IMPORTANT

WARNING/CAUTION/NOTE

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

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

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

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

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

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

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

FOREWORD

This manual (Volumes 1 and 2) contains procedures for diagnosis, maintenance, adjustments, minor service operations, replacement of components (Service) and for disassembly and assembly of major components (Unit Repair-Overhaul).

VOLUME 1 contains Chassis, Electrical and Body sections (all sections except engine).
VOLUME 2 contains Engine sections (Sections 6 – 6K).

Applicable model: SQ416/SQ420/SQ625 of and after the vehicle identification number below.

☒ JSAFTA03V00150001☒	JS3TA03V☐14150001	2S2GTA03C00470001
☒ JSAFTA03V10150001☒	JS3TA52V☐14150001	2S2GTA03C10470001
☒ JSAFTA03V14150001☒	JS3TL52V☐14150001	2S2GTA03C16470001
☒ JSAFTA52V00150001☒	JS3TD62V☐14150001	2S3TA03C☐16100001
☒ JSAFTA52V10150001☒		2S3TA52C☐16100001
☒ JSAFTA52V14150001☒		2S2GTA52C00470001
☒ JSAFTL52V00150001☒		2S2GTA52C10470001
☒ JSAFTL52V10150001☒		
☒ JSAFTL52V14150001☒		
☒ JSAFTD62V00150001☒		
☒ JSAFTD62V10150001☒		
☒ JSAFTD62V14150001☒		

The contents are classified into sections each of which is given a section number as indicated in the Table of Contents on next 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.

NOTE:
Refer to the next page for RELATED MANUALS.

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OVERSEAS SERVICE DEPARTMENT

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RELATED MANUAL

MANUAL NAME	MANUAL NO.	APPLICABILITY
SQ416/SQ420/SQ625 Unit Repair Manual	99501-65D01-xxx	Transmission, Transfer and Differentials (Front and Rear) of SQ series.
SQ416/SQ420/SQ625 Wiring Diagram Manual	99512-65D10-015	Applicable model mentioned in FOREWORD of this manual.
SQ416/SQ420/SQ625 Service Manual	99500-65D00-xxx	Vehicles before the vehicle identification number mentioned in FOREWORD of this manual.
SQ416/SQ420/SQ625 Wiring Diagram Manual	99512-65D01-015	

TABLE OF CONTENTS	SECTION
GENERAL INFORMATION	
General Information	0A
Maintenance and Lubrication	0B
HEATING AND AIR CONDITIONING	
Heater and Ventilation	1A
Air Conditioning	1B
STEERING, SUSPENSION, WHEELS AND TIRES	3
Front End Alignment	3A
Power Steering (P/S) System	3B1
Steering Wheel and Column (Not Equipped with Air Bag)	3C
Air Bag Steering Wheel and Column	3C1
Front Suspension	3D
Rear Suspension	3E
Wheel and Tires	3F
DRIVE SHAFT/PROP. SHAFT	
Front Drive Shaft/Shaft Bearing, Oil Seal	4A2
Propeller Shaft	4B
BRAKES	5
Brake Pipe/Hose/Master Cylinder	5A
Front Brakes	5B
Parking and Rear Brakes	5C
Antilock Brake System	5E1

TABLE OF CONTENTS	SECTION
ENGINE	
General Information and Diagnosis (G16/J20)	6
General Information and Diagnosis (H25)	6-1
Engine Mechanical (G16)	6A1
Engine Mechanical (H25)	6A2
Engine Mechanical (J20)	6A4
Engine Cooling	6B
Engine Fuel	6C
Engine and Emission Control System (SFI for G16/J20)	6E1
Engine and Emission Control System (SFI for H25)	6E2
Ignition System (G16)	6F1
Ignition System (J20/H25)	6F2
Cranking System (Reduction Type)	6G
Cranking System (No-Reduction Type)	6G1
Charging System	6H
Exhaust System	6K
TRANSMISSION, CLUTCH AND DIFFERENTIAL	
Manual Transmission (Type 1)	7A
Manual Transmission (Type 2)	7A1
Automatic Transmission	7B1
Clutch (Hydraulic Type)	7C1
Transfer	7D
Differential (Front)	7E
Differential (Rear)	7F
BODY ELECTRICAL SYSTEM	8
Wiring Diagram	8A
Lighting System	8B
Instrumentation/Driver Information	8C
Windows, Mirrors, Security and Lock	8D
Immobilizer Control System	8G
BODY SERVICE	9
RESTRAINT SYSTEM	10
Seat Belt	10A
Air Bag System	10B

NOTE:
The screen toned Sections 6 – 6K are included in Volume 2 and Section 8A is in Wiring Diagram Manual.

SECTION 0A

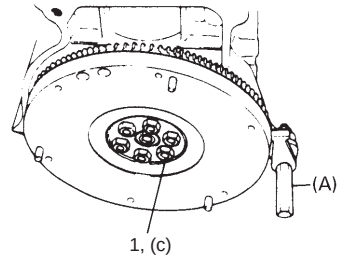
GENERAL INFORMATION

CONTENTS

HOW TO USE THIS MANUAL 0A- 2
PRECAUTIONS 0A- 3
Precautions for Vehicle Equipped with a Supplemental Restraint (Air Bag) System 0A- 3
Diagnosis 0A- 3
Servicing and Handling 0A- 4
General Precautions 0A- 7
Precautions for Catalytic Converter 0A- 9
Precautions for Electrical Circuit Service 0A-10
Electrical Circuit Inspection Procedure 0A-12
Intermittent and Poor Connection 0A-15
Precaution for Installing Mobile Communication Equipment 0A-16
IDENTIFICATION INFORMATION 0A-17
Body Number 0A-17
Engine Identification Number 0A-17
Transmission Identification Number 0A-17
WARNING, CAUTION AND INFORMATION LABELS 0A-18
VEHICLE LIFTING POINTS 0A-19
ABBREVIATIONS MAY BE USED IN THIS MANUAL 0A-21
METRIC INFORMATION 0A-23
Metric Fasteners 0A-23
Fasteners Strength Identification 0A-23
Standard Tightening Torque 0A-24

HOW TO USE THIS MANUAL

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

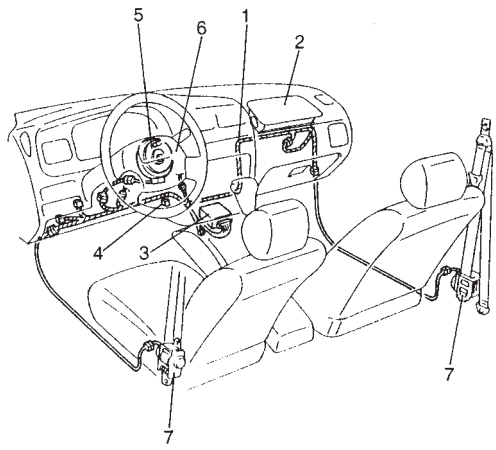


1. Flywheel bolts or drive plate bolts for A/T vehicle

6) Install oil pump. Refer to “Oil pump”.
7) Install flywheel (for M/T vehicle) or drive plate (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 are used in the text.
   For their full explanations, refer to **“ABBREVIATIONS MAY BE USED IN THIS MANUAL”** of 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.



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

PRECAUTIONS

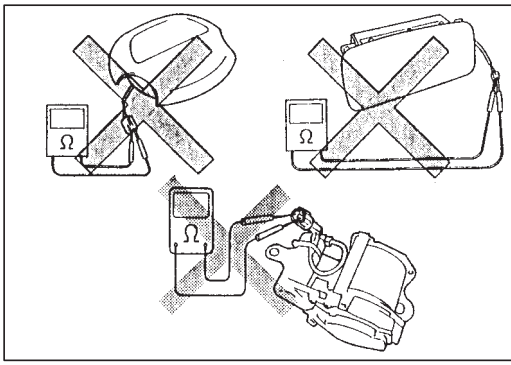
PRECAUTION FOR VEHICLES EQUIPPED WITH A SUPPLEMENTAL RESTRAINT (AIR BAG) SYSTEM

WARNING:

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

DIAGNOSIS

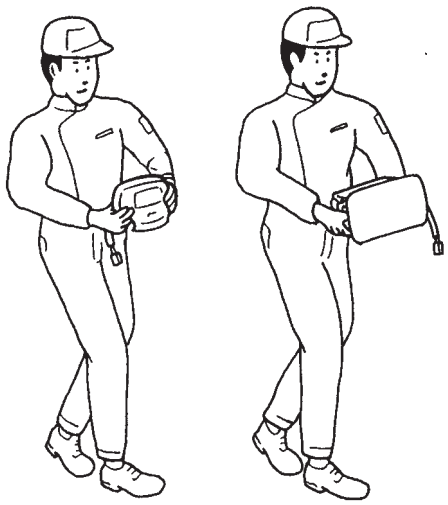
- **When troubleshooting air bag system, be sure to follow "DIAGNOSIS" in SECTION 10B. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacement.**
- **Never use electrical test equipment other than that specified in this manual.**



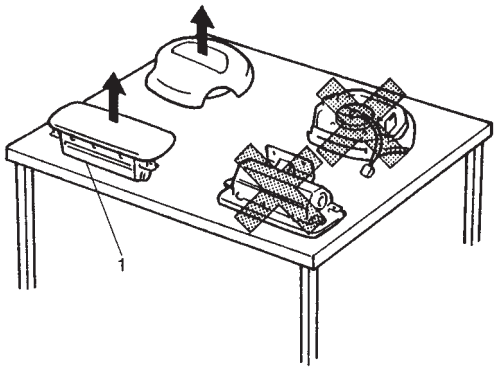
WARNING:

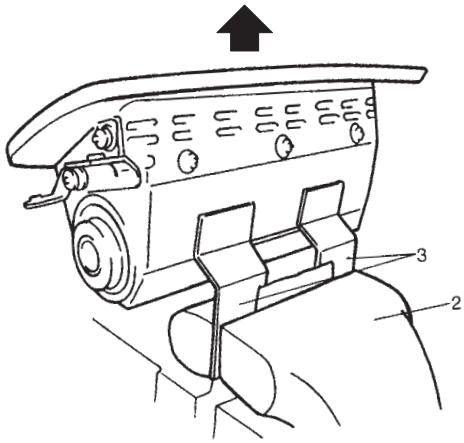
Never attempt to measure the resistance of the air bag (inflator) modules (driver and passenger) and seat belt pretentioners (driver and passenger). It is very dangerous as the electric current from the tester may deploy the air bag or activate the pretensioner.

ALWAYS CARRY AIR BAG (INFLATOR) MODULE WITH TRIM COVER (AIR BAG OPENING) AWAY FROM BODY.



ALWAYS PLACE AIR BAG (INFLATOR) MODULE ON WORKBENCH WITH TRIM COVER (AIR BAG OPENING) UP, AWAY FROM LOOSE OBJECTS.





1. Slit on workbench
2. Workbench vise
3. Lower mounting bracket

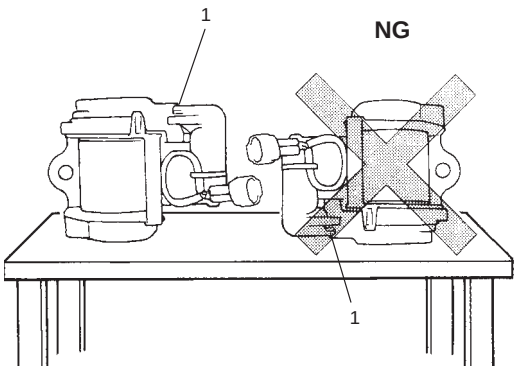
SERVICING AND HANDLING

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 and Passenger Air Bag (Inflator) Modules

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

WARNING:
SDM

- **During service procedures, be very careful when handling a Sensing and Diagnostic Module (SDM). Never strike or jar the SDM.**
  Never power up the air bag system when the SDM is not rigidly attached to the vehicle. All SDM and mounting bracket fasteners must be carefully torqued and the arrow must be pointing toward the front of the vehicle to ensure proper operation of the air bag system.
  The SDM could be activated when powered while not rigidly attached to the vehicle which could cause deployment and result in personal injury.



1. Exhaust hole

WARNING:
Driver and Passenger Seat Belt Pretensioners

- **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 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 (driver and passenger). If disposal is necessary, be sure to activate them according to activation procedures described in SECTION 10B before disposal.**
- **The seat belt pretensioner immediately after activation is very hot. Wait for at least half an hour to cool it off before proceeding the work.**
- **With many service procedures, gloves and safety glasses should be worn to prevent any possible irritation of the skin or eyes.**

CAUTION:

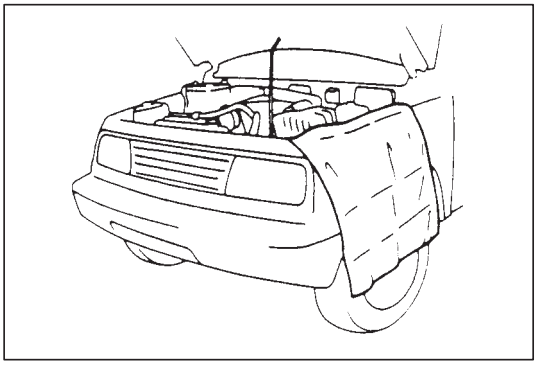
- **Even when the accident was light enough not to cause air bags to activate, be sure to inspect system parts and other related parts according to instructions under "Repair and Inspection Required after an Accident" in SECTION 10B.**
- **When servicing parts other than air bag system, if shocks may be applied to air bag system component parts, remove those parts beforehand.**
- **When handling the air bag (inflator) modules (driver and passenger), seat belt pretensioners (driver and passenger) or SDM, be careful not to drop it or apply an impact to it. If an excessive impact was applied (e.g., dropped from a height of 91.4 cm (3 feet) or more), never attempt disassembly or repair but replace it with a new one.**
- **When grease, cleaning agent, oil, water, etc. has got onto air bag (inflator) modules (driver and passenger) or seat belt pretensioners (drive and passenger), wipe off immediately with a dry cloth.**
- **Air bag wire harness can be identified easily as it is covered with a yellow protection tube. Be very careful when handling it.**
- **When an open in air bag wire harness, damaged wire harness, connector or terminal is found, replace wire harness, connectors and terminals as an assembly.**
- **Do not apply power to the air bag system unless all components are connected or a diagnostic chart requests it, as this will set a diagnostic trouble code.**
- **Never use air bag system component parts from another vehicle.**
- **When using electric welding, be sure to temporarily disable air bag system referring to "Disabling Air Bag System" described in "Service Precautions" under "On-Vehicle Service" 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" described in "Diagnosis" 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.

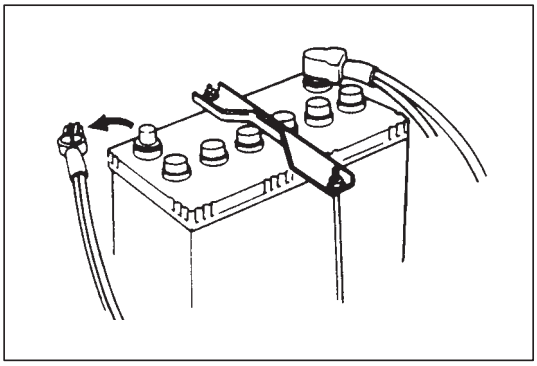
WARNING:

- **Whenever raising a vehicle for service, be sure to follow the instructions under "VEHICLE LIFTING POINTS" on SECTION 0A.**
- **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 dishwashing 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.**

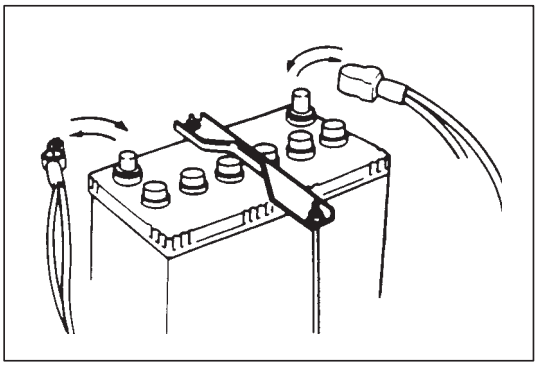


CAUTION:

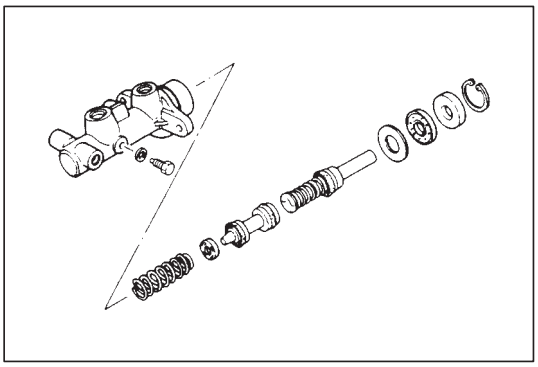
- **Before starting any service work, cover fenders, seats and any other parts that are likely to get scratched or stained during servicing. Also, be aware that what you wear (e.g, buttons) may cause damage to the vehicle's finish.**



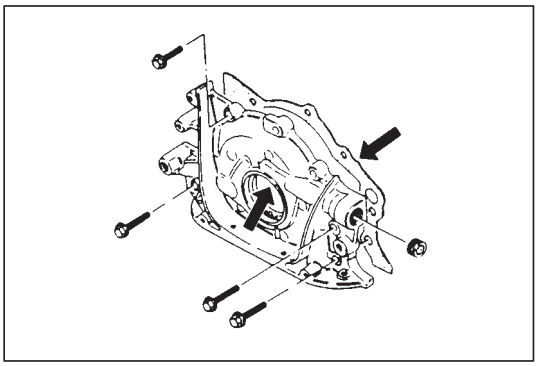
- **When performing service to electrical parts that does not require use of battery power, disconnect the negative cable of the battery.**



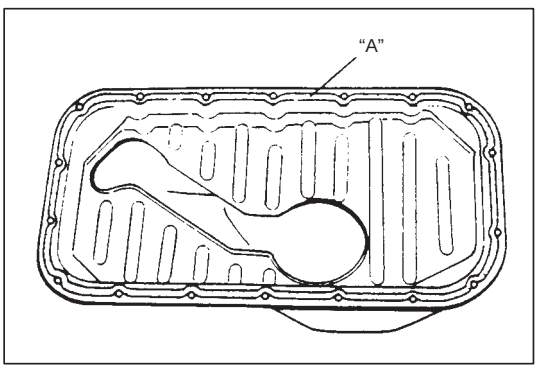
- When removing the battery, be sure to disconnect the negative cable first and then the positive cable. When reconnecting the battery, connect the positive cable first and then the negative cable, and replace the terminal cover.



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

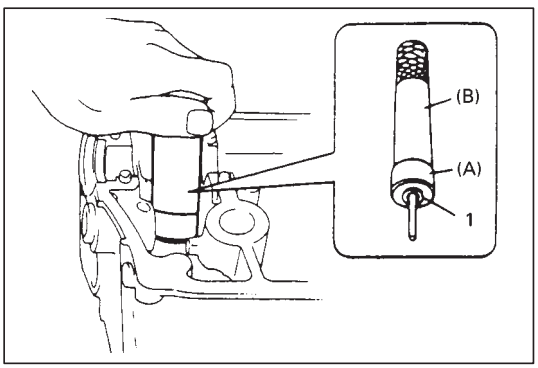


- Whenever you use oil seals, gaskets, packing, O-rings, locking washers, split pins, self-locking nuts, and certain other parts as specified, be sure to use new ones. Also, before installing new gaskets, packing, etc., be sure to remove any residual material from the mating surfaces.



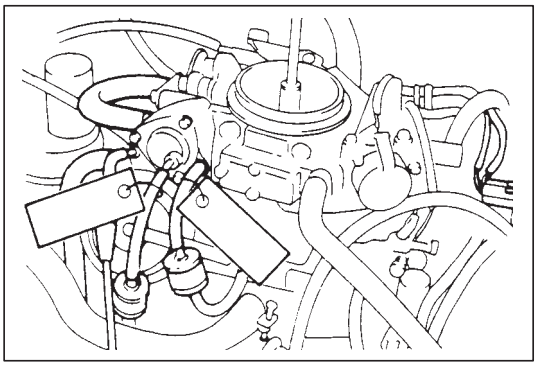
- Make sure that all parts used in reassembly are perfectly clean.
- When use of a certain type of lubricant, bond or sealant is specified, be sure to use the specified type.

"A": Sealant 99000-31150

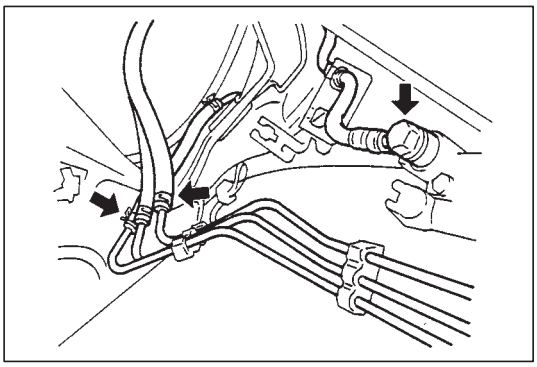


- Be sure to use special tools when instructed.

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



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



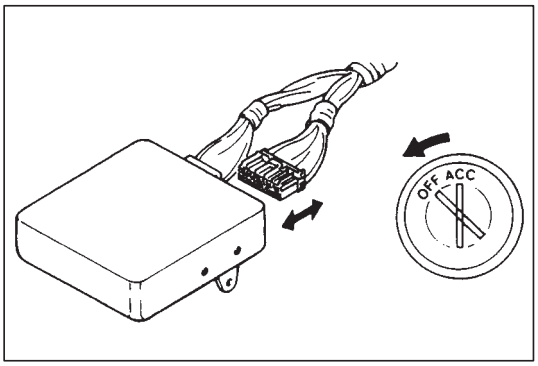
- After servicing fuel, oil, coolant, vacuum, exhaust or brake systems, check all lines related to the system for leaks.

- 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.

PRECAUTIONS FOR CATALYTIC CONVERTER

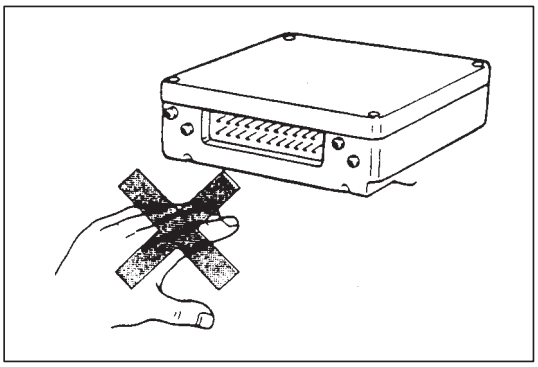
For vehicles equipped with a catalytic converter, use only unleaded gasoline and be careful not to let a large amount of unburned gasoline enter the converter or it can be damaged.

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



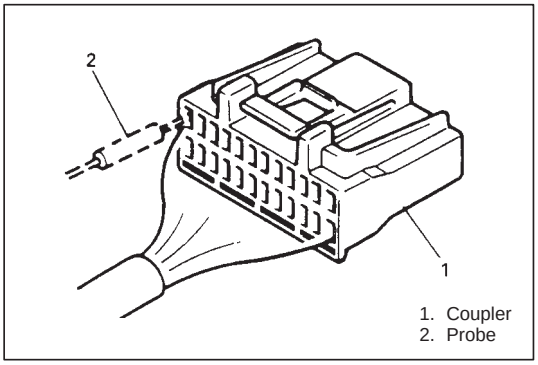
PRECAUTIONS FOR ELECTRICAL CIRCUIT SERVICE

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



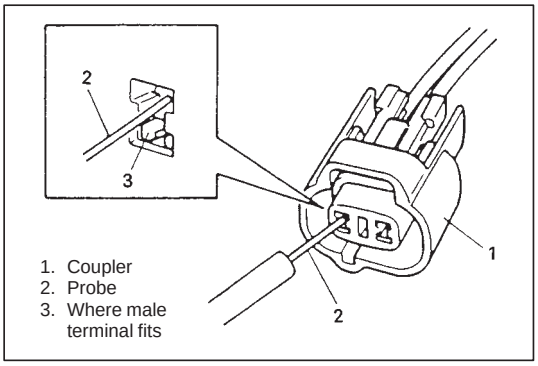
- **Be careful not to touch the electrical terminals of parts which use microcomputers (e.g. electronic control unit like as ECM, PCM, P/S controller, etc.). The static electricity from your body can damage these parts.**

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



1. Coupler
2. Probe

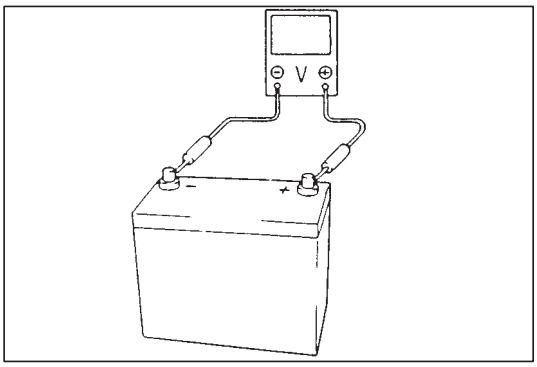
- **When taking measurements at electrical connectors using a tester probe, be sure to insert the probe from the wire harness side (backside) of the connector.**



1. Coupler
2. Probe
3. Where male terminal fits

- **When connecting meter probe from terminal side of coupler 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 11V or higher. Such terminal voltage check at low battery voltage will lead to erroneous diagnosis.**

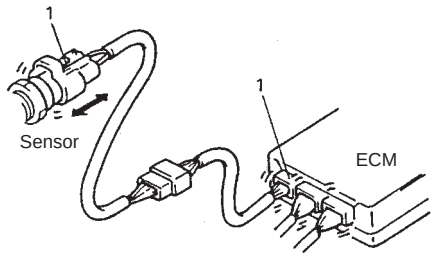
ELECTRICAL CIRCUIT INSPECTION PROCEDURE

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

OPEN CIRCUIT CHECK

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

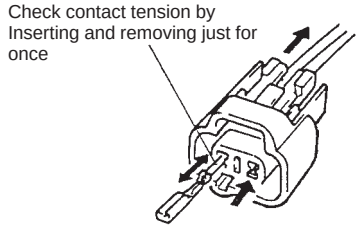
- Loose connection of connector
- Poor contact of terminal (due to dirt, corrosion or rust on it, poor contact tension, entry of foreign object etc.)
- Wire harness being open



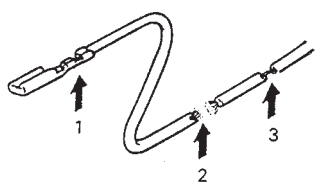
1. Check for loose connection

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

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

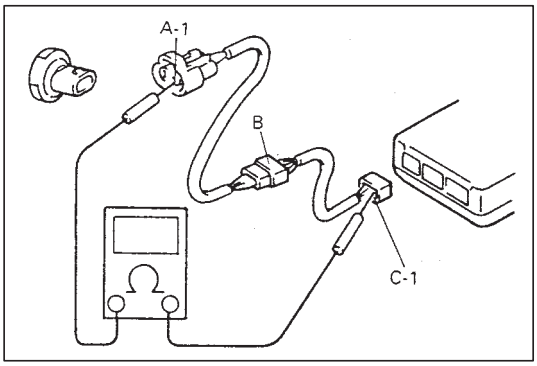


3) Using a test male terminal, check both terminals of the circuit being checked for contact tension of its female terminal.
   Check each terminal visually for poor contact (possibly caused by dirt, corrosion, rust entry of foreign object, etc.).
   At the same time, check to make sure that each terminal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



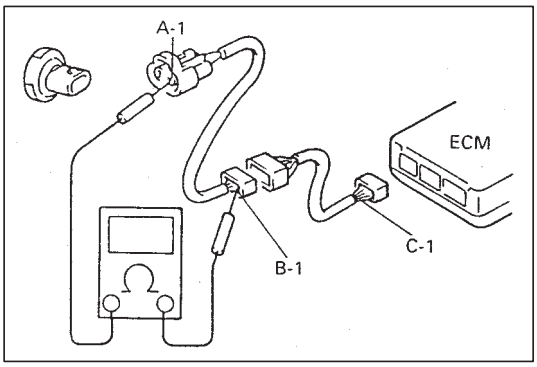
1. Looseness of crimping
2. Open
3. Thin wire (Single strand of wire)

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

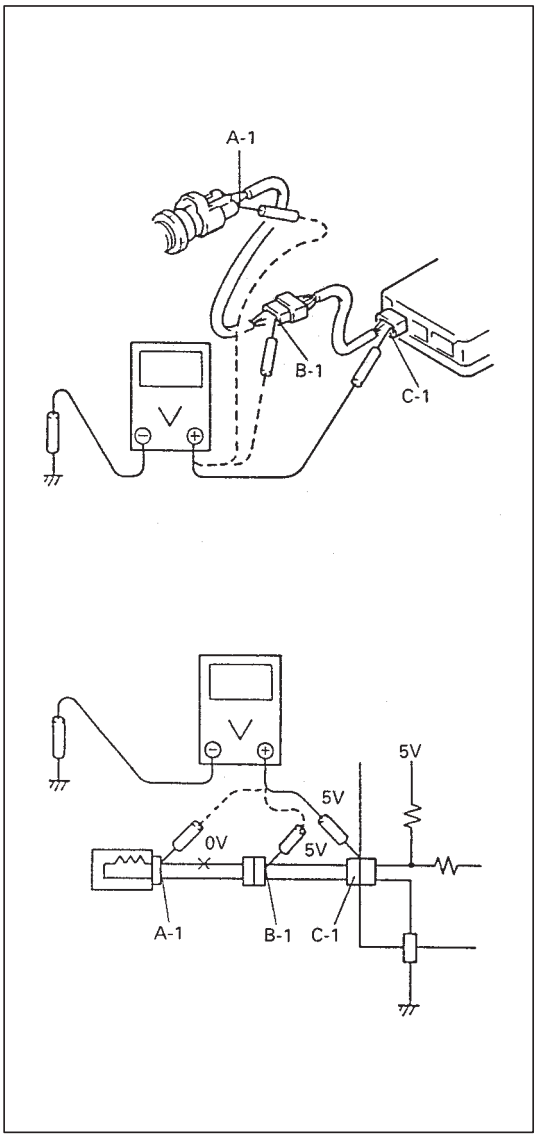


Continuity Check

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.

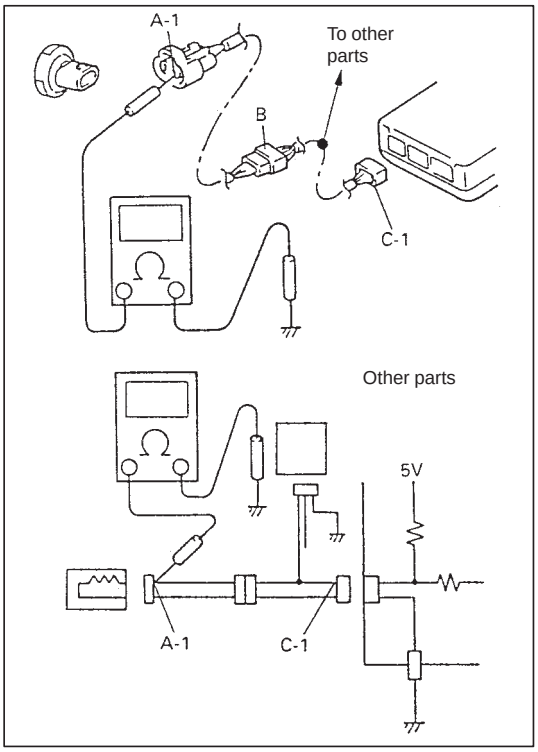
1) With all connectors connected and voltage applied to the circuit being checked, measure voltage between each terminal and body ground.

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

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

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

   Voltage Between:
   C-1 and body ground: Approx. 5V
   B-1 and body ground: Approx. 5V
   A-1 and body ground: Approx. 3V — 2V voltage drop

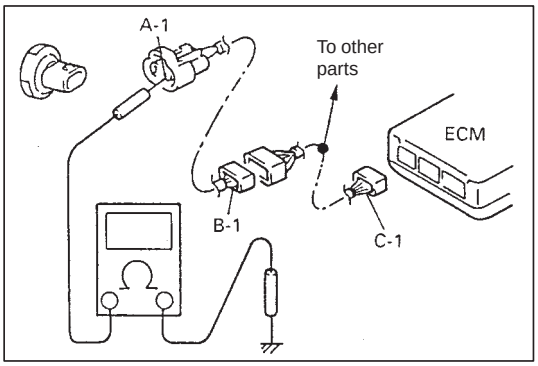


SHORT CIRCUIT CHECK (Wire harness to ground)

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

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

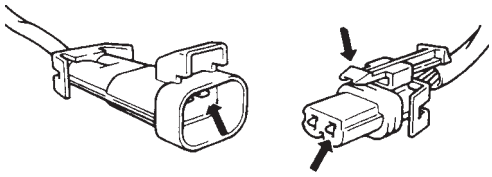
3) Measure resistance between terminal at one end of circuit (A-1 terminal in figure) and body ground. If continuity is indicated, it means that there is a short to ground between terminals A-1 and C-1 of the circuit.



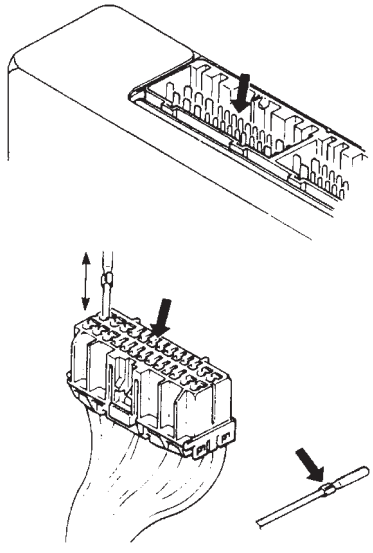
4) Disconnect the connector included in circuit (connector B) and measure resistance between A-1 and body ground.
If continuity is indicated, it means that the circuit is shorted to the ground between terminals A-1 and B-1.

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:

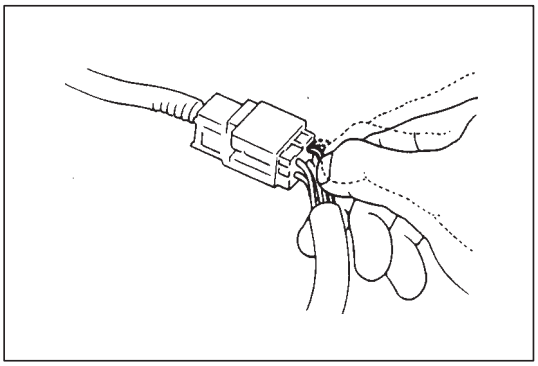


- Poor mating of connector halves, or terminals not fully seated in the connector body (backed out).
- Dirt or corrosion on the terminals. The terminals must be clean and free of any foreign material which could impede proper terminal contact.
  However, cleaning the terminal with a sand paper or the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

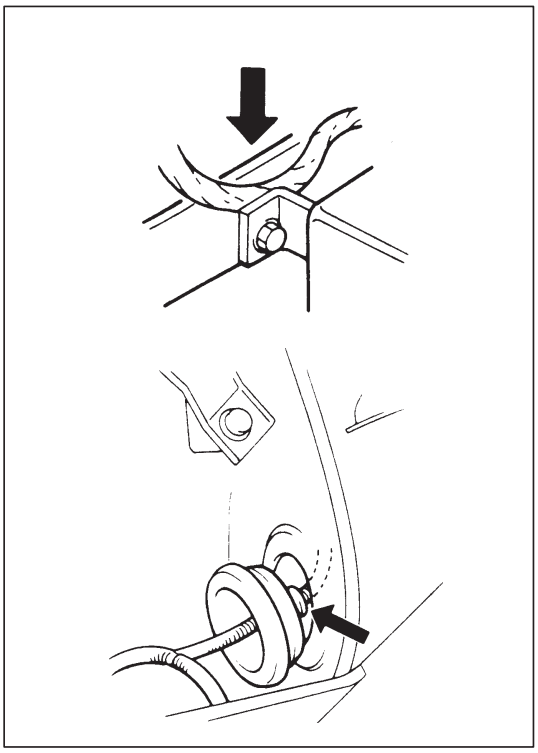


1. Check contact tension by inserting and removing just once.
2. Check each terminal for bend and proper alignment.

- 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.

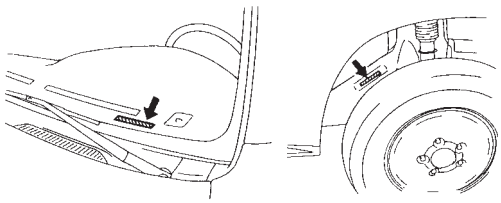


- Wire insulation which is rubbed through, causing an intermittent short as the bare area touches other wiring or parts of the vehicle.
- Wiring broken inside the insulation. This condition could cause continuity check to show a good circuit, but if only 1 or 2 strands of a multi-strand-type wire are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

PRECAUTION FOR INSTALLING MOBILE COMMUNICATION EQUIPMENT

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

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



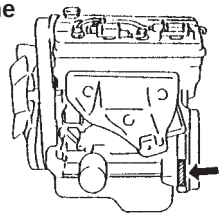
IDENTIFICATION INFORMATION

BODY NUMBER

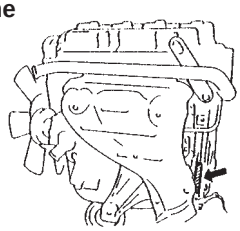
The vehicle body number is on the left side of instrument panel and punched on the chassis inside the tire housing on the right front side. It is possible to identify the country of origin (the production plant) of the vehicle by the first three digits of the body number as shown below.

JSAxxx . . . . . Japan (Iwata) produced
2S2xxx . . . . . Canada (CAMI) produced

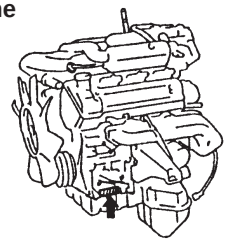
G16 engine



J20 engine



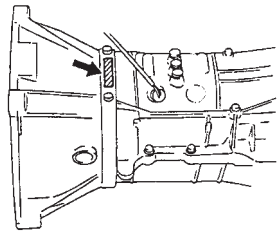
H25 engine



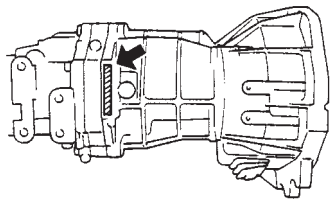
ENGINE IDENTIFICATION NUMBER

The number is punched on the cylinder block.

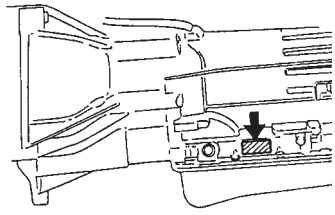
M/T (Type1)



M/T (Type2)



4-speed A/T



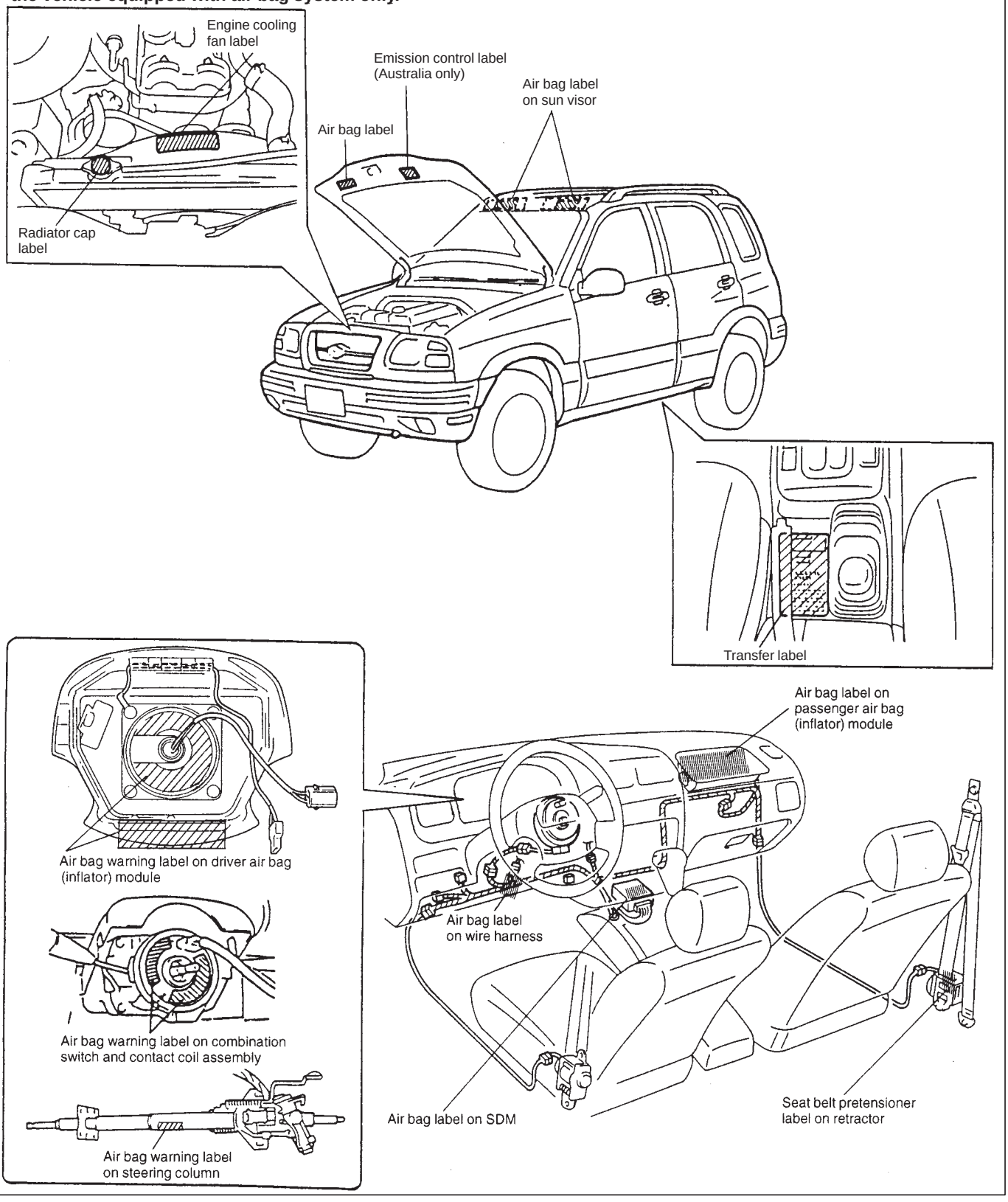
TRANSMISSION IDENTIFICATION NUMBER

The number is located on the transmission case.

WARNING, CAUTION AND INFORMATION LABELS

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

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

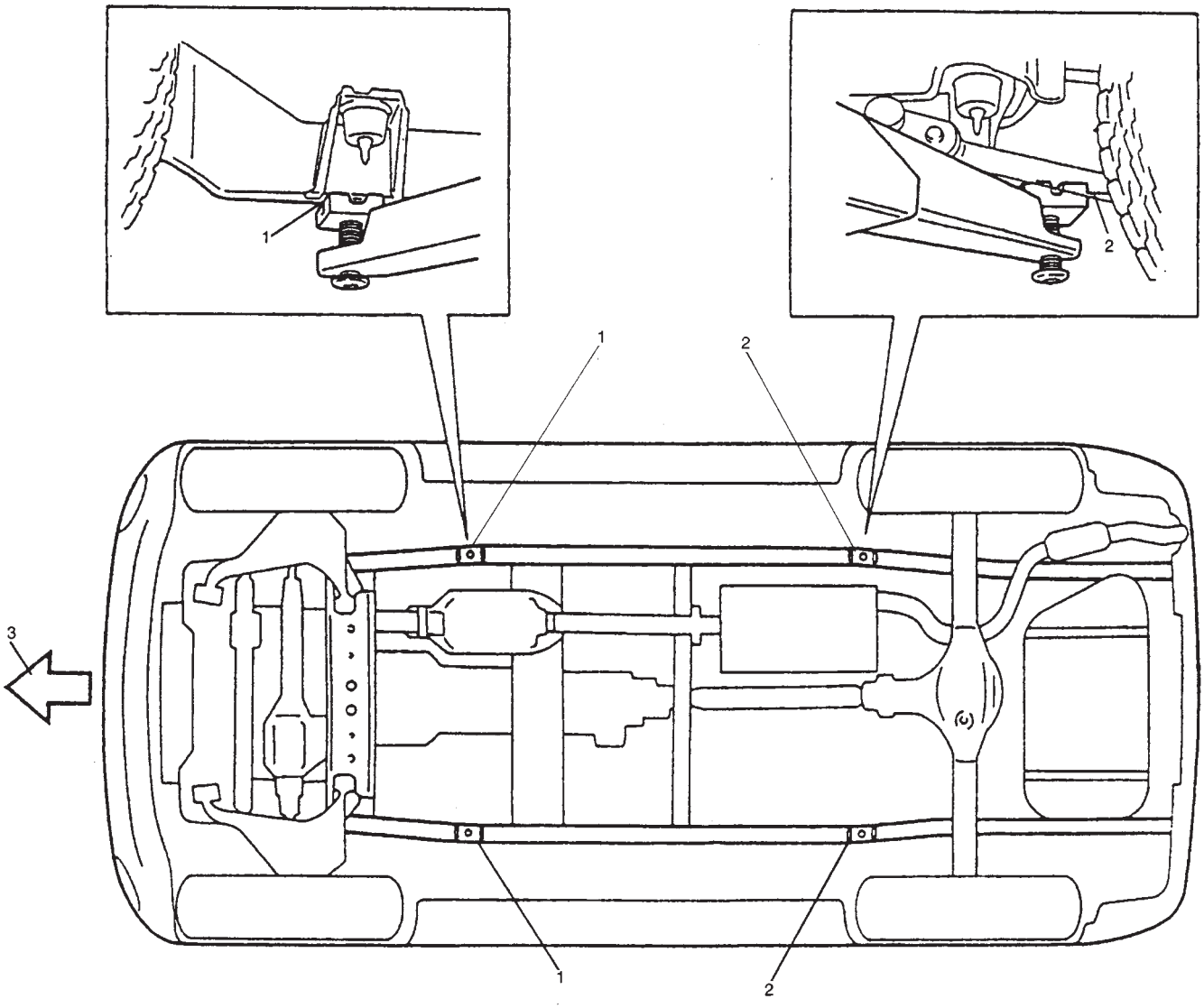


VEHICLE LIFTING POINTS

WARNING

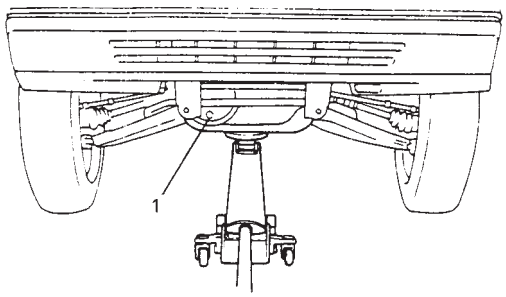
- **When using frame contact hoist, apply hoist as shown (right and left at the same position). Lift up the vehicle till 4 tires are a little off the ground and make sure that the vehicle will not fall off by trying to move vehicle body in both ways. Work can be started only after this confirmation.**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

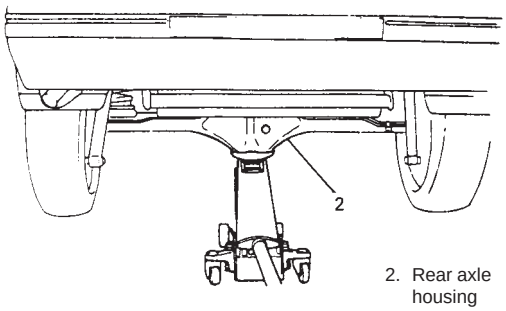


1. Front lifting point
2. Rear lifting point
3. Front

When using floor jack:



1. Front differential housing



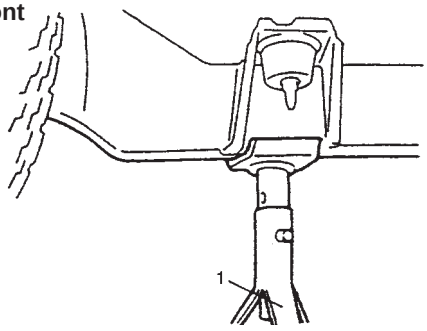
2. Rear axle housing

In raising front or rear vehicle end off the floor by jacking, be sure to put the jack against the center portion of the front suspension frame or rear axle housing.

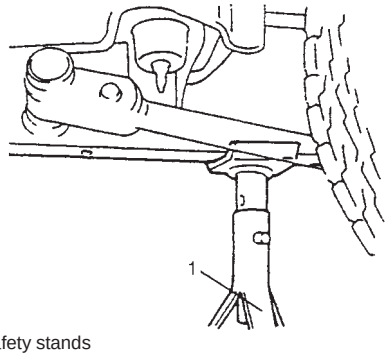
WARNING:

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



1. Safety stands

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

ABBREVIATIONS MAY BE USED IN THIS MANUAL

A

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

B

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

C

CKT	:	Circuit
CMP Sensor	:	Camshaft Position Sensor (Crank Angle Sensor, CAS)
CO	:	Carbon Monoxide
CPP Switch	:	Clutch Pedal Position Switch (Clutch Switch, Clutch Start Switch)
CPU	:	Central Processing Unit
CRS	:	Child Restraint System

D

DC	:	Direct Current
DLC	:	Data Link Connector (Assembly Line Diag. Link, ALDL, Serial Data Link, SDL)
DOHC	:	Double Over Head Camshaft
DOJ	:	Double Offset Joint
DRL	:	Daytime Running Light
DTC	:	Diagnostic Trouble Code (Diagnostic Code)

E

EBCM	:	Electronic Brake Control Module, ABS Control Module
EBD	:	Electric Brake force Distribution
ECM	:	Engine Control Module
ECT Sensor	:	Engine Coolant Temperature Sensor (Water Temp. Sensor, WTS)
EGR	:	Exhaust Gas Recirculation
EGRT Sensor	:	EGR Temperature Sensor (Recirculated Exhaust Gas Temp. Sensor, REGTS)
EFE Heater	:	Early Fuel Evaporation Heater (Positive Temperature Coefficient, PTC Heater)
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 Sensor

I

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

L

- LH : Left Hand
- LSPV : Load Sensing Proportioning Valve

M

- MAF Sensor : Mass Air Flow Sensor (Air Flow Sensor, AFS, Air Flow Meter, AFM)
- MAP Sensor : Manifold Absolute Pressure Sensor (Pressure Sensor, PS)
- Max : Maximum
- MFI : Multiport Fuel Injection (Multipoint Fuel Injection)
- Min : Minimum
- MIL : Malfunction Indicator Lamp (“CHECK ENGINE” Light)
- M/T : Manual Transmission

N

- NOx : Nitrogen Oxides

O

- OBD : On-Board Diagnostic System (Self-Diagnosis Function)
- O/D : Overdrive
- OHC : Over Head Camshaft

P

- PNP : Park/Neutral Position
- P/S : Power Steering
- PSP Switch : Power Steering Pressure Switch (P/S Pressure Switch)
- PCM : Powertrain Control Module
- PCV : Positive Crankcase Ventilation

R

- RH : Right Hand

S

- SAE : Society of Automotive Engineers
- SDM : Sensing and Diagnostic Module (Air bag controller, Air bag control module)
- SFI : Sequential Multiport Fuel Injection
- SOHC : Single Over Head Camshaft

T

- TBI : Throttle Body Fuel Injection (Single-Point Fuel Injection, SPI)
- TCC : Torque Converter Clutch
- TCM : Transmission Control Module (A/T Controller, A/T Control Module)
- TP Sensor : Throttle Position Sensor
- TVV : Thermal Vacuum Valve (Thermal Vacuum Switching Valve, TVSV, Bimetal Vacuum Switching Valve, BVSV)
- TWC : Three Way Catalytic Converter (Three Way Catalyst)
- 2WD : 2 Wheel Drive

V

- VIN : Vehicle Identification Number
- VSS : Vehicle Speed Sensor

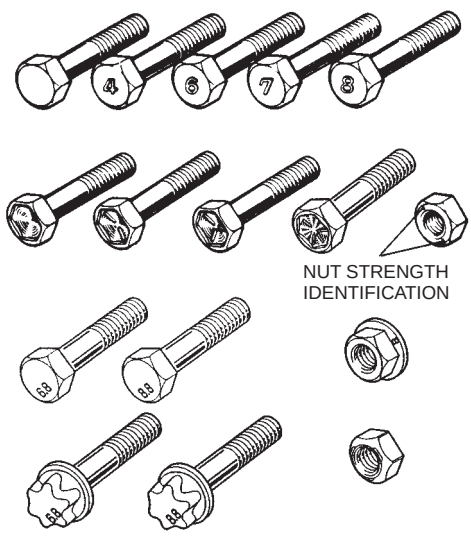
W

- WU-OC : Warm Up Oxidation Catalytic Converter
- WU-TWC : Warm Up Three Way Catalytic Converter

METRIC INFORMATION

METRIC FASTENERS

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



METRIC BOLTS–IDENTIFICATION CLASS NUMBERS OR MARKS CORRESPOND TO BOLT STRENGTH–INCREASING NUMBERS REPRESENT INCREASING 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.

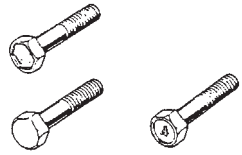
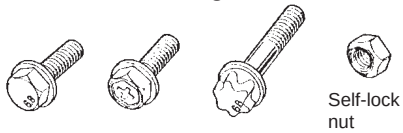
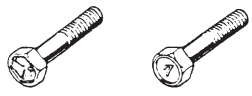
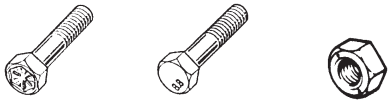
STANDARD TIGHTENING TORQUE

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 or 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

SECTION 0B

MAINTENANCE AND LUBRICATION

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

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

CONTENTS

MAINTENANCE SCHEDULE 0B- 2
Maintenance Schedule Under Normal Driving Conditions 0B- 2
Maintenance Recommended Under Severe Driving Conditions 0B- 4
MAINTENANCE SERVICE 0B- 5
Engine 0B- 5
Ignition System 0B-12
Fuel System 0B-12
Emission Control System 0B-14
Chassis and Body 0B-15
Final Inspection 0B-24
RECOMMENDED FLUIDS AND LUBRICANTS 0B-25

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
ENGINE							
1-1. Drive belt	V-belt	I	R	I	R	I	R
	V-rib belt (Flat type)	–	–	I	–	–	R
1-2. Camshaft timing belt (G16 engine only)		Replace every 100,000 km or 60,000 miles					
1-3. Valve lash (clearance)	G16 engine only	–	I	–	I	–	I
1-4. Engine oil and oil filter	J20/H25 engines G16 engine with HO2S (SG, SH, SJ)	R	R	R	R	R	R
	G16 engine with HO2S (SE, SF), G16 engine without HO2S	Replace every 10,000 km (6,000 miles) or 8 months					
1-5. Engine coolant		–	–	R	–	–	R
1-6. Exhaust system		–	I	–	I	–	I
IGNITION SYSTEM							
2-1. Spark plugs	When unleaded fuel is used – Vehicle without HO2S – Nickel plug	–	R	–	R	–	R
	When unleaded fuel is used – Vehicle without HO2S – Iridium plug	–	–	–	R	–	–
	When unleaded fuel is used – Vehicle with HO2S – Nickel plug	–	–	R	–	–	R
	When unleaded fuel is used – Vehicle with HO2S – Iridium plug	Replace every 105,000 km or 63,000 miles					
	When leaded fuel is used, refer to “Severe Driving Condition” schedule						
FUEL SYSTEM							
3-1. Air cleaner filter		I	I	R	I	I	R
3-2. Fuel lines and connections		–	I	–	I	–	I
3-3. Fuel filter		Replace every 105,000 km or 63,000 miles					
3-4. Fuel tank		–	–	I	–	–	I
EMISSION CONTROL SYSTEM							
4-1. Crankcase ventilation hoses and connections (Vehicle without HO2S)		–	–	I	–	–	I
4-2. PCV valve	Vehicle without HO2S	–	–	I	–	–	I
	Vehicle with HO2S	–	–	–	–	–	I
4-3. Fuel evaporative emission control system	Vehicle without HO2S	–	I	–	I	–	I
	Vehicle with HO2S	–	–	–	–	–	I

NOTES:

- **“R” : Replace or change**
- **“I” : Inspect and correct, replace or lubricate 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, 4-2 and 4-3 should be performed by odometer reading only.**
- **For Item 2-1. Spark plugs, replace every 50,000 km if the local law requires.**
- **Nickel spark plug: BKR6E-11 or K20PR-U11**
- **Iridium spark plug: IFR6E11 or SK20PR-A11 for G16 engine, IFR5J11 or SK16PR11 for J20/H25 engines**

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
CHASSIS AND BODY							
6-1. Clutch (pedal and fluid level)		–	I	–	I	–	I
6-2. Brake discs and pads (thickness, wear, damage)		I	I	I	I	I	I
Brake drums and shoes (wear, damage)		–	I	–	I	–	I
6-3. Brake hoses and pipes (leakage, damage, clamp)		–	I	–	I	–	I
6-4. Brake fluid		–	R	–	R	–	R
6-5. Brake lever and cable (damage, stroke, operation)		Inspect at first 15,000 km (9,000 miles) only					
6-6. Tires (wear, damage, rotation)		I	I	I	I	I	I
6-7. Wheel discs (damage)		I	I	I	I	I	I
6-8. Suspension system (tightness, damage, rattle, breakage)		–	I	–	I	–	I
6-9. Propeller shafts and drive shafts		–	–	I	–	–	I
6-10. Manual transmission oil (leakage, level) (I: 1st 15,000 km only)		I	–	R	–	–	R
6-11. Automatic transmission	Fluid level	–	I	–	I	–	I
	Fluid change	Replace every 165,000 km (99,000 miles)					
	Fluid hose	–	–	–	R	–	–
6-12. Transfer oil (leakage, level)		I	–	I	–	I	–
6-13. Differential oil (leakage, level) (R: 1st 15,000 km only)		R or I	–	I	–	I	–
6-14. Steering system (tightness, damage, breakage, rattle)		–	I	–	I	–	I
6-15. Power steering (if equipped)		I	I	I	I	I	I
6-16. All latches, hinges and locks		–	I	–	I	–	I
6-17. Air conditioning filter (if equipped)		–	I	R	–	I	R

NOTES:
"R": Replace or change
"I" : Inspect and correct, replace or lubricate if necessary

MAINTENANCE RECOMMENDED UNDER SEVERE DRIVING CONDITIONS

If the vehicle is usually used under the conditions corresponding to any severe condition code given below, it is recommended that applicable maintenance operation be performed at the particular interval as 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 – Leaded fuel use
G – – – – – – – – –
H – Trailer towing (if admitted)

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 F – H	ITEM 1-4 Engine oil and oil filter		R	Every 5,000 km (3,000 miles) or 4 months
– B – – – – – –	ITEM 1-6 Exhaust pipe mountings		I	Every 15,000 km (9,000 miles) or 12 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
A B C – E F – H	ITEM 2-1 Spark plugs	Nickel plug	R	Every 10,000 km (6,000 miles) or 8 months
		Iridium plug	R	Every 30,000 km (18,000 miles) or 24 months
– B – D E – – H	ITEM 6-9 Propeller shafts and drive shafts		I	Every 15,000 km (9,000 miles) or 12 months
– B – – E – – H	ITEM 6-10, 6-12, 6-13 Manual transmission, transfer and differential oil		R	Every 30,000 km (18,000 miles) or 24 months
– B – – E – – H	ITEM 6-11 Automatic transmission fluid		R	Every 30,000 km (18,000 miles) or 24 months
– B – – – – – –	ITEM 6-8 Suspension bolts and nuts		T	Every 15,000 km (9,000 miles) or 12 months
– B C D – – – H	ITEM 6-7 Wheel bearing		I	Every 15,000 km (9,000 miles) or 12 months
– – C D – – – –	ITEM 6-17 Air conditioning filter *2 (if equipped)		I	Every 15,000 km (9,000 miles) or 12 months
			R	Every 45,000 km (27,000 miles) or 36 months

NOTES:
"I" : Inspect and correct, replace or lubricate if necessary
"R" : Replace or change
"T" : Tighten to the specified torque
***1 : Inspect or replace more frequently if necessary.**
***2 : Clean or replace more frequently if the air from the air conditioning decreases.**

MAINTENANCE SERVICE

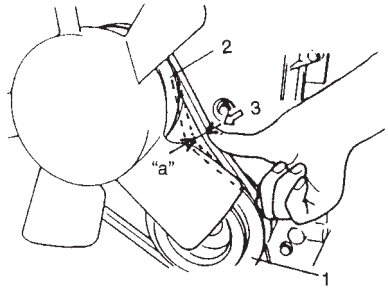
ENGINE

ITEM 1-1

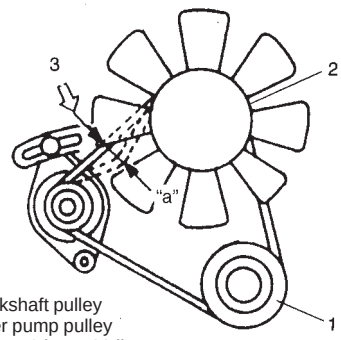
Drive Belt Inspection and Replacement

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

G16



H25



1. Crankshaft pulley
2. Water pump pulley
3. 100 N, 10 kg or 22 lb

Water pump and generator drive belt (G16 and H25 engines)

Inspection

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

   Water pump and generator belt tension
   "a": 6 – 8 mm (0.24 – 0.32 in.) deflection for G16, 9 – 11 mm (0.35 – 0.43 in.) deflection for H25 under 100 N, 10 kg or 22 lb pressure

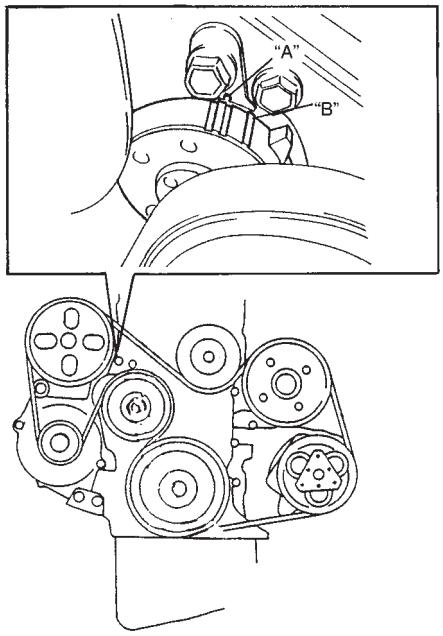
   NOTE:
   When replacing belt with a new one, adjust belt tension to 5 – 6 mm (0.20 – 0.24 in.) for G16, 7 – 9 mm (0.28 – 0.35 in.) for H25.

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

Replacement

Replace belt. Refer to Section 6B for replacement procedure of pump belt.

J20



Water pump, generator, power steering and/or A/C compressor (if equipped) drive belt (J20 engine)

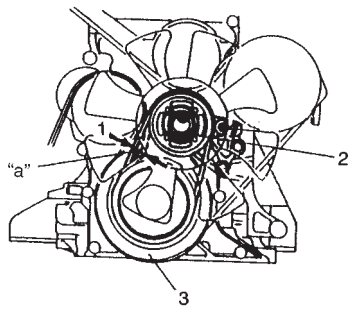
Inspection

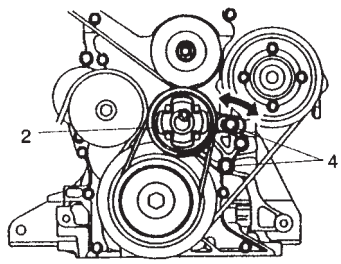
1) Disconnect negative cable at battery.
2) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If any of above conditions are found, replace.
   Also, check belt for tension.
   Tension indicator "B" should be the right of indicator "A" as shown in figure. If indicator "B" is found to the left of indicator "A", replace generator belt.

Replacement

Replace belt referring to Section 6H for replacement procedure of generator drive belt.

J20





1. 100 N, 10 kg or 22 lb
2. Fan pulley
3. Crankshaft pulley
4. Adjusting and pivot bolt

Engine cooling fan drive belt (J20 engine)

Inspection

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

   Cooling fan belt tension
   "a": 5 – 7 mm (0.20 – 0.27 in.) deflection under 100 N, 10 kg or 22 lb pressure.

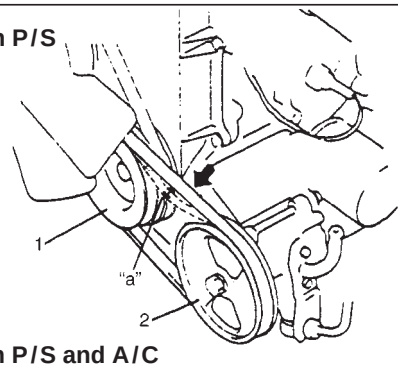
   NOTE:
   When replacing belt with a new one, adjust belt deflection to 4 – 5 mm (0.16 – 0.19 in.).

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

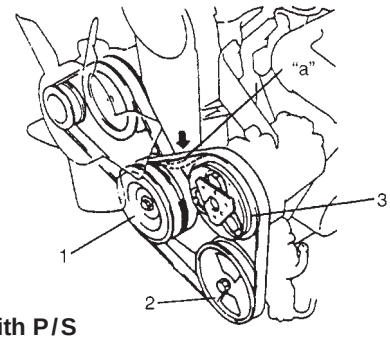
Replacement

Replace belt referring to Section 6B for replacement procedure of cooling fan drive belt.

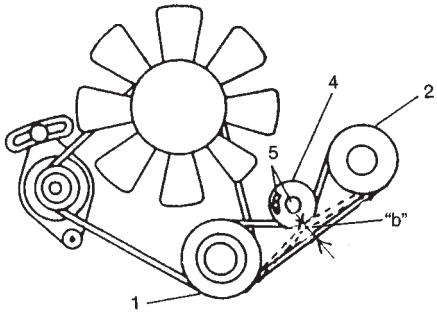
G16 with P/S



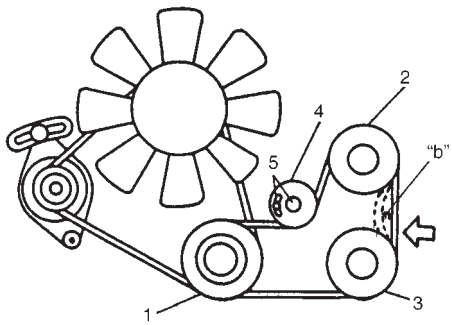
G16 with P/S and A/C



H25 with P/S



H25 with P/S and A/C



1. Crankshaft pulley
2. P/S pump pulley
3. A/C compressor pulley (if equipped)
4. Tension pulley
5. Tension pulley bolts

Power steering pump and/or A/C compressor drive belts (if equipped) for G16 and H25 engines.

Inspection

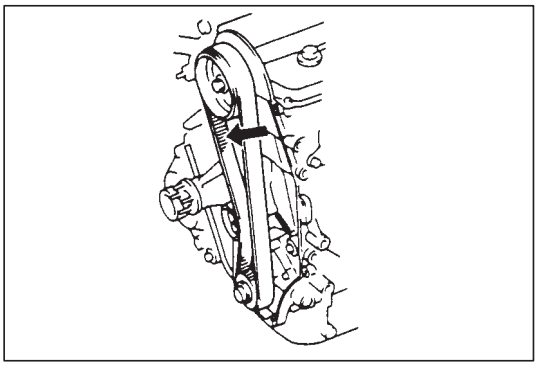
1) Disconnect negative cable at battery.
2) Inspect belt for cracks, cuts, deformation, wear and cleanliness.
   If any defect exists, replace.
   Check belt for tension.

   Power steering pump and/or A/C compressor drive belt tension.
   "a": 6 – 9 mm (0.24 – 0.35 in.) deflection under 100 N, 10 kg or 22 lb pressure.
   "b": 4 – 7 mm (0.16 – 0.28 in.) deflection under 100 N, 10 kg or 22 lb pressure.

   If belt tension is out of above specification, adjust it referring to Section 1B or 3B1.
3) Connect negative cable to battery.

Replacement

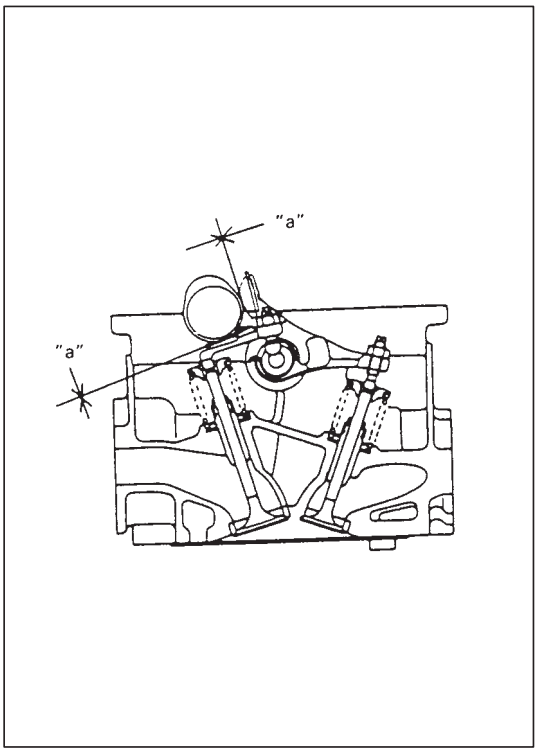
Replace belt referring to Section 1B or 3B1 for replacement procedure of belt.



ITEM 1-2

Camshaft Timing Belt Replacement (G16 engine only)

Replace timing belt referring to Section 6A1.



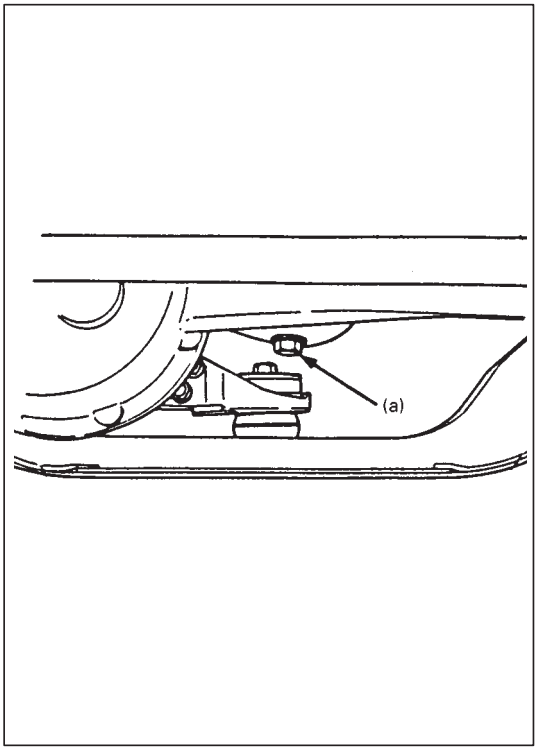
ITEM 1-3

Valve Lash Inspection (G16 engine only)

1) Remove cylinder head cover.
2) Inspect intake and exhaust valve lash and adjust as necessary. Refer to Section 6A1 for valve lash inspection and adjustment procedure.

		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 lash (gap "a") specification	Intake	0.13 – 0.17 mm (0.005 – 0.007 in.)	0.17 – 0.21 mm (0.007 – 0.008 in.)
	Exhaust	0.23 – 0.27 mm (0.009 – 0.011 in.)	0.28 – 0.32 mm (0.011 – 0.013 in.)

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



ITEM 1-4

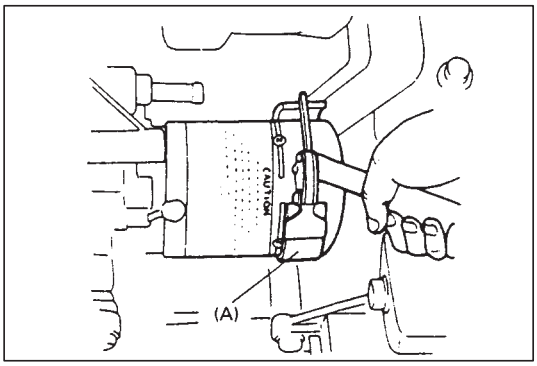
Engine Oil and Filter Change

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.

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

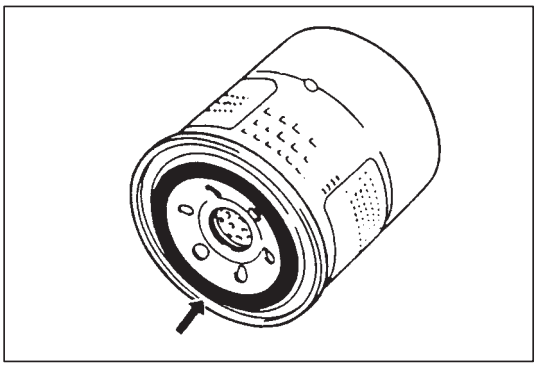
1) Drain engine oil by removing drain plug.
2) After draining oil, wipe drain plug clean. Reinstall drain plug, and tighten it securely as specified below.

Tightening Torque
(a): 35 N·m (3.5 kg-m, 25.5 lb-ft)



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

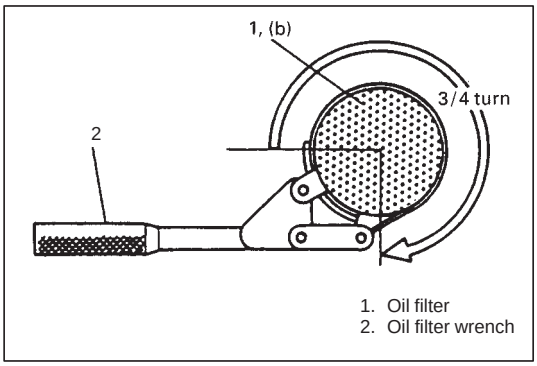
Special Tool
(A): 09915-47310 (H25 engine)
09915-47330 (G16 and J20 engines)



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

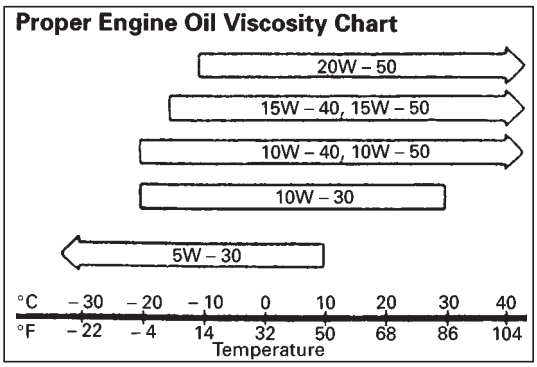
4) Screw new filter on oil filter stand by hand until the filter O-ring contacts the mounting surface.

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



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

Tightening Torque (Reference)
(b): 14 N·m (1.4 kg-m, 10.5 lb-ft)



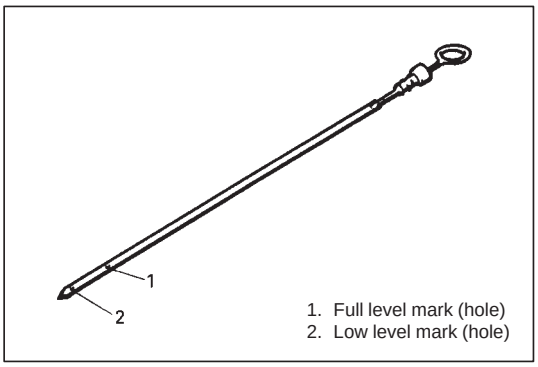
6) Replenish oil until oil level is brought to FULL level mark on dipstick. (oil pan and oil filter capacity). The filler inlet is at the top of the cylinder head cover.
It is recommended to use engine oil of SG, SH or SJ grade.

NOTE:
For temperature between –20°C (–4°F) and 30°C (86°F), it is highly recommended to use SAE 10W – 30 oil.

	G16 Engine	J20 Engine	H25 Engine
Oil pan capacity	About 4.0 liters (10.6/8.8 US/Imp pt.)	About 5.0 liters (10.6/8.8 US/Imp pt.)	←
Oil filter capacity	About 0.2 liters (0.4/0.3 US/Imp pt.)	←	About 0.5 liters (1.1/0.9 US/Imp pt.)
Others	About 0.3 liters (0.6/0.5 US/Imp pt.)	About 0.4 liters (1.1/0.9 US/Imp pt.)	About 0.7 liters (1.5/1.2 US/Imp pt.)
Total	About 4.5 liters (9.5/7.9 US/Imp pt.)	About 5.6 liters (11.8/9.8 US/Imp pt.)	About 6.2 liters (13.1/10.9 US/Imp pt.)

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

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



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

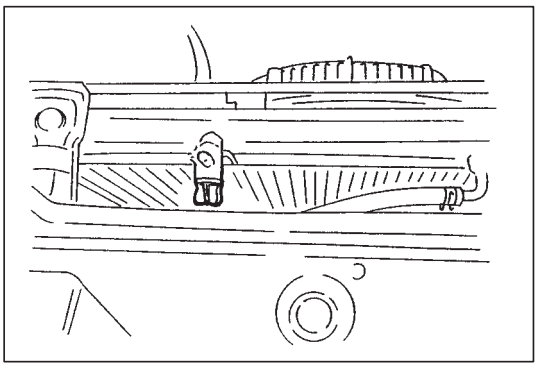
8) Start engine and run it for three minutes. Stop it and wait five minutes before checking oil level. Add oil, as necessary, to bring oil level to FULL level mark on dipstick.

NOTE:
Step 1) – 7) outlined above must be performed with ENGINE NOT RUNNING. For step 8), be sure to have adequate ventilation while engine is running.

ITEM 1-5

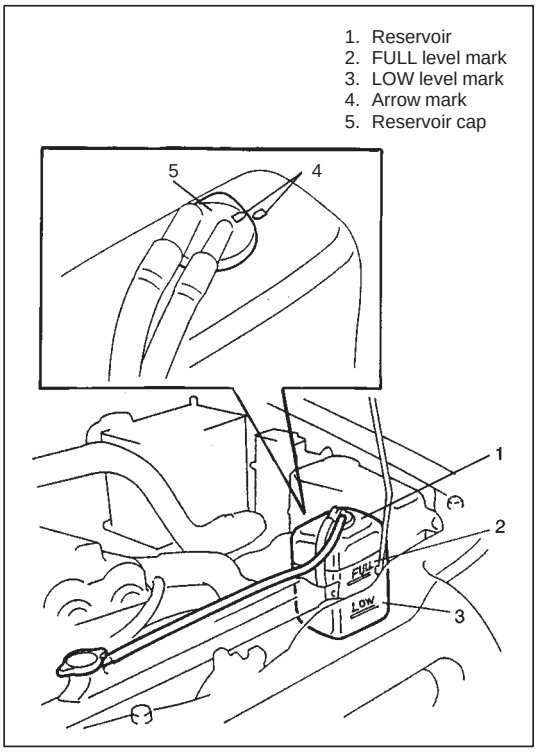
Engine Coolant Change

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.



1) Remove radiator cap when engine is cool.
2) Loosen radiator drain plug to drain coolant.
3) Remove reservoir, which is on the side of radiator, and drain.
4) Tighten plug securely. Also reinstall reservoir.

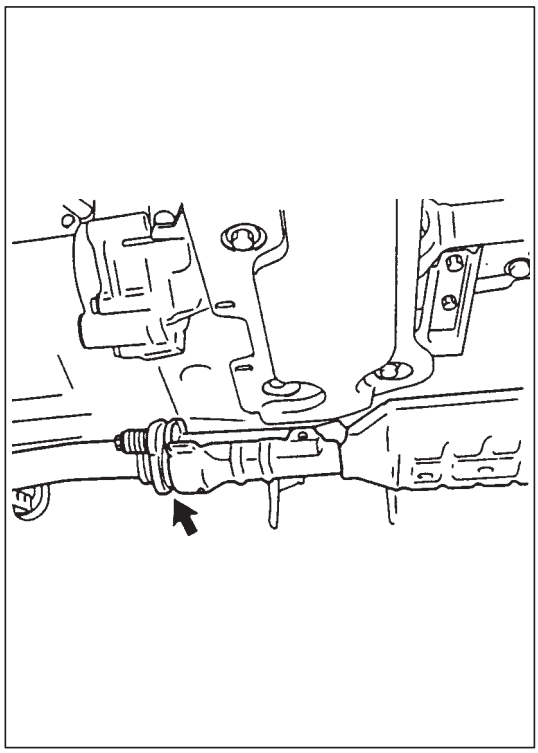
5) Fill radiator with specified amount of coolant, and run engine for 2 or 3 minutes at idle. This drives out any air which may still be trapped within cooling system. STOP ENGINE. Add coolant as necessary until coolant level reaches the filler throat of radiator. Reinstall radiator cap.



6) Add coolant to reservoir so that its level aligns with Full mark. Then, reinstall cap aligning arrow marks on reservoir and cap.

NOTE:
When installing reservoir cap, align arrow marks on reservoir and cap.

CAUTION:
When changing engine coolant, use mixture of 50% water and 50% ANTIFREEZE/ANTICORROSION COOLANT for the market where ambient temperature falls lower than –16°C (3°F) in winter, and mixture of 70% water and 30% ANTIFREEZE/ANTICORROSION 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% ANTIFREEZE/ANTICORROSION COOLANT should be used for the purpose of corrosion protection and lubrication.



ITEM 1-6

Exhaust System Inspection

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

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

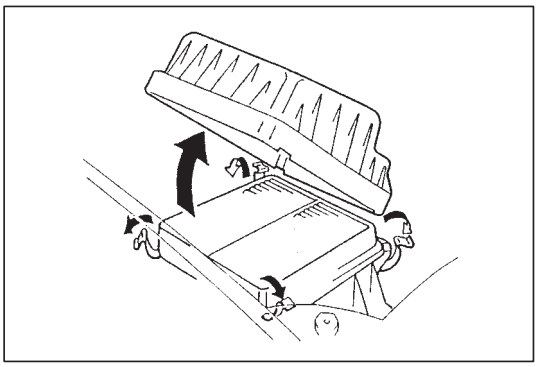
- Check rubber mountings for damage, deterioration, and out of position.
- Check exhaust system for leakage, loose connections, dents and damages.
  If bolts or nuts are loose, tighten them to specification.
- Check nearby body areas for damaged, missing, or mispositioned parts, open seams, holes, loose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

IGNITION SYSTEM

ITEM 2-1

Spark Plugs Replacement

Replace spark plugs with new ones referring to Section 6F1 or 6F2.



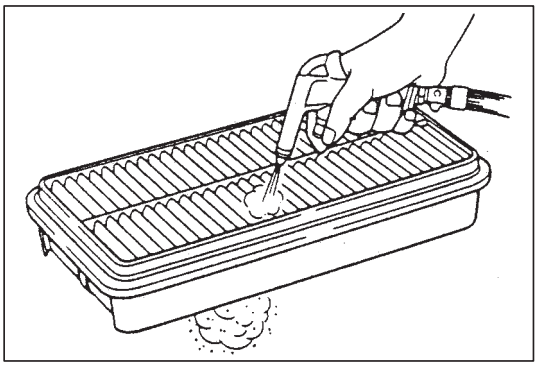
FUEL SYSTEM

ITEM 3-1

Air Cleaner Filter

Inspection

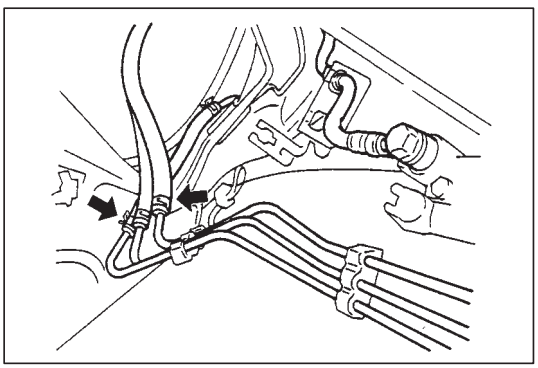
1) Remove air cleaner case clamps.
2) Take cleaner filter out of air cleaner case.
3) Check air cleaner filter for dirt. Replace excessively dirty filter.



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

Replacement

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



ITEM 3-2

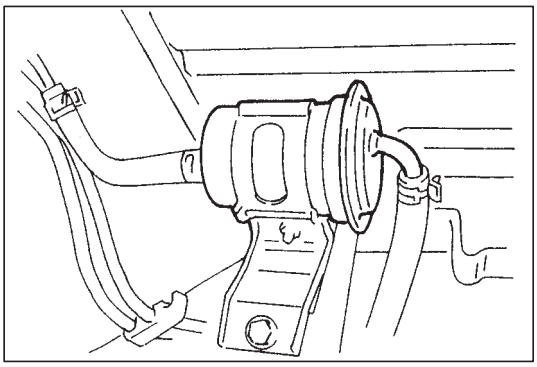
Fuel Lines and Connections Inspection

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

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 is located at the front part of fuel tank, inside the right-hand side of chassis.
Replace fuel filter with new one periodically, referring to Section 6C for proper procedure.

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.

EMISSION CONTROL SYSTEM

ITEM 4-1

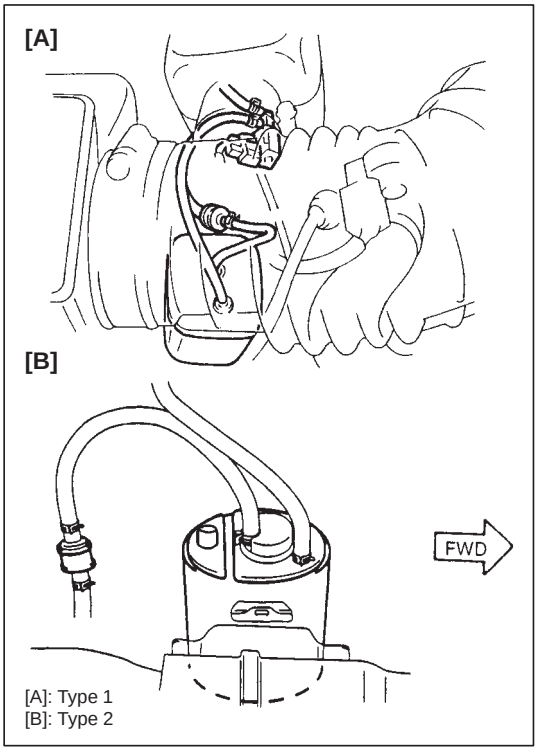
Crankcase Ventilation Hoses and Connections Inspection (Vehicle not equipped with oxygen sensor)

Refer to the following item 4-2, PCV valve inspection.

ITEM 4-2

PCV (Positive Crankcase Ventilation) Valve Inspection

Check crankcase ventilation hose and PCV hose for leaks, cracks or clog, and PCV valve for stick or clog. Refer to On-vehicle service of Section 6E1/6E2 for PCV valve checking procedure.

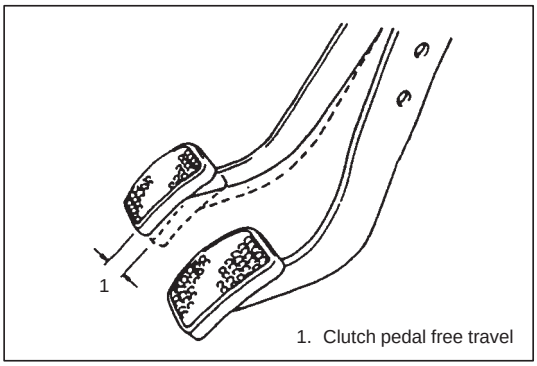


[A]: Type 1
[B]: Type 2

ITEM 4-3

Evaporative Emission Control System Inspection

1) Visually inspect hoses for cracks, damage, or excessive bends. Inspect all clamps for damage and proper position.
2) Check EVAP canister for operation and clog, referring to Section 6E1/6E2.
   If a malfunction is found, repair or replace.



1. Clutch pedal free travel

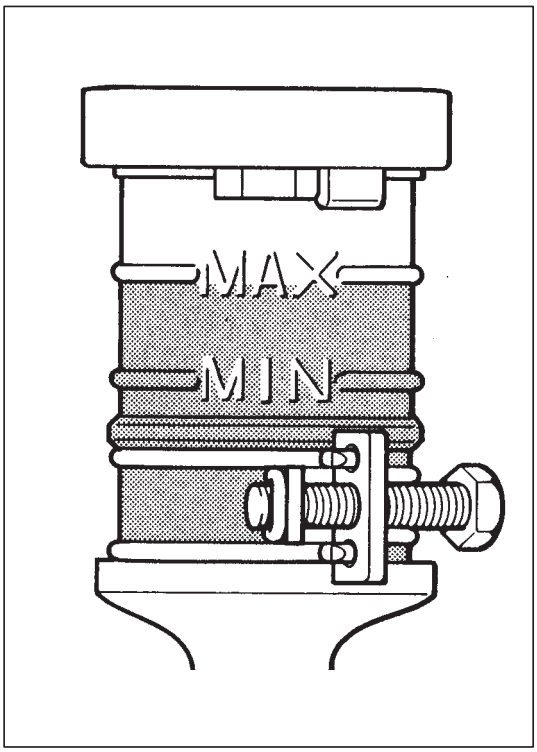
CHASSIS AND BODY

ITEM 6-1

Clutch

Pedal inspection

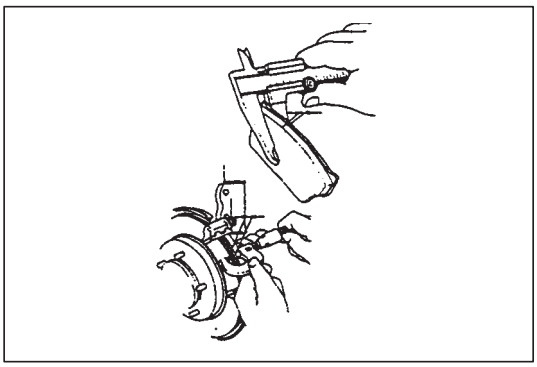
Check clutch pedal for height and free travel referring to Section 7C1. Adjust or correct if necessary.



Fluid inspection

1) Check around master cylinder and reservoir for fluid leakage. If found leaky, correct.
2) Check fluid level.
   If fluid level is lower than the minimum level of reservoir, refilling is necessary. Fill reservoir with specified brake fluid indicated on clutch reservoir cap.
   For the details, refer to On-vehicle service in Section 7C1.

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

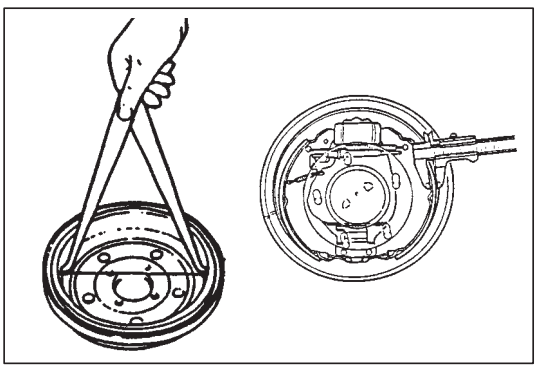


ITEM 6-2

Brake Discs, Pads, Brake Drums and Shoes Inspection

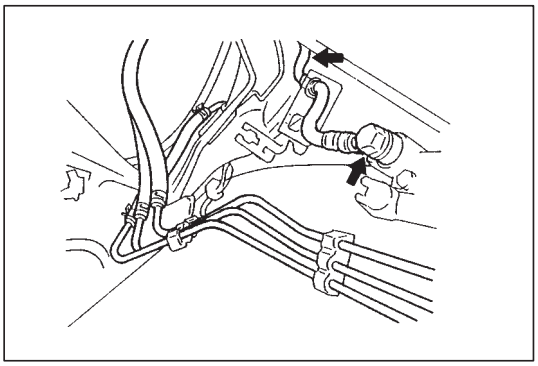
[Brake discs and pads]

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 details, refer to Section 5B.
   Be sure to torque caliper pin bolts to specification.



[Brake drums and shoes]

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



ITEM 6-3

Brake Hoses and Pipes Inspection

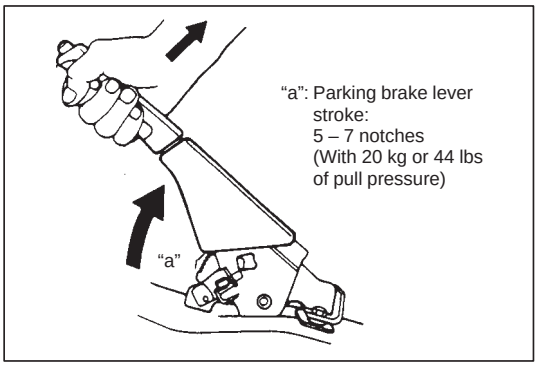
Check brake hoses and pipes for proper hookup, leaks, cracks, chafing and other damage.
Replace any of these parts as necessary.

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

ITEM 6-4

Brake Fluid Change

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.

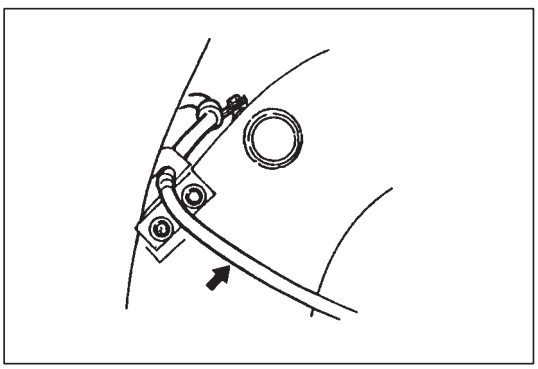


ITEM 6-5

Parking Brake Lever and Cable Inspection

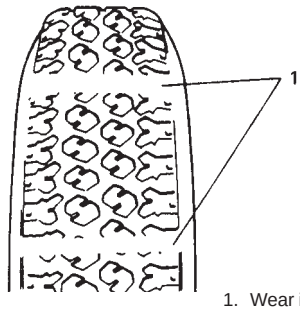
Parking brake lever

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



Parking brake cable

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



1. Wear indicator

ITEM 6-6

Tire Inspection and Rotation

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

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

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

3) Rotate tires.
   For details, refer to Section 3F.

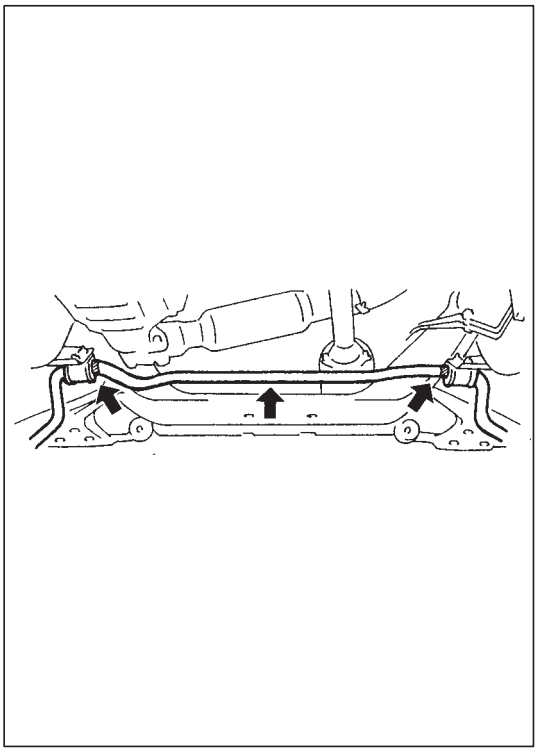
ITEM 6-7

Wheel Discs Inspection

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

Wheel Bearing Inspection

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



ITEM 6-8

Suspension System Inspection

Check suspension bolts and nuts for tightness and retighten them as necessary.

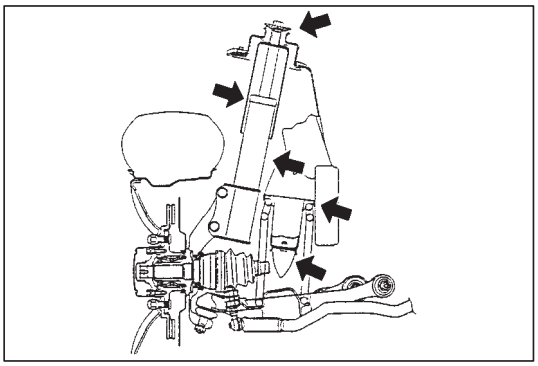
Repair or replace defective parts, if any.

NOTE:

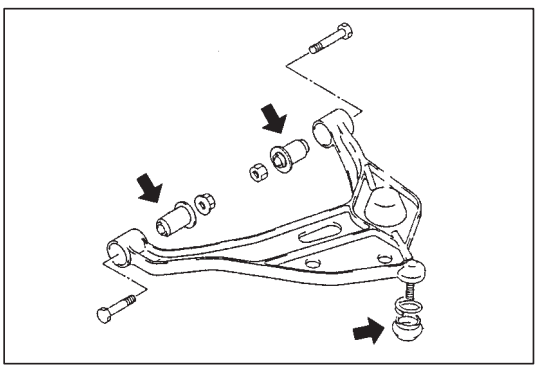
For details of check points, refer to tables of Tightening Torque Specification in Section 3D and 3E.

Front

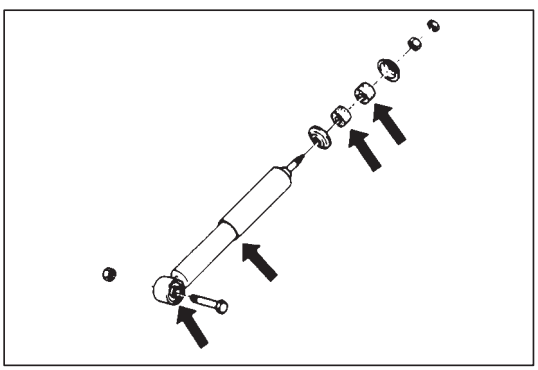
1) Check stabilizer bar for damage or deformation.
2) Check bushing for damage, wear or deterioration.



3) Inspect strut for damage, deformation, oil leakage and operation. If strut is found faulty, replace it as an assembly unit, because it can not be disassembled.
   Refer to strut check Section 3D for operation check.
4) Inspect strut boot for damage or crack.
5) Inspect for cracks or deformation in spring seat.
6) Inspect for deterioration of bump stopper.
7) Inspect strut mount for wear, cracks or deformation.

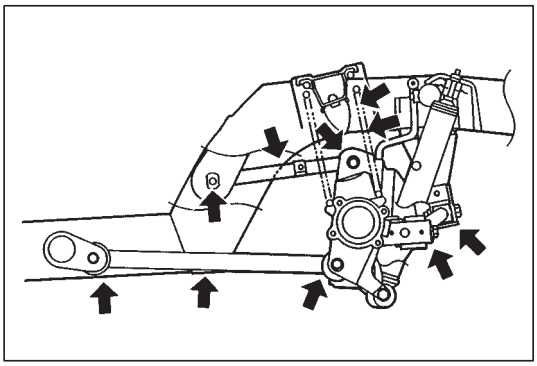


8) Check ball joint stud dust seal (boot) for leaks, detachment, tear or other damage. Check suspension arm bushing for damage, wear or deterioration.



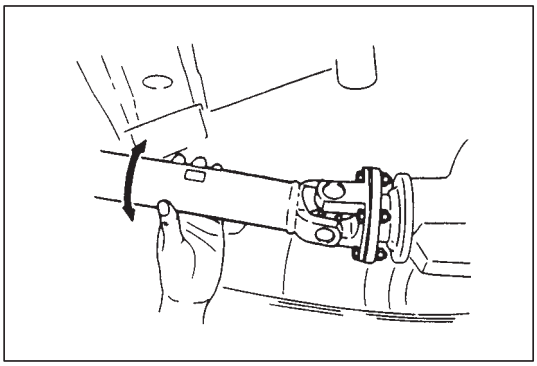
Rear

9) Check shock absorber for damage, deformation, oil leakage and operation.
10) Check bushings for wear and damage.



11) Check coil spring, upper rod, lower rod and lateral rod for deformation and damage.
12) Check upper rod, lower rod and lateral rod bushings and bump stopper for wear, damage and deterioration.

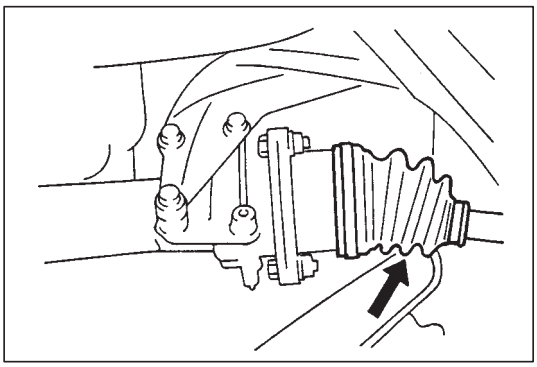
13) Check other suspension parts for damage, loose or missing parts; also for parts showing signs of wear or lack of lubrication. Replace any parts found defective in steps 1) to 13).



ITEM 6-9

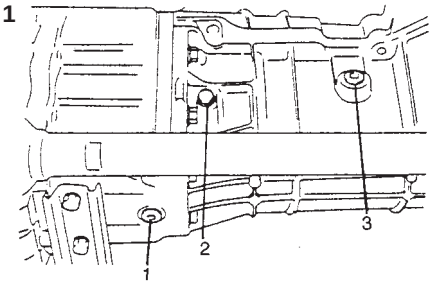
Propeller Shafts and Drive Shafts Inspection

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



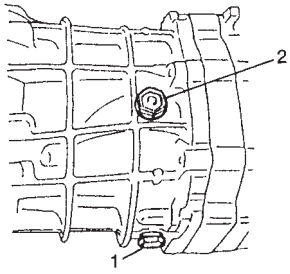
3) Check drive axle boots (wheel side and differential side) for leaks, detachment, tear or other damage.
   Replace boot as necessary.

Type 1



1. Drain plug (Apply sealant)
2. Reverse idle gear shaft bolt (DO NOT LOOSEN IT)
3. Filler / level plug (Apply sealant)

Type 2



1. Drain plug
2. Filler / level plug

ITEM 6-10

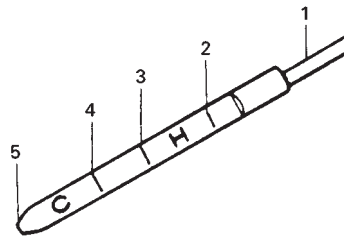
Manual Transmission Oil Inspection and Change

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 level plug of transmission.
4) Check oil level.
   Oil level can be checked roughly by means of level plug hole. That is, if oil flows out of level plug hole or if oil level is found up to hole when level plug is removed, oil is properly filled.
   If oil is found insufficient, pour specified amount of specified oil.
5) Tighten level plug to specified torque.
   Refer to Section 7A or 7A1 for installation and tightening torque.

Change

Change transmission oil with new specified oil referring to Section 7A or 7A1.



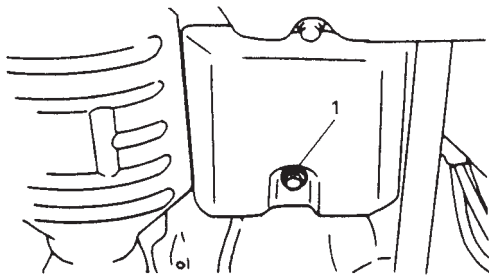
1. Level gauge
2. FULL HOT mark
3. LOW HOT mark
4. FULL COLD mark
5. LOW COLD mark

ITEM 6-11

Automatic Transmission Fluid Inspection and Change

Inspection

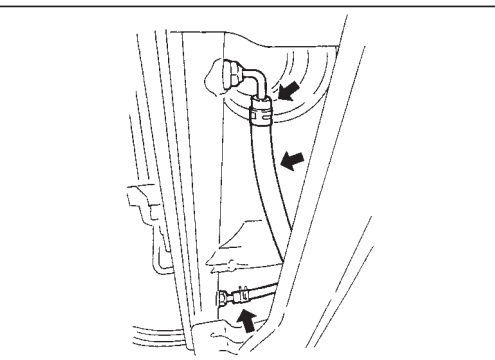
1) Inspect transmission case for evidence of fluid leakage.
   Repair leaky point, if any.
2) Make sure that vehicle is placed level for fluid level check.
3) Check fluid level.
   For fluid level checking procedure, refer to On-vehicle service in Section 7B1 and be sure to perform it under specified conditions.
   If fluid level is low, replenish specified fluid.



1. Drain plug

Change

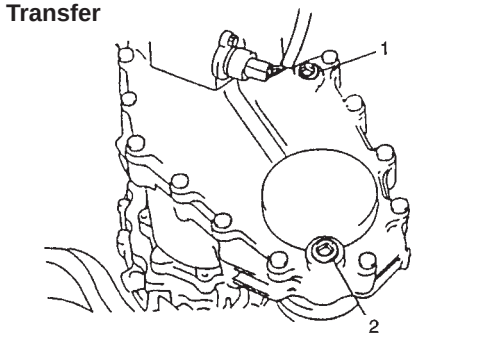
1) Inspect transmission case for evidence of fluid leakage. Repair leaky point, if any.
2) Make sure that vehicle is placed level for fluid level check.
3) Change fluid. For its procedure, refer to On-vehicle service in Section 7B1.



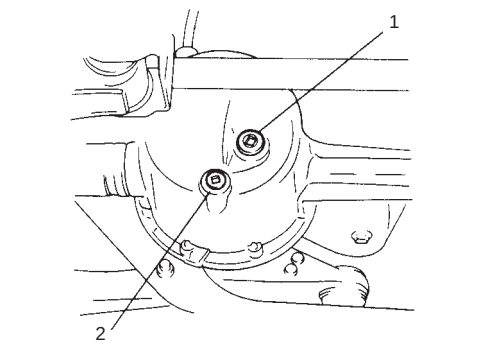
Fluid cooler hose change

Replace inlet and outlet hoses of cooler hose and their clamps. For replacement procedure, refer to On-vehicle service in Section 7B1.

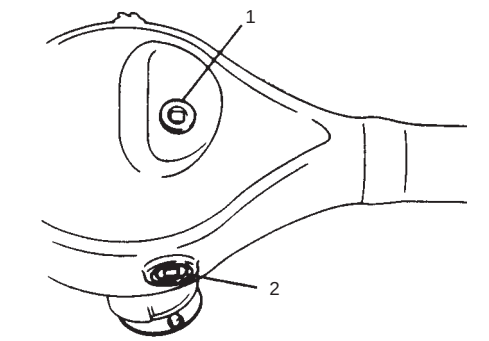
Transfer



Front differential



Rear differential



ITEM 6-12 and 6-13

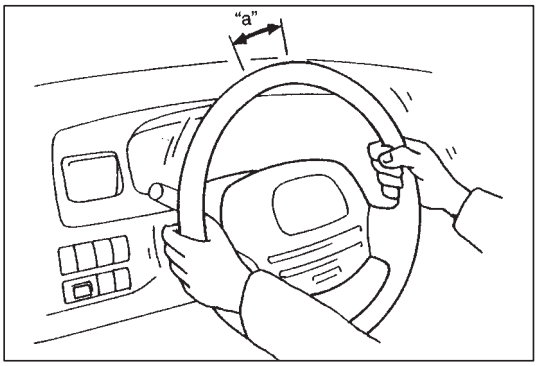
Transfer and Differential Oil Inspection and Change

Inspection

1) Check transfer case and differential for evidence of oil leakage. Repair leaky point if any.
2) Make sure that vehicle is placed level for oil level check.
3) Remove level plug of transfer or differentials (front and rear) and check oil level.
   Oil level can be checked roughly by means of level plug hole. That is, if oil flows out of level plug hole or if oil level is found up to hole when level plug is removed, oil is properly filled.
   If oil is found insufficient, pour specified amount of specified oil referring to Section 7D, 7B or 7F.
4) Tighten level plug to specified torque.
   Refer to Section 7D, 7E or 7F for tightening torque.

Change

Change transfer oil or differentials oil with new specified oil referring to Section 7D, 7E and 7F respectively.

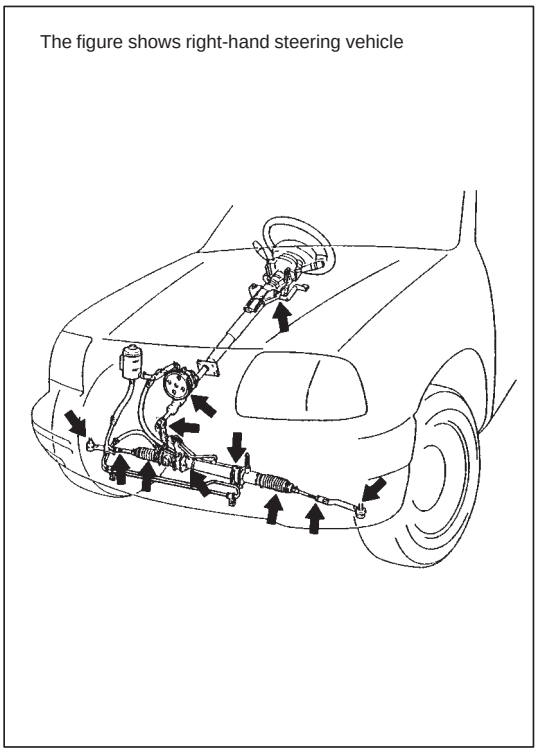


ITEM 6-14

Steering System Inspection

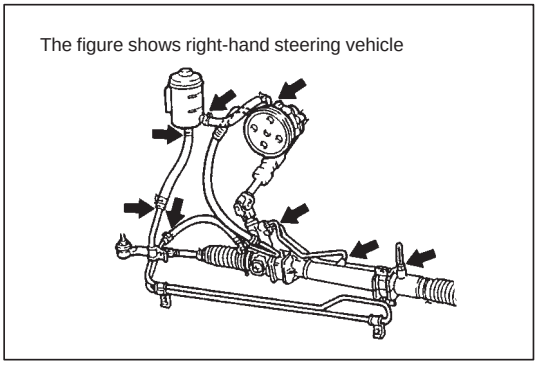
1) Check steering wheel for play and rattle, holding vehicle in straight forward condition on the ground.

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



2) Check universal joints of steering shaft for rattle and damage. If rattle or damage is found, replace defective part with a new one.
3) Check steering linkage for looseness and damage. Repair or replace defective part, if any.
4) Check bolts and nuts for tightness and retighten them as necessary. Repair or replace defective parts, if any.
   Refer to table of Tightening Torque Specification in Section 3B (or 3B1) and 3C (or 3C1) for particular check points.
5) Check boots of steering linkage for damage (leaks, detachment, tear, dent, etc.). If damage is found, replace it with new one.
   If any dent is found on steering rack boots, correct it to original shape by turning steering wheel to the right or left as far as it stops and holding it for a few seconds.
6) Check wheel alignment.

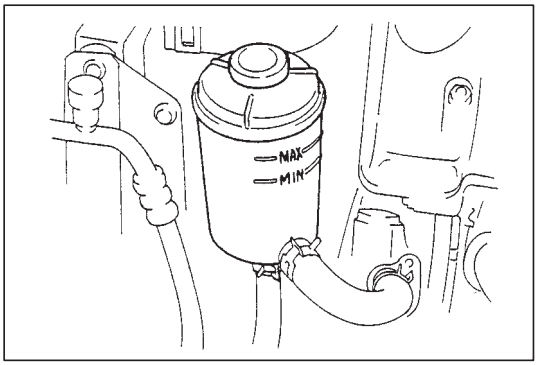
   NOTE:
   For details of wheel alignment, refer to Wheel Alignment in Section 3A.



ITEM 6-15

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

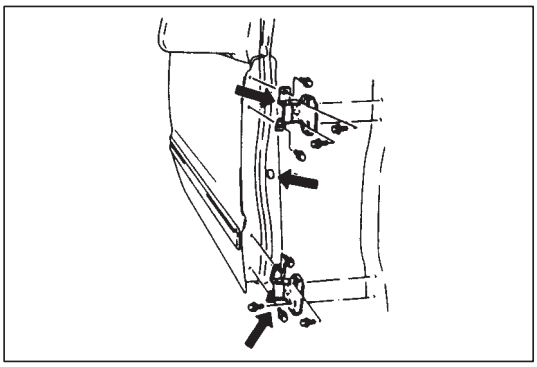
1) Visually check power steering system for fluid leakage and hose for damage and deterioration.
   Repair or replace defective parts, if any.



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

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

3) Visually check pump drive belt for cracks and wear.
4) Check belt for tension, referring to item 1-1.
   If necessary, have belt adjusted or replaced.



ITEM 6-16

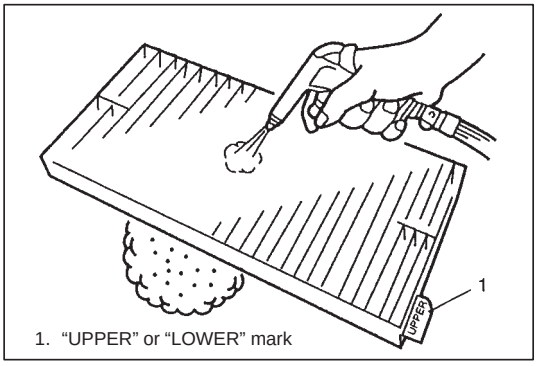
All Hinges, Latches and Locks Inspection

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.



1. "UPPER" or "LOWER" mark

ITEM 6-17

Air Conditioning Filter (if equipped)

Inspection

1) Remove air conditioning filter from cooling unit referring to Section 1B.
2) Check filter for dirt. Replace excessively dirty filter.
3) Blow off dust by compressed air from air outlet side of filter.
4) Install filter to cooling unit referring to Section 1B.

Replacement

Replace air conditioning filter with new one referring to Section 1B.

FINAL INSPECTION

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

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

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

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

Accelerator Pedal Operation
Check that pedal operates smoothly without getting caught or interfered by 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.
With automatic transmission equipped vehicle, make sure that vehicle is at complete stop when shifting select lever to "P" range position and release all brakes.

Brake
[Foot brake]
Check the following:
- that brake pedal has proper travel,
- that brake works properly,
- that it is free from noise,
- that braking force is applied equally on all wheels,
- and that brake do not drag.

[Parking brake]
Check that lever has proper travel.

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

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

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

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

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

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

Lights
Check that all lights operate properly.

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

RECOMMENDED FLUIDS AND LUBRICANTS

Engine oil	SG, SH or SJ (Refer to engine oil viscosity chart in item 1-4)
Engine coolant (Ethylene glycol base coolant)	“Antifreeze/Anticorrosion coolant”
Brake fluid	DOT 3
Manual transmission oil	Refer to Section 7A or 7A1.
Transfer oil	
Differential oil (front & rear)	Refer to Section 7E or 7F.
Automatic transmission fluid and Power steering fluid	Refer to Section 3B1 or 7B1.
Door hinges	Engine oil or water resistance chassis grease
Hood latch assembly	
Key lock cylinder	Spray lubricant

SECTION 1A

HEATER AND VENTILATION

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

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

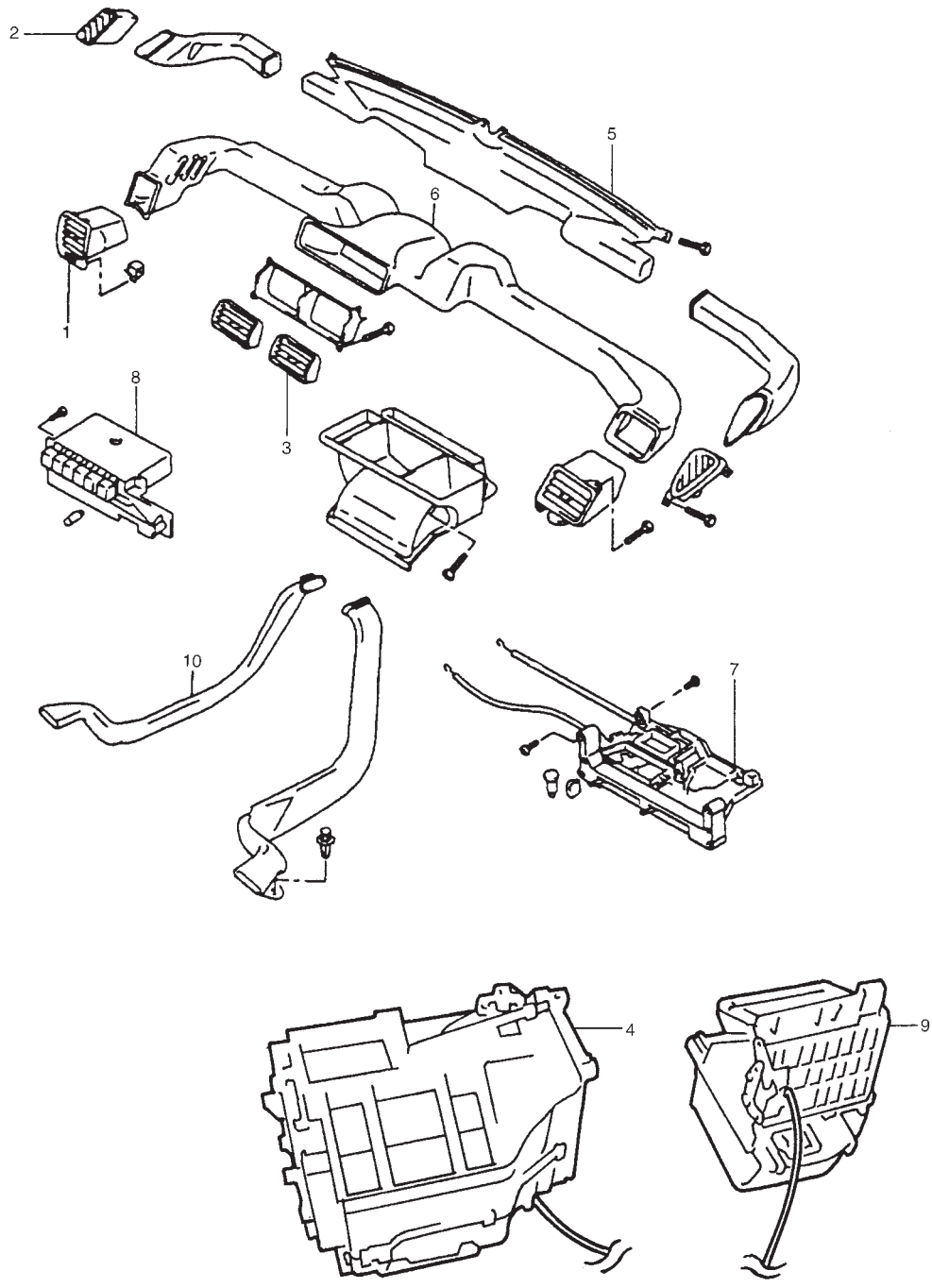
NOTE:
The link mechanism of the heater varies depending on the specifications.

CONTENTS

GENERAL DESCRIPTION 1A- 2
Body Ventilation 1A- 3
DIAGNOSIS 1A- 3
Diagnosis Table 1A- 3
Wiring Circuit 1A- 4
ON-VEHICLE SERVICE 1A- 5
Blower Unit 1A- 5
Blower Motor 1A- 7
Blower Motor Relay 1A- 8
Blower Motor Resistor 1A- 9
Heater Mode Control Switch 1A-10
Heater Mode Control Actuator 1A-12
Heater Control Lever Assembly 1A-14
Heater Control Cables 1A-15
Heater Unit 1A-16
Rear Duct 1A-19

GENERAL DESCRIPTION

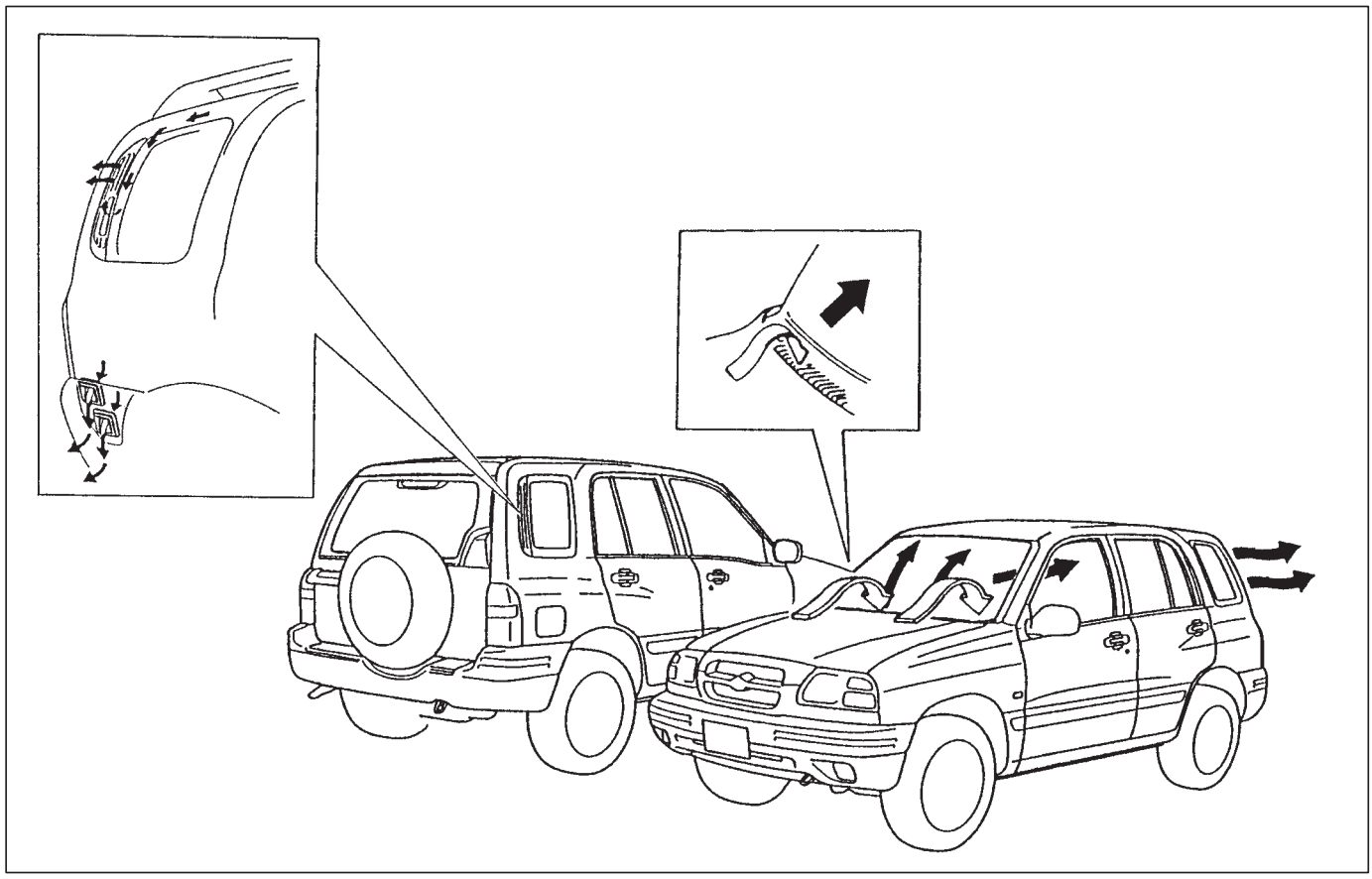
The heater, an in and out air selectable-type hot water heater, is so constructed that it is possible to assure an agreeable ventilation at all times by providing the ventilator air outlets at the center and both sides (right and left) of the instrument panel, the hot air outlet at a place close to the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



1. Side ventilator outlet
2. Side defroster outlet
3. Center ventilator outlet
4. Heater unit
5. Defroster duct
6. Ventilator duct
7. Heater control lever assembly
8. Heater mode control switch
9. Blower unit
10. Rear duct

BODY VENTILATION

The body ventilation system of this vehicle has a fresh air intake located at the cowl top panel. When fresh air intake control lever is at FRESH AIR position, ventilating air is drawn into the interior from the cowl center garnish and drawn out from the ventilator outlet provided at each side body outer panel (both right and left side).



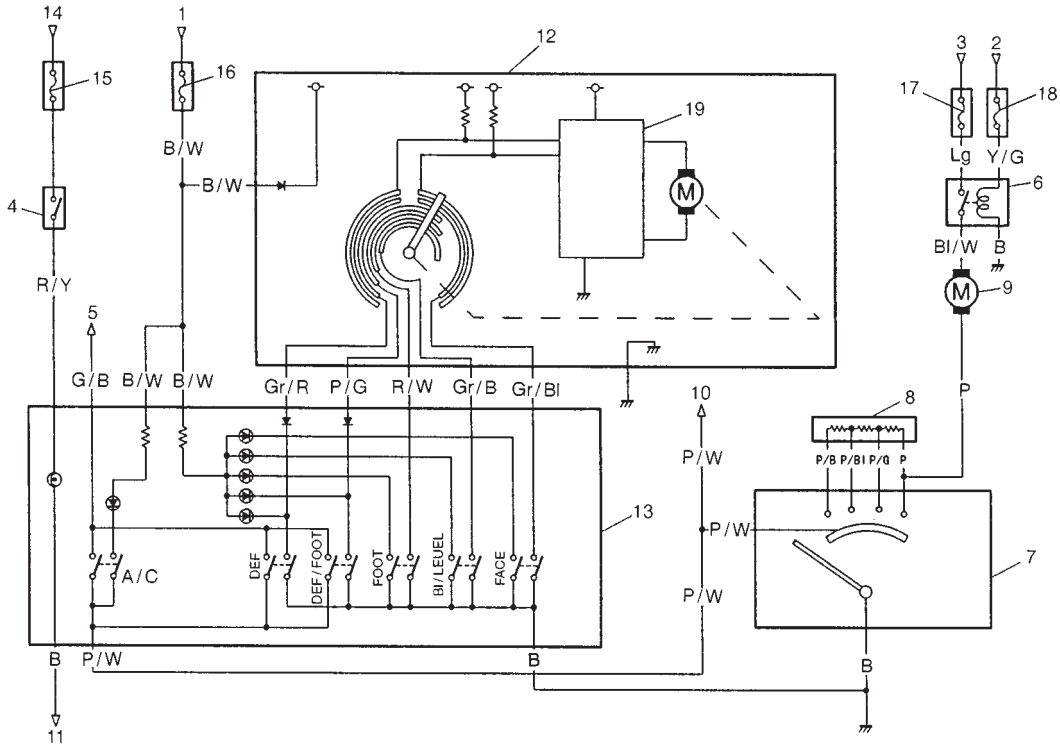
DIAGNOSIS

DIAGNOSIS TABLE

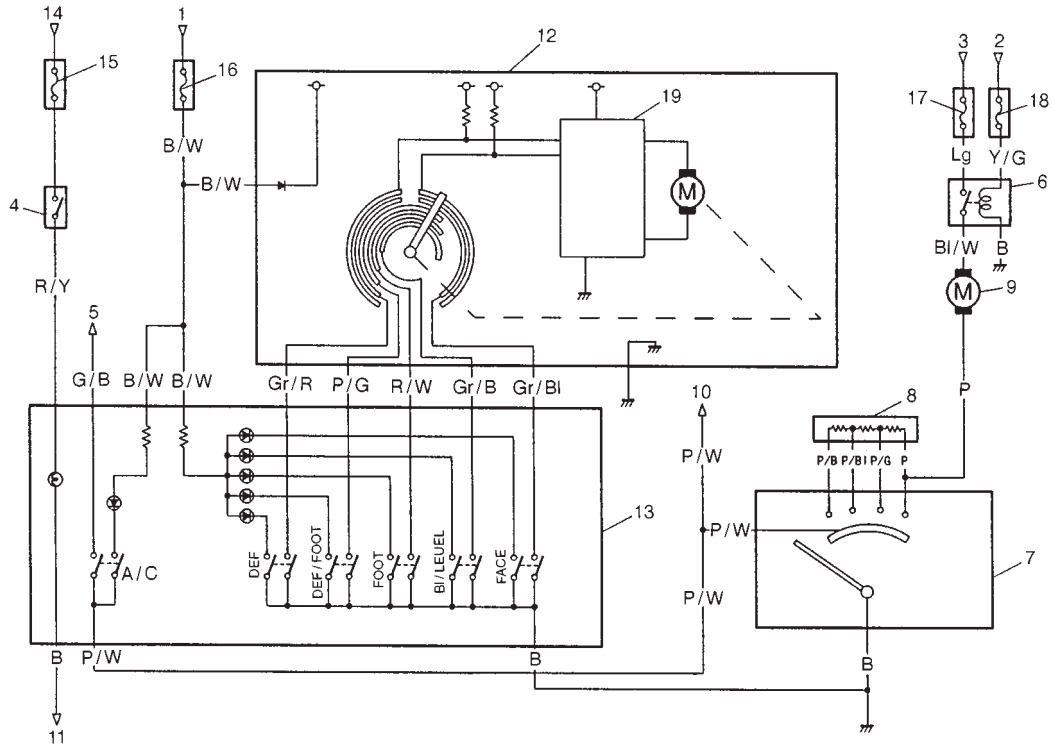
Trouble	Possible cause	Remedy
Heater blower won't work even when its switch is ON.	Blower fuse blown Blower resistor faulty Blower motor faulty Wiring or grounding faulty	Replace fuse to check for short. Check resistor. Replace motor. Repair as necessary.
Incorrect temperature output.	Control cables broken or binding Air damper broken Air ducts clogged Heater radiator leaking or clogged Heater hoses leaking or clogged	Check cables. Repair damper. Repair air ducts. Replace radiator. Replace hoses.
When mode control switch is changed, air outlet port is not changed.	Mode control switch faulty Mode actuator faulty Fuse blown Wiring or grounding faulty Air damper broken Air ducts clogged	Check and replace as necessary. Check and replace as necessary. Replace fuse to check for short. Repair as necessary. Repair damper. Repair air ducts.

WIRING CIRCUIT

FOR LH VEHICLE



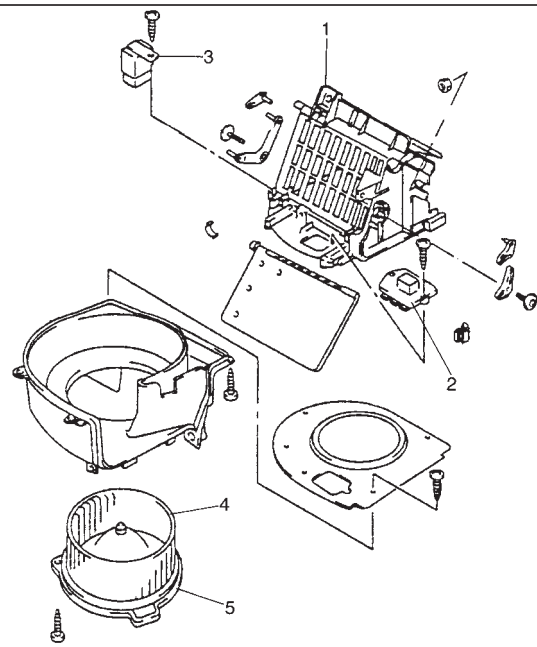
FOR RH VEHICLE



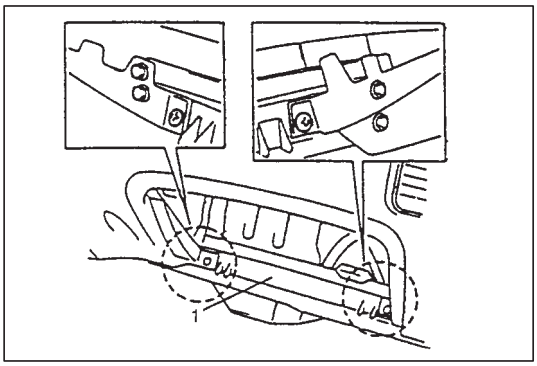
1. From ignition switch 1
2. From ignition switch 2
3. From blower fuse
4. Head light relay
5. To A/C controller
6. Blower motor relay
7. Blower motor switch
8. Blower resistor
9. Blower motor
10. To ECM
11. To illumination controller (if equipped) or body ground
12. Mode control actuator
13. Mode control switch
14. From main fuse
15. TAIL fuse 15 A
16. IG METER fuse 20 A
17. HEATER fuse 30 A
18. REAR DEFG fuse 15 A
19. Drive circuit

ON-VEHICLE SERVICE

BLOWER UNIT

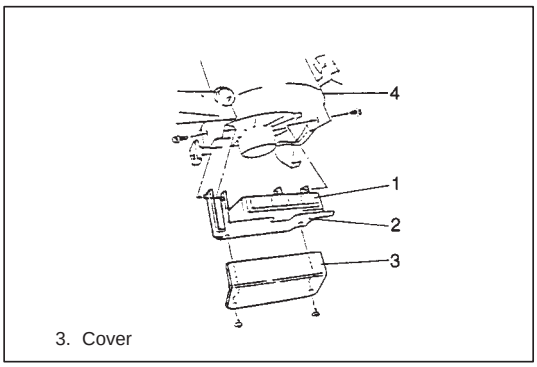


1. Blower unit
2. Blower motor resistor
3. Blower motor relay
4. Blower fan
5. Blower motor



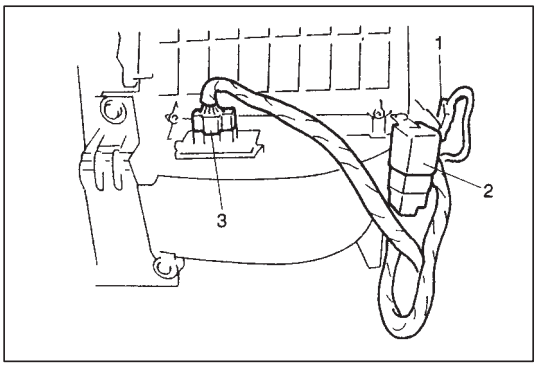
REMOVAL

1) Disconnect negative (–) cable at battery.
2) Disable air bag system, if equipped. Refer to DISABLING AIR BAG SYSTEM in Section 10B.
3) Remove passenger lower member (1).

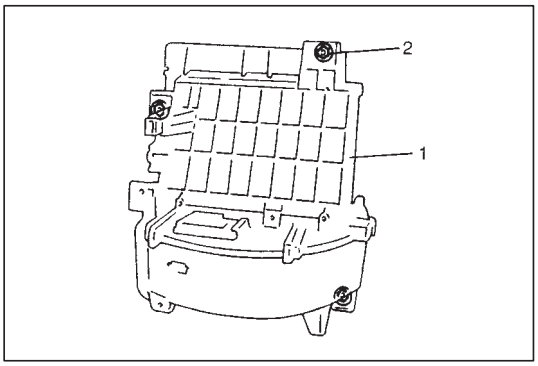


3. Cover

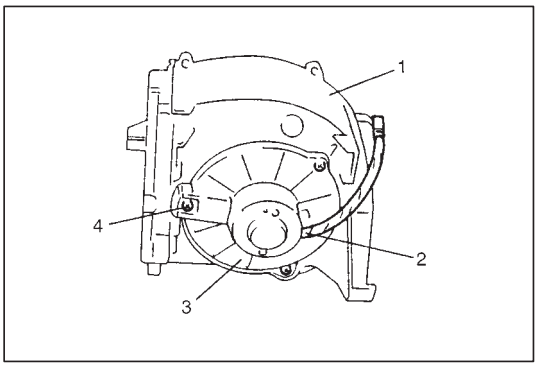
4) Remove ECM (1) with bracket (2) from blower motor unit (4).



5) Disconnect blower motor (1), blower motor relay (2) and resistor lead wires (3) at couplers.



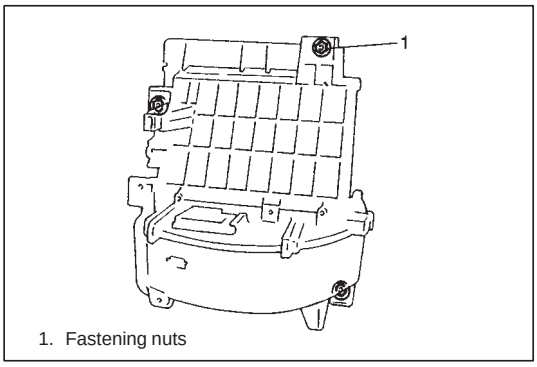
6) Remove cooling unit (If equipped).
   Refer to item COOLING UNIT (EVAPORATOR) REMOVAL in Section 1B.
7) Disconnect fresh air control cable from blower motor case.
8) Remove blower motor unit (1) by removing its fastening nuts (2).



9) Disconnect blower motor lead wire (2) at coupler from blower unit (1).
10) Remove blower motor (3) by removing its mounting screws (4).

INSTALLATION

1) Reverse removal procedure for installation.
2) Connect fresh air control cable, refer to HEATER CONTROL CABLES INSTALLATION.
3) Enable air bag system, if equipped. Refer to ENABLING AIR BAG SYSTEM in Section 10B.

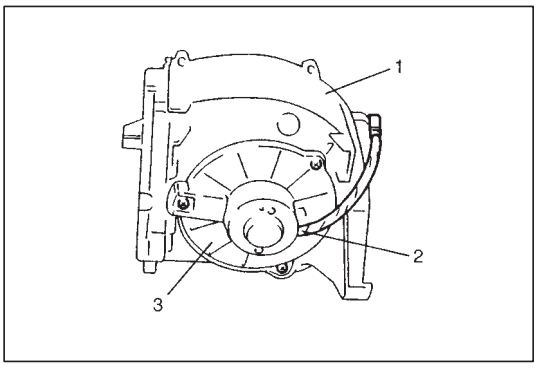


1. Fastening nuts

BLOWER MOTOR

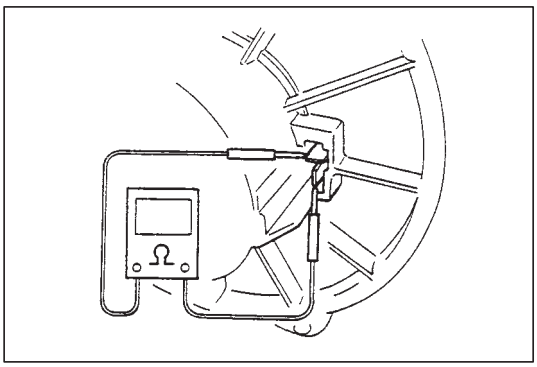
REMOVAL

1) Disconnect negative (–) cable at battery.
2) Disable air bag system, if equipped. Refer to DISABLING AIR BAG SYSTEM in Section 10B.
3) Remove ECM with bracket from blower motor unit.
4) Disconnect harness clamps from dash panel.
5) Loosen three nuts fastening blower unit.

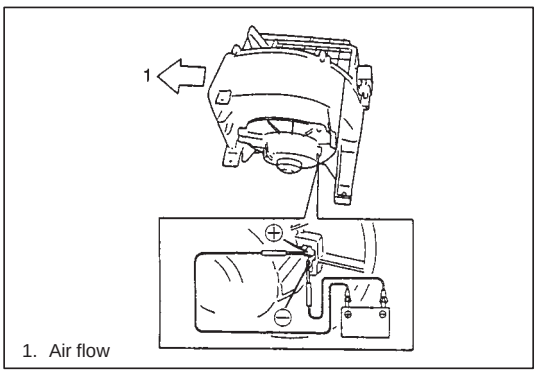


6) Disconnect blower motor lead wire at coupler (2).
7) Remove blower motor (3) from blower unit (1).

INSPECTION



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



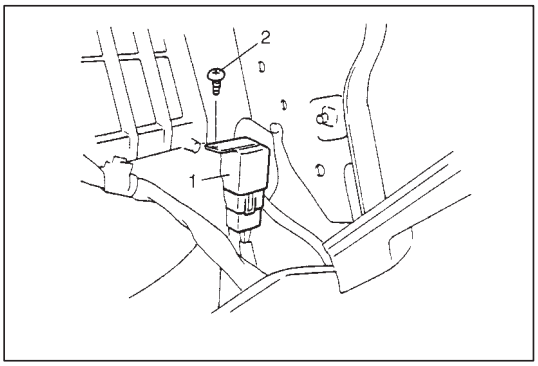
1. Air flow

- Connect battery to blower motor as shown, then check that the blower motor operates smoothly and specified current.

  Specified current: Max. 25 A at 12 V

INSTALLATION

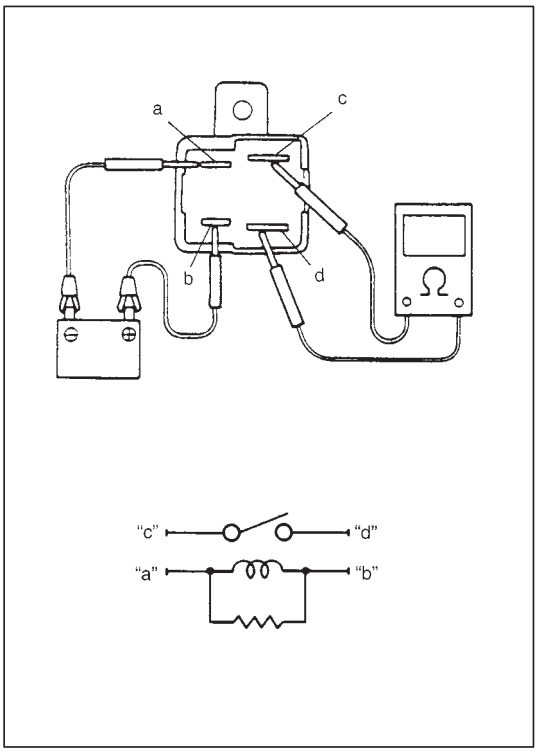
1) Reverse removal procedure for installation.
2) Enable air bag system, if equipped. Refer to ENABLING AIR BAG SYSTEM in Section 10B.



BLOWER MOTOR RELAY

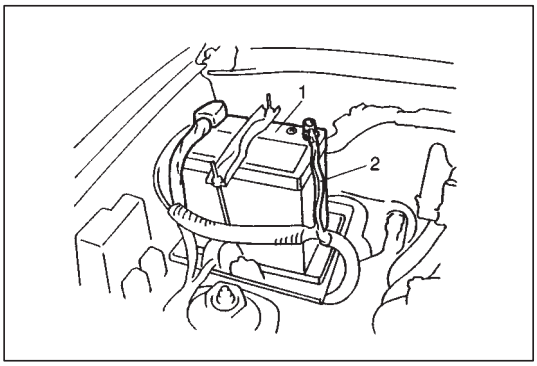
REMOVAL

1) Disconnect negative (–) cable at battery.
2) Disable air bag system, if equipped. Refer to DISABLING AIR BAG SYSTEM in Section 10B.
3) Open glove box, then remove screw.
4) Remove glove box.
5) Disconnect relay coupler.
6) Remove blower motor relay (1) by removing its fastening screw (2).



INSPECTION

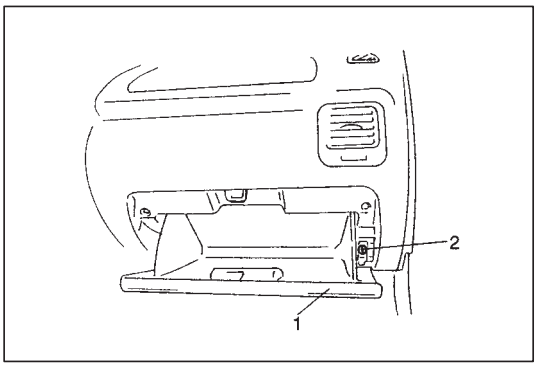
1) Check that there is no continuity between terminal "c" and "d".
   If there is continuity, replace relay.
2) Connect battery positive (+) terminal to terminal "b" of relay.
   Connect battery negative (–) terminal "a" of relay.
   Check continuity between terminal "c" and "d".
   If there is no continuity when relay is connected to the battery, replace relay.



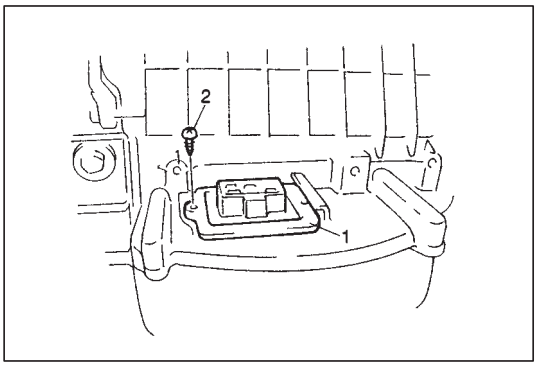
BLOWER MOTOR RESISTOR

REMOVAL

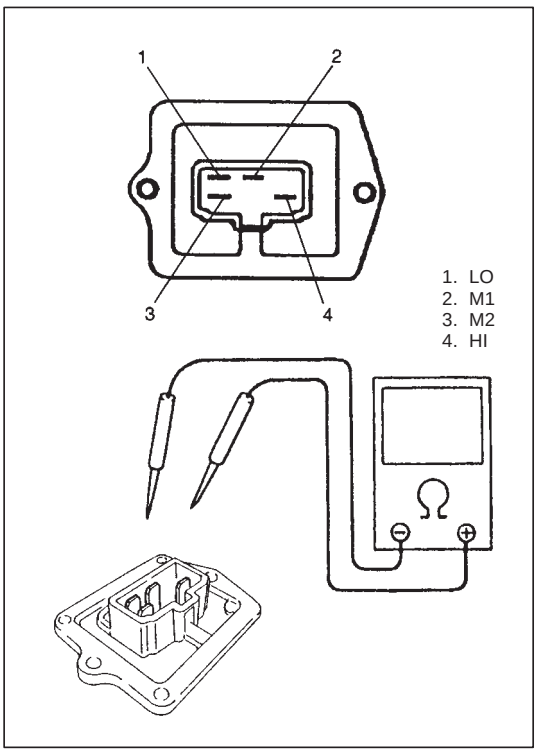
1) Disconnect negative (–) cable (2) at battery (1).
2) Disable air bag system, if equipped. Refer to DISABLING AIR BAG SYSTEM in Section 10B.



3) Open glove box (1), then remove screw (2).
4) Remove glove box.



5) Disconnect blower motor resistor (1) at coupler.
6) Remove heater blower resistor (1) by removing its fastening screw (2).



INSPECTION

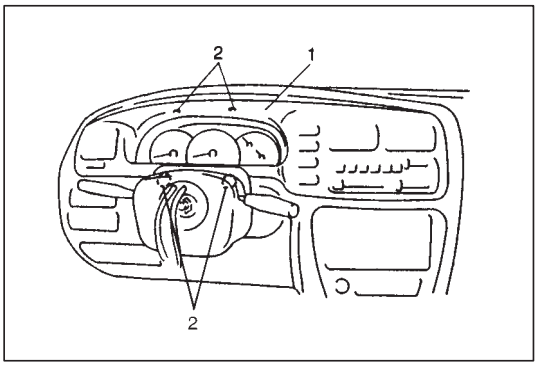
Measure each terminal-to-terminal resistance on resistor.

Resistance H-LO: Approx. 2.0 Ω
H-M1: Approx. 1.0 Ω
H-M2: Approx. 0.4 Ω

If measured resistance is incorrect, replace heater blower resistor.

INSTALLATION

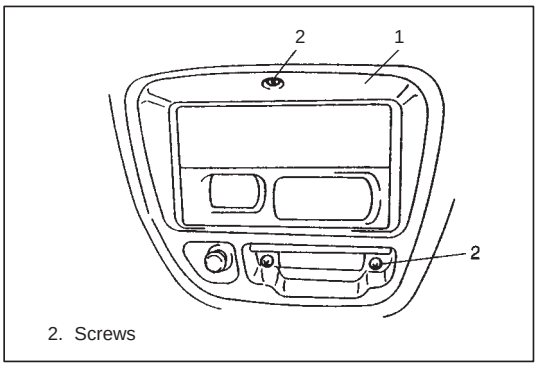
1) Install heater blower resistor with screws.
2) Enable air bag system, if equipped. Refer to ENABLING AIR BAG SYSTEM in Section 10B.



HEATER MODE CONTROL SWITCH

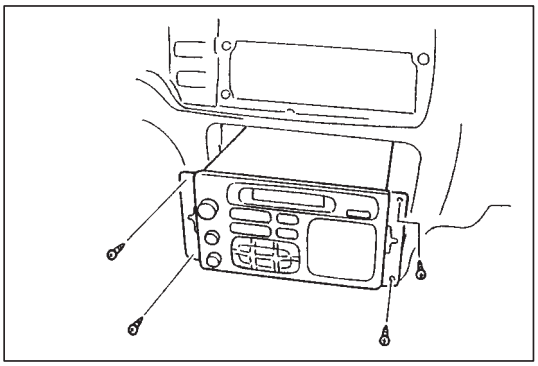
REMOVAL

1) Disconnect negative (–) cable at battery.
2) If equipped with air bag system, disable air bag system. Refer to DISABLING AIR BAG SYSTEM in Section 10B.
3) Remove meter cluster hood (1) by removing its mounting screws (2).

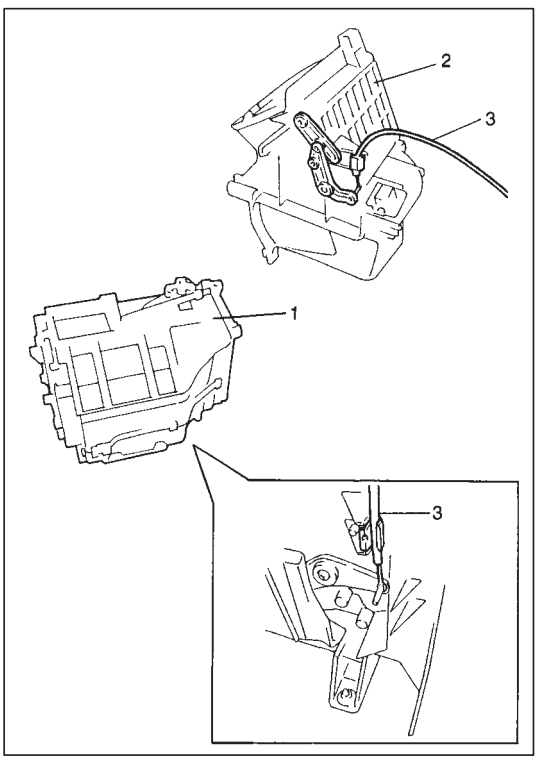


2. Screws

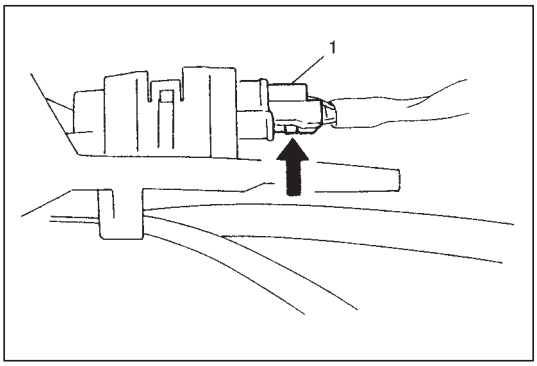
4) Remove ashtray, center garnish (1) and instrument glove box compartment.



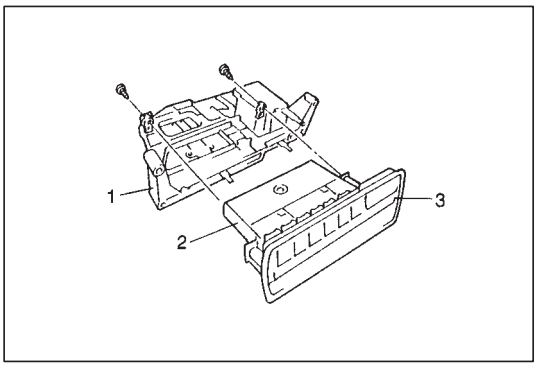
5) Remove radio (1) (if equipped) or clock or accessory case.



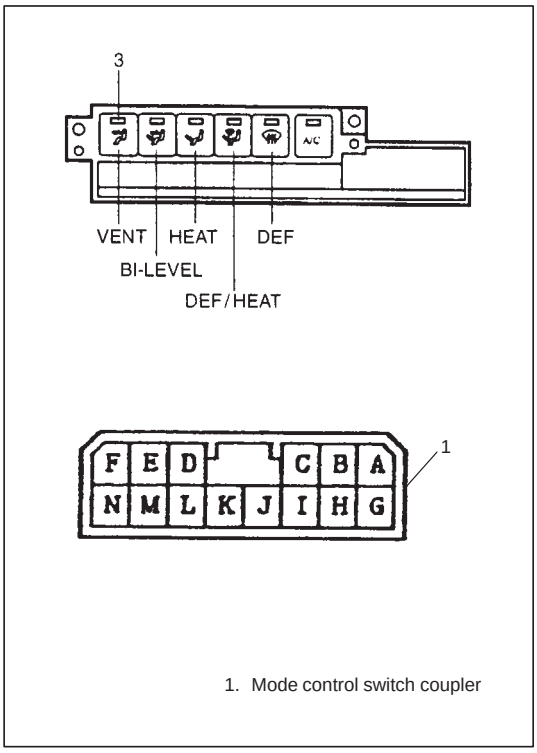
6) Disconnect control cables (3) from blower motor unit (2) and heater unit (1).



7) Disconnect heater blower motor switch connector (1).
8) Remove mode control switch with heater control lever assembly from the removed hole in mentioned step (5).



9) Pull off heater control lever knob.
10) Remove heater mode control switch (2) with heater control panel (3) from heater control lever assembly (1).
11) Remove heater control panel from mode control switch.



1. Mode control switch coupler

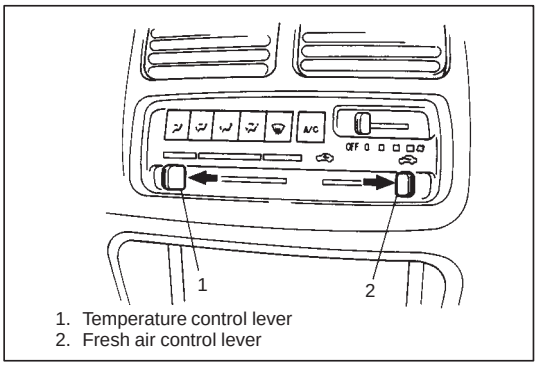
INSPECTION

Mode Control Switch

- Check if continuity exists between each pair of terminals listed below when mode control button is pressed.

Mode	Mode control switch terminals
VENT	F – M
BI-LEVEL	F – N
HEAT	F – E
DEF/HEAT	F – B
DEF	F – C

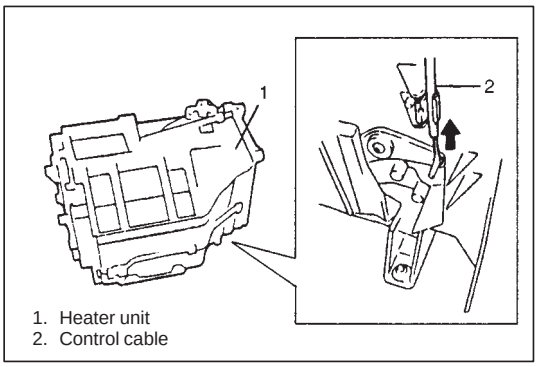
- With battery voltage (+) connected to terminal “I” and (–) to terminal “F”, press each mode control button and check if indicator lamp (3) lights.
- With battery voltage (+) connected to terminal “A” and (–) to terminal “H”, check if illumination lamp lights.



1. Temperature control lever
2. Fresh air control lever

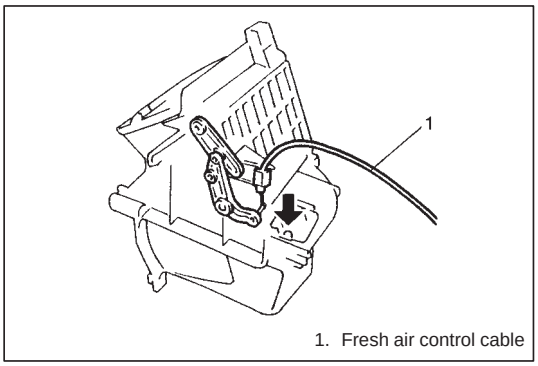
INSTALLATION

1) Install in reverse order of removal procedure.
2) Adjust cables as follows.
   (1) Move control lever fully in arrow direction.



