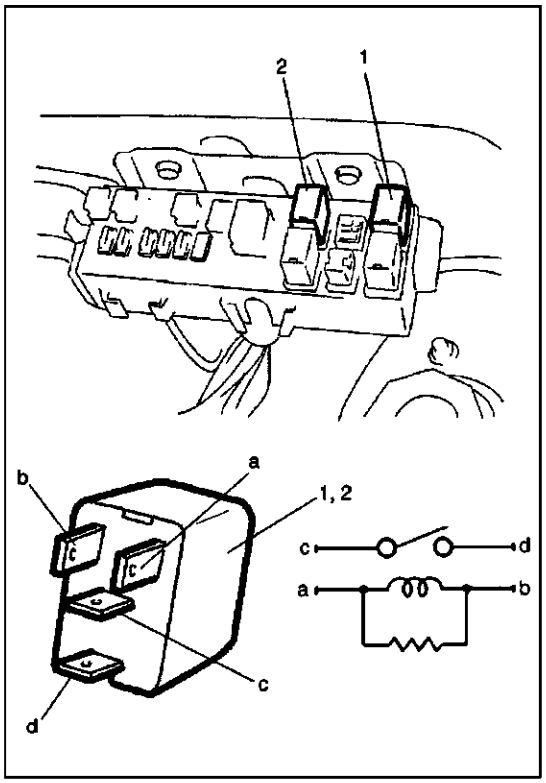
Refer to "HEATER CONTROL LEVER ASSEMBLY" in SECTION 1A.



1. Blower fan and A/C switch

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 check if indicator lamp lights.



RADIATOR/CONDENSER COOLING FAN MOTOR RELAY AND COMPRESSOR RELAY

INSPECTION

1) Disconnect negative (–) cable at battery.
2) Remove radiator/condenser cooling fan motor relay (1) and compressor relay (2) from vehicle.
3) Check that there is no continuity between terminal "c" and "d".

   If there is continuity, replace relay.
4) Check that there is continuity between terminals "c" and "d" when battery is connected to terminal "a" and "b".

   If there is no continuity, replace relay.

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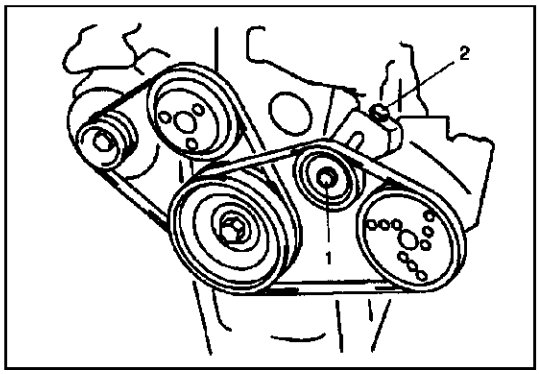
COMPRESSOR

REMOVAL

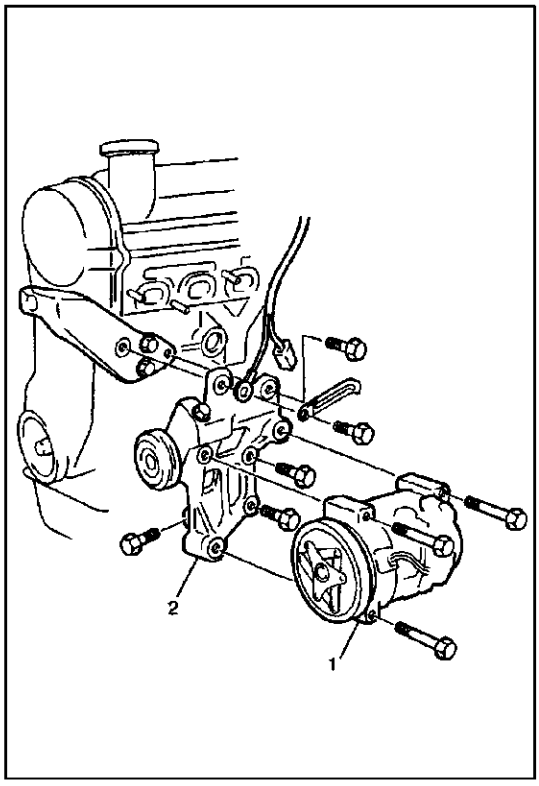
1) Run engine at idle speed with air conditioning ON for 10 minutes. After that stop the engine.
2) Disconnect negative (–) cable at battery.
3) Recover refrigerant from refrigeration system by referring to "RECOVERY" in this section.

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



4) Remove compressor drive belt by loosening tension pulley bolt (1) and adjust bolt (2).
5) Remove front bumper by referring to "FRONT BUMPER" in SECTION 9.
6) Disconnect magnet clutch lead wire coupler.
7) Disconnect suction and discharge hoses from compressor.

NOTE:
Cap open fittings immediately to keep moisture out of system.



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

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

9) Remove compressor bracket assembly (2).

INSTALLATION

Reverse removal procedure for installation, noting the following instructions.

- If compressor is replaced, pour new compressor oil by referring to "REPLENISHING COMPRESSOR OIL" in this section.
- Evacuate and charge system by referring to "RECOVERY" in this section.

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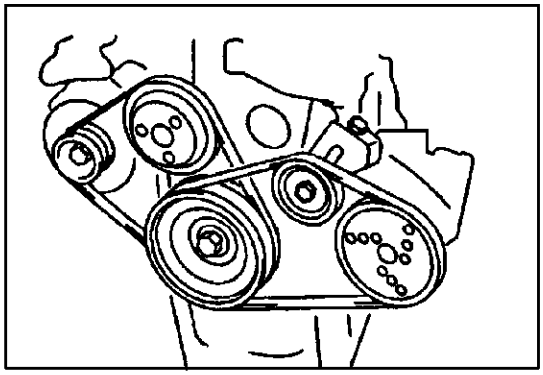
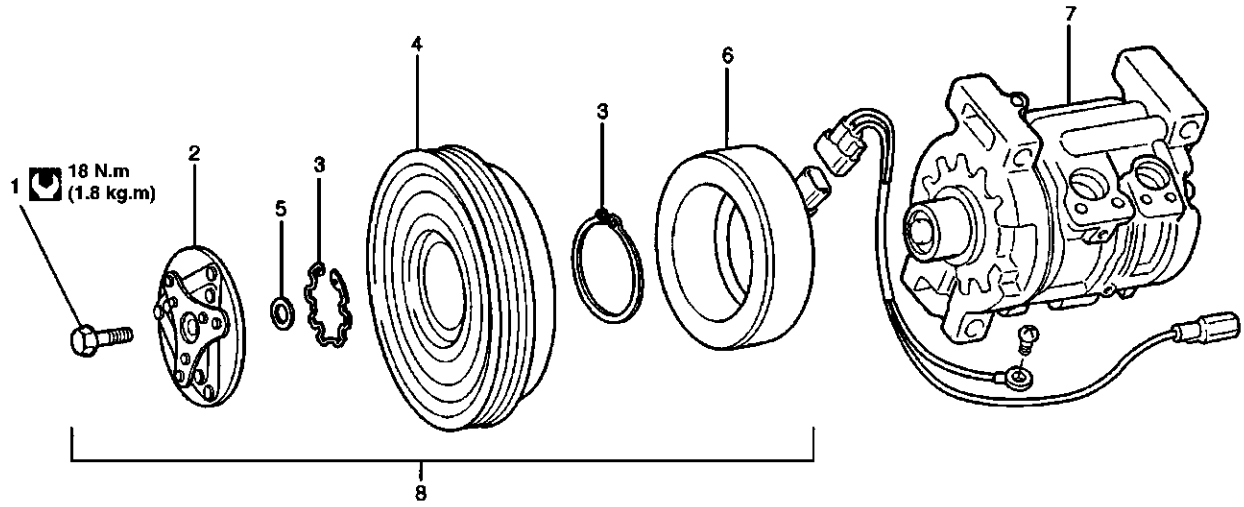
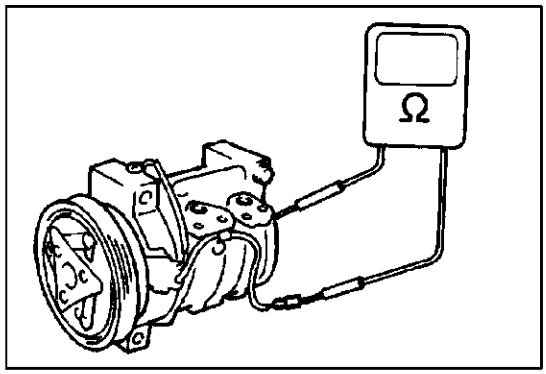


- Adjust drive belt tension by referring to "COMPRESSOR DRIVE BELT INSPECTION" in this section.

MAGNET CLUTCH



1. Clutch plate bolt	5 Shim	Tightening Torque
2. Clutch plate	6 Clutch coil	
3. Circlip	7 Compressor body assembly	
4. Clutch pulley	8 Magnet clutch assembly	



INSPECTION

1) Inspect clutch plate and clutch pulley for leaks of compressor oil.
2) Check clutch pulley bearings for noise and grease leakage.
3) Using ohmmeter, measure resistance of clutch coil between magnet clutch lead wire and compressor mounting leg.

   If measured resistance is not within tolerance, replace clutch coil.

   Standard resistance: 3.5 – 4.5Ω at 20°C (68°F)

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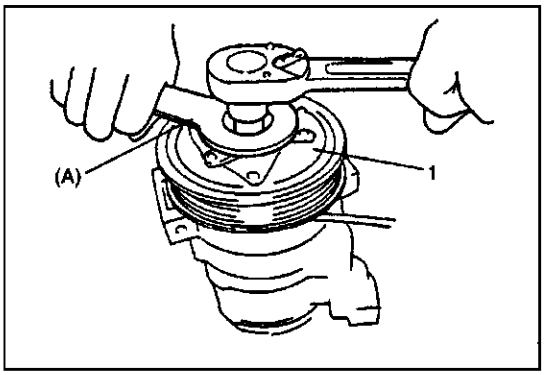


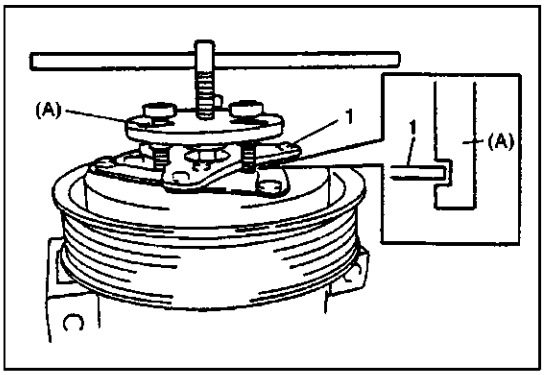
REMOVAL

1) Remove compressor from vehicle by referring to "COMPRESSOR" in this section.
2) Fix clutch plate (1) with special tool and remove clutch plate bolt.

   Special Tool

   (A): 09991-06020

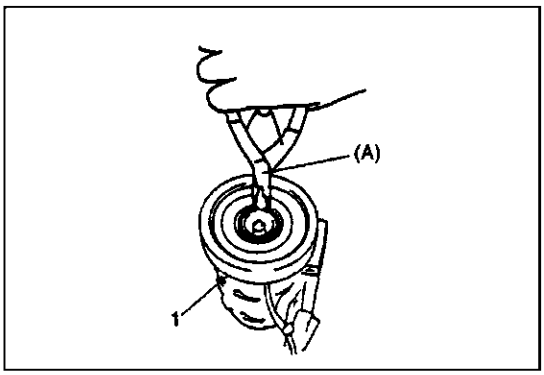
   NOTE:
   Do not reuse clutch plate bolt.



3) Using special tool, remove clutch plate (1).

   Special Tool

   (A): 09991-06030

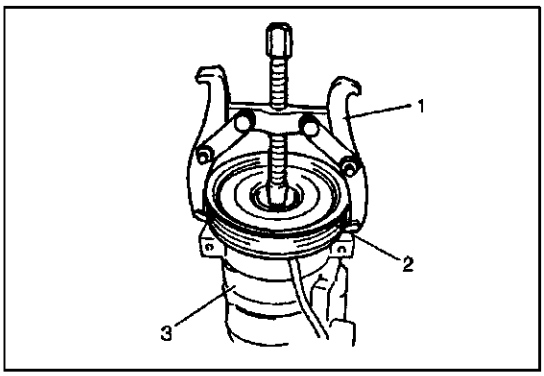


4) Remove shims from shaft.
5) Using special tool, remove circlip from compressor (1).

   Special Tool

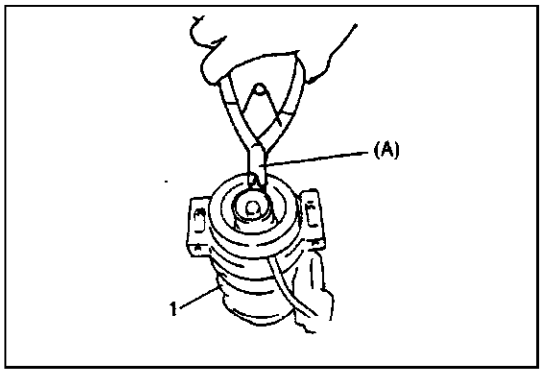
   (A): 09900-06107

6) Remove clutch coil lead wire clamp screw, and remove magnet clutch lead wire ground terminal.



7) Remove clutch pulley (2) from compressor (3) with puller (1).

   NOTE:
   Be careful not to damage pulley when tapping magnet clutch.



8) Using special tool, remove circlip from compressor (1).

   Special Tool

   (A): 09900-06107

9) Remove clutch coil.

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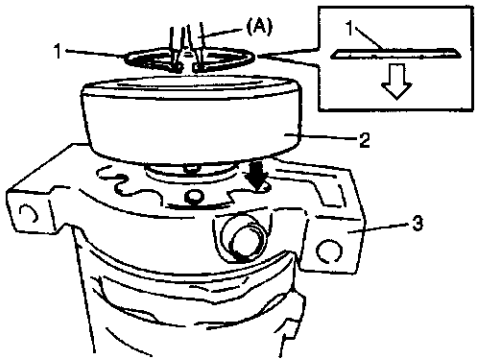


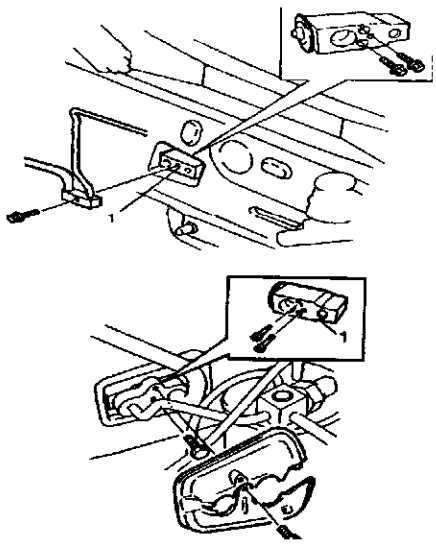
3. Compressor assembly

INSTALLATION

1) Install clutch coil (2).

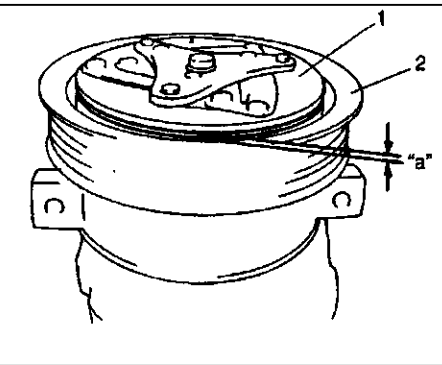
NOTE:
Protrusion on under side of coil ring must match hole in compressor assembly to prevent movement and correctly locate lead wire.

2) Using special tool, install circlip (1) as shown.
Special Tool
(A): 09900-06107
3) Install clamp portion and ground terminal of lead wire.



4) Set clutch pulley (1) squarely over clutch installation boss.
Place special tool onto clutch bearing.
Ensure that edge rests only on inner race of bearing.
5) Install circlip.
Special Tool
(A): 09991-06010

CAUTION:
Be careful not to scratch bearing seal.



6) Adjust clearance, between clutch plate (1) and clutch pulley (2) by putting shim on compressor shaft.
Standard clearance "a": 0.25–0.50 mm (0.0098–0.020 in.)

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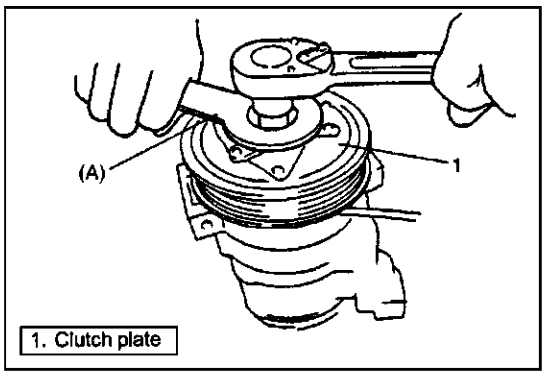


7) Tighten new clutch plate bolt as specified below.

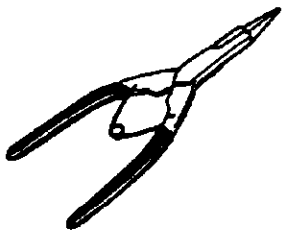
Tightening Torque for clutch plate bolt
18 N-m (1.8 kg-m, 13.0 lb-ft)

Special Tool
(A): 09991-06020

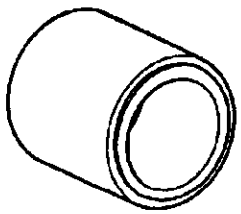
REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Compressor oil (Refrigerant oil)	COMPRESSOR OIL (ND-OIL8, 250cc) 99000-27080-0000	• O-ring • Each component

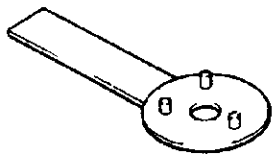
SPECIAL TOOLS



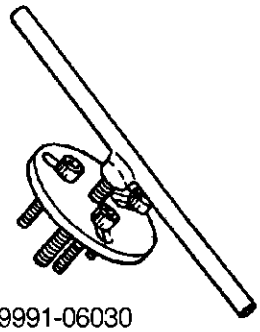
09900-06107
Snap ring remover (Open type)



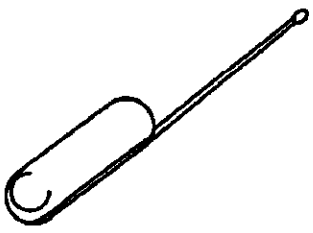
09991-06010
Magnet clutch pulley installer



09991-06020
Armature plate spanner



09991-06030
Armature plate remover



09990-86011
Electronic leak detector

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SECTION 3

STEERING, SUSPENSION, WHEELS AND TIRES

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FRONT END ALIGNMENT ..... SECTION 3A
MANUAL RACK AND PINION ..... SECTION 3B
ELECTRICAL POWER STEERING (P/S) SYSTEM ..... SECTION 3B1
STEERING WHEEL AND COLUMN ..... SECTION 3C
FRONT SUSPENSION ..... SECTION 3D
REAR SUSPENSION ..... SECTION 3E
WHEELS AND TIRES ..... SECTION 3F

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DIAGNOSIS

GENERAL DIAGNOSIS

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

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

DIAGNOSIS TABLE

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

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Condition	Possible Cause	Correction
Shimmy, Shake or Vibration	• Tire or wheel out of balance.	Balance wheels or replace tire and/or wheel.
	• Loosen wheel bearings.	Replace wheel bearing.
	• Worn tie rod ends.	Replace tie rod end.
	• Worn lower ball joints.	Replace front suspension arm.
	• Excessive wheel runout.	Repair or replace wheel and/or tire.
	• Blister or bump on tire.	Replace tire.
	• Excessively loaded radial runout of tire/ wheel assembly.	Replace tire or wheel.
	• Disturbed front end alignment.	Check and adjust front end alignment.
	• Loose or worn steering linkage.	Tighten or replace steering linkage.
	• Loose steering gear case bolts.	Tighten case bolts.
Hard Steering	• Tire not adequately inflated.	Inflate tires to proper pressure.
	• Malfunction of power steering system. (Power steering only.)	Check and correct.
	• Bind in tie rod end ball studs or lower ball joints.	Replace tie rod end or front suspension arm.
	• Disturbed front end alignment.	Check and adjust front end alignment.
	• Rack and pinion adjustment.	Check and adjust rack and pinion torque.
	• Bind in steering column.	Repair or replace.
Too Much Play in Steering	• Wheel bearings worn.	Replace.
	• Loose steering gear case bolts.	Tighten.
	• Rack and pinion adjustments.	Check and adjust rack and pinion torque.
	• Worn steering shaft joints.	Replace joint.
	• Worn tie rod ends or tie rod inside ball joints.	Replace tie rod end or tie rod.
	• Worn lower ball joints.	Replace front suspension control arm.
Poor Returnability	• Bind in tie rod end ball studs.	Replace tie rod end.
	• Bind in ball joints.	Replace.
	• Bind in steering column.	Repair or replace.
	• Poorly lubricated rack and pinion.	Check, repair or lubricate rack and pinion.
	• Disturbed front end alignment.	Check and adjust front end alignment.
	• Rack and pinion adjustment.	Check and adjust rack and pinion torque.
	• Tires not adequately inflated.	Adjust tire pressure.

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Condition	Possible Cause	Correction
Rack and Pinion Noise (Rattle or Chuckle)	• Loose steering gear case bolts. • Worn rack bush. • Rack and pinion adjustment.	Tighten. Replace. Check and adjust rack and pinion torque.
Abnormal Noise, Front End	• Worn, sticky or loose tie rod ends, lower ball joints, tie rod inside ball joints or drive shaft joints. • Damaged struts or mountings. • Worn suspension arm bushings. • Loose stabilizer bar. • Loose wheel nuts. • Loose suspension bolts or nuts. • Broken or otherwise damaged wheel bearings. • Broken suspension springs. • Poorly lubricated or worn strut bearings.	Replace tie rod end, suspension arm, tie rod or drive shaft joint. Repair or replace. Replace. Tighten bolts or nuts, replace bushes. Tighten wheel nuts. Tighten suspension bolts or nuts. Replace. Replace. Replace strut bearing.
Wander or Poor Steering Stability	• Mismatched or uneven tires. • Loosen ball joints and tie rod ends. • Faulty struts or mountings. • Loose stabilizer bar. • Broken or sagging springs. • Rack and pinion adjustment. • Front end alignment.	Replace or inflate tires to proper pressure. Replace suspension arm or tie rod end. Replace strut or repair mounting. Tighten or replace stabilizer bar or bush. Replace spring. Check and adjust rack and pinion torque. Check and adjust front end alignment.
Erratic Steering When Braking	• Worn wheel bearings. • Broken or sagging springs. • Wheel tires are inflated unequally. • Disturbed front end alignment. • Brakes not working in unison. • Leaking wheel cylinder or caliper. • Warped discs. • Badly worn brake linings. • Drum is out of round in some brakes. • Defective wheel cylinders.	Replace. Replace coil spring. Inflate tires to proper pressure. Check and adjust front end alignment. Refer to Section 5. Repair or replace wheel cylinder or caliper. Replace brake disc. Replace brake shoe lining. Replace brake drum. Replace or repair wheel cylinder.

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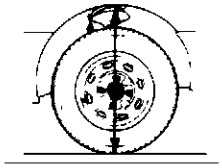
Condition	Possible Cause	Correction
Low or Uneven Trim Height Right-to-left trim height (H) difference should be within 10 mm (0.4 in.) with curb weight.  *Same with rear side.	• Broken or sagging springs. • Over loaded. • Incorrect springs.	Replace. Check loading. Replace.
Ride Too Soft	• Faulty struts (shock absorber).	Replace strut.
Suspension Bottoms	• Overloaded. • Faulty struts (shock absorber). • Incorrect, broken or sagging springs.	Check loading. Replace strut. Replace.
Body Leans or Sways in Corners	• Loose stabilizer bar. • Faulty struts (shock absorbers) or mountings. • Broken or sagging springs. • Overloaded.	Tighten stabilizer bar bolts or nuts, or replace bushes. Replace strut or tighten mounting. Replace. Check loading.
Cupped Tires	• Front struts defective. • Worn wheel bearings. • Excessive tire or wheel run-out. • Worn ball joints. • Tire out of balance.	Replace. Replace. Replace tire or wheel disc. Replace front suspension arm. Adjust tire balance.

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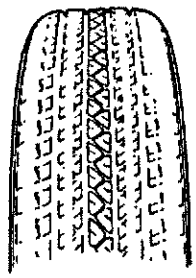
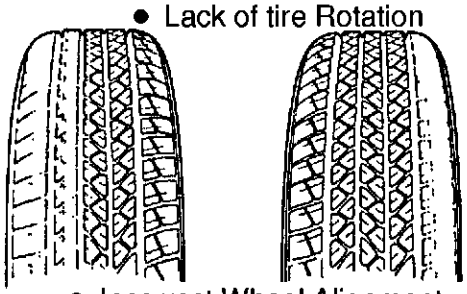


- Hard Cornering
- Under Inflation
- Lack of tire Rotation



- Incorrect Wheel Alignment
- Tire Construction not Uniform
- Wheel Heavy Acceleration

TIRE DIAGNOSIS

IRREGULAR AND/OR PREMATURE WEAR

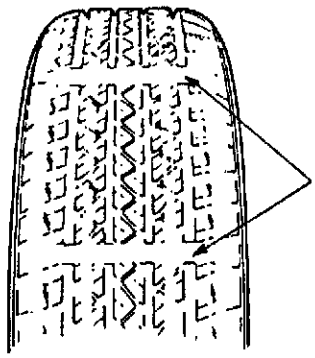
Irregular and premature wear has many causes. Some of them are: incorrect inflation pressures, lack of tire rotation, driving habits, improper alignment.

If the following conditions are noted, rotation is necessary:

1) Front tire wear is different from rear.
2) Uneven wear exists across the tread of any tire.
3) Front tire wear is unequal between the right and left.
4) Rear tire wear is unequal between the right and left.
5) There is cupping, flat spotting, etc.

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

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

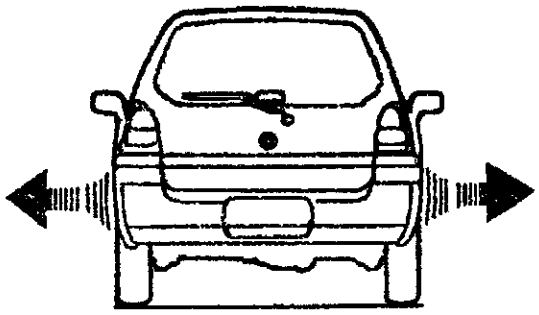


WEAR INDICATORS

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

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

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 a low speed, 5 to 30 mph.

It is possible to locate the faulty tire by road testing the vehicle. If it is on the rear, the rear end of the vehicle shakes from side to side or "waddles". To the driver in his seat, it feels as though someone is pushing on the side of vehicle.

If the faulty tire is on the front, waddling is more visual. The front sheet metal appears to be moving back and forth and the driver feels as though he is at the pivot point in vehicle.

Waddle can be quickly diagnosed by using Tire Problem Detector (TPD) and following the equipment manufacture's recommendations.

If TPD is not available, an alternative method of substituting known good tire/wheel assemblies can be used as follows, although it takes a longer time.

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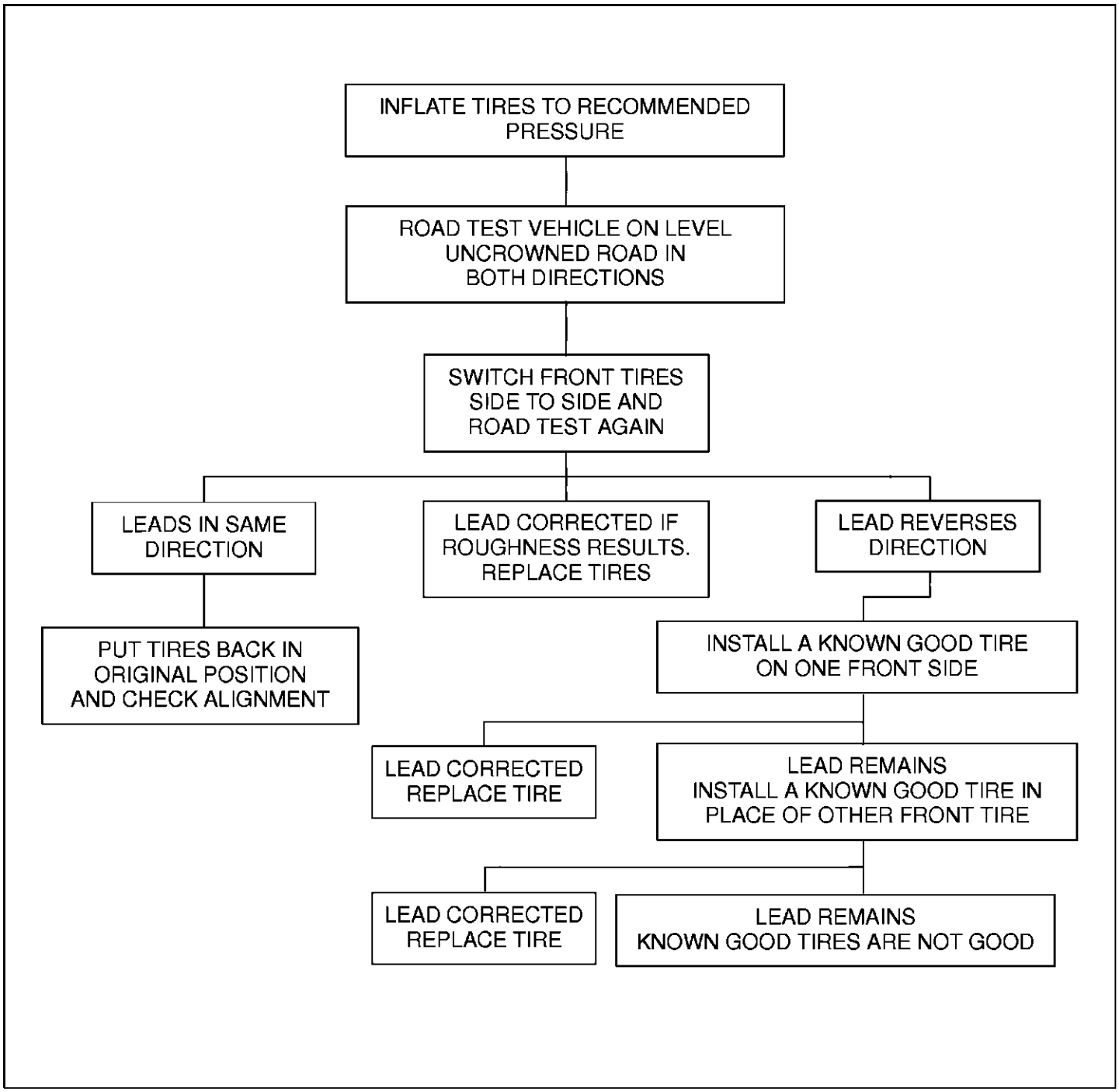
1) Ride vehicle to determine whether the front or rear waddles.
2) Install tires and wheels that are known to be good (on similar vehicle) in place of those on waddling end of vehicle. If waddling end cannot be identified, substitute rear ones.
3) Road test again. If improvement is noted, reinstall originals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



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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.

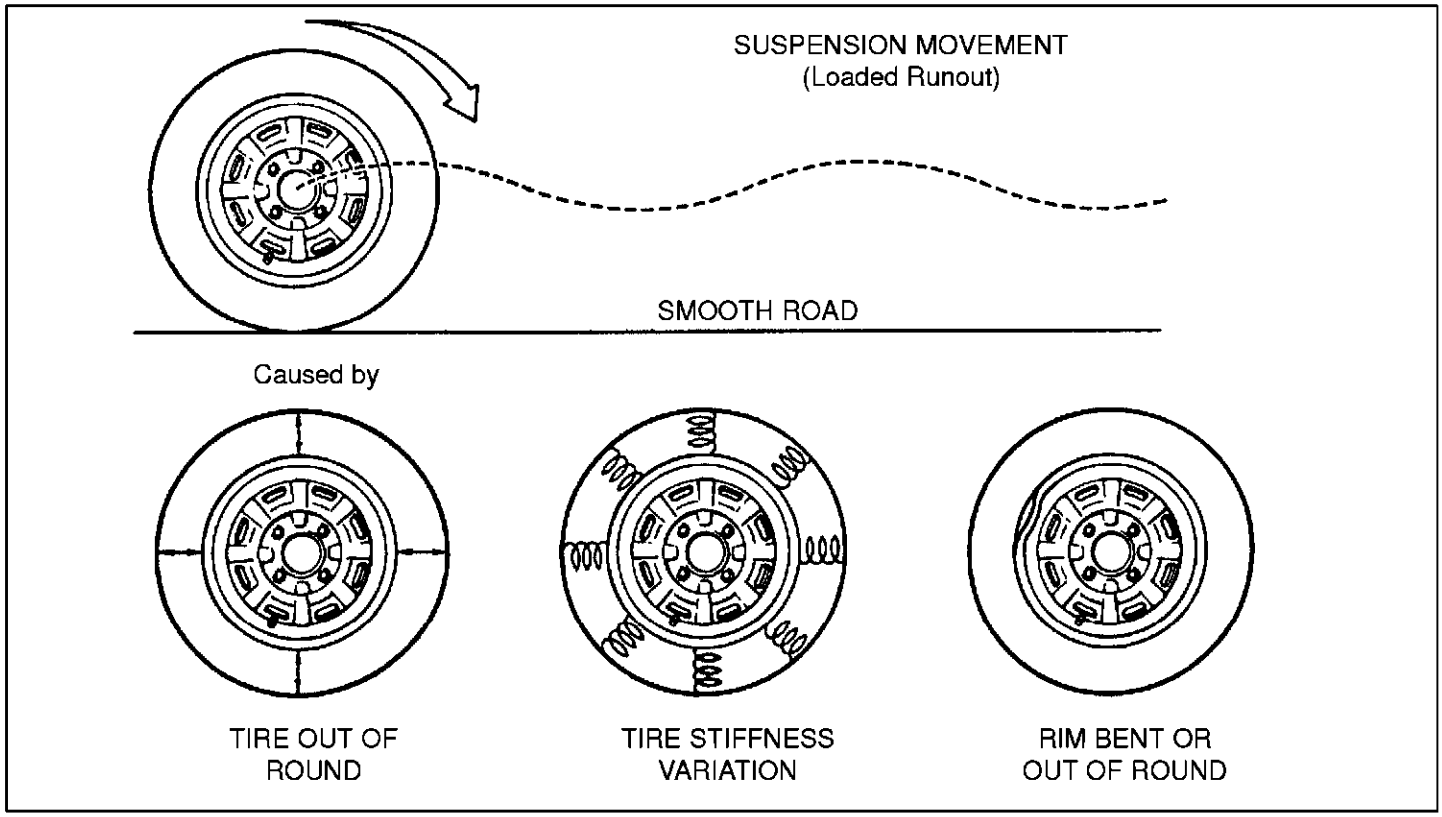
1) Part of the lead diagnosis procedure is different from the proper tire rotation pattern currently in the owner and service manuals. If a medium to high mileage tire is moved to the other side of the vehicle, be sure to check that ride roughness has not developed.
2) Rear tires will not cause lead.

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.



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SECTION 3A

FRONT END ALIGNMENT

CONTENTS

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Camber 3A-1
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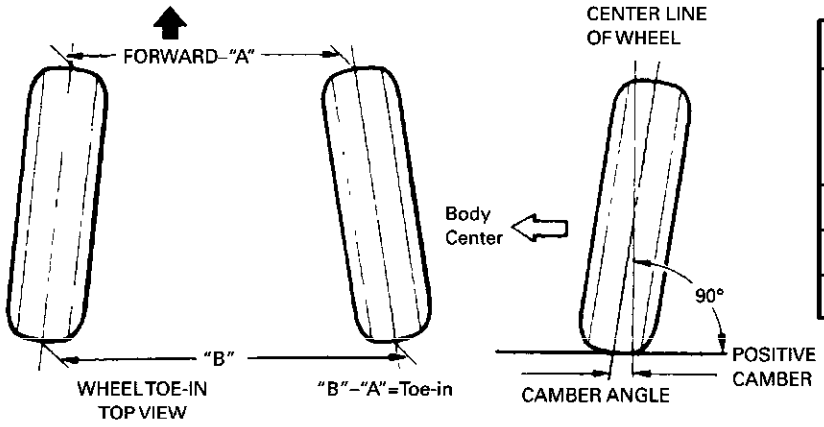
GENERAL DESCRIPTION



Alignment service data	
Toe-in (Toe-in gauge measurement)	0 ± 1 mm (0 ± 0.04 in.)
Camber	0°10' ± 1°
Caster	3°35' ± 1°
Kingpin inclination	11°40' ± 1°

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

TOE SETTING

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

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.

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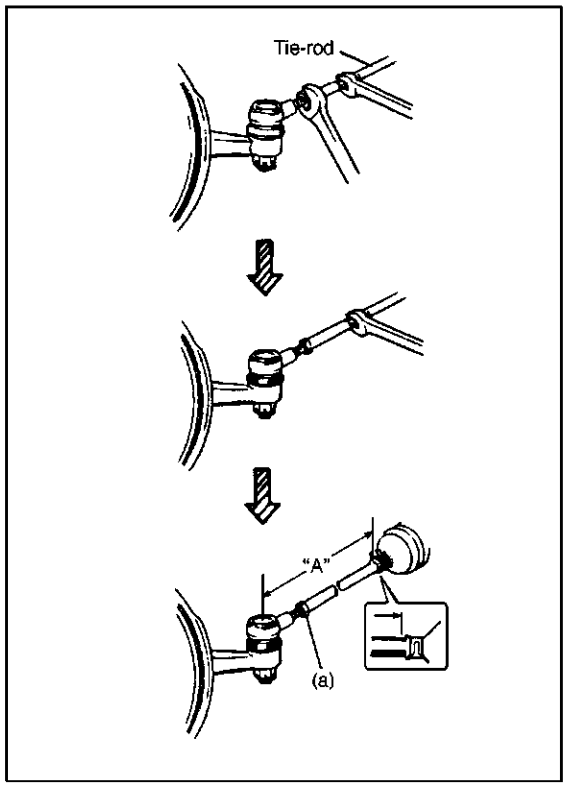
PRELIMINARY CHECKS PRIOR TO ADJUSTING FRONT ALIGNMENT

Steering and vibration complaints are not always the result of improper alignment. An additional item to be checked is the possibility of tire lead due to worn or improperly manufactured tires. "Lead" is the deviation of the vehicle from a straight path on a level road without hand pressure on the steering wheel. 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 ball joints. 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 the tie rod length. Loosen right and left tie rod end lock nuts first and then rotate right and left tie rods by the same amount to align toe-in to specification. In this adjustment, right and left tie rods should become equal in length ("A" in left figure).

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

After adjustment, tighten lock nuts to specified torque and make sure that rack boots are not twisted.

Tightening Torque

(a): 45 N·m (4.5 kg-m, 32.5 lb-ft)

CAMBER AND CASTER 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, they should be replaced. If it is in vehicle body, repair it so as to attain specifications.

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

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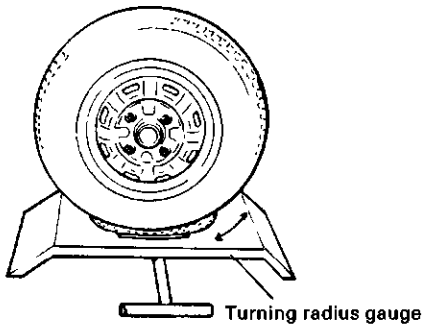

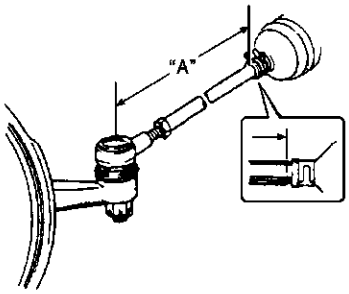

STEERING ANGLE

When tie rod or tie rod end was replaced, check toe and then also steering angle with turning radius gauge.
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 : 38° ± 3°**
outside : 33° ± 3°

Reference Information:
Side slip:
For inspecting front wheel side slip with side slip tester:

Side slip limit : Less than 3 mm/m
(Less than 0.118 in/3.3 ft)

If side slip exceeds above limit, toe-in or front wheel alignment may not be correct.

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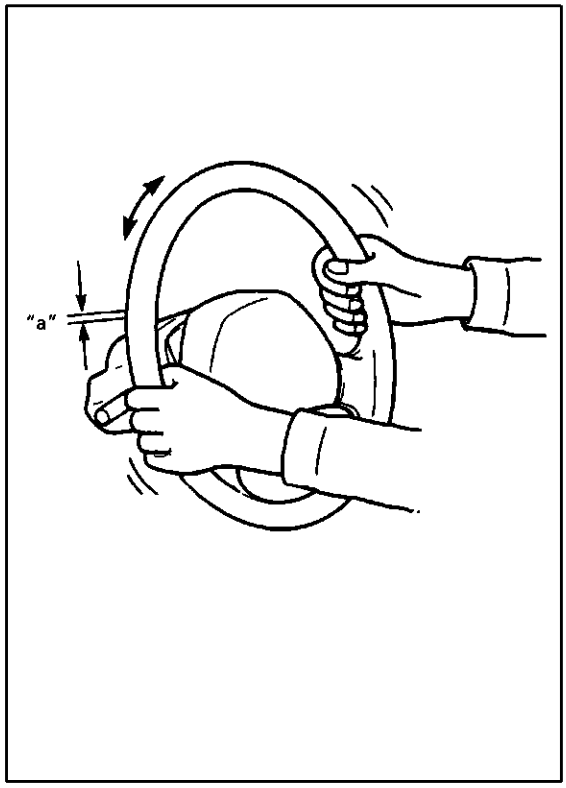
DIAGNOSIS

DIAGNOSIS TABLE

Refer to Section 3.



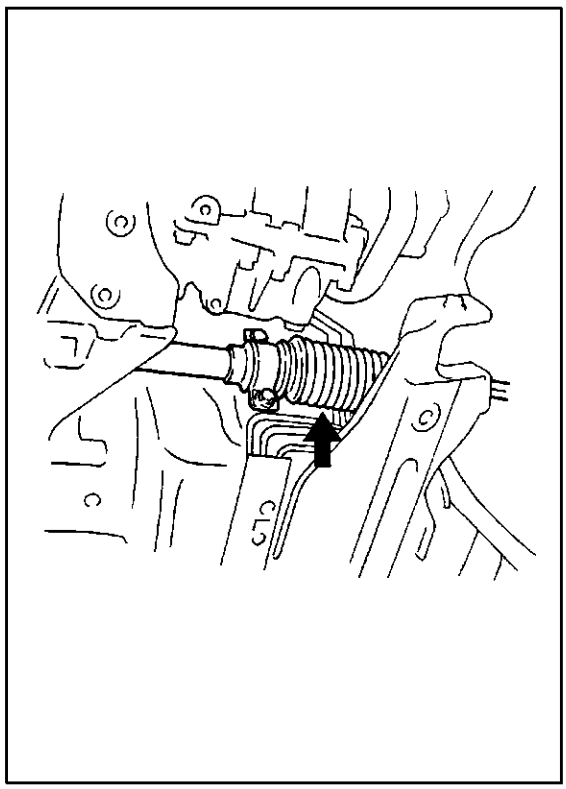
STEERING WHEEL CHECK

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

Steering wheel play "a": 0 – 30 mm (0 – 1.18 in)

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

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



STEERING RACK BOOT CHECK

Hoist vehicle.

Inspect each boot for tear. A torn boot allows entry of dust and water which can cause wear to steering rack and pinion to produce noise as well as rust to result in malfunction of steering system. If even a small tear is noted, replace with new one.

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

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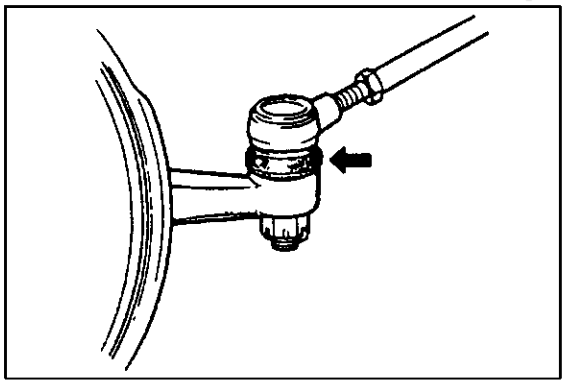
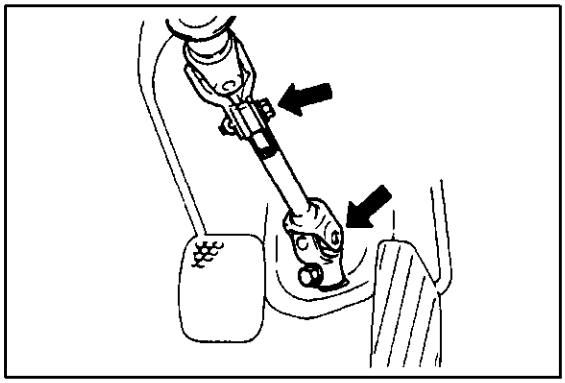


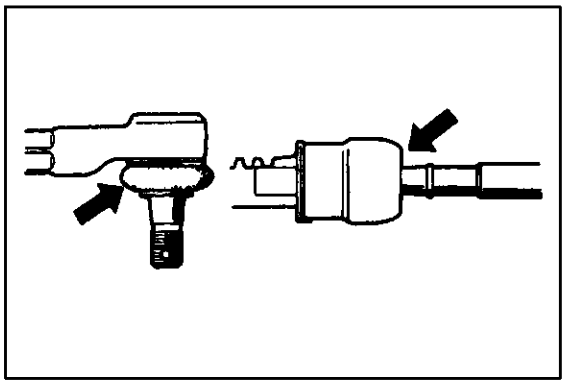
TIE ROD END BOOT CHECK

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



STEERING SHAFT JOINT CHECK

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



TIE ROD END CHECK

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

ON-VEHICLE SERVICE

LUBRICATION

When inner parts of the steering gear case were disassembled, they should be washed clean before reassembly. It is recommended to use the grease as given at the right where grease application is indicated in the text.

SUZUKI SUPER GREASE E (99000-25050) or Lithium grease (applicable for –40°C ~ 130°C (–40°F ~ 266°F))

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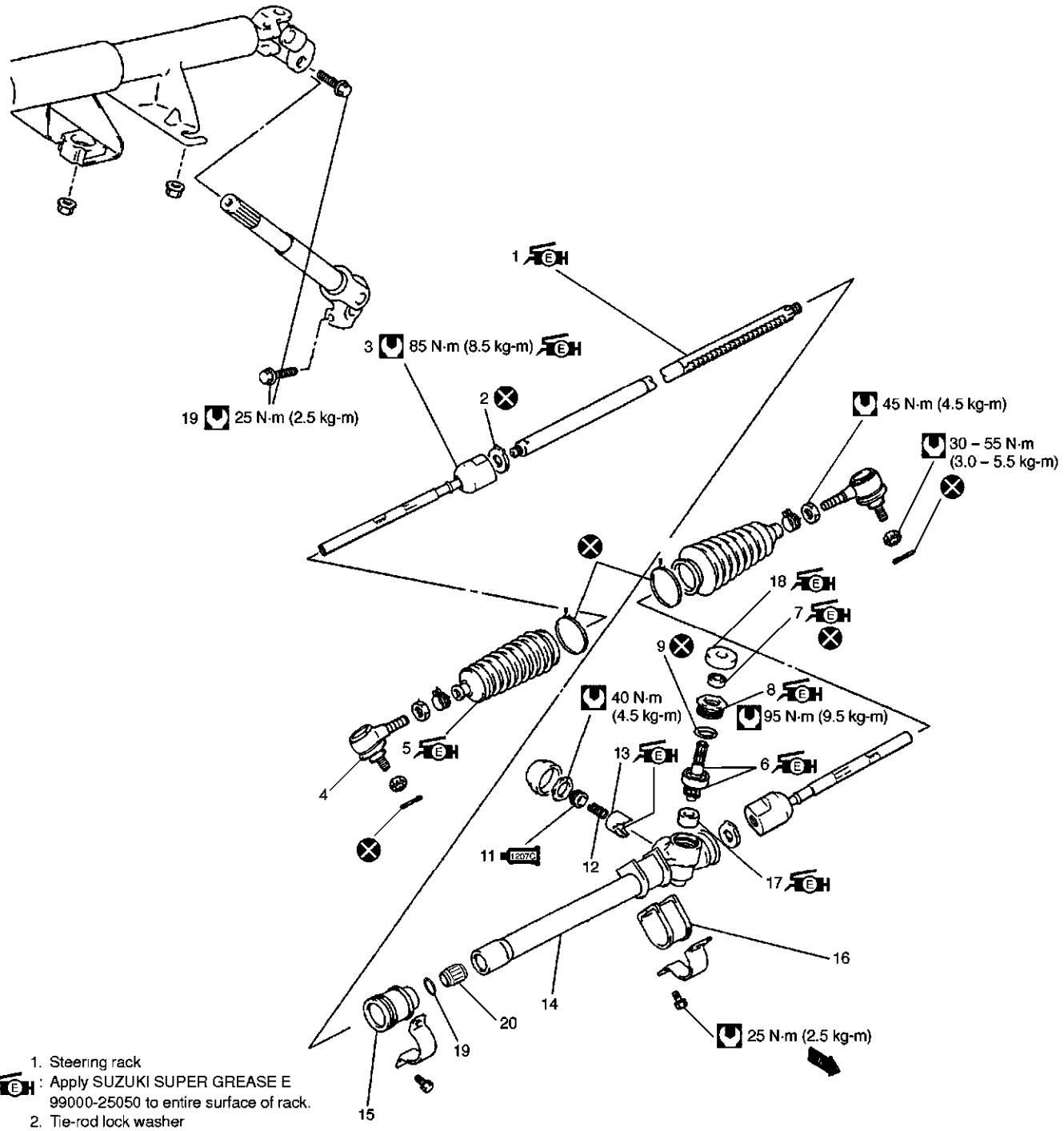

1. Steering rack
: Apply SUZUKI SUPER GREASE E 99000-25050 to entire surface of rack.
2. Tie-rod lock washer
3. Steering tie-rod
: Apply SUZUKI SUPER GREASE E 99000-25050 to rack end ball joint.
4. Tie-rod end
5. Boot
: Apply SUZUKI SUPER GREASE E 99000-25050 to contacting part of tie-rod and boot.
6. Steering pinion
: Apply SUZUKI SUPER GREASE E 99000-25050 to all around pinion teeth and mating surface of pinion needle bearing.
7. Steering gear case oil seal
: Apply SUZUKI SUPER GREASE E 99000-25050 to oil seal lip.
8. Pinion bearing plug
: Fill SUZUKI SUPER GREASE E 99000-25050 to inside of pinion bearing plug.
9. O-ring
10. Steering pinion needle bearing
11. Rack damper screw
1207C Apply SUZUKI BOND No. 1207C 99000-31150 to thread of damper screw.
12. Rack plunger spring
13. Steering rack plunger
Apply SUZUKI SUPER GREASE E 99000-25050 to sliding part of plunger
14. Steering rack housing and gear case
15. Steering rack side mount
16. Steering pinion side mount
17. Pinion bearing
Apply SUZUKI SUPER GREASE E 99000-25050 to rollers of pinion bearing.
18. Packing
Apply SUZUKI SUPER GREASE E 99000-25050 to inside of packing.
19. Snap ring
20. Steering rack bushing

Tightening Torque

Do not reuse

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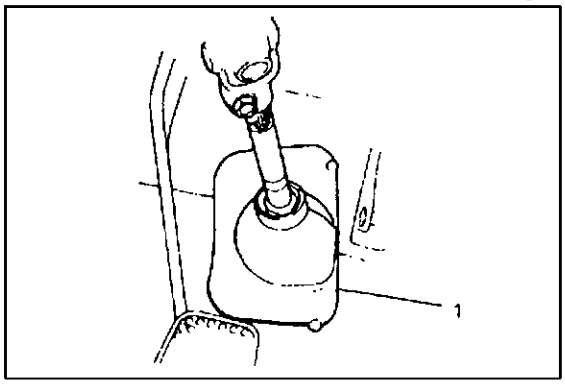
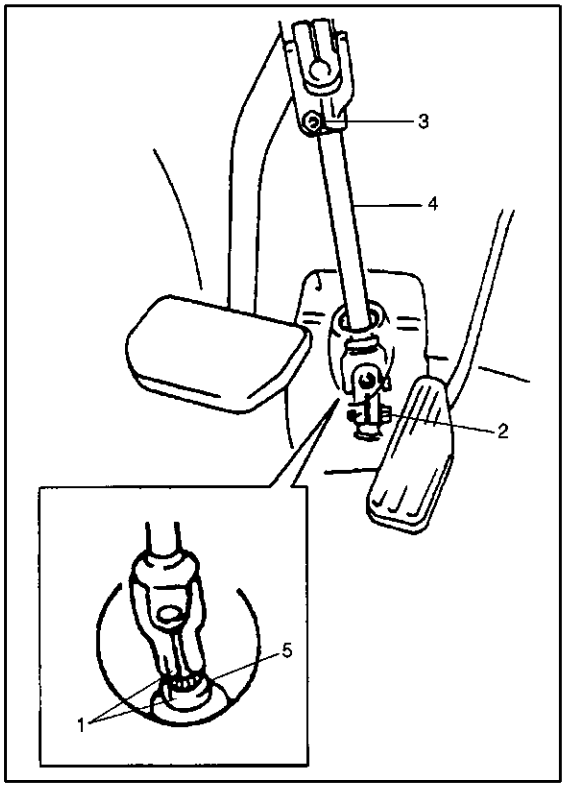


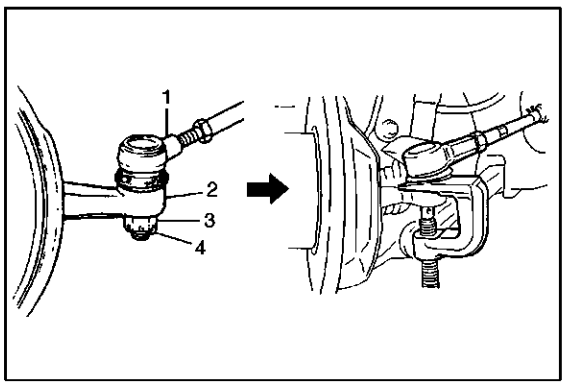
MANUAL RACK AND PINION ASSEMBLY (STEERING GEAR CASE)

REMOVAL

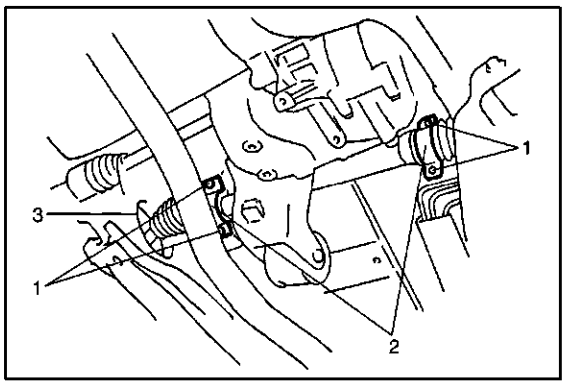
1) Remove steering joint cover (1).



2) With vehicle's front tires in straight-ahead position, make alignment marks (1) on joint of steering lower shaft and pinion shaft for a guide during reinstallation, and remove steering lower shaft lower bolt (2).
3) Loosen steering lower shaft upper bolt (3), but don't remove.
4) Disconnect steering lower shaft (4) from steering pinion shaft (5).
5) Hoist vehicle and remove front wheels.



6) Remove split pins (4) and castle nuts (3), and disconnect both tie rod ends (1) from knuckles (2), using puller.



7) Remove steering gear case mount bolts (1), and then remove steering gear case mount brackets (2).
8) Take manual rack and pinion assembly off vehicle through hole (3).

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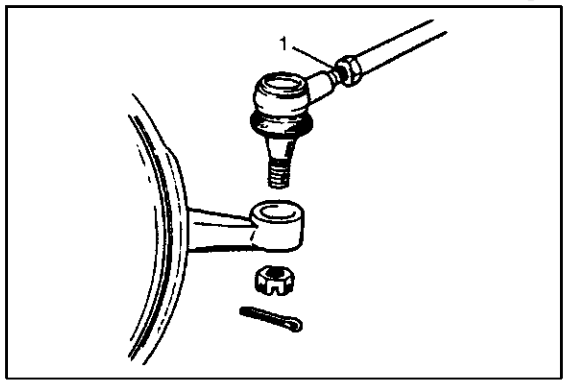
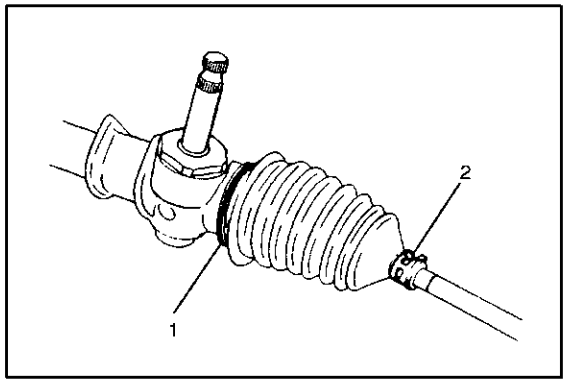
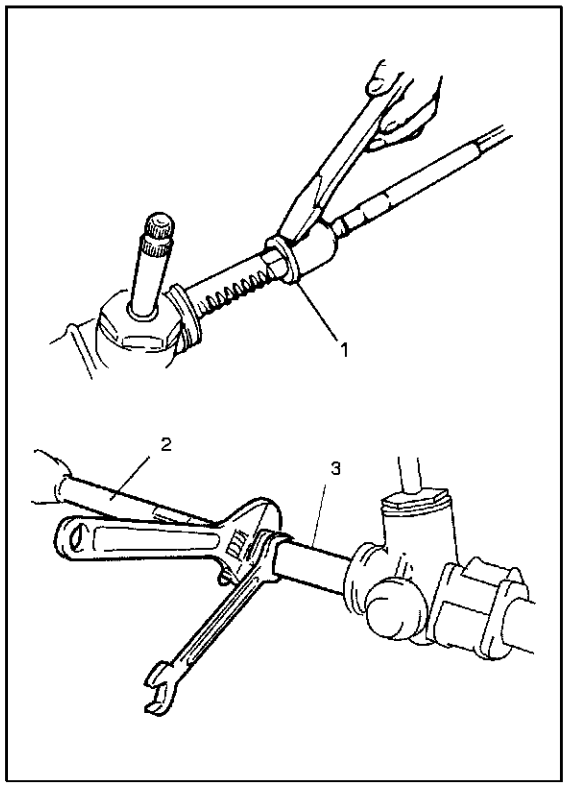


DISASSEMBLY

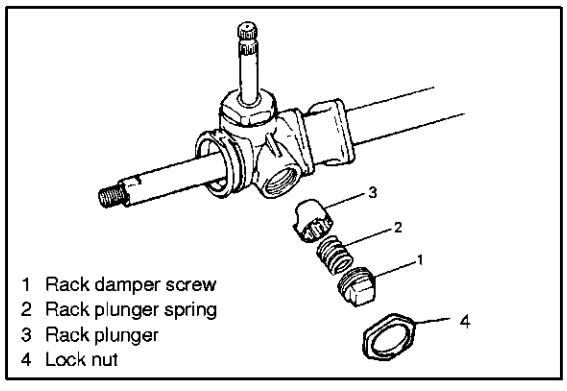
1) Remove steering gear case.
2) For ease of adjustment after installation, make marking (1) on tie rod end lock nut position of tie rod end thread.
3) Loosen tie rod end lock nut and remove tie rod end.



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



6) Unbend bent part of tie rod lock washer (1) and remove tie rod (2) from rack (3).



7) Remove parts as shown.

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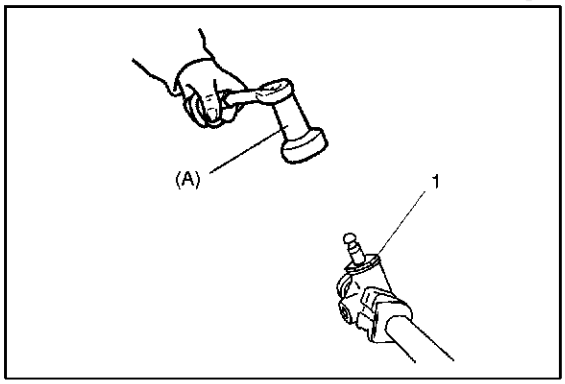
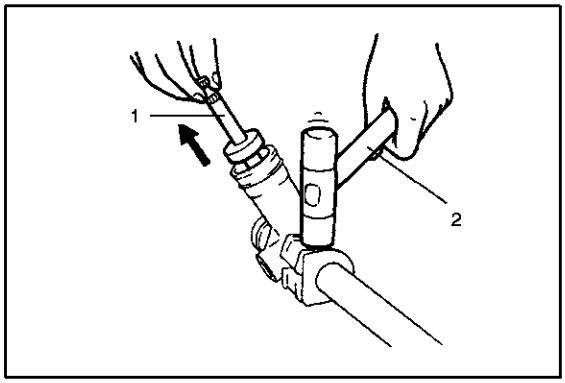
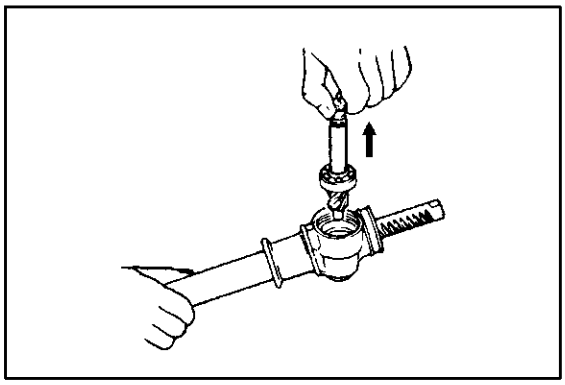


8) Remove pinion bearing plug (1) with special tool.

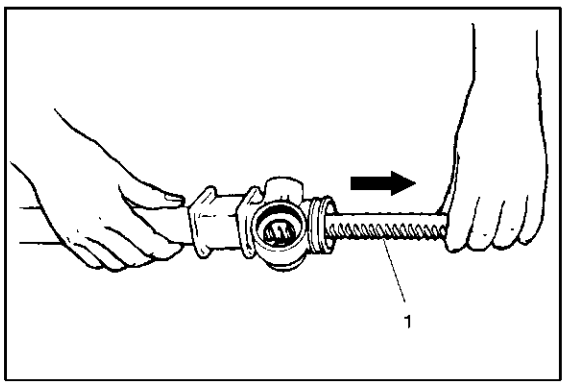
Special Tool (43 mm socket)
(A): 09944-26011



9) Tap on position as shown with plastic hammer (2) to separate pinion assembly (1) from housing.

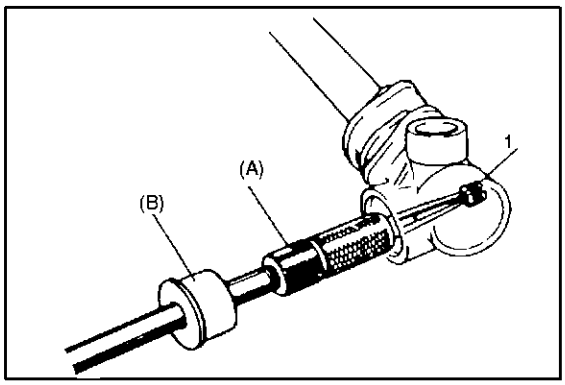


10) Remove pinion assembly.



11) Remove rack from gear case (1). Direction for rack removal is as shown.

CAUTION:
- **Inside of steering rack bushing is coated with special coating. As it is damageable, be very careful not to cause damage to it when removing rack from steering gear case.**
- **Do not use a wire brush when cleaning.**



12) Pull out pinion bearing (1) from gear case with special tools.

Special Tool
(A): 09921-20200
(B): 09930-30102

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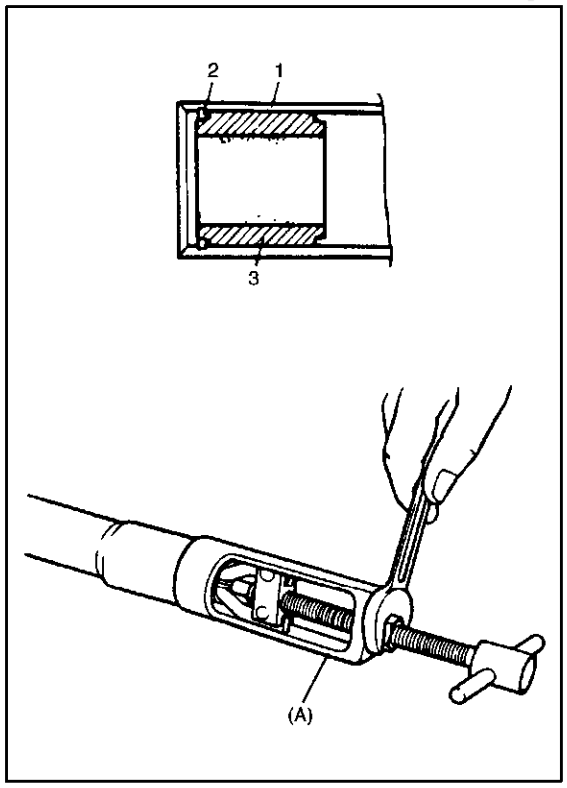
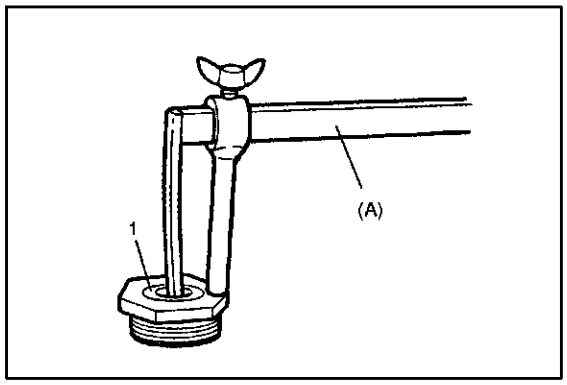


13) Remove snap ring (2).

NOTE:
When removing rack bushing, be careful not to pull out bushing by holding gear case in a vise. Or housing (pipe) may come off gear case. For this work, be sure to use the below specified special tool.

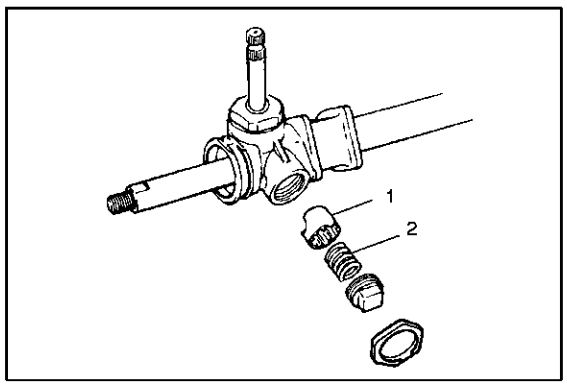
14) Pull out bushing (3) from rack housing (1) with special tool as shown.

Special Tool
(A): 09944-48210



15) Remove oil seal (1) with special tool.

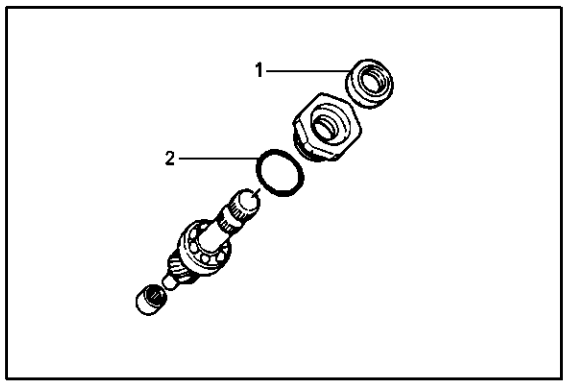
Special Tool
(A): 09913-50121



INSPECTION

Rack Plunger

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



Steering Pinion

- Inspect pinion teeth surface for wear or damage.
- Inspect oil seal (1) for damage.
- Inspect gear case O-ring (2) for damage.
  Replace any part found defective.

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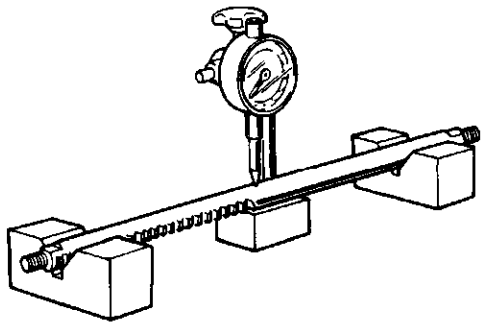
Steering Pinion Bearing

Check rotation condition of bearing and inspect for wear.
If found defective, replace.



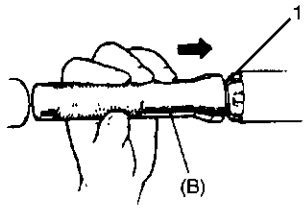
Do not use a wire brush when cleaning.

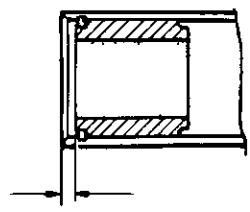
Steering Rack

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

Limit of rack deflection: 0.25 mm (0.01 in)

If deflection exceeds limit, replace rack.





1.0 – 2.0 mm (0.04 – 0.08 in)

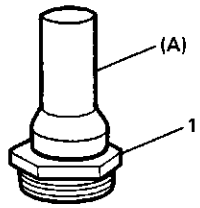
ASSEMBLY

Install in reverse order of disassembly, noting the following points.

- Apply grease lightly to entire inner surface of bushing.
- Directing pipe groove (1) of bushing upward (so that it is upward when gear case assembly is installed to vehicle), press-fit bushing as far into rack housing as shown by using special tool and install snap ring securely.

> **CAUTION:**
> **Inside of bushing is coated with special coating. As it is damageable, be sure to use special tool and special care not to cause damage to inside of bushing when press-fitting it.**

Special Tool
(B): 09943-78210



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

Special Tool
(A): 09925-98210

- Apply grease to oil seal lip.

Grease: SUZUKI SUPER GREASE E (99000-25050)

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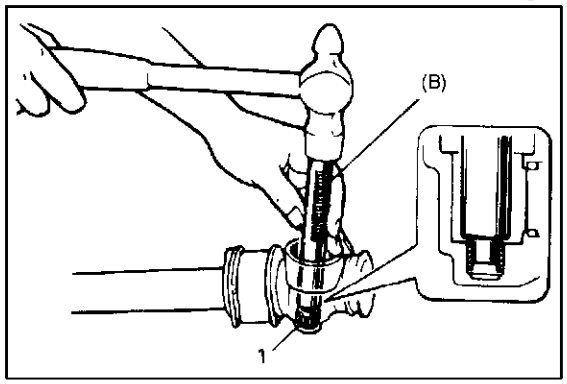
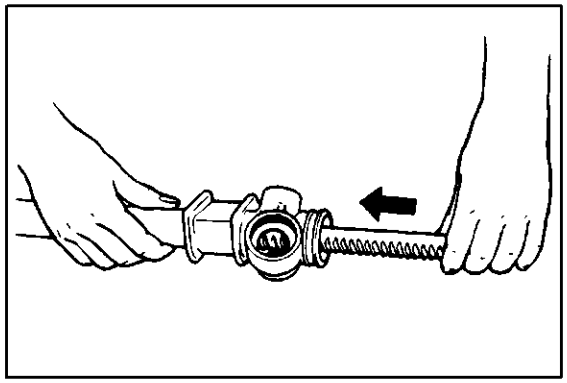


- Apply grease to rollers of pinion bearing (1).
- Press-fit pinion bearing into gear case with special tool.
  After press-fitting, make sure that bearing rollers are installed properly.

Special Tool
(B): 09943-88211

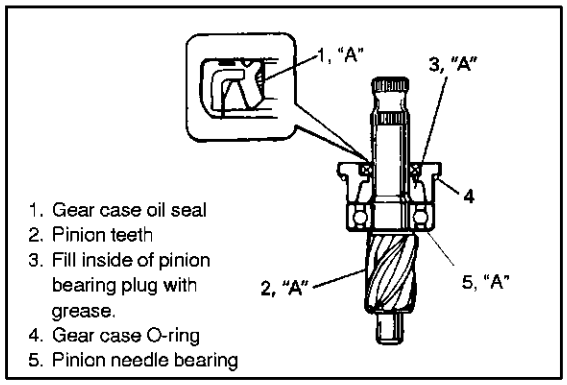


- Apply grease to entire teeth surface of rack and its periphery.

Grease: SUZUKI SUPER GREASE E (99000-25050)

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

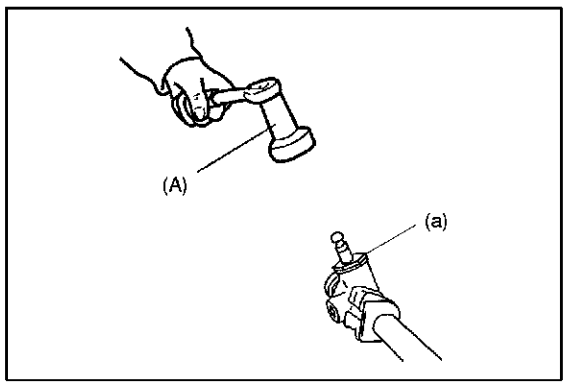
CAUTION:
Inside of steering rack bushing is coated with special coating. As it is damageable, be very careful not to cause damage to it when inserting rack into steering gear case.



- Apply grease to all around pinion teeth (2), pinion needle bearing (5) and gear case oil seal lip (1).

"A": Grease 99000-25050

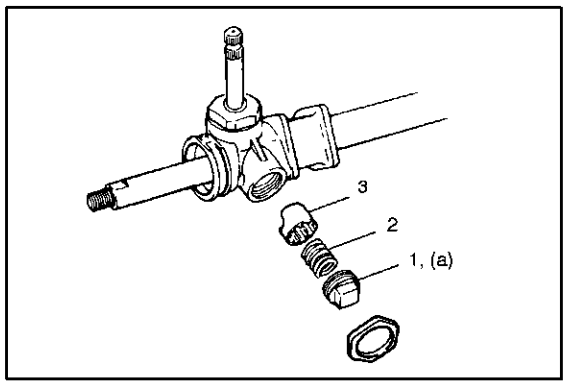
- Fit gear case O-ring (4) in groove of pinion bearing plug.



- Install pinion assembly and tighten pinion bearing plug to specified torque.

Special Tool (43 mm socket)
(A): 09944-26011

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



- Apply grease lightly to sliding part of plunger against rack.

Grease: SUZUKI SUPER GREASE E (99000-25050)

- Install rack plunger (3), rack plunger spring (2) and rack damper screw (1) and adjust rotation torque of pinion as follows.
  (i) Tighten rack damper screw (1) to specified torque.

Tightening Torque
(a): 12 N·m (1.2 kg-m, 9.0 lb-ft)

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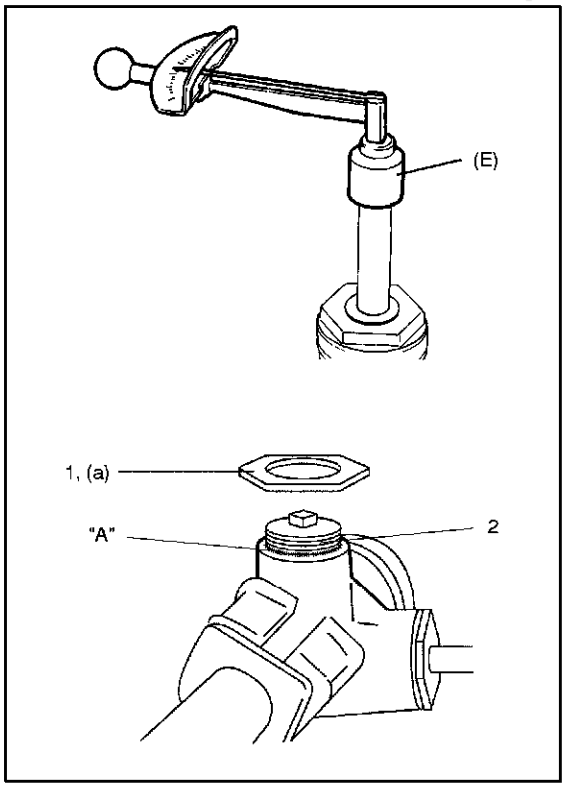


(ii) After tightening rack damper screw to specified torque, turn it back by 75° – 90° and check for rotation torque of pinion. If it is not as specified below, adjust so that it will be within specified torque range.

Special Tool
(E): 09944-18211

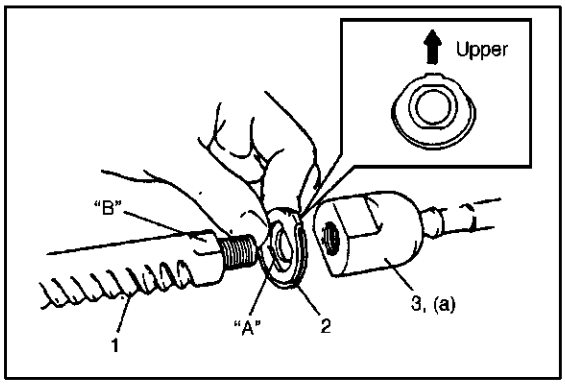
Rotation torque of pinion
0.4 – 1.1 N·m (0.04 – 0.11 kg-m, 0.3 – 1.0 lb-ft)

Also, check if rack as a whole moves smoothly.

(iii) Apply sealant to thread of damper screw (2) and tighten lock nut (1) to specified torque with holding damper screw at the position.

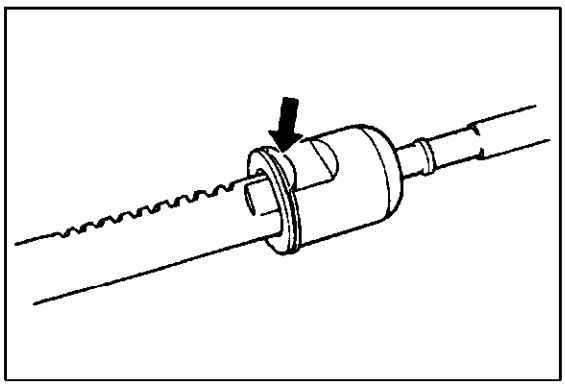
"A": Sealant 99000-31150

Tightening Torque
(a): 40 N·m (4.0 kg-m, 29.0 lb-ft)

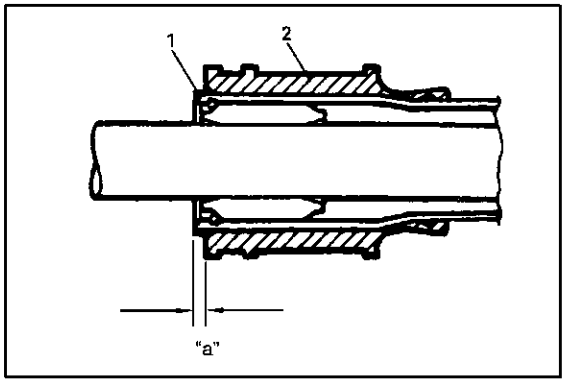


- Install new tie rod lock washer (2) as shown and tie rod (3) to steering rack (1). Align straight part "A" of washer with flat part "B" of steering rack.
- Tighten tie rod inside ball nut to specified torque.

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



- Bend lock washer to tie rod side as shown.



- Before installing boot to steering rack housing (1), make sure that rack side mount (2) is positioned as shown.

"a": 8 mm (0.31 in)

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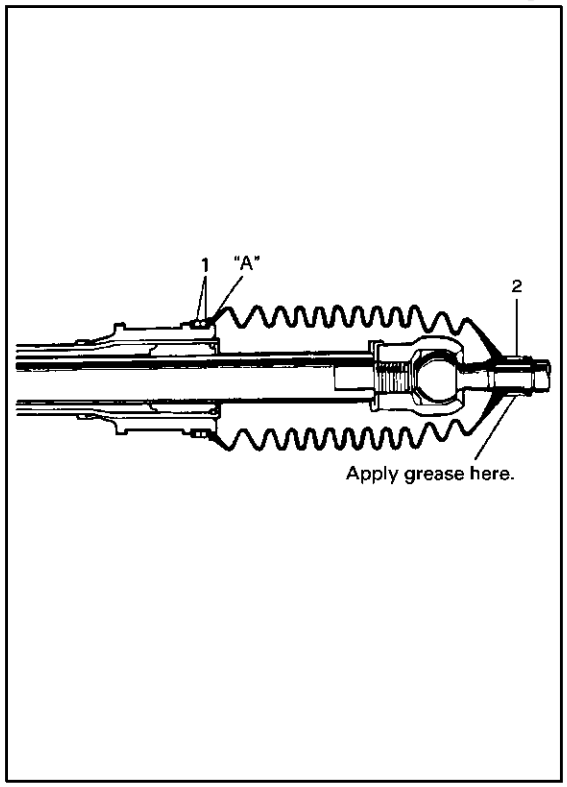
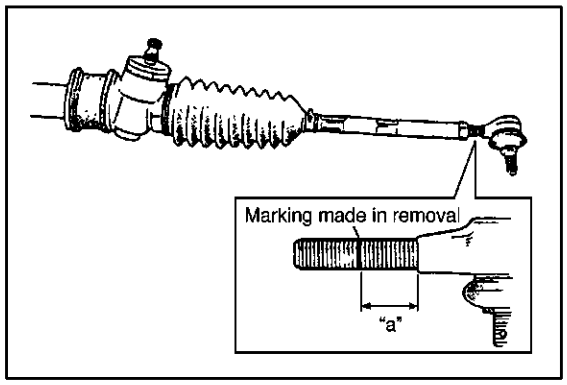


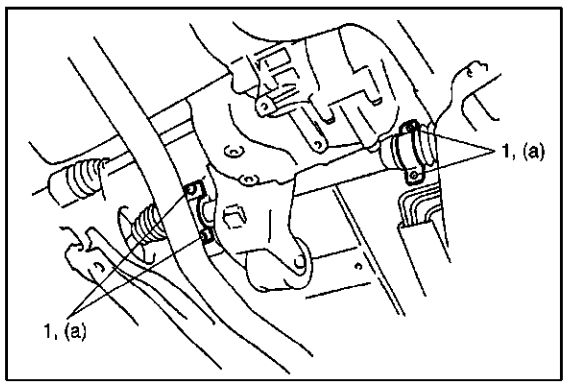
- Position boot properly in grooves of gear case and tie rod and clamp it with wire (1) and clip (2).
  Wire (1) should be new and should go around twice and be tightened with its both ends twisted together. The twisted ends should be bent in the circumferential direction. After this, check to ensure that boot is free from twist and bent.

CAUTION:
Never apply grease to part which contacts rack side rack mount part "A".



- Install tie rod end lock nut to tie rod end and then tie rod end to tie rod. Position lock nut to marking made in removal.

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

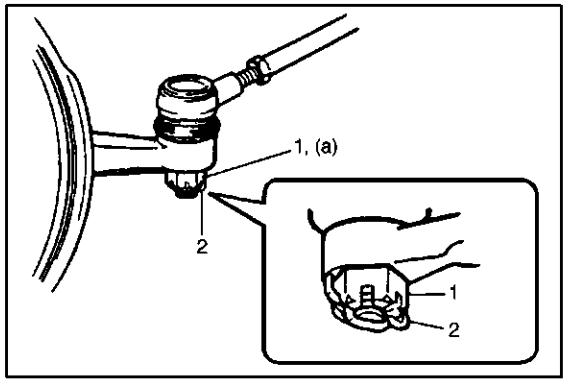


INSTALLATION

For installation, reverse removal procedure, observing the following instructions.

- Apply grease to inside of pinion packing and install pinion packing onto pinion.
- Tighten gear case mounting bolts (1) to specified torque.

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



- Connect tie rod ends to knuckles (R & L). Tighten each castle nut (1) until holes for split pin align but within specified torque and then bend new split pin (2) as shown.

Tightening Torque
(a): 30 – 55 N·m (3.0 – 5.5 kg-m, 22.0 – 39.5 lb-ft)

NOTE:
Removed split pin should be replaced with new one.

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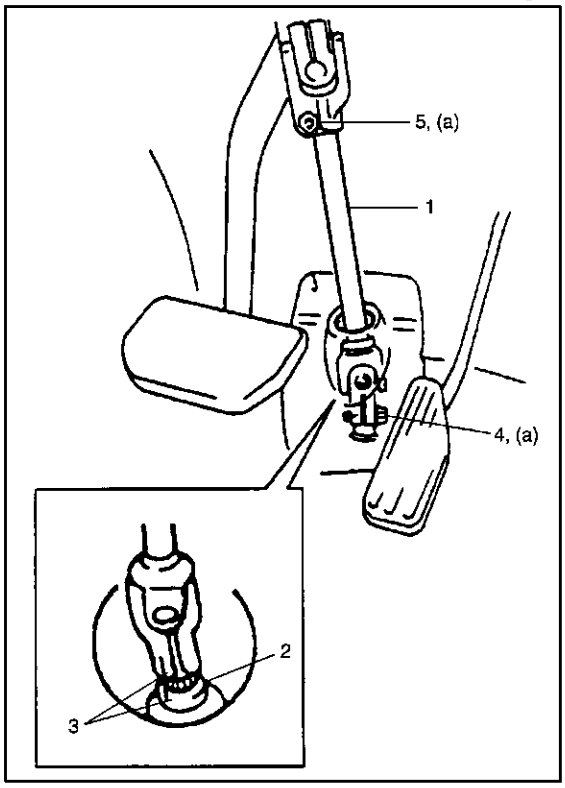
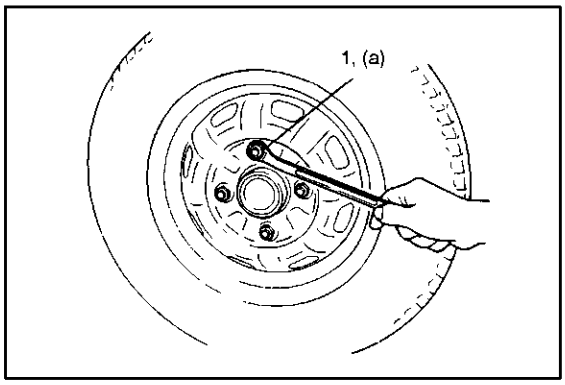


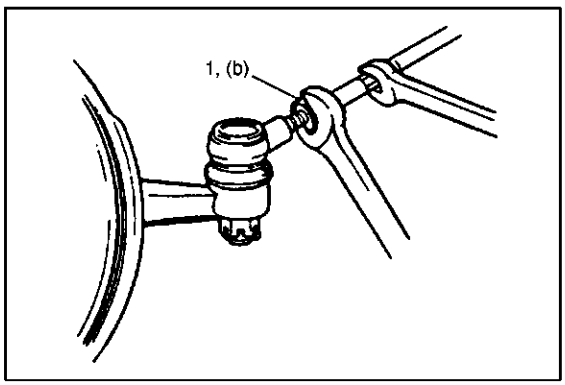
- Be sure that steering wheel and brake discs (right & left) are all straight-ahead position and then insert steering lower shaft (1) to steering pinion shaft (2) with matching mark (3) if marked.
- Tighten steering lower shaft lower bolt (4) and upper bolt (5) in that order.

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



- Tighten wheel nut (1) to specified torque.

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



- Lower hoist and check toe setting.
  Adjust as required referring to section 3A FRONT END ALIGNMENT.
- Tighten tie rod end lock nut (1) to specified torque.

Tightening Torque
(b): 45 N·m (4.5 kg-m, 32.5 lb-ft)

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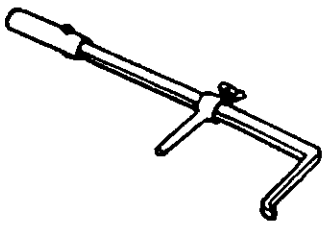
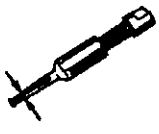
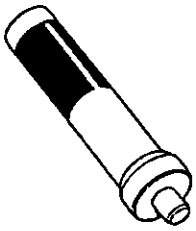
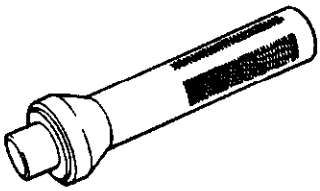
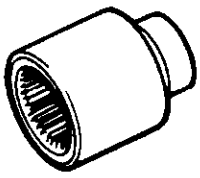
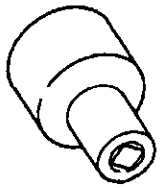
REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium Grease (Should be applicable for –40°C~130°C)	SUZUKI SUPER GREASE E (99000-25050)	• Sliding part of rack against steering housing (All around rack plunger, rack bushing and rack) • Sliding part against steering pinion (Oil seal lip, needle bearing) • Steering rack and pinion gear teeth • Filled into pinion bearing plug • Contacting parts of tie rod and rack side boots • Rack end ball joint
Sealant	SUZUKI BOND No. 1207C (99000-31150)	• Thread part of rack damper screw

SPECIAL TOOLS

 09913-50121 Oil seal remover	 09921-20200 Bearing remover	 09925-98210 Bearing installer	 09930-30102 Sliding shaft
 09943-78210 Rack bush installer	 09943-88211 Bearing installer	 09944-18211 Pinion torque checking socket	 09944-26011 Pinion bearing plug socket (43 mm)

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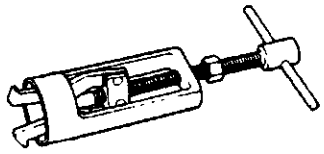

09944-48210
Rack bush remover

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SECTION 3B1

ELECTRICAL POWER STEERING (P/S) 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).**

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GENERAL DESCRIPTION

SYSTEM COMPONENTS

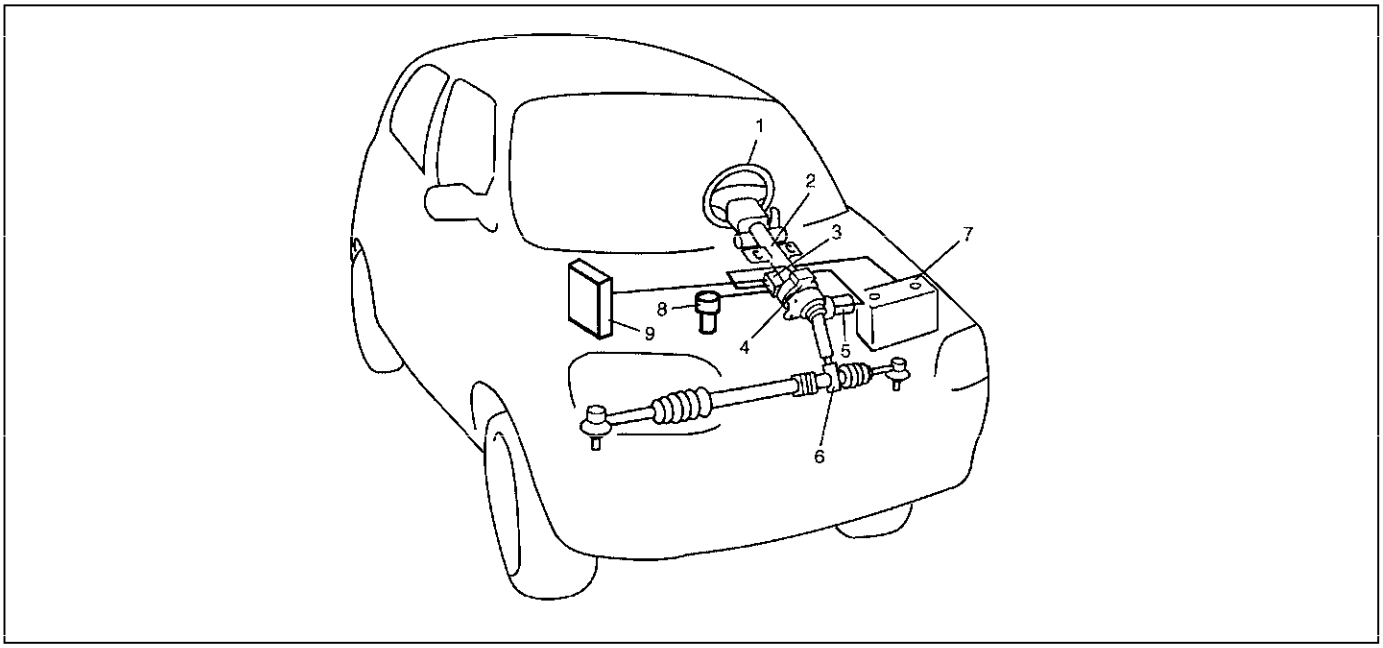
This power steering (P/S) system consists of a P/S control module, a torque sensor, a motor assembly with clutch installed to the steering column.
In this system, the P/S control module determines the level and direction of the assist force for the steering wheel according to the signals from the torque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

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

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

NOTE:

The location of steering wheel/column and ECM to LH steering vehicle are opposite to those location to RH steering vehicle.



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

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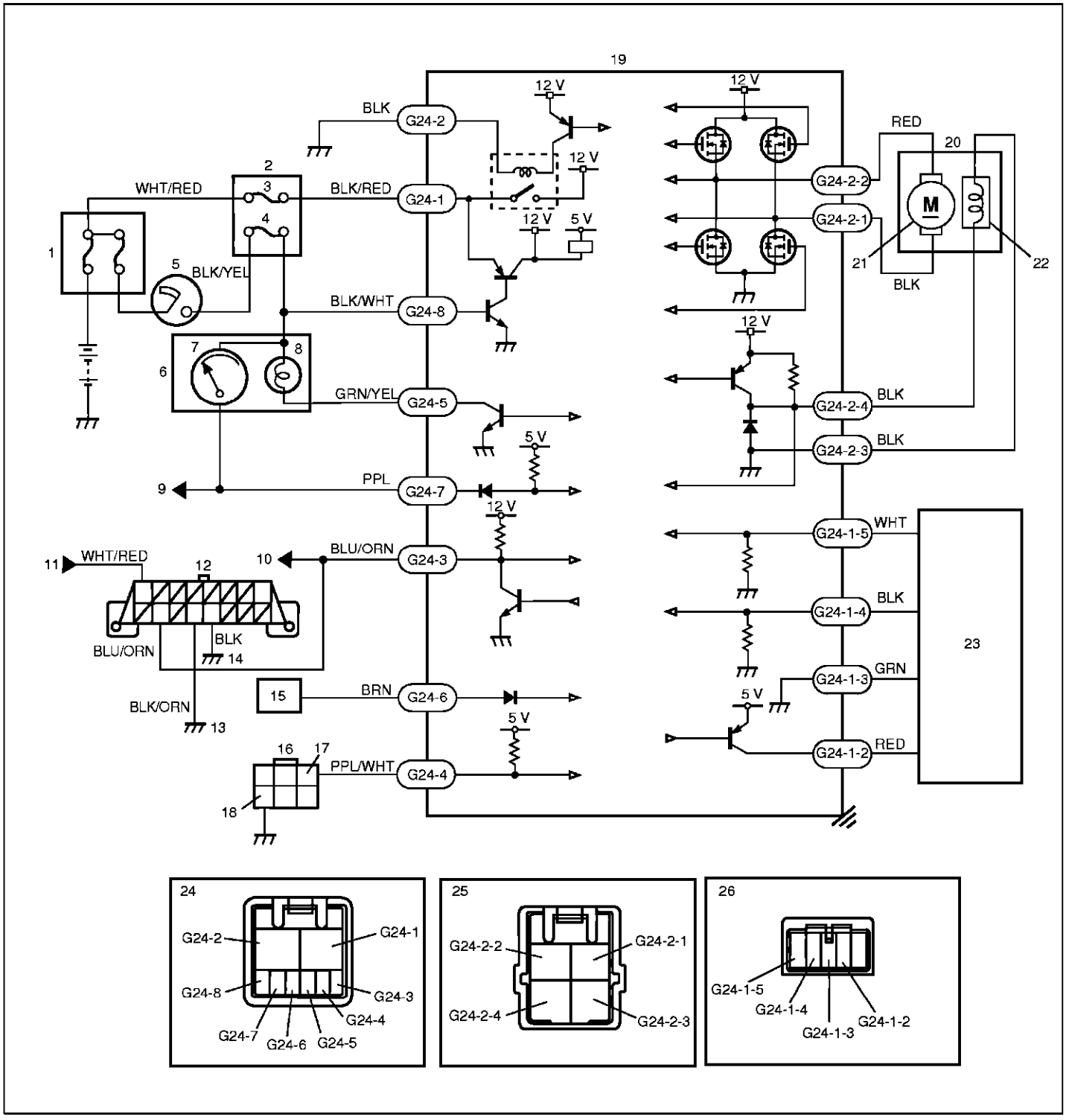
WIRING DIAGRAM



1. Main fuse box	10. To ECM, SDM and ABS hydraulic unit/control module	19. P/S control module
2 Circuit fuse box	11. To circuit fuse box	20. Motor assembly with clutch
3. "P/S" fuse	12. Data link connector (DLC)	21. P/S motor
4. "IG METER" fuse	13. Ground on body	22. P/S motor clutch
5 Ignition switch	14. Ground on engine block	23. Torque sensor
6 Combination meter	15. ECM	24. Connector G24 (viewed from harness side)
7 Speedometer	16 Monitor coupler	25. Connector G24-2 (viewed from harness side)
8. "EPS" warning lamp	17. Diagnosis switch terminal (for P/S system)	26. Connector G24-1 (viewed from harness side)
9. To vehicle speed sensor (VSS)	18. Ground terminal	

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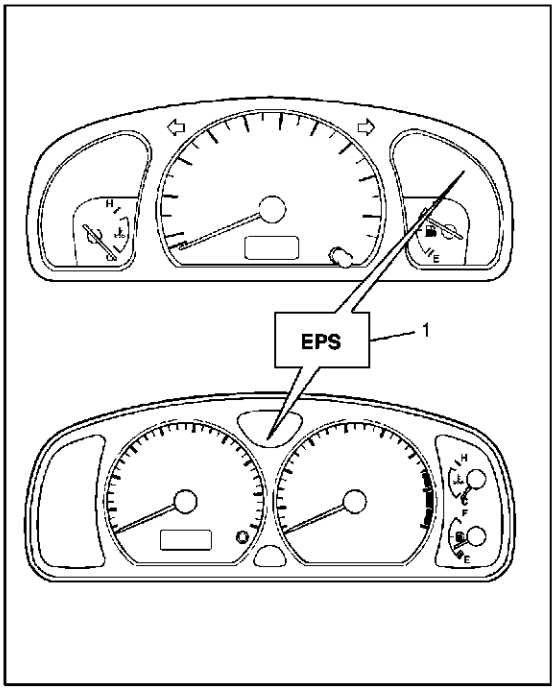
DIAGNOSIS

The P/S system in this vehicle is controlled by P/S control module. P/S control module has an on-board diagnostic system which detects a malfunction in this system.
When diagnosing troubles, be sure to have full understanding of the outline of "ON-BOARD DIAGNOSTIC SYSTEM" and each item in "PRECAUTION IN DIAGNOSING TROUBLES" and execute diagnosis according to "SYSTEM CHECK FLOW TABLE".

ON-BOARD DIAGNOSTIC SYSTEM



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

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

PRECAUTIONS IN DIAGNOSING TROUBLES

- Take a note of DTC indicated first.
- Be sure to read "PRECAUTIONS FOR ELECTRICAL CIRCUIT SERVICE" in Section 0A before inspection and observe what is written there.
- When two or more troubles have occurred, their DTCs are indicated 3 times each starting with the smallest code number and up.
- DTC C1122 (DTC No.22) (engine speed signal failure) is indicated when ignition switch is ON position and engine is not running but if indication changes to a normal one when engine is started, it means nothing abnormal.
- As DTC is stored in memory of P/S control module, be sure to clear memory after repair by performing the procedure described in "DTC CLEARANCE".

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SYSTEM CHECK FLOW TABLE

Step	Action	Yes	No
1	1) Record details of the problem (failure, complaint) and how it occurred as described by the customer. For this purpose, use of such a questionnaire from as shown below will facilitate collecting information to the point required for proper analysis and diagnosis. 2) Check if what the customer claimed in "CUSTOMER QUESTIONNAIRE" is actually found in the vehicle and if that symptom is found, whether it is identified as a failure. (This step should be shared with the customer if possible.) 3) Check malfunction indicator lamp ("EPS" warning lamp) operation referring to "EPS" WARNING LAMP CHECK" in this section. 4) Check DTC referring to "DTC CHECK" in this section and record the DTC(s). 5) Clear DTC if any malfunction DTC exists referring to "DTC CLEARANCE" in this section, then recheck DTC. Is any malfunction DTC detected?	Go to Step 2.	Go to Step 3.
2	1) Inspect and repair referring to applicable "DTC TABLE" in this section. 2) Clear DTC referring to "DTC CLEARANCE" in this section. Does the trouble recur?	Go to Step 5.	Go to Step 4.
3	1) Test drive the vehicle and turn steering wheel fully to the right and left during test driving. See WARNING. Check if any trouble exists. 2) Inspect and repair basic parts referring to "DIAGNOSIS CHART" in Section 3. 3) If the trouble cannot be repaired in Step 3-2), inspect and repair referring to "TROUBLE DIAGNOSIS (FOR TROUBLE NOT INDICATED BY ON-BOARD DIAGNOSTIC SYSTEM)" in this section. Does the trouble recur?	Go to Step 5.	Go to Step 4.
4	1) Confirm that the problem symptom has gone and P/S system 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 as in Step 3-1) and confirm that no DTC is indicated. Is any malfunction DTC detected?	Go to Step 5.	END
5	1) Check DTC referring to "DTC CHECK" in this section. Is any malfunction DTC detected?	Go to Step 2.	Go to Step 3.

WARNING:
Carry out test in very little traffic area to prevent an accident.

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NOTE:

- **As execution of "DTC CLEARANCE" will clear all malfunction DTCs, be sure to record all DTCs before servicing.**
- **When 2 or more codes are indicated, the lowest numbered code will appear first.**
- **If a code not listed on "DTC TABLE" is displayed, then the P/S control module is faulty.**
- **DTC C1122 or DTC No.22 (flashing pattern : 22) is indicated when ignition switch is ON and engine is not running but if DTC No.12 (flashing pattern : 12) is indicated when engine is started, it means nothing abnormal.**
- **Current DTC and history DTC can be identified by lighting and flashing of "EPS" warning lamp. "EPS" warning lamp operates as follow depending on the trouble condition.**

	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.)	Current DTC and history DTC exist.
"EPS" warning lamp after engine started	Remains ON.	Turn OFF.	Remains ON.
"EPS" warning lamp when shorting diagnosis switch terminal and ground terminal	Displays current DTC.	Displays history DTC.	Displays current DTC and history DTC.

For identify current DTC, clear history DTC referring to "DTC CLEARANCE" in this section.

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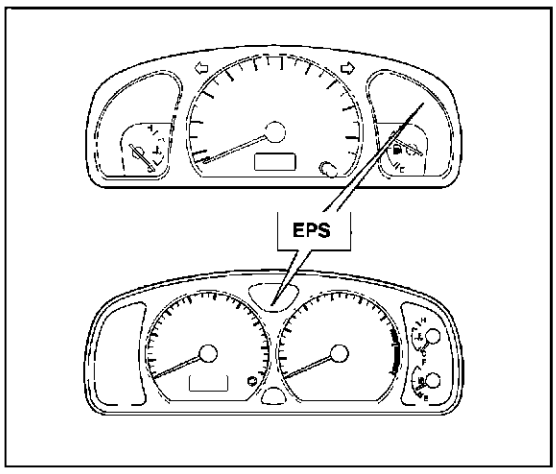
CUSTOMER QUESTIONNAIRE (EXAMPLE)

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

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



"EPS" WARNING LAMP CHECK

1) Turn ignition switch to ON position (but without running engine), check that malfunction indicator lamp ("EPS" warning lamp) lights up. If lamp does not light up, go to TABLE A-"EPS" WARNING LAMP DOSE NOT COME ON AT IGNITION ON BUT LEAVING ENGINE OFF. If lamp flashes, go to TABLE B-"EPS" WARNING LAMP FLASHES AT IGNITION SWITCH ON.
2) Start engine and check that malfunction indictor lamp ("CHECK ENGINE" light) turns OFF.
   If lamp comes OFF, P/S system is in good condition.

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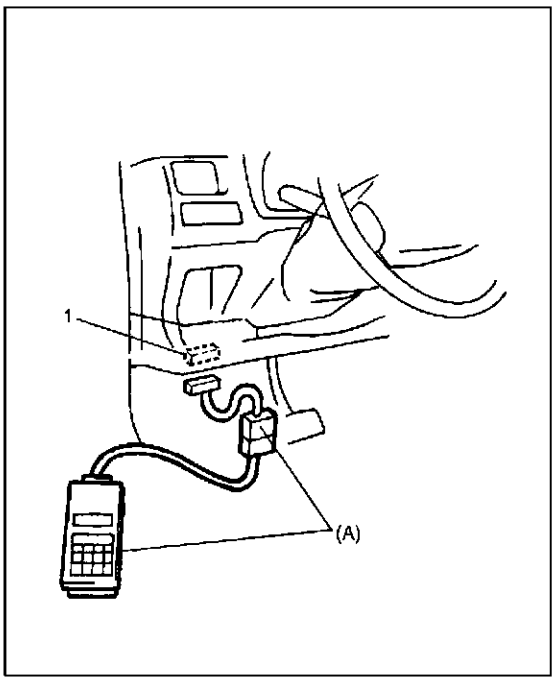
DTC CHECK

USING SUZUKI SCAN TOOL



1) Turn ignition switch to OFF position.
2) After setting cartridge connect SUZUKI scan tool to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

Special tool
(A) : SUZUKI scan tool

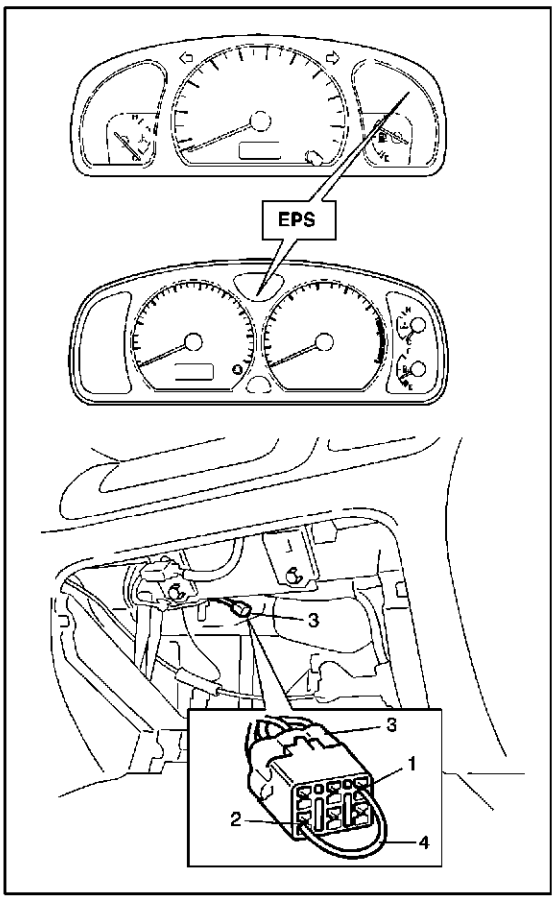
3) Turn ignition switch to ON position.
4) Read DTC according to instructions displayed on SUZUKI scan tool and print it or write it down referring to SUZUKI SCAN TOOL OPERATOR'S MANUAL for further details.

NOTE:

If Suzuki scan tool cannot communicate with P/S control module, perform "SERIAL DATA LINK CIRCUIT CHECK" described in this section.

5) After completing the check, turn ignition switch to OFF position and disconnect SUZUKI scan tool from DLC.

NOT USING SUZUKI SCAN TOOL



1) Remove glove box.
2) Apply chocks to wheels, set shift lever to neutral position and pull parking brake fully.
3) Start engine.
4) Using jumper wire (4), short diagnosis switch terminal (1) to ground terminal (2) of monitor coupler (3).
5) Read flashing of "EPS" warning lamp which represents DTC and write it down. When more than 2 DTCs are stored in memory, each DTC is repeated 3 times starting with the smallest DTC number in increasing order.
   For details and example of DTC, refer to "DTC TABLE" in this section.

NOTE:

DTC No.22 is indicated when ignition switch is ON and engine is not running but if DTC No.12 is indicated when engine is started, it means nothing abnormal.

6) After completing the check, turn ignition switch to OFF position and disconnect jumper wire (4) from monitor coupler.

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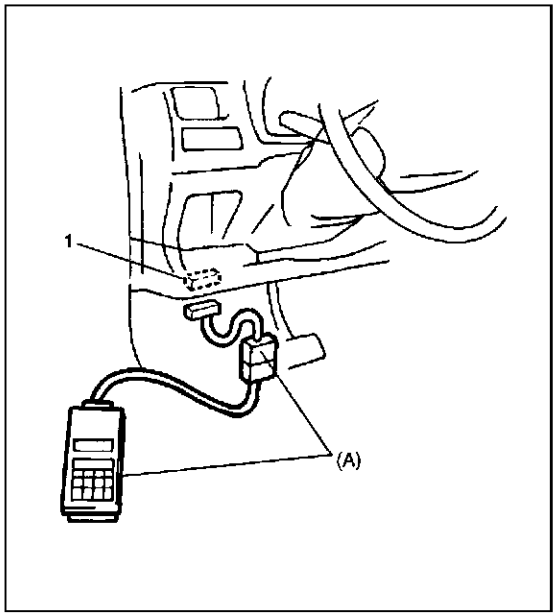
DTC CLEARANCE

USING SUZUKI SCAN TOOL



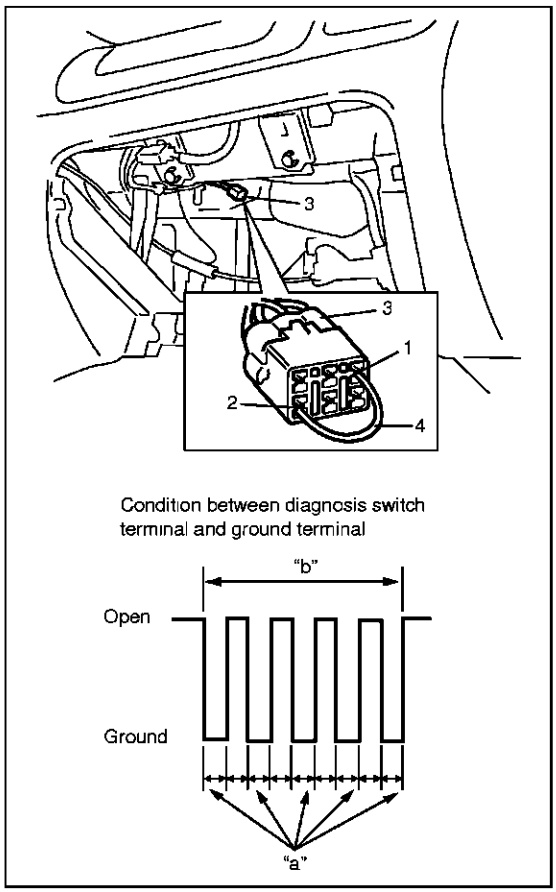
1) Turn ignition switch to OFF position.
2) After setting cartridge connect SUZUKI scan tool, connect scan tool to data link connector (DLC) (1) located on underside of instrument panel at driver's seat side.

Special tool
(A) : SUZUKI scan tool

3) Turn ignition switch to ON position.
4) Erase DTC according to instructions displayed on SUZUKI scan tool referring 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.

NOT USING SUZUKI SCAN TOOL

1) Remove glove box.
2) Turn ignition switch to ON position.



3) Using jumper wire, short diagnosis switch terminal (1) to ground terminal (2) of monitor coupler (3).
4) Make the disconnected end of jumper wire (4) contact where disconnected (short) and repeat these actions (open and short) at least 5 times within 10 seconds.

DTC clearance procedure specification
"a" : about 1 second
"b" : within 10 seconds

5) Perform "DTC CHECK" and confirm that normal DTC (DTC No.12) is displayed and not malfunction DTC.

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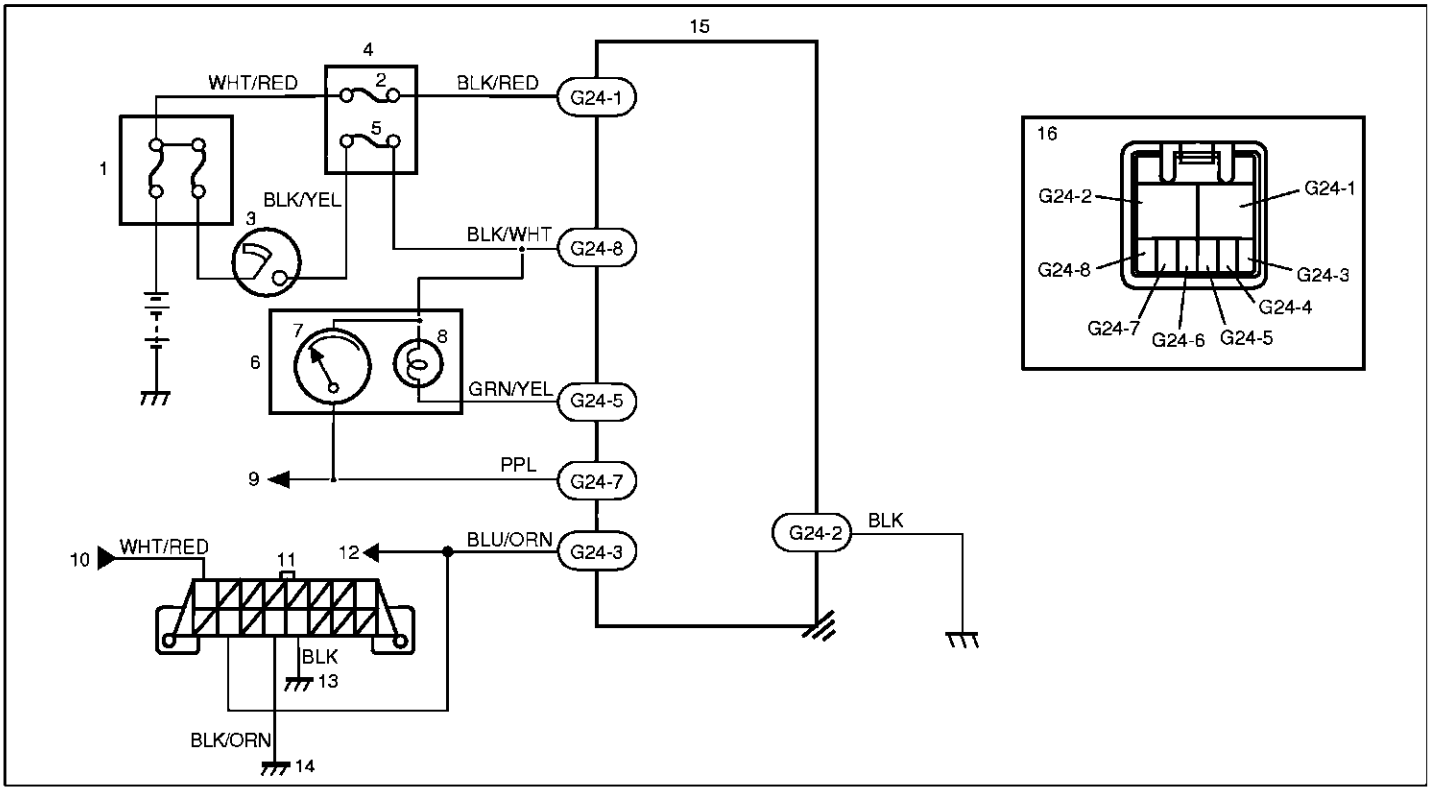
SERIAL DATA LINK CIRCUIT CHECK

CAUTION:
Be sure to perform "SYSTEM CHECK FLOW TABLE" before starting diagnosis according to flow table.



1. Main fuse box	7. Speedometer	13. Ground on engine block
2. "EPS" fuse	8. "EPS" warning lamp	14. Ground on body
3. Ignition switch	9. To vehicle speed sensor (VSS)	15. P/S control module
4. Circuit fuse box	10. To circuit fuse box	16. Connector G24 (viewed from harness side)
5. "IG METER" fuse	11. Data link connector (DLC)	
6. Combination meter	12. To ECM, SDM and ABS hydraulic unit/control module	

DIAGNOSTIC FLOW TABLE

Step	Action	Yes	No
1	Was "SYSTEM CHECK FLOW TABLE" performed?	Go to Step 2.	Go to "SYSTEM CHECK FLOW TABLE" in this section.
2	1) Make sure that SUZUKI scan tool is free from malfunction for P/S system is used. 2) Turn ignition switch to OFF position. 3) Check proper connection of SUZUKI scan tool to DLC. Is connection in good condition?	Go to Step 3.	Properly connect SUZUKI scan tool to DLC.

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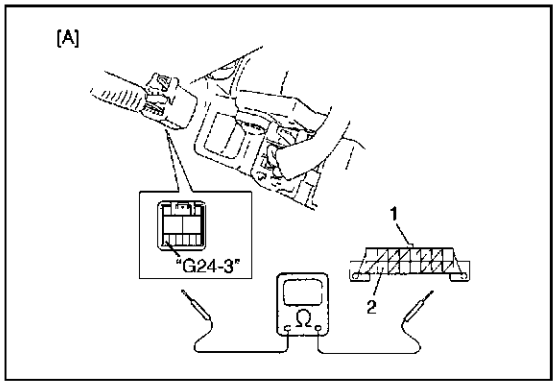
Step	Action	Yes	No
3	1) Check if communication is possible by trying communication with other controller (ECM, ABS hydraulic unit/control module assembly (if equipped) or SDM). Is it possible to communicate with other controller?	Go to Step 4.	Repair open in common section of serial data circuit ("BLU/ORN" wire circuit) used by all controllers or short to ground or power circuit which has occurred somewhere in serial data circuit ("BLU/ORN" wire circuit).
4	1) With ignition switch is OFF position, disconnect 8-pin ("G24") connector from P/S control module. 2) Check proper connection at "G24-3" ("BLU/ORN" wire) terminal for serial data circuit. 3) If OK, then check resistance between "G24-3" ("GRN/ORN" wire) terminal and "BLU/ORN" wire terminal for serial data circuit in DLC. Is resistance 1 Ω or less?	Substitute a known-good P/S control module and recheck.	Repair high resistance or open in "BLU/ORN" wire circuit for P/S system.



[A]: Fig. for Step 4
1. DLC
2. "BLU/ORN" wire terminal

DTC TABLE

CAUTION:
Be sure to perform "SYSTEM CHECK FLOW TABLE" before starting diagnosis according to flow table of each DTC.

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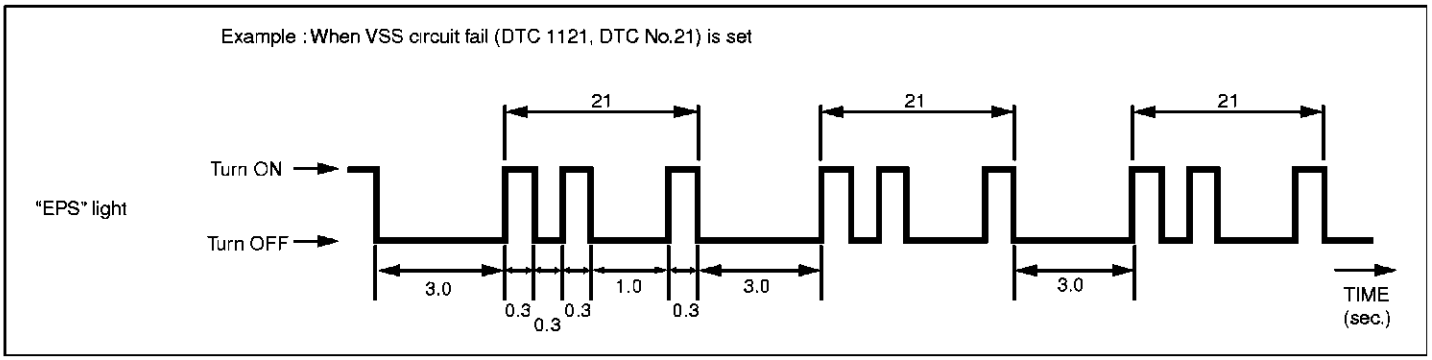

DTC (displayed on SUZUKI scan tool)	"EPS" light flashing pattern		DIAGNOSTIC ITEM	DIAGNOSIS
	DTC (indicated by "EPS" light flashing pattern)	Model		
NO DTC	12		Normal	This code appears when none of the other codes are identified.
C1111	11		Torque sensor	Diagnose trouble according to "DIAGNOSTIC FLOW TABLE" corresponding to each code No.
C1113	13			
C1114	14			
C1115	15			
C1121	21		VSS signal	
C1123	23			
C1124	24			
C1122	22		Engine speed signal	
C1141	41		Motor	
C1142	42			
C1143	43			
C1144	44			
C1145	45			
C1151	51		Clutch	
C1152	52		P/S control module	
C1154	54			
C1155	55			
C1153	53		P/S control module power supply	

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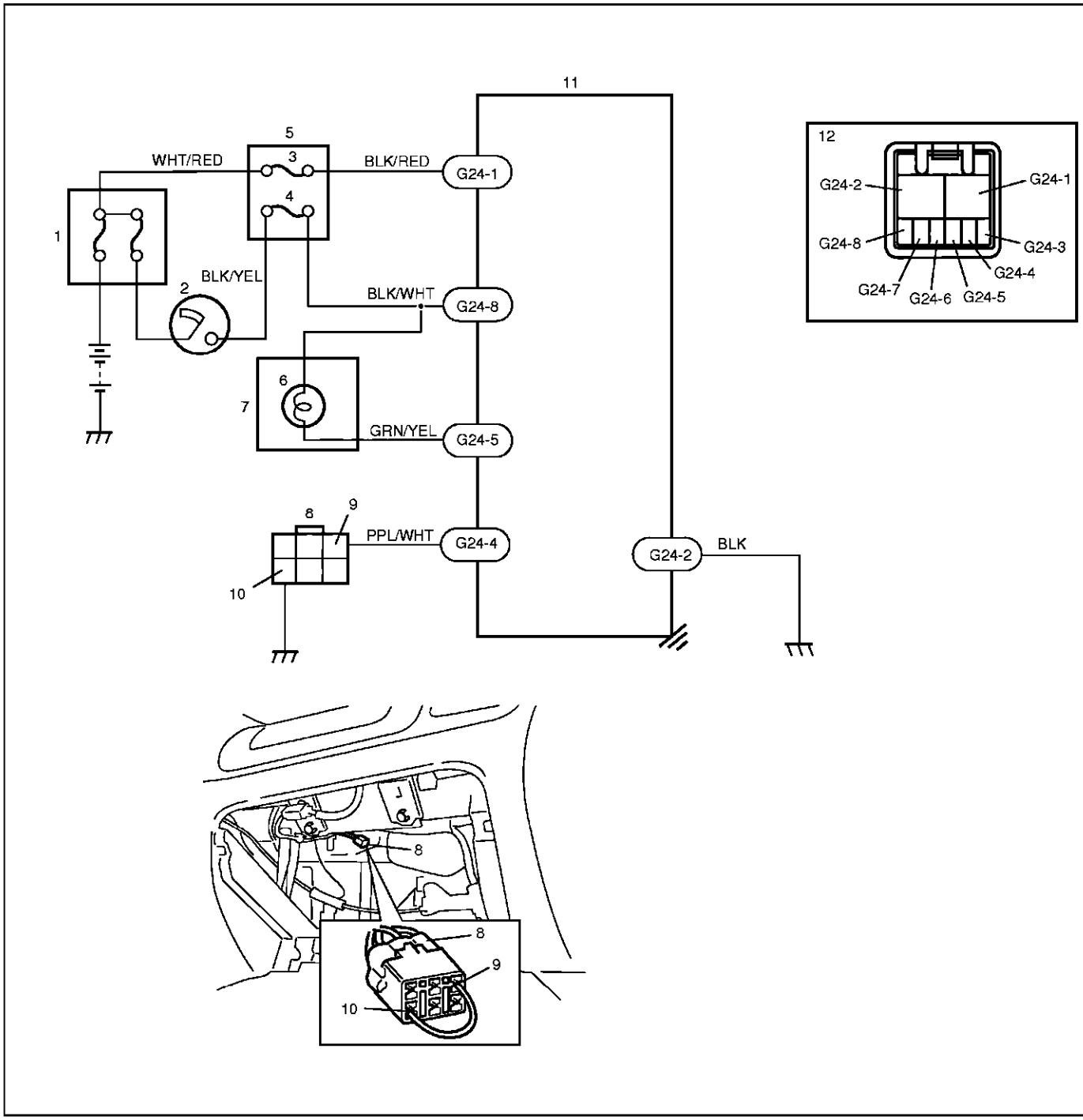
TABLE A - "EPS" WARNING LAMP DOES NOT COME ON AT IGNITION SWITCH ON BUT LEAVING ENGINE OFF

CIRCUIT



1. Main fuse box	5. Circuit fuse box	9. Diagnosis switch terminal
2. Ignition switch	6. "EPS" warning lamp	10. Ground terminal
3. "P/S" fuse	7. Combination meter	11. P/S control module
4. "IG METER" fuse	8. Monitor coupler	12. Connector "G24" (viewed from harness side)

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INSPECTION

Step	Action	Yes	No
1	1) Set parking brake. 2) Note combination meter when ignition switch is turned to ON position. Does the "BRAKE" indicator (warning lamp) come ON?	Go to Step 2.	"BLK/YEL", "BLK/WHT" wire circuit or "IG METER" fuse open or short to ground.
2	1) Ignition switch OFF. 2) Remove and inspect "P/S" fuse. Is fuse in good condition?	Reinstall "P/S" fuse, and then go to Step 3.	Check "BLK/RED" wire circuit for short to ground. If OK, replace "P/S" fuse.
3	1) Turn ignition switch OFF. 2) Remove and inspect "EPS" warning lamp bulb and combination meter referring to "COMBINATION METER" in Section 8. Are there in good condition?	Reinstall "EPS" warning lamp bulb and combination meter, and then go to Step 4.	Replace bulb "EPS" warning lamp bulb or combination meter.
4	1) With ignition switch OFF, disconnect P/S control module connector ("G24"). 2) Check proper connection to P/S control module at "G24-1" terminal. 3) If OK, check voltage between "G24-1" ("BLK/RED" wire) terminal and body ground with ignition switch ON. Is it 10 – 14 V?	Go to Step 5.	"WHT/RED" or "BLK/RFD" wire circuit open or short to ground.
5	1) Check proper connection to P/S control module at "G24-8" terminal. 2) If OK, check voltage between "G24-8" ("BLK/WHT" wire) terminal and body ground with ignition switch ON. Is it 10 – 14 V?	Go to Step 6.	"BLK/WHT" wire circuit open or short to ground.
6	1) Check proper connection to P/S control module at "G24-5" terminal. 2) If OK, check voltage between "G24-5" ("YEL" wire) terminal and body ground with ignition switch ON. Is it 10 – 14 V?	Substitute a known-good P/S control module and recheck.	Check "GRN/YEL" wire circuit open or short to ground.

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TABLE B - "EPS" WARNING LAMP FLASHES AT IGNITION SWITCH ON

CIRCUIT

Refer to TABLE-A for System Circuit Diagram.

Step	Action	Yes	No
1	1) Check monitor coupler. Is it connected diagnosis switch terminal ("9") and ground terminal ("10") in monitor connector by jumper wire?	Disconnect jumper wire from monitor coupler.	Go to Step 2.
2	1) Check voltage between diagnosis switch terminal of monitor coupler and body ground with ignition switch ON. Is it 4 – 6 V?	Substitute a known-good P/S control module and recheck.	"PPL/WHT" wire circuit short to ground.

TABLE C - "EPS" WARNING LAMP DOES NOT FLASH, JUST REMAINS ON OR JUST REMAINS OFF EVEN WITH DIAGNOSIS SWITCH TERMINAL GROUNDED

CIRCUIT

Refer to TABLE-A for System Circuit Diagram.

Step	Action	Yes	No
1	1) Inspect connection between diagnosis switch and ground terminals on monitor coupler by jumper wire. Is it securely connected between them by jumper wire?	Go to Step 2.	Properly connection diagnosis switch and ground terminals on monitor coupler by jumper wire.
2	1) With ignition switch OFF, disconnect P/S control module connector ("G24"). 2) Check proper connection to P/S control module at "G24-4" terminal. 3) If OK, check resistance between "G24-4" ("PPL/WHT" wire) terminal and diagnosis switch terminal ("9") of monitor coupler. Is there continuity?	Go to Step 3.	"PPL/WHT" wire circuit open.
3	1) Check proper connection to P/S control module at "G24-2" terminal. 2) If OK, check resistance between "G24-2" ("BLK" wire) terminal and body ground. Is there continuity?	Go to Step 4.	"BLK" wire circuit open.
4	1) Check proper connection to P/S control module at "G24-5" terminal. 2) If OK, check voltage between "G24-5" ("GRN/YEL" wire) terminal and body ground with ignition switch ON. Is it 10 – 14 V?	Substitute a known-good P/S control module and recheck.	"GRN/YEL" wire circuit or inside of combination meter short to other circuit or ground.

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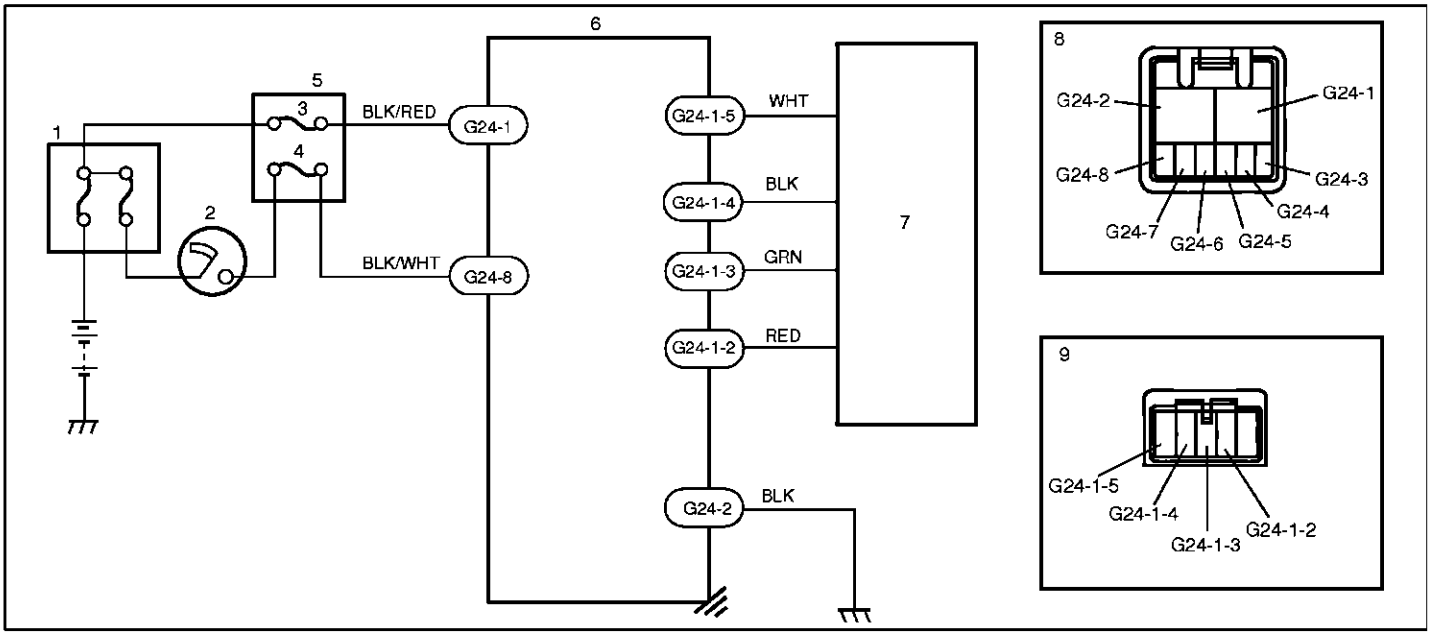
DTC C1111 (DTC No.11) TORQUE SENSOR MAIN CIRCUIT FAILURE
DTC C1113 (DTC No.13) TORQUE SENSOR MAIN AND SUB CIRCUIT FAILURE
DTC C1115 (DTC No.15) TORQUE SENSOR SUB CIRCUIT FAILURE



1. Main fuse box	4. "IG METER" fuse	7. Torque sensor
2. Ignition switch	5. Circuit fuse box	8. Connector "G24" (viewed from harness side)
3. "P/S" fuse	6. P/S control module	9. Connector "G24-1" (viewed from harness side)

Step	Action	Yes	No
1	1) Was "SYSTEM CHECK FLOW TABLE" performed?	Go to STEP 2.	Go to "SYSTEM CHECK FLOW TABLE".
2	1) Is DTC C1114 (DTC No.14) indicated?	Go to "DTC C1114 (DTC No.14) TORQUE SENSOR 5V POWER SUPPLY CIRCUIT FAILURE" in this section.	Go to STEP 3.
3	1) Check proper connection for torque sensor connector ("G24-1") to P/S control module. 2) If OK, check torque sensor and its circuit. Refer to "TORQUE SENSOR" in this section. Is torque sensor in good condition?	Substitute a known-good P/S control module and recheck.	Replace steering column assembly and recheck.

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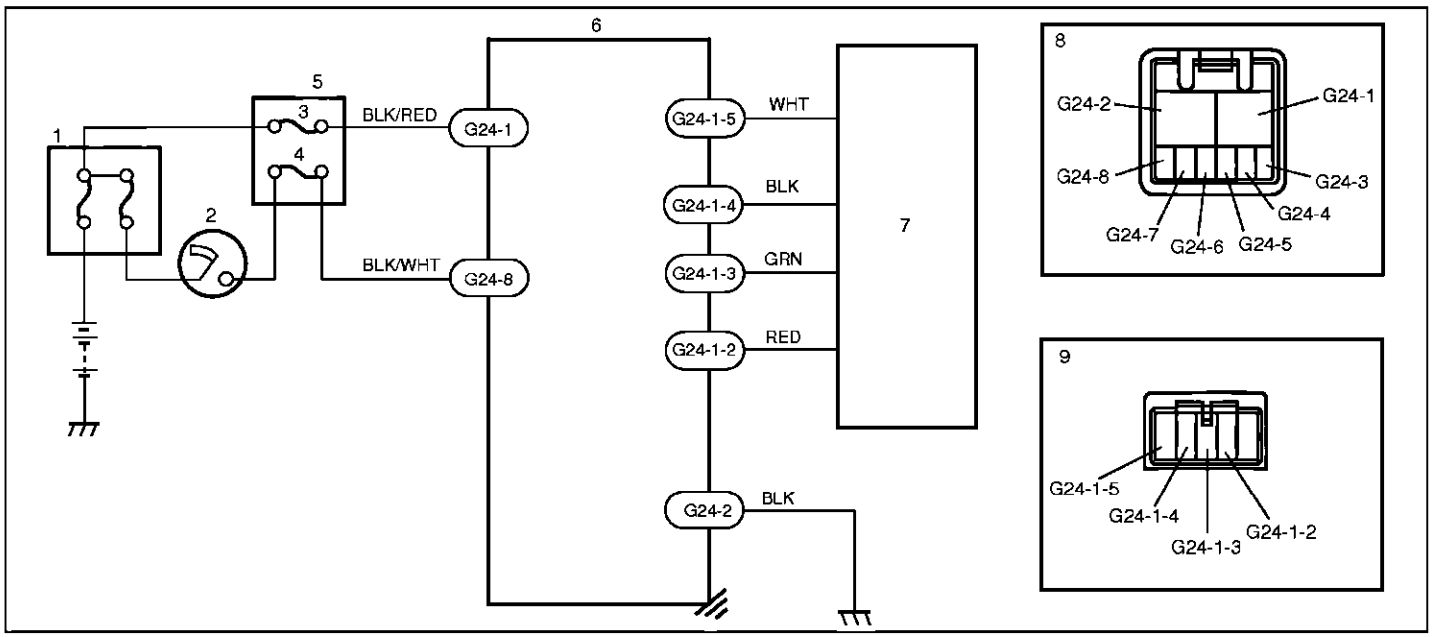
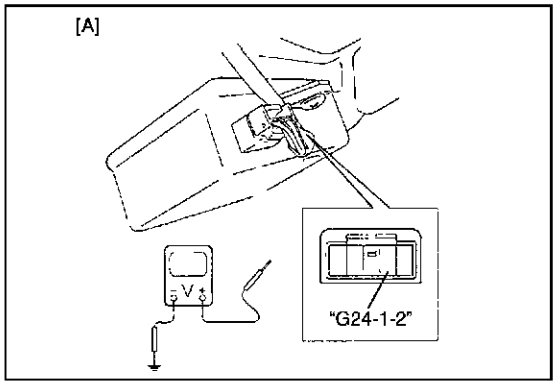
DTC C1114 (DTC No.14) TORQUE SENSOR 5V POWER SUPPLY CIRCUIT FAILURE



1. Main fuse box	4. "IG METER" fuse	7. Torque sensor
2. Ignition switch	5. Circuit fuse box	8. Connector "G24" (viewed from harness side)
3. "P/S" fuse	6. P/S control module	9. Connector "G24-1" (viewed from harness side)

Step	Action	Yes	No
1	Was "SYSTEM CHECK FLOW TABLE" performed?	Go to STEP 2.	Go to "SYSTEM CHECK FLOW TABLE".
2	1) Remove steering column hole cover. 2) Check proper connection for torque sensor connector ("G24-1") to P/S control module. 3) If OK, turn ignition switch ON. 4) Check voltage between "G24-1-2" ("RED" wire) terminal of torque sensor connector ("G24-1") and body ground with connector ("G24-1") connected to P/S control module. Is it about 5 V?	Go to STEP 3.	Repair high resistance, open or short to power circuit or ground in 5V power supply ("RED" wire) circuit.
3	1) Check torque sensor and its circuit. Refer to "TORQUE SENSOR" in this section. Is torque sensor in good condition?	Substitute a known-good P/S control module and recheck.	Replace steering column assembly and recheck.



[A]: Fig. for Step 2

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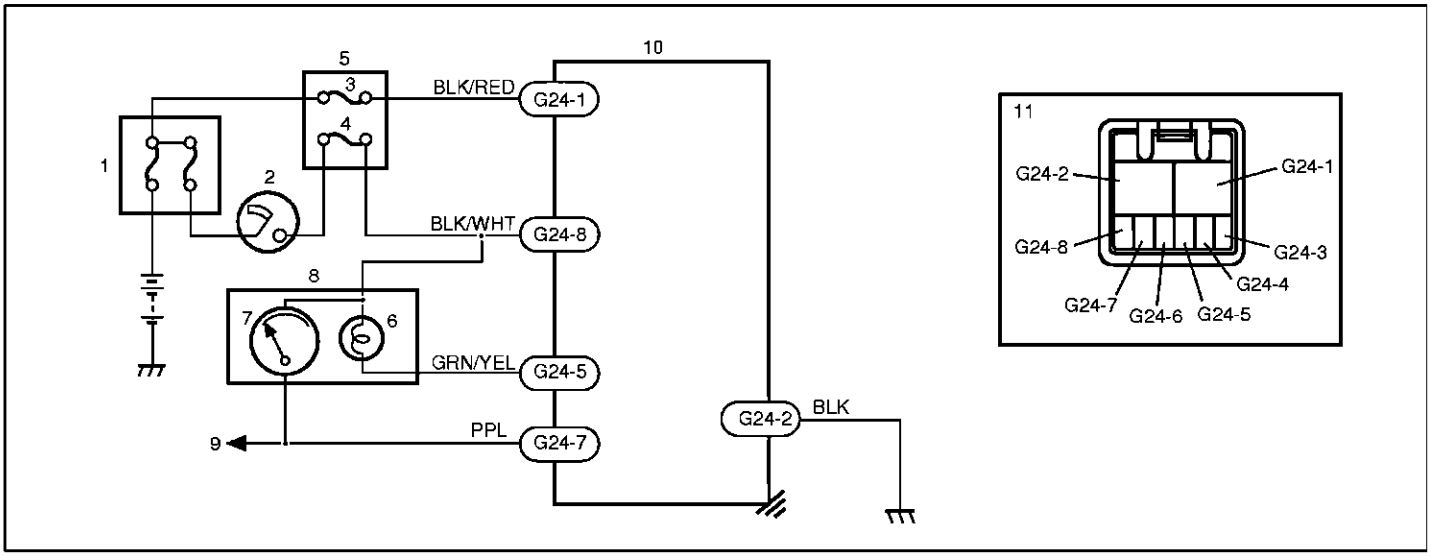
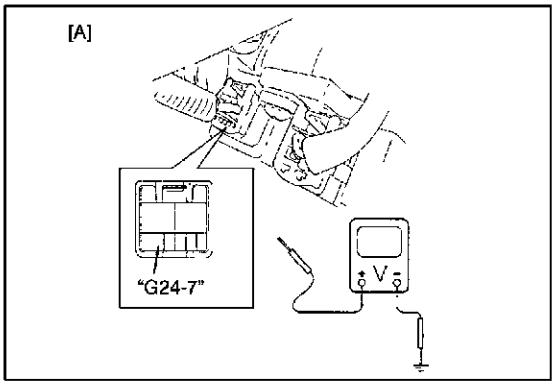
DTC C1121/C1123/C1124 (DTC No.21/23/24) VSS CIRCUIT FAILURE



1. Main fuse box	5. Circuit fuse box	9. To VSS
2. Ignition switch	6. "EPS" warning lamp	10. P/S control module
3. "P/S" fuse	7. Speedometer	11. Connector "G24" (viewed from harness side)
4. "IG METER" fuse	8. Combination meter	

Step	Action	Yes	No
1	Was "SYSTEM CHECK FLOW TABLE" performed?	Go to STEP 2.	Go to "SYSTEM CHECK FLOW TABLE".
2	1) Ignition switch OFF. 2) Remove steering column hole cover. 3) Disconnect P/S control module connector ("G24"). 4) Check proper connection to P/S control module at "G24-7" ("PPL" wire) terminal. 5) If OK, connect voltmeter between "G24-7" ("PPL" wire) terminal and body ground with connector ("G24") connected. 6) Hoist rear end of vehicle and lock rear right tire. 7) Turn rear left tire quickly with ignition switch ON. Does voltmeter indicate deflection between 0 – 1 V and 9 – 11 V a few times while tire is turned one revolution?	Check intermittent trouble. Refer to "INTERMITTENT AND POOR CONNECTION" in Section 0A. If OK, substitute a known-good P/S control module and recheck.	Repair VSS or its ("PPL" wire) circuit.



[A]: Fig. for Step 2

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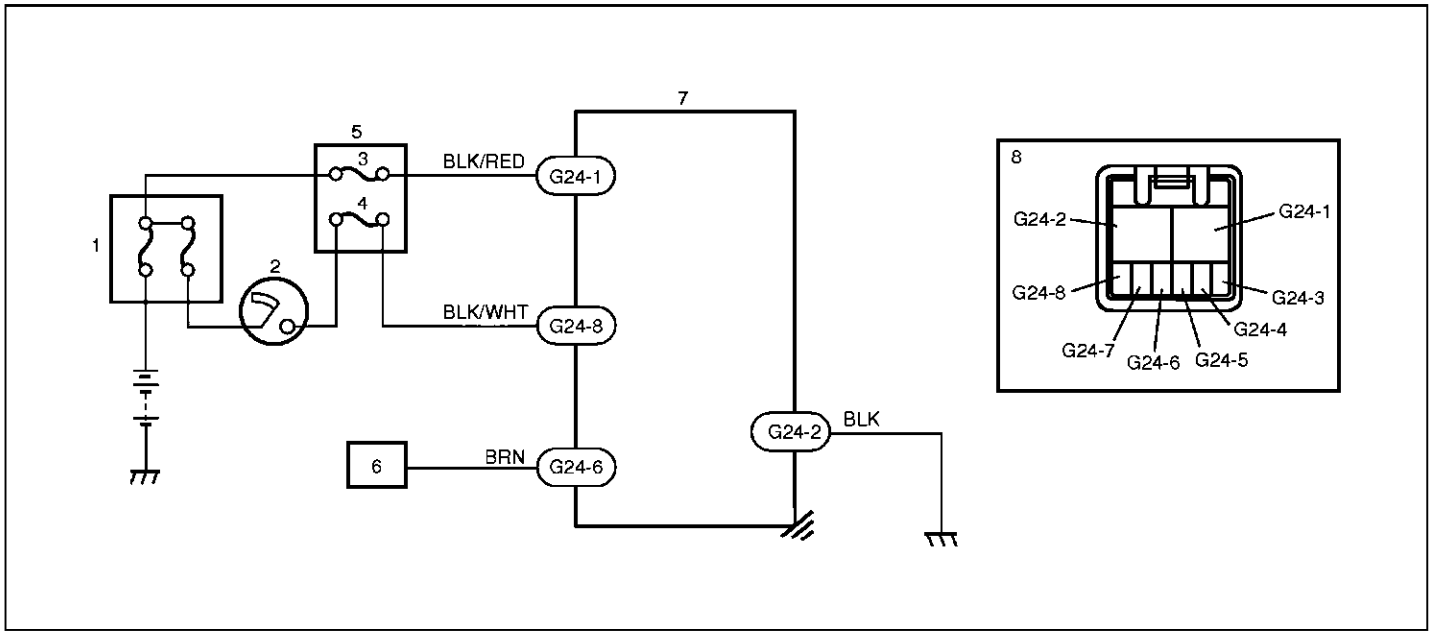
DTC C1122 (DTC No.22) ENGINE SPEED SIGNAL CIRCUIT FAILURE



1. Main fuse box	4. "IG METER" fuse	7. P/S control module
2. Ignition switch	5. Circuit fuse box	8. Connector "G24" (viewed from harness side)
3. "P/S" fuse	6. ECM	

Step	Action	Yes	No
1	Was "SYSTEM CHECK FLOW TABLE" performed?	Go to STEP 2.	Go to "SYSTEM CHECK FLOW TABLE".
2	1) Recheck DTC with engine running. Is DTC C1122 (DTC No.22) indicated?	Go to STEP 3.	It is nothing abnormal for DTC C1122 (DTC No.22). P/S system is in normal condition.
3	1) Check proper connection to P/S control module and ECM at each "BRN" wire terminal (P/S control module side: "G24-6" terminal, ECM side : Refer to in Section 6E1), then check intermittent trouble. Refer to "INTERMITTENT AND POOR CONNECTION" in Section 0A. 2) If they are OK, check high resistance, open or short to power circuit or ground in "BRN" wire circuit. Is check result in good condition?	Substitute a known-good P/S control module and recheck.	Repair.

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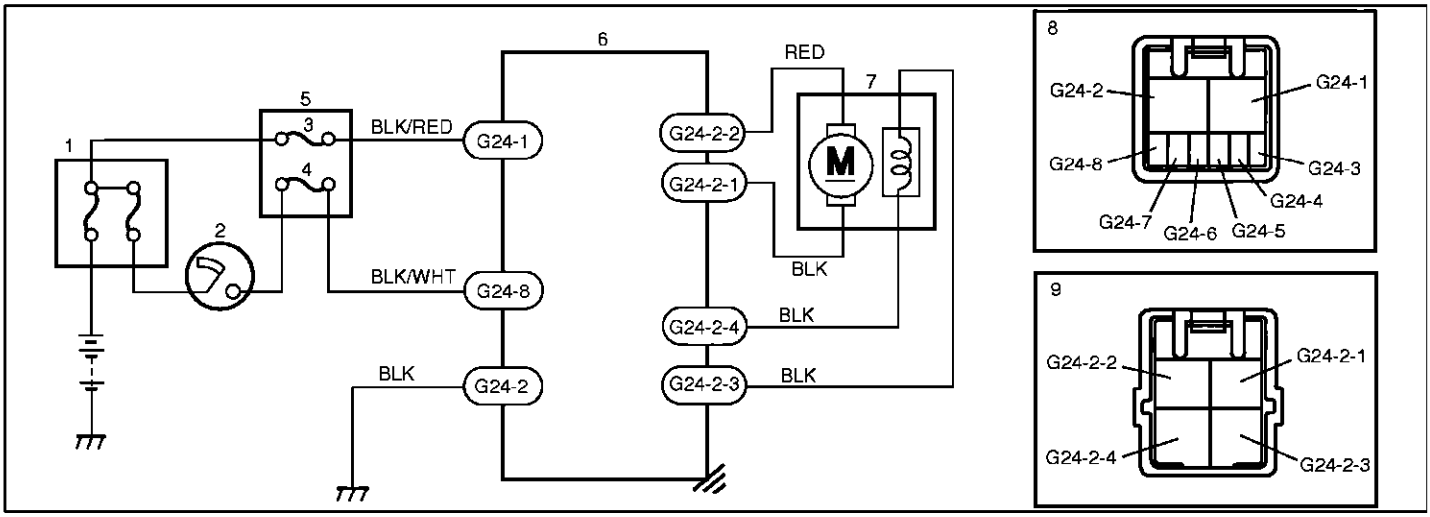
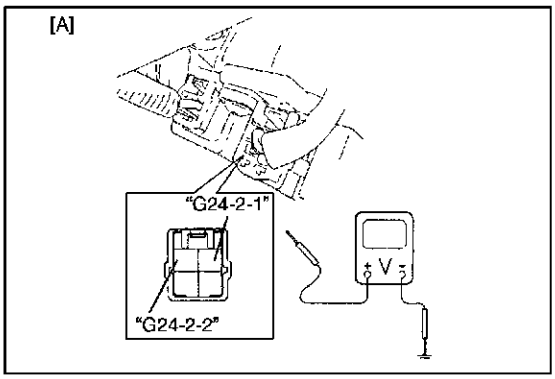
DTC C1141/C1142/C1143/C1144/C1145 (DTC No.41/42/43/44/45) MOTOR CIRCUIT FAILURE



1. Main fuse box	4. "IG METER" fuse	7. Motor assembly with clutch
2. Ignition switch	5. Circuit fuse box	8. Connector "G24" (viewed from harness side)
3. "P/S" fuse	6. P/S control module	9. Connector "G24-2" (viewed from harness side)

Step	Action	Yes	No
1	Was "SYSTEM CHECK FLOW TABLE" performed?	Go to STEP 2.	Go to "SYSTEM CHECK FLOW TABLE".
2	1) Remove steering column hole cover. 2) Check proper connection for motor assembly with clutch connector ("G24-2") to P/S control module. 3) If OK, start engine. 4) Check voltage between "G24-2-2" ("RED" wire) terminal and body ground and "G24-2-1" ("BLK" wire) terminal and body ground with connector ("G24") connected to P/S control module. Are they 5 – 7 V with steering wheel held at position for vehicle to run straight?	Go to STEP 3.	Repair poor connection, high resistance, open or short to power circuit or ground in "G24-2" ("RED" wire) or "G24-2-1" ("BLK" wire) circuit.
3	1) Check motor and its circuit. Refer to "MOTOR ASSEMBLY" (WITH CLUTCH) in this section. Is motor and clutch in good condition?	Substitute a known-good P/S control module and recheck.	Replace steering column assembly and recheck.



[A]: Fig. for Step 2

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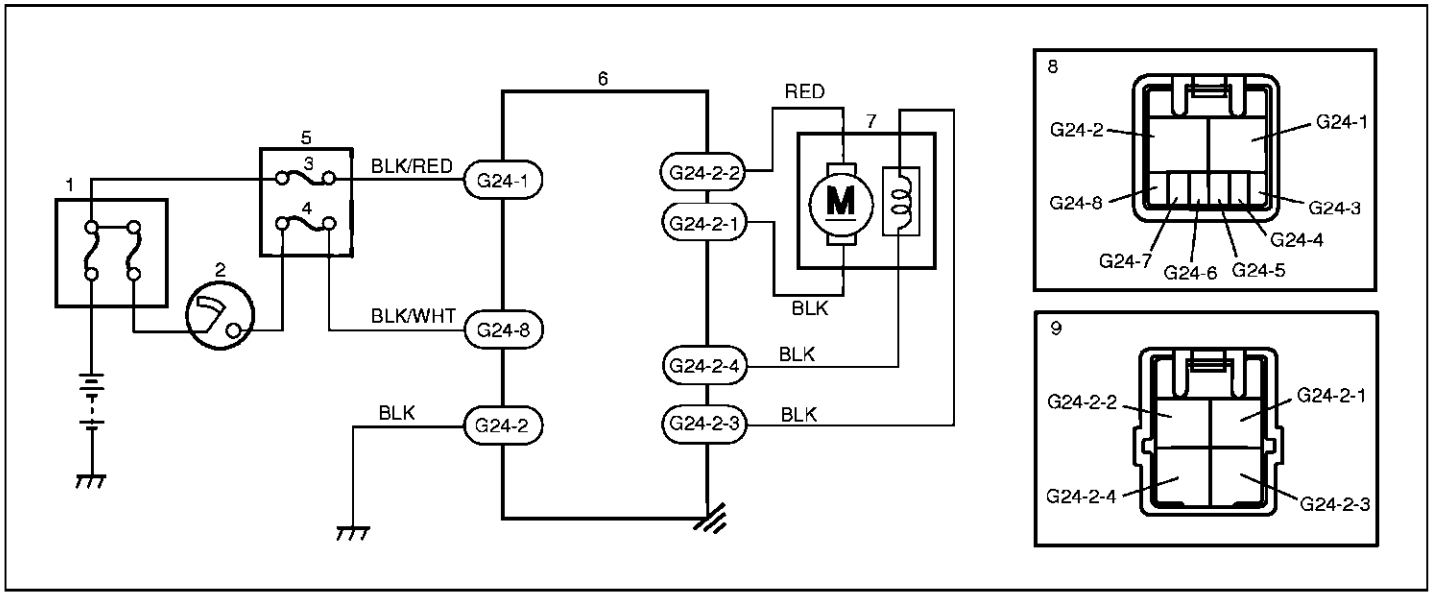
DTC C1151 (DTC No.51) CLUTCH CIRCUIT FAILURE



1. Main fuse box	4. "IG METER" fuse	7. Motor assembly with clutch
2. Ignition switch	5. Circuit fuse box	8. Connector "G24" (viewed from harness side)
3. "P/S" fuse	6. P/S control module	8 Connector "G24-2" (viewed from harness side)

Step	Action	Yes	No
1	Was "SYSTEM CHECK FLOW TABLE" performed?	Go to STEP 2.	Go to "SYSTEM CHECK FLOW TABLE".
2	1) Remove steering column hole cover. 2) Check proper connection for motor assembly with clutch connector ("G24-2") to P/S control module. 3) If OK, start engine. 4) Check voltage between "G24-2-4" ("BLK" wire) terminal and body ground with connector ("G24-2") connected to P/S control module. Is it 0 V?	Go to STEP 3.	Repair poor connection, high resistance, open or short to power circuit or ground in "G24-2-4" ("BLK" wire) circuit.
3	1) Check voltage between "G24-2-3" ("BLK" wire) terminal and body ground with connector ("G24-2") connected to P/S control module. Is it 10 – 14 V with steering wheel held at position for vehicle to run straight?	Go to STEP 4.	Repair poor connection, high resistance, open or short to power circuit or ground in "G24-2-3" ("BLK" wire) circuit.
4	1) Check motor and its circuit. Refer to "MOTOR ASSEMBLY" (WITH CLUTCH) in this section. Is motor and clutch in good condition?	Substitute a known-good P/S control module and recheck.	Replace steering column assembly and recheck.

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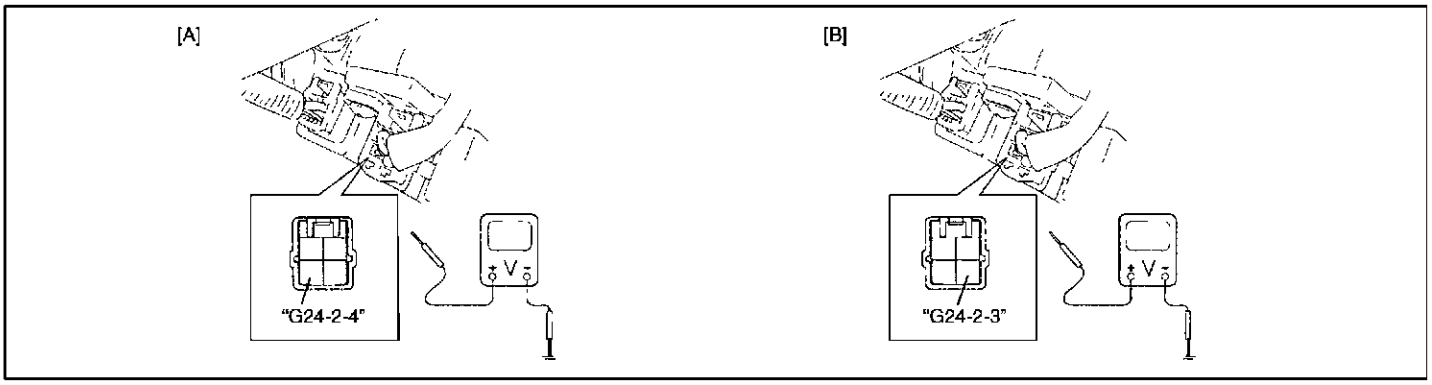

[A]: Fig. for Step 2
[B]: Fig. for Step 3

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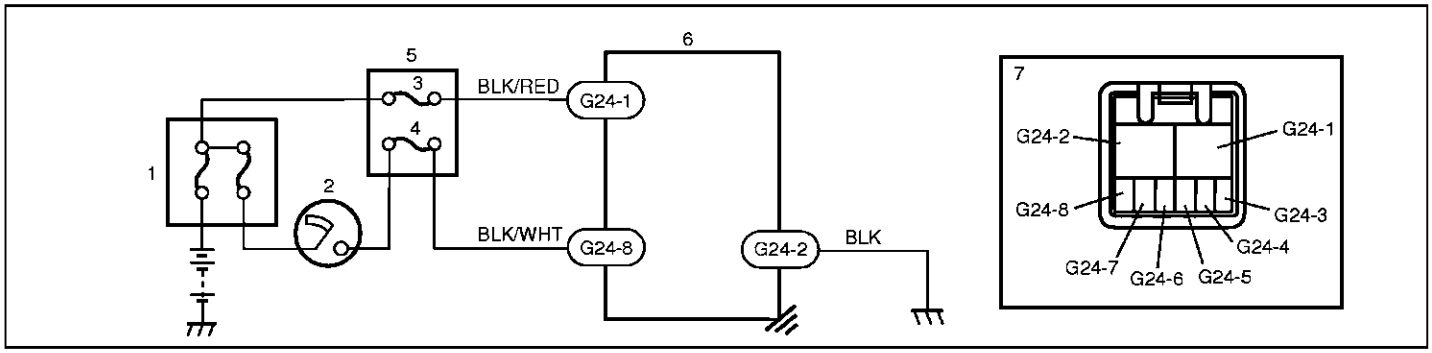
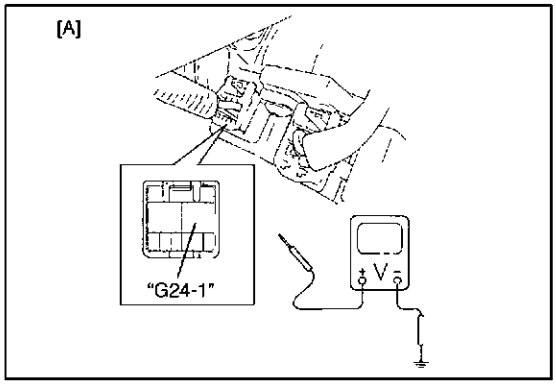
DTC C1153 (DTC No.53) P/S CONTROL MODULE POWER SUPPLY CIRCUIT FAILURE



1. Main fuse box	4. "IG METER" fuse	7 Connector "G24" (viewed from harness side)
2. Ignition switch	5 Circuit fuse box	
3. "P/S" fuse	6 P/S control module	

Step	Action	Yes	No
1	Was "SYSTEM CHECK FLOW TABLE" performed?	Go to STEP 2.	Go to "SYSTEM CHECK FLOW TABLE".
2	1) Remove steering column hole cover. 2) Check "P/S" fuse and proper connection to P/S control module at "G24-1" ("BLK/WHT" wire) terminal. 3) If OK, check voltage between "G24-1" terminal and body ground with connector ("G24") connected to P/S control module. Is it 10 – 14 V?	Check intermittent trouble. Refer to "INTERMIT AND POOR CONNECTION" in Section 0A. If OK, substitute a known-good P/S control module and recheck.	Repair poor connection or high resistance in "G24-1" ("BLK/RED" wire) circuit.



[A]: Fig. for Step 2

DTC C1152/C1154/C1155 (DTC No.52/54/55) P/S CONTROL MODULE FAILURE

Substitute a known-good P/S control module and recheck.

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TROUBLE DIAGNOSIS (FOR TROUBLE NOT INDICATED BY ON BOARD DIAGNOSTIC SYSTEM)

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

Condition	Possible Cause	Correction
Steering wheel feels heavy (Perform STEERING FORCE INSPECTION before diagnosis.)	Steering wheel installed improperly (twisted)	Install steering wheel correctly.
	Poor performance of torque sensor	Check torque sensor. Refer to "TORQUE SENSOR" in this section.
	Poor performance of motor and clutch	Check motor and clutch. Refer to "MOTOR ASSEMBLY WITH CLUTCH".
	Faulty steering column	Replace.
	Poor performance of VSS	Check VSS. Refer to Section 6E1.
Vehicle pulls to one side during straight driving	Poor performance of torque sensor	Check torque sensor. Refer to "TORQUE SENSOR" in this section.
Poor recovery from turns	Poor performance of torque sensor	Check torque sensor. Refer to "TORQUE SENSOR" in this section.
	Faulty steering column	Replace.

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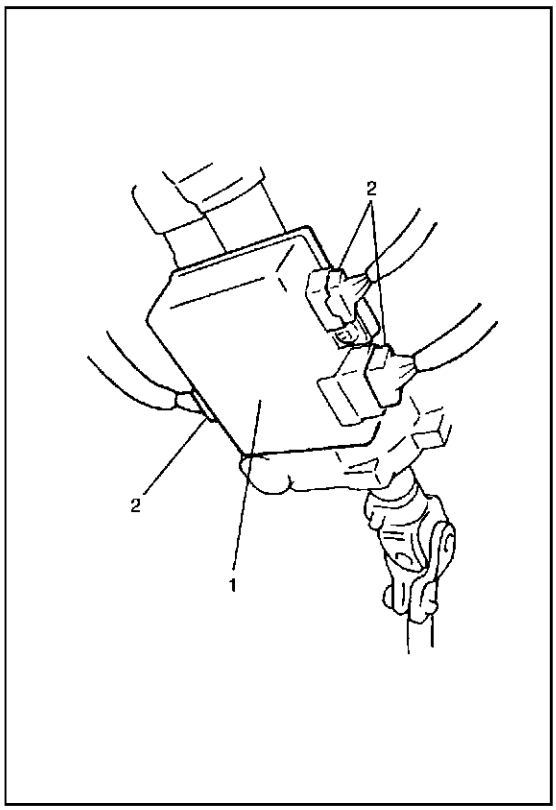
INSPECTION OF P/S CONTROL MODULE AND ITS CIRCUITS



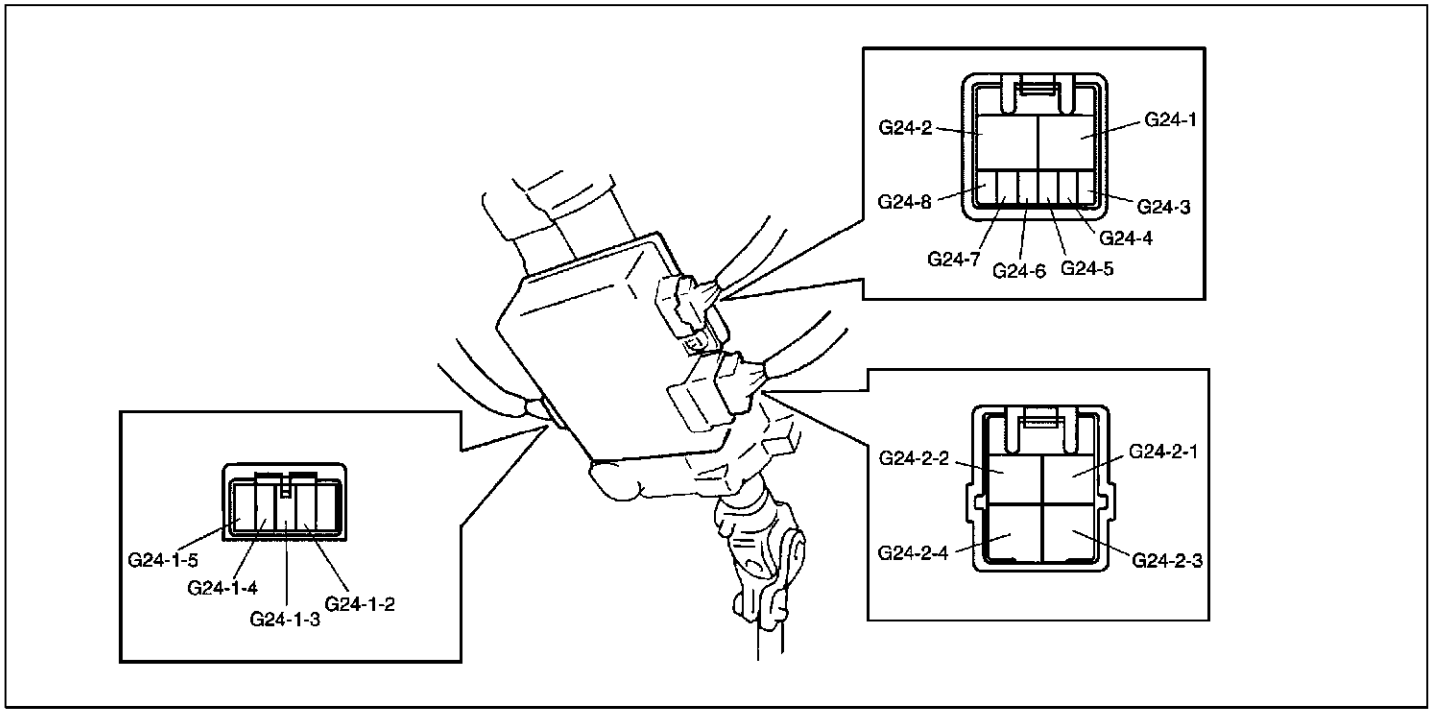
P/S control module (1) and its circuits can be checked at P/S control module wiring couplers (2) by measuring voltage and resistance.

CAUTION:
P/S control module cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to P/S control module with connector disconnected from it.

Voltage Check

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

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



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TERMINAL NO.	CIRCUIT	NORMAL VOLTAGE	CONDITION
G24-2	Ground	–	–
G24-1	P/S control module power supply from battery	10 – 14V	–
G24-8	P/S control module power supply from ignition switch	10 – 14V	Ignition switch ON
G24-7	VSS	✱ Indicator deflection repeated 0 – 1V and 9 – 11V	Ignition switch ON Front left tire turned quickly with right tire locked
G24-6	Engine speed signal	✱ Indicator deflection repeated 0 – 1V and 10 – 14V	Engine idling
G24-5	"EPS" light	0V	"EPS" warning lamp ON
G24-4	Diagnosis switch terminal	4 – 6V	Ignition switch ON
G24-3	Data link connector	–	–
G24-2-2	Motor output 2	5 – 7V	Engine idling and steering wheel held at position for vehicle to run straight
G24-2-1	Motor output 1	5 – 7V	Engine idling and steering wheel held at position for vehicle to run straight
G24-2-4	Clutch output 2	0V	–
G24-2-3	Clutch output 1	10 – 14V	Engine idling
G24-1-5	Torque sensor (Main)	About 2.5V	Ignition switch ON and steering wheel held at position for vehicle to run straight Check voltage between "G24-1-5" and "G24-1-3" terminals
G24-1-4	Torque sensor (Sub)	About 2.5V	Ignition switch ON and steering wheel held at position for vehicle to run straight Check voltage between "G24-1-4" and "G24-1-3" terminals
G24-1-3	Torque sensor (GND)	0V	–
G24-1-2	5V power supply for torque sensor	About 5V	Ignition switch ON Check voltage between "G24-1-2" and "G24-1-3" terminals

NOTE:

✱ : The voltage of this circuit may fail to check by voltmeter.
If so, use oscilloscope.

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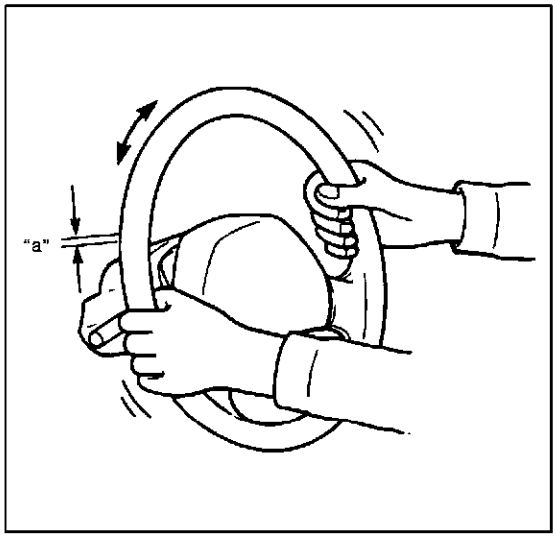
STEERING WHEEL PLAY INSPECTION

Check steering wheel for looseness or rattle by trying to move it in its shaft direction and lateral direction.
If found defective, repair or replace.



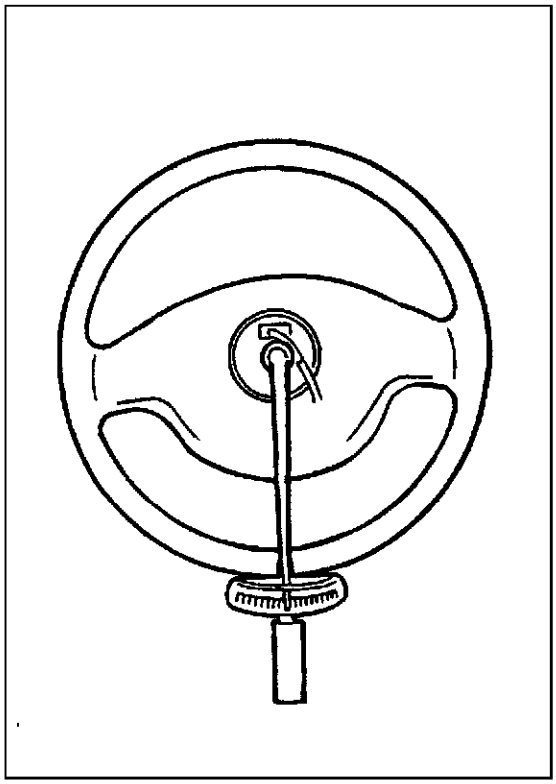
Check steering wheel play, holding vehicle in straight forward condition on the ground and with engine stopped.
If steering wheel play is not within specification, inspect as follows and replace if found defective.

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

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

STEERING FORCE INSPECTION

1) Place vehicle on level road and set steering wheel at straight-ahead position.
2) Check that tire inflation pressure is as specified. (Refer to "TIRE PLACARD" on vehicle.)
3) Remove driver air bag (inflator) module referring to DRIVER AIR BAG (INFLATOR) MODULE in Section 3C.
4) Start engine.
5) With engine idling, measure steering force by turning torque wrench.



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

6) Install drive air bag (inflator) module referring to DRIVER AIR BAG (INFLATOR) MODULE in Section 3C.

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ON-VEHICLE SERVICE

STEERING COLUMN ASSEMBLY

Refer to "STEERING WHEEL AND COLUMN" in Section 3C for removal and installation of steering column assembly but perform the following step beforehand.

- Remove steering hole cover.
- Disconnect all couplers from P/S control module.

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

CHECKING STEERING COLUMN ASSEMBLY AND LOWER SHAFT 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.

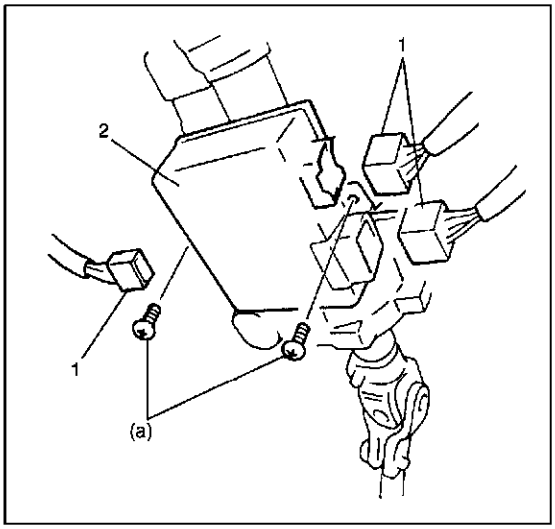
CHECKING PROCEDURE

Refer to "CHECKING STEERING COLUMN ASSEMBLY AND LOWER SHAFT FOR ACCIDENT DAMAGE (FOR EPS MODEL)" in Section 3C

P/S CONTROL MODULE

REMOVAL

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



INSTALLATION

Reverse removal procedure for installation, noting the following.

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

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

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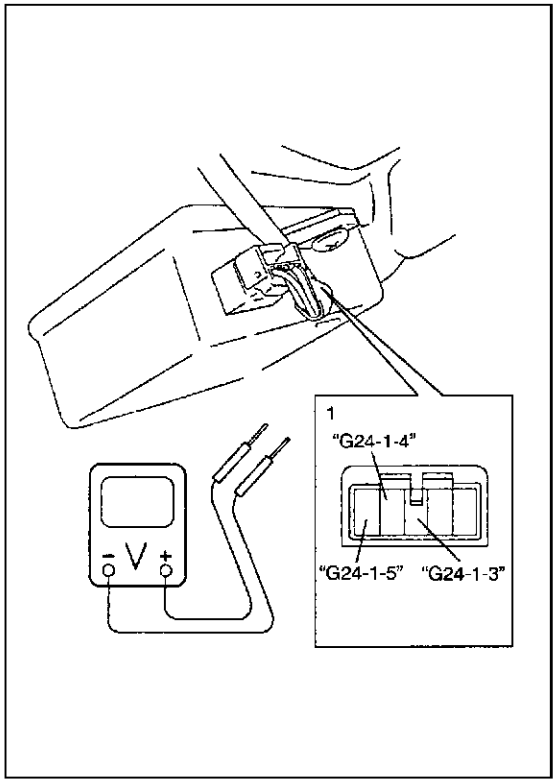
TORQUE SENSOR

ON-VEHICLE INSPECTION

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



Torque sensor specification

	Steering wheel turned fully left	Steering wheel held at position for vehicles torque straight	Steering wheel turned fully right
Main sensor ("G24-1-4" – "G24-1-3")	1.5 V below	About 2.5 V	Above 3.5 V
Sub sensor ("G24-1-5" – "G24-1-3")	1.5 V below	About 2.5 V	Above 3.5 V

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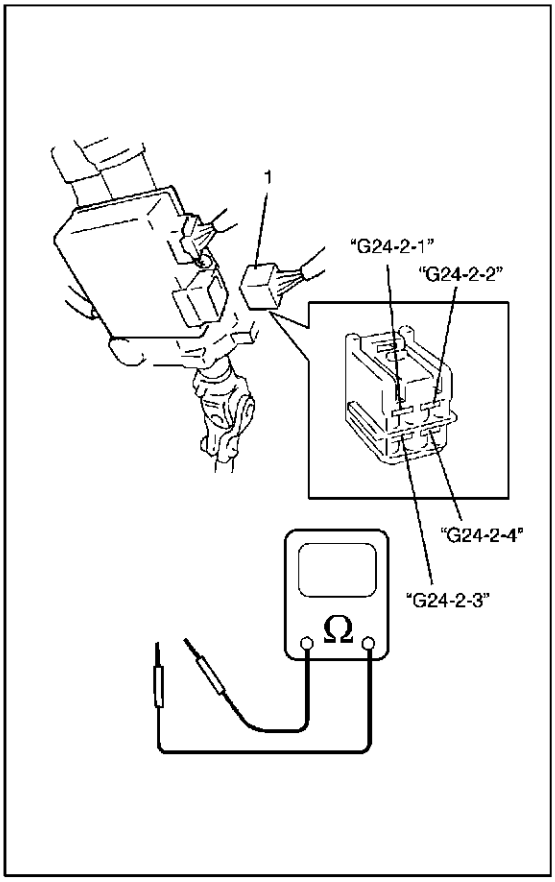
MOTOR ASSEMBLY WITH CLUTCH

ON-VEHICLE INSPECTION

1) Remove steering column hole cover.



2) Disconnect motor and clutch connector (1) from P/S control module with ignition switch OFF.
3) Check resistance between terminals of motor and clutch connector (1)
   If check result is not as specified above, replace steering column assembly.

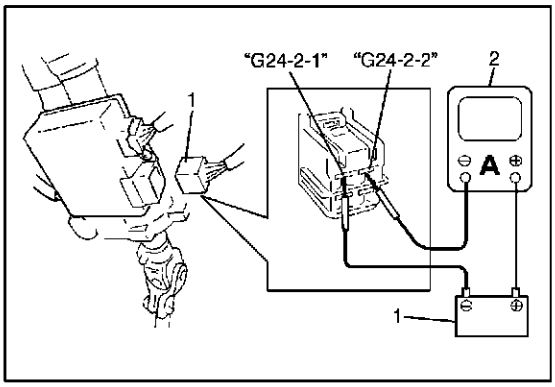
Motor and clutch circuit resistance

"G24-2-2" and "G24-2-1" (For motor)	**About 1 Ω**
"G24-2-4" and "G24-2-3" (For clutch)	**About 12 Ω (at 20°C (68°F))**

4) Check continuity between terminal of motor and clutch connector (1) and body ground.
   If check result is not as specified above, replace steering column assembly.

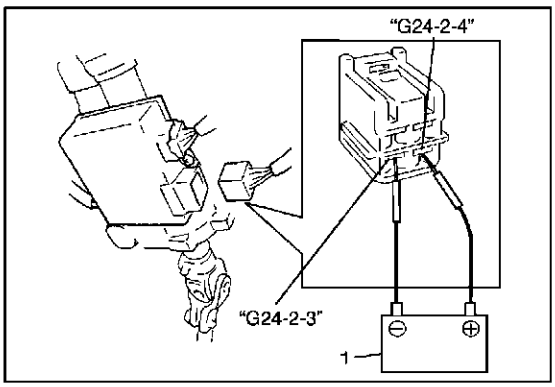
Motor and clutch circuit resistance (to body ground)

"G24-2-4" and body ground	**No continuity**
"G24-2-2" and body ground	**No continuity**



5) Connect battery (1) between "G24-2-2" and "G24-2-1". Check that motor rotates smoothly, then measure current between "G24-2-1" and "G24-2-2" using ammeter (2) as shown in figure.
   If check result is not satisfactory, replace steering column assembly.

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



6) Connect battery (1) between "G24-2-4" and "G24-2-3", then check that clutch operation sound is heard.
   If check result is not satisfactory, replace steering column assembly.

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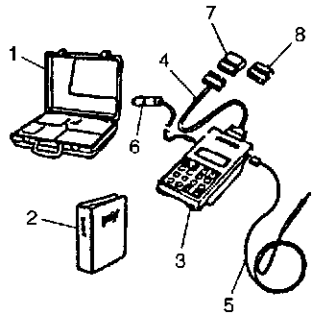
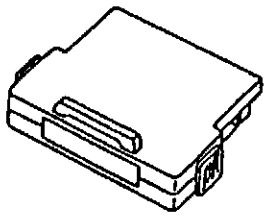
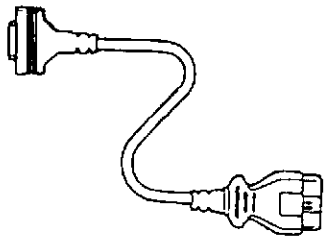
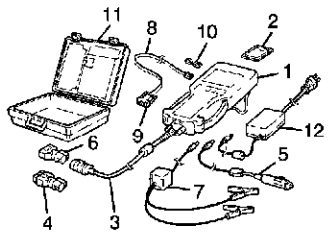
SPECIAL TOOL

			
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, 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

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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.

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GENERAL DESCRIPTION

STEERING COLUMN

This double tube type steering column has 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.

STEERING WHEEL AND DRIVER AIR BAG (INFLATOR) MODULE

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 and "SERVICE PRECAUTIONS" under "ON-VEHICLE SERVICE" in SECTION 10B.

DIAGNOSIS

For maintenance service of the steering wheel and column, refer to SECTION 0B.

For diagnosis of the steering wheel and column, refer to SECTION 3.

For diagnosis of the air bag system, refer to SECTION 10B.

INSPECTION AND REPAIR REQUIRED AFTER ACCIDENT

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 ASSEMBLY FOR ACCIDENT DAMAGE" as well as "REPAIRS AND INSPECTIONS REQUIRED AFTER AN ACCIDENT" under "ON-VEHICLE SERVICE" in SECTION 10B.

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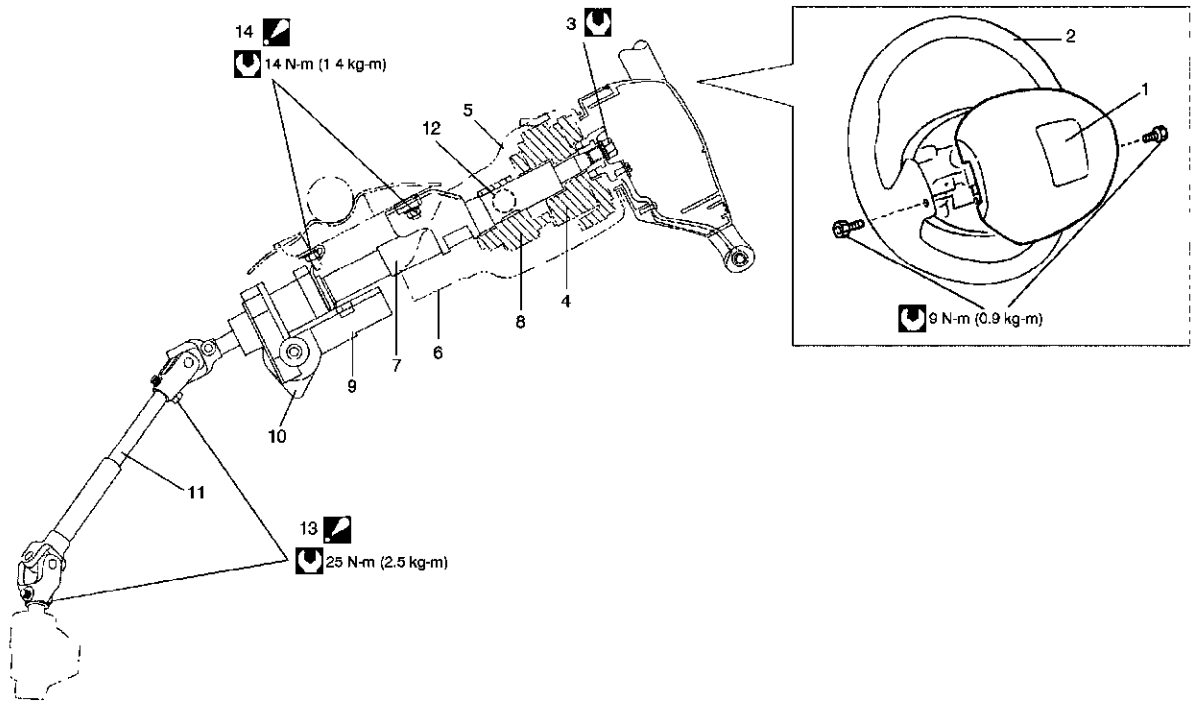
ON-VEHICLE SERVICE



1. Driver air bag (inflator) module	7 Steering column assembly	13.	Upper and lower joint bolt : After tightening lower joint bolt, tighten upper joint bolt
2. Steering wheel	8 Steering lock assembly (ignition switch)		
3. Steering wheel nut	9 P/S control module (if equipped)		
4. Contact coil and combination switch assembly	10 Motor for P/S system (if equipped)	14.	Steering column mounting nut After tightening lower nut, tightening upper nut
5. Steering column upper cover	11 Steering lower shaft		
6. Steering column lower cover	12 Immobilizer control module (if equipped)		Tightening torque

SERVICE PRECAUTIONS

For service precautions, refer to "SERVICE PRECAUTIONS" under "ON-VEHICLE SERVICE" in SECTION 10B.

SERVICE AND DIAGNOSIS

For diagnosis and servicing, refer to "SERVICE AND DIAGNOSIS" under "SERVICE PRECAUTIONS" in SECTION 10B.

DISABLING AIR BAG SYSTEM

For disabling air bag system, refer to "DISABLING AIR BAG SYSTEM" under "SERVICE PRECAUTIONS" in SECTION 10B.

ENABLING AIR BAG SYSTEM

For enabling air bag system, refer to "ENABLING AIR BAG SYSTEM" under "SERVICE PRECAUTIONS" in SECTION 10B.

HANDLING AND STORAGE

For handling and storage, refer to "HANDLING AND STORAGE" under "SERVICE PRECAUTIONS" in SECTION 10B.

DISPOSAL

For disposal, refer to "DISPOSAL" under "SERVICE PRECAUTIONS" in SECTION 10B.

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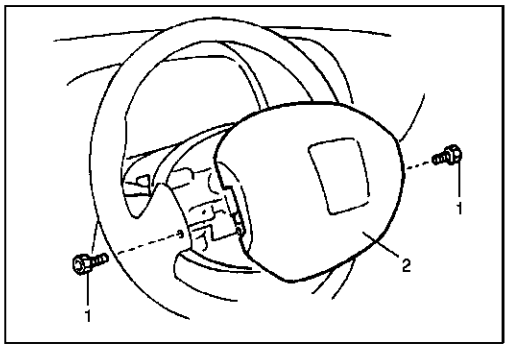
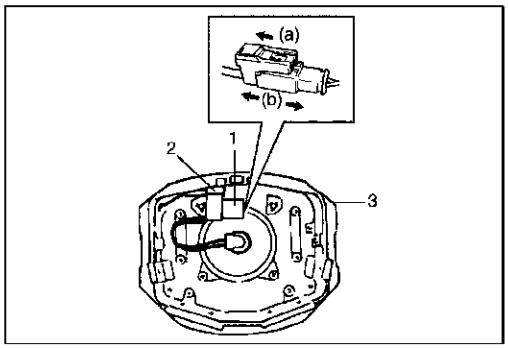
DRIVER AIR BAG (INFLATOR) MODULE

WARNING:
When handling an air bag (inflator) module, be sure to read "SERVICE PRECAUTIONS" in SECTION 10B and observe each instruction. Failure to follow them could cause a damage to the air bag (inflator) module or result in personal injury.

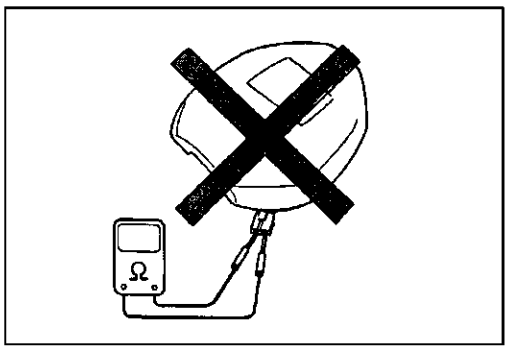


REMOVAL

1) Disconnect negative cable at battery.
2) Disable air bag system. Refer to "DISABLING AIR BAG SYSTEM" under "SERVICE PRECAUTIONS" in SECTION 10B.
3) Remove driver air bag (inflator) module (2) mounting bolts (1).



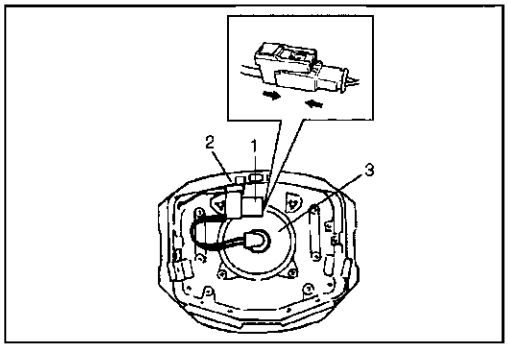
4) Remove driver air bag (inflator) module (3) from steering wheel.
5) Disconnect yellow connector (1) of driver air bag (inflator) module (3) as follows.
   a) Release locking of lock slider.
   b) After unlocked, disconnect connector.
6) Disconnect horn connector (2).



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 (pad surface) (1) being cracked
- Wire harness or connector (2) being damaged
- Air bag (inflator) module being damaged or having been exposed to strong impact (dropped)

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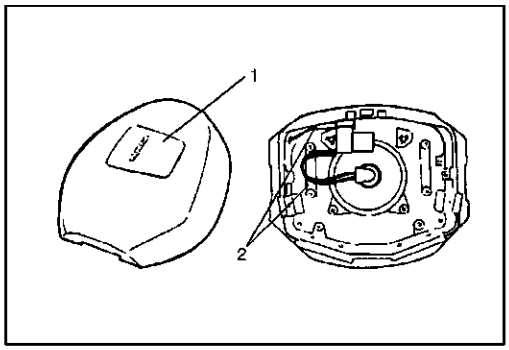
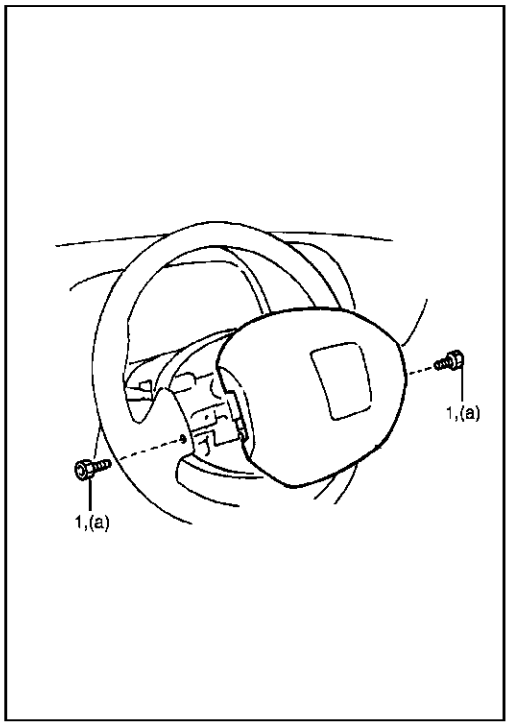


INSTALLATION

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



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 bolt
   (a) : 9 N-m (0.9 kg-m, 6.5 lb-ft)

6) Connect negative cable at battery.
7) Enable air bag system. Refer to "ENABLING AIR BAG SYSTEM" under "SERVICE PRECAUTIONS" in SECTION 10B.

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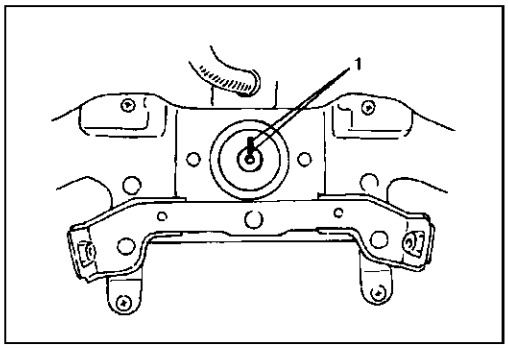
STEERING WHEEL

CAUTION:
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 quarter turns from the center position clockwise or counterclockwise respectively), or coil will break.

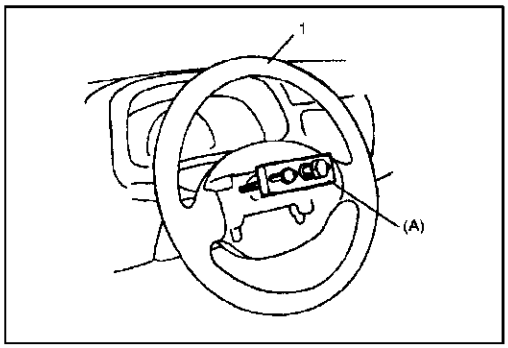
REMOVAL

1) Remove driver air bag (inflator) module from steering wheel. Refer to "DRIVER AIR BAG (INFLATOR) MODULE" in this section.



2) Remove steering shaft nut.
3) Make alignment marks (1) on steering wheel and shaft for a guide during reinstallation.

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.



4) Remove steering wheel (1) with special tool.
Special tool
(A) : 09944-36011

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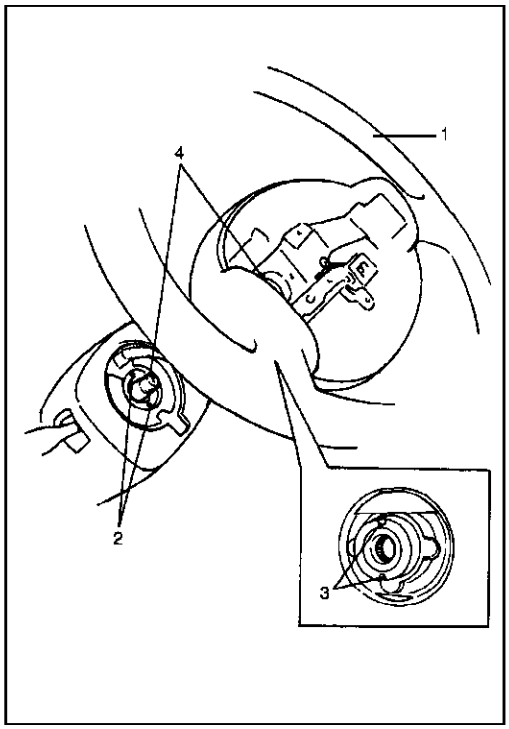
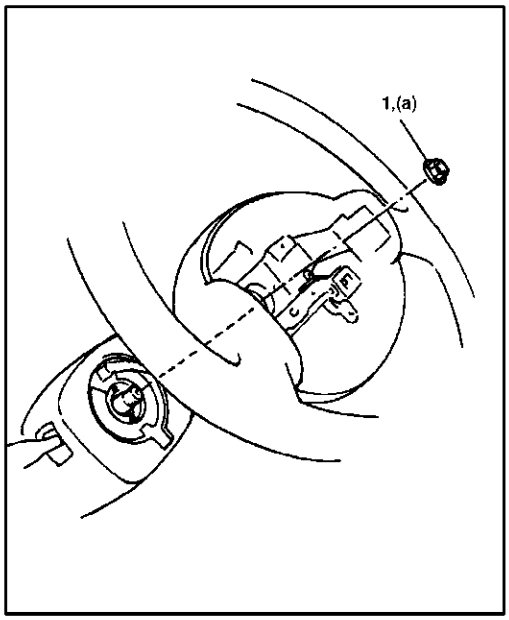


INSTALLATION

1) Check that vehicle's front tires are at straight-ahead position and contact coil is centered. Refer to "CENTERING CONTACT COIL" in this section.

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

2) When install steering wheel, place match mark at the same position of new steering wheel as that of removed steering wheel.
3) Install steering wheel (1) to steering shaft with 2 lugs (2) on contact coil fitted in two grooves (2) in the back of steering wheel and also aligning marks (4) on steering wheel and steering shaft.



4) Tighten steering shaft nut (1) to specified torque.

Tightening torque
Steering shaft nut (a) : 33 N-m (3.3 kg-m, 24.0 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.

5) Install driver air bag (inflator) module to steering wheel. Refer to "DRIVER AIR BAG (INFLATOR) MODULE" in this section.

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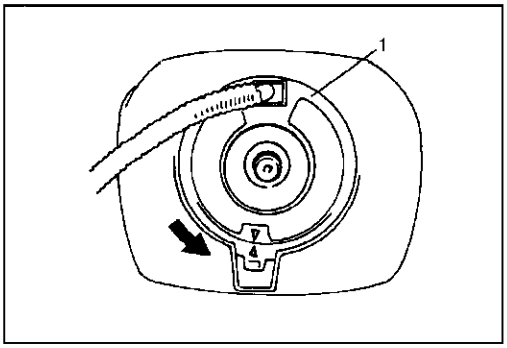
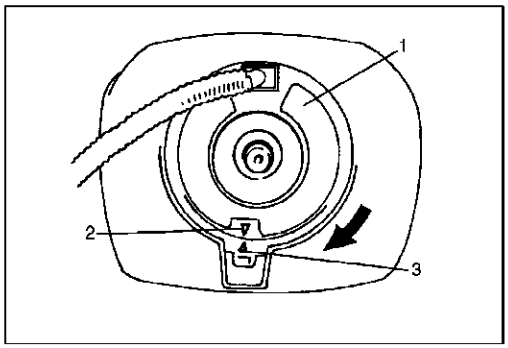
CENTERING CONTACT COIL

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



3) Turn contact coil (1) counterclockwise slowly with a light force till contact coil (1) will not turn any further.

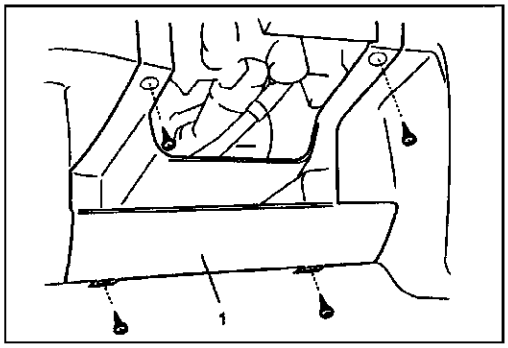
NOTE:
Contact coil (1) can turn about 5 and a half turns at maximum, that is, if it is at the center position, can turn about two and a quarter turns both clockwise and counterclockwise.



4) From the position where contact coil (1) became unable to turn any further (it stopped), turn it back clockwise about two and a quarter rotations and align center mark (2) with alignment mark (3).

CONTACT COIL AND COMBINATION SWITCH ASSEMBLY

CAUTION:
Do not turn contact coil (on combination switch) more than allowable number of turns (about two and a quarter turns from the center position clockwise or counterclockwise 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).

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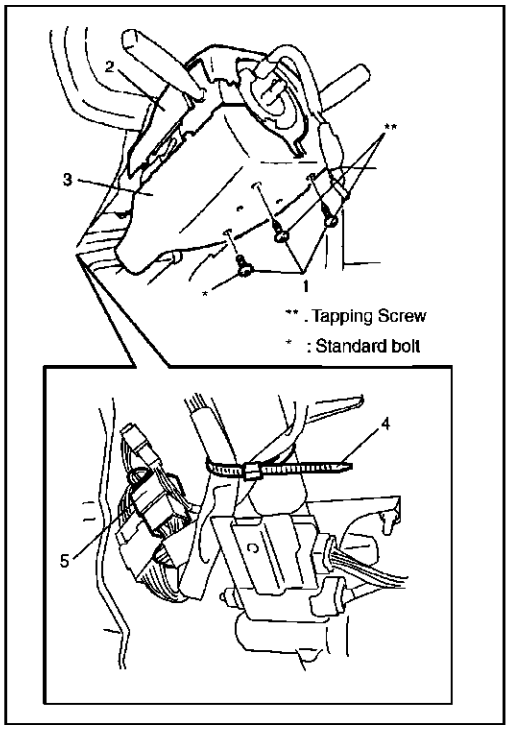
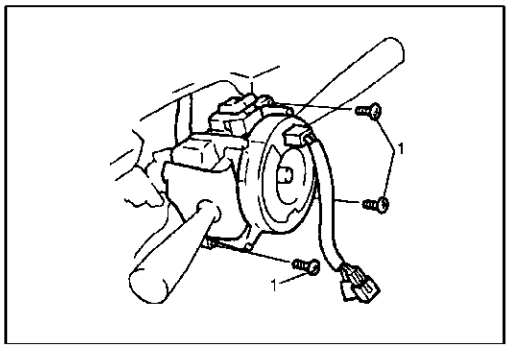
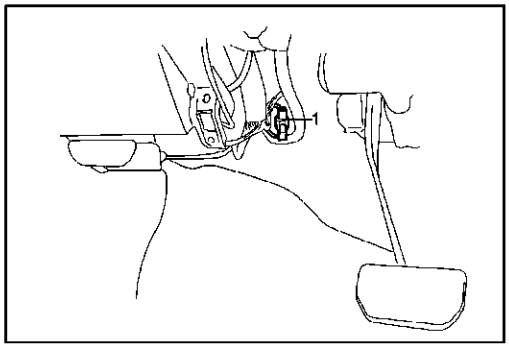


3) Remove steering column cover screws (1).
4) Separate upper cover (2) and lower cover (3), then remove them.
5) Undo lead wires clamp (4) and then disconnect combination switch lead wire connector (5).



6) Remove contact coil and combination switch assembly screws (1).



7) Disconnect horn connector (1) from instrument panel harness.

8) Remove contact coil and combination switch assembly from steering column.

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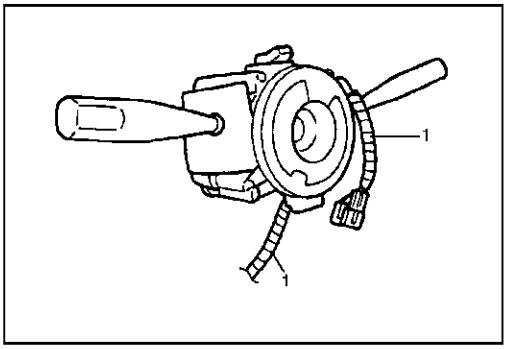
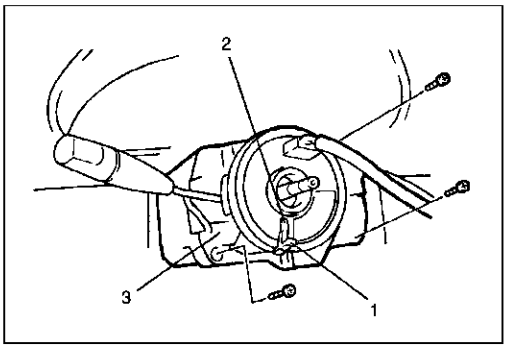


INSPECTION

Check contact coil harness (1) for any signs of scorching, melting or other damage.
If it is damaged, replace.

INSTALLATION

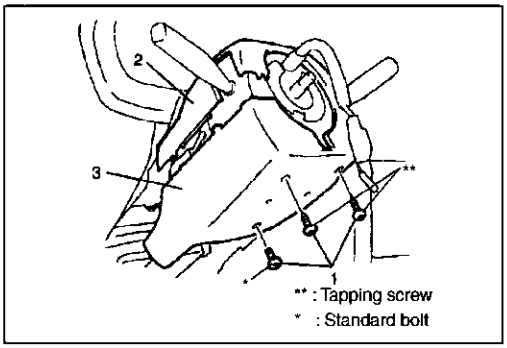
1) Check to make sure that vehicle's front tires are set at straight-ahead position and then ignition switch is at "LOCK" position.



2) Install contact coil and combination switch assembly (3) to steering column.

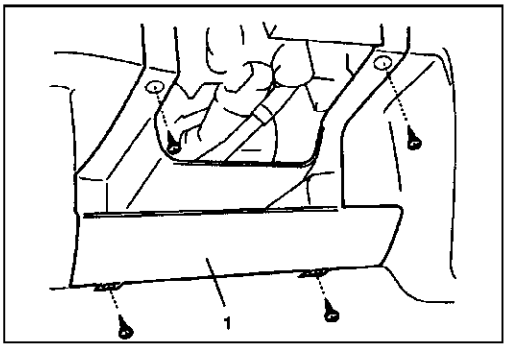
NOTE:
New contact coil and combination switch assembly is supplied with contact coil set and held at its center position with a lock pin (1) and seal (2). Remove this lock pin after installing contact coil and combination switch assembly to steering column.

3) Connect horn connector, then connect combination switch lead wire connector and fix harness with clamp.



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

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



5) Install steering column hole cover (1).
6) Install steering wheel to steering column. Refer to "STEERING WHEEL" in this section.

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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.**

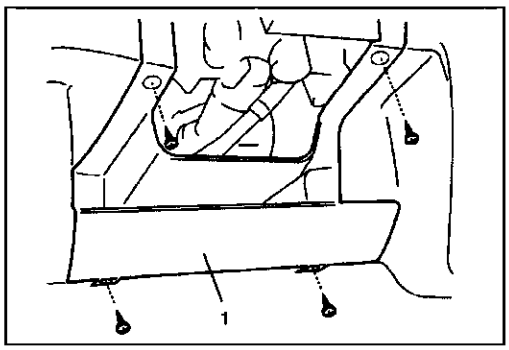
Any of the above damage could impair the column's collapsible design.

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.**
- **Steering column is supplied as an assembly (include steering column and steering lower shaft). If steering column or steering lower shaft is defective, replace as an assembly.**

REMOVAL

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

1) Disconnect negative cable at battery.
2) Disable air bag system. Refer to "DISABLING AIR BAG SYSTEM" under "SERVICE PRECAUTIONS" in SECTION 10B.
3) If it is necessary to remove steering wheel and contact coil and combination switch assembly, remove them, referring to "STEERING WHEEL" and "CONTACT COIL AND COMBINATION SWITCH ASSEMBLY" in this section.
   If it is not necessary to remove steering wheel and contact coil and 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).

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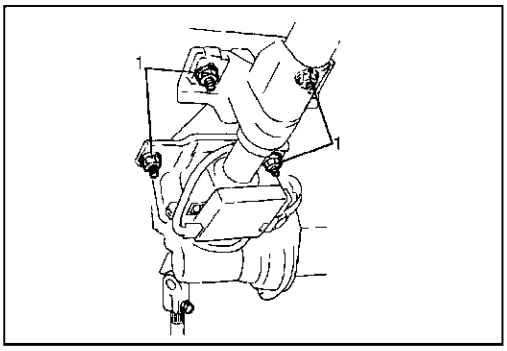
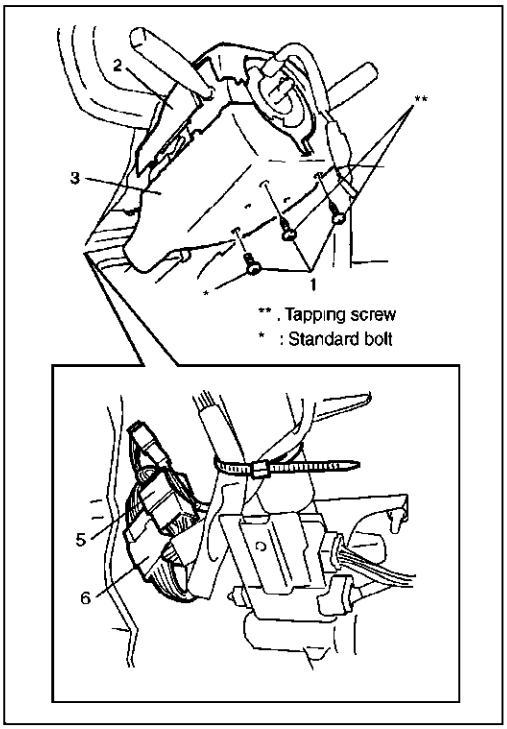
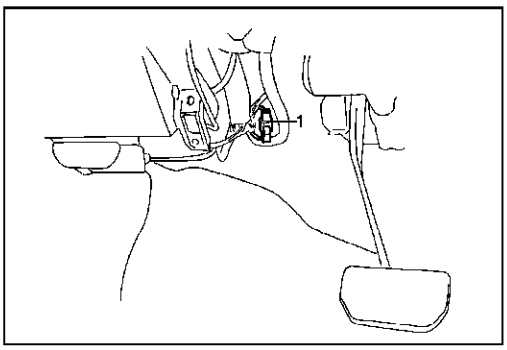


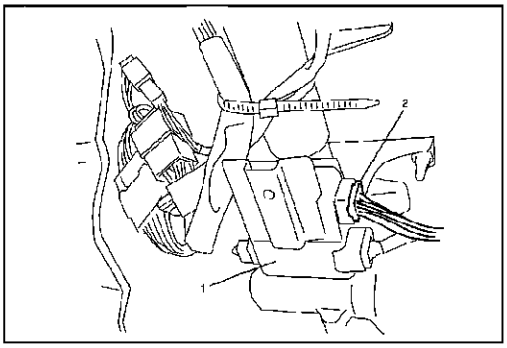
5) Loosen steering column cover screws (1).



6) Remove steering column cover screws (1).
7) Seperate upper coulmn cover (2) and lower column cover (3), then remove them.
8) Undo lead wire clamp (4) and then disconnect combination switch lead wire connector (5), ignition switch lead wire connector (6) and immobilizer controller lead wire connector (7).



9) Disconnect horn connectors (1) from instrument panel harness.



10) If equipped with power steering (P/S) system, disconnect connector (2) from P/S control module.

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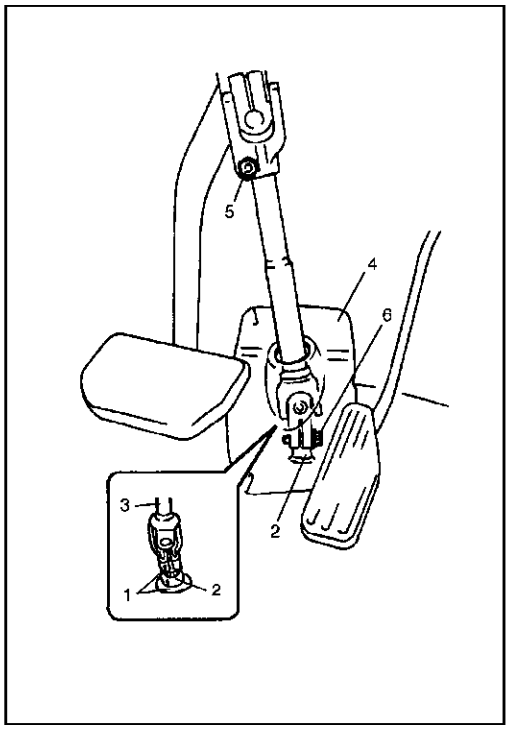
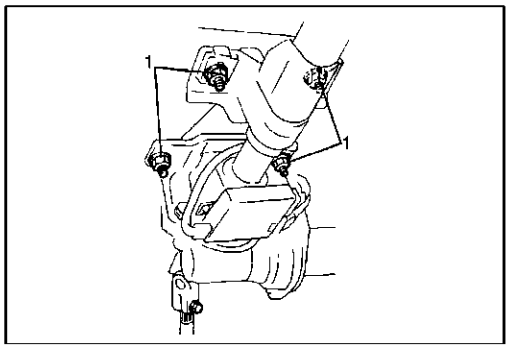


11) Remove steering joint cover (4).
12) Make alignment marks (1) on pinion shaft (2) and joint of steering lower shaft (3) for a guide during reinstalltion.12) Make alignment marks (1) on pinion shaft (2) and joint of steering lower shaft (3) for a guide during reinstalltion.
13) Loosen joint bolt (steering column side) (5) and remove joint bolt (pinion shaft side) (6) and disconnect steering lower shaft (3) from pinion shaft (2).



14) Remove steering column mounting nuts (1).
15) Remove steering column assembly from vehicle.
16) If it is necessary to remove steering lock assembly (ignition switch), remove it referring to "STEERING LOCK ASSEMBLY (IGNITION SWITCH)" in this section.

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. For checking procedure of steering column assembly, refer to "CHECKING STEERING COLUMN ASSEMBLY FOR ACCIDENT DAMAGE" in this section.

INSTALLATION

CAUTION:
After tightening steering column mounting nuts, shaft joint bolts should be tightened. Wrong tightening order above could cause a damage to shaft joint.

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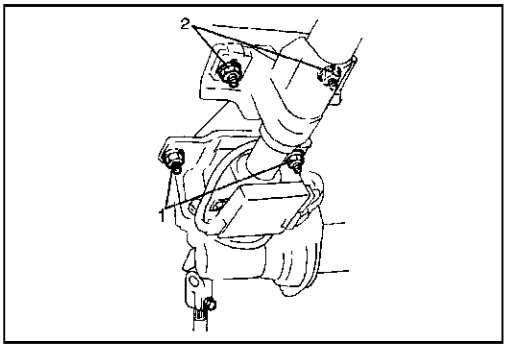
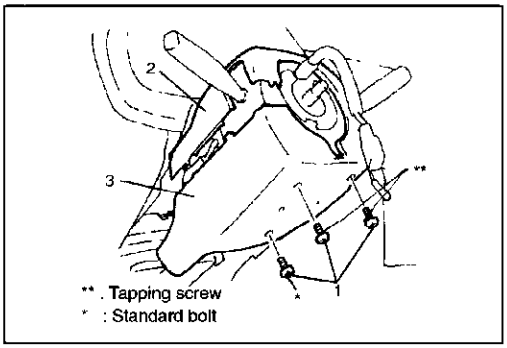
1) Be sure that front wheels and steering wheel are in straight forward state.
   If steering lock assembly (ignition switch) is removed, install it referring to "STEERING LOCK ASSEMBLY (IGNITION SWITCH)" in this section.
2) When installing new steering column assembly, place match mark at the same position of new steering column assembly as that of removed steering column.



3) Install steering column and tighten steering column lower mounting nuts (1) steering column upper mounting nuts (2) by hand.

4) If contact coil and combination switch assembly is removed, install it. Refer to "CONTACT COIL AND COMBINATION SWITCH ASSEMBLY" in this section.
5) Connect all connectors disconnected in REMOVAL.
   - Ignition switch
   - Combination switch
   - Horn
   - Immobilizer control module (if equipped)



6) Install upper and lower column covers (2 and 3) to steering column assembly.

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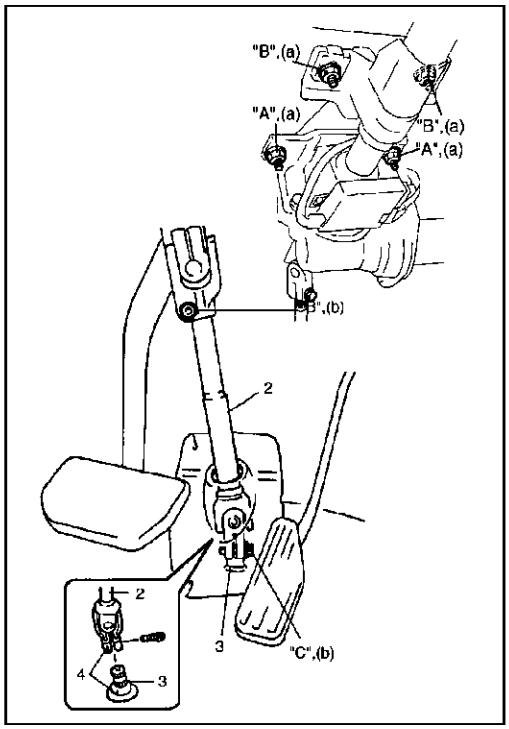


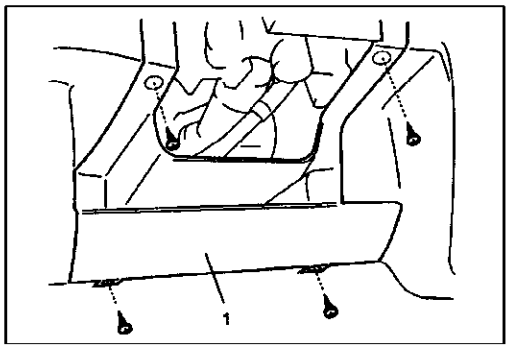
7) Tighten mounting nuts to specified torque in the order "A" – "B" indicated in figure.

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

8) Insert lower shaft (2) into pinion shaft (3) with matching marks (4).
9) Tighten joint bolts (1) to specified torque.

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

10) Install steering joint cover.



11) Install steering column hole cover (1).

12) If steering wheel is removed, install steering wheel. Refer to "STEERING WHEEL" in this section.
13) Enable air bag system. Refer to "ENABLING AIR BAG SYSTEM" under "SERVICE PRECAUTIONS" in SECTION 10B.
14) Connect negative cable at battery.

STEERING LOCK ASSEMBLY (IGNITION SWITCH)

REMOVAL

1) Remove steering column. Refer to "STEERING COLUMN ASSEMBLY" in this section.

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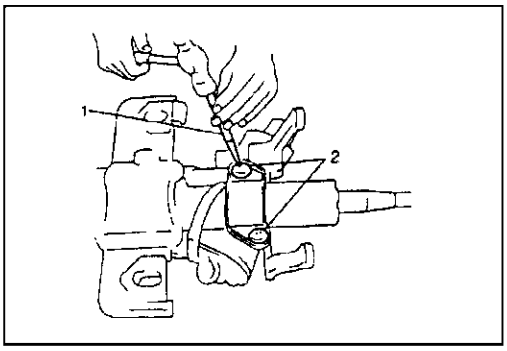
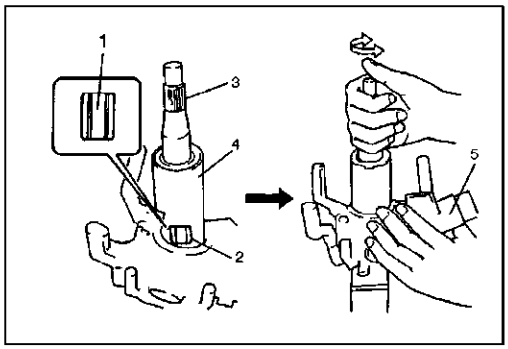


2) Using center punch (1), loosen and remove steering lock mounting bolts (2).

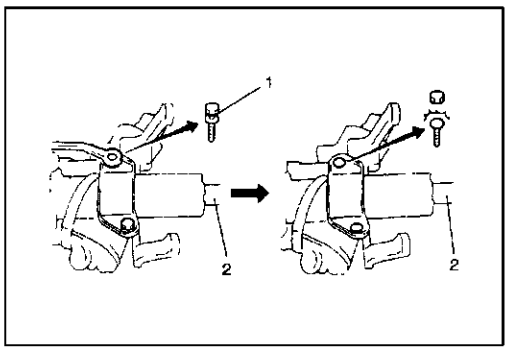
NOTE:
Use care not to damage aluminum part of steering lock body with center punch.

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 (3) in the center of hole (2) 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 (3) and rotate shaft to assure that steering shaft (3) is locked.



5) Tighten new bolts (1) 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 (2) rotates smoothly. Also check for lock operation.
7) Install steering column. Refer to "STEERING COLUMN".

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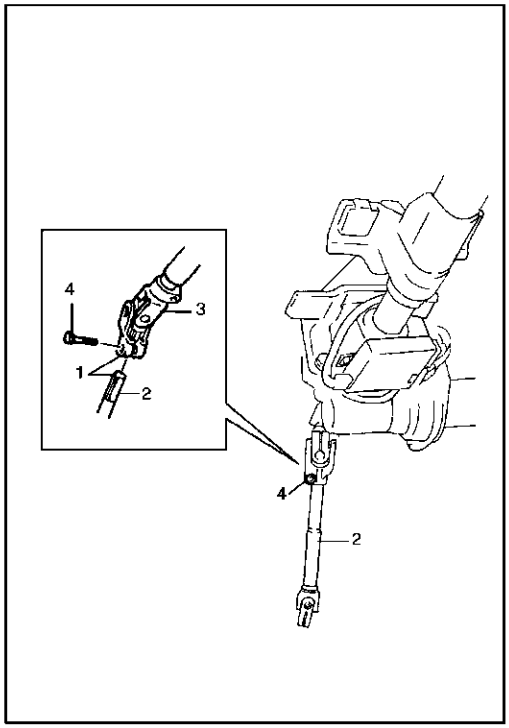
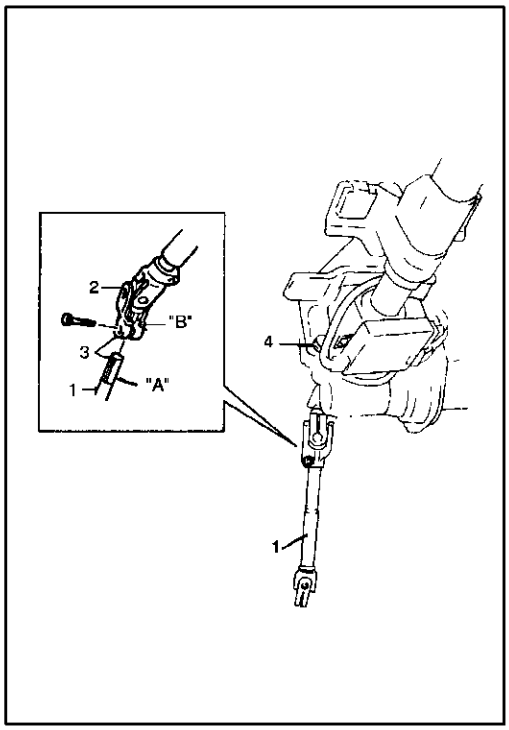
STEERING LOWER SHAFT

CAUTION:
Never turn steering wheel while steering lower shaft 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 quarter turns will break contact coil.



REMOVAL
1) Remove steering column assembly referring to "STEERING COLUMN ASSEMBLY" in this section.
2) Make alignment marks (1) on lower shaft (2) and shaft joint of steering column (3).
3) Remove lower shaft joint bolts (4).
4) Remove steering lower shaft (2).



INSTALLATION
1) Align flat part "A" of steering lower shaft (1) with bolt hole "B" of shaft joint (2) of column as shown. Then insert lower shaft into shaft joint of steering column with matching narks (3).
2) Install steering column assembly (4) referring to "STEERING COLUMN ASSEMBLY" in this section.

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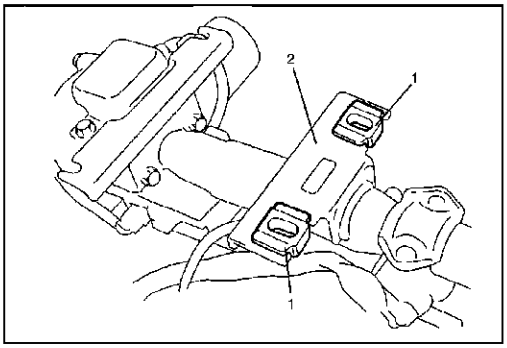
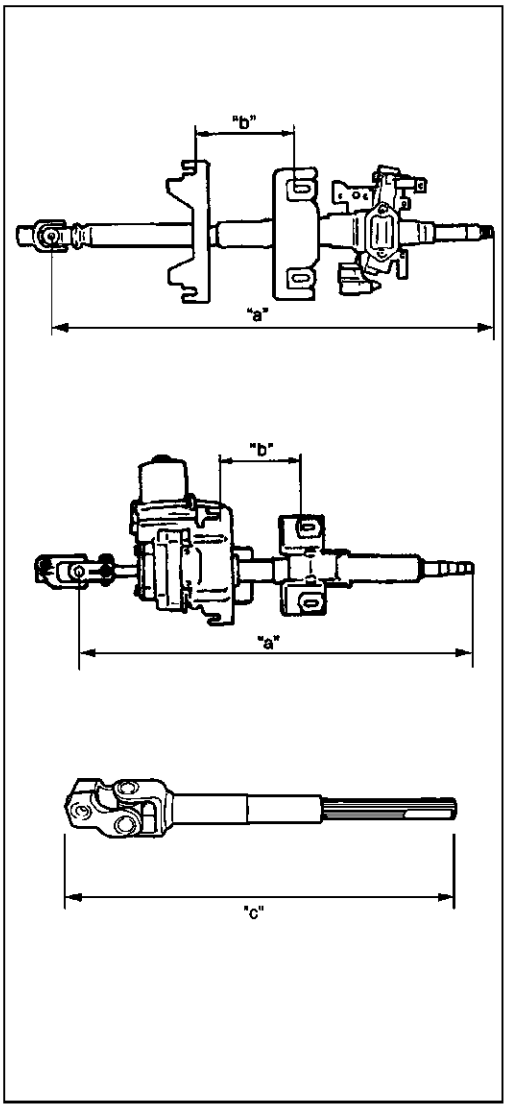
CHECKING STEERING COLUMN ASSEMBLY FOR ACCIDENT DAMAGE

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 each capsule (1) is attached to steering column bracket (2) securely.
   If capsules are loosen, replace steering column assembly.
2) Check two capsules for any damages such as stering column assembly.
   If anything is found faulty, replace as steering column assembly.



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

   Steering shaft, column and lower shaft length
   "a" : 518 - 521 mm (20.39 - 20.51 in.)
   "b" : 50 mm (1.97 in.)
   "c" : 283 - 285 mm (11.14 - 11.22 in.) (With EPS model)
   : 291 - 293 mm (11.46 - 11.54 in.) (Without EPS model)

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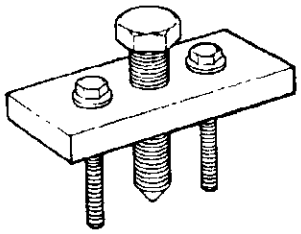
4) Check steering shaft joints and shaft for any damages such as crack, breakage, malfunction or excessive play.
   If anything is found faulty, replace column assembly.
5) Check steering shaft for smooth rotation.
   If found defective, replace as column assembly.
6) Check steering shaft and column for bend, cracks or deformation.
   If found defective, replace.

SPECIAL TOOL



09944-36011
Steering wheel remover

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SECTION 3D

FRONT SUSPENSION

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

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- Strut Assembly Check 3D-4
- Suspension Control Arm/Steering Knuckle Check 3D-5
- Suspension Control Arm Joint Check 3D-5
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ON-VEHICLE SERVICE 3D-6
- Strut Assembly 3D-6
- Stabilizer Bar and/or Bushings 3D-9
- Wheel Hub and Steering Knuckle 3D-11
- Suspension Control Arm/Bushing 3D-16

REQUIRED SERVICE MATERIAL 3D-19

SPECIAL TOOLS 3D-19

GENERAL DESCRIPTION

The front suspension is the strut type independent suspension. The upper end of a strut is anchored to the vehicle body by a strut support. The strut and strut support are isolated by a rubber mount. A strut bearing is also installed a little lower to the rubber mount.

The lower end of the strut is connected to the upper end of a steering knuckle and lower end of knuckle is attached to the strut of a ball joint which is incorporated in a unit with a suspension control arm. And connected to this steering knuckle is the tie rod end.

Thus, movement of the steering wheel is transmitted to the tie rod end and then to the knuckle, eventually causing the wheel-and-tire to move. In this operation, with the movement of the knuckle, the strut also rotates by means of the strut bearing and lower ball joint.

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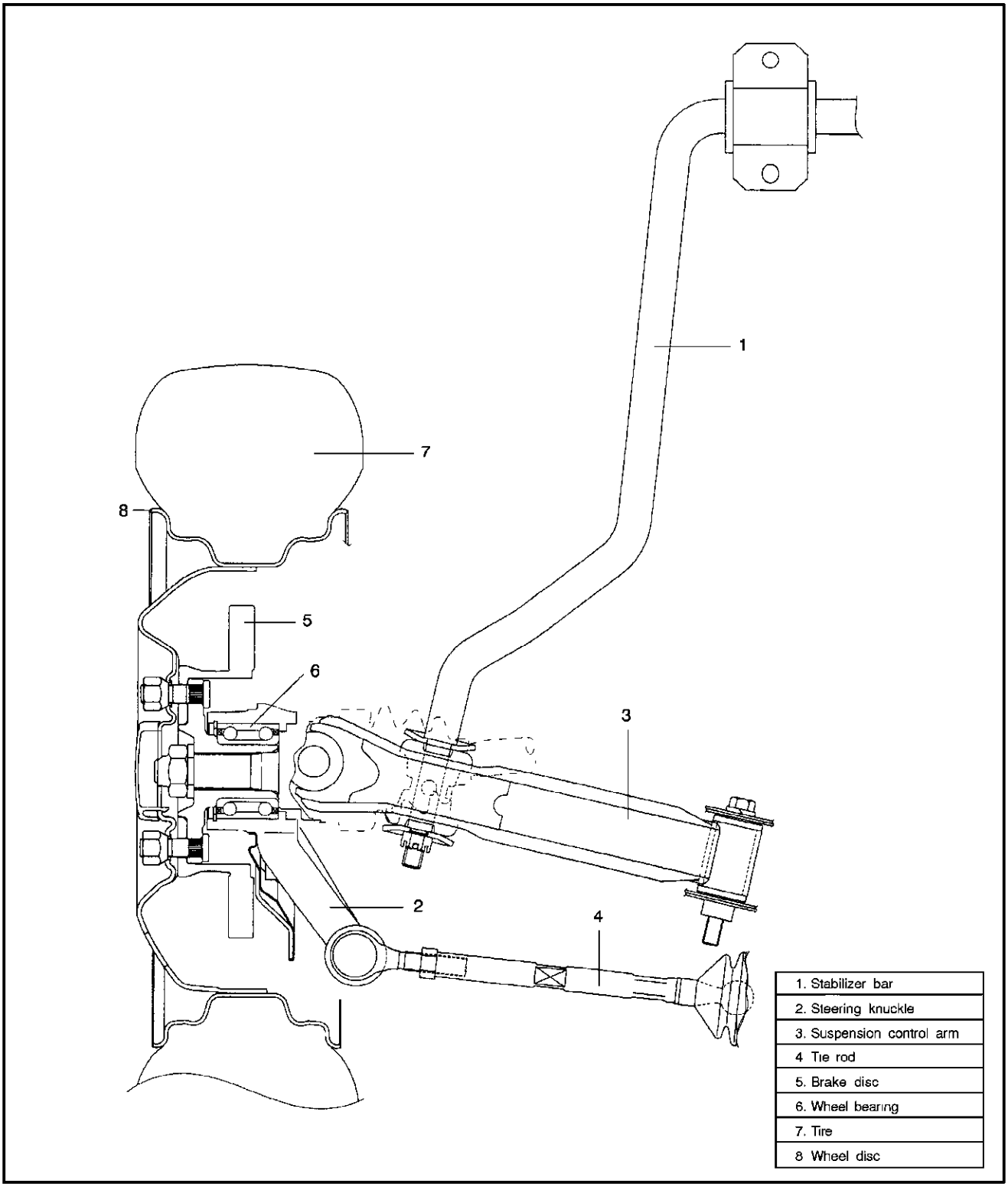

1. Stabilizer bar
2. Steering knuckle
3. Suspension control arm
4 Tie rod
5. Brake disc
6. Wheel bearing
7. Tire
8 Wheel disc

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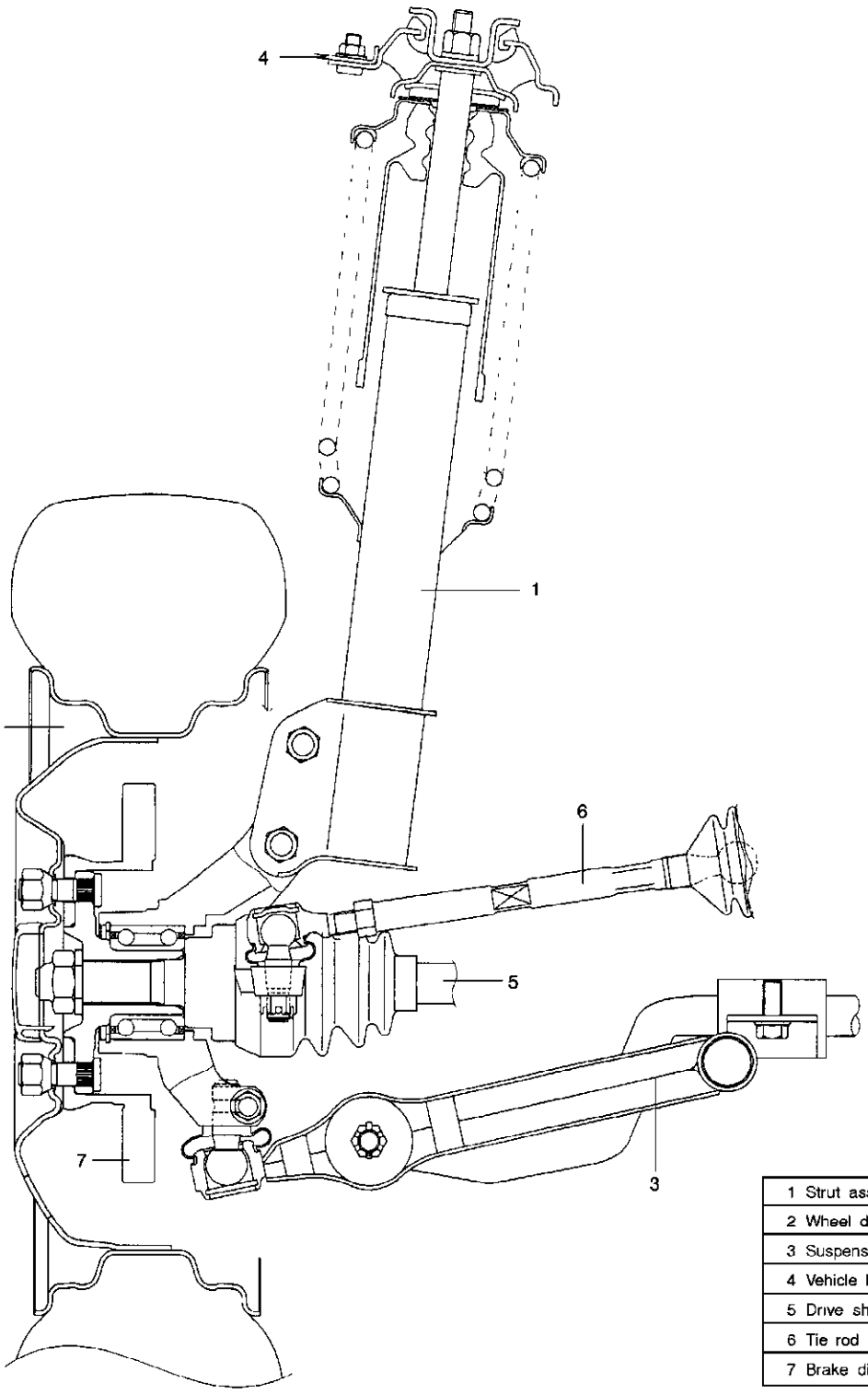

1 Strut assembly
2 Wheel disc
3 Suspension control arm
4 Vehicle body
5 Drive shaft
6 Tie rod
7 Brake disc

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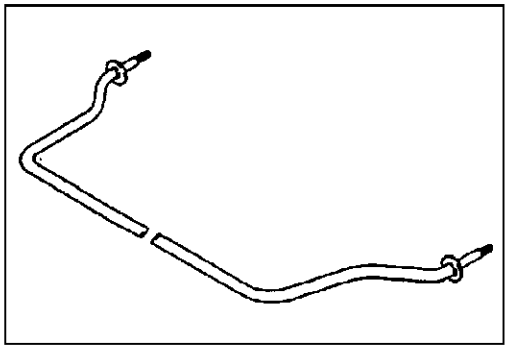


DIAGNOSIS

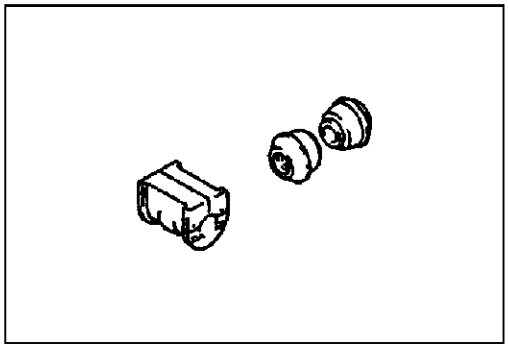
DIAGNOSIS TABLE

Refer to SECTION 3.

STABILIZER BAR AND/OR BUSHING CHECK

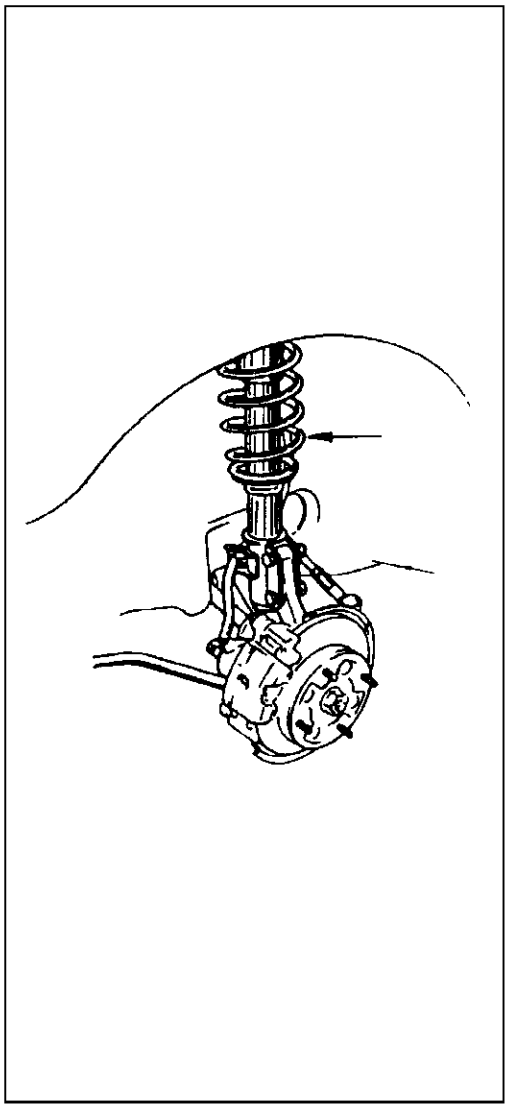
Bar

Inspect for damage or deformation. If defective, replace.



Bushing

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



STRUT ASSEMBLY CHECK

1) Inspect strut for oil leakage. If strut is found faulty, replace it as an assembly unit, becouse it can not be disassembled.
2) Strut function check.
   Check and adjust tire pressure as specified. Bounce vehicle body three or four times continuously by pushing front end on the side with strut to be checked. Apply the same amount of force at each push and note strut resistance both when pushed and rebounding.
   Also, note how many times vehicle body rebounces bofore coming to stop after hands are off. Do the same for strut on the other side.
   Compare strut resistance and number of rebounce on the right with those on the left. And they must be equal in both. With proper strut, vehicle body should come to stop the moments hands are off or after only one or two small rebounces. If conditions of struts are in doubt, compare them with known good vehicle or strut.
3) Inspect for damage or deformation.
4) Inspect bearing for weat, abnormal noise or gripping.
5) Inspect spring seat for cracks or deterioration.
6) Inspect bump stopper for deterioration.
7) Inspect rebound stopper and strut mount for wear, cracks or deformation.

   Replace any parts found defective in steps 2)–7).

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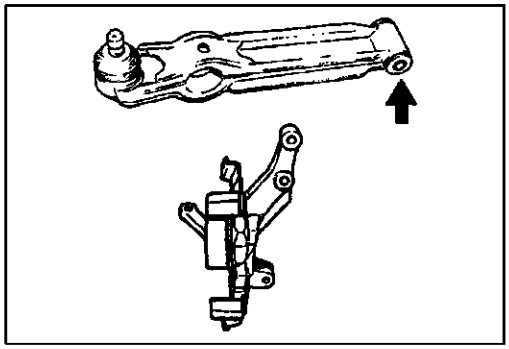
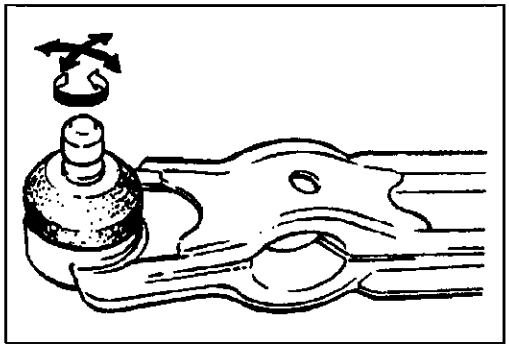


SUSPENSION CONTROL ARM/STEERING KNUCKLE CHECK

Inspect control arm/knuckle for cracks, deformation or damage.
Inspect control arm bushing for damage, wear or deterioration.

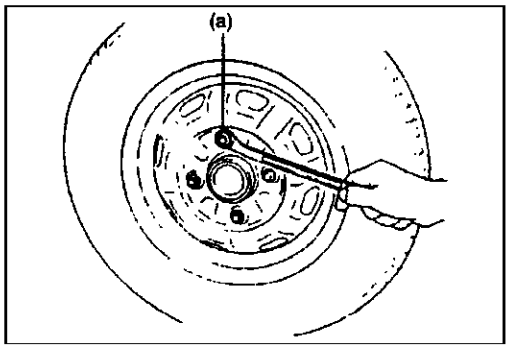


SUSPENSION CONTROL ARM JOINT CHECK

1) Check for smooth rotation.
2) Inspect ball stud for damage.
3) Inspect dust cover for damage.
4) Inspect for play in ball joint. If found defective, replace

NOTE:
Suspension control arm and arm joint cannot be separated.

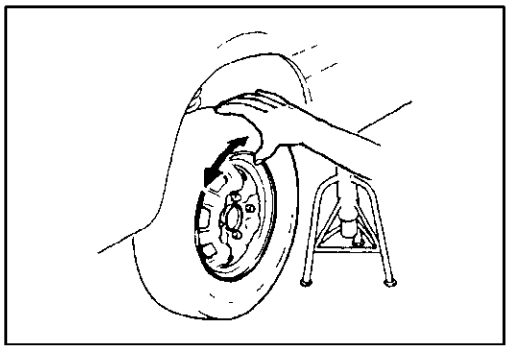
If there is any damage to either, control arm assembly must be replaced as a complete unit.



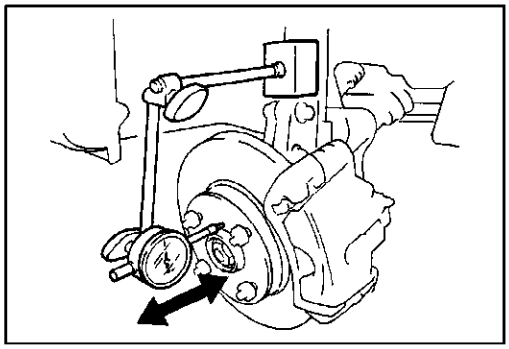
WHEEL DISC, NUT AND BEARING CHECK

1) Inspect each wheel disc for dents, distortion and cracks. A disc in badly damaged condition must be replaced.
2) Check wheel nuts for tightness and, as necessary, retighten them to specification.

Tightening Torque
(a): 85 N-m (8.5 kg-m, 61.5 lb-ft)



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



4) Check wheel bearing for wear. When measuring thrust play,
   i) Remove wheel.
   ii) Fix brake disc tightening wheel nuts.
   iii) Set dial gauge.
   iv) Check wheel bearing for thrust play.

Thrust play limit "a" : 0.1 mm (0.004 in.)

When measurement exceeds limit, replace bearing.

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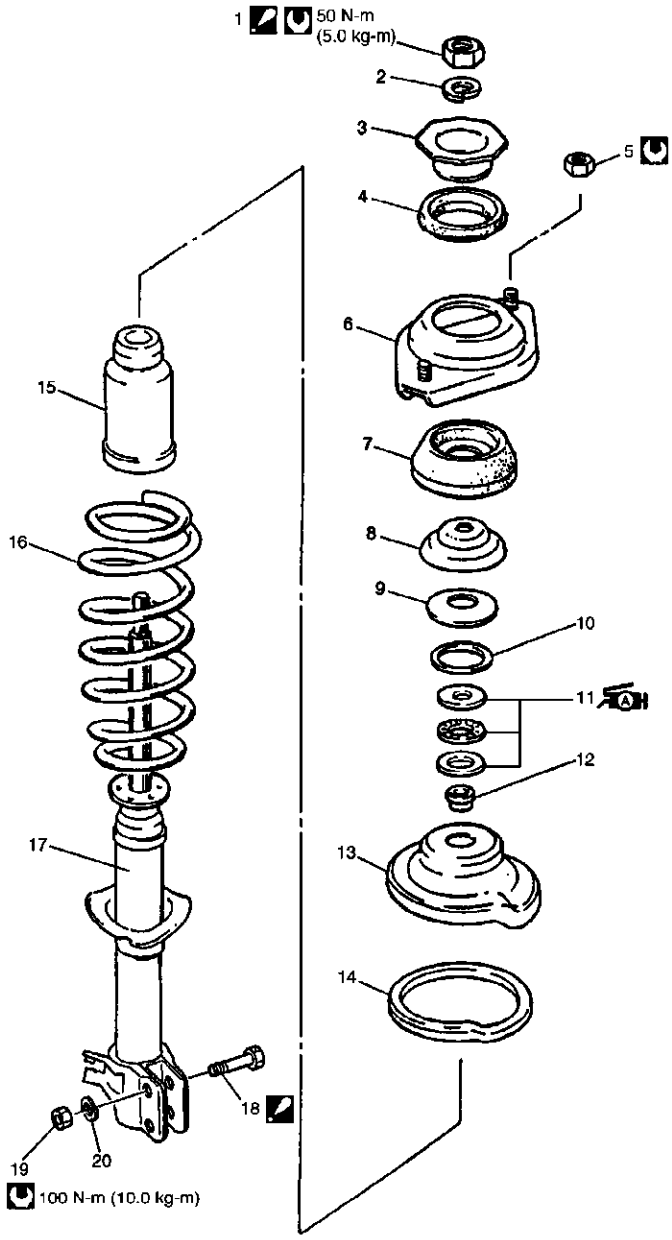
ON-VEHICLE SERVICE

STRUT ASSEMBY



◢	1.	Strut nut. Apply water-proof coating (paint or lacquer) all around nut and strut rod screw part.
	2.	Strut lock washer
	3.	Strut inner support
	4.	Strut rebound stopper
	5.	Strut support nut
	6.	Strut support
	7	Strut mount
	8.	Strut mount seat
	9.	Strut bearing seat
	10	Bearing seal
A	11.	Strut bearing: Apply lithium gease (SUZUKI SUPER GREASE A 99000-25010) to bearing
	12.	Bearing spacer
	13.	Coil spring upper seat
	14.	Coil spring seat
	15	Bumper stopper
	16	Coil spring
	17	Strut
◢	18.	Strut bracket bolt: Insert from vehicle rear side.
	19.	Strut bracket nut
	20.	Washer
	:	Tightening Torque

REMOVAL

NOTE:
When disassembling strut assembly, loosen strut nut a little before removing strut assembly from vehicle. This will make disassembly easier. Note, however, nut must not be removed at this point.

1) Hoist vehicle, allowing front suspension to hang free.
2) Remove wheel.

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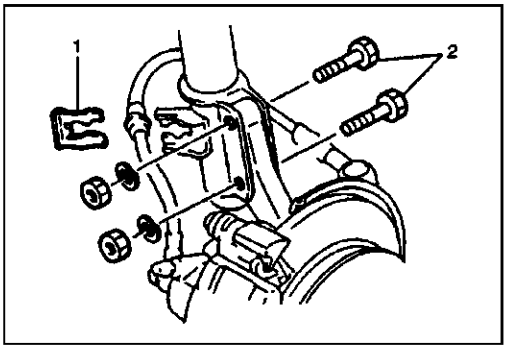
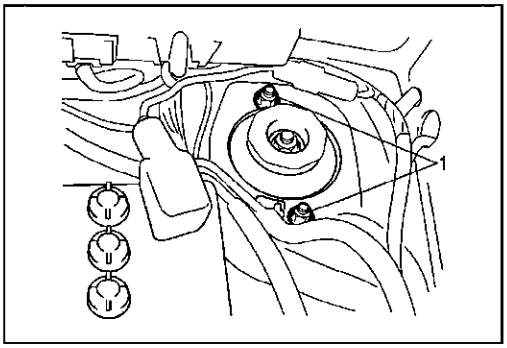
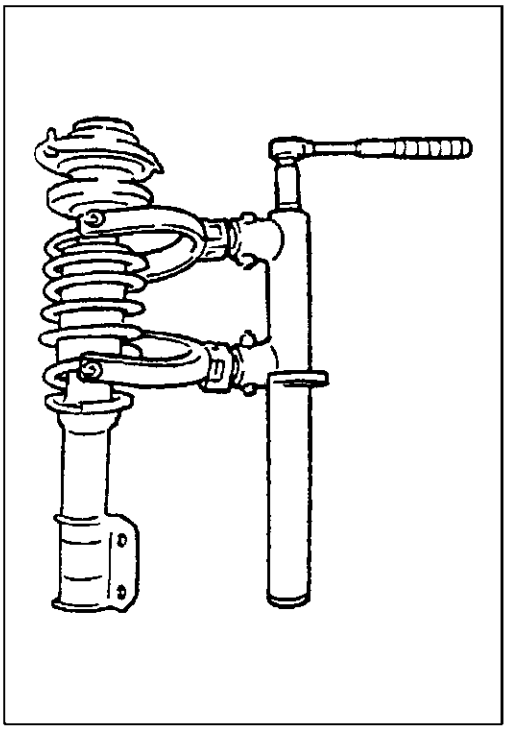


3) Remove E-ring (1) securing brake hose, and then remove brake hose from strut bracket as shown.
4) Remove wheel speed sensor harness clamp bolt from strut (if equipped with ABS).
5) Remove strut bracket bolts (2).



6) Remove strut support nuts (1).
   Hold strut by hand so that it will not fall off.
7) Remove strut assembly.



DISASSEMBLY

1) Using a spring compressor, compress the strut spring till its force pressing the spring seat is released.

> **WARNING:**
> **Use a commercially available spring compressor and follow the operation procedure described in the Instruction Manual supplied with that spring compressor.**

2) While keeping spring compressed with special tool as shown, remove strut nut and then disassemble parts.

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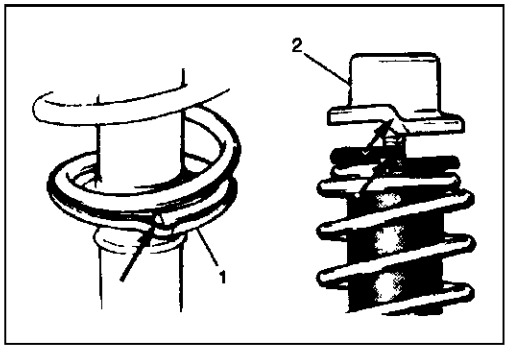
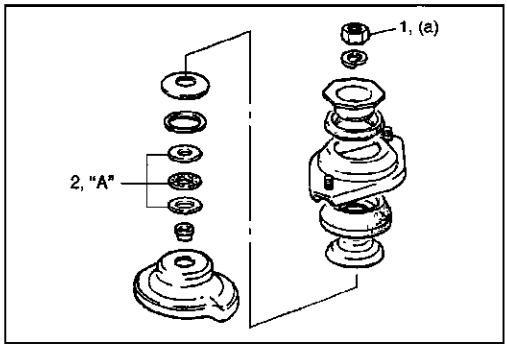


REASSEMBLY

Reverse disassembly procedure, and then note the following instruction.

- Install coil spring so that paint mark on it comes to down.
- Mate spring end with stepped part of spring lower seat (1) as shown.
- Install spring upper seat (2), mating stepped part of seat with spring upper end as shown.

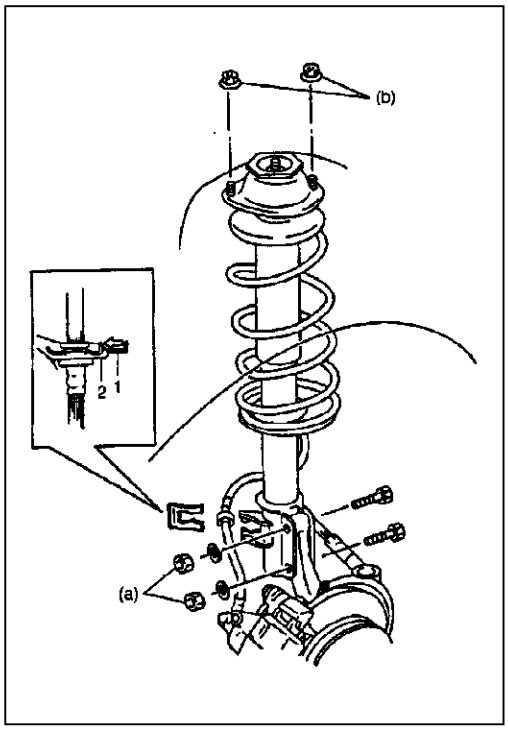


- Wash strut bearing (2) and apply grease when installing it.

  "A": GREASE 99000-25010

- Tighten strut nut (1) to specified torque and apply water proof coating (paint or lacquer) all around nut and strut and strut rod screw part.

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



INSTALLATION

Reverse removal procedure for installation noting the following instructions.

- Tighten all fasteners to specified torque.

  Tightening torque
  (a): 100 N-m (10.0 kg-m, 72.5 lb-ft)
  (b): 23 N-m (2.3 kg-m, 17.0 lb-ft)

- Don't twist brake hose when installing it.
- Install E-ring (1) as far as it fits to bracket (2) as shown.
- Tighten wheel nut to specified torque.

  Tightening torque for wheel nuts
  85 N-m (8.5 kg-m, 61.5 lb-ft)

- Confirm front end (wheel) alignment referring to SECTION 3A FRONT END ALIGNMENT.

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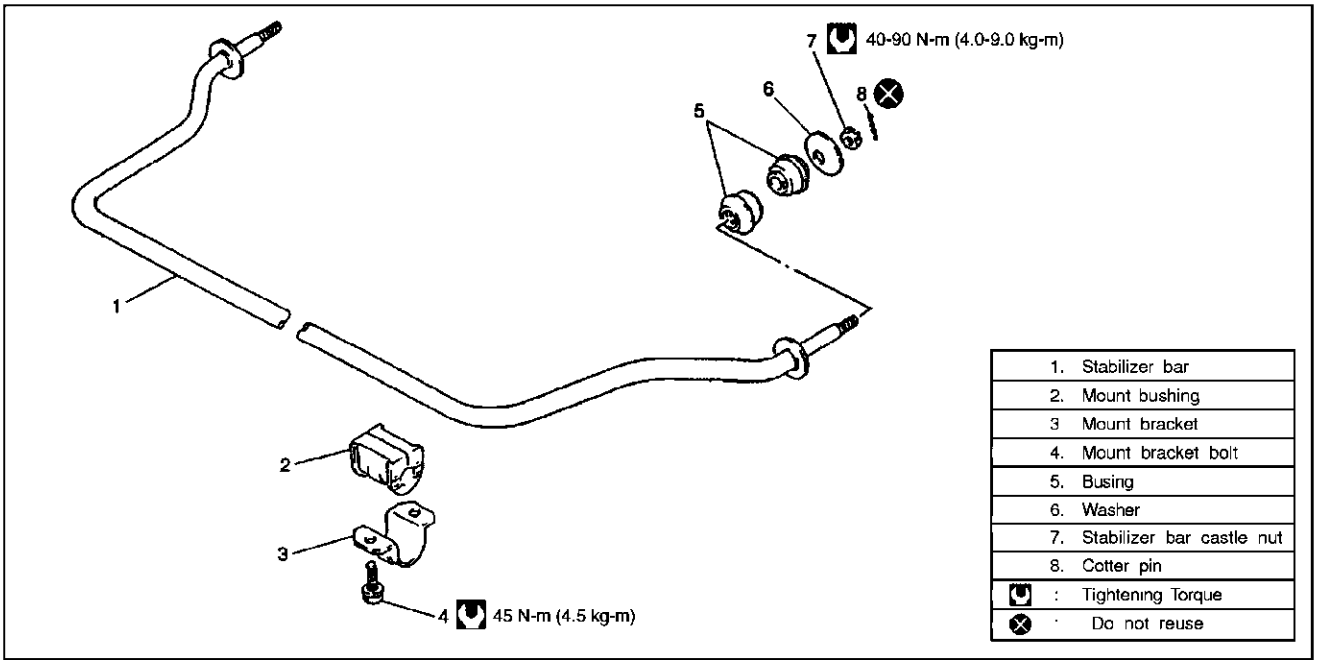
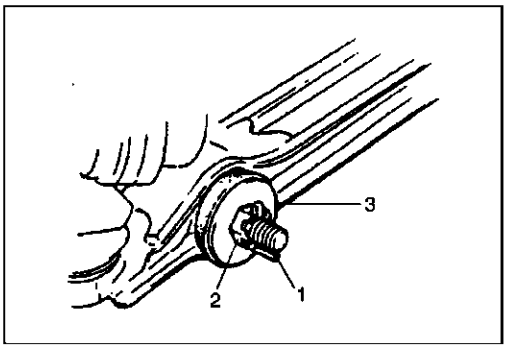
STABILIZER BAR AND/OR BUSHING

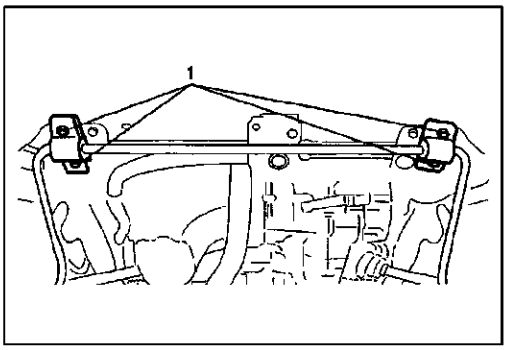


1.	Stabilizer bar
2.	Mount bushing
3	Mount bracket
4.	Mount bracket bolt
5.	Busing
6.	Washer
7.	Stabilizer bar castle nut
8.	Cotter pin
	: Tightening Torque
	: Do not reuse

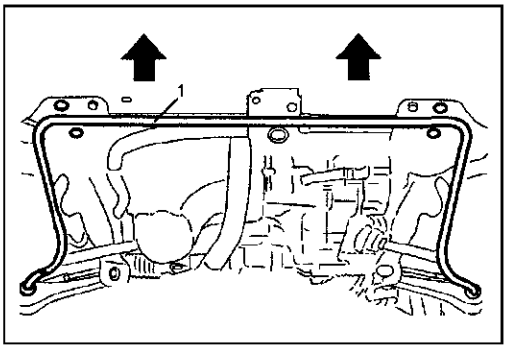


REMOVAL

1) Remove cotter pin (1), stabilizer bar nut (2) and washer (3).



2) Remove stabilizer bar mounting bracket bolts (1).



3) Remove stabilizer bar (1).

NOTE:
If it is hard to remove stabilizer bar, set tires in contact with ground (with suspension compressed).

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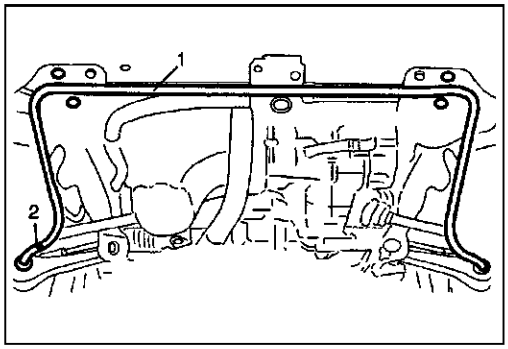
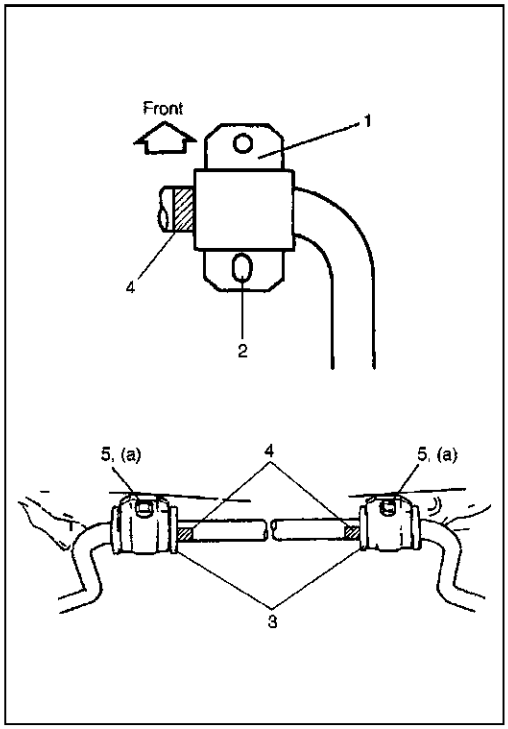


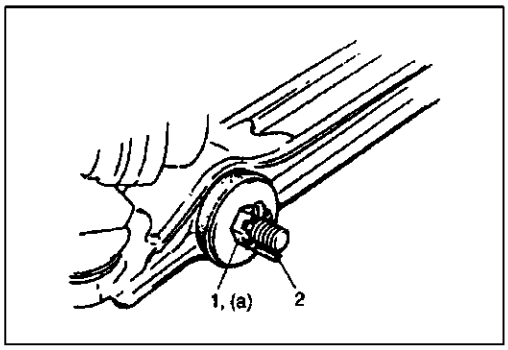
INSTALLATION

1) Install strut assembly by reversing removal procedure, noting the following instructions.



2) Install mount bracket (1) so that its oblong hole side (2) comes to the rear.
3) Align the inside edge (3) of mount bushing with the outside edge (4) of paint as shown in figure.
4) Tighten stabilizer bar mounting bracket bolts (5) to specified torque.

Tightening torque
(a): 45 N-m (4.5 kg-m, 32.5 lb-ft)



5) After tightening castle nut (1) to specified torque, be sure to bent cotter pin (2) as shown.

Tightening torque
(a): 40–90 N-m (4.0–9.0 Kg-m, 30–65 lb-ft)

NOTE:
Removed cotter pin should be replaced with new one.

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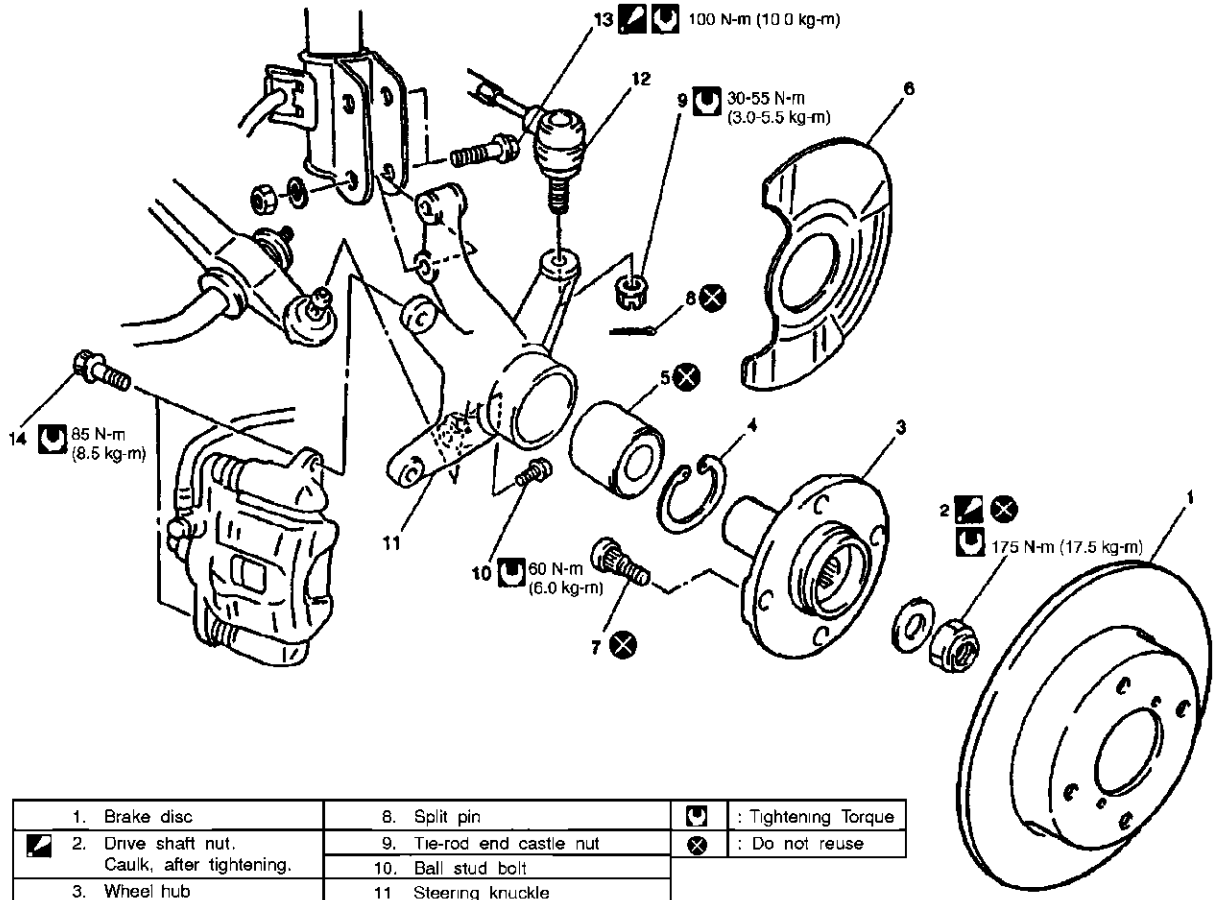
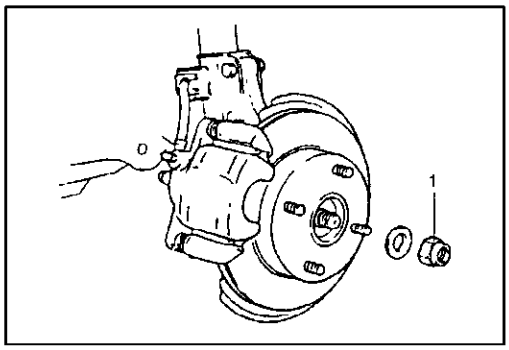
WHEEL HUB AND STEERING KNUCKLE

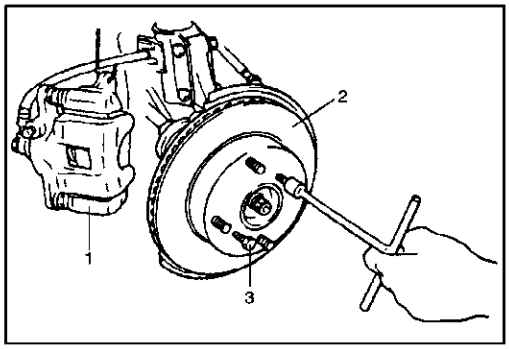


	1. Brake disc		8. Split pin		: Tightening Torque
	2. Drive shaft nut. Caulk, after tightening.		9. Tie-rod end castle nut		: Do not reuse
			10. Ball stud bolt		
	3. Wheel hub		11 Steering knuckle		
	4. Circlip		12. Tie-rod end		
	5. Wheel bearing		13. Strut bracket bolt Note the direction as shown.		
	6. Dust cover				
	7. Hub bolt		14 Brake caliper carrier bolt		



REMOVAL

1) Hoist vehicle and remove wheel.
2) Uncaulk drive shaft nut (1).
3) Depress foot brake pedal and hold it there. Remove drive shaft nut (1).
4) Remove caliper carrier bolts.



5) Remove caliper (1) with carrier.

NOTE:
Hang removed caliper with a wire hook or the like so as to prevent brake hose from bending and twisting excessively or being pulled.
Don't operate brake pedal with caliper removed.

6) Pull brake disc (2) off by using two 8 mm bolts (3).

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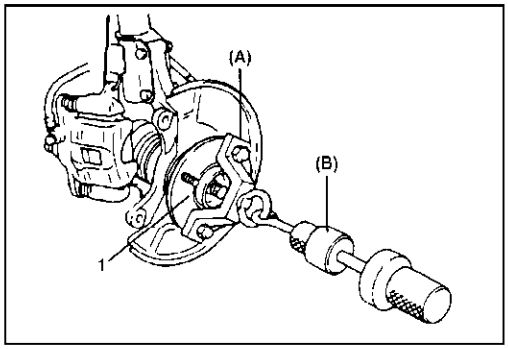
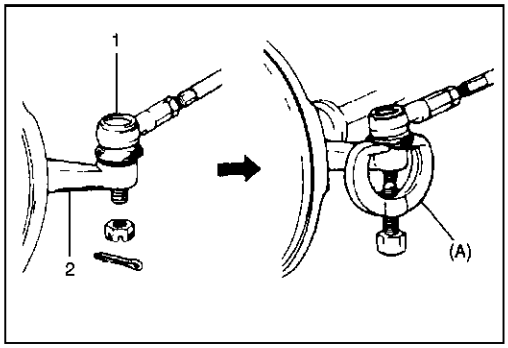


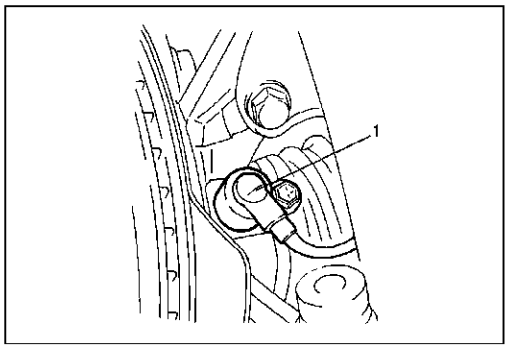
7) Pull out wheel hub (1) with special tools.

Special Tool
(A): 09946-17912
(B): 09942-15511

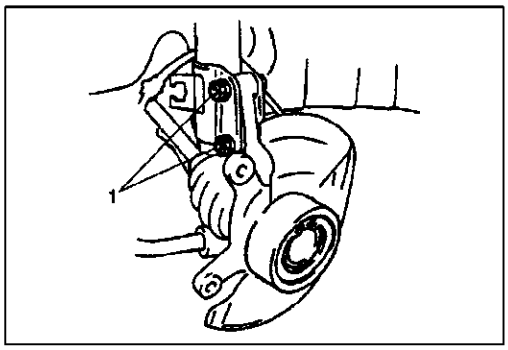


8) Disconnect tie rod end (1) from steering knuckle (2) using special tool.

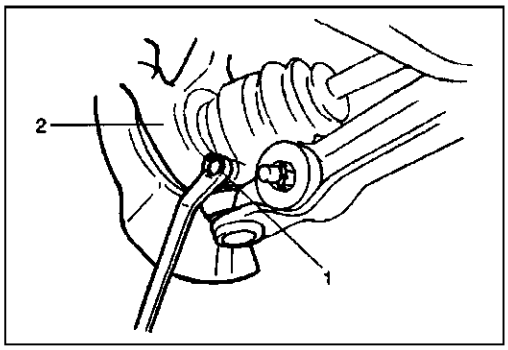
Special Tool
(A): 09913-65210



9) Remove wheel speed sensor (1) from knuckle (if equipped with ABS).



10) Loosen strut bracket nuts (1).



11) Remove ball stud bolt (1).
12) Remove strut bracket bolts from strut bracket, and then remove steering knuckle (2).

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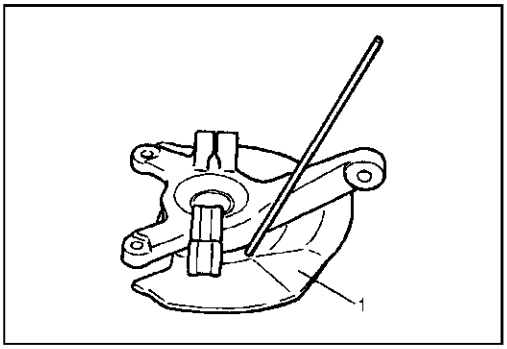
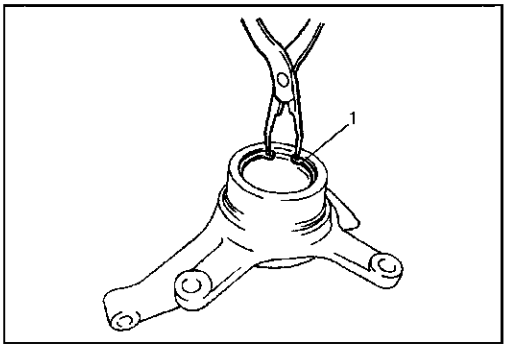
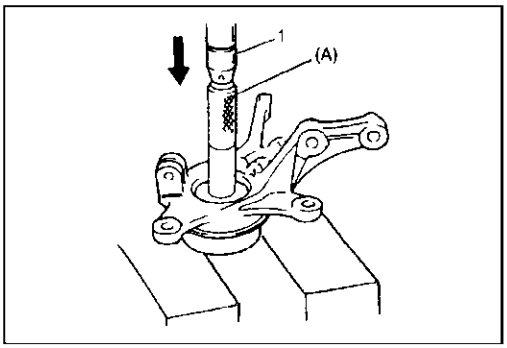


DISASSEMBLY

1) Uncaulk and remove dust cover (1).

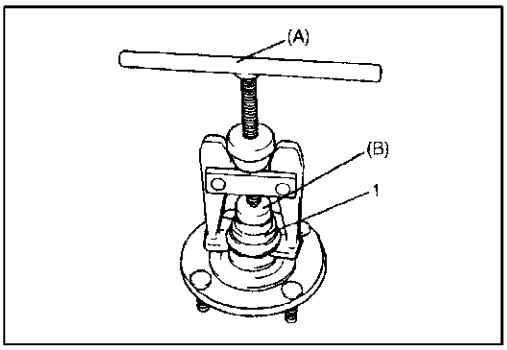


2) Remove circlip (1) from steering knuckle.



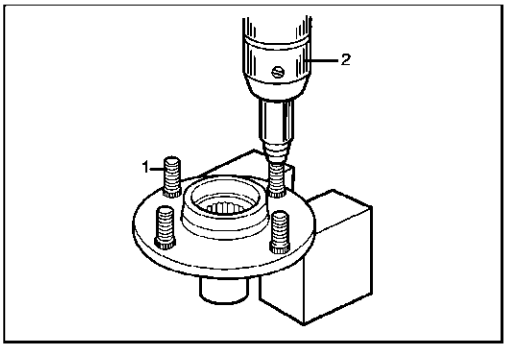
3) Using hydraulic press (1) and special tool, remove wheel bearing.

Special Tool
(A): 09913-75810



4) Remove wheel bearing inner race (1).

Special Tool
(A): 09913-61110
(B): 09925-88210



5) Remove hub bolts (1) with hydraulic press (2) or copper hammer.

CAUTION:
Never remove bolt unless replacement is necessary.
Always use a new bolt for replacement.

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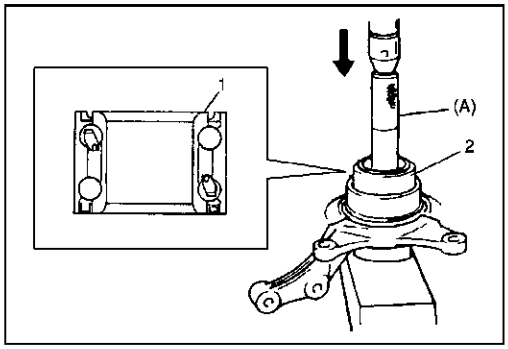
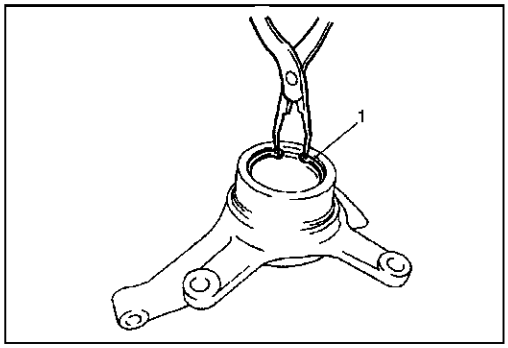


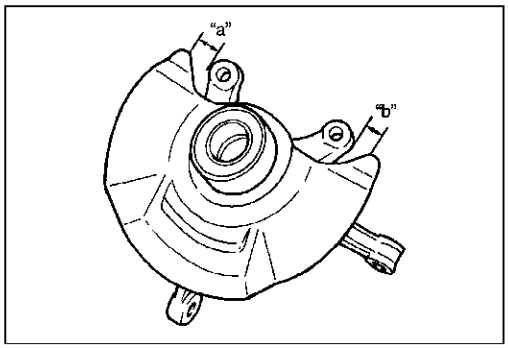
REASSEMBLY

1) Face grooved rubber seal side (1) of new wheel bearing (2) upward as shown and press-fit new wheel bearing (2) into steering knuckle (3) using special tools and hydraulic press (4).

Special Tool
(A): 09913-75520
(B): 09951-18210

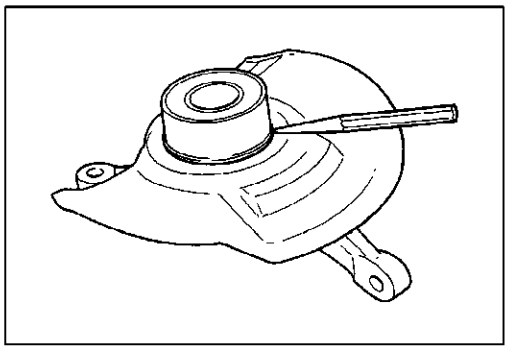


2) Install circlip (1) to steering knuckle (2).

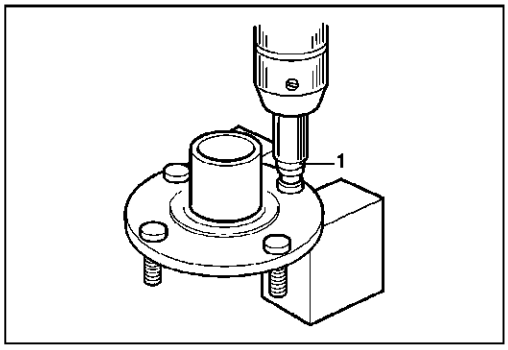


3) Drive in dust cover so that dimensions "a" and "b" become equal as shown.

CAUTION:
When driving in dust cover, be careful not to deform it.



4) Caulk with a punch.



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

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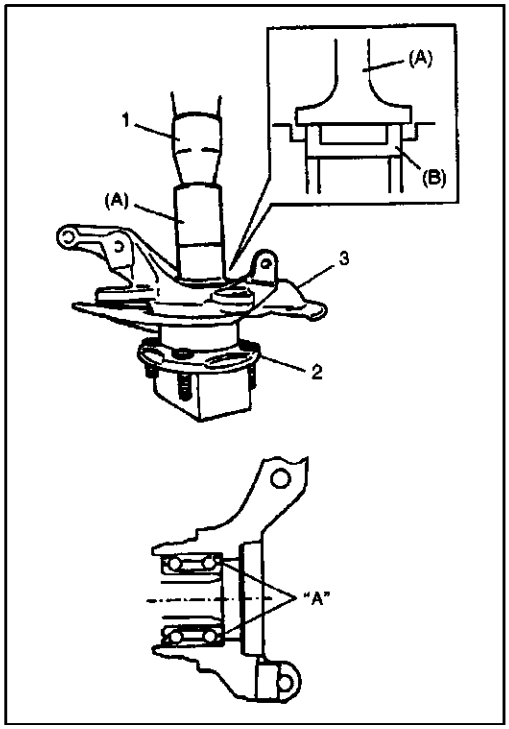


INSTALLATION

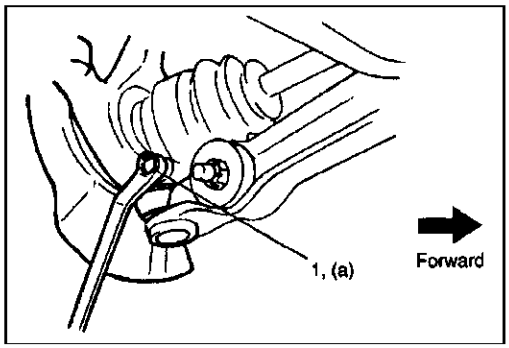
Reverse removal procedure for installation, and note the following instruction.

- Using special tools and hydraulic press (1), drive wheel hub (2) into steering knuckle (3) as shown.

  Special Tool
  (A): 09913-75520
  (B): 09944-66020

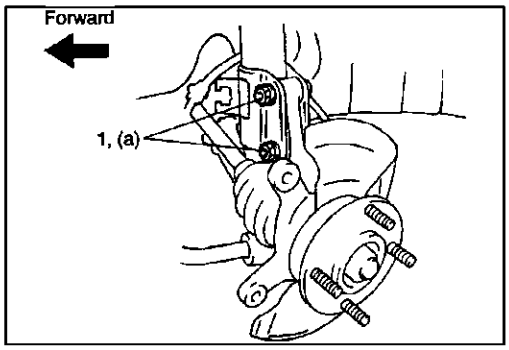
- Apply grease to wheel bearing end face.

  "A" GREASE 99000-25010



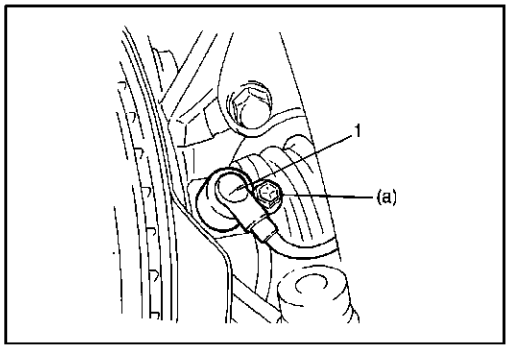
- Install suspension arm ball stud bolt as shown and tighten suspension arm ball stud bolt (1) to specified torque.

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



- Install strut bracket bolt as shown and tighten strut bracket nuts (1) to specified torque.

  Tightening torque
  (a): 100 N-m (10.0 kg-m, 72.5 lb-ft)



- Install ABS wheel speed sensor (1) (if equipped with ABS).

  Tightening torque
  ABS wheel speed sensor mounting bolt
  (a): 23 N-m (2.0 kg-m, 17.0 lb-ft)

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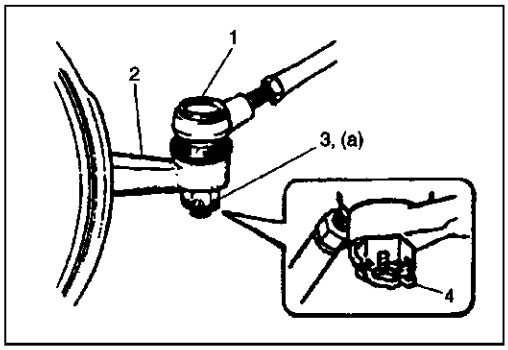
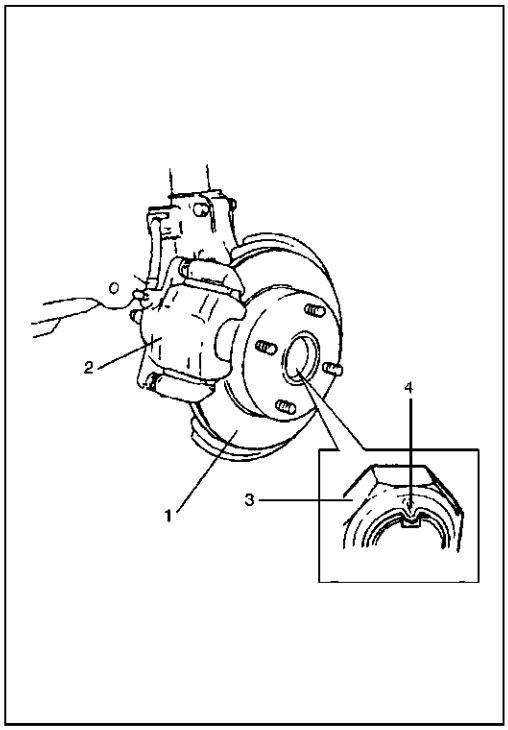


- Connect tie rod end (1) to steering knuckle (2) and tighten tie rod end castle nut (3) to specified torque, and then install new split pin (4).

Tightening torque
(a): 30 - 55 N-m (3.0 - 5.5 kg-m, 22.0 - 39.5 lb-ft)



- Install brake disc (1) and brake caliper (2) with carrier.
- Tighten brake caliper carrier bolts to specified torque.

Tightening torque for brake caliper carrier bolts
85 N-m (8.5 kg-m, 61.5 lb-ft)

- Depress foot brake pedal and hold it there.
  Tighten new drive shaft nut (3) to specified torque.

Tightening torque
(a): 175 N-m (17.5 kg-m, 127.0 lb-ft)

- Caulk (4) drive shaft nut (3) as shown.

> **CAUTION:**
> **Be careful while caulking nut so that no crack will occur in caulked part of nut. Cracked nut must be replaced with new one.**

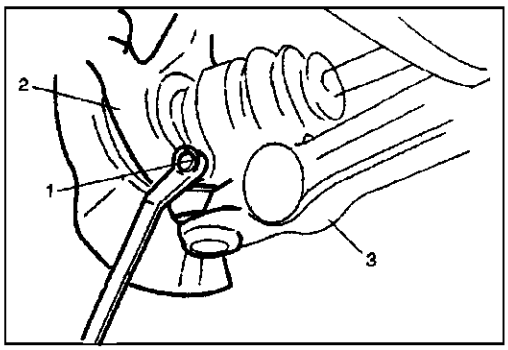
- Install wheel and tighten wheel nuts to specified torque.

Tightening torque for wheel nuts
85 N-m (8.5 kg-m, 61.5 lb-ft)

SUSPENSION CONTROL ARM/BUSHING

REMOVEL

1) Hoist vehicle, and remove wheel.
2) Remove stabilizer bar referring to STABILIZER BAR AND/OR BUSHING REMOVAL in this section.



3) Remove suspension control arm ball stud bolt (1) and disconnect steering knuckle (2) from suspension control arm (3).

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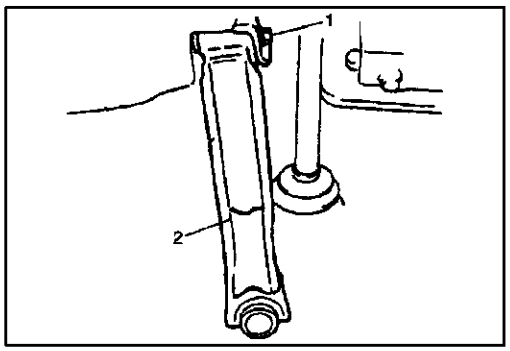
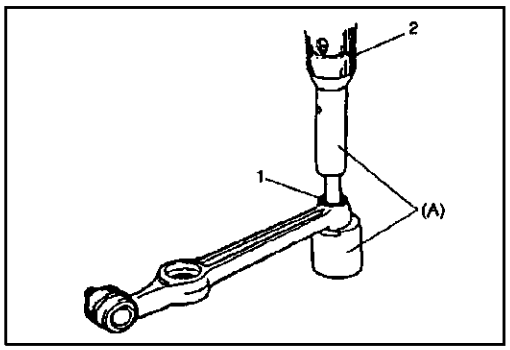
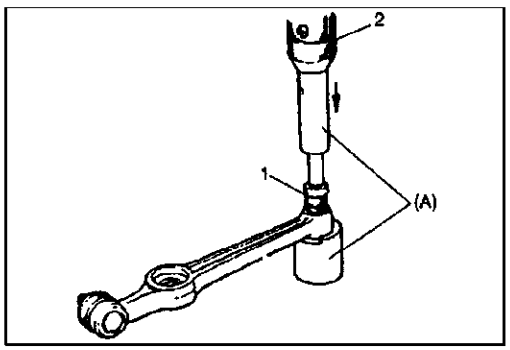


4) Remove suspension control arm bolt (1).
5) Remove suspension control arm (2).



6) Pull out bushing (1) using special tool and oil hydraulic press (2) as shown.

Special Tool
(A): 09943-77910

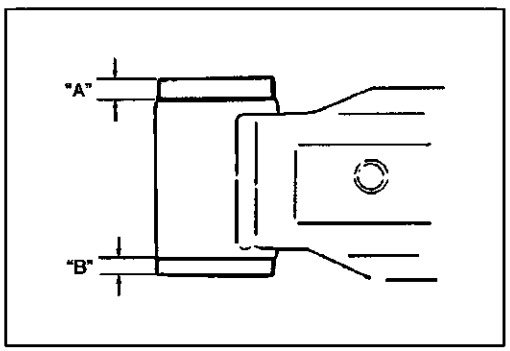


INSTALLATION

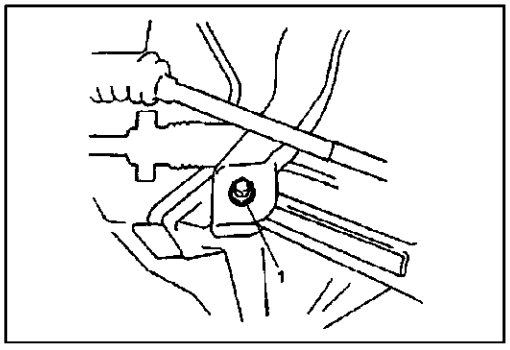
1) Install new busing (1) with special tool and oil hydraulic press (2) as shown.

Special Tool
(A): 09943-77910

NOTE:
- **Before installing bushing, apply soap water on its circumference to facilitate installation.**



- **When installed, bush should be equal on "A" and "B" of arm as shown.**



2) Install suspension control arm to vehicle body and tighten suspension control arm bolt (1) temporarily at this step.

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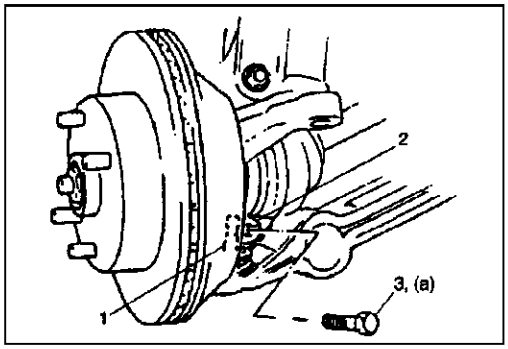
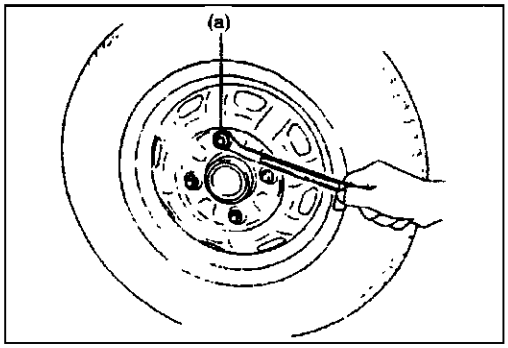
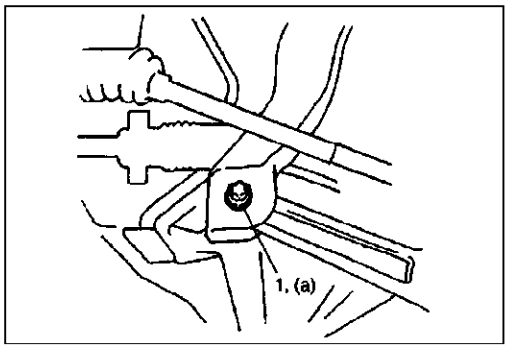


3) Install ball stud (1) to steering knuckle (2). Align ball stud groove with knuckle bolt hole as shown.
Then install ball stud bolt (3) from the direction as shown. Tighten ball stud bolt to specified torque.
Tightening Torque
(a): 60 N-m (6.0 kg-m, 43.5 lb-ft)



4) Install wheel and tighten wheel nuts to specified torque.
Tightening Torque
(a): 85 N-m (8.5 kg-m, 61.5 lb-ft)
5) Lower hoist, and bounce vehicle up and down several times to stabilize suspension.
Be sure that vehicle is in non-loaded condition.



6) Tighten control arm bolt (1) to specified torque.
Tightening Torque
(a): 60 N-m (6.0 kg-m, 43.5 lb-ft)

7) Install stabilizer bar, referring to STABILIZER BAR AND/OR BUSHINGS INTALLATION in this section.
8) Confirm front end (wheel) alignment referring to SECTION 3A FRONT END ALIGNMENT.

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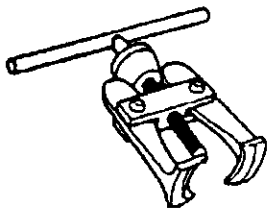
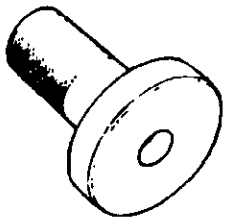
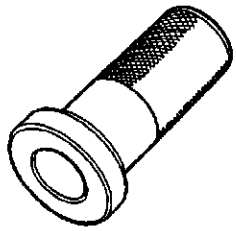
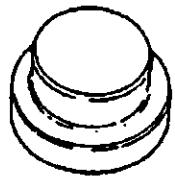
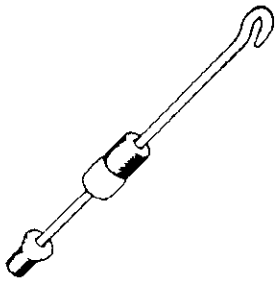
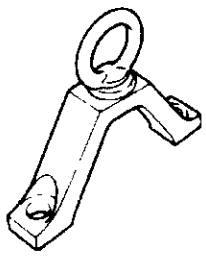
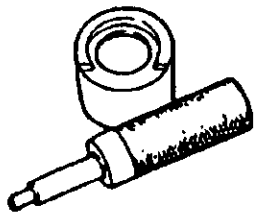
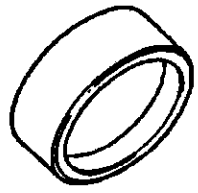
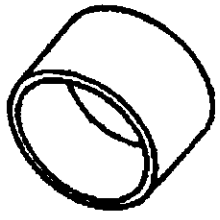
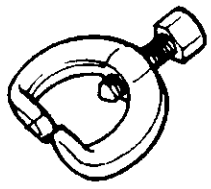
REQUIRED SERVICE MATERIAL

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium wheel bearing grease	SUZUKI SUPER GREASE A (99000-25010)	• Strut bearing • Wheel bearing

SPECIAL TOOL

 09913-61110 Bearing puller	 09913-75520 Bearing installer	 09913-75810 Bearing installer	 09913-88210 Bearing puller attachment
 09942-15511 Sliding hammer	 09943-17912 Front wheel hub remover	 09943-77910 Bushing remover	 09944-66020 Bearing installer
 09951-18210 Oil seal remover & installer No. 2	 09913-65210 Tie-rod end remover		

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SECTION 3E

REAR SUSPENSION

NOTE:

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

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GENERAL DESCRIPTION

Rear suspension is Isolated Trailing Link (I.T.L.) type which consists of coil springs, rear axle, shock absorbers, lateral rod and trailing arms.

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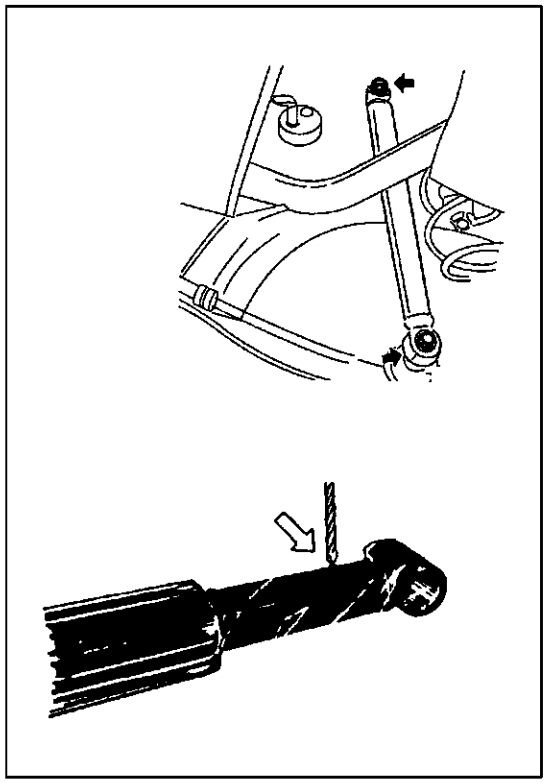
DIAGNOSIS

DIAGNOSIS TABLE

Refer to SECTION 3.



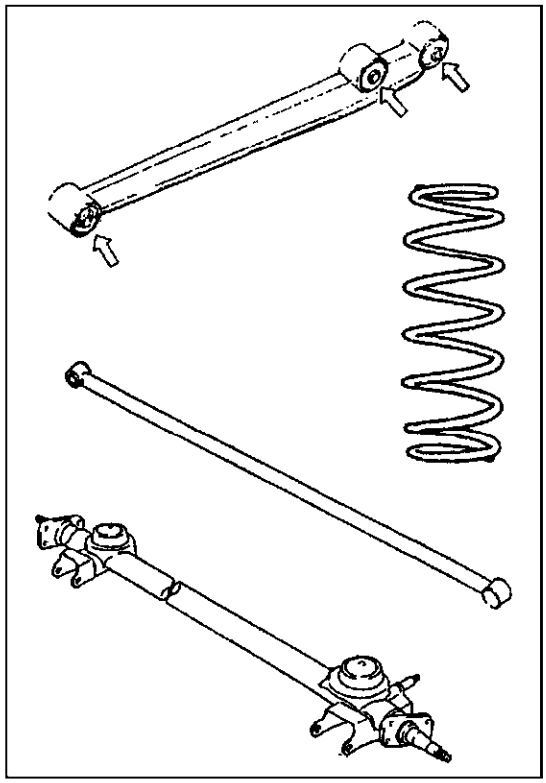
REAR SHOCK ABSORBER CHECK

- 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.

1) **Don't disassemble it.**
2) **Don't put it into the fire.**
3) **Don't store it where it gets hot.**
4) **Before disposing it, be sure to drill a hole (approximately 3 mm (0.12 in.) diameter) in it where shown by an arrow in figure and let gas and oil out.**
   Lay it down sideways for this work.
5) **The gas itself is harmless but it may issue out of the hole together with chips generated by the drill. Therefore, be sure to wear goggle.**



TRAILING ARM, LATERAL ROD, REAR AXLE AND COIL SPRING CHECK

- Inspect for cracks, deformation or damage.
- Inspect bushing for damage, wear or breakage.
  Replace any defective part.

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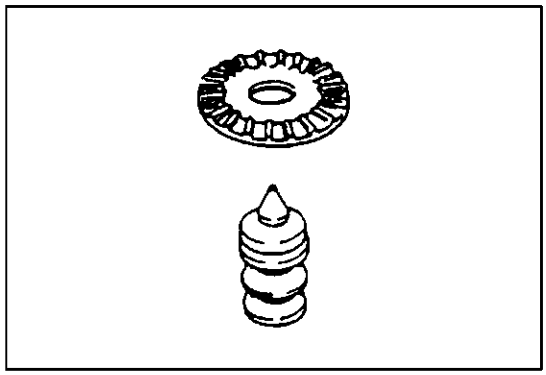
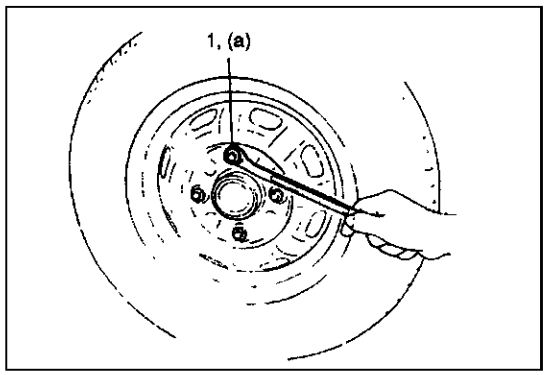


BUMP STOPPER AND SPRING UPPER SEAT CHECK

Inspect for cracks, deformation or damage.
Replace any defective part.

REAR SUSPENSION FASTENERS

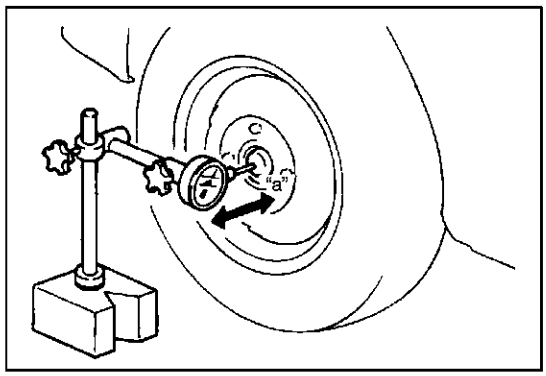
Check each bolt and nut fastening suspension parts for tightness.
Tighten loose one, if any, to specified torque, referring to ON-VEHICLE SERVICE of this section.



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 nuts for tightness and, as necessary, retighten to specification.

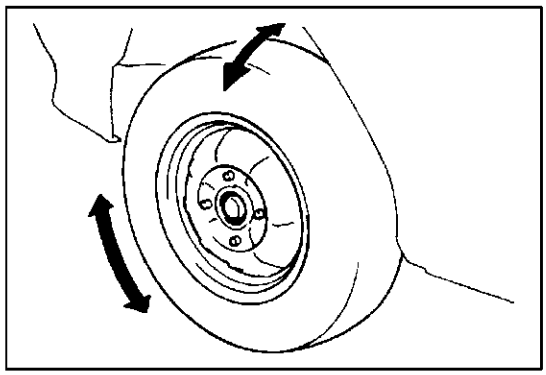
Tightening Torque
(a): 85 N-m (8.5 kg-m, 61.5 lb-ft)



- Check wheel bearings for wear. When measuring thrust play, apply a dial gauge to spindle cap center.

Thrust play limit "a": 0.1 mm (0.004 in.)

When measurement exceeds limit, replace bearing.



- By rotating wheel actually, check wheel bearing for noise and smooth rotation. If it is defective, replace bearing.

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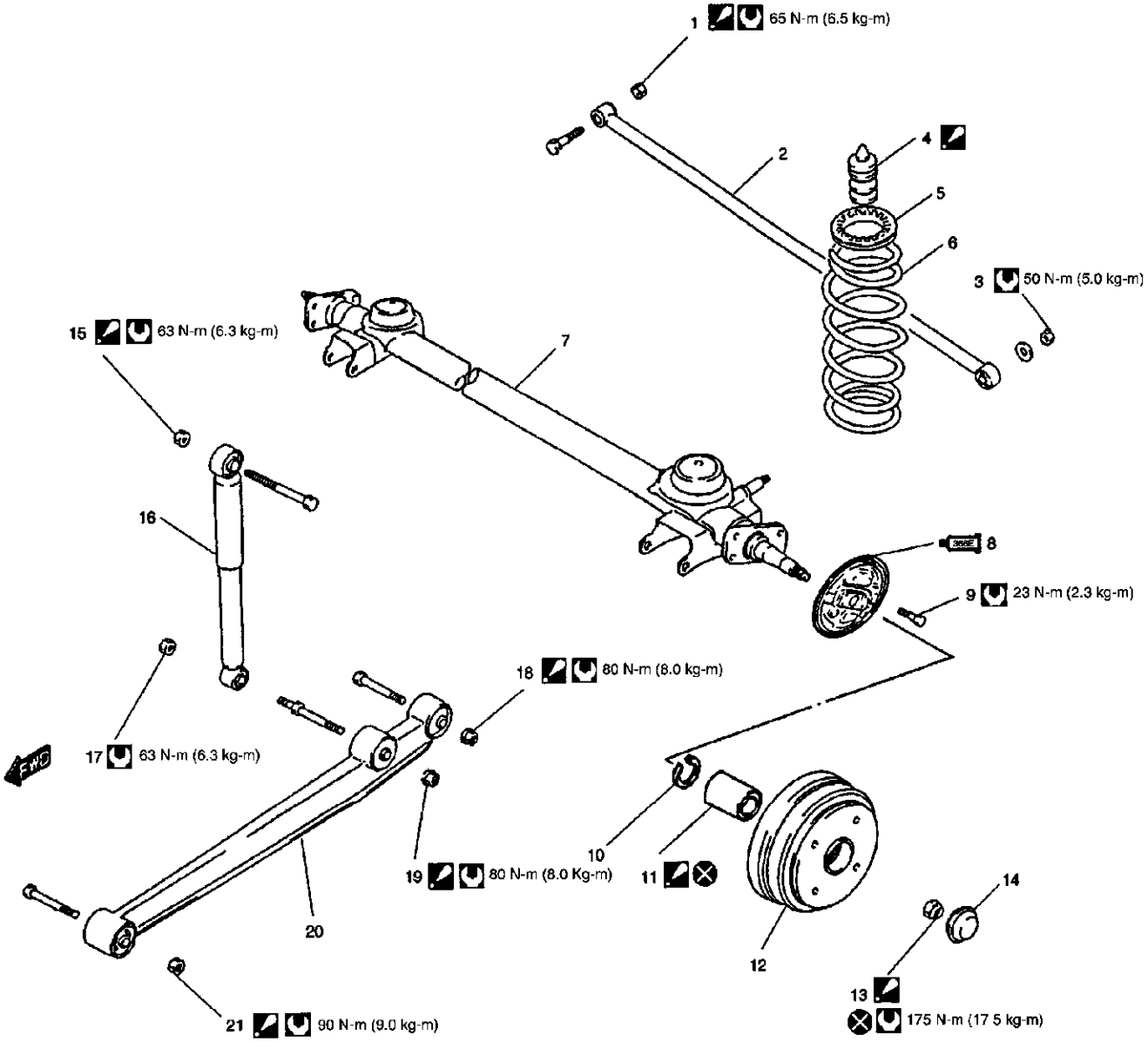
ON-VEHICLE SERVICE



✎	1. Lateral rod body side nut Install from the direction as shown.		9. Brake back plate bolt		17. Shock absorber lower nut
	2. Lateral rod		10. Circlip	✎	18. Trailing arm rear nut: Insert from vehicle outside
	3. Lateral rod axle side nut	✎	11. Bearing: Seal side of bearing comes inside of brake drum.	✎	19. Trailing arm center nut: Install from vehicle outside.
✎	4. Rear bump stopper: Apply soap water, when installing.		12. Brake drum		20. Trailing arm
	5. Rear spring upper seat	✎	13. Spindle nut: Caulk, after tightening.	✎	21. Trailing arm front nut: Insert from vehicle outside
	6. Rear coil spring		14. Spindle cap		: Tightening Torque
	7. Rear axle	✎	15. Shock absorber upper nut: Install from vehicle inside.	⊗	: Do not reuse
SEAL	8. Brake back plate: Apply water tight sealant 99000-31090 to joint of plate and axle.		16. Rear shock absorber		

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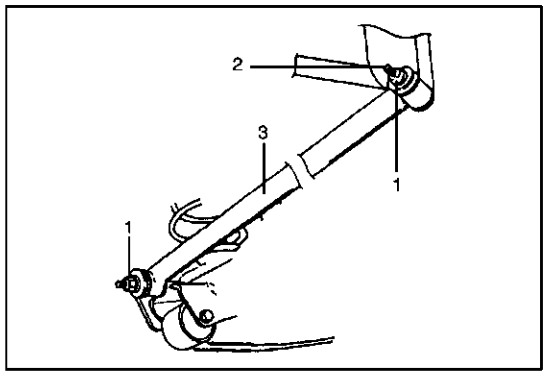
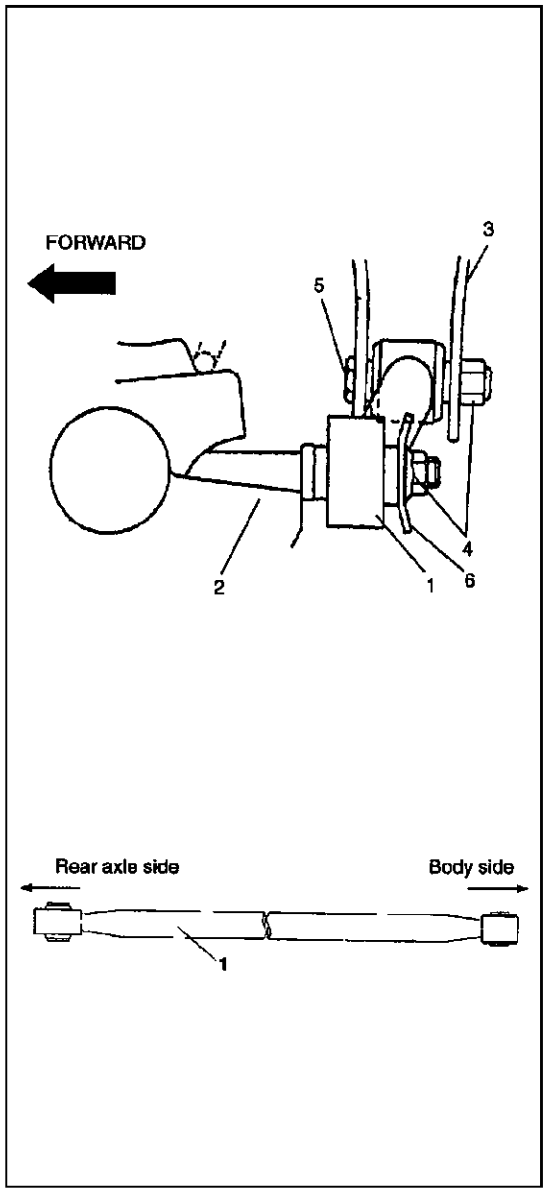


LATERAL ROD

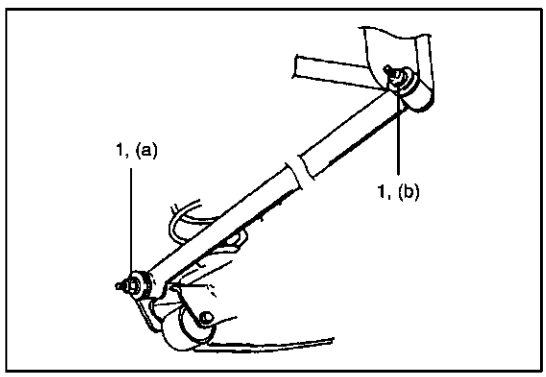
REMOVAL

1) Hoist vehicle.
2) Remove lateral rod nuts (1) and bolt (2).
3) Remove lateral rod (3).



INSTALLATION

1) Install lateral rod (1) to rear axle (2) and vehicle body (3) referring to figure for proper installing direction of nuts (4), bolt (5) and washer (6).
   Tighten nuts temporarily at this step.
2) Lower hoist and bounce vehicle up and down several times to stabilize suspension.
   Be sure that vehicle in non-loaded condition.



3) Tighten lateral rod nuts (1) to specified torque.
   Tightening Torque
   (a): 50 N-m (5.0 kg-m, 36.5 lb-ft)
   (b): 65 N-m (6.5 kg-m, 47.0 lb-ft)

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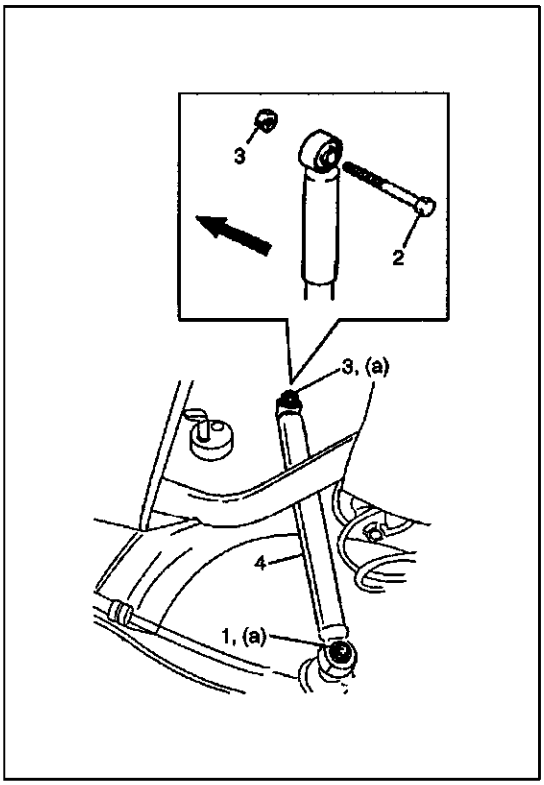


REAR SHOCK ABSORBER

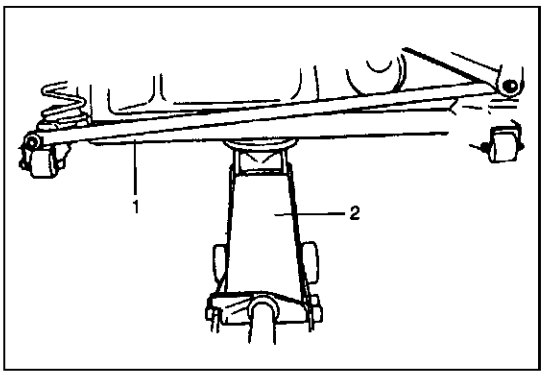
REMOVAL

1) Hoist vehicle.
2) Support rear axle using floor jack to prevent it from lowering.
3) Remove shock absorber lower nut (1).
4) Remove shock absorber upper bolt (2) and nut (3), then remove shock absorber (4).

INSTALLATION

1) Install shock absorber (4).
   Tighten nuts temporarily at this step.
2) Remove floor jack from rear axle, lower hoist and bounce vehicle up and down several times to stabilize suspension. Be sure that vehicle in non-loaded condition.
3) Tighten nuts to specified torque.

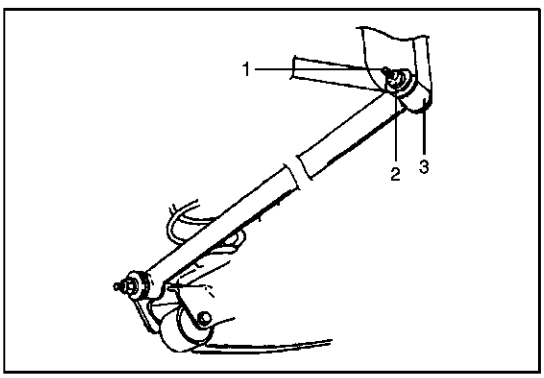
   Tightening Torque
   (a): 63 N-m (6.3 kg-m, 46.0 lb-ft)



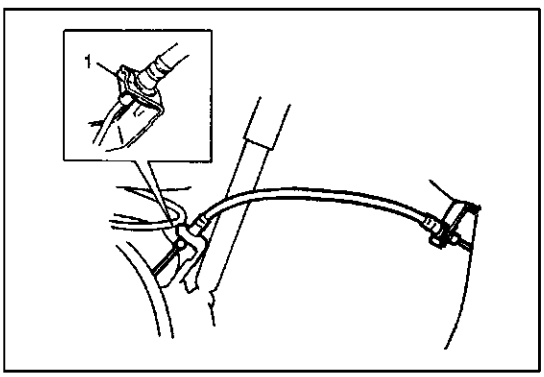
COIL SPRING

REMOVAL

1) Hoist vehicle and remove rear wheel.
2) Support rear axle (1) using floor jack (2) to prevent it from lowering.



3) Remove lateral rod body side bolt (1) and nut (2), and then detach lateral rod (3) from vehicle body.



4) Remove brake flexible hose E-rings (1).

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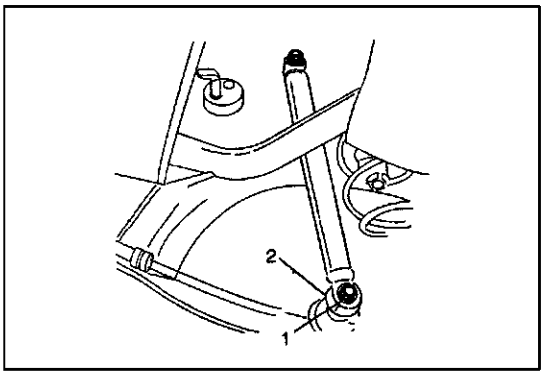
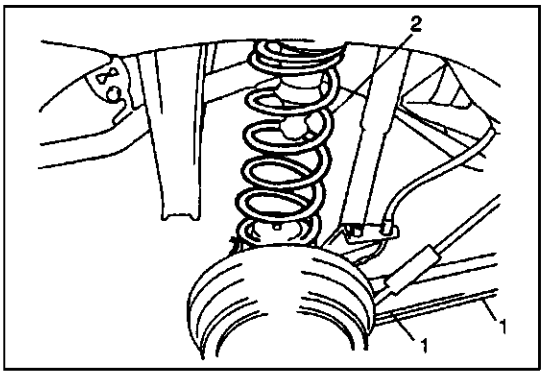


5) Remove shock absorber lower nut (1). Detach shock absorber lower end (2) from rear axle or remove shock absorber referring to REAR SHOCK ABSORBER REMOVAL in this section.

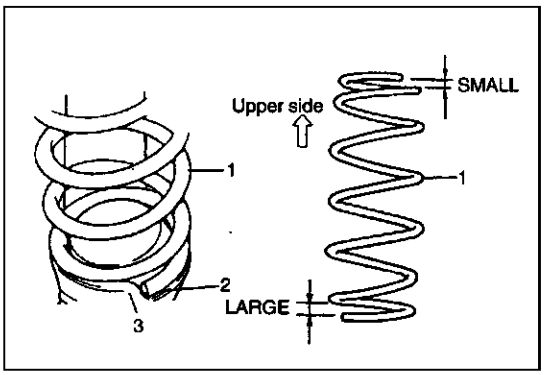


6) Lower rear axle (1) gradually as far down as where coil spring (2) can be removed.

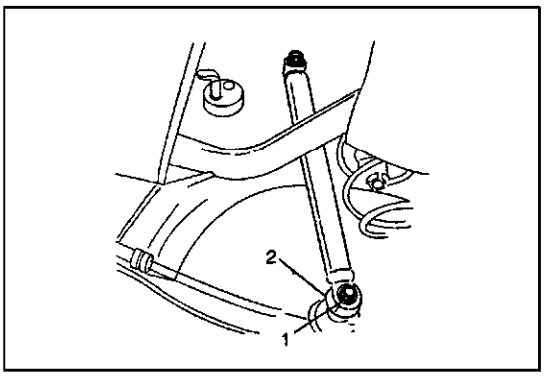
CAUTION:
Be careful not to let rear axle down too much. It may cause damage to brake flexible hose and parking brake cable.

7) Remove coil spring.

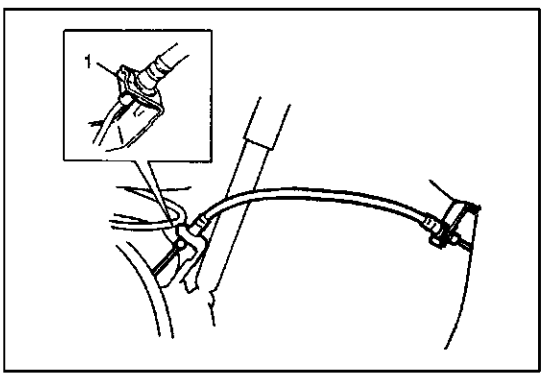
INSTALLATION



1) Install coil spring (1) with its small pitch end facing up and large pitch end (with paint marking) down and make sure that spring end contact to stepped part (2) of spring seat (3) as shown.



2) If shock absorber is removed, install it referring to REAR SHOCK ABSORBER INSTALLATION in this section.
3) Install shock absorber lower end (1) to rear axle.
Tighten shock absorber lower nut (2) temporarily at this step.
4) Remove floor jack from rear axle.



5) Install brake flexible hose E-rings (1).

NOTE:
For proper installing direction of E-rings, refer to figure.

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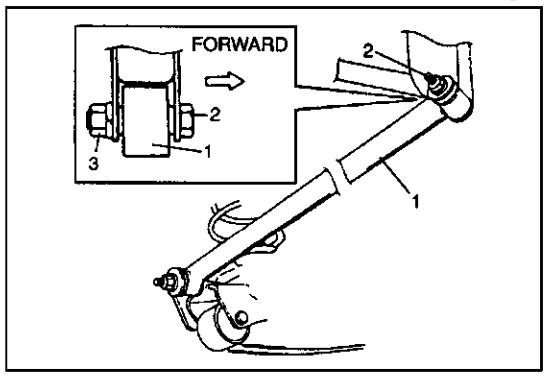
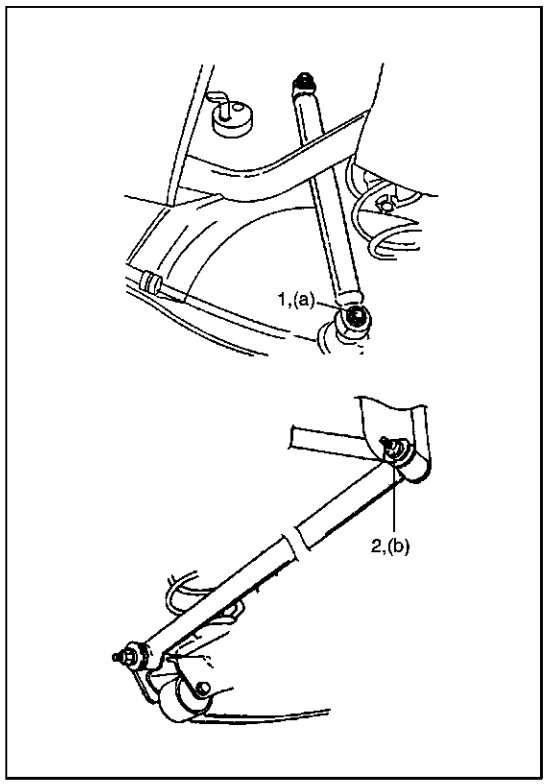


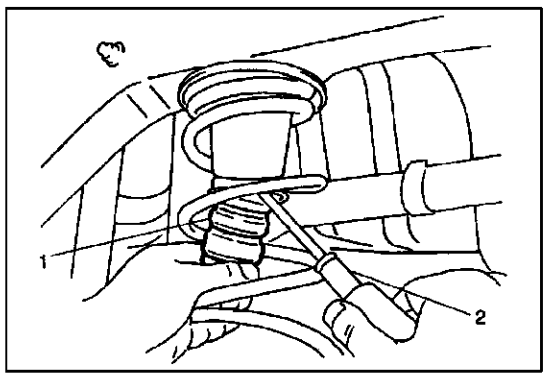
6) Install lateral rod (1) to vehicle body referring to figure for proper installing direction of bolt (2).
   Tighten nut (3) temporarily at this step.
7) Remove floor jack from rear axle.
8) Install wheel and tighten wheel nuts to specified torque.

Tightening Torque
(a): 85 N-m (8.5 kg-m, 61.5 lb-ft)



9) Lower hoist and bounce vehicle up and down several times to stabilize suspension.
   Be sure that vehicle in non-loaded condition.
10) Tighten absorber lower nut (1) and lateral rod body side nut (2) to specified torque.

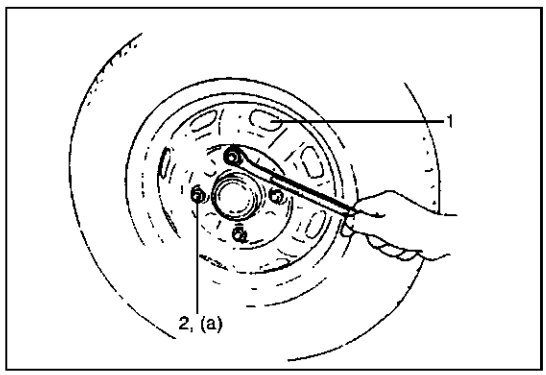
Tightening Torque
(a): 63 N-m (6.3 kg-m, 46.0 lb-ft)
(b): 65 N-m (6.5 kg-m, 47.0 lb-ft)



BUMP STOPPER

REMOVAL

1) Hoist vehicle and remove rear wheel.
2) Remove bump stopper using flat end rod or the like.



INSTALLATION

1) Install bump stopper.

   NOTE:
   Before installing bushing, apply soap water on it.

2) Install wheel (1) and tighten wheel nuts (2) to specified torque.

Tightening Torque
(a): 85 N-m (8.5 kg-m, 61.5 lb-ft)

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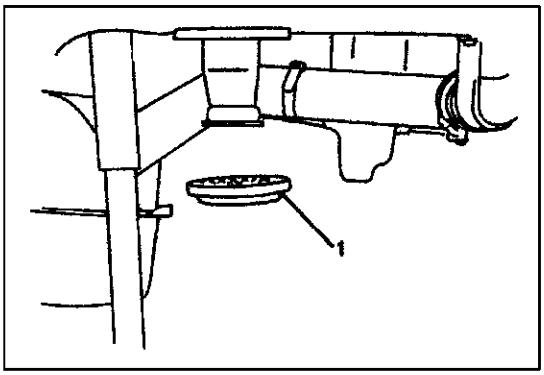
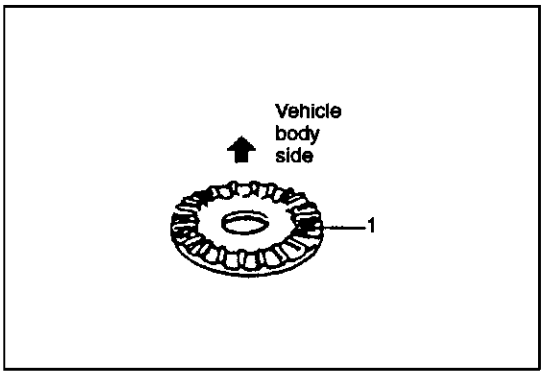


SPRING UPPER SEAT

REMOVAL

1) Removal coil spring. For details, refer to COIL SPRING REMOVAL in this section.
2) Remove spring upper seat (1).

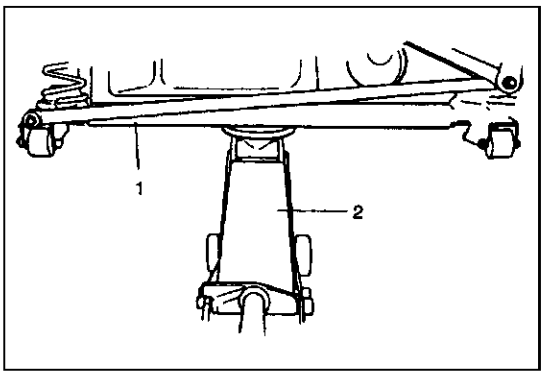


INSTALLATION

1) Install spring upper seat (1).

NOTE:
For proper installing direction of spring upper seat, refer to figure.

2) Install coil spring. For details, refer to COIL SPRING INSTALLATION in this section.

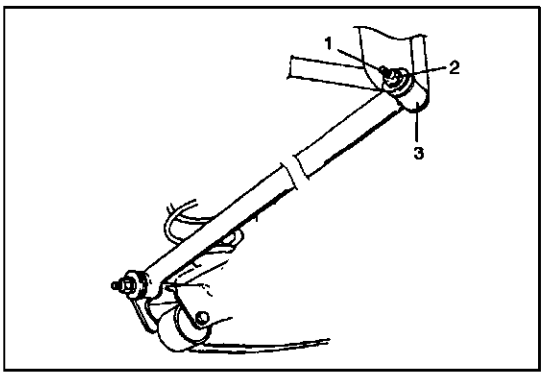


TRAILING ARM

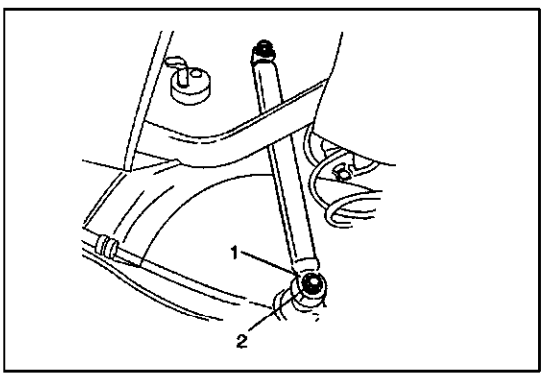
REMOVAL

1) Hoist vehicle and remove rear wheel.
2) Support rear axle (1) by using floor jack (2).

CAUTION:
Never apply floor jack against lateral rod as it may get deformed.



3) Remove lateral rod body side bolt (1) and nut (2), and then detach lateral rod (3) from vehicle body.



4) Remove shock absorber lower nut (1). Detach shock absorber lower end (2) from rear axle or remove shock absorber referring to REAR SHOCK ABSORBER REMOVAL in this section.

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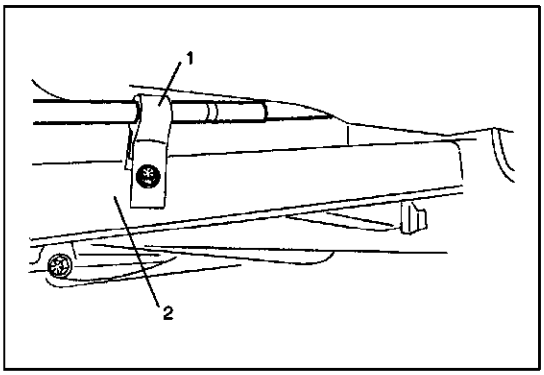
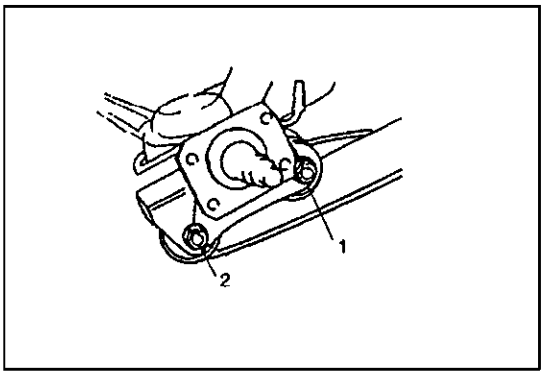
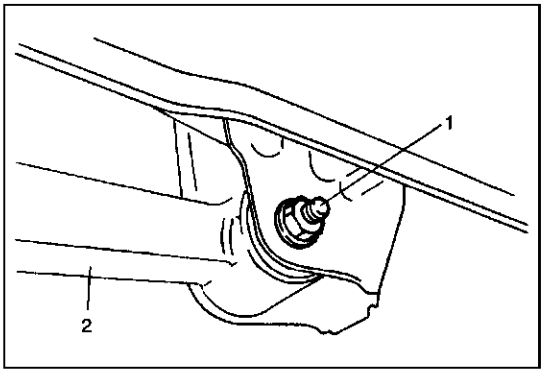


5) Remove parking brake cable clamp (1) from trailing arm (2).
[With ABS]
Release wheel speed sensor lead wire clamps (right & left) from trailing arm.

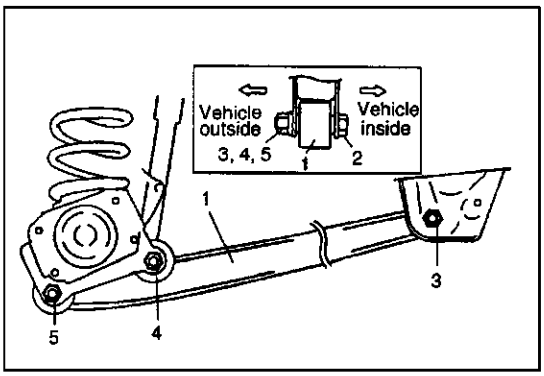


6) Remove trailing arm center bolt (1) and rear bolt (2).

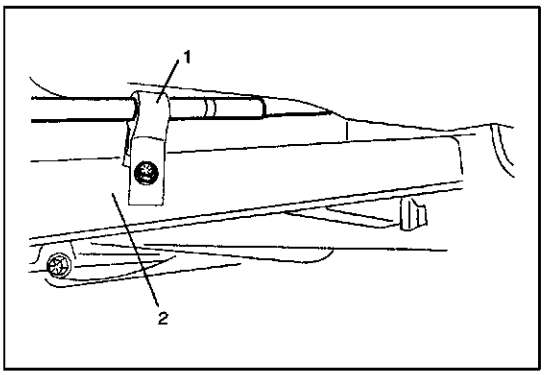


7) Remove trailing arm front bolt (1), and then remove trailing arm (2).

INSTALLATION



1) Install trailing arm (1) to vehicle body and rear axle, referring to figure for proper installing direction of bolts (2).
Tighten front nut (3), center nut (4) and rear nut (5) temporarily by hand at this step.



2) Install parking brake cable clamp (1) to trailing arm (2).
[With ABS]
Clamp wheel speed sensor lead wire (right & left) to trailing arm securely.

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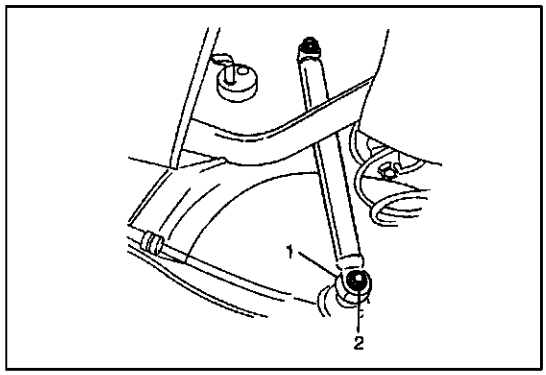
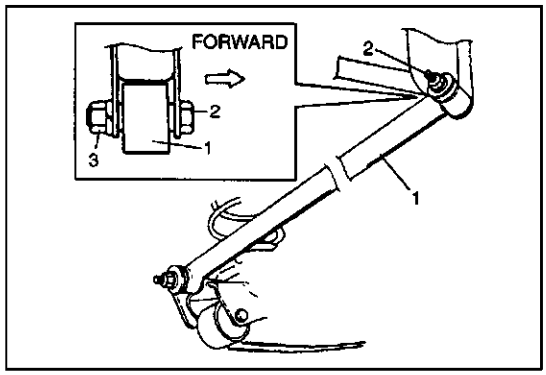


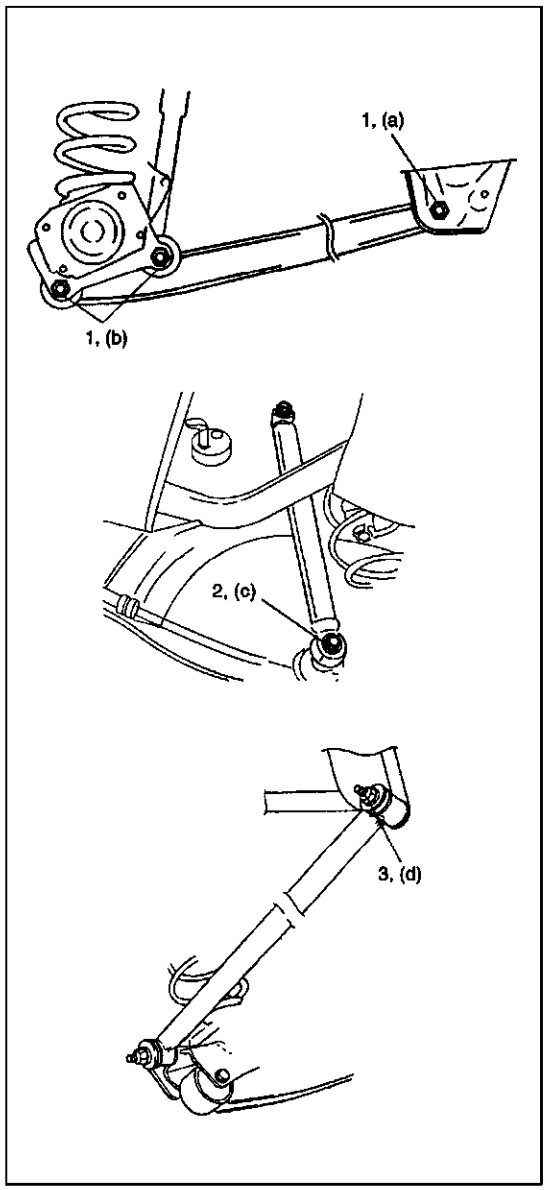
3) If shock absorber is removed, install it referring to REAR SHOCK ABSORBER INSTALLATION in this section.
4) Install shock absorber lower end (1) to rear axle.
   Tighten shock absorber lower nuts (2) temporarily by hand at this step.



5) Install lateral rod (1) to vehicle body. Refer to figure for proper installing direction of bolt (2).
   Tighten nut (3) temporarily by hand at this step.
6) Remove floor jack from rear axle.
7) Install wheel and tighten wheel nuts to specified torque.

   Tightening Torque
   85 N-m (8.5 kg-m, 61.5 lb-ft)

8) Lower hoist and bounce vehicle up and down several times to stabilize suspension.
   Be sure that vehicle in non-loaded condition.



9) Tighten front, center and rear trailing arm nuts (1), shock absorber lower nuts (2) and lateral rod body side nut (3) to specified torque.

   Tightening Torque
   (a): 90 N-m (9.0 kg-m, 65.0 lb-ft)
   (b): 80 N-m (8.0 kg-m, 58.0 lb-ft)
   (c): 63 N-m (6.3 kg-m, 46.0 lb-ft)
   (d): 65 N-m (6.5 kg-m, 47.0 lb-ft)

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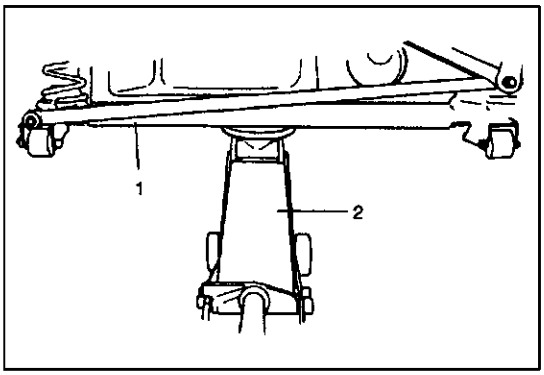
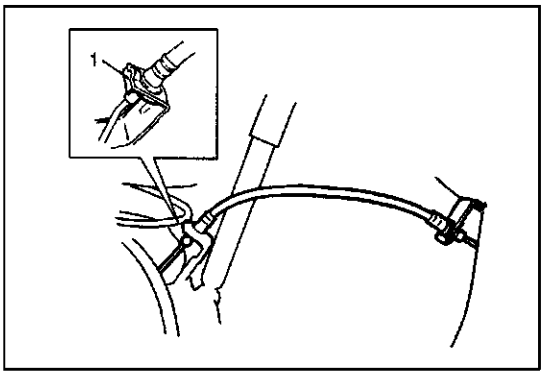


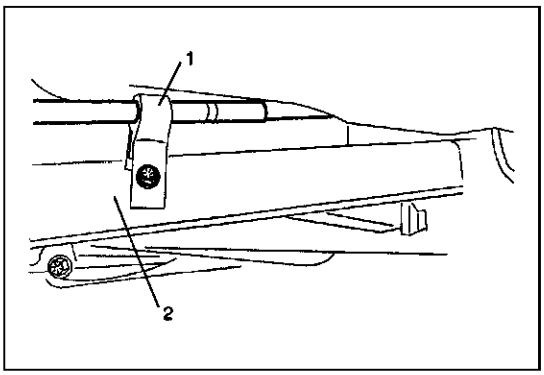
REAR AXLE

REMOVAL

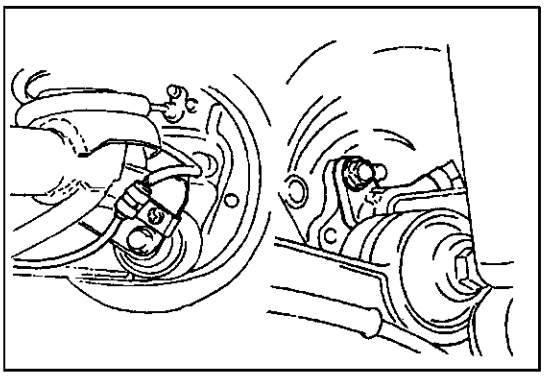
1) Hoist vehicle and remove rear wheels.
2) Support rear axle (1) by using floor jack (2).
3) Remove rear brake drums. Refer to BRAKE DRUM REMOVAL in SECTION 5.



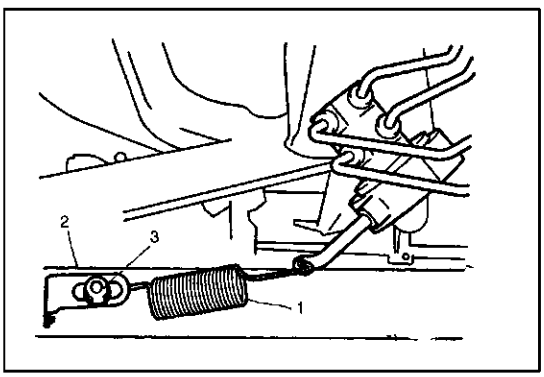
4) Remove brake flexible hose E-rings (1).



5) Remove parking brake cable clamps (1) from trailing arms (2).



[With ABS]
Remove wheel speed sensor and release clamps (right & left)



[With ABS]
Remove nut (1) and detach spring end from rear axle (2).

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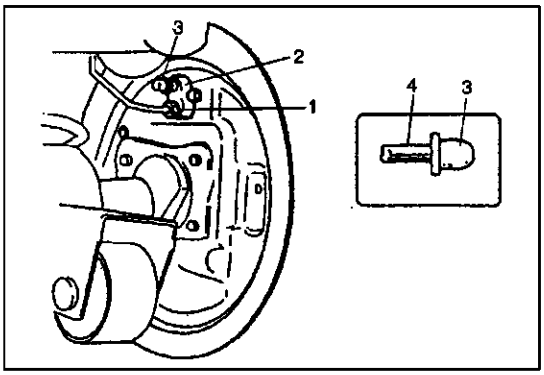
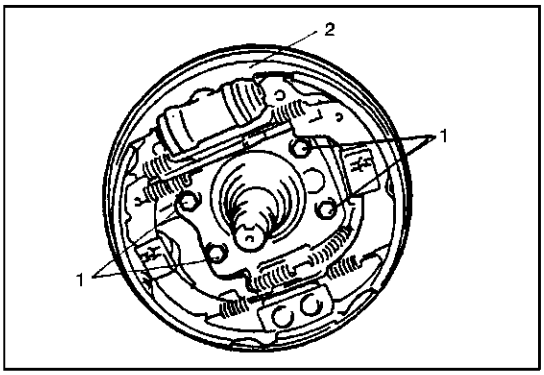
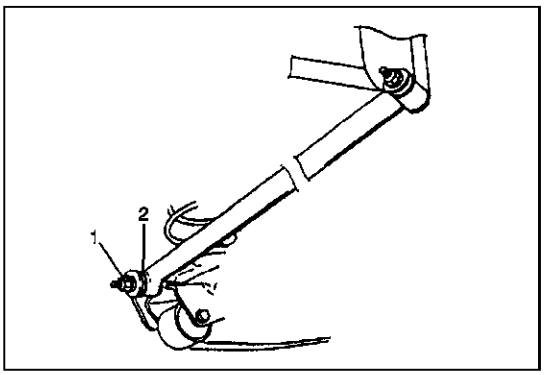


6) Disconnect brake pipe flare nuts (1) from wheel cylinders (2) and put bleeder plug cap (3) onto brake pipe (4) to prevent fluid from spilling.

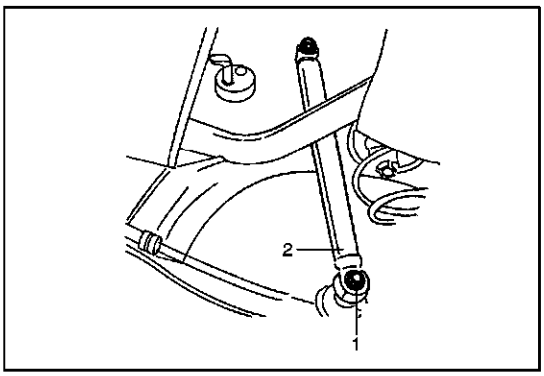
CAUTION:
Do not allow brake fluid to get on painted surface.



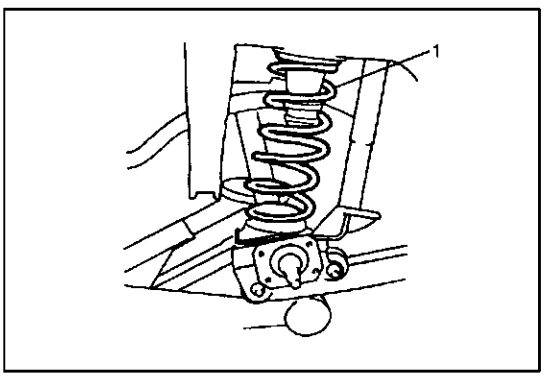
7) Remove back plate bolts (1), and then remove brake back plates (2) from rear axle and hang removed back plate with a wire hook.



8) Remove lateral rod axle side nut (1), and then detach lateral rod (2) from rear axle.



9) Remove shock absorber lower nuts (1). Detach shock absorber lower end (2) from rear axle or remove shock absorber referring to REAR SHOCK ABSORBER REMOVAL in this section.



10) Lower rear axle gradually as far down as where coil spring (1) can be removed.

CAUTION:
Be careful not to let rear axle down too much. It may cause damage to brake flexible hose and parking brake cable.

11) Remove coil springs.

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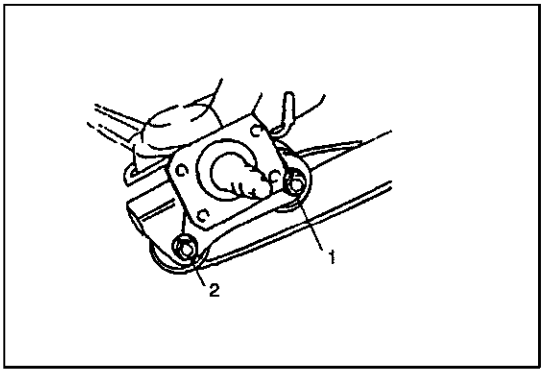
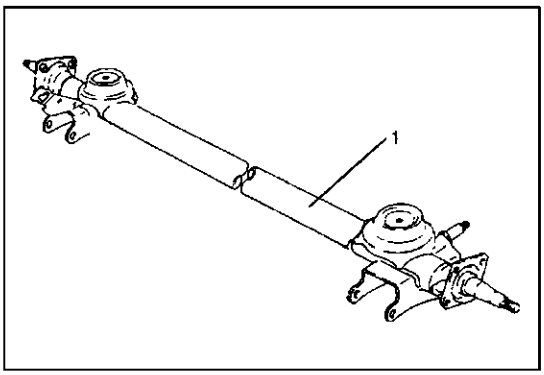
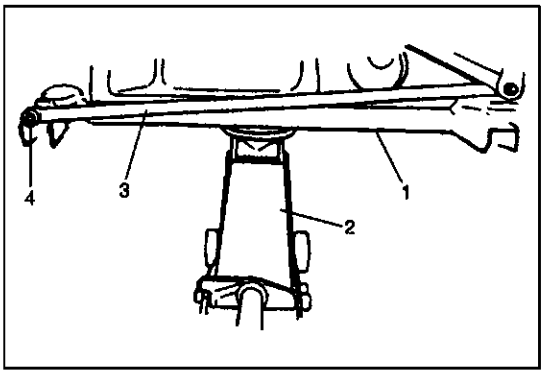


12) Loosen center trailing arm nuts (1) and rear trailing arm nuts (2) but don't remove bolts.

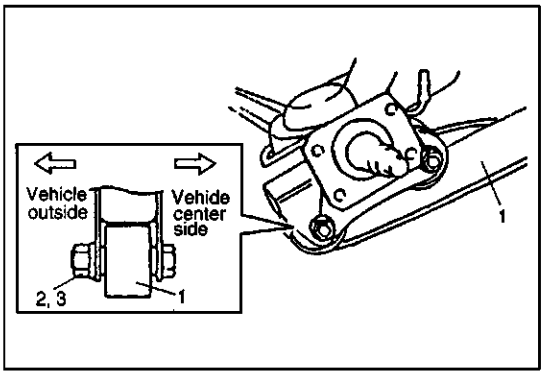


13) While supporting rear axle at both ends, remove center and rear trailing arm bolts, and then remove rear axle from chassis by lowering floor jack gradually.

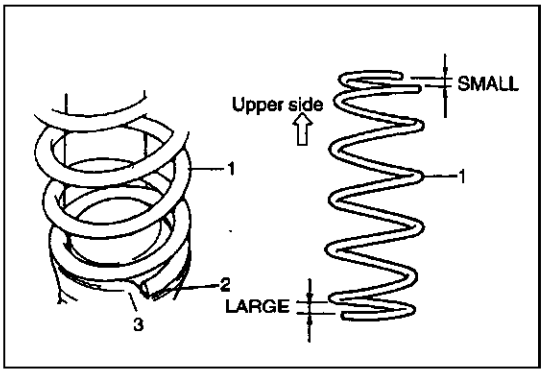


INSTALLATION

1) Place rear axle (1) on floor jack (2).
   Then install lateral rod (3) to rear axle (1) and tighten nut (4) temporarily by hand at this step.



2) Install trailing arms (1) to rear axle in proper direction as shown in figure.
   Tighten trailing arm center nuts (2) and trailing arm rear nuts (3) temporarily by hand at this step.



3) Install coil springs (1) with its small pitch end facing up and large pitch end (with paint marking) down and make sure that spring end contact to stepped part (2) of lower seat (3) as shown.

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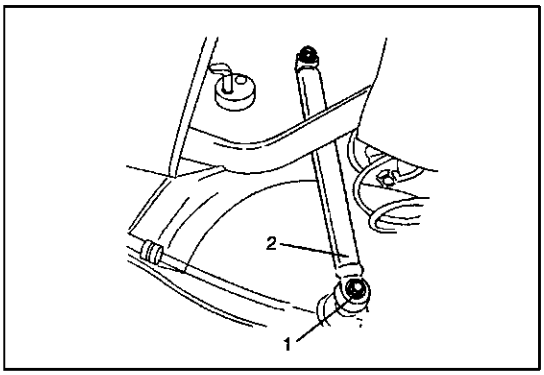
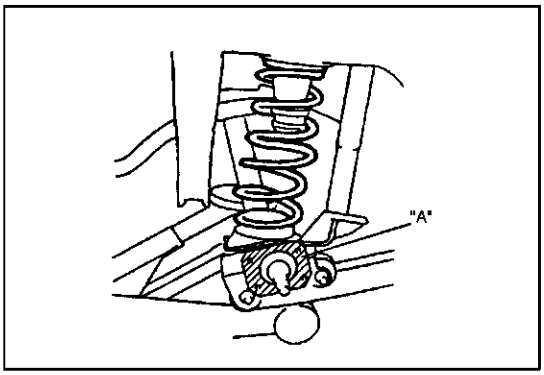
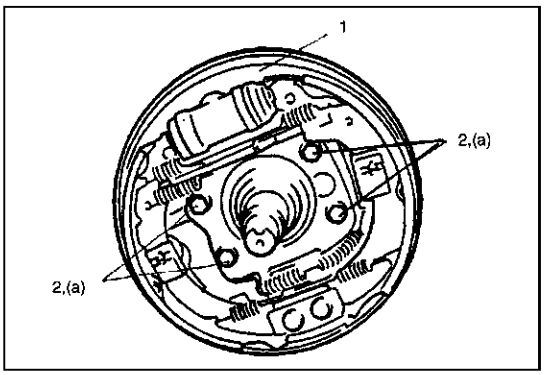


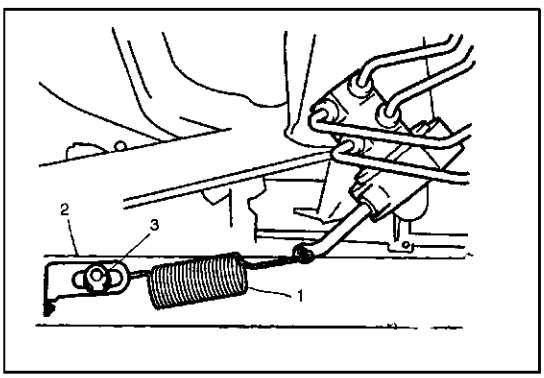
4) If shock absorber is removed, install it referring to REAR SHOCK ABSORBER INSTALLATION in this section.
5) Install shock absorber lower end (1) to rear axle.
   Tighten shock absorber lower nuts (2) temporarily at this step.
6) Remove floor jack from rear axle.



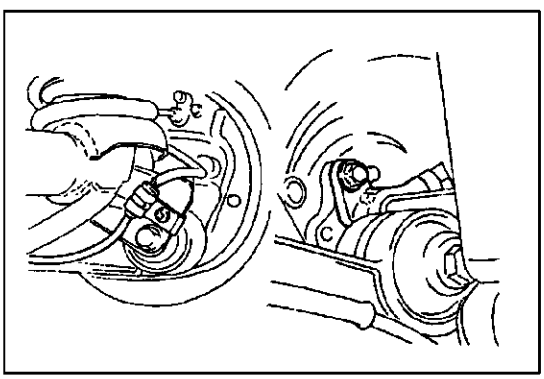
7) Clean mating surface of rear axle with brake back plate and apply water tight sealant as shown.
   "A": Sealant 99000-31090



8) Install brake back plates (1) and tighten back plate bolts (2) to specified torque.
   Tightening Torque
   (a): 23 N-m (2.3 kg-m, 17.0 lb-ft)



[With LSPV]
Install LSPV spring (1) to rear axle (2). Tighten nut (3) temporarily by hand at this step.



[With ABS]
Install wheel speed sensor and clamp wire securely (right and left).

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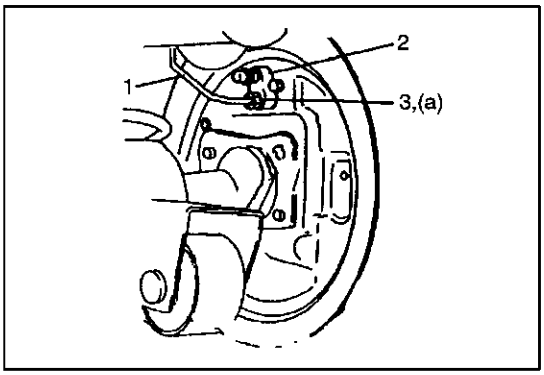
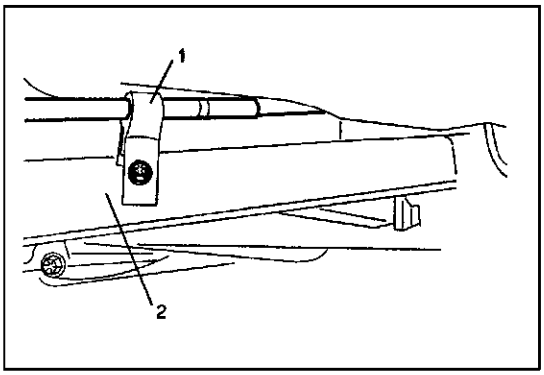


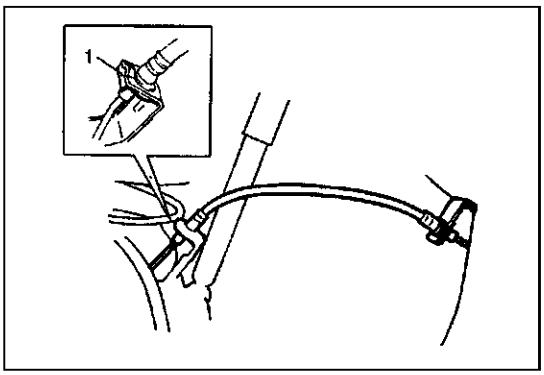
9) Connect brake pipes (1) to wheel cylinders (2) and tighten brake pipe flare nuts (3) to specified torque.

Tightening Torque
(a): 16 N-m (1.6 kg-m, 11.5 lb-ft)

CAUTION:
Do not allow brake fluid to get on painted surface.



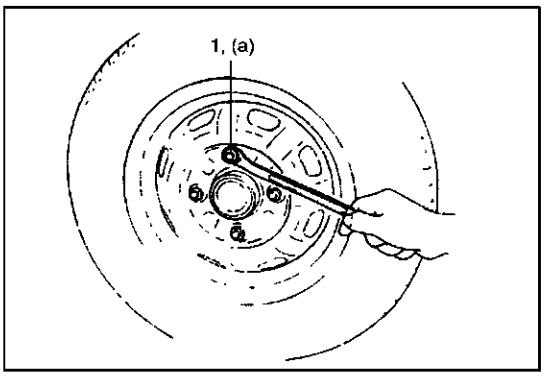
10) Install parking brake cable clamps (1) to trailing arms (2).



11) Connect brake flexible hoses to brackets on rear axle and vehicle body, and then fix it with E-rings (1).

NOTE:
For proper installing direction of E-rings, refer to figure.

12) Install brake drum and fill reservoir with brake fluid and bleed brake system. Refer to BRAKE DRUM INSTALLATION and BLEEDING BRAKES in SECTION 5.



13) Install wheel and tighten wheel nuts (1) to specified torque.

Tightening Torque
(a): 85 N-m (8.5 kg-m, 61.5 lb-ft)

14) Upon completion of all jobs, depress brake pedal with about 30 kg (66 lbs) load three to five times so as to obtain proper drum-to-shoe clearance.
Adjust parking brake cable (for adjustment, see SECTION 5 in this manual.)
15) Lower hoist and bounce vehicle up and down several times to stabilize suspension.
Be sure that vehicle in non-loaded condition.

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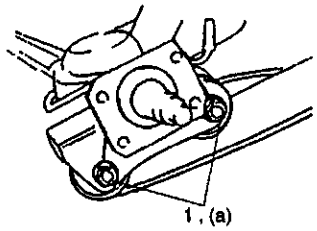
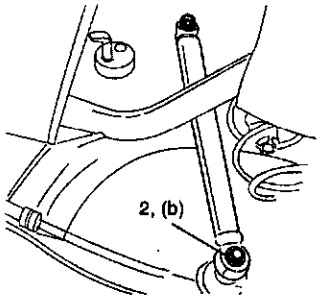
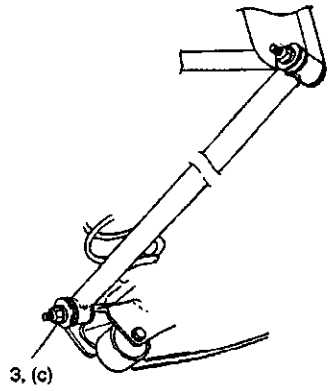






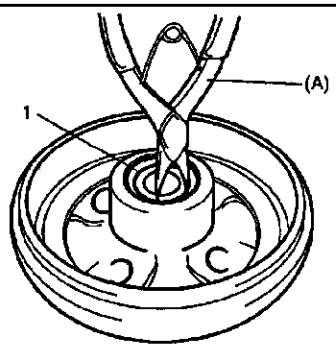
16) Tighten center and rear trailing arm nuts (1), shock absorber lower nuts (2) and lateral rod axle side nut (3) to specified torque.

Tightening Torque
(a): 80 N-m (8.0 kg-m, 58.0 lb-ft)
(b): 63 N-m (6.3 kg-m, 46.0 lb-ft)
(c): 50 N-m (5.0 kg-m, 36.5 lb-ft)

17) Check to ensure that brake drum is free from dragging and proper braking is obtained.

[With LSPV]
Check and adjust LSPV spring referring to "LSPV INSPECTION AND ADJUSTMEN" and perform "FUEL PRESSURE TEST" in SECTION 5.

18) Perform brake test (foot brake and parking brake).

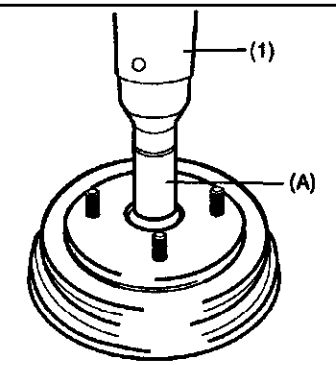


WHEEL BEARING AND WHEEL STUD

REMOVAL

1) Remove rear brake drum. For details, refer to REAR BRAKE DRUM REMOVAL in SECTION 5.
2) Remove bearing circlip (1) using special tool.

Special Tool
(A): 09900-06108



3) Remove wheel bearing using special tool and hydraulic press (1).

Special Tool
(A): 09951-76010

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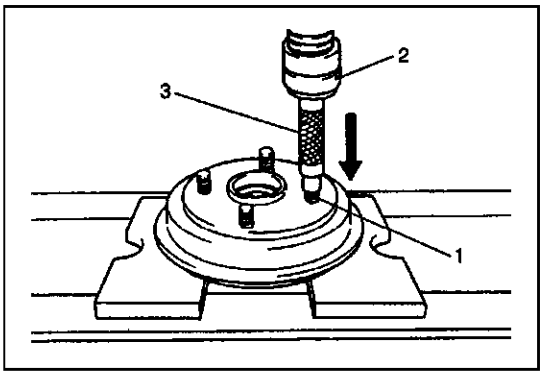
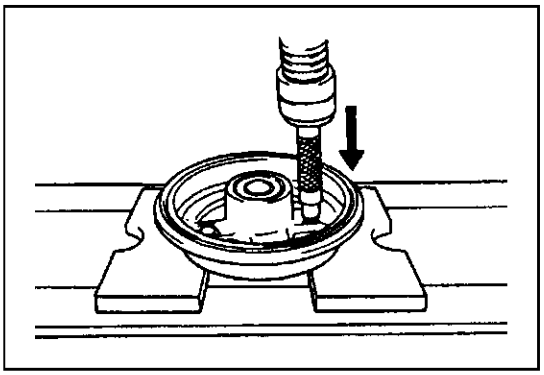
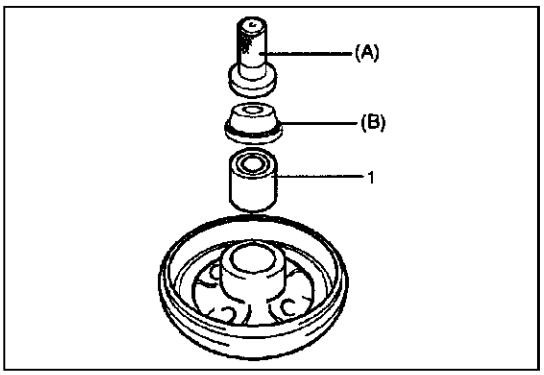


4) Remove wheel stud bolts (1) using hydraulic press (2) and general rod (3).



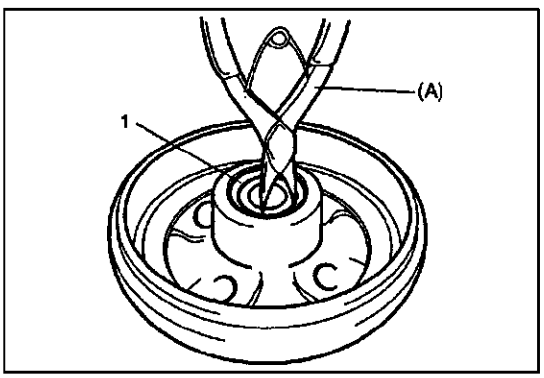
INSTALLATION

1) Insert new stud in drum hole and rotate it slowly to assure serrations are aligned with those made by replaced bolt.



2) Press-fit wheel bearing (1) with it's seal side facing back plate side using special tools and hydraulic press.

Special Tool
(A): 09951-76010
(B): 09924-84510-004



3) Install bearing circlip (1) using special tool.

Special Tool
(A): 09900-06108

4) Install brake drum and wheel. For details, refer to REAR BRAKE DRUM INSTALLATION in SECTION 5.

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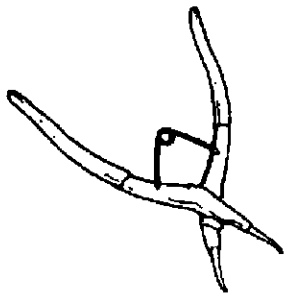
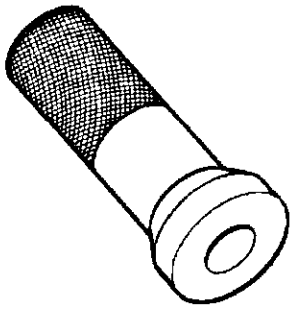
REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Brake fluid	DOT3	Brake reservoir
Water tight sealant	SEALING COMPOUND 366E (99000-31090)	Join seam of rear axle and brake back plate

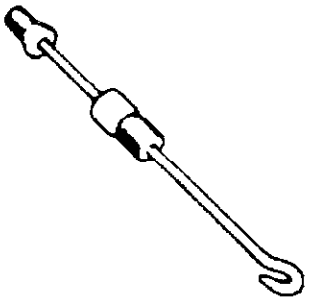
SPECIAL TOOLS



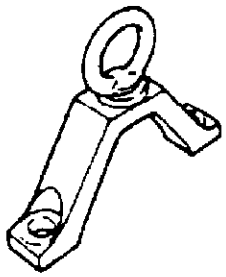
09900–06108
Snap ring pliers



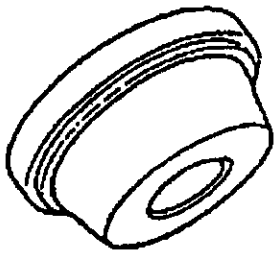
09942-15510
Sliding hammer



09943-17912
Brake drum remover



09913-76010
Rear wheel bearing installer



09924-84510-004
Bearing installer attachment

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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.

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Wheels 3F-1
Replacement Tires 3F-1
Replacement Wheels 3F-2
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GENERAL DESCRIPTION

TIRES

This vehicle is equipped with the following tire.
155/65 R13
The tire is tubeless type. The tire is designed to operate satisfactorily with loads up to the full rated load capacity when inflated to the recommended inflation pressures.
Correct tire pressures and driving habits have an important influence on tire life. Heavy cornering, excessively rapid acceleration, and unnecessary sharp braking increase tire wear.

WHEELS

Standard equipment wheels are the following steel wheel.
13 x 4½ J

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.

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kPa	kgf/cm²	psi
160	1.6	23
180	1.8	26
200	2.0	29
220	2.2	32
240	2.4	35
260	2.6	38
280	2.8	41
300	3.0	44

WARNING:
Do not mix different types of tires on the same vehicle such as radial, bias and bias-belted tires except in emergencies, because handling may be seriously affected and may result in loss of control.

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 is usually printed in both kPa and psi on the Tire Placard.

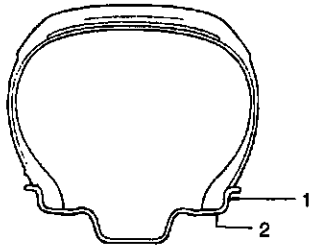
Metric tire gauges are available from tool suppliers.

The chart, shown left table, converts commonly used inflation pressures from kPa to psi.

REPLACEMENT WHEELS

Wheels must be replaced if they are bent, dented, have excessive lateral or radial runout, air leak 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 figure below may cause objectional vibrations.

Replacement wheels must be equivalent to the original equipment wheels in load capacity, diameter, rim with offset and mounting configuration. A wheel of improper size or type may affect wheel and bearing life, brake cooling, speedometer/ odometer calibration, vehicle ground clearance and tire clearance to body and chassis.



* TOTAL INDICATOR READING IGNORE INDICATOR "JUMP" DUE TO WELD SEAMS, PAINT RUNS, SCRATCHES, ETC.

HOW TO MEASURE WHEEL RUNOUT

To measure the wheel runout, it is necessary to use an accurate dial indicator. The tire may be on or off the wheel. The wheel should be installed to the wheel balancer of the like for proper measurement.

Take measurements of both lateral runout (1) and radial runout (2) at both inside and outside of the rim flange. With the dial indicator set in place securely, turn the wheel one full revolution slowly and record every reading of the indicator.

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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.

	Radial runout limit	Lateral runout limit
Steel wheel	0.7 mm (0.08 in.)	0.9 mm (0.035 in.)

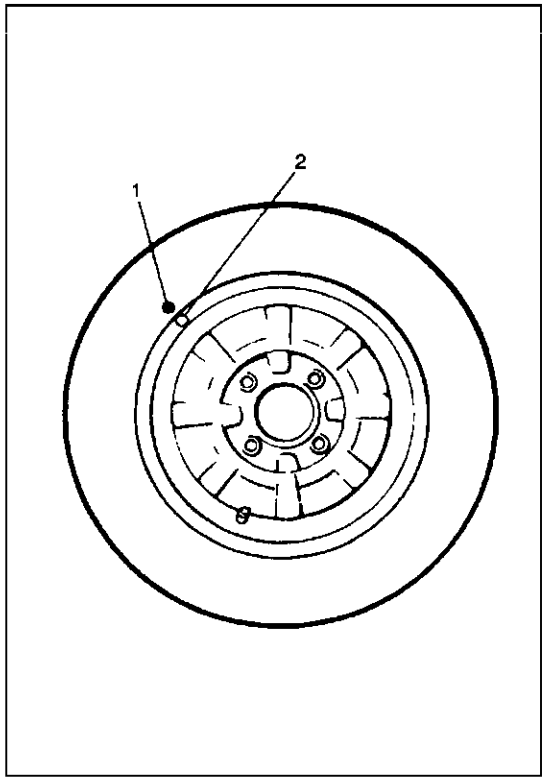
MAINTENANCE AND MINOR ADJUSTMENTS

WHEEL MAINTENANCE

Wheel repairs that use welding, heating, or peening are not approved. All damaged wheels should be replaced.

WHEEL ATTACHING STUDS

If a broken stud is found, see SECTION 3E (rear) or SECTION 3D (front) for Note and Replacement procedure.



MATCHED TIRES AND 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 from the tire.

The "low spot" of the wheel is originally marked by paint dot (2) on the wheel rim-flange. Properly assembled, the paint dot of wheel rim should be aligned with the paint dot of tire as shown.

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.

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INFLATION OF TIRES

The pressure recommended for any model is carefully calculated to give a satisfactory ride, stability, steering, tread wear, tire life and resistance to bruises.
Tire pressure, with tires cold, (after vehicle has set for three hours or more, or driven less than one mile) should be checked monthly or before any extended trip. Set to the specifications on the tire placard located on the left door (right door for right-hand side steering vehicle) lock pillar.
It is normal for tire pressure to increase when the tires become hot during driving.
Do not bleed or reduce tire pressure after driving. Bleeding reduces the "Cold Inflation Pressure".

Higher than recommended pressure can cause:

1. Hard ride
2. Tire bruising or carcass damage
3. Rapid tread wear at center of tire

Unequal pressure on the same axle can cause:

1. Uneven braking
2. Steering lead
3. Reduced handling
4. Swerve on acceleration

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 temperature
7. Reduced handling
8. High fuel consumption
   Valve caps should be on the valves to keep dust and water out.

TIRE PLACARD

The tire placard is located on the left door (right door for righthand side steering vehicle) lock pillar and should be referred to for tire information.
The placard lists the maximum load, tire size and cold tire pressure where applicable.

NOTE:
Whether rim size and/or maximum load are listed or not depends on regulations of each country.

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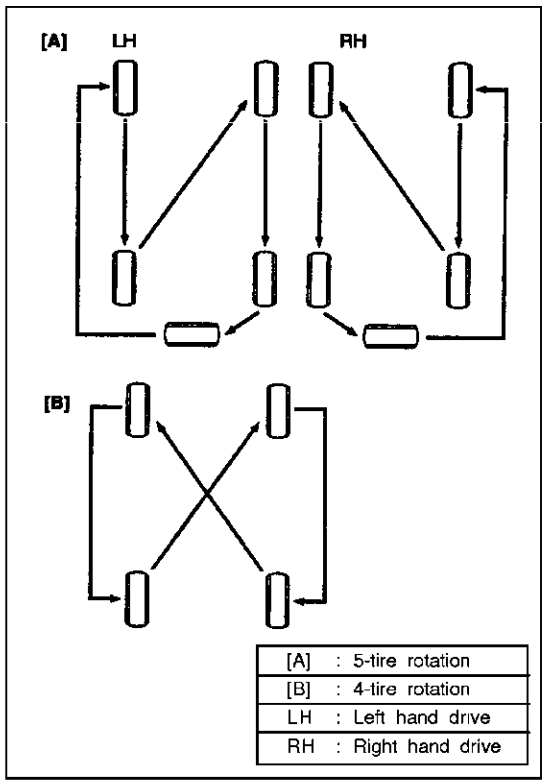

TIRE ROTATION

To equalize wear, rotate tires as shown. 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.

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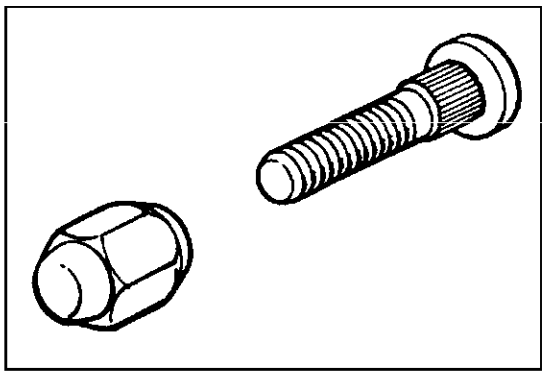
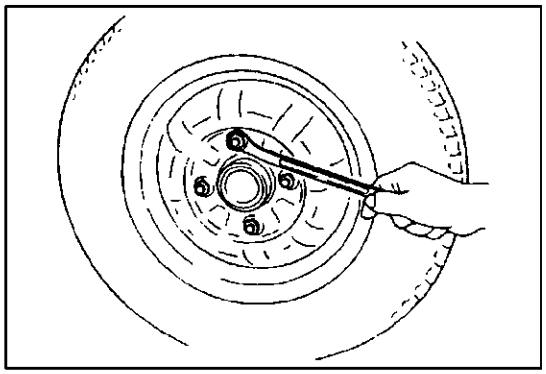


ON-VEHICLE SERVICE

SERVICE OPERATIONS

METRIC LUG NUTS AND WHEEL STUDS

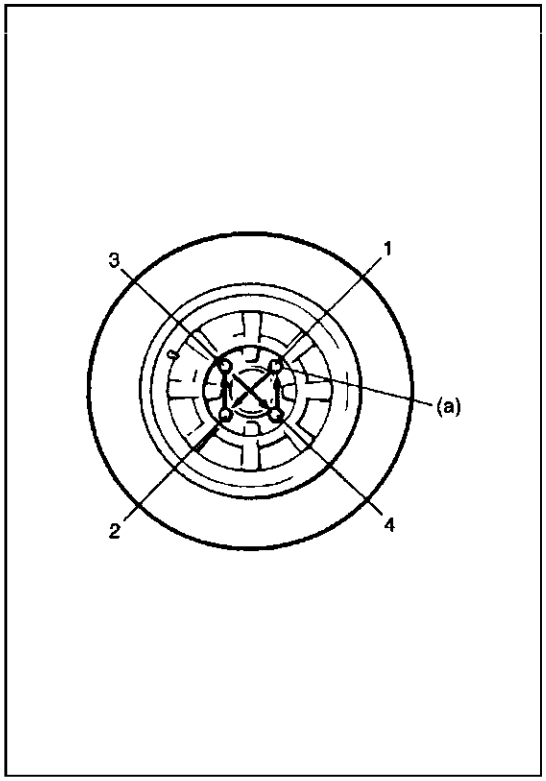
All models use metric lug nuts and wheel studs (Size: M12x1.25).



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.



Wheel nuts must be tightened in sequence and to proper torque to avoid bending wheel or brake disc, left figure.

NOTE:

Before installing wheels, remove any build-up of corrosion on wheel mounting surface and brake disc mounting surface by scraping and wire brushing. Installing wheels without good metal-to-metal contact at mounting surfaces can cause wheel nuts to loosen, which can later allow a wheel to come off while vehicle is moving.

Tightening Torque
(a): 85 N-m (8.5 kg-m, 61.5 lb-ft)

TIRE MOUNTING AND DEMOUNTING

Use a 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 a wire brush or coarse steel wool to remove lubricants, old rubber and light rust. Before mounting or demounting a tire, bead area should be well lubricated with approved tire lubricant.

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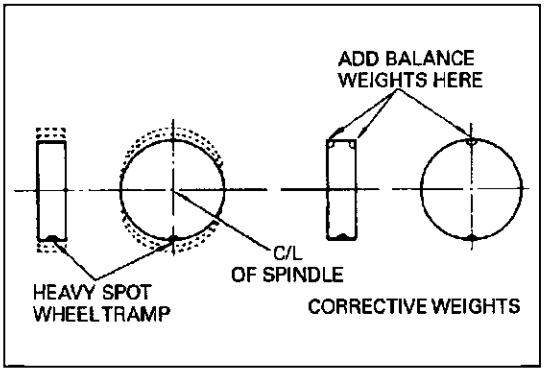
After mounting, inflate to specified pressure shown on tire placard so that beads are completely seated. Install valve core and inflate to proper pressure.

WARNING:
Do not stand over tire when inflating. Bead may break when bead snaps over rim's safety hump and cause serious personal injury.
Do not exceed specified pressure when inflating. If specified pressure will not seat beads, deflate, re-lubricate and reinflate.
Over inflation may cause bead to break and cause serious personal injury.

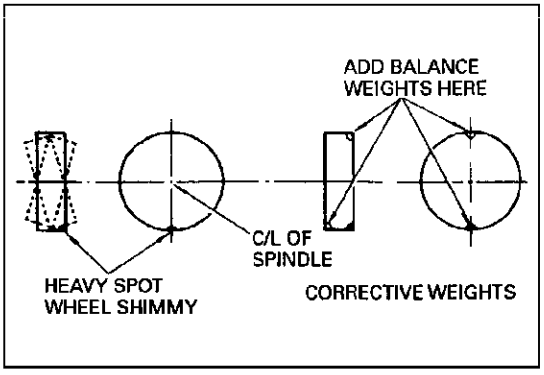
TIRE REPAIR

There are many different materials and techniques on the market to repair tires. As not all of these work on all types of tires, tire manufacturers have published detailed instructions on how and when to repair tires. These instructions can be obtained from each tire manufacturer.

BALANCING WHEELS



There are two types of wheel and tire balance: static and dynamic. Static balance, as shown in left figure, is the equal distribution of weight around the wheel. Wheels that are statically unbalanced cause a bouncing action called tramp. This condition will eventually cause uneven tire wear.



Dynamic balance, as shown in left figure, is the equal distribution of weight on each side of the 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.

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GENERAL BALANCE PROCEDURES

Deposits of mud, etc. must be cleaned from inside of rim.

> **WARNING:**
> **Stones should be removed from the tread in order to avoid operator injury during spin balancing and to obtain good balance.**

Each tire should be inspected for any damage, then balanced according to equipment manufacturer's recommendation.

OFF-VEHICLE BALANCING

Most electronic off-vehicle balancers are more accurate than the on-vehicle spin balancers. They are easy to use and give a dynamic (two plane) balance. Although they do not correct for drum or disc unbalance as does on-vehicle spin balancing, this is overcome by their accuracy, usually to within 1/8 ounce.

ON-VEHICLE BALANCING

On-vehicle balancing methods vary with equipment and tool manufacturers. Be sure to follow each manufacturer's instructions during balancing operation.

> **WARNING:**
> **Wheel spin should be limited to 55 km/h (35 mph) as indicated on speedometer.**
> **This limit is necessary because speedometer only indicates one-half of actual wheel speed when one drive wheel is spinning and the other drive wheel is stopped.**
> **Unless care is taken in limiting drive wheel spin, spinning wheel can reach excessive speeds. This can result in possible tire disintegration or differential failure, which could cause serious personal injury or extensive vehicle damage.**

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SECTION 4A

FRONT DRIVE SHAFT

CONTENTS

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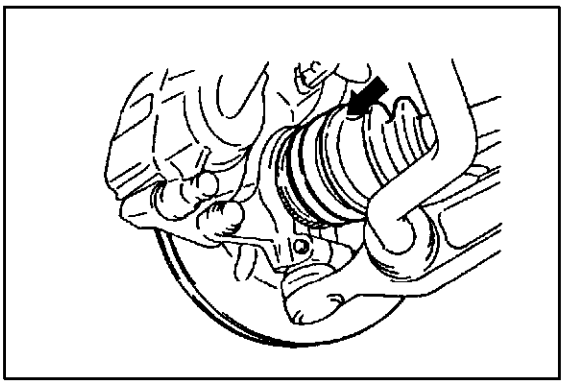
GENERAL DESCRIPTION

A constant velocity double offset joint (DOJ) is used on the differential side of the left side drive shaft assembly.
A constant velocity tripod joint is used on the differential side of the right side drive shaft assembly.
A constant velocity ball joint is used on the wheel side of both right and left drive shaft assemblies. The drive shaft can slide through the tripod joint or DOJ in the extension/contraction direction.

DIAGNOSIS

DIAGNOSIS TABLE

Condition	Possible Cause	Correction
Abnormal Noise	Worn or breakage drive shaft joint	Replace.



DRIVE SHAFT BOOT CHECK

Inspect drive shaft boot for tear.
If even a small tear is found, replace with a new one.

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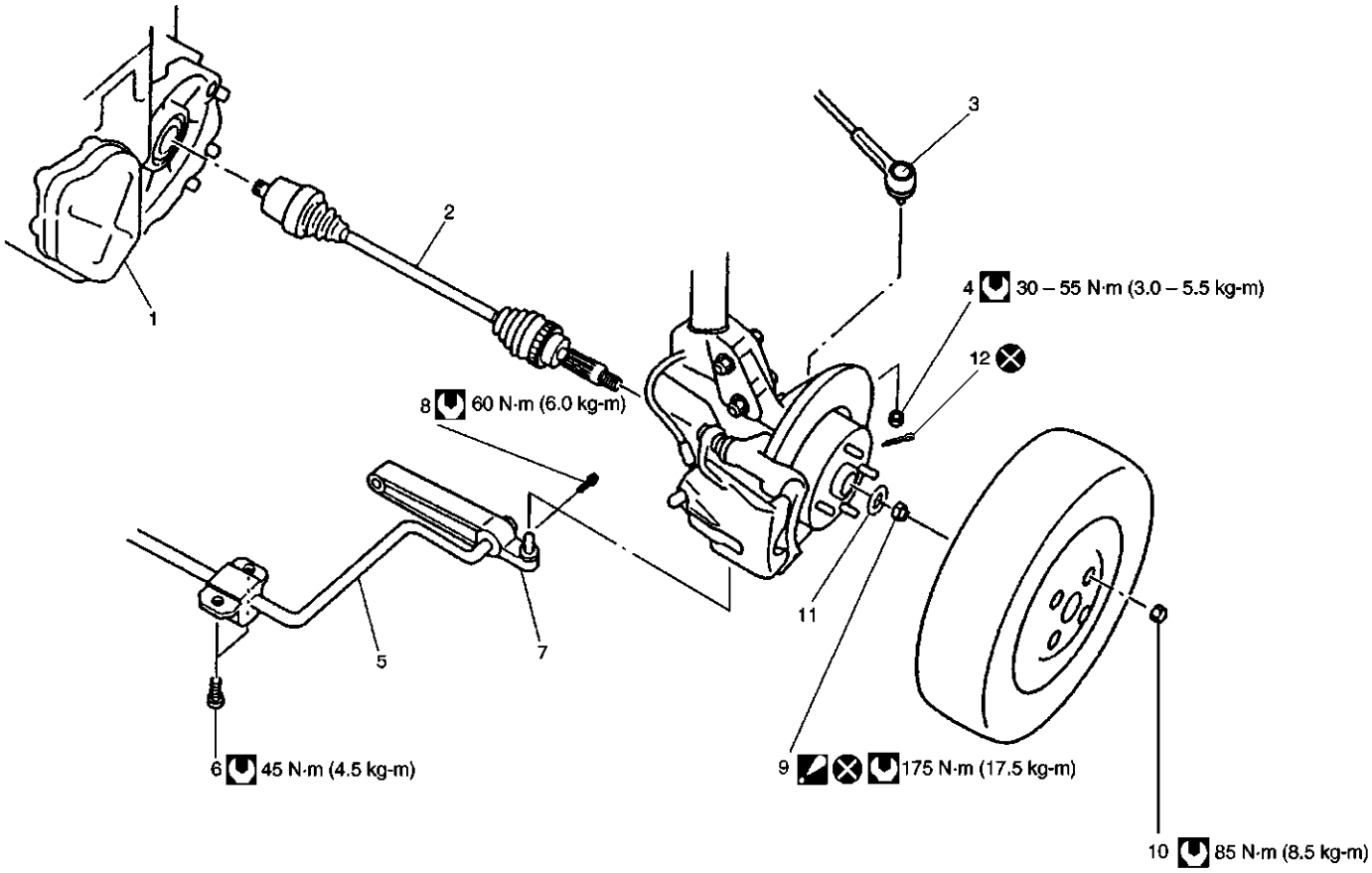
ON-VEHICLE SERVICE

REMOVAL & INSTALLATION



1 Transmission
2 Drive shaft assembly
3 Tie-rod end
4 Tie-rod end nut
5 Stabilizer
6 Stabilizer mount nut
7 Suspension control arm
8. Ball stud bolt
9. Drive shaft nut: Caulk, after tightening
10. Wheel nut
11. Washer
12. Split pin

: Tightening Torque
: Do not reuse

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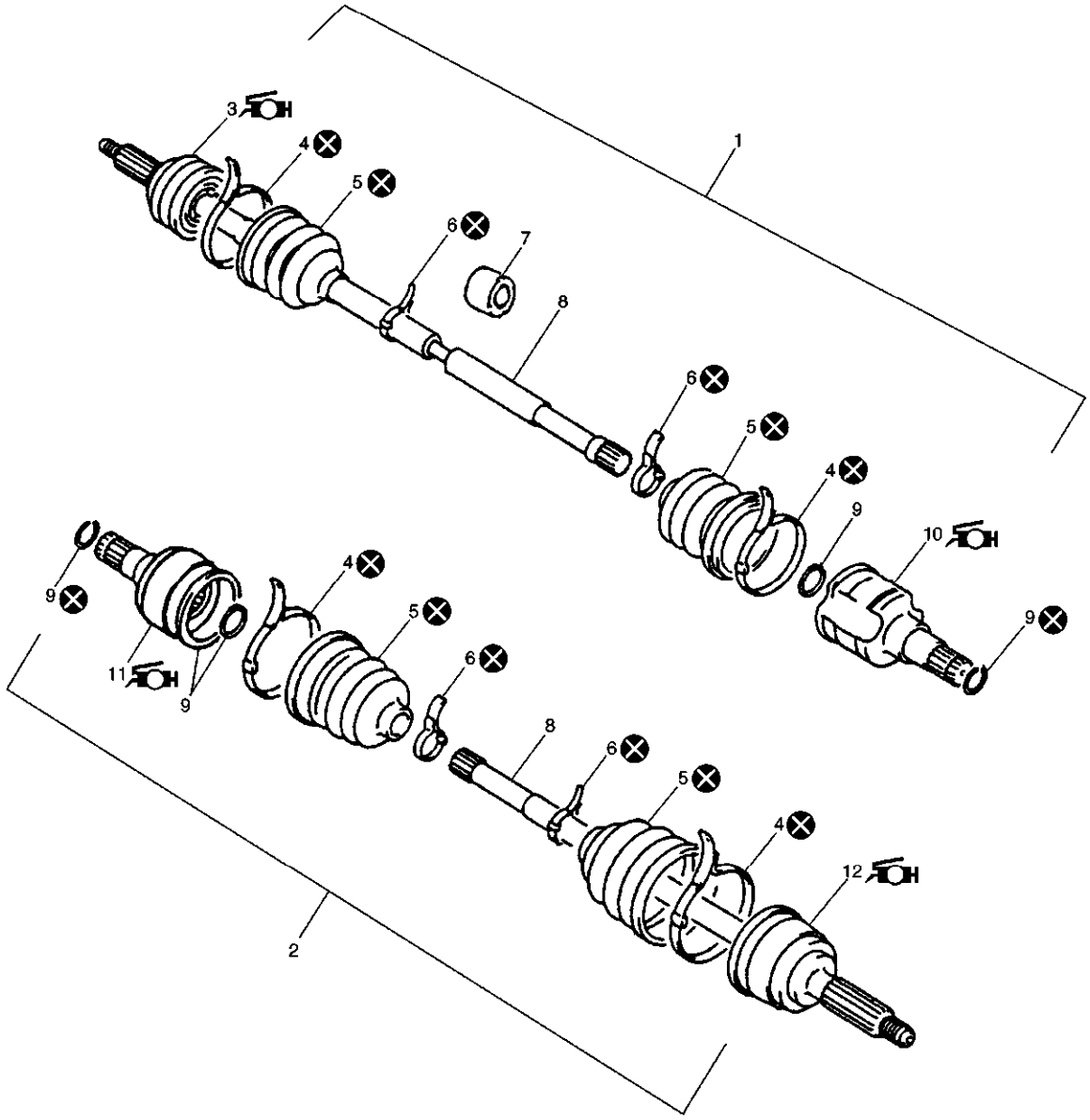
DISASSEMBLY & REASSEMBLY



1. Right side drive shaft assembly
2. Left side drive shaft assembly
3. Wheel side joint (Constant velocity ball joint): Apply gray grease 60 – 80g (2.1 – 2.8 oz) included in spare parts to ball joint.
4. Boot band (large)
5. Boot
6. Boot band (small)
7. Damper
8. Drive shaft
9. Circlip
10. Differential side joint (Constant velocity tripod joint): Apply green grease 90 – 110g (3.2 – 3.9 oz) included in spare part to tripod joint)
11. Differential side joint (Constant velocity DOJ): Apply gray grease 55 – 75g (1.9 – 2.6 oz) included in spare parts to DOJ.
12. Wheel side joint (Constant velocity ball joint): Apply gray grease 60 – 80 g (2.1 – 2.8 oz) included in spare parts to ball joint.

⊗ Do not reuse

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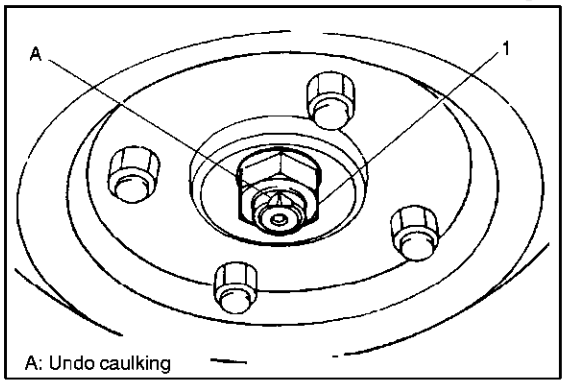
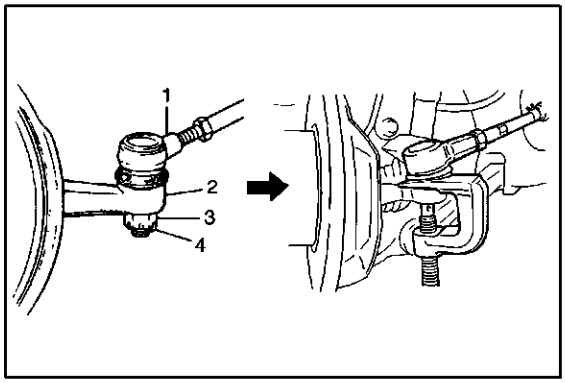


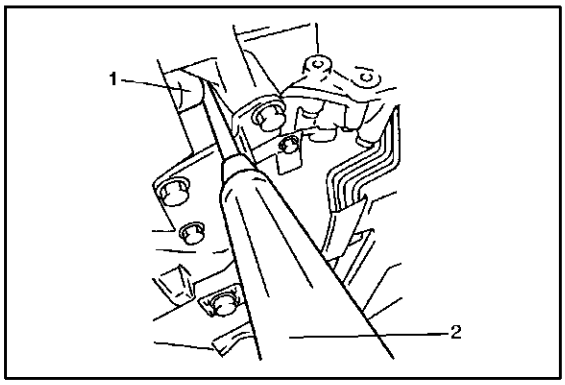
DRIVE SHAFT ASSEMBLY

REMOVAL

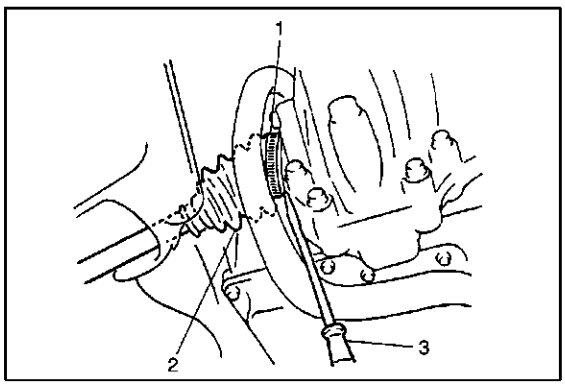
1) Undo caulking and remove drive shaft nut (1) and washer.



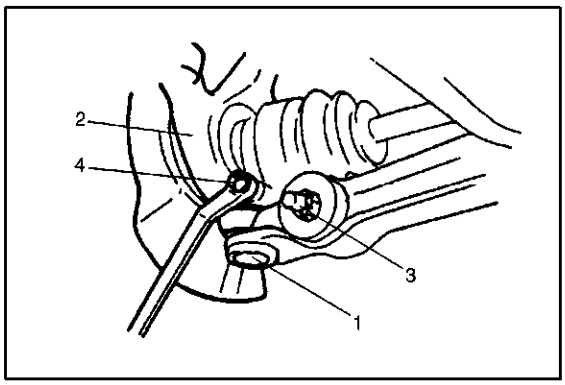
2) Hoist vehicle.
3) Remove wheel.
4) Remove tie-rod end split pin (4) and castle nut (3).
5) Disconnect tie-rod end (1) from steering knuckle (2) using puller.
6) Drain transmission fluid.



7) Disconnect drive shaft joint from differential gear.
   - Pull out drive shaft joint (1) by using large size lever (2) so as to release snap ring fitting of joint spline at differential side.



   - For left side drive shaft assembly of A/T vehicle, install appropriate metal band (1) to left side drive shaft joint (2), and then pull out left side drive shaft joint (2) by using large size lever (3) as shown.



8) Disconnect front suspension control arm ball stud (1) from steering knuckle (2) by pushing down stabilizer bar (3) after removing ball stud bolt (4).

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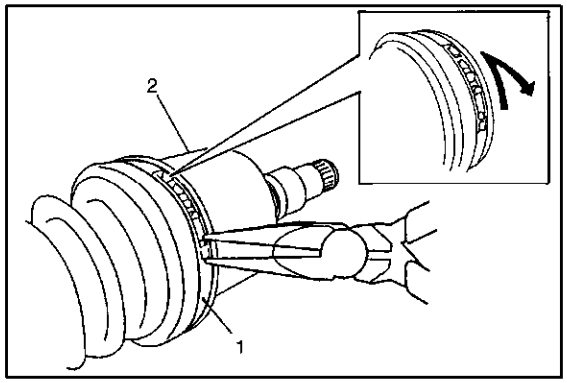
9) Remove drive shaft assembly.

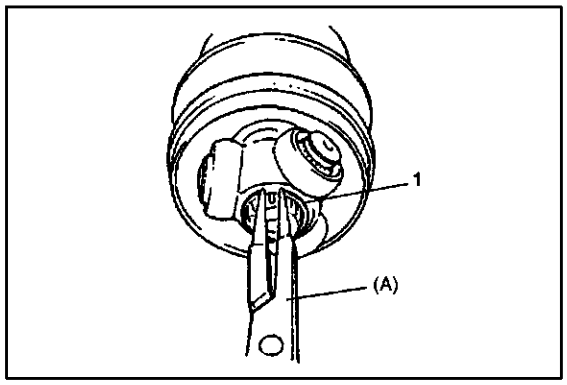
CAUTION:
To prevent breakage of boots, be careful not to bring them into contact with other parts, when removing drive shaft assembly.



DISASSEMBLY

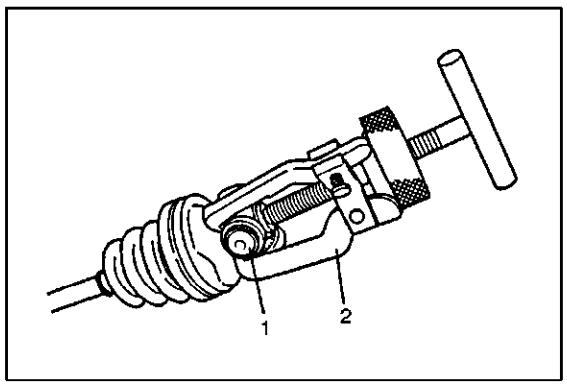
For Tripod joint type drive shaft (Right side)

1) Remove differential side boot band (1), then take out tripod joint housing (2).



2) Wipe off grease from shaft and remove circlip (1) by using special tool.

Special Tool
(A): 09900-06107



3) Remove spider (1) by using 3 arms puller (2).

CAUTION:
To prevent needle bearing of joint from being degreased, do not wash it if it is to be reused.

4) Remove boot band, then pull out differential side boot from shaft.

5) Pull out dynamic damper through shaft.
6) Undo boot bands of wheel side joint boot, then pull out boot through shaft.

CAUTION:
- **Disassembly of wheel side joint is not allowed. If noise or damage exists in it, replace it as assembly.**
- **Do not disassemble tripod joint spider. If any malfunction is found in it, replace it as differential side joint assembly.**

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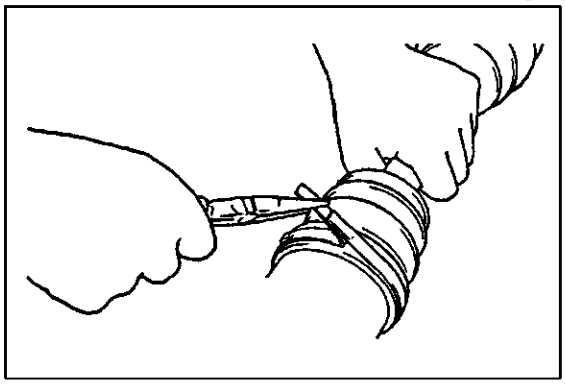
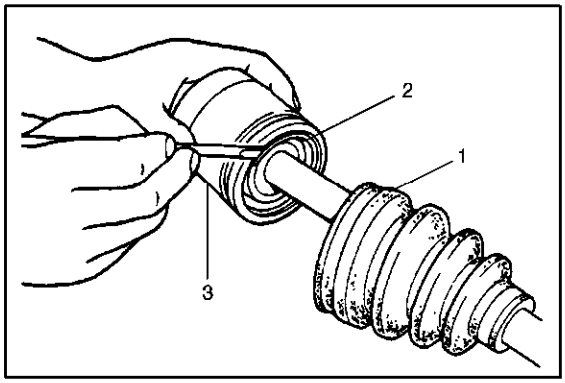
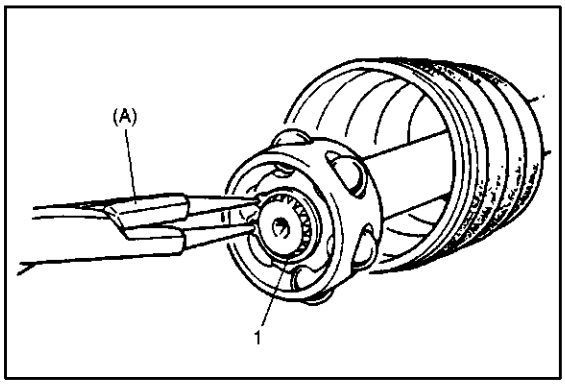


For DOJ type drive shaft (Left side)

1) Remove boot band (1) of differential side joint.



2) Slide boot (1) toward the center of shaft and remove snap ring (2) from outer race, then take shaft out of outer race (3).



3) Wipe off grease from shaft and remove circlip (1) used to fix cage by using special tool.

Special Tool
(A): 09900-06107

4) Remove cage by hand and remove boot from shaft.

NOTE:
Do not disassemble wheel side joint (outboard joint). If any malfunction is found in any joint, replace it as assembly.

INSPECTION

- Inspect boots for breakage or deterioration.
  Replace them as necessary.
- Inspect circlip, snap ring and boot bands for breakage or deformation. Replace them as necessary.

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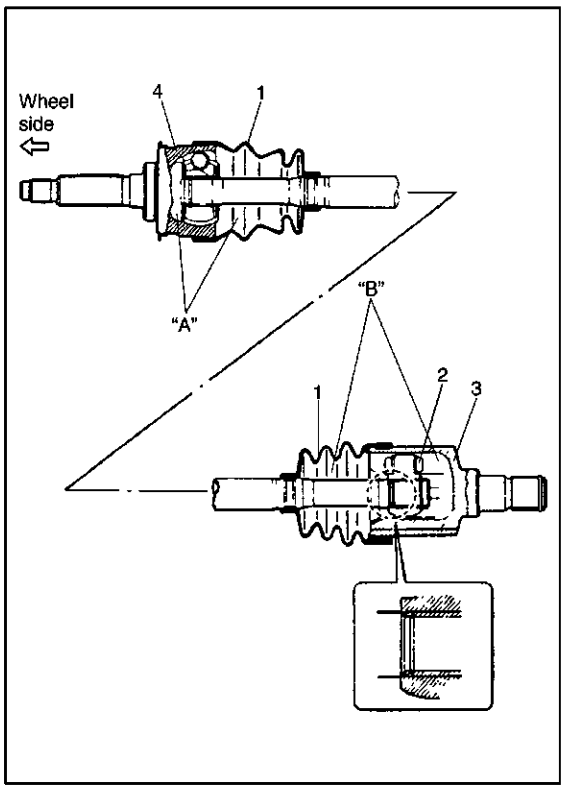
REASSEMBLY

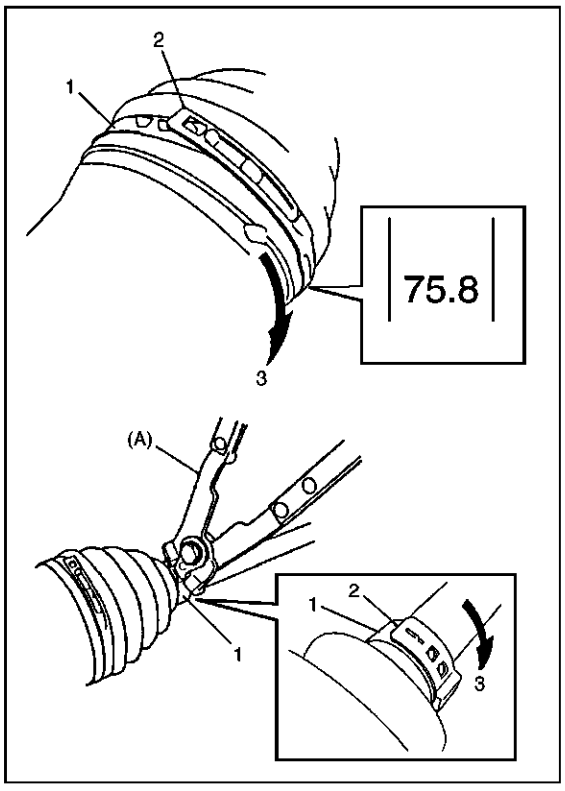
Judging from abnormality noted before disassembly and what is found through visual check of component parts after disassembly, prepare replacing parts and proceed to reassembly.



For Tripod joint type drive shaft (Right side)

CAUTION:

- **To prevent any problem caused by washing solution, do not wash joint boots (1) and tripod joint (2) except its housing (3) and wheel side joint assembly (4). Degreasing of those parts with cloth is allowed.**
- **To ensure full performance of joint as designed, be sure to distinguish between two types of grease in repair set and apply specified volume to respective joint.**
  "A": Gray grease
  60 – 80 g (2.1 – 2.8 oz)
  "B": Green grease
  90 – 110 g (3.2 – 3.9 oz)
- **Do not squeeze or distort boot (1) when fastening it with bands. Distorted boot caused by squeezing air may reduce its durability.**



1) Wash disassembled parts (except boots and tripod joint spider with needle bearings). After washing, dry parts completely by blowing air.
2) Clean boots with cloth. Do not wash boots in degreaser, such as gasoline or kerosene, etc. Washing in degreaser causes deterioration of boot.
3) Apply grease to wheel side joint. Use Gray grease included in wheel side boot set.
4) Install wheel side boot on shaft.
5) Fill up boot inside with grease.
6) Place new bands (1) onto boot putting band outer ends (2) against forward rotation (3) as shown in figure.
7) Confirm that boot is not stretched or contracted and fasten boot small band securely at that position.

Special Tool
(A): 09943-55010

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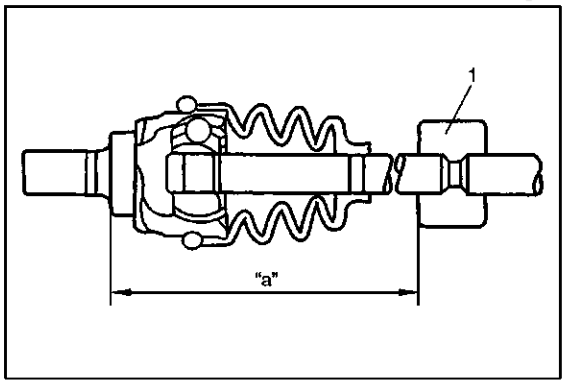
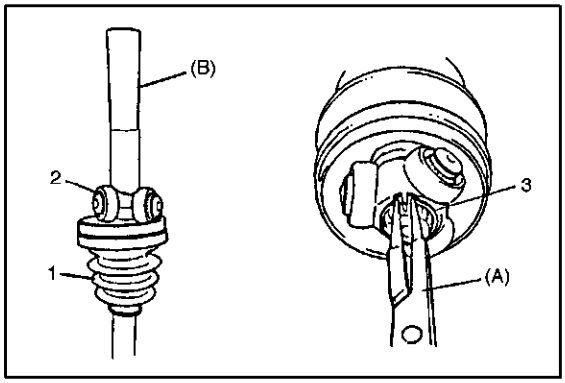


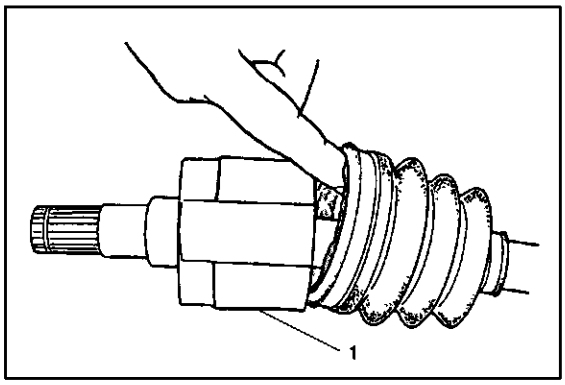
8) Install dynamic damper (1) on right side drive shaft groove according to dimension specified below.

Length "a": 313 mm (12.3 in.)

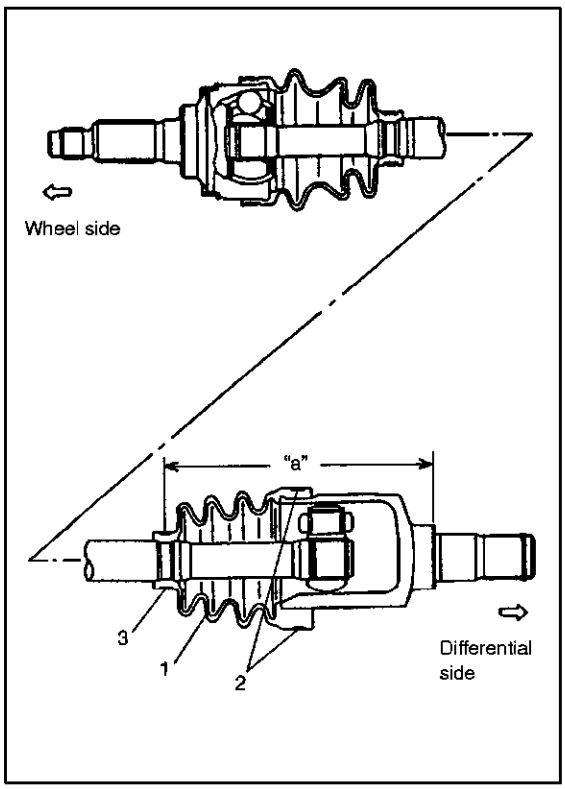


9) Install differential side boot (1) on shaft.
10) Install tripod joint spider (2) on shaft by using special tool with hammer, facing its chamfered spline inward (wheel side), then fasten it with circlip (3).

Special Tool
(A): 09900-06107
(B): 09913-80112



11) Apply grease to tripod joint and inside of housing (1).
Use green grease in tube included in spare parts.
Install housing to joint and fit boot to housing.



12) Adjust so that measurements become as indicated below.
Insert screwdriver into boot on outer race side and allow air to enter boot so that air pressure in boot becomes the same as atmospheric pressure.

Length "a": 146.2 – 184.8 mm (5.76 – 7.28 in.) MT Vehicle
133.4 – 172.0 mm (5.25 – 6.78 in.) AT Vehicle

13) Fix boot (1) with boot bands (2) and (3) at that position of step 12) in the same procedure as previous step 6).

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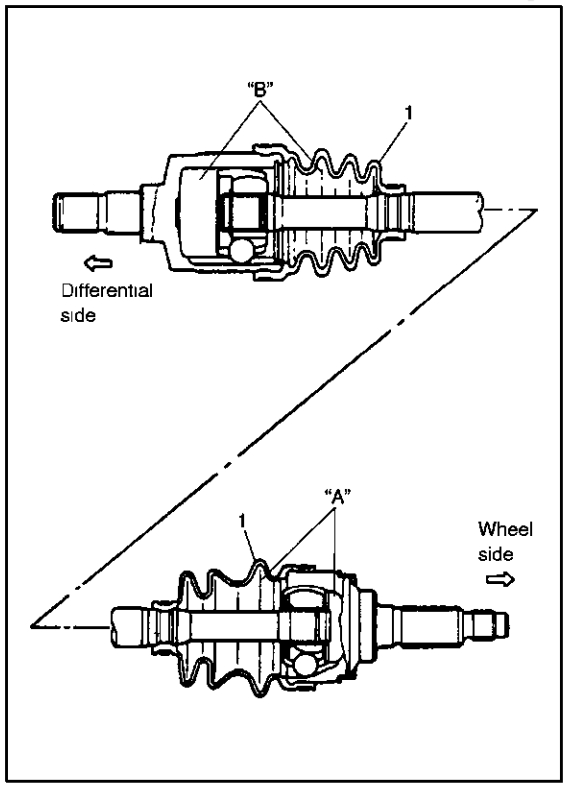
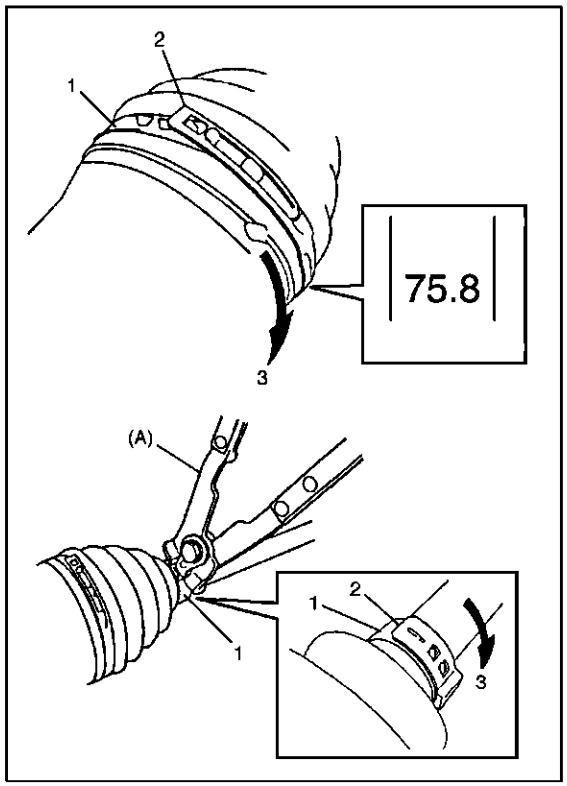


For DOJ type drive shaft (Left side)

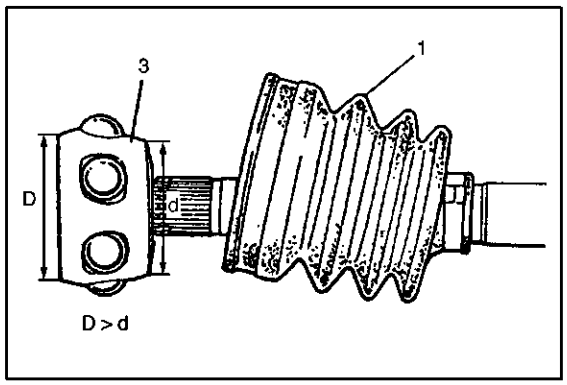
CAUTION:

- **To prevent any problem caused by washing solution, do not wash joint boots (1). Degreasing of those parts with cloth is allowed.**
- **To ensure full performance of joint as designed, apply specified volume grease in repair set to respective joint.**
  "A": Gray grease
  60 – 80 g (2.1 – 2.8 oz)
  "B": Gray grease
  55 – 75 g (1.9 – 2.6 oz)
- **Do not squeeze or distort boot (1) when fastening it with bands. Distorted boot caused by squeezing air may reduce its durability.**



1) Wash disassembled parts (except boots). After washing, dry parts completely by blowing air.
2) Clean boots with cloth. Do not wash boots in degreaser, such as gasoline or kerosene, etc. Washing in degreaser causes deterioration of boot.
3) Apply grease to wheel side joint. Use Gray grease included in wheel side boot set.
4) Install wheel side boot on shaft.
5) Fill up boot inside with grease.
6) Place new bands (1) onto boot putting band outer ends (2) against forward rotation (3) as shown in figure.
7) Confirm that boot is not stretched or contracted and fasten boot small band securely at that position.

Special Tool
(A): 09943-55010



8) Install differential side boot (1) on shaft.
9) Install cage (3) by hand.

CAUTION:
Install cage directing smaller outside diameter side to wheel side.

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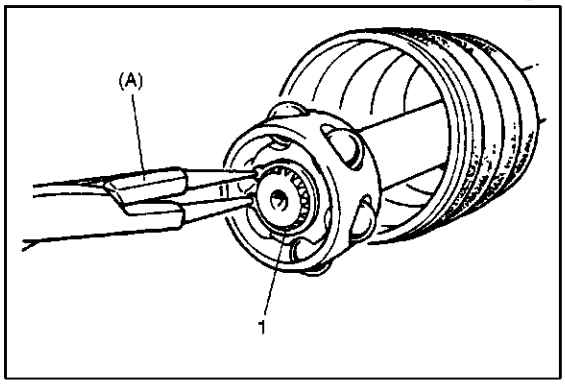
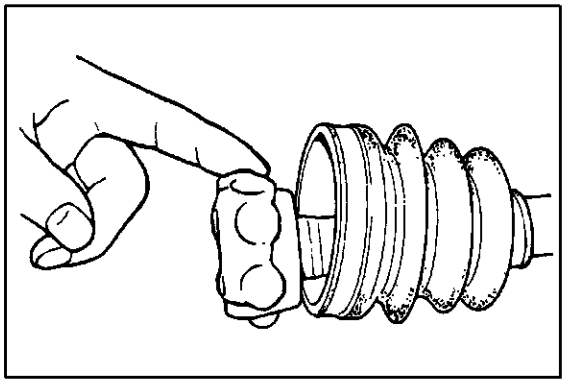
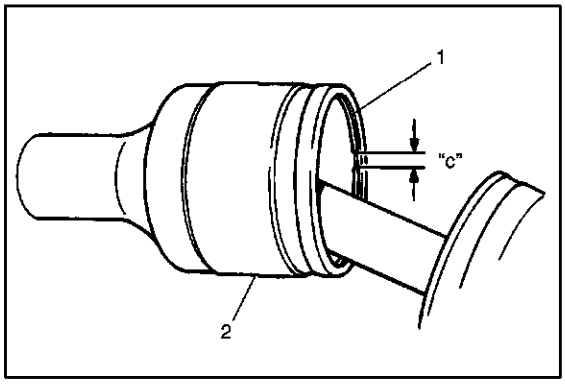


10) Install circlip (1) by using special tool.

Special Tool
(A): 09900-06107

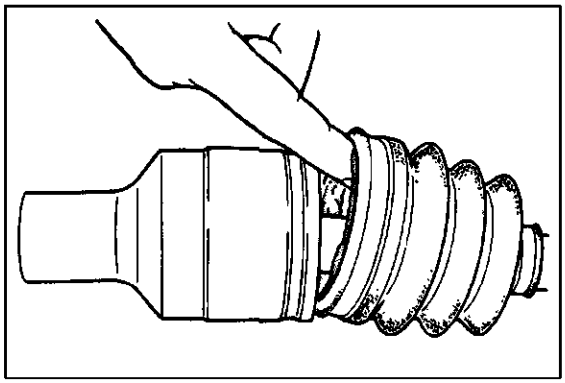


11) Apply grease to entire surface of cage and inside of boot. Use gray grease in tube included in spare parts.



12) Insert cage into outer race and fit snap ring (1) into groove of outer race (2).

CAUTION:
Position opening of snap ring "c" so that it will not be lined up with a ball.



13) Apply grease to inside of outer race, and fit boot to outer race.

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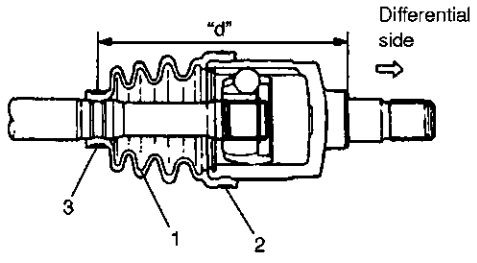
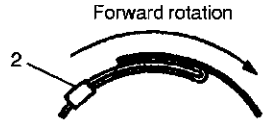
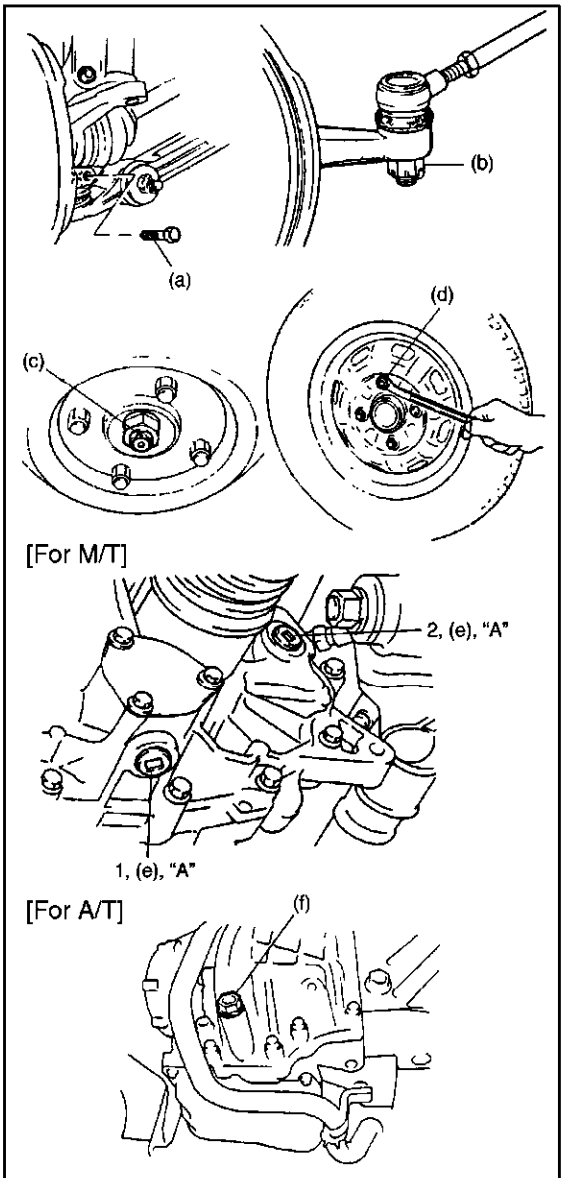




14) Adjust so that measurements "d" become as specified. Insert screwdriver into boot on outer race side and allow air to enter boot so that air pressure in boot becomes the same as atmospheric pressure.

Length "d": 144.5 – 191.0 mm (5.69 – 7.52 in.) M/T vehicle
131.5 – 178.0 mm (5.18 – 7.01 in.) A/T vehicle

15) Fix boot (1) with boot bands (2) and (3) at that position of step 14) as shown in figure.



INSTALLATION

CAUTION:
- **To avoid excessive expansion of boot and consequential disconnection of joint in boot, do not pull differential side joint housing.**
- **Protect boots from any damage, preventing them from unnecessary contact while installing drive shaft.**
- **Do not hit joint boot with hammer. Inserting joint only by hands is allowed.**
- **Make sure that differential side joint is inserted fully and its snap ring is seated as it was.**

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

- Tighten each bolts and nuts to the specified torque.

Tightening Torque
(a): 60 N·m (6.0 kg-m, 43.5 lb-ft)
(b): 30 – 55 N·m (3.0 – 5.5 kg-m, 22.0 – 39.5 lb-ft)
(c): 175 N·m (17.5 kg-m, 127.0 lb-ft)
(d): 85 N·m (8.5 kg-m, 61.5 lb-ft)
(e): 21 N·m (2.1 kg-m, 15.5 lb-ft)
(f): 40 N·m (4.0 kg-m, 29.0 lb-ft)

- Apply sealant to drain plug (1) and level/filler plug (2) for manual transmission.

"A": Sealant 99000-31110

- Fill transmission with oil or fluid as specified. (Refer to SECTION 7A or 7B.)

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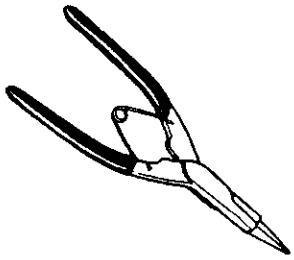
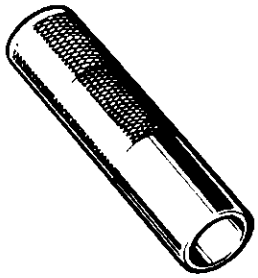
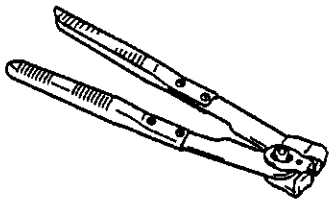
REQUIRED SERVICE MATERIAL

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	Oil drain and filler plug for manual transmission

SPECIAL TOOLS

 09900-06107 Snap ring pliers (Open type)	 09913-80112 Bearing installer	 09943-55010 Boot clamp plier

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SECTION 5

BRAKES

NOTE:

- **All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.**

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GENERAL DESCRIPTION

When the foot brake pedal is depressed, hydraulic pressure is developed in the master cylinder to actuate pistons (two in front and two in rear).

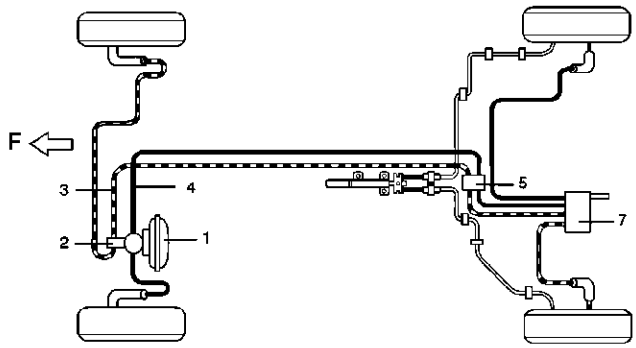
The master cylinder is a tandem master cylinder. The brake pipes are connected to the master cylinder and they make two independent circuits. One connects front right & rear left brakes and the other connects front left & rear right brakes.

The proportioning valve (P valve) is included in these circuits between the master cylinder and rear wheels. In this brake system, the disc brake type is used of 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.

FOR LEFT-HAND STEERING VEHICLE

[A]



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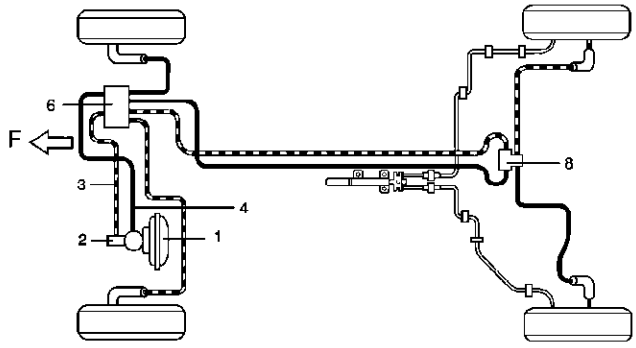
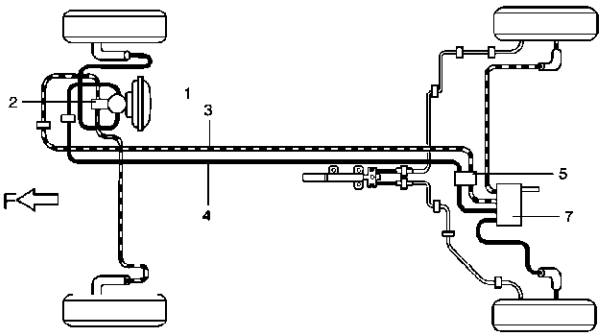


FOR RIGHT-HAND STEERING VEHICLE

[A]



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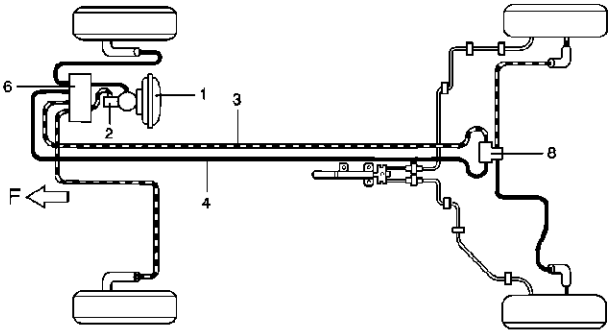

1. Brake booster	5. 4-way joint	F Forward
2. Master cylinder	6. ABS hydraulic unit/control module assembly	[A]. For Vehicle without ABS
3. Secondary side	7. LSPV (Load Sensing Proportioning valve)	[B]. For vehicle with ABS
4. Primary side	8. P (Proportioning) valve	

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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 one of piston cups are swollen, rubber parts have deteriorated. This deterioration may also be evidenced by swollen wheel cylinder piston cups into 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 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.

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DIAGNOSIS TABLE

Condition	Possible Cause	Correction
Not enough braking force	• Brake fluid 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.
	• Mal-adjusted sensor spring length of LSPV, (if equipped).	Check or adjust.
	• Broken sensor spring of LSPV, (if equipped)	Replace
	• Defective LSPV, (if equipped)	Replace
	• Malfunctioning ABS (Antilock brake system), (if equipped).	Check system and replace as necessary.
Brake pull (Brakes not working in unison)	• Pad or shoe linings are wet with water or stained with oil in some brakes.	Replace.
	• Drum-to-shoe clearance out of adjustment in some brakes. (Malfunctioning auto adjusting mechanism)	Check for inoperative auto adjusting mechanism.
	• Disc and/or drum is out of round in some brakes.	Replace.
	• Wheel tires are inflated unequally.	Inflate equally.
	• Malfunctioning wheel cylinders.	Repair or replace.
	• Disturbed front end alignment.	Adjust as prescribed.
	• Unmatched tires on same axle.	Tires with approximately the same amount of tread should be used on the same axle.
	• Restricted brake pipes or hoses.	Check for soft hoses and damaged lines. Replace with new hoses and new brake pipes.
	• Malfunctioning caliper assembly.	Check for stuck or sluggish pistons and proper lubrication of caliper slide bush. Caliper should slide.
	• Loose suspension parts.	Check all suspension mountings.
	• Loose calipers.	Check and tighten bolts to specified torque.
Noise (high pitched squeak without brake applied)	• Front lining worn out.	Replace linings.
Rear brake locked prematurely	• Maladjusted sensor spring length of LSPV, (if equipped).	Check or adjust.
	• Malfunction LSPV assmebly, (if equipped).	Replace assembly.

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DIAGNOSIS TABLE

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.
Brake locked (For vehicle equipped with ABS)	• Malfunctioning ABS	Check system referring to SECTION 5B.
Dragging brakes (A very light drag is present in all brakes immediately after pedal is released)	• Master cylinder pistons not returning correctly.	Repair master cylinder.
	• Restricted brake pipes or hoses.	Check for soft hoses or damaged pipes and replace with new hoses and/or new brake pipes.
	• 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.	Repair or replace.
	• Wheel cylinder or caliper piston sticking.	Repair as necessary.
	• Badly worn piston seal in the caliper.	Replace piston seal.
Pedal pulsation (Pedal pulsates when depressed for braking.)	• Damaged or loose wheel bearings.	Replace wheel bearings.
	• Distorted steering knuckle or rear wheel spindle.	Replace knuckle or rear wheel spindle.
	• 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 within specifications, replace or machine the disc.
	• Rear drums out of round.	Check runout. Repair or replace drum as necessary.

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DIAGNOSIS TABLE

Condition	Possible Cause	Correction
Braking noise	• Glazed shoe linings, or foreign matters stuck to linings.	Repair or replace shoe linings.
	• Worn or distorted shoe linings.	Replace shoe linings (or pads).
	• Loose front wheel bearing.	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.
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.
Brake warning light fails to turn on even when parking brake is applied	• Brake warning light circuit faulty.	Replace bulb or repair circuit.
ABS warning lamp turns on after engine start (If equipped)	• Malfunctioning ABS	Check system referring to DIAGNOSIS of SECTION 5B.
ABS warning lamp turns on when brake is applied (If equipped)	• Malfunctioning ABS	Check system referring to DIAGNOSIS of SECTION 5B.
ABS warning lamp does not turn on for 2 sec. after ignition switch has turned ON	• Bulb burnt out • Malfunctioning ABS	Replace bulb. Check system referring to DIAGNOSIS of SECTION 5B.
ABS warning lamp flashes	• New ABS hydraulic unit/control module assembly installed.	Perfrom "ABS Hydraulic Unit Operation Check".

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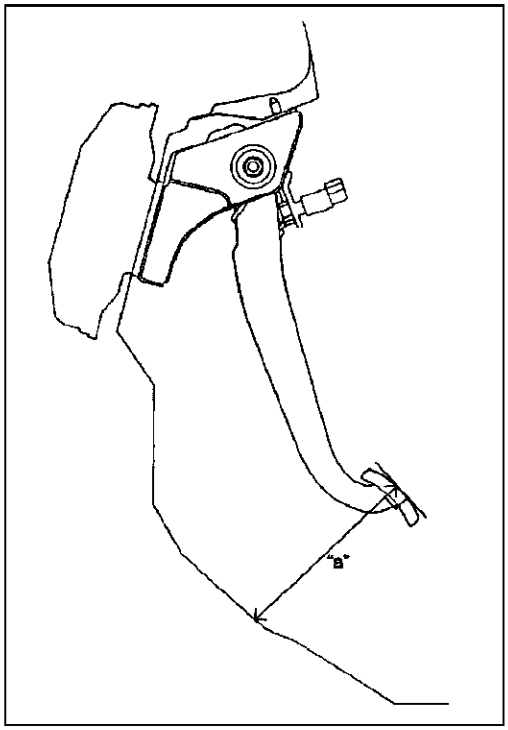


ON-VEHICLE SERVICE

BRAKE PEDAL FREE HEIGHT CHECK

Peel off carpet & dash silencer and check brake pedal free height.

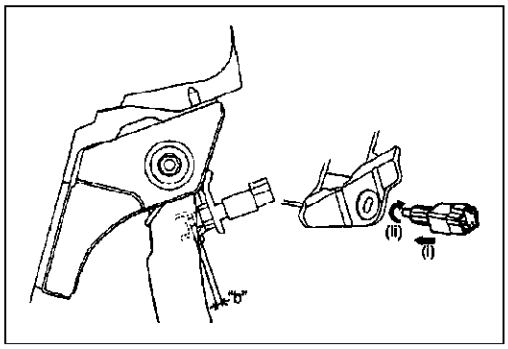
Brake pedal free height "a"

from metal sheet : 175 mm (6.89 in.) ... Right-hand steering vehicle

: 205 mm (8.07 in.) ..... Left-hand steering vehicle

If it is not within specification, check and adjust following items 1) to 4).

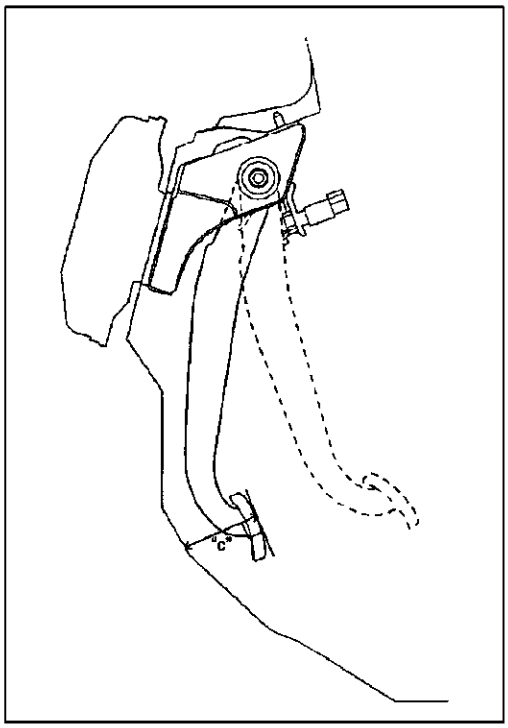
1) Check brake pedal for dent.
2) Check that brake booster is installed securely.
3) Check stop light switch position referring to "BRAKE LIGHT SWITCH ADJUSTMENT" in this section.
4) Check measurement between booster mounting surface and center of clevis pin hole referring to "BRAKE BOOSTER INSPECTION" in this section.



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 thread part end of switch and stay is within specification.

Clearance "b": 0.5 – 1.5 mm (0.02 – 0.06 in.)



EXCESSIVE PEDAL TRAVEL CHECK

1) Peel off carpet & dash silencer and start engine.
2) Depress brake pedal a few times.
3) With brake pedal depressed with approximately 30kg (66 lbs) load, measure brake pedal to wall clearance "c".

   Clearance "c" :
   Over 110 mm (4.33 in.).....Right Hand steering vehicle
   Over 140 mm (5.51 in.).....Left Hand steering vehicle

4) If clearance "c" is less than specification, the most possible cause is either rear brake shoes are worn out beyond limit or air is in lines.
   Should clearance "c" remain less than specification even after replacement of brake shoes and bleeding of system, check brake systems and repair as necessary.

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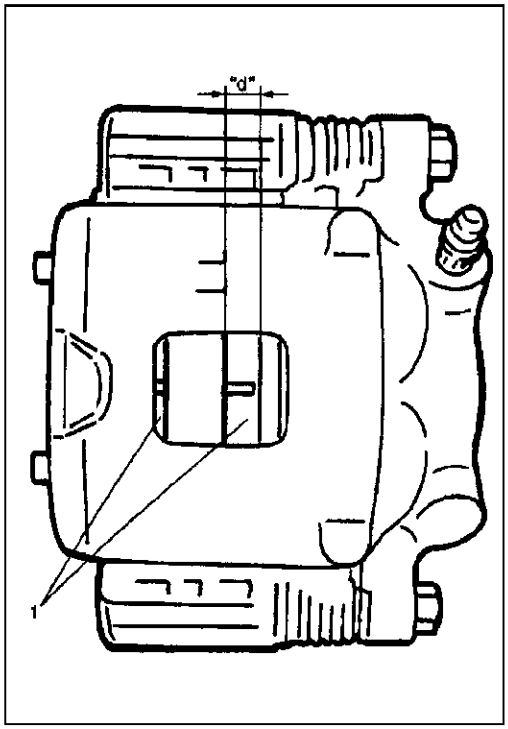
FRONT BRAKE DISC INSPECTION

Refer to "BRAKE PAD" in this section.

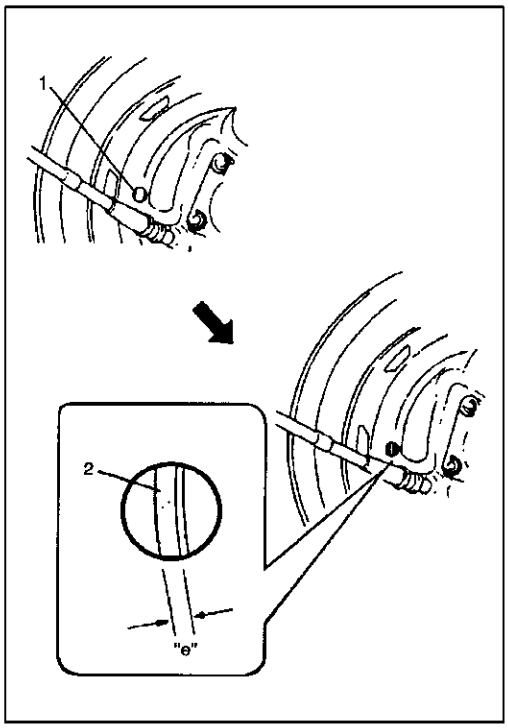


FRONT BRAKE PAD LINING INSPECTION

Inspect pad linings (1) 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 ("d" in figure) is less than limit, all pads must be replaced at the same time.

Thickness "d"

Service limit: 2.0 mm (0.08 in.)



REAR BRAKE SHOE INSPECTION

Inspection should be carried out on the 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 "e" is found less than limit, replace all shoes with new ones at the same time.

   Thickness "e"
   Service limit: 1.0 mm (0.04 in.)

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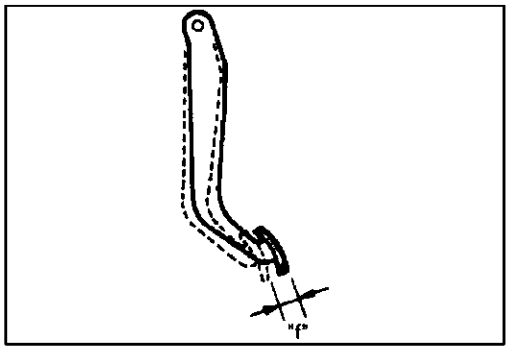


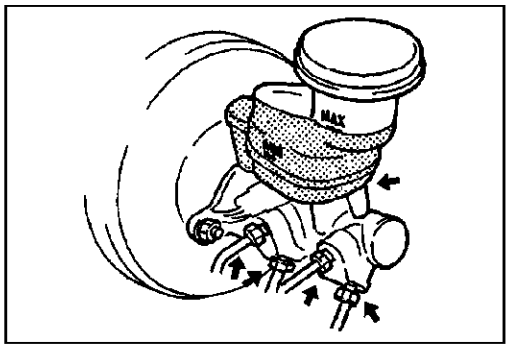
BRAKE PEDAL PLAY INSPECTION

Pedal play should be within specification below.

If out of specification, check stop light switch for proper installation position and adjust if necessary.

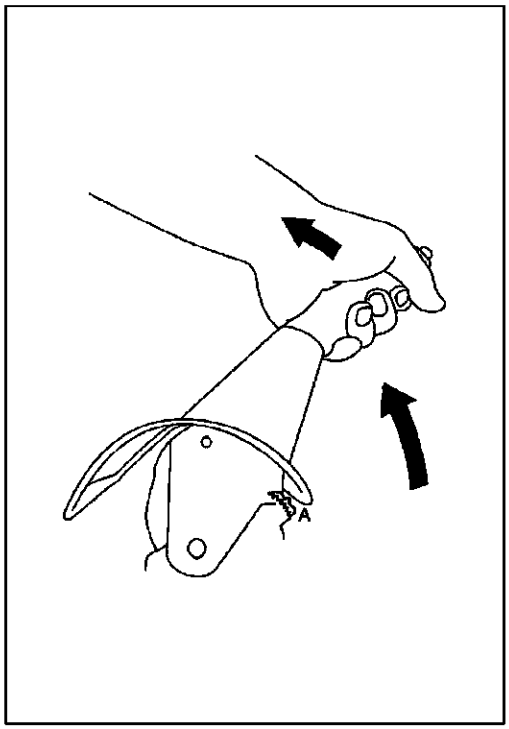
Also check pedal shaft bolt and master cylinder pin installation for looseness and replace if defective.

Pedal play "f ": 1 – 8 mm (0.04 – 0.31 in.)



MASTER CYLINDER INSPECTION

Check for cracked master cylinder casting or brake fluid around the master cylinder. Leaks are indicated only if there is at least a drop of fluid. A damp condition is not normal.



PARKING BRAKE INSPECTION AND ADJUSTMENT

INSPECTION

Hold center of parking brake lever grip and pull it up with about 200 N (20 kg, 44 lbs) force.

With parking brake lever pulled up as above, count ratchet notches in "A" as shown in figure.

There should be 4 to 9 notches.

Also, check if both right and left rear wheels are locked firmly. To count number of notches easily, listen to click sounds that ratchet makes while pulling parking brake lever without pressing its button.

One click sound corresponds to one notch.

If number of notches is out of specification, adjust cable by referring to adjustment procedure so as to obtain specified parking brake stroke.

NOTE:

Check tooth tip of each notch for damage or wear. If any damage or wear is found, replace parking brake lever.

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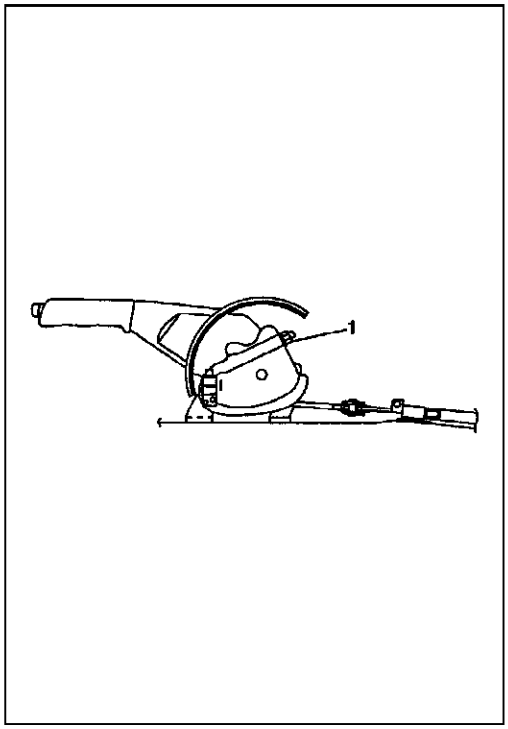

ADJUSTMENT

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 300 N (30 kg, 66 lbs) load.**
- **Parking brake lever has been pulled up a few times with about 200 N (20 kg, 44 lbs) force.**
- **Rear brake shoes are not worn beyond limit.**

After confirming that above conditions are all satisfied, adjust parking brake lever stroke by loosening or tightening adjusting nut (1).

NOTE:
Check brake drum for dragging after adjustment.

Parking brake stroke: when lever is pulled up at about 200 N (20 kg, 44 lbs)	Within 4 – 9 notches

FLUSHING BRAKE HYDRAULIC SYSTEM

It is recommended that entire hydraulic system be thoroughly flushed with clean brake fluid whenever new parts are installed in hydraulic system.

Periodical changing of brake fluid is also recommended.

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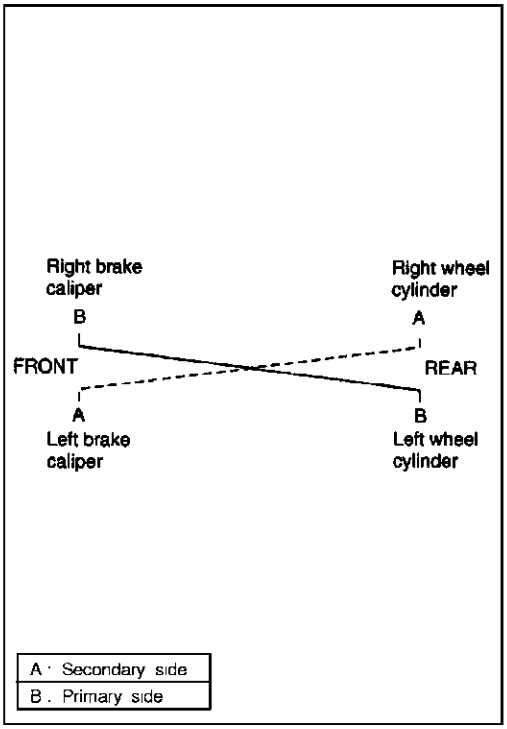


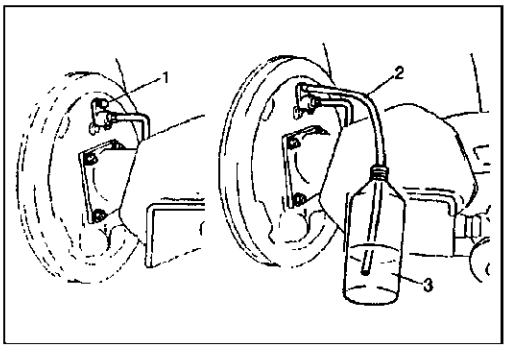
BLEEDING BRAKES

CAUTION:
Brake fluid is extremely damaging to paint. If fluid should accidentally touch painted surface, immediately wipe fluid from paint and clean painted surface.

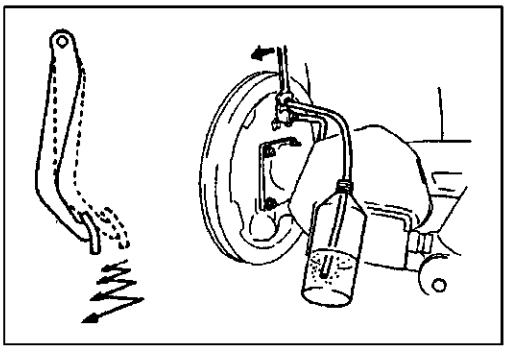
Bleeding operation is necessary to remove air whenever it entered hydraulic brake system.

Hydraulic lines of brake system are based on the diagonal split system. When a brake pipe or hose was disconnected at the wheel, bleeding operation must be performed at both ends of the line of the removed pipe or hose. When any joint part of the master cylinder or other joint part between the master cylinder and each brake (wheel) was removed, the hydraulic brake system must be bled at all 4 wheel brakes.

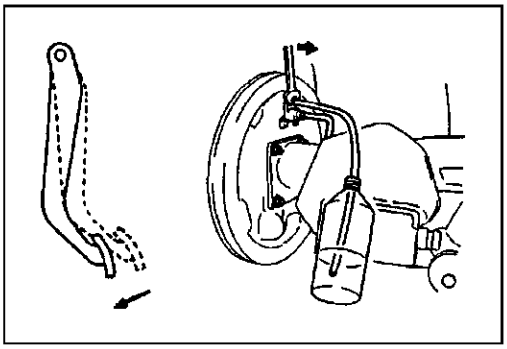
NOTE:
Perform bleeding operation starting with wheel cylinder farthest from master cylinder and then at front caliper of the same brake line. Do the same on the other brake line.



1) Fill master cylinder reservoir with brake fluid and keep at least one-half full of fluid during bleeding operation.
2) Remove bleeder plug cap (1).
   Attach a vinyl tube (2) to bleeder plug of wheel cylinder, and insert the other end into container (3).



3) Depress brake pedal several times, and then while holding it depressed, loosen bleeder plug about one-third to onehalf 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.

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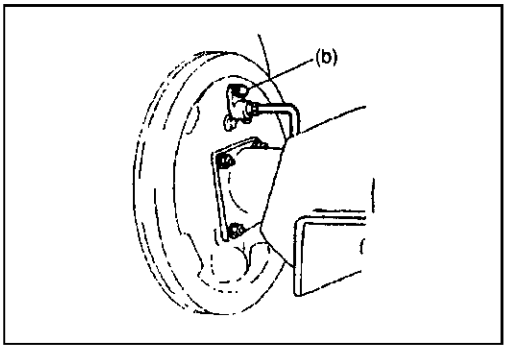
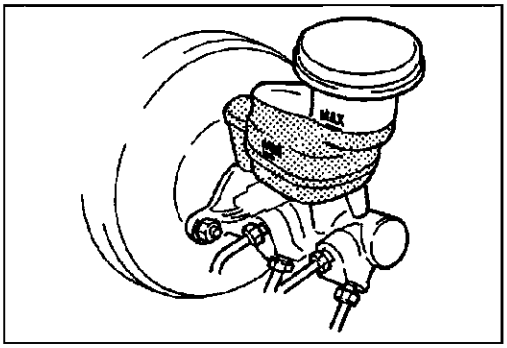


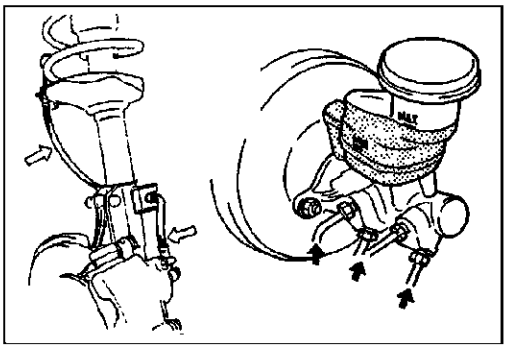
6) When bubbles stop, depress and hold brake pedal and tighten bleeder plug.

Tightening Torque
(b): 8.0 N-m (0.8 kg-m, 5.5 lb-ft)

7) Then attach bleeder plug cap.
8) After completing bleeding operation, apply fluid pressure to pipe line and check for leakage.

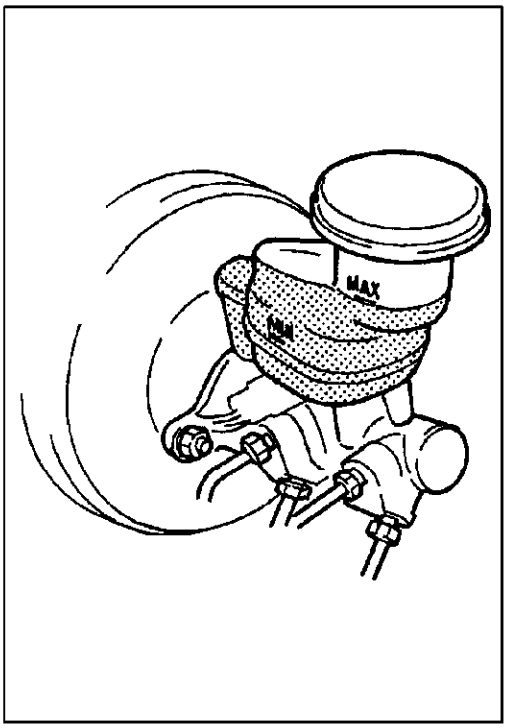


9) Replenish fluid into reservoir up to specified level.
10) Check brake pedal for "sponginess". If found spongy, repeat entire procedure of bleeding.



BRAKE HOSE AND PIPE INSPECTION

The brake hose assembly should be checked for road hazard damage, for cracks and chafing of the outer cover, for leaks and blisters.
A light and mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, it is necessary to replace it.
Inspect the pipe for damage, cracks, dents and corrosion. If any defect is found, replace it.



BRAKE FLUID LEVEL INSPECTION

Be sure to use particular brake fluid either as indicated on reservoir cap of that vehicle or recommended in owner's manual which comes along with that vehicle.
Use of any other fluid is strictly prohibited.
Fluid level should be between MIN and MAX lines marked on reservoir. When warning light lights sometimes during driving, replenish fluid to MAX line.
When fluid decreases quickly, inspect brake system for leakage. Correct leaky points and then refill to specified level.

CAUTION:
Do not use shock absorber fluid or any other fluid which contains mineral oil. Do not use a container which has been used for mineral oil or a container which is wet from water. Mineral oil will cause swelling and distortion of rubber parts in hydraulic brake system and water mixed into brake fluid will lower fluid boiling point. Keep all fluid containers capped to prevent contamination.

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BOOSTER OPERATION INSPECTION

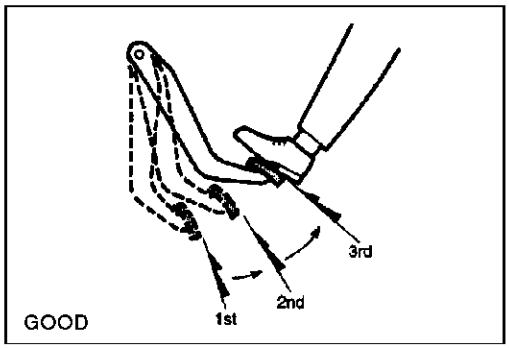
There are two ways to perform this inspection, with and without a tester. Ordinarily, it is possible to roughly determine its condition without using a tester.

NOTE:
For this check, make sure that no air is in hydraulic line.

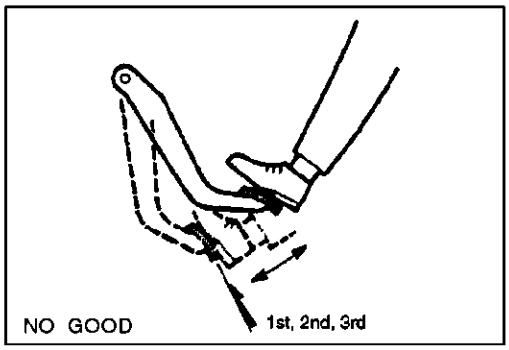
INSPECTION WITHOUT TESTER

Check Air Tightness

1) Start engine.
2) Stop engine after running for 1 to 2 minutes.

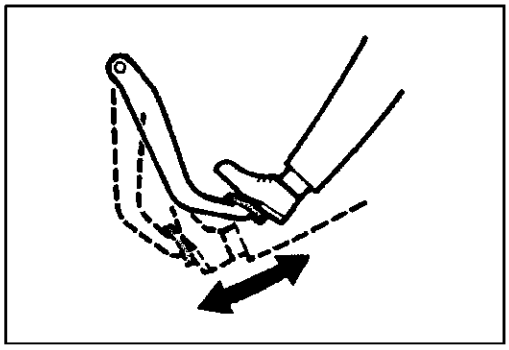


3) Depress brake pedal several times with the same load as in ordinary braking and observe pedal travel. If pedal goes down deep the first time but its travel decreases as it is depressed the second and more times, air tightness is obtained.



4) If pedal travel doesn't change, air tightness isn't obtained.

NOTE:
If defective, inspect vacuum lines and sealing parts, and replace any faulty part.
When this has been done, repeat the entire test.



Check Operation

1) With engine stopped, depress brake pedal several times with the same load and make sure that pedal travel doesn't change.

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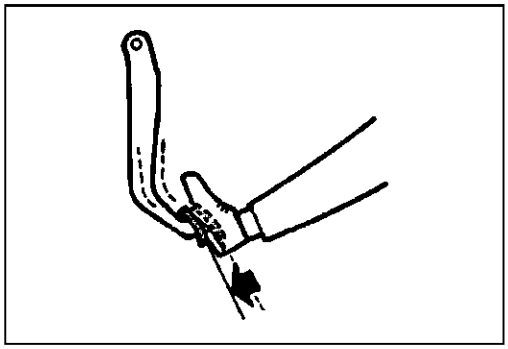
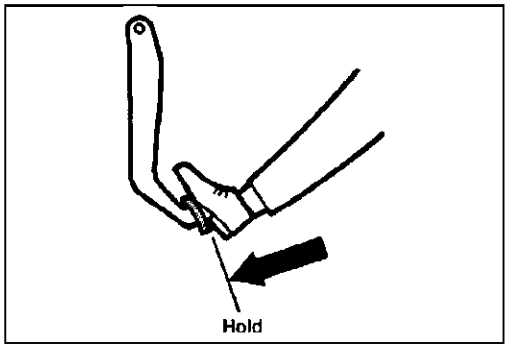
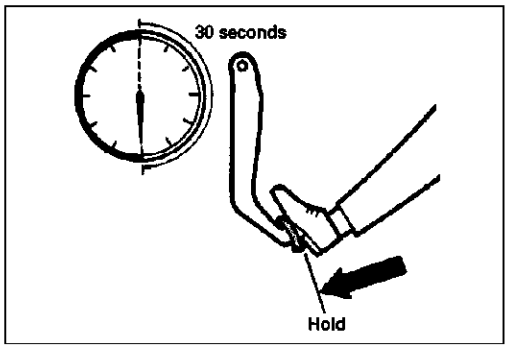


2) Start engine while depressing brake pedal. If pedal travel increases a little, operation is satisfactory. But no change in pedal travel indicates malfunction.



Check Air Tightness Under Load

1) With engine running, depress brake pedal. Then stop engine while holding brake pedal depressed.



2) Hold brake pedal depressed for 30 seconds. If pedal height does not change, condition is good. But it isn't if pedal rises.

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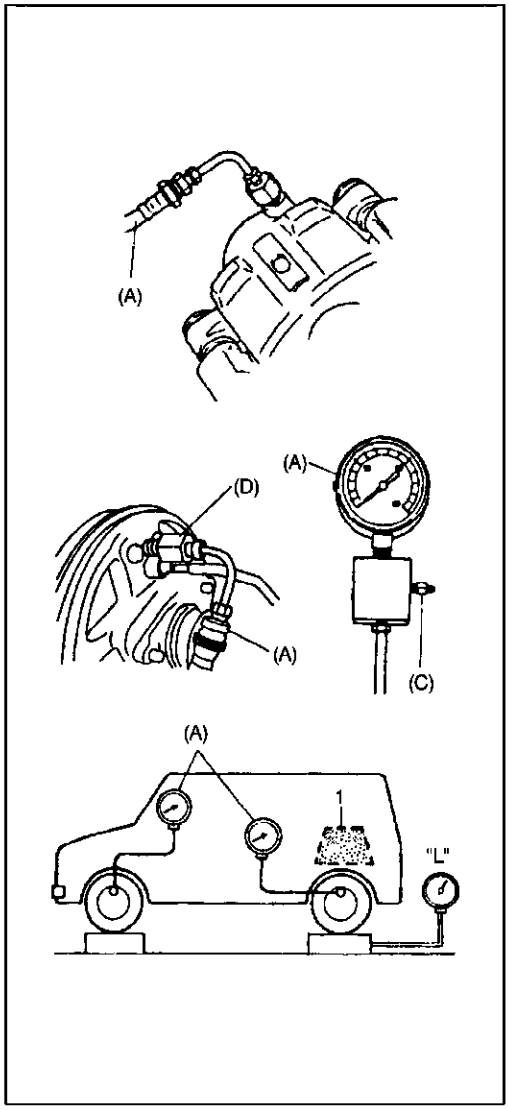
FLUID PRESSURE TEST (IF EQUIPPED WITH LSPV)

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 1,000 N (100kg, 220 lbs) weight (1) on rear housing so that rear axle weighs 4,500 N (450 kg, 992 lbs).

   Rear axle weight
   "L" : 4,500 N (450 kg, 992 lbs)

2) Install special tool to front and rear brake.

   NOTE:
   Pressure gauge should be connected to bleeder plug hole of front (left side brake) and rear (right side brake). After testing front left side and rear right side, test front right side and rear left side in the same way.

For front wheel
Special tool
(A): 09956-02310
(C): 55473-82030 (Air bleeder plug as a spare part)

For rear wheel
Special tool
(A): 09956-02310
(C): 55473-82030 (Air bleeder plug as a spare part)
(D): 09952-36310

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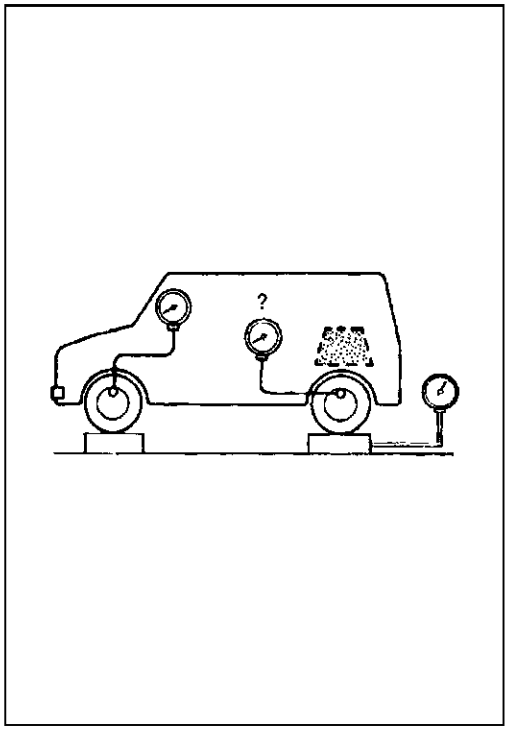


3) Deperss brake pedal gradually till fluid pressure of front brake becomes as specified below and check corresponding pressure of rear brake then. It should be within specificatioin given below.

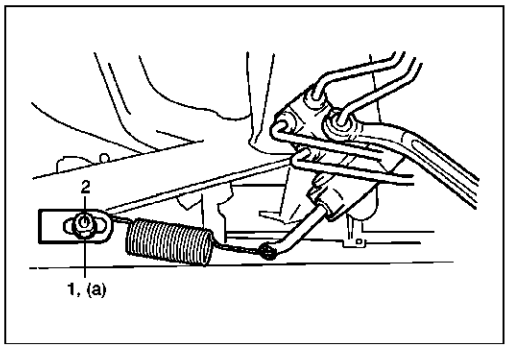
LSPV specification

Front brake	Rear brake
7,500 kPa 75 kg/cm² 1,067 psi	5,405 – 6,660 kPa 54 – 66 kg/cm² 768 – 953 psi

4) As done above, apply 100 kg/cm² pressure to front brake and check that rear brake pressure then is within specification as given below.

LSPV specification (apply 100 kg/cm² pressure to front brake)

Front brake	Rear brake
10,000 kPa 100 kg/cm² 1,422 psi	6,100 – 7,410 kPa 61 – 74 kg/cm² 868 – 1,053 psi



5) If rear brake pressure is not within specification, adjust it by changing bolt (2) position as follows.
   - If rear brake pressure is higher than specification, move bolt (2) center side and if it is lower, out side.
   - Repeat steps 3) and 4) until rear brake pressure is within specification.
   - After adjustment, be sure to torque nut (1) to specification.

   Tightening torque
   LSPV nut (a): 23 N-m (2.3 kg-m, 17.0 lb-ft)

6) Upon completion of fluid pressure test, bleed brake system and perform brake test.

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BRAKE HOSE/PIPE

FRONT BRAKE HOSE/PIPE

REMOVAL

1) Raise and support vehicle properly. Remove tire and wheel.

   NOTE:
   This operation is not necessary when removing pipes connecting master cylinder.

2) Clean dirt and foreign material from both flexible hose ends and pipe end fittings.
3) Drain brake fluid in reservior.

CAUTION:
Do not allow brake fluid to get on painted surface. Painted surface will be damaged by brake fluid, flush it with water immediately if any fluid is spilled.

4) Remove brake flexible hose or pipe.

INSTALLATION

Reverse brake flexible hose installation procedure, noting the followings.

- Make sure that steering wheel is in straight-forward position and flexible hose has not twist or kink.
- Check to make sure that flexible hose doesn't contact any part of suspension, both in extreme right and extreme left turn conditions. If it does at any point, remove and connect. Fill and maintain brake fluid level in reservoir.
- Bleed brake system. Refer to "AIR BLEEDING OF BRAKE SYSTEM" in this section.
- Perform brake test and check installed part for fluid leakage.

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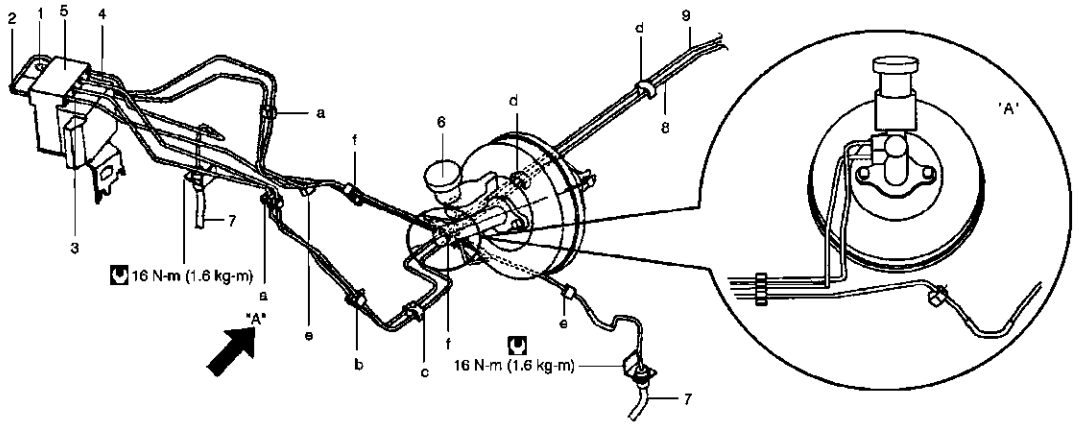
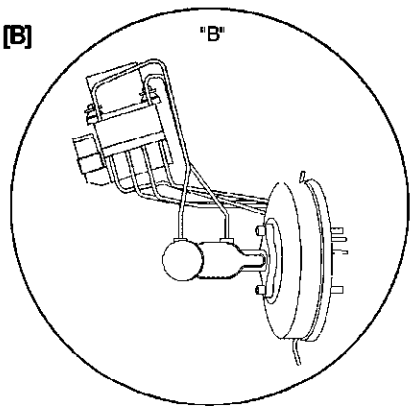
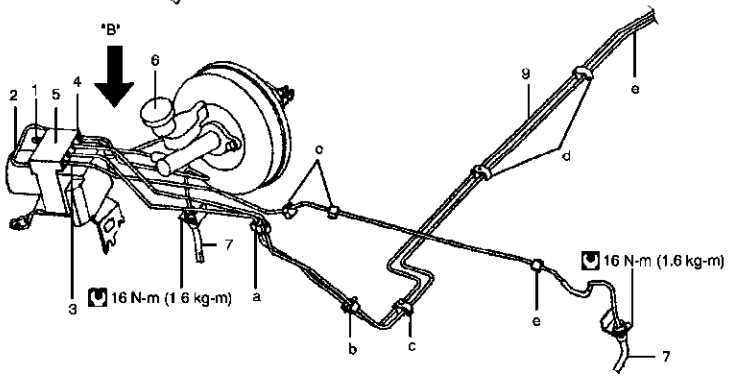
For vehicle with ABS

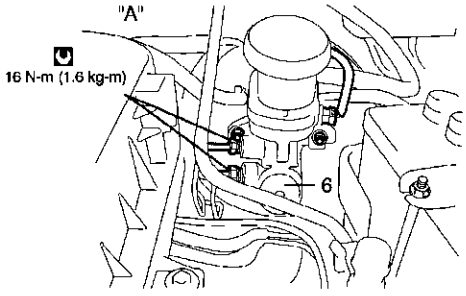
[A]

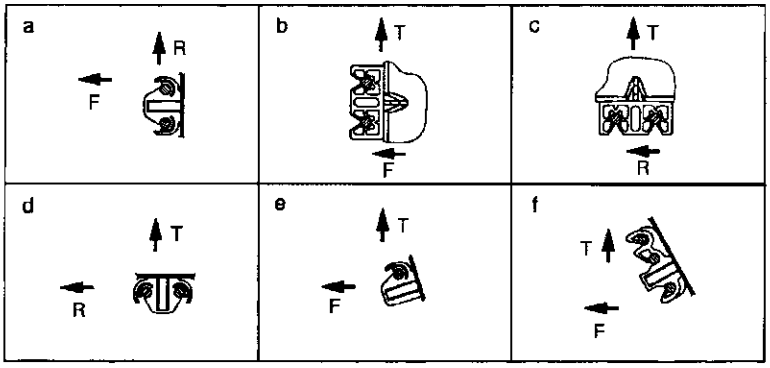


[B]









T Top side	1. From master cylinder primary to ABS hydraulic unit	8. From ABS hydraulic unit to P valve (to left side rear brake)	
F Front sied	2. From master cylinder secondary to ABS hydraulic unit		
R Right side	3. From ABS hydraulic unit to left front brake	9 From ABS hydraulic unit to P vlave (to right side rear brake)	
"A": View "A"	4 From ABS hydraulic unit to right front brake		
"B". View "B"	5. ABS hydraulic unit	: Tightening torque	
[A]: For left-hand steering vehicle	6. Master cylinder	a-f. Clamp	
[B]: For right-hand steering vehicle	7. Front brake hose		

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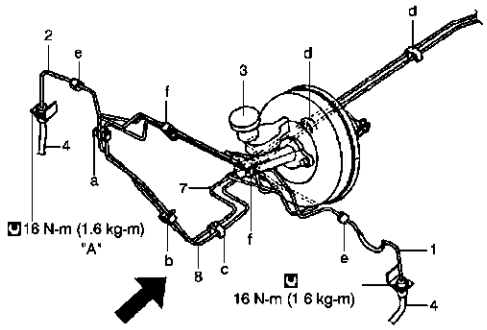
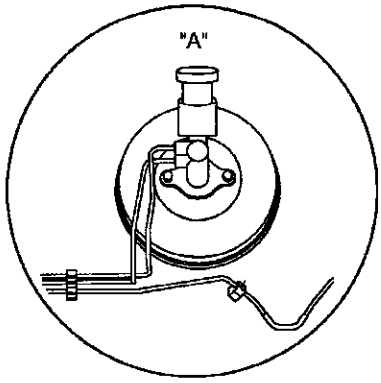
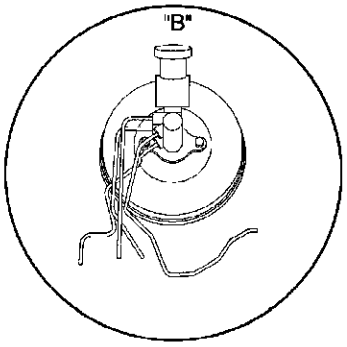
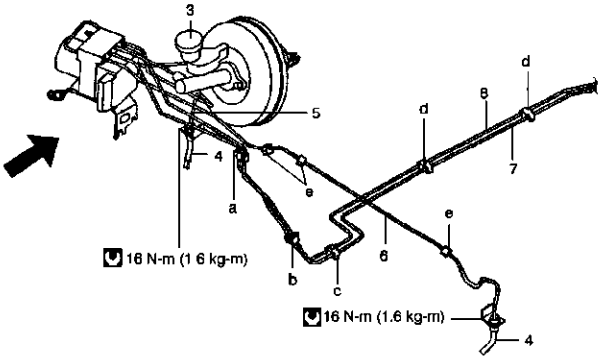
For vehicle without ABS

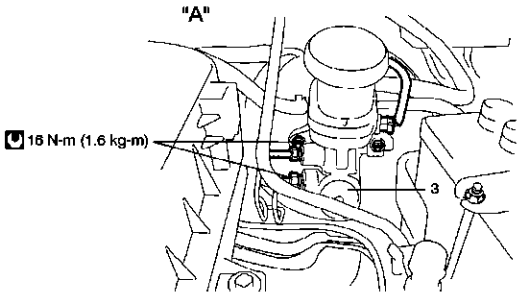


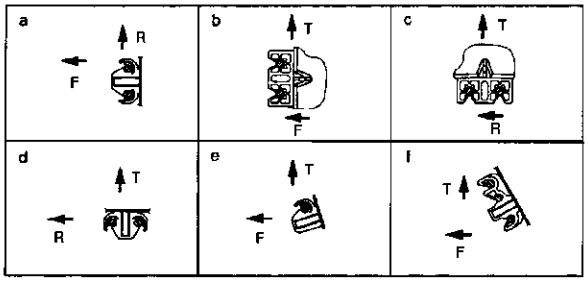




"B"







1. From master cylinder primary to left front brake	[A]: For left-hand steering vehicle
2. From master cylinder secondary to right front brake	[B]: For right-hand steering vehicle
3. Master cylinder	a-f: Clamp
4. Front brake hose	: Tightening torque
5. From master cylinder primary to right front brake	T: Top side
6. From master cylinder secondary to left front brake	F: Front side
7. From master cylinder primary to 4-way joint	R: Right side
8. From master cylinder secondary to 4-way joint	"A": View "A"
	"B": View "B"

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REAR BRAKE HOSE/PIPE

REMOVAL

1) Raise and support vehicle properly. Remove tire and wheel.
2) Clean dirt and foreign material from both flexible hose ends and pipe end fittings.
3) Drain brake fluid in reservior.

CAUTION:
Do not allow brake fluid to get on painted surface. Painted surface will be damaged by brake fluid, flush it with water immediately if any fluid is spilled.

4) Remove brake flexible hose or pipe.

INSTALLATION

Reverse brake flexible hose installation procedure, noting the followings.

- Fill and maintain brake fluid level in reservoir.
- Bleed brake system. Refer to "AIR BLEEDING OF BRAKE SYSTEM" in this section.
- Perform brake test and check each installed part for fluid leakage.
- Install clamps properly referring to figure below and tighten bolts
- When installing hose, make sure that it has no twist or kink.

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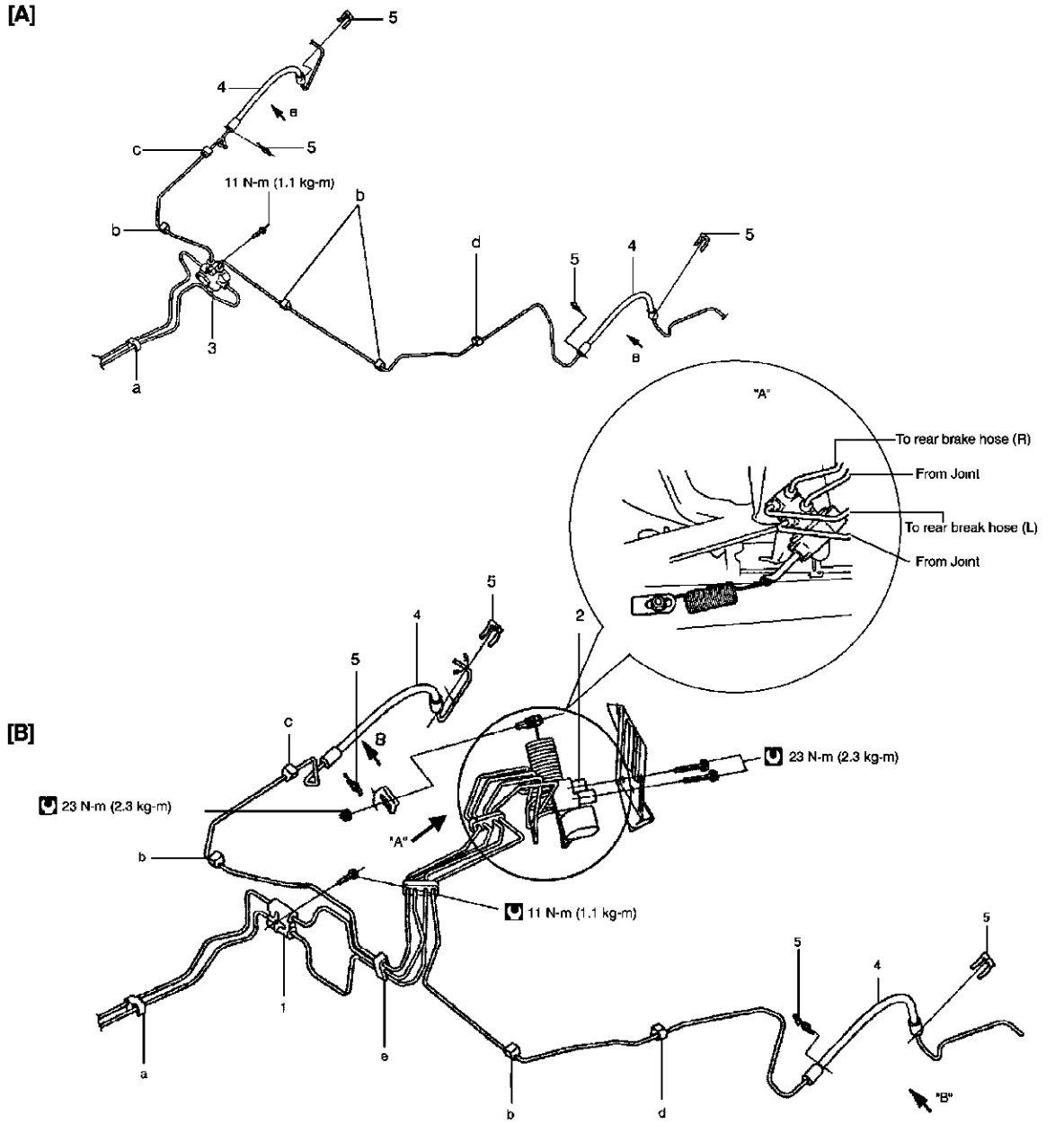

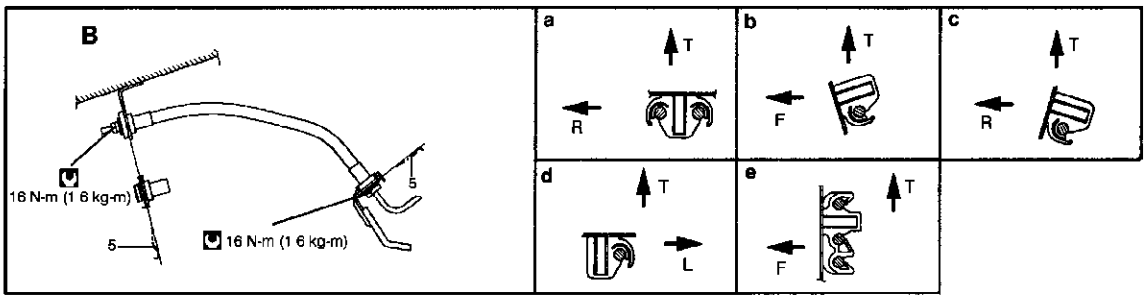

T Top side	1. 4-way joint	a-e: Clamp
F Front side	2 LSPV assembly	[A]: Without LSPV
R Right side	3. P valve	[B]: With LSPV
L Left side	4. Rear brake hose	Tightening torque
"A": View "A"	5. E-ring	
"B": View "B"		

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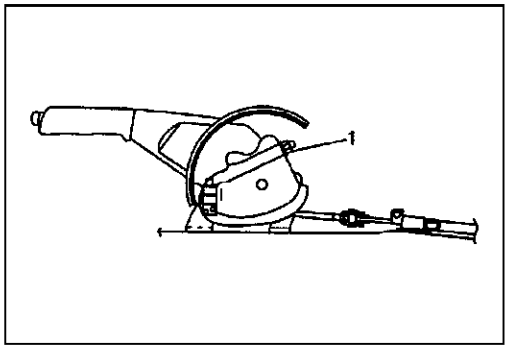
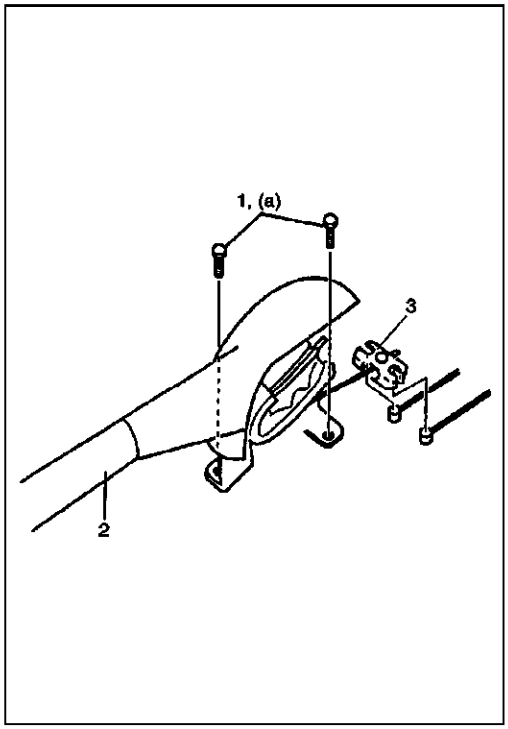


PARKING BRAKE

PARKING BRAKE LEVER

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Remove console box.
3) Block vehicle wheels and release parking brake lever.
4) Disconnect lead wire of parking brake switch at coupler.
5) Loosen parking brake cable adjusting nut (1).



6) Remove parking brake lever bolts (1) and then remove parking brake lever assembly (2) with equalizer (3).

NOTE:
Don't disassemble parking brake lever switch. It must be removed and installed as a complete switch assembly.

INSTALLATION

1) Install in reverse order of REMOVAL procedure.

Tightening Torque
(a): 25 N-m (2.5 kg-m, 18.0 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.

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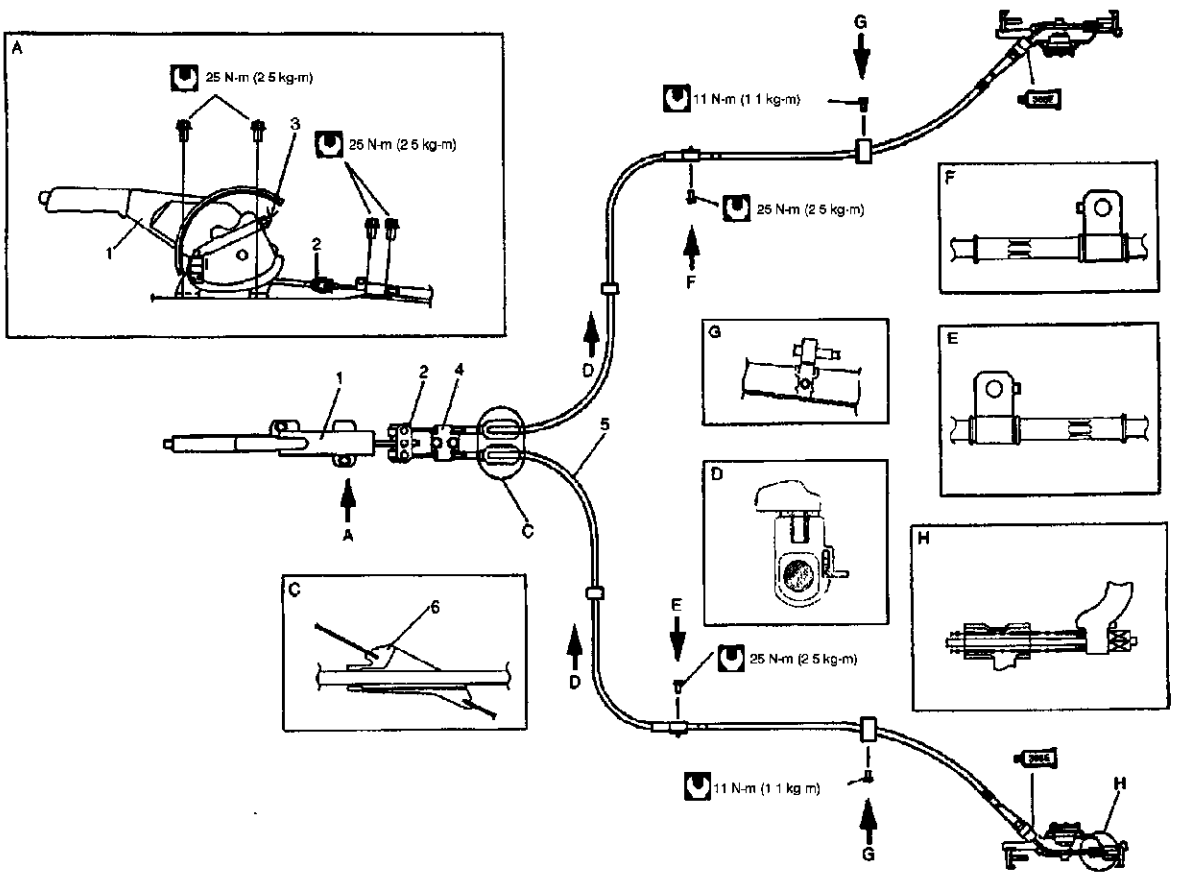
PARKING BRAKE CABLE



1. Parking brake lever assembly	5. Parking brake cable. Apply water tight sealant 99000-31090 to plate and cable contact	: Tightening Torque
2. Equalizer		
3. Adjusting nut		
4. Parking cable bracket	6. Grommet	

REMOVAL

1) Remove brake drum, referring to steps 1) to 5) of "BRAKE DRUM REMOVAL" in this section.
2) Disconnect parking brake cable from brake shoe lever, referring to steps 2) to 4) of "BRAKE SHOE REMOVAL" in this section.
3) Disconnect brake cable from brake back plate, referring to step 4) of "BRAKE BACK PLATE REMOVAL" in this section.

   NOTE:
   When it is necessary to remove both right and left parking brake cables, repeat above steps 1) to 3) on right and left wheels.

4) Remove cable from equalizer.

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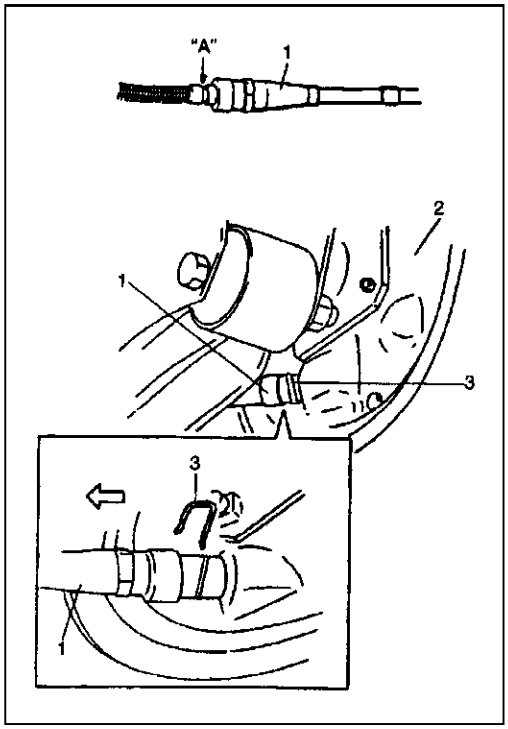
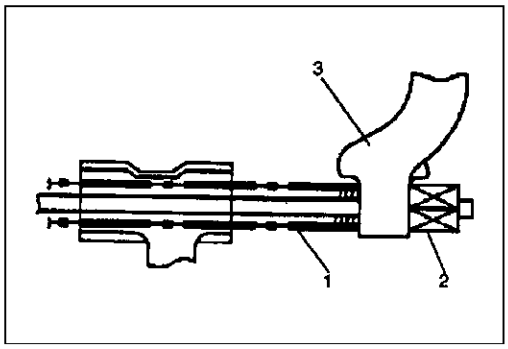


INSTALLATION

Install parts in reverse order of REMOVAL procedure, noting the following.

1) Distinguish right side parking brake cable from left side one with its clamp width.
   Parking brake cable with narrow clamp should be installed to right side of vehicle.
2) Apply water tight sealant where plate and cable contact, and run parking brake cable (1) through brake back plate (2) and secure it with clip (3).

"A": Sealant 366E, 99000-31090



3) Install brake cable spring (1) and nipple end (2) to parking brake shoe lever (3) securely as shown in figure.

4) Install brake shoe referring to steps 1) to 3) of "BRAKE SHOE INSTALLATION" of this section.
5) Install brake drum referring to steps 2) to 7) of "BRAKE DRUM INSTALLATION" of this section.
6) For proper routing and secure clamping of parking brake cable.
7) Install cable to equalizer.
8) Upon completion of installation, adjust cable referring 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.

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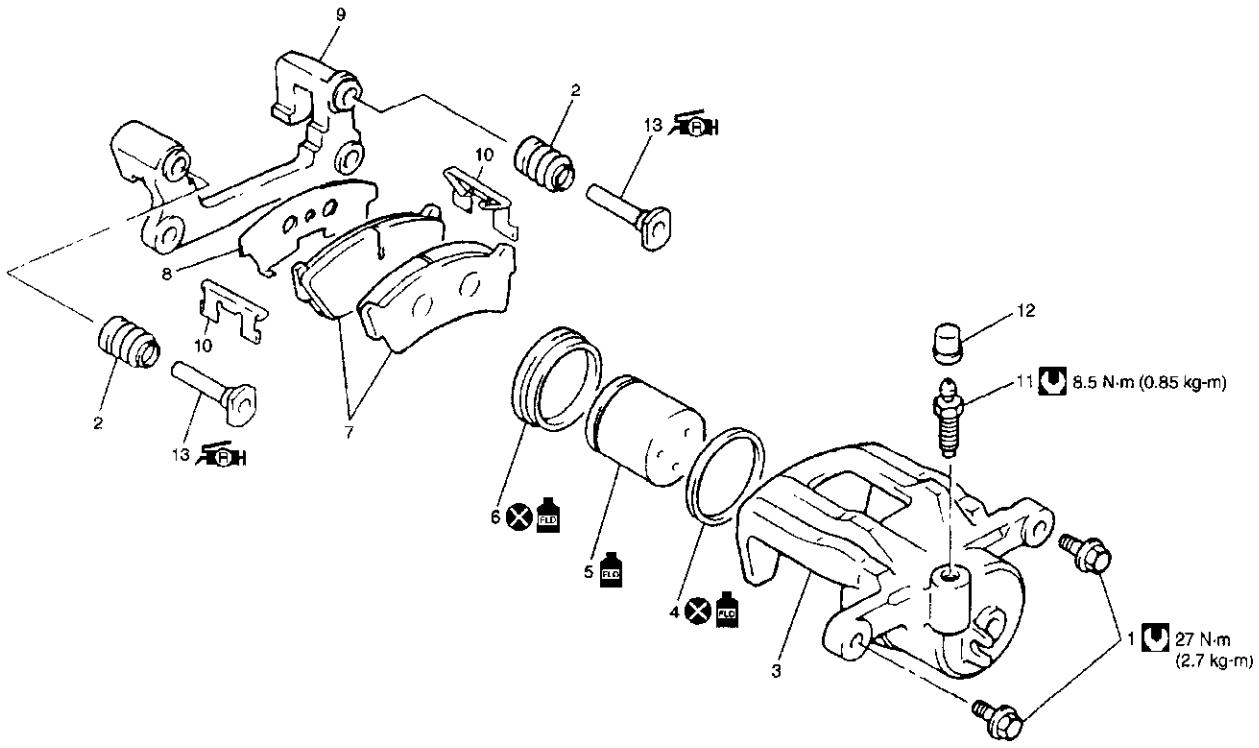
FRONT BRAKE

CAUTION:
Lubricate parts as specified. Do not use lubricated shop air on brake parts as damage to rubber components may result. If any component is removed or line disconnected, bleed the brake system. Replace pads in axle sets only. The torque values specified are for dry, unlubricated fasteners.



1. Caliper pin bolt	6. Piston boot Apply specified brake fluid	12. Bleeder plug cap
2. Dust boot	7. Disc brake pad	13. Cylinder slide guide pin: Apply specified rubber grease to pin surface for smooth movement
3. Disc brake caliper	8. Anti noise shim	. Tightening Torque
4. Piston seal. Apply specified brake fluid.	9. Brake caliper carrier	. Do not reuse
5. Disc brake piston Apply specified brake fluid.	10. Pad spring	
	11. Bleeder plug	

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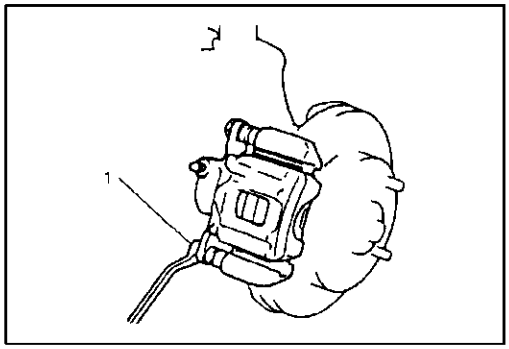
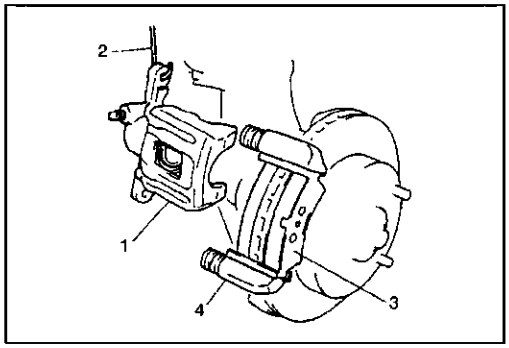


BRAKE PAD

REMOVAL

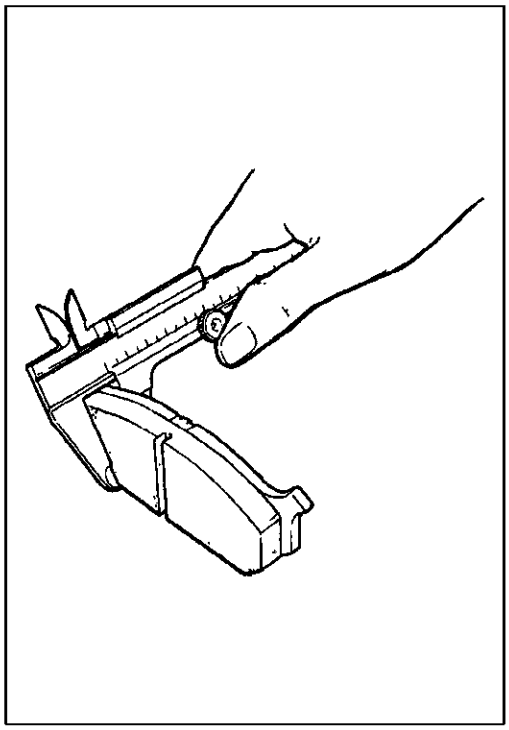
1) Hoist vehicle and remove wheel.
2) Remove caliper pin bolts (1).



3) Remove caliper (1) from caliper carrier (4).

NOTE:
Hang removed caliper with a wire hook (2) or the like so as to prevent brake flexible hose from bending and twisting excessively or being pulled.
Don't operate brake pedal with pads removed.

4) Remove pads (3).



INSPECTION

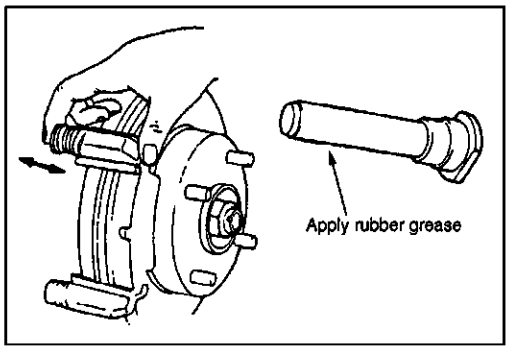
Brake Pad

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.

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.



Cylinder Slide Guide Pin

Check guide pin for smooth movement as shown.
If it is found faulty, correct or replace. Apply rubber grease to guide pin outer surface. Rubber grease should be the one whose viscosity is less affected by such low temperature as -40° C (-40° F).

Dust Boot

Check boot for breakage, crack and damage. If defective, replace.

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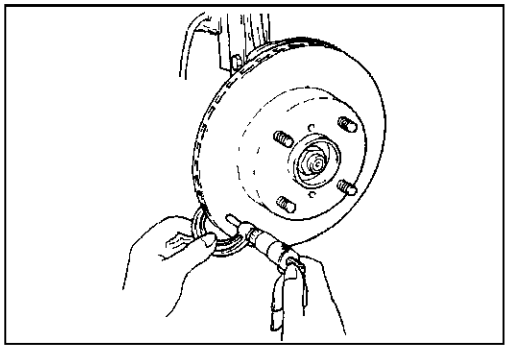
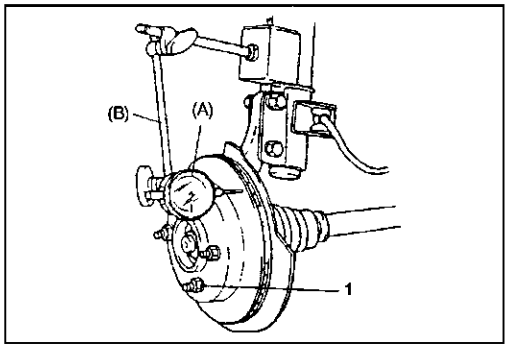


Brake Disc
Check disc surface for scratches in wearing parts.
Scratches on disc surface noticed at the time of specified inspection or replacement are normal and disc is not defective unless they are serious.
But when there are deep scratches or scratches all over disc surface, replace it. When only one side is scratched, polish and correct that side.

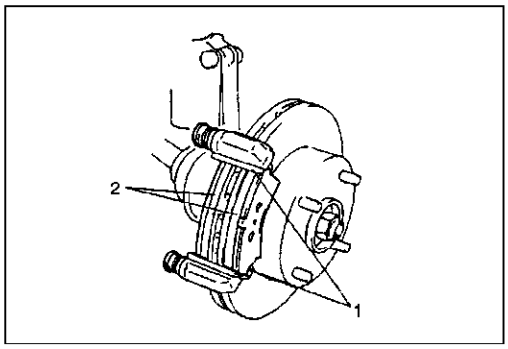
Disc thickness
Standard : 17.0 mm (0.67 in.)
Limit : 15.0 mm (0.59 in.)



Use wheel nuts (1) to hold the disc securely against the hub, then mount a dial gauge as shown.
To measure deflection of disc, take measurement at 2 points on its periphery and center with dial gauge while rotating it.

Limit on disc deflection: 0.15 mm (0.006 in.) max.
Special Tool
(A): 09900-20606
(B): 09900-20701

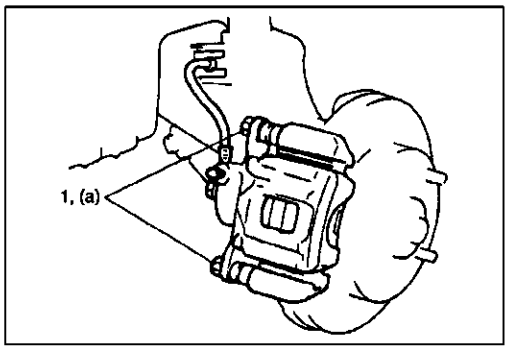
NOTE:
Check front wheel bearing for looseness before measurement.



INSTALLATION

CAUTION:
Observe CAUTION at the beginning of this section.

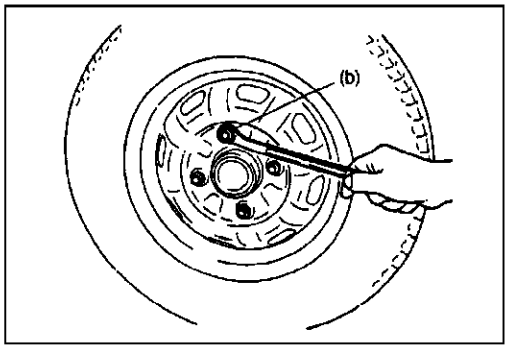
1) Install pad springs (1) and pads (2).



2) Install caliper and tighten caliper pin bolts (1) to specified torque.

NOTE:
Make sure that boots are fit into groove securely.

Tightening Torque
(a): 27 N-m (2.7 kg-m, 19.5 lb-ft)



3) Tighten front wheel nuts to specified torque.

Tightening Torque
(b): 85 N-m (8.5 kg-m, 61.5 lb-ft)

4) Upon completion of installation, perform brake test.

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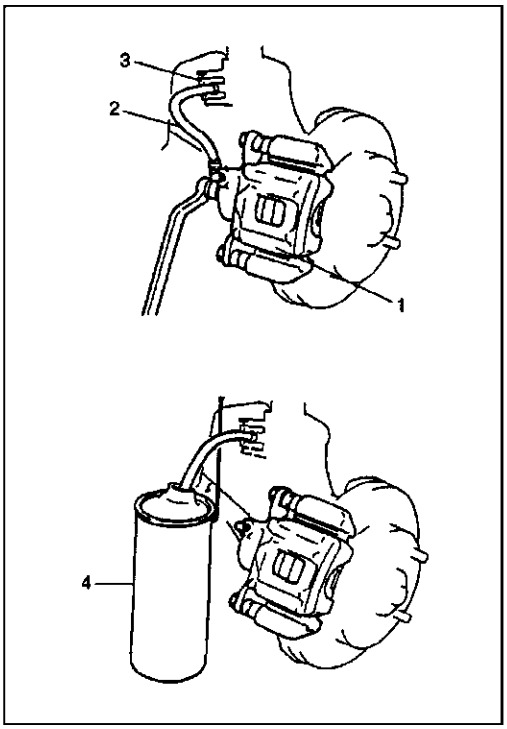
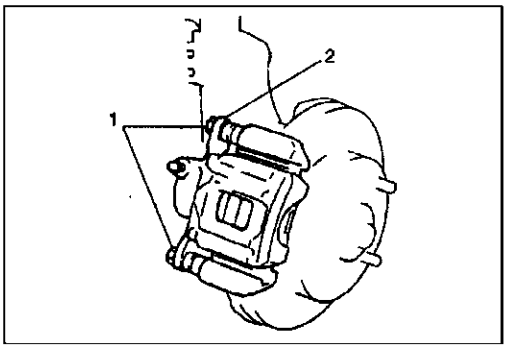


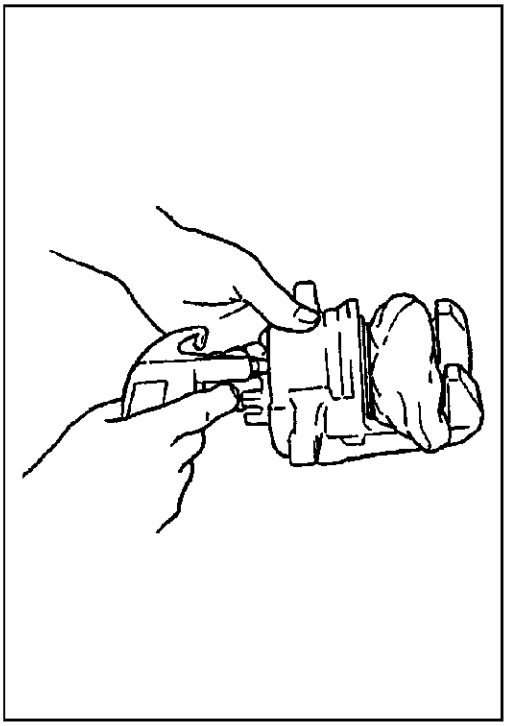
CALIPER ASSEMBLY

REMOVAL

1) Hoist vehicle and remove wheel.
2) Remove E-ring (3).
3) Remove brake flexible hose (2) from caliper (1). As this will allow fluid to flow out of hose, have a container (4) ready beforehand.



4) Remove caliper pin bolts (1).
5) Remove caliper from carrier (2).



DISASSEMBLY

Before disassembly, clean all around caliper with brake fluid.

1) Blow compressed air into cylinder through bolt hole where flexible hose was fitted. With this air pressure, piston can be pushed out of cylinder.

> **WARNING:**
> **Do not apply too highly compressed air which will cause piston to jump out of cylinder. It should be taken out gradually with moderately compressed air. Do not place your fingers in front of piston when using compressed air.**

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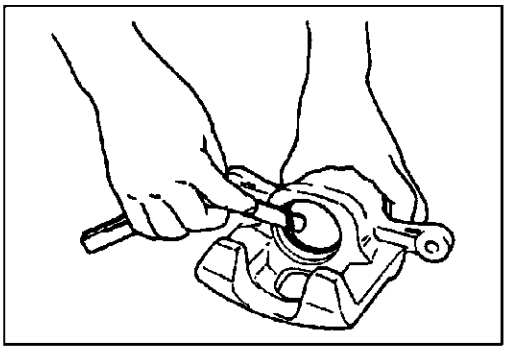
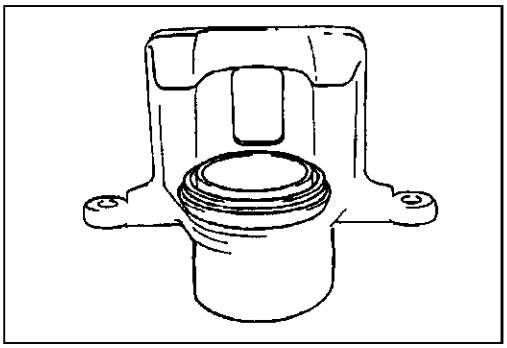


2) Remove piston seal using a thin blade like a thickness gauge, etc.

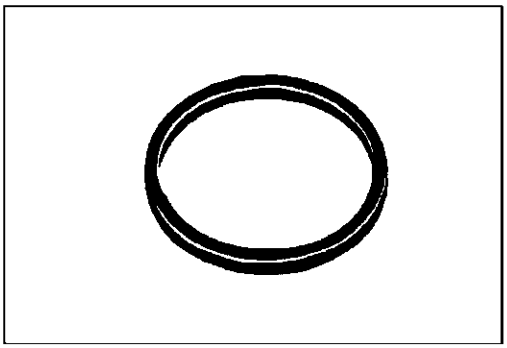
CAUTION:
Be careful not to damage inside (bore side) of cylinder.



INSPECTION

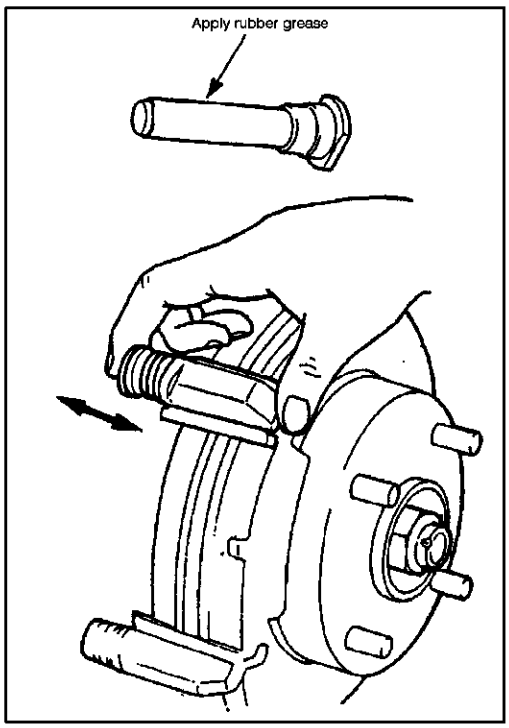
Piston Boot

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.



Caliper pin

Before installing caliper (cylinder body) to carrier, check to ensure that pin can be moved smoothly in thrust direction.

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).

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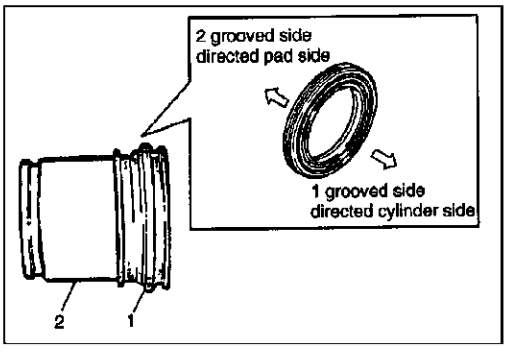
ASSEMBLY

Reassemble front brake in reverse order of disassembly, noting the following points.

CAUTION:
- **Wash each part cleanly before installation in the same fluid as the one used in master cylinder reservoir.**
- **Never use other fluid or thinner.**
- **Before installing piston and piston seal to cylinder, apply fluid to them.**
- **After reassembling brake lines, bleed air from them.**

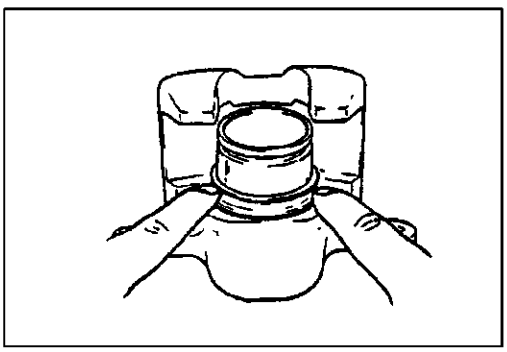
Piston Seal

Piston seal is used to seal piston and cylinder and to adjust clearance between pad and disc. Replace with a new one at ever overhaul. Fit piston seal into groove in cylinder taking care not to twist it.

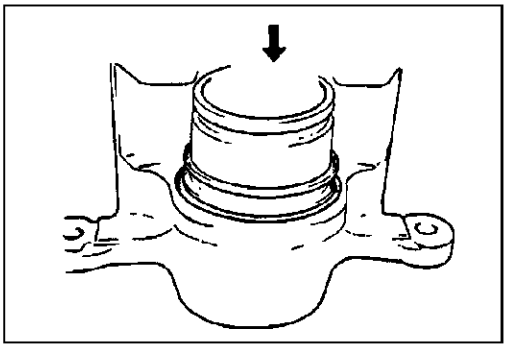


Piston and Boot

1) Before inserting piston (2) into cylinder, install boot (1) onto piston as shown.



2) Fit boot as it is in figure into boot groove in cylinder with fingers.



3) Insert piston into cylinder by hand and fit boot in boot groove in piston.

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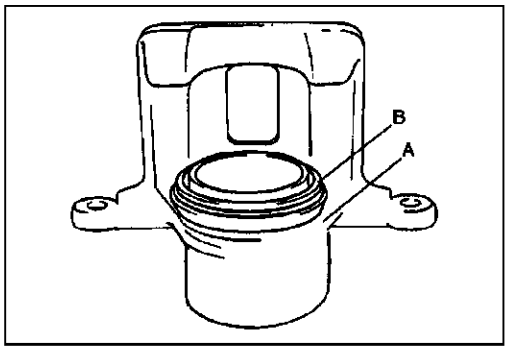
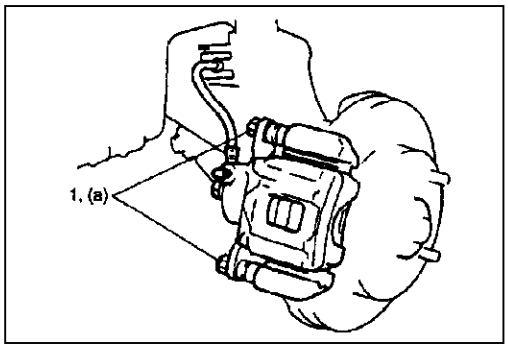


4) To confirm that boot is fitted in its groove in cylinder properly, pull piston out of cylinder a little but do not take it all out.

NOTE:
Boot's face B should be at the same level from cylinder's face A all around.

5) Insert piston into cylinder by hand.

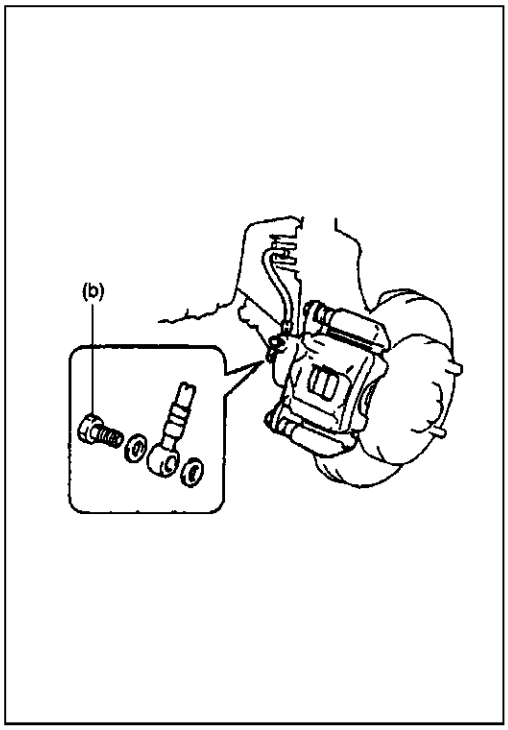


INSTALLATION

1) Apply rubber grease to caliper pin, then install caliper to caliper carrier.
2) Tighten caliper pin bolts (1) to specified torque.

NOTE:
Make sure that boots are fit into groove securely.

Tightening Torque
(a): 27 N-m (2.7 kg-m, 19.5 lb-ft)



3) Tighten flexible hose bolt to specified torque.

Tightening Torque
(b): 23 N-m (2.3 kg-m, 16.5 lb-ft)

WARNING:
Make sure that flexible hose is not twisted when tightening hose bolt. If it is twisted, reconnect it using care not to twist it.

4) Install E-ring to strut securely.
5) Lower hoist.
6) Tighten wheel nuts to specified torque.
7) After completing installation, fill reservoir with brake fluid and bleed air from brake system. Perform brake test and check each installed part for fluid leakage.

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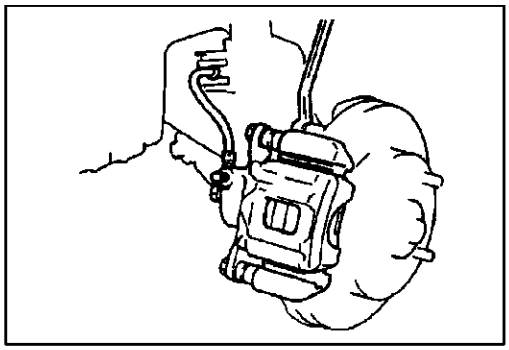
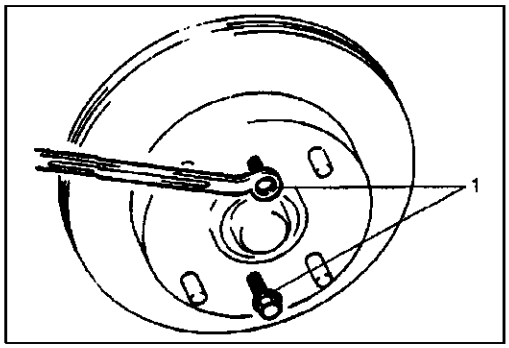


BRAKE DISC

REMOVAL

1) Hoist vehicle and remove wheel.
2) Remove caliper assembly by removing carrier bolts.

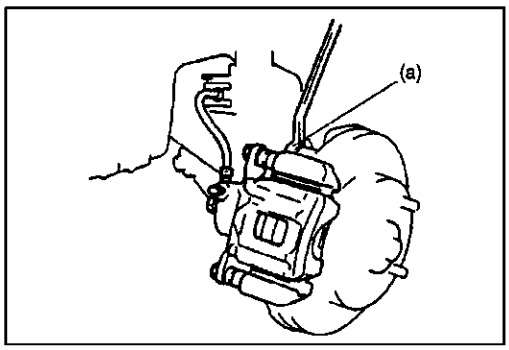
CAUTION:
During removal, be careful not to damage brake flexible hose and not to depress brake pedal. Refer to "REMOVAL of BRAKE PAD" in this section.



3) Pull brake disc off by using 8 mm bolts (1).

INSPECTION

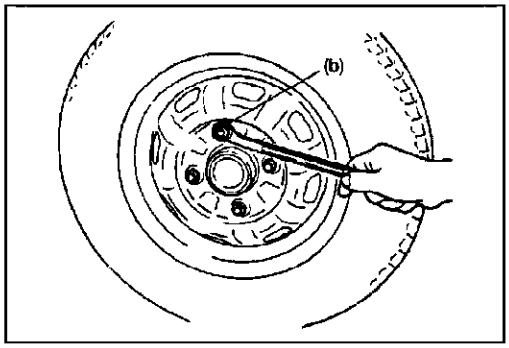
Refer to "BRAKE PAD INSPECTION" in this section.



INSTALLATION

1) Install disc to wheel hub.
2) Install caliper assembly to steering knuckle.
3) Tighten caliper carrier bolts to specified torque.

Tightening Torque
(a): 85 N-m (8.5 kg-m, 61.5 lb-ft)



4) Tighten front wheel nuts to specified torque.

Tightening Torque
(b): 85 N-m (8.5 kg-m, 61.5 lb-ft)

5) Upon completion of installation, perform brake test.

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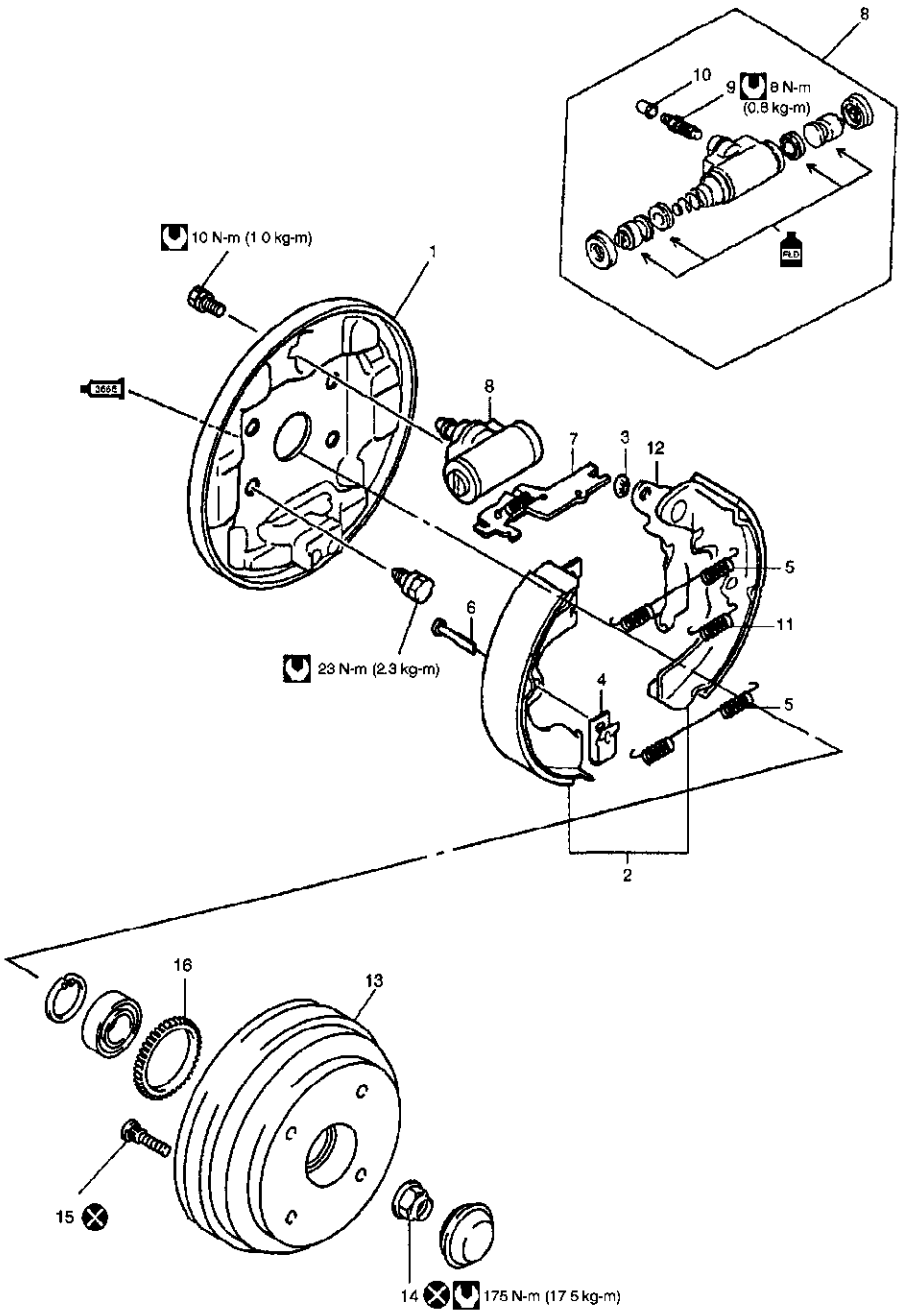
REAR BRAKE

CAUTION:
- **Replace all components included in repair kits to service this drum brake. Lubricate parts as specified.**
- **If any hydraulic component is removed or brake line disconnected, bleed the brake system.**
- **The torque values specified are for dry, unlubricated fasteners.**



366E	1. Brake back plate: Apply sealant 366E 99000-31090 to joint seam of brake back plate and rear axle	7	Brake strut	14.	Spindle nut* Caulk spindle nut after tightening
		FLD 8	Wheel cylinder. Apply brake fluid to piston cup	15.	Stud bolt
2.	Brake shoe	9	Bleeder plug	16.	ABS sensor ring (if equipped with ABS System)
3.	Push nut	10.	Bleeder plug cap		: Tightening Torque
4.	Shoe hold down spring	11.	Parking lever spring		. Do not reuse
5.	Shoe return spring	12.	Parking brake shoe lever		
6.	Shoe hold down pin	13	Brake drum		

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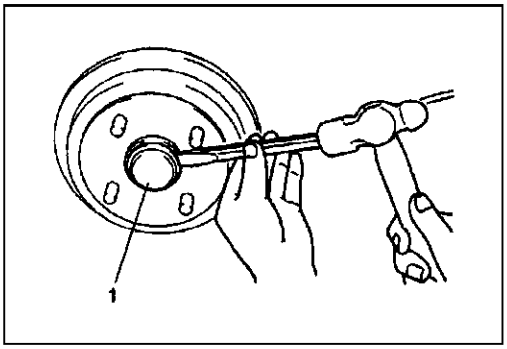
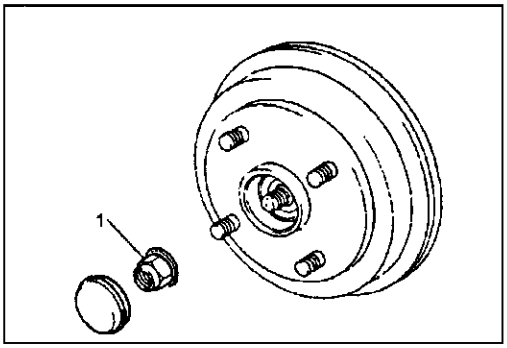


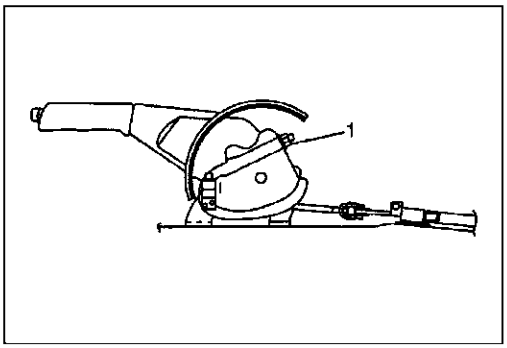
BRAKE DRUM

REMOVAL

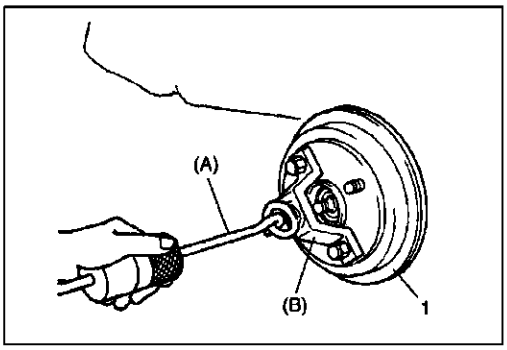
1) Hoist vehicle and remove wheel.
2) Remove spindle cap (1) as shown (by hammering lightly at 3 locations around it so as not to deform or cause damage to seating part of cap).



3) Uncaulk spindle nut, remove spindle nut (1).

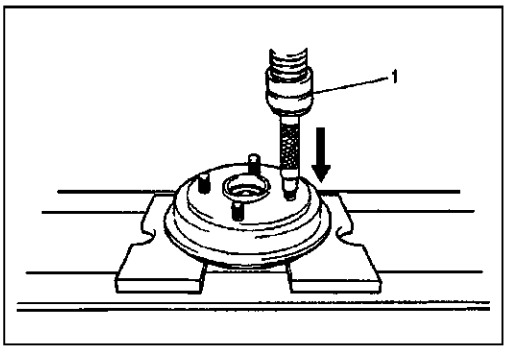


4) Release parking brake lever.
5) Remove brake drum.
   If brake drum can not be removed easily, increase clearance between brake shoes and drum as follows.
   a) Remove console box and loosen parking brake cable adjusting nut (1).



   b) Pull brake drum (1) off by hand. If it is hard to remove, use special tools.

      Special Tool
      (A): 09942-15510
      (B): 09943-17912



6) Remove wheel stud bolt by using hydraulic press (1).

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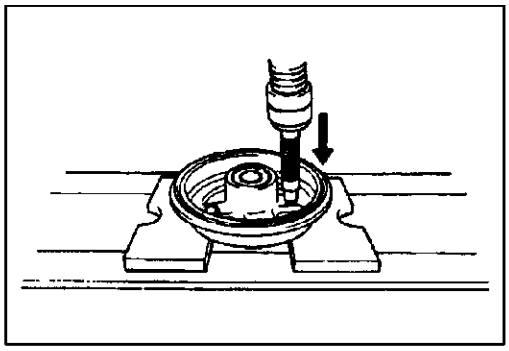
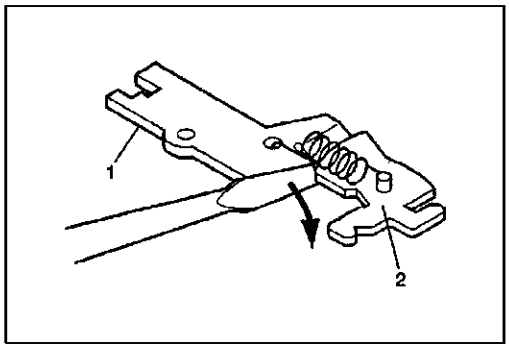
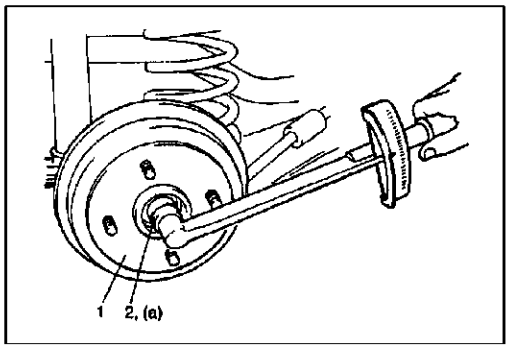


INSTALLATION

1) Insert new stud in drum hole and rotate it slowly to assure serrations are aligned with those made by replaced bolt.

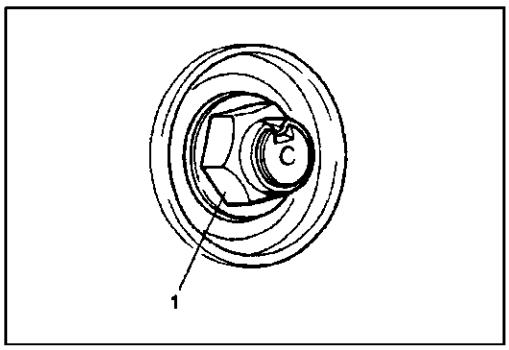


2) Put flat head rod or the like between rod (1) and ratchet (2) and pull ratchet as shown to maximize clearance between shoe and drum.



3) Install brake drum (1) after making sure that inside of brake drum and brake shoes are free from dirt and oil.
4) Install new spindle nut (2).
5) Tighten spindle nut to specified torque.

Tightening Torque
(a): 175 N-m (17.5 kg-m, 126.5 lb-ft)



6) Calk spindle nut (1).
7) Install spindle cap.

NOTE:
- **When installing spindle cap, hammer lightly several locations on the collar of cap until collar comes closely into contact with brake drum.**
- **If fitting part of cap is deformed or damaged or if it is fitted loosely, replace with a new one.**

8) Upon completion of all jobs, depress brake pedal with about 300 N (30 kg, 66 lbs) load three to five times so as to obtain proper drum-to-shoe clearance.
   Adjust parking brake cable referring to "PARKING BRAKE INSPECTION AND ADJUSTMENT" in this section.
9) Install console box if removed.

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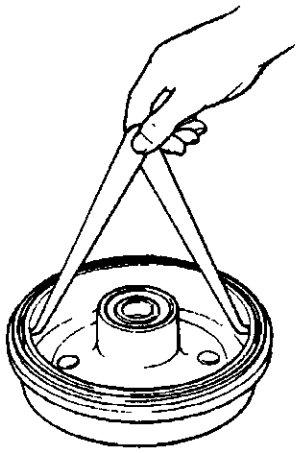


INSPECTION

Brake Drum

Inspect drum for cleanliness. Check wear of its braking surface by measuring its inside diameter.

Brake drum inside diameter

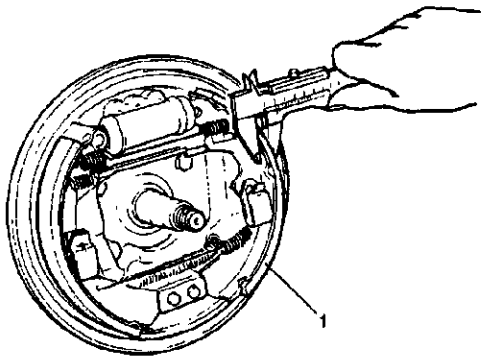
Standard	:	**180 mm (7.09 in.)**
Service limit	:	**182 mm (7.16 in.)**

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 (1) is worn out beyond service limit, replace shoes.

Brake lining thickness (lining + shoe rim)

Standard	:	**5.5 mm (0.22 in.)**
Service limit	:	**2.6 mm (0.10 in.)**

If one of brake linings is worn to service limit, all linings must be replaced at the same time.

CAUTION:
Never polish lining with sandpaper. If lining is polished with sandpaper, hard particles of sandpaper will be deposited in lining and may damage drum. When it is required to correct lining, replace it with a new one.

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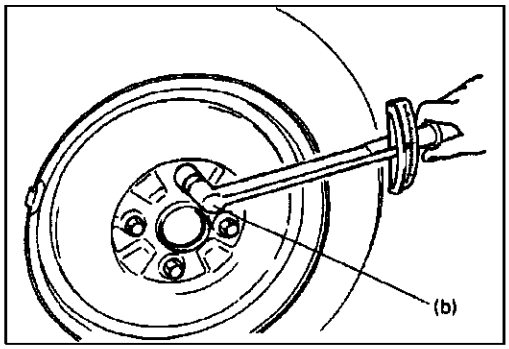
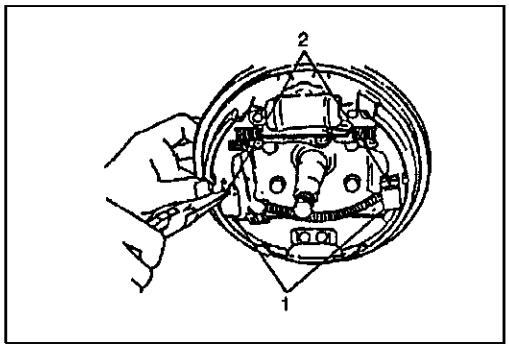


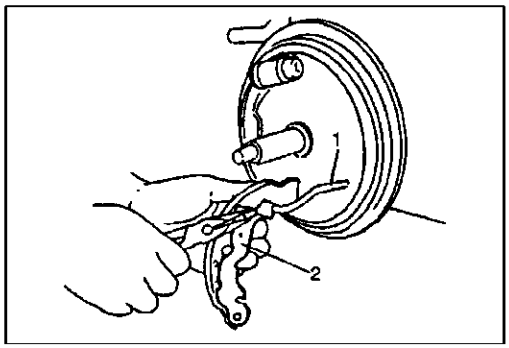
10) Install wheel and tighten wheel nuts to specified torque.
Tightening Torque
(b): 85 N-m (8.5 kg-m, 61.5 lb-ft)
11) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then lower vehicle and preform brake test (foot brake and parking brake).



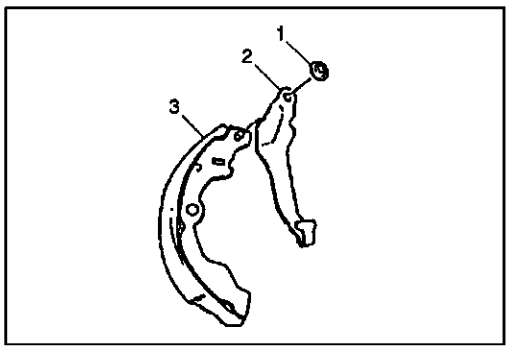
BRAKE SHOE

REMOVAL

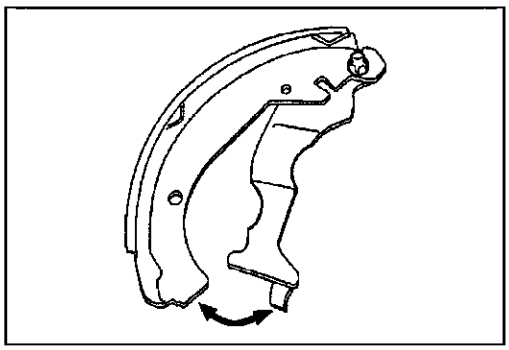
1) Remove brake drum referring to "BRAKE DRUM REMOVAL" in this section.
2) Remove shoe hold down springs (1) by turning shoe hold down pins (2).
3) Remove return springs, brake shoes and strut.



4) Disconnect parking brake cable (1) from parking brake shoe lever (2).



5) Remove push nut (1).
6) Remove parking brake shoe lever (2) from shoe rim (3).



INSPECTION

Parking Shoe Lever

Inspect brake shoe lever for smooth movement along shoe rim. If defective, correct or replace.

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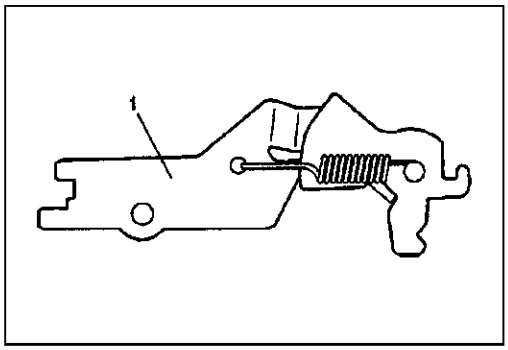
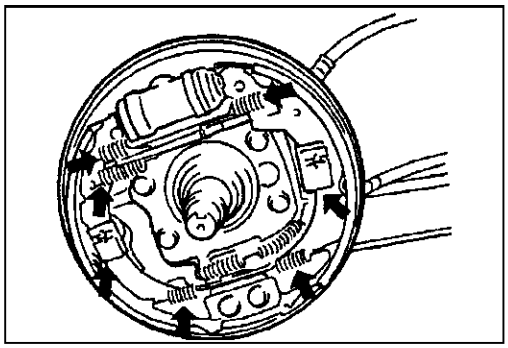


Brake Strut

- Check ratchet of brake strut (1) assembly for wear or damage.
- Check shoe return spring, strut shoe return spring and shoe hold down spring for damage, corrosion and weakening.

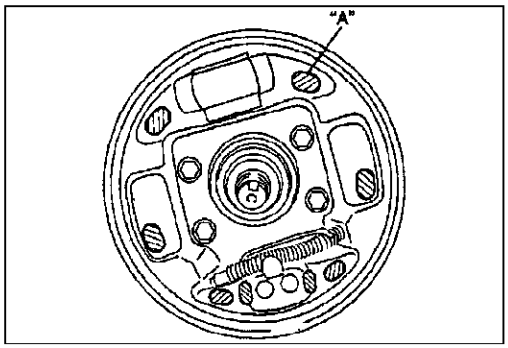


Springs

Inspect for damage or weakening.
Inspect each part with arrow for rust. If found defective, replace.

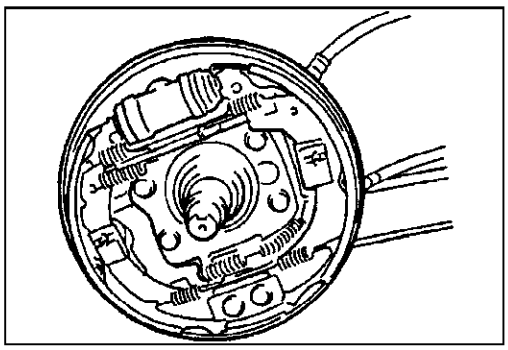
Brake Shoe

Refer to "BRAKE DRUM INSPECTION" in this section.

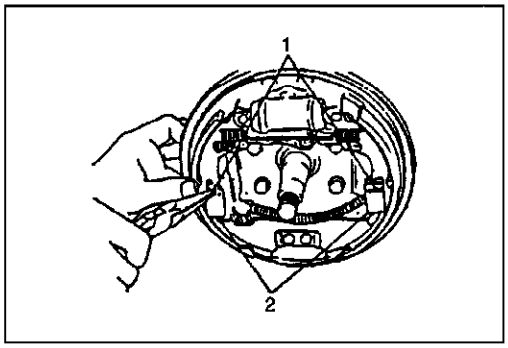


INSTALLATION

1) Clean brake back plate and apply thin coat of grease to eight surfaces on which shoe rims rest.
   "A": Brake grease (Anti-squeal agent)



2) Assemble parts as shown in reverse order of REMOVAL.



3) Install shoe hold down springs (2) by pushing them down in place and turning hold down pins (1).
4) Install brake drum referring to "BRAKE DRUM INSTALLATION" in this section.

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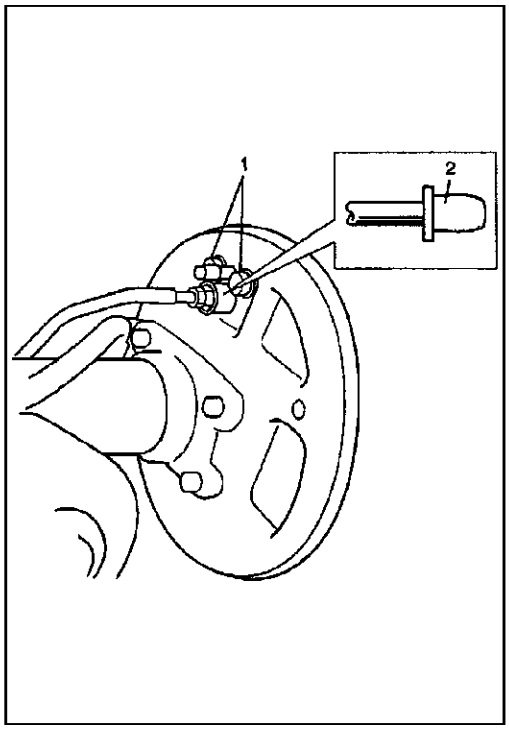
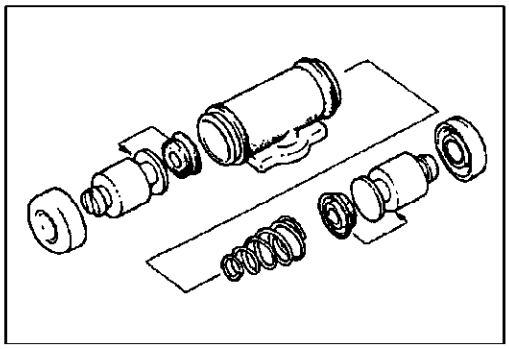


WHEEL CYLINDER

REMOVAL

1) Remove brake drum referring to steps 1) to 5) of "BRAKE DRUM REMOVAL" in this section.
2) Remove brake shoe referring to steps 2) to 4) of "BRAKE SHOE REMOVAL" in this section.
3) Loosen brake pipe flare nut but only within the extent that fluid does not leak.
4) Remove wheel cylinder mounting bolts (1). Disconnect brake pipe from wheel cylinder and put wheel cylinder bleeder plug cap (2) onto pipe to prevent fluid from spilling.



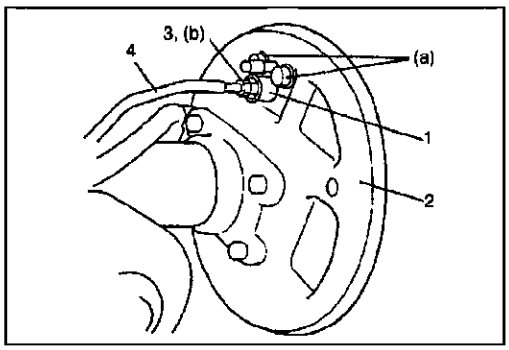
INSPECTION

Inspect wheel cylinder disassembled parts for wear, cracks, corrosion or damage.

NOTE:
Clean wheel cylinder components with brake fluid.

INSTALLATION

1) Take off bleeder plug cap from brake pipe and connect pipe (for pipes) to wheel cylinder just enough to prevent fluid from leaking.



2) Tighten wheel cylinder (1) to brake back plate (2) to specified torque.
3) Tighten flare nut (3) of brake pipe (4) which was connected in step 1) to specified torque.

Tightening Torque
(a): 10 N-m (1.0 kg-m, 7.5 lb-ft)
(b): 16 N-m (1.6 kg-m, 12.0 lb-ft)

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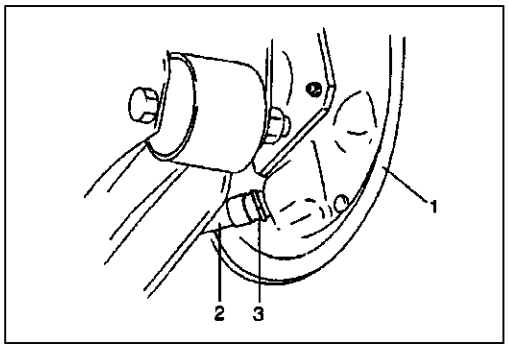
4) Install bleeder plug cap taken off from pipe back to bleeder plug.
5) For procedure hereafter, refer to "BRAKE SHOE INSTALLATION" in this section.

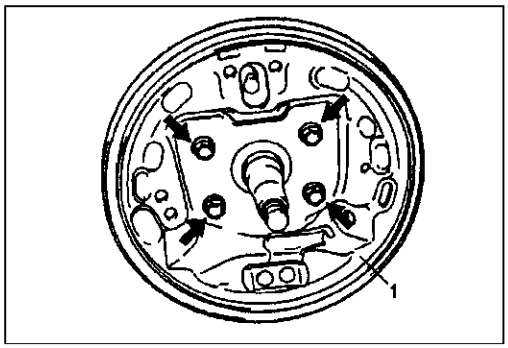
NOTE:
Be sure to bleed brake system. (Refer to "BLEEDING BRAKES" in this section.)



BRAKE BACK PLATE

REMOVAL

1) Remove brake drum referring to steps 1) to 5) of "BRAKE DRUM REMOVAL" in this section.
2) Remove brake shoes referring to steps 2) to 4) of "BRAKE SHOE REMOVAL" in this section.
3) Remove wheel cylinder referring to steps 3) to 4) of "WHEEL CYLINDER REMOVAL" in this section.
4) Remove parking brake cable securing clip (3) and disconnect brake cable (2) from brake back plate (1).

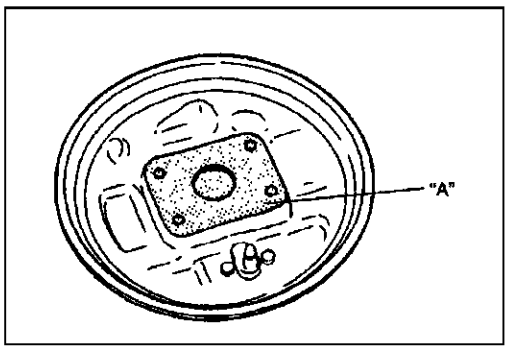


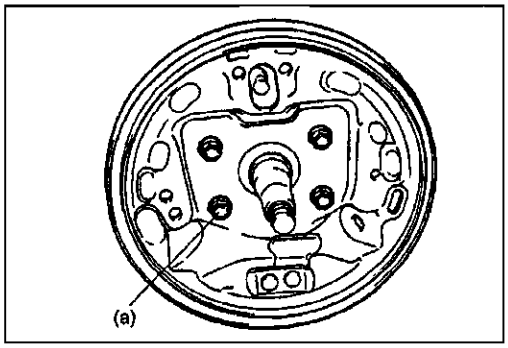
5) Remove brake back plate (1) from rear axle.

INSTALLATION

1) Apply water tight sealant to mating surfaces of brake back plate and rear axle.

"A": Sealant 366E 99000-31090





2) Install brake back plate and tighten back plate bolts to specified torque.

Tightening Torque
(a): 23 N-m (2.3 kg-m, 17.0 lb-ft)

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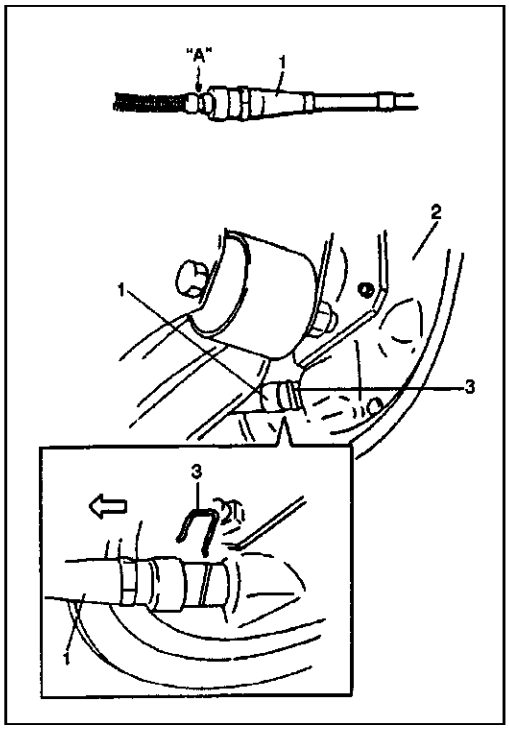
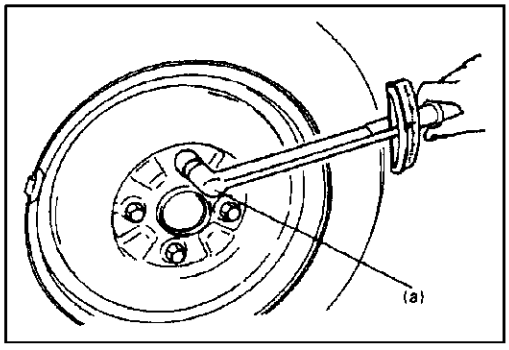


3) Apply water tight sealant where plate and cable contact, and run parking brake cable (2) through brake back plate (1) and secure it with clip (3).
   "A": Sealant 366E 99000-31090

4) Install wheel cylinder and tighten wheel cylinder bolts and brake pipe flare nut to specified torque, referring to steps 1) to 4) of "WHEEL CYLINDER INSTALLATION" in this section.
5) Install brake shoes referring to steps 1) to 3) of "BRAKE SHOE INSTALLATION" in this section.
6) Install brake drum referring to steps 3) to 7) of "BRAKE DRUM INSTALLATION" in this section.
7) Fill reservoir with brake fluid and bleed brake system referring to "BLEEDING BRAKES" in this section.



8) Install wheel and tighten wheel nuts to specified torque.
   Tightening Torque
   (a): 85 N-m (8.5 kg-m, 61.5 lb-ft)

9) Upon completion of all jobs, depress brake pedal with about 30 kg (66 lbs) load three to five times so as to obtain proper drum-to-shoe clearance.
   Adjust parking brake cable referring to "PARKING BRAKE INSPECTION AND ADJUSTMENT" in this section.
10) Install console box if removed.
11) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then lower vehicle and perform brake test (foot brake and parking brake).
12) Check each installed part for fluid leakage.

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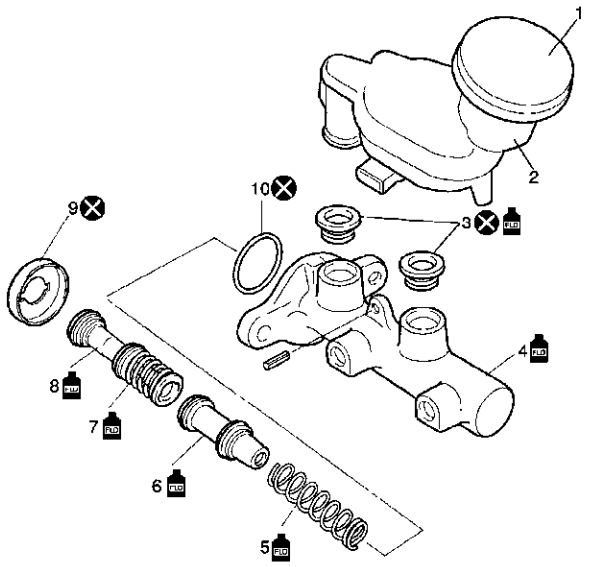
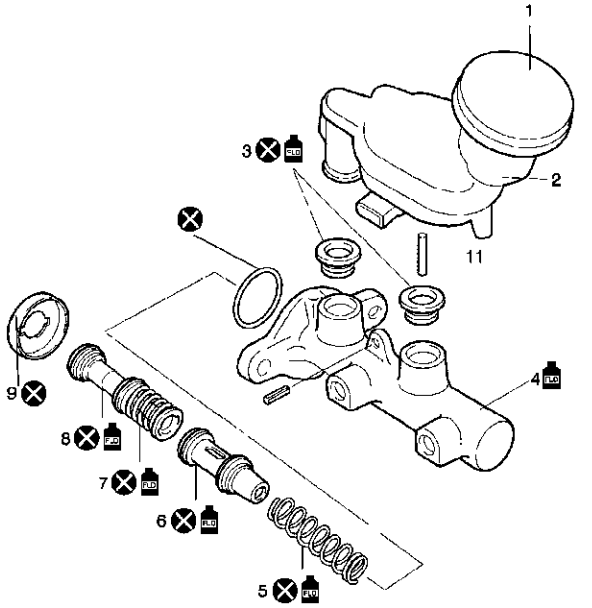
MASTER CYLINDER ASSEMBLY

CAUTION:
Replace all components included in repair kits to service this master cylinder. Lubricate rubber parts with clean, fresh brake fluid to ease assembly. Do not use lubricated shop air on brake parts as damage to rubber components may result. If any hydraulic component is removed or brake line disconnected, bleed the brake system. The torque values specified are for dry, unlubricated fasteners.

[A]



[B]



[A]: For vehicle without ABS	5. Secondary piston return spring: Apply brake fluid.	9. Stopper cap
[B]: For vehicle with ABS		10 O-ring
1 Master cylinder reservoir cap	6. Secondary piston: Apply brake fluid.	11 Piston stopper pin
2. Master cylinder reservoir		⊗ : Do not reuse.
3. Grommet Apply brake fluid	7. Primary piston return spring: Apply brake fluid	
4. Master cylinder body Apply brake fluid to inside of cylinder	8. Primary piston: Apply brake fluid.	

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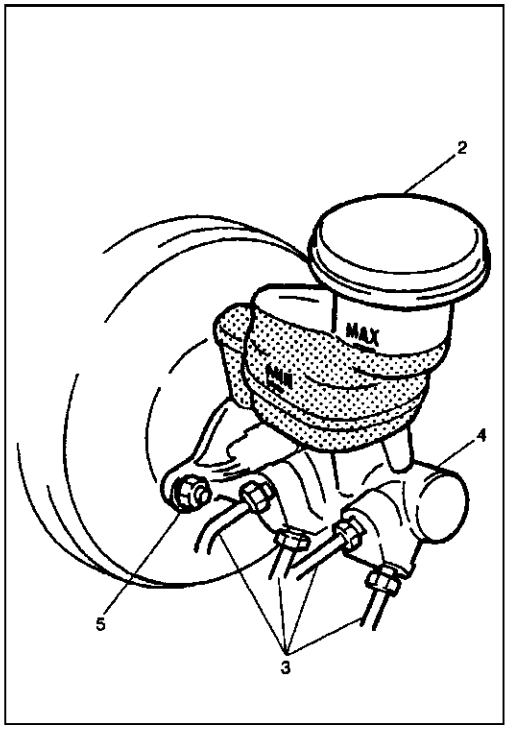
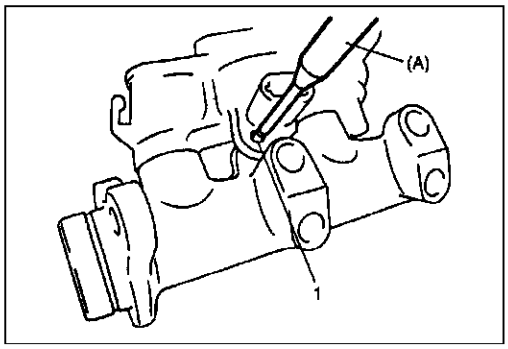


REMOVAL

1) Disconnect reservoir lead wire coupler.
2) Clean around reservoir cap (2) and take out fluid with syringe or such.
3) Disconnect brake pipes (3) from master cylinder (4).

CAUTION:
Do not allow brake fluid to get on painted surfaces.

4) Remove attaching nuts (5).
5) Remove master cylinder.

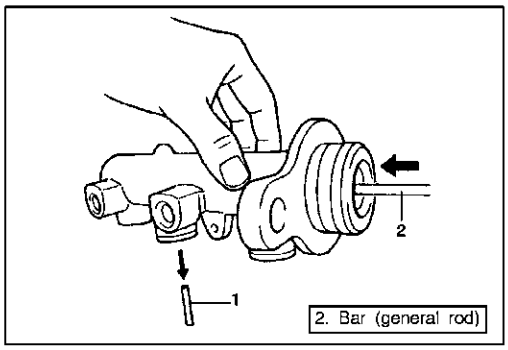


DISASSEMBLY

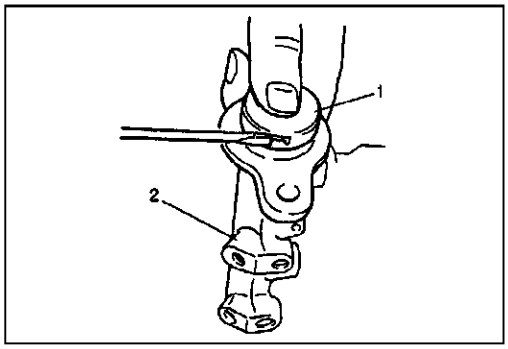
1) Remove reservoir pin (1) that fixes cylinder body and reservoir by using special tool.

Special Tool
(A): 09922-89810

2) Remove reservoir and 2 grommets.



[For vehicle with ABS]
Remove secondary piston stopper pin (1) from master cylinder by pushing primary piston.



3) Insert flat head rod or the like under each claw of stopper cap (1), straighten it and remove stopper cap. As piston in master cylinder (2) may jump out at this time, be sure to hold stopper cap.

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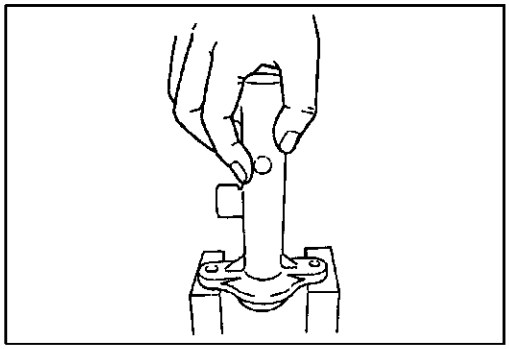
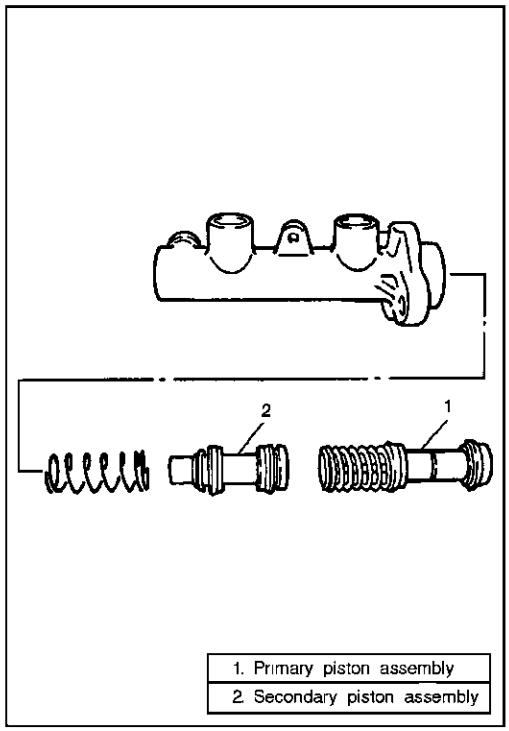


4) Pull out primary piston assembly straight so as not to cause any damage to inside of cylinder wall.
5) Pull out secondary piston assembly straight so as not to cause any damage to inside of cylinder wall and by tapping flange with a piece of wood or something soft.



1. Primary piston assembly
2. Secondary piston assembly

INSPECTION

Inspect all disassembled parts for wear or damage, and replace parts if necessary.

NOTE:
- **Wash disassembled parts with specified brake fluid.**
- **Do not reuse piston assembly.**

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.

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

CAUTION:
- **Never use any mineral oil such as kerosene oil and gasoline when washing and assembling parts.**
- **Check inside of cylinder wall, pistons and cups are free from any foreign objects such as dust and dirt and use care not to cause any damage with a tool during assembly.**
- **Do not drop parts. Do not use any part which has been dropped.**

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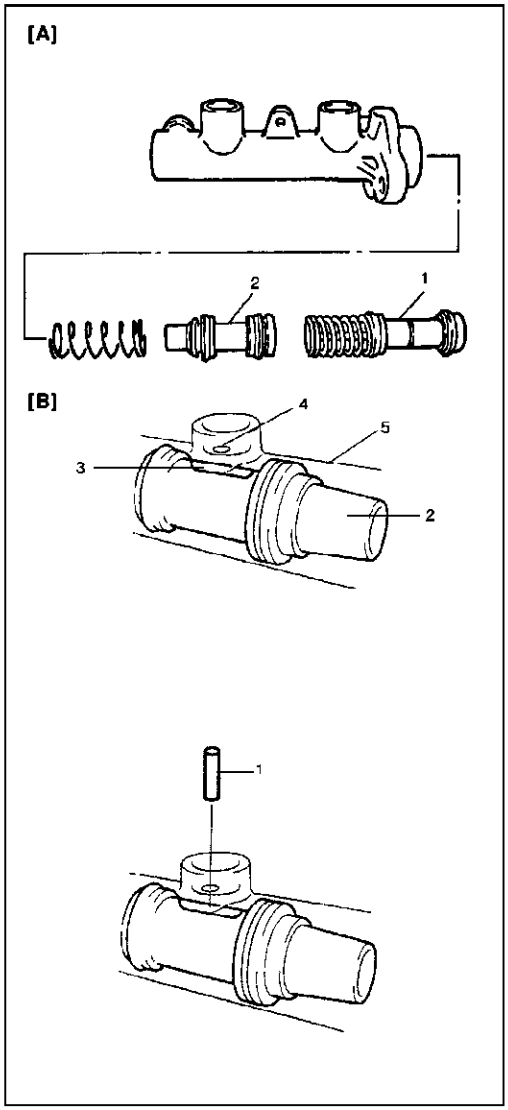
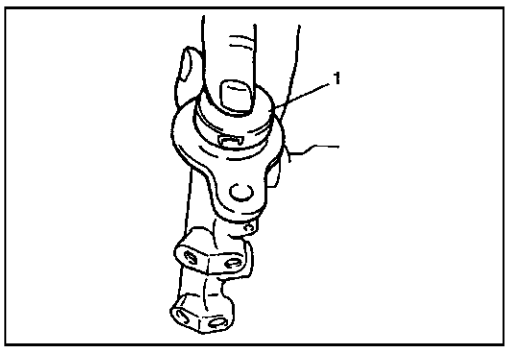


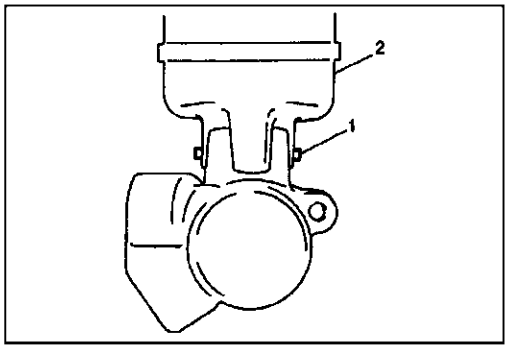
1) Apply brake fluid to inside of cylinder and contact surface of piston assemblies and insert secondary piston (2) and next primary piston (1) into cylinder body.
Be sure to install piston cup in correct installation direction and straight into cylinder so that it is not caught.

[A]: For vehicle not equipped with ABS
[B]: For vehicle equipped with ABS

[For vehicle with ABS]
Align oblong hole (3) in secondary piston (2) with stopper pin hole (4) in master cylinder body (5) and install piston stopper pin (1) with pistons pushed in all the way.



2) Install stopper cap (1).
While holding piston with a new stopper cap, push it in as far as groove in cylinder and check that claw of stopper cap is caught in cylinder groove securely.
Be sure to use a new stopper cap.



3) Apply thin coat of brake fluid to all around new grommets (2pcs.) and install them to cylinder body, then install reservoir (2).
4) Set a new pin (1) in reservoir hole and drive it in. At this time, make end of pin and end face margin of reservoir equal.

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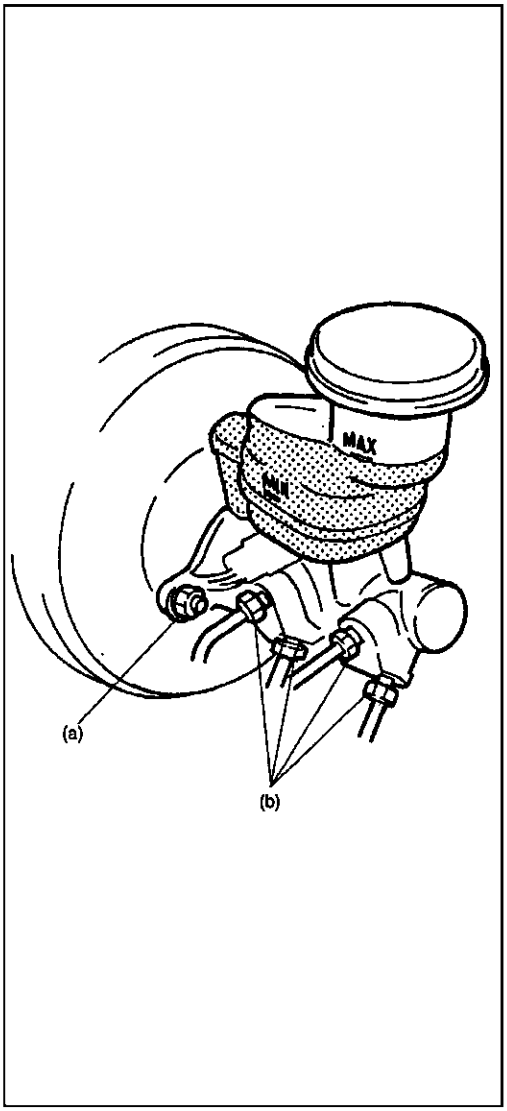

INSTALLATION

NOTE:
Confirm booster piston rod length referring to "BRAKE BOOSTER" in this section.

1) Install master cylinder as shown and tighten attaching nuts to specified torque.

   Tightening Torque
   (a): 13 N-m (1.3 kg-m, 9.5 lb-ft)

2) Connect brake pipe to master cylinder and tighten flare nuts to specified torque.

   Tightening Torque
   (b): 16 N-m (1.6 kg-m, 12.0 lb-ft)

3) Connect reservoir lead wire at coupler.
4) Fill reservoir with specified brake fluid to MAX line.

> **CAUTION:**
> **Do not use shock absorber fluid or any other fluid which contains mineral oil. Mineral oil will cause swelling and distortion of rubber parts in hydraulic brake system and lowering fluid boiling point.**

5) Check brake pedal play referring to "BRAKE PEDAL PLAY INSPECTION" in this section.
6) Bleed air from brake system referring to "BLEEDING BRAKES" in this section.

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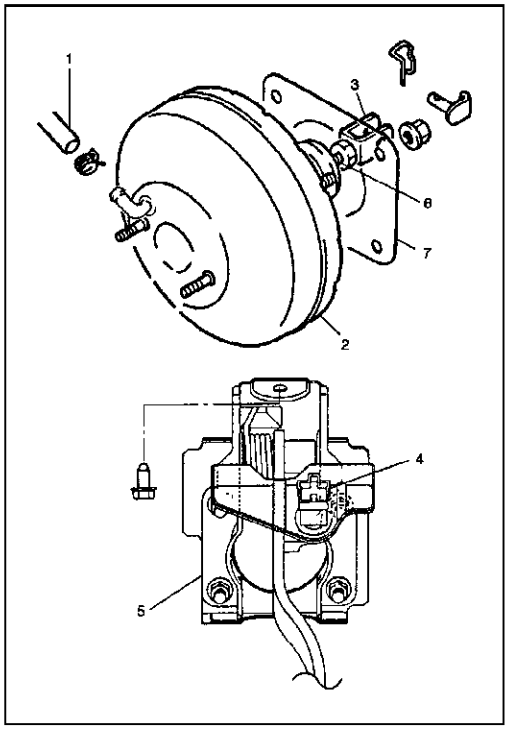
BRAKE BOOSTER

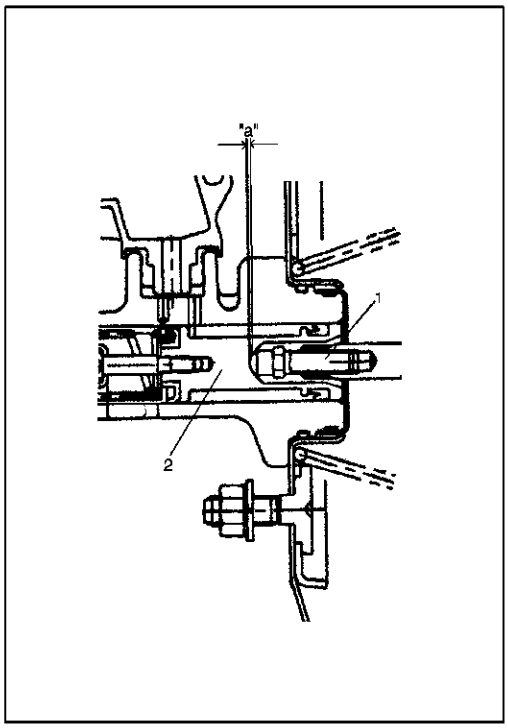
CAUTION:
- **Never disassemble brake booster. Disassembly will spoil its original function. If faulty condition is found, replace it with a new one.**
- **The torque values specified are for dry, unlubricated fasteners. If any hydraulic component is removed or brake line disconnected, bleed the brake system.**



REMOVAL

1) Remove master cylinder assembly referring to "MASTER CYLINDER ASSEMBLY" in this section.
2) Disconnect vacuum hose (1) from booster (2).
3) [For left-hand steering vehicle]
   a) Remove battery and its tray.
   b) Remove push rod clevis pin.

   [For right-hand steering vehicle]
   a) Disconnect push rod clevis (3) from brake pedal arm.
   b) Disconnect stop light switch coupler.
   c) Remove brake pedal bracket (5) with brake pedal and stop light switch (4).
   d) For ease of installation, make marking (6) on clevis lock nut position of push rod thread.
   e) Remove push rod clevis (3) from push rod if clevis obstructs booster removal.
   f) Remove engine hook and A/C hose clamp if necessary.
4) Remove booster mounting nuts and then remove booster.



INSPECTION AND ADJUSTMENT

Booster Piston Rod and Master Cylinder Piston Clearance

The length of booster piston rod (1) is adjusted to provide specified clearance "a" between piston rod end and master cylinder piston (2).

- Before checking length of booster piston rod, push piston rod several times so as to make sure reaction disc is in place.
- Keep inside of booster at atmospheric pressure for checking.

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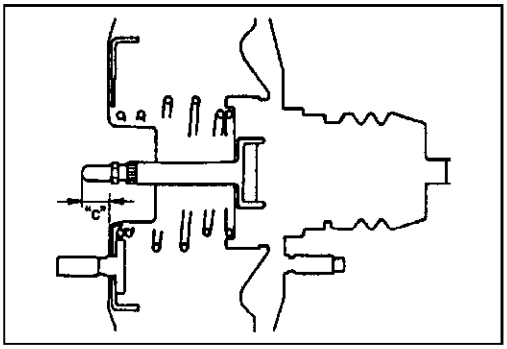
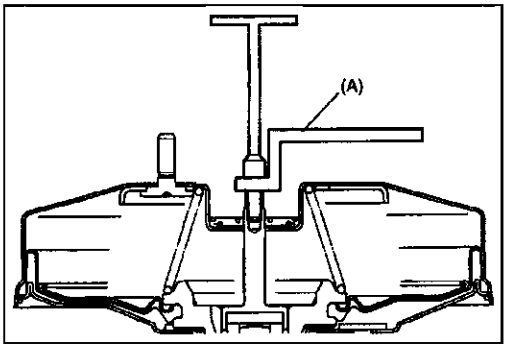


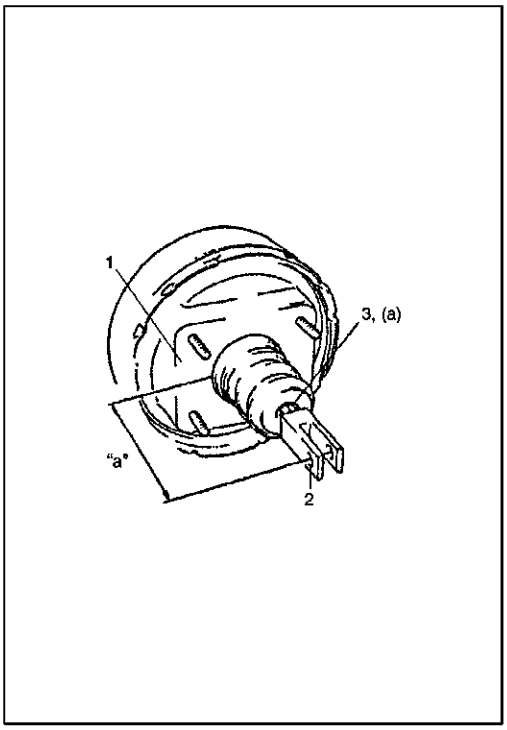
1) Measure length of piston rod, i.e. distance between piston rod and mating surface of booster-to-master cylinder.

Length of piston rod "c": 10.1–10.4 mm (0.40–0.41 in.)



2) If measurement is out of specified value, adjust length by turning adjusting screw of piston rod.

Special Tool
(A): 09952-16030



Push Rod Clevis

1) If clevis is removed at booster removal, install lock nut (3) and clevis (2) to push rod aligning lock nut end surface with marking made in removal.
2) Check measurement between booster mounting surface (1) (without packing) and center (2) of clevis pin hole.

Measurement "a": 97.0–98.0 mm (3.82–3.86 in.)

If it is out of specification, loosen clevis lock nut (3) and adjust measurement to specification by turning clevis.

3) Tighten clevis lock nut to specified torque with holding clevis at that position.

Tightening Torque
(a): 14 N-m (1.4 kg-m, 10.0 lb-ft)

4) For ease of installation, make marking on clevis lock nut position of push rod thread if it is not made.

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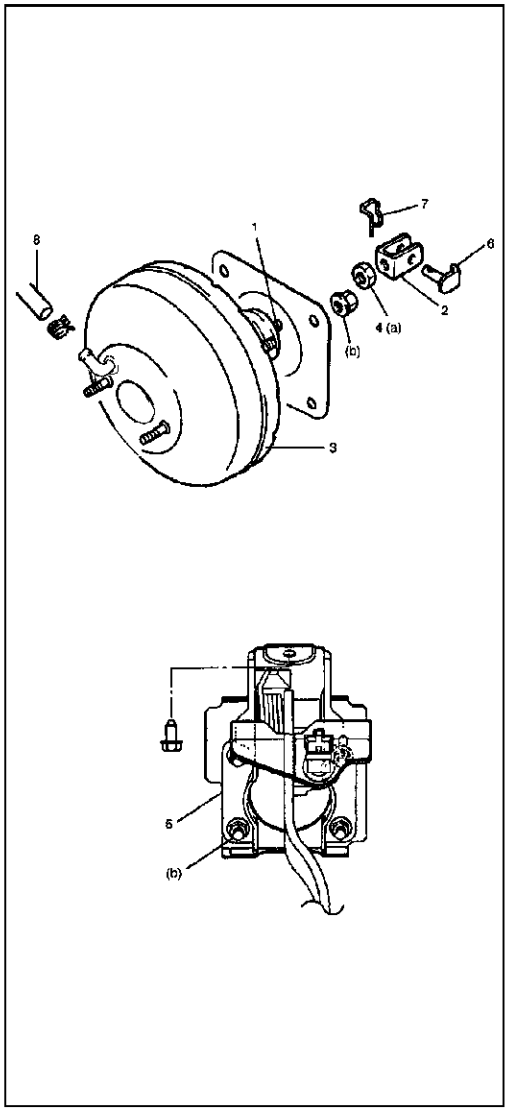

INSTALLATION

1) Install brake booster to dash panel.
   Install it according to the following procedure if clevis obstructs booster installation.

   [For right-hand steering vehicle]
   a) Make marking (1) on clevis lock nut position of push rod thread if it is not marked.
   b) Remove clevis (2) if it is installed.
   c) Install booster (3) to dash panel.
   d) Install lock nut (4) and clevis to push rod aligning lock nut end surface with marking made in removal or in above step a).
      Tighten lock nut to specified torque at that position.

      Tightening Torque
      (a): 14 N-m (1.4 kg-m, 10.0 lb-ft)

   e) Install brake pedal bracket and tighten bracket and booster mounting nuts to specified torque.

      Tightening Torque
      (b): 13 N-m (1.3 kg-m, 9.5 lb-ft)

   f) Connect booster push rod clevis to pedal arm with clevis pin (6) and clip (7).
   g) Connect stop light switch coupler.

   [For left-hand steering vehicle]
   a) Connect push rod clevis to pedal arm with clevis pin and clip.
   b) Tighten booster mounting nuts to specified torque.

      Tightening Torque
      (b): 13 N-m (1.3 kg-m, 9.5 lb-ft)

2) Install master cylinder to booster referring to "MASTER CYLINDER ASSEMBLY INSTALLATION" in this section.
3) Connect booster vacuum hose (8).
4) Connect reservoir lead wire at coupler.
5) Fill reservoir with specified fluid.
6) [For left-hand steering vehicle]
   Install battery and its tray and then connect cables.
7) Bleed air from brake system. (Refer to "BLEEDING BRAKES" in this section)
8) Install A/C hose clamp and engine hook if removed.
9) After installing, check pedal height and play referring to "BRAKE PEDAL FREE HEIGHT CHECK" and "BRAKE PEDAL PLAY INSPECTION" in this section.
10) Perform brake test and check each installed part for fluid leakage.

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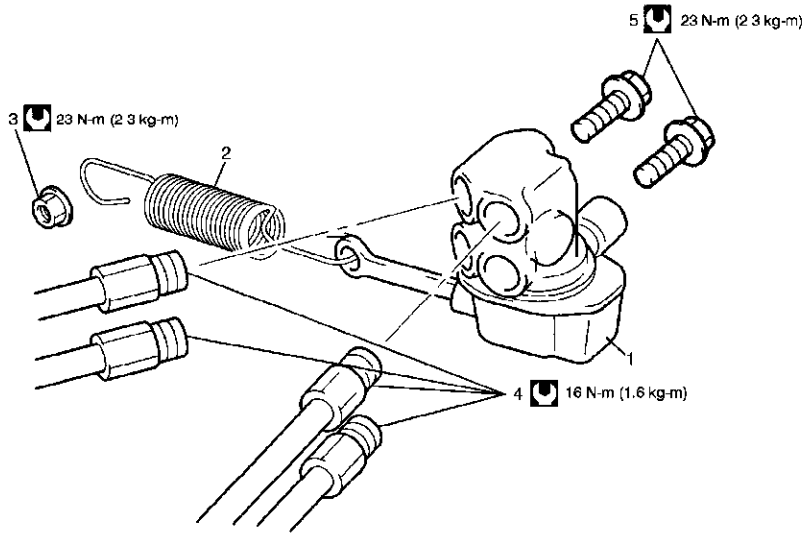
LSPV (LOAD SENSING PROPORTIONING VALVE) ASSEMBLY (IF EQUIPPED)



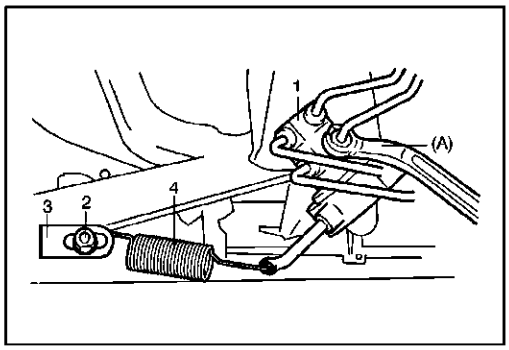
1.	LSPV assembly
2.	Spring
3.	Adjust nut
4.	Brake pipe
5.	LSPV mounting bolt
:	Tightening torque

CAUTION:
Never disassemble LSPV assembly. Disassembly will spoil its original performance. Replace with new one if detective.

REMOVAL

1) Clean around reservoir cap and take out fluid with syringe or such.
2) Hoist vehicle.
3) Disconnect brake pipes from LSPV assembly.

   Special tool
   (A): 09950-78230 (10 x 11 mm)



4) Remove nut (2) and detach spring end from rear axle (3).
5) Remove LSPV assembly (1) with spring (4) from vehicle body.

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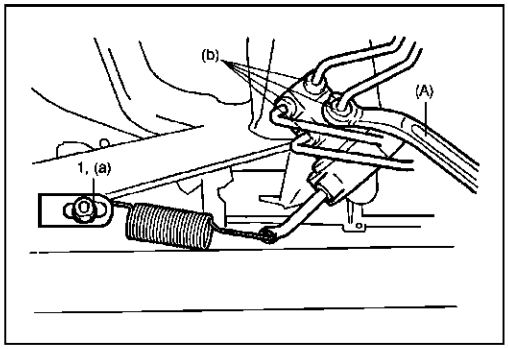


INSTALATION

1) Install LSPV assembly with spring to vehicle body.
2) Torque each bolt and nut (1) to specification as indicated respectively in figure.

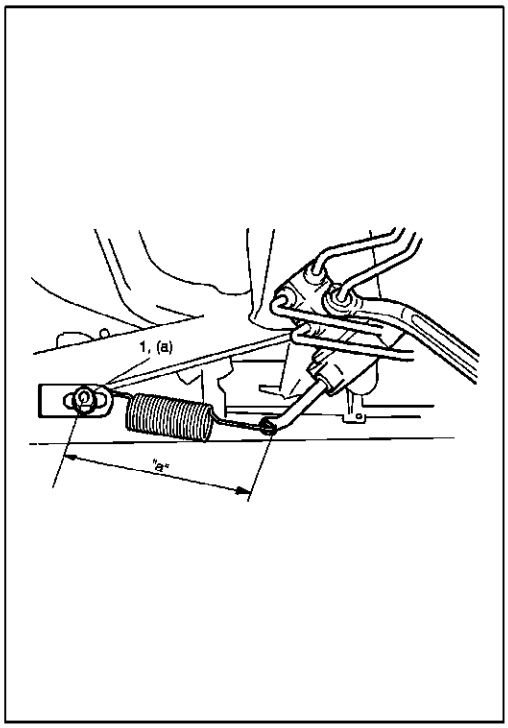
   Special tool
   (A) : 09950-78230 (10 x 11 mm)

   Tightening torque
   LSPV adjsut nut (a) : 23 N-m (2.3 kg-m, 17.0 lb-ft)
   Brake pipe flare nuts (b) : 16 N-m (1.6 kg-m, 11.5 lb-ft)

3) Fill reservoir with specified fluid and bleed air from brake system.
4) After bleeding air, check that LSPV is installed properly referring to following "INSPECTION AND ADJUSTMENT".

INSPECTION AND ADJUSTMENT

1) Confirm the following before inspection and adjustment.
   - Fuel tank is filled with fuel fully.
   - Vehicle is equipped with spare tire, tools, jack and jack handle.
   - Vehicle is free from any other load,
   - Vehicle is placed on level floor.



2) Push up LSPV lever with finger till it stops and measure length of coil speing ("a" in figure).
3) Spring length "a" should be as specified.

   Spring length "a" : 108 mm (4.25 in.)

4) If it isn't, adjust it to specificatin by changing spring positioin as shown in figure. After adjustment, tighten nut (1) to specified torque.

   Tightening torque
   LSPV adjust nut (a) : 23 N-m (2.3 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.

5) Confirm fluid pressure referring to "Fluid Pressure Test".

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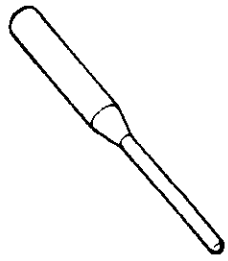
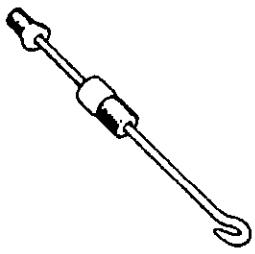
REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED (SUZUKI) PRODUCT	USE
Brake fluid	DOT 3	• 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 axle. • To apply to mating surfaces of brake back plate and parking brake cable.
Anti-squeal agent	Hydrocarbon base brake grease	• To coat thinly to surface on which shoe rims rest.