1. Heater unit
2. Control cable

   (2) Push heater lever fully in arrow direction and fix cable with clamp in position as shown in left figure.



1. Fresh air control cable

   (3) Push blower lever fully in arrow direction and fix cable with clamp in position as shown in left figure.

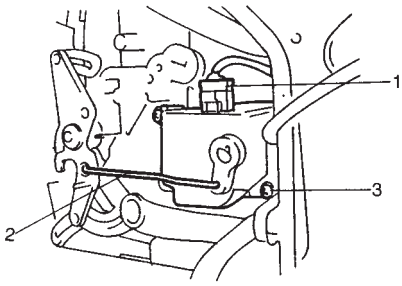
   NOTE:
   After installing control cables, be sure that control levers move smoothly and stop at proper position.

3) If equipped with air bag, enable air bag system. Refer to "ENABLING AIR BAG SYSTEM" in Section 10B.

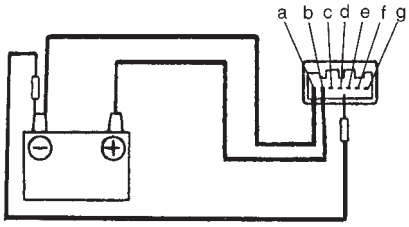
HEATER MODE CONTROL ACTUATOR

REMOVAL

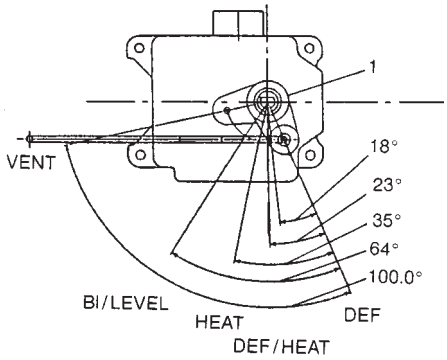
1) Disconnect negative (–) cable at battery.
2) If equipped with air bag system, disable air bag system. Refer to DISABLING AIR BAG SYSTEM in Section 10B.
3) Remove column hole cover.



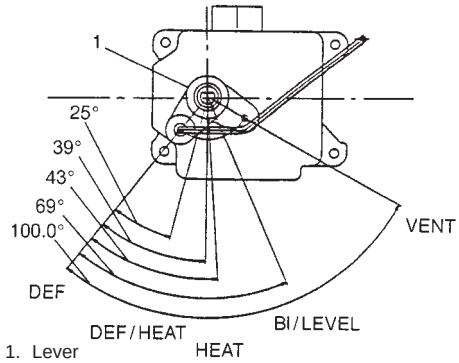
4) Disconnect heater mode control actuator coupler (1).
5) Disconnect heater mode control actuator rod (2) from heater unit.
6) Remove heater mode control actuator from heater unit by removing its mounting screw (3).



FOR LEFT HAND STEERING VEHICLE



FOR RIGHT HAND STEERING VEHICLE



1. Lever

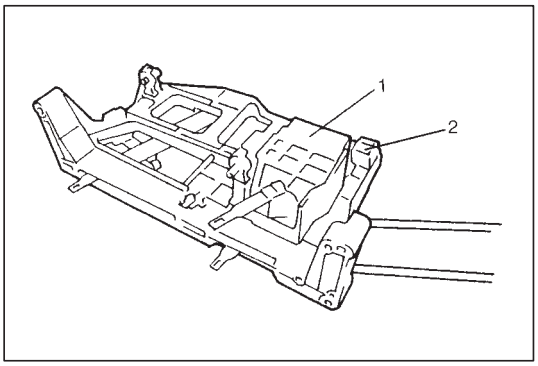
INSPECTION

1) Connect battery voltage (+) to terminal "b'" and (–) to terminal "a".
2) Connect each terminal listed below to terminal "a'" (negative (–) terminal of battery) and check if lever rotation angle is as specified in figure.

MODE	TERMINAL
VENT	c
BI-LEVEL	d
HEAT	e
DEF/HEAT	f
DEF	g

INSTALLATION

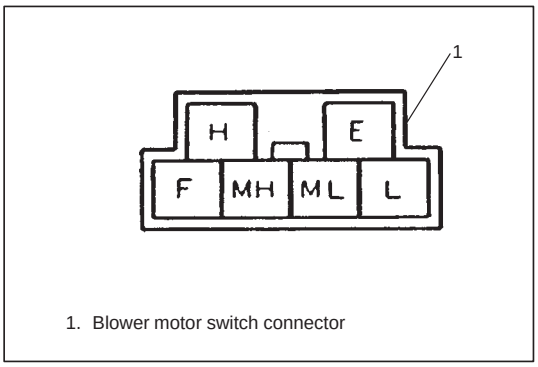
1) Install in reverse order of removal procedure.
2) If equipped with air bag system, enable air bag system. Refer to ENABLING AIR BAG SYSTEM in Section 10B.



HEATER CONTROL LEVER ASSEMBLY

REMOVAL

1) Disconnect negative (–) cable at battery.
2) If equipped with air bag system, disable air bag system. Refer to DISABLING AIR BAG SYSTEM in Section 10B.
3) Remove mode control switch. Refer to item HEATER MODE CONTROL SWITCH in this section.



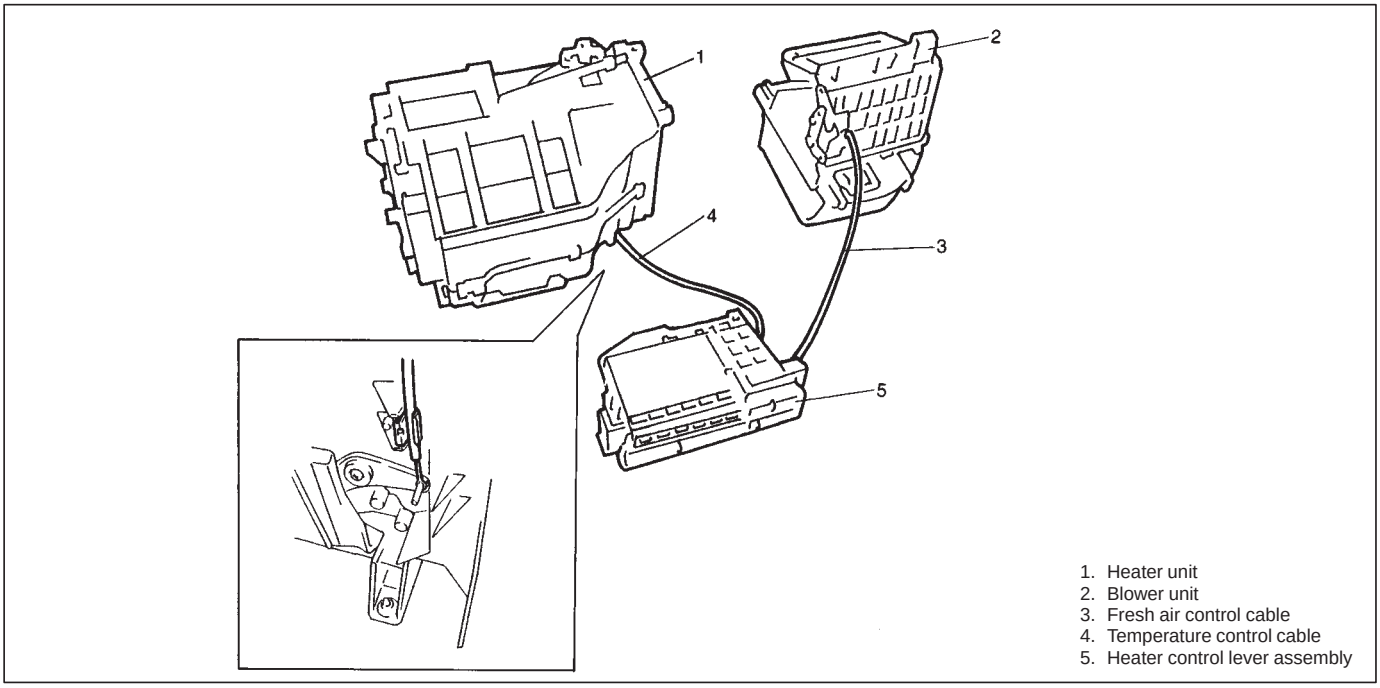
1. Blower motor switch connector

INSPECTION

Check heater blower motor switch for each terminal-to-terminal continuity. For the detail refer to WIRING CIRCUIT earlier in this section.

	E	F	L	ML	MH	H
LOW	○	○	○			
M1	○	○		○		
M2	○	○			○	
HIGH	○	○				○

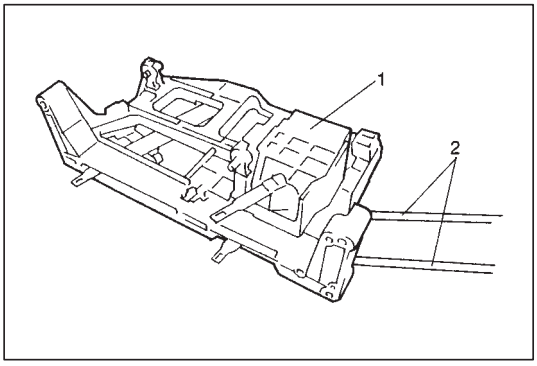
HEATER CONTROL CABLES



1. Heater unit
2. Blower unit
3. Fresh air control cable
4. Temperature control cable
5. Heater control lever assembly

REMOVAL

1) Remove heater control lever assembly.
   Refer to HEATER CONTROL LEVER ASSEMBLY in this section.

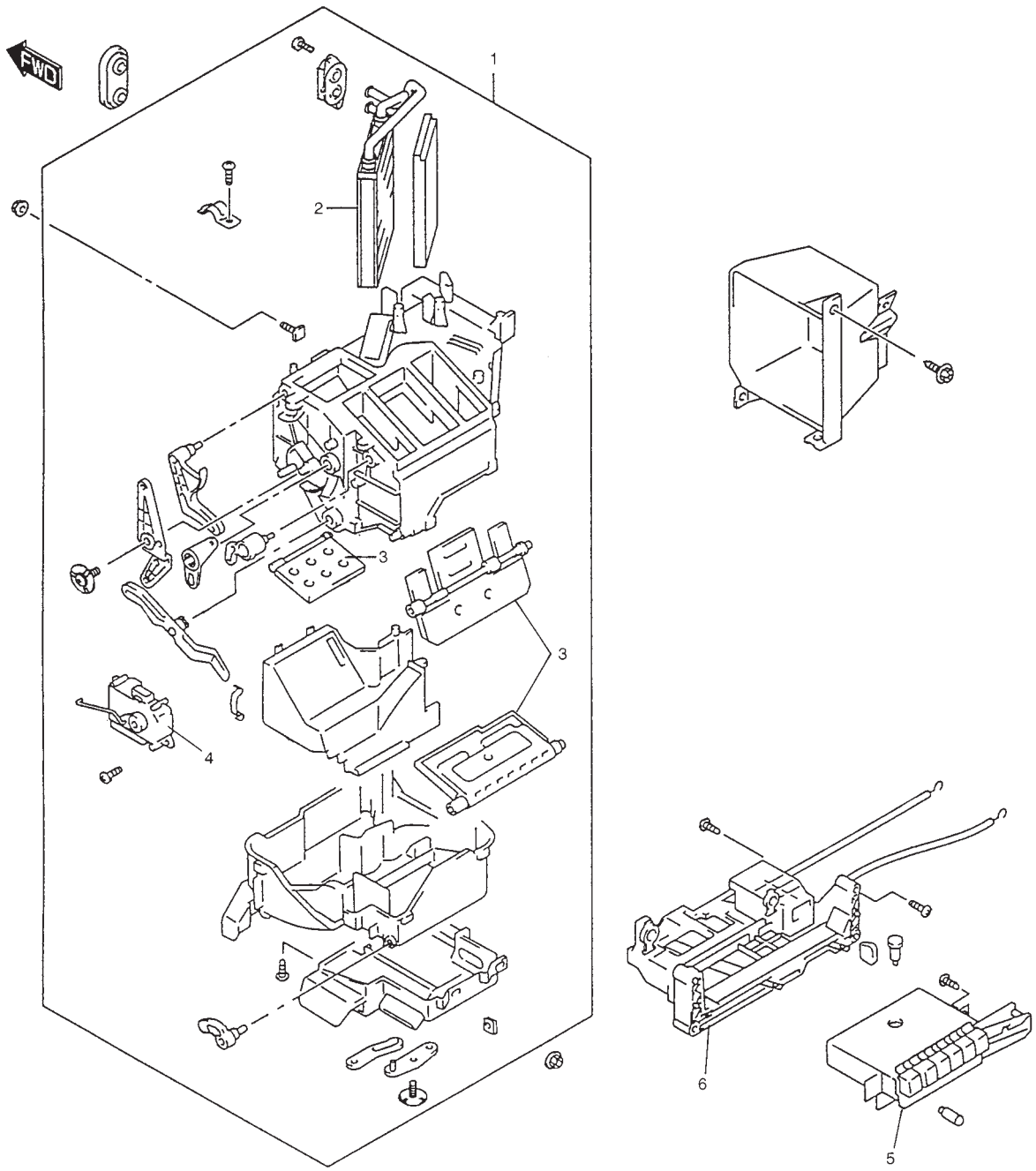


2) Remove control cables (2) from control lever assembly (1).

INSTALLATION

1) Install in reverse order of removal procedure.
   Refer to HEATER MODE CONTROL SWITCH in this section.
2) If equipped with air bag, enable air bag system.
   Refer to ENABLING AIR BAG SYSTEM in Section 10B.

HEATER UNIT

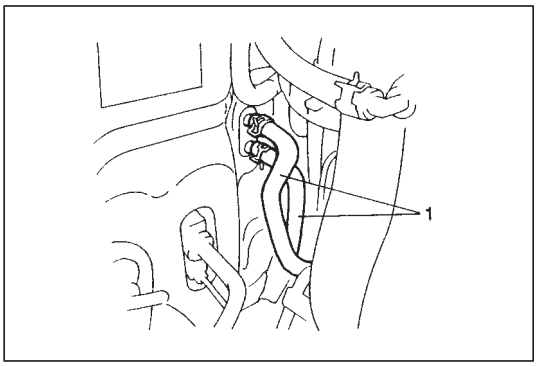


1. Heater unit
2. Heater core
3. Damper
4. Heater mode control actuator
5. Heater mode control switch
6. Heater control lever assembly

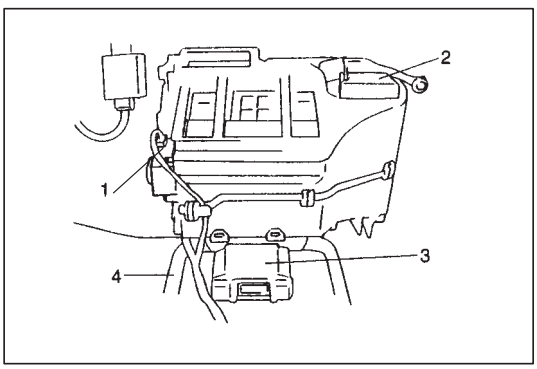
REMOVAL

WARNING:
Failure to follow the following procedure and WARNING may cause air bag deployment, personal injury, damage to parts, or air bag being unable to deploy.
- **Never rest a steering column assembly on steering wheel with air bag (inflator) module face down and column vertical.**
- **When handling the air bag (inflator) modules (driver and passenger), be careful not to drop it or apply an impact to it. If an excessive impact was applied (e.g., dropped from a height of 91.4 cm (3 feet) or more, never attempt disassembly or repair but replace it with a new one.**
- **When grease, cleaning agent. Oil, water, etc. has got onto air bag (inflator) modules (driver and passenger), wipe off immediately with a dry cloth.**

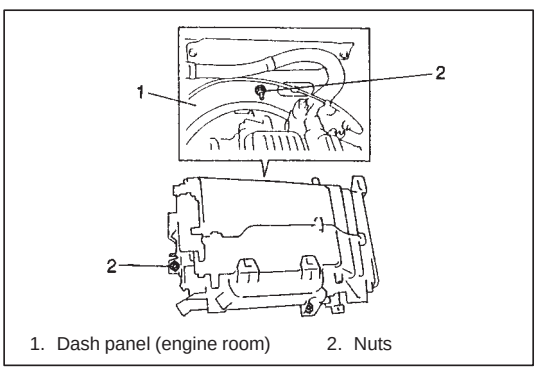
1) Disconnect negative (–) cable at battery.
2) Disable air bag system, if equipped. Refer to DISABLING AIR BAG SYSTEM in Section 10B.



3) Drain engine coolant and disconnect heater hose (1) from heater unit.
4) Remove instrument panel, refer to item INSTRUMENT PANEL REMOVAL in Section 9.
5) Remove cooling unit (If equipped).
   Refer to item EVAPORATOR (COOLING UNIT) REMOVAL in Section 1B.

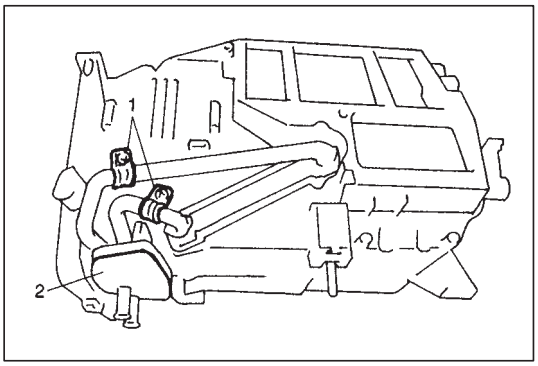


6) Disconnect rear duct (4) from heater unit.
7) Disconnect heater mode control actuator lead wire (1) at couplers.
8) Remove A/C controller (2) (If equipped).
9) Remove SDM (3) (If equipped).

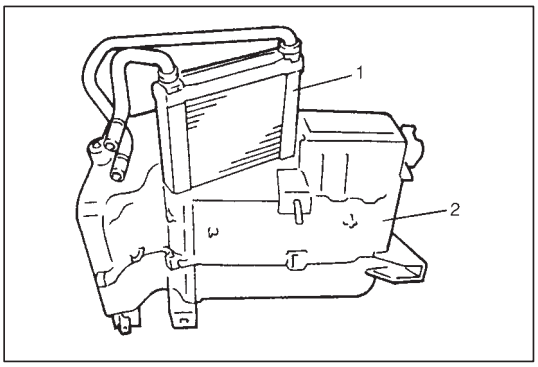


1. Dash panel (engine room) 2. Nuts

10) Remove heater unit.



11) Remove heater core pipe clamps (1) and grommet (2).

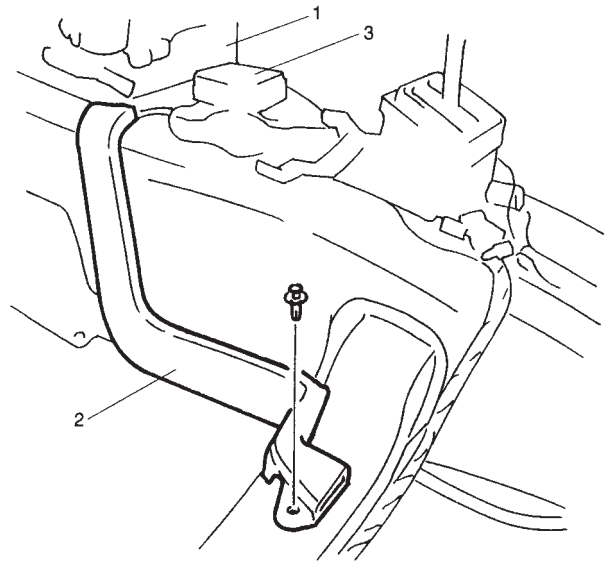


12) Pull out heater core (1) from unit (2).

INSTALLATION

1) Install heater unit by reversing removal procedure, noting the following items.
   - When installing each part, be careful not to catch any cable or wiring harness.
   - When installing steering column assembly, refer to STEERING COLUMN INSTALLATION in Section 3C or 3C1.
2) Install control cables. (Refer to HEATER CONTROL CABLES in this section.)
3) Fill engine coolant to radiator.
4) Enable air bag system, if equipped. Refer to ENABLING AIR BAG SYSTEM in Section 10B.
5) Evacuate and charge system. Refer to items EVACUATING SYSTEM and PROCEDURE OF CHARGING in Section 1B.

REAR DUCT



1. Heater unit
2. Rear duct
3. SDM

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Remove front seat.
3) Remove console box.
4) Take off carpet till rear duct is totally exposed.
5) Remove rear duct.

INSTALLATION

Reverse removal sequence to install rear duct.

SECTION 1B

AIR CONDITIONING (OPTIONAL)

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

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

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

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

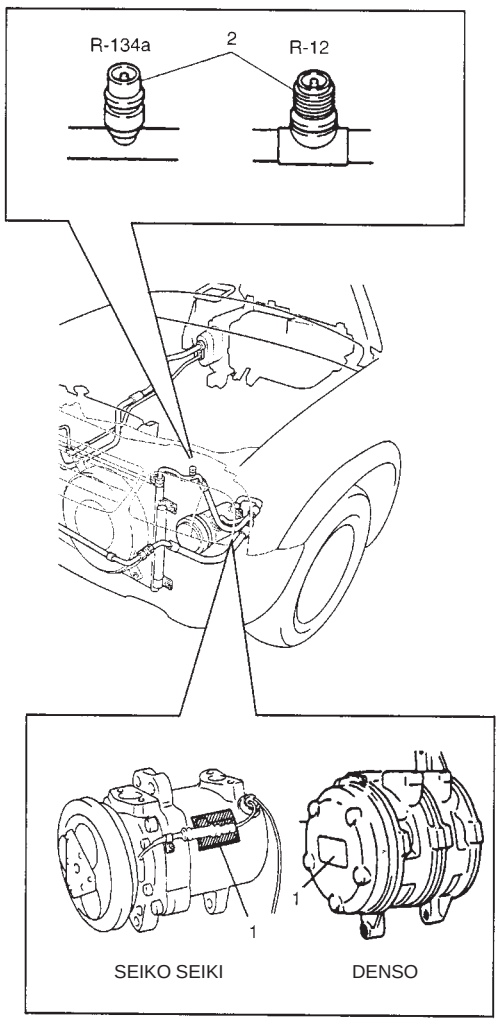
CONTENTS

GENERAL DESCRIPTION 1B- 3
Identification of Refrigerating System 1B- 3
Refrigerant Flow of Air Conditioning System 1B- 4
Major Components and Location 1B- 5
DIAGNOSIS 1B- 6
General 1B- 6
Diagnosis of Abnormal Noise 1B- 8
Quickly Checking of Refrigerant Charge (If Equipped with Sight Glass) 1B-10
Compression System Diagnosis 1B-11
Performance Diagnosis 1B-12
Wiring Circuit 1B-16
Inspection of A/C Controller and Its Circuits 1B-18
REFRIGERANT RECOVERY, EVACUATION AND CHARGING 1B-23
Operation Procedure for Charging A/C with Refrigerant 1B-23
Recovery 1B-24
Evacuating 1B-25
Charging 1B-26
Removing Manifold Gauge Set 1B-29
Leak-Testing Refrigerant System 1B-29
Liquid Leak Detectors 1B-29
ON-VEHICLE SERVICE 1B-30
Precaution 1B-30
A/C Condenser Assembly 1B-33
Condenser Cooling Fan Assembly 1B-35

Condenser Dryer (Receiver/Dryer) 1B-36
Air Filter Element 1B-37
Cooling Unit (Evaporator) 1B-39
Expansion Valve 1B-42
A/C Evaporator Thermistor (Evaporator Temperature Sensor) 1B-43
Refrigerant Pipes and Hoses 1B-44
A/C Switch 1B-45
A/C Controller 1B-46
Dual Pressure Switch 1B-47
A/C Compressor Relay and A/C Condenser Cooling Fan Relay 1B-48
Compressor Assembly 1B-49
Magnet Clutch Assembly (For Denso Compressor) 1B-53
Magnet Clutch Assembly (For Seiko Seiki Compressor) 1B-56
Lip Type Seal (For Seiko Seiki) 1B-59
REQUIRED SERVICE MATERIAL 1B-61
SPECIAL TOOLS 1B-61

GENERAL DESCRIPTION

The air conditioning system of this model differs by the country of origin (the production plant.).
One is Japan (IWATA) produced, other one is Canada (CAMI) produced.
For the details of the identification, please refer to IDENTIFICATION INFORMATION of Section 0A in this manual.
The compressor used of Japan (IWATA) produced vehicle is made of SEIKO SEIKI and the compressor used of Canada (CAMI) produced vehicle is made of DENSO.

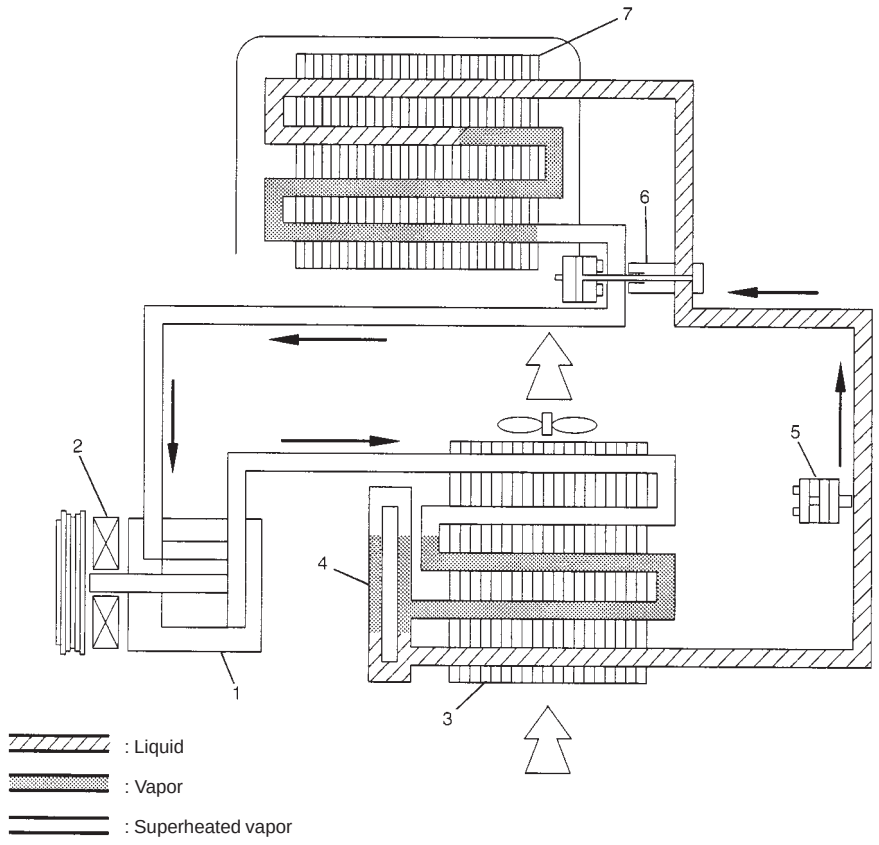


1. Compressor label
2. Service valve

IDENTIFICATION OF REFRIGERATING SYSTEM

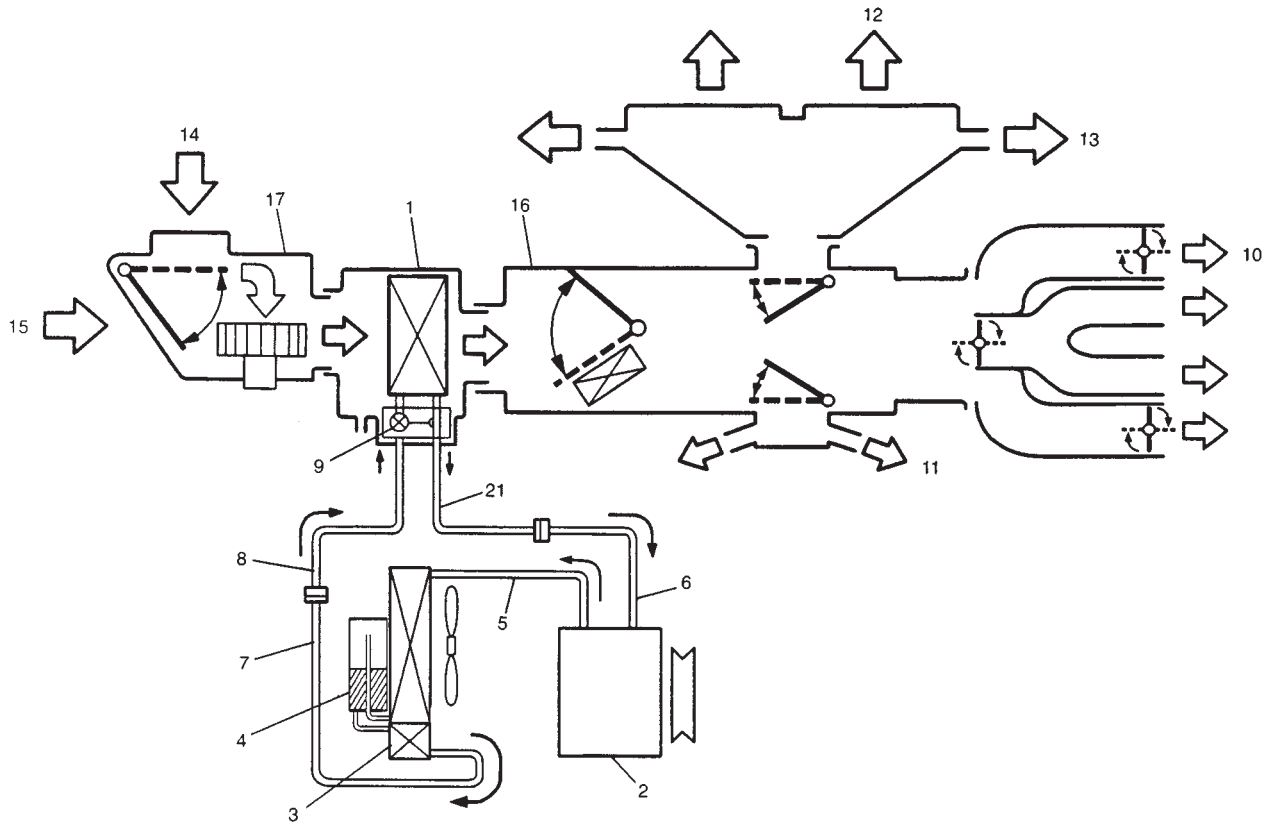
Whether the A/C equipped with the vehicle being serviced uses refrigerant R-134a or R-12 is indicated on the LABEL installed the compressor.
Also, it can be identified by the shape of the service (charge) valve.
The compressor manufacturer, it can be identified by the LABEL on compressor body.

REFRIGERANT FLOW OF AIR CONDITIONING SYSTEM

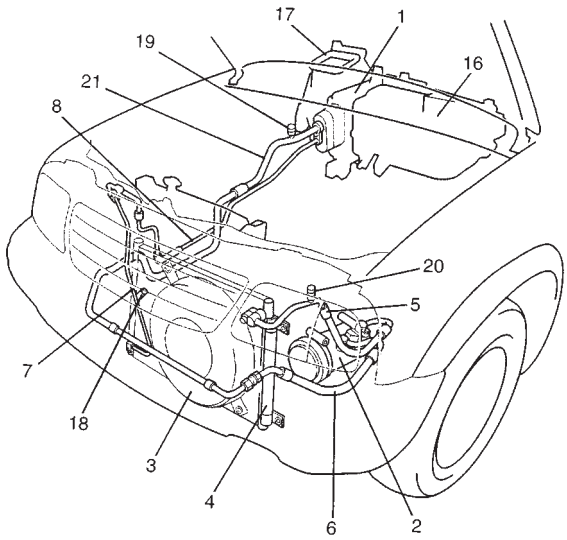


1. Compressor
2. Magnet clutch
3. Condenser assembly
4. Receiver / dryer
5. Dual pressure switch
6. Expansion valve
7. Evaporator

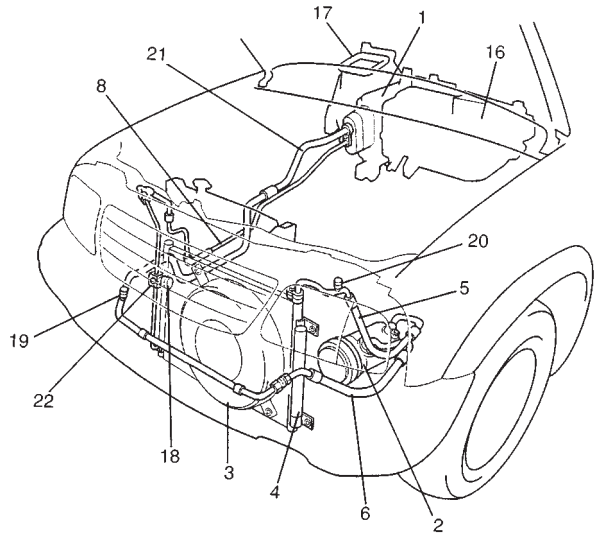
MAJOR COMPONENTS AND LOCATION



CAMI PRODUCTION VEHICLE



IWATA PRODUCTION VEHICLE



1. Cooling unit
2. Compressor
3. Condenser assembly
4. Receiver / dryer
5. Discharge hose
6. Suction hose
7. Condenser outlet pipe
8. Liquid pipe
9. Expansion valve
10. Ventilation air
11. Foot air
12. Defroster air
13. Demister air
14. Fresh air
15. Recirculation air
16. Heater unit
17. Air inlet box
18. Dual pressure switch
19. Low pressure charge valve
20. High pressure charge valve
21. Suction pipe
22. Sight glass

DIAGNOSIS

GENERAL

Condition	Possible Cause	Correction
Cool air won't come out (A/C system won't operative)	● No refrigerant	Recover, evacuation and charging.
	● Fuse blown	Check "IG METER" fuse, "REAR DEFG" fuse, and "A/C FUSE" and check for short circuit to ground.
	● A/C switch faulty	Check A/C switch.
	● Blower motor switch faulty	Check blower motor switch.
	● A/C thermistor faulty	Check A/C evaporator thermistor.
	● Dual pressure switch faulty	Check dual pressure switch.
	● Wiring or grounding faulty	Repair as necessary.
	● A/C ON permission signal in ECM faulty	Check ON permission signal.
	● A/C controller and its circuit faulty	Check A/C controller and its circuit.
Cool air won't come out (A/C compressor won't operative)	● Magnet clutch faulty	Check magnet clutch.
	● Compressor relay faulty	Check compressor thermal switch.
	● Compressor thermal switch faulty (if equipped)	Check compressor relay.
	● Drive belt loose or broken	Adjust or replace drive belt.
	● Compressor faulty	Check compressor.
	● A/C ON permission signal in ECM faulty	Check ON permission signal.
	● A/C controller faulty	Check A/C controller.
Cool air won't come out (A/C condenser cooling fan motor won't operative)	● Condenser cooling fan relay faulty	Check condenser cooling fan relay.
	● Wiring or grounding faulty	Repair as necessary.
	● "A/C condenser cooling fan relay" signal in ECM faulty	Check A/C condenser cooling fan relay signal.
	● Condenser cooling fan motor faulty	Check condenser cooling fan motor.
Cool air won't come out (Blower motor won't operative)	● Fuse blown	Check "HEATER FUSE", "REAR DEFG" fuse and check for short circuit to ground.
	● Blower motor relay faulty	Check blower motor relay.
	● Blower motor resistor faulty	Check blower motor resistor.
	● Blower motor switch faulty	Check blower motor switch.
	● Wiring or grounding faulty	Repair as necessary.
	● Blower motor faulty	Check blower motor.
Cool air won't come out or insufficient cooling (A/C system normal operative)	● Insufficient or excessive charge of refrigerant	Check charge of refrigerant.
	● Refrigerant leak in system	Check system for leaks.
	● Condenser clogged	Check condenser.
	● A/C evaporator clogged or frosted	Check A/C evaporator.
	● A/C thermistor faulty	Check A/C thermistor.
	● A/C controller faulty	Check A/C controller.
	● Expansion valve faulty	Check expansion valve.
	● Drive belt slipping	Check or replace drive belt.
	● Magnetic clutch faulty	Check magnetic clutch.

Condition	Possible Cause	Correction
Cool air does not come out or insufficient cooling (A/C system normal operative)	● Compressor faulty	Check compressor.
	● Air in A/C system	Replace condenser dryer, and evacuation and charging.
	● Air leaking from cooling unit or air duct	Repair as necessary.
	● Heater and ventilation system faulty	Check blower unit. Check heater control lever assembly. Check heater assembly.
	● Blower motor faulty	Check blower motor.
	● Excessive compressor oil existing in A/C system	Pull out compressor oil in A/C system circuit, and replace compressor.
Cool air does not comes out only intermittently	● Wiring connection faulty	Repair as necessary.
	● Expansion valve faulty	Check expansion valve.
	● Excessive moisture in A/C system	Replace condenser dryer, and evacuation and charging.
	● A/C controller faulty	Check A/C controller.
	● Magnetic clutch faulty	Check magnetic clutch.
	● Excessive charge of refrigerant	Check charge of refrigerant.
Cool air comes out only at high speeds	● Condenser clogged	Check condenser.
	● Insufficient charge of refrigerant	Check charge of refrigerant.
	● Air in A/C system	Replace condenser dryer, and evacuation and charging.
	● Drive belt slipping	Adjust or replace drive belt.
	● Compressor faulty	Check compressor.
Cool air does not comes out only at high speeds	● Excessive charge of refrigerant	Check charge refrigerant.
	● A/C evaporator frosted	Check A/C evaporator. Check A/C thermistor.
Insufficient velocity of cooled air	● A/C evaporator clogged or frosted	Check A/C evaporator.
	● Air leaking from cooling unit or air duct	Repair as necessary.
	● Blower motor faulty	Check blower motor.
	● Wiring or grounding faulty	Repair as necessary.

DIAGNOSIS OF ABNORMAL NOISE

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 V-belt. ● Loose mounting bolts.	● Adjust V-belt tension, or replace belt. ● Retighten mounting bolts.
● A loud rattle is heard at low engine rpm.	● Loose compressor center bolt.	● Retighten center 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 bearings.
● A chattering noise is heard when compressor is engaged.	● Faulty clutch gap (excessive). ● Worn clutch friction surface. ● Compressor oil leaked from shaft seal, contaminating the friction surface.	● Adjust clutch gap. ● Replace clutch. ● Replace compressor shaft oil seal.

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 mounting stay and body.	● Firmly insert a silencer between condenser mounting stay and body.

ABNORMAL NOISE FROM CRANKSHAFT PULLEY

Condition	Possible Cause	Correction
● A large rattling noise is heard at idle or sudden acceleration.	● Loosen pulley mounting bolt. ● Worn or broken bearings.	● Retighten bolt. ● Replace bearings.

ABNORMAL NOISE FROM TENSION PULLEY

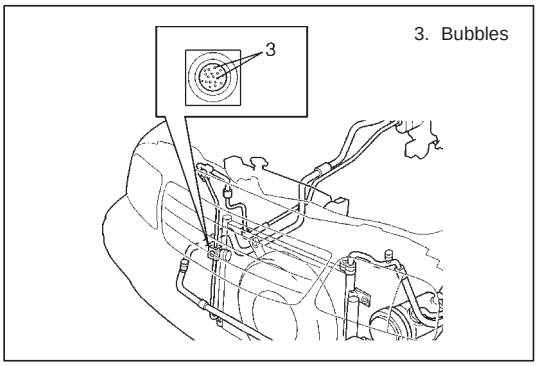
Condition	Possible Cause	Correction
● Clattering noise is heard from pulley.	● Worn or damaged bearings.	● Replace bearings.
● Pulley cranks upon contact.	● Cracked or loose bracket.	● Replace or retighten bracket.

ABNORMAL NOISE FROM EVAPORATOR

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

ABNORMAL NOISE FROM BLOWER MOTOR

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



QUICKLY CHECKING OF REFRIGERANT CHARGE (IF EQUIPPED WITH SIGHT GLASS)

CHARGE OF REFRIGERANT

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 max. cooling capacity for a few minutes. Then, look at the sight glass (1) on receiver/dryer (2) and compare what is observed with the symptoms listed in "CHECKING REFRIGERANT CHARGE" table given below.

CHECKING REFRIGERANT CHARGE

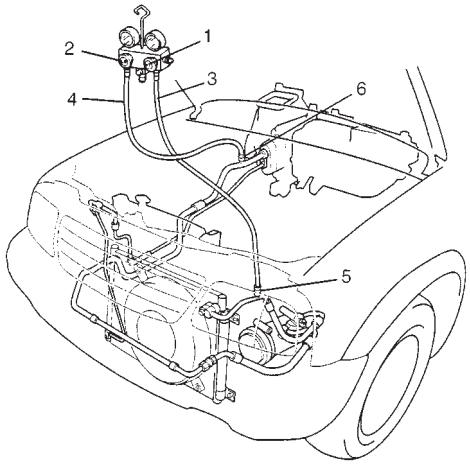
CONDITION	POSSIBLE CAUSES	CORRECTION
Bubbles observed in sight glass	Insufficient charge of refrigerant in system	Check system for leaks with a leak tester.
No bubbles observed in sight glass	No charge or proper or too much charge of refrigerant in system	Refer to the following item.
No temperature difference between compressor inlet and outlet	Empty or nearly empty system	Recovery, evacuate and charge system and then check it for leaks with a leak tester.
Noticeable temperature difference between compressor inlet and outlet	Proper or too much charge of refrigerant in system	Refer to the following item.
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.
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.

COMPRESSION SYSTEM DIAGNOSIS

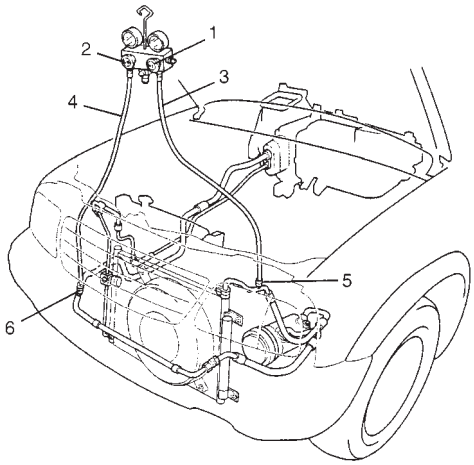
Compressor troubles are mainly following three types: gas leakage, noise and insufficient pressure.
Compressor gas leakages in most cases develop from the shaft seal. When detecting gas leakage, always use a leak tester. If a small amount of oil seeps out from the shaft seal, there is no necessity of replacing the seal. The shaft seal has been designed to allow a small amount of oil to leak out for lubricating purpose. Thus, the shaft seal should be replaced only when a large amount of compressor oil is leaking out or when gas leakage is discovered by using gas tester.
In regard to noise and insufficient pressure, repairs should be made only after diagnosing the trouble properly.

CONDITION	POSSIBLE CAUSES	CORRECTION
Noise from compressor	● Defective bearing ● Defective cylinder and/or shaft	Replace. Replace.
Noise from magnetic clutch	● Defective bearing ● Defective clutch face	Replace. Replace.
Insufficient cooling	● Defective gasket ● Defective reed valve	Replace. Replace.
Not rotating	● Locked compressor ● Seized magnetic clutch ● Rotating parts seized by insufficient oil amount	Replace. Replace. Replace.
Oil and/or gas leakage	● Defective seal ● Defective O-ring	Replace. Replace.

For CAMI production vehicle



For IWATA production vehicle

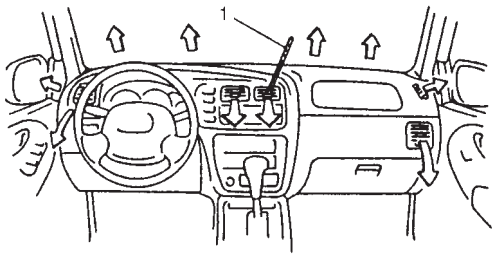


PERFORMANCE DIAGNOSIS

1) Confirm that vehicle and environmental conditions are as follows.
   - Vehicle is not exposed to direct sun.
   - Ambient temperature is within 15°C – 35°C (59°F – 95°F).
2) Make sure that high pressure valve (1) and low pressure valve (2) of manifold gauge are firmly closed.
3) Connect high pressure charging hose (3) to high pressure service valve (5) on vehicle, and connect low pressure charging hose (4) to low pressure service valve (6) on vehicle.
4) Bleed the air in charging hoses (3), (4) by loosening their respective nuts on manifold gauge, utilizing the refrigerant pressure. When a hiss is heard, immediately tighten nut.

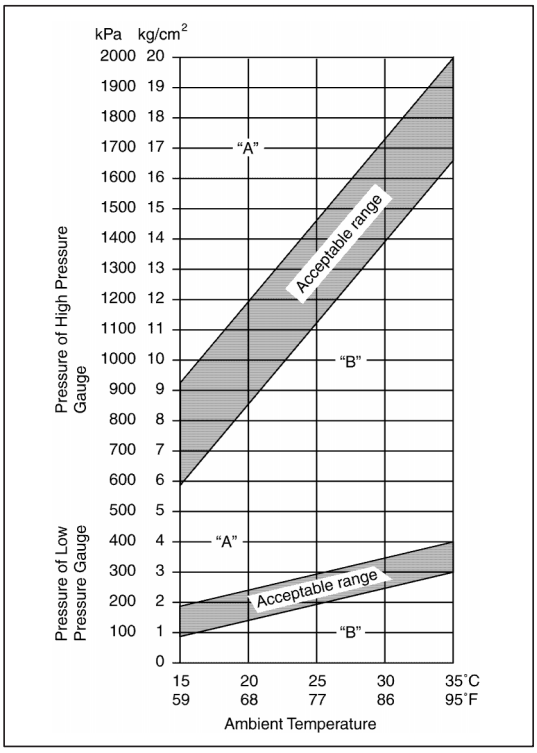
CAUTION:
Do not interchange high and low pressure charging hoses by mistake.

5) Warm up engine to normal operating temperature (engine coolant temperature at 80 – 90°C (176 – 194°F)) and keep it at specified idle speed. (Radiator cooling fan should not be working when checking pressure and temperature.)
6) Turn A/C switch ON, and set blower switch at "HI" (4th position), temperature control knob at "COOL", air outlet control knob at "FACE", fresh/circulation control knob at "CIRCULATION". (Confirm that A/C compressor and condenser fan are working.)
7) Keep all windows, doors and engine food open.



Ambient temperature	15 – 35°C (59°F – 95°F)
Engine rpm	Keep to 1,500 rpm.
Blower motor switch	Max. (4th position)
Temperature control	Max. cool
Air outlet control	Face
Vehicle doors	All open
Air inlet door position	Recirculation

8) With about 20 mm (0.8 in.) of dry bulb thermometer (1) inserted into center duct air outlet and another one set near evaporator air inlet, read temperature indicated on each thermometer.

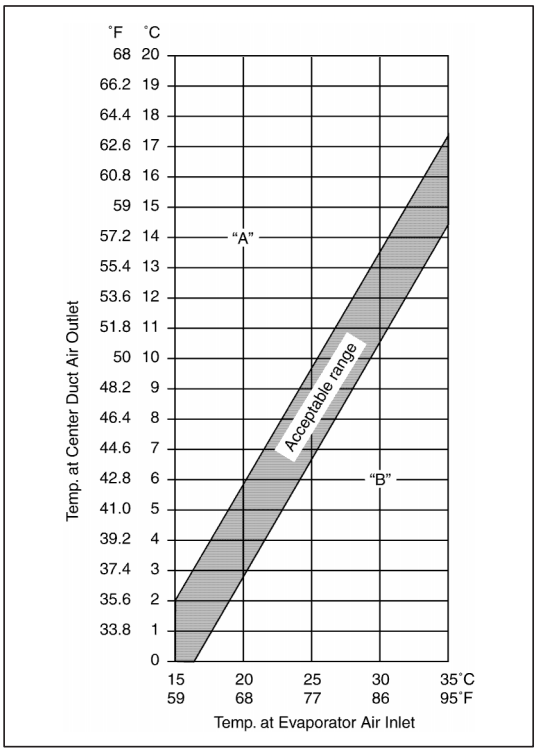


9) Check for each pressure of low side and high side if it is within shaded range of graph.
If each gauge reading is out of specified pressure, correct defective part referring to following Test Diagnosis table.

Example:

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

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



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

PERFORMANCE DIAGNOSIS TABLE

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

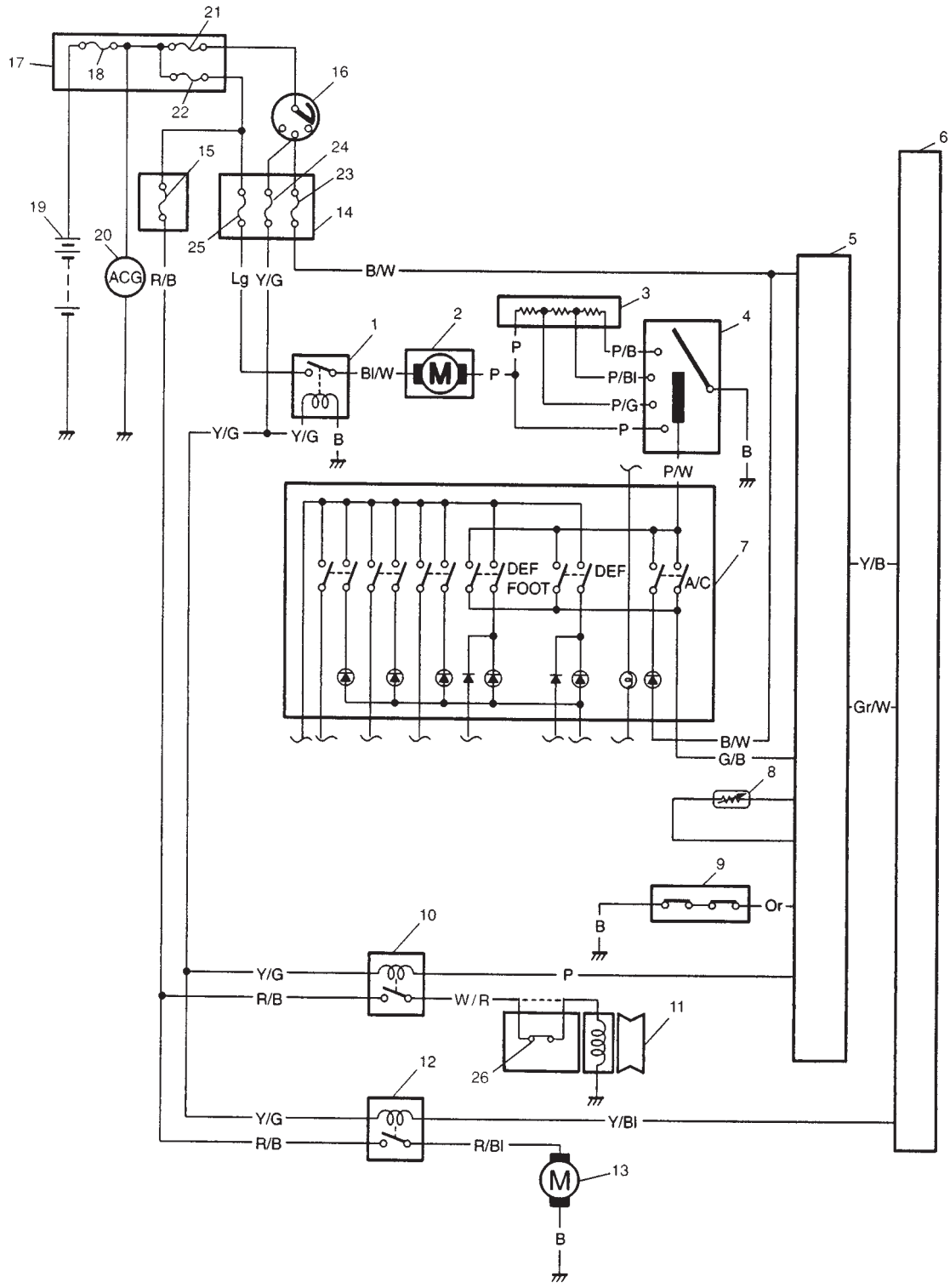
NOTE:
If ambient temperature is within 30 – 35°C (85 – 95°F), it is possible to do using next page table for more detail diagnosis.

AMBIENT TEMPERATURE WITHIN 30 – 35°C (85 – 95°F)

CONDITION			CAUSE	CORRECTION
MANIFOLD GAUGE	MPa (kg/cm²) (psi)	DETAIL		
Lo	Hi			
0.23 – 0.35 (2.3 – 3.5) (33 – 50)	1.4 – 1.75 (14 – 17.5) (200 – 249)	Normal condition.	——	——
Negative pressure	0.5 – 0.6 (5 – 6) (71.2 – 85.3)	● The low pressure side reads a negative pressure, and the high pressure side reads an extremely low pressure. ● Presence of frost around tubing to and from receiver/dryer and expansion valve.	● Dust particles or water droplets are either stuck or frozen inside expansion valve, preventing the refrigerant from flowing.	● Clean expansion valve. Replace it if it cannot be cleaned. ● Replace receiver/dryer. ● Evacuate the A/C system and recharge with fresh refrigerant.
Normal: 0.23 – 0.35 (2.3 – 3.5) (33 – 50) ↑ ↓ Abnormal: Negative pressure	Normal: 1.4 – 1.75 (14 – 17.5) (200 – 249) ↑ ↓ Abnormal: 0.69 – 0.98 (7 – 10) (100 – 142)	● During A/C operation, the low pressure side sometimes indicates negative pressure, and sometimes normal pressure. Also high pressure side reading fluctuates between the abnormal and normal pressure.	● Expansion valve is frozen due to moisture in the system, and temporarily shuts off the refrigeration cycle.	● Replace expansion valve. ● Replace receiver/dryer. ● Evacuate A/C system and recharge with fresh refrigerant.
0.05 – 0.15 (0.5 – 1.5) (4.2 – 21.3)	0.69 – 0.98 (7 – 10) (100 – 142)	● Both low and high pressure sides indicate low readings. ● Continuous air bubbles are visible through sight glass. ● Output air is slightly cold.	● Insufficient refrigerant in system. (Refrigerant leaking)	● Using 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) (56.9 – 85.3)		● Pressure on low pressure side is high. ● Pressure on high pressure side is low. ● Both pressure becoming equal right after A/C is turned OFF.	● Internal leak in compressor.	● Inspect compressor and repair or replace as necessary.
0.35 – 0.45 (3.5 – 4.5) (50 – 64)	1.96 – 2.45 (20 – 25) (285 – 355)	● High pressure reading on both low and high pressure sides. ● Air bubbles are not visible even when engine rpm is lowered.	● Overcharged A/C system. ● Faulty condenser cooling operation. ● Faulty condenser fan operation.	● Adjust refrigerant to specified amount. ● Clean condenser. ● Inspect and repair condenser fan.
		● High pressure reading on both low and high pressure sides. ● Low pressure side tubing is not cold when touched. ● Air bubbles are visible through sight glass.	● Presence of air in A/C system. (Improperly evacuated)	● Replace receiver/dryer. ● Inspect quantity of compressor oil and presence of contaminants in oil. ● Evacuate system and recharge with fresh refrigerant.
0.45 – 0.55 (4.5 – 5.5) (64 – 78)		● High pressure reading on both low and high pressure sides. ● Large amount of frost or dew on the low pressure side tubing.	● Faulty expansion valve. ● Refrigerant flow is not regulated properly.	● Replace expansion valve.

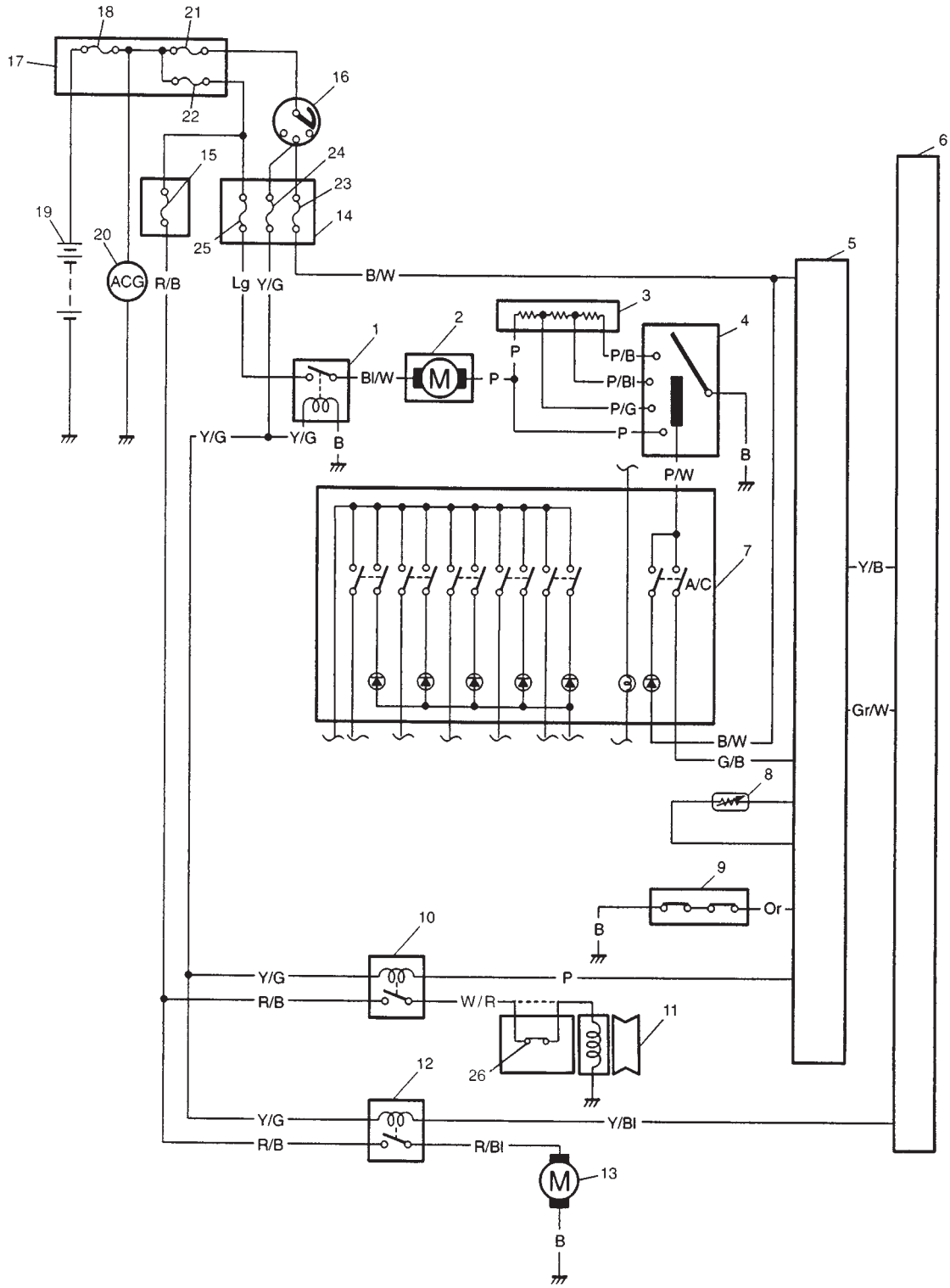
WIRING CIRCUIT

FOR LH VEHICLE



1. Blower motor main relay
2. Blower motor
3. Blower motor resistor
4. Blower motor switch
5. A/C controller
6. ECM
7. Heater mode control switch
8. Evaporator temperature sensor
9. Refrigerant pressure switch
10. Compressor relay
11. Compressor
12. Condenser cooling fan relay
13. Condenser cooling fan
14. Fuse box
15. A/C fuse 25 A
16. Ignition switch
17. Main fuse box
18. Battery main fuse 80 A
19. Battery
20. Generator
21. Ignition main fuse 60 A
22. Heater/A/C main fuse 60 A
23. Ignition/meter fuse 20 A
24. Rear defogger fuse 15 A
25. Heater fuse 30 A
26. Compressor thermal switch (only IWATA production vehicle)

FOR RH VEHICLE



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10. Compressor relay
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12. Condenser cooling fan relay
13. Condenser cooling fan
14. Fuse box
15. A/C fuse 25 A
16. Ignition switch
17. Main fuse box
18. Battery main fuse 80 A
19. Battery
20. Generator
21. Ignition main fuse 60 A
22. Heater/A/C main fuse 60 A
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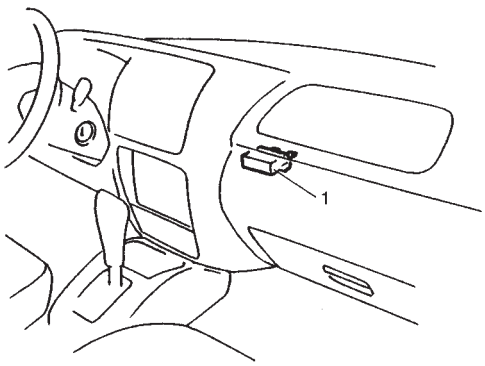


INSPECTION OF A/C CONTROLLER AND ITS CIRCUITS

CAUTION:
A/C controller and ECM cannot be checked by itself.
It is strictly prohibited to connect voltmeter or ohmmeter to A/C controller and ECM with couplers disconnected from it.

A/C controller (1) and its circuits can be checked at A/C controller wiring couplers by measuring voltage.

Fig. A

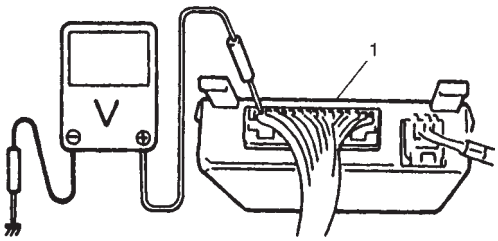


Fig. B

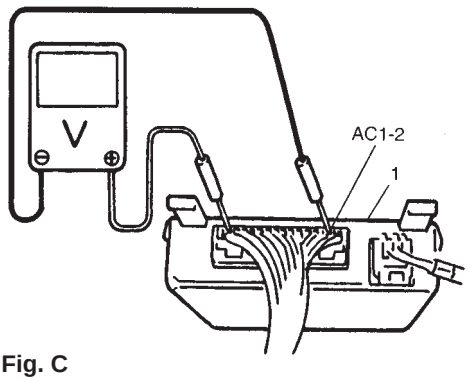
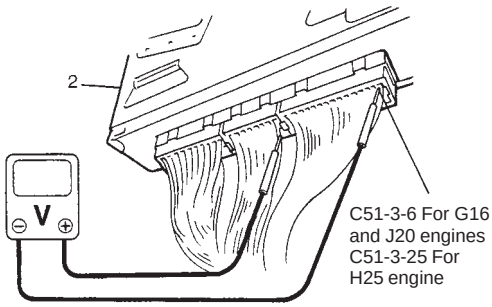


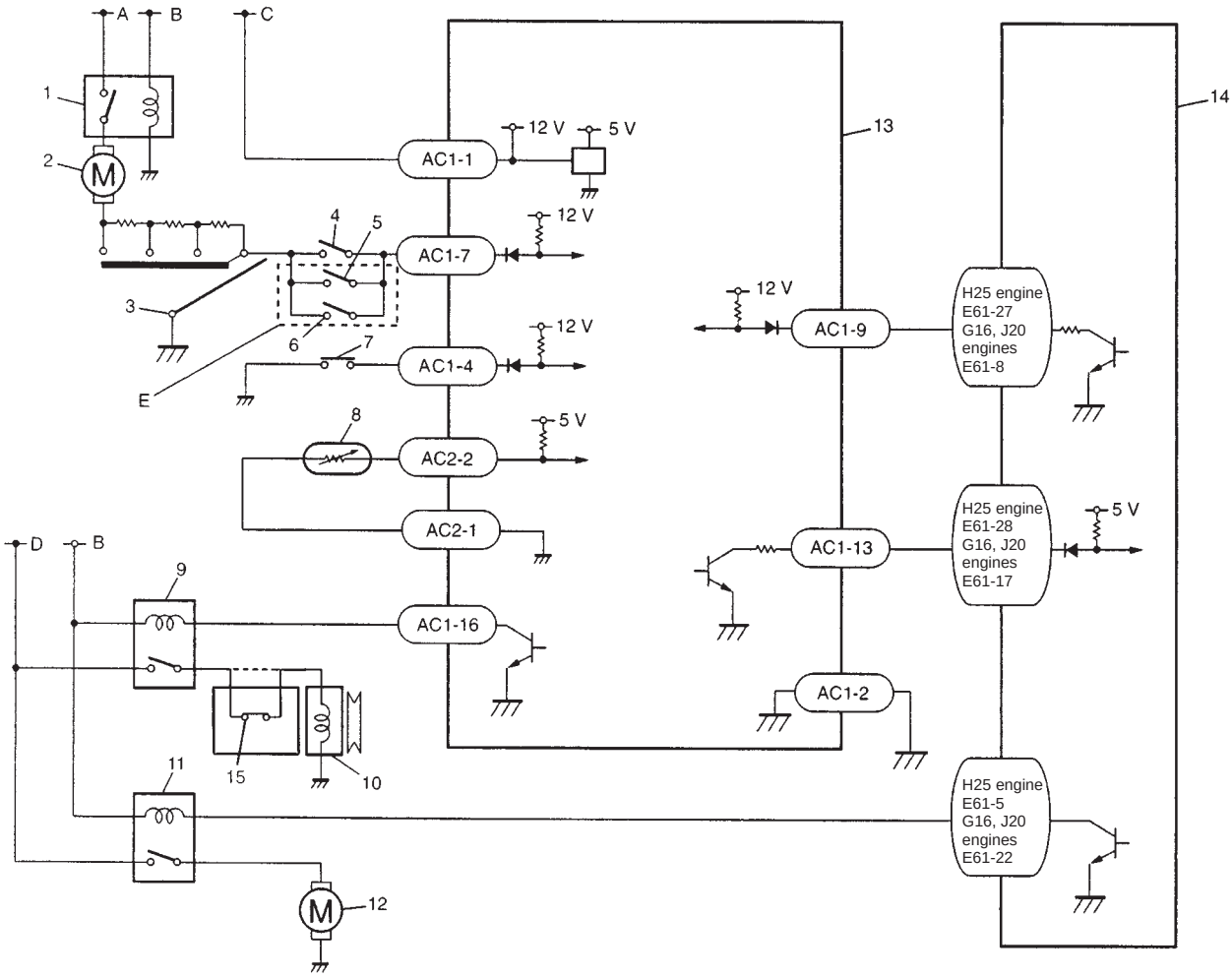
Fig. C



Voltage Check

1) Remove A/C controller (1) from vehicle (refer to "A/C CONTROLLER REMOVAL" in this section).
2) Remove ECM (2) from vehicle.
3) Connect A/C controller couplers to A/C controller and connect ECM couplers to ECM.
4) Check each terminal voltage with couplers connected by referring to the A/C CONTROLLER VOLTAGE VALUES TABLE the later.

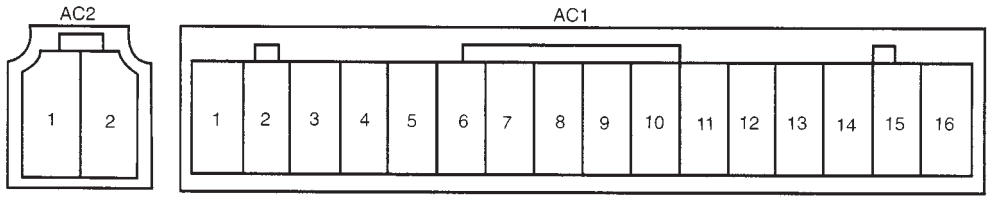
SYSTEM CIRCUIT



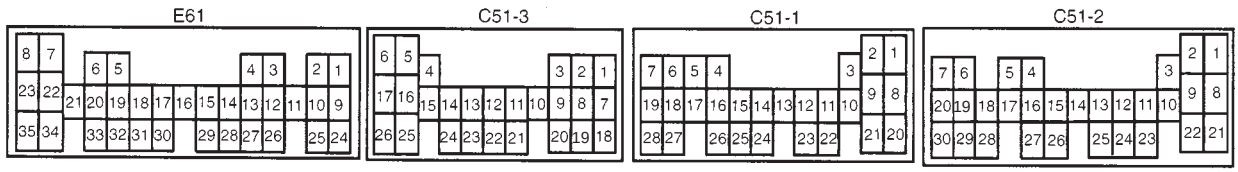
A. To heater fuse
B. To rear defogger fuse
C. To ignition / meter fuse
D. To A / C fuse
E. Only LH vehicle

1. Blower motor relay
2. Blower motor
3. Blower motor switch
4. A / C switch
5. Defiloster position switch
6. Defiloster / foot position switch
7. Dual pressure (refrigerant pressure) switch
8. A / C thermistor (evaporator temperature sensor)
9. Compressor relay
10. Compressor
11. Condenser fan motor relay
12. Condenser fan motor
13. A / C controller
14. ECM
15. Compressor thermal switch (only IWATA production vehicle)

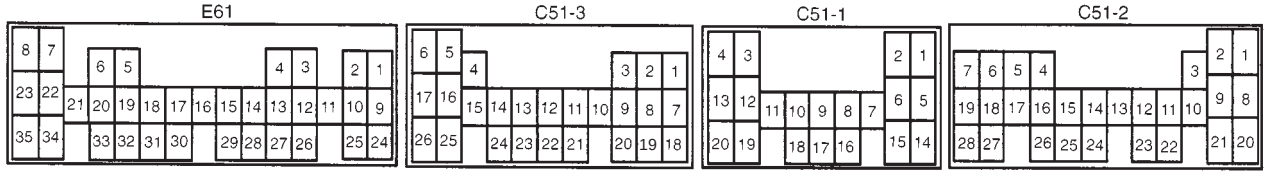
TERMINAL ARRANGEMENT OF A / C CONTROLLER



TERMINAL ARRANGEMENT OF ECM FOR G16, J20 ENGINE



TERMINAL ARRANGEMENT OF ECM FOR H25 ENGINE



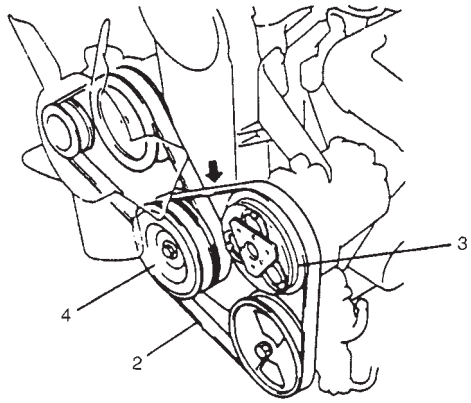
A/C CONTROLLER VOLTAGE VALUES TABLE

Terminal	Wire	Circuit	Measurement ground	Normal value	Condition
AC1-1	B/W	Controller main power supply	Ground to engine (Fig. B)	10 – 14 volts	Ignition switch ON with engine stopped
AC1-2	B/Y	Controller main ground	Ground to body (Fig. A)	–0.4 – 0 volt	Engine running
AC1-4	Or	Refrigerant pressure switch input	Ground to engine (Fig. B)	0 – 1 volt	Refrigerant pressure within 225 kPa (2.3 kg/cm^2, 32.7 psi) to 2548 kPa (26 kg/cm^2, 370 psi) with engine running
				10 – 14 volts	Refrigerant pressure below 196 kPa (2.0 kg/cm^2, 28 psi) or above 3140 kPa (32 kg/cm^2, 455 psi) with engine running
AC1-7	G/B	A/C switch input and/or defroster position switch input (see NOTE)	Ground to engine (Fig. B)	8 – 14 volts	Blower fan motor switch and A/C or defroster position switch (see NOTE) ON with engine running
				0 – 1.5 volts	Blower fan motor switch or A/C or defroster position switch (see NOTE) OFF with engine running
AC1-9	Gr/W	Signal input from ECM (A/C ON permission signal)	Ground to engine (Fig. B)	10 – 14 volts	Approve of A/C ON
				0 – 1 volt	A/C ON forbid
AC1-13	Y/B	Signal output to ECM (A/C ON request signal)	Ground to engine (Fig. B)	0 – 1.5 volts	Blower fan motor switch and A/C or defroster position switch (see NOTE) ON with engine running at evaporator thermistor temperature input more than approx. 2.5°C (less than 2.5 V (5840 Ω)) and refrigerant pressure switch is ON
				10 – 14 volts	Except the above-mentioned with engine running
AC1-16	P	Compressor magnet clutch relay output	Ground to engine (Fig. B)	0 – 1 volt	Blower fan motor switch and A/C or defroster position switch ON with engine running at evaporator thermistor temperature input more than approx. 2.5°C (less than 2.5 V (5840 Ω)), refrigerant pressure switch ON and signal input from ECM ON
				10 – 14 volts	Except the above-mentioned with engine running

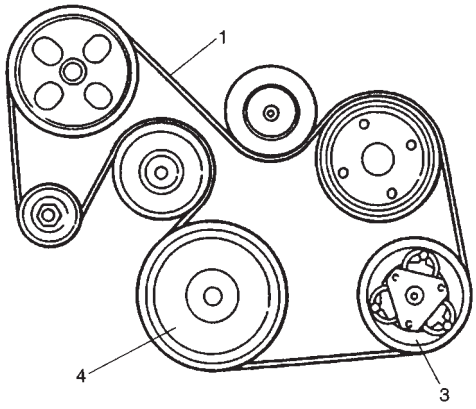
Terminal	Wire	Circuit	Measurement ground	Normal value	Condition
AC2-1	L/Y	Sensor ground	Ground to body (Fig. A)	–0.4 – 0 volt	Engine running
AC2-2	W/B	Evaporator thermistor temperature (evaporator temp. sensor) input	Ground to engine (Fig. B)	1.5 volts (3150 Ω)	Evaporator thermistor temperature at approx. 15°C (59°F) with engine running
				2.62 volts (6.311 Ω)	Evaporator thermistor temperature at approx. 1°C (34°F) with engine running * If the temperature is less than approx. 1°C, in this case compressor and condenser fan should be stop (come back at more than approx. 2.5°C (less than 5840 Ω, 2.5 V))
H25 engine E61-27/ G16, J20 engines E61-8	Gr/W	Signal output to A/C controller (A/C ON permission signal)	Ground to engine (Fig. C)	10 – 14 volts	Required A/C ON (terminal AC-A13) at engine running with normal condition (refer to "INSPECTION OF ECM AND ITS CIRCUIT" in Section 6E)
				0 – 1 volt	Except the above-mentioned with engine running In this case compressor should be stop
H25 engine E61-28/ G16, J20 engines E61-17	Y/B	Signal input from A/C controller (A/C ON request signal)	Ground to engine (Fig. C)	0 – 1.5 volts	Require A/C ON
				10 – 14 volts	Turn off the A/C
H25 engine E61-5/ G16, J20 engines E61-22	Y/L	A/C condenser cooling fan relay output	Ground to engine (Fig. C)	0 – 1 volt	● Blower fan motor switch and A/C or defroster position switch (see NOTE) ON with engine running at evaporator thermistor temperature input more than approx. 2.5°C (less than 2.5 V (5840 Ω)), refrigerant pressure switch ON and signal input from ECM ON ● Engine coolant temperature sensor more than 113°C (236°F) with engine running
				10 – 14 volts	Except the above-mentioned with engine running

NOTE:
Defroster position switch circuit is equipped with LH vehicle only.

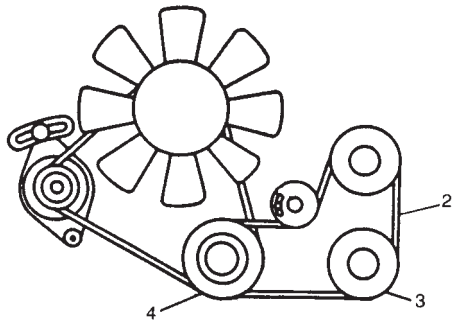
G16 engine



J20 engine



H25 engine



1. Generator belt
2. Compressor drive belt
3. Compressor pulley
4. Crankshaft pulley

DRIVE BELT

INSPECTION

For G16 and H25 engines

Refer to Section 3B1 for details.

For J20 engine

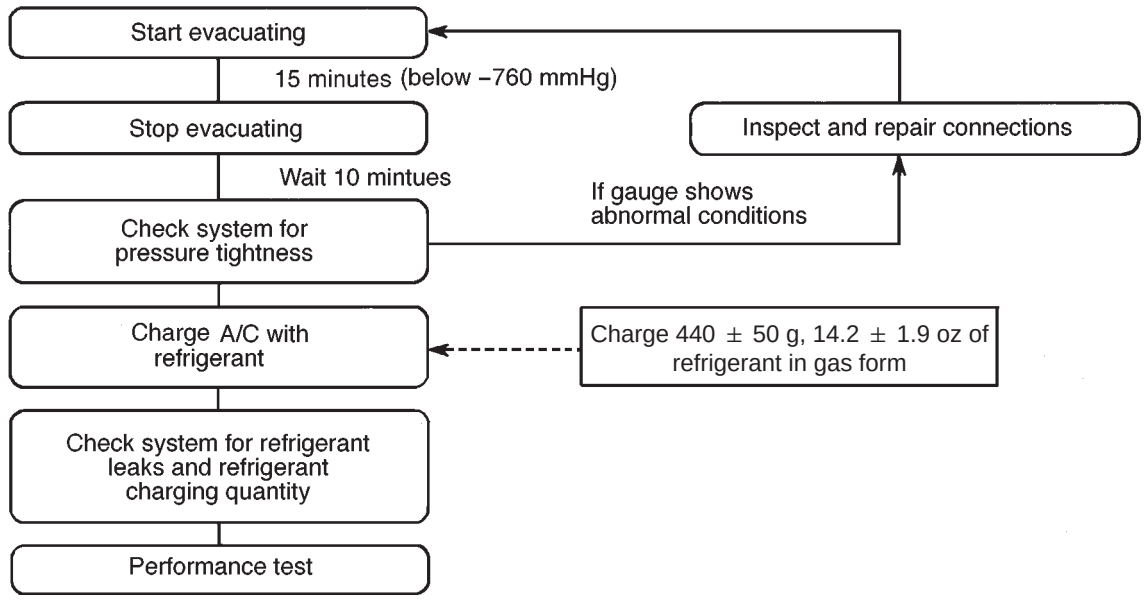
Refer to Section 6H for details.

REFRIGERANT RECOVERY, EVACUATION AND CHARGING

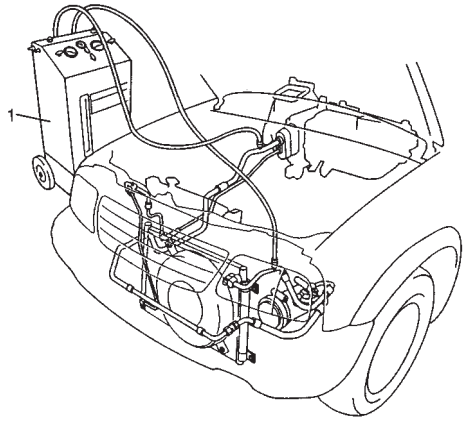
WARNING:

- **Your eyes should not be exposed to refrigerant (liquid).**
  Any liquid Refrigerant-134a escaping by accident shows a temperature as low as approx. –6°C (42.8°F) below freezing point. Should liquid HFC-134a (R-134a) get into your eyes, it may cause a serious injury. To protect your eyes against such accident, it is necessary to always wear goggles. Should it occur that HFC-134a (R-134a) strikes your eye(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.**

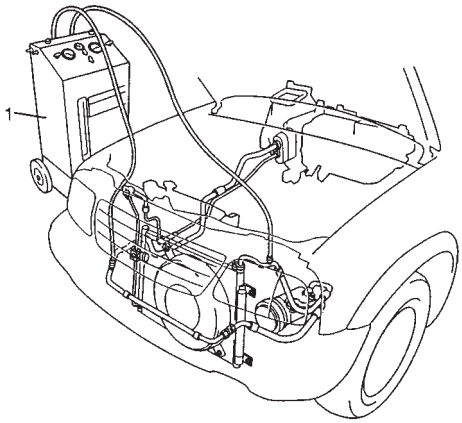
OPERATION PROCEDURE FOR CHARGING A/C WITH REFRIGERANT



For CAMI production vehicle



For IWATA production vehicle

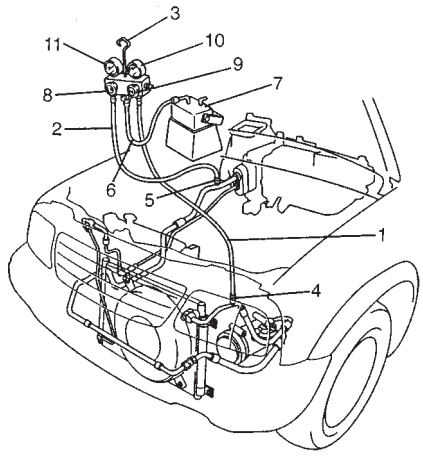


RECOVERY

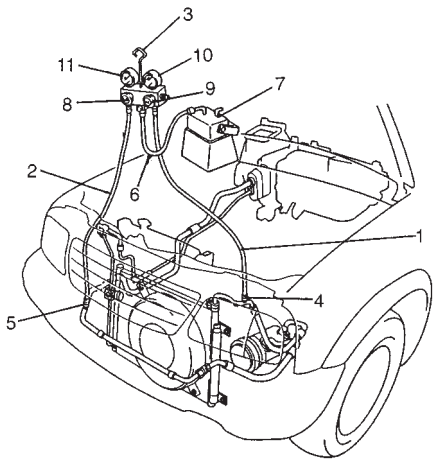
NOTE:

- **When discharging refrigerant out of A/C system, always recover it by using refrigerant recovery and recycling equipment (1). Discharging it into atmosphere would cause adverse effect to environments.**
- **When handling recovery and recycling equipment, be sure to follow the instruction manual for the equipment.**

For CAMI production vehicle



For IWATA production vehicle



EVACUATING

EVACUATING PROCEDURE

CAUTION:
Do not evacuate before recovering refrigerant in system.

NOTE:
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 approx. 15 minutes.

1) Connect high charging hose (1) and low charging hose (2) of manifold gauge set (3) respectively as follows:
   High Charging Hose (1) ➡ High pressure charging valve (4) on Discharge Hose
   Low Charging Hose (2) ➡ Low pressure charging valve (5) on Suction Pipe
2) Attach center charging hose (6) of manifold gauge set (3) to vacuum pump (7).
3) Operate vacuum pump (7), and then open discharge-side valve (9) (Hi) of manifold gauge set (3).
   If there is no blockage in the system, there will be an indication on high pressure gauge (10).
   When this occurs, open the other-side valve (8) (Lo) of the set.
4) Approx. 10 minutes later, low pressure gauge (11) should show a vacuum lower than –760 mmHg providing no leakage exists.

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

5) Evacuation should be carried out for a total of at least 15 minutes.
6) Continue evacuation until low pressure gauge indicates a vacuum less than –760 mmHg, and then close both valves (8), (9).
7) Stop vacuum pump (7). Disconnect center charging hose (6) from pump inlet. Now, the system is ready for charging refrigerant.

CHECKING SYSTEM FOR PRESSURE LEAKS

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

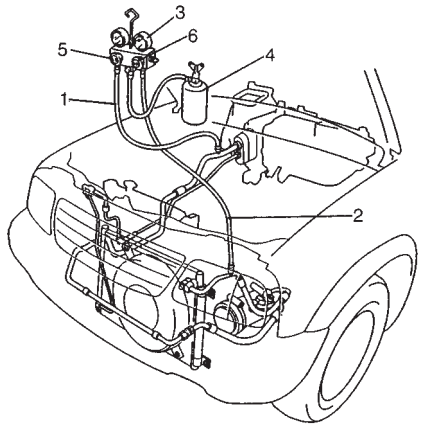
CAUTION:
If the gauge reading moves closer to "0", there is a leak somewhere. Inspect the tubing connections, make necessary corrections, and evacuate system once again, making sure that there are no leaks.

CHARGING

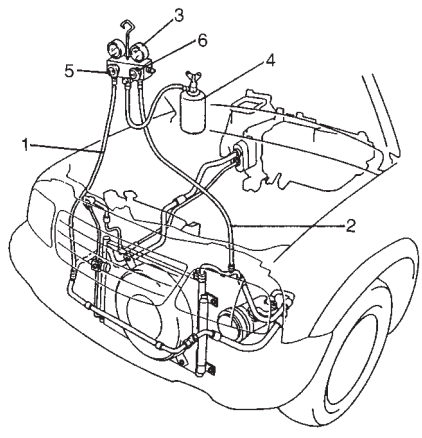
CAUTION:
- **ALWAYS CHARGE THROUGH LOW PRESSURE-SIDE of A/C system at after the initial charging is performed from the high-pressure side with the engine stopped.**
- **NEVER CHARGE TO HIGH PRESSURE-SIDE of A/C system with engine running.**
- **Do not charge while compressor is hot.**
- **When installing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

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

For CAMI production vehicle



For IWATA production vehicle

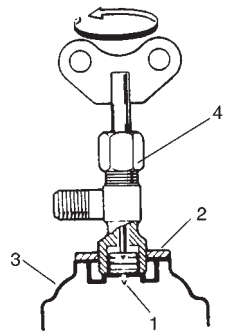


The initial charging of the A/C system is performed from the high-pressure side with the engine stopped.
And next, this method must be followed by charging from the low-pressure side with the engine running.

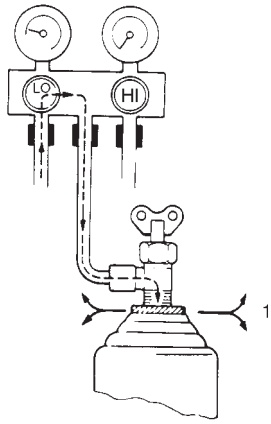
1) Check to make sure that hoses are routed properly after evacuating the system.
2) Connect Low-side hose (1) and High side hose (2) of the manifold gauge set (3) in position. Thus open refrigerant container valve (4) to purge the charging line.
3) Open the high-pressure side valve (6) and charge refrigerant to system.
4) After a while, open the low-pressure side valve (5) and close the high-pressure side valve (6).

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.



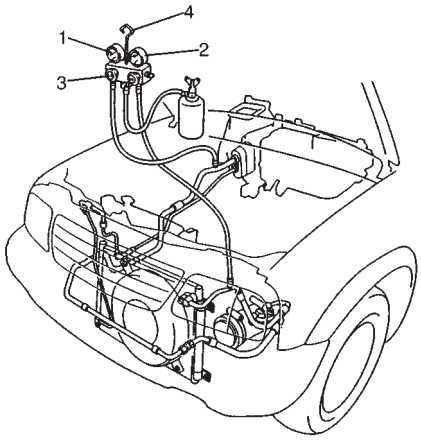
7) When refrigerant container (3) is emptied, use following procedure to replace it with a new refrigerant container (3).
   a. Close low pressure valve.
   b. Replace empty container (3) with a refrigerant container which has been charged with refrigerant. When using refrigerant container tap valve (4), use 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).



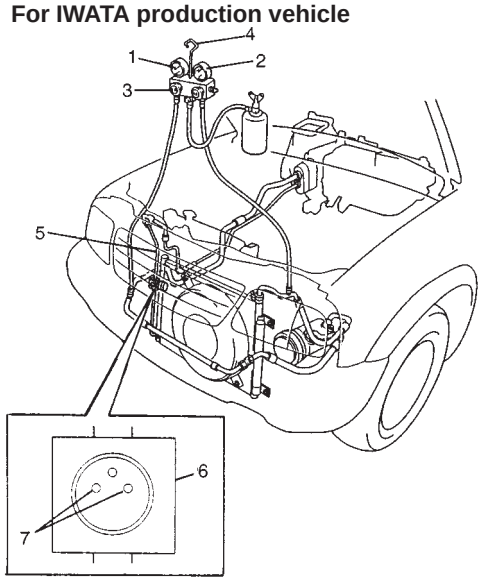
1. "Hiss"

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

For CAMI production vehicle



For IWATA production vehicle



8) After the system has been charged with specified amount of refrigerant or when low pressure gauge (1) and high pressure gauge (2) have indicated about 2 and 15 kg/cm^2 respectively, close low pressure side vale (3) of manifold gauge set (4). If equipped with sight glass in this time, look into the sight glass (6) of condenser outlet pipe (5) and check that there are no bubbles (7) in it, which means that the system is fully charged.

Low pressure gauge when charged with specified amount:
About 200 – 300 kPa (2 – 3 kg/cm^2, 29 – 43 psi)
(At A/C inlet temperature 30 – 35°C, 86 – 95°F)

High pressure gauge when charged with specified amount:
About 1370 – 1670 kPa (14 – 17 kg/cm^2, 200 – 244 psi)
(At A/C inlet temperature 30 – 35°C, 86 – 95°F)

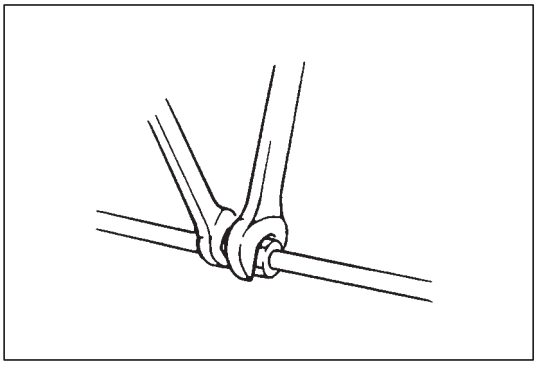
REMOVING MANIFOLD GAUGE SET

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.

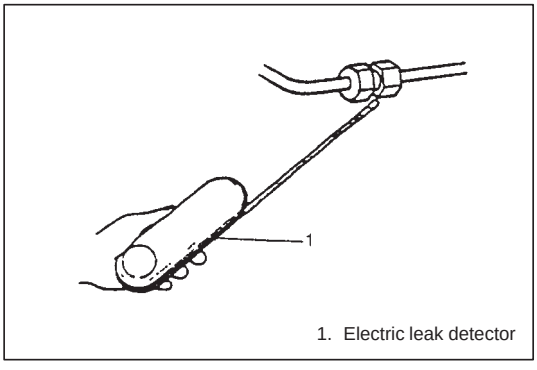
WARNING:
High pressure-side is naturally under high pressure. So, care must be used to protect your eyes and skin.

5) Put caps on service valves.



LEAK-TESTING REFRIGERANT SYSTEM

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.



1. Electric leak detector

LIQUID LEAK DETECTORS

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, bubbles will form within seconds if there is a leak.
For confined areas, such as sections of the evaporator and condenser, an electronic (gas) leak detector is more practical for determining leaks.

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

ON-VEHICLE SERVICE

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.

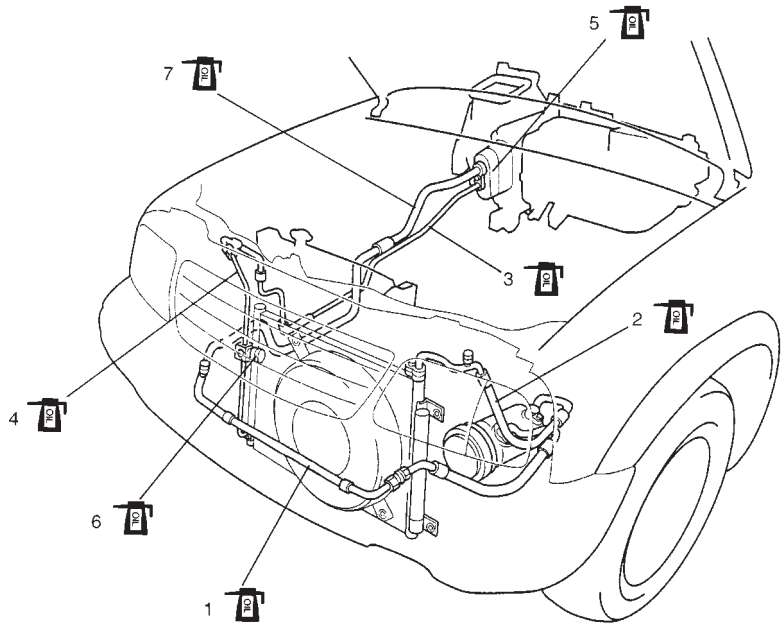
CAUTION:
None of refrigerant, compressor oil and component parts is interchangeable between two types of A/C: one using CFC-12 (R-12) and the other using HFC-134a (R-134a).
(For identification between these two types, refer to page 1B-2).
When replenishing or changing refrigerant and compressor oil and when replacing parts, make sure that the material or the part to be used is appropriate to the A/C installed in the vehicle being serviced. Use of incorrect one will result in leakage of refrigerant, damage in parts or other faulty condition.

PRECAUTION

When servicing air conditioning system, the following rules must be observed.

PIPING

- When connecting hoses and pipes, apply a few drops of compressor oil (refrigerant oil) to seats of coupling nuts and O-ring.



: Apply compressor oil (refrigerant oil) to O-ring.

1. Suction hose
2. Discharge hose
3. Liquid pipe
4. Condenser outlet pipe
5. Expansion valve
6. Dual pressure switch
7. Suction pipe

- 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 tightening or loosening a fitting, use two wrenches, one for turning and the other for support.

- Tighten flared nuts to specified torque.

Tightening Torque (Flared Nut Used for)
8 mm pipe: 13 N·m (1.3 kg-m, 9.5 lb-ft)
14.5 mm pipe: 23 N·m (2.3 kg-m, 16.6 lb-ft)
16 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.

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

- When handling refrigerant, always wear goggles to protect your eyes.
- Avoid you direct contact to liquid refrigerant.
- Do not heat refrigerant container higher than 40°C (104°F).
- Do not discharge refrigerant into atmosphere.
- Do not allow liquid refrigerant to touch bright metals. Refrigerant combined with moisture is corrosive and will tarnish surfaces of bright metals including chrome.
- After recovering refrigerant from system, the amount of compressor oil removed must be measured and the same amount added to the system.

REFRIGERANT RECOVERY

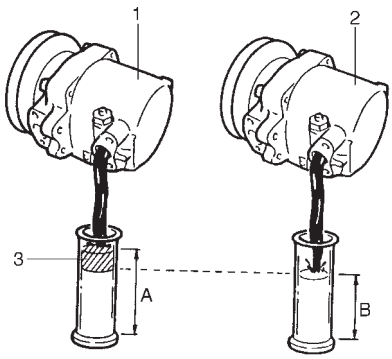
When discharging refrigerant out of A/C system, always recover it by using refrigerant recovery and recycling equipment. Discharging refrigerant HFC-134a (R-134a) into atmosphere would cause adverse effect to environments.

NOTE:
When handling recovery and recycling equipment, be sure to follow the instruction manual for the equipment.

REFRIGERANT CHARGE

Charge a proper amount of refrigerant to A/C system according to charging procedure described in recovery, evacuation and charging.

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



1. New compressor
2. Removed compressor
3. Excess oil (A – B)

REPLENISHING COMPRESSOR OIL

When replacing air conditioning parts with new ones, it is necessary to replenish oil by the amount supposedly remaining in each part.

When changing gas only

When it is unavoidable to change gas without replacing any component part for engine removal and installation or for some other reason, replenish 20 cc oil. When replenishing gas only, oil replenishment it not necessary.

When replacing compressor

Compressor oil is sealed in each new compressor by the amount required for air conditioner cycle. 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

When replacing other part

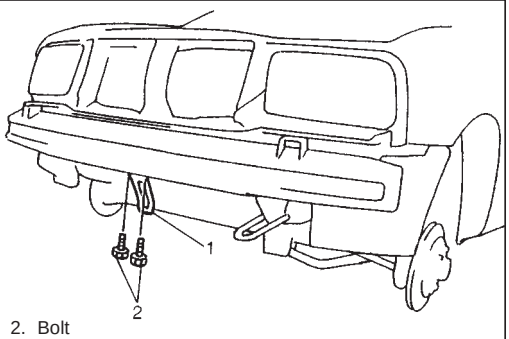
Replaced part	Amount of compressor oil to be replenished
Evaporator	25 cc
Condenser	15 cc
Receiver/dryer	20 cc
Hoses	10 cc each
Pipes	10 cc each

A/C CONDENSER ASSEMBLY

INSPECTION

Check
a) condenser fins for blockage
b) condenser fittings for leakage
c) condenser fins for damage
Clogged condenser fins should be washed with water, and should be dried with compressed air.

CAUTION:
Be careful not to damage condenser fins. If condenser fin is bent, straighten it by using a screwdriver or pair of pliers. If any leakage is found from fitting or tube, repair or replace condenser.

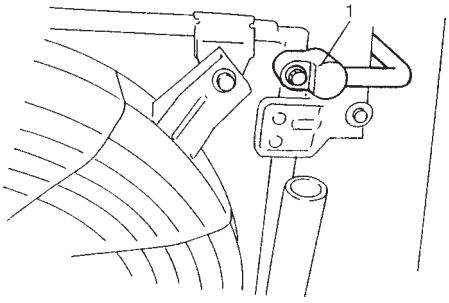


2. Bolt

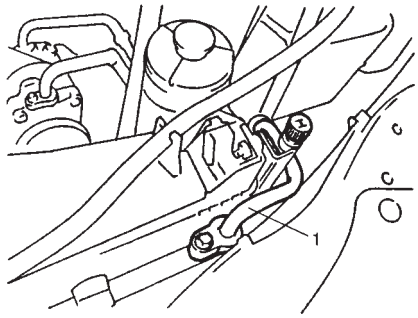
REMOVAL

1) Disconnect negative (–) cable at battery.
2) Recover refrigerant by using recovery and recycling equipment. Be sure to follow the instruction manual for the equipment. The amount of compressor oil removed must be measured and the same amount added to the system.
3) Remove front bumper assembly and remove lower stay (1) if equipped (Refer to Section 9 “BODY SERVICE”).

For CAMI production vehicle

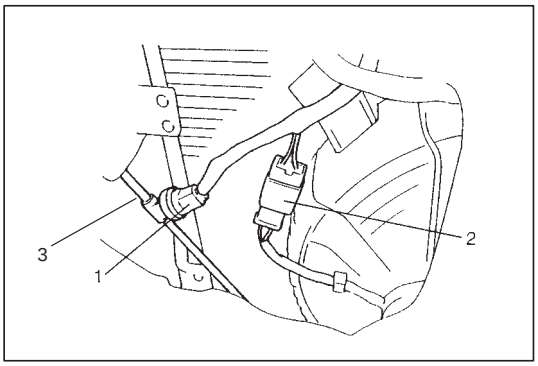


For IWATA production vehicle

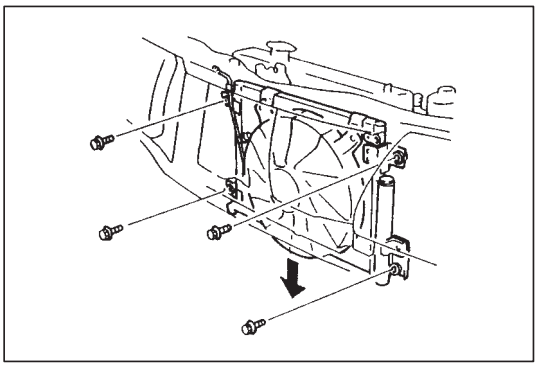


4) Disconnect compressor discharge hose (1) from condenser inlet fittings.

CAUTION:
As soon as above hose and pipe are disconnected, cap opened fittings so that moisture and dust do not enter condenser.



5) Disconnect coupler from dual pressure switch (1).
6) Disconnect condenser outlet pipe (3).
7) Disconnect condenser cooling fan motor coupler (2).



8) Remove condenser with fan.

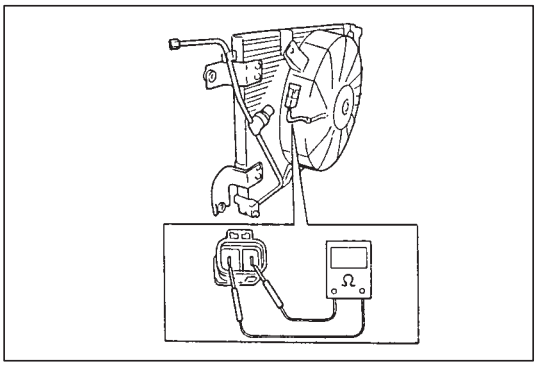
NOTE:
Be careful not to damage fins of condenser and radiator.

9) Remove A/C condenser cooling fan assembly from condenser.

INSTALLATION

Reverse removal sequence to install condenser, noting following point.

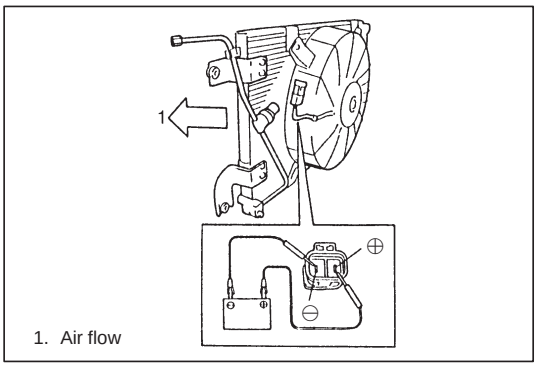
1) When replacing condenser, add 20 to 30 cc of refrigerating oil from compressor suction-side.
2) Evacuate and charge system according to previously-described procedure.



CONDENSER COOLING FAN ASSEMBLY

INSPECTION

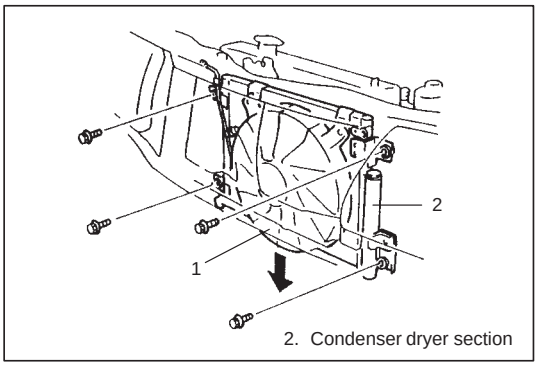
- Remove condenser assembly (Refer to “A/C CONDENSER ASSEMBLY REMOVAL” in this section).
- Check continuity between terminal to terminal as shown.
  If check results are continuity, proceed to next operation check.
  If not, replace.



1. Air flow

- Connect battery to condenser fan motor as shown, then check that the condenser fan motor operates smoothly and specified current.

  Specified current: Maximum 12 A at 12 V

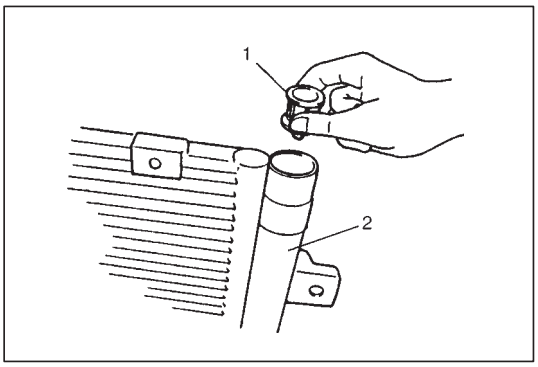


2. Condenser dryer section

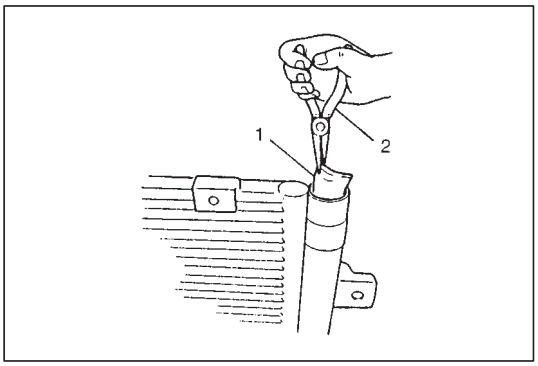
CONDENSER DRYER (RECEIVER/DRYER)

REMOVAL

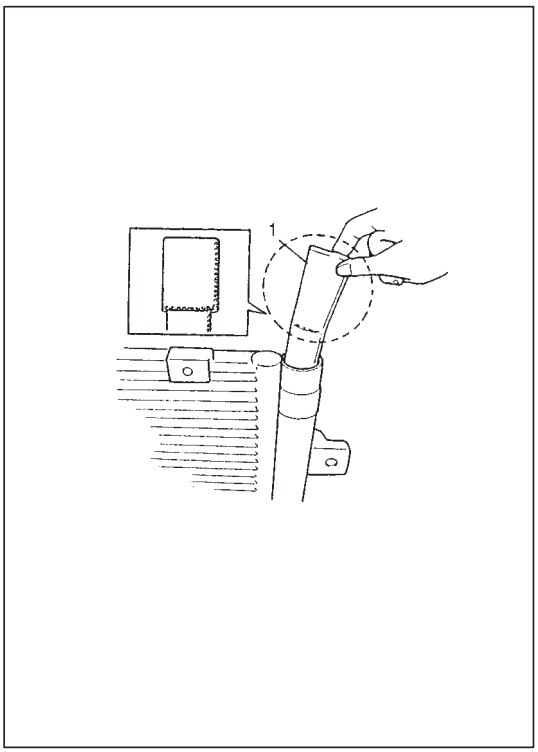
1) Remove A/C condenser assembly (1) from vehicle (Refer to "A/C CONDENSER ASSEMBLY REMOVAL" in this section.).
2) Remove the condenser dryer cap from condenser.



3) Remove the filter (1) from the condenser (2).



4) Remove the dryer (1) using a plier (2).



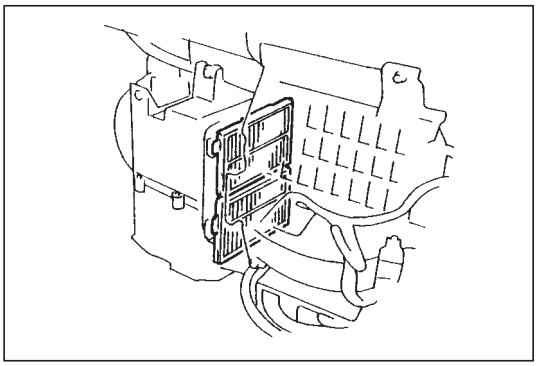
INSTALLATION

Reverse removal sequence to install condenser dryer, according to instruction manual with supply parts.

NOTE:

- **When replacing condenser dryer, add 40 cc of refrigerating oil the same as compressor oil.**
- **Do not remove the dryer from the plastic bag until just before inserting it into the receiver.**
- **Install the condenser dryer (1) with its double-layer portion facing the bottom of the receiver.**
- **If condenser dryer cap installing is bolt type, tighten specified torque for its bolt.**

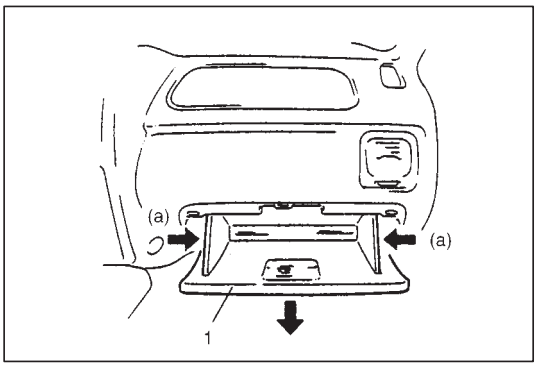
Tightening Torque:
Cap: 12.5 N·m (1.25 kg-m, 9 lb-ft)



AIR FILTER ELEMENT

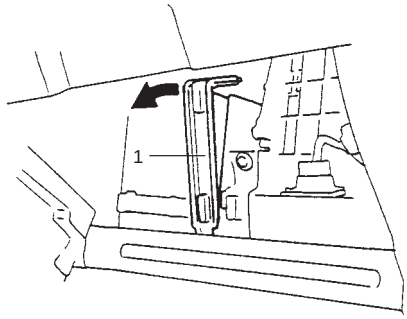
REMOVAL

1) Disconnect negative (–) cable at battery.
2) For vehicle with air bag system, disable air bag system. Refer to “DISABLING AIR BAG SYSTEM” in Section 10B.

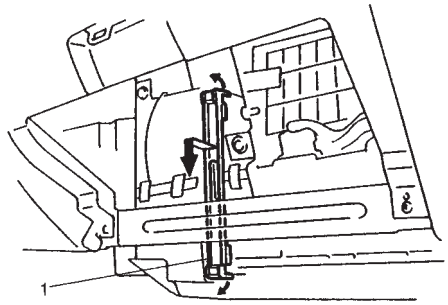


3) Pull down glove box (1) by pushing the shown part (a).

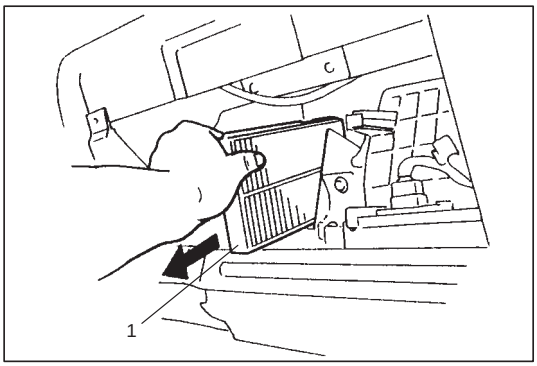
For CAMI production vehicle



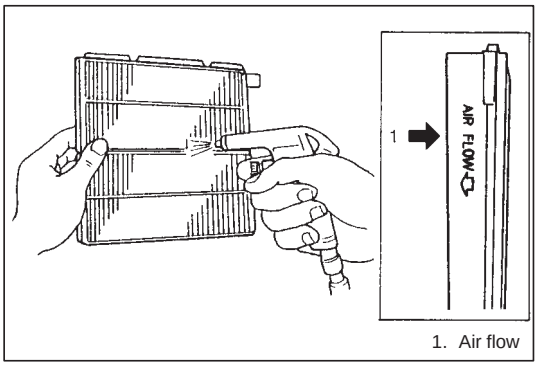
For IWATA production vehicle



4) Remove filter cover (1).



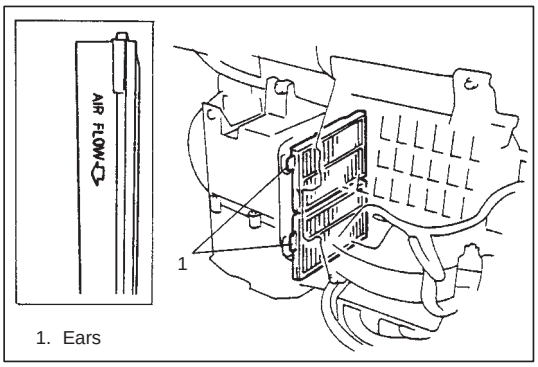
5) Pull out filter element (1). Pull out upper filter first then the lower one.



1. Air flow

CLEAN

Blow off dust by compressed air from air outlet side of the filter element.



1. Ears

INSTALLATION

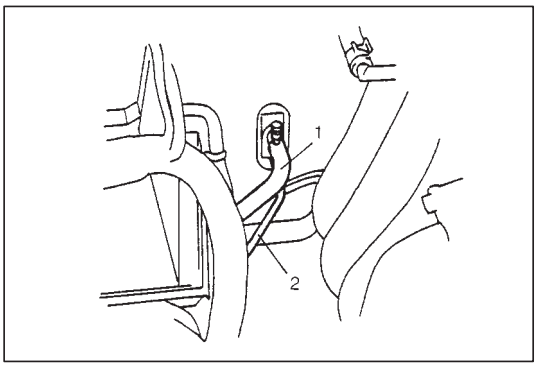
Reverse removal procedure for installation noting the followings:

- Install filter into cooling unit directing arrow mark on its end face to heater unit.
- Enable air bag system after installation. Refer to “ENABLING AIR BAG SYSTEM” in Section 10B.

COOLING UNIT (EVAPORATOR)

REMOVAL

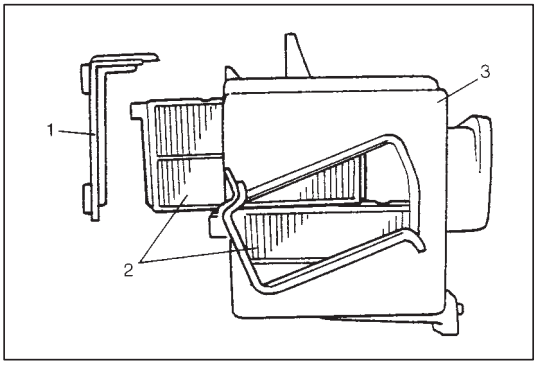
1) Disconnect negative (–) cable at battery.
2) Disable air bag system. Refer to “Disabling Air Bag System” in Section 10B.
3) Recover refrigerant by using recovery and recycling equipment. Be sure to follow the instruction manual for the equipment. The amount of compressor oil removed must be measured and the same amount added to the system.



4) For G16 and J20 engine
   Disconnect suction pipe (1), and liquid pipe (2) from evaporator (cooling unit).

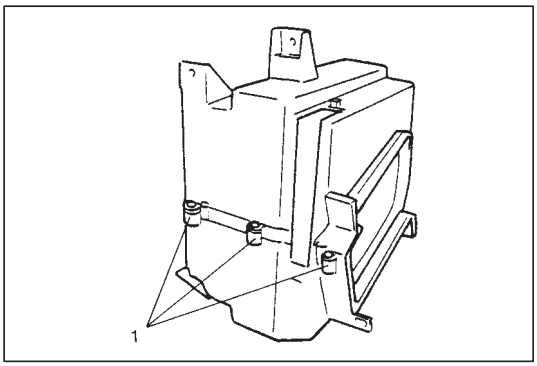
CAUTION:
As soon as above hose and pipe are disconnected, cap opened fittings so that moisture and dust may not enter cooling unit.

5) Remove blower motor unit. Refer to Section 1A “HEATER AND VENTILATION”.
6) Disconnect thermistor wire coupler.
7) Remove cooling unit (evaporator).

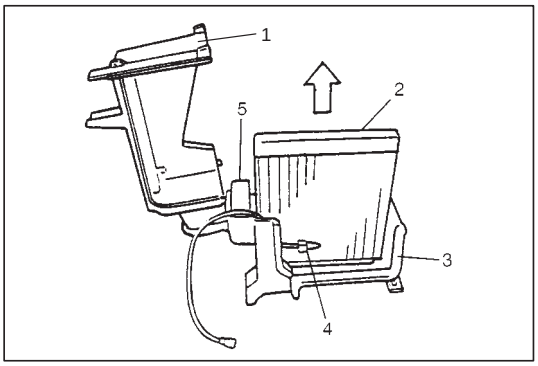


DISASSEMBLY (FOR CAMI PRODUCTION VEHICLE)

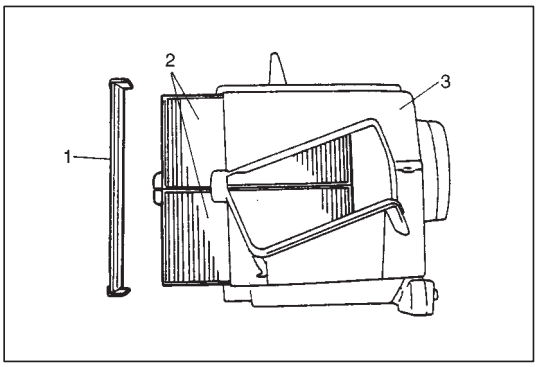
1) Remove filter (2) from cooling unit (3) assembly by removing filter cover (1).



2) Remove screws (1) to separate evaporator upper and lower cases from each other.

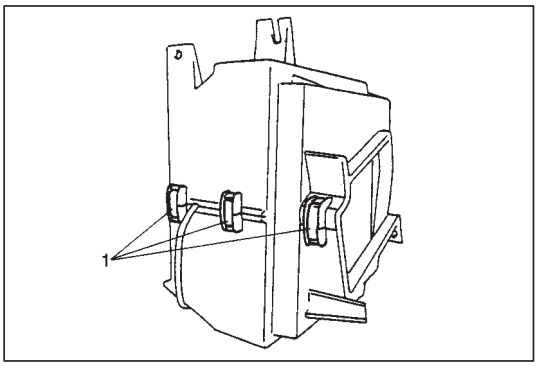


3) Remove upper case (1) and remove evaporator (2) from lower case (3).
4) Remove following components from evaporator.
   - Expansion valve (5)
   - Thermistor (evaporator temperature sensor) (4)

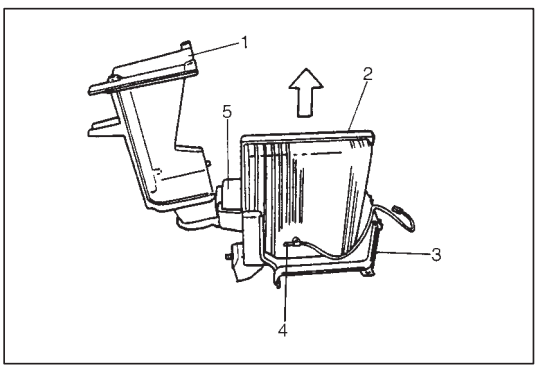


DISASSEMBLY (FOR IWATA PRODUCTION VEHICLE)

1) Remove filter (2) from cooling unit (3) assembly by removing filter cover (1).



2) Detach clamps (1) to separate evaporator upper and lower cases from each other.



3) Remove upper case (1) and remove evaporator (2) from lower case (3).
4) Remove following components from evaporator.
   - Expansion valve (5)
   - Thermistor (evaporator temperature sensor) (4)

INSPECTION

1) Check evaporator fins for blockage. If found clogged, use compressed air to clean the fins.

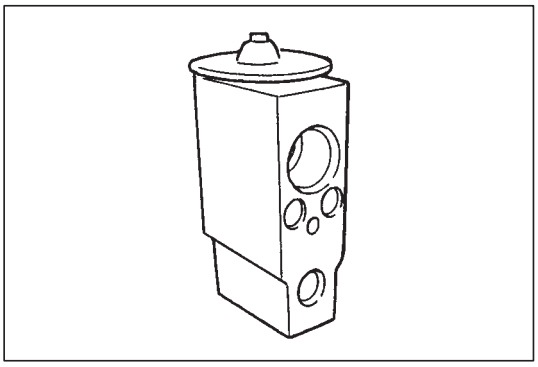
CAUTION:
Do not use water for cleaning of evaporator.
Be careful not to damage evaporator fins. If evaporator fin is bent, straighten it by using a screwdriver or pair of pliers. If any leakage is found from fitting or tube, repair or replace evaporator.

2) Check inlet and outlet fittings for crack or scratch. Repair them as required.

REASSEMBLY and INSTALLATION

1) Reverse removal and disassembly sequence to install cooling unit, noting the following points.
   - Install uniformly the evaporator packing to dash panel hole for expansion valve.
   - Adjust fresh air control cable, refer to “HEATER CONTROL LEVER ASSEMBLY” in Section 1A.
2) Enable air bag system. Refer to “Enabling Air Bag System” in Section 10B.
3) Evacuate and charge system. Refer to “EVACUATING” and “CHARGING” in this section.

NOTE:
When the thermistor removed, it should be reinstalled in original position.
If cooling unit or evaporator is replaced, pour 25 cc of refrigerating oil to compressor suction-side.



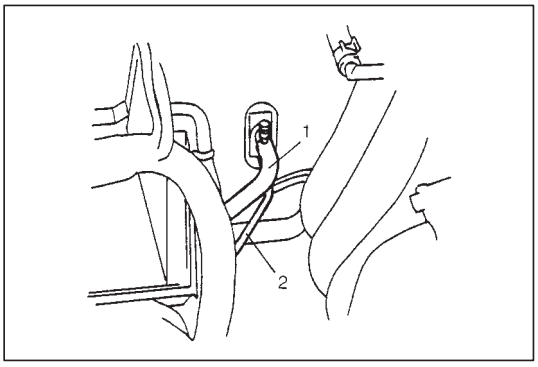
EXPANSION VALVE

INSPECTION

Refer to “Troubleshooting Procedure Using Manifold Gauge Set” in this section.

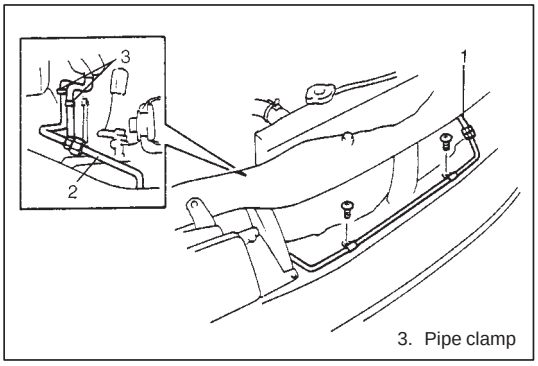
REMOVAL

1) Recover refrigerant by using recovery and recycling equipment. Be sure to follow the instruction manual for the equipment. The amount of compressor oil removed must be measured and the same amount added to the system.
2) Remove front grill.



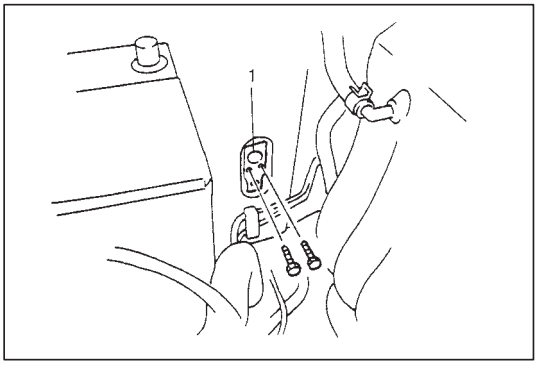
3) Disconnect suction pipe (1), and liquid pipe (2) from evaporator (Cooling unit).

CAUTION:
As soon as above hose and pipe are disconnected, cap opened fittings so that moisture and dust may not enter cooling unit.



3. Pipe clamp

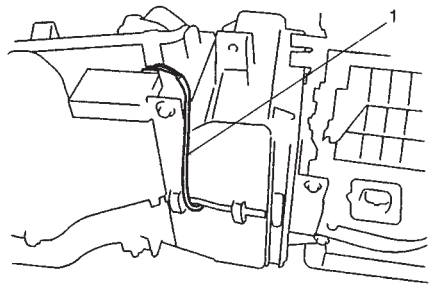
4) Disconnect suction pipe, and liquid pipe from suction hose (1) and condenser outlet pipe (2).
5) Remove pipe clamp then remove suction pipe and liquid pipe.

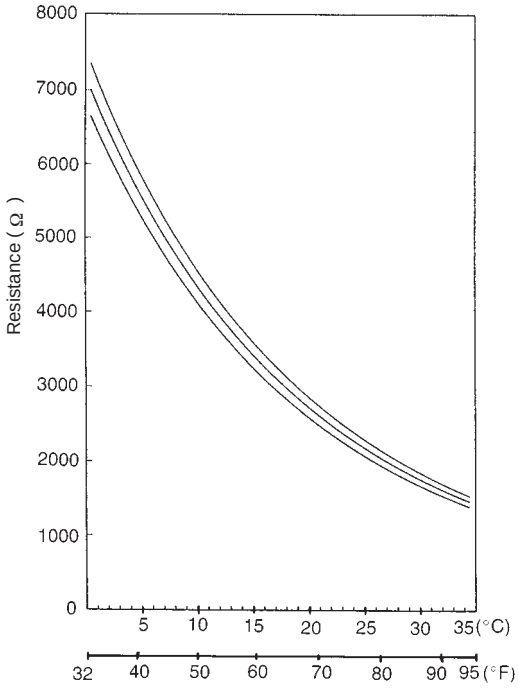


6) Remove expansion valve (1).

INSTALLATION

1) Reverse removal sequence to install expansion valve.
2) Evacuate and charge system. Refer to “EVACUATING” and “CHARGING” in this section.





A/C EVAPORATOR THERMISTOR (EVAPORATOR TEMPERATURE SENSOR)

A thermistor is a temperature sensor to sense the temperature of air discharged from evaporator. The electrical characteristic is shown in the figure.

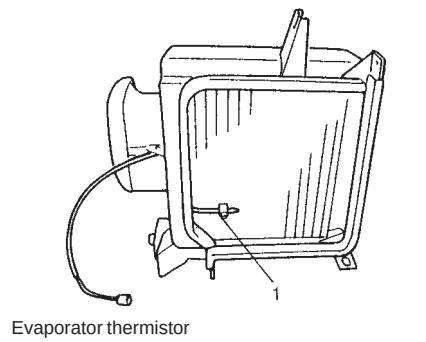
When temperature is lower than preset temperature, amplifier makes magnet clutch turn off to prevent evaporator from frosting.

INSPECTION

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

If check results are as not specified, replace thermistor.

Sensor Temperature	Resistance
0°C, 32°F	7.0 – 7.7 kΩ
25°C, 77°F	2.1 – 2.4 kΩ



1. Evaporator thermistor

REMOVAL

Refer to “COOLING UNIT (EVAPORATOR)” in this section.

INSTALLATION

1) Reverse removal sequence to install thermistor.
2) Enable air bag system. Refer to “ENABLING AIR BAG SYSTEM” in Section 10B.
3) Evacuate and charge system. Refer to “EVACUATING” and “CHARGING” in this section.

REFRIGERANT PIPES AND HOSES

INSPECTION

1) Use a leak tester to check hoses and pipes for any gas leakage.
2) Check each hose or pipe clamp for tightness.
   Retighten or replace loose clamp as required, if any.

REMOVAL

1) Recover refrigerant by using recovery and recycling equipment.
   Be sure to follow the instruction manual for the equipment.
   The amount of compressor oil removed must be measured and the same amount must be added to the system when reinstalling.
2) Replace defective hose or pipe.

> **CAUTION:**
> **As soon as the above hose or pipe is disconnected, cap its opened fitting to prevent moisture and dust from entering.**

INSTALLATION

1) Reverse removal procedure to install refrigerant line.
2) Evacuate and charge system. Refer to “EVACUATING” and “CHARGING” in this section.

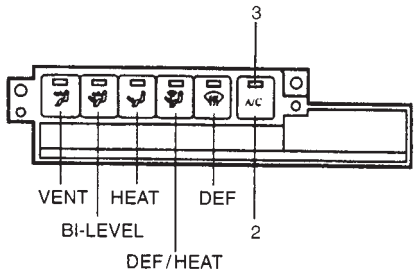
INSPECTION OF IDLE SPEED WITH A/C ON

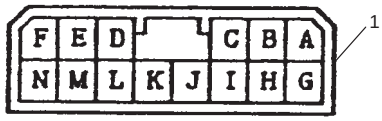
For G16 and J20 engines model, refer to Section 6E1.
For H25 engine model, refer to Section 6E2.

A/C SWITCH

REMOVAL

1) Disconnect negative (–) cable at battery.
2) If equipped with air bag system, disable air bag system. Refer to “DISABLING AIR BAG SYSTEM” in Section 10B.
3) Remove mode control switch (Refer to “MODE CONTROL SWITCH” in Section 1A).





1. Mode control switch coupler
2. A/C switch
3. Indicator lamp

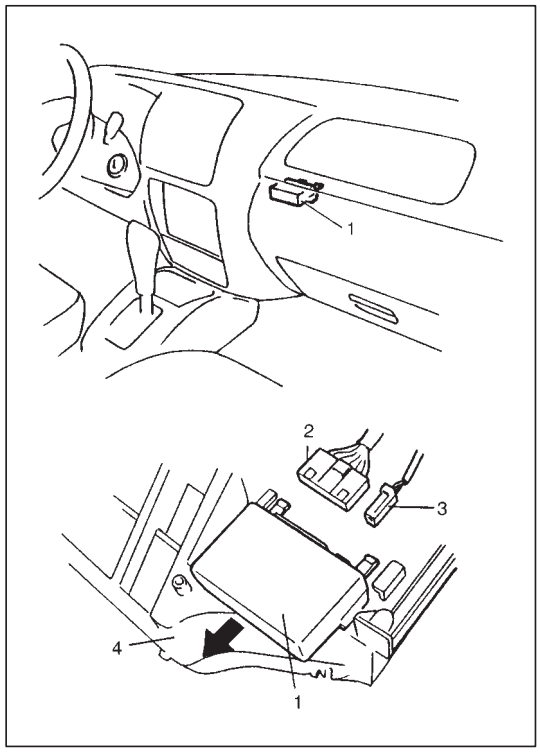
INSPECTION

A/C Switch

- Press A/C button and check if there is continuity between terminals “D” and “G”.
- With battery voltage (+) connected to terminal “K” and (–) to terminal “D”, press A/C button and check if indicator lamp lights.

INSTALLATION

1) Install in reverse order of removal procedure.
2) If equipped with air bag system, enable air bag system. Refer to “ENABLING AIR BAG SYSTEM” in Section 10B.



A/C CONTROLLER

REMOVAL

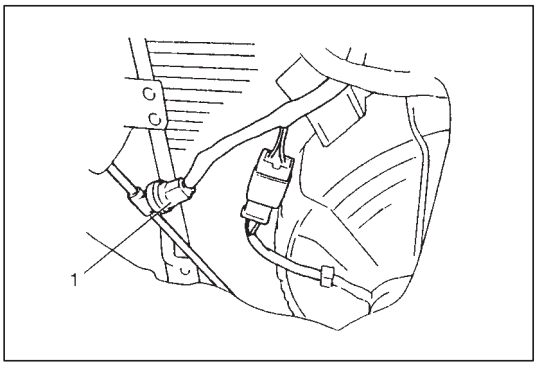
1) Disconnect negative (–) cable at battery.
2) Disable air bag system, if equipped.
   Refer to “DISABLING AIR BAG SYSTEM” in Section 10B.
3) Open glove box, then remove screw.
4) Remove glove box.
5) Disconnect A/C controller coupler (2), evaporator thermistor coupler (3).
6) Remove A/C controller (1) from heater unit (4).

INSPECTION

Refer to “INSPECTION OF A/C CONTROLLER AND ITS CIRCUIT” in this section.

INSTALLATION

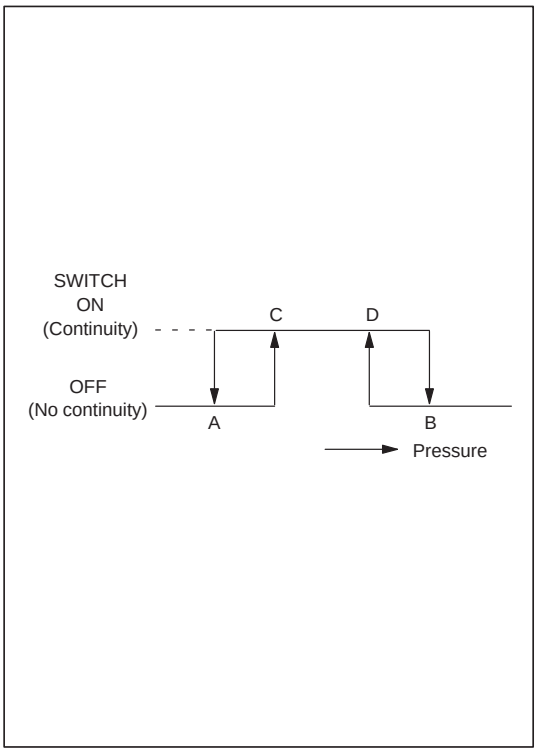
1) Install in reverse order of removal procedure.
2) If equipped with air bag system, enable air bag system. Refer to “ENABLING AIR BAG SYSTEM” in Section 10B.



DUAL PRESSURE SWITCH

INSPECTION

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

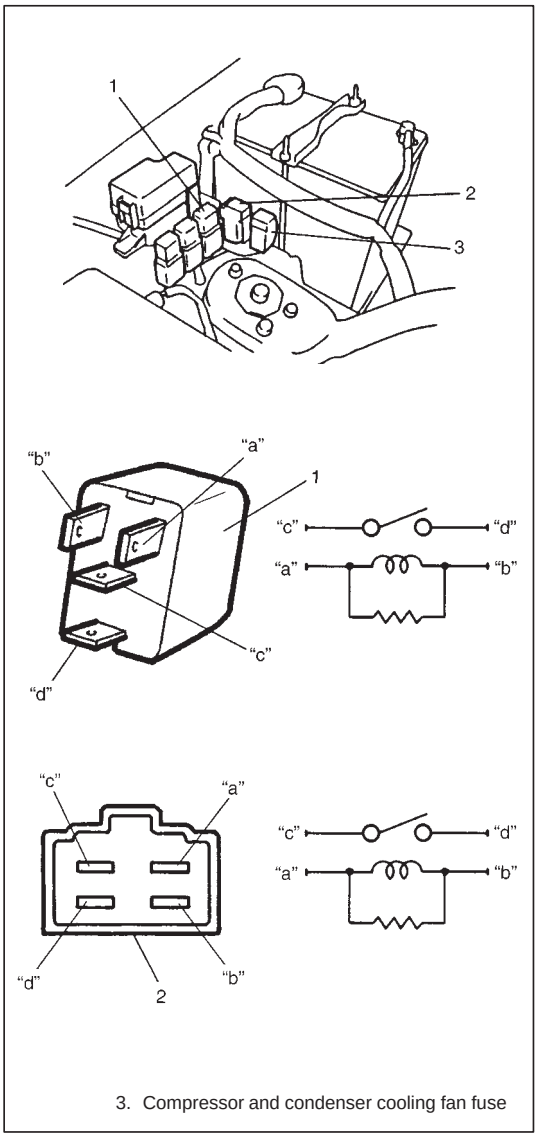


2) Using a manifold gauge set, check switch for operation at specified pressure as shown, refer to "PERFORMANCE DIAGNOSIS" in this section.

Switch ON : above "C" and below "D"
Switch OFF : below "A" or above "B"

"A": Approx. 200 kPa (2.0 kg/cm^2)
"B": Approx. 3200 kPa (32 kg/cm^2)
"C": Approx. 230 kPa (2.3 kg/cm^2)
"D": Approx. 2800 kPa (28 kg/cm^2)

Tightening torque:
Dual pressure switch: 10 N·m (1.0 kg-m, 7.5 lb-ft)



3. Compressor and condenser cooling fan fuse

A/C COMPRESSOR RELAY AND A/C CONDENSER COOLING FAN RELAY

INSPECTION

1) Disconnect negative (–) cable at battery.
2) Remove condenser cooling fan motor relay (2) and/or compressor relay (1) from vehicle.
3) Check that there is no continuity between terminal "c" and "d".
   If there is continuity, replace relay.
4) Connect battery positive (+) terminal to terminal "b" of relay.
   Connect battery negative (–) terminal "a" of relay.
   Check continuity between terminal "c" and "d".
   If there is no continuity when relay is connected to the battery, replace relay.

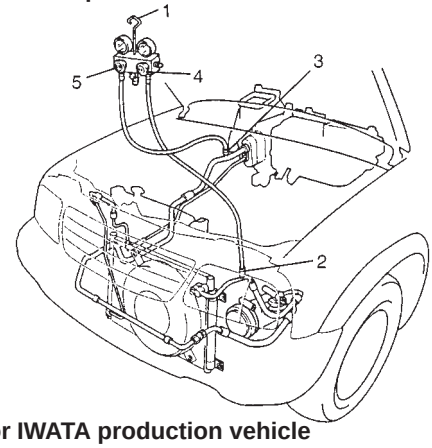
COMPRESSOR ASSEMBLY

CAUTION:
None of refrigerant, compressor oil and component parts is interchangeable between two types of A/C: one using CFC-12 (R-12) and the other using HFC-134a (R-134a).
For identification between these two types, refer to page 1B-2.
When replenishing or changing refrigerant and compressor oil and when replacing parts, make sure that the material or the part to be used is appropriate to the A/C installed in the vehicle being serviced. Use of incorrect refrigerant or compressor oil will result in leakage of refrigerant, damage in parts or other faulty condition.

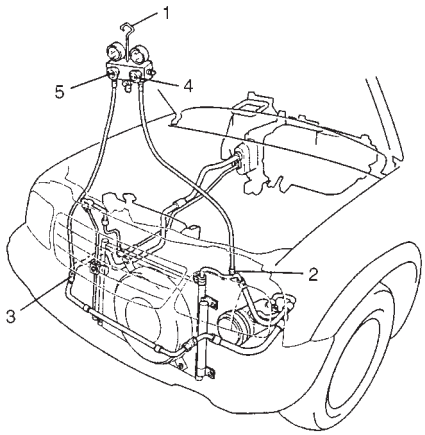
PRECAUTION

When servicing the compressor, keep dirt or foreign material away from getting on or into the compressor parts and system. Clean tools and a clean work area are important for proper service.
The compressor connection and the outside of the compressor should be cleaned before any “On-vehicle” repair or before removal of the compressor. The parts must be kept clean at all times and any parts to be reassembled should be cleaned with Trichloroethane, naphtha, kerosene or equivalent solvent and dried with dry air. Use only lint free cloths to wipe parts.
The operations described are based on bench overhaul with compressor removed from the vehicle, except as noted. They have been prepared in order of accessibility of the components.
When compressor is removed from the vehicle for servicing, the oil remaining in the compressor should be discarded and new refrigerant oil added to the compressor.
Minor repair procedures may be done on the vehicle without discharging the system. Major repair procedures require that the system be discharged of refrigerant.

For CAMI production vehicle



For IWATA production vehicle



2. High pressure side (Delivery side hose)
3. Lower pressure side (Suction side pipe)

INSPECTION

1) Install manifold gauge set (1) as shown in the figure.
2) Close Hi (4) and Lo (5) hand valves.
3) Run engine at fast idle.
4) Check compressor assembly for following items.
   If any of the above checks indicated a defect, repair compressor assembly.
   - High pressure gauge reading is not low and low pressure gauge reading is not higher than normal.
   - Metallic sound.
   - Leakage from shaft seal.

REMOVAL

1) Run engine at idle with A/C ON for 10 minutes.
2) Disconnect negative (–) cable at battery.
3) Recover refrigerant from refrigeration system using recovery and recycling equipment.

   NOTE:
   The amount of compressor oil at removed must be measured and the same amount must be poured when installing the compressor.

4) Disconnect thermal protector lead wire.
5) Disconnect suction and discharge hoses from compressor assembly.

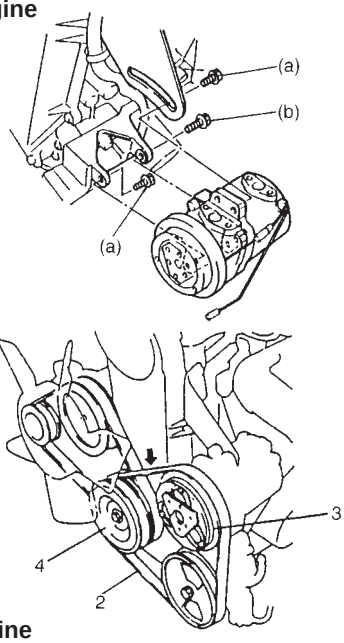
   NOTE:
   Cap open fitting immediately to keep moisture out of system.

6) **For G16 engine:**
   Remove compressor drive belt by loosening compressor assembly mounting bolts.

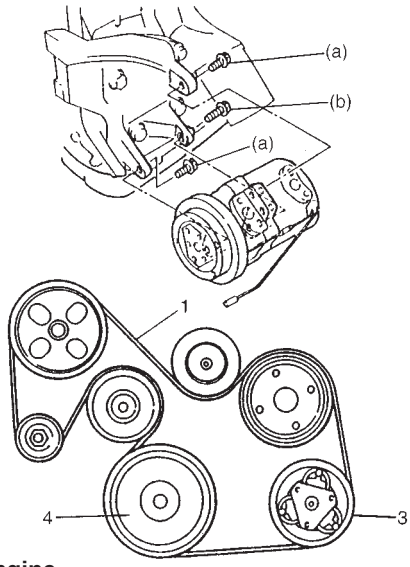
   For J20 engine:
   Remove generator belt. Refer to Section 6H.

   For H25 engine:
   Remove compressor drive belt by loosening tension pulley bolt.
7) Remove compressor with magnet clutch assembly from its mount.
8) If compressor assembly is replaced. Drain oil from compressor assembly, and measure its amount.

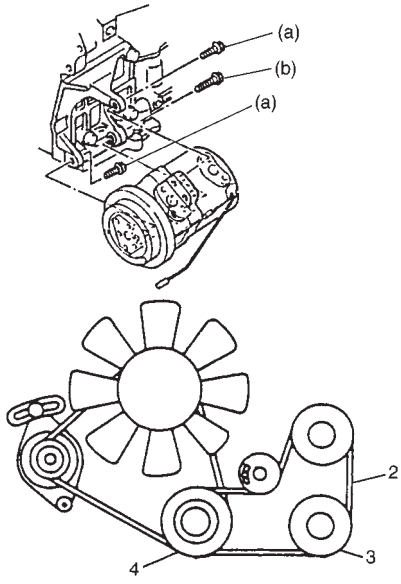
G16 engine



J20 engine



H25 engine



3. Compressor pulley
4. Crankshaft pulley

INSTALLATION

FOR IWATA PRODUCTION VEHICLE

1) Pour new compressor oil. The amount must be the same with the amount measured in REMOVAL.

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

   Amount of oil in compressor: 120 cm^3 (120 cc, 7.5 in^3)

2) **For G16 engine:**
   Install compressor assembly temporarily to bracket, then install compressor drive belt (2).

   For J20 and H25 engines:
   Install compressor assembly to its bracket.
   Tighten bolts (a) first, then (b).

   Tightening Torque
   (a), (b): 23 N·m (2.3 kg-m, 17.0 lb-ft)

3) Connect suction and discharge hoses to compressor assembly.

4) **For G16 engine:**
   Tension compressor drive belt (2) by tightening compressor assembly mounting bolts. Refer to Section 3B1 for drive belt tension.
   Tighten bolt (a) first, then (b).

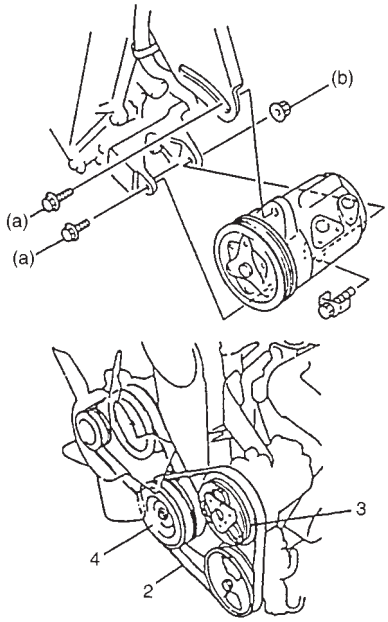
   Tightening Torque
   (a), (b): 23 N·m (2.3 kg-m, 17.0 lb-ft)

   For J20 engine:
   Install generator belt (1). Refer to Section 6H for details.

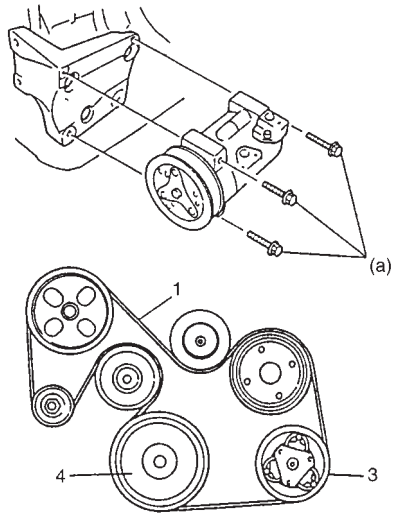
   For H25 engine:
   Install compressor drive belt (2). Refer to Section 3B1 for installation and belt tension.
5) Connect thermal protector lead wire.
6) Evacuate and charge system according to previously described procedure.

CAUTION:
Be sure to use HFC-134a (R-134a) compressor oil.

G16 engine



J20 engine



3. Compressor pulley
4. Crankshaft pulley

FOR CAMI PRODUCTION VEHICLE

1) Pour new compressor oil. The amount must be the same with the amount measured in REMOVAL.

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

   Amount of oil in compressor: 120 cm^3 (120 cc, 7.5 in^3)

2) **For G16 engine:**
   Install compressor assembly temporarily to bracket, then install compressor drive belt (2).

   For J20 engine:
   Install compressor assembly to its bracket.
   Tighten bolts (a).

   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

3) Connect suction and discharge hoses to compressor assembly.

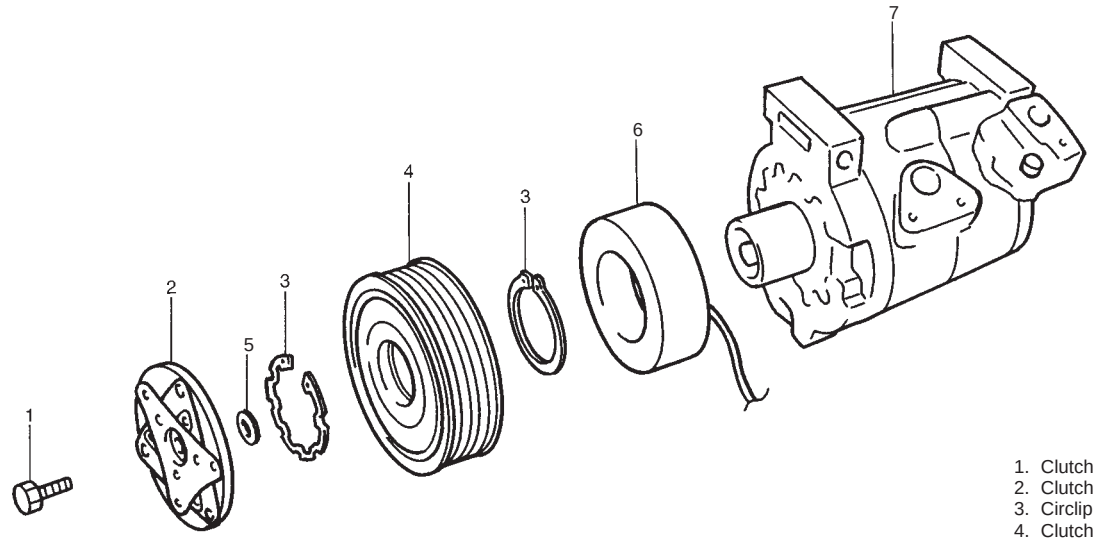
4) **For G16 engine:**
   Tension compressor drive belt (2) by tightening compressor assembly mounting bolts. Refer to Section 3B1 for drive belt tension.
   Tighten bolt (a) first, then (b).

   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

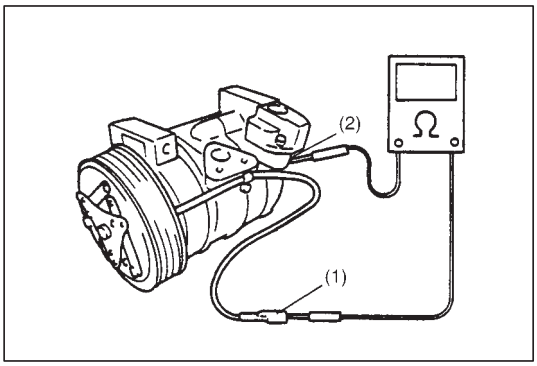
   For J20 engine:
   Install generator belt (1). Refer to Section 6H for details.
5) Connect thermal protector lead wire.
6) Evacuate and charge system according to previously described procedure.

CAUTION:
Be sure to use HFC-134a (R-134a) compressor oil.

MAGNET CLUTCH ASSEMBLY (FOR DENSO)



1. Clutch plate bolt
2. Clutch plate
3. Circlip
4. Clutch pulley
5. Shim
6. Clutch coil
7. Compressor

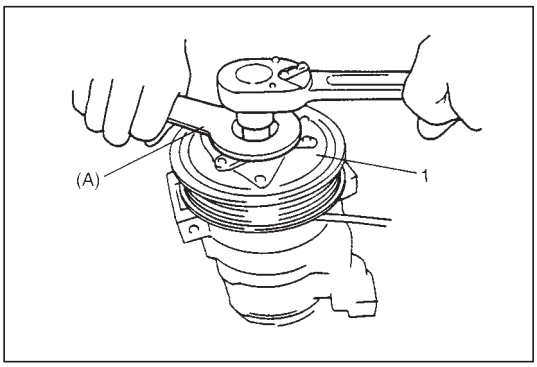


INSPECTION

- Inspect clutch plate and clutch pulley for signs of oil.
- Check clutch pulley for noise and grease leakage.
- Using an ohmmeter, measure resistance of clutch coil between clutch lead wire (1) and compressor body (2).

If measured resistance is not within tolerance, replace magnet clutch assembly.

Standard resistance: 3.5 – 5.0 Ω at 20°C, 68°F

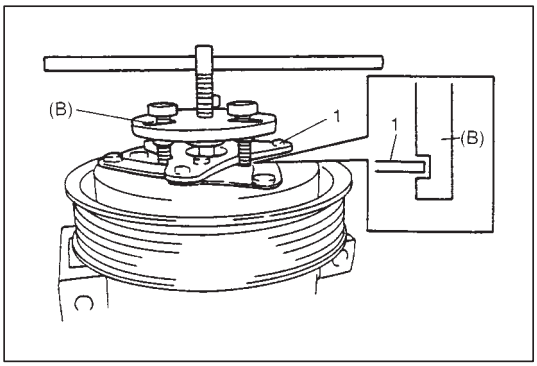


REMOVAL

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

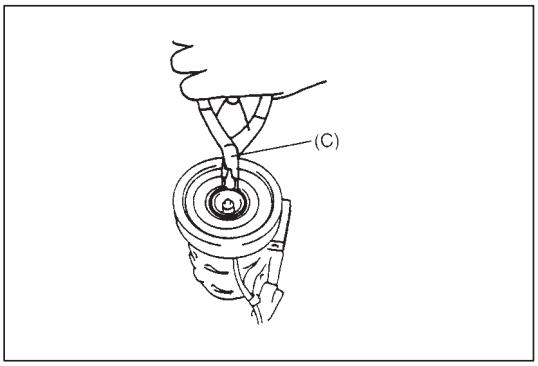
Special Tool
(A): 09991-06020

NOTE:
Do not reuse clutch plate bolt.



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

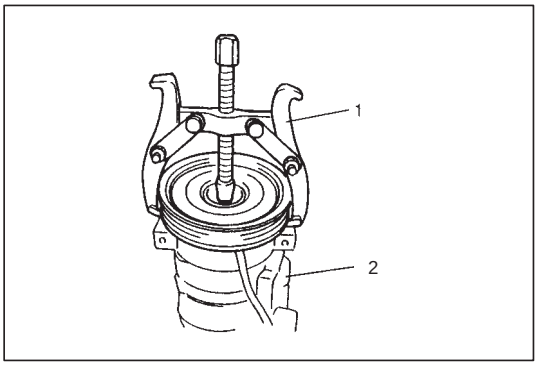
Special Tool
(B): 09991-06030



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

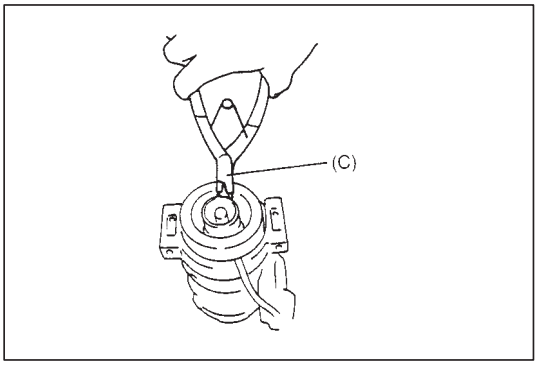
Special Tool
(C): 09900-06107

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



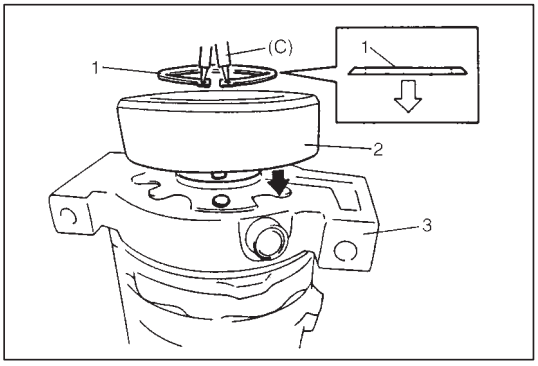
7) Remove clutch pulley with puller (1) from compressor (2).

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



8) Remove clutch coil.

Special tool
(C): 09900-06107

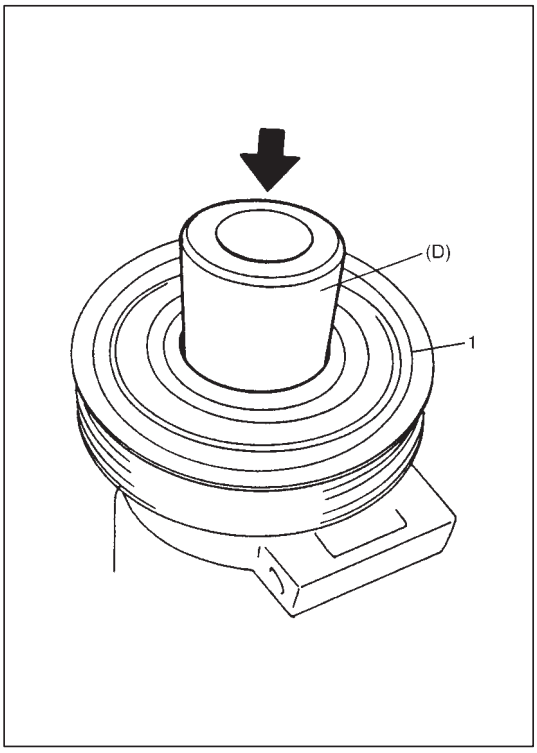


INSTALLATION

1) Install clutch coil (2).
   Protrusion on under side of coil ring must match hole in compressor (3) to prevent movement ant correctly locate lead wire.
2) Using special tool (C), install snap ring (1) as shown.

Special Tool
(C): 09990-06107

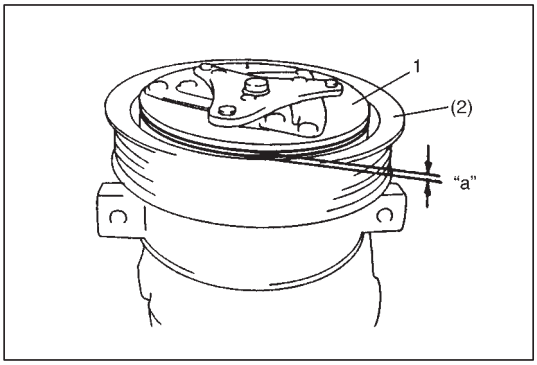
3) Install clamp portion and ground terminal of lead wire.



4) Clutch pulley (1).
   (1) Set clutch pulley squarely over clutch pulley installation boss.
   (2) Place special tool (D) onto clutch pulley bearing.
   Ensure that edge rests only on inner race of bearing.
   (3) Install snap ring.

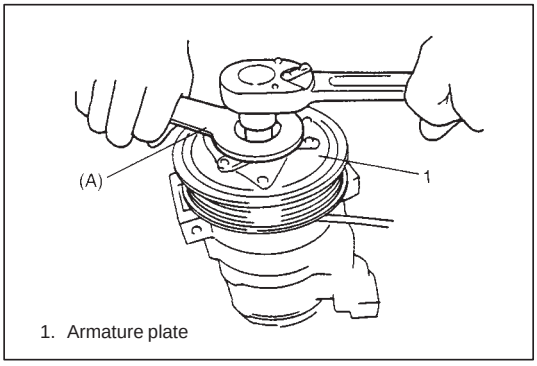
Special Tool
(D): 09991-06010

CAUTION:
Be careful not to scratch bearing seal.



5) Adjust clearance, between clutch plate (1) and clutch pulley by putting shim on compressor shaft.

Standard clearance "a": 0.3 – 0.5 mm (0.012 – 0.02 in.)