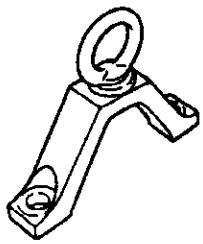
SPECIAL TOOLS



09922-89810
Pin remover

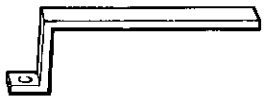


09942-15510
Sliding hammer

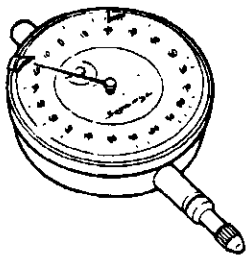


09943-17912
Brake drum remover
(Front wheel hub remover)

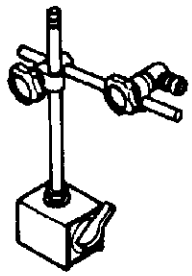
09950-78230
Flare nut wrench (10x11 mm)



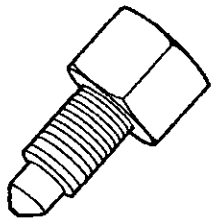
09952-16030
Booster piston rod adjuster



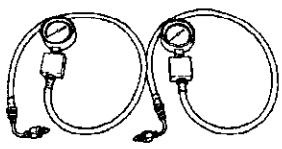
09900-20606
Dial gauge



09900-20701
Magnetic stand



09952-36310
Fluid pressure gague
attachment (7mm)



09956-02310
Fluid pressure gague

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SECTION 5B

ANTILOCK BRAKE SYSTEM

WARNING:

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

- **Service on and around the air bag system components or wiring must be performed only by and authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in 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 or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the "LOCK" position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

NOTE:

All brake fastners 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 weakning of the metal.

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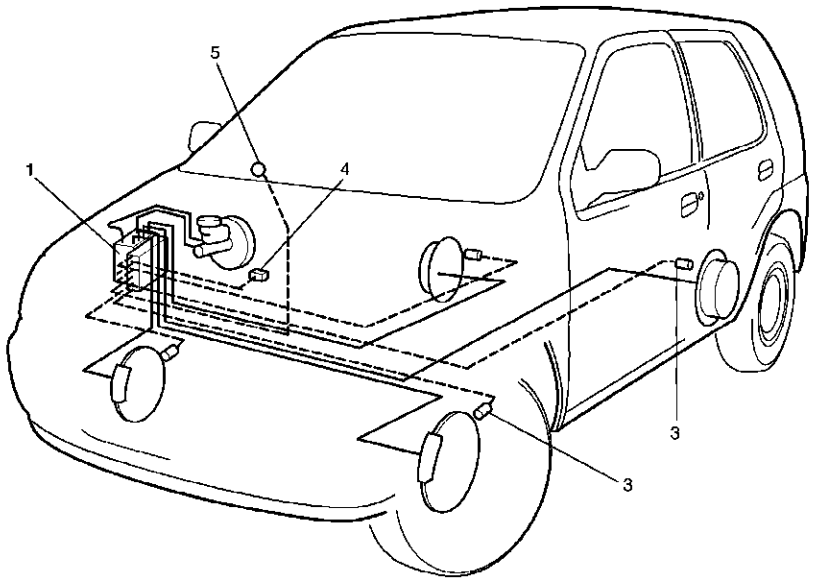
GENERAL DESCRIPTION

COMPONENTS/PARTS LOCATION AND BRAKE HOSE/PIPE ROUTING

The ABS (Antilock Brake System) controls the fluid pressure applied to the wheel cylinder of each brake from the master cylinder so that each wheel is not locked even when hard braking is applied.
This ABS has also the following function.
While braking is applied, but before ABS control becomes effective, braking force is distributed between the front and rear so as to prevent the rear wheels from being locked too early for better stability of the vehicle.
The main component parts of this ABS include the following parts in addition to those of the conventional brake system.

- Wheel speed sensor which senses revolution speed of each wheel and outputs its signal.
- ABS warning lamp which lights to inform abnormality when system fails to operate properly.
- ABS hydraulic unit/control module assembly is incorporated ABS control module, ABS hydraulic unit (actuator assembly), fail-safe relay and pump motor relay.
  - ABS control module which sends operation signal to ABS hydraulic unit to control fluid pressure applied to each wheel cylinder based on signal from each wheel speed sensor so as to prevent wheel from locking.
  - ABS hydraulic unit which operates according to signal from ABS control module to control fluid pressure applied to wheel cylinder of each 4 wheels.
  - Fail-safe relay (solenoid valve) which supplies power to solenoid valve in ABS hydraulic unit.

[A]



[A]: RH steering vehicle shown	4. Stop lamp switch
1 ABS hydraulic unit/control module assembly	5. ABS warning lamp
3 Wheel speed sensors	

NOTE:
The above figure shows RH steering vehicle. Component location of LH steering vehicle is symmetrical.

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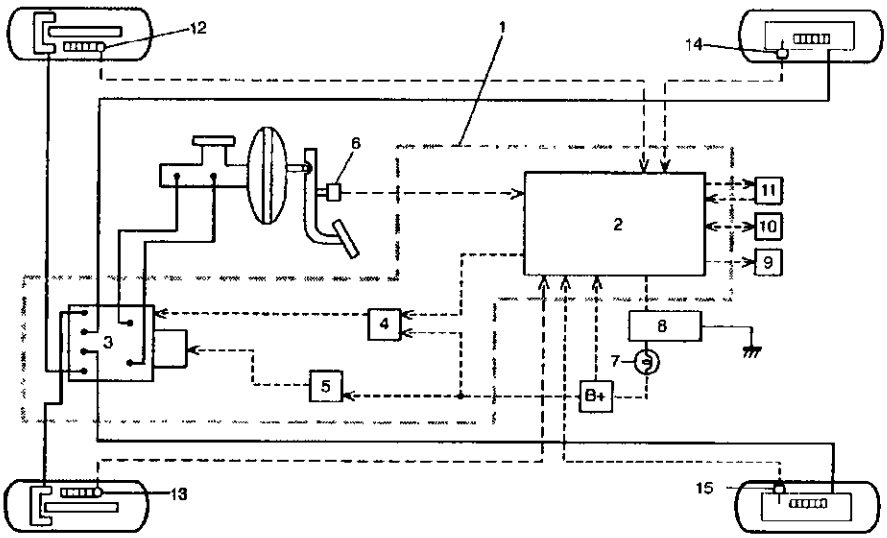
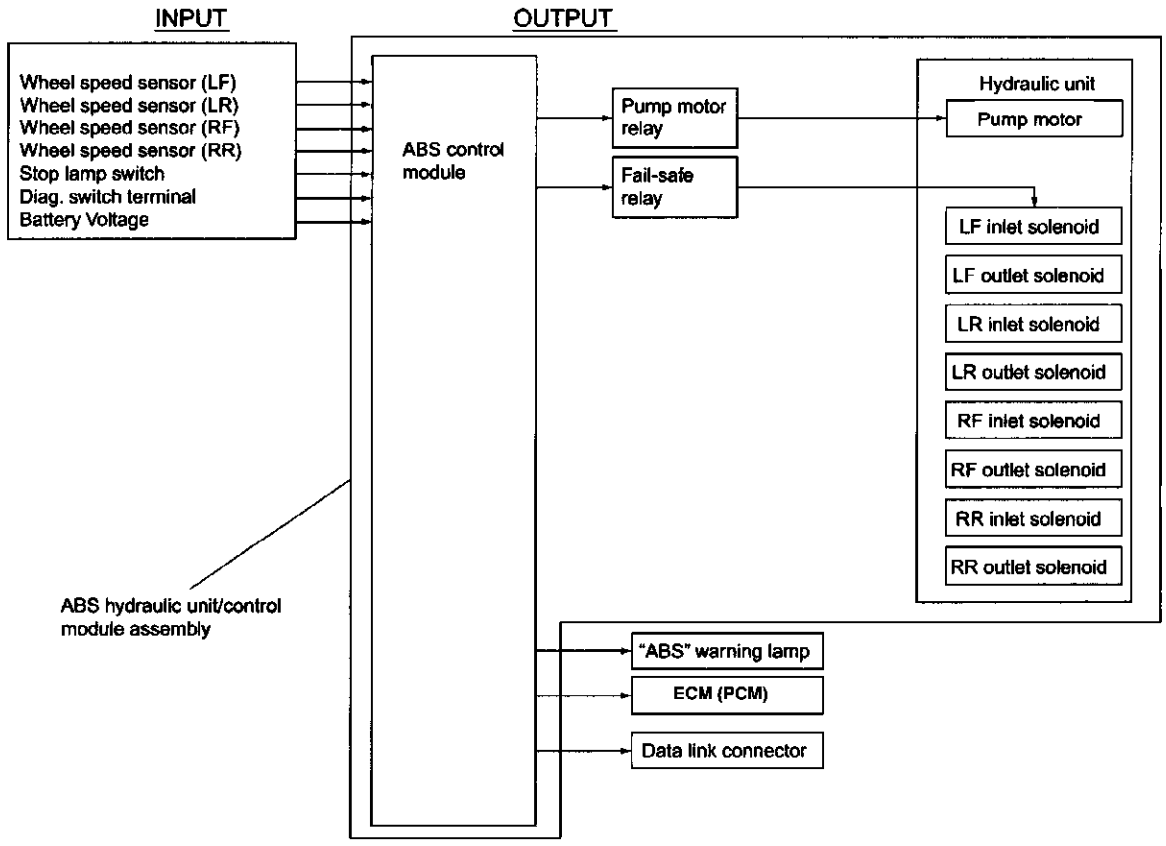
SYSTEM SCHEMATIC





1 ABS hydraulic unit/control module assembly	7 "ABS" warning lamp	13 Wheel speed sensor (Left-front)
2. ABS control module	8 Lamp driver module	14 Wheel speed sensor (Right-rear)
3 ABS hydraulic unit	9 ECM (PCM)	15 Wheel speed sensor (Left-rear)
4. Fail safe relay	10 Data link connector	
5. Pump motor relay	11 Monitor connector	
6 Stop lamp switch	12 Wheel speed sensor (Right-front)	

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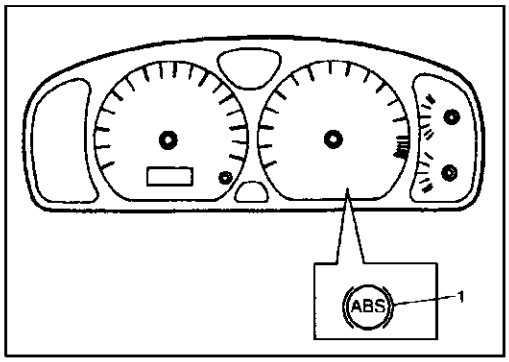
ABS HYDRAULIC UNIT/CONTROL MODULE ASSEMBLY

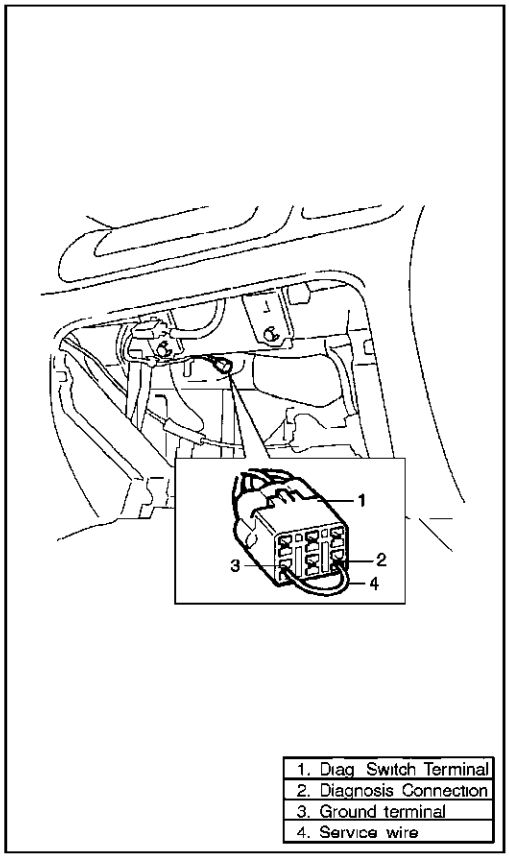
ABS control module is a component of ABS hydraulic unit/control module assembly and has the following functions.

SELF-DIAGNOSIS FUNCTION

ABS control module diagnoses conditions of the system component parts (whether or not there is any abnormality) all the time and indicates the results (warning of abnormality occurrence and DTC) through the ABS warning lamp as described below.



1) When ignition switch is turned ON, ABS warning lamp 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 of EEPROM in ABS control module.



4) When Diag. switch terminal (2) of monitor connector (1) (monitor connector) is grounded, the abnormal area is output as DTC. It is indicated by flashing of ABS warning lamp. (Refer to the table below.)

SYSTEM CONDITION		ABS WARNING LAMP	
		Diag. switch terminal is not grounded	Diag. switch terminal is grounded
In good condition at present	No trouble in the past	OFF	DTC 12
	Trouble occurred in the past	OFF	History DTC
Abnormality exists at present	No trouble in the past	ON	Current DTC
	Trouble occurred in the past	ON	Current and history DTCs

5) For procedure to clear all DTC's, refer to "DIAGNOSTIC TROUBLE CODE CLEARANCE" in this section.

FAIL-SAFE FUNCTION

When an abnormality occurs (an abnormal DTC is detected), ABS control module turns OFF the fail-safe relay which supplies power to ABS hydraulic unit. Thus, with ABS not operating, brakes function just like the brake system of the vehicle without ABS.

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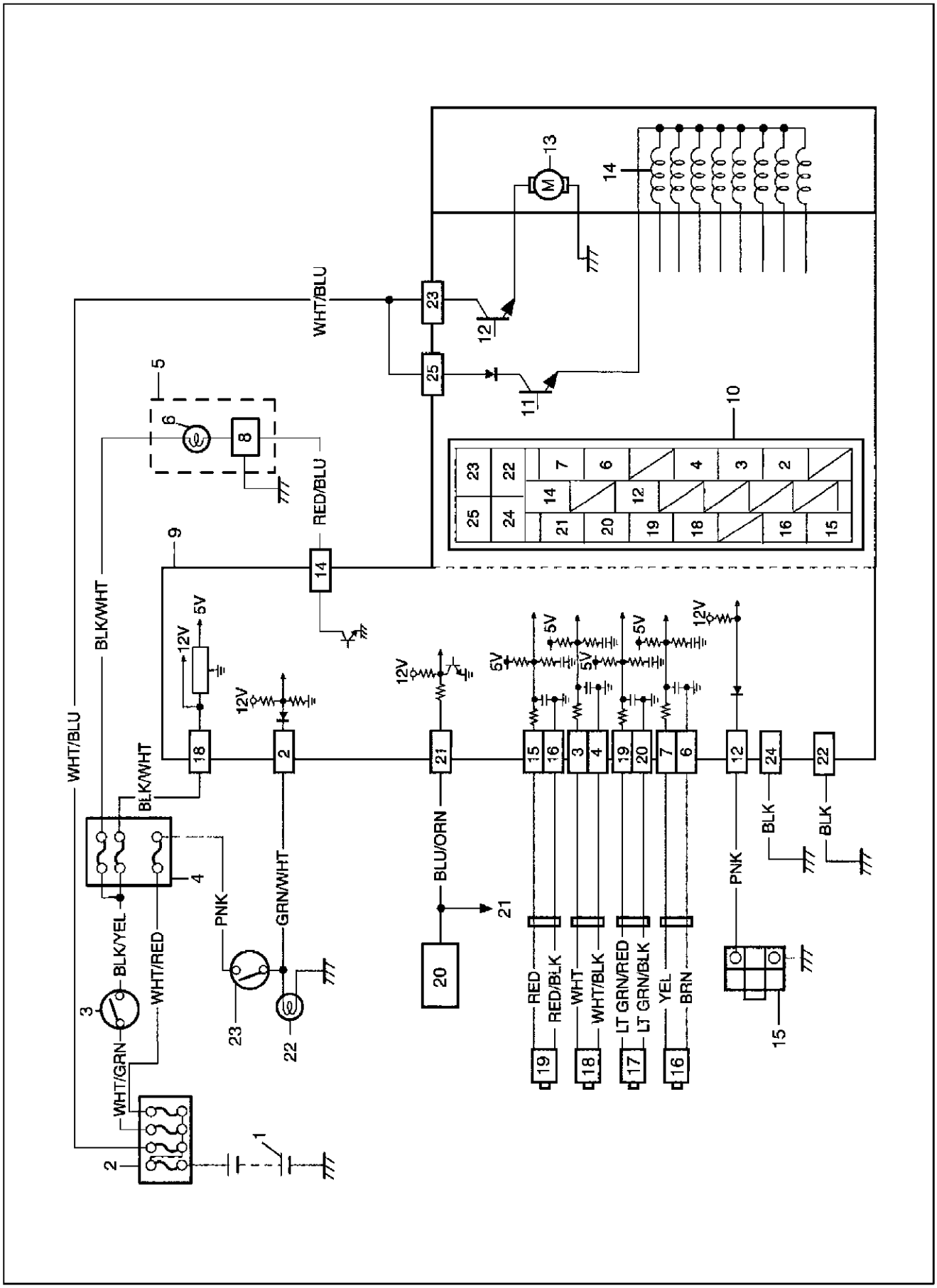
SYSTEM CIRCUIT



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1. Battery	10 Terminal arrangement of connector E19 for ABS hydraulic unit/control module assembly	18 Right-front wheel speed sensor
2. Main fuses	11. ABS fail-safe relay (Solenoid valve relay)	19. Left-front wheel speed sensor
3. Ignition switch	12. ABS pump motor relay	20. Data link connector
4. Circuit fuses	13. Pump motor	21. To ECM
5. Combination meter	14. Solenoid valves	22. Stop lamp
6. ABS warning lamp	15. Monitor connector	23. Stop lamp switch
8. Warning lamp driver module	16. Right-rear wheel speed sensor	
9. ABS hydraulic unit/control module assembly	17. Left-rear wheel speed sensor	

Wire color					
BLK :	Black	LT GRN/BLK :	Light Green/Black	WHT :	White
BLK/ORN :	Black/Orange	LT GRN/RED :	Light Green/Red	WHT/BLK :	White/Black
BLK/RED :	Black/Red	ORN :	Orange	WHT/BLU :	White/Blue
BLU :	Blue	PNK :	Pink	WHT/GRN :	White/Green
BLU/ORN:	Blue/Orange	PNK/GRN:	Pink/Green	WHT/RED :	White/Red
BRN :	Brown	RED :	Red	YEL :	Yellow
GRN :	Green	RED/BLK :	Red/Black		
GRN/WHT :	Green/White	RED/WHT :	Red/White		
GRN/ORN :	Green/Orange				

TERMINAL		CIRCUIT
E19	1	–
	2	Stop lamp switch
	3	Right-front wheel speed sensor (+)
	4	Right-front wheel speed sensor (–)
	5	–
	6	Right-rear wheel speed sensor (–)
	7	Right-rear wheel speed sensor (+)
	8	–
	9	–
	10	–
	11	–
	12	Diagnosis switch terminal
	13	–
	14	ABS warning lamp
	15	Left-front wheel speed sensor (+)
	16	Left-front wheel speed sensor (–)
	17	–
	18	Ignition switch
	19	Left-rear wheel speed sensor (+)
	20	Left-rear wheel speed sensor (–)
	21	Data link connector
	22	Ground
	23	ABS pump motor relay
	24	Ground
	25	ABS fail-safe relay

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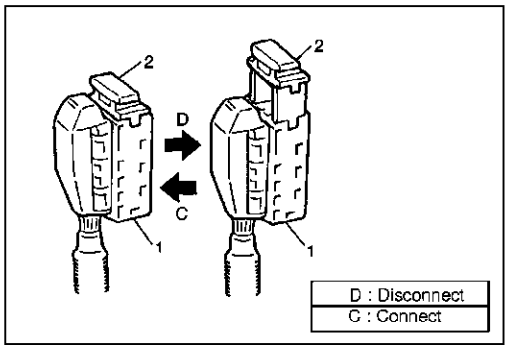
DIAGNOSIS

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 ELECTRICAL CIRCUIT SERVICE" in Section 0A before inspection and observe what is written there.
- Be sure to use the trouble diagnosis procedure as described in the flow table. Failure to follow the flow table may result in incorrect diagnosis. (Some other diagnosis trouble code may be stored by mistake in the memory of ABS control module during inspection.)
- When disconnecting ABS hydraulic unit/control module connector (1), pull up lock (2) of connector.
  When connecting, set the connector on ABS hydraulic unit/ control module assembly and push the lock (2) down.



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ABS DIAGNOSTIC FLOW TABLE

Refer to the following pages for the details of each step.

Step	Action	Yes	No
1	1) Perform "Customer Complaint Analysis". 2) Perform "Problem Symptom Confirmation". 3) Perform "Diagnostic Trouble Code Check, Record and Clearance". Is there any malfunction DTC?	Go to Step 2.	Go to Step 5.
2	1) Perform "DRIVING TEST". Is trouble symptom identified?	Go to Step 3.	Go to Step 6.
3	1) Check diagnostic trouble code. Is it malfunction code?	Go to Step 4.	Go to Step 5.
4	1) Inspect and repair referring to applicable diagnostic trouble code table in this section. 2) Perform "FINAL CONFIRMATION TEST" after cleared DTC. Does trouble recur?	Go to Step 7.	End.
5	1) Inspect and repair referring to "DIAGNOSIS" in "BRAKES" section. 2) Perform "FINAL CONFIRMATION TEST".	–	–
6	1) Check intermittent troubles referring to "INTERMITTENT AND POOR CONNECTION" in "GENERAL INFORMATION" section and related circuit of trouble code recorded in Step 2. 2) Perform "FINAL CONFIRMATION TEST" after cleared diagnostic trouble code. Does trouble recur?	Go to Step 7.	End.
7	1) Perform "Diagnostic Trouble Code Check, Record and Clearance". Is there any malfunction code?	Go to Step 2.	Go to Step 5.

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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 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	• Continous/Intermittent (times a day,a month)/ other_____
Conditons 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 Conditional	• Weather: fair/cloudy/rain/snow/other_____ • Temperature: °F (°C)
Diagnostic Trouble Code	• First check: Normal code/malfunction code ( ) • Second check after test drive: Normal code/malfunction code ( )

b) Problem Symptom Confirmation

Check if what the customer claimed in "CUSTOMER QUESTIONNAIRE" is actually found in the vehicle and if that symptom is found, whether it is identified as a failure. (This step should be shared with the customer if possible.) Check warning lamp related to brake system referring to "ABS WARNING LAMP CHECK" in this section.

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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 control module for proper self-diagnosis function.
If the malfunction DTC which was once displayed and then cleared can be detected (indicated) again when ignition switch is turned ON, proceed to Step 3).

2) DRIVING TEST
Test drive the vehicle at 40 km/h for more than a minute and check if any trouble symptom (such as abnormal lighting of ABS warning light) exists.
If the malfunction DTC is confirmed again at ignition switch ON, driving test as described in above is not necessary. Proceed to Step 3).

3) DIAGNOSTIC TROUBLE CODE CHECK
Recheck diagnostic trouble code referring to "DTC CHECK" as shown in the following page.

4) DIAGNOSTIC TROUBLE CODE FLOW TABLE
According to Diagnostic flow table for the diagnostic trouble code confirmation in Step 3), locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator assembly or other part and repair or replace faulty parts.

5) "DIAGNOSIS" IN "BRAKES" SECTION
Check the parts or system suspected as a possible cause referring to "DIAGNOSIS" in "BRAKES" section and based on symptoms appearing on the vehicle (symptom obtained through Steps 1)-a, 1)-b and 2) and repair or replace faulty parts, if any).

6) CHECK FOR INTERMITTENT PROBLEM
Check parts where an intermittent trouble is easy to occur (e.g., wire harness, connector, etc.), referring to "INTERMITTENT AND POOR CONNECTION" in "GENERAL INFORMATION" section and related circuit of trouble code recorded in Step 1)-c.

7) FINAL CONFIRMATION TEST
Confirm that the problem symptom has gone and the ABS is free from any abnormal conditions. If what has been repaired is related to the malfunction DTC, clear the DTC once and perform test driving and confirm that no DTC is indicated.

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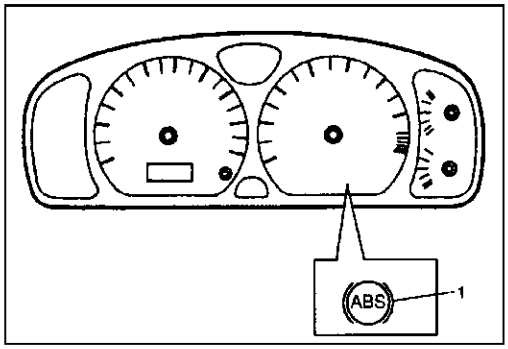

ABS WARNING LAMP CHECK

1) Turn ignition switch ON.
2) Check that ABS warning lamp (1) comes ON for about 2 seconds and then goes off.
   If any faulty condition is found, advance to Diagnostic Flow Table-A, B, C or D.

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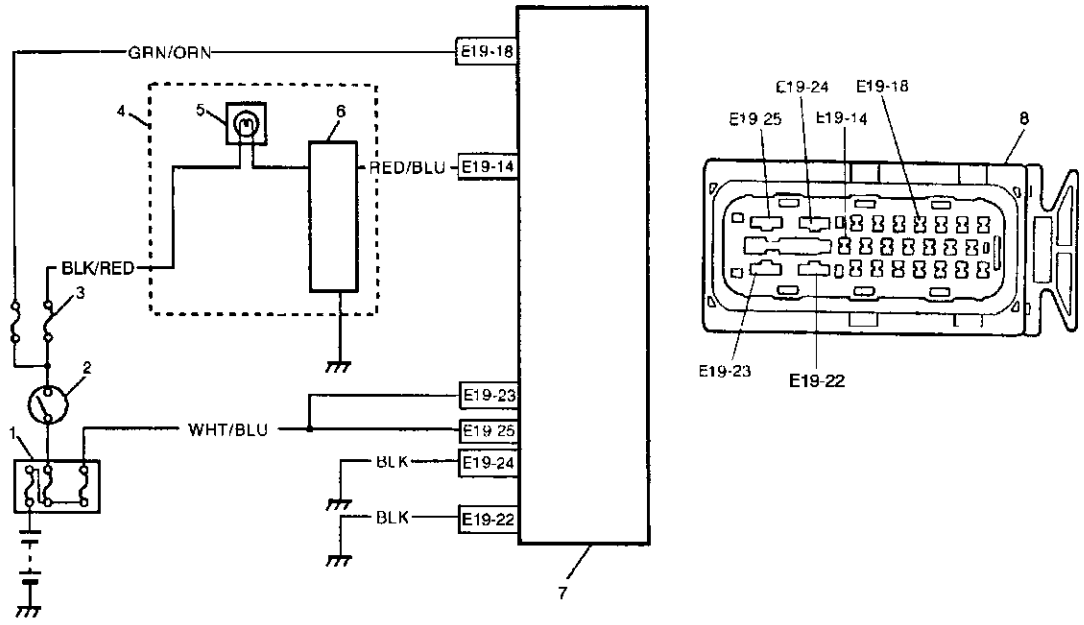
Table-A ABS Warning Lamp Circuit Check – Lamp Does Not Come "ON" at Ignition Switch ON



1.	Main fuse	5.	ABS warning lamp
2.	Ignition switch	6.	Lamp driver module
3.	Circuit fuse	7.	ABS hydraulic unit/control module assembly
4.	Combination meter	8.	ABS hydraulic unit/control module connector

CIRCUIT DESCRIPTION

Operation (ON/OFF) of ABS warning lamp is controlled by ABS control module through lamp driver module in combination meter.

If the Antilock brake system is in good condition, ABS control module turns ABS warning lamp ON at the ignition switch ON, keeps it ON for 2 seconds and then turns it OFF. If an abnormality in the system is detected, ABS warning lamp is turned ON continuously by ABS control module. Also, it is turned ON continuously by lamp driver module when the connector of ABS control module is disconnected.

INSPECTION

Step	Action	Yes	No
1	1) Turn ignition switch 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?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	Go to Step 3.
3	1) Remove combination meter. Is bulb of ABS warning lamp in good condition?	"RED/BLU" circuit shorted to ground. If OK, replace combi nation meter (lamp driver module).	Replace Bulb
4	Is meter fuse in good condition?	Open in "BLK/RED" wire to combination meter or poor connection.	Repair and replace.

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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	Does malfunction DTC (other than code No.12) exist 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 "E19-14", "E19-18" , "E19-24" and "E19-22". 3) If OK then ignition switch ON and measure voltage at terminal "E19-18" of connector. Is it 10 – 14 V?	Go to Step 4.	"GRN/ORN" circuit open.
4	1) With ABS hydraulic unit/control module connector disconnected, turn ignition switch ON and light ABS warning lamp. 2) Connect terminal "E19-14" of disconnected connector to ground using service wire. Does ABS warning lamp turn off?	Go to Step 5.	"RED/BLU" circuit open. If wire and connections are OK, replace combination meter (lamp driver module).
5	1) Measure resistance between connector terminal "E19-24" or "E19-22" body ground. Is continuity indicated?	Substitute a known-good ABS hydraulic unit/ control module assembly and recheck.	"BLK" circuit open.

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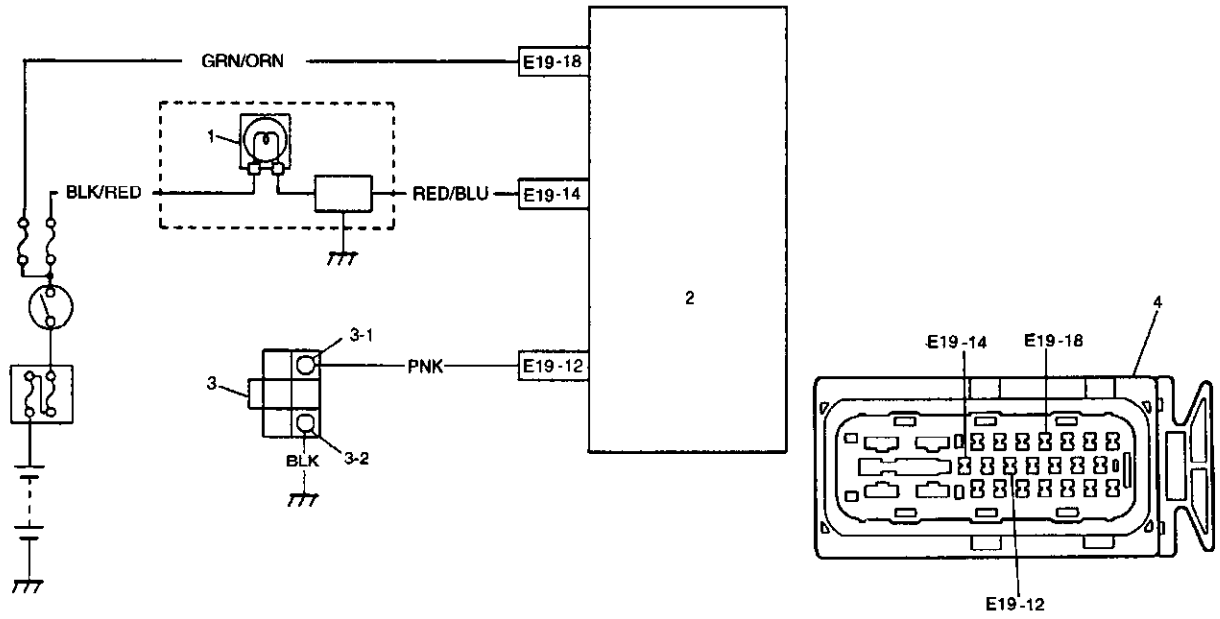
Table-C ABS Warning Lamp Circuit Check – The Lamp Flashes Continuously While Ignition Switch Is ON



1. "ABS" warning lamp in combination meter	3. Monitor connector	3-2. Diagnosis ground terminal
2. ABS hydraulic unit/control module assembly	3-1. Diagnosis switch terminal	4. ABS hydraulic unit/control module connector

CIRCUIT DESCRIPTION

When diagnosis switch terminal is shorted or connected to the ground with ignition switch ON, diagnosis trouble code (DTC) is indicated by flashing of ABS warning lamp only in the 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 diagnosis 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 diagnosis switch terminal and ground. Is it 10 – 14 V?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	"PNK" wire circuit shorted to ground.
3	1) Ignition switch ON. 2) Does flashing of ABS warning lamp indicate 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.

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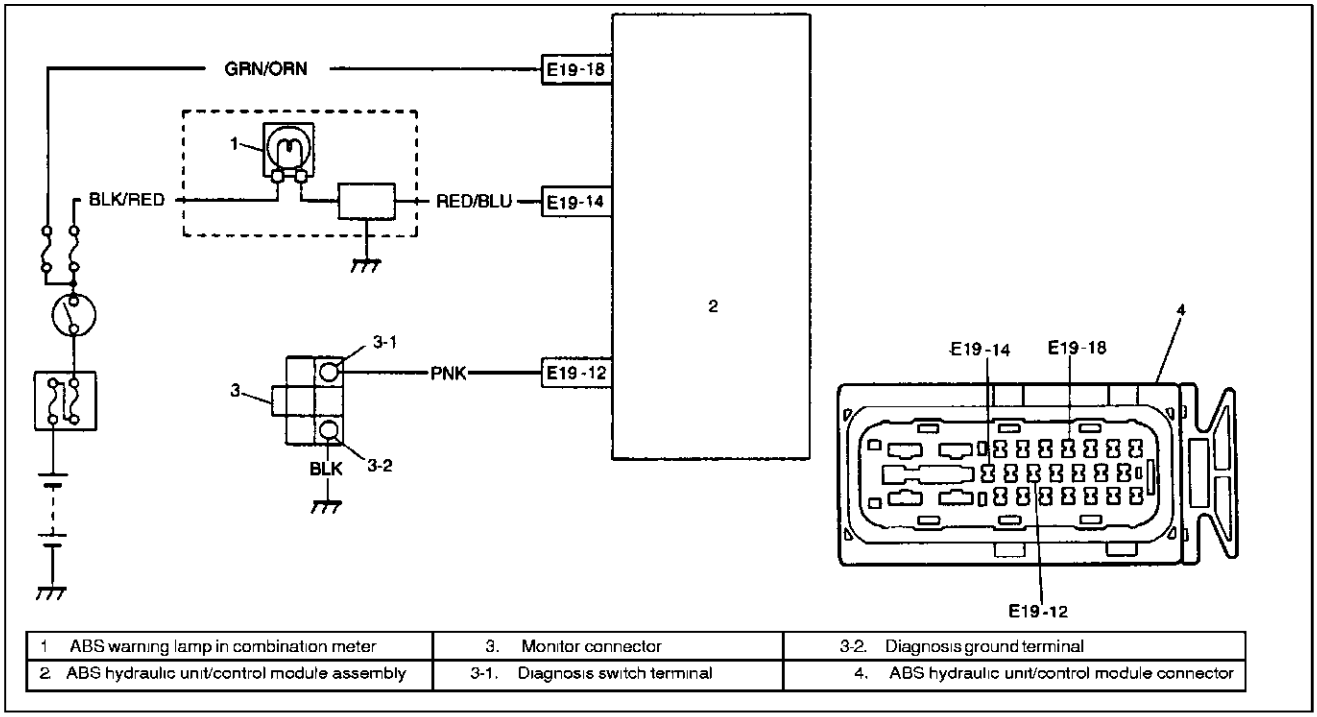
Table-D Code (DTC) Is Not Outputted Even with Diagnosis Switch Terminal Connected to Ground



1 ABS warning lamp in combination meter	3. Monitor connector	3-2. Diagnosis ground terminal
2. ABS hydraulic unit/control module assembly	3-1. Diagnosis switch terminal	4. ABS hydraulic unit/control module connector

CIRCUIT DESCRIPTION

When diagnosis switch terminal is connected to ground with ignition switch turned ON, the ABS control module outputs diagnostic trouble code by flashing ABS warning lamp.

INSPECTION

Step	Action	Yes	No
1	Is it shorted diagnosis 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 diagnosis switch terminal and connector terminal "E19-12". Is it infinite (∞)?	"PNK" circuit open.	Go to Step 3.
3	1) Measure resistance between ground terminal of monitor coupler and body ground. Is continuity indicated?	Go to Step 4.	"BLK" circuit open or poor connection.
4	1) Check for proper connection to ABS hydraulic unit/control module at terminal "E19-12". 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 with/control module assembly and recheck.	Repair "ABS" warning lamp circuit.

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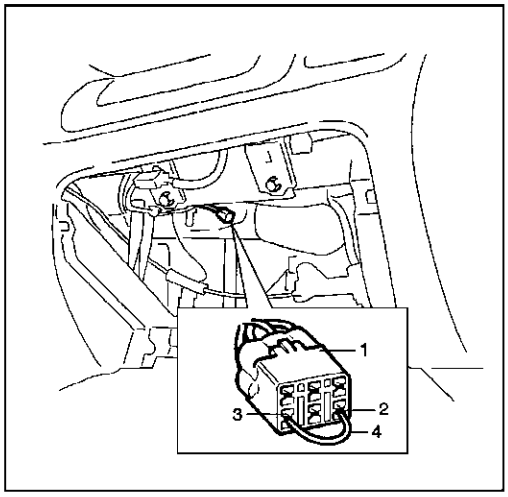
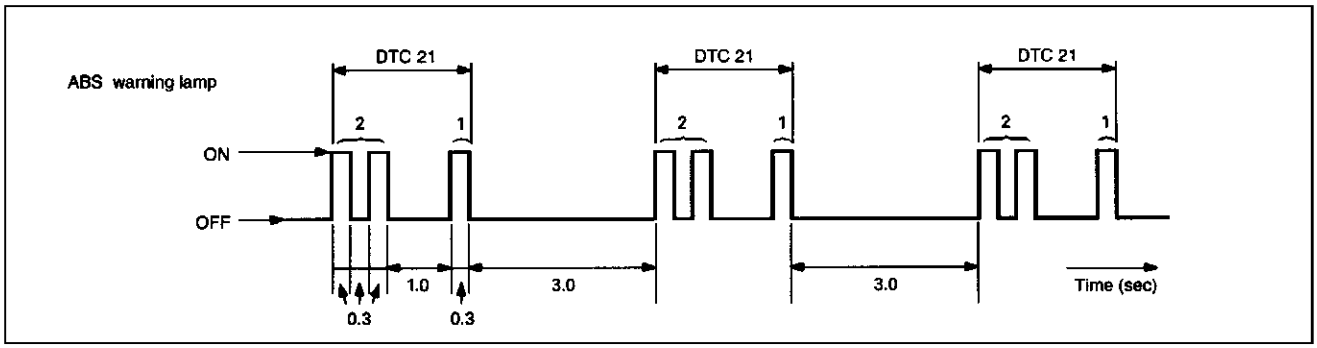


DIAGNOSTIC TROUBLE CODE (DTC) CHECK (USING ABS WARNING LAMP)

1) Perform ABS WARNING LAMP CHECK described above.
2) Using service wire (4), connect diagnosis switch terminal (2) of monitor coupler (1) to ground (3).
3) Turn ignition switch ON.
4) Read flashing of ABS warning lamp which represents DTC as shown in example below and write it down. When more than 2 DTCs 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)



5) After completing the check, turn ignition switch off, disconnect service wire from monitor coupler.

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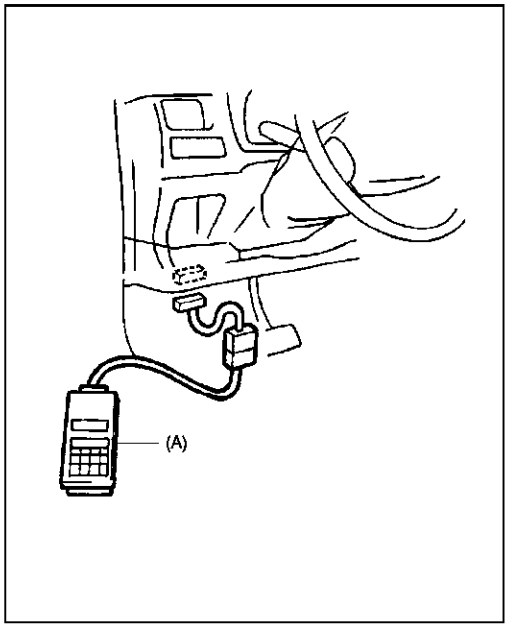
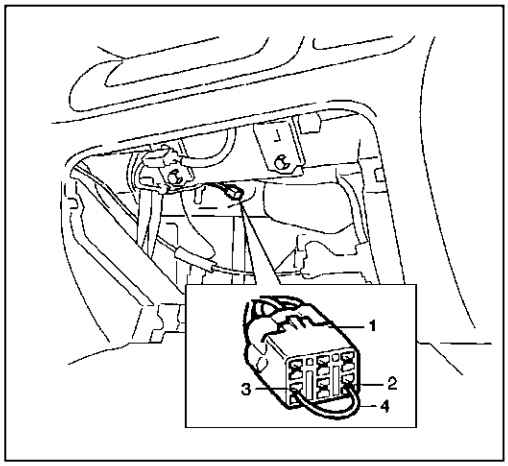


DIAGNOSTIC TROUBLE CODE (DTC) CHECK (USING SUZUKI SCAN TOOL)

1) After setting cartridge for ABS to SUZUKI scan tool, connect SUZUKI scan tool to data link connector (1).

   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 performing a driving test, select a safe place where there is neither any traffic nor any traffic accident possibility and be very careful during testing to avoid occurrence of an accident.

After repair or replace malfunction part(s), clear all DTCs by performing
the following procedure.

1) Turn ignition switch OFF.
2) Using service wire (4), connect diagnosis switch terminal (2) of monitor coupler (1) to ground terminal (3).
3) With connection described in above Step 2) maintained, turn ignition switch ON.

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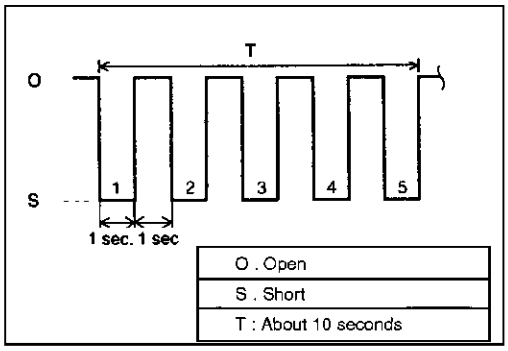

4) Repeat disconnecting and reconnecting of service wire between diagnosis and ground terminals 5 times or more at about 1sec. interval within 10 seconds.

5) Turn ignition switch OFF and disconnect service wire from monitor coupler.
6) Perform "DRIVING TEST" (Step 2 of "ABS DIAGNOSTIC FLOW TABLE" in this section) and "DTC CHECK" and confirm that normal DTC (DTC 12) is displayed ; not malfunction DTC.

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

CAUTION:
Be sure to perform "ABS DIAGNOSTIC FLOW TABLE" before starting diagnosis.

DTC (displayed on SUZUKI scan tool)	DTC (indicated by ABS warning lamp)	ABS warning lamp flashing pattern	DIAGNOSTIC ITEMS	
NO DTC	12	1 2	Normal	
C1021	21	2 1	RF	Wheel speed sensor circuit
C1025	25	2 5	LF	
C1031	31	3 1	RR	
C1035	35	3 5	LR	

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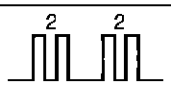
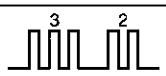
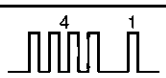
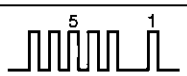
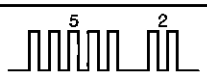
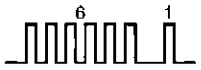
DTC (displayed on SUZUKI scan tool)	DTC (indicated by ABS warning lamp)	ABS warning lamp flashing pattern	DIAGNOSTIC ITEMS	
C1022	22		RF	Wheel speed sensor circuit or sensor rotor
C1026	26		LF	
C1032	32		RR	
C1036	36		LR	
C1041	41		RF	Inlet solenoid valve circuit
C1042	42			Outlet solenoid valve circuit
C1045	45		LF	Inlet solenoid valve circuit
C1046	46			Outlet solenoid valve circuit
C1051	51		RR	Inlet solenoid valve circuit
C1052	52			Outlet solenoid valve circuit
C1055	55		LR	Inlet solenoid valve circuit
C1056	56			Outlet solenoid valve circuit
C1057	57		Power source	
C1061	61		ABS pump motor and/or motor relay circuit	
C1063	63		Fail safe-relay	
C1071	71		ABS control module	

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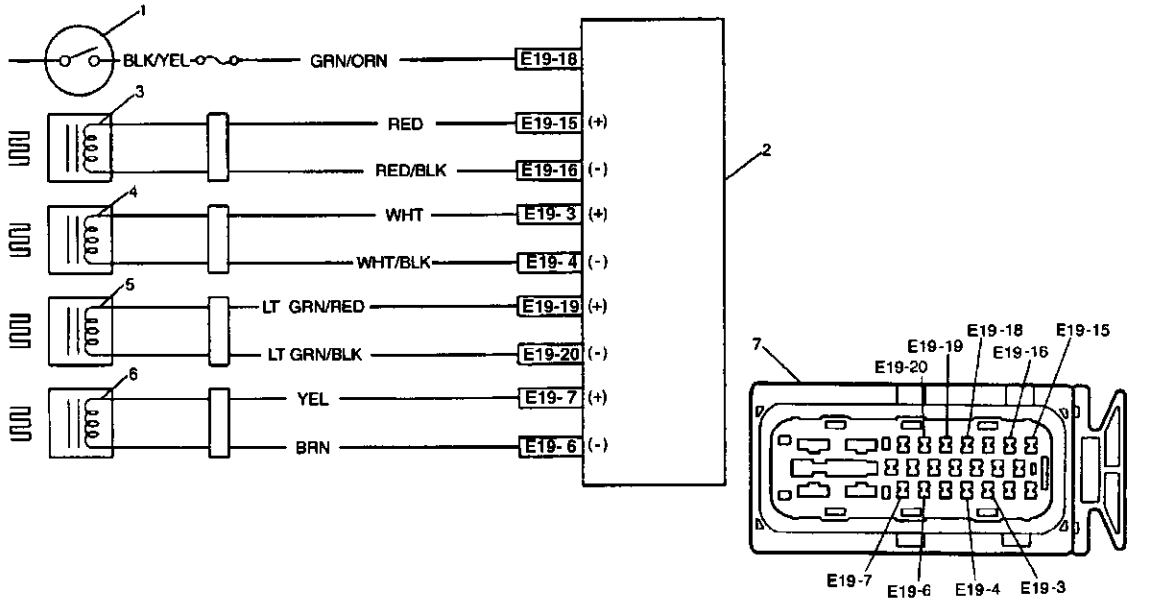
DTC C1021 (DTC 21), DTC C1022 (DTC 22) – RIGHT-FRONT WHEEL SPEED SENSOR CIRCUIT OR SENSOR ROTOR

DTC C1025 (DTC 25), DTC C1026 (DTC 26) – LEFT-FRONT WHEEL SPEED SENSOR CIRCUIT OR SENSOR ROTOR

DTC C1031 (DTC 31), DTC C1032 (DTC 32) – RIGHT-REAR WHEEL SPEED SENSOR CIRCUIT OR SENSOR ROTOR

DTC C1035 (DTC 35), DTC C1036 (DTC 36) – LEFT-REAR WHEEL SPEED SENSOR CIRCUIT OR SENSOR ROTOR



1. Ignition switch	4. Right-front wheel speed sensor	7. ABS hydraulic unit/control module connector
2 ABS control module/hydraulic unit 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 terminal of each sensor while the ignition switch is ON. When the voltage is not within the specified range, an applicable DTC will be set. Also, when no sensor signal is inputted at starting or while running, an applicable DTC will be set.

NOTE:

When the vehicle was operated in any of the following ways, one of these DTCs may be set even when the sensor is in good condition. If such possibility is suspected, repair the trouble (dragging of brake, etc.) of the vehicle, clear DTC once and then after performing the driving test as described in Step 2 of "ABS DIAGNOSIS FLOW TABLE", check whether or not any abnormality exists.

- **The vehicle was driven with parking brake pulled.**
- **The vehicle was driven with brake dragging.**
- **Wheel spin occurred while driving.**
- **Wheel(s) was turned while the vehicle was jacked up.**
- **The vehicle was stuck.**

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INSPECTION

Step	Action	Yes	No
1	1) Disconnect applicable ABS wheel speed sensor coupler with ignition switch OFF. 2) Measure resistance between terminals of ABS wheel speed sensor. Refer to "FRONT WHEEL SPEED SENSOR" and/or "REAR WHEEL SPEED SENSOR" in this section. Is measured resistance value as specified?	Go to Step 2.	Replace ABS wheel speed sensor assembly.
2	1) Turn ignition switch OFF. 2) Disconnect ABS hydraulic unit/control module connector. 3) Check for proper connection to ABS control module at each sensor terminal. 4) If OK, then turn ignition switch ON and measure voltage between sensor terminal of module connector and body ground. Is it 0V?	Go to Step 3.	ABS wheel speed sensor circuit shorted to power.
3	1) Turn ignition switch OFF. 2) Connect ABS wheel speed sensor coupler. 3) Measure resistance between the following points. • Both ABS hydraulic unit/control module connector terminals of the corresponding sensor. This check result should be the same as above Step 1. • Either terminal of wheel speed sensor coupler and body ground. This check result should be no continuity. Are both check results OK?	Go to Step 4.	Circuit open or shorted to ground.
4	1) Remove applicable ABS wheel speed sensor. 2) Check sensor for damage or foreign material attached. Is it in good condition?	Go to Step 5.	Clean, repair or replace.
5	Check front and/or rear sensor rotor for the following (remove rear drum as necessary) : • Rotor serration (teeth) neither missing nor damaged. • No foreign material being attached. • Rotor not being eccentric. • Wheel bearing free from excessive play. Are they in good condition?	Go to Step 6.	Clean, repair or replace.
6	1) Install ABS wheel speed sensor to knuckle. 2) Tighten sensor bolt to specified torque and check that there is no clearance between sensor and knuckle. Is it OK?	Go to Step 7.	Replace ABS wheel speed sensor.
7	Referring to "Reference" of "FRONT WHEEL SPEED SENSOR" and/or "Reference" of "REAR WHEEL SPEED SENSOR" in this section, check output voltage or waveform. Is specified voltage and/or waveform obtained?	Substitute a known good ABS hydraulic unit/control module assembly and recheck.	Replace sensor and recheck.

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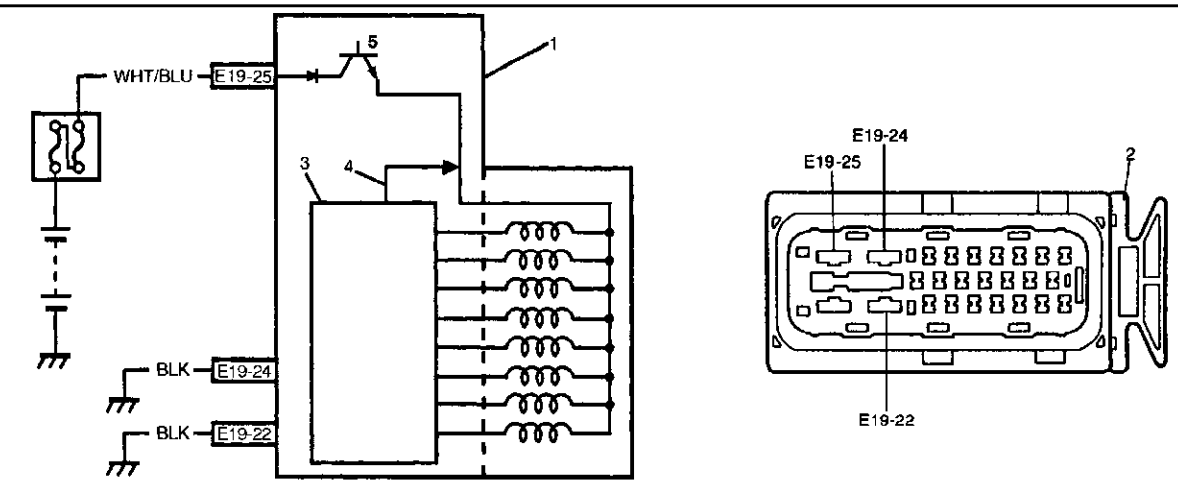
DTC C1041 (DTC 41) – RIGHT-FRONT INLET SOLENOID CIRCUIT
DTC C1045 (DTC 45) – LEFT-FRONT INLET SOLENOID CIRCUIT
DTC C1051 (DTC 51) – RIGHT-REAR INLET SOLENOID CIRCUIT
DTC C1055 (DTC 55) – LEFT-REAR INLET SOLENOID CIRCUIT
DTC C1042 (DTC 42) – RIGHT-FRONT OUTLET SOLENOID CIRCUIT
DTC C1046 (DTC 46) – LEFT-FRONT OUTLET SOLENOID CIRCUIT
DTC C1052 (DTC 52) – RIGHT-REAR OUTLET SOLENOID CIRCUIT
DTC C1056 (DTC 56) – LEFT-REAR OUTLET SOLENOID CIRCUIT



1. ABS hydraulic unit/control module assembly	3. ABS control module	5. Fail-safe relay
2. ABS hydraulic unit/control module assembly connector	4. Signal	

DESCRIPTION

The ABS control module monitors the output from the valve.
When the output of each valve exceeds the specified value compared with the signal sent from ABS control module, this DTC is set.

INSPECTION

Step	Action	Yes	No
1	1) Check solenoid operation referring to item "ABS HYDRAULIC UNIT OPERATION CHECK" in this section. Is it in good condition?	Check terminal "E19-25" connection. If connection is 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 "E19-25". 4) If OK, then measure voltage between terminal "E19-25" of module connector and "E19-24". or "E19-22" Is it 10 – 14 V?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	"WHT/BLU" or "BLK" circuit open.

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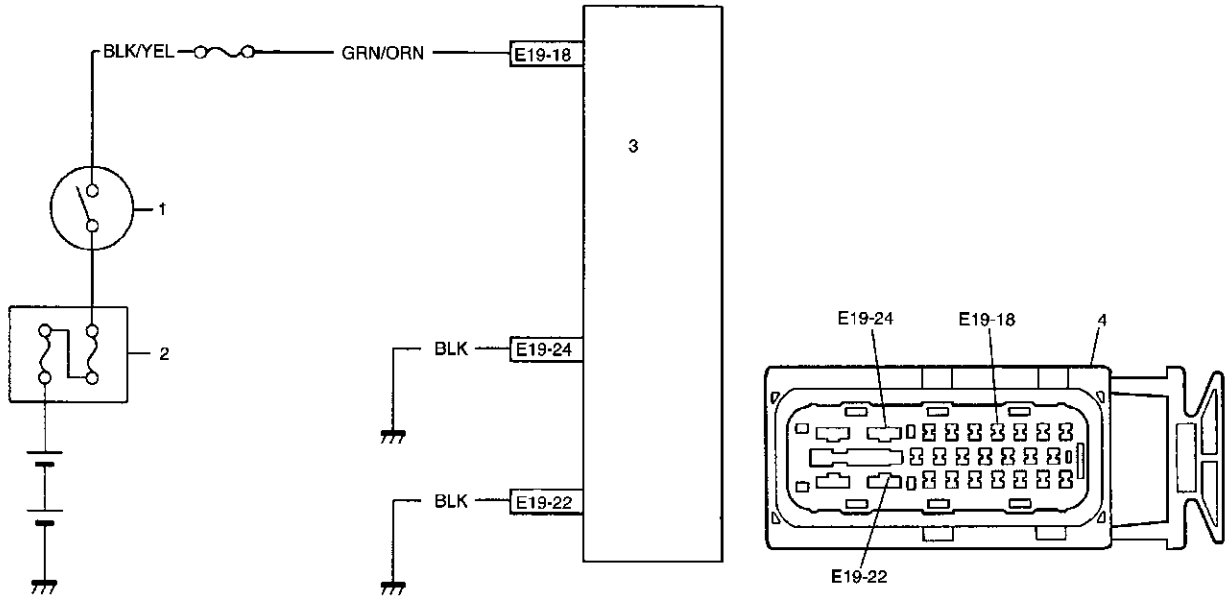
DTC C1057 (DTC 57) – POWER SOURCE CIRCUIT



1. Ignition switch	3. ABS hydraulic unit/control module assembly
2. Main fuse	4. ABS hydraulic unit/control module connector

DESCRIPTION

The ABS control module monitors the power source voltage at terminal "E19-18". When the power source voltage becomes extremely high or low, this DTC will be set. As soon as the voltage rises or lowers to the specified level, the set DTC will be cleared.

INSPECTION

Step	Action	Yes	No
1	1) Connect a voltmeter between battery positive (+) terminal and body ground. 2) Start the engine and measure the maximum voltage when racing the engine. Is it over 18V?	Check charging system referring to "CHARGING SYSTEM" section.	Go to Step 2.
2	1) Disconnect ABS hydraulic unit/control module connector. 2) Keep the engine idling, measure the voltage between terminal "E19-18" of ABS control module and body ground. Is it always under 9V?	Check charging system referring to "CHARGING SYSTEM" section. Imperfect short between wire "GRN/ORN" and ground.	Poor connection of terminal "E19-18" , "E19-24" or "E19-22" of the ABS control module. If the above are in good condition, substitute a known-good ABS hydraulic unit/ control module and recheck.

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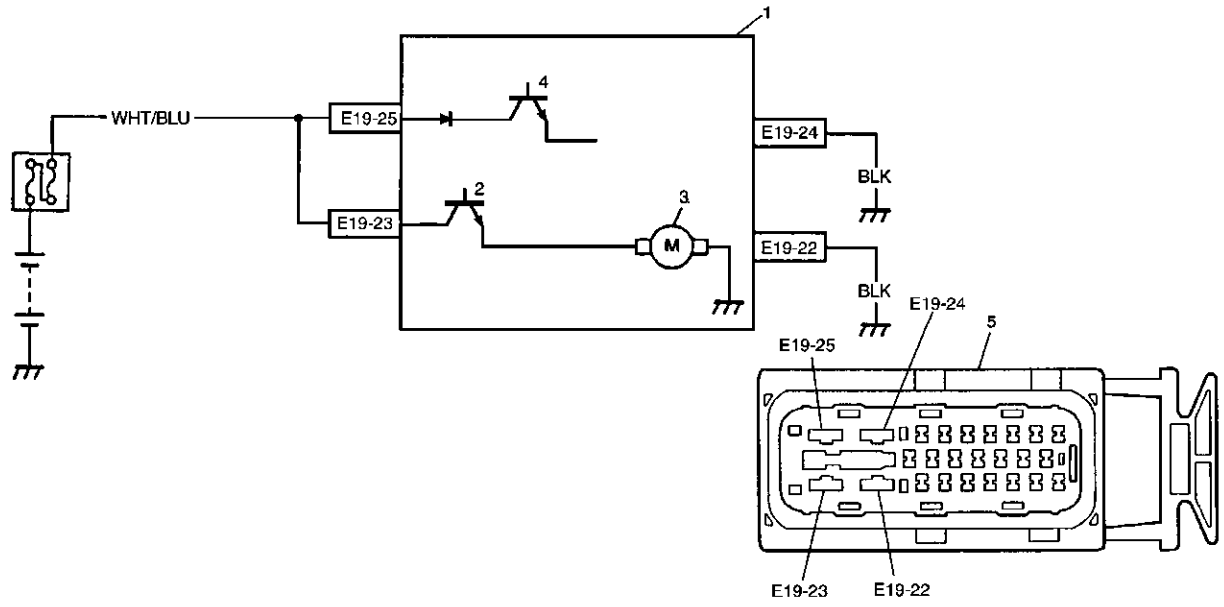
DTC C1061 (DTC 61) – ABS PUMP MOTOR CIRCUIT



1	ABS hydraulic unit/control module assembly	3	ABS pump motor	5.	ABS hydraulic unit/control module connector
2	ABS pump motor relay	4	ABS fail safe relay		

DESCRIPTION

The ABS control module monitors the voltage at monitor terminal of pump motor circuit constantly with the ignition switch turned ON. It sets this DTC when the voltage at the monitor terminal does not become high/low according to ON/OFF commands to the motor relay of the module (does not follow these commands).

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 terminals "E19-25" and "E19-23" 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 "E19-23". 4) If OK, then measure voltage between terminal "E19-23" of module connector and body ground. Is it 10 – 14 V?	Go to Step 3.	"WHT/BLU" circuit open.
3	Measure resistance between terminal "E19-22" or "E19-24" of ABS hydraulic unit/control module connector and body ground. Is it infinity (∞) ?	"BLK" circuit open.	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.

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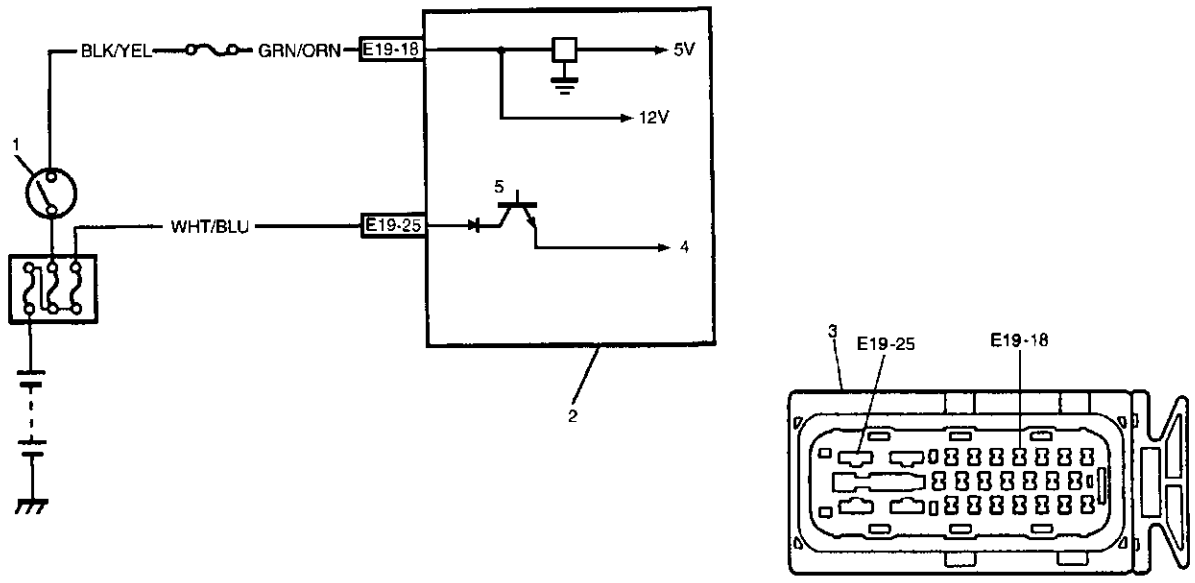
DTC C1063 (DTC 63) – ABS FAIL-SAFE RELAY CIRCUIT



1.	Ignition switch	3	ABS hydraulic unit/control module connector	5	Fail-safe relay
2.	ABS hydraulic unit/control module assembly	4	To solenoid valves		

DESCRIPTION

ABS control module monitors the voltage at the terminal of solenoid circuit constantly with ignition switch turned ON. Also, immediately after ignition switch is turned ON, perform initial check as follows.
Switch fail-safe relay in the order of OFF → ON and check if voltage changes to Low → High. If anything faulty is found in the initial check and when the voltage is low with ignition switch turned ON, this DTC will be set.

INSPECTION

Step	Action	Yes	No
1	Check battery voltage. Is it about 11 V or higher?	Go to Step 2.	Check charging system referring to "CHARGING SYSTEM" section.
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 "E19-25". 4) If OK, then measure voltage between connector terminal "E19-25" and body ground. Is it 10 – 14 V?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	"WHT/BLU" circuit open or short to ground.

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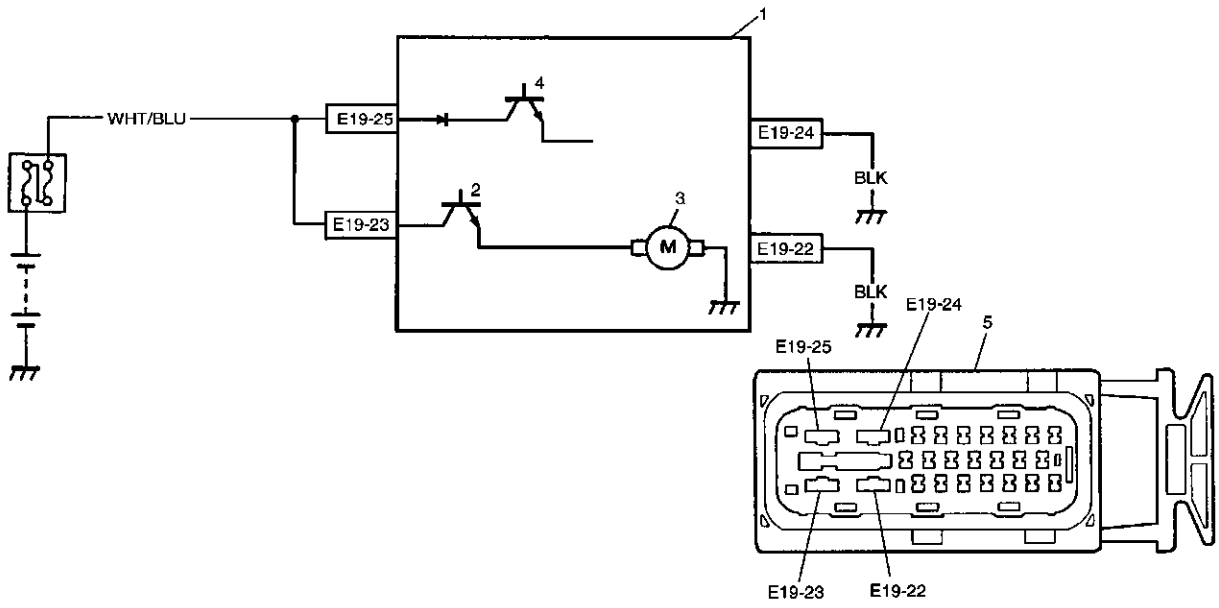
DTC C1071 (DTC 71) – ABS CONTROL MODULE



1. ABS hydraulic unit/control module assembly	3. ABS pump motor	5. ABS hydraulic unit/control module connector
2. ABS pump motor relay	4. ABS fail safe relay	

DESCRIPTION

This DTC will be set when an internal malfunction is detected in the ABS control module.

INSPECTION

Step	Action	Yes	No
1	Clear all DTCs and check DTC. Is it DTC 71?	Go to Step 2.	Could be a temporary malfunction of the ABS control module.
2	1) Check proper connection of ABS hydraulic unit/control module connector. 2) If OK, disconnect ABS hydraulic unit/control module connector and check the followings. • Voltage "E19-25" terminal : 10 – 14 V • Resistance between "E19-22" or "E19-24" and body ground : Continuity Are the check result as specified above?	Replace ABS hydraulic unit/control module assembly.	Repair and recheck.

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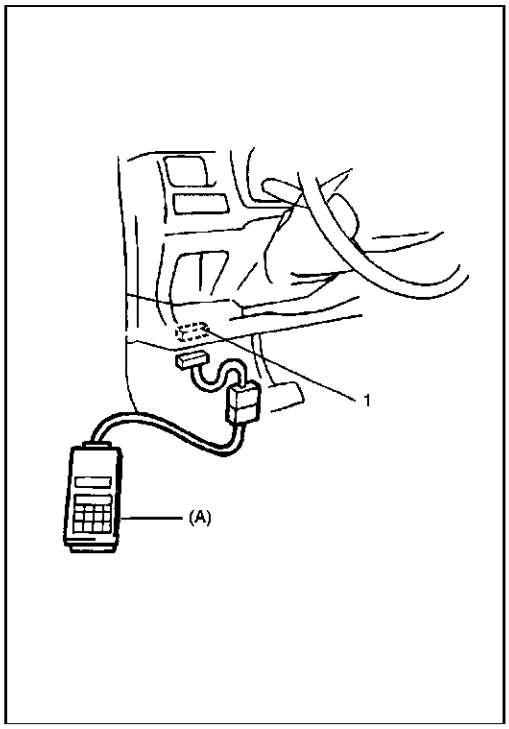
ON-VEHICLE SERVICE

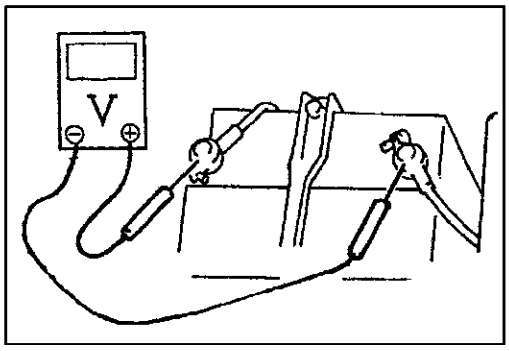
PRECAUTIONS

When connector is connected to ABS hydraulic unit/control module assembly, do not disconnect connectors of sensors with ignition switch ON. Then DTC will be set in ABS control module.

ABS HYDRAULIC UNIT OPERATION CHECK (USING SUZUKI SCAN TOOL)



1) Connect SUZUKI scan tool to data link connector (DLC) (1) with ignition switch OFF.
   Special tool
   (A): SUZUKI scan tool
2) Turn ignition switch to ON position and check actuator operation using "HYDRAULIC CONTROL TEST" under "miscellaneous test" ("MISC. TEST") mode of SUZUKI scan tool.



ABS HYDRAULIC UNIT OPERATION CHECK (NOT USING SUZUKI SCAN TOOL)

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.

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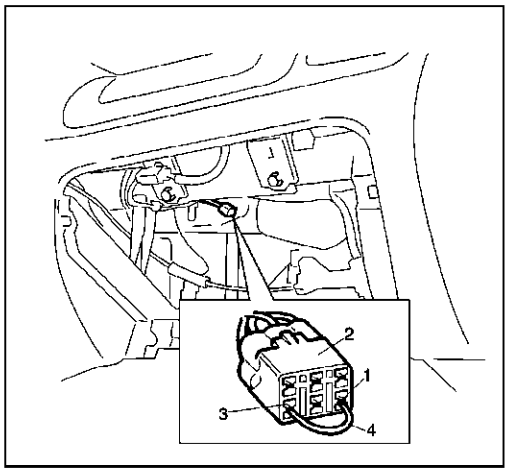
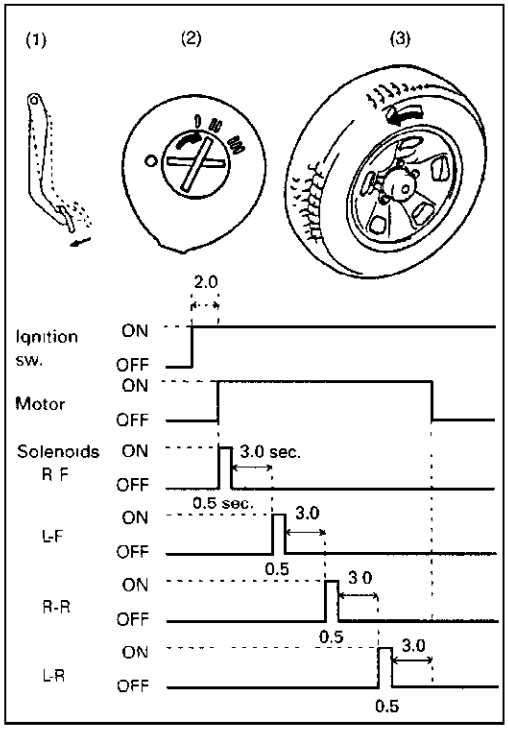


7) With diagnosis switch terminal (1) of monitor coupler (2) connected to ground terminal (3) using service wire (4), turn ignition switch ON and check if ABS warning lamp indicates DTC 12.
   If malfunction DTC is indicated, repair it first.
8) Turn ignition switch OFF.



9) Perform the 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/control module assembly.
11) Turn ignition switch OFF and remove service wire from monitor coupler.

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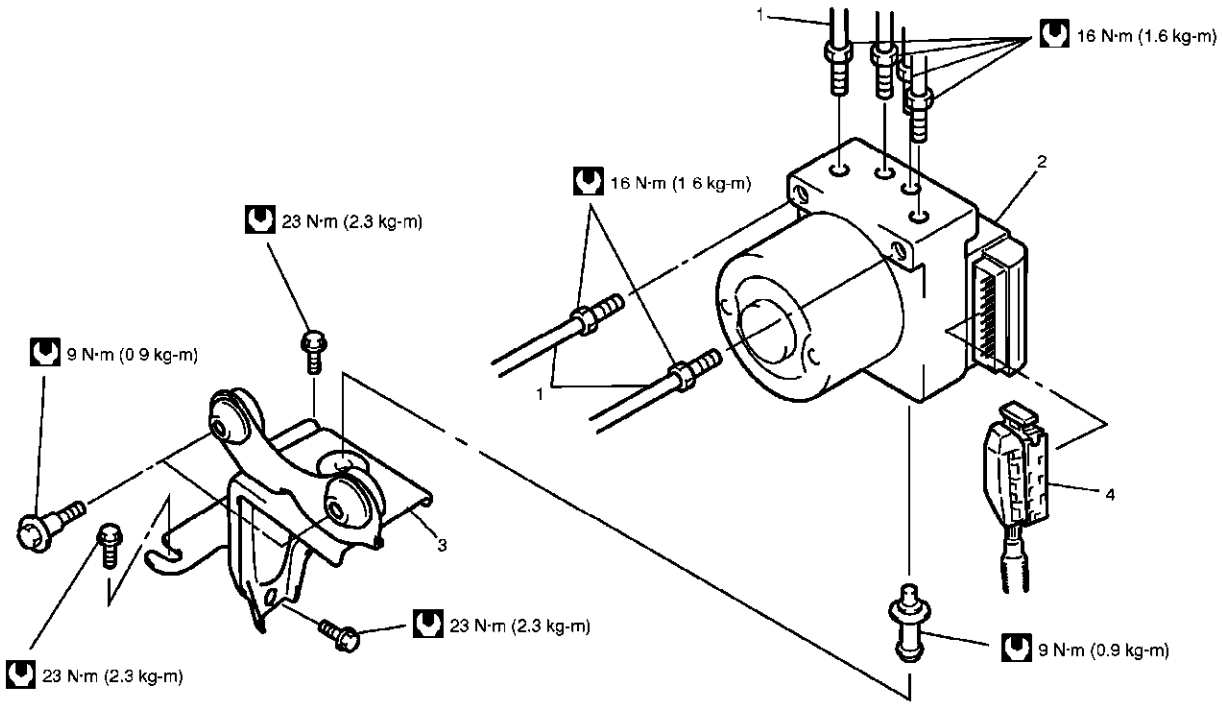
ABS HYDRAULIC UNIT/CONTROL MODULE ASSEMBLY

CAUTION:
Never disassemble ABS hydraulic unit/control module assembly, loosen blind plug or remove motor. Performing any of these prohibited services will affect original performance of ABS hydraulic unit/control module assembly.



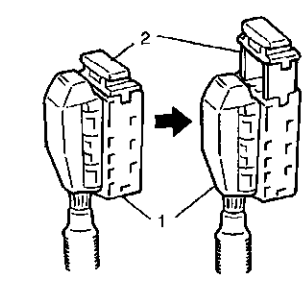
1	Brake pipe	3	Bracket
2	ABS hydraulic unit/control module assembly	4	Connector

HYDRAULIC UNIT INSPECTION

Check hydraulic unit for fluid leakage.
If any, repair or replace.

REMOVAL

1) Disconnect negative cable from battery.
2) Disconnect ABS hydraulic unit/control module assembly connector (1) by pulling up lock (2).



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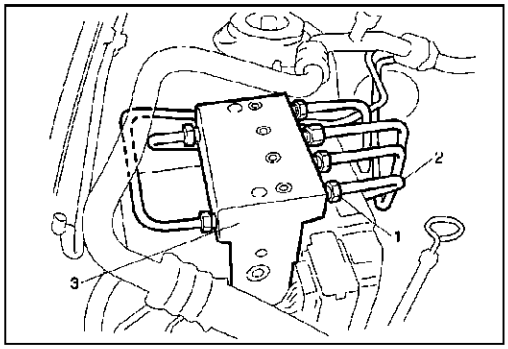
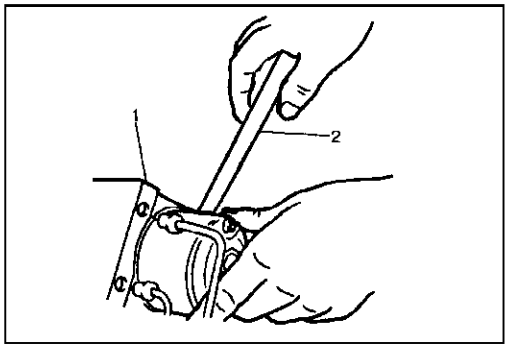


3) Using special tool, loosen flare nuts (1) and disconnect brake pipes (2) from ABS hydraulic unit/control module assembly (3).

Special tool
(A) : 09950-78220

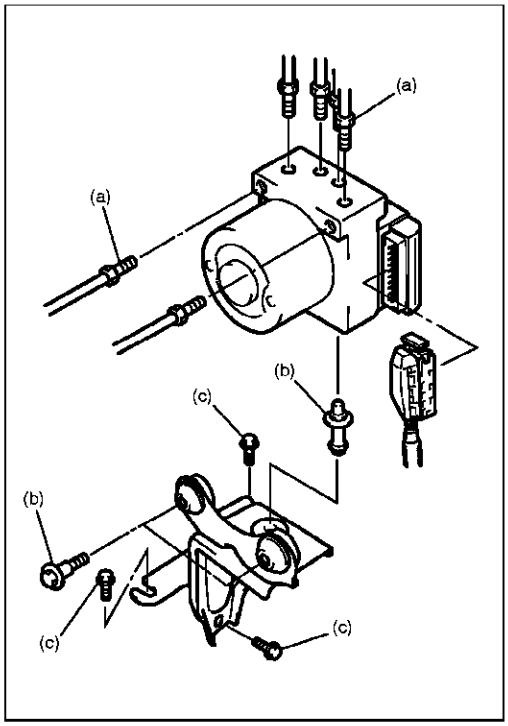
NOTE:
Put bleeder plug cap or the like onto pipe to prevent fluid from spilling. Do not allow brake fluid to get on painted surfaces.



4) Remove two bolts and disconnect take out ABS hydraulic unit/control module assembly (1) from bracket using flat end rod or the like (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/control module assembly by reversing removal procedure.

Tightening torque
Brake pipe flare nut
(a): 16 N-m (1.6 kg-m, 11.5 lb-ft)
ABS hydraulic unit/control module assembly bolt
(b): 9 N-m (0.9 kg-m, 6.5 lb-ft)
ABS hydraulic unit/control module assembly bracket bolt
(c) : 23 N-m (2.3 kg-m, 16.5 lb-ft)

2) Bleed air from brake system referring to "BRAKES" section.
3) Check each installed part for fluid leakage and perform "ABS HYDRAULIC UNIT OPERATION CHECK" in this section.

NOTE:
For new ABS hydraulic unit/control module assembly, if "ABS HYDRAULIC UNIT OPERATION CHECK" procedure has not been performed, "ABS" warning lamp may flash when ignition switch is turned ON position.
Accordingly preform "ABS HYDRAULIC UNIT OPERATION CHECK" to stop flashing of ABS warning lamp.

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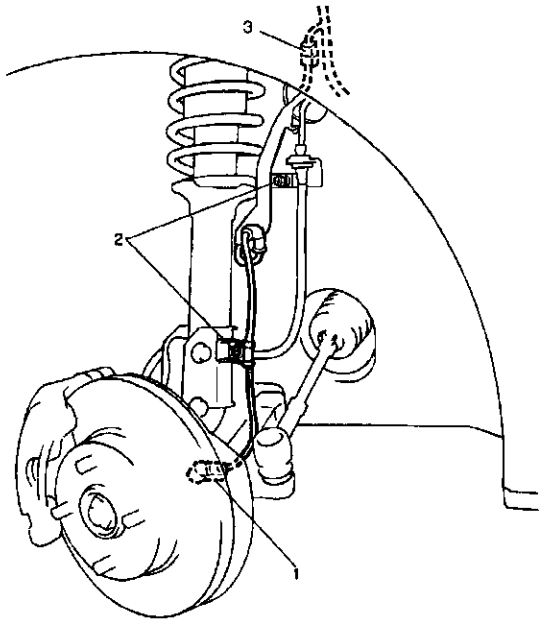
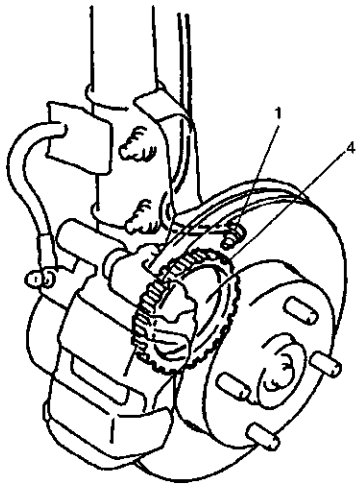
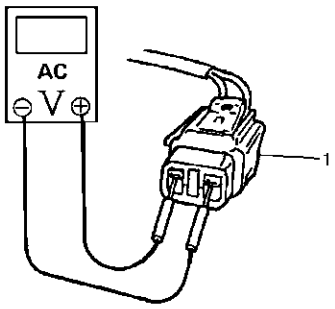
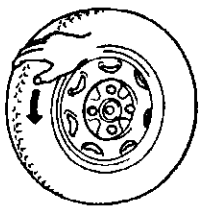
FRONT WHEEL SPEED SENSOR





1. Left front wheel speed sensor	3. Connector
2. Clamp bolt	4. Sensor rotor





OUTPUT VOLTAGE INSPECTION

1) Turn ignition switch OFF.
2) Hoist vehicle a little.
3) Disconnect wheel speed sensor connector.
4) Connect voltmeter between connector (1) terminals.
5) While turning wheel by hand at a speed of approximately 1/2 to 1 rotation per second, check AC voltage of sensor.
   Output AC voltage at 1/2 to 1 rotation per second : 106 mV or more
6) If measured voltage is not as specified, check sensor, rotor and their installation conditions.

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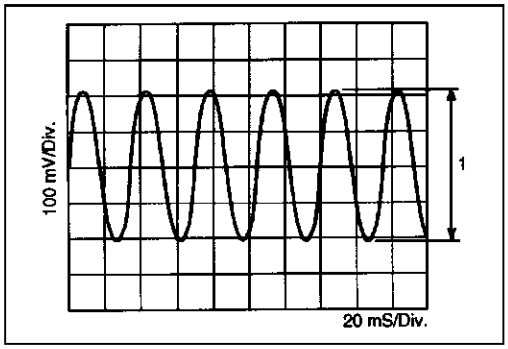
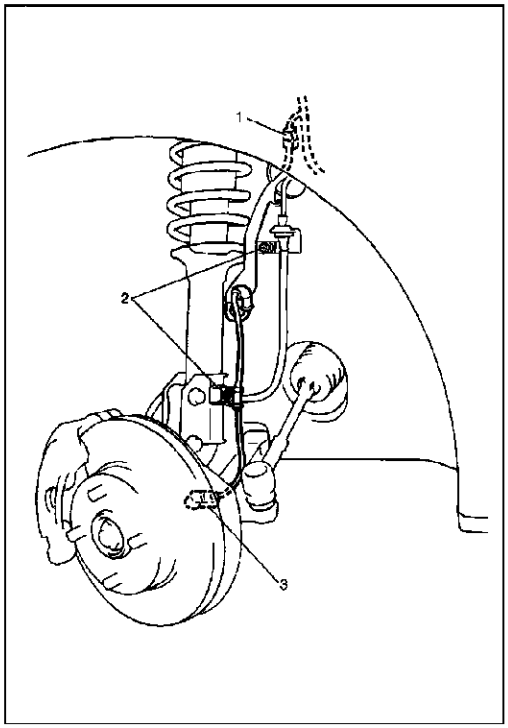


Reference

When using oscilloscope for this check, check if peak-to-peak voltage (1) meets specification and waveform is complete.

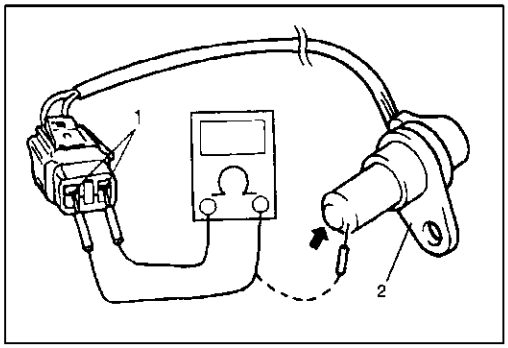
Peak-to-peak voltage at 1/2 to 1 rotation per second
: 150 mV or more at 21 – 42 Hz



REMOVAL

1) Disconnect negative cable at battery.
2) Disconnect front wheel speed sensor coupler (1).
3) Hoist vehicle and remove wheel.
4) Remove harness clamp bolts (2).
5) Remove front wheel speed sensor (3) 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 and continuity.
  Between both terminals (1) of sensor
  : 1.2 – 1.6 KΩ at 20°C (68°F)
  Between sensor terminal and sensor body (2)
  : No continuity
- If the check result is not as specified and any malcondition is found, replace.

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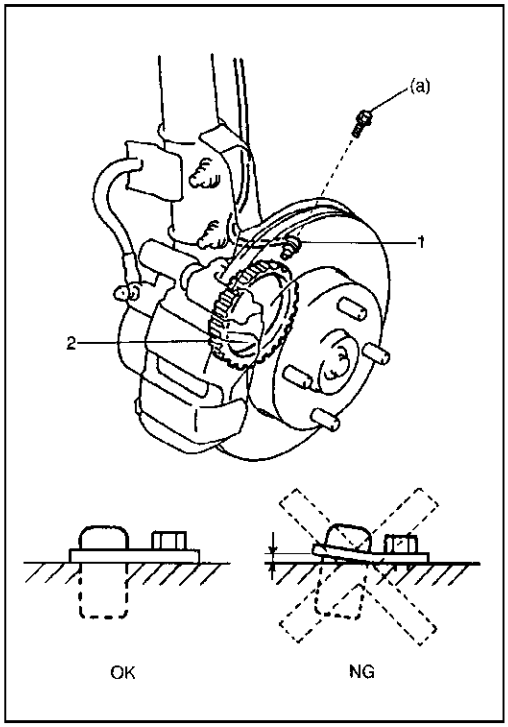


INSTALLATION

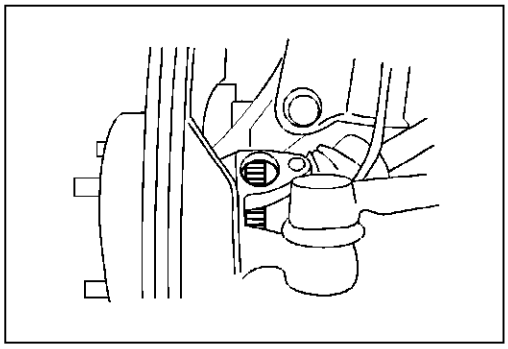
1) Check that no foreign material is attached to sensor (1) and sensor rotor (2).
2) Install it by reversing removal procedure.

Tightening torque
Front wheel speed sensor bolt (a) :
11 N-m (1.1 kg-m, 8.0 lb-ft)

CAUTION:
Do not pull or twist wire harness more than necessary when installing front wheel speed sensor.

3) Check that there is no clearance between sensor and knuckle.

FRONT WHEEL SPEED SENSOR ROTOR



SENSOR ROTOR INSPECTION

- Check rotor for being missing, damaged or deformed.
- Turn drive shaft and check if ring rotor is free from eccentricity and looseness.
- Check that no foreign material is attached.
  If any faulty is found, repair or replace. Refer to "DRIVE SHAFT ASSEMBLY" in SECTION 4A.

NOTE:
The front wheel sensor rotor can not be removed or replaced alone. If front wheel sensor rotor needs to be replaced, replace it as a wheel side joint assembly of drive shaft.

For removal and installation of wheel side joint assembly of drive shaft, refer to "FRONT DRIVE SHAFT" SECTION 4A.

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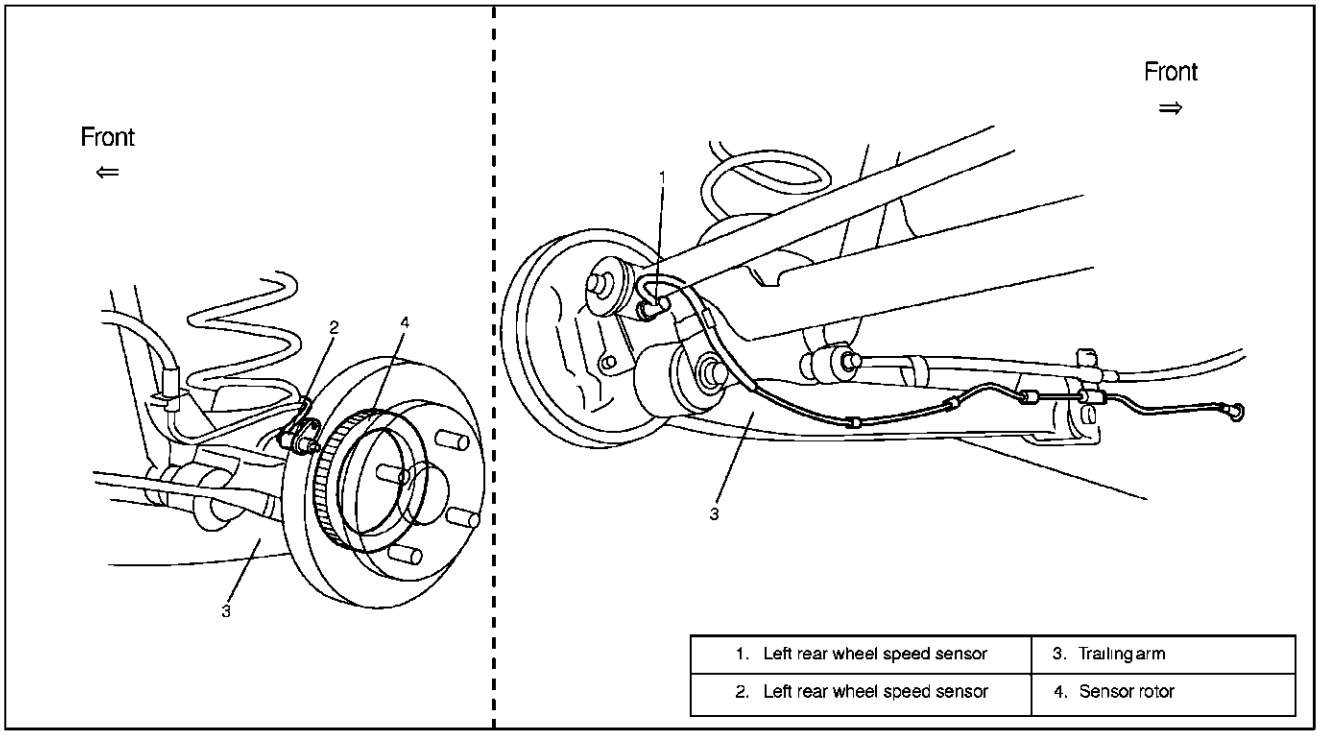
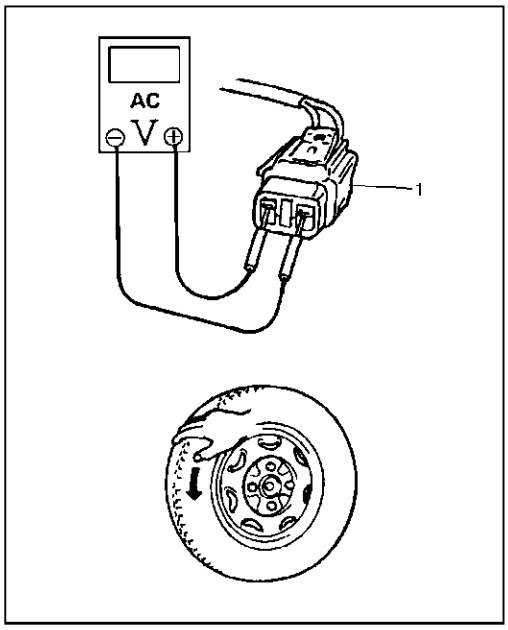
REAR WHEEL SPEED SENSOR



1. Left rear wheel speed sensor	3. Trailing arm
2. Left rear wheel speed sensor	4. Sensor rotor



OUTPUT VOLTAGE INSPECTION

1) Turn ignition switch OFF.
2) Remove quarter inner trim (1).
3) Turn over floor carpet.
4) Hoist vehicle.
5) Disconnect connector of wheel speed sensor.
6) Connect voltmeter between connector (1) terminals.
7) While turning wheel at a speed of approximately 1/2 to 1 rotation per second, check AC voltage of sensor.

   Output AC voltage at 1/2 to 1 rotation per second : 85 mV or more

8) If measured voltage is not as specified, check sensor, rotor and their installation conditions.

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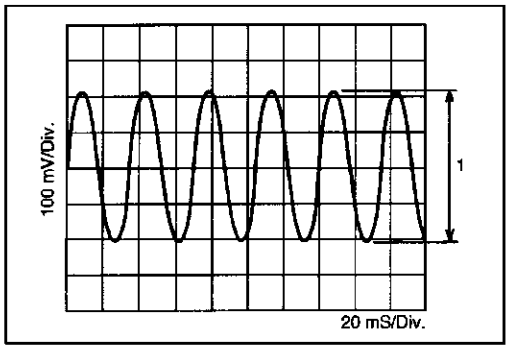
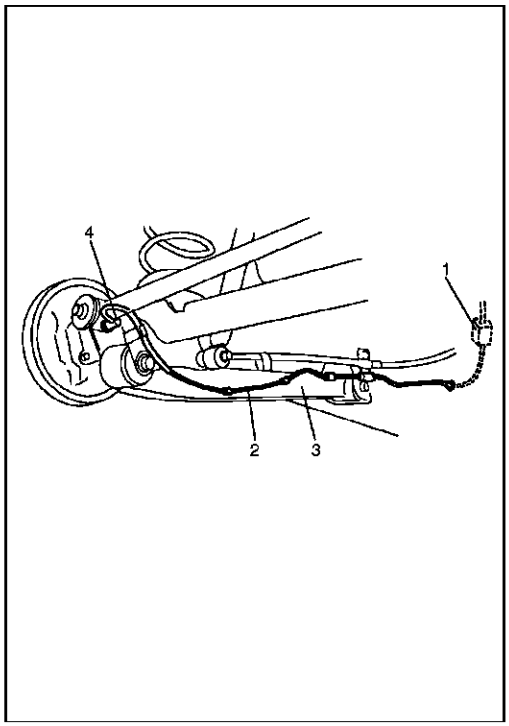


Reference

When using oscilloscope for this check, check if peak-to-peak voltage (1) meets specification and waveform is complete.

Peak-to-peak voltage at 1/2 to 1 rotation per second
: 120 mV or more at 20 Hz



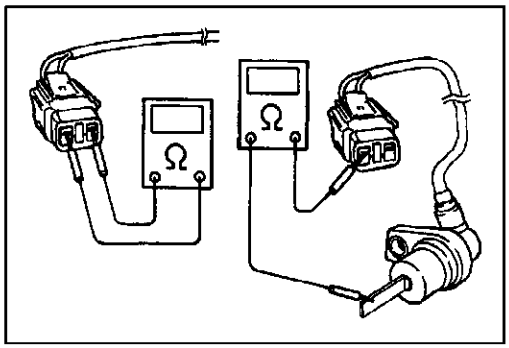
REMOVAL

1) Disconnect negative cable at battery.
2) Remove rear seat referring to SECTION 9.
3) Turn over floor carpet.
4) Hoist vehicle.
5) Disconnect rear wheel speed sensor coupler (1).
6) Detach ABS wheel sensor wire harness (2) from suspension frame (3).

NOTE:
Do not detach clip of rear wheel speed sensor connector from vehicle body unless replacement is necessary.

7) Remove rear wheel speed sensor (4) from rear axle housing.

CAUTION:
- **Do not pull wire harness when removing rear wheel speed sensor.**
- **Do not cause damage to surface of rear wheel speed sensor and do not allow dust, etc. to enter its installation hole.**



SENSOR INSPECTION

- Check sensor for damage.
- Check sensor for resistance and continuity.
  Between both terminals of sensor
  : 0.9 – 1.3 kΩ at 20°C (68°F)

  Between sensor terminal and sensor body
  : No continuity

- If the check result is not as specified and any malcondition is found, replace.

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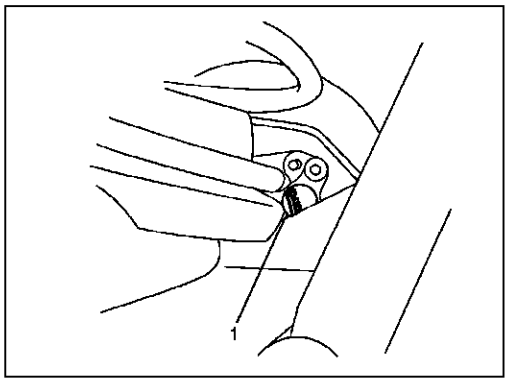
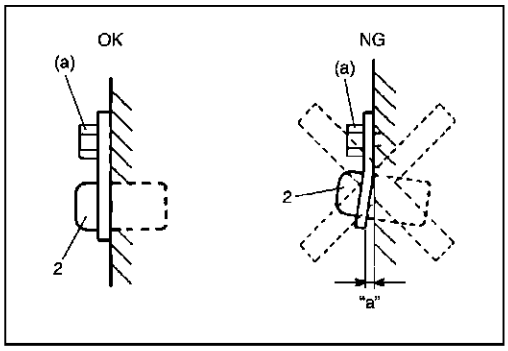


INSTALLATION

Reverse removal procedure for installation noting the following.

- Check that no foreign material is attached to sensor and rotor (1).



- Be sure to install wheel speed sensor (2) and its bolt at the correct (upper) position as shown in figure.
  Tighten sensor bolt to specified torque.

  Tightening torque
  Sensor bolt (a) : 11 N-m (1.1 kg-m, 8.0 lb-ft)

CAUTION:
Do not pull or twist wire harness more than necessary when installing rear wheel speed sensor.

- Check that there is no clearance between sensor and rear axle shaft.

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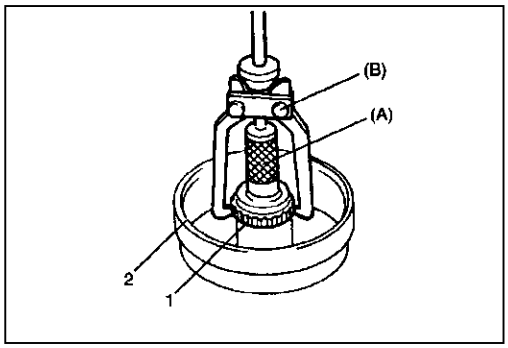
REAR WHEEL SPEED SENSOR ROTOR

REMOVAL

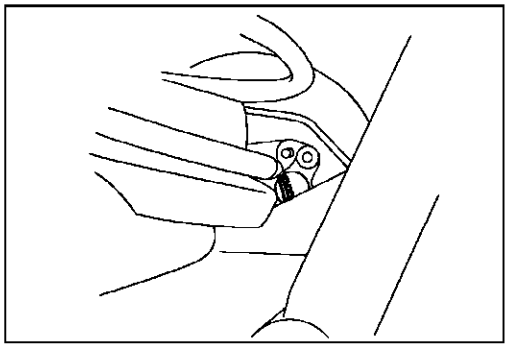
1) Remove rear wheel sensor from rear axle housing.
2) Remove brake drum referring to SECTION 5.



3) Remove sensor rotor (1) from brake drum (2) using special tools.

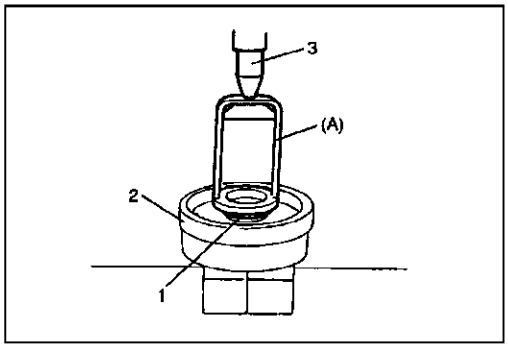
Special tool
(A) : 09913-75520
(B) : 09913-65135

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



SENSOR ROTOR INSPECTION

- Check rotor serration (teeth) for being missing, damaged or deformed.
- Turn wheel and check if rotor rotation is free from eccentricity and looseness.
- Check that no foreign material is attached.
- If any fault is found, repair or replace.



INSTALLATION

NOTE:
Do not reuse (Reinstall) removed sensor rotor

1) Install new sensor rotor (1) to brake drum (2) using special tool and hydraulic press (3).

Special tool
(A): 09913-75840

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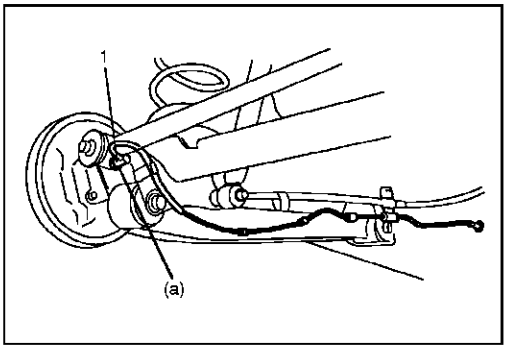

2) Install brake drum. Refer to SECTION 5.
3) Install rear wheel speed sensor (1) to rear axle housing.

Tightening torque
Rear wheel speed sensor (a) : 11 N-m (1.1kg-m, 8.0 lb-ft)

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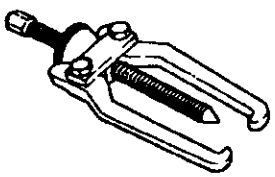
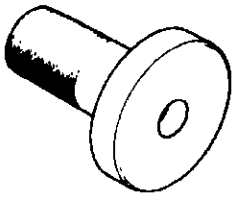
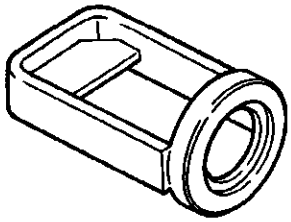
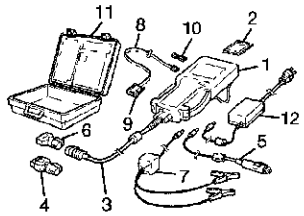
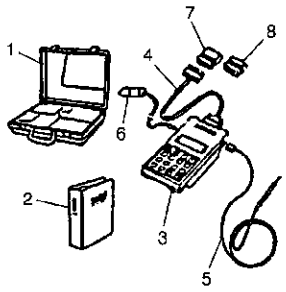
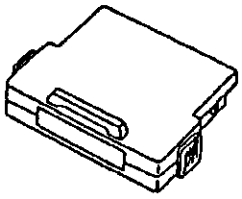
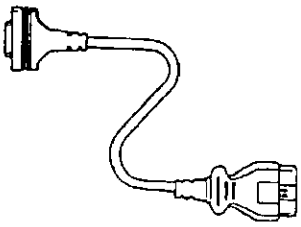
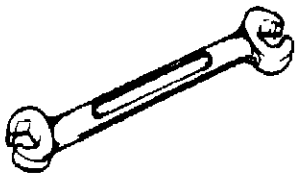
SPECIAL TOOL

 09913-65135 Bearing puller	 09913-75520 Bearing installing tool	 09913-75840 Sensor ring installer	 Tech 2 kit (SUZUKI scan tool) See NOTE "B" below.
 09931-76011 Tech 1A kit (SUZUKI scan tool) (See note "A" below).	 Mass storage cartridge for Tech 1A	 09931-76030 16/1/4 pin DLC cable for Tech 1A	 09950-78220 Flare nut wrench (10 mm)

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

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SECTION 6

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).**

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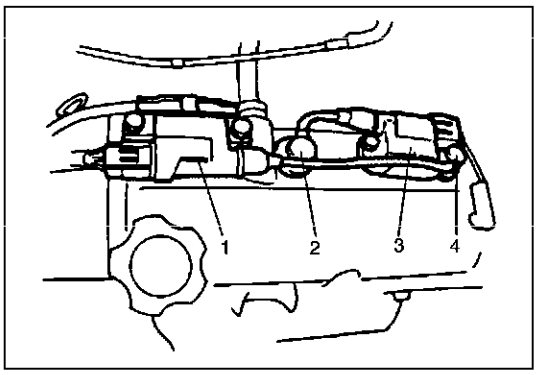
General Information

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 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 is identified by numbers; No.1, No.2, No.3 and No.4 as counted from crankshaft pulley side to flywheel side.

1. No.1 cylinder
2. No.2 cylinder
3 No 3 cylinder
4. No.4 cylinder

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 could possibly be grounded, ground cable of the battery should be disconnected at battery.
- Any time the air cleaner, air intake hose, 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.

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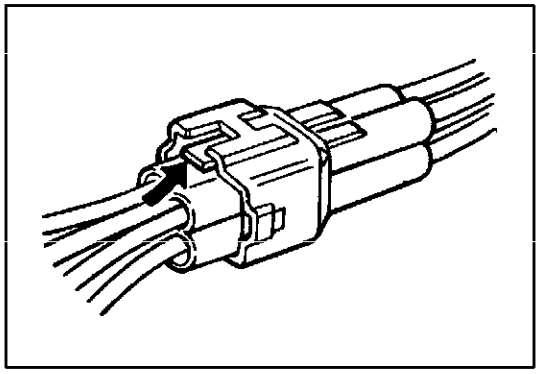
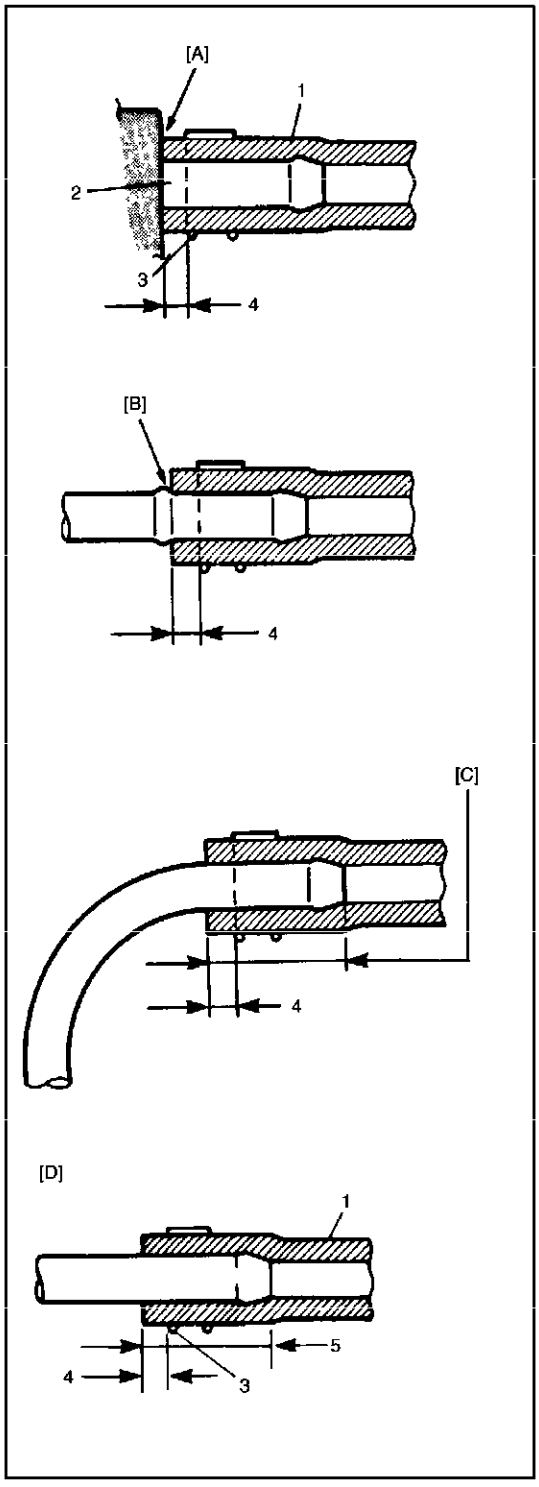


- When disconnecting couplers, don't pull wire harness but make sure to hold coupler itself. With lock type coupler, be sure to unlock before disconnection. Attempt to disconnect coupler without unlocking may result in damage to coupler. When connecting lock type coupler, insert it till clicking sound is heard and connect it securely.

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 left figure.
  After connecting, make sure that the hose has no twist or kink.
- When installing injector, fuel feed pipe or fuel pressure regulator, lubricate its O-ring with gasoline.

[A] :	With short pipe, fit hose as far as it reaches pipe joint as shown.
[B] :	With following type pipe, fit hose as far as its peripheral projection as shown.
[C] :	With bent pipe, fit hose as far as its bent part as shown or till pipe is about 20 to 30 mm (0.79 – 1.18 in.) into the hose.
[D] :	With straight pipe, fit hose till pipe is about 20 to 30 mm (0.79 – 1.18 in.) into the hose.
1.	Hose
2.	Pipe
3.	Clamp
4.	Clamp securely at a position 3 to 7 mm (0.12 – 0.27 in.) from hose end.
5.	20 to 30 mm (0.79 – 1.18 in.)

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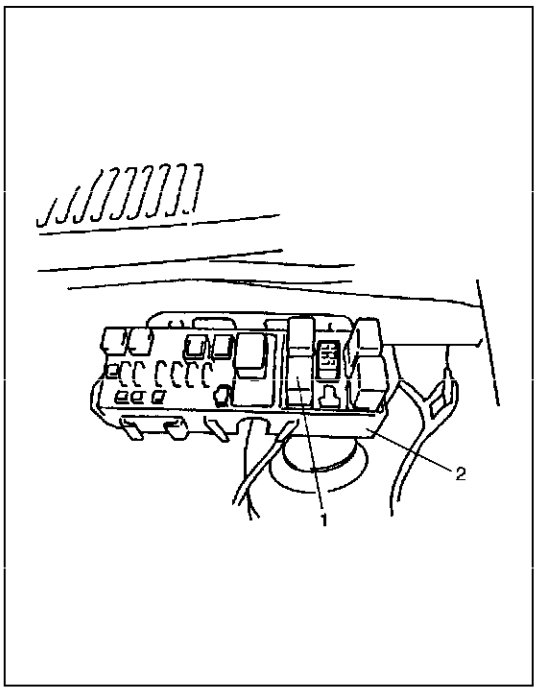
Fuel pressure relief procedure



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, relief fuel pressure as follows.

1) Place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T vehicle), set parking brake, and block drive wheels.
2) Remove fuel pump relay (1) from relay/fuse box (2).
3) Remove fuel filler cap to release fuel vapor pressure in fuel tank and then reinstall it.
4) 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.
5) Upon completion of servicing, install fuel pump relay to relay/fuse box.

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 the ignition switch ON position for 2 seconds (to operate fuel pump) and then turn it OFF position.
   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 return hose).
2) In this state, check to see that there are no fuel leakages from any part of fuel system.

Engine Diagnosis

This vehicle is equipped with an engine and emission control system, which controls the A/F mixture, ignition timing, emission, etc. suitably to engine conditions by ECM (PCM). ECM (PCM) has an On-Board Diagnostic system which detects a malfunction in this system.
When diagnosing a trouble in the engine including this system, be sure to have understanding of the outline of "On-Board Diagnostic system" and each item in "Precaution in Diagnosing Trouble" and follow "ENGINE DIAGNOSTIC FLOW TABLE" given below to obtain correct result smoothly.

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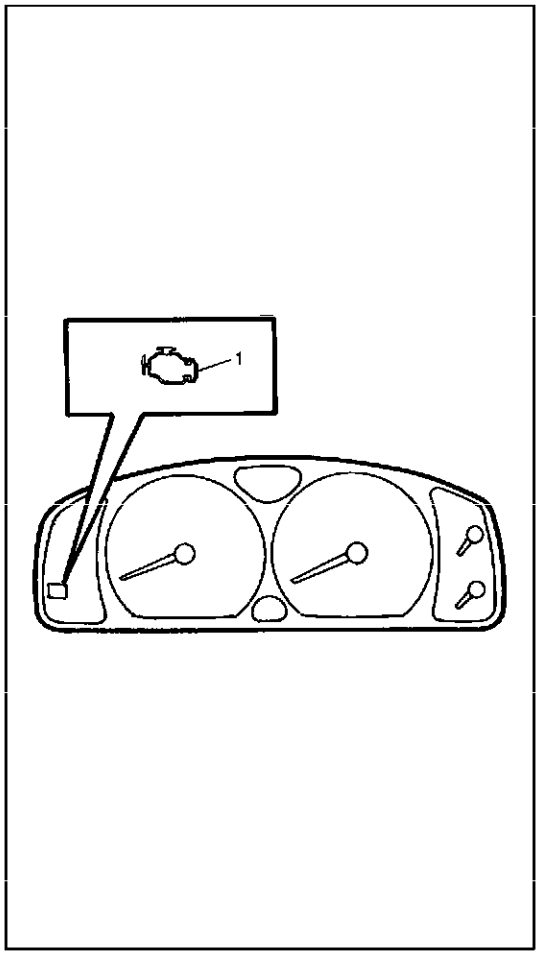
Diagnosis

The engine and emission control system in this vehicle are controlled by ECM (PCM). ECM (PCM) has an On-Board Diagnostic system which detects a malfunction in this system.
When diagnosing troubles, be sure to have full understanding of the outline of "ON-BOARD DIAGNOSTIC SYSTEM" and each item in "PRECAUTION IN DIAGNOSING TROUBLE" and execute diagnosis according to "ENGINE DIAGNOSTIC FLOW TABLE" in Section 6.
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



ECM (PCM) 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 (PCM) 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 (PCM) 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 (PCM) 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 but also generic scan tool. (Diagnostic information can be accessed by using a scan tool.)

Precautions in Diagnosing Troubles

- Before identifying diagnostic trouble code, don't disconnect couplers from ECM (PCM), battery cable from battery, ECM (PCM) ground wire harness from engine. Such disconnection will erase memorized trouble in ECM (PCM) memory.

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- Be sure to read "PRECAUTIONS FOR ELECTRICAL CIRCUIT SERVICE" in Section 0A before inspection and observe what is written there.
- ECM (PCM) replacement
  When substituting a known-good ECM (PCM), check for following conditions. Neglecting this check may cause damage to known-good ECM (PCM).
  - Resistance value of all relays, actuators is as specified respectively.
  - TP sensor and MAP sensor are in good condition and none of power circuits of these sensors is shorted to ground.

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, driving mode where a malfunction would be detected if present, 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.

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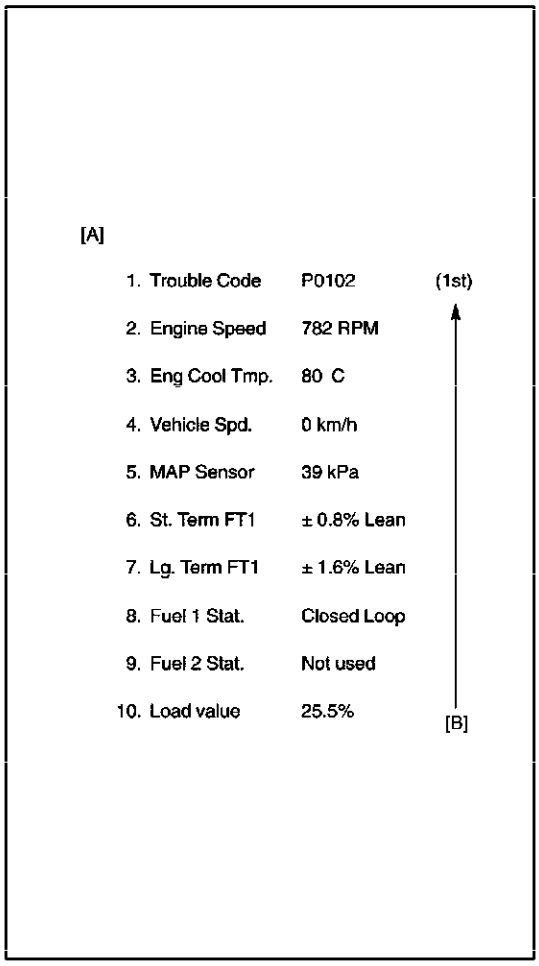
FREEZE FRAME DATA



ECM (PCM) stores the engine and driving conditions (in the form of data as shown) 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 (PCM) has a function to store each freeze frame data for three different malfunctions in the order as the malfunction is detected. Utilizing this function, it is possible to know the order of malfunctions that have been detected. Its use is helpful when rechecking or diagnosing a trouble.

Priority of freeze frame data :

ECM (PCM) has 4 frames where the freeze frame data can be stored. The first frame stores the freeze frame data of the malfunction which was detected first. However, the freeze frame data stored in this frame is updated according to the priority described below. (If malfunction as described in the upper square "1" below is detected while the freeze frame data in the lower square "2" has been stored, the freeze frame data "2" will be updated by the freeze frame data "1".)

[A] : An Example of Freeze Frame Data
[B] : 1st, 2nd or 3rd in parentheses here represents which position in the order the malfunction is detected.

PRIORITY	FREEZE FRAME DATA IN FRAME 1
1	Freeze frame data at initial detection of malfunction among misfire detected (P0300-P0304), fuel system too lean (P0171) and fuel system too rich (P0172)
2	Freeze frame data when a malfunction other than those in "1" above is detected

In the 2nd through the 4th frames, the freeze frame data of each malfunction is stored in the order as the malfunction is detected. These data are not updated.
Shown in the table below are examples of how freeze frame data are stored when two or more malfunctions are detected.

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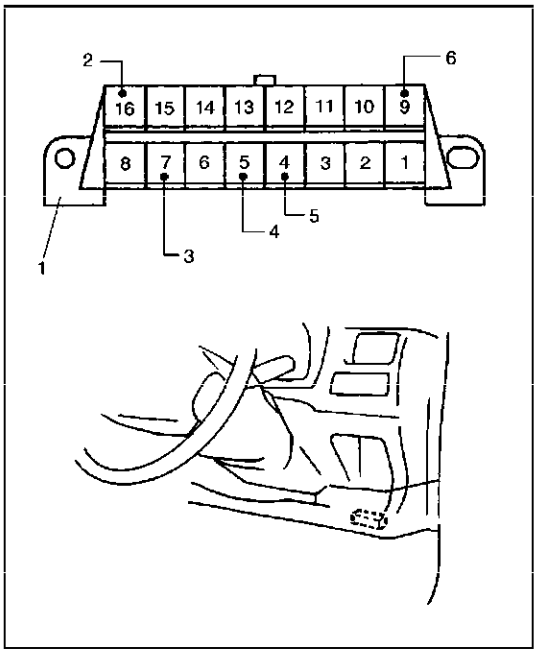
			FRAME			
			FRAME 1	FRAME 2	FRAME 3	FRAME 4
			FREEZE FRAME DATA to be updated	1st FREEZE FRAME DATA	2nd FREEZE FRAME DATA	3rd FREEZE FRAME DATA
MALFUNCTION DETECTED ORDER		No malfunction	No freeze frame data			
	1	P0400 (EGR) detected	Data at P0400 detection	Data at P0400 detection	–	–
	2	P0171 (Fuel 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) is used for SUZUKI scan tool or generic scan tool to communicate with ECM (PCM), ABS control module, Air bag SDM and P/S control module.
SUZUKI serial data line is used for SUZUKI scan tool to communicate with immobilizer control module.

2. B+
3. Serial data line (K line of ISO 9141)
4. ECM (PCM) ground
5. Body ground
6. SUZUKI serial data line

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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. Was customer complaint analysis performed?	Go to Step 2.	Perform customer complaint analysis.
2	Diagnostic Trouble Code (DTC)/Freeze Frame Data Check, Record and Clearance. 1) Check for DTC (including pending DTC) referring to "DTC Check" in Section 6E1. Is there any malfunction DTC(s)?	Print DTC and freeze frame data or write them down and clear them by referring to "DTC Clearance" in Section 6E1. Go to Step 3.	Go to Step 4.
3	Visual Inspection. 1) Perform visual inspection referring to the "Visual Inspection" in this section. 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 "Visual Inspection" in this section. Is there any faulty condition?		Go to Step 8.
5	Trouble Symptom Confirmation. 1) Confirm trouble symptom referring to the "Trouble Symptom Confirmation" in this section. 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" in Section 6E1. 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" in Section 6E1. Is there any malfunction DTC(s)?		Go to Step 10.
8	Engine Basic Inspection and Engine Diagnosis Table. 1) Check and repair according to "Engine Basic Check" and "Engine 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	Trouble shooting for DTC. 1) Check and repair according to applicable DTC diag. flow table in Section 6E1. Are check and repair complete?		
10	Check for Intermittent Problems. 1) Check for intermittent problems by referring to "Check for Intermittent Problem" in this section. 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 "Final Confirmation Test" in this section. Is there any problem symptom, malfunction DTC or abnormal condition?	Go to Step 6.	End.

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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.

Customer problem inspection form (example)

User name:	Model:	VIN:	
Date of issue:	Date of 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 ☐ Axal. 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 ☐ Normal code ☐ Malfunction code ( )
	Second check:	☐ No code ☐ Normal code ☐ Malfunction code ( )

NOTE:

The above form is a standard sample. It should be modified according to conditions characteristic of each market.

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2. DIAGNOSTIC TROUBLE CODE (DTC)/FREEZE FRAME DATA CHECK, RECORD AND CLEARANCE

First, check DTC (including pending DTC) referring to "DTC Check" in Section 6E1. If DTC is indicated, print it and freeze frame data or write them down and then clear them by referring to "DTC Clearance" in Section 6E1. 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 5 and recheck DTC according to Step 6 or 7.
Attempt to diagnose a trouble based on DTC in this step only or failure to clear the DTC in this step will lead to incorrect diagnosis, trouble diagnosis of a normal circuit or difficulty in troubleshooting.

3. and 4. VISUAL INSPECTION

Be sure to perform visual check of the following items that support proper function of the engine.

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	Section 6E1
• Vacuum hoses of air intake system - - - - - disconnection, looseness, deterioration, bend	
• 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 (MIL) - - - - - operation	Section 6
– Charge warning lamp - - - - - operation	Section 6H
– Engine oil pressure warning lamp - - - - - operation	Section 8
– Engine coolant temp. meter - - - - - operation	Section 8
– Fuel lever meter - - - - - operation	Section 8
• Abnormal air being inhaled from air intake system	
• Exhaust system - - - - - leakage of exhaust gas, noise	
• Other parts that can be checked visually	

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" in Section 6E1.

6. and 7. RECHECKING AND RECORD OF DTC

Refer to "DTC Check" in Section 6E1 for checking procedure.

8. ENGINE BASIC INSPECTION AND ENGINE DIAGNOSIS TABLE

Perform basic engine check according to the "Engine Basic Inspection Flow Table" 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.

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Engine basic inspection flow table

This check is very important for troubleshooting when ECM (PCM) 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 7.
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 750 – 850 r/min.?	Go to Step 6.	Go to "ENGINE DIAGNOSIS TABLE".
6	Check ignition timing as follows : 1) Select "MISC" mode on SUZUKI scan tool and fix ignition timing to initial one. See Fig. 2. 2) Remove air cleaner assembly. 3) Using timing light (1), check initial ignition timing. See Fig. 3. Is it 5° ± 3° BTDC at specified idle speed?	Go to "ENGINE DIAGNOSIS TABLE".	Check ignition control related parts referring to Section 6F.
7	Is immobilizer control system equipped?	Go to Step 8.	Go to Step 9.
8	Check immobilizer control system malfunction as follows. 1) Check immobilizer indicator lamp for flashing. Is it flashing when ignition switch is turned to ON position?	Go to "DIAGNOSIS" in Section 8G.	Go to Step 9.
9	Check fuel supply as follows : 1) Check to make sure that enough fuel is filled in fuel tank. 2) Turn ON ignition switch for 2 seconds and then OFF. See Fig. 4. Is fuel return pressure (returning sounds) felt from fuel return hose (1) when ignition switch is turned ON?	Go to Step 11.	Go to Step 10.
10	Check fuel pump for operating. Was fuel pump operating sound heard from fuel filler for about 2 seconds after ignition switch ON and stop?	Go to "DIAG. FLOW TABLE B-3".	Go to "DIAG. FLOW TABLE B-1".

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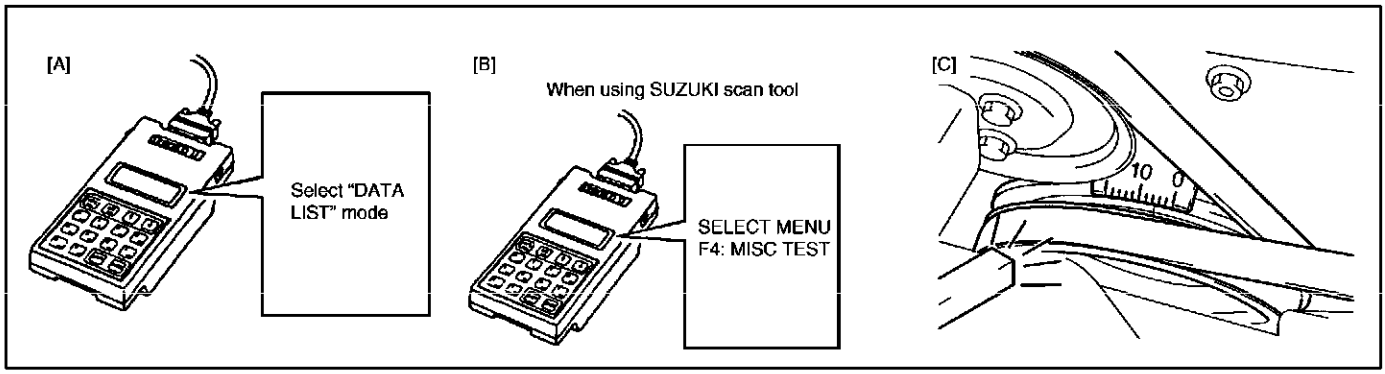
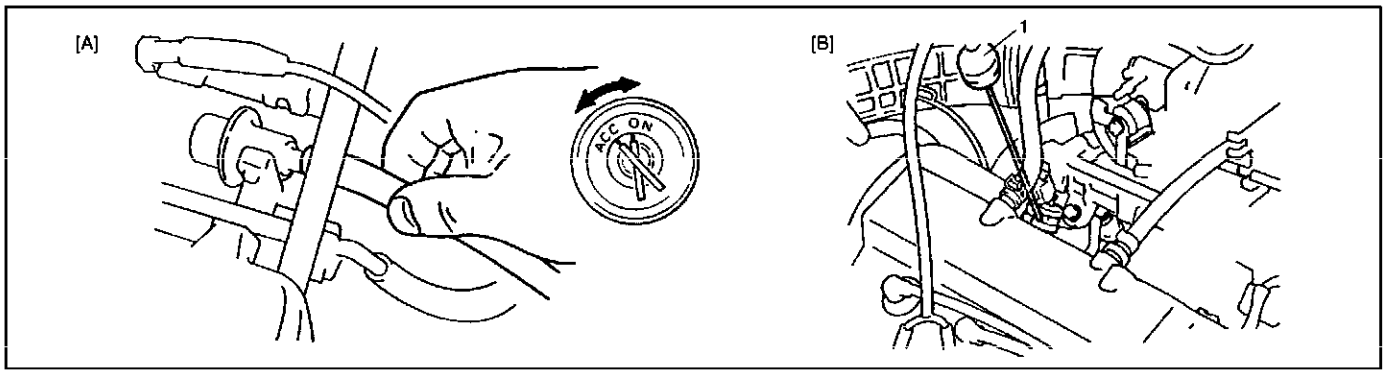
Step	Action	Yes	No
11	Check ignition spark as follows : 1) Disconnect injector couplers. 2) Remove spark plugs and connect them to high tension cords. 3) Ground spark plugs. 4) Crank engine and check if each spark plug sparks. Is it in good condition?	Go to Step 12.	Go to "DIAGNOSIS" in Section 6F.
12	Check fuel injector for operation as follows : 1) Install spark plugs and connect injector connectors. 2) Using sound scope (1), check operating sound of each injector when cranking engine. See Fig. 5. Was injector operating sound heard from all injectors?	Go to "ENGINE DIAGNOSIS TABLE".	Go to "DIAG. FLOW TABLE B-2".



[A] : Fig.1 for Step 5
[B] : Fig.2 for Step 6
[C] : Fig.3 for Step 6



[A] : Fig.4 for Step 7
[B] : Fig.5 for Step 10
1. Sound scope

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9. TROUBLESHOOTING FOR DTC

Based on the DTC indicated in Step 6 or 7 and referring to the applicable DTC diag. flow table in Section 6E1, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ECM (PCM) or other part and repair or replace faulty parts.

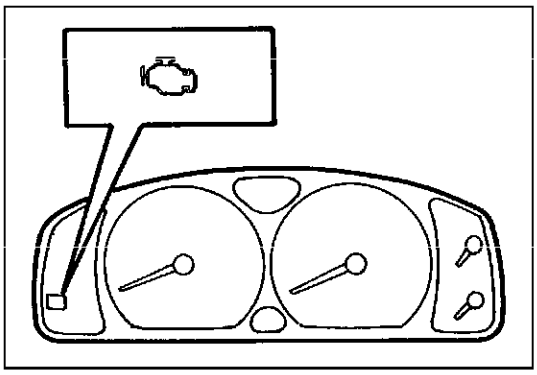
10. CHECK FOR INTERMITTENT PROBLEM

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 malfunction DTC (a normal code) is indicated.

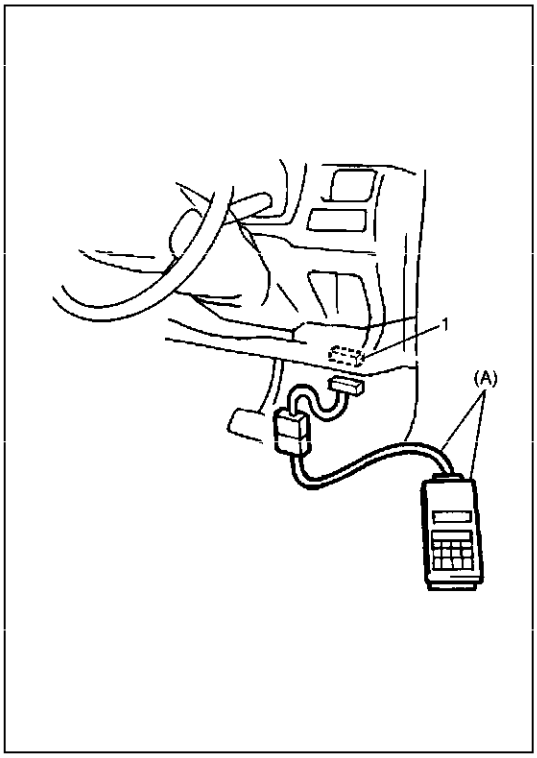
Malfunction Indicator Lamp (MIL) Check



1) Turn ON ignition switch (but engine at stop) and check that malfunction indicator lamp lights up.
   If lamp does not light up, go to DIAGNOSTIC FLOW TABLE A-1 in this section.
2) Start engine and check that malfunction indicator lamp turns OFF.
   If MIL remains ON and no DTC is stored in ECM (PCM), go to "Diagnostic Flow Table A-2" for troubleshooting.

Diagnostic Trouble Code (DTC) Check

1) Check malfunction indicator lamp referring to "MALFUNCTION INDICATOR LAMP (MIL) CHECK" in this section.
2) Turn ignition switch OFF.



3) 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

4) Turn ignition switch ON
5) Read DTC, pending DTC and freeze frame data according to instructions displayed on SUZUKI scan tool and print it or write it down. Rfere to SUZUKI scan tool operator's manual for further details.
   If communication between SUZUKI scan tool and ECM (PCM) is not possible, check if SUZUKI scan tool is communicable by connecting it to ECM (PCM) 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.
6) After completing the check, turn ignition switch OFF and disconnect SUZUKI scan tool from data link connector (DLC).

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Diagnostic Trouble Code (DTC) Clearance

1) Turn ignition switch OFF.
2) Connect SUZUKI scan tool to data link connector (DLC) in the same manner as when making this connection for DTC check.
3) Turn ignition switch ON.
4) Erase DTC and pending DTC according to instructions displayed on SUZUKI scan tool.
   Refer to SUZUKI scan tool operator's manual for further details.
5) After completing the clearance, turn ignition switch OFF and disconnect SUZUKI scan tool from data link connector (DLC).

NOTE:

DTC and freeze frame data stored in ECM (PCM) memory are also cleared in following cases. Be careful not to clear them before keeping their record.

- **When power to ECM (PCM) is cut off (by disconnecting battery cable, removing fuse or disconnecting ECM (PCM) connectors for 30 sec. or longer)**
- **When the same malfunction (DTC) is not detected again during 41 engine warm-up cycles.**

Diagnostic Trouble Code (DTC) Table

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting :)	MIL
P0105	Manifold absolute pressure circuit malfunction	Low pressure-high vacuum-low voltage (or MAP sensor circuit shorted to ground)	1 driving cycle
		High pressure-low vacuum-high voltage (or MAP sensor circuit open)	
P0110	Intake air temp. circuit malfunction	Intake air temp. circuit low input Intake air temp. circuit high input	1 driving cycle
P0115	Engine coolant temp. circuit malfunction	Engine coolant temp. circuit low input Engine coolant temp. circuit high input	1 driving cycle
P0120	Throttle position circuit malfunction	Throttle position circuit low input Throttle position circuit high input	1 driving cycle
P0121	Throttle position circuit performance problem	Poor performance of TP sensor	2 driving cycles
P0130	HO2S circuit malfunction (Sensor-1)	Min. output voltage of HO2S-higher than specification Max. output voltage of HO2S-lower than specification	2 driving cycles
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
P0134	HO2S circuit no activity detected (Sensor-1)	Output voltage of HO2S-1 fails to go above or below specification. (or HO2S-1 circuit open or short).	2 driving cycles

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DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting :)	MIL
P0135	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
P0136	HO2S circuit malfunction (Sensor-2)	Max. voltage of HO2S-2 is lower than specification or its min. voltage is higher than specification	2 driving cycles
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
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
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
P0300 Random misfire detected P0301 Cylinder 1 misfire detected P0302 Cylinder 2 misfire detected P0303 Cylinder 3 misfire detected P0304 Cylinder 4 misfire detected		Misfire of such level as to cause damage to three way catalyst	MIL flashing during misfire detection
		Misfire of such level as to deteriorate emission but not to cause damage to three way catalyst	2 driving cycles
P0325	Knock sensor circuit malfunction	Knock sensor circuit low input Knock sensor circuit high input	1 driving cycle
P0335	Crankshaft position sensor circuit malfunction	No signal during engine running	1 driving cycle
P0340	Camshaft position sensor circuit malfunction	No signal for 2 sec. during engine cranking	1 driving cycle
P0400	Exhaust gas recirculation flow malfunction detected	Excessive or insufficient EGR flow	2 driving cycles
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
P0443	Purge control valve circuit malfunction	Purge control valve circuit is open or shorted to ground	2 driving cycles
P0480	Radiator fan control circuit malfunction	Radiator fan relay terminal voltage is low when cooling temp. is lower than specification	2 driving cycles
P0500	Vehicle speed sensor malfunction	No signal while running in “D” range or during fuel cut at decelerating	2 driving cycles
P0505	Idle control system malfunction	No closed signal to IAC valve is detected	2 driving cycles
P0601	Internal control module memory check sum error	Data write error (or check sum error) when written into ECM	2 driving cycles
P1450	Barometric pressure sensor circuit malfunction	Barometric pressure is lower or higher than specification. (or sensor malfunction)	1 driving cycle

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DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting :)	MIL
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
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
P1510	ECM backup power source malfunction	No backup power after starting engine	1 driving cycle
P1620	ECU code not registered	Refer to Section 8G.	
P1621	No ECU code transmitted from Immobilizer Control Module		
P1622	Fault in ECM		
P1623	ECU code not matched		

(A/T : Refer to Section 7B for DIAGNOSIS)

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting :)	MIL
P0705	Transmission range sensor (switch) circuit malfunction (A/T)	No signal or multiple signals inputted with shifted in "D" range	1 driving cycle
P0715	Input/turbine speed sensor circuit malfunction	No sensor signal is inputted although input shaft speed sensor signal is inputted.	1 driving cycle
P0720	Output speed sensor circuit malfunction (A/T)	No signal while running vehicle with "D" or "2" range.	1 driving cycle
P0751	Shift solenoid A (#1) performance or stuck off	While running in "D" range, engine speed as compared to vehicle speed is higher or lower than specified value.	2 driving cycles
P0756	Shift solenoid B (#2) performance or stuck off		
P0753	Shift solenoid A (#1) electrical (A/T)	Output command from PCM and output voltage do not agree. (solenoid circuit shorted to ground or open)	1 driving cycle
P0758	Shift solenoid B (#2) electrical (A/T)		

Fail-safe Table

When any of the following DTCs is detected, ECM (PCM) enters fail-safe mode as long as malfunction continues to exist but that mode is canceled when ECM (PCM) detects normal condition after that.

DTC NO.	DETECTED ITEM	FAIL-SAFE OPERATION
P0105	Manifold absolute pressure circuit malfunction	• ECM (PCM) uses value determined by throttle opening and engine speed. • ECM (PCM) stops EGR, EVAP purge and idle air control.
P0110	Intake air temp. circuit malfunction	ECM (PCM) controls actuators assuming that intake air temperature is 20°C (68°F).
P0115	Engine coolant temp. circuit malfunction	ECM (PCM) controls actuators assuming that engine coolant temperature is 80°C (176°F).
P0120	Throttle position circuit malfunction	ECM (PCM) controls actuators assuming that throttle opening is 20°.

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DTC NO.	DETECTED ITEM	FAIL-SAFE OPERATION
P0340	Camshaft position sensor circuit malfunction	ECM (PCM) controls injection system sequential injection to synchronous injection.
P0500	Vehicle speed sensor malfunction	ECM (PCM) stops idle air control.
P1450	Barometric pressure sensor low/high input	ECM (PCM) controls actuators assuming that barometric pressure is 100 kPa (760 mmHg).

Engine Diagnosis Table

Condition	Possible Cause	Reference Item
Hard Starting (Engine cranks OK)	**Ignition system out of order**	
	Faulty spark plug	Spark plugs in Section 6F1.
	Leaky high-tension cord	High-tension cords in Section 6F1.
	Loose connection or disconnection of high-tension cords or lead wires	High-tension cords in Section 6F1.
	Faulty ignition coil	Ignition coil in Section 6F1.
	Fuel system out of order	
	Dirty or clogged fuel hose or pipe	Diagnostic Flow Table B-3 in Section 6E1.
	Malfunctioning fuel pump	Diagnostic Flow Table B-3 in Section 6E1.
	Air inhaling from intake manifold gasket or throttle body gasket	
	Engine and emission control system out of order	
	Faulty CMP signal rotor	CMP signal rotor inspection in Section 6F1.
	Faulty idle air control system	Diag. Flow Table B-4 in Section 6E1.
	Faulty ECT sensor or MAP sensor	ECT sensor or MAP sensor in Section 6E1.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in Section 6E1.
	Low compression	Compression check in Section 6A.
	Poor spark plug tightening or faulty gasket	Spark plugs in Section 6F1.
	Compression leak from valve seat	Valves inspection in Section 6A.
	Sticky valve stem	Valves inspection in Section 6A.
	Weak or damaged valve springs	Valves spring inspection in Section 6A.
	Compression leak at cylinder head gasket	Cylinder head inspection in Section 6A.
	Sticking or damaged piston ring	Piston ring inspection in Section 6A.
	Worn piston, ring or cylinder	Cylinders, pistons and piston rings inspection in Section 6A.
	Others	
	Malfunctioning PCV valve	PCV system inspection in Section 6E1.

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Condition	Possible Cause	Reference Item
Engine has no power	**Engine overheating**	Refer to "Overheating" section.
	Ignition system out of order	
	Defective spark plug	Spark plugs in Section 6F1.
	Faulty ignition coil with ignitor	Ignition coil in Section 6F1.
	Leaks, loose connection or disconnection of high-tension cord	High-tension cord in Section 6F1.
	Faulty knock sensor	Knock sensor malfunction in Section 6E1.
	Fuel system out of order	
	Fuel pressure out of specification • Dirty fuel filter (faulty fuel pump) • Dirty or clogged fuel hose or pipe • Malfunctioning fuel pressure regulator • Malfunctioning fuel pump	Diag. Flow Table B-3 in Section 6E1.
	Air inhaling from intake manifold gasket or throttle body gasket	
	Engine and emission control system out of order	
	Faulty injector	Fuel injector in Section 6E1.
	Faulty TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E1.
	Malfunctioning EGR valve	EGR system in Section 6E1.
	Maladjusting accelerator cable play	Accelerator cable play in Section 6E1.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in Section 6E1.
	Low compression	Previously outlined.
	Others	
	Dragging brakes	Diagnosis in Section 5.
	Slipping clutch	Diagnosis in Section 7C.

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Condition	Possible Cause	Reference Item
Improper engine idling or engine fails to idle	**Ignition system out of order**	
	Faulty spark plug	Spark plugs in Section 6F1.
	Faulty ignition coil with ignitor	Ignition coil in Section 6F1.
	Leaks, loose connection or disconnection of high-tension cord	High-tension cord in Section 6F1.
	Fuel system out of order	
	Fuel pressure out of specification • Malfunctioning fuel pressure regulator	Diag. Flow Table B-3 in Section 6E1.
	Leaky manifold, throttle body or cylinder head gasket	
	Engine overheating	Refer to "Overheating" section.
	Engine and emission control system out of order	
	Faulty idle air control system	Diag. Flow Table B-4 in Section 6E1.
	Faulty evaporative emission control system	EVAP emission control system in Section 6E1.
	Faulty injector	Fuel injector in Section 6E1.
	Faulty ECT sensor, TP sensor or MAP sensor	ECT sensor, TP sensor or MAP sensor in Section 6E1.
	Malfunctioning EGR valve	EGR system in Section 6E1.
	Faulty EGR system	EGR system in Section 6E1.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in Section 6E1.
	Low compression	Previously outlined.
	Others	
	Malfunctioning PCV valve	PCV system inspection in Section 6E1.
	Loose connection or disconnection of vacuum hoses	
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.)	**Ignition system out of order**	
	Spark plug faulty or plug gap as out of adjustment	Spark plugs in Section 6F1.
	Leaky high-tension cord	High-tension cord in Section 6F1.
	Fuel system out of order	
	Fuel pressure out of specification • Clogged fuel filter (faulty fuel pump) • Faulty fuel pressure regulator	Diag. Flow Table B-3 in Section 6E1.
	Clogged fuel filter (faulty fuel pump), hose or pipe	Fuel pressure check in Section 6E1.
	Engine overheating	Refer to "Overheating" section.
	Engine and emission control system out of order	
	Malfunctioning EGR valve	EGR system in Section 6E1.
	Faulty injector	Fuel injector in Section 6E1.
	Faulty TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E1.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in Section 6E1.
	Low compression	Previously outlined.

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Condition	Possible Cause	Reference Item
Surges (Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and down with no change in the accelerator pedal.)	**Ignition system out of order**	
	Defective spark plug (excess carbon deposits, improper gap, and burned electrodes, etc.)	Spark plugs in Section 6F1.
	Leaky or loosely high-tension cord	High-tension cord in Section 6F1.
	Fuel system out of order	
	Variable fuel pressure • Clogged fuel filter (faulty fuel pump) • Kinky or damaged fuel hose and line • Faulty fuel pressure regulator	Diag. Flow Table B-3 in Section 6E1.
	Engine and emission control system out of order	
	Malfunctioning EGR valve	EGR system in Section 6E1.
	Faulty MAP sensor	MAP sensor in Section 6E1.
	Faulty injector	Fuel injector in Section 6E1.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in Section 6E1.
Excessive detonation (The engine makes continuously sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.)	**Engine overheating**	Refer to "Overheating" section.
	Ignition system out of order	
	Faulty spark plug	Spark plugs in Section 6F1.
	Improper ignition timing	Ignition timing in Section 6F1.
	Loose connection of high-tension cord	High-tension cords in Section 6F1.
	Fuel system out of order	
	Clogged fuel filter (faulty fuel pump) and fuel lines	Fuel pressure check in Section 6E1.
	Air inhaling from intake manifold or throttle body gasket	
	Engine and emission control system out of order	
	Malfunctioning EGR valve	EGR system in Section 6E1.
	Faulty ECT sensor, knock sensor or MAP sensor	ECT sensor, knock sensor or MAP sensor in Section 6E1.
	Faulty injector	Fuel injector in Section 6E1.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in Section 6E1.
	Others	
	Excessive combustion chamber deposits	Piston and cylinder head cleaning in Section 6A.
Overheating	Inoperative thermostat	Thermostat in Section 6B.
	Poor water pump performance	Water pump in Section 6B.
	Clogged or leaky radiator	Radiator in Section 6B.
	Improper engine oil grade	Engine oil and oil filter change in Section 0B.
	Clogged oil filter or oil strainer	Oil pressure check in Section 6A.
	Poor oil pump performance	Oil pressure check in Section 6A.
	Dragging brakes	Diagnosis in Section 5.
	Slipping clutch	Diagnosis in Section 7C.
	Blown cylinder head gasket	Cylinder head inspection in Section 6A.
	Faulty radiator fan control system	Diag. Flow Table B-5 in Section 6E1.

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Condition	Possible Cause	Reference Item
Poor gasoline mileage	**Ignition system out of order**	
	Faulty spark plug (improper gap, heavy deposits, and burned electrodes, etc..)	Spark plugs in Section 6F1.
	Leaky or loosely high-tension cord	High-tension cord in Section 6F1.
	Engine and emission control system out of order	
	Malfunctioning EGR valve	EGR system in Section 6E1.
	High idle speed	Refer to "Improper engine idle speed" previously outlined.
	Faulty EGR valve	EGR system in Section 6E1.
	Fuel pressure out of specification	Diag. Flow Table B-3 in Section 6E1.
	Faulty TP sensor, ECT sensor or MAP sensor	TP sensor, ECT sensor or MAP sensor in Section 6E1.
	Faulty injector	Fuel injector in Section 6E1.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in Section 6E1.
	Low compression	Previously outlined.
	Others	
	Dragging brakes	Diagnosis in Section 5.
	Slipping clutch	Diagnosis in Section 7C.
	Thermostat out of order	Thermostat in Section 6B.
	Improper tire pressure	
Excessive engine oil consumption	**Oil entering combustion chamber**	
	Blown cylinder head gasket	Cylinder head in Section 6A.
	Leaky camshaft oil seals	Camshaft in Section 6A.
	Sticky piston ring	Piston cleaning in Section 6A.
	Worn piston and cylinder	Cylinders, pistons and piston rings inspection in Section 6A.
	Worn piston ring groove and ring	Pistons and piston rings inspection in Section 6A.
	Improper location of piston ring gap	Pistons installation in Section 6A.
	Worn or damaged valve stem seal	Valves and cylinder head in Section 6A.
	Worn valve stem	Valves inspection in Section 6A.
Low oil pressure	Improper oil viscosity	Engine oil and oil filter change in Section 0B.
	Malfunctioning oil pressure switch	Oil pressure switch inspection in Section 8.
	Clogged oil strainer	Oil pan and oil pump strainer cleaning in Section 6A.
	Functional deterioration of oil pump	Oil pump in Section 6A.
	Worn oil pump relief valve	Oil pump in Section 6A.
	Excessive clearance in various sliding parts	

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Condition	Possible Cause	Reference Item
Engine noise **Note : Before checking the mechanical noise, make sure that :** **ignition timing is properly adjusted.** **Specified spark plug is used.** **Specified fuel is used.**	**Valve noise**	
	Improper valve lash	Valve lash in Section 6A.
	Worn valve stem and guide	Valves inspection in Section 6A.
	Weak or broken valve spring	Valve springs inspection in Section 6A.
	Warped or bent valve	Valves inspection in Section 6A.
	Loose camshaft housing bolts	Camshafts in Section 6A.
	Piston, ring and cylinder noise	
	Worn piston, ring and cylinder bore	Pistons and cylinders inspection in Section 6A.
	Connecting rod noise	
	Worn crankpin bearing	Crankpin and connecting rod bearing inspection in Section 6A.
	Worn crankpin	Crankpin and connecting rod bearing inspection in Section 6A.
	Loose connecting rod nuts	Connecting rod installation in Section 6A.
	Low oil pressure	Previously outlined.
	Crankshaft noise	
	Low oil pressure	Previously outlined.
	Worn crankshaft journal bearing	Crankshaft and bearing inspection in Section 6A.
	Worn crankshaft journal	Crankshaft and bearing inspection in Section 6A.
	Loose bearing cap bolts	Crankshaft inspection in Section 6A.
	Excessive crankshaft thrust play	Crankshaft installation in Section 6A.

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Condition	Possible Cause	Reference Item
Excessive hydrocarbon (HC) emission or Excessive carbon monoxide (CO) emission	**Ignition system out of order**	
	Defective spark plug	
	Leaky or loosely high-tension cord	High-tension cord in Section 6F1.
	Faulty ignition coil with ignitor	Ignition coil in Section 6F1.
	Fuel system out of order	
	Fuel pressure out of specification	Fuel pressure check in Section 6E1.
	Engine and emission control system out of order	
	Lead contamination of three way catalytic converter	Check for absence of filler neck restrictor.
	Malfunctioning PCV valve	PCV valve in Section 6E1.
	Faulty EVAP control system	EVAP control system check in Section 6E1.
	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 referring to DTC P0130 Diag. Flow Table in Section 6E1.
	Faulty injector	Fuel injector in Section 6E1.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in Section 6E1.
	Low compression	Previously outlined.
	Others	
	Engine not at normal operating temperature	
	Clogged air cleaner	
	Vacuum leaks	
Excessive nitrogen oxides (NOx) emission	**Ignition system out of order**	
	Improper ignition timing	See Section 6F1.
	Fuel system out of order	
	Fuel pressure out of specification	Fuel pressure check in Section 6E1.
	Engine and emission control system	
	Faulty EGR valve	EGR system in Section 6E1.
	Lead contamination of three way catalytic converter	Check for absence of filler neck restrictor.
	Closed loop system (A/F feed back compensation) fails (vehicle with oxygen sensor) • Faulty TP sensor • Faulty ECT sensor or MAP sensor • Faulty oxygen sensor	Check oxygen sensor output voltage referring to DTC P0130 Diag. Flow Table in Section 6E1.
	Faulty injector	Fuel injector in Section 6E1.
	Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in Section 6E1.

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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 (PCM) and output from ECM (PCM) as commands and there may be cases where the engine or actuator is not operating (in the condition) as indicated by the scan tool. Be sure to use the timing light to check the ignition timing.

NOTE:

- **With the generic scan tool, only star (✱) marked data in the table below can be read.**
- **When checking the data with the engine running at idle or racing, be sure to shift M/T gear to the neutral gear position and A/T gear to the "Park" position and pull the parking brake fully. Also, if nothing or "no load" is indicated, turn OFF A/C, all electric loads, P/S and all the other necessary switches.**

	SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
✱	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, 185 – 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		– 20 – +20%
✱	MAP (INTAKE MANIFOLD ABSOLUTE PRESSURE)	At specified idle speed with no load after warming up		21 – 40 kPa, 160 – 300 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 - 15° BTDC
✱	INTAKE AIR TEMP.	At specified idle speed after warming up		Ambient temp. : +63°C (113°F) –9°C (–16°F)
✱	MAF (MASS AIR FLOW RATE)	At specified idle speed with no load after warming up		1 – 4 gm/sec
		At 2500 r/min with no load after warming up		3 – 9 gm/sec
✱	THROTTLE POS (ABSOLUTE THROTTLE POSITION)	Ignition switch ON/engine stopped	Throttle valve fully closed	0 – 18%
			Throttle valve fully open	70 – 90%
✱	O2S B1 S1 (HEATED OXYGEN SENSOR-1)	At specified idle speed after warming up		0.05 – 0.95 V

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	SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
*	O2S B1 S2 (HEATED OXYGEN SENSOR-2)	When engine is running at 2000 r/min. for 3 min or longer after warming up.		0.05 – 0.95 V
	DESIRED IDLE (DESIRED IDLE SPEED)	At idling with no load after warming up, M/T at neutral, A/T at "P" range		800 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		0.8 – 3.6 msec.
		At 2500 r/min with no load after warming up		0.8 – 3.6 msec.
	IAC FLOW DUTY (IDLE AIR CONTROL FLOW DUTY)	At idling with no load after warming up		5 – 35%
	TOTAL FUEL TRIM	At specified idle speed after warming up		– 40 – +40%
	BATTERY VOLTAGE	Ignition switch ON/engine stop		10 – 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
	RADIATOR FAN (RADIATOR FAN CONTROL RELAY)	Ignition switch ON	Engine coolant temp. : Lower than 93℃ (199℉)	OFF
			Engine coolant temp. : 98℃ (208℉) or higher	ON
	ELECTRIC LOAD	Ignition switch ON/Headlight, small light and rear window defogger all turned OFF		OFF
		Ignition switch ON/Headlight, small light 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
	EGR VALVE	At specified idle speed after warming up		0%
	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
	BLOWER FAN	Ignition switch ON	Blower fan switch ON	ON
			Blower fan switch OFF	OFF

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	SCAN TOOL DATA	VEHICLE CONDITION		NORMAL CONDITION/ REFERENCE VALUES
	SHIFT SOL 1-CON (SHIFT SOLENOID 1-COMMAND SIGNAL) SHIFT SOL 2-CON (SHIFT SOLENOID 2-COMMAND SIGNAL) SHIFT SOL 1-MON (SHIFT SOLENOID 1-MONITOR) SHIFT SOL 2-MON (SHIFT SOLENOID 2-MONITOR)	Ignition switch ON, selector lever is shifted at P, R or N range		OFF
		Ignition switch ON, selector lever is shifted at D range and vehicle stops		ON
	THROT POS LEVEL (THROTTLE POSITION LEVEL FOR A/T)	"0" (about idle position), "1", "2", "3", "4", "5", "6" or "7" (about full open) appears according to throttle valve opening.		
	TRANS. RANGE (TRANSMISSION RANGE SENSOR)	"P", "R", "N", "D", "2" or "L" appears according to selector lever position.		
	GEAR POSITION	Select lever at R, D, 2 or L range		1
		Select lever at P or N range		–
	BRAKE SW	Ignition switch ON	Brake pedal is depressing	ON
			Brake pedal is releasing	OFF
	A/C MAG CLUTCH	Ignition switch ON	A/C switch ON	ON
			A/C switch OFF	OFF
	VSS (A/T)	At stop		0 km/h, 0 MPH

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 (PCM) 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, ℃, ℉)

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.

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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 (PCM). 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 (PCM) internal parameter which indicates the ECM (PCM) 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 (PCM) (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 (PCM).

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.

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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

RAD FAN (RADIATOR FAN CONTROL RELAY, ON/OFF)

ON : Command for radiator fan control relay operation being output.
OFF : Command for relay operation not being output.

ELECTRIC LOAD (ON/OFF)

ON : Headlight, small light 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 (PCM) 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.

EGR VALVE (%)

This parameter indicates opening rate of EGR valve which controls the amount of EGR flow.

TRANS RANGE (TRANSMISSION RANGE SENSOR, P, R, N, D, 2 OR L)

It is indicated transmission range detected by transmission range sensor.

SHIFT SOL 1-CON (SHIFT SOLENOID-1, ON/OFF)

ON : ON command being output to shift solenoid-1.
OFF : ON command not being output.

SHIFT SOL 2-CON (SHIFT SOLENOID-2, ON/OFF)

ON : ON command being output to shift solenoid-2.
OFF : ON command not being output.

SHIFT SOL 1-MON (SHIFT SOLENOID-1, ON/OFF)

The monitor result of the shift solenoid-1 circuit is displayed.
ON : Electricity being passed to shift solenoid-1 or circuit open.
OFF : Electricity not being passed or circuit short.

SHIFT SOL 2-MON (SHIFT SOLENOID-2, ON/OFF)

The monitor result of the shift solenoid-2 circuit is displayed.
ON : Electricity being passed to shift solenoid-2 or circuit open.
OFF : Electricity not being passed or circuit short.

THROT POS LEVEL (THROTTLE POSITION LEVEL FOR A/T, "0", "1", "2", "3", "4", "5", "6" or "7")

This parameter indicates which level (zone) the throttle valve opening is in. The throttle opening is divided into 8 levels (zones) from "0" (about idle position) to "7" (about full open) and signals are assigned to each opening level (zone). ECM (PCM) control the automatic gear change of the automatic transmission by using these signals according to the signal from the TP sensor.

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GEAR POSITION

This parameter indicates the A/T gear position which is computed on signals from the Transmission Range Switch, VSS, TP Sensor, and so forth.

Inspection of ECM (PCM) and Its Circuits

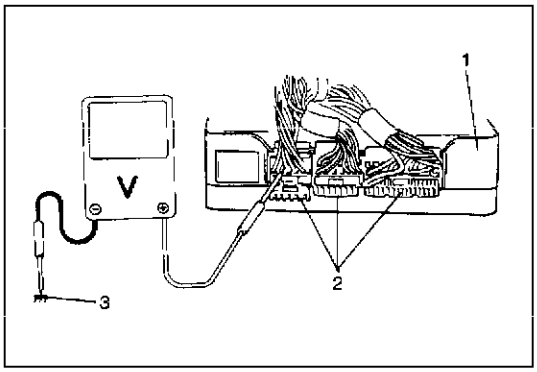
ECM (PCM) and its circuits can be checked at ECM (PCM) wiring couplers by measuring voltage and resistance.

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

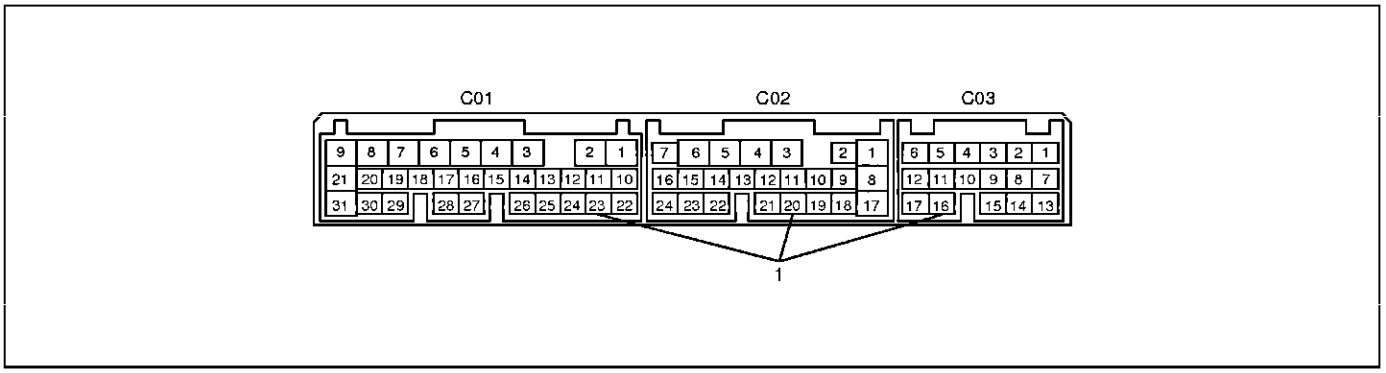
VOLTAGE CHECK

1) Remove ECM (PCM) from body with ignition switch OFF referring to ECM (PCM) REMOVAL.
2) Connect ECM (PCM) couplers (2) to ECM (PCM) (1).
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



1. ECM (PCM) couplers (viewed from harness side)

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TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
CONNECTOR "C01"	1	Ground	–	–
	2	Ground	–	–
	3	Ground	–	–
	4	EVAP canister purge valve	10 – 14 V	Ignition switch ON
	5	–	–	–
	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 (+)	–	–
	12	Camshaft position sensor (–)	–	–
	13	Heated oxygen sensor-1	Refer to DTC P0130 diag. flow table	
	14	Engine coolant temp. sensor	0.55 – 0.95 V	Ignition switch ON Engine coolant temp. : 80℃ (176℉)
	15	Intake air temp. sensor	2.0 – 2.7 V	Ignition switch ON Intake air temp. : 20℃ (68℉)
	16	Throttle position sensor	0.18 – 1.03 V	Ignition switch ON Throttle valve at idle position
			3.27 – 4.58 V	Ignition switch ON Throttle valve at full open position
	17	EGR valve (stepper motor coil 3)	10 – 14 V	Ignition switch ON
	18	EGR valve (stepper motor coil 1)	10 – 14 V	Ignition switch ON
	19	Ignition coil NO.2	–	–
	20	Ignition coil NO.1	–	–
	21	Fuel injector NO.2	10 – 14 V	Ignition switch ON
	22	Power source for sensor	4.75 – 5.25 V	Ignition switch ON
	23	Crankshaft position sensor (+)	–	–
	24	Crankshaft position sensor (–)	–	–
	25	Knock sensor	–	Ignition switch ON
	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	–	–
	28	EGR valve (stepper motor coil 4)	10 – 14 V	Ignition switch ON
	29	EGR valve (stepper motor coil 2)	10 – 14 V	Ignition switch ON
	30	–	–	–
	31	Fuel injector NO.3	10 – 14 V	Ignition switch ON

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TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
CONNECTOR "C02"	1	A/C compressor magnet clutch relay (with A/C)	0 – 1 V	Engine running, A/C compressor : ON
			10 – 14 V	Engine running, A/C compressor : OFF
	2	MIL	0 – 2 V	Ignition switch ON (Engine stops)
			10 – 14 V	Engine running
	3	Data link connector (12 V)	10 – 14 V	Ignition switch ON
	4	Heater of HO2S-2	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	0 – 1 V	Ignition switch ON
			10 – 14 V	Engine running
	9	–	–	–
	10	Main relay	10 – 14 V	Ignition switch OFF
			0.4 – 1.5 V	Ignition switch ON
	11	Ignition signal output	–	Ignition switch ON
	12	Data link connecter (5 V)	–	–
	13	Heated oxygen sensor-2	Refer to DTC P0130 diag. flow table	
	14	–	–	–
	15	–	–	–
	16	A/C switch signal	10 – 14 V	Ignition switch ON A/C switch OFF
			0 – 2 V	Ignition switch ON A/C switch ON
	17	Electric load signal (Rear defogger switch)	0 – 1 V	Ignition switch ON, rear defogger switch OFF
			10 – 14 V	Ignition switch ON, rear defogger switch ON
	18	Radiator fan relay	10 – 14 V	Ignition switch ON Engine coolant temp. : Below 93°C (199°F)
			0 – 1 V	Ignition switch ON Engine coolant temp. : 98°C (208°F) or higher
	19	Fuel pump relay	0 – 1 V	For 2 seconds after ignition switch ON
			10 – 14 V	After the above time
	20	–	–	–
	21	Vehicle speed sensor	Indicator deflection repeated 0 V and 10 – 14 V	Ignition switch ON Front left tire turned slowly with front right tire locked
	22	Fuel level sensor (gauge)	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	10 – 14 V	Ignition switch ON, heater blower switch OFF
			0 – 2.5 V	Ignition switch ON, heater blower switch ON

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TERMINAL NO.		CIRCUIT	NORMAL VOLTAGE	CONDITION
CONNECTOR "C03"	1	Generator control signal	–	Ignition switch ON
	2	"R" range signal (A/T)	10 – 14 V	Ignition switch ON Selector lever at "R" range
			0 – 1 V	Ignition switch ON Selector lever at other than "R" range
	3	"P" range signal (A/T)	10 – 14 V	Ignition switch ON Selector lever at "P" range
			0 – 1 V	Ignition switch ON Selector lever at other than "P" range
	4	Shift solenoid A (A/T)	0 – 1 V	Ignition switch ON Selector lever at "P" range
			10 – 14 V	Ignition switch ON Selector lever at "D" range
	5	Shift solenoid B (A/T)	0 – 1 V	Ignition switch ON Selector lever at "P" range
			10 – 14 V	Ignition switch ON Selector lever at "D" range
	6	"D" range signal (A/T)	10 – 14 V	Ignition switch ON Selector lever at "D" range
			0 – 1 V	Ignition switch ON Selector lever at other than "D" range
	7	Stop light switch (brake pedal switch)	0 – 1.5 V	Brake pedal released (switch OFF), Ignition switch ON
			10 – 14 V	Brake pedal released (switch ON), Ignition switch ON
	8	Electric load signal (Lighting switch)	0 – 1 V	Ignition switch ON, lighting switch OFF
			10 – 14 V	Ignition switch ON, lighting switch ON
	9	Ignition switch signal	10 – 14 V	Ignition switch ON
	10	Input shaft speed sensor (–) (A/T)	0.4 – 0.8 V	Ignition switch ON
	11	Input shaft speed sensor (+) (A/T)	0.4 – 0.8 V	Ignition switch ON
	12	"N" range signal (A/T)	10 – 14 V	Ignition switch ON Selector lever at "N" range
			0 – 1 V	Ignition switch ON Selector lever at other than "N" range
	13	Engine start signal	6 – 12 V	While engine cranking
			0 – 1 V	Other than above
	14	–	–	–
	15	–	–	–
	16	"2" range signal (A/T)	10 – 14 V	Ignition switch ON Selector lever at "2" range
			0 – 1 V	Ignition switch ON Selector lever at other than "2" range
	17	"L" range signal (A/T)	10 – 14 V	Ignition switch ON Selector lever at "L" range
			0 – 1 V	Ignition switch ON Selector lever at other than "L" range

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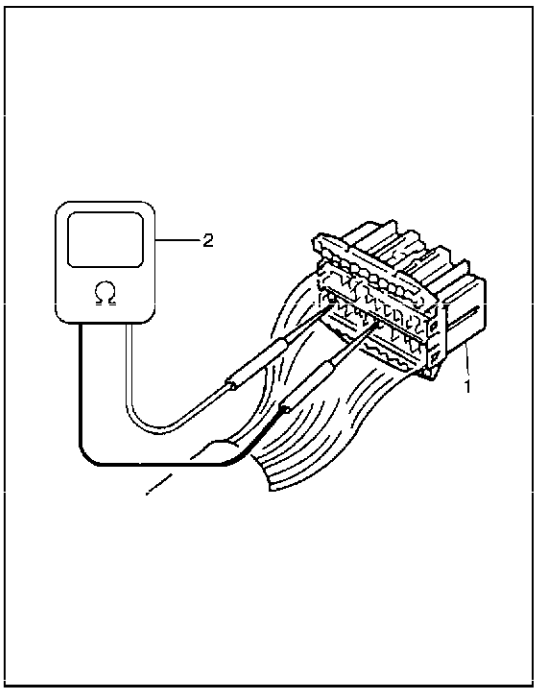
RESISTANCE CHECK

1) Disconnect ECM (PCM) couplers from ECM (PCM) with ignition switch OFF.

CAUTION:
Never touch terminals of ECM (PCM) itself or connect voltmeter or ohmmeter.



2) Check resistance between each pair of terminals of disconnected couplers (1) as listed in following table.

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).**

TERMINALS	CIRCUIT	STANDARD RESISTANCE
C01-7 to C03-9	HO2S-1 heater	5.0 – 6.4 Ω
C02-4 to C03-9	HO2S-2 heater	11.7 – 14.3 Ω
C01-9 to C02-5/6	No.1 injector	11.3 – 13.8 Ω
C01-21 to C02-5/6	No.2 injector	11.3 – 13.8 Ω
C01-31 to C02-5/6	No.3 injector	11.3 – 13.8 Ω
C01-8 to C02-5/6	No.4 injector	11.3 – 13.8 Ω
C01-28 to C02-5/6	EGR valve (stepper motor coil 4)	20 – 24 Ω
C01-17 to C02-5/6	EGR valve (stepper motor coil 3)	20 – 24 Ω
C01-29 to C02-5/6	EGR valve (stepper motor coil 2)	20 – 24 Ω
C01-18 to C02-5/6	EGR valve (stepper motor coil 1)	20 – 24 Ω
C01-4 to C02-5/6	EVAP canister purge valve	30 – 34 Ω
C02-19 to C03-9	Fuel pump relay	70 – 110 Ω
C02-18 to C02-5/6	Radiator fan relay	70 – 110 Ω
C02-10 to C02-7	Main relay	70 – 110 Ω
C01-1 to Body ground	Ground	Continuity
C01-2 to Body ground	Ground	Continuity
C01-3 to Body ground	Ground	Continuity

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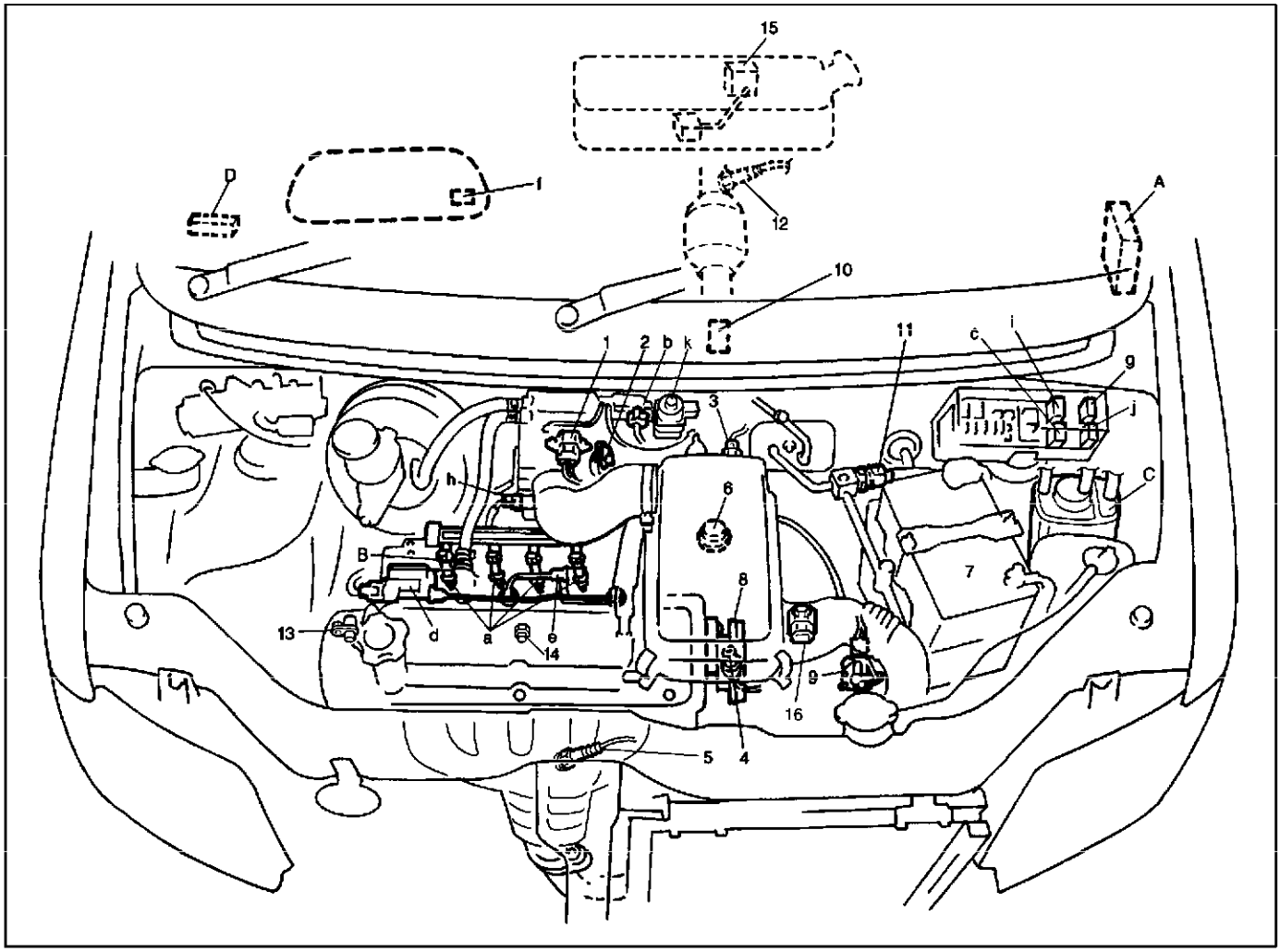
Component Location



INFORMATION SENSORS	CONTROL DEVICES	OTHERS
1. MAP sensor	a : Fuel injectors	A : ECM (PCM)
2. TP sensor	b : EVAP canister purge valve	B : PCV valve
3. IAT sensor	c : Fuel pump relay	C : EVAP canister
4. ECT sensor	d : Ignition coil assembly (No.1 and No.4 spark plugs)	D : DLC
5. Heated oxygen sensor-1	e : Ignition coil assembly (No.2 and No.3 spark plugs)	
6. VSS	f : Malfunction indicator lamp	
7. Battery	g : Radiator fan control relay	
8. CMP sensor	h : IAC valve	
9. Transmission range switch (3 A/T)	i : A/C compressor control relay (if equipped)	
10. A/C evaporator temp. sensor (if equipped)	j : Main relay	
11. A/C dual pressure switch (if equipped)	k : EGR valve (step motor)	
12. Heated oxygen sensor-2		
13. CKP sensor		
14. Knock sensor		
15. Fuel level sensor (gauge)		
16. Input shaft speed sensor (3 A/T)		

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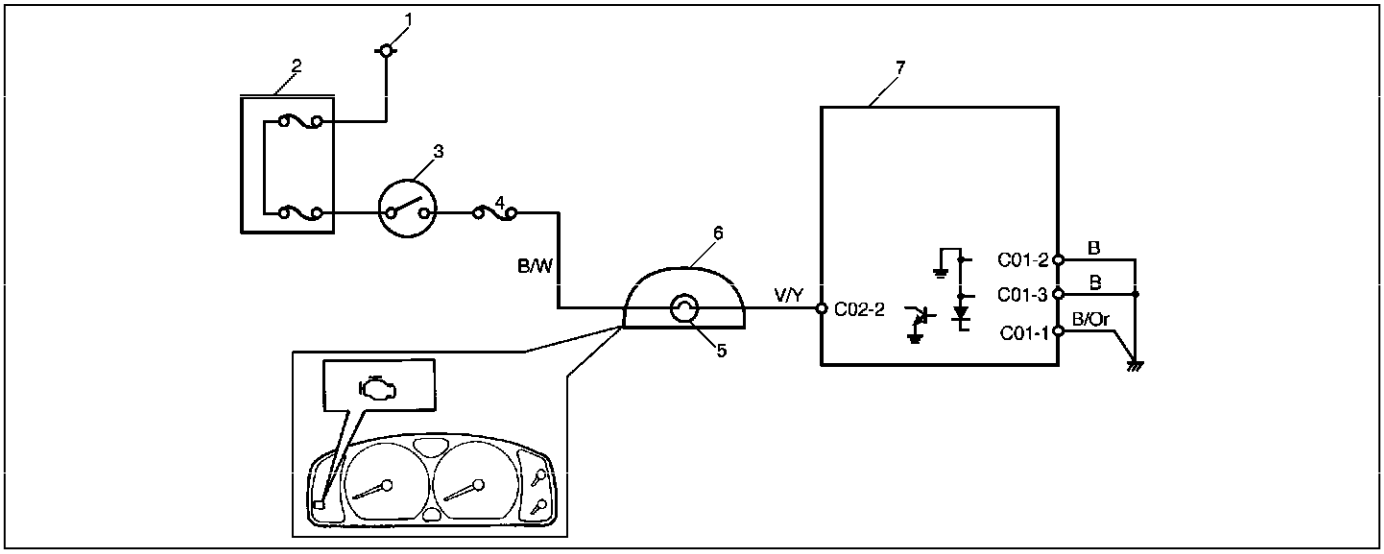
A-1 Malfunction Indicator Lamp Circuit Check (Malfunction Indicator Lamp Does not Light at Ignition Switch ON.)

CIRCUIT DESCRIPTION



1. Battery positive voltage	3. Ignition switch	5. Malfunction indicator lamp	7. ECM (PCM)
2. Relay/fuse box	4. "IG METER" fuse	6. Combination meter	

When the ignition switch is turned ON, ECM (PCM) causes the main relay to turn ON (close the contact point). Then, ECM (PCM) 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 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	ECM (PCM) Power and Ground Circuit Check. Does engine start?	Go to Step 3.	Go to TABLE A-3 ECM (PCM) POWER AND GROUND CIRCUIT CHECK. If engine is not cranked, go to "DIAGNOSIS" in Section 6G.
3	MIL Circuit Check. 1) Turn ignition switch OFF and disconnect connectors from ECM (PCM). 2) Check for proper connection to ECM (PCM) at terminal "C02-2". 3) If OK, then using service wire, ground terminal "C02-2" in connector disconnected. Does MIL turn on at ignition switch ON?	Substitute a known-good ECM (PCM) and recheck.	Bulb burned out or "V/Y" wire circuit open.

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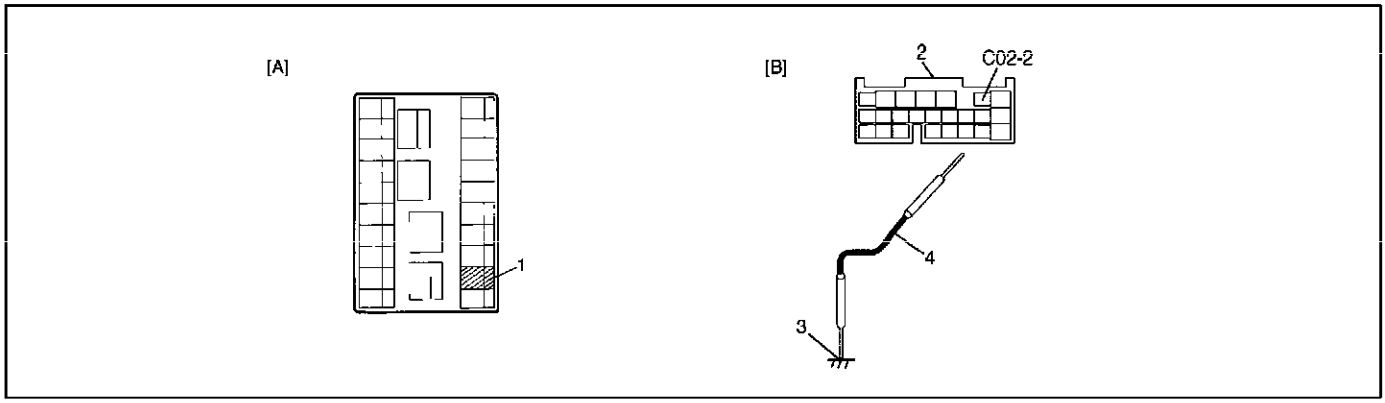

[A] : Fig. for Step 1	1. "IG METER" fuse	3. Body ground
[B] : Fig. for Step 3	2. ECM (PCM) coupler disconnected	4. Service wire

A-2 Malfunction Indicator Lamp Circuit Check (Malfunction Indicator 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. 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 (PCM). Does MIL turn ON at ignition switch ON?	"V/Y" wire circuit shorted to ground.	Substitute a known-good ECM (PCM) and recheck.

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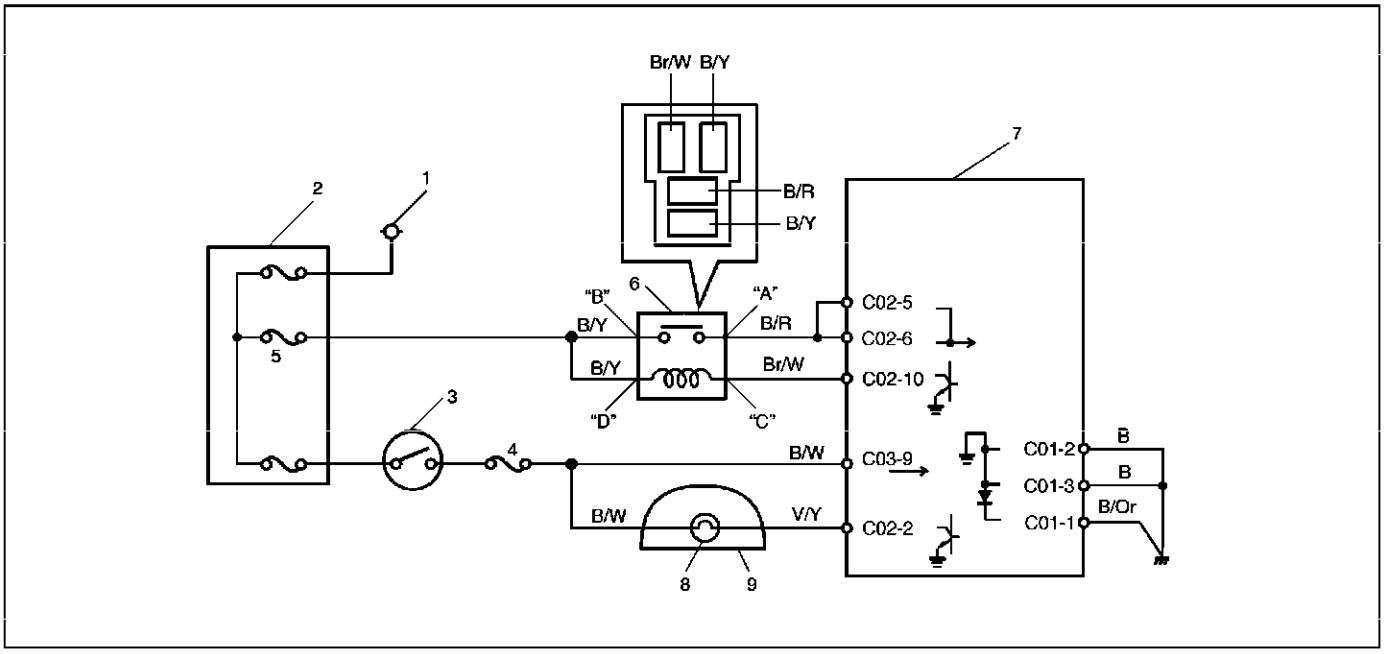
A-3 ECM (PCM) Power and Ground Circuit Check (Malfunction Indicator Lamp does not Light at Ignition Switch ON and Engine does not Start Though it is Cranked up.)

CIRCUIT DESCRIPTION



1. Battery positive voltage	4. "IG METER" fuse	7. ECM (PCM)
2. Relay/fuse box	5. "FI" fuse	8. Malfunction indicator lamp
3. Ignition switch	6. Main relay	9. Combination meter

When the ignition switch tuned ON, the main relay turns ON (the contact point closes) and the main power is supplied to ECM (PCM).

INSPECTION

Step	Action	Yes	No
1	Main Relay Opening Sound Check. Is operating sound of main relay heard at ignition switch ON?	Go to Step 5.	Go to Step 2.
2	Fuse Check. Is main "FI" fuse in good condition?	Go to Step 3.	Check for short in circuits connected to this fuse.
3	Main Relay Check. 1) Turn OFF ignition switch and remove main relay. 2) Check for proper connection to main relay at terminal "A" and "B". 3) If OK, check main relay for resistance and operation referring to MAIN RELAY INSPECTION in this section. Is check result satisfactory?	Go to Step 4.	Replace main relay.

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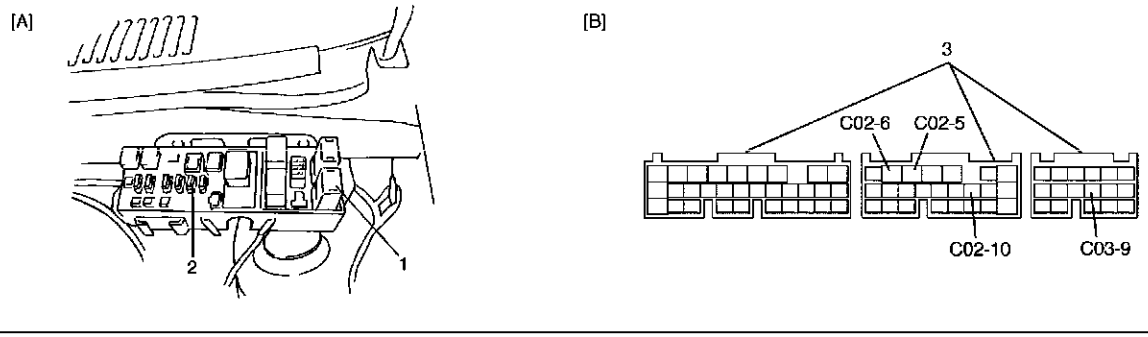
Step	Action	Yes	No
4	ECM (PCM) Power Circuit Check. 1) Turn OFF ignition switch, disconnect connectors from ECM (PCM) and install main relay. 2) Check for proper connection to ECM (PCM) at terminals "C02-5", "C02-6", "C02-10" and "C03-9". 3) If OK, then measure voltage between terminal "C02-10" and ground, "C03-9" and ground with ignition switch ON. Is each voltage 10 – 14 V?	Go to Step 5.	"Br/W", "B/Y" or "B/W" circuit open.
5	ECM (PCM) Power Circuit Check. 1) Using service wire, ground terminal "C02-10" and measure voltage between terminal "C02-5" ("C02-6") and ground. Is it 10 – 14 V?	Check ground circuits "B/Or" and "B" for open. If OK, then substitute a known-good ECM (PCM) and recheck.	Go to Step 6.
6	Is operating sound of main relay heard in Step 1?	Go to Step 7.	"B/Y" or "B/R" wire open.
7	Main Relay Check. 1) Check main relay according to procedure in Step 3. Is main relay in good condition?	"B/Y" or "B/R" wire open.	Replace main relay.



[A] : Fig. for Step 2 and 3	1. Main relay
[B] : Fig. for Step 4 and 5	2. "FI" fuse
	3. ECM (PCM) coupler disconnected

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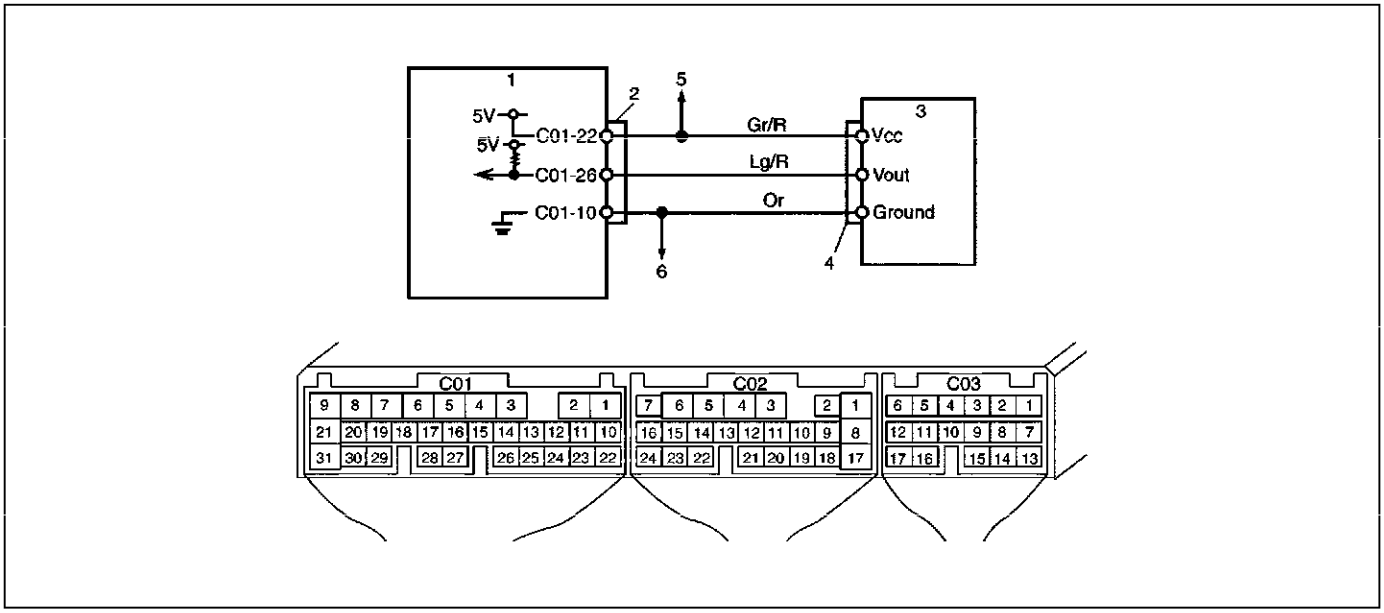
DTC P0105 Manifold Absolute Pressure (MAP) Circuit Malfunction

CIRCUIT DESCRIPTION



1. ECM (PCM)	3. MAP sensor	5. To TP sensor
2. ECM (PCM) coupler	4. MAP sensor coupler	6. To other sensors

DTC DETECTING CONDITION	POSSIBLE CAUSE
• MAP sensor signal is 0.75 V or lower. (Low pressure – High vacuums – Low voltage) or • MAP sensor signal is 4.5 V or higher (High pressure – Low vacuums – High voltage)	• "Or" circuit open • "Gr/R" circuit open or shorted to ground • "Lg/R" circuit open or shorted to ground • MAP sensor malfunction • ECM (PCM) malfunction

NOTE:

- **When DTC P0105, P0110, P0115, P0120, P0130 and P0136 are indicated together, it is possible that "Or" circuit is open.**
- **When this DTC and DTC P0120 are indicated together, it is possible that "Gr/R" 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. 2) Turn ignition switch ON. 3) Check intake manifold pressure. Is it 146 kPa (43.1 in.Hg) or 0 kPa (0 in.Hg)?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If OK, go to Step 8.

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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 "Lg/R" and "Gr/R" wire terminals. 3) If OK, then with ignition switch ON, check voltage at each of "Gr/R" and "Lg/R" wire terminals. See Fig. 1. Is voltage about 4 – 6 V at each terminal?	Go to Step 6.	Go to Step 4.
4	Check ECM (PCM) voltage. 1) Check proper connection of connector at "C01-22" and "C01-26" wire terminals. 2) If OK, disconnect connector from TP sensor. 3) Turn ON ignition switch, check voltage between "C01-22" and body ground and between "C01-26" and body ground. Is voltage about 4 – 6 V at each terminal?	"Gr/R" and/or "Lg/R" wire open circuit. Check TP sensor according to "TP Sensor inspection" in Section 6E1. If they are OK, go to Step 5.	Go to Step 5.
5	Check wire circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Check that there is insulating between "Gr/R" wire terminal and body ground and between "Lg/R" wire terminal and body ground. Is there insulating?	Go to Step 6.	"Gr/R" and/or "Lg/R" wire shorted to ground circuit. If wire are OK, substitute a known-good ECM (PCM) and recheck.
6	Check wire circuit. 1) Turn ignition switch ON. 2) Check voltage between "Gr/R" wire terminal and body ground and between "Lg/R" wire terminal and body ground. Is voltage about 0 V at each terminal?	Go to Step 7.	"Gr/R" and/or "Lg/R" wire shorted to power supply circuit. If wire are OK, substitute a known-good ECM (PCM) and recheck.
7	Check wire circuit. 1) Measure resistance between "C01-26" terminal and "Lg/R" wire terminal in MAP sensor connector with ignition switch turn OFF. Is resistance below 5 Ω?	Go to Step 8.	"Lg/R" wire in high resistance circuit.
8	Check ground circuit. 1) Connect connector to ECM (PCM). 2) Check proper connection of MAP sensor at "Or" wire terminal. 3) Measure resistance between "Or" wire terminal in MAP sensor connector and body ground. Is resistance below 10 Ω?	Go to Step 10.	Go to Step 9.
9	Check ground circuit. 1) Measure resistance between "C01-10" terminal and body ground. Is resistance below 5 Ω?	"Or" wire open circuit or high resistance circuit. Poor "C01-10" connection.	Faulty ECM ground circuit. If circuit are OK, substitute a known-good ECM (PCM) and recheck.

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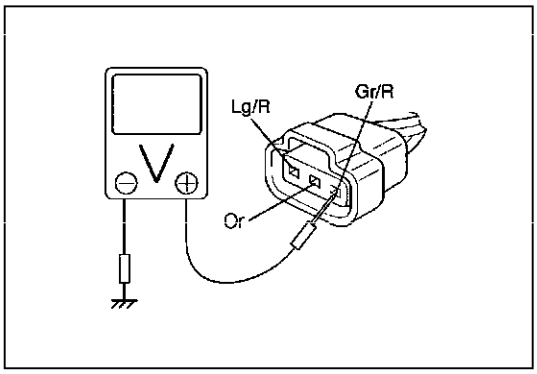
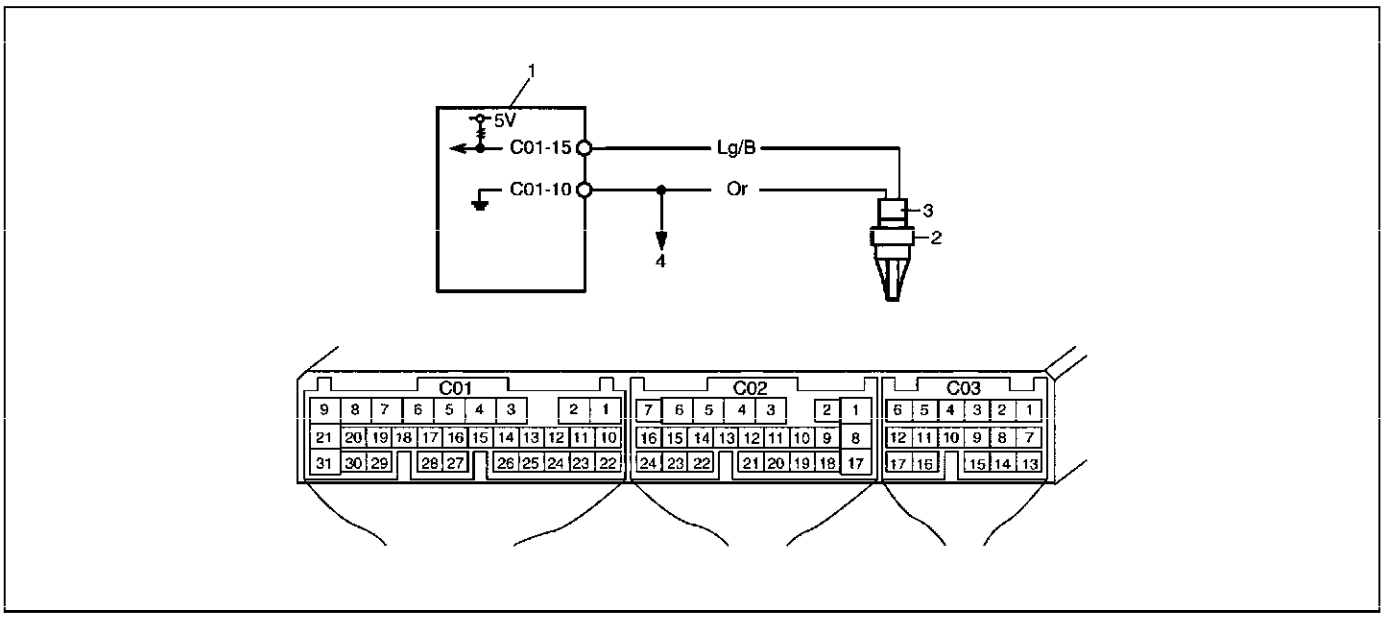
Step	Action	Yes	No
10	Check MAP sensor according to "MAP Sensor Individual Check" in this section. Is it in good condition?	Substitute a known-good ECM (PCM) and recheck.	Replace MAP sensor.

Fig. for Step 3



DTC P0110 Intake Air Temp. (IAT) Circuit Malfunction

CIRCUIT DESCRIPTION



1. ECM (PCM)	3. IAT sensor coupler
2. IAT sensor	4. To other sensors

DTC DETECTING CONDITION	POSSIBLE CAUSE
• Low intake air temperature (High voltage-High resistance) or • High intake air temperature (Low voltage-Low resistance)	• "Lg/B" circuit open or shorted to power • "Or" circuit open • IAT sensor malfunction • ECM (PCM) malfunction

NOTE:

- **When DTC P0105, P0110, P0115, P0120, P0130 and P0136 are indicated together, it is possible that "Or" circuit is open.**
- **Before inspecting, be sure to check that ambient temperature is higher than –40 °C (–40 °F).**

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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 IAT Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF. 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.
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 "Or" wire terminal. 3) If OK, then with ignition switch ON. Is voltage applied to "Lg/B" wire terminal about 4 – 6 V? See Fig. 1.	Go to Step 7.	Go to Step 4.
4	Check ECM (PCM) voltage. 1) Check proper connection of connector at "C01-15" wire terminals. 2) If OK, then turn ON ignition switch, check voltage between "C01-15" and body ground. Is voltage about 4 – 6 V at each terminal?	"Lg/B" wire open circuit. If wire and connection are OK, go to Step 5.	Go to Step 5.
5	Check wire circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Check that there is insulation between "Lg/B" wire terminal and body ground. Is there insulation?	Go to Step 6.	"Lg/B" wire shorted to ground circuit. If wire are OK, substitute a known-good ECM (PCM) and recheck.
6	Check wire circuit. 1) Turn ignition switch ON. 2) Check voltage between "Lg/B" wire terminal and body ground. Is voltage about 0 V at each terminal?	Go to Step 7.	"Lg/B" wire shorted to power circuit. If wire are OK, substitute a known-good ECM (PCM) and recheck.
7	Check wire circuit. 1) Measure resistance between "C01-15" terminal and "Lg/B" wire terminal in IAT sensor connector with ignition switch turn OFF. Is resistance below 5 Ω?	Go to Step 8.	"Lg/B" wire in high resistance circuit.

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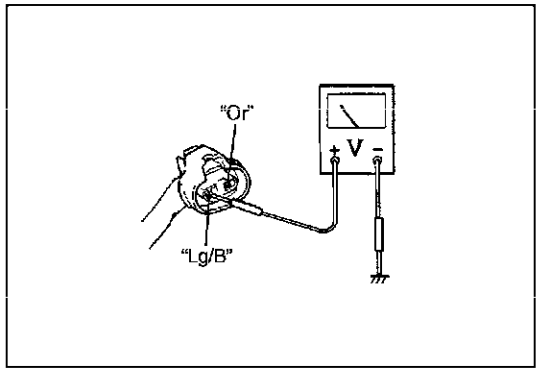
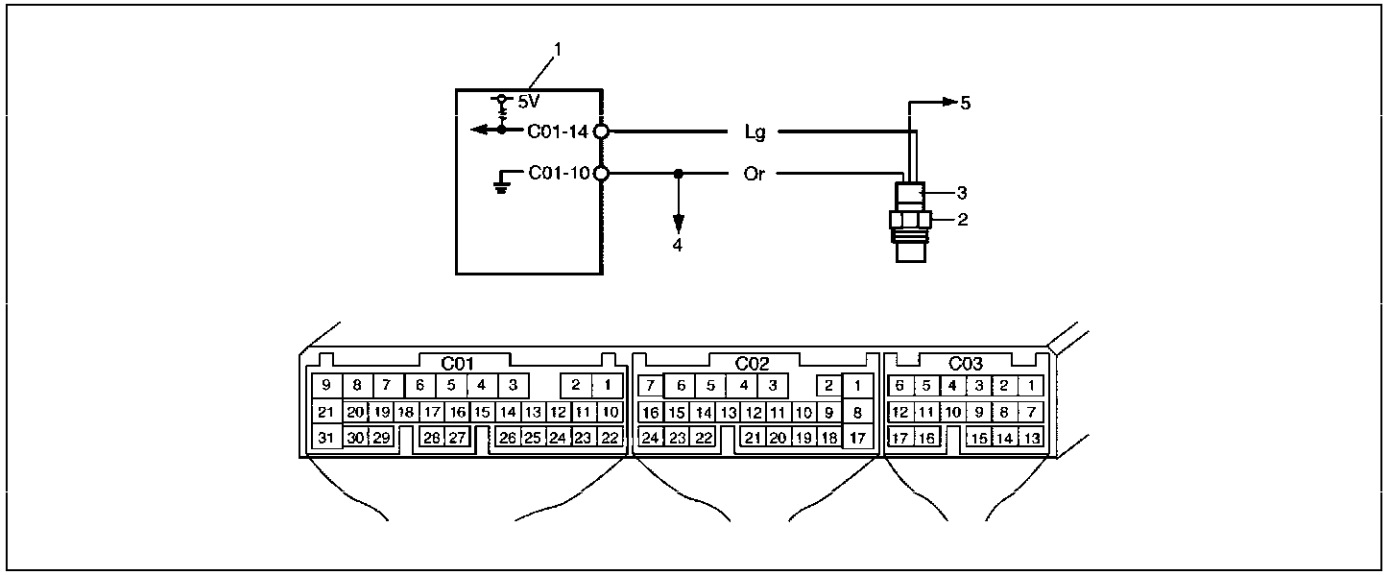
Step	Action	Yes	No
8	Check ground circuit. 1) Connect connector to ECM (PCM). 2) Check proper connection of IAT sensor at "Or" wire terminal. 3) Measure resistance between "Or" wire terminal in IAT sensor connector and body ground. Is resistance below 10 Ω?	Go to Step 10.	Go to Step 9.
9	Check ground circuit. 1) Measure resistance between "C01-10" terminal and body ground. Is resistance below 5 Ω?	"Or" wire open circuit or high resistance circuit. Poor "C01-10" connection.	Faulty ECM ground circuit. If circuit are OK, substitute a known-good ECM (PCM) and recheck.
10	Check IAT sensor according to "IAT Sensor inspection" in Section 6E1. Is it in good condition?	Substitute a known-good ECM (PCM) and recheck.	Replace IAT sensor.

Fig.1 for Step 3



DTC P0115 Engine Coolant Temperature (ECT) Circuit Malfunction

CIRCUIT DESCRIPTION



1. ECM (PCM)	3. ECT sensor coupler	5. To combination meter
2. ECT sensor	4. To other sensors	

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DTC DETECTING CONDITION	POSSIBLE CAUSE
• Low engine coolant temperature (High voltage-High resistance) or • High engine coolant temperature (Low voltage-Low resistance)	• "Lg" circuit open or shorted to power • "Or" circuit open • ECT sensor malfunction • ECM (PCM) malfunction

NOTE:

- **Before inspecting, be sure to check that coolant temp. meter in combination meter indicates normal operating temperature (Engine is not overheating).**
- **When DTC P0105, P0110, P0115, P0120, P0130 and P0136 are indicated together, it is possible that "Or" 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 ECT Sensor and Its Circuit. 1) Connect scan tool with ignition switch OFF. 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 with ignition switch OFF. 2) Check for proper connection to ECT sensor at "Or" and "Lg" wire terminals. 3) If OK, then with ignition switch ON. Is voltage applied to "Lg" wire terminal about 4 – 6 V? See Fig. 1.	Go to Step 7.	Go to Step 4.
4	Check ECM (PCM) voltage. 1) Check proper connection of connector at "C01-14" wire terminals. 2) If OK, then turn ON ignition switch, check voltage between "C01-14" and body ground. Is voltage about 4 – 6 V at each terminal?	"Lg" wire open circuit. If wire and connection are OK, go to Step 5.	Go to Step 5.
5	Check wire circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Check that there is no continuity between "Lg" wire terminal and body ground. Is there no continuity?	Go to Step 6.	"Lg" wire shorted to ground circuit. If wire are OK, substitute a known-good ECM (PCM) and recheck.

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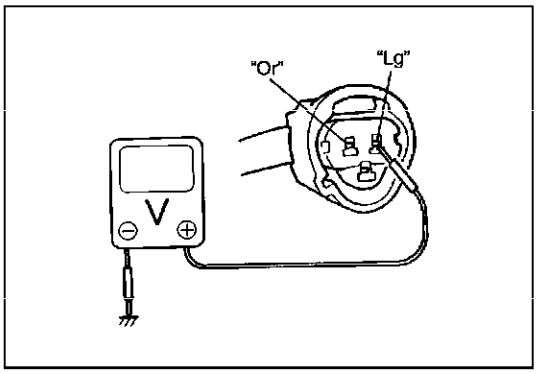
Step	Action	Yes	No
6	Check wire circuit. 1) Turn ignition switch ON. 2) Check voltage between "Lg" wire terminal and body ground. Is voltage about 0 V at each terminal?	Go to Step 7.	"Lg" wire shorted to power circuit. If wire are OK, substitute a known-good ECM (PCM) and recheck.
7	Check wire circuit. 1) Measure resistance between "C01-14" terminal and "Lg" wire terminal in ECT sensor connector with ignition switch turn OFF. Is resistance below 5 Ω?	Go to Step 8.	"Lg" wire in high resistance circuit.
8	Check ground circuit. 1) Connect connector to ECM (PCM). 2) Check proper connection of ECT sensor at "Or" wire terminal. 3) Measure resistance between "Or" wire terminal in ECT sensor connector and body ground. Is resistance below 10 Ω?	Go to Step 10.	Go to Step 9.
9	Check ground circuit. 1) Measure resistance between "C01-10" terminal and body ground. Is resistance below 5 Ω?	"Or" wire open circuit or high resistance circuit. Poor "C01-10" connection.	Faulty ECM ground circuit. If circuit are OK, substitute a known-good ECM (PCM) and recheck.
10	Check ECT sensor according to "ECT Sensor inspection" in Section 6E1. Is it in good condition?	Substitute a known-good ECM (PCM) and recheck.	Replace ECT sensor.

Fig.1 for Step 3



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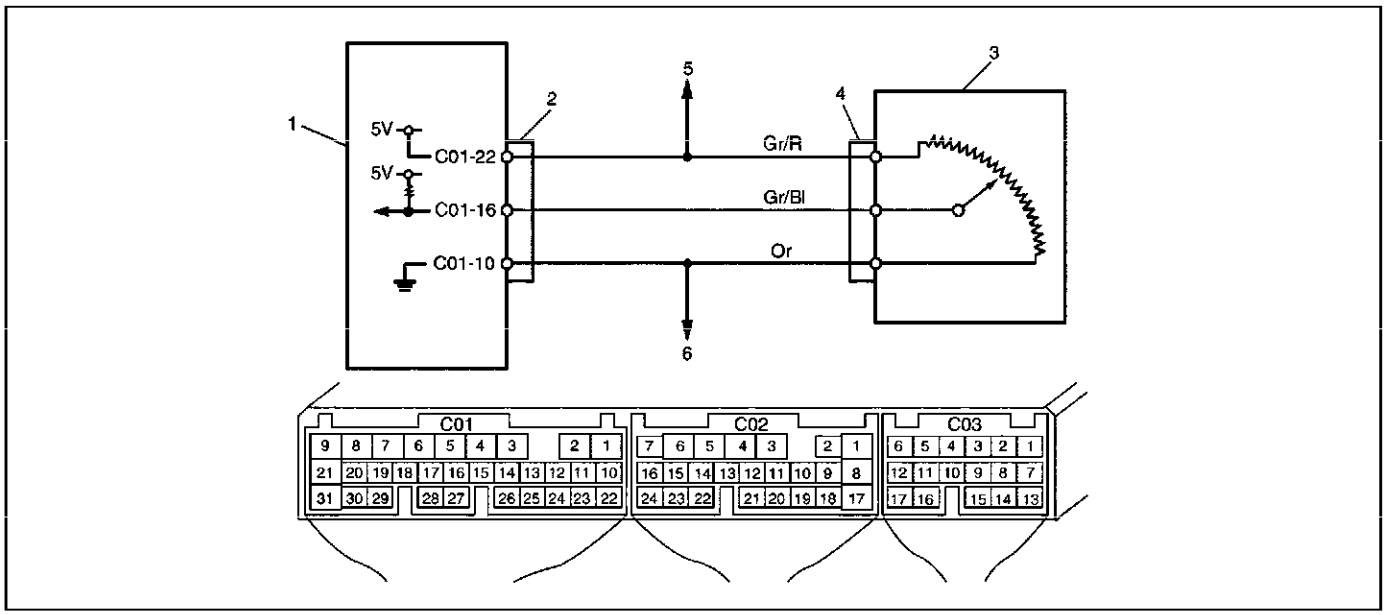
DTC P0120 Throttle Position Circuit Malfunction

CIRCUIT DESCRIPTION



1. ECM (PCM)	3. TP sensor	5. To MAP sensor
2. ECM (PCM) coupler	4. TP sensor coupler	6. To other sensors

DTC DETECTING CONDITION	POSSIBLE CAUSE
• Signal voltage high or • Signal voltage low	• "Or" circuit open • "Gr/Bl" circuit open or shorted to ground • "Gr/R" circuit open or shorted to power or ground • TP sensor malfunction • ECM (PCM) malfunction

NOTE:

- **When DTC P0105, P0110, P0115, P0120, P0130 and P0136 are indicated together, it is possible that "Or" circuit is open.**
- **When this DTC and DTC P0105 are indicated together, it is possible that "Gr/R" 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".

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Step	Action	Yes	No
2	Check TP Sensor and its Circuit. 1) Connect scan tool to DLC with ignition switch OFF and then turn ignition switch ON. 2) Check throttle valve opening percentage displayed on scan tool. 3) Check throttle valve opening percentage displayed on scan tool while opening throttle valve from idle position to full open position. Is it displayed 100% or 0%?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.
3	Check Wire Harness. 1) Disconnect connector from TP sensor with ignition switch OFF. 2) Check for proper connection to TP sensor at "Gr/R", "Gr/Bl" and "Or" wire terminal. 3) If OK, then with ignition switch ON, check voltage at each of "Gr/R" and "Gr/Bl" wire terminals. See Fig. 1. Is voltage about 4 – 6 V at each terminal?	Go to Step 7.	Go to Step 4.
4	Check ECM (PCM) voltage. 1) Check proper connection of connector at "C01-22" and "C01-16" wire terminals. 2) If OK, disconnect connector from MAP sensor. 3) Turn ON ignition switch, check voltage between "C01-22" and body ground and between "C01-16" and body ground. Is voltage about 4 – 6 V at each terminal?	"Gr/R" and/or "Gr/Bl" wire open circuit. Check MAP sensor according to "MAP Sensor inspection" in Section 6E1. If they are OK, go to Step 5.	Go to Step 5.
5	Check wire circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Check that there is insulation between "Gr/R" wire terminal and body ground and between "Gr/Bl" wire terminal and body ground. Is there insulation?	Go to Step 6.	"Gr/R" and/or "Gr/Bl" wire shorted to ground circuit. If wire are OK, substitute a known-good ECM (PCM) and recheck.
6	Check wire circuit. 1) Turn ignition switch ON. 2) Check voltage between "Gr/R" wire terminal and body ground and between "Gr/Bl" wire terminal and body ground. Is voltage about 0 V at each terminal?	Go to Step 7.	"Gr/R" and/or "Gr/Bl" wire shorted to power circuit. If wire are OK, substitute a known-good ECM (PCM) and recheck.
7	Check wire circuit. 1) Measure resistance between "C01-16" terminal and "Gr/Bl" wire terminal in TP sensor connector with ignition switch turn OFF. Is resistance below 5 Ω?	Go to Step 8.	"Gr/Bl" wire in high resistance circuit.

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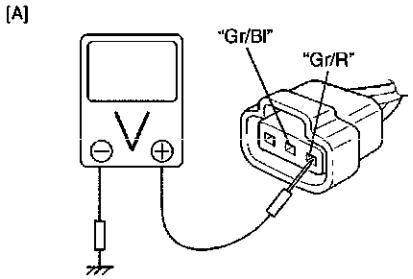
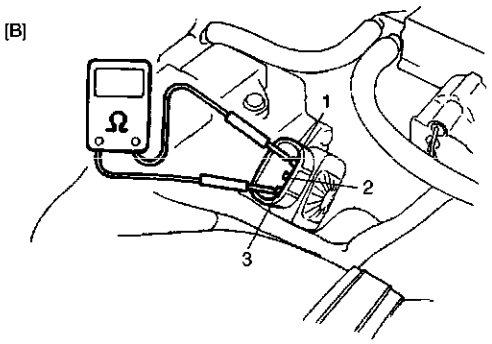
Step	Action	Yes	No
8	Check ground circuit. 1) Connect connector to ECM (PCM). 2) Check proper connection of MAP sensor at "Or" wire terminal. 3) Measure resistance between "Or" wire terminal in MAP sensor connector and body ground. Is resistance below 10 Ω?	Go to Step 10.	Go to Step 9.
9	Check ground circuit. 1) Measure resistance between "C01-10" terminal and body ground. Is resistance below 5 Ω?	"Or" wire open circuit or high resistance circuit. Poor "C01-10" connection.	Faulty ECM ground circuit. If circuit are OK, substitute a known-good ECM (PCM) and recheck.
10	Check TP Sensor. 1) Check resistance between terminals of TP sensor. See Fig. 2. **TP sensor resistance** **Between 1 and 3 : 4.0 – 6.0 kΩ** **Between 2 and 3 : 0.6 Ω – 5.4 kΩ** Are measured values within specifications?	Substitute a known-good ECM (PCM) and recheck.	Replace TP sensor.





[A] : Fig.1 for Step 3
[B] : Fig.2 for Step 8

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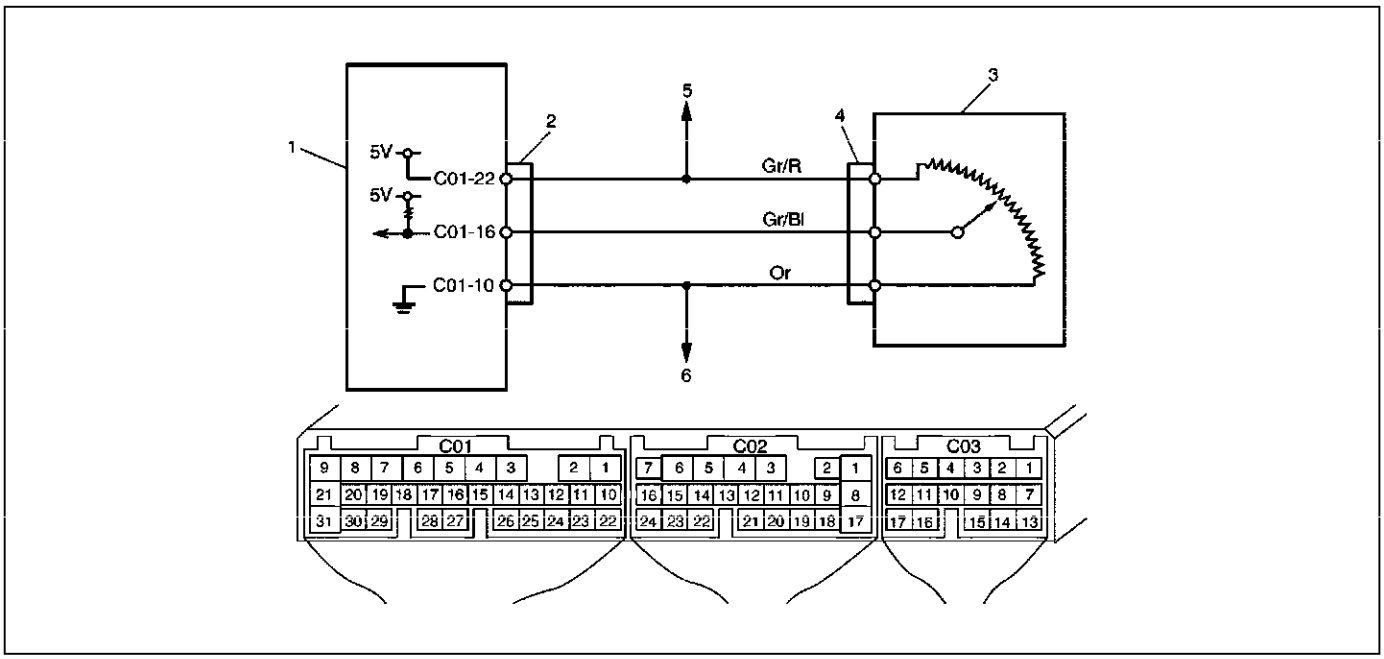
DTC P0121 Throttle Position Circuit Range/Performance Problem

CIRCUIT DESCRIPTION



1. ECM (PCM)	3. TP sensor	5. To MAP sensor
2. ECM (PCM) coupler	4. TP sensor coupler	6. To other sensors

DTC DETECTING CONDITION	POSSIBLE CAUSE
• After engine warmed up. • While vehicle running at specified engine speed. • No change in intake manifold pressure (constant throttle opening) • Difference between actual throttle opening (detected from TP sensor) and opening calculated by ECM (PCM) (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 (PCM) malfunction • MAP sensor malfunction • Throttle body clog

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) 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.

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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) Turn ignition switch OFF and connect SUZUKI scan tool to DLC. 2) Turn ignition switch ON and check TP sensor output voltage when throttle valve is at idle position and fully opened. See Fig. 1. Dose voltage vary within specified value linearly as shown in figure?	Go to Step 10.	Go to Step 3.
3	Check TP sensor voltage. 1) Disconnect connector from TP sensor with ignition switch turn OFF. 2) Check proper connection to TP sensor at "Gr/R", "Gr/Bl" and "Or". 3) If OK, then with ignition switch turn ON, check voltage at each of "Gr/R", "Gr/Bl" wire terminals. Is voltage about 4 – 6 V at each terminal?	Go to Step 7.	Go to Step 4.
4	Check ECM (PCM) voltage. 1) Check proper connection of connector at "C01-22" and "C01-16" wire terminals. 2) If OK, disconnect connector from MAP sensor. 3) Turn ON ignition switch, check voltage between "C01-22" and body ground and between "C01-16" and body ground. Is voltage about 4 – 6 V at each terminal?	"Gr/R" and/or "Gr/Bl" wire open or high resistance circuit. Faulty MAP sensor, check MAP sensor according to "MAP Sensor inspection" in this section. If they are OK, go to Step 5.	Go to Step 5.
5	Check wire circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Check that there is insulation between "Gr/R" wire terminal and body ground and between "Gr/Bl" wire terminal and body ground. Is there insulation?	Go to Step 6.	"Gr/R" and/or "Gr/Bl" wire shorted to ground circuit. If wire are OK, substitute a known-good ECM (PCM) and recheck.
6	Check wire circuit. 1) Turn ON ignition switch. 2) Check voltage between "Gr/R" wire terminal and body ground and between "Gr/Bl" wire terminal and body ground. Is voltage about 0 V at each terminal?	Go to Step 7.	"Gr/R" and/or "Gr/Bl" wire shorted to power circuit. If wire are OK, substitute a known-good ECM (PCM) and recheck.
7	Check wire circuit. 1) Measure resistance between "C01-16" terminal and "Gr/Bl" wire terminal in TP sensor connector with ignition switch turn OFF. Is resistance below 5 Ω?	Go to Step 8.	"Gr/Bl" wire in high resistance circuit.

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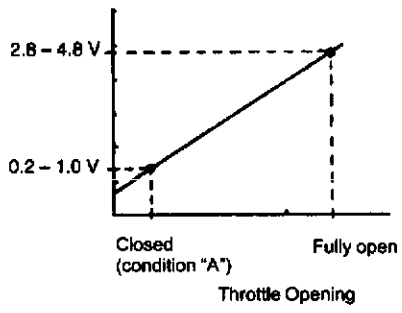
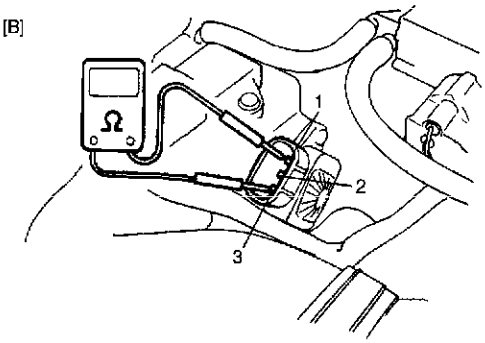
Step	Action	Yes	No
8	Check ground circuit. 1) Connect connector to ECM (PCM). 2) Check proper connection of MAP sensor at "Or" wire terminal. 3) Measure resistance between "Or" wire terminal in MAP sensor connector and body ground. Is resistance below 10 Ω?	Go to Step 10.	Go to Step 9.
9	Check ground circuit. 1) Measure resistance between "C01-10" terminal and body ground. Is resistance below 5 Ω?	"Or" wire open circuit or high resistance circuit. Poor "C01-10" connection.	Faulty ECM ground circuit. If circuit are OK, substitute a known-good ECM (PCM) and recheck.
10	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. 2. **TP sensor resistance** **Between 1 and 3 : 4.0 – 6.0 kΩ** **Between 2 and 3 : 0.6 Ω – 5.4 kΩ, varying according to throttle valve opening.** Are measured values as specified?	Go to Step 11.	Replace TP sensor.
11	Check throttle body. 1) Check throttle body for clog or leak. Is it are OK?	Substitute a known-good ECM (PCM) and recheck.	Repair throttle body.

[A]



[B]



[A] : Fig.1 for Step 2
[B] : Fig.2 for Step 8

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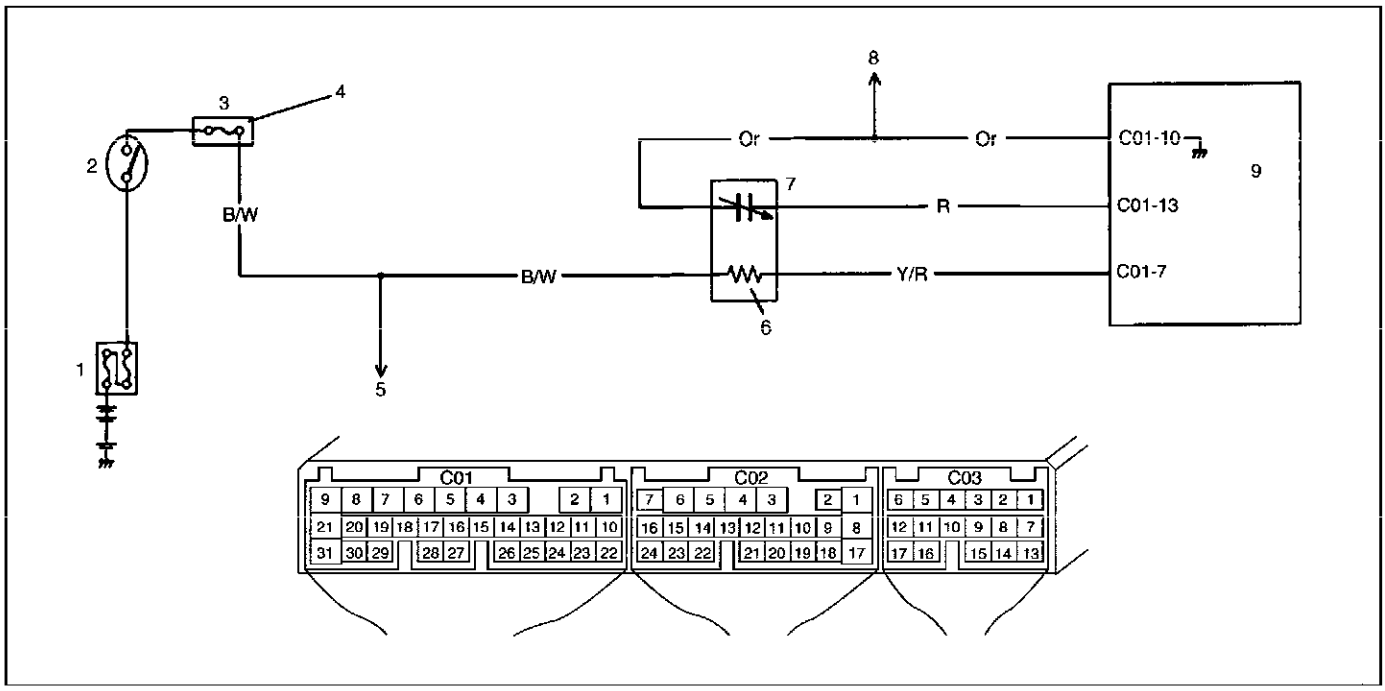
DTC P0130 Heated Oxygen Sensor (HO2S) Circuit Malfunction (Sensor-1)

CIRCUIT DESCRIPTION



1. Main fuse	4. "IG METER" fuse	7. HO2S-1
2. Ignition switch	5. To HO2S-2 heater	8. To other sensor
3. Fuse box	6. Heater	9. ECM (PCM)

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 • "Or" or "R" circuit open (poor connection) or short • Fuel system malfunction • Exhaust gas leakage

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.

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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	Check HO2S-1 signal. 1) Connect scan tool to DLC with ignition switch OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously and take foot off from pedal to enrich and enlean A/F mixture). See Fig. 1. 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. If they are OK, go to Step 8.	Go to Step 4.
4	Check HO2S-1 sensor ground. 1) Disconnect connector from HO2S-1 sensor with ignition switch turn OFF. 2) Check proper connection to HO2S-1 sensor at "R", "Or" and "Y/R". 3) If wire and connection are OK, check there is continuity between "Or" wire terminal and engine ground. Is there continuity?	Go to Step 5.	"Or" wire open circuit. Poor "C01-10" terminal connection. Faulty ECM (PCM) ground. If they are OK, substitute a known-good ECM (PCM) and recheck.
5	Check HO2S-1 sensor ground. 1) With ignition switch turn ON, check voltage between "Or" wire terminal and engine ground. Is voltage about 0.1 V or less?	Go to Step 6.	"Or" wire high resistance circuit. Poor "C01-10" terminal connection. Faulty ECM (PCM) ground. If they are OK, substitute a known-good ECM (PCM) and recheck.
6	Check wire circuit. 1) Measure resistance between "R" wire terminal and engine ground. Is resistance less than 1.6 MΩ?	Go to Step 7.	"R" wire high resistance circuit or open circuit. Poor "C01-13" terminal connection. Faulty ECM (PCM) ground. If they are OK, substitute a known-good ECM (PCM) and recheck.

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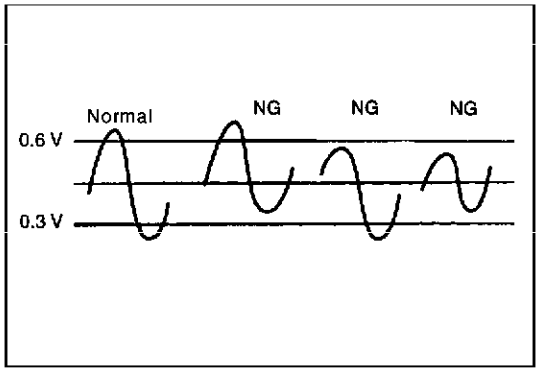
Step	Action	Yes	No
7	Check wire circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Check that there is insulating between "R" wire terminal and body ground. Is there insulating?	Go to Step 8.	"R" wire shorted to ground circuit.
8	Check HO2S-1 heater circuit. 1) Check HO2S-1 heater circuit, referring to DTC P0135 diagnosis flow table. Is result in good condition?	Go to Step 9.	Repair or replace it.
9	Check exhaust system. 1) Check exhaust system for exhaust gas leakage. Is it OK?	Go to Step 4 in DTC P0171 and P0172 diagnosis flow table. If it is in good condition, go to Step 10.	Repair exhaust system for leakage.
10	Check throttle body. 1) Check throttle body for clog or leak. Is it are OK?	Check HO2S-1 referring to "HEATED OXYGEN SENSOR" in Section 6E. If it in good condition, substitute a known-good HO2S-1 or ECM (PCM) and recheck.	Repair throttle body.

Fig. 1 for Step 3



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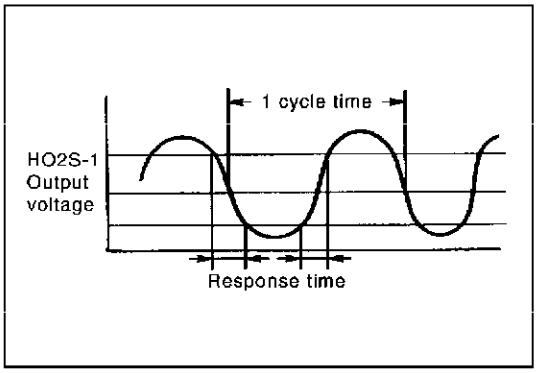
DTC P0133 Heated Oxygen Sensor (HO2S) Circuit Slow Response (Sensor-1)

WIRING DIAGRAM / CIRCUIT DESCRIPTION

Refer to DTC P0130 section.

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 • Fuel system malfunction • Exhaust gas leakage

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.	Go to Step 3.
3	Check HO2S-1 heater circuit. 1) Check HO2S-1 heater circuit, referring to DTC P0135 diagnosis flow table. Is result in good condition?	Go to Step 4.	Repair or replace it.
4	Check exhaust system. 1) Check exhaust system for exhaust gas leakage. Is it OK?	Check HO2S-1 referring to "HEATED OXYGEN SENSOR" in Section 6E1. If it is in good condition, substitute a known-good HO2S-1 or ECM (PCM) and recheck.	Repair exhaust system for leakage.

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DTC P0134 Heated Oxygen Sensor (HO2S) Circuit No Activity Detected (Sensor-1)

WIRING DIAGRAM / CIRCUIT DESCRIPTION

Refer to DTC P0130 section.

DTC DETECTING CONDITION	POSSIBLE CAUSE
• Engine warmed up. • While running under other than high load and high engine speed conditions or at specified idle speed (engine is closed loop condition), HO2S-1 output voltage is high or low continuously. ✱2 driving cycle detection logic, Continuous monitoring.	• "R", "Or" circuit open or short • Heated oxygen sensor malfunction • Fuel system malfunction • Exhaust gas leakage

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 Fuel system (DTC P0171/P0172) and HO2S-1 (DTC P0134)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	Check HO2S-1 and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously and take foot off from pedal to enrich and enlean A/F mixture). Does HO2S-1 output voltage deflect between 0.3 V and over 0.6 V repeatedly?	Go to DTC P0171 and P0172 Diag. Flow Table (Fuel System Check).	Go to Step 4.
4	Check HO2S-1 sensor ground. 1) Disconnect connector from HO2S-1 sensor with ignition switch turn OFF. 2) Check proper connection to HO2S-1 sensor at "R", "Or" and "Y/R". 3) If wire and connection are OK, check there is continuity between "Or" wire terminal and engine ground. Is it continuity?	Go to Step 5.	"Or" wire open circuit. Poor "C01-10" terminal connection. Faulty ECM (PCM) ground. If they are OK, substitute a known-good ECM (PCM) and recheck.

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Step	Action	Yes	No
5	Check HO2S-1 sensor ground. 1) With ignition switch turn ON, check voltage between "Or" wire terminal and engine ground. Is voltage about 0.1 V or less?	Go to Step 6.	"Or" wire high resistance circuit. Poor "C01-10" terminal connection. Faulty ECM (PCM) ground. If they are OK, substitute a known-good ECM (PCM) and recheck.
6	Check wire circuit. 1) Measure resistance between "R" wire terminal and engine ground. Is resistance less than 1.6 MΩ?	Go to Step 7.	"R" wire high resistance circuit or open circuit. Poor "C01-13" terminal connection. Faulty ECM (PCM) ground. If they are OK, substitute a known-good ECM (PCM) and recheck.
7	Check wire circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Check that there is insulating between "R" wire terminal and body ground. Is there insulating?	Go to Step 8.	"R" wire shorted to ground circuit.
8	Check HO2S-1 heater circuit. 1) Check HO2S-1 heater circuit, referring to DTC P0135 diagnosis flow table. Is result in good condition?	Go to Step 9.	Repair or replace it.
9	Check exhaust system. 1) Check exhaust system for exhaust gas leakage. Is it in good condition?	Go to Step 4 in DTC P0171 and P0172 diagnosis flow table. If it is in good condition, go to Step 10.	Repair exhaust system for leakage.
10	Check throttle body. 1) Check throttle body for clog or leak. Is it in good condition?	Check HO2S-1 referring to "HEATED OXYGEN SENSOR" in Section 6E1. If it is in good condition, substitute a known-good HO2S-1 or ECM (PCM) and recheck.	Repair throttle body.

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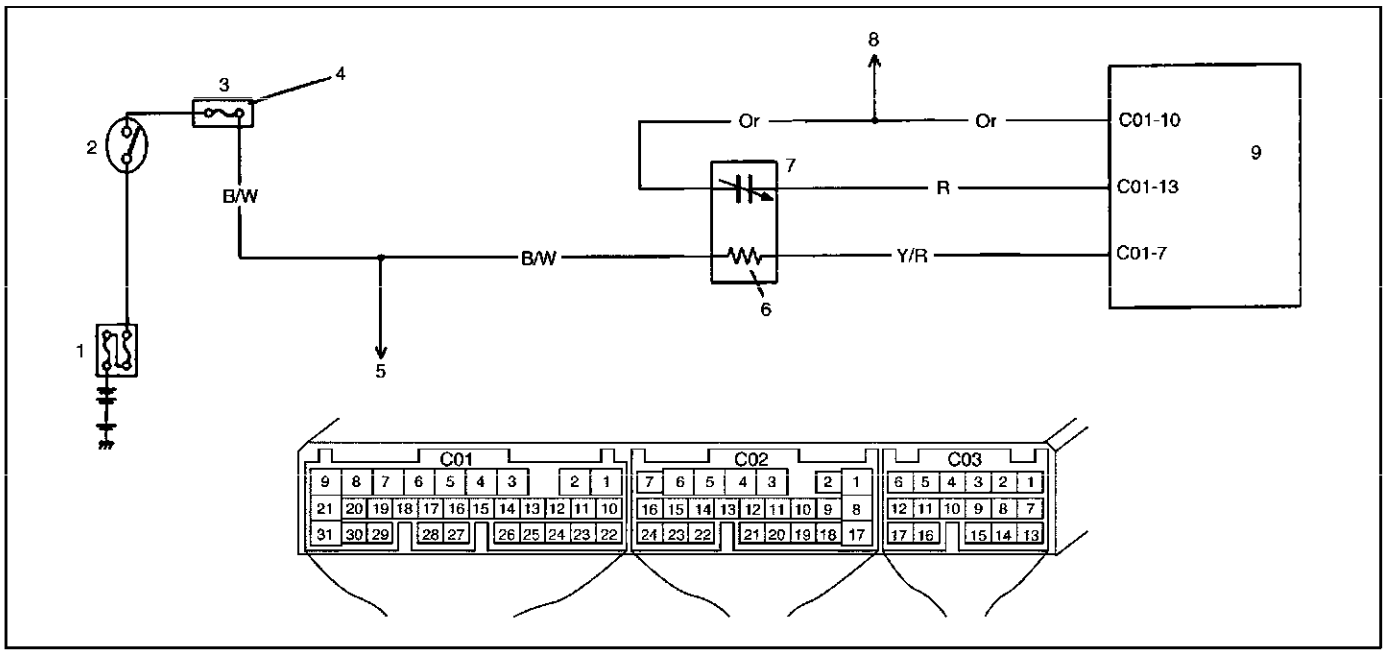
DTC P0135 Heated Oxygen Sensor (HO2S) Heater Circuit Malfunction (Sensor-1)

CIRCUIT DESCRIPTION



1. Main fuse	4. "IG METER" fuse	7. HO2S-1
2. Ignition switch	5. To HO2S-2 heater	8. To other sensor
3. Fuse box	6. Heater	9. ECM (PCM)

DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B condition is met. A : • Low voltage at terminal "C01-7" when engine is running at high load. B : • High voltage at terminal "C01-7" 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 • HO2S-1 heater characteristics malfunction • ECM (PCM) 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.

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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-1 heater power circuit. 1) Disconnect connector from HO2S-1 sensor with ignition switch turn OFF. 2) Check proper connection to HO2S-1 sensor at "B/W" and "Y/R". 3) If wire and connection are OK, Measure voltage between "B/W" wire terminal and engine ground with ignition switch turn ON. Is voltage over 10 V?	Go to Step 3.	"B/W" wire open circuit or shorted to ground circuit.
3	Check HO2S-1 heater power circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Measure resistance between "B/W" wire terminal in HO2S-1 connector and "C03-9" terminal wire in ECM connector. Is resistance below 5 Ω?	Go to Step 4.	"B/W" wire high resistance circuit.
4	Check HO2S-1 heater drive circuit. 1) Check that there is insulating between "Y/R" wire terminal and vehicle body ground. Is there insulating?	Go to Step 5.	"Y/R" wire shorted to ground circuit.
5	Check HO2S-1 heater drive circuit. 1) Turn ON ignition switch. 2) Measure voltage between "Y/R" wire terminal and vehicle body ground. Is voltage 0 V?	Go to Step 6.	"Y/R" wire shorted to power circuit.
6	Check HO2S-1 heater drive circuit. 1) Connect connector to HO2S-1 with ignition switch turn OFF. 2) Turn ON ignition switch. 3) Measure voltage between "C01-7" terminal wire and vehicle body ground with disconnect connector from ECM (PCM). See Fig. 1. Is it result over 10 V?	Go to Step 7.	"Y/R" wire open circuit.
7	Check heater of sensor-1. 1) Disconnect HO2S-1 coupler with ignition switch OFF. 2) Check HO2S-1 heater resistance. See Fig. 2. It is 5.0 – 6.4 Ω at 20°C, 68°F?	Go to Step 8.	Replace HO2S-1.
8	Check HO2S-1 heater power circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Measure resistance between "C01-7" terminal wire and "C03-9" terminal wire. Is resistance below 10 Ω?	HO2S-1 heater circuit are OK. Substitute a known-good ECM (PCM) and recheck.	"Y/R" wire high resistance circuit.

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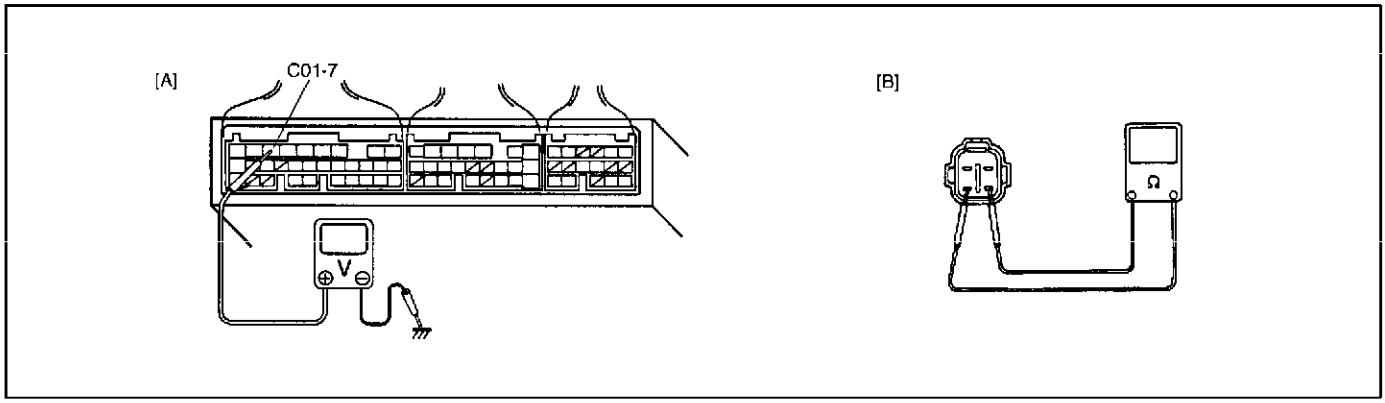
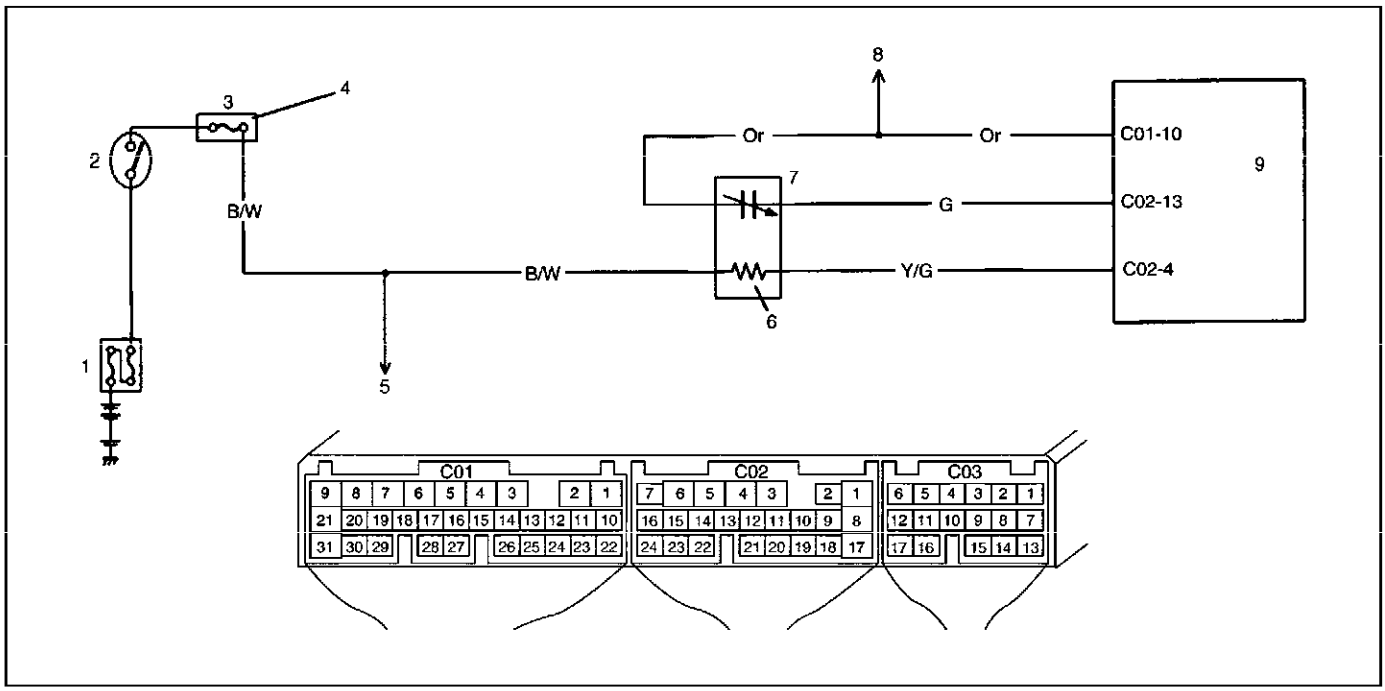


[A] :	Fig.1 for Step 6
[B] :	Fig.2 for Step 7

DTC P0136 Heated Oxygen Sensor (HO2S) Circuit Malfunction (Sensor-2)

CIRCUIT DESCRIPTION



1. Main fuse	4. "IG METER" fuse	7. HO2S-2
2. Ignition switch	5. To HO2S-1 heater	8. To other sensor
3. Fuse box	6. Heater	9. ECM (PCM)

DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B conditions is detected. A : • Max. output voltage of HO2S-2 is lower than specified value or Min. output voltage is higher than specified value while vehicle driving. B : • 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 • "Or" or "G" circuit open or short • Heated oxygen sensor-2 malfunction • Fuel system malfunction

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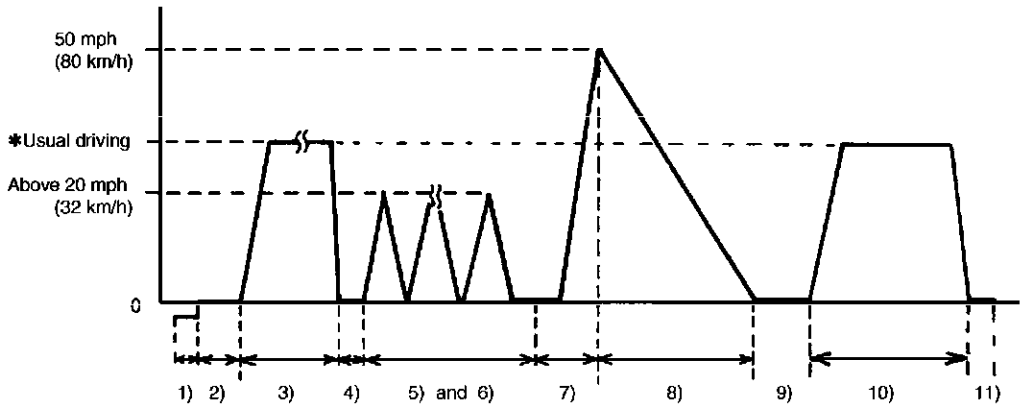
DTC CONFIRMATION PROCEDURE

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 10 sec. 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 COMPLETED" 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)

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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 short term fuel trim. Did short term fuel trim very within – 20 – + 20% range in step 3) of DTC confirmation test?	Go to Step 4.	Check fuel system. Go to DTC P0171/P0172 Diag. Flow Table. If it is in good condition, go to Step 7.
4	Check HO2S-2 sensor ground. 1) Disconnect connector from HO2S-2 sensor with ignition switch turn OFF. 2) Check proper connection to HO2S-1 sensor at "G", "Or", "Y/G" and "B/W". 3) If wire and connection are OK, check there is continuity between "Or" wire terminal and engine ground. Is there continuity?	Go to Step 5.	"Or" wire open circuit. Poor "C01-10" terminal connection. Faulty ECM (PCM) ground. If they are OK, substitute a known-good ECM (PCM) and recheck.
5	Check HO2S-2 sensor ground. 1) With ignition switch turn ON, check voltage between "Or" wire terminal and engine ground. Is voltage about 0.1 V or less?	Go to Step 6.	"Or" wire high resistance circuit. Poor "C01-13" terminal connection. Faulty ECM (PCM) ground. If they are OK, substitute a known-good ECM (PCM) and recheck.
6	Check wire circuit. 1) Measure voltage between "G" wire terminal and engine ground with ignition switch turn ON. Is voltage 4 – 6 V?	Go to Step 7.	If result are below 5 V, "G" wire open circuit or shorted to ground circuit. If result are over 6 V, "G" wire shorted to power supply circuit. Poor "C01-13" terminal connection. If they are OK, substitute a known-good ECM (PCM) and recheck.
7	Check H02S-2 heater circuit. 1) Check H02S-2 heater circuit, referring to DTC P0141 diagnosis flow table. Is it in good condition?	Go to Step 8.	Repair or replace it.

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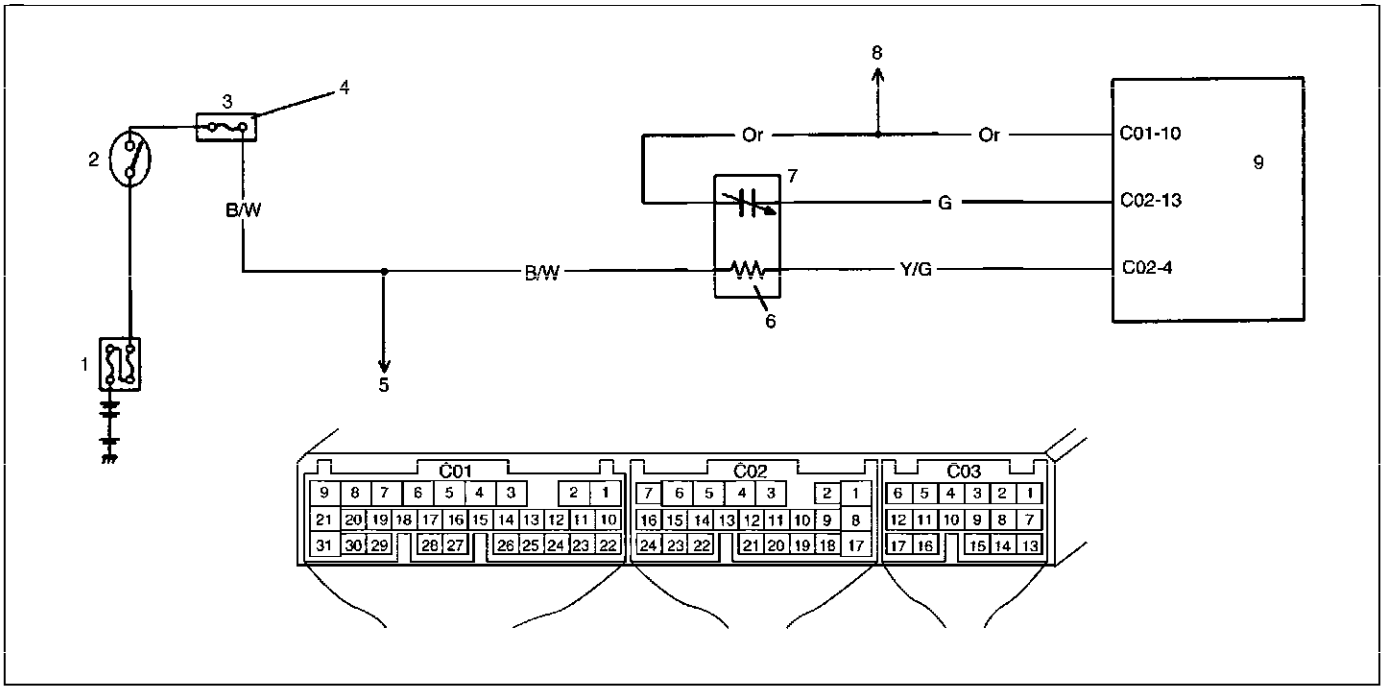
Step	Action	Yes	No
8	Check catalytic converter. Check catalytic converter for clogs, damage and clacks. Is it in good condition?	Check HO2S-2 referring to "HEATED OXYGEN SENSOR" in Section 6E1. If it is in good condition, substitute a known-good HO2S-2 or ECM (PCM) and recheck.	Replace catalytic converter.

DTC P0141 Heated Oxygen Sensor (HO2S) Heater Circuit Malfunction (Sensor-2)

CIRCUIT DESCRIPTION



1. Main fuse	4. "IG METER" fuse	7. HO2S-2
2. Ignition switch	5. To HO2S-1 heater	8. To other sensor
3. Fuse box	6. Heater	9. ECM (PCM)

DTC DETECTING CONDITION	POSSIBLE CAUSE
DTC will set when A or B conditions is met. A : • Low voltage at terminal "C02-4" for specified time after engine start or while engine running at high load. B : • High voltage at terminal "C02-4" 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 (PCM) 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.

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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 power circuit. 1) Disconnect connector from HO2S-2 sensor with ignition switch turn OFF. 2) Check proper connection to HO2S-2 sensor at "B/W" and "Y/R". 3) If wire and connection are OK, Measure voltage between "B/W" wire terminal and engine ground with ignition switch turn ON. Is voltage over 10 V?	Go to Step 3.	"B/W" wire open circuit or shorted to ground circuit.
3	Check HO2S-2 heater power circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Measure resistance between "B/W" wire terminal and "C03-9" terminal wire. Is resistance below 5 Ω?	Go to Step 4.	"B/W" wire high resistance circuit.
4	Check HO2S-2 heater drive circuit. 1) Check that there is insulating between "Y/G" wire terminal and vehicle body ground. Is there insulating?	Go to Step 5.	"Y/G" wire shorted to ground circuit.
5	Check HO2S-2 heater drive circuit. 1) Turn ON ignition switch. 2) Measure voltage between "Y/G" wire terminal and vehicle body ground. Is voltage 0 V?	Go to Step 6.	"Y/G" wire shorted to power circuit.
6	Check HO2S-2 heater drive circuit. 1) Connect connector to HO2S-2 with ignition switch turn OFF. 2) Turn ON ignition switch. 3) Measure voltage between "C01-4" terminal wire and vehicle body ground with disconnected connector from ECM (PCM). See Fig. 1. Is voltage over 10 V?	Go to Step 7.	"Y/G" wire open circuit.
7	Check Heater of Sensor-2. 1) Disconnect HO2S-2 coupler with ignition switch OFF. 2) Check heater resistance. Is it 11.7 – 14.3 Ω at 20°C, 68°F?	Go to Step 8.	Replace HO2S-2.
8	Check HO2S-2 heater power circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Measure resistance between "C02-4" terminal wire and "C03-9" terminal wire. Is resistance below 10 Ω?	HO2S-2 heater circuit are OK. Substitute a known-good ECM (PCM) and recheck.	"Y/G" wire high resistance circuit.

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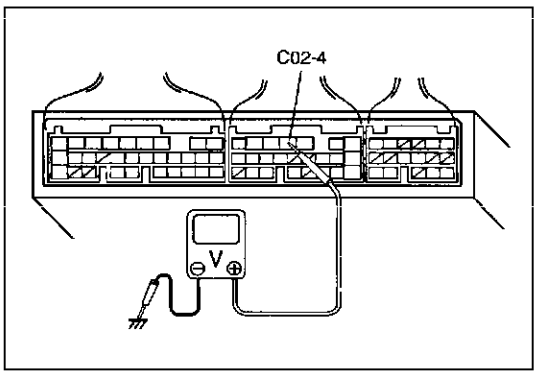
Fig. 1 for Step 2



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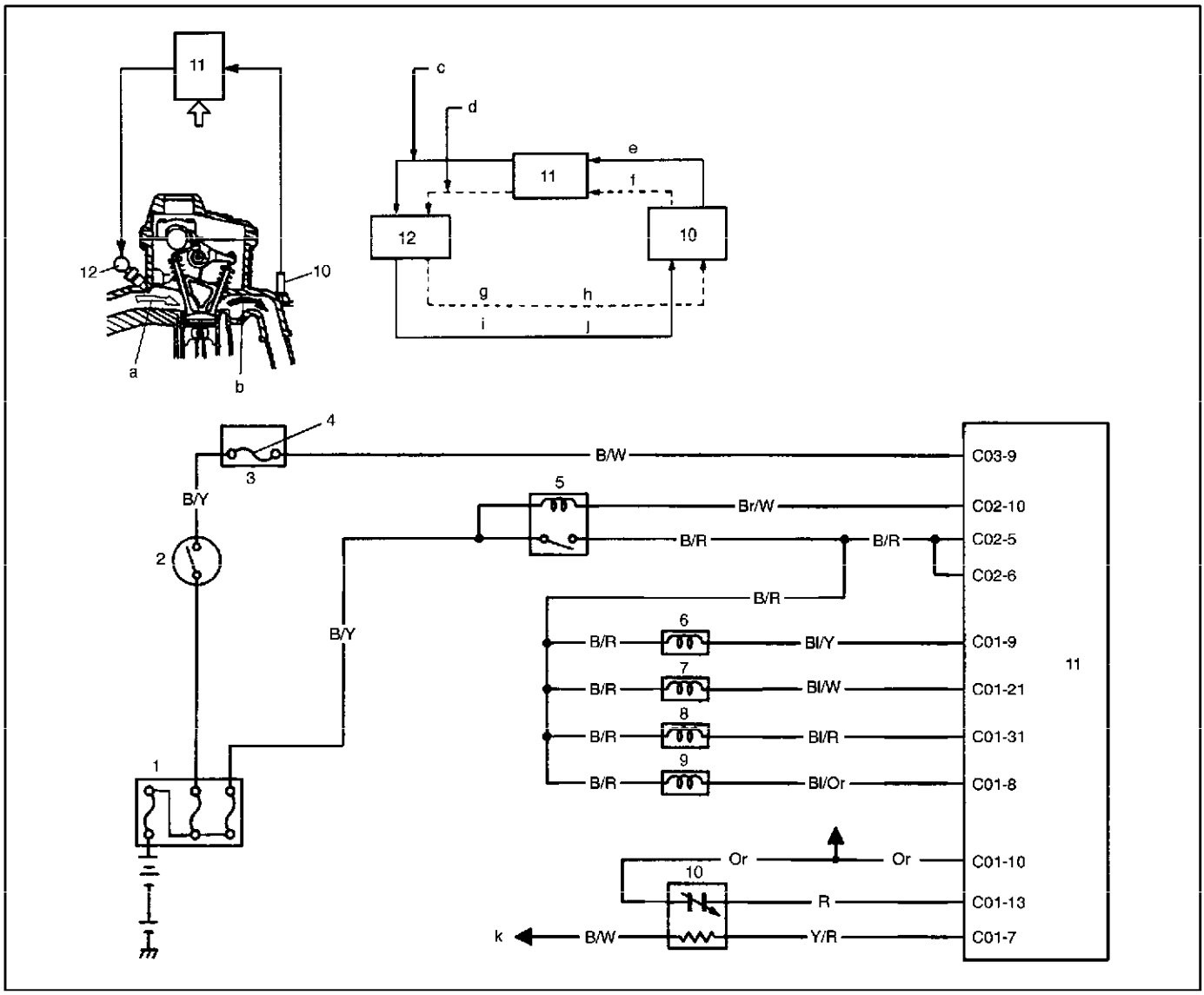
DTC P0171 Fuel System too Lean
DTC P0172 Fuel System too Rich

CIRCUIT DESCRIPTION



1. Main fuse	9. No.4 injector	[e] : High voltage
2. Ignition switch	10. HO2S-1	[f] : Low voltage
3. Fuse box	11. ECM (PCM)	[g] : A/F mixture becomes richer
4. "IG METER" fuse	12. Injector	[h] : Oxygen concentration decreases
5. Main relay	[a] : A/F mixture	[i] : A/F mixture becomes leaner
6. No.1 injector	[b] : Exhaust gas	[j] : Oxygen concentration increases
7. No.2 injector	[c] : Signal to decrease amount of fuel injection	[k] : To ignition switch
8. No.3 injector	[d] : Signal to increase amount of fuel injection	

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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. 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).

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Step	Action	Yes	No
4	Check fuel pressure (Refer to "FUEL PRESSURE INSPECTION" in Section 6E1 for details). 1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. 3) Check fuel pressure. See Fig. 1. **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** **200 – 240 kPa, 2.0 – 2.4 kg/cm^2,** **28.4 – 34.1 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) Using sound scope (1) or such, check operating sound of each injector (2) 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. See Fig. 3. 4) If OK, then check injector resistance. **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 "FUEL INJECTOR" in Section 6E1. See Fig. 4. **Injected Fuel Volume 43.7 – 46.3 cc/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 EVAP canister purge valve. 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. 5. Is vacuum felt?	Check EVAP control system (See "EVAP CANISTER PURGE INSPECTION" in section 6E1.).	Go to Step 7.
7	Check intake manifold absolute pressure sensor for performance (See DTC P0105 Diag. Flow Table). Is it in good condition?	Go to Step 8.	Repair or replace.

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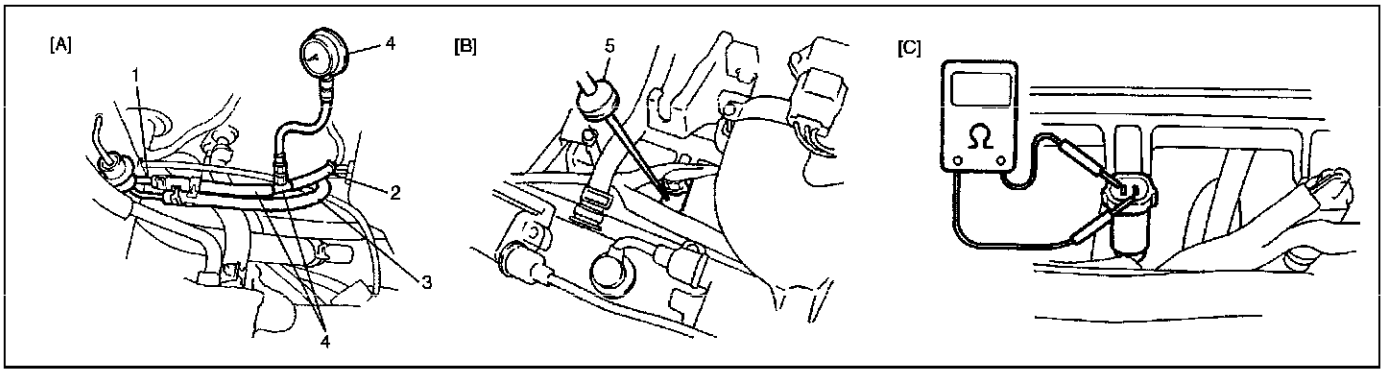
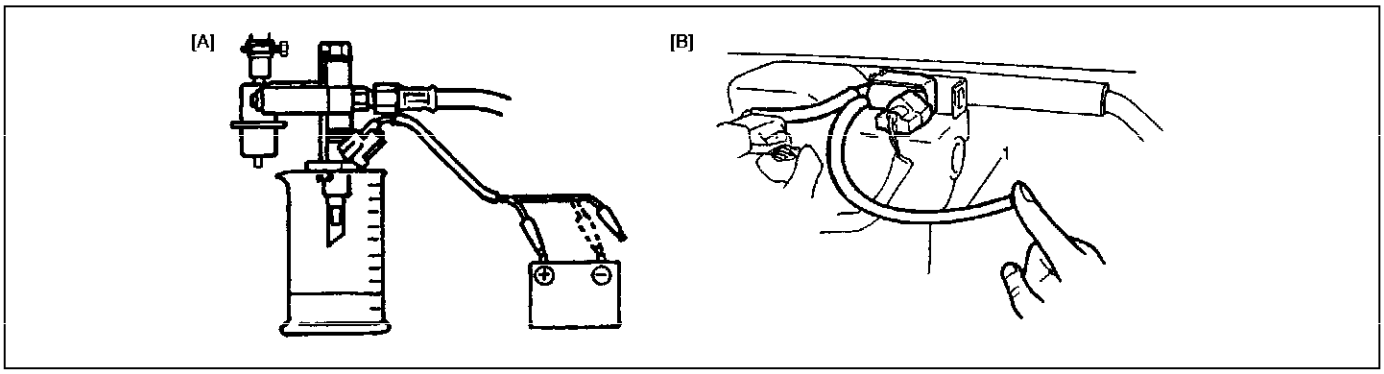
Step	Action	Yes	No
8	Check engine coolant temp. sensor for performance (See "ECT SENSOR" in Section 6E1). Is it in good condition?	Go to Step 9.	Replace engine coolant temp. sensor.
9	Check intake air temp. sensor for performance (See "IAT SENSOR" in Section 6E1). Is it in good condition?	Go to Step 10.	Replace intake air temp. sensor.
10	Check throttle position sensor for performance (See Step 2 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 "PCV VALVE" in Section 6E1). Is it in good condition?	Substitute a known-good ECM (PCM) and recheck.	Replace PCV valve.



[A] : Fig.1 for Step 4	1. Fuel delivery pipe	4. Fuel pressure gauge & 3 way joint
[B] : Fig.2 for Step 5	2. Fuel feed hose	5. Sound scope
[C] : Fig.3 for Step 5	3. Fuel return hose	



[A] : Fig.4 for Step 5
[B] : Fig.5 for Step 6
1. Purge hose

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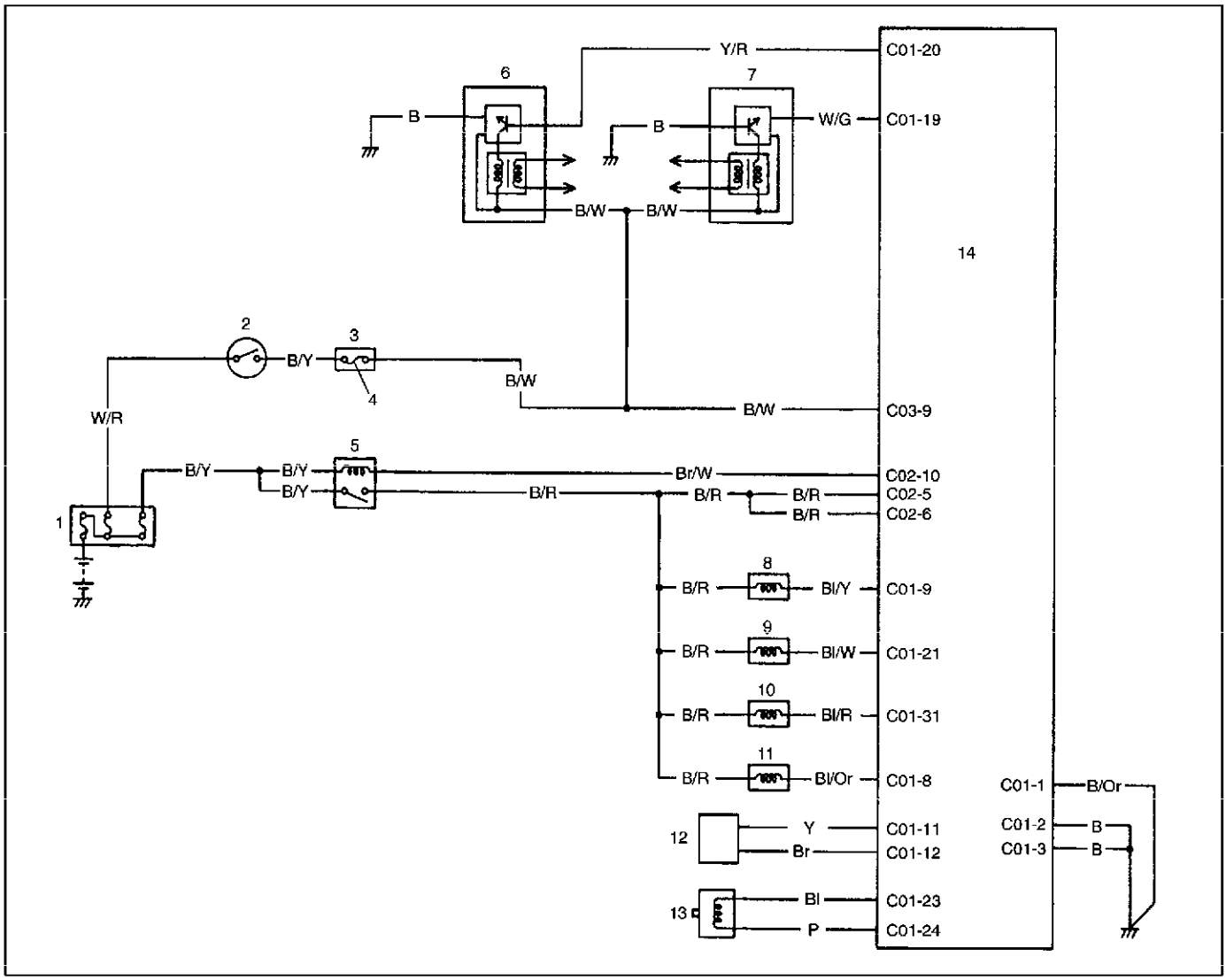
DTC P0300 Random Misfire Detected (Misfire Detected at 2 or More Cylinders)
DTC P0301 Cylinder 1 Misfire Detected
DTC P0302 Cylinder 2 Misfire Detected
DTC P0303 Cylinder 3 Misfire Detected
DTC P0304 Cylinder 4 Misfire Detected



1. Main fuse	6. Ignition coil assembly for No.1 & No.4 spark plugs	11. No.4 injector
2. Ignition switch	7. Ignition coil assembly for No.2 & No.3 spark plugs	12. CMP sensor
3. Fuse box	8. No.1 injector	13. CKP sensor
4. "IG METER" fuse	9. No.2 injector	14. ECM (PCM)
5. Main relay	10. No.3 injector	

CIRCUIT DESCRIPTION

ECM (PCM) 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 (PCM) 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.

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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 (PCM) 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".

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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.
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. 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 "FUEL PRESSURE INSPECTION" in Section 6E1 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** **200 – 240 kPa, 2.0 – 2.4 kg/cm^2, 28.4 – 34.1 psi.** Is measured value as specified?	Go to Step 5.	Go to Diag. Flow Table B-3 fuel pressure check.

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Step	Action	Yes	No
5	Check fuel injectors and circuit. 1) Using sound scope (1) or such, check operating sound of each injector 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. See Fig. 5. 4) If OK, then check injector resistance. **Injector Resistance 11.3 – 13.8 ohm at 20℃ (68℉)** 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 43.7 – 46.3 cc/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 "PCV VALVE" in Section 6E1). Is it in good condition?	Go to Step 7.	Replace PCV valve.
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 "EVAP CANISTER PURGE INSPECTION" in Section 6E1).	Go to Step 8.
8	Check intake manifold pressure sensor for performance (See 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 "ECT SENSOR" in Section 6E1). 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 (PCM) ground, ignition system and fuel injector for intermittent open and short.	Repair or replace.

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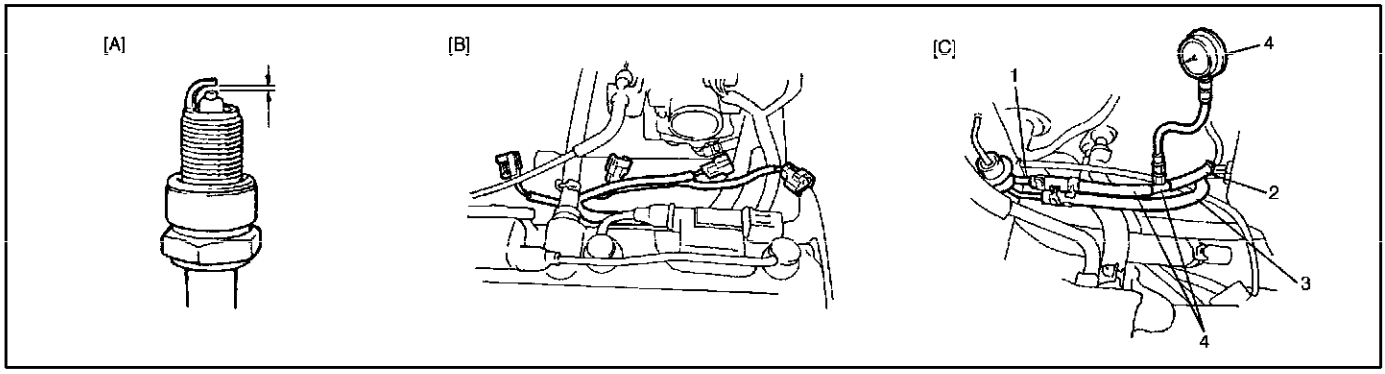
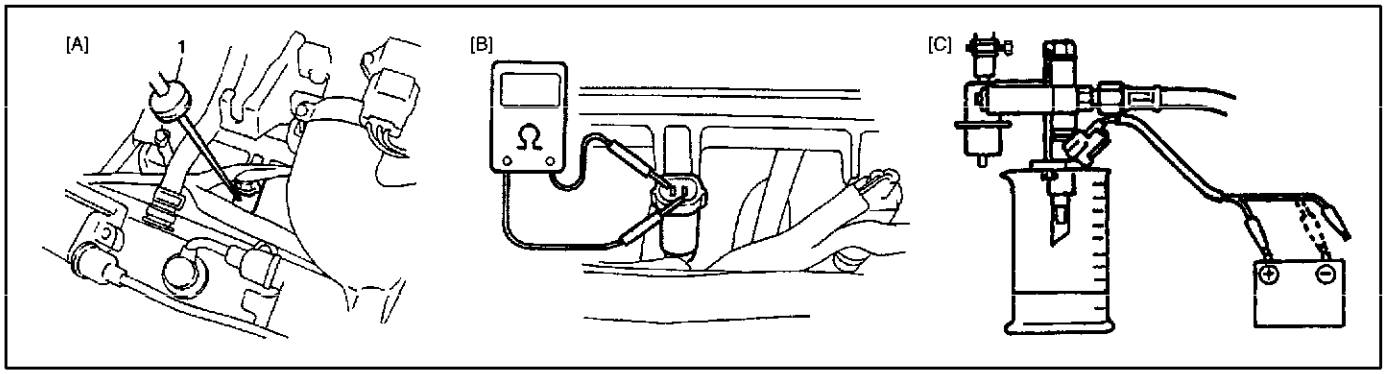
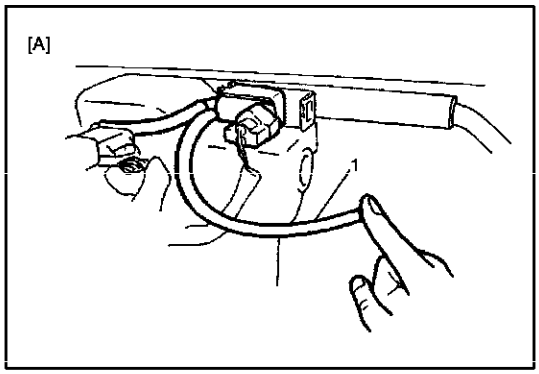


[A] : Fig.1 for Step 3	1. Fuel delivery pipe	4. Fuel pressure gauge & 3 way joint
[B] . Fig.2 for Step 3	2. Fuel feed hose	
[C] : Fig.3 for Step 4	3. Fuel return hose	



[A] : Fig.4 for Step 4	[C] : Fig 6 for Step 5
[B] : Fig.5 for Step 4	1. Sound scope



[A] : Fig.7 for Step 7
1. Purge hose

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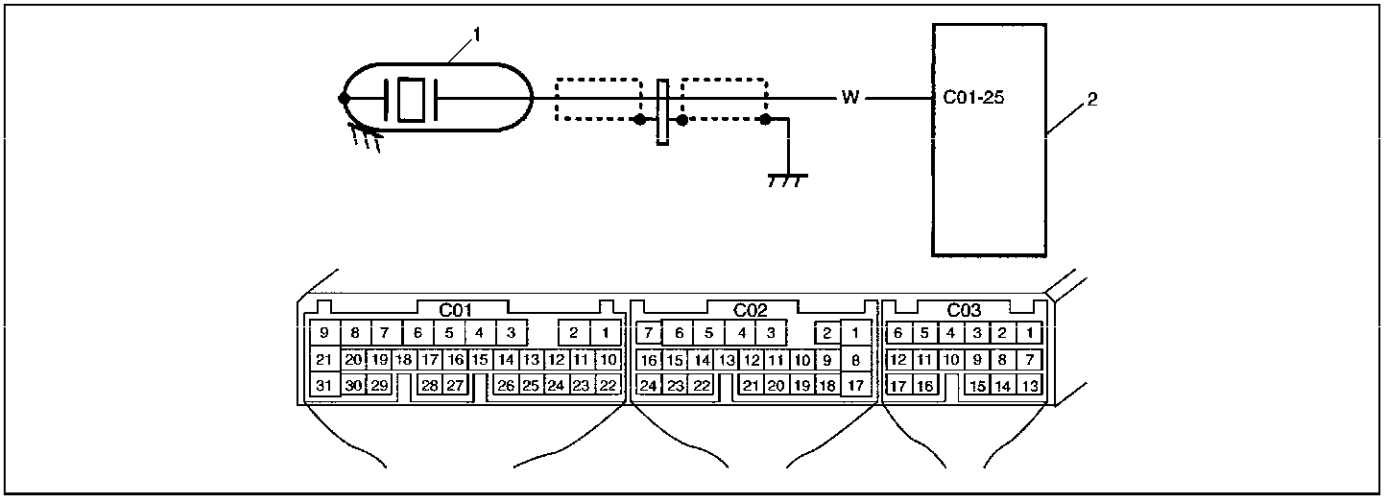
DTC P0325 Knock Sensor Circuit Malfunction

CIRCUIT DESCRIPTION



1. Knock sensor
2. ECM (PCM)

DTC DETECTING CONDITION	POSSIBLE CAUSE
• Knock : 3.91 V or more. • Knock : 1.23 V or less.	• "W" circuit open or shorted to ground • Knock sensor malfunction • ECM (PCM) 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 "C01-25" terminal of ECM (PCM) connector to body ground. See Fig. 1. Is voltage about 1.23 – 3.91 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 "C01-25" connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.

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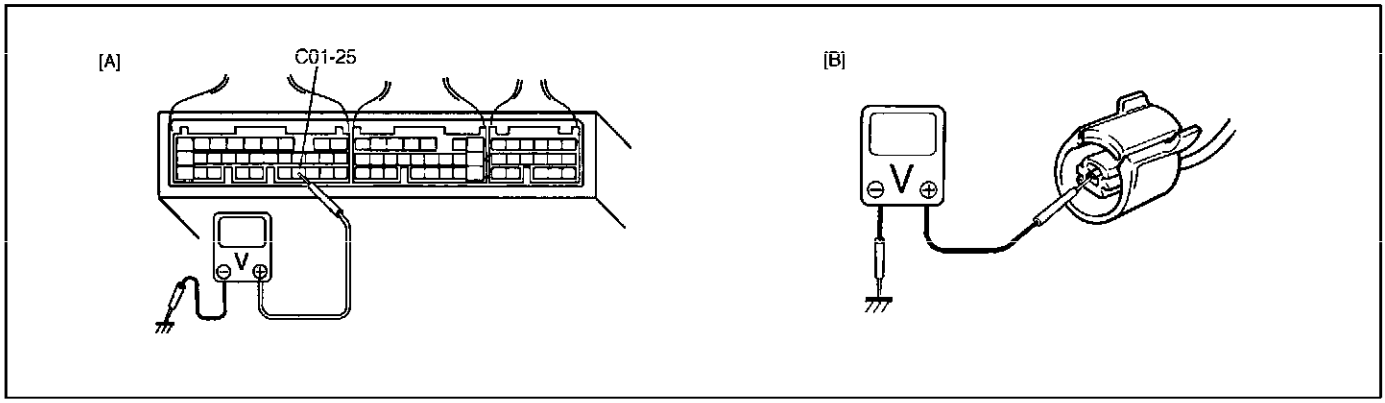
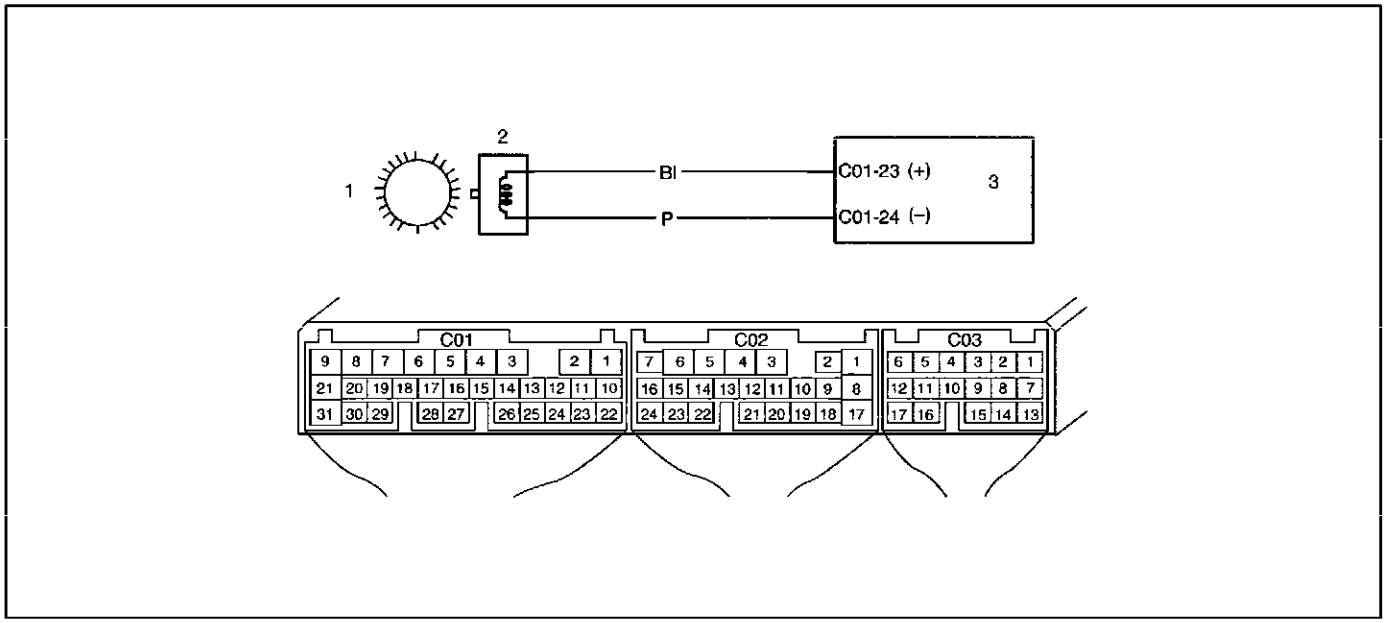


[A] : Fig.1 for Step 2
[B] : Fig.2 for Step 2

DTC P0335 Crankshaft Position (CKP) Sensor Circuit Malfunction

CIRCUIT DESCRIPTION



1. Crankshaft timing belt pulley
2. CKP sensor
3. ECM (PCM)

DTC DETECTING CONDITION	POSSIBLE CAUSE
• No CKP sensor signal for 2 seconds at engine cranking.	• CKP sensor circuit open or short • Crankshaft timing belt pulley teeth damaged • CKP sensor malfunction, foreign material being attached or improper installation • ECM (PCM) malfunction

REFERENCE

Connect oscilloscope between terminals “C01-23” (+) and “C01-24” (–) of ECM (PCM) connector connected to ECM (PCM) and check CKP sensor signal.

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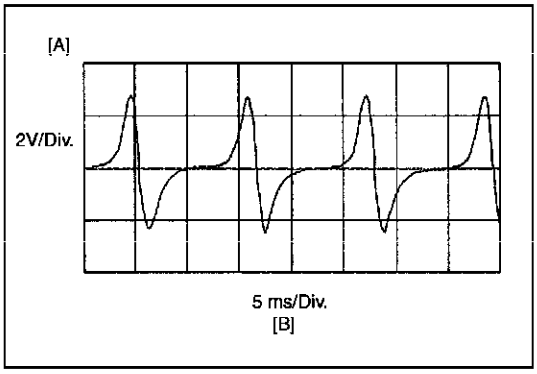

[A] :	Oscilloscope Waveforms
[B] :	Waveforms at specified idle speed

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 for resistance. 1) Disconnect CKP sensor connector with ignition switch OFF. 2) Then check for proper connection to CKP sensor at "BI" and "P" wire terminals. 3) If OK, measure sensor resistance between terminals. See Fig. 1. **CKP sensor resistance 1.85 – 2.45 KΩ at 20°C, 68°F** 4) Measure resistance between each terminal and ground. **Between CKP sensor terminal and ground resistance 1 MΩ or more.** Were measured resistance valves in step 3) and 4) as specified?	Go to Step 3.	Replace CKP sensor.
3	Check ECM (PCM) voltage. 1) Turn ON ignition switch, check voltage between "BI" wire terminal and engine ground and between "P" wire terminal and engine ground. Is voltage about 0 V at each terminal?	Go to Step 4.	"BI" and/or "P" wire shorted to power supply circuit. If wires are OK, substitute a known-good ECM (PCM) and recheck.
4	Check ECM (PCM) circuit. 1) Turn OFF ignition switch, check that there is continuity between "BI" wire terminal and engine ground and between "P" wire terminal and engine ground. Is there continuity?	Go to Step 5.	"BI" and/or "P" wire open circuit. If wires are OK, substitute a known-good ECM (PCM) and recheck.

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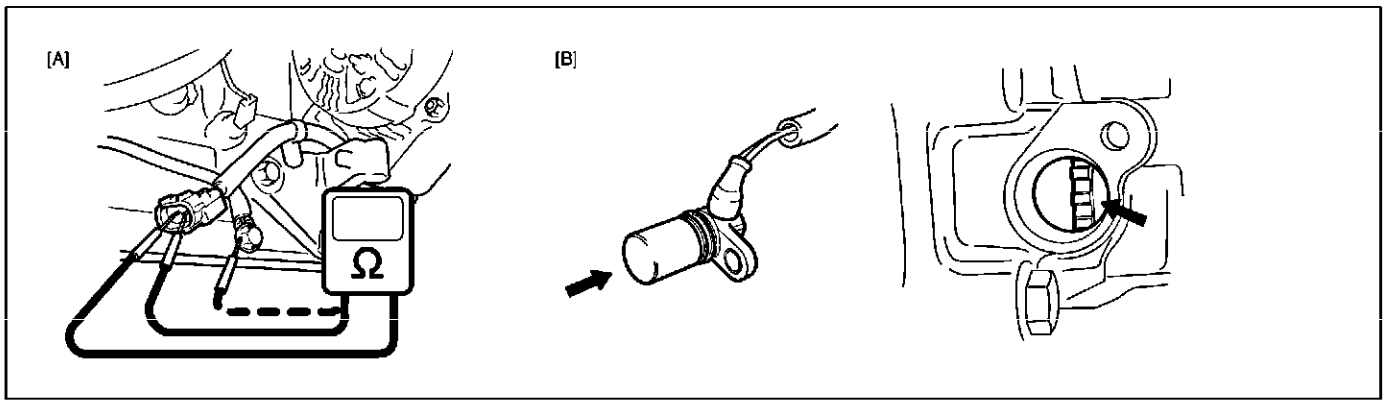
Step	Action	Yes	No
5	Check wire circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Check that there is insulating between "C01-23" terminal wire and body ground and between "C01-24" terminal wire and body ground. Is there insulating?	Go to Step 6.	"Bl" and/or "P" wire shorted to ground circuit.
6	Check wire circuit. 1) Connect connector to CKP sensor with ignition switch turn OFF. 2) Measure resistance between "C01-23" terminal wire and "C01-24" terminal wire at ECM (PCM) connector. Is resistance below 2.5 KΩ at 20°C, 68°F?	Go to Step 7.	"Bl" and/or "P" wire in high resistance circuit.
7	Check visually CKP sensor and pulley for the following. See Fig. 2. • Damage • No foreign material attached • Correct installation Are they in good condition?	Intermittent trouble or faulty ECM (PCM). Recheck for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Clean, repair or replace.



[A] : Fig.1 for Step 2
[B] : Fig.2 for Step 7

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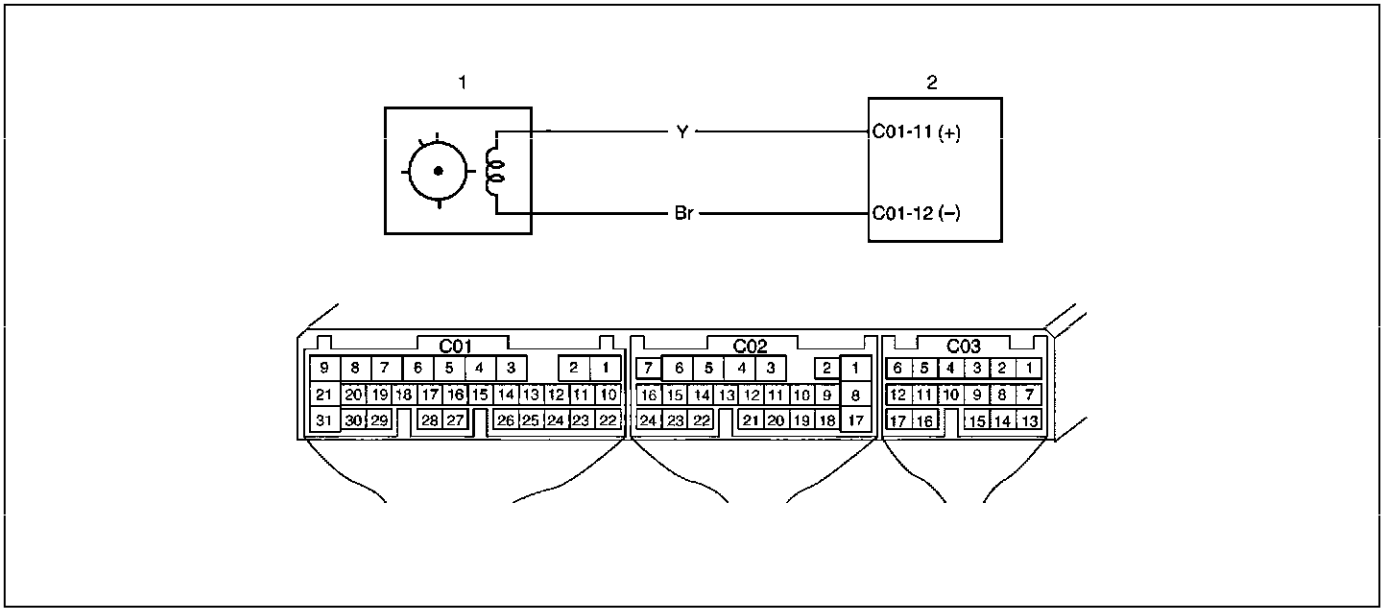
DTC P0340 Camshaft Position (CMP) Sensor Circuit Malfunction

CIRCUIT DESCRIPTION



1. CMP sensor
2. ECM (PCM)

DTC DETECTING CONDITION	POSSIBLE CAUSE
• No CMP sensor signal for 2 sec. at engine cranking. • Phase displacement CMP sensor signal at compared with CKP sensor signal with engine cranking.	• CMP sensor circuit open or short • Signal rotor teeth damaged • CMP sensor malfunction, foreign material being attached or improper installation • ECM (PCM) malfunction

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

NOTE:

If starter circuit is open (i.e., start signal circuit is OK but starter fails to run), this DTC is stored in memory at starter switch ON, even though CMP sensor is in good condition. When starter motor fails to run and this DTC appears, check starter circuit first.

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.

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Step	Action	Yes	No
3	Check ECM (PCM) voltage. 1) Disconnect connector from CMP sensor with ignition switch turn OFF. 2) Turn ON ignition switch, check voltage between "Y" wire terminal and engine ground and between "Br" wire terminal and engine ground. Is voltage about 0 V at each terminal?	Go to Step 4.	"Y" and/or "Br" wire shorted to power supply circuit. If wires are OK, substitute a known-good ECM (PCM) and recheck.
4	Check wire circuit. 1) Check that there is continuity between "Y" wire terminal and "Br" wire terminal. Is it result continuity?	Go to Step 5.	"Y" and/or "Br" wire in open circuit.
5	Check wire circuit. 1) Disconnect connectors from ECM (PCM) with ignition switch turn OFF. 2) Check that there is insulating between "C01-11" terminal wire and body ground and between "C01-12" terminal wire and body ground. Is there insulating?	Go to Step 6.	"Y" and/or "Br" wire shorted to ground circuit.
6	1) Measure resistance between "C01-11" and "C1-12" terminals of ECM (PCM) coupler. **CMP sensor resistance 185 – 275 Ω at 20°C (68°F)** 2) Measure resistance between "C01-11" terminal of ECM (PCM) connector and ground. Insulation resistance : 1 MΩ or more Were measured resistance values in above 2) and 3) as specified?	Go to Step 8.	Go to Step 7.
7	Check wire circuit. 1) Connect connectors to ECM (PCM) with ignition switch turn OFF. 2) Measure resistance between "Y" wire terminal and "Br" wire terminal at CMP sensor connector. Is resistance below 25 KΩ	Faulty CMP sensor.	"Y" and/or "Br" wire in high resistance circuit. If wires are OK, substitute a know-good ECM (PCM) and recheck.
8	1) Check CMP sensor referring to SIGNAL ROTOR AIR GAP INSPECTION in Section 6F1. Is it in good condition?	Intermittent trouble. Check for intermittent refer to "INTERMITTENT AND POOR CONNECTION" in Section 0A. If OK, substitute a known-good ECM (PCM) and recheck.	Faulty CMP sensor.