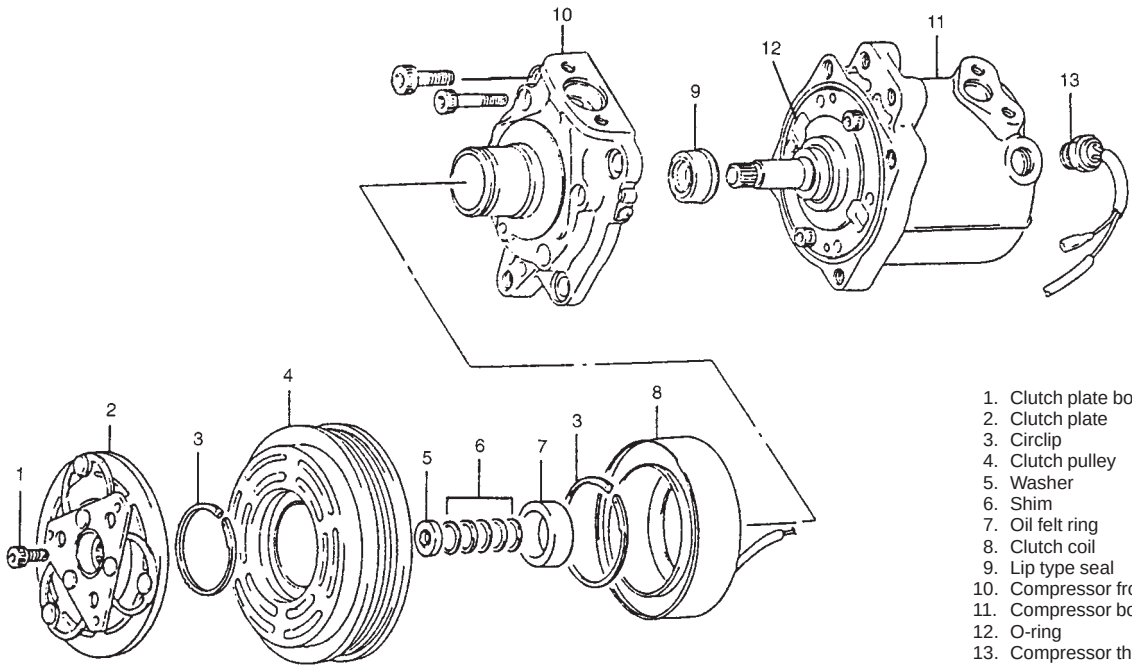
1. Armature plate

6) Tighten new clutch plate bolt as specified below.

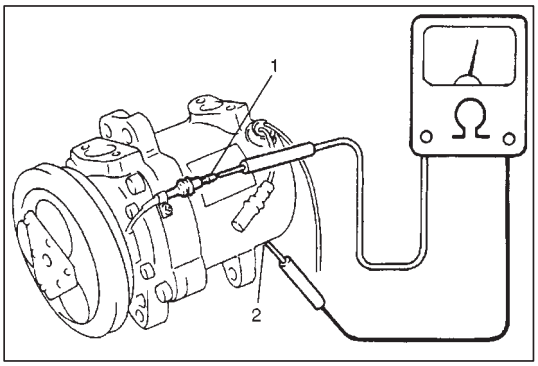
Tightening Torque
(a): 14 N·m (1.4 kg-m, 10.5 lb-ft)

Special Tool
(A): 09991-06020

MAGNET CLUTCH ASSEMBLY (FOR SEIKO SEIKI)



1. Clutch plate bolt
2. Clutch plate
3. Circlip
4. Clutch pulley
5. Washer
6. Shim
7. Oil felt ring
8. Clutch coil
9. Lip type seal
10. Compressor front head
11. Compressor body component
12. O-ring
13. Compressor thermal switch



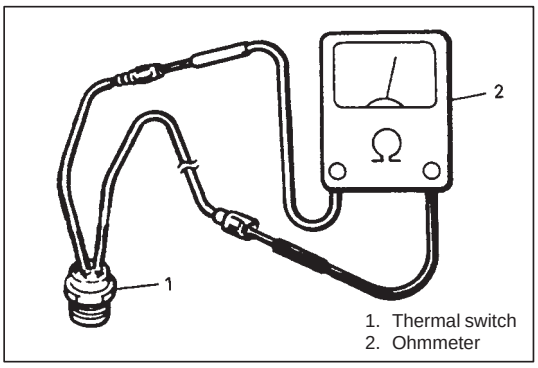
INSPECTION

MAGNET CLUTCH

- Inspect clutch plate and clutch pulley for signs of oil.
- Check clutch pulley bearings for noise and grease leakage.
- Using and ohmmeter, measure resistance of clutch coil between clutch coil lead wire (1) and compressor body.

If measured resistance is not within tolerance, replace coil.

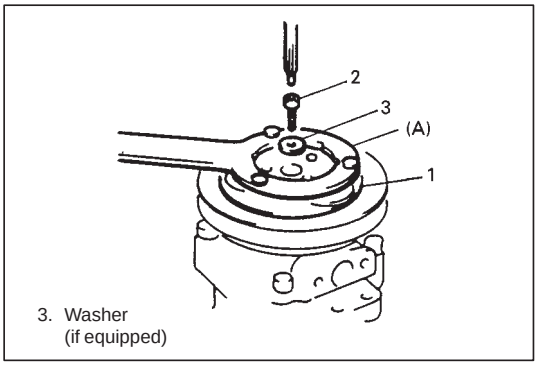
Standard resistance: 2.5 – 4.5 Ω at 20°C, 68°F



1. Thermal switch
2. Ohmmeter

COMPRESSOR THERMAL SWITCH

Use an ohmmeter to check thermal switch for continuity. If there is no continuity, replace it.



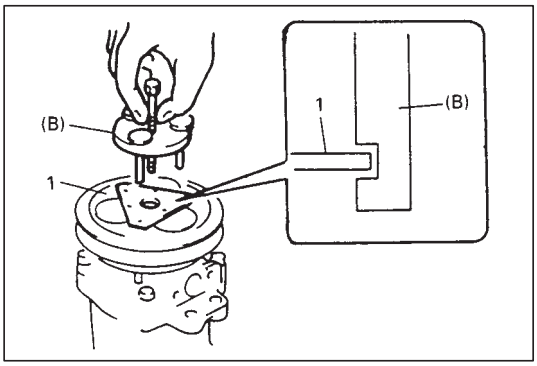
3. Washer (if equipped)

REMOVAL

1) Remove compressor assembly from vehicle. Refer to COMPRESSOR ASSEMBLY in this section.
2) Fix clutch plate (1) with special tool (A) and remove clutch plate bolt (2).

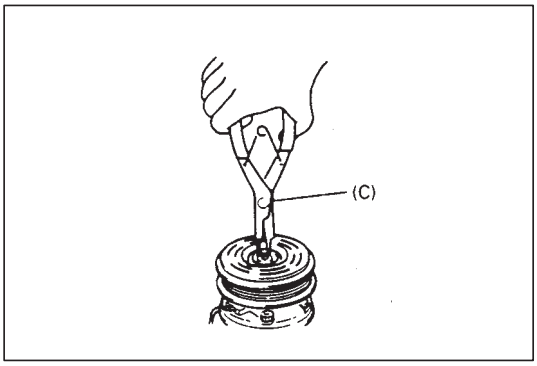
Special Tool
(A): 09991-06020

NOTE:
Do not reuse armature plate nut.



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

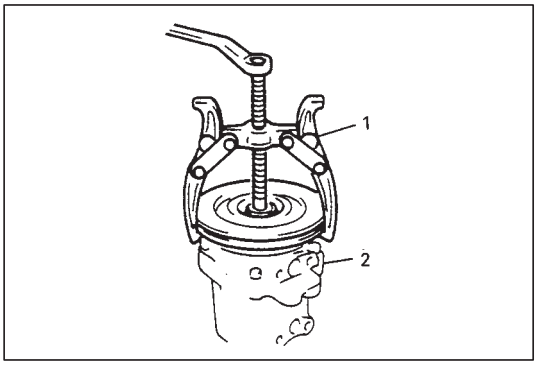
Special Tool
(B): 09991-06030



4) Disconnect clutch coil lead wire from compressor thermal switch led wire.
5) Remove felt ring (if equipped) and shims from shaft.
6) Using special tool (C), remove circlip.

Special Tool
(C): 09900-06107

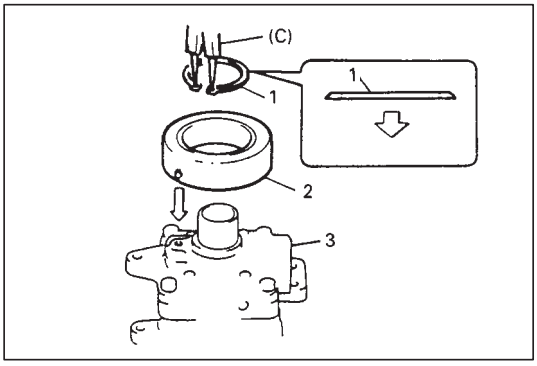
7) Remove clutch coil lead wire clamp screw.



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

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

9) Remove clutch coil.

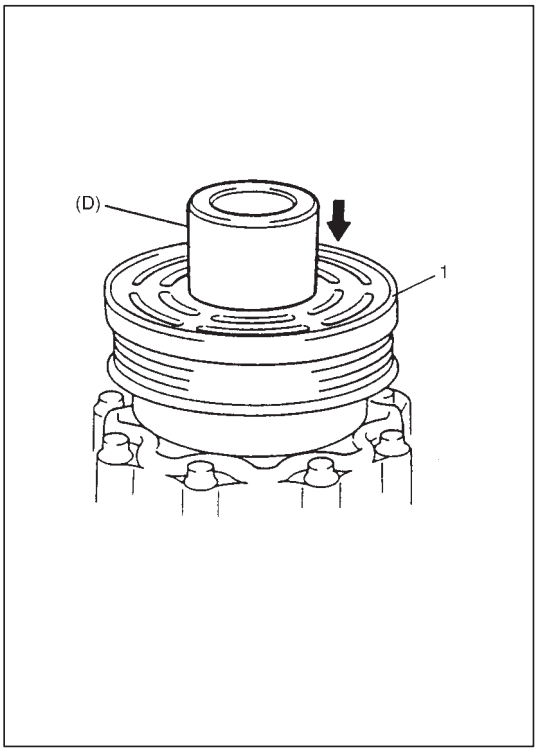


INSTALLATION

1) Install clutch coil (2).
   Protrusion on under side of clutch coil must match hole in compressor (3) to prevent movement ant correctly locate lead wire.
2) Using special tool (C), install snap ring (1) as shown.

Special Tool
(C): 09990-06107

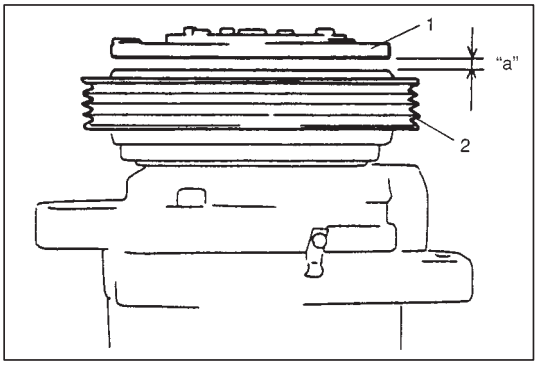
3) Clamp covering portion of lead wire.



4) Install clutch pulley (1).
   (1) Set clutch pulley squarely over clutch pulley installation boss.
   (2) Place special tool (D) onto clutch pulley bearing.
   Ensure that edge rests only on inner race of bearing.
   (3) Install snap ring.

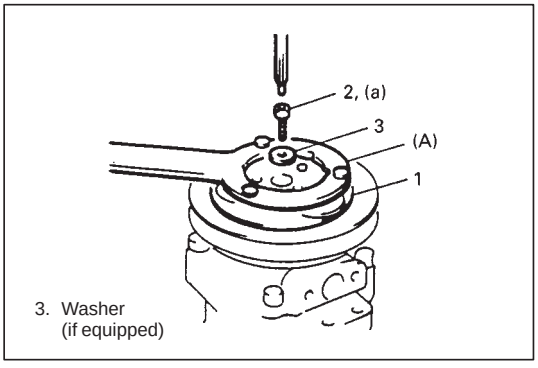
Special Tool
(D): 09991-06010

CAUTION:
Be careful not to scratch bearing seal.



5) Adjust clearance, between clutch plate and clutch pulley (2) by putting shim on compressor shaft.

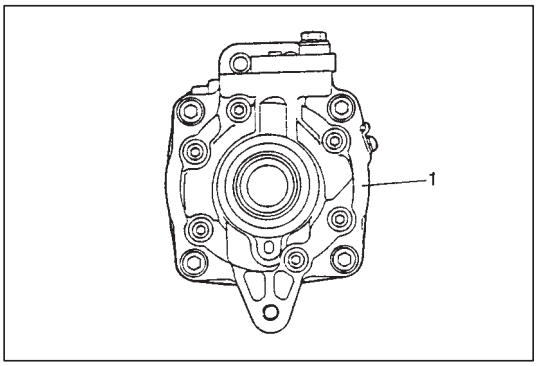
Standard clearance "a": 0.3 – 0.6 mm (0.012 – 0.024 in.)



6) Tighten new clutch plate (1) bolt (2) as specified below.

Tightening Torque
(a): 14 N·m (1.4 kg-m, 10.5 lb-ft)

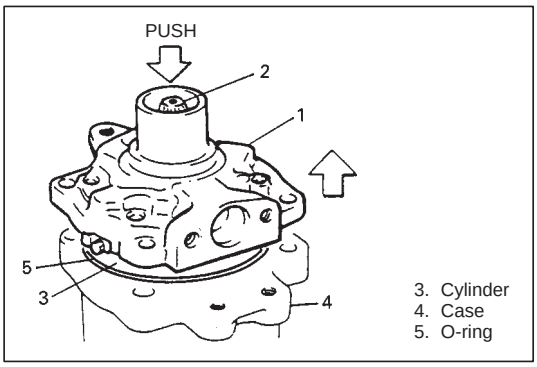
Special Tool
(A): 09991-06020



LIP TYPE SEAL (FOR SEIKO SEIKI)

REMOVAL

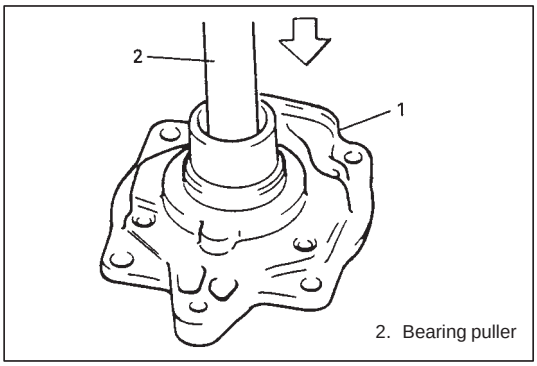
1) Remove magnet clutch assembly, referring to “MAGNET CLUTCH ASSEMBLY” in this section.
2) Remove compressor front head (1) mounting bolt (10 pcs.).



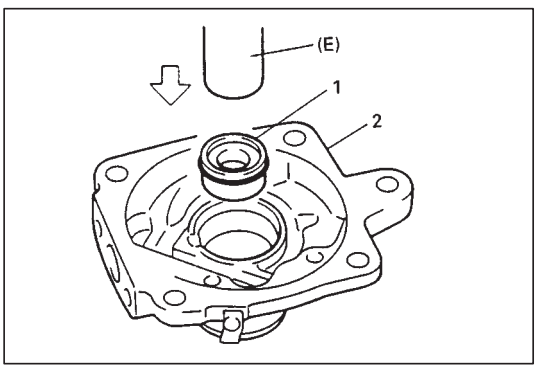
3) Remove compressor front head (1) by pushing cylinder shaft (2).

NOTE:
Be careful not to remove cylinder from case.

4) Remove O-ring.



5) Remove lip seal from compressor front head (1).

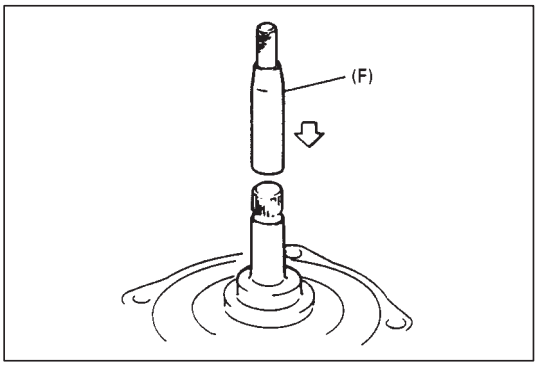


INSTALLATION

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

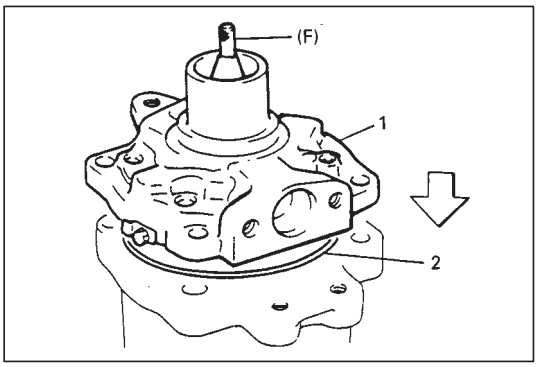
Special Tool
(E): 09991-06050

CAUTION:
Do not reuse mechanical seal once removed from compressor.

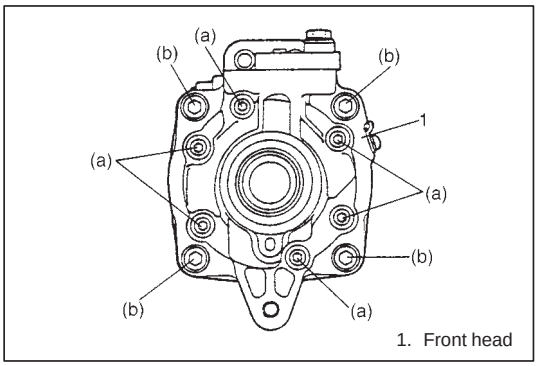


2) Coat special tool (F) surface with oil and place it on the shaft.

Special Tool
(F): 09991-06040



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



1. Front head

6) Tighten compressor front head bolt.

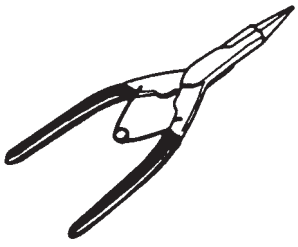
Tightening Torque
(a): 14 N·m (1.4 kg-m, 10.5 lb-ft)
(b): 23 N·m (2.3 kg-m, 17.0 lb-ft)

NOTE:
- **Be sure to use new front head bolt washer.**
- **Tighten bolt (a) first, and next (b).**

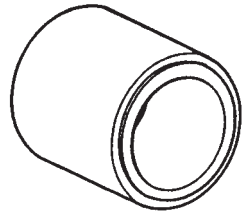
REQUIRED SERVICE MATERIAL

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Compressor oil for DENSO compressor (Refrigerant oil)	COMPRESSOR OIL (ND-OIL 8, 250 cc) 99000-27080	● O-ring ● Each component
Compressor oil for SEIKO SEIKI compressor (Refrigerant oil)	COMPRESSOR OIL RS20 (150 cc) 99000-99088-00D	● O-ring ● Each component
Refrigerant	REFRIGERANT DRUM (200 g) 95794-50G00	● Refrigerant charge

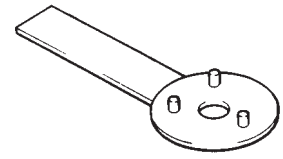
SPECIAL TOOLS



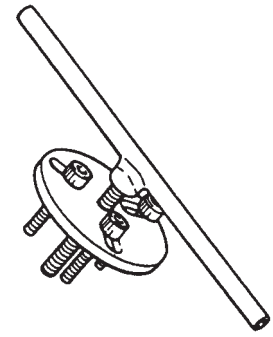
09900-06107
Snap ring pliers
(Opening type)



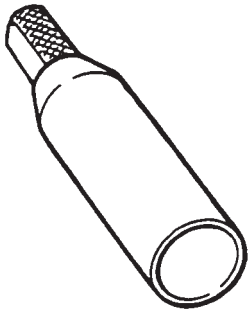
09991-06010
Magnet clutch pulley installer



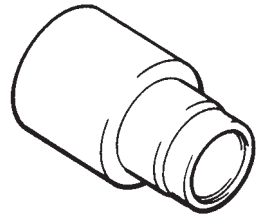
09991-06020
Armature plate spanner



09991-06030
Armature plate remover



09991-06040
Lip type seal protector



09991-06050
Lip type seal installer

SECTION 3

STEERING, SUSPENSION, WHEELS AND TIRES

DIAGNOSIS 3-1
FRONT END ALIGNMENT 3A-1
POWER STEERING SYSTEM 3B1-1
AIR BAG STEERING WHEEL AND COLUMN 3C1-1
FRONT SUSPENSION 3D-1
REAR SUSPENSION 3E-1
WHEELS AND TIRES 3F-1

CONTENTS

GENERAL DIAGNOSIS 3-1
Diagnosis Table 3-1
TIRE DIAGNOSIS 3-6
Irregular and/or Premature Wear 3-6
Wear Indicator 3-6
Radial Tire Waddle 3-6
Radial Tire Lead 3-8
VIBRATION DIAGNOSIS 3-8

GENERAL DIAGNOSIS

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

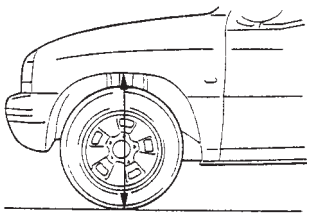
1) Inspect tires for proper pressure and uneven wear.
2) Raise vehicle on a hoist and inspect front and rear suspension and steering system for loose or damaged parts.
3) Spin front wheel. Inspect for out-of-round tires, out-of-balance tires, bent rims, loose and/or rough wheel bearings.

DIAGNOSIS TABLE

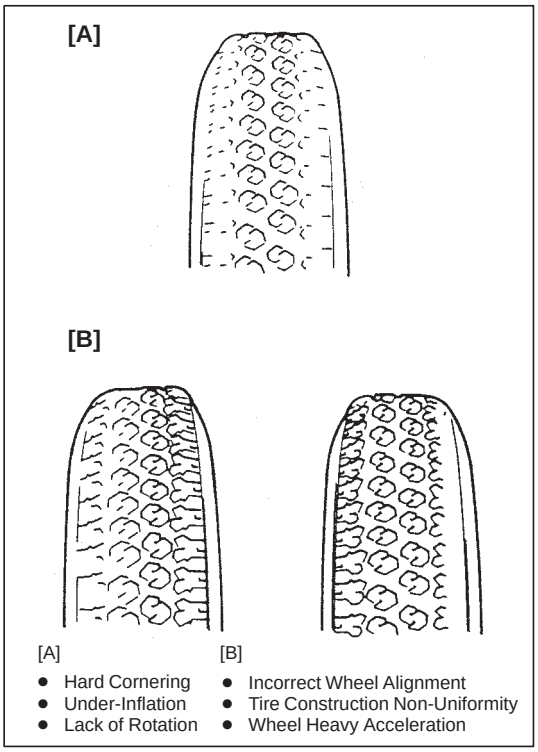
Condition	Possible Cause	Correction
Vehicle Pulls (Leads)	● Mismatched or uneven tires.	Replace tire.
	● Tires not adequately inflated.	Adjust tire pressure.
	● Broken or sagging springs.	Replace spring.
	● Radial tire lateral force.	Replace tire.
	● Disturbed front end alignment.	Check front end alignment.
	● Disturbed rear axle alignment.	Check rear axle alignment.
	● Brake dragging in one road wheel.	Repair front brake.
	● Loose, bent or broken front or rear suspension parts.	Tighten or replace suspension part.

Condition	Possible Cause	Correction
Abnormal or Excessive Tire Wear	● Sagging or broken springs. ● Tire out of balance. ● Disturbed front end alignment. ● Faulty shock absorber. ● Hard driving. ● Overloaded vehicle. ● Tires not rotating. ● Worn or loose road wheel bearings. ● Wobbly wheel or tires. ● Tires not adequately inflated.	Replace spring. Adjust balance or replace tire. Check front end alignment. Replace shock absorber. Replace tire. Replace tire. Replace or rotate tire. Replace wheel bearing. Replace wheel or tire. Adjust the pressure.
Wheel Tramp	● Blister or bump on tire. ● Improper shock absorber action.	Replace tire. Replace shock absorber.
Shimmy, Shake or Vibration	● Tire or wheel out of balance. ● Loose wheel bearings. ● Worn tie rod ends. ● Worn lower ball joints. ● Excessive wheel runout. ● Blister or bump on tire. ● Excessively loaded radial runout of tire/wheel assembly. ● Disturbed front end alignment. ● Loose or worn tie-rod end. ● Loose steering gear case bolts.	Balance wheels or replace tire and/or wheel. Replace wheel bearing. Replace tie rod end. Replace front suspension control arm. Repair or replace wheel and/or tire. Replace tire. Replace tire or wheel. Check front end alignment. Tighten or replace tie-rod end. Tighten case bolts.
Hard Steering	● Bind in tie rod end ball studs or lower ball joints. ● Disturbed front end alignment. ● Rack and pinion not properly adjusted. (if equipped with manual steering gear case) ● Tire not adequately inflated. ● Bind in steering column. ● Low fluid level, loose drive belt or malfunction of power steering system. (if equipped with P/S)	Replace tie rod end or front suspension control arm. Check front end alignment. Check and adjust steering gear box. Inflate tires to proper pressure. Repair or replace. Check and correct.

Condition	Possible Cause	Correction
Too Much Play in Steering	● Wheel bearings worn. ● Loose steering gear case bolts. ● Rack and pinion not properly adjusted. (if equipped with manual steering gear case) ● Worn steering shaft joints. ● Worn tie rod ends or tie rod inside ball joints. ● Worn lower ball joints.	Replace wheel bearing. Tighten. Check and adjust rack and pinion torque. Replace joint. Replace tie rod end or steering gear case. Replace front suspension control arm.
Poor Returnability	● Bind in tie rod end ball studs. ● Bind in ball joints. ● Bind in steering column. ● Poorly lubricated rack and pinion. (if equipped with manual steering gear case) ● Disturbed front end alignment. ● Rack and pinion not properly adjusted. (if equipped with manual steering gear case) ● Tires not adequately inflated.	Replace tie rod end. Replace ball joint. Repair or replace. Check, repair or lubricate rack and pinion. Check and adjust front end alignment. Check and adjust rack and pinion torque. Adjust pressure.
Steering Noise (Rattle or Chuckle)	● Loose bolts and nuts. ● Broken or otherwise damaged wheel bearings. ● Worn or sticky tie rod ends. ● Rack and pinion not properly adjusted. (if equipped with manual steering gear case)	Retighten. Replace. 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 shock absorbers, struts or mountings. ● Worn control 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, control arm, steering gear case or drive shaft joint. Replace or repair. Replace. Tighten bolts or replace bushes. Tighten wheel nuts. Tighten suspension bolts or nuts. Replace wheel bearing. Replace spring. Lubricate or replace strut bearing.

Condition	Possible Cause	Correction
Wander or Poor Steering Stability	● Mismatched or uneven tires. ● Loose ball joints and tie rod ends. ● Faulty shock absorbers/struts or mounting. ● Loose stabilizer bar. ● Broken or sagging springs. ● Rack and pinion not properly adjusted. (if equipped with manual steering gear case) ● Disturbed front end alignment.	Replace tire or inflate tires to proper pressure. Replace suspension control arm or tie rod end. Replace absorber/strut or repair mounting. Tighten or replace stabilizer bar or bushes. Replace spring. Check or adjust rack and pinion torque. Check and adjust front end alignment.
Erratic Steering when Braking	● Worn wheel bearings. ● Broken or sagging springs. ● Leaking wheel cylinder or caliper. ● Warped discs. ● Badly worn brake linings. ● Drum is out of round in some brakes. ● Wheel tires are inflated unequally. ● Defective wheel cylinders. ● Disturbed front end alignment.	Replace wheel bearing. Replace spring. Repair or replace wheel cylinder or caliper. Replace brake disc. Replace brake shoe lining. Replace brake drum. Inflate tires to proper pressure. Replace or repair wheel cylinder. Check front end alignment.
Low or Uneven Trim Height Right-to-left trim height (H) difference should be within 15 mm (0.6 in.) with curb weight.  *Same with rear side.	● Broken or sagging springs. ● Overloaded. ● Incorrect springs.	Replace spring. Check loading. Replace spring.
Ride Too Soft	● Faulty shock absorber or struts.	Replace shock absorber or strut.
Suspension Bottoms	● Overloaded. ● Faulty shocks or struts. ● Incorrect broken or sagging springs.	Check loading. Replace shock absorber or strut. Replace spring.

Condition	Possible Cause	Correction
Body Leans or Sways in Corners	● Loose stabilizer bar. ● Faulty shock absorbers, struts or mounting. ● Broken or sagging springs. ● Overloaded.	Tighten stabilizer bar bolts or replace bushes. Replace shock absorber, strut or tighten mounting. Replace spring. Check loading.
Cupped Tires	● Front struts defective. ● Worn wheel bearings. ● Excessive tire or wheel run-out. ● Worn ball joints. ● Tire out of balance.	Replace strut. Replace wheel bearing. Replace tire or wheel disc. Replace front suspension control arm. Adjust tire balance.



TIRE DIAGNOSIS

IRREGULAR AND/OR PREMATURE WEAR

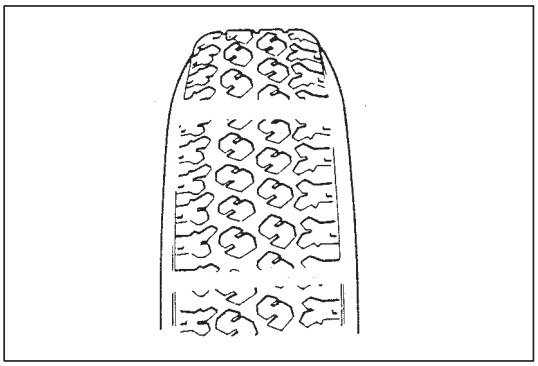
Irregular and premature wear has many possible causes. Some of them are: incorrect inflation pressures, lack of tire rotation, driving habits, improper alignment.

If the following conditions are noted, rotation is in order:

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

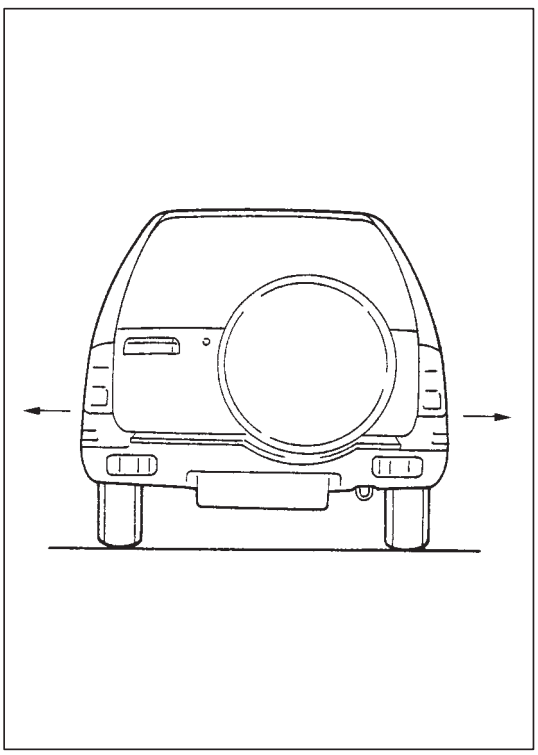
A wheel alignment check is in order if the following conditions are noted:

1. Left front and right front tire wear is unequal.
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 INDICATOR

The original equipment tires have built-in tread wear indicators to show when tires need replacement. These indicators will appear as 12 mm (0.47 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.



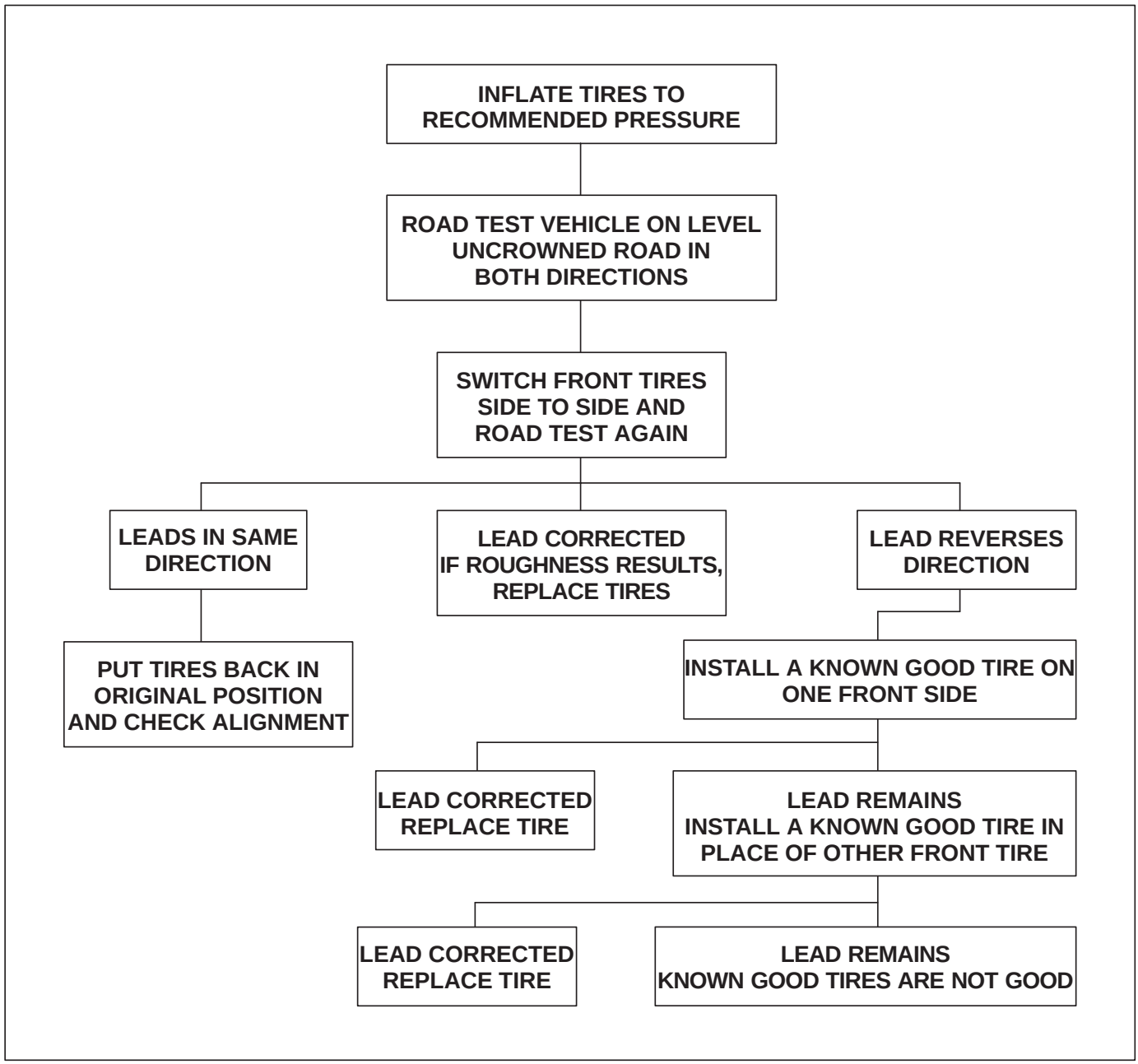
RADIAL TIRE WADDLE

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 low speed, 8 to 48 km/h (5 to 30 mph). It is possible to road test a vehicle and tell on which end of the vehicle the faulty tire is located. If the waddle tire is on the rear, the rear end of the vehicle will shake from side to side or “waddle”. From the driver’s seat it feels as though someone is pushing on the side of the vehicle. If the faulty tire is on the front, the waddle is more visual. The front sheet metal appears to be moving back and forth and the driver feels as though he is at the pivot point in the vehicle.

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

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

1. Ride vehicle to determine if the waddle is coming from the front or rear.
2. Install tires and wheels that are known to be good (on similar vehicle) in place of those on the offending end of the vehicle. If the waddle cannot be isolated to front or rear, substitute the rears.
3. Road test again. If improvement is noted, install originals one at a time until offender is found. If no improvement is noted, install known good tires in place of all four. Then install originals one at a time until offender if found.



RADIAL TIRE LEAD

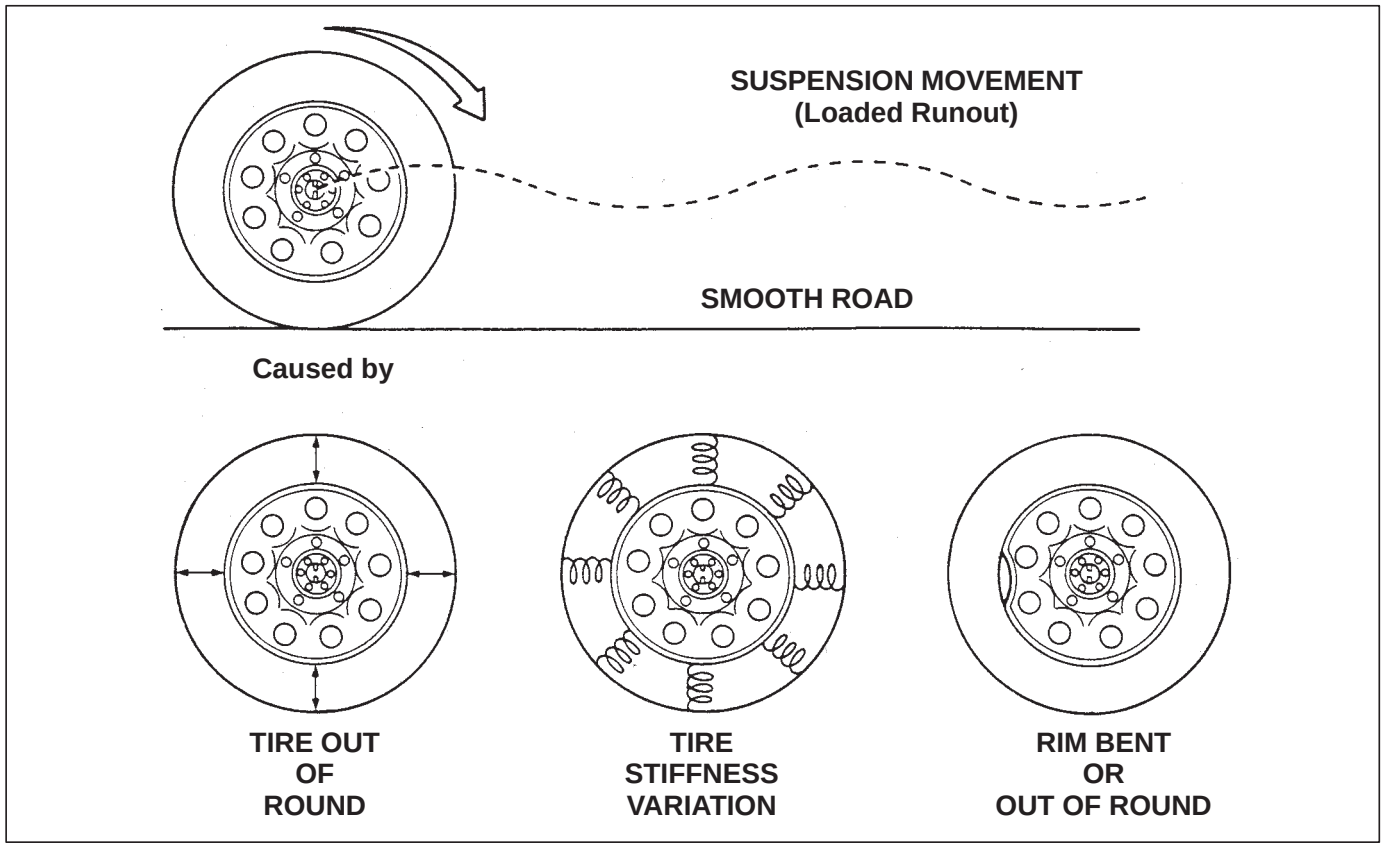
"Lead" is the deviation of the vehicle from a straight path on a level road with no pressure on the steering wheel.
Lead is usually caused by:
1) Incorrect alignment.
2) Uneven brake adjustment.
3) Tire construction.

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 is 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 on previous page 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 tire rotation pattern currently in the owner's 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, it can be caused by three things.
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 a TPD is not available, the more time consuming method of substituting known good tire and wheel assemblies on the problem vehicle can be used.


SUSPENSION MOVEMENT
(Loaded Runout)
SMOOTH ROAD
Caused by
TIRE OUT OF ROUND
TIRE STIFFNESS VARIATION
RIM BENT OR OUT OF ROUND

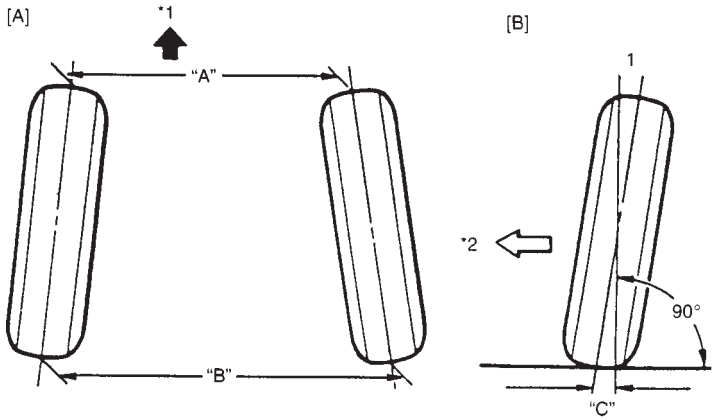
SECTION 3A

FRONT END ALIGNMENT

CONTENTS

DIAGNOSIS 3-1
GENERAL INFORMATION 3A-1
Toe-Setting 3A-1
Camber 3A-2
Preliminary Checks Prior to Adjusting Front Alignment 3A-2
Toe Adjustment 3A-2
Camber and Caster Adjustment 3A-2
Steering Angle 3A-3

GENERAL INFORMATION



Alignment service data (without load)
Toe-in (Toe-in gauge measurement)
"B" – "A": **0 ± 2 mm (0 ± 0.08 in.)**
Camber angle "C": 0' ± 1°
Caster: **2°40' ± 1°**

*1. Forward [A] : Top view
*2. Body center [B] : Front view

1. Center line of wheel

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 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" front "B" as shown in above figure and therefore is given in mm (in.).

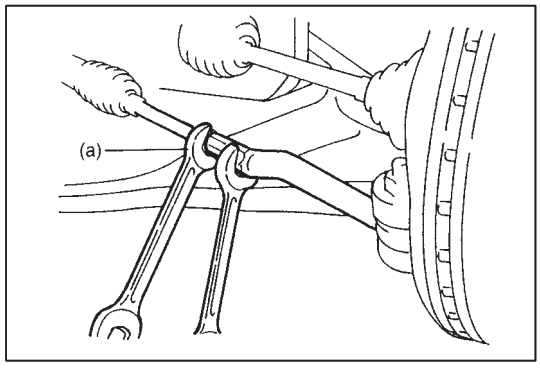
CAMBER

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.

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 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 control arms.
6) Check for loose or missing stabilizer bar attachments.
7) Consideration must be given to excess loads, such as tool boxes. If this excess load is normally carried in vehicle, it should remain in vehicle during alignment checks.
8) Consider condition of equipment being used to check alignment and follow manufacturer’s instructions.
9) Regardless of equipment used to check alignment, vehicle must be on a level surface both fore and aft and transversely.



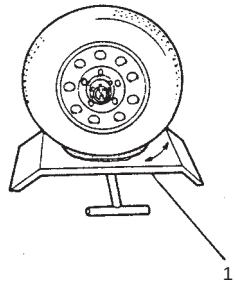
TOE ADJUSTMENT

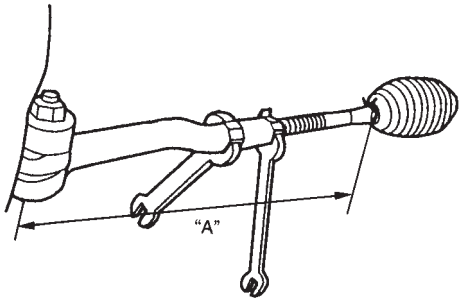
Toe is adjusted by changing tie rod length. Loosen right and left tie rod end lock nuts first and then rotate right and left tie rods by the same amount to align toe-in to specification.
In this adjustment, right and left tie rods should become equal in length.
After adjustment, tighten lock nuts to specified torque.

Tightening Torque
(a): 65 N·m (6.5 kg-m, 47.0 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 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.





1. Turning radius gauge

STEERING ANGLE

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

Steering angle
inside: 35° ± 3°
outside: 33° ± 3°

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

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 ft)

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

SECTION 3B1

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).**

NOTE:
- **Some parts in the Power Steering Gear Box cannot be disassembled or adjusted. For detailed information, refer to the description of "POWER STEERING GEAR BOX ASSEMBLY".**
- **All steering gear fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.**
- **Although the figures in this section show only the left-hand steering vehicle, the same work procedure and data apply to the right-hand steering vehicle.**

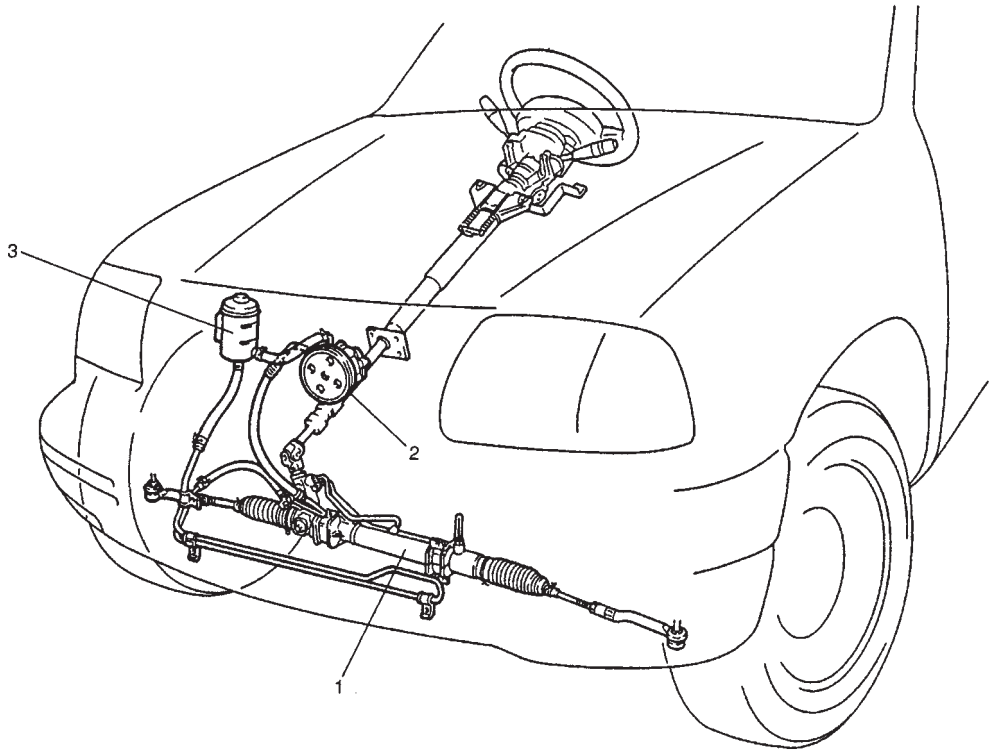
CONTENTS

GENERAL DESCRIPTION 3B1- 2
Power Steering System 3B1- 2
Steering Gear Box 3B1- 3
Power Steering (P/S) Pump 3B1- 4
DIAGNOSIS 3B1- 5
General Diagnosis Table 3B1- 5
Steering Wheel 3B1- 7
Steering Wheel Play Check 3B1- 7
Steering Force Check 3B1- 7
Power Steering Fluid 3B1- 7
Power Steering Fluid Level Check 3B1- 7
Power Steering Pump Drive Belt 3B1- 8
Belt Tension Check 3B1- 8
Belt Tension Adjustment 3B1- 8
Idle Up System 3B1- 9
Idle Up System Check 3B1- 9
Fluid 3B1- 9
Fluid Leakage Check 3B1- 9
Hydraulic Pressure in P/S Circuit 3B1-10
Hydraulic Pressure Check 3B1-10
Boot 3B1-11
Steering Rack Boot Check 3B1-11
Tie-Rod End Boot Check 3B1-12
Air Bleeding Procedure 3B1-12
ON-VEHICLE SERVICE 3B1-13
Tie-Rod End 3B1-13
Power Steering Gear Box Assembly 3B1-14
Rack Boot and Tie-Rod (Except Canvas Top LH Model) 3B1-16
Rack Boot and Tie-Rod (For Canvas Top LH Model) 3B1-17
Power Steering Pump 3B1-19
TIGHTENING TORQUE SPECIFICATION . . . 3B1-26
REQUIRED SERVICE MATERIAL 3B1-26
SPECIAL TOOL 3B1-26

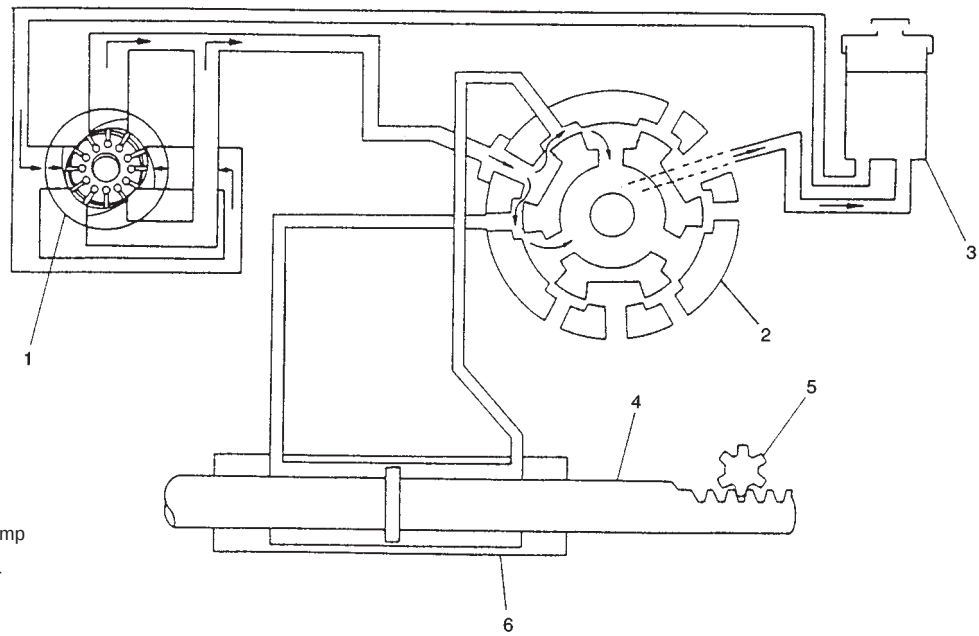
GENERAL DESCRIPTION

POWER STEERING SYSTEM

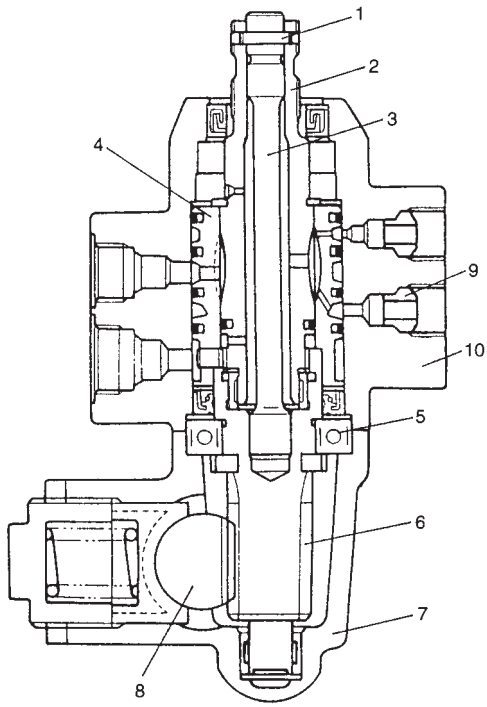
The power steering (P/S) system in this vehicle reduces the driver's effort needed in turning the steering wheel by utilizing the hydraulic pressure generated by the power steering (P/S) pump which is driven by the engine. It is an integral type with the rack and pinion gears and the control valve unit,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



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



1. Power steering pump
2. Valve section
3. P/S fluid reservoir
4. Rack
5. Pinion
6. Cylinder



1. Pin
2. Stub shaft (Rotor)
3. Torsion bar
4. Sleeve
5. Bearing
6. Pinion
7. Gear box
8. Rack
9. Ferrule
10. Valve case

STEERING GEAR BOX

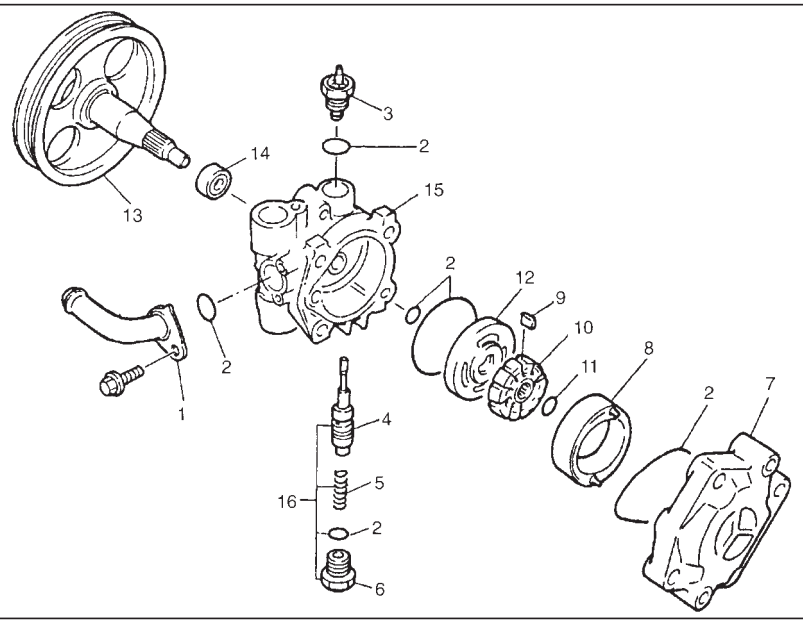
The steering gear box consists of two sections: one including a cylinder and the other a valve. Main components of the cylinder section are a gear box, a rack and a tube and those of the valve section are a valve case, a sleeve and a stub shaft. The sleeve is linked with the pinion through a pin and the valve and stub shaft are integrated into one unit. Then the pinion and the stub shaft are linked to each other by means of the torsion bar.

Thus, when the stub shaft moves, the valve changes its position, thereby switching the hydraulic passage from the pump to the cylinder to help steering operation.

When turning the steering wheel feels heavy due to P/S fluid leakage or for some other reason (i.e., when in the manual steering mode), the stub shaft and pinion are in direct linkage and the force is output directly through the pinion and rack.

POWER STEERING (P/S) PUMP

The power steering pump is a vane type and is driven by the V-ribbed belt from the crankshaft.



1. Suction connector
2. O-ring
3. Pressure switch
4. Flow control valve (Relief valve)
5. Spring
6. Plug
7. Pump cover
8. Cam ring
9. Vane
10. Rotor
11. Snap ring
12. Side plate
13. Pulley (pump shaft)
14. Oil seal
15. Pump body
16. Flow control valve Assembly

Model		Vane type
Hydraulic pressure control	Relieved pressure	6500 kPa (65 kg/cm^2, 924 psi) ..... G16 Type engine 7000 kPa (70 kg/cm^2, 995 psi) ..... J20 Type engine 7350 kPa (73.5 kg/cm^2, 1045 psi) ..... H25 Type engine
	Control device	Flow control valve
		Relief valve
Power steering pressure switch		Switch turns on (closes) when the pressure is higher than 2500 – 3500 kPa (25 – 35 kg/cm^2, 356 – 498 psi). ECM uses this signal for idle speed control.
Capacity		0.70 – 0.75 ℓ (1.48/1.23 – 1.58/1.32 US/Imp. pt)
Specified fluid		DEXRON®II, DEXRON®III A/T fluid or equivalent

FLOW CONTROL VALVE

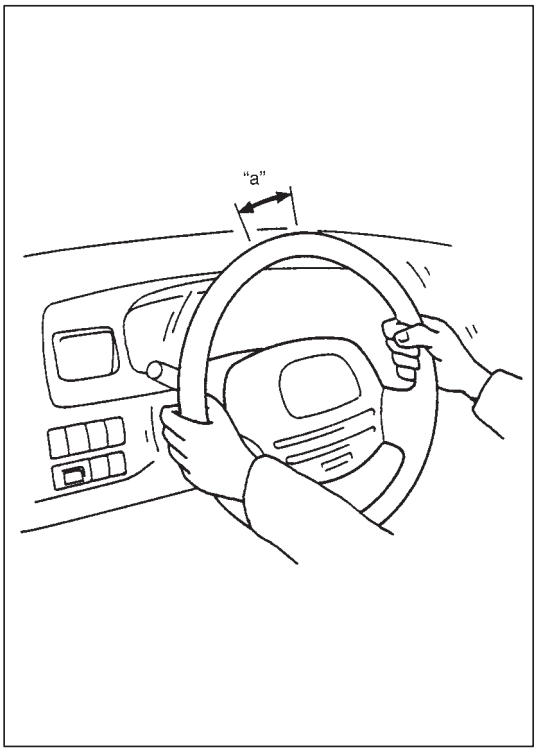
As the discharge rate of the P/S pump increases in proportion to the pump revolution speed, a flow control valve is added to control it so that the optimum amount of fluid for steering operation is supplied according to the engine speed (driving condition).
Described below is its operation at different engine speed.

DIAGNOSIS

GENERAL DIAGNOSIS TABLE

Condition	Possible Cause	Correction
Steering wheel feels heavy (at low speed)	● Fluid deteriorated, low viscosity, different type of fluid mixed	Replace fluid.
	● Pipes or hoses deformed, air entering through joint	Replace defective part.
	● Insufficient air purging from P/S circuit	Purge air.
	● P/S belt worn, lacking in tension	Adjust belt tension or replace belt as necessary.
	● Tire inflation pressure excessively low	Inflate tire.
	● Front end alignment out of order	Check and adjust front end alignment.
	● Steering wheel installed improperly (twisted)	Install steering wheel correctly.
	● Bind in tie rod or tie rod end ball joint	Replace defective part.
	● P/S pump hydraulic pressure fails to increase	Check pressure and repair or replace defective part.
	● P/S pump hydraulic pressure increases but slowly	Check pressure and repair or replace defective part.
	● Steering gear box malfunction	Replace gear box.
Steering wheel feels heavy momentarily when turning it to the left or right	● Air drawn in due to insufficient amount of fluid	Add fluid and purge air.
	● Slipping P/S belt	Adjust belt tension or replace belt as necessary.
	● P/S pump hydraulic pressure fails to increase	Check pressure and repair or replace defective part.
	● P/S pump hydraulic pressure increases but slowly	Check pressure and repair or replace defective part.
	● Steering gear box malfunction	Replace gear box.
Poor recovery from turns	**NOTE:** **To check steering wheel for recovery, with vehicle running at 22 mile/h (35 km/h), turn steering wheel 90° and let it free. It should return more than 60°.**	
	● Deformed pipes or hoses	Replace defective part.
	● Steering column installed improperly	Install steering column correctly.
	● Front end alignment out of order	Check and adjust front end alignment.
	● Ball joints binding	Replace defective part.
	● P/S pump hydraulic pressure fails to increase	Check pressure and repair or replace defective part.
	● P/S pump hydraulic pressure increases but slowly	Check pressure and repair or replace defective part.
	● Steering gear box malfunction	Replace gear box.

Condition	Possible Cause	Correction
Vehicle pulls to one side during straight driving	● Mismatched or uneven tire	Replace tire.
	● Low or uneven tire inflation pressure	Inflate tires to proper pressure or adjust right & left tires inflation pressure.
	● Brake dragging in one wheel	Repair.
	● Front end alignment out of order	Check and adjust front end alignment.
	● Rear end alignment out of order	Check and adjust rear end alignment.
	● Malfunction of control valve in gear box	Replace gear box.
Steering wheel play is large and vehicle wanders	● Refer to “Diagnosis” in Section 3.	
Fluid leakage	● Loose joints of (hydraulic pressure) pipes and hoses	Retighten.
	● Deformed or damaged pipes or hoses	Replace defective part.
Abnormal noise	● Air drawn in due to insufficient amount of fluid	Add fluid and purge air.
	● Air mixed into fluid from pipes or hoses	Replace pipes or hoses.
	● Slipping (loose) P/S belt	Adjust belt tension.
	● Worn P/S belt	Replace belt.
	● Loose gear box fastening bolt	Retighten bolts.
	● Loose linkage or joints	Retighten.
	● Pipes or hoses in contact with part of vehicle body	Install pipes and hoses correctly.
	● Vanes of P/S pump defective	Replace defective part.
	● Malfunction of control valve in gear box	Replace gear box.
	● Bearing of P/S pump shaft defective	Replace bearing.
No idle up	● Power steering pressure switch defective	Replace power steering pressure switch.



STEERING WHEEL

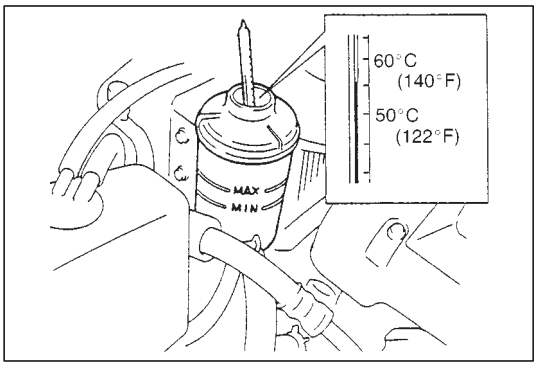
STEERING WHEEL PLAY CHECK

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 for play, holding car in straight forward condition on the ground and with engine stopped.

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

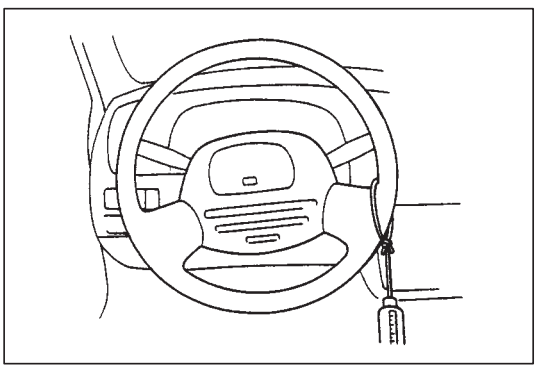
If steering wheel play is not within specification, inspect as follows and replace if found defective.

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



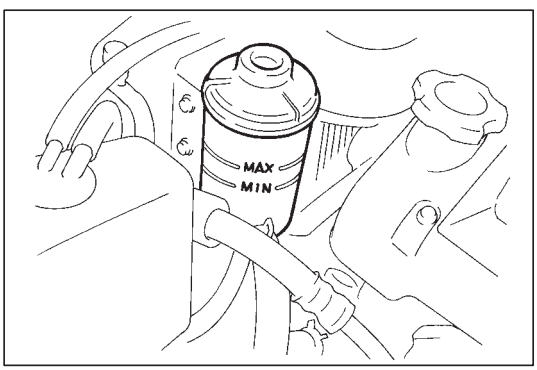
STEERING FORCE CHECK

1) Place vehicle on level road and set steering wheel at straight-ahead position.
2) Check that tire inflation pressure is as specified. (Refer to tire placard.)
3) Start engine and keep it running till power steering fluid is warmed to 50 to 60°C (122 to 140°F).



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

   Steering force: Less than 50 N (5.0 kg, 11.0 lb)



POWER STEERING FLUID

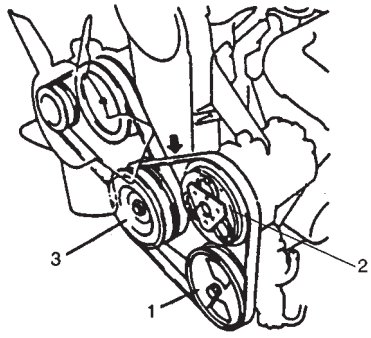
POWER STEERING FLUID LEVEL CHECK

With engine stopped, check fluid level indicated on P/S fluid reservoir, which should be between "MAX" and "MIN" marks. If it is lower than "MIN" mark, fill fluid up to "MAX" mark.

NOTE:

- **Be sure to use an specified power steering fluid.**
- **Fluid level should be checked when fluid is cool.**

[A]



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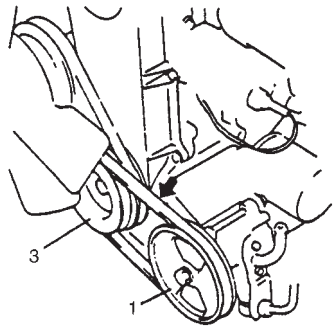

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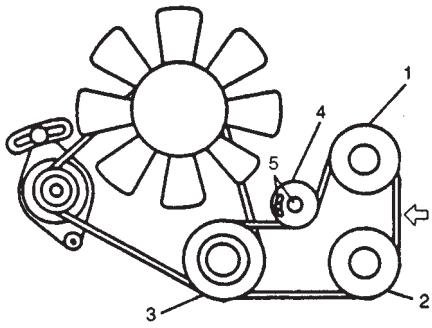

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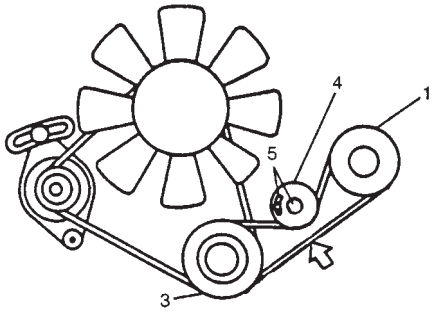


1. P/S pump pulley
2. A/C compressor pulley (if equipped)
3. Crankshaft pulley
4. Tension pulley
5. Tension pulley bolts

[A]: G16 type engine with A/C
[B]: G16 type engine without A/C
[C]: H25 type engine with A/C
[D]: H25 type engine without A/C

POWER STEERING PUMP DRIVE BELT

NOTE:
For J20 Type engine, refer to Section 6H "GENERATOR BELT".

INSPECTION

Check that belt is free from any damage and properly fitted in pulley groove.

BELT TENSION CHECK

Check belt tension by measuring how much it deflects when pushed at intermediate point between pulleys with about 10 kg (22 lb) force.

Deflection of P/S belt:
6 – 9 mm (0.24 – 0.35 in.) . . . . . G16 Type engine
4 – 7 mm (0.16 – 0.28 in.) . . . . . H25 Type engine

BELT TENSION ADJUSTMENT

[For G16 Type engine]

a) To adjust P/S pump drive belt tension, use adjusting bolt of compressor for A/C equipped vehicles and that of P/S pump for vehicles without A/C.
b) Adjust belt tension to above specification.
c) Then tighten adjusting and mounting bolts to specified torque.

[For J20 Type engine]

To adjust P/S pump drive belt tension, refer to "GENERATOR BELT" in Section 6H.

[For H25 Type engine]

a) To adjust P/S pump drive belt tension, loosen tension pulley bolts and turn tension pulley using hexagon wrench.
b) Adjust belt tension to above specification.
Then tighten tension pulley bolts to specified torque.

Tightening Torque
Tension pulley bolts: 25 N·m (2.5 kg-m, 18.5 lb-ft)

IDLE UP SYSTEM

IDLE UP SYSTEM CHECK

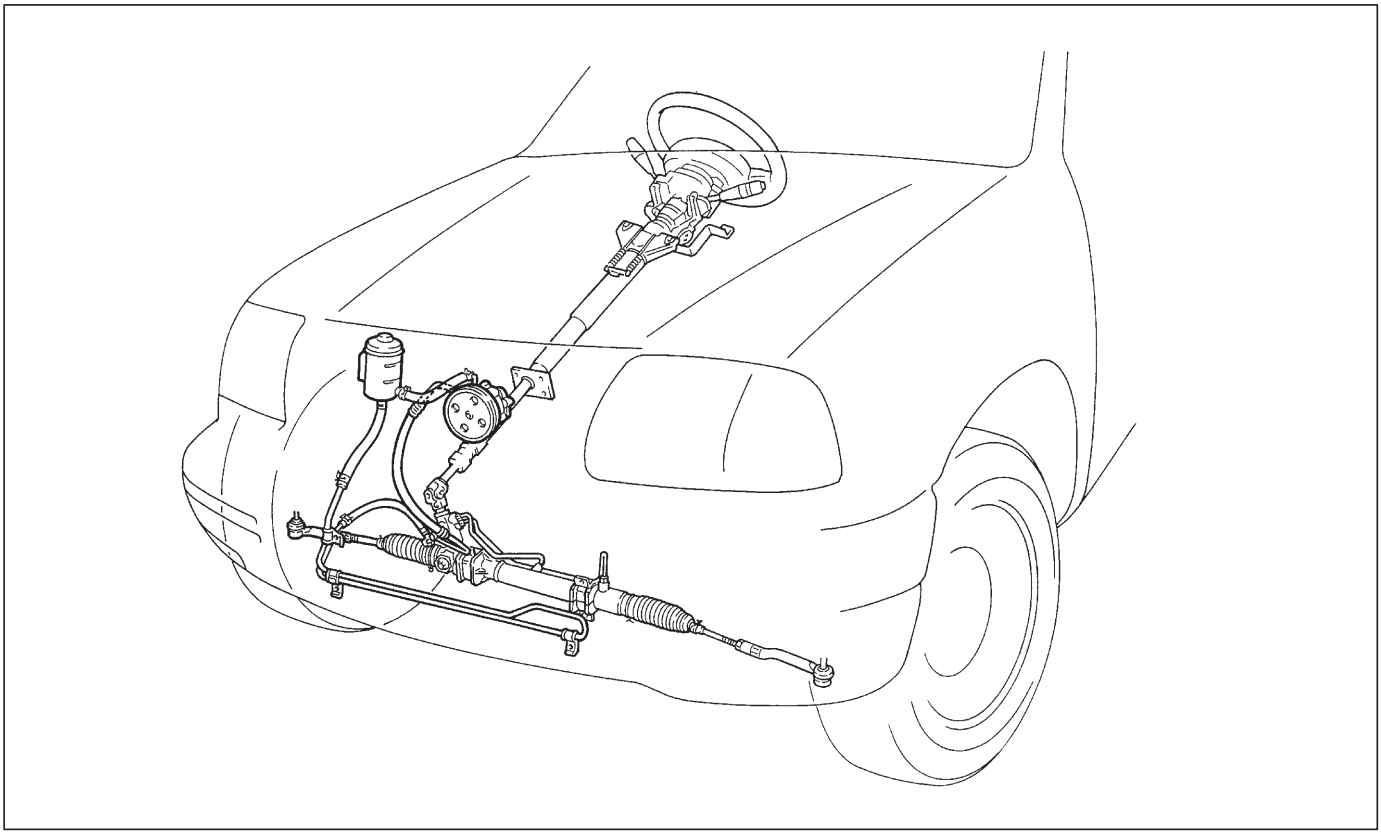
1) Warm up engine to normal operating temperature.
2) Turn A/C switch OFF, if equipped.
3) Turn steering wheel fully and check idle speed.
   Engine idle speed drops a little momentarily when steering wheel is turned fully but returns to its specified level immediately. If power steering pressure switch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

FLUID

FLUID LEAKAGE CHECK

Start engine and turn steering wheel fully to the right and left so that maximum hydraulic pressure is provided. Then visually check gear box, P/S pump and P/S fluid reservoir themselves and each joint of their connecting pipes for leakage.

CAUTION:
Never keep steering wheel turned fully for longer than 10 seconds.



HYDRAULIC PRESSURE IN P/S CIRCUIT

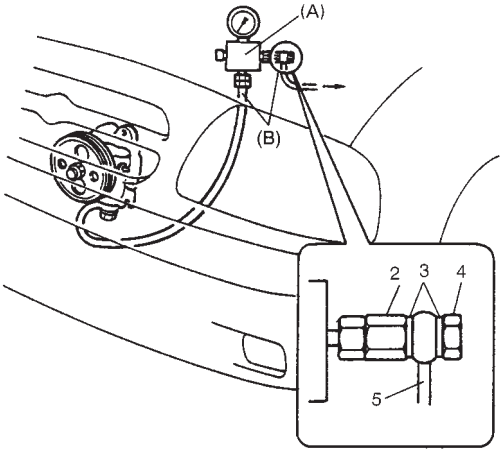
HYDRAULIC PRESSURE CHECK

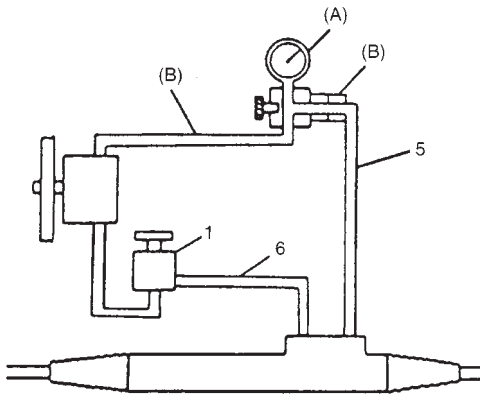
1) After cleaning joint of high pressure hose and P/S pump thoroughly, disconnect hose from pump and install special tool (oil pressure gauge, attachment and hose).
Tighten each flare nut to specified torque.

CAUTION:
Take care not to cause damage to A/C condenser during service operation, if equipped.

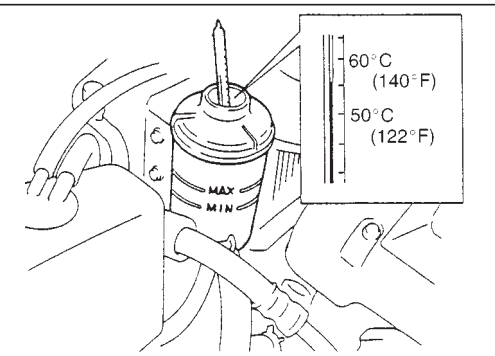
Special Tool
(A): 09915-77410 (Oil pressure gauge)
(B): 09915-77420

2) Check each connection for fluid leakage and bleed air.
Refer to "AIR BLEEDING PROCEDURE" in this section.

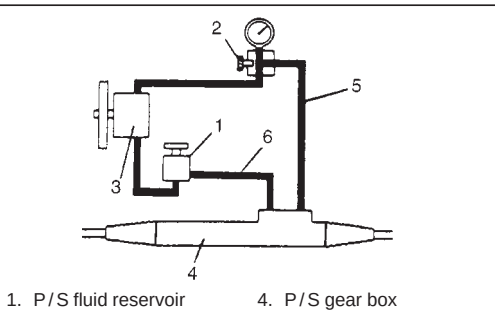




1. P/S fluid reservoir
2. Attachment
3. Gasket
4. Union bolt
5. High pressure side
6. Low pressure side



3) With engine idling, turn steering wheel and warm up engine till temperature of fluid in P/S fluid reservoir rises to 50 – 60°C (122 – 140°F).

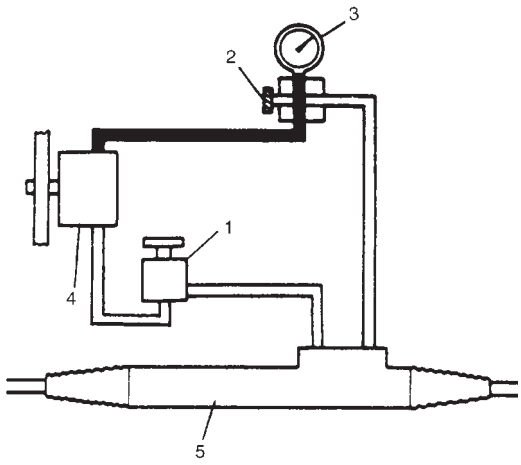


1. P/S fluid reservoir
2. Gauge valve (open)
3. P/S pump
4. P/S gear box
5. High pressure side
6. Low pressure side

4) Check back pressure by measuring hydraulic pressure with engine idling and hands off steering wheel.

Back pressure: Lower than 1000 kPa (10 kg/cm^2, 142 psi)

When back pressure is higher than specified values, check control valve and piping for clogging.



1. P/S fluid reservoir
2. Gauge valve (shut)
3. Oil pressure gauge
4. P/S pump
5. P/S gear box

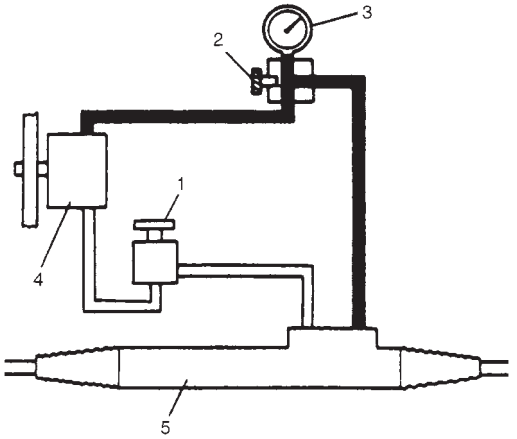
5) Check relief pressure

- Increase engine speed to about 1,500 r/min (rpm). Close gauge valve gradually while watching pressure increase indicated by gauge and take reading of relief pressure (maximum hydraulic pressure).

  Relief pressure:
  6200 – 7000 kPa
  (62 – 70 kg/cm^2, 882 – 995 psi) . . . . . G16 Type engine
  6700 – 7500 kPa
  (67 – 75 kg/cm^2, 953 – 1067 psi) . . . . . J20 Type engine
  7050 – 7850 kPa
  (70.5 – 78.5 kg/cm^2, 1003 – 1116 psi) . . H25 Type engine

- When it is higher than specified values, possible cause is malfunction of relief valve.
- When it is lower than specified values, possible cause is either failure of P/S pump or settling of relief valve spring.

CAUTION:
Be sure not to close gauge valve for longer than 10 seconds.



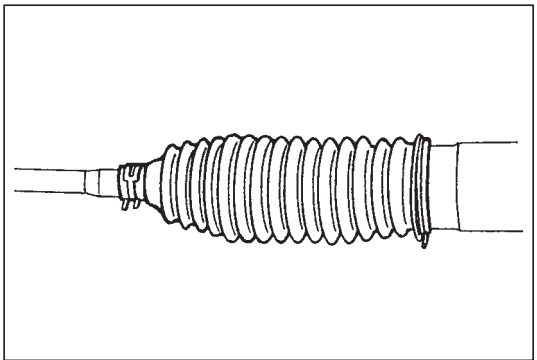
1. P/S fluid reservoir
2. Gauge valve (open)
3. Oil pressure gauge
4. P/S pump
5. P/S gear box

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

  Relief pressure:
  6200 – 7000 kPa
  (62 – 70 kg/cm^2, 882 – 995 psi) . . . . . G16 Type engine
  6700 – 7500 kPa
  (67 – 75 kg/cm^2, 953 – 1067 psi) . . . . . J20 Type engine
  7050 – 7850 kPa
  (70.5 – 78.5 kg/cm^2, 1003 – 1116 psi) . . H25 Type engine

- When it is higher than specified values, possible cause is malfunction of relief valve.
- When it is lower than specified values, possible cause is failure in steering gear box. Replace gear box.

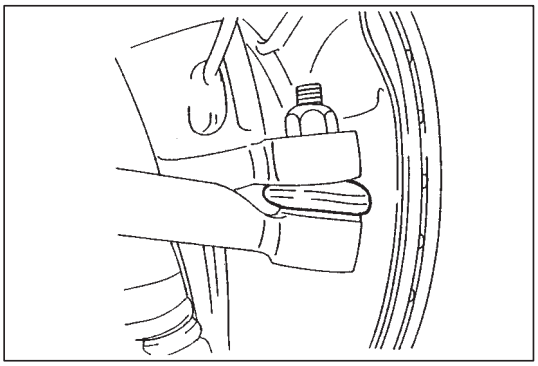
CAUTION:
Be sure not to hold steering wheel at fully turned position for longer than 10 seconds.



BOOT

STEERING RACK BOOT CHECK

Check boot for crack and damage which, if any, means possibility of rusty gear, entry of dust or lack of grease. Also, check if any of such faulty conditions exists.
Check steering rack boot for dent or breakage.
If there is a dent, keep boot in most compressed state for some seconds to correct dent.



TIE-ROD END BOOT CHECK

Check boot for crack and damage and if any, replace it with a new one.

AIR BLEEDING PROCEDURE

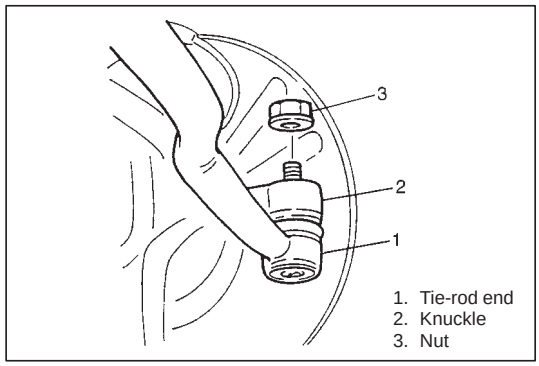
1) Hoist the front end of vehicle and apply safety stands.
2) Fill P/S fluid reservoir with fluid up to specified level.

   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.

3) After running engine at idling speed for 3 to 5 seconds, stop it and add fluid to satisfy specification.
4) With engine stopped, turn steering wheel to the right and left as far as it stops, repeat it a few times and fill fluid to specified level.
5) With engine running at idling speed, repeat stop-to-stop turn of steering wheel till all foams in P/S fluid reservoir are gone.

   NOTE:
   Make sure to bleed air completely. If air remains in fluid, P/S pump may make humming noise or steering wheel may feel heavy.

6) Finally check to make sure that fluid is filled to specified level.



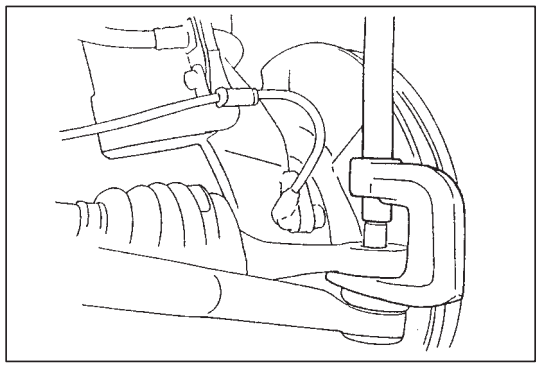
1. Tie-rod end
2. Knuckle
3. Nut

ON-VEHICLE SERVICE

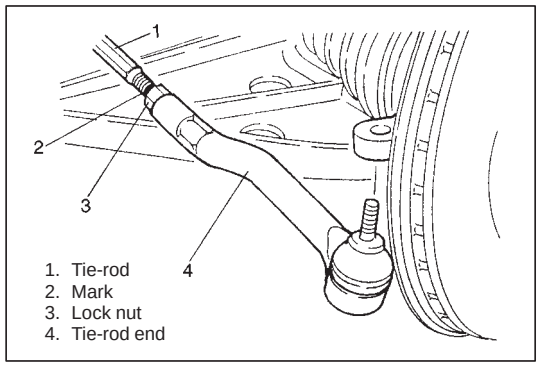
TIE-ROD END

REMOVAL

1) Hoist vehicle and remove wheel.
2) Remove tie-rod end nut.

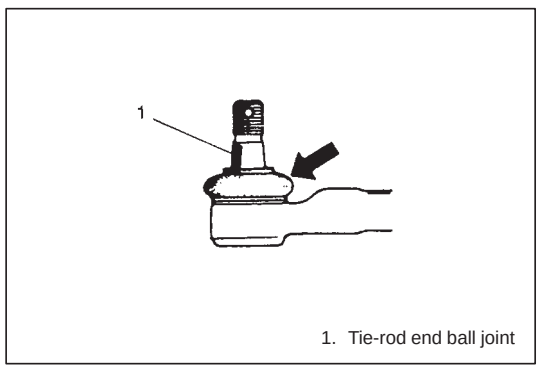


3) Disconnect tie-rod end by using puller.



1. Tie-rod
2. Mark
3. Lock nut
4. Tie-rod end

4) To facilitate adjustment after installation, put a mark on tie-rod thread indicating position of tie-rod end lock nut. Then loosen lock nut and remove tie rod end from tie rod.

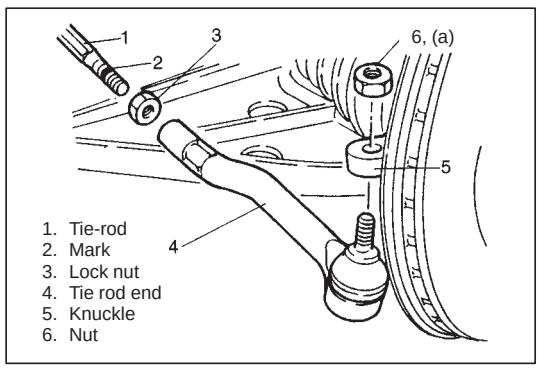


1. Tie-rod end ball joint

INSPECTION

Tie-rod End Ball Joint

Inspect for play in tie-rod end ball joint. If found defective, replace.

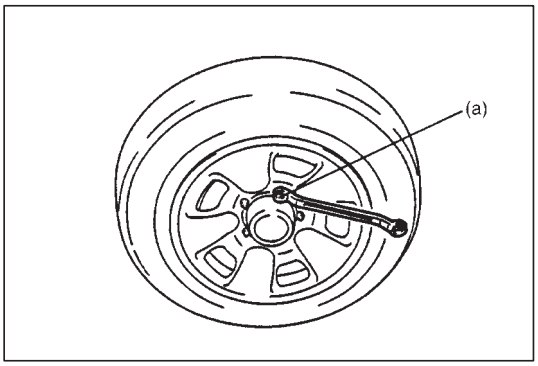


1. Tie-rod
2. Mark
3. Lock nut
4. Tie rod end
5. Knuckle
6. Nut

INSTALLATION

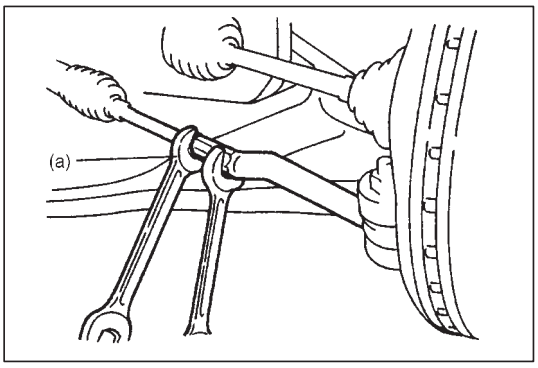
1) Install tie-rod end lock nut and tie rod end to tie-rod. Tighten lock nut to mark on tie-rod thread.
2) Install tie-rod end to knuckle. Tighten tie-rod end nut to specified torque.

Tightening Torque
(a): 48 N·m (4.8 kg-m, 35.0 lb-ft)



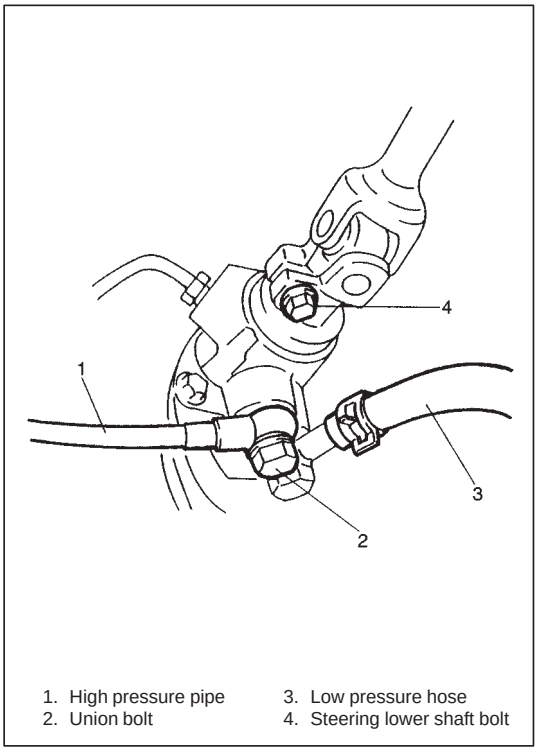
3) After installing wheels, lower vehicle and tighten wheel nuts to specified torque.

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



4) Check that proper amount of toe-in is obtained by referring to "FRONT WHEEL ALIGNMENT".
5) After confirming proper amount of toe-in, tighten tie-rod end lock nut to specified torque.

Tightening Torque
(a): 65 N·m (6.5 kg-m, 47.0 lb-ft)



1. High pressure pipe
2. Union bolt
3. Low pressure hose
4. Steering lower shaft bolt

POWER STEERING GEAR BOX ASSEMBLY

REMOVAL

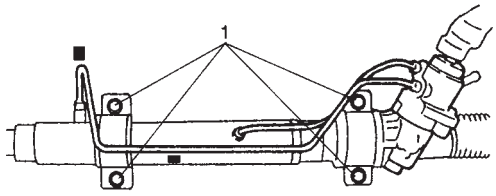
1) Take out fluid in P/S fluid reservoir with syringe or such.
2) Disconnect high pressure pipe from steering gear box by removing union bolt.

NOTE:
As fluid flows out of disconnected joints, put a receptacle under joints or a plug to pipe.

3) Disconnect low pressure hose from steering gear box.

NOTE:
As fluid flows out of disconnected joints, put a receptacle under joints or a plug to hose.

4) Remove steering lower shaft bolt.
5) Hoist vehicle and remove both right and left wheels.
6) Disconnect both right and left tie rod ends from knuckle, refer to steps 2) to 3) of "TIE-ROD END REMOVAL" in this section.



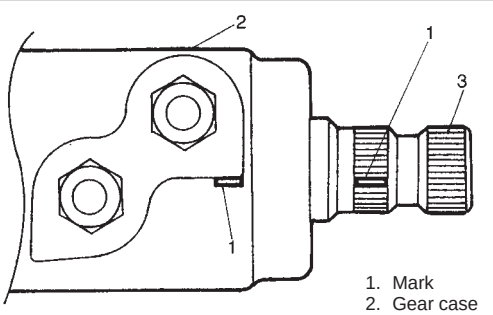
1. Steering gear box mounting bolts

7) Remove steering gear box mounting bolts and then remove steering gear box from vehicle.
Steering gear box found to be in defective condition should be replaced with a new one.

CAUTION:
Never disassemble P/S gear box. If perform this prohibited service, it will affect original performance.

INSTALLATION

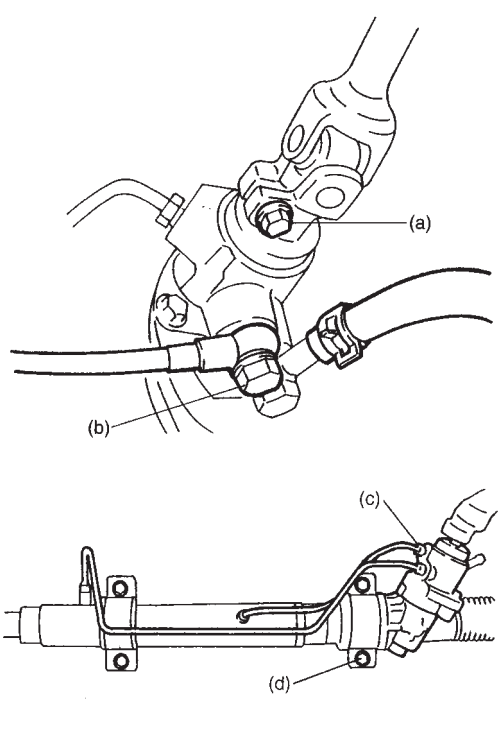
Reverse removal procedure for installation of steering gear box noting the following points.



1. Mark
2. Gear case
3. Pinion shaft

- After confirming that front tire is in straight position, install steering gear box to body temporarily. Next, with tie-rod end installed to knuckle, set rack in position close to neutral. Then obtain the neutral state by aligning match marks on pinion shaft and steering gear case and insert steering lower joint into pinion shaft.

CAUTION:
Be sure to confirm that steering wheel and front tires (wheels) are in straight position when inserting steering lower joint into steering pinion shaft.



- If a plug was put to disconnected pipe when removing steering gear box, remove that plug before reconnecting pipe.
- Use specified torque as given below.

Tightening Torque
(a): 25 N·m (2.5 kg-m, 18.0 lb-ft)
(b): 40 N·m (4.0 kg-m, 29.0 lb-ft)
(c): 25 N·m (2.5 kg-m, 18.0 lb-ft)
(d): 55 N·m (5.5 kg-m, 40.0 lb-ft)

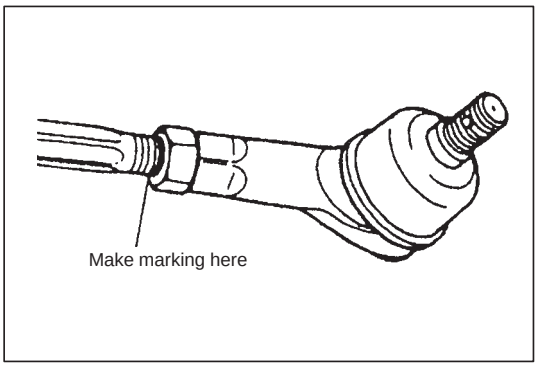
- After installation, be sure to fill specified power steering fluid and bleed air.
- Check toe setting. Adjust as required. (Refer to Front End Alignment.)

RACK BOOT AND TIE-ROD (EXCEPT CANVAS TOP LH MODEL)

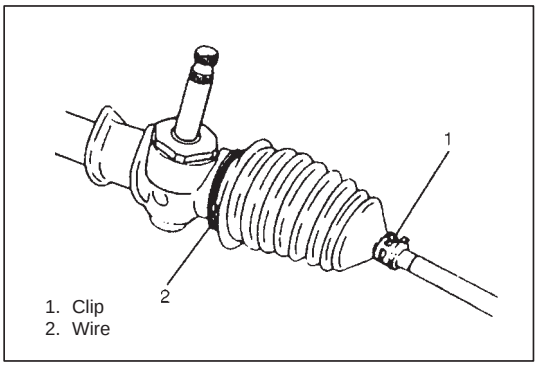
REMOVAL

CAUTION:
Never disassemble tie-rod except for canvas top LH model. Performing this prohibited service will affect original performance.

1) Remove steering gear box by referring to "POWER STEERING GEAR BOX ASSEMBLY REMOVAL" in this section.

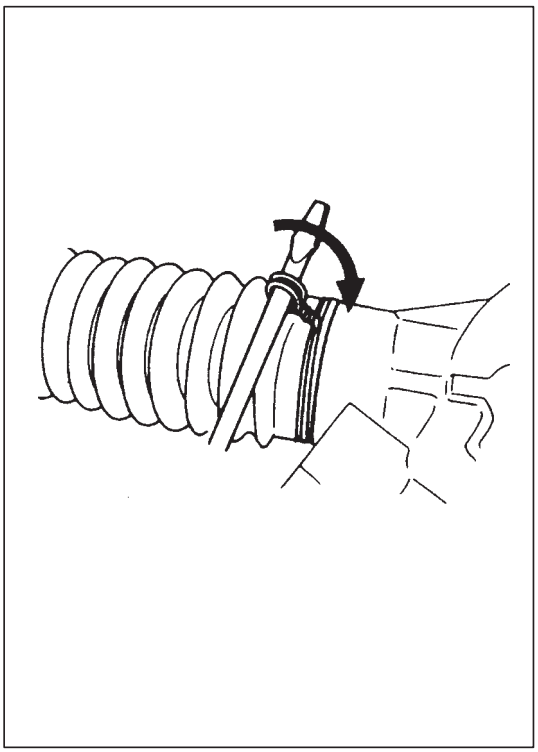


2) For ease of adjustment after installation, make marking of tie-rod end lock nut position of tie-rod end thread.
3) Loosen tie-rod end lock nut and remove tie-rod end.



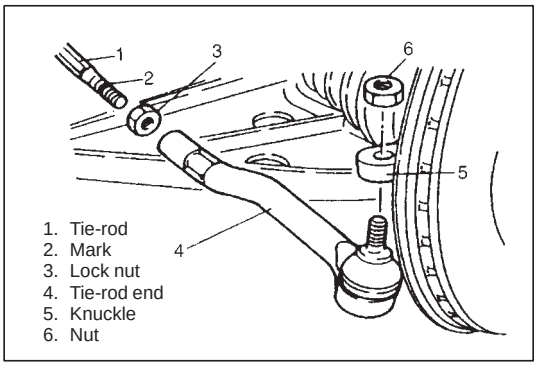
1. Clip
2. Wire

4) Remove boot wire and clip.
5) Remove boot from tie-rod.



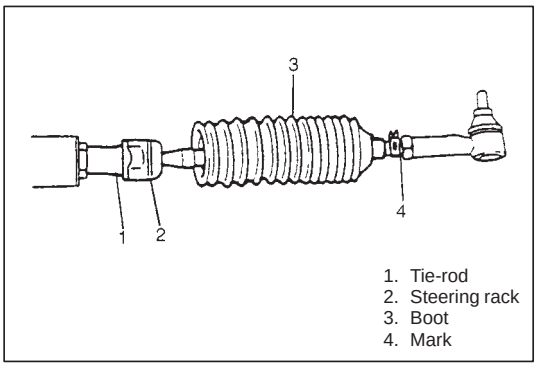
INSTALLATION

1) Visually inspect that rack and rack end ball joint are free from dirt or foreign matters. Clean thoroughly with cloth or such.
   Position boot properly in grooves of gear case and tie-rod and clamp it with wire and clip.
   Wire should be new and should go around twice.
   Pull its both ends together by screw driver or such and make sure that the wire won't be crossed. Then twist the ends several times, the twisted ends should be bent in the circumferential direction.
   After this, check to ensure that wire is tight and boot is free from twist and dent.



1. Tie-rod
2. Mark
3. Lock nut
4. Tie-rod end
5. Knuckle
6. Nut

2) Install tie-rod end lock nut and tie-rod end to tie-rod. Position lock nut to the mark made in removal.
3) Install steering gear box assembly by referring "POWER STEERING GEAR BOX ASSEMBLY INSTALLATION" in this section.
   After installation, fill specified P/S fluid and bleed air from system. Then check toe setting and adjust as required.

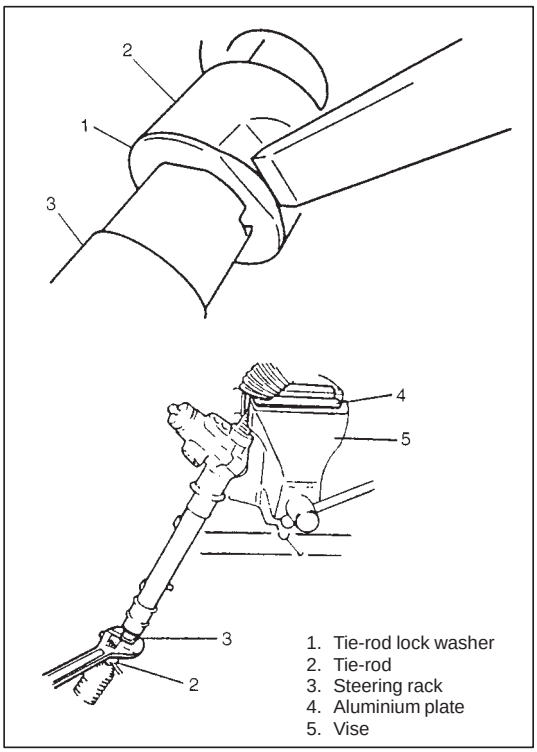


1. Tie-rod
2. Steering rack
3. Boot
4. Mark

RACK BOOT AND TIE-ROD (FOR CANVAS TOP LH MODEL)

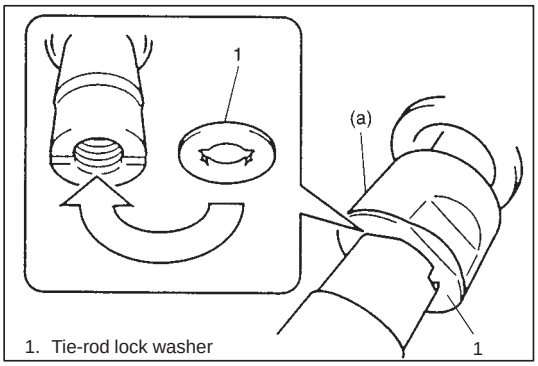
REMOVAL

1) Remove steering gear case, refer to "POWER STEERING GEAR BOX ASSEMBLY REMOVAL" in this section.
2) For ease of adjustment after installation, make marking of tie-rod end lock nut position of tie-rod thread.
3) Loosen tie-rod end lock nut and remove tie-rod end.
4) Remove boot band and clip.
5) Remove boot from tie-rod.



1. Tie-rod lock washer
2. Tie-rod
3. Steering rack
4. Aluminium plate
5. Vise

6) Unbend washer (2 places), and remove tie-rod from rack.



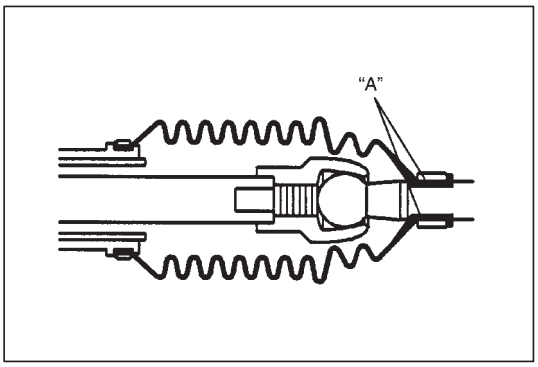
1. Tie-rod lock washer

INSTALLATION

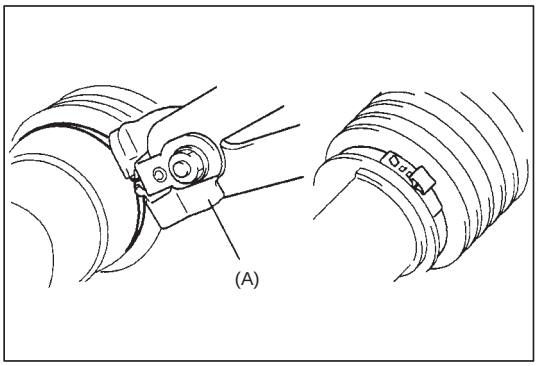
1) Install new tie-rod lock washer and tie-rod to rack.
2) Tighten tie-rod ball nut to specified torque.

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

3) Bend lock washer 2 place at the flat part of tie-rod ball nut.

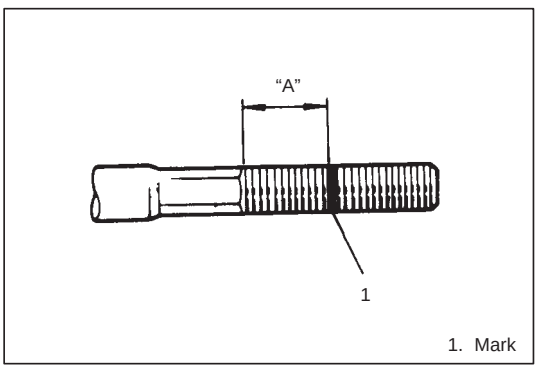


4) Apply grease to "A" indicated in figure.
5) Position boot properly in grooves of gear case and tie-rod. Check to ensure that boot is free from twist and dent.



6) Fasten boot with new clamp and clip securely.

Special Tool
(A): 09943-55010



1. Mark

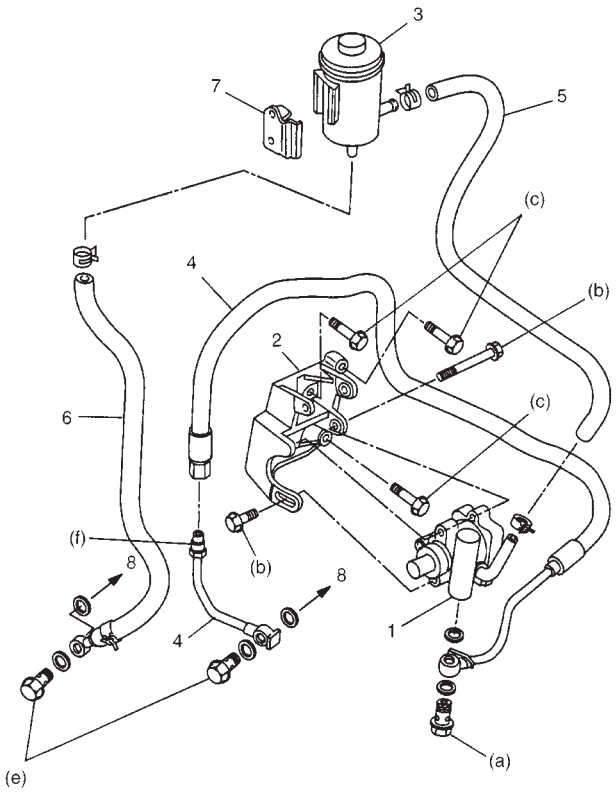
7) Install tie-rod end lock nut and tie-rod end to tie-rod. Position lock nut to marking made in removal.

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

8) Install steering gear case. Refer to "POWER STEERING GEAR BOX ASSEMBLY INSTALLATION" in this section.

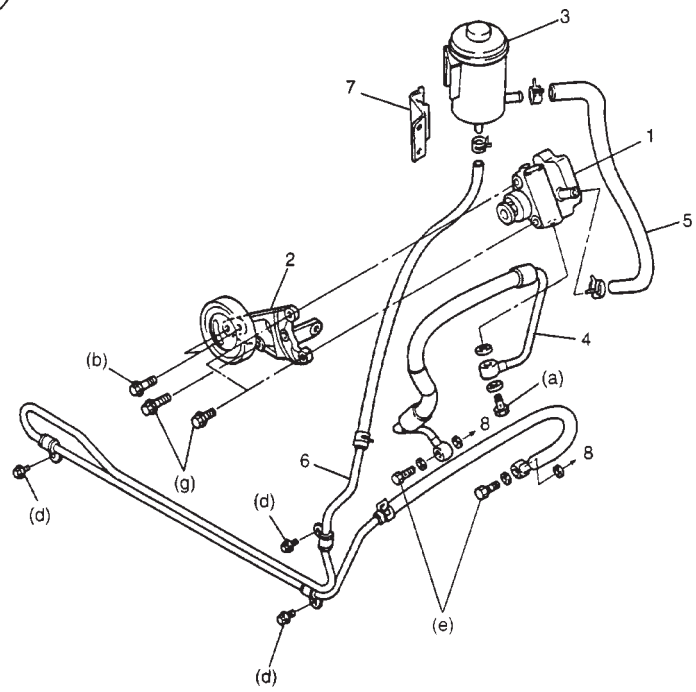
POWER STEERING PUMP

[G16 ENGINE MODEL]

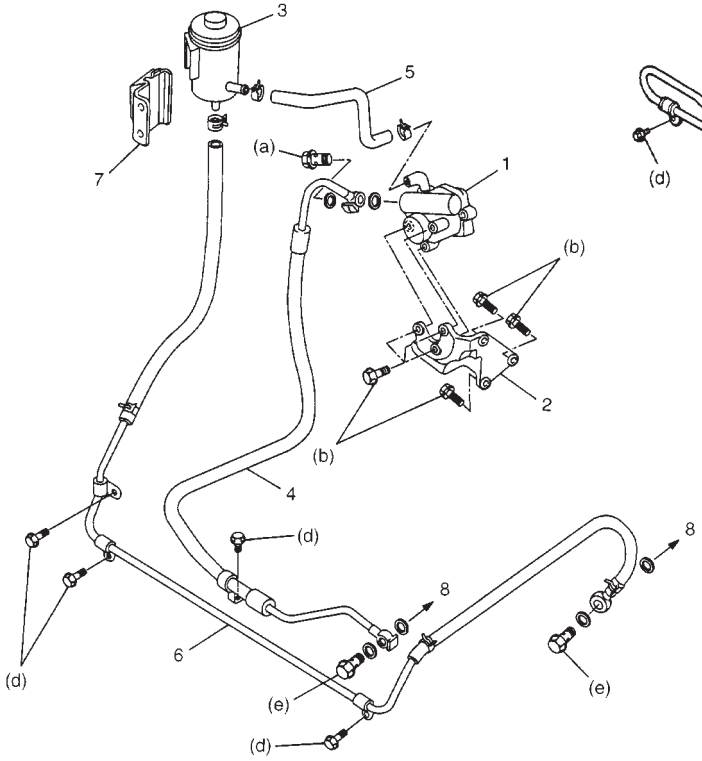


Tightening Torque
(a): 60 N·m (6.0 kg-m, 43.5 lb-ft)
(b): 25 N·m (2.5 kg-m, 18.5 lb-ft)
(c): 55 N·m (5.5 kg-m, 40.0 lb-ft)
(d): 11 N·m (1.1 kg-m, 8.0 lb-ft)
(e): 35 N·m (3.5 kg-m, 25.5 lb-ft)
(f): 40 N·m (4.0 kg-m, 29.0 lb-ft)
(g): 45 N·m (4.5 kg-m, 33.0 lb-ft)

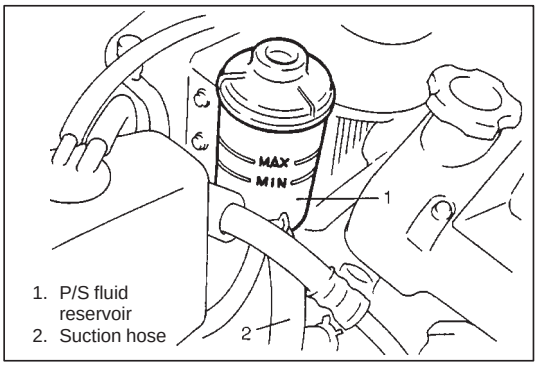
[H25 ENGINE MODEL]



[J20 ENGINE MODEL]



1. Power steering pump assembly
2. Bracket
3. P/S fluid reservoir
4. High pressure hose & pipe
5. Suction hose
6. Low pressure return hose
7. Oil tank bracket
8. To P/S gear box



1. P/S fluid reservoir
2. Suction hose

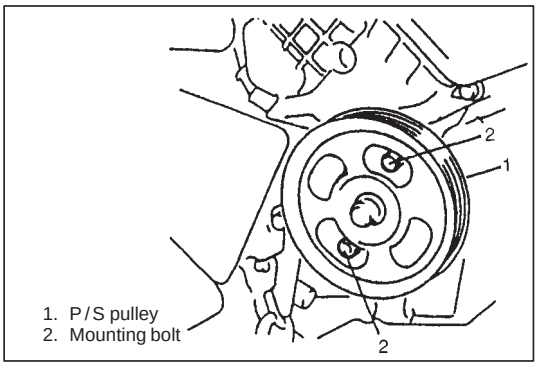
REMOVAL

NOTE:
Be sure to clean each joint of suction and discharge sides thoroughly before removal.

1) Remove suction hose from pump, then disconnect battery negative cable.
2) Remove P/S fluid reservoir with suction hose.
3) Remove union bolt. Then disconnect high pressure pipe from pump.

   NOTE:
   As fluid flows out of disconnected joints, put a receptacle under joints or a plug to pipe.

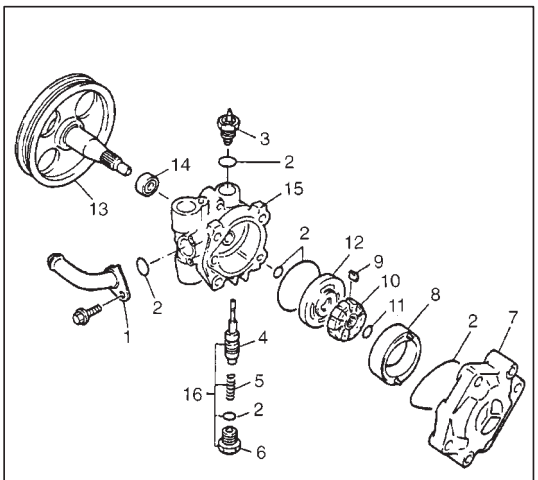
4) Disconnect pressure switch lead wire at switch terminal.
5) Loosen related bolts and remove power steering drive belt.



1. P/S pulley
2. Mounting bolt

6) Remove P/S pump mounting bolt (s).
7) Remove P/S pump.

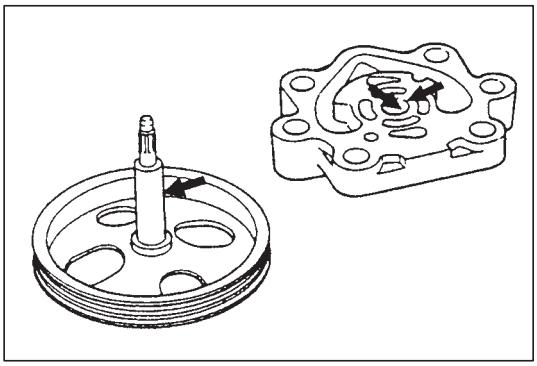
   NOTE:
   Plug each port of removed pump to prevent dust or any other foreign matter from entering.



1. Suction connector
2. O-ring
3. Pressure switch
4. Flow control valve (Relief valve)
5. Spring
6. Plug
7. Pump cover
8. Cam ring
9. Vane
10. Rotor
11. Snap ring
12. Side plate
13. Pulley (pump shaft)
14. Oil seal
15. Pump body
16. Flow control valve Assembly

DISASSEMBLY

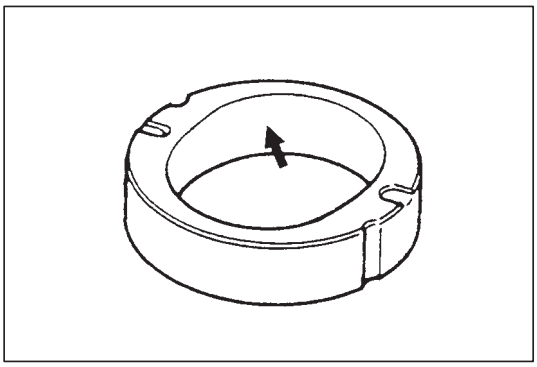
1) Clean its exterior thoroughly.
2) With aluminum plates placed on vise first, grip pump body with it.
3) Remove suction connector bolt, suction connector and O-ring from pump body.
4) Remove power steering pressure switch (terminal set) from pump body.
5) Remove plug, flow control spring and relief valve (flow control valve) from pump body.
6) Remove cover bolts, pump cover and O-ring from pump body.
7) Remove snap ring from pump shaft.
8) Remove vanes from rotor.
9) Remove cam ring, rotor, side plate and O-rings from pump body.
10) Pull out pulley from pump body.
11) Remove oil seal from pump body.



INSPECTION

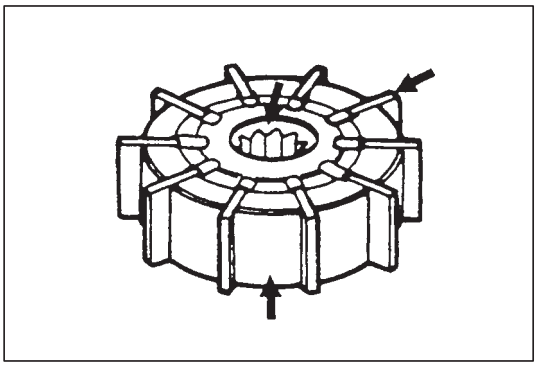
Pump Body, Cover, Side Plate and Shaft

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



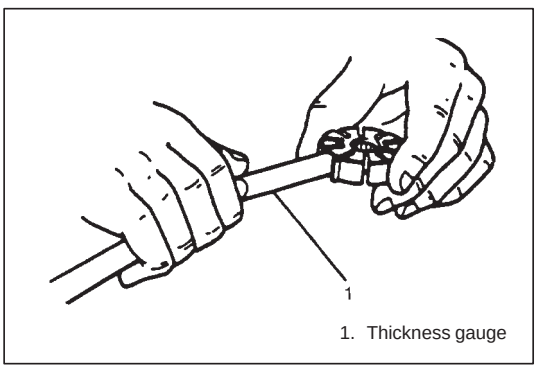
Cam Ring

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



Rotor and Vane

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

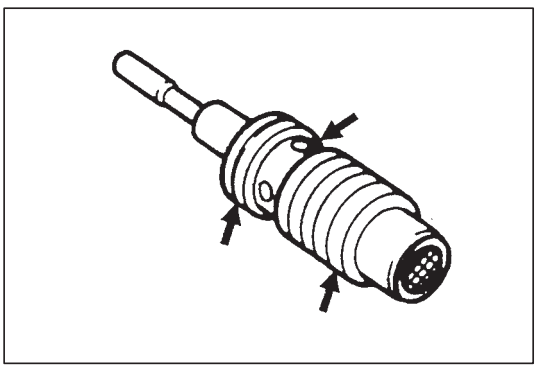


1. Thickness gauge

- Check clearance between rotor and vane.

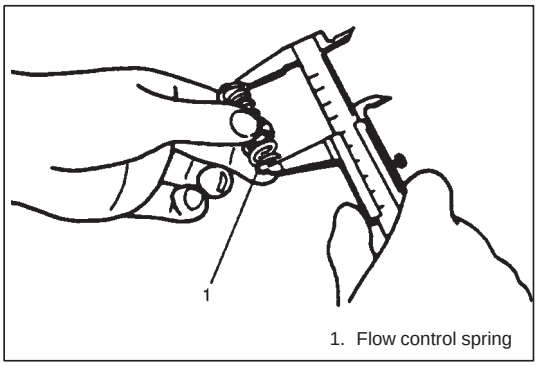
Clearance: Standard 0.015 mm (0.0006 in.)
Limit 0.027 mm (0.0011 in.)

Replace pump assembly if any defect is found in above checks.



Relief Valve (Flow Control Valve) and Its Spring

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

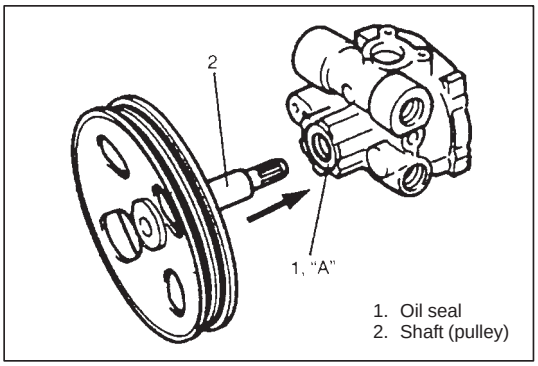


1. Flow control spring

- Check free length of relief valve spring.

Free length: Standard 22.0 mm (0.866 in.)
Limit 19.0 mm (0.748 in.)

Replace if any defective is found.



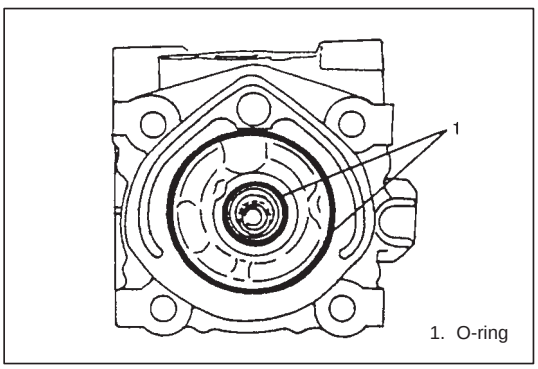
1. Oil seal
2. Shaft (pulley)

ASSEMBLY

Reverse disassembly procedure for assembly, noting the following.

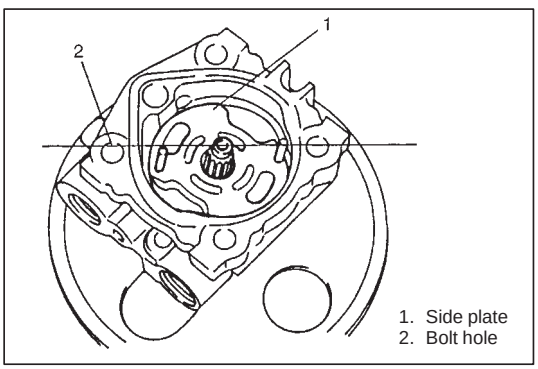
1) Apply grease to oil seal lip and apply power steering fluid to sliding surface of the shaft then insert pulley's shaft from oil seal side of the pump body.

"A": Grease 99000-25010



1. O-ring

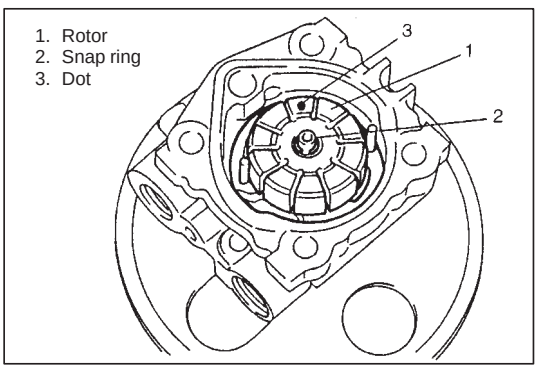
2) Apply power steering fluid to O-rings and fit them to pump body.



1. Side plate
2. Bolt hole

3) Install side plate to pump body.

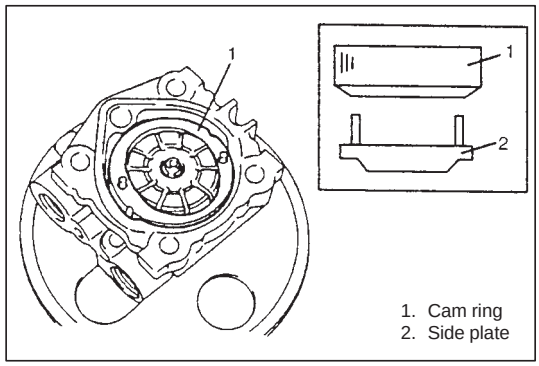
NOTE:
Carefully align the dowel pins on the side plate at bolt hole as shown in figure.



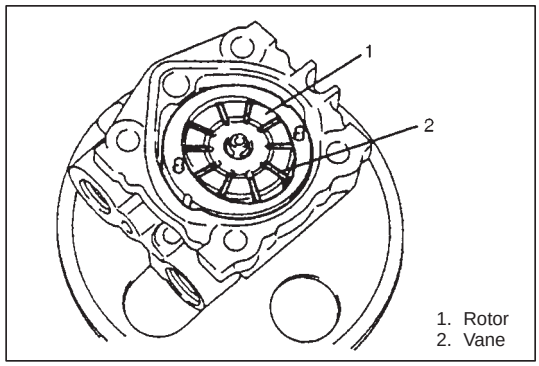
1. Rotor
2. Snap ring
3. Dot

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

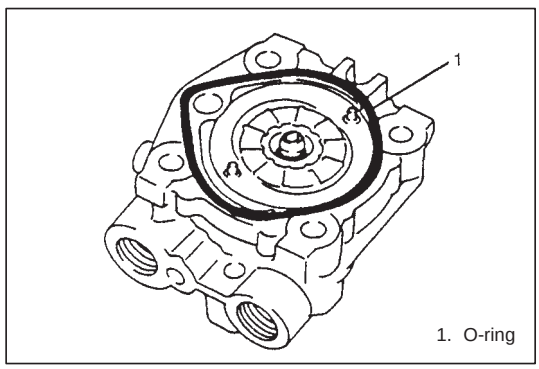
NOTE:
Never reuse the removed snap ring.



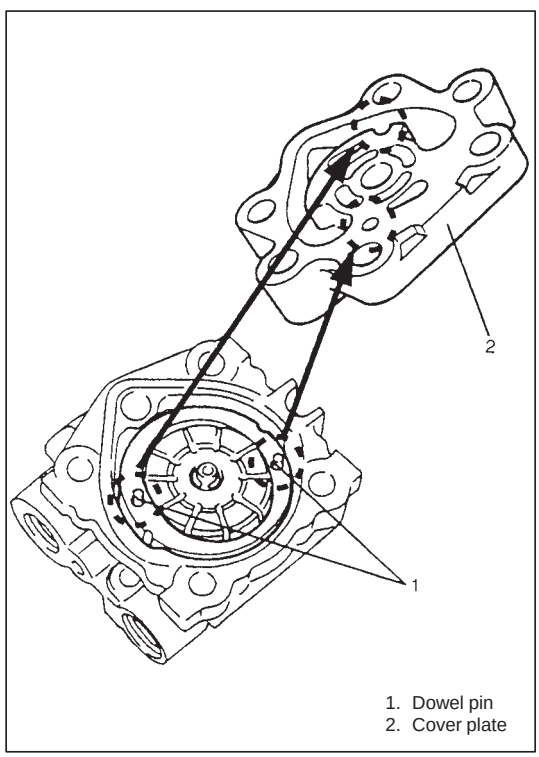
7) Apply power steering fluid to sliding surface of cam ring.
8) Install cam ring to pump body. The tapered end of cam ring should face the side plate.



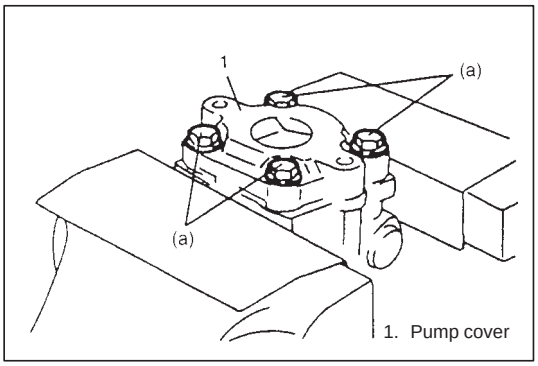
9) Apply power steering fluid to each vane.
10) Install vanes (10 pieces) to rotor.



11) Apply power steering fluid to O-ring.
12) Install O-ring to pump body.



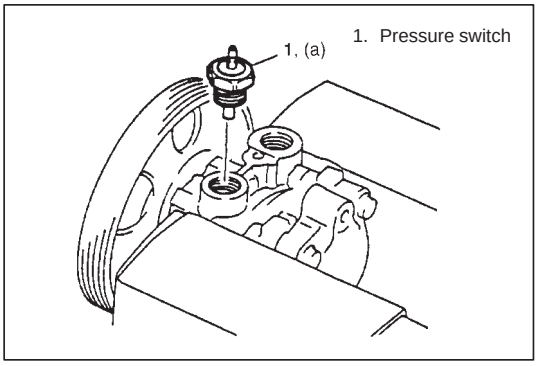
13) Apply power steering fluid to sliding surface of pump cover and rotor.
14) Match the dowel pins to the holes of the cover plate as shown and install pump cover to pump body.



15) Gradually tighten new pump cover bolts to specified torque.

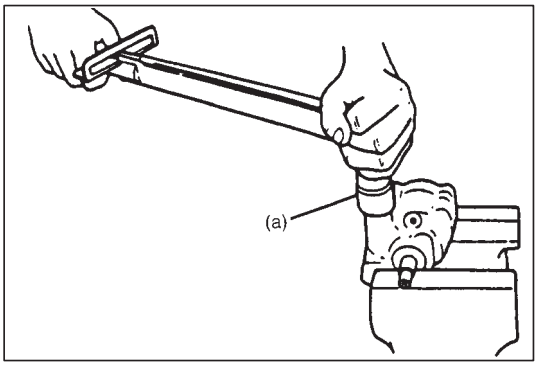
NOTE:
After installing pump cover, check to make sure that shaft can be turned by hand.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



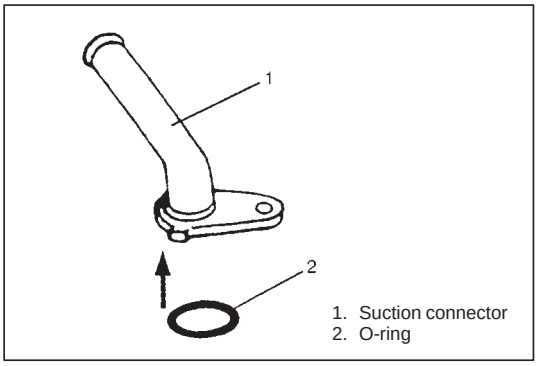
16) Apply power steering fluid to O-ring of terminal switch.
17) Install pressure switch to pump body.

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

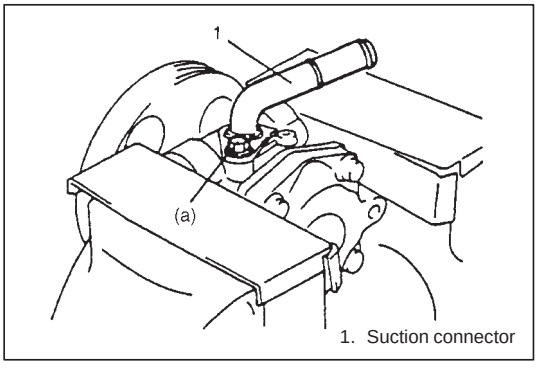


18) Apply power steering fluid to relief valve (flow control valve).
19) Install relief valve (flow control valve) to pump body.
20) Install flow control spring.
21) Apply power steering fluid to O-rings of plug.
22) Install O-rings to plug.
23) Tighten plug to specified torque.

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



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



26) Install suction connector to pump body as shown in figure. Tighten new suction connector bolts to specified torque.

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

INSTALLATION

Reverse removal procedure, and then noting the following instructions.

- For tightening torques, refer to structural diagram on previous page.
- Adjust power steering pump drive belt by referring to “BELT TENSION ADJUSTMENT” under “POWER STEERING PUMP DRIVE BELT” in this section.
- Fill specified power steering fluid after installation and bleed air without failure. (Refer to “AIR BLEEDING PROCEDURE” in this section.)

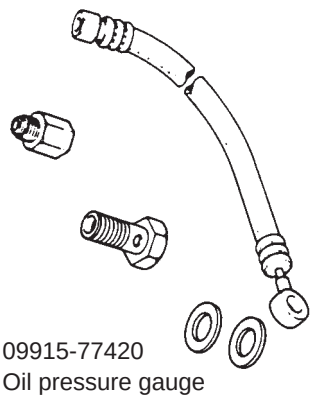
TIGHTENING TORQUE SPECIFICATION

Fastening parts		Tightening torque		
		N·m	kg-m	lb-ft
Gear box mounting bolts		55	5.5	40.0
Gear box cylinder pipe flare nuts		29	2.9	21.0
Gear box low pressure pipe union bolt		40	4.0	29.0
Gear box high pressure pipe union bolt		35	3.5	25.5
Tie-rod end lock nut		65	6.5	47.0
Pump bracket bolt	G16 Type engine	55	5.5	40.0
	J20 Type engine	25	2.5	18.5
	H25 Type engine	45	4.5	32.5
Pump union bolt		60	6.0	43.5
Oil pump mount bolts		25	2.5	18.5
Pipe clamp bolt/Reservoir bracket bolt		11	1.1	8.0
Steering shaft joint bolt		25	2.5	18.0
High pressure flare nuts		40	4.0	29.0
Pump cover bolts		23	2.3	17.0
Plug		60	6.0	43.5
Pressure switch (Terminal)		28	2.8	20
Suction connector bolt		10	1.0	7.5
Tie-rod end nut		48	4.8	35.0
Tie-rod (for canvas top LH model only)		85	8.5	61.5

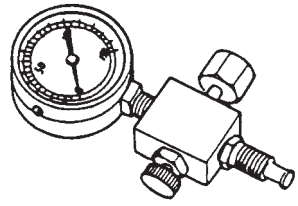
REQUIRED SERVICE MATERIAL

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUPER GREASE (A) (99000-25010)	● Oil seal lip of P/S pump pulley shaft
Power steering fluid	An equivalent of DEXRON®-III or DEXRON®-II	● To fill P/S fluid reservoir ● Parts lubrication when installing

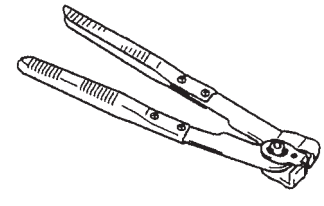
SPECIAL TOOL



09915-77420
Oil pressure gauge attachment and hose set



09915-77410
Oil pressure gauge



09943-55010
Boot clamp plier

SECTION 3C

STEERING WHEEL AND COLUMN (NOT EQUIPPED WITH AIR BAG)

NOTE:
All steering wheel and column fasteners are important 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 of substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.

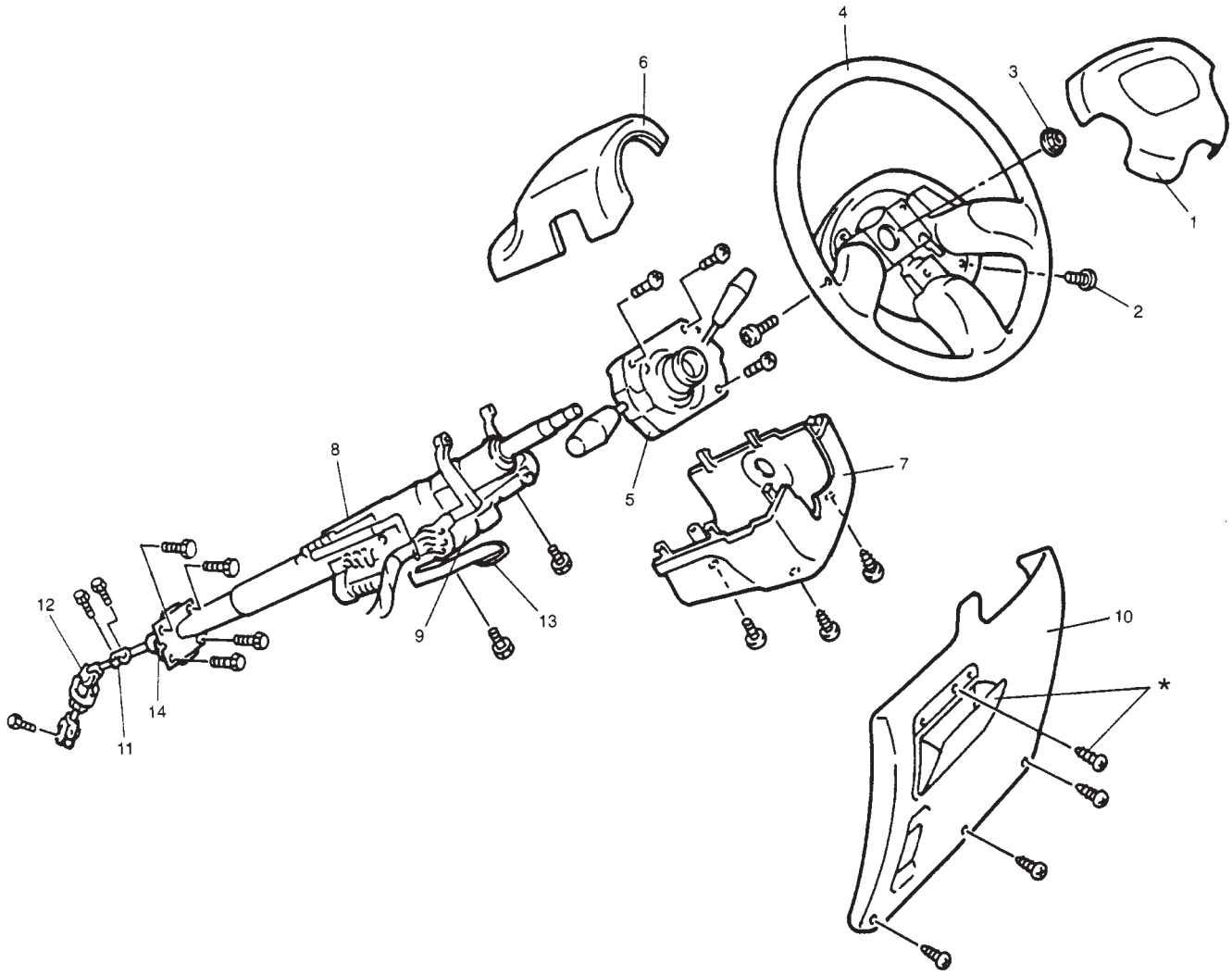
CONTENTS

GENERAL DESCRIPTION 3C- 1
DIAGNOSIS 3C- 2
Inspection and repair required after accident 3C- 2
ON-VEHICLE SERVICE 3C- 3
Steering wheel 3C- 3
Combination switch 3C- 4
Steering column assembly 3C- 5
Steering lock assembly (ignition switch) 3C-10
Steering lower shaft assembly 3C-11
Checking steering column for accident damage 3C-13
Adjustable steering column release lever 3C-14
TIGHTENING TORQUE SPECIFICATIONS 3C-14
SPECIAL TOOL 3C-14

GENERAL DESCRIPTION

This double tube type steering column has the following three important features in addition to the steering function:
- The column is energy absorbing, designed to compress in a front-end collision.
- The ignition switch and lock are mounted conveniently on this column.
- With the column mounted lock, the ignition and steering operations can be locked to inhibit theft of the vehicle.

To insure the energy absorbing action, it is important that only the specified bolts 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.



1. Steering wheel pad
2. Steering wheel pad screw
3. Steering wheel nut
4. Steering wheel
5. Combination switch
6. Steering column upper cover
7. Steering column lower cover
8. Steering column assembly
9. Steering lock assembly
10. Steering column hole cover
11. Steering shaft joint
12. Steering lower shaft assembly
13. Adjustable steering column release lever
14. Steering column lower seal

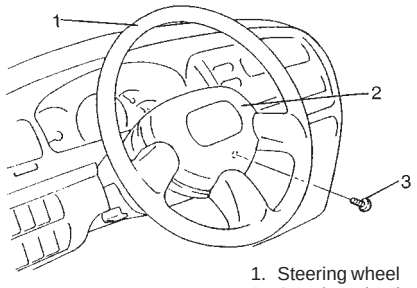
*: If equipped

DIAGNOSIS

For diagnosis of the steering wheel, steering column and steering shaft lower assembly, refer to Section 3.

INSPECTION AND REPAIR REQUIRED AFTER ACCIDENT

After an accident, be sure to perform checks, inspections and repairs described under “CHECKING STEERING COLUMN FOR ACCIDENT DAMAGE” in this section.



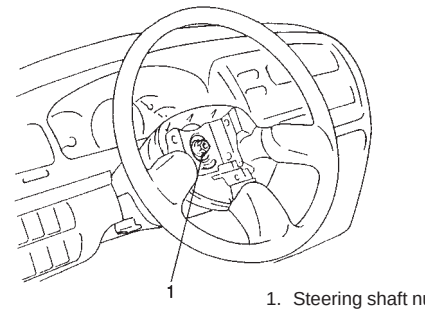
1. Steering wheel
2. Steering wheel pad
3. Screw

ON-VEHICLE SERVICE

STEERING WHEEL

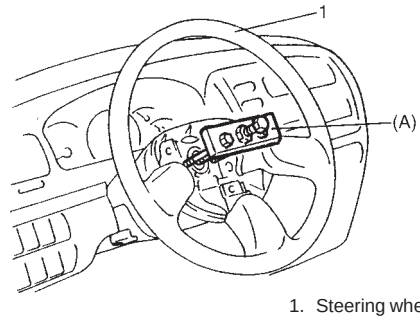
REMOVAL

1) Disconnect negative battery cable at battery terminal.
2) Remove steering wheel pad screw.
3) Remove steering wheel pad and disconnect horn harness.



1. Steering shaft nut

4) Remove steering shaft nut.
5) Make alignment marks on steering wheel and shaft for a guide during reinstallation.



1. Steering wheel

6) Remove steering wheel with special tool.

Special Tool
(A): 09944-36011

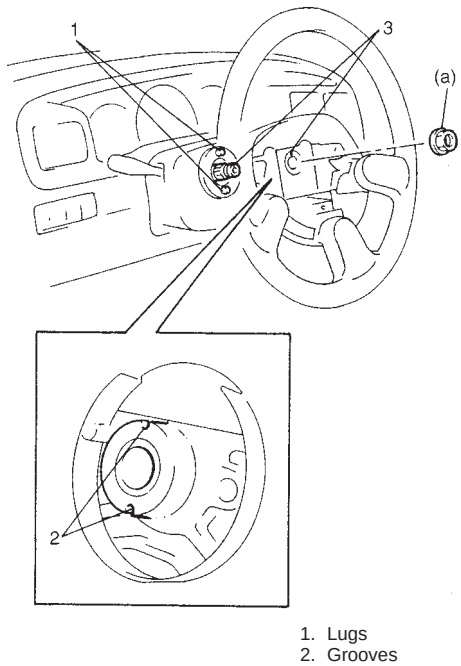
CAUTION:
Do not hammer the end of the shaft. Hammering it will loosen the plastic shear pins which maintain the column length and impair the collapsible design of the column.

INSTALLATION

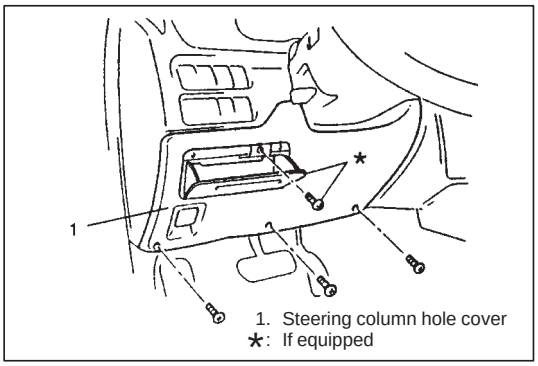
1) Install steering wheel to steering shaft with 2 lugs on combination switch fitted in two grooves in the back of steering wheel and also aligning marks on steering wheel and steering shaft.
2) Tighten steering shaft nut to specified torque.

Tightening Torque
(a): 33 N·m (3.3 kg-m, 23.5 lb-ft)

3) Connect horn harness and install steering wheel pad.
4) Tighten steering wheel pad screw.
5) Connect negative battery cable.



1. Lugs
2. Grooves
3. Alignment marks

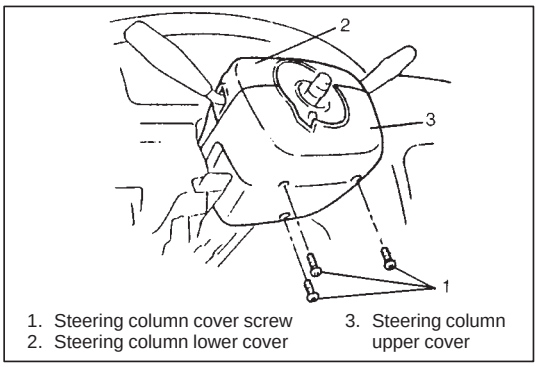


1. Steering column hole cover
*: If equipped

COMBINATION SWITCH

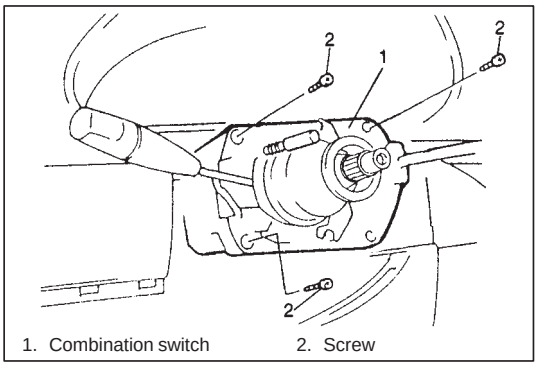
REMOVAL

1) Disconnect negative battery cable at battery terminal.
2) Remove steering wheel from steering column. Refer to "STEERING WHEEL" in this section.
3) Remove steering column hole cover.



1. Steering column cover screw
2. Steering column lower cover
3. Steering column upper cover

4) Remove steering column cover screws (3 pieces).
5) Separate upper cover and lower cover, then remove them.
6) Disconnect all connectors for combination switch.

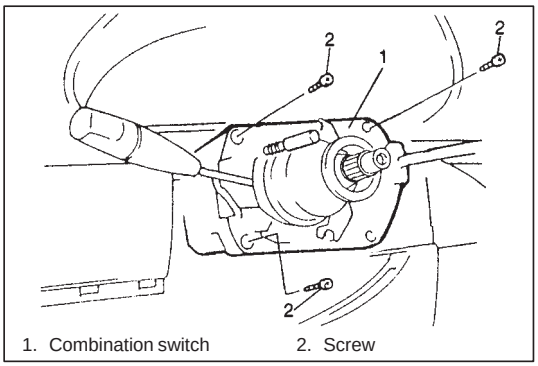


1. Combination switch
2. Screw

7) Remove combination switch from steering column.

INSPECTION

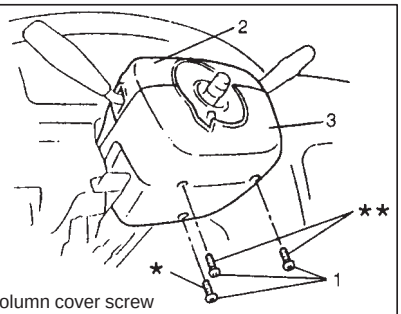
Check combination switch wire harness for any signs of scorching, melting or other damage. If it is damaged, replace.



1. Combination switch
2. Screw

INSTALLATION

1) Install combination switch to steering column.
2) Connect all connectors that have been removed in removal.

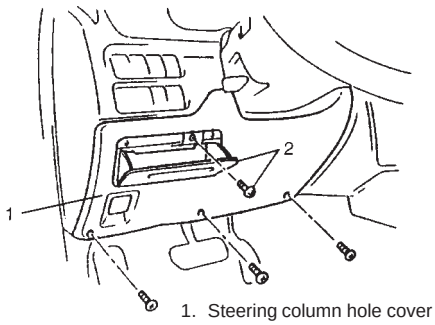


1. Steering column cover screw
2. Steering column lower cover
3. Steering column upper cover

**: Tapping screw
*: Standard screw

3) Install steering column upper and lower cover.
4) Tighten steering column cover screws.

CAUTION:
When installing lower cover and upper cover, be careful so that combination switch lead wire is not caught between covers.



1. Steering column hole cover
2. If equipped

5) Install steering column hole cover.
6) Install steering wheel to steering column. Refer to “STEERING WHEEL” in this section.
7) Connect battery negative cable.

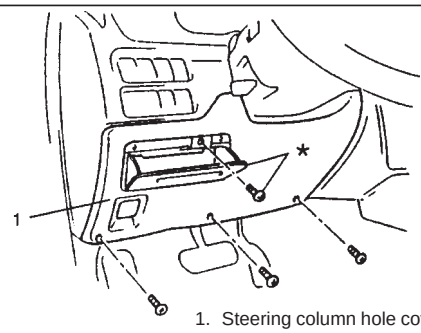
STEERING COLUMN ASSEMBLY

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.
When loosening steering column mounting bolts, make sure that steering column assembly and steering shaft lower assembly have been separated. Loosening them with steering column assembly and steering shaft lower assembly assembled could cause damage to bearing in steering shaft lower assembly.

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

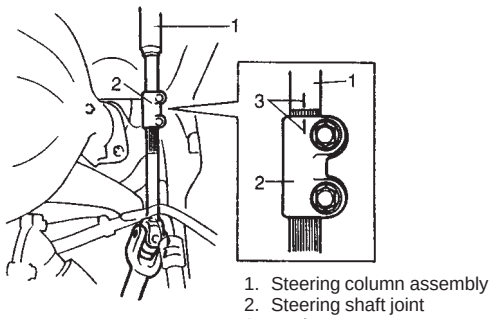
REMOVAL
1) Disconnect negative battery cable at battery terminal.

2) Remove steering wheel and combination switch, if necessary. Refer to “STEERING WHEEL” and “COMBINATION SWITCH” in this section.
   Perform the following procedure if not removing steering wheel and/or combination switch.
   i) Turn steering wheel so that vehicle’s front tires are at straight-ahead position.
   ii) Turn ignition switch to “LOCK” position and remove key.



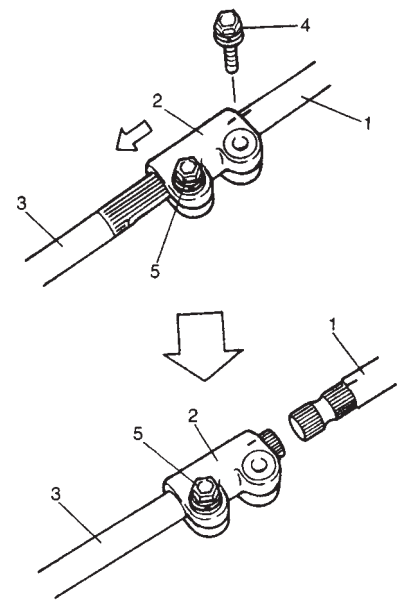
1. Steering column hole cover
*: If equipped

3) Remove steering column hole cover.
4) Disconnect all connectors for the following parts.
   - Combination switch
   - Ignition switch
   - Immobilizer control system parts (if equipped)



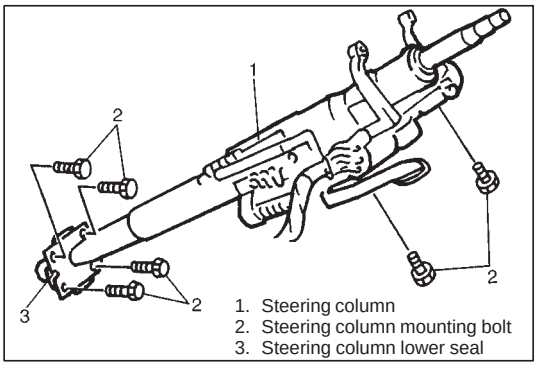
1. Steering column assembly
2. Steering shaft joint
3. Marks

5) Make alignment marks on shaft joint and shaft (column side) for a guide during reinstallation.



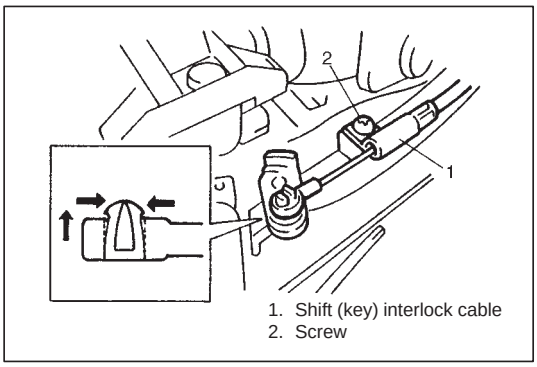
1. Steering column assembly
2. Steering shaft joint
3. Steering lower shaft assembly
4. Bolt (column side)
5. Bolt (lower shaft assembly side)

6) After removing bolt on column side of shaft joint and loosening bolt on its lower shaft assembly side, move shaft joint to lower shaft assembly side (in arrow direction in the figure).



1. Steering column
2. Steering column mounting bolt
3. Steering column lower seal

7) Remove steering column mounting bolts (6 pieces).

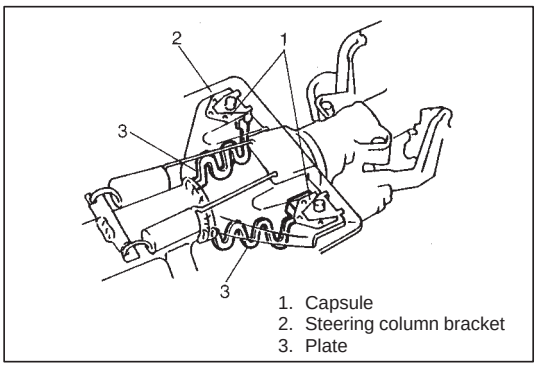


1. Shift (key) interlock cable
2. Screw

8) If equipped with shift (key) interlock cable, remove shift (key) interlock cable screw and then disconnect its cable from ignition switch.
9) Remove steering column from vehicle.

INSPECTION

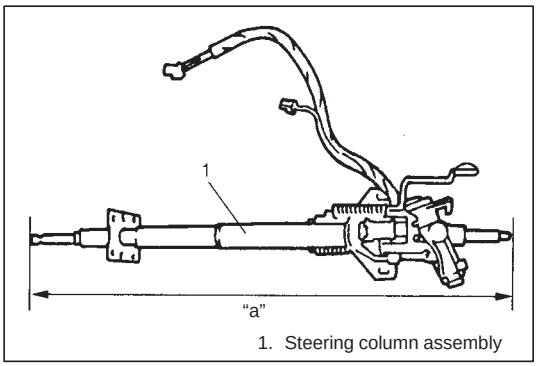
NOTE:
Vehicles involved in accidents resulting in body damage, where steering column has been impacted or air bag deployed, may have a damaged or misaligned steering column.



1. Capsule
2. Steering column bracket
3. Plate

CHECKING PROCEDURE

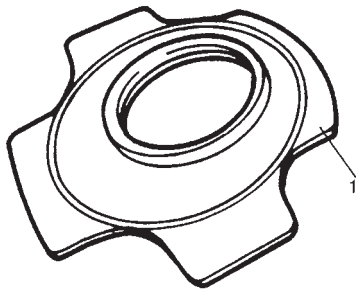
1) Check that two capsules are attached to steering column bracket securely. Check clearance between capsules and steering column bracket. Clearance should be 0 mm (0 in.) on both sides. If found loose or clearance, replace steering column assembly.
2) Check two plates for any damages such as crack or breakage. If anything is found faulty, replace as steering column assembly.



1. Steering column assembly

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

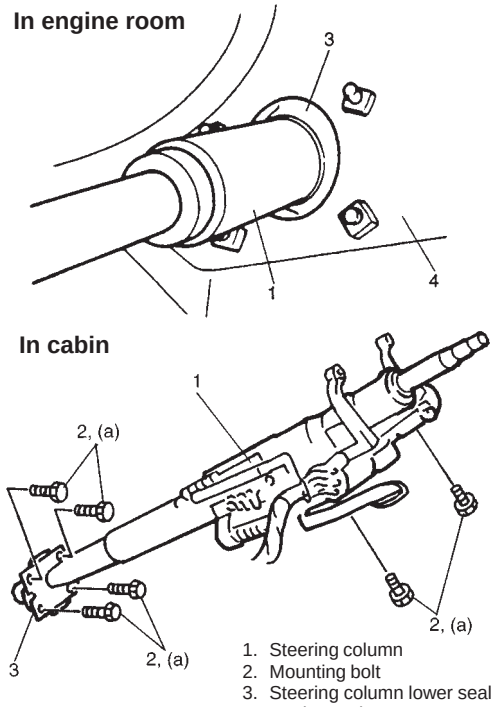
Length "a": 895 ± 0.8 mm (35.24 ± 0.03 in.)



1. Steering column lower seal

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

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



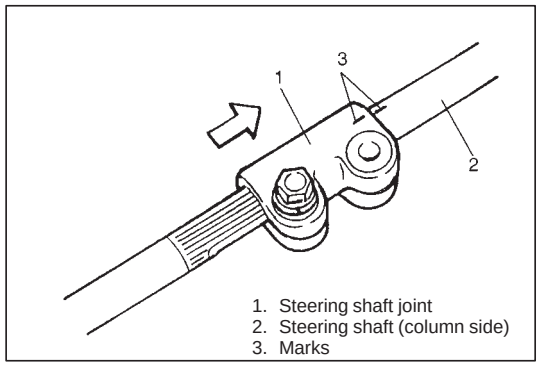
1. Steering column
2. Mounting bolt
3. Steering column lower seal
4. Dash panel

INSTALLATION

CAUTION:
- **After tightening steering column mounting bolts, steering shaft joint bolts should be tightened.**
- **After tightening steering column lower bolts, steering column upper bolts should be tightened.**

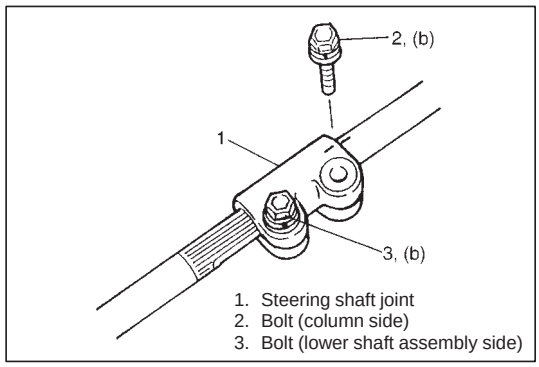
1) Be sure that front wheels and steering wheel are in straight-ahead position.
2) If equipped with shift (key) interlock cable, install shift (key) interlock cable to ignition switch.
3) Install steering column assembly to dash panel and upper bracket so that boss of steering column lower seal and all around it project out of hole in dash panel into engine room. Tighten steering column lower bolts (4 pieces) first and then upper bolts (2 pieces) to specified torque.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



1. Steering shaft joint
2. Steering shaft (column side)
3. Marks

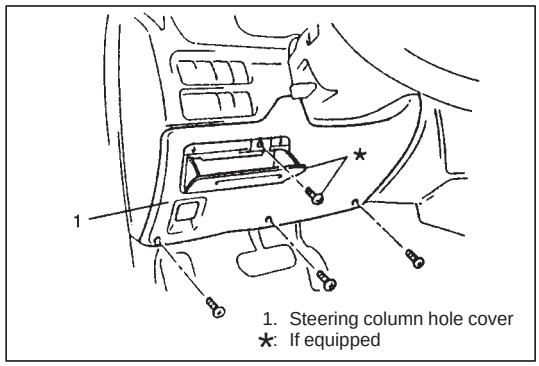
4) Install steering shaft joint to steering shaft by matching it to marks made before removal.



1. Steering shaft joint
2. Bolt (column side)
3. Bolt (lower shaft assembly side)

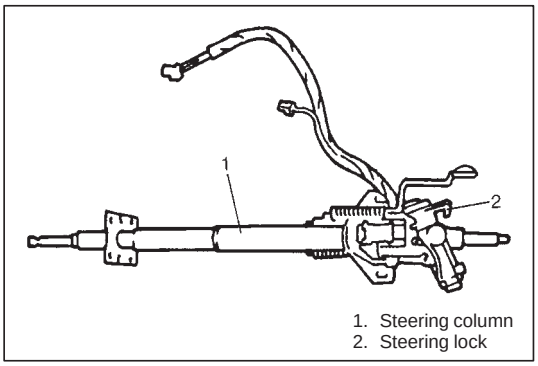
5) Install shaft joint bolt (column side) to steering shaft joint. Tighten shaft joint bolt (column side) to specified torque first and then shaft joint bolt (lower shaft assembly side) to specified torque.

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



1. Steering column hole cover
*: If equipped

6) If combination switch is removed, install combination switch. Refer to “COMBINATION SWITCH” in this section.
7) Connect all connectors that have been removed in removal.
8) Install steering column hole cover.
9) If steering wheel is removed, install steering wheel. Refer to “STEERING WHEEL” in this section.
10) Connect negative battery cable.

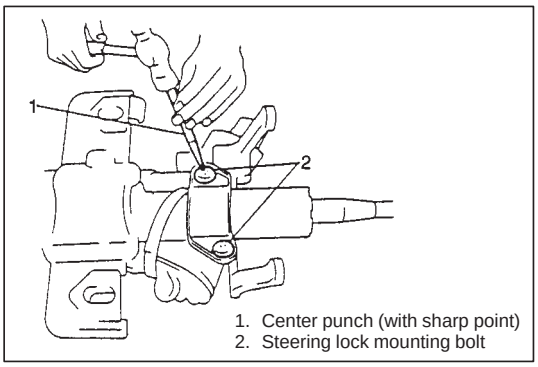


1. Steering column
2. Steering lock

STEERING LOCK ASSEMBLY (IGNITION SWITCH)

REMOVAL

1) Remove steering column. Refer to “STEERING COLUMN” in this section.



1. Center punch (with sharp point)
2. Steering lock mounting bolt

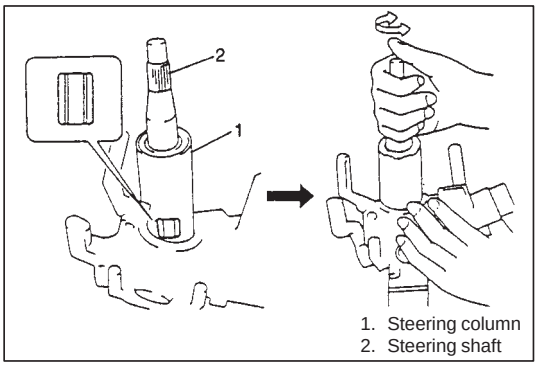
2) Using center punch as shown, loosen and remove steering lock mounting bolts.

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

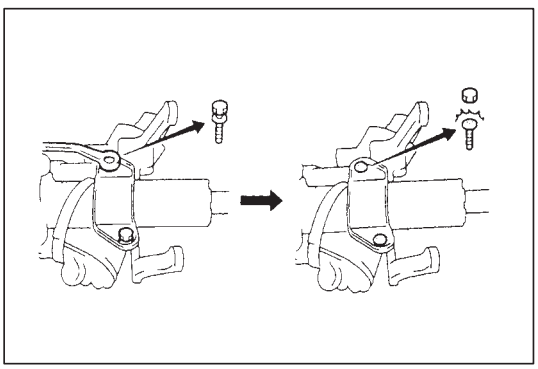
3) Turn ignition key to “ACC” or “ON” position and remove steering lock assembly from steering column.

INSTALLATION

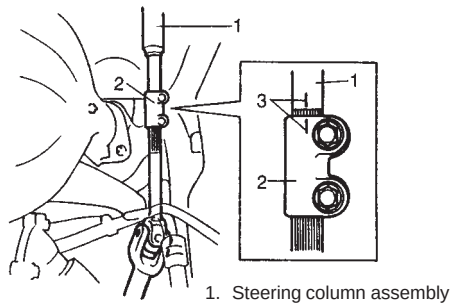
1) Position oblong hole of steering shaft in the center of hole in column.
2) Turn ignition key to “ACC” or “ON” position and install steering lock assembly onto column.
3) Now turn ignition key to “LOCK” position and pull it out.
4) Align hub on lock with oblong hole of steering shaft and rotate shaft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



1. Steering column
2. Steering shaft



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

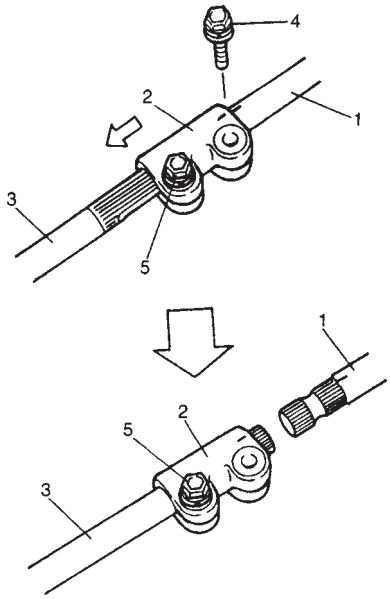


1. Steering column assembly
2. Steering shaft joint
3. Marks

STEERING LOWER SHAFT ASSEMBLY

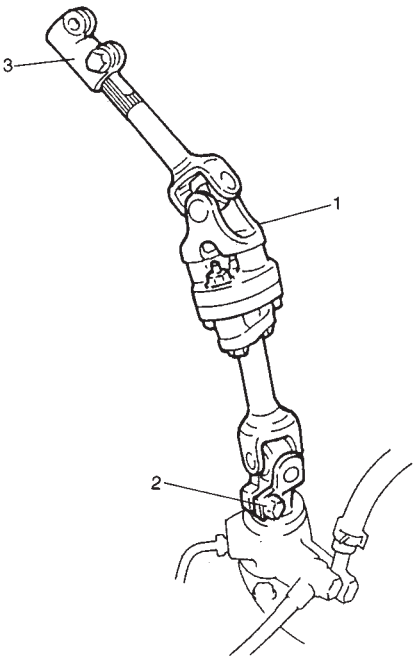
REMOVAL

1) Turn steering wheel so that vehicle's front tires are at straight-ahead position.
2) Turn ignition switch to "LOCK" position and remove key.
3) Make alignment marks on shaft joint and shaft (column side) for a guide during reinstallation.



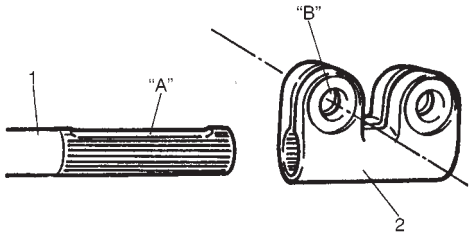
1. Steering column assembly
2. Steering shaft joint
3. Steering lower shaft assembly
4. Bolt (column side)
5. Bolt (lower shaft assembly side)

4) After removing bolt on column side of shaft joint and loosening bolt on its lower shaft assembly side, move shaft joint to lower shaft assembly side (in arrow direction in figure).



1. Steering lower shaft assembly
2. Steering lower shaft assembly lower joint bolt
3. Steering shaft joint

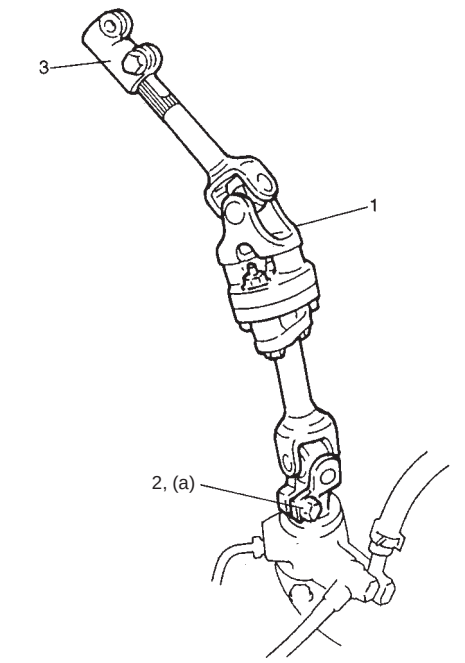
5) Make alignment marks on lower shaft assembly lower joint and pinion shaft for a guide during reinstallation.
6) Remove lower shaft assembly lower joint bolt and then remove lower shaft assembly.
7) Remove shaft joint bolt (lower shaft assembly side) from shaft joint and then remove shaft joint from lower shaft assembly.



1. Steering shaft joint
2. Steering lower shaft assembly

INSTALLATION

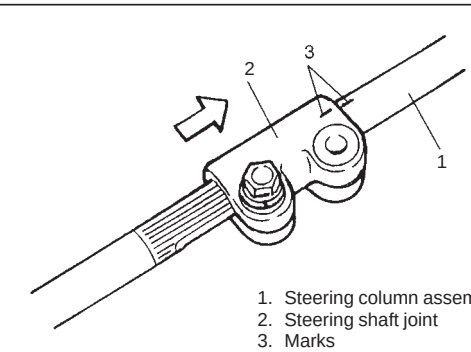
1) Be sure that front wheels and steering wheel are in straightforward position.
2) Align flat part "A" of lower shaft assembly with bolt hole "B" of shaft joint as shown. Then insert shaft joint into lower shaft assembly.
3) Install shaft joint bolt (lower shaft assembly side) to shaft joint. Then tighten it by hand.



1. Steering lower shaft assembly
2. Steering lower shaft assembly lower joint bolt
3. Steering shaft joint

4) Insert pinion shaft into lower shaft assembly lower joint by matching it to marks made before removal. And then install lower shaft assembly lower joint bolt to lower shaft assembly lower joint. Tighten it to specified torque.

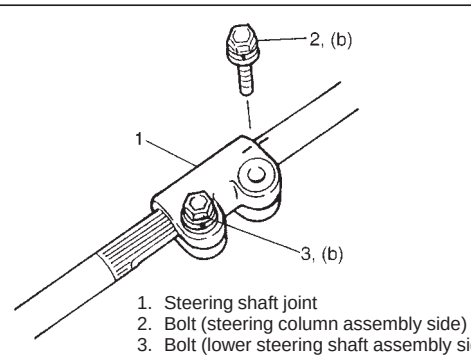
Tightening Torque
(a): 25 N·m (2.5 kg-m, 18.0 lb-ft)



1. Steering column assembly
2. Steering shaft joint
3. Marks

5) Install steering shaft joint to steering shaft by matching it to marks made before removal.

NOTE:
Be sure that front wheels and steering wheel are in straight-ahead position.



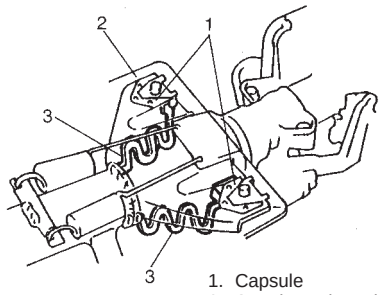
1. Steering shaft joint
2. Bolt (steering column assembly side)
3. Bolt (lower steering shaft assembly side)

6) Install shaft joint bolt (column side) to shaft joint. Tighten shaft joint bolt (column side) to specified torque first and then shaft joint bolt (lower shaft assembly side) to specified torque.

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

CHECKING STEERING COLUMN FOR ACCIDENT DAMAGE

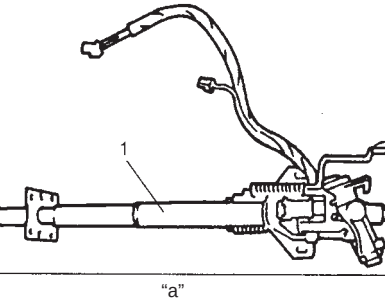
NOTE:
Vehicles involved in accidents resulting in body damage, where steering column has been impacted, may have a damaged or misaligned steering column.



1. Capsule
2. Steering column bracket
3. Plate

CHECKING PROCEDURE

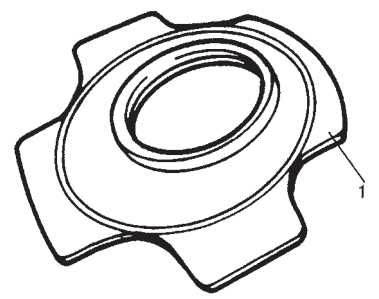
1) Check that two capsules are attached to steering column bracket securely. Check clearance between capsules and steering column bracket. Clearance should be 0 mm (0 in.) on both sides.
   If found loose or clearance, replace steering column assembly.
2) Check two plates for any damages such as crack or breakage.
   If anything is found faulty, replace as steering column assembly.



1. Steering column assembly

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

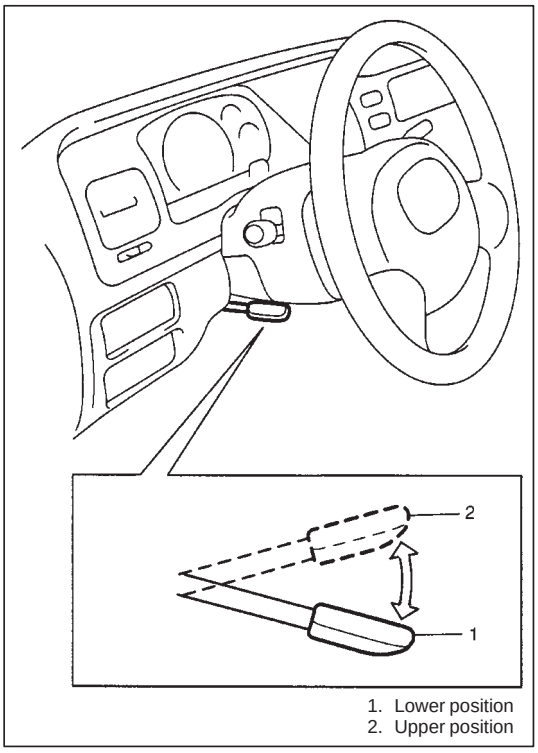
   Length "a": 895 ± 0.8 mm (35.24 ± 0.03 in.)



1. Steering column lower seal

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

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



1. Lower position
2. Upper position

ADJUSTABLE STEERING COLUMN RELEASE LEVER

INSPECTION

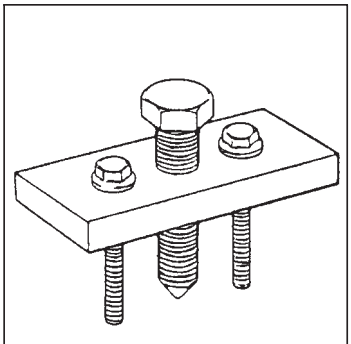
Check to make sure that the following:

- Steering column moves smoothly when adjustable steering column release lever is at lower position (i.e., steering column is not locked).
- Steering column is fixed securely when adjustable steering column release lever is at higher position (i.e., steering column is locked).

TIGHTENING TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Steering shaft nut	33	3.3	23.5
Steering column mounting bolt	23	2.3	17.0
Steering shaft joint bolt	25	2.5	18.0
Steering lower shaft assembly lower joint bolt	25	2.5	18.0

SPECIAL TOOL



09944-36011
Steering wheel remover

SECTION 3C1

AIR BAG STEERING WHEEL AND COLUMN

WARNING:

- **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 disable the air bag system temporarily and prevent false diagnostic trouble codes from setting. Failure to follow procedures could result in possible activation of the air bag system, personal injury or otherwise unneeded air bag system repairs.**

CAUTION:

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

CONTENTS

GENERAL DESCRIPTION 3C1- 2
DIAGNOSIS 3C1- 3
Inspection and Repair Required after Accident 3C1- 3
ON-VEHICLE SERVICE 3C1- 3
Service Precautions 3C1- 3
Diagnosis and Servicing 3C1- 3
Disabling Air Bag System 3C1- 3
Enabling Air Bag System 3C1- 3
Handling and Storage 3C1- 3
Disposal 3C1- 3
Driver Air Bag (Inflator) Module 3C1- 4
Steering Wheel 3C1- 6
Centering Contact Coil 3C1- 6
Contact Coil and Combination Switch Assembly 3C1- 7
Steering Column 3C1- 9
Steering Lock Assembly (Ignition Switch) 3C1-14
Steering Lower Shaft Assembly 3C1-15
Checking Steering Column for Accident Damage 3C1-17
Adjustable Steering Column Release Lever 3C1-18
TIGHTENING TORQUE SPECIFICATIONS 3C1-18
SPECIAL TOOL 3C1-18

GENERAL DESCRIPTION

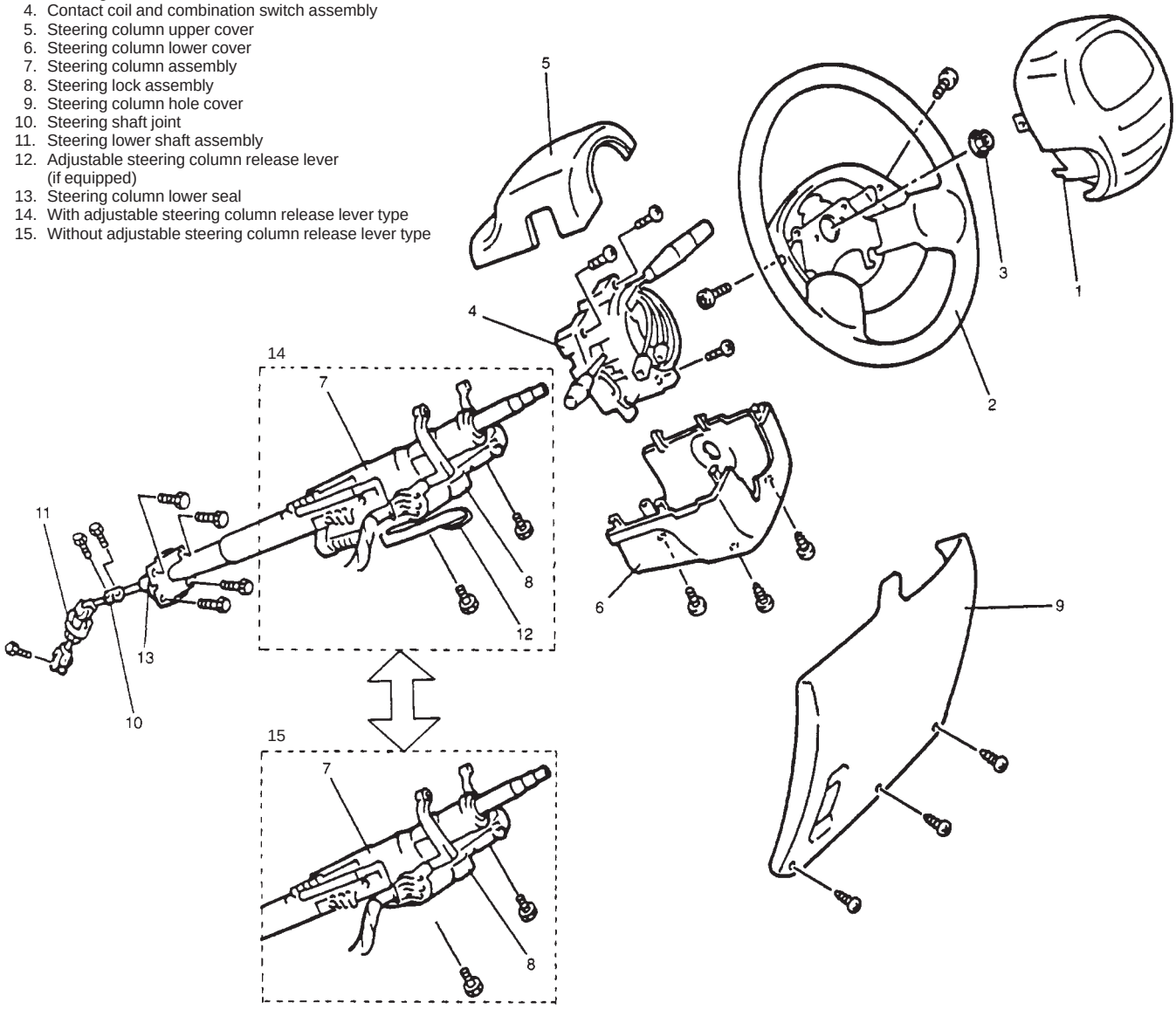
This double tube type steering column has the following three important features in addition to the steering function:

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

To insure the energy absorbing action, it is important that only the specified screws, bolts, and nuts be used as designated and that they are tightened to the specified torque. When the column assembly is removed from the vehicle, special care must be taken in handling it. Use of a steering wheel puller other than the one recommended in this manual or a sharp blow on the end of the steering shaft, leaning on the assembly, or dropping the assembly could shear the plastic shear pins which maintain column length and position.

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

1. Driver air bag (inflator) module
2. Steering wheel
3. Steering wheel nut
4. Contact coil and combination switch assembly
5. Steering column upper cover
6. Steering column lower cover
7. Steering column assembly
8. Steering lock assembly
9. Steering column hole cover
10. Steering shaft joint
11. Steering lower shaft assembly
12. Adjustable steering column release lever (if equipped)
13. Steering column lower seal
14. With adjustable steering column release lever type
15. Without adjustable steering column release lever type



DIAGNOSIS

For diagnosis of the steering wheel and steering 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 FOR ACCIDENT DAMAGE” in this section as well as “REPAIRS AND INSPECTIONS REQUIRED AFTER ACCIDENT” in Section 10B.

ON-VEHICLE SERVICE

SERVICE PRECAUTIONS

For service precautions, refer to “SERVICE PRECAUTIONS” under “ON-VEHICLE SERVICE” in Section 10B.

DIAGNOSIS AND SERVICING

For diagnosis and servicing, refer to “DIAGNOSIS AND SERVICING” 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

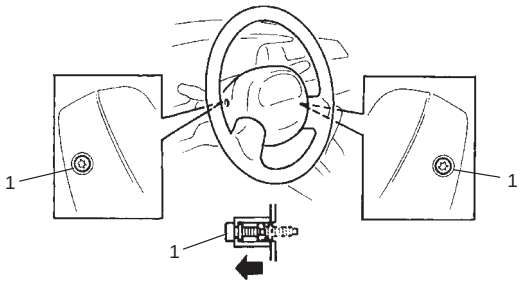
For disposal, refer to “DISPOSAL” under “SERVICE PRECAUTIONS” in Section 10B.

DRIVE AIR BAG (INFLATOR) MODULE

WARNING:
When handling an air bag (inflator) module, be sure to read "SERVICE PRECAUTIONS" under "ON-VEHICLE SERVICE" 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.

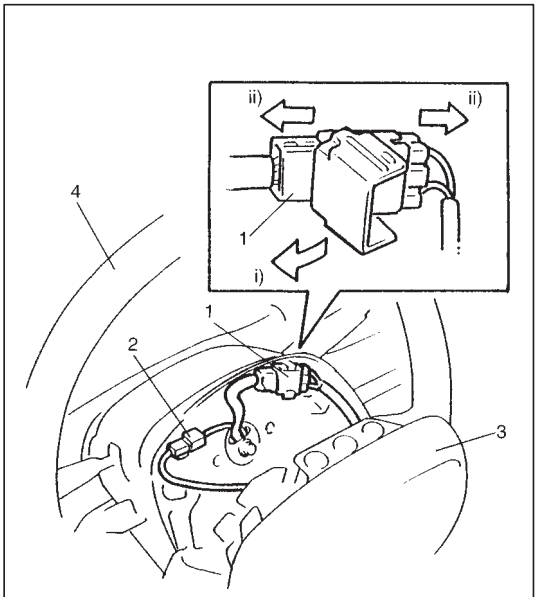
REMOVAL

1) Disconnect negative battery cable at battery terminal.
2) Disable air bag system. Refer to "DISABLING AIR BAG SYSTEM" under "SERVICE PRECAUTIONS" in Section 10B.



1. Mounting bolt

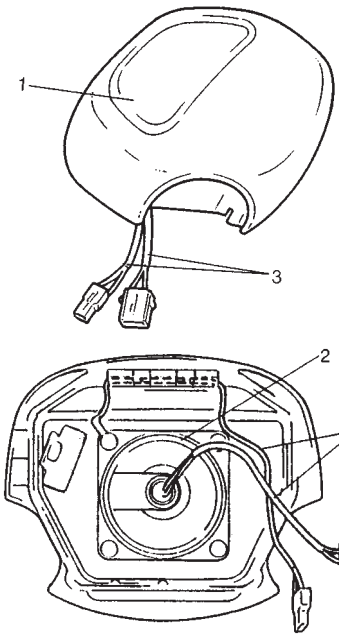
3) Loosen 2 bolts mounting driver air bag (inflator) module till it turns freely, pull them out and fix them to bolt clamps.
4) Remove air bag (inflator) module from steering wheel.



1. Driver air bag (inflator) module connector
2. Horn connector
3. Driver air bag (inflator) module
4. Steering wheel

5) Remove driver air bag (inflator) module (yellow) connector and horn connector from steering wheel.
6) Disconnect driver air bag (inflator) module (yellow) connector of driver air bag (inflator) module and horn connector as shown in the figure.
   i) Release locking of lever.
   ii) After unlocked, disconnect connector.

WARNING:
Special care is necessary when handling and storing a live (undeployed) air bag (inflator) module. Observe "SERVICE PRECAUTIONS" under "ON-VEHICLE SERVICE" in Section 10B. Otherwise, personal injury may result.



1. Trim cover (pad surface)
2. Inflator case
3. Wire harness

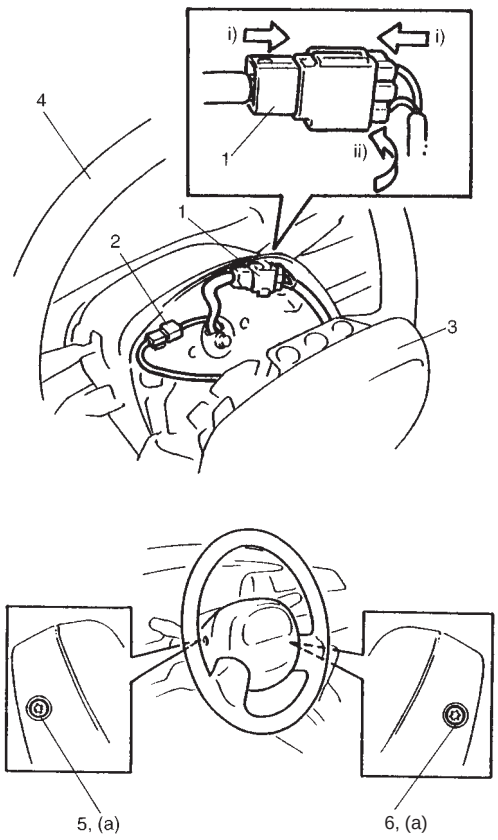
INSPECTION

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

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

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

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



1. Driver air bag (inflator) module connector
2. Horn connector
3. Driver air bag (inflator) module
4. Steering wheel
5. Mounting bolt (left side)
6. Mounting bolt (right side)

INSTALLATION

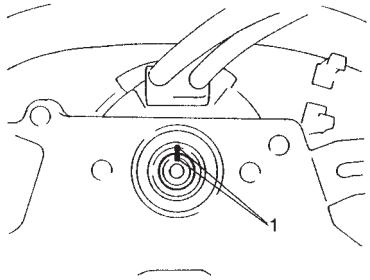
1) Connect horn connector securely.
2) Connect yellow connector of driver air bag (inflator) module connector as shown in the figure securely.
   i) Connect connector.
   ii) Lock connector with lock lever.
3) Install horn connector and driver air bag (inflator) module connector.
4) Install driver air bag (inflator) module to steering wheel, taking care so that no part of wire harness is caught between them.
5) Make sure that clearance between module and steering wheel is uniform all the way.
6) Tighten driver air bag (inflator) module mounting bolt (left side) to specified torque first and then driver air bag (inflator) module mounting bolt (right side) to specified torque.

   Tightening Torque
   (a): 9 N·m (0.9 kg-m, 6.5 lb-ft)

7) Connect negative battery cable.
8) Enable air bag system. Refer to “ENABLING AIR BAG SYSTEM” under “SERVICE PRECAUTIONS” in Section 10B.

STEERING WHEEL

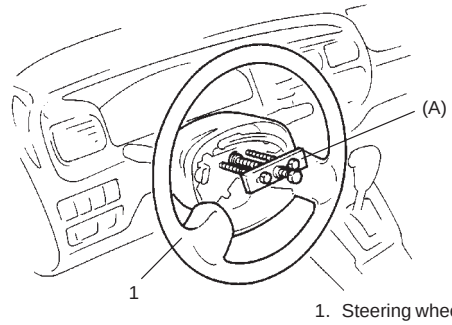
CAUTION:
Removal of the steering wheel allows the contact coil to turn freely but do not turn the contact coil (on the combination switch) more than allowable number of turns (about two and a half turns from the center position clockwise or counterclockwise respectively), or coil will break.



1. Make alignment marks

REMOVAL

1) Remove driver air bag (inflator) module from steering wheel referring to “DRIVER AIR BAG (INFLATOR) MODULE” earlier in this section.
2) Remove steering shaft nut.
3) Make alignment marks on steering wheel and shaft for a guide during reinstallation.



1. Steering wheel

4) Remove steering wheel with special tool.

Special Tool
(A): 09944-36011

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

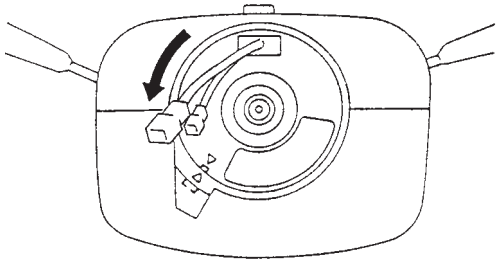
CENTERING CONTACT COIL

1) Check that vehicle’s wheels (front tires) are set at straight-ahead position.
2) Check that ignition switch is at “LOCK” position.
3) Turn contact coil counterclockwise slowly with a light force till contact coil will not turn any further.

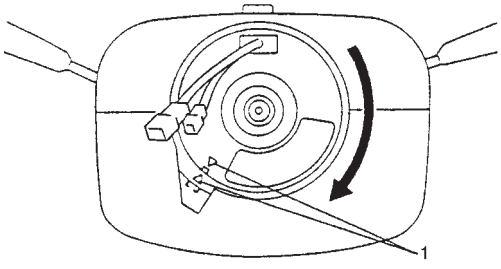
NOTE:
Contact coil can turn about 5 turns at maximum, that is, if it is at the center position, can turn about two and a half turns both clockwise and counterclockwise.

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

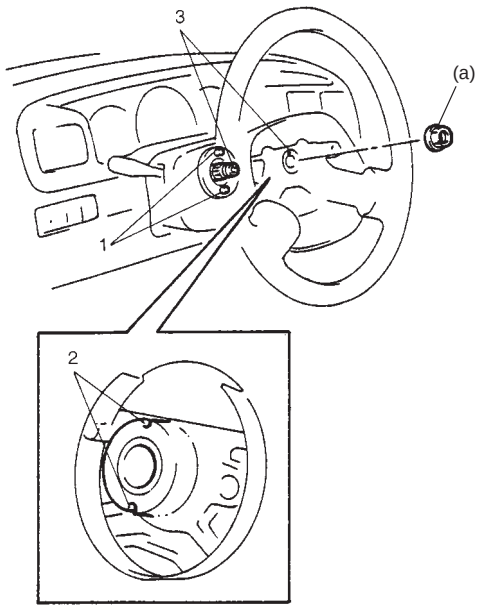
Turn slowly till coil stops



Turn contact coil back about 2 and a half turns



1. Align marks



1. Lugs
2. Grooves
3. Alignment marks

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.

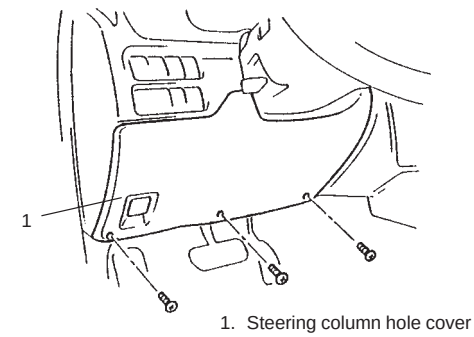
2) Install steering wheel to steering shaft with 2 lugs on contact coil fitted in two grooves in the back of steering wheel and also aligning marks on steering wheel and steering shaft.
3) Tighten steering shaft nut to specified torque.

Tightening Torque
(a): 33 N·m (3.3 kg-m, 23.5 lb-ft)

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

CONTACT COIL AND COMBINATION SWITCH ASSEMBLY

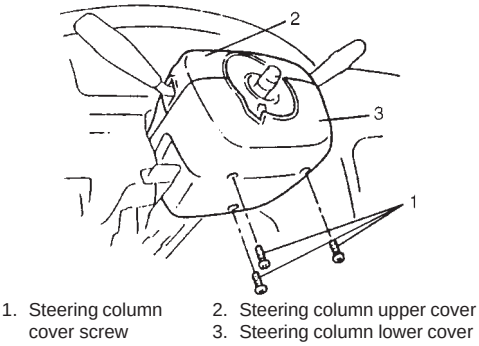
CAUTION:
Do not turn contact coil (on combination switch) more than allowable number of turns (about two and a half turns from the center position clockwise or counterclockwise respectively), or coil will break.



1. Steering column hole cover

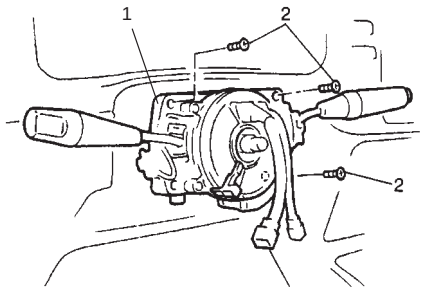
REMOVAL

1) Remove steering wheel from steering column. Refer to "STEERING WHEEL" in this section.
2) Remove steering column hole cover.



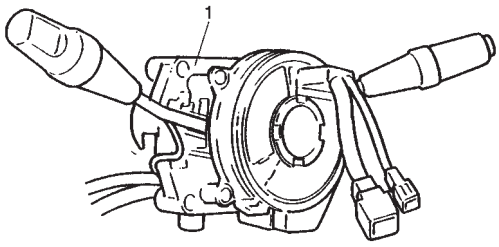
1. Steering column cover screw
2. Steering column upper cover
3. Steering column lower cover

3) Remove steering column cover screws (3 pieces).
4) Separate upper cover and lower cover, then remove them.
5) Disconnect all connectors for contact coil and combination switch assembly.



1. Contact coil and combination switch assembly
2. Screw

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



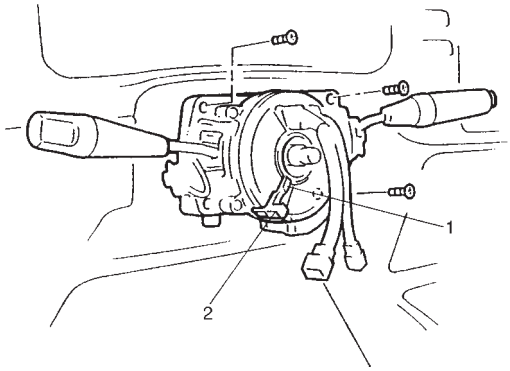
1. Contact coil and combination switch assembly

INSPECTION

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

INSTALLATION

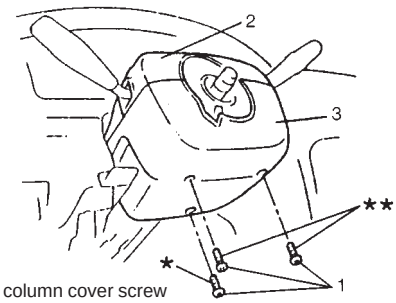
1) Check to make sure that vehicle's front tires are set at straight-ahead position and then ignition switch is at "LOCK" position.



1. Seal (if equipped, remove lock pin after installing contact coil and combination switch assembly.)
2. Lock pin (if equipped, remove lock pin after installing contact coil and combination switch assembly.)

2) Install contact coil and combination switch assembly 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 and seal. Remove this lock pin after installing contact coil and combination switch assembly to steering column.

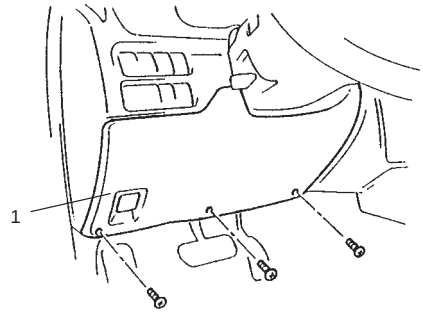


1. Steering column cover screw
2. Steering column upper cover
3. Steering column lower cover

*: Standard screw
**: Tapping screw

3) Connect all connectors that have been removed in removal.
4) Install steering column upper and lower cover, and then tighten steering column cover screws.

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



1. Steering column hole cover

5) Install steering column hole cover.
6) Install steering wheel to steering column. Refer to “STEERING WHEEL” in this section.

STEERING COLUMN

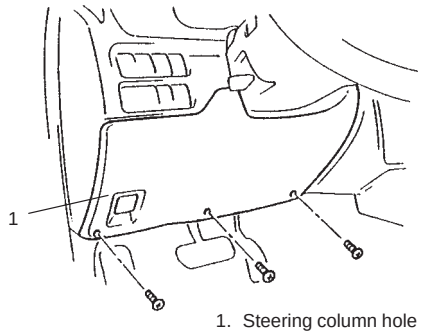
CAUTION:
Once the steering column is removed from the vehicle, the column is extremely susceptible to damage.
Dropping the column assembly on its end could collapse the steering shaft or loosen the plastic shear pins which maintain column length leaning on the column assembly could cause it to bend or deform.
Any of the above damage could impair the column’s collapsible design.
When loosening steering column mounting bolts, make sure that steering column assembly and steering shaft lower assembly have been separated. Loosening them with steering column assembly and steering shaft lower assembly assembled could cause damage to bearing in steering shaft lower assembly.

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

REMOVAL

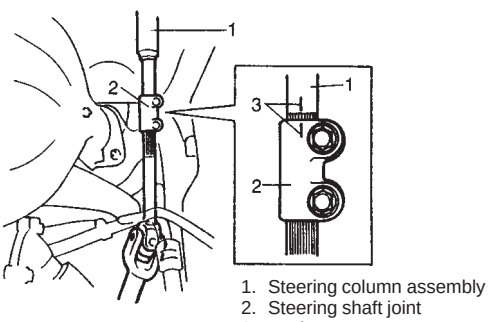
WARNING:
Never rest a steering column assembly on the steering wheel with air bag (inflator) module face down and column vertical. Otherwise personal injury may result.

1) Disconnect negative battery cable at battery terminal.
2) Disable air bag system. Refer to “DISABLING AIR BAG SYSTEM” under “SERVICE PRECAUTIONS” in Section 10B.
3) Remove steering wheel and contact coil and combination switch assembly, if necessary. Refer to “STEERING WHEEL” and “CONTACT COIL AND COMBINATION SWITCH ASSEMBLY” in this section.
   Perform the following procedure if not removing steering wheel and/or combination switch.
   i) Turn steering wheel so that vehicle’s front tires are at straight-ahead position.
   ii) Turn ignition switch to “LOCK” position and remove key.



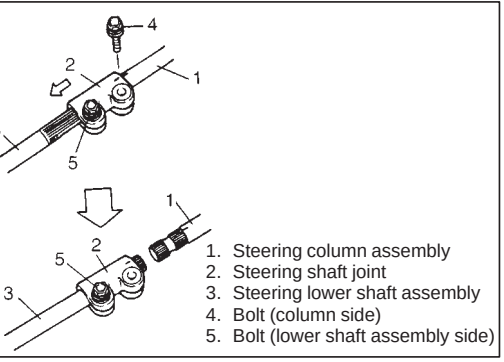
1. Steering column hole cover

4) Remove steering column hole cover.
5) Disconnect all connectors for the following parts.
   - Contact coil and combination switch
   - Ignition switch



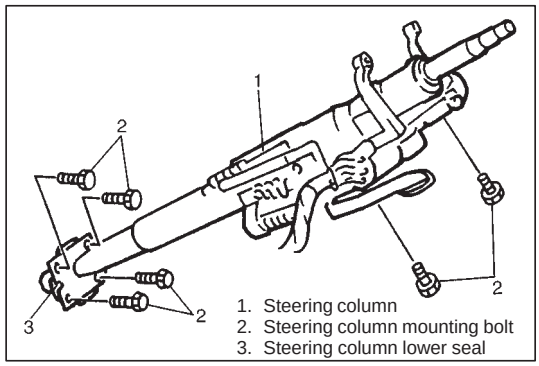
1. Steering column assembly
2. Steering shaft joint
3. Marks

6) Make alignment marks on shaft joint and shaft (column side) for a guide during reinstallation.



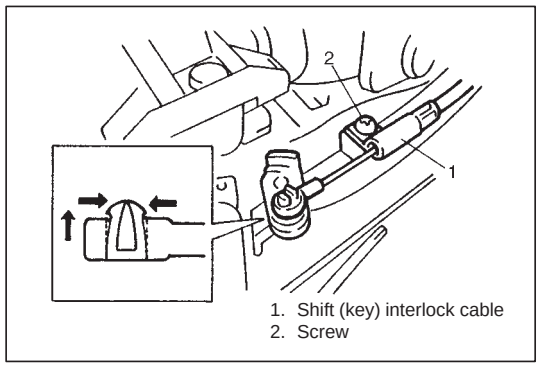
1. Steering column assembly
2. Steering shaft joint
3. Steering lower shaft assembly
4. Bolt (column side)
5. Bolt (lower shaft assembly side)

7) After removing bolt on column side of shaft joint and loosening bolt on its lower shaft assembly side, move shaft joint to lower shaft assembly side (in arrow direction in the figure).



1. Steering column
2. Steering column mounting bolt
3. Steering column lower seal

8) Remove steering column mounting bolts (6 pieces).

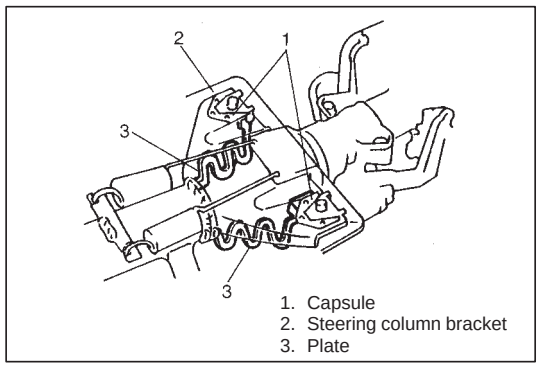


1. Shift (key) interlock cable
2. Screw

9) If equipped with shift (key) interlock cable, remove shift (key) interlock cable screw and then disconnect its cable from ignition switch.
10) Remove steering column from vehicle.

INSPECTION

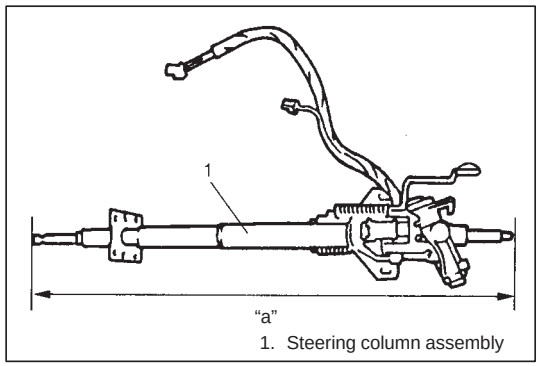
NOTE:
Vehicles involved in accidents resulting in body damage, where steering column has been impacted or air bag deployed, may have a damaged or misaligned steering column.



1. Capsule
2. Steering column bracket
3. Plate

CHECKING PROCEDURE

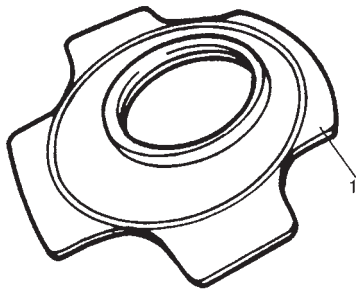
1) Check that two capsules are attached to steering column bracket securely. Check clearance between capsules and steering column bracket. Clearance should be 0 mm (0 in.) on both sides. If found loose or clearance, replace steering column assembly.
2) Check two plates for any damages such as crack or breakage. If anything is found faulty, replace as steering column assembly.



1. Steering column assembly

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

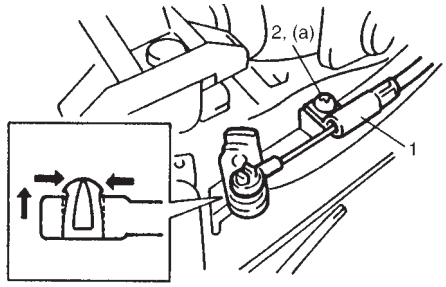
Length "a": 895 ± 0.8 mm (35.24 ± 0.03 in.)



1. Steering column lower seal

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

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

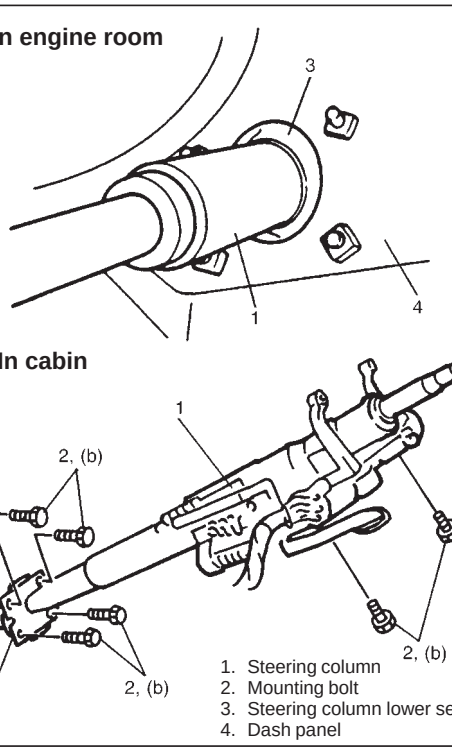


1. Shift (key) interlock cable
2. Screw

INSTALLATION

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

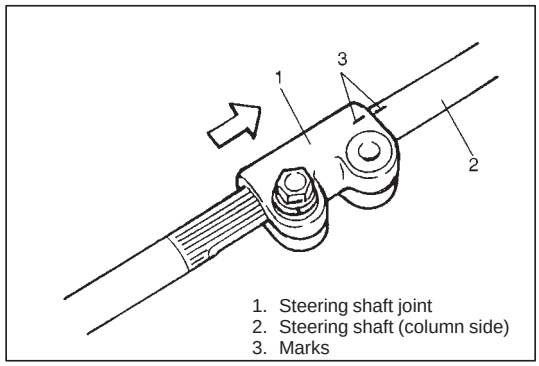
1) Be sure that front wheels and steering wheel are in straight-ahead position.
2) If equipped with shift (key) interlock cable, install shift (key) interlock cable to ignition switch.
   Tightening Torque
   (a): 2.2 N·m (0.22 kg-m, 1.6 lb-ft)



1. Steering column
2. Mounting bolt
3. Steering column lower seal
4. Dash panel

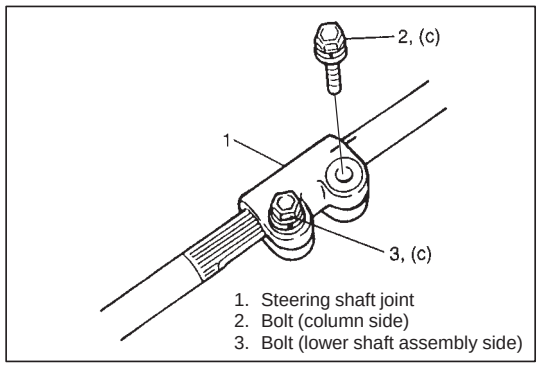
3) Install steering column assembly to dash panel and upper bracket so that boss of steering column lower seal and all around it project out of hole in dash panel into engine room. Tighten steering column lower bolts (4 pieces) first and then upper bolts (2 pieces) to specified torque.

   Tightening Torque
   (b): 23 N·m (2.3 kg-m, 17.0 lb-ft)



1. Steering shaft joint
2. Steering shaft (column side)
3. Marks

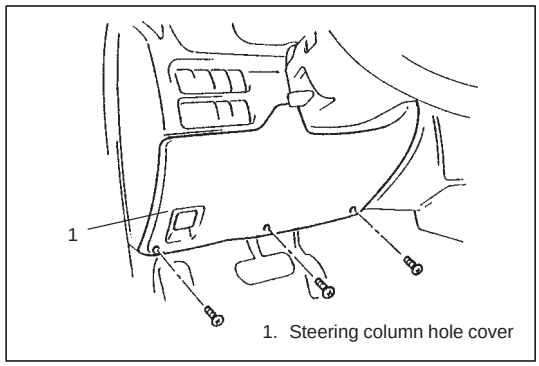
4) Install steering shaft joint to steering shaft by matching it to marks made before removal.



1. Steering shaft joint
2. Bolt (column side)
3. Bolt (lower shaft assembly side)

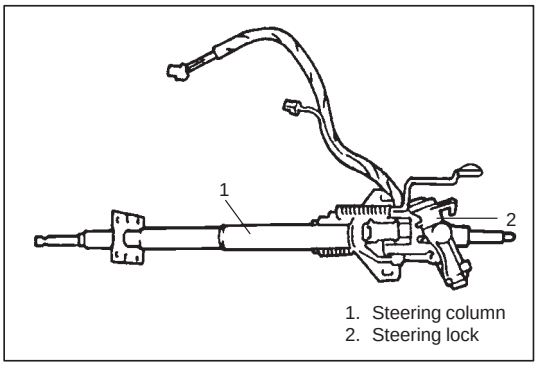
5) Install shaft joint bolt (column side) to steering shaft joint. Tighten shaft joint bolt (column side) to specified torque first and then shaft joint bolt (lower shaft assembly side) to specified torque.

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



1. Steering column hole cover

6) If contact coil and combination switch assembly is removed, install it, referring to “CONTACT COIL AND COMBINATION SWITCH ASSEMBLY” in this section.
7) Connect all connectors that have been removed in removal.
8) Install steering column hole cover.
9) If steering wheel is removed, install it by referring to “STEERING WHEEL” in this section.
10) Connect negative battery cable.
11) After installing steering column assembly, be sure to enable air bag system by referring to “ENABLING AIR BAG SYSTEM” under “SERVICE PRECAUTIONS” in Section 10B.

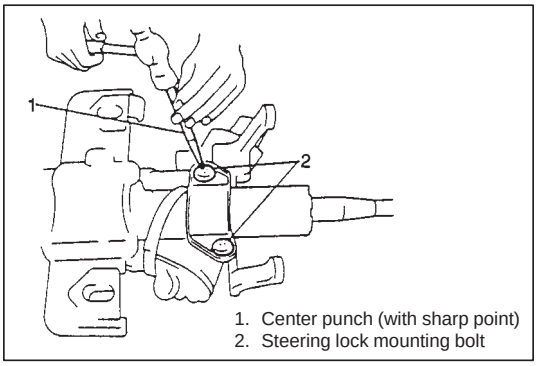


1. Steering column
2. Steering lock

STEERING LOCK ASSEMBLY (IGNITION SWITCH)

REMOVAL

1) Remove steering column. Refer to “STEERING COLUMN” in this section.



1. Center punch (with sharp point)
2. Steering lock mounting bolt

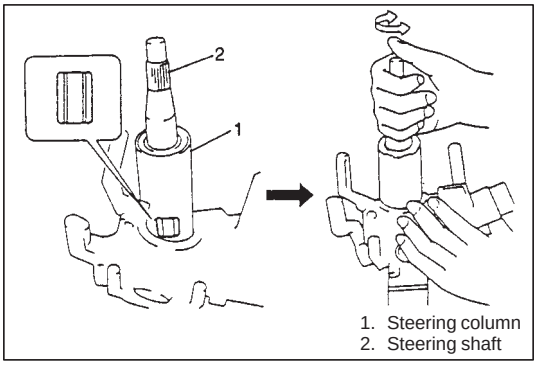
2) Using center punch as shown, loosen and remove steering lock mounting bolts.

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

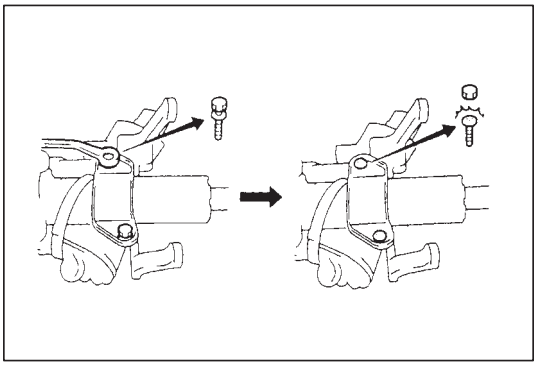
3) Turn ignition key to “ACC” or “ON” position and remove steering lock assembly from steering column.

INSTALLATION

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



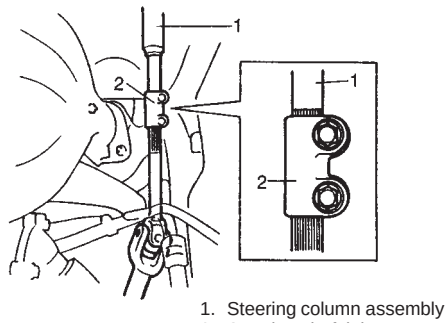
1. Steering column
2. Steering shaft



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

STEERING LOWER SHAFT ASSEMBLY

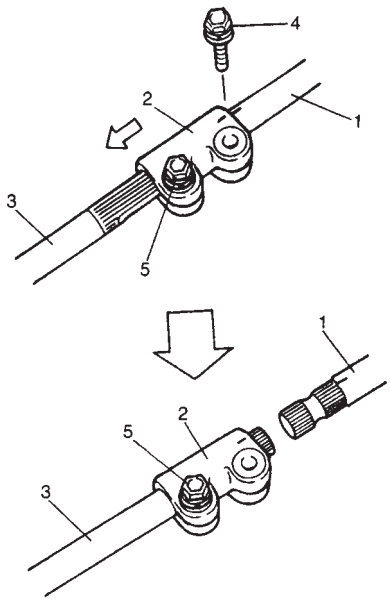
CAUTION:
Never turn steering wheel while steering lower shaft assembly is removed.
Should it have been turned and contact coil (on combination switch) have got out of its centered position, it needs to be centered again. Also, turning steering wheel more than about two and a half turns will break contact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



1. Steering column assembly
2. Steering shaft joint

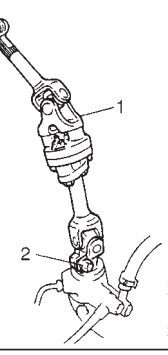
REMOVAL

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



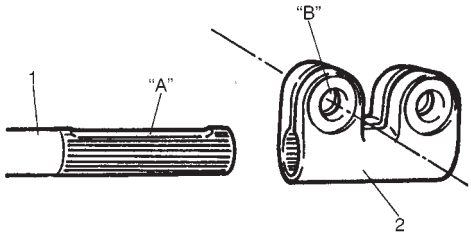
1. Steering column assembly
2. Steering shaft joint
3. Steering lower shaft assembly
4. Bolt (column side)
5. Bolt (lower shaft assembly side)

3) After removing bolt on column side of shaft joint and loosening bolt on its lower shaft assembly side, move shaft joint to lower shaft assembly side (in arrow direction in figure).



1. Steering lower shaft assembly
2. Steering lower shaft assembly lower joint bolt
3. Steering shaft joint

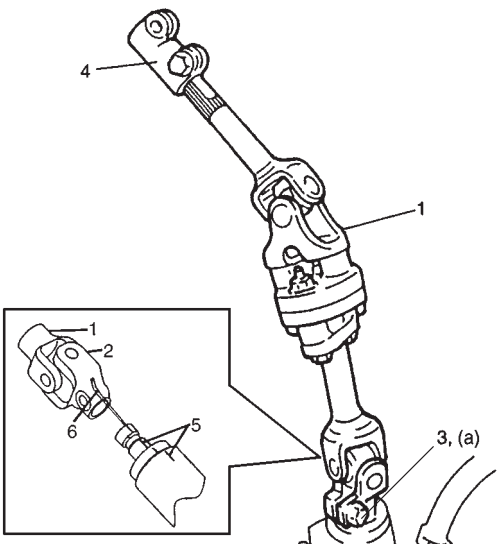
4) Remove lower shaft assembly lower joint bolt and then remove lower shaft assembly.
5) Remove shaft joint bolt (lower shaft assembly side) from shaft joint and then remove shaft joint from lower shaft assembly.



1. Steering shaft joint
2. Steering lower shaft assembly

INSTALLATION

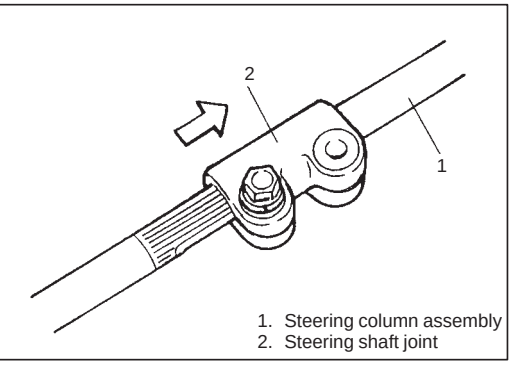
1) Be sure that front wheels and steering wheel are in straight ahead position.
2) Align flat part "A" of lower shaft assembly with bolt hole "B" of shaft joint as shown. Then insert shaft joint into lower shaft assembly.
3) Install shaft joint bolt (lower shaft assembly side) to shaft joint. Then tighten it by hand.



1. Steering lower shaft assembly
2. Steering lower shaft assembly lower joint
3. Steering lower shaft assembly lower joint bolt
4. Steering shaft joint
5. Mark
6. Slit

4) Insert pinion shaft into lower shaft assembly lower joint with slit of lower joint, marks on pinion shaft and gear case aligned. And then install lower shaft assembly lower joint bolt to lower shaft assembly lower joint. Tighten it to specified torque.

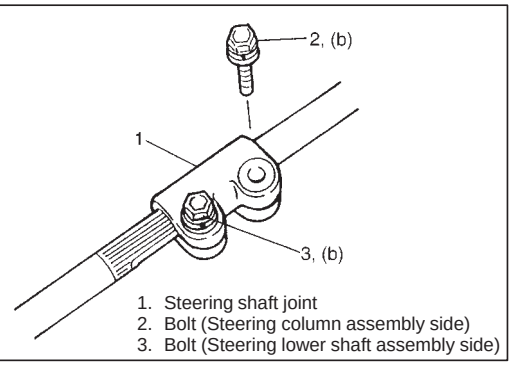
Tightening Torque
(a): 25 N·m (2.5 kg-m, 18.0 lb-ft)



1. Steering column assembly
2. Steering shaft joint

5) Install steering shaft joint to steering shaft.

NOTE:
Be sue that front wheels and steering wheel are in straight-ahead position.



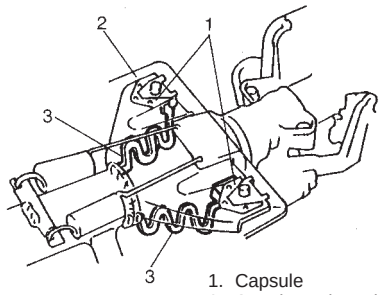
1. Steering shaft joint
2. Bolt (Steering column assembly side)
3. Bolt (Steering lower shaft assembly side)

6) Install shaft joint bolt (column side) to shaft joint. Tighten shaft joint bolt (column side) to specified torque first and then shaft joint bolt (shaft lower assembly side) to specified torque.

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

CHECKING STEERING COLUMN FOR ACCIDENT DAMAGE

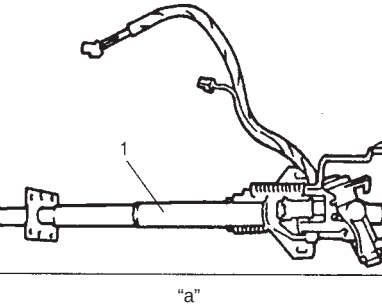
NOTE:
Vehicles involved in accidents resulting in body damage, where steering column has been impacted or air bag deployed, may have a damaged or misaligned steering column.



1. Capsule
2. Steering column bracket
3. Plate

CHECKING PROCEDURE

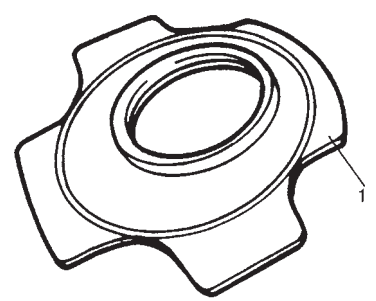
1) Check that two capsules are attached to steering column bracket securely. Check clearance between capsules and steering column bracket. Clearance should be 0 mm (0 in.) on both sides.
   If found loose or clearance, replace steering column assembly.
2) Check two plates for any damages such as crack or breakage.
   If anything is found faulty, replace as steering column assembly.



1. Steering column assembly

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

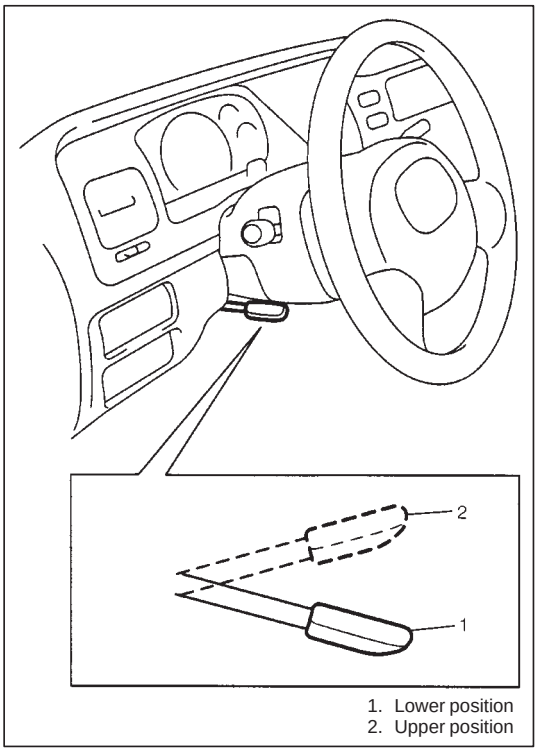
   Length "a": 895 ± 0.8 mm (35.24 ± 0.03 in.)



1. Steering column lower seal

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

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



1. Lower position
2. Upper position

ADJUSTABLE STEERING COLUMN RELEASE LEVER

INSPECTION

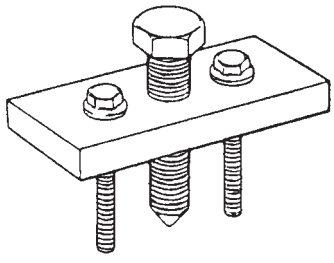
Check to make sure that the following:

- Steering column moves smoothly when adjustable steering column release lever is at lower position (i.e., steering column is not locked).
- Steering column is fixed securely when adjustable steering column release lever is at upper position (i.e., steering column is locked).

TIGHTENING TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Driver air bag (inflator) module bolt	9	0.9	6.5
Steering shaft nut	33	3.3	23.5
Steering column mounting bolt	23	2.3	17.0
Steering shaft joint bolt	25	2.5	18.0
Steering lower shaft assembly lower joint bolt	25	2.5	18.0
Shift (key) interlock cable screw	2.2	0.22	1.6

SPECIAL TOOL



09944-36011
Steering wheel remover

SECTION 3D

FRONT SUSPENSION

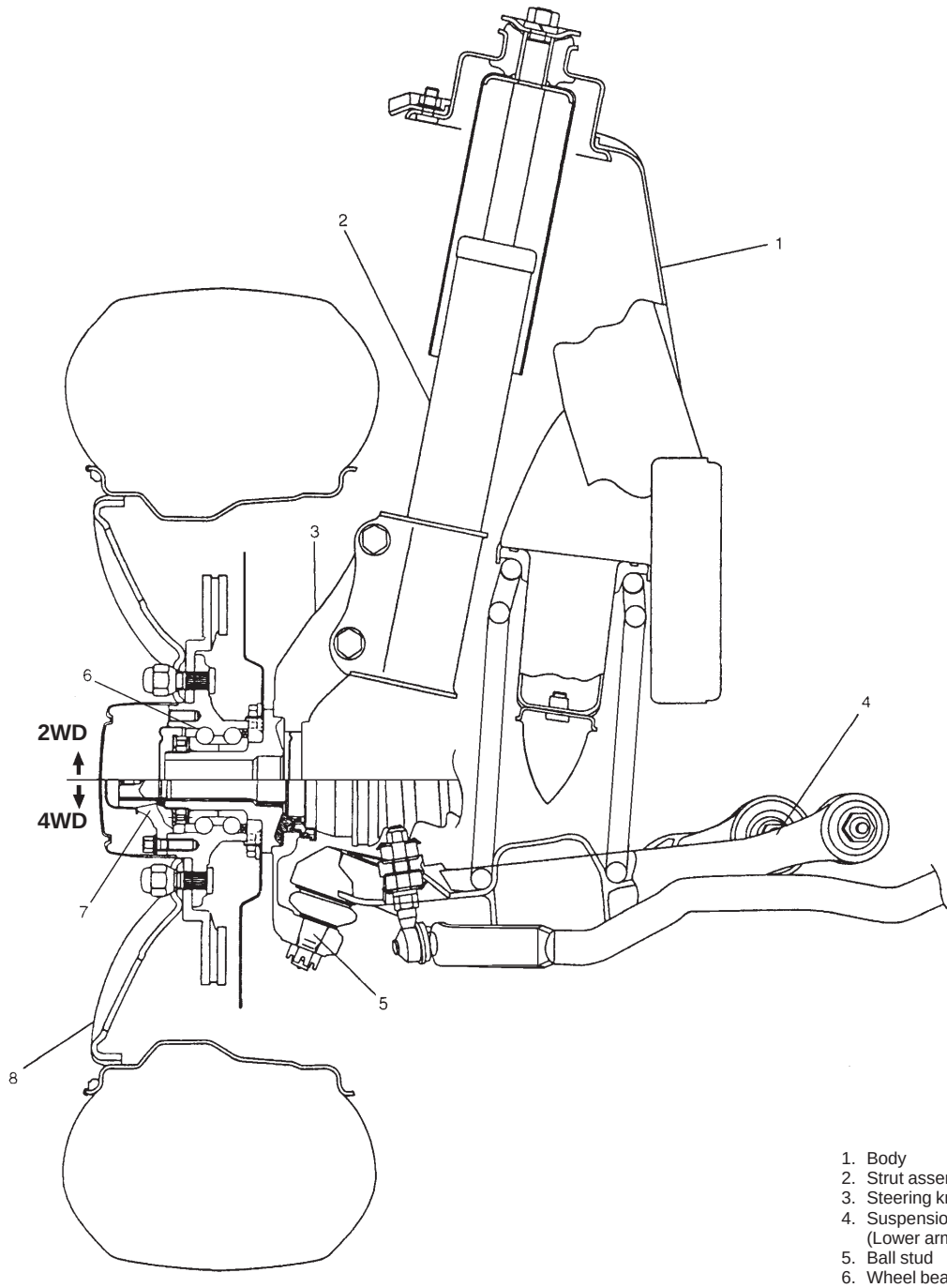
CAUTION:
- **All front suspension fasteners are an important attaching part in that it could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary.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

CONTENTS

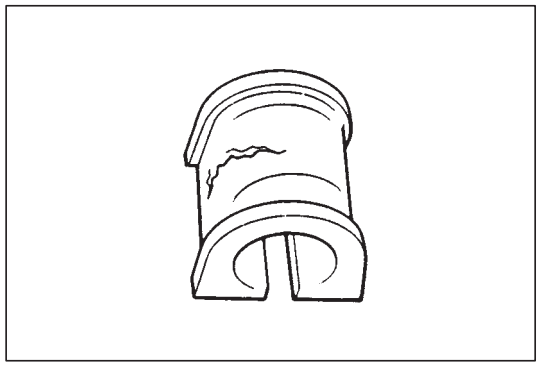
GENERAL DESCRIPTION 3D- 2
DIAGNOSIS 3D- 3
Diagnosis Table 3D- 3
Stabilizer Bar and Bushing Check 3D- 3
Strut Damper and/or Coil Spring Check .. 3D- 3
Suspension Arm/Knuckle Check 3D- 3
Suspension Control Arm Joint Check 3D- 4
Suspension Control Arm Bushing Check . 3D- 4
Wheel Disc, Nut & Bearing Check 3D- 4
ON-VEHICLE SERVICE 3D- 5
Stabilizer Bar/Bushings 3D- 5
Strut Damper 3D- 6
Coil Spring 3D- 8
Bump Stopper/Spring Rubber Seat 3D-11
Wheel Hub (Included Wheel Bearing) ... 3D-12
Knuckle/Wheel Spindle 3D-17
Suspension Control Arm/Bushings 3D-21
TIGHTENING TORQUE SPECIFICATIONS 3D-23
REQUIRED SERVICE MATERIALS 3D-24
SPECIAL TOOLS 3D-25

GENERAL DESCRIPTION

The front suspension is the strut type independent suspension. The upper end of a strut is anchored to the body by a strut support. The strut and strut support are isolated by a 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 stud of a ball joint which is incorporated in a unit with a suspension control arm. And this steering knuckle is connected to 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.



1. Body
2. Strut assembly
3. Steering knuckle
4. Suspension control arm (Lower arm)
5. Ball stud
6. Wheel bearing
7. Axle shaft drive flange
8. Wheel



DIAGNOSIS

DIAGNOSIS TABLE

Refer to Section 3.

STABILIZER BAR AND BUSHING CHECK

BAR

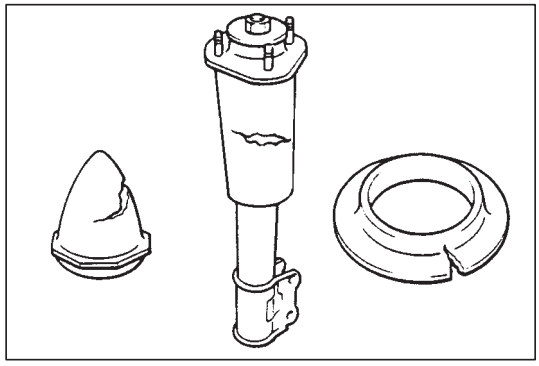
Inspect for damage or deformation. If defective, replace.

BUSHING

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

STRUT DAMPER AND/OR COIL SPRING CHECK

1) Inspect strut for oil leakage. If strut is found faulty, replace it as an assembly unit, because it can not be disassembled.
2) Strut function check
   Check and adjust tire pressures as specified.
   Bounce 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 rebounds before coming to stop after hands are off. Do the same for strut on the other side.
   Compare strut resistance and number of rebound on the right with those on the left.
   And they must be equal in both. With proper strut, body should come to stop the moment hands are off or after only one or two small rebounds. If struts are suspected, compare them with known good vehicle or strut.

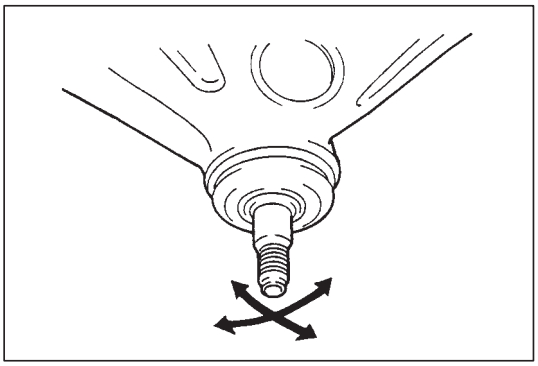


3) Inspect for damage or deformation.
4) Inspect strut boot for damage or crack.
5) Inspect for cracks or deformation in spring seat.
6) Inspect for deterioration of bump stopper.
7) Inspect strut mount for wear, cracks or deformation.

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

SUSPENSION ARM/KNUCKLE CHECK

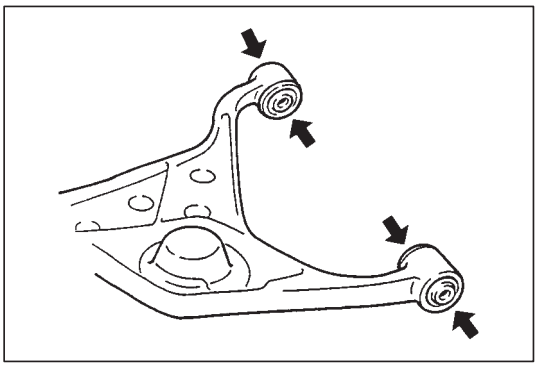
Inspect for cracks, deformation or damage.



SUSPENSION CONTROL ARM JOINT CHECK

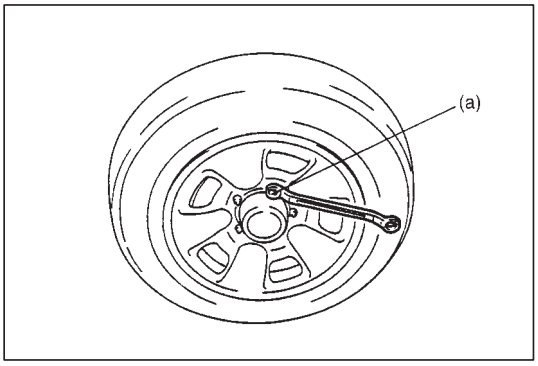
1) Check for smoothness of rotation.
2) Inspect ball stud for damage.
3) Inspect dust cover for damage.

Replace any parts found defective in steps 1) – 3).



SUSPENSION CONTROL ARM BUSHING CHECK

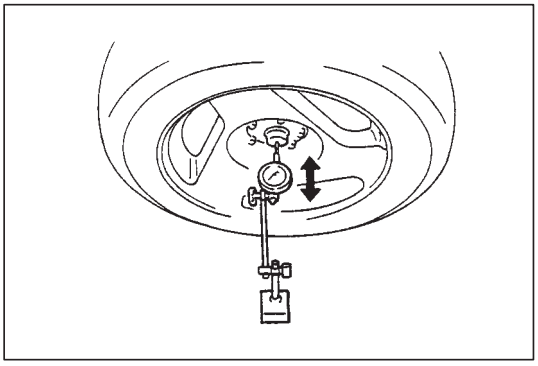
Inspect for damage, wear or deterioration.



WHEEL DISC, NUT & BEARING CHECK

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

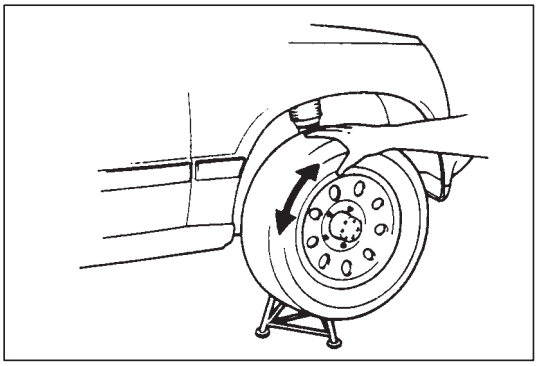
Tightening Torque
(a): 100 N·m (10.0 kg-m, 72.5 lb-ft)



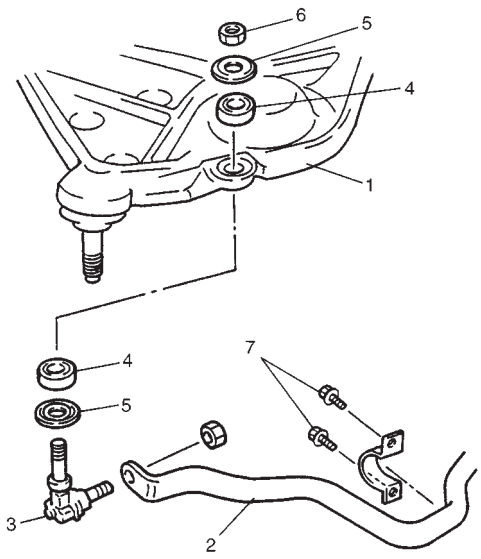
3) Check wheel bearing for wear. After retightening lock nut to specified torque, apply dial gauge to wheel hub center and measure thrust play.

Thrust play limit: 0.05 mm (0.002 in.)

When measurement exceeds limit, replace bearing.



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



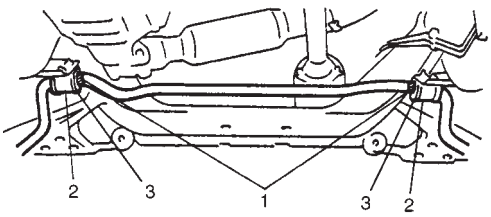
1. Suspension control arm
2. Stabilizer bar
3. Stabilizer ball joint
4. Ball joint bushings
5. Ball joint washers
6. Ball joint nuts
7. Bracket bolts

ON-VEHICLE SERVICE

STABILIZER BAR/BUSHINGS

REMOVAL

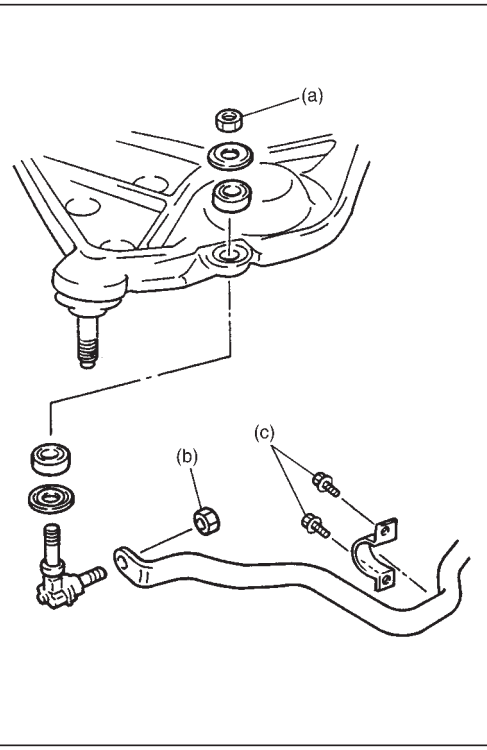
1) Hoist vehicle.
2) Remove stabilizer bar mount bush bracket bolts.
3) Remove stabilizer ball joint nuts, washers and bushings.
4) Remove stabilizer bar with its ball joints.
5) Disconnect stabilizer ball joints from stabilizer bar.



1. Painted
2. Mount bush bracket
3. Mount bush

INSTALLATION

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

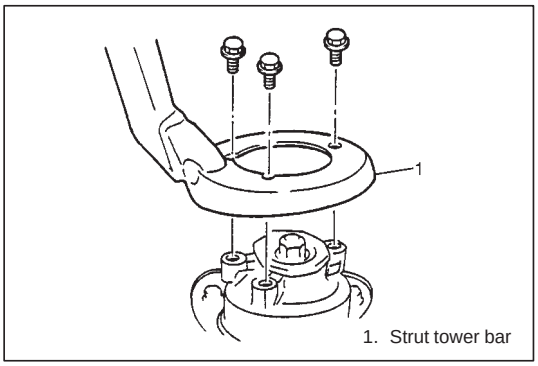


1) Connect stabilizer ball joints and stabilizer bar.
2) Install stabilizer ball joints to control arms.

   NOTE:
   Do not tighten stabilizer ball joint nuts completely.

3) Install stabilizer bar mount bush brackets.
4) When installing stabilizer, loosely assemble all components while insuring that stabilizer is centered, side-to-side.
   Check that ball joint is set at neutral position seeing from body upper side.
5) Tighten stabilizer bracket bolts and stabilizer ball joint nuts to specified torque.

   Tightening Torque
   (a): 29 N·m (2.9 kg-m, 21.0 lb-ft)
   (b): 50 N·m (5.0 kg-m, 36.5 lb-ft)
   (c): 23 N·m (2.3 kg-m, 17.0 lb-ft)

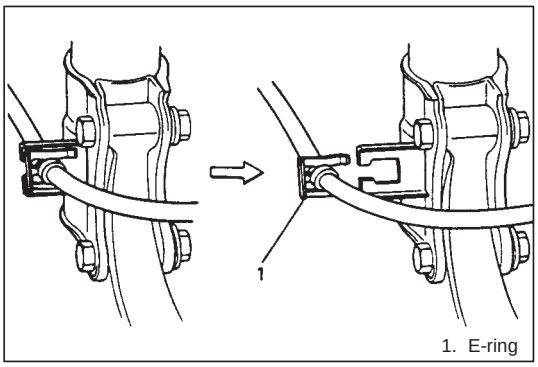


1. Strut tower bar

STRUT DAMPER

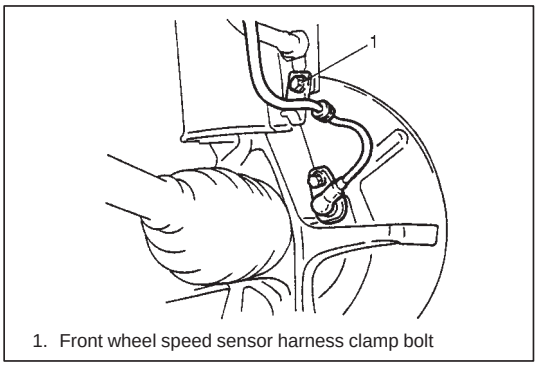
REMOVAL

1) Remove strut tower bar (if equipped).



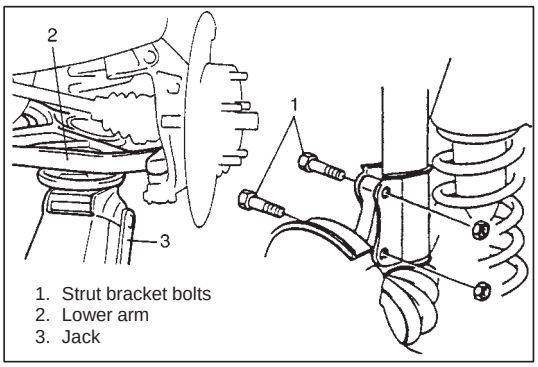
1. E-ring

2) Hoist vehicle, allowing front suspension to hang free.
3) Remove wheel.
4) Remove E-ring securing brake hose and take brake hose off strut bracket as shown.



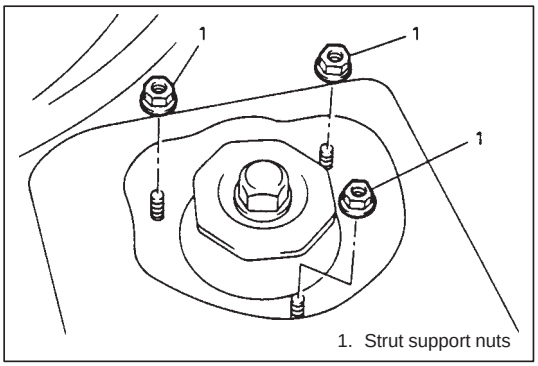
1. Front wheel speed sensor harness clamp bolt

5) If equipped with ABS, remove front wheel speed sensor harness clamp bolt.



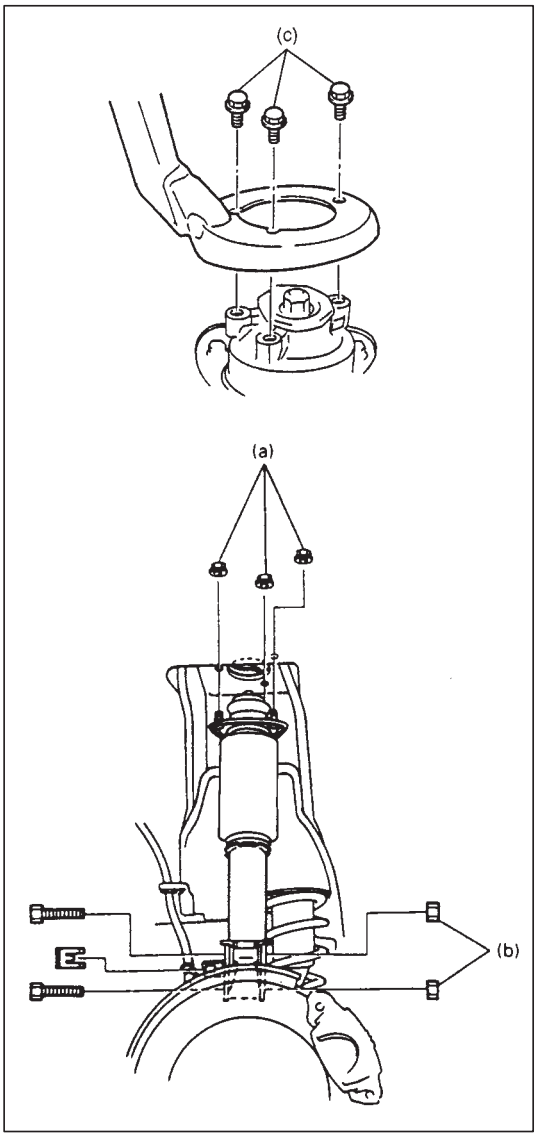
1. Strut bracket bolts
2. Lower arm
3. Jack

6) Remove strut bracket bolts, then support lower arm with jack.



1. Strut support nuts

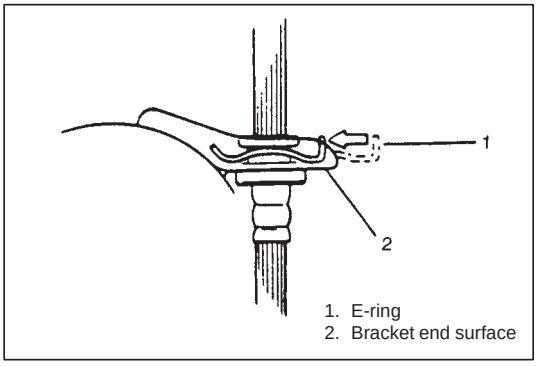
7) Remove strut support nuts.
   Hold strut by hand so that it will not fall off.
8) Remove strut.



INSTALLATION

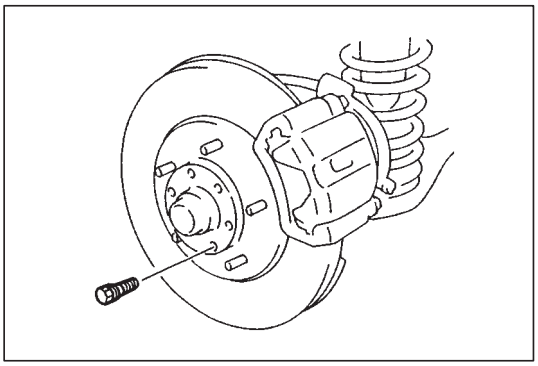
1) Install strut by reversing removal steps 1) – 8). Insert bolts in such a direction as shown.
2) Torque all fasteners to specifications.

Tightening Torque
(a): 55 N·m (5.5 kg-m, 40.0 lb-ft)
(b): 95 N·m (9.5 kg-m, 69.0 lb-ft)
(c): 50 N·m (5.0 kg-m, 36.5 lb-ft)



1. E-ring
2. Bracket end surface

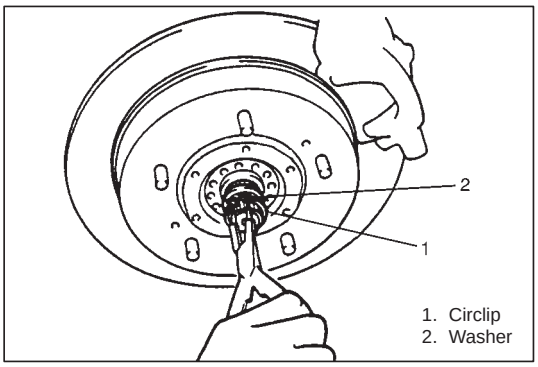
NOTE:
Brake hose installation.
Don't twist hose when installing it. Install E-ring as far as bracket end surface as shown.



COIL SPRING

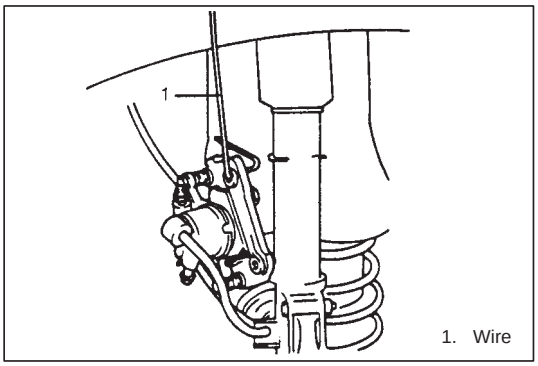
REMOVAL

1) Hoist vehicle, allowing front suspension to hang free.
2) Remove wheels.
3) Remove axle shaft drive flange (For 4WD vehicle).



1. Circlip
2. Washer

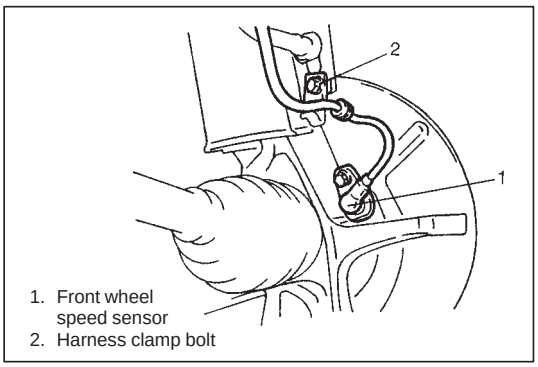
4) Remove front drive shaft circlip and washer (For 4WD vehicle).



1. Wire

5) Remove caliper bolts and suspend caliper with a wire hook.

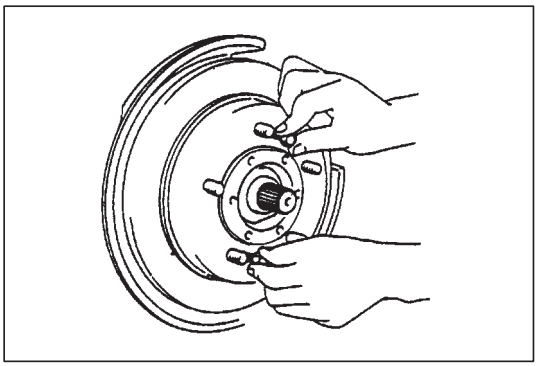
CAUTION:
Hang removed caliper with a wire hook so as to prevent brake hose from bending and twisting excessively or being pulled.
Don't operate brake pedal with pads removed.



1. Front wheel speed sensor
2. Harness clamp bolt

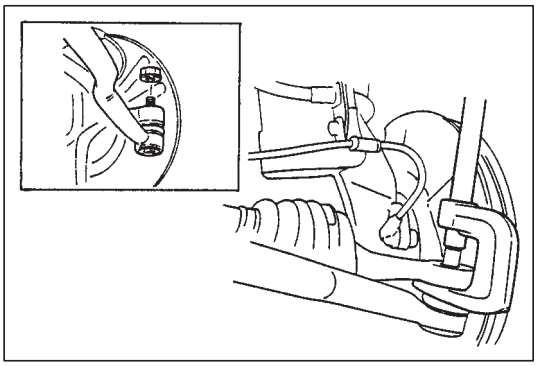
6) If equipped with ABS, remove harness clamp bolt and remove front wheel speed sensor from knuckle.

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.**

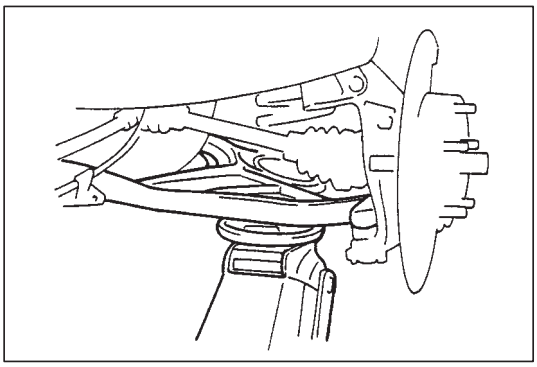


7) Remove brake disc.

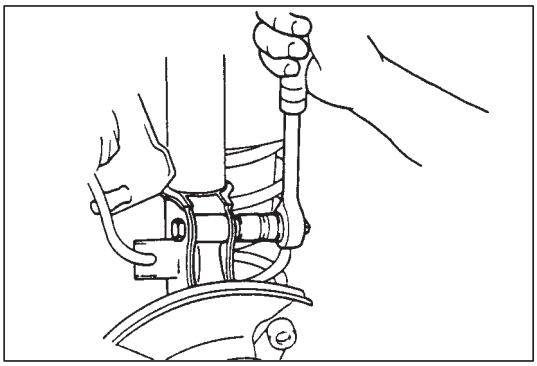
NOTE:
If brake disc can not be removed by hand, use 8 mm bolts as shown.



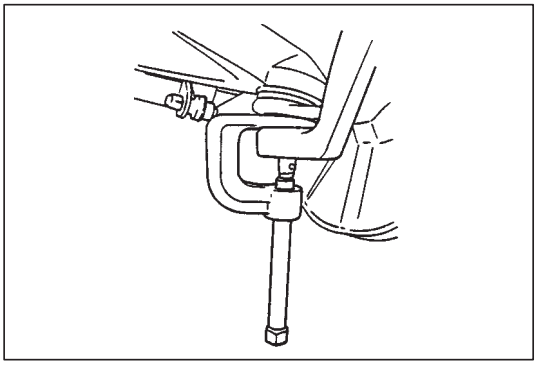
8) Remove stabilizer bar, refer to steps 2) to 5) of item STABILIZER BAR/BUSHINGS REMOVAL in this section.
9) Disconnect tie rod end from knuckle by using puller.



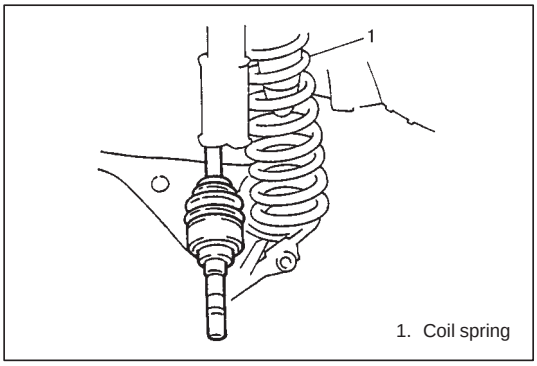
10) Support lower arm, using jack as shown.



11) Remove strut bracket bolts.

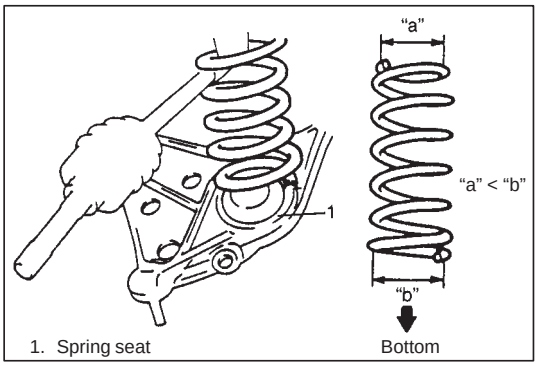


12) Remove ball stud castle nut.
13) Using puller, disconnect knuckle from ball stud.



1. Coil spring

14) Remove knuckle and wheel hub comp, while lowering jack.
15) Remove coil spring.



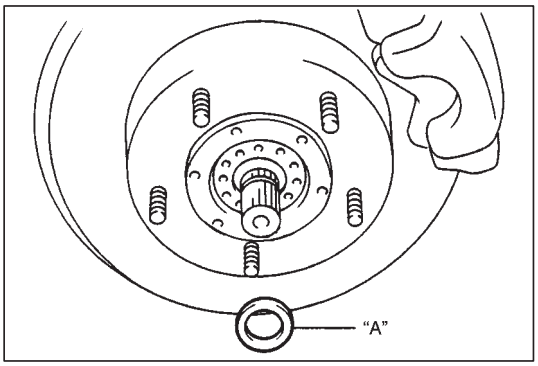
INSTALLATION

Reverse removal procedure to install coil spring.

NOTE:

Upper and lower diameters of coil spring are different. Bring larger diameter end at bottom and set its open end in place on spring seat.

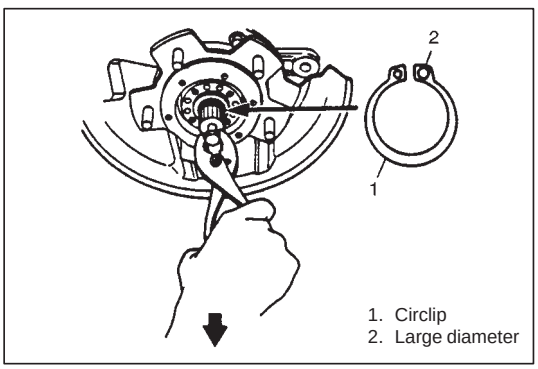
- Be sure to use specified torque for tightening each fastener.
- Refer to torque specification chart at the end of this section.
- As for ball stud nut, be sure to insert split pin and bend it after tightening it.
- Tighten tie-rod end nut with pushing ball stud to upper side so as not ball stud to be rotated.



- For 4WD vehicle

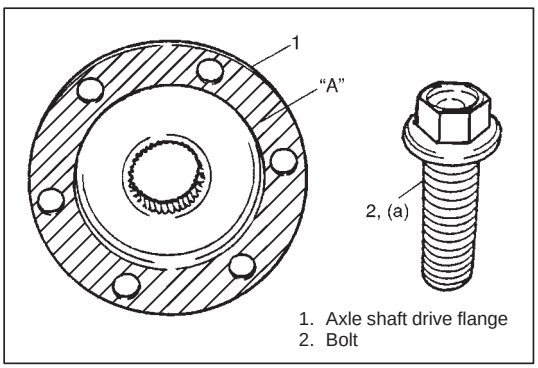
  Apply lithium grease to front drive shaft washer and front wheel spindle outer.

  "A": Grease 99000-25010



- For 4WD vehicle

  When installing circlip to drive shaft, utilize screw hole in drive shaft to pull it out and bring large diameter of circlip at right as shown.

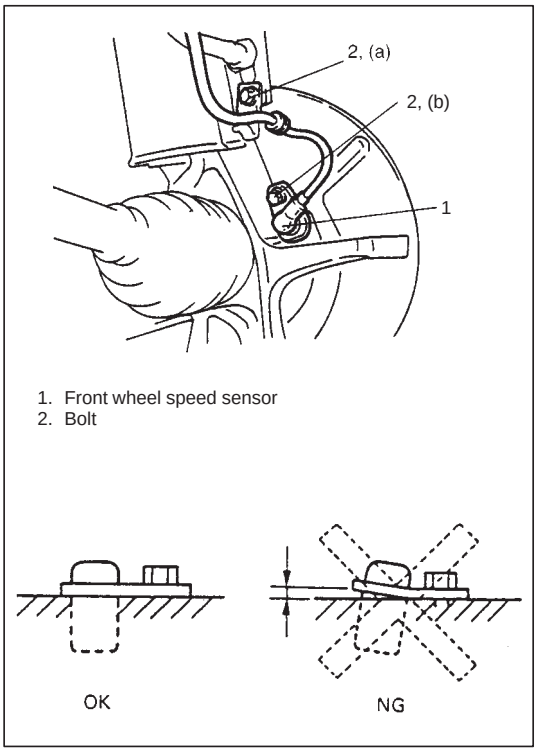


- For 4WD vehicle

  When installing axle shaft drive flange to wheel hub, apply sealant to mating surface of axle shaft drive flange and tighten flange bolt to specified torque.

  "A": Sealant 99000-31090

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



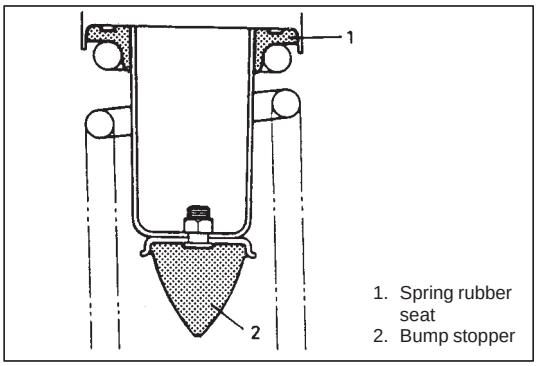
1. Front wheel speed sensor
2. Bolt

● Check that no foreign material is attached to sensor and rotor. Install wheel speed sensor and its harness clamp.

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)

CAUTION:
- **Do not pull wire harness or twist more than necessary when installing front wheel speed sensor.**
- **Fit harness grommet to inner fender securely.**

● Check that there is no clearance between sensor and knuckle.

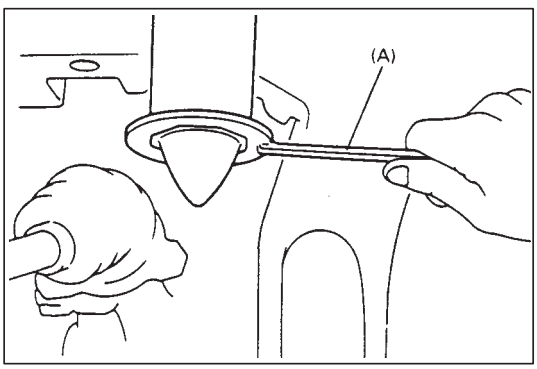


1. Spring rubber seat
2. Bump stopper

BUMP STOPPER/SPRING RUBBER SEAT

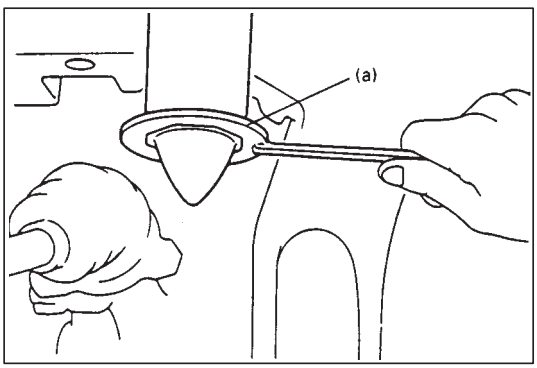
REMOVAL

1) Remove coil spring. Refer to steps 1) to 15) of item “COIL SPRING REMOVAL” in this section.
2) Remove spring rubber seat.



3) Remove bump stopper, using special tool.

Special Tool
(A): 09941-66010

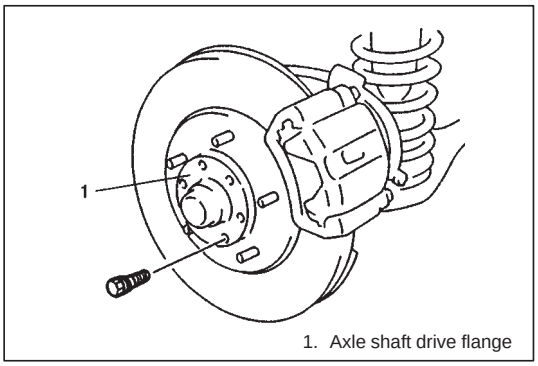


INSTALLATION

1) Tighten bump stopper to specified torque, using special tool.

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

2) Install spring rubber seat.
3) Install coil spring. Refer to item “COIL SPRING INSTALLATION” in this section.

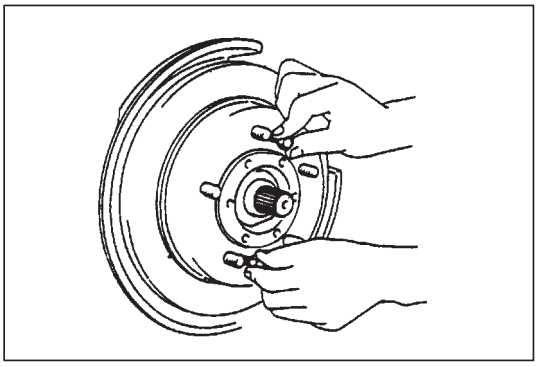


1. Axle shaft drive flange

WHEEL HUB (INCLUDED WHEEL BEARING)

REMOVAL

1) Hoist vehicle and remove wheel.
2) Remove axle shaft drive flange (4WD vehicle) or hub cap (2WD vehicle).

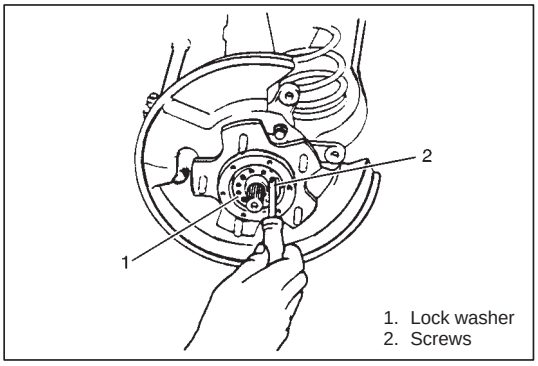


3) If equipped with ABS, remove wheel speed sensor from knuckle and harness clamp from strut.
4) Remove caliper bolt and suspend caliper.

CAUTION:
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 pads removed.

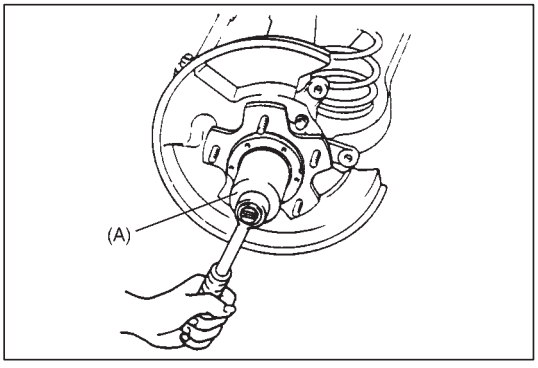
5) Remove brake disc.

NOTE:
If brake disc can not be removed by hand, use 8 mm bolts as shown.



1. Lock washer
2. Screws

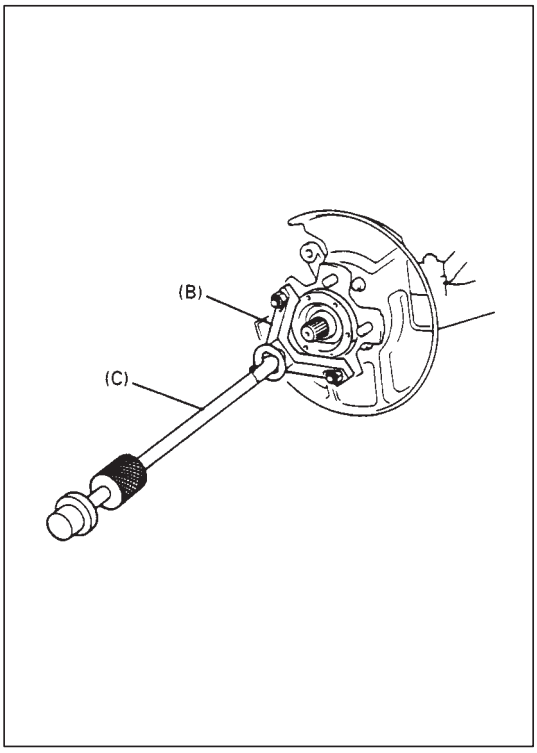
6) Remove front wheel bearing lock washer by loosening 4 screws.



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

Special Tool
(A): 09951-16050

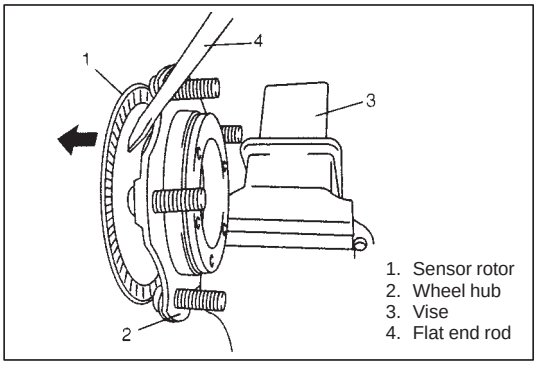
8) Remove front wheel bearing washer.
9) Remove wheel hub component by hand.



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

Special Tool
(B): 09943-35512
(C): 09942-15510

CAUTION:
If wheel bearing inner race remains on wheel spindle when removing wheel hub, which means break of wheel bearing, replace wheel hub component (included wheel bearing).



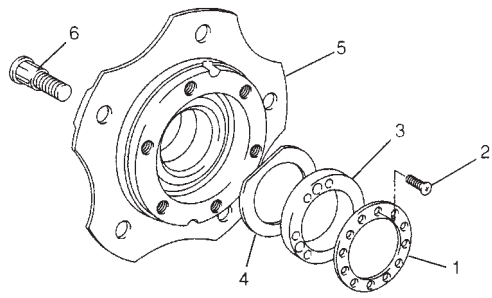
1. Sensor rotor
2. Wheel hub
3. Vise
4. Flat end rod

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

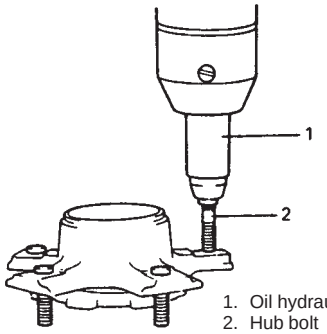
CAUTION:
- **Pull out sensor rotor from wheel hub gradually and evenly.**
- **Do not reuse sensor rotor once removed. Be sure to new sensor rotor when installing.**

11) Remove hub bolts from hub.

INSTALLATION

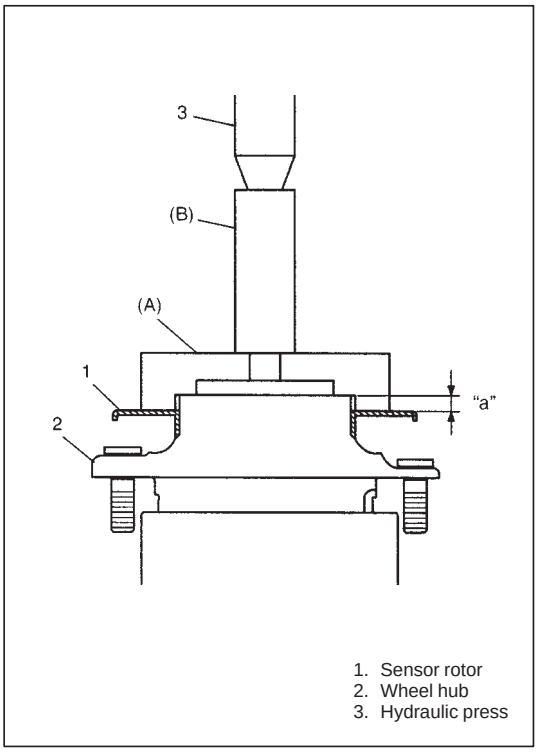


1. Bearing lock washer
2. Screw
3. Bearing lock nut
4. Wheel bearing washer
5. Wheel hub component
6. Bolt



1. Oil hydraulic press
2. Hub bolt

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



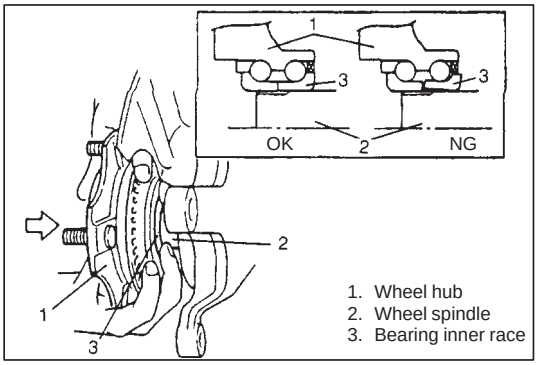
1. Sensor rotor
2. Wheel hub
3. Hydraulic press

2) Install new sensor rotor by using special tool (if equipped with ABS).

NOTE:
Use care not to insert wheel hub diagonally.

Special Tool
(A): 09952-86510
(B): 09924-74510

Wheel speed sensor rotor installing position
Reference Dimension "a" : 4.9 ± 0.1 mm (0.19 ± 0.004 in.)

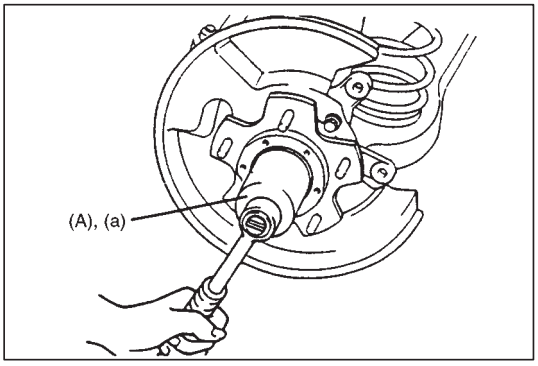


1. Wheel hub
2. Wheel spindle
3. Bearing inner race

3) Install wheel hub component to spindle supporting wheel bearing inner race by finger as shown.

CAUTION:
Don't tap wheel hub component by hammer or the like. Otherwise, it will be broken.

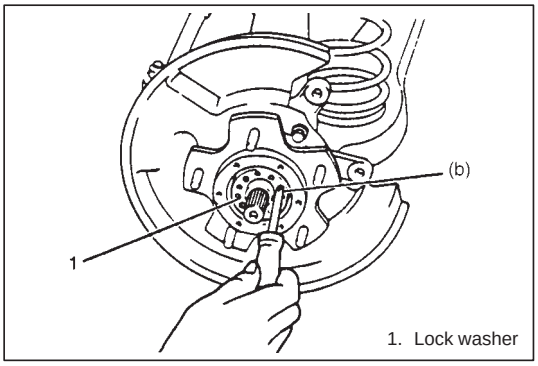
NOTE:
When it is impossible to install wheel hub component by hand, which means the inner race is out of alignment, remove wheel hub component once and reinstall it.



4) Install wheel bearing washer, and the install wheel bearing lock nut.
5) Tighten wheel bearing lock nut to specified torque while turning wheel hub by hand.

Special Tool
(A): 09951-16050

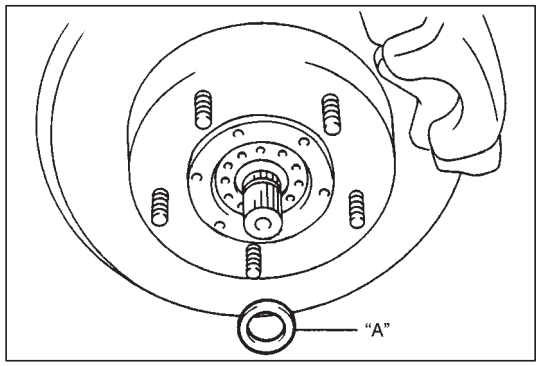
Tightening Torque
(a): 216 N·m (21.6 kg-m, 157 lb-ft)



1. Lock washer

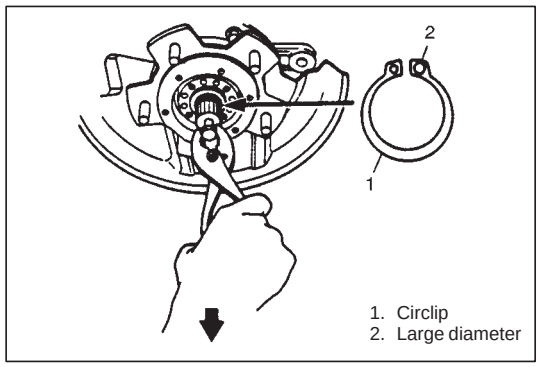
6) Using lock washer, lock bearing lock nut. If lock screw hole is not aligned with screw hole in lock nut, turn lock nut in tightening direction till they align.

Tightening Torque
(b): 1.5 N·m (0.15 kg-m, 1.1 lb-ft)

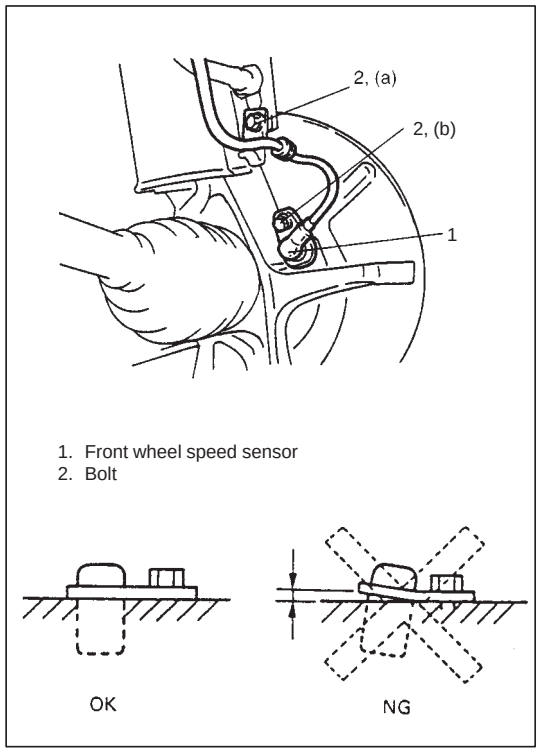


7) For 4WD vehicle, apply lithium grease to front drive shaft washer and front wheel spindle outer.

"A": Grease 99000-25010



8) For 4WD vehicle, when installing circlip to drive shaft, utilize screw hole in drive shaft to pull it out and bring large diameter of circlip at right as shown.

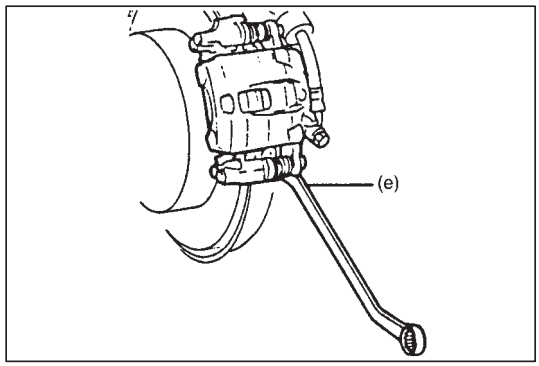


9) For vehicle with ABS, check that no foreign material is attached to sensor and rotor. Install wheel speed sensor and its harness clamp.

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)

CAUTION:
- **Do not pull wire harness or twist more than necessary when installing front wheel speed sensor.**
- **Fit harness grommet to inner fender securely.**

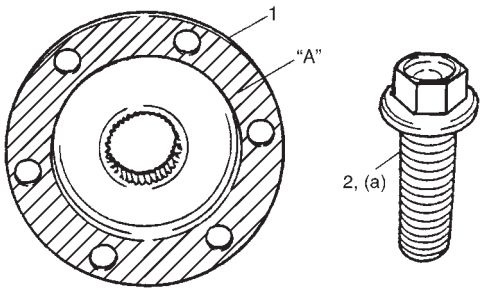
Check that there is no clearance between sensor and knuckle.



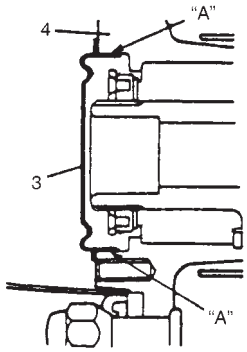
10) Install brake disc and caliper assembly.

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

For 4WD vehicle



For 2WD vehicle



1. Axle shaft drive flange
2. Bolt
3. Hub cap
4. Wheel hub

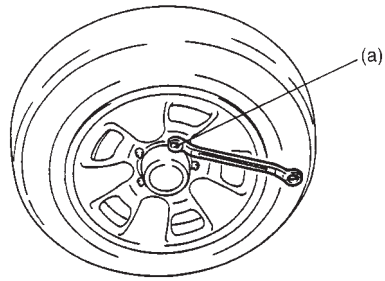
11) Apply sealant and install axle shaft drive flange or hub cap.
- For 4WD vehicle
  Apply sealant mating surface of axle shaft drive flange, then install axle shaft drive flange and tighten flange bolt to specified torque.

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

  "A": Sealant 99000-31090

- For 2WD vehicle
  Remove grease, old sealant and dusts from mating surfaces of hub cap and hub to clean, apply water tight sealant "A" to cap mating surface evenly, and install cap to hub.

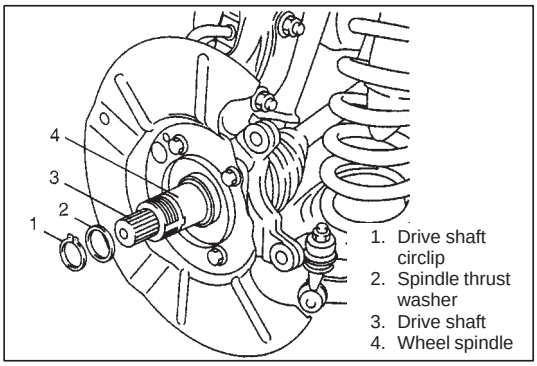
  "A": Sealant 99000-31090



12) Install wheel.

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

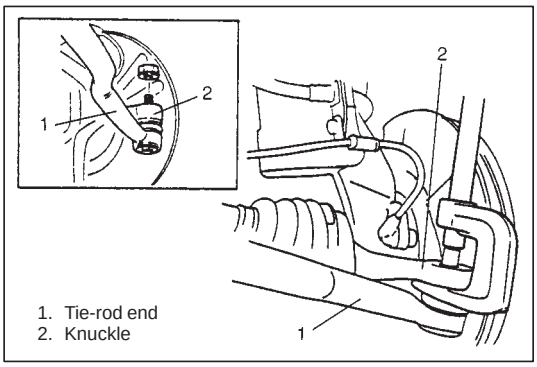
13) For vehicle equipped with ABS, perform driving test referring to "DRIVING TEST" of "ABS DIAGNOSTIC FLOW TABLE" in Section 5E or 5E1.



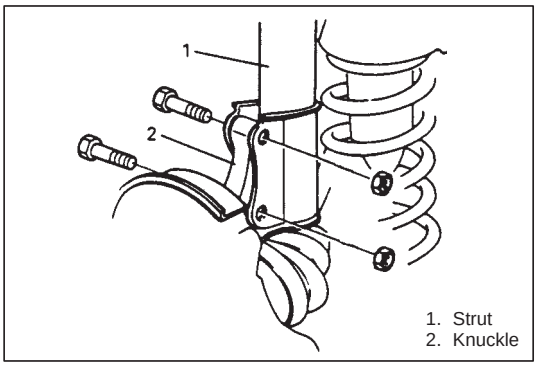
KNUCKLE/WHEEL SPINDLE

REMOVAL

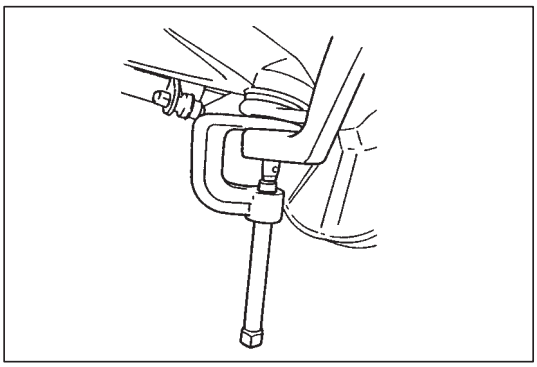
1) Remove wheel hub. Refer to “WHEEL HUB (INCLUDED WHEEL BEARING)” in this section.
2) Remove front drive shaft circlip and front spindle thrust washer (for 4WD vehicle) or front hub cap (for 2WD vehicle).



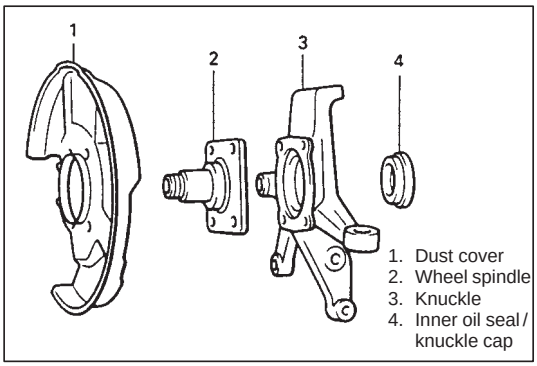
3) Disconnect tie-rod end from knuckle.
4) Remove stabilizer bar. Refer to “STABILIZER BAR/BUSHINGS” in this section.



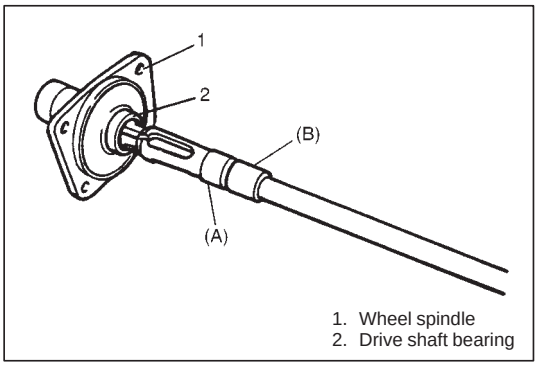
5) Remove ball stud nut.
6) Support lower arm with jack.
7) Remove strut bracket bolts from strut bracket.



8) By using puller, disconnect knuckle from ball stud.



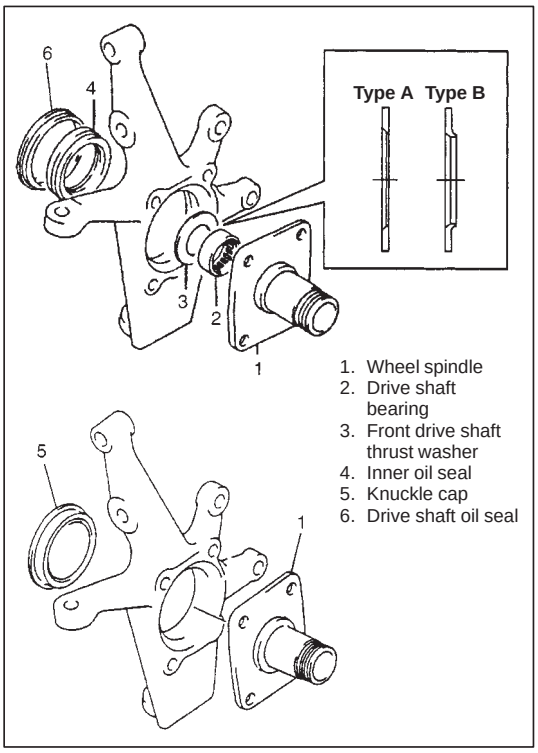
9) While lowering jack, remove knuckle/wheel spindle comp.
10) Remove inner oil seal (for 4WD vehicle), knuckle cap (for 2WD vehicle), dust cover and wheel spindle.



1. Wheel spindle
2. Drive shaft bearing

11) For 4WD vehicle
Remove drive shaft bearing by using special tool.

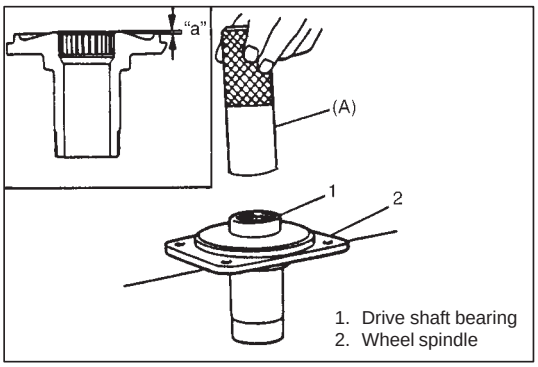
Special Tool
(A): 09923-74510
(B): 09930-30102



1. Wheel spindle
2. Drive shaft bearing
3. Front drive shaft thrust washer
4. Inner oil seal
5. Knuckle cap
6. Drive shaft oil seal

INSTALLATION

Reverse removal sequence to install knuckle, wheel spindle oil seal and drive shaft bearing,noting following points.

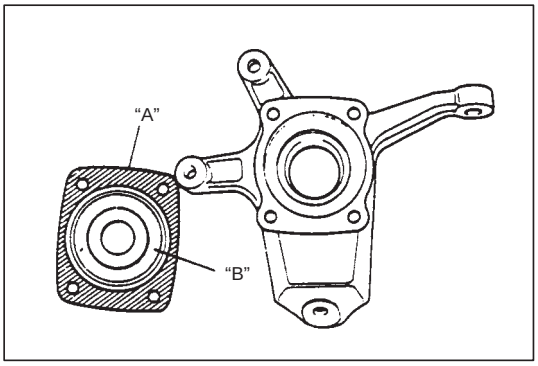


1. Drive shaft bearing
2. Wheel spindle

- For 4WD vehicle
  Install drive shaft bearing by using special tool.

  Special Tool
  (A): 09913-76010 . . . . . Type A drive shaft thrust washer
  09913-80112 . . . . . Type B drive shaft thrust washer

  Dimension "a": 0 – 1 mm (0 – 0.04 in.)
  . . . . . Type A drive shaft thrust washer
  1.75 – 2.50 mm (0.069 – 0.098 in.)
  . . . . . Type B drive shaft thrust washer

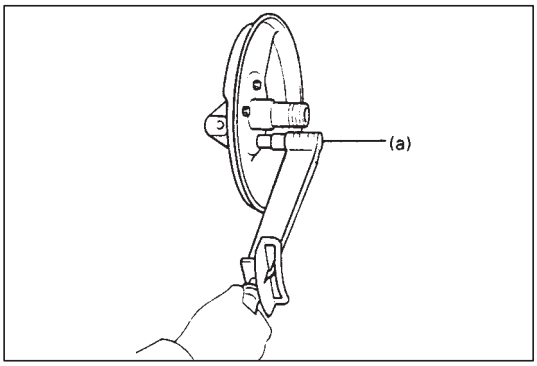


- When installing wheel spindle to knuckle, coat their mating surfaces with sealant.

  "A": Sealant 99000-31110

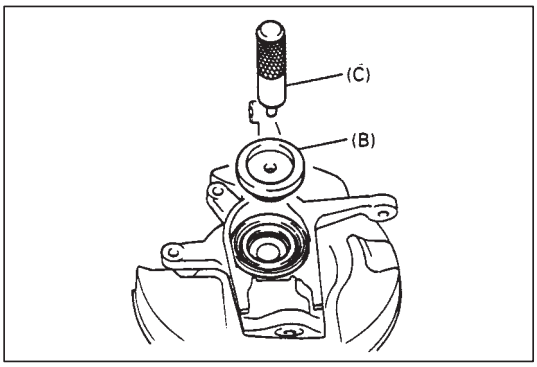
- For 4WD vehicle
  Also, fill recess in wheel spindle with about 10 g lithium grease.

  "B": Grease 99000-25010



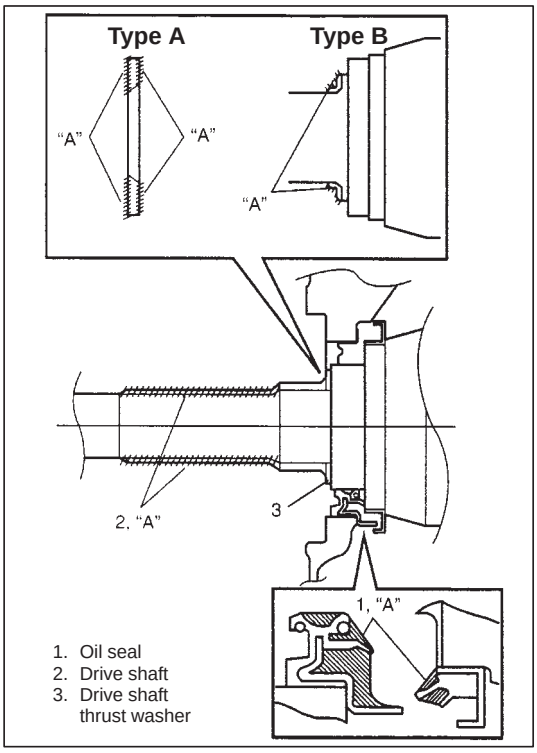
● Tighten wheel spindle nut to specified torque.

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



● For 4WD vehicle
Press-fitting inner oil seal.
Drive in inner oil seal until its end contacts stepped surface of knuckle by using special tools.

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



● For 4WD vehicle
- Apply lithium grease to oil seal lip and into its hollow to fill more than 60% of its vacant space.
- Apply lithium grease "A" to drive shaft.

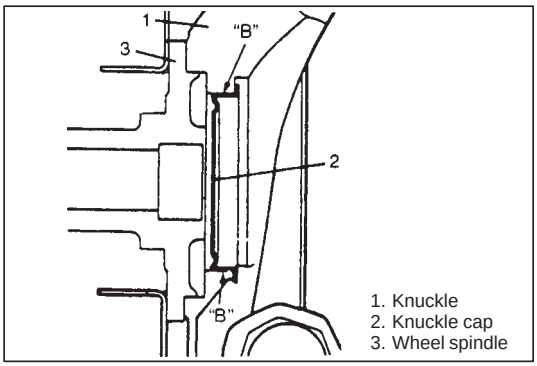
"A": Grease 99000-25010

- Press-fit front drive shaft thrust washer to drive shaft, if it is removed (for Type B drive shaft thrust washer). Apply lithium grease "A" to drive shaft thrust washer.

"A": Grease 99000-25010

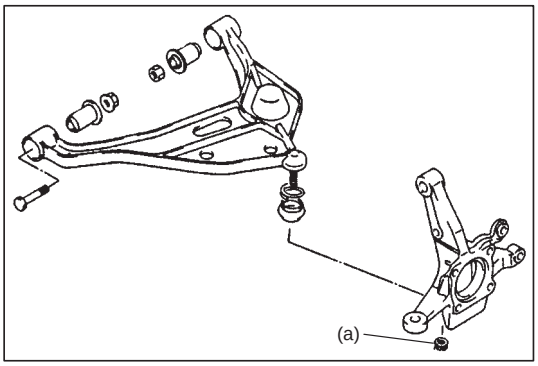
- Apply lithium grease "A" and install front drive shaft thrust washer with its chamfered side facing to center side (for Type A drive shaft thrust washer).

"A": Grease 99000-25010



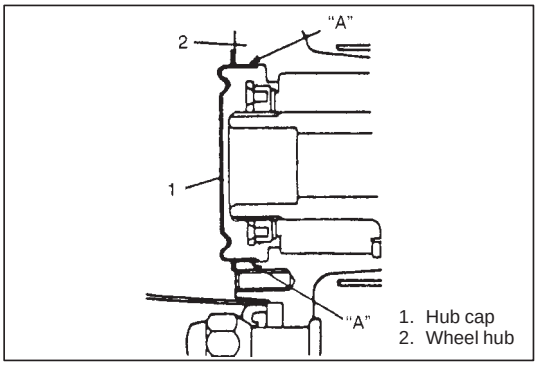
● For 2WD vehicle
Remove grease, old sealant and dusts from mating surfaces of knuckle cap and knuckle to clean, apply water tight sealant to cap mating surface evenly, and install cap to knuckle.

"B": Sealant 99000-31090



● Tighten control arm ball stud nut
When tightening ball stud nut, use new nut and tighten it to specified torque.

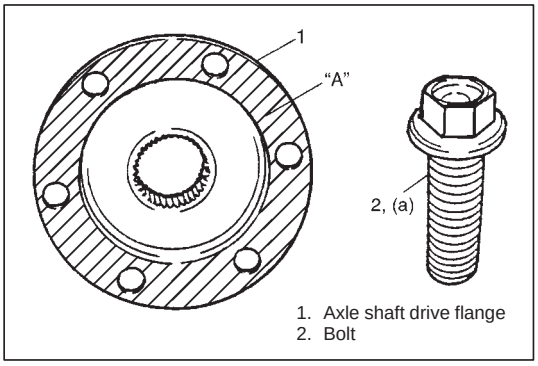
Tightening Torque
(a): 60 N·m (6.0 kg-m, 43.5 lb-ft)



1. Hub cap
2. Wheel hub

● For 2WD vehicle
Apply water tight sealant to mating surface of wheel hub and install hub cap to wheel hub.

"A": Sealant 99000-31090



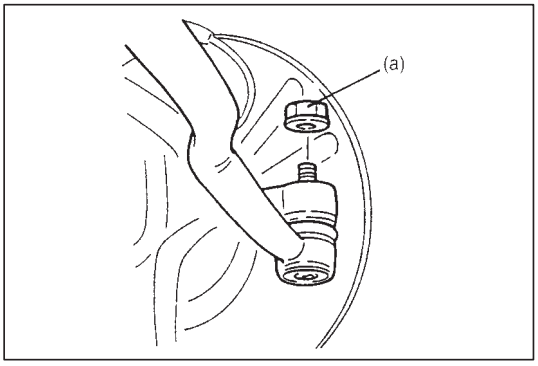
1. Axle shaft drive flange
2. Bolt

● For 4WD vehicle
When installing axle shaft drive flange to wheel hub, apply sealant to mating surface of axle shaft drive flange.

"A": Sealant 99000-31090

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

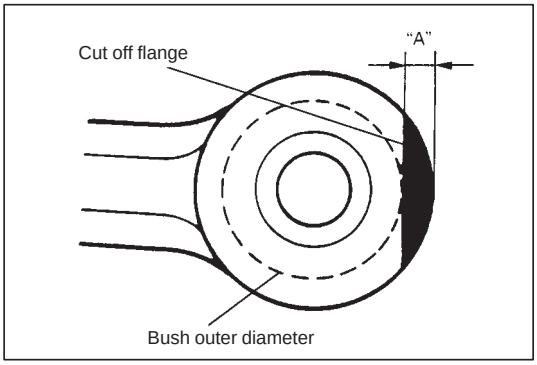
● For installation procedures of wheel hub component, refer to "WHEEL HUB (INCLUDED WHEEL BEARING)" in this section.



● Connect tie-rod end to knuckle and tighten new tie-rod end nut.

Tightening Torque
(a): 43 N·m (4.3 kg-m, 31.5 lb-ft)

● For any tightening torque other than those specified in text, refer to "TIGHTENING TORQUE SPECIFICATION" in this section.

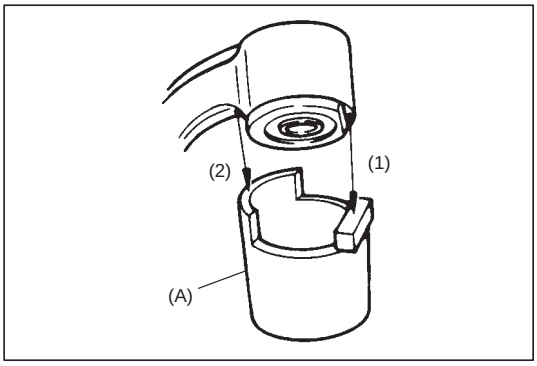


SUSPENSION CONTROL ARM/BUSHINGS

REMOVAL

1) Remove coil spring. Refer to COIL SPRING in this section.
2) Remove control arm bolts and nuts. Then remove control arm.
3) Cut flange part of control arm bush (rubber and steel) with using care not to damage control arm end surface.

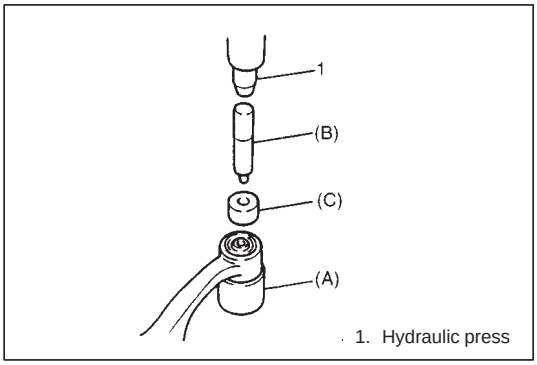
Dimension "A": Approx. 6 mm (0.236 in.)



4) Place control arm and special tool on hydraulic press. Set control arm cutting flange to welded part (1) of the special tool and control arm joint side to the stepped part (2) of special tool.

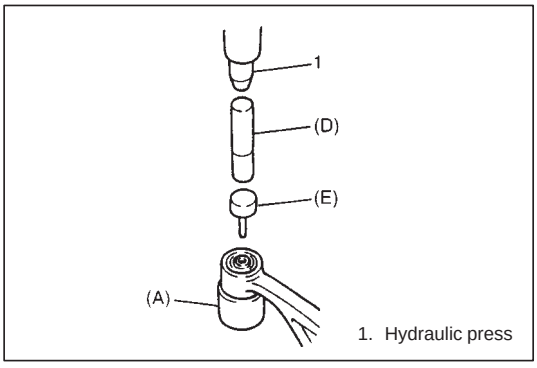
CAUTION:
Use special care in driving out control arm bush to press it vertically.
Or it may cause personally injury.

Special tool
(A): 09951-46020



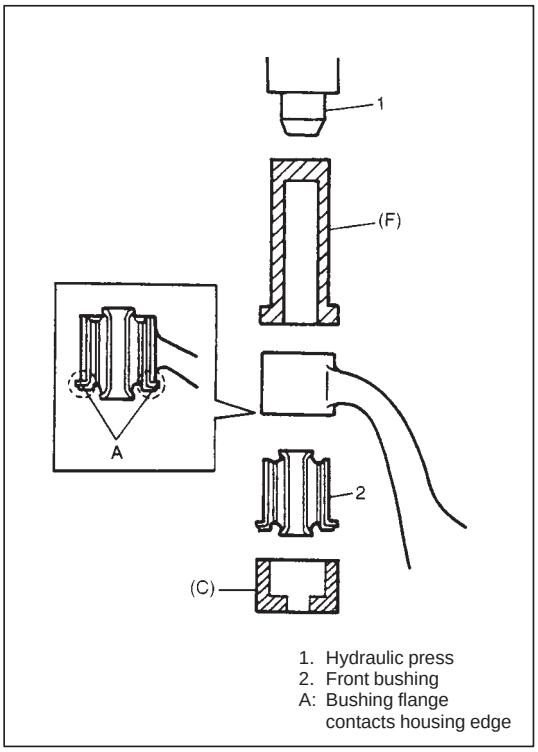
5) Remove front bushing by using hydraulic press and special tools, pull out bushing.

Special Tool
(A): 09951-46020
(B): 09924-74510
(C): 09951-16060



6) Remove rear bushing by using hydraulic press and special tools, pull out bushing.

Special Tool
(A): 09951-46020
(D): 09913-80112
(E): 09925-58210



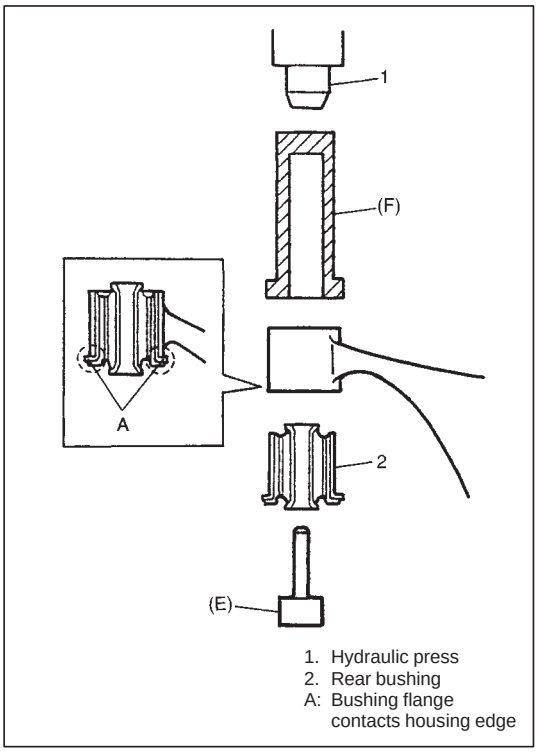
1. Hydraulic press
2. Front bushing
A: Bushing flange contacts housing edge

INSTALLATION

1) Front bushing
Press-fit front bushing until its flange contacts housing edge of control arm, use special tools as shown.

Special Tool
(C): 09951-16060
(F): 09913-85210

NOTE:
When press-fitting bushing, compounding oil or soap water applied to inside of control arm housing will facilitate work.

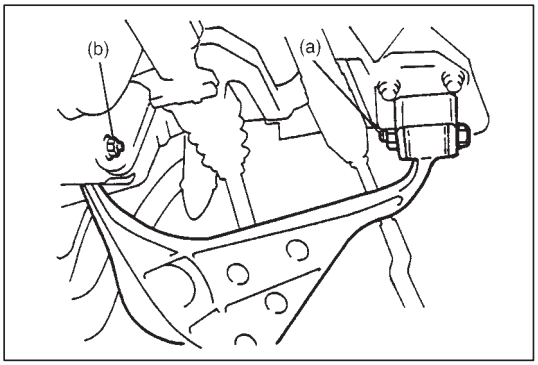


1. Hydraulic press
2. Rear bushing
A: Bushing flange contacts housing edge

2) Rear bushing
Press-fit rear bushing until its flange contacts housing edge of control arm, use special tools as shown.

Special Tool
(E): 09925-58210
(F): 09913-85210

NOTE:
When press-fitting bushing, compounding oil or soap water applied to inside of control arm housing will facilitate work.

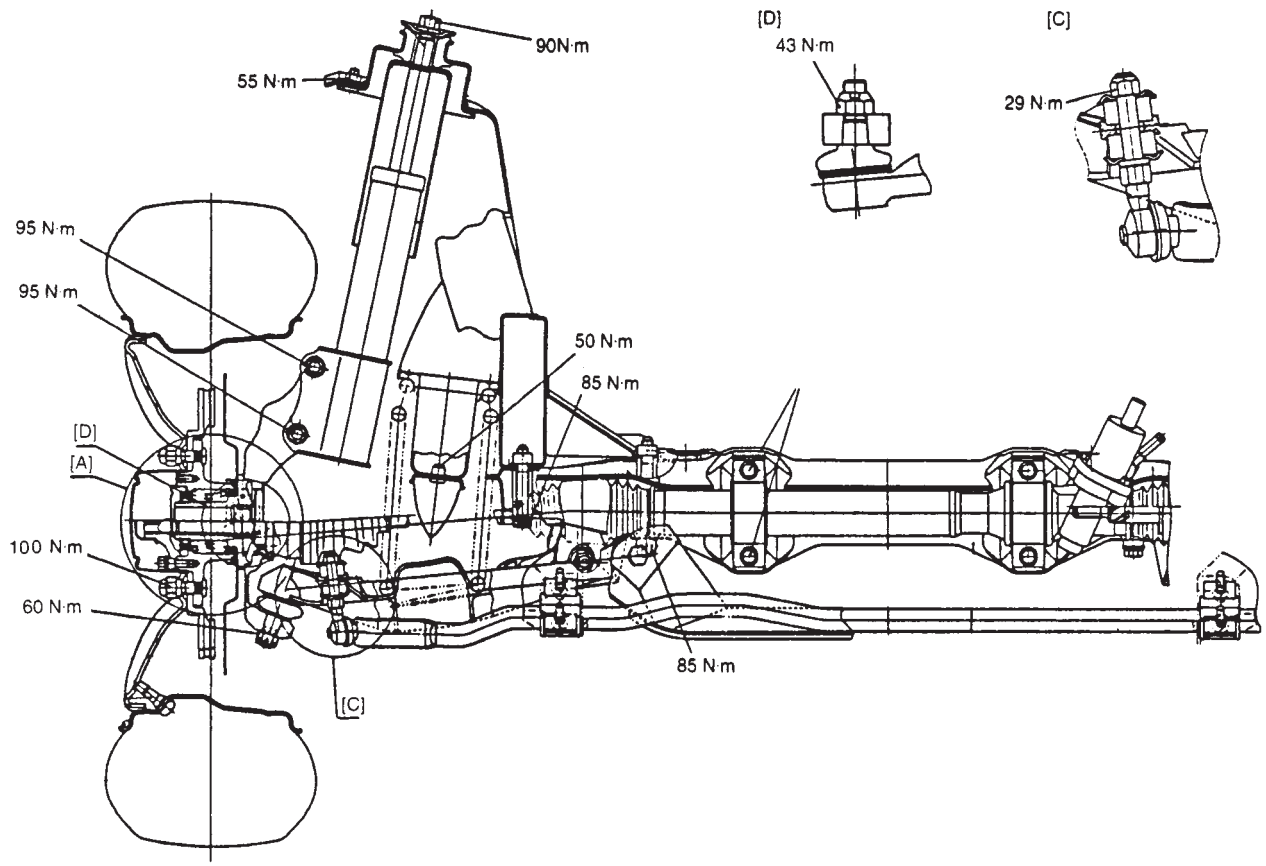


3) Install control arm to chassis.
Tighten suspension arm nut to specified torque after lowering hoist and vehicle in non-loaded condition.
Tightening Torque
(a): 85 N·m (8.5 kg-m, 61.5 lb-ft)
(b): 127 N·m (12.7 kg-m, 92.0 lb-ft)

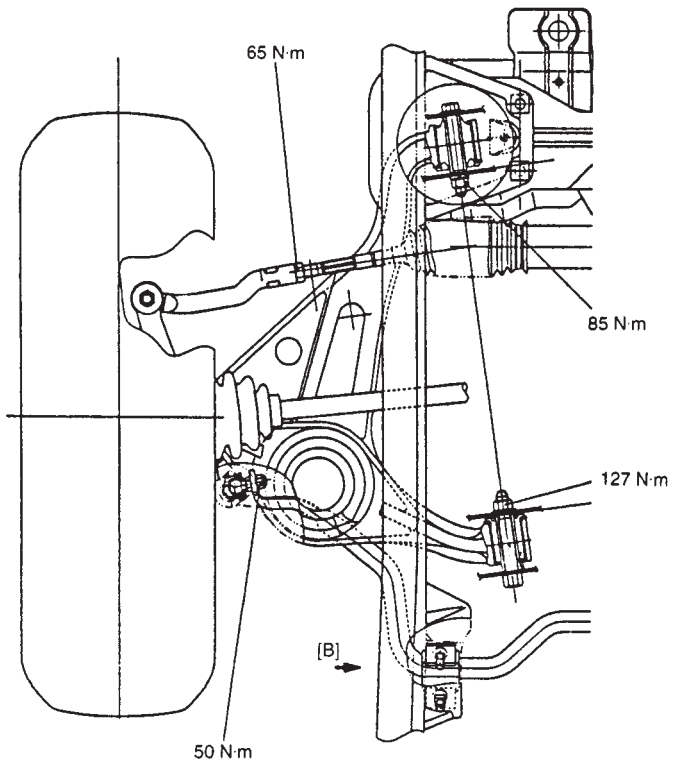
4) As installation procedure hereafter is the same as that for coil spring. Refer to “COIL SPRING” in this section.

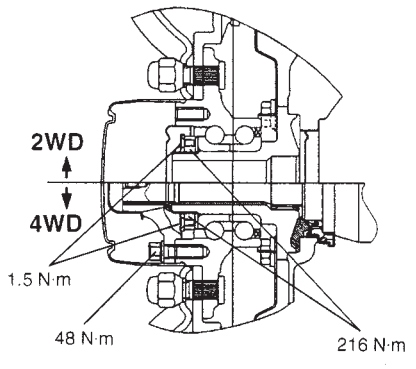
NOTE:
For any tightening torque other than those specified in text, refer to “TORQUE SPECIFICATION TABLE” at the end of this section.