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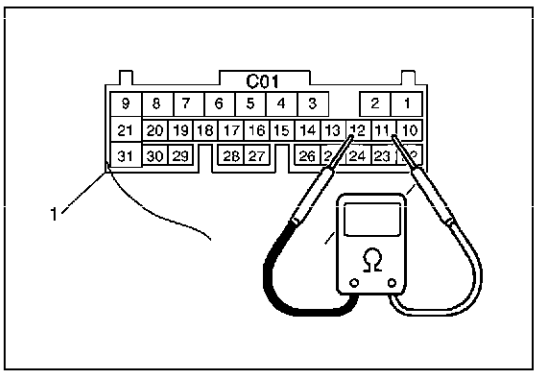
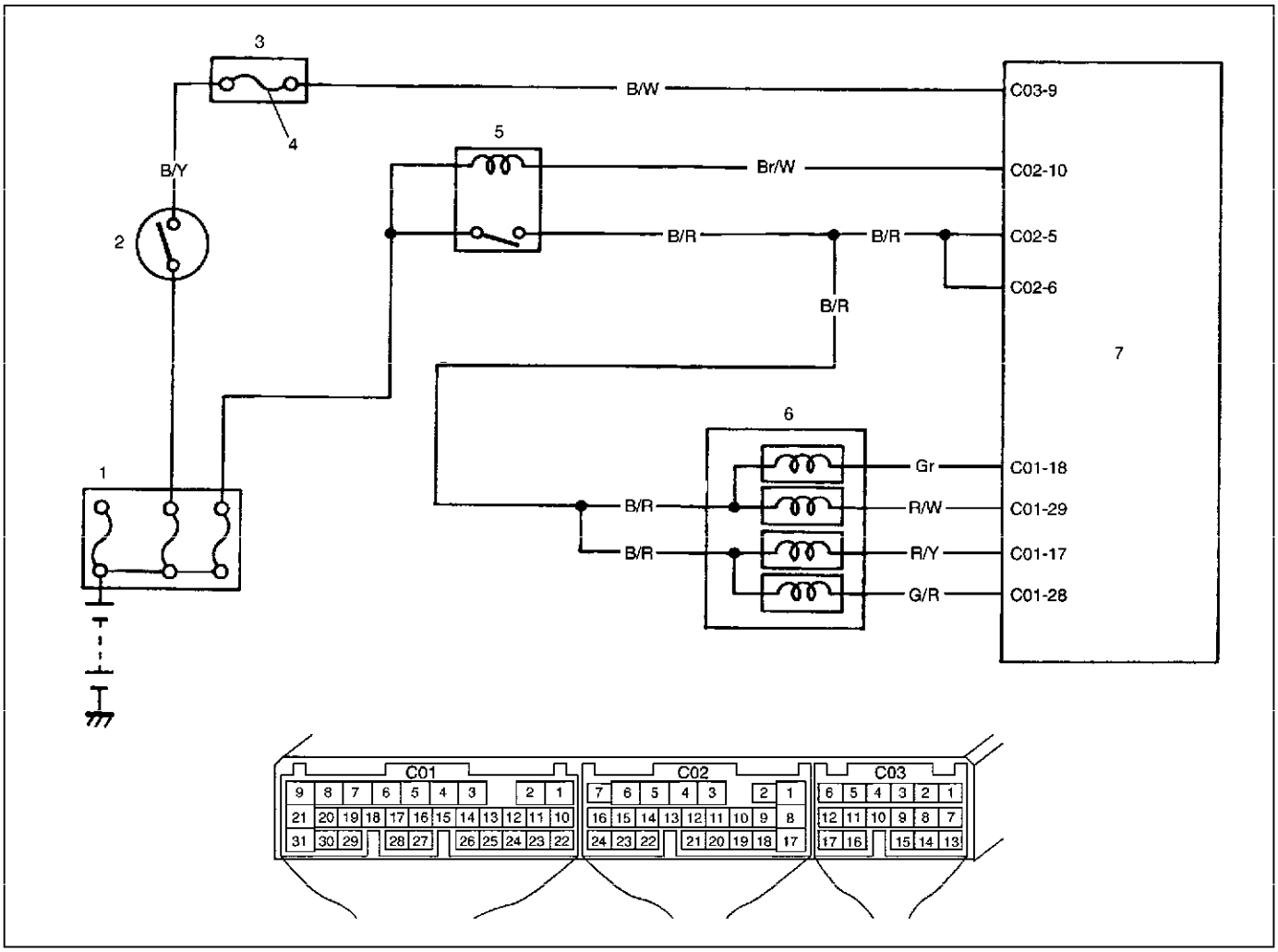
Fig. 1 for Step 3



1. ECM (PCM) connector disconnected

DTC P0400 Exhaust Gas Recirculation Flow Malfunction

CIRCUIT DESCRIPTION



1. Main fuse	3. Fuse box	5. Main relay	7. ECM (PCM)
2. Ignition switch	4. "IG METER" fuse	6. EGR valve	

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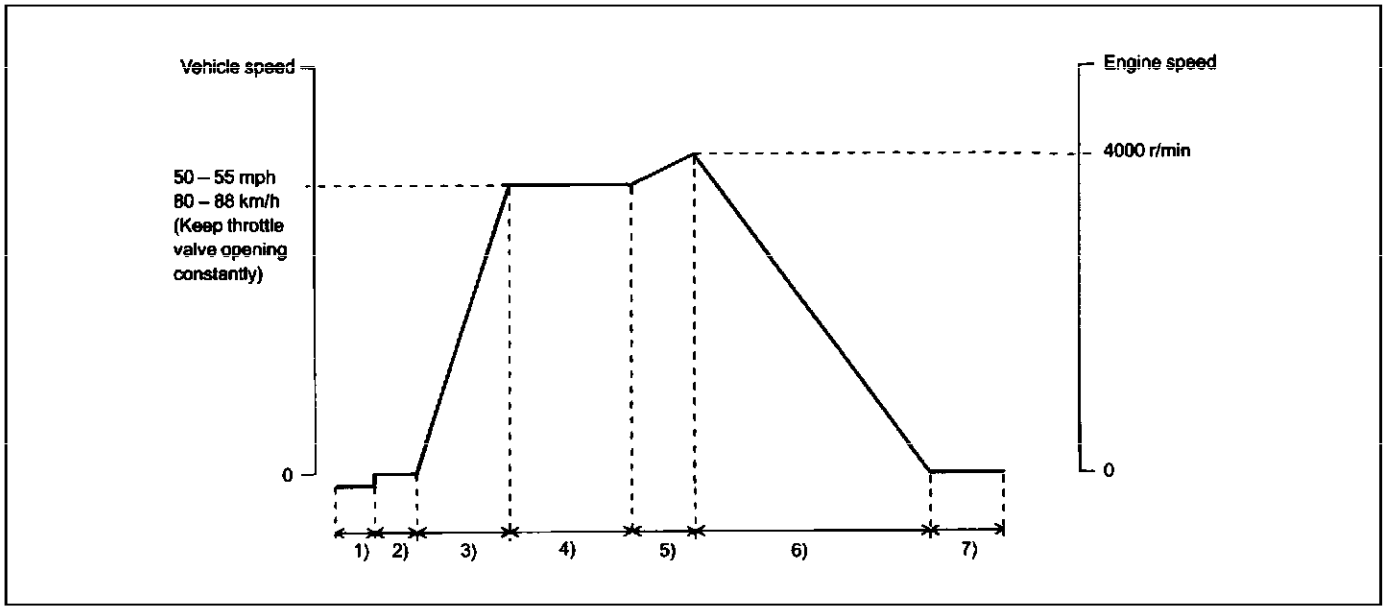
DTC DETECTING CONDITION	POSSIBLE CAUSE
• While running at specified vehicle speed after engine warm-up. • During deceleration (engine speed high with closed throttle position ON) in which fuel cut is involved, difference in intake manifold absolute pressure between when EGR valve is opened at specified 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 (PCM)

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".



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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	EGR Valve Operation Check : 1) With ignition switch OFF, install SUZUKI scan tool. 2) Check EGR system referring to "EGR SYSTEM" in Section 6E1. Is it in good condition?	Go to Step 3.	Go to Step 4.
3	MAP Sensor Check : 1) Check MAP sensor for performance referring to "MAP SENSOR" in Section 6E1. Is check result satisfactory?	Intermittent trouble or faulty ECM (PCM). Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Repair or replace.
4	EGR Valve Power Supply Circuit Check : 1) With ignition switch OFF, disconnect EGR valve coupler. 2) With ignition switch ON, check voltage between "B/R" wire terminals of EGR valve coupler and body ground. Is check voltage 10 – 14 V?	Go to Step 5.	Faulty "B/R" wire.
5	Check wire circuit. 1) Measure voltage between engine ground and each "Gr", "R/W", "R/Y", "G/R" wire terminal. Is each voltage 0 V?	Go to Step 6.	Some wire shorted to power supply circuit. If wires are OK, substitute a known-good ECM (PCM) and recheck.
6	Check wire circuit. 1) With ignition switch turn OFF, check that there are insulating between engine ground and each "Gr", "R/W", "R/Y", "G/R" wire terminal. Are there insulating.	Go to Step 7.	Some wire shorted to ground circuit. If wires are OK, substitute a known-good ECM (PCM) and recheck.

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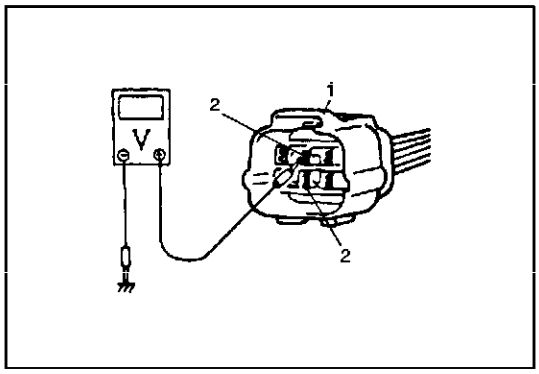
Step	Action	Yes	No
7	EGR Valve Stepper Motor Coil Circuit Check : 1) With ignition switch OFF, connect EGR valve coupler and disconnect ECM (PCM) couplers. 2) Check resistance between "C02-5 (or 6)" and "C01-17", "C01-18", "C01-28","C01-29". Is each resistance 20 – 24 Ω at 20°C, 68°F?	Go to Step 9.	Go to Step 8.
8	Check wire circuit. 1) Measure voltage between engine ground and each "Gr", "R/W", "R/Y", "G/R" wire terminal. Is each voltage 10 – 14 V?	Some wire in high resistance circuit. If wires are good condition, faulty EGR valve.	Some wire open circuit. If wires are good condition, faulty EGR valve.
9	MAP Sensor Check : 1) Check MAP sensor for performance referring to MAP SENSOR INDIVIDUAL CHECK in this section. Is check result satisfactory?	EGR passage clogged or EGR valve malfunction. If all above are OK, intermittent trouble or faulty ECM (PCM). Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Repair or replace.

Fig. 1 for Step 4



1.	EGR valve coupler
2	"B/R" wire terminal

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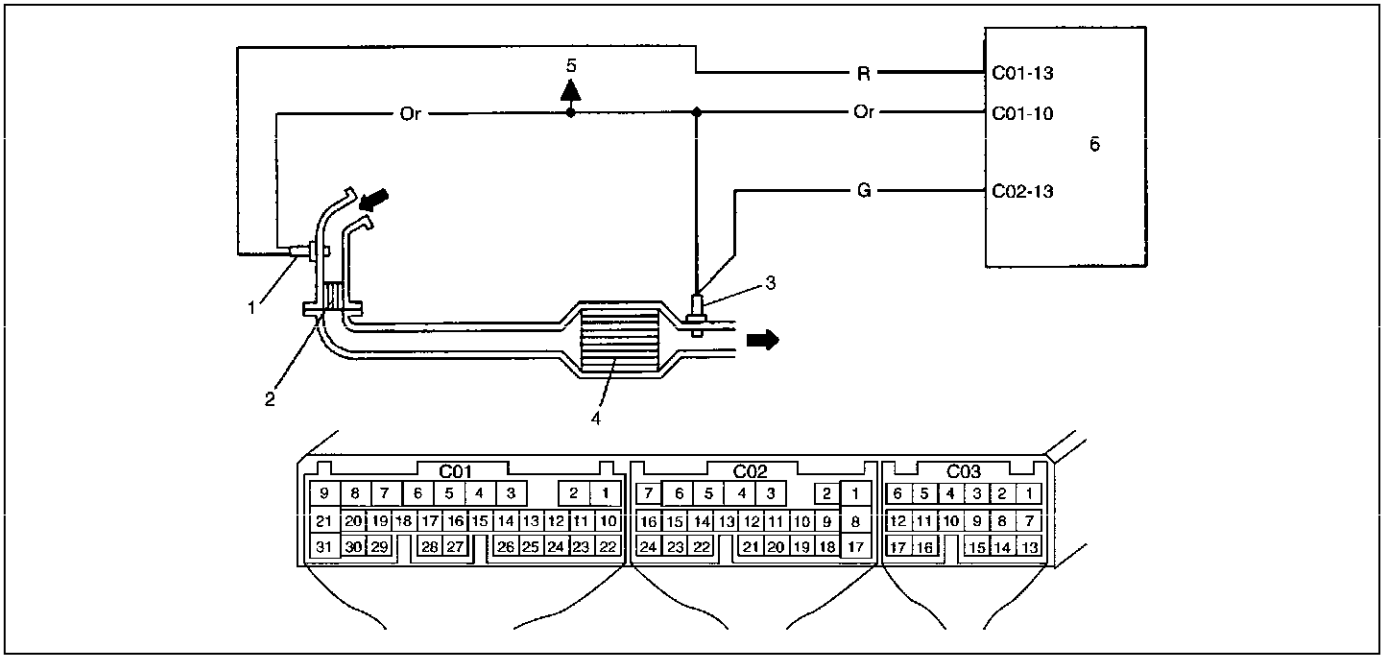
DTC P0420 Catalyst System Efficiency below Threshold

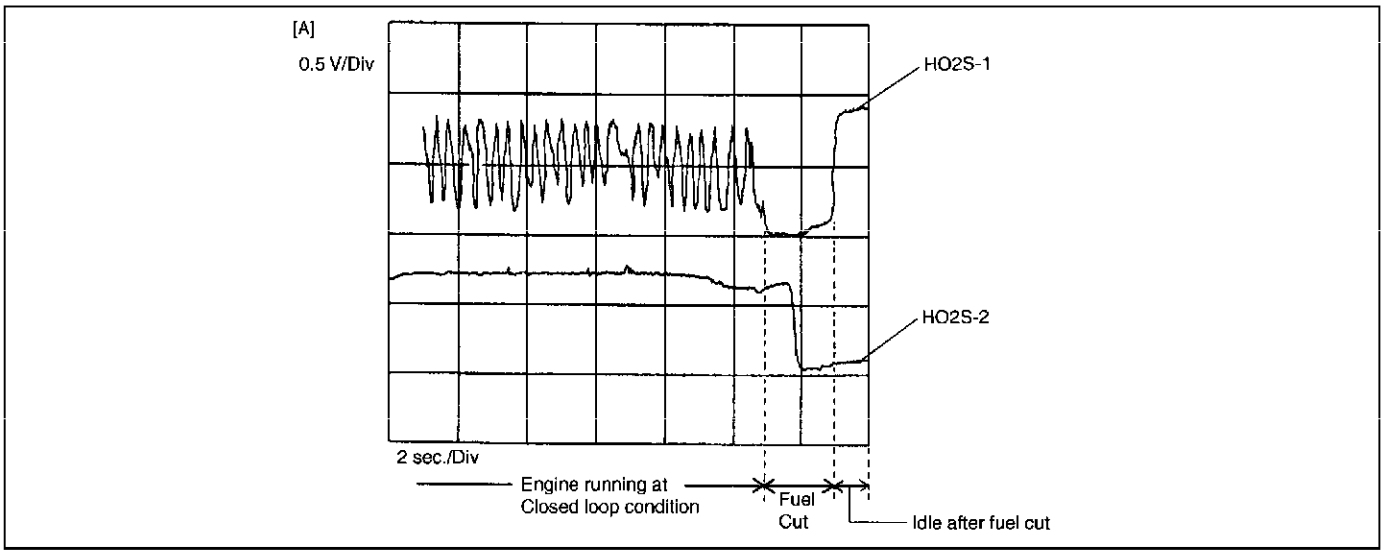
CIRCUIT DESCRIPTION



1. HO2S-1	3. HO2S-2	5. To other sensor
2. Warm up three way catalytic converter	4. Three way catalytic converter	6. ECM (PCM)

ECM (PCM) 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



[A] : Oscilloscope Waveforms

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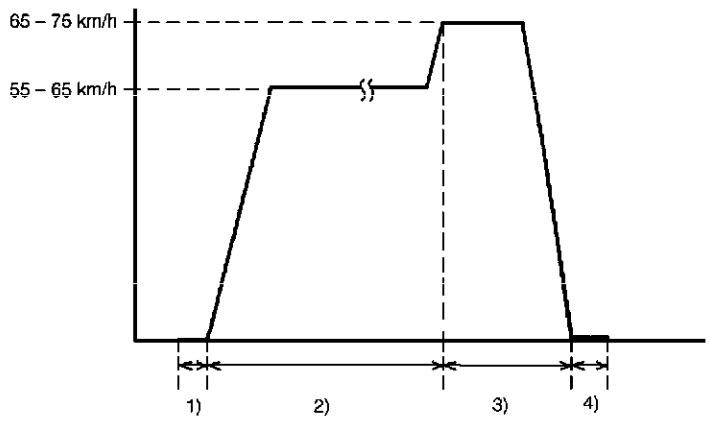
DTC DETECTING CONDITION	POSSIBLE CAUSE
• While vehicle running at constant speed under other than high load. • Time from rich or lean switching command is output till HO2S-2 output voltage crosses 0.45 V is less than specified value. ✱2 driving cycle detection logic, monitoring once/1 driving.	• Exhaust 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 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 COMPLETED" is still being displayed, continue test driving.
3) Decrease vehicle speed at 65 – 75 km/h (5th or D range), 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.

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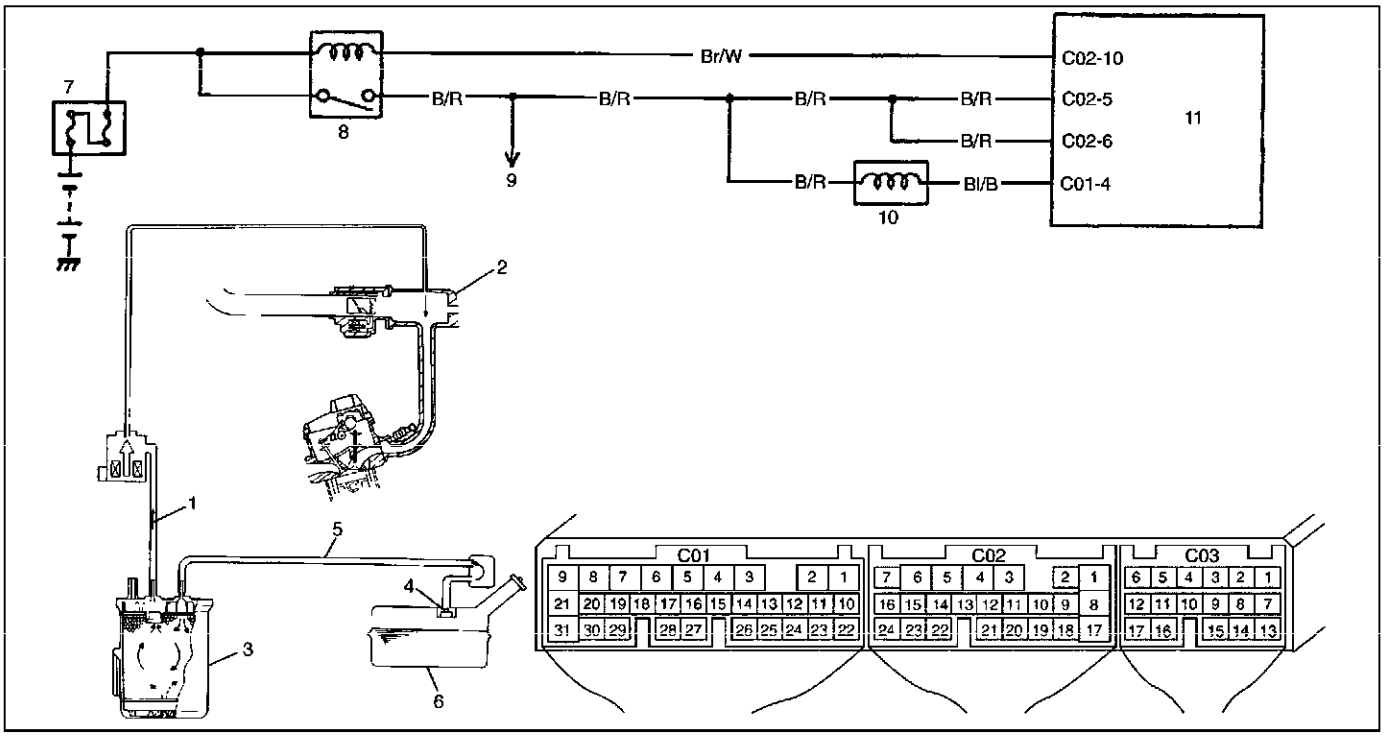
INSPECTION

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.	Go to DTC P0136 Diag Flow Table.

DTC P0443 Purge Control Valve Circuit Malfunction

CIRCUIT DESCRIPTION



1. Fuel vapor	4. Tank pressure control valve	7. Main fuse	10. EVAP canister purge valve
2. Intake manifold	5. Fuel vapor line	8. Main relay	11. ECM (PCM)
3. EVAP canister	6. Fuel tank	9. To other valve	

DTC DETECTING CONDITION	POSSIBLE CAUSE
Canister purge control valve circuit is opened or shorted.	• "B/R" circuit open or short • "Bl/B" circuit open • Canister purge valve malfunction

DTC CONFIRMATION PROCEDURE

1) Clear DTC with ignition switch ON.
2) Select "DTC" mode on scan tool and check DTC.

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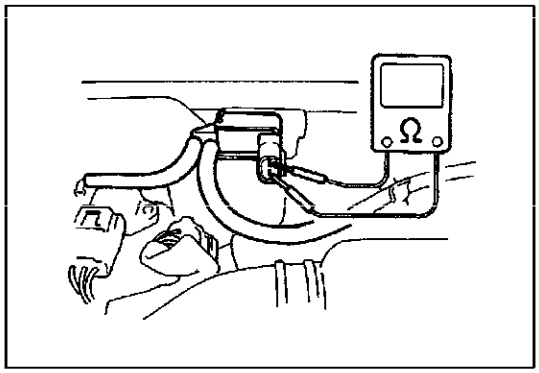
INSPECTION

Step	Action	Yes	No
1	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. **EVAP canister purge valve resistance** **Resistance between two terminals : 30 – 34 Ω at 20°C (68°F)** **Resistance between terminal and body : 1 MΩ or higher** Is it as specified?	Go to Step 2.	Replace EVAP canister purge valve.
2	Check wire circuit. 1) Turn ON ignition switch, measure voltage between engine ground and "B/R" wire terminal. Is it voltage 10 – 14 V?	Go to Step 3.	"B/R" wire open circuit.
3	Check wire circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Check that there is insulating between "C01-4" terminal wire and vehicle body ground. Is there insulating?	Go to Step 4.	"Bl/B" wire shorted to ground circuit.
4	Check wire circuit. 1) Connect connector to purge control valve with ignition switch turn OFF. 2) Turn ON ignition switch, measure voltage between vehicle body ground and "Bl/B" wire terminal. Is it voltage 10 – 14 V?	Go to Step 5.	"Bl/B" wire open circuit.
5	Check wire circuit. 1) With ignition switch turn OFF, measure resistance between "C02-5" (or "C02-6") terminal wire and "C01-4" terminal wire. Is resistance below 40 Ω at 20°C, 68°F?	Check purge control valve, referring to "EVAP CANISTER PURGE VALVE INSPECTION" in Section 6E1. If result in good condition, substitute a known-good ECM (PCM) and recheck.	"B/R" and/or "Bl/B" wire in high resistance circuit.

Fig. 1 for Step 1



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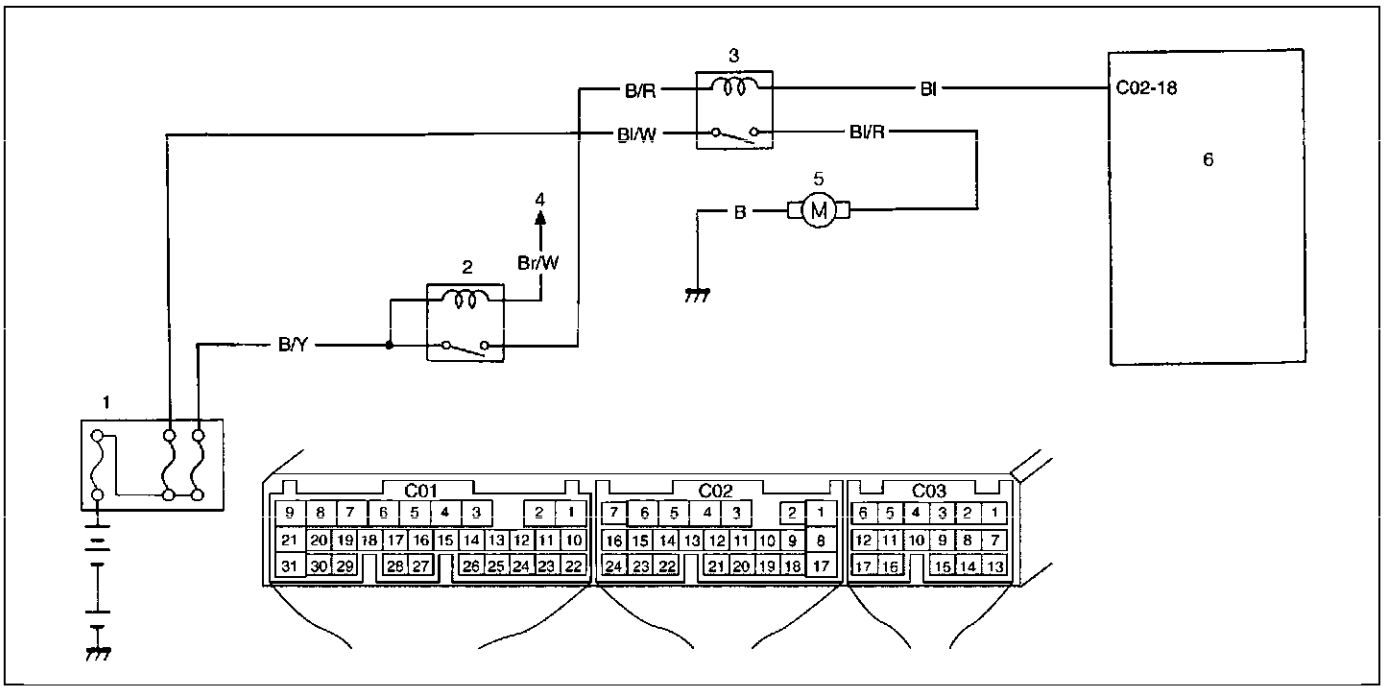
DTC P0480 Radiator Fan Control System Malfunction

CIRCUIT DESCRIPTION



1. Main fuse	3. Radiator fan control relay	5. Radiator fan motor
2. Main relay	4. To ECM (PCM)	6. ECM (PCM)

DTC DETECTING CONDITION	POSSIBLE CAUSE
• Low voltage at terminal "C02-18" when engine coolant temp. is below 93°C, 199°F. *2 driving cycle detection logic, continuous monitoring.	• "B/R" or "Bl" circuit open or short • Radiator fan relay malfunction • ECM (PCM) malfunction

DTC CONFIRMATION PROCEDURE

1) Turn ignition switch OFF.
2) Clear DTC with ignition switch ON.
3) Warm up engine until radiator cooling fan starts to operate.
4) Check pending DTC in "ON BOARD TEST" or "PENDING DTC" mode and DTC in "DTC" mode.

INSPECTION

Step	Action	Yes	No
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check wire circuit. 1) Disconnect connector from radiator fan control relay with ignition switch turn OFF. 2) Turn ON ignition switch, measure voltage between engine ground and "B/R" wire terminal. Is voltage 10 – 14 V?	Go to Step 3.	"B/R" wire open circuit.

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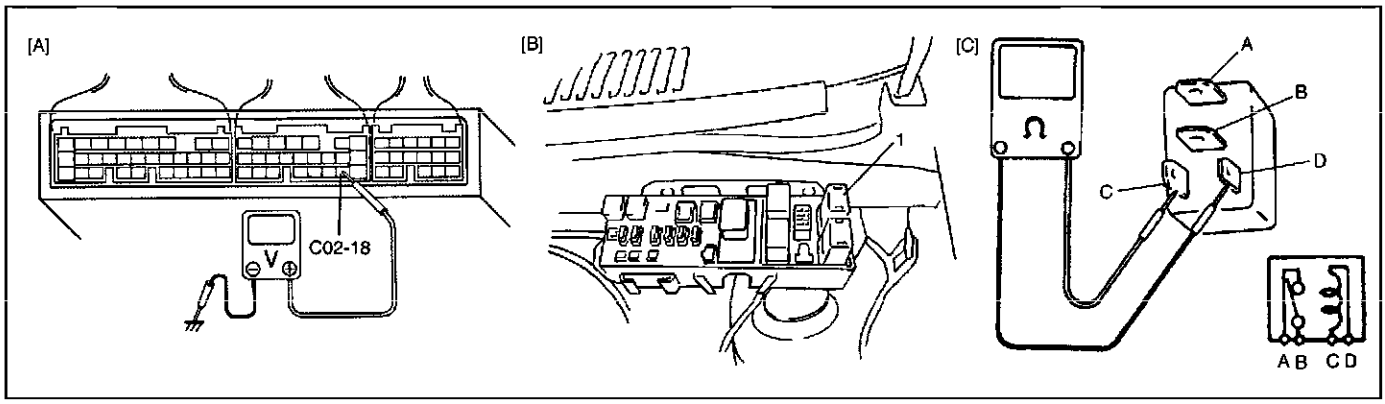
Step	Action	Yes	No
3	Check radiator fan control relay. 1) Check for proper connection to the relay at "B/R" and "Bl" wire terminals. 2) If OK, then measure resistance between terminals "C" and "D". See Fig. 2 and 3. Is it 70 – 110 Ω?	Go to Step 4.	Replace radiator fan relay.
4	Check wire circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Check that there is insulating between "C02-18" terminal wire and vehicle body ground. Is there insulating?	Go to Step 5.	"Bl/B" wire shorted to ground circuit.
5	Check wire circuit. 1) Connect connector to radiator fan control relay with ignition switch turn OFF. 2) Turn ON ignition switch, measure voltage between vehicle body ground and "C02-18" terminal wire. See Fig 1. Is voltage 10 – 14 V?	Go to Step 6.	"Bl" wire open circuit.
6	Check radiator fan control relay. 1) Check radiator fan control relay, referring to "MAIN/FUEL PUMP/RADIATOR FAN CONTROL RELAY" in Section 6E1. Is result in good condition?	Go to Step 7.	Faulty relay.
7	Check radiator fan control. 1) Connect connectors to ECM (PCM) with ignition switch turn OFF. 2) Run engine at ECT is over 93°C, 199°F. 3) Measure voltage between vehicle body ground and "C02-18" terminal wire. Is voltage lower 1.5 V?	Intermittent trouble. Check for intermittent refer to "INTERMITTENT AND POOR CONNECTION" in Section 0A. If OK, substitute a known-good ECM (PCM) and recheck.	Faulty ECM (PCM).



[A] : Fig.1 for Step 5	[C] : Fig.3 for Step 3
[B] : Fig.2 for Step 3	1. Radiator fan relay

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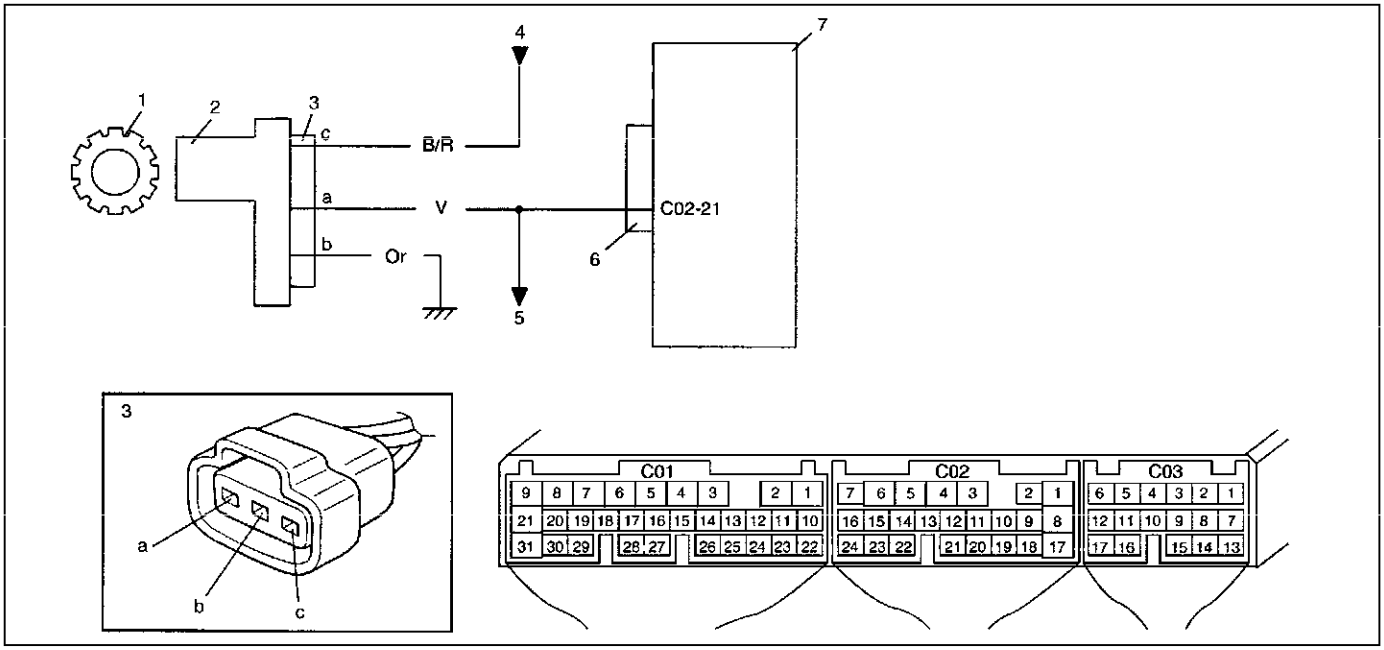
DTC P0500 Vehicle Speed Sensor (VSS) Malfunction

CIRCUIT DESCRIPTION



1. VSS sensing rotor	4. Power supply from ignition switch	7. ECM (PCM)
2. VSS (vehicle speed sensor)	5. Speedometer, P/S control module	
3. VSS connector	6. ECM (PCM) connector	

DTC DETECTING CONDITION	POSSIBLE CAUSE
• VSS signal not inputted while fuel is kept cut at lower than 4000 r/min for longer than 4 sec. ✱2 driving cycle detection logic.	• "V" or "B/Or" circuit open or short. • VSS malfunction. • ECM malfunction.

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester.**

1) 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.
3) Release accelerator pedal and with engine brake applied, keep vehicle coasting (fuel cut condition) for 4 sec. or more.
4) Stop vehicle and 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	Does speedometer indicate vehicle speed?	Go to Step 3.	Go to Step 5.

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Step	Action	Yes	No
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	Check VSS signal circuit. 1) Turn ignition switch to OFF position. 2) Disconnect combination meter connectors. Refer to Section 8. 3) Disconnect P/S control module connector (if equipped). 4) With ignition switch turn OFF, disconnect connector from VSS. 5) Turn ignition switch to ON position, without running engine. 6) Measure voltage from terminal "a" of VSS connector to ground. Is voltage within 4 – 5 V?	Faulty ECM (PCM).	"V" wire open circuit. Poor connection of ECM connector terminal. If OK, substitute a known-good ECM and recheck.
5	Check power supply circuit. 1) With turn OFF ignition switch, disconnect connector from VSS. 2) Check proper connection for "B/R", "O/R" and "V" wire terminal. 3) If wires are OK, turn ON ignition switch, measure voltage between engine ground and "B/R" wire terminal. Is it voltage 10 – 14 V?	Go to Step 6.	"B/R" wire open or shorted to ground circuit.
6	Check ground circuit. 1) Check that there is continuity between engine ground and "Or" wire terminal with ignition switch turn OFF. Is there continuity?	Go to Step 7.	"Or" wire open circuit.
7	Check wire circuit. 1) Turn ON ignition switch, measure voltage between engine ground and "V" wire terminal. Is it voltage 10 – 14 V?	Go to Step 9.	Go to Step 8.
8	Check wire circuit. 1) Disconnect connectors from power steering control module (if equipped) with ignition switch turn OFF. 2) Turn ON ignition switch, measure voltage between engine ground and "V" wire terminal. Is it voltage 10 – 14 V?	Faulty power steering control module.	Go to Step 9.

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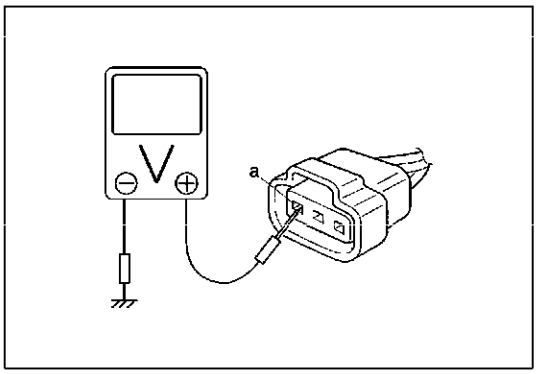
Step	Action	Yes	No
9	Check wire circuit. 1) Disconnect connectors from combination meter with ignition switch turn OFF. 2) Turn ON ignition switch, measure voltage between engine ground and "V" wire terminal. Is it voltage 4 – 5 V?	Faulty combination meter.	Go to Step 10.
10	Check wire circuit. 1) Turn ON ignition switch, measure voltage between engine ground and "V" wire terminal at VSS connector. Is it voltage 4 – 5 V?	Go to Step 14.	Go to Step 11.
11	Check ECM (PCM) voltage. 1) Turn ON ignition switch, measure voltage between vehicle body ground and "C02-21" terminal at ECM (PCM) connector. Is it voltage 4 – 5 V?	"V" wire open circuit.	Go to Step 12.
12	Check short circuit. 1) Disconnect connectors from ECM (PCM) with ignition switch turn OFF. 2) Turn ON ignition switch, measure voltage between engine ground and "V" wire terminal. Is it voltage 0 V?	Go to Step 13.	"V" wire shorted to power supply circuit.
13	Check short circuit. 1) Check that there is insulating between engine ground and "V" wire terminal with ignition switch turn OFF. Is there insulating?	Go to Step 14.	"V" wire shorted to ground circuit. If wire are OK, substitute a known-good ECM (PCM) and recheck.
14	Check signal rotor. 1) Remove VSS. 2) Visually inspect VSS sensor signal rotor for damage. Was any damage found?	Faulty VSS signal rotor.	Go to Step 15.
15	Check VSS. 1) Check VSS, referring to "VSS" in Section 6E1. Is VSS in good condition?	Substitute a known-good ECM (PCM) and recheck.	Faulty VSS.

Fig. 1 for Step 4, Step 7 and Step 8



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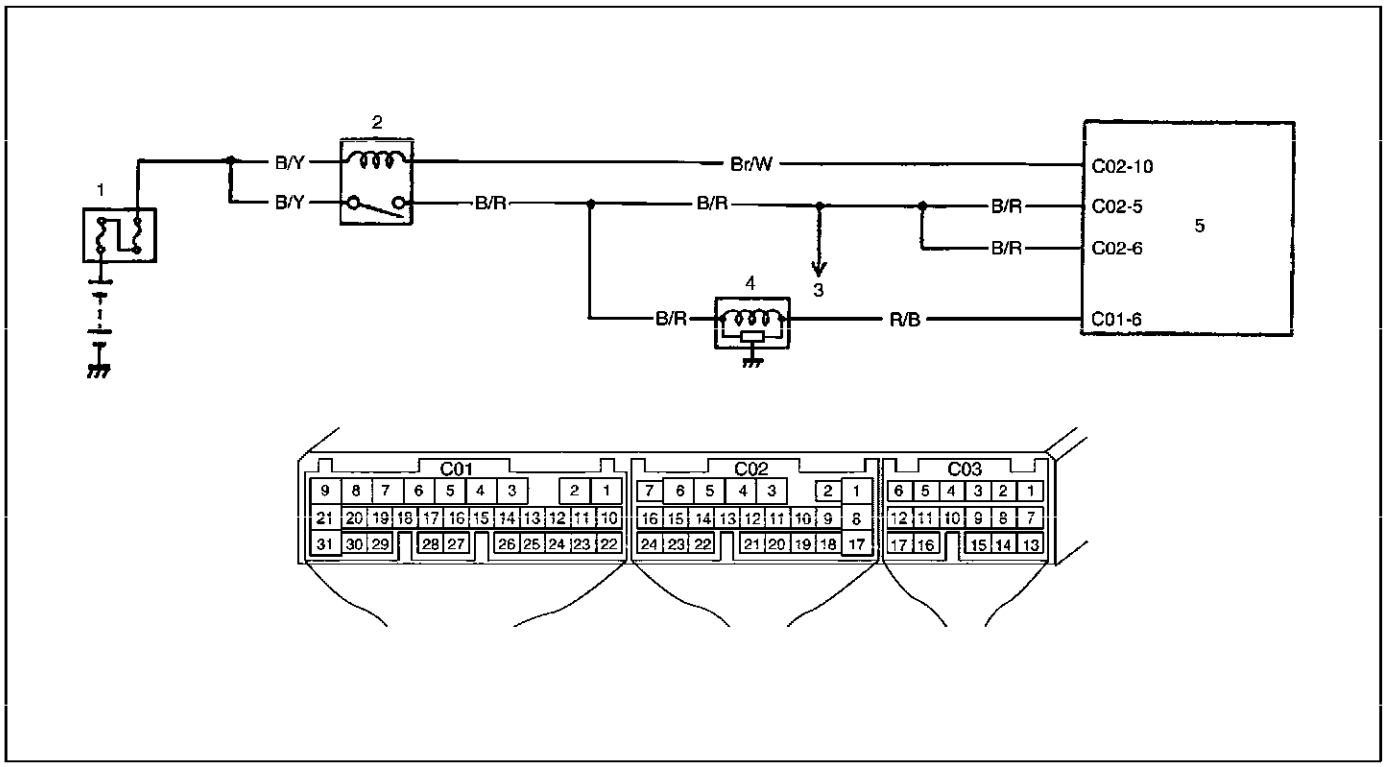
DTC P0505 Idle Control System Malfunction

CIRCUIT DESCRIPTION



1. Main fuse	3. To other valve	5. ECM (PCM)
2. Main relay	4. IAC valve	

DTC DETECTING CONDITION	POSSIBLE CAUSE
• No closed signal to IAC valve is detected after engine start. ✱2 driving cycle detection logic, continuous monitoring.	• "B/R", "R/B" or "B" circuit open or short • IAC valve malfunction • ECM (PCM) 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.

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INSPECTION

Step	Action	Yes	No
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Check IAC valve power supply. 1) Disconnect connector from IAC valve with ignition switch turn OFF. 2) Check proper connection to IAC valve at each terminals. 3) If it is OK, turn ON ignition switch, measure voltage between engine ground and "B/R" wire terminal. Is it voltage 10 – 14 V?	Go to Step 3.	"B/R" wire open circuit.
3	Check IAC valve ground. 1) Check that there is continuity between engine ground and "B" wire terminal with ignition switch turn OFF. Is there continuity?	Go to Step 4.	"B" wire open circuit.
4	Check signal circuit. 1) Disconnect connector from ECM (PCM) with ignition switch turn OFF. 2) Connect connector to IAC valve with ignition switch turn OFF. 3) Turn ON ignition switch, measure voltage between vehicle body ground and "R/B" wire terminal. Is it voltage 10 – 14 V?	Go to Step 6.	Go to Step 5.
5	Check wire circuit. 1) Check that there is insulating between "C01-6" terminal wire and vehicle body ground. Is there insulating?	Go to Step 6.	"R/B" wire shorted to ground circuit.
6	Check wire circuit. 1) Disconnect connector from IAC valve with ignition switch turn OFF. 2) Turn ON ignition switch, measure voltage between "C01-6" terminal wire and vehicle body ground. Is voltage 0 V?	Go to Step 7.	"R/B" wire shorted to power supply circuit.
7	Check wire circuit. 1) Check that there is continuity between "R/B" wire terminal at IAC valve connector and "C01-6" terminal. Is there continuity?	Go to Step 8.	"B/R" wire in open circuit.
8	Check IAC valve. 1) Check IAC valve, referring to "IDLE AIR CONTROL VALVE" in Section 6E1. Is result in good condition?	Substitute a known-good ECM (PCM) and recheck.	Faulty IAC control valve.

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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 (PCM).

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 (PCM) 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	1) Connect scan tool to DLC with ignition switch OFF. 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 (PCM) and recheck.	Go to Step 2.

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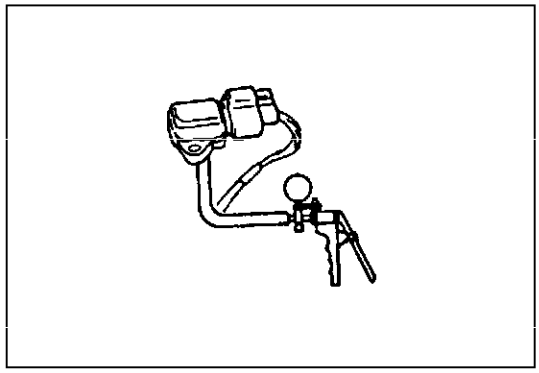
Step	Action	Yes	No
2	Check MAP Sensor. 1) Remove MAP sensor from intake manifold and connect vacuum pump gauge to MAP sensor. See Fig. 1. 2) Connect scan tool to DLC and turn ignition switch ON. 3) Check intake manifold absolute pressure displayed on scan tool for specified value. See Table 1. Is check result satisfactory?	Check air intake system for air being drawn in and engine compression. If OK, then substitute a known-good ECM (PCM) and recheck.	Replace MAP sensor.

Table 1

Applying Vacuum	Displayed Value on Scan Tool
0	Barometric pressure (Approx. 100 kPa, 760 mmHg)
27 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)

Fig. 1 for Step 2



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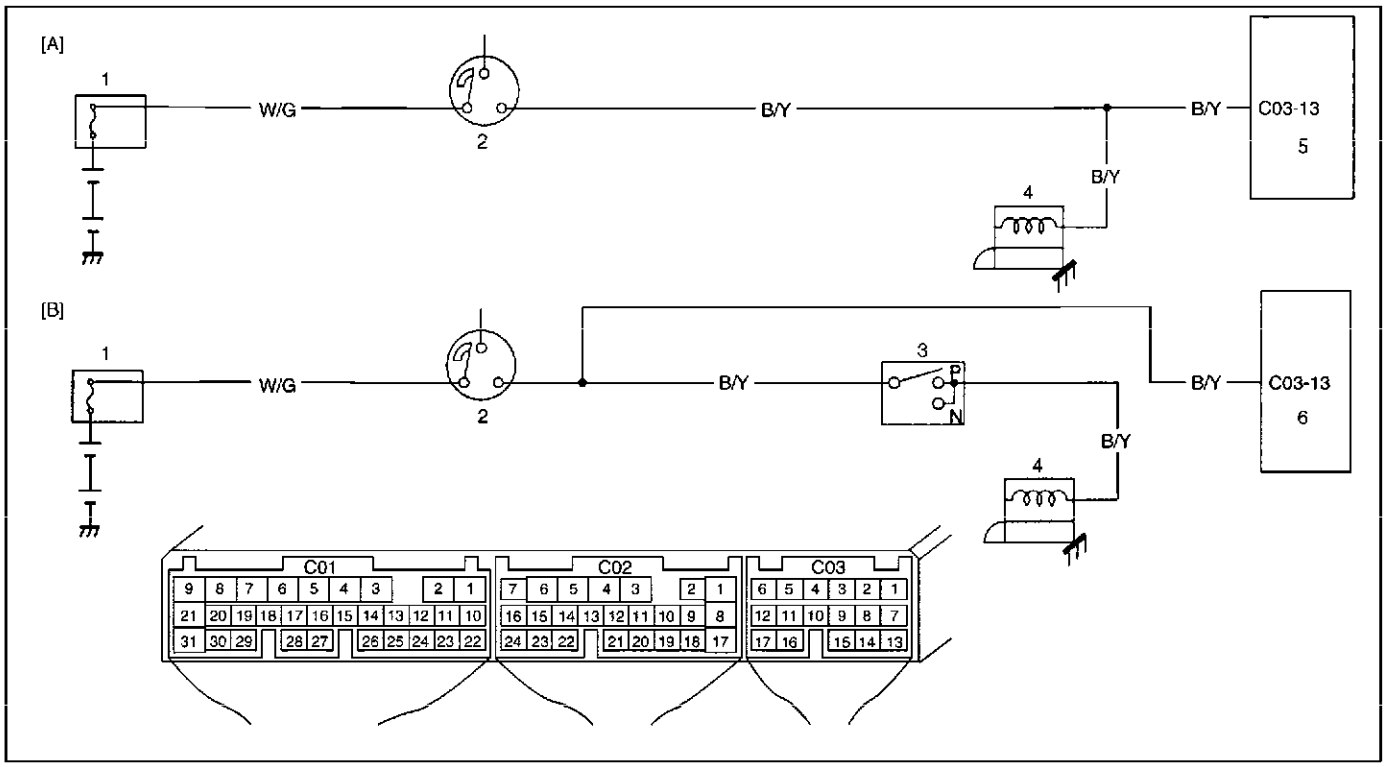
DTC P1500 Engine Starter Signal Circuit Malfunction

CIRCUIT DESCRIPTION



[A] : M/T vehicle	1. Main fuse	3. Transmission range sensor	5. ECM
[B] : A//T vehicle	2. Ignition switch	4. Starting motor	6. ECM (PCM)

DTC DETECTING CONDITION	POSSIBLE CAUSE
• Low voltage at terminal "C03-13" when cranking engine. or • High voltage at terminal "C03-13" after starting engine. ✱2 driving cycle detection logic, continuous monitoring.	• "B/Y" circuit open • ECM (PCM) 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 "C03-13" of ECM (PCM) connector connected, under following condition. **Starting signal voltage** **While engine cranking : 6 – 10 V** **After starting engine : 0 V** Is voltage as specified?	Poor "C03-13" 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 (PCM) and recheck.	"B/Y" circuit open.

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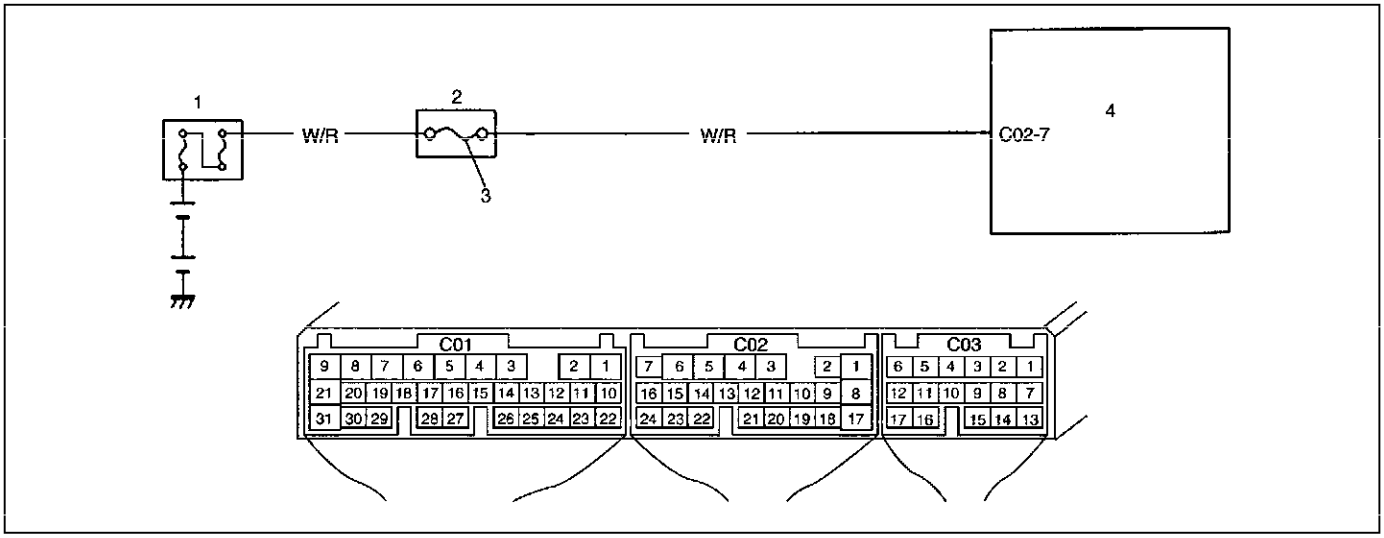
DTC P1510 ECM (PCM) Back-Up Power Supply Malfunction

CIRCUIT DESCRIPTION



1. Main fuse	3. "RADIO" fuse
2. Fuse box	4. ECM (PCM)

Battery voltage is supplied so that diagnostic trouble code memory, values for engine control learned by ECM (PCM), etc. are kept in ECM (PCM) even when the ignition switch is turned OFF.

DTC DETECTING CONDITION	POSSIBLE CAUSE
• Low voltage at terminal "C02-7" after starting engine.	• "W/R" circuit open • ECM (PCM) 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 "C02-7" of ECM (PCM) connector connected, under each condition, ignition switch OFF and engine running. Is it 10 – 14 V at each condition?	Poor "C02-7" 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 (PCM) and recheck.	"W/R" circuit open.

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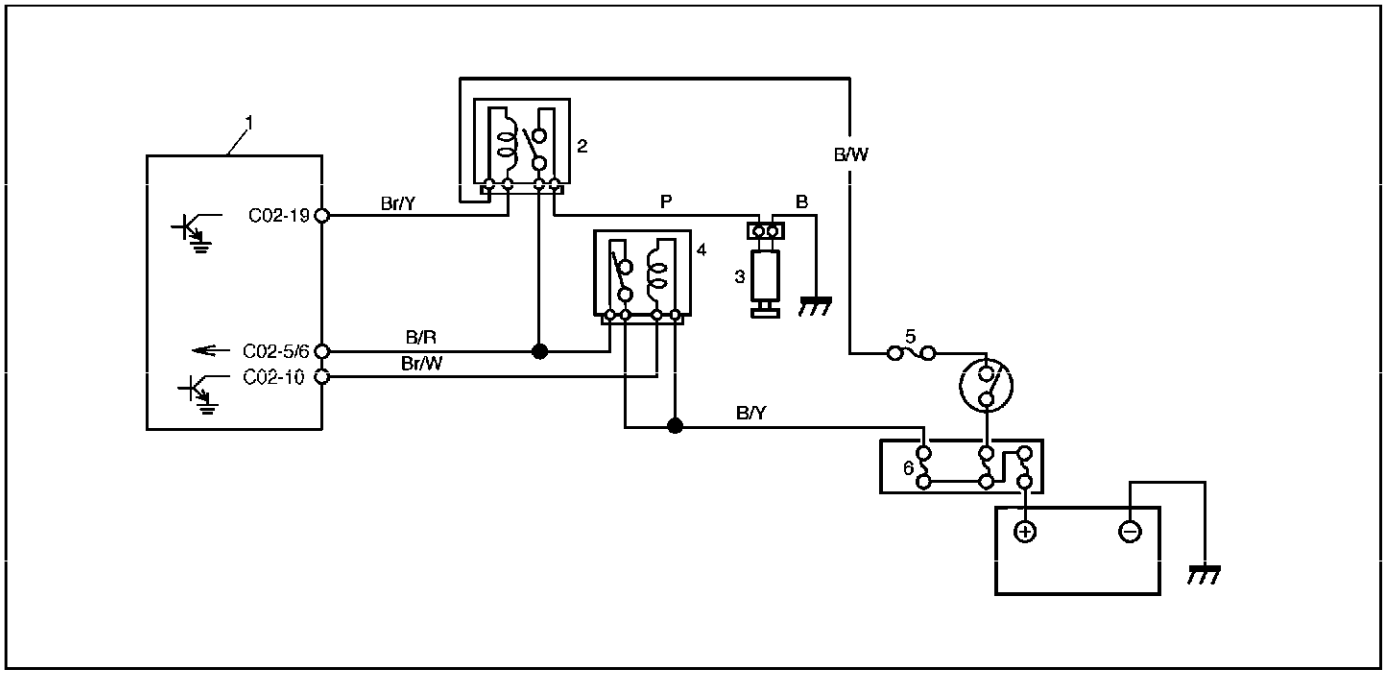
B-1 Fuel Pump and Its Circuit Check



1. ECM (PCM)	3. Fuel pump	5. "IG METER" fuse
2. Fuel pump relay	4. Main relay	6. "FI" fuse

INSPECTION

Step	Action	Yes	No
1	Is fuel pump heard to operate 2 seconds after ignition switch ON?	Fuel pump and its circuit are in good condition.	Go to Step 2.
2	Check fuel pump relay power supply. 1) Disconnect fuel pump relay from relay/fuse box with ignition switch turn OFF. 2) Check proper connection to fuel pump relay at each terminals. 3) If it is OK, turn ON ignition switch, measure voltage between engine ground and "B/R" wire terminal. Is voltage 10 – 14 V?	Go to Step 3.	Go to Diag Flow Table A-3. If result in good condition, "B/R" wire open or shorted to ground circuit.
3	Check fuel pump relay power supply. 1) Turn ON ignition switch, measure voltage between engine ground and "B/W" wire terminal. Is voltage 10 – 14 V?	Go to Step 4.	"B/W" wire open circuit or shorted to ground circuit.
4	Check fuel pump relay. 1) Check fuel pump relay, referring to "MAIN/ FUEL PUMP/RADIATOR FAN CONTROL RELAY" in this section. Is result in good condition?	Go to Step 5.	Faulty relay.

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Step	Action	Yes	No
5	Check fuel pump relay drive signal. 1) Disconnect connectors between floor harness and instrument harness with ignition switch turn OFF. 2) Connect fuel pump relay to relay/fuse box. 3) Connect voltmeter between "C02-19" terminal and vehicle body ground. 4) Measure voltage at after 2 second ignition switch turned ON. Is voltage 10 – 14 V?	Go to Step 6.	"Br/Y" wire open circuit or shorted to ground circuit.
6	Check fuel pump relay drive signal. 1) Measure voltage at within 2 second after ignition switch turned ON. Is voltage 0 – 1 V?	Go to Step 7.	Substitute a known-good ECM (PCM) and recheck.
7	Check wire circuit. 1) Turn OFF ignition switch. 2) Connect connectors between floor harness and instrument harness. 3) Detach fuel tank, referring to Section 6C. 4) Disconnect connector from fuel pump. 5) Check that there is insulating between "P" wire terminal and vehicle body ground. Is there insulating?	Go to Step 8.	"P" wire shorted to ground.
8	Check fuel pump circuit. 1) Turn OFF ignition switch. 2) Connect service wire between "C02-19" terminal and vehicle body ground. 3) Turn ON ignition switch, measure voltage between "P" terminal at fuel pump connector and vehicle body ground. Is voltage 10 – 14 V?	Go to Step 9.	"P" wire open circuit.
9	Check fuel pump circuit. 1) Turn OFF ignition switch. 2) Check that there is continuity between "B" terminal at fuel pump connector and vehicle body ground. Is there continuity?	Faulty fuel pump.	"B" wire open circuit.

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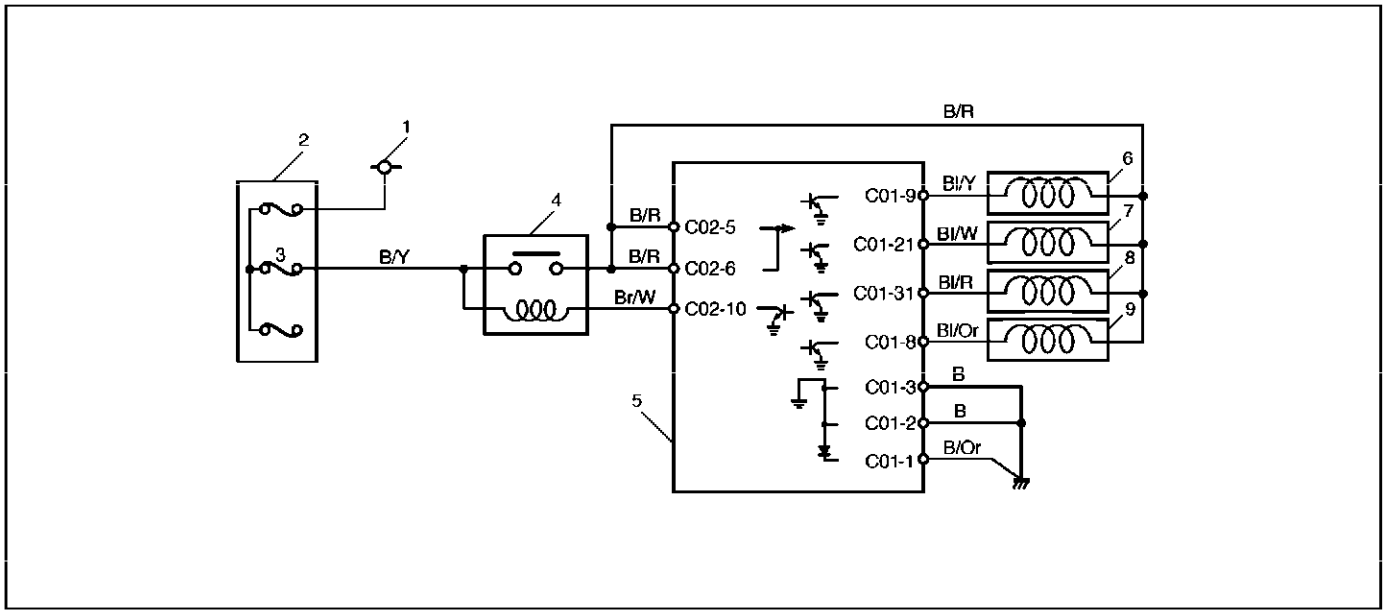
B-2 Fuel Injector and Its Circuit Check



1. Battery positive voltage	4. Main relay	7. No.2 injector
2. Relay/fuse box	5. ECM (PCM)	8. No.3 injector
3. "FI" fuse	6. No.1 injector	9. No.4 injector

INSPECTION

Step	Action	Yes	No
1	Check each injector for operating sound at engine cranking using sound scope. Do all 4 injector make operating sound?	Fuel injector circuit is in good condition.	Go to Step 2.
2	Check fuel injector resistance. 1) Disconnect connectors from fuel injectors with ignition switch turn OFF. 2) Check proper connection to fuel injector at each terminals. 3) If it is OK, check all 4 fuel injectors for resistance, referring to "FUEL INJECTOR" in this section. Is result in good condition?	Go to Step 3.	Faulty fuel injector.
3	Check fuel injector insulation resistance. 1) Check that there is insulating between each fuel injector terminals and engine ground. Is there insulating?	Go to Step 4.	Faulty fuel injector.
4	Check fuel injector power supply. 1) Measure voltage between each "B/R" wire terminal and engine ground with ignition switch turn ON. Is voltage 10 – 14 V?	Go to Step 5.	"B/R" wire open circuit or shorted to ground circuit. If it is in good condition, go to Diag Flow Table A-3.

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Step	Action	Yes	No
5	Check wire circuit. 1) Turn OFF ignition switch. 2) Disconnect connectors from ECM (PCM). 3) Check that there is insulating between each "Bl/Y", "Bl/W", "Bl/R", "Bl/Or" wire terminal and vehicle body ground. Is there insulating?	Go to Step 6.	"Bl/Y", "Bl/W", "Bl/R", "Bl/Or" wire shorted to ground.
6	Check wire circuit. 1) Measure voltage between each "Bl/Y", "Bl/W", "Bl/R", "Bl/Or" wire terminal and vehicle body ground with ignition switch turn ON. Is voltage 0 V?	Go to Step 7.	"Bl/Y", "Bl/W", "Bl/R", "Bl/Or" wire shorted to power supply circuit.
7	Check fuel injector drive signal. 1) Connect connectors to each fuel injectors and ECM (PCM) with ignition switch turn OFF. 2) Turn ON ignition switch. 3) Measure voltage "C01-9", "C01-21", "C01-31", "C01-8" terminal and vehicle body ground. Is voltage 10 – 14 V?	Check fuel injector, referring to "FUEL INJECTOR" in Section 6E1. If result in good condition, substitute a known-good ECM (PCM) and recheck.	"Bl/Y", "Bl/W", "Bl/R", "Bl/Or" open circuit.

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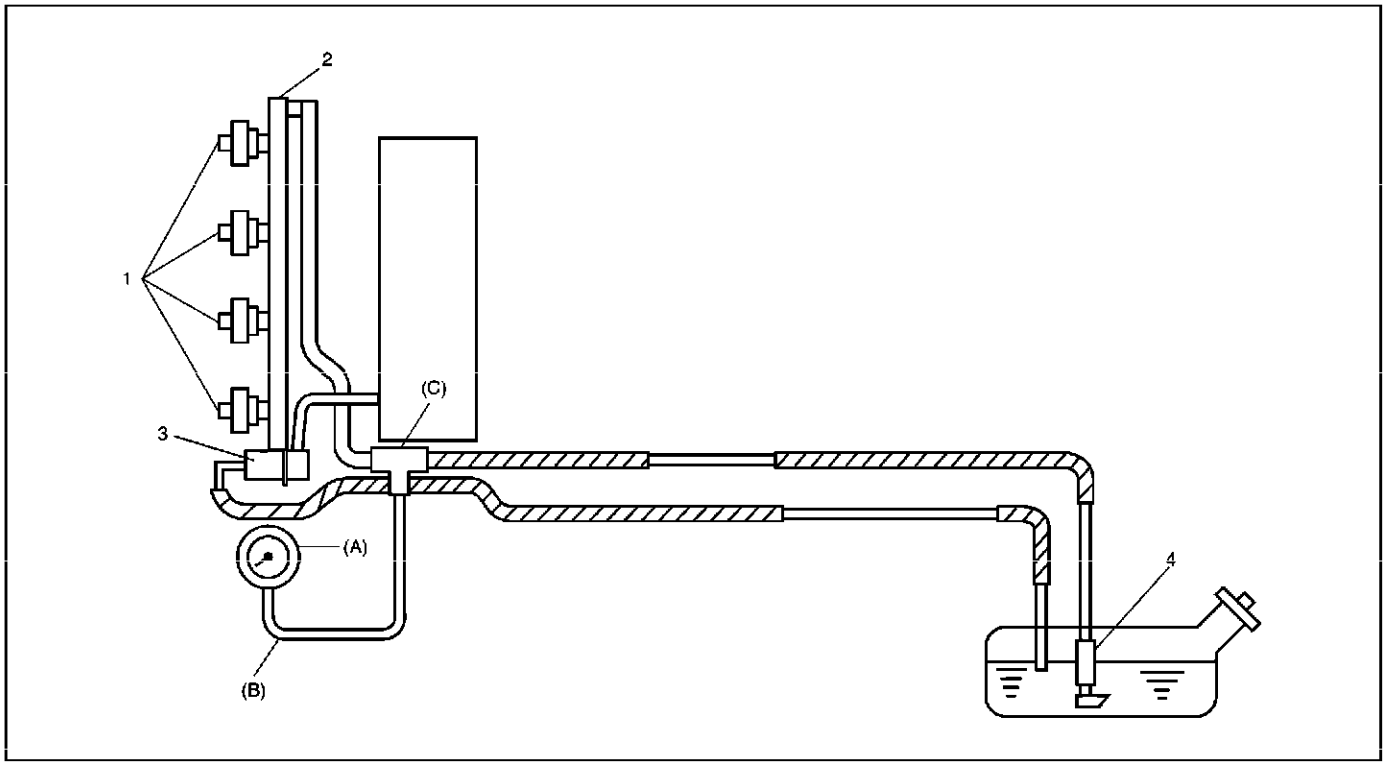
B-3 Fuel Pressure Check



1. Fuel Injector	3. Fuel regulator	(A) : Gauge	(C) : 3-way joint
2. Delivery pipe	4. Fuel pump	(B) : Hose	

INSPECTION

Step	Action	Yes	No
1	1) Release fuel pressure from fuel feed line. 2) Install fuel pressure gauge. 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 5.
2	Is 200 kPa (2.0 kg/cm^2, 28.4 psi) or higher fuel pressure retained for 1 minute after fuel pump is stopped at step 1?	Go to Step 3.	Go to Step 4.
3	1) Start engine and warm it up to normal operating temperature. 2) Keep it running at specified idle speed. Is fuel pressure then within 200 – 240 kPa (2.0 – 2.4 kg/cm^2, 28.4 – 34.1 psi)?	Normal fuel pressure.	Clogged vacuum passage for fuel pressure regulator or faulty fuel pressure regulator.
4	Is there fuel leakage from fuel feed line hose, pipe or their joint?	Fuel leakage from hose, pipe or joint.	Go to Step 10.
5	Was fuel pressure higher than spec. in step 1?	Go to Step 6.	Go to Step 7.

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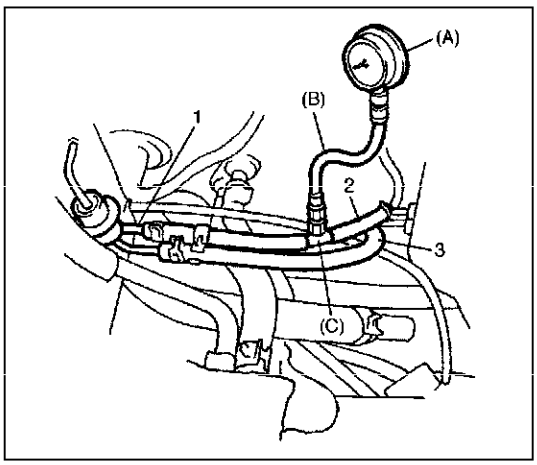
Step	Action	Yes	No
6	1) Disconnect fuel return hose from fuel pressure regulator and connect new return hose to it. 2) Put the other end of new return hose into approved gasoline container. 3) Operate fuel pump. Is specified fuel pressure obtained then?	Restricted fuel return hose or pipe.	Faulty fuel pressure regulator.
7	Was no fuel pressure applied in step 1?	Go to Step 8.	Go to Step 9.
8	With fuel pump operated and fuel return hose blocked by pinching it, is fuel pressure applied?	Faulty fuel pressure regulator.	Shortage of fuel or fuel pump or its circuit malfunction
9	1) Operate fuel pump. 2) With fuel return hose blocked by pinching it, check fuel pressure. Is it 450 kPa (4.5 kg/cm^2, 63.9 psi) or more?	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.
10	1) Disconnect fuel return hose from pressure regulator and connect new return hose to it. 2) Insert the other end of new return hose into approved gasoline container. 3) Check again if specified pressure is obtained. While doing so, does fuel come out of return hose?	Faulty fuel pressure regulator.	Fuel leakage from injector, fuel leakage from between injector and delivery pipe, faulty fuel pump (faulty check valve in fuel pump) or fuel leakage from fuel pressure regulator diaphragm.

Fig. for Step 1



1.	Fuel delivery pipe
2.	Fuel feed hose
3.	Fuel return hose

Special tool
(A) : Gauge (09912-58441)
(B) : Hose (09912-58431)
(C) : 3-way joint (09912-58490)

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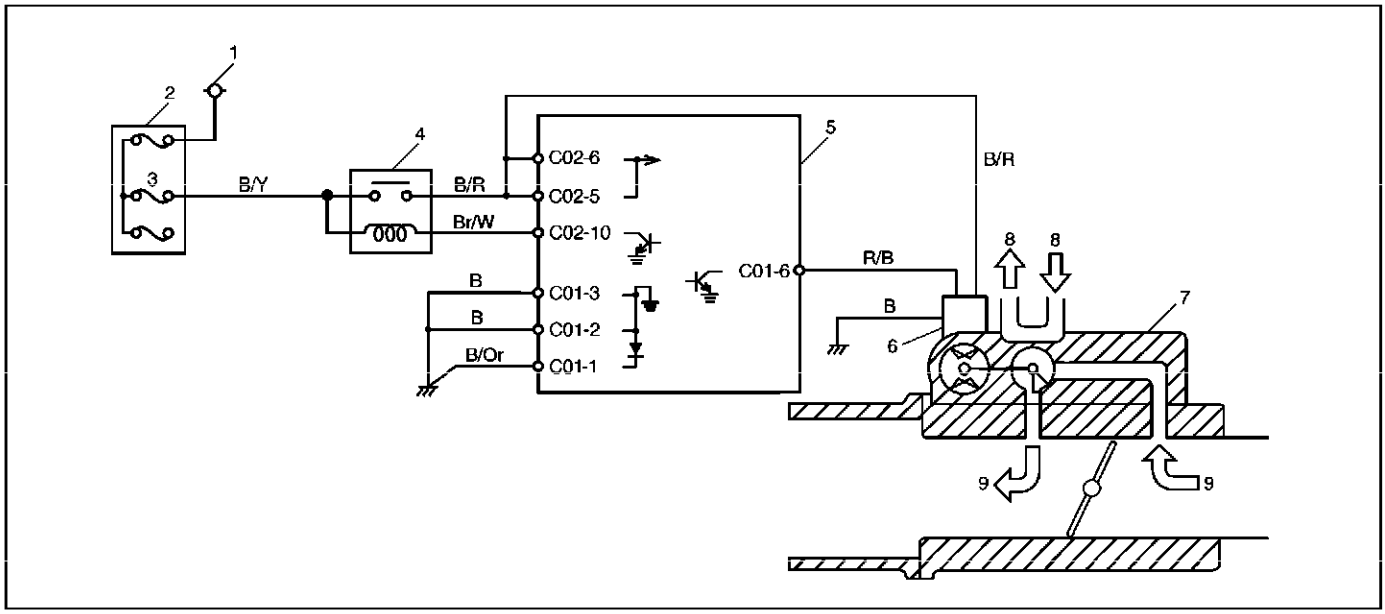
B-4 Idle Air Control System Check



1. Battery positive voltage	4. Main relay	7. Throttle body
2. Relay/fuse box	5. ECM (PCM)	8. Engine coolant
3. "FI" fuse	6. IAC valve	9. Bypass air

INSPECTION

Step	Action	Yes	No
1	Check engine idle speed and IAC duty referring to "Idle Speed/IAC Duty Inspection" in Section 6E1. Is idle speed within specification?	Go to Step 2.	Go to Step 4.
2	Is IAC duty within specification in step 1?	Go to Step 3.	Check for followings : Vacuum leak EVAP canister purge control system Clog of IAC air passage Accessory engine load Stuck of PCV valve
3	Is engine idle speed kept specified speed even with headlight ON?	System is in good condition.	Go to Step 11.
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 "B-6 A/C Signal Circuits Check", if equipped. 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 11 of this table. Is check result satisfactory?	Go to Step 7.	Go to Step 12.

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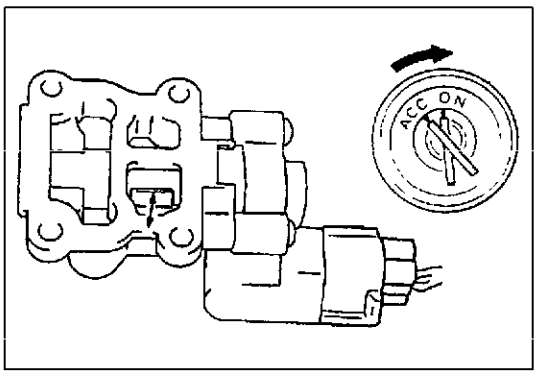
Step	Action	Yes	No
7	Was IAC duty less than about 5% in step 1 of this table?	Check abnormal air inhaling from air intake system, PCV valve and EVAP canister purge control system.	Check TP sensor (closed throttle position) and ECT sensor for performance. If sensors are OK, substitute a known-good ECM (PCM).
8	Check transmission range signal referring to "B-8 Transmission Range Signal Check (3A/T Vehicle Only)". Is it in good condition?	Go to Step 9.	Repair or replace.
9	Check IAC system referring to step 11 of this table. Is check result satisfactory?	Go to Step 10.	Go to Step 12.
10	Was IAC duty more than about 35% in step 1 of this table?	Check parts or system which can cause engine low idle. Accessory engine load Clog of air passage Etc.	Substitute a known-good ECM (PCM) and recheck.
11	1) Remove IAC valve from throttle body referring to "IAC Valve" in Section 6E1. 2) Check IAC valve for operation referring to "IAC Valve" in Section 6E1. Is check result satisfactory?	Intermittent trouble or faulty ECM (PCM). Recheck for referring to "Intermittent Trouble" on Section 0A.	Go to Step 12.
12	1) Turn ignition switch OFF. 2) Disconnect IAC valve coupler. 3) Check for proper connection to IAC valve at each terminals. 4) If OK, disconnect ECM (PCM) couplers. 5) Check for proper connection to ECM (PCM) at "C01-6" terminal. 6) If OK, check "B/R", "R/B" and "B" circuits for open and short. Are they in good condition?	Replace IAC valve and recheck.	Repair or replace.

Fig. for Step 6, 9 and 11



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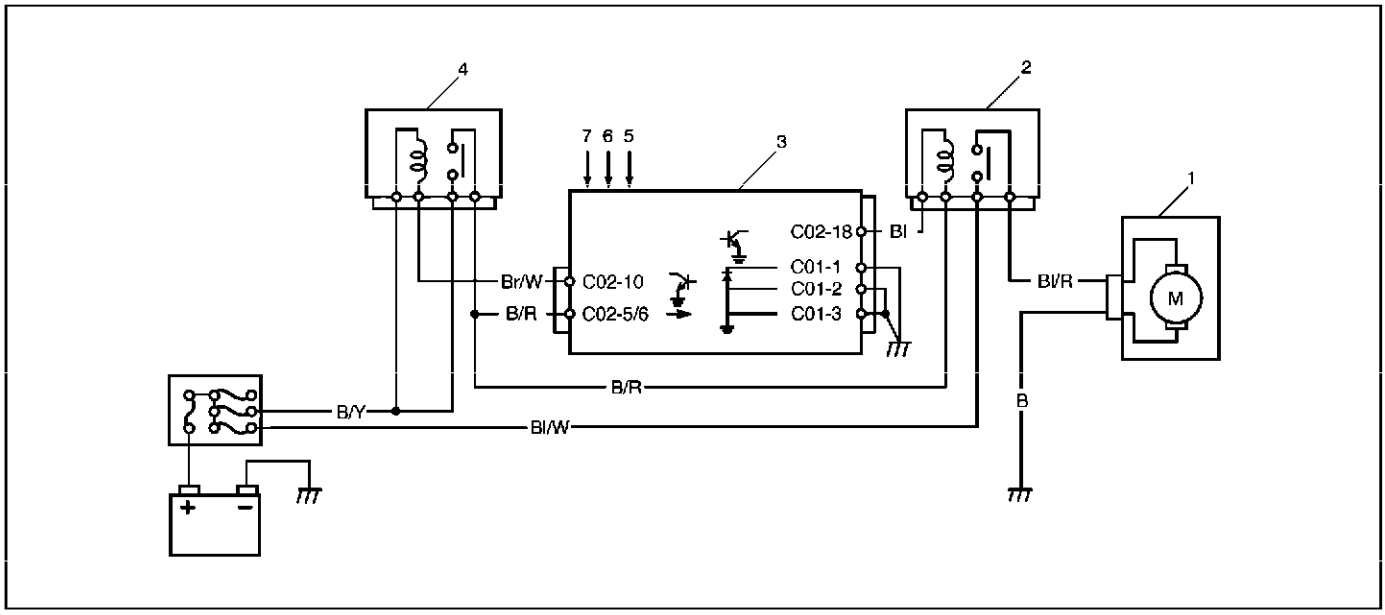
B-5 Radiator Fan Control System Check



1. Radiator fan motor	3. ECM (PCM)	5. Engine coolant temp. (ECT) sensor	7. A/C signal
2. Radiator fan control (RFC) relay	4. Main relay	6. Vehicle speed sensor	

INSPECTION

Step	Action	Yes	No
1	Check radiator fan control system referring to "RADIATOR FAN CONTROL SYSTEM" in Section 6E1. Is it in good condition?	RFC system is in good condition.	Go to Step 2.
2	Check RFC relay referring to "RADIATOR FAN CONTROL SYSTEM" in Section 6E1. Is it in good condition?	Go to Step 3.	Faulty RFC relay.
3	Check wire harnesses and connections for open or short. Are they in good condition?	Poor performance of ECT sensor. If ECT sensor is OK, substitute a known-good ECM (PCM) and recheck.	Wire open or short Poor connection or faulty radiator fan motor

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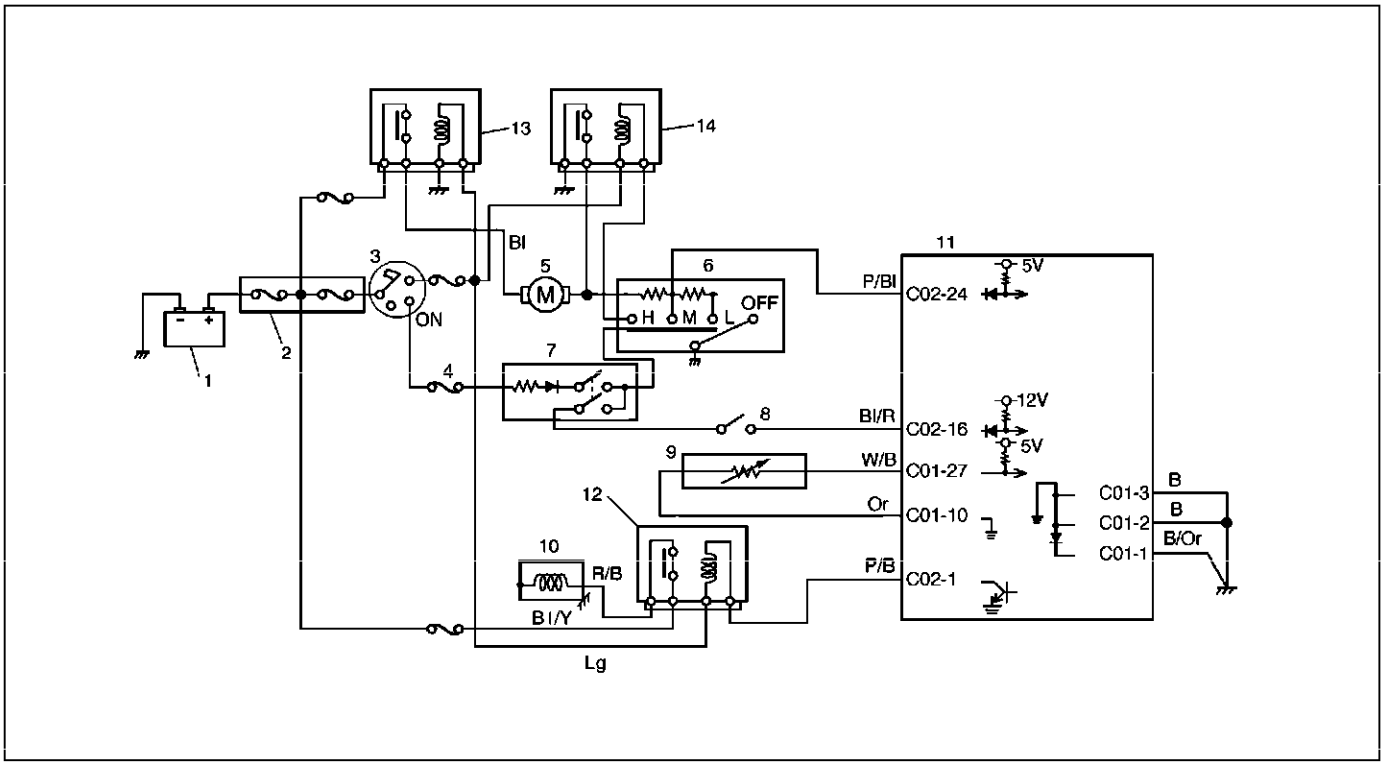
B-6 A/C Control Signal Check (If Equipped)



1. Battery	6. Blower fan switch	11. ECM (PCM)
2. Relay/fuse box	7. A/C switch	12. A/C compressor control relay
3. Ignition switch	8. Dual pressure switch	13. Heater relay
4. Circuit fuse	9. A/C evaporator thermistor	14. High relay
5. Blower fan motor	10. A/C compressor	

INSPECTION

Step	Action	Yes	No
1	1) Check voltage at "C02-16" terminal under each condition given in table 1. Is check result satisfactory?	A/C control signal is in good condition.	"Bl/R" wire open or short Poor "C02-16" terminal connection If wire and connection are OK, check dual pressure switch and A/C switch referring to Section 1B.

Table 1

Ignition switch ON A/C switch OFF Blower fan switch OFF	10 – 14 V
Ignition switch ON A/C switch ON Blower fan switch ON	2 V or less

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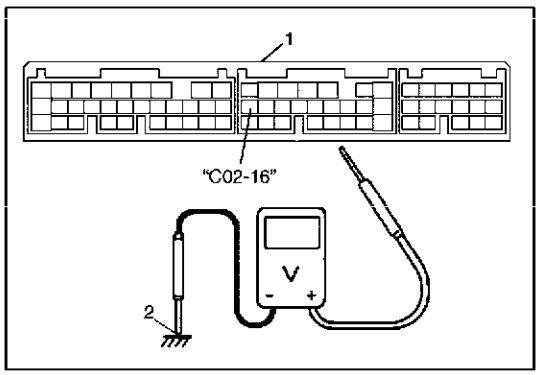
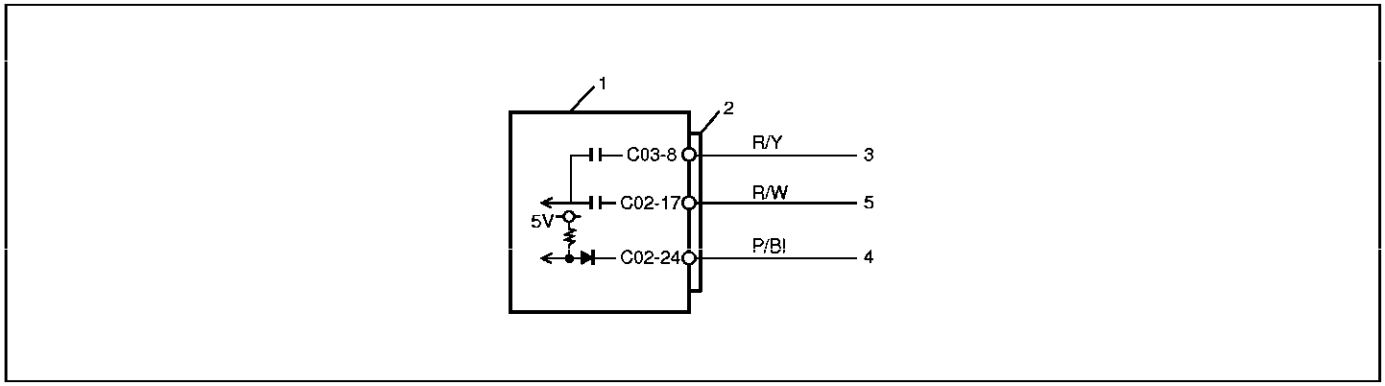
Fig. for Step 1



1.	ECM (PCM) coupler connected
2.	Body ground

B-7 Electric Load Signal Circuits Check



1. ECM (PCM)	3. From lighting switch (small)	5. From rear defogger switch (if equipped)
2. ECM (PCM) coupler	4. From heater blower switch	

INSPECTION

Step	Action	Yes	No
1	Check voltage at "C03-8" terminal under each condition. See Table 1. Is check result satisfactory?	Go to Step 2.	"Y/Bl" wire open or short Poor "C03-8" terminal connection
2	Check voltage at "C02-24" terminal under each condition. See Table 2. Is check result satisfactory?	Go to Step 3.	"P/Bl" wire open or short Poor "C02-24" terminal connection
3	Check voltage at "C02-17" terminal under each condition. See Table 3. Is check result satisfactory?	Electric load signal circuit are in good condition.	"R/W" wire open or short Poor "C02-17" terminal connection

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Table 1

Small light turned OFF	1 V or less
Small light turned ON	10 – 14 V

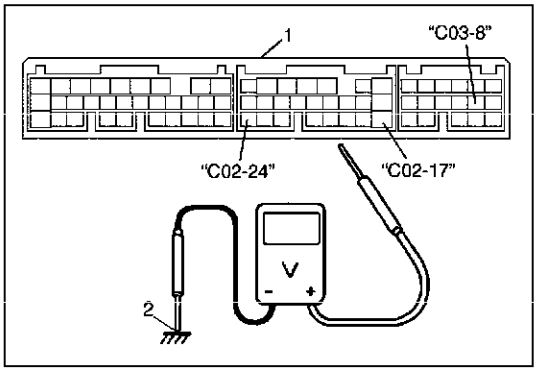
Table 2

Ignition switch ON Heater blower fan switch : OFF or Low position	4 – 14 V
Ignition switch ON Heater blower fan switch : High or Middle position	2 V or less

Table 3

Ignition switch ON Rear defogger switch : OFF	1 V or less
Ignition switch ON Rear defogger switch : ON	10 – 14 V

Fig. for Step 1 and 2



1.	ECM (PCM) coupler connected
2.	Body ground

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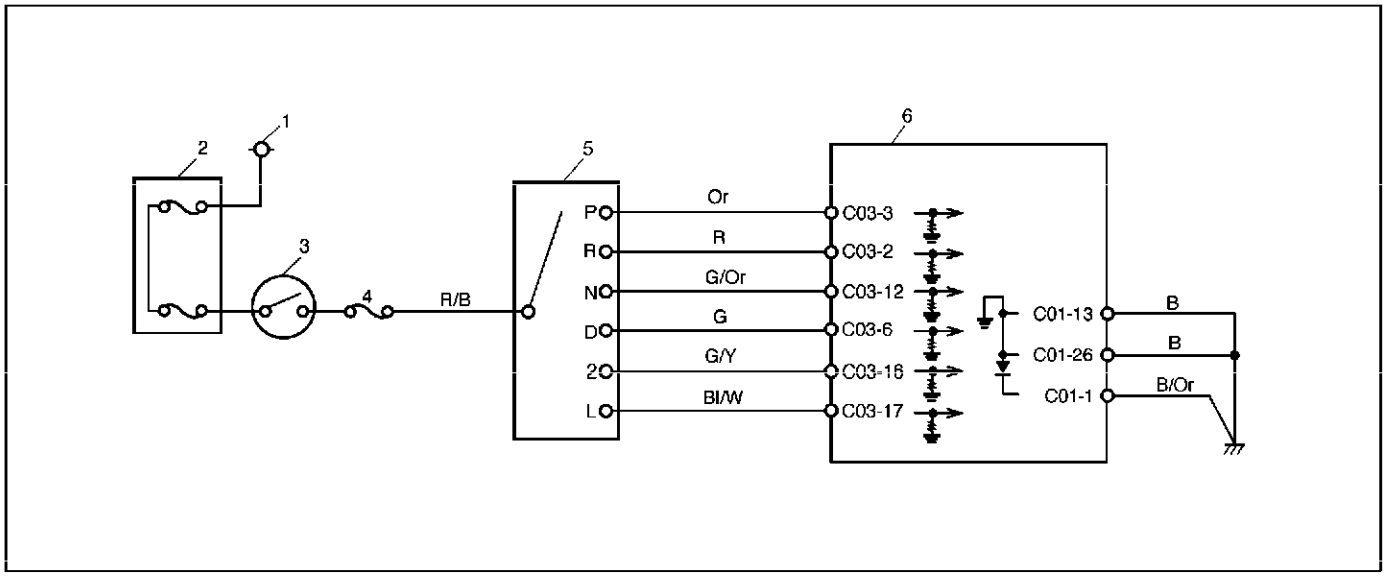
B-8 Transmission Range Signal Circuits Check (A/T Vehicle Only)



1. Battery positive voltage	3. Ignition switch	5. Transmission range switch
2. Relay/fuse box	4. "TURN BACK" fuse	6. ECM (PCM)

INSPECTION

Step	Action	Yes	No
1	Ignition switch ON and check voltage at each terminal in ECM (PCM) coupler under each condition. See Table 1. Is check result satisfactory?	Transmission range signal circuits are in good condition.	Wire open or short Poor each terminal connection If wire and connection are OK, check transmission range switch, referring to Section 7B.

Table 1

		Terminal					
		C03-3	C03-2	C03-12	C03-6	C03-16	C03-17
Select lever position	P	10 – 14 V	About 0 V	About 0 V	About 0 V	About 0 V	About 0 V
	R	About 0 V	10 – 14 V	About 0 V	About 0 V	About 0 V	About 0 V
	N	About 0 V	About 0 V	10 – 14 V	About 0 V	About 0 V	About 0 V
	D	About 0 V	About 0 V	About 0 V	10 – 14 V	About 0 V	About 0 V
	2	About 0 V	About 0 V	About 0 V	About 0 V	10 – 14 V	About 0 V
	L	About 0 V	About 0 V	About 0 V	About 0 V	About 0 V	10 – 14 V

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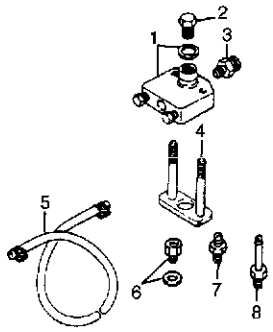
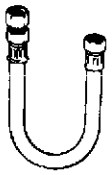
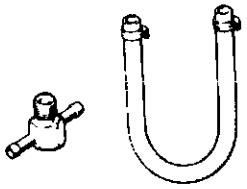
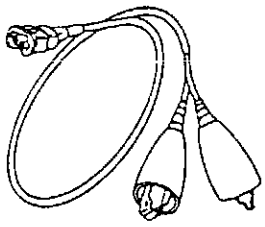
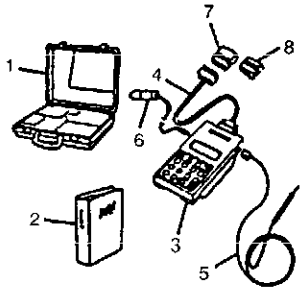
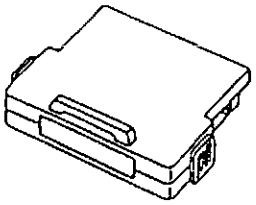
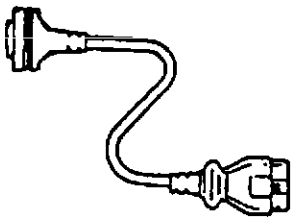
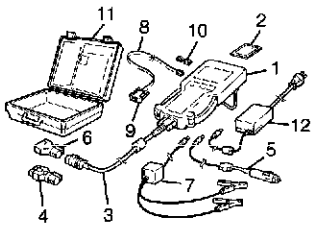
Special Tool

 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 Tech 1A kit (SUZUKI scan tool) (See NOTE "B".)	 Mass storage cartridge for Tech 1A	 09931-76030 16/14 pin DLC adapter for Tech 1A
 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

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SECTION 6A

ENGINE MECHANICAL
(F10D 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).**

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NOTE:
For what each abbreviation stands for (i.e., full term), refer to SECTION 0A.

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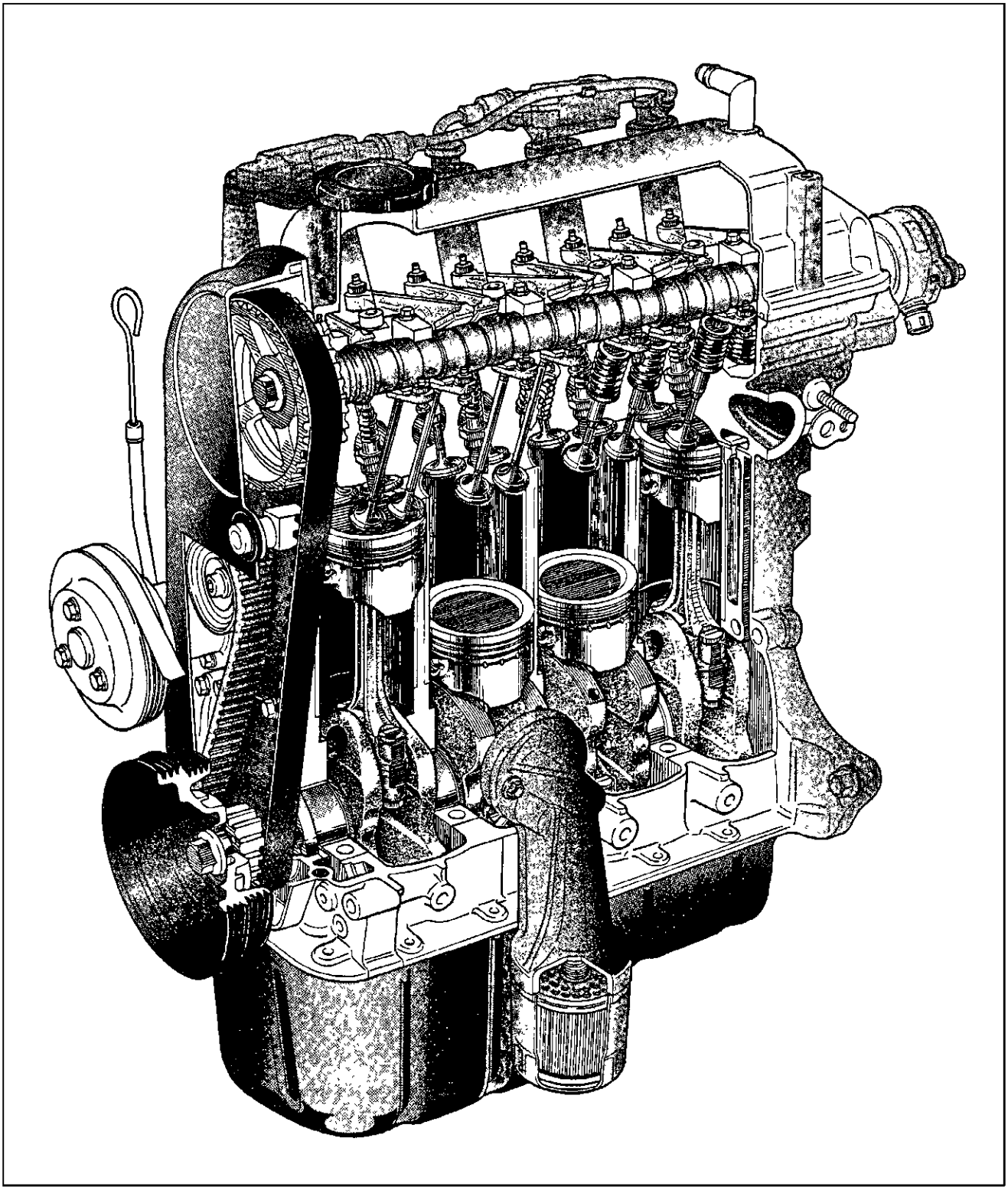
GENERAL DESCRIPTION

ENGINE

The engine is a water-cooled, in line 4 cylinders, 4 stroke cycle gasoline unit equipped with its S.O.H.C. (Single Overhead Camshaft) valve mechanism arranged for "V"-type valve configuration and 16 valves (IN 2 and EX 2/ one cylinder).

The single overhead camshaft is mounted over the cylinder head: it is driven from crankshaft through timing belt and opens and closes its valves via the rocker arms.



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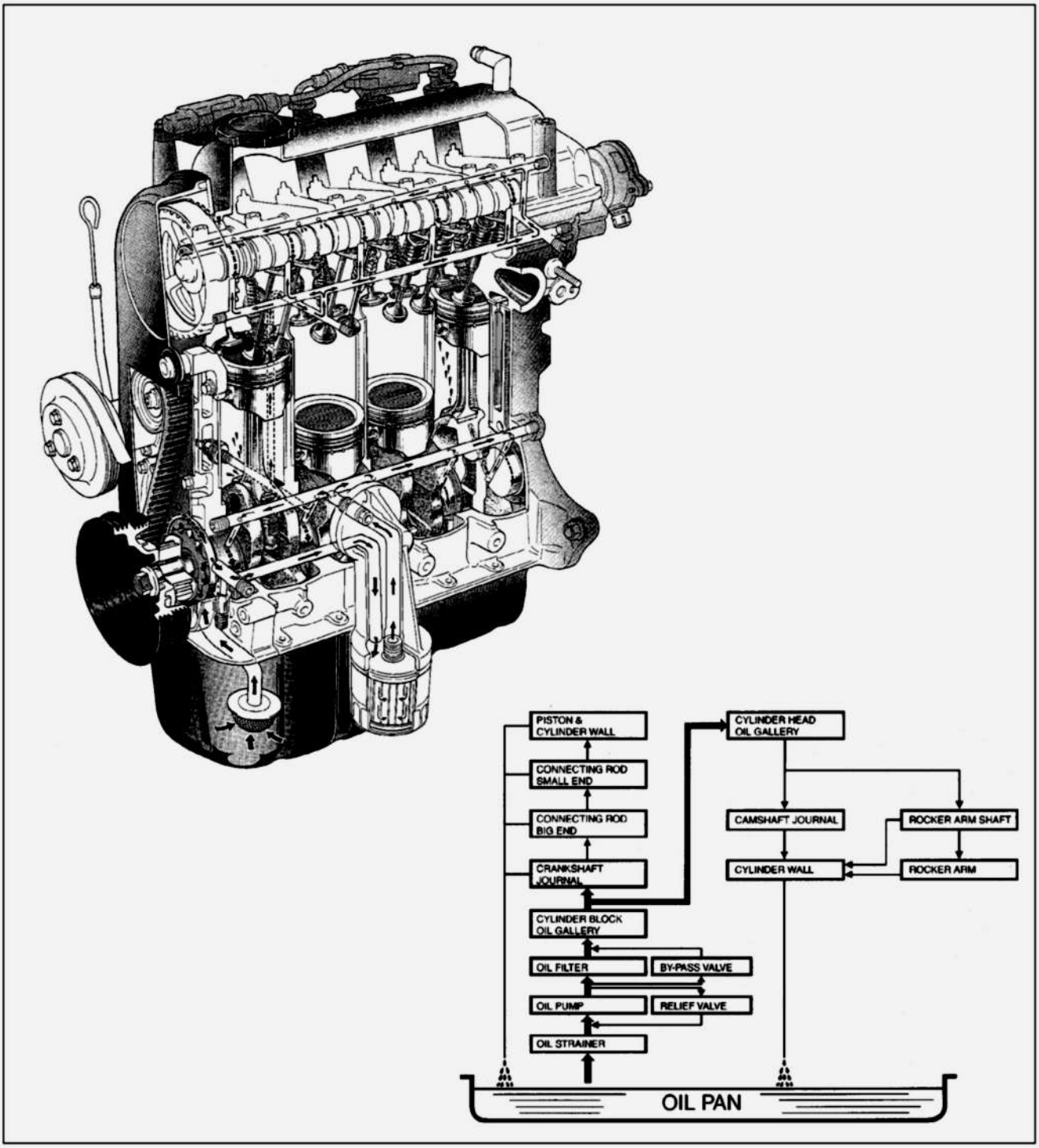
ENGINE LUBRICATION

The oil pump is of a trochoid type, and mounted on crankshaft at crankshaft pulley side.
Oil is drawn up throught oil pump strainer and passed through pump to oil filter.
The filtered oil flows into two paths in cylinder block.
In one path, oil reaches crankshaft journal bearings.
Oil from crankshaft journal bearings is supplied to connecting rod bearings by means of intersecting passages drilled in crankshaft, and then injected from a small hole provided on big end of connecting rod to lubricate piston, rings, and cylinder wall.
In another path, oil goes up to cylinder head and lubricates camshaft journals, rocker arms, camshaft, etc., passing through oil gallery in rocker arm shaft.
An oil relief valve is provided on oil pump. This valve starts relieving oil pressure when the pressure comes over about 400 kPa (4.0 kg/cm², 56.9 psi) Relived oil drains back to oil pan.



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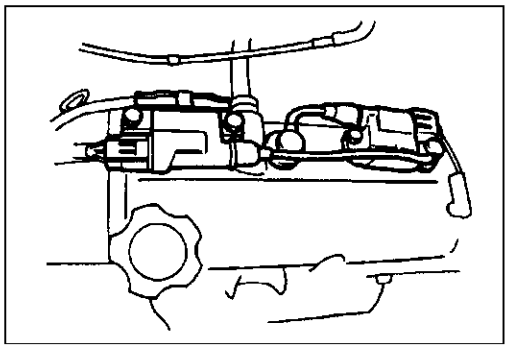
ON-VEHICLE SERVICE

COMPRESSION CHECK

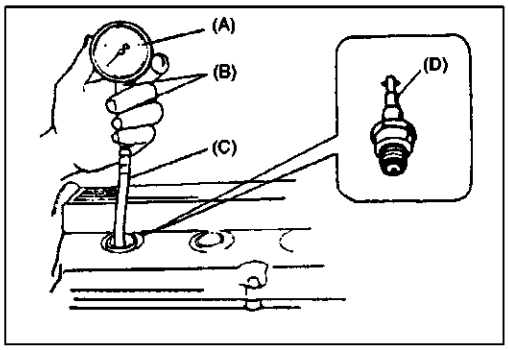
Check compression pressure on all four cylinders as follows:

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.

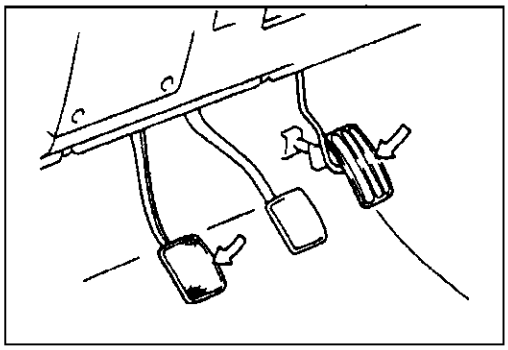


3) Disconnect wire harness connectors from four fuel injectors.
4) Remove ignition coil assemblies and all spark plugs referring to SECTION 6F.



5) Install special tool (Compression gauge) into spark plug hole.

Special Tool
(A): 09915-64510-001
(B): 09915-64510-002
(C): 09915-64530
(D): 09915-64550



6) Disengage clutch (to lighten starting load on engine) for M/T model, and depress accelerator pedal all the way to make throttle valve full-open.

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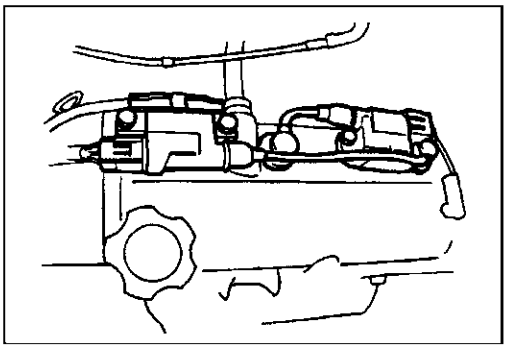
7) Crank engine with fully charged battery, and read the highest pressure on compression gauge.

NOTE:
For measuring compression pressure, crank engine at least 250 r/min. by using fully charged battery.

	Compression pressure
Standard	1400 kPa (14.0 kg/cm^2, 199.0 psi)
Limit	1100 kPa (11.0 kg/cm^2, 156.0 psi)
Max. difference between any two cylinders	100 kPa (1.0 kg/cm^2, 14.2 psi)



8) Carry out steps 5) through 7) on each cylinder to obtain four readings.
9) After checking, install spark plugs and ignition coil assemblies and connect injector wire harness connector securely.

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, 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.

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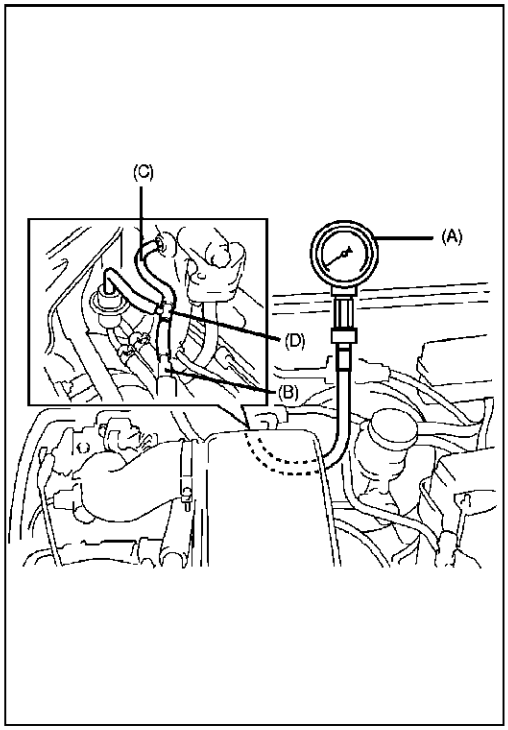


2) With engine stopped, disconnect pressure regulator vacuum hose from intake manifold and connect 3-way joint, hose and special tool (vacuum gauge and joint) between intake manifold and vacuum hose disconnected.

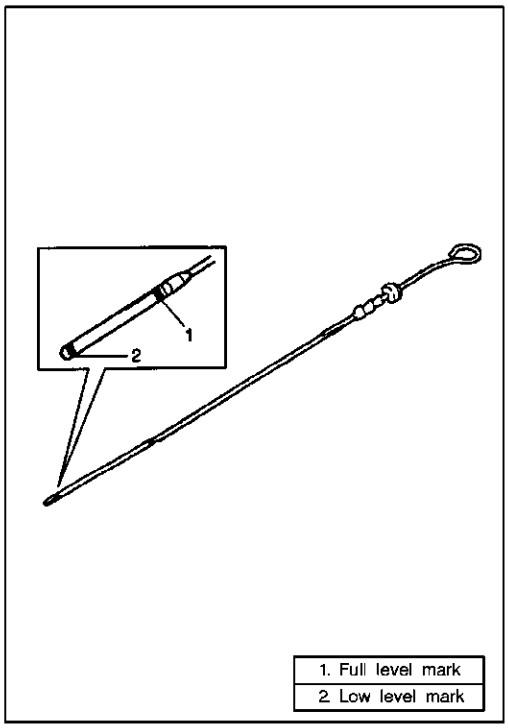
Special Tool
(A): 09915-67311
(B): 09918-08210

SUZUKI GENUINE PARTS
(C): Hose 09343-03087
(D): 3-way joint 09367-04002

3) Run engine at specified idle speed, and read vacuum gauge. Vacuum should be within following specification.

Vacuum specification (at sea level):
More than 53.7 kPa (40 cmHg, 15.7 in.Hg) at specified idling speed

4) After checking, connect vacuum hose to Intake manifold.



1. Full level mark
2. Low level mark

OIL PRESSURE CHECK

NOTE:
Prior to checking oil pressure, check following items.

- **Oil level in oil pan.**
  If oil level is low, add oil up to Full level mark on oil level gauge.
- **Oil quality.**
  If oil is discolored, or deteriorated, change it.
  For particular oil to be used, refer to the table in MAINTENANCE SERVICE section.
- **Oil leaks.**
  If leak is found, repair it.

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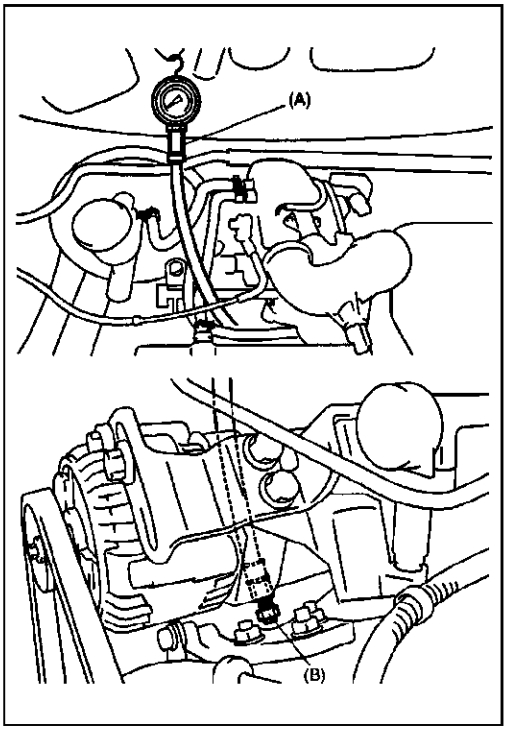


1) Hoist vehicle. Remove oil pressure switch from cylinder block.
2) Install special tool (Oil pressure gauge) to vacated threaded hole. Then lower vehicle.

Special Tool
(A): 09915-77310
(B): 09915-78211

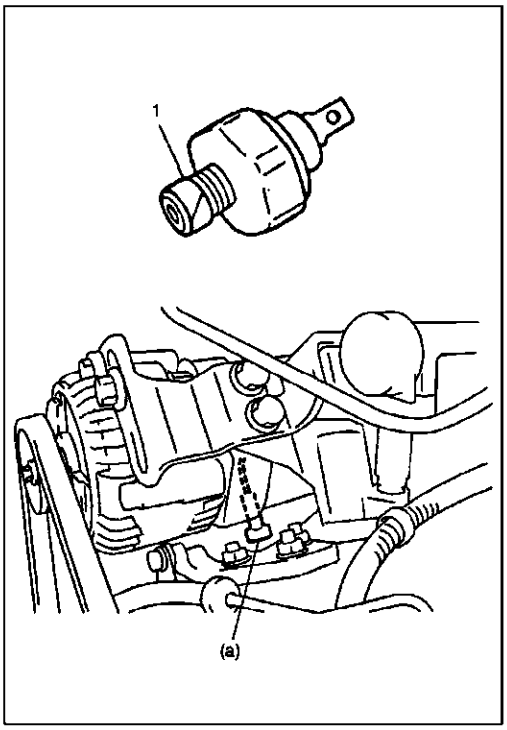
3) Start engine and warm it up to normal operating temperature.

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 r/min and mea-sure oil pressure.

Oil pressure specification:
280–450 kPa (2.8–4.5 kg/cm², 39.8–64.0 psi) at 4,000 r/min (rpm)

5) Stop engine and remove oil pressure gauge.



6) Before reinstalling oil pressure switch (1), be sure to wrap its screw threads with sealing tape and tighten switch to specified torque.

NOTE:
If sealing tape edge is bulged out from screw threads of switch, cut it off.

Tightening Torque
(a): 14 N-m (1.4 kg-m, 10.5 lb-ft)

7) Start engine and check oil pressure switch for oil leakage.
8) Stop engine and connect terminal to pressure switch terminal and cover pressure switch by boot with certainty.

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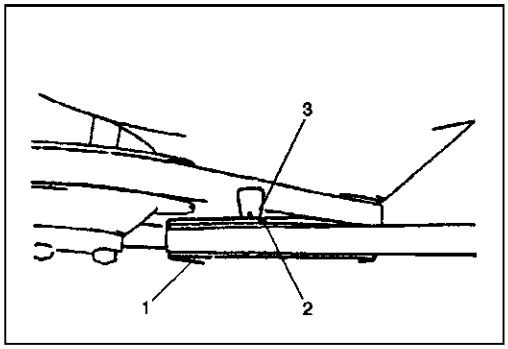
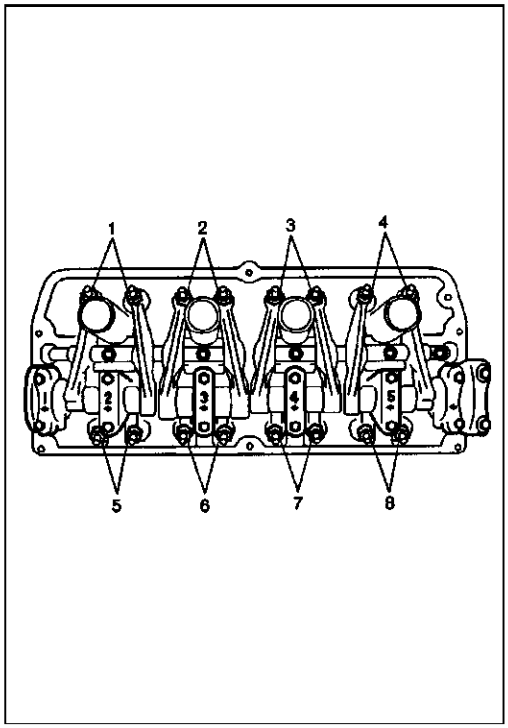


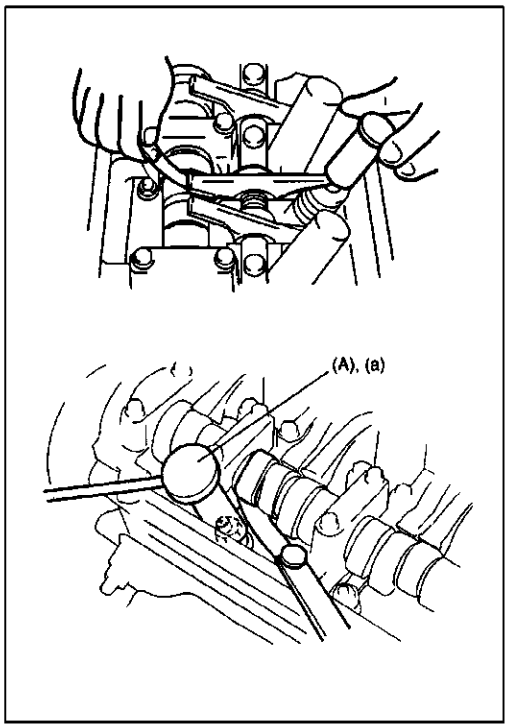
VALVE LASH (CLEARANCE)

1) Remove negative cable at battery.
2) Remove cylinder head cover referring to item "Cylinder Head cover".
3) Using 17 mm wrench, turn crankshaft pulley (1) clockwise until "V" mark (in white paint) (2) on pulley aligns with mark (3) on timing belt cover.



4) Check if the rocker arms of No.1 cylinder are off the respective cam lobes (of camshaft); if so, valves (1), (2), (5) and (7) in left figure are ready for clearance checking and adjustment.
   Check valve lashes at valves (1), (2), (5) and (7).
   If the rocker arms of No.4 cylinder are off the respective cam lobes, check valve lashes at valves (3), (4), (6) and (8).

NOTE:
When checking valve clearance, insert thickness gauge between camshaft and cam-riding face of rocker arm.



5) If valve lash is out of specification, adjust it to specification by turning adjusting screw after loosening lock nut.
   After adjustment, tighten lock nut to specified torque while hold-ing adjusting screw stationary, and then make sure again that valve lash is within 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)
Valve clearance specification	Intake	0.08–0.12mm (0.003–0.005 in.)	0.10–0.14 mm (0.006–0.006 in.)
	Exhaust	0.15–0.19 mm (0.006–0.008 in.)	0.16–0.20 mm (0.006–0.008 in.)

Special Tool
(A): 09917-18210

Tightening Torque
(a): 12 N·m (1.2 kg-m, 9.0 lb-ft)

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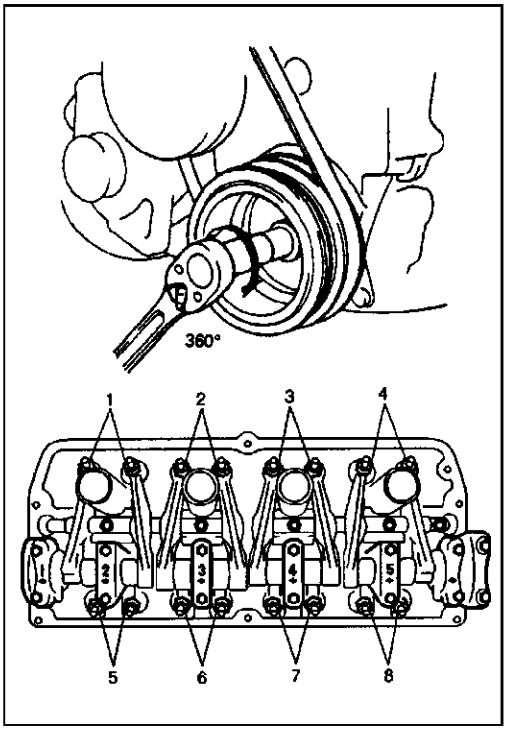
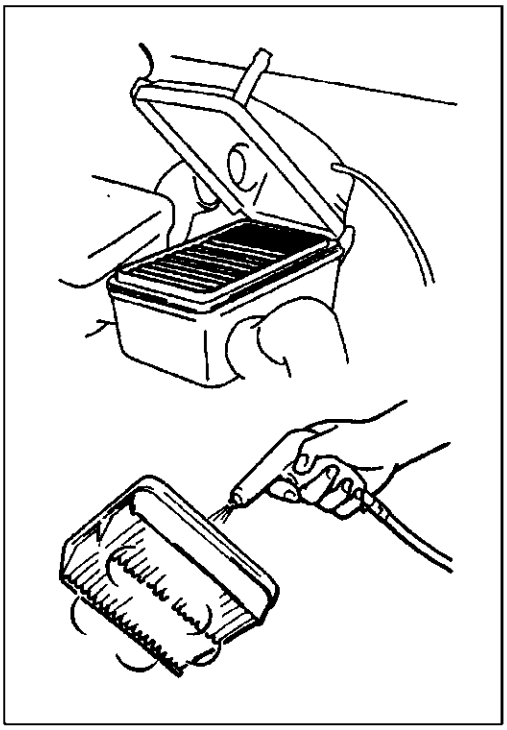


6) After checking and adjusting valve lashes at valves (1), (2), (5) and (7), (or (3), (4), (6) and (8)) rotate crankshaft exactly one full turn (360°) and check the same at valves (3), (4), (6) and (8) (or (1), (2), (5) and (7)). Adjust them as necessary.
7) After checking and adjusting all valves, reverse removal procedure for installation.



AIR CLEANER FILTER

REMOVAL AND INSTALLATION

1) Remove air cleaner case clamps.
2) Remove air cleaner filter from case.
3) Check air cleaner filter for dirt.
4) If necessary, blow off dust by compressed air from air outlet side of filter.
   If excessively dirty, replace air cleaner filter.
5) Reverse removal procedure for installation.
   Install air cleaner filter with its packing faced upward.

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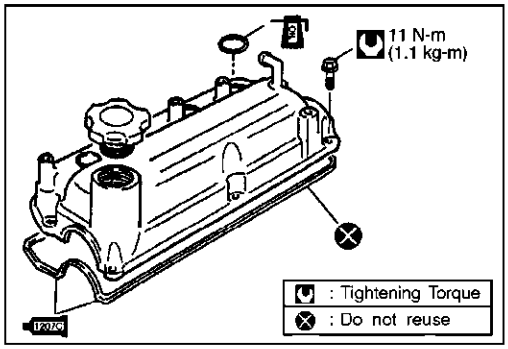
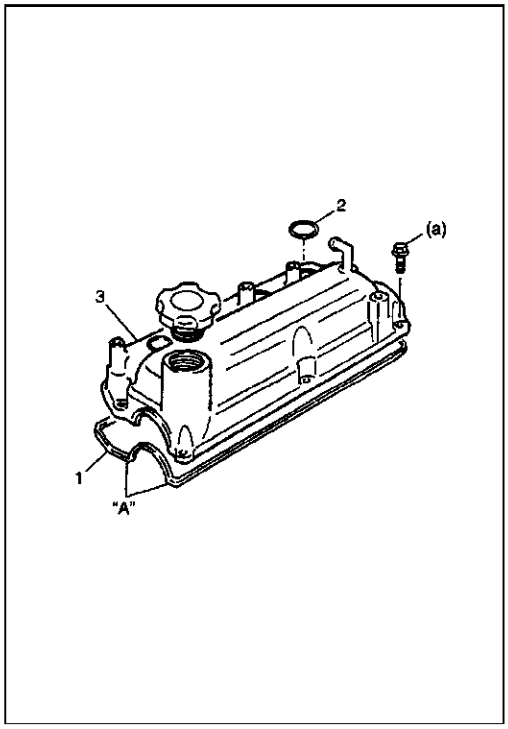


CYLINDER HEAD COVER

REMOVAL

1) Disconnect negative cable at battery.
2) Remove air cleaner case.
3) Remove ignition coil assemblies with high-tension cord.
4) Disconnect PCV valve and breather hose from head cover.
5) Remove cylinder head cover.



INSTALLATION

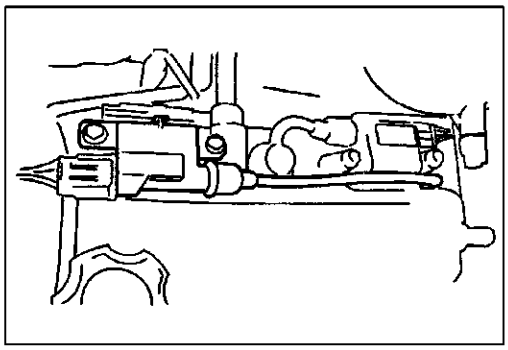
1) Install O-rings (2) and cylinder head cover gasket (1) to cylinder head cover (3).
   Apply sealant to angled parts "A" (timing pulley side and CMP sensor side) of cylinder head cover gasket indicated in figure.
   "A": sealant: 99000-31150
   Apply engine oil to O-rings.

   NOTE:
   Be sure to check each of these parts for deterioration or any damage before installation and replace if found defec-tive.

2) Install cylinder head cover to cylinder head and tighten cover bolts to specified torque.

   Tightening Torque
   (a): 11 N-m (1.1 kg-m, 8.0 lb-ft)

   NOTE:
   When installing cylinder head cover, use care so that cylinder head cover gasket or O-rings will not get out of place or fall off.



3) Install ignition coil assemblies with high-tension cord.
4) Connect PCV valve and breather hose to head cover.
5) Install air cleaner case.
6) Connect negative cable at battery.

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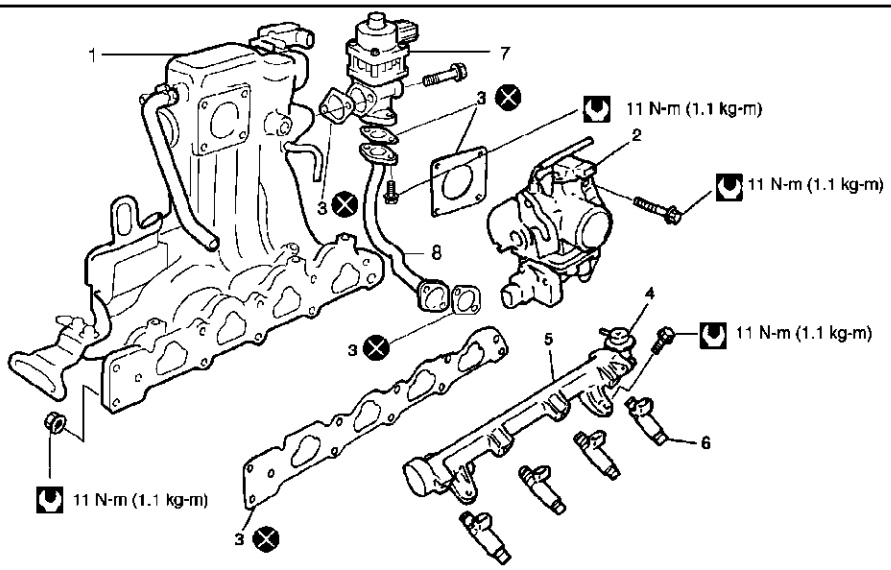
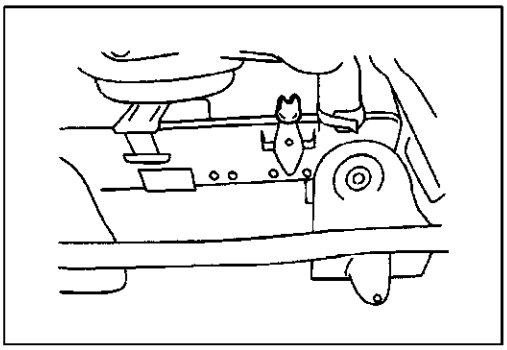
THROTTLE BODY AND INTAKE MANIFOLD



1. Intake manifold	3. Gasket	5. Fuel delivery pipe	7 EGR valve	: Tightening Torque
2. Throttle body	4 Fuel pressure regulator	6. Fuel injector	8 EGR pipe	: Do not reuse

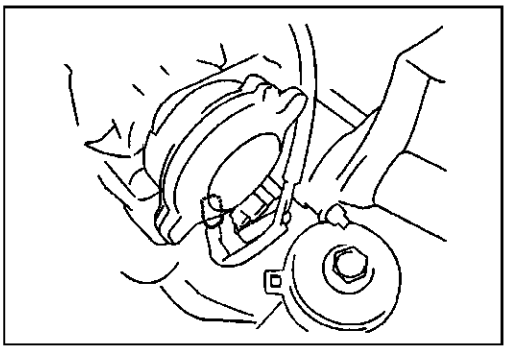
REMOVAL

1) Relieve fuel pressure according to fuel pressure relief procedure described in SECTION 6.
2) Disconnect negative cable at battery.



3) Drain cooling system.

WARNING:
To help avoid danger of being burned, do not remove drain plug 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 case.
5) Disconnect following electric lead wires:
   - Engine coolant temperature sensor
   - CMP sensor
   - Injectors lead wires at the coupler
   - EVAP canister purge valve
   - Throttle position sensor/Idle air control valve
   - Ignition coils
   - MAP sensor
   - EGR Valve

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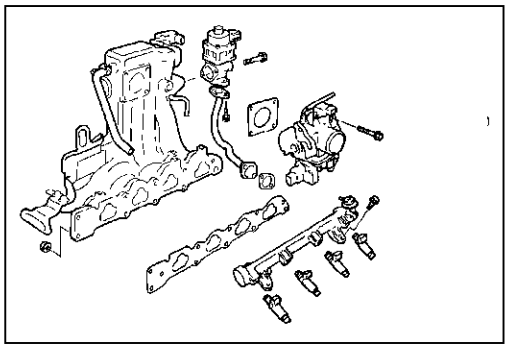
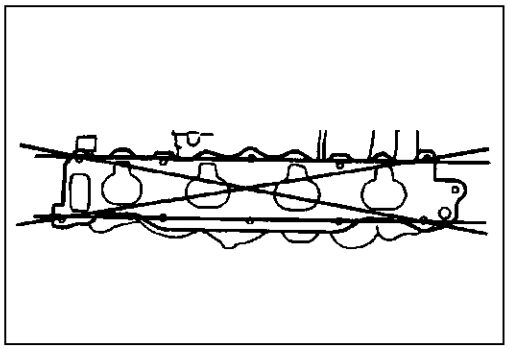
6) Disconnect harness clamps from intake manifold and engine hook.
7) Disconnect accelerator cable from throttle body.
8) Disconnect following hoses:
   - Brake booster hose from intake manifold
   - Canister purge hose from EVAP canister purge valve
   - Coolant hoses from idle air control valve
   - PCV hose from PCV valve
   - Fuel feed hose and return hose from each pipe
   - A/T vacuum hose (if equipped)



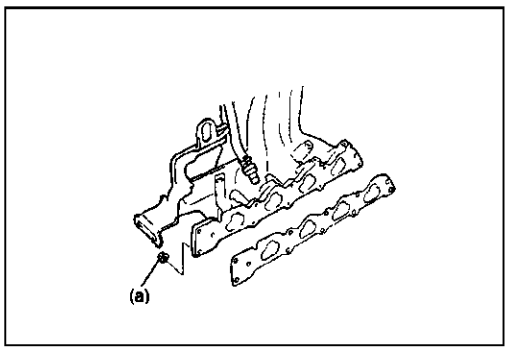
9) Remove intake manifold stiffeners.
10) Remove drive belt adjusting bolt.
11) Remove intake manifold with throttle body from cylinder head, and then its gasket.



INSPECTION

- Using a straight edge and thickness gauge, check surface con-tacting cylinder head for distortion. If distortion limit, given below, is exceeded, correct gasketed surface or replace intake manifold.

  Limit of distortion: 0.05 mm (0.002 in.)



INSTALLATION

Reverse removal procedure for installation noting the followings.

- Use new intake manifold gasket.
- Tighten nuts to specified torque.

  Tightening Torque
  (a): 11 N-m (1.1 kg-m, 8.0 lb-ft)

- Adjust accelerator cable play, referring to SECTION 6E1.
- Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
- Refill cooling system, referring to SECTION 6B.
- Adjust water pump drive belt tension, referring to SECTION 6B (6H).
- Upon completion of installation, turn ignition switch ON but en-gine OFF and check for fuel leaks.
- Finally, start engine and check for engine coolant leaks.

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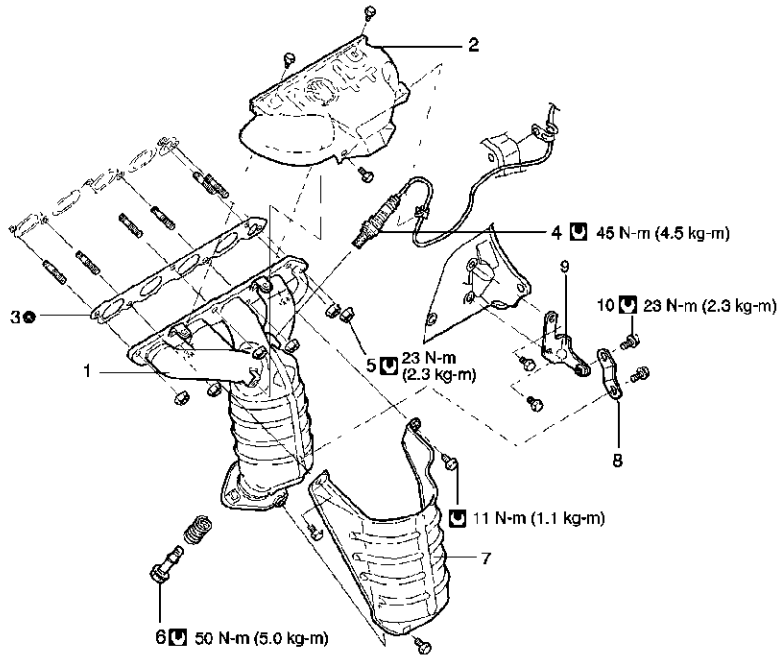
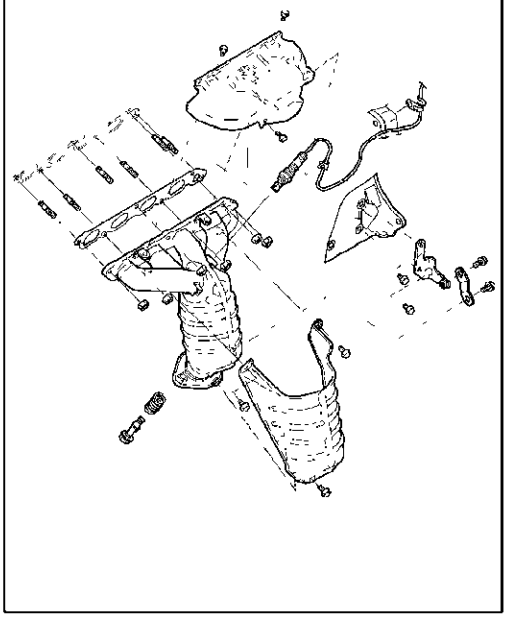
EXHAUST MANIFOLD



1. Exhaust manifold
2. Exhaust manifold cover
3. Gasket
4. Oxygen sensor
5. Exhaust manifold bolt and nut
6. Exhaust pipe bolt
7. Catalyst cover
8. Exhaust manifold bracket No. 2
9. Exhaust manifold bracket No. 1
10. Exhaust manifold bracket bolt
: Tightening Torque
: Do not reuse



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 oxygen sensor coupler.
3) Remove exhaust manifold cover of exhaust manifold.
4) Remove exhaust pipe from exhaust manifold.
5) Remove exhaust manifold bracket No. 2.
6) Remove exhaust manifold and its gasket from cylinder head.

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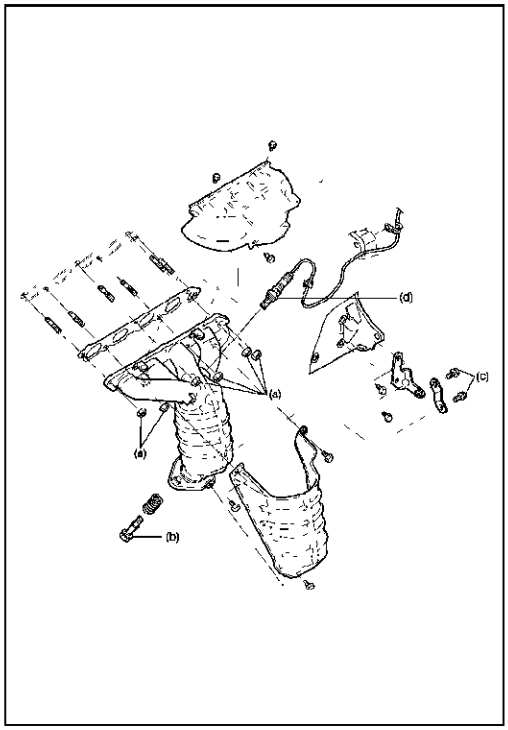

INSTALLATION

1) Install new gasket to cylinder head.
2) Install exhaust manifold.
   Tighten bolts and nuts to specified torque.

   Tightening Torque
   (a): 23 N-m (2.3 kg-m, 17.0 lb-ft)

3) Install pipe gasket and install exhaust pipe to exhaust manifold. Before installing pipe gasket, check it for deterioration or dam-age, and replace as necessary.
   Tighten pipe fasteners to specified torque.

   Tightening Torque
   (b): 50 N-m (5.0 kg-m, 36.0 lb-ft)

4) Install exhaust manifold bracket No. 2
   Tightening bolts to specified Torque.

   Tightening Torque
   (c): 23 N-m (2.3 kg-m, 17.0 lb-ft)

5) Tighten Oxygen sensor to specified torque

   Tightening Torque
   (d): 45 N-m (4.5 kg-m, 33.0 lb-ft)

6) Install upper cover and ground wire to exhaust manifold.
5) Connect oxygen sensor connector and fix wire harness with clamp.
6) Connect negative cable at battery.
7) Check exhaust system for exhaust gas leakage.

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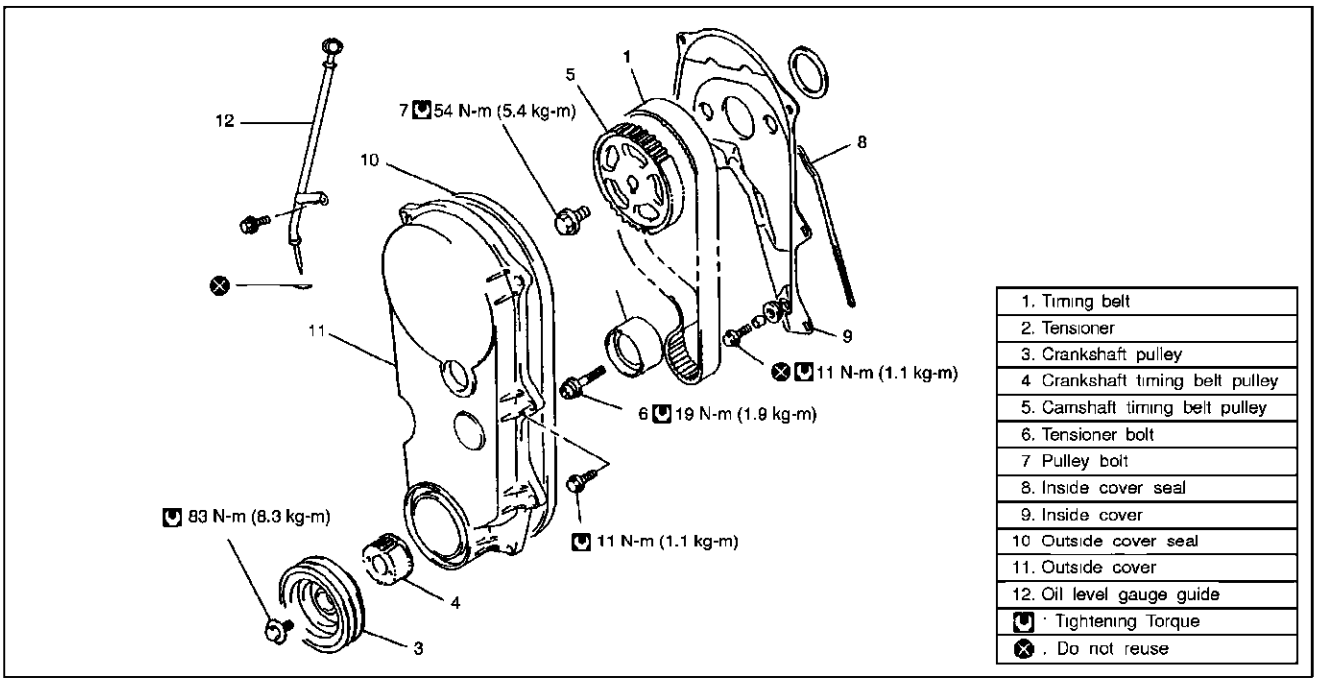
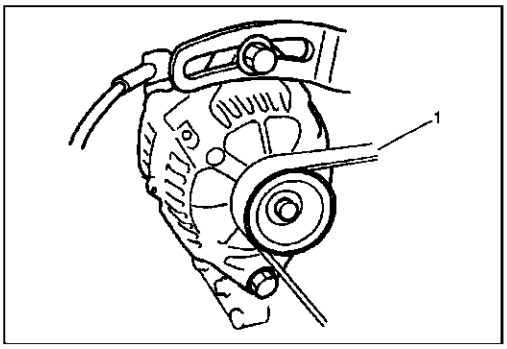
TIMING BELT AND BELT TENSIONER

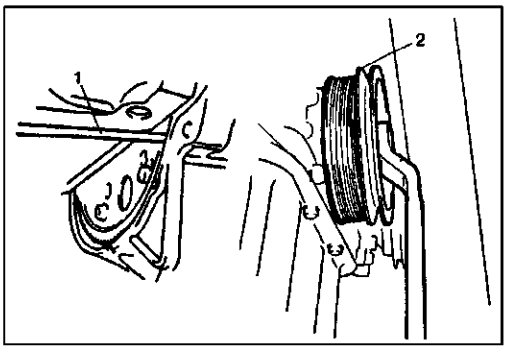


1. Timing belt
2. Tensioner
3. Crankshaft pulley
4. Crankshaft timing belt pulley
5. Camshaft timing belt pulley
6. Tensioner bolt
7. Pulley bolt
8. Inside cover seal
9. Inside cover
10. Outside cover seal
11. Outside cover
12. Oil level gauge guide
: Tightening Torque
: Do not reuse

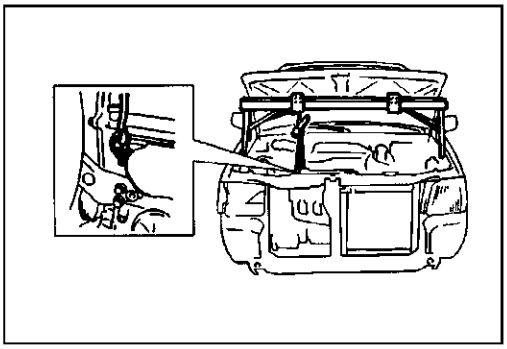


REMOVAL

1) Disconnect negative cable at battery.
2) Remove A/C compressor belt, if equipped.
3) Remove water pump pulley and water pump drive belt (1).



4) Lock crankshaft by engaging a proper size rod (1) with flywheel gear (M/T) or drive plate gear (A/T).
   Remove crankshaft pulley (2) with crankshaft locked.



5) Remove front bumper referring to "FRONT BUMPER" IN SECTION 9.
6) Remove right side head light referring to "HEADLIGHT" in SECTION 8.
7) Hold engine by using sling engine support device.
   Then, attach engine hook to exhaust manifold if necessary.

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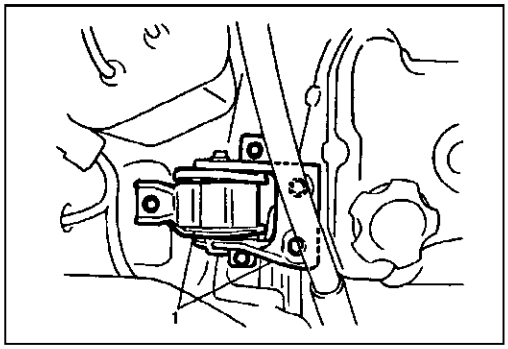
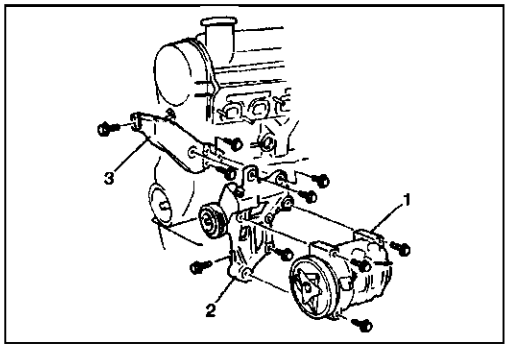
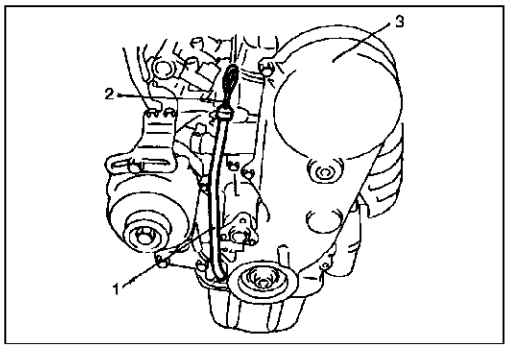


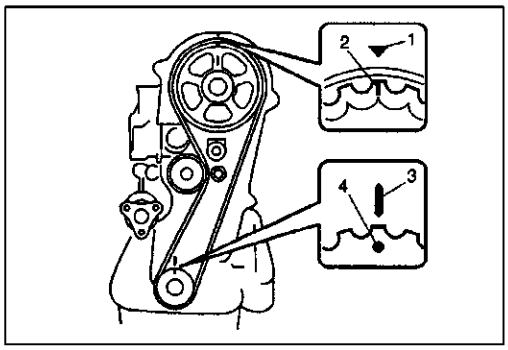
8) Detach engine mounting (1) from engine mounting bracket.



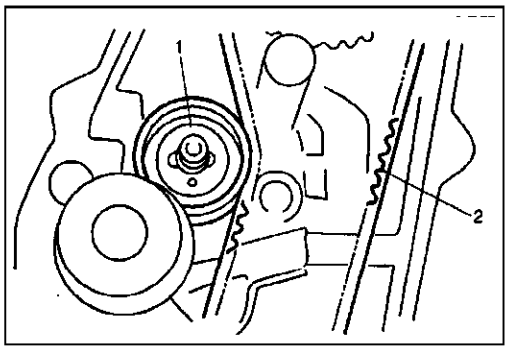
9) Detach A/C compressor (1) from its bracket with hose connected and hung it. Then remove engine mount bracket (3) and A/C compressor bracket (2) (if equipped with A/C).



10) Remove oil level gauge guide (1) with oil level gauge (2).
11) Remove timing belt outside cover (3).



12) For installation of timing belt, align 4 timing marks (1), (2), (3), (4) as shown in figure by turning crankshaft.



13) Remove timing belt tensioner (1) and timing belt (2).

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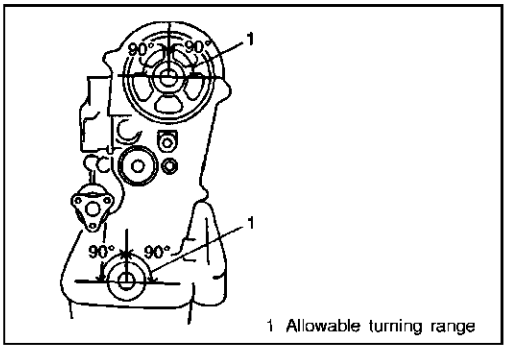
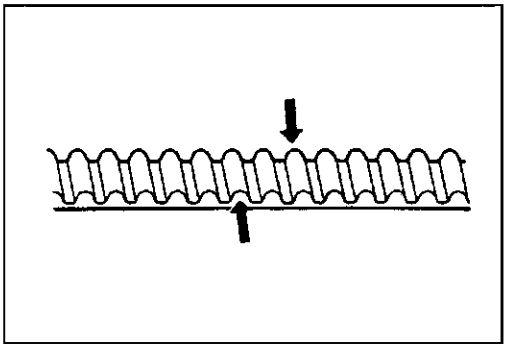


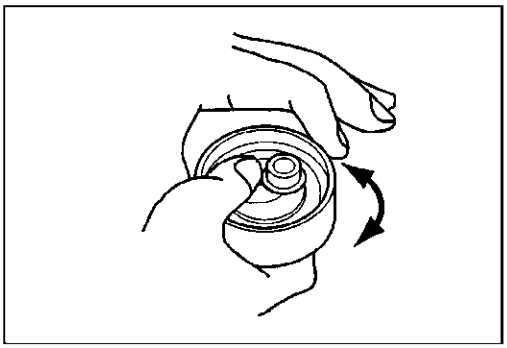
1 Allowable turning range

CAUTION:
- **After timing belt is removed, never turn camshaft and crankshaft independently more than such an extent as shown in figure. If turned, interference may occur among piston and valves, and parts related to piston and valves may be damaged.**
- **Never bend timing belt.**
- **Do not allow timing belt to come into contact with oil, water etc.**

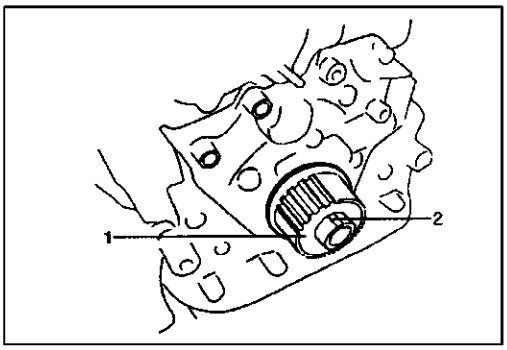


INSPECTION

- Inspect timing belt for wear or crack.
  Replace it as necessary.

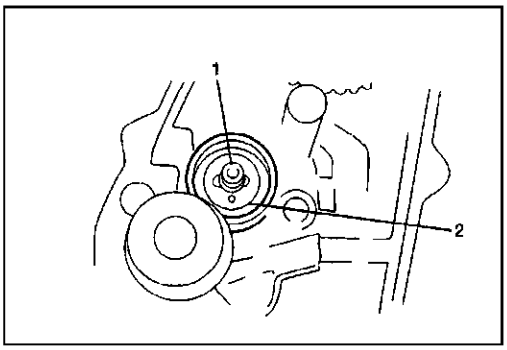


- Inspect tensioner for smooth rotation.



INSTALLATION

1) Install crank pulley key (2) to crankshaft.
   Install crankshaft timing belt pulley (1) to crankshaft, if removed.



2) Install tensioner (2).
   Do not tighten tensioner bolt (1) with wrench yet. Hand tighten only at this time.

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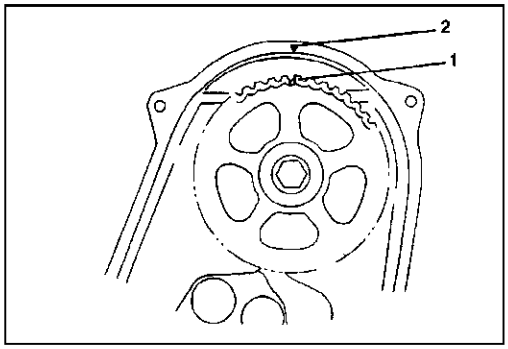
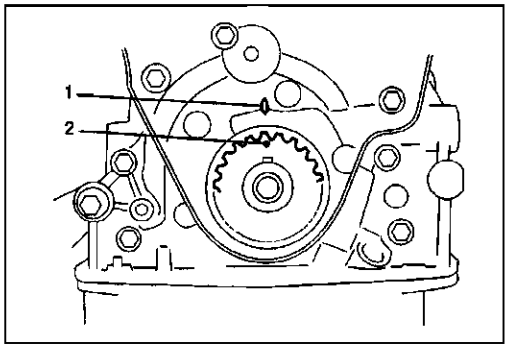
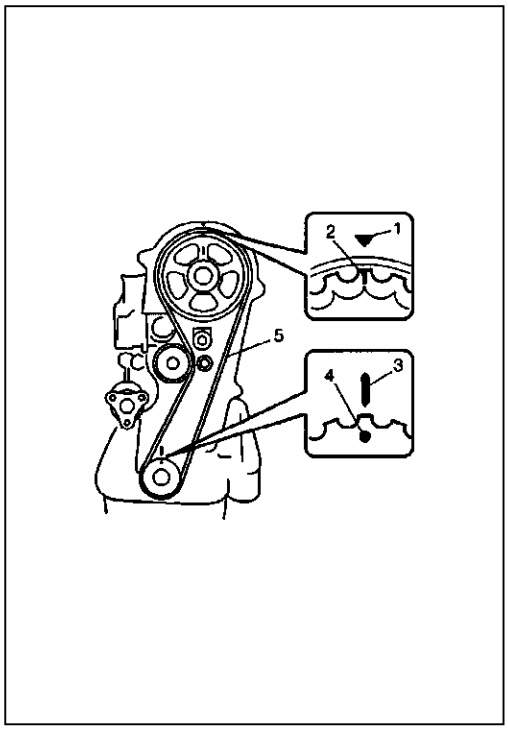


3) Check that timing mark (1) on camshaft timing belt pulley is aligned with mark (2) on timing belt inside cover. If not, align two marks by turning camshaft but be careful not to turn it more than its allowable turning range which is described on previous page.



4) Check that punch mark (2) on crankshaft timing belt pulley is aligned with arrow mark (1) on oil pump case. If not, align two marks by turning crankshaft but be careful not to turn it more than its allowable turning range which is described on previous page.



5) Remove spark plugs.
6) Install timing belt.
With two sets of marks (1), (2) and (3), (4) aligned, install timing belt on two pulleys in such a way that drive side (5) of belt is free from any slack.

NOTE:
- **When installing timing belt, match arrow mark (⇨) on timing belt with rotating direction of crankshaft.**
- **In this state, No.1 piston is at top dead center of exhaust stroke.**

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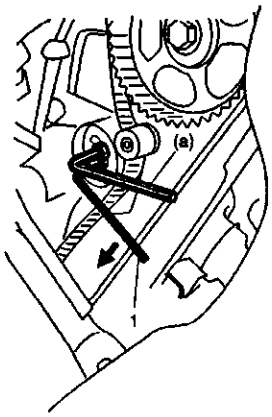
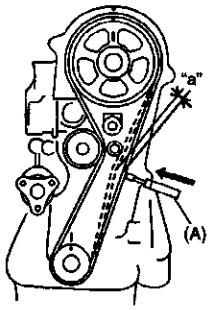




7) Attach hexagon wrench (1) to belt tensioner hole and adjust belt tension to specified.
   (a) Move tensioner by turning hexagon wrench clockwise as shown in figure till specified tension below is obtained.

   Special Tool
   (A): 09919-56010

   Belt tension under pressure 7 kg or 15.5 lb
   "a": 8 mm (0.31 in.) ..... New belt
   10 mm (0.39 in.) ..... Reuse belt

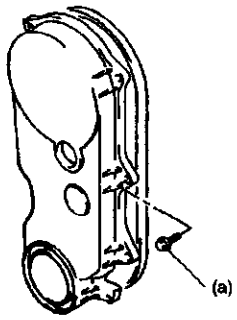
   (b) Tighten tensioner bolt at that position in step (a).

   Tightening Torque
   (a): 19 N-m (1.9 kg-m, 14.0 lb-ft)

   (c) To take up slack of timing belt, turn crankshaft two rotations clockwise after confirming that valve clearance is specification or more.

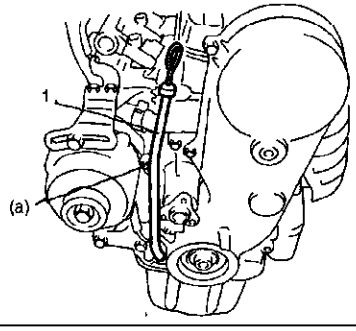
   Then confirm again that two sets of marks are aligned respectively. And confirm belt tension again as previously outlined.

If belt tension is out of specification, perform steps a) – c) repeatedly after loosen tensioner bolt.



8) Install spark plugs.
9) Install timing belt outside cover.
   Before installing, make sure that seal is between water pump and oil pump case.

   Tightening Torque
   (a): 11 N-m (1.1 kg-m, 8.0 lb-ft)



10) With engine oil applied to O-ring, install oil level guide (1).

    Tightening Torque
    (a): 11 N-m (1.1 kg-m, 8.0 lb-ft)

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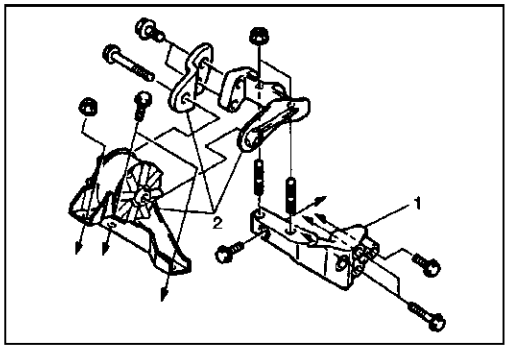
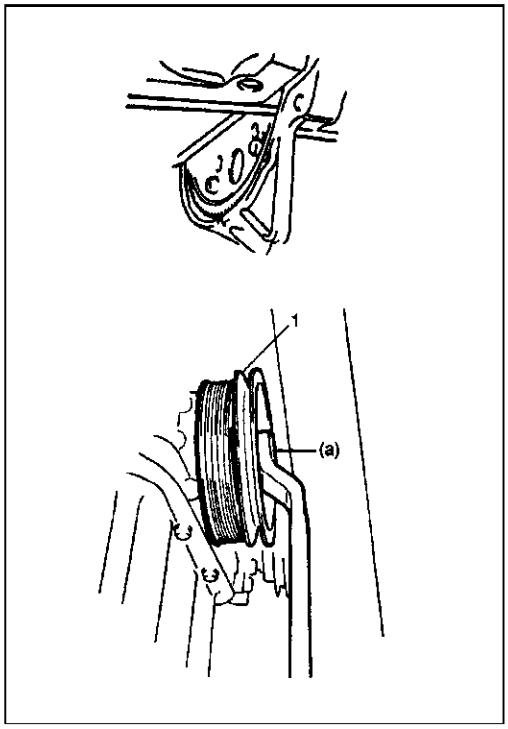
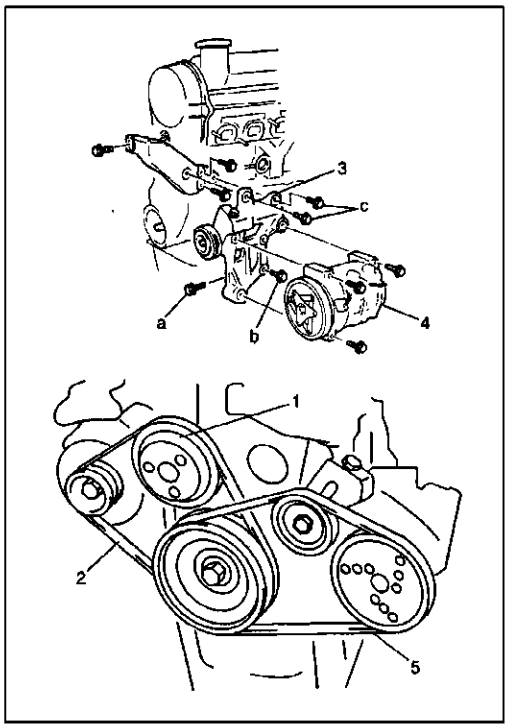


11) Install engine mounting bracket (1) and engine mountings (2) and then remove engine support device.



12) Install crankshaft pulley (1).
Lock crankshaft by engaging a proper size rod (2) with flywheel gear (M/T) or drive plate gear (A/T), and tighten pulley bolts to specified torque.

Tightening Torque
(a): 83 N-m (8.3 kg-m, 61.0 lb-ft)



13) Install water pump pulley (1) and water pump drive belt (2). Adjust water pump drive belt tension, referring to SECTION 6B.
14) Install A/C compressor bracket (3), A/C compressor (4) and A/C compressor belt (5), if equipped.
Tighten bolts as alphabetical order.
Adjust its belt tension, referring to SECTION 0B.
15) Install right side head light referring to "HEAD LIGHT" in SECTION 8.
16) Install front bumper referring to "FRONT BUMPER" in SECTION 9.
17) Connect negative cable to battery.

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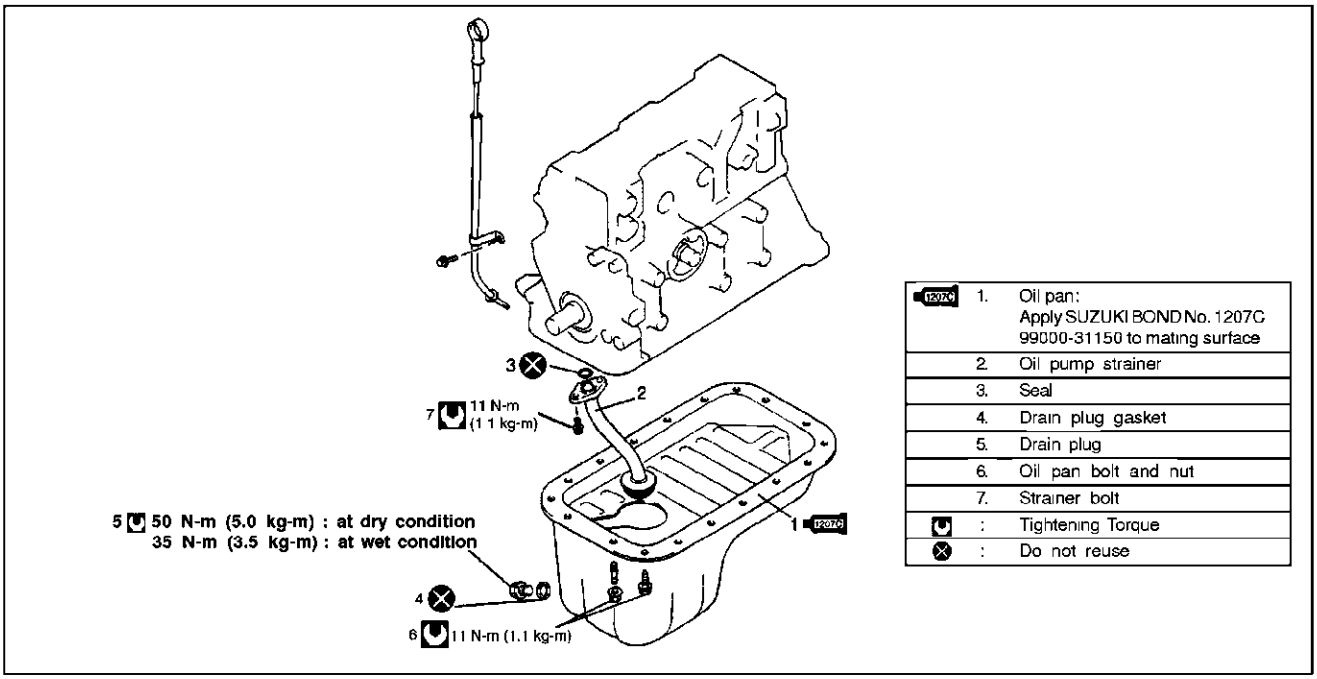
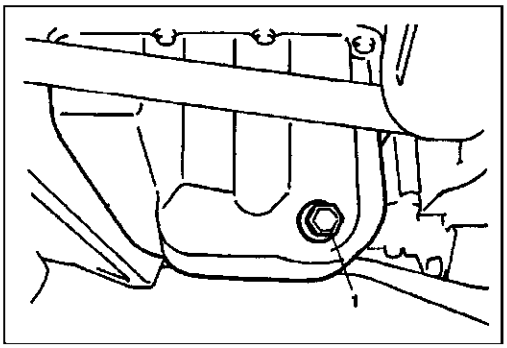
OIL PAN AND OIL PUMP STRAINER

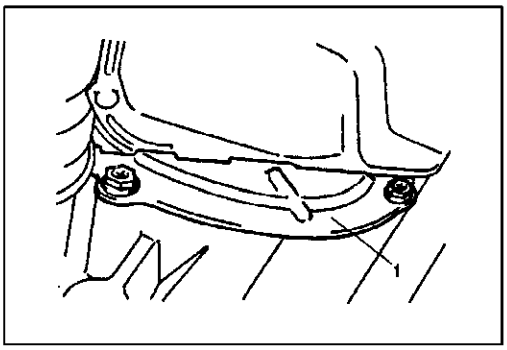


1207G	1.	Oil pan: Apply SUZUKI BOND No. 1207G 99000-31150 to mating surface
	2.	Oil pump strainer
	3.	Seal
	4.	Drain plug gasket
	5.	Drain plug
	6.	Oil pan bolt and nut
	7.	Strainer bolt
	:	Tightening Torque
	:	Do not reuse



REMOVAL

1) Drain engine oil by removing drain plug (1).



2) Remove clutch housing (torque converter housing for A/T) lower plate (1).

3) Disconnect exhaust pipe from exhaust manifold.
4) Remove oil pan and then oil pump strainer.

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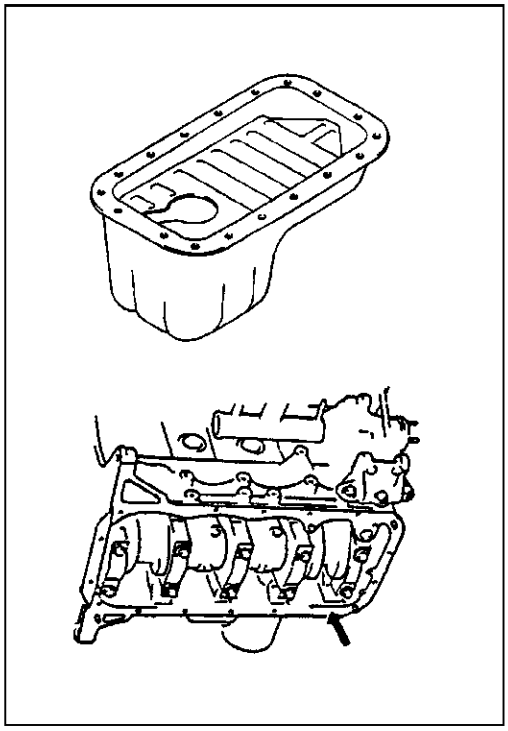
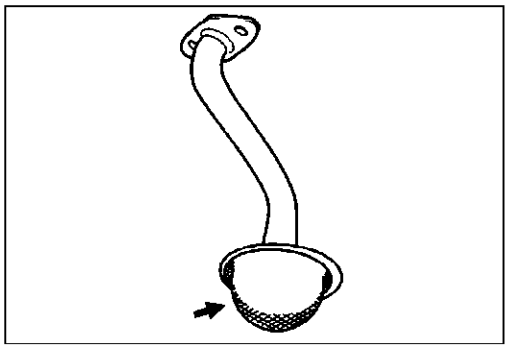
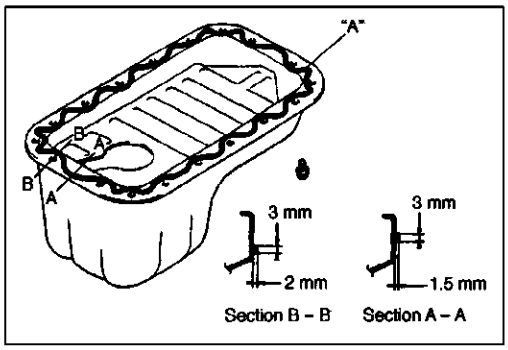


CLEANING

- Clean mating surfaces of oil pan and cylinder block. Remove oil, old sealant, and dusts from mating surfaces and oil pan inside.



- Clean oil pump strainer screen.



INSTALLATION

1) Apply sealant to oil pan mating surface continuously as shown in figure.

   "A" Sealant: 99000-31150

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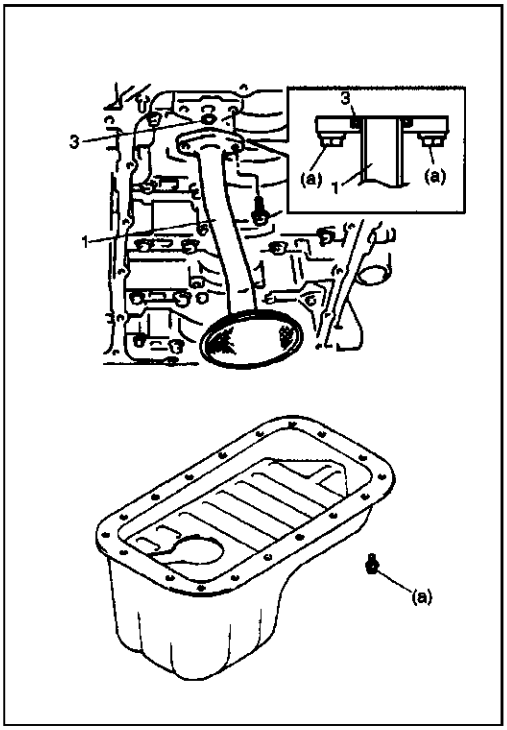


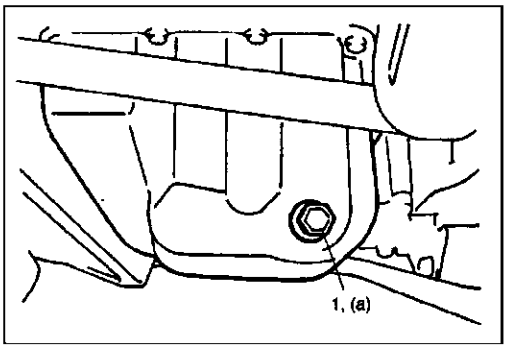
2) Install oil pump strainer (1) and oil pan (2).
Install new seal (3) to oil pump strainer in the position as shown in figure.
Install strainer to cylinder block, then tighten strainer bolt to spe-cified torque.

Tightening Torque
(a): 11 N-m (1.1 kg-m, 8.0 lb-ft)

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.

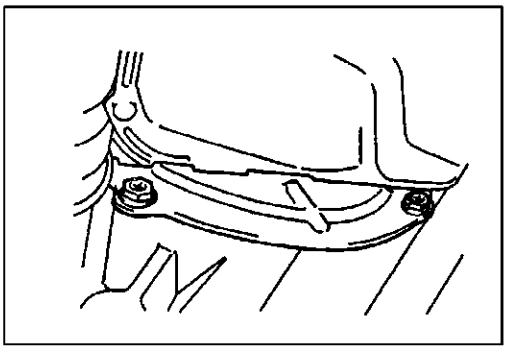
Tighten bolts to specified torque.

Tightening Torque
(a): 11 N-m (1.1 kg-m, 8.0 lb-ft)



3) Install new gasket and drain plug (1) to oil pan.
Tighten drain plug (1) to specified torque.

Tightening Torque
(a): 50 N-m (5.0 kg-m, 36.5 lb-ft) (Under dry conditon)
(a): 35 N-m (3.5 kg-m, 25.5 lb-ft) (Under wet condition)



4) Install clutch (torque converter) housing lower plate.

5) Connect exhaust manifold pipe to exhaust manifold.
6) Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in SECTION 0B.
7) Verify that there is no engine oil leakage and differential oil leakage at each connection.

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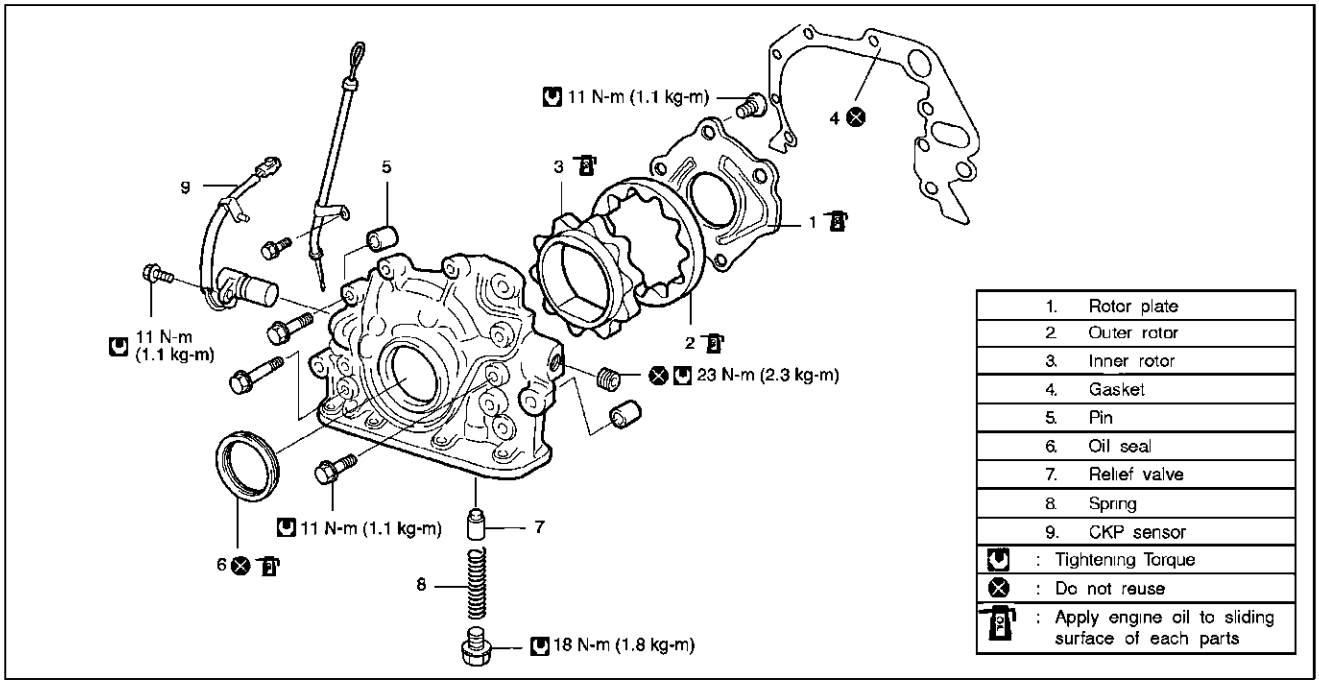
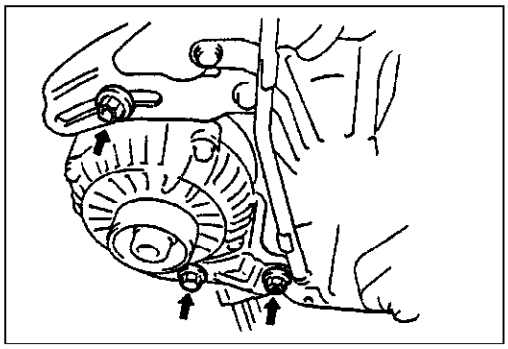
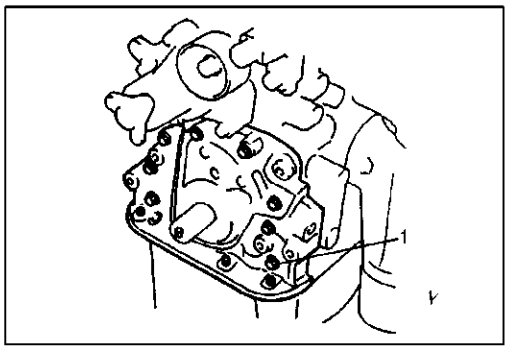
OIL PUMP



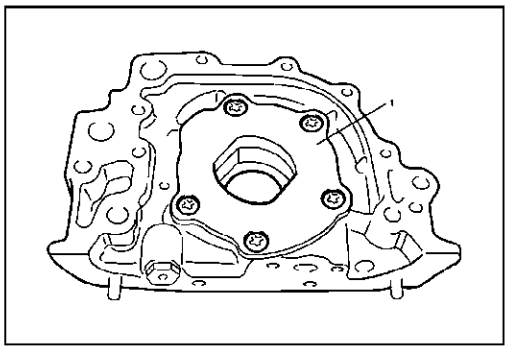


REMOVAL

1) Disconnect negative cable at battery.
2) Remove timing belt as previously outlined.
3) Remove generator and its bracket.



4) Remove timing belt inside cover.
5) Remove oil pan and oil pump strainer as previously outlined.
6) Disconnect CKP sensor connector and remove CKP sensor.
7) Remove oil pump assembly (1) after removing bolts.



DISASSEMBLY

1) Remove rotor plate (1).

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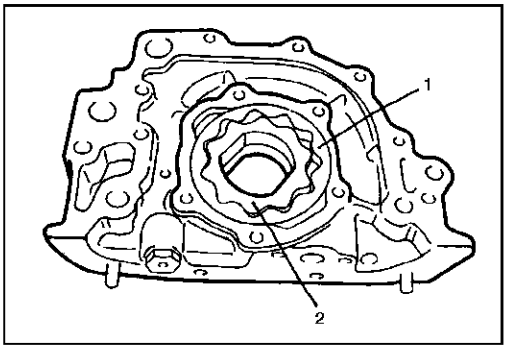
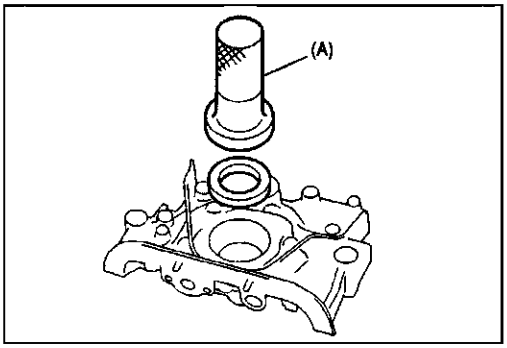


2) Remove outer roter (1) and inner rotor (2).

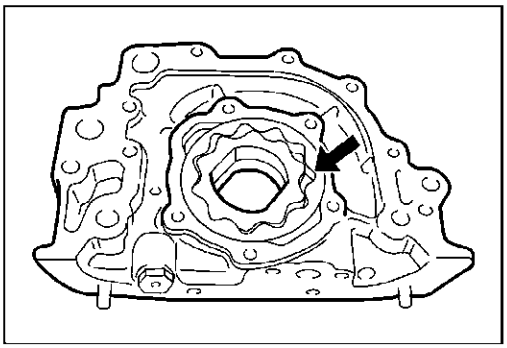


INSPECTION

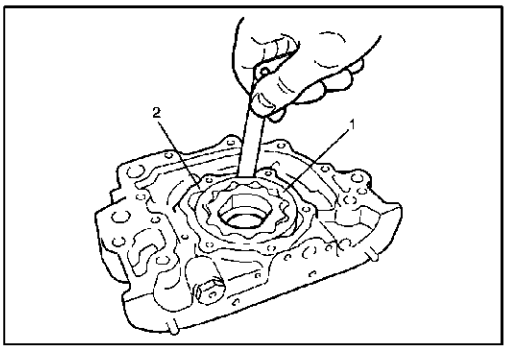
- Check oil seal lip for fault or other damage. Replace as necessary.

Special Tool
(A): 09913-75520

NOTE:
When installing oil seal, press-fit it till its end face is flush with oil pump case end face.



- Check outer and inner rotors, rotor plate, and oil pump case for excessive wear or damage.

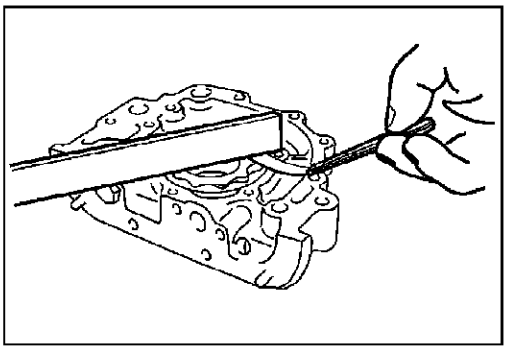


MEASUREMENT

- **Radial clearance**

Check radial clearance between outer rotor (1) and case (2), us-ing thickness gauge.
If clearance exceeds its limit, replace outer rotor or case.

Limit on radial clearance between outer rotor and case: 0.085 mm (0.0033 in.)



- **Side clearance**

Using straight edge and thickness gauge, measure side clearance.

Limit on side clearance: 0.115 mm (0.0045 in.)

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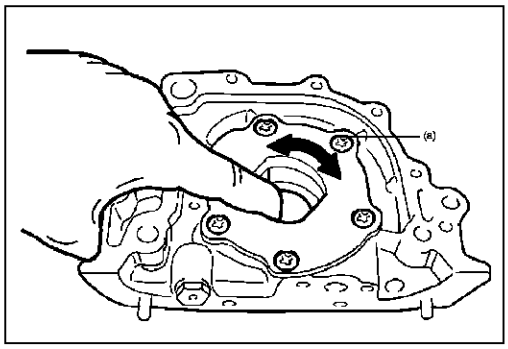
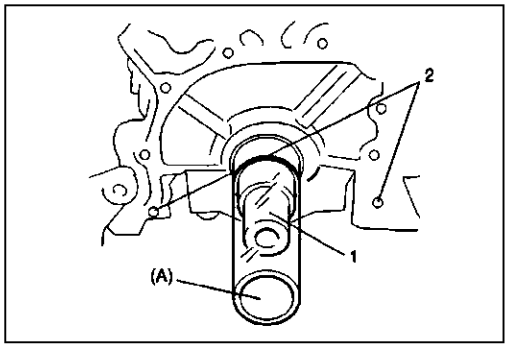
ASSEMBLY

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 and inner rotors to pump case.



4) Install rotor plate. Tighten screws securely.
   After installing plate, check to be sure that gears turn smoothly by hand.

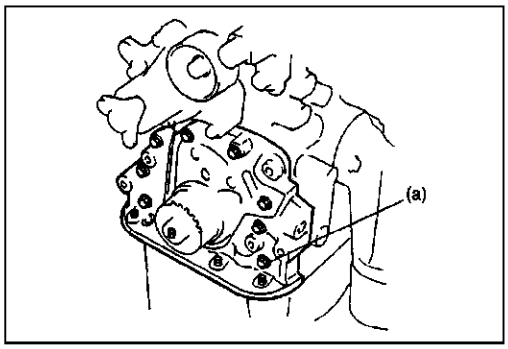
   Tightening Torque
   (a): 11 N-m (1.1 kg-m, 8.0 lb-ft)



INSTALLATION

1) Install two oil pump pins (2) and oil pump gasket to cylinder block. Use a new gasket.
2) To prevent oil seal lip from being damaged or upturned when installing oil pump to crankshaft, fit special tool (Oil seal guide) to crankshaft (1), and apply engine oil to special tool.

   Special Tool
   (A): 09926-18210



3) Install oil pump to cylinder block.

   Tightening Torque
   (a): 11 N-m (1.1 kg-m, 8.0 lb-ft)

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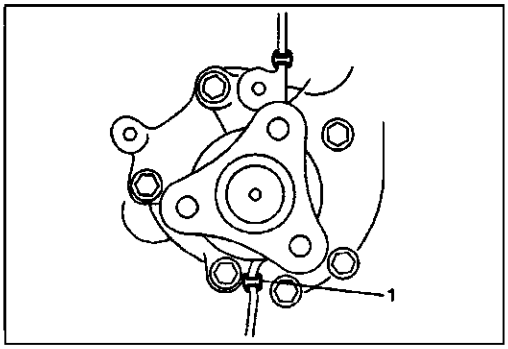

4) Install rubber seal (1) between oil pump and water pump.
5) Install timing belt, tensioner, oil pump strainer, oil pan and other parts as previously outlined.
6) Install CKP sensor to oil pump assembly and connect connector to CKP sensor.

Tightening Torque
CKP sensor bolt
(a): 11 N-m (1.1 kg-m, 8.0 lb-ft)

7) Check to ensure that all removed parts are back in place. Rein-stall any necessary parts which have not been reinstalled.
8) Adjust water pump drive belt tension, referring to "WATER PUMP BELT TENSION" in SECTION 6B.
9) If equipped with A/C, adjust A/C compressor belt tension refer-ring to "A/C COMPRESSOR DRIVE BELT INSPECTION" in SECTION 1B.
10) Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in SECTION 0B.
11) Connect negative cable at battery.
12) Verify that there is no coolant leakage and each oil leakage at each connection.
13) After completing installation, check oil pressure by running engine.

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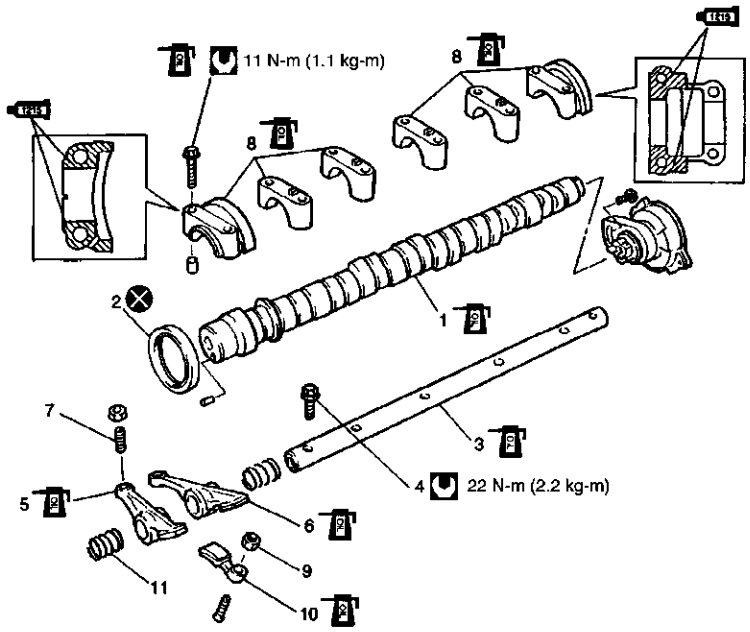
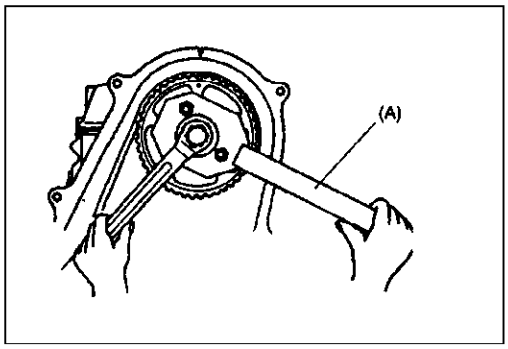
ROCKER ARMS, ROCKER SHAFT AND CAMSHAFT



	1	Camshaft
	2	Camshaft oil seal
	3	Rocker arm shaft
	4	Rocker shaft bolt
	5	Rocker arm No.1 (IN)
	6	Rocker arm No 2 (IN)
	7	Valve adjusting screw
1441	8	Camshaft housing: Apply SUZUKI BOND No.1215 to mating surfaces of housing No.1 and cylinder head, end housing and cylinder head
	9	Lock nut
	10	Rocker arm (EX)
	11.	Rocker arm spring
	: Tightening Torque	
	: Do not reuse	
	: Apply engine oil to sliding surface of each parts.	

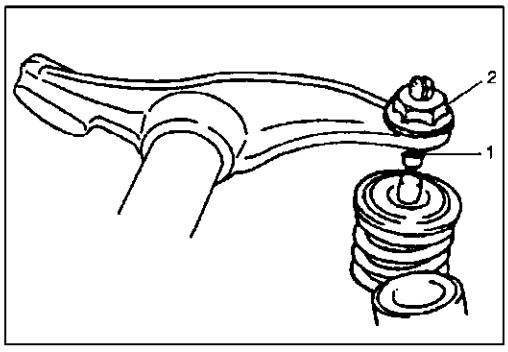


REMOVAL

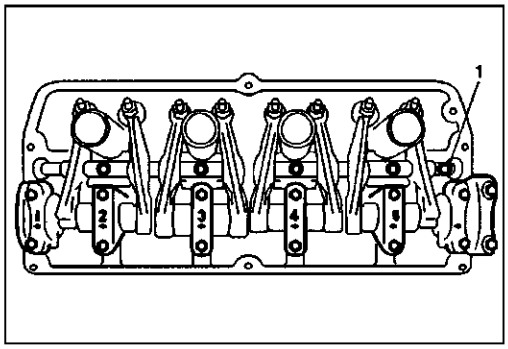
1) Disconnect negative cable at battery.
2) Remove timing belt as previously outlined.
3) Remove camshaft timing belt pulley by using special tool.

Special Tool
(A): 09917-68221

4) Remove cylinder head cover as previously outlined.



5) After loosening all valve adjusting screw lock nuts (2), turn adjusting screws (1) back all the way to allow all rocker arms to move freely.



6) Remove rocker arm shaft bolts (1).

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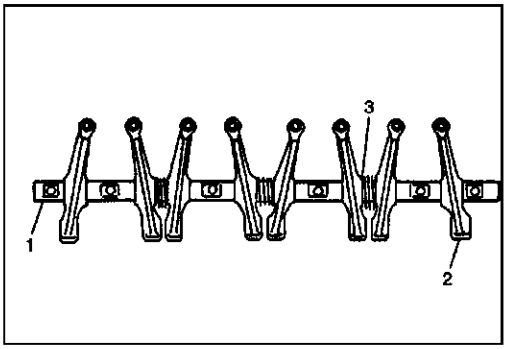
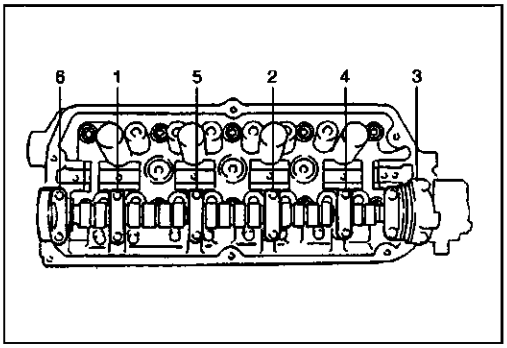
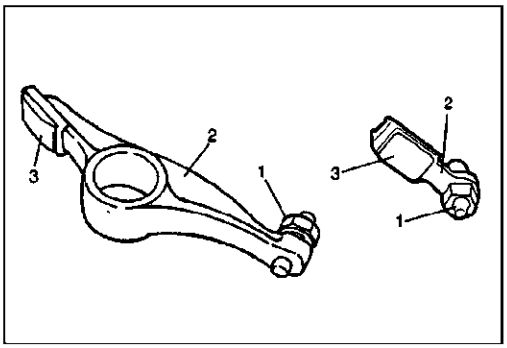


7) Remove rocker arm shaft (1) with intake rocker arms (2) and rocker arm spring (3).



8) Remove camshaft housing and camshaft.

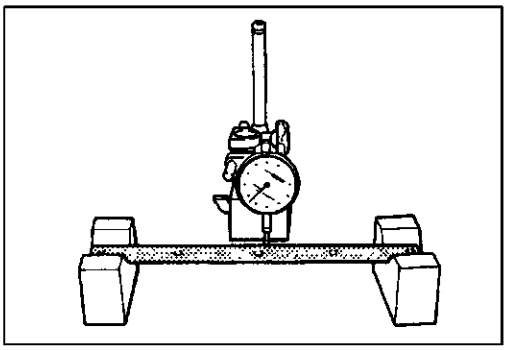
NOTE:
To remove camshaft housing bolts, loosen them in such order as indicated in figure, a little at a time.



INSPECTION

Adjusting Screw and Rocker Arm

If tip of adjusting screw (1) is badly worn, replace it.
Rocker arm (2) must be replaced if its cam-riding face (3) is badly worn.



Rocker Arm Shaft Runout

Using "V" blocks and dial gauge, check runout. If runout exceeds its limit, replace rocker arm shaft.

Runout limit: 0.20 mm (0.008 in.)

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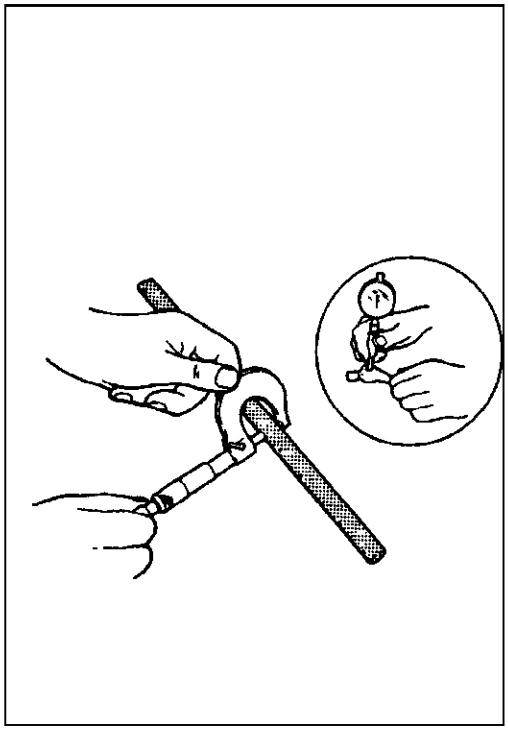


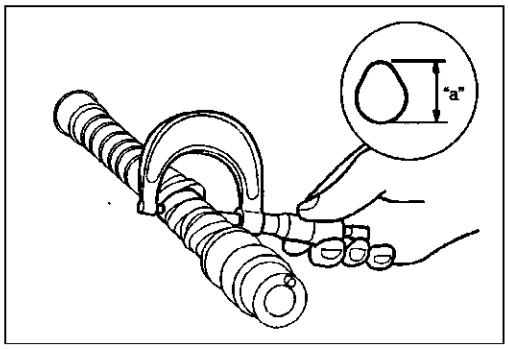
Rocker Arm-to-Rocker Arm Shaft Clearance

Using a micrometer and a bore gauge, measure rocker shaft dia. and rocker arm I.D.

Difference between two readings is arm-to-shaft clearance on which a limit is specified.

If limit is exceeded, replace shaft or arm, or both.

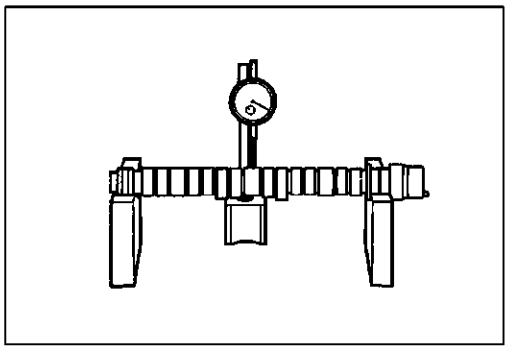
Item	Standard	Limit
Rocker arm I.D.	15.985–16.005 mm (0.629–0.630 in.)	——
Rocker arm shaft dia.	15.965 – 15.980 mm (0.6285 – 0.6291 in.)	——
Arm-to-shaft clearance	0.005 – 0.040 mm (0.0002 – 0.0016 in.)	0.06 mm (0.0024 in.)



Cam Wear

Using a micrometer, measured height of cam. If measured height is below limit, replace camshaft.

Cam height	Standard
Intake cam	30.391 – 30.551 mm (1.1965 – 1.2028 in.)
Exhaust cam	29.367 – 29.527 mm (1.1562 – 1.1625 in.)

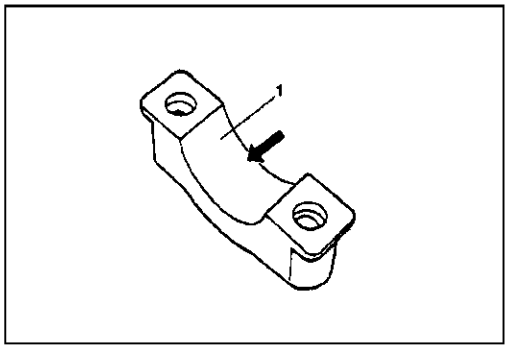


Camshaft Runout

Hold camshaft between two "V" blocks, and measure runout by using a dial gauge.

If runout exceeds the limit, replace 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 housing.

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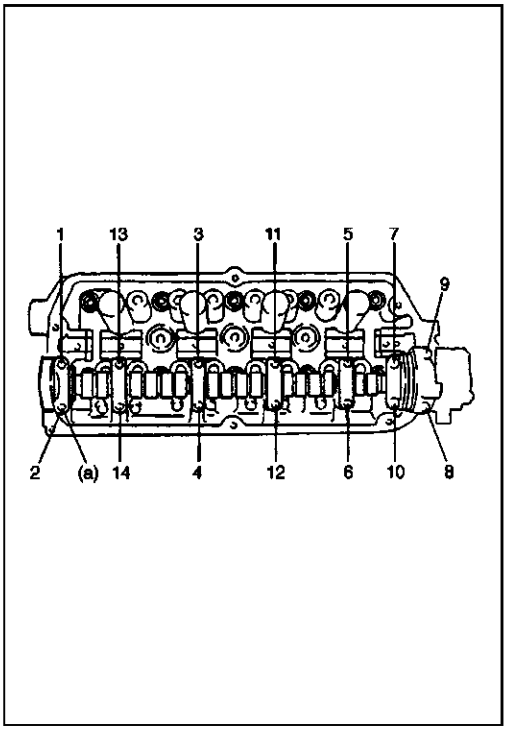


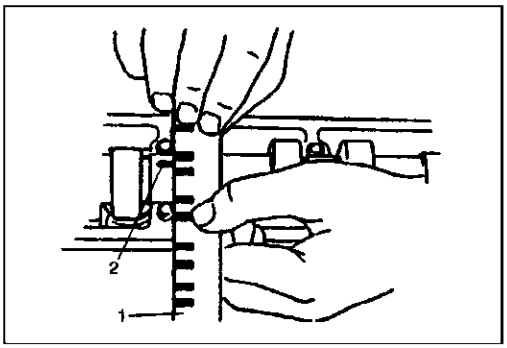
Check clearance by using gaging plastic.

The procedure is as follows.

1) Clean housing and camshaft journals.
2) Install camshaft to cylinder head.
3) Place a piece of gaging plastic the full width of journal of camshaft (parallel to camshaft).
4) Install camshaft housing, referring to the following page.
5) Tighten camshaft housing bolts in such order as indicated in figure a little at a time till they are tightened to specified torque.

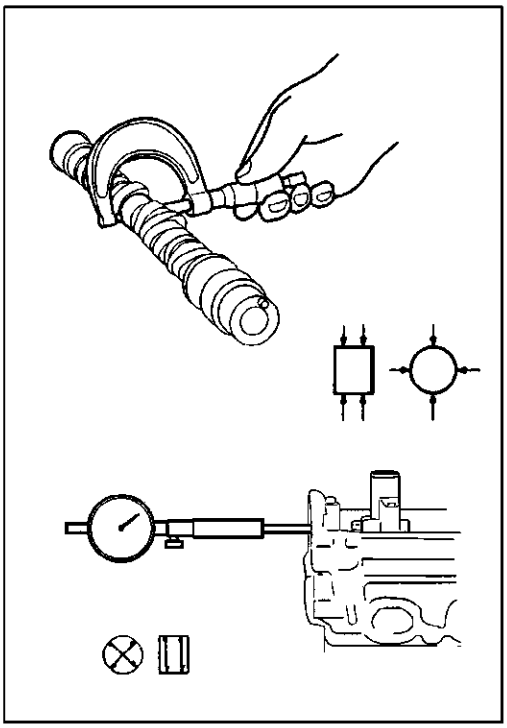
Tightening Torque
(a): 11 N-m (1.1kg-m, 8.0 lb-ft)

NOTE:
Do not rotate camshaft while gaging plastic is installed.



6) Remove housing and using scale (1) on gaging plastic envelope, measure gaging plastic width (2) at its widest point.

	Standard	Limit
Journal clearance	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.

Item	Standard
Camshaft Journal bore dia.	27.000 – 27.021 mm (1.0630 – 1.0638 in.)
Camshaft journal O.D.	26.934 – 26.955 mm (1.0603 – 1.0612 in.)

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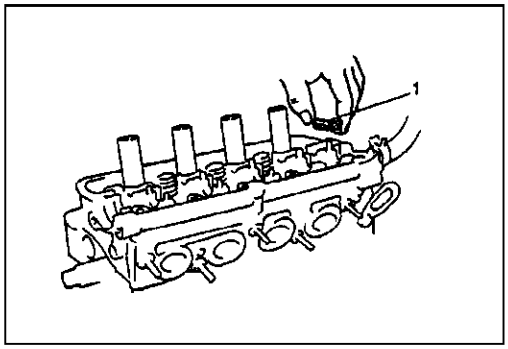
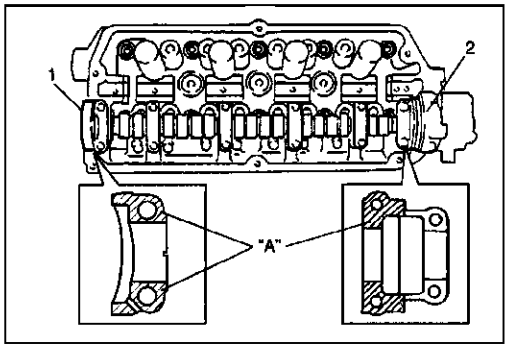


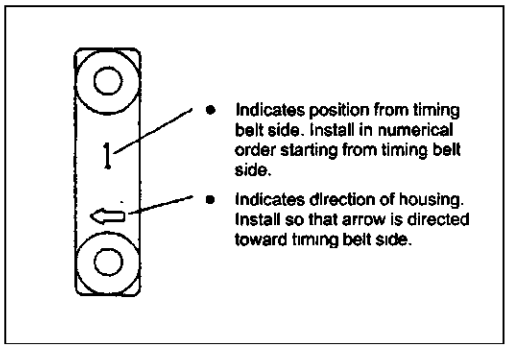
INSTALLATION

1) Fill small amount of engine oil into arm pivot holding part of cylinder head. Install rocker arm (exhaust side) (1).

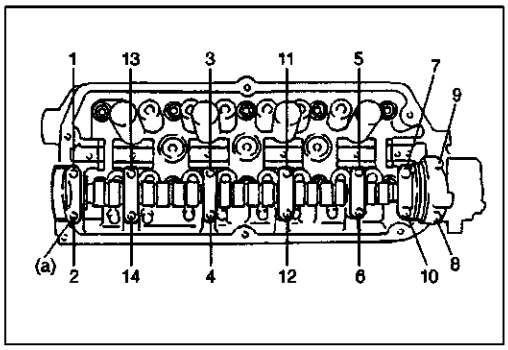


2) Apply engine oil to cams and journals on camshaft and put camshaft on cylinder head. Install camshaft housing to camshaft and cylinder head.
   - Apply engine oil to sliding surface of each housing against camshaft journal.
   - Apply sealant to mating surface of No.1 housing (1) and end housing (2) which will mate with cylinder head.

   "A" Sealant: 99000-31110

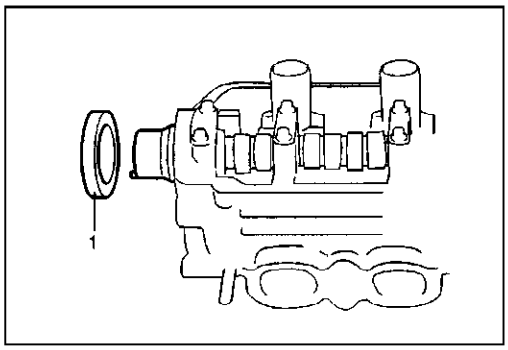


- Embossed marks are provided on each camshaft housing, indicating position and direction for installation. Install housing as indicated by these marks.
- As camshaft housing No. 1 retains camshaft in proper position as to thrust direction, make sure to first fit No. 1 housing to No. 1 journal of camshaft securely.



- After applying engine oil to housing bolts, tighten them temporarily first. Then tighten them by following sequence as indicated in figure.
  Tighten a little at a time and evenly among bolts and repeat tightening sequence three to four times before they are tightened to specified torque.

  Tightening Torque
  (a): 11 N-m (1.1 kg-m, 8.0 lb-ft)



3) Install new camshaft oil seal (1).
   After applying engine oil to oil seal lip, press-fit camshaft oil seal till oil seal surface becomes flush with housing surface.

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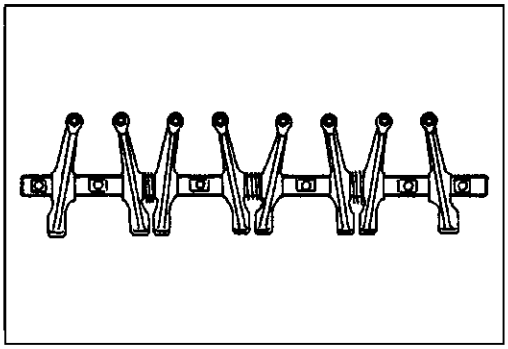
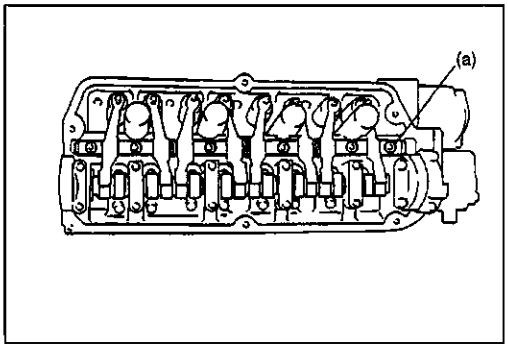
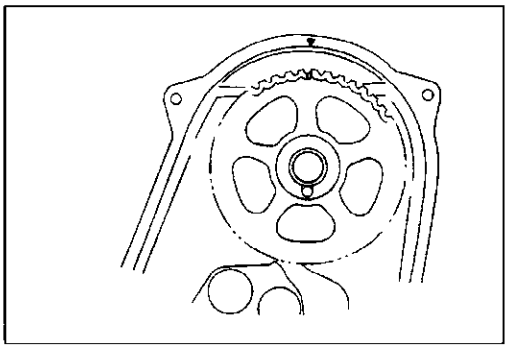


4) Apply engine oil to rocker arm shaft and rocker arms.
5) Install rocker arm shaft, rocker arm (intake side) and rocker arm spring.

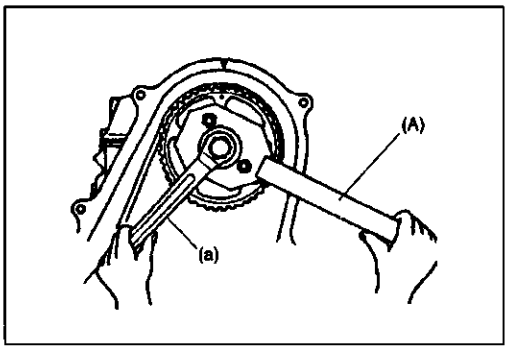


6) Install rocker arm shaft bolts and tighten them to specified torque.

Tightening Torque
(a): 22 N-m (2.2 kg-m, 16.0 lb-ft)



7) Install camshaft timing belt pulley to camshaft while fitting pin on camshaft into slot.



8) Using special tool, tighten pulley bolt to specified torque.

Tightening Torque
(a): 54 N-m (5.4 kg-m, 39.0 lb-ft)

Special Tool
(A): 09917-68221

9) Install belt tensioner, timing belt, outside cover, crankshaft pulley and water pump belt as previously outlined.

10) Adjust valve clearance as previously outlined.
11) Install cylinder head cover.
12) Connect negative cable at battery.
13) Confirm that ignition timing is within specification referring to SECTION 6F.

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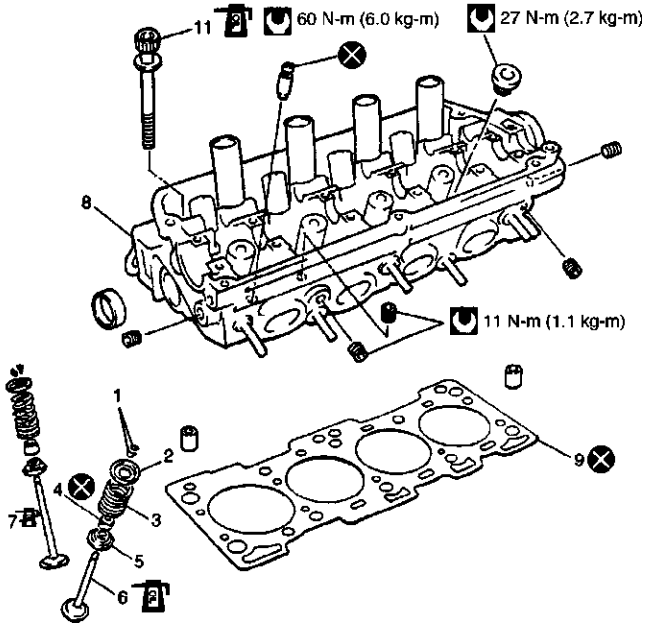
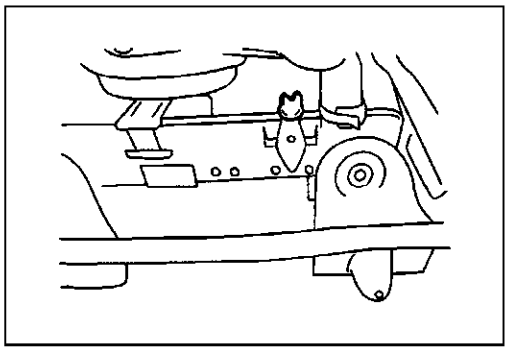
VALVES AND CYLINDER HEAD



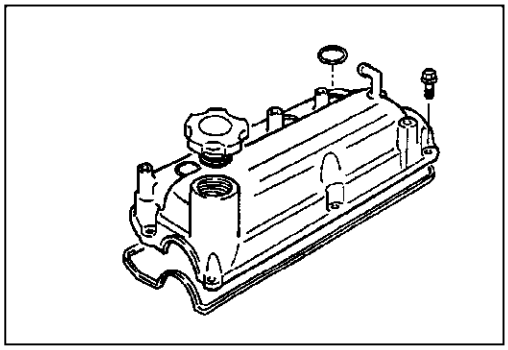
	1. Valve cotters 2. Valve spring retainer
	3. Valve spring
	4. Valve stem seal
	5. Valve spring seat
☐	6. Exhaust valve
☐	7. Intake valve
	8. Cylinder head
	9. Cylinder head gasket
	10 Oil venturi plug
☐	11 Cylinder head bolt
	Apply engine oil.
	12 Oil gallery plug
	: Tightening Torque
	: Do not reuse

REMOVAL

1) Relieve fuel pressure according to fuel pressure relief procedure described in SECTION 6.
2) Disconnect negative cable at battery.



3) Drain cooling system.



4) Remove cylinder head cover as previously outlined. Loosen all valve lash adjusting screws fully.

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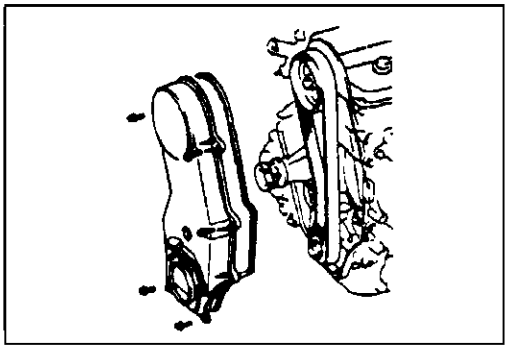
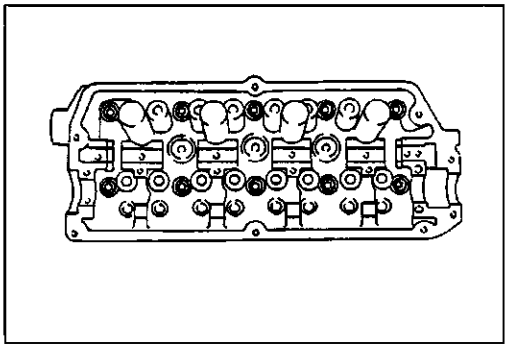


5) Remove timing belt rocker arm shaft, rocker arm and camshaft as previously outlined.
Support engine by engine supporting device and detach engine sling device.



6) Disconnect exhaust pipe from exhaust manifold.
7) Loosen cylinder head bolts in such order as indicated in figure and remove them.
8) Check all around cylinder head for any other parts required to be removed or disconnected and remove or disconnect whatever necessary.

9) Remove cylinder head with intake manifold and exhaust manifold, using lifting device.

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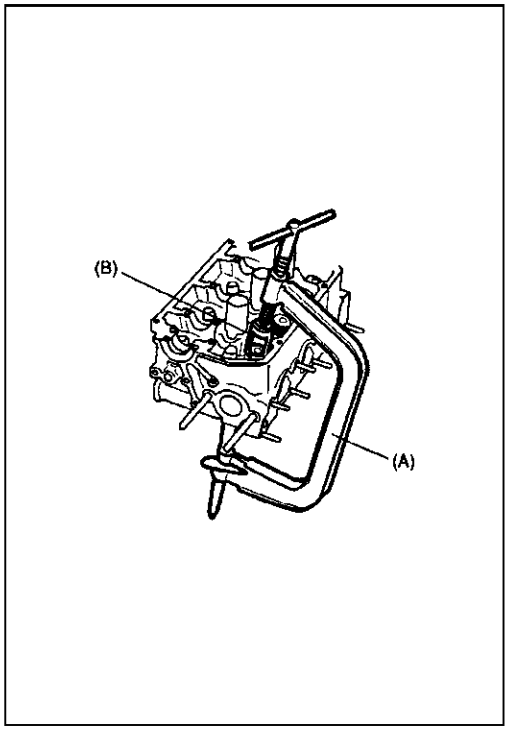
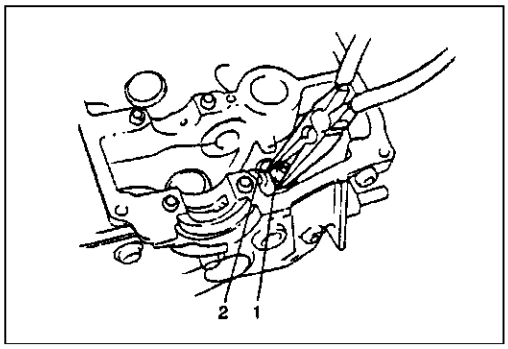


DISASSEMBLY

1) For ease in servicing cylinder head, remove intake manifold, exhaust manifold and thermostat case from cylinder head.
2) Using special tool (Valve lifter), compress valve springs and then remove valve cotters by using special tool (Forceps) as shown.

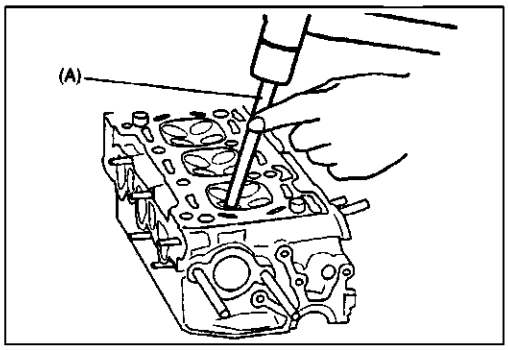
Special Tool
(A): 09916-14510
(B): 09916-14910

3) Release special tool, and remove spring retainer and valve spring.
4) Remove valve from combustion chamber side.



5) Remove valve stem oil seal (1) from valve guide, and then valve spring seat (2).

NOTE:
Do not reuse oil seal once disassembled. Be sure to use new oil 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.

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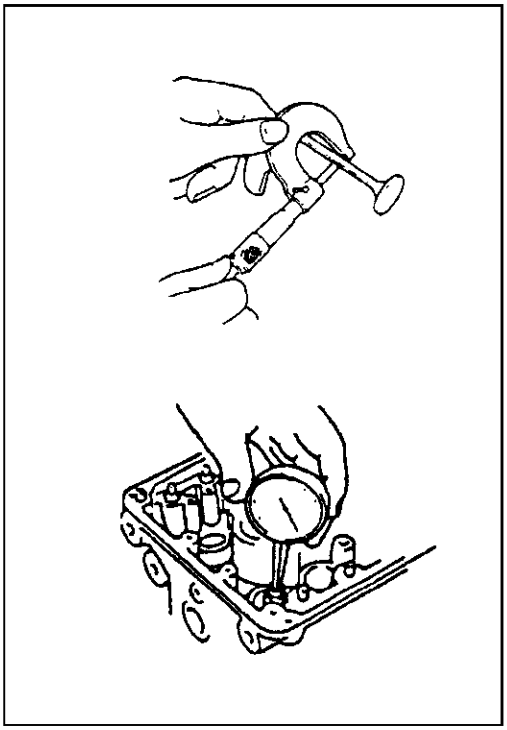


INSPECTION

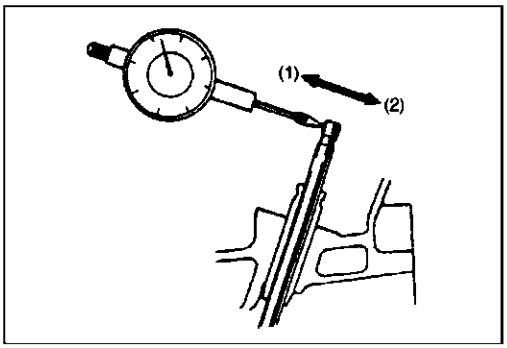
Valve Guides

Using a micrometer and caliper 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.

Item		Standard	Limit
Valve stem diameter	In	5.465 – 5.480 mm (0.2152 – 0.2157 in.)	—
	Ex	5.440 – 5.455 mm (0.2142 – 0.2148 in.)	—
Valve guide I.D.	In	5.500 – 5.512 mm g (0.2166 – 0.2170 in.)	—
	Ex		
Stem-to-guide clearance	In	0.020 – 0.047 mm (0.0008 – 0.0018 in.)	0.07 mm (0.0027 in.)
	Ex	0.045 – 0.072 mm (0.0018 – 0.0028 in.)	0.09 mm (0.0035 in.)

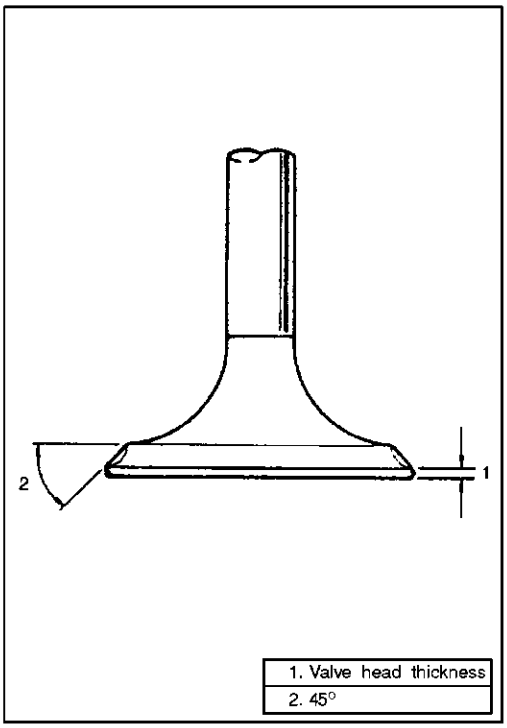


If caliper gauge is not available, check end deflection of valve stem with a dial gauge instead.

Move stem end in directions (1) and (2) to measure end deflection.

If deflection exceeds its limit, replace valve stem and valve guide.

Valve stem end deflection limit	In	0.14 mm (0.005 in.)
	Ex	0.18 mm (0.007 in.)



1. Valve head thickness
2. 45°

Valves

- Remove all carbon from valves.
- Inspect each valve for wear, burn or distortion at its face and stem and, as necessary, replace it.
- Measure thickness of valve head. If measured thickness exceeds limit, replace valve.

Valve head thickness		
	Standard	Limit
IN	(0.8 – 1.2 in.) (0.03 – 0.047 in)	0.6 mm (0.024 in.)
EX	(0.8 – 1.2 in.) (0.03 – 0.047 in)	0.7 mm (0.027 in.)

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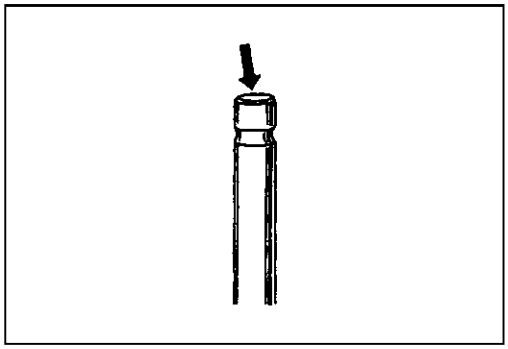
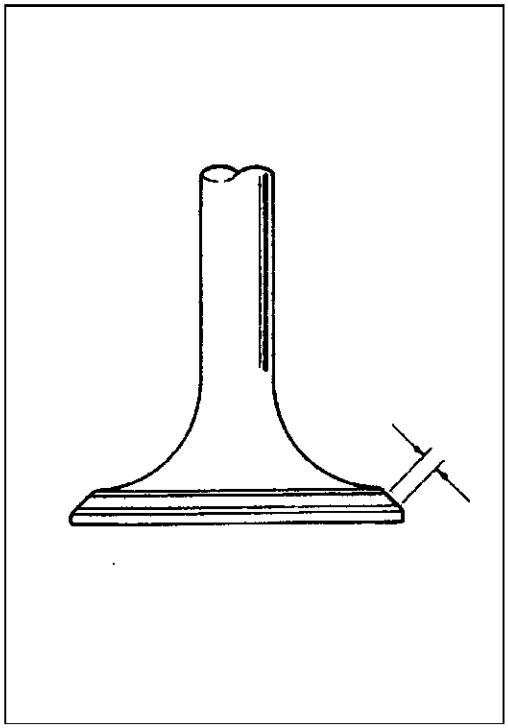


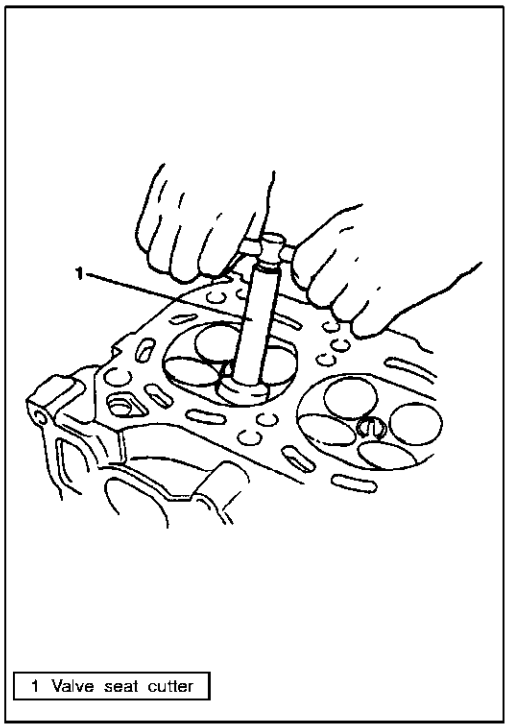
- Inspect valve stem end face for pitting and wear. If pitting or wear is found there, valve stem end may be resurfaced, but not so much as to grind off its chamfer. When it is worn so much that its chamfer is gone, replace valve.



- 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 revealed by contact pattern on valve face	In	1.15 – 1.35 mm (0.0453 – 0.0531 in.)
	Ex	



1 Valve seat cutter

- 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 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:
     1.15 – 1.35 mm (0.0453 – 0.0531 in.)

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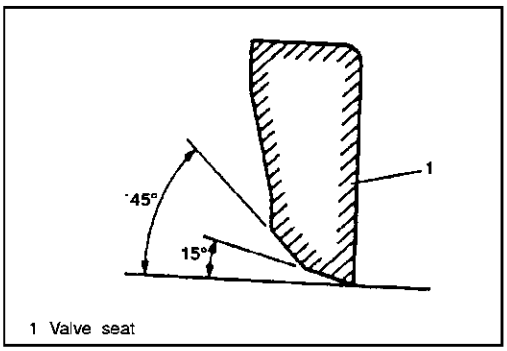
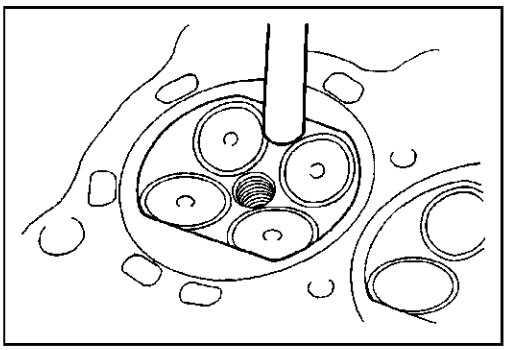


1 Valve seat

2) INTAKE VALVE SEAT: Cutting sequence is the same as for exhaust valve seats.

Seat width for intake valve seat:
1.15 – 1.35 mm (0.0453 – 0.0531 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.

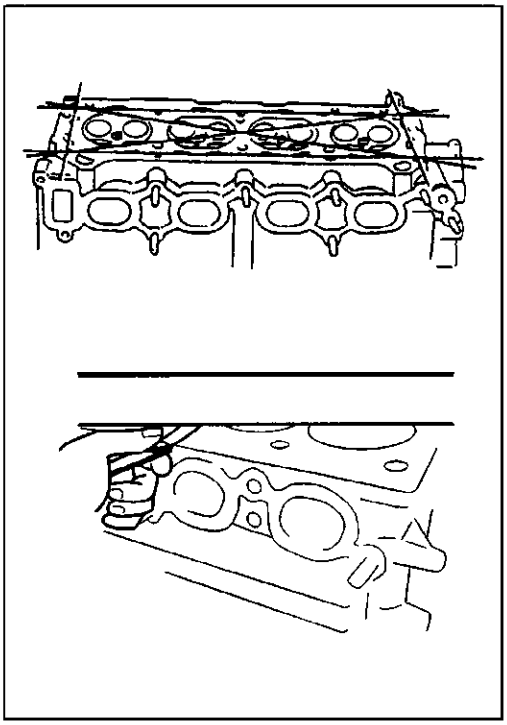


Cylinder Head

- Remove all carbon from combustion chambers.

NOTE:
Do not use any sharpedged tool to scrape off carbon. 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 in intake and exhaust ports, combustion chambers, and head surface.



- Flatness of gasketed surface:
  Using a straightedge and thickness gauge, check surface at a total of 6 locations. If distortion limit, given below, is exceeded, correct gasketed surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper): place 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: 0.05 mm (0.002 in.)

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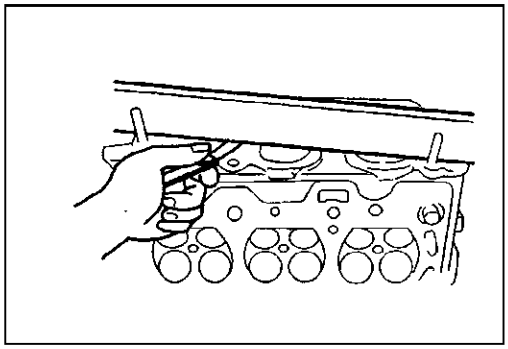
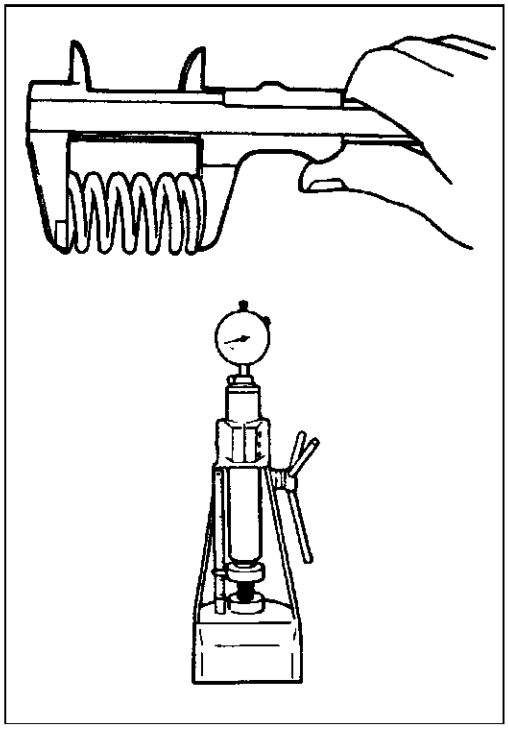


- Distortion of manifold seating faces:
  Check seating faces of cylinder head for manifolds, using a straightedge and thickness gauge, in order to determine whether these faces should be corrected or cylinder head replaced.

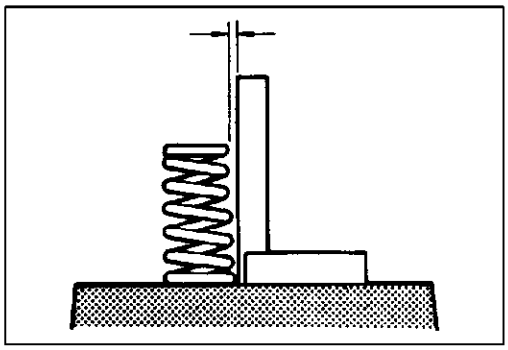
  Limit of distortion: 0.10 mm (0.004 in.)



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.

Item	Standard	Limit
Valve spring free length	37.09 mm (1.460 in.)	36.2 mm (1.4252 in.)
Valve spring preload	13.3–15.7 kg for 32.0 mm (29.3 – 34.6 lb/1.26 in.)	13.0 kg for 32.0 mm (28.7 lb/1.26 in.)



- Spring squareness:
  Use a square and surface plate to check each spring for squareness in terms of clearance between end of valve spring and square. Valve springs found to exhibit a larger clearance than limit given below must be replaced.

  Valve spring squareness limit: 2.0 mm (0.079 in.)

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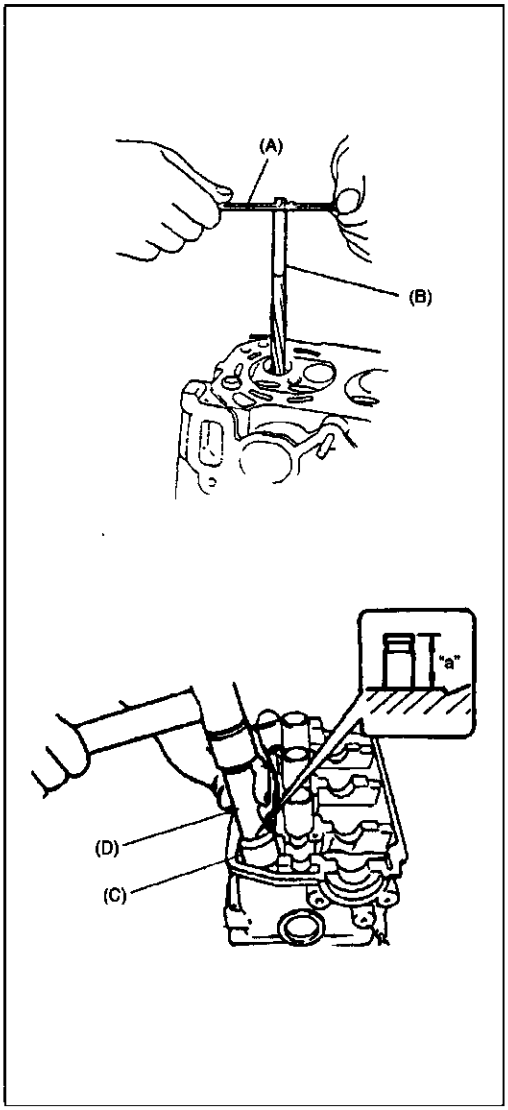


ASSEMBLY

1) Before installing valve guide into cylinder head, ream guide hole with special tool (10.5 mm reamer) so remove burrs and make it truly round.

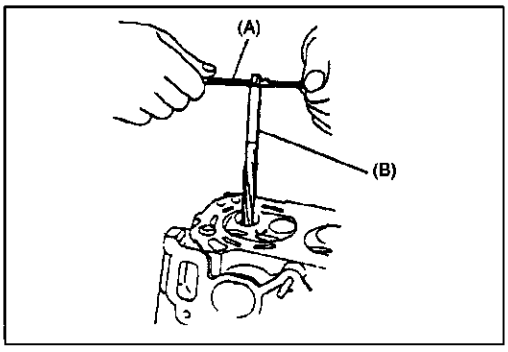
   Special Tool
   (A): 09916-34542
   (B): 09916-37320

2) Install valve guide to cylinder head.
   Heat cylinder head uniformly at 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 13.0 mm (0.51 in.) from cylinder head.

   Special Tool
   (C): 09916-57340
   (D): 09916-58210

   NOTE:
   - **Do not reuse valve guide once disassembled. Install new valve guide (Oversize).**
   - **Intake and exhaust valve guides are identical.**

   Valve guide oversize: 0.03 mm (0.0012 in.)
   Valve guide protrusion "a" (In and Ex): 13.0 mm (0.51 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

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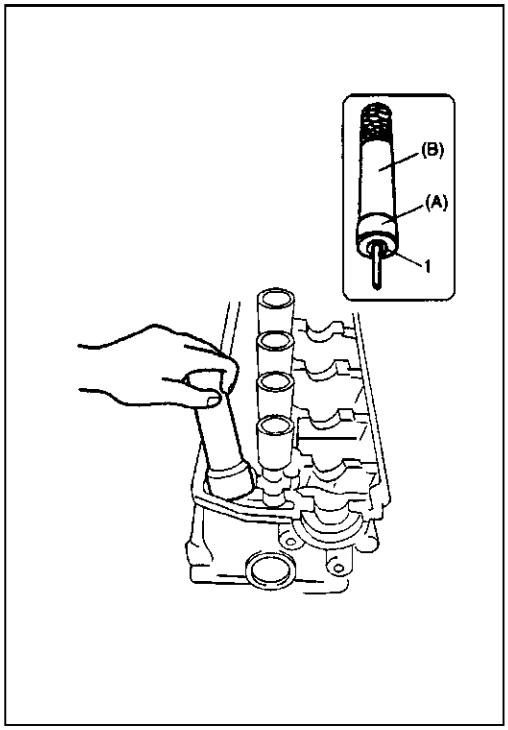
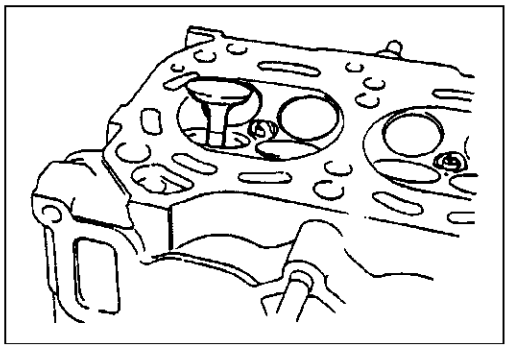


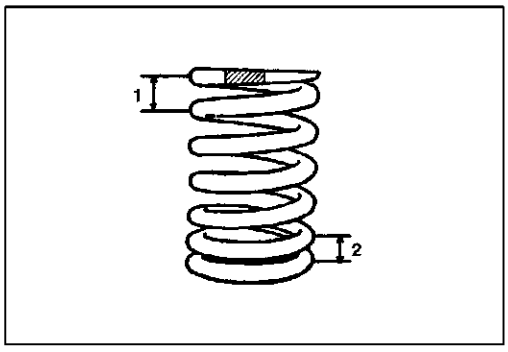
4) Install valve spring seat to cylinder head.
5) Install new valve stem seal (1) to valve guide.
After applying engine oil to seal and spindle of special tool (Valve guide installer handle), fit oil seal to spindle, and then install seal to valve guide by pushing special tool by hand.
After installing, check to be sure that seal is properly fixed to valve guide.

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

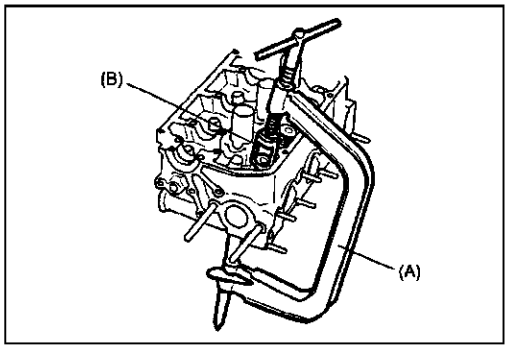
NOTE:
- **Do not reuse seal once disassembled. Be sure to install new seal.**
- **When installing, never tap or hit special tool with a hammer or else. Install seal to guide only by pushing special tool by hand. Tapping or hitting special tool may cause damage to seal.**



6) Install valve to valve guide.
Before installing valve to valve guide, apply engine oil to stem seal, valve guide bore, and valve stem.



7) Install valve spring and spring retainer.
Each valve spring has top end (large-pitch end) (1) and bottom end (small-pitch end) (2). Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).



8) Using special tool (Valve lifter), compress valve spring and fit two valve cotters into groove in valve stem.

Special Tool
(A): 09916-14510
(B): 09916-14910

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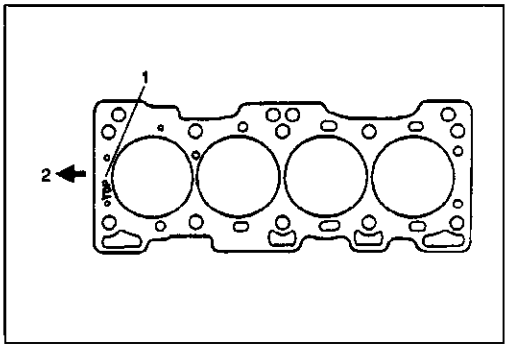
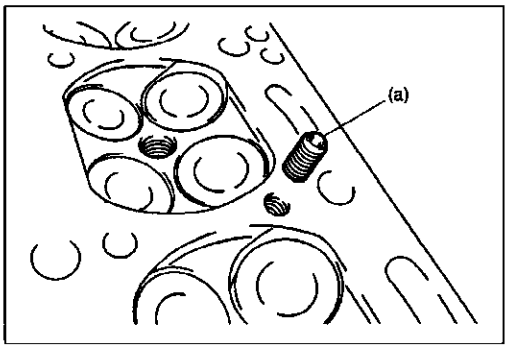
9) Install rocker arms, springs and rocker arm shaft as previously outlined.
10) Install intake manifold, exhaust manifold and thermostat case.



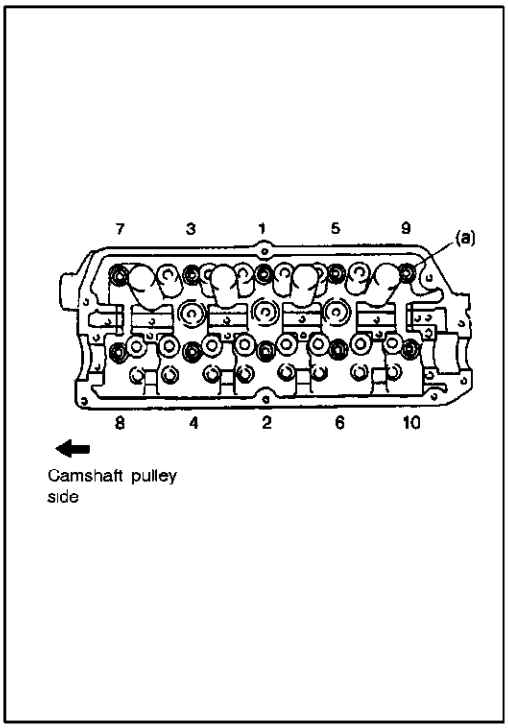
INSTALLATION

1) Remove old gasket and oil on mating surfaces and install new head gasket as shown in figure, that is, "TOP" mark (1) provided on gasket comes to crankshaft pulley side (2), facing up (toward cylinder head side).



2) Check to make sure that oil jet (venturi plug) is installed and if it is, that it is not clogged.
When installing it, be sure to tighten to specified torque.

Tightening Torque
(a): 5 N-m (0.5 kg-m, 4.0 lb-ft)



3) Apply engine oil to cylinder head bolts and tighten them gradu-ally as follows.
   i) Tighten all bolts to 30 N-m (3.0 kg-m, 21.5 lb-ft) according to numerical order in figure.
   ii) In the same manner as in i), tighten them to 48 N.m (4.8 kg-m, 34.5 lb-ft).
   iii) Loosen all bolts to 0 N-m (0 kg-m, 0 lb-ft) reversing to numerical order in figure.
   iv) In the same manner as in i) again, tighten them to 48 N.m (4.8 kg-m, 34.5 lb-ft).
   v) In the same manner as in i), tighten them to specified torque.

Tightening Torque
(a): 60 N-m (6.0 kg-m, 43.5 lb-ft)

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4) Reverse removal procedure for installation.
5) Adjust water pump drive belt tension, referring to SECTION 6B.
6) Adjust A/C compressor belt tension, if equipped. Refer to SECTION 0B.
7) Adjust intake and exhaust valve lashes as previously outlined.
8) Adjust accelerator cable play. Refer to SECTION 6E1.
9) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
10) Refill cooling system referring to SECTION 6B.
11) Connect negative cable at battery.
12) Verify that there is no fuel leakage, coolant leakage and exhaust gas leakage at each connection.
13) Confirm that ignition timing is within specification referring to SECTION 6F.

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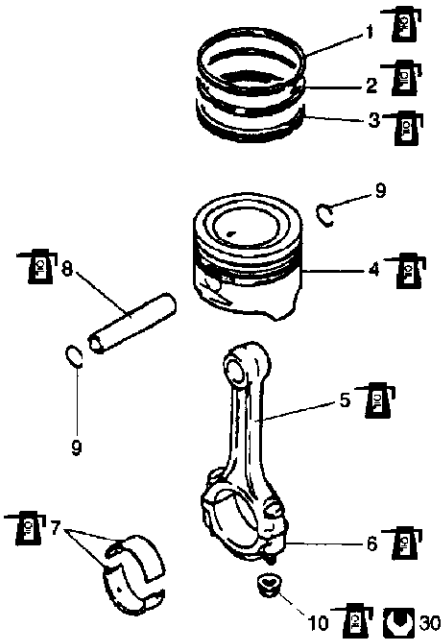
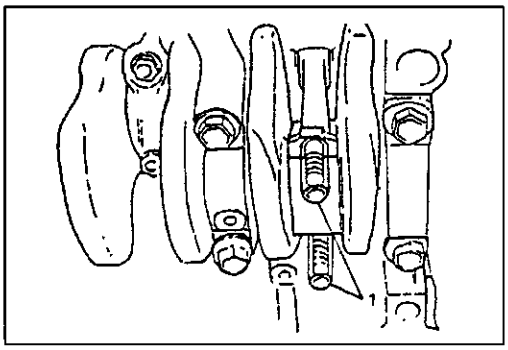
PISTON, PISTON RINGS, CONNECTING RODS AND CYLINDERS



	1. Top ring
	2. 2nd ring
	3. Oil ring
	4. Piston
◆2◆	5. Connecting rod: Apply engine oil except inner surface of big end.
◆2◆	6. Connecting rod bearing cap Apply engine oil except inner surface of big end.
◆2◆	7. Connecting rod bearing: Apply engine oil to inner surface.
	8. Piston pin
	9. Piston pin circlip
	10. Bearing cap nut
◆3◆	: Tightening Torque
◆2◆	: Apply engine oil to sliding surface of each parts.

REMOVAL

1) Remove cylinder head from cylinder block as previously outlined.
2) Drain engine oil.
3) Remove oil pan and oil pump strainer as previously outlined.
4) Mark cylinder number on all pistons, connecting rods and rod bearing caps, using silver pencil or quick drying paint.



5) Remove rod bearing caps.
6) Install guide hose (1) over threads of rod bolts. This is to prevent damage to bearing journal and rod bolt threads when removing connecting rod.
7) Decarbon top of cylinder bore before removing piston from cylinder.
8) Push piston and connecting rod assembly out through the top of cylinder bore.

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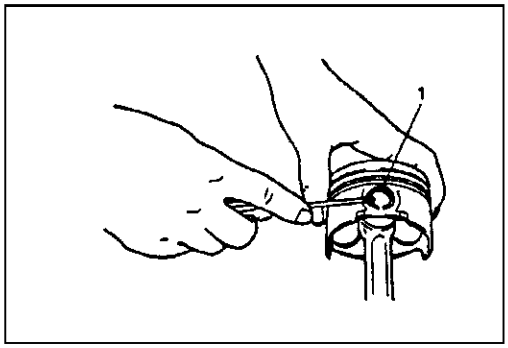
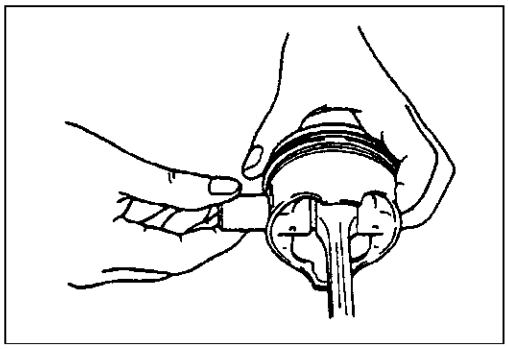
DISASSEMBLY

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

Clean carbon from piston head and ring grooves, using a suitable tool.

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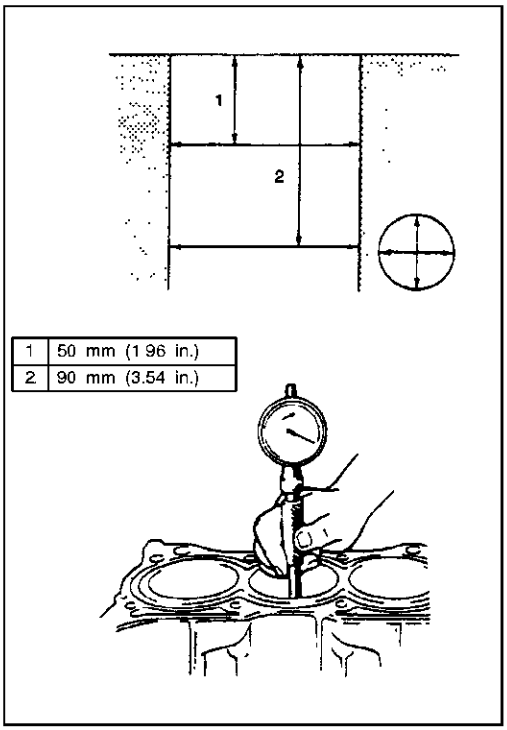
INSPECTION

Cylinders

- 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.



1	50 mm (1.96 in.)
2	90 mm (3.54 in.)

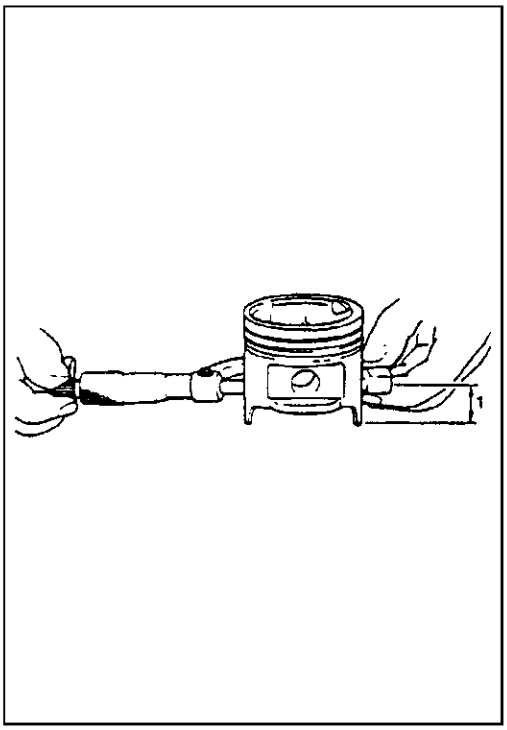
- Using a cylinder gauge, measure cylinder bore in thrust and axial directions at two positions as shown in figure.

  If any of following conditions is noted, rebore cylinder.

1) Cylinder bore dia. exceeds limit.
2) Difference of measurements at two positions exceeds taper limit.
3) Difference between thrust and axial measurements exceeds out-of-round limit.

Cylinder bore dia. limit: 68.57 mm (2.6996 in.)
Taper and out-of-round limit: 0.10 mm (0.0039 in.)

NOTE:
If any one of four cylinders has to be rebored, rebore all four to the same next oversize. This is necessary for the sake of uniformity and balance.



Pistons

- 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 (1) 20 mm (0.79 in.) from piston skirt end in the direction perpendicular to piston pin.

Piston diameter	Standard	68.449 – 68.469 mm (2.6948 – 2.6956 in.)
	Over size: 0.25mm (0.0098 in.)	68.720 – 68.740 mm (2.7055 – 2.7063 in.)
	0.50 mm (0.0196 in.)	68.949 – 68.969 mm (2.7145 – 2.7153 in.)

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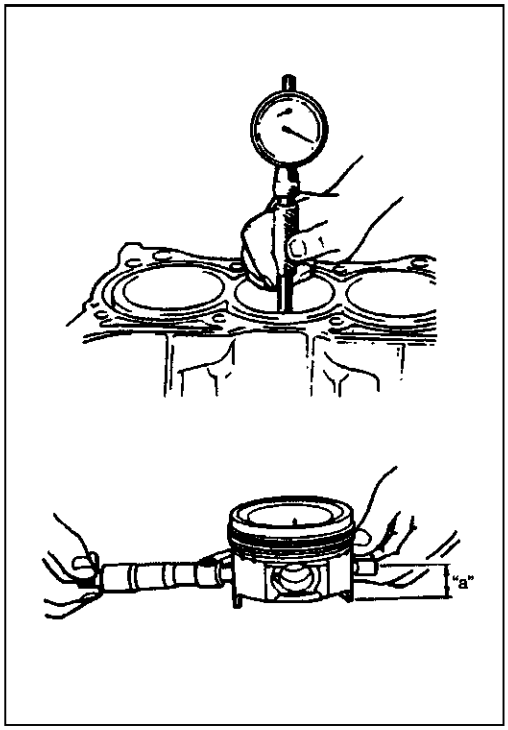
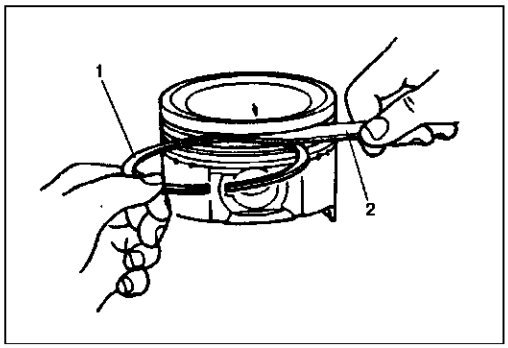


- Piston clearance:
  Measure cylinder bore diameter and piston diameter to find their difference which is piston clearance. Piston clearance should be within specification as given below. If it is out of specification, re-bore cylinder and use oversize piston.

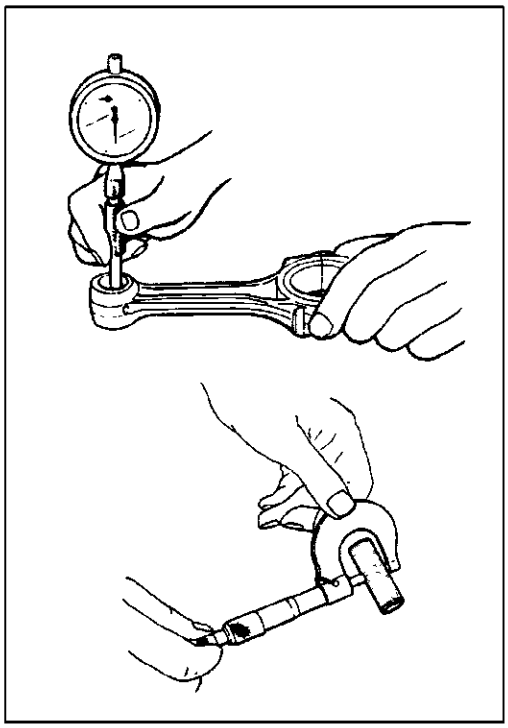
  Piston clearance "a" : 0.025 – 0.045 mm (0.0009 – 0.0017 in.)

  NOTE:
  Cylinder bore diameters used here are measured in thrust direction at two positions.



- Ring groove clearance:
  Before checking, piston grooves must be clean, dry and free of carbon.
  Fit new piston ring into piston groove, and measure clearance between ring (1) and ring land by using thickness gauge (2). If clearance is out of specification, replace piston.

  Ring groove clearance:
  Top:0.03 – 0.07 mm (0.0012 – 0.0027 in.)
  2nd :0.02 – 0.06 mm (0.0008 – 0.0023 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 or piston.
- Piston pin clearance:
  Check piston pin clearance in small end. Replace connecting rod if its small end is badly worn or damaged or if measured clearance exceeds limit.

Item	Standard	Limit
Piston pin clearance in small end	0.003 – 0.021 mm (0.0001 – 0.0008 in.)	0.05 mm (0.0020 in.)

Small-end bore:
16.003 – 16.011 mm (0.6300 – 0.6303 in.)
Piston pin dia.:
15.990 – 16.000 mm (0.6295 – 0.6299 in.)

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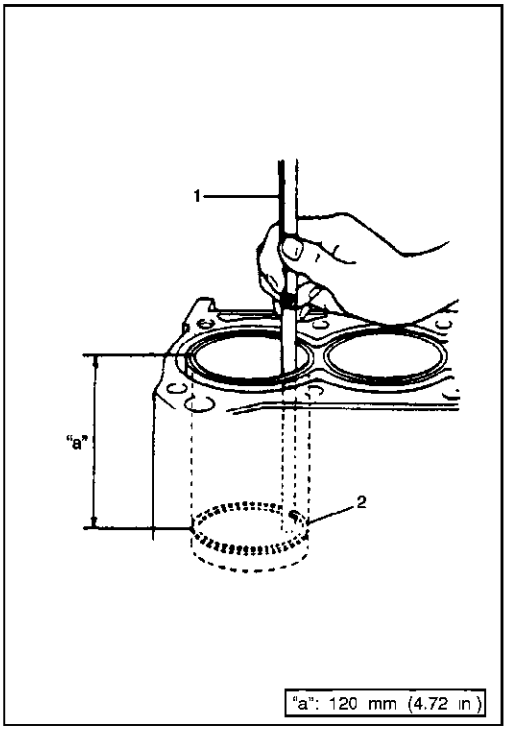
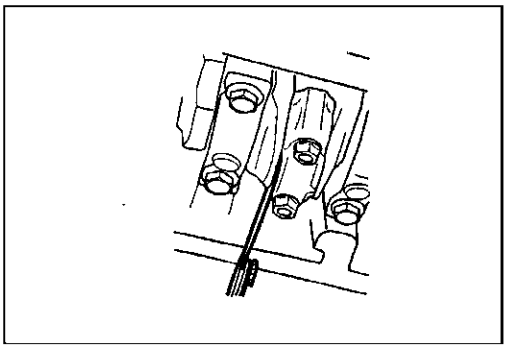


Piston Rings

To measure end gap, insert piston ring (2) into cylinder bore and then measure the gap by using thickness gauge (1).
If measured gap is out of specification, replace ring.

NOTE:
Decarbon and clean top of cylinder bore before inserting piston ring.

Item		Standard	Limit
Piston ring end gap	Top ring	0.12–0.26 mm (0.0047 – 0.0102 in.)	0.7 mm (0.0275 in.)
	2nd ring	0.12 – 0.26 mm (0.0047 – 0.0102 in.)	0.7 mm (0.0275 in.)
	Oil ring	0.2 – 0.7 mm (0.0079 – 0.0275 in.)	1.8 mm (0.0709 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 con-necting rod.

Item	Standard	Limit
Big-end side clearance	0.10 – 0.20 mm (0.0039 – 0.0097 in.)	0.35 mm (0.0137 in.)

- Connecting rod alignment:
  Mount connecting rod on aligner to check it for bow and twist and, if limit is exceeded, replace it.

  Limit on bow: 0.05 mm (0.0020 in.)
  Limit on twist: 0.10 mm (0.0039 in.)

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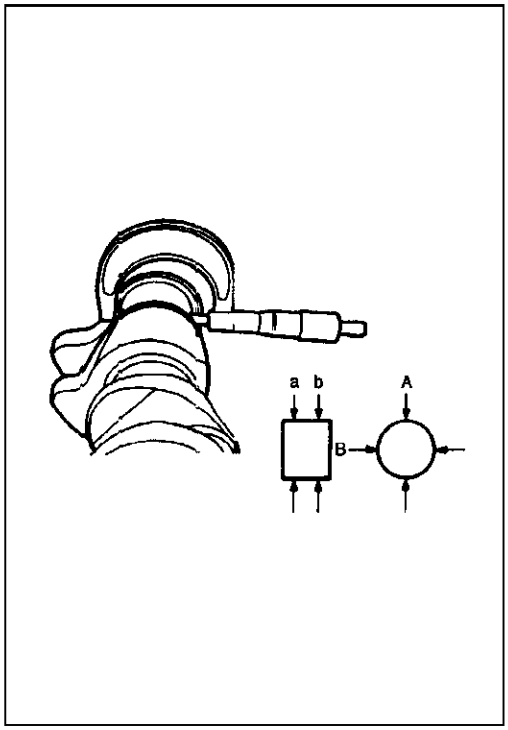
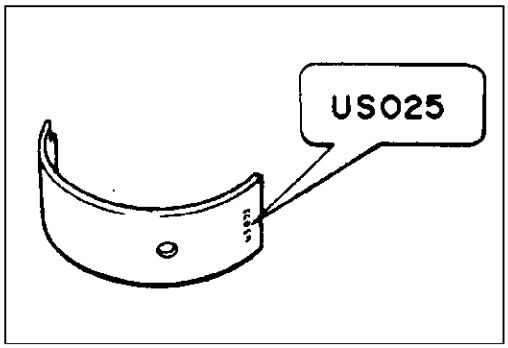


Crank Pin and Connecting Rod Bearings

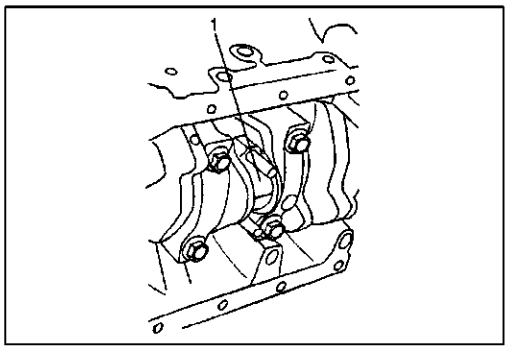
- Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged, or out-of-round or taper is out of limit, replace crank-shaft or regrind crank pin referring to following step 6).

Connecting rod bearing size	Crank pin diameter
Standard	37.982 – 38.000 mm (1.4953 – 1.4960 in.)
0.25 mm (0.0098 in.) undersize	37.732 – 37.750 mm (1.4855 – 1.4862 in.)

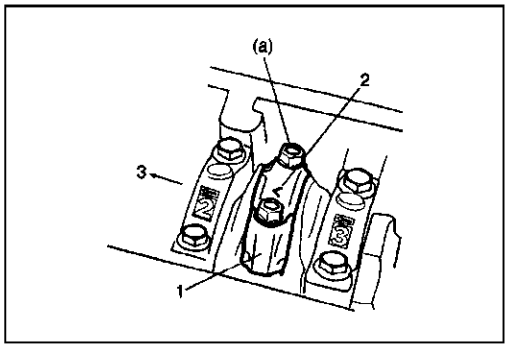
Out-of-round and taper limit: 0.01 mm (0.0004 in.)



- 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 undersize bearing. To distinguish them, 0.25 mm undersize bearing has the stamped number (US025) on its backside as indicated in figure, but standard size one has no number.



- Rod bearing clearance:
  1) Before checking bearing clearance, clean bearing and crank pin.
  2) Install bearing in connecting rod and bearing cap.
  3) Place a piece of gaging plastic (1) to full width of crankpin 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 (3), as shown in figure. After applying engine oil to rod bolts, tighten cap nuts to specified torque.
   DO NOT turn crankshaft with gaging plastic installed.

   Tightening Torque
   (a): 30 N-m (3.0 kg-m, 22.0 lb-ft)

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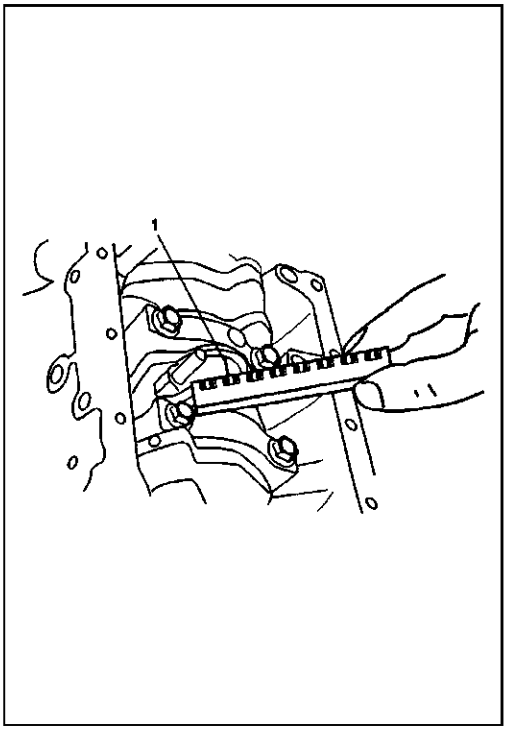


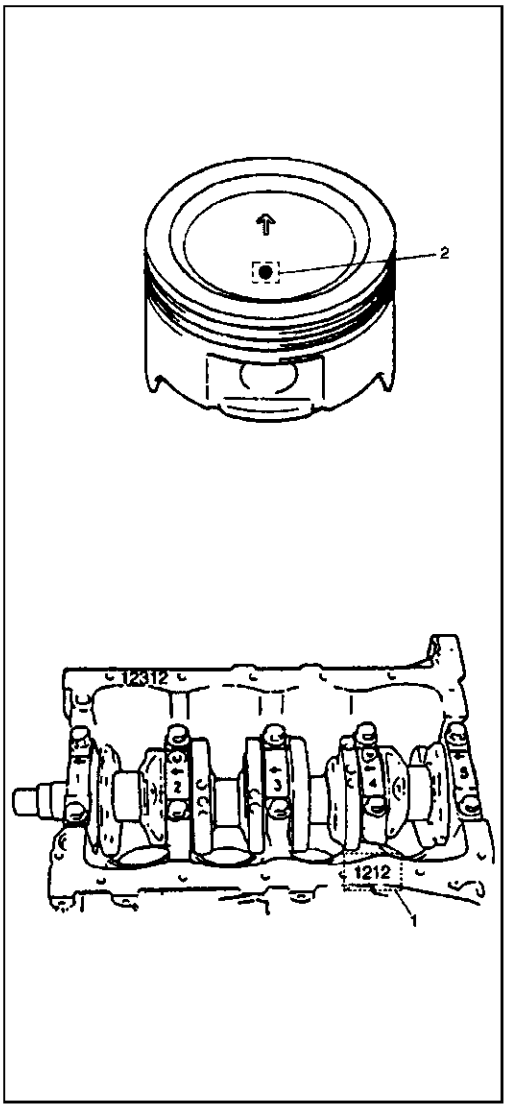
5) Remove cap and using a scale on gaging plastic envelope, measure gaging plastic (1) width at the widest point (clearance).
If clearance exceeds its limit, use a new standard size bearing and remeasure clearance.

Item	Standard	Limit
Bearing clearance	0.020 – 0.040 mm (0.0008 – 0.0016 in.)	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, replace crankshaft or regrind crankpin to undersize as follows.
– Install 0.25 mm undersize bearing to connecting rod big end.
– Measure bore diameter of connecting rod big end.
– Regrind crankpin to following finished diameter.

Finished crankpin dia.	=	Measured big end bore dia. (including undersize bearing)	–	0.030 mm (0.0012 in.)

– Confirm that bearing clearance is within above standard value.



ASSEMBLY

NOTE:
Two sizes of piston are available as standard size spare part so as to ensure proper piston-to-cylinder clearance. When installing a standard size piston, make sure to match piston with cylinder as follows.

a) Each new piston has painted color (2) as shown. It represents outer diameter of piston.
b) There are stamped numerals (1) on the cylinder block as shown. The numeral (1 or 2) represents cylinder bore diameter.
The first numeral from crank pulley side represents inner diameter of No.1 cylinder, the second numeral of No.2 cylinder, the third numeral of No.3 cylinder and the fourth numeral of No.4 cylinder.
c) Painted color on piston and stamped numerals on cylinder block should correspond. That is, install blue color painted piston to cylinder which is identified with numeral "2" and red color painted piston to cylinder with numeral "1".

	Piston		Cylinder	Piston-to-cylinder clearance
Color (paint)	Outer diameter	Numeral (mark)	Bore diameter	
Red	68 475–68 485 mm (2.6959–2.6962 in.)	1	68.51–68.52 mm (2.6973 – 2.6976 in.)	0.025 – 0.045 mm (0 0010 – 0.0018 in.)
Blue	68.465–68.475 mm (2.6955–2.6959 in.)	2	68 50–68 51 mm (2.6968 – 2.6973 in.)	0 025–0 045 mm (0.0010 – 0.0018 in.)

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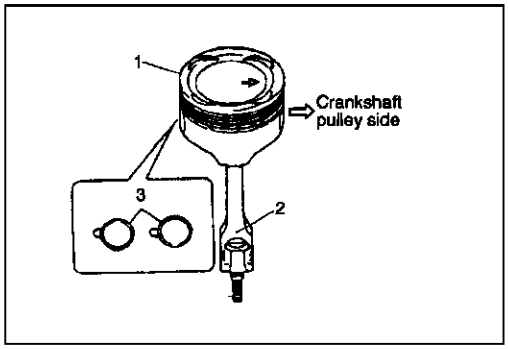
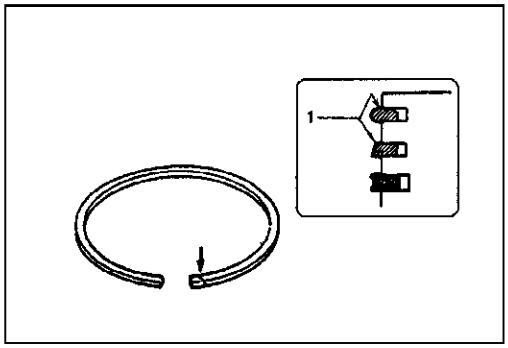


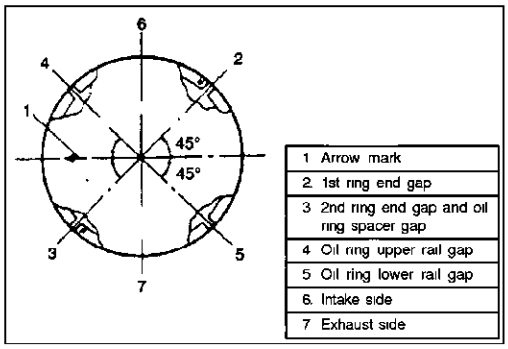
1) Install piston pin to piston (1) and connecting rod:
After applying engine oil to piston pin and piston pin holes in piston and connecting rod, fit connecting rod to piston as shown in figure and insert piston pin to piston and connecting rod, and install piston pin circlips (3).

NOTE:
Circlip should be installed with its cut part facing either up or down as shown in figure.

The oil hole (3) should come on intake side



2) Install piston rings to piston:
- As indicated in figure at the left, 1st and 2nd rings have "RN", "T" or "R" mark (1) respectively. When installing these piston rings to piston, direct marked side of each ring toward top of piston.
- 1st ring differs from 2nd ring in thickness, shape and color of surface contacting cylinder wall.
  Distinguish 1st ring from 2nd ring by referring to figure.
- When installing oil ring, install spacer first and then two rails.

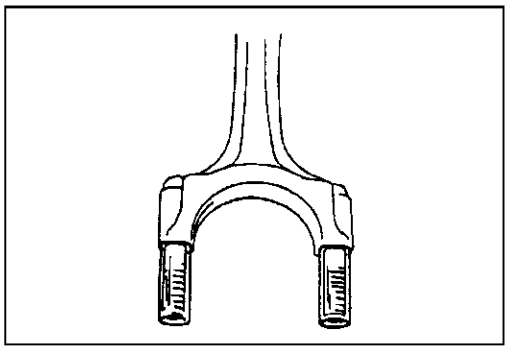


3) After installing three rings (1st, 2nd and oil rings), distribute their end gaps as shown in figure.

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 over connecting rod bolts.
These guide hoses protect crankpin and threads of rod bolt from damage during installation of connecting rod and piston assembly.

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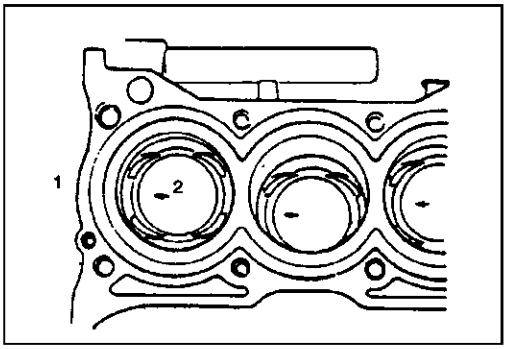
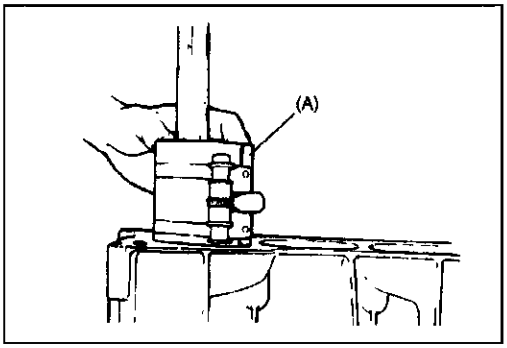
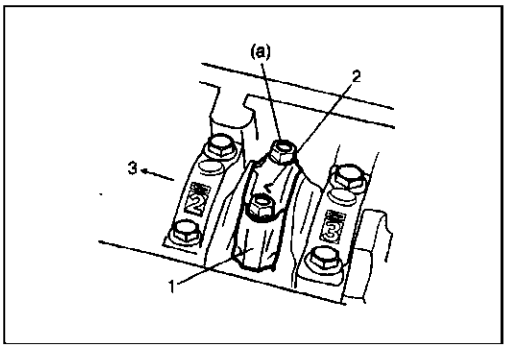


3) When installing piston and connecting rod assembly into cylinder bore, point arrow mark (2) on piston head to crankshaft pulley side (1).



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:
Point arrow mark (2) on cap (1) to crankshaft pulley side (3).
Tighten cap nuts to specification.

Tightening Torque
(a): 30 N-m (3.0 kg-m, 22.0 lb-ft)

6) Reverse removal procedure for installation, as previously outlined.
7) Adjust water pump drive belt tension, referring to SECTION 0B.
8) Adjust A/C compressor belt tension, if equipped. Refer to SECTION 0B.
9) Adjust intake and exhaust valve lashes as previously outlined.
10) Adjust accelerator cable play. Refer to SECTION 6E1.
11) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
12) Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in SECTION 0B.
13) Refill cooling system referring to SECTION 6B.
14) Connect negative cable at battery.
15) Verify that there is no fuel leakage, coolant leakage, oil leakage and exhaust gas leakage at each connection.
16) Verify that ignition timing is within specification referring to SECTION 6F.

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UNIT REPAIR OVERHAUL

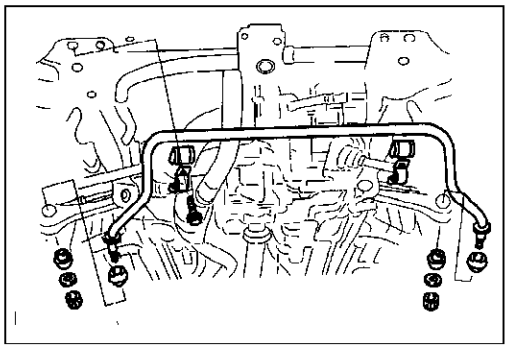
ENGINE ASSEMBLY

REMOVAL

1) Release fuel pressure according to fuel pressure relief procedure described in SECTION 6.
2) Drain coolant.

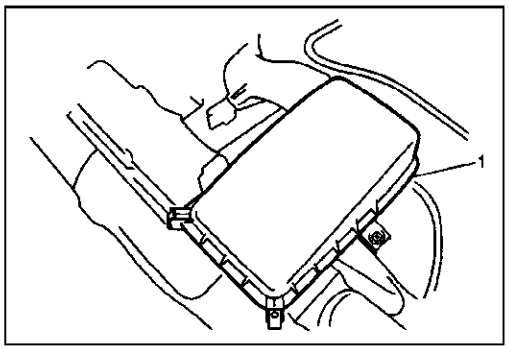
> **WARNING:**
> **To help avoid danger of being burned, do not remove drain plug and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.**

3) Drain engine oil and transmission oil, if necessary.
4) Remove exhaust pipe.



5) Remove stabilizer bar, referring to SECTION 3D.

6) Remove right-side stabilizer bracket.
7) Remove drive shafts.
   Refer to SECTION 4A.
8) Remove engine hood and front bumper.
   Refer to SECTION 9.
9) Remove battery and its tray.



10) Remove air cleaner assembly (1) and their hoses as previously outlined.

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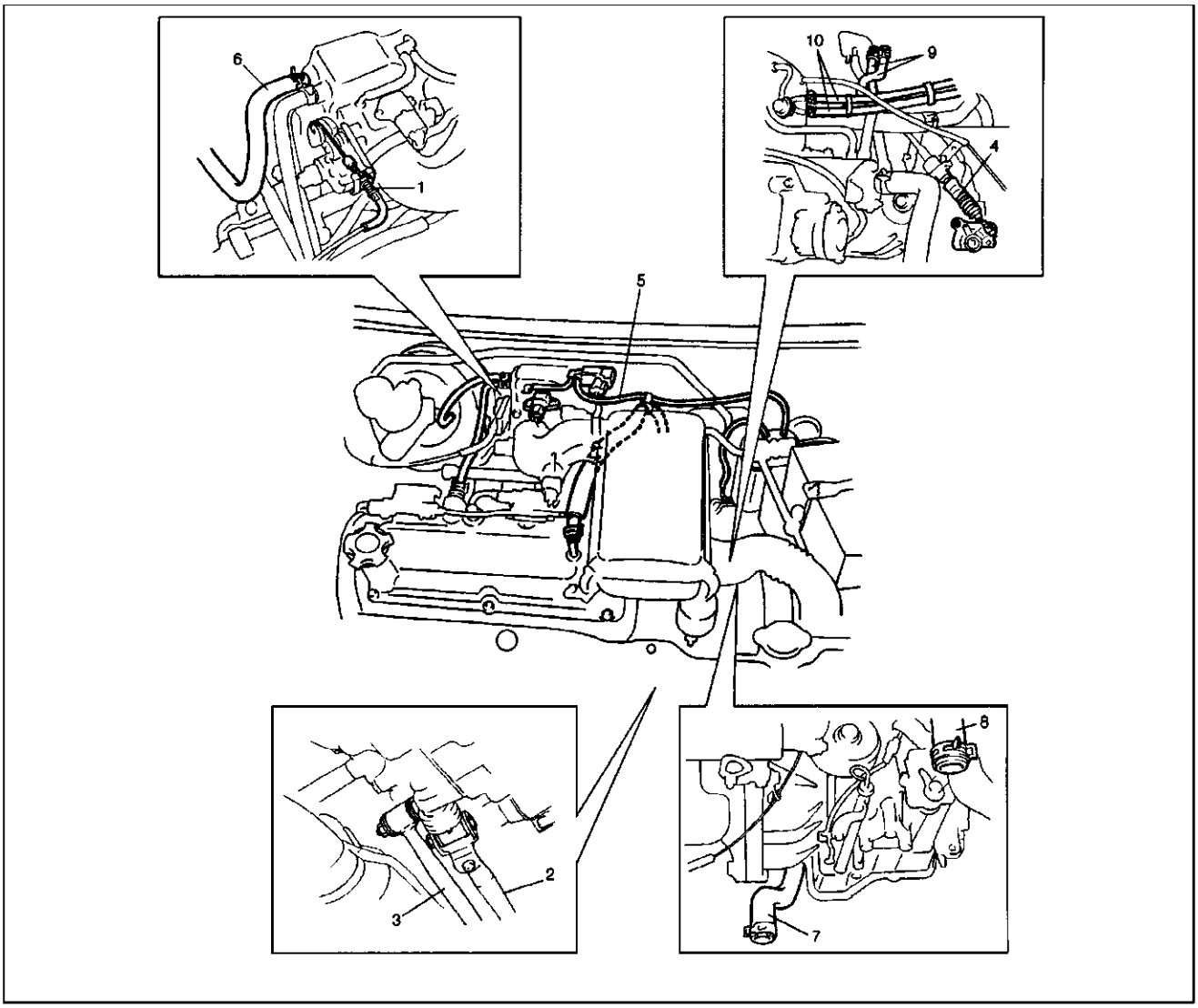
11) Disconnect following:
- Fuse box from its stay.
- Accelerator cable (1) from throttle body.
- Clutch cable, gear shift control rod (2) and extension rod (3) (M/T).
- Gear select cable (4) from transmission (A/T).

12) Disconnect the following hoses:
- Canister purge hose (5) from EVAP canister purge valve.
- Brake booster hose from surge tank (6).
- Radiator outlet hose (7) from radiator.
- Radiator inlet hose (8) from radiator.
- Heater inlet and outlet hoses (9) from heater unit.
- Fuel feed and return hoses (10) from pipes.



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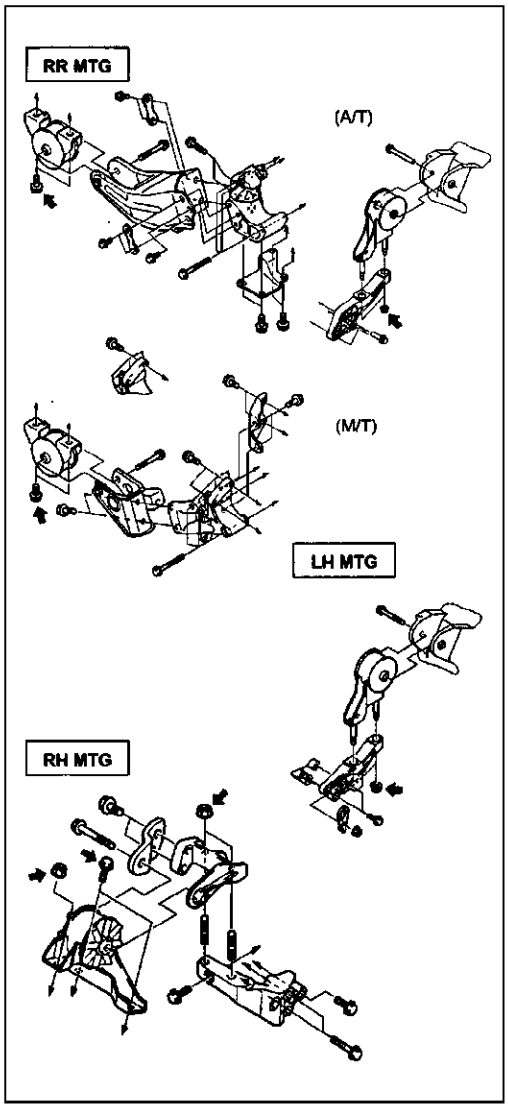
13) Disconnect following electric wires:
    - ECM
    - Instrument panel harness
    - Fuse box
    - A/C dual pressure switch
    - A/C compressor
    - Ground cable at transmission
    - Ground cable at exhaust manifold
14) Remove water pump drive belt and A/C compressor drive belt.
15) Remove A/C compressor with hose still attached (if equipped).

    NOTE:
    Suspend removed compressor at a place where no damage will be caused during removal and installation of engine assembly.

16) Install lifting or sling device.
17) Check to ensure all hoses, electric wires and cables are disconnected from engine.



18) Remove bolts indicated in figure.
19) Lower engine assembly together with transmission out of vehicle slowly and carefully.

    RR MTG: Rear mounting
    LH MTG: Left mounting
    RH MTG: Right mounting

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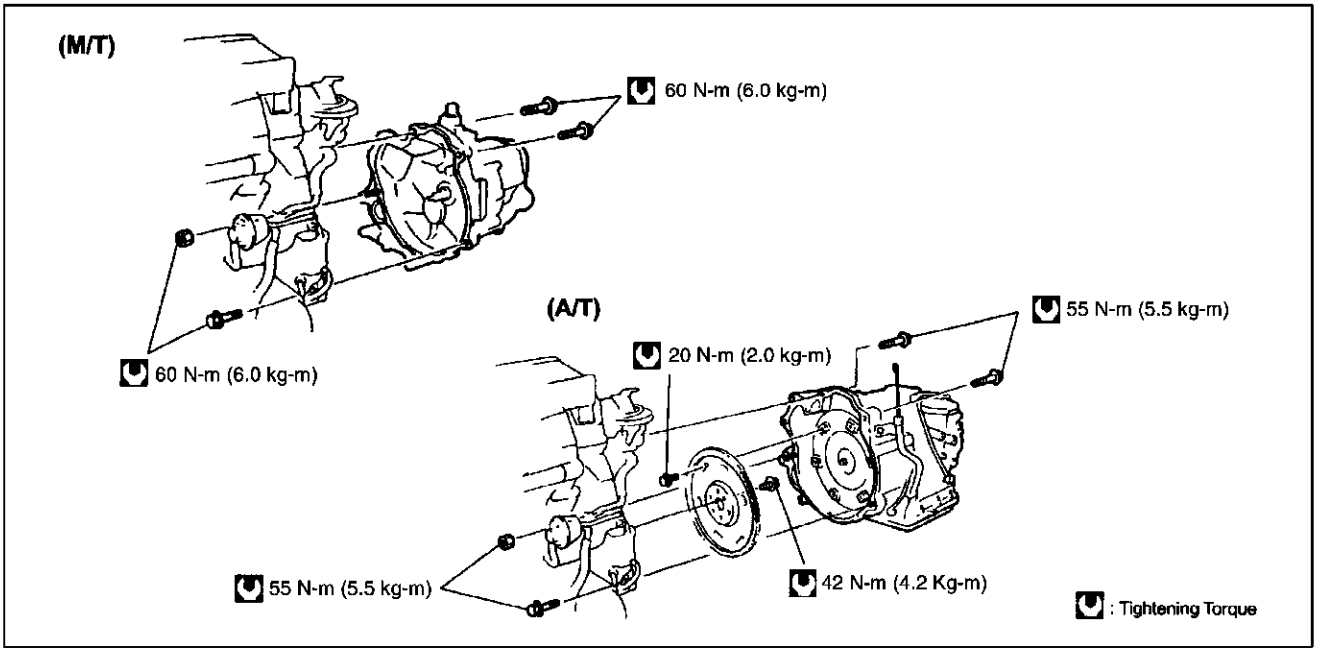
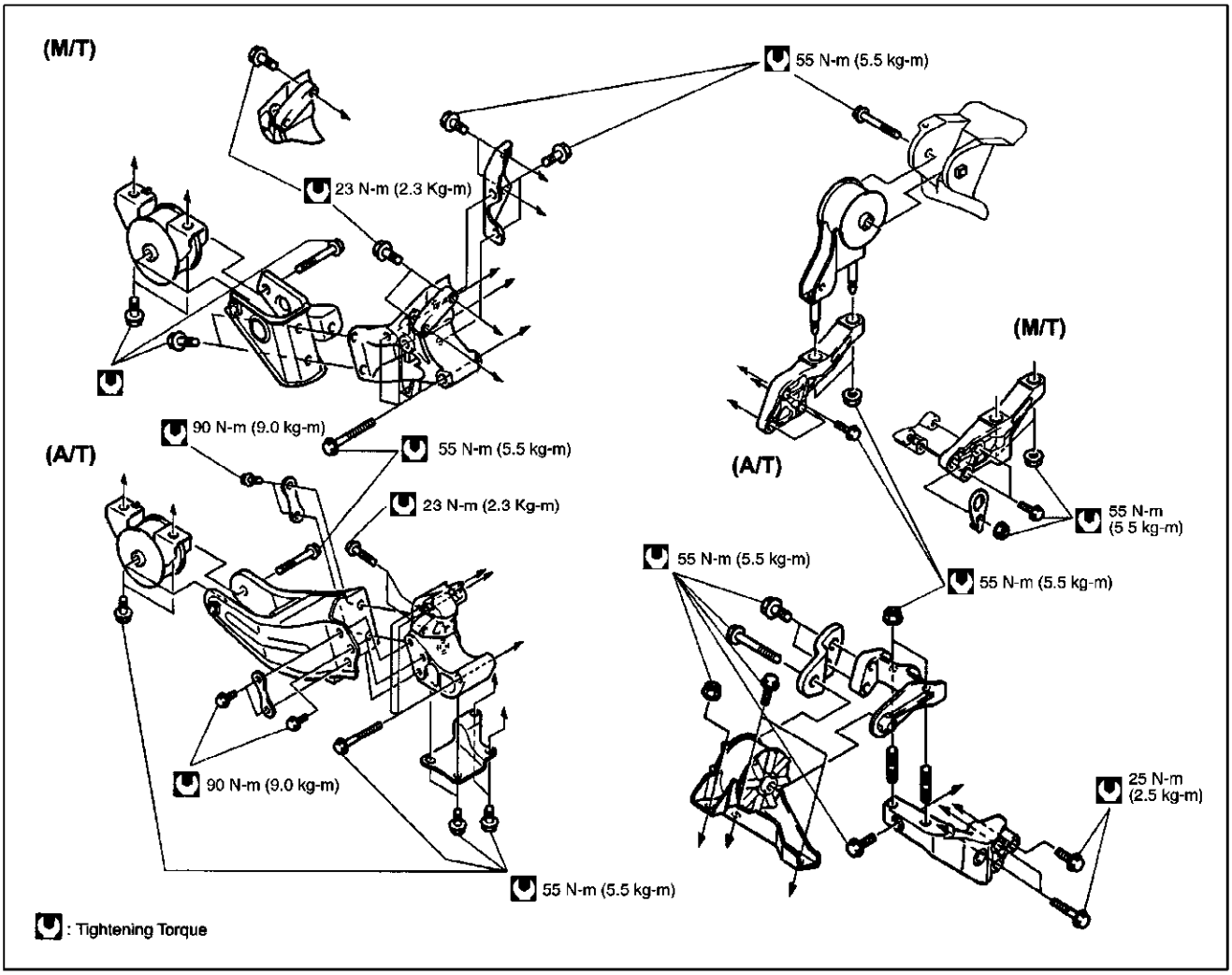
INSTALLATION

1) Install transmission to engine.



2) Install engine assembly together with transmission to vehicle.