TIGHTENING TORQUE SPECIFICATIONS



[A]





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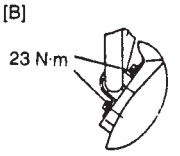
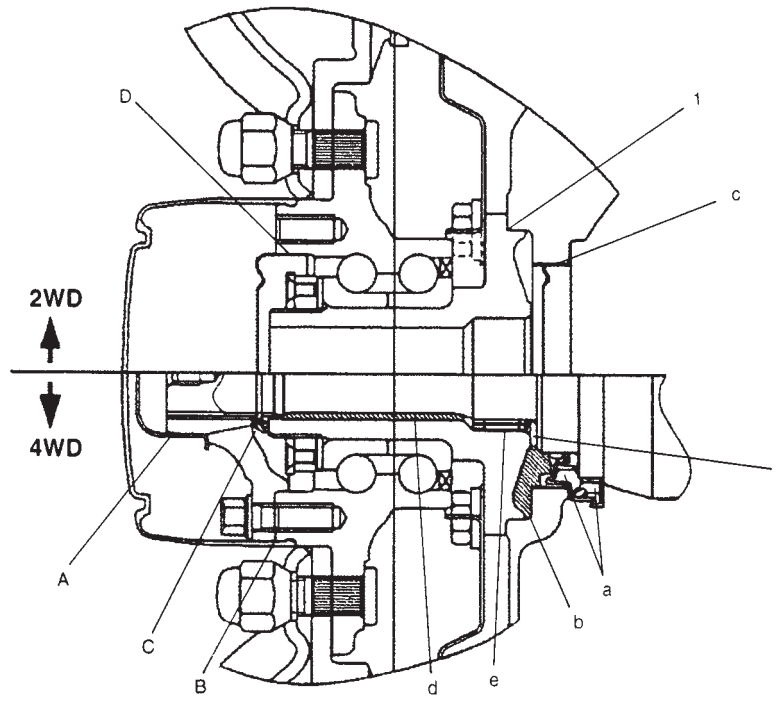
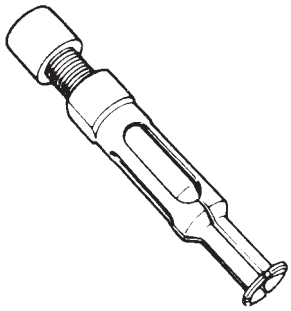
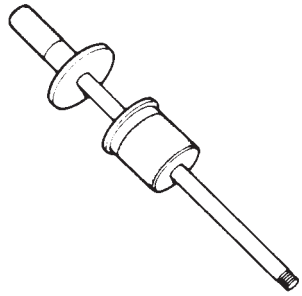
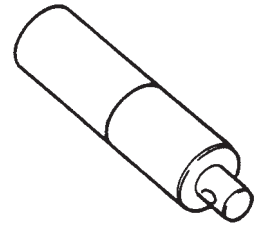
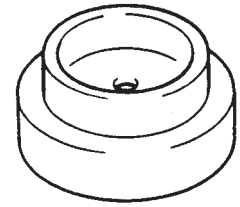
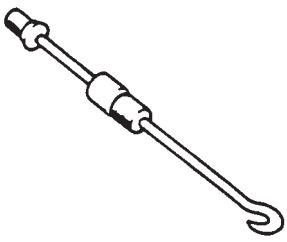
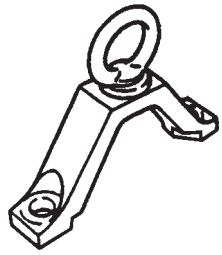
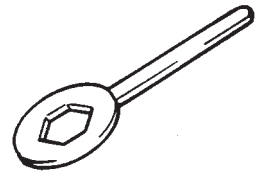
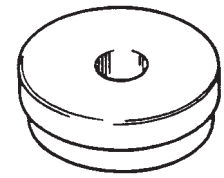
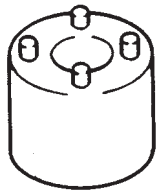
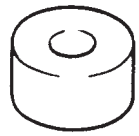
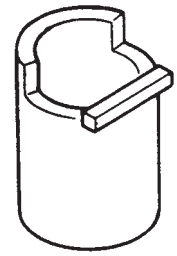
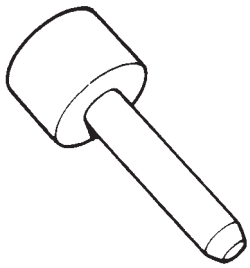
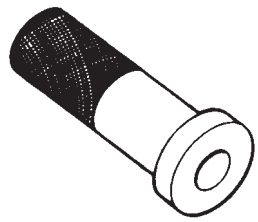
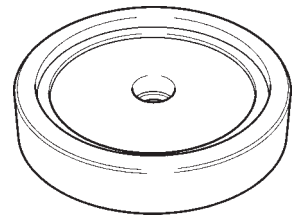


REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE	NO.
Lithium grease	SUZUKI SUPER GREASE (A) (99000-25010)	Bearing inner oil seal/drive shaft oil seal Recess of wheel spindles Spindle outer washer Spindle part of drive shaft Spindle bush (inside and flange part) Spindle inner washer	a b c d e f
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	Mating surfaces of wheel spindle and knuckle	1
Sealing compound	SUZUKI SEALING COMPOUND 366E (99000-31090)	Front axle cap Mating surfaces of wheel hub and drive flange Knuckle cap Hub cap	A B C D



SPECIAL TOOLS

 09923-74510 Bearing remover	 09930-30102 Sliding shaft	 09924-74510 Bearing installer handle	 09941-66010 Bump stopper wrench
 09942-15510 Sliding hammer	 09943-35512 Brake drum remover	 09944-66010 Wheel hub/knuckle oil seal installer	 09944-68210 Bearing & oil seal installer
 09951-16050 Wheel bearing tightening tool	 09951-16060 Control arm bush remover (front)	 09951-46020 Control arm remover support	 09913-80112 Bearing installer
 09925-58210 Oil seal installer	 09913-85210 Oil seal installer	 09952-86510 Front sensor rotor installer	

SECTION 3E

REAR SUSPENSION

NOTE:

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

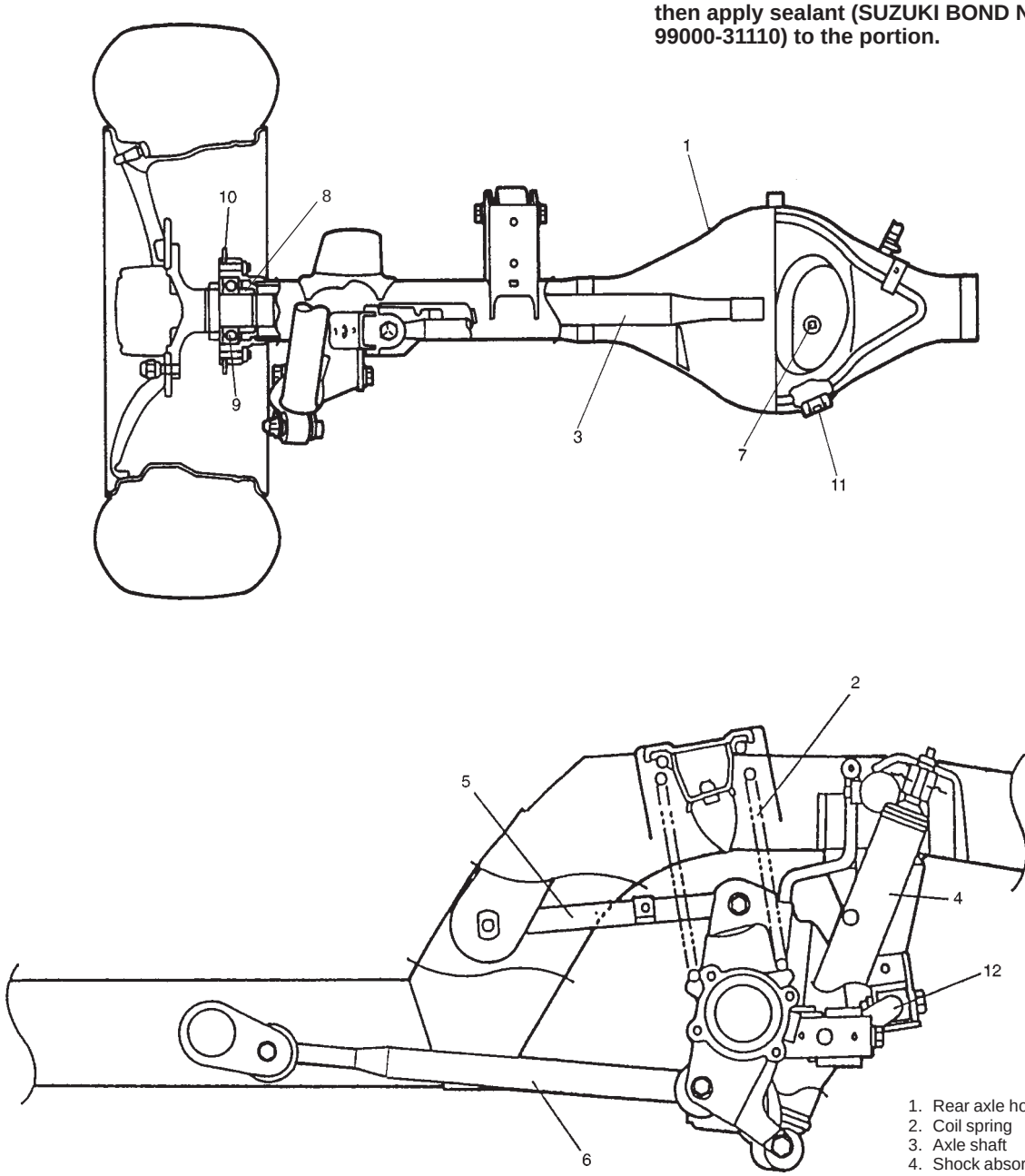
CONTENTS

GENERAL DESCRIPTION 3E- 2
DIAGNOSIS 3E- 3
Diagnosis Table 3E- 3
Shock Absorber Check 3E- 3
Lower/Upper/Lateral Rod Check. 3E- 3
Axle Housing and Coil Spring Check 3E- 3
Bearing Retainer & Axle Shaft Inner Oil Seal Check 3E- 4
Wheel Disc, Nut & Bearing Check 3E- 4
ON-VEHICLE SERVICE 3E- 5
Shock Absorber 3E- 5
Coil Spring 3E- 6
Lower Rod 3E- 8
Upper Rod 3E- 9
Lateral Rod 3E-10
Rear Axle Shaft and Wheel Bearing 3E-10
Rear Axle Shaft Inner Oil Seal 3E-15
Rear Axle Housing 3E-16
TIGHTENING TORQUE SPECIFICATIONS 3E-23
REQUIRED SERVICE MATERIALS 3E-23
SPECIAL TOOLS 3E-24

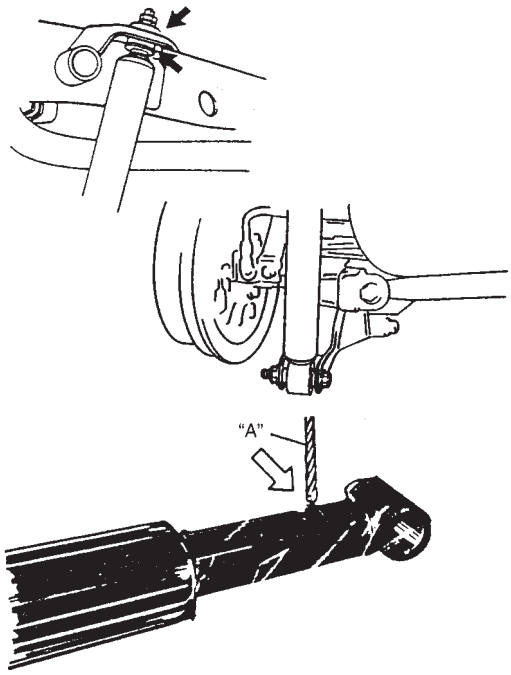
GENERAL DESCRIPTION

Rear suspension is 5 link type of rigid axle which consists of coil springs, rear axle, shock absorbers, upper rods, lower rods and lateral rod.
The lower rod and upper rod are connected with the axle and body by using bushes so that axle moves up and down with bushes as their supporting points.
The shock absorber is installed between the body and axle to absorb up-and-down movement of the vehicle body.

NOTE:
When installing differential gear oil drain plug, clean the thread portion of the plug and then apply sealant (SUZUKI BOND No. 1215, 99000-31110) to the portion.



1. Rear axle housing
2. Coil spring
3. Axle shaft
4. Shock absorber
5. Upper rod
6. Lower rod
7. Oil level plug
8. Wheel bearing retainer
9. Rear wheel bearing
10. Brake back plate
11. Oil drain plug
12. Lateral rod



"A": Drill hole with approximately 3 mm (0.12 in.) diameter.

DIAGNOSIS

DIAGNOSIS TABLE

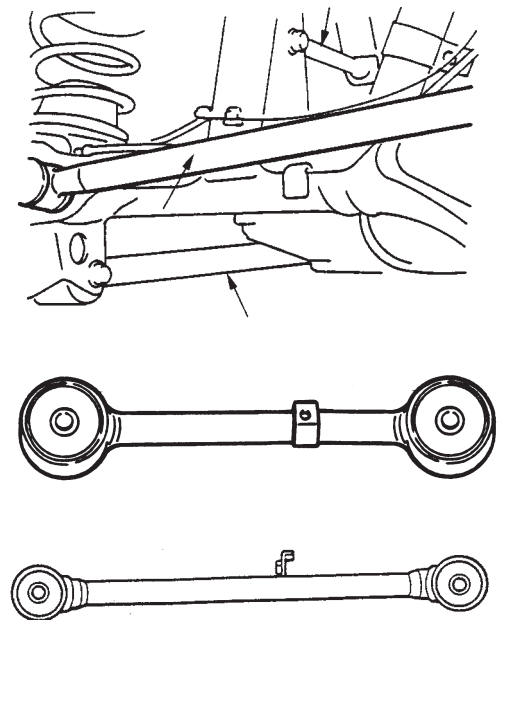
Refer to SECTION 3.

SHOCK ABSORBER CHECK

- Inspect for deformation or damage.
- Inspect bushings for wear or damage.
- Inspect for evidence of oil leakage.

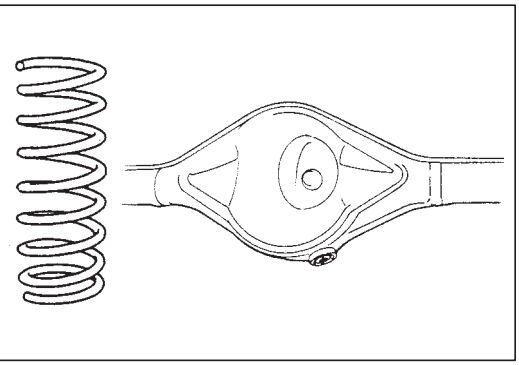
Replace any defective part.

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 in it where shown by an arrow in the 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.



LOWER ROD, UPPER ROD, LATERAL ROD CHECK

Inspect for cracks, deformation or damage.
Replace any defective part.
Inspect each bush for wear and breakage. If found defective, replace.

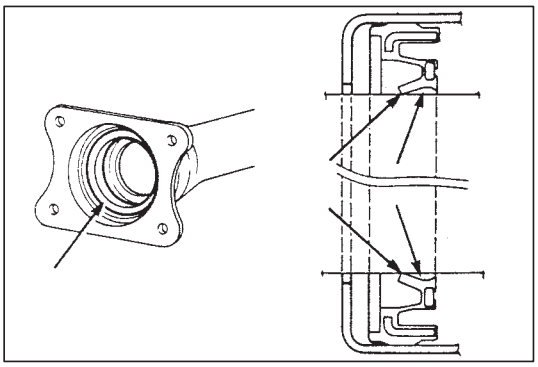


AXLE HOUSING AND COIL SPRING CHECK

Inspect for cracks, deformation or damage.
Inspect for evidence of oil leakage at axle housing.
If any, replace defective part.

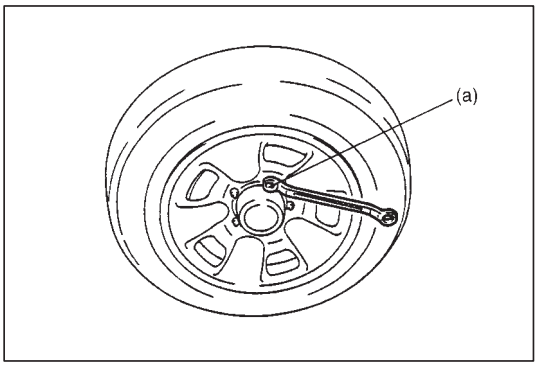
REAR SUSPENSION FASTENERS

Check each bolt and nut fastening suspension parts for tightness. Tighten loose one, if any, to specified torque, referring to “TIGHTENING TORQUE SPECIFICATIONS” of this section.



BEARING RETAINER AND AXLE SHAFT INNER OIL SEAL CHECK

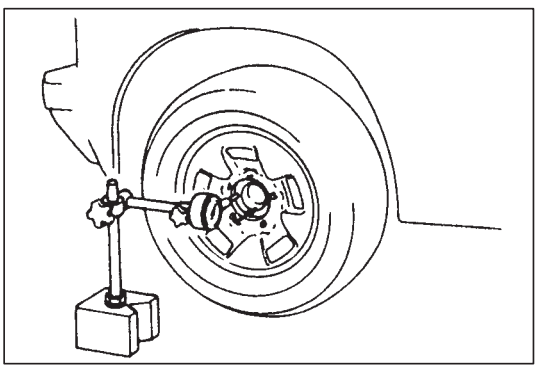
- When brake drum has been removed, check inside of brake drum for gear oil leakage.
- Also, check backside of brake back plate for oil leakage.
  If oil leakage is found, replace defective oil seal.
- Whenever it is possible to check oil seal during disassembly, check its lip for wear.
  If oil leakage or worn lip is found, replace defective oil seal.



WHEEL DISC, NUT & BEARING CHECK

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

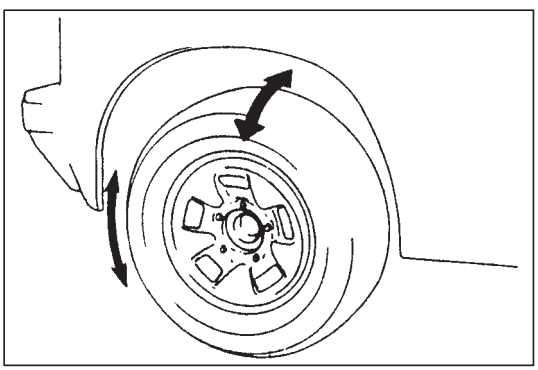
Tightening Torque
(a): 100 N·m (10.0 kg-m, 72.5 lb-ft)



- Check wheel bearings for wear. When measuring thrust play, apply a dial gauge to axle shaft center after removing wheel center cap from wheel.

Thrust play limit	Rear	0.8 mm (0.03 in.)

When measurement exceeds limit, replace bearing.

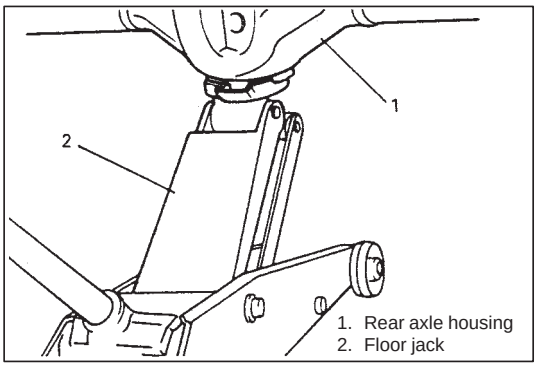


- By rotating wheel actually, check wheel bearing for noise and smooth rotation. If it is defective, replace bearing.

ON-VEHICLE SERVICE

SHOCK ABSORBER

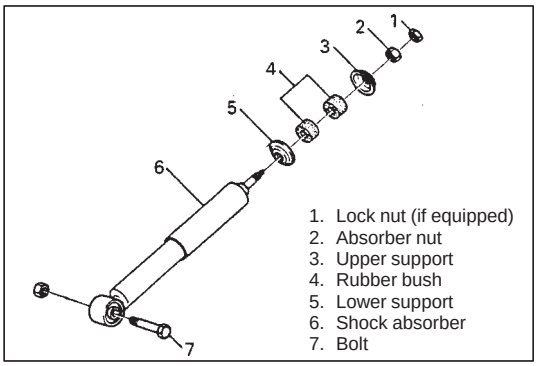
The shock absorber is non-adjustable, non-refillable, and cannot be disassembled. The only service the shock absorber requires is replacement when it has lost its resistance, is damaged, or leaking fluid.



1. Rear axle housing
2. Floor jack

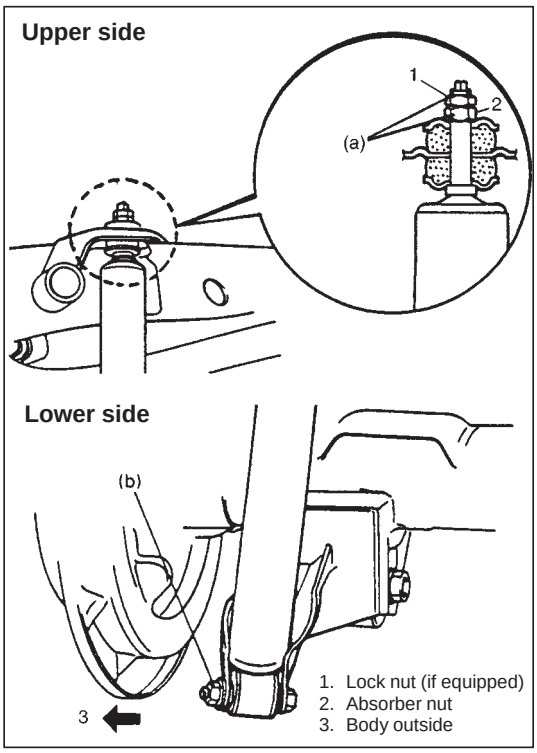
REMOVAL

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



1. Lock nut (if equipped)
2. Absorber nut
3. Upper support
4. Rubber bush
5. Lower support
6. Shock absorber
7. Bolt

3) Remove lock nut (if equipped) and absorber nut.
4) Remove lower mounting bolt.
5) Remove shock absorber.



1. Lock nut (if equipped)
2. Absorber nut
3. Body outside

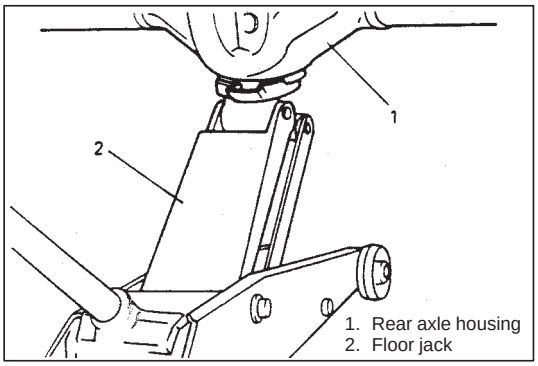
INSTALLATION

1) Install shock absorber. Refer to figure for proper installing direction of lower mounting bolt.
2) Remove floor jack.
3) Lower hoist.
4) Tighten nuts to specified torque.

NOTE:

- **Tighten lower nut with vehicle off hoist and in non-loaded condition.**

Tightening Torque
(a): 29 N·m (2.9 kg-m, 21.0 lb-ft)
(b): 85 N·m (8.5 kg-m. 61.5 lb-ft)

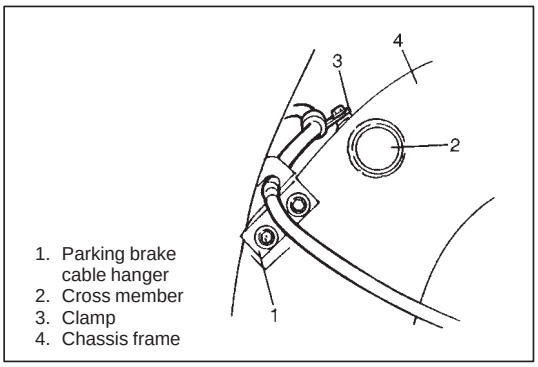


1. Rear axle housing
2. Floor jack

COIL SPRING

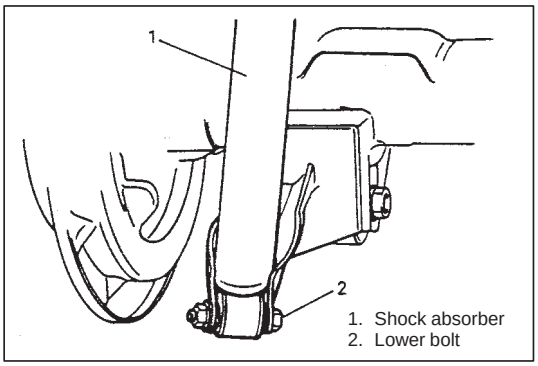
REMOVAL

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



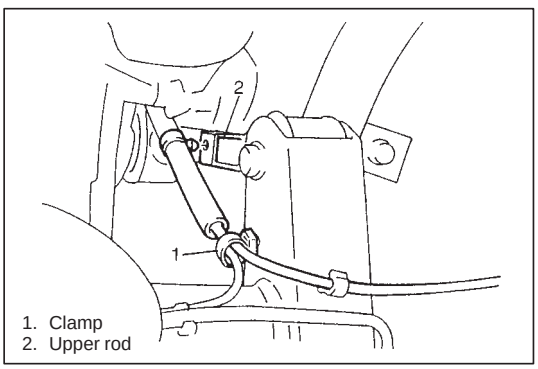
1. Parking brake cable hanger
2. Cross member
3. Clamp
4. Chassis frame

3) Disconnect parking brake cable hanger from chassis frame and clamp from cross member.



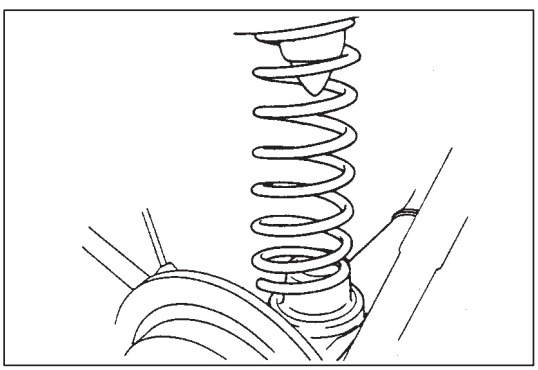
1. Shock absorber
2. Lower bolt

4) Remove shock absorber lower mounting bolt.

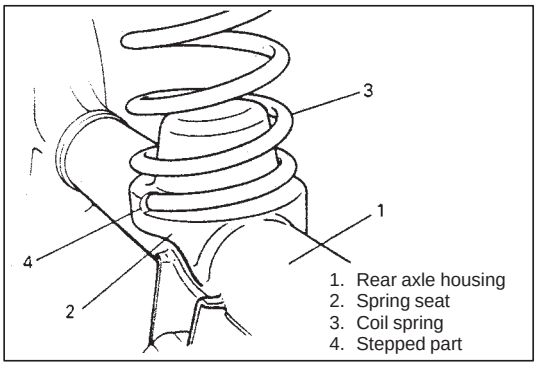


1. Clamp
2. Upper rod

5) Remove wheel speed sensor clamps from upper rod and axle housing, if equipped with ABS.
   For right side, remove E-ring for fixing brake pipe from cross member and disconnect breather hose from axle housing.



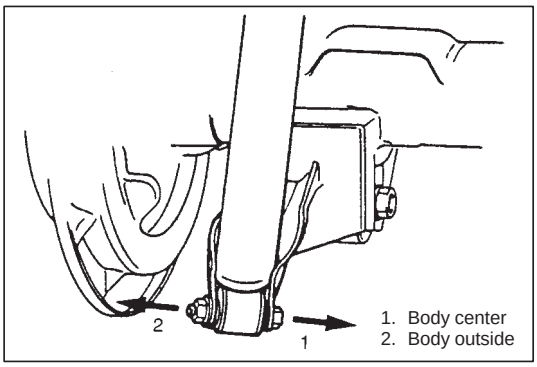
6) Lower rear axle housing gradually as far down as where coil spring can be removed.
7) Remove coil spring.



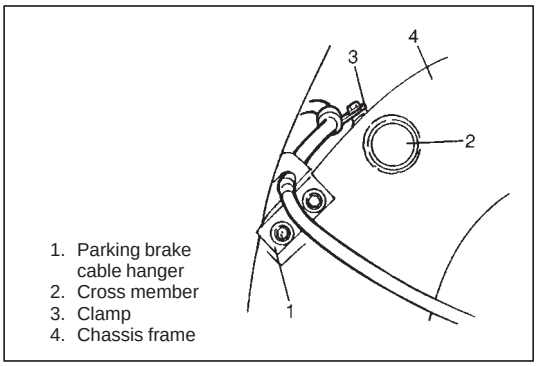
INSTALLATION

1) Install coil spring on spring seat of axle housing and then raise axle housing.

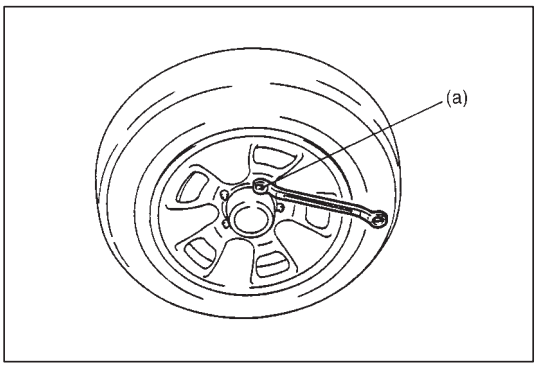
NOTE:
When seating coil spring, mate spring end with stepped part of rear axle spring seat as shown.



2) Install shock absorber lower bolt. For its proper installing direction, refer to figure.
Nut should not be tightened.

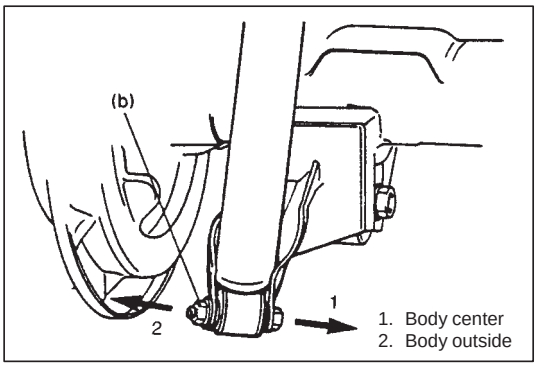


3) Install wheel speed sensor clamp (if equipped) and E-ring, and connect breather hose to axle housing.
4) Connect cable hanger to chassis frame and clamp to cross member. Remove floor jack from axle housing.



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

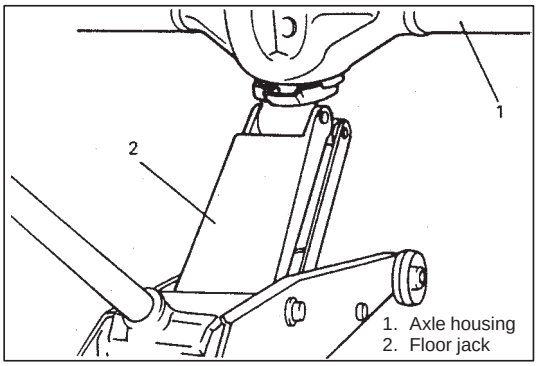
Tightening Torque
(a): 100 N·m (10.0 kg-m, 72.5 lb-ft)



6) Lower hoist and tighten absorber lower nut to specified torque.

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

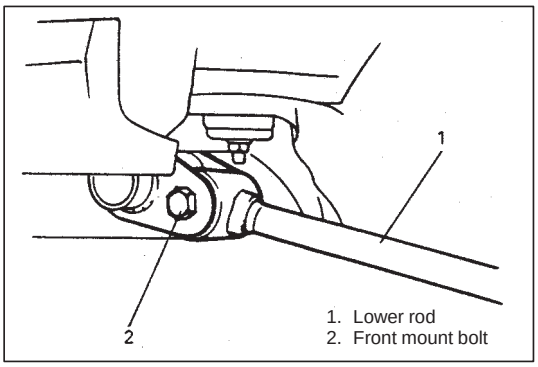
NOTE:
For tightening of lower nut, refer to NOTE given under SHOCK ABSORBER INSTALLATION in this section.



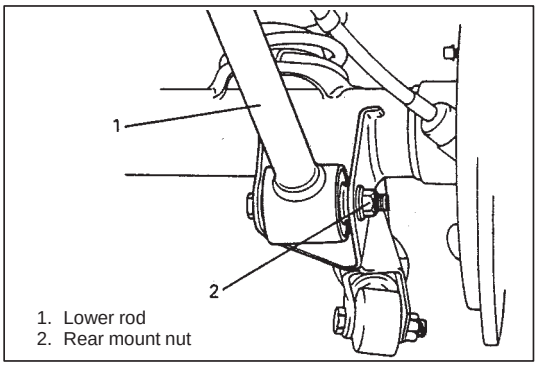
LOWER ROD

REMOVAL

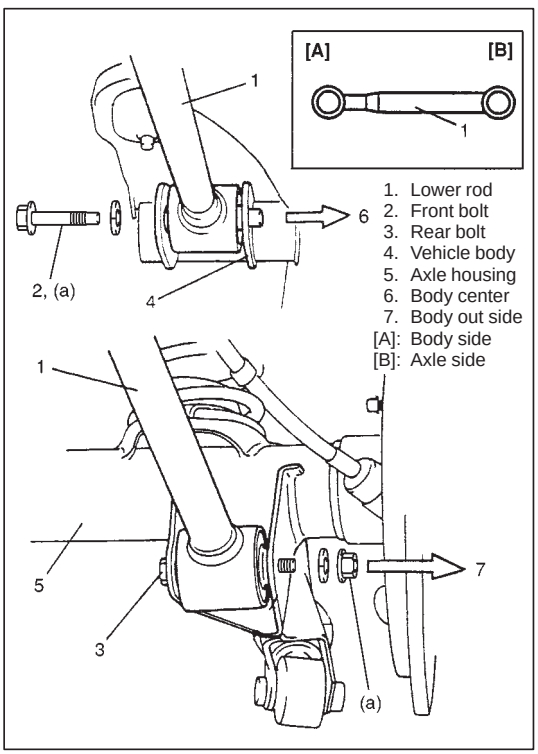
1) Hoist vehicle and remove rear wheel.
2) Support rear axle housing by using floor jack.



3) Remove lower rod front mount bolt.



4) Remove lower rod rear mount bolt.



INSTALLATION

1) Install lower rod to chassis frame and axle housing, referring to figure for proper installing direction of bolts.

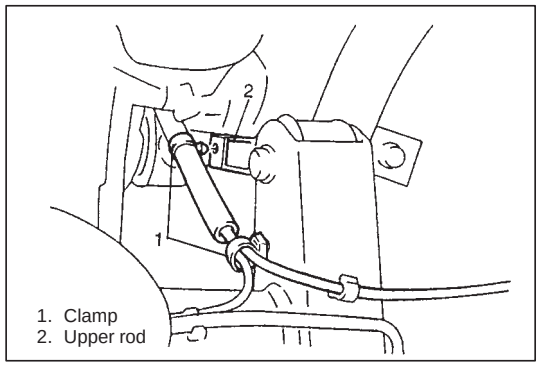
   Nuts should not be tightened.

2) Remove floor jack from rear axle housing.
3) Install wheel and tighten wheel nuts to specified torque.

   Tightening Torque for wheel nuts
   100 N·m (10.0 kg-m, 72.5 lb-ft)

4) Lower hoist and with vehicle in non loaded condition, tighten front bolt and rear nut of lower rod to specified torque.

   Tightening Torque
   (a): 90 N·m (9.0 kg-m, 65.0 lb-ft)

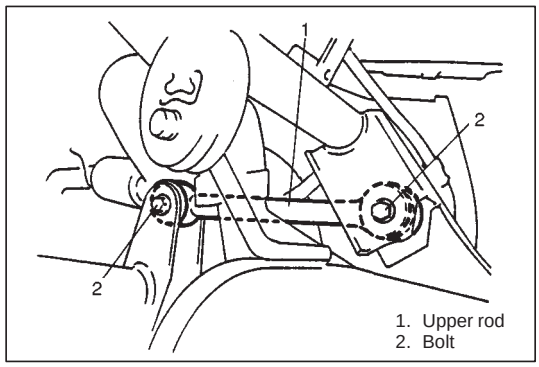


1. Clamp
2. Upper rod

UPPER ROD

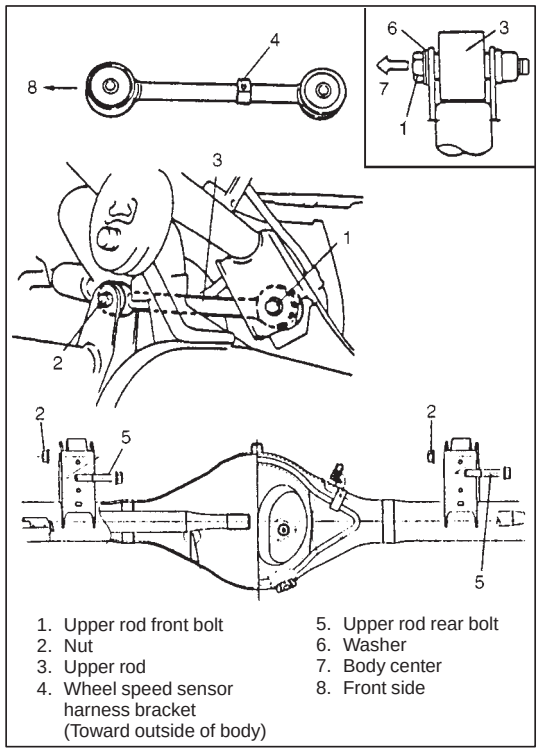
REMOVAL

1) Hoist vehicle and remove rear wheel.
2) If equipped with ABS, disconnect wheel speed sensor harness clamp from left upper rod.



1. Upper rod
2. Bolt

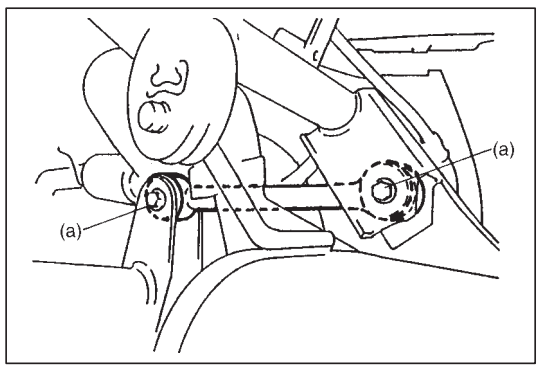
3) Remove upper rod.



1. Upper rod front bolt
2. Nut
3. Upper rod
4. Wheel speed sensor harness bracket (Toward outside of body)
5. Upper rod rear bolt
6. Washer
7. Body center
8. Front side

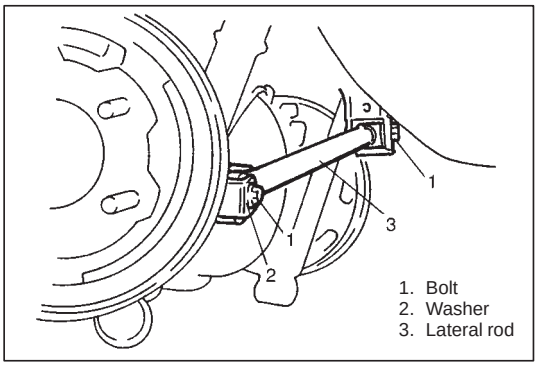
INSTALLATION

1) Install upper rod to chassis frame and axle housing, referring to figure for installing direction of bolts.
   Nuts should not be tightened.
2) See figure for distinction of installing direction of left side upper rod for vehicle equipped with ABS.
3) Connect wheel speed sensor harness clamp to upper rod (if equipped with ABS).



4) Lower hoist and with vehicle in non-loaded condition, tighten front bolt and rear nut of upper rod to specified torque.

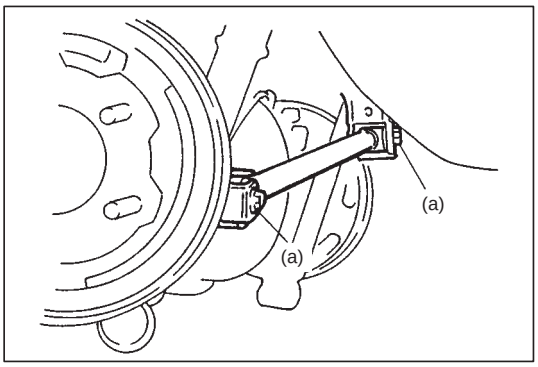
Tightening Torque
(a): 90 N·m (9.0 kg-m, 65 lb-ft)



LATERAL ROD

REMOVAL

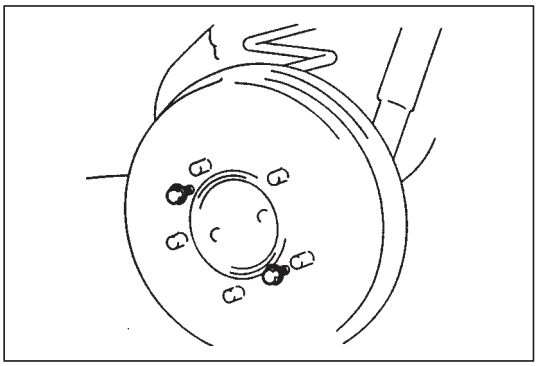
1) Hoist vehicle.
2) Remove lateral rod mounting bolts.
3) Remove lateral rod.



INSTALLATION

1) Install lateral rod to rear axle, and vehicle body.
2) Lower hoist.
3) Tighten lateral rod mounting bolts to specified torque.

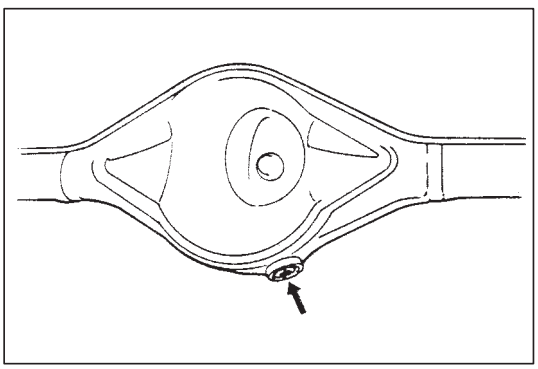
Tightening Torque
(a): 90 N·m (9.0 kg-m, 65.0 lb-ft)



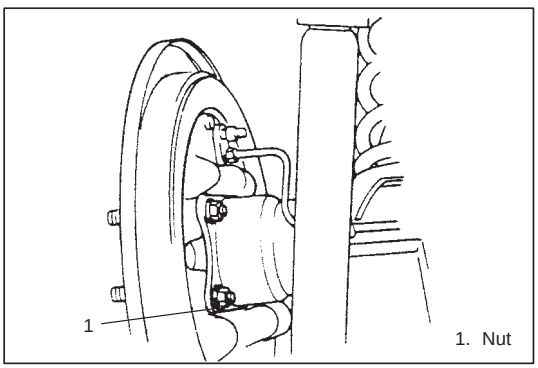
REAR AXLE SHAFT AND WHEEL BEARING

REMOVAL

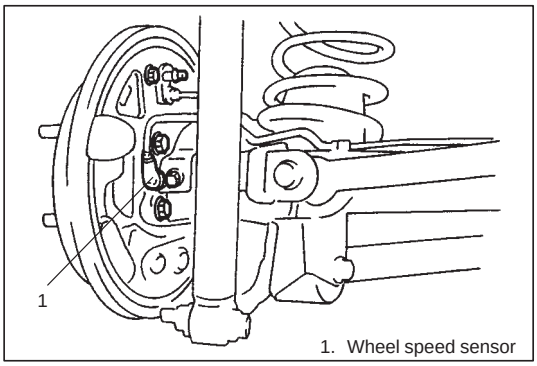
1) Remove rear brake drum. For details, refer to REAR BRAKE DRUM REMOVAL in SECTION 5C.



2) Drain gear oil from rear axle housing by loosening drain plug.



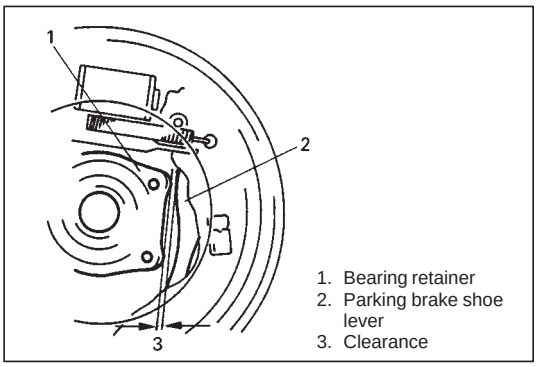
3) Remove rear wheel bearing retainer nuts from axle housing.



1. Wheel speed sensor

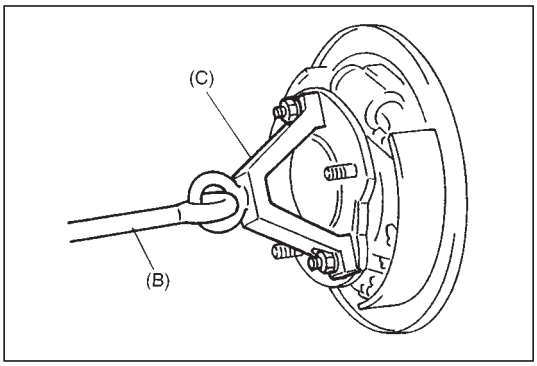
4) Remove wheel speed sensor from rear axle housing (if equipped with ABS).

CAUTION:
- **Do not pull wire harness or twist more than necessary when removing rear wheel speed sensor.**
- **Do not cause damage to surface of rear wheel speed sensor or pole piece and do not allow dust, etc. to enter its installation hole.**



1. Bearing retainer
2. Parking brake shoe lever
3. Clearance

5) Check to ensure that there is clearance between rear wheel bearing retainer and parking brake shoe lever. If no clearance is found, loosen cable locking nut further to obtain clearance.

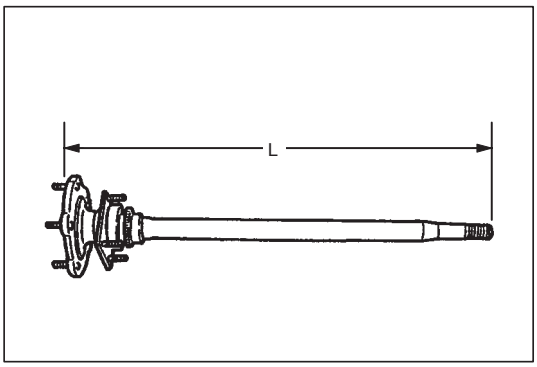


6) Using special tools (B) & (C) indicated below, draw out axle shaft.

NOTE:
Use care not to pull brake back plate along with shaft.

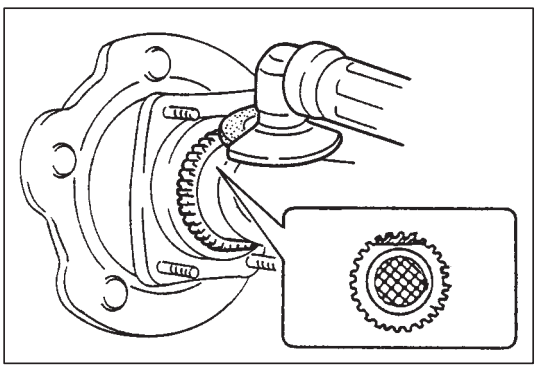
CAUTION:
Pull out axle shaft using care so that upper and lower brake struts and parking cable are not caught.

Special Tool
(C): 09943-35512
(B): 09942-15510

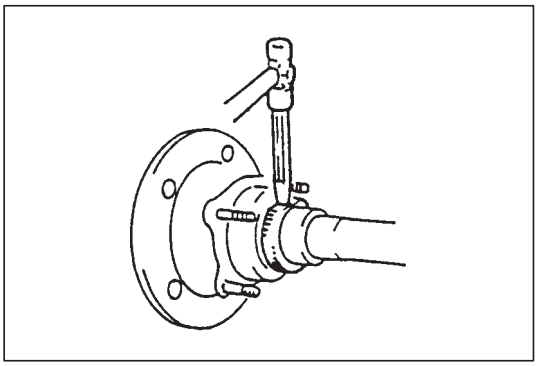


7) Rear axle shaft that was drawn out.

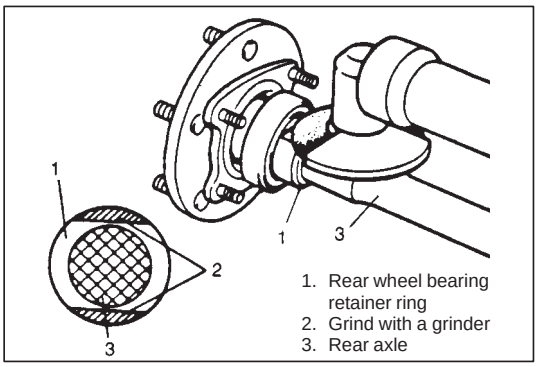
Shaft length "L":
Left side: 711.5 mm (28.0 in.)
Right side: 757.5 mm (29.8 in.)



8) If equipped with ABS, in order to remove sensor rotor from retainer ring, grind with a grinder one part of the sensor rotor as illustrated till it becomes thin.



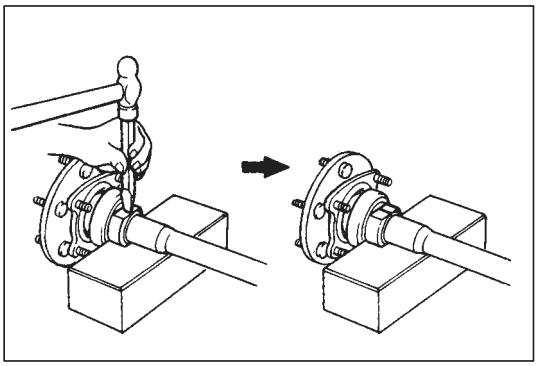
9) Break with a chisel the thin ground sensor rotor, and it can be removed (if equipped with ABS).



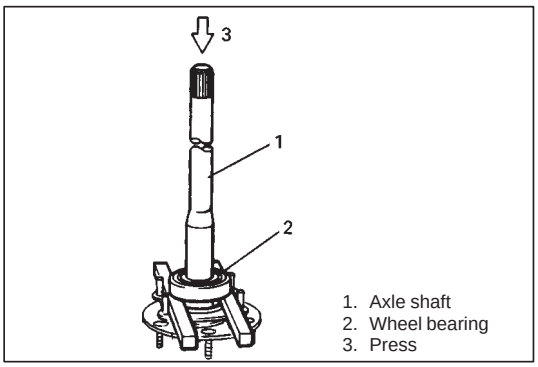
1. Rear wheel bearing retainer ring
2. Grind with a grinder
3. Rear axle

10) In order to remove the retainer ring from the shaft, grind with a grinder two parts of the bearing retainer ring as illustrated till it becomes thin.

CAUTION:
Be careful not to grind too far not to damage the shaft.

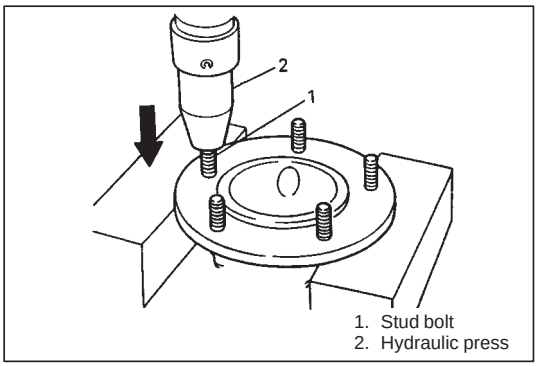


11) Break with a chisel the thin ground retainer ring, and it can be removed.



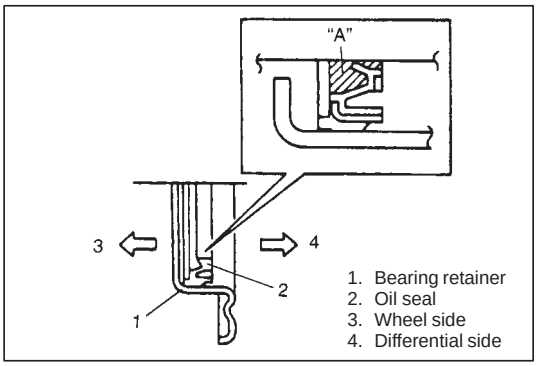
1. Axle shaft
2. Wheel bearing
3. Press

12) Remove bearing from shaft by using hydraulic press.
13) Remove bearing retainer.



1. Stud bolt
2. Hydraulic press

14) Remove stud bolt(s) by using hydraulic press.



1. Bearing retainer
2. Oil seal
3. Wheel side
4. Differential side

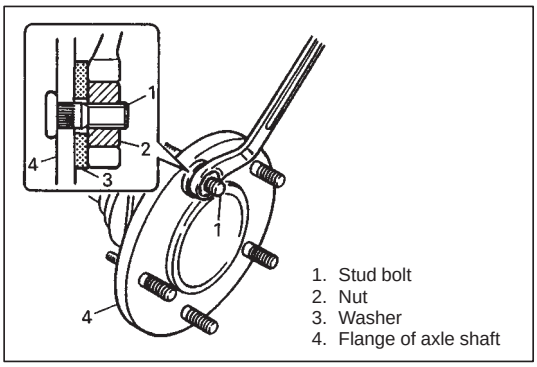
INSTALLATION

Install removed parts in reverse order of removal procedure, noting the following.

1) Apply grease to oil seal lip as shown and install it to axle shaft.

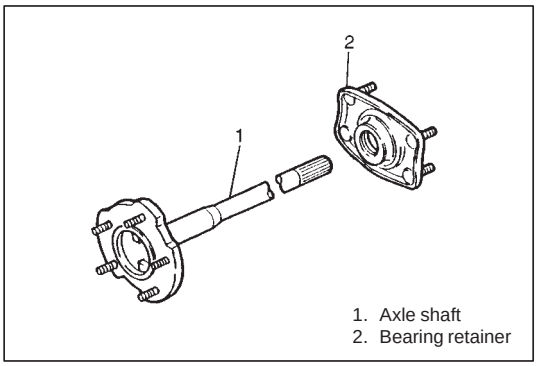
NOTE:
Amount of grease applied to hollow in oil seal should be more than 60% of its vacant space.

"A": Grease 99000-25010



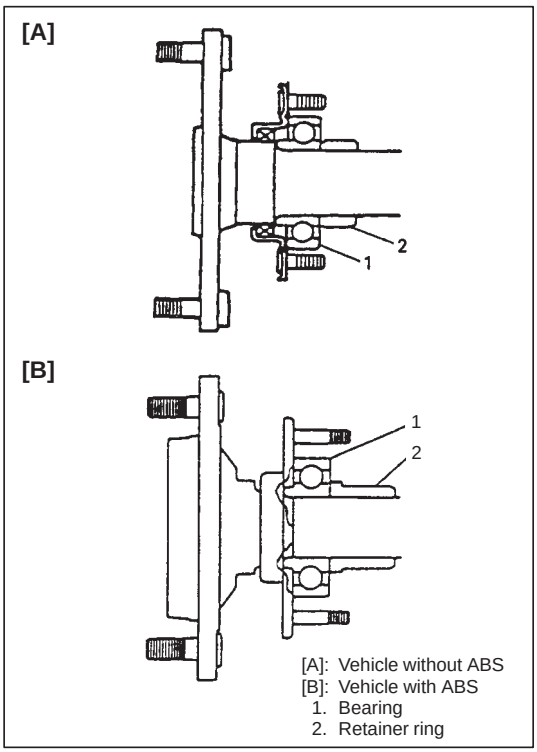
1. Stud bolt
2. Nut
3. Washer
4. Flange of axle shaft

2) Aligning serrations between new stud bolt(s) and flange, install new stud bolt(s) by tightening nut as shown.



1. Axle shaft
2. Bearing retainer

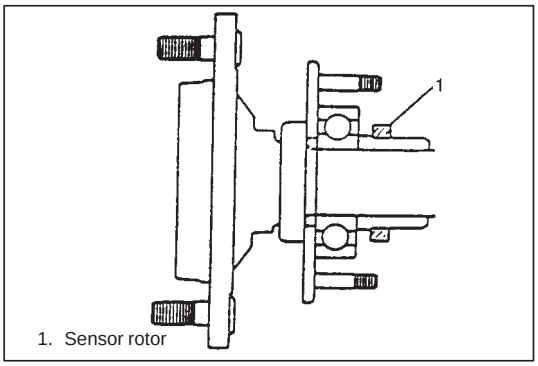
3) Install bearing retainer to shaft.



[A]: Vehicle without ABS
[B]: Vehicle with ABS
1. Bearing
2. Retainer ring

4) Press-fit wheel bearing and retainer ring as shown.

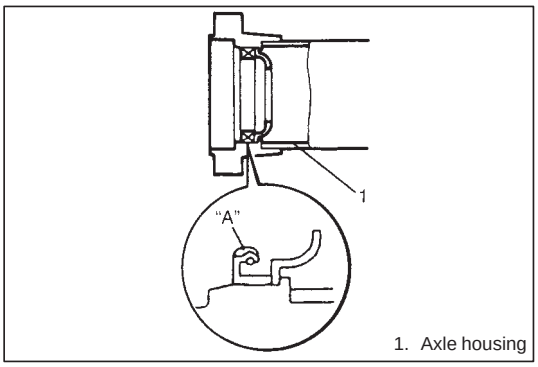
NOTE:
- **Use care not to cause any damage to outside of retainer ring.**
- **Refer to figure so that wheel bearing is installed in proper direction.**



1. Sensor rotor

5) For vehicle with ABS, press-fit new sensor rotor as shown.

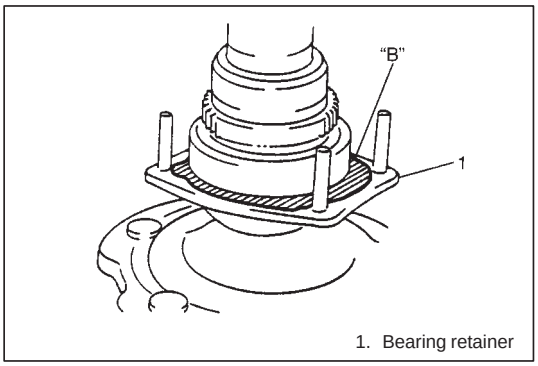
NOTE:
Use care not to cause any damage to outside of retainer ring.



1. Axle housing

6) Apply grease to axle shaft inner oil seal lip as shown.

"A": Grease 99000-25010

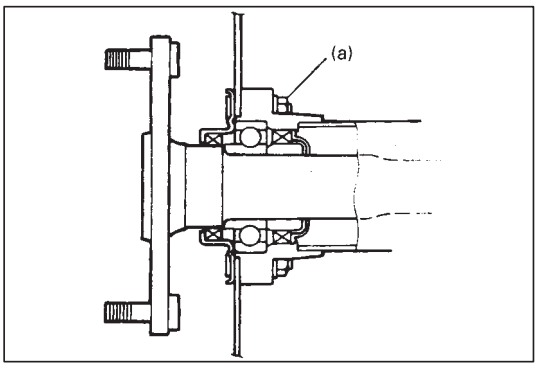


1. Bearing retainer

7) Apply sealant to mating surface of bearing retainer with brake back plate.

NOTE:
Make sure to remove old sealant before applying it anew.

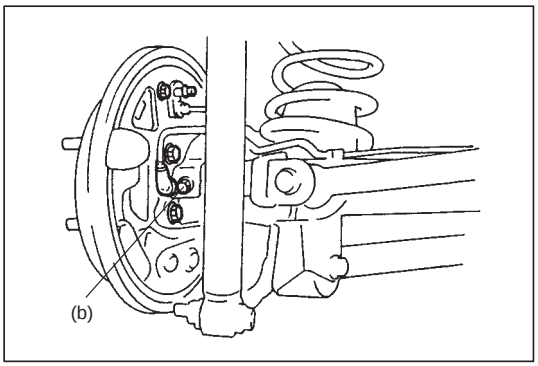
"B": Sealant 99000-31110



8) Install rear axle shaft to rear axle housing and tighten bearing retainer nuts to specified torque.

NOTE:
When installing rear axle shaft, be careful not to cause damage to oil seal lip in axle housing.

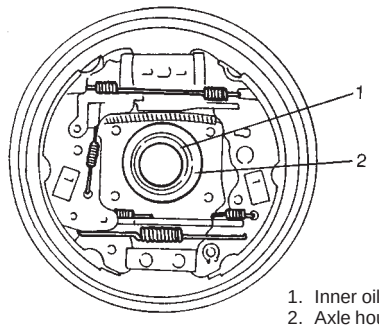
Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



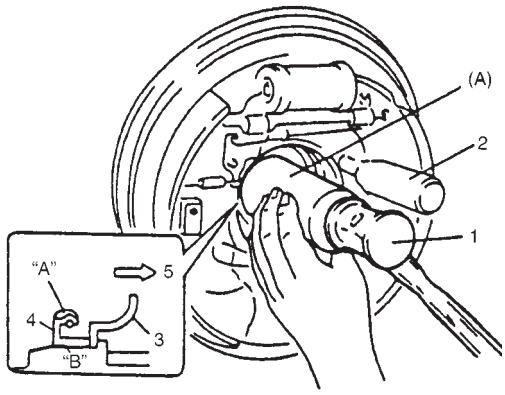
9) Tighten wheel speed sensor bolt to specified torque (if equipped with ABS).

Tightening Torque
(b): 21 N·m (2.1 kg-m, 15.5 lb-ft)

10) Refill rear axle (differential) housing with new specified gear oil. Refer to SECTION 7F for refill.
11) Install brake drum. (For details, refer to BRAKE DRUM INSTALLATION in SECTION 5.)



1. Inner oil seal
2. Axle housing



1. Hammer
2. Screwdriver
3. Oil seal protector
4. Oil seal
5. Body center

REAR AXLE SHAFT INNER OIL SEAL

REMOVAL

1) Remove rear axle shaft. For details, refer to steps 1) to 7) of REAR AXLE SHAFT REMOVAL in this section.
2) Fix brake back plate by inserting screwdriver to the hole for bearing retainer mounting.
3) Remove rear axle shaft inner oil seal.

NOTE:
Take care not to bend the brake pipe.

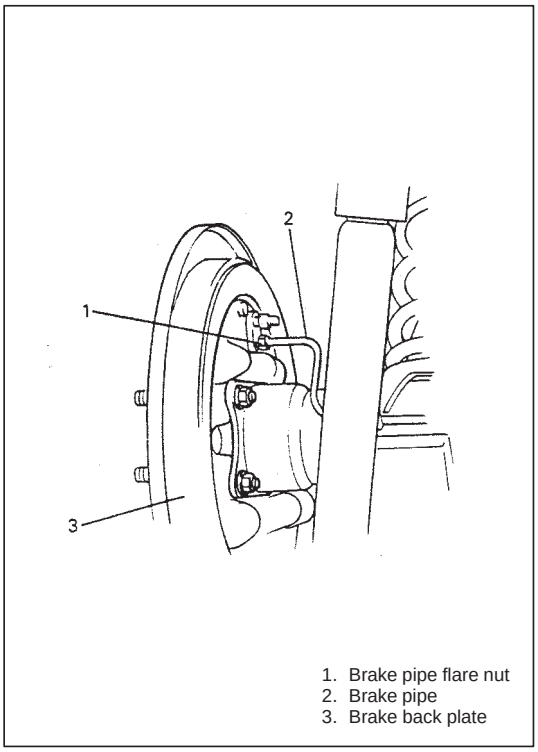
INSTALLATION

1) Using special tool drive in oil seal until it contacts oil seal protector in axle housing.

NOTE:
- **Make sure that oil seal is free from inclination as it is installed.**
- **Refer to figure so that oil seal is installed in proper direction.**

Special Tool
(A): 09913-75510
"A": Grease 99000-25010
"B": Sealant 99000-31110

2) For procedure hereafter, refer to steps 6) to 11) of REAR AXLE SHAFT INSTALLATION in this section.

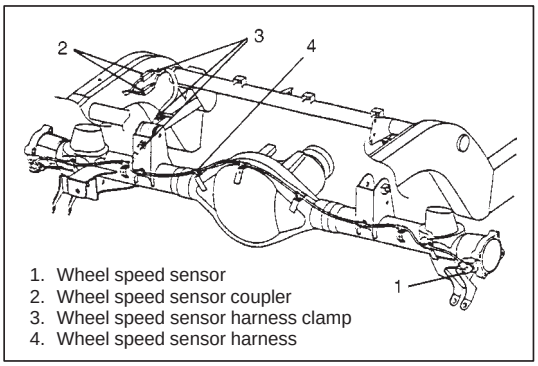


1. Brake pipe flare nut
2. Brake pipe
3. Brake back plate

REAR AXLE HOUSING

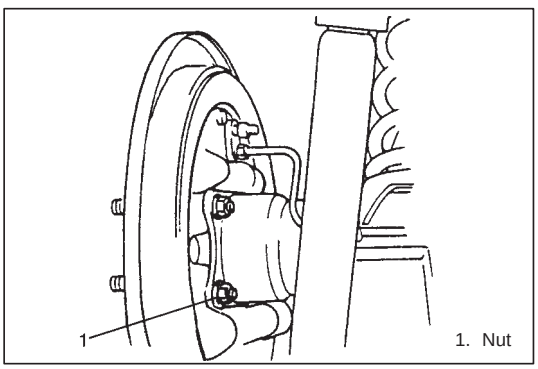
REMOVAL

1) Drain differential gear oil.
   Carry out steps 2) to 7) and 15) to 18) on both right and left wheels.
   Note that left wheel and its related parts are used in illustrations in this section.
2) Remove rear brake drum. (Refer to steps 1) to 5) of BRAKE DRUM REMOVAL.)
3) Disconnect brake pipe from wheel cylinder. With right side wheel cylinder, disconnect 2 brake pipes.



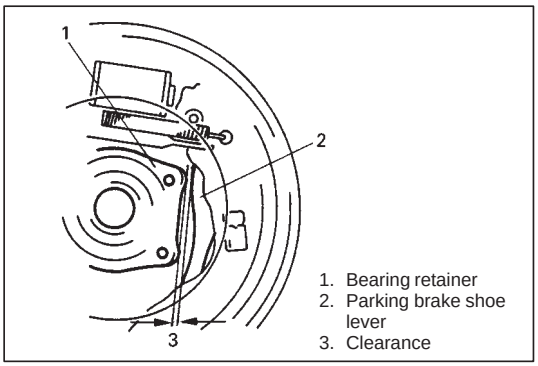
1. Wheel speed sensor
2. Wheel speed sensor coupler
3. Wheel speed sensor harness clamp
4. Wheel speed sensor harness

4) For vehicle with ABS, disconnect wheel speed sensor coupler and remove wheel speed sensor with its harness.



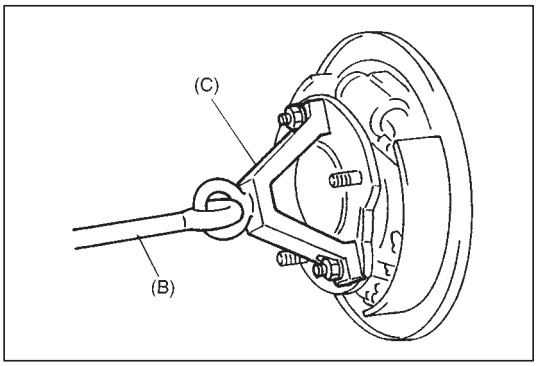
1. Nut

5) Remove rear wheel bearing retainer nuts from rear axle housing.



1. Bearing retainer
2. Parking brake shoe lever
3. Clearance

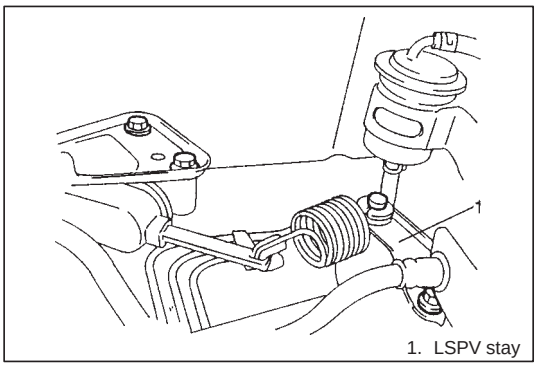
6) Check to ensure that there is clearance between rear wheel bearing retainer and parking brake shoe lever. If no clearance is found, loosen cable locking nut further to obtain clearance.



7) Using special tools (B) & (C) indicated below, draw out axle shafts. For vehicle equipped with ABS, remove wheel speed sensor from axle housing before drawing out axle shaft.

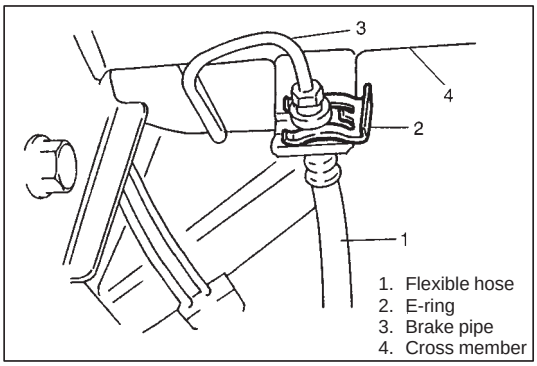
NOTE:
Use care not to pull brake back plate along with shaft.

Special Tool
(C): 09943-35512
(B): 09942-15510



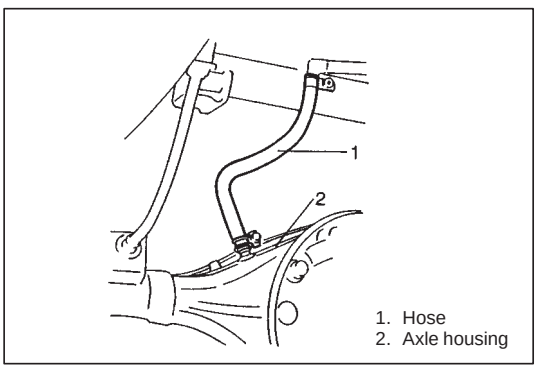
1. LSPV stay

8) For vehicle without ABS, remove LSPV stay from axle housing.



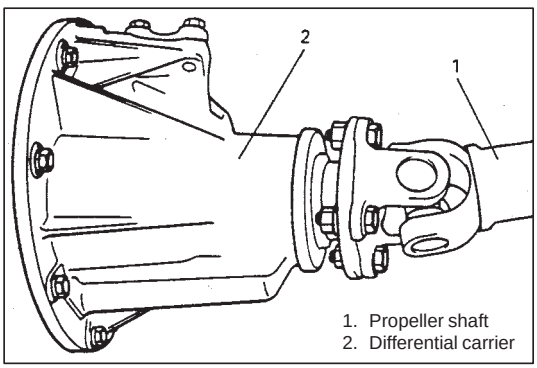
1. Flexible hose
2. E-ring
3. Brake pipe
4. Cross member

9) Remove brake back plate from rear axle housing.
10) Disconnect brake pipe from flexible hose and remove E-ring (front side).



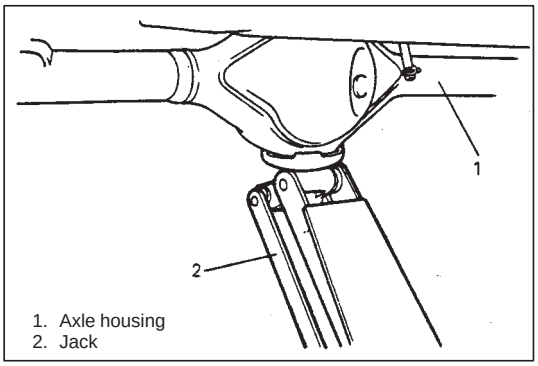
1. Hose
2. Axle housing

11) Remove brake pipe clamps and pipes from axle housing and disconnect breather hose from axle housing.



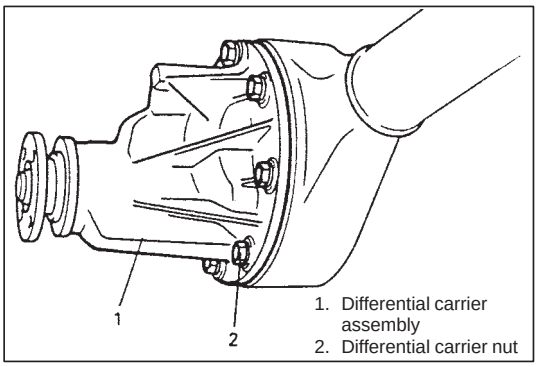
1. Propeller shaft
2. Differential carrier

12) Disconnect propeller shaft and remove propeller shaft from transmission.



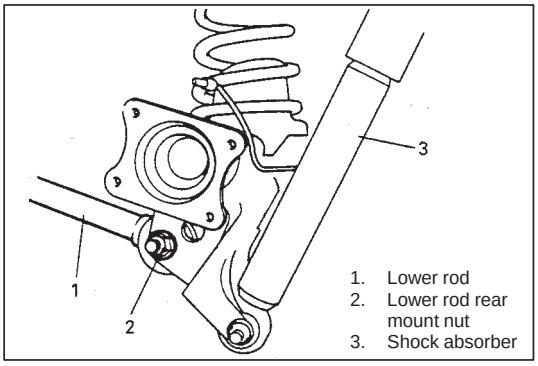
1. Axle housing
2. Jack

13) For jobs hereafter, support rear axle housing by using floor jack under axle housing.



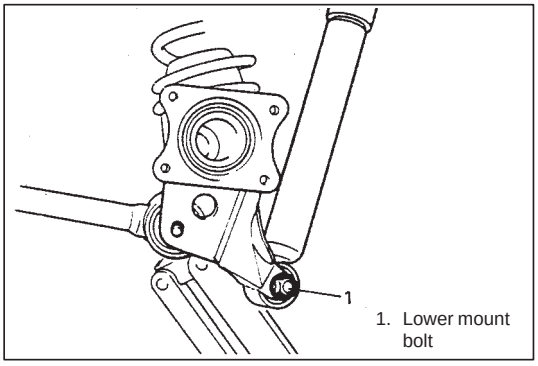
1. Differential carrier assembly
2. Differential carrier nut

14) Remove differential carrier assembly.



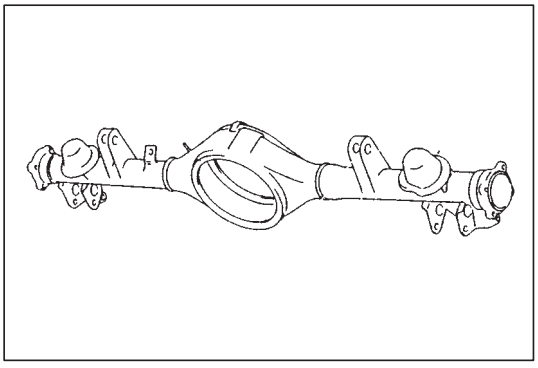
1. Lower rod
2. Lower rod rear mount nut
3. Shock absorber

15) Loosen rear mount nut of upper rod but don't remove bolt.
16) Loosen rear mount nut of lower rod but don't remove bolt.

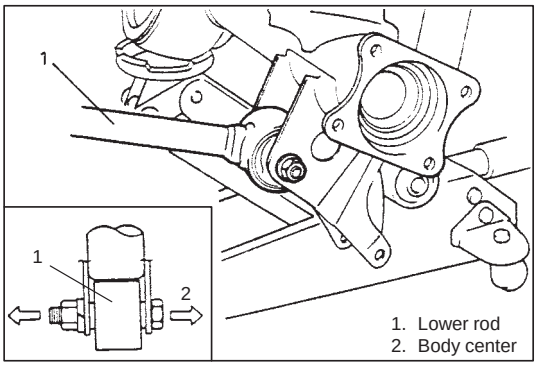


1. Lower mount bolt

17) Remove rear axle side lateral rod mount bolt.
18) Remove shock absorber lower mount bolt.



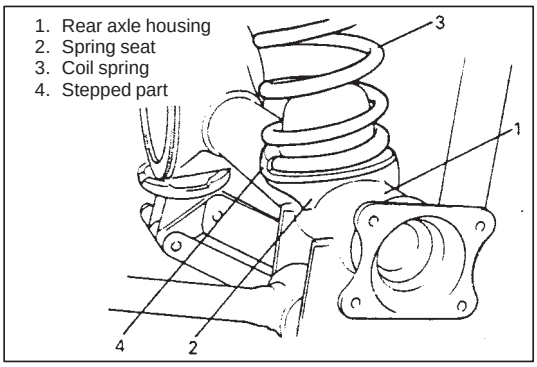
19) Lower floor jack until tension of suspension coil spring becomes a little loose and remove rear mount bolt of upper , lower and lateral rod.
20) Lower rear axle housing gradually.
21) Remove axle housing.



INSTALLATION

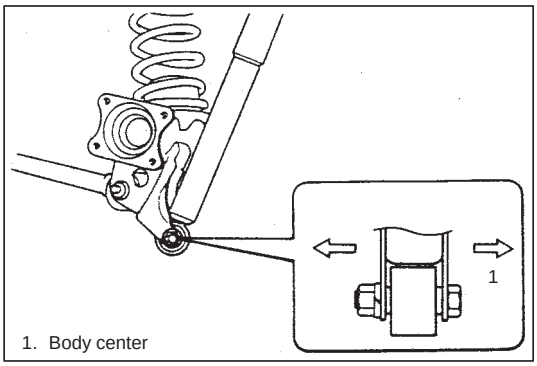
Install removed parts in reverse order of removal, noting the following.

1) Place rear axle housing on floor jack. Then install upper/lower rod rear mounting bolts (right & left) in proper direction as shown (refer to UPPER ROD INSTALLATION for upper rod bolts). At this time, mount nuts but don't tighten them.

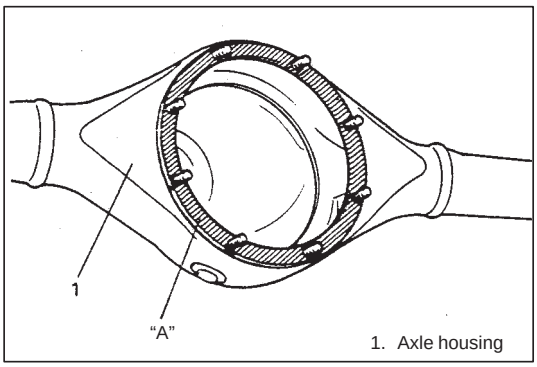


2) Install coil spring (right & left) on spring seat of axle housing and raise axle housing.

NOTE:
When seating coil spring, mate spring end with stepped part of rear axle spring seat as shown.

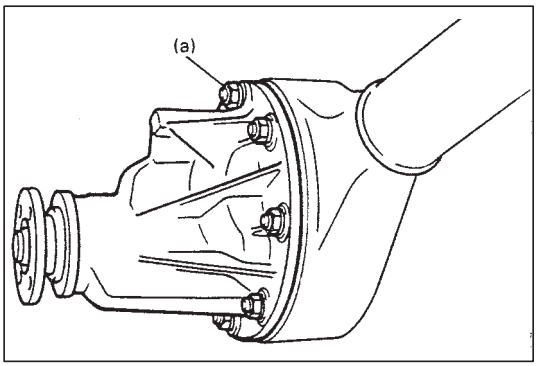


3) Install lateral rod to rear axle housing.
4) Install lower part of shock absorber to right and left sides of axle housing and install bolts in proper direction as shown in figure. At this time, mount nuts but don't tighten them.



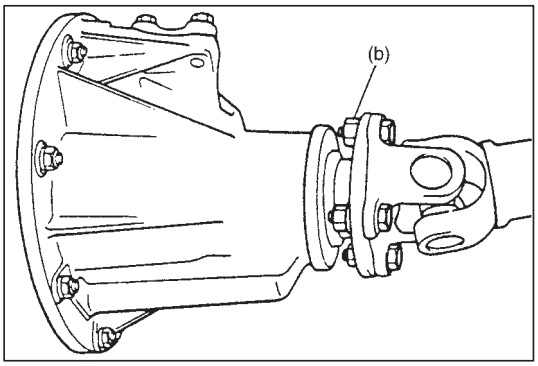
5) Clean mating surfaces of axle housing and differential carrier and apply sealant to housing side.

"A": Sealant 99000-31110



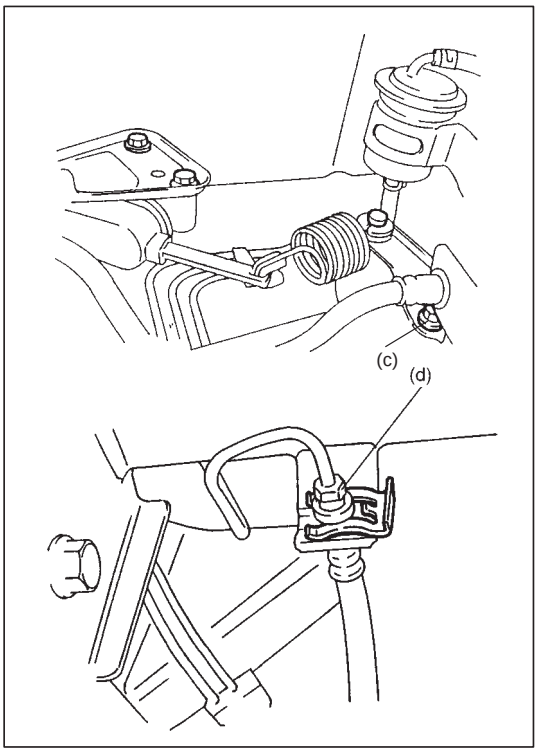
6) Install differential carrier assembly to axle housing and tighten carrier nuts to specified torque.

Tightening Torque
(a): 55 N·m (5.5 kg-m, 40.0 lb-ft)



7) For vehicle with ABS, connect wheel speed sensor coupler and install harness.
8) Install propeller shaft and torque nuts to specification.

Tightening Torque
(b): 50 N·m (5.0 kg-m, 36.5 lb-ft)

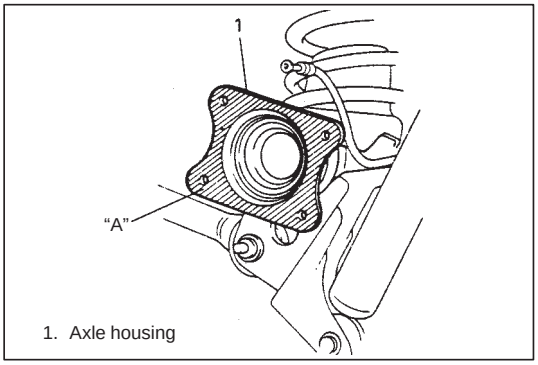


9) Remove floor jack from axle housing and connect breather hose onto axle housing and clamp it securely.
10) Connect brake pipes onto axle housing and clamp them securely.
For clamping positions, refer to SECTION 5A of this manual.
11) Connect brake flexible hose to bracket on axle housing and secure it with E-ring.
12) Install LSPV stay to axle housing, tighten LSPV stay bolt to specified torque.
And adjust LSPV referring to "LSPV ASSEMBLY INSPECTION AND ADJUSTMENT" in SECTION 5A.

Tightening Torque
(c): 23 N·m (2.3 kg-m, 17.0 lb-ft)

13) Connect brake pipe to brake flexible hose and tighten brake pipe flare nut to specified torque.

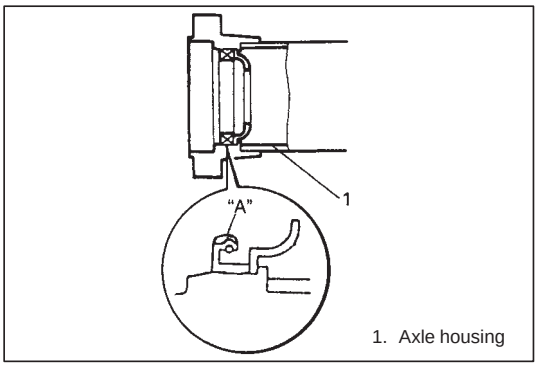
Tightening Torque
(d): 16 N·m (1.6 kg-m, 11.5 lb-ft)



1. Axle housing

14) Clean mating surface of axle housing (right & left) and brake back plate, then apply sealant as shown.

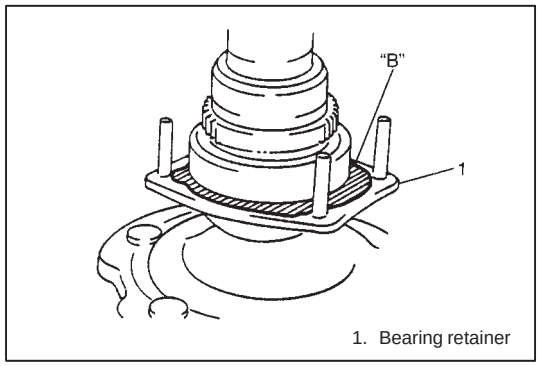
"A": Sealant 99000-31110



1. Axle housing

15) Apply grease to axle shaft inner oil seal lip as shown.

"A": Grease 99000-25010

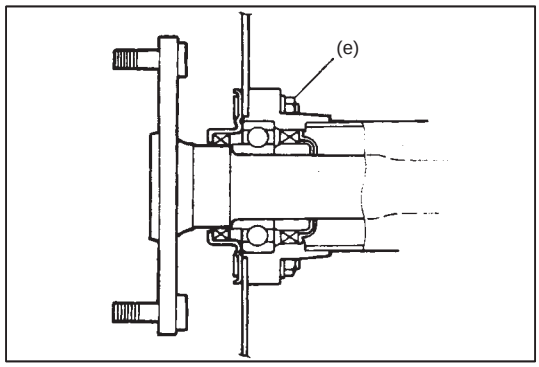


1. Bearing retainer

16) Apply sealant to mating surface of bearing retainer with brake back plate.

NOTE:
Make sure to remove old sealant before applying it anew.

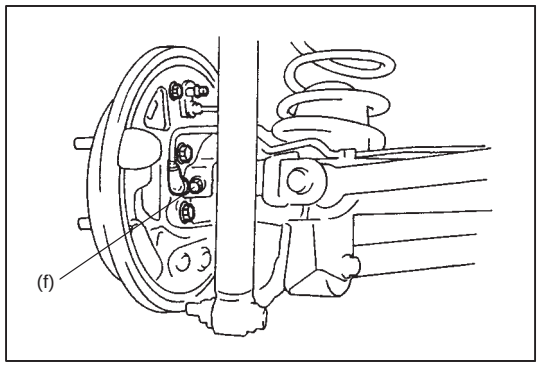
"B": Sealant 99000-31110



17) Install rear axle shaft to rear axle housing and tighten bearing retainer nuts to specified torque.

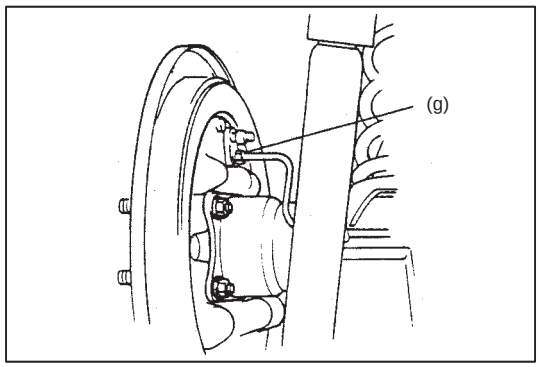
NOTE:
When installing rear axle shaft, be careful not to cause damage to oil seal lip in axle housing.

Tightening Torque
(e): 23 N·m (2.3 kg-m, 17.0 lb-ft)



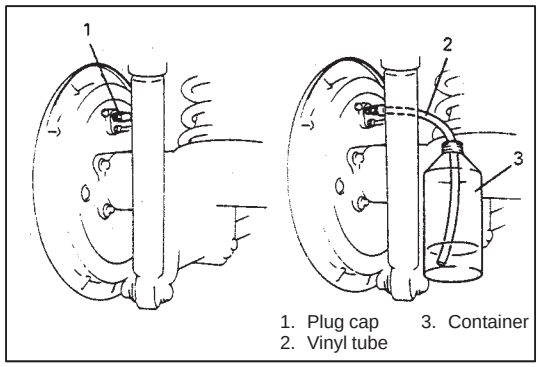
18) For vehicle with ABS, tighten wheel speed sensor bolt to specified torque.

Tightening Torque
(f): 21 N·m (2.1 kg-m, 15.5 lb-ft)



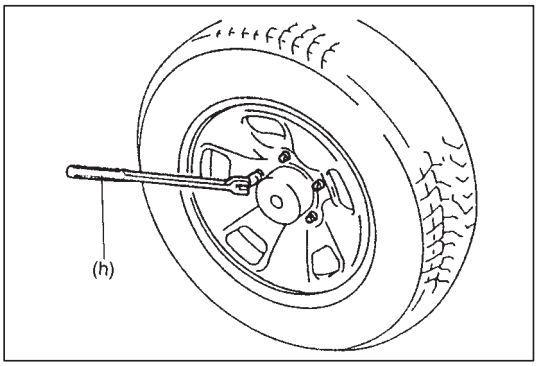
19) Connect brake pipes to wheel cylinders (right & left) and tighten brake pipe flare nuts to specified torque.

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



1. Plug cap
2. Vinyl tube
3. Container

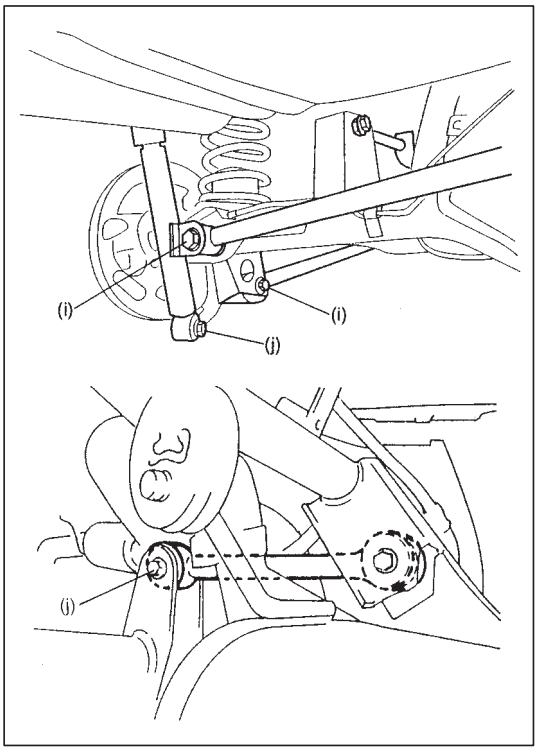
20) Install brake drum (right & left). For details, refer to SECTION 5C "BRAKE DRUM INSTALLATION".
21) Refill differential gear housing with new specified gear oil. Refer to "ON-VEHICLE SERVICE" in SECTION 7F for refill.
22) Fill reservoir with brake fluid and bleed brake system.(For bleeding operation, see SECTION 5.)



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

Tightening Torque
(h): 100 N·m (10.0 kg-m, 72.5 lb-ft)

24) Upon completion of all jobs, depress brake pedal with about 30 kg (66 lbs) load three to ten times so as to obtain proper drum-to-shoe clearance.
Adjust parking brake cable (for adjustment, see SECTION 5C of this manual.)
25) Tighten parking brake lever cover screws.
26) Lower hoist.



27) Tighten right and left lower/upper rod nuts lateral rod mount bolt and shock absorber nuts to specified torque.

NOTE:
When tightening these nuts, be sure that vehicle is off hoist and in non loaded condition.

Tightening Torque
(i): 90 N·m (9.0 kg-m, 65.0 lb-ft)
(j): 85 N·m (8.5 kg-m, 61.5 lb-ft)

28) Check to ensure that brake drum is free from dragging and proper braking is obtained.
29) Perform brake test (foot brake and parking brake).
30) Check each installed part for oil leakage.

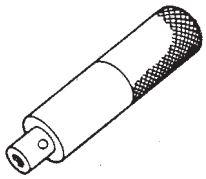
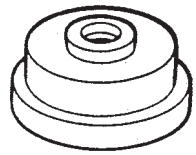
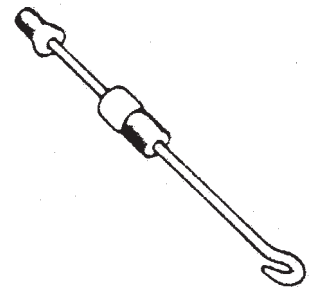
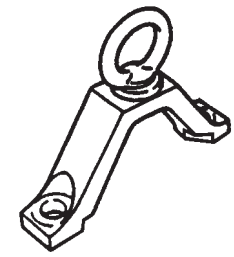
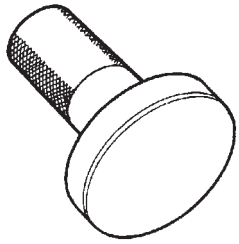
TIGHTENING TORQUE SPECIFICATIONS

Fastening parts		Tightening torque		
		N·m	Kg-m	lb-ft
Shock absorber lock nut		29	2.9	21.0
Shock absorber nut		29	2.9	21.0
Shock absorber lower nut		85	8.5	61.5
Lower rod bolt and nut		90	9.0	65.0
Upper rod bolt and nut				
Lateral rod bolt				
Differential carrier nut		55	5.5	40.0
Propeller shaft nut		50	5.0	36.5
Brake pipe flare nut		16	1.6	11.5
Bearing retainer nut		23	2.3	17.0
Differentiation gear oil filler & drain plug	Filler plug	50	5.0	36.5
	Drain plug	27	2.7	16.0
Wheel nut		100	10.0	72.5

REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	Oil seal lip
Brake fluid	DOT 3	Brake reservoir tank
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	● Joint seam of axle and brake back plate ● Joint seam of bearing retainer and brake back plate ● Joint seam of differential carrier and axle housing ● Drain plug ● Mating surface of oil seal and axle housing
Gear oil	For gear oil information, refer to SECTION 7F of this manual	Differential gear (Refer axle housing.)

SPECIAL TOOLS

 09924-74510 Bush remover handle	 09926-88310 Oil seal installer	 09942-15510 Sliding hammer	 09943-35512 Brake drum remover
 09913-75510 Oil seal installer			

SECTION 3F

WHEELS AND TIRES

NOTE:
All wheel fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts.
There is to be no welding as it may result in extensive damage and weakening of the metal.

CONTENTS

GENERAL DESCRIPTION 3F- 1
Tires 3F- 1
Wheels 3F- 1
Replacement Tires 3F- 1
Wheels Replacement 3F- 2
Metric Lug Nuts and Wheel Studs 3F- 2
DIAGNOSIS 3F- 3
Diagnosis Table 3F- 3
Balancing Wheels 3F- 3
MAINTENANCE AND MINOR ADJUSTMENTS 3F- 4
Wheel and Tire 3F- 4
ON-VEHICLE SERVICE 3F- 6
Wheel 3F- 6
Tire 3F- 7
TIGHTENING TORQUE SPECIFICATIONS 3F- 8

GENERAL DESCRIPTION

TIRES

This vehicle is equipped with following tire. P215/65 R16, 215/65 R16 or 235/60 R16
The tires are of tubeless type. The tires are designed to operate satisfactorily with loads up to the full rated load capacity when inflated to the recommended inflation pressure.
Correct tire pressures and driving habits have an important influence on tire life. Heavy cornering, excessively rapid acceleration, and unnecessary sharp braking increase tire wear.

WHEELS

Standard equipment wheels are following steel wheel. 16 × 6 1/2 J or 16 × 7JJ

REPLACEMENT TIRES

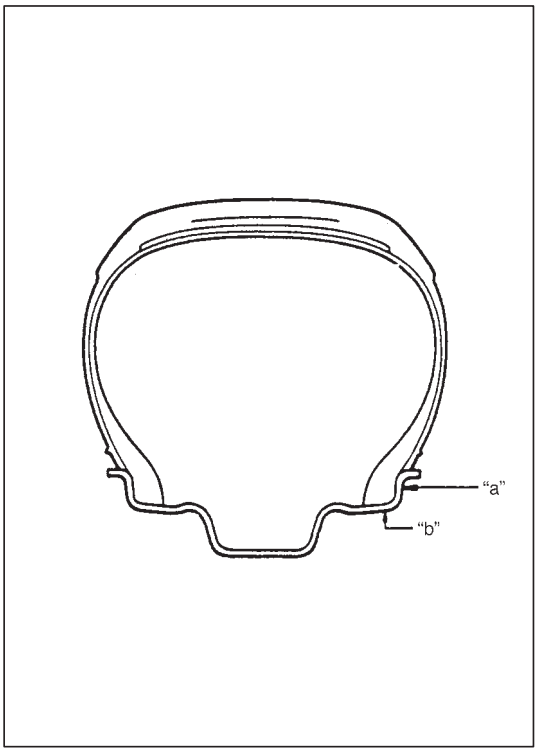
When replacement is necessary, the original equipment type tire should be used. Refer to the Tire Placard. Replacement tires should be of the same size, load range and construction as those originally on the vehicle. Use of any other size or type tire may affect ride, handling, speedometer/odometer calibration, vehicle ground clearance and tire or snow chain clearance to the body and chassis.

NOTE:
Do not mix different types of tires on the same vehicle such as radial, bias and bias-belted tires except in emergencies, because vehicle handling may be seriously affected and may result in loss of control.

It is recommended that new tires be installed in pairs on the same axle. If necessary to replace only one tire, it should be paired with the tire having the most tread, to equalize braking traction.

kPa	kgf/cm^2	psi
160	1.6	23
180	1.8	26
200	2.0	29
220	2.2	32
240	2.4	35
260	2.6	38
280	2.8	41
300	3.0	44
320	3.2	47
340	3.4	50
Conversion:	1 psi = 6.895 kPa 1 kgf/cm^2 = 98.066 kPa	

The metric term for tire inflation pressure is the kilopascal (kPa). Tire pressures will usually be printed in both kPa and psi on the Tire Placard. Metric tire gauges are available from tool suppliers. The chart, left table, converts commonly used inflation pressures from kPa to psi.



WHEELS REPLACEMENT

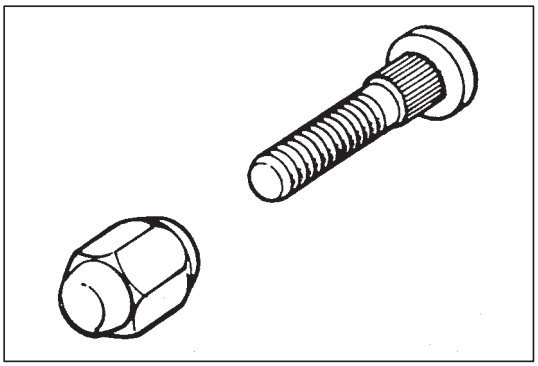
Wheels must be replaced if they are bent, dented, have excessive lateral or radial runout, leak air through welds, have elongated bolt holes, if lug nuts won't stay tight, or if they are heavily rusted. Wheels with greater runout than shown in left figure may cause objectional vibrations.

Wheels for replacement must be equivalent to the originally equipped wheels in load capacity, diameter, rim width, off-set and mounting configuration. A wheel of improper size or type may affect wheel and bearing life, brake cooling, speedometer/odometer calibration, ground clearance to the body and chassis.

To measure the wheel runout, it is necessary to use accurate dial indicator. The tire may be on or off the wheel. The wheel should be installed to the wheel balancer of the like for proper measurement. Take measurements of both lateral runout and radial runout at both inside and outside of the rim flange. With dial indicator set in place securely, turn the wheel one full revolution slowly and record every reading of the indicator.

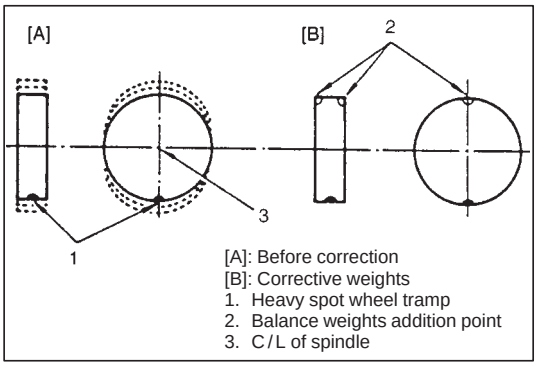
When the measured runout exceeds the specification and correction by the balancer adjustment is impossible, replace the wheel. If the reading is affected by welding, paint or scratch, it should be ignored.

Lateral runout limit "a": 1.20 mm (0.047 in.)
Radial runout limit "b": 1.20 mm (0.047 in.)

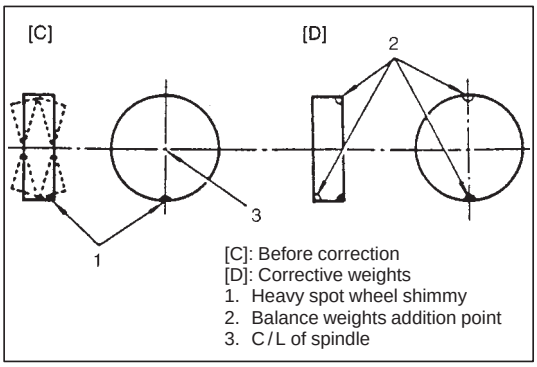


METRIC LUG NUTS AND WHEEL STUDS

All models use metric lug nuts and wheel studs (size M12 x 1.25).



[A]: Before correction
[B]: Corrective weights
1. Heavy spot wheel tramp
2. Balance weights addition point
3. C/L of spindle



[C]: Before correction
[D]: Corrective weights
1. Heavy spot wheel shimmy
2. Balance weights addition point
3. C/L of spindle

DIAGNOSIS

DIAGNOSIS TABLE

Refer to SECTION 3.

BALANCING WHEELS

There are two types of wheel and tire balance: static and dynamic. Static balance, as shown in left figure, is equal distribution of weight around wheel. Wheels that are statically unbalanced cause bouncing action called tramp. This condition will eventually cause uneven tire wear.

Dynamic balance, as shown in left figure, is equal distribution of weight on each side of wheel centerline so that when the tire spins there is no tendency for the assembly to move from side to side. Wheels that are dynamically unbalanced may cause shimmy.

GENERAL BALANCE PROCEDURE

Deposits of mud, etc. must be cleaned from inside of rim.

WARNING:
Stones should be removed from tread in order to avoid operator injury during spin balancing and to obtain good balance.

Tire should be inspected for any damage, then balanced according to equipment manufacturer's recommendation.

OFF-VEHICLE BALANCING

Most electronic off-vehicle balancers are more accurate than on-vehicle spin balancers. They are easy to use and give a dynamic (two plane) balance. Although they do not correct for drum or disc unbalance as does on-vehicle spin balancing, this is overcome by their accuracy, usually to within 1/8 ounce.

ON-VEHICLE BALANCING

ON-vehicle balancing methods vary with equipment and tool manufacturers. Be sure to follow each manufacturer's instructions during balancing operation.

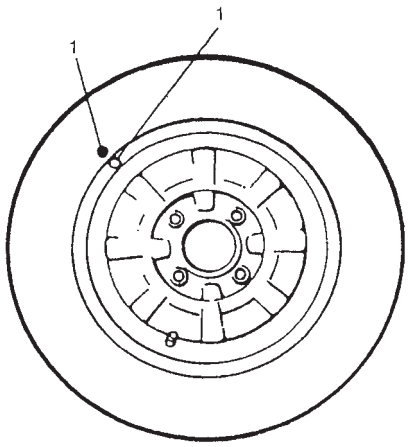
MAINTENANCE AND MINOR ADJUSTMENTS

WHEEL AND TIRE

Wheel repairs that use welding, heating, or peening are not approved. All damaged wheels should be replaced.

STUDS

If a broken stud is found, see Section 3E (rear) or Section 3D (front) for Note and Replacement procedure.



1. Paint

MATCHED TIRES AND WHEELS

(For vehicle equipped with steel wheels)

Tires and wheels are matchmounted at the assembly plant.
This means that the radially stiffest part of the tire, or “high spot”, is matched to the smallest radius or “low spot” of the wheel.
This is done to provide the smoothest possible ride.
The “high spot” of the tire is originally marked by paint dot on the outboard sidewall. This paint dot will eventually wash off the tire.
The “low spot” of the wheel is originally marked by paint dot on the wheel rim-flange. Properly assembled, the wheel rims’ paint dot should be aligned with the tires’ paint dot as shown in left figure.
Whenever a tire is dismounted from its wheel, it should be re-mounted so that the tire and wheel are matched. If the tire’s paint dot cannot be located, a line should be scribed on the tire and wheel before dismounting to assure that it is remounted in the same position.

INFLATION OF TIRES

The pressure recommended for any model is carefully calculated to give a satisfactory ride, stability, steering, tread wear, tire life and resistance to bruises.
Tire pressure, with tires cold, (after vehicle has set for three hours or more, or driven less than one mile) should be checked monthly or before any extended trip. Set to the specifications on the tire placard located on the side of instrument panel.
It is normal for tire pressure increase when the tires become hot during driving. Do not bleed or reduce tire pressure after driving. Bleeding reduces the “Cold Inflation Pressure”.

Higher than Recommended Pressure Can Cause:

1. Hard ride
2. Tire bruising or carcass damage
3. Rapid tread wear at center of tire

Unequal Pressure on Same Axle Can Cause:

1. Uneven braking
2. Steering lead
3. Reduced handling
4. Swerve on acceleration

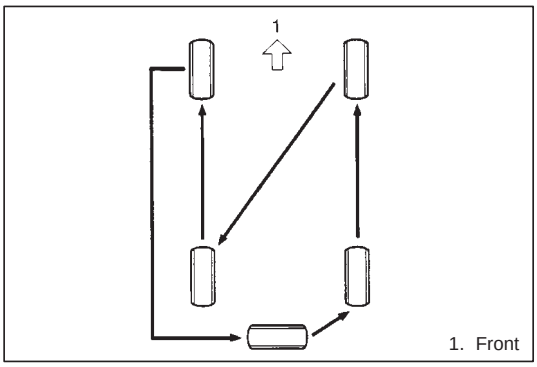
Valve caps should be kept on valves to keep dust and water out.

Lower than Recommended Pressure Can Cause:

1. Tire squeal on turns
2. Hard steering
3. Rapid and uneven wear on the edges of the tread
4. Tire rim bruises and rupture
5. Tire cord breakage
6. High tire temperatures
7. Reduced handling
8. High fuel consumption

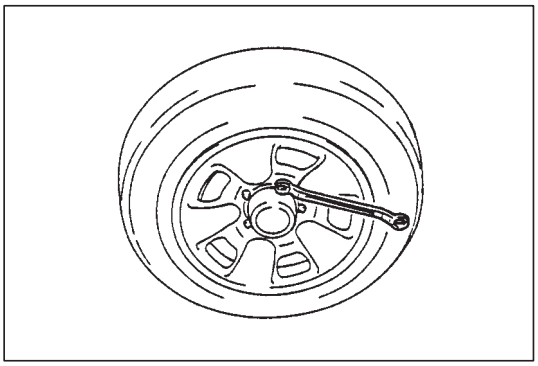
TIRE PLACARD

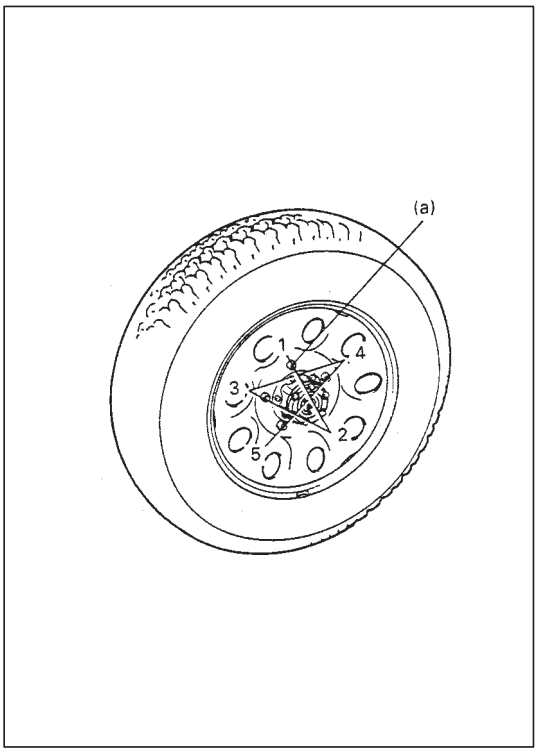
The tire placard is located on the driver's side door lock pillar and should be referred to for tire information. The placard lists the maximum load, tire size and cold tire pressure where applicable.



TIRE ROTATION

To equalize wear, rotate tires periodically as shown in figure.





ON-VEHICLE SERVICE

WHEEL

REMOVAL

1) Loosen wheel nuts by approximately 180° (half a rotation).
2) Hoist vehicle.
3) Remove wheel.

NOTE:
Never use heat to loosen tight wheel because application of heat to wheel can shorten life of wheel and damage wheel bearings.

INSTALLATION

Wheel nuts must be tightened in sequence and to proper torque to avoid bending wheel or brake drum or disc as in figure.

NOTE:
Before installing wheels, remove any build-up of corrosion on wheel mounting surface and brake drum or disc mounting surface by scraping and wire brushing. Installing wheels without good metal-to-metal contact at mounting surfaces can cause wheel nuts to loosen, which can later allow wheel to come off while vehicle is moving.

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

TIRE

MOUNTING AND DEMOUNTING

Use tire changing machine to mount or demount tires. Follow equipment manufacturer's instructions. Do not use hand tools or tire irons alone to change tires as they may damage tire beads or wheel rim.

Rim bead seats should be cleaned with wire brush or coarse steel wool to remove lubricants, old rubber and light rust. Before mounting or demounting tire, bead area should be well lubricated with approved tire lubricant.

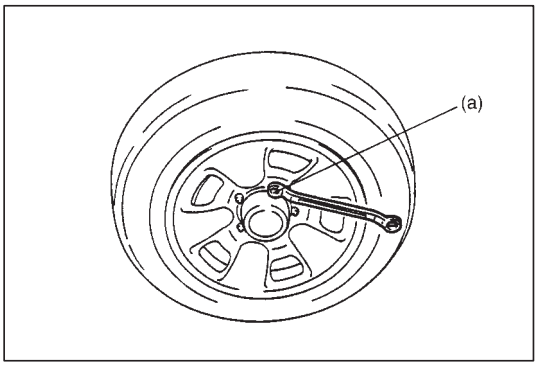
After mounting, inflate to 240 kPa (35psi) so that beads are completely seated. Then adjust pressure to specified shown an tire placard.

WARNING:
Do not stand over tire when inflating. Bead may break when bead snaps over rim's safety hump and cause serious personal injury.
Do not exceed 240 kPa (35 psi) pressure when inflating. If 240 kPa (35 psi) pressure will not seat beads, deflate, re-lubricate and reinflate. Over inflation may cause bead to break and cause serious personal injury.

Install valve core and inflate to proper pressure.

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 the tire manufacturer.



TIGHTENING TORQUE SPECIFICATIONS

Tightening Torque for wheel nut
(a): 100 N·m (10.0 kg-m, 72.5 lb-ft)

SECTION 4A2

FRONT DRIVE SHAFT/SHAFT BEARING, OIL SEAL

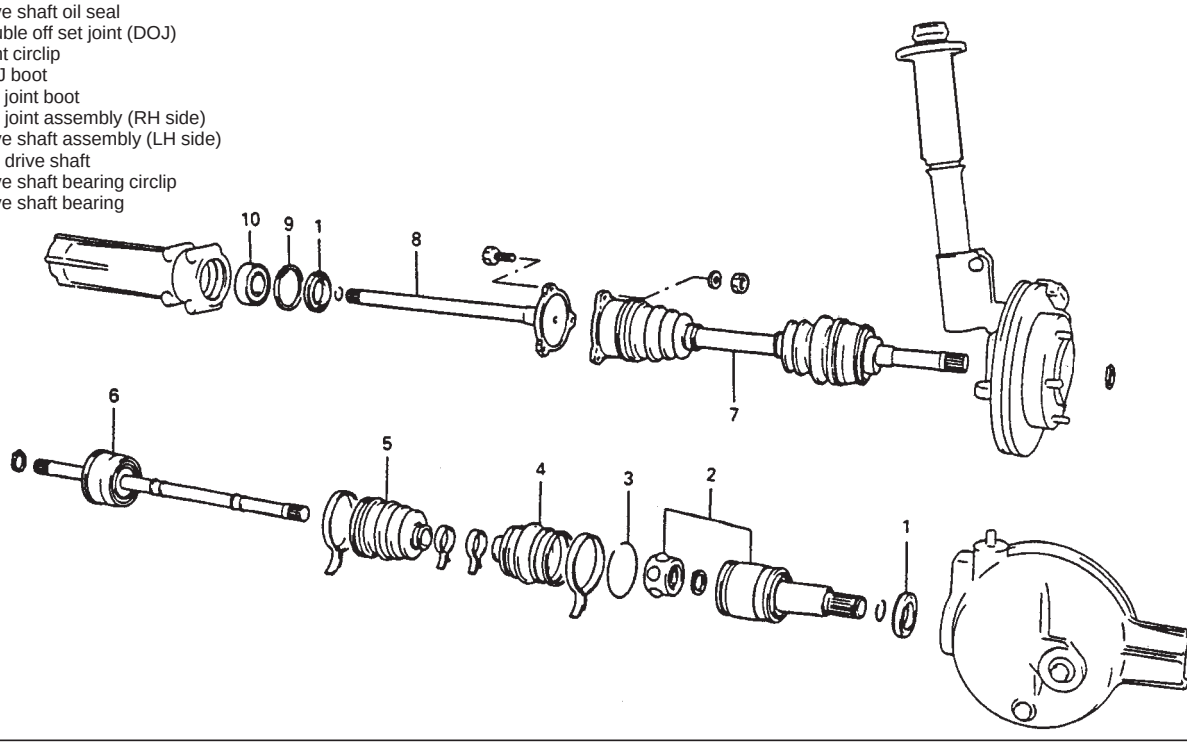
CONTENTS

GENERAL DESCRIPTION 4A2- 1
DIAGNOSIS 4A2- 2
Diagnosis Table 4A2- 2
Drive Shaft Boot And Joint Check 4A2- 2
ON-VEHICLE SERVICE 4A2- 3
Drive Shaft 4A2- 3
Shaft Bearing/Oil Seal 4A2- 9
TIGHTENING TORQUE SPECIFICATIONS 4A2-11
REQUIRED SERVICE MATERIALS 4A2-11
SPECIAL TOOLS 4A2-11

GENERAL DESCRIPTION

The drive shaft joint is a constant velocity joint (C.V. joint) which slides in the axial direction. The joint is composed of an outer race, cage, inner race and balls. In the turning direction, the joint rotates in the same way as a ball bearing. The balls lock rotation completely and transmit drive. In addition this vehicle is also characterized by a function that the shaft can slide through the balls in the grooves of the outer race in the extension/contraction direction of the drive shaft.

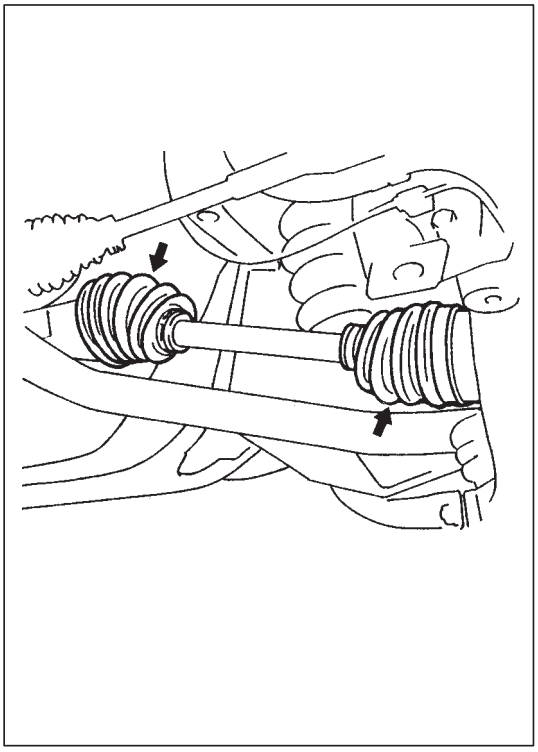
1. Drive shaft oil seal
2. Double off set joint (DOJ)
3. Joint circlip
4. DOJ boot
5. Ball joint boot
6. Ball joint assembly (RH side)
7. Drive shaft assembly (LH side)
8. Left drive shaft
9. Drive shaft bearing circlip
10. Drive shaft bearing



DIAGNOSIS

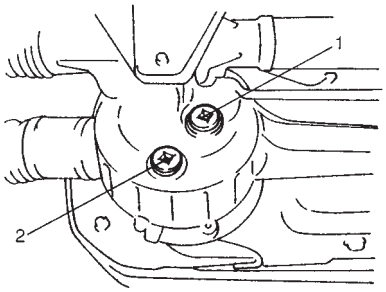
DIAGNOSIS TABLE

Condition	Possible Cause	Correction
When starting: Abnormal Noise	● Loose wheel nuts. ● Loose drive shaft flange bolts. ● Broken or otherwise damaged wheel bearing.	Tighten wheel nuts. Tighten drive shaft flange bolts. Replace or change.
When making turns: Abnormal Noise	● Grease leakage from drive shaft joint boot. ● Worn or broken drive shaft joint.	Replace joint boot and apply grease. Replace drive shaft joint.
When running: Abnormal Noise	● Broken drive shaft joint. ● Poorly lubricated or worn drive shaft joint. ● Loose drive shaft flange bolts. ● Deformed drive shaft oil seal.	Replace drive shaft joint. Lubricate or replace joint. Tighten drive shaft flange bolts. Replace.
Vibration	● Worn drive shaft joint. ● Deformed drive shaft oil seal. ● Deformed drive shaft.	Replace drive shaft joint. Replace. Replace.



DRIVE SHAFT BOOT AND JOINT CHECK

Check drive shaft boot for tear. If even a small tear is noted, replace with new one.
Check drive shaft joint for wear, breakage and other damage and replace if any defect exists.



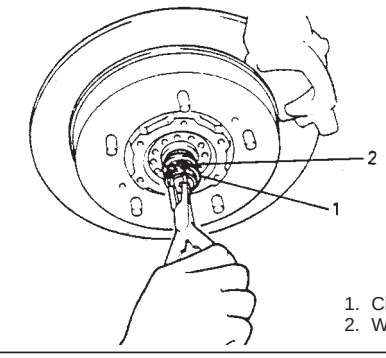
1. Oil filler / level plug
2. Front drain plug

ON-VEHICLE SERVICE

DRIVE SHAFT

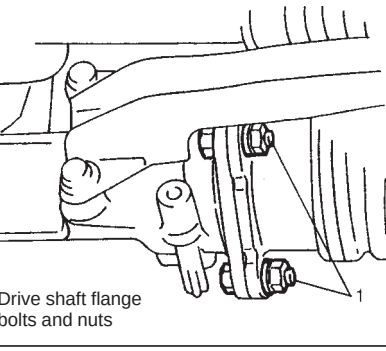
REMOVAL (LEFT SIDE)

1) Hoist vehicle and remove wheel.



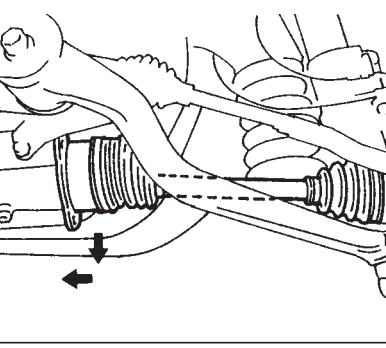
1. Circlip
2. Washer

2) Remove axle shaft drive flange.
3) Remove drive shaft circlip and front spindle thrust washer.



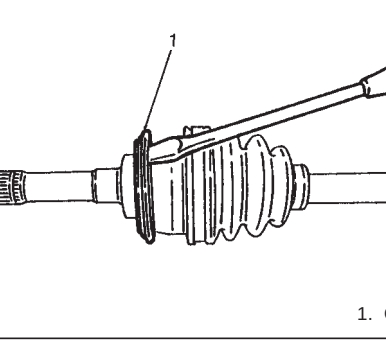
1. Drive shaft flange bolts and nuts

4) Remove drive shaft flange bolts and nuts.



5) Remove drive shaft assembly to differential side as shown in left figure.

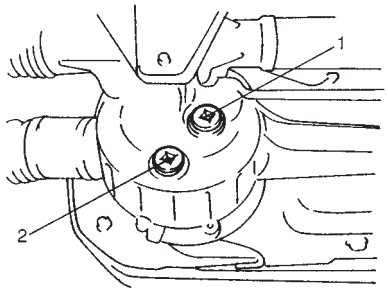
CAUTION:
To prevent breakage of boots (wheel side and differential side), be careful not to bring them into contact with other parts when removing drive shaft assembly.



1. Oil seal

6) Remove drive shaft thrust washer (vehicle with G16 or J20 engine) from drive shaft and remove drive shaft oil seal as shown in figure.

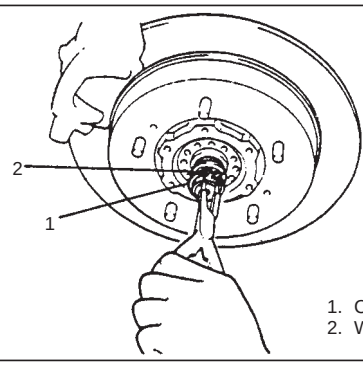
CAUTION:
Be careful not to cause damage to drive shaft joint.



1. Oil filler/level plug
2. Front drain plug

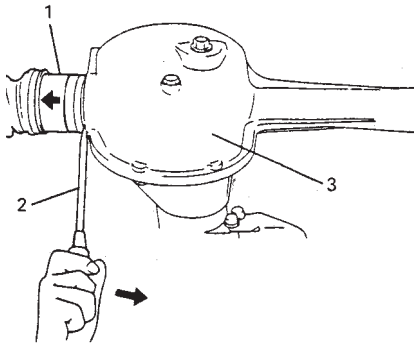
REMOVAL (RIGHT SIDE)

1) Hoist vehicle and remove wheel.
2) Drain differential gear oil.



1. Circlip
2. Washer

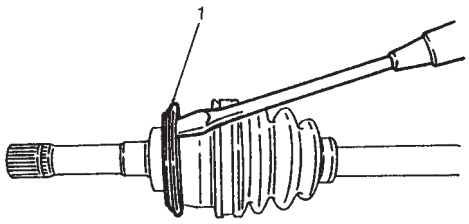
3) Remove axle shaft drive flange.
4) Remove circlip and front spindle thrust washer.
5) Remove knuckle and wheel hub comp, refer to steps 5) to 7) and 9) to 14) of item COIL SPRING REMOVAL in Section 3D.



1. Differential side joint
2. Tire lever
3. Front differential assembly

6) Remove drive shaft assembly.
   To detach snap ring fitted on the spline of differential side joint (inboard joint) from differential side gear, pull inboard joint by using a tire lever.

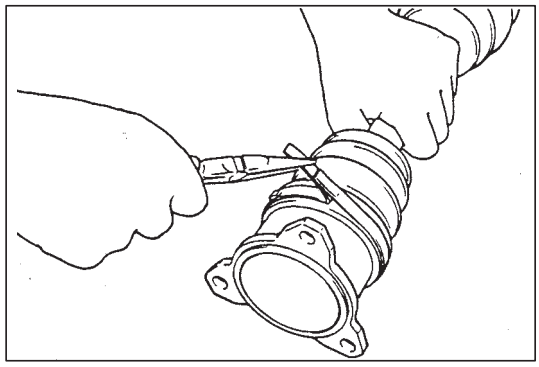
CAUTION:
To prevent breakage of boots (wheel side and differential side), be careful not to bring them into contact with other parts when removing drive shaft assembly.



1. Oil seal

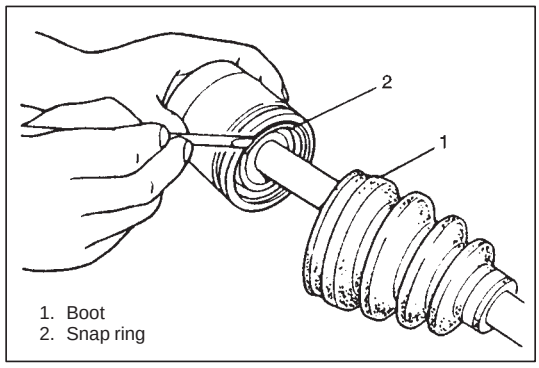
7) Remove drive shaft thrust washer (to vehicle with G16 or J20 engine) from drive shaft and remove drive shaft oil seal as shown in figure.

CAUTION:
Be careful not to cause damage to drive shaft joint.



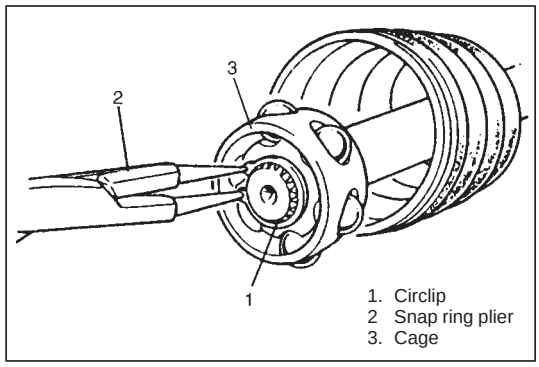
DISASSEMBLY

1) Remove boot band of differential side joint.



1. Boot
2. Snap ring

2) Slide boot toward the center of shaft and remove snap ring from outer race, then take shaft out of outer race.



1. Circlip
2 Snap ring plier
3. Cage

3) Remove circlip and then cage.
4) Remove inside and outside boots from shaft.

CAUTION:
- **Do not disassemble wheel side joint (outboard joint). If any malcondition is found in joint, replace it as assembly.**
- **Do not disassemble ball joint of differential side joint. If any malcondition is found in ball joint, replace differential side joint assembly.**

INSPECTION

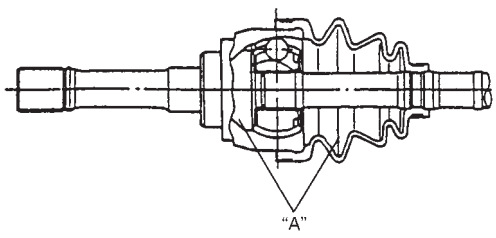
- Check boots for breakage or deterioration. Replace them as necessary.
- Check circlip, snap ring and boot bands for breakage or deformation. Replace as necessary.

CLEANING

- Wash disassembled parts (except boots) in degreaser. After washing, dry parts completely by blowing air.
- Clean boots with cloth. DO NOT wash boots in degreaser, such as gasoline or kerosene, etc.
  Washing in degreaser causes deterioration of boot.

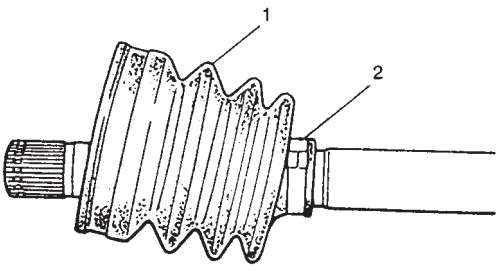
ASSEMBLY

CAUTION:
- **To prevent any problem caused by washing solution, do not wash joint boots. Degreasing of those parts with cloth is allowed.**
- **For M/T vehicle with H25 engine**
  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. i.e. yellow grease to wheel side joint and black one to differential side.
- **Bend each boot band against forward rotation.**
- **Do not squeeze or distort boot when fastening it with bands.**
  Distorted boot caused by squeezing air may reduce its durability.



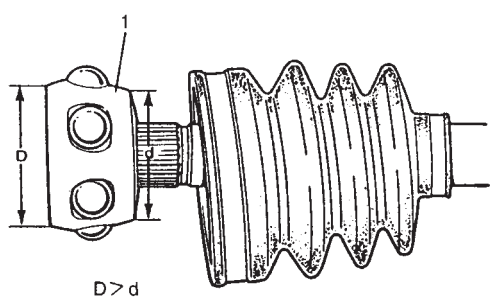
"A" Fill grease 85g (3.0 oz)

1) Fully apply joint grease to wheel side joint.
   Use joint grease in the tube included in spare part.



1. Boot
2. Boot band

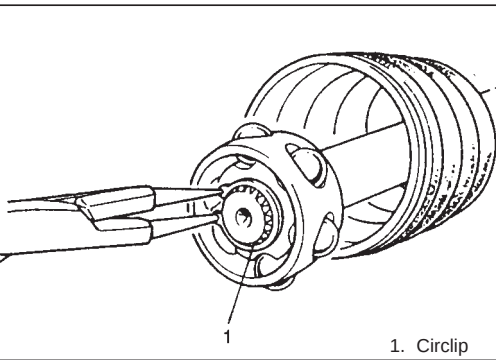
2) Fit wheel side boot on shaft.
   Fill up inside of boot with joint grease of about 90 gram.
   Before fixing boot band, insert screwdriver into boot on joint side and allow air to enter boot so that air pressure in boot becomes the same as atmospheric pressure.
3) Fixing boot band.
4) Install boot onto drive shaft till its small diameter side fits to shaft groove and fix there with boot band.



1. Cage

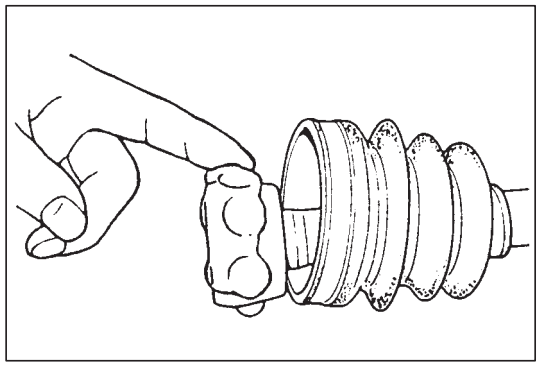
5) Install cage to shaft.

CAUTION:
Install cage directing smaller outside diameter side to shaft end.

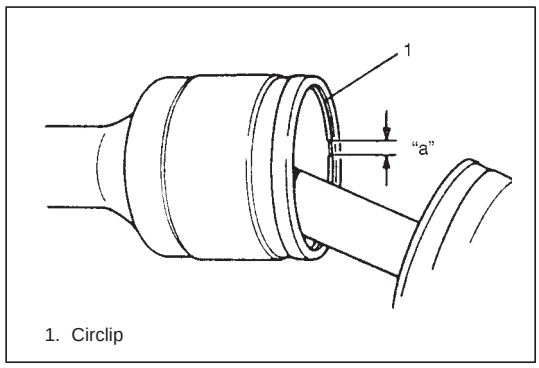


1. Circlip

6) Install circlip by using snap ring plier.



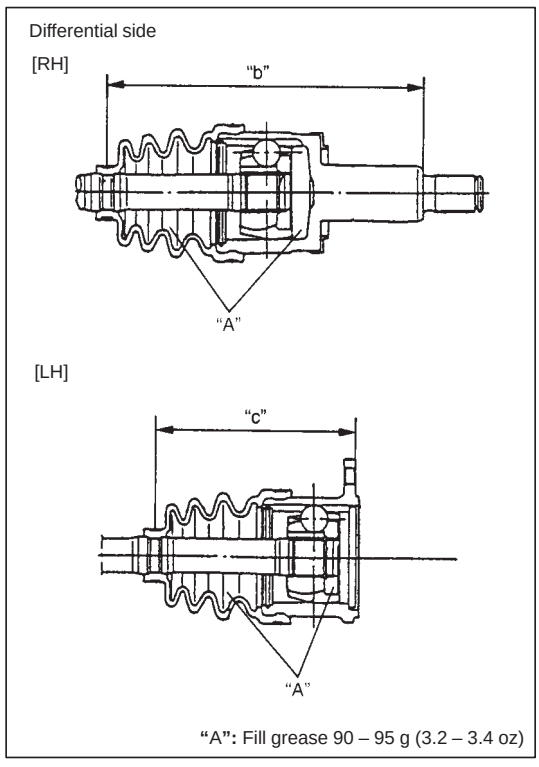
7) Apply grease to entire surface of cage.
Use joint grease in tube included in spare part or joint grease (99000-25120).



1. Circlip

8) Insert cage into outer race and fit circlip into groove of outer race.

CAUTION:
Position opening of circlip "a" so that it will not be lined up with a ball.



"A": Fill grease 90 – 95 g (3.2 – 3.4 oz)

9) Apply grease to inside of outer race, and fit boot to outer race. Fill up inside of boot with joint grease.

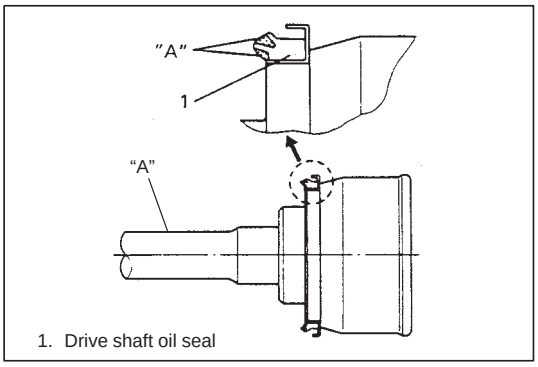
"A": Joint Grease 99000-25120
(about 90 – 95g /3.2 – 3.4 oz)

10) Fitting boot to outer race, adjust so that measurements "b" and "c" become as indicated in figure.

Length "b": 203.2 – 213.2 mm
(8.00 – 8.40 in.)
196.8 – 206.8 mm
(7.75 – 8.14 in.) . . . . . M/T vehicle with H25 engine
"c": 125.5 – 135.5 mm
(4.94 – 5.33 in.)
127.5 – 137.5 mm
(5.02 – 5.41 in.) . . . . . M/T vehicle with H25 engine

Before fixing boot band, insert screwdriver into boot on joint side and allow air to enter boot so that air pressure in boot becomes the same as atmospheric pressure.

11) Clamp boot band. Check boots for distortion or dent.



1. Drive shaft oil seal

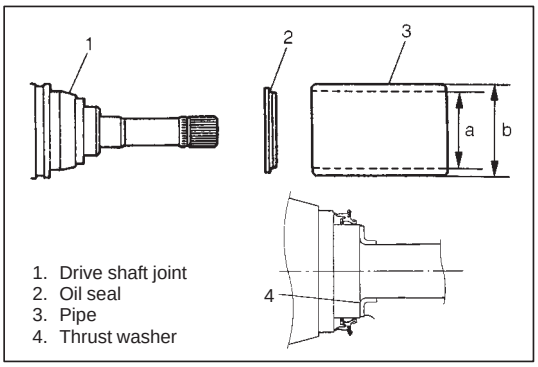
INSTALLATION

Install drive shaft assembly by reversing removal procedure and noting following points.

- Clean front drive shaft oil seal and then apply lithium grease to oil seal and DOJ shaft.

  "A": Grease 99000-25010

- Check oil seal for breakage or deterioration.
  Replace it as necessary.

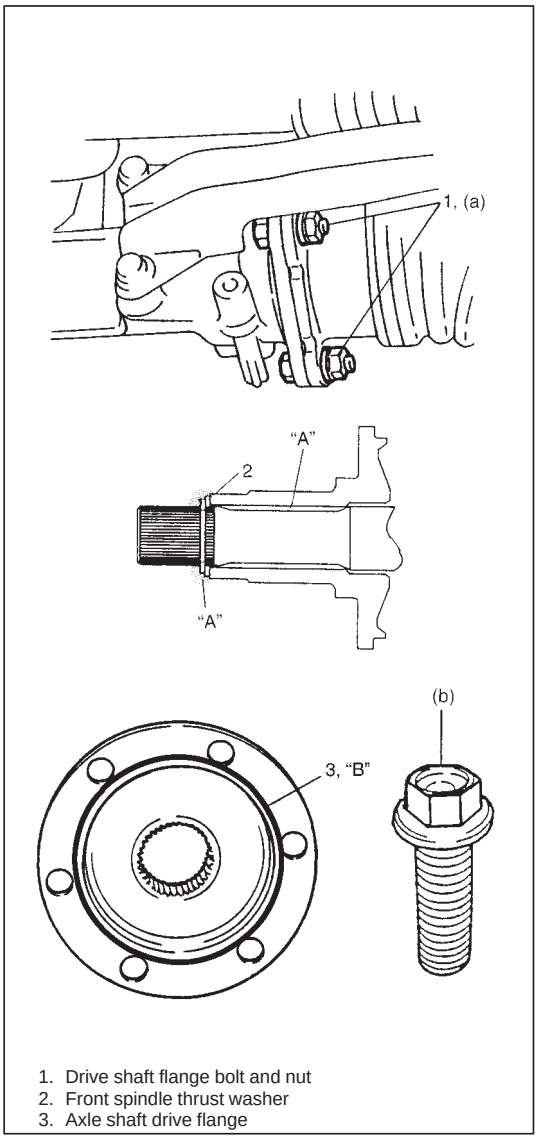


1. Drive shaft joint
2. Oil seal
3. Pipe
4. Thrust washer

- Drive in oil seal until its end contacts stepped surface of drive shaft joint by using a pipe whose inner diameter is 76 mm (2.992 in.) or more and outer diameter is 80 mm (3.150 in.) or less.

  Diameter "a": 76 mm (2.992 in.) or more
  Diameter "b": 80 mm (3.150 in.) or less

- Drive in drive shaft thrust washer (Vehicle with G16 or J20 engine).



1. Drive shaft flange bolt and nut
2. Front spindle thrust washer
3. Axle shaft drive flange

- RH Side
  Push differential side joint by hand until it is positioned by snap ring fitted to its spline.

  LH Side
  Connect drive shaft flange bolts and nuts.

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

- Apply grease to front spindle thrust washer and front spindle part of drive shaft.

  "A": Grease 99000-25010

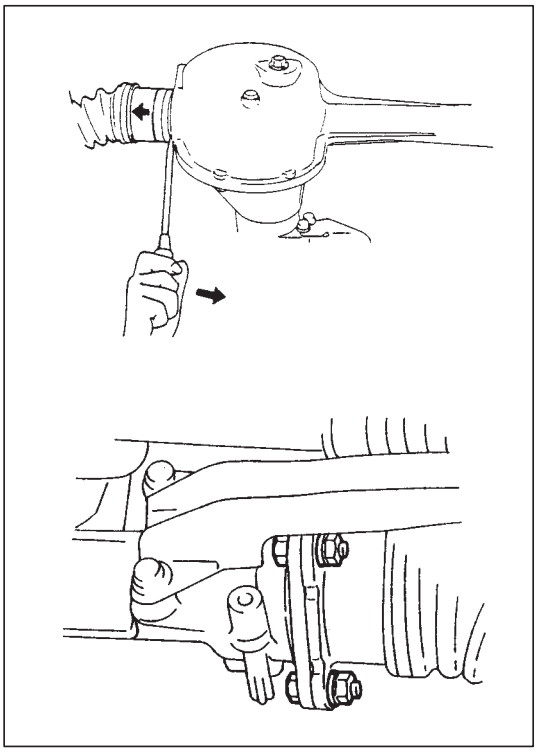
- When installing axle shaft drive flange to wheel hub, apply sealant to mating surface of axle shaft drive flange.

  "B": Sealant 99000-31090

  Tightening Torque
  (b): 50 N·m (5.0 kg-m, 36.5 lb-ft)

CAUTION:
- **To prevent breakage of boots (wheel side and differential side), be careful not to bring them into contact with other parts when installing drive shaft assembly.**
- **Do not pull housing of differential side joint.**
  If housing is pulled, it may be detached from drive shaft.

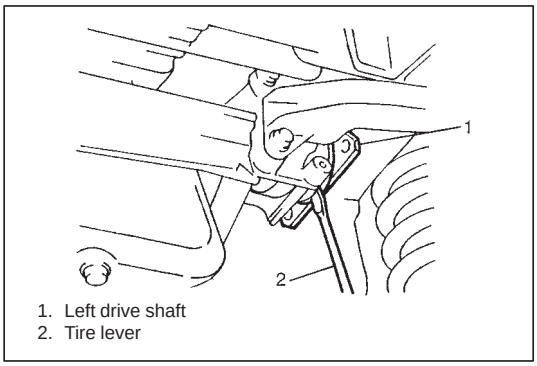
- Fill specified differential gear oil into differential case to specified level.



SHAFT BEARING/OIL SEAL

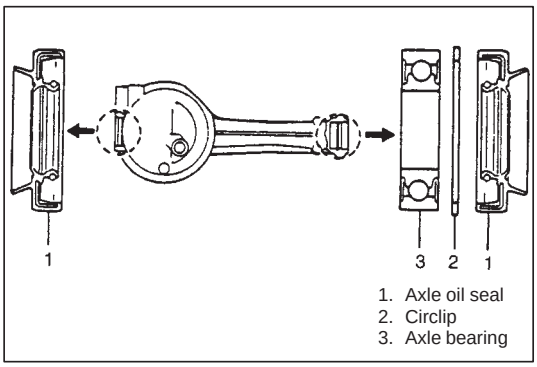
REMOVAL

1) Remove drive shaft assembly.
   Refer to item DRIVE SHAFT REMOVAL (LEFT and RIGHT) in this section.
   For right side shaft bearing/oil seal removal, drain differential gear oil.



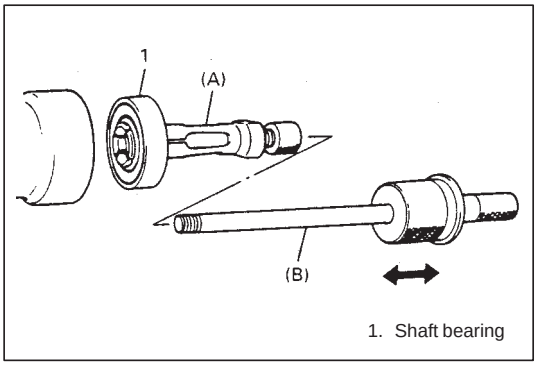
1. Left drive shaft
2. Tire lever

2) Remove left drive shaft by using tire lever.
3) Remove left side strut. Refer to steps 1) and 4) to 8) of item STRUT DAMPER REMOVAL in Section 3D.



1. Axle oil seal
2. Circlip
3. Axle bearing

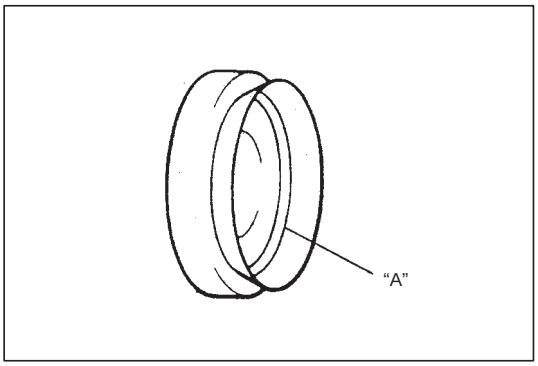
4) Remove oil seal, using plain screw driver.
5) Remove circlip.



1. Shaft bearing

6) Remove bearing, using special tools (A) and (B).

Special Tool
(A): 09941-64510
(B): 09930-30102

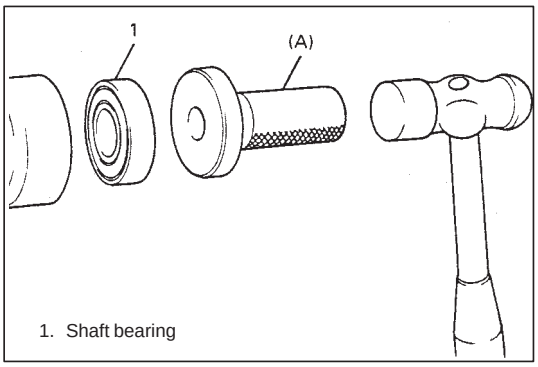


INSTALLATION

1) Clean drive shaft oil seal and then apply lithium grease.

   "A": Grease 99000-25010

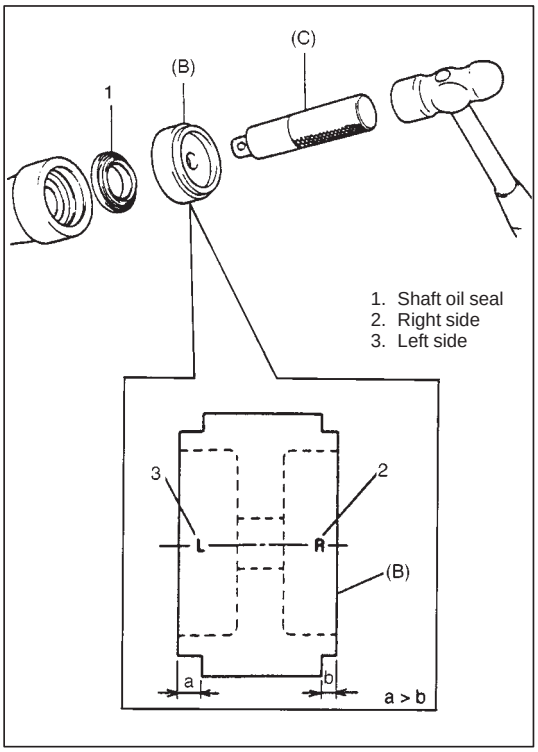
   Check oil seal for breakage or deterioration.
   Replace it as necessary.



2) Drive in drive shaft bearing with special tool (A) (on left hand side).

   Special Tool
   (A): 09913-75520

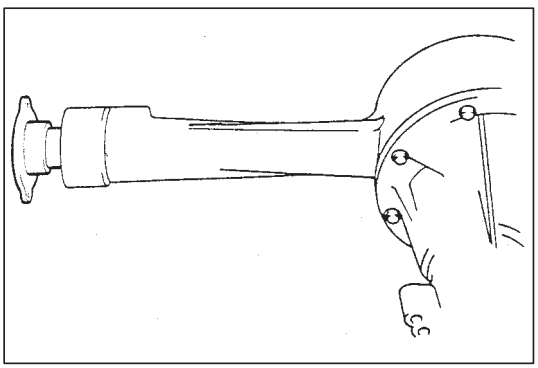
3) Install circclip.



4) Drive in oil seal with special tools (B) and (C).

   Special Tool
   (B): 09951-16090
   (C): 09924-74510

   NOTE:
   As depth to which oil seal should be driven into axle housing is different between the left and right, be sure to check stamped marks on special tool (B) and drive each oil seal to corresponding mark.



5) Install left drive shaft.
6) Install left side strut. Refer to steps 1) to 2) of item STRUT DUMPER INSTALLATION in Section 3D.
7) Install drive shaft assembly.
   Refer to DRIVE SHAFT INSTALLATION in this section.
8) Fill specified differential gear oil into differential case to specified level.

TIGHTENING TORQUE SPECIFICATIONS

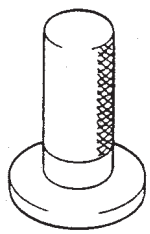
Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Drive shaft flange nut (Dif. side)	50	5.0	36.5
Oil level plug	23	2.3	17.0
Drain plug	23	2.3	17.0
Axle shaft drive flange bolt	48	4.8	35.0

NOTE:
Refer to standard tightening torque specifications, if no description or specification is provided.

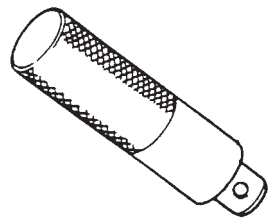
REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Joint grease (Molybdenum grease)	SUZUKI SUPER GREASE H (99000-25120)	Drive axle joint
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	Drive shaft oil seal Wheel spindle part of differential side drive shaft (RH)
Sealant	SEALING COMPOUND 366E (99000-31090)	Axle shaft drive flange

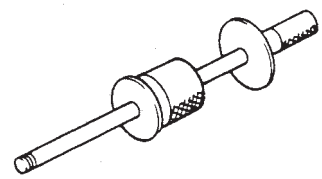
SPECIAL TOOLS



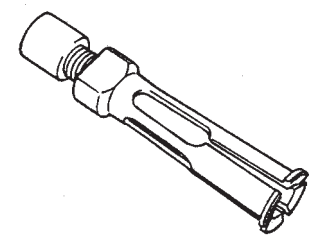
09913-75520
Bearing installer



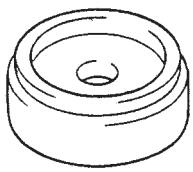
09924-74510
Installer attachment



09930-30102
Sliding shaft



09941-64510
Bearing remover



09951-16090
Oil seal installer

SECTION 4B

PROPELLER SHAFTS

NOTE:

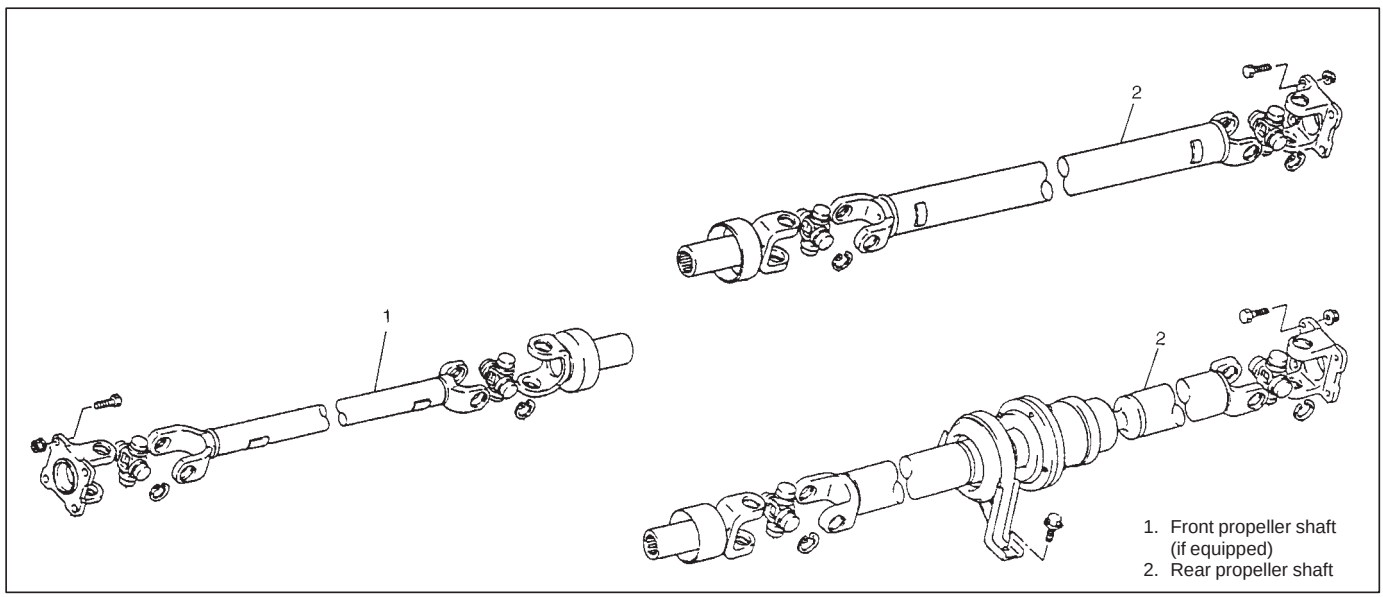
- **All propeller shaft fasteners are an important attaching part in that it could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not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

CONTENTS

GENERAL DESCRIPTION 4B- 1
DIAGNOSIS 4B- 2
Diagnosis Table 4B- 2
Propeller Shaft Joint Check 4B- 2
ON-VEHICLE SERVICE 4B- 3
Propeller Shaft 4B- 3
TIGHTENING TORQUE SPECIFICATION 4B- 6
REQUIRED SERVICE MATERIAL 4B- 6
SPECIAL TOOLS 4B- 6

GENERAL DESCRIPTION

Most universal joints require no maintenance. They are lubricated for life and can not be lubricated on the vehicle. If a universal joint becomes noisy or worn, it must be replaced.
The propeller shaft is a balanced unit. Handle it carefully so that balance can be maintained.

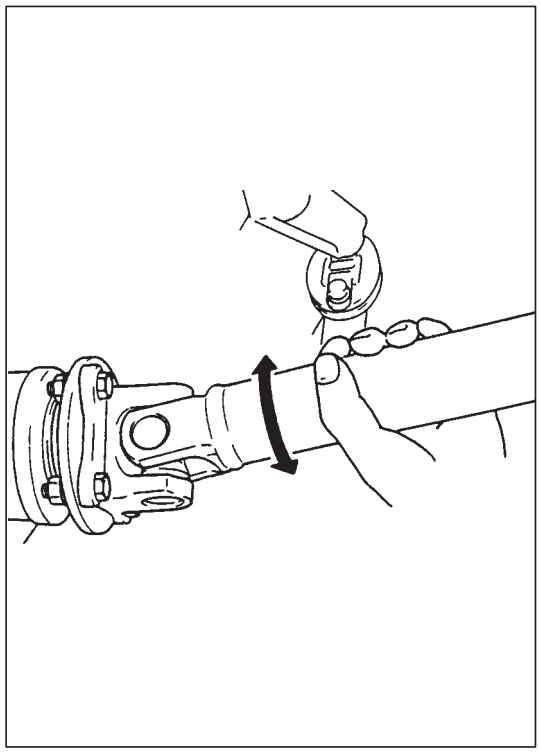


1. Front propeller shaft (if equipped)
2. Rear propeller shaft

DIAGNOSIS

DIAGNOSIS TABLE

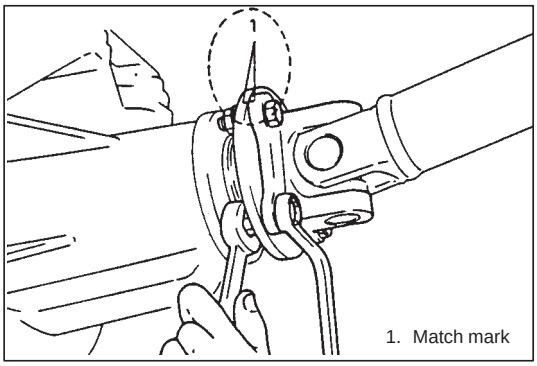
Condition	Possible Cause	Correction
Abnormal noise	● Loose universal joint bolt. ● Spider bearing worn out or stuck. ● Wear spider.	Tighten universal joint bolt. Replace. Replace propeller shaft.
Vibration	● Deformed propeller shaft.	Replace.



PROPELLER SHAFT JOINT CHECK

If universal joints are suspected of producing chattering or rattling noise, inspect them for wear. Check to see if cross spider rattles in yokes or if splines are worn down and replace defective propeller shaft with new one.

Noise coming from universal joint can be easily distinguished from other noises because rhythm of chattering or rattling is in step with cruising speed. Noise is pronounced particularly on standing start or in coasting condition (when braking effect of engine is showing in the drive line).

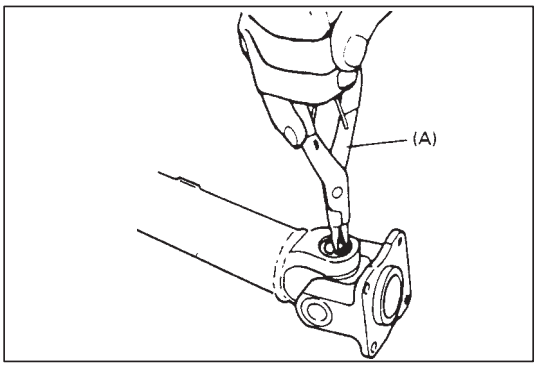


ON-VEHICLE SERVICE

PROPELLER SHAFT

REMOVAL

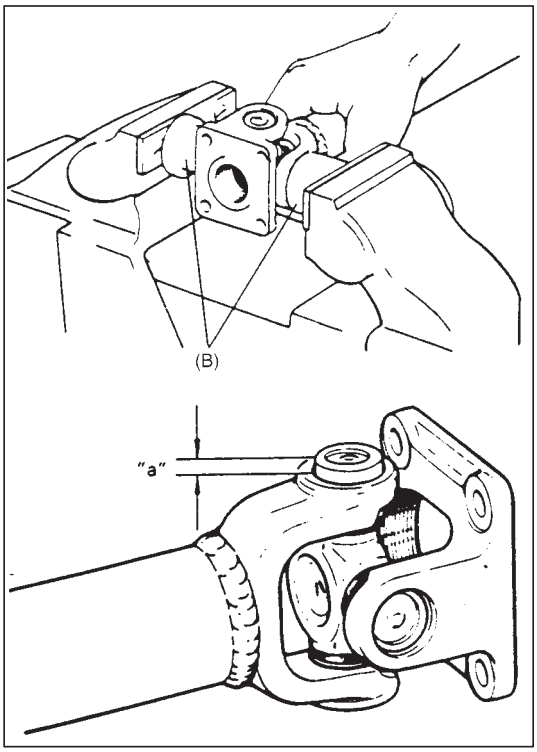
1) Hoist vehicle.
2) Drain transfer oil only when servicing front propeller shaft.
3) Before removing propeller shaft, give match marks on joint flange and propeller shaft as shown.
4) Remove propeller shaft.



DISASSEMBLY

1) Using special tool(A), remove 2 circlips.

Special Tool
(A): 09900-06108

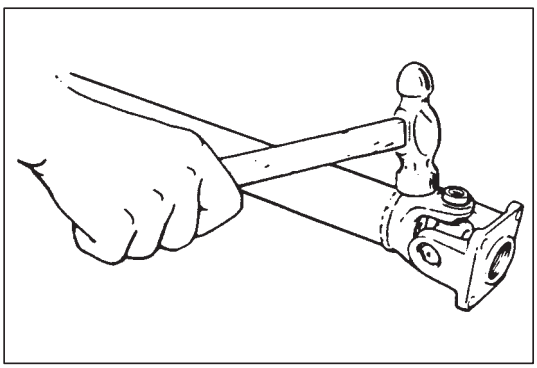


2) Using special tool(B), push spider bearing race out 3 – 4 mm (0.12 – 0.16 in.) from shaft yoke race.

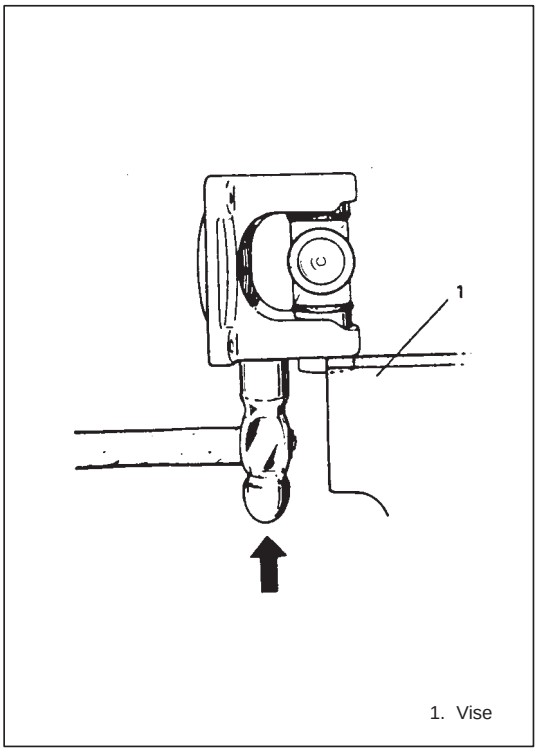
NOTE:
Before pushing it out, apply penetrate lubricant between bearing race and yoke race.

Special Tool
(B): 09926-48010

Length "a": 3 – 4 mm (0.12 – 0.16 in.)



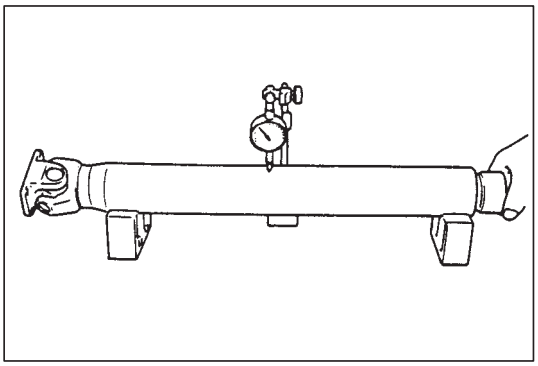
3) Tapping yoke with a hammer, completely remove bearing race.
4) Take out bearing race on the other side in the same way as in 2) and 3).



1. Vise

5) Push out bearing race on flange yoke side as described in 1) and 2), and then, holding bearing race in a vise, tap flange yoke and take out race. (Refer to the figure.)
Remove bearing race on the opposite side in the same way.

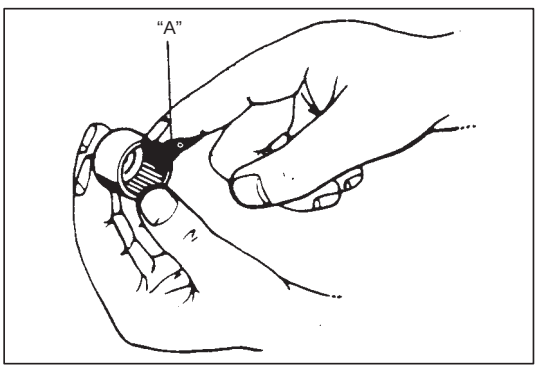
NOTE:
- **Take care not to lose rollers in spider bearing race when removing it.**
- **Fit removed bearings temporarily in spider so that they can be reinstalled in their original positions.**



INSPECTION

Inspect propeller shaft and flange yoke for damage, and propeller shaft for runout.
If damage is found or shaft runout exceeds its limit, replace.

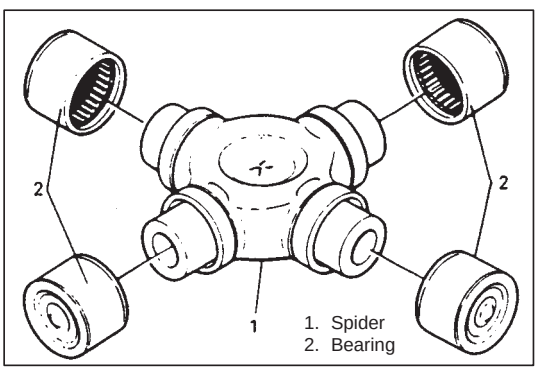
Runout limit: 0.8 mm (0.031 in.)



ASSEMBLY

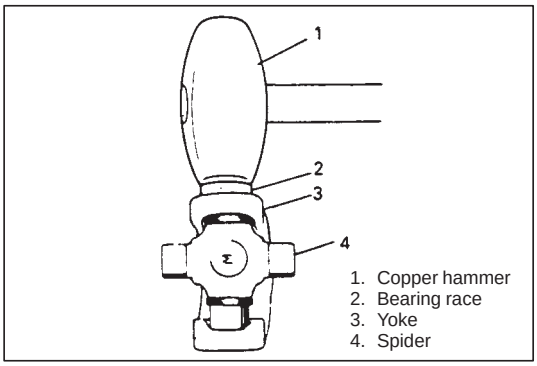
NOTE:
- **Make sure that rollers inside spider bearing race are all in place.**
- **Make sure to apply grease to spider bearing race.**

"A": Grease 99000-25030



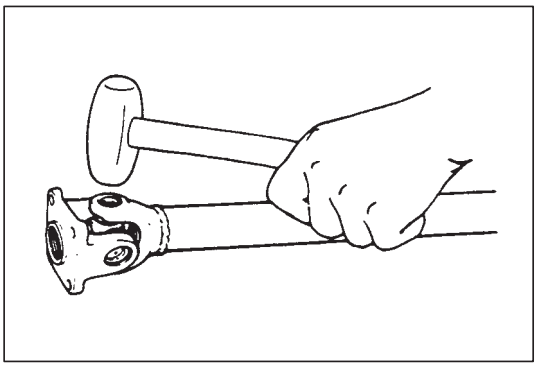
1. Spider
2. Bearing

CAUTION:
In assembly, be sure to use new circlips, spider and bearings. Reuse of circlips, spider and bearings once assembled is prohibited.



1. Copper hammer
2. Bearing race
3. Yoke
4. Spider

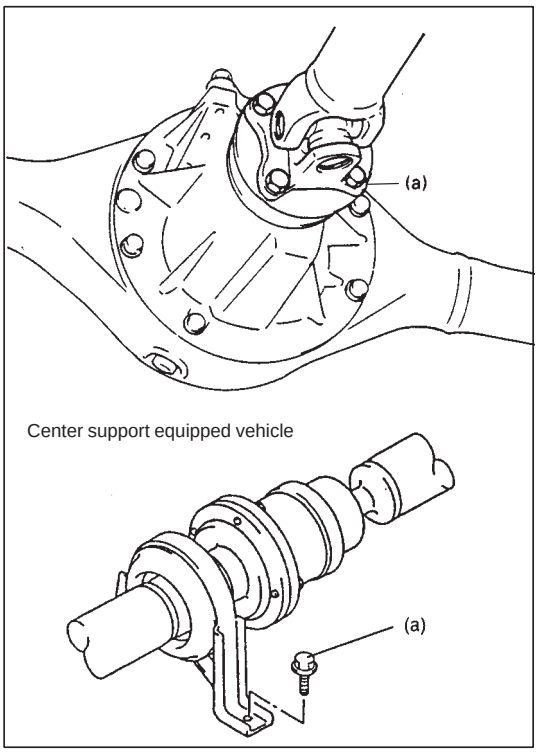
1) Insert bearing race into yoke, tapping it with a hammer, until it is flush with yoke face. When doing this, insert spider into bearing race to prevent rollers in bearing race from coming out.



2) Insert the other bearing race on the opposite side into yoke, tapping with a hammer until it is flush with yoke face.
3) Insert bearing races on the flange yoke side in the same way as described in 1) and 2) above.

4) Place a metal plate on bearing races when tapping them in to avoid damaging yoke.
5) Securely fit 4 circlips to shaft and flange yoke.

NOTE:
- **After assembly, check to ensure that both shaft yoke and flange yoke move smoothly.**
- **Make sure that each circlip is fitted in groove securely.**



INSTALLATION

Reverse removal procedure to install propeller shaft.

- Use following specification to torque universal joint flange bolts (and center support bolts).

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

- When installing propeller shaft, align the match marks. Otherwise, vibration may occur during driving.

NOTE:
If transfer oil was drained for front propeller shaft removal, pour specified gear oil into transfer case to specified level.

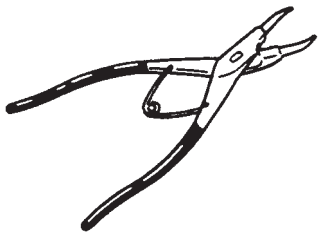
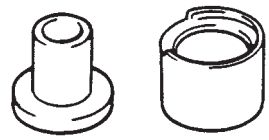
TIGHTENING TORQUE SPECIFICATION

Fastener	Tightening torque		
	N·m	kg-m	lb-ft
Propeller shaft nut/Center support bolt	50	5.0	36.5

REQUIRED SERVICE MATERIAL

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUPER GREASE C (99000-25030)	To apply to spider bearing race.

SPECIAL TOOLS

	
09900-06108 Snap ring pliers (Closing type)	09926-48010 Universal joint disassembling tool set

SECTION 5

BRAKES

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

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

NOTE:

- **When inspecting and servicing vehicle equipped with ABS, be sure to refer to section 5E or 5E1 first.**
- **All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.**

DIAGNOSIS 5-3
BRAKE PIPE/HOSE/MASTER CYLINDER 5A-1
FRONT BRAKE 5B-1
PARKING AND REAR BRAKE 5C-1

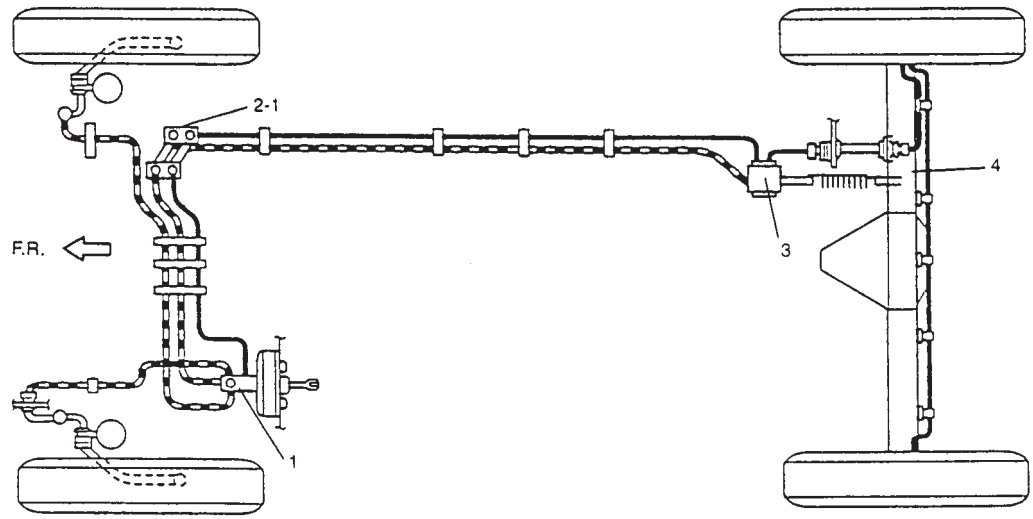
CONTENTS

GENERAL DESCRIPTION 5- 2
DIAGNOSIS 5- 3
Road Testing Brakes 5- 3
Brake Fluid Leaks 5- 3
Substandard or Contaminated Brake Fluid 5- 3
Diagnosis Table 5- 4
CHECK AND ADJUSTMENT 5- 7
Bleeding Brakes 5- 7
Brake Pedal Free Height Check 5- 9
Brake Light Switch Adjustment 5- 9
Excessive Pedal Travel Check 5- 9
Brake Pedal Play Check 5-10
Brake Fluid Level Check 5-10
Brake Hose and Pipe Check 5-10
Master Cylinder Check 5-10
Brake Disc Check 5-11
Brake Pad Check 5-11
Brake Shoe Check 5-11
Parking Brake Check and Adjustment 5-12
Flushing Brake Hydraulic System 5-13
Fluid Pressure Test 5-13
Booster Operation Check 5-15
TIGHTENING TORQUE SPECIFICATIONS 5-17
REQUIRED SERVICE MATERIAL 5-17
SPECIAL TOOLS 5-18

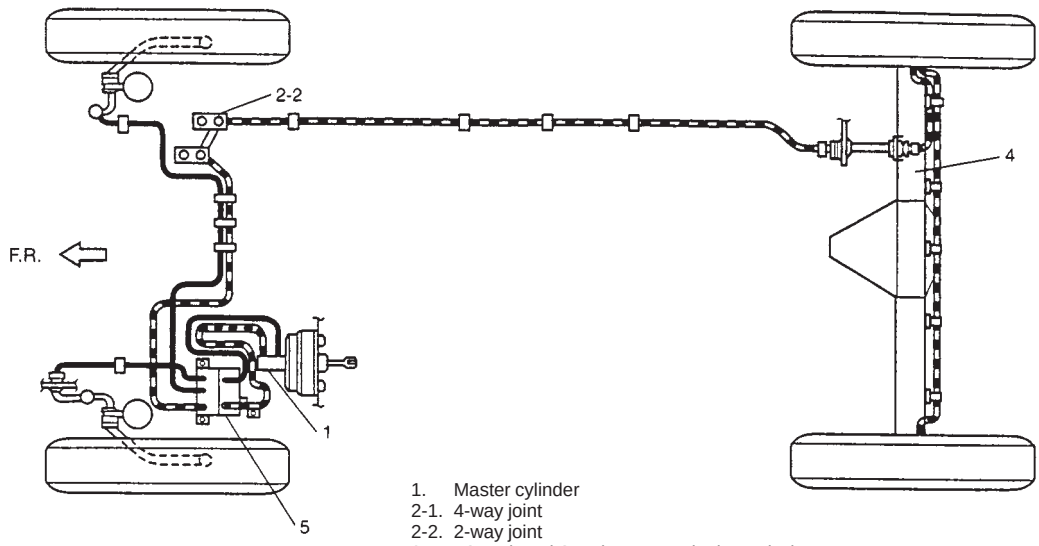
GENERAL DESCRIPTION

When the foot brake pedal is depressed, hydraulic pressure is developed in the master cylinder to actuate pistons (two in front and four in rear).
The master cylinder is a tandem master cylinder. Brake pipes are connected to the master cylinder and they make two independent circuits. One connects front brakes (right and left) and the other connects rear brakes (right and left).
The load sensing proportioning valve (LSPV) is included in these circuits between the master cylinder and the rear brake for the vehicle without ABS.
In this brake system, the disc brake type is used for the front wheel brake and a drum brake type (leading/trailing shoes) for the rear brake.
The parking brake system is mechanical. It applies brake force to only rear wheels by means of the cable and mechanical linkage system. The same brake shoes are used for both parking and foot brakes.

[FOR VEHICLE WITHOUT ABS]



[FOR VEHICLE WITH ABS]



1. Master cylinder
2-1. 4-way joint
2-2. 2-way joint
3. LSPV (Load Sensing Proportioning Valve)
4. Rear axle housing
5. ABS actuator (H.U.)

F.R.:Front side

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 chart for other causes.

BRAKE FLUID LEAKS

Check the master cylinder fluid levels. While a slight drop in reservoir level does result from normal lining wear, an abnormally low level indicates a leak in the system. In such a case, check the entire brake system for leakage. If even a slight evidence of leakage is noted, the cause should be corrected or defective parts should be replaced.
If fluid level is lower than the minimum level of reservoir, refilling is necessary. Fill reservoir with specified brake fluid.

Brake fluid: Refer to reservoir tank cap.

CAUTION:
Since brake system of this vehicle is factory-filled with brake fluid indicated on reservoir tank cap, do not use or mix different type of fluid when refilling; otherwise serious damage will occur.
Do not use old or used brake fluid, or any fluid from a unsealed container.

SUBSTANDARD OR CONTAMINATED BRAKE FLUID

Improper brake fluid, mineral oil or water in the fluid may cause the brake fluid to boil or the rubber components in the hydraulic system to deteriorate.

If primary piston cups are swollen, then rubber parts have deteriorated. This deterioration may also be evidenced by swollen wheel cylinder piston cups on the drum brake wheels.

If deterioration of rubber is evident, disassemble all hydraulic parts and wash with alcohol. Dry these parts with compressed air before assembly to keep alcohol out of the system. Replace all rubber parts in the system, including hoses. Also, when working on the brake mechanisms, check for fluid on the linings. If excessive fluid is found, replace the linings.

If master cylinder piston seals are satisfactory, check for leakage or excessive heat conditions. If condition is not found, drain fluid, flush with brake fluid, refill and bleed system.

The system must be flushed if there is any doubt as to the grade of fluid in the system or if fluid has been used which contained parts that have been subjected to contaminated fluid.

DIAGNOSIS TABLE

Condition	Possible Cause	Correction
Not enough braking force	● Brake oil leakage from brake lines.	Locate leaking point and repair.
	● Brake disc or pads stained with oil.	Clean or replace.
	● Overheated brakes.	Determine cause and repair.
	● Poor contact of shoes on brake drum.	Repair for proper contact.
	● Brake shoes linings stained with oil or wet with water.	Replace.
	● Badly worn brake shoe linings.	Replace.
	● Defective wheel cylinders.	Repair or replace.
	● Malfunctioning caliper assembly.	Repair or replace.
	● Air in system.	Bleed system.
	● Maladjusted sensor spring length of LSPV.	Check or adjust.
	● Broken sensor spring of LSPV.	Replace.
	● Defective collar of LSPV.	Replace.
	● Malfunctioning ABS (Antilock brake system), if equipped.	Check system and replace as necessary.
Brake pull (Brakes not working in unison)	● Pad or shoe linings are wet with water or stained with oil in some brakes.	Replace.
	● Drum-to-shoe clearance out of adjustment in some brakes. (Malfunctioning auto adjusting mechanism)	Check for inoperative auto adjusting mechanism.
	● Drum is out of round in some brakes.	Replace.
	● Wheel tires are inflated unequally.	Inflate equally.
	● Malfunctioning wheel cylinders.	Repair or replace.
	● Disturbed front 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.
	● Loose suspension parts.	Caliper should slide. Check all suspension mountings.
	● Loose calipers.	Check and torque bolts to specifications.
Noise (High pitched squeak without brake applied)	● Front lining worn out.	Replace linings.
Rear brake locked prematurely	● Maladjusted sensor spring length of LSPV.	Check or adjust.
	● Malfunction LSPV assembly.	Replace assembly.
Brake locked (For vehicles equipped with ABS)	● Malfunctioning ABS, if equipped.	Check system and replace as necessary.

Condition	Possible Cause	Correction
Excessive pedal travel (Pedal stroke too large)	● Partial brake system failure.	Check brake systems and repair as necessary.
	● Insufficient fluid in master cylinder reservoirs.	Fill reservoirs with approved brake fluid. Check for leaks and air in brake systems. Check warning light. Bleed system if required.
	● Air in system. (pedal soft/spongy)	Bleed system.
	● Rear brake system not adjusted. (malfunctioning auto adjusting mechanism)	Repair auto adjusting mechanism. Adjust rear brakes.
	● Bent brake shoes.	Replace brake shoes.
	● Worn rear brake shoes.	Replace brake shoes.
Dragging brakes (A very light drag is present in all disc brakes immediately after pedal is released)	● Master cylinder pistons not returning correctly.	Replace 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 or linkage.	Repair or replace.
	● Wheel cylinder or caliper piston sticking.	Repair as necessary.
	● Malfunctioning ABS, if equipped with ABS.	Check system and replace as necessary.
Pedal pulsation (Pedal pulsates when depressed for braking)	● Damaged or loose wheel bearings.	Replace wheel hub component.
	● Distorted steering knuckle or rear axle shafts.	Replace knuckle or rear axle shaft.
	● Excessive disc lateral runout.	Check per instructions. If not within specifications, replace or machine the disc.
	● Parallelism not within specifications.	Check per instructions. If not within specifications, replace or machine the disc.
	● Rear drums out of round.	Check runout. Repair or replace drum as necessary.
Braking noise	● Glazed shoe linings, or foreign matters stuck to linings.	Repair or replace shoe lining.
	● Worn or distorted shoe linings.	Replace shoe lining (or pad).
	● Loose front wheel bearings.	Replace wheel hub component.
	● Distorted backing plates or loose mounting bolts.	Replace or retighten securing bolts.

Condition	Possible Cause	Correction
Brake warning light turns on after engine start	● Parking brake applied. ● Insufficient amount of brake fluid. ● Brake fluid leaking from brake line. ● Brake warning light circuit faulty. ● Malfunctioning EBD system, if equipped with ABS.	Release parking brake and check that brake warning light turns off. Add brake fluid. Investigate leaky point, correct it and add brake fluid. Repair circuit. Check system referring to "DIAGNOSIS" of ABS section.
Brake warning light turns on when brake is applied	● Brake fluid leaking from brake line. ● Insufficient amount of brake fluid.	Investigate leaky point, correct it and add brake fluid. Add brake fluid.
Brake warning light fails to turn on even when parking brake is applied	● Bulb burnt out. ● Brake warning light circuit open.	Replace bulb. Repair circuit.
ABS warning light does not turn on for 2 sec. after ignition switch has turned ON	● Bulb burnt out. ● ABS warning light circuit open, if equipped with ABS. (including check relay)	Replace bulb. Check system referring to "DIAGNOSIS" of ABS section.
ABS warning light remains on after ignition switch has turned on for 2 sec.	● Malfunctioning ABS, if equipped with ABS.	Check system referring to "DIAGNOSIS" of ABS section.

CHECK AND ADJUSTMENT

BLEEDING BRAKES

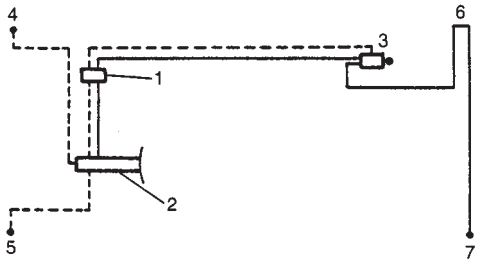
CAUTION:
Brake fluid is extremely damaging to paint. If fluid should accidentally touch painted surface, immediately wipe fluid from paint and clean painted surface.

NOTE:
For vehicle equipped with ABS, make sure that ignition switch turns off.

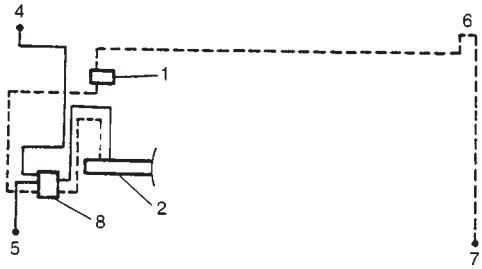
Be sure to bleed air of brake system according to following procedure when its oil hydraulic circuit has been disconnected.

Hydraulic lines of brake system consists of two separate lines, one for front wheel brakes and the other for rear wheel brakes.
Air bleeding is necessary at right and left front wheel brakes, left rear wheel brake and LSPV (if equipped without ABS), i.e. 4 places (3 places for vehicle with ABS) in all.

[A]

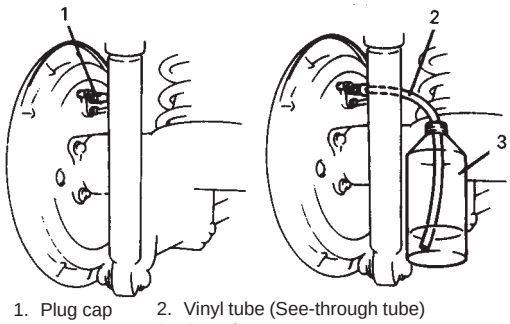


[B]



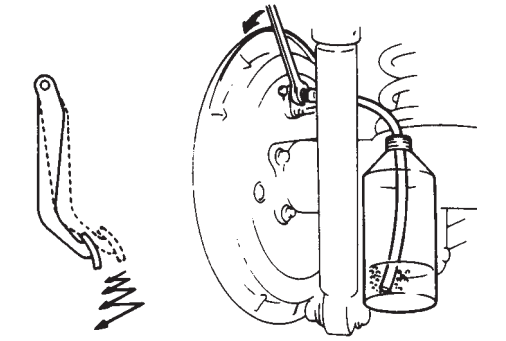
[A]: Without ABS
[B]: With ABS

1. 4-way joint / 2-way joint
2. Master cylinder
3. LSPV
4. Right brake caliper
5. Left brake caliper
6. Right wheel cylinder
7. Left wheel cylinder
8. ABS actuator
: Air bleeding point

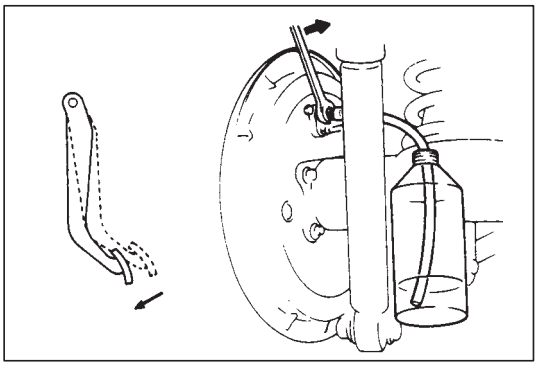


1. Plug cap
2. Vinyl tube (See-through tube)
3. Container

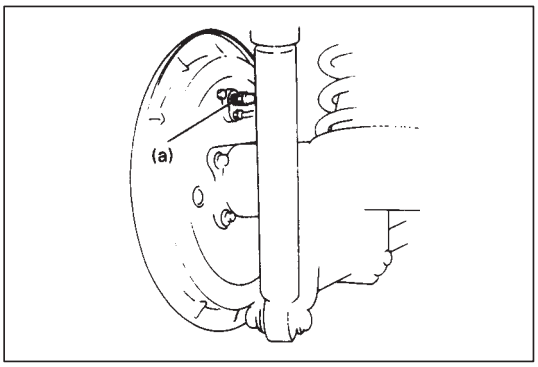
1) Fill master cylinder reservoir with brake fluid and keep at least one-half full of fluid during bleeding operation.
2) Remove bleeder plug cap.
Attach a vinyl tube to bleeder plug of wheel cylinder, and insert the other end into container.



3) Depress brake pedal several times, and then while holding it depressed, loosen bleeder plug about one-third to one half turn.



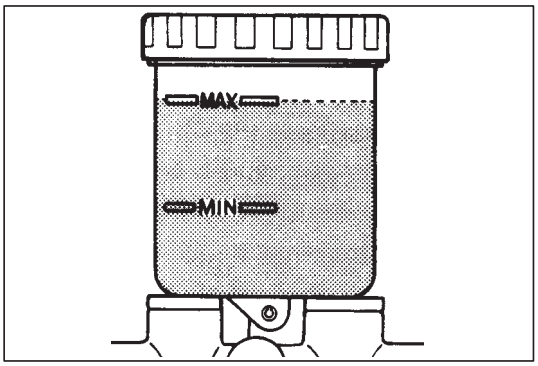
4) When fluid pressure in the cylinder is almost depleted, retighten bleeder plug.



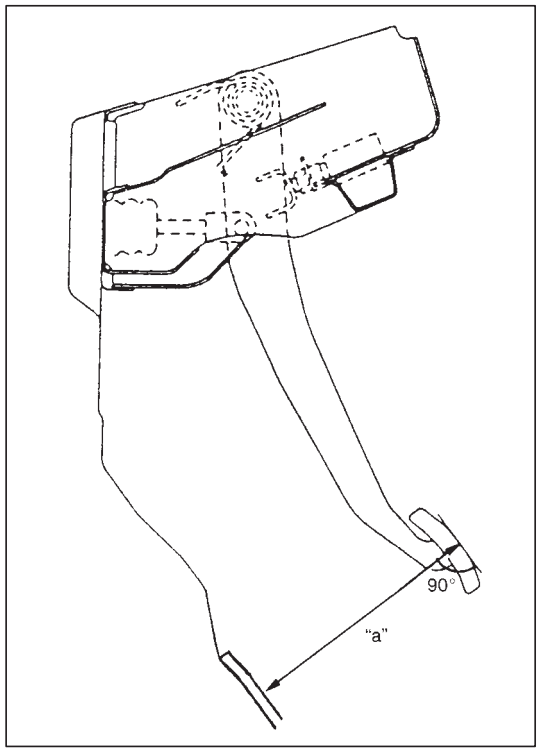
5) Repeat this operation until there are no more air bubbles in hydraulic line.
6) When bubbles stop, depress and hold brake pedal and tighten bleeder plug.

For tightening torque specification of air bleeder plug, refer to "TIGHTENING TORQUE SPECIFICATION" in this section.

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.



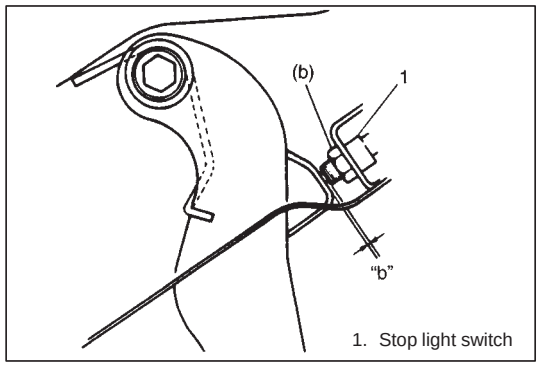
BRAKE PEDAL FREE HEIGHT CHECK

Remove foot rest and displace carpet and dash silencer(s) so as to measure brake pedal free height between pedal face and asphalt sheet installed on dash panel.

Brake pedal free height "a" from asphalt sheet:
208 – 218 mm (8.19 – 8.58 in.)

If the measurement is not within the specification, check the position of booster push rod clevis and/or stop light switch according to the instruction shown in this section.

The free height varies depending on installation position of booster push rod clevis and stop light switch.



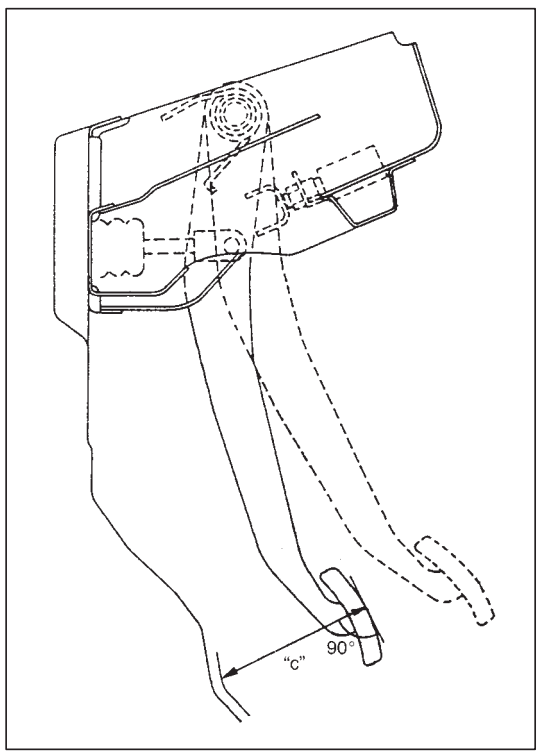
1. Stop light switch

BRAKE LIGHT SWITCH ADJUSTMENT

Adjustment should be made as follows when installing switch. Pull up brake pedal toward you and while holding it there, adjust switch position so that clearance between end of thread and brake pedal return cushion (shown as "b" in figure).
Then tighten lock nut to specified torque.

Clearance "b": 1.5 – 2.0 mm (0.06 – 0.08 in.)

Tightening Torque
(b): 7.5 N·m (0.75 kg-m, 5.5 lb-ft)

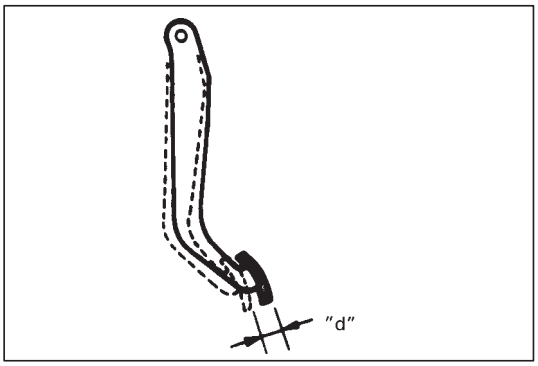


EXCESSIVE PEDAL TRAVEL CHECK

1) Remove foot rest and displace carpet and dash silencer(s).
2) Start engine.
3) Depress brake pedal a few times.
4) With brake pedal depressed with approximately 30 kg (66 lbs) load, measure pedal to asphalt sheet clearance "c".

   Clearance "c": over 115 mm (4.53 in.)

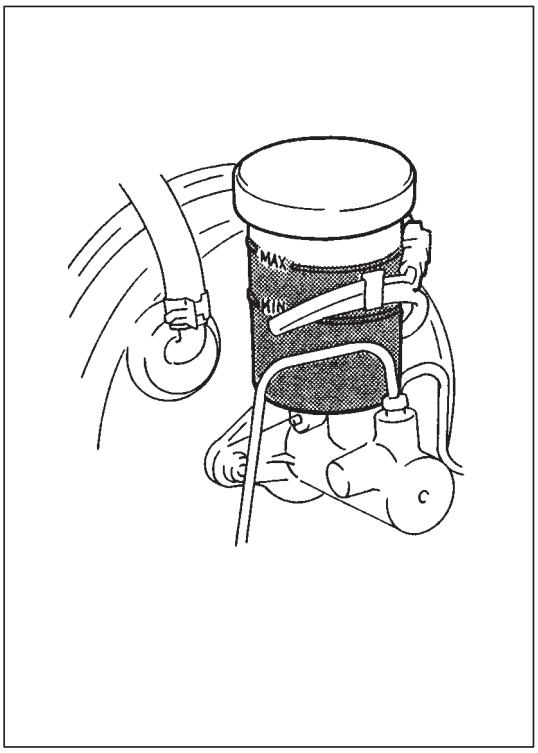
5) If clearance "c" is less than specification, the most possible cause is either rear brake shoes are worn out beyond limit or air is in lines.
   Should clearance "c" remain less than specification even after replacement of brake shoes and bleeding of system, other possible but infrequent cause is malfunction of rear brake shoe adjusters or booster push rod length out of adjustment.



BRAKE PEDAL PLAY CHECK

Pedal play should be within specification. If out of specification, check brake light switch for proper installation position and adjust if necessary.
Also check pedal shaft bolt and master cylinder pin installation for looseness and replace if defective.

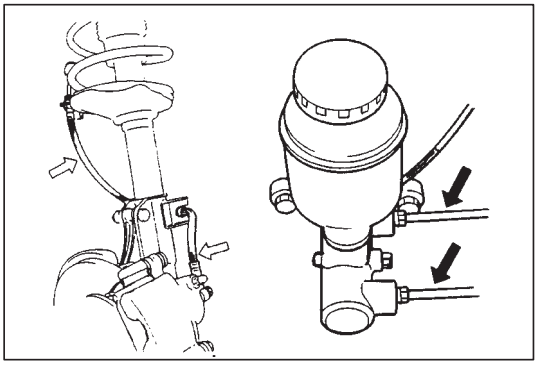
Pedal play "d": 1 – 8 mm (0.04 – 0.32 in.)



BRAKE FLUID LEVEL CHECK

Be sure to use particular brake fluid either as indicated on reservoir cap of that vehicle or recommended in owner's manual which comes along with that vehicle.
Use of any other fluid is strictly prohibited.
Fluid level should be between MIN and MAX lines marked on reservoir.
When warning light lights sometimes during driving, replenish fluid to MAX line.
When fluid decreases quickly, inspect brake system for leakage. Correct leaky points and then refill to specified level.

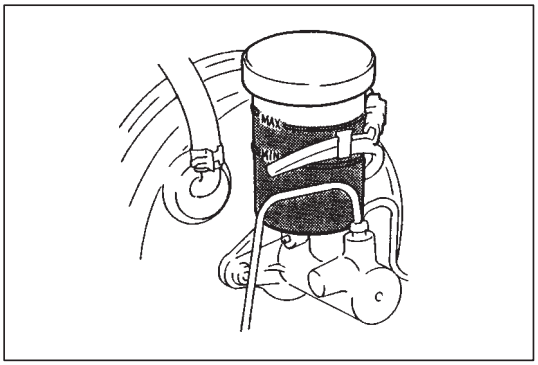
CAUTION:
Do not use shock absorber fluid or any other fluid which contains mineral oil. Do not use a container which has been used for mineral oil or a container which is wet from water. Mineral oil will cause swelling and distortion of rubber parts in hydraulic brake system and water mixed into brake fluid will lower fluid boiling point. Keep all fluid containers capped to prevent contamination.



BRAKE HOSE AND PIPE CHECK

The brake hose assembly should be checked for road hazard damage, for cracks and chafing of the outer cover, for leaks and blisters. A light and mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, it is necessary to replace it.

Inspect the pipe for damage, cracks, dents and corrosion. If any defect is found, replace it.



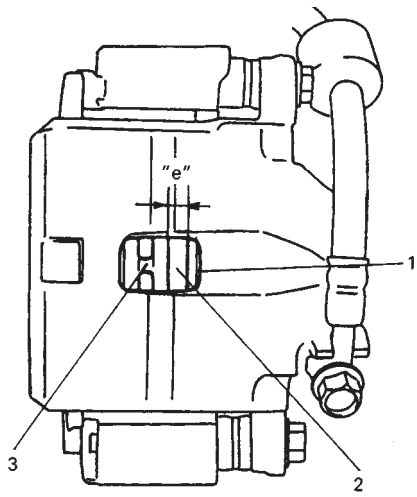
MASTER CYLINDER CHECK

Check for a 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 abnormal.

BRAKE DISC CHECK

Refer to FRONT DISC BRAKE PAD of Section 5B for inspection point and procedure.

BRAKE PAD CHECK



1. Pad rim
2. Lining
3. Disc

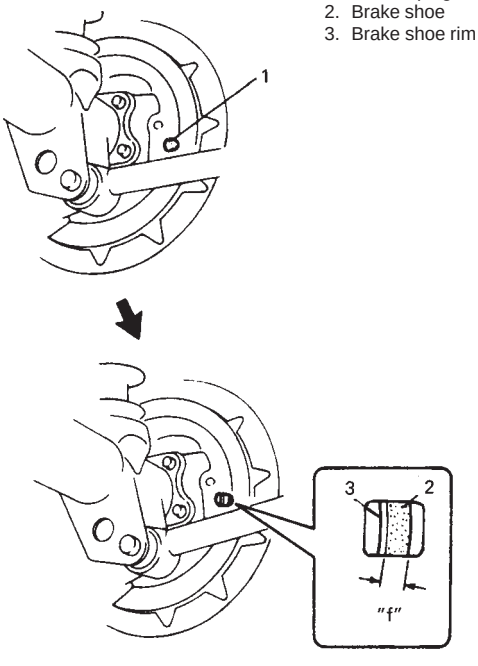
Inspect pad linings periodically according to maintenance schedule whenever wheels are removed (for tire rotation or other reason). Take a look through hole of caliper and check lining thickness of inside pad.

Thickness "e"
Standard: 10.0 mm (0.39 in.)
Service Limit: 2.0 mm (0.08 in.)

If one of brake pad is worn to service limit, all linings must be replaced at the same time.

BRAKE SHOE CHECK

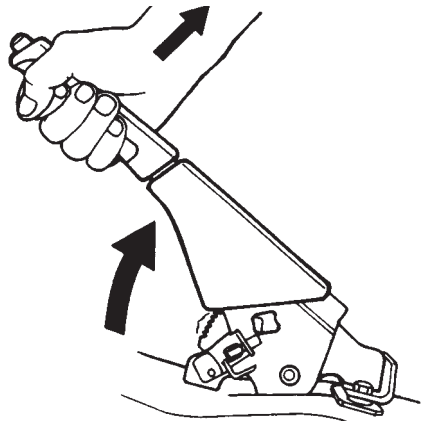
1. Rubber plug
2. Brake shoe
3. Brake shoe rim



Inspection should be carried out on following points after brake pedal travel "c" (pedal to asphalt sheet clearance) check as described on previous page of this section, even when it is more than 115 mm (4.53 in.).
Amount of brake shoe wear can be checked as follows.

1) Hoist vehicle.
2) Remove rubber plug from brake back plate.
3) Through hole of back plate, visually check for thickness of brake shoe lining. If lining thickness "f" is found less than below specified wear limit, replace with new brake shoes.

Thickness "f"
Service Limit: 1.0 mm (0.04 in.)



PARKING BRAKE CHECK AND ADJUSTMENT

CHECK

Hold center of parking brake lever grip and pull it up with 20 kg (40 lbs) force.

With parking brake lever pulled up as shown, count ratchet notches.

There should be 5 to 7 notches.

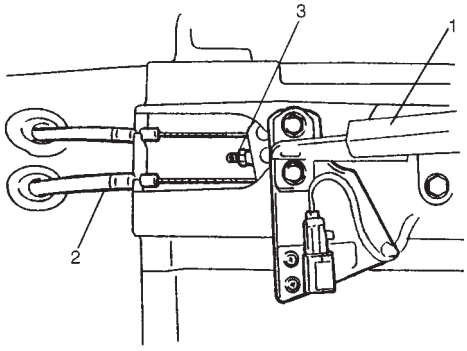
Also, check if both right and left rear wheels are locked firmly.

To count number of notches easily, listen to click sounds that ratchet makes while pulling parking brake lever without pressing its button. One click sound corresponds to one notch.

If number of notches is out of specification, adjust cable by referring to adjustment procedure described on the following 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.



1. Parking brake lever
2. Brake cable
3. Self locking nut

ADJUSTMENT

NOTE:

Make sure for following conditions before cable adjustment.

- **No air is trapped in brake system.**
- **Brake pedal travel is proper.**
- **Brake pedal has been depressed a few times with about 30 kg (66 lbs) load.**
- **Parking brake lever has been pulled up a few times with about 20 kg (44 lbs) force.**
- **Rear brake shoes are not worn beyond limit, and self adjusting mechanism operates properly.**
- **To slacken parking brake cable, loosen self locking nut as far as end of bolt. Then depress brake pedal a few times with about 30 kg (66 lbs) load.**

After confirming that above 6 conditions are all satisfied, adjust parking brake lever stroke by loosening or tightening locking nut.

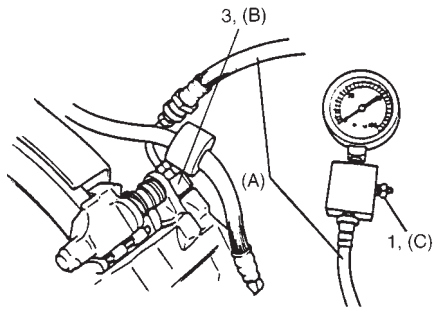
NOTE:

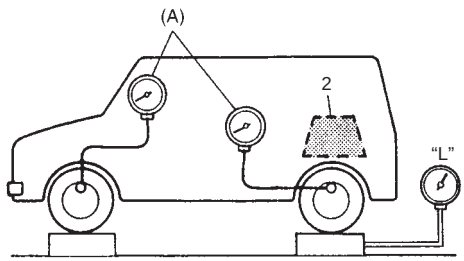
Check brake drum for dragging after adjustment.

Parking brake stroke: 5 to 7 notches
(When lever is pulled up at 20 kg (44 lbs).)

FLUSHING BRAKE HYDRAULIC SYSTEM

It is recommended that entire hydraulic system be thoroughly flushed with clean brake fluid whenever new parts are installed in hydraulic system.
Periodical change of brake fluid is also recommended.





1. Air bleeder plug
2. Weight
3. Attachment

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 200 kg (441 lbs) weight on rear housing so that rear axle weight 800 kg (1764 lb).

   Rear axle weight "L": 800 kg (1764 lb)

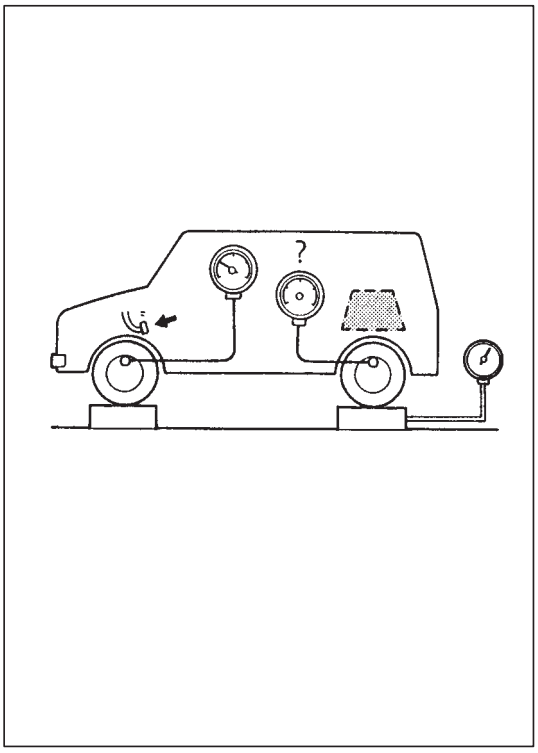
2) Install special tool to front and rear brake.

   NOTE:
   Special tool should be connected to breather of front (driver's side brake) and rear brakes.

   Special Tool
   Front brake
   (A): 09956-02310
   (B): 09952-46510 (Attachment for vehicle with SUMITOMO ELECTRIC brake caliper)
   (C): 55473-82030 (Air bleeder plug supplied as a spare part)

   Rear brake
   (A): 09956-02310
   (B): 09952-36310 (Attachment for thread diameter 7 mm of bleeder plug) or
   09952-46510 (Attachment for thread diameter 8 mm of bleeder plug)
   (C): 55473-82030 (Air bleeder plug supplied as a spare part)

   NOTE:
   - **Special tool (B) is used instead of thread diameter 10 mm attachment of special tool (A).**
     So remove the attachment from (A) and install (B) as shown in figure.
   - **For vehicle with TOKICO brake caliper, use the attachment included in special tool (A).**
   - **For identification of brake caliper type, refer to GENERAL DESCRIPTION in SECTION 5B.**

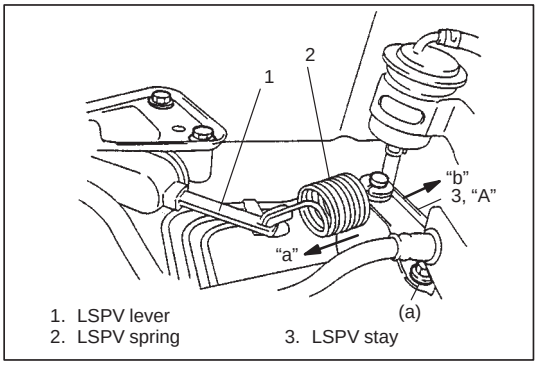


3) Depress brake pedal gradually till fluid pressure of front brake becomes as specified below and check corresponding pressure of rear brake then. It should be within specification given below.

Front brake	Rear brake	
8,000 kPa 80 kg/cm^2 1,138 psi	3 Door	6,000 – 7,300 kPa 60 – 73 kg/cm^2 853 – 1,038 psi
	5 Door	4,500 – 7,300 kPa 45 – 73 kg/cm^2 640 – 1,038 psi

As done above, apply 100 kg/cm^2 pressure to front brake and check that rear brake pressure then is within specification as given below.

Front brake	Rear brake	
10,000 kPa 100 kg/cm^2 1,422 psi	3 Door	6,500 – 8,000 kPa 65 – 80 kg/cm^2 924 – 1,138 psi
	5 Door	5,000 – 8,000 kPa 50 – 80 kg/cm^2 711 – 1,138 psi



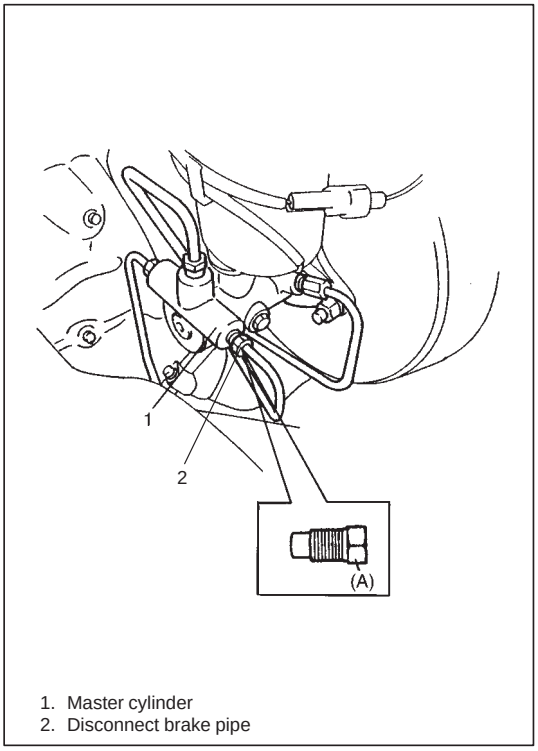
1. LSPV lever
2. LSPV spring
3. LSPV stay

4) If rear brake pressure is not within specification, adjust it by changing stay "A" position as follows.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

- If rear brake pressure is higher than specification, move stay "A" to direction "a" and if it is lower, to direction "b".
- Repeat steps 3) and 4) until rear brake pressure is within specification.
- After adjustment, be sure to torque bolt to specification.

5) Disconnect brake pipe (connecting between master cylinder secondary side and 4-way joint) from master cylinder.
Tighten plug (special tool) to master cylinder.
Depress brake pedal. If rear brake pressure is 95 – 100 kg/cm^2 when front brake pressure is 100 kg/cm^2, it means that front fail-safe system functions properly.



1. Master cylinder
2. Disconnect brake pipe

Front brake	Rear brake
10000 kPa 100 kg/cm^2 1422 psi	9500 – 10000 kPa 95 – 100 kg/cm^2 1350 – 1422 psi

Special Tool
(A): 09956-02210

6) Upon completion of fluid pressure test, bleed brake system and perform brake test.

BOOSTER OPERATION CHECK

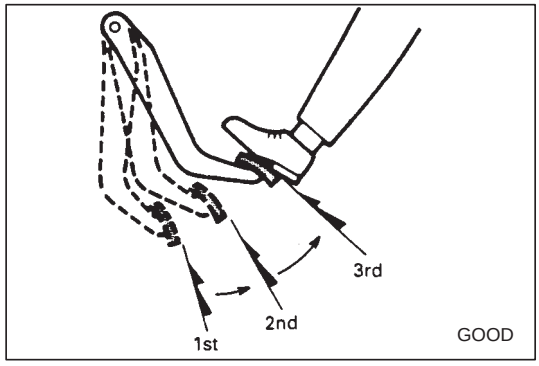
There are two ways to perform this inspection, with and without a tester. Ordinarily, it is possible to roughly determine its condition without using a tester.

NOTE:
For this check, make sure that no air is in hydraulic line.

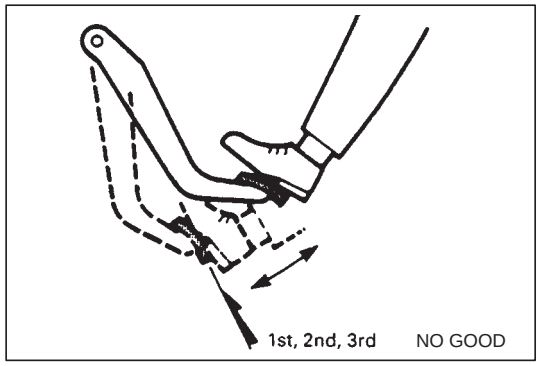
INSPECTION WITHOUT TESTER

Check Air Tightness

1) Start engine.
2) Stop engine after running for 1 to 2 minutes.

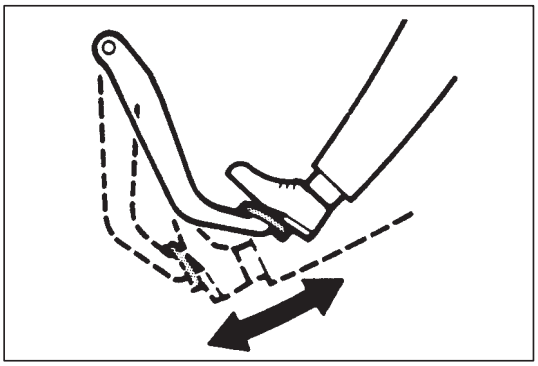


3) Depress brake pedal several times with the same load as in ordinary braking and observe pedal travel. If pedal goes down deep the first time but its travel decreases as it is depressed the second and more times, air tightness is obtained.



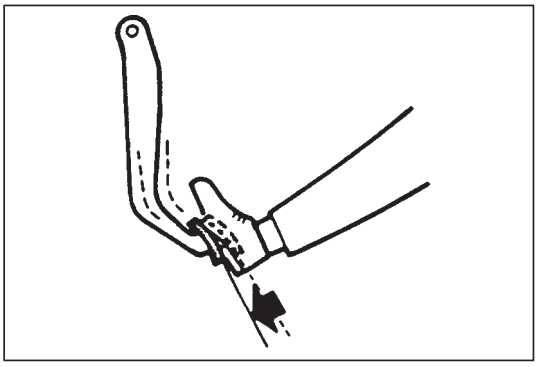
4) If pedal travel doesn't change, air tightness isn't obtained.

NOTE:
If defective, inspect vacuum lines and sealing parts, and replace any faulty part.
When this has been done, repeat the entire test.

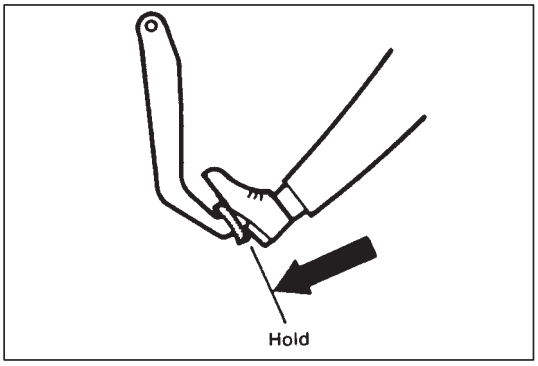


Check Operation

1) With engine stopped, depress brake pedal several times with the same load and make sure that pedal travel doesn't change.

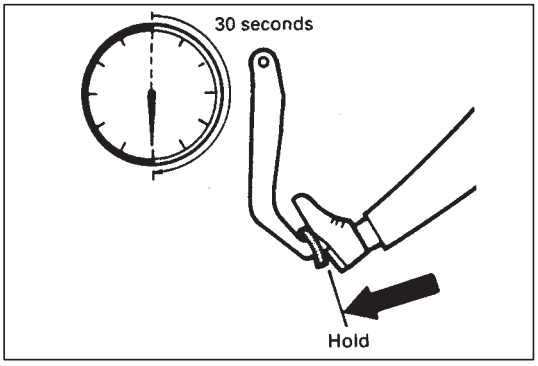


2) Start engine while depressing brake pedal. If pedal travel increases a little, operation is satisfactory. But no change in pedal travel indicates malfunction.



Check Air Tightness Under Load

1) With engine running, depress brake pedal. Then stop engine while holding brake pedal depressed.



2) Hold brake pedal depressed for 30 seconds. If pedal height does not change, condition is good. But it isn't if pedal rises.

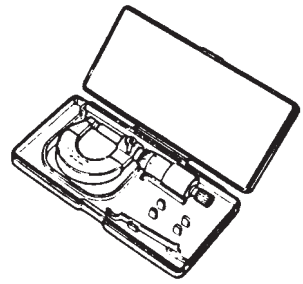
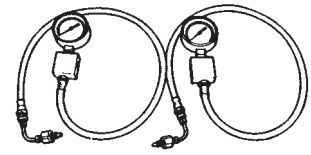
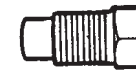
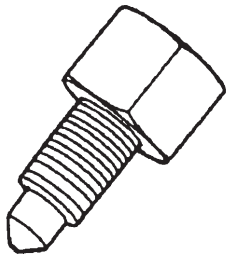
TIGHTENING TORQUE SPECIFICATIONS

Fastening parts			Tightening torque		
			N·m	kg-m	lb-ft
Brake pipe 2-way (or 4-way) joint bolt			23	2.3	17.0
Brake pipe flare nut			16	1.6	11.5
Brake bleeder plug	Front caliper	M8	8.0	0.8	6.0
		M10	8.5	0.85	6.5
	Wheel cylinder		7.5	0.75	5.5
	LSPV		7.5	0.75	5.5
LSPV mounting bolt			23	2.3	17.0
LSPV stay bolt					
LSPV spring nut					
Wheel nut			100	10.0	72.5
Stop light switch lock nut			7.5	0.75	5.5

REQUIRED SERVICE MATERIAL

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Brake fluid	Indicated on reservoir cap or described in owner's manual of vehicle	● To fill master cylinder reservoir. ● To clean and apply to inner parts of master cylinder caliper and wheel cylinder when they are disassembled.

SPECIAL TOOLS

 09950-78220 Flare nut wrench (10 mm)	 09900-20205 Micrometer (0 – 25 mm)	 09956-02310 Fluid pressure gauge	 09956-02210 Brake circuit plug
 09952-36310/09952-46510 Pressure gauge attachment			

SECTION 5A

BRAKES PIPE/HOSE/MASTER CYLINDER

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

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "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:
All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.

CONTENTS

GENERAL DESCRIPTION 5A- 2
Master Cylinder Assembly 5A- 2
Booster Assembly 5A- 2
LSPV (Load Sensing Proportioning Valve) Assembly 5A- 3
DIAGNOSIS 5A- 4
CHECK AND ADJUSTMENT 5A- 4
ON-VEHICLE SERVICE 5A- 4
Front Brake Hose/Pipe 5A- 4
Rear Brake Hose/Pipe 5A- 7
Master Cylinder Reservoir 5A- 8
Master Cylinder Assembly 5A-10
Brake Booster 5A-14
LSPV (Load Sensing Proportioning Valve) Assembly 5A-17
TIGHTENING TORQUE SPECIFICATIONS 5A-19
REQUIRED SERVICE MATERIAL 5A-19
SPECIAL TOOLS 5A-19

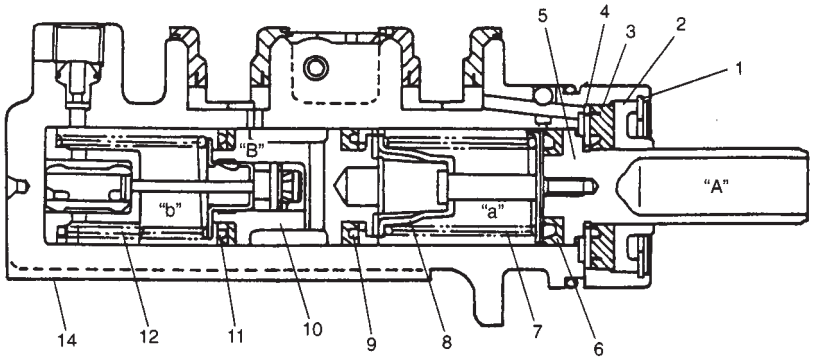
GENERAL DESCRIPTION

MASTER CYLINDER ASSEMBLY

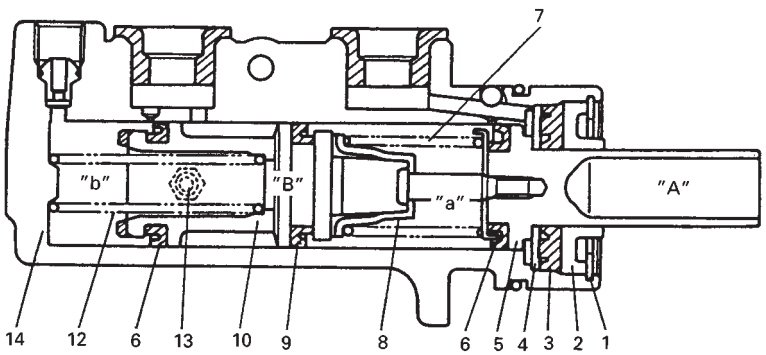
The master cylinder has two pistons and three piston cups. Its hydraulic pressure is produced in the primary ("a" in the figure below) and secondary ("b") chambers. The hydraulic pressure produced in the primary chamber ("a") acts on the front (for vehicle without ABS, rear) wheel brakes.
Also, the hydraulic pressure produced in the secondary chamber ("b") acts on the rear (for vehicle without ABS, front) wheel brakes.

NOTE:
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]: With ABS
[B]: Without ABS

1. Piston stopper circlip
2. Piston stopper
3. Cylinder cup
4. Plate
5. Primary piston
6. Piston cup
7. Primary piston return spring
8. Primary spring retainer
9. Secondary piston pressure cup
10. Secondary piston
11. Return spring secondary seat
12. Secondary piston return spring
13. Secondary piston stopper bolt
14. Master cylinder body

"A": Primary piston
"B": Secondary piston

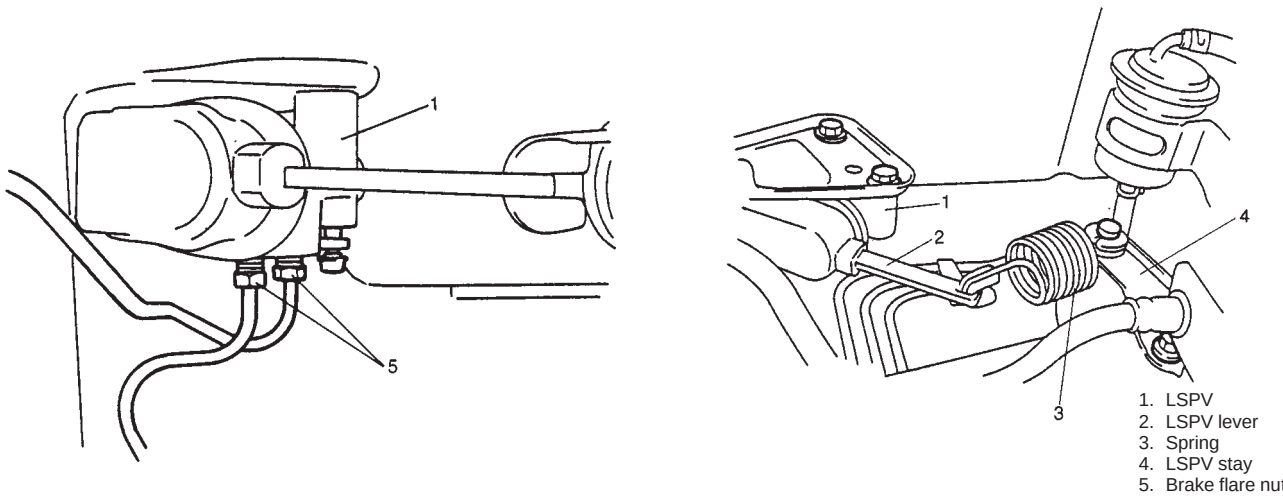
BOOSTER ASSEMBLY

The booster is located between the master cylinder and the brake pedal. It is so designed that the force created when the brake pedal is depressed is mechanically increased combined with the engine vacuum.
The booster has two diaphragms of Ø7.5 in. (191 mm) effective diameter.

CAUTION:
- **Never disassemble brake booster assembly. If it is found faulty, replace it with new assembly.**
- **The torque values specified are for dry, unlubricated fasteners. If any hydraulic component is removed or brake line disconnected, bleed the brake system.**

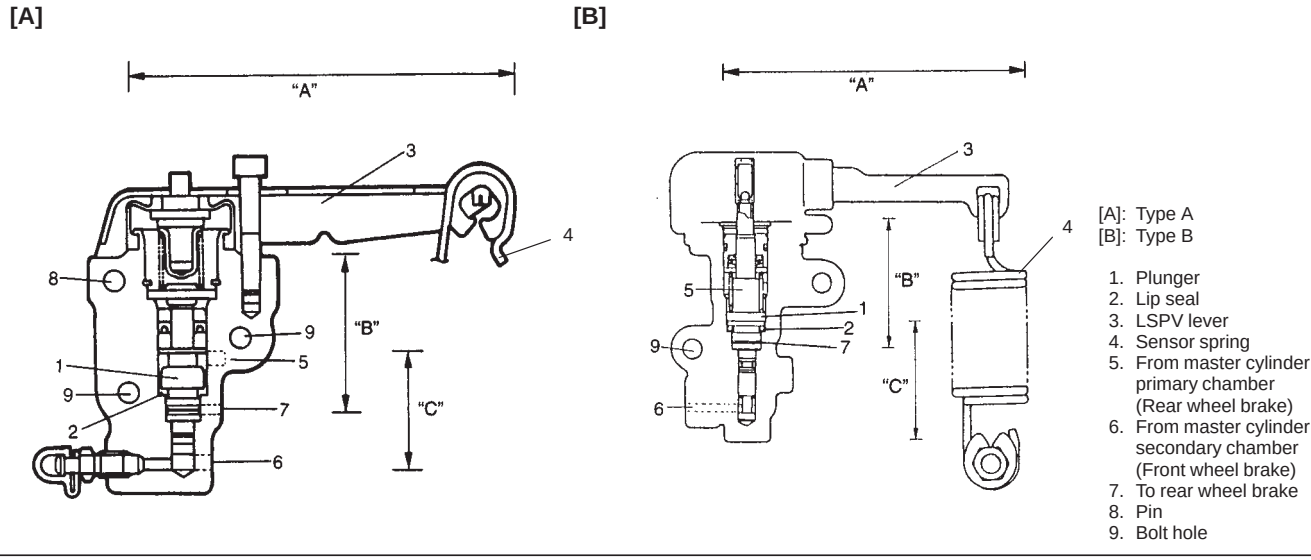
LSPV (Load Sensing Proportioning Valve) ASSEMBLY (if equipped)

As shown in figure below, LSPV is included within the brake circuit which connects the master cylinder and the rear wheel brake. It controls the hydraulic pressure applied to the rear wheel brake according to the loaded state of the vehicle (or weight of the load), whereby preventing the rear wheels from getting locked prematurely.
Also, it releases the above described control over the hydraulic pressure applied to the rear wheel brake, should any failure occur in the hydraulic circuit of the front wheel brake so that the hydraulic pressure produced in the master cylinder is applied to the rear wheel brake directly to operate it.



1. LSPV
2. LSPV lever
3. Spring
4. LSPV stay
5. Brake flare nut

CONSTITUTION



[A]: Type A
[B]: Type B

1. Plunger
2. Lip seal
3. LSPV lever
4. Sensor spring
5. From master cylinder primary chamber (Rear wheel brake)
6. From master cylinder secondary chamber (Front wheel brake)
7. To rear wheel brake
8. Pin
9. Bolt hole

The LSPV components are grouped into three sections as follows.

"A": Sensor section

The main parts in this section are a lever and a spring which senses variation in the vehicle height as affected by the loaded condition and converts it into the load.

"B": Hydraulic pressure control section

Included in this section are a stepped plunger and valve mechanism to execute proportional control.

"C": Fail-safe section

The main parts in this section are a chamber which draws in the hydraulic pressure from the front wheel brake system and a fail-safe piston which releases the valve mechanism in the control section connected to the rear wheel brake, should any failure occur in the front wheel brake system.

DIAGNOSIS

Refer to Section 5 (BRAKES)

CHECK AND ADJUSTMENT

Refer to Section 5 (BRAKES)

ON-VEHICLE SERVICE

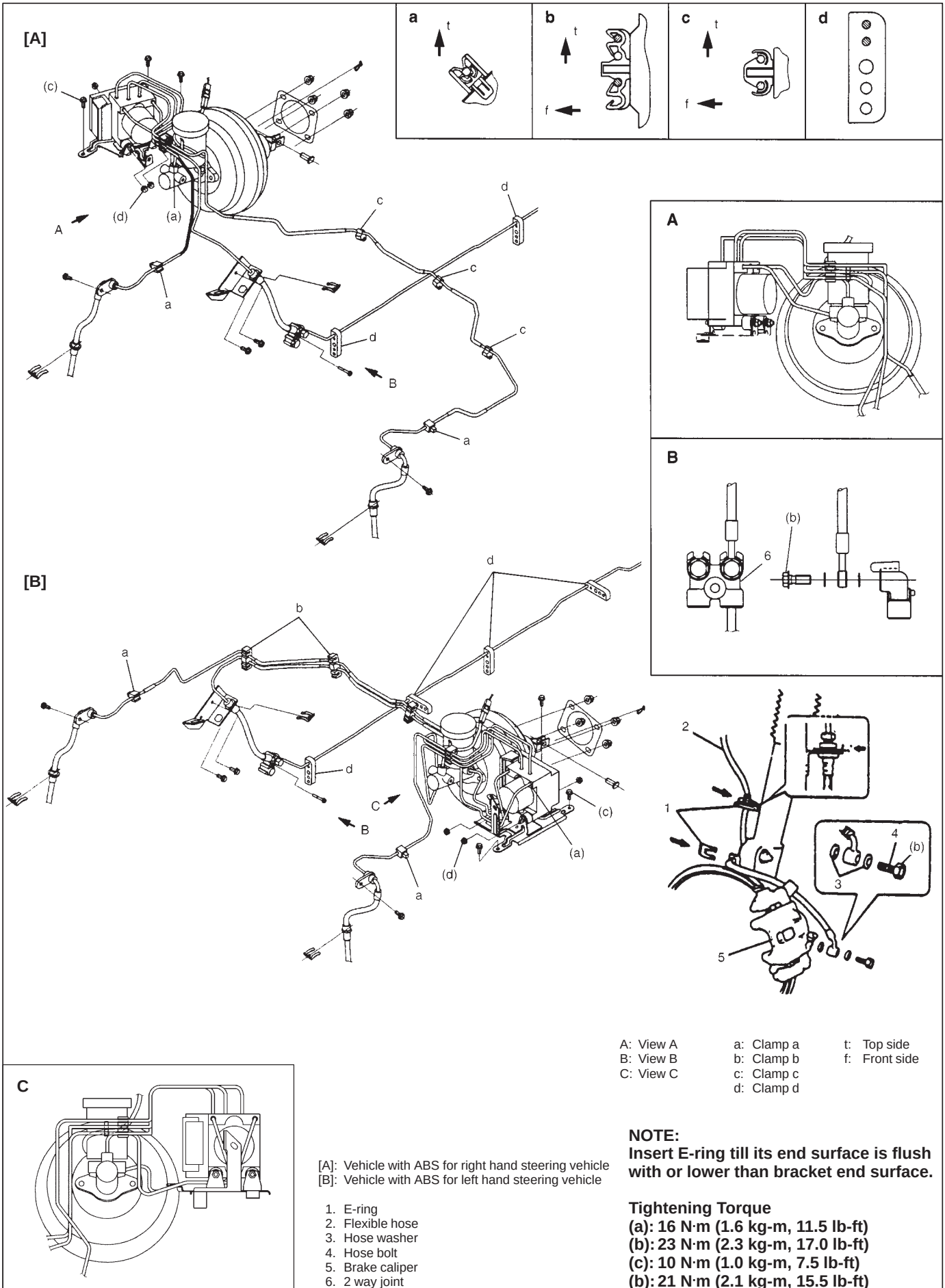
FRONT BRAKE HOSE/PIPE

REMOVAL

1) Raise and suitably support vehicle. Remove tire and wheel.
   This operation is not necessary when removing pipes connecting master cylinder and flexible hose.
2) Clean dirt and foreign material from both hose end or pipe end fittings. Remove brake hose or pipe.

INSTALLATION

1) Reverse removal procedure for brake hose and pipe installation procedure.
   For installation, make sure that steering wheel is in straightforward position and hose has no twist or kink. Check to make sure that hose doesn't contact any part of suspension, both in extreme right and extreme left turn conditions. If it does at any point, remove and correct. Fill and maintain brake fluid level in reservoir. Bleed brake system.
2) Perform brake test and check installed part for fluid leakage.



C

A: View A
B: View B
C: View C

a: Clamp a
b: Clamp b
c: Clamp c
d: Clamp d

t: Top side
f: Front side

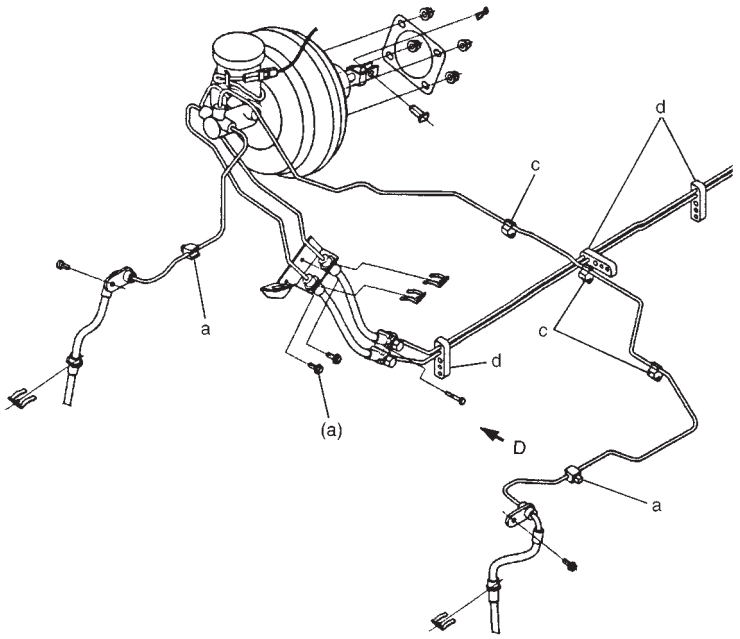
[A]: Vehicle with ABS for right hand steering vehicle
[B]: Vehicle with ABS for left hand steering vehicle

1. E-ring
2. Flexible hose
3. Hose washer
4. Hose bolt
5. Brake caliper
6. 2 way joint

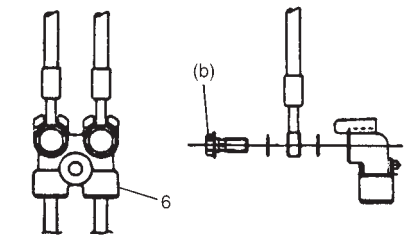
NOTE:
Insert E-ring till its end surface is flush with or lower than bracket end surface.

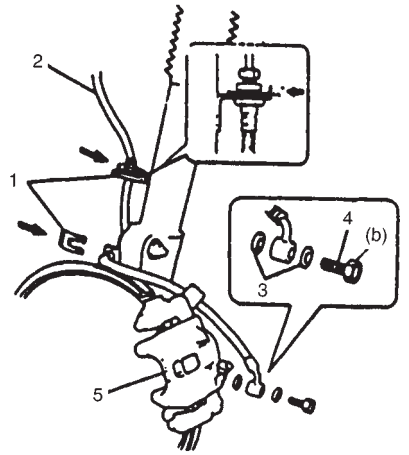
Tightening Torque
(a): 16 N·m (1.6 kg-m, 11.5 lb-ft)
(b): 23 N·m (2.3 kg-m, 17.0 lb-ft)
(c): 10 N·m (1.0 kg-m, 7.5 lb-ft)
(b): 21 N·m (2.1 kg-m, 15.5 lb-ft)

[C]

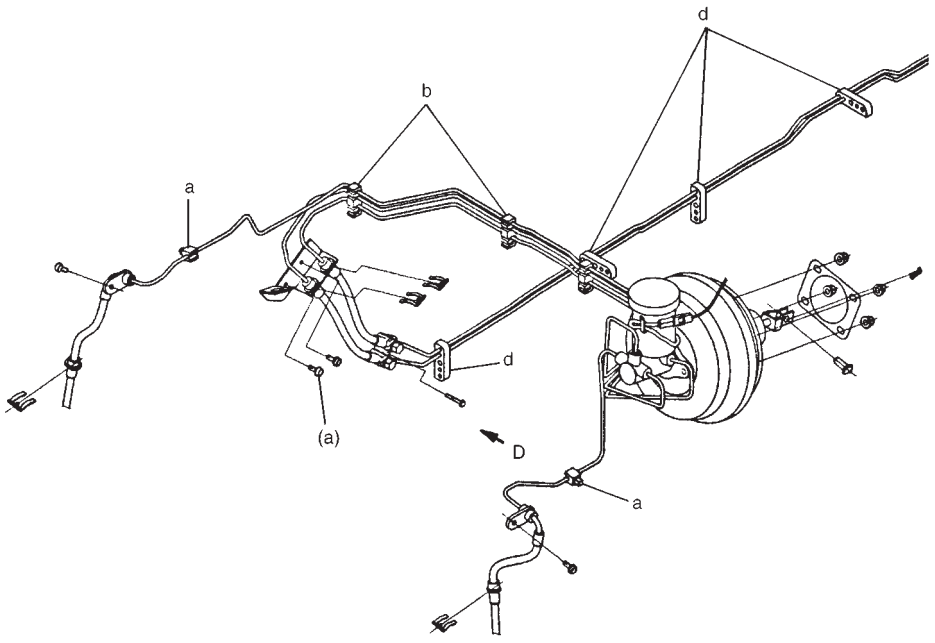


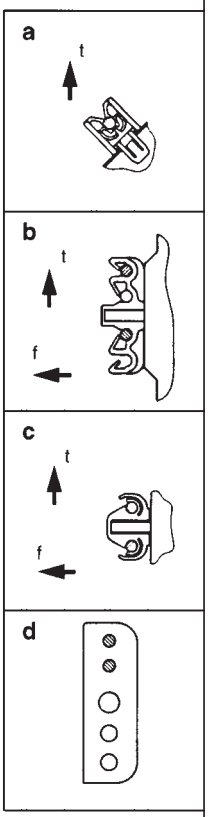
D





[D]





D: View D

a: Clamp a
b: Clamp b
c: Clamp c
d: Clamp d

t: Top side
f: Front side

[C]: Vehicle without ABS for right hand steering vehicle
[D]: Vehicle without ABS for left hand steering vehicle

1. E-ring
2. Flexible hose
3. Hose washer
4. Hose bolt
5. Brake caliper
6. 4way joint

NOTE:
Insert E-ring till its end surface is flush with or lower than bracket end surface.

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)

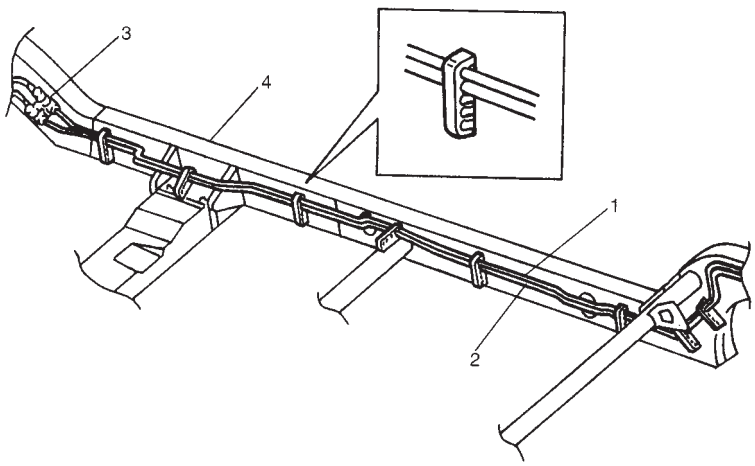
REAR BRAKE HOSE/PIPE

REMOVAL

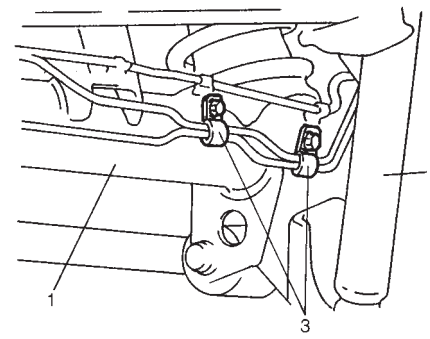
1) Raise and suitably support vehicle. Remove tire and wheel.
2) Clean dirt and foreign material from both hose end or pipe end fittings. Remove brake hose or pipe.

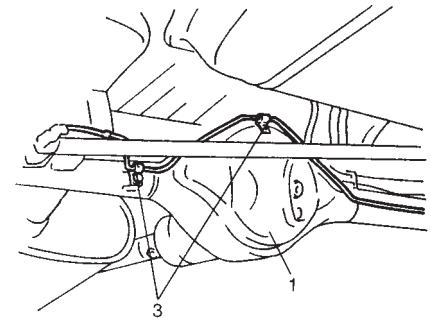
INSTALLATION

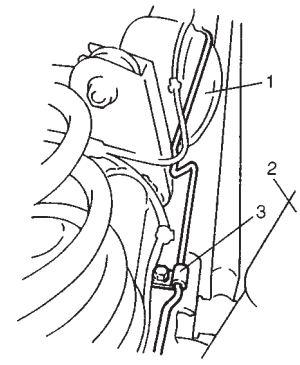
1) Reverse removal procedure for brake hose or pipe installation procedure.
   - Be sure to obtain more than 3 mm (0.118 in.) clearance between axle housing and brake pipe.
   - Install clamps properly referring to figure below and tighten bolts.
   - When installing hose, make sure that it has no twist or kink.
2) Fill and maintain brake fluid level in reservoir. Bleed brake system.
3) Perform brake test and check each installed part for fluid leakage.



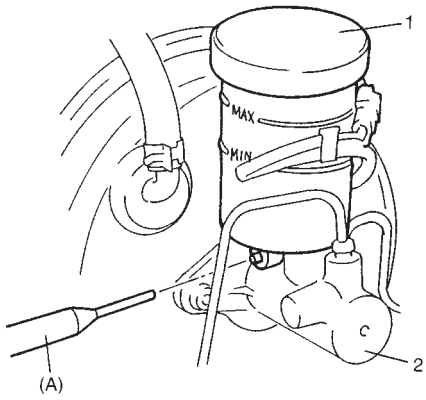
1. Brake pipe (to rear)
2. Brake pipe (to LSPV, for vehicle without ABS)
3. 4-way (2-way) joint
4. Chassis frame







1. Rear axle
2. Shock absorber
3. Clamp



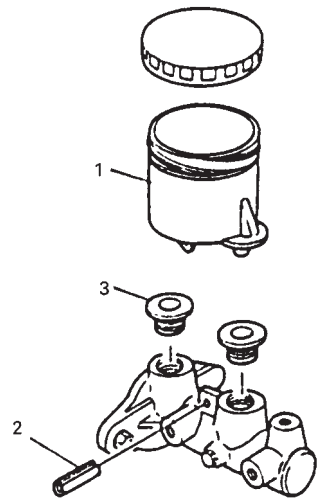
1. Reservoir
2. Master cylinder

MASTER CYLINDER RESERVOIR

REMOVAL

1) Disconnect reservoir lead wire at coupler.
2) Clean outside of reservoir.
3) Take out fluid with syringe or such.
4) Remove reservoir connector pin by using special tool.

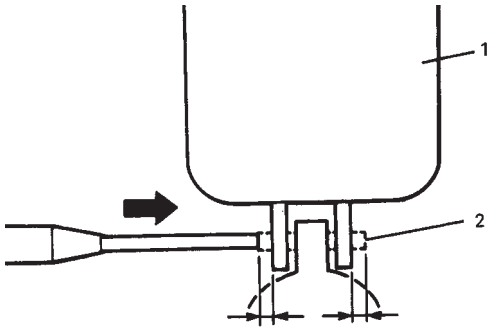
Special Tool
(A): 09922-85811



1. Reservoir
2. Connector pin
3. Grommets

5) Remove reservoir.

NOTE:
Do not allow brake fluid to get on painted surfaces.



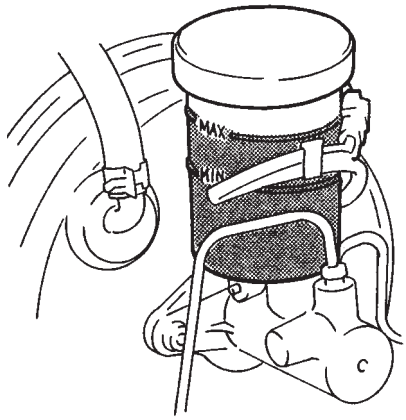
1. Reservoir
2. Pin

INSTALLATION

NOTE:
See NOTE at the beginning of this section.

1) When using new grommets, lubricate them with the same fluid as the one to fill reservoir with. Then press-fit grommets to master cylinder. Grommets must be seated in place.
2) Install reservoir and drive in reservoir pin.

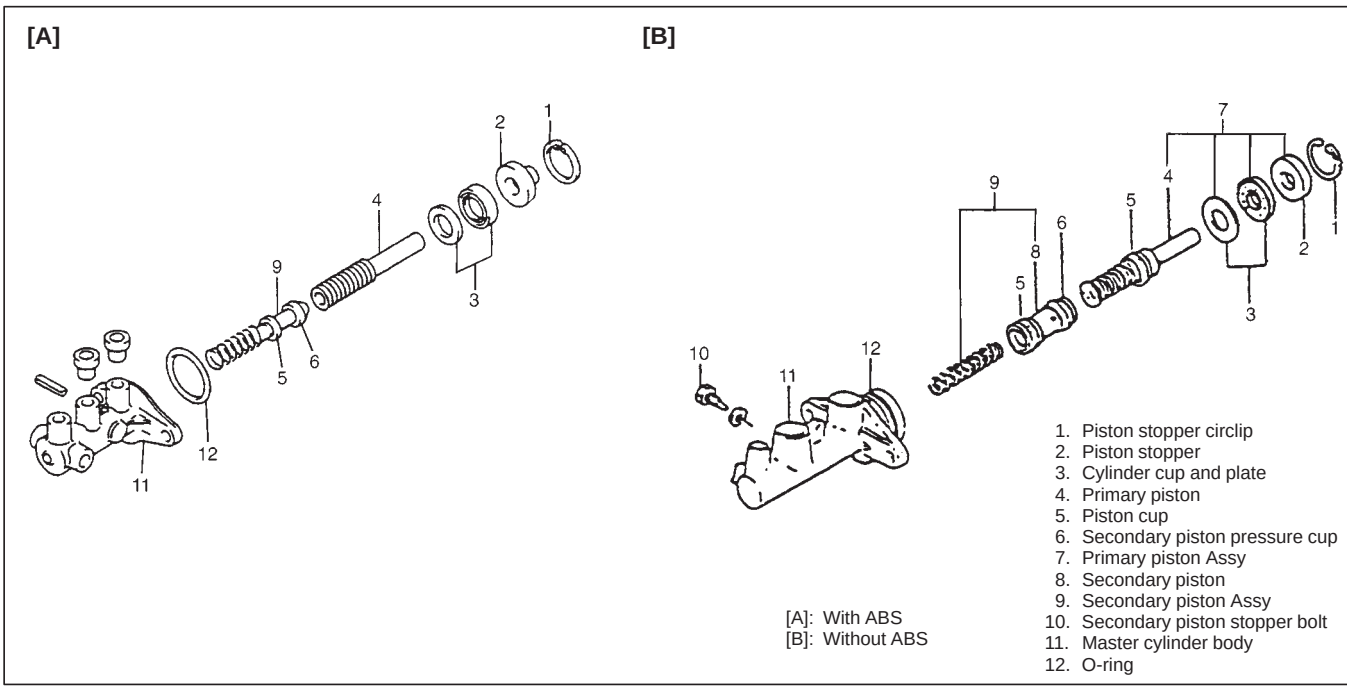
NOTE:
Drive in reservoir pin till both of its ends at the right and left or reservoir becomes the same length.



1. Reservoir
2. Cap

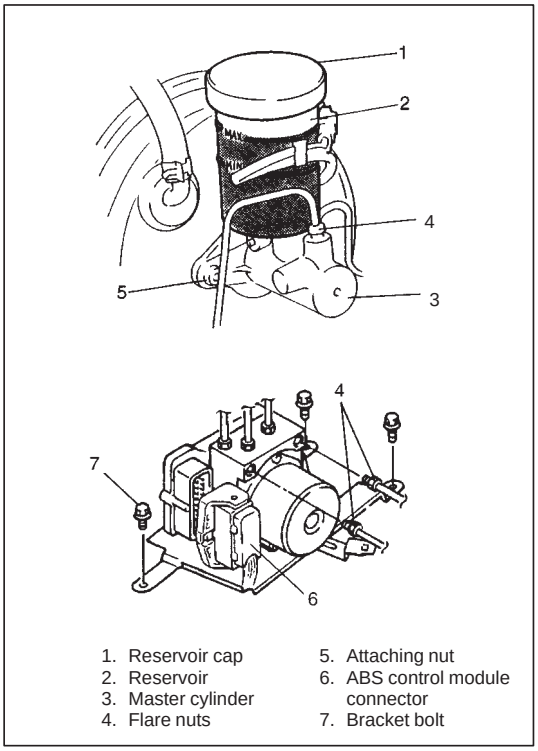
3) Connect reservoir lead wire.
4) Fill reservoir with specified fluid.
5) Upon completion of installation, check for fluid leakage.

MASTER CYLINDER ASSEMBLY



[A]: With ABS
[B]: Without ABS

1. Piston stopper circlip
2. Piston stopper
3. Cylinder cup and plate
4. Primary piston
5. Piston cup
6. Secondary piston pressure cup
7. Primary piston Assy
8. Secondary piston
9. Secondary piston Assy
10. Secondary piston stopper bolt
11. Master cylinder body
12. O-ring



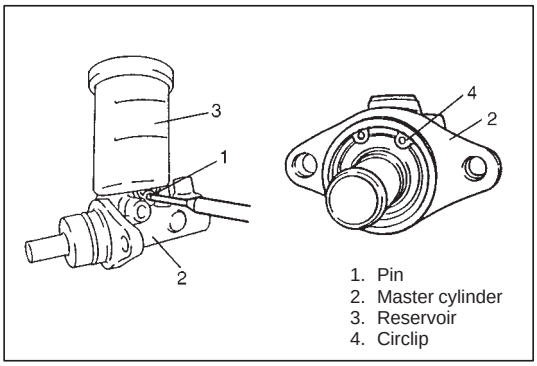
1. Reservoir cap
2. Reservoir
3. Master cylinder
4. Flare nuts
5. Attaching nut
6. ABS control module connector
7. Bracket bolt

REMOVAL

NOTE:

Do not allow brake fluid to get on painted surfaces.

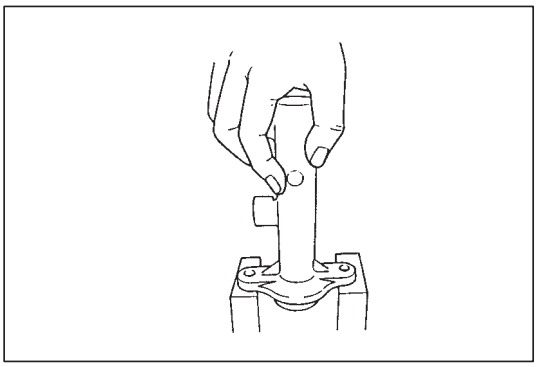
1) Disconnect reservoir lead wire at coupler.
2) Clean around reservoir cap and take out fluid with syringe or such.
3) Remove master cylinder with reservoir from brake booster.
   - For vehicle with ABS
     a) Loosen flare nuts for master cylinder and ABS hydraulic unit as shown.
     b) For LH steering vehicle, disconnect ABS control module connector.
     c) For RH steering vehicle, remove ABS hydraulic unit bracket bolts.
     d) Disconnect brake pipes between master cylinder and ABS hydraulic unit.
   - For vehicle without ABS
     a) Loosen flare nuts for master cylinder.
     b) Disconnect brake pipes for master cylinder.



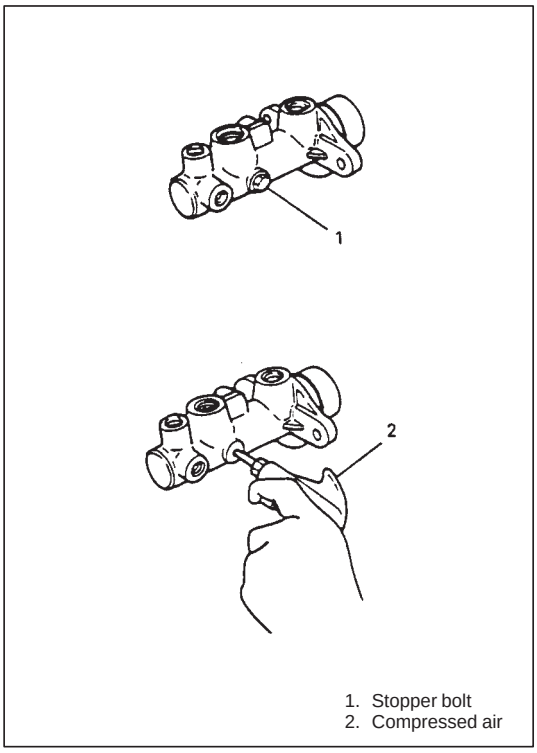
1. Pin
2. Master cylinder
3. Reservoir
4. Circlip

DISASSEMBLY

1) Remove reservoir pin and reservoir.
2) Remove circlip.



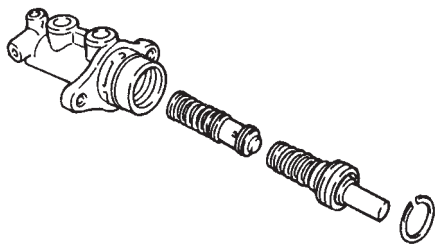
3) For vehicle with ABS
   Pull out primary piston assembly straight so as not to cause any damage to inside of cylinder wall.
   Pull out secondary piston assembly straight so as not to cause any damage to inside of cylinder wall and by tapping flange with a piece of wood or something soft.



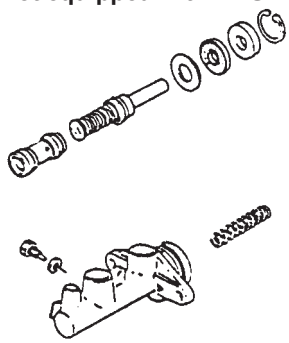
1. Stopper bolt
2. Compressed air

3') For vehicle without ABS
   Remove piston stopper bolt. Then remove secondary piston by blowing compressed air into hole from which piston stopper bolt was removed.
   Be cautious during removal as secondary piston jumps out.

Vehicle equipped with ABS



Vehicle not equipped with ABS



INSPECTION

Inspect all disassembled parts for wear or damage, and replace parts if necessary.

NOTE:
- **Wash disassembled parts with brake fluid.**
- **Do not reuse piston cups.**

Inspect master cylinder bore for scoring or corrosion. It is best to replace corroded cylinder.
Corrosion can be identified as pits or excessive roughness.

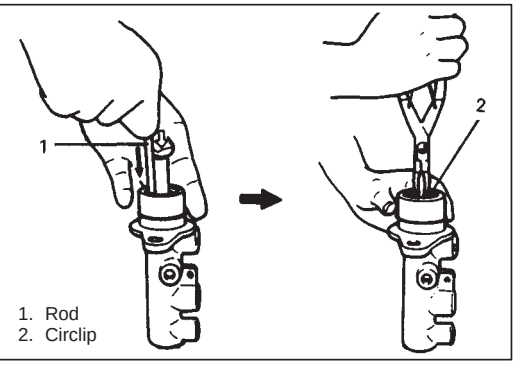
NOTE:
Polishing bore or master cylinder with cast aluminum body with anything abrasive is prohibited, as damage to cylinder bore may occur.

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

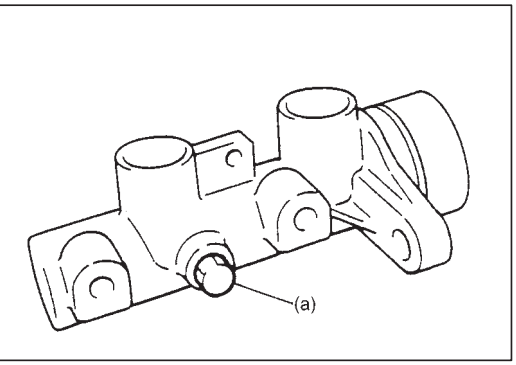
NOTE:
- **See NOTE at the beginning of this section.**
- **Before assembling, wash each part in fluid recommended to use for that vehicle.**

1) Install secondary piston assembly into cylinder.
2) Install primary piston assembly in cylinder.



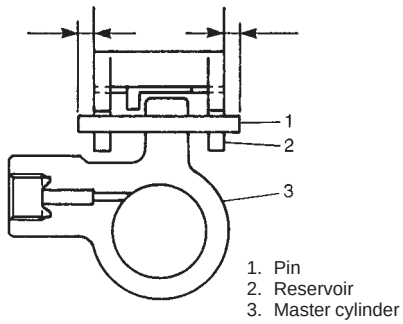
1. Rod
2. Circlip

3) Depress, and install circlip.



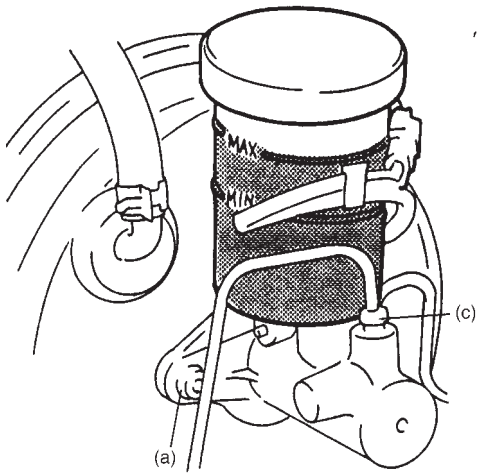
4) Install piston stopper bolt with pistons pushed in all the way and tighten it to specified torque (For vehicle without ABS).

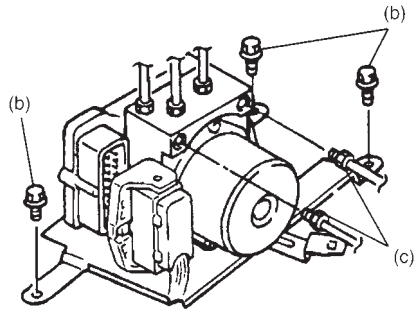
Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)



1. Pin
2. Reservoir
3. Master cylinder

5) Apply thin coat of brake fluid to all around new grommets (2pcs.) and install them to cylinder body, then install reservoir.
6) Set a new pin in reservoir hole and drive it in. At this time, make end of pin and end face margin of reservoir equal.





INSTALLATION

NOTE:

- **See NOTE at the beginning of this section.**
- **Adjust clearance between booster piston rod and primary piston with special tool, referring to CLEARANCE BETWEEN BOOSTER PISTON AND MASTER CYLINDER PISTON ADJUSTMENT in this section.**

1) Install master cylinder to brake booster.
2) Tighten master cylinder attaching nuts to specification.

Tightening Torque
(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)

3) Connect brake pipes to master cylinder.
   - For vehicle with ABS
     a) Connect brake pipes between master cylinder and ABS hydraulic unit.
     b) For LH steering vehicle, connect ABS control module connector.
     c) For RH steering vehicle, install ABS hydraulic unit bracket bolts and tighten it to specified torque.

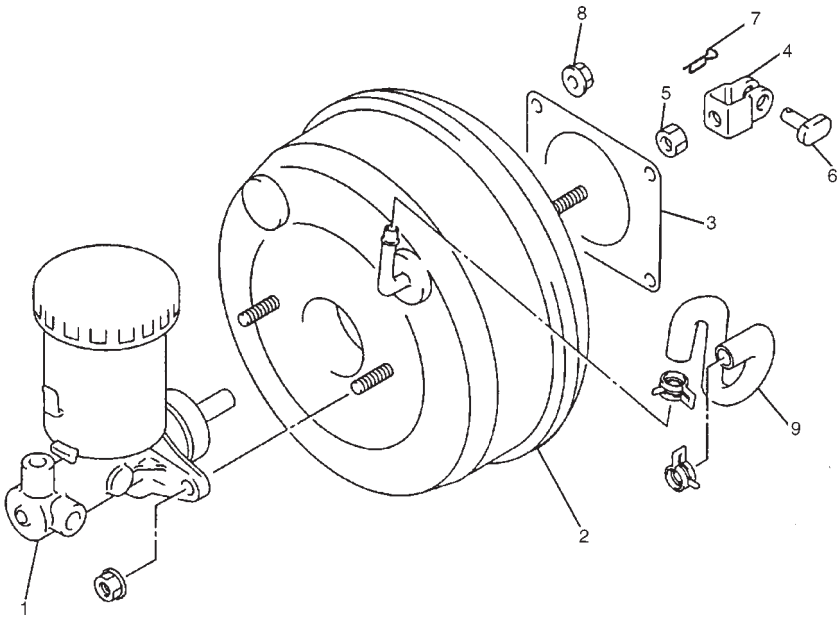
Tightening Torque
(b): 10 N·m (1.0 kg-m, 7.5 lb-ft)

4) Tighten flare nuts to specification.

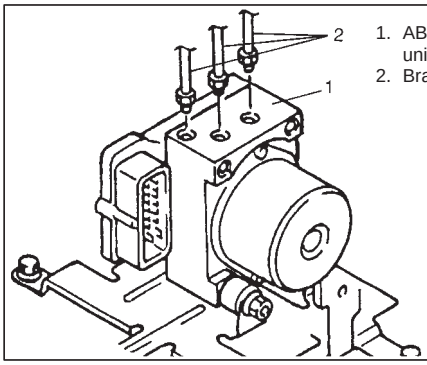
Tightening Torque
(c): 16 N·m (1.6 kg-m, 12.0 lb-ft)

5) Connect reservoir lead wire.
6) Fill reservoir with specified brake fluid.
7) Check brake pedal play and bleed air from system.
8) Perform brake test and check each installed part for fluid leakage.

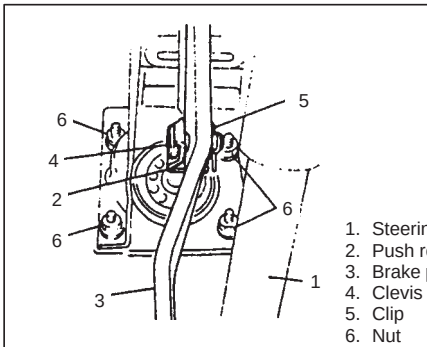
BRAKE BOOSTER



1. Brake master cylinder ass'y
2. Brake booster ass'y
3. Gasket
4. Push rod clevis
5. Nut
6. Clevis pin
7. Clip
8. Nut
9. Brake vacuum hose



1. ABS hydraulic unit
2. Brake pipes



1. Steering column
2. Push rod clevis
3. Brake pedal arm
4. Clevis pin
5. Clip
6. Nut

REMOVAL

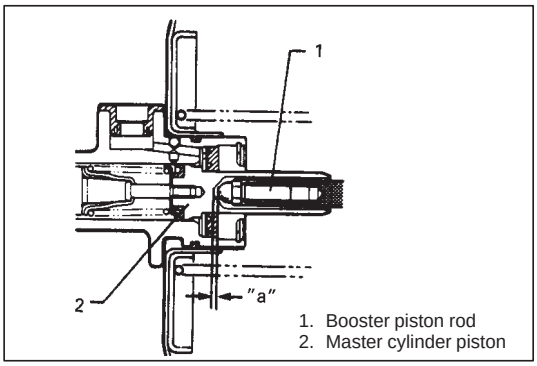
NOTE:

Do not allow brake fluid to get on painted surfaces.

1) For vehicle equipped with ABS, disconnect brake pipes from ABS hydraulic unit.
2) Remove master cylinder assembly, referring to MASTER CYLINDER ASSEMBLY REMOVAL in this section.
3) Disconnect brake vacuum hose from brake booster.
4) Disconnect push rod clevis from brake pedal arm.
5) Remove attaching nuts and then booster as shown.

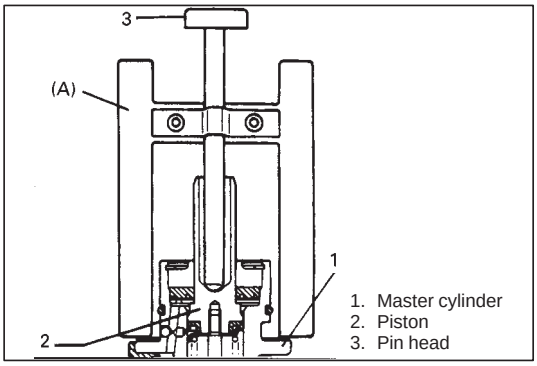
CAUTION:

Never disassemble brake booster. Disassembly will spoil its original function. If it is found faulty, replace it with new one.



CLEARANCE BETWEEN BOOSTER PISTON ROD AND MASTER CYLINDER PISTON ADJUSTMENT

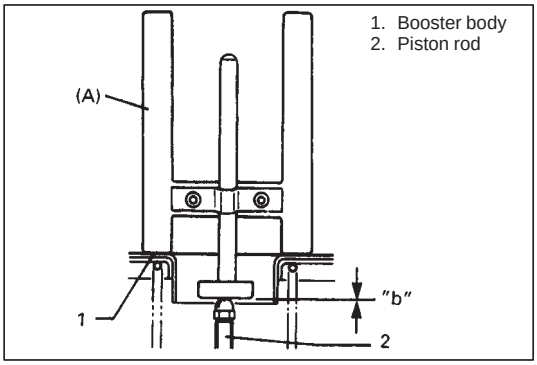
The length of booster piston rod is adjusted to provide specified clearance "a" between piston rod end and master cylinder piston.



- Before measuring clearance, push piston rod several times so as to make sure reaction disc is in place.
- Keep inside of booster at atmospheric pressure for measurement.

1) Set special tool (A) on master cylinder and push pin until contacts piston.

Special Tool
(A): 09950-96010

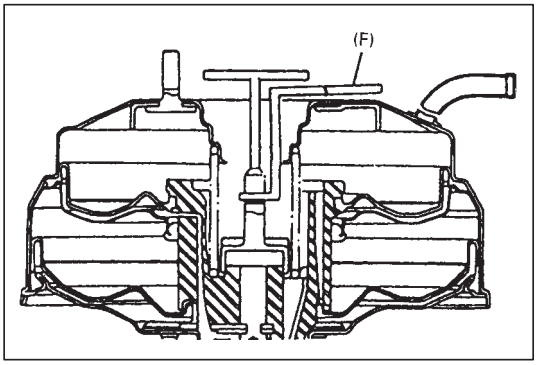


2) Turn special tool upside down and place it on booster. Adjust booster piston rod length until rod end contacts pin head.

Special Tool
(A): 09950-96010

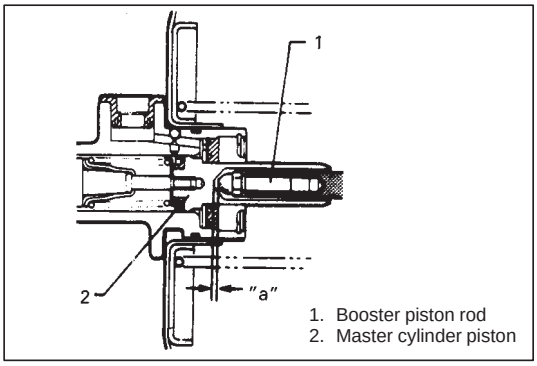
Clearance "b": 0 mm (0 in.)

NOTE:
Take measurement with booster set vertically and rod at the center.



3) Adjust clearance by turning adjusting screw of piston rod.

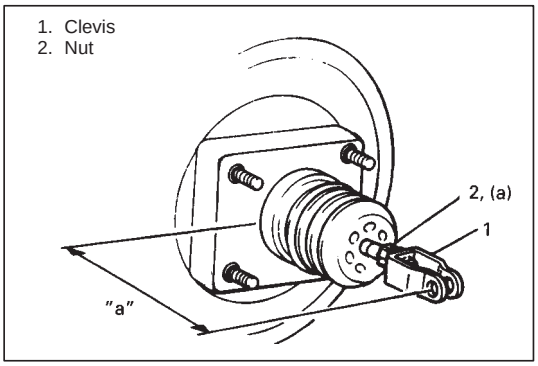
Special Tool
(F): 09952-16010



Reference

When adjusted as above, its negative pressure is applied to booster with engine at idle, piston to piston rod clearance "a" should become below.

Clearance "a": 0.25 – 0.5 mm (0.010 – 0.020 in.)

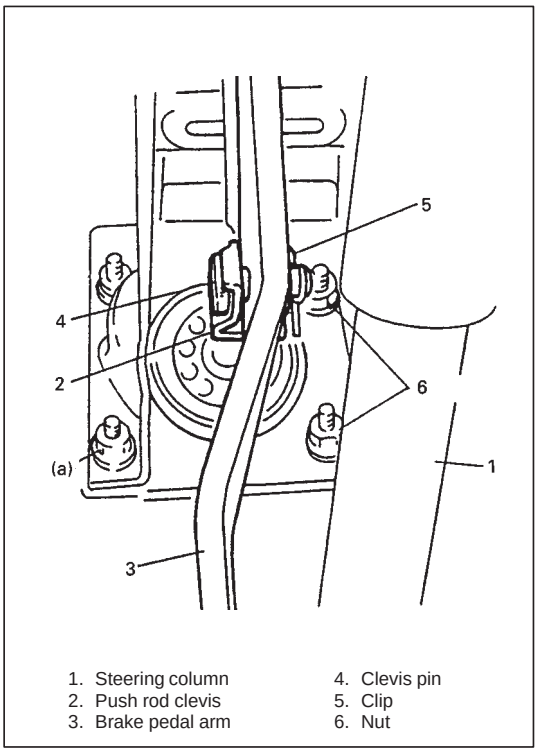


BOOSTER PUSH ROD CLEVIS ADJUSTMENT

Install push rod clevis so that measurement "a" is obtained and torque nut to specification.

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

Length
"a": 109.5 – 110.5 mm (4.31 – 4.35 in.)



1. Steering column
2. Push rod clevis
3. Brake pedal arm
4. Clevis pin
5. Clip
6. Nut

INSTALLATION

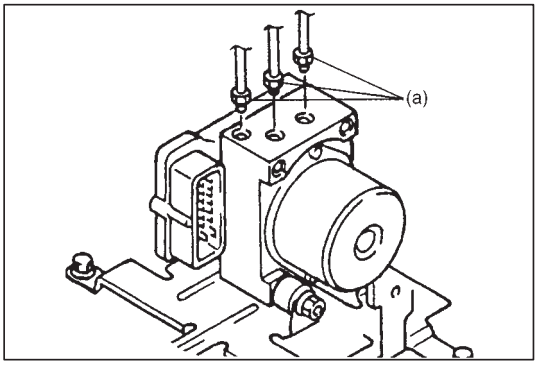
NOTE:

- **See NOTE at the beginning of this section.**
- **Check length of push rod clevis. (Refer to BOOSTER PUSH ROD CLEVIS ADJUSTMENT.)**
- **Before installing master cylinder, adjust booster piston rod. (Refer to CLEARANCE BETWEEN BOOSTER PISTON ROD AND MASTER CYLINDER PISTON ADJUSTMENT of this section.)**
- **Apply silicone grease to master cylinder piston.**

1) Install booster to dash panel as shown. Then connect booster push rod clevis to pedal arm with clevis pin and clip.
2) Tighten booster attaching nuts to the specified torque.

   Tightening Torque
   (a): 13 N·m (1.3 kg-m, 9.5 lb-ft)

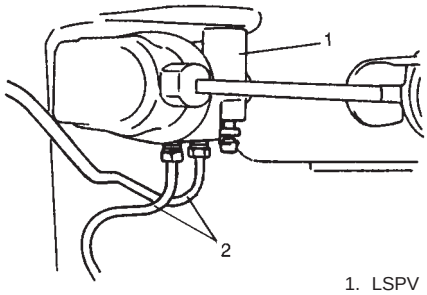
3) Connect brake vacuum hose to brake booster.



4) For vehicle equipped with ABS, connect brake pipes to ABS hydraulic unit. If ABS hydraulic unit bracket bolts removed, tighten flare nuts to specification after installing master cylinder.

   Tightening Torque
   (a): 16 N·m (1.6 kg-m, 12.0 lb-ft)

5) Install master cylinder, referring to MASTER CYLINDER ASSEMBLY INSTALLATION in this section.

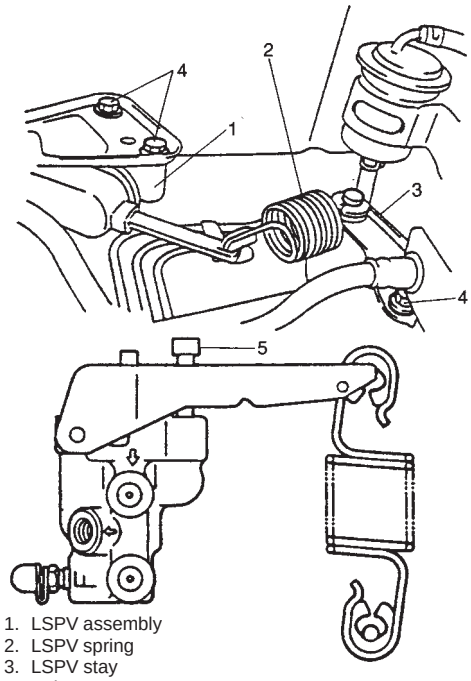


1. LSPV
2. Brake pipe

LSPV (Load Sensing Proportioning Valve) ASSEMBLY (if equipped)

REMOVAL

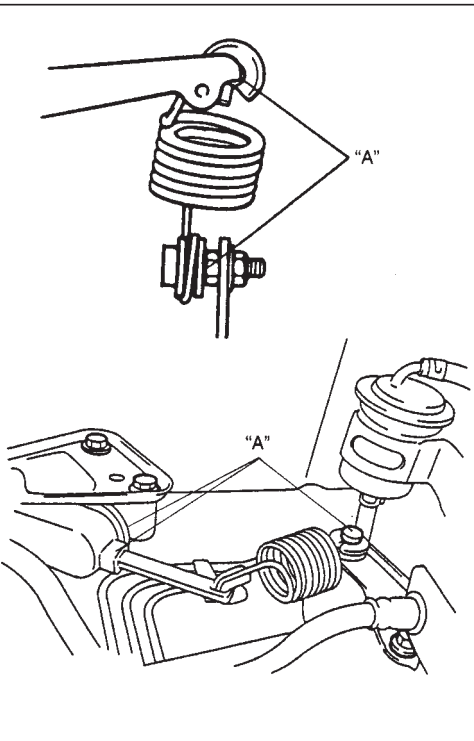
1) Clean around reservoir cap and take out fluid with syringe or such.
2) Hoist vehicle.
3) Disconnect brake pipes from LSPV.



1. LSPV assembly
2. LSPV spring
3. LSPV stay
4. Bolt
5. Stepper bole

4) Remove LSPV assembly with spring from vehicle body.
5) Remove spring from lever.

CAUTION:
- **LSPV assembly must not be disassembled. Replace with new one if defective.**
- **Stopper bolt should not be loosened or tightened. (if equipped)**

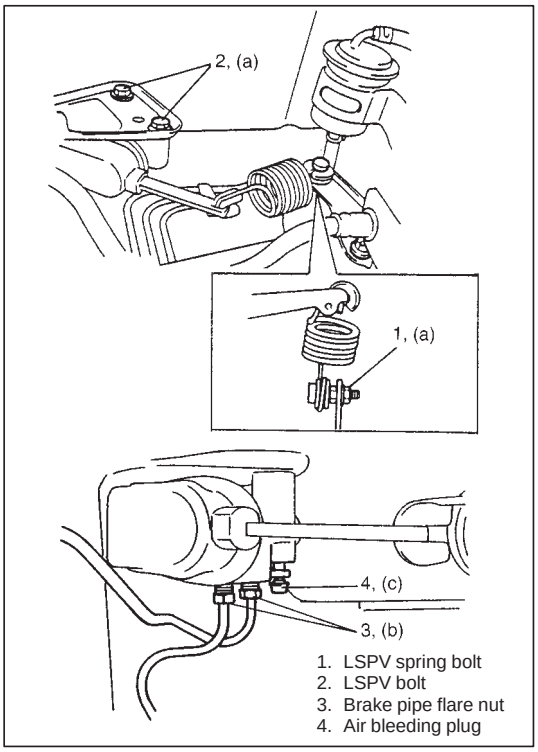


INSTALLATION

CAUTION:
Refer to above CAUTION.

Install by reversing removal procedure, noting the following.

1) Apply multi-purpose grease "A" to upper and lower joint of coil spring.



1. LSPV spring bolt
2. LSPV bolt
3. Brake pipe flare nut
4. Air bleeding plug

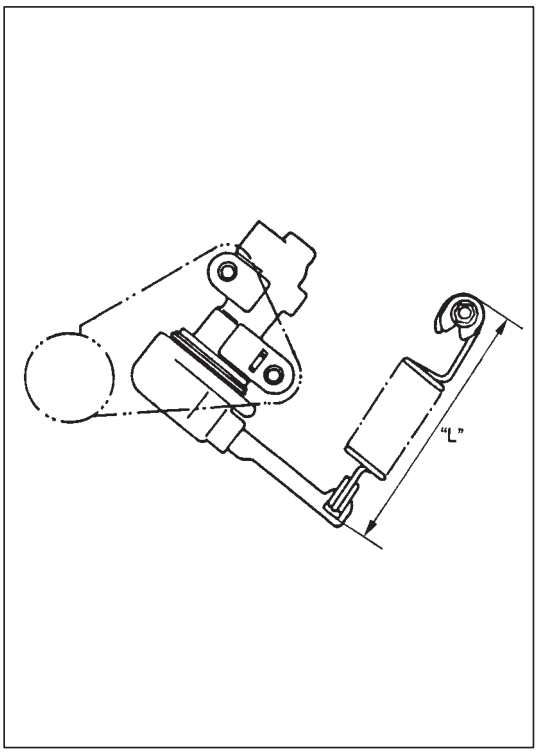
2) Torque each bolt and nut to specification as indicated respectively in figure.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)
(b): 16 N·m (1.6 kg-m, 11.5 lb-ft) (brake flare nut)
(c): 7.5 N·m (0.75 kg-m, 9.0 lb-ft) (bleeder plug)

3) Upon completion of installation, fill reservoir tank with specified fluid and bleed air from brake system.

NOTE:
Make sure to bleed air from LSPV bleeder without failure.

4) After bleeding air, check that LSPV is installed properly, referring to following INSPECTION & ADJUSTMENT.

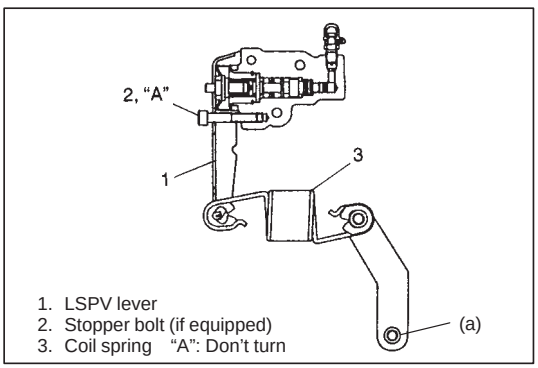


INSPECTION & ADJUSTMENT

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.

With vehicle in above conditions;
1) Place it on level floor.
2) Push up (for 5 door model) or push down (for 3 door model) LSPV lever with finger till it stops and measure length "L" of coil spring as it is pulled.
3) Spring length "L" should be the value specified below.

Spring length (between spring end and spring bolt)
"L": 103 mm (4.06 in.) . . . . . (5 door model)
157 mm (6.18 in.) . . . . . (3 door model)



1. LSPV lever
2. Stopper bolt (if equipped)
3. Coil spring "A": Don't turn

4) If it isn't, adjust it to specification by changing stay positions as shown in figure. After adjustment, tighten bolt to specified torque.
For details, refer to left figure.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

NOTE:
Check to make sure that LSPV body and brake pipe joints are free from fluid leakage. Replace defective parts, if any.

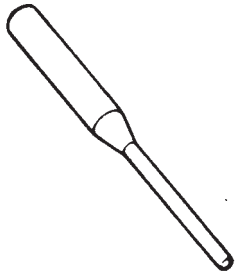
TIGHTENING TORQUE SPECIFICATIONS

Fastening parts			Tightening torque		
			N·m	kg-m	lb-ft
Brake flexible hose bolt (Brake caliper / 2 (4) way joint)			23	2.3	17.0
Master cylinder attaching nut			13	1.3	9.5
Booster nut			13	1.3	9.5
Clevis nut			25	2.5	18
2-way (or 4-way) joint mounting bolt			10	1.0	7.5
Brake pipe flare nut			16	1.6	11.5
Brake bleeder plug	Front caliper	M8	8.0	0.8	6.0
		M10	8.5	0.85	6.5
	Wheel cylinder		7.5	0.75	5.5
	LSPV		8.0	0.8	6.0
LSPV mounting bolt			23	2.3	17.0
LSPV stay bolt					
LSPV spring nut					
Wheel nut			100	10.0	72.5

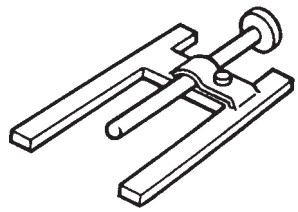
REQUIRED SERVICE MATERIAL

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Brake fluid	Indicated on reservoir cap or described in owner's manual of vehicle	● To fill master cylinder reservoir. ● To clean and apply to inner parts of master cylinder caliper and wheel cylinder when they are disassembled.

SPECIAL TOOLS



09922-85811
Connector pin remover



09950-96010
Booster piston rod gauge

09952-16010
Booster piston rod adjuster

SECTION 5B

FRONT BRAKE

NOTE:
All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.

CONTENTS

GENERAL DESCRIPTION 5B- 2
DIAGNOSIS 5B- 3
CHECK AND ADJUSTMENT 5B- 3
ON-VEHICLE SERVICE 5B- 3
Front Disc Brake Pad 5B- 3
Front Disc Brake Caliper 5B- 6
Front Brake Disc 5B-10
TIGHTENING TORQUE SPECIFICATIONS 5B-11
REQUIRED SERVICE MATERIAL 5B-11

GENERAL DESCRIPTION

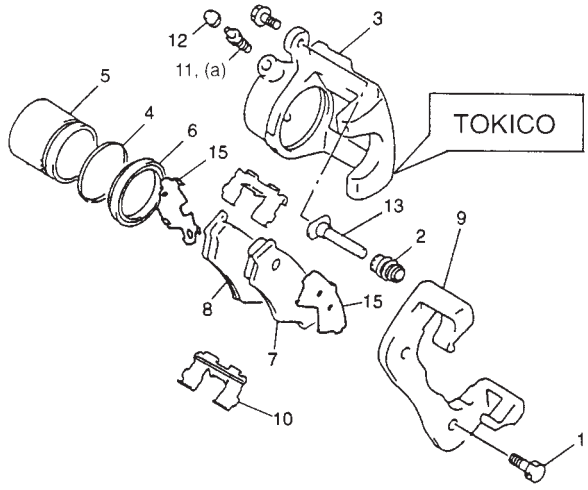
DISC BRAKE CALIPER ASSEMBLY

This caliper is mounted to the brake caliper carrier with two caliper pin bolts. Hydraulic force, created by applying force to the brake pedal, is converted by the caliper to friction. The hydraulic force acts equally against the piston and the bottom of the caliper bore to move the piston outward and to move (slide) the caliper inward, resulting in a clamping action on the disc. This clamping action forces the pads (linings against the disc, creating friction to stop the vehicle.

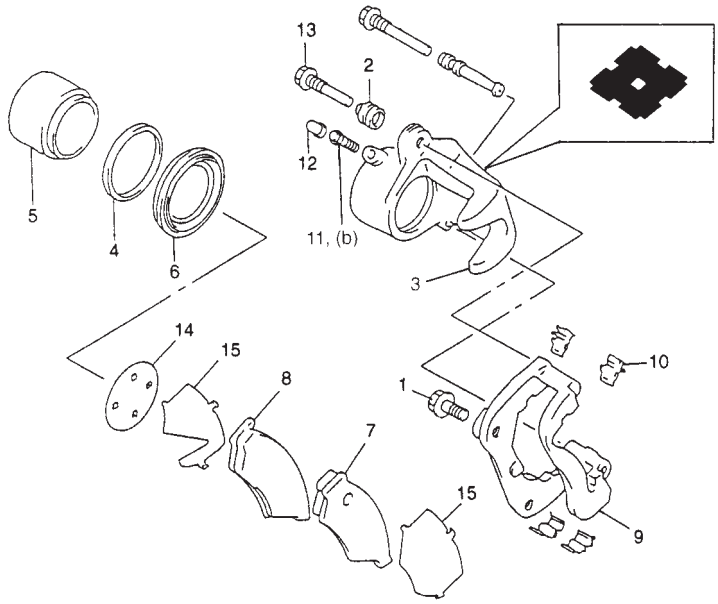
NOTE:

- **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.**
- **For identification of the brake caliper type, see maker name or mark on brake caliper as shown.**

[A]



[B]



1. Caliper pin bolt
2. Boot
3. Disc brake caliper (Disc brake cylinder)
4. Piston seal
5. Disc brake piston
6. Cylinder boot
7. Disc brake inner pad
8. Disc brake outer pad
9. Brake caliper carrier
10. Pad spring
11. Bleeder plug
12. Bleeder plug cap
13. Caliper pin
14. Anti noise shim
15. Inner shim

Tightening torque
(a): 8.5 N·m (0.85 kg-m, 6.5 lb-ft)
(b): 8.0 N·m (0.80 kg-m, 6.0 lb-ft)

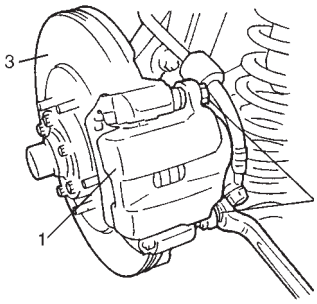
[A]: TOKICO produced
[B]: SUMITOMO ELECTRIC produced

DIAGNOSIS

Refer to Section 5 (BRAKES).

CHECK AND ADJUSTMENT

Refer to Section 5 (BRAKES).



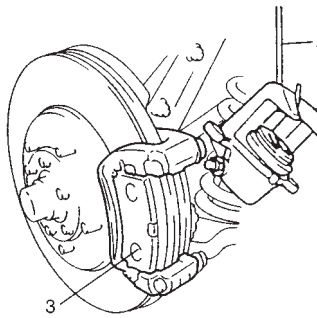
1. Caliper
2. Caliper pin bolts
3. Disc

ON-VEHICLE SERVICE

FRONT DISC BRAKE PAD

REMOVAL

1) Hoist vehicle and remove wheel.
2) Remove caliper pin bolts.

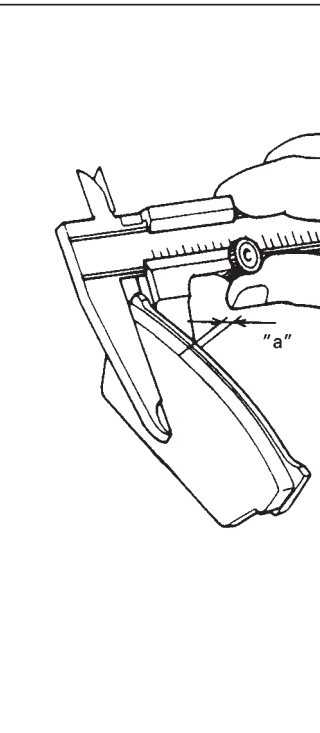


1. Caliper
2. Wire hook
3. Pad

3) Remove E-ring from strut and then remove caliper from caliper 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 pads removed.

4) Remove pads.



INSPECTION

Brake Pad

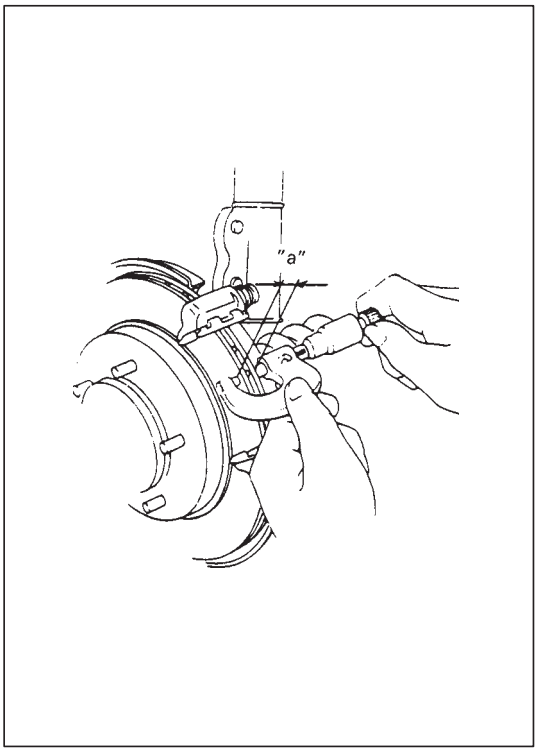
Check pad lining for wear. When wear exceeds limit, replace with new one.

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 + rim) "a"

Standard:	**15.0 mm (0.590 in.) . . .**	**For SUMITOMO ELECTRIC brake calliper**
	15.5 mm (0.610 in.) . . .	**For TOKICO brake caliper**
Service limit:	**7.0 mm (0.275 in.) . .**	**For SUMITOMO ELECTRIC brake caliper**
	7.5 mm (0.295 in.) . .	**For TOKICO brake caliper**

NOTE:
When pads are removed, visually inspect caliper for brake fluid leak. Correct leaky point, if any.

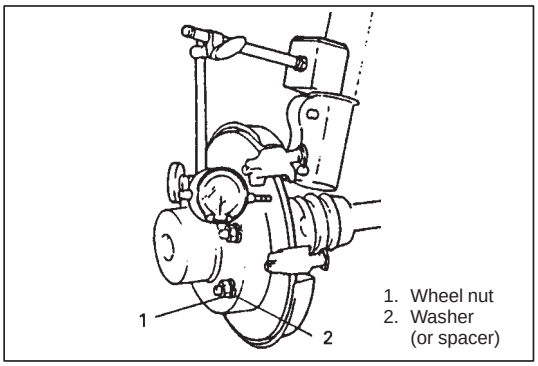


Brake Disc

Before this inspection, brake pads must be removed.
Check disc surface for scratches in wearing parts. Scratches on disc surface noticed at the time of specified inspection or replacement are normal and disc is not defective unless they are serious. But when there are deep scratches or scratches all over disc surface, replace it. When only one side is scratched, polish and correct that side.

Disc thickness "a"

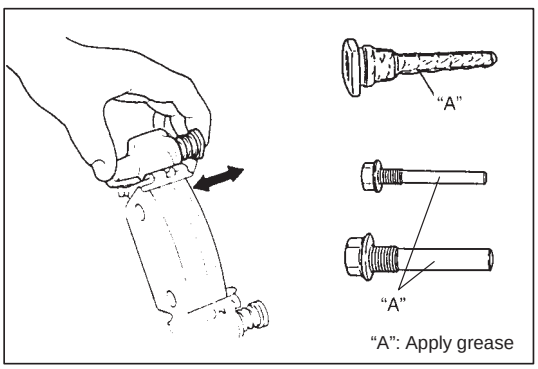
Standard:	**22 mm (0.866 in.) . . . . .**	**For SUMITOMO ELECTRIC brake caliper**
	17 mm (0.670 in.)	**For TOKICO brake caliper**
Service limit:	**20 mm (0.787 in.) . .**	**For SUMITOMO ELECTRIC brake caliper**
	15 mm (0.590 in.) . .	**For TOKICO brake caliper**



Use wheel nuts and suitable plain washers to hold the disc securely against the hub, then mount a dial indicator as shown and measure the runout at 25 mm (0.98 in.) from the outer edge of the disc.

Limit on disc deflection: 0.15 mm (0.006 in.)

NOTE:
Check front wheel bearing for looseness before measurement.

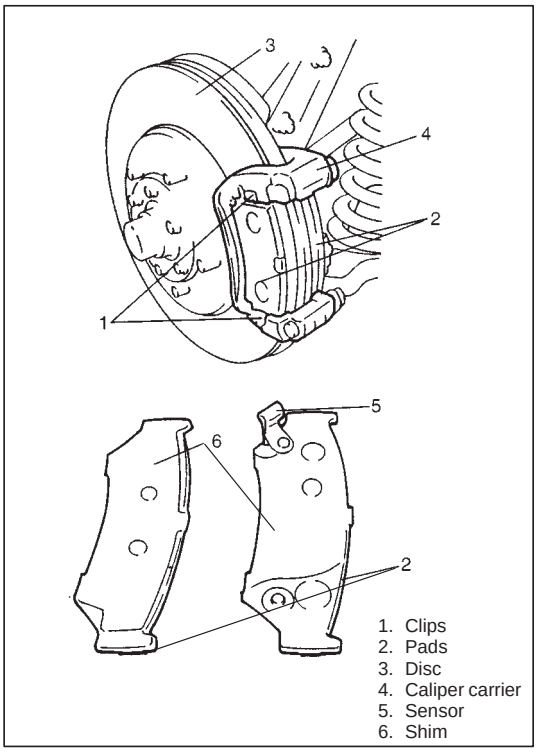


Cylinder Slide Guide Pin/Pin Bolt

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 on whose viscosity is less affected by such low temperature a –40°C (–40°F).

Dust Boot

Check boot for breakage, crack and damage. If defective, replace.



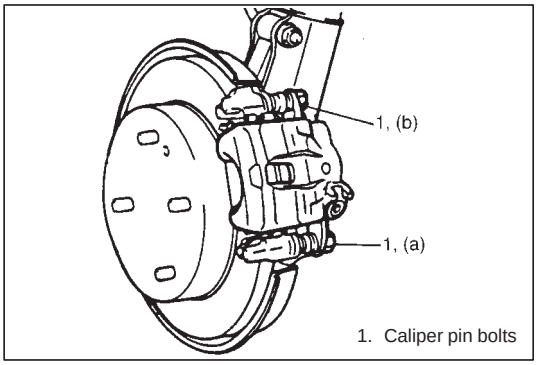
1. Clips
2. Pads
3. Disc
4. Caliper carrier
5. Sensor
6. Shim

INSTALLATION

NOTE:
See NOTE at the beginning of this section.

1) Install pad clips and pads.

NOTE:
Install pad with sensor to body center side of caliper.



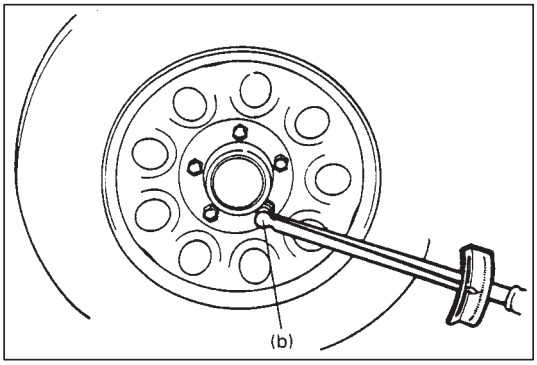
1. Caliper pin bolts

2) Install caliper and torque caliper pin bolts to specification.

Tightening Torque

(a), (b): 27 N·m (2.7 kg-m, 20.0 lb-ft) . .	**For TOKICO brake caliper**
(a): 50 N·m (5.0 kg-m, 36.5 lb-ft)	**For SUMITOMO ELECTRIC brake caliper**
(b): 85 N·m (8.5 kg-m, 61.5 lb-ft)	

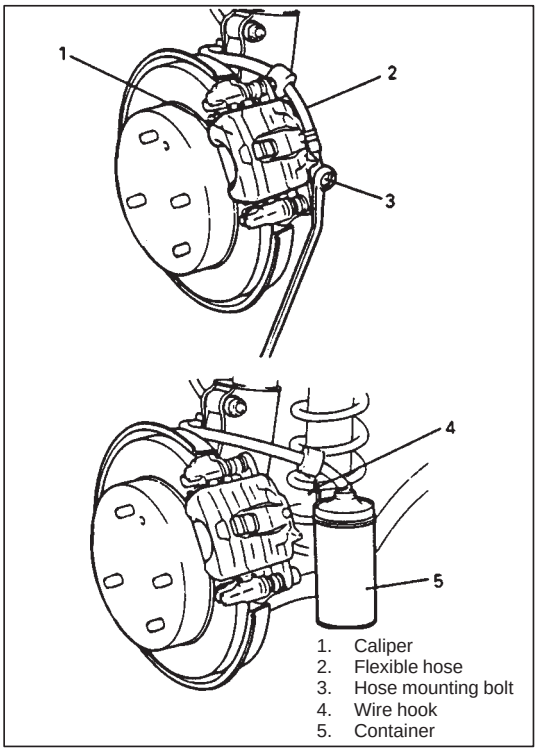
NOTE:
Make sure that boots are fit into groove securely.



3) Torque front wheel nuts to specification.

Tightening Torque
(b): 100 N·m (10.0 kg-m, 72.5 lb-ft)

4) Upon completion of installation, perform brake test.

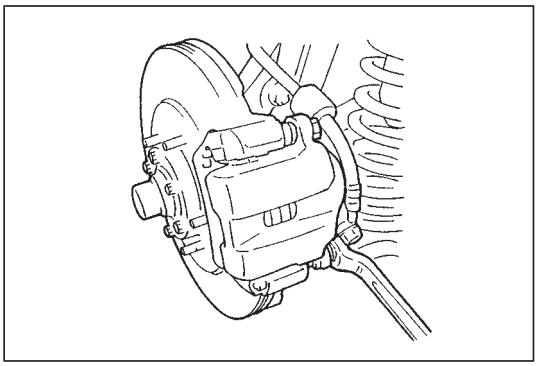


1. Caliper
2. Flexible hose
3. Hose mounting bolt
4. Wire hook
5. Container

FRONT DISC BRAKE CALIPER

REMOVAL

1) Hoist vehicle and remove wheel.
2) Remove brake flexible hose mounting bolt from caliper. As this will allow fluid to flow out of hose, have a container ready beforehand.



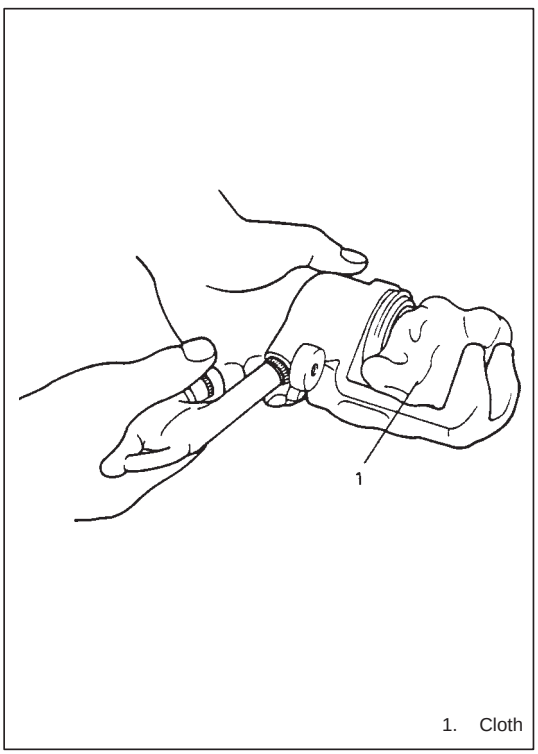
3) Remove caliper pin bolts.
4) Remove caliper.

DISASSEMBLY

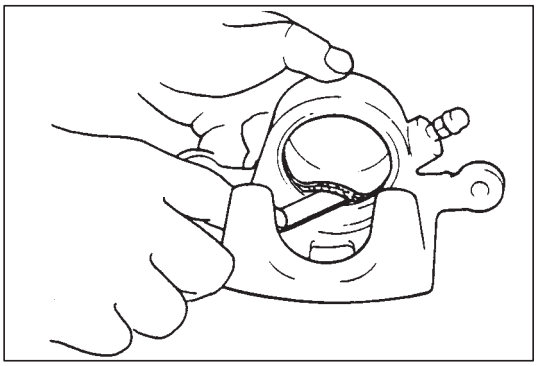
Before disassembly, clean all around caliper with brake fluid.

1) Remove anti noise shim (if equipped) and 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.

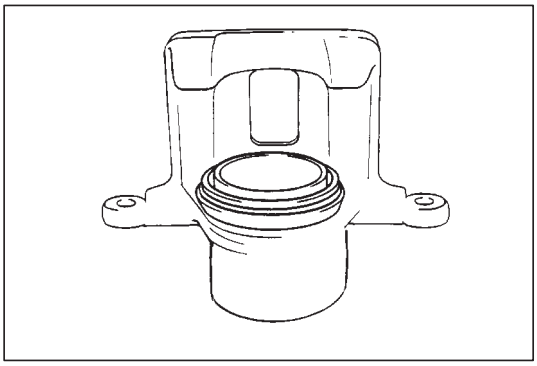


1. Cloth



2) Remove piston seal using a thin blade like a thickness gauge, etc.

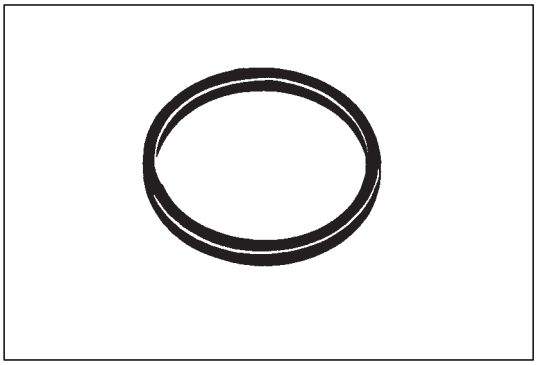
CAUTION:
Be careful not to damage inside (bore side) of cylinder.



INSPECTION

Cylinder Boot

Check boots for breakage, crack and damage. If defective, replace.



Piston Seal

Excessive or uneven wear of pad lining may indicate unsmooth return of the piston. In such a case, replace rubber seal.

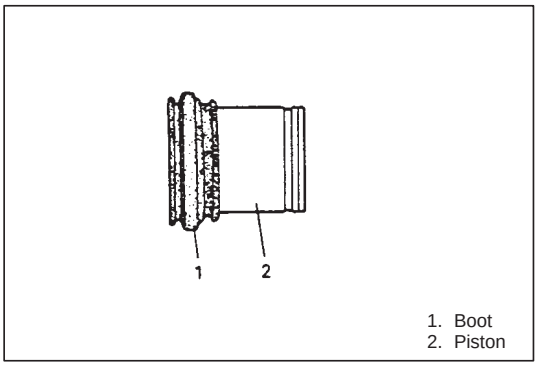
ASSEMBLY

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

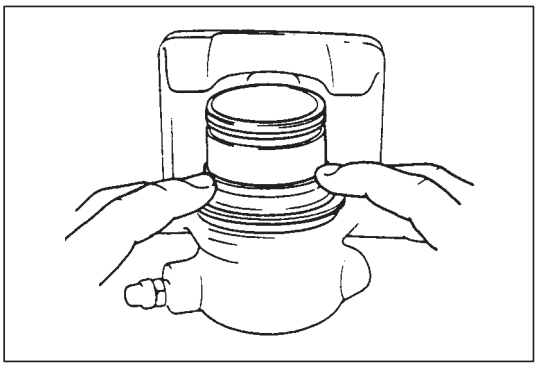
Piston seal is used to seal piston and cylinder and to adjust clearance between pad and disc. Replace with a new one at every overhaul. Fit piston seal into groove in cylinder taking care not to twist it.



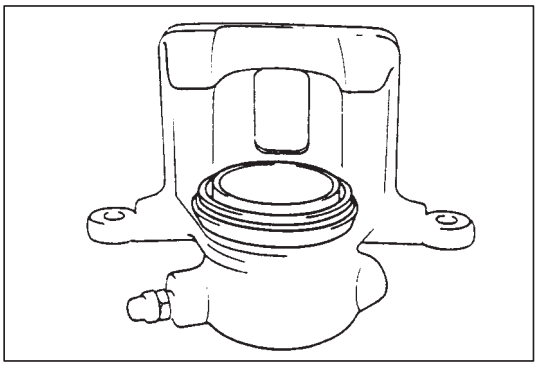
1. Boot
2. Piston

Piston and Boot

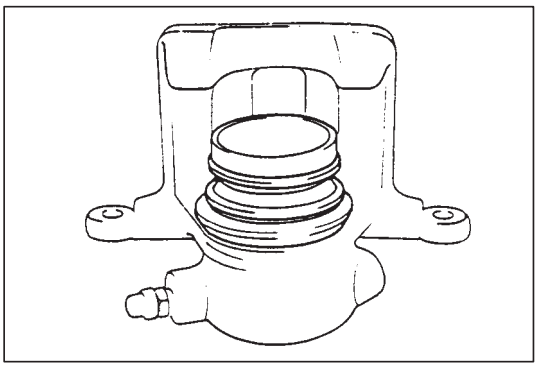
1) Before inserting piston into cylinder, install boot onto piston as shown.



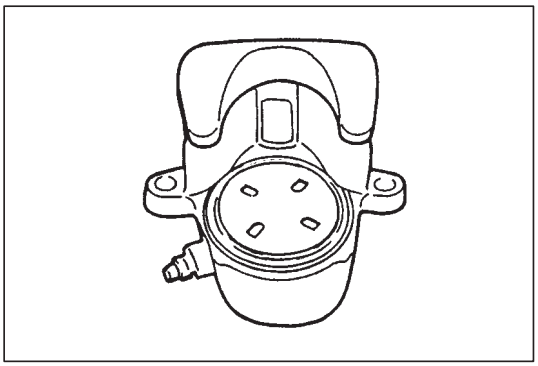
2) Fit boot as it is in above figure into boot groove in cylinder with fingers.
   Check to make sure that boot is fitted into boot groove in cylinder completely in its circumference.



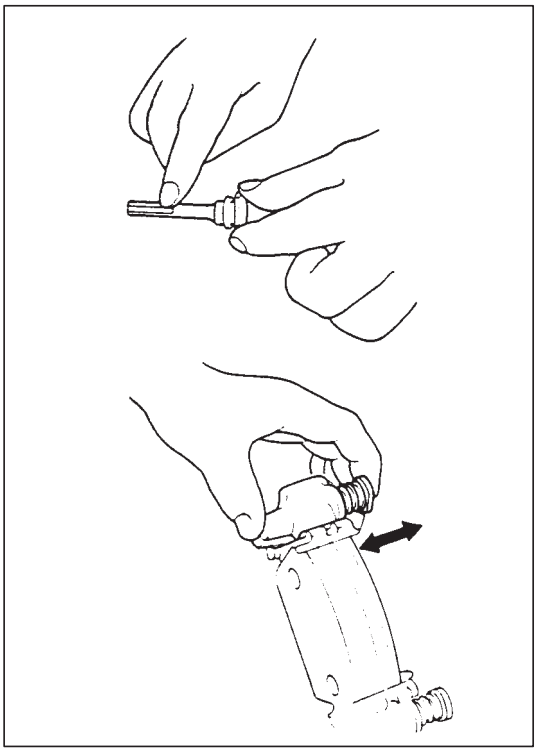
3) Insert piston into cylinder by hand and fit boot in boot groove in piston.



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.



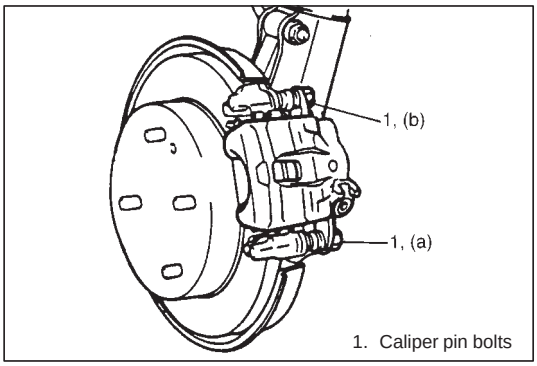
5) Insert piston into cylinder by hand.
6) Install anti noise shim, if equipped.



Caliper

Before installing caliper (cylinder body) to carrier, check to ensure that guide pin (pin bolt) inserted in each caliper carrier hole can be moved smoothly in thrust direction.

NOTE:
Where temperature gets as low as –30°C in cold weather, use rubber grease whose viscosity varies very little even at –40°C (–40°F).



1. Caliper pin bolts

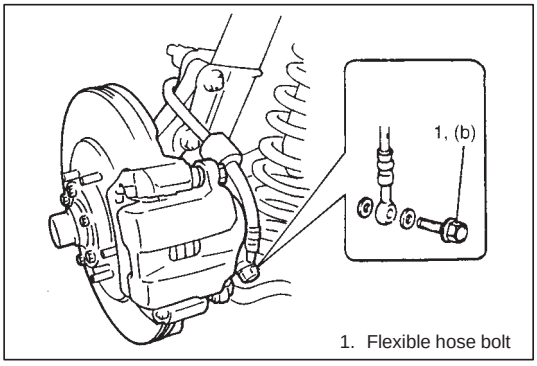
INSTALLATION

1) Install caliper to caliper carrier.
2) Torque caliper pin bolts to specifications.

Tightening Torque

(a), (b): 27 N·m (2.7 kg-m, 20.0 lb-ft) . .	**For TOKICO brake caliper**
(a): 50 N·m (5.0 kg-m, 36.5 lb-ft)	**For SUMITOMO ELECTRIC brake caliper**
(b): 85 N·m (8.5 kg-m, 61.5 lb-ft) . . .	

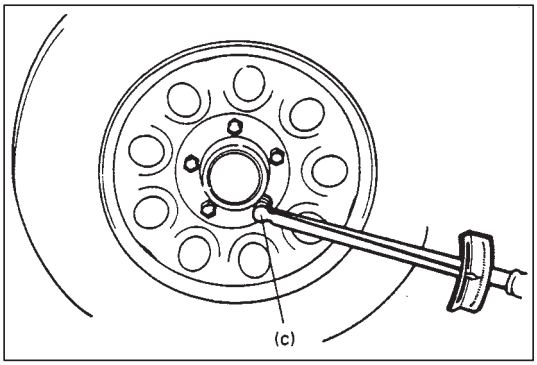
NOTE:
Make sure that boots are fit into groove securely.



1. Flexible hose bolt

3) Install brake flexible hose as shown and torque hose mounting bolt to specification.

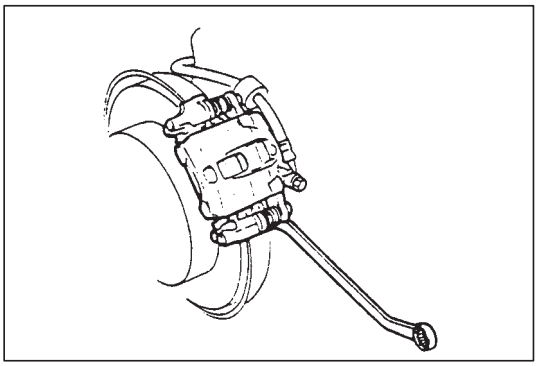
Tightening Torque
(b): 23 N·m (2.3 kg-m, 17.0 lb-ft)



4) Torque wheel nuts to specification.

Tightening Torque
(c): 100 N·m (10.0 kg-m, 72.5 lb-ft)

5) After completing installation, fill reservoir with brake fluid and bleed brake system. Perform brake test and check each installed part for oil leakage.

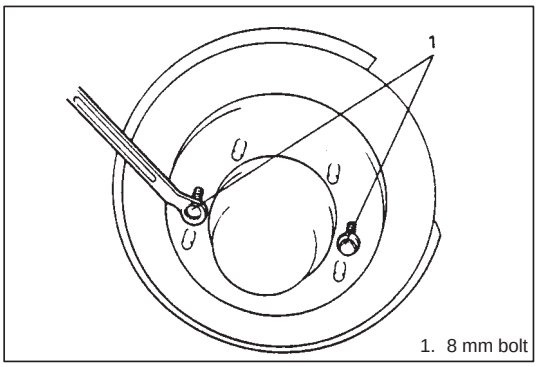


FRONT BRAKE DISC

REMOVAL

1) Hoist vehicle and remove wheel.
2) Remove caliper assembly by loosening carrier bolts (2 pcs.).

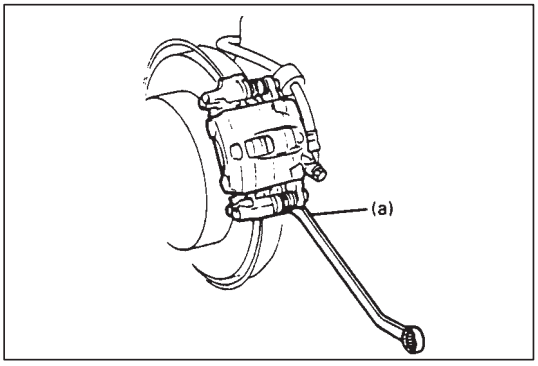
CAUTION:
During removal, be careful not to damage brake flexible hose and not to depress brake pedal.



3) Remove disc by using 8 mm bolts (2 pcs.).

INSPECTION

Refer to FRONT DISC BRAKE PAD INSPECTION.

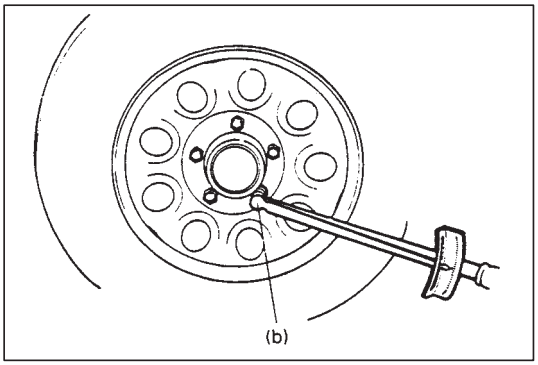


INSTALLATION

NOTE:
See NOTE at the beginning of this section.

1) Install disc to wheel hub.
2) Install caliper assembly to steering knuckle.
3) Torque caliper carrier bolts to specification.

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



4) Torque front wheel nuts to specifications.

Tightening Torque
(b): 100 N·m (10.0 kg-m, 72.5 lb-ft)

5) Upon completion of installation, perform brake test.

TIGHTENING TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Brake caliper bleeder plug (For SUMITOMO ELECTRIC brake caliper)	8.0	0.80	6.0
Brake caliper bleeder plug (For TOKICO brake caliper)	8.5	0.85	6.5
Caliper pin bolt (For TOKICO brake caliper)	27	2.7	20.0
Caliper pin bolt (M10) (For SUMITOMO ELECTRIC brake caliper)	50	5.0	36.5
Caliper pin bolt (M12) (For SUMITOMO ELECTRIC brake caliper)	85	8.5	61.5
Flexible hose bolt	23	2.3	17.0
Brake carrier bolt	85	8.5	61.5
Wheel nut	100	10.0	72.5

REQUIRED SERVICE MATERIAL

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Brake fluid	Indicated on reservoir cap or described in owner's manual of vehicle	● To fill master cylinder reservoir. ● To clean and apply to inner parts of master cylinder caliper and wheel cylinder when they are disassembled.

SECTION 5C

PARKING AND REAR BRAKE

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

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "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:
All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.

CONTENTS

GENERAL DESCRIPTION 5C- 2
Drum Brake Assembly 5C- 2
DIAGNOSIS 5C- 3
CHECK AND ADJUSTMENT 5C- 3
ON-VEHICLE SERVICE 5C- 3
Parking Brake Lever 5C- 3
Parking Brake Cable 5C- 5
Brake Drum 5C- 7
Brake Shoe 5C- 9
Wheel Cylinder 5C-12
Brake Back Plate 5C-14
TIGHTENING TORQUE SPECIFICATIONS 5C-17
REQUIRED SERVICE MATERIALS 5C-17
SPECIAL TOOLS 5C-17

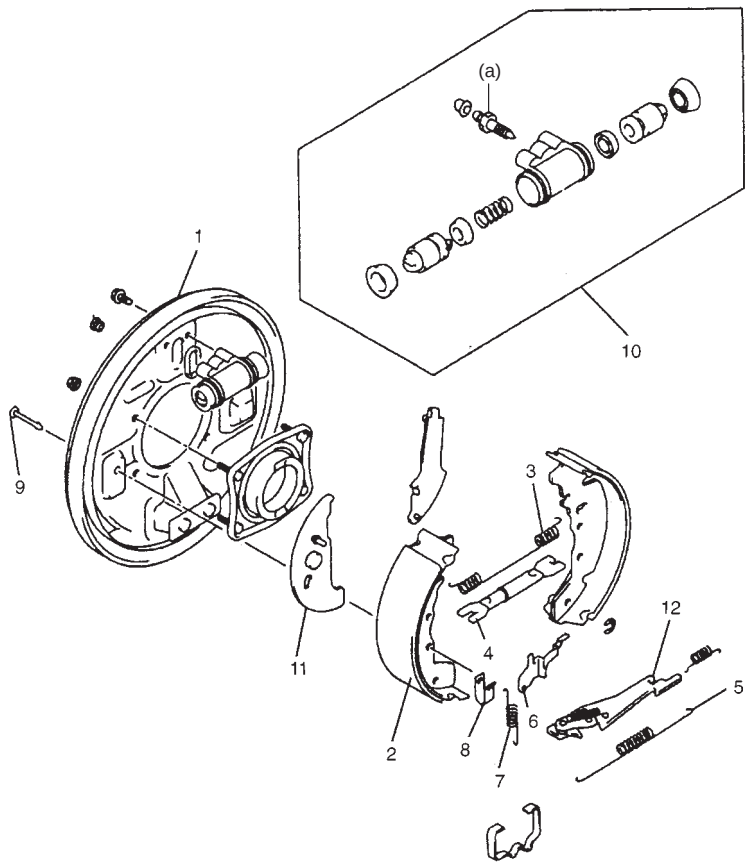
GENERAL DESCRIPTION

DRUM BRAKE ASSEMBLY

The drum brake assembly has a self shoe clearance adjusting system so that drum-to-shoe clearance is maintained appropriate at all times. Rear brake is a drum type. It uses leading trailing operation when brake pedal is depressed and when parking brake is applied on level road.
It also uses duo servo operation when parking brake is applied on gradient road and load is applied in longitudinal direction of vehicle.