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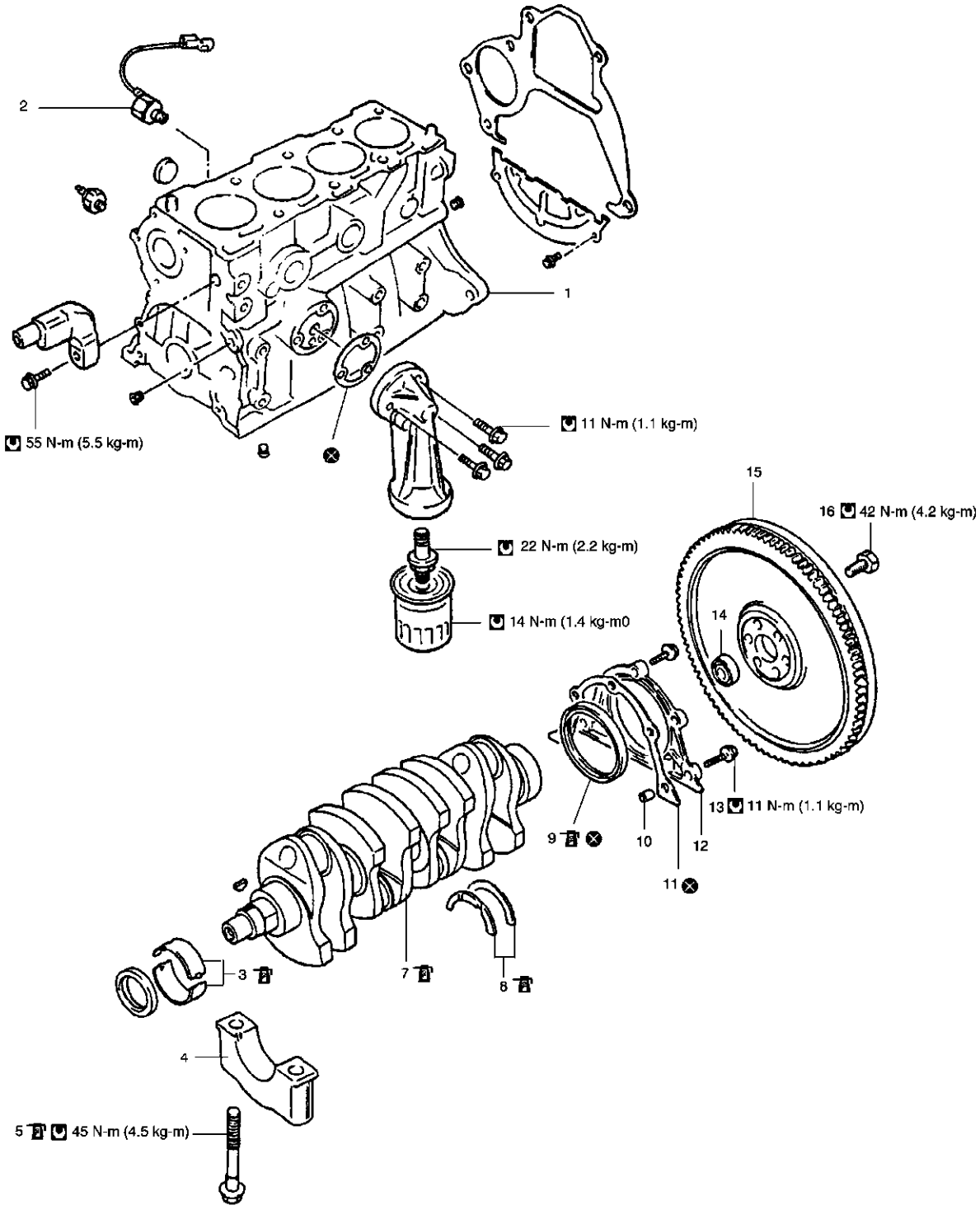
MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK



1. Cylinder block	7. Crankshaft Apply engine oil to crankshaft journals.	13.	Housing bolt
2. Knock sensor		14	Input shaft bearing Apply engine oil.
3. Main bearing Apply engine oil to bearing inside surfaces.	8. Thrust bearing: Apply engine oil.	15.	Flywheel
4. Bearing cap	9. Rear oil seal	16.	Flywheel bolt
5. Cap bolt: Apply engine oil.	10. Pin		: Tightening Torque
6. Timing pulley key	11. Oil seal housing gasket		: Do not reuse
	12. Oil seal housing		

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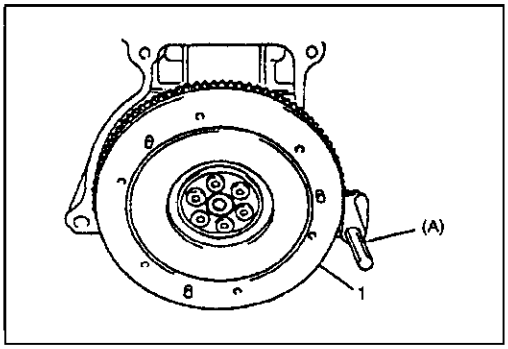
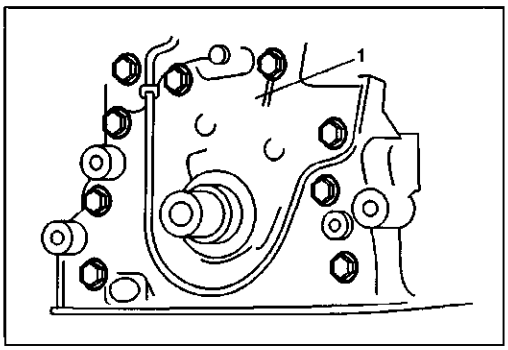


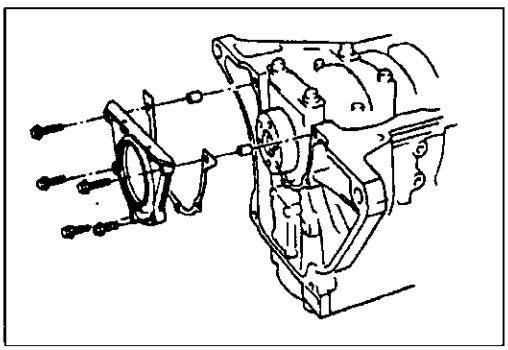
REMOVAL

1) Remove engine assembly from body as previously outlined.
2) Remove clutch cover, clutch disc and flywheel (1) (for M/T vehicle).

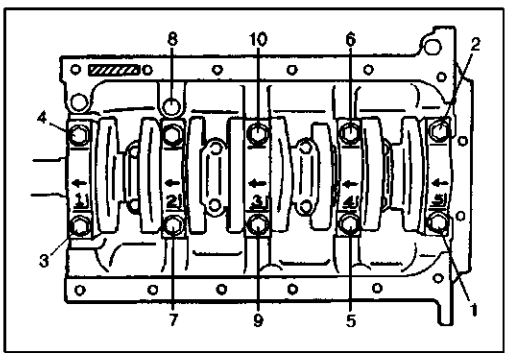
Special Tool
(A): 09924-17811



3) Remove crankshaft pulley, timing belt and crankshaft timing pulley.
4) Remove cylinder head assembly.
5) Remove oil pan and oil pump strainer.
6) Remove oil pump (1).



7) Remove oil seal housing.
8) Remove connecting rod bearing caps.



9) Loosen crankshaft bearing cap bolts in such order as indicated in figure a little at a time and remove bearing caps.
10) Remove crankshaft from cylinder block.

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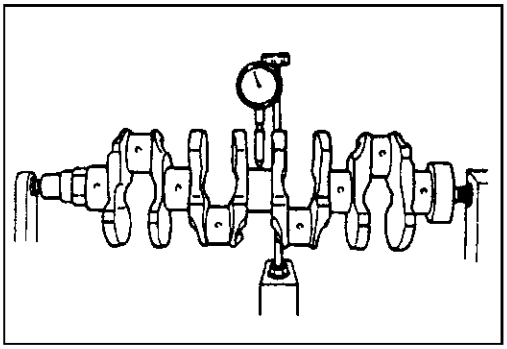


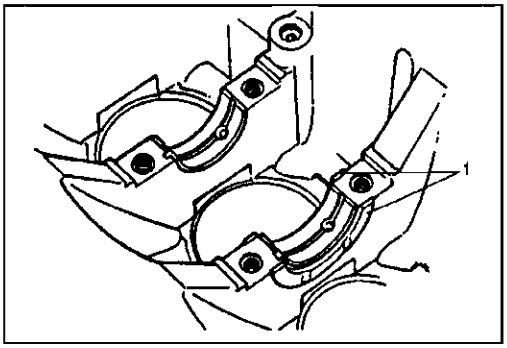
INSPECTION

Crankshaft

Crankshaft runout

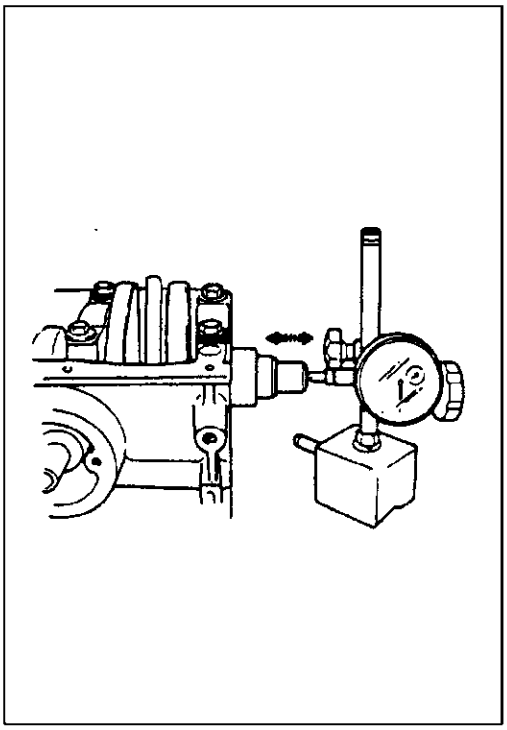
Using a dial gauge, measure runout at center journal. Rotate crankshaft slowly. If runout exceeds its limit, replace crankshaft.

Limit on runout: 0.06 mm (0.0023 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.

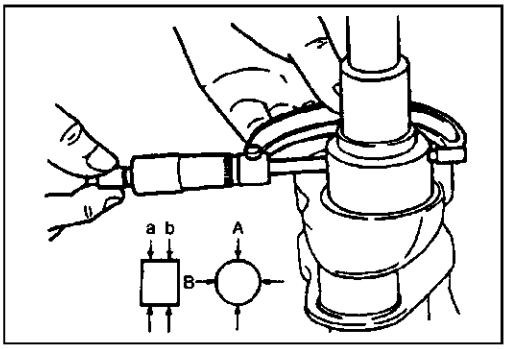


Use a dial gauge to read displacement in axial (thrust) direction of crankshaft.

If its limit is exceeded, replace thrust bearing with new standard one or oversize one to obtain standard thrust play.

Item	Standard	Limit
Crankshaft thrust play	0.11 – 0.31 mm (0.0044 – 0.0122 in.)	0.35 mm (0.0138 in.)

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.)



Out-of-round and taper (uneven wear) of journals

An unevenly worn crankshaft journal shows up as a difference in diameter at a cross section or along its length (or both). This difference, if any, is determined by taking micrometer readings. If any one of journals is badly damaged or if amount of uneven wear in the sense explained above exceeds its limit, regrind or replace crankshaft.

Limit on out-of-round and taper: 0.01 mm (0.0004 in.)

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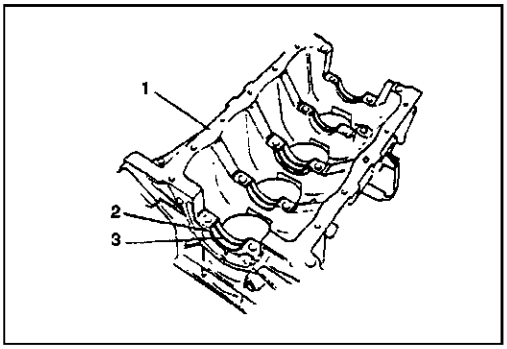
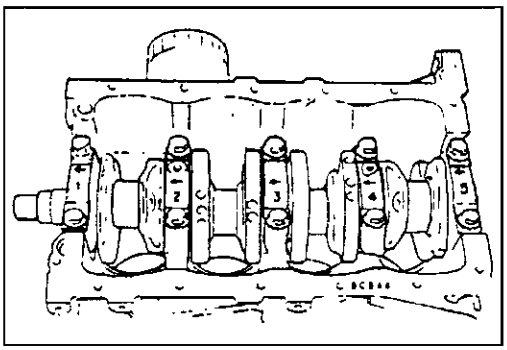


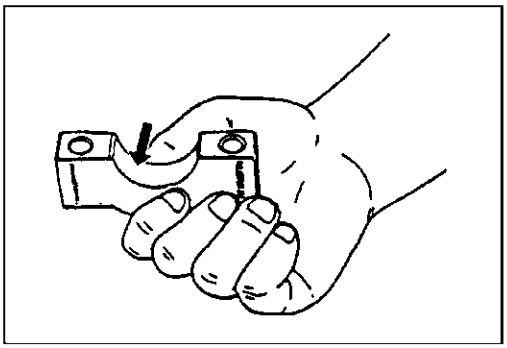
Main Bearings

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 (2) has oil groove (3) as shown in figure. Install this half with oil groove to cylinder block (1).

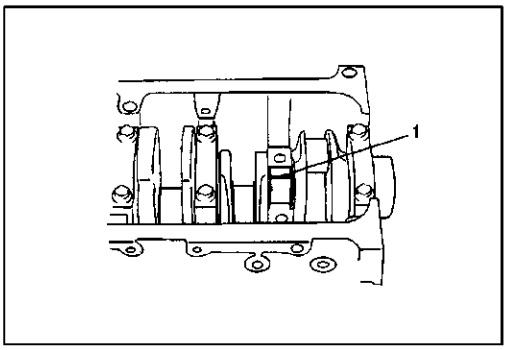


- On each main bearing cap, arrow mark and number are embossed as shown in figure.
  When installing each bearing cap to cylinder block, point arrow mark toward crankshaft pulley side and install each cap from that side to flywheel side in ascending order of numbers "1", "2", "3", "4" and "5". Tighten cap bolts to specified torque.



Inspection

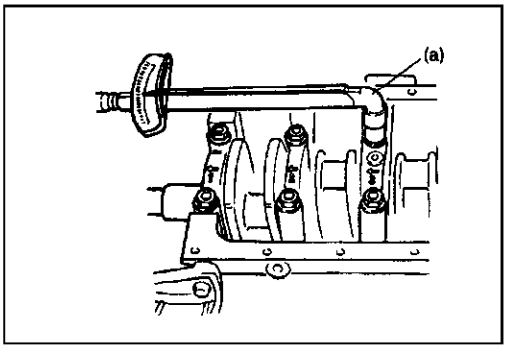
Check bearings for pitting, scratches, wear or damage.
Never replace one half without replacing the other half.



Main bearing clearance

Check clearance by using gaging plastic according to following procedure.

1) Remove bearing caps.
2) Clean bearings and main journals.
3) Place a piece of gaging plastic (1) to full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.



4) Install bearing cap as previously outlined and evenly torque cap bolts to specified torque.
   Bearing cap must be torqued to specification in order to assure proper reading of clearance.

   Tightening Torque
   (a): 45 N-m (4.5 kg-m, 32.5 lb-ft)

   NOTE:
   Do not rotate crankshaft while gaging plastic is installed.

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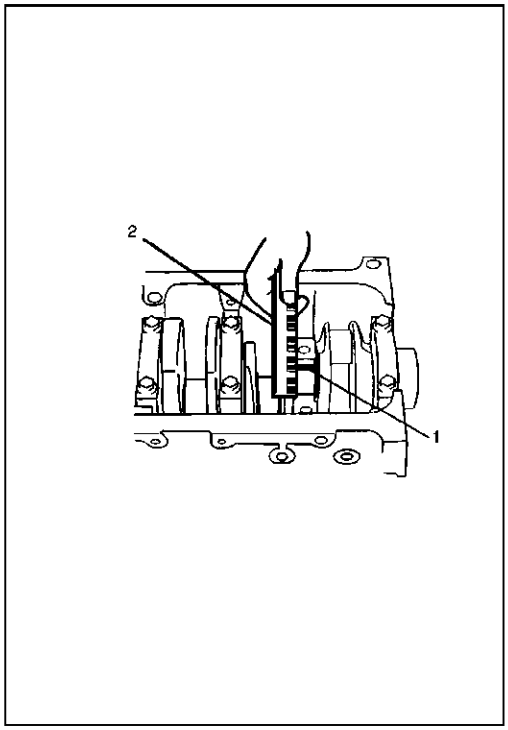
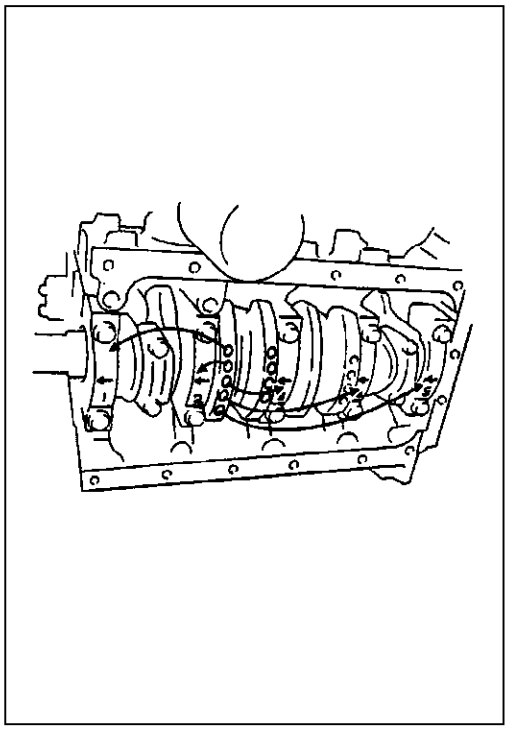


5) Remove cap and using scale (2) on gaging plastic (1) envelope, measure gaging plastic width at its widest point. If clearance exceeds its limit, replace bearing. Always replace both upper and lower inserts as a unit.
A new standard bearing may produce proper clearance. If not, it will be necessary to regrind crankshaft journal for use of 0.25 mm undersize bearing.
After selecting new bearing, recheck clearance.

	Standard	Limit
Bearing clearance	0.020–0.040 mm (0.0008 – 0.0016 in.)	0.065 mm (0.0026 in.)



Selection of main bearings

STANDARD BEARING:

If bearing is in malcondition, or bearing clearance is out of specification, select a new standard bearing according to following procedure and install it.

1) First check journal diameter by using following procedure.
As shown in figure, crank web of No.1 or No.2 cylinder has four or five stamped numerals.
Three kinds of numerals ("1", "2" and "3") represent following journal diameters.

Numeral stamped	Journal diameter
2	43.994 – 44.000 mm (1.7320 – 1.7323 in.)
2	43.988 – 43.994 mm (1.7318 – 1.7320 in.)
3	43.982 – 43.988 mm (1.7316 – 1.7318 in.)

The first, second, third, fourth and fifth (left to right) stamped nu-merals represent journal diameters at bearing caps "1", "2", "3", "4" and "5" respectively.
For example, in figure, the first (leftmost) numeral "3" indicates that journal dia. at bearing cap "1" is within 43.982 – 43.988 mm, and second one "1" indicate that journal dia. at cap "2" is within 43.994 – 44.000 mm.

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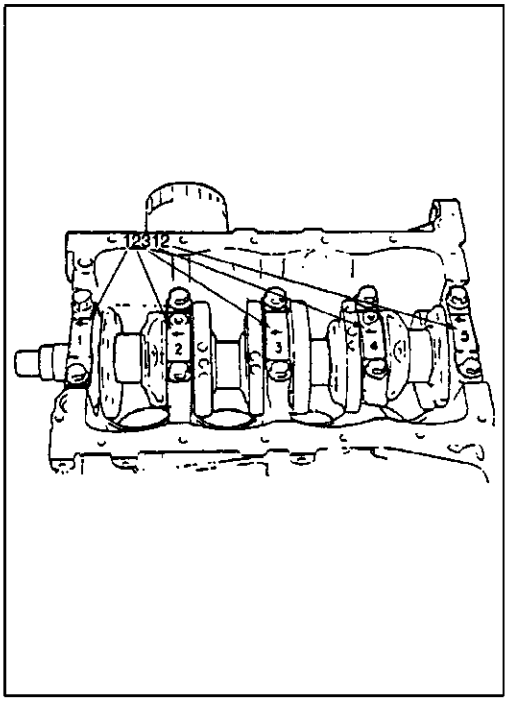
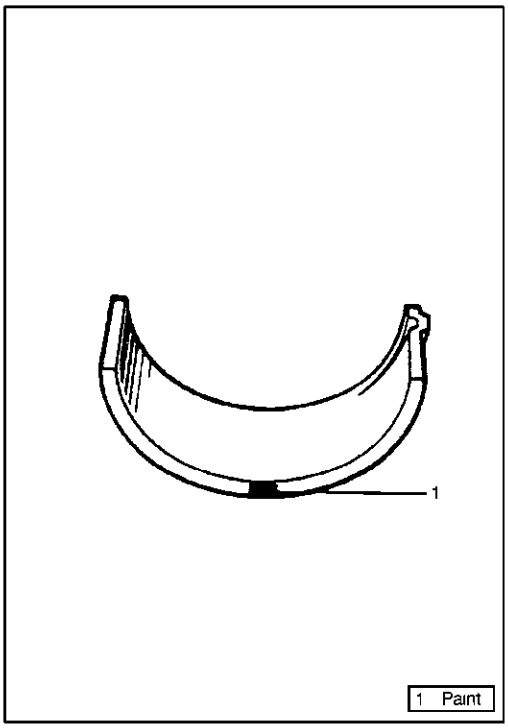


2) Next, check bearing cap bore diameter without bearing. On mating surface of cylinder block, five or four alphabets are stamped as shown in figure.
Three kinds of alphabets (1, 2 and 3) represent following cap bore diameters.

Alphabet stamped	Bearing cap bore diameter (without bearing)
1	48.000 – 48.006 mm (1.8898 – 1.8900 in.)
2	48.006 – 48.012 mm (1.8900 – 1.8902 in.)
3	48.012 – 48.018 mm (1.8902 – 1.8905 in.)

The first, second, third, fourth and fifth (left to right) stamped al-phabets represent cap bore diameters of bearing caps "1", "2", "3", "4" and "5", respectively.

For example, in figure, the first (leftmost) alphabet "1" indicates that cap bore dia. of bearing cap "1" is within 48.000 – 48.006 mm, and the fifth (rightmost) alphabet "2" indicates that cap bore dia. of cap "5" is within 48.012–48.018 mm.



3) There are five kinds of standard bearings differing in thickness.
To distinguish them, they are painted in following colors at the position as indicated in figure.
Each color indicates following thickness at the center of bearing.

Color painted	Bearing thickness
Green	1.986 – 1.990 mm (0.0782 – 0.0783 in.)
Black	1.989 – 1.993 mm (0.0783 – 0.0784 in.)
Colorless (no paint)	1.992 – 1.996 mm (0.0784 – 0.0785 in.)
Yellow	1.995 – 1.999 mm (0.0785 – 0.0787 in.)
Blue	1.998 – 2.002 mm (0.0781 – 0.0788 in.)

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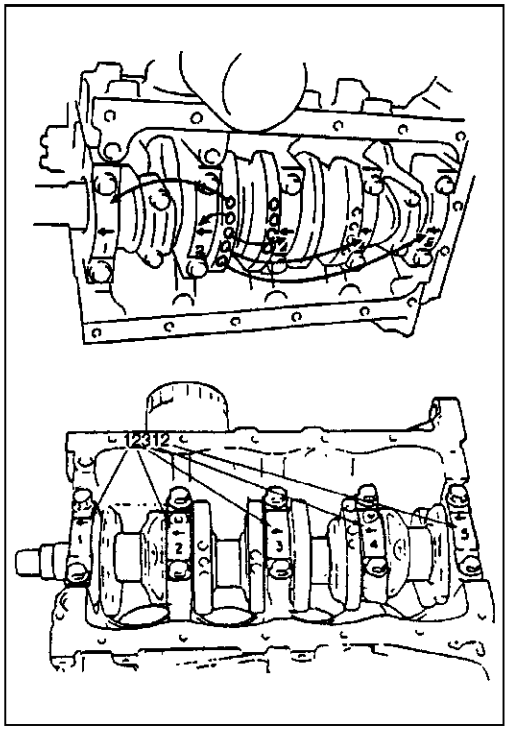
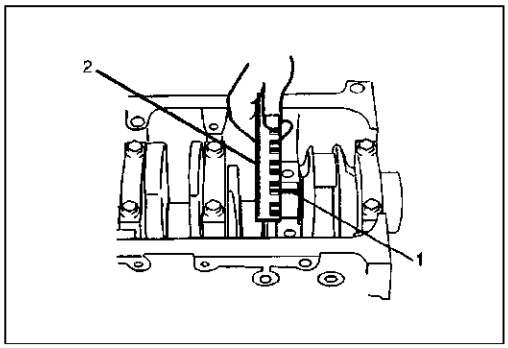
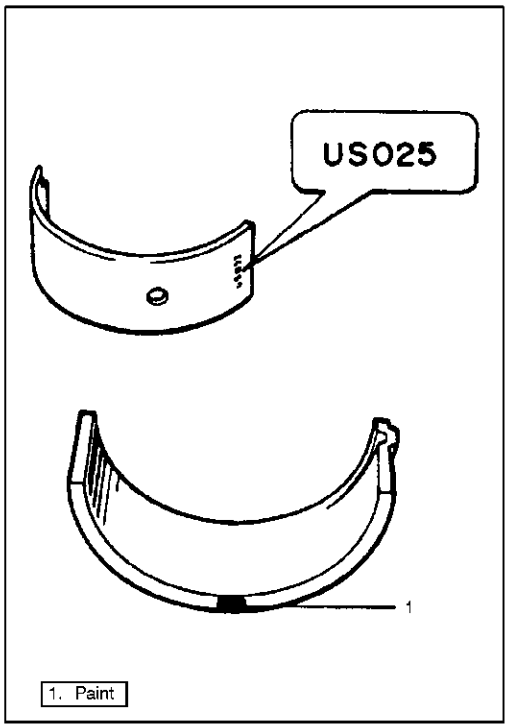


4) From numerals stamped on crank web of No.1 or No.2 cylinder and the alphabets stamped on mating surface of cylinder block, determine new standard bearing to be installed to journal, by referring to table given below.
For example, if numeral stamped on crank web is "1" and alphabet stamped on mating surface is "2", install a new standard bearing painted in "Black" to its journal.

		Numeral stamped on crank web (Journal diameter)		
		1	2	3
Alphabet stamped on mating surface (Bearing cap bore dia.)	1	Green	Black	Colorless
	2	Black	Colorless	Yellow
	3	Colorless	Yellow	Blue
		New standard bearing to be installed.		



5) Using scale (2) on gaging plastic (1), 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 numerals stamped on new crankshaft or alphabets stamped on mating surface of 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 following colors at such position as indicated in figure.
Each color represents following thickness at the center of bearing.

Color painted	Bearing thickness
Green	2.111 – 2.115 mm (0.0831 – 0.0832 in.)
Black	2.114 – 2.118 mm (0.0832 – 0.0833 in.)
Red	2.117 – 2.121 mm (0.0833 – 0.0835 in.)
Yellow	2.120 – 2.124 mm (0.0835 – 0.0836 in.)
Blue	2.123 – 2.127 mm (0.0836 – 0.0837 in.)

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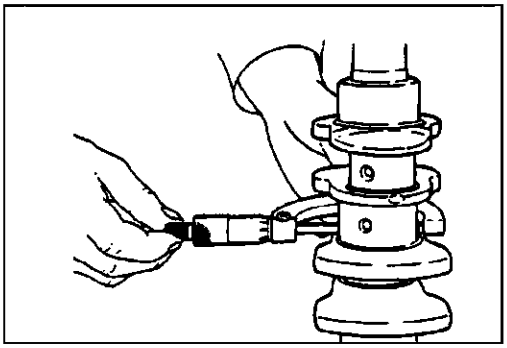
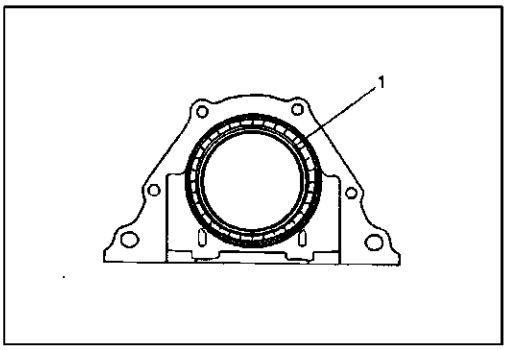
- If necessary, regrind crankshaft journal and select under-size bearing to use with it as follows.
  1) Regrind journal to following finished diameter.

     Finished diameter: 43.732 – 43.750 mm (1.7217 – 1.7224 in.)



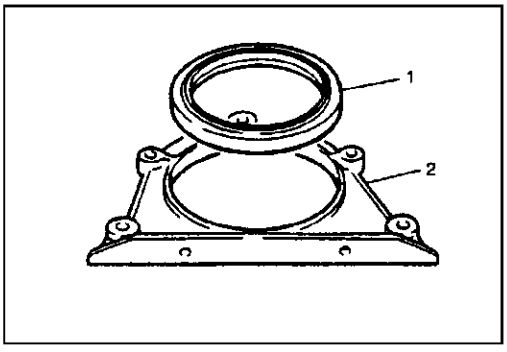
1) Using micrometer, measure reground journal diameter. Measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.
2) Using journal diameter measured above and alphabets stamped on mating surface of cylinder block, select an undersize bearing by referring to table given below. Check bearing clearance with newly selected undersize bearing.

		Measured journal diameter		
		43.744–43.750 mm (1.7220–1.7224 in.)	43.738–43.744 mm (1.7219–1.7220 in.)	43.732–43.738 mm (1.72173–1.7219 in.)
Alphabet stamped on mating surface of cylinder block	A	Green	Black	Red
	B	Black	Red	Yellow
	C	Red	Yellow	Blue
		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) so that oil seal housing (2) end face is flush with oil seal end face.

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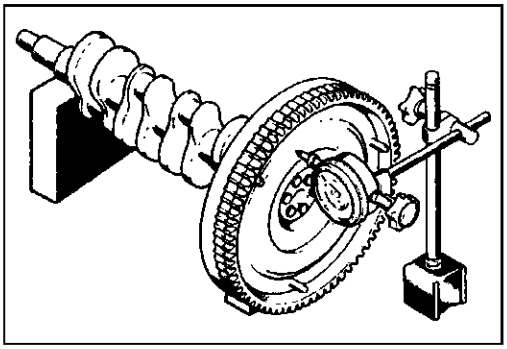
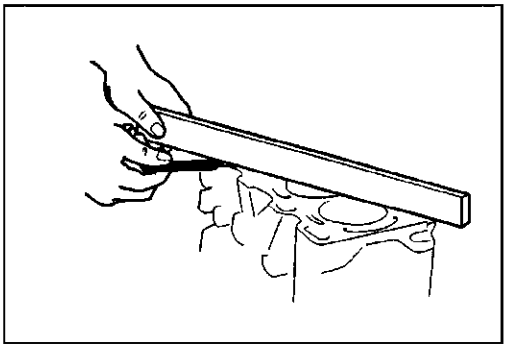


Flywheel

- 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 dial gauge.
  If runout exceeds its limit, replace flywheel.

  Limit on runout: 0.2 mm (0.0078 in.)



Cylinder Block

Distortion of gasketed surface

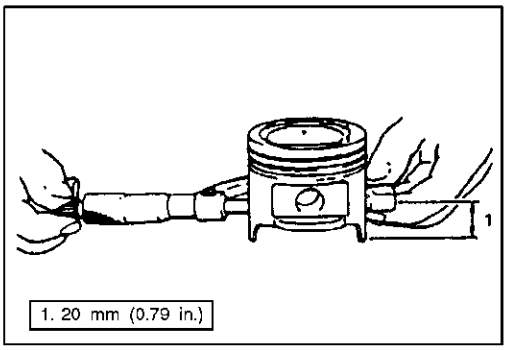
Using straightedge and thickness gauge, check gasketed surface for distortion and, if flatness exceeds its limit, correct it.

Item	Limit
Flatness	0.03 mm (0.0012 in.)

Honing or reboring cylinders

1) When any cylinder needs reboring, all other cylinders must also be rebored at the same time.
2) Select oversized piston according to amount of cylinder wear.

Size	Piston diameter
O/S 0.50	68.970 – 68.990 mm (2.7154 – 2.7161 in.)



1. 20 mm (0.79 in.)

3) Using micrometer, measure piston diameter.

4) Calculate cylinder bore diameter to be rebored.
   D = A + B – C
   D: Cylinder bore diameter to be rebored.
   A: Piston diameter as measured.
   B: Piston clearance = 0.025 – 0.045 mm (0.0009 – 0.0017 in.)
   C: Allowance for honing = 0.02 mm (0.0008 in.)

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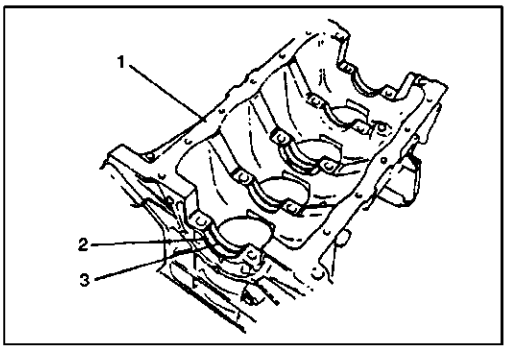
5) Rebore and hone cylinder to calculated dimension.

NOTE:
Before reboring, install all main bearing caps in place and tighten to specification to avoid distortion of bearing bores.

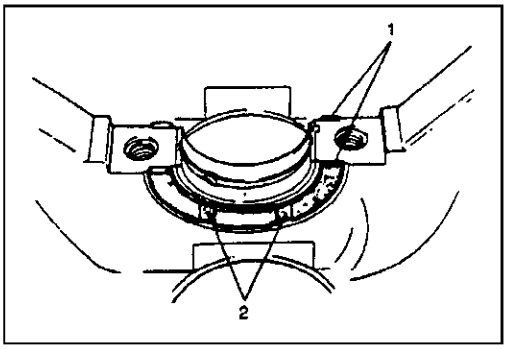
6) Measure piston clearance after honing.

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, bearing 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 main bearings to cylinder block (1).
One of two halves of main bearing (2), has an oil groove (3).
Install it to cylinder block, and the other half without oil groove to bearing cap.
Make sure that two halves are painted in the same color.



2) Install thrust bearings (1) to cylinder block between No.2 and No. 3 cylinders. Face oil groove (2) sides to crank webs.

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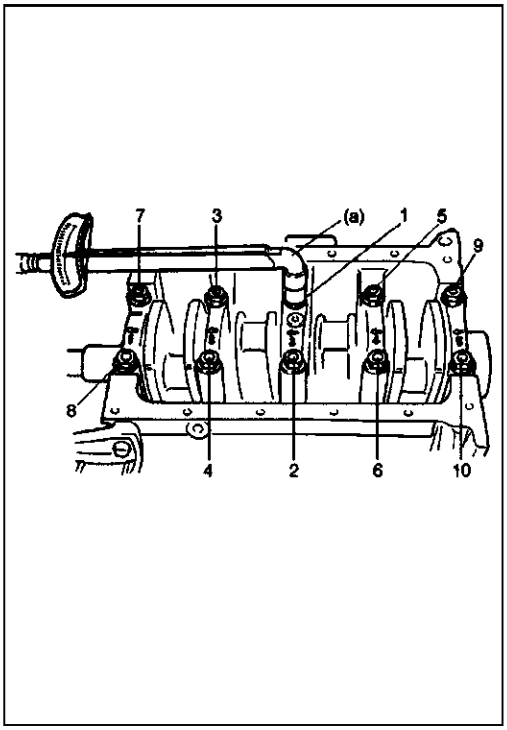
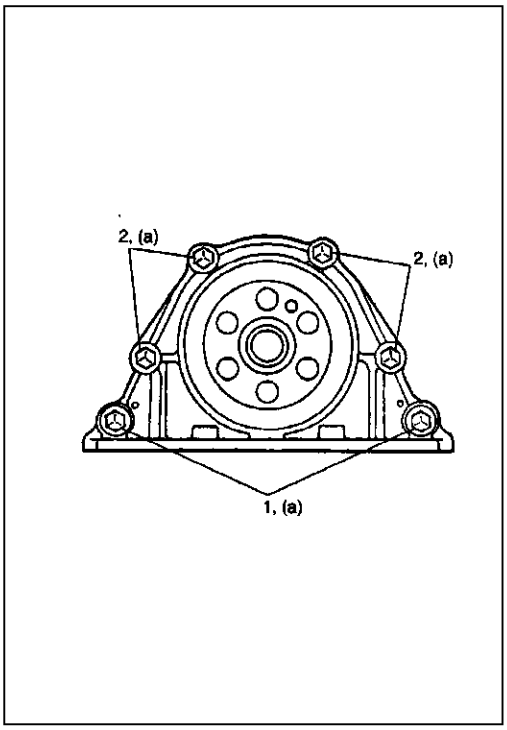


3) Install crankshaft to cylinder block.
4) Install bearing cap to cylinder block, making sure to point arrow mark (on each cap) to crankshaft pulley side. Fit them sequentially in ascending order, 1, 2, 3, 4 and 5, starting from pulley side.

   Tighten bearing cap bolts in such order as shown in figure a little at a time and repeat it till they are tightened to specified torque.

   Tightening Torque
   (a): 45 N-m (4.5 kg-m, 32.5 lb-ft)

   NOTE:
   After tightening cap bolts, check to be sure that crankshaft rotates smoothly when turning it by 7.0 N-m (0.7 kg-m, 5.0 lb-ft) torque or below.



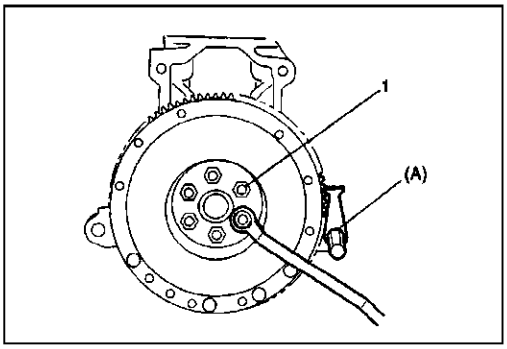
5) Install new gasket and oil seal housing.
   Do not reuse gasket removed in disassembly. Apply engine oil to oil seal lip before installation. Tighten housing bolts to specification.

   Tightening Torque
   (a): 11 N-m (1.1 kg-m, 8.0 lb-ft)

   NOTE:
   As there are 2 types (long bolts (1) and short bolts (2) of housing bolts, refer to figure for their correct use.

   After installing oil seal housing, gasket edges might bulge out; if so, cut them off to make them flush with cylinder block and oil seal housing.

6) Install oil pump.
   Refer to item OIL PUMP for installation of oil pump.



7) Install flywheel (M/T model).
   Using special tool, lock flywheel or drive plate, and torque its bolts (1) to specification.

   Special Tool
   (A): 09924-17810

   Tightening Torque
   (a): 42 N-m (4.2 kg-m, 30.5 lb-ft)

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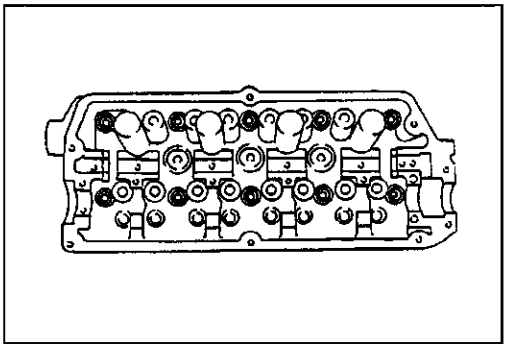
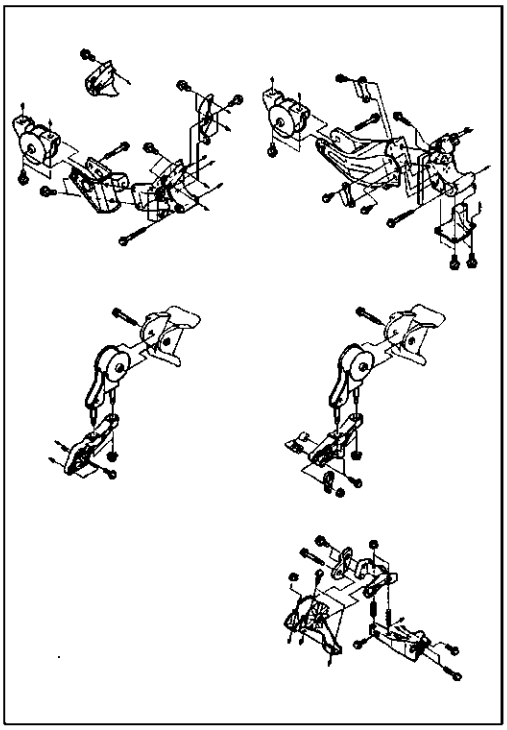
8) Install pistons and connecting rods as previously outlined.
9) Install oil pump strainer and oil pan as previously outlined.



10) Install cylinder head assembly to cylinder block, referring to "VALVES AND CYLINDER HEAD INSTALLATION" in this section.
11) Install camshaft, crankshaft timing belt pulley, timing belt, crankshaft pulley, water pump pulley, etc., as previously outlined.
12) Install clutch to flywheel (for M/T vehicle). For clutch installation, refer to SECTION 7C.



13) Install transmission and engine mountings brackets.
14) Install engine assembly with transmission to vehicle, referring to "ENGINE ASSEMBLY INSTALLATION" in this section.

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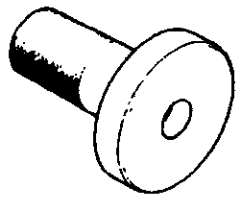
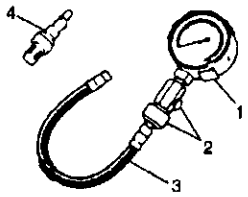
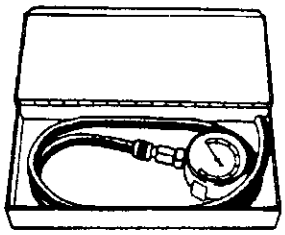
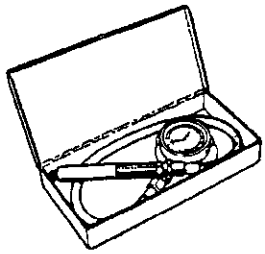
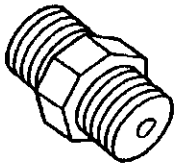
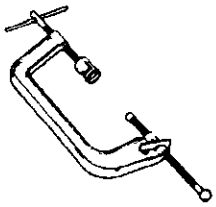
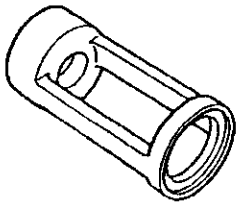
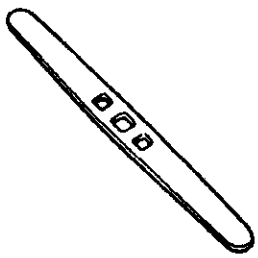
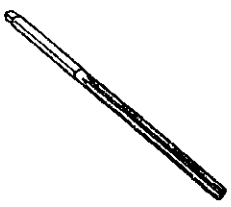
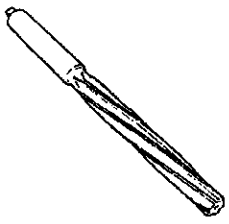
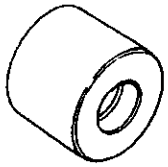
REQUIRED SERVICE MATERIAL

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Sealant	SUZUKI BOND NO. 1207C (99000-31150)	• Mating surfaces of cylinder block and oil pan. • Cylinder head cover gasket and cylinder head side seal.
	SUZUKI BOND NO. 1215 (99000-31110)	• Mating surface of camshaft No.1 housing and end housing.

SPECIAL TOOLS

 09913-75520 Bearing installer	 1. 09915-64510-001 Compression gauge 2. 09915-64510-002 Connector 3. 09915-64530 Hose 4. 09915-64550 Attachment	 09915-67311 Vacuum gauge	 09915-77311 Oil pressure gauge
 09915-78211 Oil pressure gauge attachment	 09916-14510 Valve lifter	 09916-14910 Valve lifter attachment	 09916-34542 Reamer handle
 09916-34550 Reamer (5.5 mm)	 09916-37320 Reamer (10.5 mm)	 09916-44910 Valve guide remover	 09916-57340 Valve guide installer attachment

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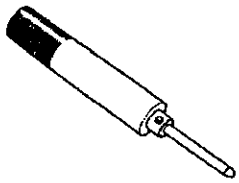
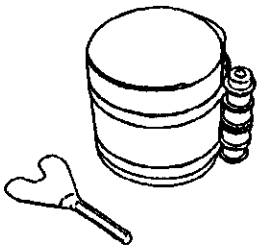
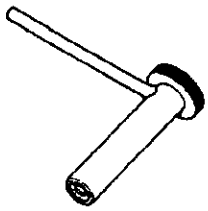
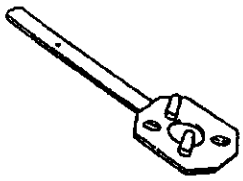
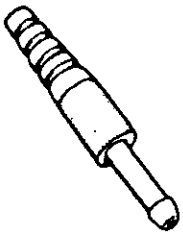
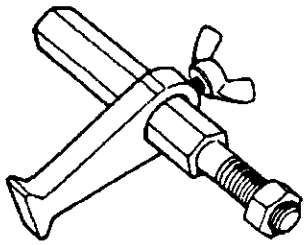
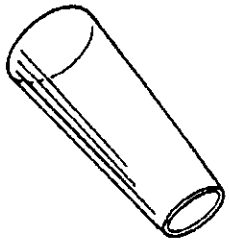
 09916-58210 Valve guide installer handle	 09916-77310 Piston ring compressor	 09917-18211 Tappet adjuster wrench	 09917-68221 Camshaft pulley holder
 09917-98221 Valve stem seal installer	 09918-08210 Vacuum gauge hose joint	 09924-17811 Flywheel holder	 09926-18210 Oil seal guide (Vinyl resin)

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SECTION 6B

ENGINE COOLING

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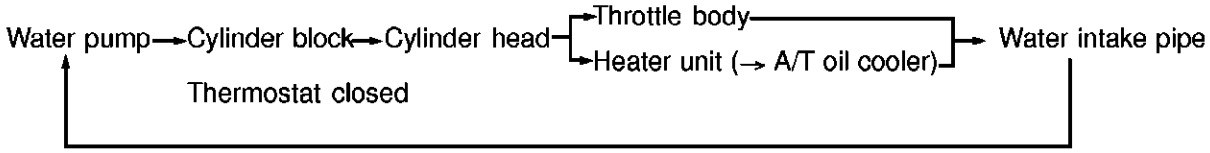
GENERAL DESCRIPTION

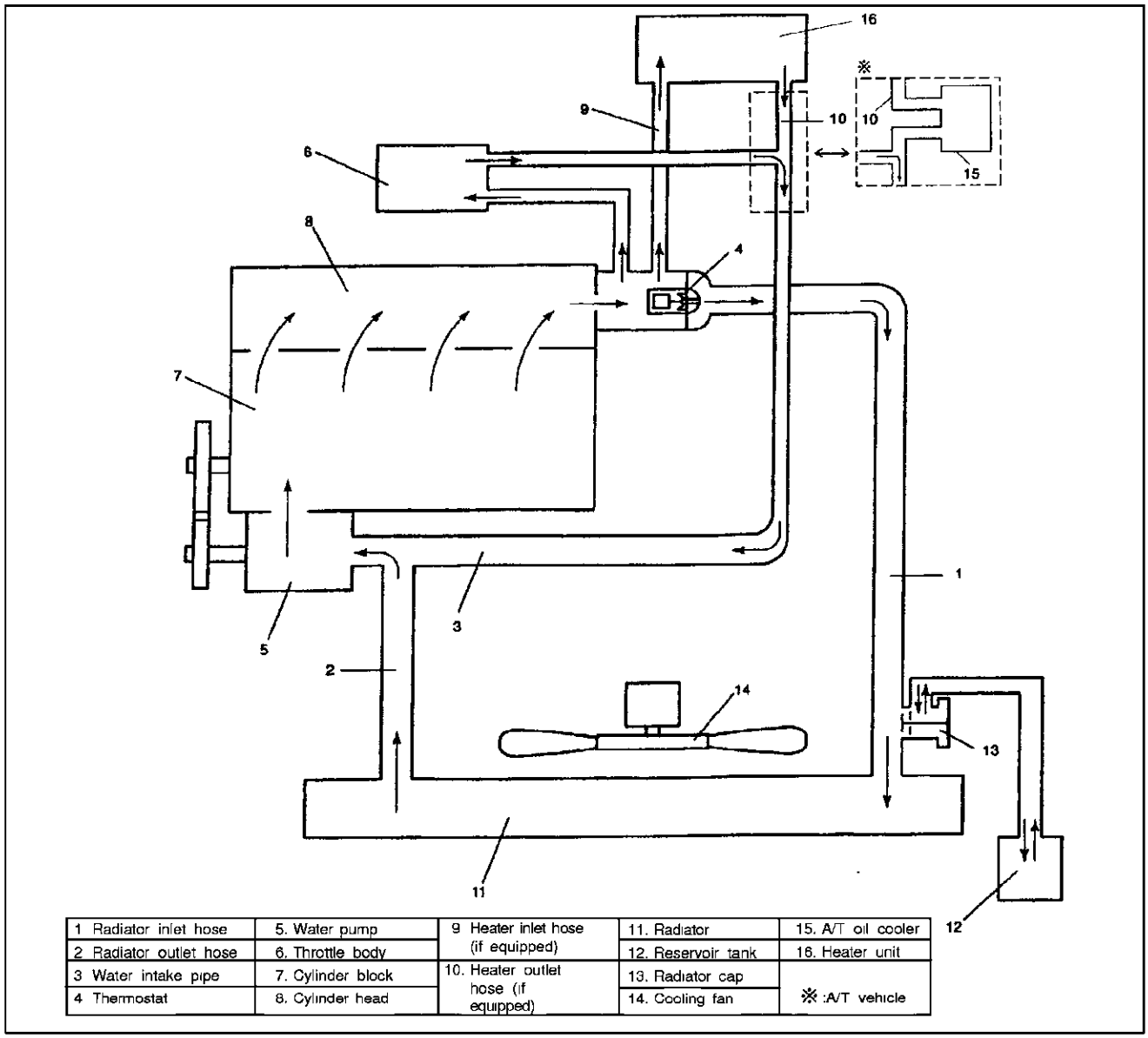
The cooling system mainly consists of the radiator cap, radiator, coolant reservoir, hoses, water pump, cooling fan and thermostat. The radiator is of tube-and-fin type.

COOLING SYSTEM CIRCULATION

1) While the engine is warmed up (thermostat closed), coolant circulates as follows.



2) When coolant is warmed up to normal temperature and the thermostat opens, coolant passes through the radiator core to be cooled as well as the above flow circuit.



1 Radiator inlet hose	5. Water pump	9 Heater inlet hose (if equipped)	11. Radiator	15. A/T oil cooler
2 Radiator outlet hose	6. Throttle body		12. Reservoir tank	16. Heater unit
3 Water intake pipe	7. Cylinder block	10. Heater outlet hose (if equipped)	13. Radiator cap	※ :A/T vehicle
4 Thermostat	8. Cylinder head		14. Cooling fan	

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DIAGNOSIS

Symptom	Possible Cause	Remedy
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 motor	Check and replace as necessary.
	• Faulty fan motor control circuit	Refer to "RADIATOR FAN CONTROL SYSTEM CHECK" in SECTION 6E1.
	• Plugged radiator	Check and replace radiator as necessary.
	• Faulty radiator cap	Replace.
	• Improper ignition timing	Adjust.
	• Dragging brakes	Adjust brake.
	• Slipping clutch	Adjust or replace.

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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 a 50/50 mixture of water and ethylene glycol antifreeze (70/30; in a market where no freezing temperature is anticipated).

This 50/50 mixture coolant solution provides freezing protection to –36°C (–33°F).

- Maintain cooling system freeze protection at –36°C (–33°F) to ensure protection against corrosion and loss of coolant from boiling. This should be done even if freezing temperatures are not expected.
- Add ethylene glycol base coolant when coolant has to be added because of coolant loss or to provide added protection against freezing at temperature lower than –36°C (–33°F).

NOTE:

- **Alcohol or methanol base coolant or plain water alone should not be used in cooling system at any time as damage to cooling system could occur.**
- **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.**

ANTI-FREEZE PROPORTIONING CHART

ANTI-FREEZE PROPORTIONING CHART	Freezing temperature	°C	-16	-36
		°F	3	-33
	Anti-freeze/Anti-corrosion coolant concentration	%	30	50
	Ratio of compound to cooling water	ltr.	1.05/2.45	1.75/1.75
		US pt.	2.22/5.18	3.70/3.70
		Imp pt.	1.85/4.31	3.08/3.08
COOLANT CAPACITY	Engine radiator and heater		3.1 liters (6.55/5.46 US/Imp. pt.)	
	Reservoir		0.40 liters (0.85/0.70 US/Imp. pt.)	
	Total		3.5 liters (7.40/6.16 US/Imp. pt.)	

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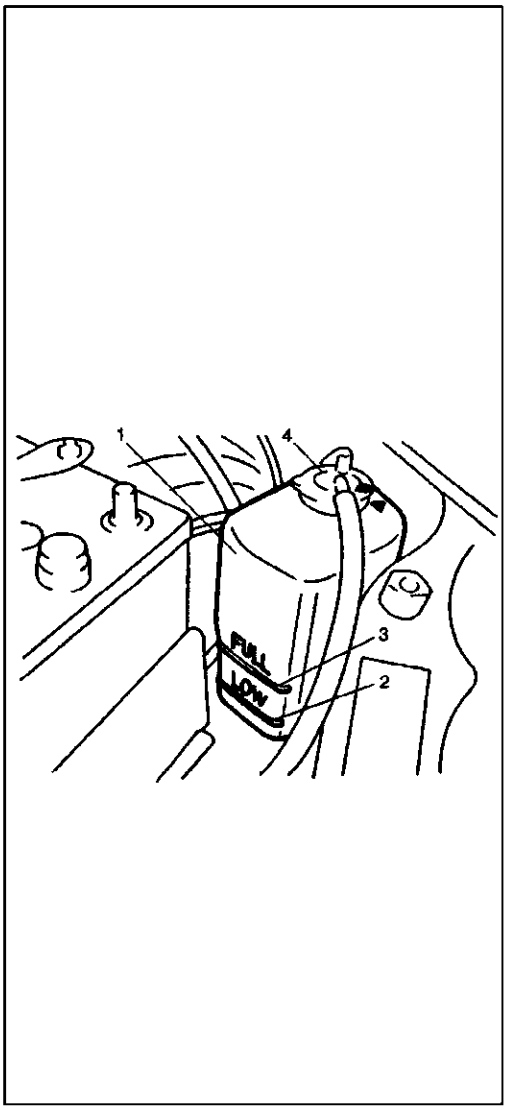

COOLANT LEVEL

Coolant Level

To check level, lift hood and look at "see-through" coolant reservoir.
It is not necessary to remove radiator cap to check coolant level.

WARNING:
To help avoid danger of being burned:
- **do not remove reservoir tank 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.

When engine is cool, check coolant level in reservoir (1).
A normal coolant level should be between FULL and LOW marks on reservoir.
If coolant level is below LOW mark (2), remove reservoir cap and add proper coolant to reservoir to bring coolant level up to FULL mark (3). Then, reinstall cap (4) and align match marks on reservoir and 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, and are unnecessary expense.**
- **When installing reservoir cap, align arrow marks on reservoir and cap.**

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.

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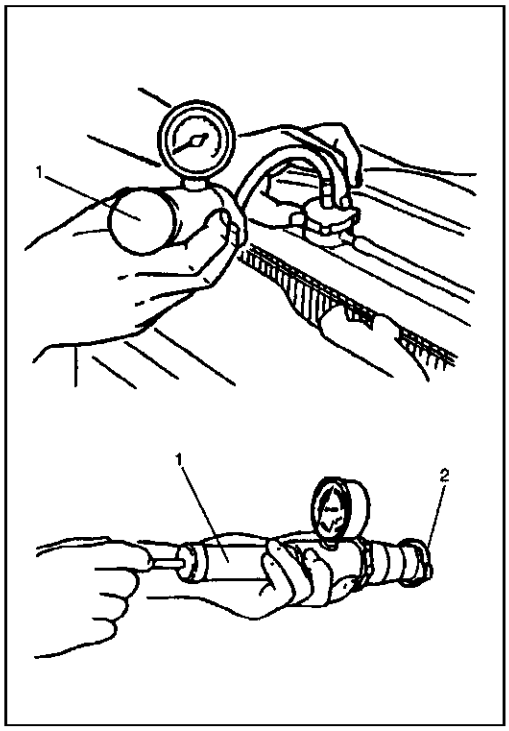


4) Using a pressure tester (1), check system and radiator cap (2) for proper pressure holding capacity about 110 kPa (1.1 kg/cm², 15.6 psi). If replacement of cap is required, use a proper cap for this vehicle.

NOTE:
After installing radiator cap to radiator, make sure that the ear of cap lines is parallel to radiator.

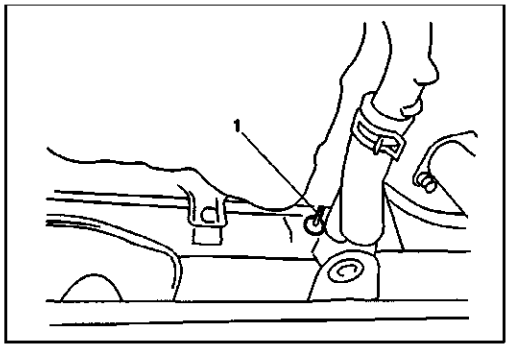
5) Tighten hose clamps and inspect all hoses. Replace hoses whenever cracked, swollen or otherwise deteriorated.
6) Clean frontal area of radiator core.

COOLING SYSTEM FLUSH AND REFILL

1) Remove radiator cap when engine is cool:
Turn cap counterclockwise slowly 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 counterclockwise.

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.

2) With radiator cap removed, run engine until upper radiator hose is hot (this shows that thermostat is open and coolant is flowing through system).



3) Stop engine and drain coolant.
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 (1) tightly.

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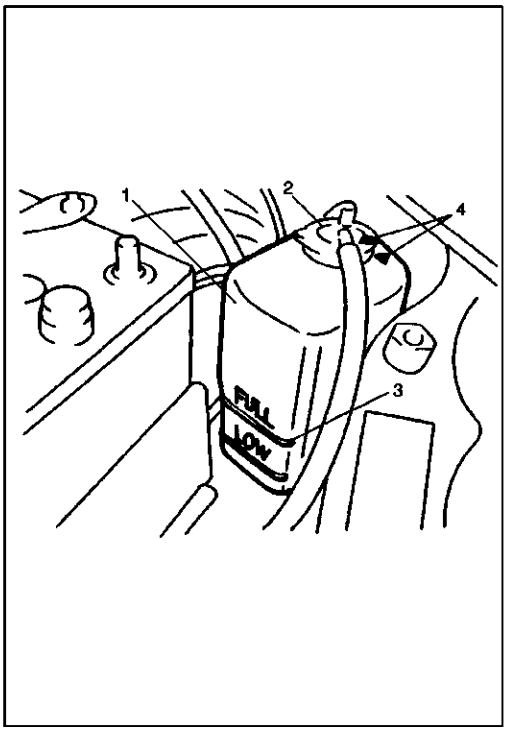


7) Remove reservoir (1) and remove cap (2) from reservoir and pour out any fluid, scrub and clean inside of reservoir with soap and water.

   Flush it well with clean water and drain. Reinstall reservoir.

8) Add 50/50 mixture of good quality ethylene glycol antifreeze and water to radiator and reservoir.

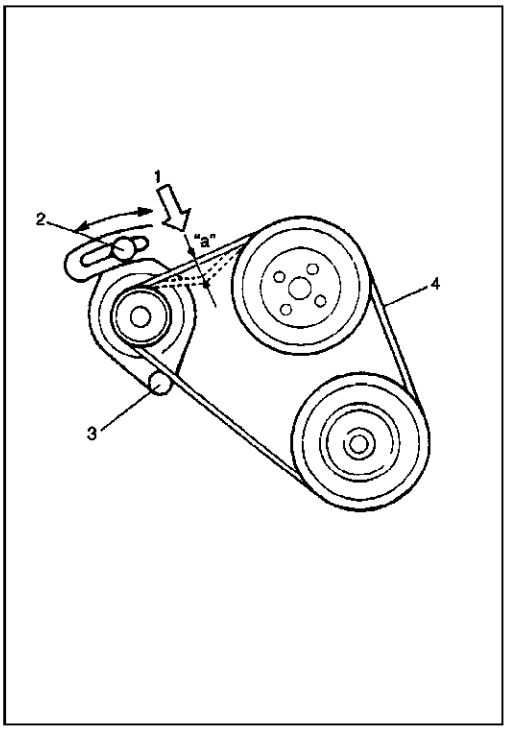
   Fill radiator to the base of radiator filler neck and reservoir to FULL level mark (3). Reinstall reservoir cap and align match marks (4) on reservoir and cap.

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 is parallel to radiator.

WATER PUMP BELT TENSION

WARNING:
- **Disconnect negative cable at battery before checking and adjusting belt tension.**
- **See WARNING described in COOLING SYSTEM SERVICE.**



1) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If it is necessary to replace belt, refer this section for procedure.

2) Check belt (4) for tension. Belt is in proper tension when it deflects specification below under thumb pressure (1) (about 100 N, 10 kg or 22 lb.).

   Belt tension "a": 12 – 15 mm (0.45 – 0.6 in.) as deflection

   NOTE:
   When replacing belt with a new one, adjust belt tension to 8 – 9 mm (0.3 – 0.35 in.).

3) If belt is too tight or too loose, adjust it to proper tension by displacing generator position.

4) Tighten belt adjusting bolt (2) and generator pivot bolt (3).

5) Connect negative cable at battery terminal.

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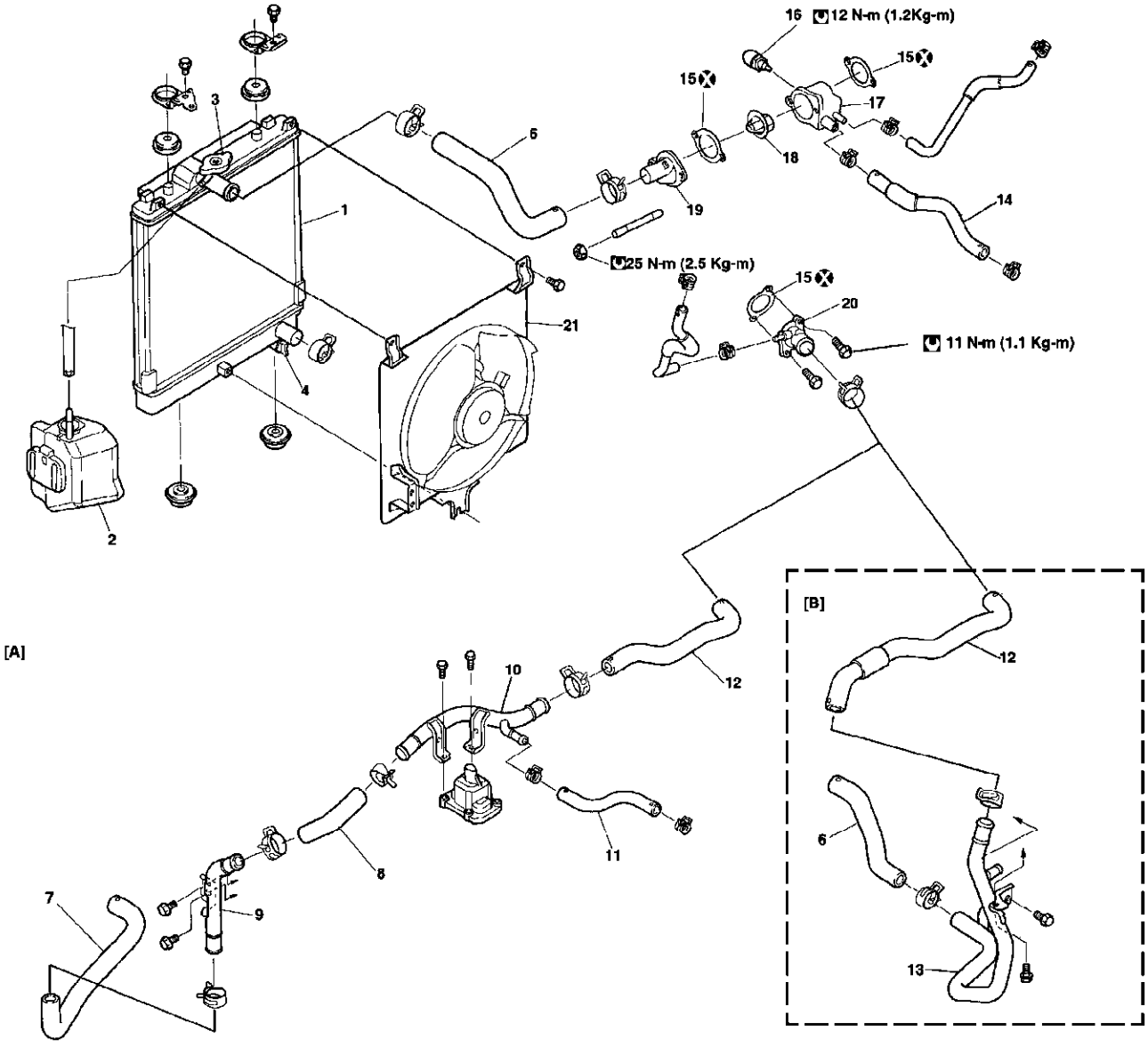
ON-VEHICLE SERVICE

WARNING:
- **Check to make sure that engine coolant temperature is cold before removing any part of cooling system.**
- **Also be sure to disconnect negative cord from battery terminal before removing any part.**

SYSTEM COMPONENTS



[A]	For M/T vehicle	8.	Radiator outlet hose No.2	17.	Thermostat case
[B]	For A/T vehicle	9.	Radiator outlet pipe No 1	18.	Thermostat
1	Radiator	10.	Radiator outlet pipe No 2	19.	Thermostat cap
2	Reservoir tank	11.	Heater outlet hose	20.	Water inlet cap
3	Radiator cap	12.	Water inlet hose	21.	Radiator cooling fan assembly
4	Drain plug	13.	Radiator outlet pipe	●	Tightening torque
5	Radiator inlet hose	14	Heater inlet hose		
6	Radiator outlet hose	15	Gasket	⊗	Do not reuse
7	Radiator outlet hose No.1	16.	ECT sensor		

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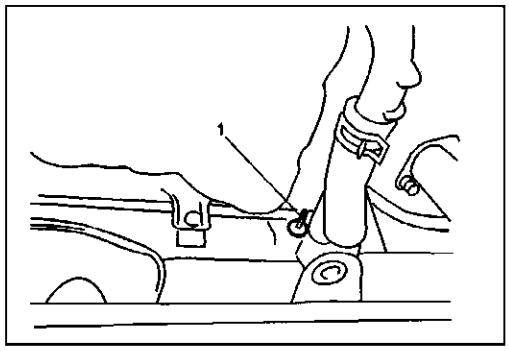
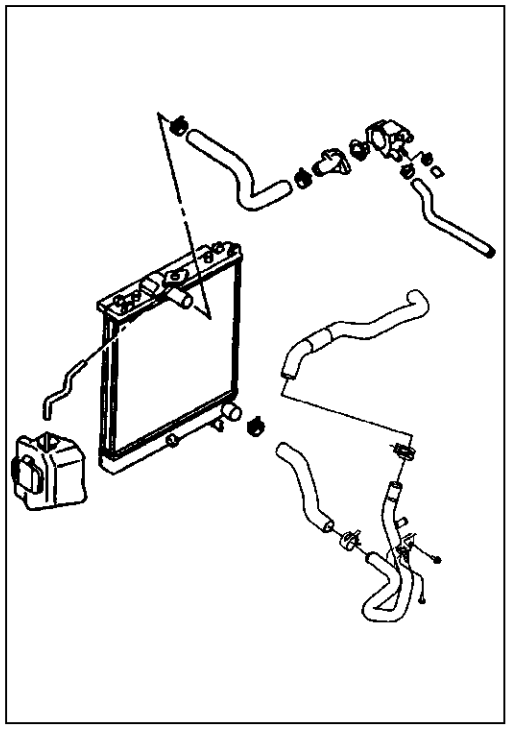


COOLING SYSTEM DRAINING

1) Remove radiator cap.
2) Loosen drain plug (1) on radiator to drain coolant.
3) After draining coolant, be sure to tighten drain plug securely.
4) Fill cooling system. (Refer to Item COOLANT of MAINTENANCE.)



COOLING WATER PIPES OR HOSES

REMOVAL

1) Drain cooling system.
2) To remove these pipes or hoses, loosen clamp on each hose and pull hose end off.

INSTALLATION

Install removed parts in reverse order of removal procedure, noting the following.

- Tighten each clamp securely.
- Refill cooling system with proper coolant, referring to description on COOLANT of MAINTENANCE.

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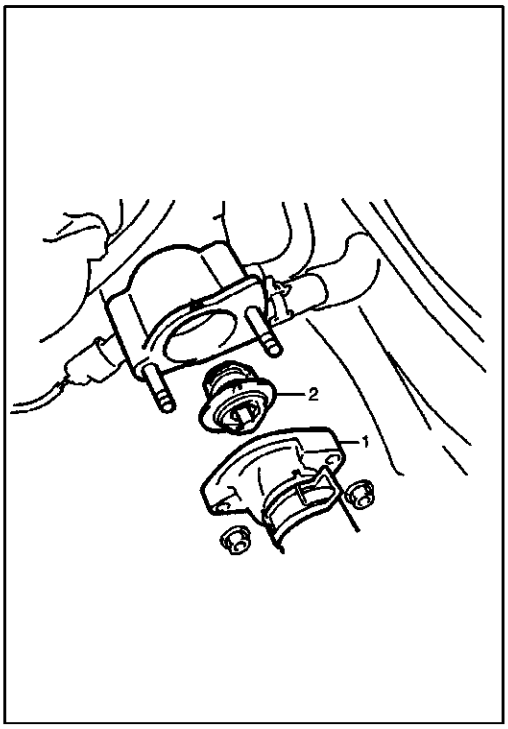
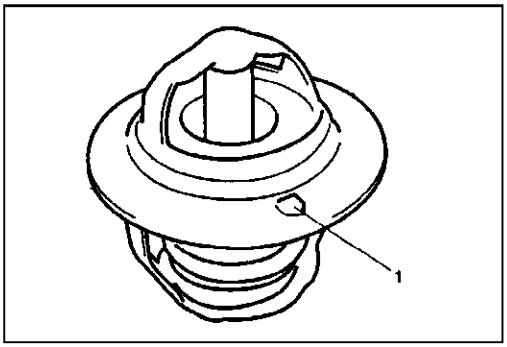


THERMOSTAT

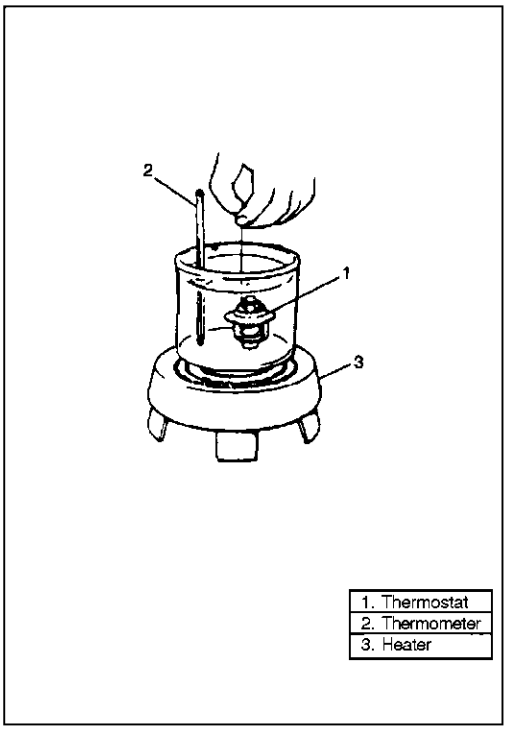
REMOVAL

1) Drain coolant and tighten drain plug.
2) Remove air cleaner case together with air inlet hose.
3) Remove thermostat cap (1) with air cleaner case bracket.
4) Remove gasket and thermostat (2).



INSPECTION

1) Make sure that air bleed valve (1) of thermostat is clean.
   Should this valve be clogged, engine would tend to overheat.
2) Check to make sure that valve seat is free from foreign matters which would prevent valve from seating tight.



4) Check thermostatic movement of wax pellet as follows:
   i) Immerse thermostat in water, and heat water gradually.
   ii) Check that valve starts to open at specific temperature.
   iii) If valve starts to open at a temperature substantially below or above specific temperature, thermostat unit should be replaced with a new one. Such a unit, if reused, will bring about overcooling or overheating tendency.

Thermostat functional spec. ±1.5°C (2.7°F)	
Temp. at which valve begins to open	82°C (179°F)
Temp. at which valve become fully open	95°C (203°F)
Valve lift	More than 8 mm at 95°C

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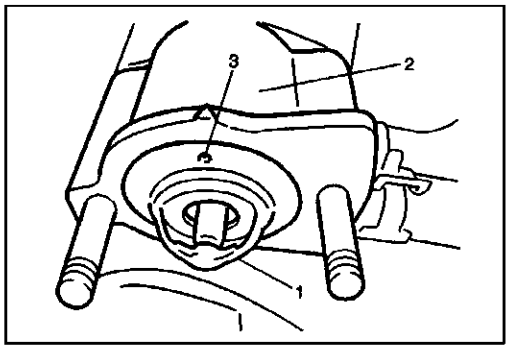
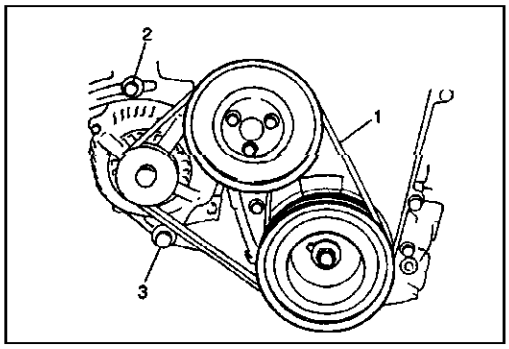


INSTALLATION

1) When positioning thermostat (1) on thermostat case (2), be sure to position it so that air bleed valve (3) comes at position as shown in figure.
2) Install gasket.

NOTE:
Use new gasket.

3) Install thermostat cap to thermostat case.
4) Connect cooling water hose.
5) Fill cooling system, referring to "COOLING SYSTEM FLUSH AND REFILL" in this section.
6) Install air cleaner case.
7) Connect negative cable at battery.
8) After installation, check each part for leakage.



WATER PUMP BELT

REMOVAL

1) Disconnect negative cable at battery.
2) Loosen drive belt adjusting bolt (2) and generator pivot bolt (3).
   When servicing car equipped with A/C, remove compressor drive belt before removing water pump belt (1).
3) Slacken belt by displacing generator and then remove it.

INSTALLATION

1) Install belt to water pump pulley, crankshaft pulley and generator pulley.
   When servicing car equipped with A/C, install compressor drive belt, too.
2) Adjust tension of water pump belt and A/C compressor drive belt respectively, referring to "WATER PUMP BELT TENSION" in this section and "A/C COMPRESSOR DRIVE BELT INSPECTION" in SECTION 1B.
3) Connect negative cable at battery.

WATER PUMP BELT TENSION INSPECTION AND ADJUSTMENT

For this inspection or adjustment, refer to "WATER PUMP BELT TENSION" in this section.

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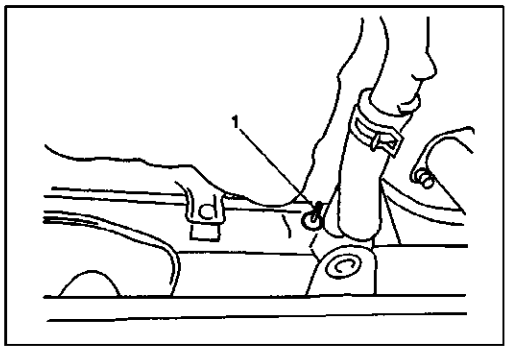
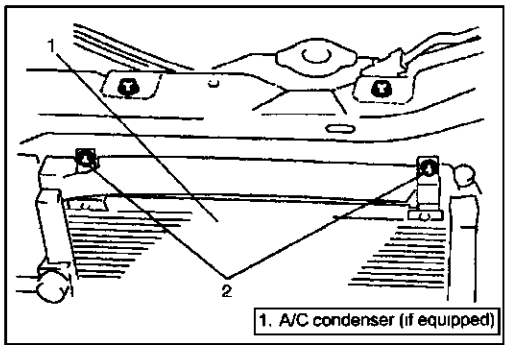


RADIATOR AND FAN

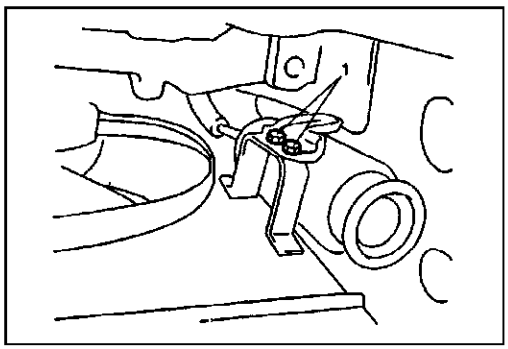
REMOVAL

1) Disconnect negative cable at battery.
2) Drain cooling system by loosening drain plug (1) of radiator.
3) Disconnect coupler of cooling fan motor.
4) Remove air intake hose from air cleaner case.
5) Disconnect radiator inlet and outlet hoses and reservoir hose from radiator.



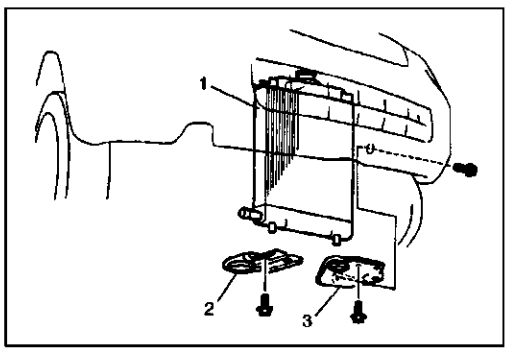
1. A/C condenser (if equipped)

6) Remove front bumper, referring to "BUMPERS" in SECTION 9.
7) Remove A/C condenser mounting bolts (2) if equipped.

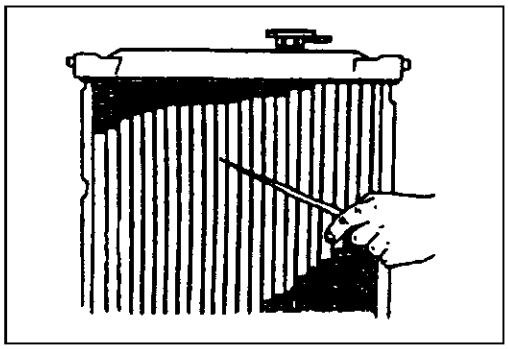


8) Remove A/C receiver/dryer mounting bolts (1) from cooling fan and then pull out A/C condenser a little and make its bottom off from radiator, if equipped.

NOTE:
Hang removed A/C condenser with a wire hook or the like so as to prevent A/C condenser hoses bending and twisting excessively or being pulled.



9) Remove stabilizer bar mounting bracket bolts.
10) Remove left side stabilizer mount bracket (3) and radiator mount bracket (2) from vehicle body.
11) Remove radiator (1) with cooling fan motor.



INSPECTION

Check radiator for leakage or damage. Straighten bent fins, if any.

CLEANING

Clean frontal area of radiator cores.

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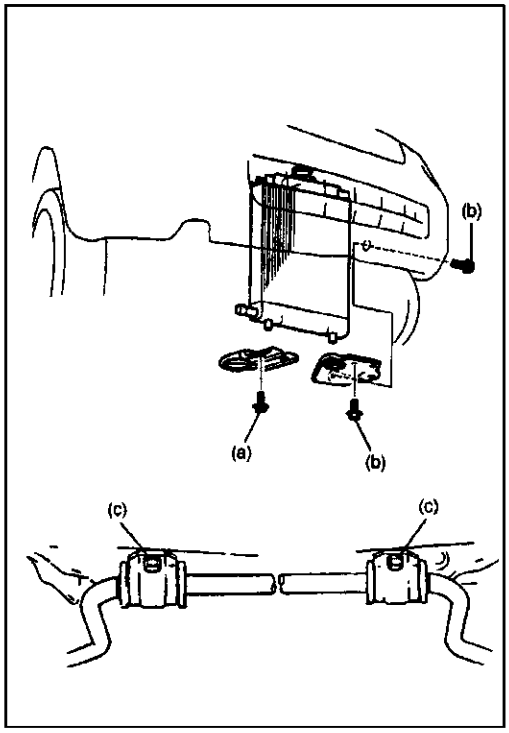


INSTALLATION

Reverse removal procedures, noting the followings.

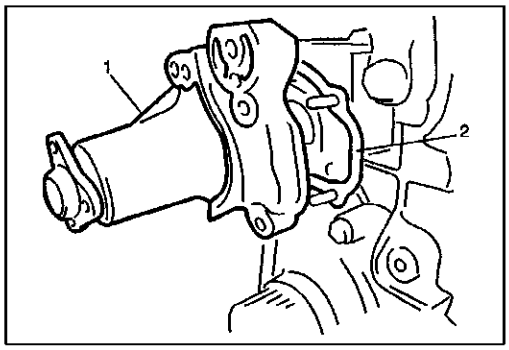
- Tighten mounting bolts and bracket bolts to specified torque.

Tightening Torque
(a): 23 N-m (2.3 kg-m, 17.0 lb-ft)
(b): 50 N-m (5.0 kg-m, 36.5 lb-ft)
(c): 45 N-m (4.5 kg-m, 32.5 lb-ft)

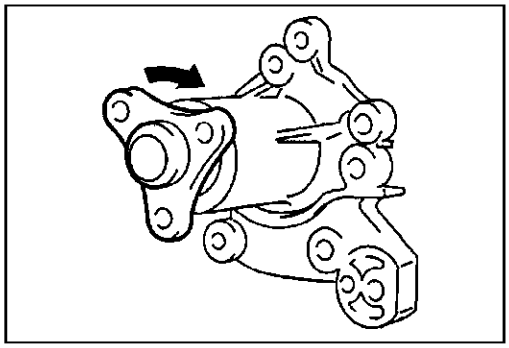
- Fill cooling system, referring to "COOLING SYSTEM FLUSH AND REFILL" in this section.
- After installation, check each joint for leakage.

WATER PUMP

1) Disconnect negative cable at battery.
2) Drain cooling system.
3) Remove oil level gauge guide with oil level gauge.
4) Remove timing belt and tensioner according to procedure described in item "TIMING BELT AND BELT TENSIONER" of SECTION 6A.



5) Remove water pump (1), gasket (2) and rubber seal.



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 abnormal noise, replace it.

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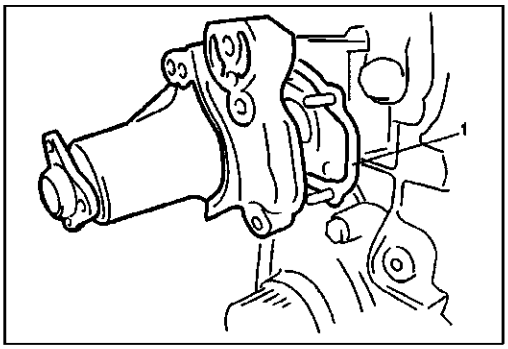
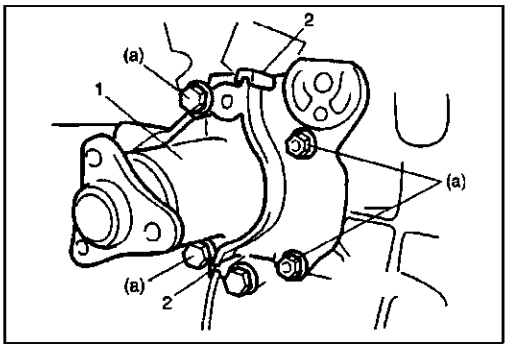


INSTALLATION

1) Install new pump gasket (1) to cylinder block.



2) Install water pump (1) to cylinder block.
   Tightening Torque
   (a): 11 N- m (1.1 kg-m, 8.0 lb-ft)
3) After installing water pump, install rubber seal (2).
4) Install belt tensioner, timing belt and timing belt outside cover according to procedure described in item "TIMING BELT AND BELT TENSIONER" of SECTION 6A.
5) With engine oil applied to O-ring, install oil level gauge guide.
6) Adjust drive belt tension, referring to "WATER PUMP BELT INSTALLATION" in this section.
7) Fill cooling system, referring to "COOLING SYSTEM FLUSH AND REFILL in this section.
8) After installation, check each part for leakage.

REQUIRED SERVICE MATERIAL

MATERIAL	USE
Ethylene glycol base coolant (Anti-freeze/Anti-corrosion coolant)	Engine cooling system for improving cooling efficiency and for protection against rusting.

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SECTION 6C

ENGINE FUEL

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).**

CAUTION:
The engine of this vehicle requires the use of unleaded fuel only. Use of leaded and/or low lead fuel can result in damage and reduce the effectiveness of the catalytic converter.

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Fuel System 6C- 2
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ON-VEHICLE SERVICE 6C- 3
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Fule Tank 6C- 5
Fuel Pump Assembly (with Fuel Filter, Fuel Level Gauge & Tank Pressure Control Valve) 6C-10
Disassembly and Assembly of Fuel Pump 6C-12
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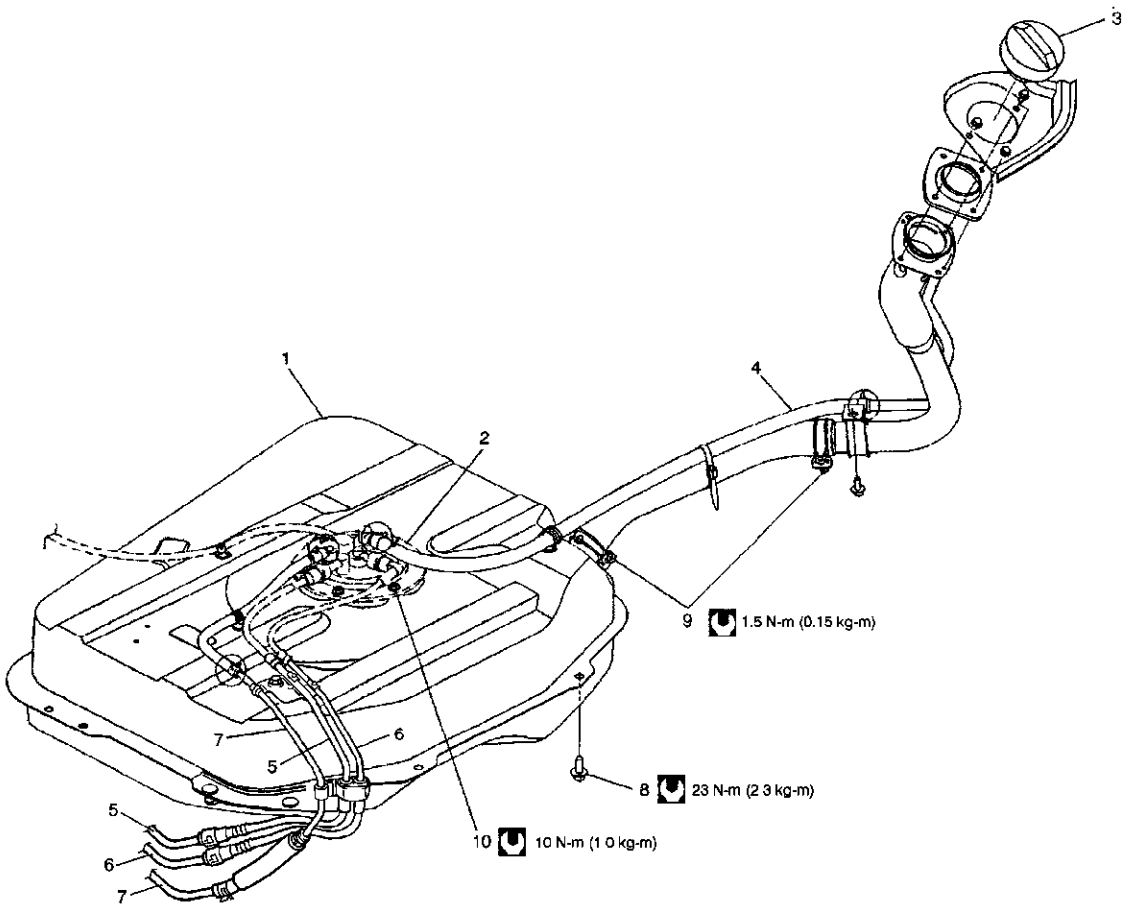
GENERAL DESCRIPTION

FUEL SYSTEM

The main components of the fuel system are fuel tank, fuel pump assembly (with fuel filter, fuel level gauge and tank pressure control valve) fuel feed line, fuel return line and fuel vapor line.
For the details of fuel flow and fuel vapor flow, refer to SECTION 6E1.

COMPONENTS



1.	Fuel tank
2.	Fuel pump (with fuel level gauge, fuel filter and tank pressure control valve)
3.	Fuel filler cap
4.	Breather Hose
5.	Fuel feed line (to delivery pipe)
6	Fuel return line (from fuel pressure regulator)
7.	Fuel vapour line (to EVAP canister)
8.	Fuel tank bolt
9.	Clamp bolt
10	Fuel pump bolt
:	Tightening torque

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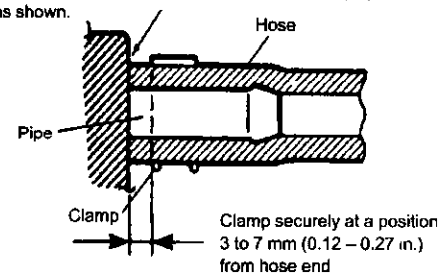
DIAGNOSIS

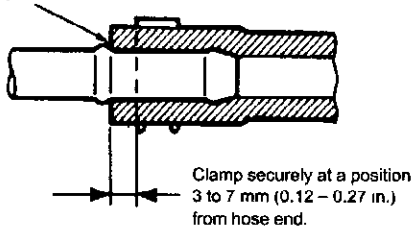
DIAGNOSIS CHART

Refer to SECTION 6.

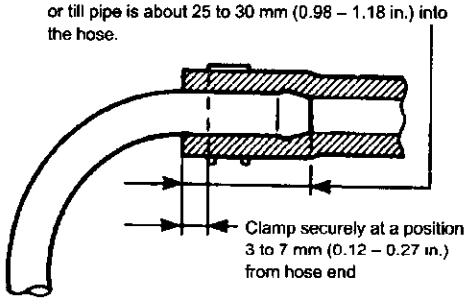
With short pipe, fit hose as far as it reaches pipe joint as shown.



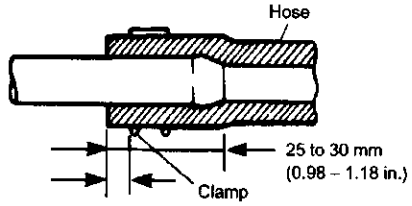
With following type pipe, fit hose as far as its peripheral projection as shown.



With bent pipe, fit hose as far its bent part as shown or till pipe is about 25 to 30 mm (0.98 – 1.18 in.) into the hose.



With straight pipe, fit hose till pipe is about 25 to 30 mm (0.98 – 1.18 in.) in the hose.



Clamp securely at a position 3 to 7 mm (0 12 – 0.27 in.) from hose end.

ON-VEHICLE SERVICE

PRECAUTIONS

WARNING:
Before attempting service of any type on fuel system, the followings should be always observed in order to reduce the risk or fire and personal injury.

- **Disconnect negative cable at battery.**
- **Do not smoke, and place no smoking signs near work area.**
- **Be sure to have CO2 fire extinguisher handy.**
- **Be sure to perform work in a well-ventilated area and away from any open flames (such as gas hot heater).**
- **Wear safety glasses.**
- **To relieve fuel vapor pressure in fuel tank, remove fuel filler cap from fuel filler neck and then reinstall it.**
- **As fuel feed line is still under high fuel pressure even after engine was stopped, loosening or discon-necting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected. Before loosening or disconnecting fuel feed line, make sure to relieve fuel pressure "FUEL PRESSURE RELIEF PROCEDURE" in SECTION 6.**
- **A small amount of fuel may be released after the fuel line is disconnected.**
  In order to reduce the chance of personal injury, cover the fitting to be disconnected with a shop cloth. Be sure to put that cloth in an approved container when disconnection is completed.
- **Note that fuel hose connection varies with each type of pipe. Be sure to connect and clamp each hose correctly referring to the figure.**

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FUEL LINES

Due to the fact that fuel feed line is under high pressure, use special care when servicing it.

INSPECTION

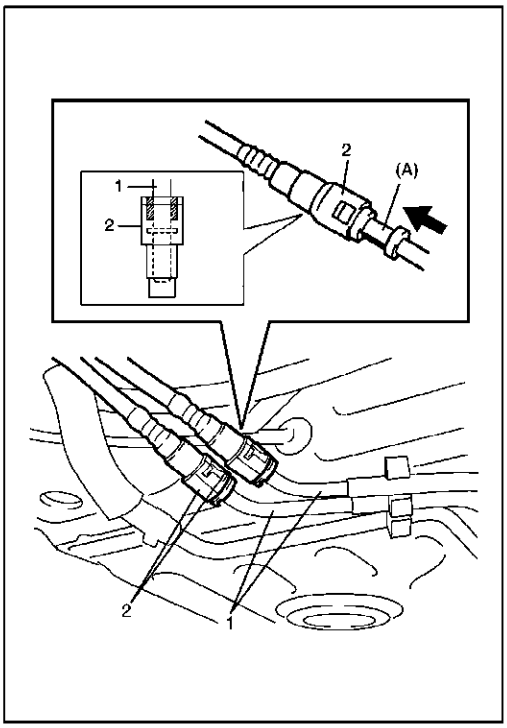
Visually inspect fuel lines for evidence of fuel leakage, hose crack and deterioration, or damage.
Make sure all clamps are secure.
Replace parts as needed.

FUEL PIPE

REMOVAL

1) Relieve fuel pressure in fuel feed line according to "FUEL PRESSURE RELIEF PROCEDURE" in SECTION 6.
2) Disconnect negative cable at battery.
3) Remove steering gear case assembly, referring to "STEERING GEAR CASE REMOVAL" in this SECTION 3B.
4) Disconnect fuel hoses from fuel pipe at the front and rear of each fuel pipe.

WARNING:
A small amount of fuel may be released after fuel hose is disconnected. In order to reduce the chance of personal injury, cover hose and pipe to be disconnected with a shop cloth.
Be sure to put that cloth in an approved container when disconnection is completed.



5) Disconnect fuel pipe joint and fuel hose from fuel pipe at the front and rear of each fuel pipe.
   For quick joint (2), disconnect it as follows:
   a) Remove mud, dust and /or foreign material between pipe (1) and joint by blowing compressed air.
   b) Unlock joint lock by inserting special tool between pipe and joint.

   Special tool
   (A) : 09919-47020

   c) Disconnect joint (2) from pipe (1).
6) Disconnect fuel vapour hose (3) from pipe.

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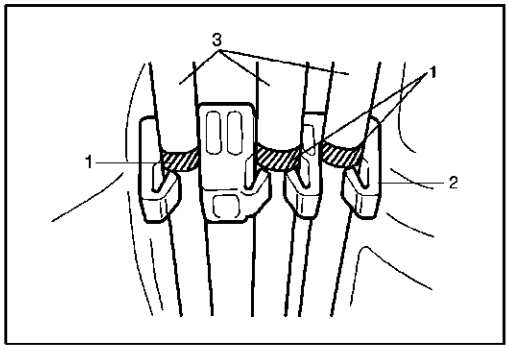


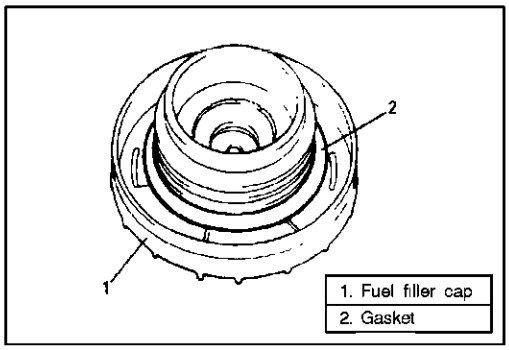
7) Mark the location (1) of clamps (2) on fuel pipes, so that the clamps can be reinstalled to where they were.
8) Remove pipes (3) with clamp from vehicle under body.
9) Remove clamp from pipes.

INSTALLATION

1) Install clamps to marked location on pipes. If clamp is deformed or its claw is bent or broken, replace it with new one.
2) Install pipes with pipe clamps to vehicle under body.
3) Connect fuel hoses and pipes to each pipe.

CAUTION:
When connecting joint, clean outside surfaces of pipe where joint is to be inserted, push joint into pipe till joint lock clicks and check to ensure that pipes are connected securely, or fuel leak may occur.

4) Install steering gear box assembly, referring to "STEERING GEAR CASE INSTALLATION" in SECTION 3B.
5) With engine "OFF", turn ignition switch to "ON" position and check for fuel leaks.



FUEL FILLER CAP

Remove cap (1), and check gasket for even filler neck imprint, and deterioration or any damage. If gasket (2) is in malcondition, replace cap.

NOTE:
If fuel filler cap needs to be replaced, use a genuine SUZUKI cap or its equivalent. Use of an improper cap can result in a malfunction of the fuel system or emission control system.
Failure to use correct cap can result in critical malfunction of system.

FUEL TANK

REMOVAL

1) Relieve fuel pressure in fuel feed line according to "FUEL PRESSURE RELIEF PROCEDURE" in SECTION 6.

CAUTION:
This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

2) Disconnect negative cable at battery and remove fuel filler cap.

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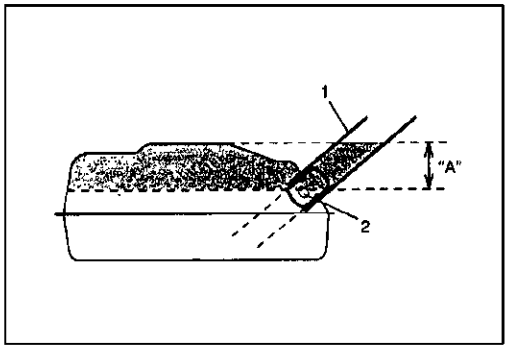
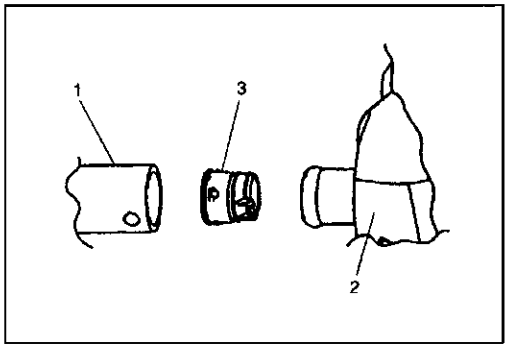


3) Insert hose of a hand operated pump into fuel filler hose (1) and drain fuel in space "A" in the figure (drain fuel through it till fuel stops).

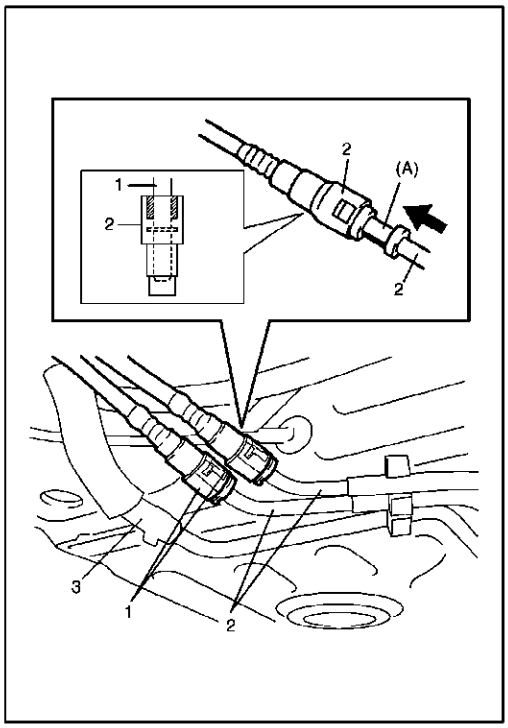
CAUTION:
Do not force hose of a hand operated pump into fuel tank. Doing so can damage fuel tank inlet valve (2).



4) Disconnect filler hose (1) from fuel tank (2) and breather hose from filler neck.

5) Remove fuel tank inlet valve (3).
Use care not to damage inlet valve when removing.
6) Drain fuel tank by pumping fuel out through fuel tank filler.
Use hand operated pump device to drain fuel tank.

CAUTION:
Never drain or store fuel in an open container due to possibility of fire or explosion.



7) Disconnect fuel pipe joints from pipes.
For quick joint, disconnect it as follows:
a) Remove mud, dust and/or foreign material between pipe and joint by blowing compressed air.
b) Unlock joint (1) lock by inserting special tool between pipe (2) and joint (1).

Special tool
(A) : 09919-47020

c) Disconnect joint from pipe.

WARNING:
A small amount of fuel may be released after the fuel hose is disconnected. In order to reduce the chance of personal injury, cover the hose and pipe to be disconnected with a shop cloth. Be sure to put that cloth in an approved container when disconnection is completed.

8) Disconnect fuel vapour hose (3) from pipe.

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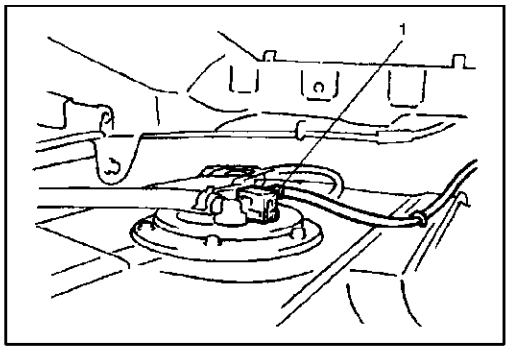
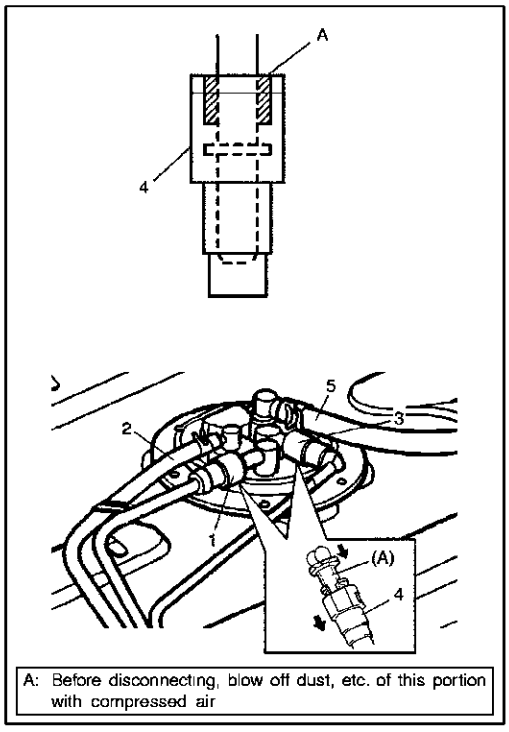


9) Remove fuel tank bolts and then lower fuel tank gradually while holding it horizontally and pull out coupler (1) at fuel pump.

INSPECTION

After removing fuel tank, check hoses and pipes connected to fuel tank for leaks, loose connections, deterioration or damage. Also check fuel pump assembly gaskets for leaks, visually inspect fuel tank for leaks and damage.
Replace any damaged or mal-conditioned parts.



A: Before disconnecting, blow off dust, etc. of this portion with compressed air

FUEL TANK PURGING PROCEDURE

WARNING:
This purging procedure will not remove all fuel vapor. Do not attempt any repair on tank using heat of flame as an explosion resulting in personal injury could occur.

The following procedure is used for purging fuel tank.
1) After removing fuel tank, disconnect fuel breather hose (5), fuel feed hose (1), fuel vapour hose (2) and fuel return hose (3) from fuel pump assembly. When disconnecting joint (4) of fuel feed line or return line from pipe, unlock joint (4) by inserting special tool between pipe and joint lock first.

Special tool
(A): 09919-47020

Disconnect joint from pipe.

WARNING:
A small amount of fuel may be released after the fuel hose is disconnected. In order to reduce the chance of personal injury, cover the hose and pipe to be disconnected with a shop cloth. Be sure to put that cloth in an approved container when disconnection is completed.

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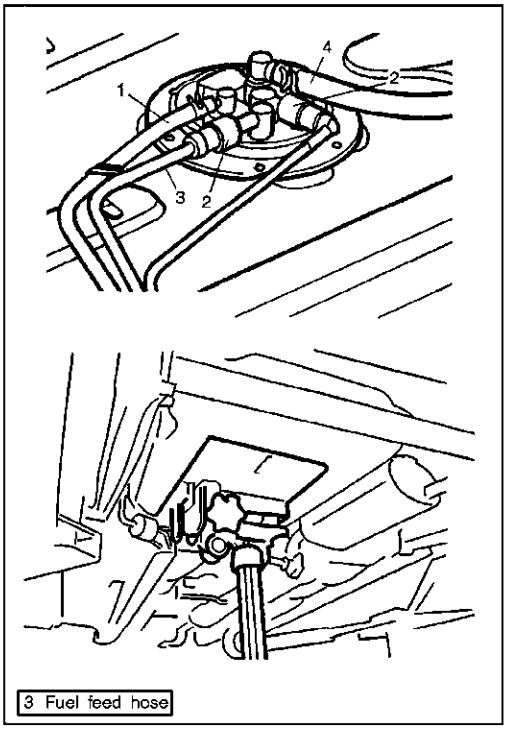
2) Remove fuel pump assembly from fuel tank.
3) Drain all remaining fuel from tank.
4) Move tank to flushing area.
5) Fill tank with warm water or tap water, and agitate vigorously and drain. Repeat this washing until inside of tank is clean. Replace tank if its inside is rusty.
6) Completely flush out remaining water after washing.

CAUTION:
Never remain water in fuel tank after washing, or fuel tank inside will get corrosion.



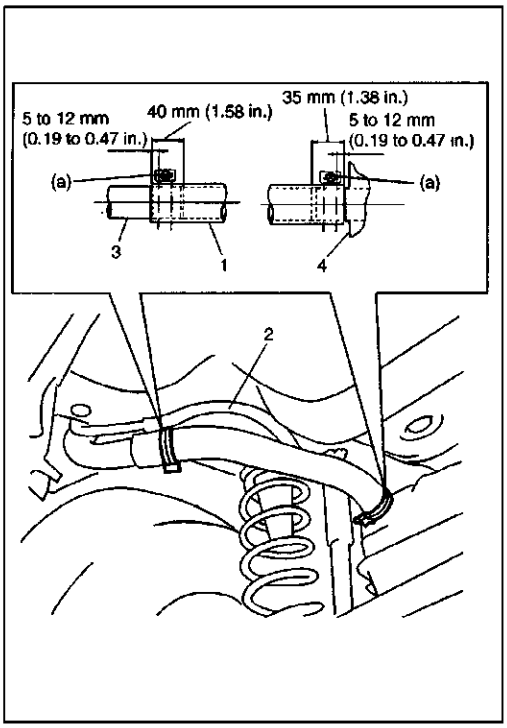
INSTALLATION

1) If parts have been removed from fuel tank, install them before installing fuel tank to vehicle.
2) Connect fuel breather hose (4), fuel vapor hose (1) (refer to 6C-2 for connection) and pipe joints (2) to fuel pump assembly, and clamp hoses 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.

3) With fuel tank supported on jack, connect coupler to fuel pump assembly.
4) Install fuel tank to vehicle.

Tightening torque for fuel tank bolts
23 N-m (2.3 kg-m, 17.0 lb-ft)



5) Connect fuel filler hose (1) to fuel tank (4) and fuel breather hose (2) to fuel filler neck (3) and clamp hoses securely.

Tightening torque
(a): 1.5 N-m (0.15 kg-m, 1.0 lb-ft)

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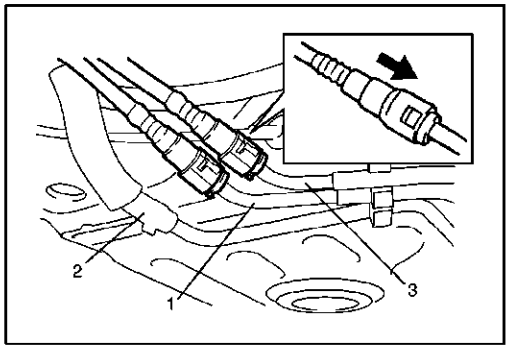

6) Connect fuel feed pipe joint (1), fuel return pipe (3) and fuel vapour hose (2) to each pipe as shown in figure and clamp them securely.

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.

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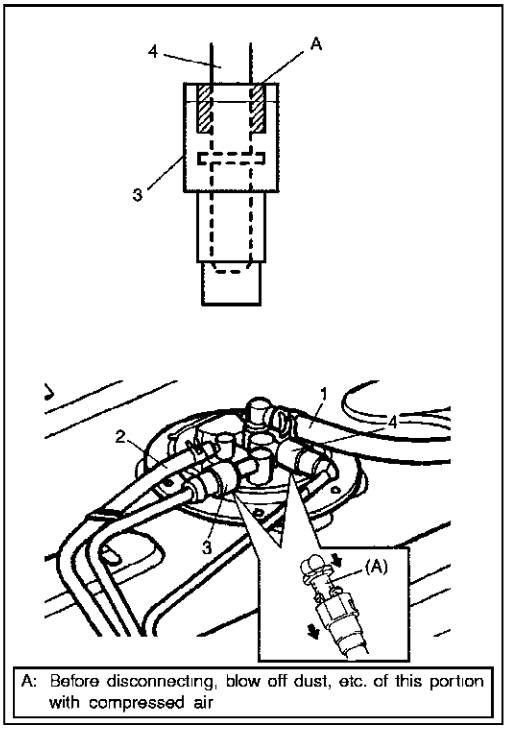


A: Before disconnecting, blow off dust, etc. of this portion with compressed air

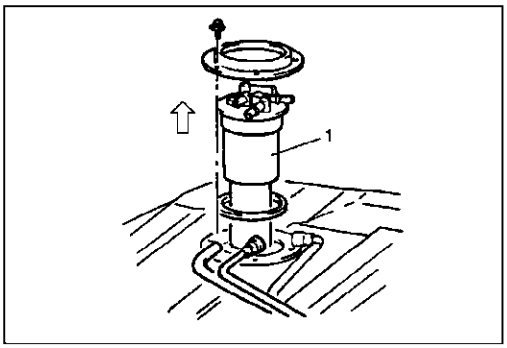
FUEL PUMP ASSEMBLY (WITH FUEL FILTER, FUEL LEVEL GAUGE AND TANK PRESSURE CONTROL VALVE)

WARNING:
Refer to the WARNING at the beginning of ON-VEHICLE SERVICE in this Section.

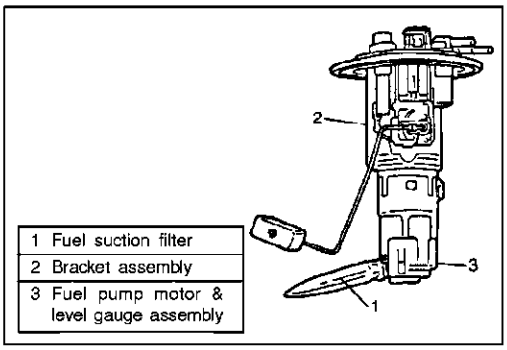
REMOVAL

1) Remove fuel tank from vehicle. Refer to "FUEL TANK REMOVAL" in this section.
2) Disconnect fuel breather hose (1)and, fuel vapour hose (2) from fuel pump assembly.
   When disconnecting joint (3) of fuel feed line and fuel return line from pipe (4), unlock joint by inserting special tool between pipe and joint lock first.

   Special tool
   (A): 09919-47020



3) Remove fuel pump assembly (1) from fuel tank.



1 Fuel suction filter
2 Bracket assembly
3 Fuel pump motor & level gauge assembly

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 SECTION 6E1 of this manual.
  For inspection of fuel level gauge, refer to SECTION 8 of this manual.
- Check tank pressure control valve referring to the following procedures.

WARNING:
Do not suck air through fuel vapor line hose. Fuel vapor inside valve is harmful.

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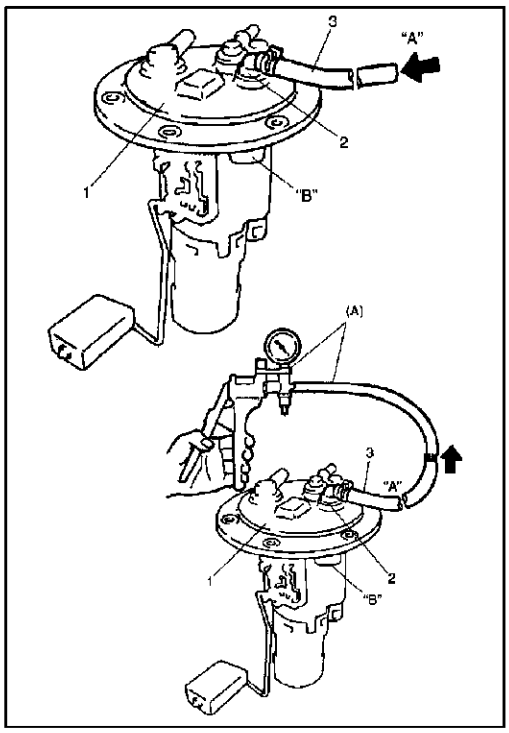

a) Air should pass through valve (2) smoothly from fuel vapor line hose (3) "A" to "B" when blown hard.
b) Also, when vacuum pump (4) is connected to fuel vapor hose and pump air through valve, air should pass from "B" to "A".

Special tool
(A): 09917-47010

If air doesn't pass through valve in Step a) or vacuum is maintained in Step b), replace fuel filter assembly (1).

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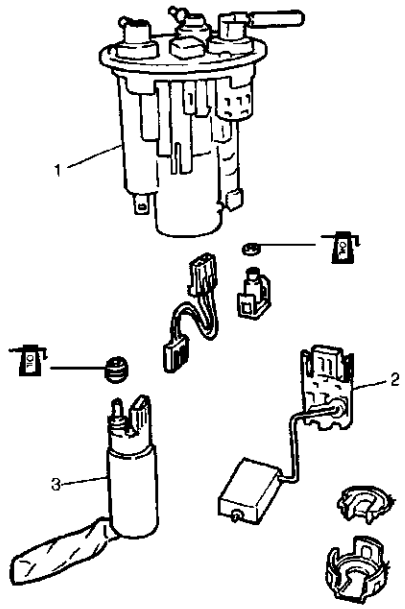
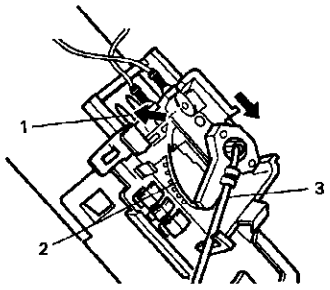
DISASSEMBLY AND REASSEMBLY OF FUEL PUMP



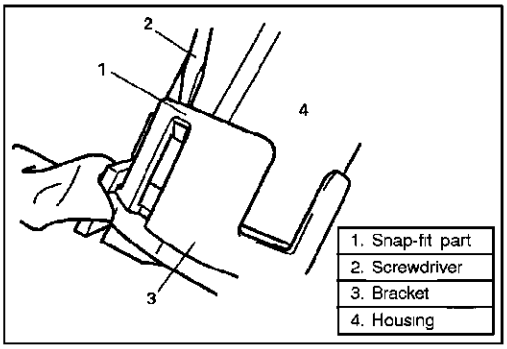
:	Apply engine oil
1	Fuel filter assembly
2.	Fuel level gauge (Fuel sender gauge)
3.	Fuel pump



1.	Snap-fit part
2.	Resistor plate
3.	Float arm

1) Disconnect gauge lead wire connector from bracket sub assembly.
2) While pressing snap-fit part, remove fuel level gauge (sender gauge) by sliding it in the arrow direction.

CAUTION:
While removing fuel level gauge, do not contact resistor plate or deform arm. It may cause fuel level gauge to fail.



1.	Snap-fit part
2.	Screwdriver
3.	Bracket
4.	Housing

3) Remove bracket located under fuel pump by opening its snap-fit parts with screwdriver.
Then remove cushion.

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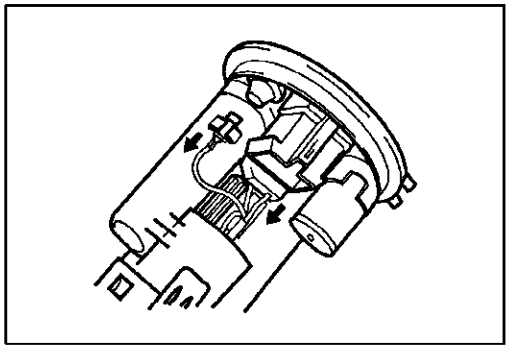


4) Disconnect fuel pump lead wire connector from bracket sub assembly.
5) Remove fuel pump with lead wire, fuel tube and grommets from bracket sub assembly.

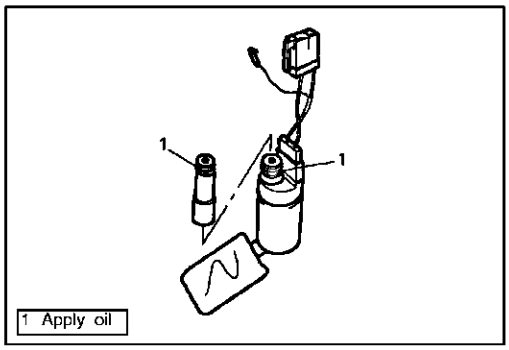
6) Remove lead wire, fuel tube and/ or grommets as necessary.

CAUTION:
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.

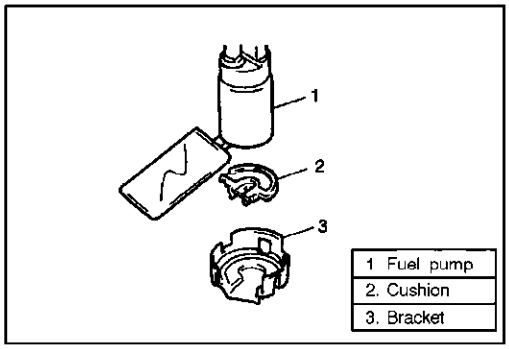
7) Remove housing from bracket sub assembly by opening its snap-fit parts.

REASSEMBLY

NOTE:
use of new parts is recommended for all parts other than fuel pump and fuel level gauge.
Also, be sure to use new grommets, or oil leakage may occur.



1) Install lead wire, spacer and new grommet to fuel pump. Check that no foreign object is caught between grommet and fuel pump.
2) Apply engine oil and around grommet and install fuel tube. Check that no foreign object is caught between grommet and fuel tube.



3) Fit cushion and bracket to fuel pump.

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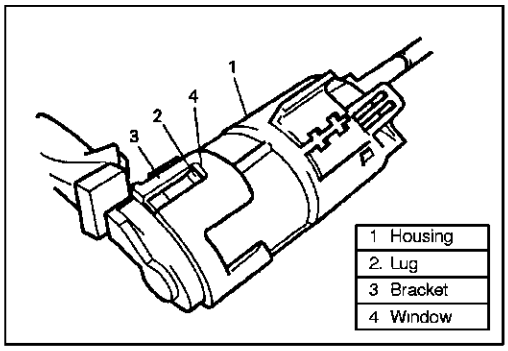
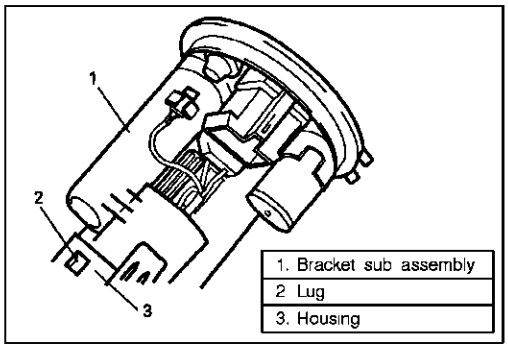
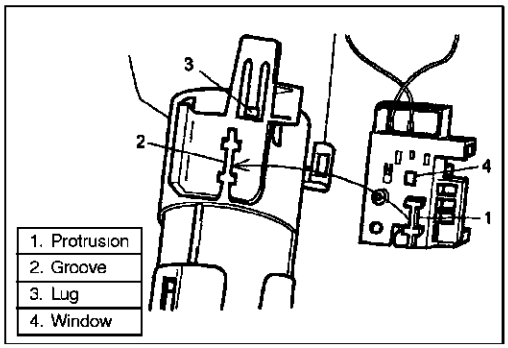


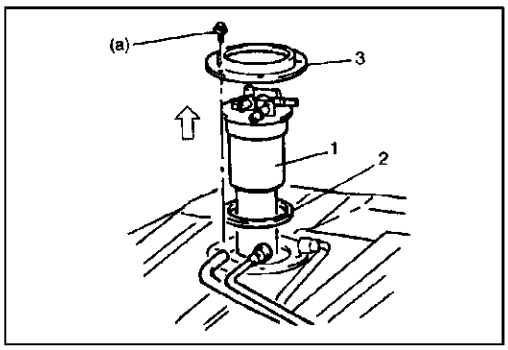
4) Install housing to assembly made in Step 3) above. Check that lug of housing fits in window of bracket securely.



5) Install assembly made in Step 4) above to bracket sub assembly. Check that no foreign object is caught between grommet and bracket sub assembly.
Also, check that lug of bracket sub assembly fits in window of housing.
6) Connect lead wire connector and terminal to bracket sub assembly. Check that wire is not twisted.



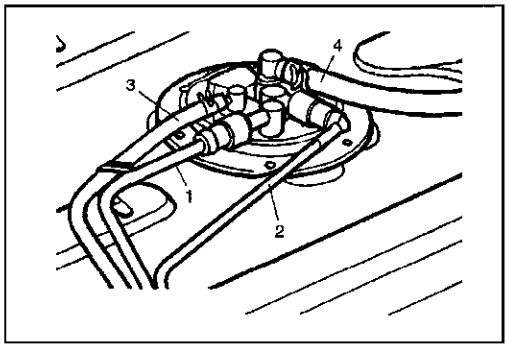
7) Install fuel level gauge to housing. Fit protrusion of fuel level gauge in groove in housing and slide it up till lug fits in window securely.
8) Connect fuel level gauge connector to bracket sub assembly.



INSTALLATION

1) Clean mating surface of fuel pump assembly (1) 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
(a): 10 N-m (1.0 kg-m, 7.5 lb-ft)



3) Connect fuel breather hose (4), fuel feed hose (1), return hose (2) and fuel vapour hose (3) to fuel pump assembly.

CAUTION:
When connecting joint, clean outside surfaces of pipe where joint is to be inserted, push joint into pipe till joint lock clicks and check to ensure that pipes are connected securely, or fuel leak may occur.

4) Install fuel tank to vehicle, referring to "FUEL TANK INSTALLATION" in this section.

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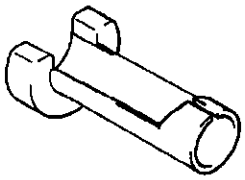
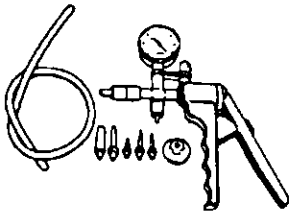
SPECIAL TOOL

	
09919-47020 Quick joint remover	09917-47010 Vacuum pump gauge

TIGHTENING TORQUE SPECIFICATION

Fastening part	Tightening torque		
	N·m	kg-m	lb-ft
Fuel tank bolts	23	2.3	17
Fuel filler hose clamps	1.5	0.15	1
Fuel pump assembly bolts	10	1.0	7.5

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SECTION 6E1

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).**

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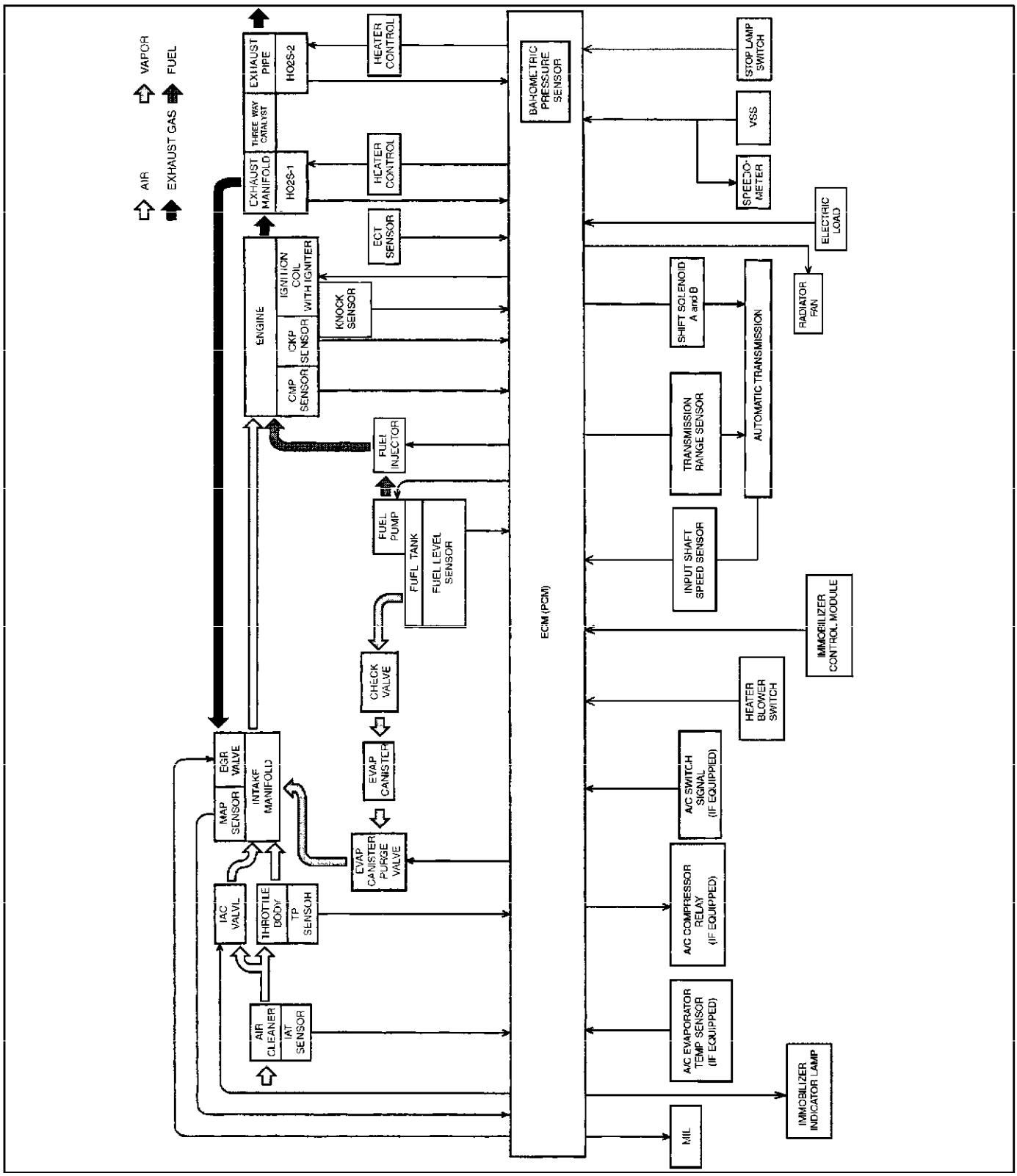
General Description

The engine and emission control system has 4 major sub-systems: air intake system, fuel delivery system, electronic control system and emission control system.
Air intake system includes air cleaner, MAP sensor, throttle body, IAC valve and intake manifold.
Fuel delivery system includes fuel pump, delivery pipe, fuel pressure regulator, fuel injectors, etc.
Electronic control system includes ECM (PCM), various sensors and controlled devices.
Emission control system includes EGR, EVAP and PCV systems.

ENGINE AND EMISSION CONTROL SYSTEM FLOW CHART



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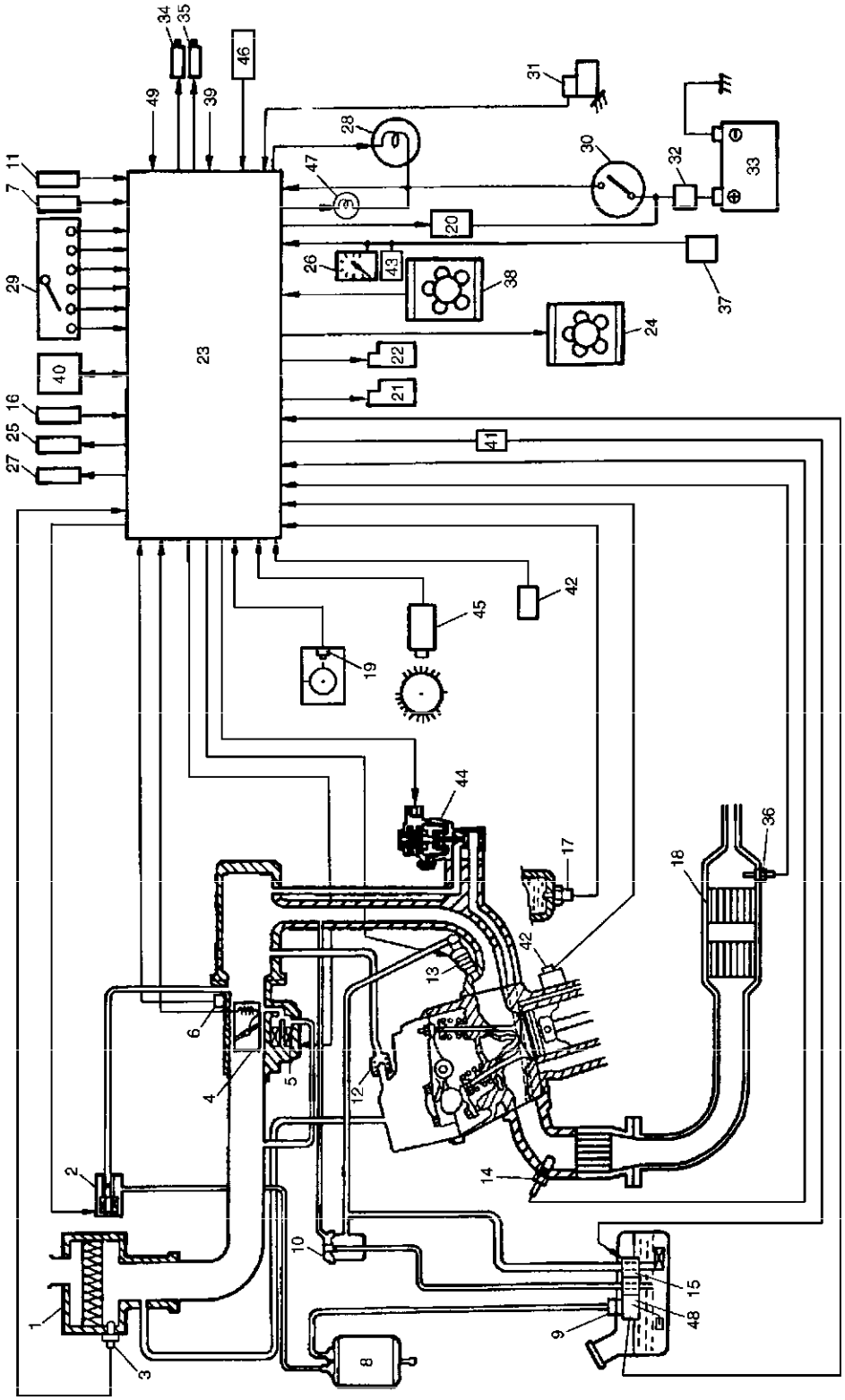
ENGINE AND EMISSION CONTROL SYSTEM CHART



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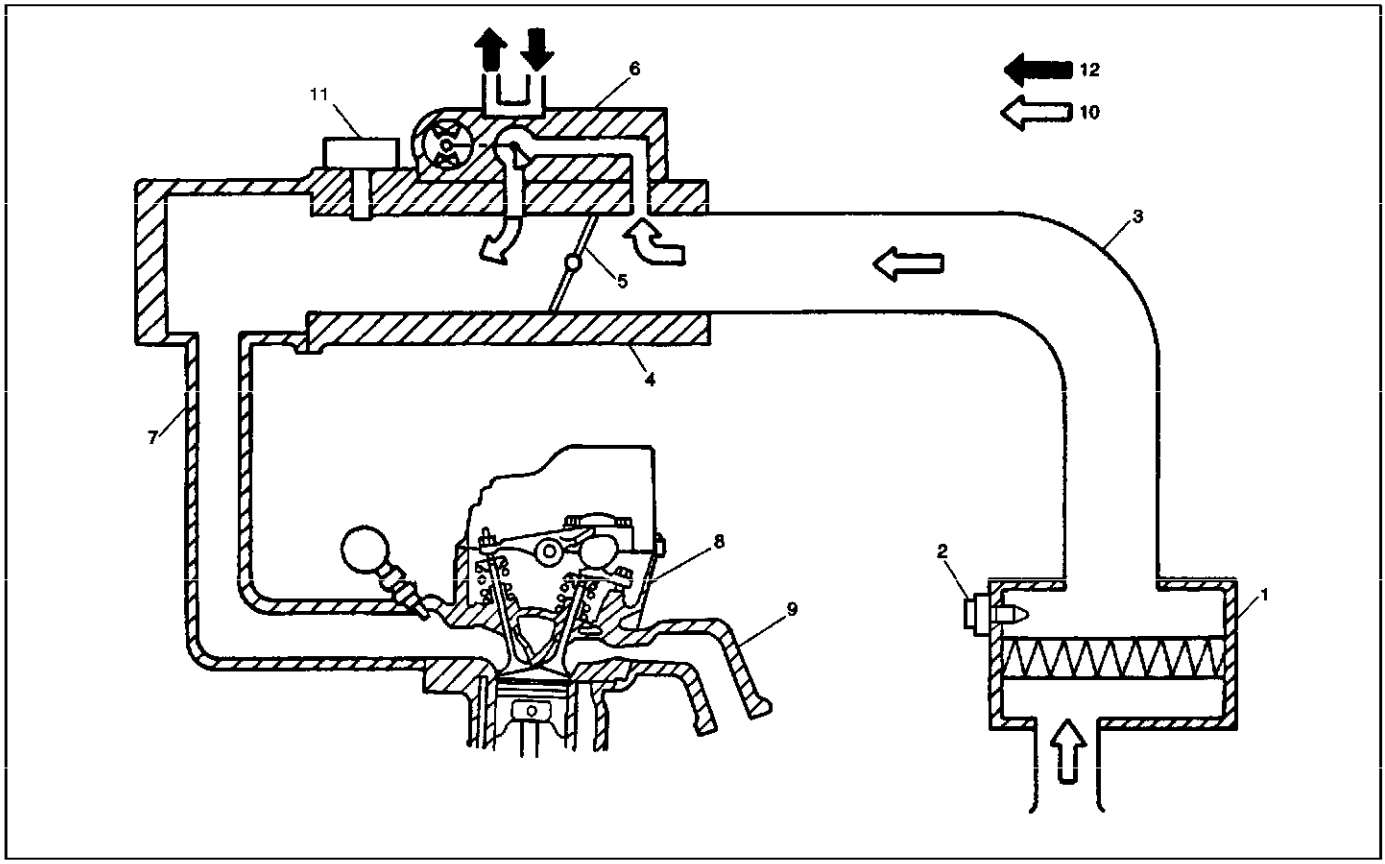
1. Air cleaner	18. Three way catalytic convertor	35. Shift solenoid B (A/T)
2. EVAP canister purge valve	19. CMP sensor	36. Heated oxygen sensor (HO2S)-2
3. IAT sensor	20. Main relay	37. VSS
4. TP sensor	21. Ignition coil assembly for No.1 and No.4 spark plugs	38. Heater blower fan
5. IAC valve	22. Ignition coil assembly for No.2 and No.3 spark plugs	39. Electric load (small light)
6. MAP sensor	23. ECM (PCM)	40. Data link connector (DLC)
7. A/C evaporator temp. sensor (if equipped)	24. Radiator fan	41. Fuel pump relay
8. EVAP canister	25. Radiator fan control relay	42. Knock sensor
9. Tank pressure control valve	26. Speedometer in combination meter	43. EPS (if equipped)
10. Fuel pressure regulator	27. A/C compressor control relay	44. EGR valve
11. A/C dual pressure switch (if equipped)	28. Malfunction indicator lamp in combination meter	45. CKP sensor
12. PCV valve	29. Transmission range switch (A/T)	46. Inputshaft speed sensor (A/T)
13. Fuel injector	30. Ignition switch	47. Immobilizer indicator lamp in combination meter
14. Heated oxygen sensor (HO2S)-1	31. Starter magnetic switch	48. Fuel level sensor
15. Fuel pump (with Fuel filter)	32. Main fuse	49. Electric load (rear defogger)
16. Stop light switch	33. Battery	
17. ECT sensor	34. Shift solenoid A (A/T)	

Air Intake System

The main components of the air intake system are air cleaner (1), air cleaner outlet hose (3), throttle body (4), IAC valve (6) and intake manifold (7).

The air (by the amount corresponding to the throttle valve (5) opening and engine speed) is filtered by the air cleaner, passes through the throttle body, is distributed by the intake manifold and finally drawn into each combustion chamber.

When the IAC valve is opened according to the signal from ECM (PCM), the air bypasses the throttle valve through bypass passage and is finally drawn into the intake manifold.



2. IAT sensor	9. Exhaust manifold	11. MAP sensor
8. Cylinder head	10. Air flow	12. Engine coolant

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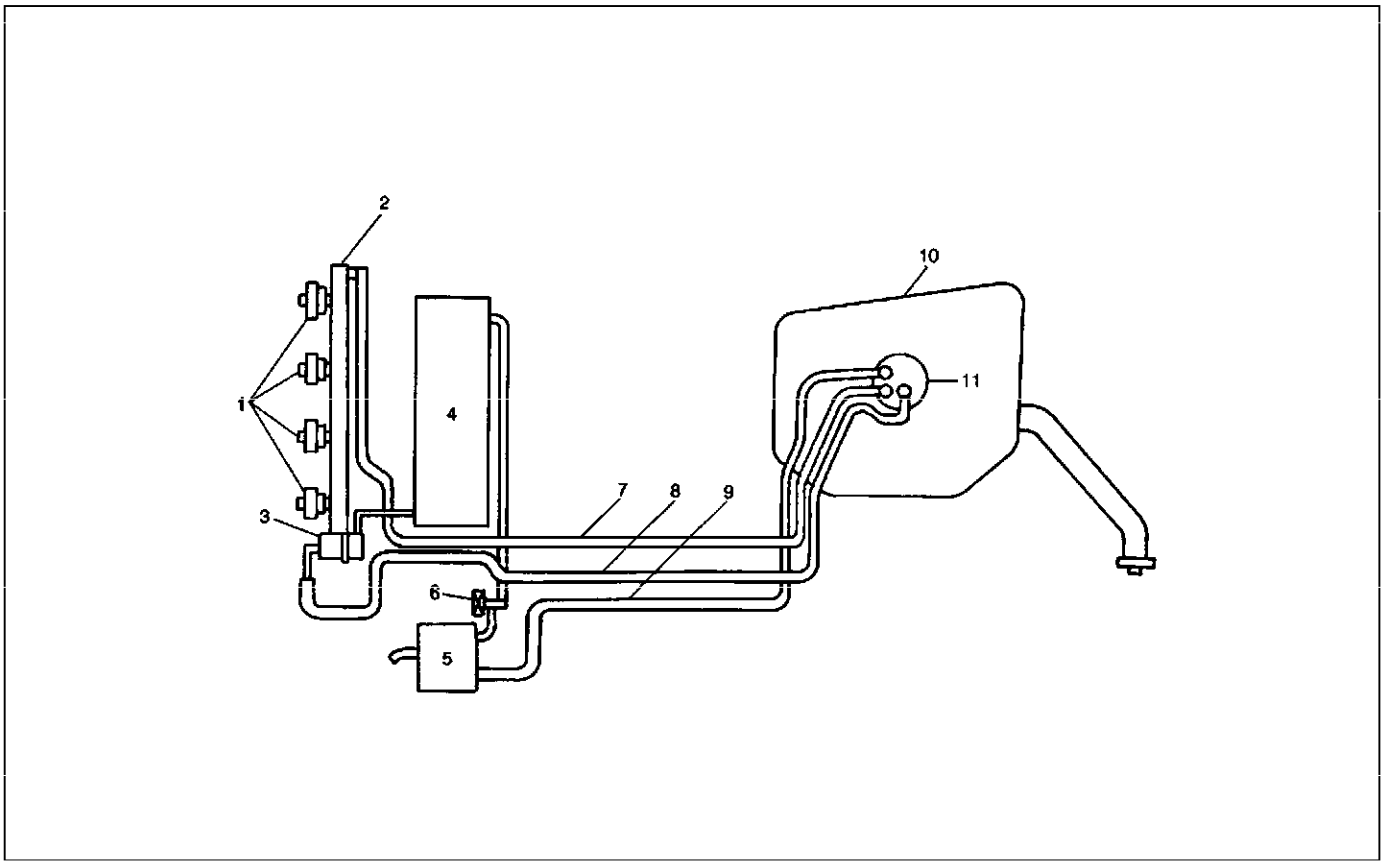
Fuel Delivery System

The fuel delivery system consists of the fuel tank (10), fuel pump (with built-in fuel filter) (11), fuel pressure regulator, delivery pipe and fuel injectors.
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 (1) through the delivery pipe (2). As the fuel pressure applied to the injector (the fuel pressure in the fuel feed line (7)) is always kept a certain amount higher than the pressure in the intake manifold (4) by the fuel pressure regulator (3), the fuel is injected into the intake port of the cylinder head when the injector opens according to the injection signal from ECM (PCM).

The fuel relieved by the fuel pressure regulator returns through the fuel return line (8) to the fuel tank.



5.	EVAP canister
6.	EVAP canister purge valve
9.	Fuel vapor line

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Electronic Control System

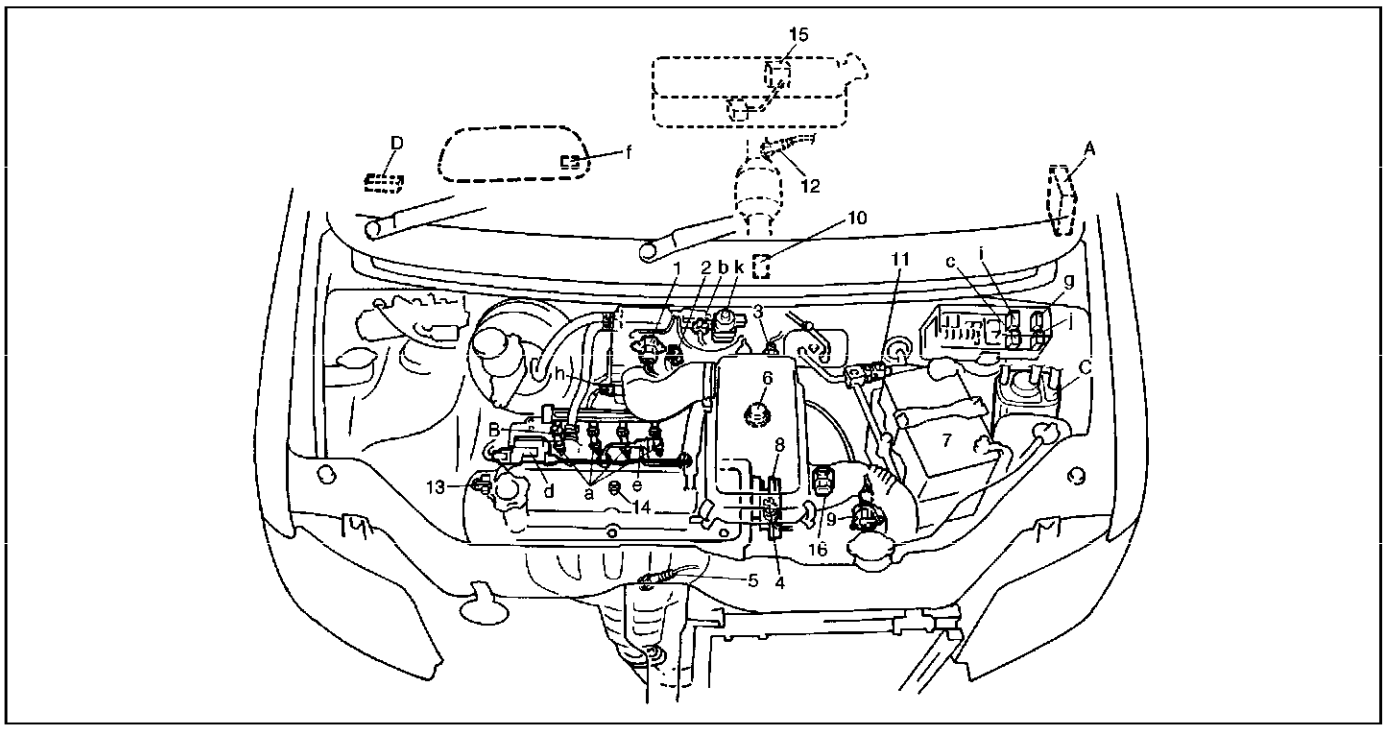
The electronic control system consists of 1) various sensors which detect the state of engine and driving conditions, 2) ECM (PCM) which controls various devices according to the signals from the sensors and 3) various controlled devices.

Functionally, it is divided into the following sub systems:

- Fuel injection control system
- Idle speed control system
- Fuel pump control system
- Ignition control system
- Radiator fan control system
- Evaporative emission control system
- A/C control system (if equipped)
- EGR system
- Oxygen sensor heater control system

Also, with 3 A/T model, ECM (PCM) controls automatic transmission.

ELECTRONIC CONTROL SYSTEM LOCATION



INFORMATION SENSORS	CONTROL DEVICES	OTHERS
1. MAP sensor	a : Fuel injectors	A : ECM (PCM)
2. TP sensor	b : EVAP canister purge valve	B : PCV valve
3. IAT sensor	c : Fuel pump relay	C : EVAP canister
4. ECT sensor	d : Ignition coil assembly (No.1 and No.4 spark plugs)	D : DLC
5. Heated oxygen sensor-1	e : Ignition coil assembly (No.2 and No.3 spark plugs)	
6. VSS	f : Malfunction indicator lamp	
7. Battery	g : Radiator fan control relay	
8. CMP sensor	h : IAC valve	
9. Transmission range switch (3 A/T)	i : A/C compressor control relay (if equipped)	
10. A/C evaporator temp. sensor (if equipped)	j : Main relay	
11. A/C dual pressure switch (if equipped)	k : EGR valve (step motor)	
12. Heated oxygen sensor-2		
13. CKP sensor		
14. Knock sensor		
15. Fuel level sensor (gauge)		
16. Input shaft speed sensor (3 A/T)		

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ENGINE AND EMISSION CONTROL INPUT/OUTPUT REFERENCE TABLE

	INPT \ OTPT	ELECTRIC CONTROL DEVICE											
		FEL PMP RELA	FEL INECTOR	HO2S HEATER	IAC VALVE	IGNITION COIL WITH IGNITER	EGR VALVE	EVAP CANISTER PRGE VALVE	A/C COMPRESSOR RELA (IF EIPPED)	RADIATOR FAN RELA	GENERATOR	MIL	MAIN RELA
SIGNAL FROM SENSOR, SWITCH AND CONTROL MODLE	FEL LEVEL SENSOR	For detecting fuel level											
	BAROMETRIC PRESSRE SENSOR		○		○	○		○				○	
	STOP LAMP SWITCH				○								
	START SWITCH	○	○	○	○		○		○		○	○	
	IGNITION SWITCH	○	○	○	○	○	○	○	○	○	○		○
	LIGHTING SWITCH				○						○		
	REAR DEFOGGER SWITCH				○						○		
	BLOWER SWITCH				○				○		○		
	A/C SWITCH (IF EIPPED)				○			○	○	○			
	A/C EVAPOATOR TEMP. SENSOR (IF EIPPED)								○				
	VSS		○		○		○		○	○	○	○	
	HEATED OGEN SENSOR-1		○					○				○	
	HEATED OGEN SENSOR-2	For detecting deterioration of three way catalytic converter										○	
	IAT SENSOR		○		○	○	○	○	○	○		○	
	ECT SENSOR		○	○	○	○	○	○	○	○		○	
	TP SENSOR		○		○	○	○	○	○		○	○	
	MAP SENSOR		○	○	○	○	○	○	○			○	
	CMP SENSOR	○	○			○						○	
	CKP SENSOR	○	○	○	○	○	○	○	○		○	○	
	KNOCK SENSOR					○						○	

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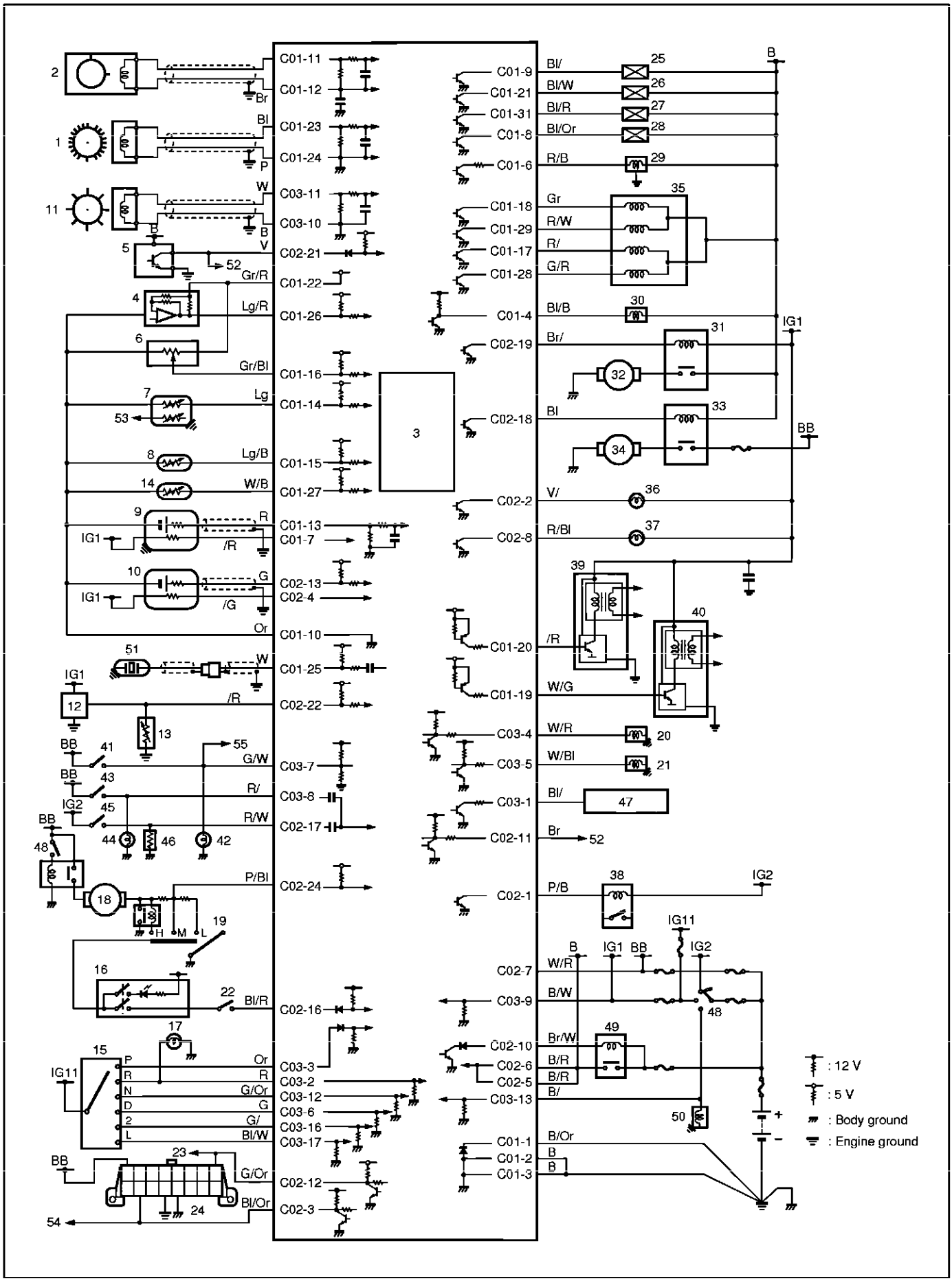
ECM(PCM) INPUT/OUTPUT CIRCUIT DIAGRAM



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1. CKP sensor	20. Shift solenoid A (A/T)	39. Ignition coil assembly (for No.1 and No.4 spark plugs)
2. CMP sensor	21. Shift solenoid B (A/T)	40. Ignition coil assembly (for No.2 and No.3 spark plugs)
3. Barometric pressure sensor	22. A/C pressure switch (if equipped)	41. Stop lamp switch
4. MAP sensor	23. Immobilizer control module	42. Stop lamp
5. VSS	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	28. Injector No.4	47. Generator
10. Heated oxygen sensor-2	29. IAC valve	48. Ignition switch
11. Inputshaft speed sensor (A/T)	30. EVAP canister purge valve	49. Main relay
12. Combination meter	31. Fuel pump relay	50. Starting motor
13. Fuel level sensor	32. Fuel pump	51. Knock sensor
14. A/C evaporator temp. sensor (if equipped)	33. Radiator fan relay	52. To combination meter and EPS
15. Transmission range switch (A/T)	34. Radiator fan motor	53. To combination meter
16. A/C switch (if equipped)	35. EGR valve	54. To ABS, Air bag and EPS
17. Backup lamp	36. Malfunction indicator lamp	55. To ABS
18. Heater fan motor	37. Immobilizer indicator lamp	
19. Heater fan switch	38. A/C compressor relay (if equipped)	

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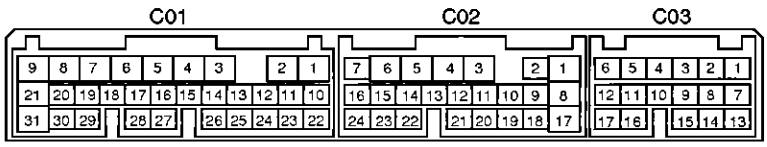
TERMINAL ARRANGEMENT OF ECM (PCM) COUPLER (VIEWED FROM HARNESS SIDE)



CONNEC-TOR	TERMINAL	WIRE COLOR	CIRCUIT
C01	1	B/Or	Ground for ECM (PCM)
	2	B	Ground for drive circuit
	3	B	Ground for drive circuit
	4	Bl/B	EVAP canister purge valve
	5	–	–
	6	R/B	IAC valve
	7	Y/R	Heater of HO2S-1
	8	Bl/Or	No 4 fuel injector
	9	Bl/Y	No.1 fuel injector
	10	Or	Ground for sensor circuit
	11	Y	CMP sensor (+)
	12	Br	CMP sensor (-)
	13	R	Heated oxygen sensor-1
	14	Lg	Engine coolant temp. sensor
	15	Lg/B	Intake air temp. sensor
	16	Gr/Bl	Throttle position sensor
	17	R/Y	EGR valve (stepper motor coil 3)
	18	Gr	EGR valve (stepper motor coil 1)
	19	W/G	Ignition coil No.2
	20	Y/R	Ignition coil No.1
	21	Bl/W	No.2 fuel injector
	22	Gr/R	Power source for sensors
	23	Bl	CKP sensor (+)
	24	P	CKP sensor (-)
	25	W	Knock sensor
	26	Lg/R	MAP sensor
	27	W/B	A/C evaporator temp. sensor (if equipped)
	28	G/R	EGR valve (stepper motor coil 4)
	29	R/W	EGR valve (stepper motor coil 2)
	30	–	–
	31	Bl/R	No.3 fuel injector
C02	1	P/B	A/C compressor relay (if equipped)
	2	V/Y	MIL
	3	Bl/Or	Data link connector (12 V)
	4	Y/G	Heater of HO2S-2
	5	B/R	Power source
	6	B/R	Power source
	7	W/R	Backup power source
	8	R/Bl	Immobilizer indicator lamp
	9	–	–
	10	Br/W	Ground for main relay
	11	Br	Ignition signal output
C02	12	G/Or	Data link connector (5 V)
	13	G	Heated oxygen sensor-2
	14	–	–
	15	–	–
	16	Bl/R	A/C switch signal (if equipped)
	17	R/W	Electric load signal
	18	Bl	Radiator fan relay
	19	Br/Y	Fuel pump relay
	20	–	–
	21	V	Vehicle speed sensor
	22	Y/R	Fuel level gauge
	23	–	–
	24	P/Bl	Heater blower switch signal
G03	1	Bl/Y	Generator control signal
	2	R	R-range signal
	3	Or	P-range signal
	4	W/R	Shift solenoid A
	5	W/Bl	Shift solenoid B
	6	G	D-range signal
	7	G/W	Stop lamp switch (Brake pedal switch)
	8	R/Y	Electric load signal
	9	B/W	Ignition switch signal
	10	B	Inputshaft speed sensor (-) (A/T)
	11	W	Inputshaft speed sensor (+) (A/T)
	12	G/Or	N-range signal
	13	B/Y	Engine start signal
	14	–	–
	15	–	–
	16	G/Y	2-range signal
	17	Bl/W	L-range signal

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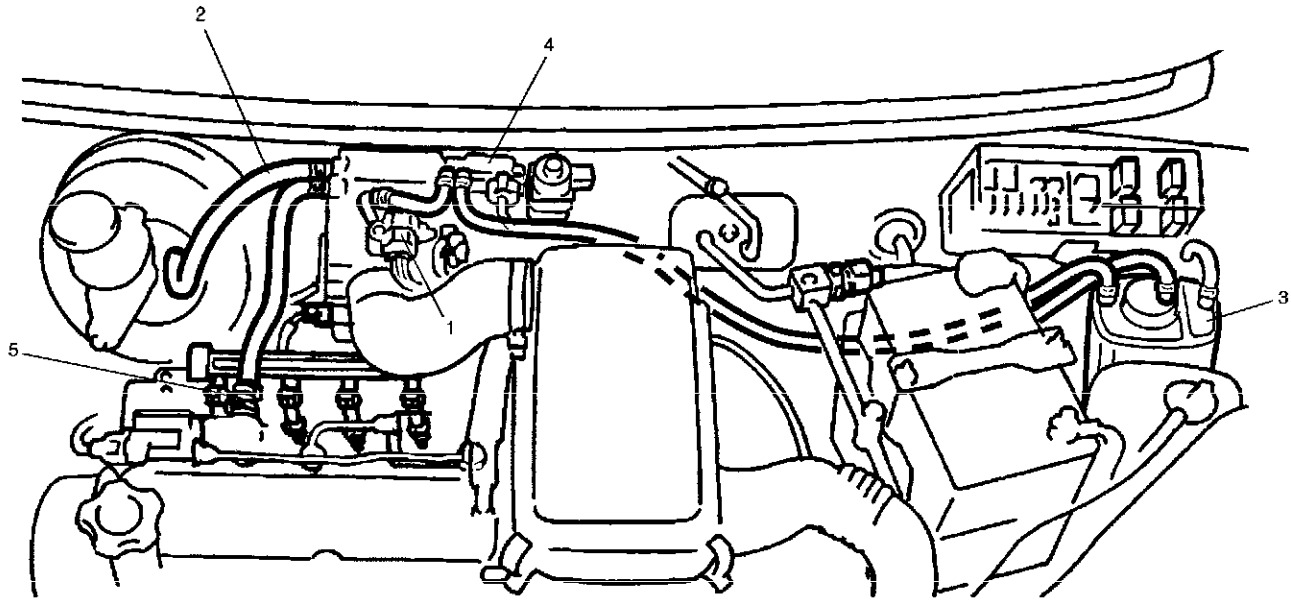
On-vehicle Service



1. MAP sensor	3. EVAP canister	5. PCV valve
2. Brake booster vacuum hose	4. EVAP canister purge valve	

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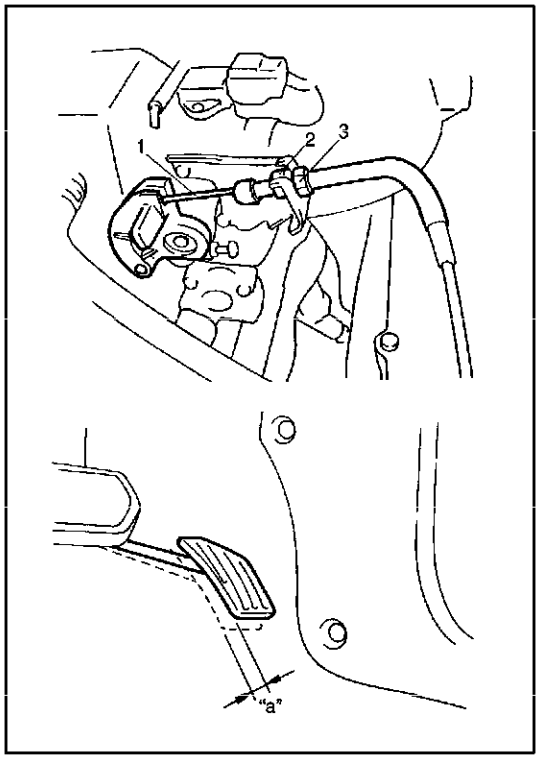
General

When hoses are disconnected and system components are removed for service, reinstall components properly, and route and connect hoses correctly after service. Refer to figure on previous page for proper routing of hoses.

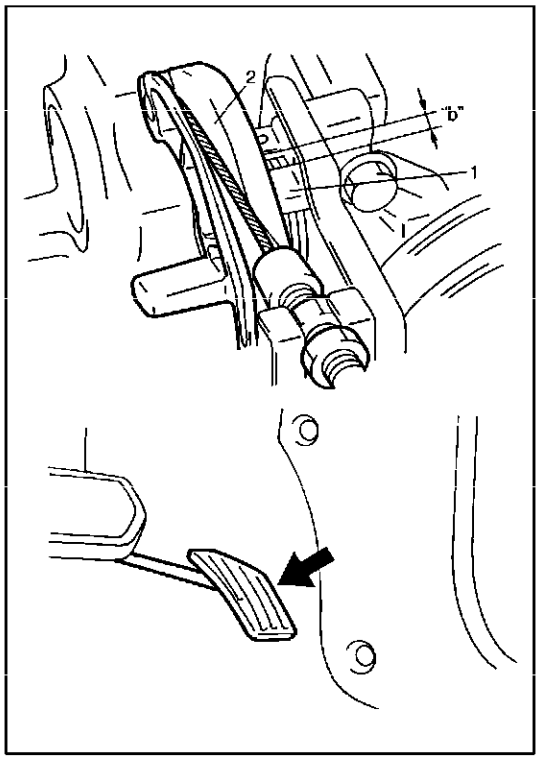
Accelerator Cable Adjustment



1) With throttle valve closed, check accelerator pedal play which should be within the following specification.
   If measured value is out of specification, adjust it to specification with cable adjusting nut (2).

Accelerator pedal play "a" : 2 – 7 mm (0.08 – 0.27 in.)

1.	Accelerator cable
3.	Lock nut



2) With accelerator pedal depressed fully, check clearance between throttle lever (2) and lever stopper (throttle body) (1) which should be within following specification.

Accelerator cable adjustment clearance (with pedal depressed fully) "b" : 0.5 – 2.0 mm (0.02 – 0.07 in.)

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Idle Speed/Idle Air Control (IAC) Duty Inspection

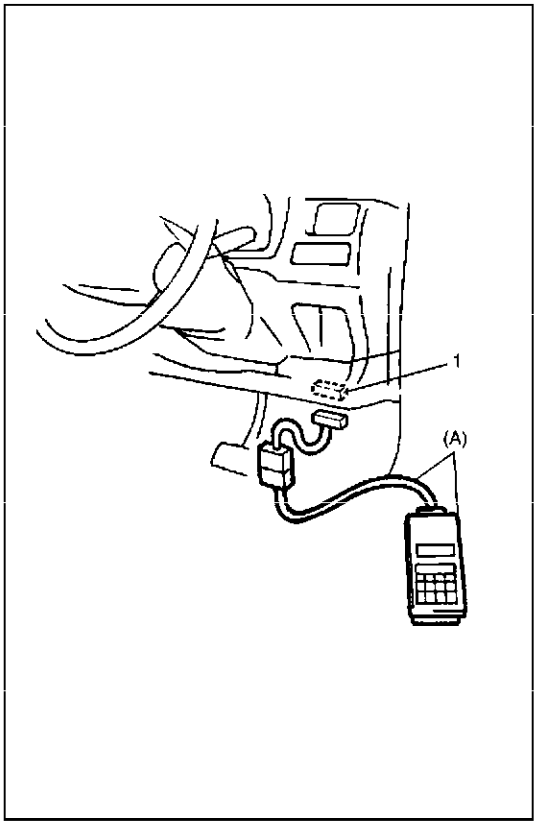
Before idle speed/IAC duty check, make sure of the following.

- Lead wires and hoses of Electronic Fuel Injection system is 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.
- ECM (PCM) does not detect any malfunction DTC.

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 (1) with ignition switch OFF.

Special tool
(A): SUZUKI scan tool

2) Start engine and warm it up to normal operating temperature.
3) Check idle speed and IAC duty by using "DATA LIST" mode of SUZUKI scan tool.
   If duty and/or idle speed is out of specifications, inspect idle air control system referring to "B-4 Idle Air Control System Check" in Section 6.

NOTE:

Check to ensure that radiator fan is not running and then measure IAC duty.

Engine idle speed and IAC duty

A/C OFF	A/C ON
800 ± 50 r/min. 5 – 35 %	900 ± 50 r/min.

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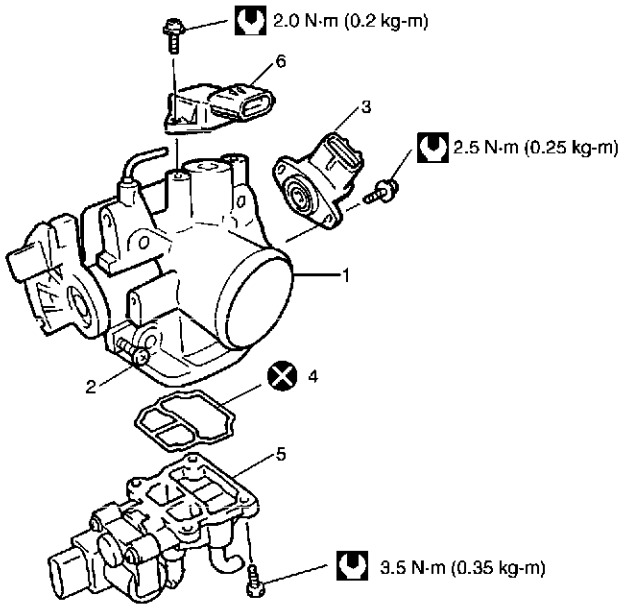
Air Intake System

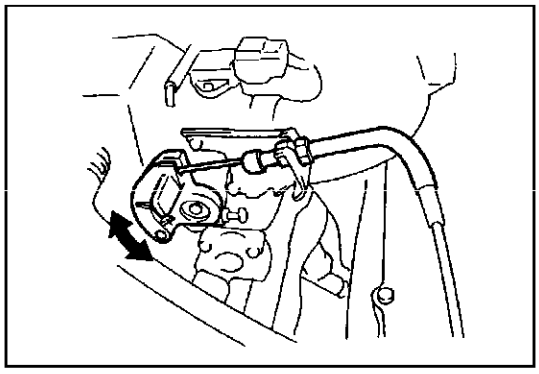
Throttle body

CAUTION:
- **Do not remove or adjust throttle stop screw as it is factory adjusted precisely.**
- **Do not disassemble IAC valve. Disassembly spoils its original performance.**



1. Throttle body	4. O-ring	Tightening torque
2. Throttle stop screw	5. IAC valve	Do not reuse.
3. TP sensor	6. MAP sensor	

ON-VEHICLE INSPECTION



Check that throttle valve lever moves smoothly.

REMOVAL

1) Disconnect negative cable at battery.
2) Drain cooling system referring to Section 6B.

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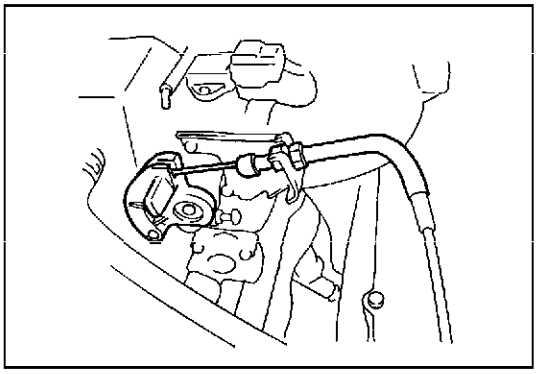
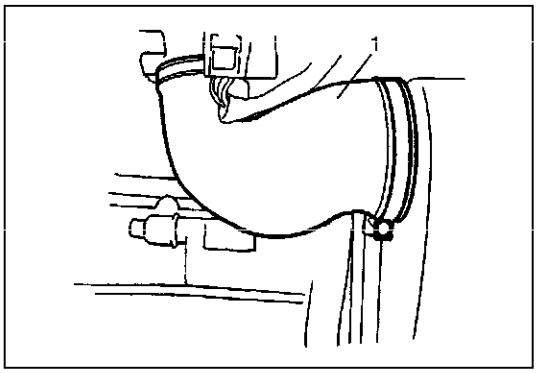
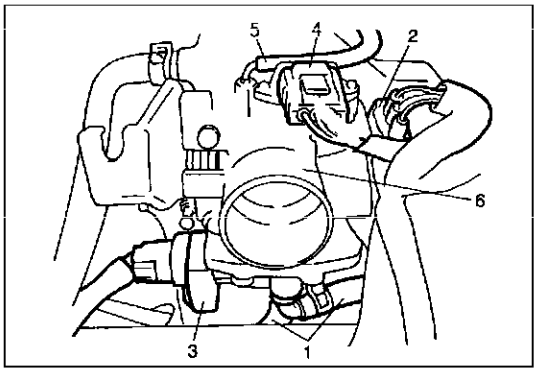


3) Disconnect accelerator cable from throttle body.



4) Remove air cleaner outlet hose (1).



5) Disconnect couplers from TP sensor (2), MAP sensor (4) and IAC valve (3).
6) Remove throttle body (6) from intake manifold.
7) Disconnect engine coolant hoses (1) and EVAP canister purge valve hose (5) 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.

Remove TP sensor, MAP sensor and IAC valve from throttle body.

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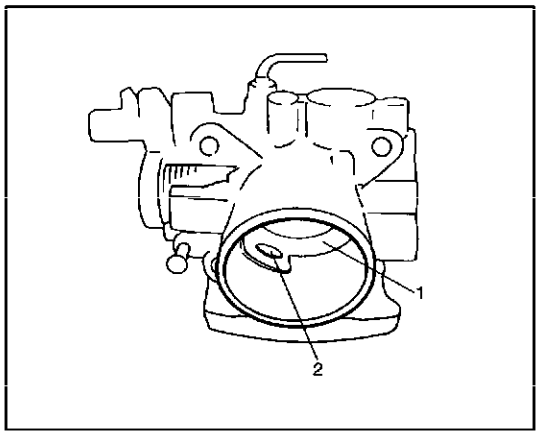
CLEANING



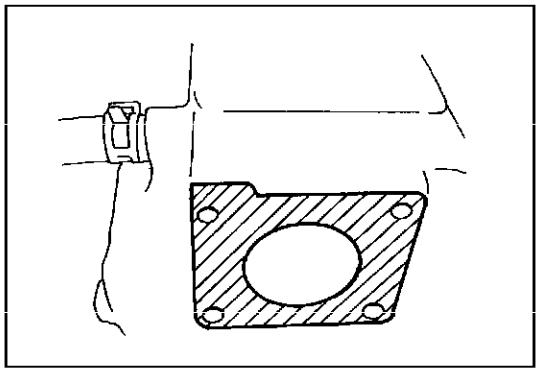
Clean throttle body bore (1) and idle air passage (2) by blowing compressed air.

CAUTION:
- **TP sensor, IAC valve, MAP sensor 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.**
- **Do not blow compressed air through bypass air passage with IAC valve installed to throttle body. This will cause IAC valve to malfunction.**

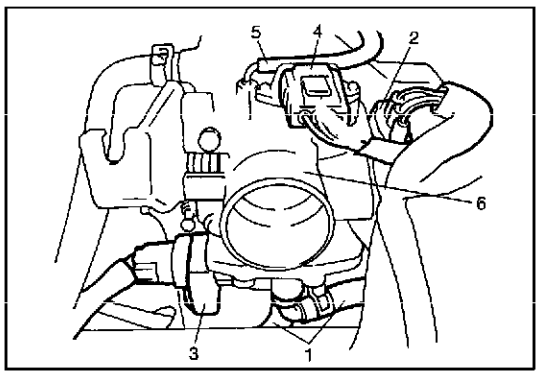
REASSEMBLY

1) Install IAC valve to throttle body referring to "IAC valve Installation" section.
2) Install TP sensor to throttle body referring to "TP sensor Installation" section.
3) Install MAP sensor to throttle body referring to "MAP sensor Installation" section.

INSTALLATION



1) Clean mating surfaces and install throttle body gasket to intake manifold.
   Use new gasket.



2) Install throttle body (6) to intake manifold.
3) Connect engine coolant hoses (1) and EVAP canister purge valve hose (5).
4) Connect couplers to TP sensor (2), MAP sensor (4) and IAC valve (3) securely.

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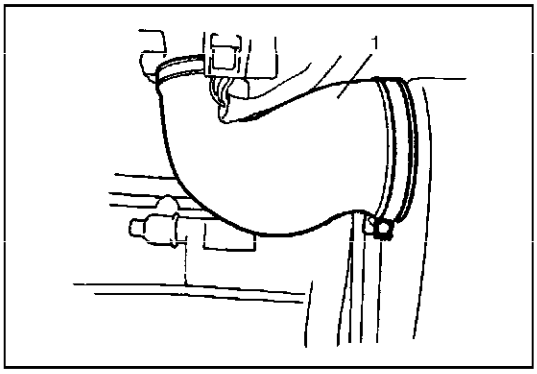
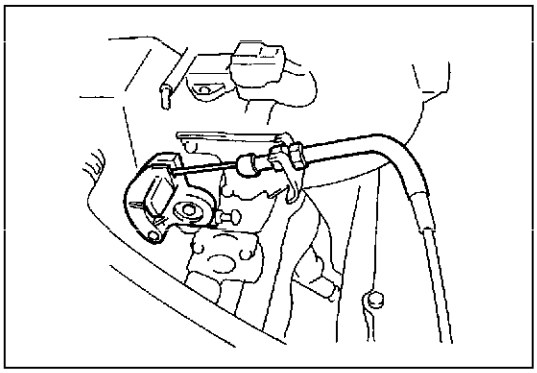


5) Install air cleaner outlet hose (1).



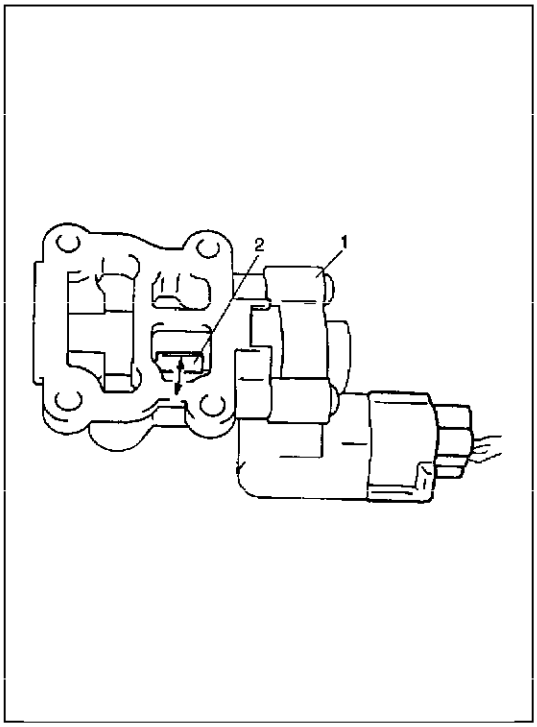
6) Connect accelerator cable and adjust cable play to specification.
7) Refill cooling system.
8) Connect negative cable at battery.

Idle air control valve (IAC valve)

REMOVAL

1) Remove throttle body from intake manifold referring to "Throttle Body Removal" section.
2) Remove IAC valve from throttle body.

INSPECTION



1) Remove IAC valve (1) from throttle body.
2) Connect each connector to IAC valve, MAP sensor, TP sensor and IAT sensor.
3) 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 harnesses for open and short. If wire harnesses are in good condition, replace IAC valve and recheck.

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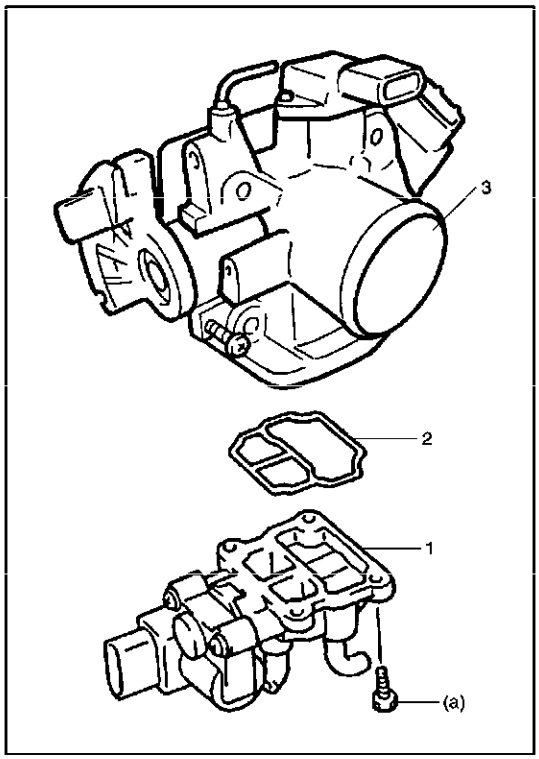
INSTALLATION



1) Install new O-ring (2) to IAC valve (1).
2) Install IAC valve to throttle body (3).
   Tighten IAC valve screws to specified torque.

Tightening torque
IAC valve screw (a) : 3.5 N·m (0.35 kg-m, 2.5 lb-ft)

3) Install throttle body to intake manifold referring to "Throttle Body Installation" section.

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.

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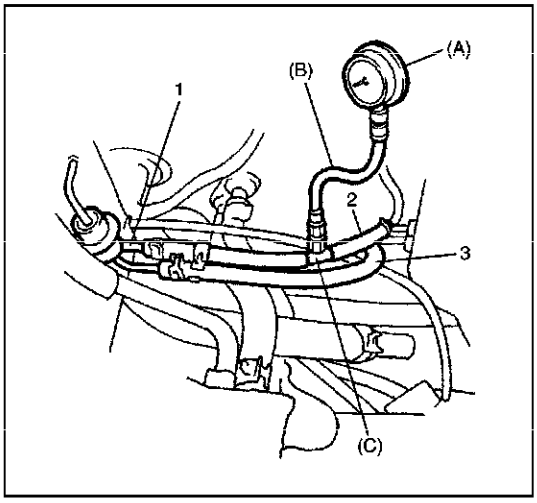


3) Connect special tools and hose between fuel delivery pipe (1) and fuel feed hose (2) as shown in figure, and clamp hoses securely to ensure no leaks occur during checking.

Special tool
(A) : 09912-58441
(B) : 09912-58431
(C) : 09912-58490

3. Fuel return hose

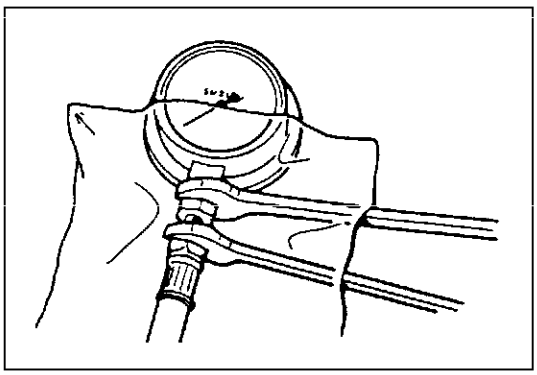
4) Check that battery voltage is above 11 V.

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	**200 – 240 kPa** **2.0 – 2.4 kg/cm^2** **28.4 – 34.1 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 "B-3 Fuel Pressure Check" in Section 6 and check each possibly defective part. Replace if found defective.



8) After checking fuel pressure, remove fuel pressure gauge.

CAUTION:
As fuel feed line is still under high fuel pressure, make sure to release fuel pressure according to following procedures.
- **Place fuel container under joint.**
- **Cover joint with rag and loosen joint nut slowly to release fuel pressure gradually.**

9) Remove special tools from fuel delivery pipe.
10) Connect fuel feed hose to fuel delivery pipe and clamp it securely.

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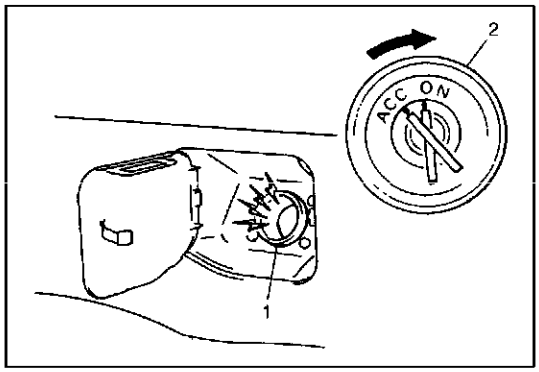
11) With engine "OFF" and ignition switch "ON", check for fuel leaks.

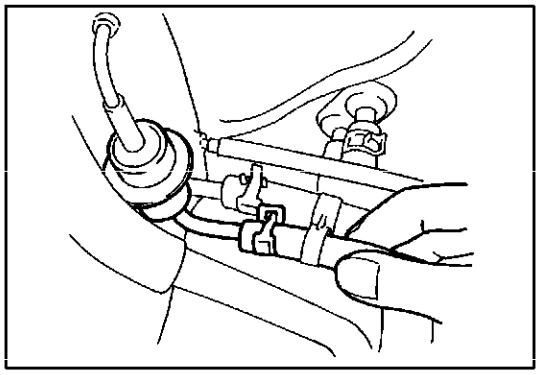
Fuel pump

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.



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-1 in Section 6.



2) Fuel pressure should be felt at fuel return hose 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 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

Install fuel pump to fuel tank and then install fuel tank to body according to procedure described in Section 6C.

Fuel pressure regulator

ON-VEHICLE INSPECTION

Perform fuel pressure inspection according to procedure described in "Fuel Pressure Inspection" in this section.

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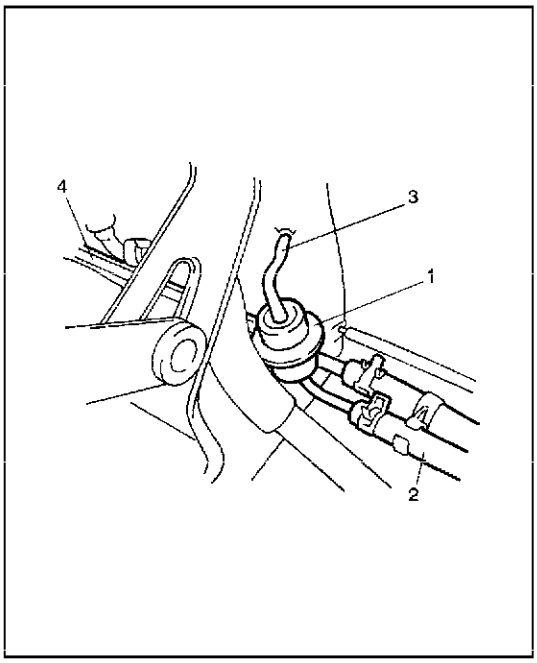
REMOVAL

1) Relieve fuel pressure according to procedure described in Section 6.
2) Disconnect battery negative cable at battery.



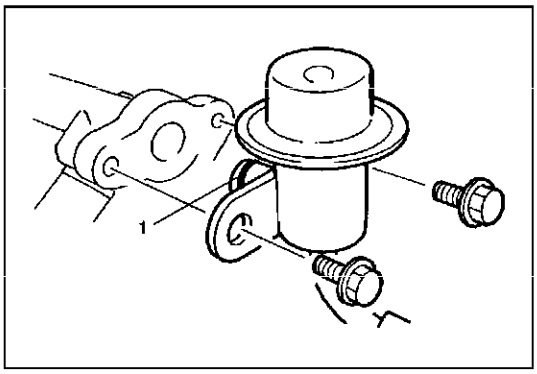
3) Disconnect vacuum hose (3) from fuel pressure regulator (1).
4) Remove air cleaner outlet hose.
5) Remove air cleaner case by removing its fastening bolts.
6) Disconnect fuel return hose (2) from fuel pressure regulator.

CAUTION:
A small amount of fuel may be released when hose is disconnected. Cover hose to be disconnected with a shop cloth.

7) Remove fuel pressure regulator from fuel delivery pipe (4).

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.

INSTALLATION

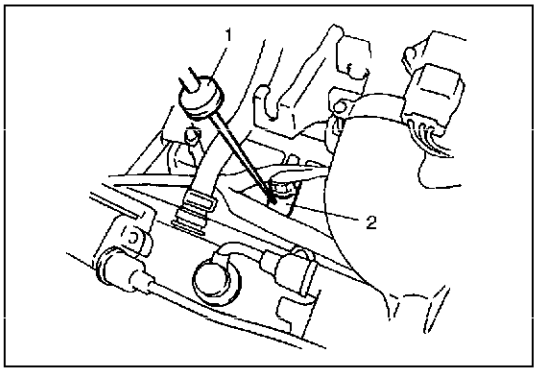


For installation, reverse removal procedure and note following precautions.

- Use new O-ring (1).
- Apply thin coat of spindle oil or gasoline to O-ring to facilitate installation.
- With engine "OFF" and ignition switch "ON", 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, preform "B-2 Fuel Injector and Its Circuit Check" in Section 6.

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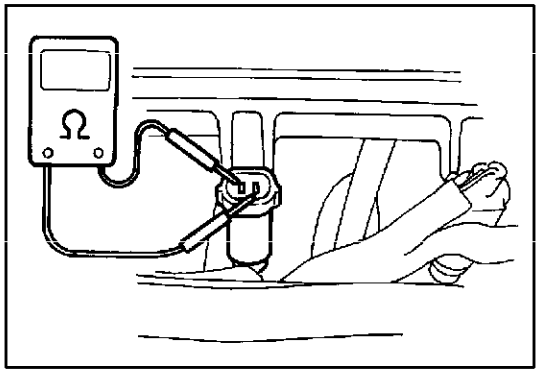


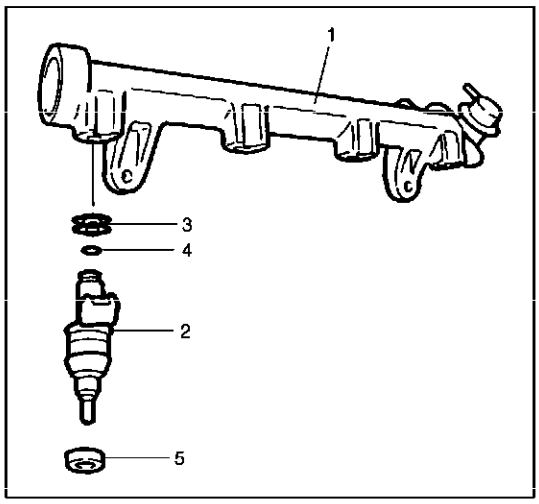
2) Disconnect coupler from injector, connect ohmmeter between terminals of injector and check resistance.
   If resistance is out of specification, replace.

   Resistance of injector : 11.3 – 13.8 Ω

3) Connect coupler to injector securely.

REMOVAL

1) Relieve fuel pressure according to procedure described in Section 6.
2) Disconnect battery negative cable at battery.
3) Remove air cleaner outlet hose.
4) Remove intake manifold stiffener and engine hook.
5) Disconnect fuel injector couplers.
6) Remove fuel delivery pipe bolts.
7) Remove fuel injector(s) (2).



CAUTION:
A small amount of fuel may come out after removal of fuel injectors, cover them with shop cloth.

1.	Fuel delivery pipe
3.	Grommet
4.	O-ring
5.	Cushion

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.

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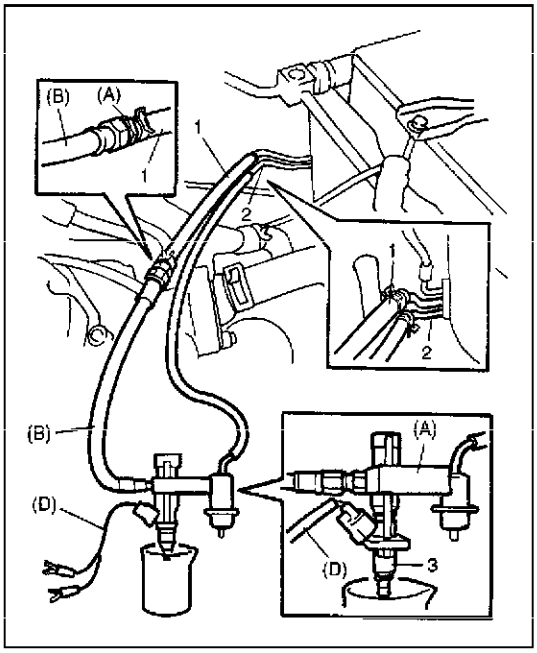


1) Install injector (3) and fuel pressure regulator to special tool (injector checking tool).

Special tool
(A) : 09912-58421

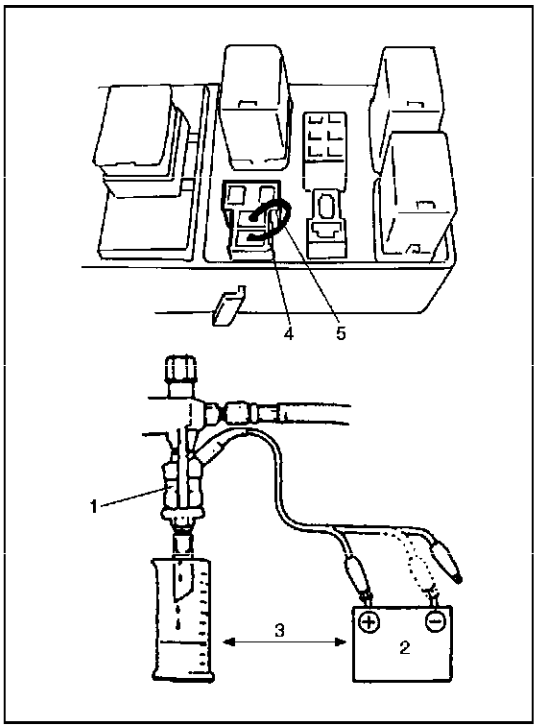
2) Connect special tools (hose and attachment) to fuel feed hose (1).

Special tool
(B) : 09912-58431

3) Connect special tool (test lead) to injector.

Special tool
(D) : 09930-88530

2. Fuel return pipe



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) Remove fuel pump relay.
7) To operate fuel pump and apply fuel pressure to injector (1), connect two terminals of relay box using service wire (5) as shown in figure.

CAUTION:
Check to make sure that connections made between correct terminals. Wrong connection can cause damage to ECM, wire harness, etc.

8) Apply battery voltage to injector 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:
38.3 – 40.7 cc/15 sec. (1.29/1.35 – 1.37/ 1.43 US/Imp. oz/15 sec.)

2. Battery
3. Keep as far apart as possible
4. Fuel pump relay coupler

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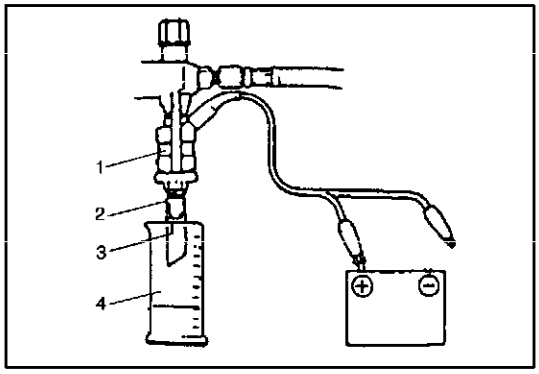
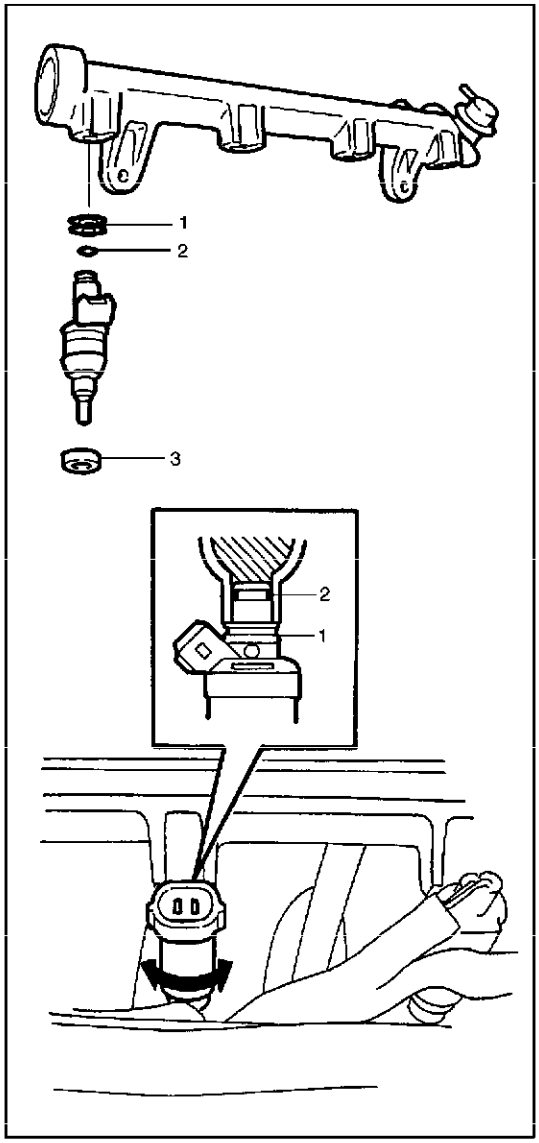


9) Check fuel leakage from injector nozzle. Do not operate injector (1) for this check (but fuel pump should be at work). If fuel leaks more than following specification, replace.

Fuel leakage : Less than 1 drop/min.

2.	Vinyl tube
3.	Less than one fuel drop/min.
4.	Graduated cylinder

INSTALLATION



For installation, reverse removal procedure and note following precautions.

- Replace injector O-ring (2) with new one using care not to damage it.
- Check if cushion (3) is scored or damaged. If it is, replace with new one.
- Apply thin coat of fuel to O-rings and then install injectors into delivery pipe and intake manifold.
  Make sure that injectors rotate smoothly. If not, probable cause is incorrect installation of O-ring. Replace O-ring with new one.
- Tighten delivery pipe bolts and make sure that injectors rotate smoothly.
- With engine "OFF" and ignition switch "ON", check for fuel leaks around fuel line connection.

1.	Grommet

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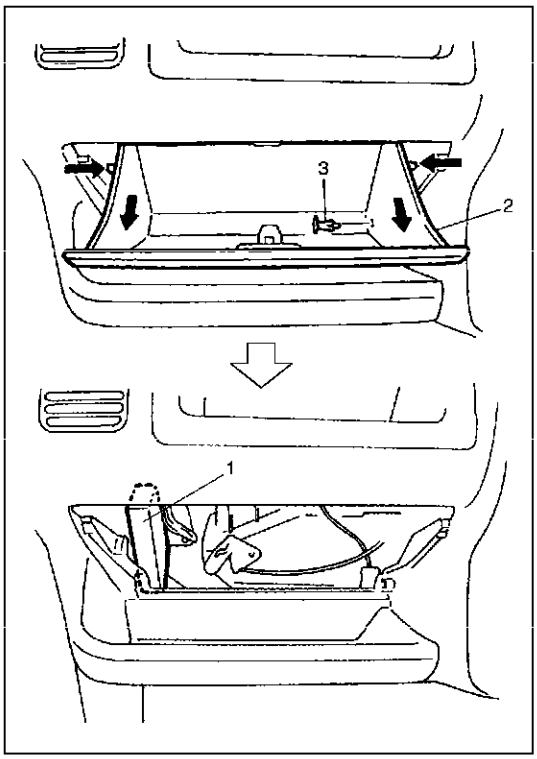
Electronic Control System

ECM (PCM)

CAUTION:
As ECM (PCM) consists of precision parts, be careful not to expose it to excessive shock.

REMOVAL

1) Disconnect battery negative cable at battery.



2) Open glove box (2) and the remove clip (3).
3) While pressing glove box stopper, pull out glove box from instrument panel.
4) Disable air bag system, refer to "DISABLING THE AIR BAG SYSTEM" in Section 10B.
5) Remove ECM (PCM) (1) from body.
6) Disconnect couplers from ECM (PCM).

INSTALLATION

1) Install ECM (PCM) to body.
2) Connect couplers to ECM (PCM) securely.
3) Connect battery negative cable at battery.

MAP sensor

OUTPUT VOLTAGE CHECK

1) Remove ECM (PCM) according to previously outlined.
2) Connect couplers to ECM (PCM) securely.

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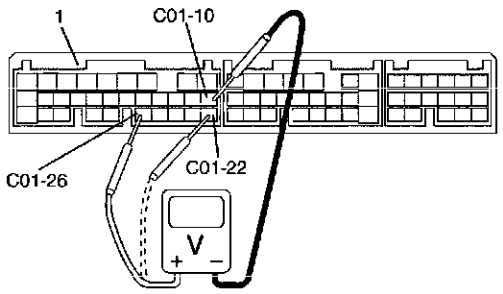

3) With coupler connected to ECM (PCM), connect digital type voltmeter as shown and check that ECM (PCM) supply voltage 4.75 – 5.25 V is applied to coupler terminal "C01-22".
4) Check output voltage at coupler terminal "C01-26".
Note that it varies with atmospheric pressure and altitude. Also, start engine, it it can, and check if output voltage varies.

Output voltage (ECM (PCM) supply voltage 4.75 – 5.25 V, ambient temp. 10 – 40°C, 50 – 104°F)

ALTITUDE (Reference)		BAROMETRIC PRESSURE	OUTPUT VOLTAGE
(ft)	(m)	(kPa(mmHg))	(V)
0	0	101.3 (760)	3.3 – 3.9
1000	305	97.7 (733)	3.2 – 3.8
2000	610	94.3 (707)	3.1 – 3.7
3000	914	90.9 (682)	3.0 – 3.6
4000	1219	87.7 (658)	3.0 – 3.5
5000	1524	84.5 (634)	2.9 – 3.4
6000	1829	81.5 (611)	2.8 – 3.3
7000	2133	78.5 (589)	2.7 – 3.2
8000	2438	75.6 (567)	2.6 – 3.1
9000	2743	72.8 (546)	2.5 – 3.0
10000	3048	70.1 (526)	2.5 – 3.0

NOTE:
Note that atmospheric pressure varies depending on weather conditions as well as altitude.
Take that into consideration when performing above check.

If check result is not satisfactory in previous step 3) or 4), check MAP sensor and its circuit according to Diagnostic Flow Table for P0105.

NOTE:
If output voltage does not vary when engine is started, it is possible that vacuum passage is clogged. Clean them. Another possibility is that filter in MAP sensor is clogged from freezing. If it is suspected, leave it at room temperature (20°C, 68°F) for a while and recheck.

1. ECM (PCM) coupler connected

5) Upon completion of checking, install ECM (PCM) and connect ECM (PCM) couplers securely.

MAP SENSOR INDIVIDUAL CHECK

1) Remove MAP sensor referring MAP sensor removal.

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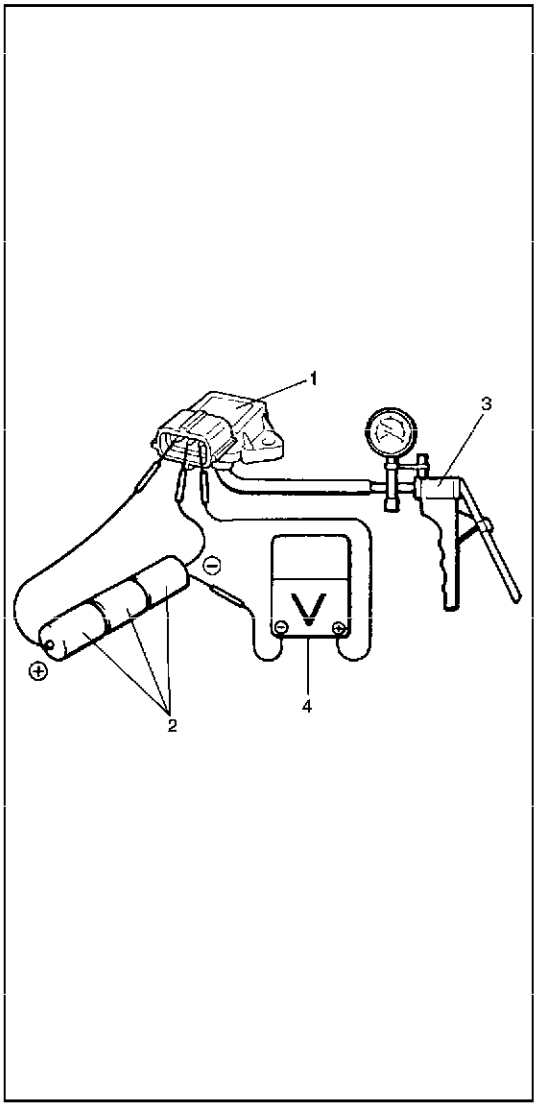


2) Connect 3 new 1.5 V batteries (2) in series (check that total voltage is 4.5 – 5.0 V) and connect its positive terminal to "Vcc" terminal of sensor and negative terminal to "Ground" terminal. Then check voltage between "Vout" and "Ground". Also, check if voltage reduces when vacuum is applied up to 40 cmHg by using vacuum pump (3).
If check result is not satisfactory, replace MAP sensor (1).

Output voltage (Input voltage 4.5 – 5.0 V, ambient temp. 20 – 30℃, 68 – 86℉)

ALTITUDE (Reference)		BAROMETRIC PRESSURE	OUTPUT VOLTAGE
(ft)	(m)	(kPa(mmHg))	(V)
0 | 2000	0 | 610	101.3 (760) | 94.3 (707)	3.0 – 3.7
2001 | 5000	611 | 1524	Under 94.3 (707) over 84.5 (634)	2.7 – 3.5
5001 | 8000	1525 | 2 438	Under 84.5 (634) over 75.6 (567)	2.5 – 3.2
8001 | 10000	2439 | 3048	Under 75.6 (567) over 70.1 (526)	2.3 – 2.9

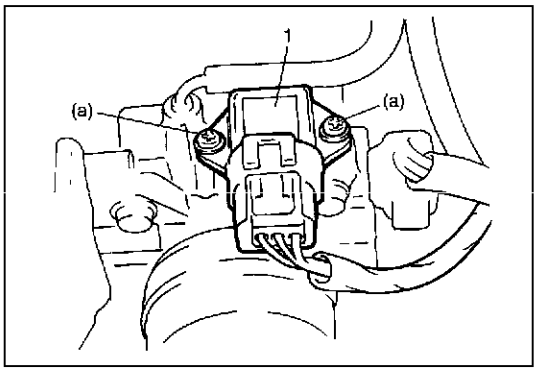
4. Digital type voltmeter

3) Install MAP sensor referring to MAP sensor installation.

REMOVAL

1) Disconnect battery negative cable at battery.
2) Disconnect coupler from MAP sensor.
3) Remove MAP sensor from throttle body.

INSTALLATION



1) Install MAP sensor (1) to throttle body.

Tightening torque
MAP sensor screw (a): 2.0 N·m (0.20 kg-m, 1.5 lb-ft)

2) Connect coupler to MAP sensor.
3) Connect battery negative cable to battery.

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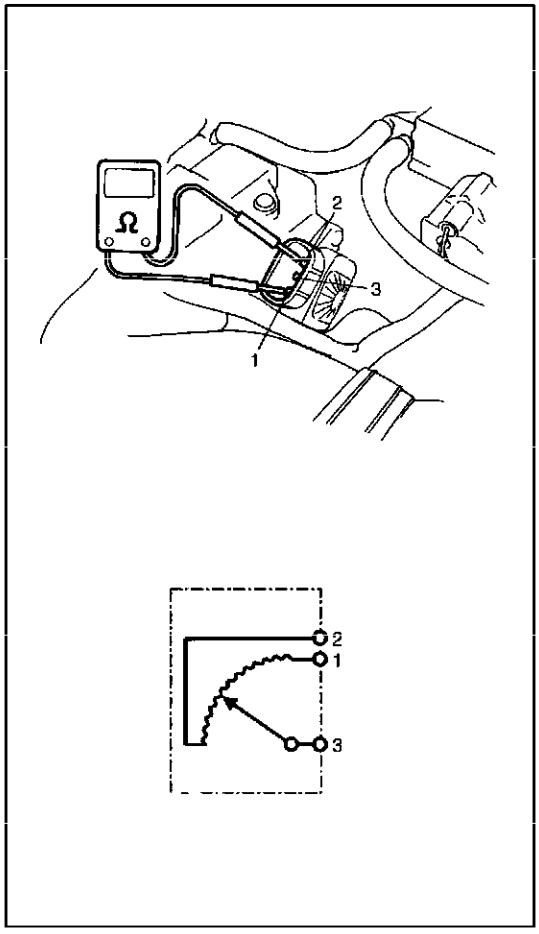
TP sensor

INSPECTION

1) Disconnect negative cable at battery and coupler 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

TERMINAL	RESISTANCE	
Between "Vcc" and "GND" terminals	4 – 6 kΩ	
Between "Vout" and "GND" terminals	Throttle valve is at idle position	0.6 – 1.2 kΩ
	Throttle valve is fully opened	3.2 – 5.4 kΩ

NOTE:

There should be more than 1.5 kΩ resistance difference between when throttle valve is at idle position and when it is fully open.

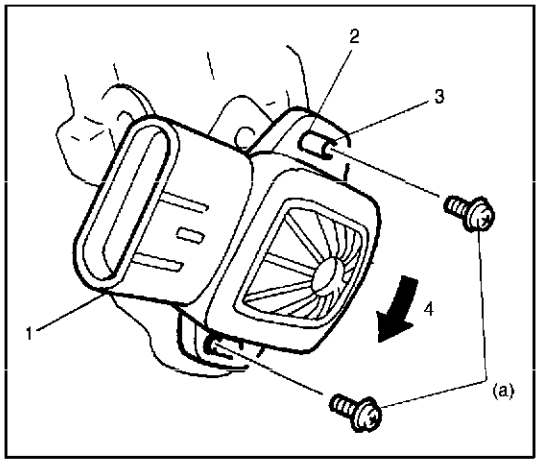
1. Ground terminal
2. Reference voltage terminal
3. Output voltage terminal

3) Connect TP sensor coupler securely.
4) Connect negative cable to battery.

REMOVAL

1) Disconnect battery negative cable at battery.
2) Disconnect coupler from TP sensor.
3) 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 (2) are a little away from TP sensor screw holes (3) as shown in the figure and turn TP sensor clockwise so that those holes align.

Tightening torque
TP sensor screw (a): 2.5 N·m (0.25 kg-m, 2.0 lb-ft)

4. Turn TP sensor after fitting and align holes.

2) Connect coupler to TP sensor securely.
3) Connect battery negative cable to battery.

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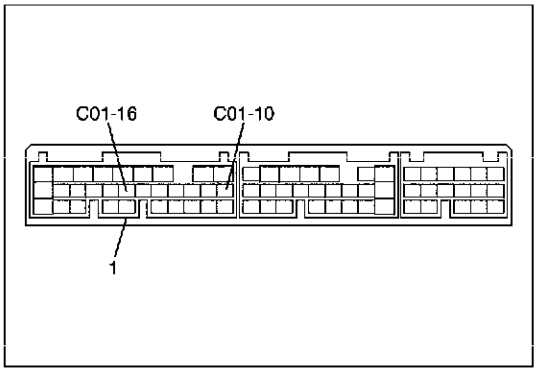
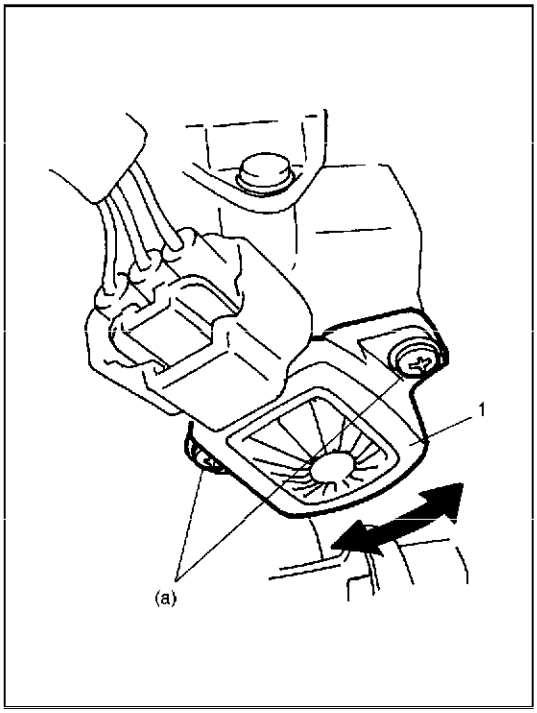
ADJUSTMENT

1) Loosen TP sensor screws.



2) [Using SUZUKI scan tool]
   Connect SUZUKI scan tool to DLC with ignition switch OFF and check "TP SENSOR VOLT" value displayed on scan tool by using "DATA LIST" mode.
   [Not using SUZUKI scan tool]
   Remove ECM (PCM) as previously outlined and with couplers connected to ECM (PCM), connect digital type voltmeter between "C01-16" and "C01-10" terminal.

1. ECM (PCM) coupler (viewed from harness side)



3) Turn TP sensor (1) clockwise or counterclockwise and tighten TP sensor screw at a position where voltage as specified below is obtained.

TP sensor output voltage when throttle is fully close
0.805 ± 0.025 V

4) Tighten TP sensor screw to specified torque.

Tightening torque
TP sensor screw (a): 2.5 N·m (0.25 kg-m, 2.0 lb-ft)

5) Check to make sure that TP sensor voltage is as shown below when throttle is fully open.

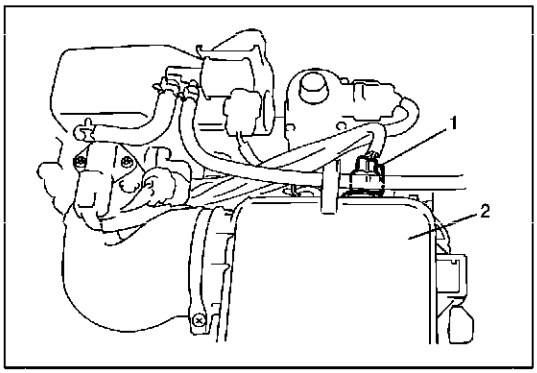
TP sensor output voltage when throttle is fully open
4.2 ± 0.5 V

6) [Not using SUZUKI scan tool]
   Install ECM (PCM) as previously outlined.
7) With ignition switch at OFF position, disconnect negative cable at battery for 30 seconds and connect it.

IAT sensor

REMOVAL

1) Disconnect battery negative cable at battery.



2) Disconnect coupler (1) from IAT sensor.
3) Remove IAT sensor from air cleaner case (2).

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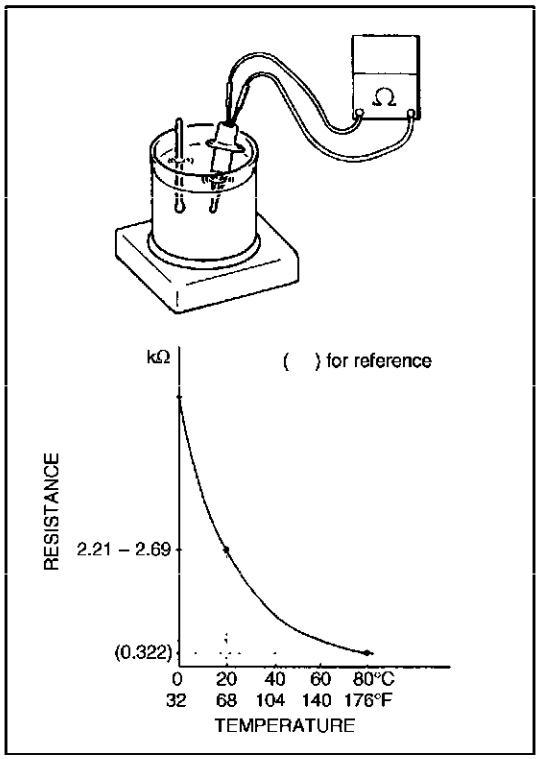
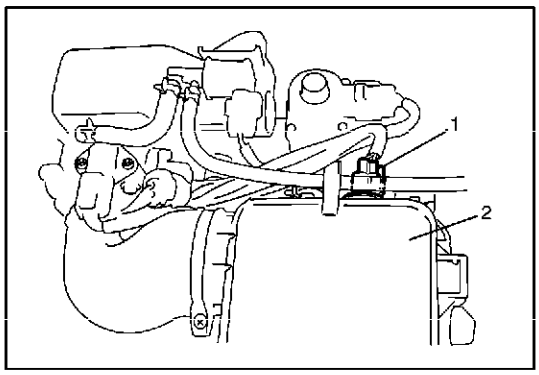
INSPECTION



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 the figure, replace IAT sensor.

INSTALLATION



Reverse removal procedure noting the following.

- Clean mating surfaces of IAT sensor and air cleaner case (2).
- Connect IAT sensor coupler (1) securely.

ECT sensor

REMOVAL

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 it cap is taken off too soon.

1) Disconnect battery negative cable at battery.
2) Drain coolant referring to Section 6B.

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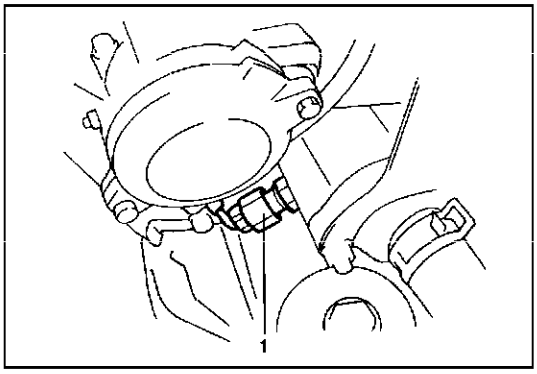
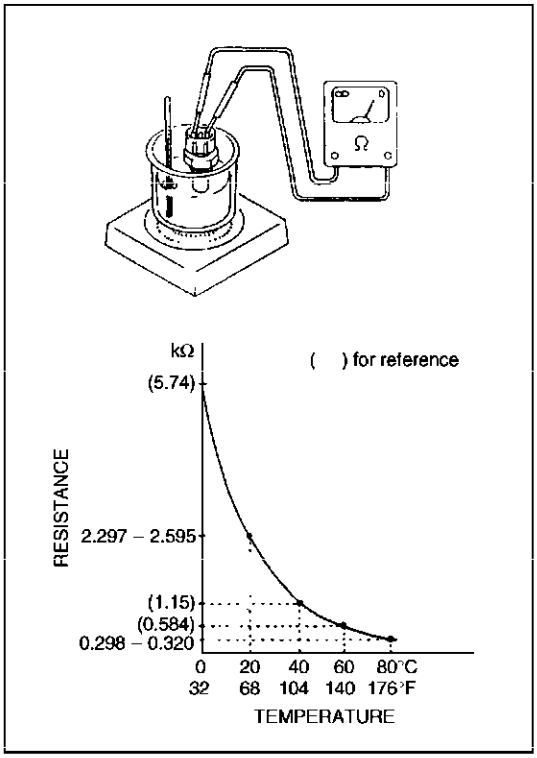


3) Disconnect coupler from ECT sensor (1).
4) Remove ECT sensor from water outlet pipe.

INSPECTION

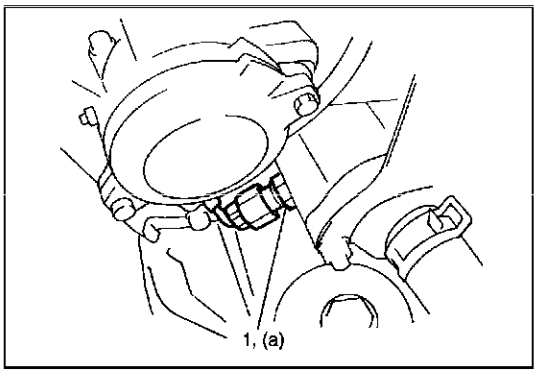


Immerse temperature sensing part of ECT sensor in water (or ice) and measure resistance between sensor terminals while heating water gradually.
If measured resistance doesn't show such characteristic as shown in left figure, replace ECT sensor.

INSTALLATION

Reverse removal procedure noting the following.

- Clean mating surfaces of ECT sensor and water outlet pipe.
- Check O-ring for damage and replace if necessary.



- Tighten ECT sensor (1) to specified torque.

Tightening torque
ECT sensor (a): 12 N·m (1.2 kg-m, 9.0 lb-ft)

- Connect coupler to ECT sensor securely.
- Refill coolant referring to Section 6B.

Main/Fuel pump/Radiator fan control relay

INSPECTION

1) Disconnect negative cable at battery.

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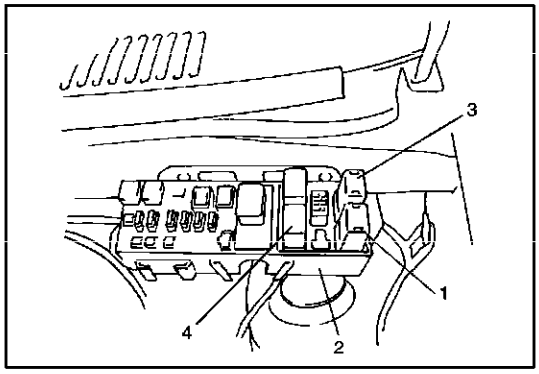
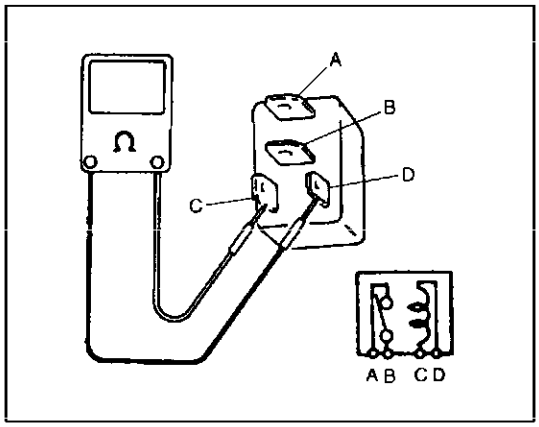


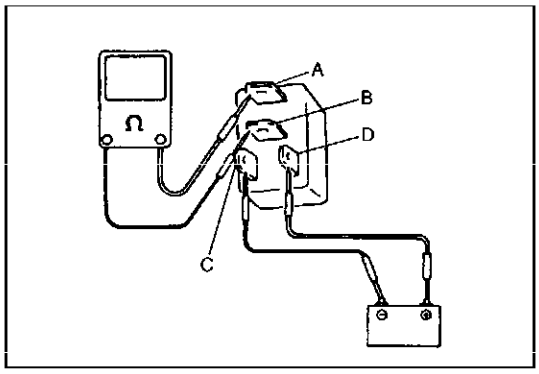
2) Remove main (1) or fuel pump (4) or radiator fan control relay (3) from relay/fuse box (2).



3) Check resistance between each two terminals as in table below.
If check results are as specified to next operation check. If not, replace.

Main relay, fuel pump relay and radiator fan control relay resistance

TERMINALS	RESISTANCE
Between A and B	∞ (infinity)
Between C and D	100 – 150 Ω



4) Check that there is continuity between terminals "A" and "B" when battery is connected to terminals "C" and "D".
If found defective, replace.

Heated Oxygen Sensor (Sensor-1 and Sensor-2)

OXYGEN SENSOR HEATER INSPECTION

1) Disconnect sensor connector.

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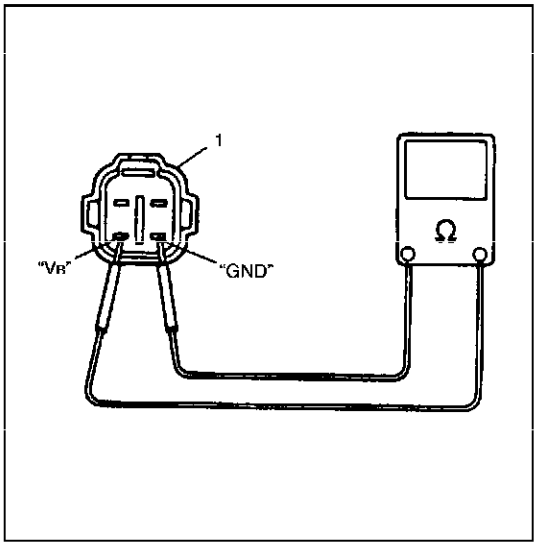


2) Using ohmmeter, measure resistance between terminals "V_B" and "GND" of sensor connector.
If found faulty, replace oxygen sensor.

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)

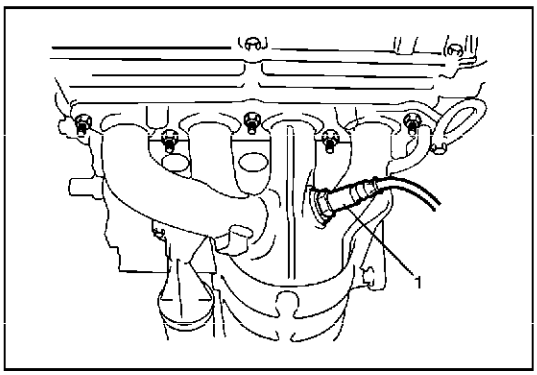
1. Viewed from terminal side

3) Connect sensor connector securely.

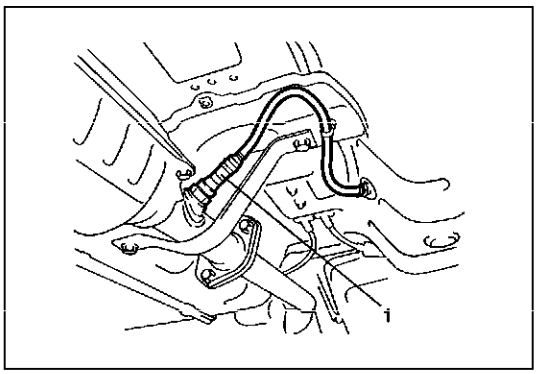
REMOVAL

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) Remove HO2S-1 (1) as follows.
   a) Disconnect connector of HO2S-1 and release its wire harness from clamps, then remove exhaust manifold cover.
   b) Remove front bumper, if necessary.
   c) Remove HO2S-1 from exhaust manifold.



3) Remove HO2S-2 (1) as follows.
   a) Remove left front seat assembly and console box, then disconnect connector of HO2S-2.
   b) Hoist vehicle and release HO2S-2 wire harness from clamp.
   c) Remove HO2S-2 from exhaust pipe.

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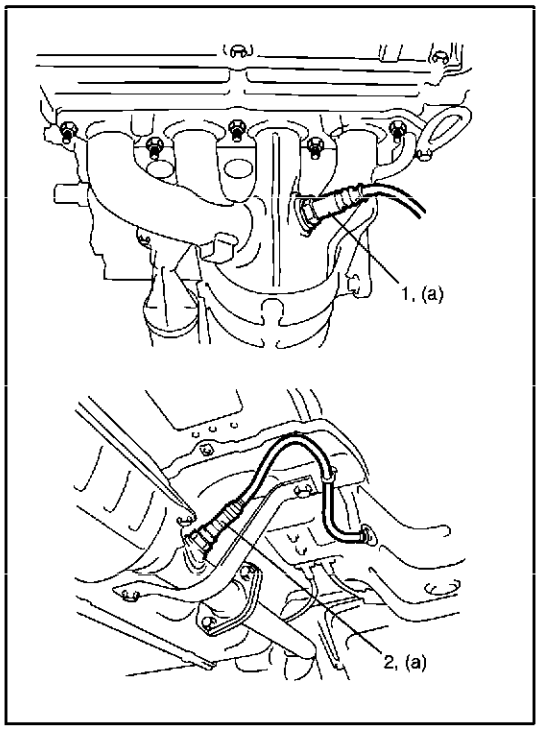
INSTALLATION



Reverse removal procedure noting the following.

- Tighten heated oxygen sensor to specified torque.

Tightening torque
Heated oxygen sensor: 45 N·m (4.5 kg-m, 32.5 lb-ft)

1. HO2S-1
2. HO2S-2

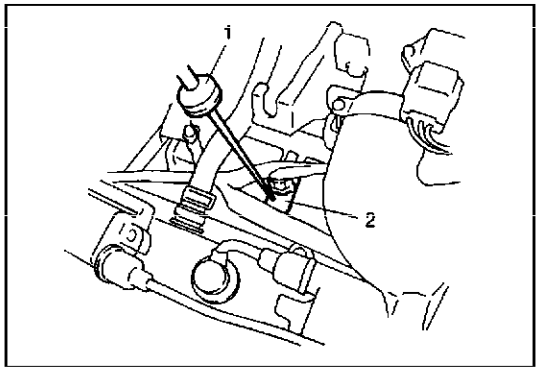
- Connect coupler of heated oxygen sensor and clamp wire harness securely.
- After installing heated oxygen sensor, start engine and check that no exhaust gas leakage exists.

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) 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 (2) by using sound scope (1) 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.

Knock sensor

INSPECTION

Check knock sensor referring to DTC P0325 Flow Table in Section 6.
If malfunction is found, replace.

REMOVAL

1) Disconnect negative cable at battery.
2) Remove starting motor referring to Section 6G.

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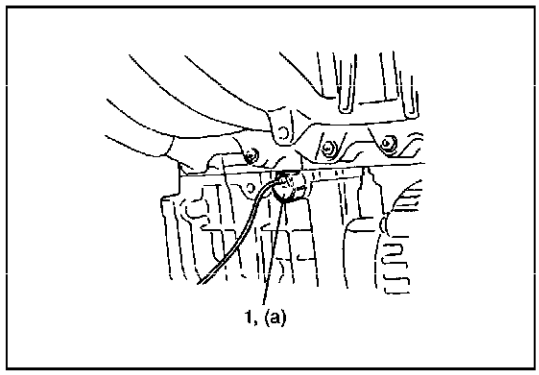
3) Disconnect knock sensor connector.
4) Remove knock sensor from cylinder head.

INSTALLATION



Reverse removal procedure for installation.

- Tighten knock sensor (1) to specified torque.

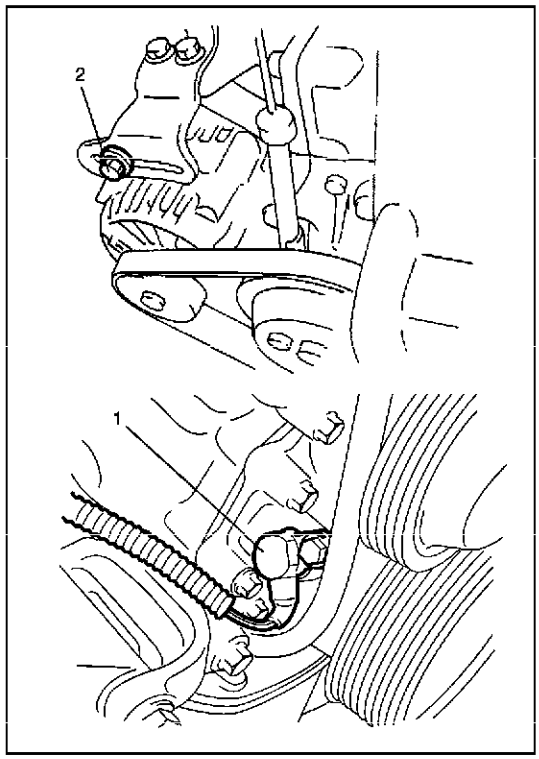
Tightening torque
Knock sensor (a): 22 N·m (2.2 kg-m, 16.0 lb-ft)

CKP sensor

INSPECTION

Check crankshaft position sensor referring to DTC P0335 Flow Table in Section 6. If malfunction is found, replace.

REMOVAL



1) Disconnect negative cable at battery.
2) Remove generator drive belt, remove adjusting bolt (2) and move generator outward.
3) Disconnect connector of crankshaft position sensor.
4) Remove crankshaft position sensor (1) from oil pump case.

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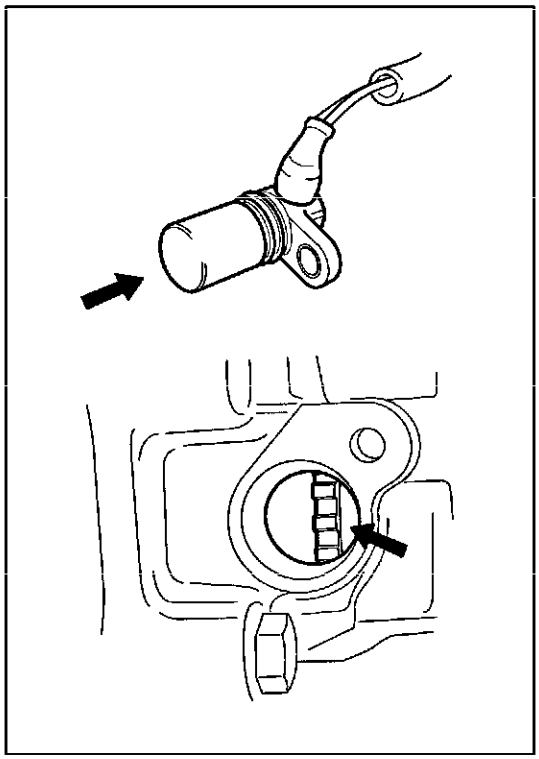

INSTALLATION

1) Check to make sure that crankshaft position sensor and pulley teeth are free from any metal particles and damage.
2) Install crankshaft position sensor to oil pump case.
3) Connect connector to it securely.
4) Adjust generator drive belt tension referring to Section 6B.
5) Connect negative cable to battery.

Radiator fan control system

SYSTEM INSPECTION

WARNING:

Keep hands, tools and clothing away from engine cooling fan to help prevent personal injury. This fan is electric and can come on whether or not the engine is running. The fan can start automatically in response to the ECT sensor with the ignition switch in the "ON" position.

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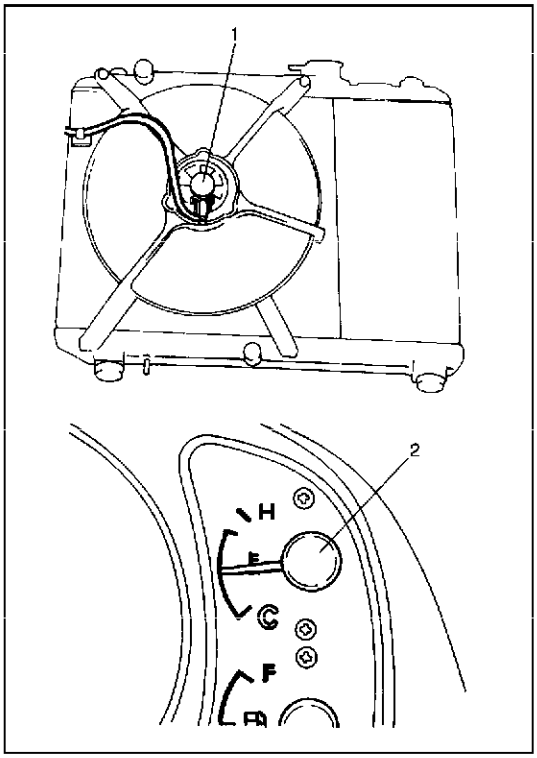
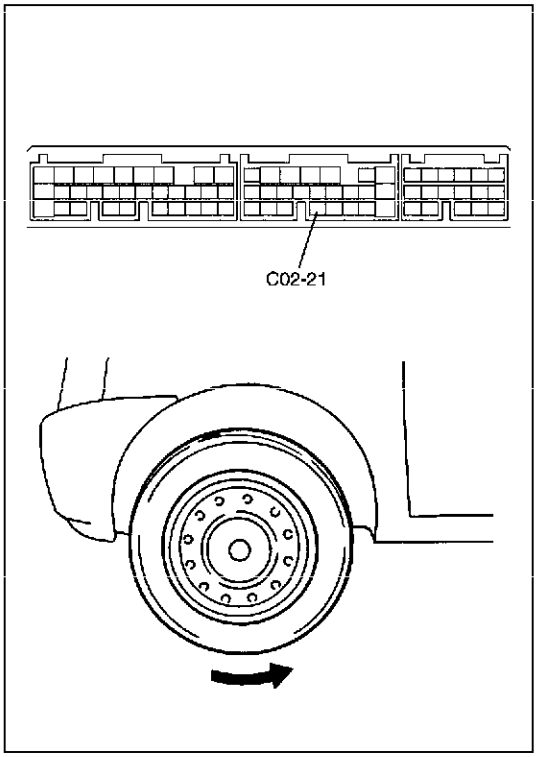


Start engine and keep it running to warm it up.
Now check to ensure that radiator fan (1) is started when indicator of coolant temp. meter (2) moves to as shown in figure.
If check result is not satisfactory, check radiator fan control relay, wire harness, ECT sensor, ECM (PCM), coolant temp. meter and sender gauge unit.
Refer to "DIAGNOSTIC FLOW CHART B-5" of this section and "COOLANT TEMP. METER AND SENDER GAUGE INSPECTION" of Section 8.

VSS

ON-VEHICLE INSPECTION

1) Hoist vehicle.
2) Release parking brake lever, set transmission in neutral state.



3) Connect voltmeter between "C02-21" terminal of ECM (PCM) connector and body ground.
4) Turn ignition switch to ON position and turn front right tire slowly with front left tire locked.
   Voltmeter should indicate deflection between 0 – 1 V and 10 – 14 V a few times while tire is turned one revolution.
   If check result is not satisfactory, proceed to flow table of diagnostic trouble code P0500 in Section 6.

REMOVAL

1) Disconnect negative cable at battery.
2) Disconnect VSS coupler.

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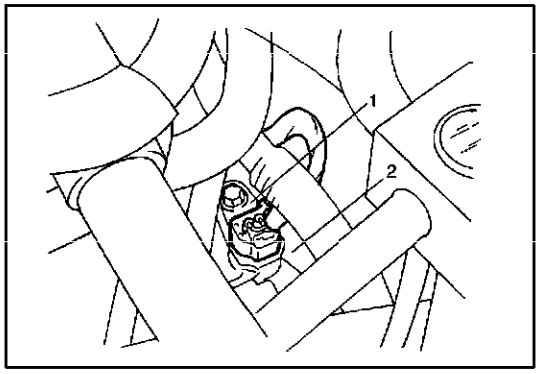
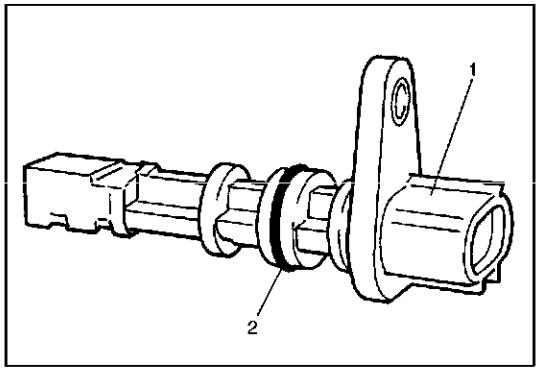


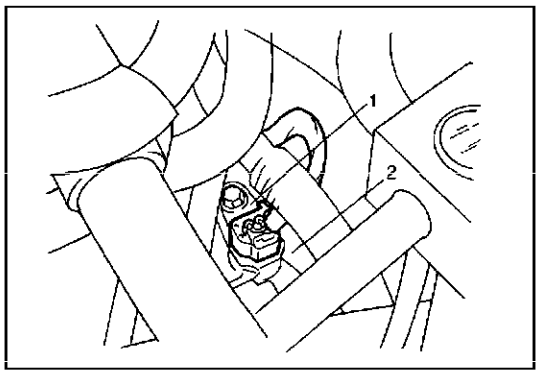
3) Remove VSS (1).

2. Transmission case

INSTALLATION



1) Check O-ring (2) and VSS (1) surface for their flawlessness, apply oil to O-ring.



2) Install VSS (1) to transmission case (2).
3) Connect VSS coupler.
4) Connect negative cable at battery.

EVAP Emission 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) Warn up engine to normal operating temperature.

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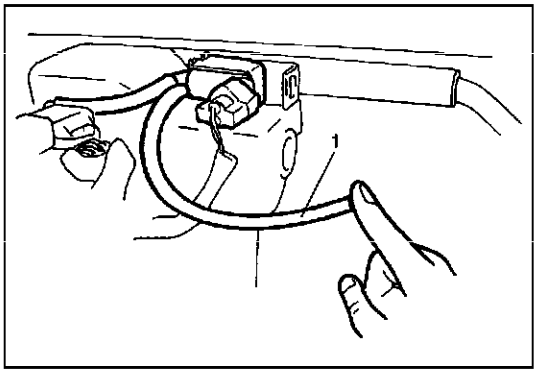
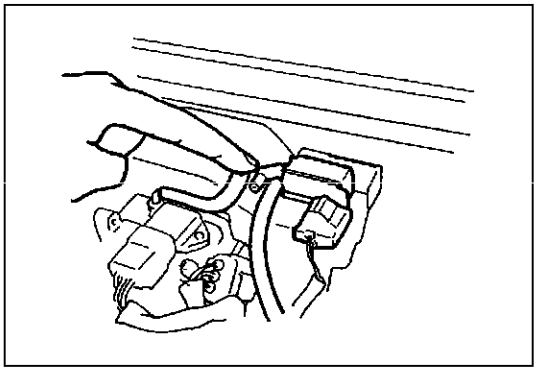


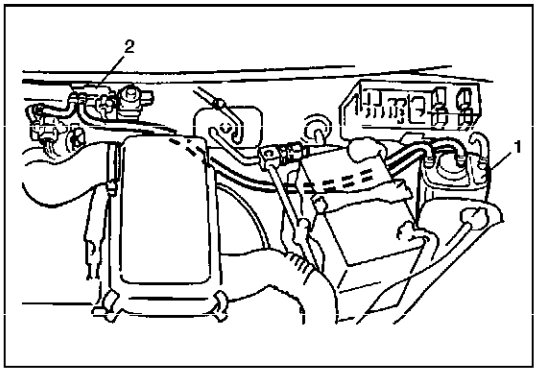
2) Disconnect purge hose (1) from EVAP canister.
3) Place finger against the end of disconnected hose and check that vacuum is not felt there when engine is running at idle speed.
4) Also check that vacuum is felt when engine speed is increased to higher than about 3000 r/min.
   If check result is not satisfactory, check vacuum passage, hoses, EVAP canister purge valve, wire harness and ECM (PCM).

VACUUM PASSAGE INSPECTION



Start engine and run it at idle speed. Disconnect vacuum hose from EVAP canister purge valve. 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



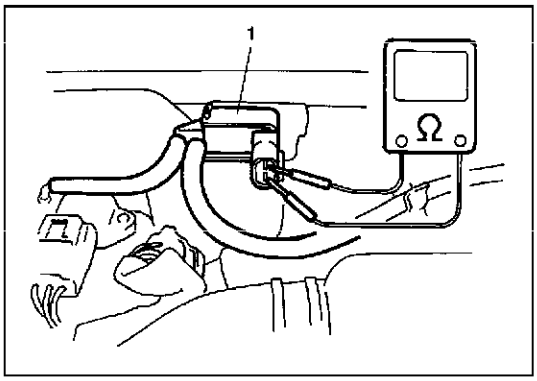
Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

1.	EVAP canister
2.	EVAP canister purge valve

EVAP CANISTER PURGE VALVE INSPECTION

[Using SUZUKI scan tool]

WARNING:
Do not suck the air through valve. Fuel vapor inside valve is harmful.



1) With ignition switch OFF, disconnect coupler from EVAP canister purge valve (1).
2) Check resistance between two terminals of EVAP canister purge valve.
   If resistance is as specified, proceed to next operation check.
   If not, replace.

   Resistance of EVAP canister purge valve
   30 – 34 Ω at 20°C (68°F)

3) Connect coupler to EVAP canister purge valve.

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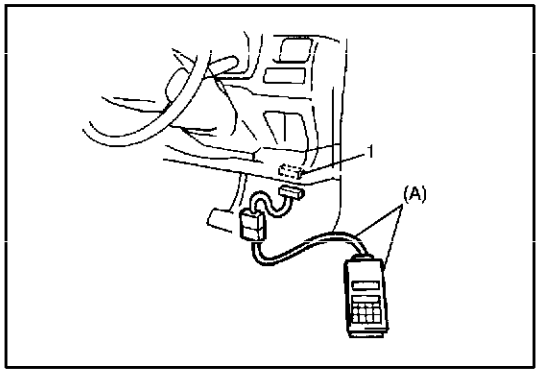
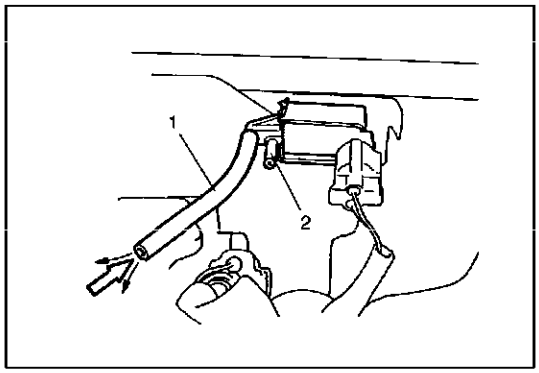
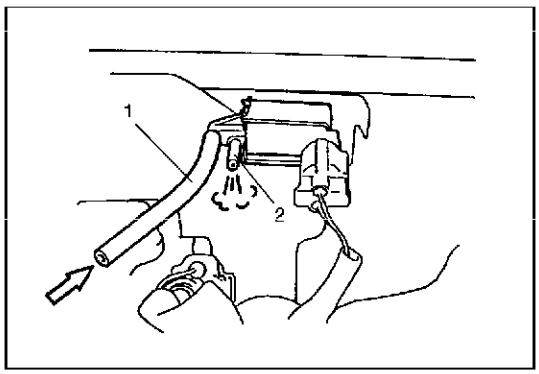


4) Connect SUZUKI scan tool to DLC (1) with ignition switch OFF.

Special tool
(A): SUZUKI scan tool



5) Disconnect vacuum hoses from intake manifold.
Blow into hose (1). Air should not come out of nozzle (2).

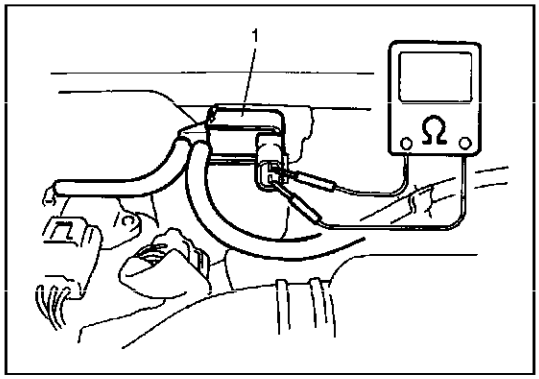


6) Open EVAP canister purge valve using "MISC TEST" mode of SUZUKI scan tool with ignition switch ON. In this state, blow hose (1).
Air should come out of nozzle (2).
If check result is not as described, check wire harnesses for open or short. If it is in good condition, replace EVAP canister purge valve and recheck.

7) Connect vacuum hoses.

[Not using SUZUKI scan tool]

WARNING:
Do not suck the air through valve. Fuel vapor inside valve is harmful.



1) With ignition switch OFF, disconnect coupler from EVAP canister purge valve (1).
2) Check resistance between two terminals of EVAP canister purge valve.
If resistance is as specified, proceed to next operation check.
If not, replace.

Resistance of EVAP canister purge valve
30 – 34 Ω at 20°C (68°F)

3) Disconnect vacuum hoses from intake manifold and its pipe.

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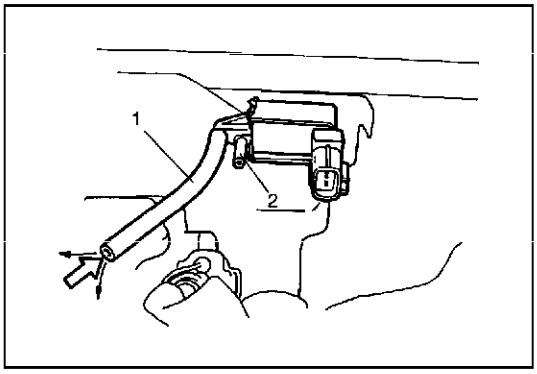
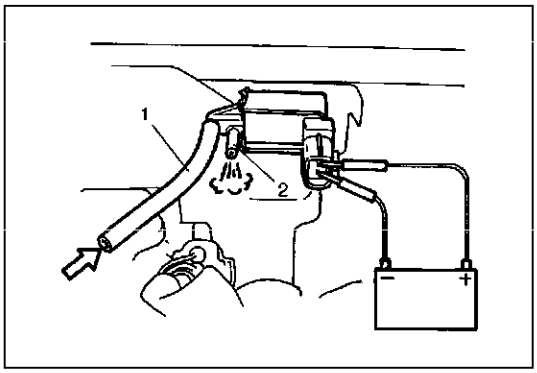


4) With coupler disconnected, blow into hose (1). Air should not come out of hose (2).



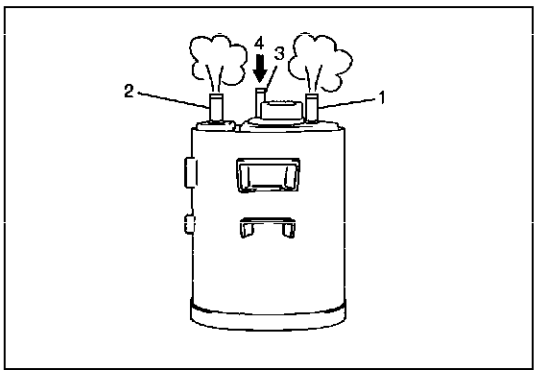
5) Connect 12 V-battery to EVAP canister purge valve terminals. In this state, blow hose (1).
Air should come out of hose (2).
If check result is not as described, replace EVAP canister purge valve.

6) Connect vacuum hoses.
7) Connect EVAP canister purge valve coupler securely.

EVAP CANISTER INSPECTION

WARNING:
DO NOT SUCK nozzles on EVAP canister. Fuel vapor inside EVAP canister is harmful.

1) Disconnect vacuum hoses from EVAP canister.



2) When air is blown into tank pipe (1), there should be no restriction of flow through purge pipe (2) and air pipe (3).

4. Blow air

3) If operation differs from above description, EVAP canister must be replaced.
4) Connect hoses to canister.

Tank pressure control valve

INSPECTION

WARNING:
DO NOT SUCK air through fuel vapor line hose. Fuel vapor inside valve is harmful.

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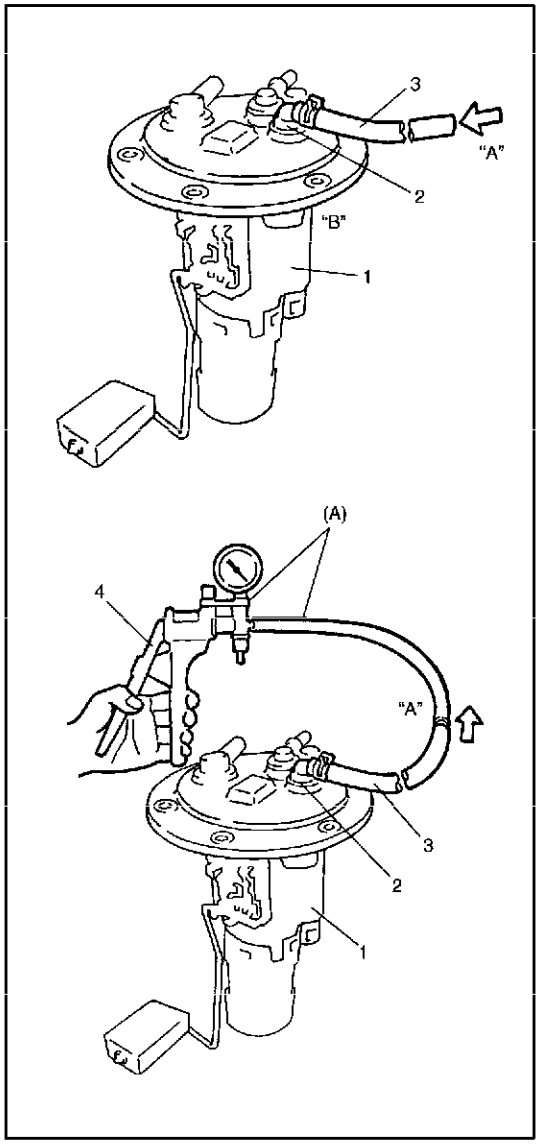


1) Remove fuel pump assembly (1) installed on fuel tank, referring to Section 6C.
2) Check if air should pass through tank pressure control valve (2) smoothly from fuel vapor line hose (3) "A" to "B" when blown hard.
3) Also, check if vacuum pump gauge indicates 0 cmHg after vacuum is applied to fuel vapor line hose using vacuum pump (4).

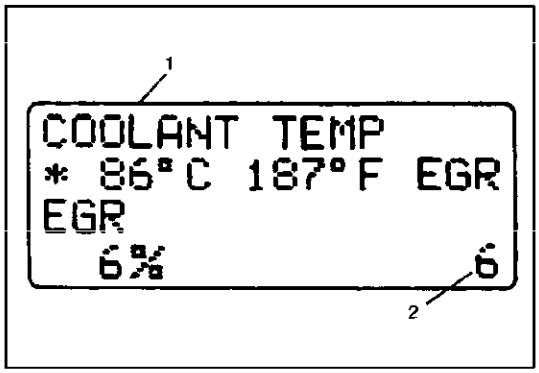
Special tool
(A): 09917-47910

4) If check results are not satisfactory, replace fuel pump assembly.
5) Install fuel pump assembly to fuel tank, referring to Section 6C.

EGR system

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)

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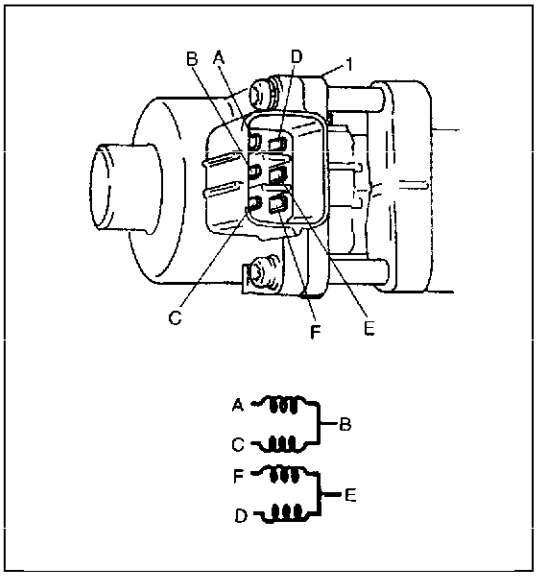
REMOVAL

1) Disconnect negative cable at battery.
2) Remove EGR pipe.
3) Disconnect EGR valve connector.
4) Remove EGR valve and gasket from intake manifold.

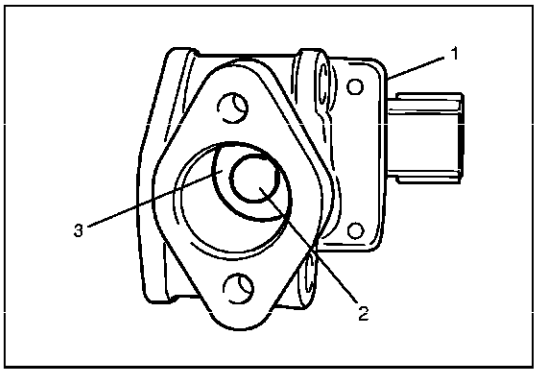
INSPECTION



1) Check resistance between following terminals of EGR valve (1) in each pair.
   If found faulty, replace EGR valve assembly.

EGR valve resistance

TERMINAL	STANDARD RESISTANCE
A – B C – B F – E D – E	20 – 24 Ω



2) Remove carbon from EGR valve gas passage.

NOTE:

Do not use any sharp-edged tool to remove carbon. Be careful not to damage or bend EGR valve (1), valve seat (3) and rod.

3) Inspect valve (2), valve seat and rod for fault, cracks, bend or other damage.
   If found faulty, replace EGR valve assembly.

INSTALLATION

Reverse removal procedure noting following.

- Clean mating surface of valve and intake manifold.
- Use new gaskets.

PCV system

NOTE:

Be sure to check that there is no obstruction in PCV valve or its hoses before checking engine idle speed/IAC duty, for obstructed PCV valve or hose hampers its accurate checking.

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PCV HOSE

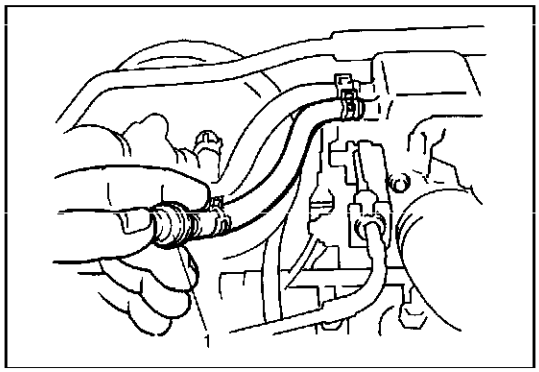
inspection

Check hoses for connection, leakage, clog and deterioration. Replace as necessary.

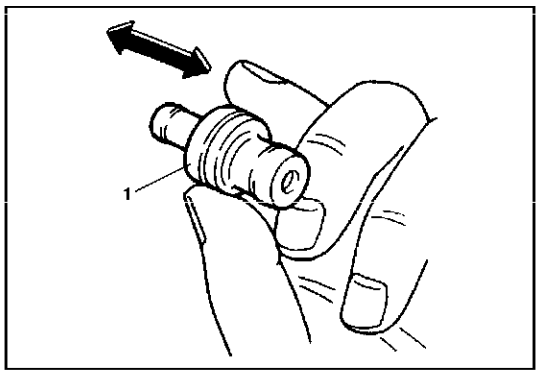
PCV VALVE

Inspection

1) Disconnect PCV valve from cylinder head cover and install plug to head cover hole.
2) Run engine at idle speed.

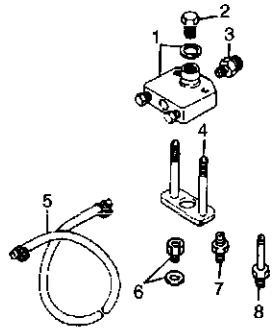
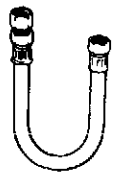
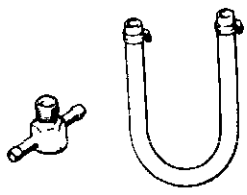


3) Place your finger over end of PCV valve (1) to check for vacuum.
   If there is no vacuum, check for clogged valve. Replace as necessary.



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 rattle, replace it.
5) After checking, remove plug and install PCV valve.

Special Tool

			
09912-58421 Checking tool set (See NOTE "A".)	09912-58431 Pressure hose	09912-58441 Pressure gauge	09912-58490 3-way joint & hose

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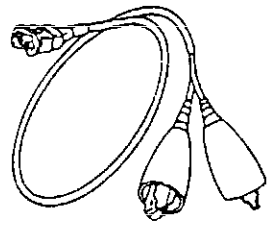
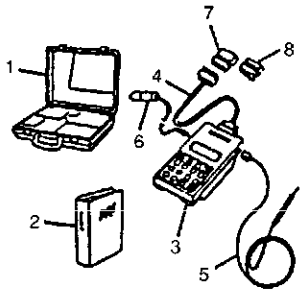
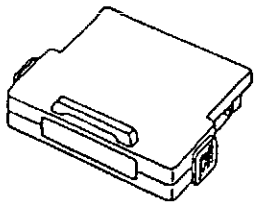
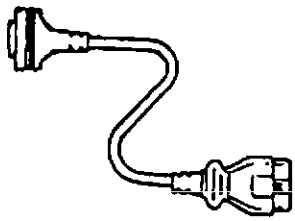
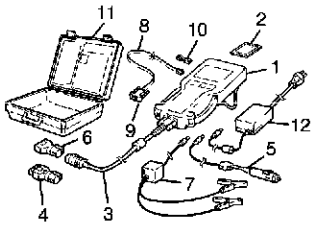
			
09930-88530 Injector test lead	09931-76011 Tech 1A kit (SUZUKI scan tool) (See NOTE "B".)	Mass storage cartridge for Tech 1A	09931-76030 16/14 pin DLC adapter for Tech 1A
			
Tech 2 kit (SUZUKI scan tool) (See NOTE "C".)			

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 Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
IAC valve screw	3.5	0.35	2.5
TP sensor screw	2.5	0.25	2.0
ECT sensor	12	1.2	9.0
Heated oxygen sensor-1 and -2	45	4.5	32.5
MAP sensor	20	0.20	1.5

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SECTION 6F

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

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High-Tension Cords 6F- 7
Spark Plugs 6F- 8
Ignition Coil Assembly 6F- 9
Camshaft Position Sensor 6F- 9
Ignition Timing 6F-12
SPECIAL TOOLS 6F-14

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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)
  Using signals from this sensor, ECM identifies the specific cylinder whose piston is in the compression stroke and detects the crank angle.
- TP sensor, ECT sensor, MAP sensor and other sensors/switches
  Refer to SECTION 6E1 for details.

Although this ignition system does not have a distributor, it has two ignition coil assemblies (one is for No.1 and No.4 spark plugs and the other is for No.2 and No.3 spark plugs). When an ignition signal is sent from ECM to the ignitor in the ignition coil assembly for No.1 and No.4 spark plugs, a high voltage is induced in the secondary coil and that passes through the high-tension cords and causes No.1 and No.4 spark plugs to spark simultaneously. Likewise, when an ignition signal is sent to the ignitor in the other ignition coil assembly, No.2 and No.3 spark plugs spark simultaneously.

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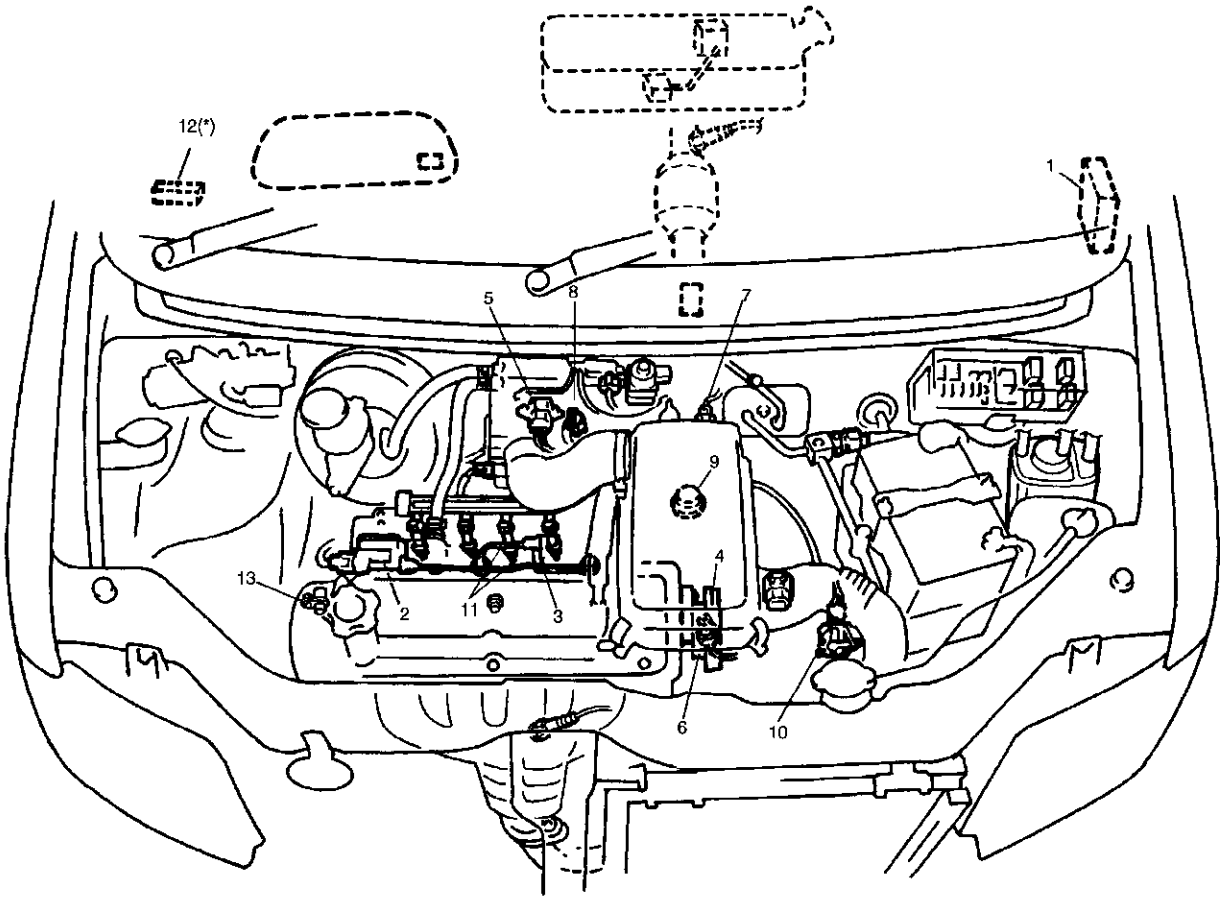
SYSTEM COMPONENTS



1.	ECM	4.	CMP sensor	9.	VSS
2.	Ignition coil assembly for No.1 and No.4 spark plugs	5.	MAP sensor	10.	Transmission range switch (A/T)
		6.	ECT sensor	11.	High-tension cords
3.	Ignition coil assembly for No.2 and No.3 spark plugs	7.	IAT sensor	12.	DLC
		8.	TP sensor	13.	CKP sensor

NOTE:
Figure shows right-hand steering vehicle. For left-hand steering vehicle, parts with (*) are installed at symmetrical position.

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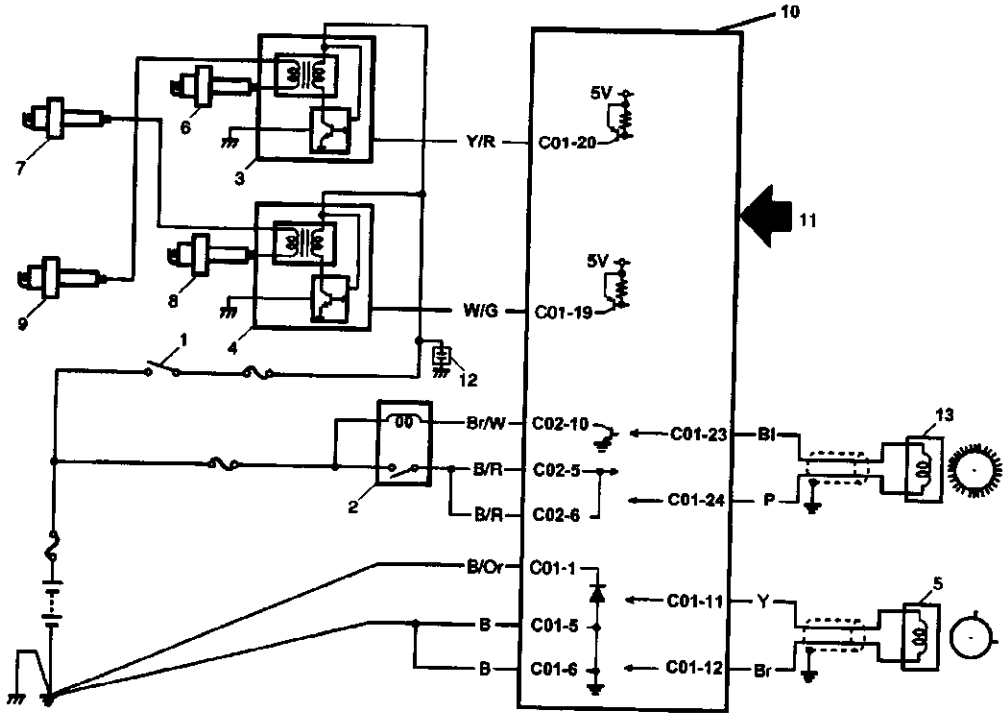
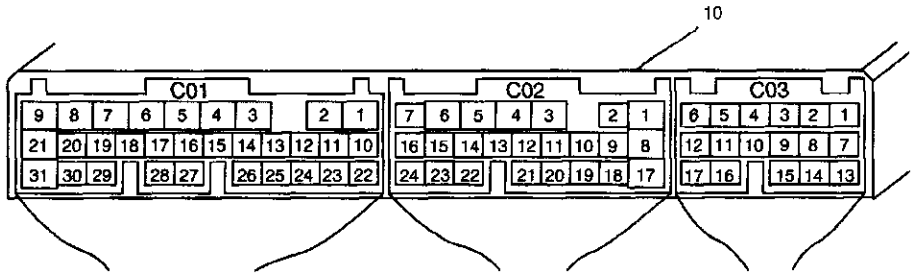
SYSTEM WIRING DIAGRAM





1. Ignition switch	5. CMP sensor	11. Sensed information • MAP sensor • ECT sensor • IAT sensor • TP sensor • VSS	12. Noise suppressor • Park / Neutral position signal • Electric load signal • Engine start signal • Test switch terminal
2 Main relay	6 NO 1 spark plug		
3 Ignition coil assembly for NO 1 and NO.4 spark plugs	7. NO 2 spark plug		
	8. NO 3 spark plug		
4 Ignition coil assembly for NO 2 and NO.3 spark plugs	9. NO 4 spark plug		13. CKP sensor
	10. ECM		

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DIAGNOSIS

Condition	Possible Cause	Correction
Engine cranks, but will not start or hard to start	No spark • Blown fuse for ignition coil • Loose connection or disconnection of lead wire or high-tension cord(s) • Faulty high-tension cord(s) • Faulty spark plug(s) • Maladjusted signal rotor air gap • Faulty ignition coil • Faulty CMP sensor • Faulty ECM	 Replace Connect securely Replace Adjust, clean or replace Adjust Replace ignition coil assembly Replace Replace
Poor fuel economy or engine performance	• Incorrect ignition timing • Faulty spark plug(s) or high-tension cord(s) • Faulty ignition coil assembly • Faulty CMP sensor • Faulty CKP sensor • Faulty ECM	Adjust Adjust, clean or replace Replace Replace Replace Replace

IGNITION SYSTEM DIAGNOSTIC FLOW TABLE

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" 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 hightension 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.

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STEP	ACTION	YES	NO
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	Camshaft Position (CMP) Sensor Check 1) Check camshaft position sensor referring to "Camshaft Position Sensor" section. Is check result satisfactory?	Go to Step 9.	Adjust or replace.
9	Crankshaft position (CKP) sensor check 1) Check Crankshaft position (CKP) sensor referring to "CKP sensor" in SECTION 6E1 Is check result satisfactory?	Go to Step 10	Repair or replace.
10	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 11.	Repair or Replace
11	A Known-good Ignition Coil Assembly Substitution 1) Substitute a known-good ignition coil assembly and then repeat Step 2. Is check result of Step2 satisfactory?	Go to Step 12.	Substitute a known-good ECM and then repeat STEP 2.
12	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.	Go to Step 13
13	Ignition Timing Adjustment And Recheck 1) Adjust initial ignition timing, referring to "Ignition Timing" section. 2) Recheck initial ignition timing and ignition timing advance, referring to "Ignition Timing" section. Is check result satisfactory?	System is in good condition.	Substitute a known-good ECM and then repeat STEP 2

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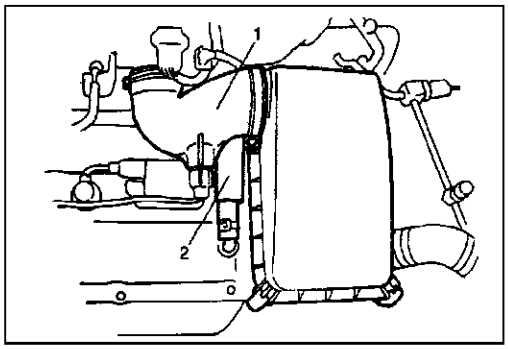
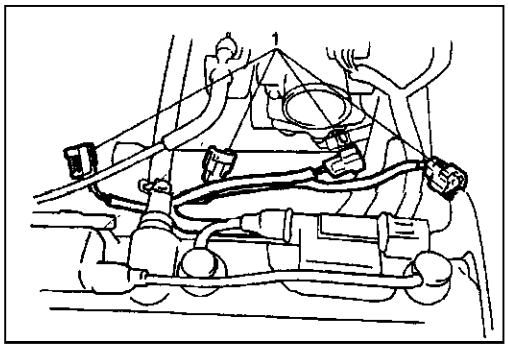


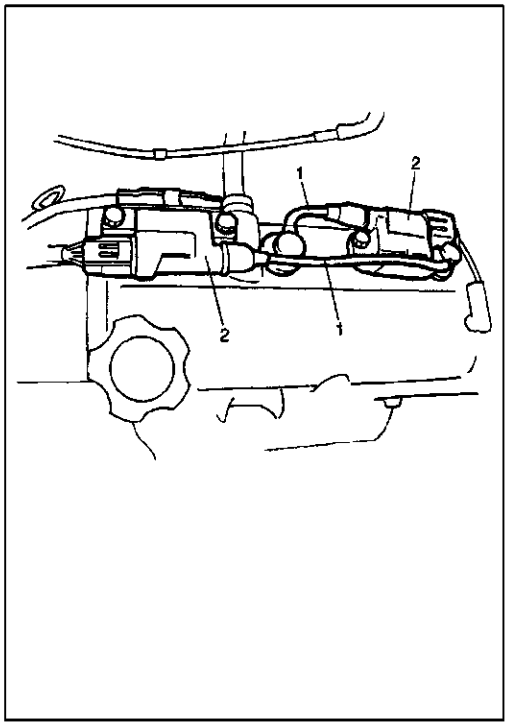


ON-VEHICLE SERVICE

IGNITION SPARK TEST

WARNING:
Without disconnection of injector coupler, combustible gas may come out from spark plug holes during this test and may get ignited in engine room.

1) Remove air cleaner outlet hose (1) and disconnect breather hose (2) from cylinder head cover.
2) Disconnect all injector coupler (1) from injectors.
3) Remove spark plug and check it for condition and type, referring to "Spark Plugs" in this section.
4) If OK, connect ignition coil coupler to ignition coil assembly and connect spark plug to ignition coil assembly or high-tension cord. Ground spark plug.
5) Crank engine and check if each spark plug sparks.
6) If no spark is emitted, inspect the related parts as described under "Diagnosis" earlier in this section.



HIGH-TENSION CORDS

1) Remove air cleaner outlet hose and disconnect breather hose from cylinder head cover.
2) Disconnect high-tension cords (1) from ignition coil assemblies (2) while gripping each cap.
3) Pull out high-tension cords from spark plugs while gripping each cap.

CAUTION:
- **Removal of high-tension cords together with clamps will be recommended so as not to damage their inside wire (resistive conductor).**
- **For the same reason, pull out each connection by gripping cap portion.**

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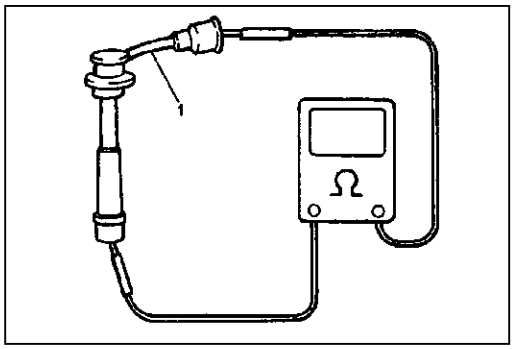
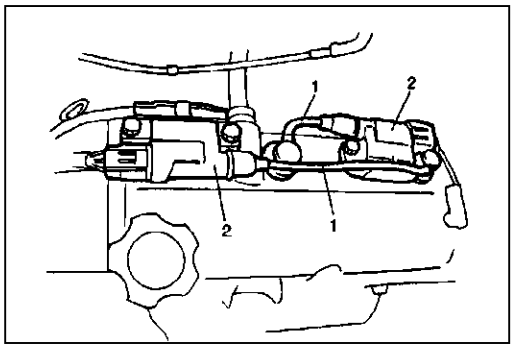


4) Measure resistance of high-tension cord (1) by using ohmmeter.

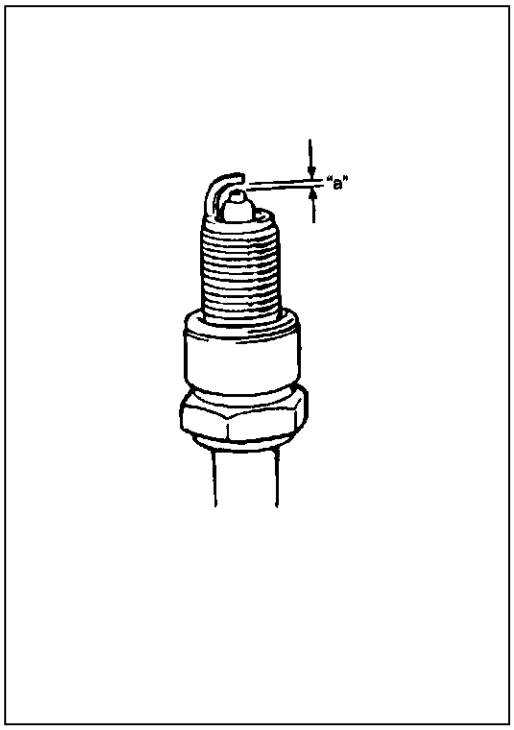
Resistance coefficient of
High-tension cord : 10–22kΩ/m(3.0–6.7kΩ/ft)
High-tension cord resistance
for No.2 cylinder : 0.8k-1.8KΩ
High-tension cord resistance
for No.4 cylinder : 2.2K-5KΩ

5) If resistance exceeds specification, replace high-tension cord(s).



6) Install high-tension cords (1) to spark plugs and ignition coil assemblies (2) 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) Remove air cleaner outlet hose and disconnect breather hose from cylinder head cover.
2) Pull out high-tension cords by gripping their caps and then remove ignition coil assemblies referring to "IGNITION COIL ASSEMBLY" in this section.
3) Remove spark plugs.
4) Inspect them for:
   - Electrode wear
   - Carbon deposits
   - Insulator damage
5) If any abnormality is found, adjust air gap, clean with spark plug cleaner or replace them with specified new plugs.

Spark plug air gap "a": 0.8 – 0.9 mm (0.031– 0.035 in.)
Spark plug type : DCPR7E (NGK) or XU22EPR-V (DENSO)

6) Install spark plugs and torque them to specification.

Tightening Torque for spark plug
17.5 N-m (1.75 kg-m, 12.5 lb-ft)

7) Install ignition coil assemblies referring to IGNITION COIL ASSEMBLY in this section.
8) Install high-tension cords securely by gripping their caps.

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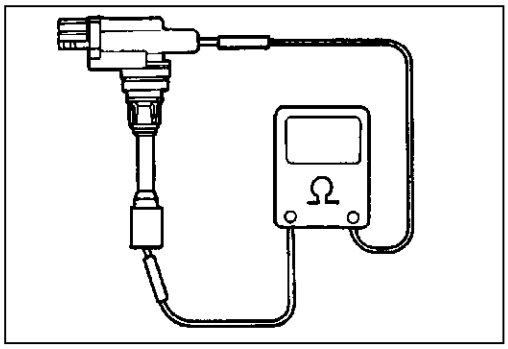
IGNITION COIL ASSEMBLY (INCLUDING IGNITOR)

Inspection

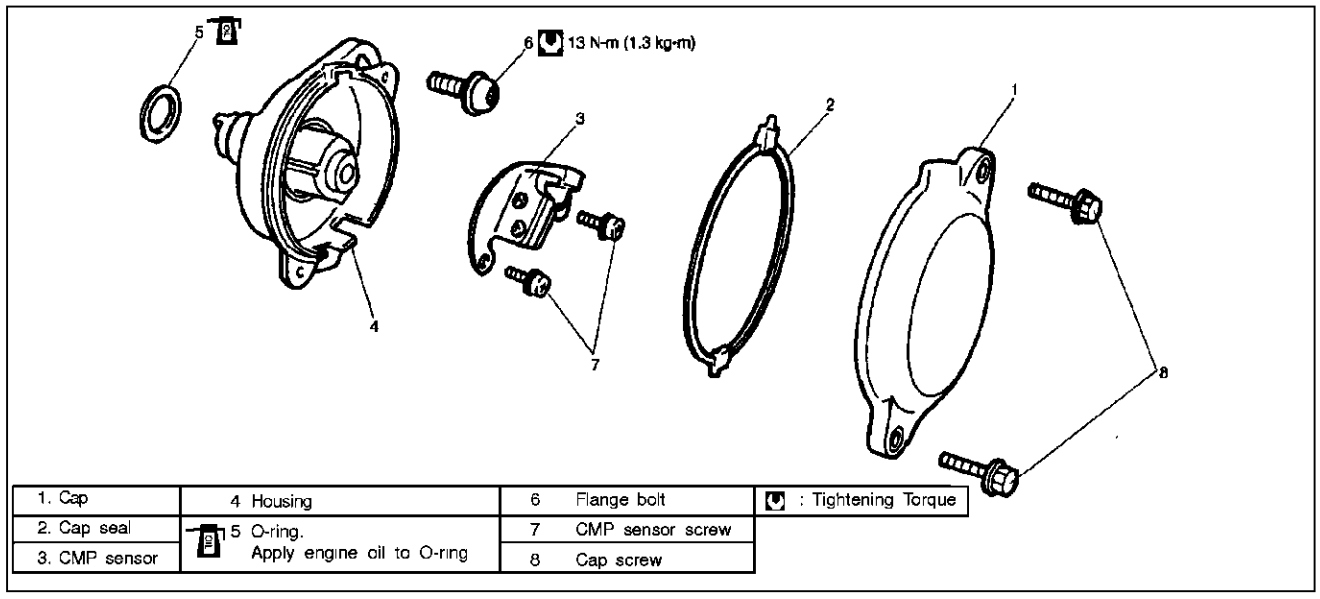


1) Disconnect negative cable at battery.
2) Remove air cleaner outlet hose and disconnect breather hose from cylinder head cover, if necessary.
3) Disconnect ignition coil coupler.
4) Disconnect high-tension cord from ignition coil assembly.
5) Remove ignition coil bolts and then pull out ignition coil assembly.
6) Measure secondary coil for resistance.

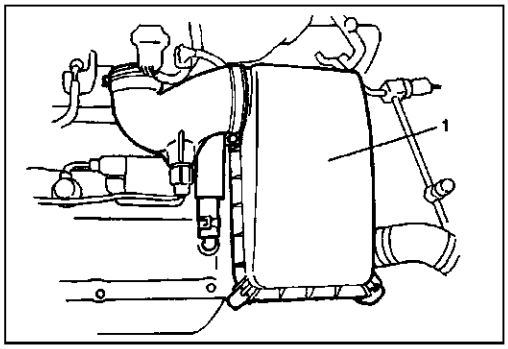
   Secondary coil resistance : 8.0 – 10.0 KΩ at 20°C, 68°F

   If resistance is out of specification, replace ignition coil assembly.
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.

CAMSHAFT POSITION SENSOR (CMP SENSOR)



1. Cap	4 Housing	6 Flange bolt	: Tightening Torque
2. Cap seal	5 O-ring. Apply engine oil to O-ring	7 CMP sensor screw	
3. CMP sensor		8 Cap screw	



REMOVAL

1) Disconnect negative cable at battery.
2) Remove air cleaner assembly (1).

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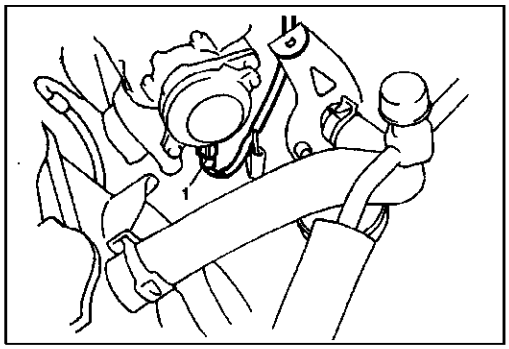
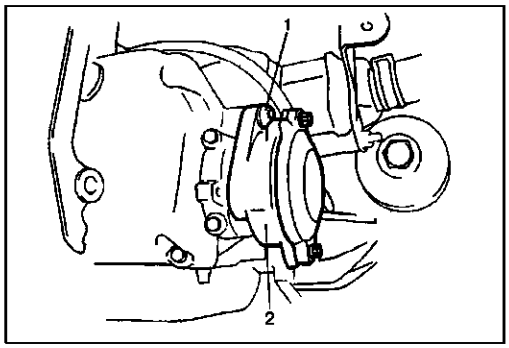
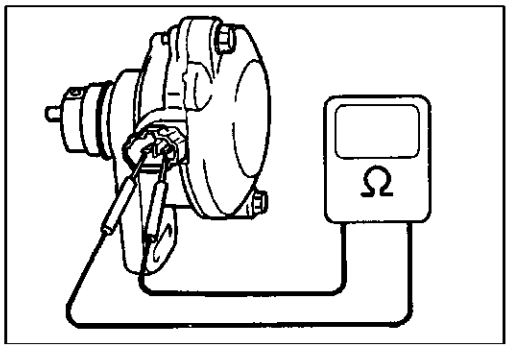


3) Disconnect CMP sensor lead wire coupler (1).



4) Remove flange bolt (1) and pull out CMP sensor assembly (2).



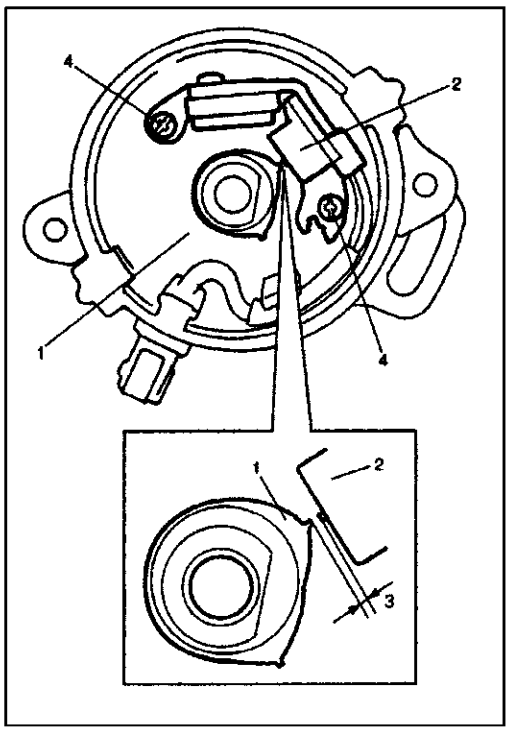
INSPECTION

CMP Sensor Resistance

1) Measure resistance of CMP sensor by using ohmmeter as shown in figure.

   CMP sensor resistance: Approx. 230 (at 20°C/68°F)

2) If resistance is out of specification, replace CMP sensor.



Signal Rotor Air Gap

1) Remove cap.
2) Using thickness gauge, measure air gap (3), between signal rotor tooth (1) and CMP sensor (2).

   Signal rotor air gap "3": 0.2 – 0.4 mm (0.008 – 0.016 in.)

3) If gap is out of specification, loosen CMP sensor securing screws (4). Using blade (–) screw driver, move CMP sensor and adjust gap to specification. After adjustment, tighten securing screws and recheck gap.

   NOTE:
   Check that CMP sensor tooth is free from any metal particles.

4) Install cap.

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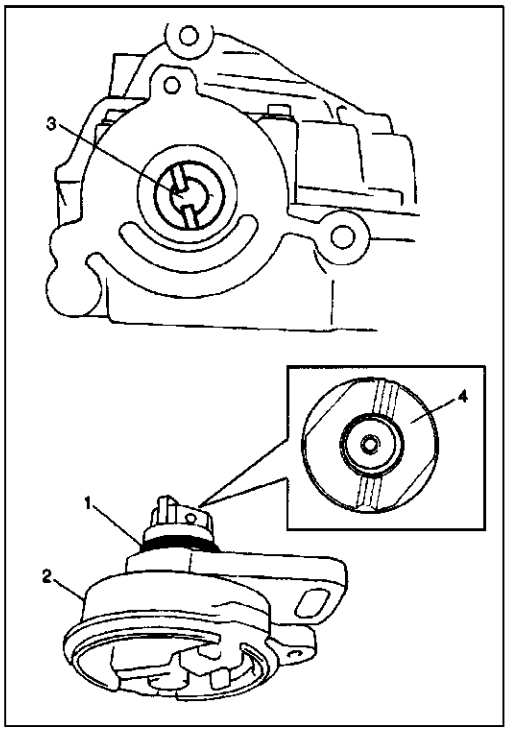
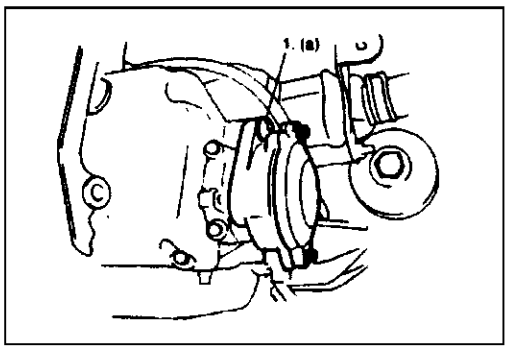


INSTALLATION

NOTE:

- **Before installing CMP sensor assembly (2), check to make sure that its O-ring (1) is in good condition.**
- **If new O-ring (1) is to be installed, apply oil.**

1) Fit the dogs of CMP sensor assembly coupling into the slots of camshaft (3), when installing. The dogs of CMP sensor assembly coupling are offset (4). Therefore, if the dogs can not be fitted into the slots, turn CMP sensor assembly shaft by 180° and try again.



2) Tighten Flange bolt (1) with specified torque

   Tightening Torque:

   (a): 13N-m (1.3kg-m, 9.5 lb-ft)

3) Make sure that cap seal is placed properly and install cap, and then fasten it with screws.
4) Connect CMP sensor lead coupler.
5) Check ignition timing referring to IGNITION TIMING in this section.

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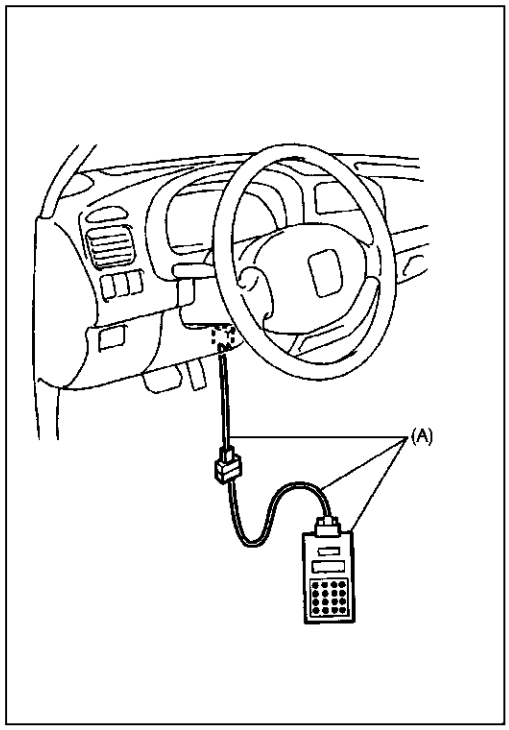
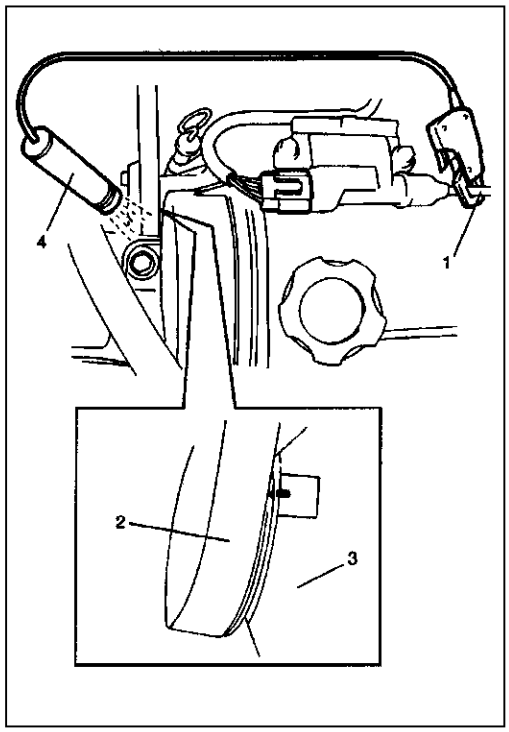
IGNITION TIMING

NOTE:
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/ADJUSTMENT

1) When using SUZUKI scan tool, connect SUZUKI scan tool to DLC 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 SECTION 6E1)
5) Fixed ignition timing to initial one as follows:
   Using SUZUKI scan tool :
   Select "MISC" mode on SUZUKI scan tool and fix ignition timing to initial one.



6) Set timing light to high-tension cord (1) of No.1 ignition coil.
7) Using timing light (4), check that ignition timing is within specification.

NOTE:
To check ignition timing, read it through the opening between water pump belt (2) and timing belt cover (3).
Initial ignition timing fixed with SUZUKI scan tool) : 5 ± 1° BTDC at idle speed
Ignition order : 1-3-4-2

8) If ignition timing is out of specification, check the followings:
   - CKP sensor
   - CKP sensor plate
   - TP sensor
   - VSS
   - Timing chain cover installation

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9) After checking release fixed ignition timing and disconnect SUZUKI scan tool from DLC.

10) With engine idling (ignition timing is not fixed, vehicle stopped), check that ignition timing vary more or less of initial ignition timing (about 8°).

    Also, check that increasing engine speed advances ignition timing.

    If above check results are not satisfactory, check TP (closed throttle position) sensor, and ECM.

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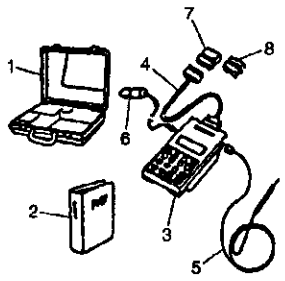
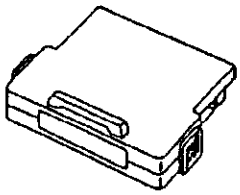
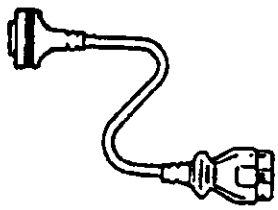
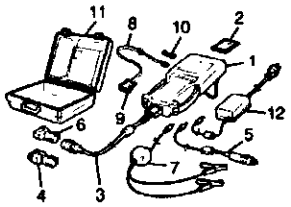
SPECIAL TOOLS

 09913-76011 Tech1 A kit (SUZUKI scan tool) (See NOTE "A")	 Mass storage cartridge (for tech 1A)	 09931-76030 16/14 pin DLC cable for Tech 1A.
 Tech 2kit (SUZUKI scan tool) (See NOTE "B")		

NOTE:

- **"A": This kit includes the following items and subsitutes 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. Tech2, 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

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SECTION 6G

CRANKING SYSTEM

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- Starting Motor Circuit 6G-2
- Starting Motor 6G-3

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GENERAL DESCRIPTION

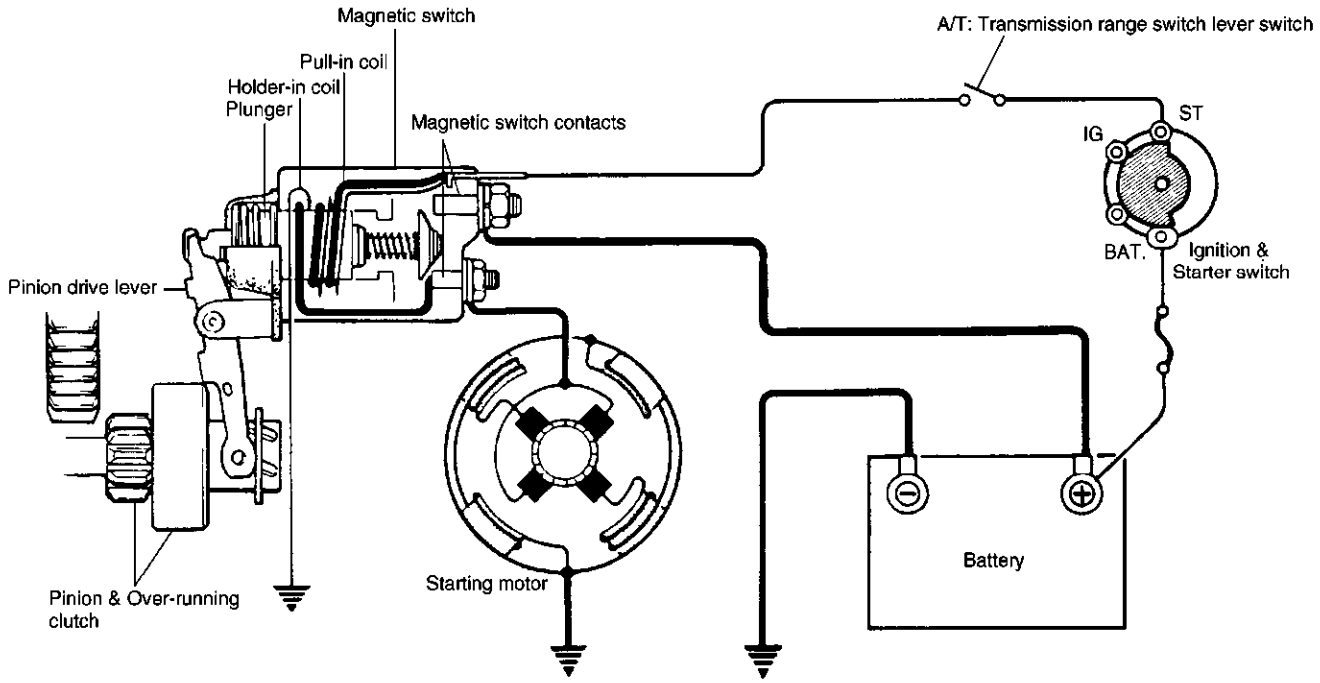
CRANKING CIRCUIT

The cranking circuit consists of the battery, starting motor, ignition switch, and related electrical wiring. These components are connected electrically.

Only the starting motor will be covered in this section.

STARTING MOTOR CIRCUIT

- The magnetic switch coils are magnetized when the ignition switch is closed.
- The resulting plunger and pinion drive lever movement causes the pinion to engage the engine flywheel gear and the magnetic switch main contacts to close, and cranking takes place.
- When the engine starts, the pinion over-running clutch protects the armature from excessive speed until the switch is opened, at which time the return spring causes the pinion to disengage.



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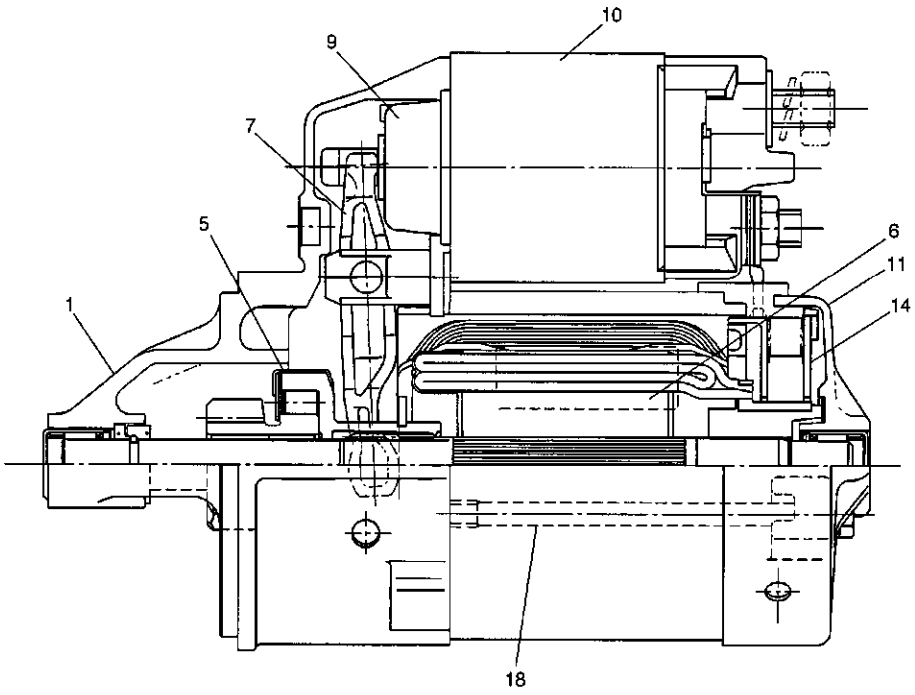
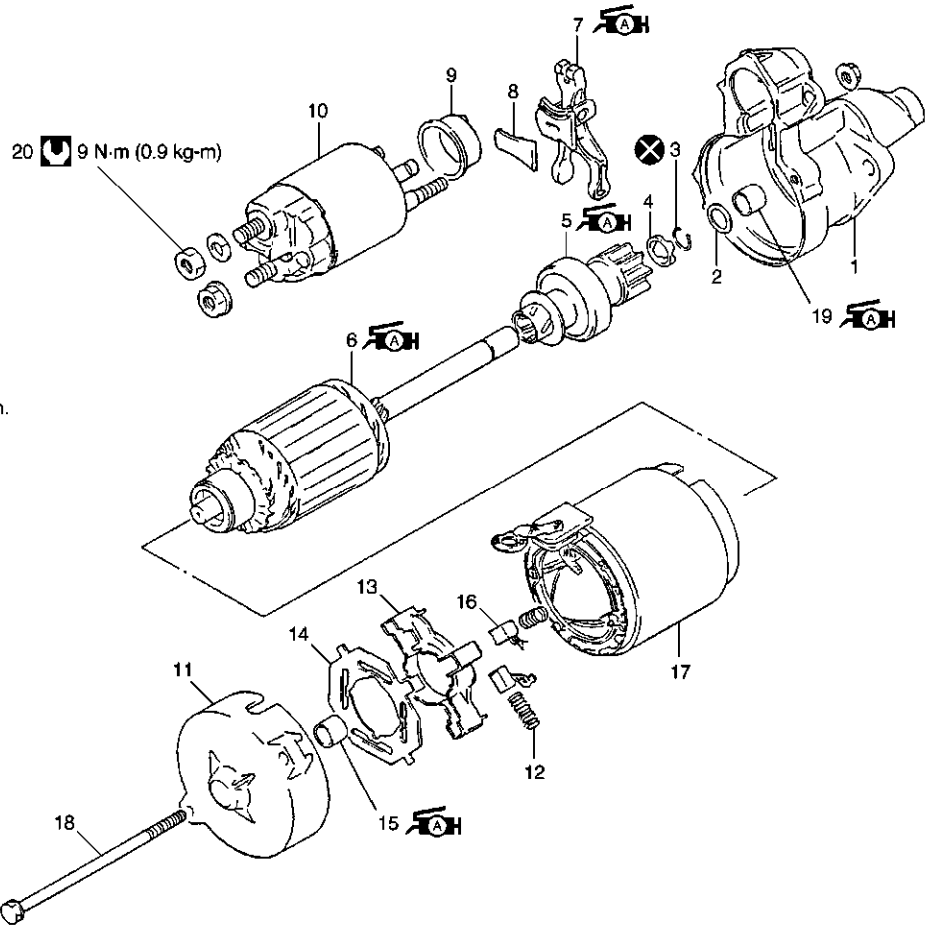
STARTING MOTOR

Both of them consist of yoke assembly, armature assembly, over-running clutch assembly, magnetic switch assembly, front housing, rear housing, brush holder and drive lever.

The magnetic switch assembly and parts in the starting motor are enclosed in the housings so that they will be protected against possible dirt and water splash.





1. Drive housing assembly
2. Washer
3. Snap ring
4. Pinion stop ring
5. Over-running clutch assembly: Apply grease A 99000-25010 to inside and outside of spline.
6. Armature: Apply grease A 99000-25010 to joint of drive housing bush, over-running clutch and armature shaft bush.
7. Pinion drive lever: Apply grease A 99000-25010 to joint of magnetic switch and over-running clutch.
8. Seal
9. Boot
10. Magnetic switch
11. Rear housing
12. Brush spring
13. Brush holder
14. Insulator
15. Bush: Apply grease A 99000-25010 to inside and outside (For 0.6 kW type only)
16. Brush
17. Yoke assembly
18. Housing bolt
19. Bush: Apply grease A 99000-25010 to inside and outside (For 0.6 kW type only)
20. Nut

⊗ : Do not reuse

: Tightening Torque

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DIAGNOSIS

Possible symptoms due to starting system trouble would be as follows:

- Starting motor does not run (or runs slowly)
- Starting motor runs but fails to crank engine
- Abnormal noise is heard

Proper diagnosis must be made to determine exactly where the cause of each trouble lies ..... in battery, wiring harness, (including starting motor switch), starting motor or engine.

Do not remove motor just because starting motor does not run. Check following items and narrow down scope of possible causes.

1) Condition of trouble
2) Tightness of battery terminals (including ground cable connection on engine side) and starting motor terminals
3) Discharge of battery
4) Mounting of starting motor

Condition	Possible Cause	Correction
Motor not running	**No operating sound of magnetic switch**	
	• Transmission range 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.
	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.
	• Poor grounding of field coil	Repair.
	• Layer short-circuit of armature	Replace.
	• Crankshaft rotation obstructed	Repair.

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Condition	Possible Cause	Correction
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.
	• Poor grounding of field coil	Repair.
	• 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 over-running clutch or flywheel (M/T), drive plate (A/T).
	• Poor sliding of pinion (failure in return movement)	Repair or replace.
	• Lack of oil in each part	Lubricate.
Starting motor does not stop running	• Fused contact points of magnetic switch	Replace magnetic switch.
	• Short-circuit between turns of magnetic switch coil (layer short-circuit)	Replace magnetic switch.
	• Failure of returning action in ignition switch	Replace.

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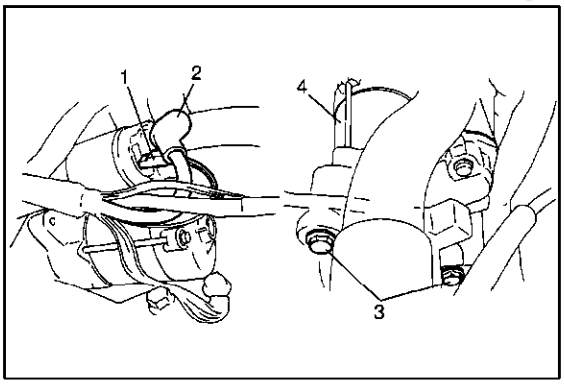
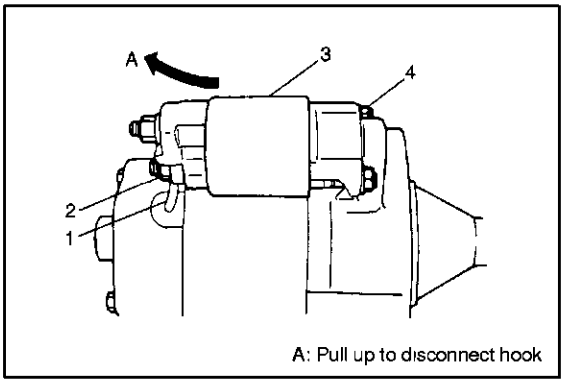


UNIT REPAIR OVERHAUL

DISMOUNTING AND REMOUNTING

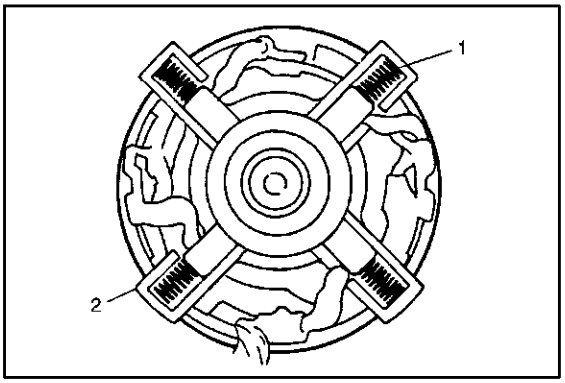
1) Disconnect negative cable at battery.
2) Disconnect magnetic switch lead wire (1) and battery cable (2) from starting motor terminals.
3) Remove 2 mounting bolts (3).
4) Remove starting motor (4).
5) To remount, reverse above procedure.



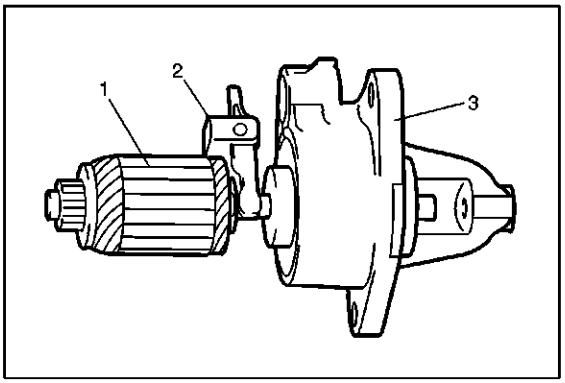
DISASSEMBLY

1) Remove nut (2) and disconnect lead wire (1) from magnetic switch (3).
2) Remove 2 nuts (4) and then take out magnetic switch by pulling up its rear portion so as to inside hook is disconnected from drive lever.

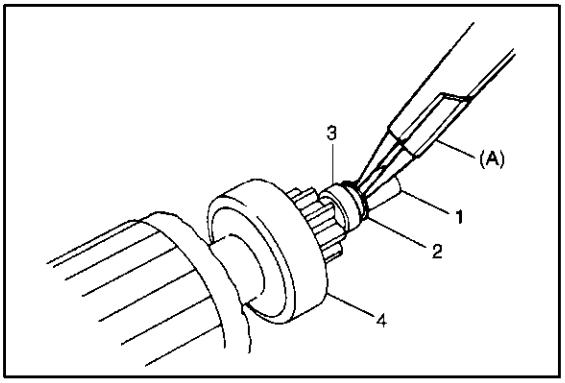
NOTE:
Do not disassemble magnetic switch. Replace it as assembly, when required.



3) Remove housing bolts and then pull out commutator end housing.
4) Remove insulator, brush springs (1) and then brush holder (2).



5) Remove yoke, armature (1) and drive lever (2) from drive housing (3).



6) Draw pinion stop ring (3) toward over-running clutch (4) side and remove snap ring (2) by using snap ring pliers assisted with screwdriver, then pull out pinion stop ring (3) and over-running clutch (4) from armature (1).

Special Tool
(A) : 09900-06107

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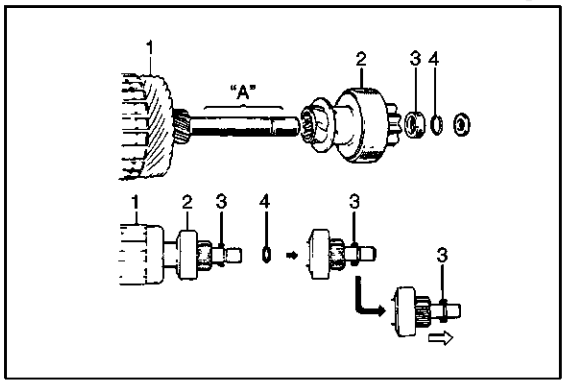
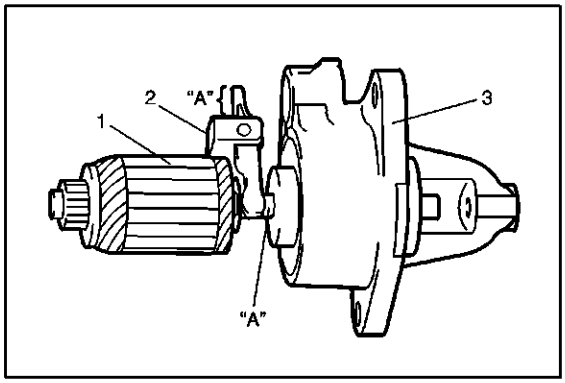


REASSEMBLY

1) Inspect component parts (Refer to INSPECTION) and replace with new ones as necessary.
2) Before installing over-running clutch (2) to armature (1), apply grease as shown in figure and then fasten stop ring (3) with snap ring (4).

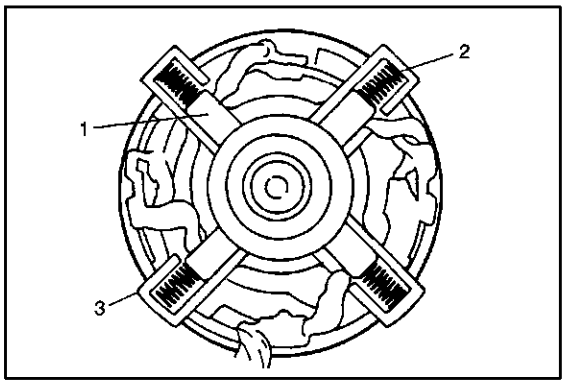
   "A" : Grease 99000-25010

   NOTE:
   Use new snap ring on shaft for installation. Do not reuse snap ring.



3) Apply grease to drive lever (2) and combine it with armature (1). Then assemble them with drive housing (3).

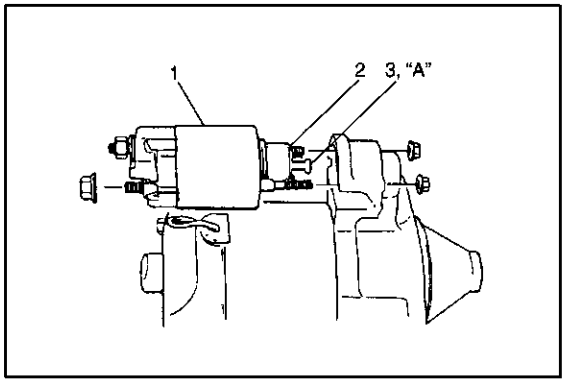
   "A" : Grease 99000-25010



4) Install yoke and brush holder (3), then set 4 brushes (1) with their springs (2). Install insulator.

   NOTE:
   - **When installing brushes, make sure that brushes and commutator have been degreased thoroughly.**
   - **Check to confirm that brush parts do not have unnecessary contacts with others.**

5) Install rear housing.



6) Replace magnetic switch (1) or its boot (2) with new one, if required, then apply grease to plunger (3).

   "A" : Grease 99000-25010

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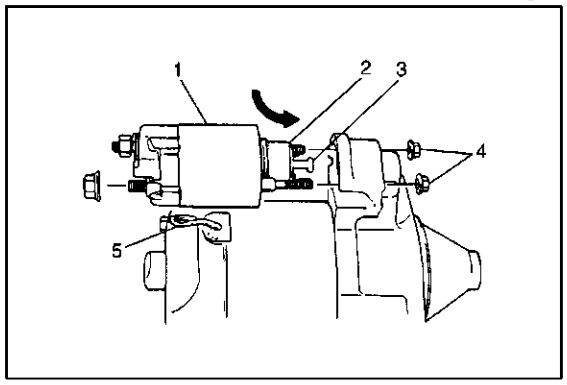
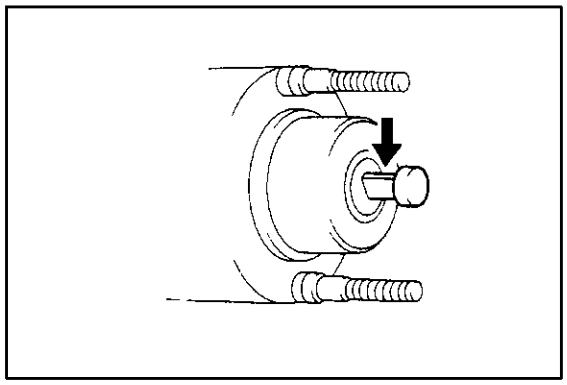


7) Hook magnetic switch plunger (3) with drive lever and then fasten magnetic switch assembly (1) with nuts (4).
8) Connect lead wire (5) as it was and then check magnetic switch for operation.

NOTE:
- **Before installing nuts, make sure that plunger hook is connected with drive lever without fail.**
- **Face boot (2) breather down.**

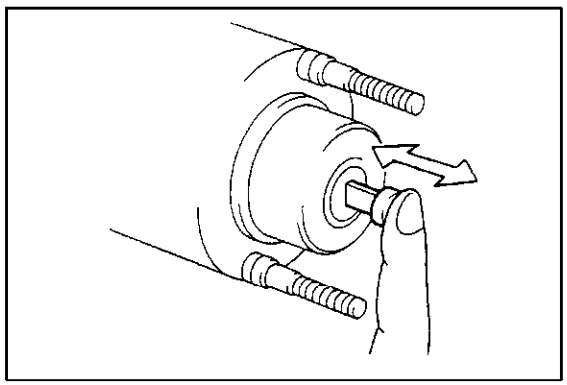
Upon completion of assembly, carry out PERFORMANCE TEST.



INSPECTION

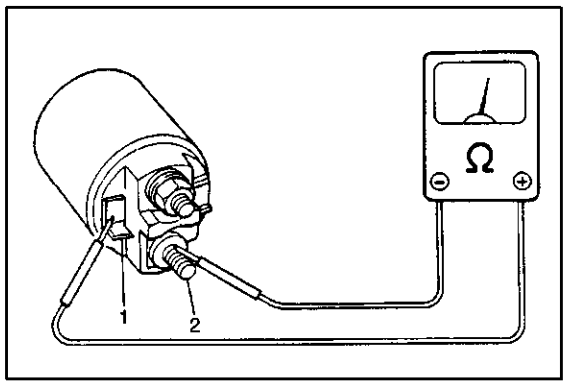
PLUNGER

Inspect plunger for wear. Replace if necessary.



MAGNETIC SWITCH

Push in plunger and release it. The plunger should return quickly to its original position. Replace if necessary.



- **Pull-In Coil Open Circuit Test**
  Check for continuity across magnetic switch 'S' terminal (1) and 'M' terminal (2). If no continuity exists, coil is open and should be replaced.

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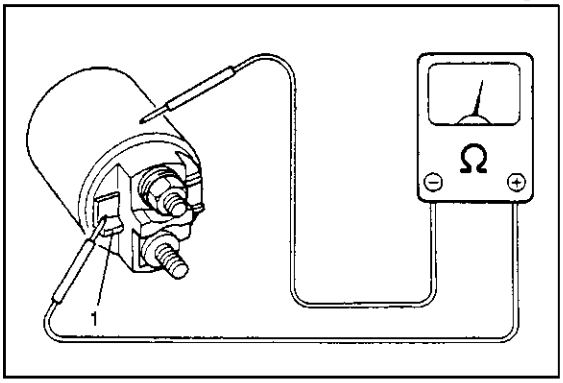
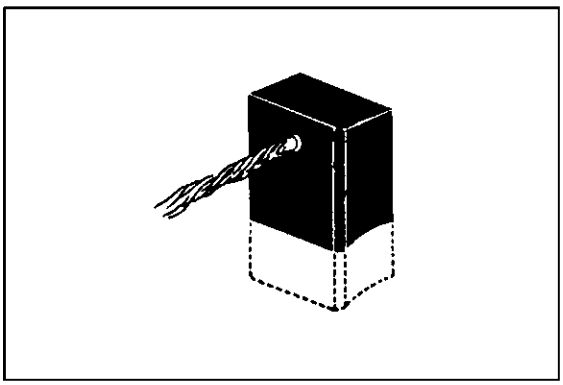


- **Hold-In Coil Open Circuit Test**
  Check for continuity across magnetic switch 'S' terminal (1) and coil case. If no continuity exists, coil is open and should be replaced.



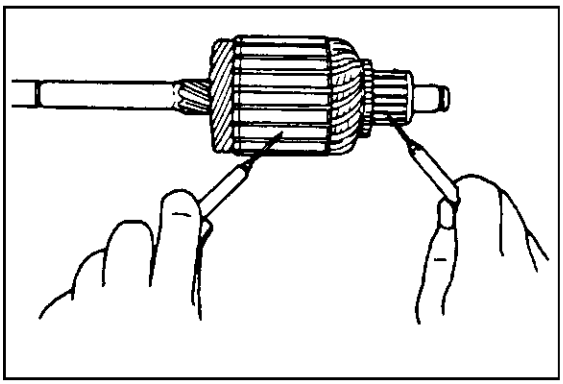
BRUSH

Measure length of brushes and replace them as necessary.

Brush length
Limit : 6.0 mm (0.236 in.)

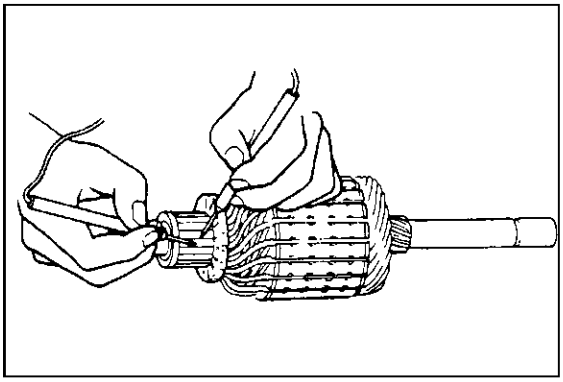
BRUSH HOLDER

Check brush springs for rust or breakage. Also check brush holder for rust and insulation. Replace it as assembly, if required.



ARMATURE

- **Ground Test**
  Between commutator segment and armature core should be insulated. Use ohmmeter for inspection.



- **Open Circuit Test**
  Check for continuity between segments. If there is no continuity at any test point, there is an open circuit and armature must be replaced.

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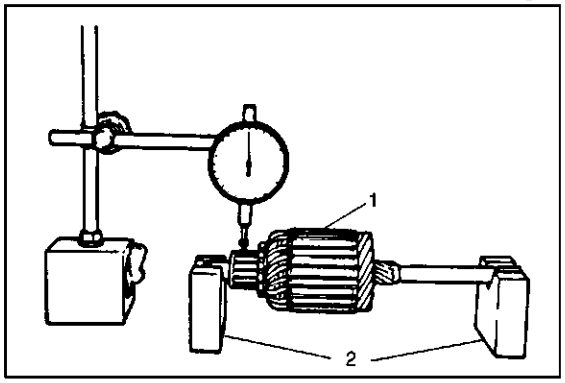
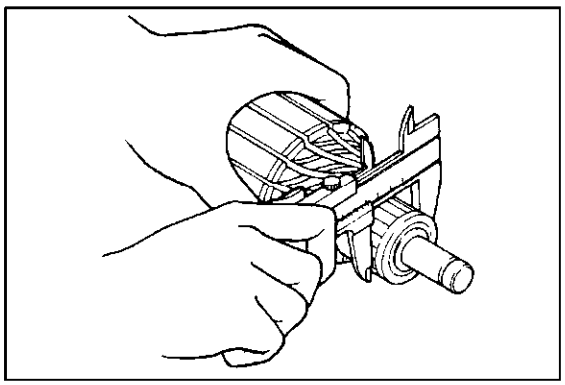


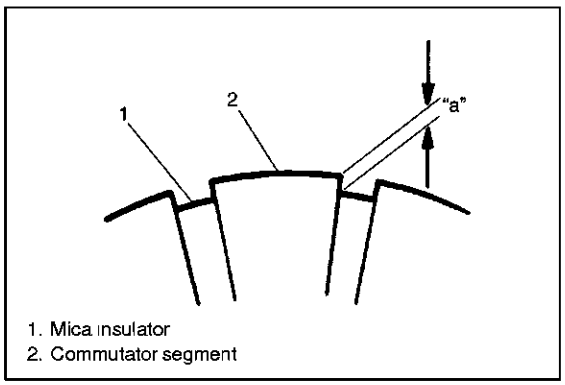
- Check commutator for run-out with armature (1) supported on V-blocks (2). Correct it by using lathe, if required.

Commutator out of round
Limit (maximum value): 0.4 mm (0.015 in.)



- Check for wear and replace armature if diameter is below limit.

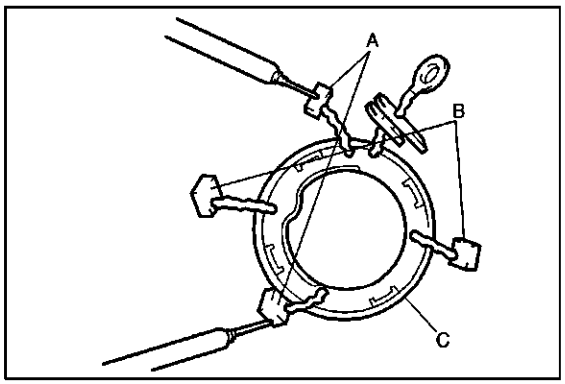
Commutator outside diameter
Limit (minimum value): 27 mm (1.063 in.)



1. Mica insulator
2. Commutator segment

- Correct and clean surface by using #400 emery cloth. Also check mica depth and correct it as required.

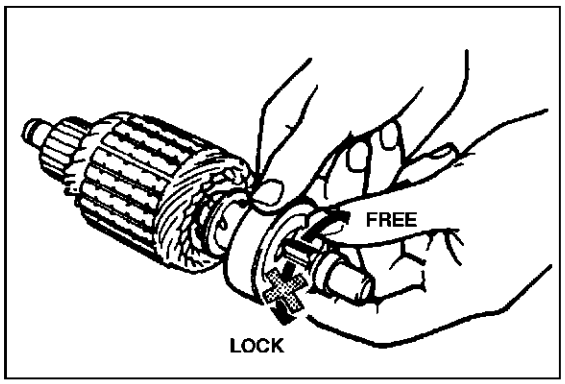
Commutator insulator depth "a"
Limit (minimum value): 0.2 mm (0.008 in.)



YOKE

Check field coil for continuity. There should be continuity between following terminals.

- Between A terminals.
- Between B terminals.
- Between B terminal and C (bare metal part of yoke body).



OVER-RUNNING CLUTCH

Inspect pinion for wear, damage or other abnormal conditions. Check that clutch locks up when turned in direction of drive and rotates smoothly in reverse direction. Replace if necessary.

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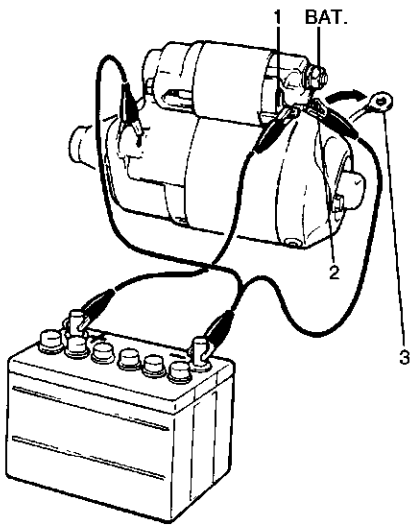


1. Terminal 'S'

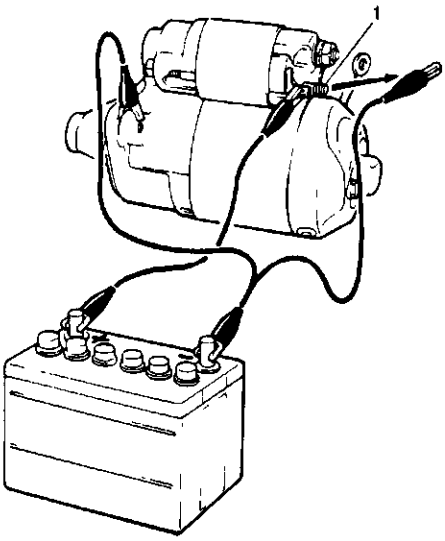
PERFORMANCE TEST

CAUTION:
Each test must be performed within 3 – 5 seconds to avoid coil from burning.

PULL-IN TEST

Connect test leads as shown in figure and check that pinion (over-running clutch) move outward. If it does not, replace magnetic switch.

NOTE:
Before testing, disconnect field coil lead (3) from 'M' terminal (2).



HOLD-IN TEST

While connected as the above with pinion out, disconnect negative lead from 'M' terminal (1) and check that pinion remains out. If not, replace magnetic switch.

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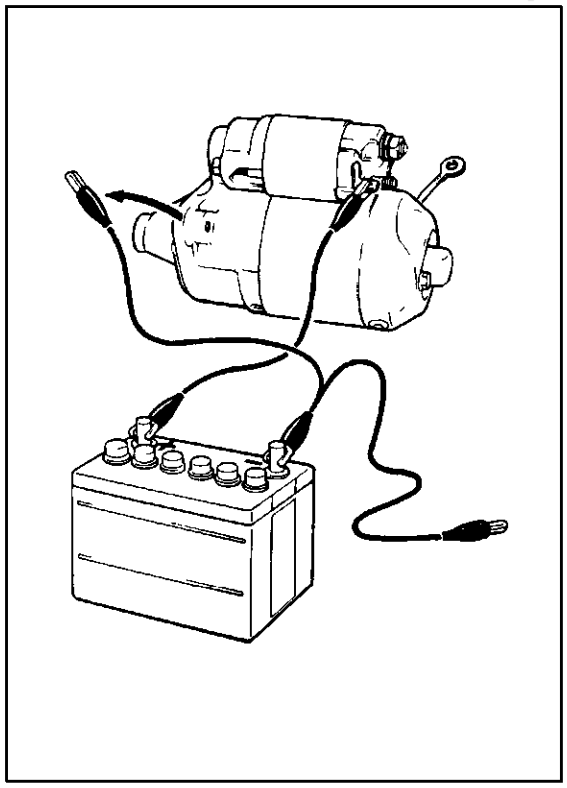
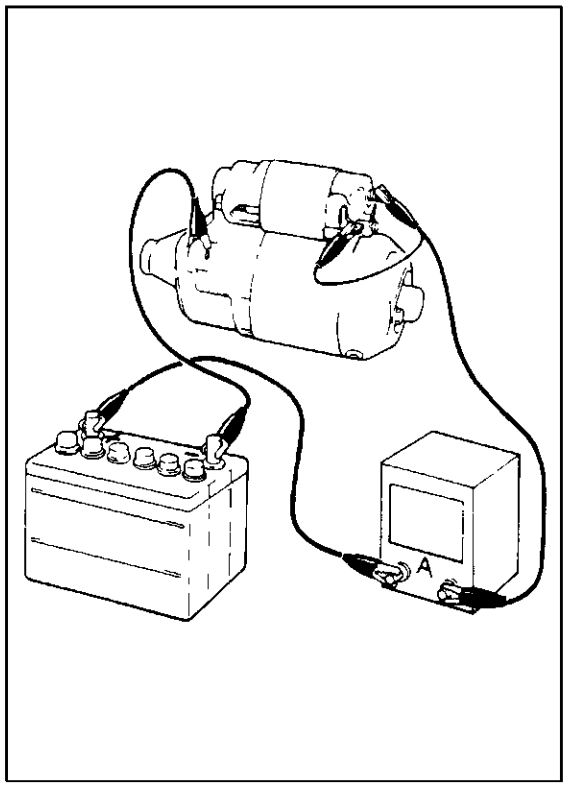


PINION (PLUNGER) RETURN TEST

As a next step to the above, disconnect negative lead and check to make sure that pinion returns inward quickly.



NO-LOAD PERFORMANCE TEST

Connect test leads as shown in left figure and check that motor runs without fail with pinion moved out. Also check that ammeter indicates specified current.

Specified Current: 50A at 11.5V

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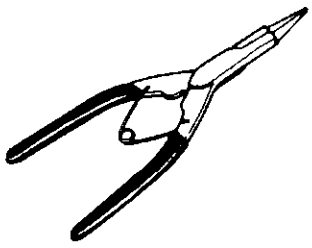
SPECIFICATIONS

Voltage			12 volts
Output			0.8 kW (0.6 kW)
Rating			30 seconds
Direction of rotation			Clockwise as viewed from pinion side
Brush length			10.0 mm (0.394 in.)
Number of pinion teeth			8
Performance		Condition	Guarantee
Around at 20°C (68°F)	No load characteristic	11.5 V	50 A maximum 6,000 rpm minimum
	Load characteristic	9 V 150 A	2.94 N·m minimum (2.75 N·m minimum) 1,950 rpm minimum (1,900 rpm minimum)
	Locked rotor current	5.5 V	430 A maximum (400 A maximum) 6.4 N·m (0.64 kg-m, 4.6 lb-ft) minimum (5.89 N·m (0.60 kg-m, 4.3 lb-ft) minimum)
	Magnetic switch operating voltage		8 volts maximum

REQUIRED SERVICE MATERIAL

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Armature shaft. • Over-running clutch. • Drive lever. • Bush. (For 0.6 kW type only)

SPECIAL TOOL



09900-06107
Snap ring pliers
(Opening type)

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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 components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in 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).**

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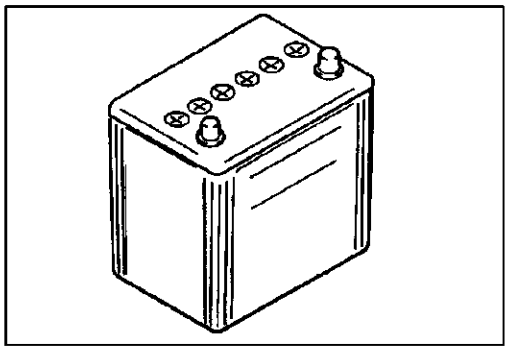

GENERAL DESCRIPTION

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.

The battery mounted in each vehicle is of the following type.

38B20L TYPE

Rated capacity	28 AH/ 5HR, 12 Volts
Electrolyte S.G.	1.28 when fully charged at 20°C (68°F)

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.

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CARE OF BATTERY

WARNING:
- **Never expose battery to open flame or electric spark because of battery generate gas which is flammable and explosive.**
- **Do not allow battery fluid to contact eyes, skin, fabrics, or painted surfaces as fluid is a corrosive acid. Flush any contacted area with water immediately and thoroughly.**
- **Batteries should always be kept out of reach of children.**

1) The battery is a very reliable component, but needs periodical attentions.

   Keep the battery carrier clean; prevent rust formation on the terminal posts; keep the electrolyte up to the upper level uniformly in all cells.

   When keeping battery on vehicle over a long period of time, follow instructions given below

   - Weekly, start the engine and run it until it reaches normal operating temperature with engine speed of 2000 to 3000 rpm. Make sure all electric switches are off before storing the vehicle.
   - Recharge the battery twice a month to prevent it from discharging excessively. This is especially important when ambient temperature is low.
     The battery discharges even when it is not used, while vehicles are being stored. Battery electrolyte can freeze and battery case can crack at cold ambient condition if battery is not properly charged.

2) Keep the battery cable connections clean.

   The cable connections, particularly at the positive (+) terminal post, tend to become corroded. The product of corrosion, or rust, on the mating faces of conductors resists the flow of current.

   Clean the terminals and fittings periodically to ensure good metal-to-metal contact, and grease the connections after each cleaning to protect them against rusting.

3) Be always in the know as to the state of charge of the battery.
   The simplest way to tell the state of charge is to carry out a hydrometer test. The hydrometer is an instrument for measuring the specific gravity (S.G.) of the battery electrolyte. The S.G. of the electrolyte is indicative of the state of charge. Refer to “BATTERY” under “DIAGNOSIS” in this section.

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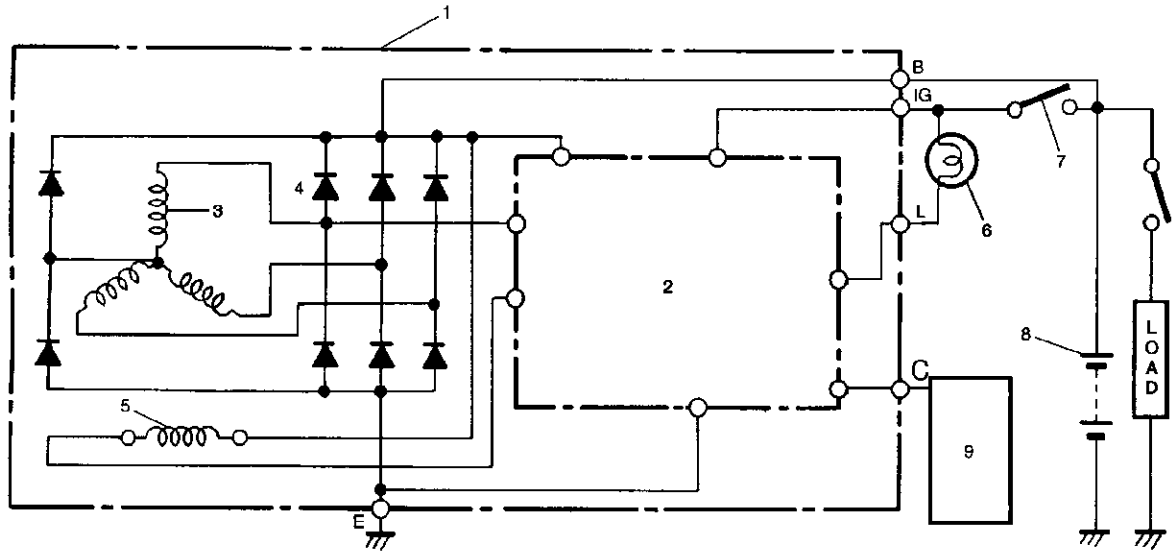
GENERATOR

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.



1. Generator with regulator ass'y	3. Stator coil	5. Field coil (rotor coil)	7. Main switch	9. ECM (PCM)
2. I.C. regulator	4. Diode	6. Charge indicator light	8. Battery	

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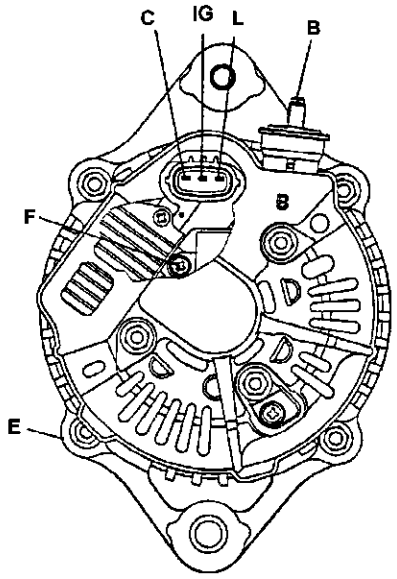

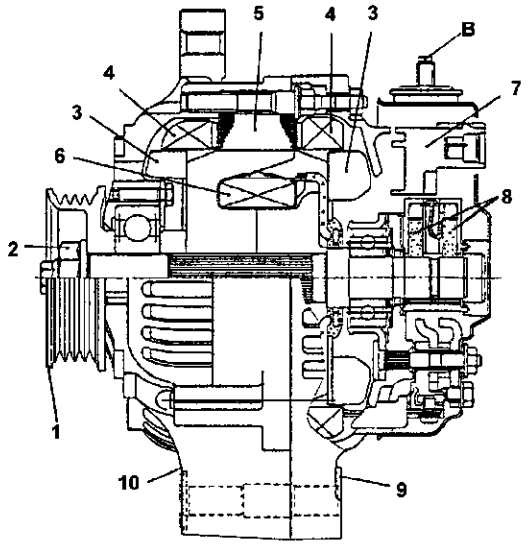

1. Pulley	5. Stator core	9. Rear end frame	E. Ground
2. Pulley nut	6. Field coil	10. Drive end frame	F: Field coil terminal
3 Rotor fan	7 Regulator	B: Generator output (Battery terminal)	IG Ignition terminal
4. Stator coil	8. Brush	C. C terminal	L. Lamp terminal

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DIAGNOSIS

BATTERY

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

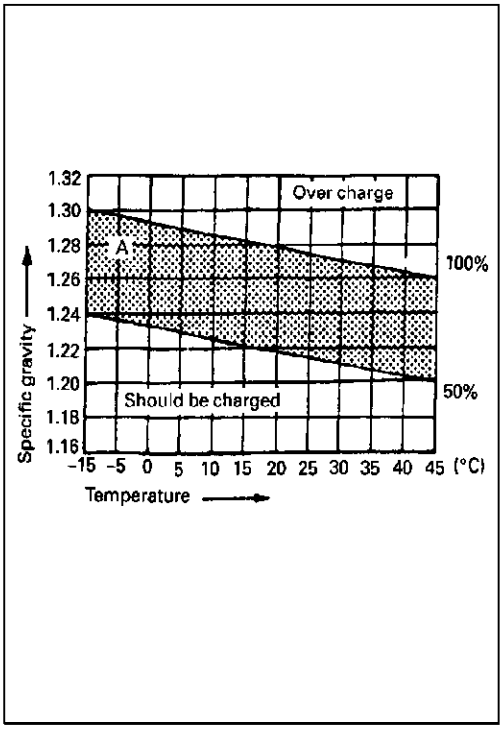
The direct method of checking the battery for state of charge is to carry out a high rate discharge test, which involves a special precise voltmeter and an expensive instrument used in the service shops, but not recommendable to the user of the vehicle.

At 20 °C of battery temperature (electrolyte temperature):

— The battery is in FULLY CHARGED STATE if the electrolyte S.G. is 1.28.

— The battery is in HALF CHARGED STATE if the S.G. is 1.22.

— The battery is in NEARLY DISCHARGED STATE if the S.G. is 1.15 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 at the left.

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.

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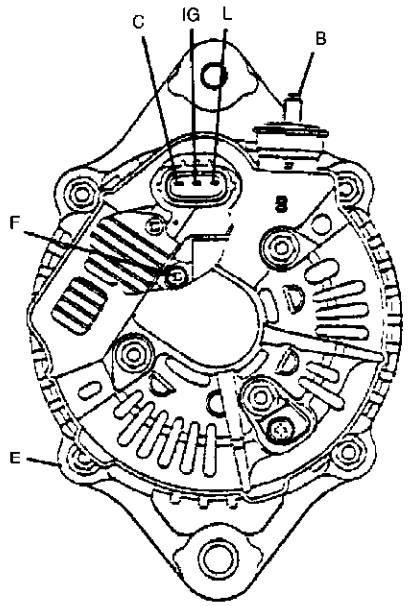

B: Generator output (Battery terminal)	F: Field coil terminal
C: C terminal	IG: Ignition terminal
E: Ground	L: Lamp terminal

GENERATOR

CAUTION:
- **Do not mistake polarities of IG terminal and L terminal.**
- **Do not create 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 charger or booster battery to vehicle battery, refer to this section describing battery charging.**

Trouble in charging system will show up as one or more of the following conditions:

1) Faulty indicator lamp operation.
2) An undercharged battery as evidenced by slow cranking or indicator dark.
3) An overcharged battery as evidenced by excessive spewing of electrolyte from vents.

   Noise from generator may be caused by loose drive pulley, loose mounting bolts, worn or dirty bearings, defective diode, or defective stator.

FAULTY INDICATOR LAMP OPERATION

PROBLEM	POSSIBLE CAUSE	CORRECTION
Charge light does not light with ignition ON and engine off	• Fuse blown • Light burned out • Wiring connection loose • IC regulator or field coil faulty • Poor contact between brush and slip ring	Check fuse. Replace light. Tighten loose connection. Check generator. Repair or replace.
Charge light does not go out with engine running (battery requires frequent recharging)	• Drive belt loose or worn • IC regulator or generator faulty • Wiring faulty	Adjust or replace drive belt. Check charging system. Repair wiring.

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UNDERCHARGED BATTERY

This condition, as evidenced by slow cranking or low specific gravity can be caused by one or more of the following conditions even though indicator lamp may be operating normal.

Following procedure also applies to cars with voltmeter and ammeter.

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 left figure.

   Voltmeter

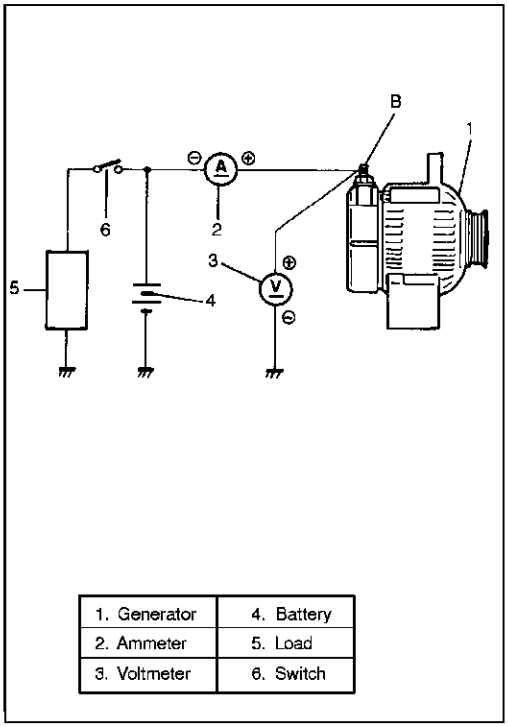
   Set between generator B terminal and ground.

   Ammeter

   Set between generator b terminal and battery (+) terminal.

   NOTE:

   Use fully charged battery.
6) Measure current and voltage.



1. Generator	4. Battery
2. Ammeter	5. Load
3. Voltmeter	6. Switch

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.).

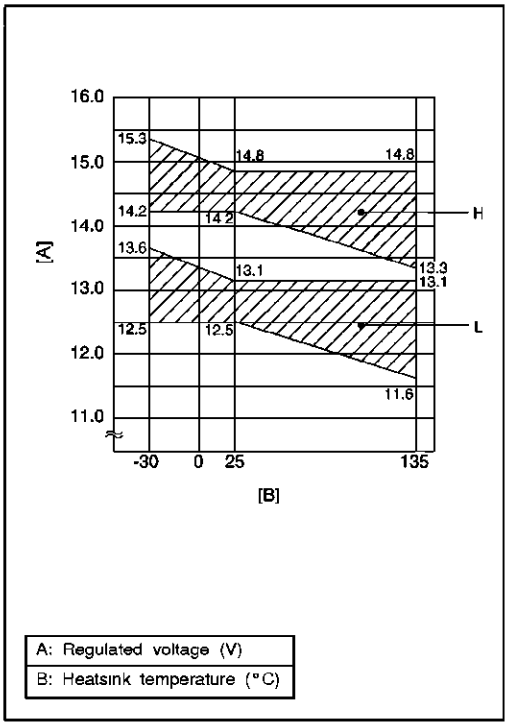
   Specification for undercharged battery (No-load check)

   Current: 10 A

   Voltage: 14.2 – 14.8 V at Hi (H) (at 25°C, 77°F)

   Voltage: 12.5 – 13.1 V at Lo (L) (at 25°C, 77°F)

NOTE:
Consideration should be taken that voltage will differ somewhat with regulator case temperature as shown in graph.



A: Regulated voltage (V)
B: Heatsink temperature (°C)

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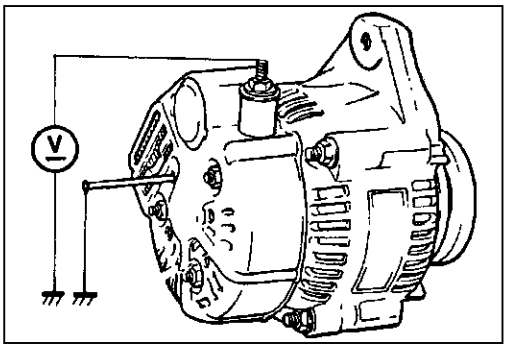
Higher Voltage

If Voltage is higher than standard value, check ground of brush. If brush ground is correct, replace IC regulator.

Lower Voltage

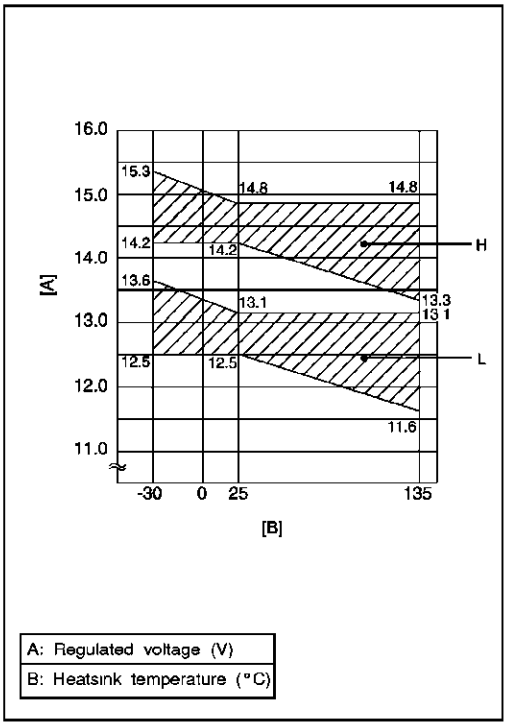
If Voltage is lower than standard value, proceed to following check.



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
     It is considered that 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 in this DIAGNOSIS.
2) If obvious overcharge condition exists as evidenced by excessive spewing of electrolyte, proceed to disassembly section of generator service and check field windings for grounds and shorts. If problem exists, replace rotor.
3) With engine running at 2,000 rpm, measure voltage.
4) If measured voltage is out of standard value, check brush ground or IC regulator.

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ON-VEHICLE SERVICE

BATTERY

JUMP STARTING IN CASE OF EMERGENCY

WITH AUXILIARY (BOOSTER) BATTERY

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:**
  1) **Serious personal injury (particularly to eyes) or property damage from such causes as battery explosion, battery acid, or electrical burns.**
  2) **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 12V 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.

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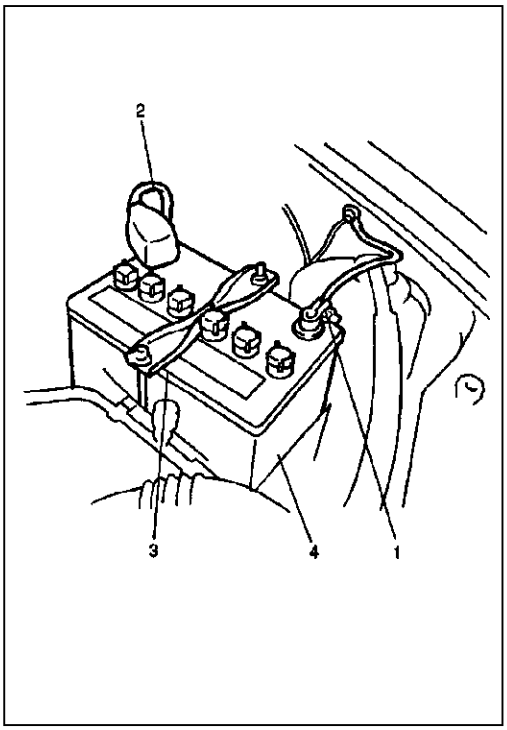
With Charging Equipment

CAUTION:
When jump starting engine with charging equipment, be sure equipment used is 12V and negative ground. Do not use 24-volt charging equipment. Using such equipment can cause serious damage to electrical system or electronic parts.



REMOVAL

1) Open engine hood.
2) Disconnect negative cable (1).
3) Disconnect positive cable (2).
4) Remove retainer (3).
5) Remove battery (4).

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.

INSTALLATION

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.**
- **Body and battery cable should not interfere with each other.**
- **After tightening positive terminal, be sure to put cap onto it securely.**

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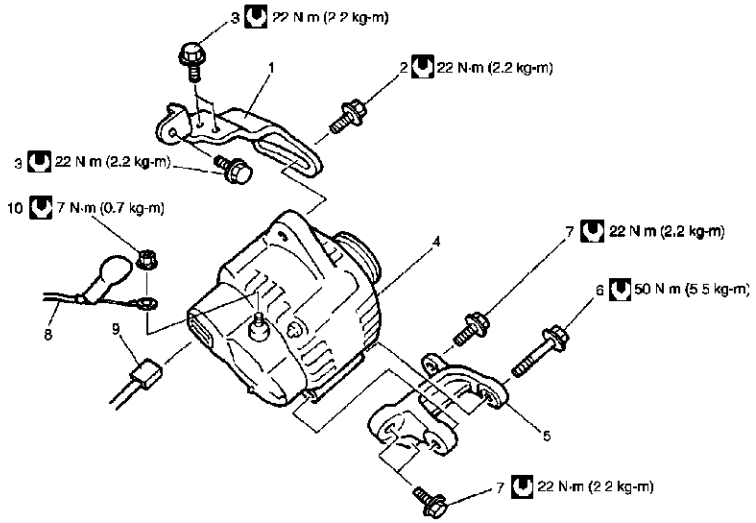
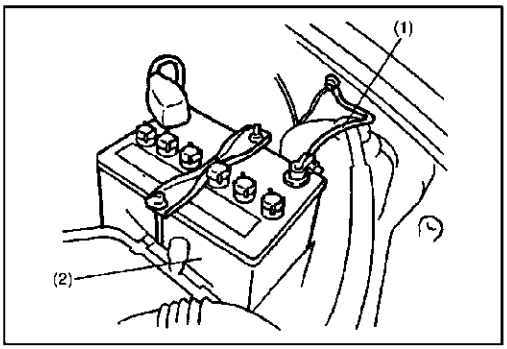
GENERATOR

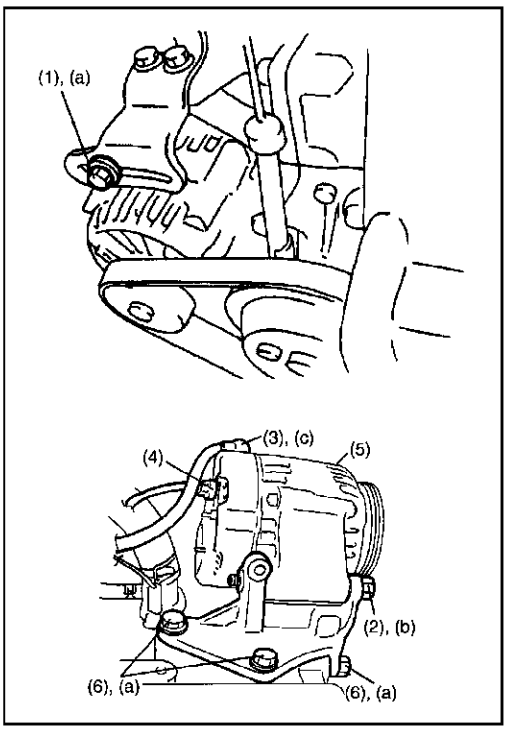


1. Adjusting arm	3. Bolt	5. Generator bracket	7. Bolt	9. Coupler
2. Adjusting bolt	4. Generator	6. Pivot bolt	8. "B" terminal wire	10. Nut
: Tightening torque				



REMOVAL

1) Disconnect negative terminal (1) at battery (2)
2) Remove engine under cover (right side).



3) Remove adjusting bolt (1) and loosen pivot bolt (2).
4) Disconnect "B" terminal wire (3) from generator (5).
5) Hoist vehicle.
6) Disconnect coupler (4) from generator (5).
7) Disconnect exhaust pipe from exhaust manifold.
8) Remove bracket bolts (6) and remove generator with bracket.

INSTALLATION

Reverse above procedure giving specified tension to drive belt. Refer to "Generator (Water Pump) Belt" for belt tension.

Tightening torque
(a) : 22 N-m (2.2 kg-m, 16.0 lb-ft)
(b) : 50 N-m (5.0 kg-m, 36.5 lb-ft)
(c) : 7 N-m (0.7 kg-m, 5.0 lb-ft).

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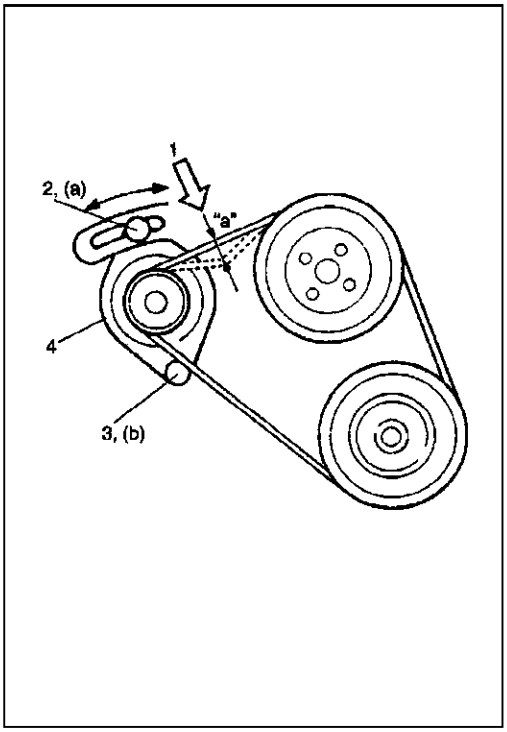


GENERATOR (WATER PUMP) BELT

BELT TENSION INSPECTION

1) Inspect belt cracks, cuts, deformation, wear and cleanliness.
2) Check belt for tension. Belt is in proper tension when it deflects 12 to 15 mm (0.47 – 0.59 in.) under thumb pressure (1) (about 10 kg or 22 lb.).

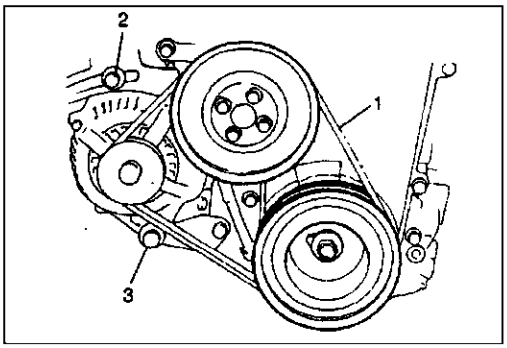
   Belt tension "a" : 12 – 15 mm (0.45 – 0.6 in.) as deflection

   NOTE:
   When replacing belt with a new one, adjust belt tension to 8 – 9 mm (0.3 – 0.35 in.).
3) If belt is too tight or too loose, loosen adjusting bolt (2) and pivot bolt (3) and adjust it to proper tension by displacing generator (4) position.
4) Tighten generator adjusting bolt and pivot bolt.

   Tightening torque

   (a): 22 N-m (2.2 kg-m, 16.0 lb-ft)

   (b): 50 N-m (5.0 kg-m, 36.5 lb-ft)
5) Connect negative cable at battery terminal.



REMOVAL

1) Disconnect negative cable at battery.
2) Loosen generator adjusting bolt (2) and generator pivot bolt (3).

   When servicing vehicle equipped with A/C, remove compressor drive belt before removing water pump belt (1).
3) Slacken belt by displacing generator and then remove it.

INSTALLATION

1) Install belt to water pump pulley, crankshaft pulley and generator pulley.

   When servicing vehicle equipped with A/C, install compressor drive belt, too.
2) Adjust belt tension.

   For Adjustment of compressor drive belt tension, refer to SECTION 0B.
3) Tighten water pump belt adjusting bolt and pivot bolt.
4) Connect negative cable at battery.

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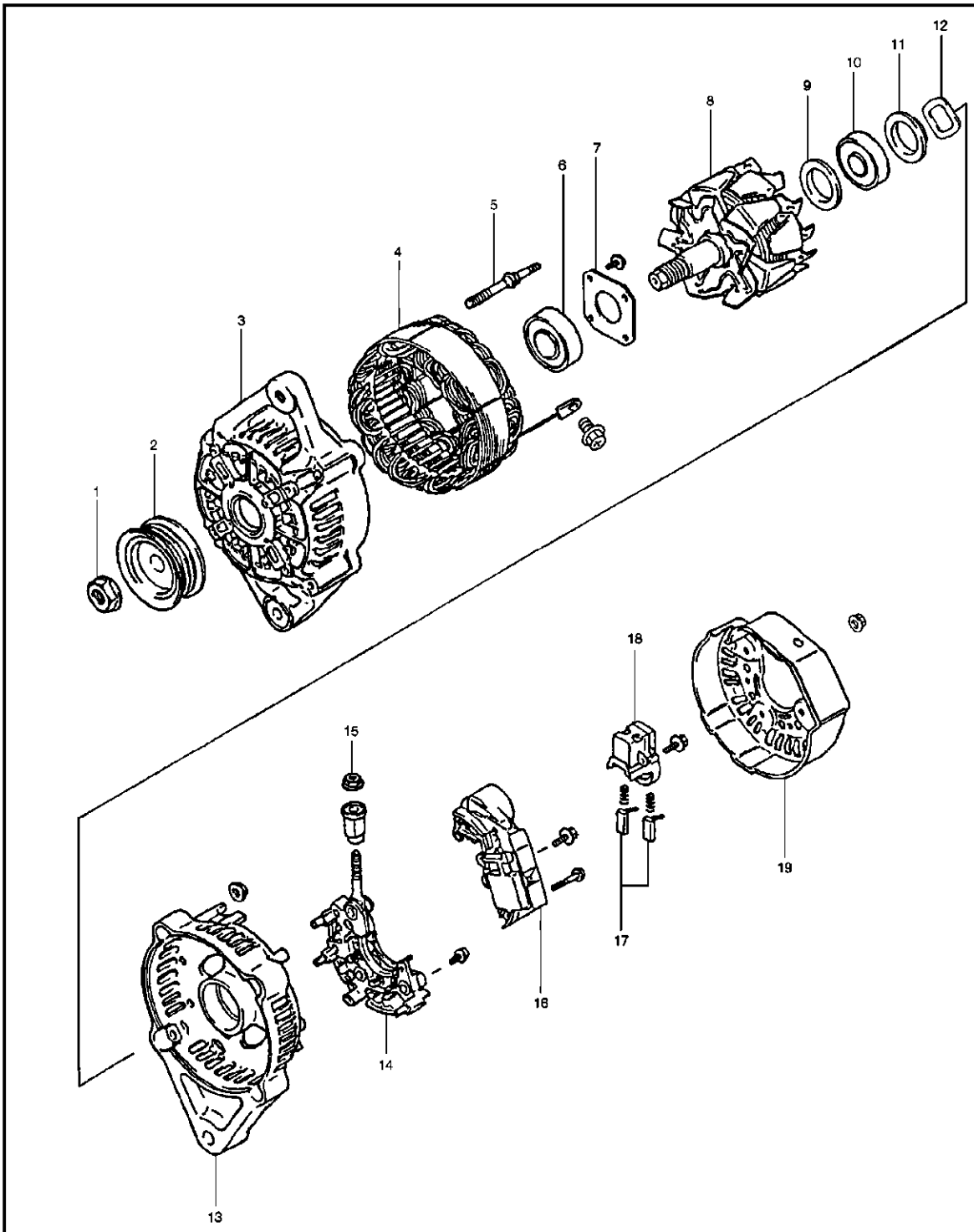
UNIT REPAIR OVERHAUL

GENERATOR



1. Pulley nut	7. Bearing retainer	13. Rear end frame	19. Rear end cover
2. Pulley	8. Rotor	14 Rectifier	
3. Drive end frame	9. Bearing cover	15 Insulator	
4. Stator	10. End housing bearing	16. Regulator	
5. Stud bolt	11. Bearing Cover	17. Brush	
6. Drive end bearing	12. Washer	18 Brush holder	

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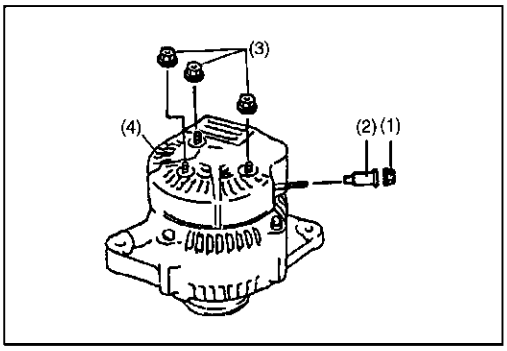
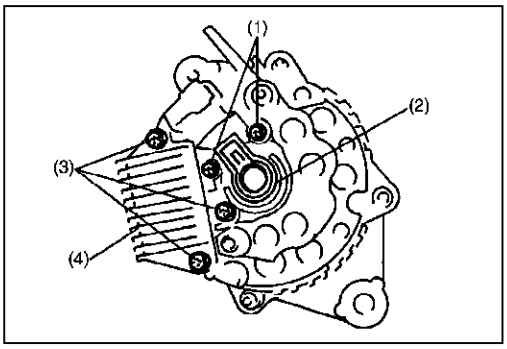
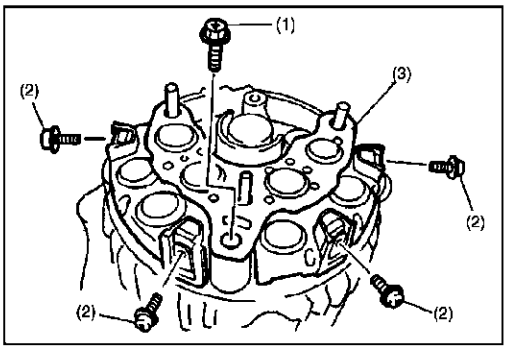


DISASSEMBLY

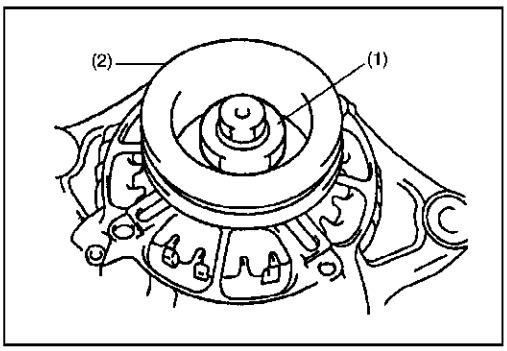
1) Remove B terminal inner nut (1) and insulator (2).
2) Remove 3 nuts (3) and remove rear end cover (4).



3) Remove 2 screws (1) and pull out brush holder assembly (2).
4) Remove 3 screws (3) and IC regulator (4).
5) Remove brush holder cover from brush holder.

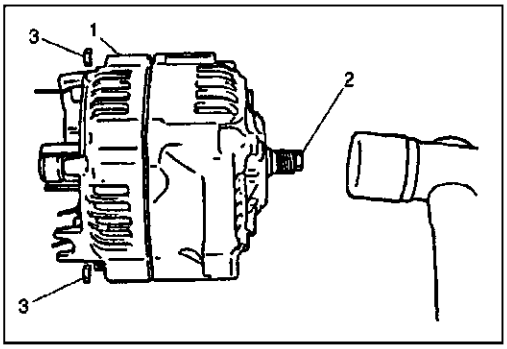


6) Remove bolt (1) and 4 screws (2).
7) Remove rectifier holder (3).



8) Hold shaft by using hexagonal box wrench and remove pulley nut (1), and then pull out pulley (2).

CAUTION:
- **To hold shaft, use hexagonal box wrench. Duodecimal box may cause slipping and consequential shaft or tool damage.**
- **Do not attempt to hold pulley by using vise or pipe wrench so as not to distort it.**



9) Remove 4 rear end frame nuts (3).
10) Drive out rear end frame (1) with rotor tapping shaft (2) lightly by using plastic hammer.
11) Separate rear end frame from rotor evenly by using plastic hammer.

CAUTION:
Do not hit shaft at slip ring side, when separating rotor and rear end frame.

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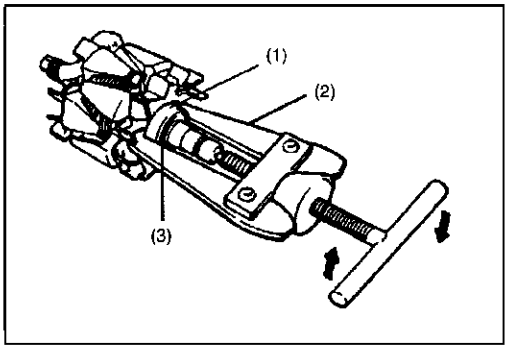
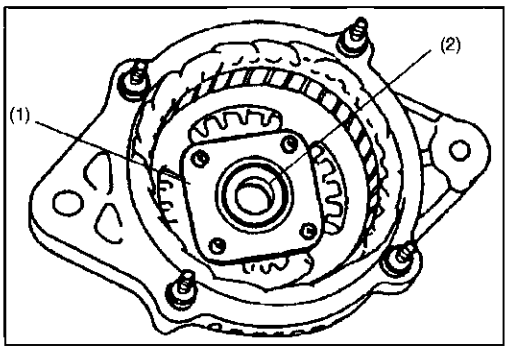


12) If required, use bearing puller (2) to remove end housing bearing (1) and bearing cover (3).

CAUTION:
Care must be exercised so as not to distort cooling fan blade while applying puller.



13) If required, remove 4 screws, retainer plate (1) and then drive out drive end bearing (2).

14) If required, remove stud bolts and then pull out stator.

NOTE:
Heating drive end frame may facilitate removal of stator.

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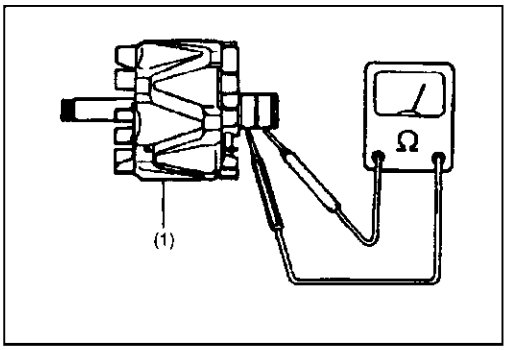


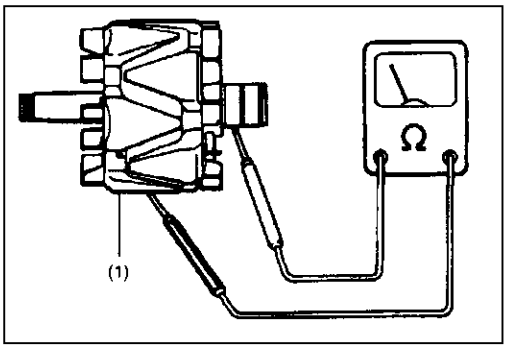
INSPECTION

Rotor

Open Circuit

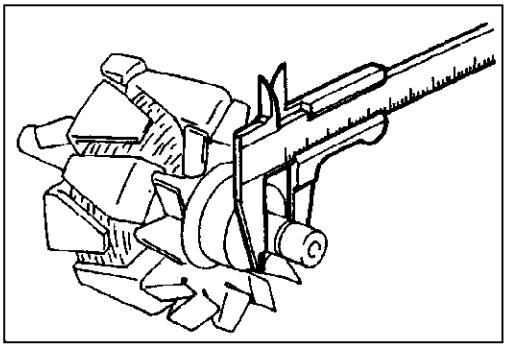
Using ohmmeter, check for continuity between slip rings of rotor (1). If there is no continuity, replace rotor.

Standard resistance between slip rings of rotor : 2.9Ω



Ground

Using ohmmeter, check that there is no continuity between slip ring and rotor (1). If there is continuity, replace rotor.



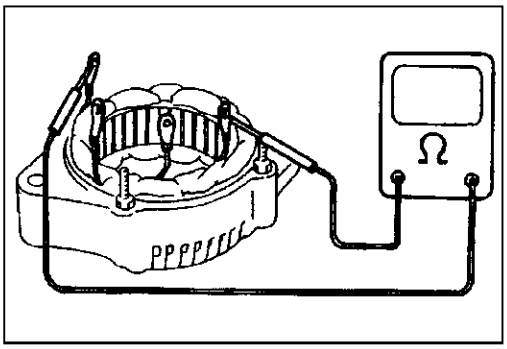
Slip Rings

- Check slip rings for roughness or scoring. If rough or scored, replace rotor.
- Using a vernier caliper, measure the slip ring diameter.

Standard diameter : 14.4 mm (0.567 in.)

Minimum diameter : 12.8 mm (0.504 in.)

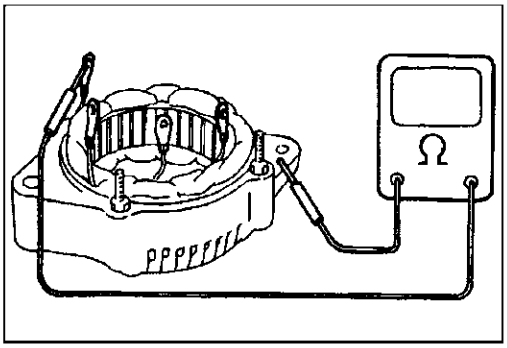
If the diameter is less than minimum, replace the rotor.



Stator

Open Circuit

Using an ohmmeter, check all leads for continuity. If there is no continuity, replace stator.



Ground

Using ohmmeter, check that there is no continuity between coil leads and stator core. If there is continuity, replace stator.

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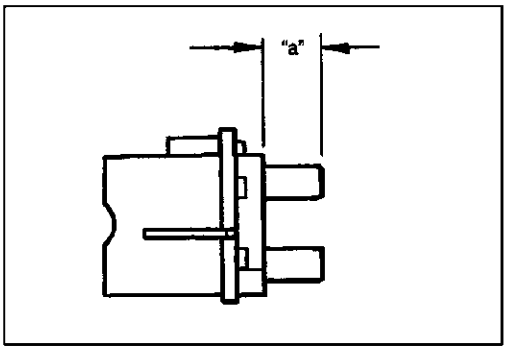


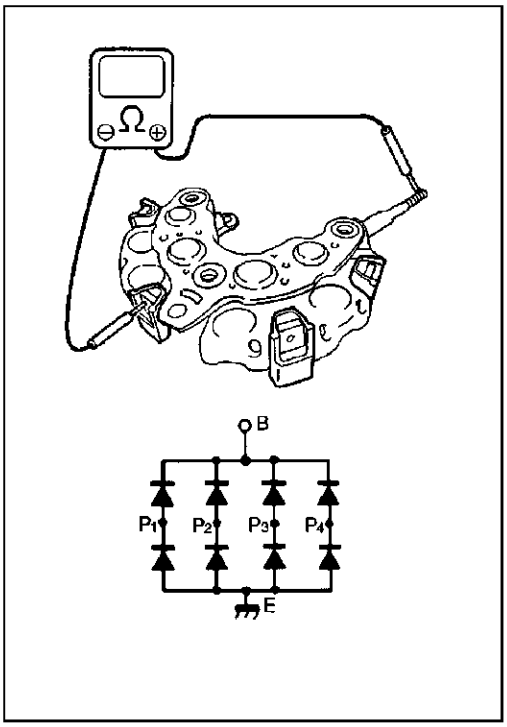
BRUSH

Exposed Brush Length

Check each brush for wear by measuring its length as shown. If brush is found worn down to service limit, replace brush. Refer to "Replace Brush" in this section.

Exposed brush length "a"

Standard: 10.5 mm (0.413 in.)
Limit: 1.5 mm (0.06 in.)

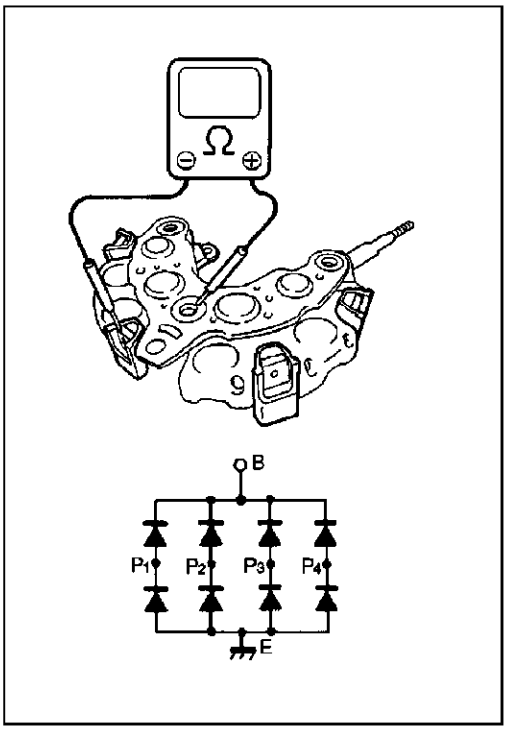


Rectifier

Positive Rectifier

1) Using an ohmmeter, connect one tester probe to the "B" terminal and the other to each rectifier terminal (P_1-P_4).
2) Reverse the polarity of the tester probes and repeat step 1).
3) Check that one shows continuity and the other shows no continuity.

   If there is continuity, replace the rectifier holder.



Negative Rectifier

1) Using an ohmmeter, connect one tester probe to each negative terminal (E) and the other to each rectifier terminal (P_1-P_4).
2) Reverse the polarity of the tester probes and repeat step 1).
3) Check that one shows continuity and the other shows no continuity.

   If there is continuity, replace the rectifier holder.

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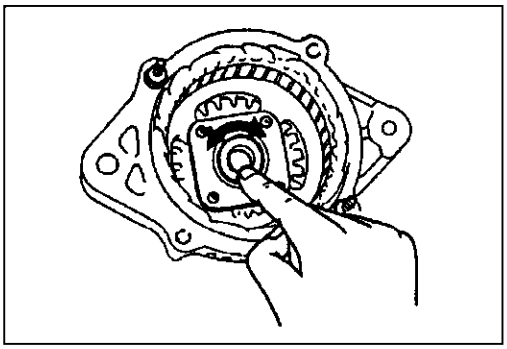
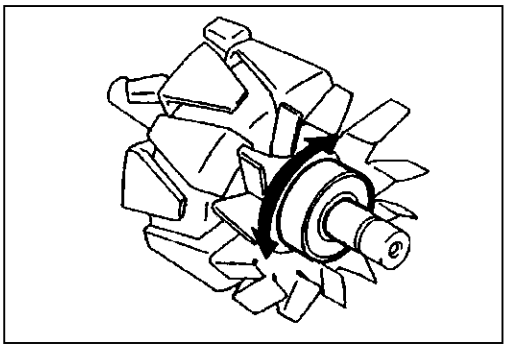
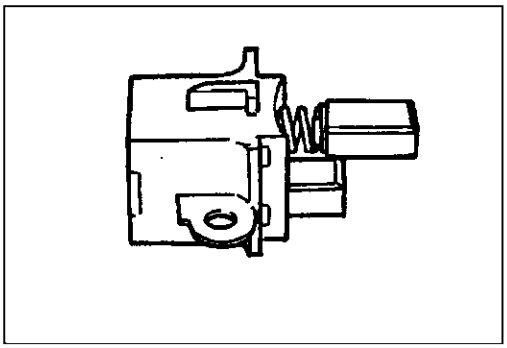


Bearing
Drive End Bearing
Check that bearing is not rough or worn.

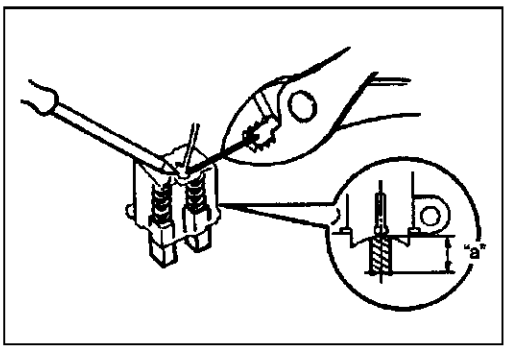


End Housing Bearing
Check that bearing is not rough or worn.
When removal is necessary, refer to disassembly of UNIT REPAIR OVERHAUL.



REPLACE BRUSH

1) Unsolder and remove brush and spring.
2) Run wire of new brush through the hole in the brush holder, and insert spring and brush into brush holder.



3) Solder brush wire to brush holder at specified exposed length.
   Exposed length "a" : 10.5 mm (0.413 in.)
4) Check that brush moves smoothly in brush holder.
5) Cut off excess wire.
6) Apply insulation paint to the soldered area.

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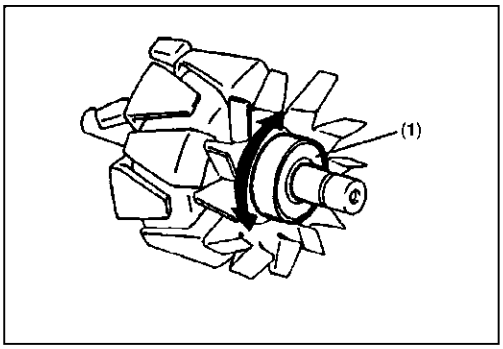
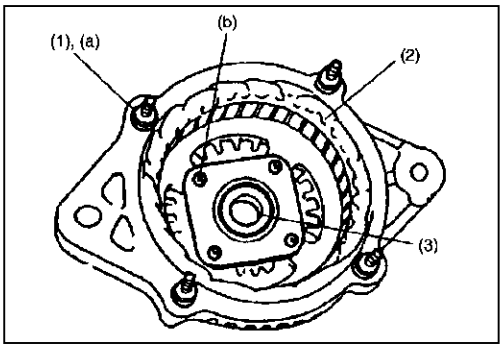


ASSEMBLY

1) If end housing bearing (1) is removed, install it.
2) Check end housing bearing turns smoothly.

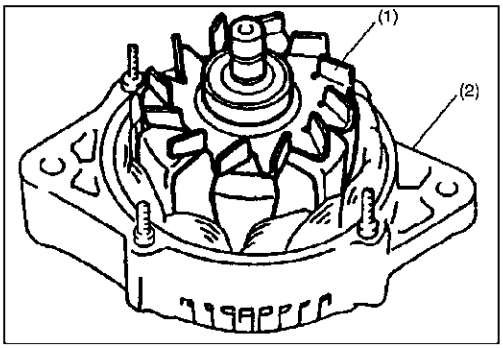


3) If stator (2) is removed, install stator and tighten stud bolts (1).
4) If drive end bearing (3) is removed, install it.
5) Check drive end bearing turns smoothly.

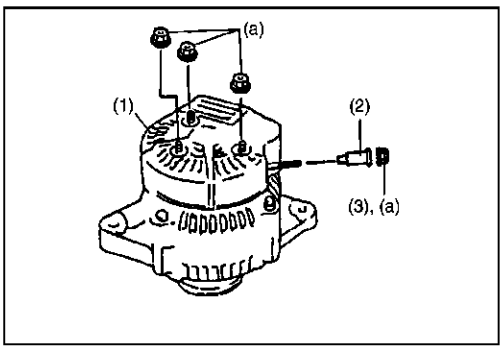
Tightening Torque

(a): 8.8 N-m (0.88 kg-m, 6.5 lb-ft)

(b): 2.6 N-m (0.26 kg-m, 2.0 lb-ft)



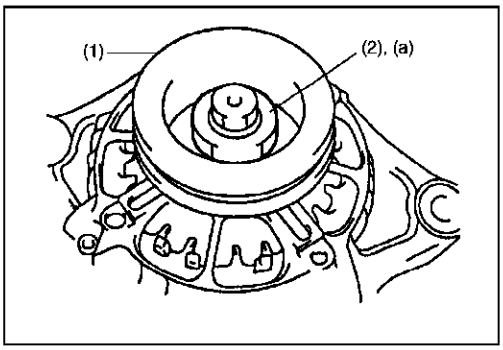
6) Place drive end frame (2) on pulley, and then install rotor (1) to drive end frame.



7) Install rear end frame to drive end frame.
8) Tighten nuts to specified torque.

Tightening Torque

(a): 4.5 N-m (0.45 kg-m, 3.5 lb-ft)



9) Install pulley (1) and tighten pulley nut (2) with holding shaft using hexagonal box wrench to specified torque.

Tightening Torque

(a): 113 N-m (11.3 kg-m, 81.5 lb-ft)

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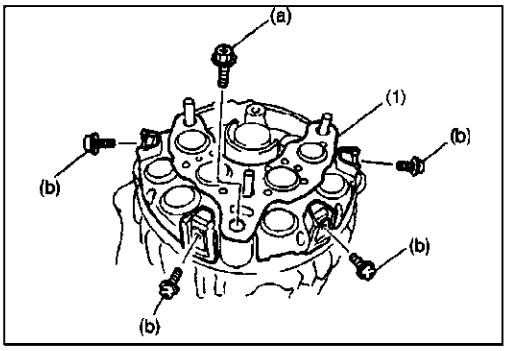
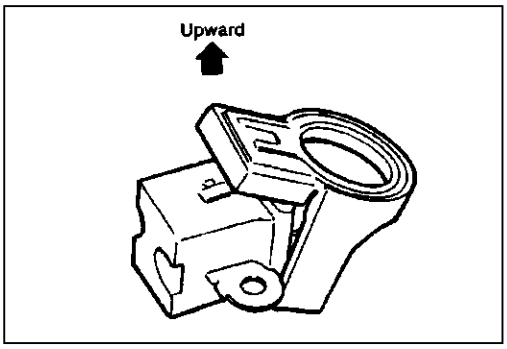


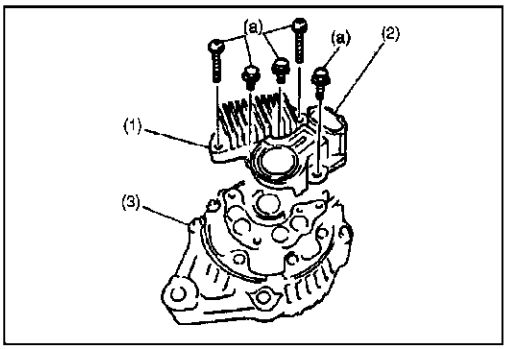
10) Install rectifier holder (1).

CAUTION:
When installing rectifier, check to confirm that startor leads have enough clearance with cooling fan blades.

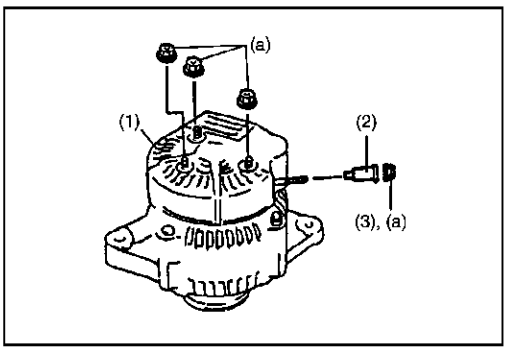
Tightening Torque
(a): 3.9 N-m (0.4 kg-m, 3.0 lb-ft)
(b): 2.0 N-m (0.2 kg-m, 1.5 lb-ft)



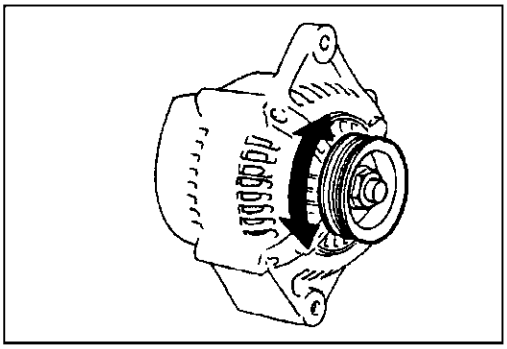
11) Install brush holder cover to brush holder.



12) Place IC regulator (1) together with brush holder (2) horizontally on rear end frame (3).
13) Install 5 screws.
Tightening Torque
(a): 2.0 N-m (0.2 kg-m, 1.5 lb-ft)



14) Install rear end cover (1).
Tightening Torque
(a): 4.5 N-m (0.45 kg-m, 3.5 lb-ft)
15) Install insulator (2) and tighten B terminal inner nut (3) to specified torque.
Tightening Torque
(b): 3.6 N-m (0.36 kg-m, 3.0 lb-ft)



16) Make sure that rotor turns smoothly.

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SPECIFICATION

BATTERY

Rated capacity	28 AH/5 HR, 12 Volts
Electrolyte	2.1 L (4.44/3.70) (US pt/Imp. pt)
Electrolyte S.G.	1.28 when fully charged at 20°C (68°F)

GENERATOR

Rated voltage	12 V	Permissible ambient temperature	– 30° to 90°C (–22° to 194°F)
Nominal output	70 A (at 13.5 V)		
Permissible max. speed	18000 r/min (rpm)	Polarity	Negative ground
No-load speed	1150 r/min (rpm)	Rotation	Clockwise viewed from pulley side
Setting voltage	14.2 to 14.8 V		

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SECTION 6K

EXHAUST SYSTEM

CONTENTS

GENERAL DESCRIPTON 6K- 2
MAINTENANCE 6K- 3
ON-VEHICLE SERVICE 6K- 4

CAUTION:
The engine of this vehicle requires the use of unleaded fuel only. Use of leaded and/or low lead fuel can result in damage and reduce the effectiveness of the catalytic converter.

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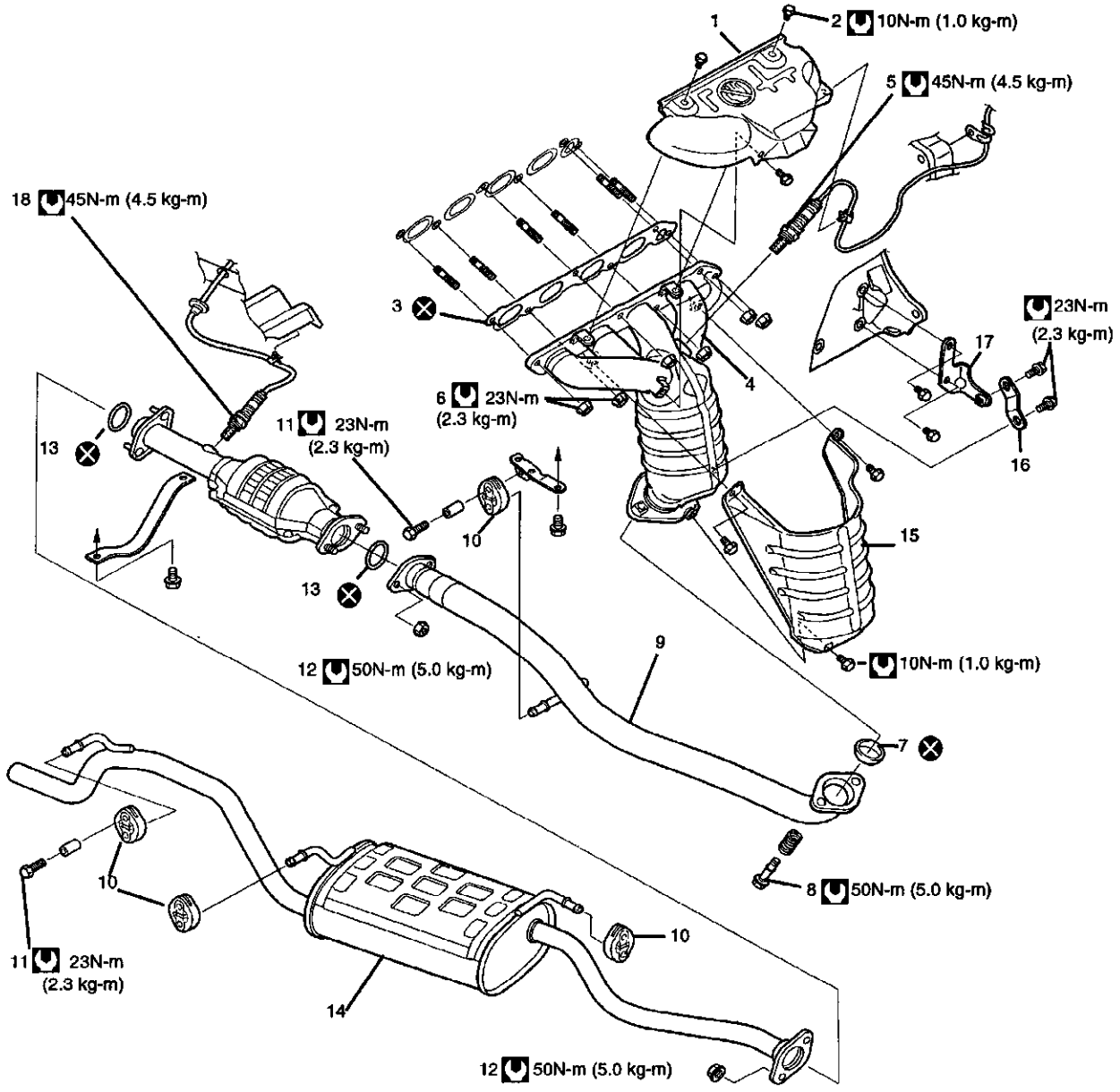
GENERAL DESCRIPTION

The exhaust system consists of an exhaust manifold, exhaust pipes, a muffler and seals, gasket etc., and then the three-way catalytic converter (TWC).
The three-way catalytic converter is an emission control device added to the exhaust system to lower the levels of Hydrocarbon (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx) pollutants in the exhaust gas.



1 Exhaust manifold cover	11 Mounting bolt
2. Exhaust manifold cover bolt	12 Exhaust pipe nut
3 Gasket	13 Gasket
4. Exhaust manifold	14. Muffler
5 Oxygen Sensor No. 1	15 Catalyst cover
6 Exhaust Manifold mounting nut	16 Exhaust manifold bracket No 2
7. Seal ring	17 Exhaust manifold bracket No. 1
8. Exhaust pipe bolt	18 Oxygen sensor No 2
9 Exhaust pipe	: Tightening torque
10 Rubber mounting	: Do not reuse

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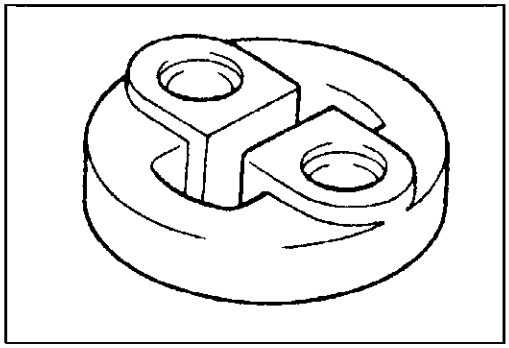
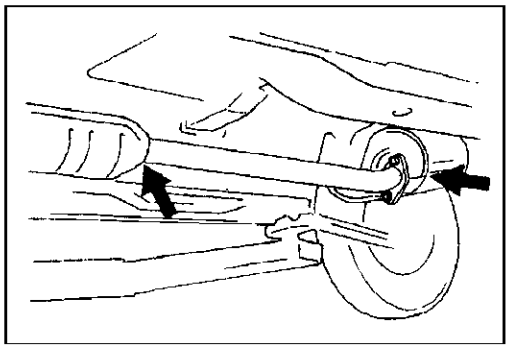
MAINTENANCE

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



At every interval of periodic maintenance service, and when vehicle is raised for other service, check exhaust system as follows:

- Check rubber mountings 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 GENERAL DESCRIPTION in this section for torque data.

- Check near by 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.

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ON-VEHICLE SERVICE

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

EXHAUST MANIFOLD

REMOVAL AND INSTALLATION

Refer to SECTION 6A for removal and installation procedures of exhaust manifold.

INSPECTION

Check gasket and seal for deterioration or damage.
Replace them as necessary.

EXHAUST PIPE

REMOVAL AND INSTALLATION

For replacement of exhaust pipe, be sure to hoist vehicle and observe WARNING under "MAINTENANCE" and the following.

CAUTION:
Exhaust pipe have three way catalytic converter in it, it should not be exposed to any impulse.
Be careful not to drop it or hit it against something.

- Tighten bolts and nuts to specified torque when reassembling. Refer to "GENERAL DESCRIPTION" for location of bolts and nuts.
- After installation, start engine and check each joint of exhaust system for leakage.

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SECTION 7A

MANUAL TRANSMISSION

CONTENTS

GENERAL DESCRIPTON 7A- 2
DIAGNOSIS 7A- 5
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Remounting 7A-12
UNIT REPAIR OVERHAUL 7A-13
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Right case 7A-18
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Fifth gears 7A-32
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SPECIAL TOOLS 7A-36

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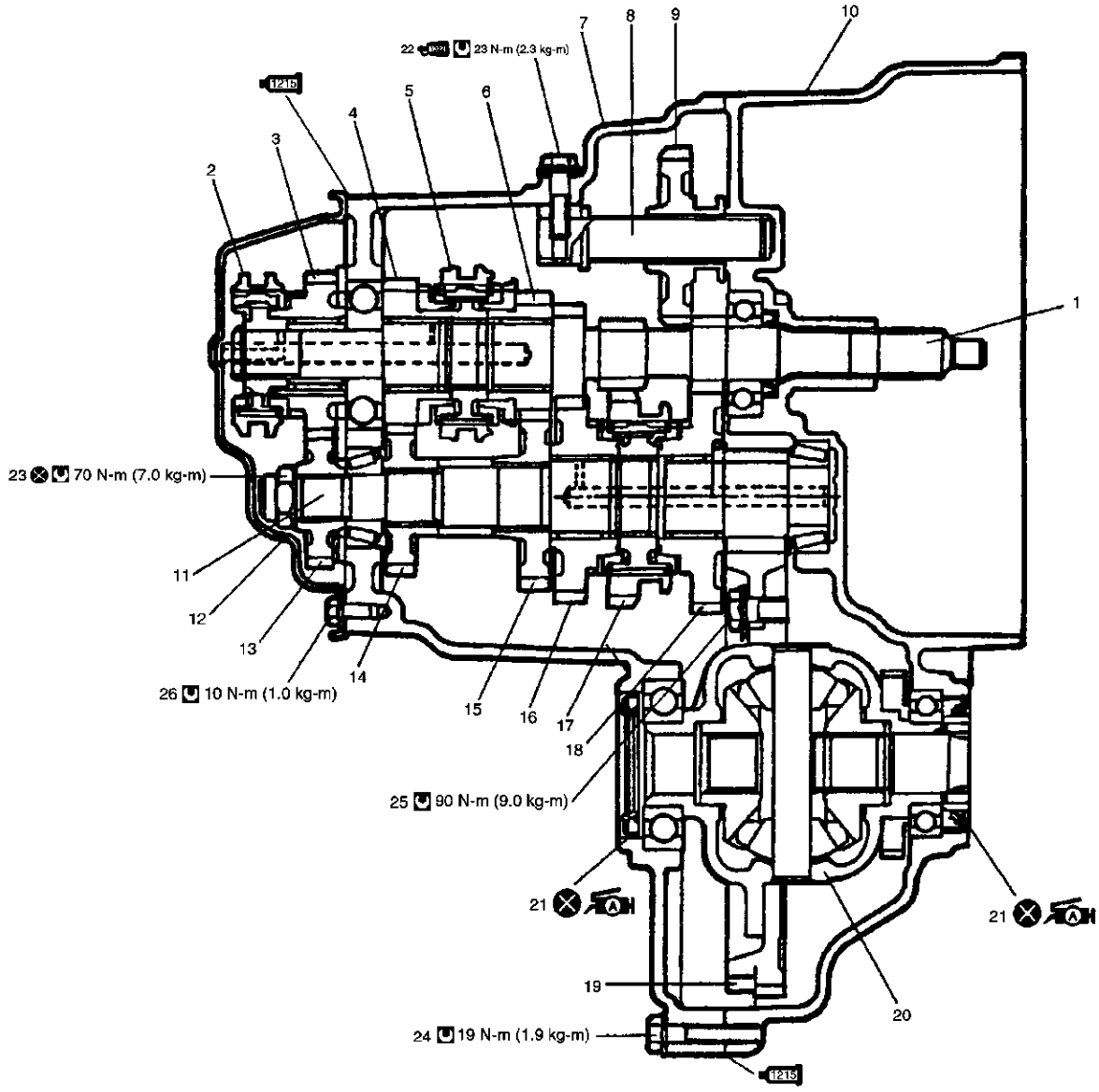
GENERAL DESCRIPTION

The transmission provides five forward speeds and one reverse speed by means of three synchronizers and three shafts–input shaft, countershaft and reverse gear shaft. All forward gears are in constant mesh, and reverse uses a sliding idler gear arrangement.



1. Input shaft	14. Countershaft 4th gear	23. Countershaft nut
2. 5th speed sleeve & hub	15. Countershaft 3rd gear	24. Transmission case bolt
3 Input shaft 5th gear	16 Countershaft 2nd gear	25 Bevel gear bolt
4. Input shaft 4th gear	17. Low speed sleeve & hub	26. Left cover bolt
5. High speed sleeve & hub	18. Countershaft 1st gear	: Tightening Torque
6. Input shaft 3rd gear	19. Final gear	: Do not reuse
7. Left case	20. Differential case	: Apply sealant, SUZUKI BOND No 1215 99000-31110, to mating surfaces of transmission case
8. Reverse gear shaft	21. Differential side oil seal Apply SUZUKI SUPER GREASE A 99000-25010 to oil seal lip	
9. Reverse idler gear		
10. Right case		
11 Countershaft	22. Reverse shaft bolt Apply THREAD LOCK 1322 99000-32110 to joint seam of reverse gear shaft.	
12. Left cover		
13. Countershaft 5th gear		

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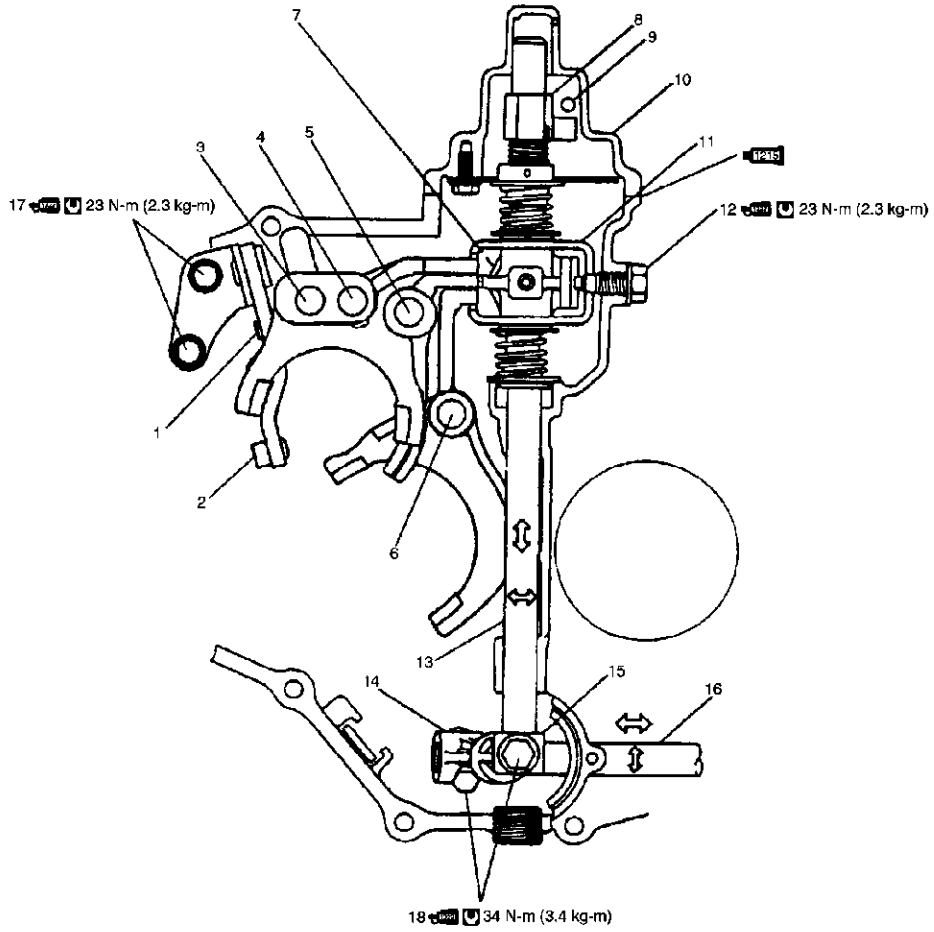
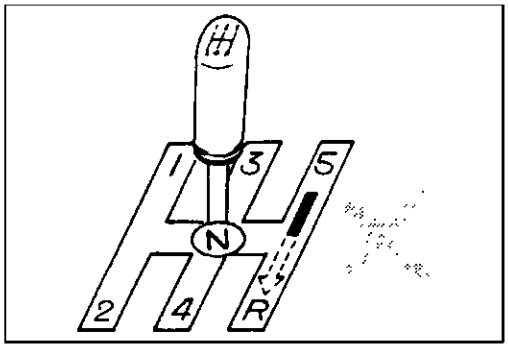
GEAR SHIFT MECHANISM

Movement of gear shift control lever is transmitted to gear shift shaft through gear shift control shaft, and gear shift & select shaft through gear shift arm and gear shift yoke, and then gear shift & select lever to each gear shift yoke, shaft and fork or arm. Gear shift interlock plate is provided to prevent the gear from engaging double.



1. Reverse gear shift arm	10. Gear shift guide case		Tightening Torque
2. Reverse gear shift lever	11. Gear shift interlock plate		Apply sealant, SUZUKI BOND No.1215 99000-31110, to mating surfaces of transmission case
3. 5th & REV gear shift guide shaft	12. Gear shift interlock bolt		
4. 5th & REV gear shift shaft	13. Gear shift & select shaft		Apply thread lock cement 99000-32110 to thread part
5 High speed gear shift shaft	14. Gear shift arm		
6. Low speed gear shift shaft	15. Gear shift yoke		
7 Gear shift & select lever	16. Gear shift shaft		
8. 5th & REV gear shift cam	17. Reverse gear shift lever bolt		
9 5th to REV interlock guide bolt	18. Gear shift arm bolt		



5th & REVERSE GEAR SHIFT CAM

5th & reverse gear shift cam, cam guide return spring and 5th to reverse interlock guide bolt are provided to prevent the gear from being directly shifted from 5th to reverse.

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DIAGNOSIS

Condition	Possible Cause	Correction
Gears slipping out of mesh	• Worn shift fork shaft	Replace.
	• Worn shift fork or synchronizer sleeve	Replace.
	• Weak or damaged locating springs	Replace.
	• Worn bearings on input shaft or countershaft	Replace.
	• Worn chamfered tooth on sleeve and gear	Replace sleeve and gear.
Hard shifting	• Inadequate lubricant	Replenish.
	• Improper clutch pedal free travel	Adjust.
	• Distorted or broken clutch disc	Replace.
	• Damaged clutch pressure plate	Replace clutch cover.
	• Worn synchronizer ring	Replace.
	• Worn chamfered tooth on sleeve or gear	Replace sleeve or gear.
	• Worn gear shift control shaft joint bush	Replace.
	• Distorted shift shaft	Replace.
Noise	• Inadequate or insufficient lubricant	Replenish.
	• Damaged or worn bearing(s)	Replace.
	• Damaged or worn gear(s)	Replace.
	• Damaged or worn synchronizer parts	Replace.

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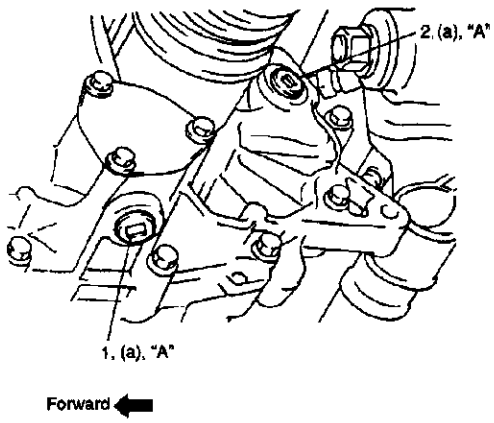

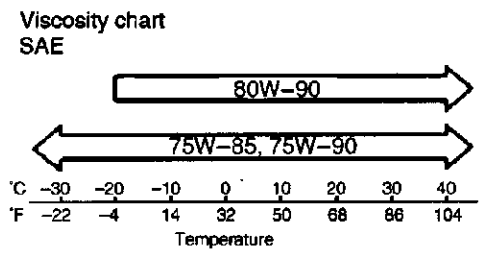

ON-VEHICLE SERVICE

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 it.
3) Drain old oil and torque drain plug (1) as specified below. Apply sealant to thread of drain plug before installation.

   "A": Sealant 99000-31110

   Tightening Torque
   (a): 21 N-m (2.1 kg-m, 15.5 lb-ft)

4) Fill new specified oil by specified amount (up to level hole).

   NOTE:
   - **It is recommended to use API GL-4 75W-90 gear oil.**
   - **Whenever vehicle is hoisted for any other service work than oil change, also be sure to check for oil leakage.**

   Oil specification: API GL-4
   For SAE classification, refer to viscosity chart at the left.

   Oil capacity: 2.2 liters (4.6/3.9 US/Imp. pt)
5) Apply sealant to thread filler plug (2) and torque it as specified.

   "A": Sealant 99000-31110

   Tightening Torque
   (a): 21 N-m (2.1 kg-m, 15.5 lb-ft)

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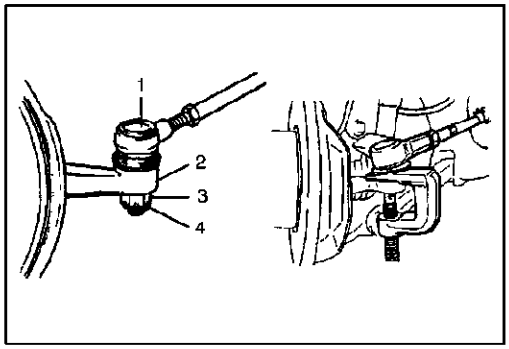
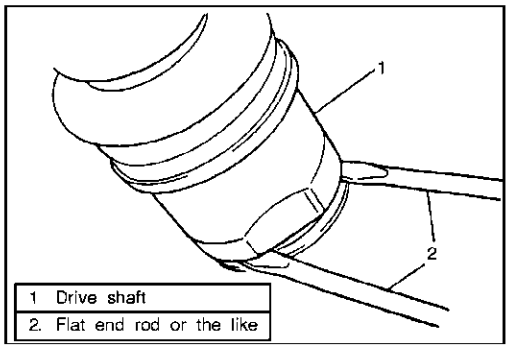


DIFFERENTIAL SIDE OIL SEAL

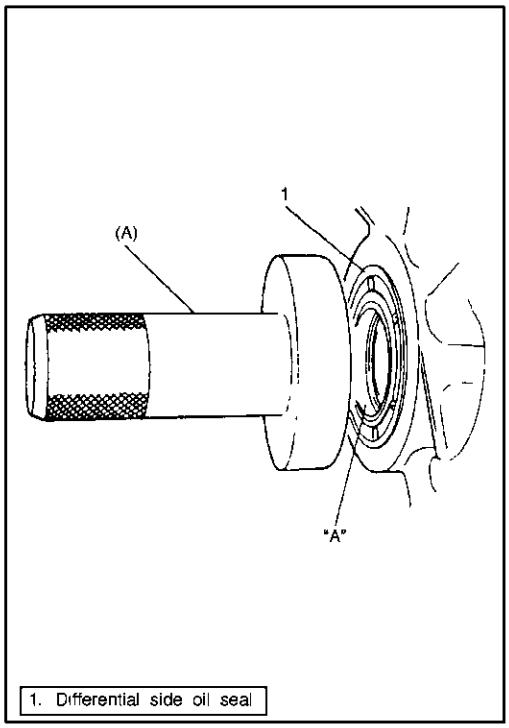
REPLACEMENT

1) Lift up vehicle and drain transmission oil.
2) Remove wheel, and then remove tie-rod end split pin (4) and castle nut (3).
3) Disconnect tie-rod end (1) from knuckle (2) by using puller.
4) Remove stabilizer referring to "STABILIZER BAR REMOVAL" in SECTION 3D.
5) Remove ball stud bolt and then separate suspension arm from knuckle.



1. Drive shaft
2. Flat end rod or the like

6) By using flat end rods or the like, pull out drive shaft joint so as to release snap ring fitting of joint spline at differential side.
   Pushing knuckle portion outward, detach drive shaft at differential side.



1. Differential side oil seal

7) Remove oil seal and install a new one until it becomes flush with case surface by using special tool and hammer.

   NOTE:
   When installing oil seal, face its spring side inward.

   Special Tool
   (A): 09913-75510

8) Apply grease to oil seal lip and at the same time check drive shaft where oil seal contacts and make sure of its smoothness.

   "A": Grease 99000-25010

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9) Insert drive shaft joint to differential gear, referring to SECTION 4A.

CAUTION:
- **Be careful not to scratch oil seal lip with drive shaft joint while inserting.**
- **Make sure to insert drive shaft joint fully and seat its snap ring as it was.**
- **Do not hit joint boot with hammer or the like. Nothing but hands are allowed to use when inserting joint.**

10) Connect ball stud with knuckle and fasten with bolt to specification, referring to SECTION 3D.
11) Connect tie-rod end with knuckle and fasten castle nut to specified torque, referring to SECTION 3D.
    Install split pin and bend it.
12) Install stabilizer mount brackets, fasten bolts to specified torque referring to SECTION 3D.
13) Fill transmission oil as specified and make sure that oil has been sealed with oil seal.

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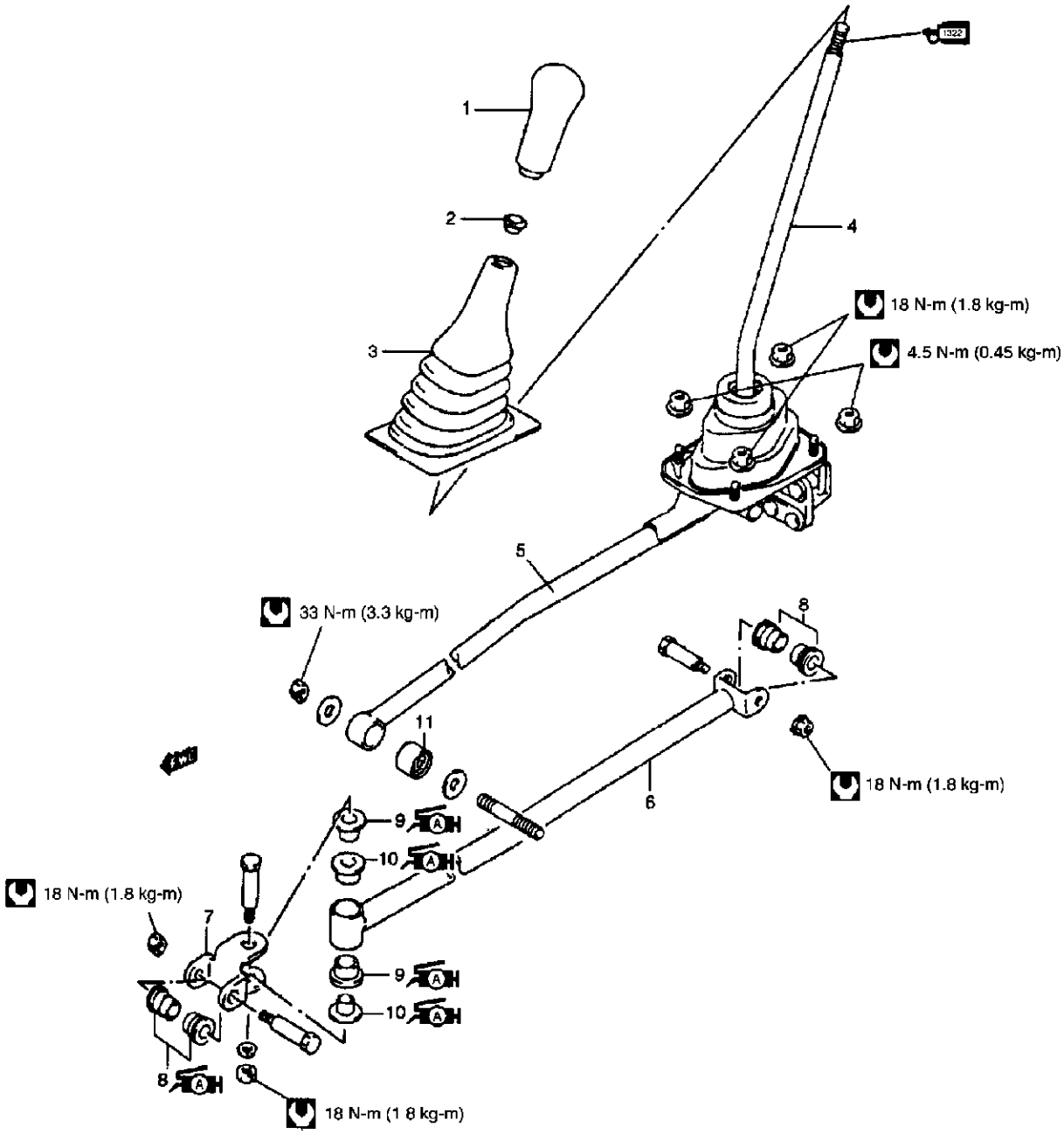
GEAR SHIFT CONTROL LEVER AND ROD



1 Gear shift control lever knob	7. Gear shift control joint	: Tightening Torque
2 Lever boot holder	8. Shift control joint bush	: Apply SUZUKI SUPER GREASE A (99000-25010)
3 Gear shift lever boot	9. Bush	: Apply THREAD LOCK 1322 (99000-32110)
4 Gear shift lever set	10. Bush	
5 Extension rod set	11. Extension bush	
6 Gear shift control shaft		

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REMOVAL

1) Disconnect gear shift control shaft from gear shift lever by removing control shaft bolt and nut.
2) Loosen extension rod nut at transmission end and then move extension rod.
3) Remove console box.
4) Remove 4 control lever housing nuts and gear shift lever set with extension rod set from body.

INSTALLATION

1) Apply grease to turning or sliding portions.
2) If knob has been removed from lever, apply thread lock cement and then install knob to control lever. Make sure that knob is aligned with lever.
3) Install control lever assembly and related parts as they were.

NOTE:
- **Do not apply grease to extension rod bush of transmission end.**
- **Apply grease to gear shift control shaft bushes.**
- **Make sure that boots are installed correctly.**

NOTE:
Check control lever for smooth movement after assembly.

VEHICLE SPEED SENSOR (VSS)

Refer to SECTION 6E1.

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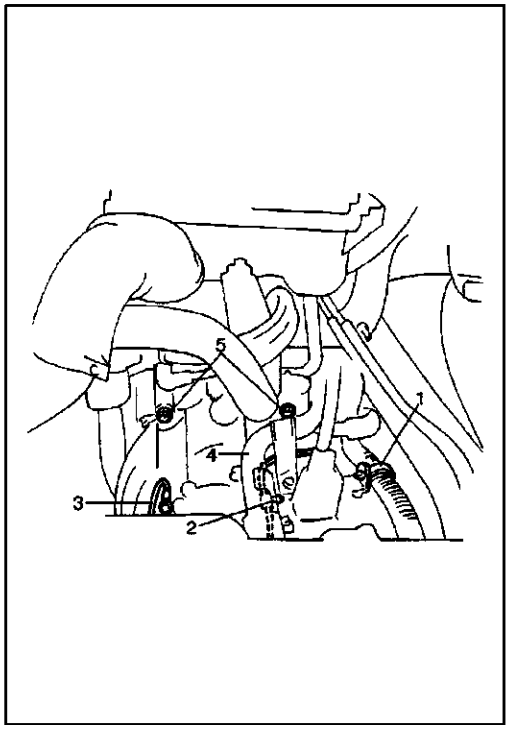
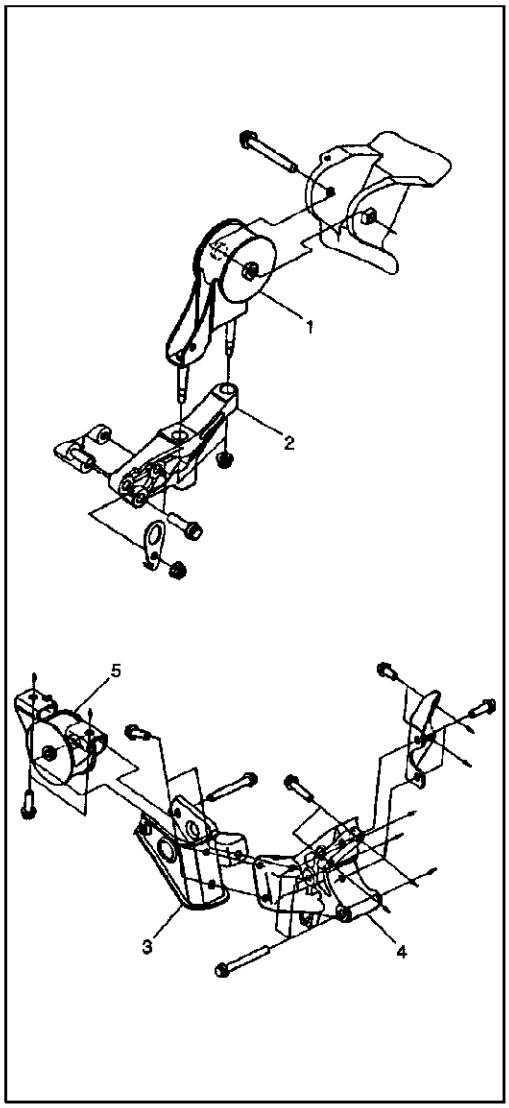


DISMOUNTING OF TRANSMISSION

UNDER HOOD

1) Disconnect negative cable at battery.
2) Remove starting motor, referring to "DISMOUNTING AND REMOUNTING" in SECTION 6G.
3) Disconnect back up light switch coupler and VSS coupler.
4) Detach wiring harness clamp (1) from its stay and back up light switch wire clamp (2) from water pipe.
5) Remove ground cable (3) from transmission.
6) Detach water pipe (4) from gear shift guide case.
7) Remove transmission to engine bolts (5).
8) Support engine by using lifting device.



ON LIFT

9) Drain transmission oil referring to "OIL CHANGE" in this section.
10) Remove left and right drive shaft referring to SECTION 4A.
11) Disconnect extension rod and gear shift control joint from transmission.
12) Disconnect clutch cable from clutch release lever and bracket.
13) Remove clutch housing lower plate.
14) Support transmission with transmission jack.
15) Remove engine left mounting (1) with bracket (2).
16) Remove engine rear mounting No.1 bracket (3) with No.2 bracket (4) and then engine rear mounting (5).
17) Remove transmission to engine bolt and nut and remove exhaust pipe from exhaust manifold referring to SECTION 6K if necessary.
18) Remove other attached parts from transmission, if any.
19) Pull transmission out so as to disconnect input shaft from clutch disc and then lower it.

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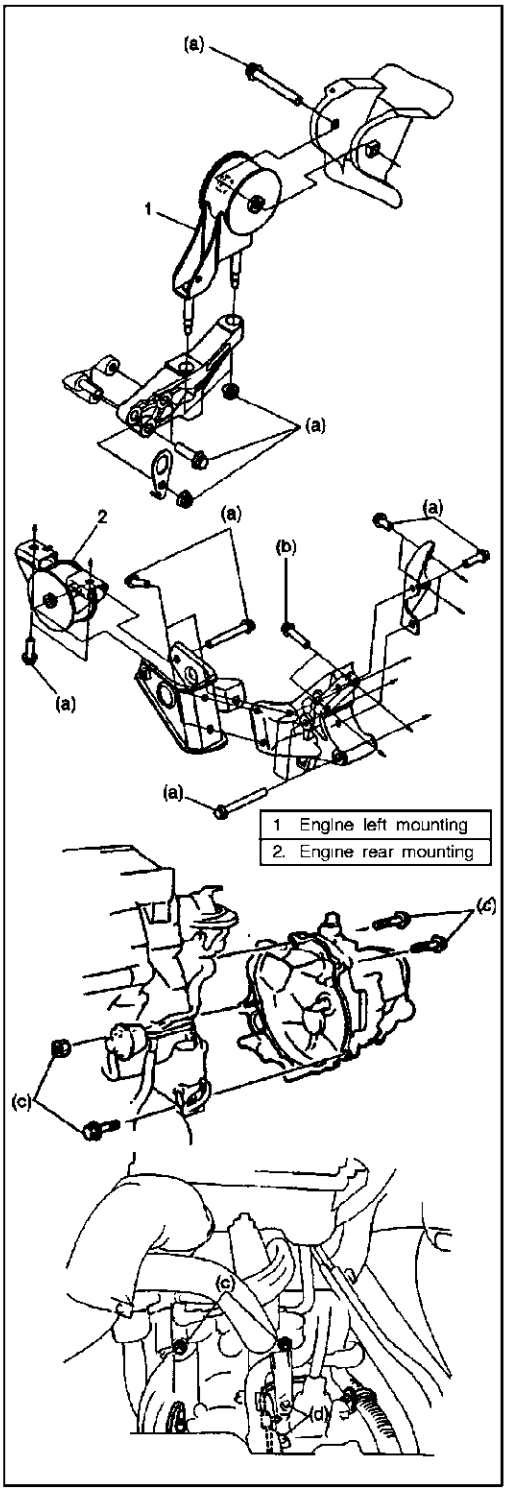

REMOUNTING

CAUTION:
Care should be taken not to scratch oil seal lip with drive shaft while raising transmission.
Do not hit drive shaft joint with hammer when installing it into differential gear.

Remount transmission in reverse order of dismounting procedure noting the following.

- Push in drive shaft joints (right & left) fully so as to snap ring of shaft engages with differential gear.
- Set each clamp for wiring securely.
- After connecting clutch cable, be sure to adjust its play properly, referring to SECTION 7C.
- Fill transmission with oil as specified.
- Tighten bolts and nuts to specification.

Tightening Torque
(a): 55 N-m (5.5 kg-m, 40.0 lb-ft)
(b): 23 N-m (2.3 kg-m, 17.0 lb-ft)
(c): 60 N-m (6.0 kg-m, 43.5 lb-ft)
(d): 10 N-m (1.0 kg-m, 7.5 lb-ft)

- Connect battery and check function of engine, clutch and transmission.

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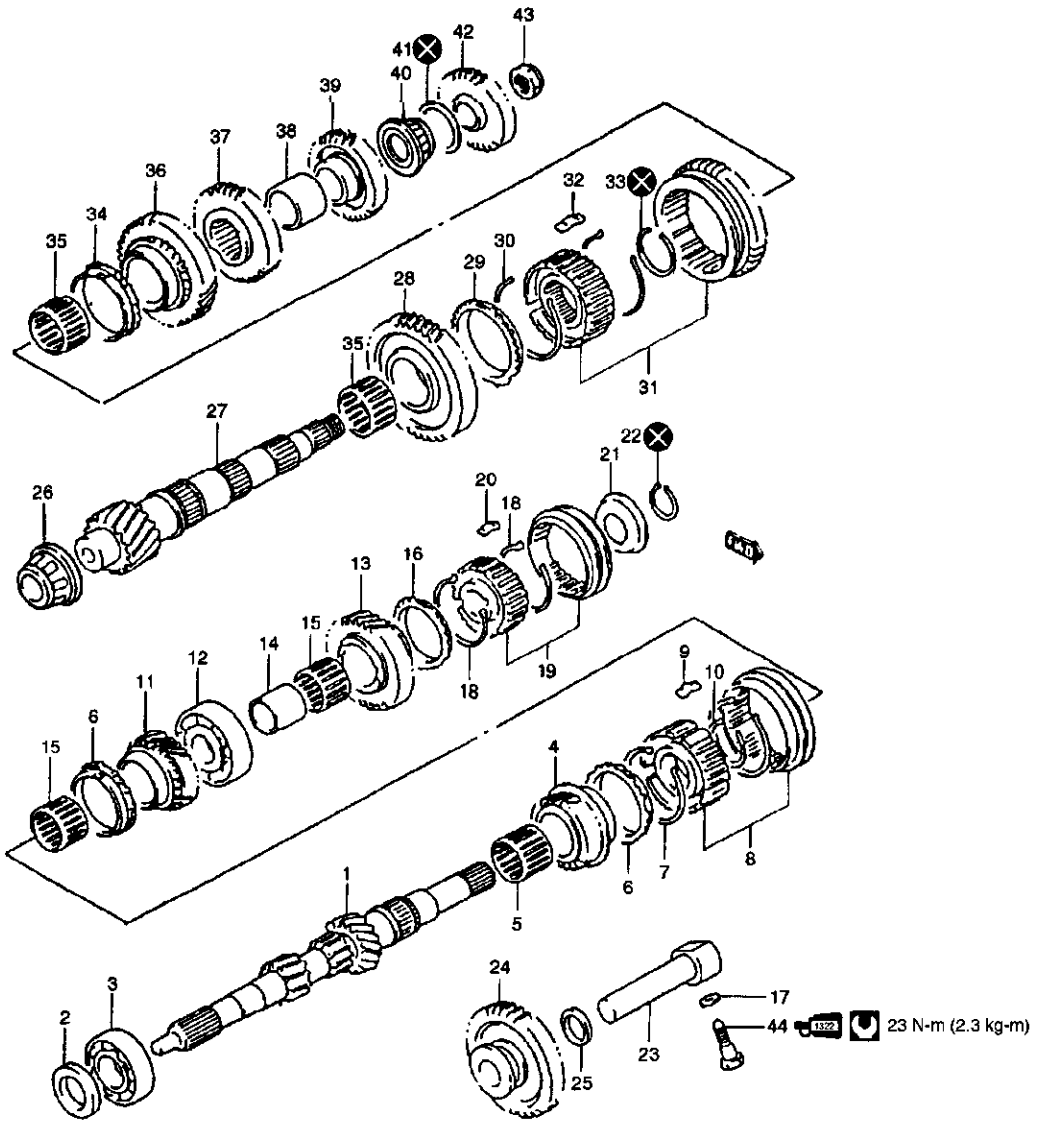
UNIT REPAIR OVERHAUL



1. Input shaft	17. Washer	33. Circlip
2 Oil seal	18 5th synchronizer spring	34 2nd gear synchronizer ring
3. Input shaft right bearing	19. 5th speed sleeve & hub	35. 1st & 2nd gear bearing
4. Input shaft 3rd gear	20. 5th synchronizer key	36. Countershaft 2nd gear
5 3rd gear bearing (resin cage)	21 5th synchronizer hub plate	37. Countershaft 3rd gear
6. High speed synchronizer ring	22. Circlip	38. 3rd & 4th gear spacer
7. High speed synchronizer spring	23. Reverse gear shaft	39. Countershaft 4th gear
8 High speed sleeve & hub	24. Reverse idler gear	40. Countershaft left bearing
9. High speed synchronizer key	25. Reverse shaft washer	41. Bearing set shim
10. Circlip	26. Countershaft right bearing	42. Countershaft 5th gear
11 Input shaft 4th gear	27 Countershaft	43. Countershaft nut
12. Input shaft left bearing	28. Countershaft 1st gear	44 Reverse shaft bolt Apply thread lock cement 99000-32110 to joint seam of reverse gear shaft
13. Input shaft 5th gear	29. 1st gear synchronizer ring	
14 5th gear spacer	30 Low speed synchronizer spring	
15. 4th & 5th gear bearing (resin or steel cage)	31. Low speed sleeve & hub	: Tightening Torque
16. 5th speed synchronizer ring	32. Low speed synchronizer key	: Do not reuse

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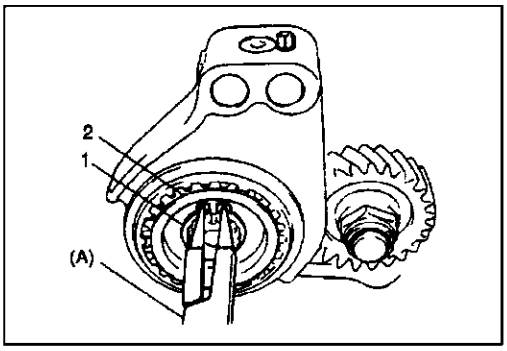


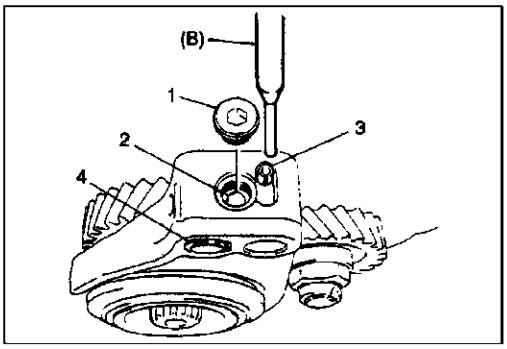
DISASSEMBLING UNIT

FIFTH GEARS

1) Remove 8 bolts and take off transmission side cover.
2) Using special tool, remove circlip (1) and then hub plate (2).

CAUTION:
Care should be taken not to distort side cover when it is removed from left case.

Special Tool
(A): 09900-06107



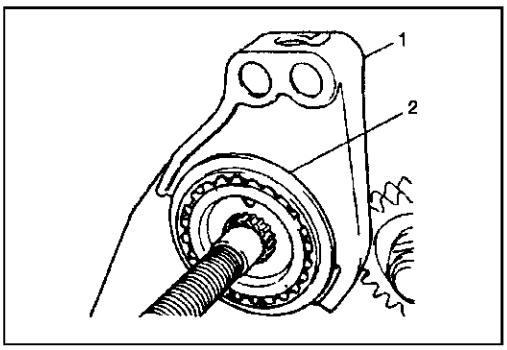
3) Remove shift fork plug (1) and guide ball (2).

NOTE:
Use of magnet would facilitate removal of guide ball.

4) Drive out spring pin (3) by using special tool and hammer.

Special Tool
(B): 09922-85811

5) Remove circlip (4).



6) Remove gear shift fork (1), sleeve & hub assembly (2), synchronizer ring spring, synchronizer ring and 5th gear all together.

CAUTION:
Be careful not to pinch synchronizer ring spring when removing.

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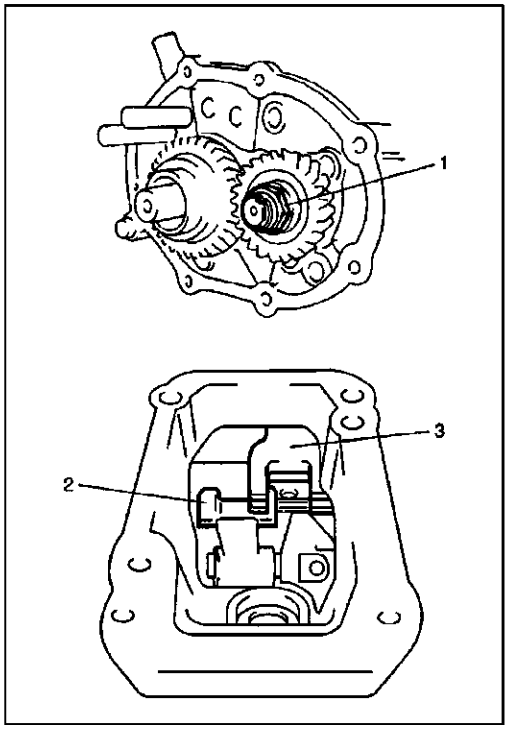
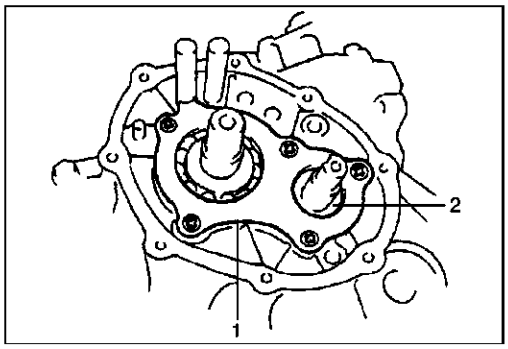
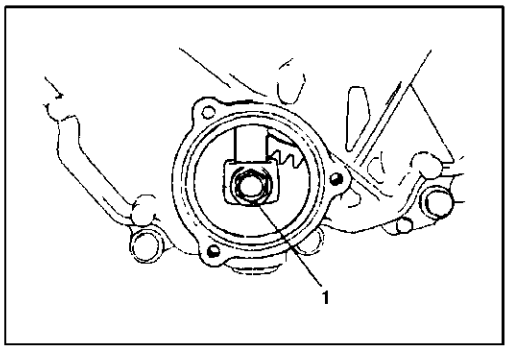


7) Remove counter shaft nut (1) as follows:
   a. Shift low speed gear shift shaft (2) to 1st gear position and high speed gear shift shaft (3) to 3rd gear position.
   b. Loosen nut with above double engagement.
8) Remove input shaft 5th gear, needle bearing and counter shaft 5th gear. Gear puller would be necessary if spline fitting of counter shaft 5th gear is tight.



9) Remove 5 screws and take off left case plate (1), and then remove bearing set shim (2).



GEAR SHIFTER, MAIN SHAFT AND COUNTERSHAFT

1) Remove 3 bolts from left case cap and then take off cap.
2) Remove gear shift yoke bolt (1).

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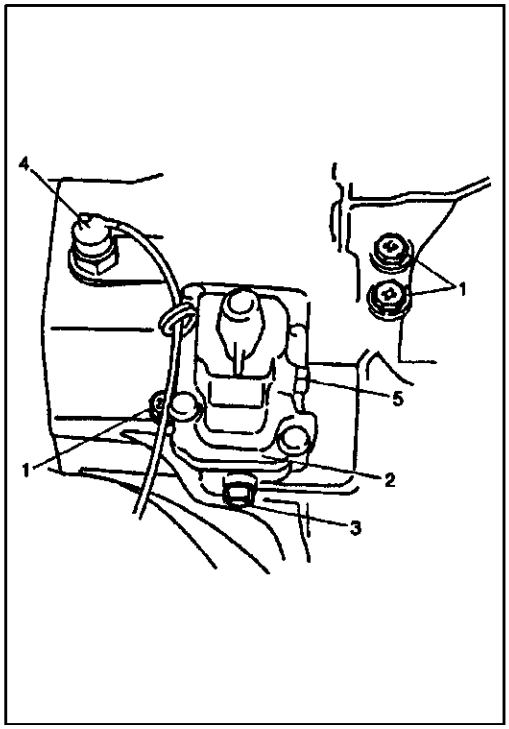
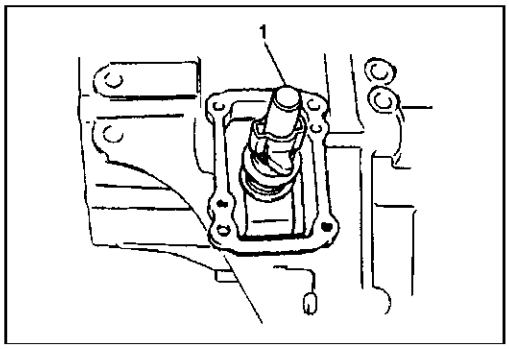
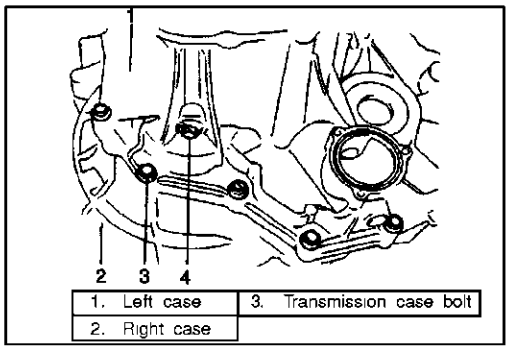


3) Remove 3 gear shift fork shaft bolts (1) with washers, then take out locating springs and steel balls.
4) Remove 2 bolts from gear shift guide case (2), and then remove gear shift guide case.
5) Remove gear shift interlock bolt (3) with washer.
6) Remove back up light switch (4).

NOTE:
Removal of 5th to REV interlock bolt (5) is not necessary for removing gear shift & select shaft assembly.



7) Pull out gear shift & select shaft assembly (1).



1. Left case	3. Transmission case bolt
2. Right case	

8) Remove reverse shaft bolt (4) with washer.
9) Remove 11 case bolts from outside and another 4 from clutch housing side.
10) Tapping left case flanges with plastic hammer, remove left case.

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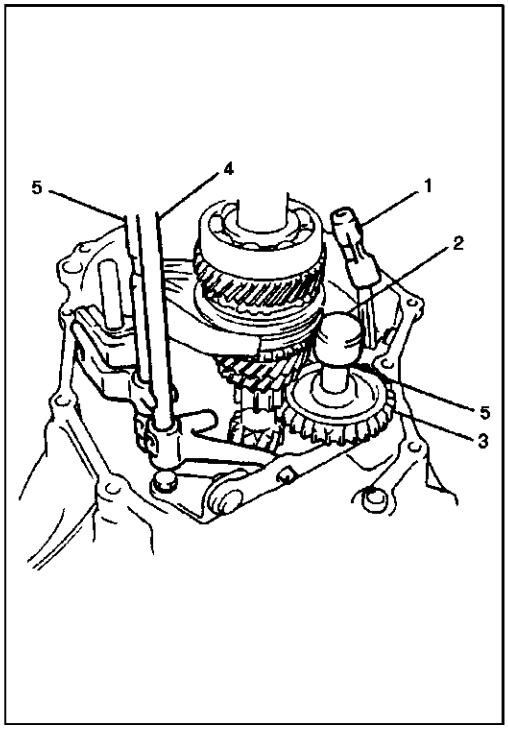
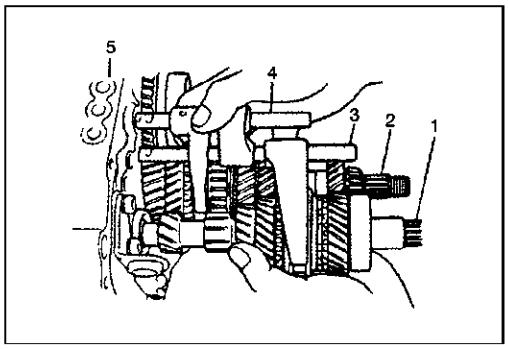


11) Remove gear shift yoke (1).
12) Pull out reverse gear shaft (2) with washer, then take off reverse idler gear (3).
13) Pull out 5th & REV gear shift guide shaft (4) together with 5th & REV gear shift shaft (5).

NOTE:
When removing 5th & REV gear shift shaft and guide shaft, push up high speed gear shift shaft and shift it to 4th to facilitate removal of 5th & REV shifter.



14) Tapping input shaft (1) end with plastic hammer, push it out as assembly from case a little, then take out input shaft assembly, counter shaft assembly (2), high speed gear shift shaft (3) and low speed gear shift shaft (4) all at once.
15) Remove countershaft L bearing cup from left case (5).
16) Remove differential side L oil seal also from left case.

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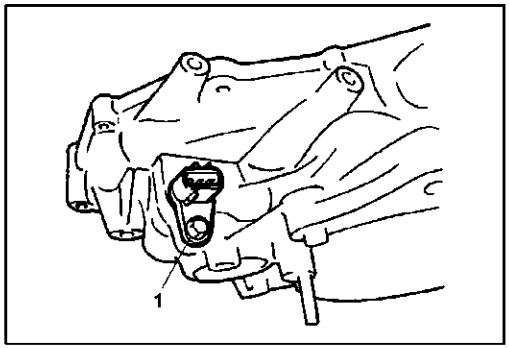
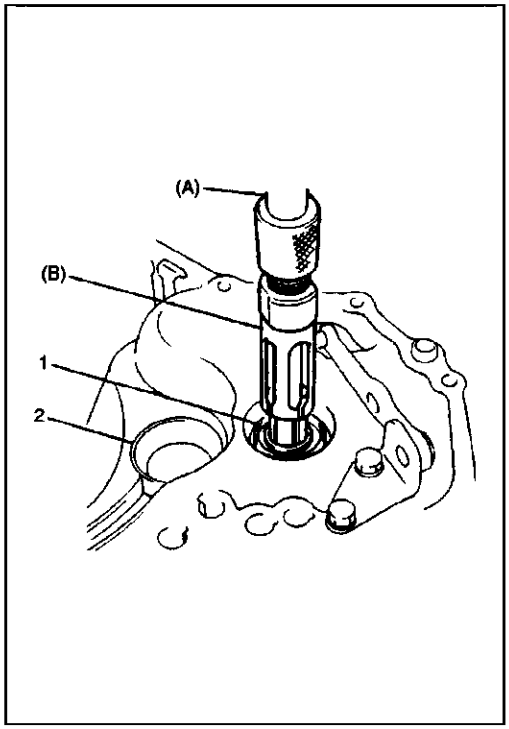


RIGHT CASE

1) Remove differential gear assembly from right case.
2) Remove bolt and then pull out speed sensor (1).

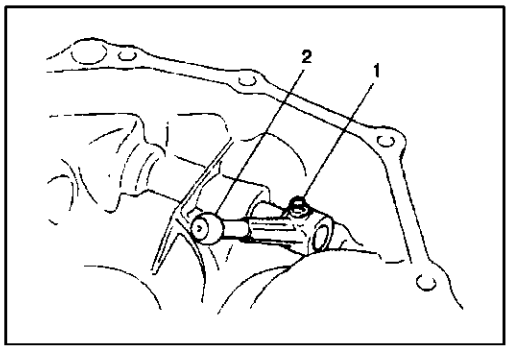


3) Remove input shaft oil seal (1) by using special tools (combination of bearing remover and sliding shaft).

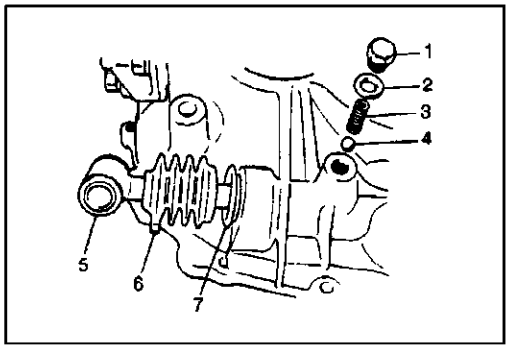
   Special Tools
   (A): 09930-30102
   (B): 09923-74510

4) Also pull out countershaft R bearing cup (2) by using bearing remover (09941-64511) with sliding shaft (09930-30102).

   NOTE:
   If input shaft R bearing has been left in right case, pull it out by using bearing remover (09923-73210) with sliding shaft (09930-30102).



5) Remove bolt (1) and then pull out gear shift arm (2).



6) Remove gear shift shaft bolt (1) with washer (2), then take out spring (3) and steel ball (4).
7) Remove gear shift shaft (5), boot (6) and oil seal (7).
8) Remove differential side R oil seal from right case.

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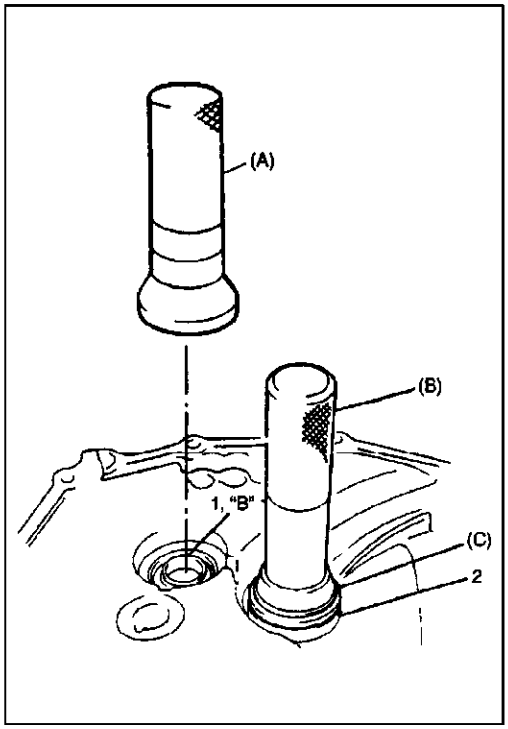


SUB ASSEMBLY SERVICE

RIGHT CASE

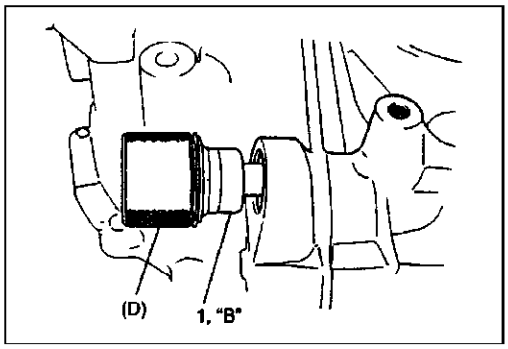
1) Install input shaft oil seal (1) facing its spring side upward. Use special tool and hammer for installation and apply grease to oil seal lip.

"B": SUZUKI SUPER GREASE A, 99000-25010

Special Tool
(A): 09951-76010

2) Install countershaft R bearing cup (2) by using special tools and hammer.

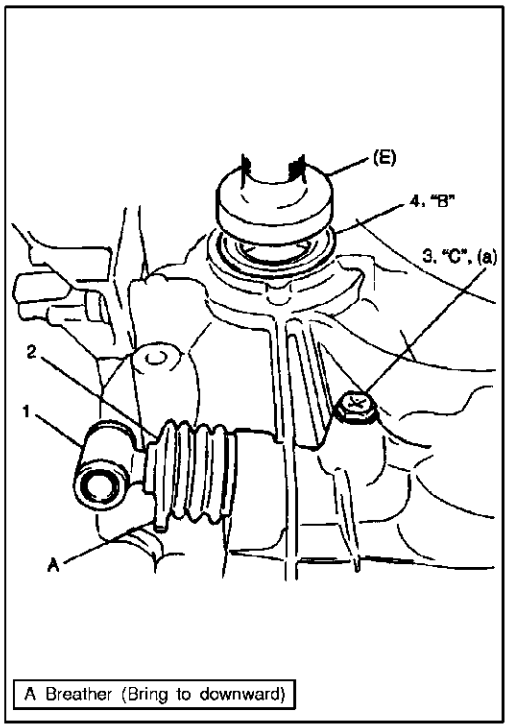
Special Tools
(B): 09924-74510
(C): 09925-68210



3) Apply grease to gear shift shaft oil seal (1) at its lip and install it up to bottom of the bore by using special tool and hammer.

"B": SUZUKI SUPER GREASE A, 99000-25010

Special Tool
(D): 09925-58210



4) Install gear shift shaft (1), boot (2), steel ball, spring and tighten bolt (3) with washer applied with sealant.

"C": SUZUKI BOND NO.1215, 99000-31110

Tightening Torque
(a): 13 N-m (1.3 kg-m, 9.5 lb-ft)

NOTE:
Bring breather of gear shift shaft boot downward.

5) Install differential side R oil seal (4) until it becomes flush with case surface by using special tool with hammer, and then apply grease to its lip.

NOTE:
Face differential side oil seal spring side inward.

"B": SUZUKI SUPER GREASE A, 99000-25010

Special Tool
(E): 09913-75510

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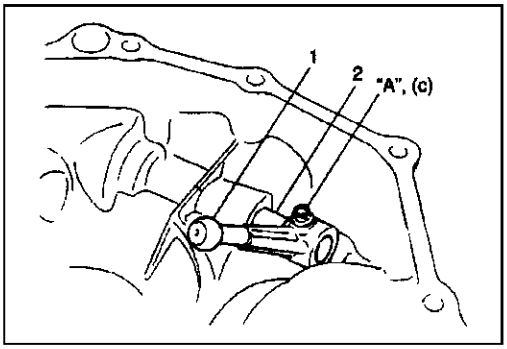
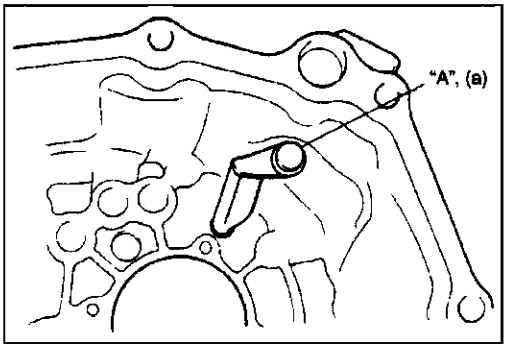


6) Insert gear shift arm (1) in gear shift shaft (2), then fasten them with bolt applied with thread lock cement.

Tightening Torque
(c): 34 N-m (3.4 kg-m, 24.5 lb-ft)

"A": Thread lock 1322, 99000-32110

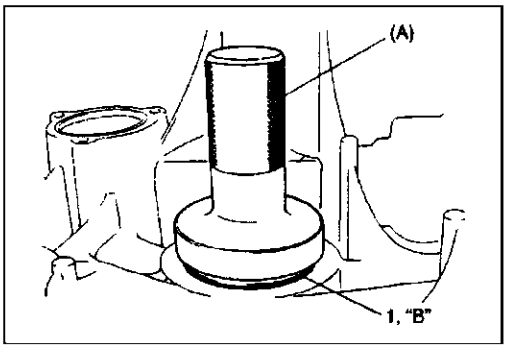


LEFT CASE

1) If input oil gutter has been removed, install it with bolt applied with thread lock cement.

"A": Thread lock 1322, 99000-32110

Tightening Torque
(a): 10 N-m (1.0 kg-m, 7.5 lb-ft)



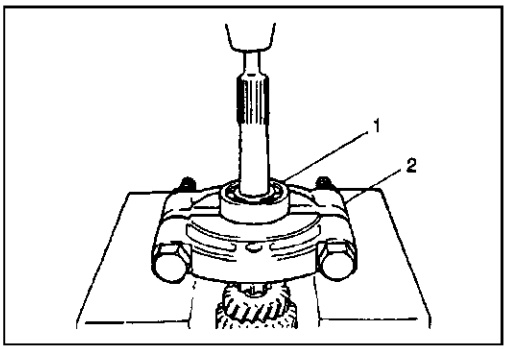
2) Install differential side L oil seal (1) until it becomes flush with case surface by using special tool with hammer, and then apply grease to its lip.

NOTE:
Face oil seal spring side inward.

"B": SUZUKI SUPER GREASE A, 99000-25010

Special Tool
(A): 09913-75510

3) Install countershaft L bearing cup into case bore by tapping it with plastic hammer lightly.



INPUT SHAFT ASSEMBLY

Disassembly

1) Remove input shaft R bearing (1) by using bearing puller (2) and press.

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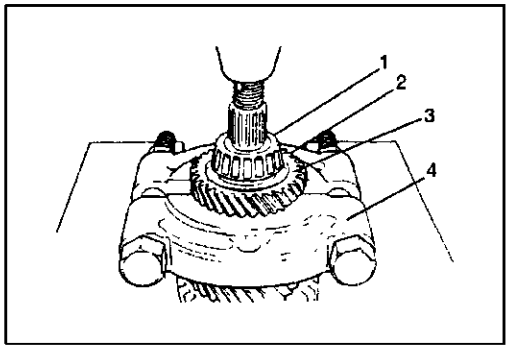
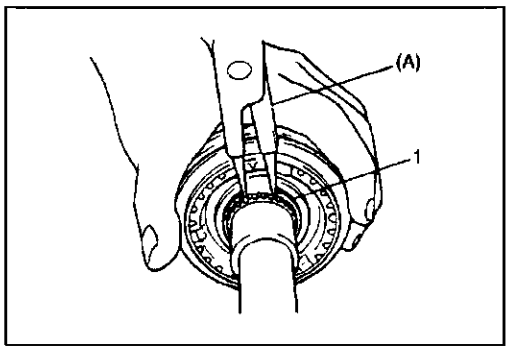


2) Drive out 5th gear spacer (1), L bearing (2) and 4th gear (3) all at once by using puller (4) and press.

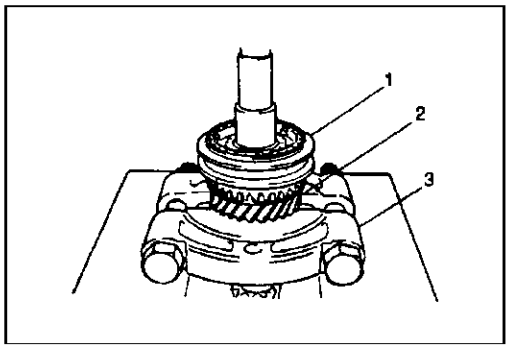
CAUTION:
- **To avoid gear tooth from being damaged, support it at flat side of bearing puller.**
- **Stop press work in the middle way and take out 5th gear bush to prevent it from being compressed and then continue to remove bearing with gear.**



3) Take out 4th gear needle bearing and high speed synchronizer ring.
4) Using special tool, remove circlip (1).

NOTE:
For smooth removal of circlip, it is recommended to correct tool tips to be flat.

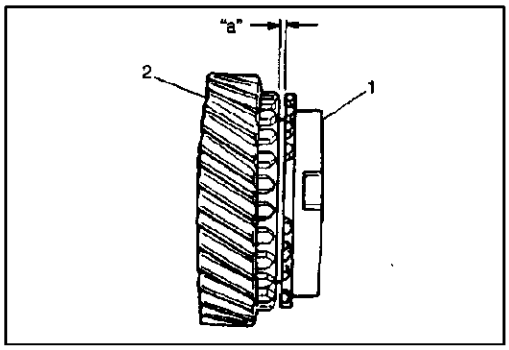
Special Tool
(A): 09900-06107



5) Drive out high speed synchronizer sleeve & hub assembly (1) together with 3rd gear (2) by using puller (3) and press.

CAUTION:
Make sure to use flat side of puller to avoid causing damage to 3rd gear tooth.

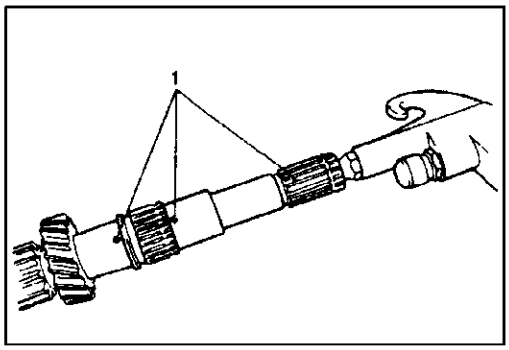
6) Take out 3rd gear needle bearing from shaft.
7) Disassemble synchronizer sleeve & hub assembly (1).



Inspection and Reassembly

1) Clean all components thoroughly, inspect them for any abnormality and replace with new ones as necessary.
2) If synchronizer parts (1) need to be repaired, check clearance "a" between ring and gear, each chamfered tooth of gear (2), ring (2) and sleeve, then determine parts replacement.

Clearance "a": Standard 1.0–1.4 mm (0.039–0.055 in.)
Service limit 0.5 mm (0.019 in.)



3) To ensure lubrication, air blow oil holes (1) and make sure that they are free from any obstruction.

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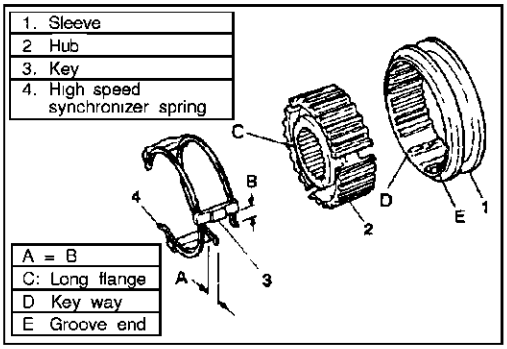
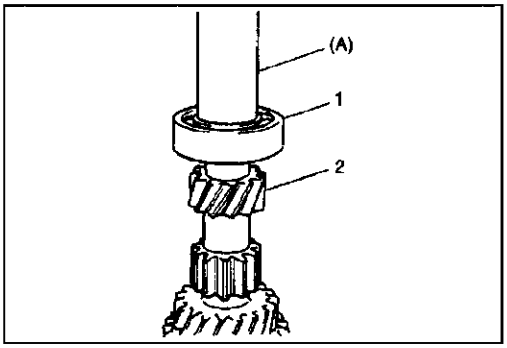


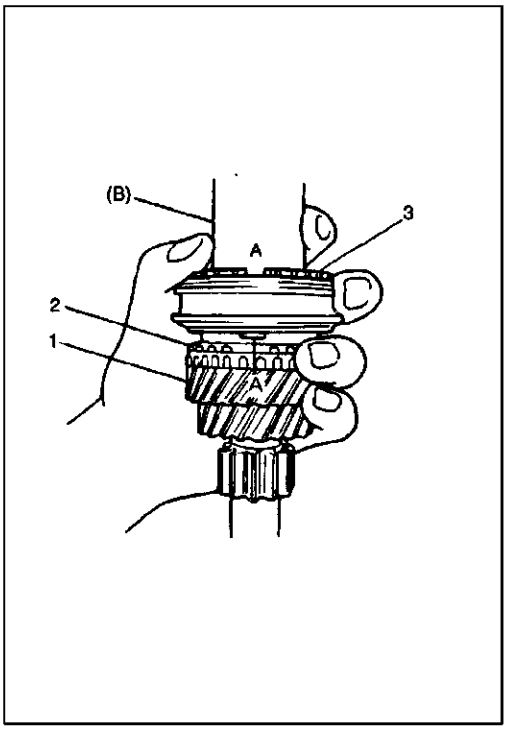
4) Fit high speed synchronizer sleeve (1) to hub (2), insert 3 keys (3) in it and then set springs (4) as illustrated left.

NOTE:
- **No specific direction is assigned to each key but it is assigned as assembly.**
- **Size of high speed synchronizer sleeve, hub, keys and springs is between those of low speed and 5th speed ones.**



5) Drive in R bearing (1) to input shaft (2) by using special tool and hammer.

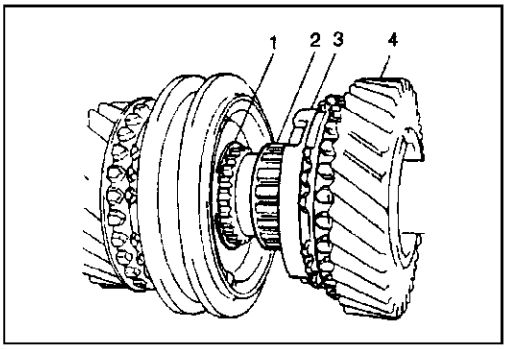
Special Tool
(A): 09925-98221



6) Install 3rd gear needle bearing, apply oil to it, then install 3rd gear (1) and synchronizer ring (2).
7) Drive in high speed sleeve & hub assembly (3) by using special tool and hammer, facing long flange side of hub to 3rd gear.

NOTE:
- **While press-fitting sleeve & hub (3), make sure that synchronizer ring key slots are aligned with keys in sleeve & hub assembly.**
- **Check free rotation of 3rd gear (1) after press-fitting sleeve & hub assembly (3).**
- **Synchronizer rings for 3rd and 4th are identical respectively.**

Special Tool
(B): 09913-84510



8) Install new circlip (1), needle bearing (2), apply oil to bearing, then install synchronizer ring (3) and 4th gear (4).

CAUTION:
Confirm that circlip (1) is installed in groove securely.

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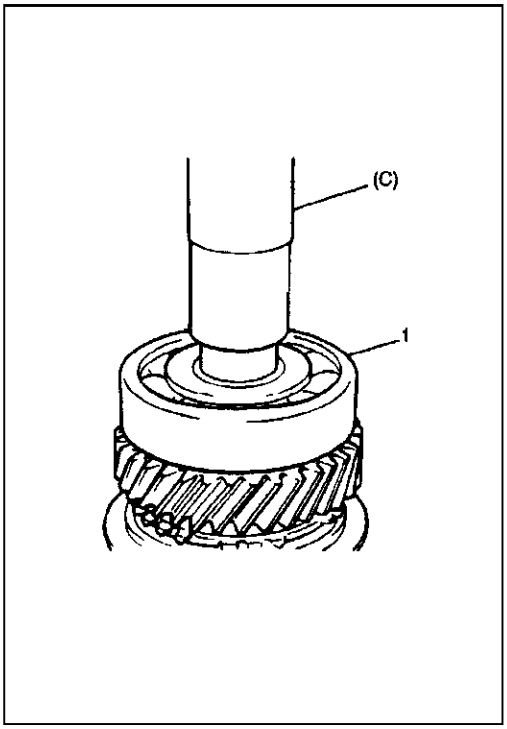
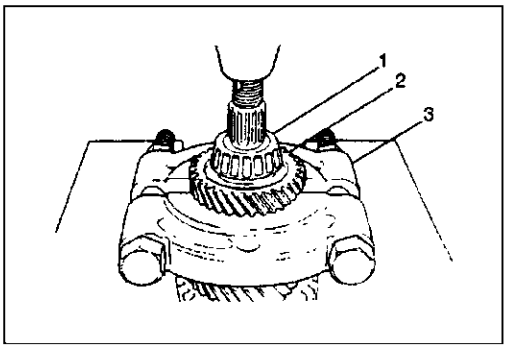


9) Press-fit L bearing (1) by using special tool and hammer.

Special Tool
(C): 09925-98221

10) Using the same special tool, drive in 5th gear spacer.

CAUTION:
To prevent 5th gear spacer from being distorted because of excessive compression, do not press-fit it with L bearing at once.

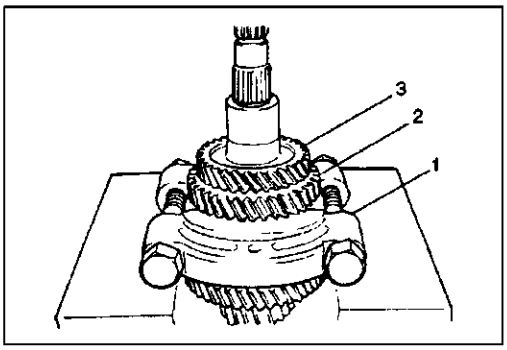


COUNTERSHAFT ASSEMBLY

Disassembly

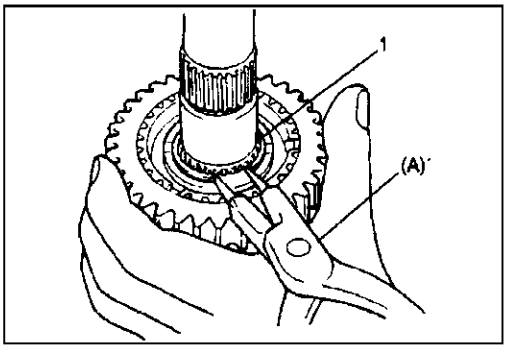
1) Drive out L bearing cone (1) with 4th gear (2) by using puller (3) and press.

CAUTION:
- **Use puller and press that will bear at least 5 ton (11,000 lb) safely.**
- **To avoid tooth damage, support 4th gear at flat side of puller.**



2) Apply puller (1) to 2nd gear (2) and drive out 3rd & 4th gear spacer (3) together with 2nd gear (2) by using press. Needle bearing would come out with 2nd gear (2).

CAUTION:
If compression exceeds 5 ton (11,000 lb), release compression once, reset puller support and then continue press work again.



3) Take out 2nd synchronizer ring.
4) Using special tool, remove circlip (1).

NOTE:
Correct tool tips to be flat to facilitate removal of circlip.

Special Tool
(A): 09900-06107

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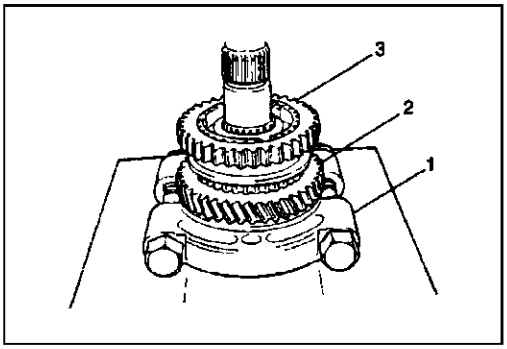
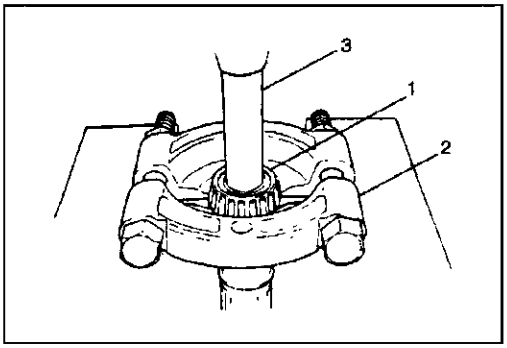
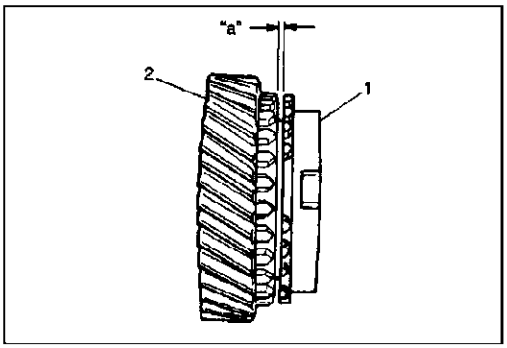


5) Apply puller (1) to 1st gear (2) and drive out low speed synchronizer sleeve & hub assembly (3) with gear by using press.
6) Disassemble synchronizer sleeve & hub assembly (3).
7) Take out needle bearing from shaft.



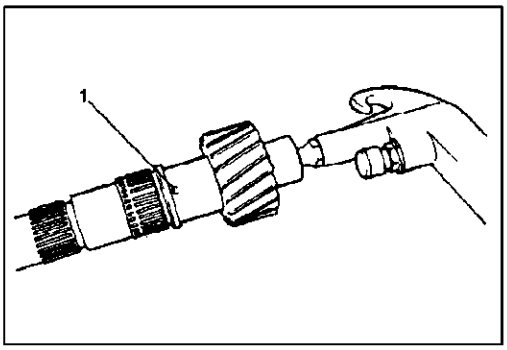
8) Remove R bearing cone (1) by using puller (2), metal stick (3) and press.



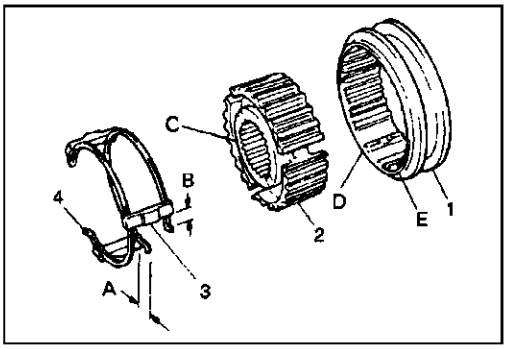
Inspection and Reassembly

1) Clean all components thoroughly, inspect them for any abnormality and replace with new ones as necessary.
2) If synchronizer parts (1) need to be repaired, check clearance "a" between ring (1) and gear (2), each chamfered tooth of gear, ring and sleeve, then determine parts replacement.

Clearance "a": Standard 1.0 – 1.4 mm (0.039 – 0.055 in.)
Service limit 0.5 mm (0.019 in.)



3) To ensure lubrication, air blow oil holes (1) and make sure that they are free from any obstruction.



4) Fit low speed synchronizer sleeve (1) to hub (2), insert 3 keys (3) in it and then set springs (4) as illustrated left.

NOTE:
- **No specific direction is assigned to low speed synchronizer hub (2) or each key (3) but it is assigned as assembly.**
- **Size of low speed synchronizer keys and springs are the largest compared with those of high speed and 5th speed ones.**

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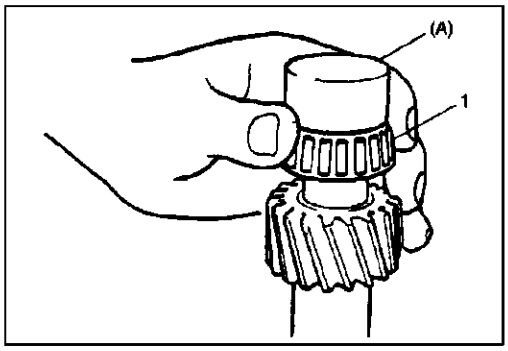
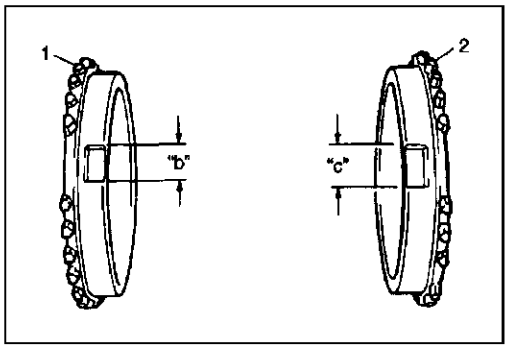


5) Install R bearing cone (1) by using special tool and hammer.

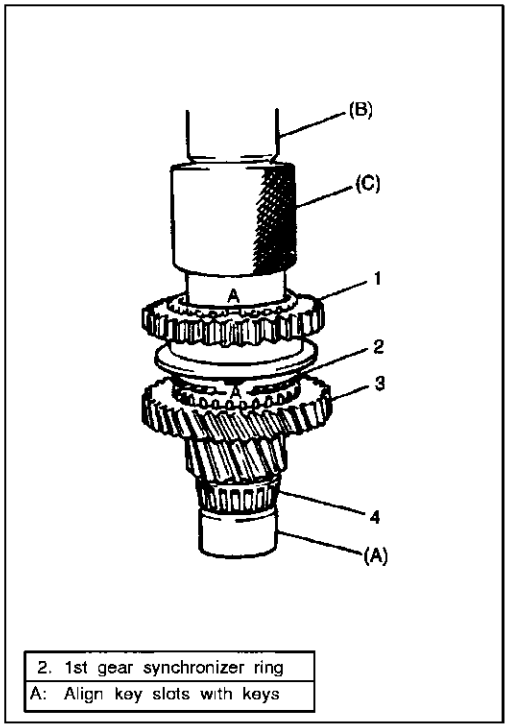
Special Tool
(A): 09923-78210



6) Install needle bearing, apply oil to it, then install 1st gear and 1st gear synchronizer ring (1).

NOTE:
- **Key slot width of 1st synchronizer ring is smaller than that of 2nd synchronizer ring (2).**
  Distinguish the difference properly.

Width "b": 8.2 mm (0.32 in.)
"c": 8.8 mm (0.35 in.)
- **Needle bearings for 1st and 2nd gear are identical.**

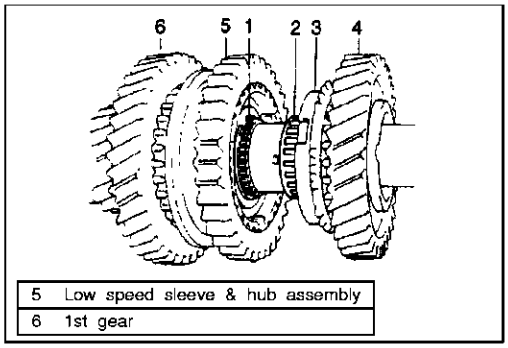


2. 1st gear synchronizer ring
A: Align key slots with keys

7) Drive in low speed sleeve & hub assembly (1) by using special tool and hammer.

NOTE:
- **Support shaft with special tool as illustrated left so that retainer of bearing cone (4) will be free from compression.**
- **Make sure that synchronizer ring key slots are aligned with keys while press-fitting sleeve & hub assembly.**
- **Check free rotation of 1st gear (3) after press-fitting sleeve & hub assembly.**

Special Tools
(A): 09923-78210
(B): 09925-18010
(C): 09940-53111



5	Low speed sleeve & hub assembly
6	1st gear

8) Install new circlip (1), needle bearing (2), apply oil to bearing, then install 2nd gear synchronizer ring (3) and 2nd gear (4).

CAUTION:
Confirm that circlip is installed in groove securely.

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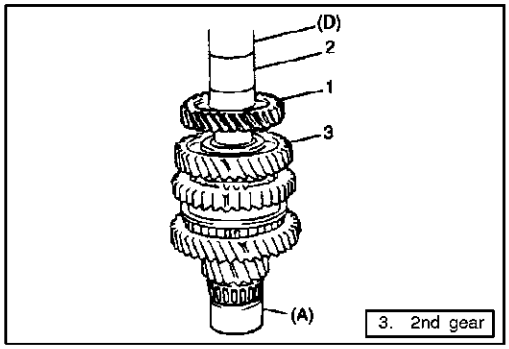
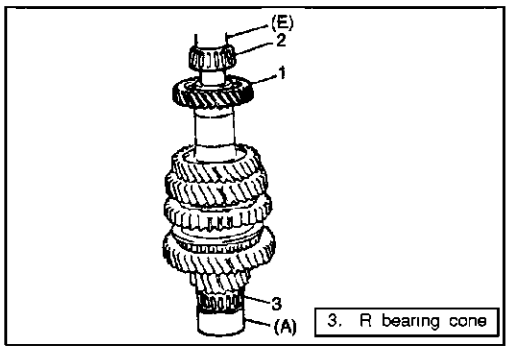


9) Press-fit 3rd gear (1) and spacer (2) by using special tool and press.

NOTE:
It is recommended to press-fit spacer and 3rd gear first, and then 4th gear later separately so that countershaft will not be compressed excessively.

Special Tools
(A): 09923-78210
(D): 09913-80112



10) Press-fit 4th gear (1) by using the same procedure as the above.
11) Install L bearing cone (2) by using special tool and hammer.

NOTE:
For protection of bearing cone, always support shaft with special tool as illustrated.

Special Tools
(A): 09923-78210
(E): 09925-98221

GEAR SHIFTER

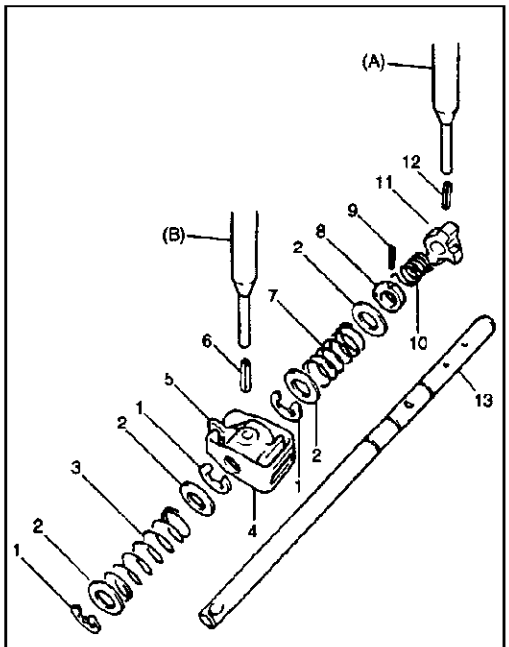
Gear Shift & Select Shaft Assembly

1) To disassemble component parts, use special tools and 2.8 – 3.0 mm (0.11 in.) pin remover in addition.

Special Tools
(A): 09922-85811 (4.5 mm)
(B): 09925-78210 (6.0 mm)

2) Clean all parts thoroughly, inspect them and replace with new ones as required.
3) Assemble component parts by reversing removal procedure.

NOTE:
- **When driving in spring pins, prevent shaft from being bent by supporting it with wood block.**
- **Assemble 5th & REV gear shift cam by winding cam guide return spring, and then drive in spring pin.**
- **Locate low speed select spring (Green-Lower position) and reverse select spring (Yellow-Upper position) correctly.**



1	E-ring
2	Washer
3	Low speed select spring (Green)
4	Gear shift interlock plate
5	Gear shift & select lever
6	Spring pin (Double)
7	Reverse select spring (Yellow)
8	5th & REV gear shift cam guide
9	Spring pin [Apply spring pin remover of 2.8 – 3.0mm/(0.11 in.) diameter]
10	Cam guide return spring
11	5th & REV gear shift cam
12	Spring pin
13	Gear shift & select shift

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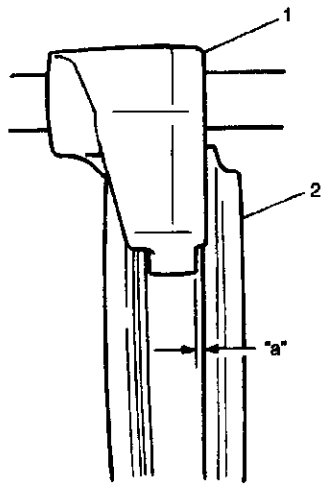


1 Gear shift form
2 Synchronizer sleeve

High Speed and Low Speed Gear Shift Shafts

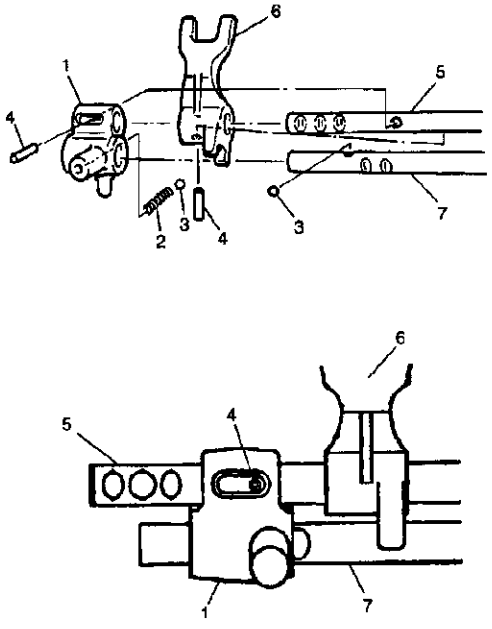
Inspection

1) Using feeler gauge, check clearance between fork and sleeve and replace those parts if it exceeds limit of 1.0 mm (0.039 in.)

   NOTE:
   For correct judgement of parts replacement, carefully inspect contact portion of fork and sleeve.

   Clearance "a": Service limit 1.0 mm (0.039 in.)

2) Insert each gear shift shaft into case and check that it moves smoothly. If it doesn't, correct by using oilstone, reamer or the like.



1. Reverse gear shift arm
2. Reverse gear shift arm spring (Blue)
3. Steel ball
4. Spring pin
5. 5th & REV gear shift shaft
6 5th & REV gear shift yoke
7. 5th & REV gear shift guide shaft
A: Face pin slit toward front

5th & REV Gear Shifter

1) Disassemble component parts by using special tool and hammer.

   Special Tool
   (A): 09922-85811 (4.5 mm)

2) Replace or correct parts as required and assemble shafts making sure that component parts are in proper order as shown left.

   NOTE:
   - **Distinguish reverse gear shift arm spring (Blue) from low speed locating spring (Purple).**
   - **Install 2 steel balls in reverse gear shift arm without fail.**
   - **Drive in spring pin for reverse shift arm facing slit A toward front.**

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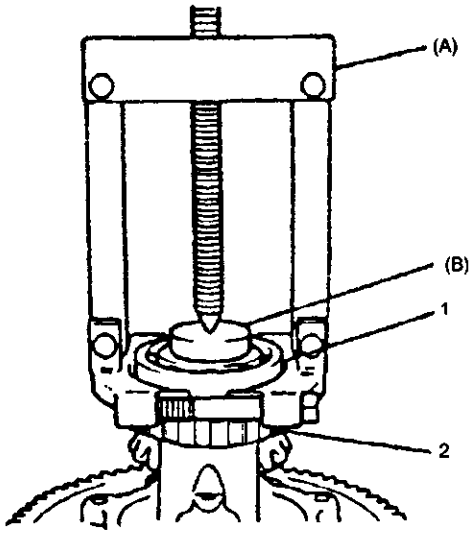


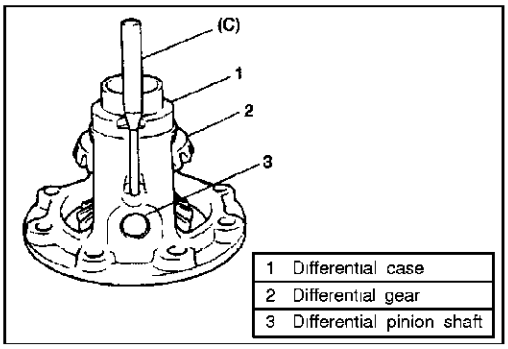
DIFFERENTIAL ASSEMBLY

Disassembly

1) Using special tool, remove right bearing (1).

Special Tools
(A): 09913-65810
(B): 09925-88210

2) Drive out speed sensor rotor (2) using puller and press.
3) Remove left bearing using puller while supporting its center shaft as described above.
4) Support differential case with soft jawed vise and remove 8 final gear bolts then take out final gear.

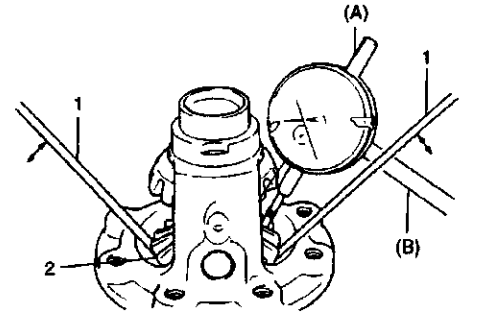


1	Differential case
2	Differential gear
3	Differential pinion shaft

5) Using special tool and hammer, drive out differential side pinion shaft pin and then disassemble component parts.

Special Tool
(C): 09922-85811 (4.5 mm)

Left side



1	Screwdriver
2.	Differential gear

Adjustment and Reassembly

Judging from abnormality noted before disassembly and what is found through visual check of component parts after disassembly, prepare replacing parts and proceed to reassembly. Make sure that all parts are clean.

1) Assemble differential gear and measure thrust play of differential gear as follows.

Special Tools
(A): 09900-20606
(B): 09900-20701

Differential gear thrust Play:
0.03 – 0.40 mm (0.002 – 0.013 in.)

Left side

- Hold differential assembly with soft jawed vise and apply measuring tip of dial gauge to top surface of gear.
- Using 2 screwdrivers, move gear up and down and read movement of dial gauge pointer.

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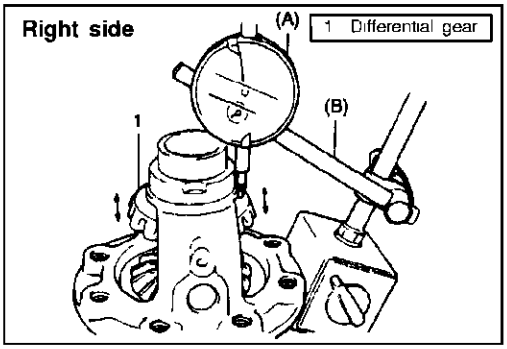
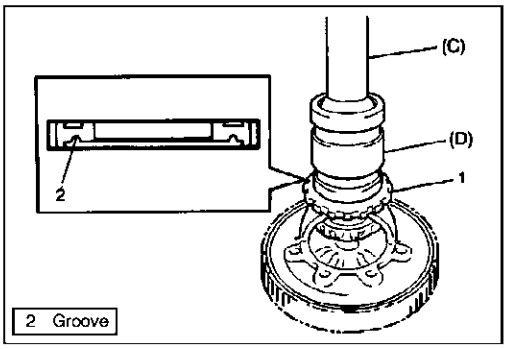


Right side

- Using similar procedure to the above, set dial gauge tip to gear shoulder.
- Move gear up and down by hand and read dial gauge.

2) If thrust play is out of specification, select suitable thrust washer from among following available size, install it and check again that specified gear play is obtained.

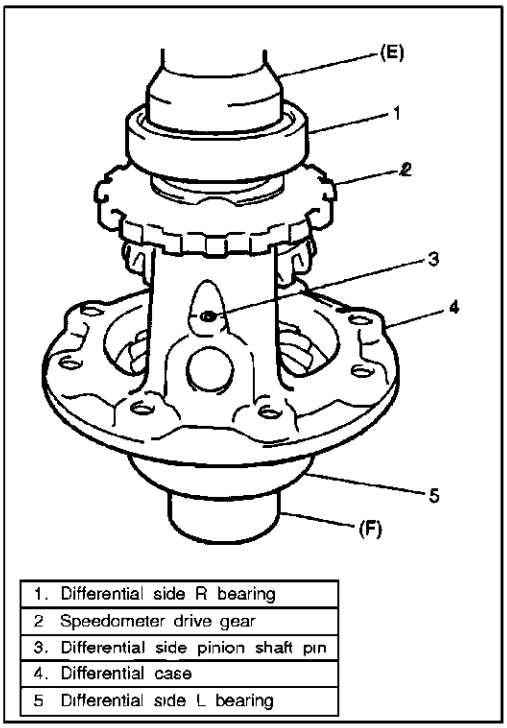
Available thrust washer thickness	0.9, 1.0 and 1.1 mm (0.035, 0.039 and 0.043 in.)



3) Install speed sensor rotor (1) using special tools and press.

NOTE:
Be sure to install in the direction as shown in figure.

Special Tools
(C): 09951-76010
(D): 09940-54910



4) Drive in spring pin (3) from right side till it is flush with differential case surface.
5) Press-fit L bearing by using special tool and copper hammer.

Special Tools
(E): 09951-76010
(F): 09951-16060

6) Install speed sensor rotor (2) drive gear, support differential assembly as illustrated so as to L bearing is floating, and then press-fit R bearing like L bearing in Step 5).

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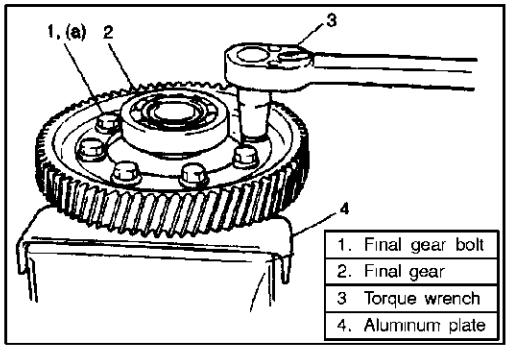


7) Hold differential assembly with aluminum plates placed on vise, install final gear and then tighten it with 8 bolts to specified torque.

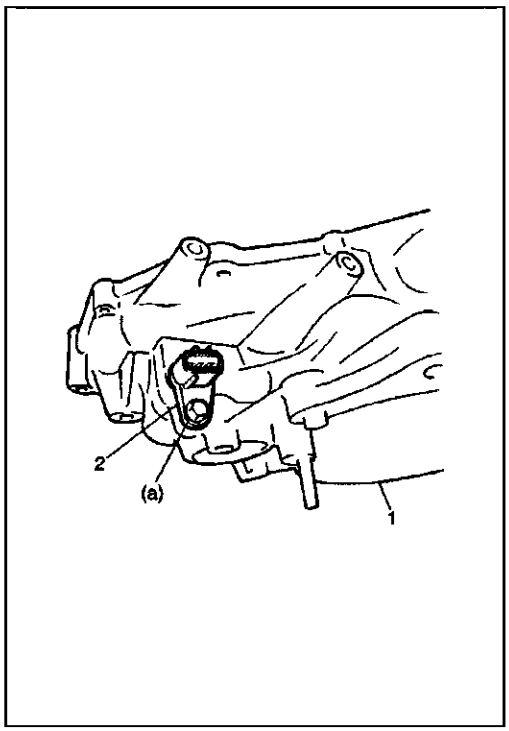
CAUTION:
Use of any other bolts than specified ones is prohibited.

Tightening Torque
(a): 90 N-m (9.0 kg-m, 65.0 lb-ft)

ASSEMBLING UNIT

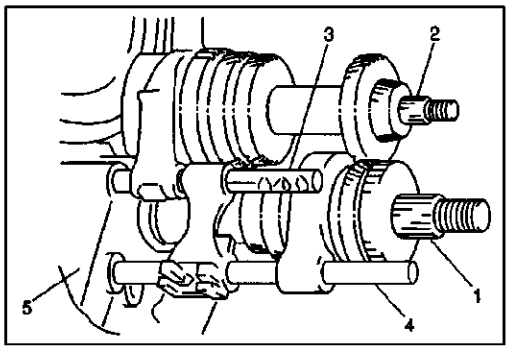
DIFFERENTIAL TO LEFT CASE

1) Install differential assembly into right case (1).
2) Insert speed sensor (2) applied with oil to its O-ring, then tighten it with bolt.



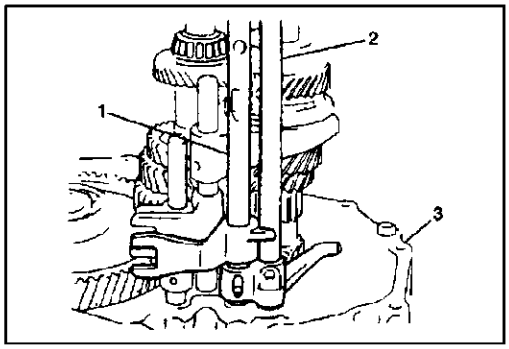
CAUTION:
- **While inserting case assembly into transmission, turn final gear by hand slightly so that gear can mesh easily.**
- **Never push or hit slit portion of case when inserting it. Such attempt may cause case to break.**

Tightening Torque
(a): 5.5 N-m (0.55 kg-m, 4.0 lb-ft)



3) Join input shaft (1), countershaft (2), low speed gear shift shaft (3) and high speed gear shift shaft (4) assemblies all together, then install them into right case (5).

NOTE:
- **Input shaft R bearing on shaft can be installed into right case by tapping shaft with plastic hammer.**
- **Check to make sure that counter shaft is engaged with final gear while installing.**



4) Install 5th & REV gear shift shaft (1) with 5th & REV gear shift guide shaft (2) into right case (3).

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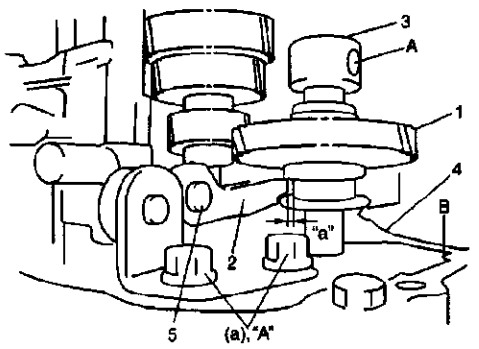


A: Thread hole

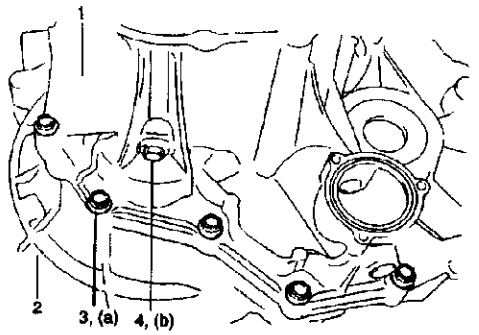
5) Install reverse gear shift lever (2). Apply thread lock to bolts. Reverse gear shift arm (5) has to be joined with reverse gear shift lever (2) at the same time.

"A": Thread lock 1322, 99000-32110

Tightening Torque
(a): 23 N-m (2.3 kg-m, 17.0 lb-ft)

6) Make reverse idler gear (1) with reverse gear shift lever (2), insert reverse gear shaft (3) into case (4) through idler gear (1) and then align A in shaft with B in case.

NOTE:
- **Make sure that washer has been installed in shaft at above the gear.**
- **Check to confirm that reverse gear shift lever (2) end has clearance "a" 1 mm (0.04 in.) to idler gear groove.**



1	Left case
2.	Right case
3.	Case bolt
4.	Reverse shaft bolt

7) Clean mating surfaces of both right and left cases, coat mating surface of left case with sealant evenly then mate it with right case.

Sealant: SUZUKI BOND No.1215, 99000-31110

8) Tighten case bolts from outside to specified torque.

Tightening Torque
(a): 19 N-m (1.9 kg-m, 14.0 lb-ft)

9) Install reverse shaft bolt with aluminum washer and tighten it.

Tightening Torque
(b): 23 N-m (2.3 kg-m, 17.0 lb-ft)

10) Install another 4 case bolts from clutch housing side and tighten them to specification.

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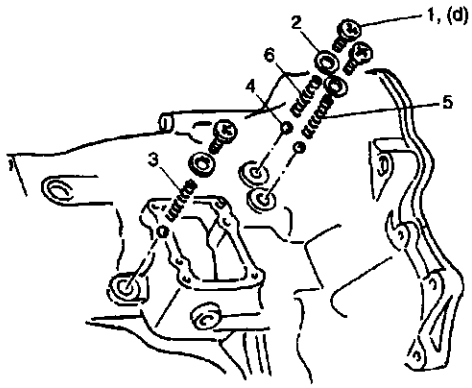

1. Gear shift locating bolt
2. Washer
3. Low speed locating spring (Green)
4. Stee ball
5. High speed locating spring (Green)
6. 5th & REV locating spring (Pink)

11) Check locating spring for deterioration and replace with new one as necessary.

Locating spring free length	Standard	Service Limit
5th & REV (Pink painted)	33.8 mm (1.331 in.)	32.7 mm (1.287 in.)
High speed, Low speed (Green painted)	33.6 mm (1.323 in.)	32.5 mm (1.280 in.)

12) Install steel ball and locating spring for respective gear shift shaft and tighten with bolt.

Tightening Torque
(d): 13 N-m (1.3 kg-m, 9.5 lb-ft)

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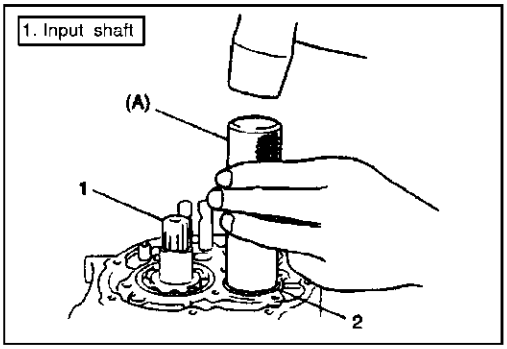
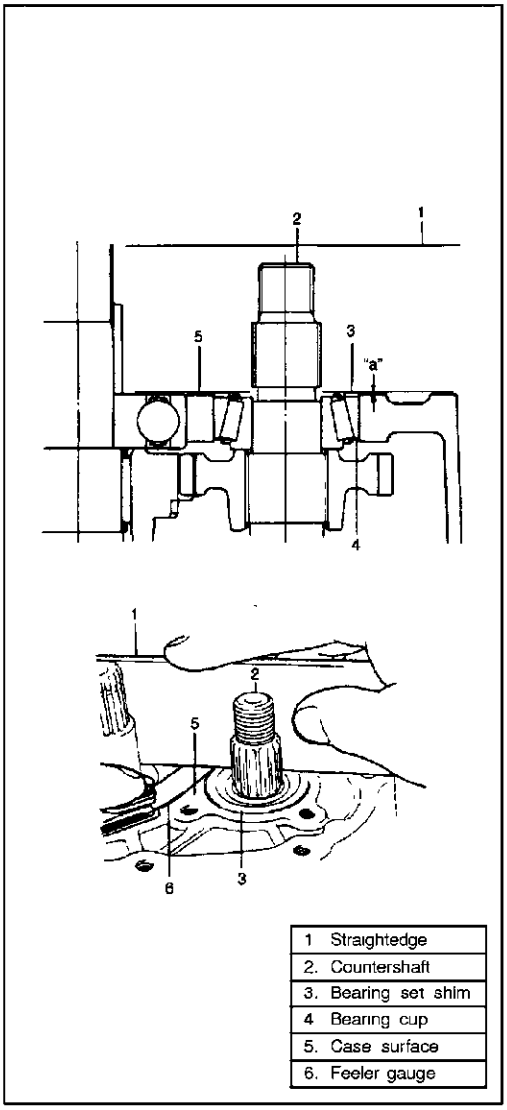


FIFTH GEARS

1) To seat countershaft L bearing cup (2) to bearing cone, tap cup by using special tool and plastic hammer.

Special Tool
(A): 09913-84510



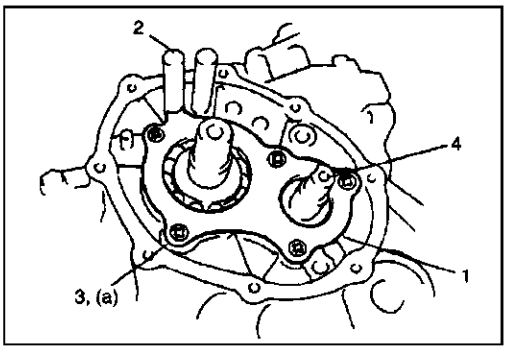
2) Put a shim on bearing cup provisionally, place straight edge over it and compress it by hand through straight edge, and then measure "a" (Clearance between case surface and straight edge) by using feeler gauge.

Clearance "a": 0.13 – 0.17 mm (0.0051 – 0.0067 in.)
(Shim protrusion)

3) By repeating above step, select a suitable shim which adjusts clearance "a" to specification and put it on bearing cup.

NOTE:
Insert 0.15 mm (0.0059 in.) feeler to know whether or not a shim fulfills specification quickly.

Available shim thickness	0.45, 0.50, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0, 1.05, 1.1, 1.15 and 1.20 mm (0.017, 0.019, 0.021, 0.023, 0.025, 0.027, 0.029, 0.031, 0.033, 0.035, 0.037, 0.039, 0.041, 0.043 0.045 and 0.047 in.)



4) Place left case plate (1) inserting its end in groove of shift guide shaft (2) and then tighten it with new screws (3).

NOTE:
- **Be sure to use new screws.**
- **After tightening screws, make sure that counter shaft (4) can be rotated by hand feeling some load.**

Tightening Torque
(a): 9 N-m (0.9 kg-m, 6.5 lb-ft)

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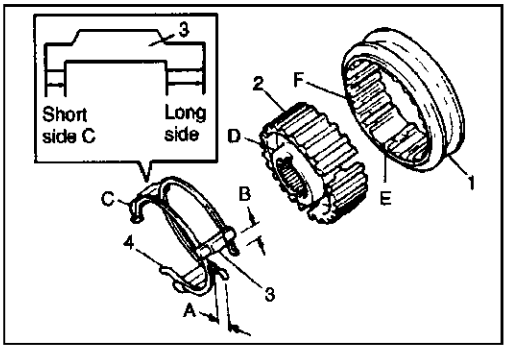
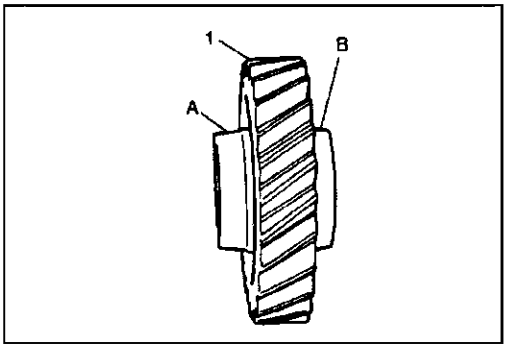
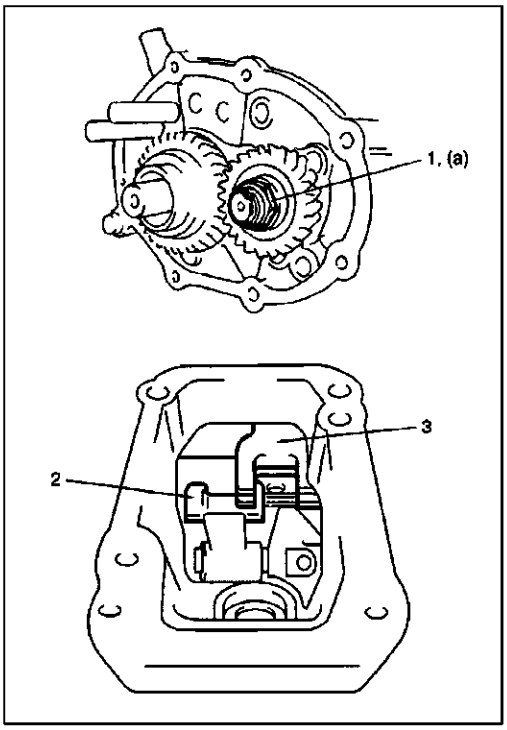


5) Assemble 5th speed synchronizer sleeve (1) and hub (2) with keys (3) and springs (4).

NOTE:
Short side C in keys, long boss D in hub and chamfere spline F in sleeve should face inward (5th gear side).



6) Install countershaft 5th gear (1) to counter shaft facing machined boss A inward.
7) Apply oil to needle bearing and install it to input shaft.
8) Install input shaft 5th gear to input shaft.



9) Install counter shaft nut (1) as follows:
   a. Shift low speed gear shift shaft (2) to 1st gear position an high speed gear shift shaft (3) to 3rd gear position.
   b. Tighten nut with above double engagement and return shift shafts to neutral position.

Tightening Torque
(a): 60 N-m (6.0 kg-m, 43.4 lb-ft)

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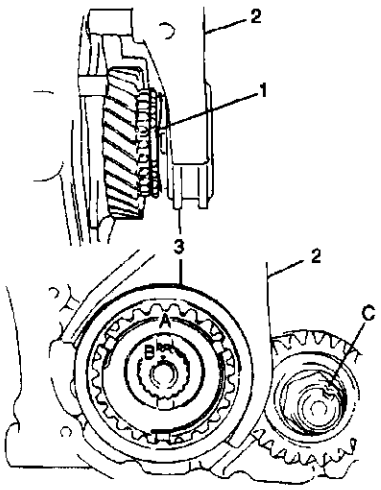
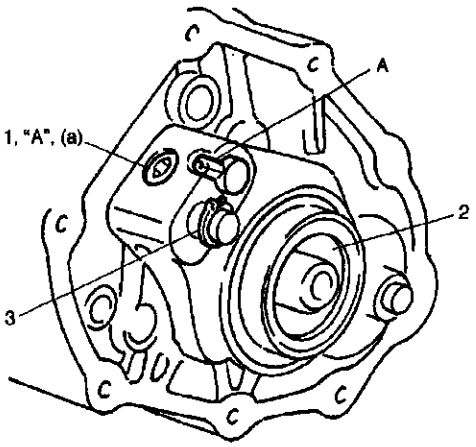


A: Oil groove (Align with B)
B: Punch mark (Shows oil hole)
C: Caulking

10) Caulk nut at C with caulking tool and hammer.
11) Install synchronizer ring (1).
12) Fit 5th gear shift fork (2) to sleeve & hub assembly (3) and install them into input shaft, shift shaft and shift guide shaft at once aligning hub oil groove A with shaft mark B.

NOTE:
Long boss of hub faces inward (gear side).



A Pin slit (Face outward)

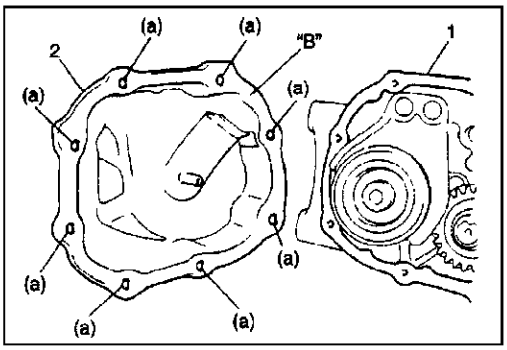
13) Drive in spring pin facing its slit A outward.
14) Install steel ball, tighten shift fork plug (1) applied with thread lock cement.

"A": Thread lock 1322, 99000-32110

Tightening Torque
(a): 9 N-m (0.9 kg-m, 6.5 lb-ft)

15) Fit hub plate (2) and fix it with circlip.
16) Install circlip (3) to the end of 5th & reverse gear shift guide shaft.
Make sure circlip is installed in shaft groove securely.

CAUTION:
Coat shift fork plug with thread lock cement reasonably. If it is done to much, excess may interfere in ball movemen and cause hard shift to 5th speed.



17) Clean mating surface of both left case (1) and side cover (2), coat mating surface with sealant evenly, mate it with left case and then tighten with 8 bolts.

"B": SUZUKI BOND No.1215, 99000-31110

Tightening Torque for left cover bolts:
(a): 10 N-m (1.0 kg-m, 7.5 lb-ft)

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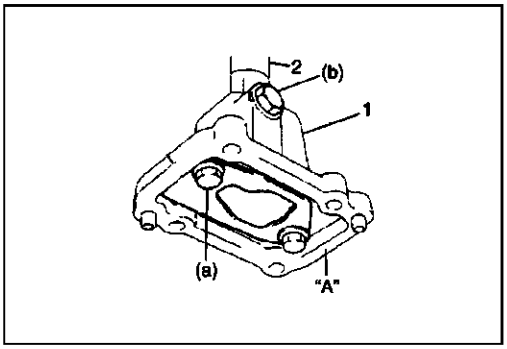


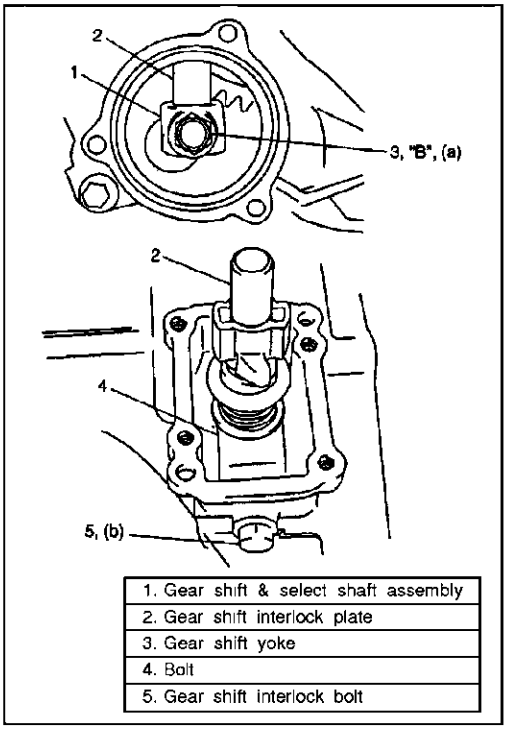
GEAR SHIFT & SELECT SHAFT ASSEMBLY

1) If gear shift guide case (1) has been disassembled or replaced, tighten bolts as specified below. Also check breather (2) hole for clog.

   Tightening Torque
   (a): 10 N-m (1.0 kg-m, 7.5 lb-ft)
   (b): 23 N- m (2.3 kg-m, 17.0 lb-ft)

2) Clean mating surface of guide case and coat it with sealant evenly.

   "A": SUZUKI BOND No.1215, 99000-31110



1. Gear shift & select shaft assembly
2. Gear shift interlock plate
3. Gear shift yoke
4. Bolt
5. Gear shift interlock bolt

3) Install gear shift yoke (1) and joint it with gear shift arm.
4) Install gear shift & select shaft assembly (2) into transmission and joint its bottom end with gear shift yoke (1).

   NOTE:
   When installing gear shift & select shaft assembly (2), position gear in neutral so that gear shift interlock plate (4) will go in smoothly.

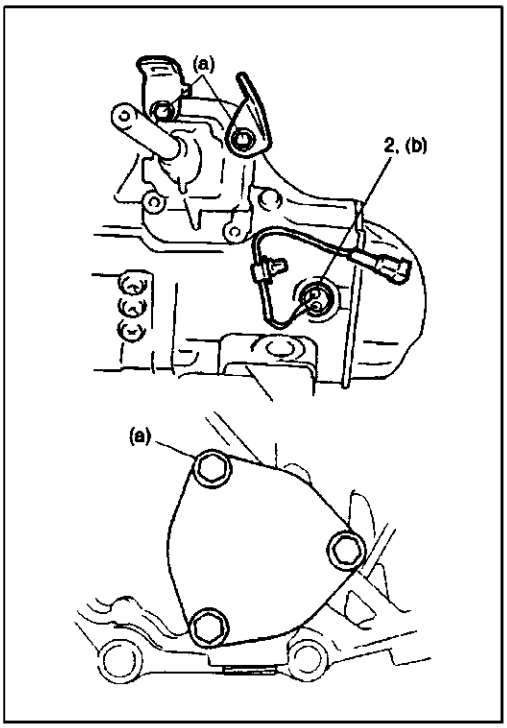
5) Tighten yoke and shaft with bolt (3) applied with thread lock cement.

   "B": Thread lock 1322, 99000-32110

   Tightening Torque
   (a): 34 N-m (3.4 kg-m, 24.5 lb-ft)

6) Install gear shift interlock bolt (5) with washer and tighten it to specification.

   Tightening Torque
   (b): 23 N-m (2.3 kg-m, 17.0 lb-ft)



7) Clean mating surface of left case and put gear shift guide case applied with sealant on it.

   Sealant: SUZUKI BOND No.1215, 99000-31110

8) Install wiring harness clamp and transmission hook, and fasten it together with gear shift guide case (1).

   Tightening Torque
   (a): 10 N-m (1.0 kg-m, 7.5 lb-ft)

9) Install back up light switch (2) and clamp its lead.

   Tightening Torque
   (b): 20 N-m (2.0 kg-m, 14.5 lb-ft)

10) Clean left case cap and mating surface of left case, check condition of O-ring and then fasten cap with 3 bolts.

    Tightening Torque
    (a): 10 N-m (1.0 kg-m, 7.5 lb-ft)

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11) Check input shaft for rotation in each gear position.
12) Also confirm function of back up light switch in reverse position by using ohmmeter.

REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCTS	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	• Oil seal lips • Gear shift control lever • Gear shift control shaft bushes
Sealant	SUZUKI BOND NO.1215 (99000-31110)	• Oil drain plug • Gear shift shaft bolt • Mating surface of transmission case • Mating surface of side cover • Mating surface of gear shift guide case
Thread lock cement	THREAD LOCK 1322 (99000-32110)	• Control lever knob • Reverse gear shift lever bolts • Oil gutter bolt • Gear shift yoke bolt • Shift fork plug

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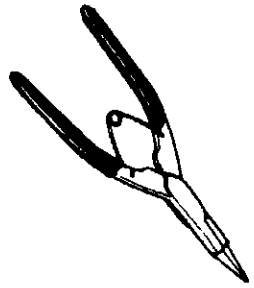
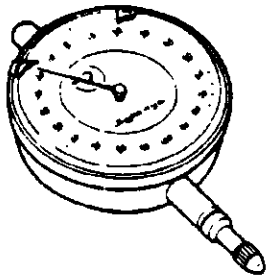
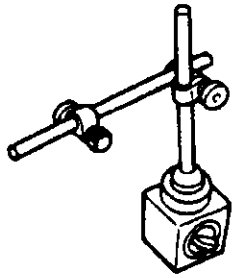
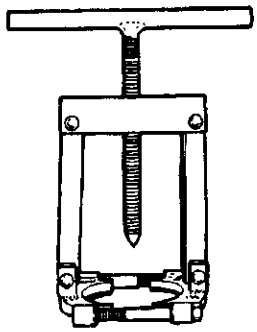
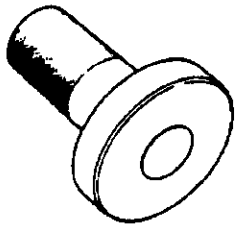
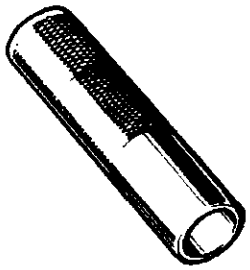
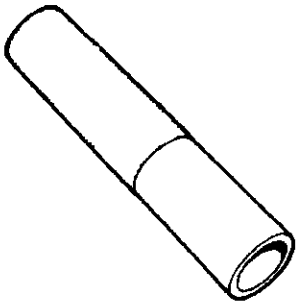
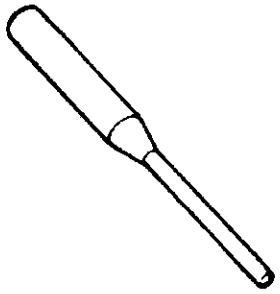
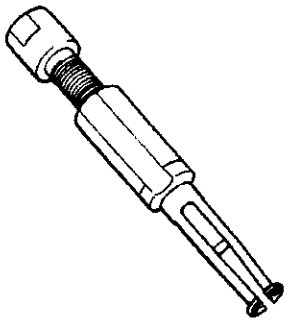
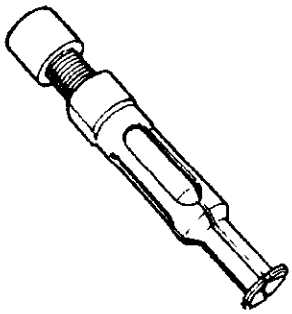
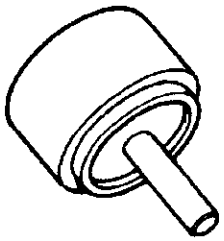
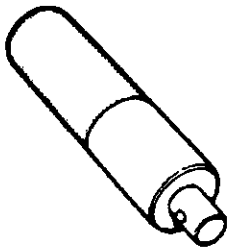
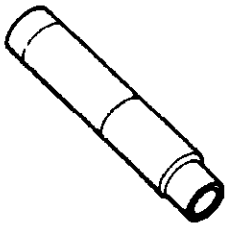
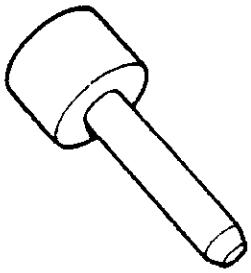
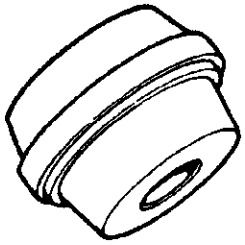
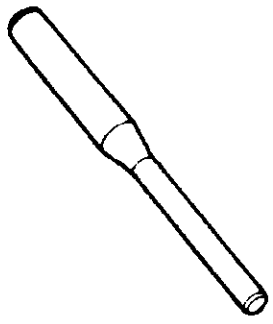
SPECIAL TOOLS

 09900-06107 Snap ring pliers (Opening type)	 09900-20606 Dial gauge	 09900-20701 Magnetic stand	 09913-65810 Bearing puller
 09913-75510 Bearing installer	 09913-80112 Bearing installer	 09913-84510 Bearing installer	 09922-85811 Spring pin remover 4.5 mm
 09923-73210 Bearing remover	 09923-74510 Bearing remover	 09923-78210 Bearing installer	 09924-74510 Installer attachment
 09925-18010 Bearing installer	 09925-58210 Oil seal installer	 09925-68210 Bearing outer race installer	 09925-78210 Spring pin remover 6 mm

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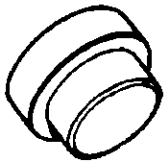
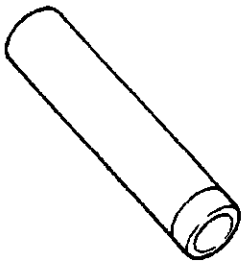
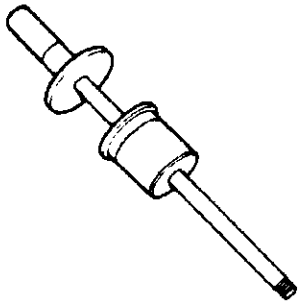
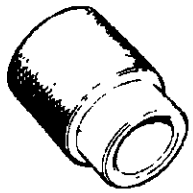
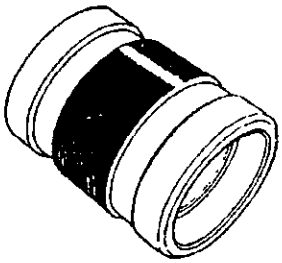
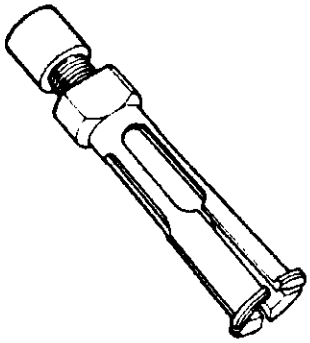
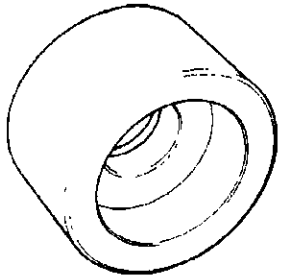
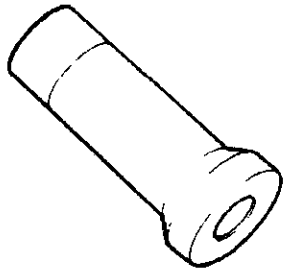
 09925-88210 Bearing puller attachment	 09925-98221 Bearing installer	 09930-30102 Sliding shaft	 09940-53111 Bearing installer
 09940-54910 Bearing installer	 09941-64511 Bearing remover	 09951-16060 Bush remover	 09951-76010 Bearing installer

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SECTION 7B

AUTOMATIC TRANSMISSION

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:

For the descriptions (items) not found in this section, refer to the same section of the Service Manual mentioned in the Foreword of this manual.

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General Description

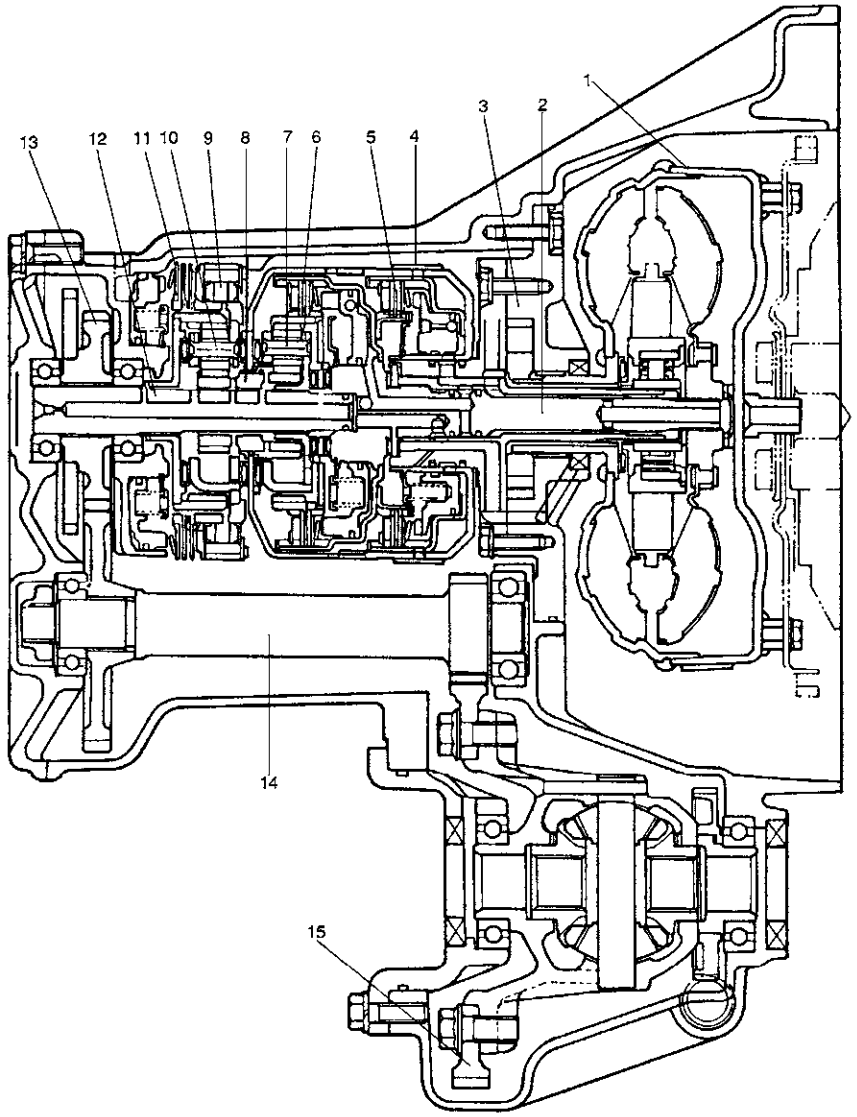
The automatic transmission consists of the hydraulic torque converter, electronically controlled 3-speed automatic transmission, counter shaft and differential.

The transmission consists of 2 planetary gears, 2 disk clutches, 1 band brake, 1 disk brake and 1 one-way clutch. Its operation is controlled by selecting a position from 6 positions (P, R, N, D, 2 and L ranges) manually by means of the select lever installed on the compartment floor.

In the D or 2 range, the gear ratio is changed for the 1st, 2nd or 3rd speed (D range only) automatically by power train control module (PCM) (electronic control).

For the automatic transmission fluid, DEXRON®-III, DEXRON®-IIE or its equivalent must be used. Lubrication in the automatic transmission is provided by the oil pump which is operated by the engine revolution. Therefore, the engine should not be stopped even during coasting to obtain proper lubrication.

When it becomes necessary to be towed, front wheels must be raised so as not to roll them.



1. Torque converter	6. Forward clutch	11 1st reverse brake
2. Input shaft	7. Front planetary gear	12 Output shaft
3. Oil pump	8. Planetary sun gear	13 Reduction drive gear
4. Second brake band	9. One-way clutch	14 Counter shaft
5 Direct clutch	10. Rear planetary gear	15 Differential

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Specifications

Item			Specifications	
Torque converter	Type Stall torque ratio		3-element, 1-step, 2-phase type 2.0	
Oil pump	Type Drive system		Trochoid type oil pump Engine driven	
Gear change device	Type		Forward 3-step, reverse 1-step planetary gear type	
	Shift position		"P" range	Gear in neutral, output shaft fixed, engine start
			"R" range	Reverse
			"N" range	Gear in neutral, engine start
			"D" range	Forward 1st ↔ 2nd ↔ 3rd automatic gear change
			"2" range	Forward 1st ↔ 2nd ← 3rd automatic gear change
			"L" range	Forward 1st ← 2nd ← 3rd reduction, and fixed at 1st gear
	Engine type		F10D	
	Gear ratio	1st (low gear)	2.659	
		2nd (second gear)	1.530	
		3rd (top gear)	1.000	
		Reverse (reverse gear)	2.129	
	Control elements		Wet type multi-disc clutch ... 2 sets Wet type multi-disc brake ... 1 set Band type brake ... 1 set One-way clutch ... 1 set	
	Final gear reduction ratio (Differential)		3.719	
Lubrication	Lubrication system		Force feed system by oil pump	
Cooling	Cooling system		Radiator assisted cooling (water-cooled)	
Fluid used			An equivalent of DEXRON®-IIE or DEXRON®-III	

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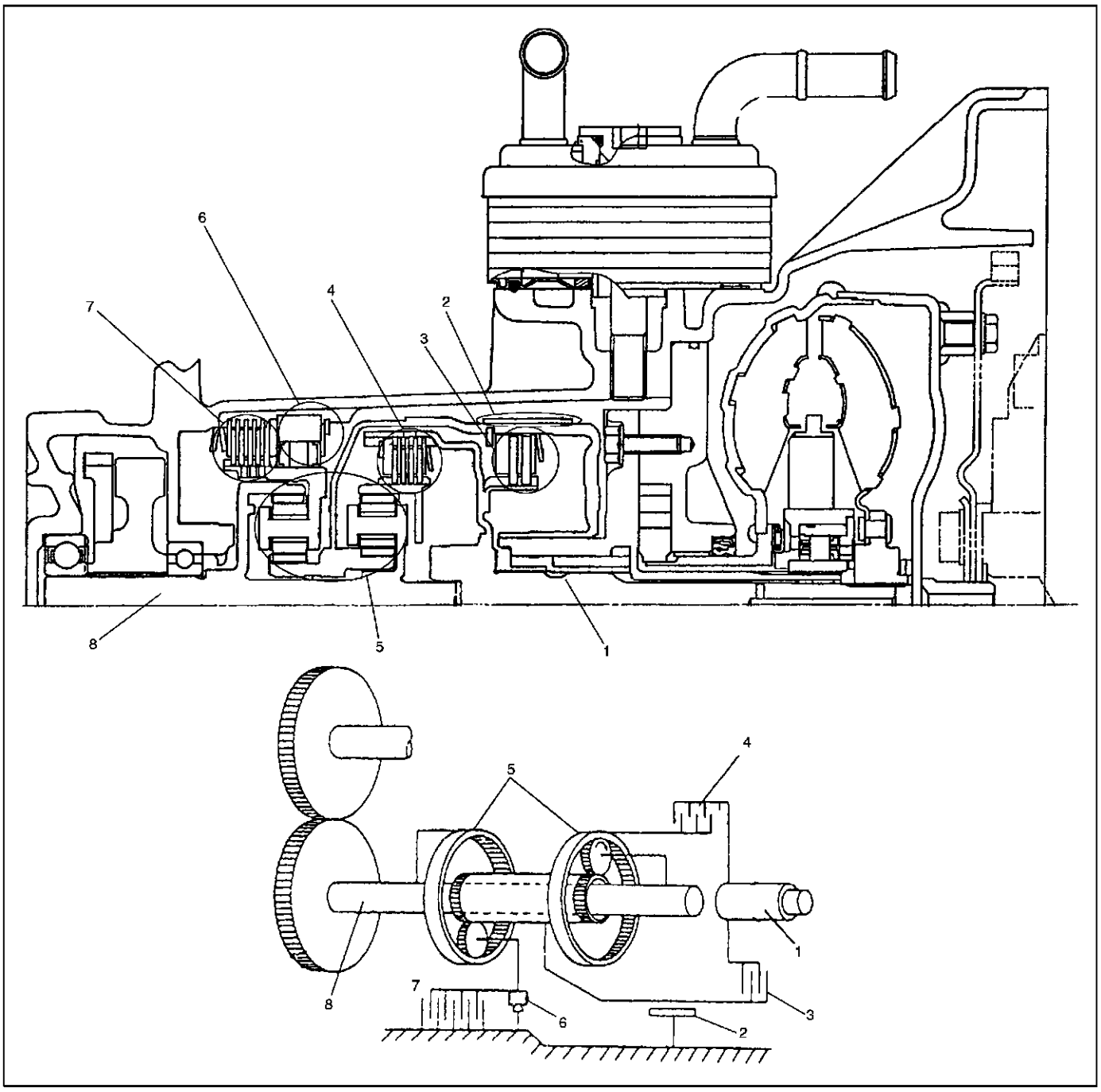
Clutch/Brake/Planetary Gear



1. Input shaft	3. Direct clutch	5. Planetary gear unit	7. First-reverse brake
2. 2nd brake	4. Forward clutch	6. One-way clutch	8. Output shaft

Functions

Part Name	Function
Forward clutch	The forward clutch connects the input shaft and internal gear of the front planetary gear unit.
Direct clutch	The direct clutch connects the input shaft and the sun gear (common to both front and rear planetary gear units).
1st-reverse brake	The 1st-reverse brake holds the rear planetary carrier stationary.
2nd brake	The second brake is of band type. It holds the sun gear of the front and rear planetary gear units stationary.

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Table of Component Operation

Element / Gear position	Forward clutch	2nd brake	Direct clutch	1st-reverse brake	One-way clutch
P					
R			○	○	
N					
3rd gear	○		○		
2nd gear	○	○			
1st gear (D and 2 range)	○				○*
1st gear (L range)	○			○	

* in acceleration

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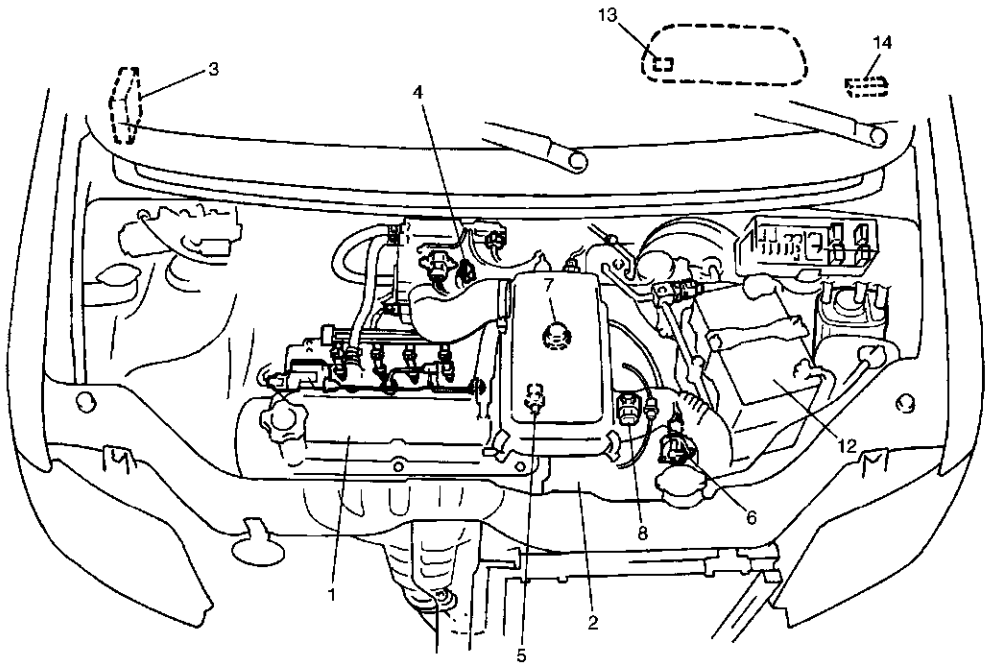
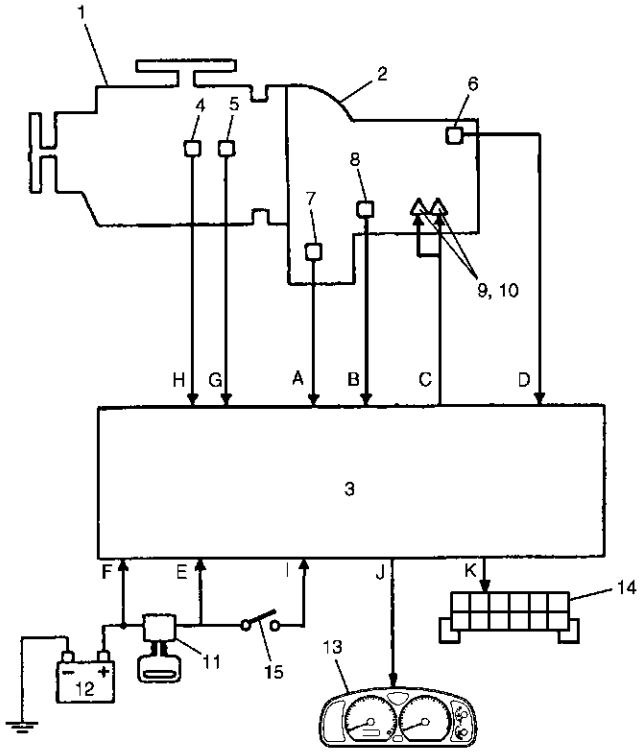
Electronic Shift Control System





1. Engine	10. Shift solenoid valve-B (No.2)	D. Transmission range signal
2. Transaxle	11. Ignition switch	E. Power supply
3. Power train control module (PCM)	12. Battery	F. Power supply for back-up
4. Throttle position sensor	13. Malfunction indicator lamp (in combination meter)	G. Engine coolant temperature signal
5. Engine coolant temperature sensor	14. Data link connector	H. Throttle opening signal
6. Transmission range sensor	15. A/C pressure switch	I. A/C signal
7. Output shaft speed sensor	A. Output shaft speed	J. MIL signal
8. Sun gear speed sensor	B. Sun gear speed	K. Serial data signal
9. Shift solenoid valve-A (No 1)	C. Automatic shift control	

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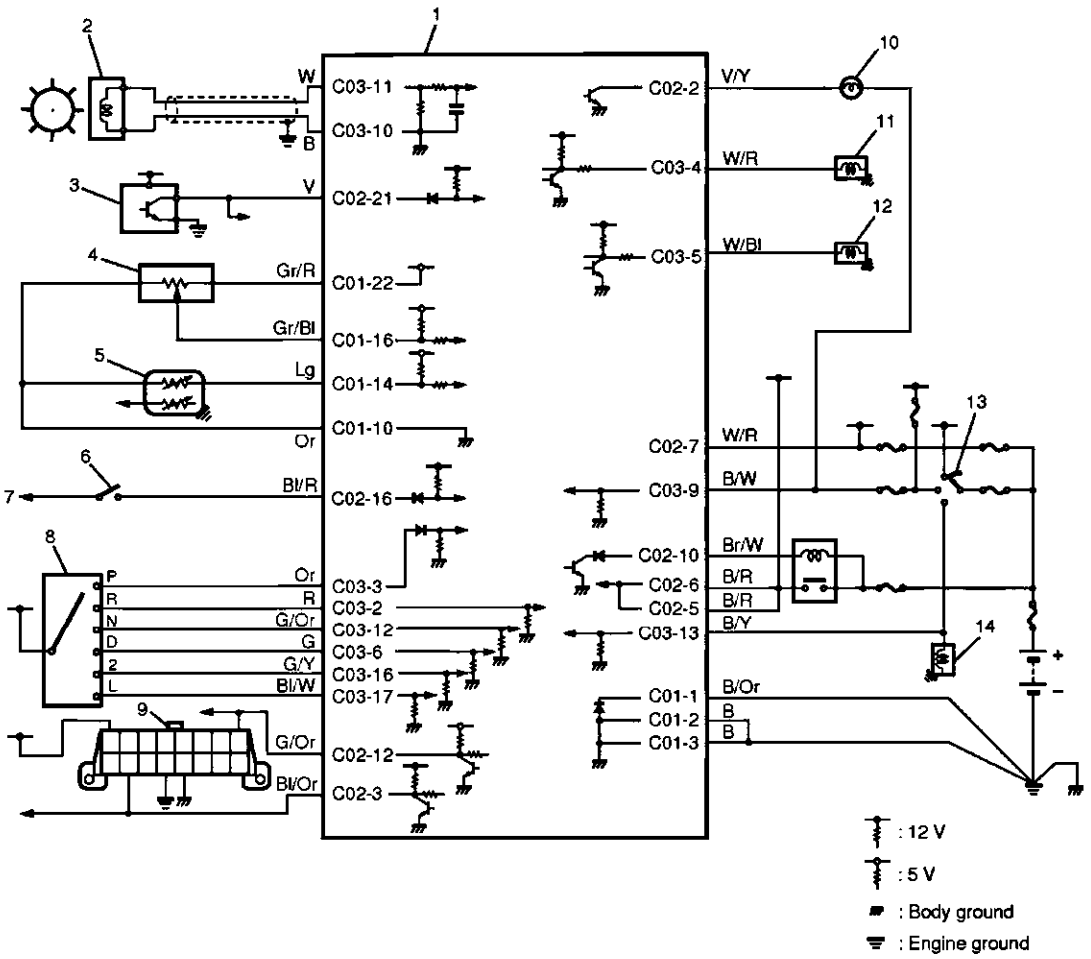

1. PCM	6. A/C pressure switch	11. Shift solenoid valve-A (No. 1)
2. Sun gear speed sensor	7. A/C switch	12. Shift solenoid valve-B (No. 2)
3. Output shaft speed sensor	8. Transmission range sensor	13. Ignition switch
4. Throttle position sensor	9. Data link connector (DLC)	14. Starter relay
5. Engine coolant temperature sensor	10. Malfunction indicator lamp (MIL)	15. Terminal arrangement of PCM coupler (viewed from harness side)

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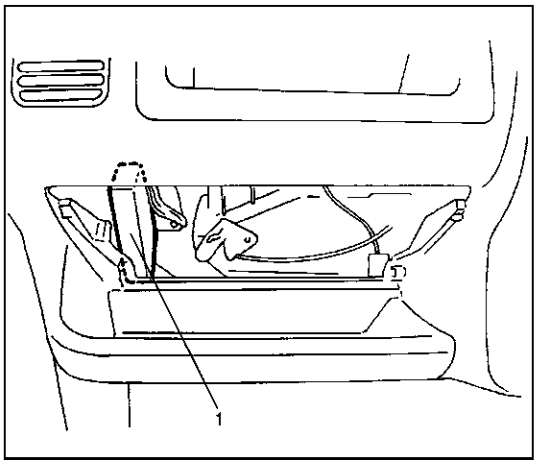
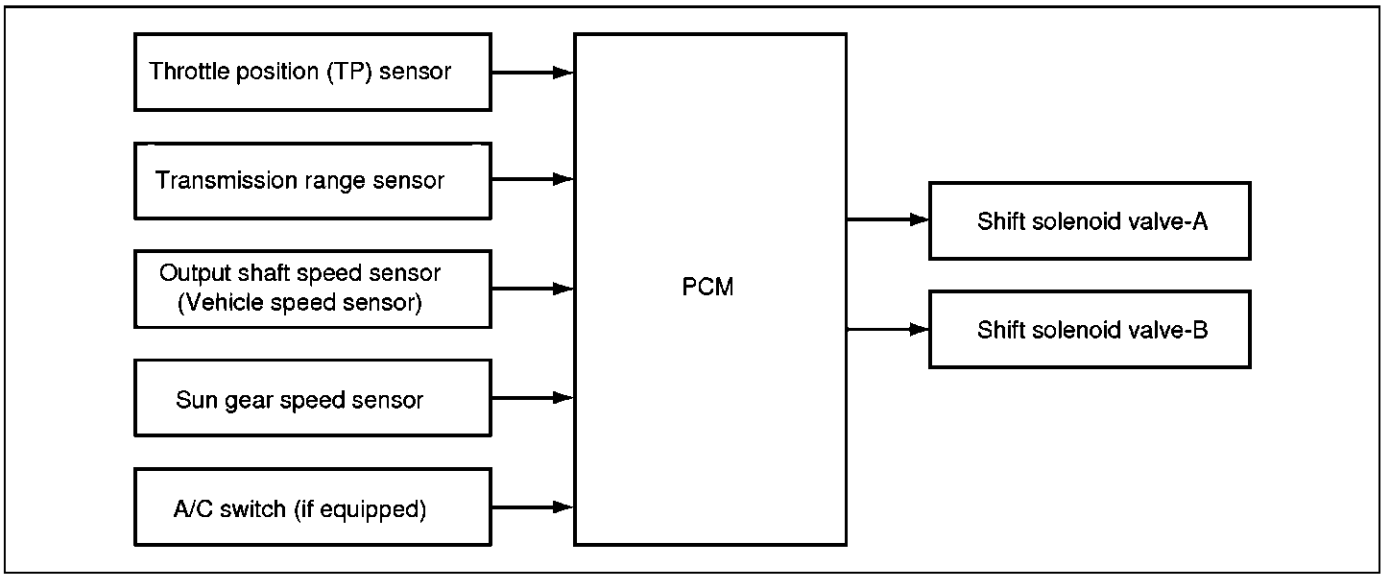
Power train control module (PCM)



The power train control module (1) controls the shift solenoid valve-A and the shift solenoid valve-B by sending electric signals to them so as to attain automatic gear shift between the 1st and 2nd gears, and the 2nd and 3rd gears. Equipped as PCM sensed parameters are the throttle position sensor, transmission range sensor, sun gear speed sensor and vehicle speed sensor. These sensors sense the throttle valve opening, select lever's position and vehicle speed and sun gear speed and send those signals to the power train control module. Then, the power train control module opens and closes valves of the above solenoids according to these signals.

Gear shift control system



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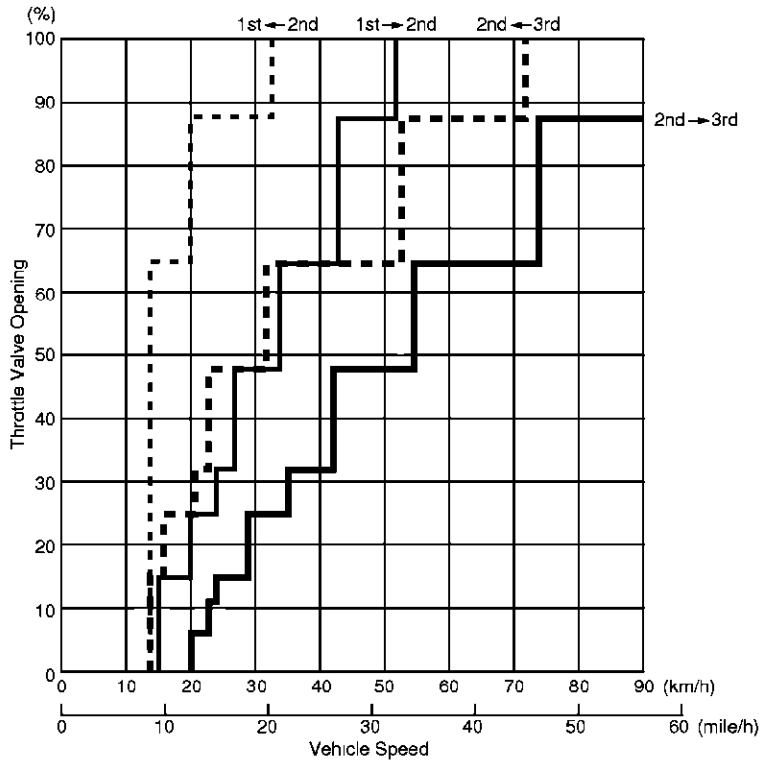
Automatic Shift Diagram

Gear change points in D, 2 and L ranges vary depending on throttle opening as given below.

	Shift			
Throttle opening	1→2	2→3	3→2	2→1
Full open km/h (mile/h)	52 (33)	91 (57)	72 (45)	33 (21)
Full close km/h (mile/h)	15 (9.5)	20 (13)	14 (9)	14 (9)

Automatic gear shift diagram



Operation of shift solenoids

Range / Gear / Solenoids	D			2		L	P, N and R
	1st	2nd	3rd	1st	2nd	1st	—
Shift solenoid valve-A	○	×	×	○	×	○	×
Shift solenoid valve-B	○	○	×	○	○	○	×

○ : Turn power ON (Valve is open) × : Turn power OFF (Valve is open)

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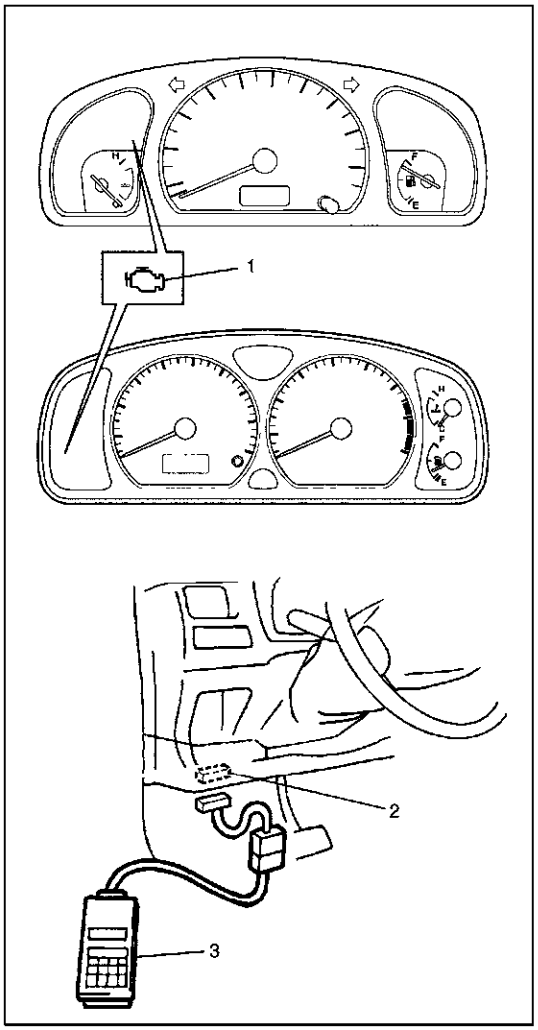
Diagnosis

General Description

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.
PCM has an On-Board Diagnosis System which detects a malfunction in this system and abnormality of those parts that influence the engine exhaust emission.
When diagnosing a trouble in transmission including this system, 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 "Automatic Transmission Diagnostic Flow Table" given below to obtain correct result smoothly.



On-board Diagnostic System

For automatic transmission control system, PCM has following functions. Refer to Section 6 for details.

- When ignition switch is turned ON with engine at a stop malfunction indicator lamp (MIL) (1) turns ON to check bulb of MIL.
- When PCM detects a malfunction in A/T control system (and/or a malfunction which gives an adverse effect to vehicle emission) while engine is running, it makes malfunction indicator lamp in meter cluster of instrument panel turn ON and stores malfunction area (DTC) in its memory.
  If it detects that continuously 3 driving cycles are normal after detecting a malfunction, however, it makes MIL turn OFF although DTC stored in its memory will remain.
- It is possible to communicate with PCM through data link connector (DLC) (2) by using SUZUKI scan tool (3).
  (Diagnostic information can be checked and erased by using a scan tool.)

2 driving cycle detection logic

Refer to "On-board Diagnostic System" in Section 6.

Freeze frame data

Refer to "On-board Diagnostic System" in Section 6.

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Precaution in Diagnosing Trouble

- Don't disconnect couplers from PCM, battery cable from battery, PCM ground wire harness from engine or main fuse before checking the diagnosis information (DTC, freeze frame data, etc.) stored in PCM memory. Such disconnection will clear memorized information in PCM memory.
- Using SUZUKI scan tool the diagnostic information stored in PCM 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.
- Priorities for diagnosing troubles
  If two or more diagnostic trouble codes (DTCs) are stored, proceed to flow table (chart) of DTC which was detected earliest in order and follow instruction in that table (chart). If no instructions are given, troubleshoot diagnostic trouble codes according to the following priorities.

1) 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)
2) DTC P0171/P0172 (Fuel system too lean/too rich) and DTC P0400 (EGR flow malfunction)
3) DTC P0300/P0301/P0302/P0303/P0304 (Misfire detected)

- Be sure to read "Precaution for Electrical Circuit Service" in Section 0A before inspection and observe what is written there.
- PCM replacement
  When substituting a known-good PCM, check for following conditions.
  Neglecting this check may result in damage to good PCM.
  - All relays and actuators have resistance of specified value.
  - MAP sensor and TP sensor are in good condition. Also, the power circuit of these sensors is not shorted to the ground.

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Automatic Transmission 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 next page. Was customer complaint analysis performed according to instruction on the next page?	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 next page. Is there any DTC(s)?	1) Print DTC and freeze frame data or write them down and clear them by referring to "Diagnostic Trouble Code (DTC) Clearance" in this section. 2) Go to Step 3.	Go to Step 4.
3	Visual Inspection 1) Perform visual inspection referring to the next page. Is there any faulty condition?	1) Repair or replace malfunction part. 2) Go to Step 11.	Go to Step 5.
4	Visual Inspection 1) Perform visual inspection referring to the next page. Is there any faulty condition?	1) Repair or replace malfunction part. 2) Go to Step 11.	Go to Step 8.
5	Trouble Symptom Confirmation 1) Confirm trouble symptom referring to the next page. Is trouble symptom identified?	Go to Step 6.	Go to Step 7.
6	Rechecking and Record of DTC/Freeze Frame Data 1) Recheck for DTC and freeze frame data referring to "Diagnostic Trouble Code (DTC) Check" in this section. Is there any DTC(s)?	Go to Step 9.	Go to Step 8.
7	Rechecking and Record of DTC/Freeze Frame Data 1) Recheck for DTC and freeze frame data referring to "Diagnostic Trouble Code (DTC) Check" in this section. Is there any DTC(s)?	Go to Step 9.	Go to Step 10.
8	Automatic Transmission Basic Check and Trouble Diagnosis Table 1) Check and repair according to "Automatic Transmission Basic Check" and "Trouble Diagnosis Table" in this section. Are check and repair complete?	Go to Step 11.	1) Check and repair malfunction part(s). 2) Go to Step 11.

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Step	Action	Yes	No
9	Troubleshooting for DTC 1) Check and repair according to applicable DTC Flow Table. Are check and repair complete?	Go to Step 11.	1) Check and repair malfunction part(s). 2) Go to Step 11.
10	Check for Intermittent Problems 1) Check for intermittent problems referring to the next page. Is there any faulty condition?	1) Repair or replace malfunction part(s). 2) 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 next page. Is there any problem symptom, DTC or abnormal condition?	Go to Step 6.	End.

1. Customer Complaint Analysis (See Customer Problem Inspection Form)
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, referring to "Diagnosis Trouble Code (DTC) Check" in this section, check DTC (including pending DTC). If DTC exists, print or write down DTC and freeze frame data and then clear malfunction DTC(s) by referring to "Diagnosis Trouble Code (DTC) Clearance" in this section. Malfunction DTC indicates malfunction in the system but it is not possible to know from it whether the malfunction is occurring now or it occurred in the past and normal condition has been restored. In order to know that, check symptom in question according to Step 5 and then recheck DTC according to Step 6.
Diagnosing a trouble based on the DTC in this step only or failure to clear the DTC in this step may result in an faulty diagnosis, trouble diagnosis of a normal circuit or difficulty in troubleshooting which is otherwise unnecessary.

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 and automatic transmission referring to "Visual Inspection" in this section.

5. Trouble Symptom Confirmation
Check trouble symptoms based on information obtained in Step 1 Customer Complaint Analysis and Step 2 DTC / Freeze Frame Data Check.
Also, reconfirm DTC according to "DTC Confirmation Procedure" described in each Diagnostic Trouble Code (DTC) Table.

6 and 7. Rechecking and Record of DTC/Freeze Frame Data
Refer to "Diagnosis Trouble Code (DTC) Check" in this section for checking procedure.

8. Automatic Transmission Basic Check and Trouble Diagnosis Table
Perform basic check of A/T according to flow table of "Automatic Transmission Basic Check" first. When the end of the flow table has been reached, check the parts of the system suspected as a possible cause referring to "Trouble Diagnosis Table" and based on symptoms appearing on the 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.

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9. Diagnostic Trouble Code Flow Table (See each DTC Flow Table)
Based on the DTC indicated in Step 6/7 and referring to Diagnostic Trouble Code (DTC) Table in this section, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, PCM 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 vehicle is free from any abnormal conditions. If what has been repaired is related to the malfunction DTC, clear the DTC once and check to ensure that no malfunction DTC is indicated.

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Customer Problem Inspection Form (Example)

User name:	Model:	VIN:	
Date of issue:	Date of Reg.:	Date of problem:	Mileage:

PROBLEM SYMPTOMS
☐ Vehicle does not move (R, D, 2, L or any range)
☐ No upshift automatically (☐ 1st to 2nd ☐ 2nd to 3rd ☐ 2 range ☐ D range)
☐ No downshift automatically (☐ 3rd to 2nd ☐ 2nd to 1st ☐ 2 range ☐ D range)
☐ No gear change manually (☐ 1st ↔ 2nd ☐ 2nd ↔ 3rd)
☐ Automatic shift point too high or too low
☐ Excessive gear change shock (1st/2nd/3rd/Reverse)
☐ No kickdown
☐ Transmission slipping in (1st/2nd/3rd/Reverse)
☐ Others_____

VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather Temperature Frequency Read	☐ Fair ☐ Cloudy ☐ Rain ☐ Always ☐ Other_____ (°F/ °C) ☐ Hot ☐ Warm ☐ Cool ☐ Cold ☐ always ☐ Always ☐ Sometimes (times/ day, month) ☐ Only once ☐ Under certain condition ☐ Urban ☐ Suburb ☐ Highway ☐ Mountainous ☐ Uphill ☐ Downhill ☐ Tarmacadam ☐ Gravel ☐ Other_____
Vehicle Condition	
Engine & transmission condition	☐ Cold/ ☐ Warming up phase/ ☐ Warmed up Engine speed (r/min.) Throttle opening (☐ Idle/ ☐ About % ☐ full)
Vehicle condition	☐ At stop/ ☐ During driving (☐ Constant speed ☐ Accelerating ☐ Decelerating ☐ Braking) ☐ Right hand corner ☐ Left hand corner ☐ Vehicle speed (km/h mile/h) ☐ Other_____

Malfunction indicator lamp	☐ Blink ☐ 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.

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Malfunction Indicator Lamp (MIL) Check

Refer to "On-board Diagnostic System" in Section 6.

Diagnostic Trouble Code (DTC) Check

Refer to "On-board Diagnostic System" in Section 6.

Diagnostic Trouble Code (DTC) Clearance

Refer to "On-board Diagnostic System" in Section 6.

Diagnostic Trouble Code (DTC) Table

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0705	Transmission range sensor circuit malfunction	No signal or multiple signals inputted.	Not applicable
P0715	Input speed sensor (sun gear speed sensor) circuit malfunction	No sensor signal is inputted although output shaft speed sensor signal inputted.	1 driving cycle
P0720	Output speed sensor circuit malfunction	No signal inputted while running vehicle with "D" or "2" range.	1 driving cycle
P0751	Shift solenoid-A performance or stuck off	While running in "D" range, sun gear speed sensor detect as compared to vehicle speed sensor detect speed is higher or lower than specified value.	2 driving cycles
P0756	Shift solenoid-B performance or stuck off		
P0753	Shift solenoid-A electrical	Output command from PCM and output voltage do not agree. (Solenoid circuit shorted or open)	1 driving cycle
P0758	Shift solenoid-B electrical		

Fail Safe Table

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.

DTC NO.	DETECTED ITEM	FAIL SAFE OPERATION	
P0705	Transmission range sensor (switch) circuit malfunction	No signal inputted	PCM controls solenoids on "D" range base.
		Multiple signal inputted	PCM controls solenoids according to following priority order. D > 2 > L > R > N > P
P0720	Output speed sensor (A/T VSS) circuit malfunction	Gear is held at 3rd gear when in "D" range, at 2nd gear when in "2" range and 1st gear when in "L" range.	
P0753	Shift solenoid-A electrical	Circuit open or shorted to ground	Gear is not shifted to 1st gear when in "D", "2" or "L" range.
		Shorted to power circuit	Gear is held at 1st gear.
P0758	Shift solenoid-B electrical	Circuit open or shorted to ground	Gear is not shifted to 2nd gear when in "D" or "2" range.
		Shorted to power circuit	Gear is not shifted to 3rd gear when in "D" range.

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Visual Inspection

Visually check the following parts and systems.

INSPECTION ITEM	REFERRING SECTION
• A/T fluid ----- level, leakage, color	Section 0B
• Throttle cable ----- play (under warm engine), installation	Section 6E1
• A/T select cable ----- installation	Section 7B
• Engine oil ----- level, leakage	Section 0B
• Engine coolant ----- level, leakage	Section 0B
• Engine mountings ----- play, looseness, damage	Section 6A
• Suspension ----- play, looseness	Section 3
• Drive shafts ----- damage	Section 4A
• Battery ----- fluid level, corrosion of terminal	
• Connectors of electric wire harness ----- disconnection, friction	Section 6E1
• Fuses ----- burning	Section 8
• Parts ----- installation, damage	
• Bolts ----- looseness	
• Other parts that can be checked visually	
Also check the following items at engine start, if possible.	
• Malfunction indicator lamp ----- Operation	Section 6E1
• Charge warning lamp ----- Operation	Section 6H
• Engine oil pressure warning lamp ----- Operation	Section 8 (Section 6A for pressure check)
• Engine coolant temp. meter ----- Operation	
• Other parts that can be checked visually	

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Automatic Transmission Basic Check

This check is important for troubleshooting when PCM has detected no DTC and no abnormality has been noted in visual inspection. Follow the flow table carefully.

Step	Action	Yes	No
1	Was "Automatic Transmission Diagnostic Flow Table" preformed?	Go to Step 2.	Go to "Automatic Transmission Diagnostic Flow Table".
2	Perform "Road Test" in this section. Is it OK?	Go to Step 3.	Proceed to "Troubleshooting" in "Road Test".
3	Perform "Manual Road Test" in this section. Is it OK?	Go to Step 4.	Proceed to "Troubleshooting" in "Manual Road Test".
4	Perform "Engine Brake Test" in this section. Is it OK?	Go to Step 5.	Proceed to "Troubleshooting" in "Engine Brake Test".
5	Perform "Stall Test" in this section. Is it OK?	Go to Step 6.	Proceed to "Troubleshooting" in "Stall Test".
6	Perform "Time Lag Test" in this section. Is it OK?	Go to Step 7.	Proceed to "Troubleshooting" in "Time Lag Test".
7	Perform "Line Pressure Test" in this section. Is it OK?	Proceed to "Trouble Diagnosis Table" in this section.	Proceed to "Troubleshooting" in "Line Pressure Test".

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Trouble Diagnosis Table

	Condition	Possible Cause	Correction
CONCERNS TRANSMISSION FLUID	**Low fluid level**	Fluid coming out of oil filler tube	Adjust fluid level.
		External fluid leak	Repair leak.
	Fluid coming out of oil filler tube	Fluid level too high	Adjust level.
		Coolant in transmission fluid	Replace oil cooler.
		Breather hose pinched	Correct piping.
	External fluid leaks in the area of torque converter housing	Leaking torque converter	Replace torque converter.
		Converter housing oil seal	Replace oil seal.
		Converter housing to case seal	Replace seal.
		Loose fastening bolts	Tighten bolts.
	External fluid leaks in the area of transmission case	Manual select shaft seal	Replace oil seal.
		Cooler fittings	Tighten fastening bolt.
		Oil filler tube O-ring	Replace O-ring.
		Line pressure gauge connection	Tighten plug.
		Electrical connector O-ring	Replace O-ring.
	Low fluid pressure	Low fluid level	Adjust fluid level.
		Clogged oil pump screen	Wash screen.
		Leak in oil pressure circuit	Overhaul.
		Pressure regulator valve malfunction	Overhaul oil pump.
	High fluid pressure	Pressure regulator valve malfunction	Overhaul oil pump.
STARTING	**Unable to run in all ranges**	Low A/T fluid level	Fill A/T fluid to specified level.
		Wear in oil pump	Replace.
		Seizure in oil pump	Replace.
		Regulator valve stuck	Replace.
		Oil strainer clogged	Wash strainer.
		Planetary gear seizure, damage	Repair or replace.
		Fluid pressure leakage to forward clutch due to worn oil pump bushing	Replace.
		Fluid pressure leakage to forward clutch due to worn or damaged input shaft seal ring	Replace.
		Internal failure of torque converter	Replace.
		Defective manual valve	Replace.
	Unable to run in 1st gear in "D" and "2" ranges, excessive slippage	Fluid pressure leakage to forward clutch due to worn or damaged input shaft seal ring	Replace.
		Forward clutch slippage	Replace.
		Defective one-way clutch	Replace.
	Unable to run in "L" range, excessive slippage	Fluid pressure leakage to forward clutch due to worn or damaged input shaft seal ring	Replace.
		First reverse brake disc slippage	Replace.
		Damaged first reverse brake piston O-ring	Replace.
	Unable to run in "R" range, excessive slippage	Fluid pressure leakage to direct clutch due to worn or damaged oil pump seal ring	Replace.
		Worn direct clutch	Replace.

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Condition		Possible Cause	Correction
GEAR CHANGE	**1st to 2nd gear change failure, excessive slippage**	Regulator valve stuck	Replace.
		Defective second brake band	Replace.
		Damaged second brake piston O-ring	Replace.
		1-2 shift valve stuck	Replace.
		Shift solenoid valve-A stuck	Replace.
	2nd to 3rd gear change failure, excessive slippage	Fluid pressure leakage to direct clutch due to worn or damaged oil pump cover seal ring	Replace.
		Direct clutch slippage	Replace.
		2-3 shift valve stuck, shift solenoid valve-B stuck	Replace.
		Foreign matter caught in direct clutch piston check ball	Replace.
STARTING	**Poor starting in "D" range**	Regulator valve stuck	Replace.
		Fluid pressure leakage to forward clutch due to worn oil pump bushing	Replace.
		Fluid pressure leakage to forward clutch due to worn or damaged input shaft seal ring	Replace.
		Malfunction of forward clutch	Replace.
	Poor starting in "R" range, juddering	Fluid pressure leakage to direct clutch due to worn or damaged oil pump cover seal ring	Replace.
		Worn direct clutch bushing	Replace.
	Excessive shock in 1st to 2nd gear change	Regulator valve stuck	Replace.
		Defective one-way clutch	Replace.
		Defective accumulator or 2nd brake piston	Replace.
	Excessive shock in 2nd to 3rd gear change	Regulator valve stuck	Replace.
		Defective accumulator or forward clutch piston	Replace.
NOISES	**Noise when starting**	Fluid pressure leakage to forward clutch due to worn oil pump bushing	Replace.
		Low A/T fluid level	Replenish A/T fluid to specified level.
	Abnormal noise in "P" and "N" ranges	Low A/T fluid level	Replenish A/T fluid to specified level.
		Wear in oil pump	Replace.
	Noise from differential	Missing tooth of differential gear	Replace.
		Seizure of differential pinion shaft	Replace.
OTHERS	**Faulty indication of speedometer**	Cracked VSS rotor	Replace.
		Faulty vehicle speed sensor (VSS)	Replace.
	Heavy steering when making a turn	Seizure of differential	Replace.

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Stall Test

This test is to check overall performance of automatic transaxle and engine by measuring stall speed at "D" and "R" ranges. Be sure to perform this test only when transaxle fluid is at normal operating temperature and its level is between FULL HOT and LOW HOT 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 1 minute before another stall test.**

1) Apply parking brake and block wheels.
2) Install tachometer.
3) Start engine with select lever shifted to "P" range.
4) Depress brake pedal fully.
5) Shift select lever to "D" range 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 at "R", "2" and "L" range.
8) Stall speed should be within following specification.

Engine stall speed
Standard : 2,300 – 2,700 rpm

Troubleshooting

Condition	Possible Cause
Lower than specification	Engine output insufficient
	Torque converter defective
Higher than specification in "D" and "2" range	One-way clutch defective
Higher than specification in "D", "2" and "L" range	Forward clutch slippage
Higher than specification in "R" range	Direct clutch slippage
	1st – reverse brake slippage
Higher than specification in "R" and "L" range	1st – reverse brake slippage
Higher than specification in all range	Low line pressure

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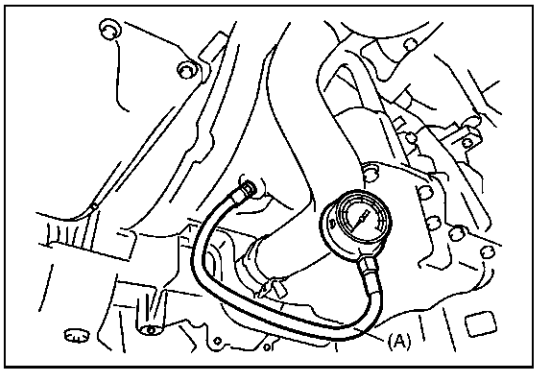
Line Pressure Test

This test is to check fluid pressure system for operation by measuring fluid pressure in fluid pressure line. Make sure to perform this test only when transmission fluid is at normal operating temperature.

NOTE:

- **Make sure that transmission fluid level is between FULL and LOW marks on fluid level gauge at normal operating temperature of fluid. (Refer to "Fluid level check at normal operating (hot) temperature (Hot check)" in this section.)**
- **Check that transmission is free from fluid leakage.**



1) With engine at stop, remove plug and connect fluid pressure gauge to plug hole.

Special tool
(A) : 09925-37810

CAUTION:
After attaching oil pressure gauge, check that no fluid leakage exists.

2) Install tachometer.
3) Apply parking brake and block vehicle wheels.
4) With selector lever shifted to "P" range, start engine.
5) Depress brake pedal fully.
6) Shift select lever to "D" range and check fluid pressure with engine running at idling speed and at stall speed respectively.
7) Repeat the same check as in step 6) with selector lever shifted to "R" range.

CAUTION:
- **Do not run engine at stall more than 5 seconds continuously, or fluid temperature may rise excessively high.**
- **After performing line pressure test, be sure to leave engine running at idle for longer than one minute before performing another line pressure test.**

8) If line pressure is within respective specification in table below, fluid pressure system is in good condition.

Engine speed	Line pressure	
	"D" range	"R" range
Idling speed	4.2 – 4.7 kg/cm^2 (60 – 67 psi)	8.8 – 9.8 kg/cm^2 (125 – 139 psi)
Stall speed (2300 – 2700 r/min)	6.7 – 7.6 kg/cm^2 (95 – 107 psi)	13.9 – 15.7 kg/cm^2 (197 – 223 psi)

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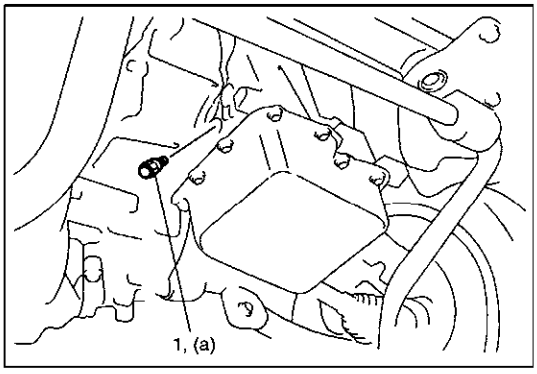
Troubleshooting

Condition	Possible Cause
Fluid pressure is higher than standard value in each range	Defective vacuum diaphragm
	Defective vacuum hose
Fluid pressure is lower than standard value in each range	Defective vacuum diaphragm
	Defective vacuum hose
	Pressure leakage from fluid pressure circuit
	Defective oil pump
	Clogged oil strainer
Fluid pressure is lower than standard value in "D" range only	Leakage from "D" range fluid pressure circuit
	Pressure leakage at forward clutch
Fluid pressure is lower than standard value in "R" range only	Leakage from "R" range fluid pressure circuit
	Leakage at direct clutch, 1st-reverse brake
Pressure does not vary between idle speed and stall speed	Poor sliding of pressure regulator valve
	Poor sliding of throttle valve
	Disconnected vacuum hose
	Clogged oil strainer



9) Reinstall plug (1) and tighten it to specification.

Tightening torque
(a) : 8 N·m (0.8 kg-m, 6.0 lb-ft)

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Time Lag Test

This test is to check conditions of clutch, 1st-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 before and behind front and rear wheels respectively, depress brake pedal.
2) Start engine.
3) With stop watch ready, 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.

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 one minute after select lever is shifted back to "N" range.**
- **Engine should be warmed up fully for this test.**
- **Repeat test 3 times and take average of those data for final lag data.**

Troubleshooting

Condition	Possible Cause
When "N" → "D" time lag exceeds specification.	Low line pressure.
	Worn forward clutch.
When "N" → "R" time lag exceeds specification.	Low line pressure.
	Worn direct clutch.
	Worn 1st-reverse brake.

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Road Test

This test is to check if upshift and downshift take place at specified speeds while actually driving vehicle on a level road.

WARNING:
- **Carry out the test in very little traffic area to prevent an accident.**
- **The test requires 2 persons, a driver and a tester.**

1) Warm up engine.
2) With engine running at idle, shift select lever to "D" range.
3) Accelerate vehicle speed by depressing accelerator pedal gradually.
4) While driving in "D" range, check if gear shift occur properly. (Refer to "Automatic Gear Shift Diagram" in this section.)

Troubleshooting

Condition	Possible Cause
No upshift from 1st to 2nd.	1 – 2 shift valve defective.
	Shift solenoid valve-A defective.
	PCM defective, or disconnection or poor connection in PCM electric circuit.
No upshift from 2nd to 3rd.	2 – 3 shift valve defective.
	Shift solenoid valve-B defective.
	PCM defective, or disconnection or poor connection in PCM electric circuit.
No downshift from 2nd to 1st or 3rd to 2nd.	Throttle position sensor defective.
	PCM defective, or disconnection or poor connection in controller electric circuit.

"P" Range Test

1) Stop vehicle on a slope of 5 degrees or more, 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, make sure no one is around vehicle or down on a slope and keep watchful for safety during test.

Troubleshooting

Condition	Possible Cause
Vehicle moves at "P" range or remains stationary at "N" range	Defective parking lock pawl or spring

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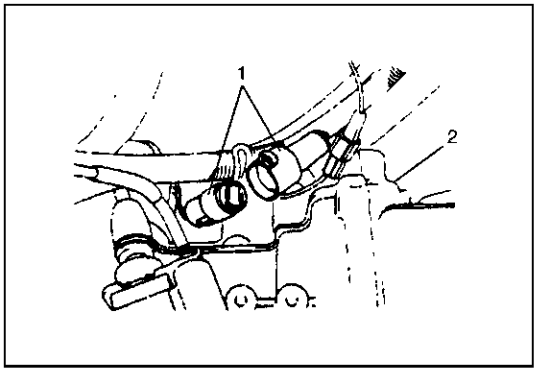
Manual Road Test

This test checks the gears being used in "L", "2" or "D" range when driven with unoperated gear shift control system.
Test drive vehicle on a level road.

NOTE:
Before this test, check diagnostic trouble code (DTC).

1) With selector lever in "P" range, start engine and warm it up.
2) After warning up engine, disconnect coupler (1) of solenoid valve wire as shown in figure.



2. Transmission

3) With select lever in "L" range, start vehicle and accelerate to 30 km/h (19 mile/h). Check in this state that 3rd gear is being used.
4) At 30 km/h (19 mile/h), shift select lever to "2" range and accelerate to 60 km/h (37 mile/h).
   Check in this state that 3rd gear is being used.
5) At 60 km/h (37 mile/h), shift select lever to "D" range and check that 3rd gear is used when speed is higher than 60 km/h (37 mile/h).
6) After above checks, stop vehicle then engine, and connect solenoid valve wire coupler.
7) Clear DTC and pending DTC.

Troubleshooting

Condition	Possible Cause
Selected gear is not correct	Faulty valve body component
	Faulty clutch or 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.

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Troubleshooting

Condition	Possible Cause
Fails to operate when shifted down to 2 range	Second brake defective
Fails to operate when shifted down to L range	1st-reverse brake defective

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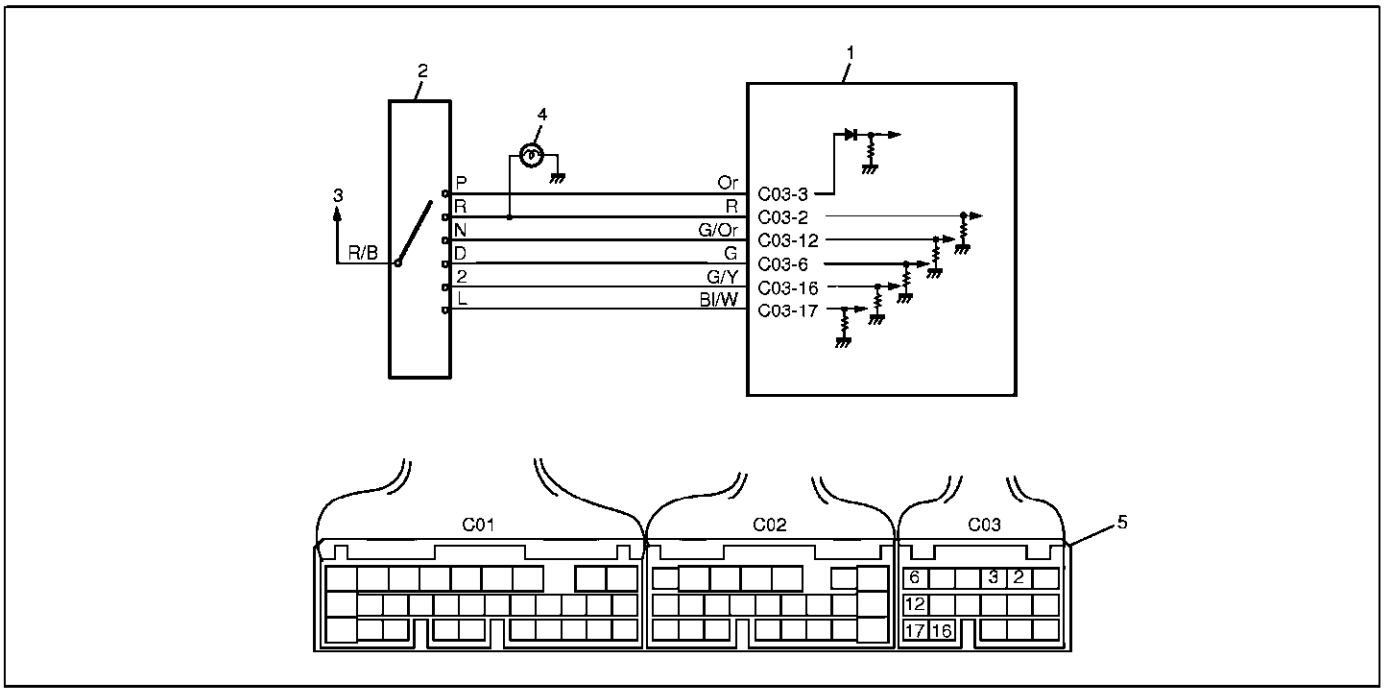
DTC P0705 Transmission Range Sensor Circuit Malfunction

Wiring Diagram



1. PCM	3 From ignition switch	5 Terminal arrangement of PCM connector (viewed from harness side)
2. Transmission range sensor	4 Backup lamp	

DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
• Transmission range sensor signal (P, R, N, D, 2, or L) is not inputted for more than 10 seconds at more than 60 km/h (35 mile/h) vehicle speed. or • Transmission range sensor signals are inputted simultaneously for 10 seconds.	• Transmission range sensor maladjusted. • Transmission range sensor or its circuit malfunction. • PCM • Select cable maladjusted.

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 tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTC and pending DTC in PCM memory by using scan tool and start engine.
3) Shift selector lever to each of "L", "2", "D", "N", "R" and "P" ranges for 20 seconds each.
4) Increase vehicle speed to about 70 km/h (44 mile/h) in D range.
5) Keep driving above vehicle speed for 20 seconds.
6) Release accelerator pedal, decrease vehicle speed and stop vehicle.
7) Check DTC, pending DTC and freeze frame data.

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Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transmission Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transmission Diagnostic Flow Table" in this section.
2	Do you have SUZUKI scan tool?	Go to Step 3.	Go to Step 4.
3	Check Transmission range sensor circuit for operation. Check by using SUZUKI scan tool: 1) Connect SUZUKI scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON and check transmission range signal (P, R, N, D, 2 or L) on display when shifting select lever to each range. Is applicable range indicated? Are check results satisfactory?	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 5.
4	Check Transmission range sensor circuit for operation. Check by not using SUZUKI scan tool: 1) Turn ignition switch ON. 2) Check voltage at terminals C03-2, C03-3, C03-6, C03-12, C03-16 and C03-17 respectively with select lever shifted to each range. Taking terminal C03-16 as an example, is battery voltage indicated only when select lever is shifted to "2" range and 0 V for other ranges as shown in table below? Check voltage at other terminals likewise, referring to figure. Are check results satisfactory?	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 5.
5	Check select cable for adjustment referring to "Select Cable" in this section. Is it adjusted correctly?	Go to Step 6.	Adjust.
6	Check Transmission range sensor referring to "Transmission Range Sensor" in this section. Are check results satisfactory?	Reinstall transmission range sensor and select cable referring to "Transmission Range Sensor" and "Select cable" in this section and recheck sensor circuit operation referring to Step 3 or 4. If NG, "Or", "R", "G/Or", "G", "G/Y", "Bl/W" or "R/B" circuit open or short. If wires and connections are OK, substitute a know-good PCM and recheck.	Replace Transmission range sensor.

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Table for Step 4

		Terminal					
		C03-3	C03-2	C03-12	C03-6	C03-16	C03-17
Select lever position	P	B + V	0 V	0 V	0 V	0 V	0 V
	R	0 V	B + V	0 V	0 V	0 V	0 V
	N	0 V	0 V	B + V	0 V	0 V	0 V
	D	0 V	0 V	0 V	B + V	0 V	0 V
	2	0 V	0 V	0 V	0 V	B + V	0 V
	L	0 V	0 V	0 V	0 V	0 V	B + V

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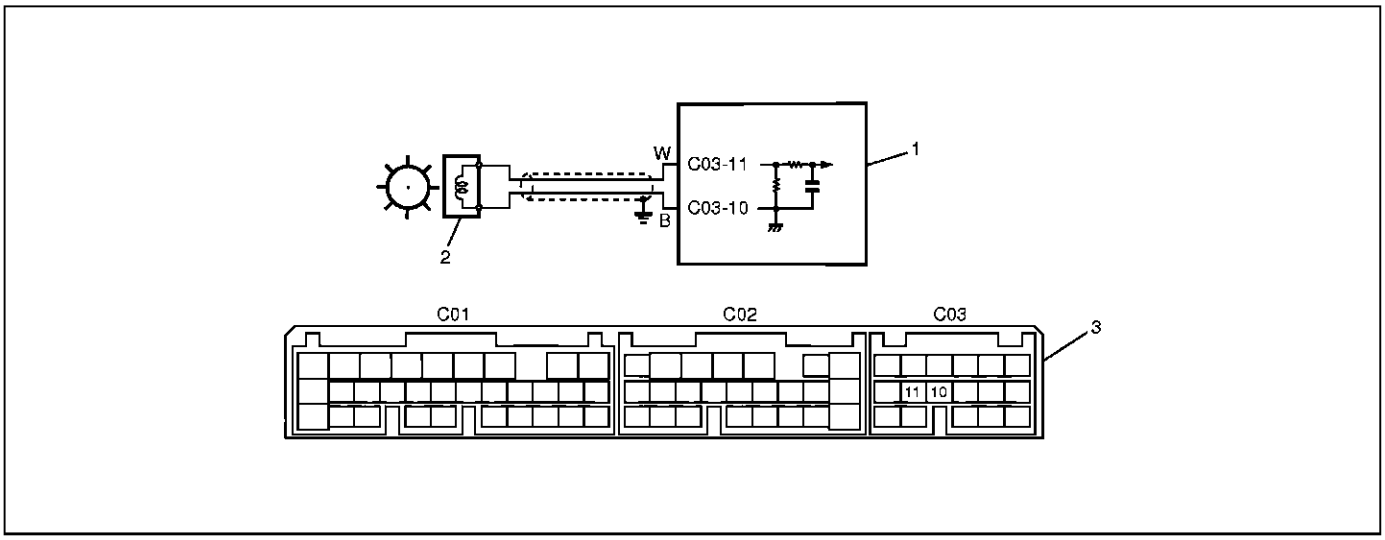
DTC P0715 Input/Turbine Speed Sensor (Sun Gear Speed Sensor) Circuit Malfunction

Wiring Diagram



1. PCM	2. Sun gear speed sensor	3. Terminal arrangement of PCM connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
No input shaft (sun gear) speed sensor signal is detected although output shaft speed sensor signals are detected under vehicle condition shown below. • Vehicle speed at 10 km/h (6 mile/h) or more with 1st gear in "D" range and • Vehicle speed at 30 km/h (19 mile/h) or more with 3rd gear in "D" range.	• Input shaft (sun gear) speed sensor or its circuit malfunction. • Improper input shaft (sun gear) speed sensor installation. • Damaged direct clutch drum. • Foreign material attachment to sensor or drum. • PCM

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 tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTC and pending DTC in PCM memory by using scan tool and start engine.
3) Shift selector lever to "D" range and start vehicle.
4) Accelerate vehicle slowly to 40 km/h (25 mile/h) taking time of about 20 seconds and hold 40 km/h (25 mile/h) for 10 seconds.
5) Stop vehicle.
6) Check DTC, pending DTC and freeze frame data.

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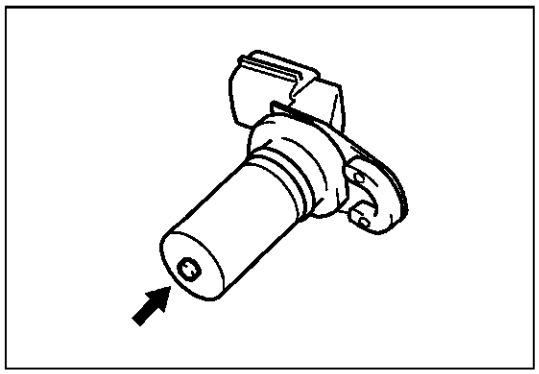
Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transmission Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transmission Diagnostic Flow Table" in this section.
2	Check Input Shaft (Sun Gear) Speed Sensor Circuit. 1) Disconnect PCM connectors with ignition switch OFF. 2) Check for proper connection to input shaft speed sensor at C03-10 and C03-11 terminals. 3) If OK, check resistance of sensor circuit. Resistance between terminals C03-10 and C03-11 of disconnected harness side PCM connector: 490 – 590 Ω at 20 °C (68 °F) Resistance between terminal C03-10/C03-11 of disconnected harness side PCM connector and ground: No continuity Are check result satisfactory?	Go to Step 4.	Go to Step 3.
3	Inspect input shaft (sun gear) speed sensor. Inspect input shaft (sun gear) speed sensor referring to "Sun Gear Speed Sensor Inspection" in this section. Is result satisfactory?	"W" or "B" circuit open or short.	Replace input shaft (sun gear) speed sensor.
4	Check Visually Input Shaft (Sun Gear) Speed Sensor and Direct Clutch Drum Using Mirror for the Followings. See Fig.. • No damage • No foreign material attached • Correct installation Are they in good condition?	Intermittent trouble or faulty PCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute a known-good PCM and recheck.	Clean, repair or replace.

Fig. for Step 4



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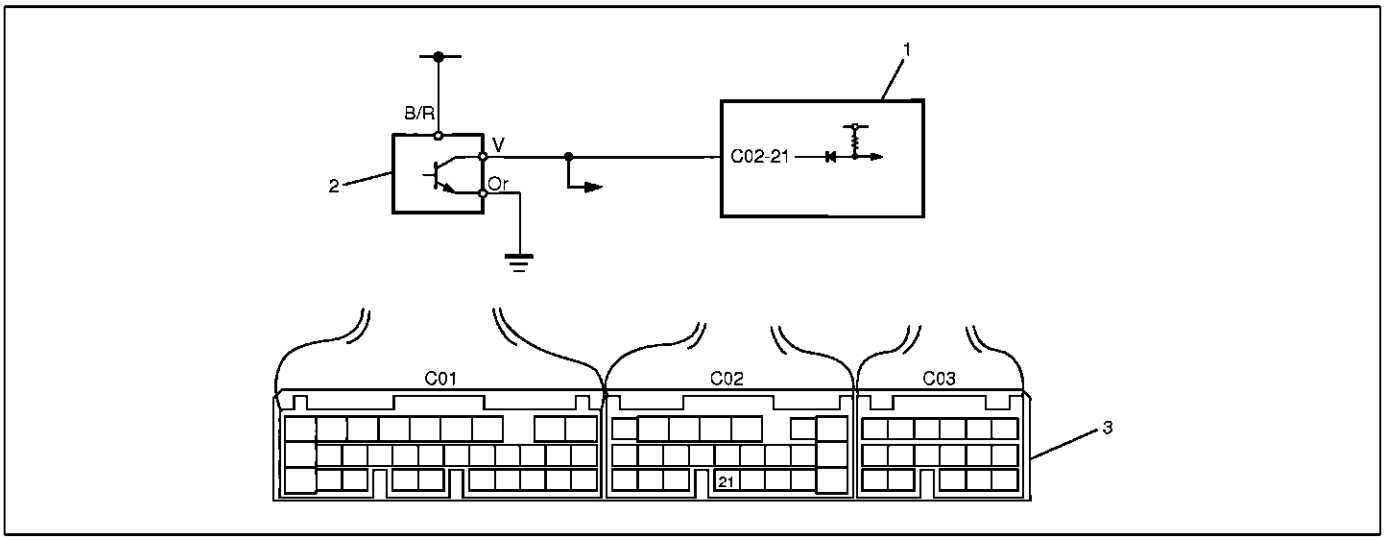
DTC P0720 Output Speed Sensor (VSS) Circuit Malfunction

Wiring Diagram



1. PCM	2. Output shaft speed sensor (VSS)	3 Terminal arrangement of PCM connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
No output shaft speed sensor (VSS) signal is inputted while vehicle running at "D" or "2" range at faster than 3500 rpm in engine speed for longer than 4 seconds.	• Output shaft speed sensor (VSS) or its circuit malfunction. • Improper output shaft speed sensor (VSS) installation. • Damaged sensor rotor. • Foreign material attachment to sensor or rotor. • PCM

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 tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTC and pending DTC in PCM memory by using scan tool and start engine.
3) Shift selector lever to "D" or "2" range and drive vehicle at faster than 3500 rpm in engine speed for longer than 10 seconds.
4) Stop vehicle.
5) Check DTC, pending DTC and freeze frame data.

Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transmission Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transmission Diagnostic Flow Table" in this section.