NOTE:
Replace all components included in repair kits to service this drum brake. Lubricate parts as specified.

WARNING:
If any hydraulic component is removed or brake line disconnected, bleed the brake system. The torque values specified are for dry, unlubricated fasteners.



1. Brake back plate
2. Brake shoe
3. Shoe return upper spring
4. Adjuster
5. Shoe return lower spring
6. Adjuster lever
7. Adjuster spring
8. Shoe hold down spring
9. Shoe hold down pin
10. Wheel cylinder
11. Link
12. Brake strut

Tightening torque
(a): 7.5 N·m (0.75 kg-m, 5.5 lb-ft)

DIAGNOSIS

Refer to Section 5 (BRAKES).

CHECK AND ADJUSTMENT

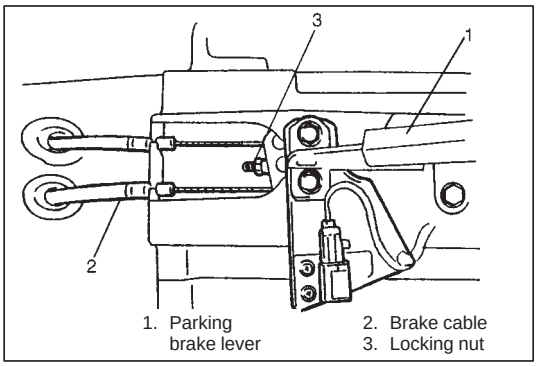
Refer to Section 5 (BRAKES).

ON-VEHICLE SERVICE

PARKING BRAKE LEVER

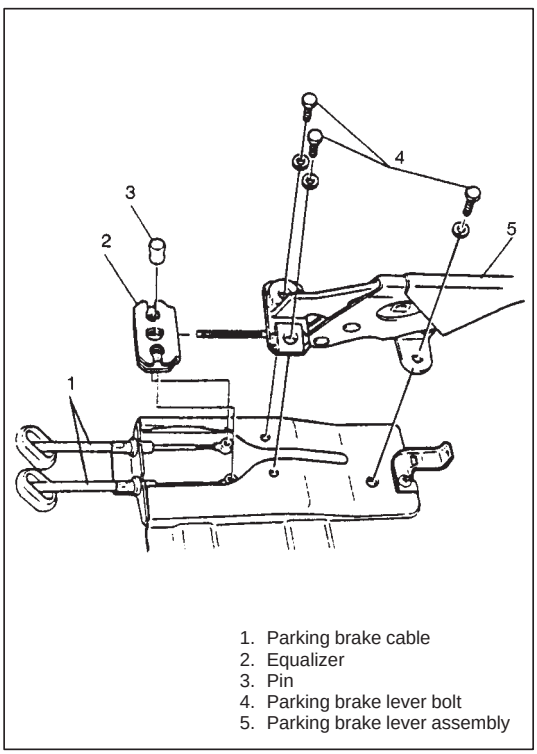
REMOVAL

1) Disconnect negative (–) cable at battery.
2) Block vehicle wheels and release parking brake lever.
3) Remove rear center console box.
4) Disconnect lead wire of parking brake switch at coupler.



1. Parking brake lever
2. Brake cable
3. Locking nut

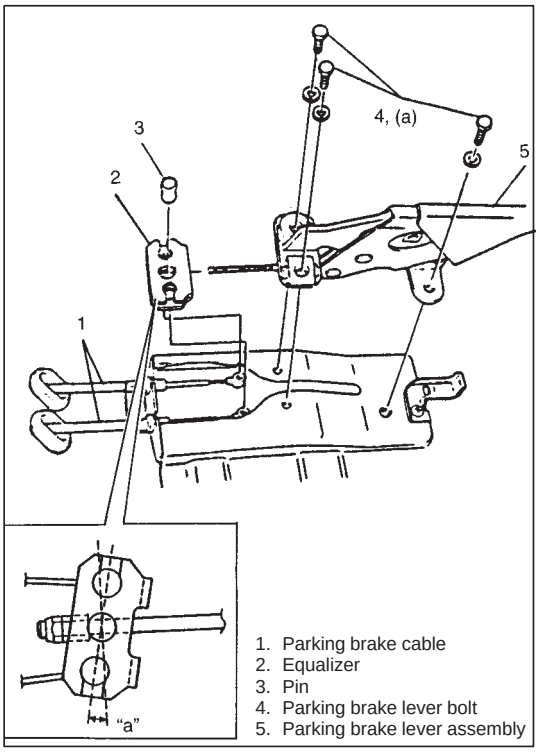
5) Remove parking brake cable locking nut.



1. Parking brake cable
2. Equalizer
3. Pin
4. Parking brake lever bolt
5. Parking brake lever assembly

6) Remove parking brake lever bolts and then remove parking brake lever assembly from equalizer.
7) Remove equalizer from parking brake cable.

NOTE:
Don't disassemble parking brake lever switch. It must be removed and installed as a complete switch assembly.



1. Parking brake cable
2. Equalizer
3. Pin
4. Parking brake lever bolt
5. Parking brake lever assembly

INSTALLATION

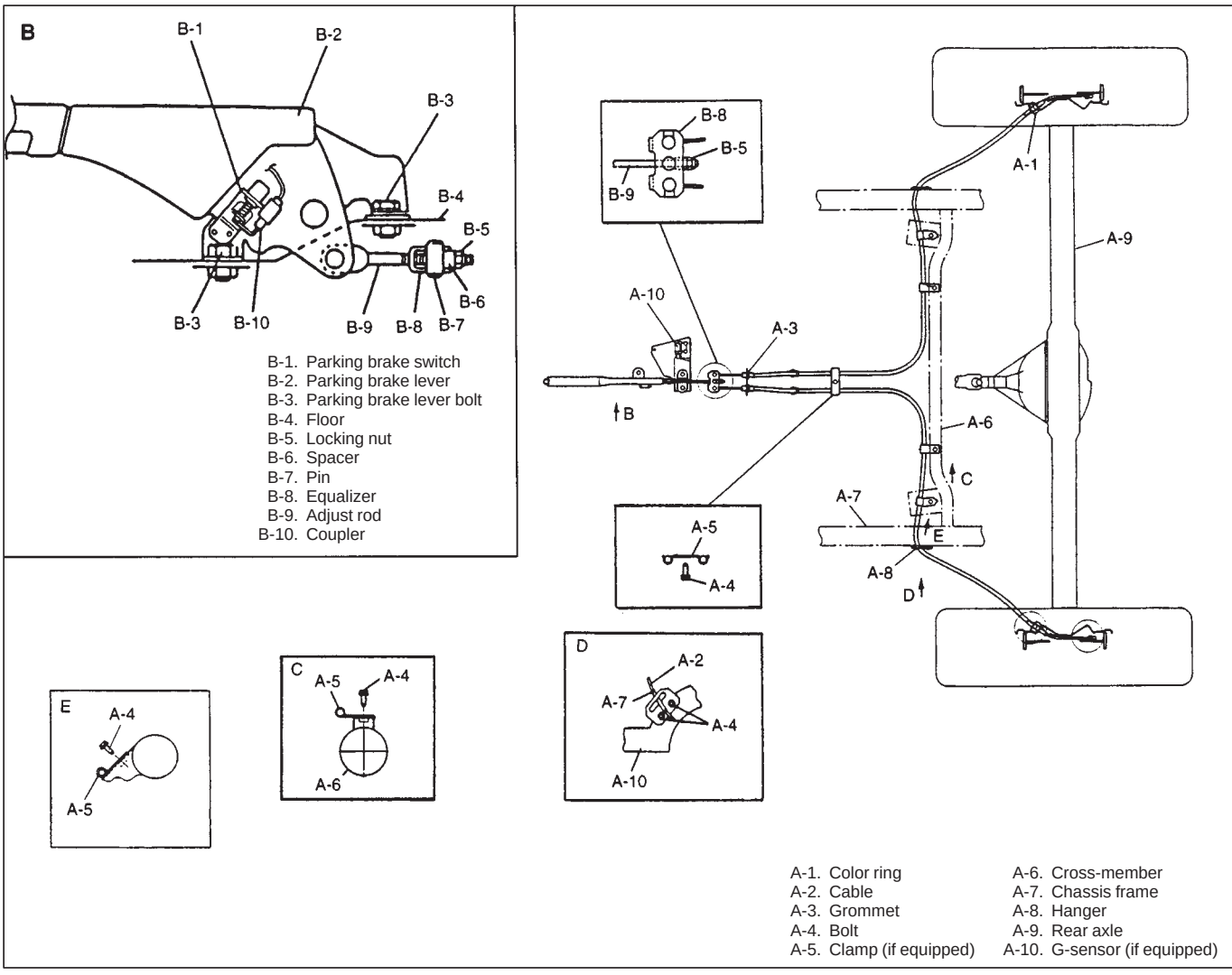
1) Install in reverse order of REMOVAL procedure.
   Check equalizer inclined angle.

   Angle "a": within 15 degrees

   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

2) After all parts are installed, parking brake lever needs to be adjusted. Refer to PARKING BRAKE INSPECTION AND ADJUSTMENT in Section 5.
3) Check brake drum for dragging and brake system for proper performance.

PARKING BRAKE CABLE



REMOVAL

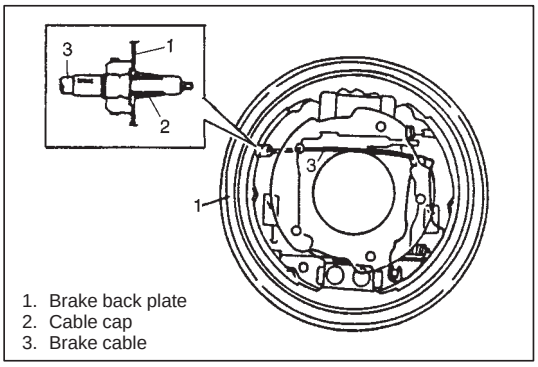
1) Remove brake drum. (Refer to steps 1) to 5) of BRAKE DRUM REMOVAL of this section.)
2) Check the color of ring or tape for reinstallation.

   NOTE:
   Color ring on brake cable is for the purpose of identification.

3) Disconnect parking brake cable from brake shoe lever. (Refer to steps 2) to 5) of BRAKE SHOE REMOVAL of this section.)
4) Disconnect brake cable from brake back plate. (Refer to step 4) of BRAKE BACK PLATE REMOVAL.)

   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.

5) Remove cable from parking brake lever. (Refer to steps 1) to 5) of PARKING BRAKE LEVER REMOVAL of this section.)



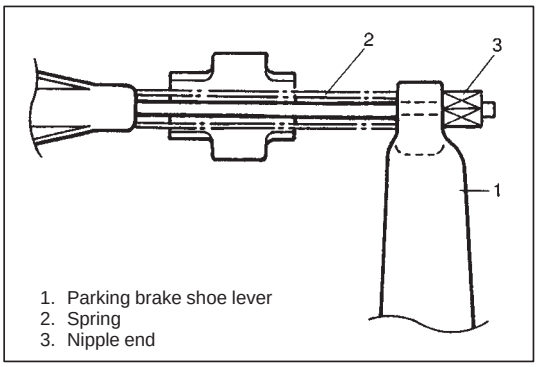
1. Brake back plate
2. Cable cap
3. Brake cable

INSTALLATION

Install parts in reverse order of removal procedure, noting the following.

1) Install brake cable cap to brake back plate securely as shown in figure.

NOTE:
Color ring or tape on brake cable is for the purpose of identification. Use cable with the same colored ring as before removal.



1. Parking brake shoe lever
2. Spring
3. Nipple end

2) Install brake cable spring and nipple end to parking brake shoe lever securely as shown in figure.

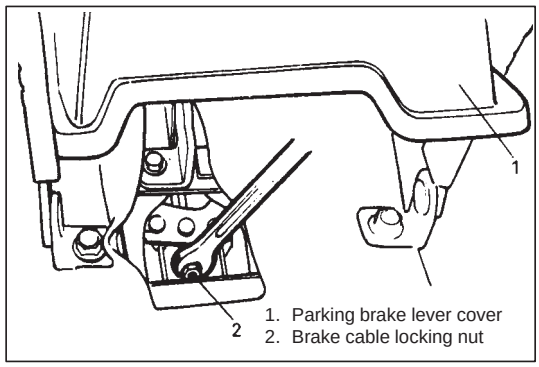
3) For brake shoe installation, refer to steps 1) and 4) of BRAKE SHOE INSTALLATION of this section.
4) For brake drum installation, refer to steps 1) and 3) of BRAKE DRUM INSTALLATION of this section.
5) For proper routing and secure clamping of parking brake cable.
6) For installation of cable to parking brake lever, refer to PARKING BRAKE LEVER INSTALLATION of this section.

7) Upon completion of installation, adjust cable. (Refer to PARKING BRAKE CHECK AND ADJUSTMENT in Section 5.) Then check brake drum for dragging and brake system for proper performance. After removing vehicle from hoist, brake test should be performed.

BRAKE DRUM

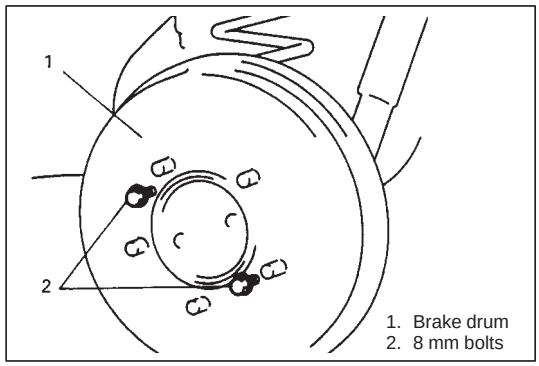
REMOVAL

1) Hoist vehicle and pull up parking brake lever.
2) Remove wheel.



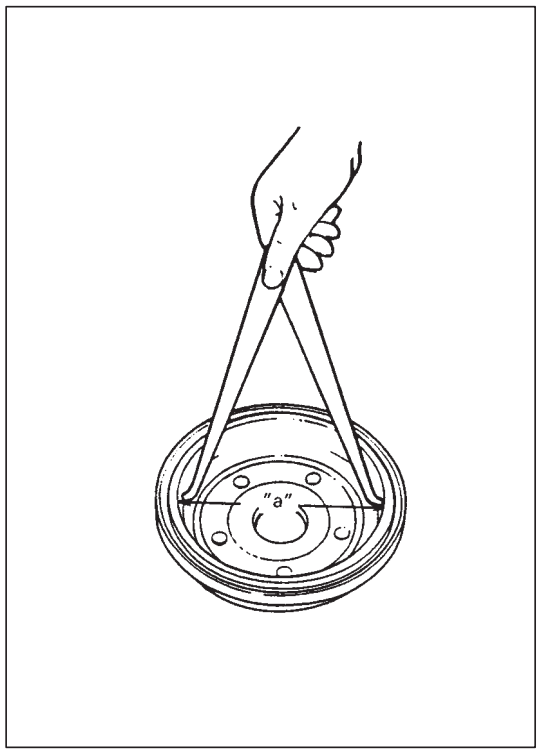
1. Parking brake lever cover
2. Brake cable locking nut

3) Release parking brake lever.
4) Remove rear center console box screws and with rear part of rear center console box lifted a little, loosen parking brake cable locking nut.



1. Brake drum
2. 8 mm bolts

5) Remove brake drum by using 8 mm bolts (2 pcs.).



INSPECTION

Brake Drum

Inspect drum for cleanliness. Check wear of its braking surface by measuring its inside diameter.

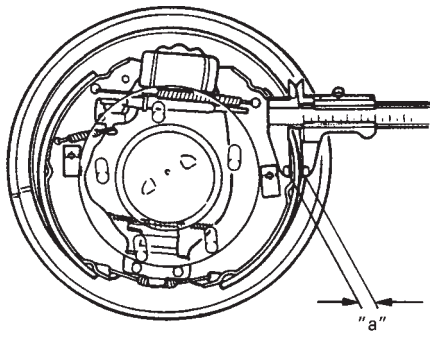
Inside diameter "a"
Standard: 220 mm (8.66 in.)
Service Limit: 222 mm (8.74 in.)

Whenever brake drums are removed, they should be thoroughly cleaned and inspected for cracks, scores, deep grooves.

Cracked, Scored, or Grooved Drum

A cracked, drum is unsafe for further service and must be replaced. Do not attempt to weld a cracked drum.
Smooth up any slight scores. Heavy or extensive scoring will cause excessive brake lining wear and it will probably be necessary to re-surface drum braking surface.
If brake linings are slightly worn and drum is grooved, drum should be polished with fine emery cloth but should no be turned.

NOTE:
When drum is removed, visually inspect wheel cylinder for brake fluid leakage. Correct leaky point, if any.



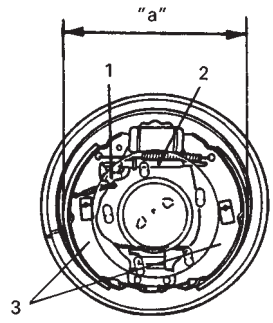
Brake Shoe

Where lining is worn out beyond service limit, replace shoe.

Thickness "a"
Standard: 6.5 mm (0.24 in.)
Service limit: 3.0 mm (0.12 in.)

If one of brake linings is to service limit, all linings must be replaced at the same time.

CAUTION:
Never polish lining with sandpaper. If lining is polished with sandpaper, hard particles of sandpaper will be deposited in lining and may damage drum. When it is required to correct lining, replace it with a new one.



1. Pawl lever
2. Adjuster
3. Brake shoes

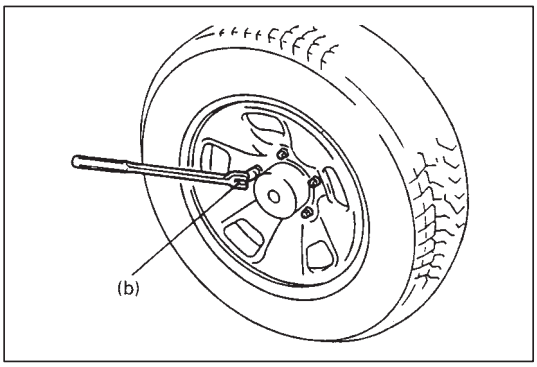
INSTALLATION

NOTE:
See NOTE at the beginning of the section.

1) Before installing brake drum, check outer diameter of brake shoes. If it is not within value as specified below, adjust it to specification by turning adjuster.

   Outer diameter of brake shoes
   "a": 219.4 – 219.7 mm (8.638 – 8.650 in.)

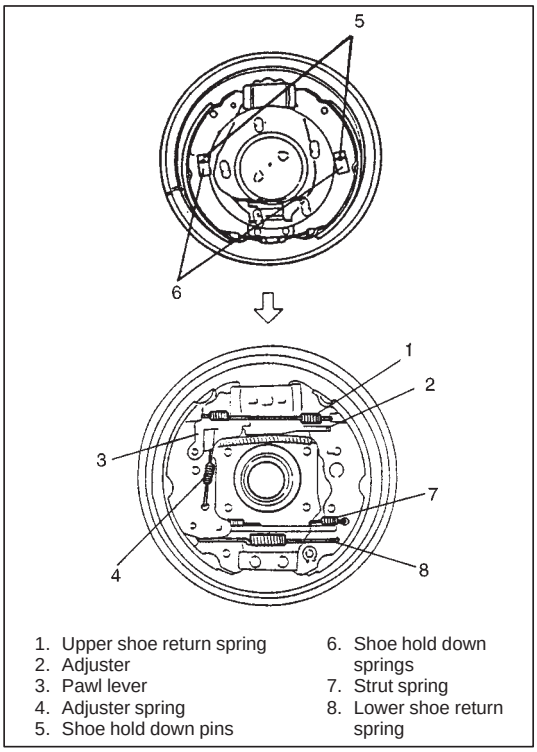
2) Install brake drum after making sure that inside of brake drum and brake shoes are free from dirt and oil.
3) Upon completion of all jobs, depress brake pedal with about 30 kg (66 lbs) load three to ten times so as to obtain proper drum-to-shoe clearance.
   Adjust parking brake cable. (For adjustment, refer to PARKING BRAKE CHECK AND ADJUSTMENT in Section 5.)
4) Tighten rear center console box screws.



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

   Tightening Torque
   (b): 100 N·m (10.0 kg-m, 72.5 lb-ft)

6) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then remove vehicle from hoist and perform brake test (foot brake and parking brake).



1. Upper shoe return spring
2. Adjuster
3. Pawl lever
4. Adjuster spring
5. Shoe hold down pins
6. Shoe hold down springs
7. Strut spring
8. Lower shoe return spring

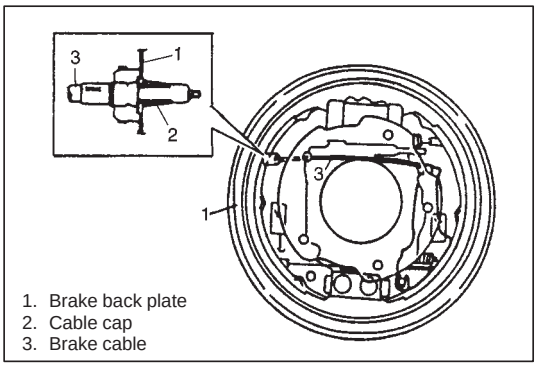
BRAKE SHOE

REMOVAL

1) Perform steps 1) to 5) of BRAKE DRUM REMOVAL.

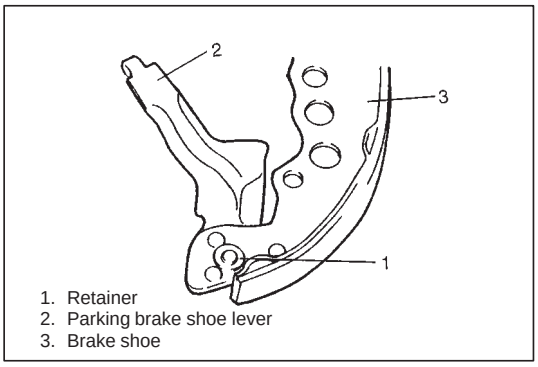
WARNING:
Use special care when installing brake shoe return spring. Failure in its proper installation may allow it to springback and cause personal injury.

2) Remove shoe hold down springs by turning shoe hold down pins.
3) Remove upper return spring, struts, adjuster, adjuster lever and springs.
4) Remove brake shoes and lower shoe return spring.



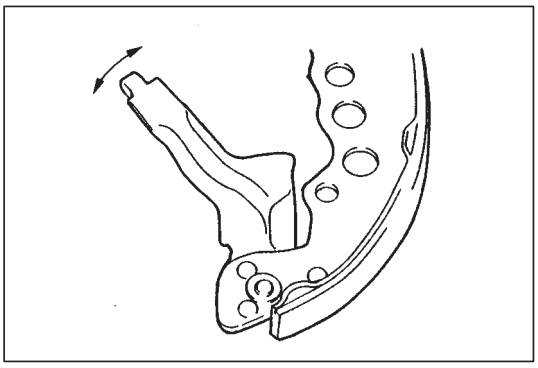
1. Brake back plate
2. Cable cap
3. Brake cable

5) Remove brake shoes and disconnect parking brake cable from parking brake shoe lever.



1. Retainer
2. Parking brake shoe lever
3. Brake shoe

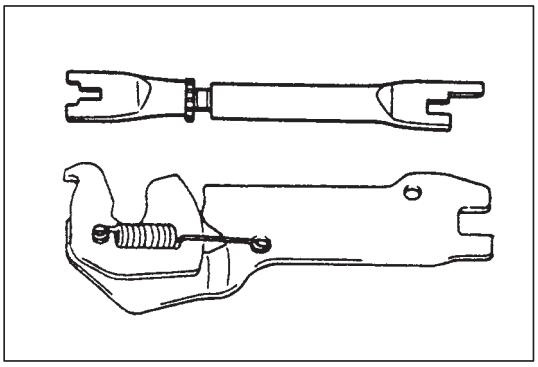
6) Remove parking brake shoe lever from brake shoe.



INSPECTION

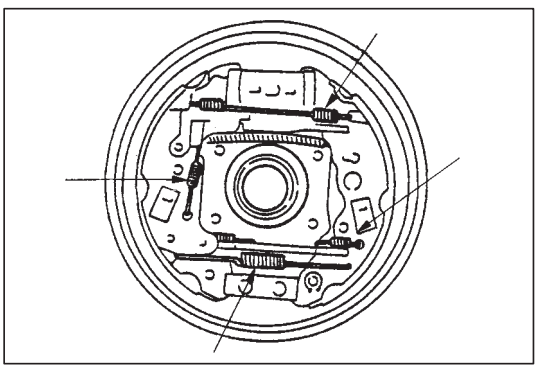
Parking Shoe Lever

Inspect brake shoe lever for free movement against brake shoe web. If defective, correct or replace.



Strut, Adjuster

Check thread or ratchet of strut and adjuster for wear, sticking and corrosion.



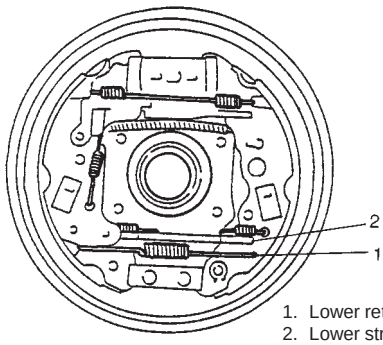
Springs

Inspect for damage or weakening.

Inspect each part with arrow for rust. If found defective, replace.

Brake Shoe

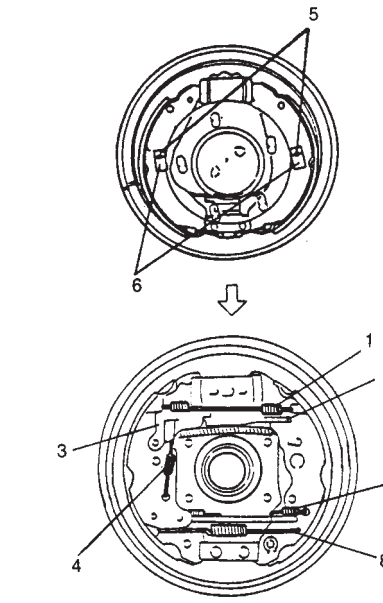
Refer to BRAKE DRUM INSPECTION.



1. Lower return spring
2. Lower strut

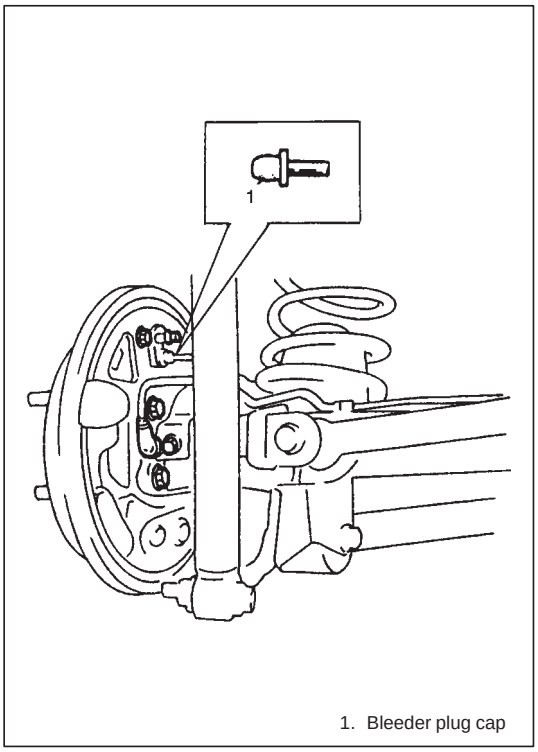
INSTALLATION

1) Assemble parts as shown in reverse order of removal.



1. Upper shoe return spring
2. Adjuster
3. Pawl lever
4. Adjuster spring
5. Shoe hold down pins
6. Shoe hold down springs
7. Strut spring
8. Lower shoe return spring

2) Install shoe hold down springs by pushing them down in place and turning hold down pins.
3) Install adjuster and upper shoe return spring.
4) Install adjuster lever, adjuster spring and strut spring.
5) For procedure hereafter, refer to steps 1) to 6) of BRAKE DRUM INSTALLATION.

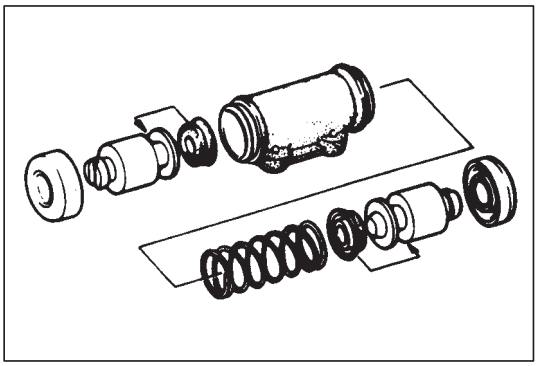


1. Bleeder plug cap

WHEEL CYLINDER

REMOVAL

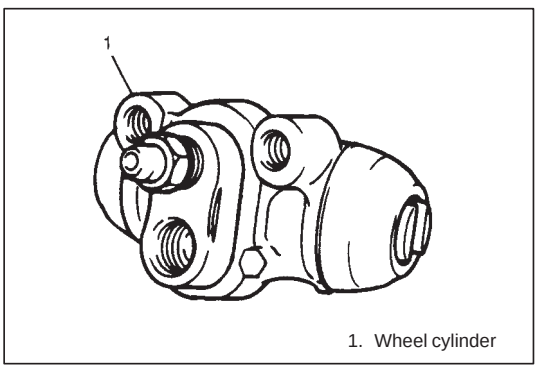
1) Perform steps 1) to 5) of BRAKE DRUM REMOVAL.
2) Perform steps 2) to 4) of BRAKE SHOE REMOVAL.
3) Loosen brake pipe flare nut (or nuts) but only within the extent that fluid does not leak.
4) Remove wheel cylinder mounting bolts. Disconnect brake pipe (or pipes) from wheel cylinder and put wheel cylinder bleeder plug cap onto pipe to prevent fluid from spilling.



INSPECTION

Inspect wheel cylinder disassembled parts for wear, cracks, corrosion or damage.

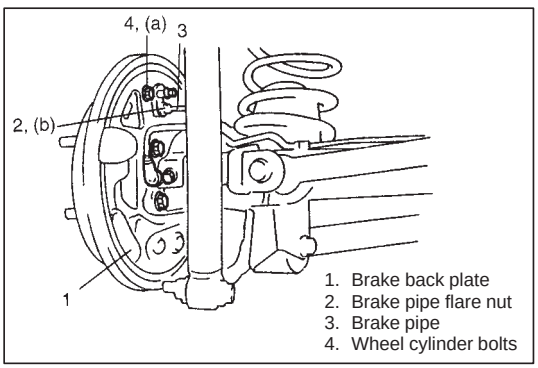
NOTE:
Clean wheel cylinder components with brake fluid.



1. Wheel cylinder

INSTALLATION (For non sealed type)

1) Take off bleeder plug cap from brake pipe and connect pipe (or pipes) to wheel cylinder just enough to prevent fluid from leaking.



1. Brake back plate
2. Brake pipe flare nut
3. Brake pipe
4. Wheel cylinder bolts

2) Tighten wheel cylinder to brake back plate to specified torque.

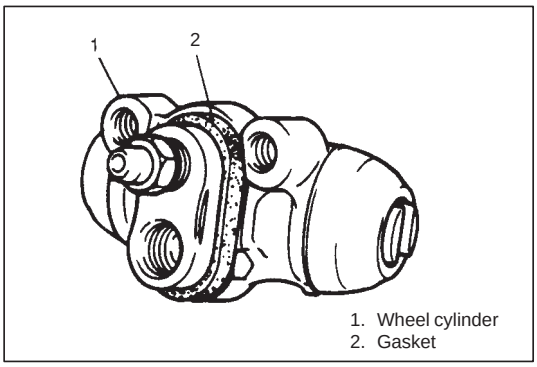
Tightening Torque
(a): 8.5 N·m (0.85 kg-m, 6.5 lb-ft)

3) Torque flare nut (or nuts) of brake pipe which was connected in step 1) to specification.

Tightening Torque
(b): 16 N·m (1.6 kg-m, 12.0 lb-ft)

4) Install bleeder plug cap taken off from pipe back to bleeder plug.
5) For procedure hereafter, refer to steps 1) to 5) of BRAKE SHOE INSTALLATION.

NOTE:
Be sure to bleed brake system. (for bleeding operation, refer to BLEEDING BRAKES in Section 5.)

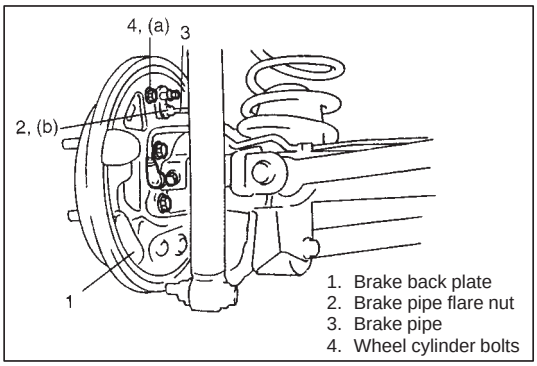


1. Wheel cylinder
2. Gasket

INSTALLATION (For gasket sealed type)

1) Install gasket to joint seam of wheel cylinder and brake back plate. Then take off bleeder plug cap from brake pipe and connect pipe (or pipes) to wheel cylinder just enough to prevent fluid from leaking.

NOTE:
Be sure to check gasket for deterioration or any damage before installation and replace if found defective.



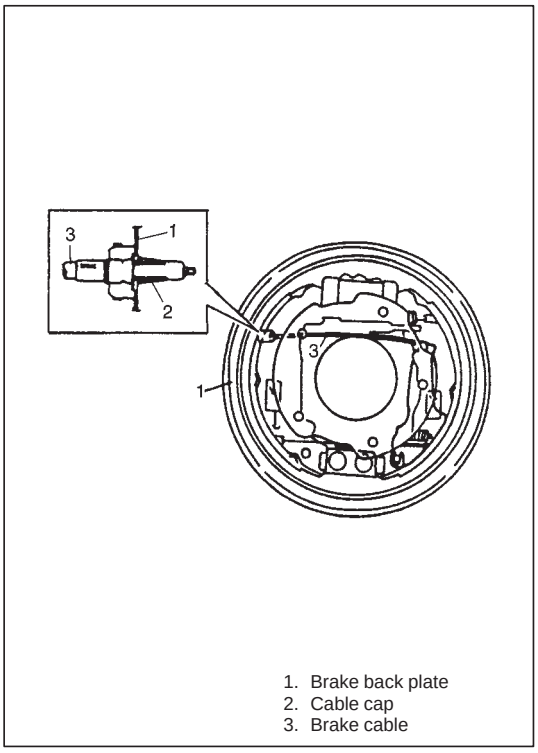
1. Brake back plate
2. Brake pipe flare nut
3. Brake pipe
4. Wheel cylinder bolts

2) Tighten wheel cylinder to brake back plate to specified torque.
3) Torque flare nut (or nuts) of brake pipe which was connected in step 1) to specification.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)
(b): 16 N·m (1.6 kg-m, 12.0 lb-ft)

4) Install bleeder plug cap taken off from pipe back to bleeder plug.
5) For procedure hereafter, refer to BRAKE SHOE INSTALLATION.

NOTE:
Be sure to bleed brake system. Refer to "CHECK AND ADJUSTMENT" in BRAKES section.

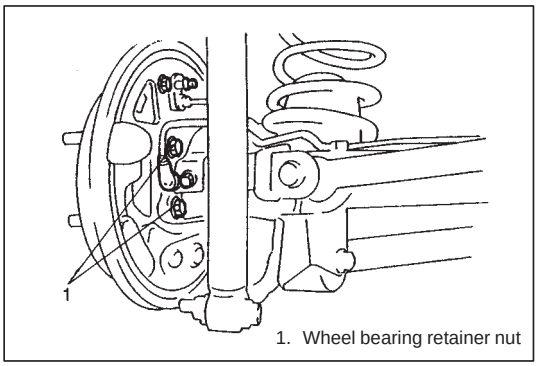


1. Brake back plate
2. Cable cap
3. Brake cable

BRAKE BACK PLATE

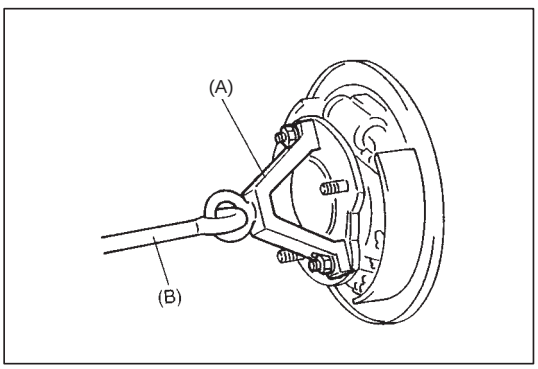
REMOVAL

1) Perform steps 1) to 5) of BRAKE DRUM REMOVAL.
2) Perform steps 2) to 4) of BRAKE SHOE REMOVAL.
3) Perform steps 3) and 4) of WHEEL CYLINDER REMOVAL.
4) Remove cable from brake back plate by squeezing parking brake cable cap.



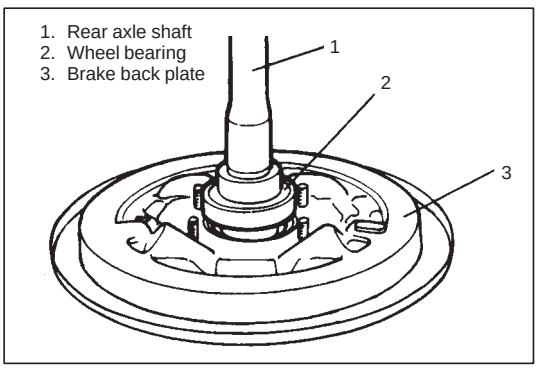
1. Wheel bearing retainer nut

5) Drain rear differential gear oil.
6) Remove wheel bearing retainer nuts from rear axle housing.

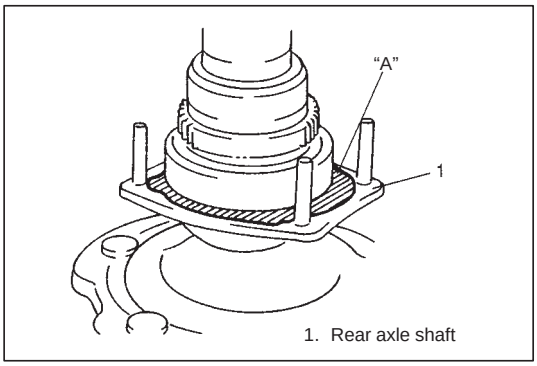


7) Using special tools, draw out rear axle shaft with brake back plate.

Special Tool
(A): 09943-35512
(B): 09942-15510



8) Remove brake back plate from rear axle shaft.

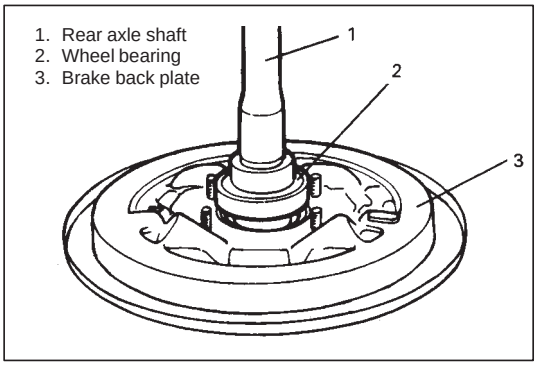


INSTALLATION

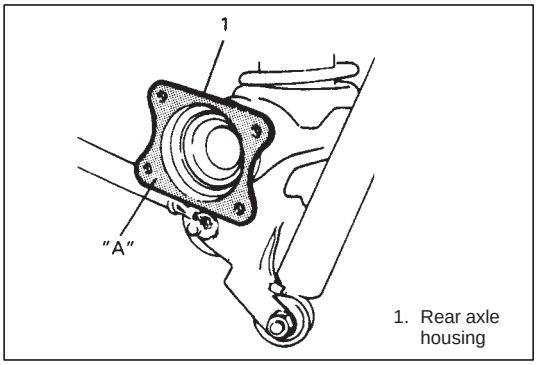
1) Apply sealant to mating surface of bearing retainer with brake back plate.

"A": Sealant 99000-31110

NOTE:
Make sure to remove old sealant before applying it anew.



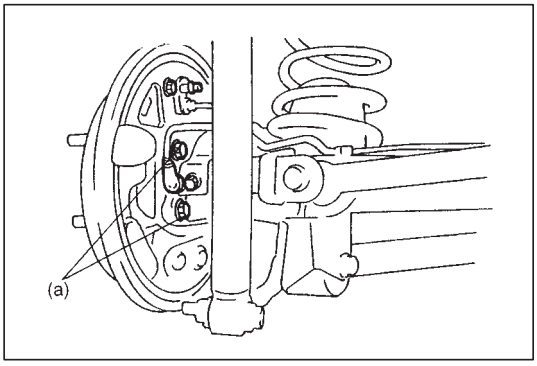
2) Install brake back plate to rear axle shaft.



3) Apply sealant to joint seam of rear axle housing and brake back plate.

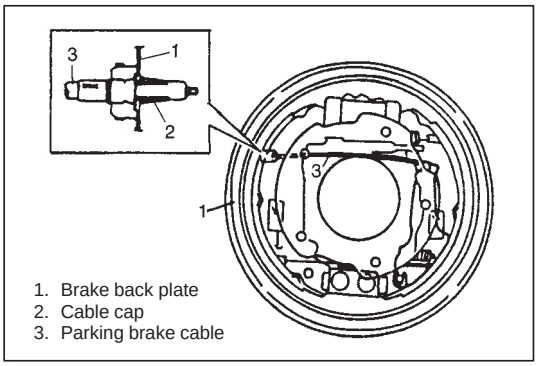
"A": Sealant 99000-31110

NOTE:
Make sure to remove old sealant before applying it anew.



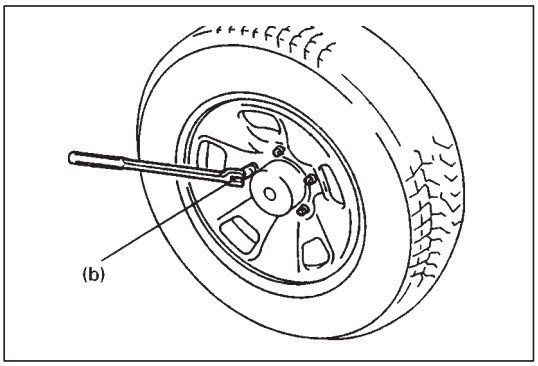
4) Install rear axle shaft to rear axle housing.
5) Tighten brake back plate nuts to specified torque.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



1. Brake back plate
2. Cable cap
3. Parking brake cable

6) Install wheel cylinder, and tighten wheel cylinder bolts and brake pipe flare nut (or nuts) to specified torque. (Refer to steps 1) to 4) of WHEEL CYLINDER INSTALLATION of this section.)
7) Install parking brake cable to brake back plate.
8) Install brake shoes, referring to steps 1) to 4) of BRAKE SHOE INSTALLATION.
9) Install brake drum. Refer to steps 1) to 2) of BRAKE DRUM INSTALLATION in this section.
10) Refill differential housing with new specified gear oil. Refer to “MAINTENANCE SERVICE” in Section 7E for refill.
11) Fill reservoir with brake fluid and bleed brake system. (For bleeding operation, refer to BLEEDING BRAKES in Section 5.)



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

Tightening Torque
(b): 100 N·m (10.0 kg-m, 72.5 lb-ft)

13) Upon completion of all jobs, depress brake pedal with about 30 kg (66 lbs) load three to ten times so as to obtain proper drum-to-shoe clearance.
Adjust parking brake cable. (For adjustment, refer to PARKING BRAKE CHECK AND ADJUSTMENT in Section 5.)
14) Tighten rear center console box screws.
15) Check to ensure that brake drum is free from dragging and proper braking is obtained. Then remove vehicle from hoist and perform brake test (foot brake and parking brake).
16) Check each installed part for oil leakage.

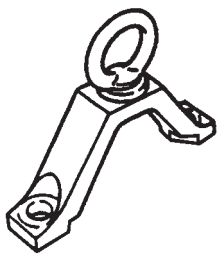
TIGHTENING TORQUE SPECIFICATIONS

Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Wheel cylinder bleeder plug	7.5	0.75	5.5
Parking brake lever bolt	23	2.3	17.0
Wheel cylinder bolt (For non sealed type)	8.5	0.85	6.5
Wheel cylinder bolt (For gasket sealed type)	11	1.1	12.0
Brake pipe flare nut	16	1.6	12.0
Brake back plate nut	23	2.3	17.0
Wheel nut	100	10.0	72.5

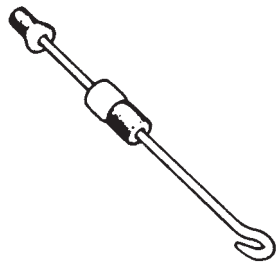
REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Brake fluid	Indicated on reservoir cap or described in owner's manual of vehicle	● To fill master cylinder reservoir. ● To clean and apply to inner parts of master cylinder caliper and wheel cylinder when they are disassembled.
Water tight sealant	SEALING COMPOUND 366E 99000-31090	● To apply to mating surfaces of brake back plate and rear wheel cylinder.
Sealant	SUZUKI BOND NO. 1215 99000-31110	● To apply to mating surfaces of brake back plate and rear axle housing. ● To apply mating surfaces of brake back plate and rear wheel bearing retainer.

SPECIAL TOOLS



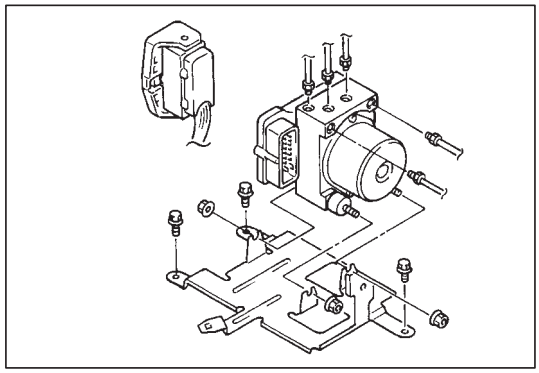
09943-35512
Brake drum remover
(Front wheel hub remover)



09942-15510
Sliding hammer

SECTION 5E1

ANTILOCK BRAKE SYSTEM (ABS) (OPTIONAL)



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

NOTE:
All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.

CONTENTS

GENERAL DESCRIPTION 5E1- 2
Brake Hose/Pipe Routing 5E1- 3
System Schematic 5E1- 4
ABS Component Parts Location 5E1- 5
ABS Hydraulic Unit/Control Module Assembly 5E1- 6
DIAGNOSIS 5E1- 7
Precaution in Diagnosing Troubles 5E1- 7
ABS Diagnostic Flow Table 5E1- 8
EBD Warning Lamp (Brake Warning Lamp) Check 5E1-11
"ABS" Warning Lamp Check 5E1-11
Diagnostic Trouble Code (DTC) Check (Using "ABS" Warning Lamp) 5E1-11
DTC Check (Using SUZUKI Scan Tool) 5E1-13
Diagnostic Trouble Code (DTC) Clearance 5E1-13

Diagnostic Trouble Code (DTC) Table . . . 5E1-14
System Circuit 5E1-15
Table – A "ABS" Warning Lamp Circuit Check – Lamp does not come "ON" at ignition switch on 5E1-16
Table – B "ABS" Warning Lamp Circuit Check – Lamp comes "ON" steady 5E1-17
Table – C "ABS" Warning Lamp Circuit Check – The lamp flashes continuously while ignition switch is on 5E1-18
Table – D Code (DTC) is not Outputted even with Diag. Switch Terminal Connected to Ground 5E1-19
Table – E EBD Warning Lamp (Brake Warning Lamp) Check-lamp Comes "ON" Steady 5E1-20
DTC 15 – G Sensor Circuit 5E1-21
DTC 21, 22, 25, 26, 31, 32, 35 or 36 – Wheel Speed Sensor Circuit 5E1-23
DTC 41, 45 or 56 – Solenoid Circuit 5E1-26
DTC 57 – Solenoid and Pump Motor Power Source Circuit 5E1-27
DTC 61 – ABS Pump Motor Circuit 5E1-28
DTC 63 – ABS Fail-Safe Relay Circuit . . . 5E1-29
DTC 71 – ABS Control Module 5E1-30

ON-VEHICLE SERVICE 5E1-31
Precaution 5E1-31
ABS Hydraulic Unit Operation Check 5E1-31
ABS Hydraulic Unit/Control Module Assembly 5E1-32
Hydraulic unit inspection 5E1-32
Removal 5E1-32
Installation 5E1-33
Front Wheel Speed Sensor 5E1-34
Output voltage inspection 5E1-34
Removal 5E1-35
Sensor inspection 5E1-35
Sensor rotor inspection 5E1-35
Installation 5E1-36
Front Sensor Rotor 5E1-36
Removal 5E1-36
Installation 5E1-36
Rear Wheel Speed Sensor 5E1-37
Output voltage inspection 5E1-37
Removal 5E1-37
Sensor inspection 5E1-38
Sensor rotor inspection 5E1-38
Installation 5E1-38
Rear Sensor Rotor 5E1-39
Removal 5E1-39
Installation 5E1-39
G Sensor 5E1-40
Removal 5E1-40
Inspection 5E1-40
Installation 5E1-40
Transfer 4WD Switch 5E1-41

TIGHTENING TORQUE SPECIFICATIONS 5E1-41

SPECIAL TOOLS 5E1-42

GENERAL DESCRIPTION

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 is a 4-wheel type which controls the fluid pressure applied to the wheel cylinder of each of the four brakes to prevent each wheel from getting locked.

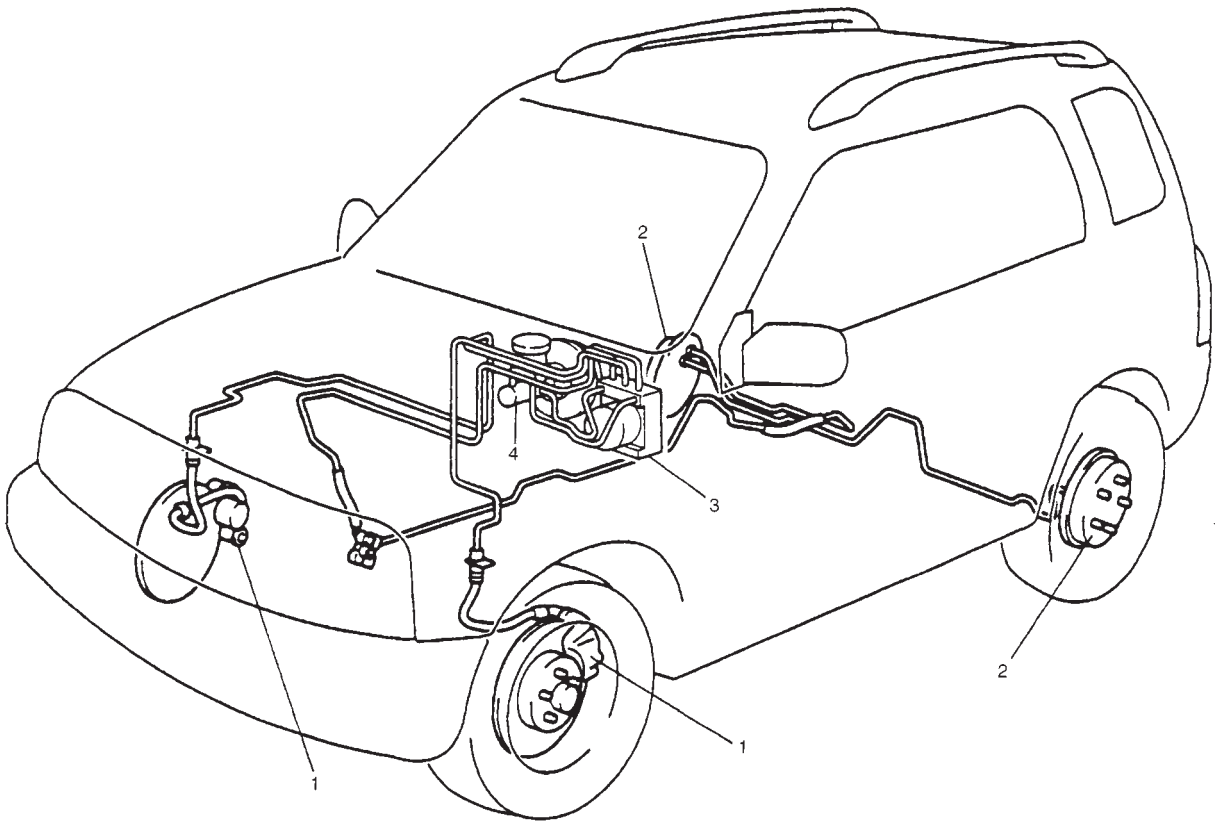
The component parts of this ABS includes following parts in addition to those of the conventional brake system.

- Wheel speed sensor which senses revolution speed of each wheel and outputs its signal.
- In this ABS, ABS hydraulic unit (actuator assembly), ABS control module, pump motor relay and fail-safe relay are combined as one component.
- 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 of 4 wheels.
- Fail-safe (solenoid valve) relay which supplies power to solenoid valve in ABS hydraulic unit and pump motor relay.
- Pump motor relay which supplies power to pump motor in ABS hydraulic unit.
- "ABS" warning lamp which lights to inform abnormality when system fails to operate properly.
- G sensor which detects body deceleration speed. (For 4WD model only)

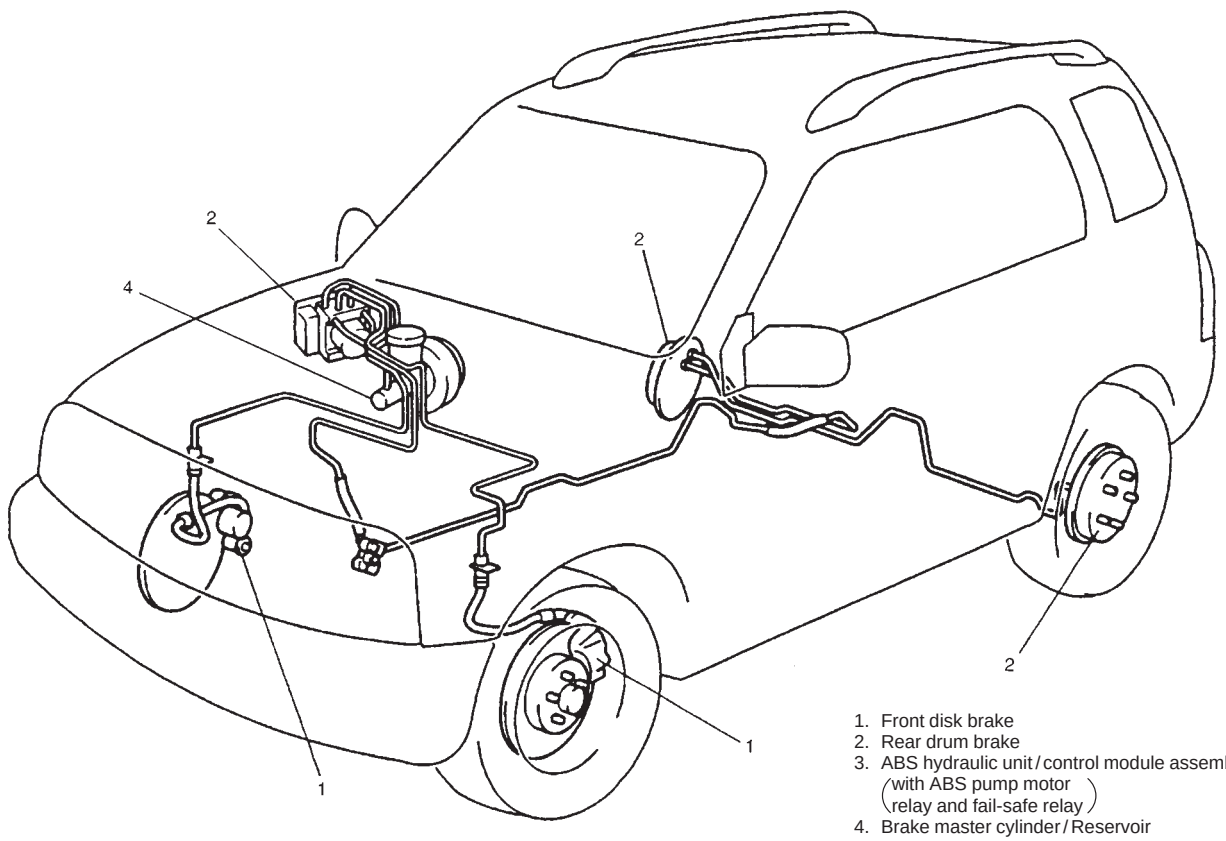
This ABS is equipped with Electronic Brake force Distribution (EBD) system that controls a fluid pressure of rear wheels to best condition, which is the same function as that of proportioning valve, by the signal from wheel sensor independently of change of load due to load capacity and so on. And if the EBD system fails to operate properly, the brake warning lamp lights to inform abnormality.

BRAKE HOSE/PIPE ROUTING

LH steering vehicle

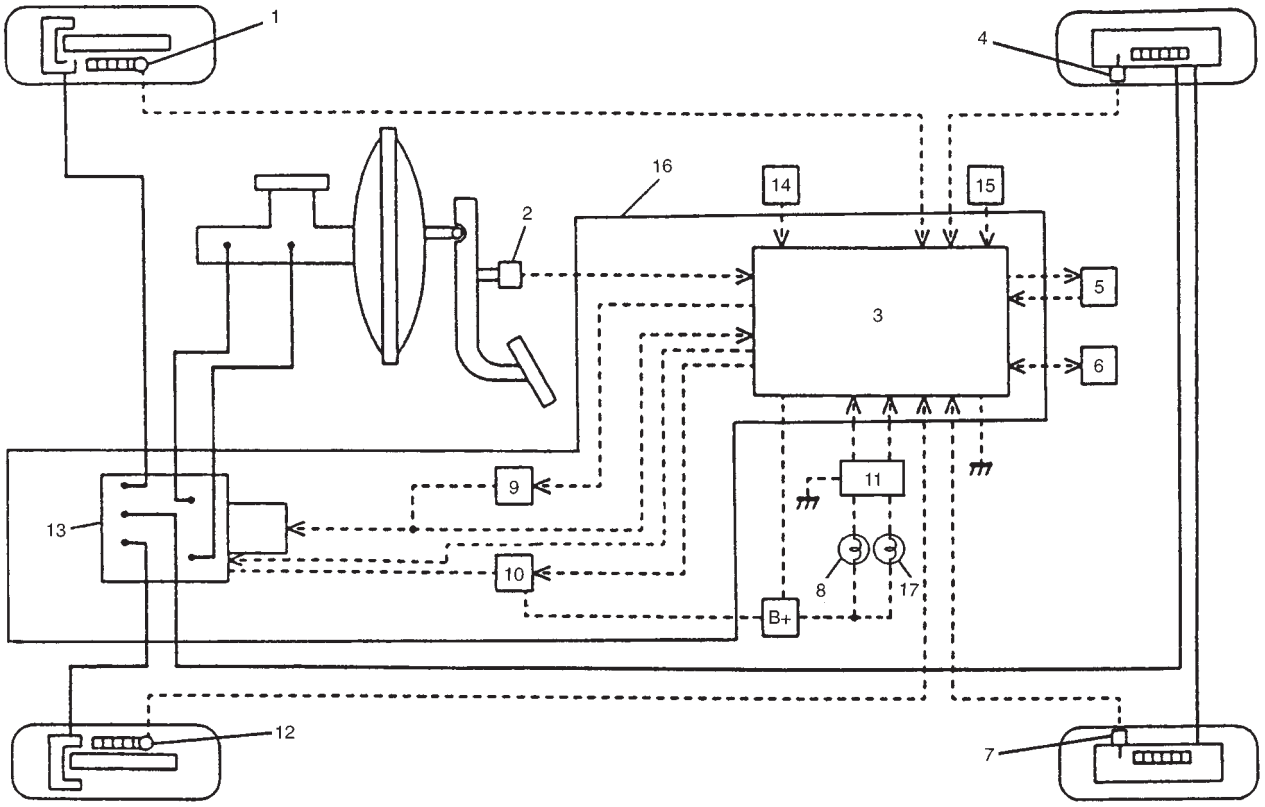


RH steering vehicle

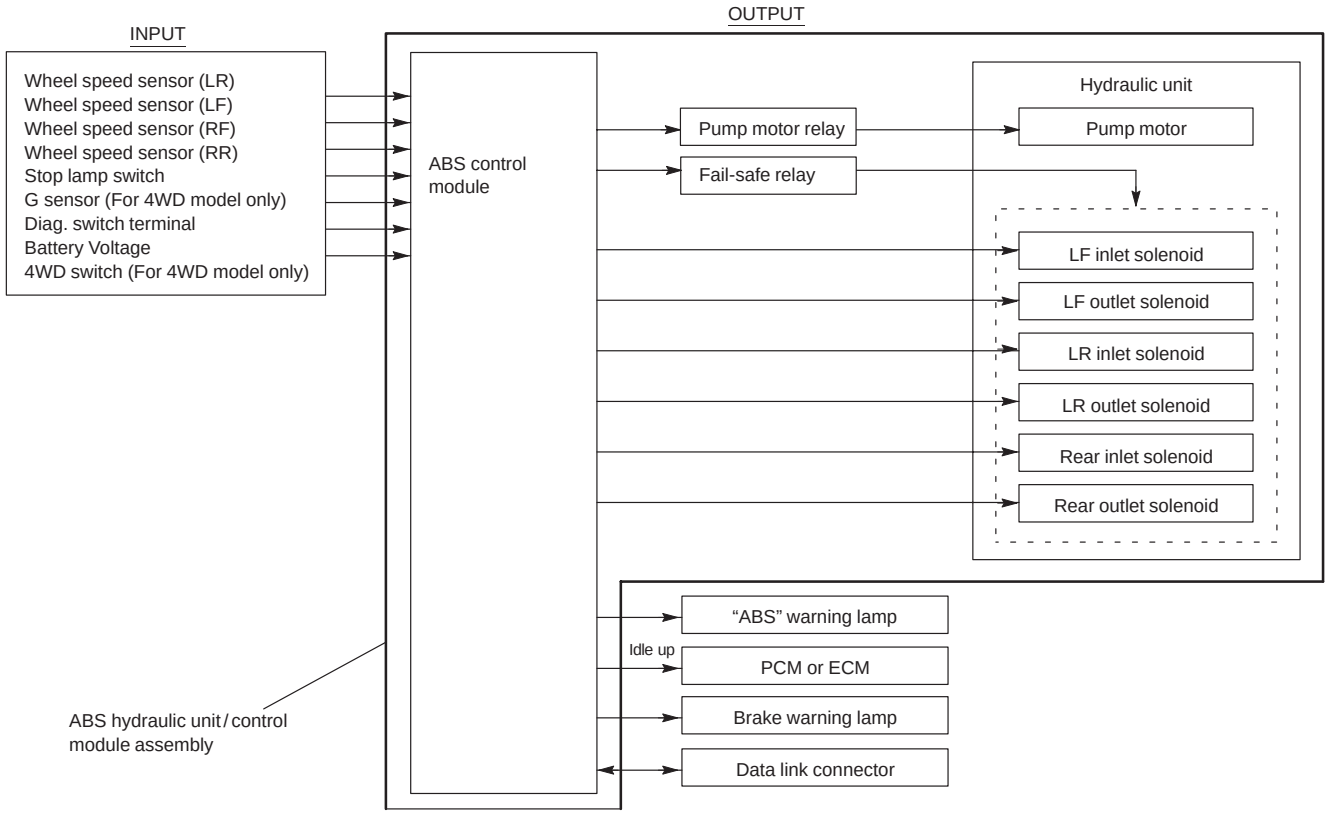


1. Front disk brake
2. Rear drum brake
3. ABS hydraulic unit/control module assembly (with ABS pump motor relay and fail-safe relay)
4. Brake master cylinder/Reservoir

SYSTEM SCHEMATIC

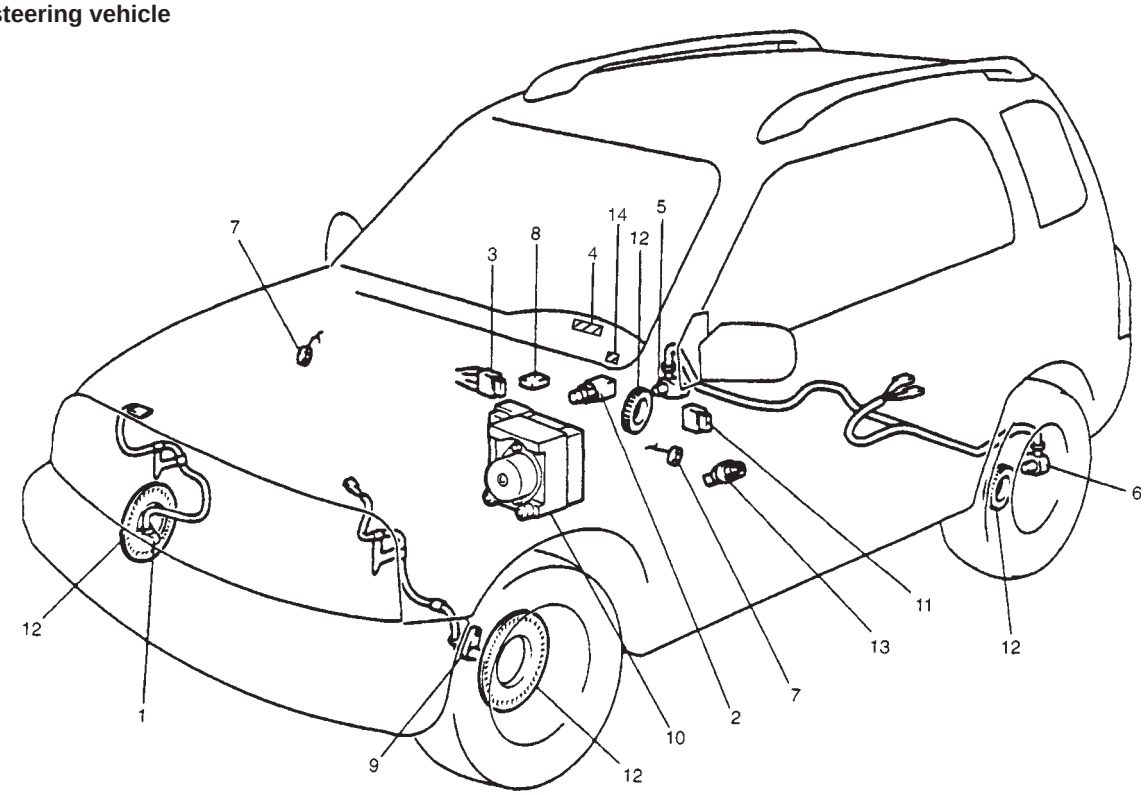


1. Wheel speed sensor (Right-front)
2. Stop lamp switch
3. ABS control module
4. Wheel speed sensor (Right-rear)
5. Diagnosis connector
6. Data link connector
7. Wheel speed sensor (Left-rear)
8. "ABS" warning lamp
9. ABS pump motor relay
10. ABS fail-safe relay (Solenoid valve relay)
11. Lamp drive module
12. Wheel speed sensor (Left-front)
13. ABS hydraulic unit
14. G sensor (For 4WD model only)
15. 4WD switch (For 4WD model only)
16. ABS hydraulic unit / control module assembly (with ABS pump motor & fail-safe relays)
17. "EBD" warning lamp (Brake warning lamp)

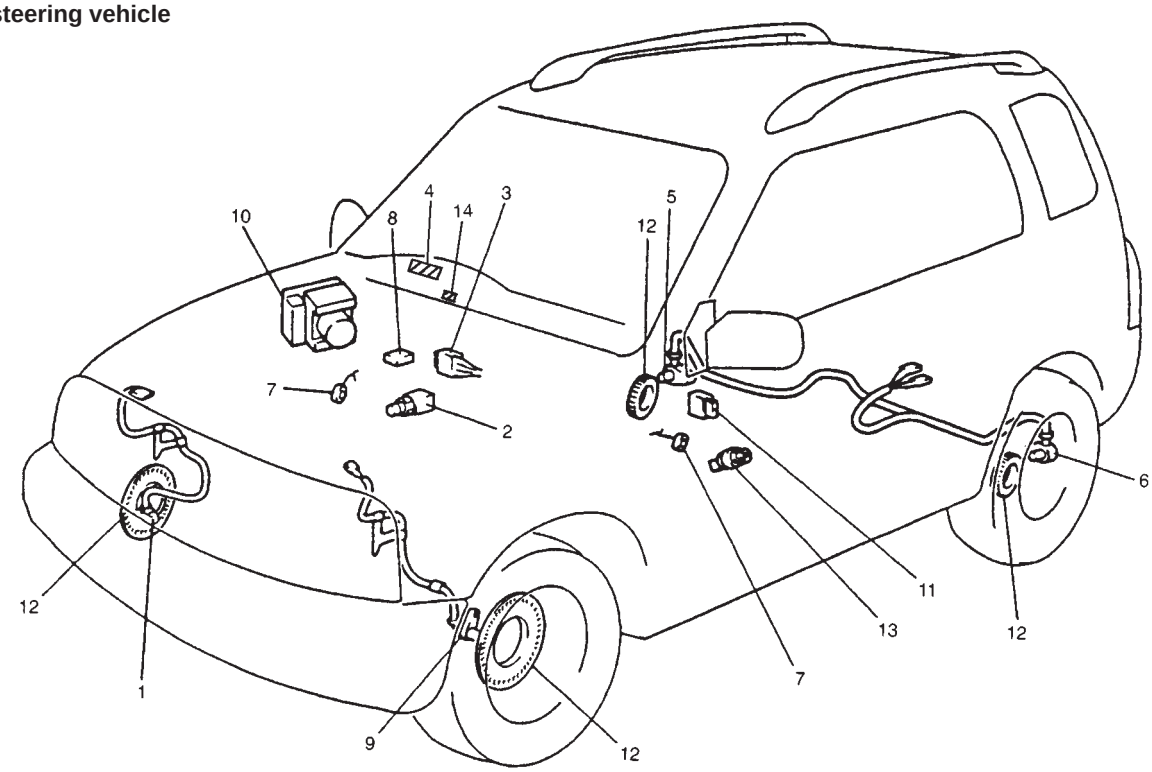


ABS COMPONENT PARTS LOCATION

LH steering vehicle



RH steering vehicle



1. Wheel speed sensor (Right-front)
2. Stop lamp switch
3. Data link connector
4. "ABS" warning lamp
5. Wheel speed sensor (Right-rear)
6. Wheel speed sensor (Left-rear)
7. Ground
8. Diagnosis connector (Black connector)
9. Wheel speed sensor (Left-front)
10. ABS hydraulic unit/control module assembly (with ABS pump motor relay and fail-safe relay)
11. G sensor (For 4WD model only)
12. Wheel speed sensor rotor (ring)
13. 4WD switch (For 4WD model only)
14. EBD warning lamp (Brake warning lamp)

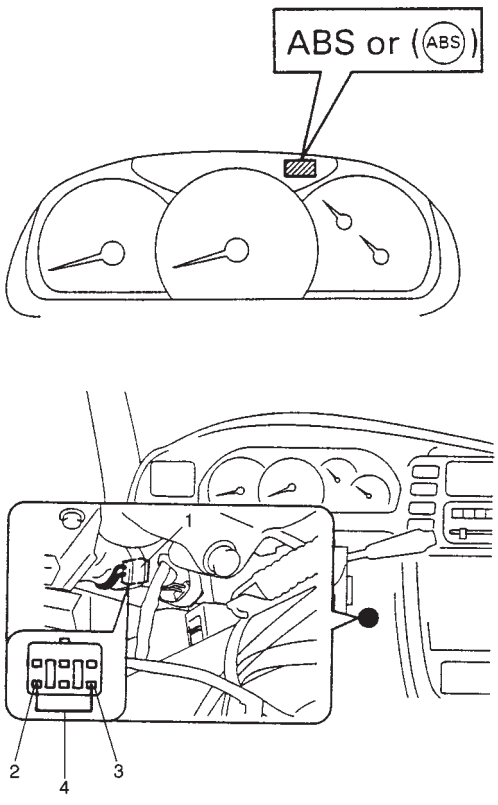
ABS HYDRAULIC UNIT/CONTROL MODULE ASSEMBLY

ABS control module is a component of ABS hydrauli 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 the vehicle starts to move after the ignition switch is turned ON (more than one wheel speed sensor signals are inputted), solenoid valves and motor of ABS hydraulic unit operate once one after another for electrical check.
   During this check, motor operation sound may be heard but that means nothing abnormal.



1. Diagnosis connector (6 pins connector)
2. Ground terminal
3. Diag. switch terminal
4. Service wire

4) 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.
5) When Diag. switch terminal of diagnosis connector (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

For procedure to clear all DTC’s, refer to the item “Diagnostic Trouble Code Clearance” in this section.

Also ABS control module turns ON EBD warning lamp (brake warning lamp) depending on the trouble that detected by the module and EBD warning lamp does not indicate DTC as well as “ABS” warning lamp.

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 not equipped with ABS.

DIAGNOSIS

To ensure that the trouble diagnosis is done accurately and smoothly, observe “Precautions in Diagnosing Troubles” and follow “ABS Diagnostic Flow Table”.

PRECAUTION IN DIAGNOSING TROUBLES

- If the vehicle was operated in any of the following ways, “ABS” warning light may light momentarily but this does not indicate anything abnormal in ABS.
  – The vehicle was driven with parking brake pulled.
  – The vehicle was driven with brake dragging.
  – The vehicle was stuck in mud, sand, etc.
  – Wheel spin occurred while driving.
  – Wheel(s) was rotated while the vehicle was jacked up.
- Be sure to read “Precautions for Electronic Circuit Service” in “GENERAL INFORMATION” section before inspection and observe what is written there.
- Be sure to use the trouble diagnosis procedure as described in the flow table. Failure to follow the flow table may result in incorrect diagnosis. (Some other diag. trouble code may be stored by mistake in the memory of ABS control module during inspection.)

ABS DIAGNOSTIC FLOW TABLE

Refer to the following pages for the details of each step.

STEP	ACTION	YES	NO
1	Perform customer complaint analysis, problem symptom confirmation and diagnostic trouble code check record and clearance. Is there any trouble code?	Go to step 2.	Go to step 5.
2	Perform driving test. Is trouble symptom identified?	Go to step 3.	Go to step 6.
3	Check diagnostic trouble code. Is it malfunction code?	Go to step 4.	Go to step 5.
4	Inspect and repair referring to applicable diagnostic trouble code table in this section. Then perform final confirmation test after clearing diagnostic trouble code. Is trouble recur?	Go to step 7.	END.
5	Inspect and repair referring to DIAGNOSIS in “BRAKES” section. Then perform final confirmation test after clearing diagnostic trouble code. Is trouble recur?	Go to step 7.	END.
6	Check for intermittent problems referring to INTERMITTENT AND POOR CONNECTION in “GENERAL INFORMATION” section and related circuit of trouble code recorded in step 1. Then perform final confirmation test after clearing diagnostic trouble code. Is trouble recur?	Go to step 7.	END.
7	Perform diagnostic trouble code check record and clearance. Is there any trouble code?	Go to step 2.	Go to step 5.

1-1. CUSTOMER COMPLAINT ANALYSIS

Record details of the problem (failure, complaint) and how it occurred as described by the customer. For this purpose, use of such a questionnaire form as shown below will facilitate collecting information to the point required for proper analysis and diagnosis.

CUSTOMER QUESTIONNAIRE (EXAMPLE)

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

Problem Symptoms	● "ABS" warning light abnormal: fails to turn on/fails to go off/ flashes ● Abnormal noise while vehicle is running: from motor, from valve, other_____ ● Wheel is locked at braking: ● Pump motor does not stop (running): ● Braking does not work: ● Other:
Frequency of occurrence	● Continuous/Intermittent (times a day, a month)/ other_____
Conditions for Occurrence of Problem	● Vehicle at stop & ignition switch ON: ● When starting: at initial start only/at every start/Other_____ ● Vehicle speed: while accelerating/while decelerating/at stop/ while turning/while running at constant speed/ other_____ ● Road surface condition: Paved road/rough road/snow-covered road/other_____ ● Chain equipment:
Environmental Condition	● Weather: fair/cloudy/rain/snow/other_____ ● Temperature: °F (°C)
Diagnostic Trouble Code	● First check: Normal code/malfunction code ( ) ● Second check after test drive: Normal code/malfunction code ( )

1-2. 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.) When “ABS” warning lamp is not operated correctly, proceed to “Diagnostic Flow Table-A, B or C”.

1-3. DIAGNOSTIC TROUBLE CODE (DTC) CHECK, RECORD AND CLEARANCE

Perform “Diagnostic Trouble Code Check” as shown below, record it and then clear it referring to “Diagnostic Trouble Code Clearance” in this section.

If the malfunction DTC which was once displayed and then cleared cannot be detected (indicated) again when the ignition switch is turned ON, attempt to diagnose the trouble based on the DTC recorded in this step may mislead the diagnosis or make diagnosing difficult. Proceed to Step 2 to check ABS control module for proper self-diagnosis function.

If the malfunction DTC which was once displayed and then cleared can be detected (indicated) again when ignition switch is turned ON, proceed to Step 3.

2. DRIVING TEST

Test drive the vehicle at 40 km/h for more than a minute and check if any trouble symptom (such as abnormal lighting of “ABS” warning lamp) exists.

If the malfunction DTC is confirmed again at ignition switch ON, driving test as described in above is not necessary. Proceed to Step 3.

3. DIAGNOSTIC TROUBLE CODE CHECK

Recheck diagnostic trouble code referring to item “DTC CHECK” as shown below.

4. DIAGNOSTIC TROUBLE CODE FLOW CHART

According to Diagnostic flow table for the diagnostic trouble code confirmed in Step 3, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ABS control module or other part and repair or replace faulty parts.

5. “DIAGNOSIS” IN “BRAKE” SECTION

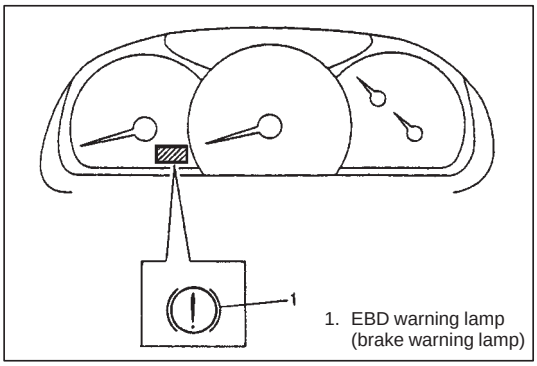
Check the parts or system suspected as a possible cause referring to “Diagnosis” in “BRAKES” section and based on symptoms appearing on the vehicle (symptoms obtained through Steps 1-1, 1-2 and 2 and repair or replace faulty parts, if any.

6. CHECK FOR INTERMITTENT PROBLEM

Check parts where an intermittent trouble is easy to occur (e.g., wire harness, connector, etc.), referring to INTERMITTENT TROUBLE in “GENERAL INFORMATION” section and related circuit of trouble code recorded in Step 1-3.

7. FINAL CONFIRMATION TEST

Confirm that the problem symptom has gone and the ABS is free from any abnormal conditions. If what has been repaired is related to the malfunction DTC, clear the DTC once and perform test driving and confirm that a normal code is indicated.



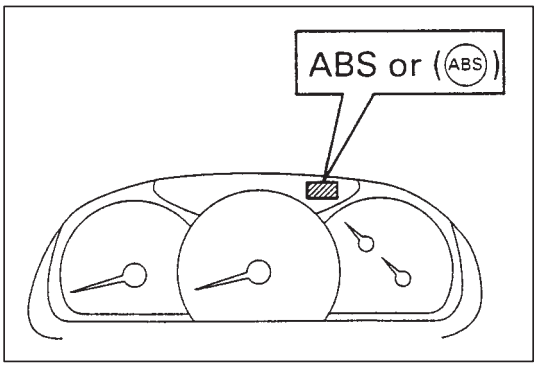
1. EBD warning lamp (brake warning lamp)

EBD WARNING LAMP (BRAKE WARNING LAMP) CHECK

NOTE:

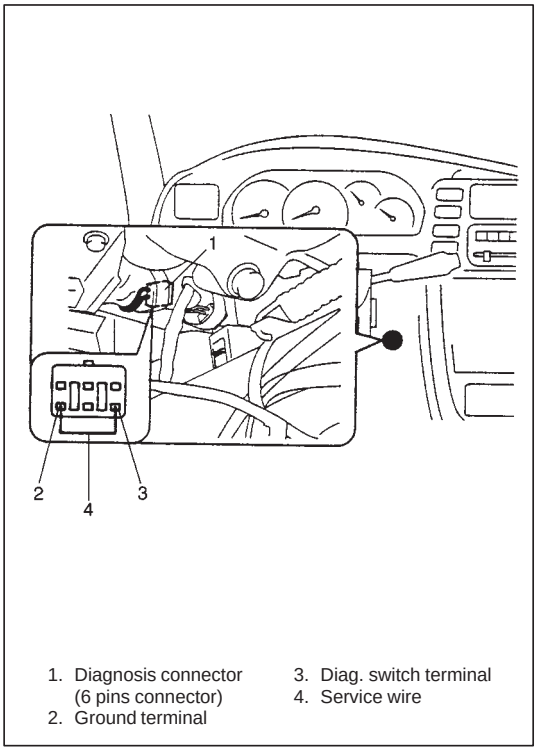
Perform this check on a level place.

1) Turn ignition switch ON with parking brake applied.
2) Check that brake warning lamp is turned ON.
3) Release parking brake with ignition switch ON and check that EBD warning lamp (brake warning lamp) goes off.
   If it doesn't go off, go to "TABLE-E" in this section.



"ABS" WARNING LAMP CHECK

1) Turn ON the ignition switch.
2) Check that "ABS" warning lamp lights for about 2 seconds and then goes OFF.
   If anything faulty is found, advance to Diagnostic table – A, B or C.

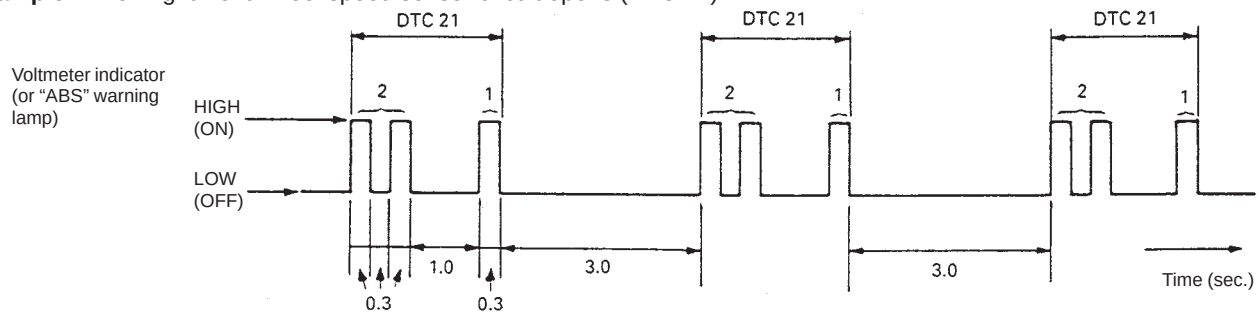


1. Diagnosis connector (6 pins connector)
2. Ground terminal
3. Diag. switch terminal
4. Service wire

DIAGNOSTIC TROUBLE CODE (DTC) CHECK (USING "ABS" WARNING LAMP)

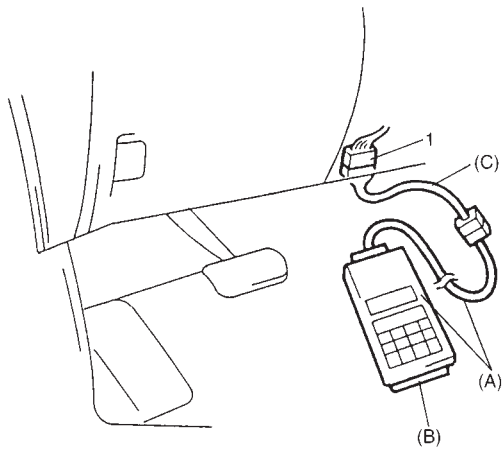
1) Using service wire, connect diag. switch terminal of diagnosis connector to ground.
2) Turn ignition switch ON.
3) Read flashing of "ABS" warning lamp which represents DTC as shown in example below and write it down. When more than 2 DTC's are stored in memory, deflection and flashing for each DTC is repeated three times starting with the smallest DTC number in increasing order.
   For details of DTC, refer to "DTC Table".

Example: When right-front wheel speed sensor circuit opens (DTC 21)



NOTE:
"ABS" warning lamp indicates only following DTC's, DTC 12 which means that no malfunction DTC is stored and history DTC which indicates history trouble area. When there is a current trouble, "ABS" warning lamp remains ON and therefore DTC is not indicated.

4) After completing the check, turn ignition switch off and disconnect service wire from DIAG. connector.



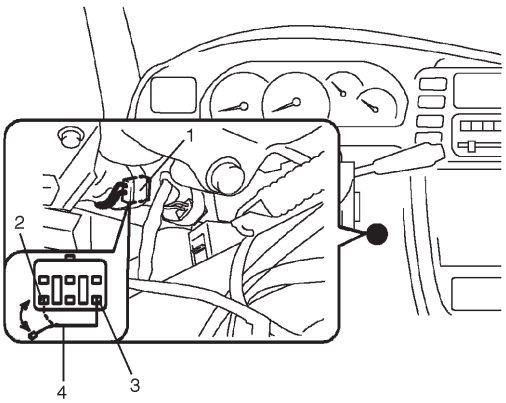
1. Data link connector (DLC)

DTC CHECK (USING SUZUKI SCAN TOOL)

1) After setting cartridge for ABS to SUZUKI scan tool, connect SUZUKI scan tool to data link connector.

   Special Tool
   (A): 09931-76011 (SUZUKI scan tool)
   (B): Mass storage cartridge
   (C): 16/14 pin DLC cable

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.



1. Diagnosis connector (6 pins connector)
2. Ground terminal
3. Diag. switch terminal
4. Service wire

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.

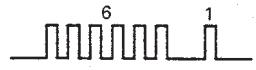
After repair or replace malfunction part(s), clear all DTC's by performing the following procedure.
1) Turn ignition switch OFF.
2) Using service wire, connect diag. switch terminal of diag. connector to diag. ground terminal.
3) With connection described in above step 2) maintained, turn ignition switch ON.
4) Repeat on/off operation of service wire at diag. ground terminal at least 5 times within 10 seconds.

   NOTE:
   Service wire ON time must be for 0.1 second and more.

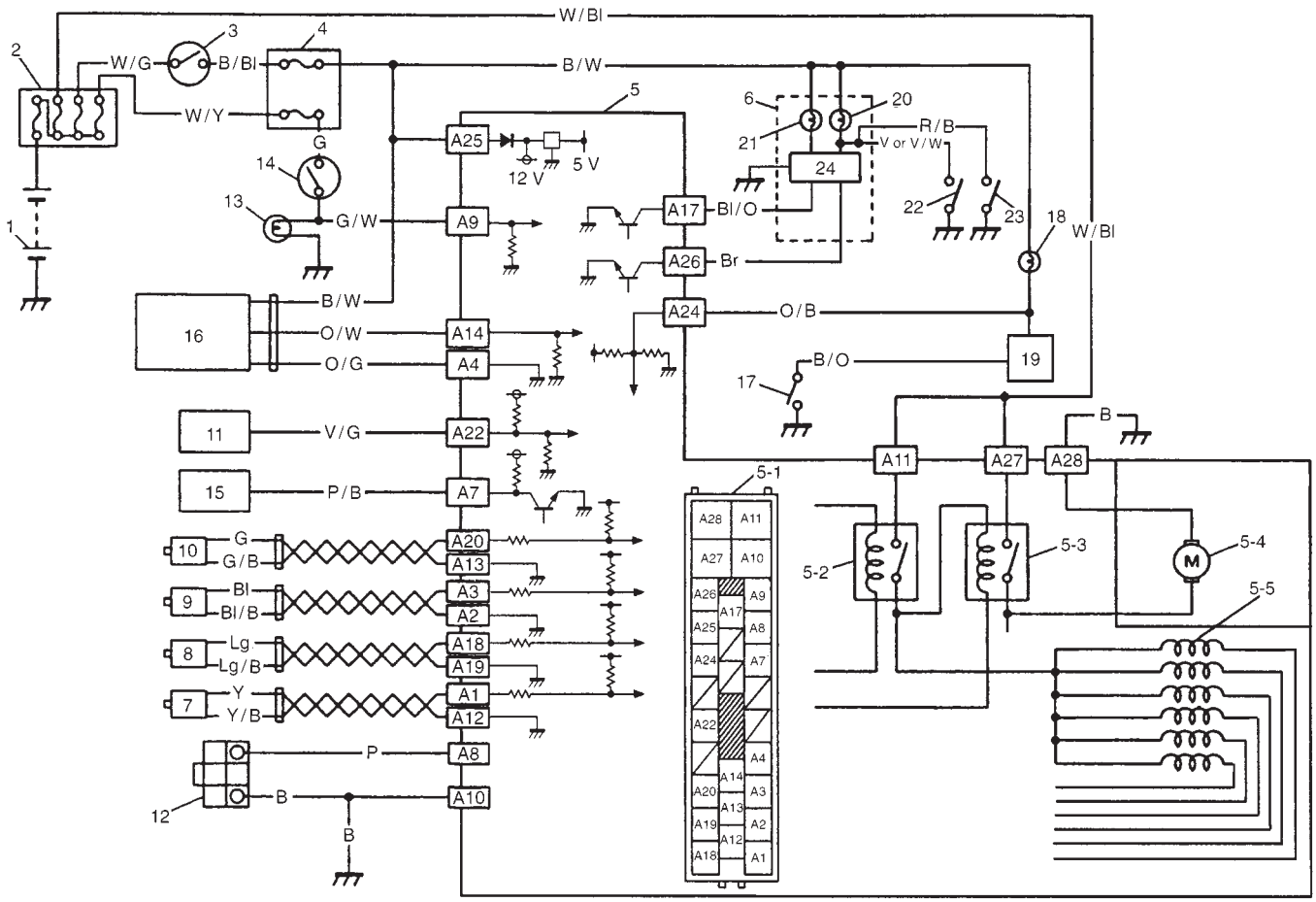
5) Turn ignition switch OFF and disconnect service wire from diag. connector.
6) Perform DRIVING TEST and DTC CHECK and confirm that normal DTC (DTC 12) is displayed; not malfunction DTC.

   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

DTC (indicated by ABS warning lamp)	DTC (displayed on SUZUKI scan tool)	VOLTMETER INDICATION (or "ABS" warning lamp flashing pattern)	DIAGNOSTIC AREA	
15	C1015		G sensor (for 4WD model only)	
21	C1021		Right-front	Wheel speed sensor circuit and rotor
25	C1025		Left-front	
31	C1031		Right-rear	
35	C1035		Left-rear	
22	C1022		Right-front	
26	C1026		Left-front	
32	C1032		Right-rear	
36	C1036		Left-rear	
41	C1041		Right-front	Inlet solenoid circuit
	C1042			Outlet solenoid circuit
45	C1045		Left-front	Inlet solenoid circuit
	C1046			Outlet solenoid circuit
56	C1055		Rear	Inlet solenoid circuit
	C1056			Outlet solenoid circuit
57	C1057		Solenoid and pump motor power source circuit	
61	C1061		ABS pump motor (in hydraulic unit) circuit	
63	C1063		ABS fail-safe relay circuit	
71	C1071		ABS control module	Internal malfunction
12	–		Normal	

SYSTEM CIRCUIT



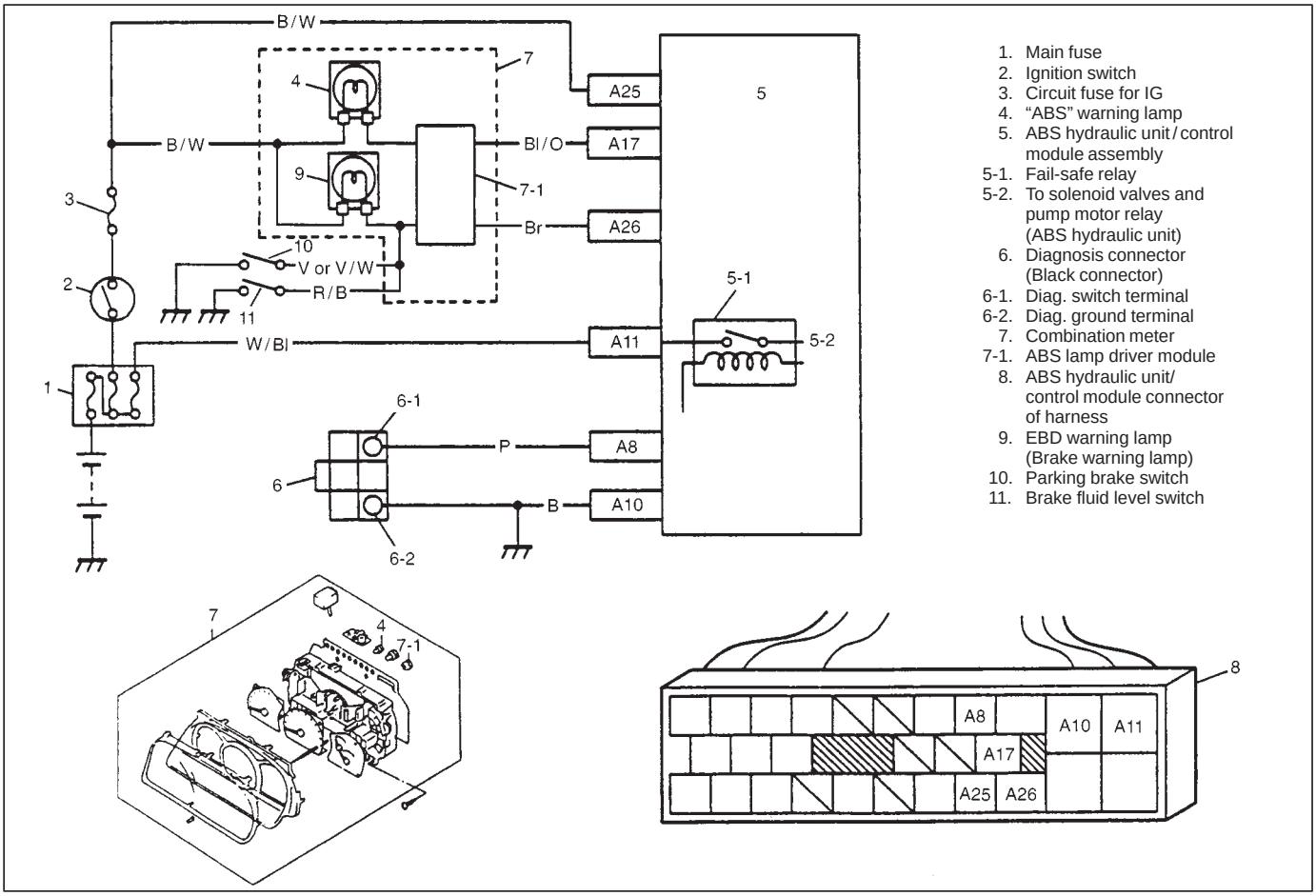
1. Battery
2. Main fuses
3. Ignition switch
4. Circuit fuses
5. ABS hydraulic unit / control module
5-1. Terminal arrangement for ABS hydraulic unit / control module assembly
5-2. ABS fail-safe relay (Solenoid valve relay)
5-3. ABS pump motor relay
5-4. Pump motor
5-5. Solenoid valves
6. "ABS" warning lamp
7. Right-rear wheel speed sensor
8. Left-rear wheel speed sensor
9. Right-front wheel speed sensor
10. Left-front wheel speed sensor
11. Data link connector
12. Diagnosis connector
13. Stop lamp
14. Stop lamp switch
15. PCM (ECM+TCM) or ECM
16. G sensor (For 4WD model only)
17. 4WD switch (For 4WD model only)
18. 4WD indicator lamp (For 4WD model only)
19. 4WD controller (If equipped)
20. EBD warning lamp (Brake warning lamp)
21. Combination meter
22. Parking brake switch
23. Brake fluid lever switch
24. Warning lamp driver module

Wire color

B	: Black
B / Bl	: Black / Blue
B / O	: Black / Orange
B / W	: Black / White
Bl	: Blue
Bl / B	: Blue / Black
Bl / O	: Blue / Orange
Br	: Brown
G	: Green
G / B	: Green / Black
G / W	: Green / White
Lg	: Lightgreen
Lg / B	: Lightgreen / Black
O / B	: Orange / Black
O / G	: Orange / Green
O / W	: Orange / White
P	: Pink
P / B	: Pink / Black
V / G	: Violet / Green
W / Bl	: White / Blue
W / G	: White / Green
W / Y	: White / Yellow
Y	: Yellow
Y / B	: Yellow / Black

TERMINAL	CIRCUIT
A1	Right-rear wheel speed sensor (+)
A2	Right-front wheel speed sensor (–)
A3	Right-front wheel speed sensor (+)
A4	G sensor ground (For 4WD model only)
A5	———
A6	———
A7	Idle up signal
A8	Diagnosis switch terminal
A9	Stop lamp switch
A10	Ground (For ABS control module)
A11	ABS fail-safe relay
A12	Right-rear wheel speed sensor (–)
A13	Left-front wheel speed sensor (–)
A14	G sensor signal (For 4WD model only)
A15	———
A16	———
A17	"ABS" warning lamp
A18	Left-rear wheel speed sensor (+)
A19	Left-rear wheel speed sensor (–)
A20	Left-front wheel speed sensor (+)
A21	———
A22	Data link connector
A23	———
A24	4WD switch (For 4WD model only)
A25	Ignition switch
A26	"EBD" warning lamp
A27	ABS pump motor relay
A28	Ground (For ABS pump motor)

TABLE – A "ABS" WARNING LAMP CIRCUIT CHECK – LAMP DOES NOT COME "ON" AT IGNITION SWITCH ON



1. Main fuse
2. Ignition switch
3. Circuit fuse for IG
4. "ABS" warning lamp
5. ABS hydraulic unit/control module assembly

5-1. Fail-safe relay
5-2. To solenoid valves and pump motor relay (ABS hydraulic unit)

6. Diagnosis connector (Black connector)

6-1. Diag. switch terminal
6-2. Diag. ground terminal

7. Combination meter

7-1. ABS lamp driver module

8. ABS hydraulic unit/control module connector of harness
9. EBD warning lamp (Brake warning lamp)
10. Parking brake switch
11. Brake fluid level switch

CIRCUIT DESCRIPTION

Operation (ON/OFF) of the "ABS" warning lamp is controlled by the ABS control module and ABS lamp driver module.

If the Antilock brake system is in good condition, the ABS control module turns the "ABS" warning lamp ON at the ignition switch ON, keeps it ON for 2 seconds only and then turns it OFF. If an abnormality in the system is detected, the lamp is turned ON by ABS control module. Also, it is turned ON by ABS lamp driver module when the connector of the ABS control module was disconnected.

INSPECTION

STEP	ACTION	YES	NO
1	1) Turn ignition switch ON. Do other warning lamp come ON?	Go to step 2.	Go to step 4.
2	1) Disconnect ABS hydraulic unit/control module connector. Does ABS warning lamp light with ignition switch ON?	Replace ABS hydraulic unit/control module assembly.	Go to step 3.
3	1) Remove combination meter. Is bulb of ABS warning lamp in good condition?	"Bl/O" circuit shorted to ground. If OK, replace ABS warning circuit (lamp driver module).	Replace bulb.
4	Is IG fuse in good condition?	Open in "B/W" wire to combination meter or poor connection.	Repair and replace.

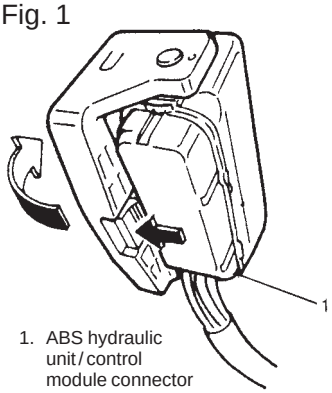
TABLE – B "ABS" WARNING LAMP CIRCUIT CHECK – LAMP COMES "ON" STEADY

Refer to TABLE – A for System Circuit Diagram and Circuit Description.

INSPECTION

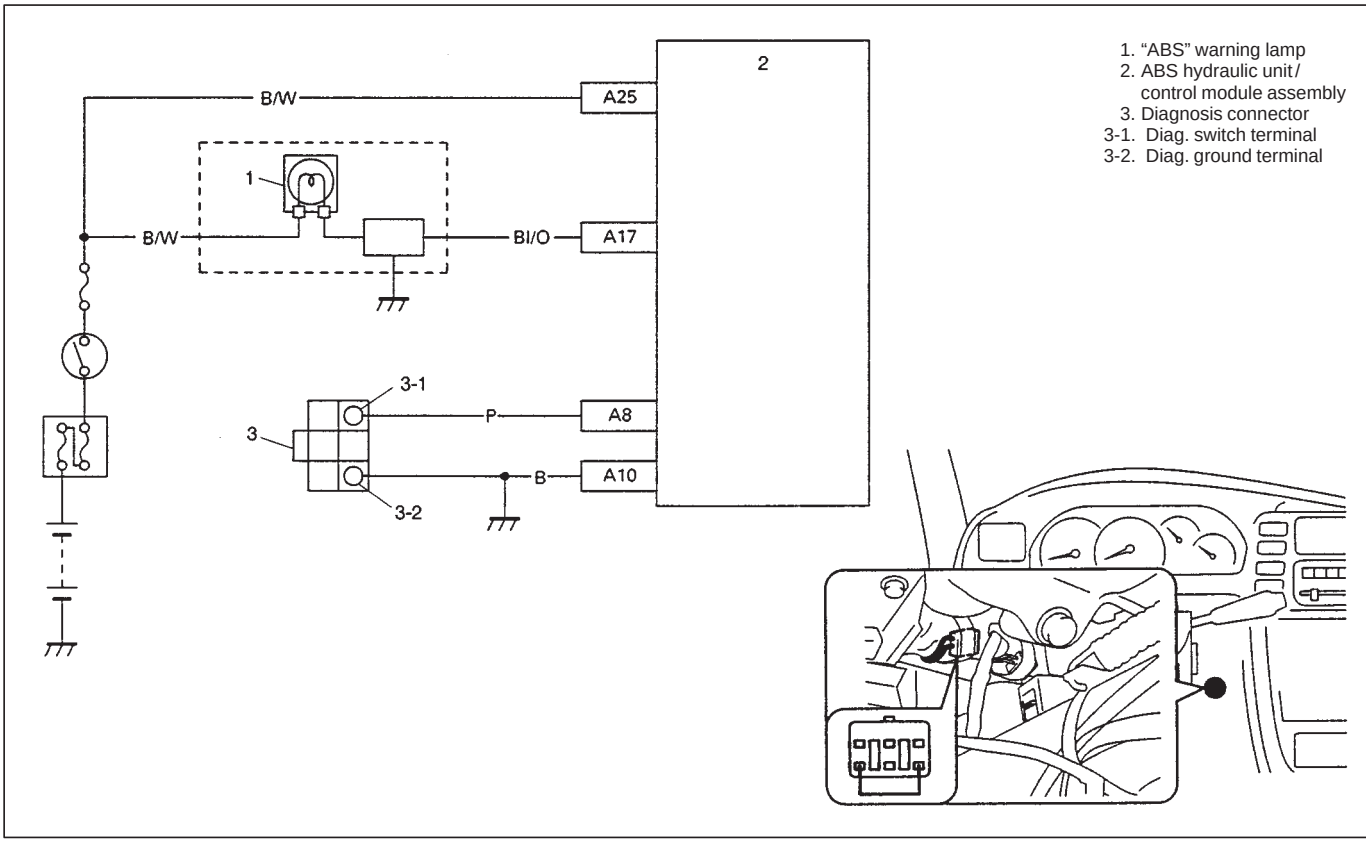
STEP	ACTION	YES	NO
1	Perform diagnostic trouble code check. Is there any DTC (including code No.12, NO CODES on SUZUKI scan tool) exists?	Go to step 2.	Go to step 3.
2	Is malfunction DTC (other than code No.12) exists at step 1?	Go to step 7 of ABS diagnostic flow table in this section.	Go to step 3.
3	1) Disconnect ABS hydraulic unit/control module connector. (See Fig. 1) 2) Check for proper connection to ABS hydraulic unit/control module connector at terminals "A17", "A25" and "A10". 3) If OK, turn ignition switch "ON" and measure voltage at terminal "A25" of connector. Is it 10 – 14 V?	Go to step 4.	"B/W" circuit open.
4	1) With ABS control module connector disconnected, turn ignition switch ON and light ABS warning lamp. 2) Connect terminal "A17" of disconnected connector to ground using service wire. Does "ABS warning lamp" turn off?	Go to step 5.	"Bl/O" circuit open. If wire and connection are OK, replace ABS lamp driver module.
5	1) Measure resistance from connector terminal "A10" to body ground. Is continuity indicated?	Substitute a known-good ABS hydraulic unit/ control module assembly and recheck.	"B" circuit open.

Fig. 1



1. ABS hydraulic unit/control module connector

TABLE – C "ABS" WARNING LAMP CIRCUIT CHECK – THE LAMP FLASHES CONTINUOUSLY WHILE IGNITION SWITCH IS ON



CIRCUIT DESCRIPTION

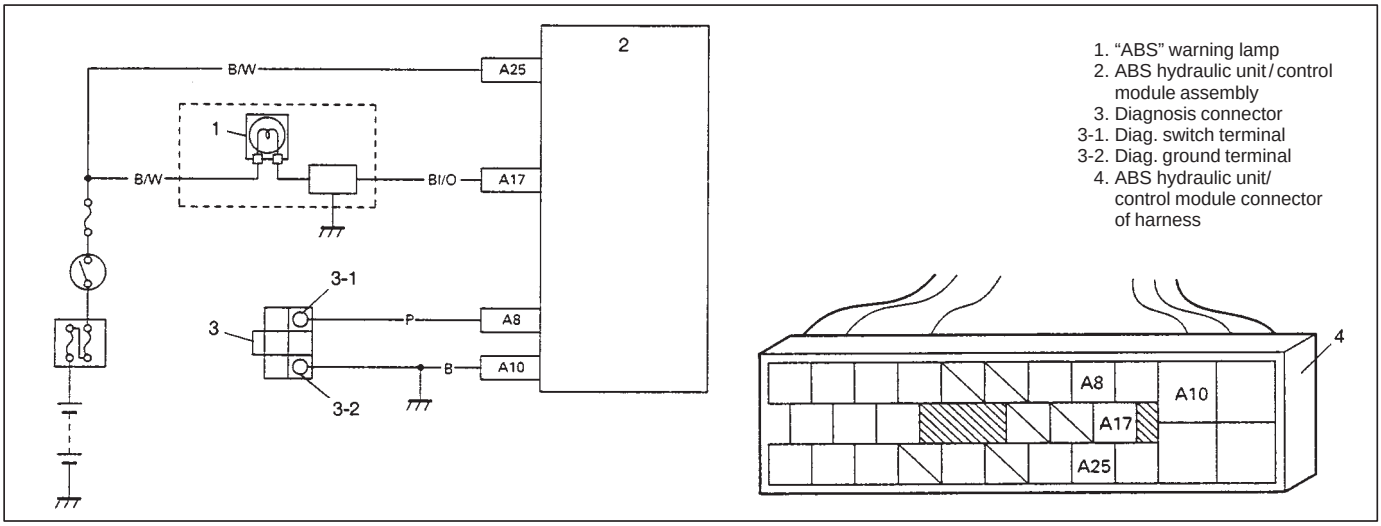
When the diag. switch terminal is shorted or connected to the ground with the ignition switch ON, the diag. trouble code (DTC) is indicated by flashing of the "ABS" warning lamp only in following cases.

- Normal DTC (12) is indicated if no malfunction DTC is detected in the ABS.
- A history malfunction DTC is indicated by flashing of the lamp if a current malfunction DTC is not detected at that point although a history malfunction DTC is stored in memory.

INSPECTION

STEP	ACTION	YES	NO
1	Is diag. switch terminal connected to ground via service wire?	Go to step 3.	Go to step 2.
2	1) Ignition switch ON. 2) Measure voltage between diag. switch terminal and ground. Is it 10 – 14 V?	Substitute a known-good ABS hydraulic unit/ control module assembly and recheck.	"P" wire circuit shorted to ground.
3	1) Ignition switch ON. 2) Does flashing of "ABS" warning lamp indicate DTC (DTC 12 or history DTC)?	Go to step 7 of ABS diagnostic flow table in this section.	Substitute a known-good ABS hydraulic unit/ control module assembly and recheck.

TABLE – D CODE (DTC) IS NOT OUTPUTTED EVEN WITH DIAG. SWITCH TERMINAL CONNECTED TO GROUND



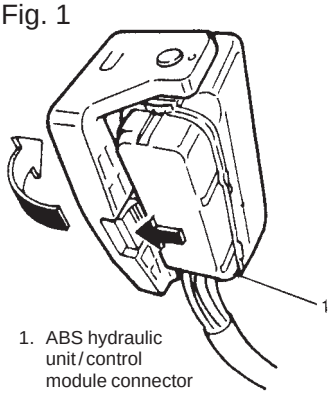
CIRCUIT DESCRIPTION

When the diag. switch terminal is connected to the ground with the ignition switch turned ON, the ABS control module outputs a diagnostic trouble code by flashing "ABS" warning lamp.

INSPECTION

STEP	ACTION	YES	NO
1	Is it shorted diag. switch terminal and ground terminal by service wire properly?	Go to step 2.	Connect service wire securely.
2	1) Disconnect service wire. 2) Disconnect ABS hydraulic unit/control module connector. (See Fig. 1) 3) Measure resistance between diag. switch terminal and connector terminal "A8". Is it infinite (∞)?	"P" circuit open.	Go to step 3.
3	1) Measure resistance between ground terminal of monitor connector and body ground. Is continuity indicated?	Go to step 4.	"B" circuit open or poor connection.
4	1) Check for proper connection to ABS hydraulic unit/control module at terminal "A8" and "A10". 2) If OK, then check "ABS" warning lamp circuit referring to "TABLE A, B and C". Is it in good condition?	Substitute a known-good ABS hydraulic unit/ control module assembly and recheck.	Repair "ABS" warning lamp circuit.

Fig. 1



1. ABS hydraulic unit/control module connector

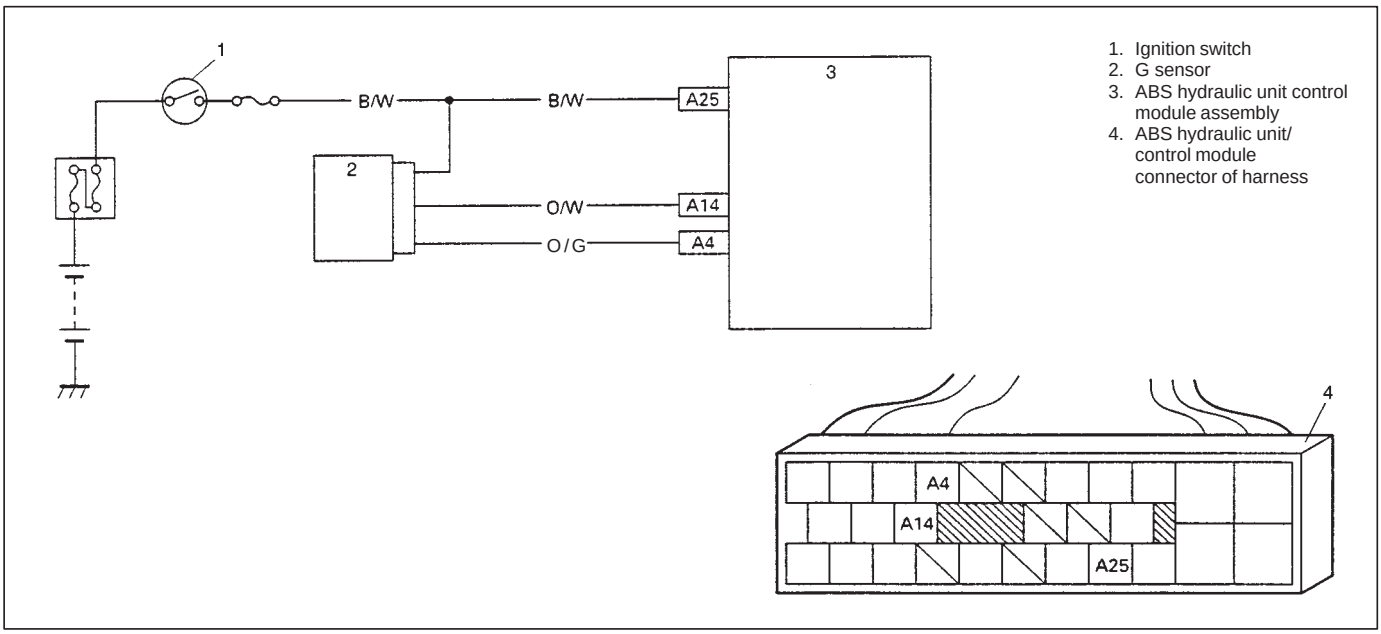
TABLE – E EBD WARNING LAMP (BRAKE WARNING LAMP) CHECK-LAMP COMES "ON" STEADY

CIRCUIT DESCRIPTION

EBD warning lamp (brake warning lamp) is controlled by parking brake switch, brake fluid level switch and ABS control module/hydraulic unit assembly through lamp driver module in combination meter. Refer to "TABLE-A" for circuit diagram.

STEP	ACTION	YES	NO
1	1) Make sure that: ● Parking brake is completely released. ● Brake fluid level is upper than the minimum level. Are the check results OK?	Go to step 2.	Release parking brake completely and/or replenish brake fluid.
2	Does "ABS" warning lamp come on?	Perform "TABLE B" previously outlined.	Go to step 3.
3	1) Disconnect ABS hydraulic unit/control module connector. 2) Check for proper connection to ABS hydraulic unit/control module connector at terminals "A26". 3) If OK, apply chocks to wheels and select gear in neutral position (P range for A/T). 4) Keep brake pedal depressed and start engine. Release parking brake. 5) Connect terminal "A26" of disconnected connector to ground using service wire. Does EBD warning lamp (brake warning lamp) turn off?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	"Br" circuit open. If wire and connection are OK, replace combination meter.

DTC 15 (DTC C1015) – G SENSOR CIRCUIT (FOR 4WD MODEL ONLY)



1. Ignition switch
2. G sensor
3. ABS hydraulic unit control module assembly
4. ABS hydraulic unit/ control module connector of harness

DESCRIPTION

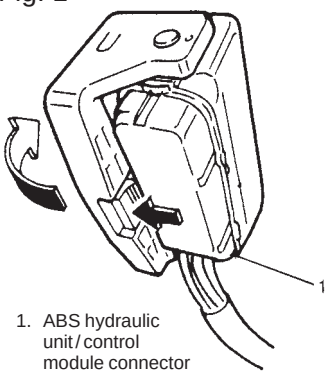
While a vehicle is at stop or running, if the potential difference between the sensor signal terminal “A14” and the sensor ground terminal “A4” is not within the specified voltage value, or if the signal voltage while at a stop does not vary from that while running, this DTC is set.

Therefore, this DTC may be set when a vehicle is lifted up and its wheel(s) is turned. In such case, clear the DTC and check again.

INSPECTION

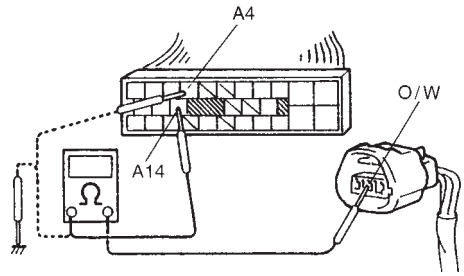
STEP	ACTION	YES	NO
1	Is G sensor installed floor securely?	Go to step 2.	Tighten sensor or bracket screw securely. If not, using new screw.
2	1) Ignition switch OFF. 2) Remove G sensor with bracket. 3) Check for proper connection to G sensor. 4) If OK then check G sensor referring to item INSPECTION of G sensor. Is it in good condition?	Go to step 3.	Replace G sensor.
3	1) Disconnect connectors from ABS hydraulic unit/control module assembly (See Fig. 1) and G sensor. 2) Check for proper connection to ABS control module at terminals “A14” and “A4”. 3) If OK, then turn ignition switch ON and measure voltage between “B/W” terminal of sensor connector and body ground. Is it 10 – 14 V?	Go to step 4.	“B/W” circuit open.
4	Measure voltage between “O/W” terminal of sensor connector and body ground. Is it 0 V?	Go to step 5.	“O/W” circuit shorted to power circuit.
5	1) Ignition switch OFF. 2) Check that “O/W” circuit is free from open or short to ground and “O/G” circuit. Is it in good condition? (See Fig. 2)	“O/G” circuit open. If circuit is OK, substitute a known-good ABS hydraulic unit/control module assembly.	“O/W” circuit open or shorted to ground or “O/G” circuit.

Fig. 1

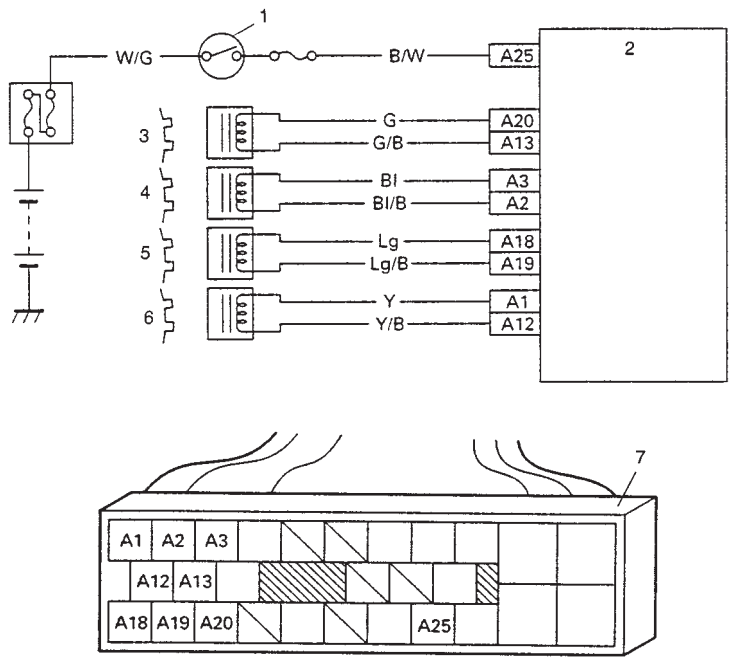


1. ABS hydraulic unit/control module connector

Fig. 2



DTC 21 (DTC C1021), 22 (DTC C1022) – RIGHT-FRONT WHEEL SPEED SENSOR CIRCUIT
25 (DTC C1025), 26 (DTC C1026) – LEFT-FRONT WHEEL SPEED SENSOR CIRCUIT
31 (DTC C1031), 32 (DTC C1032) – RIGHT-REAR WHEEL SPEED SENSOR CIRCUIT
35 (DTC C1035), 36 (DTC C1036) – LEFT-REAR WHEEL SPEED SENSOR CIRCUIT



1. Ignition switch
2. ABS hydraulic unit / control module assembly
3. Left-front wheel speed sensor
4. Right-front wheel speed sensor
5. Left-rear wheel speed sensor
6. Right-rear wheel speed sensor
7. ABS hydraulic unit / control connector of harness

DESCRIPTION

The ABS control module monitors the voltage at the positive (+) terminal of each sensor while the ignition switch is ON. When the voltage is not within the specified range, an applicable DTC will be set. Also, when no sensor signal is inputted at starting or while running, an applicable DTC will be set.

NOTE:

When the vehicle was operated in any of the following ways, one of these DTC's may be set even when the sensor is in good condition. If such possibility is suspected, repair the trouble (dragging of brake, etc.) of the vehicle, clear DTC once and then after performing the driving test as described in Step 2 of "ABS DIAG. FLOW TABLE", check whether or not any abnormality exists.

– The vehicle was driven with parking brake pulled.
– The vehicle was driven with brake dragging.
– Wheel spin occurred while driving.
– Wheel(s) was turned while the vehicle was jacked up.
– The vehicle was stuck.

INSPECTION

STEP	ACTION	YES	NO
1	1) Disconnect the applicable sensor connector with ignition switch OFF. 2) Measure resistance between sensor terminals. Resistance of wheel speed sensor: 1.2 – 1.6 kΩ (at 20°C, 68°F) 3) Measure resistance between each terminal and body ground. Insulation resistance: 1MΩ or higher Were measured resistance values in step 2) and 3) as specified? (See Fig. 1)	Go to step 2.	Replace sensor.
2	1) Ignition switch OFF. 2) Disconnect connector from ABS hydraulic unit/control module assembly. (See Fig. 2) 3) Check for proper connection to ABS hydraulic unit/control module assembly at each sensor terminal. 4) If OK then, turn ignition switch ON and measure voltage between sensor positive terminal of module connector and body ground. Is it 0 V?	Go to step 3.	Sensor positive circuit shorted to power.
3	1) Ignition switch OFF. 2) Connect connector to sensor. 3) Measure resistance between sensor terminals at module connector. 4) Measure resistance between sensor positive terminal and negative terminal of module connector, between positive terminal and body ground. Are measured resistance values within each specified range described in above step 1?	Go to step 4.	Circuit open or shorted to ground.
4	1) Remove wheel speed sensor. 2) Check sensor for damage or foreign material being attached. Is it in good condition? (See Fig. 3)	Go to step 5.	Clean or replace sensor.
5	Check visually through wheel speed sensor installation hole for following. ● Rotor neither missing or damaged. ● No foreign material being attached. ● Rotor not being eccentric. ● Wheel bearing free from excessive play. Are they in good condition? (See Fig. 4)	Go to step 6.	Clean, repair or replace.
6	1) Install sensor to knuckle or axle housing. 2) Tighten sensor bolt to specified torque and check that there is not any clearance between sensor and knuckle or axle housing. (See Fig. 5) Replace sensor if any. Referring to item OUTPUT VOLTAGE INSPECTION of FRONT WHEEL SPEED SENSOR, check output voltage or waveform of sensor. Is proper output voltage or waveform obtained?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	Replace sensor and recheck.

Fig. 1

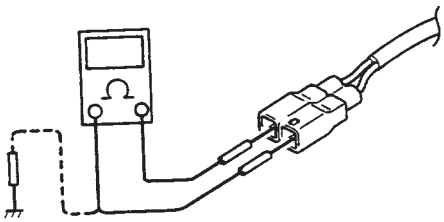
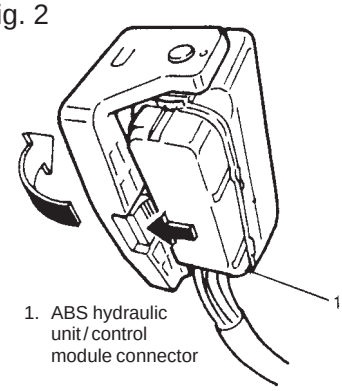


Fig. 2



1. ABS hydraulic unit / control module connector

Fig. 3

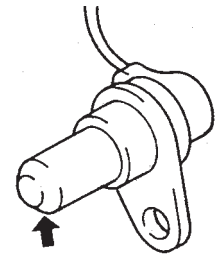


Fig. 4

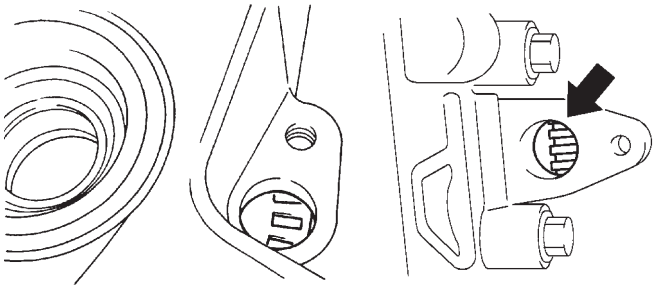
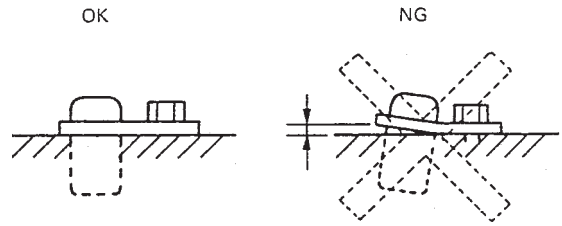
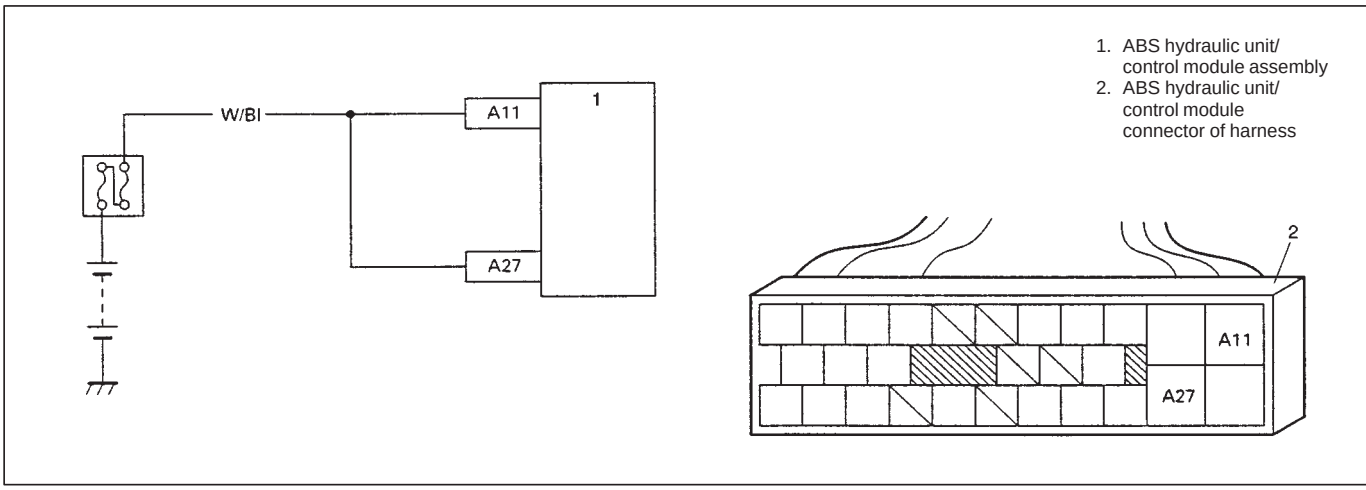


Fig. 5



DTC 41 (DTC C1041/C1042) – RIGHT-FRONT SOLENOID CIRCUIT
45 (DTC C1045/C1046) – LEFT-FRONT SOLENOID CIRCUIT
56 (DTC C1055/C1056) – REAR SOLENOID CIRCUIT



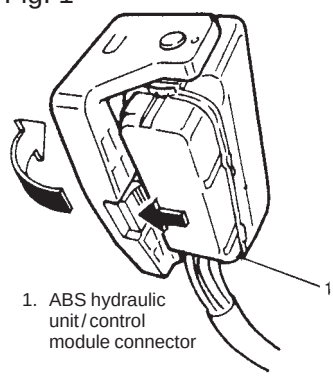
DESCRIPTION

The ABS control module monitors the voltage of the terminal of the solenoid circuit constantly with the ignition switch turned ON. It sets this DTC when the terminal voltage does not become low/high for the ON/OFF command to the solenoid or the voltage difference between solenoid circuit terminals exceeds the specified value with the solenoid turned OFF.

INSPECTION

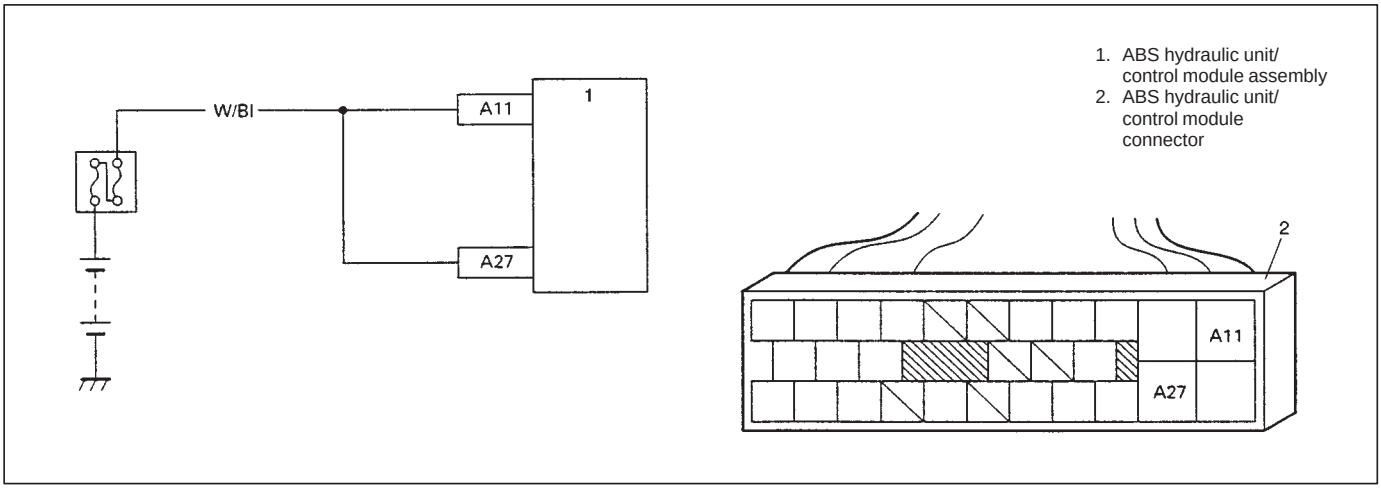
STEP	ACTION	YES	NO
1	1) Check solenoid referring to item "ABS HYDRAULIC UNIT OPERATION CHECK" in this section. Is it in good condition?	Check terminals "A11" and "A27" connection. If connections OK, substitute a known-good ABS hydraulic unit/control module assembly and recheck.	Go to step 2.
2	1) Ignition switch OFF. 2) Disconnect ABS hydraulic unit/control module connector. (See Fig. 1) 3) Check for proper connection to ABS hydraulic unit/control module connector at terminal "A11". 4) If OK, then measure voltage between terminal "A11" of module connector and body ground. Is it 10 – 14 V?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	"W/Bl" circuit open.

Fig. 1



1. ABS hydraulic unit/control module connector

DTC 57 (DTC C1057) – SOLENOID AND PUMP MOTOR POWER SOURCE CIRCUIT



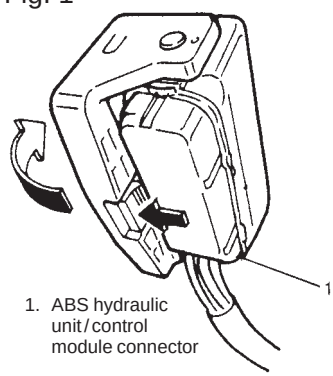
DESCRIPTION

The ABS control module monitors the voltage at terminal (“A11” and “A27”) of the fail-safe and pump motor relays circuit constantly with the ignition switch turned ON. When all solenoid circuit voltages are below the specified value or the voltage at the terminal “A27” became below the specified value while the pump motor is operating, this DTC will be set. As soon as the voltage rises to the specified level, the set DTC will be cleared.

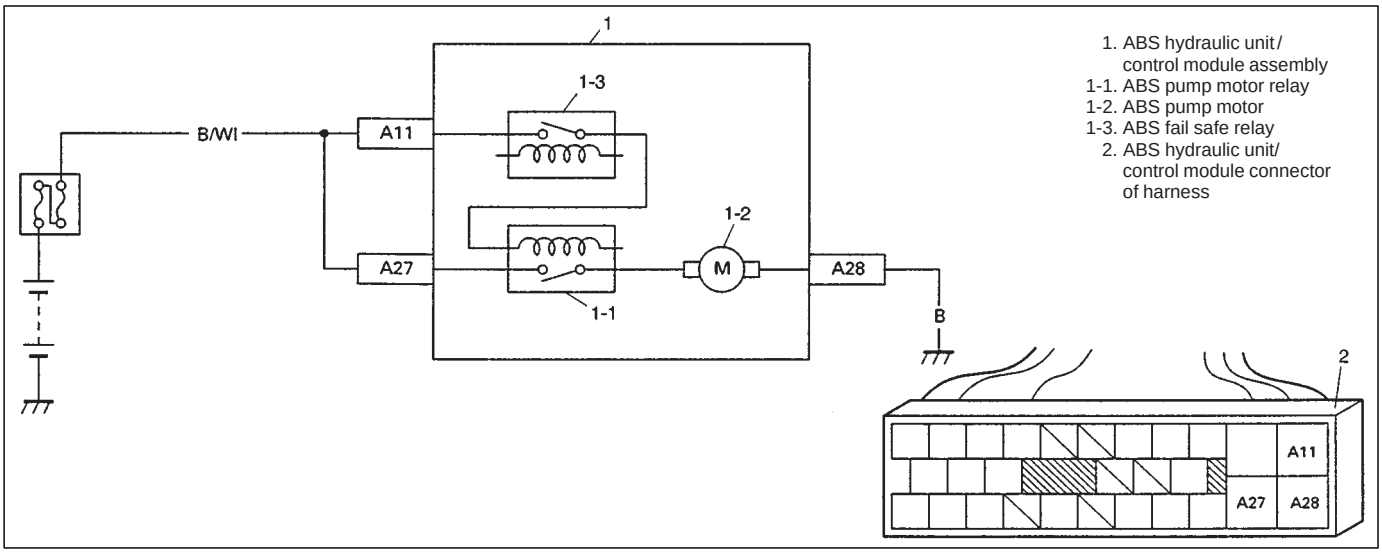
INSPECTION

STEP	ACTION	YES	NO
1	Check battery voltage. Is it about 11 V or higher?	Go to step 2.	Check charging system referring to “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. (See Fig. 1) 3) Check proper connection to ABS hydraulic unit/ control module connector at terminal “A27”. 4) If OK, then measure voltage between connector terminal “A27” and body ground. Is it 10 – 14 V?	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.	“W/Bl” circuit open.

Fig. 1



DTC 61 (DTC C1061) – ABS PUMP MOTOR CIRCUIT



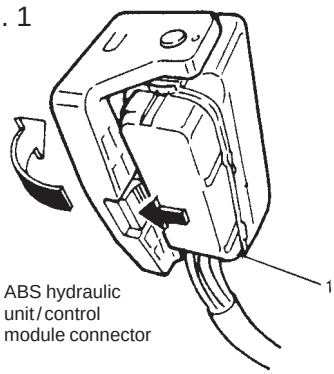
DESCRIPTION

The ABS control module monitors the voltage at the monitor terminal of the 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

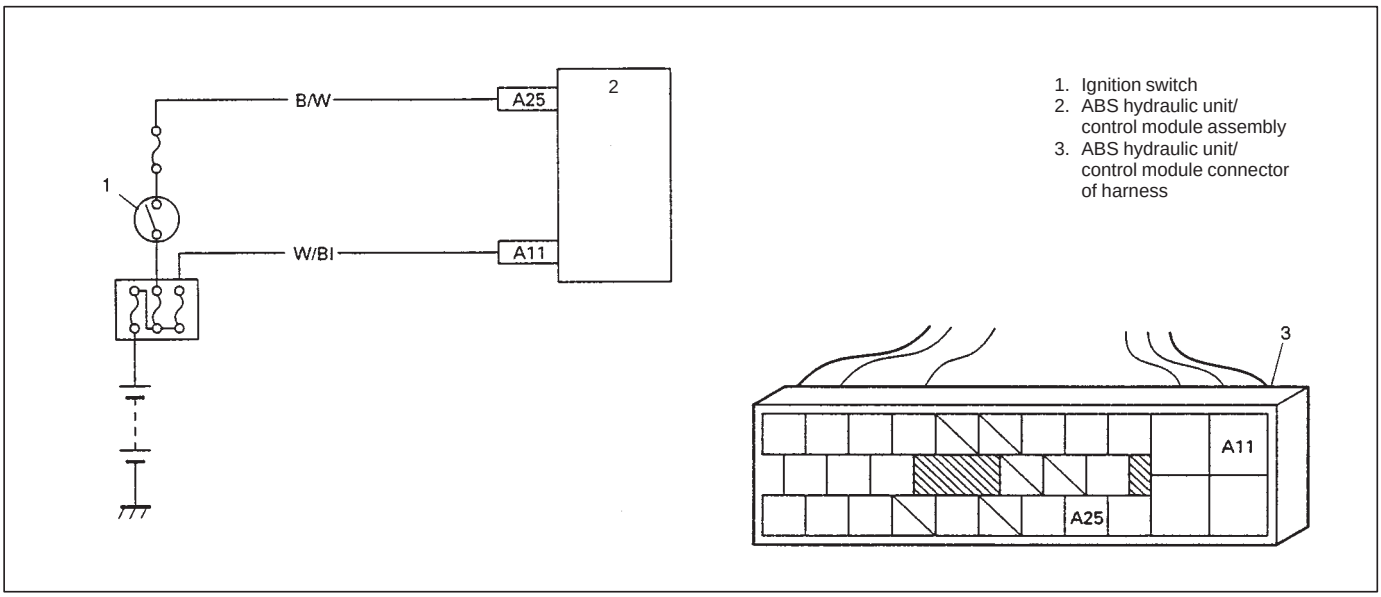
STEP	ACTION	YES	NO
1	1) Check pump motor referring to item "ABS HYDRAULIC UNIT OPERATION CHECK" in this section. Is it in good condition?	Check terminals "A11" and "A27" connection. If connections OK, substitute a known-good ABS hydraulic unit/control module assembly and recheck.	Go to step 2.
2	1) Ignition switch OFF. 2) Disconnect ABS hydraulic unit/control module connector. (See Fig. 1) 3) Check for proper connection to ABS hydraulic unit/control module connector at terminal "A27". 4) If OK, then measure voltage between terminal "A27" of module connector and body ground. Is it 10 – 14 V?	Go to step 3.	"W/Bl" circuit open.
3	Measure resistance between connector terminal "A28" of ABS hydraulic unit/control module assembly. Is it infinite (∞)?	"B" circuit open.	Substitute a known-good ABS hydraulic unit/control module assembly and recheck.

Fig. 1



1. ABS hydraulic unit/control module connector

DTC 63 (DTC C1063) – ABS FAIL-SAFE RELAY CIRCUIT



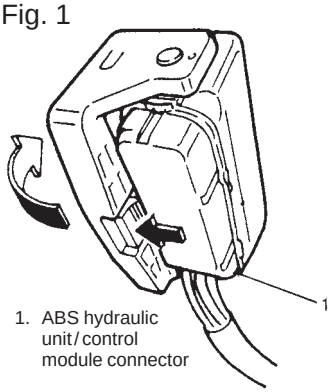
DESCRIPTION

The ABS control module monitors the voltage at the terminal of the solenoid circuit constantly with the ignition switch turned ON. Also, immediately after the ignition switch is turned "ON", perform an initial check as follows. Switch the fail-safe relay in the order of ON → OFF → ON and check if the voltage at 6 solenoid circuit terminals changes to High → Low → High. If anything faulty is found in the initial check and when the voltage at all solenoid circuit terminals is low with the ignition switch turned ON and ABS not operated, this DTC will be set.

INSPECTION

STEP	ACTION	YES	NO
1	Check battery voltage. Is it about 11 V or higher?	Go to step 2.	Check charging system referring to "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. (See Fig. 1) 3) Check proper connection to ABS hydraulic unit/ control module at terminal "A11". 4) If OK, then measure voltage between connector terminal "A11", and body ground. Is it 10 – 14 V?	Substitute a known-good ABS hydraulic unit/ control module assembly and recheck.	"W/Bl" circuit open or short to ground.

Fig. 1



1. ABS hydraulic unit/control module connector

DTC 71 (DTC C1071) – ABS CONTROL MODULE

DESCRIPTION

This DTC will be set when an internal fault is detected in the ABS control module.

INSPECTION

STEP	ACTION	YES	NO
1	1) Ignition switch OFF. 2) Disconnect connectors from ABS control module. 3) Check for proper connection to ABS control module at all terminals. Are they in good condition?	Substitute a known-good ABS control module and recheck.	Repair or replace.

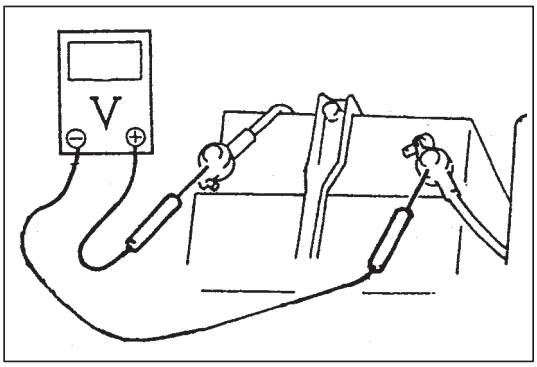
ON-VEHICLE SERVICE

PRECAUTION

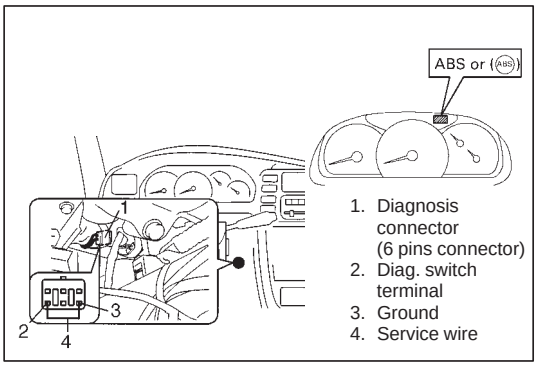
When connector are connected to ABS hydraulic unit/control module assembly, do not disconnect connectors of sensors and turn ignition switch ON. Then DTC will be set in ABS control module.

ABS HYDRAULIC UNIT OPERATION CHECK

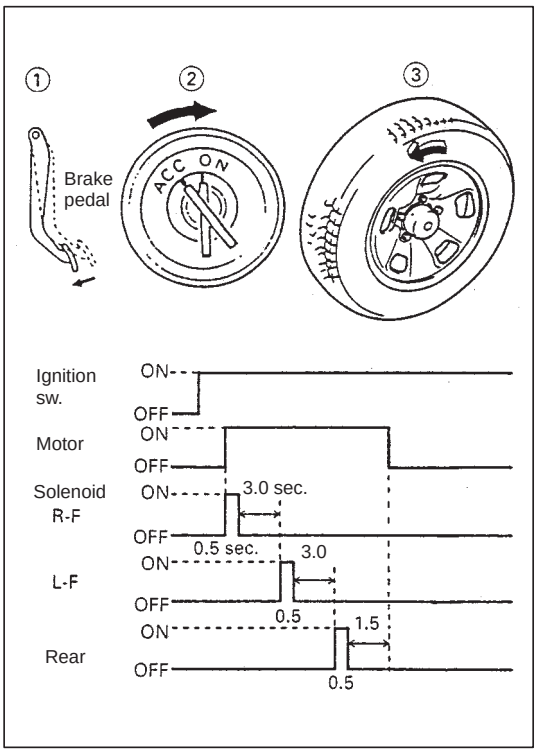
1) Check that basic brake system other than ABS is in good condition.



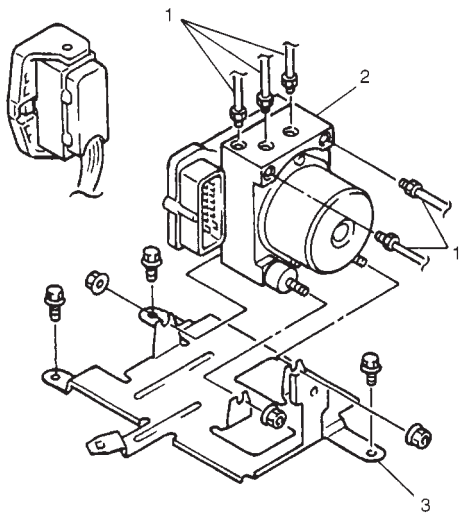
2) Check that battery voltage is 11V or higher.
3) With "ABS" warning lamp, check that no abnormality is detected in ABS. Refer to "DIAGNOSTIC TROUBLE CODE (DTC) CHECK" in this section.
4) Lift up vehicle.
5) Set transmission to neutral and release parking brake.
6) Turn each wheel gradually by hand to check if brake dragging occurs. If it does, correct.



7) With diag. switch terminal of diagnosis connector connected to ground by using service wire, turn ignition switch ON and check if "ABS" warning lamp indicates DTC 12.
8) Turn ignition switch OFF.



9) Perform following checks with help of another person.
   Brake pedal should be depressed and then ignition switch turned ON by one person and wheel 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 diagnosis connector.



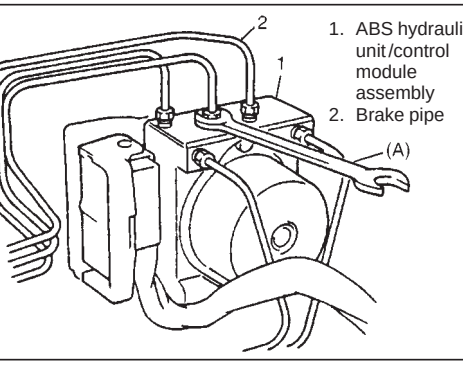
1. Brake pipe
2. ABS hydraulic unit/ control module assembly
3. Bracket

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.

HYDRAULIC UNIT INSPECTION

- Check hydraulic unit for fluid leakage.
  If any, repair or replace.



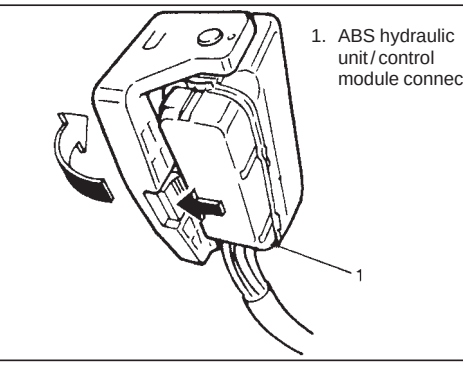
1. ABS hydraulic unit/control module assembly
2. Brake pipe

REMOVAL

1) Disconnect negative cable at battery.
2) Using special tool, disconnect brake pipes from ABS hydraulic unit/control module assembly and loosen flare nuts as shown figure.

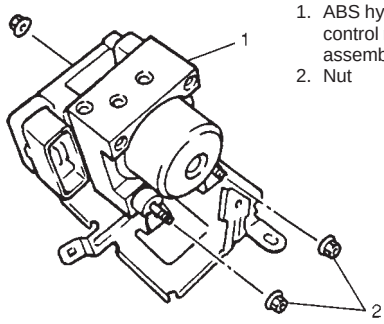
   Special Tool
   (A): 09950-78220

   NOTE:
   Put bleeder plug cap onto pipe to prevent fluid from spilling. Do not allow brake fluid to get on painted surfaces.



1. ABS hydraulic unit/ control module connector

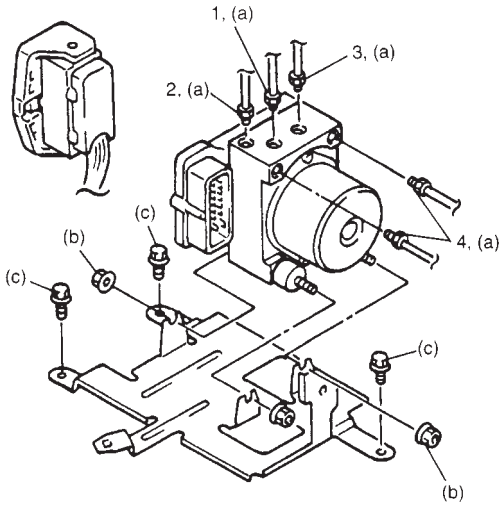
3) Disconnect ABS hydraulic unit/control module assembly connector.



1. ABS hydraulic unit/control module assembly
2. Nut

4) Remove three nuts and take out ABS hydraulic unit/control module assembly from bracket.

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.**



1. To left-front
2. To right-front
3. To rear
4. From master cylinder

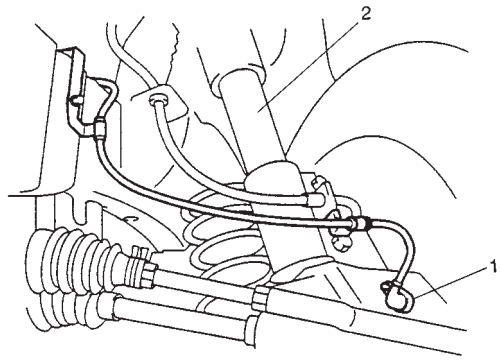
INSTALLATION

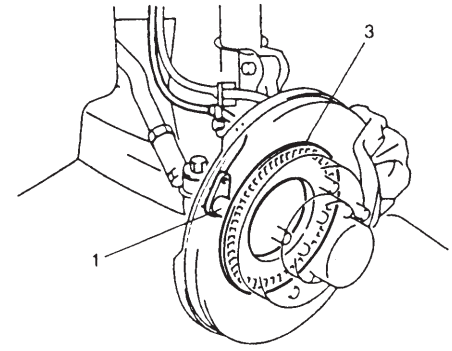
1) Install hydraulic unit by reversing removal procedure.

Tightening Torque
(a): 16 N·m (1.6 kg-m, 12.0 lb-ft)
(b): 21 N·m (2.1 kg-m, 15.5 lb-ft)
(c): 10 N·m (1.0 kg-m, 7.5 lb-ft)

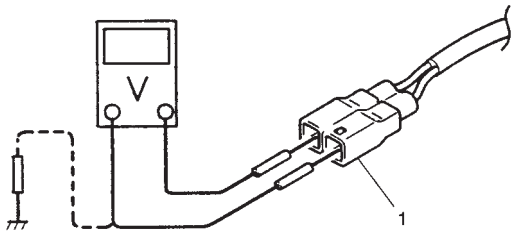
2) Bleed air from brake system. Refer to “BLEEDING BRAKES” in Section 5.
3) Check each installed part for fluid leakage and perform hydraulic unit operation check.

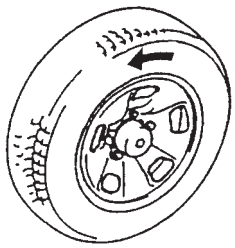
FRONT WHEEL SPEED SENSOR





1. Left front wheel speed sensor
2. Left front strut
3. Sensor rotor





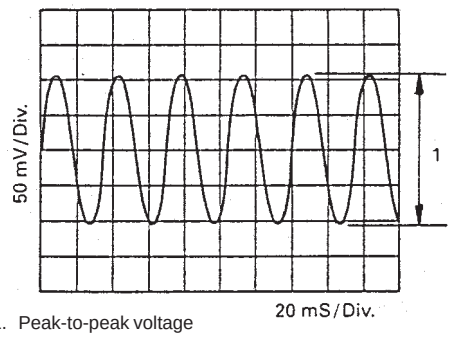
1. Wheel speed sensor connector

OUTPUT VOLTAGE INSPECTION

1) Turn ignition switch OFF.
2) Hoist vehicle a little.
3) Disconnect connector of wheel speed sensor.
4) Connect voltmeter between connector terminals.
5) While turning wheel at a speed of approximately 2/3 to 1 full rotation per second, check AC voltage of sensor.

Output AC voltage at 2/3 to
one rotation per second (35 – 53 Hz): 106 mV or more

If measured voltage is not as specified, check sensor, rotor and their installation conditions.

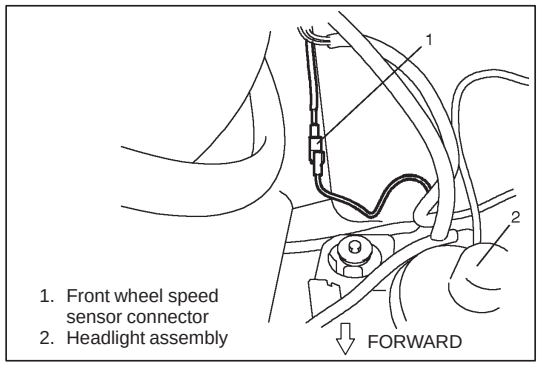


1. Peak-to-peak voltage

Reference

When using oscilloscope for this check, check if peak-to-peak voltage meets specification and waveform is complete.

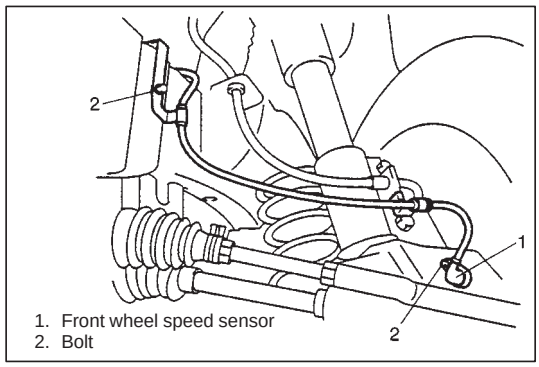
Peak-to-peak voltage
at 2/3 to one rotation per second (35 – 53 Hz): 150 mV or more



1. Front wheel speed sensor connector
2. Headlight assembly

REMOVAL

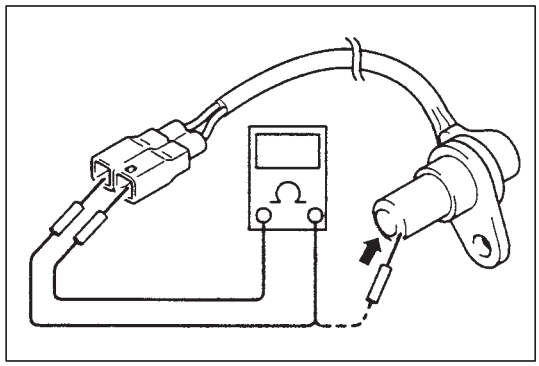
1) Disconnect negative cable at battery.
2) Hoist vehicle and remove wheel.
3) Disconnect front wheel speed sensor connector.



1. Front wheel speed sensor
2. Bolt

4) Remove harness clamp bolts and remove front wheel speed sensor 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.**

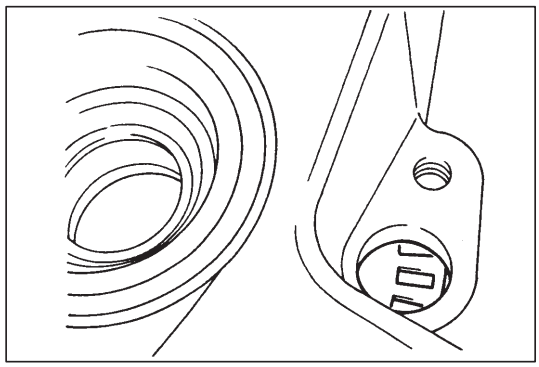


SENSOR INSPECTION

- Check sensor for damage.
- Check sensor for resistance.