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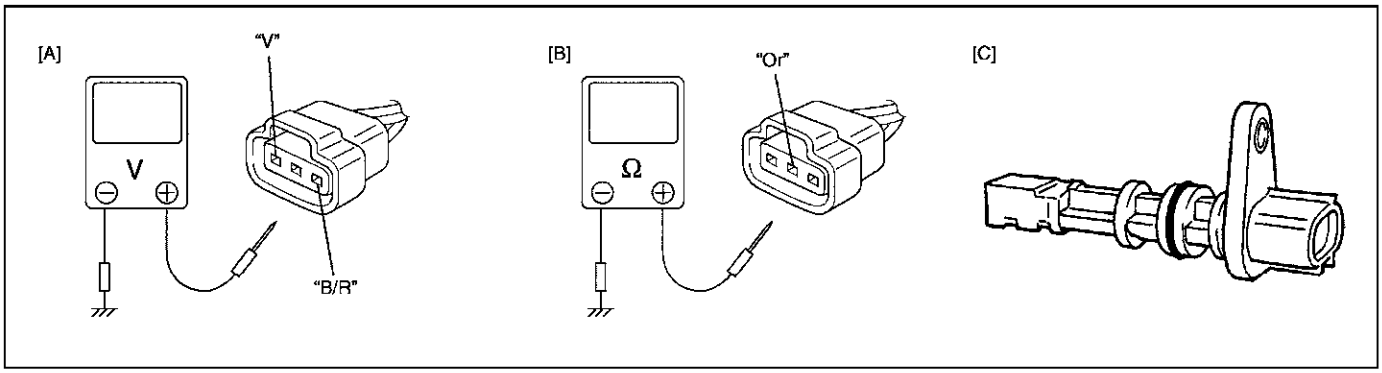
Step	Action	Yes	No
2	Check power supply circuit. 1) With ignition switch OFF disconnect connector from VSS. 2) Check proper connection for "B/R", "O/R" and "V" wire terminal. 3) If OK, turn ON ignition switch and measure voltage between engine ground and "B/R" wire terminal of VSS connector. Is it 10 – 14 V?	Go to Step 3.	"B/R" wire circuit open or shorted to ground.
3	Check ground circuit. 1) Check continuity between engine ground and "Or" wire terminal of VSS connector with ignition switch OFF. Is continuity indicated?	Go to Step 4.	"Or" wire open.
4	Check signal circuit 1) Turn ON ignition switch and measure voltage between engine ground and "V" wire terminal of VSS connector. Is it 10 – 14 V?	Go to Step 5.	"V" wire circuit open or shorted to ground.
5	Inspect Output Shaft Speed Sensor (VSS). Inspect output shaft speed sensor (VSS) referring to "Output Shaft Speed Sensor" in this section. Is result satisfactory?	Go to Step 6.	Replace output shaft speed sensor (VSS).
6	Check Visually Output Shaft Speed Sensor (VSS) and Sensor Rotor Using Mirror for the Followings. See Fig. • No damage • No foreign material attached • Correct installation Are they in good condition?	Intermittent trouble or faulty PCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A. If OK, substitute a known-good PCM and recheck.	Clean, repair or replace.



[A]: Fig. for Step 2 and 4
[B]: Fig. for Step 3
[C]: Fig. for Step 6

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DTC P0751 Shift Solenoid-A (No.1) Performance or Stuck Off
DTC P0756 Shift Solenoid-B (No.2) Performance or Stuck Off

DTC Detecting Condition and Trouble Area
[DTC P0751]

DTC DETECTING CONDITION	TROUBLE AREA
When one of the following condition is detected while driving at 15km/h (10 mile/h) or more in "D" range after engine being warmed up. • Transaxle gear ratio is detected as same as that of 1st gear although PCM command is for 2nd gear. • Transaxle gear ratio is detected as same as that of 2nd gear although PCM command is for 1st gear.	• Mechanical malfunction of shift solenoid valve-A (No.1). • Malfunction of valve body assembly. • Fluid passage clogged or leaking. • Mechanical malfunction of transaxle.

[DTC P0756]

DTC DETECTING CONDITION	TROUBLE AREA
When one of the following condition is detected while driving at 15km/h (10 mile/h) or more in "D" range after engine being warmed up. • Transaxle gear ratio is detected as same as that of 2nd gear although PCM command is for 3rd gear. • Transaxle gear ratio is detected as same as that of 3rd gear although PCM command is for 2nd gear.	• Mechanical malfunction of shift solenoid valve-B (No.2). • Malfunction of valve body assembly. • Fluid passage clogged or leaking. • Mechanical malfunction of transaxle.

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 tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTC and pending DTC in PCM memory by using scan tool.
3) Start engine and warm it up to normal operating temperature.
4) Make sure that fuel remaining amount is more than half by fuel level meter.
5) Shift selector lever to "D" range and hold it for 20 seconds or longer.
6) Drive vehicle with 1st, 2nd and 3rd gear in "D" range in that order for 20 seconds or longer each referring to "Automatic Gear Shift Diagram" in this section.
7) Stop vehicle and turn ignition switch OFF.
8) Report Step 3) to 6) one time.
9) Stop vehicle.
10) Check DTC, pending DTC and freeze frame data.

Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transmission Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transmission Diagnostic Flow Table" in this section.
2	Check Shift Solenoid valve-A or -B for Operation referring to "Solenoid Valve Inspection" in this section. Are they in good condition?	Go to Step 3.	Replace shift solenoid valve assembly.

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Step	Action	Yes	No
3	Check Valves and Fluid Passage in Valve Body. Are they in good condition?	Substitute a known-good PCM and recheck.	Clean fluid passage or replace faulty parts.

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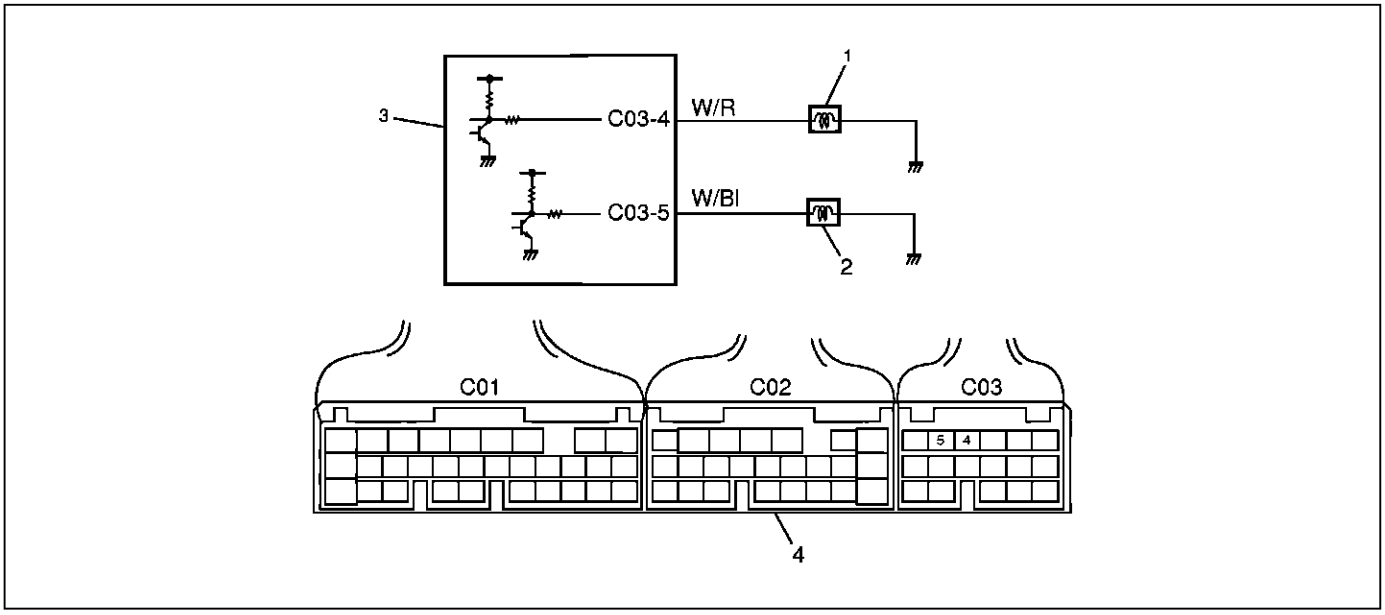
DTC P0753 Shift Solenoid-A (No.1) Electrical
DTC P0758 Shift Solenoid-B (No.2) Electrical

Wiring Diagram



1. Shift solenoid valve-A (No.1)	3. PCM
2. Shift solenoid valve-B (No.2)	4. Terminal arrangement of PCM connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC DETECTING CONDITION	TROUBLE AREA
• Voltage of shift solenoid valve PCM terminal is low although PCM is commanding shift solenoid to turn ON. • Voltage of shift solenoid valve PCM terminal is high although PCM is commanding shift solenoid to turn OFF.	• Shift solenoid valve circuit shorted to ground. • Shift solenoid valve circuit open or shorted to power circuit. • Shift solenoid valve malfunction. • PCM

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 tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTC and pending DTC in PCM memory by using scan tool.
3) Start engine and shift selector lever to “D” range.
4) Start vehicle and increase vehicle speed to 40 km/h (25 mile/h) in “D” range.
5) Keep on driving in above speed for 10 seconds and decrease vehicle speed gradually.
6) Stop vehicle.
7) Check DTC, pending DTC and freeze frame data.

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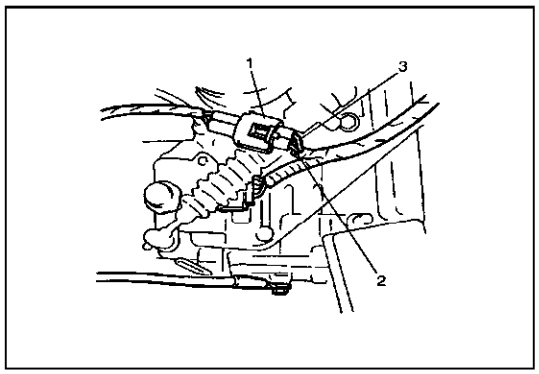
Troubleshooting

Step	Action	Yes	No
1	Was "Automatic Transmission Diagnostic Flow Table" performed?	Go to Step 2.	Go to "Automatic Transmission Diagnostic Flow Table" in this section.
2	Check Shift Solenoid Circuit for Short. 1) Turn ignition switch OFF and disconnect PCM connectors. 2) Check for proper connection to PCM at terminal C03-4 or C03-5. 3) If OK, then turn ignition switch ON and measure voltage between terminal C03-4 or C03-5 disconnected PCM connector and ground. Is it about 0 V?	Go to Step 3.	"W/R" or "W/Bl" circuit shorted to power circuit.
3	Check Shift Solenoid Circuit for Open or Short. 1) Turn ignition switch OFF. 2) Measure resistance between terminal C03-4 or C03-5 disconnected PCM connector and ground. C03-4 (Shift Solenoid Valve-A): About 18 – 22 Ω at 20°C, 68°F C03-5 (Shift Solenoid Valve-B): About 14 – 18 Ω at 20°C, 68°F Is measured value as specified?	Intermittent trouble or faulty PCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 4.
4	Check Shift Solenoid for Resistance. 1) Disconnect solenoids connector in engine room. 2) Check for proper connection to solenoid at "W/R" or "W/Bl" wire terminal. 3) If OK, then measure resistance between each terminal of solenoid and transmission. Is measured value as specified in Step 3?	"W/Bl" or "W/R" circuit open or shorted to ground.	Check solenoid wire harness for open or short. If wire and connections are OK, replace shift solenoid valve-A or -B.

Fig. for Step 4



1.	Solenoid connector
2.	Shift solenoid valve-A (No.1) harness
3.	Shift solenoid valve-B (No.2) harness

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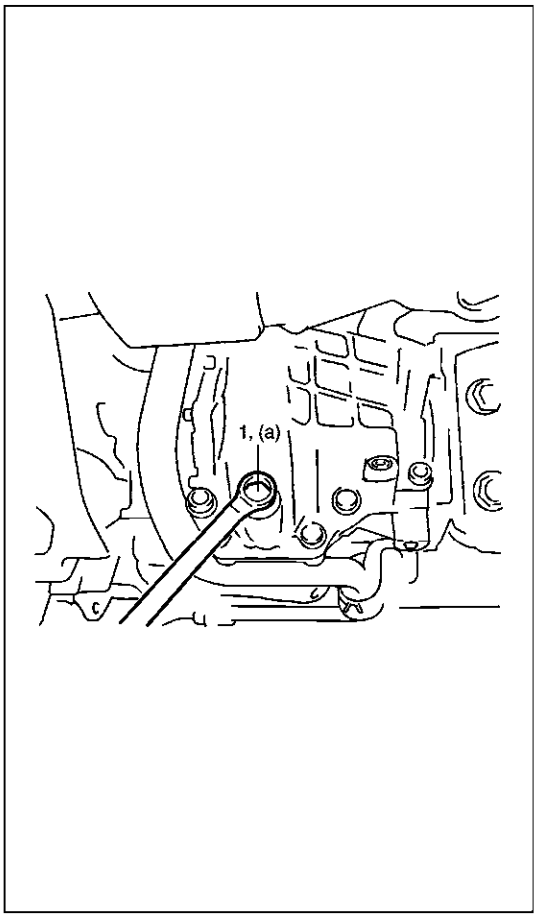
On-Vehicle Service

Maintenance Service

Fluid change



1) Raise vehicle.
2) With transmission cool, remove drain plug (1) and drain fluid.
3) Install drain plug gasket and drain plug to oil pan, and tighten drain plug to specification.

Tightening torque
A/T fluid drain plug (a) : 40 N·m (4.0 kg-m, 29.0 lb-ft)

4) Remove fluid level gauge from fluid filler tube, and add new fluid from fluid filler tube. Use DEXRON®-III or DEXRON®-IIE or equivalent automatic transmission fluid.

NOTE:

Draining or refilling volume of fluid may change depending on draining time or temperature etc.

5) Check fluid level with transmission at room temperature and at normal operating temperature as outlined in the following item.
(Refer to "Fluid level check at room (cold) temperature (Cold check)" and "Fluid level check at normal operating (hot) temperature (Hot check)" in this section.)

A/T fluid specification
An equivalent of DEXRON®-III or DEXRON®-IIE

Fluid capacity	about 4.1 liters

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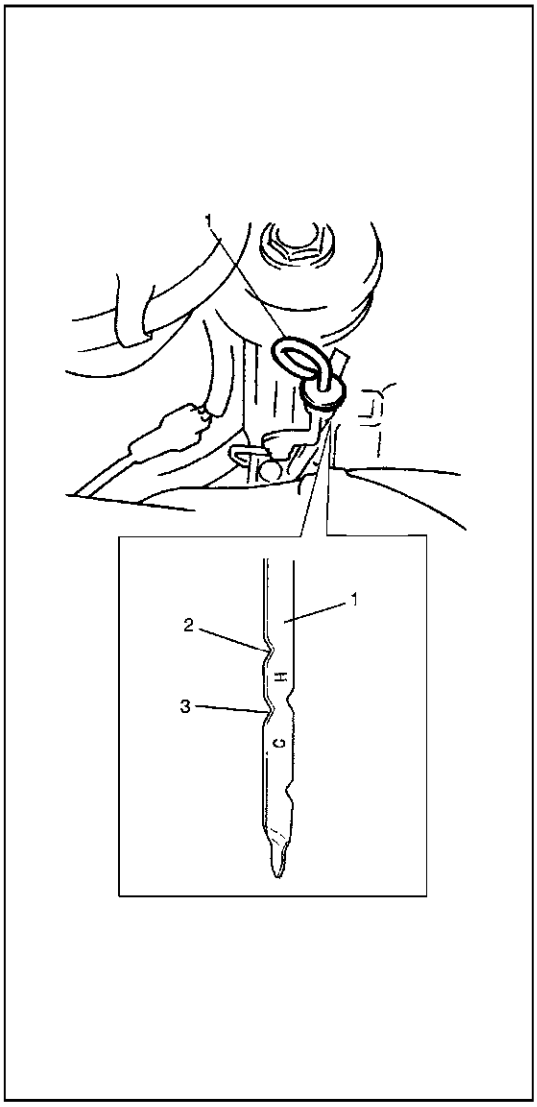
Fluid level check at normal operating (hot) temperature (Hot check)

INSPECTION



Automatic transmission fluid level can be checked properly at normal operating temperature which corresponds to 70 – 80°C (158 – 176°F) of fluid. Perform fluid level check when fluid temperature is within the above temperature range.

1) Driving at 60 km/h (37.5 mile/h) in "D" range for about 15 minutes will raise fluid temperature to normal operating temperature.
2) Park vehicle on level place.
3) Apply parking brake and block vehicle wheels.
4) With select level in "P" position, start engine. Do not race engine.
5) While running engine at idle speed, move select lever throughout each range and return it to "P" position.
6) Check fluid level using a cleaned level gauge (1). Fluid level must be in between level notches of edge strip (2) (FULL HOT) and (3) (LOW HOT). If fluid level is lower than level notch of edge strip (3) (LOW HOT), add fluid to specified level.

NOTE:

When checking fluid level, always read lower level on the gauge.

A/T fluid specification:

An equivalent of DEXRON®-IIE or DEXRON®-III

CAUTION:

Do not overfill. Overfilling can cause foaming and loss of fluid through vent. Then slippage and transmission failure can result.

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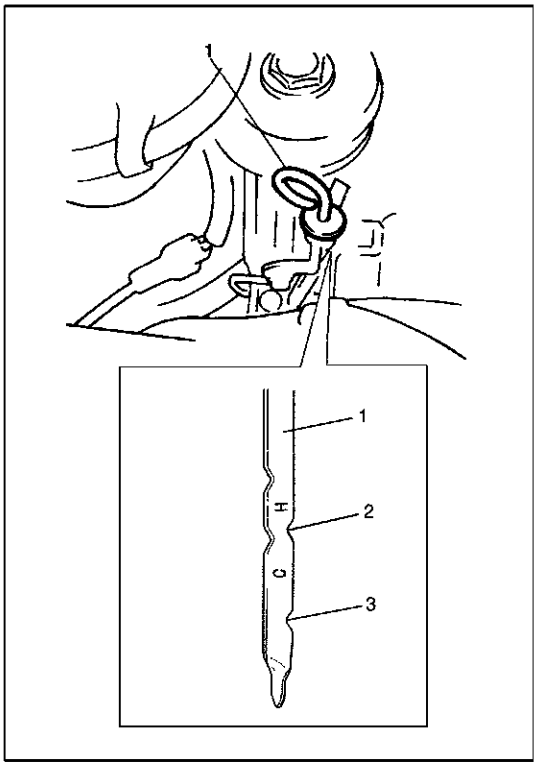
Fluid level check at room (cold) temperature (Cold check)

INSPECTION



Fluid level can be checked temporarily with fluid at room (cold) temperature which correspond to 20 – 30°C (68 – 86°F). This level check is considered to be preparation before performing level check under normal operating (hot) temperature. Fluid level must be in between level notches of edge strip (2) and (3).

CAUTION:
Fluid level check at room (cold) temperature is recommended only for the preparation of level check under normal (cold) operating condition.
Failure to perform fluid level check under normal (hot) operating temperature may result in damage to transmission.

1. Fluid level gauge

Oil Pan

REMOVAL

1) Raise vehicle and drain transmission fluid.
2) Remove oil pan from transmission.
   After removing oil pan bolts, tap around oil pan lightly with a plastic hammer for removal.

CAUTION:
- **Never hammer oil pan hard, or it may get deformed. It is recommended to hit oil pan indirectly through wood block.**
- **Do not force oil pan off by using a flat tip screwdriver or the like as it may cause damage to gasketed surface.**

3) Remove old sealing material on mating surface of oil pan thoroughly.

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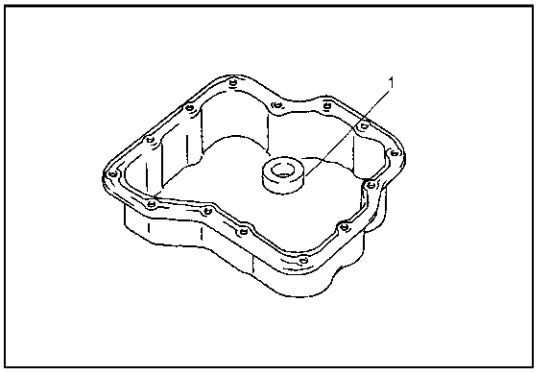
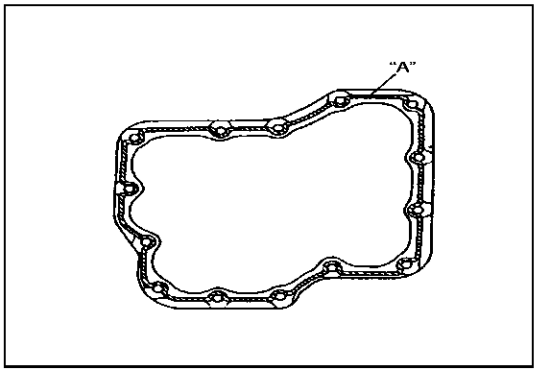
INSTALLATION

For oil pan installation, reverse its removal procedure using care for the following.

1) Make sure to remove old sealing material on mating surface of oil pan thoroughly.
2) Clean inside of oil pan before installation.

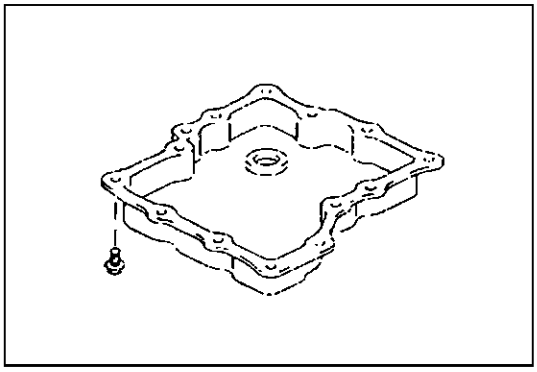


3) Clean fluid cleaner magnet (1) and install it at the position in the left figure.



4) Apply sealant to oil pan by using a nozzle as shown in figure by such amount that its section is 1.5 mm (0.059 in) in diameter.

"A": Sealant 99000-31230



5) Tighten oil pan bolts to the following torque one after another diagonally.

CAUTION:
Over tightening of bolts may cause fluid leakage.

Tightening torque for oil pan bolt
A/T oil pan bolt (a): 7 N·m (0.7 kg-m, 5.5 lb-ft)

6) Upon completion of installation, check for fluid level and leakage. (Refer to "Fluid level check at room (cold) temperature (Cold check)" and "Fluid level check at normal operating (hot) temperature (Hot check)" in this section.)

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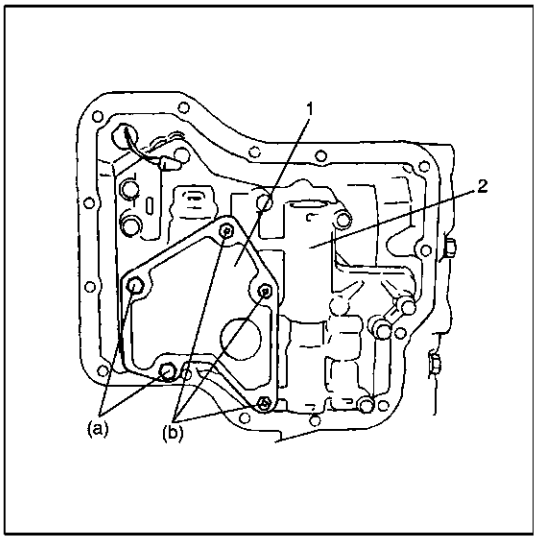
Oil Strainer



1) Drain transmission fluid.
2) Remove oil pan.
3) Remove oil strainer (1).
4) Clean oil strainer.
5) Install oil strainer (1) to lower valve body (2).

Tightening torque
Oil strainer mounting bolt (M6)
(a): 8 N·m (0.8 kg-m, 6.0 lb-ft)
Oil strainer mounting bolt (M5)
(b): 3 N·m (0.3 kg-m, 2.2 lb-ft)

6) Reinstall oil pan and refill transmission fluid.
7) Upon completion of installation, check for fluid level and leakage. (Refer to "Fluid level check at room (cold) temperature (Cold check)" and "Fluid level check at normal operating (hot) temperature (Hot check)" in this section.)

Throttle Position (TP) Sensor

INSPECTION

Check throttle position sensor referring to "Throttle Position (TP) Sensor" in Section 6E1.

Output Shaft Speed Sensor (VSS)

Refer to "Vehicle Speed Sensor (VSS)" in Section 6E1 for removal, installation and inspection.

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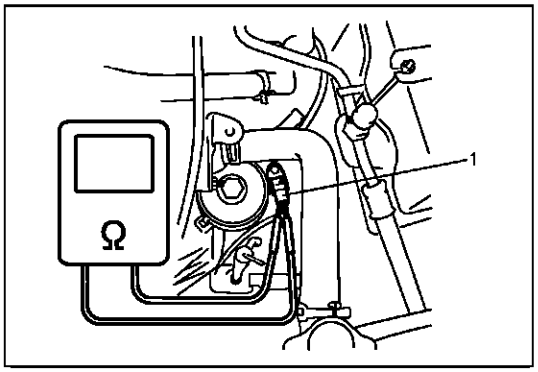
Sun Gear Speed Sensor

INSPECTION

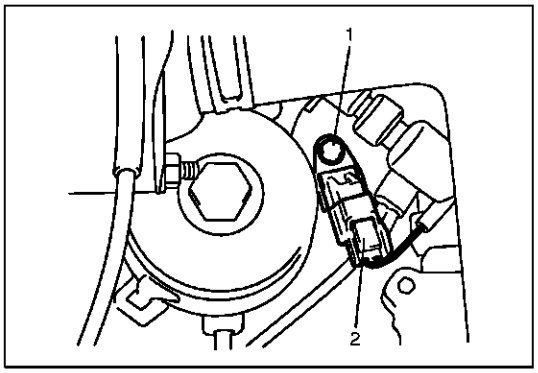


1) Disconnect negative cable at battery.
2) Disconnect sun gear speed sensor connector.
3) Check resistance between sun gear speed sensor terminals.

Sun gear speed sensor resistance
Standard: 490 – 590 Ω at 20°C (68°F)

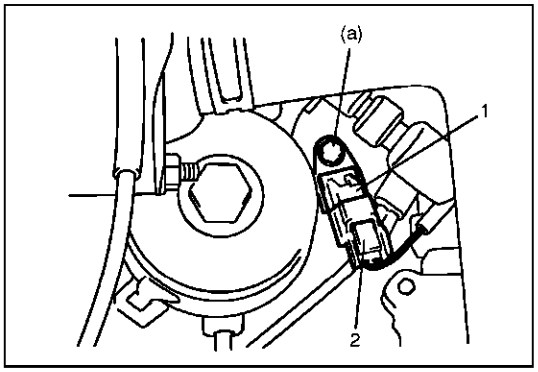
1. Sun gear speed sensor

REMOVAL



1) Disconnect negative cable at battery.
2) Disconnect sun gear speed sensor connector (2).
3) Remove sun gear speed sensor (1) by removing is bolt.

INSTALLATION



1) Apply A/T fluid to sun gear speed sensor O-ring.
2) Install sun gear speed sensor (1) to A/T case and tighten bolt to specified torque.

Tightening torque
Sun gear speed sensor bolt
(a): 5.5 N·m (0.55 kg-m, 4.0 lb-ft)

3) Connect input shaft speed sensor connector (2) to sun gear speed sensor (1).
4) Connect negative cable to battery.

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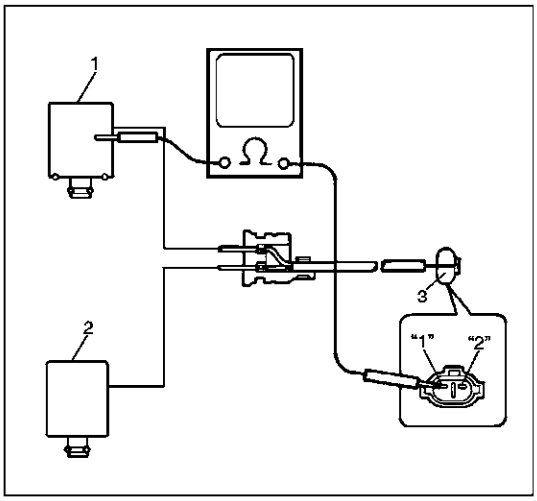
Shift Solenoid

INSPECTION

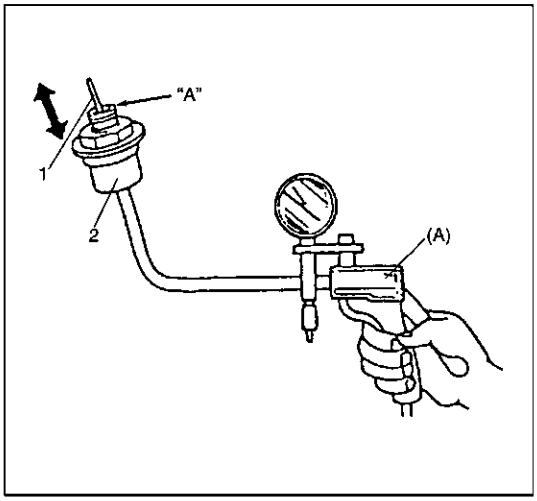


Disconnect connector (3) and measure resistance between terminal and engine ground.

Solenoid A (1): Between terminal "1" and engine ground.	about 18 – 22 Ω at 20°C (68°F)
Solenoid B (2): Between terminal "2" and engine ground.	about 14 – 18 Ω at 20°C (68°F)

Vacuum Diaphragm and Piping

INSPECTION



- Check pipe of vacuum diaphragm (2) for looseness, coming off or breakage.
- Check that rod (1) moves when vacuum is applied to vacuum diaphragm. Also, check that air is not drawn in through part "A" in figure.

Special tool
(A) : 09917-47010

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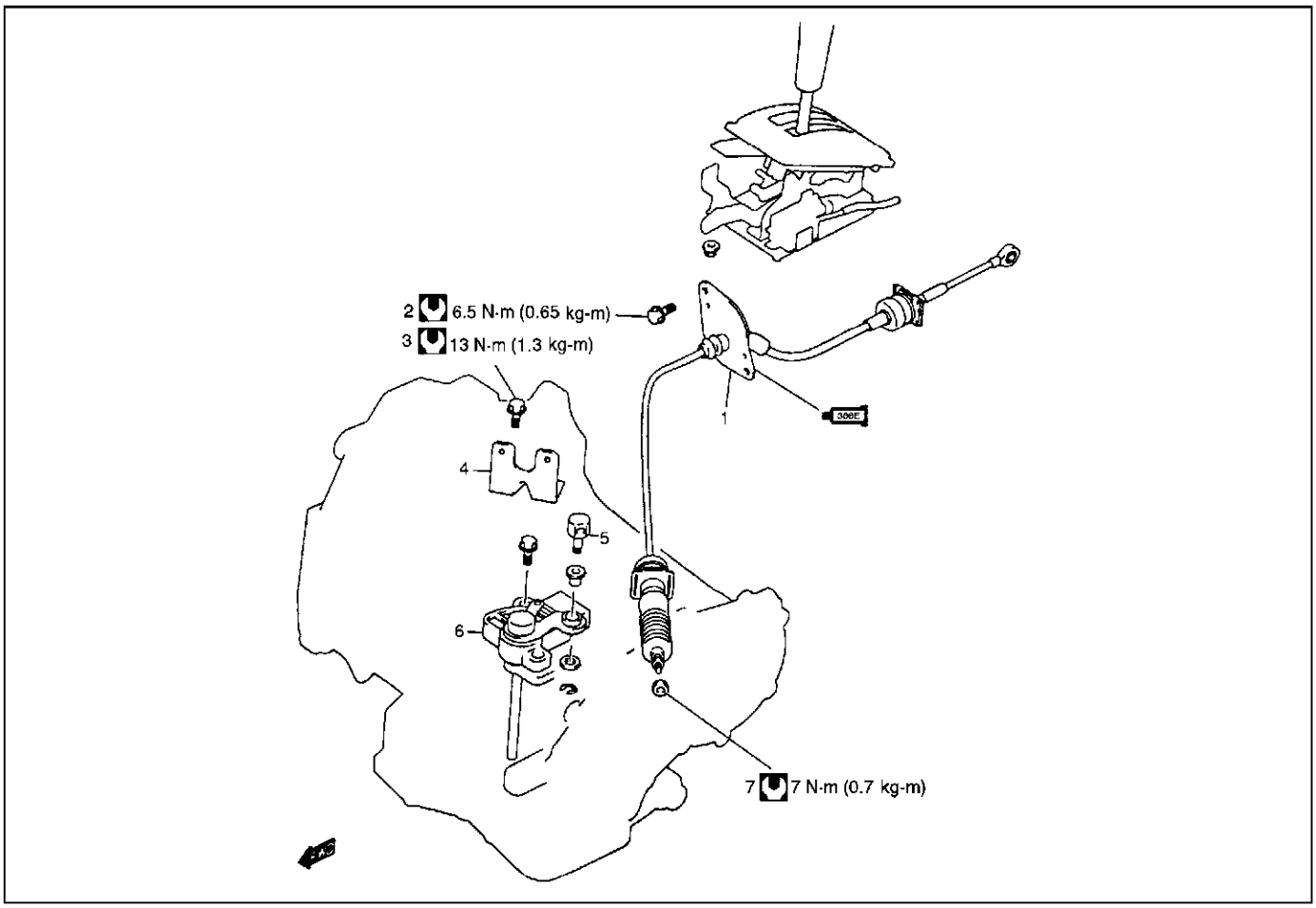
Select Cable



1. Select cable assembly	4. Cable bracket	7 Nut
2. Bolt	5. Manual selector cable joint	366E Apply SEALING COMPOUND 366E (99000-31090)
3. Bolt	6. Transmission range sensor	Tightening torque

REMOVAL

1) Remove console box.
2) Disconnect select cable from select lever and then from floor bracket.
3) Disconnect select cable from transmission.
4) Disconnect select cable from dash panel.

INSTALLATION

Install select cable by reversing removal procedure.
The important steps in installation are as follows.

- Apply sealant to select cable fastening portion with dash panel.

Sealant 99000-31090

- Tighten bolt and nut in upper figure to specified torque.

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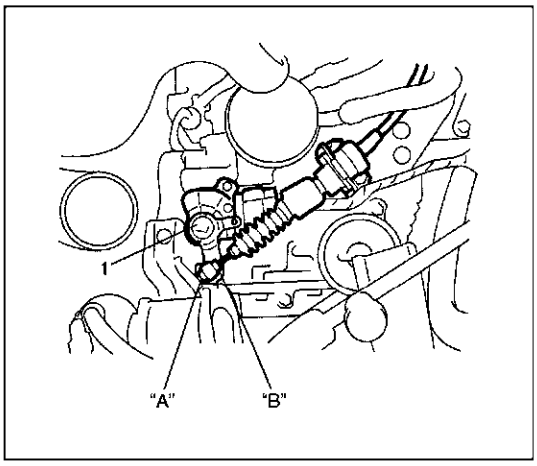


- Adjust select cable as follows:

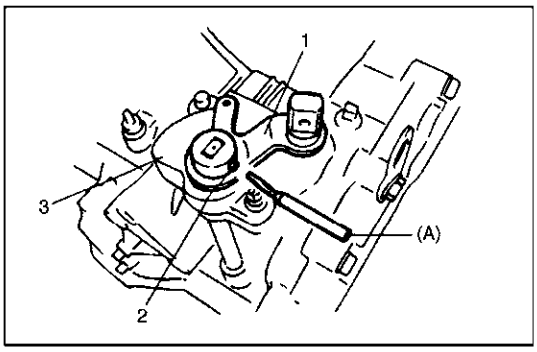
1) Before tightening cable end nut, shift select lever to "N" range.
2) Also shift manual select lever (1) to "N" range.
3) Turn nut "A" by hand till it contacts manual select cable joint.
4) Then tighten nut "B" with wrench to specified torque.

After select cable was installed, check for the following.

- Push vehicle with select lever shift to "P" range.
  Vehicle should not move.
- Turn ignition switch "START" with select lever shifted to "P" and "N" range.
  Starting motor should not operate.
- Turn ignition switch "ON" with select lever shifted to "R" range.
  Back up light should light.

Transmission Range Sensor

REMOVAL



1) Disconnect transmission range sensor connector.
2) Disconnect select cable from lever (1).
3) Using special tool, remove spring pin (2) and then remove lever.

Special tool
(A) : 09922-89810

4) Remove transmission range sensor (3).

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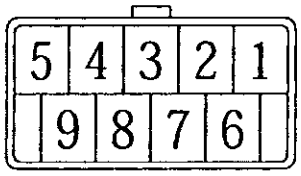
INSPECTION

Check for continuity at position indicated in the following table by shifting select lever.

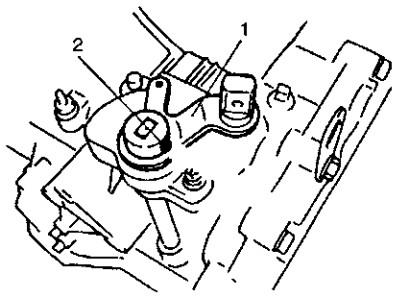


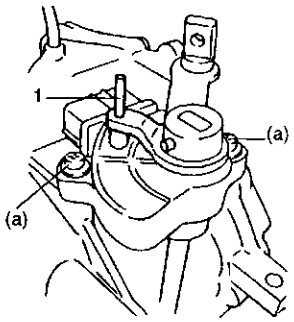
	6	9	1	4	5	3	8	2	7
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
2			○					○	
L			○						○

If any faulty condition is found in above check, replace transmission range sensor.

INSTALLATION

1) Install transmission range sensor and tighten transmission range sensor mounting bolts temporarily.
2) Install lever (1) to manual shift shaft and drive new spring pin (2) into shaft.





3) Put a 3 mm pin (1) (drill, etc.) into hole in sensor and positioning hole in manual shift shaft and fix shaft range sensor ("N" position).
4) Tighten transmission range sensor mounting bolt to specified torque.

Tightening torque
Transmission range sensor mounting bolt
(a) : 3.5 N·m (0.35 kg-m, 2.6 lb-ft)

5) Adjust select cable as previously outlined.
6) Connect transmission range switch connector.

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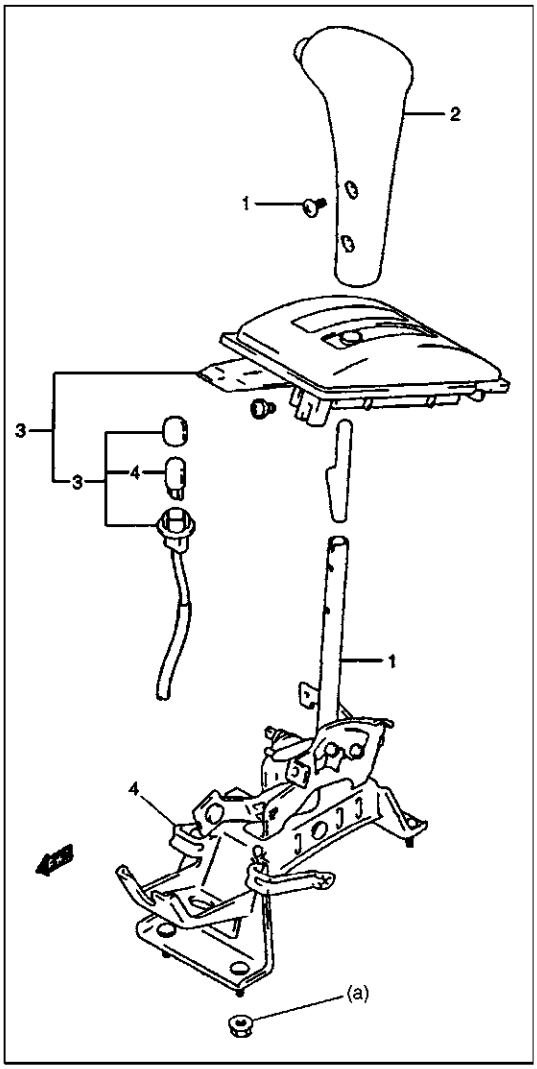
Select Lever

REMOVAL



1) Remove select knob screw (1) and then select knob (2).

NOTE:

Knob and push button must not be disassembled.

2) Remove console box and select indicator assembly (3).
3) Remove select cable from select lever.
4) Raise vehicle.
5) Remove housing nuts and then remove lever housing (4) with select lever from floor.

INSTALLATION

Assemble selector by reversing removal procedure, replacing parts with new ones as necessary.
Tightening Torque for Lever Housing Nuts

Tightening torque
Lever housing nuts (a) : 20 N·m (2.0 kg-m, 14.5 lb-ft)

NOTE:

Check selector for proper operation as follows.

- **With knob button pushed half way, N to R and D to 2 shifts are available (but not any other shift).**
- **With knob button pushed all the way in, 2 to L and R to P shifts are available.**

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Unit Repair

Refer to the same section of the service manual mentioned in the FOREWORD of this manual.

Required Service Materials

Material	Recommended SUZUKI Material	Use
Automatic transmission fluid	An equivalent of DEXRON®-III or DEXRON®-IIE	• Automatic transmission • Parts lubrication when installing
Sealant	SUZUKI BOND NO.1216B (99000-31230)	• Side and bottom cover case • Side bearing housing • Oil pan
Lithium grease	SUZUKI SUPER GREASE C (99000-25030)	• Retaining parts in place when assembling • Oil seal lip
	SUZUKI SUPER GREASE A (99000-25010)	• Cable ends
Water tight sealant	SUZUKI SEALING COMPOUND 366E (99000-31090)	• Select cable fastening portion with dash panel

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Tightening Torque Specification

Fastening part	Tightening torque		
	N•m	kg-m	lb-ft
A/T fluid drain plug	40	4.0	29
A/T oil pan bolt	7.0	0.7	5.5
Oil strainer mounting bolt (M6)	8.0	0.8	6.0
Oil strainer mounting bolt (M5)	3.0	0.3	2.2
Sun gear speed sensor bolt	7.0	0.7	5.0
Transmission range sensor mounting bolt	3.5	0.35	2.6
Lever housing nut	20	2.0	14.5
Drive plate bolt	20	2.0	14.5
Oil pump cover bolt	9.0	0.9	7.0
Counter shaft nut	55	5.5	29.0
Final gear bolt	90	9.0	65.0
Manual shaft lock bolt	7.0	0.7	5.0
Manual shaft nut	13	1.3	9.5
Side cover bolt	19	1.9	13.5
Differential lower cover mounting bolt (M8)	19	1.9	13.5
Differential lower cover mounting bolt (M10)	40	4.0	29.0
Side bearing housing bolt	28	2.8	20.5
Oil pump mounting bolt	13	1.3	9.5
Second brake band bolt	2.5	0.25	1.8
Second brake band nut	19	1.9	13.5
Oil cooler mounting bolt	35	3.5	25.5
Output speed sensor (VSS) mounting bolt	7.0	0.7	5.0
Vacuum diaphragm mounting bolt	7.0	0.7	5.0

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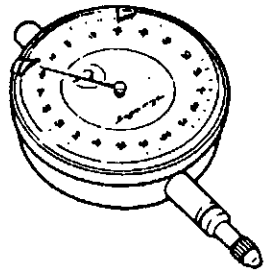
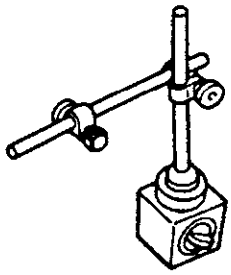
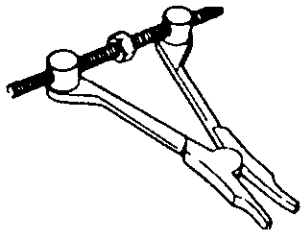
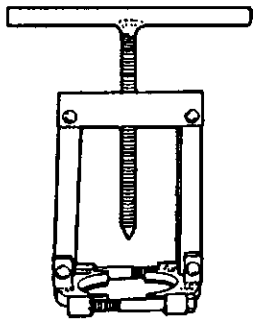
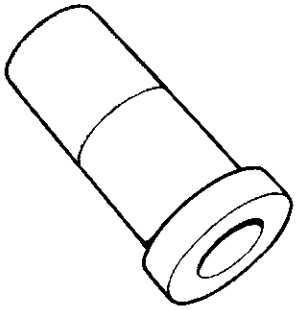
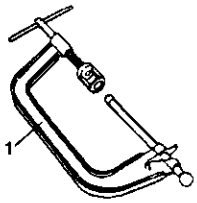
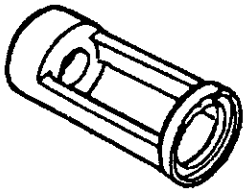
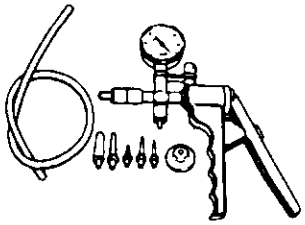
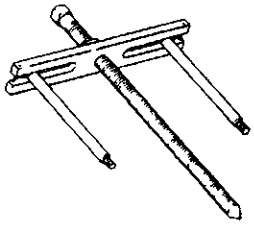
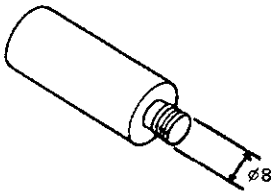
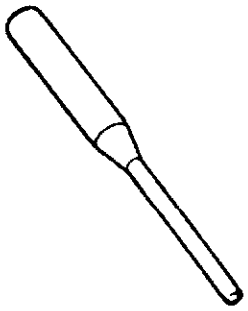
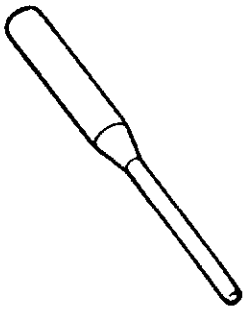
Special Tool

 09900-20606 Dial gauge	 09900-20701 Magnetic stand	 09912-34510 Case separator	 09913-65810 Bearing puller
 09913-85210 Bearing installer	 09916-14510 Valve lifter	 09916-48210 Valve lifter attachment	 09917-47010 Vacuum pump gauge
 09918-48211 Oil pump remover	 09918-48220 Oil pump remover attachment (M8)	 09922-85811 Spring pin remover 4.5 mm	 09922-89810 Spring pin remover 3.5 mm

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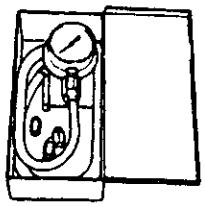
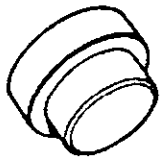
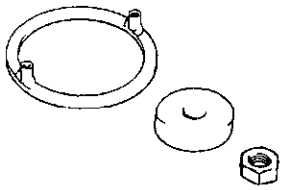
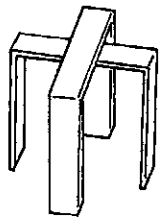
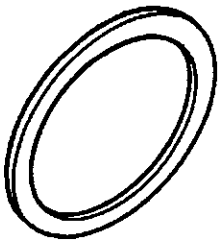
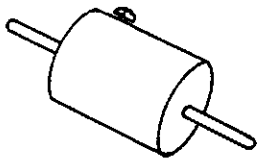
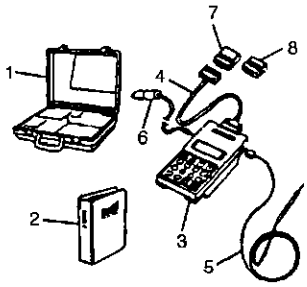
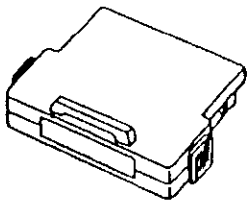
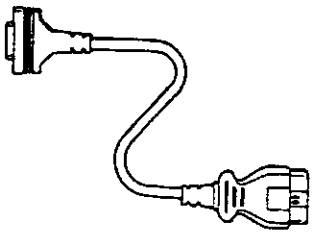
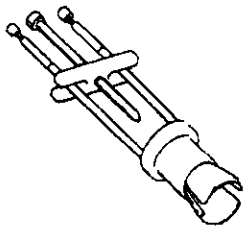
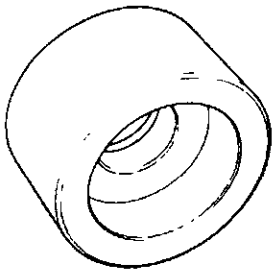
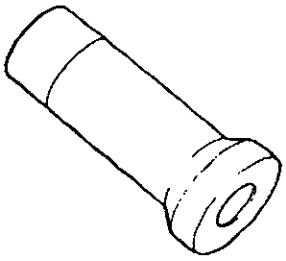
 09925-37810 Oil pressure gauge set	 09925-88210 Bearing puller attachment	 09926-98320 Spring compressor No. 1 set	 09926-98350 Spring compressor No. 4
 09926-98370 Spring compressor No. 1 attachment	 09927-87010 Depth gauge	 09931-76011 Tech 1A kit (SUZUKI scan tool) (See NOTE "A")	 Mass storage cartridge for Tech 1A
 09931-76030 16/14 pin DLC cable for Tech 1A	 09941-84510 Bearing inner race remover	 09951-16060 Bush remover	 09951-76010 Bearing installer

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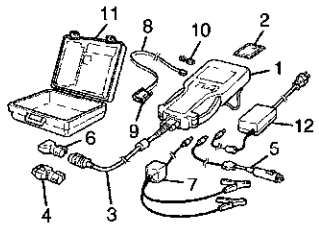

Tech 2 kit (SUZUKI scan tool) (See NOTE "B".)

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

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SECTION 7C

CLUTCH

CONTENTS

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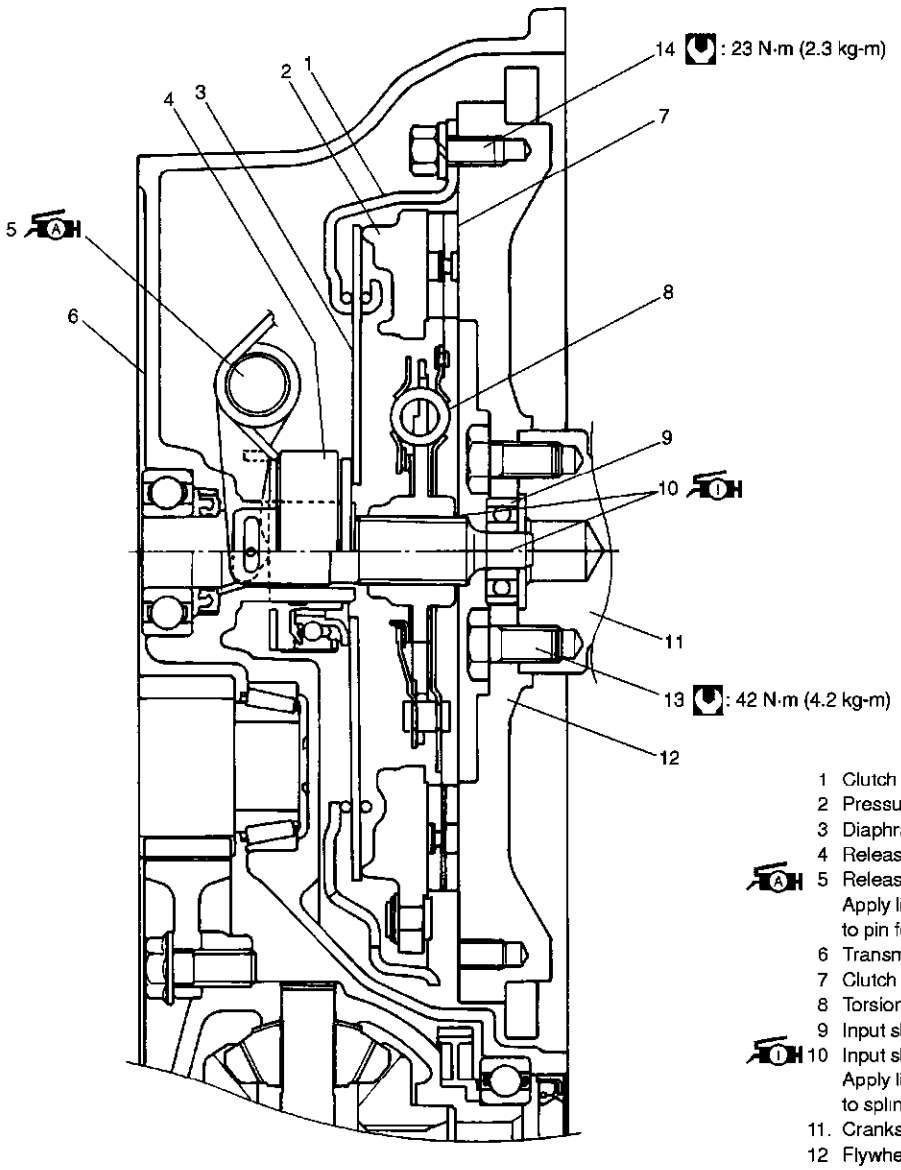
GENERAL DESCRIPTION

The clutch is a diaphragm-spring clutch of a dry single disc type. The diaphragm spring is of a tapering-finger type, which is a solid ring in the outer diameter part, with a series of tapered fingers pointing inward.
The disc, carrying 3 torsional coil springs, is positioned on the transmission input shaft with an involute spline fit.
The clutch cover is secured to the flywheel, and carries the diaphragm spring in such a way that the peripheral edge part of the spring pushes on the pressure plate against the flywheel (with the disc in between), when the clutch release bearing is held back. This is the engaged condition of the clutch.

Depressing the clutch pedal causes the release bearing to advance and pushes on the tips of the tapered fingers of the diaphragm spring. When this happens, the diaphragm spring pulls the pressure plate away from the flywheel, thereby interrupting the flow of drive from flywheel through clutch disc to transmission input shaft.



1 Clutch cover
2 Pressure plate
3 Diaphragm spring
4 Release bearing
A 5 Release shaft
Apply lithium grease 99000-25010 to pin for release bearing
6 Transmission right case
7 Clutch disc
8 Torsional spring
9 Input shaft bearing
I 10 Input shaft
Apply lithium grease 99000-25210 to spline part
11. Crankshaft
12 Flywheel
13 Flywheel bolt
14 Clutch cover bolt

: Tightening Torque

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DIAGNOSIS

Condition	Possible Cause	Correction
Slipping	• Improper clutch pedal free travel	Adjust free travel.
	• Worn or oily clutch disc facing	Replace disc.
	• Warped disc, pressure plate or flywheel surface	Replace disc, clutch cover or flywheel.
	• Weakened diaphragm spring	Replace clutch cover.
	• Rusted clutch cable	Replace cable.
Dragging clutch	• Improper clutch pedal free travel	Adjust free travel.
	• Weakened diaphragm spring, or worn spring tip	Replace clutch cover.
	• Rusted input shaft splines	Lubricate.
	• Damaged or worn splines of transmission input shaft	Replace input shaft.
	• Excessively wobbly clutch disc	Replace disc.
	• Clutch facings broken or dirty with oil	Replace disc.
Clutch vibration	• Glazed (glass-like) clutch facings	Repair or replace disc.
	• Clutch facings dirty with oil	Replace disc.
	• Release bearing slides unsmoothly on input shaft bearing retainer	Lubricate or replace input shaft bearing retainer.
	• Wobbly clutch disc, or poor facing contact	Replace disc.
	• Weakened torsion springs in clutch disc	Replace disc.
	• Clutch disc rivets loose	Replace disc.
	• Distorted pressure plate or flywheel surface	Replace clutch cover or flywheel.
	• Weakened or loosened engine mounting bolt or nut	Retighten or replace mounting.
Noisy clutch	• Worn or broken release bearing	Replace release bearing.
	• Input shaft front bearing worn down	Replace input shaft bearing.
	• Excessive rattle of clutch disc hub	Replace disc.
	• Cracked clutch disc	Replace disc.
	• Pressure plate and diaphragm spring rattling	Replace clutch cover.
Grabbing clutch	• Clutch disc facings soaked with oil	Replace disc.
	• Clutch disc facings excessively worn	Replace disc.
	• Rivet heads showing out of facing	Replace disc.
	• Weakened torsion springs	Replace disc.

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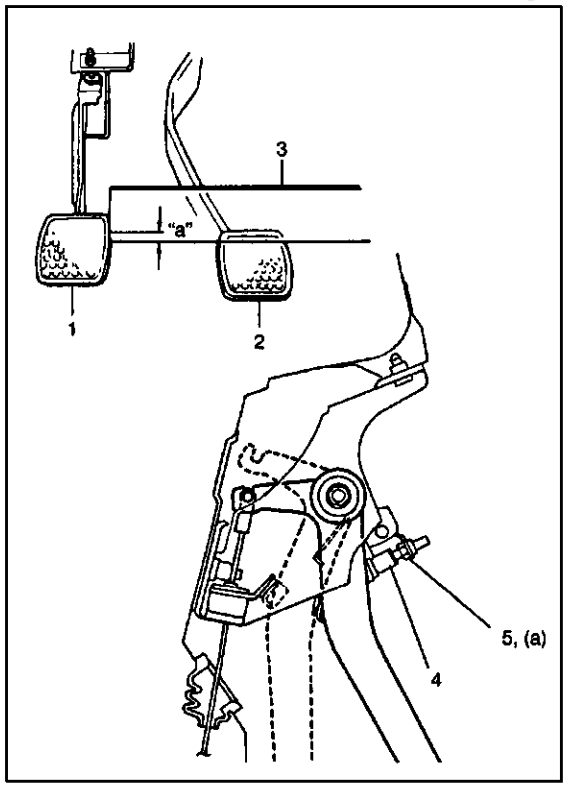


ON-VEHICLE SERVICE

CLUTCH PEDAL

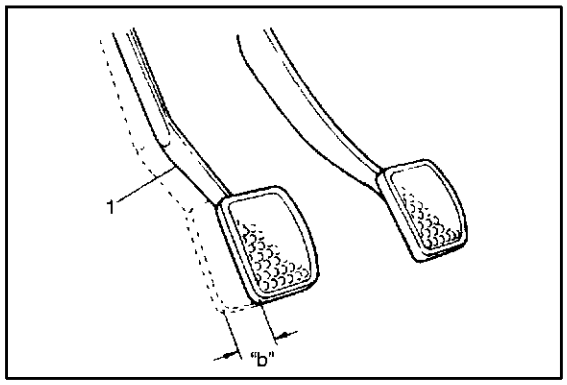
CLUTCH PEDAL HEIGHT

Measure pedal height difference "a" using measure (3) and adjust clutch pedal (1) height so that it becomes almost same as brake pedal (2) height.

Height difference "a": 0 mm (0 in.)

If clutch pedal height is not as specified above, adjust it by turning pedal stopper bolt (4).
Be sure to tighten lock nut (5) after adjustment.

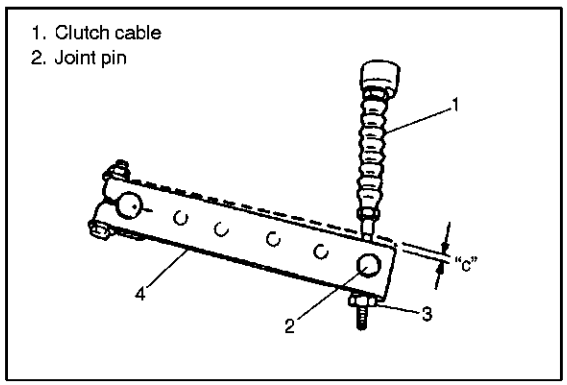
Tightening Torque
(a): 6.0 N·m (0.6 kg-m, 4.5 lb-ft)



CLUTCH PEDAL FREE TRAVEL

1) Depress clutch pedal (1), stop the moment clutch resistance is felt, and measure distance (clutch pedal free travel). Free travel should be within the following specification.

   Pedal free travel "b": 15 – 20 mm (0.6 – 0.8 in.)



2) If free travel is out of specification, adjust it with cable joint nut (3).

   Release arm (4) free travel "c": 0 – 2 mm (0 – 0.08 in.)

3) After checking clutch pedal free travel, also check clutch for proper function with engine running.

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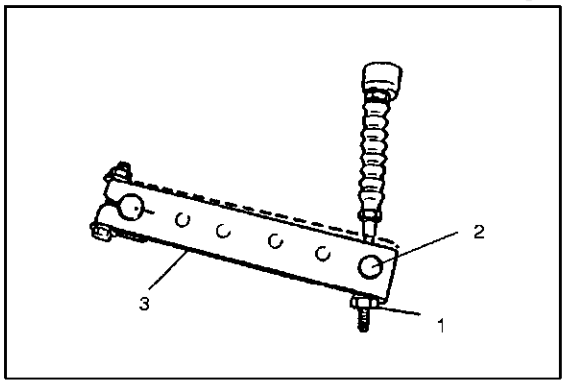
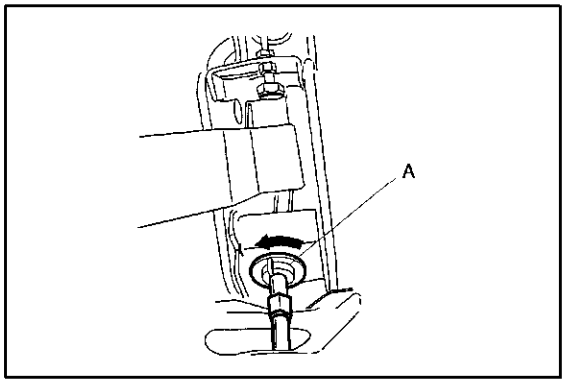


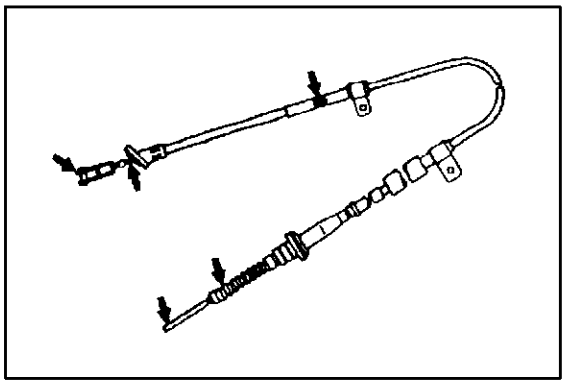
CLUTCH CABLE

REMOVAL

1) Disconnect negative cable at battery.
2) Remove clutch cable joint nut (1).
3) Remove joint pin (2) from clutch release arm (3).



4) Loosen A and disconnect clutch cable from clutch pedal upper side hook.



INSPECTION

Inspect clutch cable and replace it for any of the following conditions.

- Excessive cable friction
- Frayed cable
- Bent or kinked cable
- Broken boots
- Worn end

INSTALLATION

Reverse removal procedure for installation noting the following.

- Apply grease to cable end hook and also joint pin before installing cable.

  Grease 99000-25010

- Screw in joint nut and adjust free travel of pedal to specification by turning nut.
- Check clutch for proper function with engine running.

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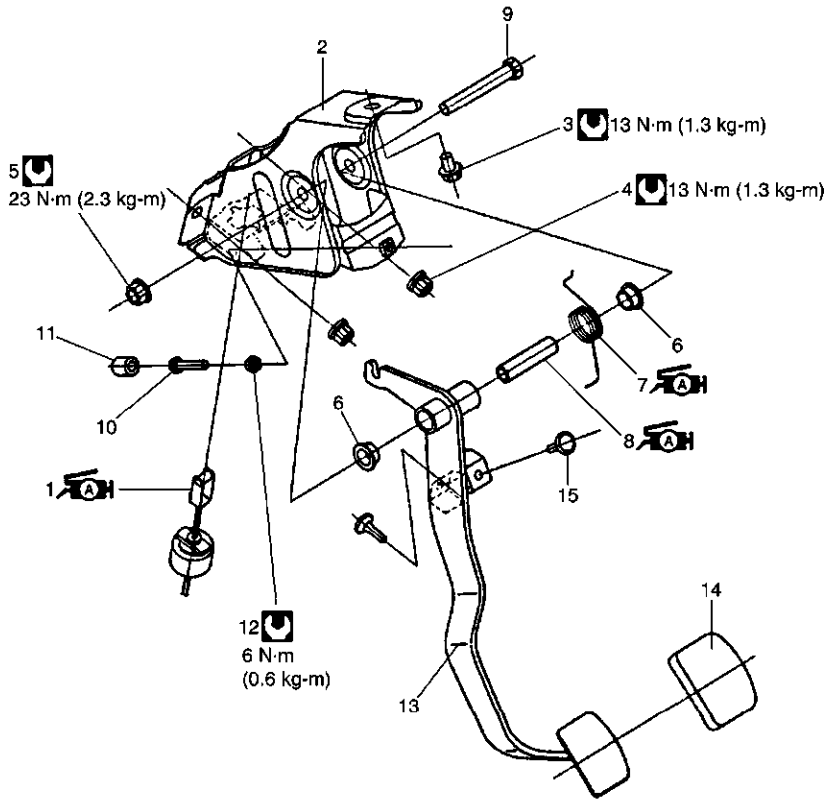
CLUTCH PEDAL AND CLUTCH PEDAL BRACKET



1. Clutch cable: Apply grease A 99000-25010 to cable hook.
2. Clutch pedal bracket
3. Bolt
4. Nut
5. Peal shaft nut
6. Pedal bush
7. Pedal spring: Apply grease A 99000-25010 to inside surface of spring.
8. Pedal shaft spacer: Apply grease A 99000-25010 to outside surface of spring.
9. Pedal shaft bolt
10. Pedal stopper bolt
11. Cap
12. Lock nut
13. Clutch pedal
14. Pedal pad
15. Cushion

: Tightening Torque

REMOVAL

1) Disconnect clutch cable hook from clutch pedal.
2) Remove attaching nuts and bolt.
3) Remove clutch pedal bracket with clutch pedal.
4) Remove each parts, if necessary.

INSTALLATION

Reverse removal procedure for installation, noting the following.

- Tighten each nuts and bolts to specified torque as indicated above figure.
- After installing, adjust clutch pedal free travel.
- Check clutch for proper function with engine running.

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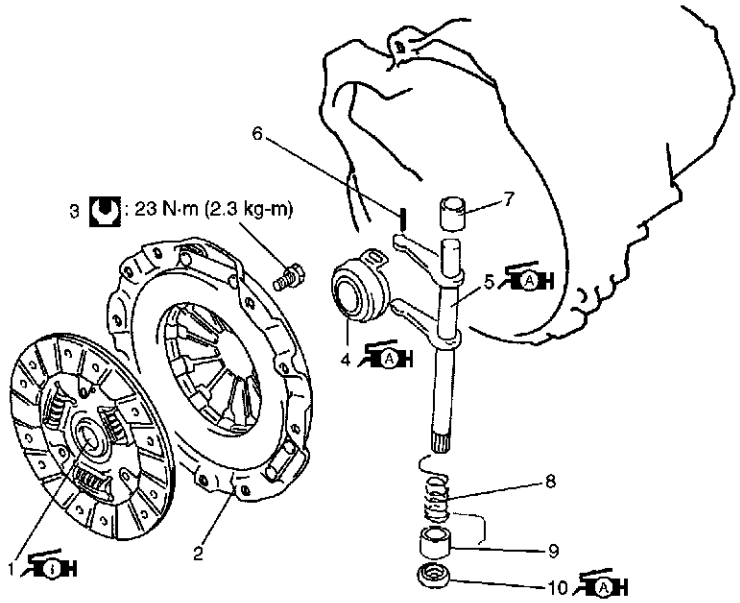
UNIT REPAIR OVERHAUL

CLUTCH COVER, CLUTCH DISC AND FLYWHEEL

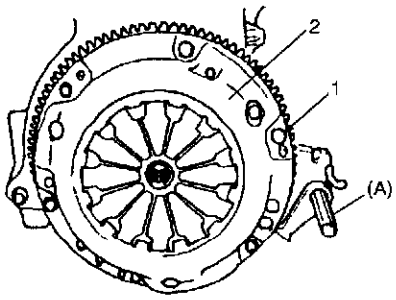


1. Clutch disc
   Apply lithium grease 99000-25210 to spline of input shaft
2. Clutch cover
3. Bolt
4. Release bearing
   Apply lithium grease 99000-25010 to joint of clutch release shaft
5. Clutch release shaft
   Apply lithium grease 99000-25010 to joint of release bearing
6. Spring pin
7. Clutch release shaft No.1 bush
   Apply lithium grease 99000-25010 to inside
8. Return spring
9. Clutch release shaft No.2 bush
   Apply lithium grease 99000-25010 to inside
10. Clutch release shaft seal
    Apply lithium grease 99000-25010 to inside

: Tightening Torque

DISMOUNTING/REMOUNTING

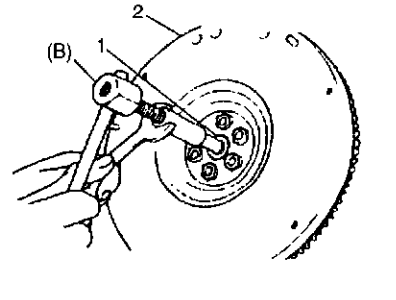
Refer to SECTION 7A for transmission dismounting and remounting.



REMOVAL

1) Hold flywheel stationary with special tool and remove clutch cover bolts (1), clutch cover (2) and clutch disc.

Special Tool
(A): 09924-17810



2) Pull out input shaft bearing (1) from flywheel (2) using special tool and wrench.

Special Tool
(B): 09917-58010

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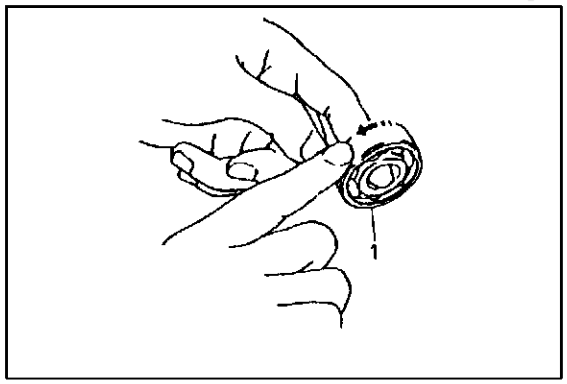
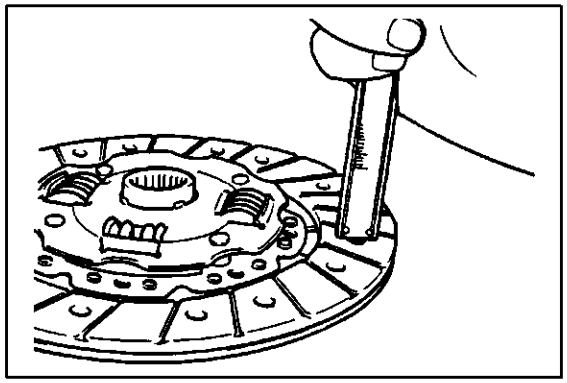


INSPECTION

Input Shaft Bearing

Check input shaft bearing (1) for smooth rotation and replace it if abnormality is found.

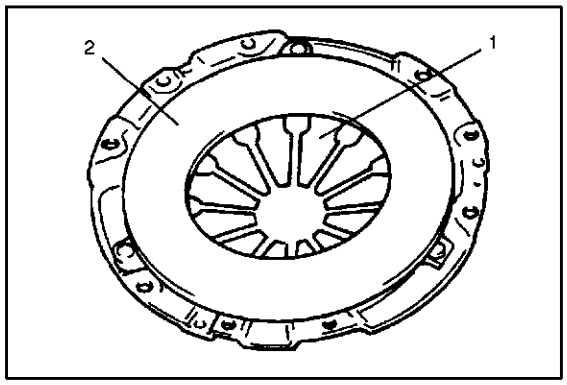


Clutch Disc

Measure depth of rivet head depression, i.e. distance between rivet head and facing surface. If depression is found to have reached service limit at any of holes, replace disc assembly.

Rivet head depth

Standard:	**1.2 mm (0.05 in.)**
Service limit:	**0.5 mm (0.02 in.)**



Clutch Cover

- Check diaphragm spring (1) for abnormal wear or damage.
- Inspect pressure plate (2) for wear or heat spots.
- If abnormality is found, replace it as assembly. Do not disassemble it into diaphragm and pressure plate.

Flywheel

Check surface contacting clutch disc for abnormal wear or heat spots. Replace or repair as required.

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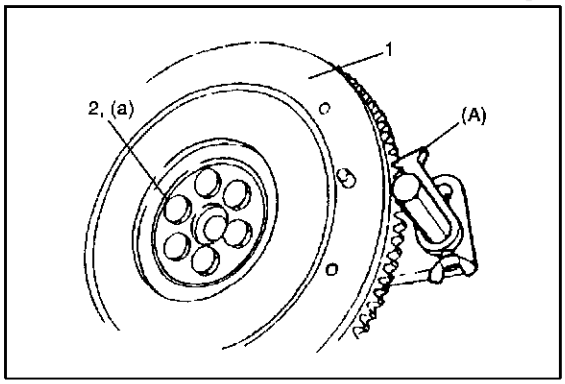
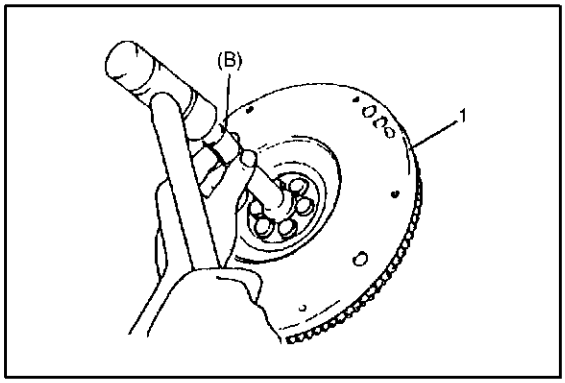


INSTALLATION

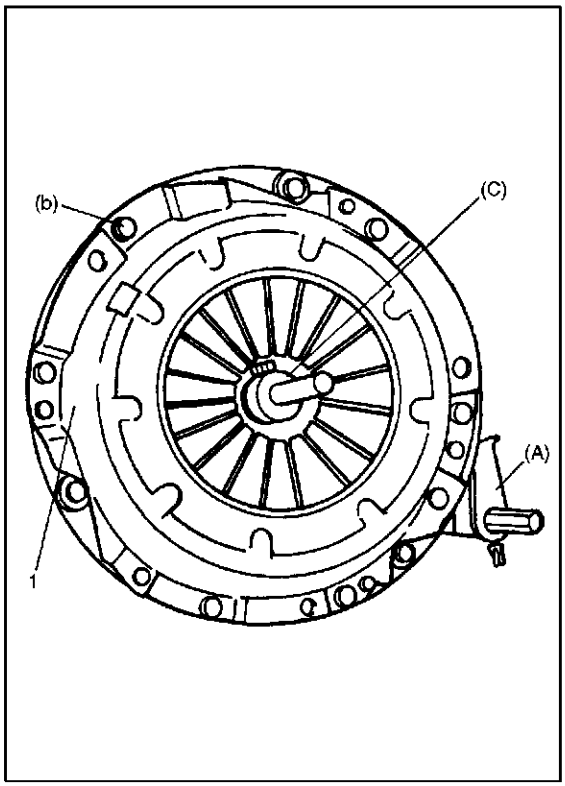
NOTE:
Before assembling, make sure that flywheel surface and pressure plate surface have been cleaned and dried thoroughly.

1) Install flywheel (1) to crankshaft and tighten bolts (2) to specification.
   Special Tool
   (A): 09924-17810
   Tightening Torque
   (a): 42 N·m (4.2 kg-m, 30.5 lb-ft)



2) Using special tool, install a new input shaft bearing to flywheel (1).

   Special Tool
   (B): 09925-98210



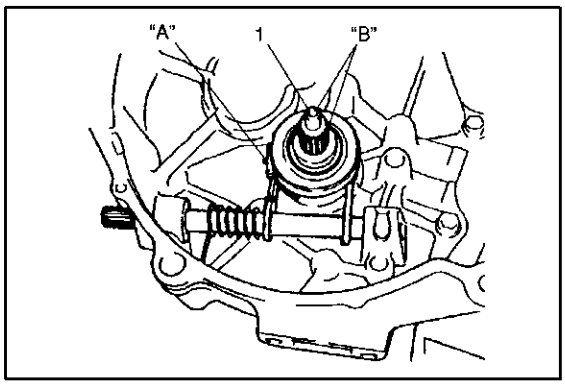
3) Aligning clutch disc to flywheel center using special tool, install clutch cover (1) and bolts. Then tighten bolts to specification.

   NOTE:
   While tightening clutch cover bolts, compress clutch disc with special tool by hand so that disc centered.

   CAUTION:
   Tighten cover bolts little by little evenly in diagonal order.

   Special Tool
   (A): 09924-17810
   (C): 09923-36330

   Tightening Torque
   (b): 23 N·m (2.3 kg-m, 16.5 lb-ft)



4) Slightly apply grease to input shaft (1), then joint transmission assembly with engine. Refer to SECTION 7A for remounting procedure.

   "A": Grease 99000-25010
   "B": Grease 99000-25210

   NOTE:
   Turn crankshaft with wrench from front while inserting transmission input shaft to clutch disc until splines mesh.

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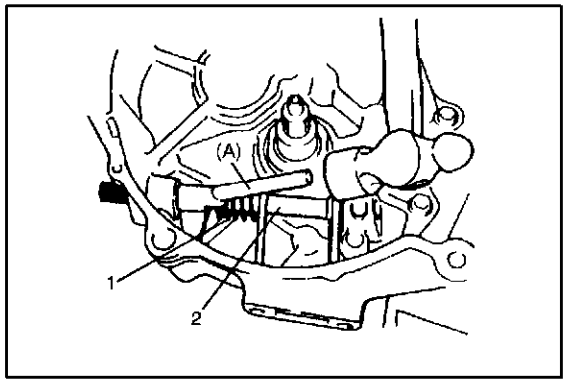
CLUTCH RELEASE SYSTEM

REMOVAL

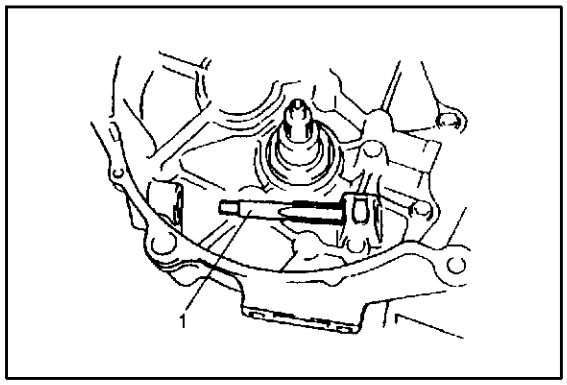
1) Remove release arm by loosening its bolt.
2) Take out release bearing by turning release shaft.



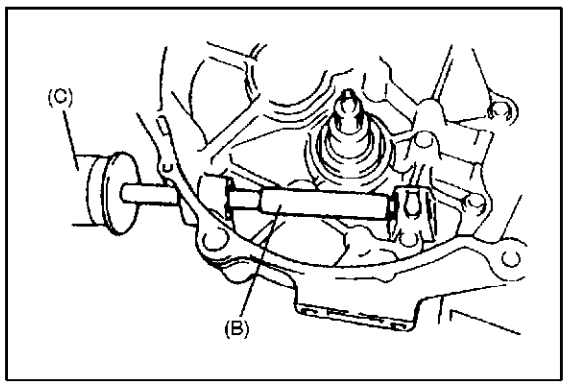
3) Unhook return spring (1) using pliers.
4) Drive out No.2 bush using special tool and hammer.
   Release shaft seal will also be pushed out.

   Special Tool
   (A): 09922-46010

5) Remove release shaft (2) and return spring (1).



6) Install tap (M14 × 1.5)(1) to clutch release shaft No.1 bush.



7) Pull No.1 bush out by using special tools.

   Special Tool
   (B): 09923-46030
   (C): 09930-30102

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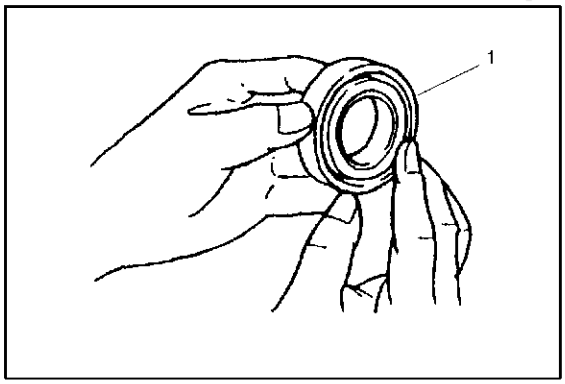
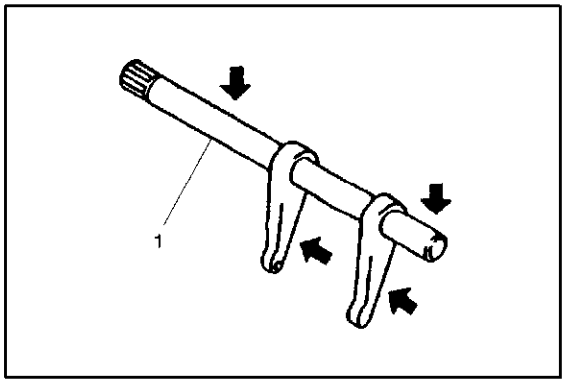


INSPECTION

Clutch release bearing

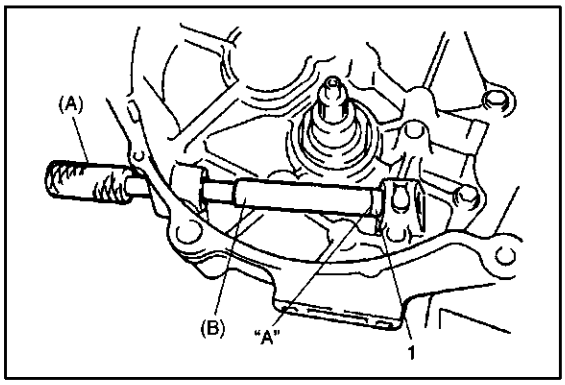
Check clutch release bearing (1) for smooth rotation.
If abnormality is found, replace it.

CAUTION:
Do not wash release bearing. Washing may cause grease leakage and consequential bearing damage.



Clutch release shaft

Check clutch release shaft (1) and its pin for deflection or damage.
If abnormality is found, replace it.

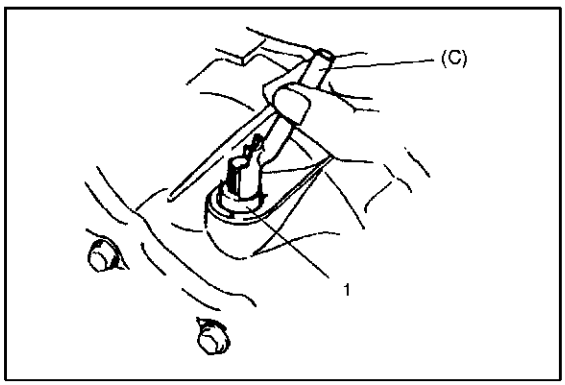


INSTALLATION

1) Drive in a new clutch release shaft No.1 bush (1) using special tools and then apply grease to bush inside.

   Special Tool
   (A): 09943-77910
   (B): 09923-46030
   "A": Grease 99000-25010

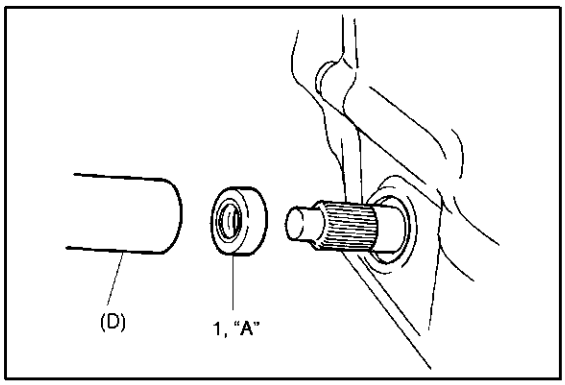
2) Install release shaft with return spring applied to it.



3) Apply grease to clutch release shaft No.2 bush (1) inside and press-fit it using the same special tool as in removal.

   Grease 99000-25010

   Special Tool
   (C): 09922-46010



4) Apply grease to inside of oil seal (1) and then install it till its upper end flush with end face of transmission case using special tool.

   "A": Grease 99000-25010

   Special Tool
   (D): 09925-98221

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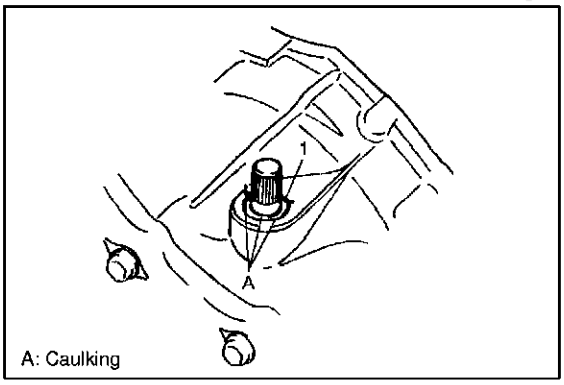
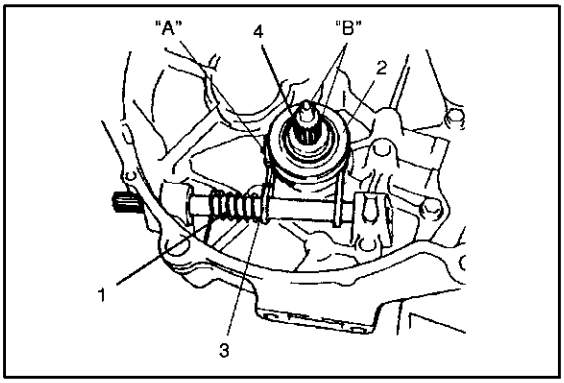


5) Caulk seal (1) at A using caulking tool and hammer.

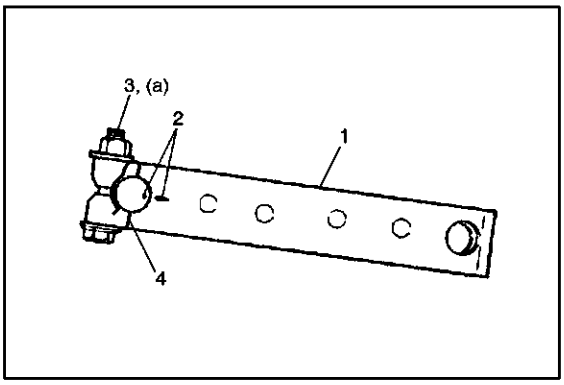


6) Hook return spring (1).
7) Apply grease to release bearing (2) inside and release shaft arm (3), then set bearing.

"A": Grease 99000-25010

8) Apply small amount of grease to input shaft spline (4) and front end as well.

"B": Grease 99000-25210



9) Set release arm (1) to release shaft aligning their punching marks (2), install clip (4) and tighten nut (3).

Tightening Torque
(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)

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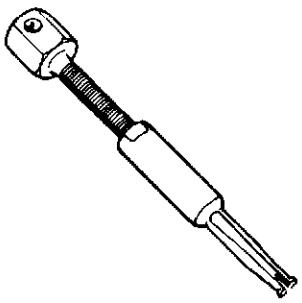
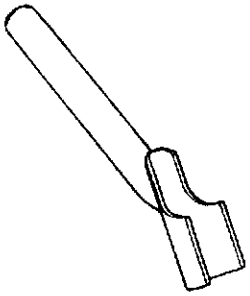
REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	● Clutch cable hook and joint pin ● Release shaft bushes and seal. ● Release shaft arm.
	SUZUKI SUPER GREASE I (99000-25210)	Input shaft spline and front end.

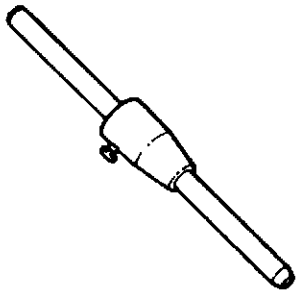
SPECIAL TOOLS



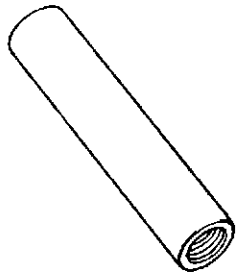
09917-58010
Bearing remover



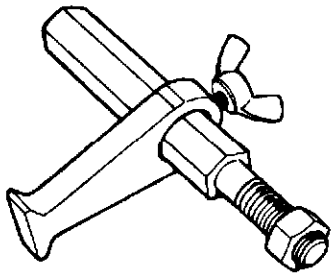
09922-46010
Bush remover



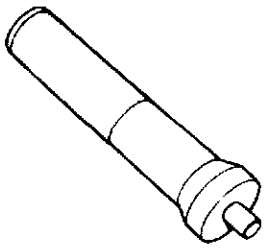
09923-36330
Clutch center guide



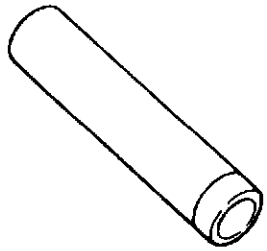
09923-46030
Joint pipe



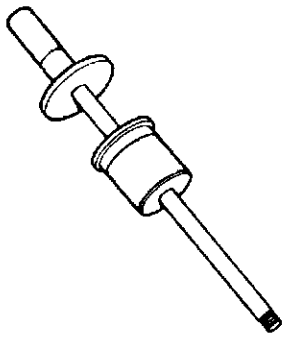
09924-17810
Flywheel holder



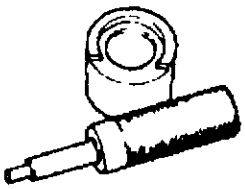
09925-98210
Input shaft bearing installer



09925-98221
Bearing installer



09930-30102
Sliding shaft



09943-77910
Front suspension lower arm bush remover

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SECTION 8

BODY ELECTRICAL SYSTEM

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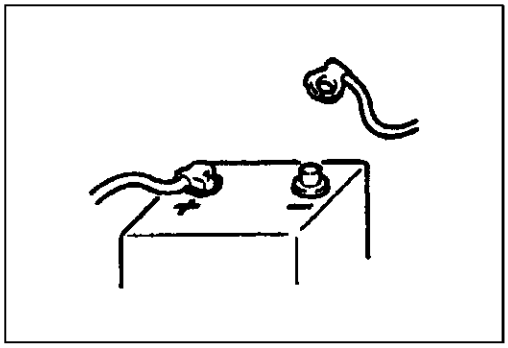
GENERAL DESCRIPTION

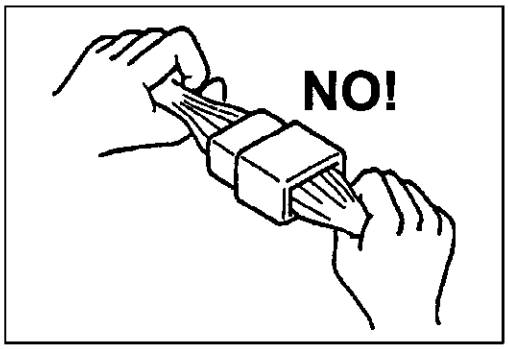
The body electrical components of this vehicle are designed to operate on 12 Volts power supplied by the battery.
The electrical system utilizes negative ground polarity.

CAUTIONS IN SERVICING

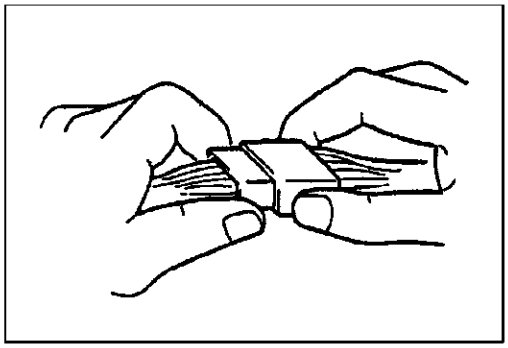
When performing works related to electric systems, observe the following cautions for the purpose of protection of electrical parts and prevention of a fire from occurrence.



- When removing the battery from the vehicle or disconnecting the cable from the battery terminals for inspection or service works on the electric systems, always confirm first that the ignition switch and all the other switches have been turned OFF. Other-wise, the semiconductor part may be damaged.
- When disconnecting cables from the battery, be sure to disconnect the one from the negative (–) terminal first and then the other from the positive (+) terminal.
- Reverse the above order when connecting the cables to the battery terminals.



- 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).

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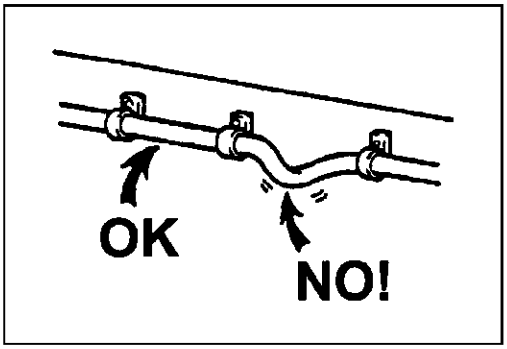
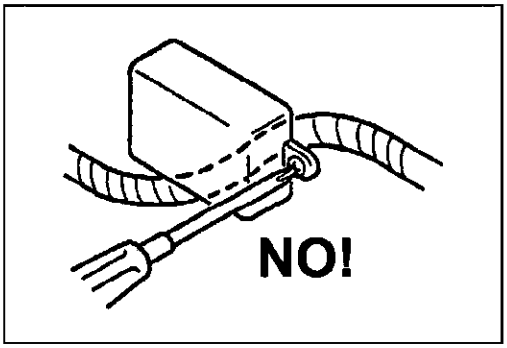
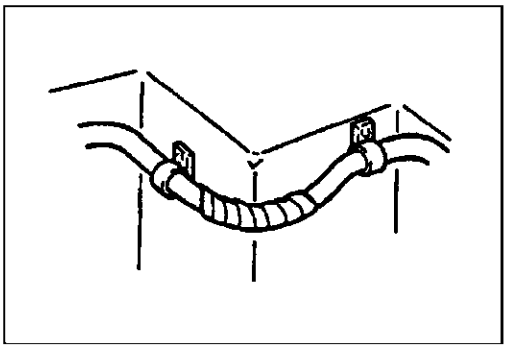


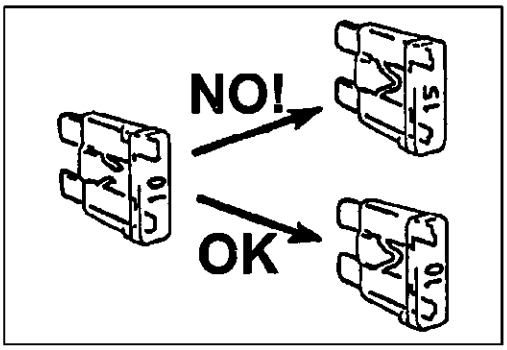
- When installing the wiring harness, fix it with clamps so that no slack is left.



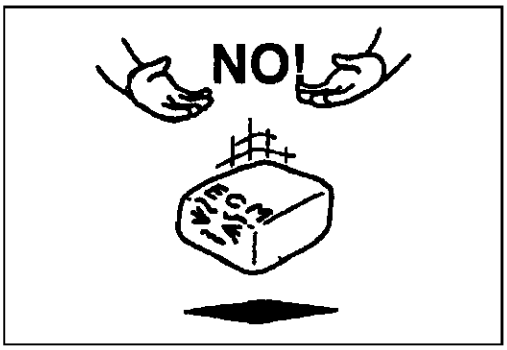
- When installing vehicle parts, be careful so that the wiring harness is not interfered with or caught by any other part.



- 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.



- 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.



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

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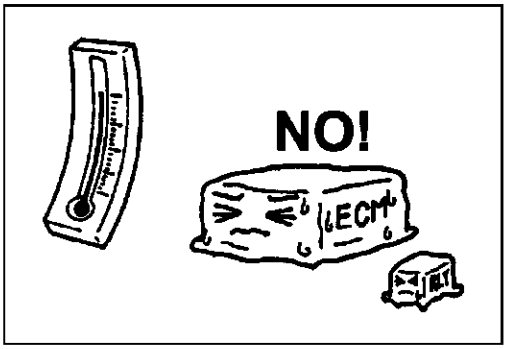
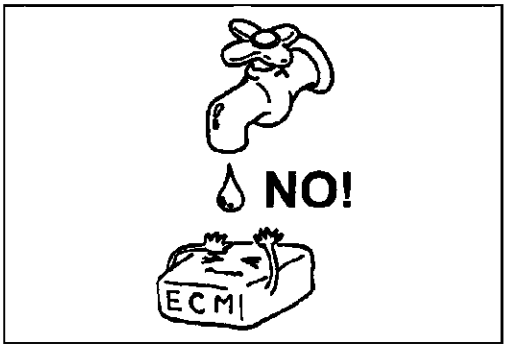
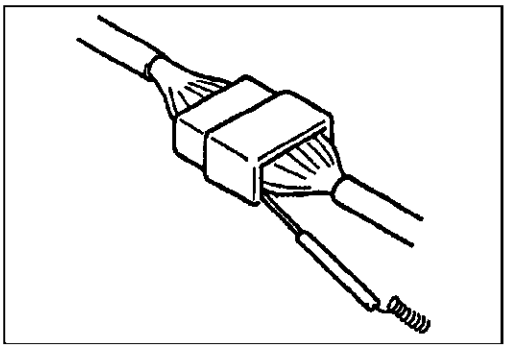


- When performing a work that produces a heat exceeding 80° C in the vicinity of the electrical parts, remove the heat sensitive electrical part(s) beforehand.



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

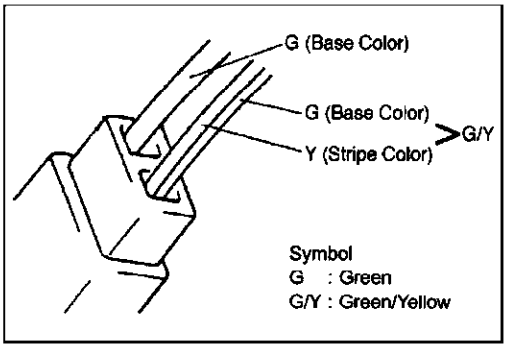


- When using a tester for checking continuity or measuring voltage, be sure to insert the tester probe from the wire harness side if possible.

WIRE COLOR SYMBOLS

The wire color is abbreviated to the first (or first two) alphabet(s) of each color.

Symbol	Wire Color	Symbol	Wire Color
B	Black	Or	Orange
Bl	Blue	R	Red
Br	Brown	W	White
G	Green	Y	Yellow
Gr	Gray	P	Pink
Lbl	Light blue	V	Violet
Lg	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. "G"). The dual-colored wire uses two color symbols (i.e. "G/Y"). The first symbol represents the base color of the wire ("G" in the figure) and the second symbol represents the color of the stripe ("Y" in the figure).

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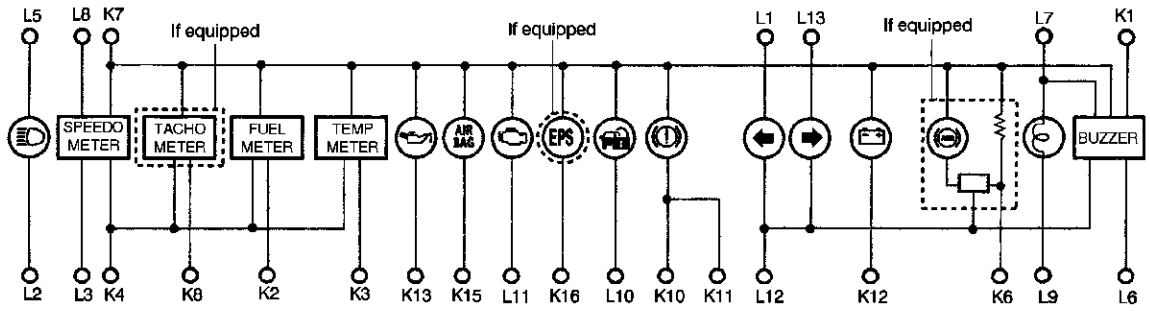
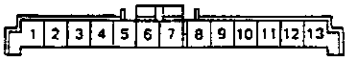
COMBINATION METER



NOTE:
Terminal arrangement of coupler viewed from harness side.

Coupler K

Coupler L

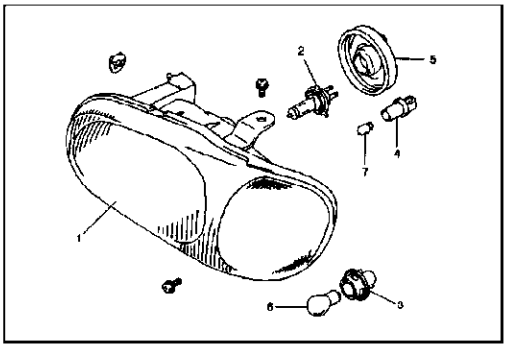


Coupler K

1 To ignition switch	Bl/Y
2 To fuel level gauge	Y/R
3 To ECT sensor	Y/Bl
4 To ground	B/Or
5 Blank	—
6 To ABS controller (if equipped)	R/Bl
7 To "IG METER" fuse	B/W
8 To ECM	Br
9 Blank	—
10. To brake fluid level switch	R/B
11. To parking brake switch	R/B
12. To alternator	W/Bl
13 To oil pressure switch	Y/B
14. Blank	—
15. To SDM (if equipped)	Y/B
16 To P/S control module (if equipped)	G/Y

Coupler L

1. To combination switch (turn L)	G/R
2. To combination switch (dimmer sw)	R
3. To VSS	V
4 Blank	—
5. To main fuse	W/Bl
6. To door switch (driver and passenger side)	B/Y
7 To combination switch	R/Y
8. To main fuse	W/R
9. To ground	B
10 To ECM	R/Bl
11 To ECM	V/Y
12 To ground	B
13 To combination switch (turn R)	Bl/Y



HEAD LIGHT ASSEMBLY

1. Headlight assembly	4. Position light socket	7. Position light bulb
2 Halogen bulb	5 Socket cover	
3. Turn signal light socket	6. Turn signal light bulb	

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DIAGNOSIS

NOTE:
Fuse name ("") in the below is shown on the fuse box cove.

HEADLIGHT

Trouble	Possible Cause	Correction
Headlights do not light up	Bulb blown Lighting or dimmer switch faulty "15A" (Headlight R and L) fuses blown Wiring or grounding faulty	Replace bulb Replace headlight switch Replace fuses to check for short Repair circuit
Only one headlight does not light up	Bulb blown "15A" (Headlight R or L) fuse blown Wiring or grounding faulty	Replace bulb Replace fuse to check for short Repair circuit
Only one beam ("Hi" or "Lo") does not light	Bulb blown Lighting or dimmer switch faulty Wiring or grounding faulty D.R.L. aontroller faulty (If equipped)	Replace bulb Replace switch Repair circuit Replace D.R.L. controller

HEADLIGHTS LEVELING SYSTEM

Trouble	Possible Cause	Correction
Both headlights do not move	"WIPER WASHER" fuse blown Head light leveling switch faulty Wiring or grounding faulty	Check circuit and replace fuse Check switch or replace it as necessary. Repair circuit.
One of headlights (eighter Right or Left) does not move	Wiring or grounding faulty Head light leveling actuator faulty Headlight assembly deformed	Repair circuit. Replace actuator Replace headlight

DAYTIME RUNNING LIGHT (D.R.L.) SYSTEM (IF EQUIPPED)

Trouble	Possible Cause	Correction
Headlights do not light when lighting switch is in OFF position and engine is running	D.R.L. controller faulty Wiring or grounding faulty "Rear DEFG" blown Light switch faulty	Replace controller Repair as necessary Replace fuse to check for short Repair or replace switch.
Headlights still light even if lighting switch is in OFF position and engine is stopped	D.R.L. controller faulty Engin oil pressure switch faulty Wiring or grouding faulty Lighting switch faulty	Replace controller Replace switch Repair as necessary Repair or replace switch
Headlights still light even if lighting switch is in tail position when engine is running	D.R.L. controller faulty Lighting switch faulty Wiring or grounding faulty	Replace controller Repair or replace switch Repair

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TURN SIGNAL AND HAZARD WARNING LIGHTS

Trouble	Possible Cause	Correction
Flash rate high or one side only flashes	One of bulb blown Incorrect bulb Turn signal/hazard warning relay faulty Open circuit or high resistance existing between Combination switch (turn signal/ hazard warning switch) and light on one side Wiring or grounding faulty	Replace bulb Replace bulb Replace relay Replace circuit
No flashing	"TURN BACK" and/or "HORN HAZARD" fuse(s) blown Open circuit or high resistance existing between battery and switch Turn signal/hazard relay faulty Combination switch or hazard warning switch faulty Wiring or grounding faulty	Replace fuse(s) to check for short Check bulb and check circuit Replace relay Replace switch Repair circuit
Flash rate low	Supply voltage low Turn signal/hazard relay faulty	Check charging system Replace relay

PARKING AND LICENSE PLATE LIGHTS

Trouble	Possible Cause	Correction
All lights do not light up	Bulb(s) blown "TAIL" fuse blown Combination switch (lighting and dimmer switch) faulty Wiring or grounding faulty	Replace bulb(s) Replace fuse to check for short Replace switch Repair circuit
Some lights do not light up	Bulb(s) blown Wiring or grounding faulty D.R.L. controller faulty	Replace bulb(s) Repair circuit Replace D.R.L. controller

BACK-UP LIGHTS

Trouble	Possible Cause	Correction
Back-up lights do not light up	Bulb(s) blown "TURN/BACK" fuse blown Back-up light switch faulty Wiring or grounding faulty	Replace bulb Replace fuse to check for short Replace switch Repair circuit
Back-up lights stay on	Back-up light switch faulty	Check or replace switch

BRAKE LIGHTS

Trouble	Possible Cause	Correction
Brake lights do not light up	Bulb(s) blown "STOP" fuse blown Brake light switch faulty Wiring or grounding faulty	Replace bulb(s) Replace fuse to check for short Replace switch Repair circuit
Brake lights stay on	Brake light switch faulty	Check, adjust or replace switch

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REAR FOG LIGHTS

Trouble	Possible Cause	Correction
Rear fog light does not come on	"Rear Fog" fuse blown Rear fog light switch faulty Wiring or grounding faulty Bulb blown	Replace fuse to check for short Check switch Repair as necessary Replace bulb

SPEEDOMETER AND VSS

Trouble	Possible Cause	Correction
Speedometer shows no operation or incorrect operation	"IG METER" fuse blown VSS faulty Printed plate in combination meter faulty Wiring or grounding faulty Speedometer faulty	Replace fuse to check for short Replace VSS Replace printed plate Repair circuit Replace speedometer

FUEL GAUGE AND FUEL LEVEL SENSOR (GAUGE UNIT)

Trouble	Possible Cause	Correction
Fuel gauge shows no operation or incorrect operation	IG METER fuse blown Fuel gauge unit faulty Printed plate in combination meter faulty Fuel gauge faulty Wiring or grounding faulty	Replace fuse to check for short Replace fuel gauge unit Replace printed plate Replace fuel gauge Repair circuit

ENGINE COOLANT TEMPERATURE (ECT) GAUGE AND ECT SENSOR

Trouble	Possible Cause	Correction
Engine coolant temperature meter shows no operation or incorrect operation	IG METER fuse blown ECT gauge faulty Printed plate in combination meter faulty ECT sensor faulty Wiring or grounding faulty	Replace fuse to check for short Replace ECT gauge Replace printed plate Replace ECT sensor Repair circuit

ENGINE OIL PRESSURE WARNING LIGHT

Trouble	Possible Cause	Correction
Engine Oil pressure warning light does not light up when turn the ignition switch to on position at engine off	Bulb in combination meter blown IG METER fuse blown Printed plate in combination meter faulty Engine Oil pressure switch faulty Wiring or grounding faulty	Replace bulb Replace fuse to check for short Replace printed plate Replace engine oil pressure switch Repair circuit
Engine oil pressure warning light stay on	Engine oil pressure switch faulty Electrical circuit shorted to ground	Replace oil pressure switch Repair circuit

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BRAKE SYSTEM WARNING LIGHT (PARKING BRAKE INDICATOR AND BRAKE FLUID LEVEL WARNING LIGHT)

Trouble	Possible Cause	Correction
Brake warning light does not light up when cranking (when turned ignition switch to START position)	Bulb in combination meter blown Printed plate in combination meter faulty IG METER fuse blown Ignition switch faulty Wiring or grounding faulty	Replace bulb Replace printed plate Replace fuse to check for short Check ignition switch Replace circuit
Brake system warning light does not light up (when fluid low level and/or parking brake pull up)	Brake fluid level switch faulty Parking brake switch faulty Printed plate in combination meter faulty Wiring or grounding faulty	Check brake fluid level switch. Check parking brake switch Check printed plate Repair circuit.
Brake warning system warning light stay on	Brake fluid level switch faulty Parking brake swtich faulty Electrical circuit shorted to ground	Check brake fluid level switch Check parking brake switch Repair circuit.

REAR WINDOW DEFOGGER (IF EQUIPPED)

Trouble	Possible Cause	Correction
Defogger does not operate	"IG METER" fuse blown Defogger wire faulty Rear window defogger switch faulty Wiring or grounding faulty	Replace fuse to check for short Repair defogger wire Replace switch Repair circuit

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WIPERS AND WASHERS

FRONT WIPER AND WASHER

REAR WIPER AND WASHER

Trouble	Possible Cause	Correction
Wiper malfunctions	WIPER WASHER fuse blown Wiper motor faulty Combination switch (wiper switch) faulty Rear wiper relay faulty Wiring or grounding faulty	Replace fuse to check for short Replace wiper motor Replace wiper switch Replace relay Repair circuit
Washer malfunctions	Washer hose or nozzle clogged WIPER WASHER fuse blown Washer pump faulty Combination switch (wiper switch) faulty Wiring or grounding faulty	Clean or repair clogged hose or nozzle Replace fuse to check for short Replace washer pump Replace wiper switch Repair circuit

POWER WINDOW CONTROL SYSTEM (IF EQUIPPED)

Trouble	Possible Cause	Correction
Both driver and passenger side power windows do not operate	"POWER WINDOW" fuse blown Ignition (main) switch faulty Power window main switch faulty Wiring or grounding faulty	Replace fuse to check for short Replace ignition (main) switch Replace power window main switch Repair circuit
Only one power window does not operate	Wiring and/or coupler faulty Power window switch (main or sub) faulty Power window actuator faulty Wiring and grounding faulty	Repair wiring and/or coupler Replace power window switch Replace actuator Repair circuit

POWER DOOR LOCK SYSTEM (IF EQUIPPED)

Trouble	Possible Cause	Correction
All power doors are not locked/unlocked	"DOOR LOCK" fuse blown Key cylinder switch (driver side) faulty Power door lock controller faulty Wiring or grounding faulty	Replace fuse to check for short Replace switch Replace controller Repair circuit
Only one power door is not locked/unlocked	Power door lock actuator (door lock motor) faulty Wiring or grounding faulty	Replace actuator Repair circuit

INTERIOR LIGHT

Trouble	Possible Cause	Correction
Interior light does not light up	Bulb blown RADIO DOME fuse blown Interior light switch faulty Door switch faulty Wiring or grounding	Replace bulb Replace fuse to check for short Replace mirror assy Replace switch Repair circuit

HORN

Trouble	Possible Cause	Correction
Horn does not operate	HORN HAZARD fuse blown Horn switch faulty Horn faulty	Replace fuse to check for short Replace horn switch Replace horn

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IGNITION KEY REMINDER/LIGHT REMINDER WARNING BUZZER

Trouble	Possible Cause	Correction
Ignition key reminder/ Light reminder warning buzzer shows no sounding	RADIO DOME fuse blown	Replace fuse to check for short
	Buzzer faulty	Replace buzzer
	Wiring or grounding faulty	Repair circuit
	Door switch (driver side) faulty	Replace door switch
	Ignition key switch faulty	Replace ignition key switch

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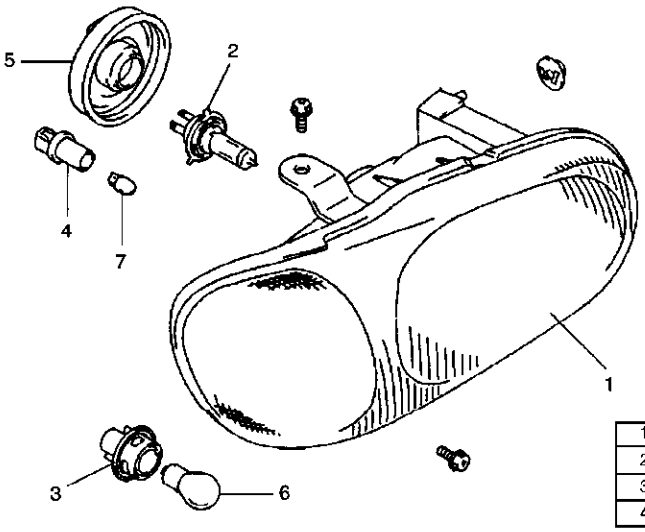
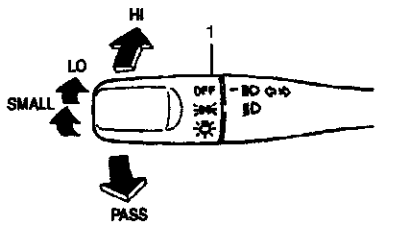
ON-VEHICLE SERVICE

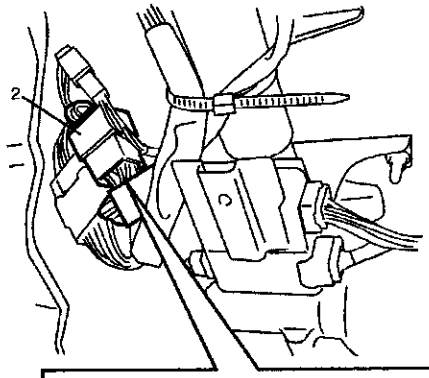
HEADLIGHT

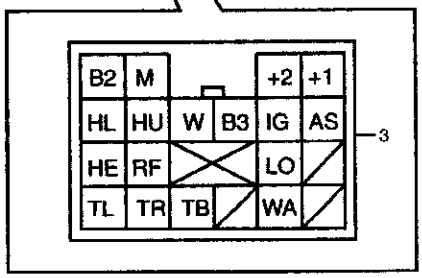
COMPONENTS



1. Headlight assembly	5. Socket cover
2 Halogen bulb	6 Turn signal light bulb
3. Turn signal light socket	7. Position light bulb
4. Position light socket	







1. Combinatin switch
2. Combination switch lead wire coupler
3. Combination switch lead wire coupler terminal arrangement (viewed from lead wire side)

HEADLIGHT SWITCH

INSPECTION

1) Disconnect negative cable at battery.
2) Remove steering column hole cover.
3) Disconnect combination switch lead wire coupler.
4) Check for continuity between terminals at each switch position as shown below. If continuity is not as specified, replace switch.

Switch Position \ Terminal		HE	HL	HU	RF	B2	M
OFF	LO						
	PASS	○		○			
	HI						
SMALL	LO						
	PASS	○		○			
	HI						
HEAD	LO	○	○		○	○	○
	PASS	○		○			
	HI	○		○	○		

REMOVAL AND INSTALLATION

Refer to CONTACT COIL AND COMBINATION SWITCH ASSEMBLY in SECTION 3C.

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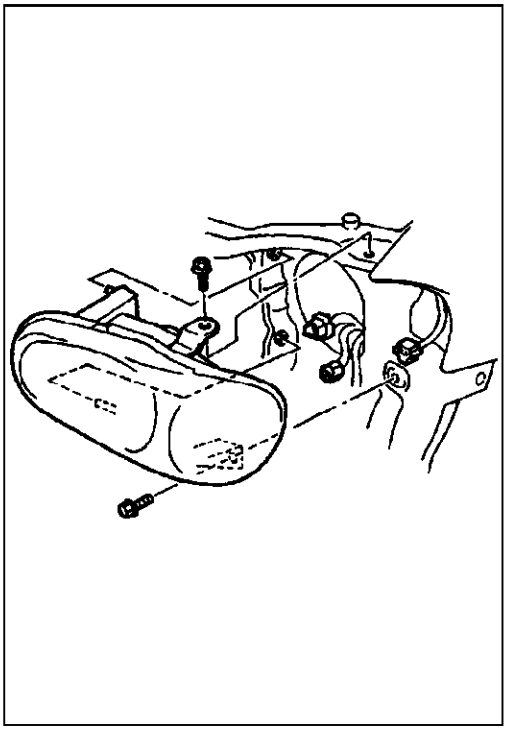


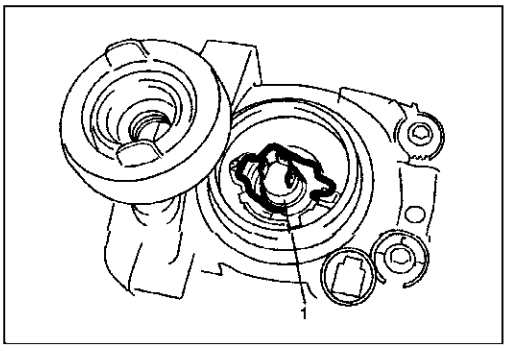
HEADLIGHT ASSEMBLY

REMOVAL

1) Disconnect negative cable at battery.
2) Remove front bumper.
3) Remove headlight mounting bolts.
4) Detach headlight assembly from vehicle.
5) Disconnect couplers from headlight assembly.
6) Remove headlight assembly.

INSTALLATION

Reverse removal procedure for installation.



BULB REPLACEMENT

WARNING:
To avoid danger of being burned, don't touch when the bulb is hot.

1) Disconnect negative (–) cable at battery.
2) Disconnect harness from bulb.
3) Remove socket cover and bulb.
4) Replace bulb (1) and assemble all removed parts.

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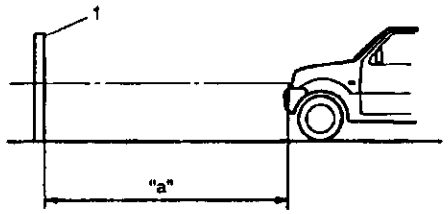
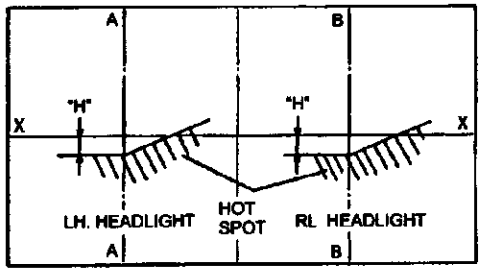
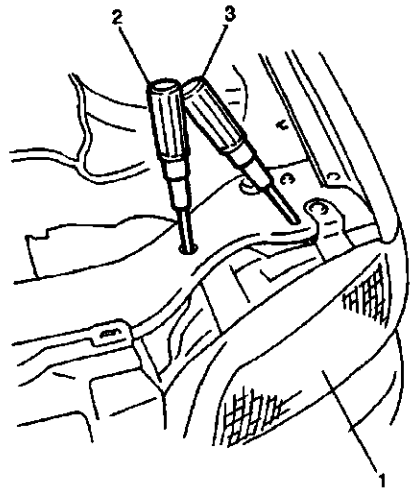




X-X: Horizontal center line of headlights bulb
A-A: Vertical center line of lieft headlight bulb
B-B: Vertical center line of right headlight bulb



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.

HEADLIGHT AIMING WITH SCREEN

NOTE:

- **Unless otherwise obligated by local regulations, adjust headlight aiming according to the following procedure.**
- **After replacing headlight, be sure to adjust aiming.**
- **Be sure that head light leveling switch set "O" position with ignition switch is ON position.**

Before adjustment, make sure the following.

a) Place vehicle on a flat surface in front of blank wall (screen) (1) ahead of headlight surface.

Distance between screen and headlights "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)

Adjustment

1) Check to see if hot spot (high intensity zone) of each low beam axis falls as illustrated.

Aiming specification "H": Approx. 130 mm (5.15 in.)

2) Align headlight aiming to specification as shown if it is not set properly.

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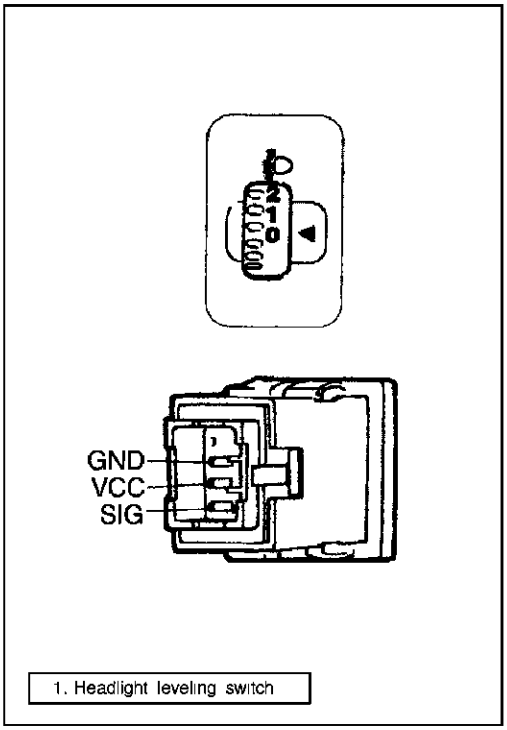

1. Headlight leveling switch

HEADLIGHT LEVELING SWITCH

INSPECTION

Check for resistance between terminals at each switch position as shown below. If check is not specified, replace.

Headlight leveling switch resistance

Position	Terminals	Resistance (KΩ)
–	VCC and GND	2.76-3.04
0	SIG and GND	0.86-0.96
1		1.12-1.24
2		1.38-1.52
3		1.64-1.80
4		1.9-2.08

LEVELING ACTUATOR

INSPECTION

All headlight system couples 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.

DAYTIME RUNNING LIGHT (D.R.L.) SYSTEM (IF EQUIPPED)

NOTE:

When the engine is started, this system turn on head light (low beam), rear parking light and licence plate lights. But this control is cancelled when head light switch is turned to any position other than OFF position.

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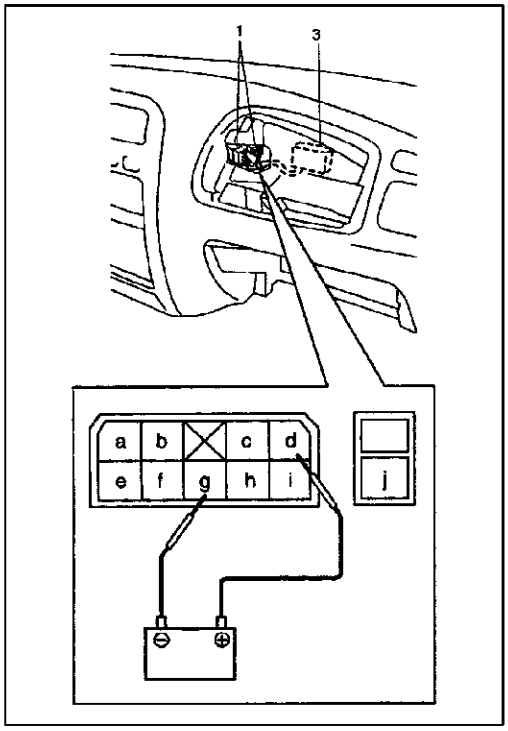
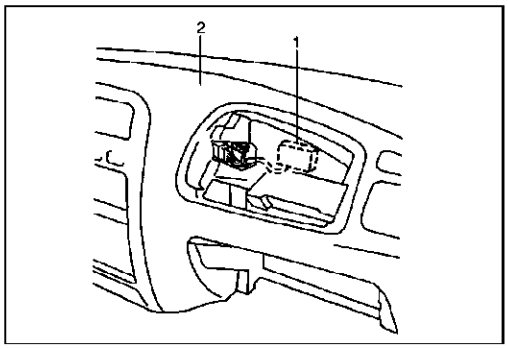


DAYTIME RUNNING LIGHT (D.R.L.) CONTROLLER

INSPECTION

1) Remove passenger air bag module referring to "PASSENGER AIR BAG (INFLATOR) MODULE" in SECTION 10 B.
2) Disconnect D.R.L. controller lead wire couplers (1).
3) Connect battery (2) terminals to combination meter terminals as shown.
4) Check for continnity between terminals as shwon below. If continuity is not as specified, replace D.R.L. controller (3).

Terminal / Terminal (d) Conditon	E	F	G	H	I	J
Open	○		○		○	○
Connected to battery negative (-) terminal	○	○		○	○	



REMOVAL

4) Remove instrument panel from vehicle referring to "INSTRUMENT PANEL" in SECTION 9.
2) Remove D.R.L. controller (1) from instrument panel (2).

INSTALLATION

Reverse removal procedure to install D.R.L controller.

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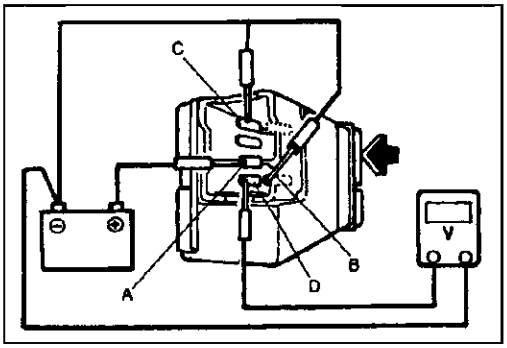
REAR FOG LIGHT

NOTE:

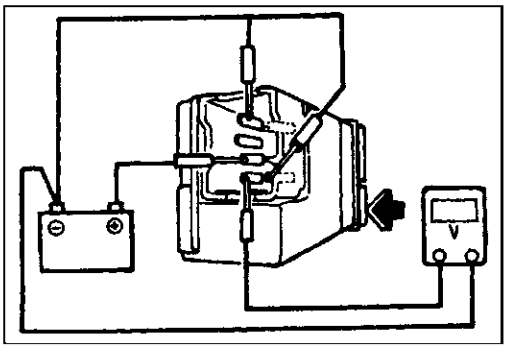
Rear fog light lights up only when headlinght switch is in HEADLIGHT poistion (low or high beams). Rear fog light turns OFF automatically when headlight switch is turned to OFF position. Although headlight switch is turned to HEADLIGHT poistion again, rear fog light does not light up. You should push rear fog light switch again.



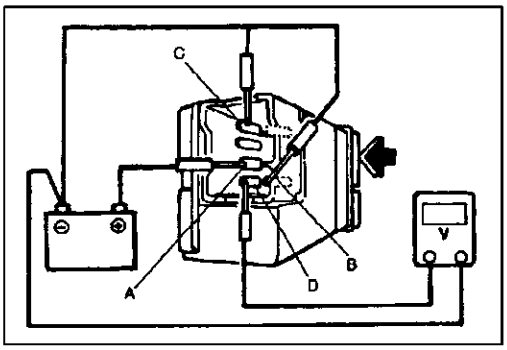
REAR FOG LIGHT SWITCH

INSPECTION

1) Connect battery positive (+) lead to terminal (A) and negative (–) lead to terminal (B), (C).
2) Connect voltmeter positive (+) lead to terminal (D) and negative lead to negative battery terminal.
3) Push the rear fog light switch on ON.
4) Check that the voltmeter indicates at the battery voltage and check light the indicator lamp.
   If not, replace switch.



5) Push the OFF button of rear fog switch to off.
6) Check that the voltmete indicates is 0 V.
   If not, replace switch.



7) Push the rear fog switch to ON.
8) Once disconnect negative lead from terminal (C) and make a second connect to it.
9) Check that the voltmeter indicates is 0V.
   If not, replace switch.

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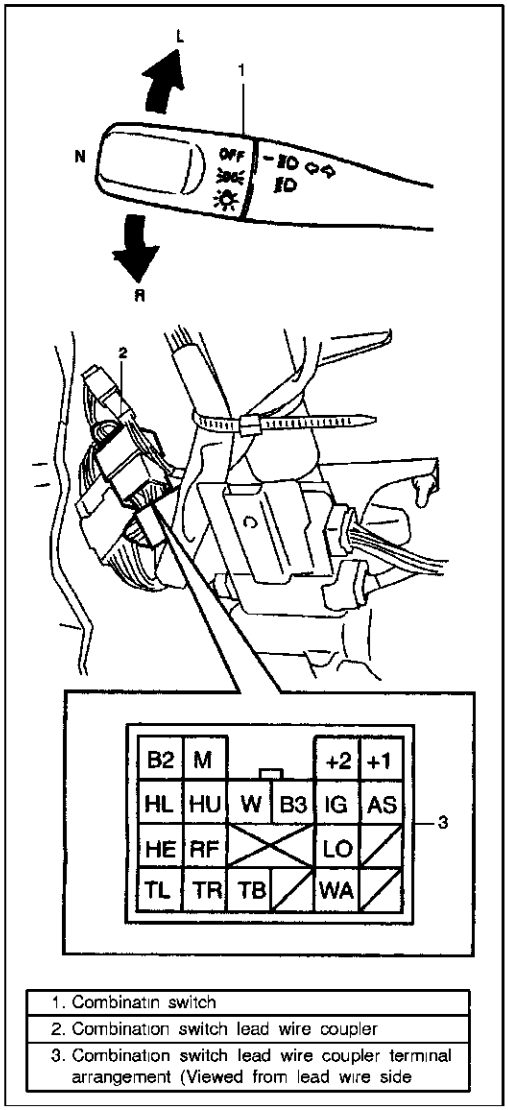


1. Combinatin switch
2. Combination switch lead wire coupler
3. Combination switch lead wire coupler terminal arrangement (Viewed from lead wire side

TURN SIGNAL AND HAZARD WARNING LIGHT

TURN SIGNAL LIGHT SWITCH

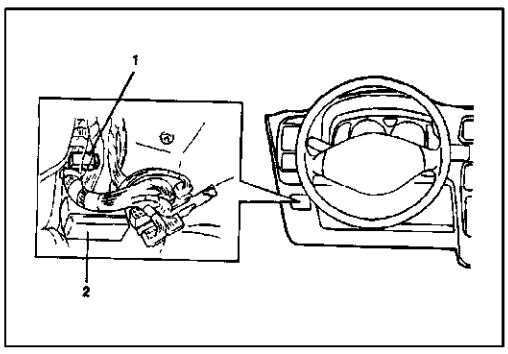
REMOVAL AND INSTALLATION

Refer to CONTACT COIL AND COMBINATION SWITCH ASSEMBLY in SECTION 3C.

INSPECTION

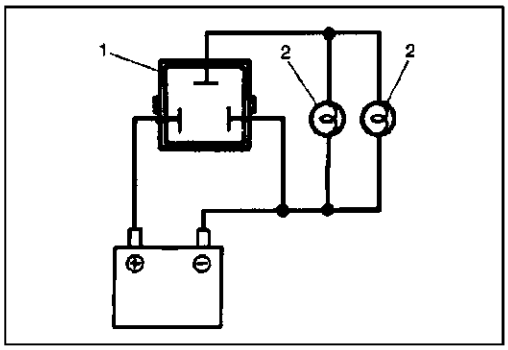
1) Disconnect negative (–) cable at battery.
2) Remove steering column hole cover.
3) Disconnect combination switch lead wire coupler.
4) Check for continuity between terminals at each switch position as shown below. If continuity is not as specified, replace switch.

Terminal / Turn signal SW	TL	TB	TR
L	○——	——○	
N			
R		○——	——○



TURN SIGNAL/HAZARD RELAY

The turn signal/hazard relay (1) is located near the fuse box (2).



INSPECTION

Connect hazard relay (1), battery and two test bulbs (12 V, 27 W) (2) as shown.
Unless a continued flash on and off is visible, replace relay.

Reference flashing cycle: 60 – 120 cycle/minute

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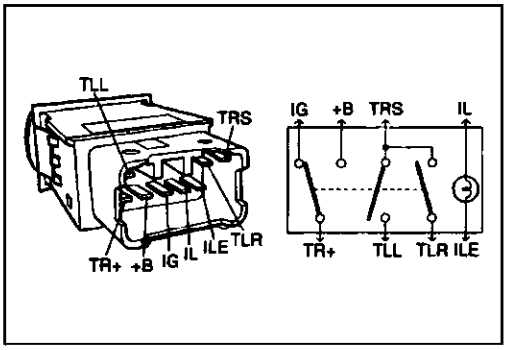

HAZARD SWITCH

INSPECTION

Check for continuity between terminals at each switch position as shown below. If coutinuity is not as specified, replace.

Terminal / Turn signal SW	+B	TR+	IG	TRS	TLL	TLR	IL	ILE
OFF		○—○					○—◎—○	
ON	○—○			○—○—○			○—◎—○	

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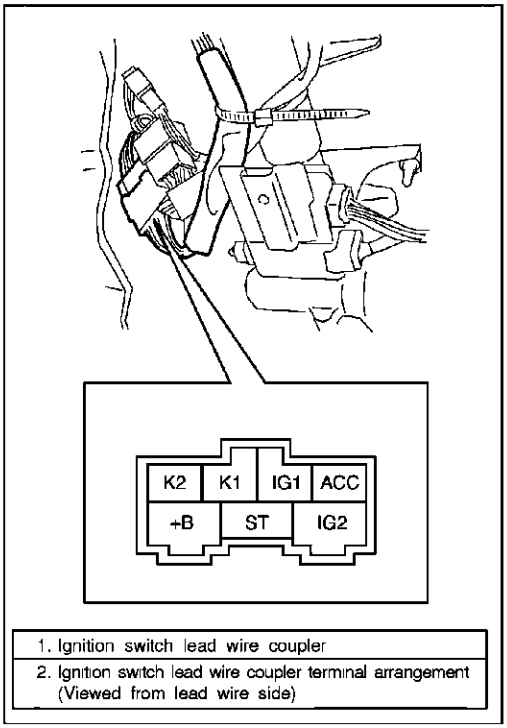
IGNITION SWITCH

REMOVAL AND INSTALLATION

Refer to STEERING LOCK ASSEMBLY (IGNITION SWITCH) in SECTION 3C.



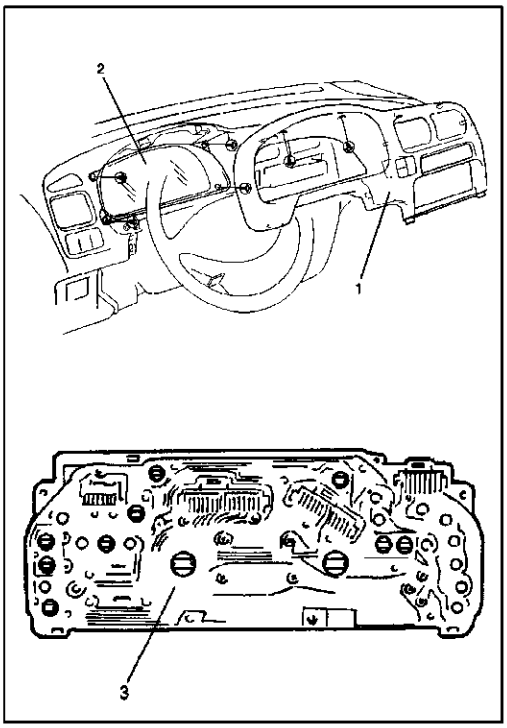
1. Ignition switch lead wire coupler
2. Ignition switch lead wire coupler terminal arrangement (Viewed from lead wire side)

INSPECTION

1) Disconnect negative cable (–) at battery.
2) Remove steering column hole cover.
3) Disconnect ignition main switch lead wire coupler.
4) Check for continuity between terminals at each switch position as shown below. If continuity is not as specified, replace main switch.

Key \ Terminal	Position	+B	ACC	IG1	IG2	ST	K1	K2
OUT	LOCK	○						
		○						
IN	ACC	○—○						
	ON	○—○	—○	—○	—○		○	—○
	START	○	—○			—○		

ACC : Accessory



COMBINATION METER

REMOVAL

1) Disconnect negative cable (–) at battery.
2) Loosen steering column mounting nuts. (Refer to SECTION 3C.)
3) Remove ashtray and then remove instrument center garnish.
4) Remove cup holder (if equipped) and remove meter cluster panel (1).
5) Remove screws fastening combination meter.
6) Disconnect couplers from combination meter. Remove combination meter (2).

INSTALLATION

Reverse removal procedure for installation.

INSPECTION

Check printed plate (3) visually for scratch, crack and discoloration. If any of such faulty conditions is found, replace the printed plate.

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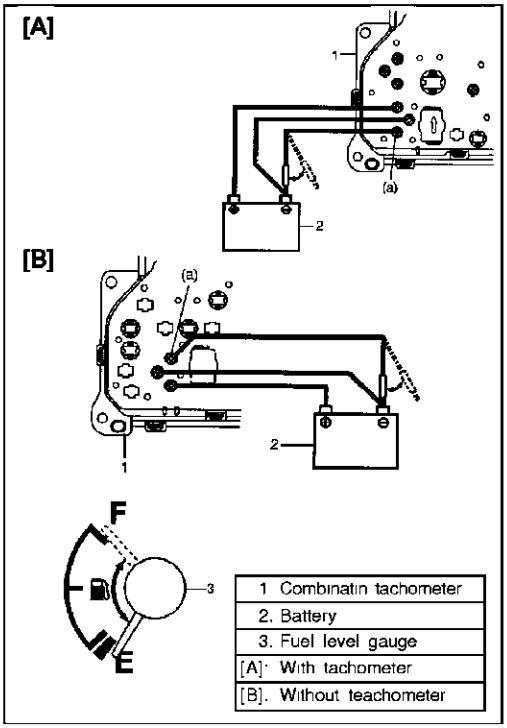
VEHICLE SPEED SENSOR

Refer to VEHICLE SPEED SENSOR (VSS) in SECTION 6E1 for removal, inspection and installation.



1. Combinatin tachometer
2. Battery
3. Fuel level gauge

[A]: With tachometer
[B]: Without teachometer

FUEL GAUGE/FUEL LEVEL SENSOR (GAUGE UNIT)

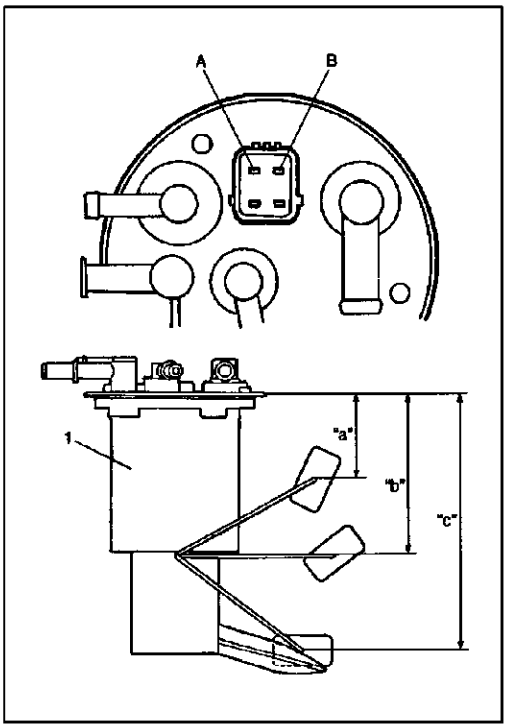
FUEL LEVEL GAUGE

INSPECTION

1) Remove combination meter referring to combination meter in this section.
2) Connect battery terminals to combination meter terminals as shown.
3) Check that the fuel lever gauge operates as shown.

Terminal (a)	Meter indicates
Open	"E" position
Connected to negative battery terminals	"F" position

If not, replace fuel level gague.



FUEL LEVEL SENSOR (GAUGE UNIT)

INSPECTION

1) Remove fuel pump assembly (1) referring to SECTION 6C of this manual.
2) Check that resistance between terminals (A) and (B) of fuel level sensor changes with change of float position.
3) Check resistance between terminals (A) and (B) under each float position.

Float Position		Reference resistance (Ω)
Full Upper "a"	51 mm (2.01 in.)	3
Middle (1/2) "b"	98.6 mm (3.88 in.)	32.5
Full Lower "c"	158 mm (6.22 in.)	120

If the measured value is out of specification, replace.

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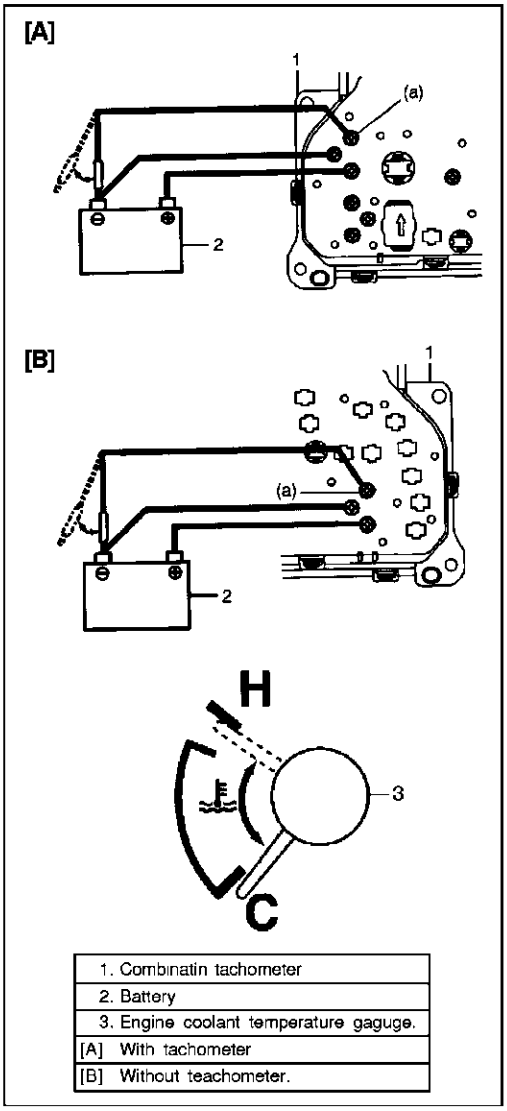


1. Combinatin tachometer
2. Battery
3. Engine coolant temperature gaguge.
[A] With tachometer
[B] Without teachometer.

ENGINE COOLANT TEMPERATURE (ECT) GAUGE AND SENSOR FOR GAUGE

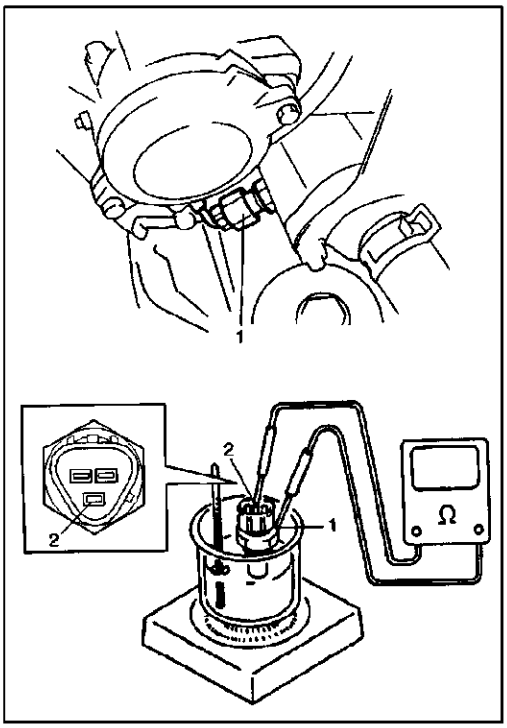
ENGINE COOLANT TEMPERATURE (ECT) GAUGE

INSPECTION

1) Remove combination meter referring to combination meter in this section.
2) Connect battery terminals to combination meter terminals as shown.
3) Check that the engine coolant temperature gauge operates as shown.

Terminal (a)	Meter indicates
Open	"C" position
Connected to battery terminals	"H" position

If not, replace fuel level gague.



ENGINE COOLANT TEMPERATURE (ECT) SENSOR FOR GAUGE

WARNING:
- **Make sure that engine coolant temperature is cold before removing any part of cooling system.**
- **Also be sure to disconnect negative (–) cable at battery before removing any part.**

REMOVAL AND INSTALLATION

Refer to ECT SENSOR (1) in SECTION 6E1.

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) shown below. If check result is not as specified below, replace sensor.

Temperature	Resistance
50°C (122°F)	136– 216Ω

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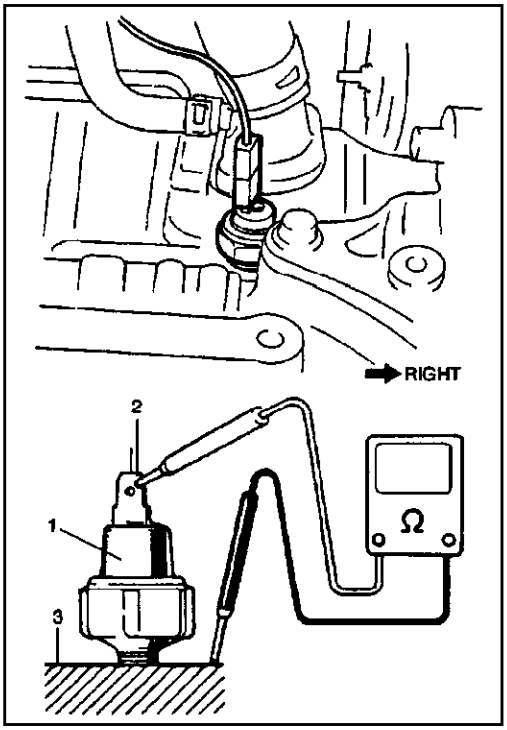


ENGINE OIL PRESSURE WARNING LIGHT

ENGINE OIL PRESSURE SWITCH

INSPECTION

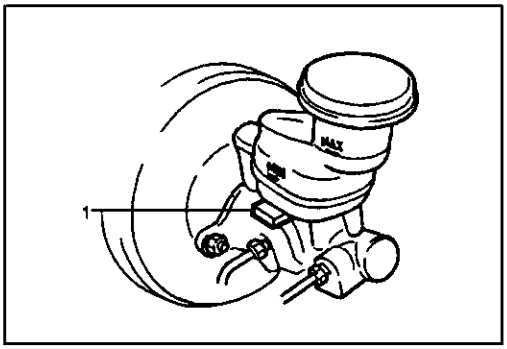
1) Disconnect engine oil pressure switch (1) lead wire.
2) Check for continuity between engine oil pressure switch terminal (2) and cylinder block (3) as shown.

During Engine Running	No continuity
At Engine Stop	Continuity

If check result is not as specified, replace engine oil pressure switch (1).

REMOVAL AND INSTALLATION

Refer to OIL PRESSURE CHECK in SECTION 6A.

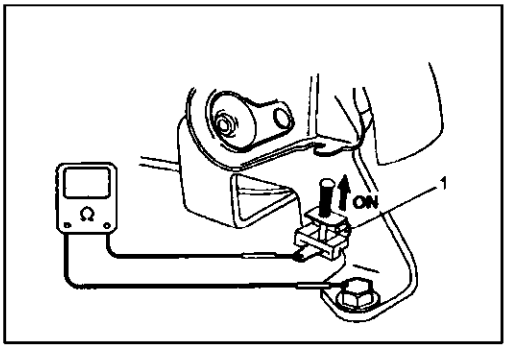


BRAKE SYSTEM WARNING LIGHT (PARKING BRAKE INDICATOR AND BRAKE FLUID LEVEL WARNING LIGHT)

INSPECTION

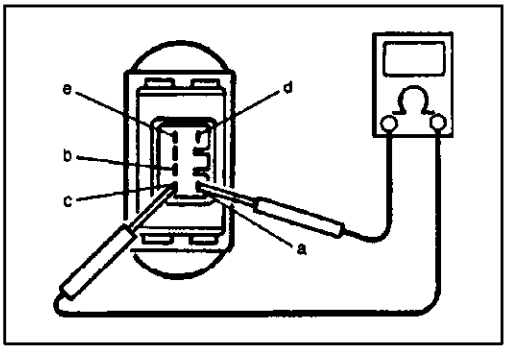
- BRAKE FLUID LEVEL SWITCH
  Check switch (1) for continuity between terminals.
  If found defective, replace switch.

OFF position (float up)	No continuity
ON position (float down)	Continuity



- PARKING BRAKE SWITCH
  Check switch (1) for continuity as shown below.
  If found defective, replace switch.

OFF position (parking brake released)	No continuity
ON position (parking brake lever pulled up)	Continuity



REAR WINDOW DEFOGGER (IF EQUIPPED)

DEFOGGER SWITCH

INSPECTION

Check defogger switch for continuity between terminals as shown below. If check result is not as specified, replace.

Terminal / Switch Position	a	b	c	d	e
OFF		○—⑦—○		○—⑦—○	
ON (PUSH IN)	○—⑦—○	○—⑦—○			

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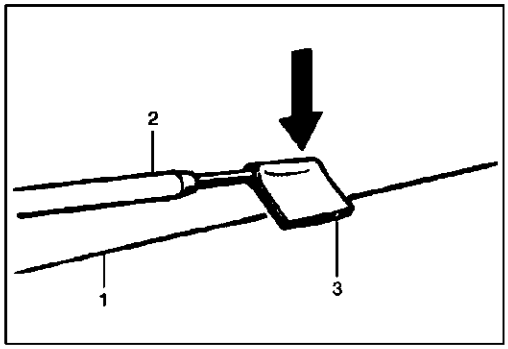
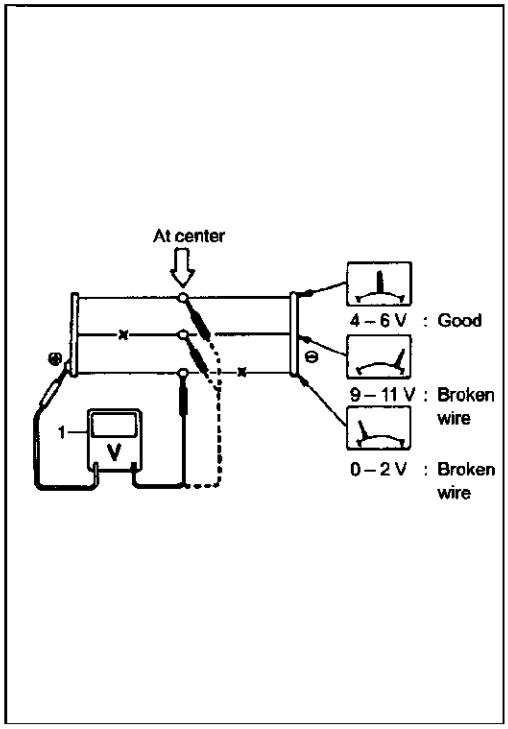


DEFOGGER WIRE

INSPECTION

NOTE:

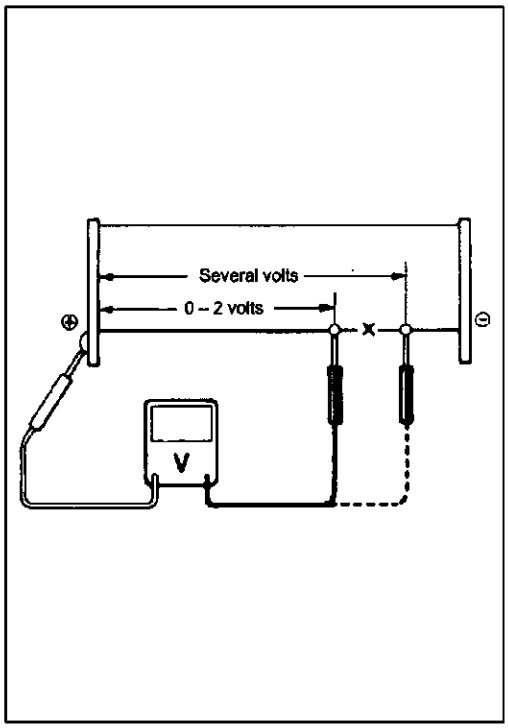
- **When cleaning rear window glass, use a dry cloth to wipe it along heat wire (1) direction.**
- **When cleaning glass, do not use detergent or abrasivecontaining glass cleaner.**
- **When measuring wire voltage, use a tester with negative probe (2) wrapped with a tin foil (3) which should be held down on wire by finger pressure.**



1) Checking wire damage
   a. Turn ignition switch to ON position.
   b. Push defogger switch ON.
   c. Check voltage at the center of each heat wire, as shown by using a voltmeter.

Voltage	Criteria
Apporx. 4–6V	Good (No break in wire)
Apporx. 9–11 V or 0–2 V	Broken wire

If measured voltage is 10V, wire must be damaged between its center and positive end. If voltage is zero, wire must be damaged between its center and ground.



2) Locating damage in wire
   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 12V at heat wire positive terminal end and its indication should decrease gradually toward zero at the other terminal (ground).

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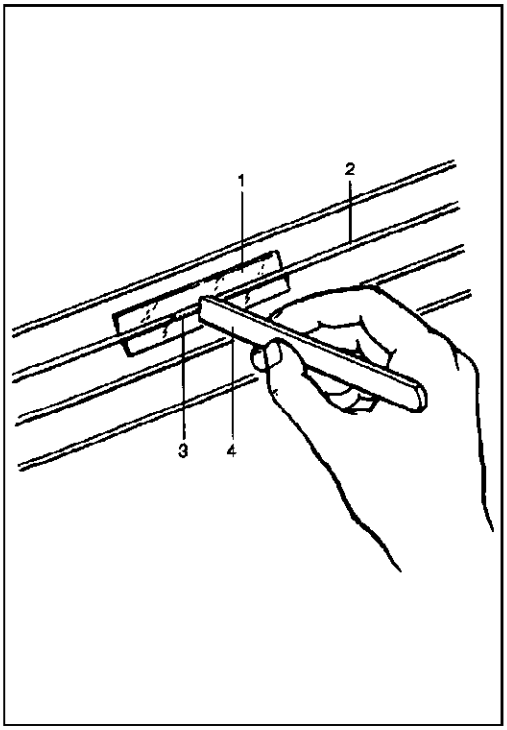
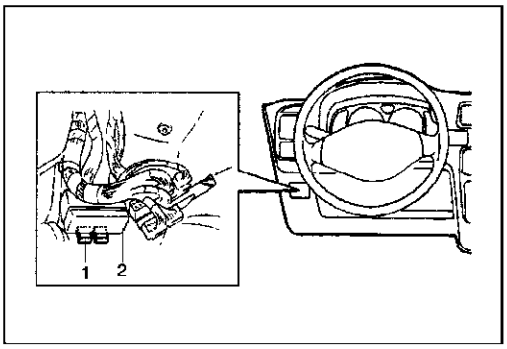


DEFOGGER CIRCUIT

REPAIR

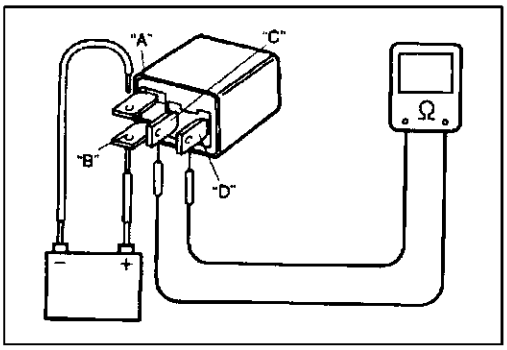
1) Use white gasoline for cleaning.
2) Apply masking tape (1) at both upper and lower sides of heat wire (2) to be repaired.
3) Apply commercially-available repair agent (3) with a fine-tip brush (4).
4) Two to three minutes later, remove masking tapes (1) previously applied.
5) Leave repaired heat wire as it is for at least 24 hours before operating defogger again.



HORN

HORN RELAY

The horn relay (1) is located near the fuse box (2).



INSPECTION

1) Check that there is no continuity between terminal "C" and "D". If there is continuity, replace relay.
2) Connect battery positive (+) terminal to terminal "B" of relay. Connect battery negative (–) terminal "C" and "D".
   If there is no continuity when relay is connected to the battery, replace relay.

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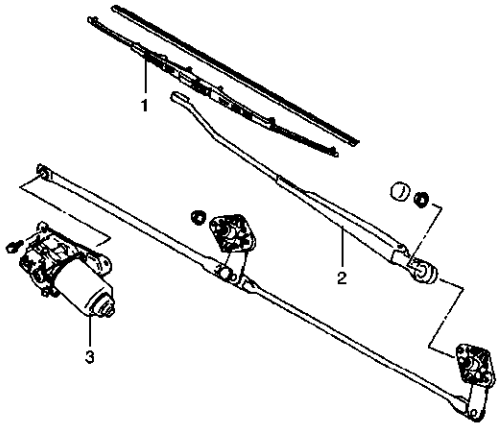
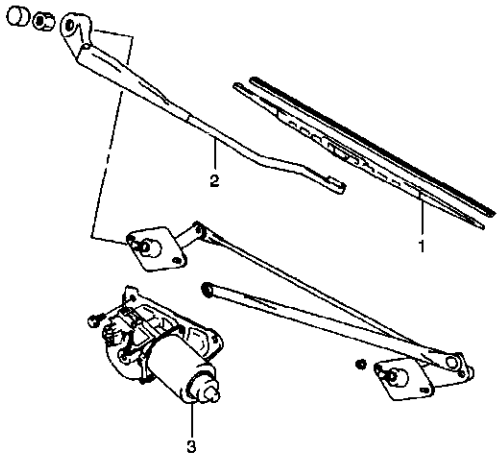
WIPERS AND WASHERS
COMPONENTS

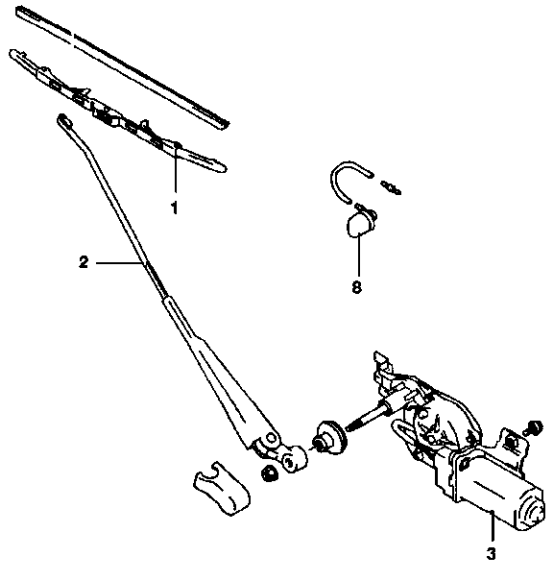
[A]



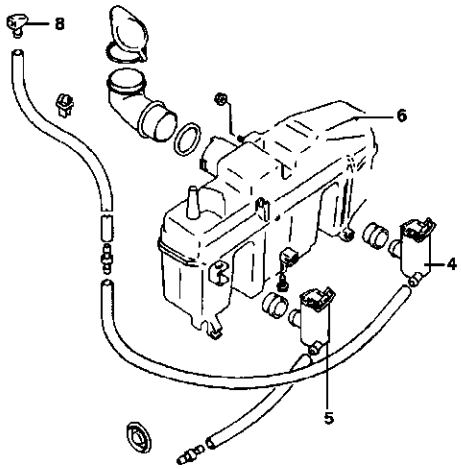
[B]



[C]



[D]



1. Wiper blade	6. Washer tank	[A] Front wiper (LH steering model)
2 Wiper arm	7 Washer hose	[B] Front wiper (RH steering model)
3. Wiper motor	8. Washer nozzle	[C]: Rear wiper
4. Washer pump (for front washer)	9. Wiper link	[D]: Washer
5 Washer pump (for rear washer)		

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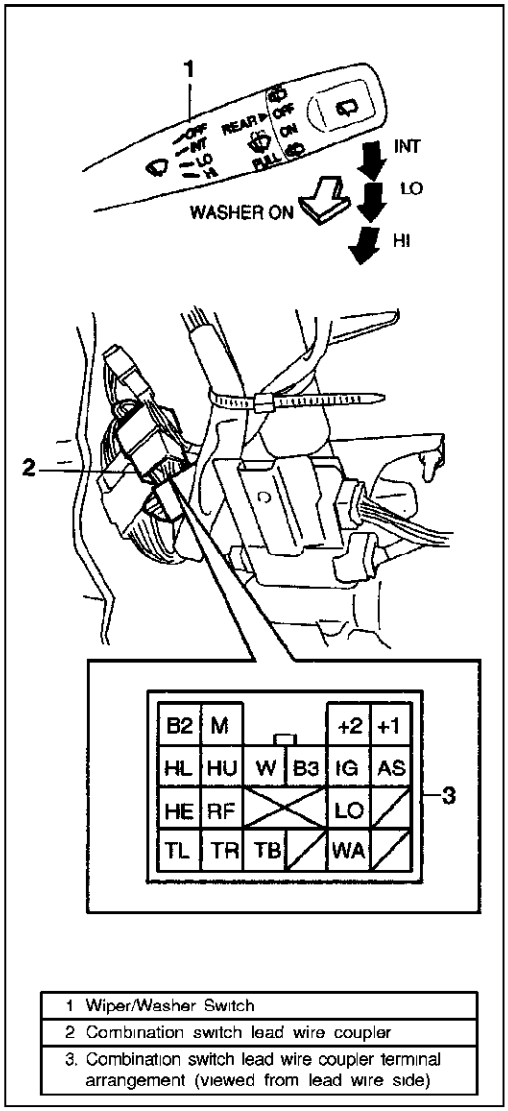

1. Wiper/Washer Switch
2. Combination switch lead wire coupler
3. Combination switch lead wire coupler terminal arrangement (viewed from lead wire side)

FRONT WIPER/WASHER SWITCH

REMOVAL AND INSTALLATION

Refer to COMBINATION SWITCH ASSEMBLY in SECTION 3C.

SWITCH OPERATION INSPECTION

1)Disconnect negative cable (–) at battery.
2)Remove steering column hole cover.
3)Disconnect combination switch lead wire coupler.
4)Check for continuity between terminals at each switch position as shown below.

If continuity is not as specified, replace switch.

Wiper SW \ Terminal	B3	+2	+1	As
OFF			○—○	
INT			○—○	
LO	○——○			
HI	○—○			

Wiper SW \ Terminal	B3	W
OFF		
ON	○—○	

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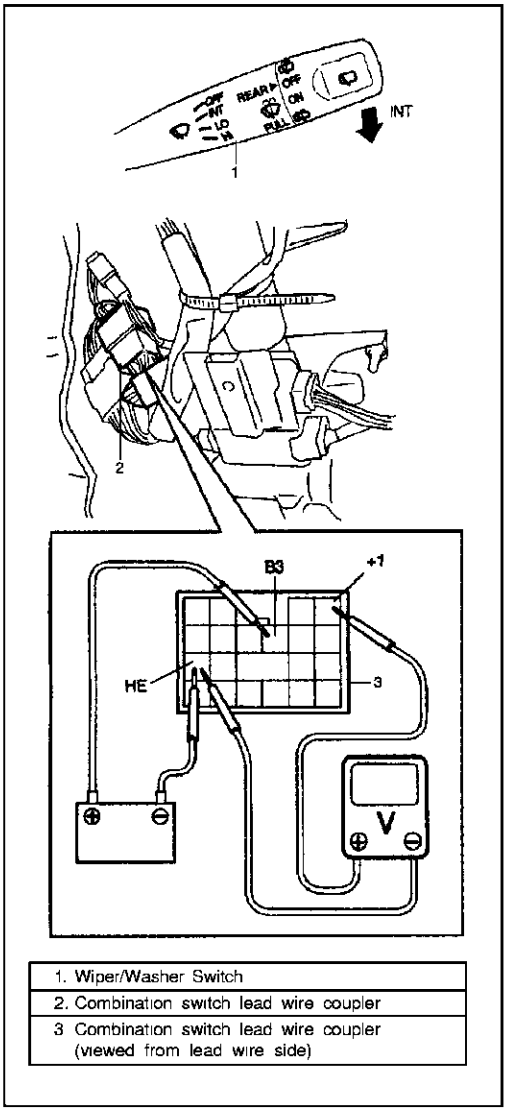
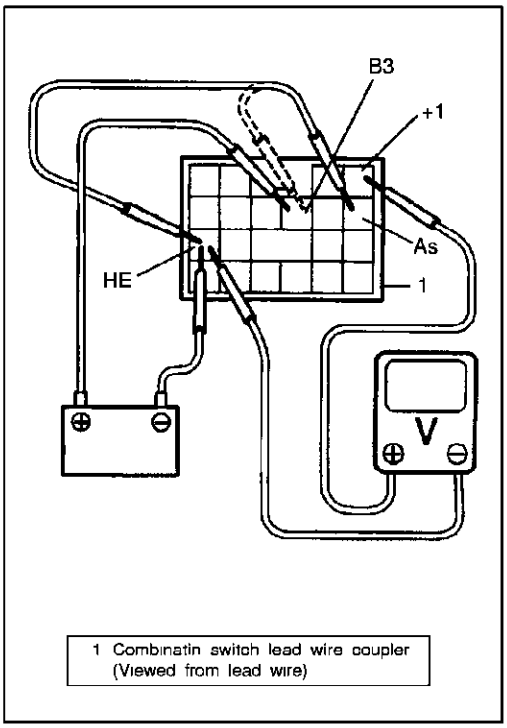


1. Wiper/Washer Switch
2. Combination switch lead wire coupler
3 Combination switch lead wire coupler (viewed from lead wire side)

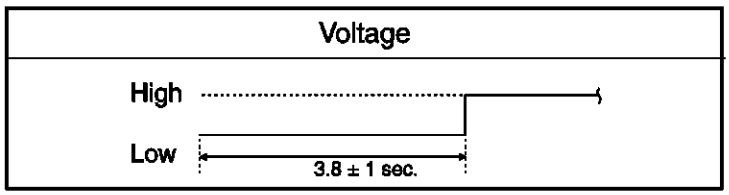
INTERMITTENT WIPER RELAY CIRCUIT INSPECTION

1) Disconnect negative cable at battery.
2) Remove steering column hole cover.
3) Disconnect combination switch lead wire coupler.
4) Turn the front wiper switch to INT position.
5) Connect battery positive terminal to terminal "B3" and battery negative terminal to terminal "HE".
6) Connect voltmeter positive lead to terminal "+1" and negative lead to terminal "HE".
   Check that the voltmeter indicates the battery voltage (10 –14V).



1 Combinatin switch lead wire coupler (Viewed from lead wire)

7) Connect terminal "AS" and terminal "B3" for 5 sec. or more by a jumper wire.
8) Disconnect end of the jumper wire from terminal "B3".
9) When connect disconnected jumper wire end to terminal "HE", check that voltage between terminal "+1" and terminal "HE" changes as shown in figure.
   If check result is not satisfied, replace.



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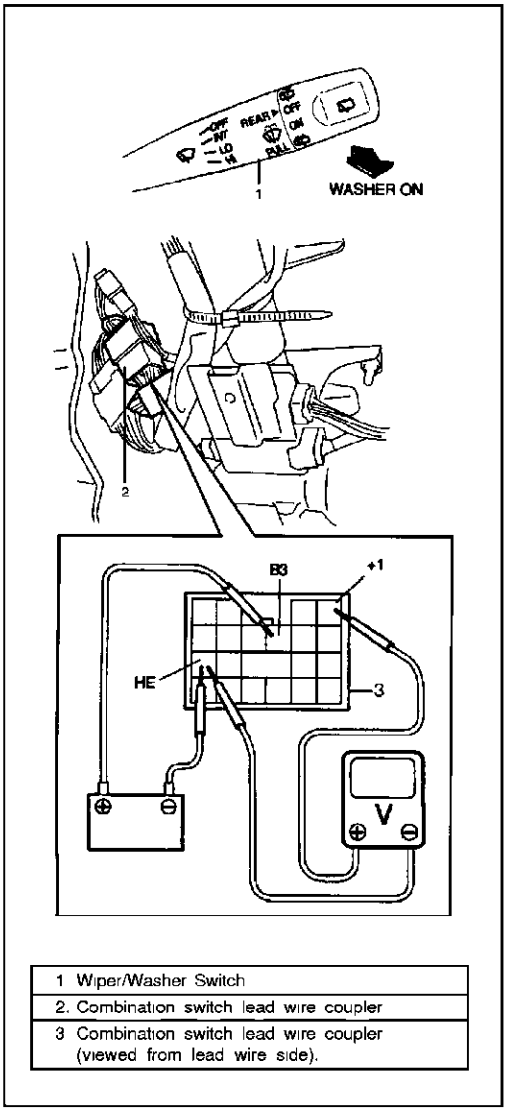
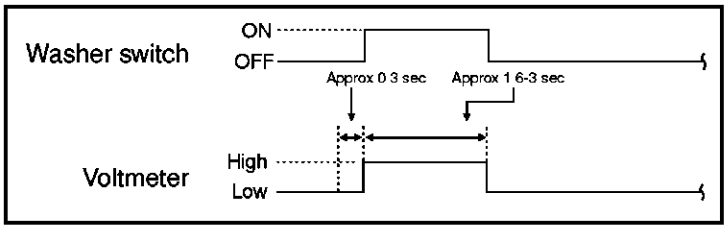
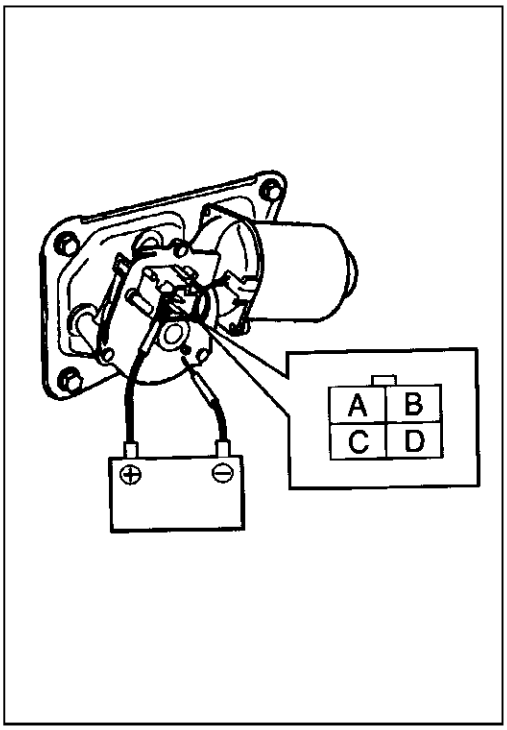


1 Wiper/Washer Switch
2. Combination switch lead wire coupler
3 Combination switch lead wire coupler (viewed from lead wire side).

WASHER LINKED OPERATION INSPECTION

1) Disconnect negative cable at battery.
2) Remove steering column hole cover.
3) Disconnect combination switch lead wire coupler.
4) Make sure that front wiper switch is at OFF position.
5) Connect battery positive terminal to terminal "B3" and battery negative terminal to terminal "HE".
6) Connect voltmeter positive lead to terminal "+1" and negative lead to terminal "HE".
7) When front washer switch is ON, check that voltage changes as shown in figure.





FRONT WIPER MOTOR

INSPECTION

Motor operation (low speed)

1) Connect battery positive terminal to terminal "A" and its negative terminal to wiper motor bracket.
2) Check wiper motor (1) revolution speed as speecification.

Specification: 44 - 52 r/min (rpm)

Motor operation (high speed)

1) Connect battery positive terminal to "B" and its negative terminal to wiper motor bracket.
2) Check wiper motor (1) revolution speed as specification

Specification: 64 - 78 r/min (rpm)

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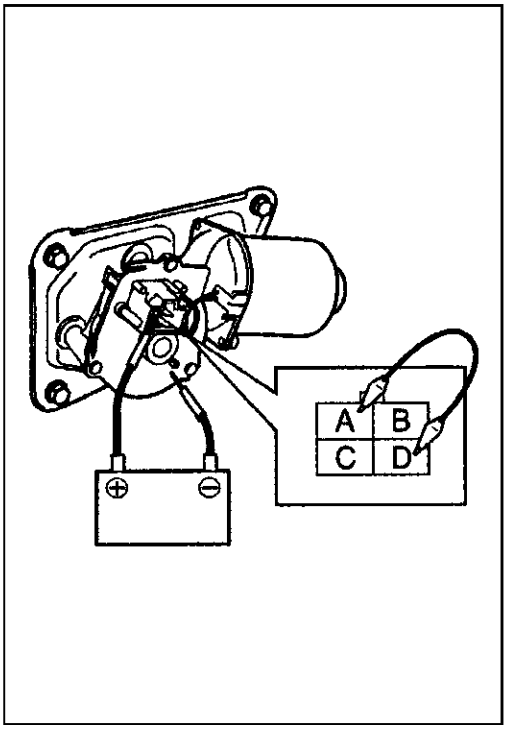

Automatic stop operation

1) Connect battery positive terminal to terminal "A" and its negative terminal to wiper motor bracket and let the wiper motor (1) turn.
2) Disconnect battery positive terminal from terminal from terminal "A", and let the wiper motor (1) stop.
3) Connect terminal "C" to battery positive terminal. Observe the motor turns once again then stops at a specified position.
4) Repeat Step 1) to 3) several times and check that the motor stops at the specified positioin every time.
   If check result is not satisified, replace.

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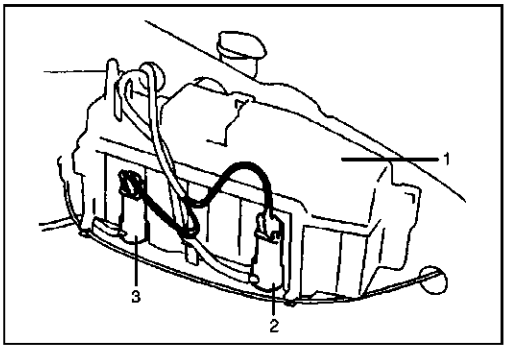
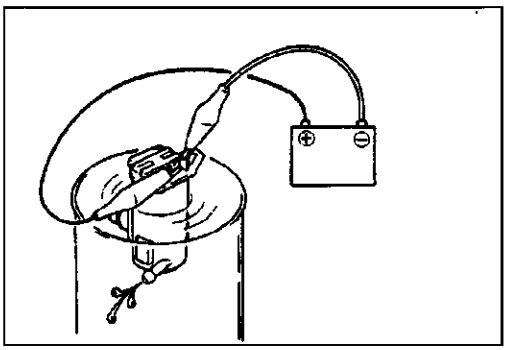


FRONT WASHER PUMP

REMOVAL

1) Disconnect negative cable at battery.
2) Remove front fender (RH) and front fender lining (RH) referring to "FRONT FENDER" in SECTION 9.
3) Remove washer tank attaching bolts.
4) Disconnect pump lead wire couplers and hose.
5) Remove washer tank (1).
6) Remove front washer pump (2) and rear washer pump (3) from washer tank (1).



INSPECTION

Connect battery (+) and (–) terminals to pump (+) and (–) terminals respectively to check pumping rate.

Check for both front and rear washer pump.

Pumping Rate: More than 1.0 l/min
(2.1 US pt./min, 1.76 Imp pt./min)

INSTALLATION

Reverse removal procedure for installation.

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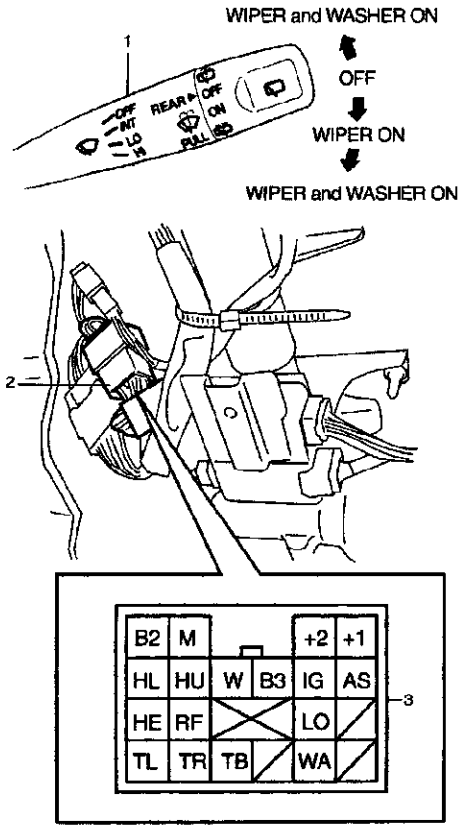

1. Wiper/Washer Switch
2. Combination switch lead wire coupler
3. Combination switch lead wire coupler (viewed from lead wire side).

REAR WIPER/WASHER SWITCH

REMOVAL AND INSTALLATION

Refer to COMBINATION SWITCH ASSEMBLY in SECTION 3C.

SWITCH OPERATION INSPECTION

1) Disconnect negative cable (–) at battery.
2) Disconnect combination switch lead wire coupler.
3) Check for continuity between terminals at each switch position as shwon below.
   If continuity is not as specified, replace switch.

Position \ Terminal	IG	LO	WA
WIRE and WASHER ON	○	○	○
WIPER ON	○	○	
OFF			
WASHER and WASHER ON	○	○	○

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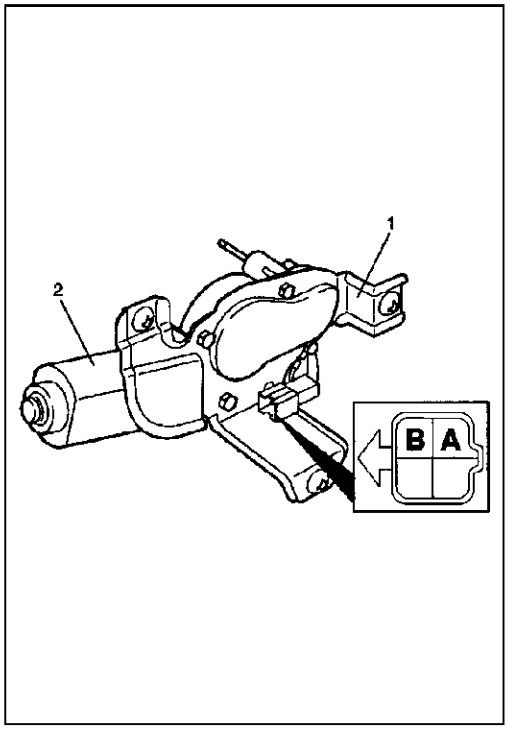
REAR WASHER PUMP

INSPECTION

Refer to FRONT WIPER AND WASHER INSPECTION in this section.



REAR WIPER MOTOR

INSPECTION

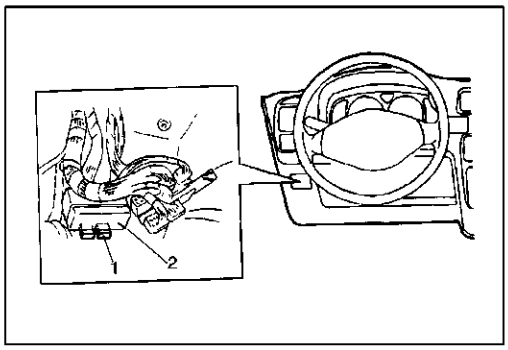
Motor operation

1) Use a 12 V battery to connect its (+) and (–) terminals to terminal "B" and rear wiper motor bracket (1) respectively.
2) Check motor (2) revolution speed as specification.

Specification: 35-45 r/min (rpm)

Automatic stop operation

1) Connect battery positive terminal to terminal "B" and its negative terminal to rear wiper motor bracket (1) and let the motor (2) turn.
2) Disconnect battery positive terminal from terminal "B" and let the motor stop.
3) Connect battery positive terminal to terminal "A". Observe the motor turns once again then stops at a specified position.
4) Repeat Step 1) to 3) several times, and check that the motor (2) stops at the specified position every time.



REAR WIPER RELAY

The rear wiper relay (1) is located near the fuse box (2).

INSPECTION

Refer to "HORN RELAY" in this section.

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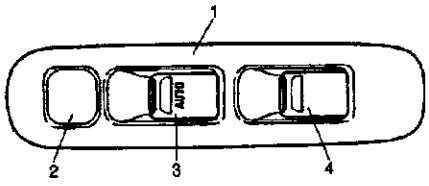
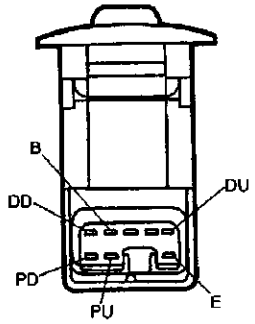




1 Power window main switch
2 Power window lock switch
3. Driver side window switch
4 Passenger side window switch

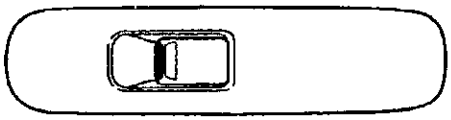
POWER WINDOW CONTROL SYSTEM (IF EQUIPPED)

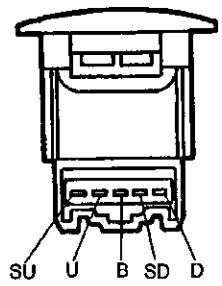
POWER WINDOW MAIN SWITCH

INSPECTION

Check switch for continuity between terminals as shown below.

Switch Position / Terminal			Drive Side Window Switch				Passenger Side Window Switch			
			B	E	DU	DD	B	E	PU	PD
Power Window Lock Switch	OFF	UP	○		○		○		○	
				○		○		○		○
		OFF		○	○			○	○	
				○		○		○		○
		DOWN	○		○		○		○	
				○		○		○		
		DOWN AUTO	○		○					
				○		○				
	ON	UP	○		○		○		○	
				○		○				
		OFF		○	○				○	○
				○		○				
		DOWN	○		○		○			○
				○		○				
		DOWN AUTO	○		○					
				○		○				





POWER WINDOW SUB SWITCH

INSPECTION

Check switch for continuity between terminals as shown below.

Switch Position / Terminal	B	SD	SU	D	U
UP	○		○	○	
		○			○
OFF		○		○	
			○		○
DOWN	○			○	
			○		○

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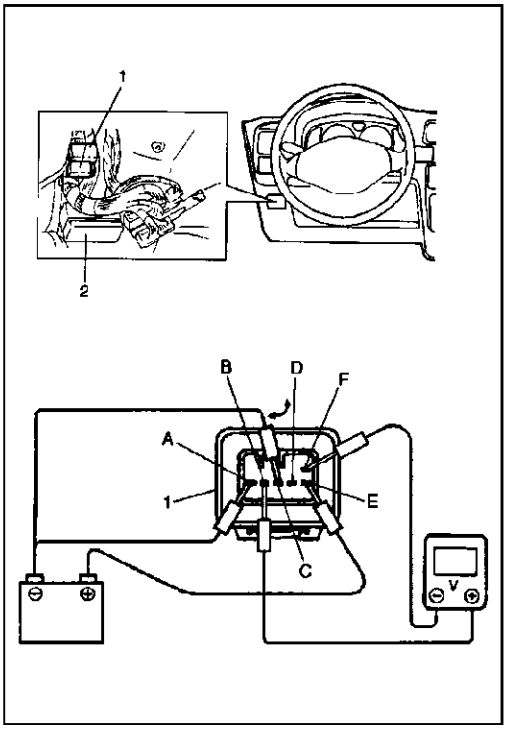


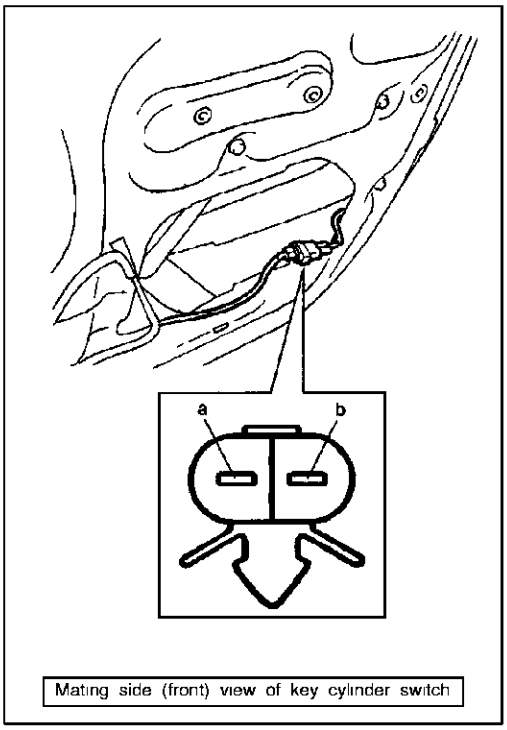
POWER DOOR LOCK SYSTEM (IF EQUIPPED)

POWER DOOR LOCK CONTROLLER

INSPECTION

1) Remove door lock controller (1) located near the fuse box (2) from vehicle. Disconnect coupler from door lock controller. Connect door lock controller terminal to 12V battery as shown.
2) Connect voltmeter as shown.
3) Connect the terminal (C) with the negative battery terminal and check the voltage indicated on the voltmeter at the moment of connection. Also, disconnect it and check the voltage at the moment of disconnection.
   The voltage values should be as listed in the table below.

Terminal C	Open	Ground
Voltmeter indication	+	–



Mating side (front) view of key cylinder switch

KEY CYLINDER SWITCH (Driver's side)

INSPECTION

1) Disconnect key cylinder switch coupler.
2) Check for continuity between terminals according to the key action.

Key \ Terminal	a	b
LOCK		
UNLOCK	O	O

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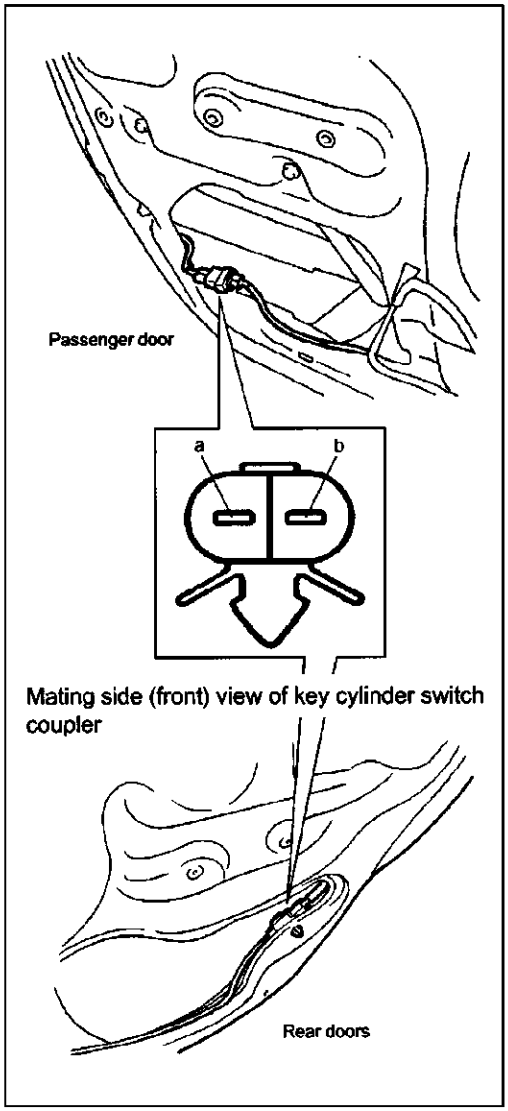
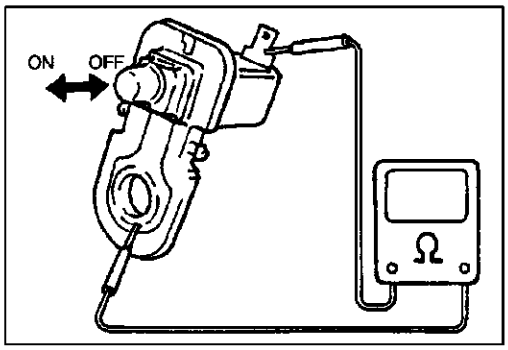


POWER DOOR LOCK ACTUATOR

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 and check operation.
   If it does not operate as specified in table below, replace door lock actuator.
   Front Passenger Door & Rear Doors

Terminal \ Operation	UNLOCK	LOCK
a	⊖	⊕
b	⊕	⊖



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

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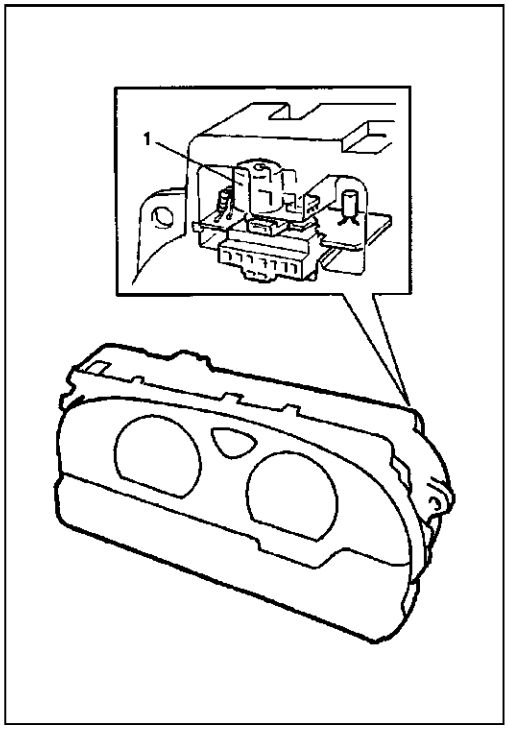

IGNITION KEY REMINDER/LIGHT REMINDER WARNING BUZZER

1) Remove combination meter referring to COMBINATION METER in this section.
2) Remove buzzer unit (1) from combination meter.

INSTALLATION

Reverse removal procedure for installation.

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SECTION 8G

IMMOBILIZER 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).**

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GENERAL DESCRIPTION

The immobilizer control system designed to prevent vehicle burglar consists of following components.

- Engine control module (ECM)
- Immobilizer control module (1) with coil antenna
- Ignition key (2) with built-in transponder

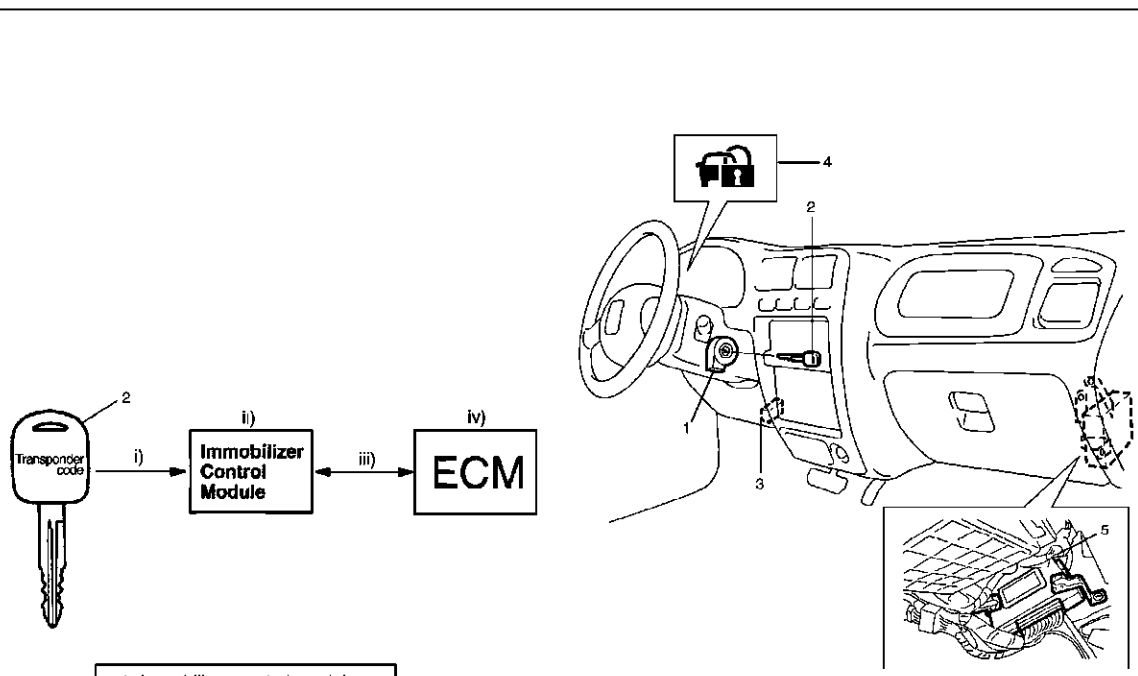
Operation of this system is as follows.

i) Each ignition key has its own code (Transponder code) stored in memory. When the ignition switch is turned ON, Immobilizer Control Module with coil antenna tries to read the Transponder code through its coil antenna.

ii) Immobilizer Control Module compares the Transponder code read in Step (i) and that registered in Immobilizer Control Module and checks if they match.

iii) When it is confirmed that two Transponder codes match each other as described above, Immobilizer Control Module and ECM check if ECM/Immobilizer Control Module codes registered in them respectively match.

iv) Only when it is confirmed that ECM/Immobilizer Control Module codes match, the engine starts running. If Transponder codes in Step (ii) or ECM/Immobilizer Control Module codes in Step (iii) do not match, ECM will stop operation of the injector and ignition of spark plug.



1 Immobilizer control module
2 Ignition key
3 Data link connector (DLC)
4 Immobilizer indicator lamp
5 ECM

NOTE:
Figure shows Left-hand steering vehicle. Right-hand steering vehicle is symmetrical

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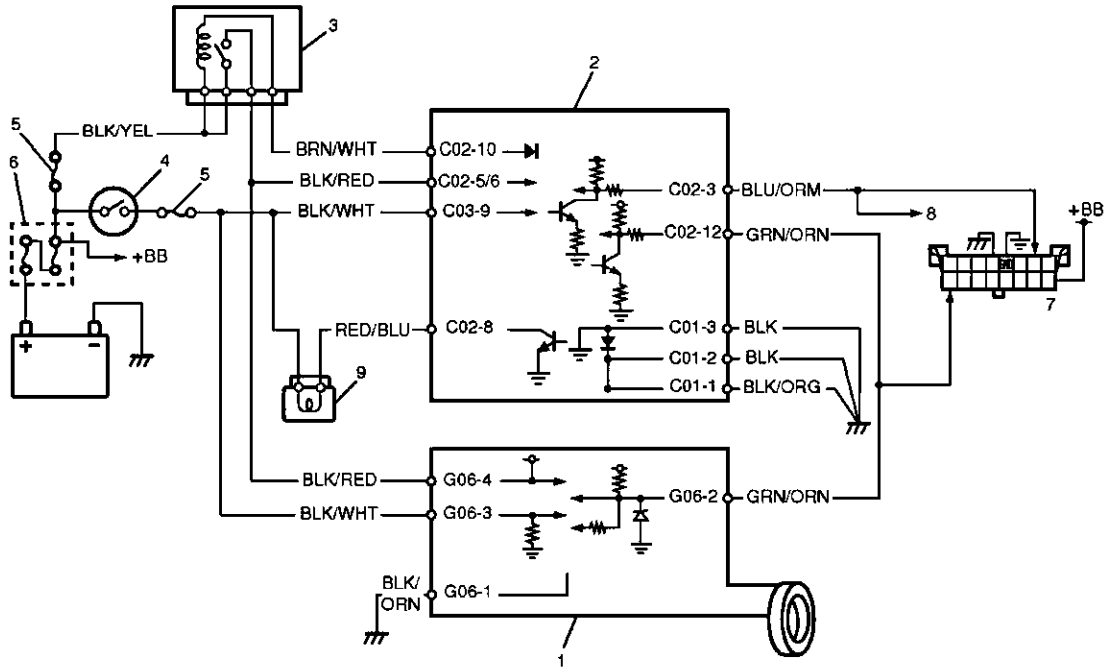
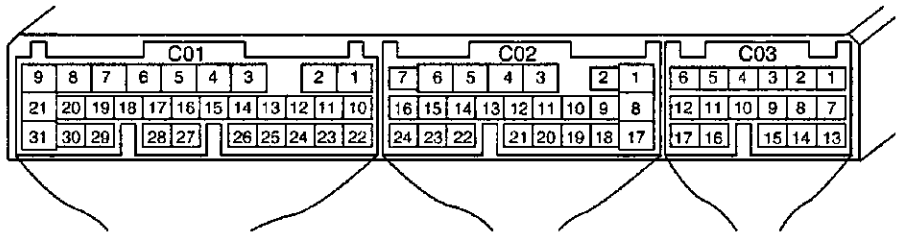
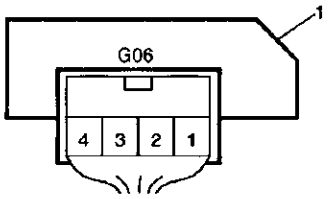
WIRING CIRCUIT







1. Immobilizer Control Module	4. Ignition switch	7. Data link connector
2. ECM	5. Fuse	8. To ABS control module, SDM and TCM
3. Main relay	6. Main fuse	9. Immobilizer indicator lamp

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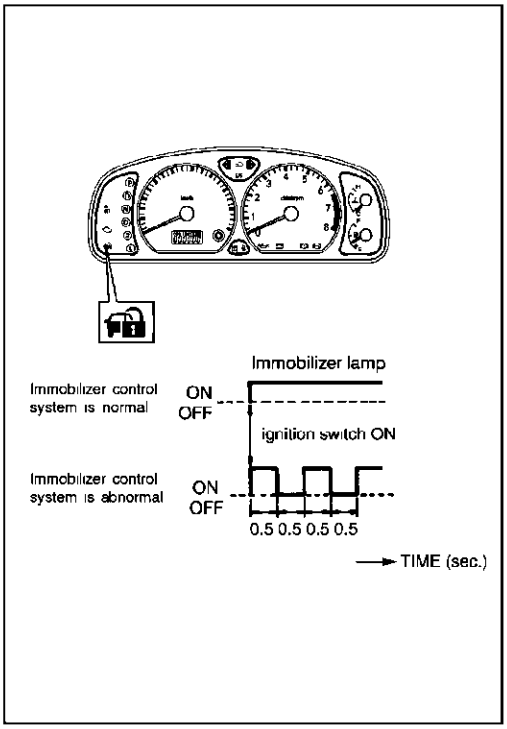
ON-BOARD DIAGNOSTIC SYSTEM (SELF-DIAGNOSIS FUNCTION)

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



With the ignition switch turned ON (but the engine at stop) regardless of the condition of the engine and emission control system, ECM indicates whether a trouble has occurred in the immobilizer control system or not by causing the immobilizer indicator lamp to flash or turn ON.

Immobilizer indicator lamp is ON :

No trouble exists in the immobilizer control system.

Immobilizer indicator lamp is flashing :

ECM or Immobilizer Control Module has detected some trouble in the immobilizer control system.

NOTE:
As soon as the ignition switch is turned ON, ECM and Immobilizer Control Module diagnose if a trouble has occurred in the immobilizer control system. While the diagnosis is being made, the immobilizer indicator lamp stays ON and if the diagnosis result is "abnormal", it immediately changes to flashing but if the result is "normal", it remains ON. Diagnosis takes about 3 seconds at maximum.

When ECM and Immobilizer Control Module detects a trouble, 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.

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DIAGNOSIS

PRECAUTIONS IN DIAGNOSING TROUBLES

PRECAUTIONS IN IDENTIFYING DIAGNOSTIC TROUBLE CODE

ECM

- Before identifying diagnostic trouble code indicated through Suzuki scan tool, don't disconnect couplers from ECM, battery cable from battery, ECM ground wire harness from engine.

  Such disconnection will clear trouble codes for engine and emission control system and immobilizer control system stored in memory of ECM.
- Take a note of diagnostic trouble code indicated first.

IMMOBILIZER CONTROL MODULE

- Take a note of diagnostic trouble code indicated first.

INTERMITTENT TROUBLES

- There is case where Suzuki scan tool 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 Suzuki scan tool indicate a trouble code :
    Diagnose trouble by using that code No. and if ignition key, coil antenna, wires and each connection are all in good condition, turn OFF ignition switch and then ON.

Then check what Suzuki scan tool 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.

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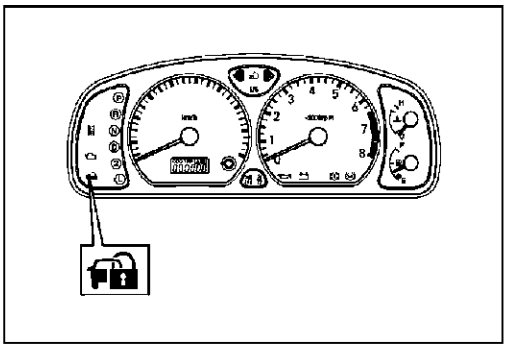
DIAGNOSTIC FLOW TABLE

Step	Action	Yes	No
1	1) Check immobilizer indicator lamp while ignition switch is ON (but without starting engine). See Fig. 1. Does immobilizer indicator lamp flash?	Go to Step 3.	If immobilizer indicator lamp remains ON, go to Step 2. If immobilizer indicator lamp remains OFF, go to "TABLE A IMMOBILIZER INDICATOR LAMP CHECK" 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 "TABLE B 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 below.

NOTE:
After replacing with a known-good ECM, register ECM/Immobilizer Control Module code in ECM by performing procedure described in "Procedure after ECM Replacement" section.

Fig. 1 for Step 1



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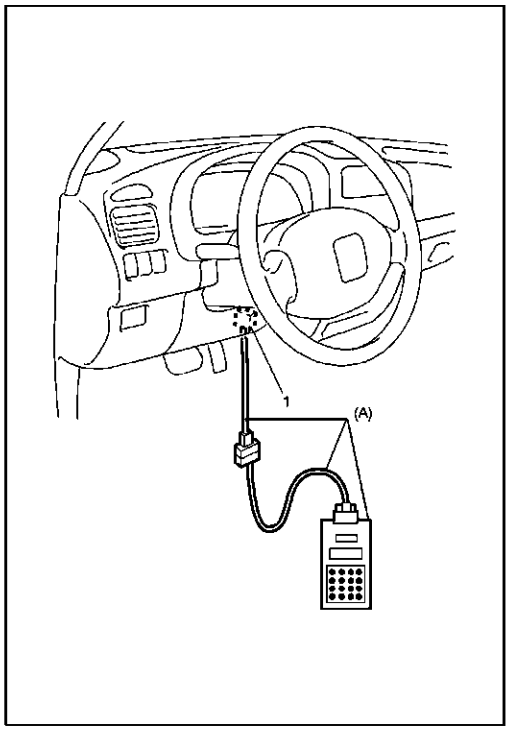

DIAGNOSTIC TROUBLE CODE (DTC) CHECK (IMMOBILIZER CONTROL MODULE)

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

   Special tool
   (A) : Suzuki scan tool

3) Turn ignition switch 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 C".

   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).

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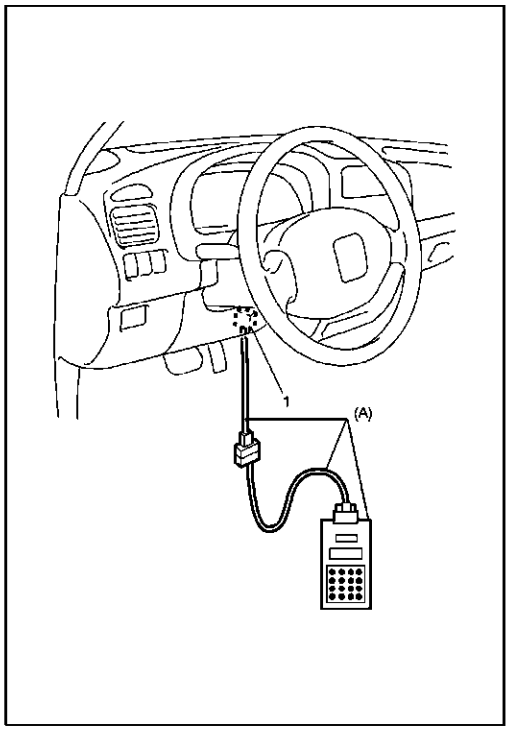

DIAGNOSTIC TROUBLE CODE (DTC) CHECK (ECM)

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

   Special tool
   (A) : Suzuki scan tool

3) Turn ignition switch 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).

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DIAGNOSTIC TROUBLE CODE TABLE

IMMOBILIZER CONTROL MODULE

DTC (indicated on Suzuki scan tool)	DIAGNOSTIC AREA	DIAGNOSIS
NO DTC	Normal (No code)	This code appears when none of the other codes are identified.
11	Transponder code	Diagnose trouble according to "Diagnostic Flow Table" corresponding to each code No.
31		
32		
12	Immobilizer Control Module	
13	Coil antenna or ignition key with built-in transponder	
21	ECM/Immobilizer Control Module code	
22	Ignition switch circuit	
23	Serial data link circuit	

ECM

DTC (indicated on Suzuki scan tool)	DIAGNOSTIC AREA	DIAGNOSIS
NO DTC	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	ECM/Immobilizer Control Module code	Diagnose trouble according to "DIAGNOSTIC FLOW TABLE" corresponding to each code No.
P1620		
P1622	ECM	
P1621	Serial data link wire	

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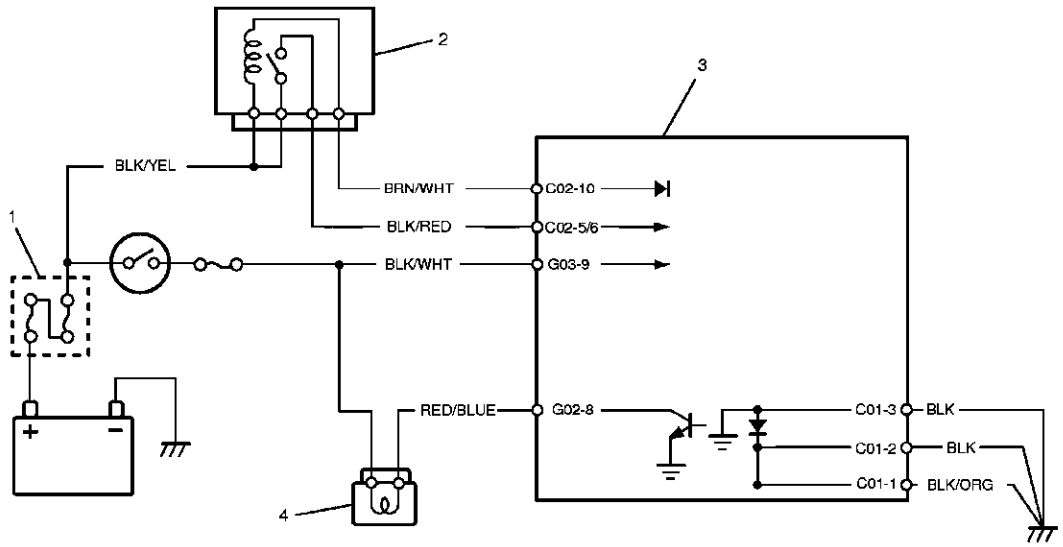
TABLE A - IMMOBILIZER INDICATOR LAMP CHECK (IMMOBILIZER INDICATOR LAMP DOES NOT LIGHT AT IGNITION SWITCH ON)

WIRING DIAGRAM



1. Main fuse	3 ECM
2. Main relay	4 Immobilizer indicator lamp

INSPECTION

Step	Action	Yes	No
1	1) Turn ignition switch ON. Do other indicator/warning lights in combination meter come ON?	Go to Step 2.	"IG" fuse blown, main fuse blown, ignition switch malfunction, "BLK/WHT" circuit between "IG" fuse and combination meter or poor coupler connection at combination meter.
2	1) Turn ignition switch OFF and disconnect connectors from ECM. 2) Check for proper connection to ECM at terminal C02-8. 3) If OK, then using service wire, ground terminal C02-8 in connector disconnected. Does immobilizer indicator lamp turn on at ignition switch ON?	Substitute a knowngood ECM and recheck.	Bulb burned out or "RED/BLU" wire circuit open.

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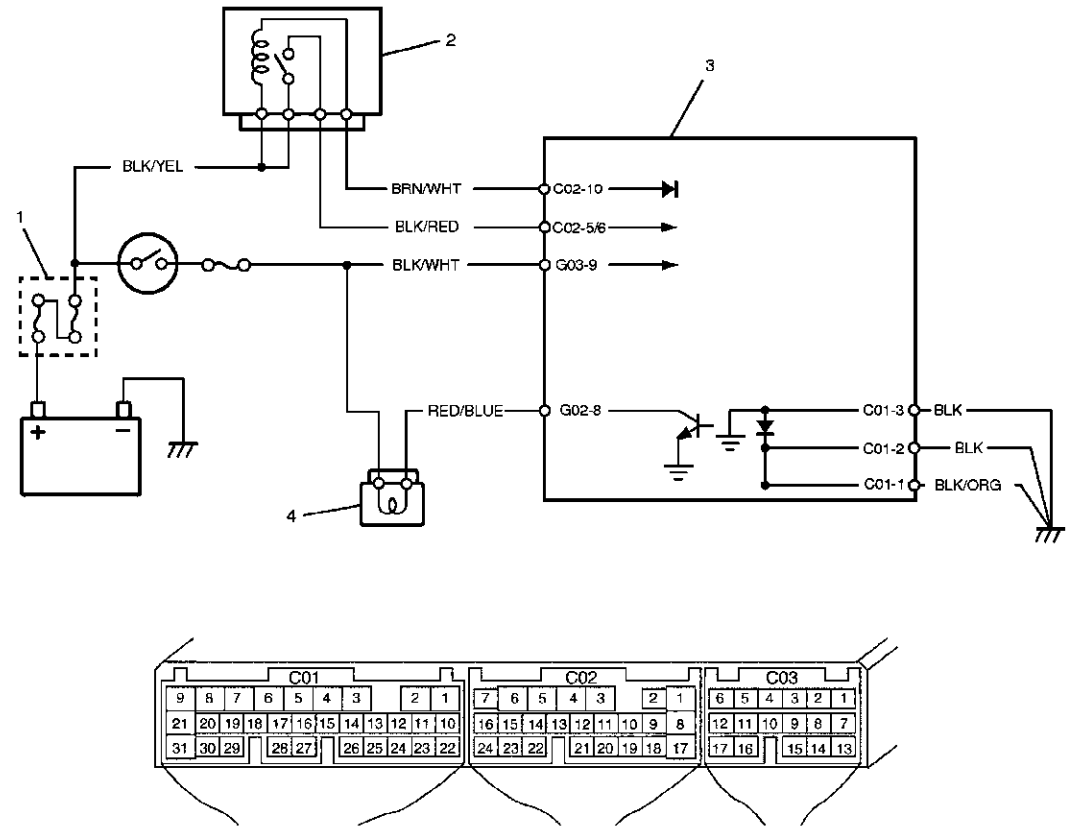
TABLE B - IMMOBILIZER INDICATOR LAMP CHECK (IMMOBILIZER INDICATOR LAMP REMAINS ON AFTER ENGINE STARTS)

WIRING DIAGRAM



1. Main fuse	3. ECM
2. Main relay	4. Immobilizer indicator lamp

INSPECTION

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect couplers from ECM. Does immobilizer indicator lamp turn ON at ignition switch ON?	"RED/BLU" wire shorted to ground circuit.	Substitute a known-good ECM and recheck.

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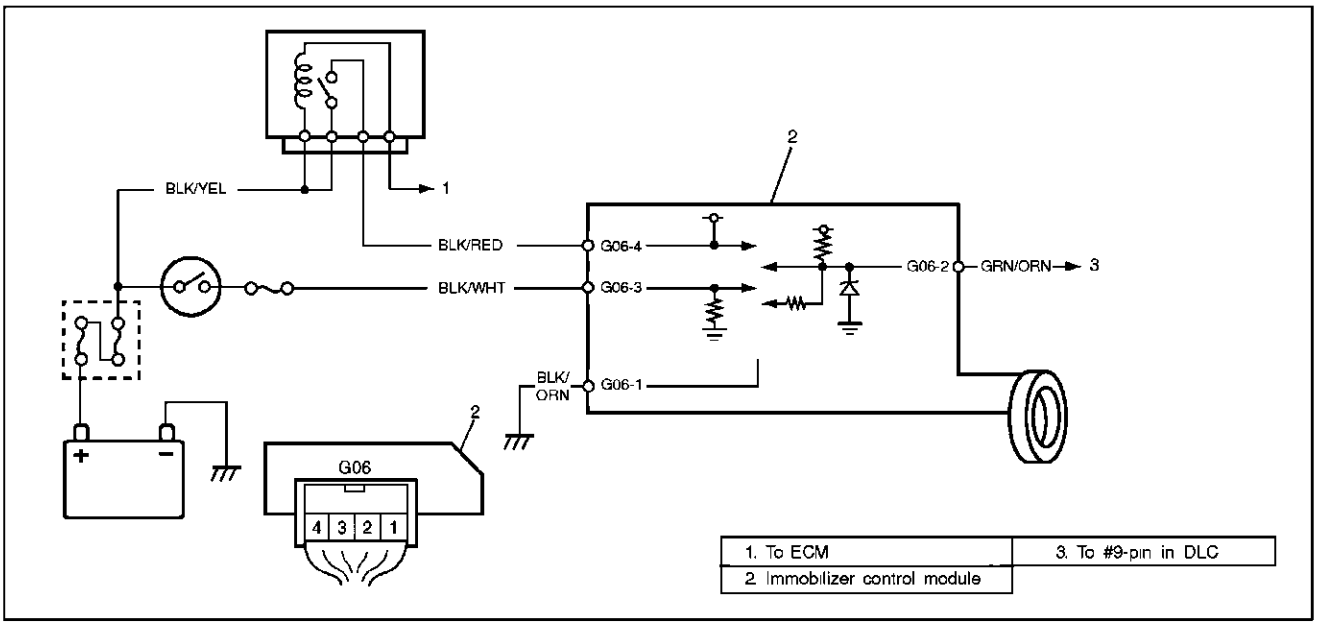
TABLE C - DTC IS NOT OUTPUT FROM IMMOBILIZER CONTROL MODULE

WIRING DIAGRAM



INSPECTION

Step	Action	Yes	No
1	Check voltage between G06-4 terminal and body ground with ignition switch turned ON. See Fig 1. Is it 10 – 14 V?	Go to Step 2.	"BLK/RED" wire open or short to ground.
2	1) Disconnect coupler (1) at immobilizer control module. Is there continuity between coupler terminal G06-1 and body ground? See Fig 2.	• Poor G06-4 or G06-1 connection • Poor #9-pin connection in DLC • Serial data line "GRN/ORN" open or short to ground If connections and line are OK, substitute a known-good Immobilizer Control Module and recheck. See NOTE below.	"BLK/ORN" 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.

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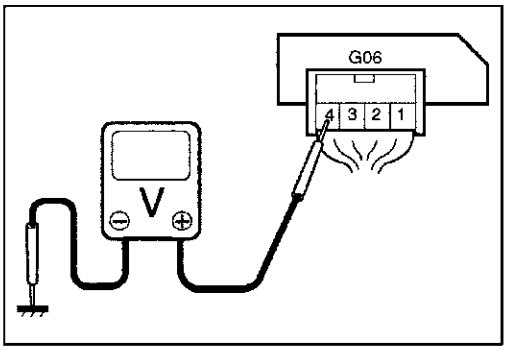

Fig. 1 for Step 1

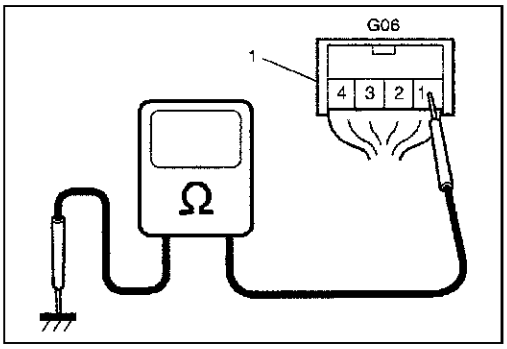

Fig. 2 for Step 2

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.

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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 below.	Repair or replace.

NOTE:
After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "PROCEDURE AFTER IMMOBILIZER CONTROL MODULE REPLACEMENT" in this section.

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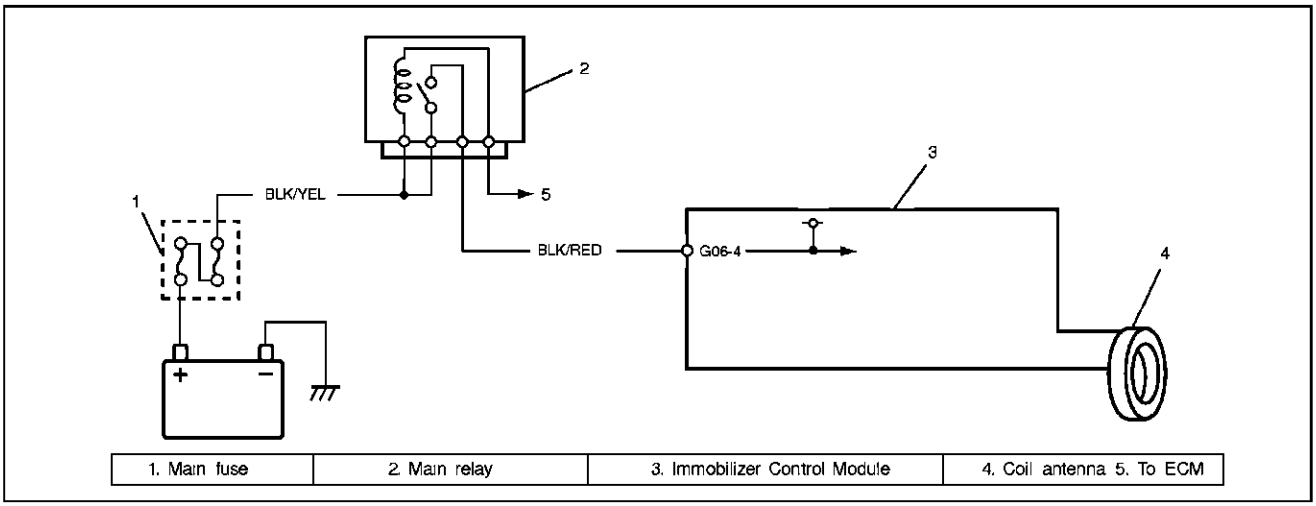
DTC13 NO TRANSPONDER CODE TRANSMITTED OR COIL ANTENNA OPENED/SHORTED



1. Main fuse	2. Main relay	3. Immobilizer Control Module	4. Coil antenna 5. To ECM

DESCRIPTION

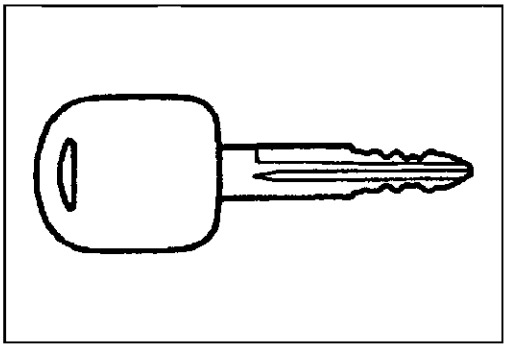
Immobilizer Control Module energizes the coil antenna when the ignition switch is ON and reads Transponder code from the ignition key. When Immobilizer Control Module cannot read Transponder code from the ignition key even when the coil antenna is energized, this DTC is set.

INSPECTION

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 below.	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 ImmobilizerControl Module by performing procedure described in "PROCEDURE AFTER IMMOBILIZER CONTROL MODULE REPLACEMENT" in this section.

Fig. 1 for Step 1



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DTC21 ECM/IMMOBILIZER CONTROL MODULE CODE NOT MATCHED (IMMOBILIZER CONTROL MODULE SIDE)

DTC P1623 ECM/IMMOBILIZER CONTROL MODULE CODE NOT MATCHED (ECM SIDE)

DTC P1620 ECM/IMMOBILIZER CONTROL MODULE CODE NOT REGISTERED

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.
- DTC P1623
  ECM checks if ECM/Immobilizer Control Module code transmitted from Immobilizer Control Module and that registered in ECM match when ignition switch is ON. If they do not, this DTC is set.
- DTC P1620
  ECM checks if code transmitted from Immobilizer Control Module and that registered in ECM match when ignition switch is ON. If there is no ECM/Immobilizer Control Module code registered in ECM, this DTC is set.

INSPECTION

Perform procedure described in "PROCEDURE AFTER ECM REPLACEMENT" in the section.

DTC 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 below.	Repair or replace.

NOTE:
After replacing with a known-good ECM, register ECM/Immobilizer Control Module code in ECM by performing procedure described in "PROCEDURE AFTER ECM REPLACEMENT" in this section.

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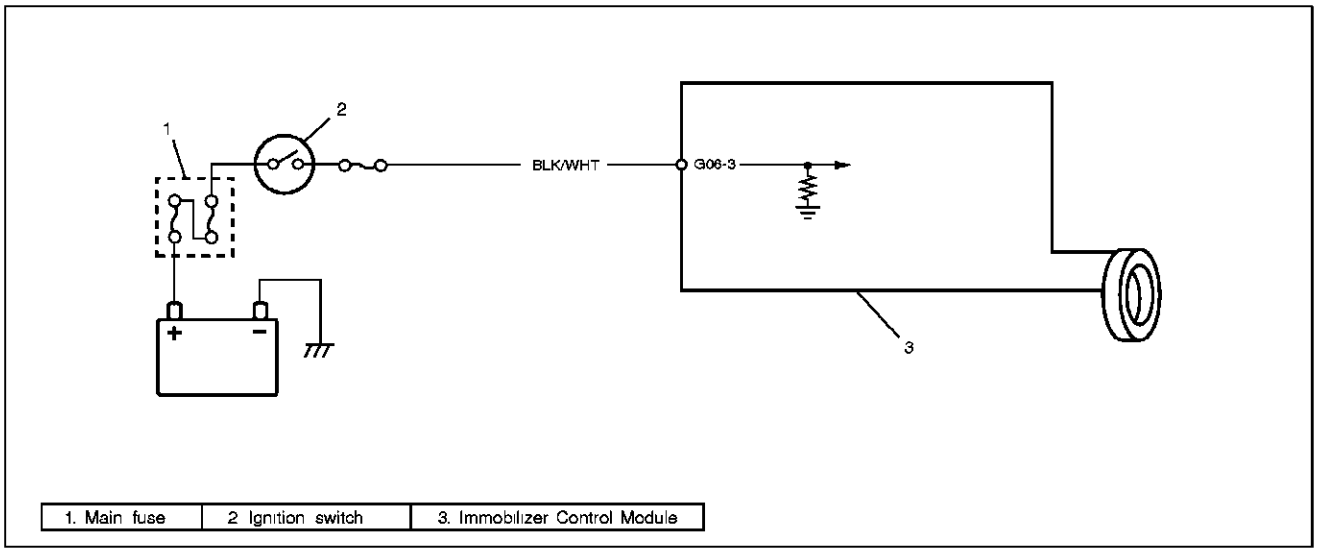
DTC22 IGNITION SWITCH CIRCUIT OPEN/SHORT



1. Main fuse	2. Ignition switch	3. Immobilizer Control Module

DESCRIPTION

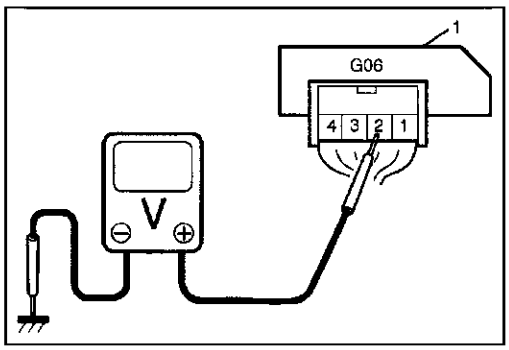
Immobilizer Control Module monitors ignition signal when the ignition switch is ON. This DTC is set when no ignition signal input is detected by Immobilizer Control Module.

INSPECTION

Step	Action	Yes	No
1	Check voltage between Immobilizer Control Module (1) coupler terminal G06-3 and body ground with ignition switch turned ON. (See Fig. 1) Is it 10 – 14V?	Poor G06-3 terminal connection. If connection is OK, substitute a known-good Immobilizer Control Module and recheck. See NOTE below.	"BLK/WHT" wire open or short.

NOTE:
After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "PROCEDURE AFTER IMMOBILIZER CONTROL MODULE REPLACEMENT" in this section.

Fig. 1 for Step 1



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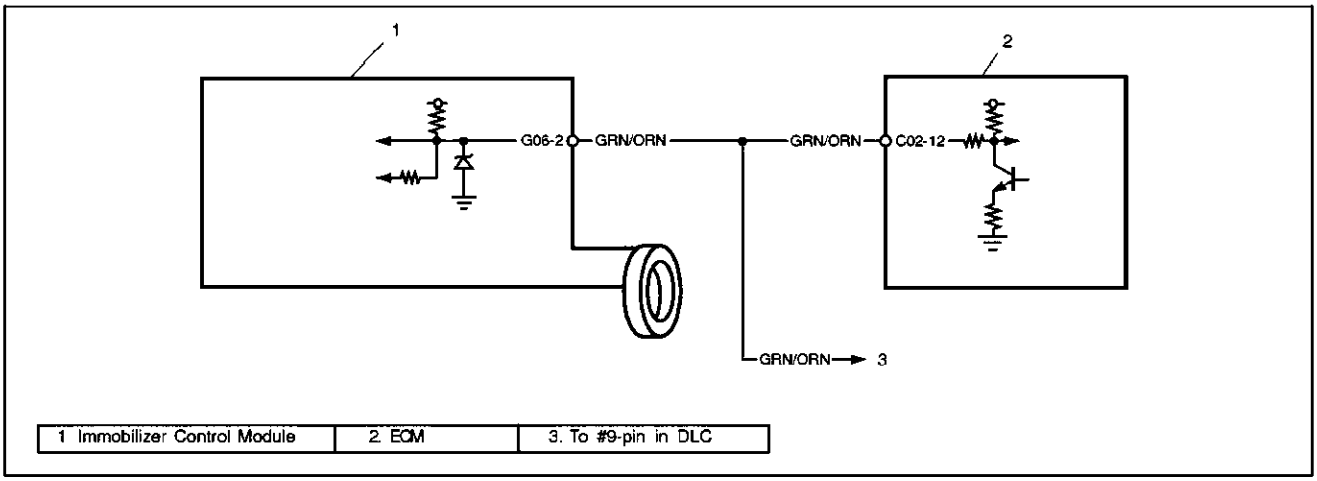
DTC23 NO ECM/IMMOBILIZER CONTROL MODULE CODE TRANSMITTED FROM ECM OR DLC CIRCUIT OPENED/SHORTED

DTC P1621 NO ECM/IMMOBILIZER CONTROL MODULE CODE TRANSMITTED FROM IMMOBILIZER CONTROL MODULE OR DLC CIRCUIT OPENED/SHORTED



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 DTC P1621.

INSPECTION

Step	Action	Yes	No
1	Check voltage between Immobilizer Control Module (1) coupler terminal G06-2 and body ground with ignition switch turned ON. Is it 4 – 5V?	Go to Step 2.	"GRN/ORN" wire short.
2	1) Disconnect ECM coupler with ignition switch turned OFF. 2) Is there continuity between Immobilizer Control Module coupler (1) terminal G06-2 and serial data link terminal (C02-12) of ECM coupler? (For positions of Data link connector terminal of ECM coupler, refer to "WIRING CIRCUIT" in this section.)	Poor G06-2 terminal connection (Immobilizer Control Module) or Poor Data link connector terminal connection (ECM). If connections are OK, substitute a known-good ECM or Immobilizer Control Module and recheck. See NOTE below.	"GRN/ORN" wire between mmobilizer Control Module and ECM open.

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NOTE:

- **After replacing with a known-good ECM, register ECM/Immobilizer Control Module code in ECM by performing procedure described in "PROCEDURE AFTER ECM REPLACEMENT" in this section.**
- **After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "PROCEDURE AFTER IMMOBILIZER CONTROL MODULE REPLACEMENT" in the section.**

Fig. 1 for Step 1

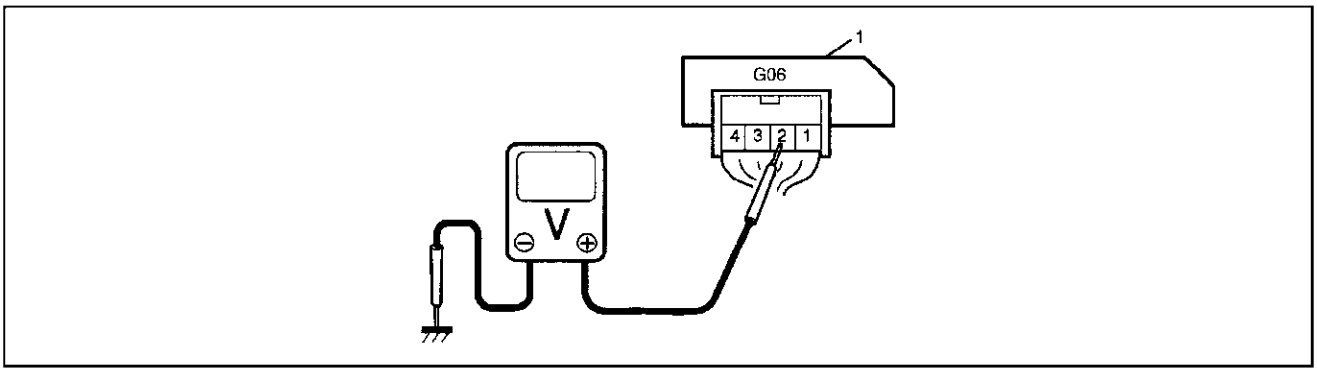
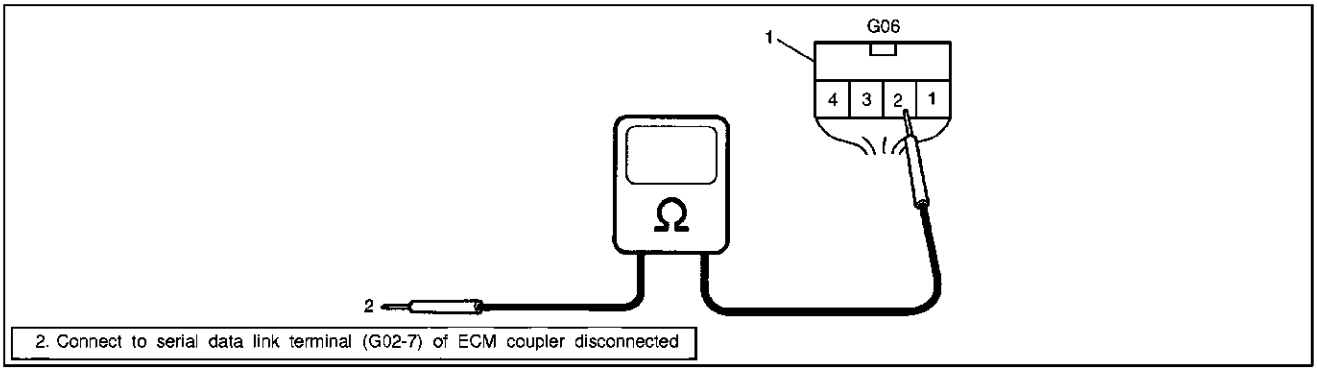


Fig. 2 for Step 2



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INSPECTION OF ECM, IMMOBILIZER CONTROL MODULE AND ITS CIRCUIT

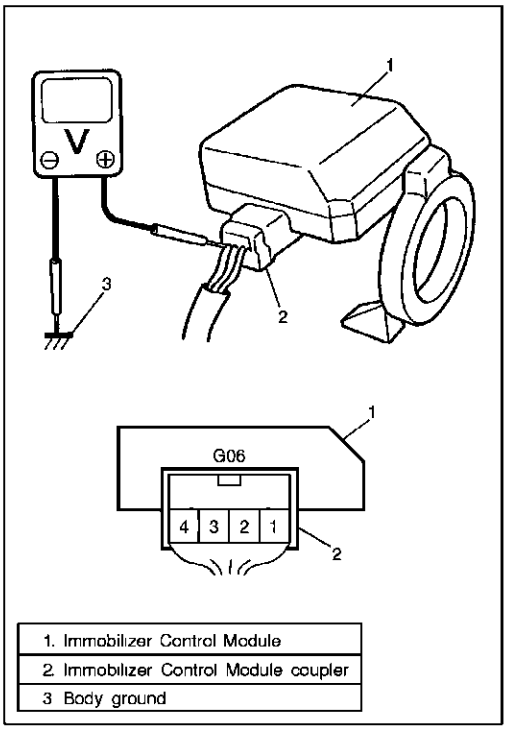
ECM, Immobilizer Control Module and its circuit can be checked at ECM wiring couplers and Immobilizer Control Module wiring coupler by measuring voltage. Described here is only inspection of Immobilizer Control Module. For inspection of ECM, refer to "INSPECTION OF ECM (PCM) AND ITS CIRCUITS" in SECTION 6E1.

CAUTION:
Immobilizer Control Module cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to Immobilizer Control Module with coupler disconnected from it.

Voltage Check

1) Remove Immobilizer Control Module from steering lock assembly with ignition switch OFF, referring to "REMOVAL" of "IMMOBILIZER CONTROL MODULE" in this section.
2) Connect Immobilizer Control Module coupler to Immobilizer Control Module.
3) Check voltage at each terminal of coupler connected.

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



1. Immobilizer Control Module
2. Immobilizer Control Module coupler
3. Body ground

TERMINAL	CIRCUIT	NOMAL VOLTAGE	CONDITION
G06-1	Ground	–	–
G06-2	Data link connector (Serial data terminal)	4 – 5V	Ignition switch ON
G06-3	Ignition signal	10 – 14V	Ignition switch ON
		0 – 0.8V	Ignition switch OFF
G06-4	Power source	10 – 14V	Ignition switch ON

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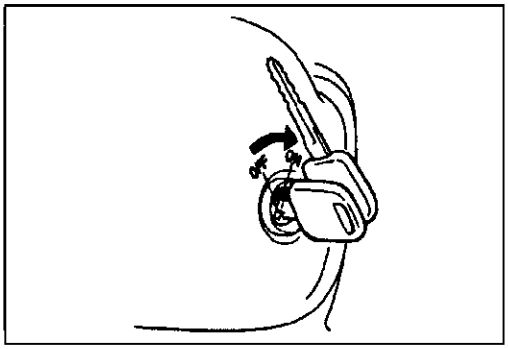
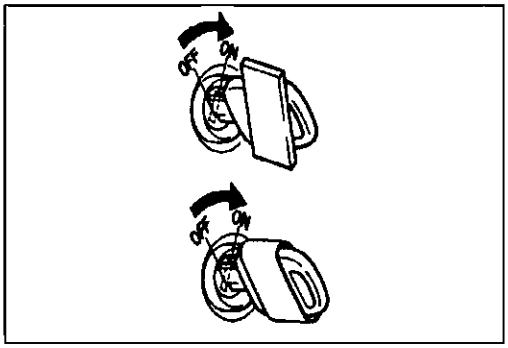


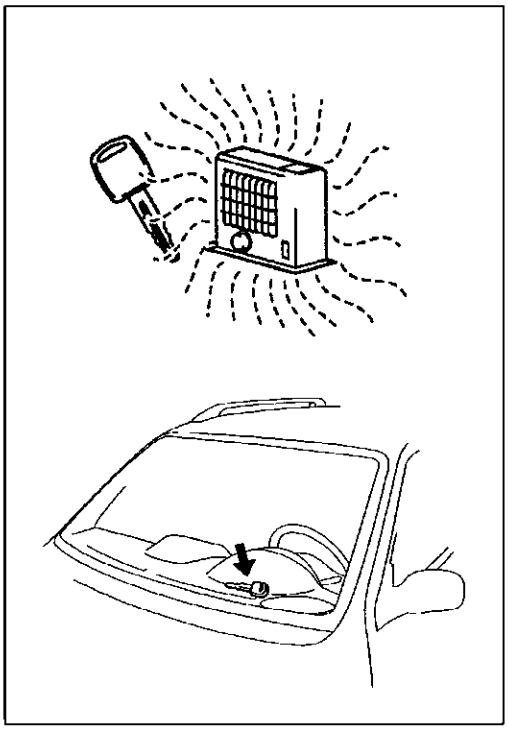
ON-VEHICLE SERVICE

PRECAUTIONS IN HANDLING IMMOBILIZER CONTROL SYSTEM

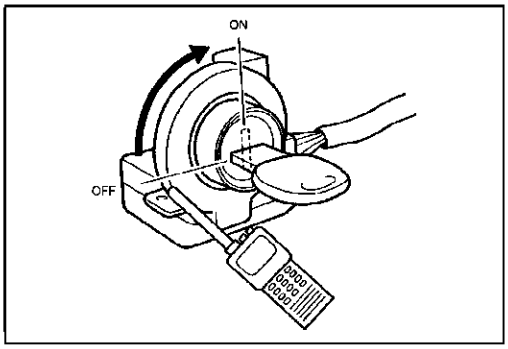
- Don't turn ON ignition switch with ignition key for immobilizer control system put together with another one or placed quite close to another one. Or the system may detect abnormal condition and prevent engine from starting.



- 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 Immobilizer Control Module. Or the system may detect abnormal condition and prevent engine from starting.

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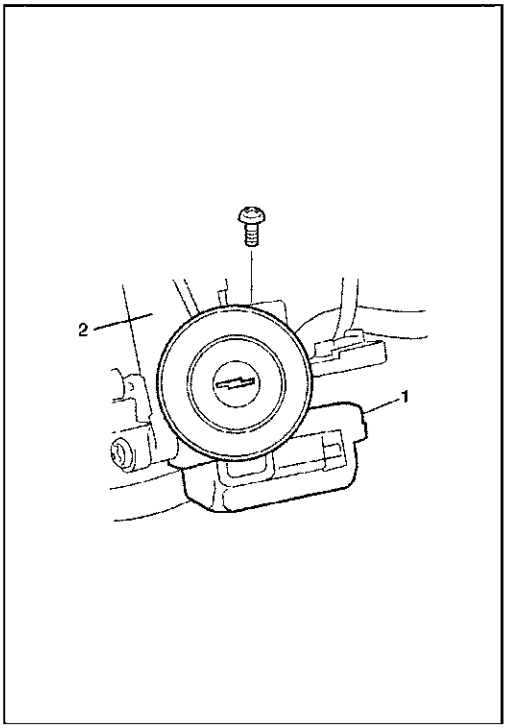
IMMOBILIZER CONTROL MODULE

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Remove steering column upper and lower cover.
3) Disconnect coupler at Immobilizer Control Module.



4) Remove immobilizer control module (1) from steering lock assembly (2) after removing instrument cluster panel.

NOTE:
If a screwdriver whose length is 40mm or less is used, the immobilizer control module can be removed without removing the instrument cluster panel.

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.

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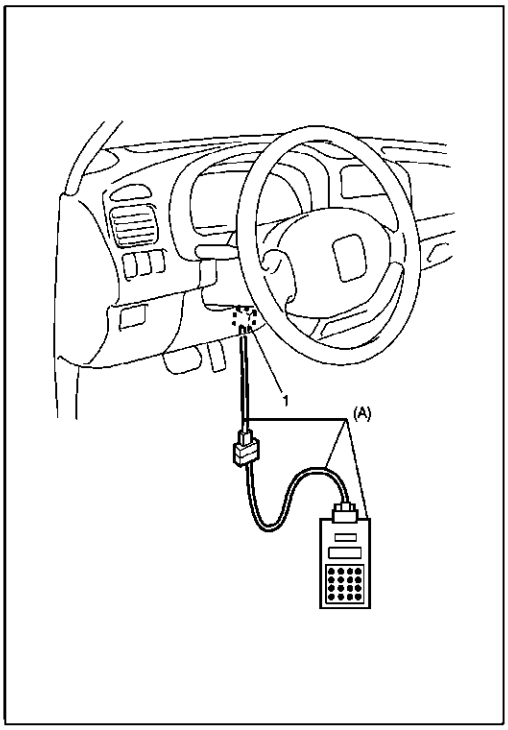
HOW TO REGISTER IGNITION KEY

Register the ignition key with a built-in transponder in Immobilizer Control Module by using the following procedure.

CAUTION:
When registering the ignition key including a transponder into the immobilizer control module by using Suzuki scan tool, confirm that the knob color of the ignition key to be registered for the vehicle is dark gray. The ignition key with wrong knob color cannot be registered.

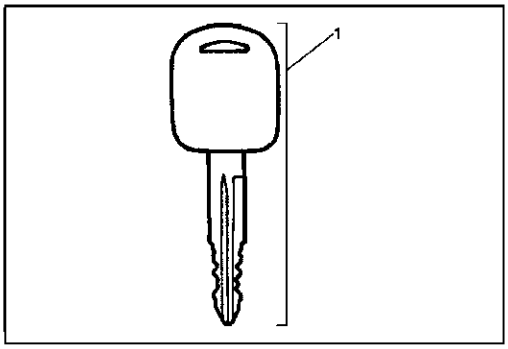
1) Prepare SUZUKI scan tool and cartridge for immobilizer control system.



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.
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.

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NOTE:

When "CLR. TRANS COD (CLEAR TP CODE)" command is executed with the immobilizer indicator lamp ON, it remains ON even after execution of that command is over. It will start flashing when the ignition switch is turned OFF once and then turned ON after some seconds.

5) Using SUZUKI scan tool, register Transponder code in Immobilizer Control Module by executing "ENT. TRANS COD (ENT. TP CODE)" command in SELECT MODE menu.
6) Make sure that immobilizer indicator lamp lights when ignition switch is turned OFF once and then ON.
7) If any other Transponder code for ignition key with a built-in transponder needs to be registered, repeat above steps 3), 5) and 6).

NOTE:

- **Up to 4 Transponder codes for ignition key with a built-in transponder can be registered.**
- **It is not possible to register the 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 is dark gray. The ignition key with wrong knob color cannot be registered.

1) Perform steps 1) and 2) described in "How To Register Ignition Key".
2) Prepare ignition key with a built-in transponder. And then turn ignition switch ON by using it.
3) Using SUZUKI scan tool, clear all transponder codes registered in Immobilizer Control Module 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 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 immobilizer indicator lamp lights when ignition switch is turned OFF once and then ON.
7) If any other Transponder code for ignition key with a built-in transponder needs to be registered, repeat above steps 2), 4) and 6).

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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.**

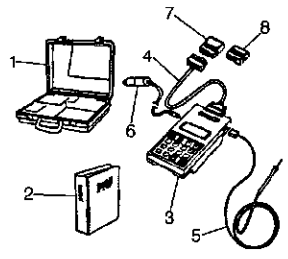
PROCEDURE AFTER ECM REPLACEMENT

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.

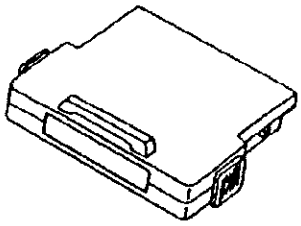
1) Perform steps 1) and 2) described in "How To Register Ignition Key". And then turn ignition switch ON.
2) Using SUZUKI scan tool, register ECM/Immobilizer Control Module code in ECM by executing "RECORD ECU (RECORD ECM/ICM)" command in SELECT MODE menu.

   NOTE:
   For operation procedure of SUZUKI scan tool, refer to SUZUKI scan tool operator's manual.
3) Make sure that malfunction indicator lamp lights when ignition switch is turned OFF once and then ON.

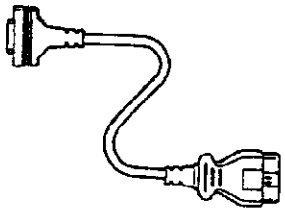
SPECIAL TOOL



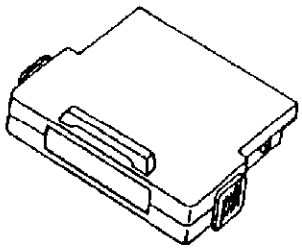
09931-76011
Tech 1A kit (SUZUKI Scan tool) See NOTE "A".



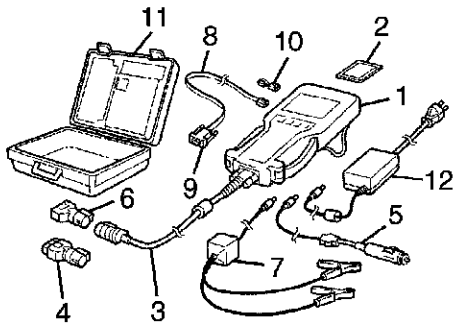
Immobilizer cartridge for Tech 1A



09931-76030
16/14 pin DLC cable for Tach 1A



Mass storage cartridge for Tech 1A



Tech 2 kit (SUZUKI Scan tool) (See NOTE "B")

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NOTE :

- "A": This kit includes the following items and substitutes for the Tech 2 kit.
  1. Storage case, 2. Operarot'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.

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SECTION 9

BODY SERVICE

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

- **Service on and around the air bag system components and Wiring must be performed only by an authorised 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 components 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 speciefied during reassembly to assure proper retention of these parts.

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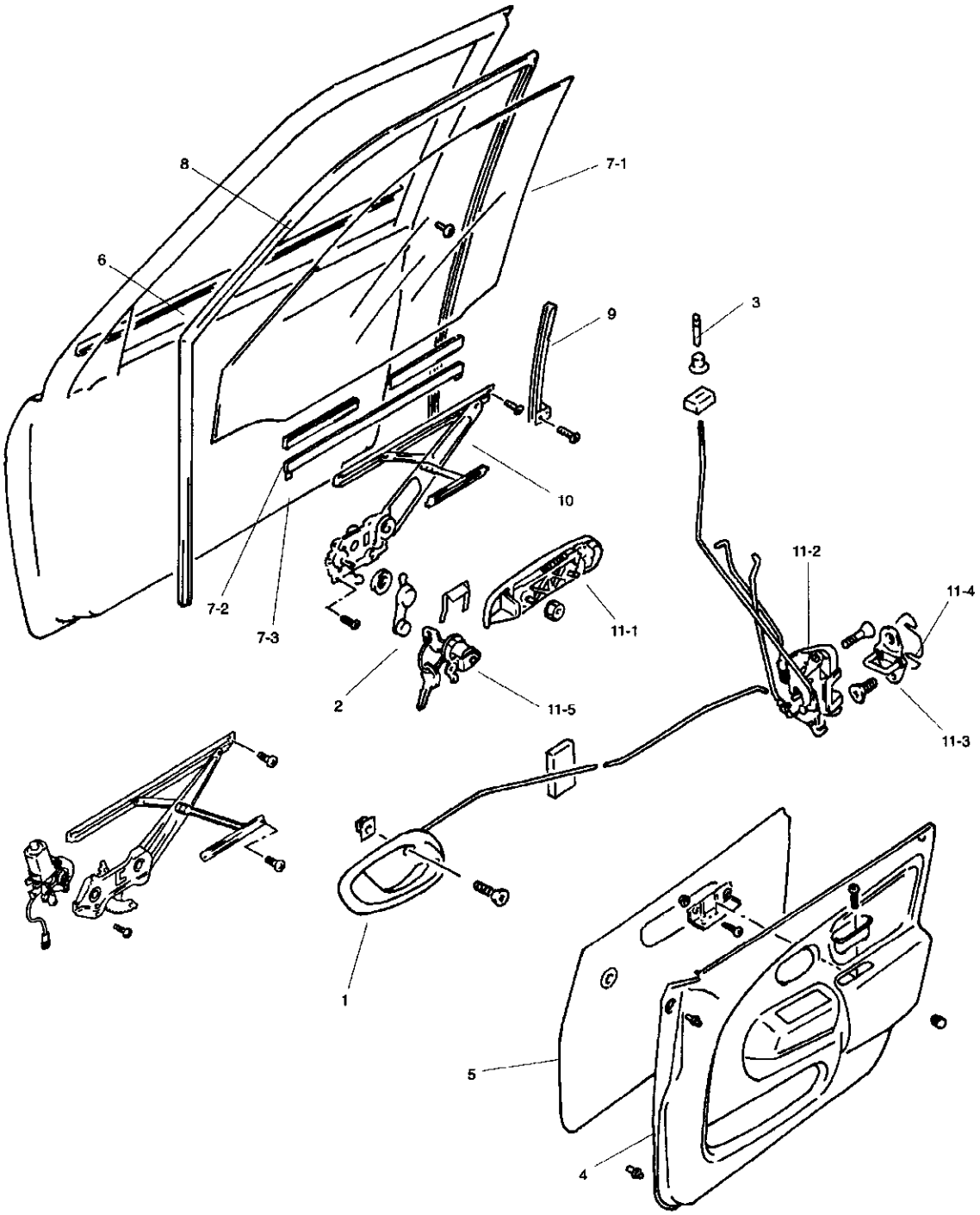
GLASS, WINDOWS AND MIRRORS

FRONT DOOR GLASS



1.	Front door inside handle	8.	Front door glass run
2.	Window regulator handle	9	Front door glass sash
3	Door inside lock knob	10	Front window regulator assembly (For manual window)
4.	Front door trim	10-1.	Front window regulator assembly (For power window)
5.	Door sealing cover	11-1.	Front door outside handle assembly
6.	Front door weatherstrip	11-2.	Front door latch assembly
7-1.	Front door glass	11-3.	Door latch striker
7-2.	Glass bottom rubber	11-4.	Spacer
7-3.	Glass bottom channel	11-5.	Front door lock cylinder

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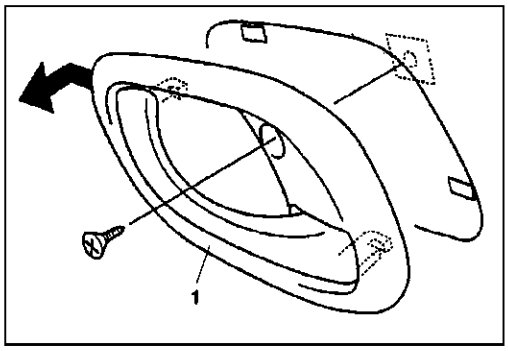
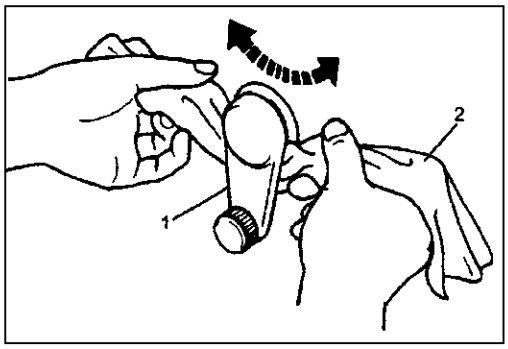
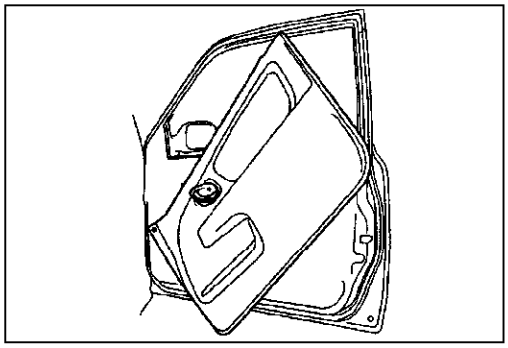


REMOVAL

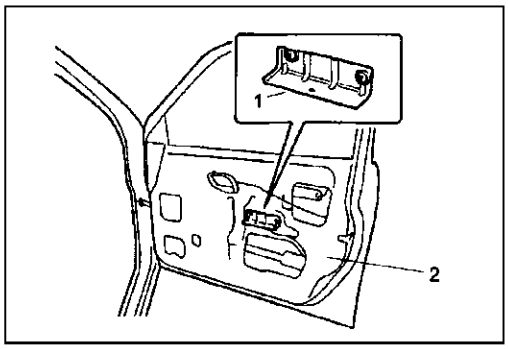
1) Detach inside handle bezel (1).
2) Remove door mirror bezel.
3) Remove door inside pull handle case fitting screw.



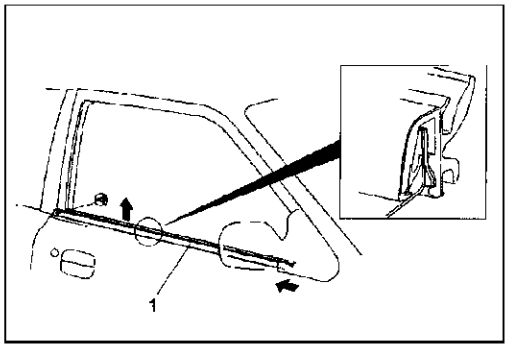
4) Remove window regulator handle (1) (if equipped).
   For its removal, pull off snap by using a cloth (2) as shown in left figure.



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 inside pull handle bracket (1).
7) Remove door sealing cover (2).



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.

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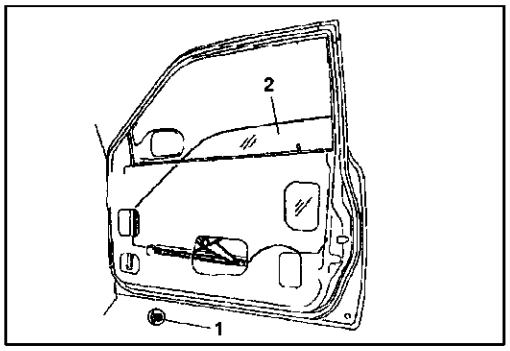
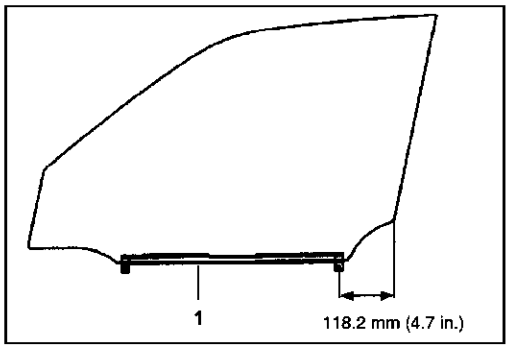


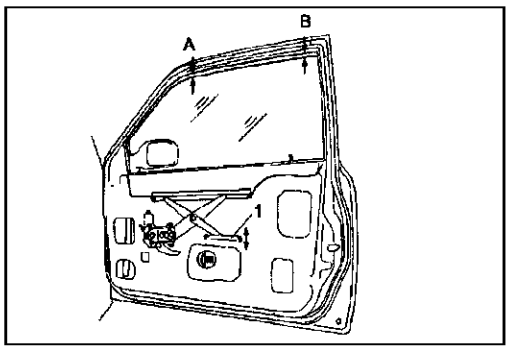
9) Remove glass attaching screws (1).
10) Take out door glass (2).



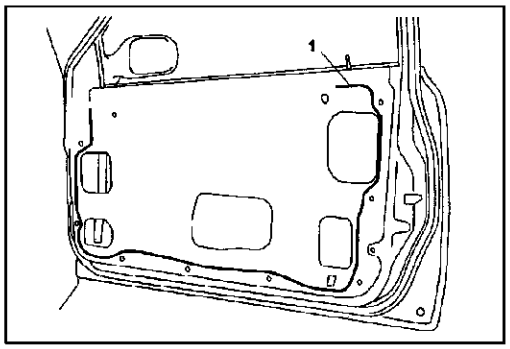
INSTALLATION

Reverse removal procedure to install door glass noting the following points:

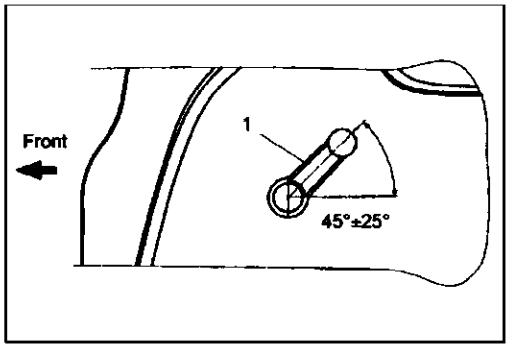
- Glass fitted position of bottom channel (1) is as shown in figure.



- Adjust equalizer (1) of window regular so that measurement A and B are equal.



- Secure door sealing cover with adhesive (1).



- Install door window regulator handle (1) so that it has a 45° angle when glass is fully closed, as shown in left figure (if equipped).

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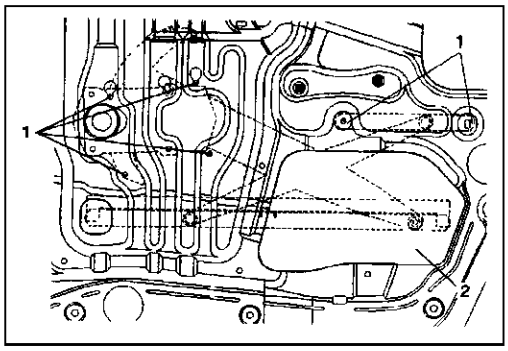
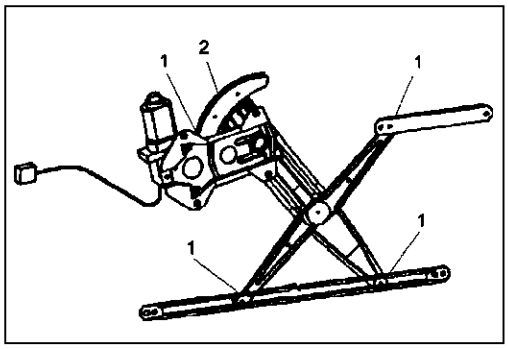


FRONT DOOR WINDOW REGULATOR

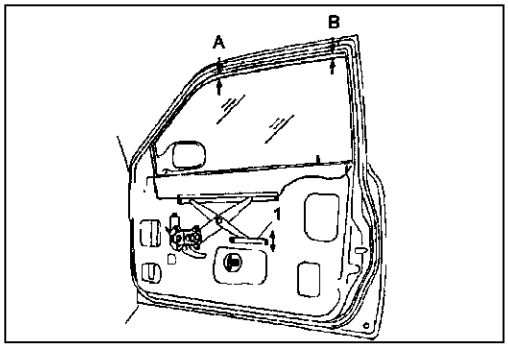
REMOVAL

1) Remove door glass, referring to steps 1) to 10) of "FRONT DOOR GLASS REMOVAL" in this section.
2) Disconnect power window motor lead wire at coupler and loosen clamp (if equipped).
3) Loosen regulator mounting screws (1) and take out regulator through hole (2) as shown in left figure.



INSPECTION

1) Check regulator sliding and rotating parts for greasing (1).
2) Check rollers (2) for wear and damage.



INSTALLATION

Reverse removal procedure to install window regulator noting the following point.

- When installing glass, check that the top part of the glass contacts the glass run evenly and that the glass moves up and down smoothly.
  If the glass is tilted with respect to the glass run, adjust equalizer (1) of window regulator so that measurement A and B are equal.

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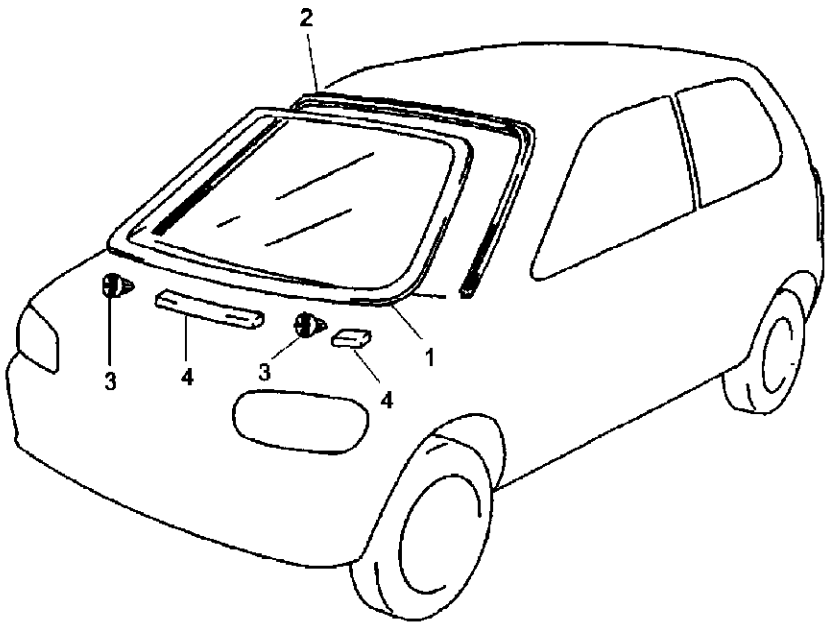
WINDSHIELD

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 to follow the proper procedure.



1.	Windshield glass
2.	Windshield molding
3.	Stopper
4.	Spacer

CAUTION:

- **Described in this section is the glass replacement by using 2 types of primers and 1 type of adhesive made by YOKOHAMA (one component urethane adhesive to be used with primer in combination). When using primer and adhesive made by other manufacturers, be sure to refer to handling instructions supplied with them. Negligence in following such procedure or misuse of the adhesive in any way hinders its inherent adhesive property. Therefore, before the work, make sure to read carefully the instruction and description given by the maker of the adhesive to be used and be sure to follow the procedure and observe each precaution throughout the work.**
- **Should coated surface be scratched or otherwise damaged, be sure to repair damaged part, or corrosion may start from there.**

Use an adhesive of above mentioned type which has the following property.

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 (290 g (10 oz.))
  Primer for glass (5 g (0.18 oz.))
  Primer for body (5 g (0.18 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)

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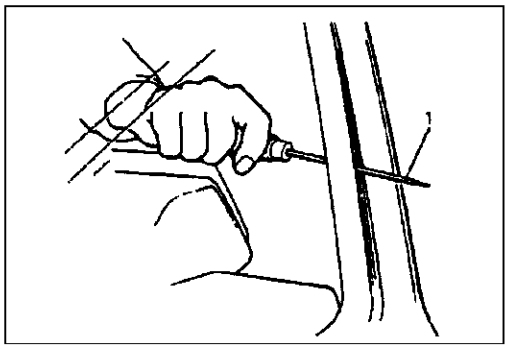
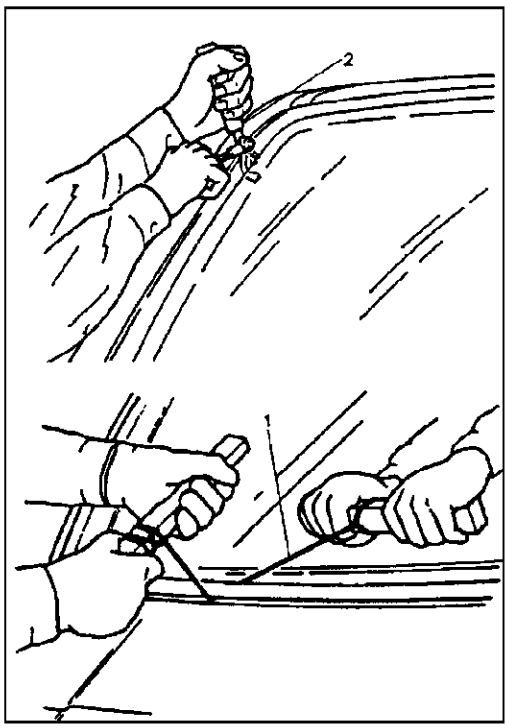
REMOVAL

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 "INSTRUM ENT PANEL " in this section.
6) If necessary, remove head lining. Refer to "HEAD LINING " in this section.
7) Remove (or cut) windshield molding until windshield edge comes out. Remove (or cut) stopper.



8) Drill hole with eyeletter (1) through adhesive and let piano string through it.



9) Cut adhesive all around windshield with piano string (1). When using tool (2) 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 (1) as close to glass as possible so as to prevent damage to body and instrument panel.

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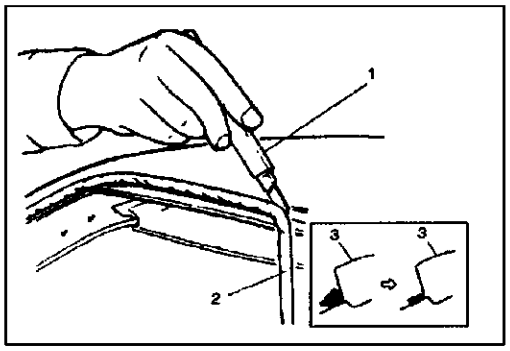
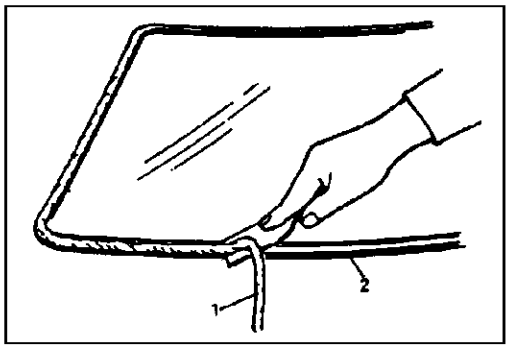
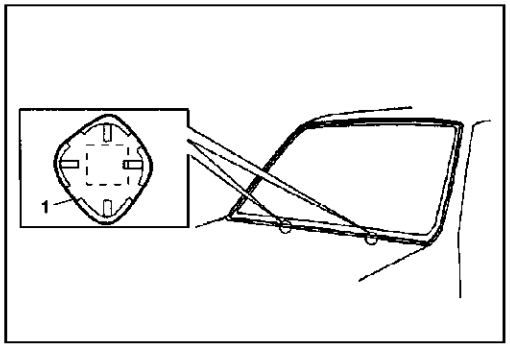


10) Using knife (1), smoothen adhesive (2) remaining on body side (3) so that it is 1 to 2 mm thick all around.

NOTE:
Before using knife (1), clean it with alcohol or the like to remove oil from it.

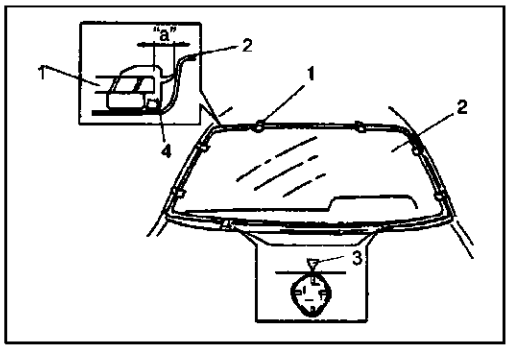


11) When reusing windshield, remove the adhesive (1) from it, using care not to damage primer coated surface (2).

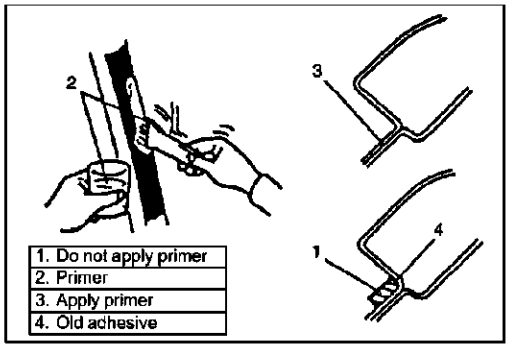


INSTALLATION

1) Using cleaning solvent, clean windshield edge where windshield glass is to be adhered. (Let it dry for more than 10 minutes.)
2) Install new glass stoppers (1) (2 pcs) to lower side of windshield.



3) To determine installing position of glass (1) to body (2), position glass (1) against body (2) so that clearance (a) between upper end of glass (1) and body (2) is 4-6mm. (0.157-0.236 in.) and clearances (a) between each side end (right & left) of glass (1) and body (2) are even. Upper clearance can be adjusted by moving stoppers position. Then mark mating marks on glass (3) and body as shown.



4) Clean contact surfaces of old adhesive, paint or bare metal thoroughly.
If surfaces of paint or bare metal come out, apply primer 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.**

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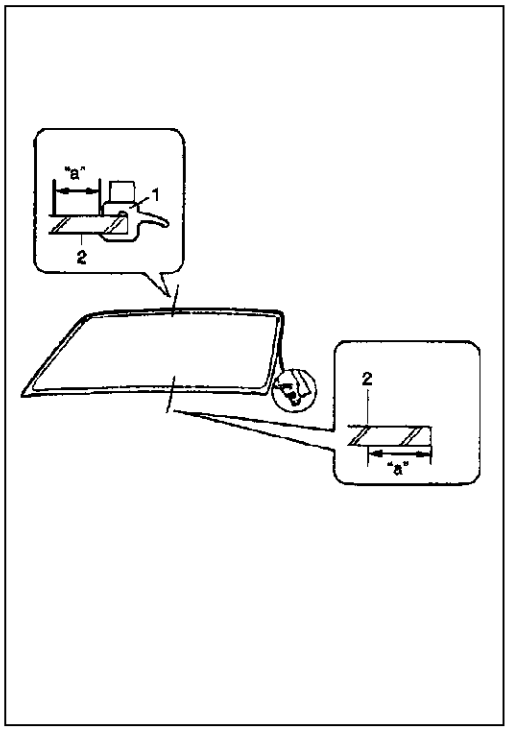
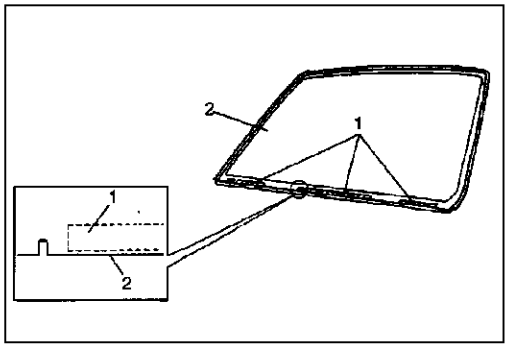
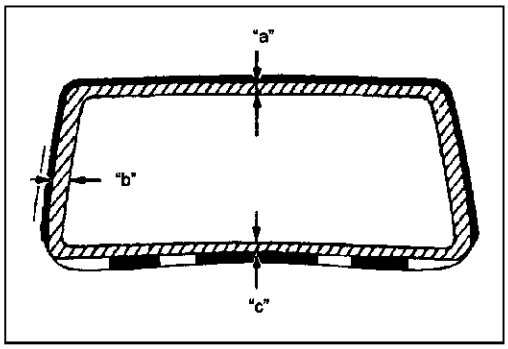


5) Install new molding (1) to glass (2).
6) Clean glass (2) surface to be adhered to body with clean cloth. If cleaning solvent is used, let it dry for more than 10 minutes.

Cleaning Area
Distance from the edge of glass or molding
"a": 30 – 50 mm (1.18 – 1.97 in.)



7) Install new spacer (1) to glass (2) as show figure.



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 "a": 15 mm (0.59 in.)
"b": 16 mm (0.63 in.)
"c": 22 mm (0.87 in.)

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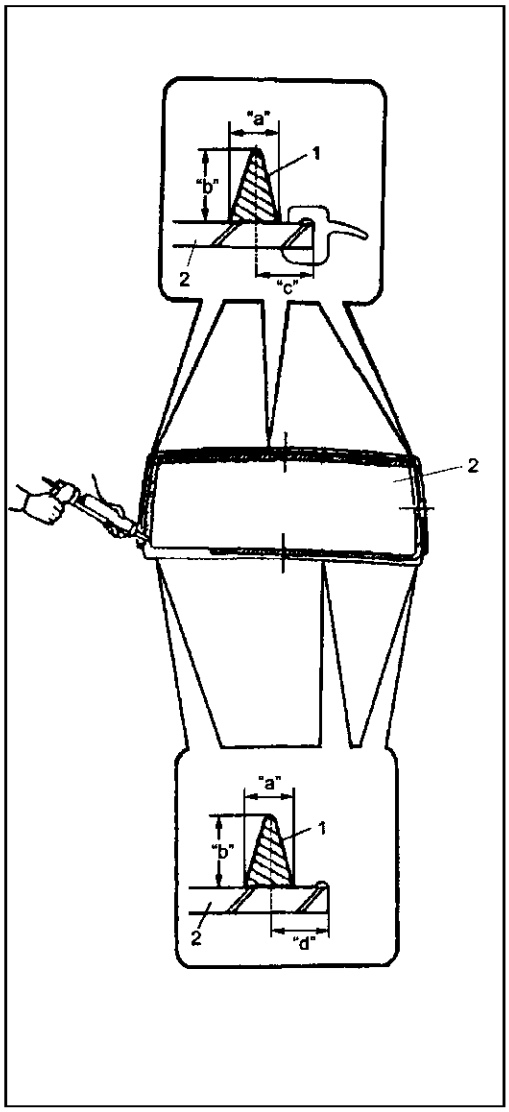
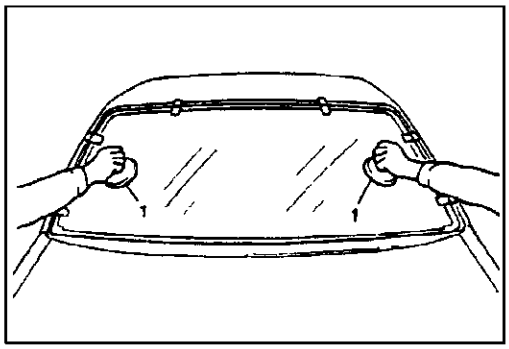


9) Apply adhesive (1) referring to figure at the left.

NOTE:

- **Start from bottom side of glass (2).**
- **Be careful not to damage primer.**
- **Height of adhesive (1) applied to lower side should be higher than that of other three sides.**
  Upper, right and left sides
  Width "a" : Approx. 7 mm (0.28 in.)
  Height "b" : Approx. 15 mm (0.59 in.)
  Distance "c" : Approx. 10.5 mm (0.41 in.)
  "d" : Approx. 17 mm (0.67 in.)
- **Press glass (2) against body quickly after adhesive (1) is applied.**
- **Use of rubber sucker grip is helpful to hold and carry glass (2) after adhesive is applied.**
- **Perform steps 9) to 10) within 10 min. to ensure sufficient adhesion.**
- **Be sure to refer to adhesive (1) maker's instruction for proper handling and drying time.**



10) Holding rubber sucker grips (1), place glass onto body by aligning mating marks marked in step 3) and press it.

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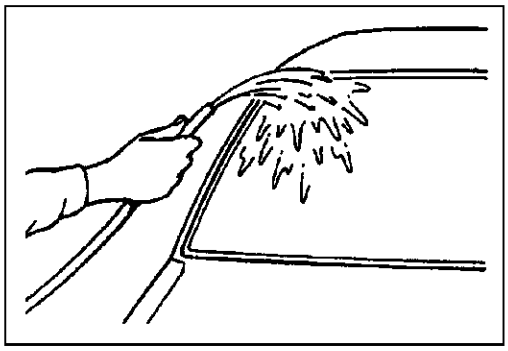

11) Check for water leakage by pouring water over windshield through hose. If leakage is found, dry windshield and fill leaky point with adhesive. If water still leaks even after that, remove glass and start installation procedure all over again.

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.**

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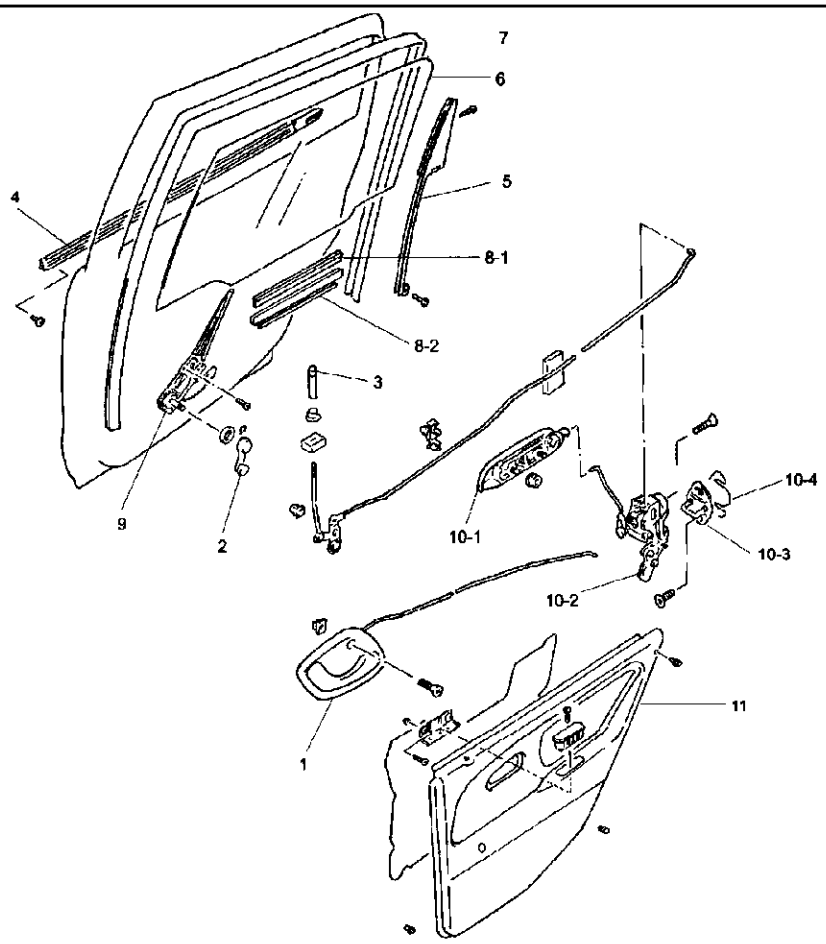
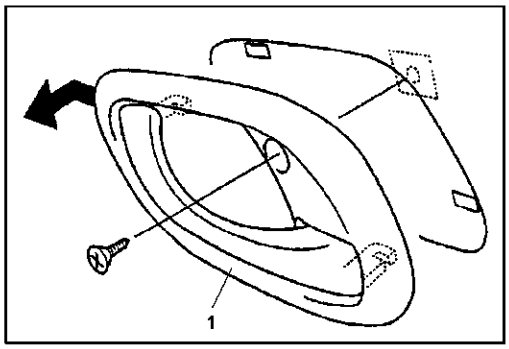
REAR DOOR GLASS

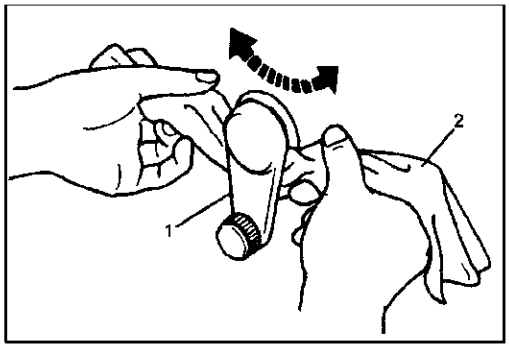


1. Rear door inside handle	6. Rear window glass	10-1. Rear door outside handle assembly
2. Window regulator handle	7. Rear door glass run	10-2. Rear door latch assembly
3. Door inside lock knob	8-1. Glass bottom rubber	10-3. Rear door latch striker
4. Rear door weathership	8-2. Glass bottom channel	10-4. Spacer
5. Rear door sash	9. Rear window regulator assembly	11. Rear door trim



REMOVAL

1) Remove door inside pull handle case fitting screw.
2) Detach inside handle bezel (1).



3) Remove window regulator handle (1).
   For its removal, pull off snap by using a cloth (2) as shown in left figure.

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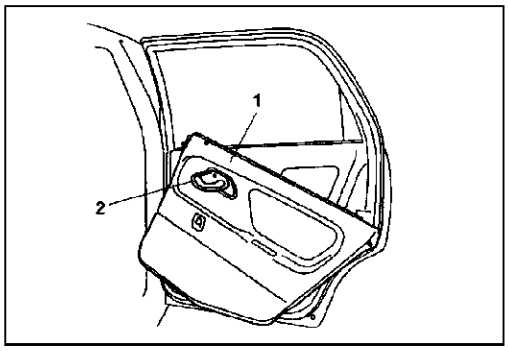
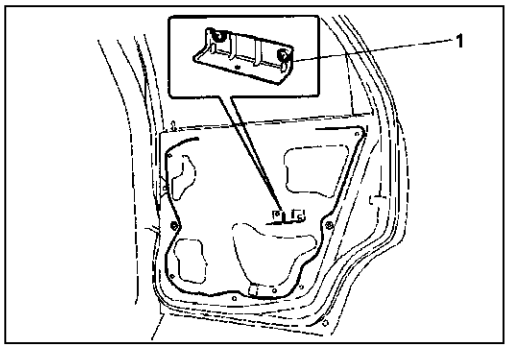
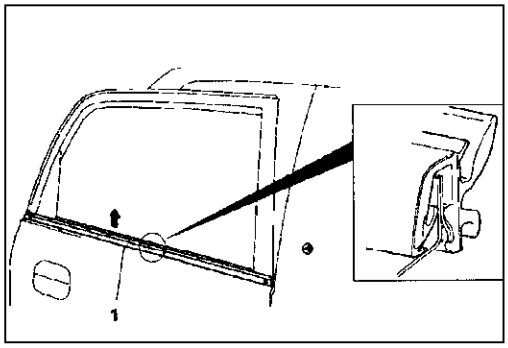


4) Remove door trim (1) with inside weatherstrip.
With inside handle bezel (2) tilted as shown in figure, turn door trim (1) 90° clockwise to remove it.

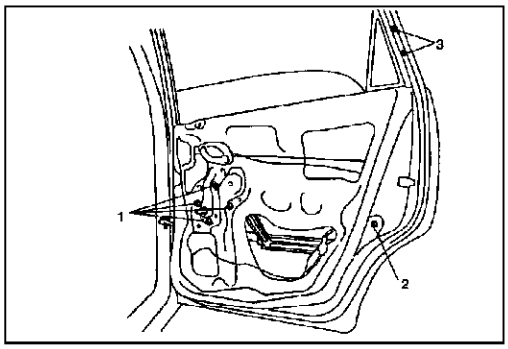


5) Remove door inside pull handle bracket (1).
6) Remove door sealing cover.

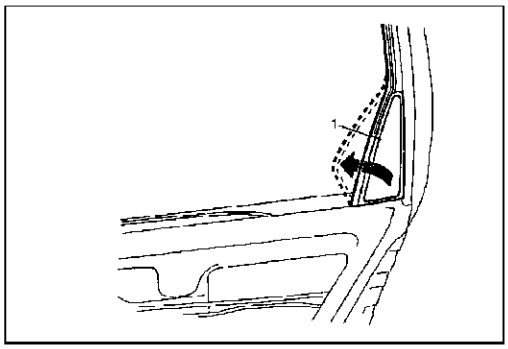


7) Remove outer weatherstrip (1).

CAUTION:
Using a tape-wrapped putty knife (or tape-wrapped screwdriver), pry off weatherstrip. Use of an uwrapped tool will cause damage to painting.



8) Remove door window regulator screws (1).
9) Remove door window regulator from rear window glass.
10) Remove sash mounting bolt (2) and screws (3).



11) Turn sash (1) 90° counter-clockwise to remove it.
12) Remove rear window glass.

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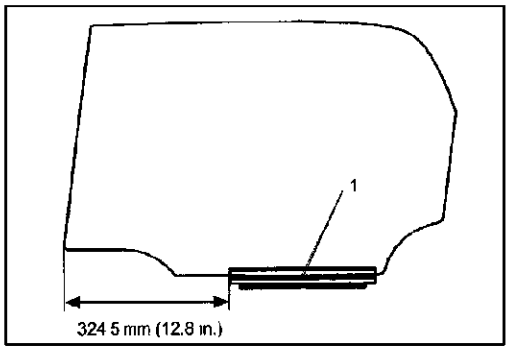
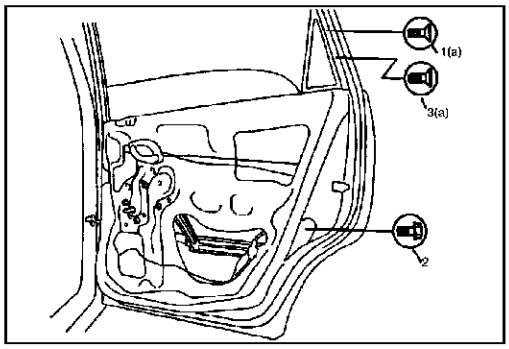


INSTALLATION

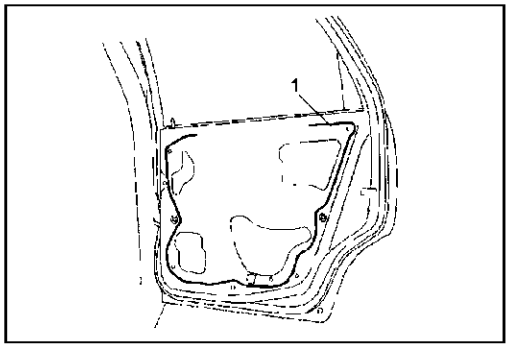
Reverse removal procedure to install door glass noting the following points:

- Glass fitted position of bottom channel (1) is as shown in figure

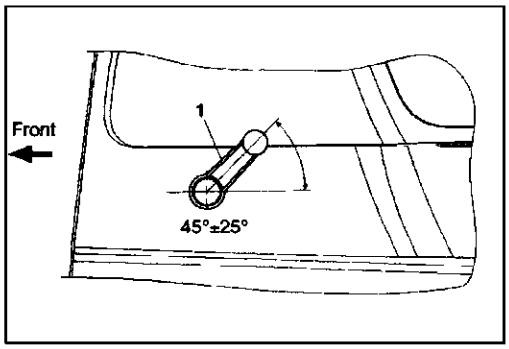


- Tighten rear door sash upper mounting screws (1,3), and rear door sash mounting bolt (2) to specified torque.
  Tighten order : (1) ---▸ (2) ---▸ (3)

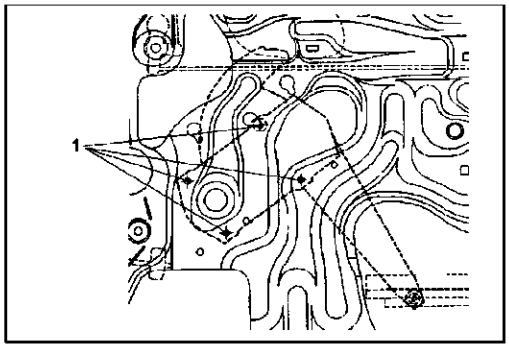
Tightening torque
Rear door sash upper mounting screw
(a): 2.5N-m (0.25 kg-m, 1.8 lb-ft)



- Secure door sealing cover with adhesive (1).



- Install door window regulator handle (1) so that it has a 45^0 angle when glass is fully closed, as shown in left figure.



REAR DOOR WINDOW REGULATOR

REMOVAL

1) Remove window glass, referring to "REAR DOOR GLASS REMOVAL" in this section.
2) Take out door window regulator

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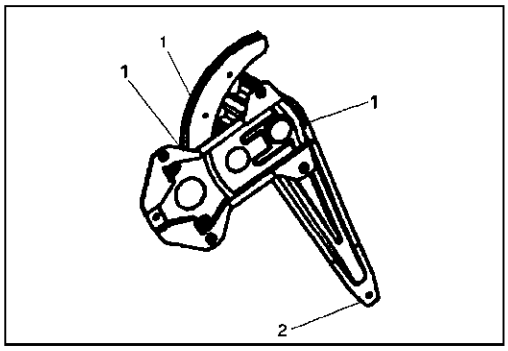
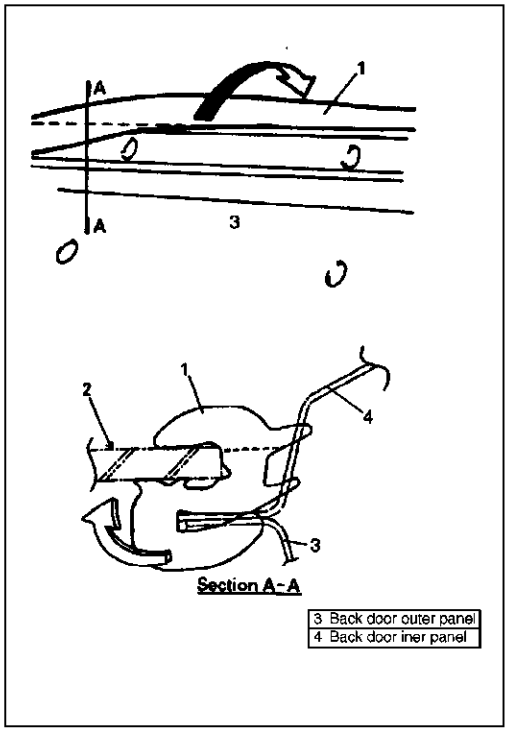


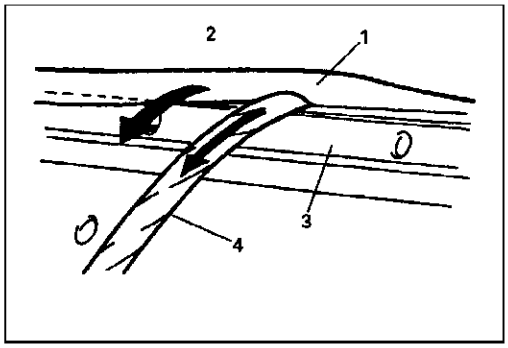
INSPECTION
1) Check regulator sliding and rotating parts for greasing (1).
2) Check rollers (2) for wear and damage.

INSTALLATION
Reverse removal procedure.



BACK DOOR GLASS
REMOVAL
1) Remove rear wiper arm.
2) Disconnect rear defogger coupler.
3) Remove high mounted stop lamp (if equipped)
4) As back door glass (2) is fixed by means of back door window weatherstrip (1), remove glass (2) and weatherstrip (1) together by removing end of weatherstrip (1) little by little while pushing the entire glass (2) from inside toward outside as shown in figure.

NOTE:
Do not apply an excessive force to glass locally.



INSTALLATION
1) Install weatherstrip (1) to glass (2).
2) Pass string through outer groove of weatherstrip (1) (groove where back door panel (3) fits in) so that weatherstrip (1) can be installed to back door.
3) Apply soap water to outer edge of back door panel (3) and install glass (2) and weatherstrip (1) together to back door by pulling the string (4) little by little.
4) Install high mounted stop lamp (if equipped).
5) Connect rear defogger coupler.
6) Install rear wiper arm.

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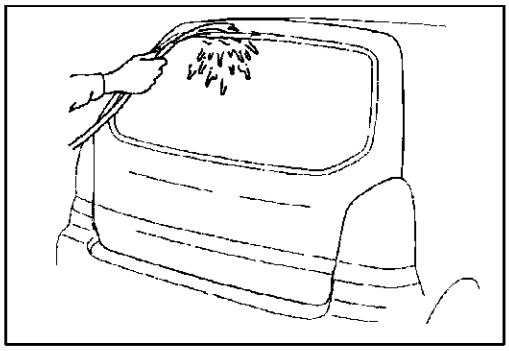
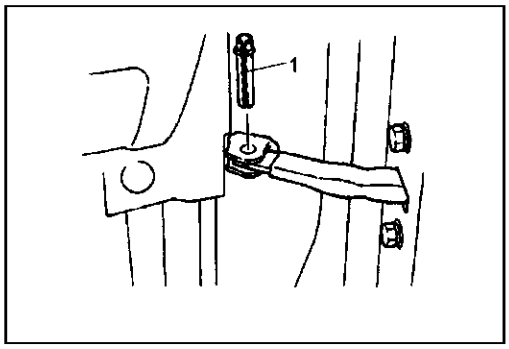


7) Check for water leakage by running water from hose over window. If leakage is found, complete the installation of leaky point. If water still leaks even after that, remove glass and start installation procedure all over again.

NOTE:
Do not use high pressure water.

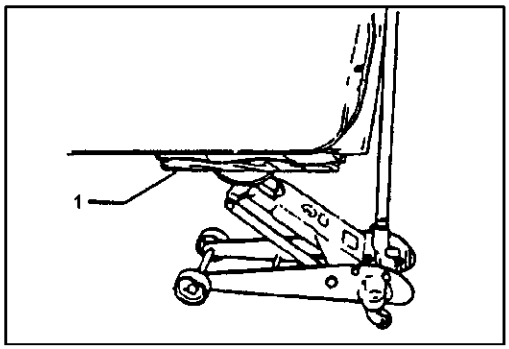


BODY STRUCTURE

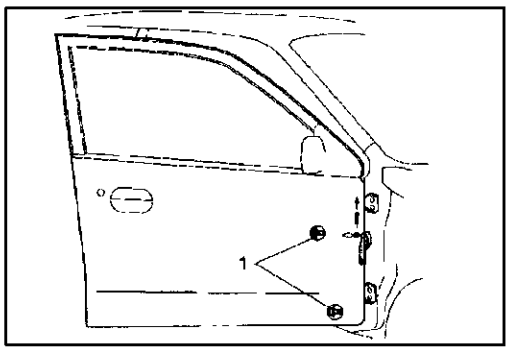
FRONT DOOR ASSEMBLY

REMOVAL

1) Remove front fender.
2) Disconnect door harness lead wires at each coupler.
3) Remove stopper pin (1).



4) Support door panel using a jack with a piece of wood (1) placed between jack and panel, as shown.



5) Remove door assy by loosening hinge mounting bolts (1).

INSTALLATION

Reverse removal procedure to install door assembly, noting the following point.

NOTE:
When replacing door, coat replacement door inside with wax for proper anticorrosion treatment.
Refer to "UNDERCOATING/ANTI-CORROSION COMPOUND APPLICATION AREA" in this section.

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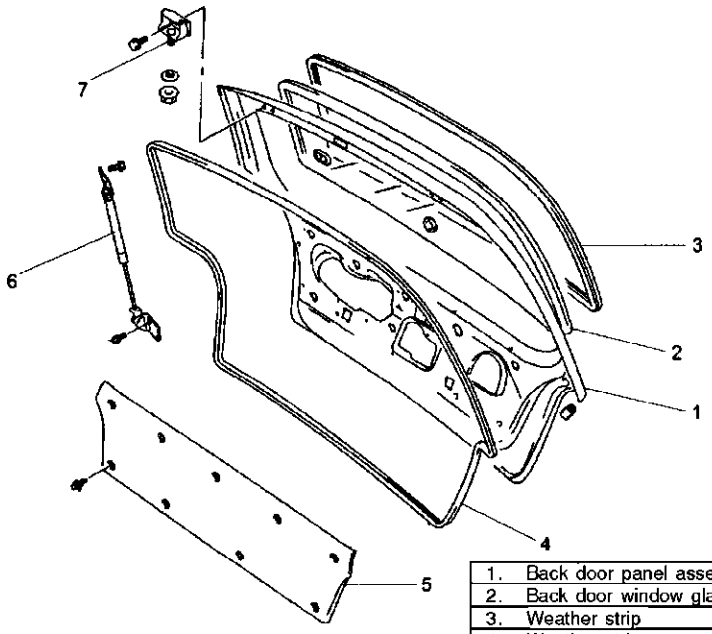
- Adjust door latch striker position by referring to "FRONT DOOR LOCK INSTALLATION" Section so that door is positioned correctly.
- Adjust front door cushion so that door becomes flush with side body.
- After installation, open and close the door to check looseness. Replace door open stopper pin when there is looseness.
- When weatherstrip is hardened, water leak may develop. In such case, replace it with new one.

REAR DOOR ASSEMBLY

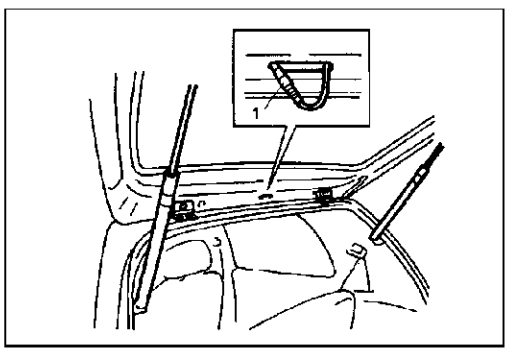
REMOVAL/INSTALLATION

Follow procedures for Front Door removal/installation in this section.

BACK DOOR ASSEMBLY



1.	Back door panel assembly	5.	Back door trim
2.	Back door window glass	6.	Back door balancer
3.	Weather strip	7.	Back door hinge
4.	Weather strip		



REMOVAL

1) Disconnect washer hose joint (1).

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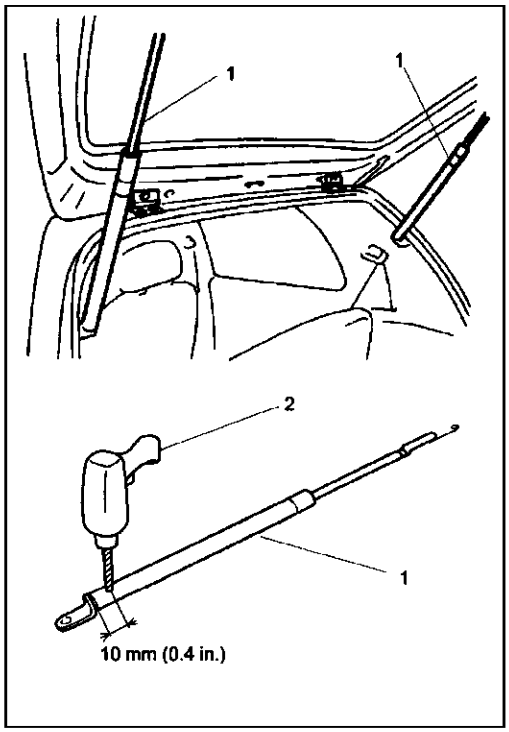

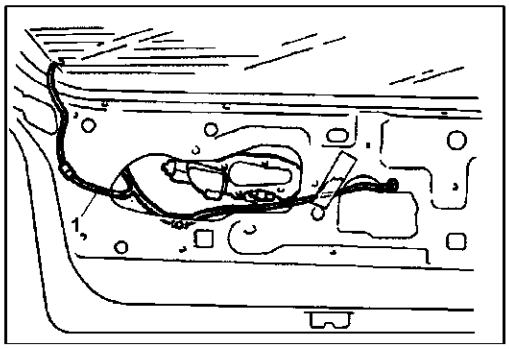

3) Remove back door trim.
4) Remove wire harness connectors inside the back door.
5) Remove back door balancers (1) (first at its door-side and next at its body side, as shown).

WARNING:
Handling of Back Door Balancer (Damper)
- **Handle balancer carefully. Do not scar ot 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
a) The gas itself in balancer is harmless but it may issue out of the hole together with chips generated by the drill (2).
b) Using a 2 to 3 mm (0.08 to 0.12 in.) drill (2) make a hole to remove gas inside as shown.

6) Remove door hinge bolts and door.

INSTALLATION
Reverse removal procedure to install back door noting the following points.
- Secure wiring harness (1).
- Adjust door latch striker position by referring "BACK DOOR LOCK ASSEMBLY INSTALLATION" so that door is positioned correctly.
- Adjust door cushion so that door contacts body when closed.

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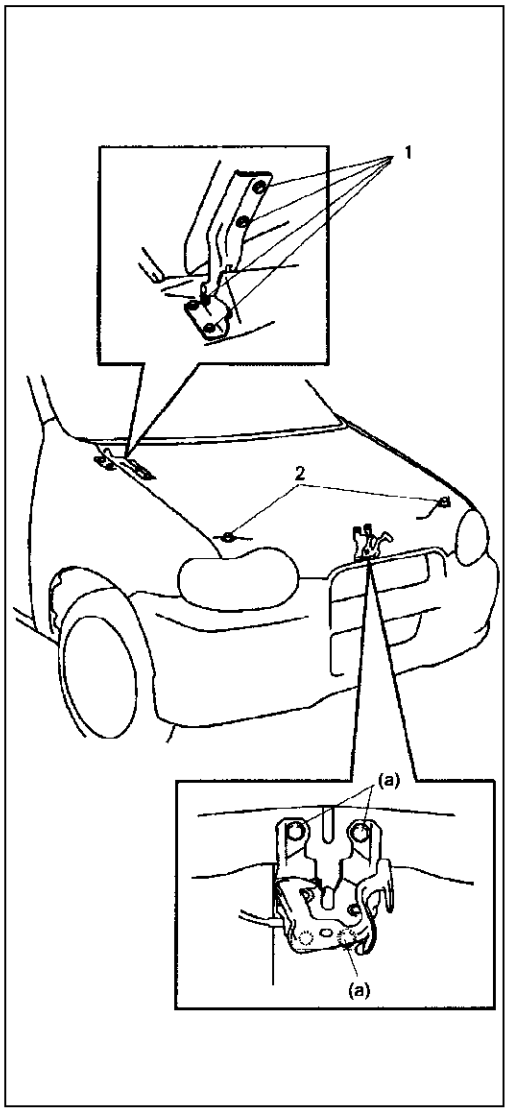

HOOD

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.

ADJUSTMENT

- Fore-and-aft and right-and-left adjustment.
  Loosen four mounting bolts (1) for adjustment.
- Hood lock adjustment
  When installing hood lock, hold hood lock at the lowest position and tighten bolts. If necessary, move it in vertical direction for adjustment.

  Tightening Torque
  (a): 10 N-m (1.0 kg-m, 7.5 lb-ft)

- Vertical adjustment
  If only one side (right or left) of hood is not level with front fender, make it level by tightening or loosening hood cushion (2).

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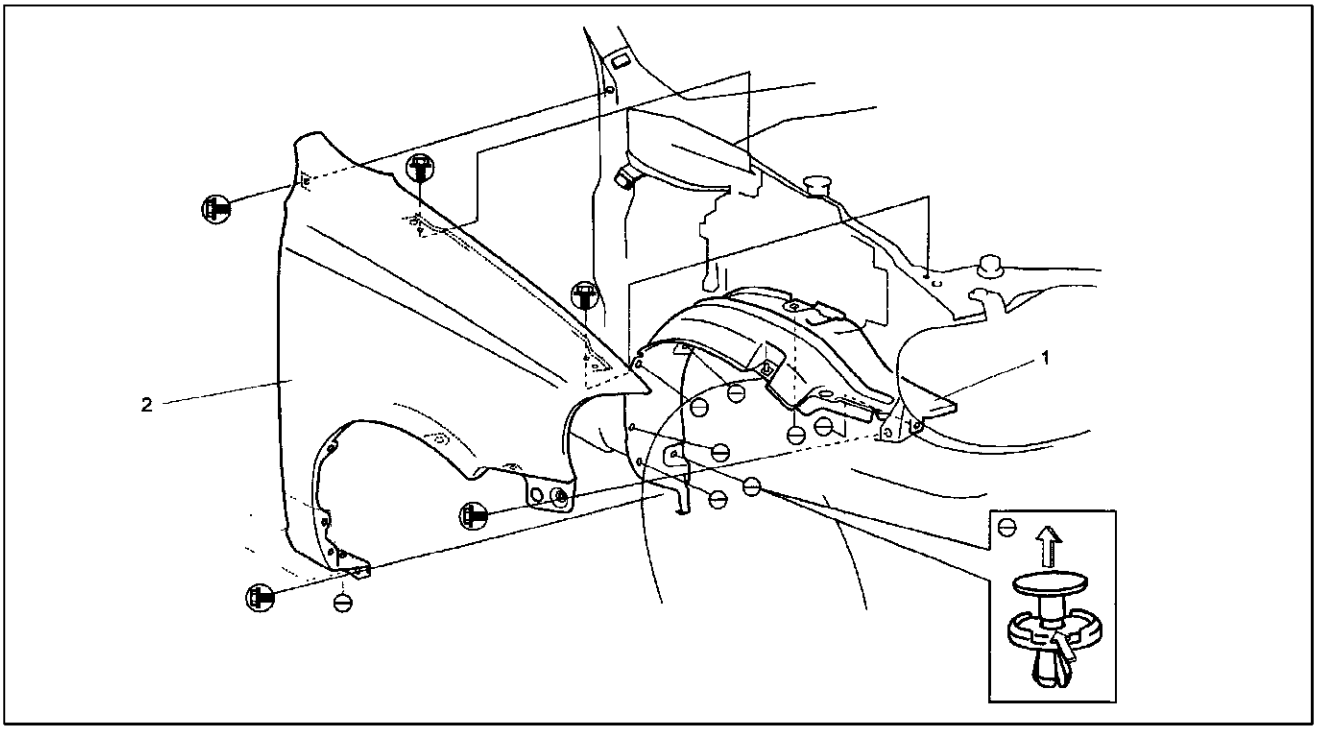
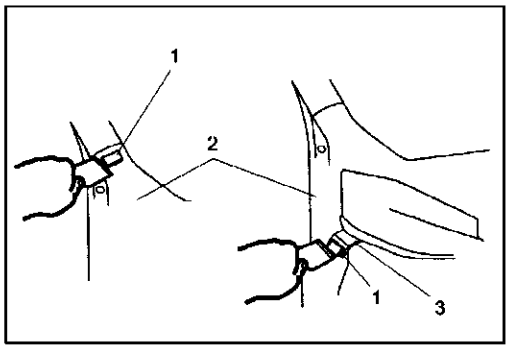
FRONT FENDER



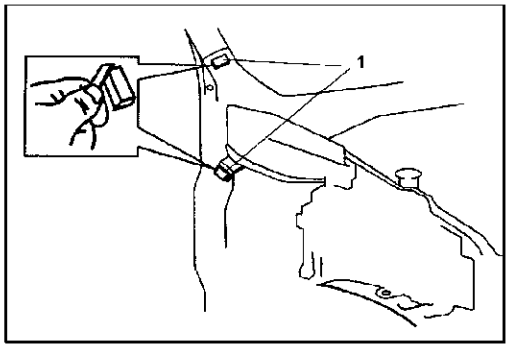
REMOVAL

1) Remove front bumper.
2) Remove mud flap (if equipped).
3) Remove front fender lining (1).
4) Disconnect coupler of side turn signal lamp.
5) Remove front fender (2).



INSTALLATION

1) Remove pad (1) from side body (2) and fender bracket (3), using care not to damage painted surface.



2) Attach new pad (1) cutting appropriately size temporarily and adjust height with a knife so that fender becomes flush with side body.
3) Reverse removal procedure for installation.

NOTE:
If paint on fender bolt is peeled off, be sure to apply paint again.

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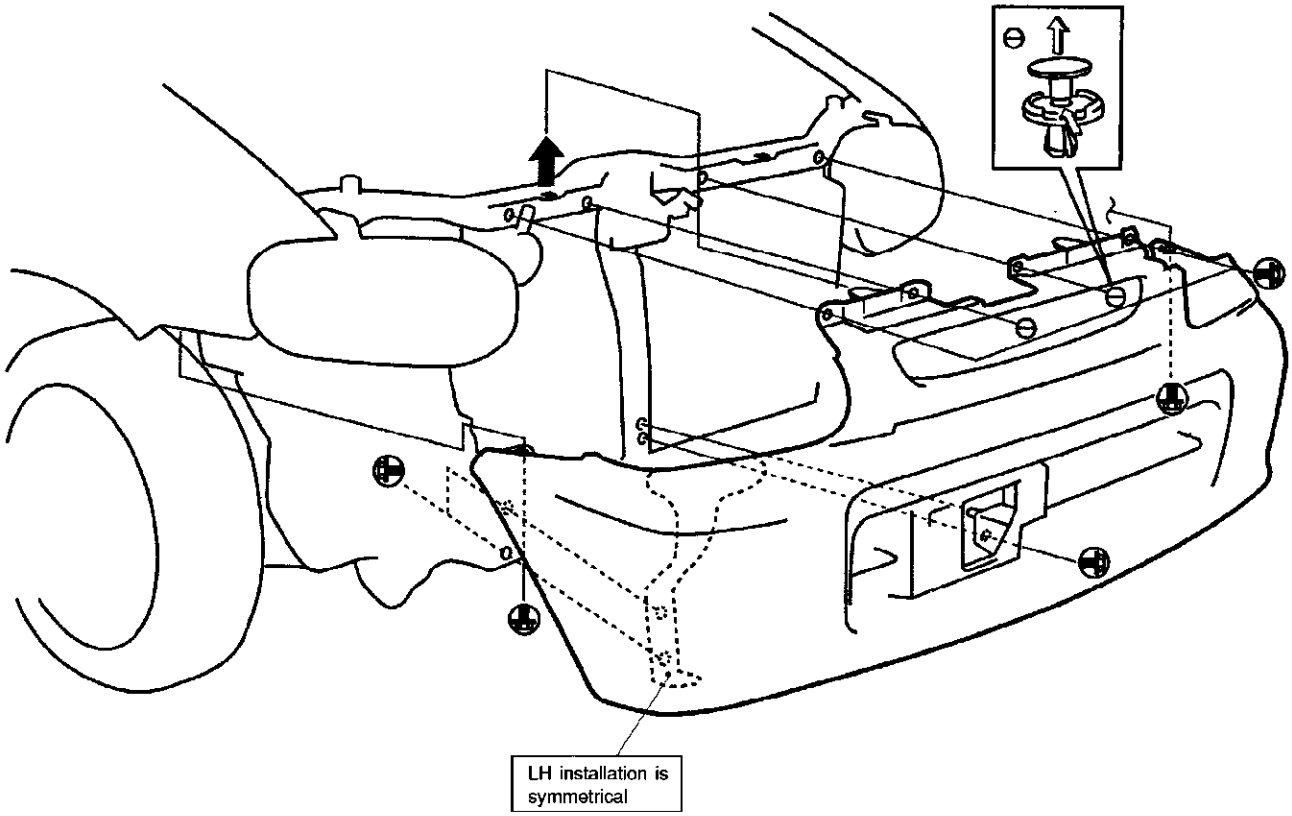
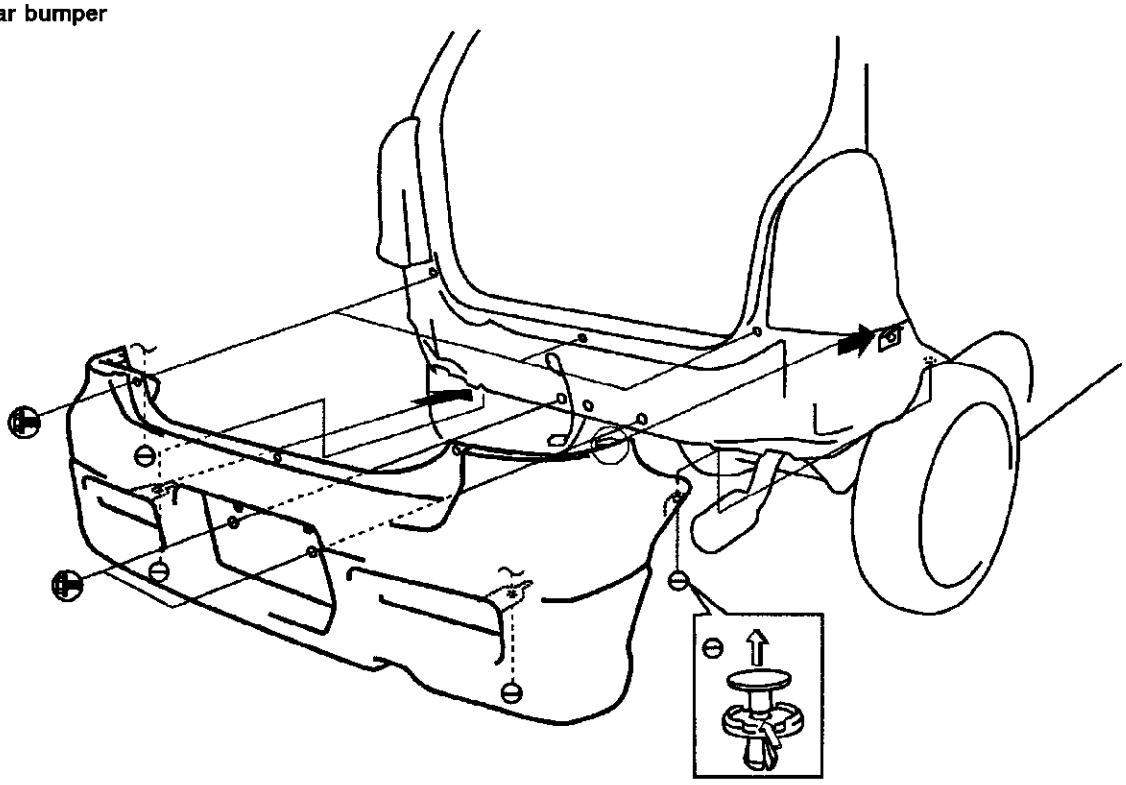
BUMPERS

Front bumper



Rear bumper



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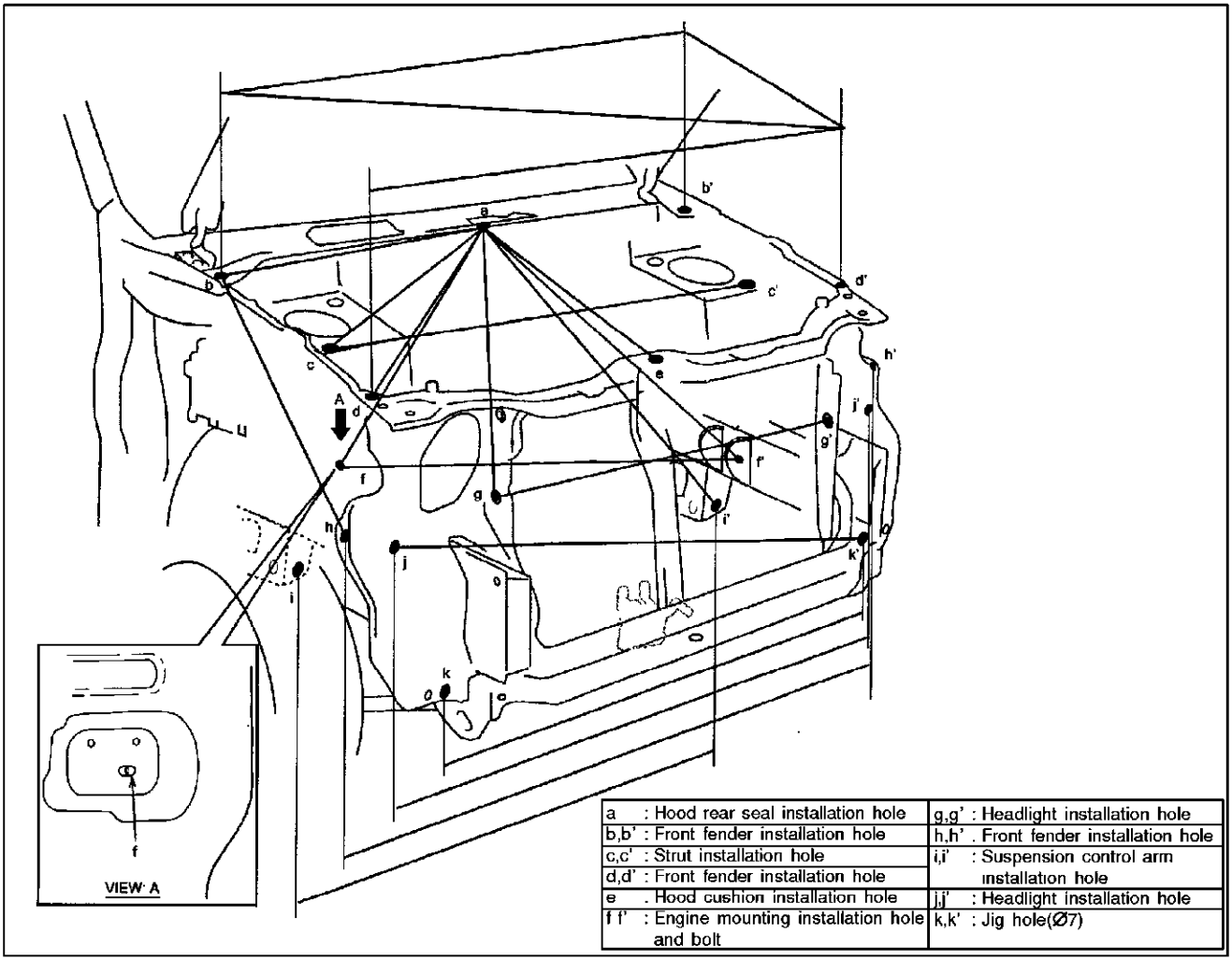
BODY DIMESIONS



a : Hood rear seal installation hole	g,g' : Headlight installation hole
b,b' : Front fender installation hole	h,h' . Front fender installation hole
c,c' : Strut installation hole	i,i' : Suspension control arm installation hole
d,d' : Front fender installation hole	
e . Hood cushion installation hole	j,j' : Headlight installation hole
f f' : Engine mounting installation hole and bolt	k,k' : Jig hole(Ø7)

MEASUREMENT POSITION	LENGTH mm (in.)		MEASUREMENT POSITION	LENGTH mm (in.)	
a – b	604	(23.78)	d – d'	1187	(46.73)
a – c	539	(21.22)	f – f'	937	(36.89)
a – d	738	(29.06)	g – g'	815	(32.09)
a – e	514	(20.24)	h – h'	1361	(53.58)
a – f	703	(27.68)	i – i'	661	(26.02)
a – f'	672	(26.47)	j – j'	1200	(47.24)
a – g	708	(27.87)	j – k'	1177	(46.34)
a – i'	784	(30.87)	k – k'	1090	(42.91)
b – b'	1202	(47.32)	c – c'	986	(38.82)
b – d'	1288	(50.71)			
b – h	577	(22.72)			
b' – d'	481	(18.94)			

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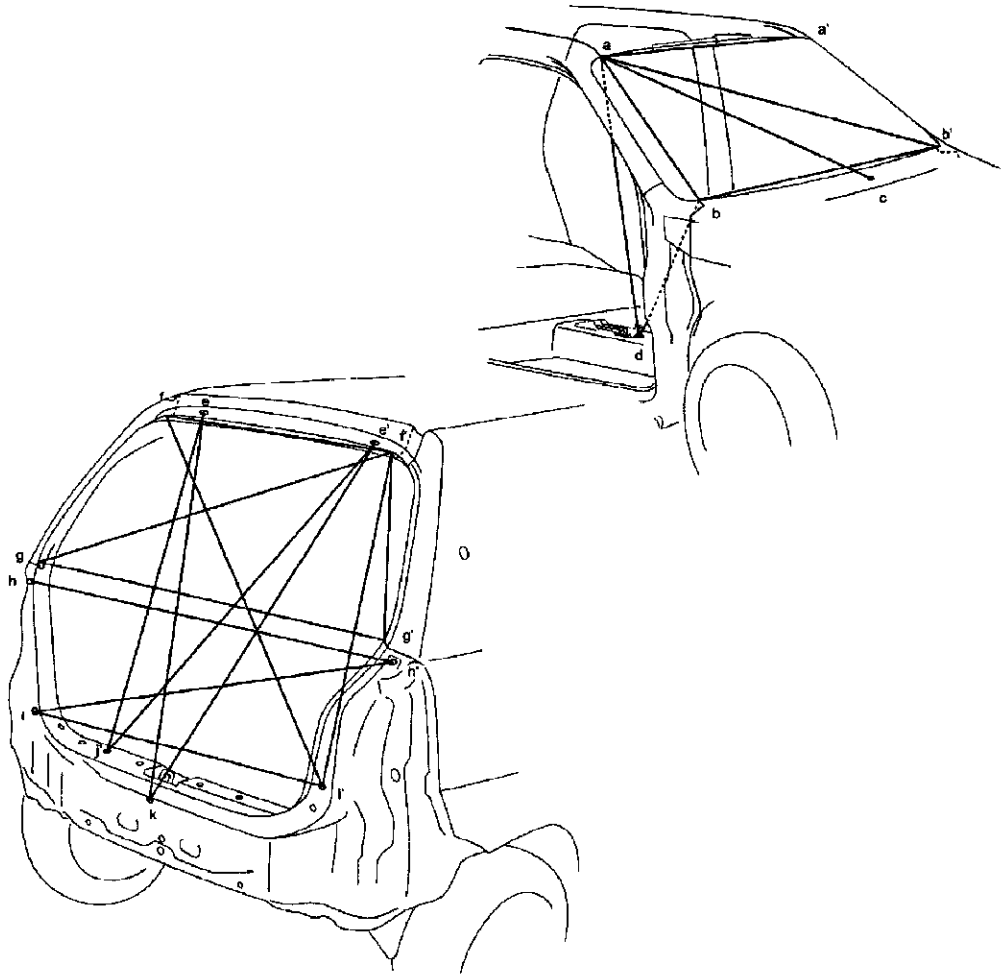

a,a' : Front end of front windshield upper installation section	d : Parking brake rear installation hole	h,h' : Combination lamp lower installation hole
	e,e' : Back door hinge installation hole	i,i' : Combination lamp lower installation hole
b,b' : Front end of front windshield lower installation section	f,f' : The end of side body outer panel	j : Tail end member trim installation hole
c : Hood rear seal installation hole	g,g' : The end of side body outer panel	k : Rear bumper installation hole

MEASUREMENT POSITION	LENGTH mm (in.)		MEASUREMENT POSITION	LENGTH mm (in.)	
a – a'	861	(33.90)	e'– k	929	(36.57)
a – b	664	(26.14)	f – f'	784	(30.87)
a – b'	1200	(47.24)	f – i'	1129	(44.45)
a – c	952	(37.48)	f' – g	1037	(40.83)
a – d	1199	(47.20)	f – g'	449	(17.68)
b – b'	1160	(45.67)	f' – i'	729	(28.70)
b – d	1349	(53.11)	g – g'	1111	(43.74)
e – j	852	(33.54)	h – h'	1166	(45.91)
e – k	961	(37.83)	i –h'	1095	(43.11)
e'– j	989	(38.94)	i – i'	947	(37.28)

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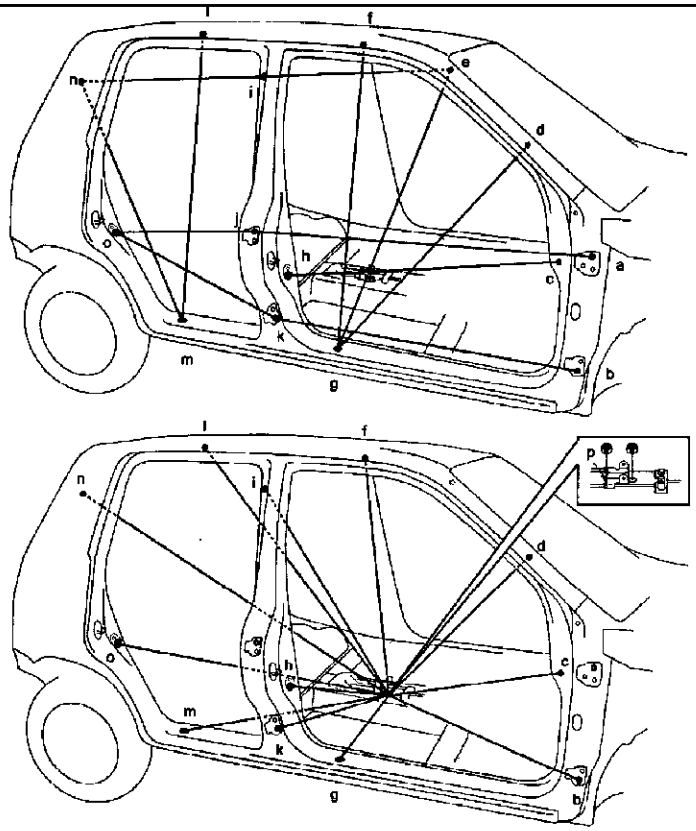

a : Front door upper hinge installation hole	g : Side sil scuff installation hole	m : Side sil scuff installation hole
b : Front door lower hinge installation hole	h : Door switch installation hole	n : Rear seat belt installation hole
c : Steering support member installation hole	i : Jig hole (Ø7)	o : Door switch installation hole
d : Jig hole (Ø8.5)	j : Rear door upper hinge installation hole	p : Parking brake rear installation hole
e : Jig hole (Ø8.5)	k : Rear door lower hinge installation hole	
f : Assistant grip installation hole	l : Assistant grip installation hole	

MEASUREMENT POSITION	LENGTH mm (in.)		MEASUREMENT POSITION	LENGTH mm (in.)	
a – j	963	(37.91)	b – p	1209	(47.60)
b – k	919	(36.18)	c – p	1192	(46.93)
c – h	831	(32.72)	d – p	1239	(48.78)
d – g	864	(34.02)	f – p	1158	(45.59)
e – g	944	(37.17)	g – p	745	(29.33)
e – i	630	(24.80)	h – p	690	(27.17)
f – g	1013	(39.88)	i –p	1051	(41.38)
i –n	897	(35.31)	k – p	680	(26.77)
j –o	825	(32.48)	l –p	1197	(47.13)
k – o	894	(35.20)	m– p	737	(29.02)
l –m	1049	(41.30)	n – p	1411	(55.55)
n – m	1048	(41.26)	o – p	1059	(41.69)

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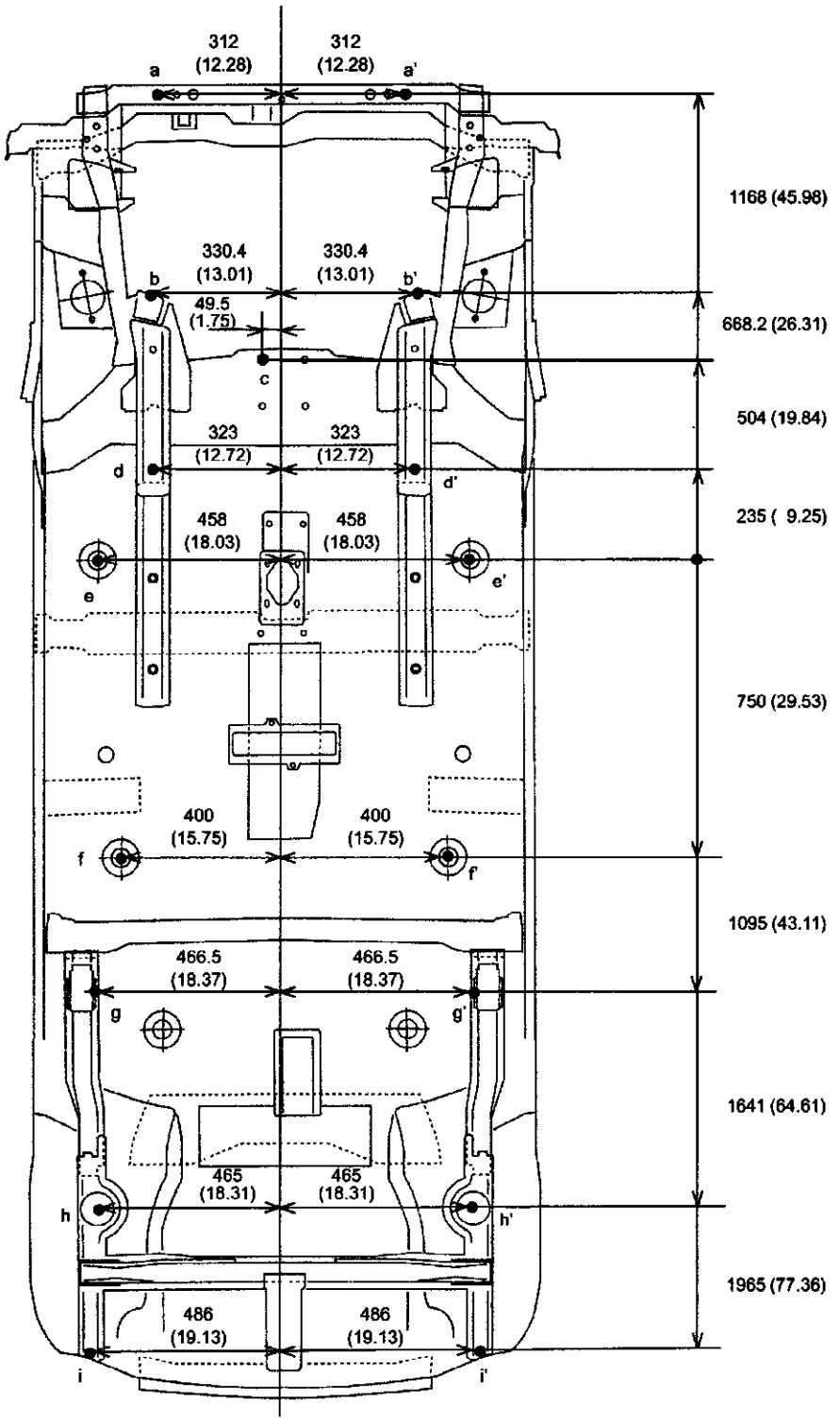
UNDER BODY DIMENSIONS

Unit : mm(in)



a,a' : Front stabilizer bracket installation hole	d,d' : Jig hole (Ø15-20)	g,g' : Suspension control arm installation hole
b,b' : Suspension control arm installation hole	e,e' : Jig hole (Ø50)	h,h' : Bump stopper installation hole
c : Engine mounting installation hole	f,f' : Jig hole (Ø50)	i,i' : Jig hole (Ø16)

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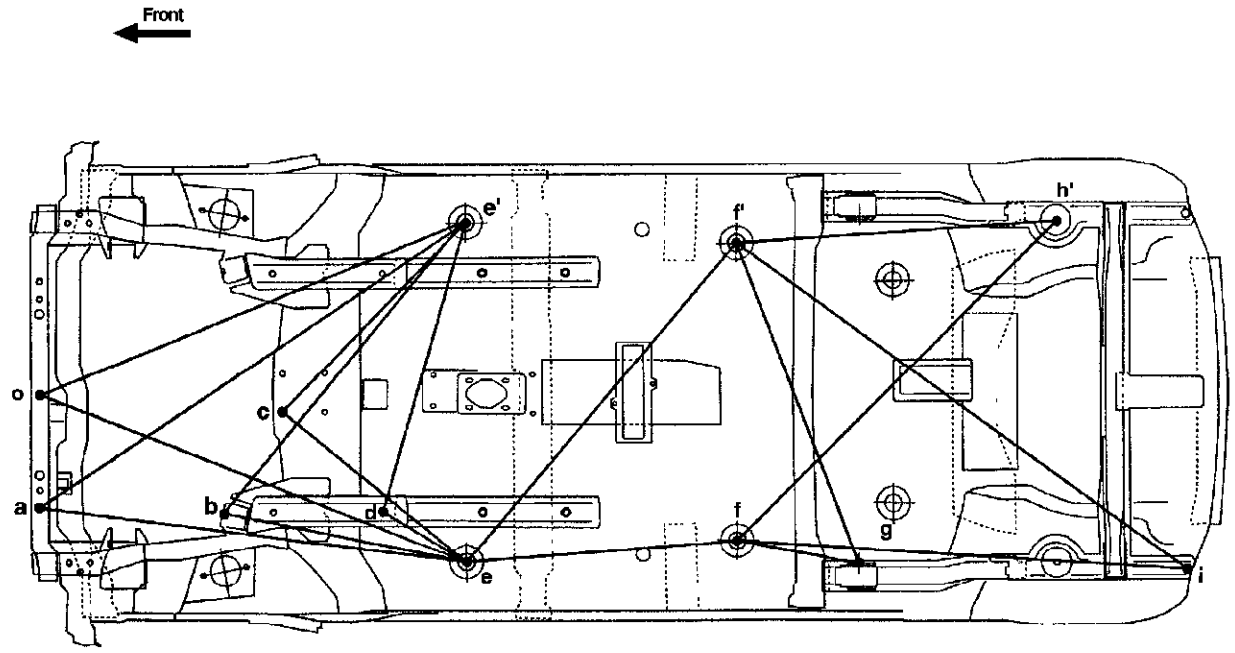

o	: Jack bracket installation hole	e,e'	: Jig hole (Ø50)
a	: Front stabilizer bracket installation hole	f,f'	: Jig hole (Ø50)
b	: Suspension control arm installation hole	g	: Trailing arm installation hole
c	: Engine mounting installation hole	h'	: Bump stopper installation hole
d	: Jig hole (Ø15-20)	i	: Jig hole (Ø16)

MEASUREMENT POSITION	LENGTH mm (in.)		MEASUREMENT POSITION	LENGTH mm (in.)	
o – e	1252	(42.29)	d – e'	816	(32.13)
o – e'	1250	(49.21)	e – f	753	(29.65)
a – e	1169	(46.02)	e – f'	1140	(44.88)
a – e'	1392	(54.80)	f – g	352	(13.86)
b – e	681	(26.81)	f – i	1256	(49.45)
b – e'	1034	(40.71)	f – h'	1262	(49.69)
c – e	654	(25.75)	f' – g	933	(36.73)
c – e'	720	(28.35)	f' – i	1535	(60.43)
d – e	271	(10.67)	f' – h'	921	(36.26)

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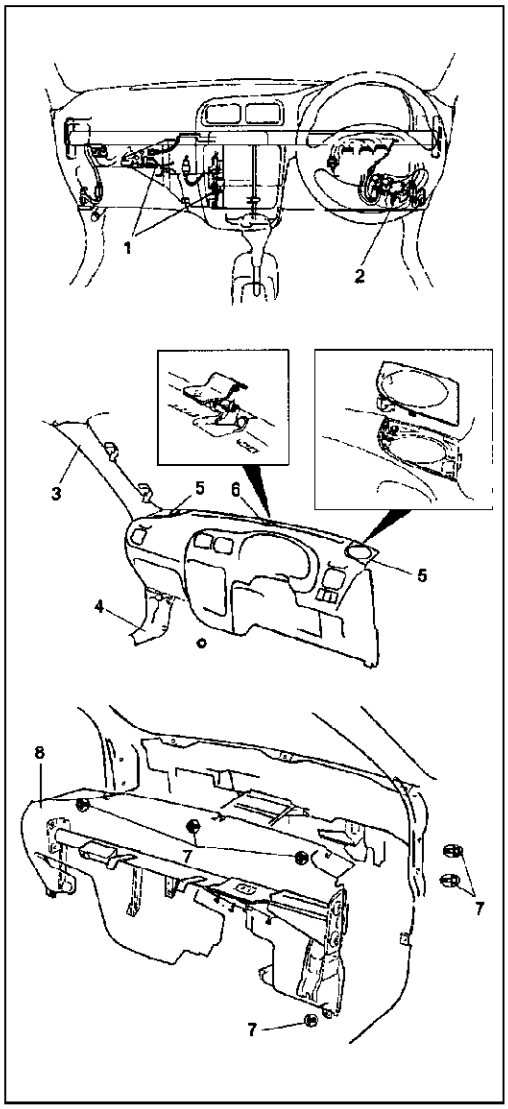

INSTRUMENTATION AND DRIVER INFORMATION

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 "DISABLE AIR BAG SYSTEM" in SECTION 10B.
3) Remove steering column hole cover, glove box and hood latch release lever.
4) Remove steering column assembly. Refer to Section 3C.
5) Disconnect heater control cables (1).
6) Disconnect wire harness couplers (2).
7) Remove speaker covers (5), front pillar trims (3), dash side trims (4) and bolt cover (6).
8) Remove ground wire from dash side.
9) Remove instrument panel mounting bolts (7).
10) Remove instrument panel (8).

INSTALLATION

1) Install instrument panel by reversing procedure, noting the following items.
   - When installing each part, be careful not to catch any cable or wiring harness.
   - When installing column assembly, refer to SECTION 3C.
2) Adjust control cables. Refer to SECTION 1A.
   - Enable air bag system if equipped. Refer to "DISABLE AIR BAG SYSTEM" in SECTION 10B.

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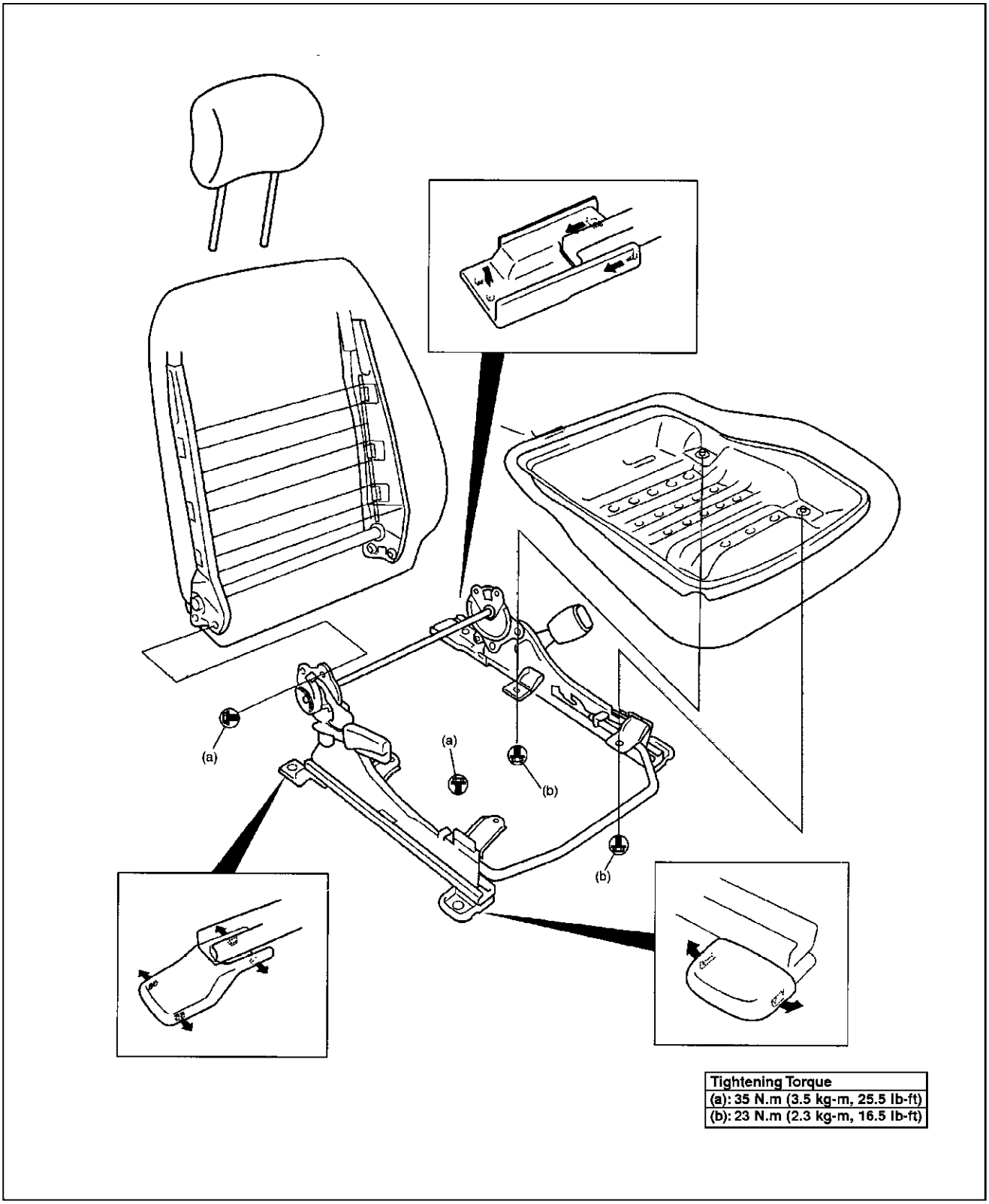
SEAT

FRONT SEAT



Tightening Torque
(a): 35 N.m (3.5 kg-m, 25.5 lb-ft)
(b): 23 N.m (2.3 kg-m, 16.5 lb-ft)

REMOVAL AND INSTALLATION

Refer to above figure when removing and installing or disassembling and assembling front seat.
Make sure to tighten each bolt as specified in above figure.
(Right and left sides are symmetrical.)

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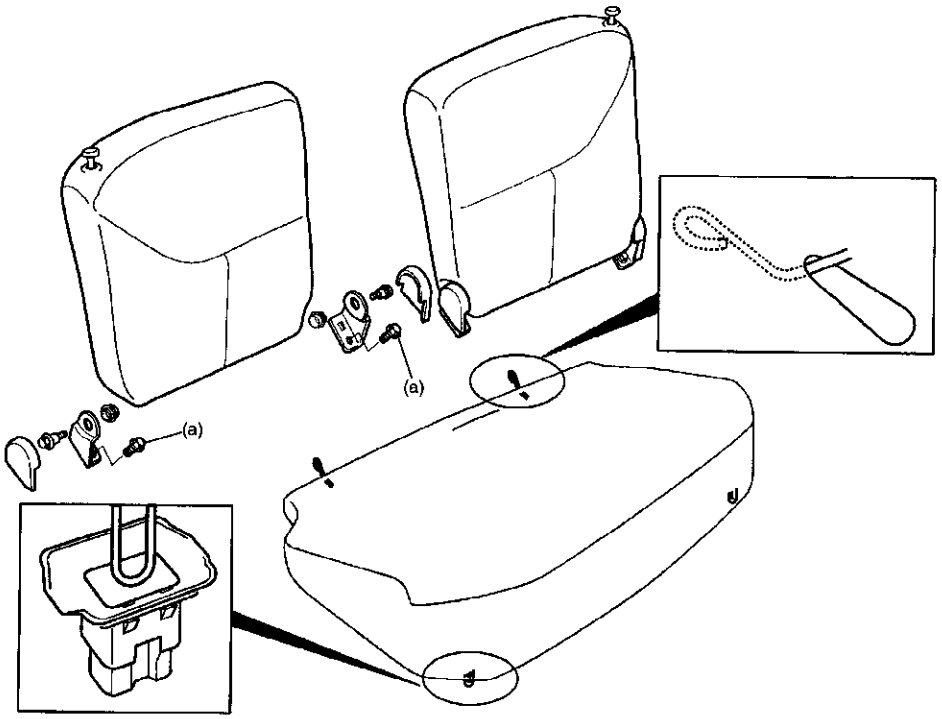
REAR SEAT



Tightening Torque
(a): 35 N.m (3.5 kg-m, 25.5 lb-ft)

REMOVAL AND INSTALLATION

Refer to above figure when removing and installing or disassembling and assembling rear seat.

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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.

1) Steel sheets are treated with cathodic electroprimer which is excellent in corrosion resistance.
2) Rust proof wax coatings are applied to door and side sill insides where moisture is liable to stay.
3) Vinyl coating is applied to body underside and wheel housing inside.
4) 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).

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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 boxtype 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

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.

1) Use wax or grease-removing solvent to clean the part.
2) 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.
3) 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.
4) 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.
5) Use a wet or dry sand-paper (No. 400) and water to polish the panel lightly.
6) Wash the part again.
7) Apply color, coating to the part.
8) Different paints demand different drying methods. Hence, follow directions advised on the pertinent paint container.
9) 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.
10) If the case of lacquer coating, wax should not be applied to coated surface until the surface has dried completely (for approx. two months).

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:

1) 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.
2) If necessary, wash parts with detergent, rinse, and dry them.
3) 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.

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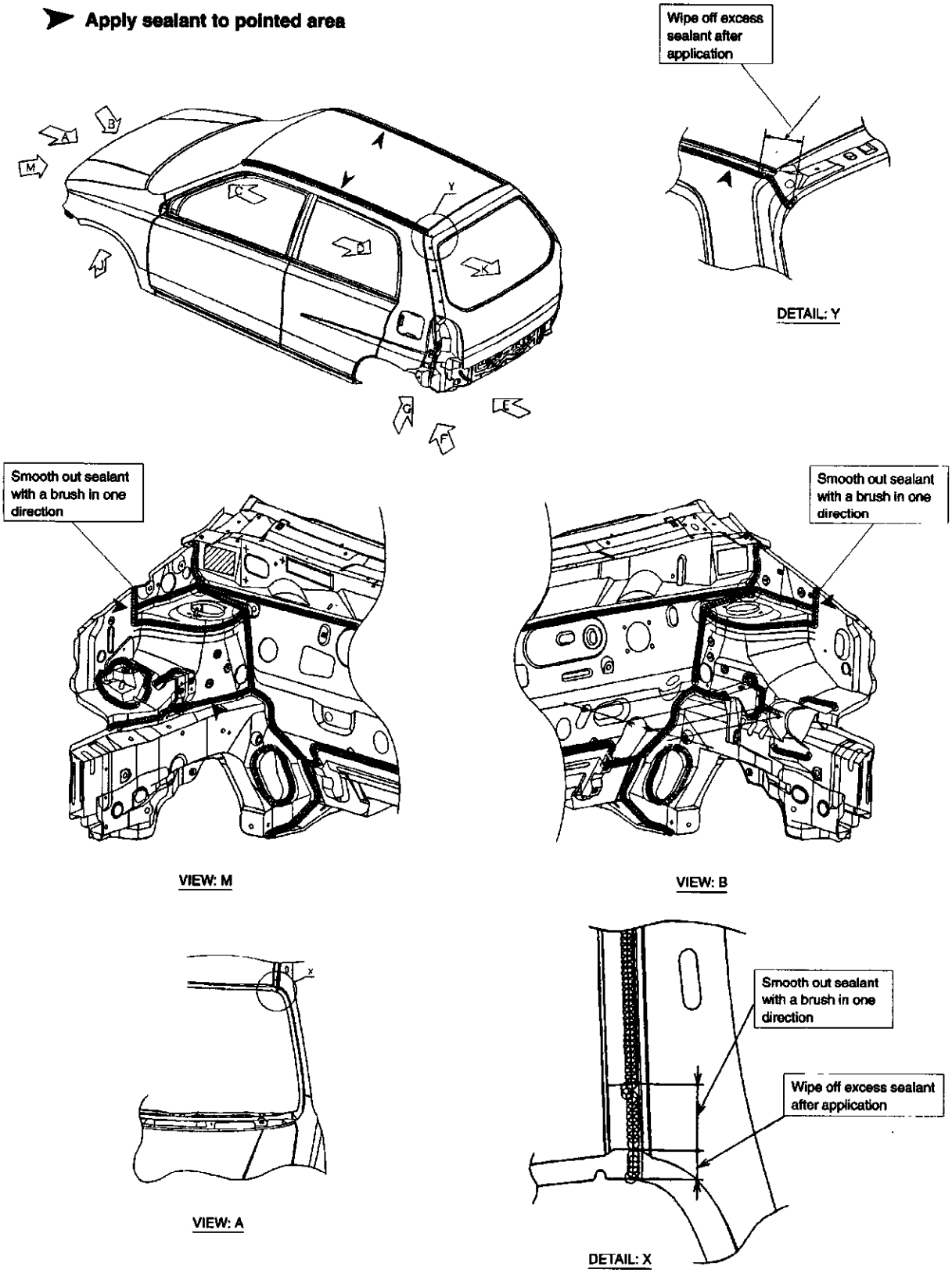
SEALANT APPLICATION AREA



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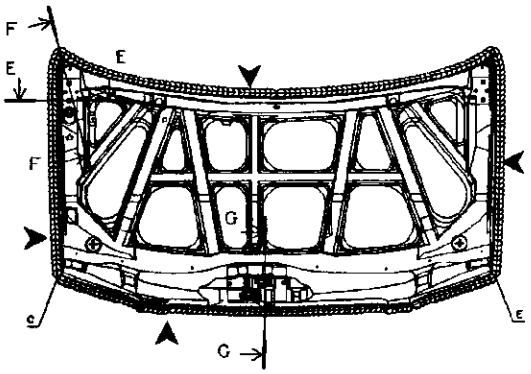
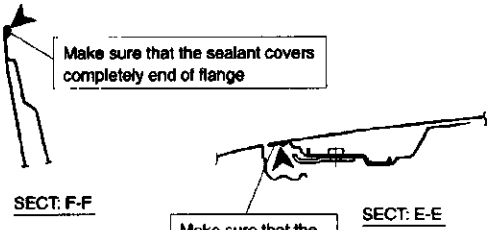
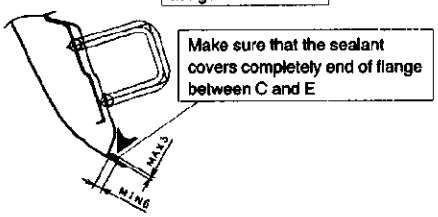
➤ **Apply sealant to pointed area**

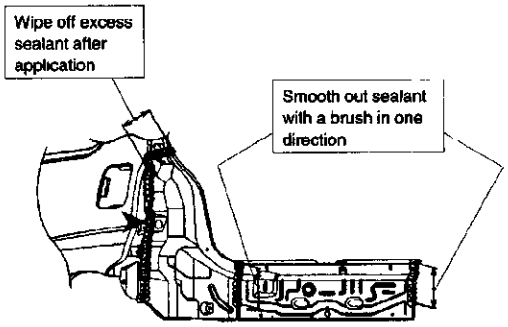


VIEW: J

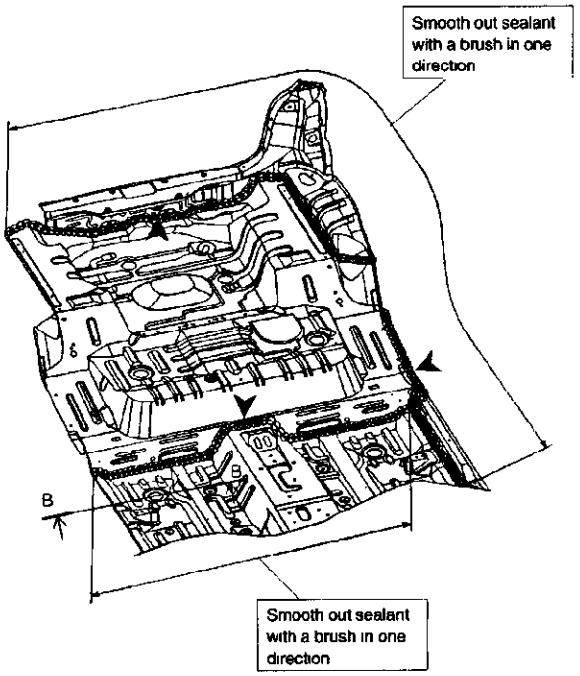




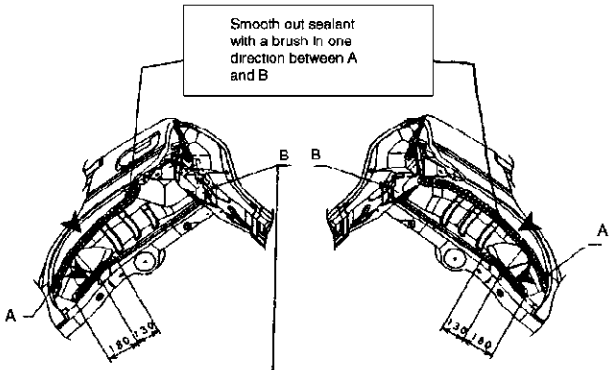
SECT: G-G



VIEW: E

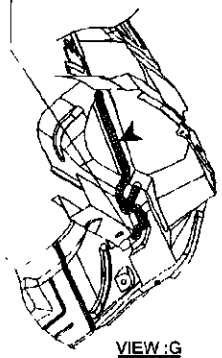


VIEW: D



VIEW : F (LH)

VIEW : F (RH)



VIEW : G

SECT: B-B

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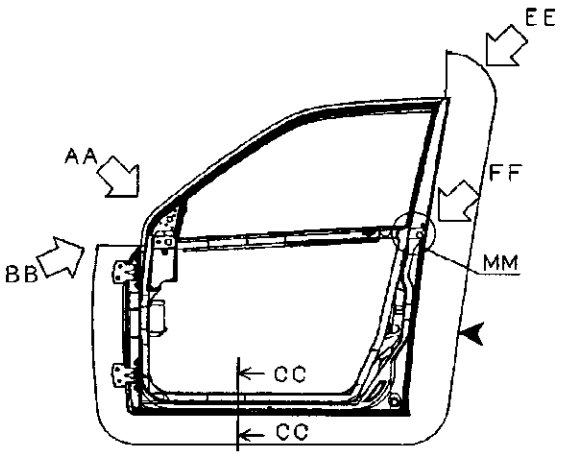
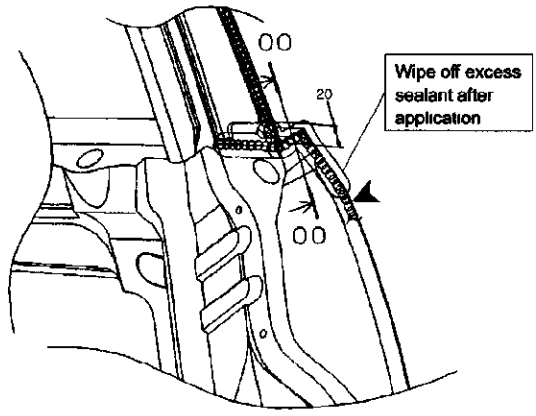
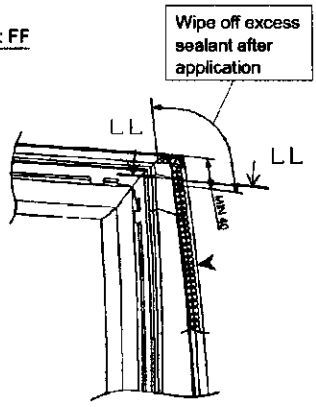
Apply sealant to pointed area

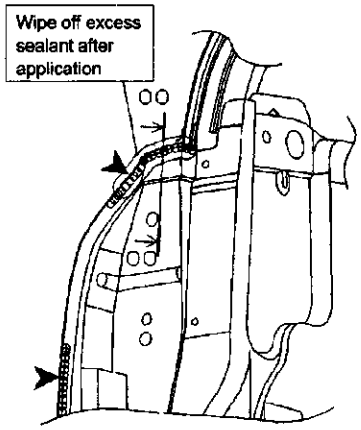




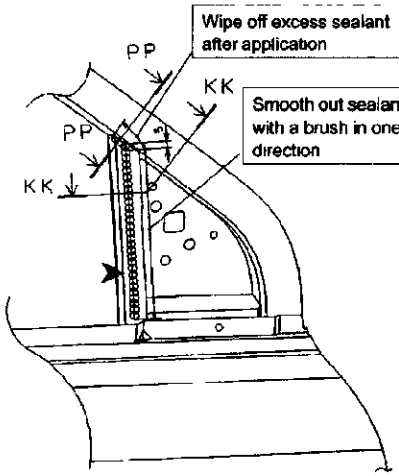
VIEW: FF



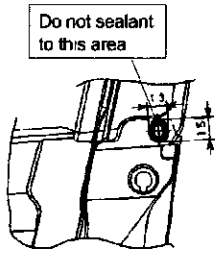
VIEW: EE



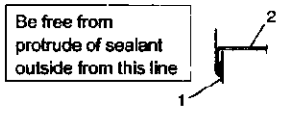
VIEW: BB



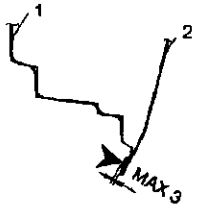
VIEW: AA



DETAIL: MM

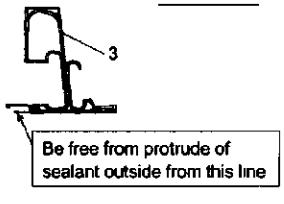


VIEW OO–OO

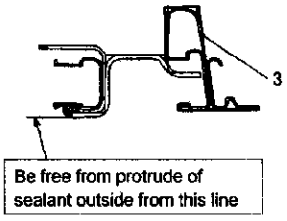


SECT: CC–CC

SECT: LL–LL



SECT: PP–PP



SECT: KK–KK

1. Front door inner panel
2. Front door outer panel
3 Front door sash

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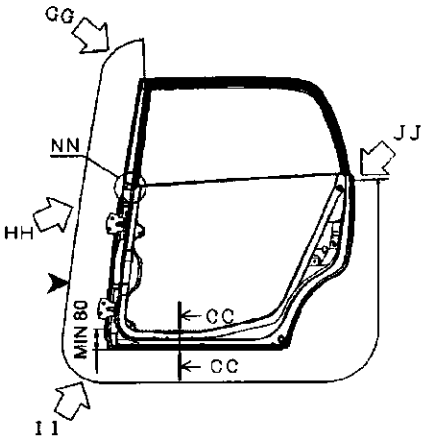
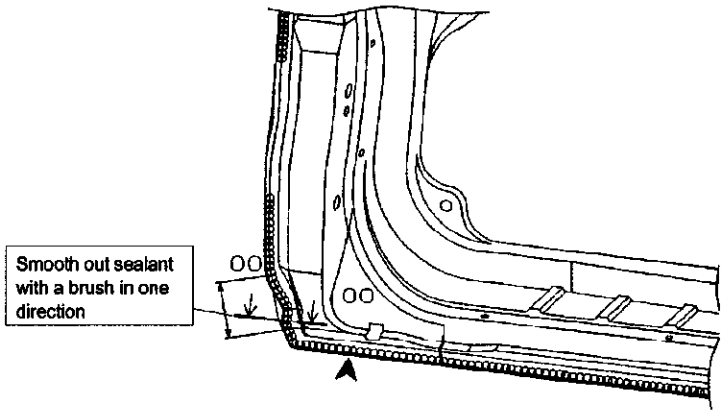
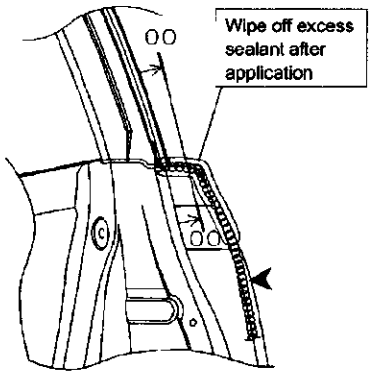
Apply sealant to pointed area

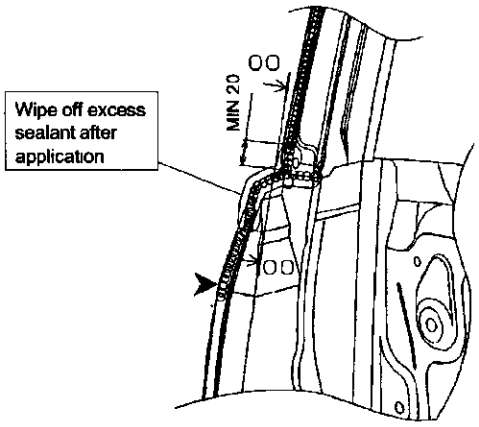




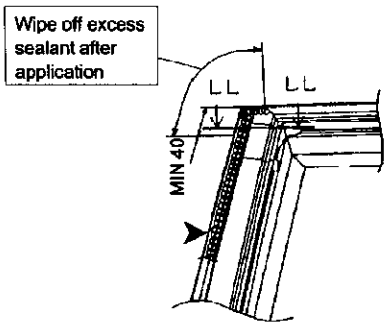
VIEW: II



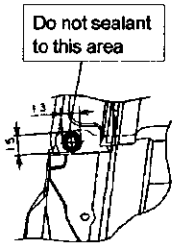
VIEW: JJ



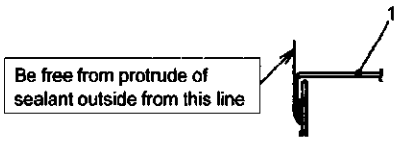
VIEW: HH



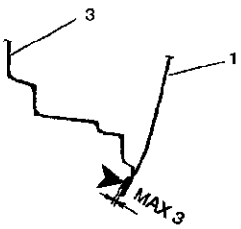
VIEW: GG



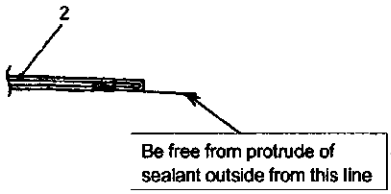
DETAIL: NN



SECT: OO–OO



SECT: CC–CC



SECT: LL–LL

1. Rear door outer panel
2. Rear door sash
3. Rear door inner panel

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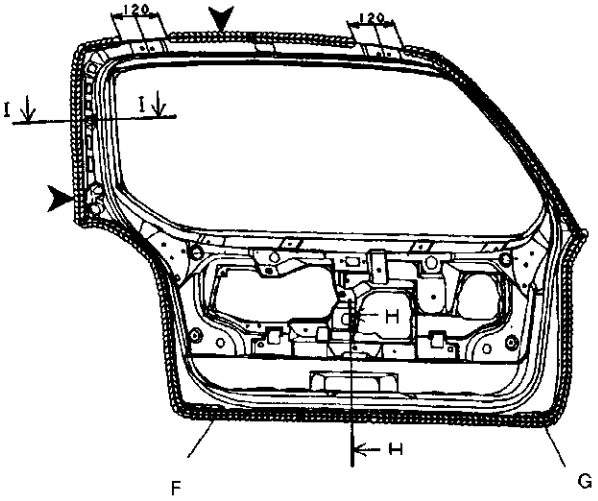
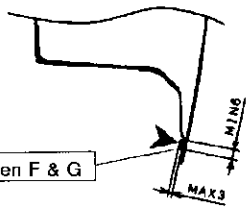
➤ **Apply sealant to pointed area**

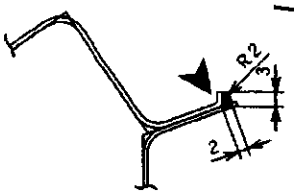


VIEW: K

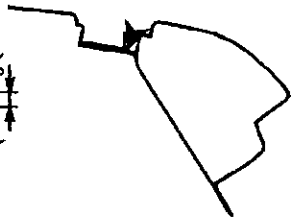
SECT: I-I



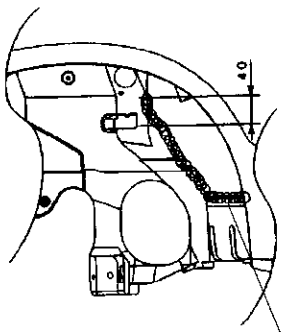
SECT: H-H



SECT: A-A

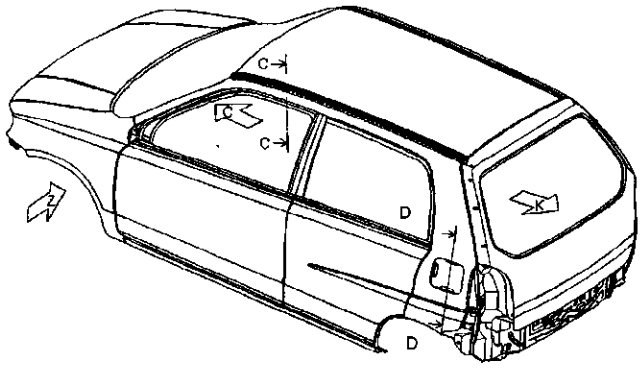


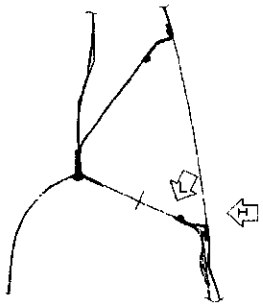
SECT: C-C



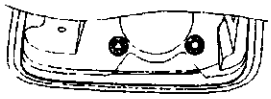
VIEW: Z

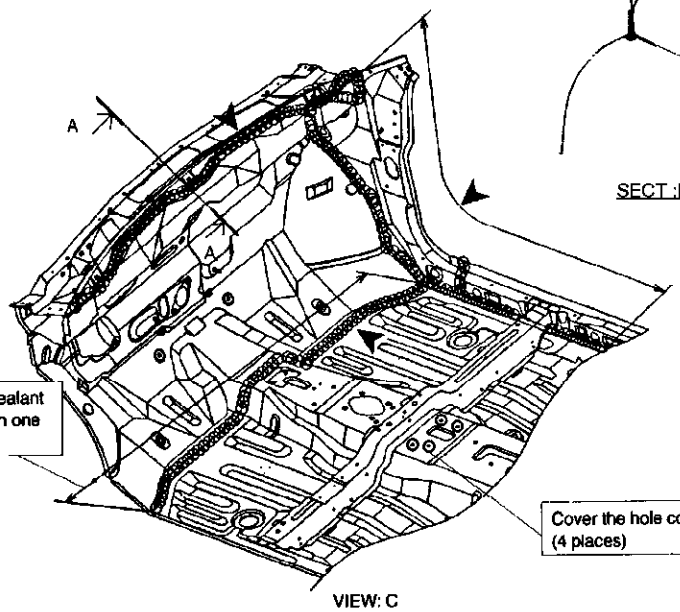
Smooth out sealant with a brush in one direction





SECT :D-D





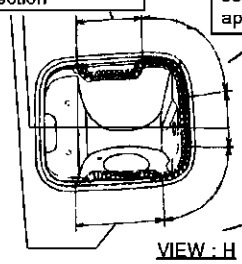
Smooth out sealant with a brush in one direction

Cover the hole completely (4 places)

VIEW: C

Smooth out sealent with a brush in one direction

Wipe off excess sealent after application



VIEW : H

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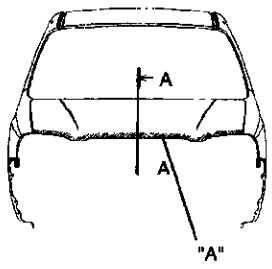
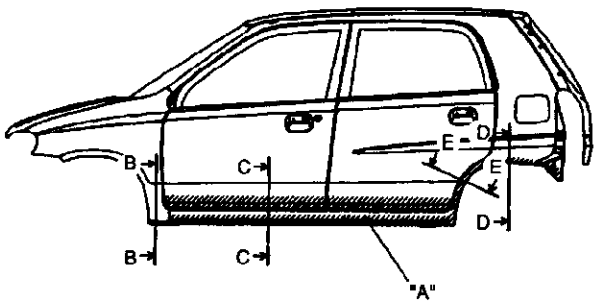
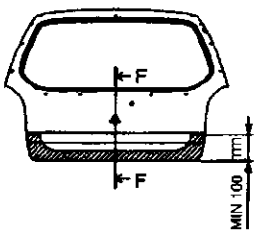
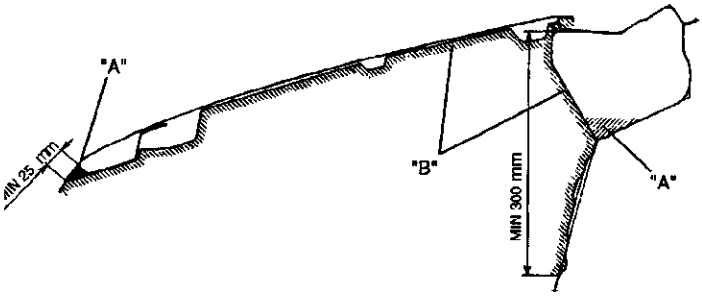
UNDER COATING /ANTI-CORROSION COMPOUND APPLICATION AREA

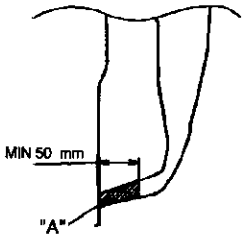




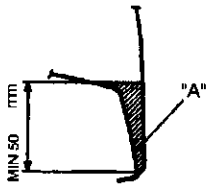




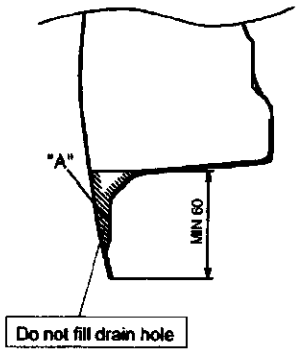
SECT: A–A



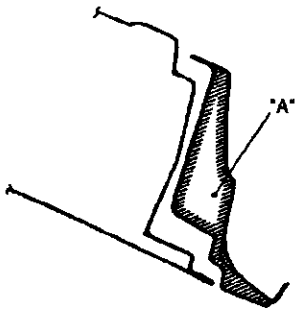
SECT: B–B



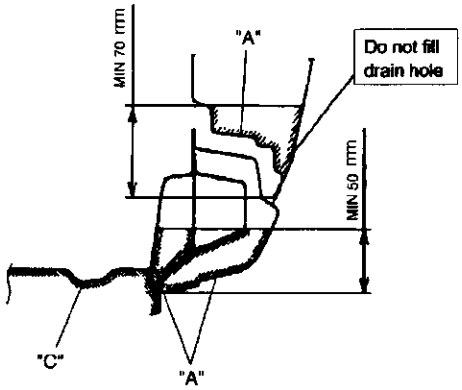
SECT: D–D



SECT: F–F



SECT: E–E



SECT: CC–CC

"A":	Apply rustproof wax (hot wax 50 µm or more)
"B":	Apply rustproof wax (low viscosity 10 µm or more)
"C":	Apply rustproof wax (high viscosity 50 µm or more)

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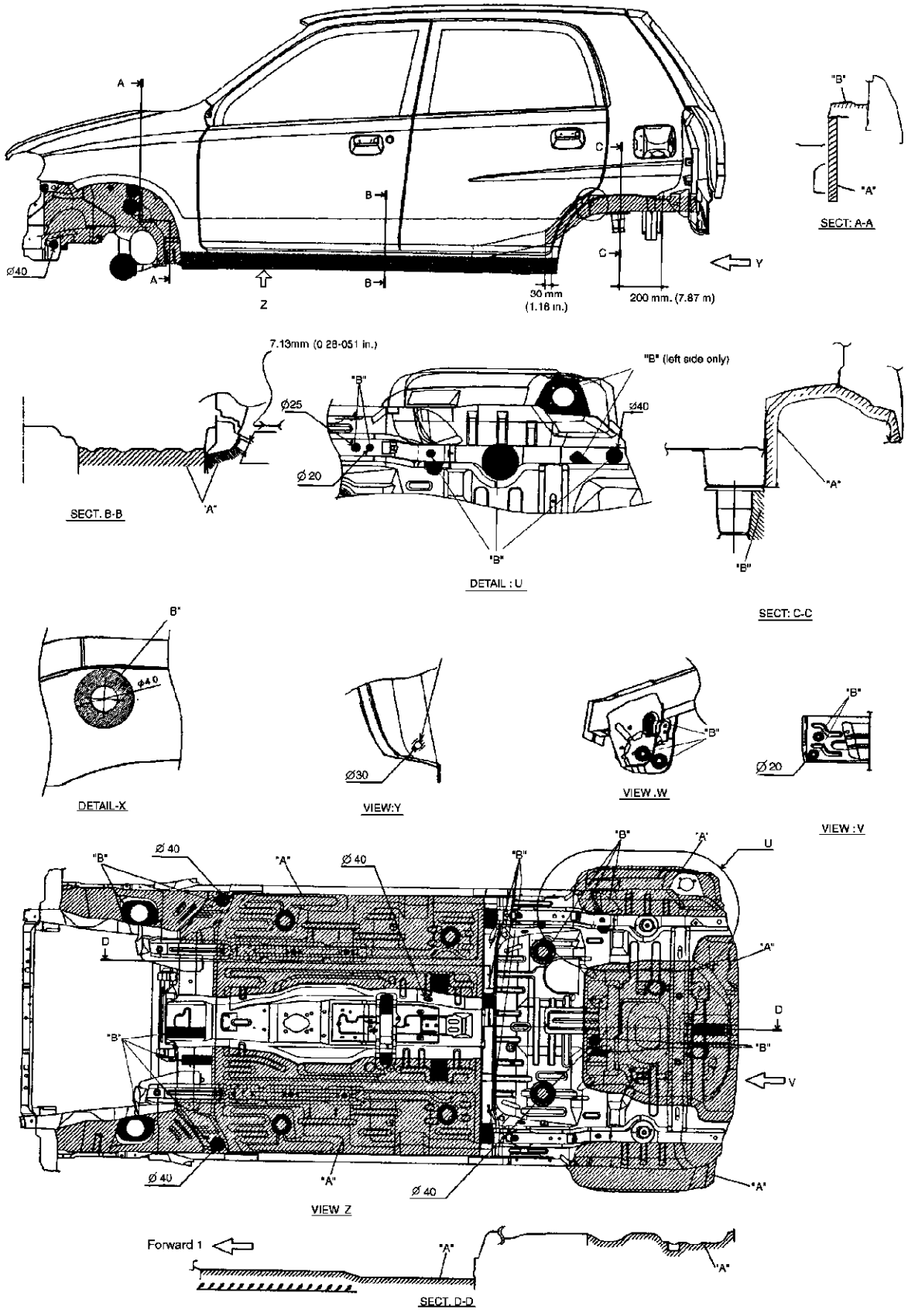

"A": Apply undercoating (PVC, 300 μm or more)
"B": Do not apply coating

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PLASTIC PARTS FINISHING

Paintable plastic parts are ABS plastic parts.

Painting

Rigid or hard ABS plastic needs no primer coating.
General acrylic lacquers can be painted properly over hard ABS plastic in terms of adherence.

1) Use cleaning solvent for paint finish to wash each part.
2) Apply conventional acrylic color lacquer to part surface.
3) Follow lacquer directions for required drying time. (Proper drying temperature range is 60 to 70°C).

Reference

Plastic parts employ not only ABS (Acrylonitrile Butadiene Styrene) plastic but also polypropylene, vinyl, or the like plastic. Burning test method to identify ABS plastic is described below.

1) Use a sharp blade to cut off a plastic sliver from the part at its hidden backside.
2) Hold sliver with pincers and set it on fire.
3) Carefully observe condition of the burning plastic.
4) ABS plastic must raise readily distinguishable back smoke while burning with its residue suspended in air temporarily.
5) Polypropylene must raise no readily distinguishable smoke while burning.

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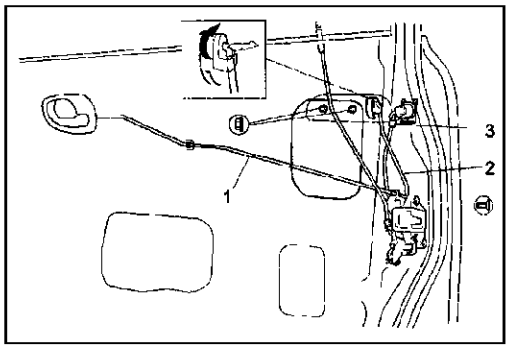
SECURITY AND LOCKS

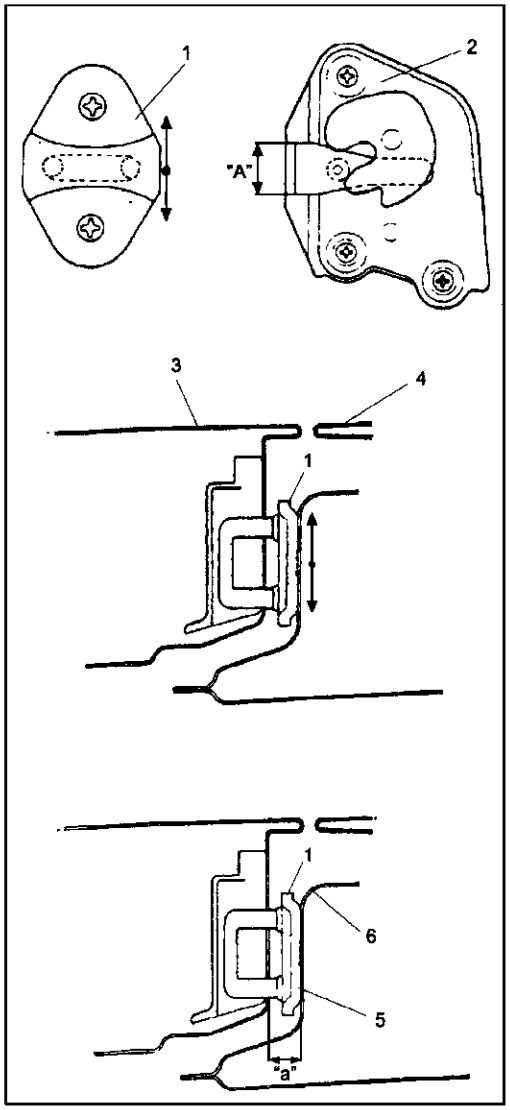
FRONT DOOR LOCK ASSEMBLY

REMOVAL

1) Raise window all the way up.
2) Remove door trim and door sealing cover, refer to step 1) to 7) of "FRONT DOOR GLASS REMOVAL" in this section.
3) Disconnect door lock motor coupler and remove door sash (if equipped with power door lock)



4) Remove door opening control rod (1).
5) Disconnect push lever (2).
6) Disconnect key cylinder rod (3).
7) Remove lock assembly.



INSTALLATION

To install front door lock, reverse removal procedure, noting the followings points.

- Door latch striker.
  Move door latch striker (1) up or down so its center aligns with the center of groove "A" on the door, as shown.

  NOTE:
  Striker (1) should be moved vertically and placed level. Do not adjust door lock (2).

- Move door latch striker (1) sideways to adjust door surface (3) flush with body surface (4), as shown.
  In order to correctly obtain door latch (1) position in the fore-and-aft direction, increase or decrease number of shims (5) inserted between body (6) and striker (1) to adjust it.

  Dimension "a": 12.0 – 14.0 mm (0.47 – 0.55 in.)

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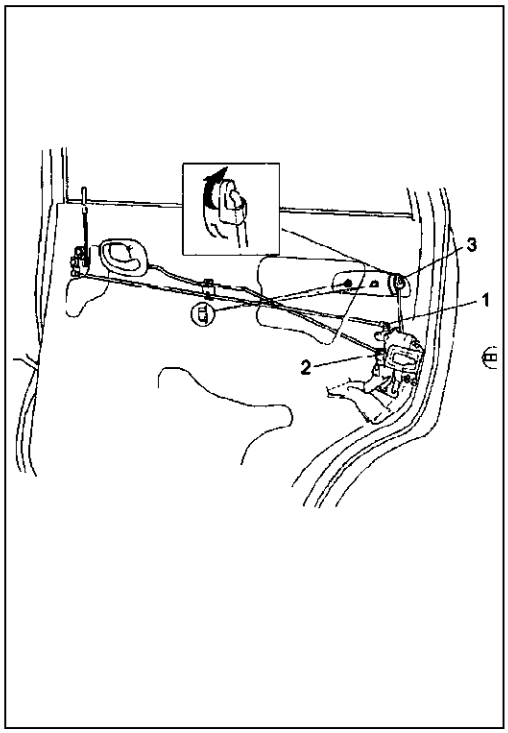


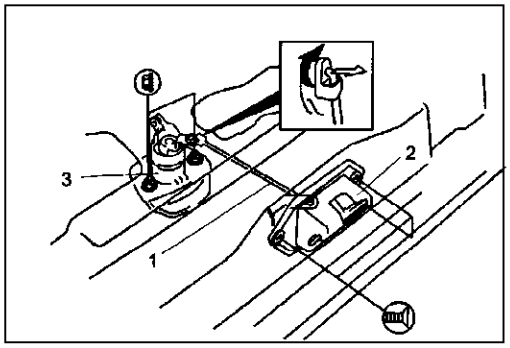
REAR DOOR LOCK ASSEMBLY

REMOVAL

1) Raise window all the way up.
2) Remove door trim and door sealing cover, refer to step 1) to 6) of "REAR DOOR GLASS REMOVAL" in this section.
3) Disconnect door lock motor coupler and remove door sash lower side screw (if equipped with power door lock)
4) Disconnect door lock control rod (1).
5) Disconnect door opening control rod (2).
6) Disconnect push lever (3).
7) Remove lock assembly.

INSTALLATION

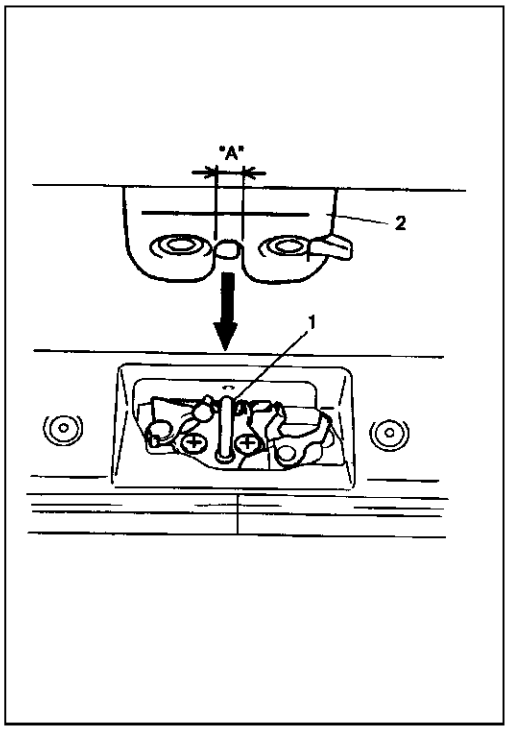
Reverse removal procedure to install rear door lock, noting points mentioned in "FRONT DOOR LOCK ASSEMBLY".



BACK DOOR LOCK ASSEMBLY

REMOVAL

1) Remove back door trim.
2) Disconnect key cylinder rod (1).
3) Remove lock assembly (2) and key cylinder assembly (3).



INSTALLATION

To install back door lock, reverse removal procedure, noting followings points.

- Make sure that door latch striker (1) center aligns with the center of groove "A" in door lock (2) as shown in figure.

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KEY CODING

KEY USAGE AND IDENTIFICATION

Key is used for ignition and door lock cylinder. Keys are cut on both edges to make them reversible.
Key identification is obtained from five character key code stamped on key code tag. Using this key code, key code cutting combination can be determined from a code list (available to owners of key cutting equipment from suppliers).
If key codes are not available from records or tags, key code can be obtained from the right hand door lock cylinder (if lock has not been replaced). Lock cylinders supplied by the factory as service parts are unmarked.
If original key is available, key code cutting combination can be determined by laying key.

IGNITION SWITCH LOCK CYLINDER

Removal/Installation

See SECTION 3C, "STEERING WHEEL AND COLUMN".

ELECTRICAL DIAGNOSIS

For ignition switch electrical troubleshooting, see SECTION 8, "BODY ELECTRICAL SYSTEM".

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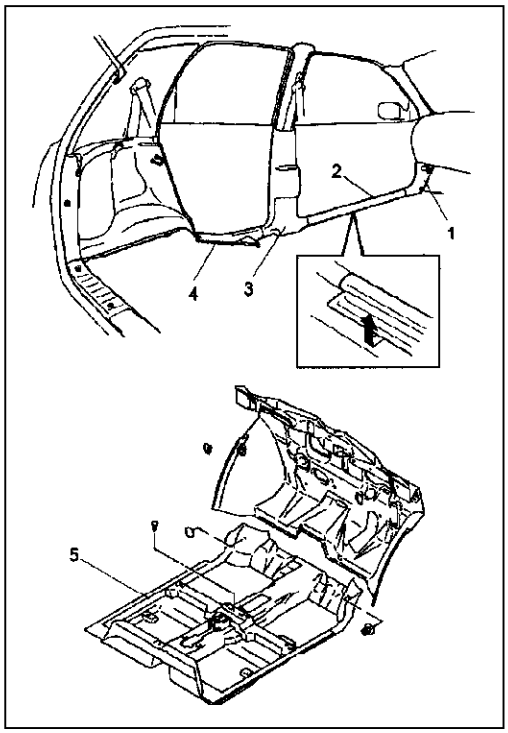

EXTERIOR AND INTERIOR TRIM

FLOOR CARPET

REMOVAL

1) Remove front seats and rear seat cushion.
2) Remove seat belt lower anchor bolts.
3) Remove dash side trims (1), front side sill scuffs (2), center pillar inner lower trims (3) and rear side sill scuffs (4).
4) Remove console box and parking brake lever cover.
5) Remove floor carpet (5).

INSTALLATION

Reverse removal procedure to install floor carpet, noting following point.

- When tightening seat belt anchor bolt, refer to SECTION 10 "FRONT SEAT BELT" for tightening torque.

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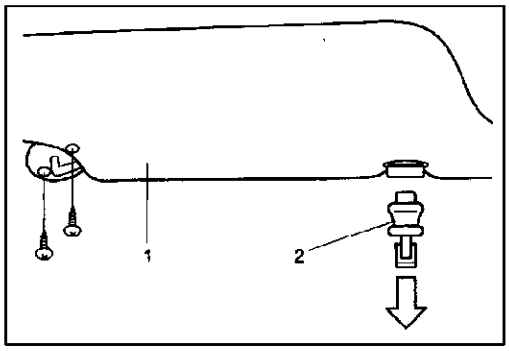
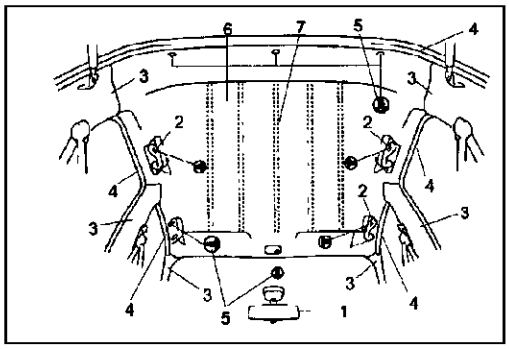


HEAD LINING

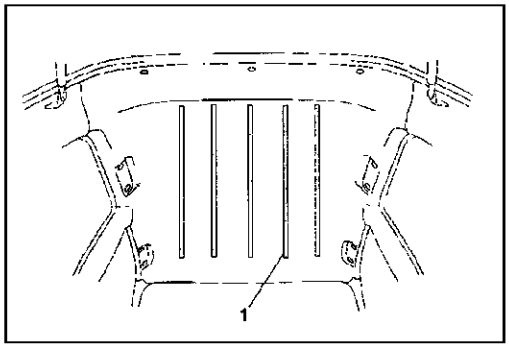
REMOVAL

1) Remove sunshade assembly (1).
2) Remove sunshade holder (2) as shown in figure.



3) Remove inside rear view mirror (1).
4) Remove assistant grips (2).
5) Remove inner trims covering head lining (3) and door opening trims (4).
6) Remove scrips (5).
7) Remove head lining (6).

NOTE:
Adhesive (7) is used to attach head lining.



INSTALLATION

1) Clean roof where adhesive of head lining will be attached.
2) Apply adhesive (1) to roof lining as shown in figure.
3) Reverse removal procedure.

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SECTION 10

RESTRAINT SYSTEM

WARNING:

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

- **Service on or around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in 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 disable the air bag system temporarily and prevent false diagnostic trouble codes from setting. Failure to follow procedures could result in possible activation of the air bag system, personal injury or otherwise unneeded air bag system repairs.**

CAUTION:

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

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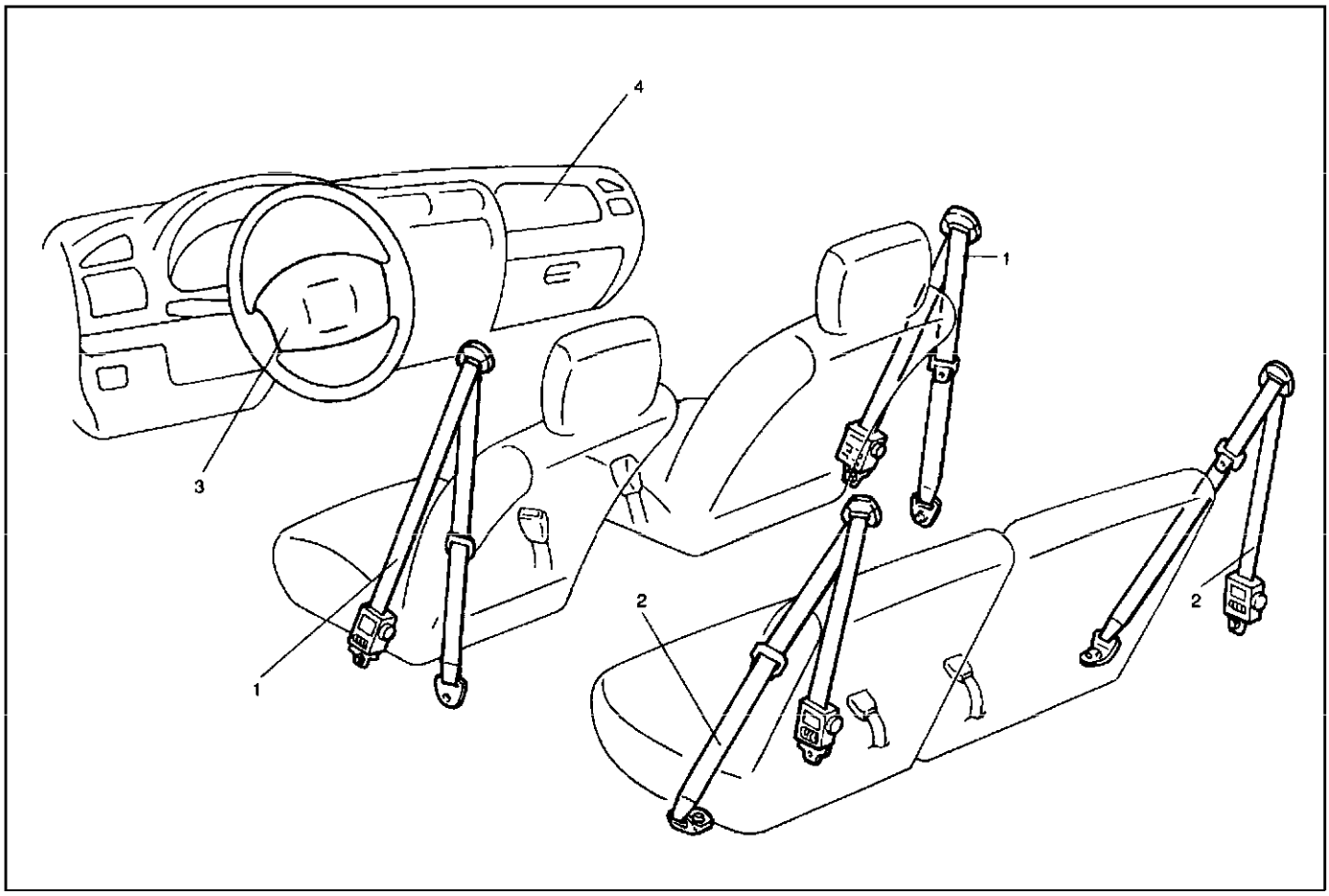
General Description



1. Front seat belt with ELR and pretensioner	3. Driver air bag
2. Rear seat belt with A-ELR	4. Passenger air bag

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 with ELR and pretensioner

The seat belt with ELR and a pretensioner has a pretensioner mechanism which operates in linkage with the air bag in addition to the above described ELR. The pretensioner is incorporated in retractor assembly and controlled by SDM as one of air bag system components. It will be activated at the same time as the air bag when an impact at the front of vehicle exceeds the specified value.

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When servicing seat belt (retractor assembly) with pretensioner, be sure to observe all WARNINGS and CAUTIONS in this section and "SERVICE PRECAUTIONS" of "ON-VEHICLE SERVICE" in Section 10B

CAUTION:

Do not reuse the seat belt pretensioner (retractor assembly) that has operated but replace it with a new one as an assembly. For checking procedure of its operation, refer to "SERVICE PRECAUTIONS" of "ON-VEHICLE SERVICE" in Section 10B.

Diagnosis

For diagnosis of air bag system (including in seat belt pretensioner), refer to Section 10B.

Inspection and Repair Required after Accident

After an accident, whether the seat belt pretensioner has been activated or not, be sure to perform checks and repairs described on "REPAIRS AND INSPECTIONS REQUIRED AFTER AN ACCIDENT" under "ON-VEHICLE SERVICE" in Section 10B.

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On-Vehicle Service

Service Precautions

Service and diagnosis

WARNING:
If replacing seat belt is necessary, replace buckle and ELR (or webbing) together as a set. This is for the reason of ensuring locking of tongue plate with buckle.
If these parts are replaced individually, such a locking condition may become unreliable. For this reason, SUZUKI will supply only the spare buckle and ELR (or webbing) in a set part.

Before servicing or replacing seat belts, refer to the following precautionary items.

- Seat belts should be normal relative to strap retractor and buckle portions.
- Keep sharp edges and damaging objects away from belts.
- Avoid bending or damaging any portion of belt buckle or latch plate.
- Do not bleach or dye belt webbing. (Use only mild soap and lukewarm water to clean it.)
- When installing a seat belt anchor bolt, it should be tightened by hand at first to prevent cross-threading and then to specified torque.
- Do not attempt any repairs on retractor mechanisms or retractor covers. Replace defective assemblies with new replacement parts.
- Keep belts dry and clean at all times.
- If there exist any parts in question, replace such parts.
- Replace belts whose webbing is cut or otherwise damaged.
- Do not put anything into trim panel opening which seat belt webbing passes through.

For seat belt with pretensioner

Refer to "SERVICE AND DIAGNOSIS" of "SERVICE PRECAUTIONS" under "ON-VEHICLE SERVICE" in Section 10B.

WARNING:
When performing service on or around air bag system components or air bag system wiring, disable the air bag system. Refer to "DISABLING AIR BAG SYSTEM" of "SERVICE PRECAUTIONS" under "ON-VEHICLE SERVICE" in Section 10B.
Failure to follow procedures could result in possible air bag activation, personal injury or unneeded air bag system repairs.

Disabling air bag system

Refer to "DISABLING AIR BAG SYSTEM" of "SERVICE PRECAUTIONS" under "ON-VEHICLE SERVICE" in Section 10B.

Enabling air bag system

Refer to "ENABLING AIR BAG SYSTEM" of "SERVICE PRECAUTIONS" under "ON-VEHICLE SERVICE" in Section 10B.

Handling and storage

Refer to "HANDLING AND STORAGE" of "SERVICE PRECAUTIONS" under "ON-VEHICLE SERVICE" in Section 10B.

Disposal

Refer to "DISPOSAL" of "SERVICE PRECAUTIONS" under "ON-VEHICLE SERVICE" in Section 10B.

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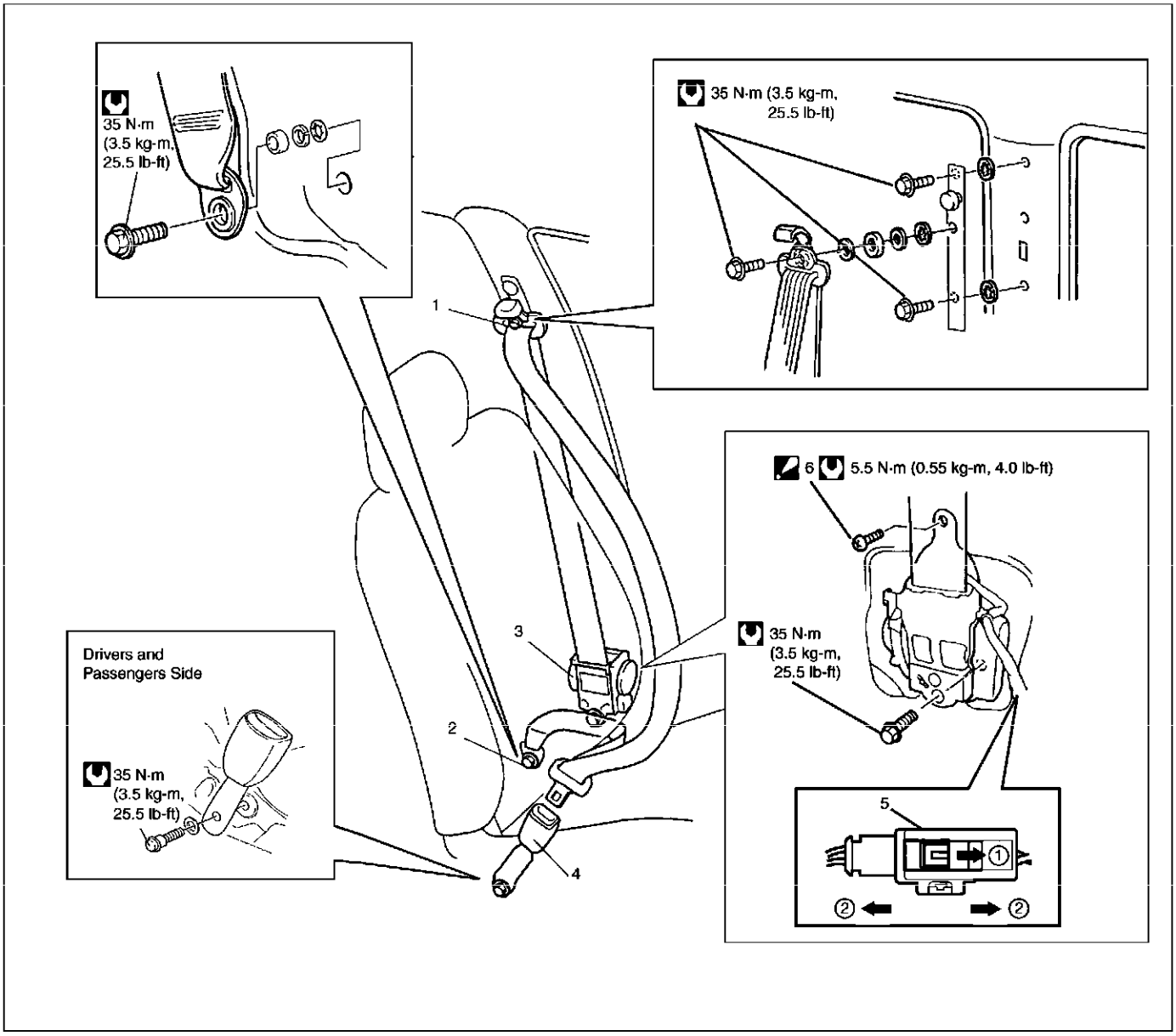
Front Seat Belt

WARNING:

- **Never attempt to disassemble or repair the seat belt pretensioner (retractor assembly). If any abnormality is found, be sure to replace it with new one as an assembly.**
- **Be sure to read "SERVICE PRECAUTIONS", before starting to work and observe every precaution during work. Neglecting them may result in personal injury or unactivation of the seat belt pretensioner when necessary.**



1. Upper anchor	4. Buckle	Tightening torque
2. Lower anchor	5. Yellow connector (for seat belt pretensioner)	
3. Retractor assembly	6. Retractor assembly upper mounting screw : After tightening lower bolt, tighten upper screw.	

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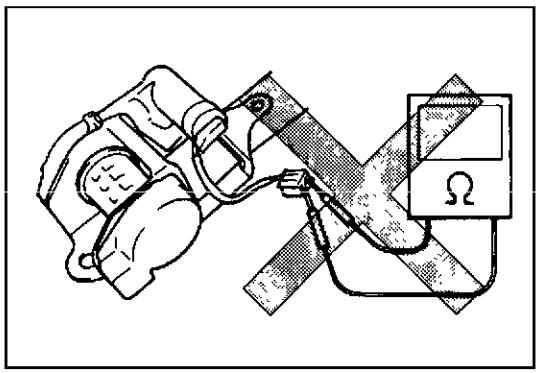
REMOVAL

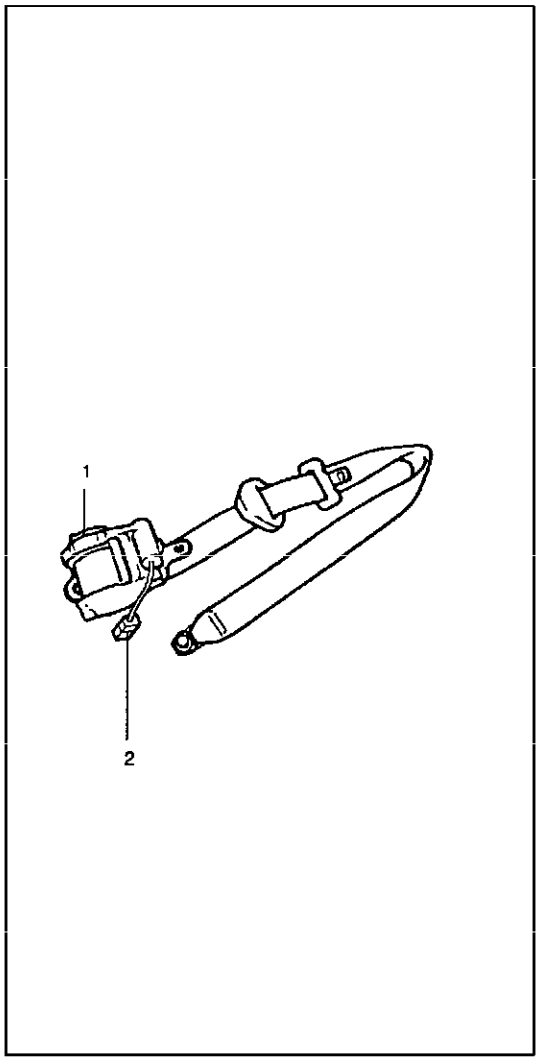
1) Disconnect negative battery cable at battery.
2) Disable air bag system. Refer to "DISABLING AIR BAG SYSTEM" of "SERVICE PRECAUTIONS" under "ON-VEHICLE SERVICE" in Section 10B.
3) Remove center pillar lower trim.
4) Disconnect Yellow connector from seat belt pretensioner.
   a) Release locking of lock slider.
   b) After unlocked, disconnect to connector.
5) Remove front seat belts from the vehicle.

INSPECTION



WARNING:
Never 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 30 cm (1 ft) or more, it should be replaced.



Seat belts and attaching parts can affect the vital components and systems of a vehicle.
Therefore, they should be inspected carefully and replaced with genuine parts only.

Seat belt
- The seat belt webbing or strap should be free from damage.

Retractor assembly
1) Let the seat belt retract fully to confirm its easy retraction.
   - The retractor assembly should lock webbing when pulled quickly.
   - The front seat belt retractor assembly (1) should pass the above inspection and should lock webbing even when tilted (approx. 15°) toward the fore and aft or right and left directions.
2) Check retractor assembly (1) with seat belt pretensioner appearance visually for following symptoms and if any one of them is applicable, replace it with a new one as an assembly.
   - Pretensioner has activated.
   - There is a crack in seat belt pretensioner (retractor assembly).
   - Wire harness or connector (2) is damaged.
   - Seat belt pretensioner (retractor assembly) is damaged or a strong impact (e.g., dropping) was applied to it.

Anchor bolt
- Anchor bolts should be torqued to specification.

Belt latch
- It should be secure when latched.

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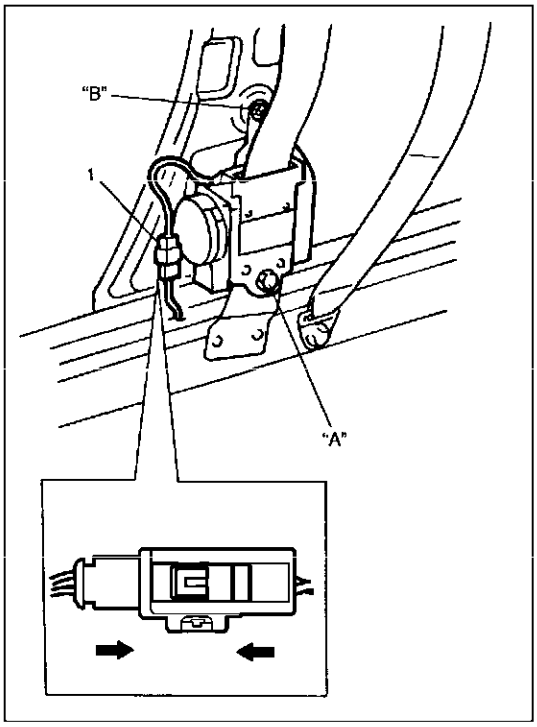
INSTALLATION

Reverse removal procedure to install front seat belt noting the following constructions.

- Seat belt anchor bolts should have an unified fine thread (7/16-20 UNF). Under no circumstances should any different sized or metric screw threads be used.



- Be sure to tighten bolt and screw in order ("A"–"B") as shown.
- Tighten bolts and screw to specified torque referring to components figure.
- Connect Yellow connector (1) to seat belt pretensioner securely.
- Enable air bag system. Refer to "ENABLING AIR BAG SYSTEM" under "SERVICE PRECAUTIONS" in Section 10B.

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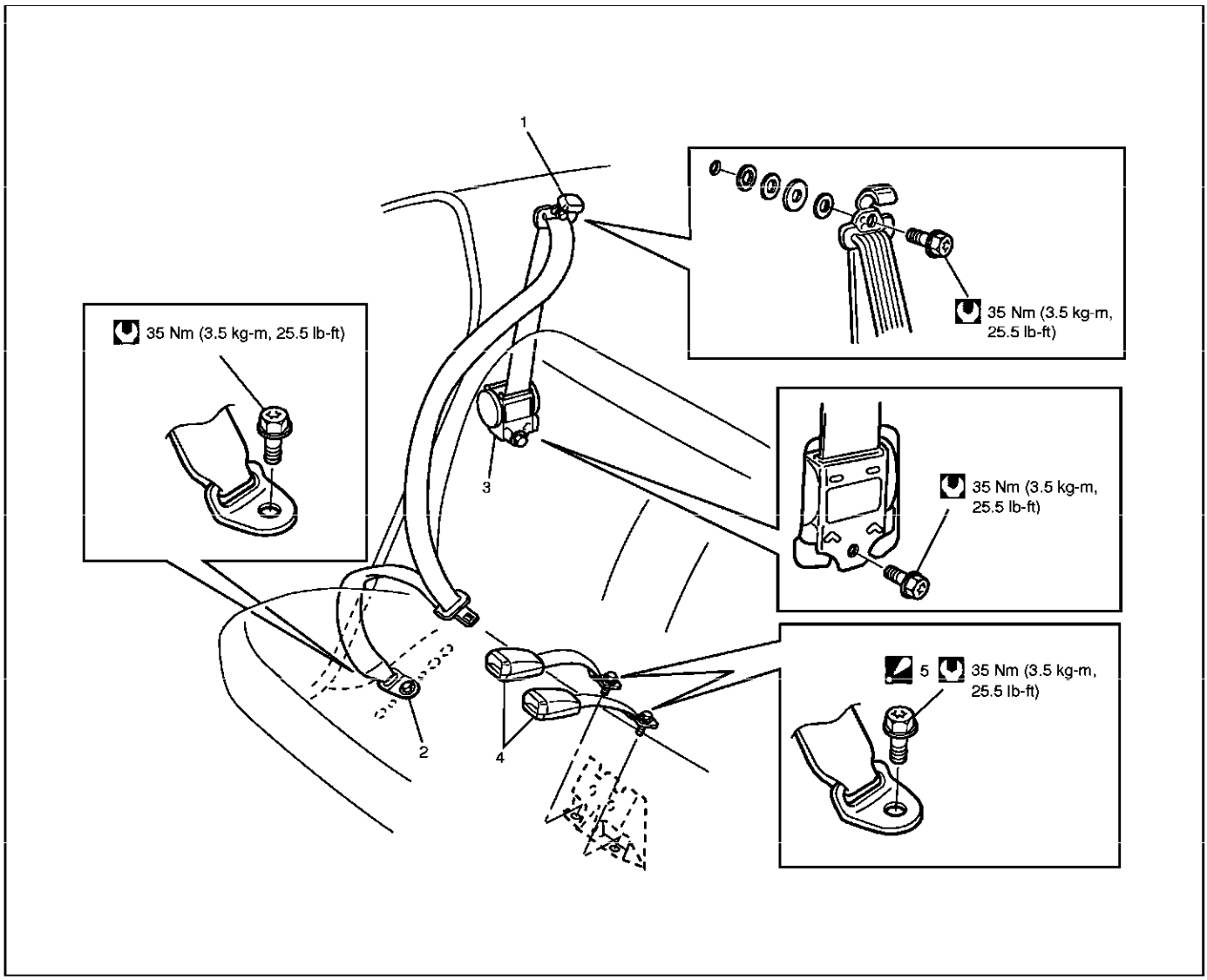
Rear Seat Belt

WARNING:
Be sure to read "SERVICE PRECAUTIONS" before starting to work and observe every precaution during work.



1 Upper anchor	3 Retractor assembly	5	Buckle mounting bolt : Tighten RH bolt first, and then tighten LH bolt.
2. Lower anchor	4. Buckle		Tightening torque

REMOVAL

Remove rear seat belts as shown in figure.

INSPECTION

- Check the rear seat belt in the same way as "INSPECTION" of "FRONT SEAT BELT".
- As to seat belts with A-ELR, check them as follows in addition to above check.
  - With vehicle at stop, pull seat belt all the way out, let it retract a little and try to pull it. It should not be pulled out, that is, it should be locked where retracted.
  - Let seat belt retract to its original state. Next, pull it half way out, let it retract a little and try to pull it again. It should be pulled out smoothly, that is it should not be locked at this time.

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INSTALLATION

Reverse removal procedure to install rear seat belt noting the following constructions.

- Seat belt anchor bolts should have an unified fine thread (7/16-20 UNF). Under no circumstances should any different sized or metric screw threads be used.
- Tighten bolts to specified torque referring to components figure.

Tightening Torque Specification

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
Retractor assembly screw	5.5	0.55	4.0
Buckle bolt	35	3.5	25.5

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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.

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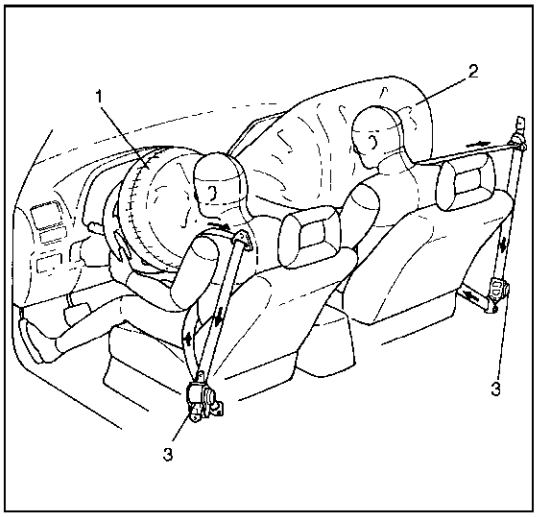
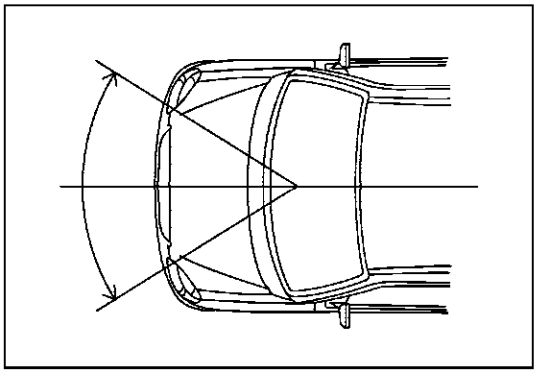
GENERAL DESCRIPTION



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.

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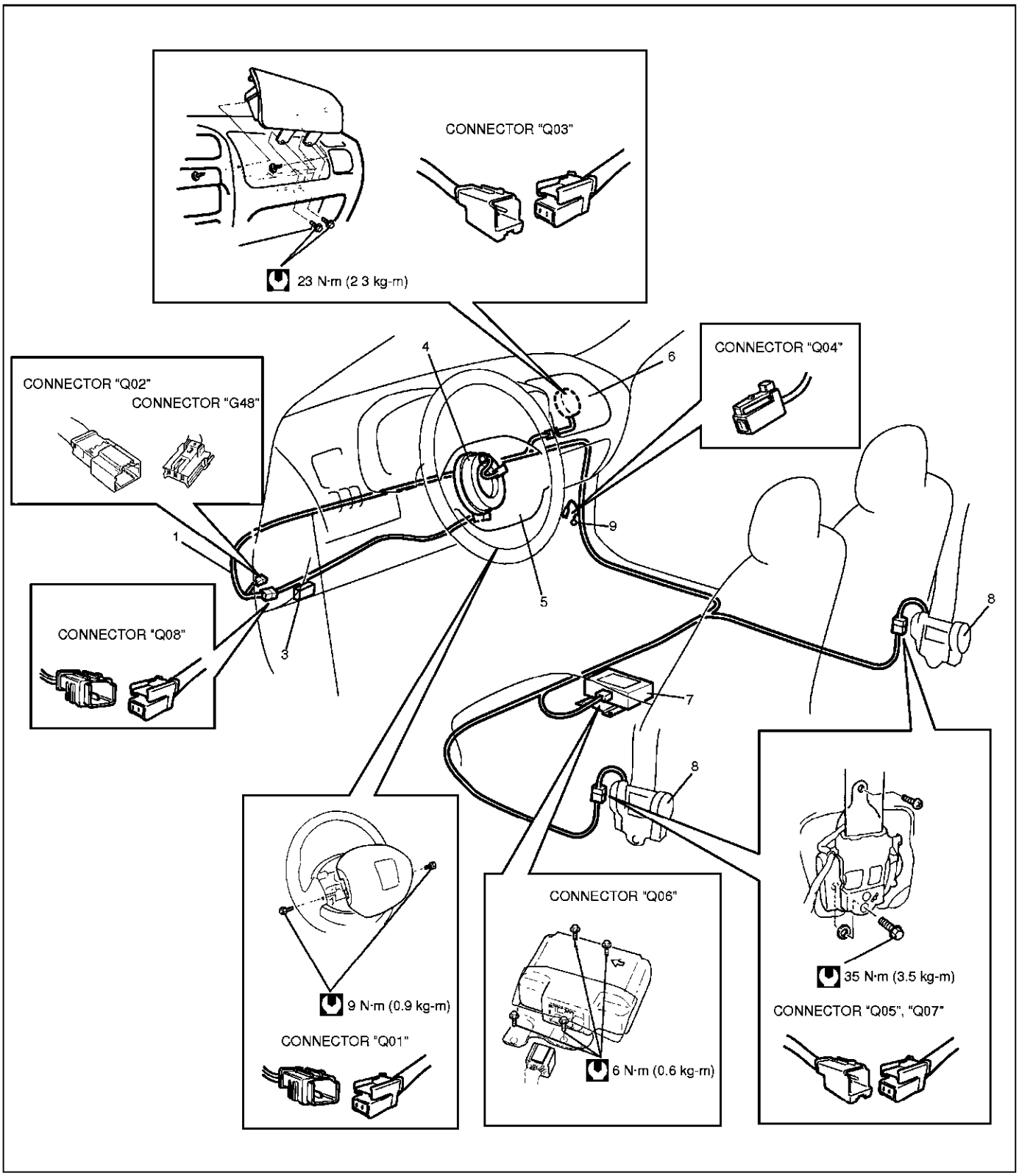
SYSTEM COMPONENTS AND WIRING LOCATION VIEW AND CONNECTORS



1. Air bag harness	6. Passenger air bag (inflator) module
2. "Air bag" monitor coupler	7. SDM
3. DLC	8. Seat belt pretensioner (retractor assembly)
4. Contact coil assembly	9. Ground for air bag system
5. Driver air bag (inflator) module	

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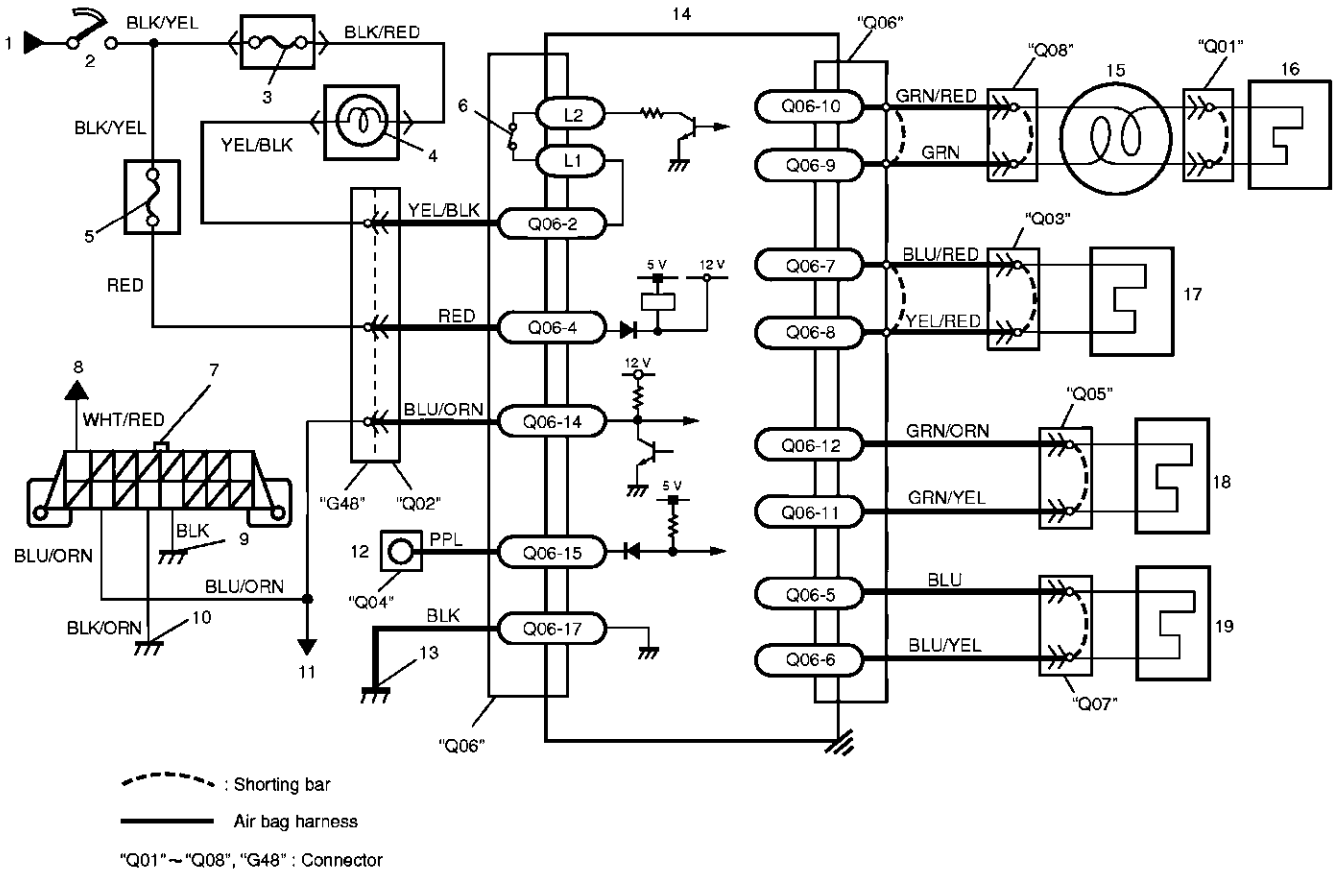
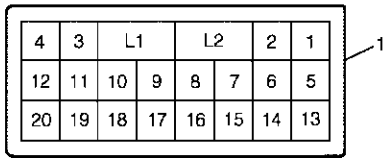
SYSTEM WIRING DIAGRAM



1. To main fuse box	8. To circuit fuse box	15. Contact coil assembly
2. Ignition switch	9. Ground on body	16. Driver air bag (inflator) module
3. "METER" fuse	10 Ground on engine block	17. Passenger air bag (inflator) module
4. "AIR BAG" warning lamp in combination meter	11 To ECM, P/S control module and ABS control module (if equipped)	18. Driver seat belt pretensioner
5. "AIR BAG" fuse	12 "AIR BAG" monitor coupler	19. Passenger seat belt pretensioner
6. Connection detection pin	13 Ground for air bag system	
7. Data link connector (DLC)	14 SDM	

TERMINAL ARRANGEMENT OF SDM (VIEWED FROM HARNESS SIDE)



1. SDM connector "Q06"

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SDM connector "Q06" terminal description

TERMINAL	CIRCUIT		TERMINAL	CIRCUIT	
Q06-1	–		Q06-11	Driver pretensioner	Low
Q06-2	"AIR BAG" warning lamp		Q06-12		High
Q06-3	–		Q06-13	–	
Q06-4	Ignition switch (power source)		Q06-14	Data link connector (DLC)	
Q06-5	Passenger pretensioner	High	Q06-15	Diagnosis switch	
Q06-6		Low	Q06-16	–	
Q06-7	Passenger air bag (inflator)	High	Q06-17	Ground	
Q06-8	module	Low	Q06-18	–	
Q06-9	Driver air bag (inflator)	Low	Q06-19	–	
Q06-10	module	High	Q06-20	–	

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)

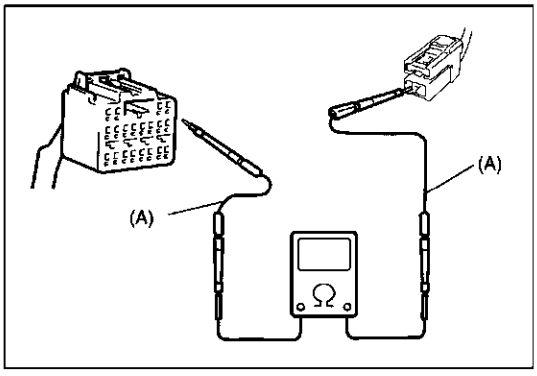
The AIR BAG DIAGNOSTIC SYSTEM CHECK must always be the starting point of any air bag system diagnosis. The AIR BAG DIAGNOSTIC SYSTEM CHECK checks for proper "AIR BAG" warning lamp operation and checks for air bag diagnostic trouble codes (DTCs) using on-board diagnosis function or SUZUKI scan tool.

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 TOOLS.You should be able to measure voltage and resistance. You should be familiar with proper use of a scan tool such as Air Bag Driver/Passenger Load Tool, Connector Test Adapter Kit and the Digital Multimeter.



Special tool
(A) : 09932-76010 (Connector Test Adapter Kit)

This must be used whenever a diagnostic procedure requests checking or probing a terminal.
Using the appropriate adapter in the special tool will ensure that no damage to the terminal will occur from the multimeter probe, such as spreading or bending.

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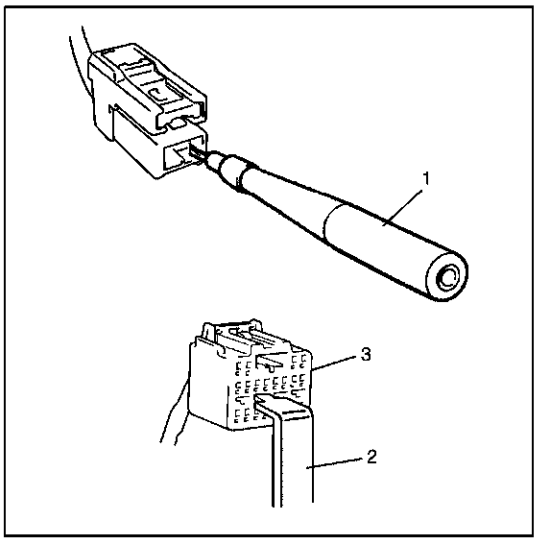
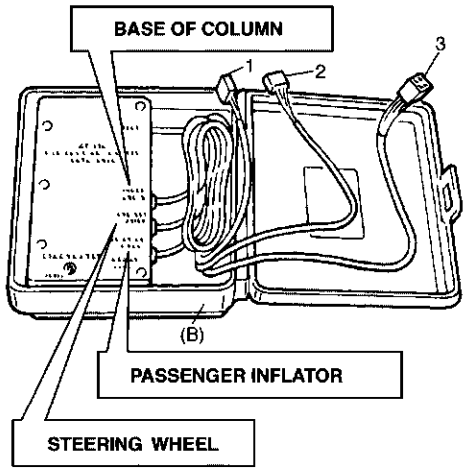


The adapter (1) will also give an idea of whether contact tension is sufficient, helping to find an open or intermittent open due to poor terminal contact.

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 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

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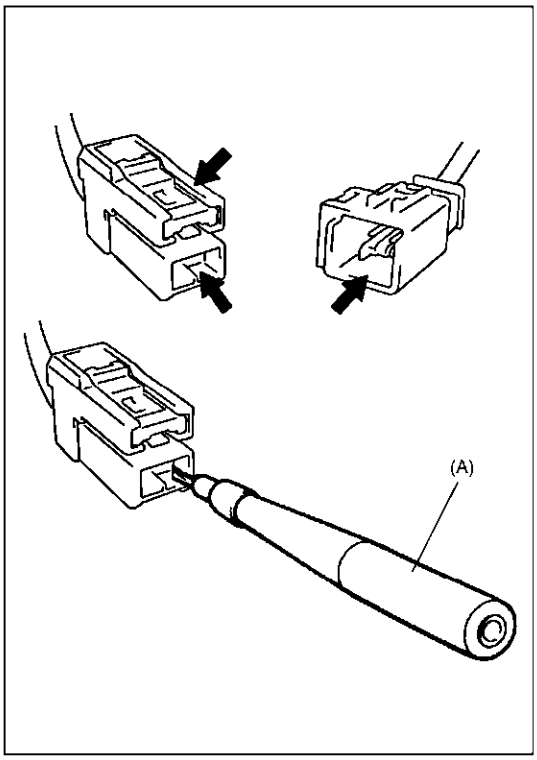
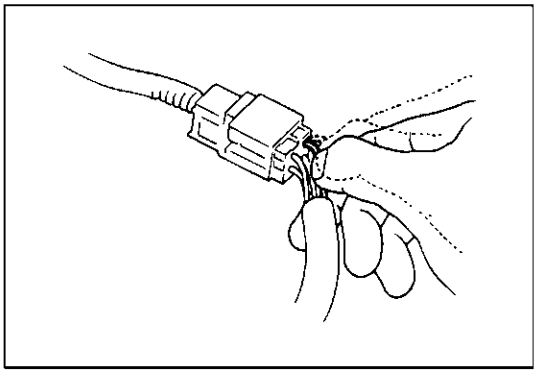
INTERMITTENTS AND POOR CONNECTIONS

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:

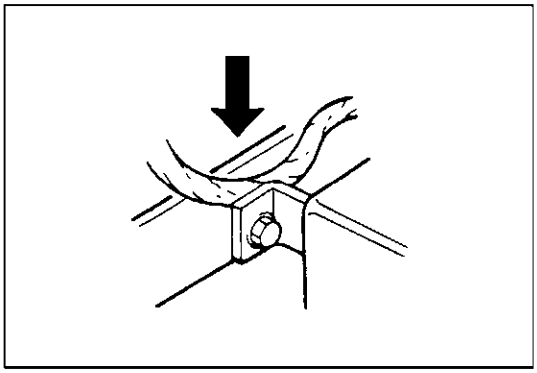


- Poor mating of connector halves, or terminals not fully seated in the connector body (backed out).
- Dirt or corrosion on the terminals. The terminals must be clean and free of any foreign material which could impede proper terminal contact.
  However, cleaning the terminal with a sand paper or the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

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AIR BAG DIAGNOSTIC SYSTEM CHECK

WARNING:

To avoid deployment when troubleshooting the air bag system, do not use electrical test equipment such as a battery powered or AC powered voltmeter, ohmmeter, etc., or any type of electrical equipment other than that specified in this manual. Do not use a non-powered probe type tester. Instructions in this manual must be followed carefully, otherwise personal injury may result.

CAUTION:

The order in which diagnostic trouble codes are diagnosed is very important. Failure to diagnose the diagnostic trouble codes in the order specified may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.

The diagnostic procedures used in this section are designed to find and repair air bag system malfunctions. To get the best results, it is important to use the diagnostic flow tables and follow the sequence listed below.

1) Perform the AIR BAG DIAGNOSTIC SYSTEM CHECK FLOW TABLE.
   (The AIR BAG DIAGNOSTIC SYSTEM CHECK FLOW TABLE must be the starting point of any air bag system diagnosis.
   The AIR BAG DIAGNOSTIC SYSTEM CHECK FLOW TABLE checks for proper "AIR BAG" warning lamp operation through "AIR BAG" warning lamp and whether air bag diagnostic trouble codes exist.)
2) Refer to the proper diagnostic table as directed by the AIR BAG DIAGNOSTIC SYSTEM CHECK FLOW TABLE.
   (The AIR BAG DIAGNOSTIC SYSTEM CHECK FLOW TABLE will lead you to the correct table to diagnose any air bag system malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.)
3) Repeat the AIR BAG DIAGNOSTIC SYSTEM CHECK FLOW TABLE after any repair or diagnostic procedures have been performed.
   (Performing the AIR BAG DIAGNOSTIC SYSTEM CHECK FLOW TABLE after all repair or diagnostic procedures will ensure that the repair has been made correctly and that no other malfunctions exist.)

FLOW TABLE TEST DESCRIPTION

STEP 1 : Check that "AIR BAG" warning lamp lights.
STEP 2 : Check that "AIR BAG" warning lamp lights.
STEP 3 : Check 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)

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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 without flashing?	Proceed to "AIR BAG" WARNING LAMP COMES ON STEADY WITHOUT FLASHING 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 using SUZUKI scan tool. Refer to DTC CHECK in this section. Is "NO CODES" displayed on SUZUKI scan tool?	Air bag system is in good condition.	An intermittent trouble has occurred at some place. Check the connector harness, etc. related to the sensed DTC. Refer to INTERMITTENT AND POOR CONNECTIONS in this section. Then clear DTC (Refer to DTC CLEARANCE in this section.) and repeat this table.
7	1) Check DTC using monitor coupler. Refer to 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 (Refer 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 using SUZUKI scan tool. Refer to DTC CHECK in this section. Is "NO CODES" displayed on SUZUKI scan tool?	Substitute a known-good SDM and recheck.	Check and repair according to corresponding DTC flow table.
10	1) Check DTC using monitor coupler. Refer to 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.

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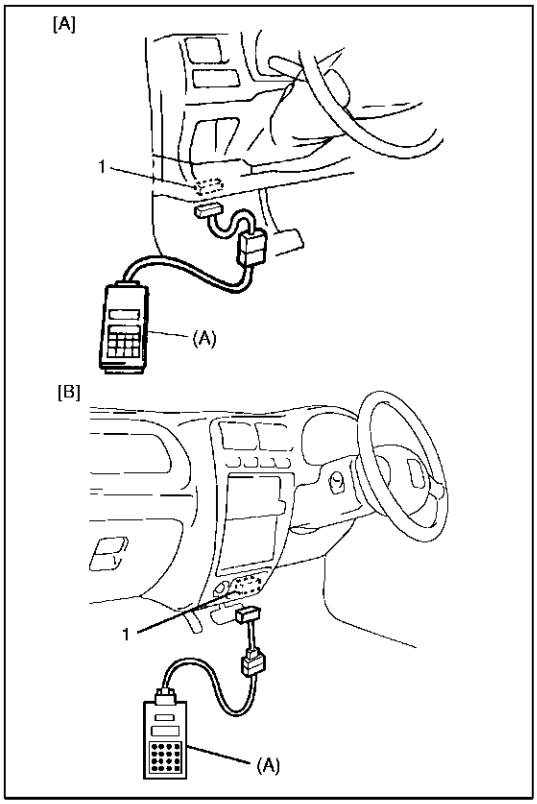
DTC CHECK

Using SUZUKI Scan Tool



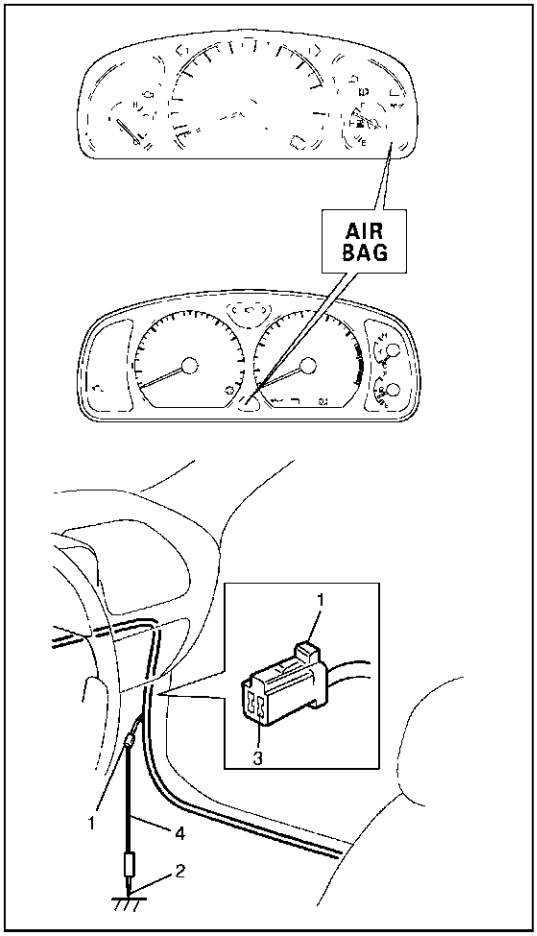
1) Turn ignition switch to OFF position.
2) After setting cartridge to SUZUKI scan tool, connect it to data link connector (DLC) located on underside of instrument panel at driver's seat side.

Special tool
(A) : SUZUKI scan 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. Refer 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).

[A]:	For LH model
[B]:	For RH model
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, ground diagnosis switch terminal in monitor coupler.
3) Read DTC from flashing pattern of "AIR BAG" warning lamp. (Refer to DTC TABLE.)
   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.

1	"AIR BAG" monitor coupler
2	Body ground
3	Diagnosis switch terminal
4	Service wire

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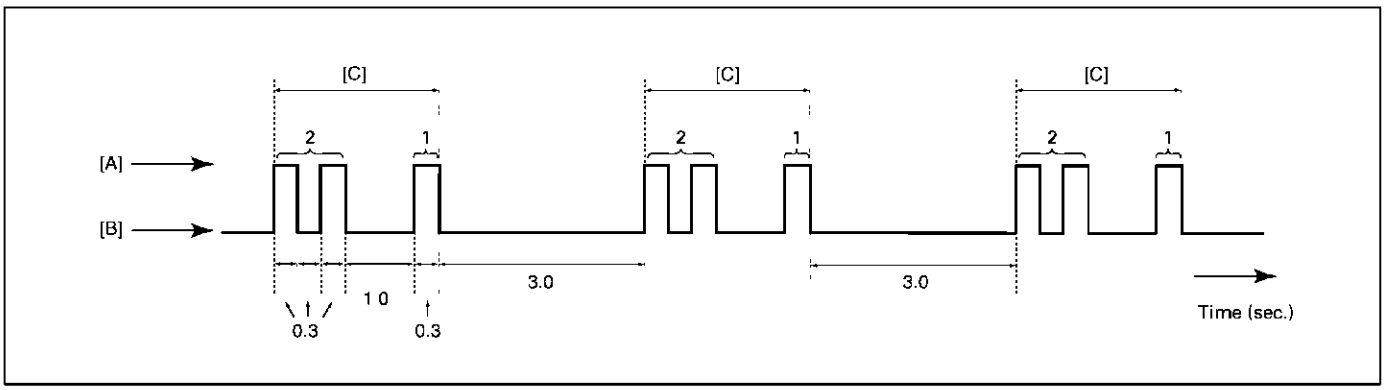
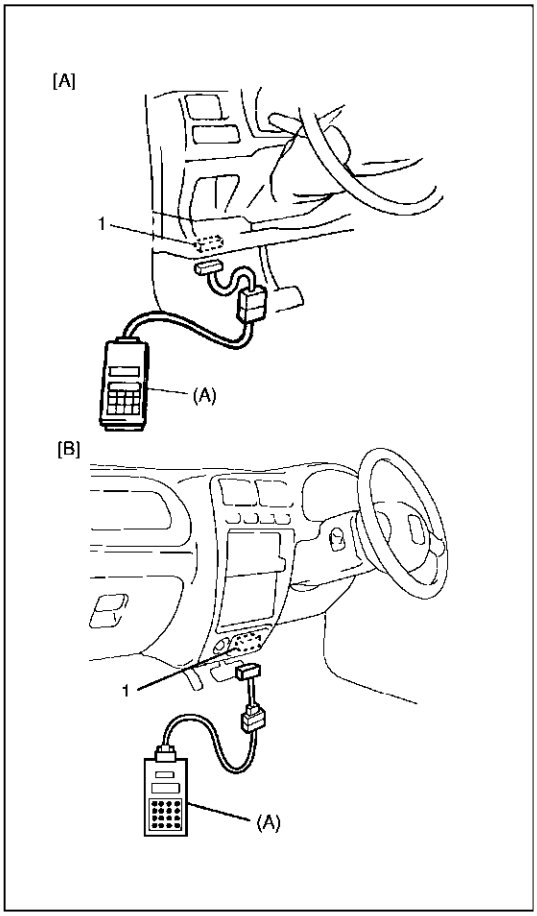
EXAMPLE : When driver air bag initiator circuit resistance high (DTC B1021) is set



[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 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.

[A]	For LH model
[B]	For RH model
1.	Data link connector (DLC)

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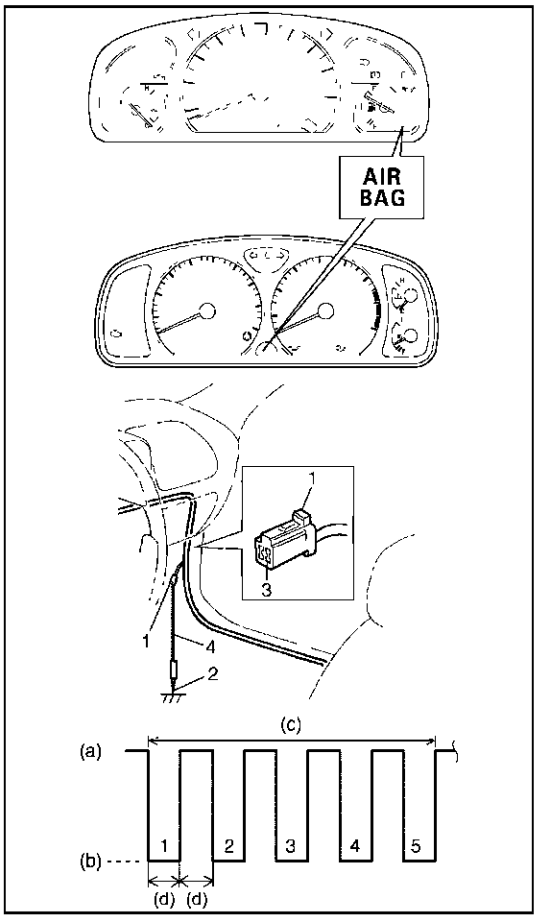

Not Using SUZUKI Scan Tool

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 and confirm that normal DTC (DTC 12) is displayed and not malfunction DTC.

NOTE:

If DTC 51 or DTC 71 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	
B1031	31		Power source voltage	Too high	
B1032	32			Too low	

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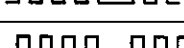
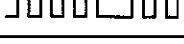
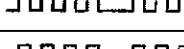
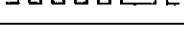
DTC	"AIR BAG" warning lamp flashing pattern		Diagnosis		
	NO.	MODE			
B1041	41		Driver pretensioner circuit	Resistance high	Diagnose trouble according to diagnostic flow table corresponding to each code No.
B1042	42			Resistance low	
B1043	43			Short to ground	
B1044	44			Short to power circuit	
B1045	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	
B1061	61		"AIR BAG" warning lamp circuit	Circuit failure	
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.**

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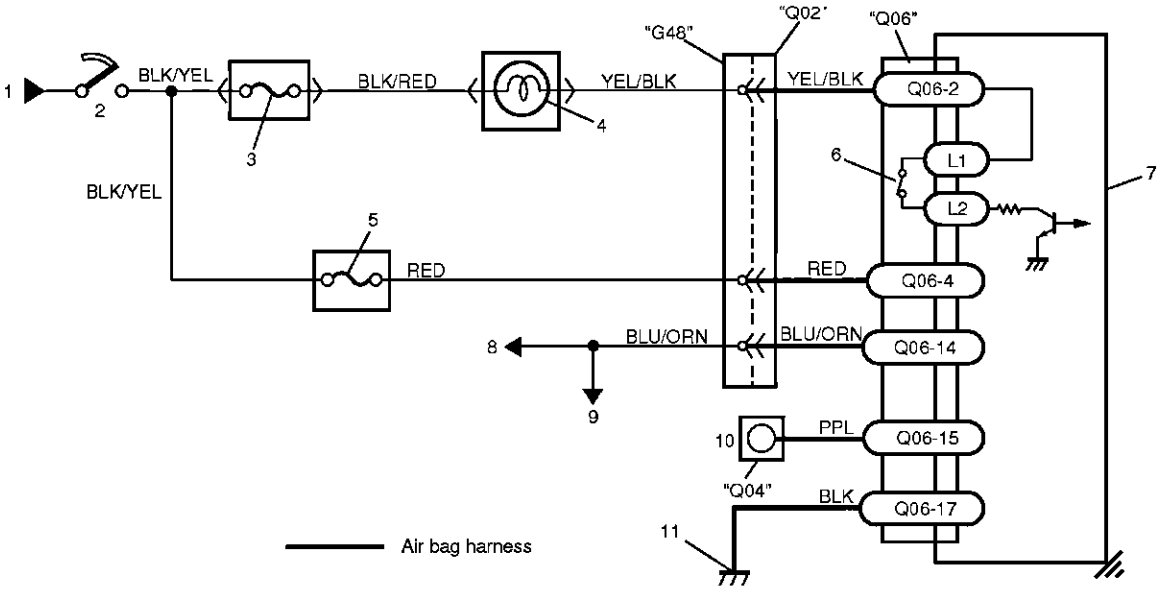
"AIR BAG" WARNING LAMP CIRCUIT TORUBLE DIAGNOSIS TABLE

WIRING DIAGRAM



1. From main fuse	5. "AIR BAG" fuse	9. To ECM, P/S control module and ABS control module (if equipped)
2. Ignition switch	6. Connection detection pin	10 "AIR BAG" monitor coupler
3. "METER" fuse	7. SDM	11 Ground for air bag system
4. "AIR BAG" warning lamp in combination meter	8. To DLC	[A]: Air bag harness

CAUTION:

- **Be sure to perform AIR BAG DIAGNOSTIC SYSTEM CHECK before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a specified digital multimeter (Refer to 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.**

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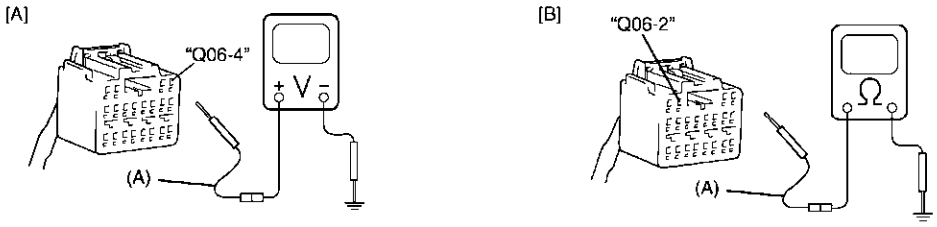
"AIR BAG" WARNING LAMP COMES ON STEADY WITHOUT FLASHING

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.	"RED" wire short to ground. After repair, replace "AIR BAG" fuse.
2	1) Disconnect SDM connector "Q06". 2) Check proper connection to SDM at terminal "Q06-4". 3) If OK then check voltage between "Q06-4" terminal of SDM connector and body ground with ignition switch ON. Is it 8 V or more?	Go to step 3.	"RED" wire (between "AIR BAG" fuse and SDM connector) open "BLK/YEL" wire (between ignition switch and "AIR BAG" fuse) open or short to ground
3	1) Disconnect 16-pin connector from combination meter. Refer to COMBINATION METER in Section 8. 2) Check resistance between "Q06-2" terminal of SDM connector and body ground. Is resistance 1 MΩ or more?	Substitute a known-good SDM and recheck.	"YEL/BLK" 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 to confirm that the trouble has been corrected.**

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"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/YEL", "BLK/RED" wire or "IG METER" fuse open or short to ground
2	1) Disconnect SDM connector "Q06". 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 "Q06-2". 2) If OK, check voltage from "Q06-2" 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 "YEL/BLK" terminal for "AIR BAG" warning lamp and to SDM at terminal "Q06-2". 2) If OK, check resistance between "YEL/BLK" wire terminal of combination meter connector (16-pin connector) and "Q06-2" terminal of SDM connector. Is resistance 1 Ω or less?	Go to step 6.	Repair high resistance or open in "YEL/BLK" wire circuit (between combination meter and SDM).
6	1) Measure voltage from "Q06-2" terminal of SDM connector to body ground with ignition switch ON. Is it 0 V or more?	Repair short from "YEL/BLK" wire circuit (between combination meter and SDM) to power circuit.	Substitute a known-good SDM and recheck.

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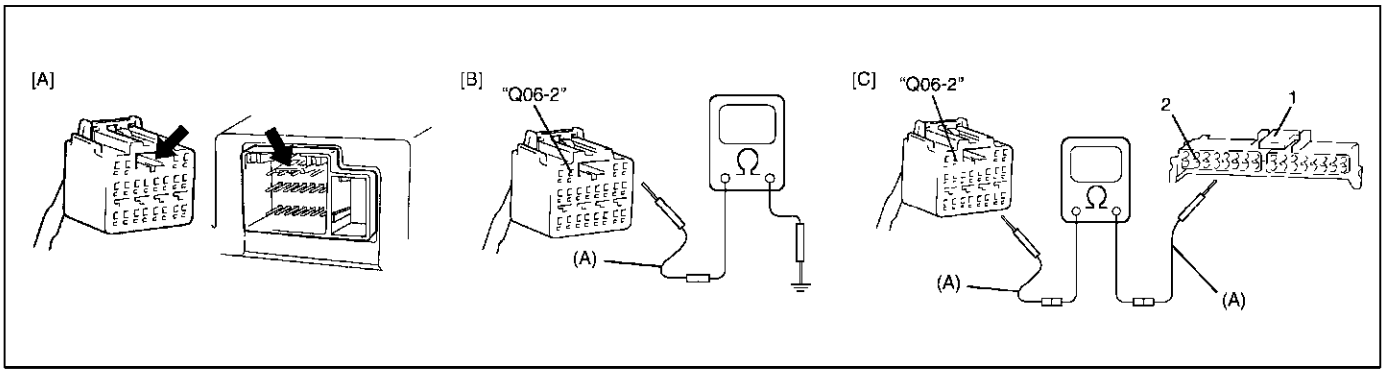

[A]. Fig. for STEP 2	1. 16-pin connector (for combination meter)
[B]: Fig. for STEP 3 and 5	2. "YEL/BLK" wire terminal
[C]: Fig. for STEP 4	

Special tool
(A) : 09932-76010

NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK to confirm that the trouble has been corrected.**

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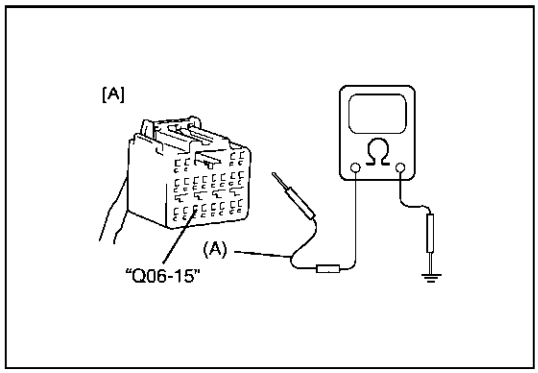
"AIR BAG" WARNING LAMP FLASHES

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 "Q04". 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 "Q06". 2) Measure resistance between "Q06-15" 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 to confirm that the trouble has been corrected.**

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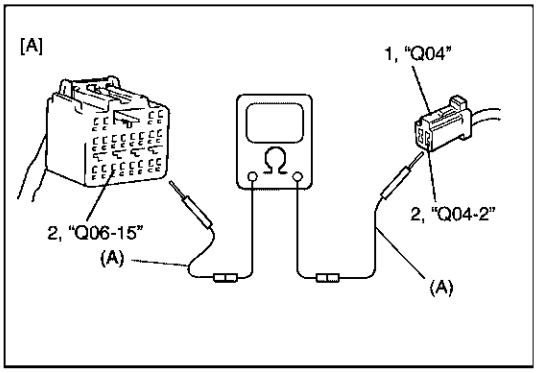
"AIR BAG" WARNING LAMP CAN NOT INDICATE FLASHING

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 "Q04" 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 "Q06" from SDM. 2) Check for proper connection at "PPL" wire ("Q06-15" terminal of SDM connector and "Q04-2" terminal of "AIR BAG" monitor coupler) terminals. 3) If OK then measure resistance between "Q06-15" terminal and "Q04-2" 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 to confirm that the trouble has been corrected.**

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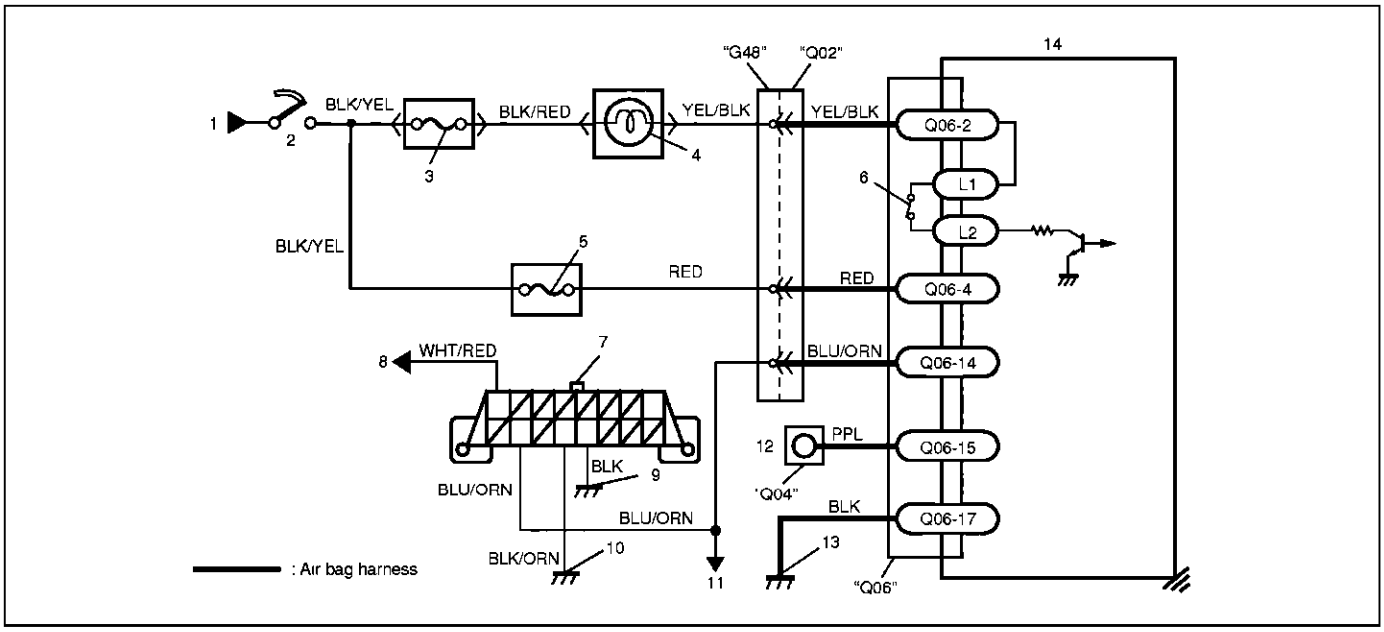
SDM SERIAL DATA CIRCUIT TORUBLE DIAGNOSIS TABLE

WIRING DIAGRAM



1. To main fuse box	6 Connection detection pin	11. To ECM, P/S control module and ABS control module (if equipped)
2. Ignition switch	7 Data link connector (DLC)	12. "AIR BAG" monitor coupler
3. "METER" fuse	8 To circuit fuse box	13. Ground for air bag system
4. "AIR BAG" warning lamp in combination meter	9 Ground on body	14. SDM
5. "AIR BAG" fuse	10. Ground on engine block	

CAUTION:

- **Be sure to perform AIR BAG DIAGNOSTIC SYSTEM CHECK before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a specified digital multimeter (Refer to 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 "BLU/ORN" 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.

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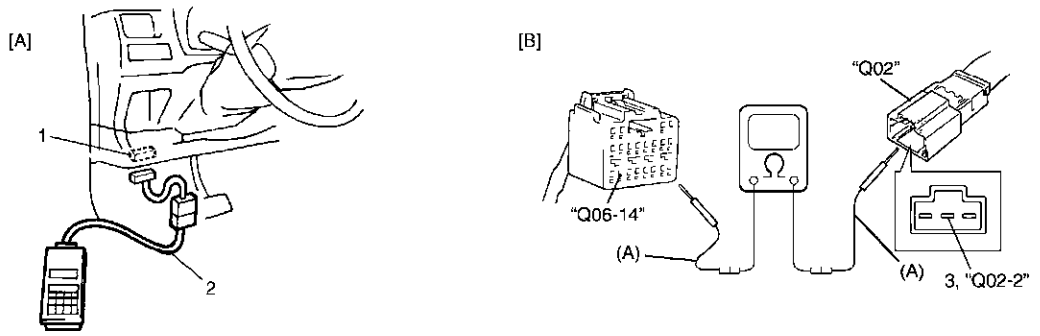
Step	Action	Yes	No
2	1) Check if communication is possible by trying communication with other control module (ECM, TCM (if equipped) or ABS control module (if equipped)). Is it possible to communicate with other control module?	Go to step 3.	Repair open in common section of serial data circuit ("BLU/ORN" wire circuit) used by all controllers or short to ground or power circuit which has occurred some-where in serial data circuit ("BLU/ORN" wire circuit).
3	1) With ignition switch OFF, disconnect SDM connector "Q06" and "Q02" connector. 2) Check proper connection at "Q02-2" ("BLU/ORN" wire) terminal for DLC. 3) If OK, then check resistance between "Q02-2" ("BLU/ORN" wire) terminal and "Q06-14" ("BLU/ORN" wire) terminal of SDM connector. Is resistance 1 Ω or less?	Substitute a known-good SDM and recheck.	Repair high resistance or open in "BLU/ORN" wire circuit (in air bag harness).



[A]: Fig. for STEP 1	1. DLC	3. "BLU/ORN" 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 to confirm that the trouble has been corrected.**

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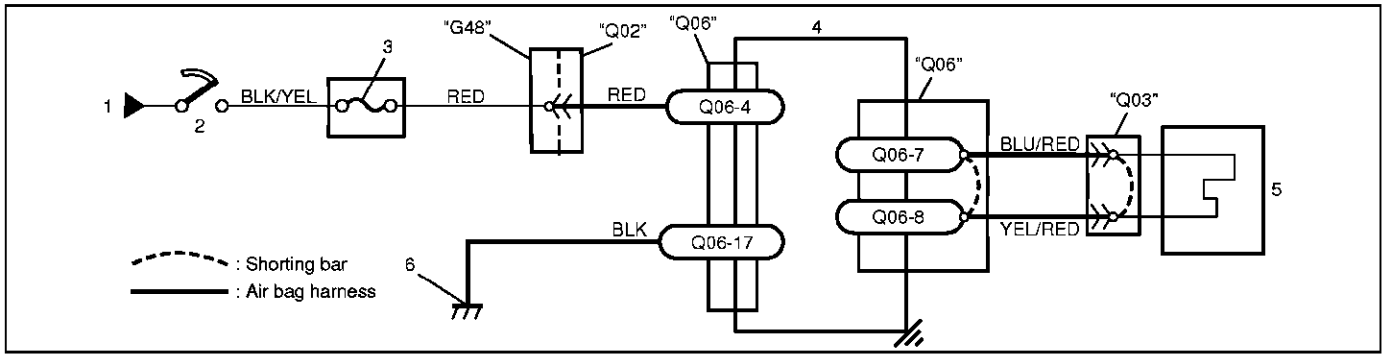
DTC B1015 - PASSENGER AIR BAG INITIATOR CIRCUIT RESISTANCE HIGH
DTC B1016 - PASSENGER AIR BAG INITIATOR CIRCUIT RESISTANCE LOW
DTC B1018 - PASSENGER AIR BAG INITIATOR CIRCUIT SHORT TO GROUND
DTC B1019 - PASSENGER AIR BAG INITIATOR CIRCUIT SHORT TO POWER CIRCUIT

WIRING DIAGRAM



1. From main fuse	3 "AIR BAG" fuse	5. Passenger air bag (inflator) module
2. Ignition switch	4 SDM	6. Ground for air bag system

CAUTION:

- **Be sure to perform AIR BAG DIAGNOSTIC SYSTEM CHECK before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a specified digital multimeter (Refer to SPECIAL TOOL in this section.) along with a correct terminal adaptor 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)

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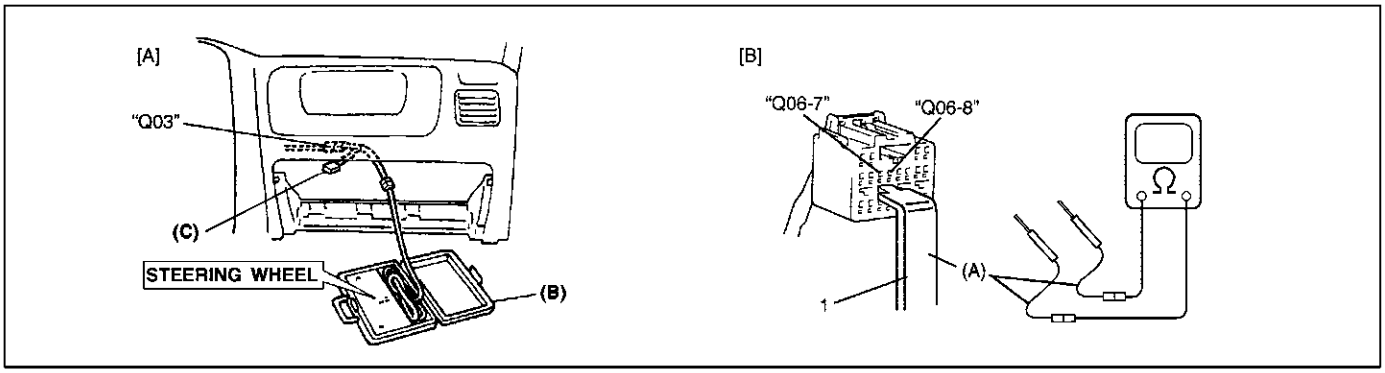
DIAGNOSTIC FLOW TABLE

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 "Q03" behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in "Q03" connector. 3) If OK then connect special tools (B) and (C) to passenger air bag (inflator) module connector "Q03". With ignition switch ON, is DTC B1015 current?	Go to step 2.	Ignition switch OFF. Replace passenger air bag (inflator) module (Refer to PASSENGER AIR BAG (INFLATOR) MODULE in this section).
2	1) With ignition switch OFF, disconnect SDM connector. 2) Check proper connection to SDM at terminals "Q06-7" and "Q06-8". 3) If OK, release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 4) Measure resistance between "Q06-7" and "Q06-8" terminals with special tools (B) and (C) connected to "Q03" connector. Is resistance 4.5 Ω or less?	Substitute a known-good SDM and recheck.	Repair high resistance or open in "YEL/RED" or "BLU/RED" wire circuit.



[A]: Fig. for STEP 1 and 2
[B]: Fig. for STEP 2

Special tool
(A) : 09932-76010
(B) : 09932-75010
(C) : 09932-78340

NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to DTC CLEARANCE), if any.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK to confirm that the trouble has been corrected.**

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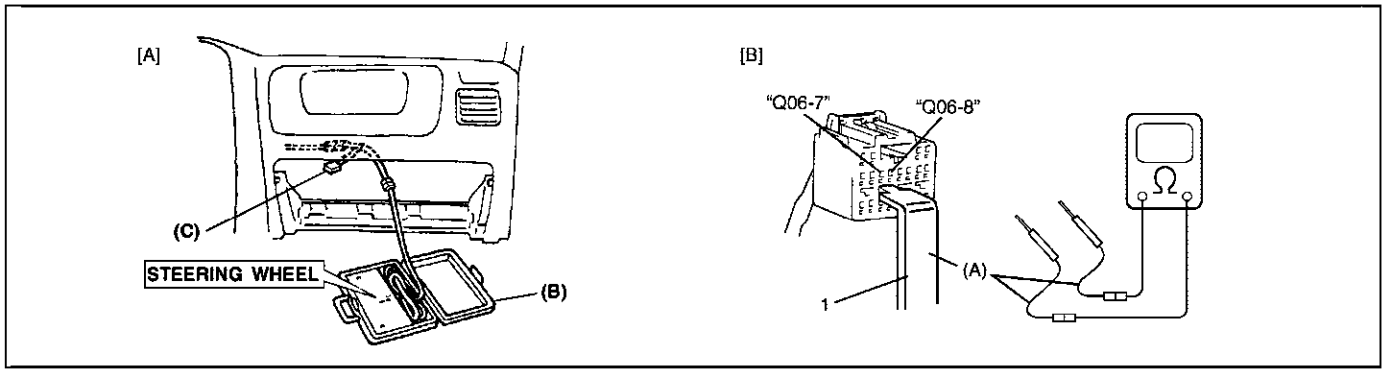
DTC B1016 : PASSENGER AIR BAG INITIATOR CIRCUIT RESISTANCE LOW

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector "Q03" behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in "Q03" connector. 3) If OK then connect special tools (B) and (C) to passenger air bag (inflator) module connector "Q03". With ignition switch ON, is DTC B1016 current?	Go to step 2.	Ignition switch OFF. Replace passenger air bag (inflator) module (Refer to PASSENGER AIR BAG (INFLATOR) MODULE in this section).
2	1) With ignition switch OFF, disconnect SDM connector. 2) Check proper connection to SDM at terminals "Q06-7" and "Q06-8". 3) If OK, release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 4) Measure resistance between "Q06-7" and "Q06-8" terminals with special tools (B) and (C) connected to "Q03" connector. Is resistance 1.4 Ω or more?	Substitute a known-good SDM and recheck.	Repair short from "YEL/RED" wire circuit to "BLU/RED" wire circuit or from "YEL/RED" or "BLU/RED" wire circuit to other wire circuit.



[A]: Fig. for STEP 1 and 2
[B]: Fig. for STEP 2

Special tool
(A) : 09932-76010
(B) : 09932-75010
(C) : 09932-78340

NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to DTC CLEARANCE), if any.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK to confirm that the trouble has been corrected.**

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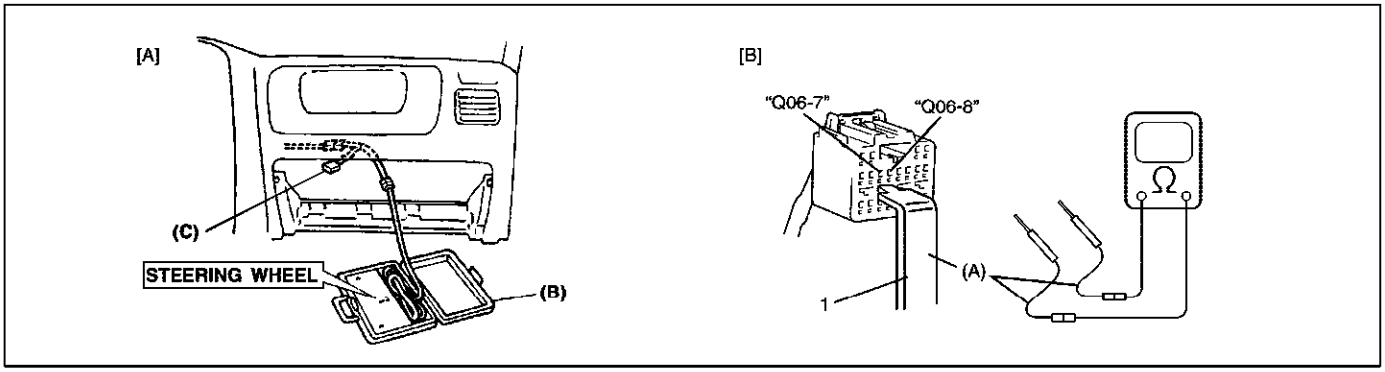
DTC B1018 :PASSENGER AIR BAG INITIATOR CIRCUIT SHORT TO GROUND

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector "Q03" behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in "Q03" connector. 3) If OK then connect special tools (B) and (C) to passenger air bag (inflator) module connector "Q03". With ignition switch ON, is DTC B1018 current?	Go to step 2.	Ignition switch OFF. Replace passenger air bag (inflator) module (Refer to PASSENGER AIR BAG (INFLATOR) MODULE in this section).
2	1) With ignition switch OFF, disconnect special tools (B) and (C) from "Q03" connector and SDM connector from SDM respectively. 2) Release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 3) Measure resistance between "Q06-7" terminals and body ground. Is resistance 1 MΩ or more?	Go to step 3.	Repair short from "BLU/RED" wire circuit to ground.
3	1) Measure resistance between "Q06-8" terminal and body ground. Is resistance 1 MΩ or more?	Substitute a known-good SDM and recheck.	Repair short from "YEL/RED" wire circuit to ground.



[A]: Fig. for STEP 1, 2 and 3
[B]: Fig. for STEP 2 and 3

Special tool
(A) : 09932-76010
(B) : 09932-75010
(C) : 09932-78340

NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to DTC CLEARANCE), if any.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK to confirm that the trouble has been corrected.**

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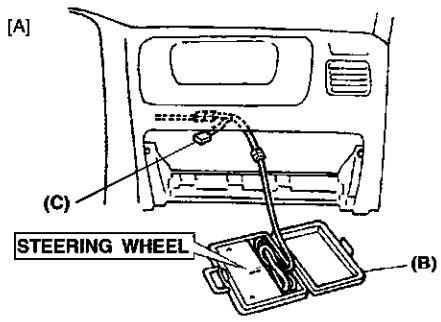
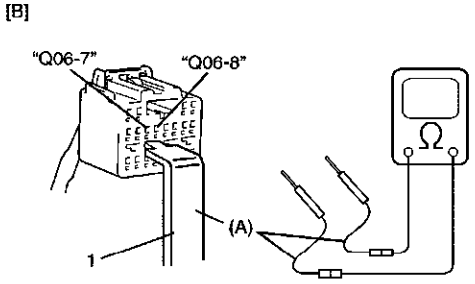
DTC B1019 : PASSENGER AIR BAG INITIATOR CIRCUIT SHORT TO POWER CIRCUIT

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector "Q03" behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in "Q03" connector. 3) If OK then connect special tools (B) and (C) to passenger air bag (inflator) module connector "Q03". With ignition switch ON, is DTC B1019 current?	Go to step 2.	Ignition switch OFF. Replace passenger air bag (inflator) module (Refer to PASSENGER AIR BAG (INFLATOR) MODULE in this section).
2	1) With ignition switch OFF, disconnect special tools (B) and (C) from "Q03" connector and SDM connector from SDM respectively. 2) Release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 3) Measure voltage from "Q06-7" terminal to body ground. With ignition switch ON, is voltage 1 V or less?	Go to step 3.	Repair short from "BLU/RED" wire circuit to power circuit.
3	1) Measure voltage from "Q06-8" 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/RED" wire circuit to power circuit.





[A]: Fig. for STEP 1, 2 and 3
[B]: Fig. for STEP 2 and 3

Special tool
(A) : 09932-76010
(B) : 09932-75010
(C) : 09932-78340

NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to DTC CLEARANCE), if any.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK to confirm that the trouble has been corrected.**

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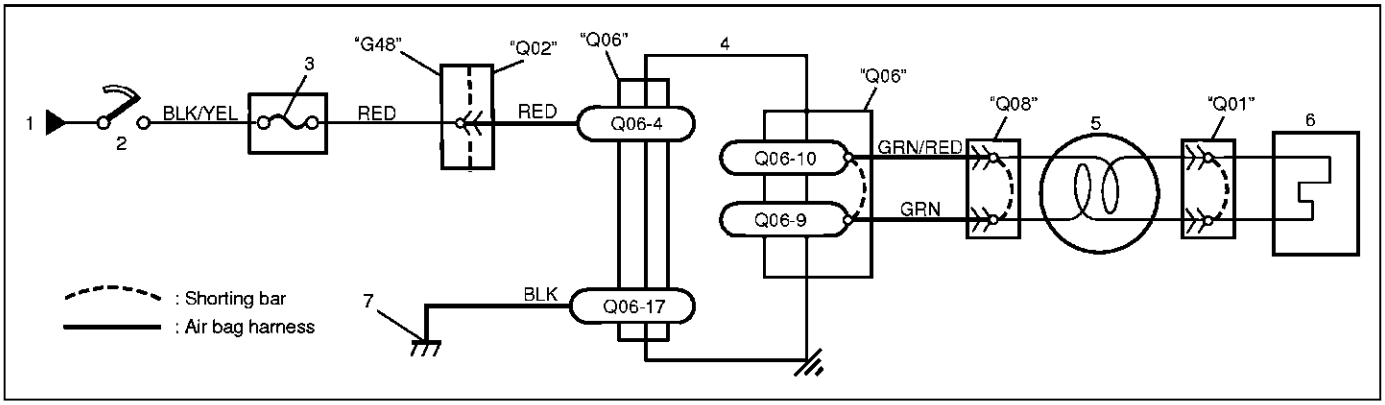
DTC B1021 – DRIVER AIR BAG INITIATOR CIRCUIT RESISTANCE HIGH
DTC B1022 – DRIVER AIR BAG INITIATOR CIRCUIT RESISTANCE LOW
DTC B1024 – DRIVER AIR BAG INITIATOR CIRCUIT SHORT TO GROUND
DTC B1025 – DRIVER AIR BAG INITIATOR CIRCUIT SHORT TO POWER CIRCUIT

WIRING DIAGRAM



1. From main fuse	4. SDM	7 Ground for air bag system
2. Ignition switch	5. Contact coil assembly	
3. "AIR BAG" fuse	6. Driver air bag (inflator) module	

CAUTION:

- **Be sure to perform AIR BAG DIAGNOSTIC SYSTEM CHECK before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a specified digital multimeter (Refer to 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 in air bag harness.
STEP 3 : Check whether malfunction is in contact coil or driver air bag (inflator) module.

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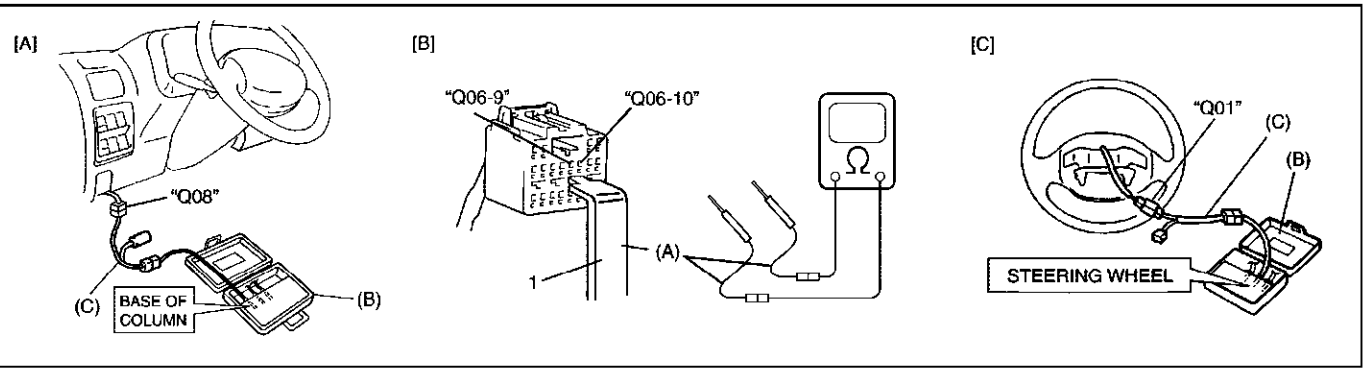
DIAGNOSTIC FLOW TABLE

DTC B1021 : DRIVER AIR BAG INITIATOR CIRCUIT RESISTANCE HIGH

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect contact coil connector "Q08" located near the base of the steering column. 2) Check proper connection to contact coil at terminals in connect coil connector "Q08". 3) If OK then connect special tools (B) and (C) to contact coil connector "Q08". With ignition switch ON, is DTC B1021 current?	Go to step 2.	Go to step 3.
2	1) With ignition switch OFF, disconnect SDM connector "Q06". 2) Check proper connection to SDM at terminals "Q06-9" and "Q06-10". 3) If OK, release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 4) Measure resistance between "Q06-9" and "Q06-10" terminals with connected special tools (B) and (C) to "Q08" 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 "Q08" connector then reconnect contact coil connector "Q08" located near the base of the steering column as it was. 2) Remove driver air bag (inflator) module from steering wheel (Refer to DRIVER AIR BAG (INFLATOR) MODULE in Section 3C). 3) Check proper connection to driver air bag (inflator) module at terminals in "Q01" connector. 4) If OK then connect special tools (B) and (C) to "Q01" connector. With ignition switch ON, is DTC B1021 current?	Ignition switch OFF. Replace contact coil assembly (Refer to COMBINATION SWITCH/CONTACT COIL AND COMBINATION SWITCH ASSEMBLY in Section 3C).	Ignition switch OFF. Replace driver air bag (inflator) module (Refer 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

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NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to DTC CLEARANCE), if any.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK 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 "Q08" located near the base of the steering column. 2) Check proper connection to contact coil at terminals in "Q08" connector. 3) If OK then connect special tools (B) and (C) to contact coil connector "Q08". With ignition switch ON, is DTC B1022 current?	Go to step 2.	Go to step 3.
2	1) With ignition switch OFF, disconnect SDM connector "Q06". 2) Check proper connection to SDM at terminals "Q06-9" and "Q06-10". 3) If OK, release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 4) Measure resistance between "Q06-9" and "Q06-10" terminals with connected special tools (B) and (C) to "Q08" 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 "Q08" connector then reconnect contact coil connector "Q08" located near the base of the steering column as it was. 2) Remove driver air bag (inflator) module from steering wheel (Refer to DRIVER AIR BAG (INFLATOR) MODULE in Section 3C). 3) Check proper connection to driver air bag (inflator) module at terminals in "Q01" connector. 4) If OK then connect special tools (B) and (C) to "Q01" connector. With ignition switch ON, is DTC B1022 current?	Ignition switch OFF. Replace contact coil assembly (Refer to COMBINATION SWITCH/ CONTACT COIL AND COMBINATION SWITCH ASSEMBLY in Section 3C).	Ignition switch OFF. Replace driver air bag (inflator) module (Refer to DRIVER AIR BAG (INFLATOR) MODULE in Section 3C).

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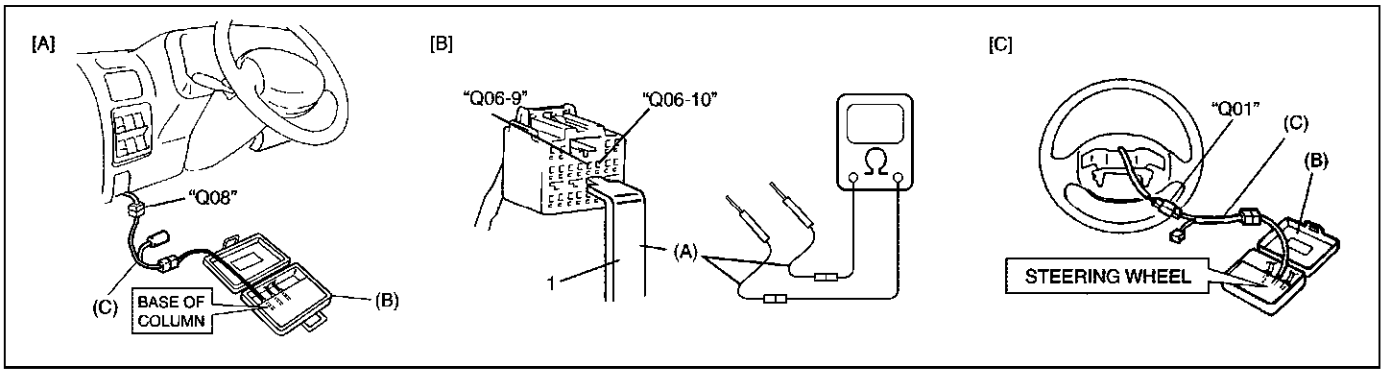

[A]: Fig. for STEP 1 and 2
[B]: Fig. for STEP 2
[C]: Fig. for STEP 3

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 (Refer to DTC CLEARANCE), if any.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK to confirm that the trouble has been corrected.**

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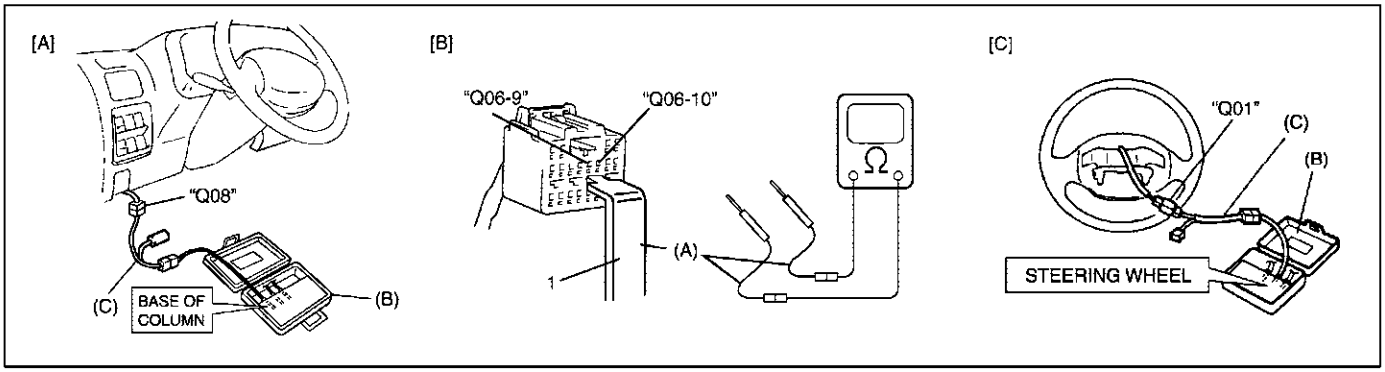
DTC B1024 : DRIVER AIR BAG INITIATOR CIRCUIT SHORT TO GROUND

Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect contact coil connector "Q08" located near the base of the steering column. 2) Check proper connection to contact coil at terminals in "Q08" connector. 3) If OK then connect special tools (B) and (C) to contact coil connector "Q08". With ignition switch ON, is DTC B1024 current?	Go to step 2.	Go to step 3.
2	1) With ignition switch OFF, disconnect special tools (B) and (C) from "Q08" connector and SDM connector "Q06" from SDM respectively. 2) Release shorting bar in SDM connector inserting release tool (1) in cluded in special tool (A). 3) Measure resistance between "Q06-9" terminal and body ground and between "Q06-10" 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 "Q08" connector then reconnect contact coil connector "Q08" located near the base of the steering column as it was. 2) Remove driver air bag (inflator) module from steering wheel (Refer to DRIVER AIR BAG (INFLATOR) MODULE in Section 3C). 3) Check proper connection to driver air bag (inflator) module at terminals in "Q01" connector. 4) If OK then connect special tools (B) and (C) to "Q01" connector. With ignition switch ON, is DTC B1024 current?	Ignition switch OFF. Replace contact coil assembly (Refer to COMBINATION SWITCH/CONTACT COIL AND COMBINATION SWITCH ASSEMBLY in Section 3C).	Ignition switch OFF. Replace driver air bag (inflator) module (Refer 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

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NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to DTC CLEARANCE), if any.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK 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 "Q08" located near the base of the steering column. 2) Check proper connection to contact coil at terminals in contact coil connector "Q08". 3) If OK then connect special tools (B) and (C) to contact coil connector "Q08". With ignition switch ON, is DTC B1025 current?	Go to step 2.	Go to step 3.
2	1) With ignition switch OFF, disconnect special tools (B) and (C) from "Q08" connector and SDM connector "Q06" from SDM respectively. 2) Release shorting bar in SDM connector inserting release tool (1) included in special tool (A). 3) Measure voltage from "Q06-9" terminal to body ground and from "Q06-10" 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 "Q08" connector then reconnect contact coil connector "Q08" located near the base of the steering column as it was. 2) Remove driver air bag (inflator) module from steering wheel (Refer to DRIVER AIR BAG (INFLATOR) MODULE in Section 3C). 3) Check proper connection to driver air bag (inflator) module at terminals in "Q01" connector. 4) If OK then connect special tools (B) and (C) to "Q01" connector. With ignition switch ON, is DTC B1025 current?	Ignition switch OFF. Replace contact coil assembly (Refer to COMBINATION SWITCH/ CONTACT COIL AND COMBINATION SWITCH ASSEMBLY in Section 3C).	Ignition switch OFF. Replace driver air bag (inflator) module (Refer to DRIVER AIR BAG (INFLATOR) MODULE in Section 3C).

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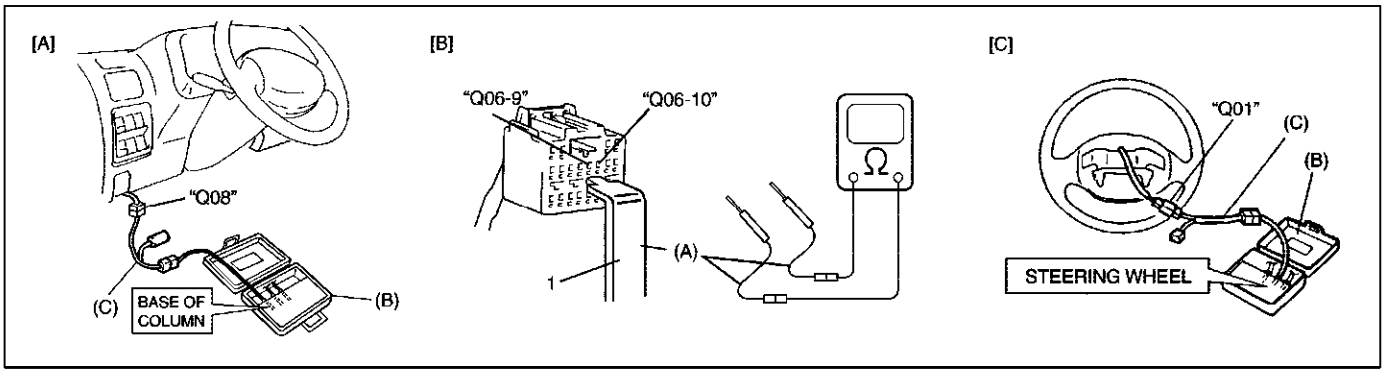

[A]. Fig. for STEP 1 and 2
[B]: Fig. for STEP 2
[C]: Fig. for STEP 3

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 (Refer to DTC CLEARANCE), if any.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK to confirm that the trouble has been corrected.**

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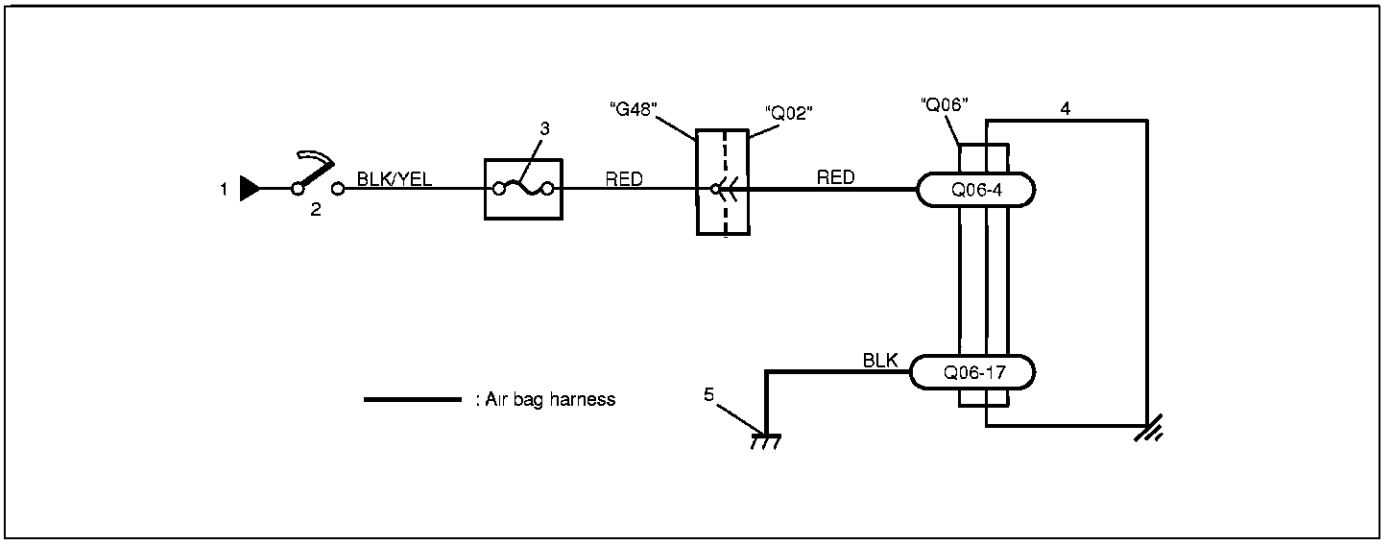
DTC B1031 – POWER SOURCE VOLTAGE HIGH
DTC B1032 – POWER SOURCE VOLTAGE LOW

WIRING DIAGRAM



1. From main fuse	3. "AIR BAG" fuse	5 Ground for air bag system
2. Ignition switch	4. SDM	

CAUTION:

- **Be sure to perform AIR BAG DIAGNOSTIC SYSTEM CHECK before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a specified digital multimeter (Refer to 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 B1031 : The power source voltage to SDM is above specified value for specified time.
DTC B1032 : The power source voltage is below specified value for specified time.

TABLE TEST DESCRIPTION :

DTC B1031

STEP 1 : Check if voltage applied to SDM is within normal range.
STEP 2 : Check if DTC B1031 still exists.

DTC B1032

STEP 1 : Check if voltage applied to SDM is within normal range.
STEP 2 : Check if DTC B1032 still exists.

DIAGNOSTIC FLOW TABLE

DTC B1031 : POWER SOURCE VOLTAGE HIGH

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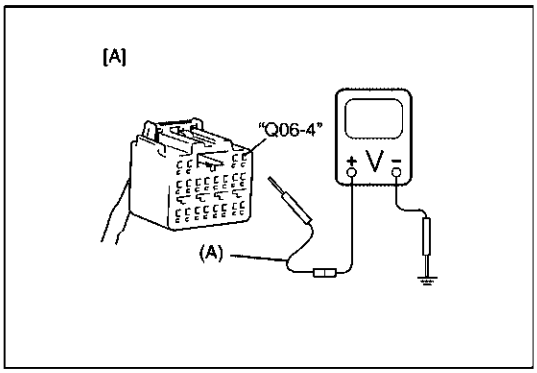
Step	Action	Yes	No
1	1) With ignition switch OFF, disconnect SDM connector "Q06". 2) Check proper connection to SDM at "Q06-4" terminal. 3) If OK then ignition switch ON, and then check voltage from "Q06-4" terminal on SDM connector to body ground. Is voltage 14 V or less?	Go to step 2.	Check Charging System and repair as necessary. (Refer to "DIAGNOSIS" in Section 6H)
2	1) With ignition switch OFF, reconnect SDM connector "Q06". 2) With ignition switch ON, is DTC B1031 current?	Substitute a known-good SDM and recheck.	Check Charging System and repair as necessary. (Refer to "DIAGNOSIS" in Section 6H)



[A]: Fig. for STEP 1

Special tool
(A): 09932-76010

NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to DTC CLEARANCE), if any.**
- **Repeat "AIR BAG DIAGNOSTIC SYSTEM CHECK" to confirm that the trouble has been corrected.**

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. (Refer to DIAGNOSIS in Section 6H)
2	1) With ignition switch OFF, disconnect SDM connector "Q06". 2) Check proper connection to SDM at "Q06-4" terminal. 3) If OK then ignition switch ON, and then check voltage from "Q06-4" terminal on SDM connector to body ground. Is voltage 8 V or more?	Go to step 4.	Go to step 3.

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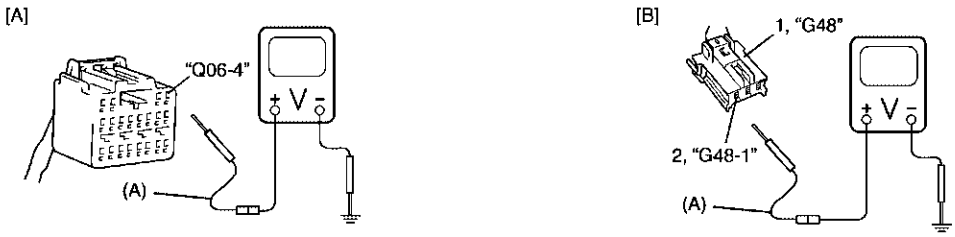
Step	Action	Yes	No
3	1) With ignition switch OFF, disconnect "G48" connector. 2) Check proper connection at "G48-1" ("RED" wire) terminal in "G48" connector. 3) If OK then ignition switch ON, and then check voltage from "G48-1" ("RED" wire) terminal in "G48" connector on instrument panel harness to body ground. Is voltage 8 V or more?	Repair poor connection, high resistance in "RED" or "BLK/YEL" circuit of air bag harness or "AIR BAG" fuse.	Possibly faulty points are as follows. Check each of them and repair as necessary. • Circuit from battery to "G48" connector • Charging System (Refer to DIAGNOSIS in Section 6H)
4	1) With ignition switch OFF, reconnect SDM connector. With ignition switch ON, is DTC B1032 current?	Substitute a known-good SDM and recheck.	Check Charging System and repair as necessary. (Refer to DIAGNOSIS in Section 6H)



[A]: Fig. for STEP 2	1 Instrument panel harness side connector
[B]: Fig. for STEP 3	2 "RED" 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.**
- **Clear diagnostic trouble codes (Refer to DTC CLEARANCE), if any.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK to confirm that the trouble has been corrected.**

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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

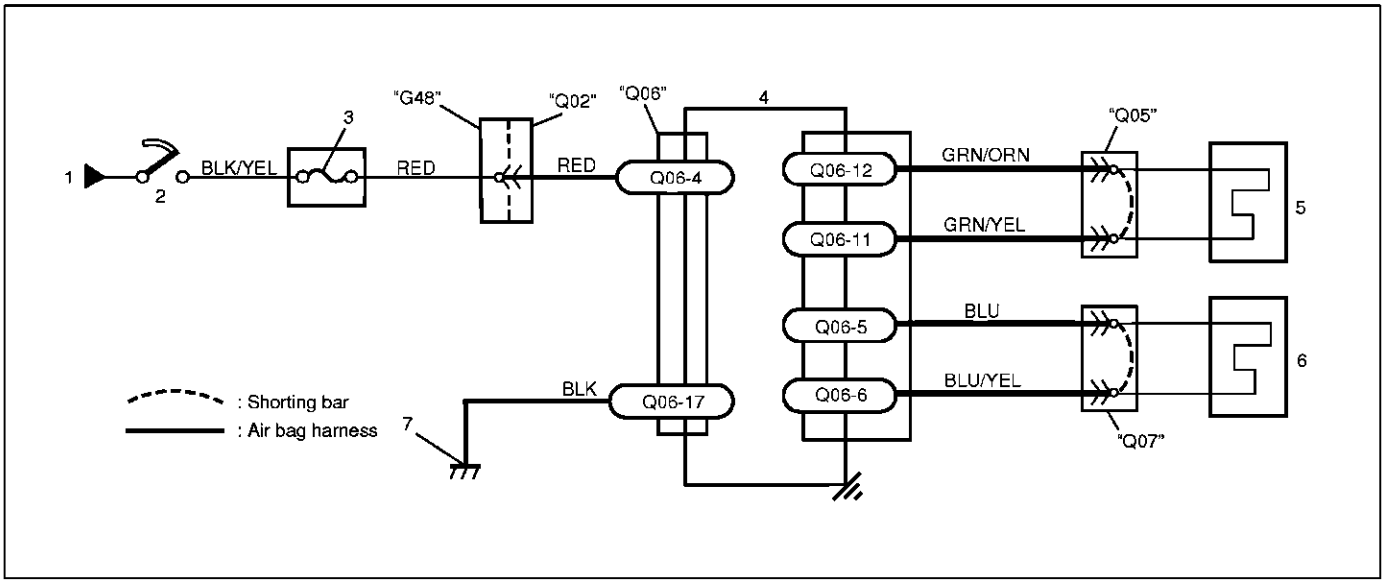
DTC B1045 – PASSENGER PRETENSIONER INITIATOR CIRCUIT RESISTANCE HIGH

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	
3. "AIR BAG" fuse	6. Passenger seat belt pretensioner	

CAUTION:

- **Be sure to perform AIR BAG DIAGNOSTIC SYSTEM CHECK before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a specified digital multimeter (Refer to 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.**

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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 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 center pillar lower garnish of applicable side then disconnect seat belt pretensioner connector (“Q05” or “Q07”). 2) Check proper connection to applicable seat belt pretensioner at terminals in “Q05” or “Q07” connector. 3) If OK then connect special tools (A), (B) and (C) to seat belt pretensioner connector (“Q05” or “Q07”). With ignition switch ON, is DTC B1041 or B1045 still current?	Go to step 2.	Ignition switch OFF. Replace seat belt pretensioner (Refer to Section 10).
2	1) With ignition switch OFF, disconnect SDM connector “Q06”. 2) Check proper connection to SDM at terminals “Q06-11” and “Q06-12” or “Q06-6” and “Q06-5”. 3) If OK then measure resistance between “Q06-11” and “Q06-12” terminals or “Q06-6” and “Q06-5” terminals with connected special tools (A), (B) and (C) to applicable seat belt pretensioner connector (“Q05” or “Q07”). Is resistance 4.5 Ω or less?	Substitute a known-good SDM and recheck.	DTC B1041 : Repair high resistance or open in “GRN/ORN” or “GRN/YEL” wire circuit. DTC B1045 : Repair high resistance or open in “BLU/YEL” or “BLU” wire circuit.

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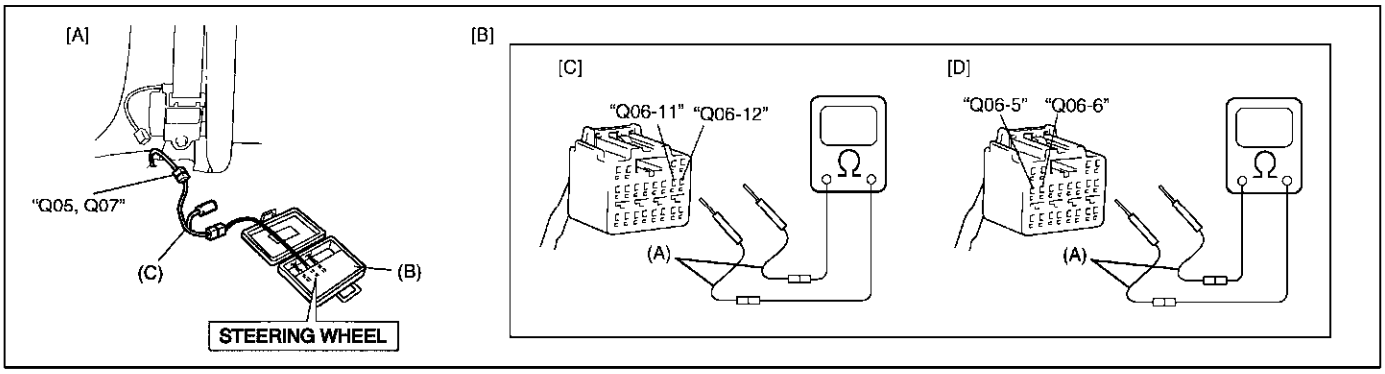

[A]. Fig. for STEP 1 and 2	[C] For DTC B1041
[B]: Fig. for STEP 2	[D] For DTC B1045

Special tool
(A) : 09932-76010
(B) : 09932-75010
(C) : 09932-78340

NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to DTC CLEARANCE), if any.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK 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 center pillar inner garnish of applicable side then disconnect seat belt pretensioner connector ("Q05" or "Q07"). 2) Check proper connection to applicable seat belt pretensioner at terminals in "Q05" or "Q07" connector. 3) If OK then connect special tools (A), (B) and (C) to seat belt pretensioner connector ("Q05" or "Q07"). With ignition switch ON, is DTC B1042 or B1046 still current?	Go to step 2.	Ignition switch OFF. Replace seat belt pretensioner (Refer to Section 10).

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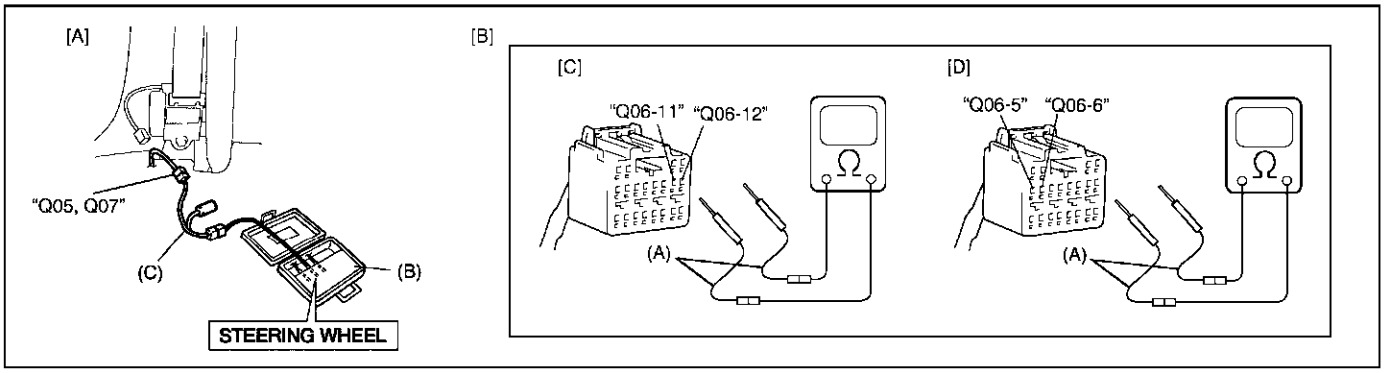
Step	Action	Yes	No
2	1) With ignition switch OFF, disconnect SDM connector "Q06". 2) Check proper connection to SDM at terminals "Q06-11" and "Q06-12" or "Q06-6" and "Q06-5". 3) If OK then measure resistance between "Q06-11" and "Q06-12" terminals or "Q06-06" and "Q06-05" terminals with connected special tools (A), (B) and (C) to applicable seat belt pretensioner connector ("Q05" or "Q07"). Is resistance 1.4 Ω or more?	Substitute a known-good SDM and recheck.	DTC B1042 : Repair short from "GRN/ORN" wire circuit to "GRN/YEL" wire circuit or from "GRN/ORN" or "GRN/YEL" wire circuit to other wire circuit. DTC B1046 : Repair short from "BLU/YEL" wire circuit to "BLU" wire circuit or from "BLU/YEL" or "BLU" wire circuit to other wire circuit.



[A]: Fig. for STEP 1 and 2	[C]: For DTC B1042
[B]: Fig. for STEP 2	[D]: For DTC B1046

Special tool
(A) : 09932-76010
(B) : 09932-75010
(C) : 09932-78340

NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to DTC CLEARANCE), if any.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK to confirm that the trouble has been corrected.**

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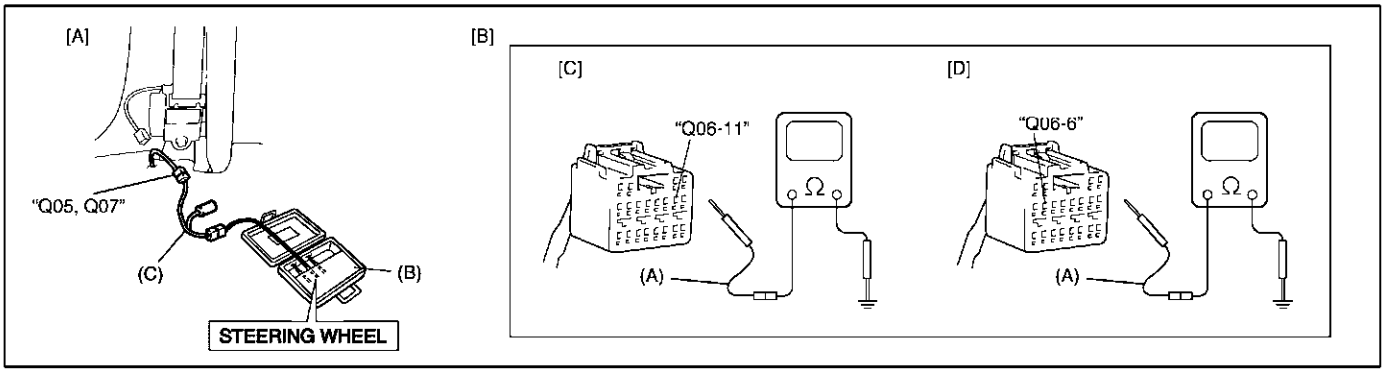
DTC B1043 : DRIVER PRETENSIONER INITIATOR CIRCUIT SHORT TO GROUND
DTC B1047 : PASSENGER PRETENSIONER INITIATOR CIRCUIT SHORT TO GROUND

Step	Action	Yes	No
1	1) With ignition switch OFF, remove center pillar inner garnish of applicable side then disconnect seat belt pretensioner connector ("Q05" or "Q07"). 2) Check proper connection to applicable seat belt pretensioner at terminals in "Q05" or "Q07" connector. 3) If OK then connect special tools (A), (B) and (C) to seat belt pretensioner connector ("Q05" or "Q07"). With ignition switch ON, is DTC B1043 or B1047 still current?	Go to step 2.	Ignition switch OFF. Replace seat belt pretensioner (Refer to Section 10).
2	1) With ignition switch OFF, disconnect special tools (A), (B) and (C) from "Q05" or "Q07" connector and SDM connector "Q06" from SDM respectively. 2) Measure resistance between "Q06-11" or "Q06-6" and body ground. Is resistance 1 MΩ or more?	Substitute a known-good SDM and recheck.	DTC B1043 : Repair short "GRN/YEL" or "GRN/ORN" wire circuit to ground. DTC B1047 : Repair short from "BLU/YEL" or "BLU" wire circuit to ground.



[A]: Fig. for STEP 1 and 2	[C] For DTC B1043
[B]: Fig. for STEP 2	[D] For DTC B1047

Special tool
(A) : 09932-76010
(B) : 09932-75010
(C) : 09932-78340

NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to DTC CLEARANCE), if any.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK to confirm that the trouble has been corrected.**

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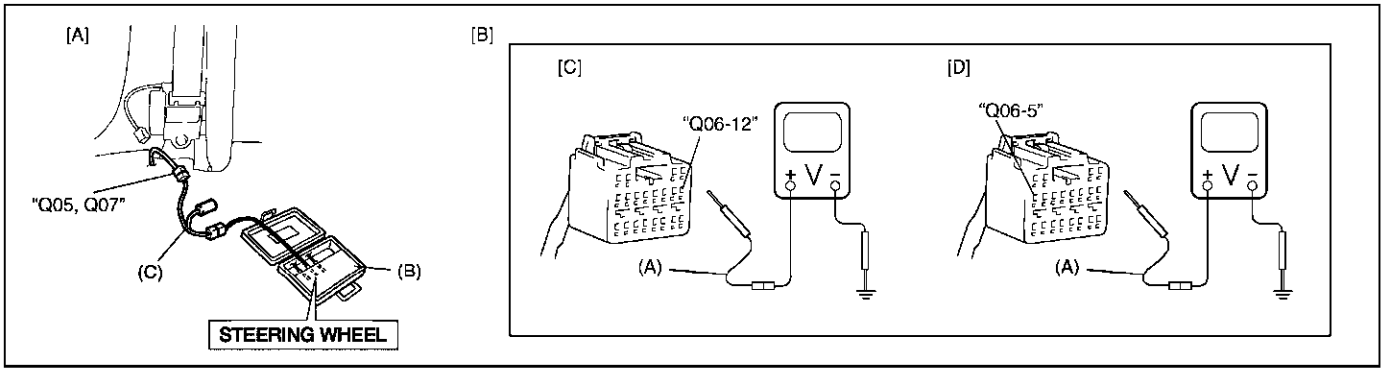
DTC B1044 : DRIVER PRETENSIONER INITIATOR CIRCUIT TO POWER CIRCUIT
DTC B1048 : PASSENGER PRETENSIONER INITIATOR CIRCUIT TO POWER CIRCUIT

Step	Action	Yes	No
1	1) With ignition switch OFF, remove center pillar inner garnish of applicable side then disconnect seat belt pretensioner connector ("Q05" or "Q07"). 2) Check proper connection to applicable seat belt pretensioner at terminals in "Q05" or "Q07" connector. 3) If OK then connect special tools (A), (B) and (C) to seat belt pretensioner ("Q05" or "Q07"). With ignition switch ON, is DTC B1044 or B1048 still current?	Go to step 2.	Ignition switch OFF. Replace seat belt pretensioner (Refer to Section 10).
2	1) With ignition switch OFF, disconnect special tools (A), (B) and (C) from "Q05" or "Q07" connector and SDM connector "Q06" from SDM respectively. 2) Measure voltage from "Q06-12" or "Q06-5" terminal to body ground. With ignition switch ON, is voltage 1 V or less?	Substitute a known-good SDM and recheck.	DTC B1044 : Repair short "GRN/ORN" or "GRN/YEL" wire circuit to power circuit. DTC B1048 : Repair short from "BLU/YEL" or "BLU" wire circuit to power circuit.



[A]: Fig. for STEP 1 and 2	[C]: For DTC B1044
[B]: Fig. for STEP 2	[D]: For DTC B1048

Special tool
(A) : 09932-76010
(B) : 09932-75010
(C) : 09932-78340

NOTE:

Upon completion of inspection and repair work, perform the following items.
- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Clear diagnostic trouble codes (Refer to DTC CLEARANCE), if any.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK to confirm that the trouble has been corrected.**

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DTC B1051 – FRONTAL CRASH DETECTED (SYSTEM ACTIVATION COMMAND OUTPUTTED)

CAUTION:
Be sure to perform AIR BAG DIAGNOSTIC SYSTEM CHECK 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.

NOTE:
Before executing items in this table, be sure to perform AIR BAG DIAGNOSTIC SYSTEM CHECK.

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 to confirm that the trouble has been corrected.**

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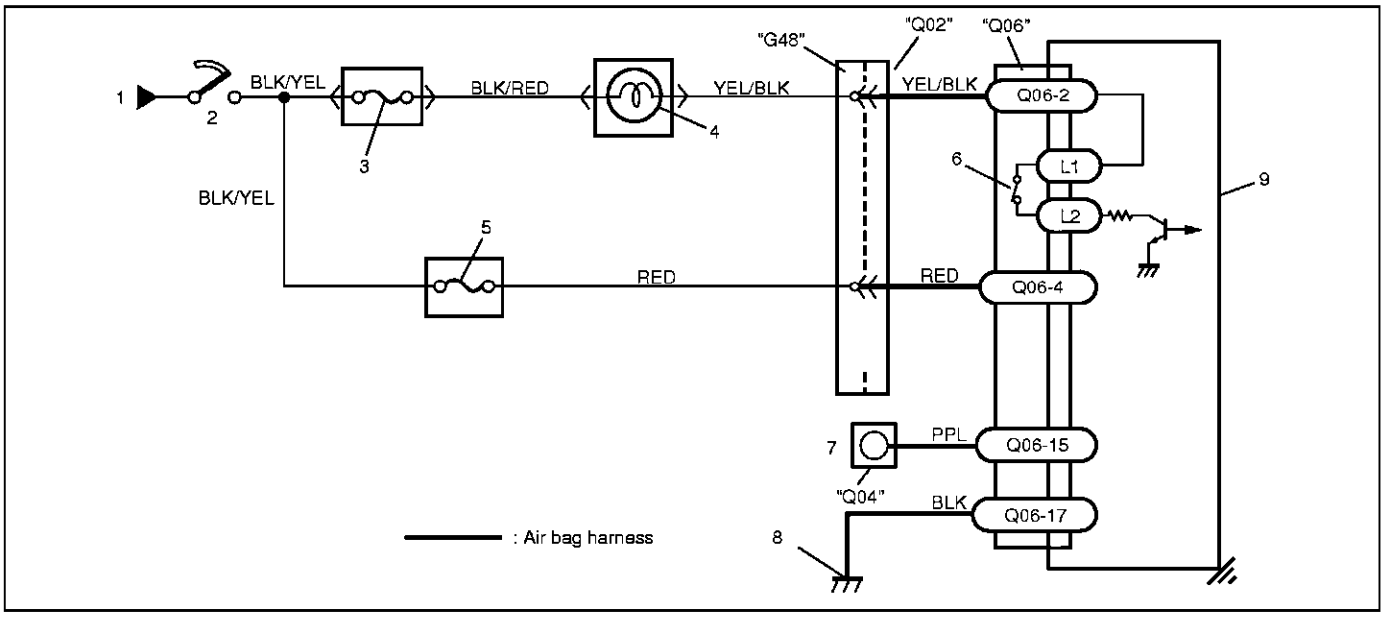
DTC B1061– "AIR BAG" WARNING LAMP CIRCUIT FAILURE

WIRING DIAGRAM



1. To main fuse box	4. "AIR BAG" warning lamp in combination meter	7. "AIR BAG" monitor coupler
2. Ignition switch	5. "AIR BAG" fuse	8. Ground for air bag system
3 "METER" fuse	6. Connection detection pin	9. SDM

CAUTION:

- **Be sure to perform AIR BAG DIAGNOSTIC SYSTEM CHECK before starting diagnosis according to flow table.**
- **When measurement of resistance or voltage is required in this table, use a specified digital multimeter (Refer to 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 voltage at the "AIR BAG" warning lamp circuit terminal "Q06-2" does not match the commanded state of the warning lamp driver for specified time.

TABLE TEST DESCRIPTION :

STEP 1 : Check that "AIR BAG" warning lamp operation.
STEP 2 : Check that DTC has been set due to failure of SDM.

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DIAGNOSTIC FLOW TABLE :

Step	Action	Yes	No
1	1) This DTC is set when there is a trouble in "AIR BAG" warning lamp circuit. Failure to properly perform AIR BAG DIAGNOSTIC SYSTEM CHECK may also result in mis-diagnosis. Therefore, check "AIR BAG" warning lamp circuit again according to AIR BAG DIAGNOSTIC SYSTEM CHECK in this section. Is "AIR BAG" warning lamp circuit in good condition?	Go to step 2.	Repair "AIR BAG" warning lamp circuit.
	1) Clear DTC (Refer to DTC CLEARANCE in this section). 2) Check DTC (Refer to DTC CHECK in this section). Is DTC B1061 set?	Substitute a known-good SDM and recheck.	Recheck air bag system. Refer to AIR BAG DIAGNOSTIC SYSTEM CHECK in this section.

NOTE:

Upon completion of inspection and repair work, perform the following items.

- **Reconnect all air bag system components, ensure all components are properly mounted.**
- **Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK to confirm that the trouble has been corrected.**

DTC 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 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 according to Removal and Installation procedure in this section.
3) Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK.

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 before starting diagnosis according to the following diagnostic procedures.

1) Ignition switch OFF.
2) Replace SDM according to Removal and Installation procedure in this section.
3) Repeat AIR BAG DIAGNOSTIC SYSTEM CHECK.

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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., SDM is dropped, air bag (inflator) module is dropped from a height of 90 cm (3 ft) or more, seat belt pretensioner (retractor assembly) is dropped from a height of 30 cm (1 ft) or more), never attempt disassembly or repair but replace it with a new one.
- When using electric welding, be sure to disconnect air bag (inflator) module connectors (driver and passenger) and seat belt pretensioner connectors (driver and passenger) respectively.
- When applying paint around the air bag system related parts, use care so that the harness or connector will not be exposed to the paint mist.
- Never expose air bag system component parts directly to hot air (drying or baking the vehicle after painting) or flames.

WARNING:

When performing service on or around air bag system components or air bag wiring, follow the procedures listed in the following pages to temporarily disable the air bag system.
Failure to follow procedures could result in possible air bag system activation, personal injury or unneeded air bag system repairs.

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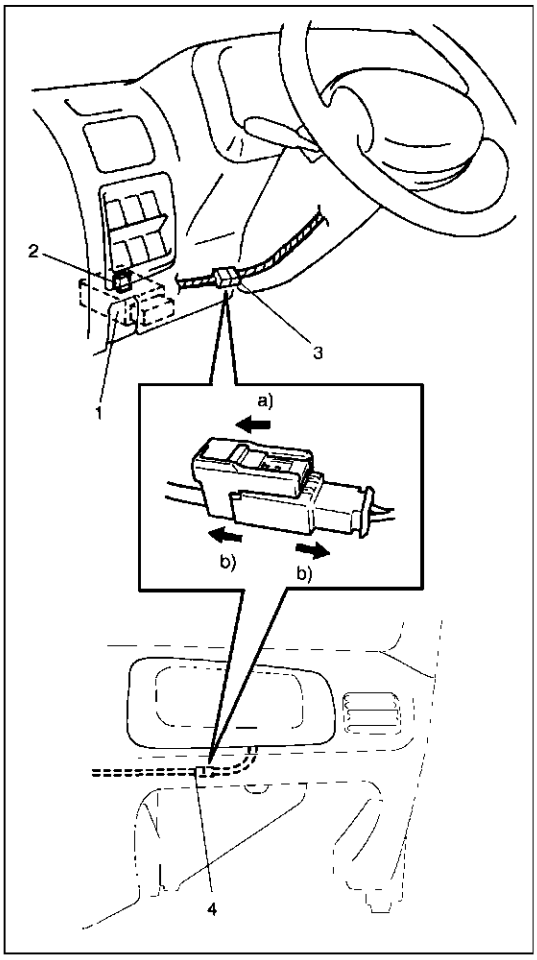
DISABLING AIR BAG SYSTEM

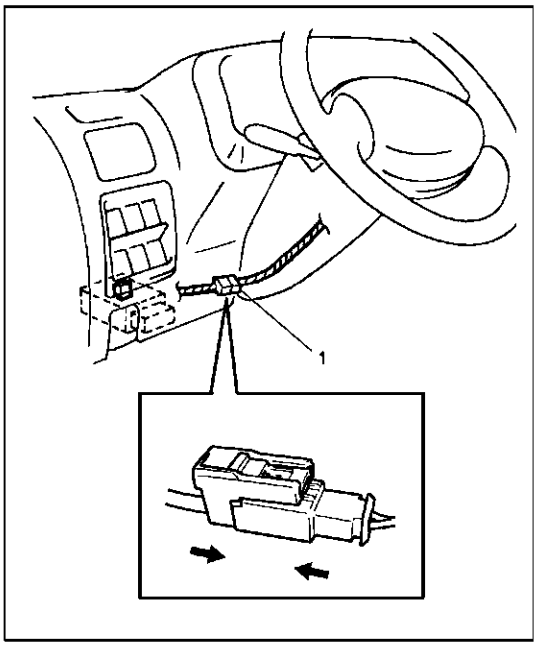


1) Turn steering wheel so that vehicle's wheels (front tires) and pointing straight ahead.
2) Turn ignition switch to "LOCK" position and remove key.
3) Remove "AIR BAG" fuse (2) from fuse box (1).
4) Disconnect Yellow connector (3) of contact coil and combination switch assembly.
   a) Release locking 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.

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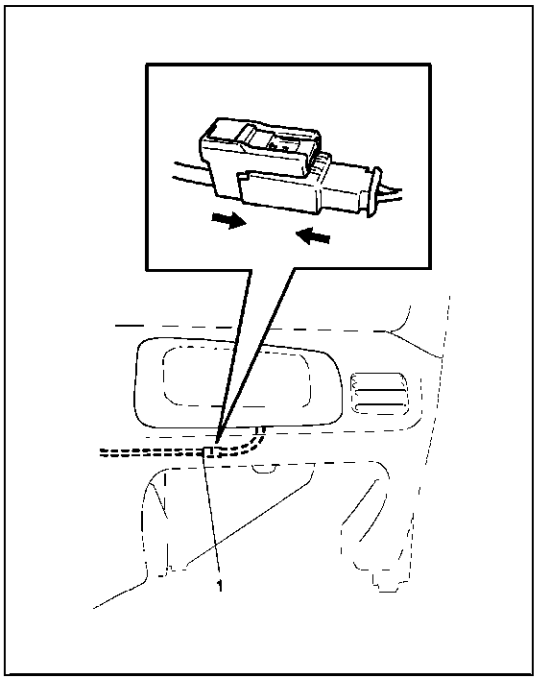
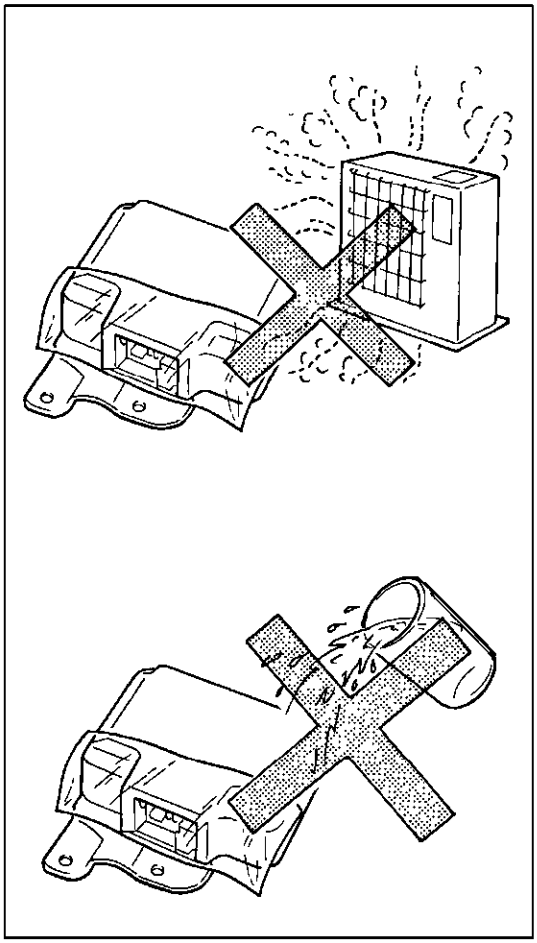


3) Connect Yellow connector (1) of passenger air bag (inflator) module by pushing connector till click is heard from it.
4) Install glove box.
5) Install "AIR BAG" fuse to fuse box.
6) Turn ignition switch to ON position and verify that "AIR BAG" warning lamp flashes 6 times and then turns OFF.
   If it does not operate as described, perform "AIR BAG DIAGNOSTIC SYSTEM CHECK".

HANDLING AND STORAGE

SDM



WARNING:
Never power up air bag system when SDM is not rigidly attached to the vehicle. Otherwise, personal injury may result.

CAUTION:
After detecting one time of such collision as to meet deployment conditions, the SDM must not be used. Refer to "AIR BAG DIAGNOSTIC SYSTEM CHECK" when checking the SDM.

- Never attempt disassembly of SDM.
- When storing SDM, select a place where neither high temperature nor high humidity is anticipated and oil, water and dust are kept off.
- If SDM has been dropped, replace it with a new one.
- If installation part of SDM was damaged, repair that part completely before reinstallation.
- All SDM and mounting bracket fasteners must be carefully torqued and the arrow must be pointed toward the front of the vehicle to ensure proper operation of the air bag system.

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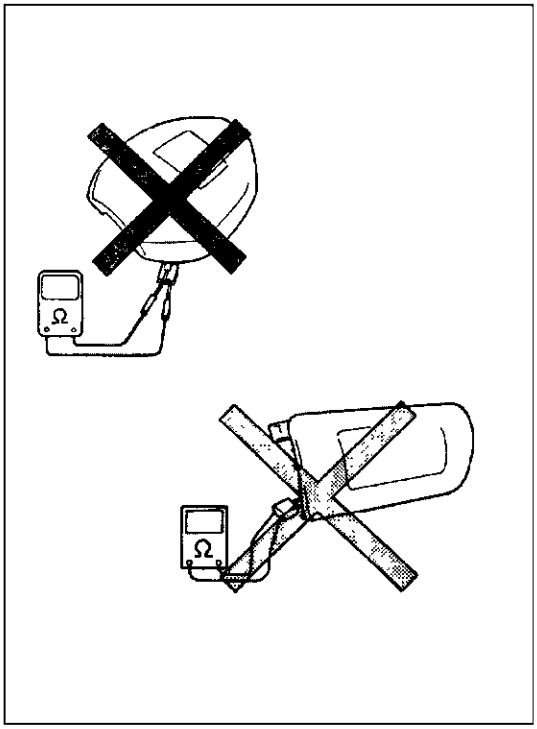
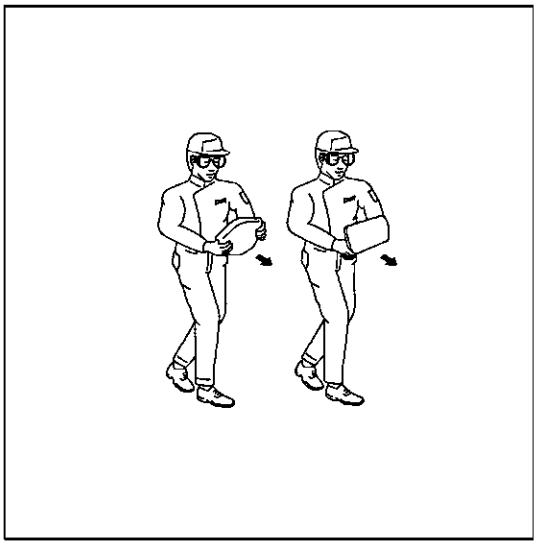
LIVE (UNDEPLOYED) AIR BAG (INFLATOR) MODULES

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.

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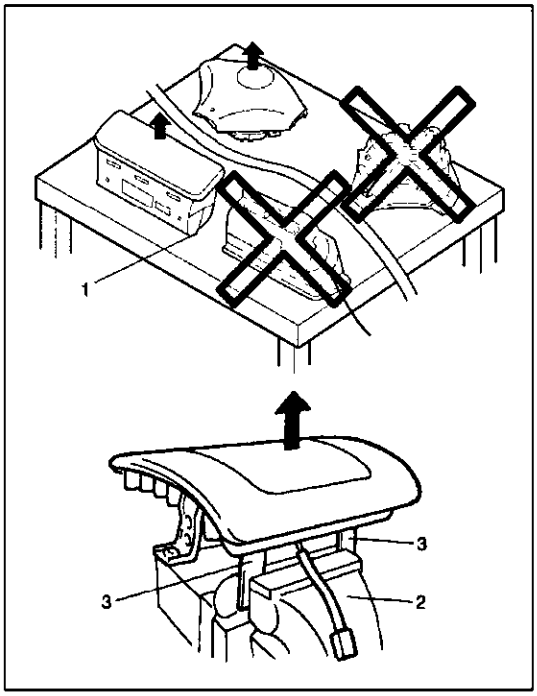
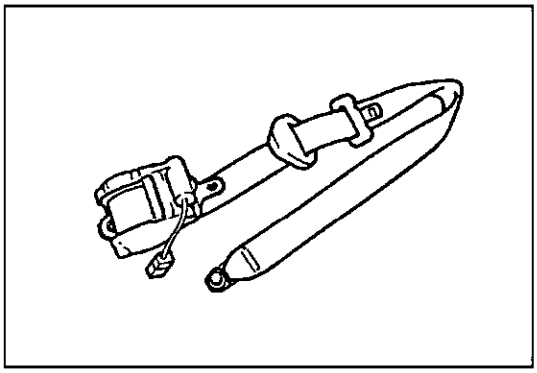


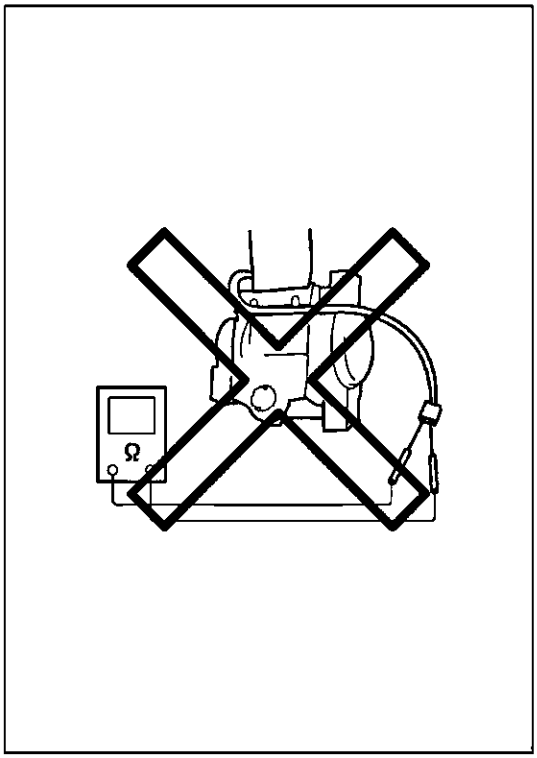
WARNING:

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 (1) is retracted into the retractor assembly (2) quickly.
Note, therefore, that if they activate accidentally, the seat belt pretensioners and other object(s) around them may be thrown through the air.



WARNING:

Never attempt to measure the resistance of the seat belt pretensioners. It is very dangerous as the electric current from the tester may activate pretensioner.

- Never attempt to disassemble the seat belt pretensioners (retractor assembly).
- If any abnormality is found, be sure to replace it with new one as an assembly.
- When an abnormality is noted as existing in the live (inactivated) seat belt pretensioner, be sure to activate it before discarding it.
- When grease, cleaning agent oil, water, etc., got on the seat belt pretensioners (retractor assembly), wipe it off immediately with a dry cloth.
- If seat belt pretensioner was dropped from a height of 30 cm (1 ft) or more, it should be replaced with a new one as an assembly.

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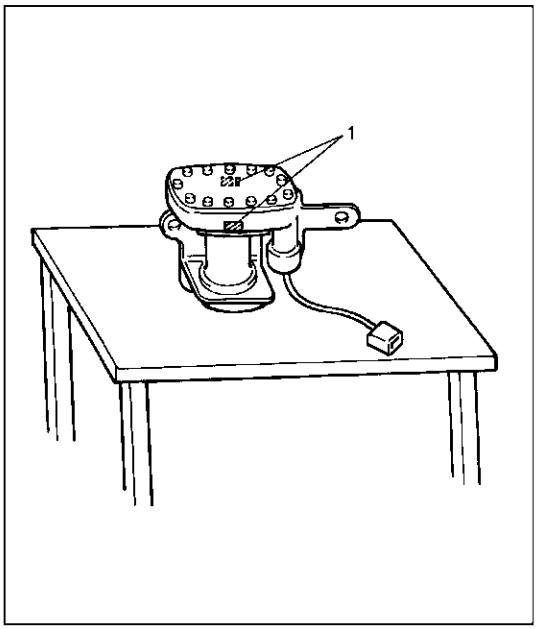

WARNING:

- **For handling and storage of a live seat belt pretensioner, select a place where the ambient temperature below 65°C (150°F), without high humidity and away from electric noise.**
- **Never carry the seat belt pretensioner by the wire or connector of the pretensioner.**
- **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.

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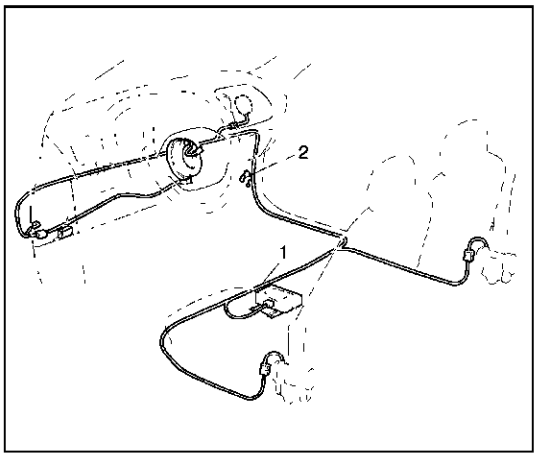
AIR BAG WIRE HARNESS AND CONNECTOR



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 points (2) are clean and grounds are securely fastened for optimum metal-to-metal contact. Poor grounding can cause intermittent problems that are difficult to diagnose.

DISPOSAL

Do not dispose of the live (undeployed) air bag (inflator) modules and the live (inactivated) seat belt pretensioners. When disposal is necessary, be sure to deploy/activate the air bag and seat belt pretensioner according to deployment/activation procedure described in "AIR BAG (INFLATOR) MODULE AND SEAT BELT PRETENSIONER DISPOSAL".

WARNING:

Failure to follow proper air bag (inflator) module and seat belt pretensioner disposal procedures can result in air bag deployment and pretensioner activation which could cause personal injury. Undeployed air bag (inflator) module and inactivated seat belt pretensioner must not be disposed of through normal refuse channels.

The undeployed air bag (inflator) module and inactivated seat belt pretensioner contain substances that can cause severe illness or personal injury if the sealed container is damaged during disposal.

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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**
- **Proper operation of the air bag system requires that any repairs to the vehicle structure return it to its original production configuration.**

CAUTION:

After detecting one time of such collision as to meet deployment conditions, the SDM must not be used. Refer to "AIR BAG DIAGNOSTIC SYSTEM CHECK" when checking the SDM.

ACCIDENT WITH DEPLOYMENT/ACTIVATION - COMPONENT REPLACEMENT

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 (1) and shaft joints
  - Check for length, damage and bend according to "CHECKING STEERING COLUMN FOR ACCIDENT DAMAGE" in Section 3C.

If any faulty condition is found in above checks, replace faulty part.

- Steering column bracket (2) and capsules (3)
  - Check for damage and bent.

If any faulty condition is found in above checks, replace faulty part.

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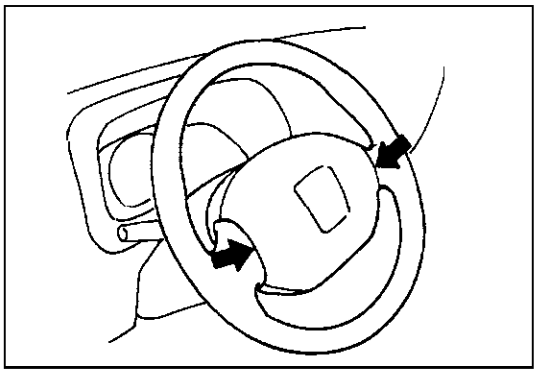
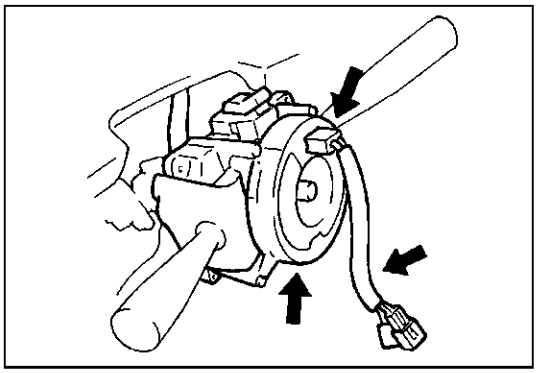


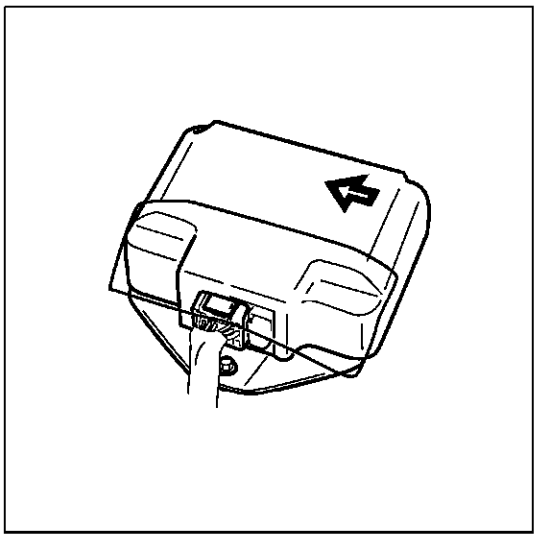
- Steering wheel and driver air bag (inflator) module
  - Check for damage or air bag (inflator) module fitness.
  - Check trim cover (pad surface) for cracks.
  - Check wire harness and connector for damage or tightness.

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.

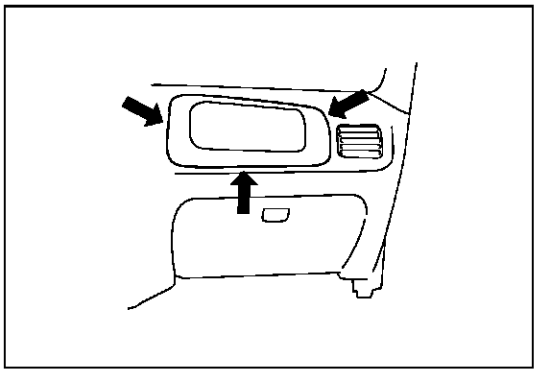


- SDM and SDM plate
  - Check for external damage such as deformation, scratch, crack, peeled paint, etc.
  - Check that SDM cannot be installed properly due to a cause in itself. (There is a gap between SDM and SDM plate, or it cannot be fixed securely.)
  - Check that connector or lead wire of SDM 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 (Refer 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.

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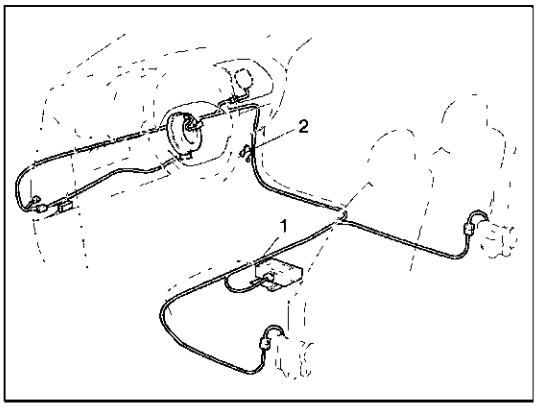
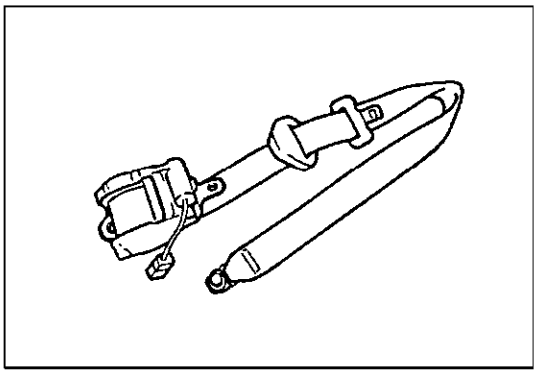


- Air bag wire harness and connections
  - Check for damages, deformities or poor connections. (Refer to "INTERMITTENTS AND POOR CONNECTIONS" in this section.)
  - Check wire harness clamps for tightness.

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.

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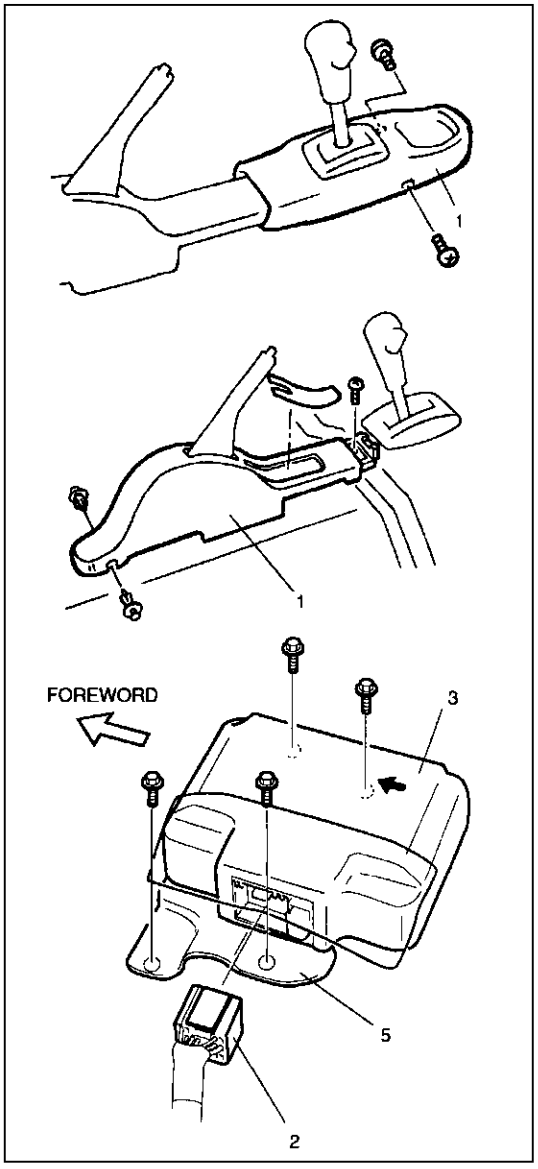
SDM

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. Refer to "DISABLING AIR BAG SYSTEM" of "SERVICE PRECAUTIONS" in this section.
3) Remove center console boxes (1) by removing screws and clips.
4) Disconnect SDM connector (2) from SDM (3).
5) Remove SDM (3) (with SDM plate (5)) as an assembly from vehicle.

CAUTION:
Do not separate SDM (3) and SDM plate (5).

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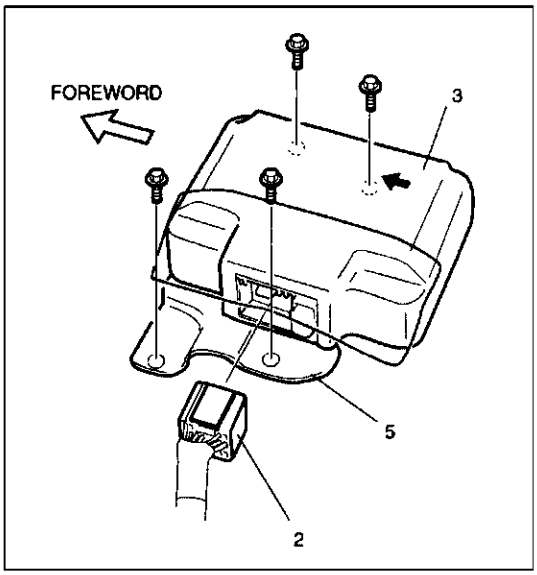
INSPECTION

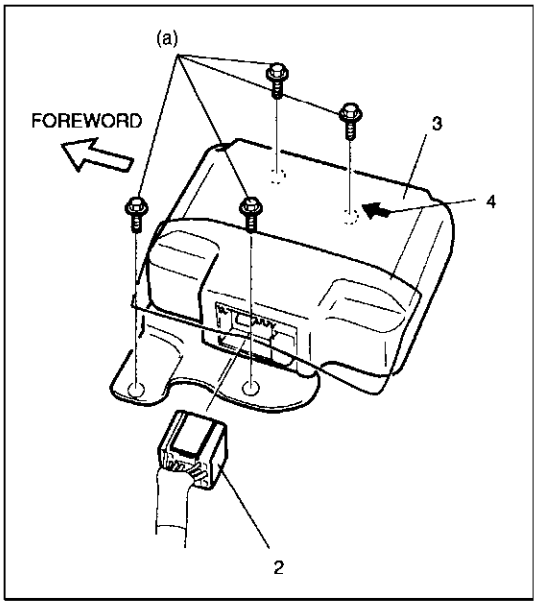


CAUTION:
- **Do not connect a tester whatever type it may be.**
- **Never repair or disassemble SDM (3).**
- **If SDM has been dropped, or if there are cracks, dents or other defects in the case or plate, replace it with a new one.**

- Check SDM (3) and SDM plate (5) for dents, cracks or deformation.
- Check SDM connector (2) for damage, cracks or lock mechanism.
- Check SDM terminal for bent, corrosion or rust.

If any faulty condition is found in above checks, replace.

INSTALLATION



For installation, reverse removal procedure, nothing following points.
- Ensure that arrow (4) on the SDM (3) is pointing toward the front of the vehicle.
- Tighten SDM bolts to specified torque.

Tightening torque
SDM mounting bolt (a) : 6 N·m (0.6 kg-m, 4.5 lb-ft)

- Connect SDM connector (2) to SDM (3) securely.
- Enable air bag system. Refer to "ENABLING AIR BAG SYSTEM" in this section.

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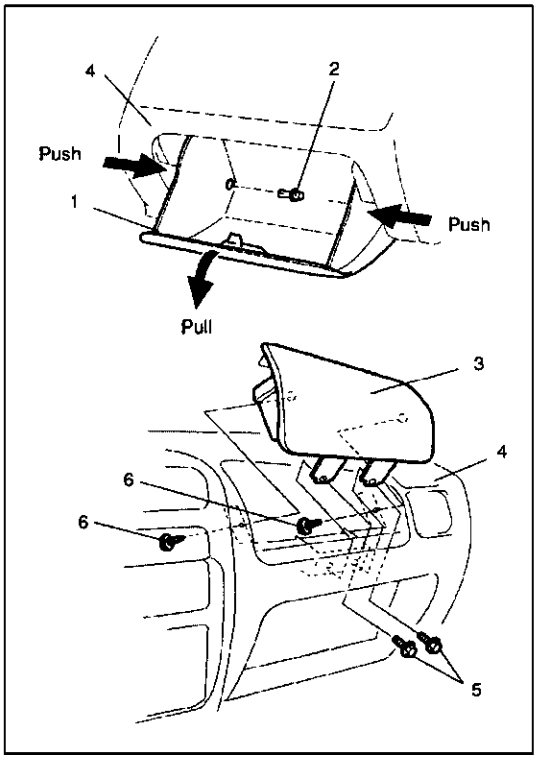
PASSENGER AIR BAG (INFLATOR) MODULE

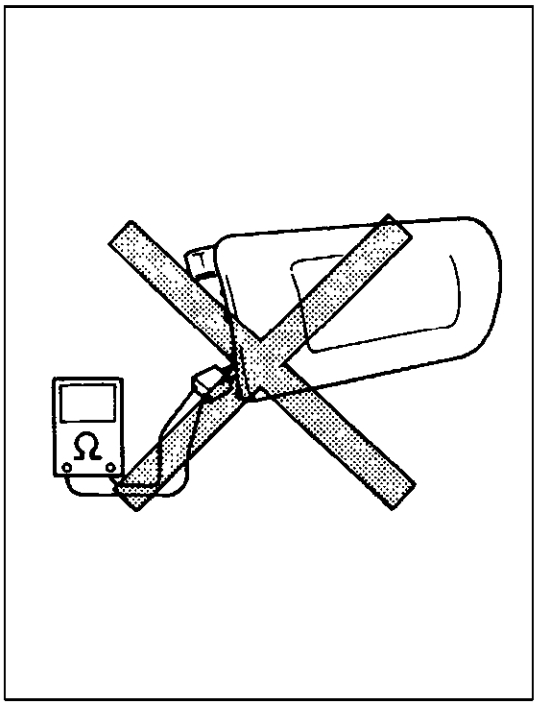
WARNING:
- **Never attempt to disassemble or repair the passenger air bag (inflator) module. If any abnormality is found, be sure to replace it with new one as an assembly.**
- **Be sure to read "SERVICE PRECAUTIONS" in this section before starting to work and observe every precaution during work. Neglecting them may result in personal injury or undeployment of the air bag when necessary.**

REMOVAL



1) Disconnect negative cable at battery.
2) Open glove box (1), then while pressing glove box stopper, pull out glove box (1) from instrument panel (4) and then remove glove box clip (2) and glove box (1) from instrument panel (4).
3) Disable air bag system. Refer to "DISABLING AIR BAG SYSTEM" in this section.
4) Remove passenger air bag (inflator) module (3) attaching bolts (5) and screws (6) and passenger air bag (inflator) module (3) 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 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.

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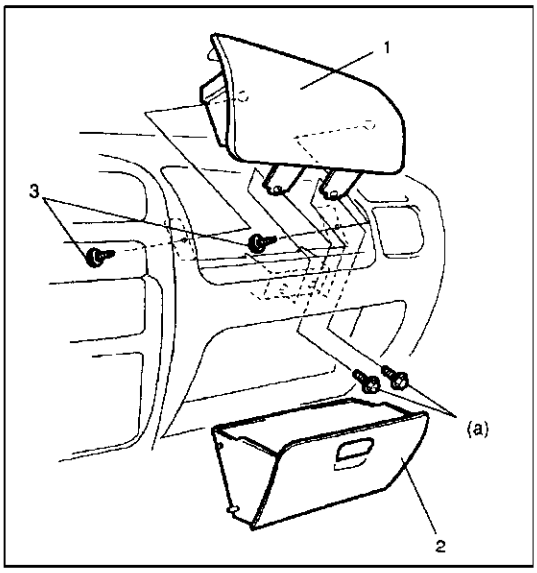

INSTALLATION

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) Tighten passenger air bag (inflator) module attaching screws (3).
4) Connect negative cable to battery.
5) 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.

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Air Bag (Inflator) Module and Seat Belt Pretensioner Disposal

WARNING:

Failure to follow proper air bag (inflator) module and seat belt pretensioner disposal procedures can result in air bag deployment and pretensioner activation which may cause personal injury.
Do not dispose of live (undeployed) air bag (inflator) modules and seat belt pretensioners. Because undeployed air bag (inflator) module/inactivated seat belt pretensioner must not be disposed of through normal refuse channels.
Undeployed air bag (inflator) module and inactivated seat belt pretensioner contain substances that can cause severe illness or personal injury if sealed container is damaged during disposal.

Air bag (inflator) module/seat belt pretensioner can be deployed/activated inside or outside of vehicle. Deployment/Activation method used depends upon final disposition of vehicle. Review the following instructions in order to determine which will work best in a given situation.

Deployment/Activation Outside of Vehicle :
When you intend to return the vehicle to service, deploy the air bag (inflator) module(s) or activate seat belt pretensioner(s) outside of the vehicle.

Deployment/Activation Inside of Vehicle :
When the vehicle will be destroyed, or salvaged for component parts, deploy the air bag modules and/or activate seat belt pretensioners installed on vehicle.

WARNING:

The following precautions must be observed for this work. Failure to observe any of them may result in personal injury.

- **Procedure should be followed strictly as described here.**
- **Be sure to read "SERVICE PRECAUTIONS" beforehand.**
- **To avoid accidental deployment/activation, this work should be performed by no more than one person.**
- **Since smoke is produced when air bag (inflator) module is deployed and pretensioner is activated, select well-ventilated area.**
- **Air bag (inflator) module and seat belt pretensioner will immediately deploy/activate when 12 volts vehicle battery is connected to it. Wear safety glasses throughout this entire deployment/activation and disposal procedure.**
- **Wear suitable ear protection when deploying air bag (inflator) module/activating seat belt pretensioner. Also, advise those who are in area close to deployment/activation site to wear suitable ear protection.**
- **Do not deploy/activate two or more air bag system components (air bag (inflator) modules and seat belt pretensioners) at the same time.**
- **Never connect deployment harness to any 12 volts vehicle battery before connecting deployment harness to air bag (inflator) module and seat belt pretensioner. Deployment harness shall remain shorted and not be connected to 12 volts vehicle battery till you are ready to deploy air bag (inflator) module or activate seat belt pretensioner.**

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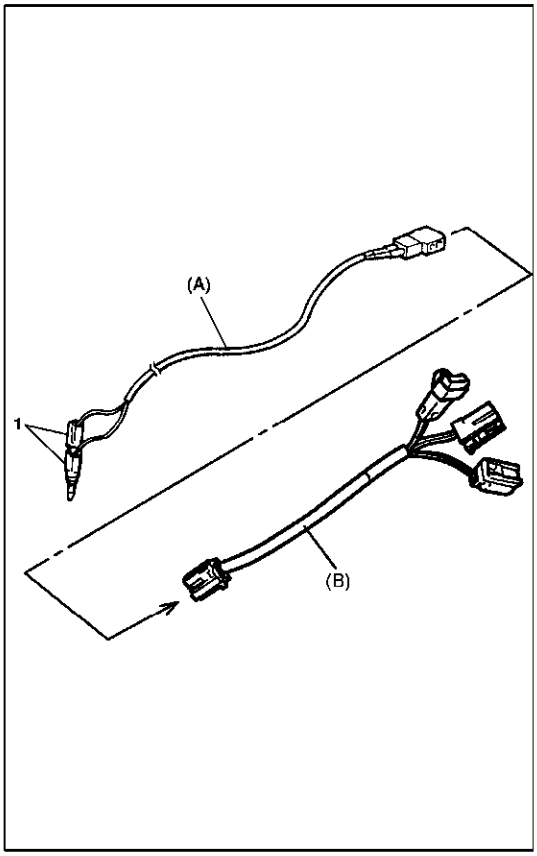
Deployment/Activation Outside of Vehicle

When you intend to return the vehicle to service, deploy the air bag (inflator) module(s) or activate seat belt pretensioner(s) outside of the vehicle.



1) Turn ignition switch to "LOCK" position and remove key.
2) Wear safety glasses during this deployment/activation procedure.
3) Check that there is no open, short or damage in special tools (deployment harness (A) and adapter cable (B)). If any faulty is found, do not use it and be sure to use new deployment harness (A).

Special tool
(A) : 09932-75030
(B) : 09932-78332

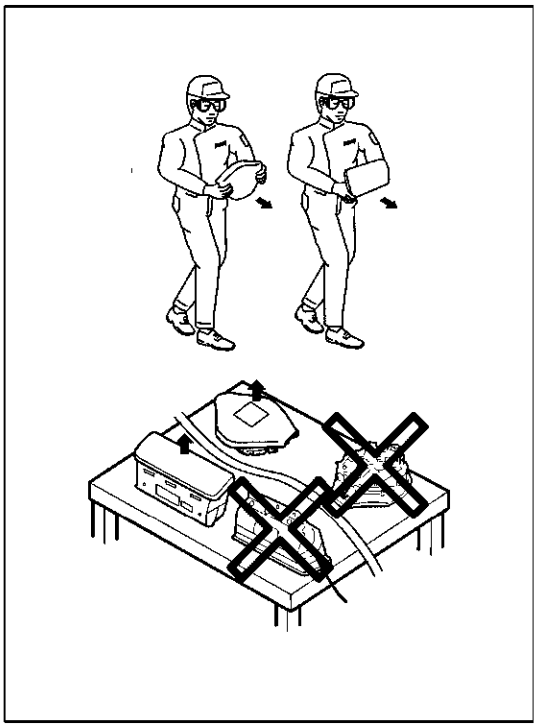
NOTE:

If faulty of seat belt pretensioner connector of adapter cable (B) is found, replace it to spare connector (special tool).

4) Short two deployment harness leads (1) together by fully seating one banana plug into the other.

WARNING:

Deployment harness (A) shall remain shorted and not be connected to 12 volts vehicle battery till you are ready to deploy air bag module or activate seat belt pretensioner.



5) Remove air bag (inflator) module(s) or seat belt pretensioner(s) from vehicle referring to Section 3C, 9, 10 and/or 10B.

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. 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.

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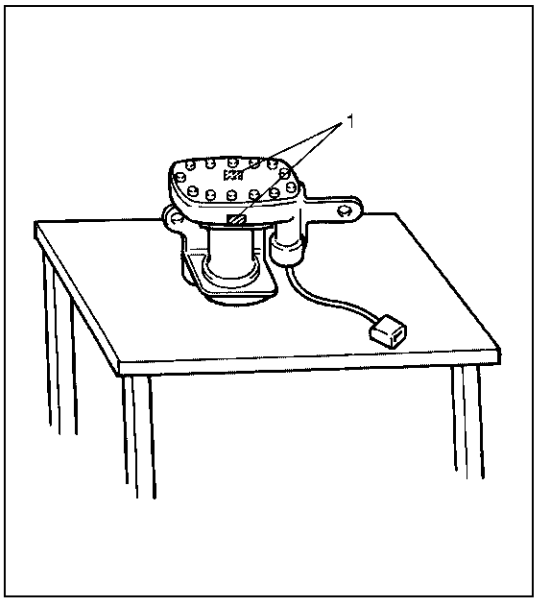
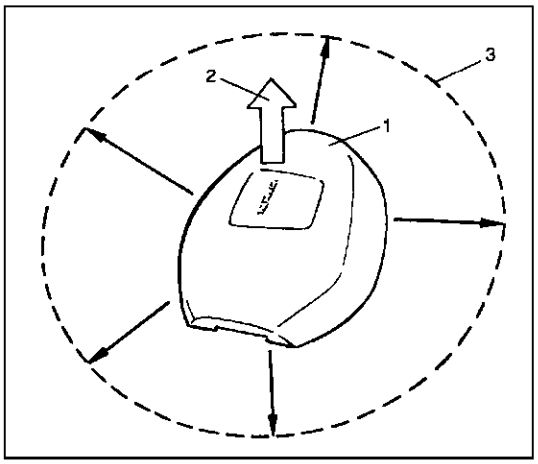


WARNING:

- **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.**
- **Never carry the seat belt pretensioner by the wire or connector of the pretensioner.**
- **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.



a) For driver air bag (inflator) module
   i) Clear space (3) on ground about 185 cm (6 ft) in diameter where driver air bag (inflator) module (1) for deployment. Paved, outdoor location where there is no activity is preferred. If outdoor location is not available, space on shop floor where there is no activity and provide sufficient ventilation. Ensure no loose or flammable objects are within deployment area.
   ii) Place driver air bag (inflator) module (1) with its vinyl trim cover facing up (2) on ground in step i).

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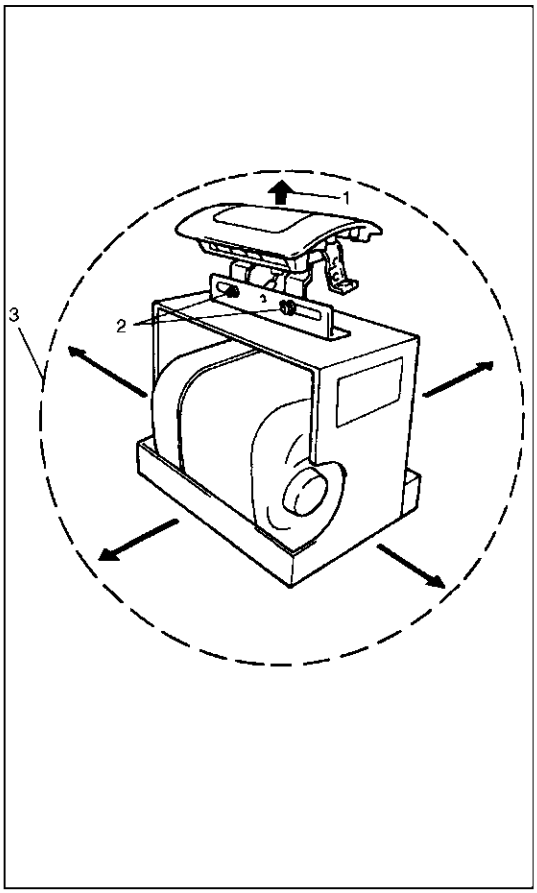
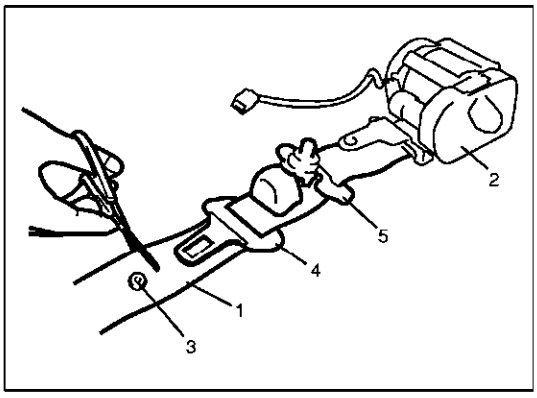


b) For passenger air bag (inflator) module
   i) Clear space (3) on ground about 185 cm (6 ft) in diameter where passenger air bag (inflator) module (1) for deployment. Paved, outdoor location where there is no activity is preferred. If outdoor location is not available, space on shop floor where there is no activity and provide sufficient ventilation. Ensure no loose or flammable objects are within deployment area.
   ii) Place deployment fixture (A) on ground in step i).

Special tool
(A) : 09932-75041

   iii) Fill plastic reservoir in deployment fixture (A) with water or sand. This is necessary to provide sufficient stabilization of fixture during deployment.
   iv) Attach passenger air bag (inflator) module (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).



c) For seat belt pretensioner
   i) 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.

   ii) Remove tongue plate (4) and shoulder anchor (5) from webbing.

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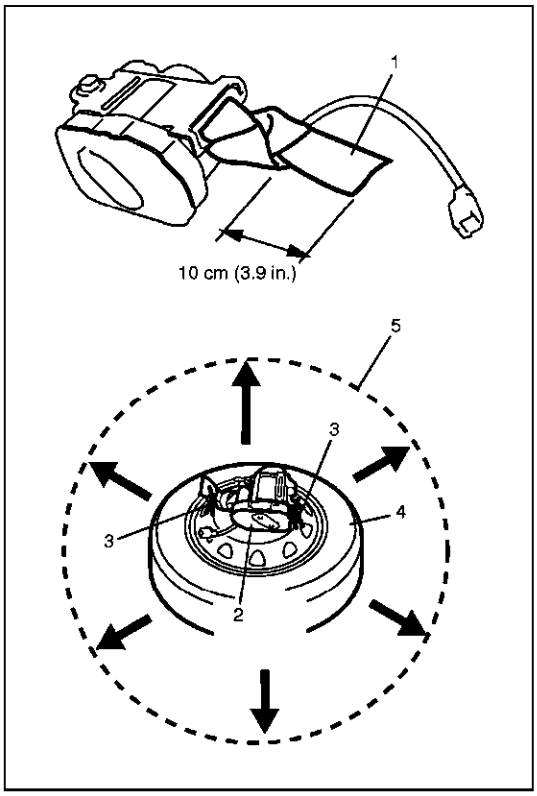

iii) Tie webbing (1) tightly at 10 cm (3.9 in.) from cutting edge as shown.
iv) Tie seat belt pretensioner (2) with wire harness (3) to wheel-installed tire (4) as shown.

Wire harness specification:

Stripped wire harness section 1.25 mm^2 (0.0019 $in.^2$) or more (Stripped wire harness diameter 1.25 mm (0.05 in.) or more)

NOTE:

Wind wire harness (3) around at least 3 times.

v) Clear space (5) on ground about 185 cm (6 ft) in diameter where seat belt pretensioner (2) is to be activated. Paved, outdoor location where there is no activity is preferred. If outdoor location is not available, space on shop floor where there is no activity and provide sufficient ventilation. Ensure no loose or flammable objects are within activation area.
vi) Place wheel-installed tire (4) with seat belt pretensioner (2) on ground in step v).

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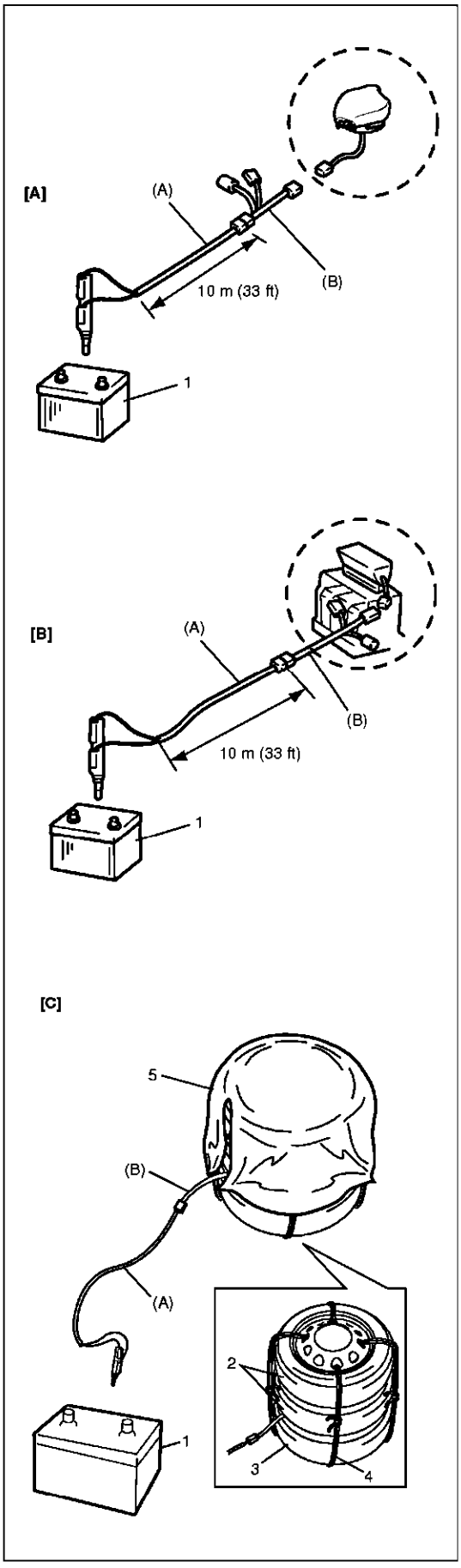

7) Stretch deployment harness (A) from air bag (inflator) module or seat belt pretensioner to its full length 10 m (33 ft).

Special tool
(A): 09932-75030

8) Place 12 volts vehicle battery (1) near shorted end of deployment harness (A).
9) Verify that area around air bag (inflator) module or seat belt pretensioner is clear of all people and loose or flammable objects.
10) Connect adapter cable (B) as follows.

Special tool
(B): 09932-78332

a) 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.
b) 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.
c) For seat belt pretensioner
Connect adapter cable (B) to seat belt pretensioner.

11) Connect adapter cable (B) to deployment harness (A) connector and lock connectors with lock slider.
12) For seat belt pretensioner
a) Pile 2 wheel-installed tires (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.

b) Drape blanket (5) over those tires.

[A]: For driver air bag (inflator) module
[B]: For passenger air bag (inflator) module
[C]: For seat belt pretensioner

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13) Notify all people in immediate area that you intend to deploy/ activate air bag (inflator) module or seat belt pretensioner.

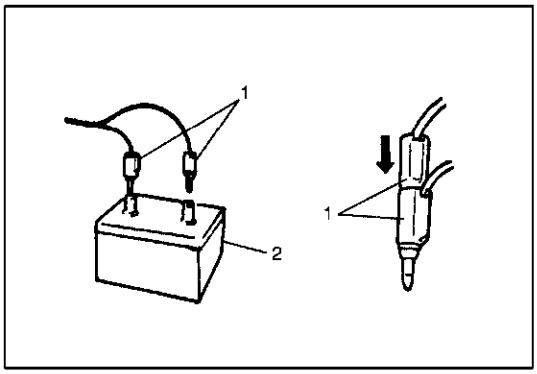
NOTE:

- **When air bag (inflator) module deploys and seat belt pretensioner activates, rapid gas expansion will create substantial report. Wear suitable ear protection. Notify all people in immediate area that you intend to deploy air bag (inflator) module or activate seat belt pretensioner and suitable ear protection should be worn.**
- **When driver air bag (inflator) module deploys, driver air bag (inflator) module may jump about 30 cm (1 ft) vertically. This is normal reaction to force of rapid gas expansion inside of drive air bag (inflator) module.**
- **After air bag (inflator) module has been deployed, surface of air bag (inflator) may contain powdery residue. This powder consists primarily of cornstarch (used to lubricate bag (inflator) as it inflates) and byproducts of chemical reaction.**

WARNING:

- **Do not place deployed air bag (inflator) module and activated seat belt pretensioner near any flammable objects.**
- **Do not apply water, oil, etc. to deployed air bag (inflator) module and activated seat belt pretensioner.**
- **Wait for about 30 minutes before touching any metal surface of air bag (inflater) module or seat belt pretensioner module. Disregarding these precautions may cause fire or personal injury.**

Failure to follow procedures may result in fire or personal injury.



14) Separate two banana plugs (1) on deployment harness.
15) Connect deployment harness to 12 volts vehicle battery (2). This will immediately deploy or activate air bag (inflator) module or seat belt pretensioner.
16) Disconnect deployment harness from 12 volts vehicle battery (2) and short two deployment harness leads together by fully seating one banana plug into the other.

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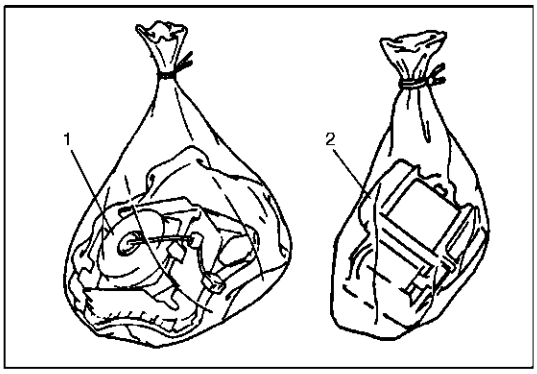
17) In the unlikely event that air bag (inflator) module or seat belt pretensioner did not deploy/activate after following these procedures, proceed immediately with Step 23) through 26). If air bag (inflator) module or seat belt pretensioner did deploy or activate, proceed with Steps 18) through 22).
18) Put on pair of shop gloves to protect your hands from possible irritation and heat when handling deployed air bag (inflator) module or activated seat belt pretensioner.
19) Disconnect adapter cable (special tool) from air bag (inflator) module or seat belt pretensioner as soon as possible. This will prevent adapter cable (special tool) from damage due to possible contact with hot air bag (inflator) module or hot seat belt pretensioner.
20) Check adapter cable connector as follows.
    Adapter cable connector (special tool) are designed to be reused. However they should be inspected for damage after deployment and replaced if necessary.



21) Dispose of deployed air bag (inflator) module (1) or activated seat belt pretensioner (2) through normal refuse channels after it has cooled for at least 30 minutes and tightly seal air bag (inflator) module (1) or seat belt pretensioner (2) in strong vinyl bag. (Refer to "Deployed Air Bag (Inflator) Module and Activated Seat Belt Pretensioner Disposal" in detail.)
22) Wash your hands with mild soap and water afterward.

NOTE:

Remaining steps are to be followed in the unlikely event that air bag (inflator) module did not deploy or seat belt pretensioner did not activate.

23) Ensure that deployment harness has been disconnected from 12 volts vehicle battery and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
24) Disconnect deployment harness and adapter cable from air bag (inflator) module or seat belt pretensioner.
25) Temporarily store undeployed air bag (inflator) module or unactivated seat belt pretensioner referring to "Service Precautions" for details.
26) Contact your local distributor for further assistance.

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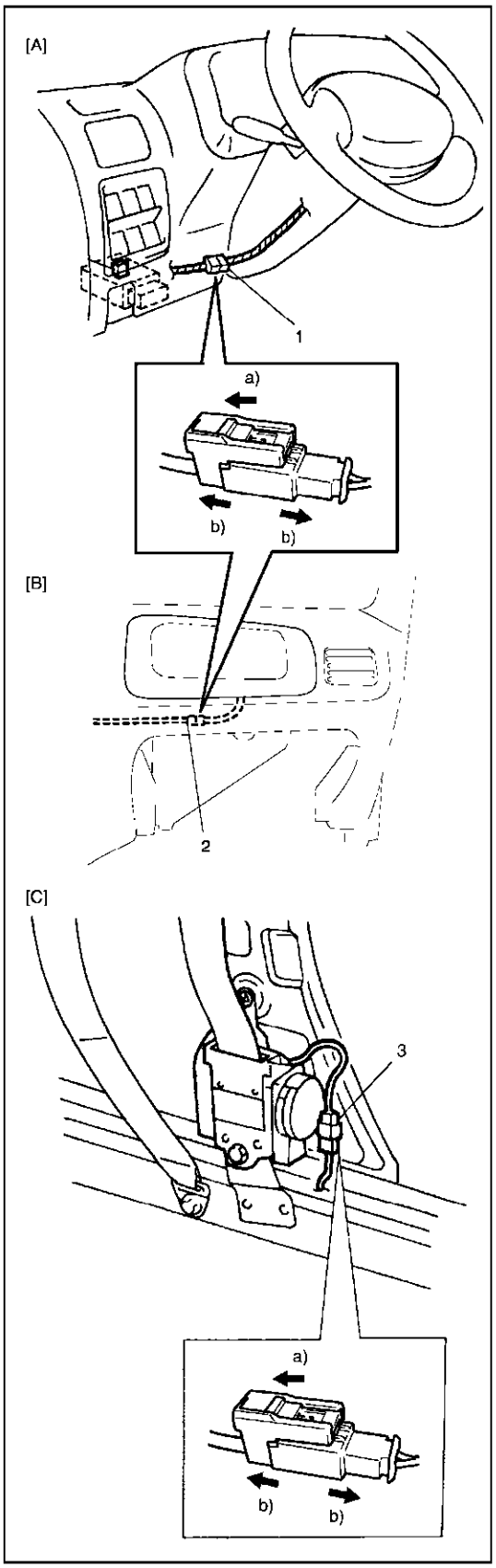
Deployment/Activation Inside Vehicle



When the vehicle will be destroyed, or salvaged for component parts, deploy the air bag modules and/or activate seat belt pretensioners installed on vehicle.

1) Turn ignition switch to "LOCK" position, remove key and put on safety glasses.
2) Remove all loose objects from front seats and instrument panel.
3) Disconnect air bag (inflator) module or seat belt pretensioner connector as follows.
   a) For driver air bag (inflator) module
      Disconnect contact coil connector (1) located near base of steering column.
   b) For passenger air bag (inflator) module
      Remove glove box from instrument panel and disconnect passenger air bag (inflator) module connector (2).
   c) For seat belt pretensioner
      Remove both side (driver and passenger side) center pillar lower trims and disconnect seat belt pretensioner connectors (3).
4) Confirm that each air bag (inflator) module and/or seat belt pretensioner is securely mounted.

[A]: Driver air bag (inflator) module
[B]: Passenger air bag (inflator) module
[C]: Seat belt pretensioner

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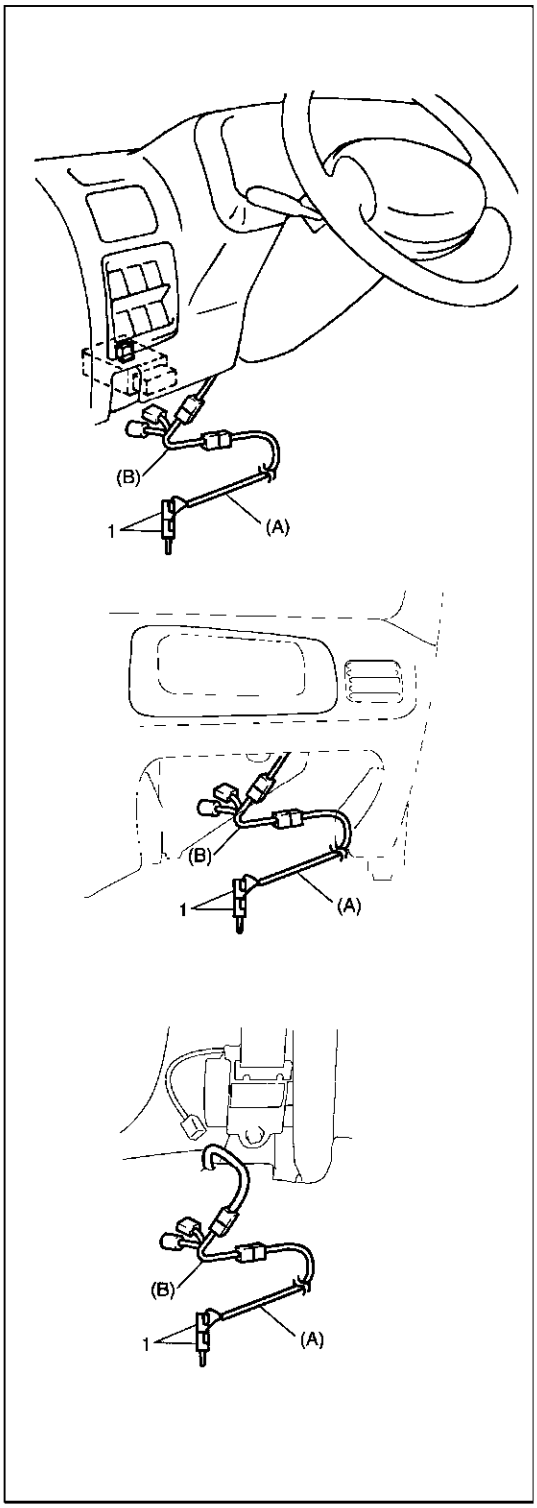

5) Check that there is no open, short or damage in special tools (deployment harness (A) and adapter cable (B)). If any faulty condition is found, do not use it and be sure to use new deployment harness (A) and/or adapter cable (B). And connect adapter cable (B) to deployment harness (A) and lock connectors with lock slider (2).

NOTE:

If faulty of seat belt pretensioner connector of adapter cable (B) is found, replace it to spare connector (special tool).

Special tool
(A) : 09932-75030
(B) : 09932-78332

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.
   a) 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.
   b) 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

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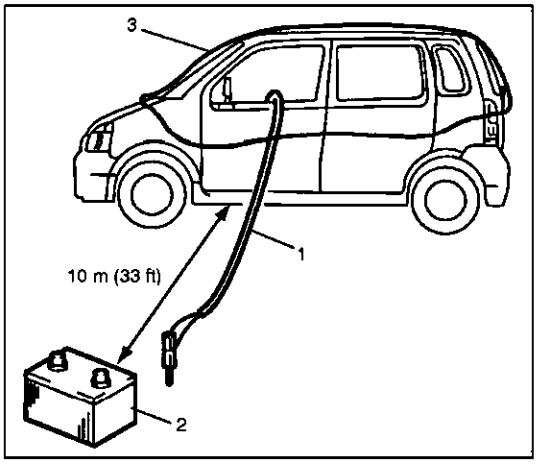

8) Route deployment harness (1) out of vehicle.
9) Verify that inside of vehicle and area surrounding vehicle are clear of all people and loose or flammable objects.
10) Stretch deployment harness (1) to its full length 10 m (33 ft).
11) Place 12 volts vehicle battery (2) near shorted end of deployment 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.

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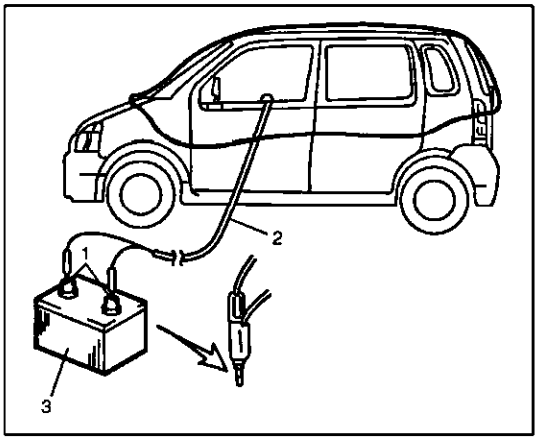

14) Separate two banana plugs (1) on deployment harness (2).
15) Connect deployment harness (2) to 12 volts vehicle battery (3). This will immediately deploy or activate air bag (inflator) module or seat belt pretensioner.
16) Disconnect deployment harness (2) from 12 volts vehicle battery (3) and short two deployment harness leads together by fully seating one banana plug into the other.
17) Repeat Steps 2) through 16) to deploy/activate air bag (inflator) modules and seat belt pretensioners which has not been deployed/activated, if any.
18) In the unlikely event that air bag (inflator) module and seat belt pretensioner after following these procedures, proceed immediately with Step 24) through 26). If air bag (inflator) module and seat belt pretensioner did deploy/activate, proceed with Steps 19) through 23).
19) Carefully remove drop cloth from vehicle and clean off any fragments or discard it entirely.
20) Put on pair of shop gloves to protect your hands from possible irritation and heat when handling deployed air bag (inflator) module and activated seat belt pretensioner.
21) Disconnect adapter cable (special tool) from air bag (inflator) module or seat belt pretensioner as soon as possible. This will prevent adapter cable (special tool) from damage due to possible contact with hot air bag (inflator) module or hot seat belt pretensioner.
22) Check adapter cable connector as follows.
    Adapter cable connector (special tool) are designed to be reused. However they should be inspected for damage after deployment and replaced if necessary.
23) With air bag (inflator) modules deployed and seat belt pretensioners activated, vehicle may be scrapped in the same manner as non-air bag system/seat belt pretensioner equipped vehicle.

NOTE:

Remaining steps are to be followed in the unlikely event that air bag (inflator) module did not deploy or seat belt pretensioner did not activate.

24) Remove undeployed air bag (inflator) module(s) and/or inactivated seat belt pretensioner(s) from vehicle. For driver air bag (inflator) module, refer to Section 3. For passenger air bag (inflator) module, refer to "ON-VEHICLE SERVICE" in this section. For seat belt pretensioner, refer to Section 10.

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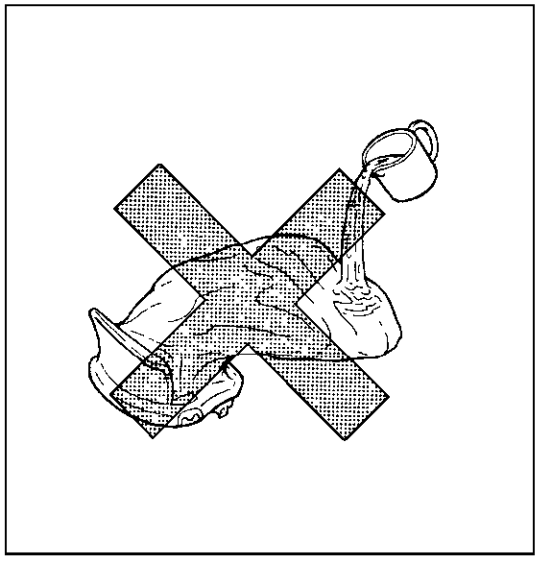
25) Temporarily store undeployed air bag (inflator) module and/or unactivated seat belt pretensioner referring to "SERVICE PRECAUTIONS" for details.
26) Contact your local distributor for further assistance.

DEPLOYED AIR BAG (INFLATOR) MODULE AND ACTIVATED SEAT BELT PRETENSIONER DISPOSAL

WARNING:
Failure to follow proper air bag (inflator) module and seat belt pretensioner disposal procedures can result in air bag deployment and pretensioner activation which may cause personal injury. 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, 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.

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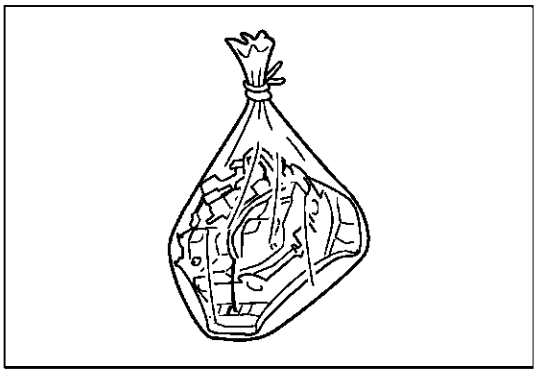
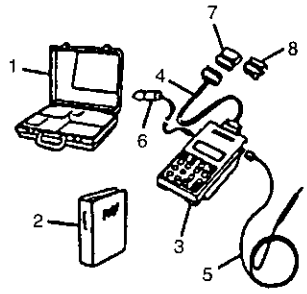
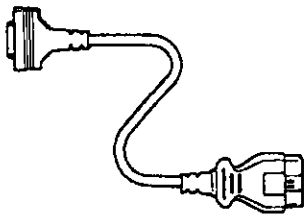
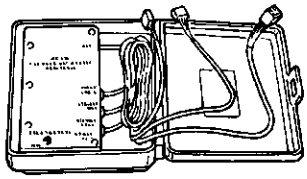
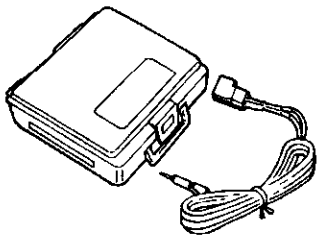
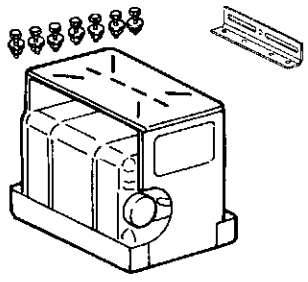
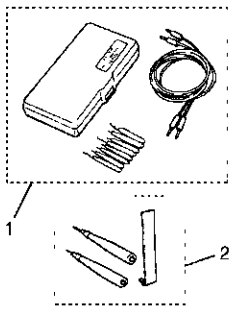
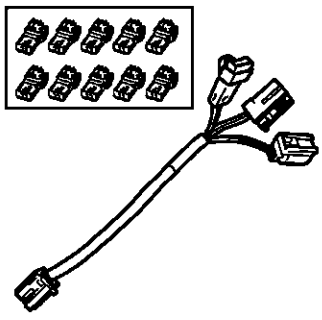
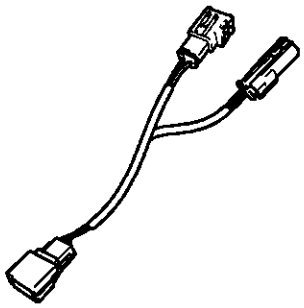


- When disposing of the deployed air bag (inflator) module and the activated seat belt pretensioner, be sure to seal it in a vinyl bag.
- When air bag (inflator) module and seat belt pretensioner have been deployed/activated inside the vehicle which is going to be scrapped, leave them as installed to 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	11	1.1	8.0
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	09932-75030 Air bag deployment harness
			
09932-75041 Passenger air bag (inflator) module deployment fixture	09932-76010 Connector test adapter set (See NOTE “D”.)	09932-78332 Adapter cable	09932-78340 Adapter cable

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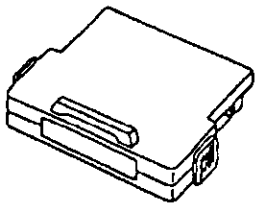	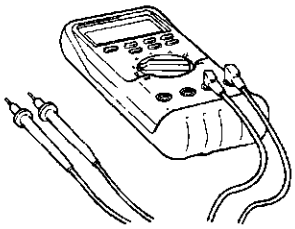	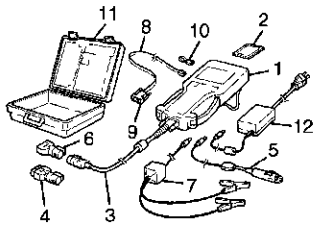
Mass storage cartridge for Tech 1A	Digital multimeter (See NOTE "B" and WARNING.)	Tech 2 kit (SUZUKI scan tool) (See NOTE "C".)

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)

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