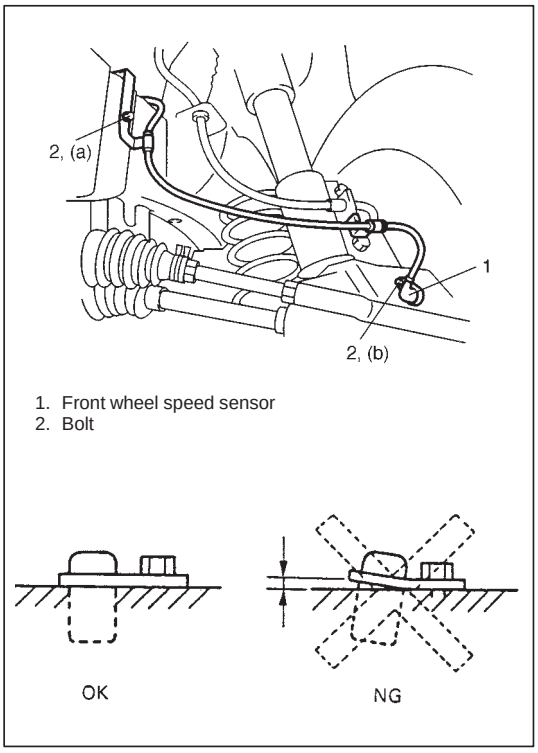
Resistance between terminals: 1.2 – 1.6 kΩ at 20°C (68°F)
Resistance between terminal and sensor body: 1 MΩ or more

If any faulty is found, replace.



SENSOR ROTOR INSPECTION

- Check rotor for being missing, damaged or deformed.
- Turn drive shaft and check if rotor rotation is free from eccentricity and looseness.
- Check that no foreign material is attached.
  If any faulty is found, repair or replace. Refer to WHEEL HUB REMOVAL and INSTALLATION in Section 3D.



1. Front wheel speed sensor
2. Bolt

INSTALLATION

1) Check that no foreign material is attached to sensor and rotor.
2) Install it by reversing removal procedure.

CAUTION:
- **Do not pull wire harness or twist more than necessary when installing front wheel speed sensor.**
- **Fit harness grommet to inner fender securely.**

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)

3) Check that there is no clearance between sensor and knuckle.

FRONT SENSOR ROTOR

REMOVAL

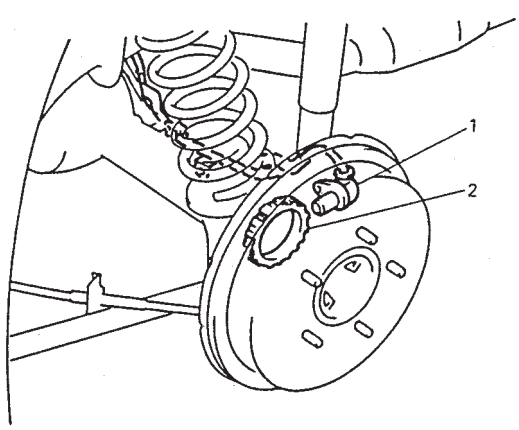
Remove front sensor rotor referring to WHEEL HUB REMOVAL in Section 3D.

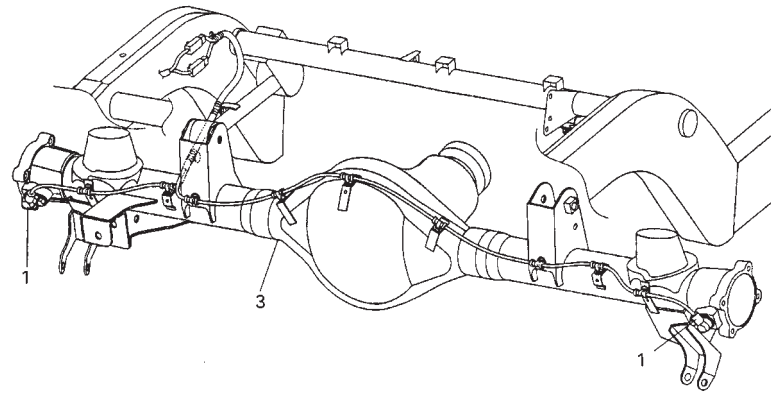
INSTALLATION

CAUTION:
Don't reuse front sensor rotor removed from front wheel hub because of it for being deformed.

Install new front sensor rotor referring to WHEEL HUB INSTALLATION in Section 3D.

REAR WHEEL SPEED SENSOR





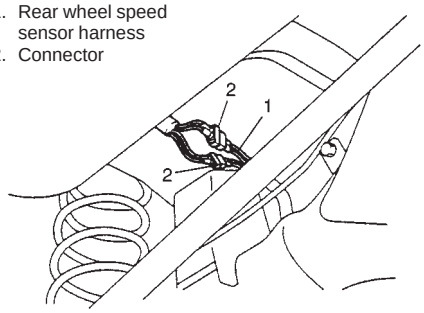
1. Rear wheel speed sensor
2. Sensor rotor
3. Rear axle housing

OUTPUT VOLTAGE INSPECTION

Check in the same procedure as that used of front wheel speed sensor check.

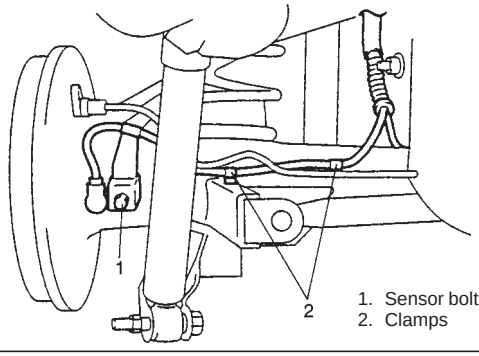
Output AC voltage at 2/3 to
one rotation per second (25 – 38 Hz): 106 mV or more
Reference
When using oscilloscope,
peak-to-peak voltage at 2/3 to
one rotation per second (25 – 38 Hz): 150 mV or more

1. Rear wheel speed sensor harness
2. Connector



REMOVAL

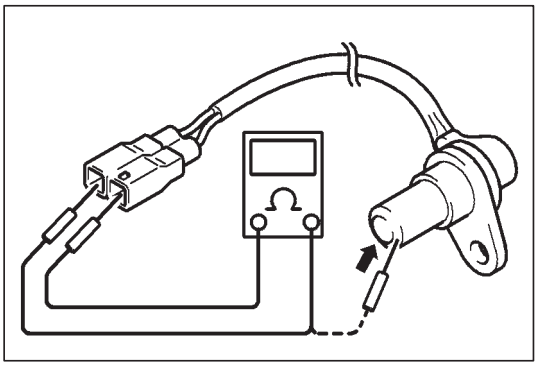
1) Disconnect negative cable at battery.
2) Hoist vehicle.
3) Disconnect rear wheel speed sensor connector and detach wire harness from vehicle body and rear axle.



1. Sensor bolt
2. Clamps

4) Remove harness clamps and remove rear wheel speed sensor from rear axle.

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.**



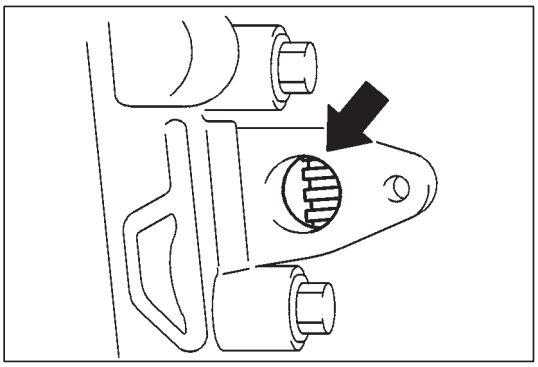
SENSOR INSPECTION

- Check sensor (pole piece) for damage or bent.
- Check sensor for resistance.

Resistance between terminals : 1.2 – 1.6 kΩ at 20°C, 68°F

Resistance between terminal and sensor body: 1 MΩ or more

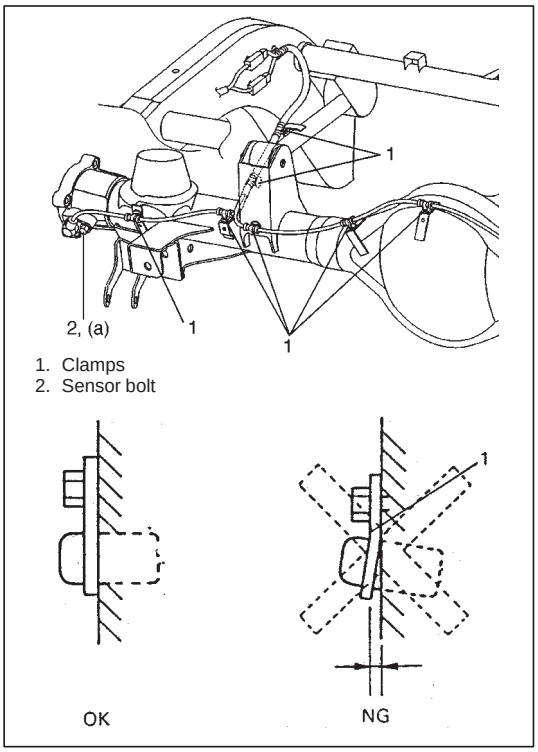
If any faulty is found, replace.



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 faulty is found, repair or replace.



INSTALLATION

1) Check that no foreign material is attached to sensor and rotor.
2) Install it by reversing removal procedure.

Tightening Torque
(a): 21 N·m (2.1 kg-m, 15.0 lb-ft)

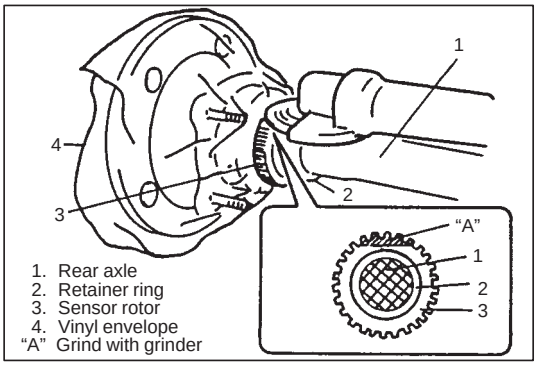
CAUTION:
Do not pull wire harness or twist more than necessary when installing rear wheel speed sensor.

3) Check that there is no clearance between sensor and knuckle.

REAR SENSOR ROTOR

REMOVAL

1) Remove rear axle shaft. Refer to REAR AXLE SHAFT REMOVAL in Section 3E.

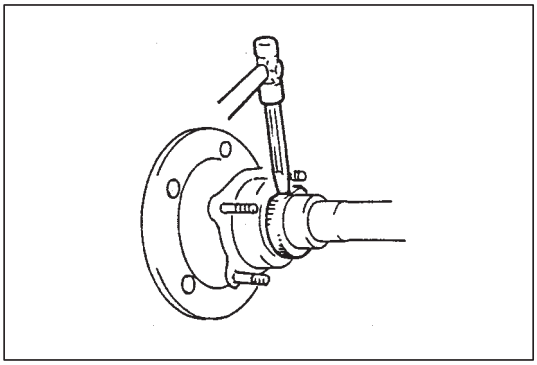


1. Rear axle
2. Retainer ring
3. Sensor rotor
4. Vinyl envelope

"A" Grind with grinder

2) In order to remove sensor rotor from retainer ring, grind with a grinder one part of the sensor rotor as illustrated till it becomes thin.

CAUTION:
- **Cover vinyl sheet or the like over wheel bearing so that fine grains from grinding will not enter there.**
- **Be careful not to go so far as to grind the retainer ring.**

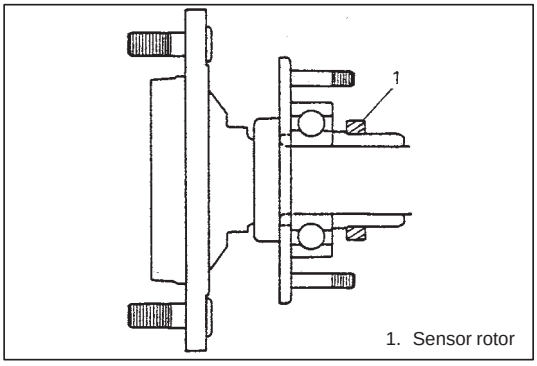


3) Break with a chisel the thin ground sensor rotor, and it can be removed.

INSTALLATION

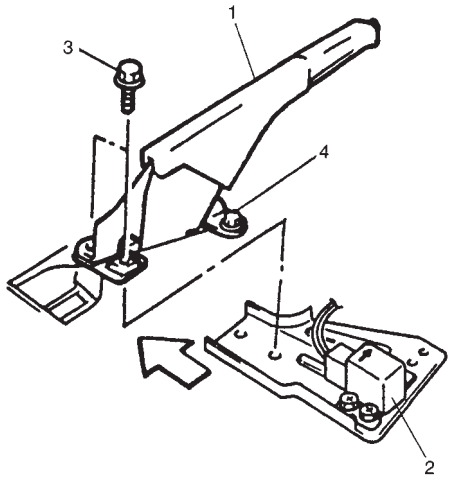
1) Press-fit sensor rotor as shown.

NOTE:
Use care not to cause any damage to outside of retainer ring.



1. Sensor rotor

2) Install rear axle shaft. Refer to REAR AXLE SHAFT INSTALLATION in Section 3E.



1. Parking brake lever ass'y
2. G sensor
3. Bolt "1"
4. Bolt "2"

G SENSOR (FOR 4WD MODEL ONLY)

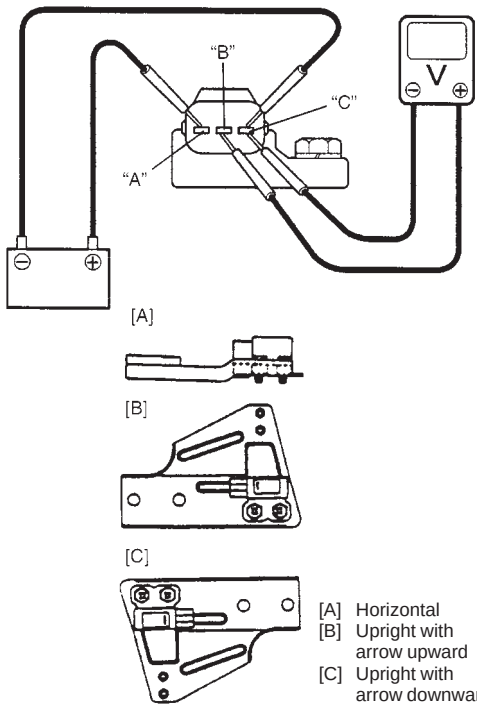
REMOVAL

1) Turn ignition switch OFF and disconnect battery negative cable.
2) Remove rear center console box.
3) Remove parking brake lever bolts "1" and G sensor with bracket from floor.

NOTE:
Loosen only bolt "2".

4) Remove sensor with bracket from floor.
5) Disconnect connector from sensor.

CAUTION:
- **Do not separate sensor and bracket. It will lead to erroneous assembly.**
- **Sensor must not be dropped or shocked. It will affect its original performance.**



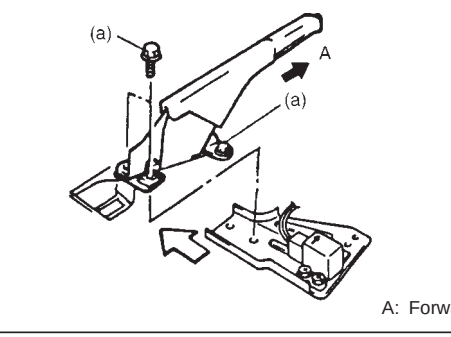
[A] Horizontal
[B] Upright with arrow upward
[C] Upright with arrow downward

INSPECTION

1) Check sensor bracket for bend.
2) Connect positive cable of 12 volt battery to "A" terminal of sensor and ground cable to "C" terminal. Then using voltmeter, check voltage between "B" terminal and "C" terminal.

When placed horizontally: 2 – 3 V
When placed upright with arrow upward: 3 – 4 V
When placed upright with arrow downward: 1 – 2 V

If measured voltage is not as specified, replace sensor with bracket.



A: Forward

INSTALLATION

1) Connect connector to sensor securely.
2) Install sensor with bracket and parking lever assy onto floor so that arrow mark directs vehicle forward.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

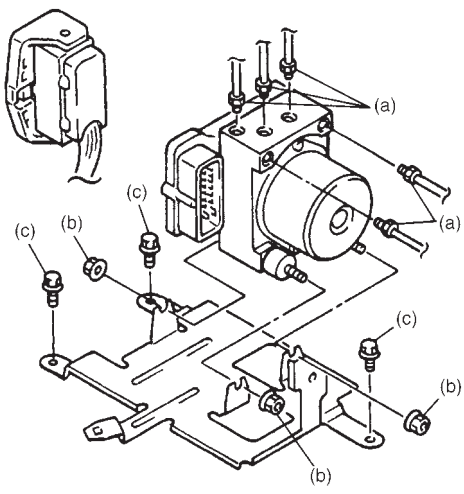
3) Install rear console box.

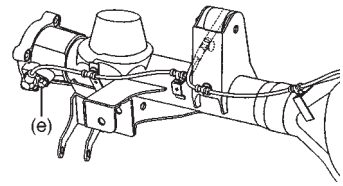
TRANSFER 4WD SWITCH

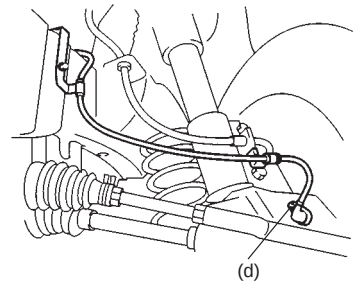
For removal, inspection and installation of this switch, refer to SWITCHES in Section 7A.

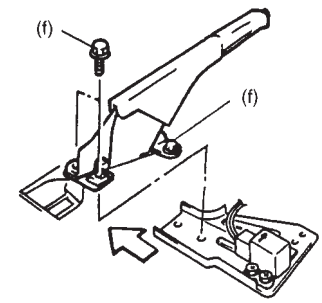
TIGHTENING TORQUE SPECIFICATIONS

Fastening parts		Tightening torque		
		N·m	kg-m	lb-ft
Brake pipe flare nut: (a)		16	1.6	11.5
ABS hydraulic unit nut: (b)		21	2.1	15.5
ABS hydraulic unit bracket bolt: (c)		10	1.0	7.5
Wheel speed sensor bolt	(Front): (d)	23	2.3	17.0
	(Rear): (e)	21	2.1	15.5
Parking lever assy mounting bolt: (f)		23	2.3	17.0



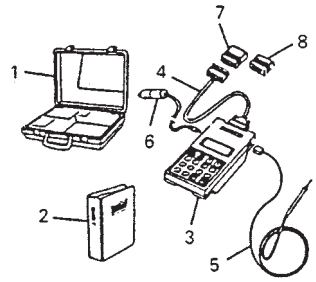






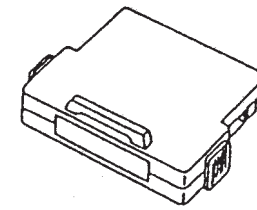
SPECIAL TOOLS

09950-78220
Flare nut wrench
(10 mm)

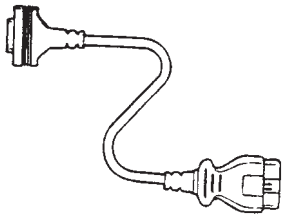


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable
5. Test lead / probe
6. Power source cable
7. DLC cable adapter
8. Self-test adapter

09931-76011
SUZUKI scan tool (Tech 1A) kit



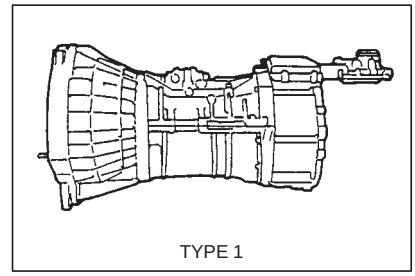
Mass storage cartridge



09931-76030
16 / 14 pin DLC cable

SECTION 7A

MANUAL TRANSMISSION (TYPE 1)



TYPE 1

CONTENTS

GENERAL DESCRIPTION 7A- 1
DIAGNOSIS 7A- 2
ON-VEHICLE SERVICE 7A- 3
Gear Oil 7A- 3
Shift Control Levers 7A- 4
Switches 7A- 6
Engine Rear Mounting 7A- 8
Dismounting of Trans. Unit 7A- 9
Remounting of Trans. Unit 7A-12
Extension Case (2WD MODEL) 7A-13
Extension Case Oil Seal (2WD MODEL) 7A-13
UNIT REPAIR 7A-14
TIGHTENING TORQUE SPECIFICATIONS 7A-14
REQUIRED SERVICE MATERIALS 7A-14
SPECIAL TOOL 7A-14

GENERAL DESCRIPTION

The manual transmission consists of the input shaft, main shaft, countershaft and reverse gear which are installed in the aluminum case. Its gears are of forward five speeds in synchro mesh and reverse one speed in constant mesh system.

The main shaft gears are held by the needle bearings and on them the synchronizer rings and synchronizer sleeve & hubs are assembled.

The gear shift lever case is located at the upper behind the transmission case and has a cam which prevents direct gear shift from the 5th speed gear to the reverse gear.

As the aluminum case is sealed with liquid type gasket, it is necessary to use genuine sealant or its equivalent on its mating surfaces when reassembling it. Also, the case fastening bolts must be tightened to specified torque by means of the torque wrench and tightening over or below the specified torque should be avoided.

The description under ON-VEHICLE SERVICE in this section covers a part of the TYPE 2 manual transmission and the transfer. The transfer is next to the transmission as well, but their gear boxes are independent and each of them has its own drain and level/filler plugs for the oil change or the level check.
For the repair procedure of the transfer unit, refer to Section 7D.

DIAGNOSIS

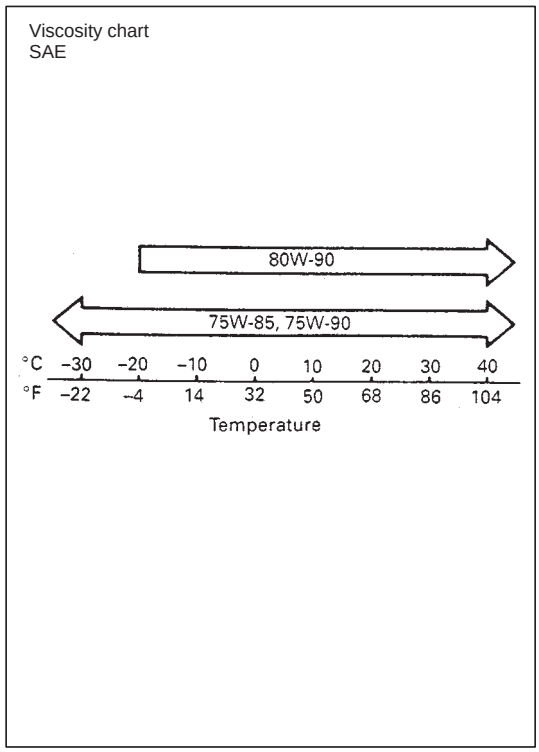
Condition	Possible Cause	Correction
Gear slipping out of mesh	● Worn shift fork shaft	Replace
	● Worn shift fork or synchronizer sleeve	Replace
	● Weak or damaged locating spring	Replace
	● Worn bearings on input shaft or main shaft	Replace
	● Worn chamfered tooth on sleeve or gear	Replace sleeve and gear
	● Missing or disengagement of circlip(s)	Install
Gears refusing to disengage	● Weakened or broken synchronizer spring	Replace
	● Distorted shift shaft or shift fork	Replace
Hard shifting	● 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 and gear
	● Distorted shift shaft	Replace
Noise	● Inadequate or insufficient lubricant	Replenish
	● Damaged or worn bearing(s)	Replace
	● Damaged or worn gear(s)	Replace
	● Damaged or worn synchronizer ring	Replace
	● Damaged or worn chamfered tooth on sleeve or gear	Replace

ON-VEHICLE SERVICE

GEAR OIL

INSPECTION AND CHANGE

1) Before changing or inspecting oil, be sure to stop engine and lift vehicle horizontally.
2) With vehicle lifted up, check oil level and leakage. If leakage exists, correct or repair it.

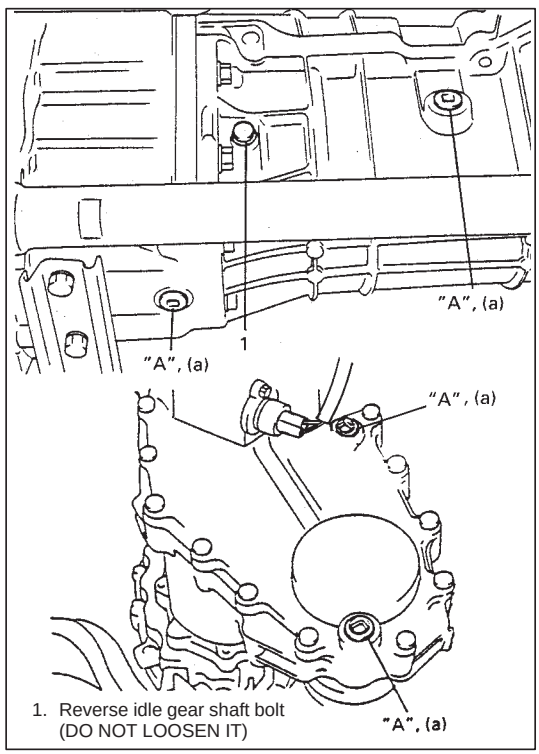


3) Drain old oil and fill new specified oil as shown below by specified amount (roughly up to level hole).

NOTE:
- **It is highly recommended to use SAE 75W-90 gear oil.**
- **Whenever vehicle is hoisted for any other service work than oil change, also be sure to check for oil leakage and status of breather hoses.**
- **If water or rust is mixed in drained oil, be sure to check breather hose and boot of transmission and transfer.**

Gear Oil Specification
Oil grade: API GL-4
Viscosity: SAE 75W-85, 75W-90 or 80W-90

Oil Capacity:
Transmission 1.5 liters (3.2/2.6 US/Imp. pt)
Transfer 1.7 liters (3.6/3.0 US/Imp. pt)



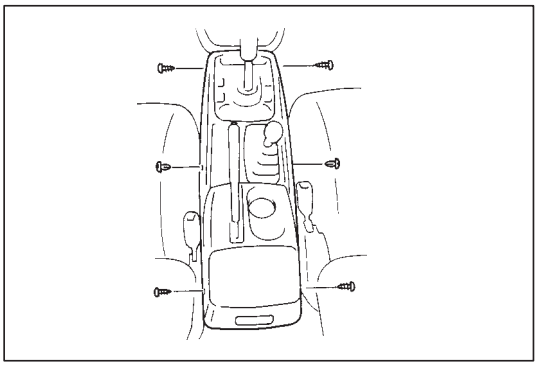
1. Reverse idle gear shaft bolt (DO NOT LOOSEN IT)

4) Torque drain plug and level/filler plug as specified below after applying sealant to its thread.

CAUTION:
- **Transmission oil must not be poured through gear shift control lever part.**
- **Do not loosen or remove reverse idle gear shaft bolt.**

"A": Sealant 99000-31110

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

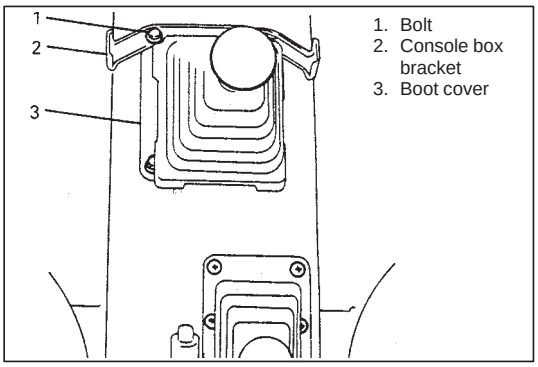


SHIFT CONTROL LEVERS

REMOVAL

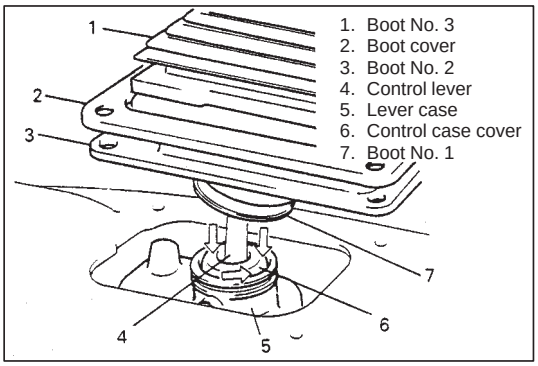
1) Remove 4 screws at the front and rear and 2 clips at the center then take off front and rear center console boxes.

NOTE:
To remove clip, push in its center pin first.



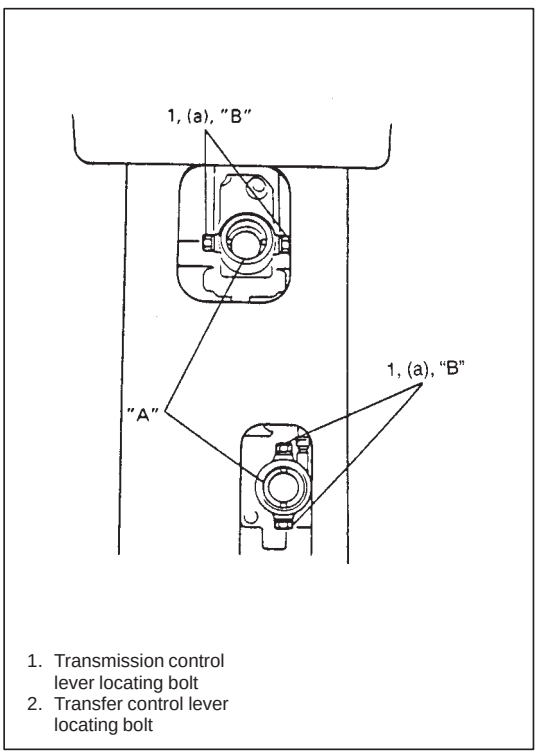
1. Bolt
2. Console box bracket
3. Boot cover

2) Remove console box bracket by removing bolts and lift up boot cover and boot No. 2.
3) Remove boot clamp and then remove boot No. 1 from transmission shift lever case.



1. Boot No. 3
2. Boot cover
3. Boot No. 2
4. Control lever
5. Lever case
6. Control case cover
7. Boot No. 1

4) With gear shift control case cover pushed down with fingers, turn it to counter clockwise and take out shift control lever.
5) Take out transfer shift control lever in similar manner as described above.



1. Transmission control lever locating bolt
2. Transfer control lever locating bolt

INSPECTION AND INSTALLATION

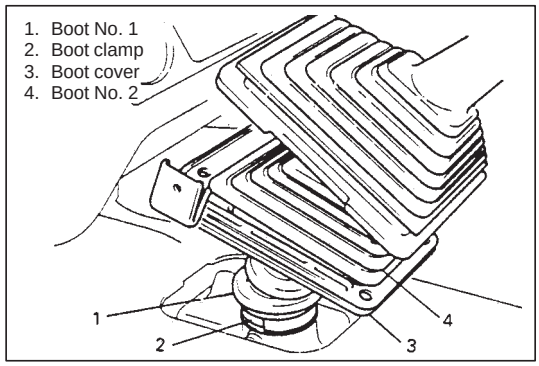
1) Check shift control lever lower portion and control lever locating sheet for excessive wear, and boot for damage. Correct or replace if necessary.
2) Apply grease to pivot portions and seat, then install shift control lever.

"A": Grease 99000-25010

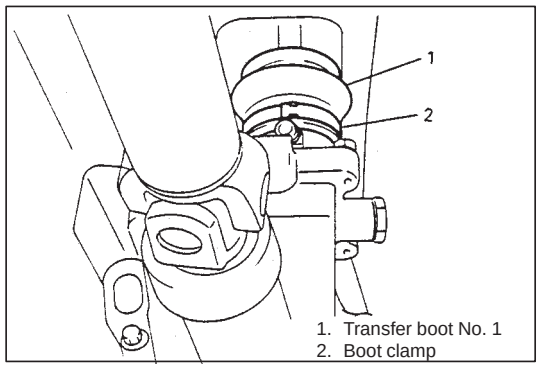
3) Perform above steps also for transfer shift control lever.
4) If control lever locating bolts (a) are replaced or retightened, torque them as specified below.
Replacing of control lever locating bolts requires thread lock cement.

"B": Cement 99000-32020

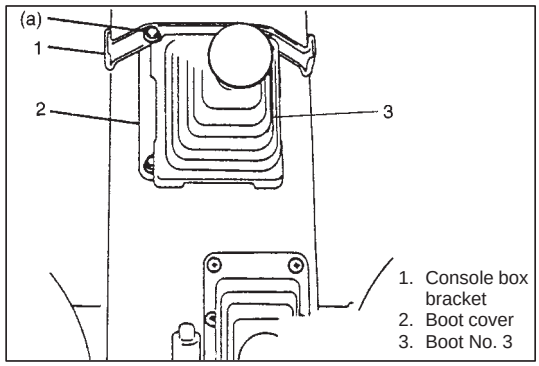
Tightening Torque
(a): 17 N·m (1.7 kg-m, 12.5 lb-ft)



5) Install transmission boot No. 1 from inside of cabin and clamp it with a new clamp securely.



6) Install transfer boot No. 1 securely on lift and clamp it by using a new clamp.

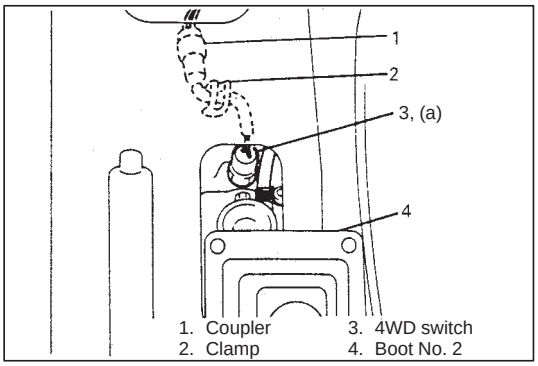


7) Tighten transmission boot No. 2 with boot cover and console box bracket.

Tightening Torque
(a): 6 N·m (0.6 kg-m, 4.0 lb-ft)

8) Install console box.

NOTE:
Be sure that flare end of transmission boot No. 3 is engaged with console box.



1. Coupler
2. Clamp
3. 4WD switch
4. Boot No. 2

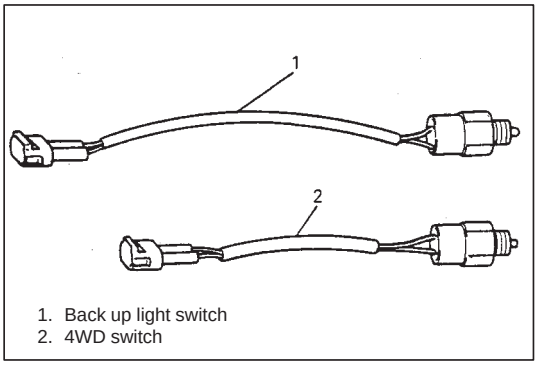
SWITCHES

TRANSFER 4WD SWITCH

1) Remove console box and lift transmission control lever boots No. 2 and No. 3. (Refer to page 7A-4.)
2) Remove transfer control lever boot No. 2, unclamp wiring on transfer case to free it and pull off coupler.
3) Replace switch and connect as it was.

Tightening Torque
(a): 20 N·m (2.0 kg-m, 14.5 lb-ft)

4) Turn ON ignition switch, shift transfer shift control lever to 4WD position and check that indicator lights. Turn OFF switch after checking.



1. Back up light switch
2. 4WD switch

NOTE:
- **When removing and reinstalling switch, use care not to let dust enter transfer box inside.**
- **Make sure to reset clamp for wiring which is located where invisible directly.**
- **It is recommended to work on transfer shift control lever boot No. 1 from underside of vehicle on lift.**
- **Identify this switch by its leg part which is different for that of back up light switch.**

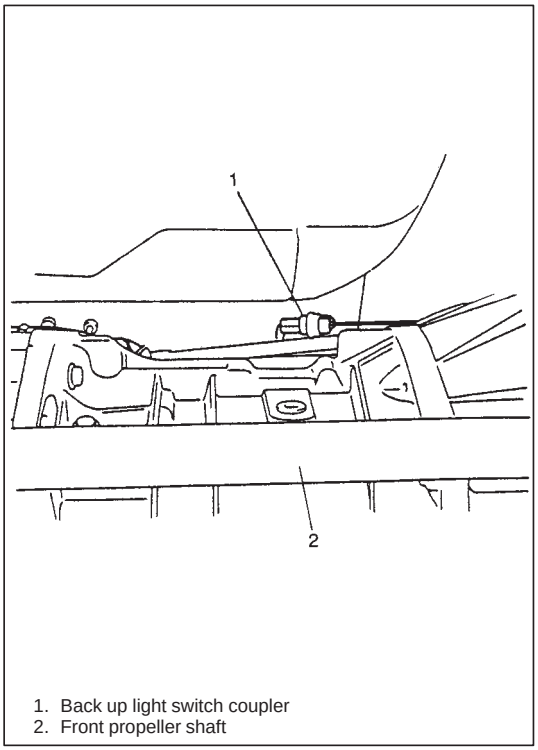
BACK UP LIGHT SWITCH

WARNING:
Refrain from work while exhaust center pipe is hot.

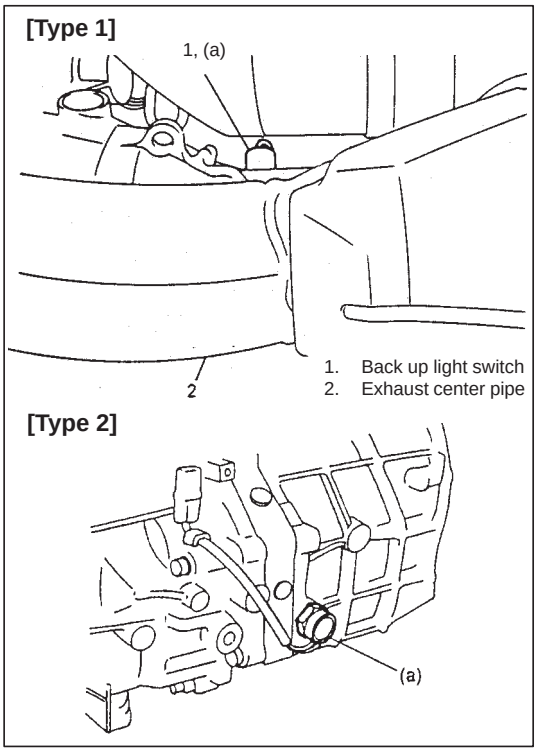
REMOVAL AND INSTALLATION

NOTE:
When replacing switch, use care not to let dust enter transmission through switch hole.

1) Lift up vehicle.
2) Remove coupler(s) for switch wiring.



1. Back up light switch coupler
2. Front propeller shaft



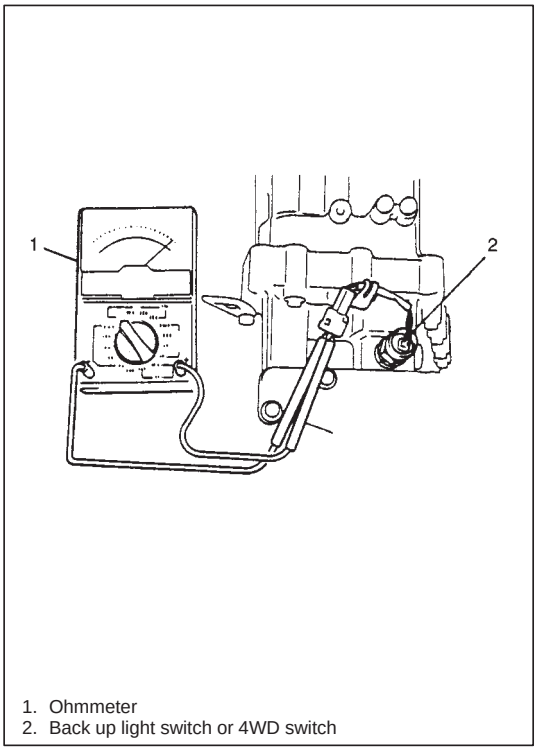
3) Replace switch, connect and clamp as they were.

Tightening Torque
(a): 20 N·m (2.0 kg-m, 14.5 lb-ft) (Type 1)
(a): 45 N·m (4.5 kg-m, 32.5 lb-ft) (Type 2)

4) When back up light switch has been replaced, check switch for proper function with ignition switch turned ON and gear shifted to reverse position. Turn OFF switch after checking its function.

INSPECTION OF 4WD SWITCH AND BACK UP LIGHT SWITCH

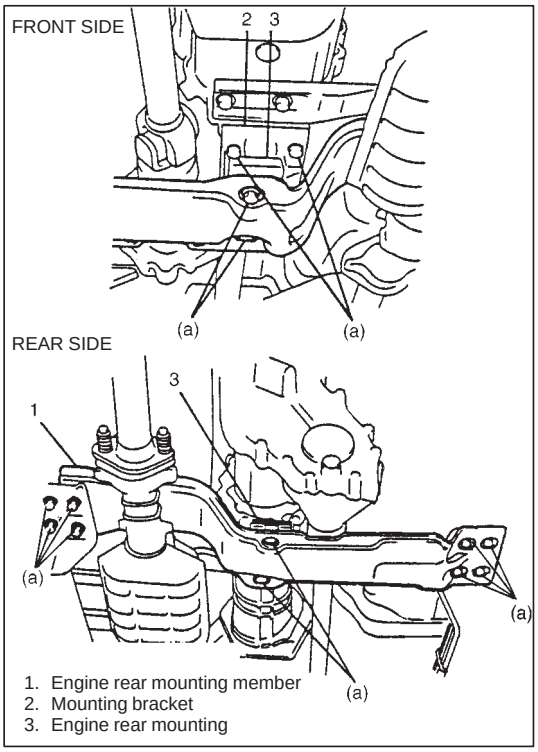
1) Undo clamp and disconnect coupler of back up light switch and/or 4WD switch.



2) Function of back up light switch can be checked as shown in figure.
   There should be conduction at these terminals only when shift lever is shifted to reverse position.
3) Function of transfer 4WD switch can be checked in the same manner as back up light switch.
   There should be conduction at these terminals when shift lever is shifted to 4H, and 4L positions.

Upon completion of check, connect coupler and clamp wiring harness as they were.

NOTE:
When replacing switch(es), use care not to let dust enter transmission through switch hole(s).

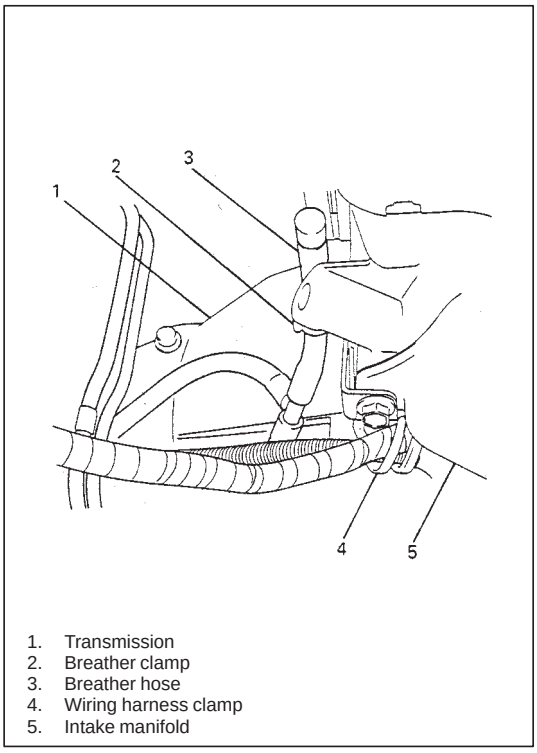


1. Engine rear mounting member
2. Mounting bracket
3. Engine rear mounting

ENGINE REAR MOUNTING

When replacement of mounting parts are necessary, torque bolts and nut as specified below.

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



1. Transmission
2. Breather clamp
3. Breather hose
4. Wiring harness clamp
5. Intake manifold

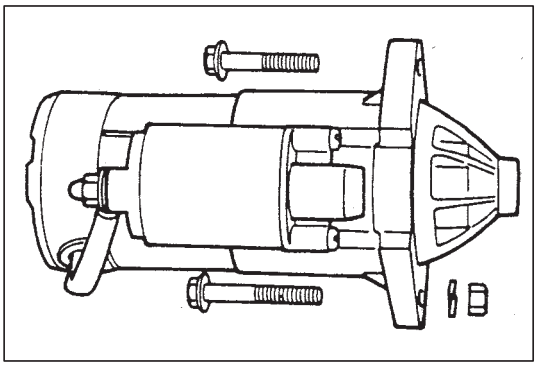
DISMOUNTING OF TRANS. UNIT

IN CABIN

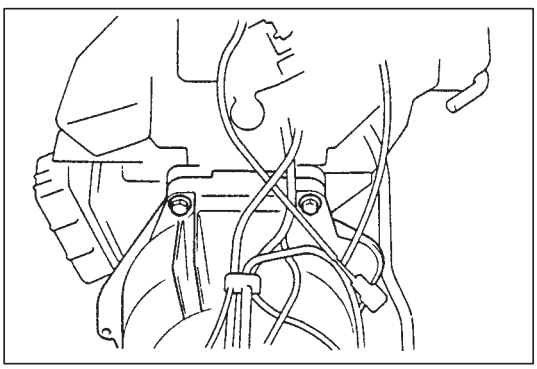
Remove transmission shift control lever (refer to page 7A-4) and transfer shift control lever knob.

IN ENGINE ROOM

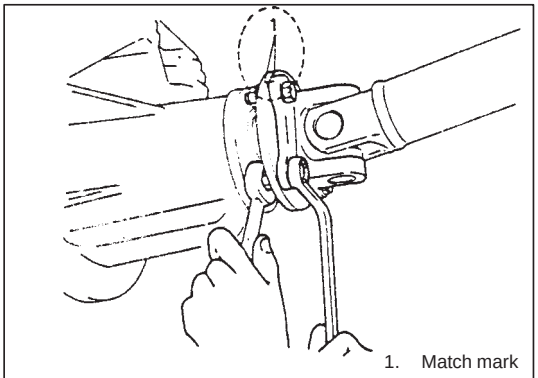
1) Disconnect negative (–) cable of battery.
2) Remove breather hose from clamp at the rear end of cylinder head.



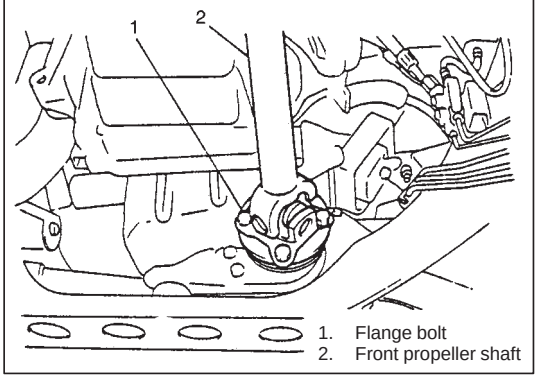
3) Remove starting motor fixing bolts and nut and then remove starter.



4) Remove transmission fastening bolts.



1. Match mark



1. Flange bolt
2. Front propeller shaft

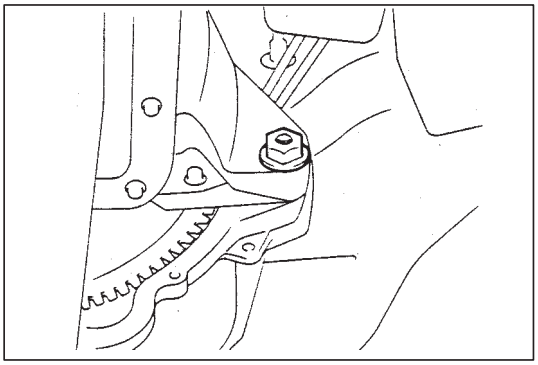
ON LIFT

1) Drain oil from transmission and transfer.
2) Give match marks on joint flange and propeller shaft as shown in figure. (front and rear)
3) Remove flange bolts of rear propeller shaft universal joint and pull out propeller shaft.
4) Remove flange bolts of front propeller shaft universal joint and pull out propeller shaft.
5) Remove clutch operating cylinder from transmission. It is not necessary to disconnect clutch hose from operating cylinder.

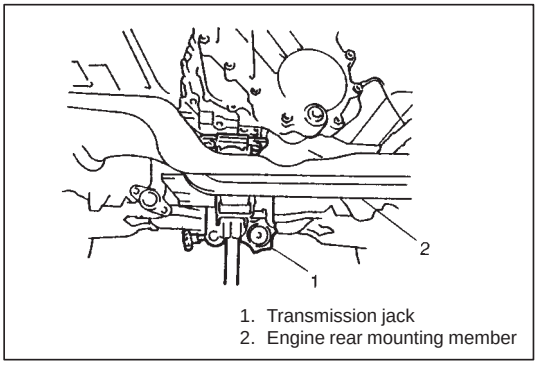
NOTE:

- **It is not necessary to drain transmission oil when dismounting transmission and transfer for clutch maintenance only.**
- **Work without draining transfer oil is possible if front propeller shaft is dismounted together with transmission and transfer.**

6) Remove clutch housing lower plate.

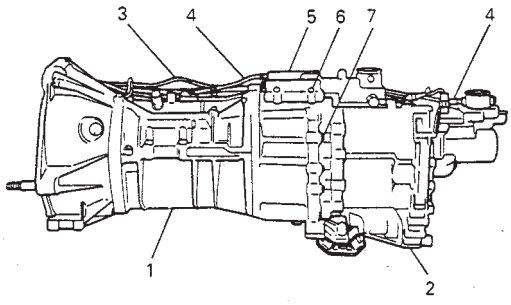


7) Disconnect couplers from 4WD switch, back up light switch and speed sensor assembly and release their harness from clamps. Remove nuts from joint with engine.



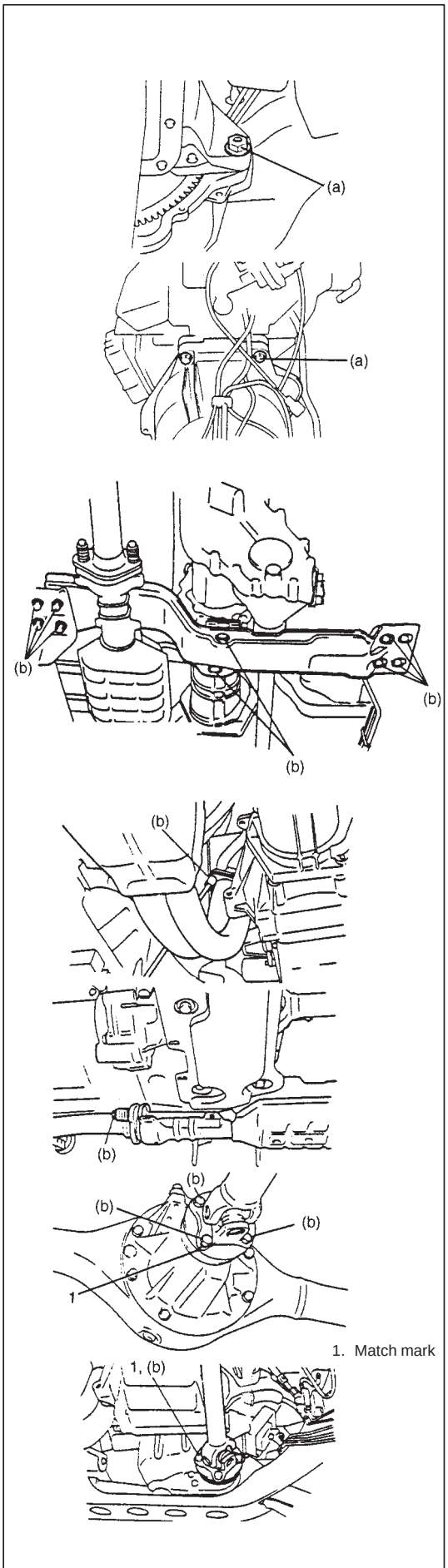
1. Transmission jack
2. Engine rear mounting member

8) Apply transmission jack and remove engine rear mounting member taking off its bolts.
9) After removing mounting member, move rearward transmission and transfer assemblies placed on jack and then lower them.



1. Transmission assembly
2. Transfer assembly
3. Wiring harness
4. Breather hose
5. Gear shift lever case
6. Bolt
7. Bolt

10) Remove wiring harness and breather hose.
11) Separate gear shift lever case and transfer assembly (or extension case: 2WD model) from transmission.



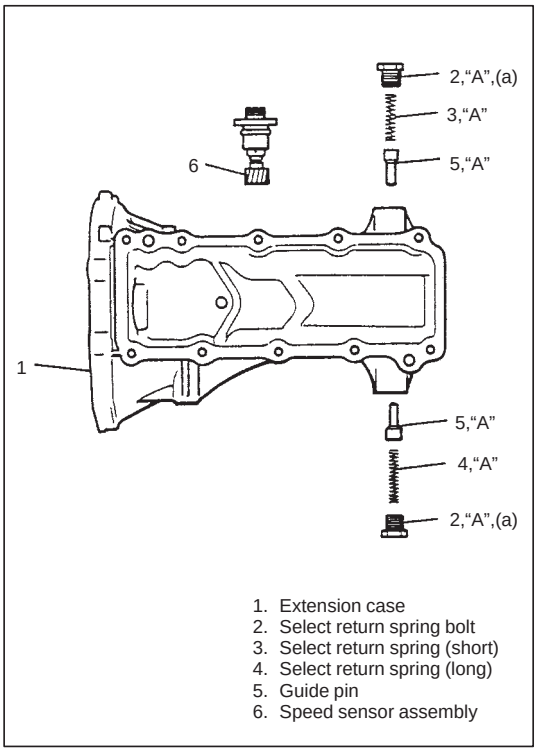
1. Match mark

REMOUNTING OF TRANS. UNIT

For remounting, reverse dismounting procedure.
Use specified torques as given below.

Tightening Torque
(a): 85 N·m (8.5 kg-m, 61.5 lb-ft)
(b): 50 N·m (5.0 kg-m, 36.5 lb-ft)

- For tightening torque of transmission stiffener bolt, refer to "ENGINE MECHANICAL" section.
- Set each clamp for wiring, hose and cable securely.
- Set clamp for shift control lever boots securely.
- After installing clutch operating cylinder, check clutch pedal free travel. Refer to SECTION 7C1 "CLUTCH".
- Fill gear oil to transmission and transfer as specified.
- Connect battery and check function of engine, clutch and trans.
- When installing propeller shaft, align the match marks.



EXTENSION CASE (2WD MODEL)

DISASSEMBLY

1) Remove oil seal.
2) Remove select return spring bolts and then springs and guide pins.
3) Remove speed sensor assembly.

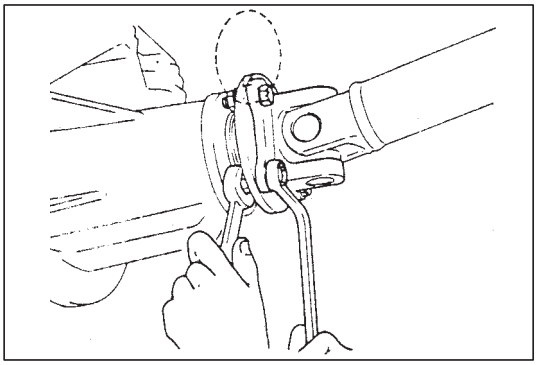
REASSEMBLY

1) Install oil seal.
2) After applying grease, install select guide pins, select return springs and spring bolts and torque them to specification.

   "A": Grease 99000-25010

   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

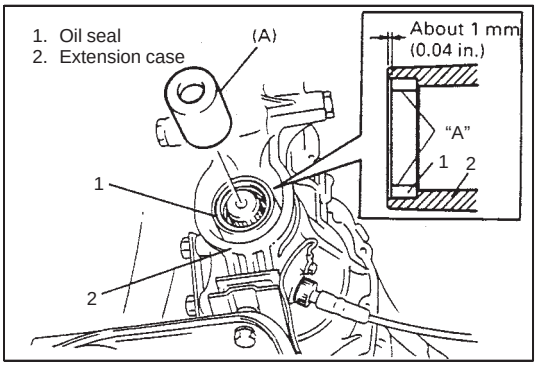
   After installing, check to make sure that each pin moves smoothly.
3) Install speedometer driven gear case assembly to extension case.



EXTENSION CASE OIL SEAL (2WD MODEL)

REMOVAL AND INSTALLATION

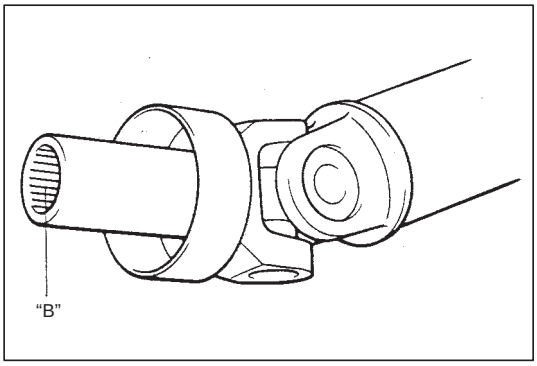
1) Remove propeller shaft referring to SECTION 4B.
2) Using screwdriver, remove oil seal.



3) Using special tool (A) and plastic hammer, press fit new oil seal into extension case till oil seal contacts stepped part of extension case as shown. Be sure to apply grease to oil seal lip.

   "A": Grease 99000-25010

   Special Tool
   (A): 09951-16060



4) Clean and inspect sliding portion of propeller shaft front end (where oil seal contacts) before installation and if even small dent or scratch exists, correct and clean it again.
   Then apply grease inside splines of propeller shaft.

   "B": Grease 99000-25010

5) Install propeller shaft referring to SECTION 4B.

UNIT REPAIR

Refer to the same section of UNIT REPAIR MANUAL mentioned in FOREWORD of this manual.

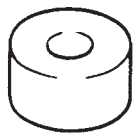
TIGHTENING TORQUE SPECIFICATIONS

Fastening portion	Tightening torque		
	N·m	kg-m	lb-ft
Oil filler/level and drain plugs	23	2.3	17.0
Control lever boot cover bolts	6	0.6	4.0
4WD switch	20	2.0	14.5
Back up light switch (Type 1)	20	2.0	14.5
Back up light switch (Type 2)	45	4.5	32.5
Control lever locating bolts	17	1.7	12.5
Transmission to engine bolts and nuts	85	8.5	61.5
Engine rear mounting bolts and nut	50	5.0	36.5
Exhaust center pipe to manifold nuts	50	5.0	36.5
Muffler to exhaust center pipe bolts	50	5.0	36.5
Universal joint flange bolts	50	5.0	36.5
Select return spring bolts	23	2.3	17.0

REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	● Shift control lever. ● Select return springs, bolts and guides.
Thread lock cement	THREAD LOCK CEMENT SUPER 1333B (99000-32020)	● Shift control lever locating bolts.
Sealant	SUZUKI BOND No. 1215 (99000-31110)	● Oil Drain and filler/level plugs.

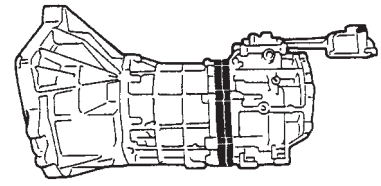
SPECIAL TOOL



09951-16060
Oil seal installer

SECTION 7A1

MANUAL TRANSMISSION (TYPE 2)



TYPE 2

CONTENTS

GENERAL DESCRIPTION 7A1-1
DIAGNOSIS 7A1-2
ON-VEHICLE SERVICE 7A1-3
Gear Oil 7A1-3
Shift Control Levers 7A1-4
Switches 7A1-4
Engine Rear Mounting 7A1-4
Dismounting/Remounting of Trans. Unit 7A1-4
UNIT REPAIR 7A1-4
TIGHTENING TORQUE SPECIFICATIONS 7A1-5
REQUIRED SERVICE MATERIALS 7A1-5

GENERAL DESCRIPTION

The manual transmission consists of the input shaft, main shaft, counter shaft and reverse gear which are installed in the aluminum and castings cases. Its gears are of forward five speeds in synchro mesh and reverse one speed in sliding idler gear arrangement system.

The main shaft gears are held by the needle bearings and on them the synchronizer rings and synchronizer sleeve & hubs are assembled.

The gear shift lever case is located at the upper behind the transmission case and has a cam which prevents direct gear shift from the 5th speed gear to the reverse gear.

As the aluminum and castings cases are sealed with liquid type gasket, it is necessary to use genuine sealant or its equivalent on its mating surfaces when reassembling them. Also, the case fastening bolts must be tightened to specified torque by means of the torque wrench and tightening over or below the specified torque should be avoided.

The description under ON-VEHICLE SERVICE in this section covers the transfer partially which is next to the transmission as well, but their gear boxes are independent and each of them has its own drain and level/filler plugs for the oil change or the level check. For the repair procedure of the transfer unit, refer to Section 7D.

DIAGNOSIS

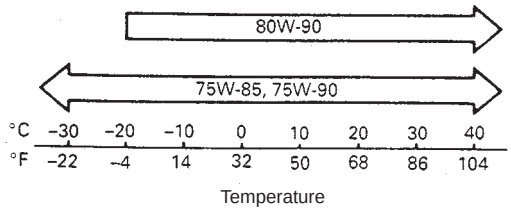
Condition	Possible Cause	Correction
Gear slipping out of mesh	● Worn shift fork shaft	Replace
	● Worn shift fork or synchronizer sleeve	Replace
	● Weak or damaged locating spring	Replace
	● Worn bearings on input shaft or main shaft	Replace
	● Worn chamfered tooth on sleeve or gear	Replace sleeve and gear
	● Missing or disengagement of circlip(s)	Install
Gears refusing to disengage	● Weakened or broken synchronizer spring	Replace
	● Distorted shift shaft or shift fork	Replace
Hard shifting	● 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 and gear
	● Distorted shift shaft	Replace
Noise	● Inadequate or insufficient lubricant	Replenish
	● Damaged or worn bearing(s)	Replace
	● Damaged or worn gear(s)	Replace
	● Damaged or worn synchronizer ring	Replace
	● Damaged or worn chamfered tooth on sleeve or gear	Replace

ON-VEHICLE SERVICE

GEAR OIL

INSPECTION AND CHANGE

1) Before changing or inspecting oil, be sure to stop engine and lift vehicle horizontally.
2) With vehicle lifted up, check oil level and leakage. If leakage exists, correct or repair it.

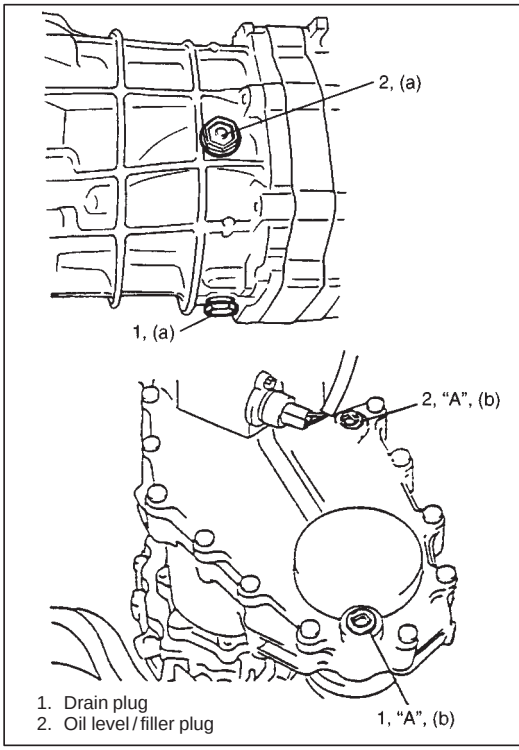


3) Drain old oil and fill new specified oil as shown below by specified amount (roughly up to level hole).

NOTE:
- **It is highly recommended to use SAE 75W-90 gear oil.**
- **Whenever vehicle is hoisted for any other service work than oil change, also be sure to check for oil leakage and status of breather hoses.**
- **If water or rust is mixed in drained oil, be sure to check breather hose and boot of transmission and transfer.**

Gear Oil Specification
Oil grade: API GL-4
Viscosity: SAE 75W-85, 75W-90 or 80W-90

Oil Capacity:
Transmission 2.6 liters (5.5/4.6 US/Imp. pt)
Transfer 1.7 liters (3.6/3.0 US/Imp. pt)



4) Torque drain plug and level/filler plug as specified below after applying sealant to thread of plug (c).

CAUTION:
Transmission oil must not be poured through gear shift control lever part.

"A": Sealant 99000-31110

Tightening Torque
(a): 38 N·m (3.8 kg-m, 27.5 lb-ft)
(b): 23 N·m (2.3 kg-m, 17.0 lb-ft)

SHIFT CONTROL LEVERS

Refer to SECTION 7A in this manual.

SWITCHES

Refer to SECTION 7A in this manual.

ENGINE REAR MOUNTING

Refer to SECTION 7A in this manual.

DISMOUNTING/REMOUNTING OF TRANS. UNIT

Refer to the same item in SECTION 7A “MANUAL TRANSMISSION”.
For tightening torque of filler and level/drain plug, refer to “Gear Oil Inspection and Change” of “ON-VEHICLE SERVICE” in this section.

UNIT REPAIR

Refer to the same section of UNIT REPAIR MANUAL mentioned in FOREWORD of this manual.

TIGHTENING TORQUE SPECIFICATIONS

Fastening portion	Tightening torque		
	N·m	kg-m	lb-ft
Transfer oil filler/level and drain plugs	23	2.3	17.0
Transmission oil filler/level and drain plugs	38	3.8	27.5
Control lever boot cover bolts	6	0.6	4.0
4WD switch	20	2.0	14.5
Back-up light switch	45	4.5	32.5
Control lever locating bolts	17	1.7	12.5
Transmission to engine bolts and nuts	85	8.5	61.5
Engine rear mounting bolts	50	5.0	36.5
Muffler to exhaust No. 2 pipe nuts	50	5.0	36.5
Universal joint flange bolts	50	5.0	36.5

REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	● Shift control lever
Thread lock cement	THREAD LOCK CEMENT SUPER 1333B (99000-32020)	● Shift control lever locating bolts
Sealant	SUZUKI BOND No. 1215 (99000-31110)	● Oil drain and filler/level plugs

SECTION 7B1

AUTOMATIC TRANSMISSION (4 A/T)

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

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

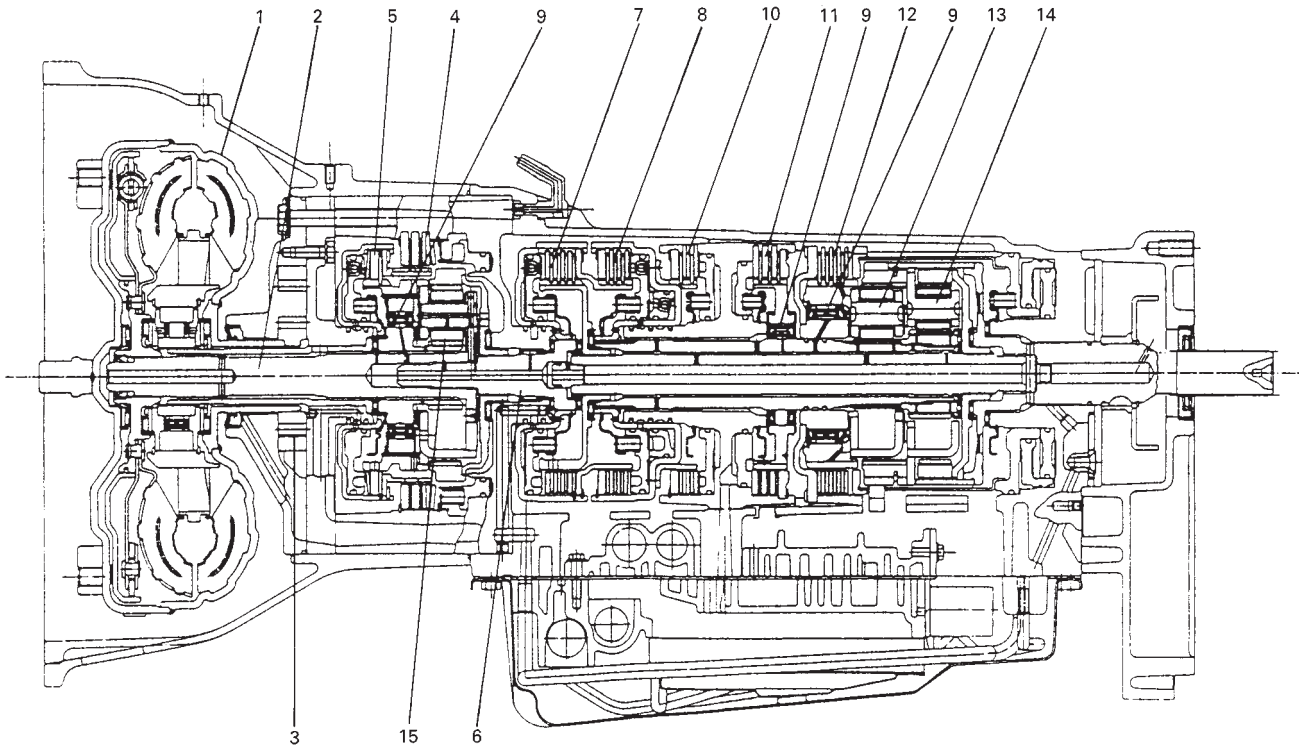
CONTENTS

GENERAL DESCRIPTION 7B1- 3
CLUTCH/BRAKE FUNCTIONS 7B1- 5
TABLE OF COMPONENT OPERATION . . . 7B1- 6
ELECTRONIC SHIFT CONTROL SYSTEM 7B1- 7
AUTOMATIC TRANSMISSION DIAGNOSIS 7B1-17
PRECAUTION IN DIAGNOSING TROUBLE 7B1-20
AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE 7B1-21
Customer Problem Inspection Form . . . 7B1-23
Malfunction Indicator lamp (MIL) Check 7B1-24
"O/D OFF" Lamp Check 7B1-24
"POWER" Lamp Check 7B1-24
Diagnostic Trouble Code (DTC) Check 7B1-24
Diagnostic Trouble Code (DTC) Clearance 7B1-24
Diagnostic Trouble Code (DTC) Table . . . 7B1-24
Fail-Safe Table 7B1-25
Visual Inspection 7B1-26
A/T Basic Check 7B1-27
Trouble Diagnosis Table 1 . . . . . 7B1-28
Trouble Diagnosis Table 2 . . . . . 7B1-28
Trouble Diagnosis Table 3 . . . . . 7B1-29
Scan Tool Data 7B1-30
Inspection of PCM and Its Circuit 7B1-30
Wire Harness and Connectors 7B1-30
Diagnostic Flow Table A-1 . . . . . 7B1-31
Diagnostic Flow Table A-2 . . . . . 7B1-33
Table B-1 "O/D OFF" Light Circuit Check 7B1-35
Table B-2 "O/D OFF" Light Circuit Check 7B1-36
Table B-3 "POWER" Light Circuit Check 7B1-37
Table B-4 "POWER" Light Circuit Check 7B1-38
DTC P0705 Transmission Range Sensor (Switch) Circuit Malfunction . . 7B1-39
DTC P0715 Input/Turbine Speed Sensor Circuit Malfunction 7B1-42
DTC P0720 Output Speed Sensor Circuit Malfunction 7B1-44
DTC P0741 TCC Solenoid Valve Performance or Stuck Off 7B1-46
DTC P0743 TCC Solenoid Electrical . . 7B1-47
DTC P0751 Shift Solenoid Valve-A (#1) Performance or Stuck Off 7B1-49
DTC P0756 Shift Solenoid Valve-B (#2) Performance or Stuck Off 7B1-49

DTC P0753 Shift Solenoid-A (#1) Electrical 7B1-50
DTC P0758 Shift Solenoid-B (#2) Electrical 7B1-50
DTC P1875 4WD Low Switch Circuit Malfunction 7B1-52
Line Pressure Test 7B1-54
Stall Test 7B1-55
Road Test 7B1-56
Manual Road Test 7B1-57
Time Lag Test 7B1-57
Engine Brake Test 7B1-58
"P" Range Test 7B1-58
ON-VEHICLE SERVICE 7B1-59
MAINTENANCE SERVICE 7B1-59
Fluid Level 7B1-59
Fluid Change 7B1-60
Oil Cooler Hoses 7B1-61
A/T THROTTLE CABLE 7B1-61
MANUAL SELECTOR ASSEMBLY 7B1-62
SELECT CABLE 7B1-63
TRANSMISSION RANGE SWITCH 7B1-64
A/T OUTPUT SPEED SENSOR 7B1-64
O/D CUT SWITCH 7B1-64
SOLENOID VALVES 7B1-64
THROTTLE POSITION SENSOR 7B1-66
POWER/NORMAL CHANGE SWITCH . . 7B1-66
OIL COOLER PIPES 7B1-67
BRAKE INTERLOCK SYSTEM 7B1-68
Shift Lock Solenoid Control 7B1-68
Shift Lock Solenoid Control Operations 7B1-68
Shift Lock (Solenoid) Manual Release . 7B1-69
System Inspection 7B1-69
KEY INTERLOCK CABLE 7B1-71
DISMOUNTING OF TRANSMISSION (WITH TRANSFER IF EQUIPPED) 7B1-74
REMOUNTING 7B1-77
UNIT REPAIR 7B1-78
TIGHTENING TORQUE SPECIFICATIONS 7B1-78
REQUIRED SERVICE MATERIALS 7B1-79
SPECIAL TOOLS 7B1-79

GENERAL DESCRIPTION

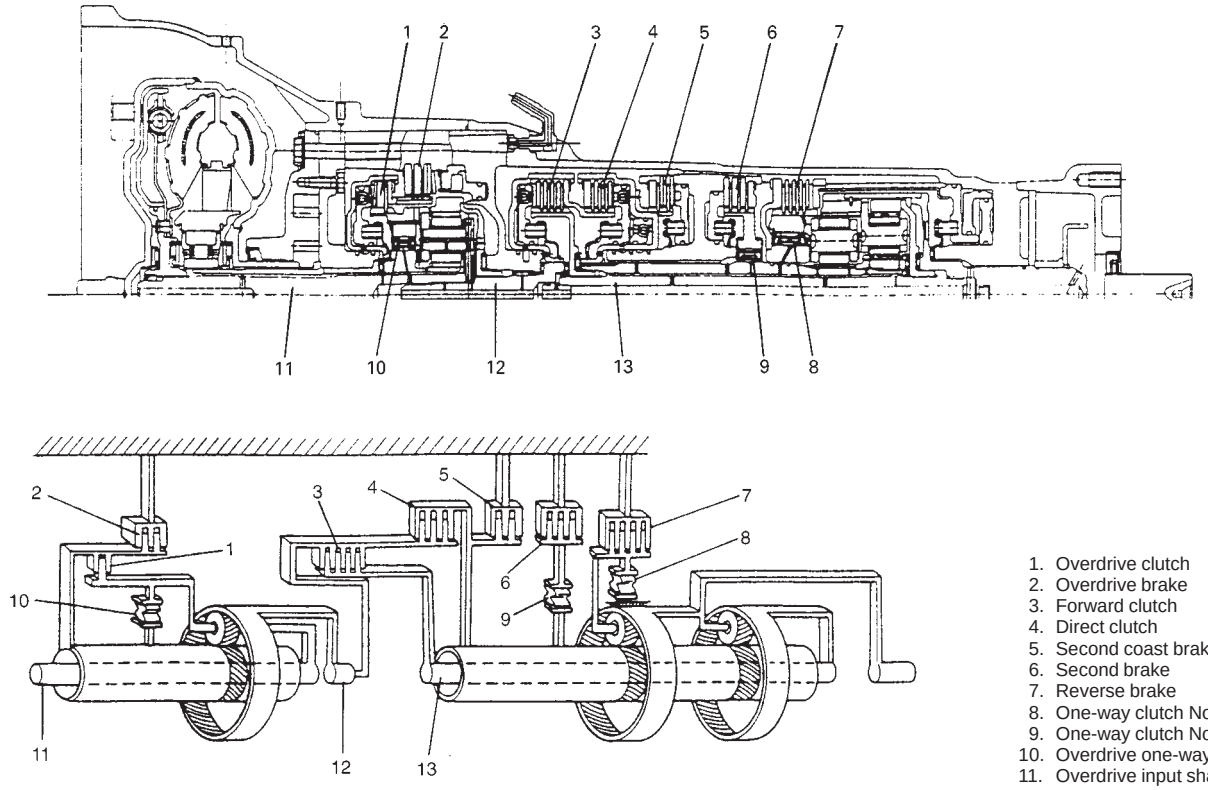
This automatic transmission is a full automatic type with 3-speed plus overdrive (O/D).
The torque converter is a 3-element, 1-step and 2-phase type and is equipped with an electronically controlled lock-up mechanism. The gear shift device consists of 3 sets of planetary gear units, 3 disc type clutches, 4 disc type brakes and 3 one-way clutches. The gear shift is done by selecting one of 6 positions (“P”, “R”, “N”, “D”, “2” and “L”) by means of the select lever installed on the floor. On the shift knob, there is an overdrive (O/D) cut switch which allows shift-up to the overdrive mode (except at 4L) and shift-down from the overdrive mode. Also, by using the P/N change switch located on the console box, it is possible to select the gear change timing of 2 modes, normal and power.



1. Torque converter
2. Overdrive input shaft
3. Oil pump
4. Overdrive brake
5. Overdrive clutch
6. Forward clutch input shaft
7. Forward clutch
8. Direct clutch
9. One-way clutch
10. Second coast brake
11. Second brake
12. Reverse brake
13. Front planetary gear
14. Rear planetary gear
15. Overdrive planetary gear

Item			Specifications		
Torque converter	Type		3-element, 1-step, 2-phase type (with TCC (lock-up) mechanism)		
	Stall torque ratio		2.4 (G16 engine) 2.0 (J20 engine) 1.9 (H25 engine)		
Oil pump	Type		Trochoid type oil pump		
	Drive system		Engine driven		
Gear change device	Type		Forward 4-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 (O/D ON): Forward 1st ↔ 2nd ↔ 3rd ↔ 4th (O/D) automatic gear change "D" range (O/D OFF): Forward 1st ↔ 2nd ↔ 3rd automatic gear change "2" range: (Normal mode) Forward 1st ↔ 2nd ← 3rd automatic gear change (Power mode) Forward 2nd ← 3rd automatic gear change and fixed at 2nd gear "L" range: Forward 1st ← 2nd ← 3rd reduction, and fixed at 1st gear		
	Engine type		G16 engine	J20/H25 engines	
	Gear ratio	1st (low gear)	2.826	2.826	
		2nd (second gear)	1.493	1.493	
		3rd (top gear)	1.000	1.000	
		4th (overdrive gear)	0.730	0.689	
		Reverse (reverse gear)	2.703	2.703	
	Control elements		Wet type multi-disc clutch . . . . . 3 sets Wet type multi-disc brake . . . . . 4 sets One-way clutch . . . . . 3 sets		
	Transfer		Hi: 1.000 Lo: 1.816 (4WD model only)		
	Final gear reduction ratio (Differential)		5.125 (G16 engine) 4.875 (J20/H25 engines)		
Lubrication	Lubrication system		Force feed system by oil pump		
Cooling	Cooling system		Radiator assisted cooling (water-cooled)		
Fluid used			An equivalent of DEXRON®III		

CLUTCH/BRAKE FUNCTIONS



1. Overdrive clutch
2. Overdrive brake
3. Forward clutch
4. Direct clutch
5. Second coast brake
6. Second brake
7. Reverse brake
8. One-way clutch No.2
9. One-way clutch No.1
10. Overdrive one-way clutch
11. Overdrive input shaft
12. Forward clutch input shaft
13. Intermediate shaft

Part Name	Function
Overdrive clutch	Meshes overdrive carrier and overdrive sun gear.
Overdrive brake	Fixes overdrive sun gear.
Overdrive one-way clutch	Meshes overdrive carrier and overdrive sun gear only when driven by engine.
Forward clutch	Meshes input shaft and intermediate shaft.
Direct clutch	Meshes input shaft with front sun gear and rear sun gear.
Second coast brake	Fixes front sun gear and rear sun gear.
Second brake	Fixes outer race of one-way clutch No.1, to prevent front sun gear and rear sun gear from turning counterclockwise (reverse direction of engine input rotation direction).
Reverse brake	Fixes front planetary carrier.
One-way clutch No.1	Prevents front sun gear and rear sun gear from turning counterclockwise only when second brake is at work.
One-way clutch No.2	Prevents front planetary carrier from turning counterclockwise.

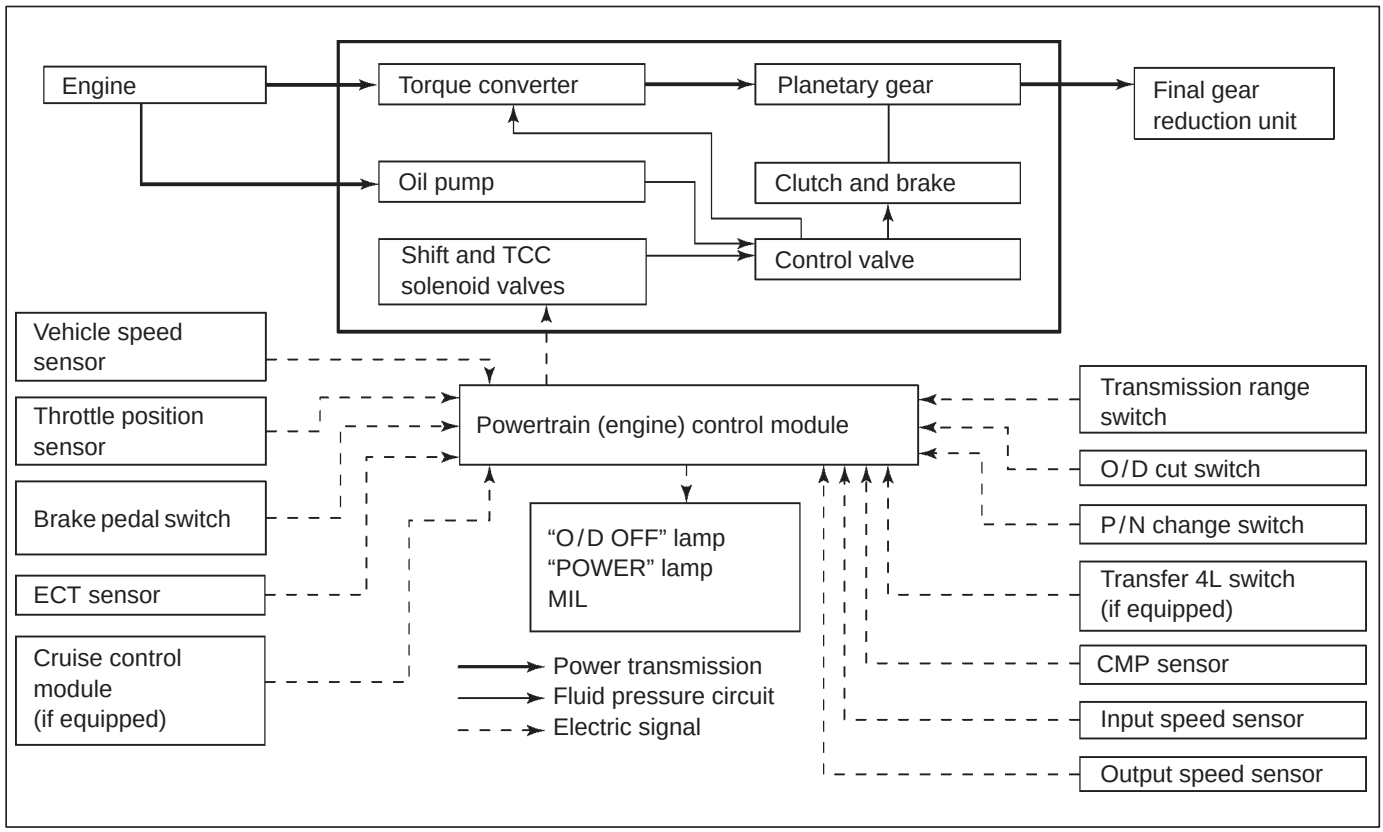
TABLE OF COMPONENT OPERATION

Shift position \ Element		Solenoid valve No. 1–A	Solenoid valve No. 1–B	O/D clutch	Forward clutch	Direct clutch		O/D brake	Second coast brake	Second brake	Reverse brake		O/D one-way clutch	One-way clutch No. 1	One-way clutch No. 2
						Inner piston	Outer piston				Inner piston	Outer piston			
P		○	X	○	–	–	–	–	–	–	–	–	○	–	–
R		○	X	○	–	○	○	–	–	–	○	○	○	–	–
N		○	X	○	–	–	–	–	–	–	–	–	○	–	–
D	1st gear	○	X	○	○	–	–	–	–	–	–	–	○	–	○
	2nd gear	○	○	○	○	–	–	–	–	○	–	–	○	○	–
	3rd gear	X	○	○	○	–	○	–	–	○	–	–	○	–	–
	O/D	X	X	–	○	–	○	○	–	○	–	–	–	–	–
2	1st gear	○	X	○	○	–	–	–	–	–	–	–	○	–	○
	2nd gear	○	○	○	○	–	–	–	○	○	–	–	○	–	–
	3rd gear (Fail safe)	X	○	○	○	–	○	–	–	○	–	–	○	–	–
L	1st gear	○	X	○	○	–	–	–	–	–	○	○	○	–	–
	2nd gear (Fail safe)	○	○	○	○	–	–	–	○	○	–	–	○	–	–

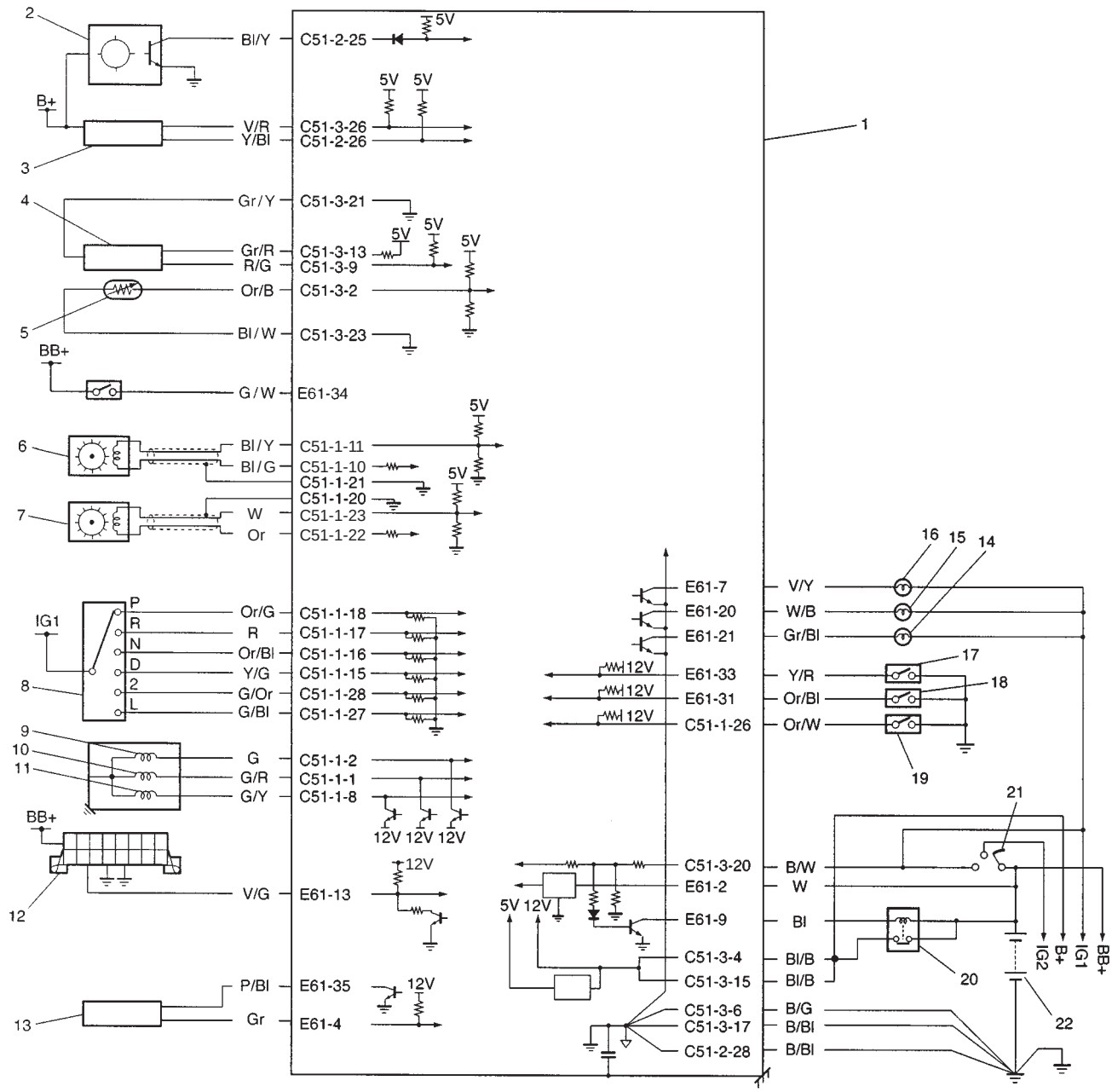
○: ON, X: OFF

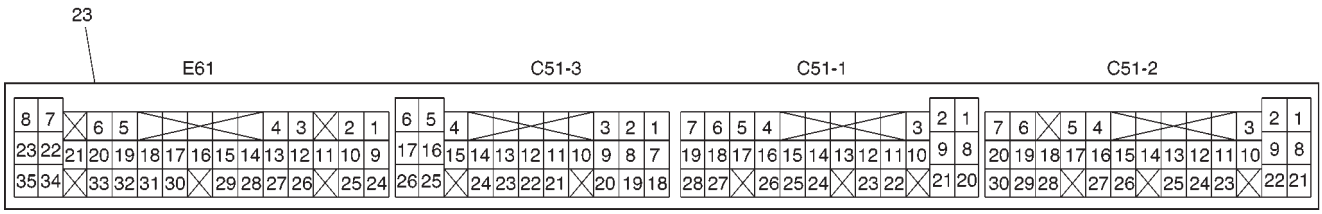
ELECTRONIC SHIFT CONTROL SYSTEM

The gear ratio change in “D” or “2” range and torque converter clutch operation are controlled by Powertrain (Engine) Control Module.



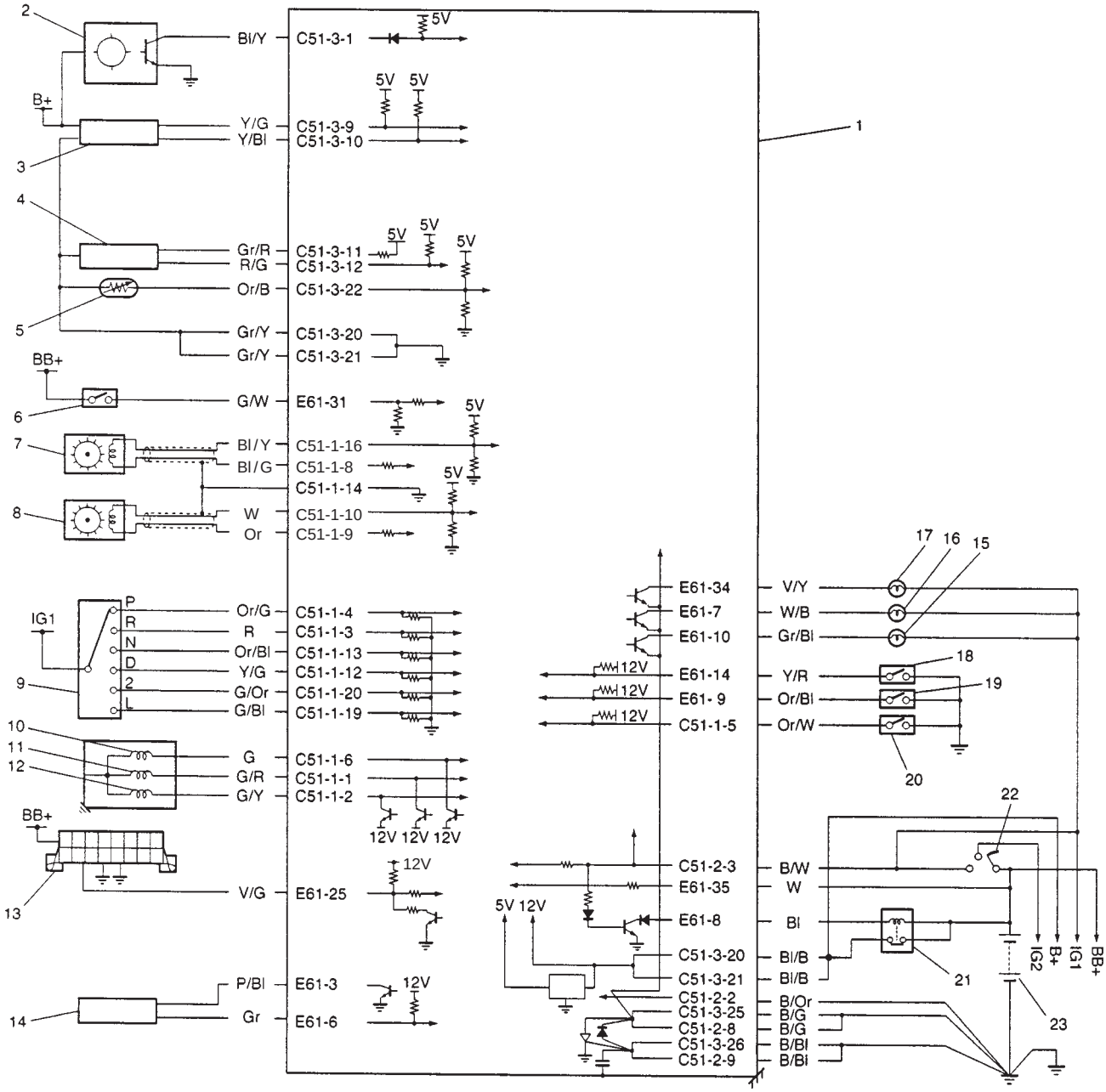
G16/J20 Engines





1. PCM (ECM)
2. VSS
3. CMP sensor
4. TP sensor
5. ECT sensor
6. A/T input speed sensor
7. A/T output speed sensor
8. Transmission range switch
9. Shift solenoid-A
10. Shift solenoid-B
11. TCC solenoid
12. Data link connector
13. Cruise control module
14. "POWER" lamp
15. "O/D OFF" lamp
16. MIL
17. O/D cut switch
18. P/N change switch
19. 4WD low switch
20. Main relay
21. Ignition switch
22. Battery
23. PCM (ECM) connector terminal (viewed from harness side)

H25 Engine

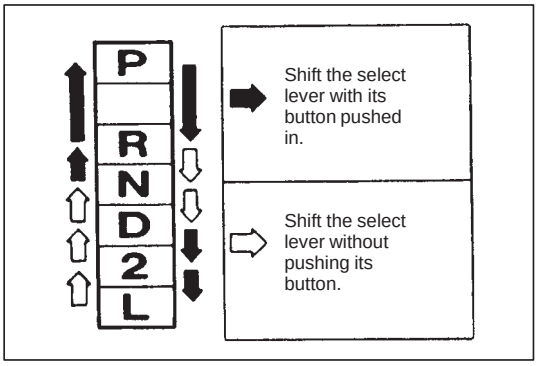


1. PCM (ECM)
2. VSS
3. CMP sensor
4. TP sensor
5. ECT sensor
6. Brake pedal switch
7. A/T input speed sensor
8. A/T output speed sensor
9. Transmission range switch
10. Shift solenoid-A
11. Shift solenoid-B
12. TCC solenoid
13. Data link connector
14. Cruise control module
15. "POWER" lamp
16. "O/D OFF" lamp
17. MIL
18. O/D cut switch
19. P/N change switch
20. 4WD low switch
21. Main relay
22. Ignition switch
23. Battery
24. PCM (ECM) connector terminal (viewed from harness side)

Fail Safe Function

This function is provided by the safe mechanism that assures safe driveability even when the shift solenoid valve or speed sensor fails.
The table below shows the gear position in each shift under a normal/abnormal condition.

Condition / Shift position	Normal	Shift solenoid valve-A(#1) abnormal	Shift solenoid valve-B(#2) abnormal	Shift solenoid valves-A&B (#1 and #2) abnormal
D	1st	3rd	1st	O/D
	2nd		O/D	
	3rd			
	O/D	O/D		
2	1st	3rd	1st	3rd
	2nd		3rd	
	(3rd)			
L	1st	1st	1st	1st
	(2nd)	(2nd)		



Change Mechanism

The same select pattern shift lever is used as the floor type and frequently used “N” and “D” ranges are made selectable freely.

Operation of Shift Solenoids and TCC Solenoid

RANGE / GEAR / SOLENOIDS	D				2		L	P, N & R	
	1st	2nd	3rd	4th (O/D)	1st	2nd	1st	—	
Shift solenoid-A (#1, NO.1)	○	○	×	×	○	○	○	○	
Shift solenoid-B (#2, NO.2)	×	○	○	×	×	○	×	×	
TCC solenoid	×	×	○	○	×	×	×	×	

○: ON (valve is open) ×: OFF (valve is closed)

AUTOMATIC GEAR SHIFT DIAGRAM

Automatic shift schedule as a result of shift control is shown below. In case that select lever is shifted to L at a higher than 52 km/h or 33 mile/h speed for G16 engine (45 km/h or 28 mile/h for J20 engine, 55 km/h or 34 mile/h for H25 engine), 2nd or 3rd gear is operated and then down shifts to 1st at a speed lower than that. No up shift is available in L.

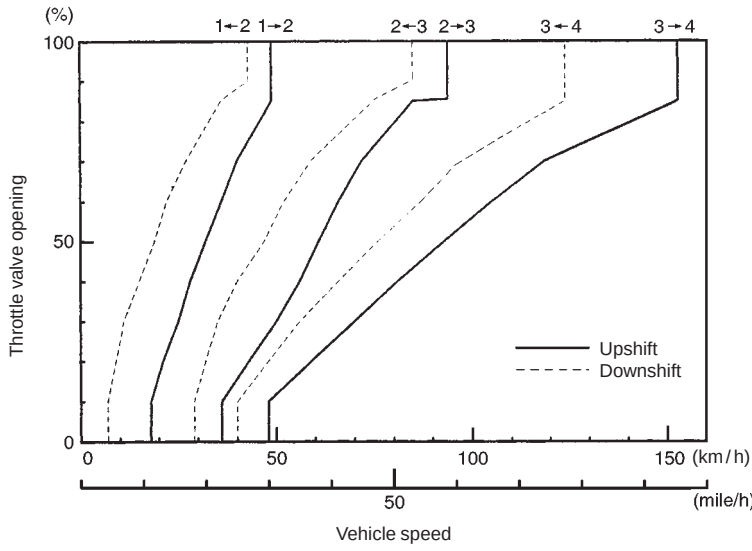
The same as, the select lever is shifted to 2 at a higher than 102 km/h (64 mile/h) speed for G16/J20 engines (105 km/h or 65 mile/h for H25 engine), 3rd gear is operated and then down shifts to 2nd at a speed lower than that.

Power Mode For G16 Engine

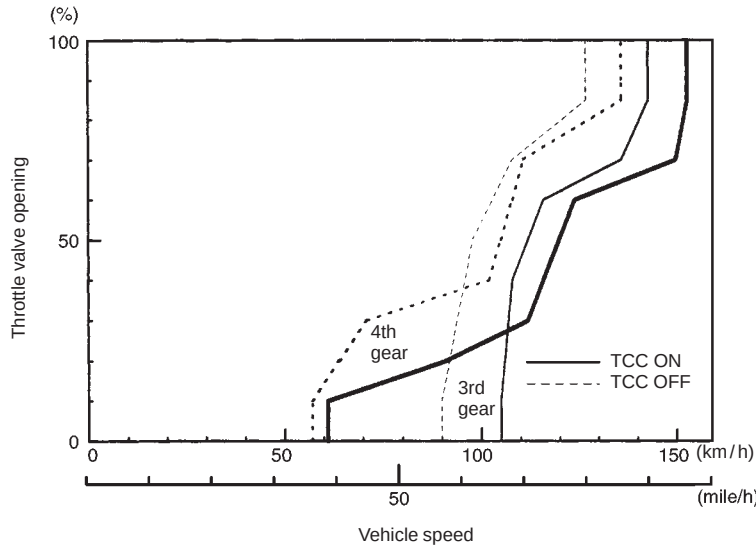
Unit: km/h (mile/h)

Shift / Throttle opening	1→2	2→3	3→4	4→3	3→2	2→1
Full throttle	49 (30)	94 (58)	153 (95)	124 (77)	85 (53)	43 (27)
Closed throttle	18 (11)	36 (23)	48 (30)	40 (25)	29 (18)	7 (4)

Gear Shift Diagram



TCC Lock-up Diagram

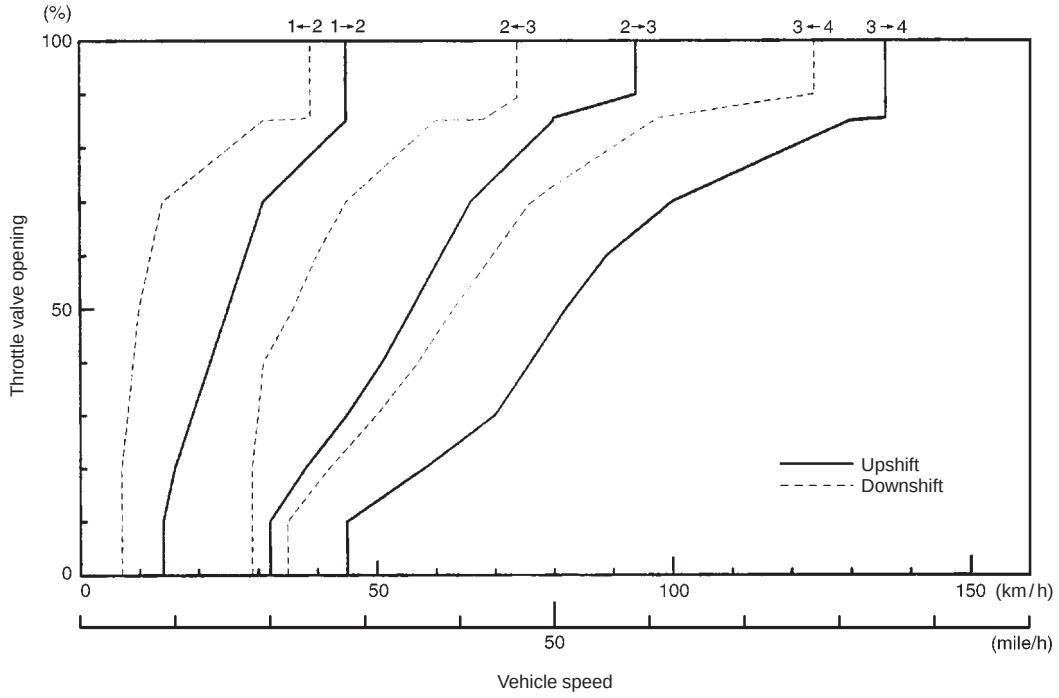


Normal Mode For G16 Engine

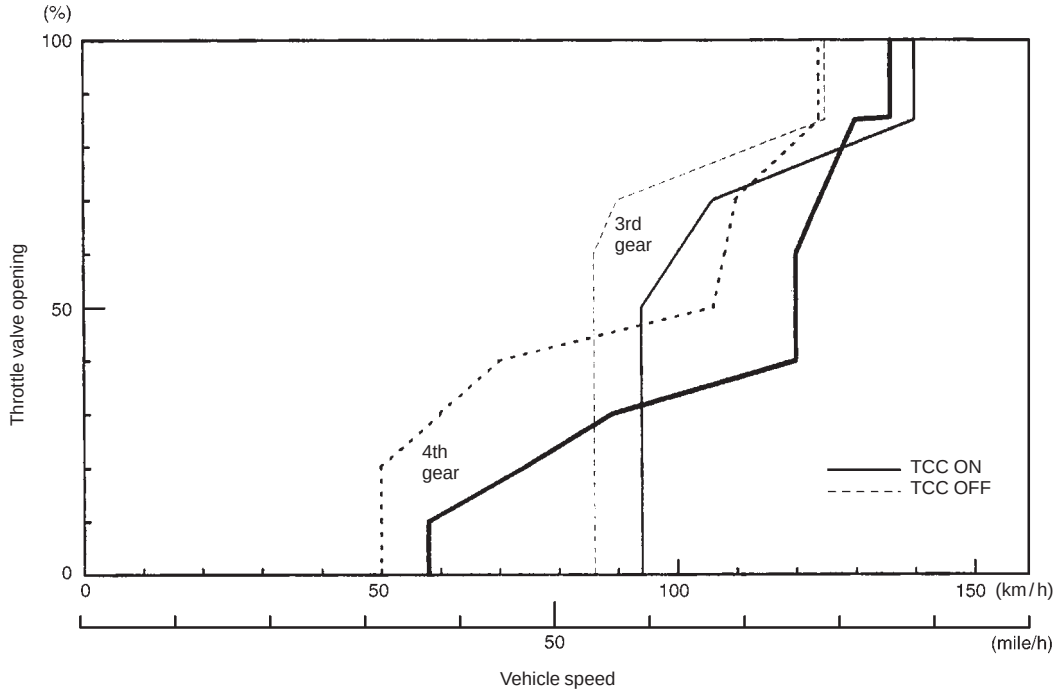
Unit: km/h
(mile/h)

Shift / Throttle opening	1→2	2→3	3→4	4→3	3→2	2→1
Full throttle	45 (28)	94 (58)	136 (85)	124 (77)	74 (46)	39 (24)
Closed throttle	14 (9)	32 (20)	45 (28)	35 (22)	29 (18)	7 (4)

Gear Shift Diagram



TCC Lock-up Diagram

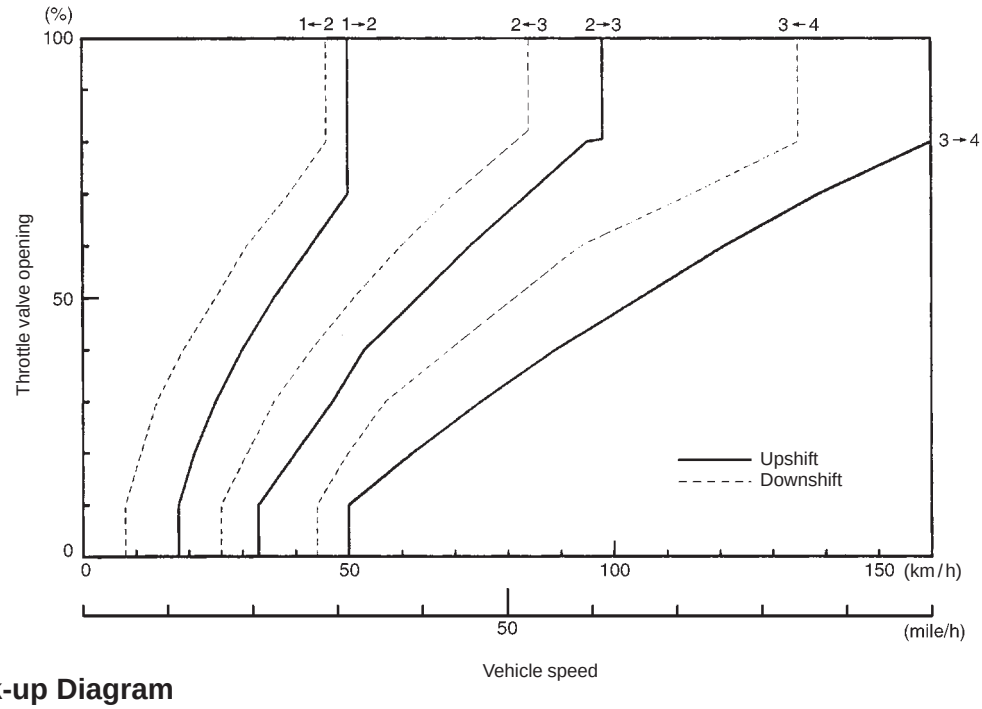


Power Mode For J20 Engine

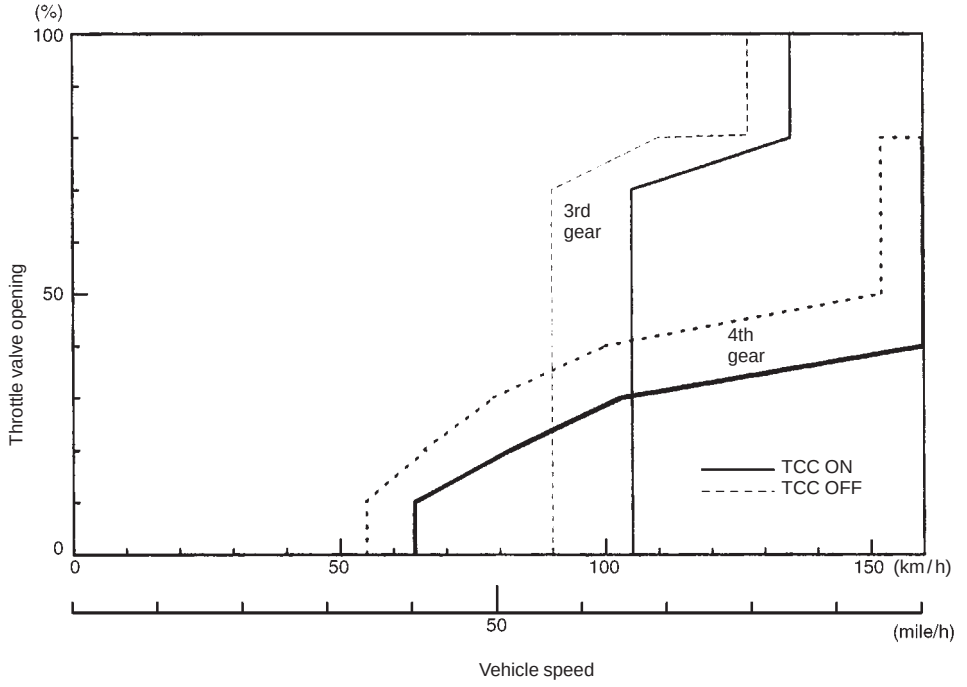
Unit: km/h
(mile/h)

Shift / Throttle opening	1→2	2→3	3→4	4→3	3→2	2→1
Full throttle	50 (31)	98 (61)	—	135 (84)	84 (52)	46 (29)
Closed throttle	18 (11)	33 (21)	50 (31)	44 (27)	26 (16)	8 (5)

Gear Shift Diagram



TCC Lock-up Diagram

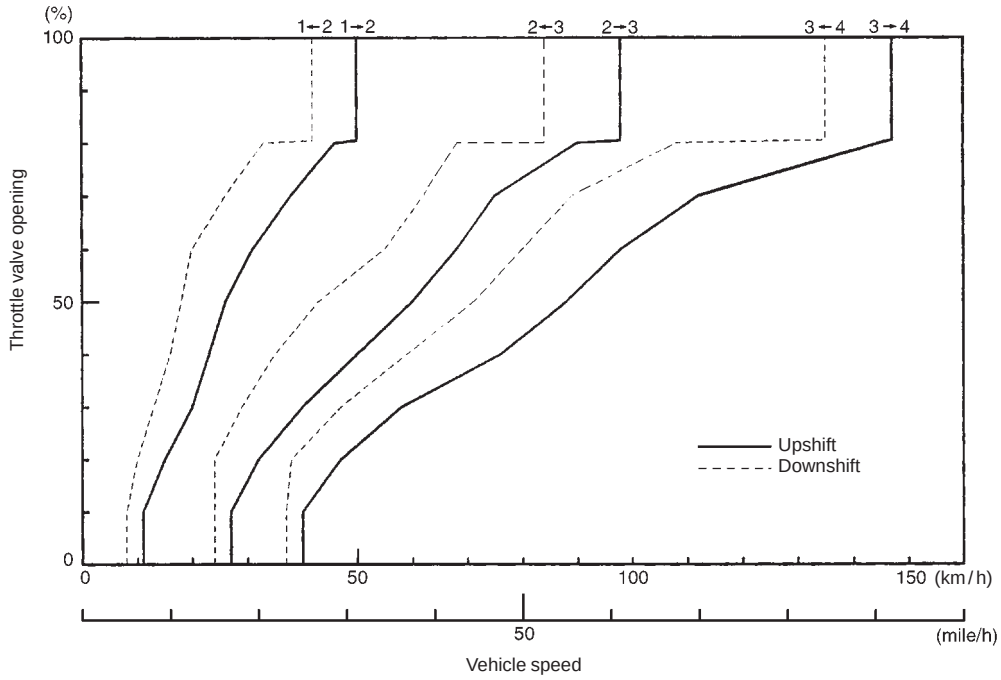


Normal Mode For J20 Engine

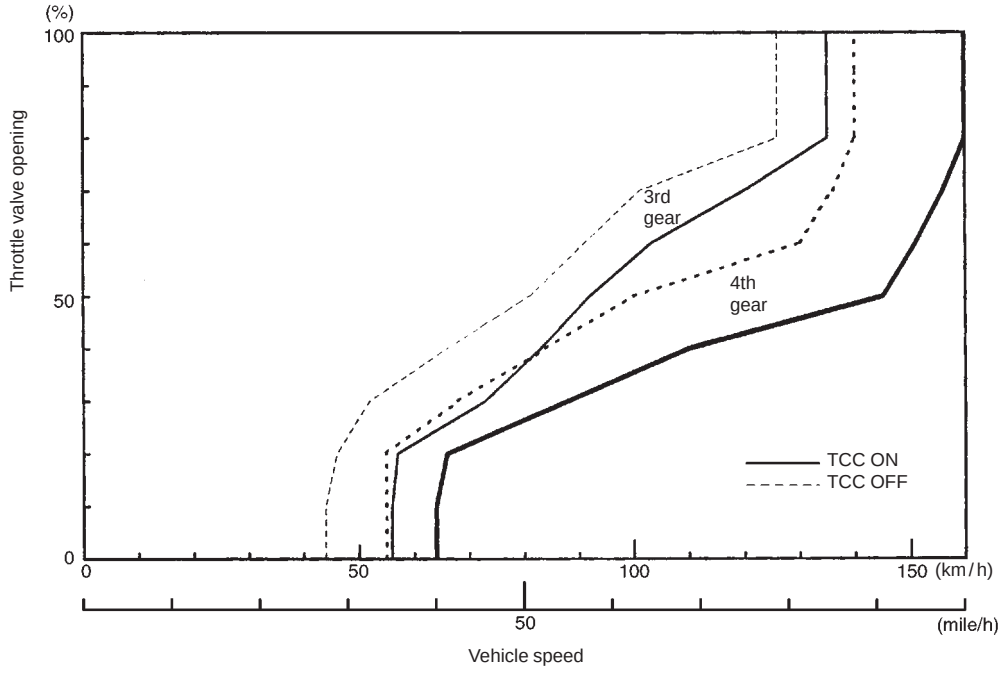
Unit: km/h
(mile/h)

Shift / Throttle opening	1→2	2→3	3→4	4→3	3→2	2→1
Full throttle	50 (31)	98 (61)	147 (91)	135 (84)	84 (52)	42 (26)
Closed throttle	11 (7)	27 (17)	40 (25)	37 (23)	24 (15)	8 (5)

Gear Shift Diagram



TCC Lock-up Diagram

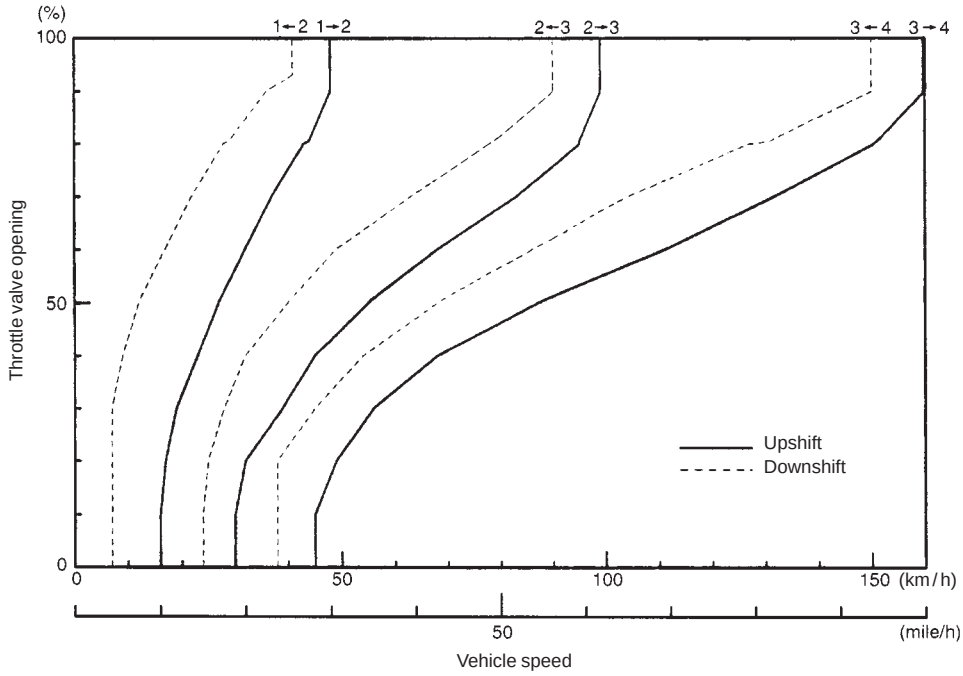


Power Mode For H25 Engine

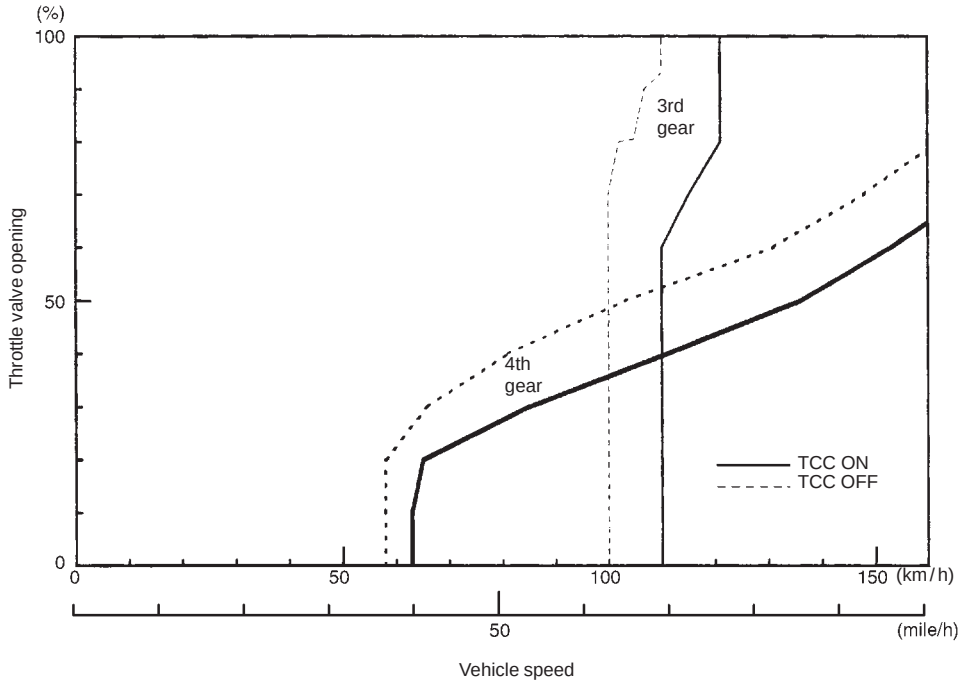
Unit: km/h
(mile/h)

Shift / Throttle opening	1→2	2→3	3→4	4→3	3→2	2→1
Full throttle	48 (30)	99 (62)	160 (99)	150 (93)	90 (56)	41 (25)
Closed throttle	16 (10)	30 (19)	45 (28)	38 (24)	24 (15)	7 (4)

Gear Shift Diagram



TCC Lock-up Diagram

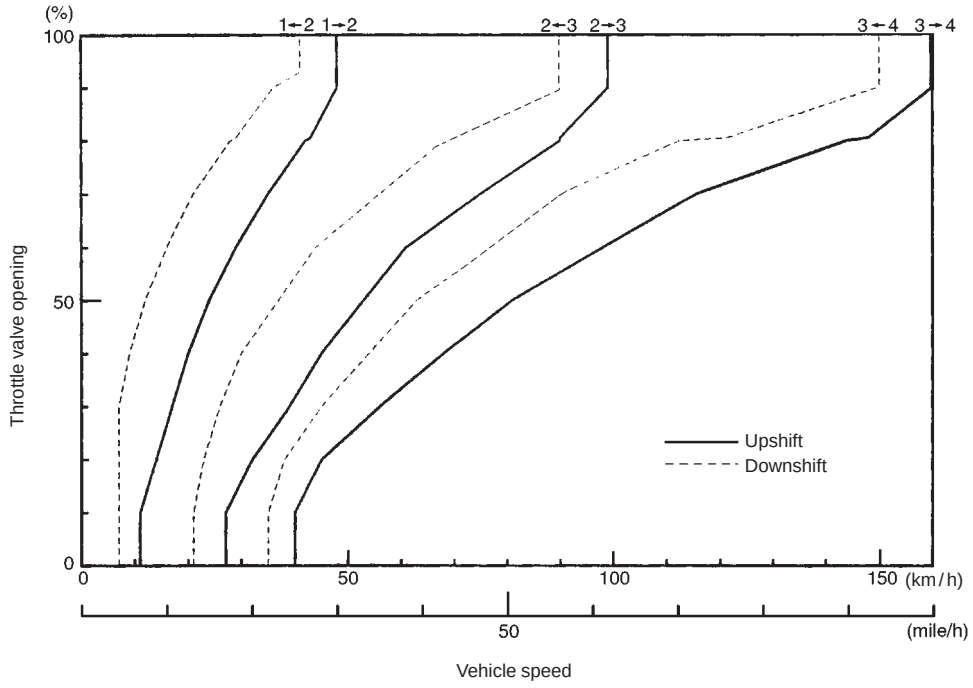


Normal Mode For H25 Engine

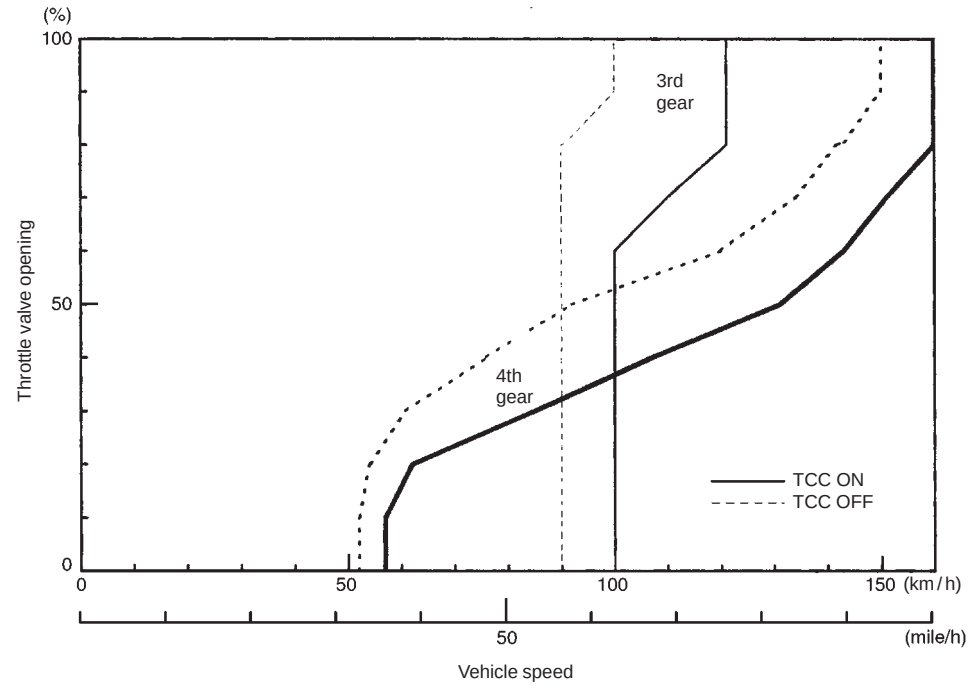
Unit: km/h
(mile/h)

Shift / Throttle opening	1→2	2→3	3→4	4→3	3→2	2→1
Full throttle	48 (30)	99 (62)	160 (99)	150 (93)	90 (56)	41 (25)
Closed throttle	11 (7)	27 (17)	40 (25)	35 (22)	21 (13)	7 (4)

Gear Shift Diagram

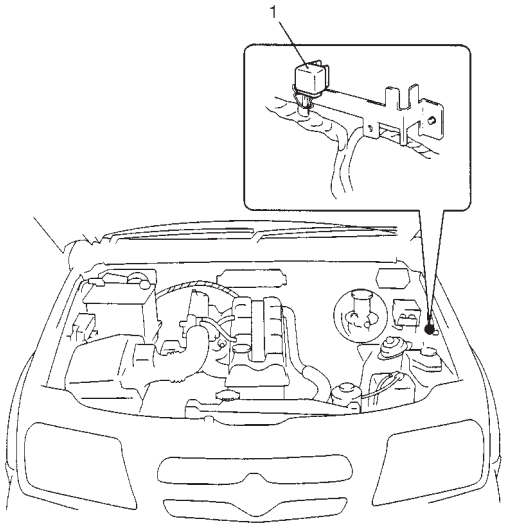


TCC Lock-up Diagram



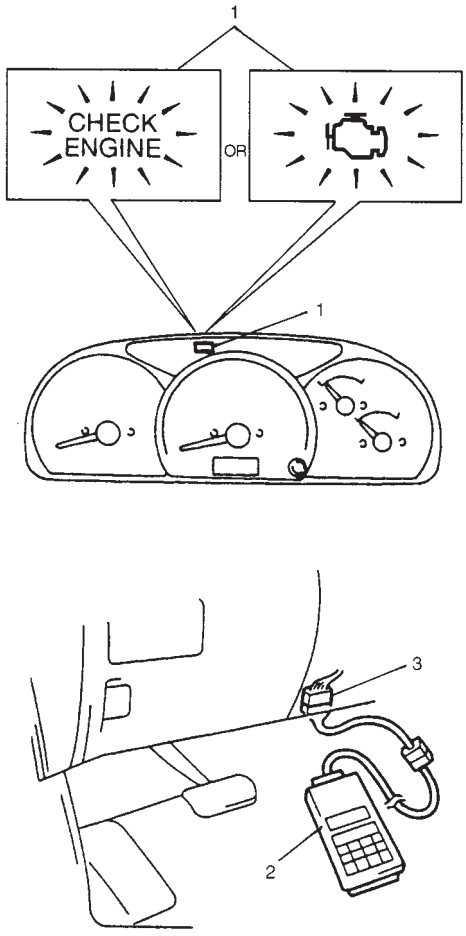
AUTOMATIC TRANSMISSION DIAGNOSIS

This vehicle is equipped with an electronic transmission control system, which control the automatic shift up and shift down timing, TCC operation, etc. suitably to vehicle driving conditions.
PCM (ECM) 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.



1. Monitor connector

NOTE:
There are two types of ON-BOARD DIAGNOSTIC SYSTEM depending on vehicle specifications. The type of system for vehicle being serviced can be identified by whether equipped with monitor connector or not.



1. Malfunction indicator lamp (MIL)
2. Scan tool
3. DLC

[For Vehicle without Monitor Connector]

ON-BOARD DIAGNOSTIC SYSTEM

For automatic transmission control system, PCM (ECM) has following functions. Refer to Section 6/6-1 for details.

- When the ignition switch is turned ON with the engine at a stop, malfunction indicator lamp (MIL) turns ON to check the bulb of the MIL.
- When PCM detects a malfunction in A/T control system (and/or a malfunction which gives an adverse effect to vehicle emission) while the engine is running, it makes the malfunction indicator lamp in the meter cluster of the instrument panel turn ON 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 turn OFF although DTC stored in its memory will remain.)
- It is possible to communicate through DLC by using not only SUZUKI scan tool (Tech-1) but also generic scan tool. (Diagnostic information can be accessed by using a scan tool.)

2 Driving Cycle Detection Logic

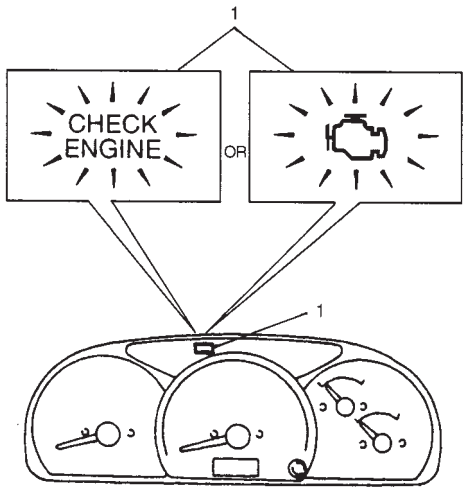
Refer to section 6/6-1 for details.

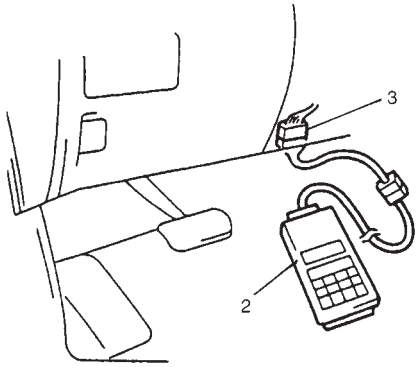
Pending DTC

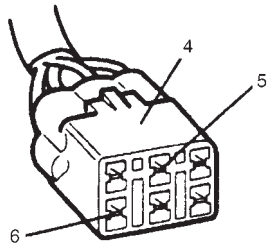
Refer to section 6/6-1 for details.

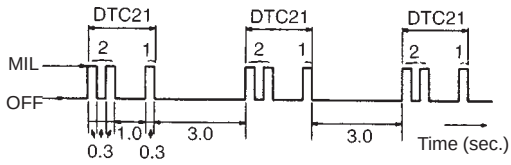
Freeze Frame Data

Refer to section 6/6-1 for details.









1. Malfunction indicator lamp (MIL)
2. Scan tool
3. DLC
4. Monitor connector
5. Diagnosis switch terminal
6. Ground terminal

[For Vehicle with Monitor Connector]

ON-BOARD DIAGNOSTIC SYSTEM

For automatic transmission control system, PCM (ECM) has following functions. Refer to Section 6/6-1 for details.

- When the ignition switch is turned ON with the engine at a stop, malfunction indicator lamp (MIL) turns ON to check the bulb of the MIL.
- When PCM detects a trouble in electronic shift control system, it stores its trouble code in back-up memory in itself. (The memory is kept as it is even if the trouble was only temporary and disappeared immediately. And it is not erased unless the power to PCM is shut off for 30 seconds or longer.)
- It is possible to communicate through DLC by using not only SUZUKI scan tool (Tech-1) but also generic scan tool. (Diagnostic information can be accessed by using a scan tool.)
- It is also possible to communicate by not using scan tool. PCM indicates trouble area in memory by means of flashing of malfunction indicator lamp at the time of inspection (i.e. when diagnosis switch terminal is grounded and ignition switch is turned ON).

PRECAUTION IN DIAGNOSING TROUBLE

- Don't disconnect couplers from PCM (ECM), 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 (Tech-1), or also generic scan tool for vehicle without monitor connector, 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 (Only for vehicle without monitor connector)
  If two or more diagnostic trouble codes (DTCs) are stored, proceed to the flow table of the DTC which was detected earliest in the order and follow the instruction in that table.
  If no instructions are given, troubleshoot diagnostic trouble codes according to the following priorities.
  1. Diagnostic trouble codes (DTCs) other than DTC P0171/P0172 (Fuel system too lean/too rich) and DTC P0400 (EGR flow malfunction)
  2. DTC P0171/P0172 (Fuel system too lean/too rich) and DTC P0400 (EGR flow malfunction)
- Be sure to read "Precautions 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.
  – MAF sensor, MDP sensor, TP sensor and fuel tank pressure sensor are in good condition. Also, the power circuit of these sensors is not shorted to the ground.

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 "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?		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 "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 "DTC Check" in this section. Is there any DTC(s)?	Go to Step 9.	Go to Step 10.
8	Automatic Transmission Basic Inspection and Trouble Diagnosis Table 1) Check and repair according to "A/T Basic Check" and "Trouble Diagnosis Table" in this section. Are check and repair complete?	Go to Step 11.	1) Check and repair malfunction part(s). 2) Go to Step 11.
9	Troubleshooting for DTC 1) Check and repair according to applicable DTC diag. flow Table. Are check and repair complete?		
10	Check for Intermittent Problems 1) Check for intermittent problems referring to the 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

Record details of the problem (failure, complaint) and how it occurred as described by the customer.
For this purpose, use of such a 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 DTC check section, check DTC (including pending DTC). If DTC exists, print or write down DTC and freeze frame data and then clear them by referring to DTC clearance section. 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 A/T and engine referring to Visual Inspection 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, recheck DTC according to “DTC Confirmation Procedure” described in each “DTC FLOW TABLE”.

6 and 7. RECHECKING AND RECORD OF DTC/FREEZE FRAME DATA

Refer to “DTC Check” section for checking procedure.

8. A/T BASIC CHECK AND TROUBLE DIAGNOSIS TABLE

Perform A/T basic check according to the “A/T Basic Check 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 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.

9. DIAGNOSTIC TROUBLE CODE FLOW TABLE

Based on the DTC indicated in Step 6 and 7 and referring to “DIAGNOSTIC TROUBLE CODE FLOW 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 A/T is free from any abnormal conditions.
If what has been repaired is related to the malfunction DTC, clear the DTC once, set conditions under which DTC was detected and A/T and/or vehicle was repaired and confirm that no DTC is indicated.

CUSTOMER PROBLEM INSPECTION FORM (EXAMPLE)

User name:	Model:	VIN:	
Date of issue:	Date of Reg:	Date of problem:	Mileage:

PROBLEM SYMPTOMS	
☐Engine does not start	☐Engine stops
☐Vehicle does not move (forward, rearward)	☐Transmission does not shift (1st, 2nd, 3rd, 4th, Rev) gear
☐No lock-up (TCC clutch operation)	☐Automatic shift does not occur
☐Shift point too high or too low	☐Transmission slipping in (1st, 2nd, 3rd, 4th, Rev) gear
☐Excessive gear change shock	☐Other:

VEHICLE/ ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather	☐Fair/☐Cloudy/☐Rain/☐Snow/☐Always/☐Other ( )
Temperature	☐Hot/☐Warm/☐Cool/☐Cold/☐(°C °F)/☐Always
Frequency	☐Always/☐Sometimes/☐(times/ day, month)/☐Only Once
Road	☐Urban/☐Suburb/☐Highway/☐Mountainous (uphill/downhill)/☐Paved road/☐Gravel/ ☐Other( )
Vehicle Condition	
Transmission range	☐(P,R,N,D,2,L) range/☐(→) range
Transmission temp.	☐Cold/☐Warming up phase/☐Warmed up
Vehicle	☐At stop/☐During driving (constant speed/accelerating/decelerating/ right hand corner/left hand corner)/☐Other ( )/☐Speed (km/h mile/h)
Engine	☐Speed(r/min)/☐Throttle opening(idle/about %/full)
Brake	☐Apply/☐Not apply
O/D cut switch	☐ON/☐OFF
P/N change switch	☐Power/☐Normal
Malfunction indicator lamp condition ☐Always ON ☐Sometimes ON ☐Always OFF ☐Good condition	
Diagnostic trouble code	First check : ☐No code ☐Malfunction code( )
	Second check : ☐No code ☐Malfunction code( )

NOTE:
The above form is a standard sample. It should be modified according to conditions characteristic of each market.

MALFUNCTION INDICATOR LAMP (MIL) CHECK

Refer to the same item in Section 6/6-1 for checking procedure.

"O/D OFF" LAMP CHECK

1) Check that O/D cut switch button is at OFF position (pushed).
2) Turn ignition switch ON.
3) Check that "O/D OFF" lamp lights for about 2 – 4 sec. and then goes OFF.
   If anything faulty is found, advance "Diagnostic flow table B-1 or B-2" O/D OFF "LAMP CIRCUIT CHECK".

"POWER" LAMP CHECK

1) Check that Power/Normal change switch button is at Normal position.
2) Turn ignition switch ON.
3) Check that "Power" Lamp light for 2 – 4 sec. and then goes OFF.
   If anything faulty is found, advance "Diagnostic flow table B-3 or B-4 "POWER" LAMP CIRCUIT CHECK 2.

DIAGNOSTIC TROUBLE CODE (DTC) CHECK

Refer to the same item in Section 6/6-1 for checking procedure.

DIAGNOSTIC TROUBLE CODE (DTC) CLEARANCE

Refer to the same item in Section 6/6-1 for clearance procedure.

DIAGNOSTIC TROUBLE CODE (DTC) TABLE (A/T RELATED CODE)

DTC NO.		DETECTED ITEM	DETECTING CONDITION	MIL	
Using scan tool	Not using scan tool			Vehicle without monitor connector	Vehicle with monitor connector
–	12	–	No trouble.	–	–
P0705	72	Transmission range sensor circuit malfunction	Multiple signals inputted simultaneously or no signal inputted while running at 60 km/h or more.	2 driving cycles	Not applicable
P0715	76	Input/Turbine speed sensor circuit malfunction	Input shaft revolution speed is lower than specified value while vehicle is running with "D" range and specified engine speed or higher.	2 driving cycles	Not applicable
P0720	75	Output speed sensor circuit malfunction	Output speed sensor signal not inputted while VSS signal being inputted.	2 driving cycles	Not applicable
*1 P0741	Not applicable	TCC (lock-up) solenoid performance or stack off	Actual TCC operation does not agree with ON/OFF control from PCM to TCC.	2 driving cycles	Not applicable
P0743	65 66	TCC (lock-up) solenoid electrical	Monitor signal OFF is detected When TCC control solenoid is ON or monitor signal ON is detected when it is OFF.	1 driving cycle	Not applicable
*1 P0751	Not applicable	Shift solenoid A (#1) performance or stuck off	Gear change control from PCM to A/T does not agree with actual gear position of A/T.	2 driving cycles	Not applicable
P0753	61 62	Shift solenoid A (#1) electrical	Monitor signal OFF is detected when shift solenoid A (#1) is ON or monitor signal ON is detected when it is OFF.	1 driving cycle	Not applicable

DIAGNOSTIC TROUBLE CODE (DTC) TABLE (A/T RELATED CODE) (cont'd)

DTC NO.		DETECTED ITEM	DETECTING CONDITION	MIL	
Using scan tool	Not using scan tool			Vehicle without monitor connector	Vehicle with monitor connector
*1 P0756	Not applicable	Shift solenoid B (#2) performance or stuck off	Gear change control from PCM to A/T does not agree with actual gear position of A/T.	2 driving cycles	Not applicable
P0758	63 64	Shift solenoid B (#2) electrical	Monitor signal OFF is detected when shift solenoid B (#2) is ON or monitor signal ON is detected when it is OFF.	1 driving cycle	Not applicable
*1 P1875	Not applicable	4WD low switch circuit malfunction	Difference between vehicle speed detected by VSS and vehicle speed detected by output speed sensor and compensated by 4WD low switch is larger than specification.	2 driving cycles	Not applicable

NOTE:
***1: Applicable to vehicle without monitor connector only.**

FAIL-SAFE TABLE

When any of the following DTC is detected, ECM (PCM) enters fail-safe mode as long as malfunction continues to exist but that mode is canceled when ECM detects normal condition after that.

DTC NO.		TROUBLE AREA	FAIL SAFE OPERATION
Using scan tool	Not using scan tool		
P0177 P0118	14 15	ECT SENSOR	● Each control except 4-A/T is permitted on the basis of 30.1°C engine coolant temp. ● 4-A/T control is performed assuming 31°C (engine warmed up) or higher after 15 min. from engine start.
P0122 P0123	21 22	TP SENSOR	● Each control except 4-A/T is performed on the basis of 124° throttle valve opening. ● 4-A/T control is performed on the basis of 0° throttle valve opening.
P0705	72	TR SWITCH	A/T control is performed in priority order of L, 2, N, D, R and P.
P0720	75	OUTPUT SPEED SENSOR CIRCUIT MALFUNCTION	A/T control is performed by using signal from VSS.
P0753	61 62	SHIFT SOLENOID A (#1)	● A/T control using 3rd gear is performed when D range, 1st or 2nd gear is used. ● TCC solenoid OFF.
P0758	63 64	SHIFT SOLENOID B (#2)	● A/T control using 4th gear is performed when D range 2nd or 3rd gear is used. ● When both shift solenoid A (#1) and B (#2) failed simultaneously, A/T control using 4th gear is always performed in D range. ● TCC solenoid OFF.
P0743	65 66	TCC (Lock-up) SOLENOID	TCC (lock-up) solenoid OFF.

VISUAL INSPECTION

Visually check following parts and systems.

INSPECTION ITEM	REFERRING SECTION
● A/T fluid – – – – – level, leakage, color	Section 0B
● A/T fluid hoses – – – – – disconnection, looseness, deterioration	Section 7B1
● Throttle (accelerator) cable – – – – – play, installation	Section 6E1/6E2
● A/T throttle cable – – – – – play, installation	Section 7B1
● A/T select cable – – – – – installation, operation	Section 7B1
● Engine oil – – – – – level, leakage	Section 0B
● Engine coolant – – – – – level, leakage	Section 0B
● Battery – – – – – fluid level, corrosion of terminal	
● Connectors of electric wire harness – – – – – disconnection, friction	Section 6/6-1/7B1
● Fuses – – – – – burning	Section 8
● Parts – – – – – installation, damage	
● Bolt – – – – – looseness	
● Other parts that can be checked visually	
Also check following items at engine start, if possible.	
● “O/D OFF” lamp — Operation	Section 7B1
● “POWER” lamp — Operation	Section 7B1
● Malfunction indicator lamp — Operation	Section 6/6-1
● Charge warning lamp — Operation	Section 6H
● Engine oil pressure warning lamp — Operation	Section 8 (Section 6A1/6A2/6A4 for pressure check)
● Engine coolant temp. meter — Operation	
● Other parts that can be checked visually	

A/T BASIC CHECK

This inspection is important for troubleshooting when PCM (ECM) has detected no DTC and no abnormality has been noted in visual inspection.
Follow flow table carefully.

STEP	ACTION	YES	NO
1	Was “A/T DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “A/T DIAG. FLOW TABLE”.
2	Perform MANUAL ROAD TEST in this section. Is it OK?	Go to Step 3.	Go to Step 4.
3	Proceed to TROUBLE DIAGNOSIS TABLE 1 in this section. Is trouble identified?	Repair or replace defective parts.	Go to Step 5.
4	Perform stall test, time rag test, line pressure test, engine brake test and “P” range test referring to STALL TEST, LINE PRESSURE TEST, ENGINE BRAKE TEST and “P” RANGE TEST in this section. Are the test results satisfactory?	Go to Step 5.	Proceed to TROUBLE DIAGNOSIS TABLE 3 in this section.
5	Proceed to TROUBLE DIAGNOSIS TABLE 2 in this section. Is trouble identified?	Repair or replace defective parts.	Proceed to TROUBLE DIAGNOSIS TABLE 3 in this section.

TROUBLE DIAGNOSIS TABLE 1

Condition	Possible Cause	Correction
TCC does not operate	● Brake pedal (stop lamp) switch or its circuit faulty (H25 engine only) ● 4WD low switch or its circuit faulty ● Engine coolant temp. sensor or its circuit faulty ● Cruise control signal circuit faulty (if equipped)	DIAGNOSTIC FLOW TABLE A-1
Gear does not change to 4th	● O/D cut switch or its circuit faulty ● 4WD low switch or its circuit faulty ● Engine coolant temp. sensor or its circuit faulty ● Cruise control signal circuit faulty (if equipped)	DIAGNOSTIC FLOW TABLE A-2

TROUBLE DIAGNOSIS TABLE 2

Condition		Possible Cause	Correction
Transmission fluid	Low fluid pressure	● Clogged oil pump strainer	Wash strainer.
		● Malfunction of pressure regulator valve	Overhaul valve body.
	High fluid pressure	● Pressure regulator valve	Overhaul valve body.
Running condition	Unable to run in all range	● Regulator valve stick	Replace.
		● Clogged oil strainer	Wash strainer.
		● Seized or broken planetary gear	Repair or replace.
		● Faulty manual valve	Replace.
Running condition	Poor 1st speed running or excessive slippage in “D” or “2”	● Faulty 1–2 shift valve	Replace.
Gear shift	Poor 1–2 shift, excessive slippage	● Regulator valve sticking	Replace.
		● 1–2 shift valve sticking	Replace.
		● Shift solenoid valve-B sticking	Replace.
		● Intermediate coast modulator valve sticking	Replace.
	Poor 2–3 shift, excessive slippage	● 2–3 shift valve sticking	Replace.
		● Shift solenoid valve-A sticking	Replace.
	Poor start or surging in “D” range	● Regulator valve sticking	Replace.

Condition		Possible Cause	Correction
Gear shift	Poor 3–4 shift, excessive slippage	● 3–4 shift valve sticking	Replace.
		● Shift solenoid valve-B sticking	Replace.
	Excessive shock on 1–2 shift	● Regulator valve sticking	Replace.
		● Faulty accumulator, second brake piston	Replace.
	Excessive shock on 2–3 shift	● Regulator valve sticking	Replace.
		● Faulty accumulator, direct clutch piston	Replace.
	Excessive shock on 3–4 shift	● Regulator valve sticking	Replace.
	Non operate lock-up system	● TCC (Lock-up) control valve sticking	Replace.
		● Solenoid valve No.2 (TCC solenoid valve) sticking	Replace.

TROUBLE DIAGNOSIS TABLE 3

Condition		Possible Cause	Correction
Transmission fluid	Low fluid pressure	● Leakage from oil pressure circuit	Overhaul.
Running condition	Unable to run in all range	● Wear in oil pump	Replace.
		● Seizure in oil pump	Replace.
		● Fluid pressure leakage to over drive clutch due to wear of oil pump bushing	Replace.
		● Faulty in torque converter	Replace.

Condition		Possible Cause	Correction
Running condition	Poor 1st speed running or excessive slippage in “D” or “2”	● Fluid pressure leakage from forward clutch due to wear or breakage of O/D case seal ring	Replace.
		● Overdrive clutch slipping	Replace.
	Unable to run or excessive slippage in “L” range	● Fluid pressure leakage of forward clutch due to wear or breakage of O/D case seal ring	Replace.
		● Reverse brake disc slipping	Replace.
		● Broken brake piston O-ring	Replace.
	Unable to run or excessive slippage in “R” range	● Fluid pressure leakage to direct clutch due to wear or breakage of center support seal ring	Replace.
		● Worn direct clutch	Replace.
Gear shift	Poor 1–2 shift, excessive slippage	● Fluid pressure leakage to overdrive clutch due to wear or breakage of O/D case seal ring	Replace.
		● Faulty second brake	Replace.
		● Broken O-ring of second brake piston	Replace.
		● Faulty second coast brake (in “2” range)	Replace.
	Poor 2–3 shift, excessive slippage	● Fluid pressure leakage to overdrive clutch due to wear or breakage of O/D case seal ring	Replace.
		● Worn direct clutch bushing	Replace.
		● Direct clutch slipping	Replace.
		● Foreign material caught in direct clutch piston check ball	Replace.
	Poor start or surging in “D” range	● Fluid pressure leakage of forward clutch due to wear or breakage of O/D case seal ring	Replace.
		● Malfunction of forward clutch	Replace.
	Poor 3–4 shift, excessive slippage	● Faulty overdrive brake	Replace.
		● Faulty overdrive clutch	Replace.
	Poor start or juddering in “R” range	● Fluid pressure leakage of direct clutch due to wear or breakage of oil center support seal ring	Replace.
		● Worn direct clutch	Replace.
	Excessive shock on 1– 2 shift	● Faulty one-way clutch	Replace.
	Non operate lock-up system	● Faulty torque converter	Replace.
Abnormal noise	Abnormal noise in “P” or “N” range	● Worn oil pump	Replace.

SCAN TOOL DATA-Refer to SECTION 6/6-1.

INSPECTION OF PCM AND ITS CIRCUIT-Refer to SECTION 6/6-1.

WIRE HARNESS AND CONNECTORS-Refer to SECTION 6/6-1.

DIAGNOSTIC FLOW TABLE A-1 (NO TCC LOCK-UP OCCURS)

SYSTEM DESCRIPTION

PCM turns TCC solenoid OFF under any of the following conditions.

- Brake pedal switch: ON
- 4WD LOW switch: ON
- Cruise control module: TCC OFF command signal is output (if equipped).
- ECT: ECT < 30°C (86°F)

TROUBLESHOOTING

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 person, a driver and tester, on a level road.**

STEP	ACTION	YES	NO
1	Was "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE" performed?	Go to Step 2.	Go to "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE".
2	ECT check: (1) Warm up engine to normal operating temperature. (2) Check ECT using scan tool. Is ECT more than 30°C (86°F)?	Go to Step 3.	Faulty ECT sensor, its circuit or engine cooling system. If OK, substitute a known-good PCM and recheck.
3	Perform running test under the following conditions and check voltage between C51-1-8 (G16/J20 engines) or C51-1-2 (H25 engine) terminal of PCM coupler and ground. ● Normal mode in "D" range. ● Transfer "2H" position. ● Cruise control is not operated (if equipped). ● Brake pedal released. ● Drive vehicle with TCC ON condition referring to "TCC lock-up diagram" in this section. Is it battery voltage?	Faulty TCC solenoid valve, its circuit or transmission.	Go to Step 4.
4	Is vehicle equipped with H25 engine?	Go to Step 5.	Go to Step 6.
5	Brake switch signal inspection: (1) With ignition switch ON, check voltage between E61-31 terminal of PCM coupler terminal and ground. Is the result as specified?	Go to Step 6.	Faulty brake pedal switch or its circuit. If OK, substitute a known-good PCM and recheck.

Brake pedal	Released	Depressed
Voltage	0 V	Battery voltage

<table>
<tr><th>STEP</th><th>ACTION</th><th>YES</th><th>NO</th></tr>
<tr><td>6</td><td>“4WD LOW” switch signal inspection:
(1) With ignition switch ON, check voltage between C51-1-26 (G16 / J20 engines) or C51-1-5 (H25 engine) terminal of PCM coupler and ground.
<table><tr><td>Transfer gear position</td><td>“4L” or “N”</td><td>“4H” or “2H”</td></tr><tr><td>Voltage</td><td>0 V</td><td>Battery voltage</td></tr></table>Is the result as specified?</td><td>Go to Step 7.</td><td>Faulty “4WD LOW” switch or its circuit.
If OK, substitute a known-good PCM and recheck.</td></tr>
<tr><td>7</td><td>Is vehicle equipped with cruise control system?</td><td>Go to Step 8.</td><td>Substitute a known-good PCM and recheck.</td></tr>
<tr><td>8</td><td>Cruise control signal inspection:
(1) With ignition switch ON, check voltage between E61-35 (G16 / J20 engines) or E61-3 (H25 engine) terminal of PCM coupler and ground.
Is it battery voltage?</td><td>Substitute a known-good PCM and recheck.</td><td>Faulty cruise control module or its circuit.
If OK, substitute a known-good PCM and recheck.</td></tr>
</table>

DIAGNOSTIC FLOW TABLE A-2 (NO GEAR SHIFT TO O/D)

SYSTEM DESCRIPTION

PCM does not shift to O/D gear under any of the following conditions.

- O/D cut switch: ON
- 4WD LOW switch: ON
- Cruise control module: O/D OFF command signal is output (if equipped).
- ECT: ECT < 30°C (86°F)

TROUBLESHOOTING

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 person, a driver and tester, on a level road.**

STEP	ACTION	YES	NO
1	Was "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE" performed?	Go to Step 2.	Go to "AUTOMATIC TRANSMISSION DIAGNOSTIC FLOW TABLE".
2	ECT check: (1) Warm up engine to normal operating temperature. (2) Check ECT using scan tool. Is ECT more than 30°C (86°F)?	Go to Step 3.	Faulty ECT sensor, its circuit or engine cooling system. If OK, substitute a known-good PCM and recheck.
3	Perform running test under the following conditions and check voltage between C51-1-2 (G16/J20 engines) or C51-1-6 (H25 engine) terminal of PCM coupler and ground, C51-1-1 terminal of PCM coupler and ground. ● O/D cut switch OFF ("O/D OFF" lamp OFF). ● Normal mode in "D" range. ● Transfer "2H" position. ● Cruise control is not operated (if equipped). ● Drive vehicle with 4th gear condition referring to "Gear shift diagram" in this section. Is each voltage about 0 V?	Faulty shift solenoid valve, its circuit or transmission.	"G" wire or "G/R" wire shorted to power circuit. If OK, go to Step 4.
4	O/D cut switch signal inspection: (1) With ignition switch ON, check voltage between E61-33 (G16/J20 engines) or E61-14 (H25 engine) terminal of PCM coupler and ground. O/D cut switch: OFF → Voltage: Battery voltage; ON → 0 V Is the result as specified?	Go to Step 5.	Faulty O/D cut switch or its circuit. If OK, substitute a known-good PCM and recheck.

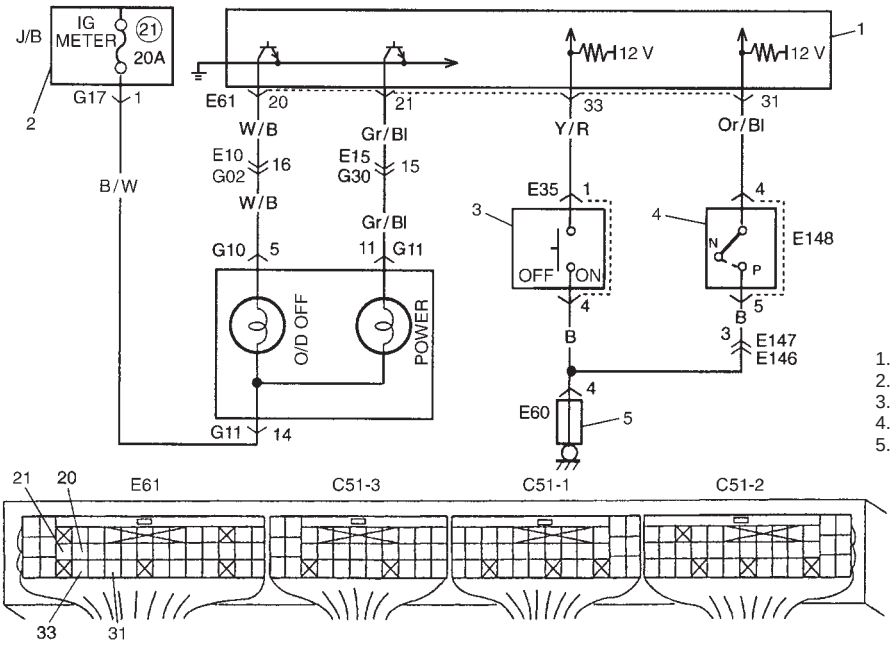
<table>
<tr><th>STEP</th><th>ACTION</th><th>YES</th><th>NO</th></tr>
<tr><td>5</td><td>4WD LOW switch signal inspection:
(1) With ignition switch ON, check voltage between C51-1-26 (G16/J20 engines) or C51-1-5 (H25 engine) terminal of PCM coupler and ground.
<table><tr><td>Transfer gear position</td><td>“4L” or “N”</td><td>“4H” or “2H”</td></tr><tr><td>Voltage</td><td>0 V</td><td>Battery voltage</td></tr></table>Is the result as specified?</td><td>Go to Step 6.</td><td>Faulty 4WD LOW switch or its circuit.
If OK, substitute a known-good PCM and recheck.</td></tr>
<tr><td>6</td><td>Is vehicle equipped with cruise control system?</td><td>Go to Step 7.</td><td>Substitute a known-good PCM and recheck.</td></tr>
<tr><td>7</td><td>Cruise control signal inspection:
(1) With ignition switch ON, check voltage between E61-35 (G16/J20 engines) or E61-3 (H25 engine) terminal of PCM coupler and ground.
Is it battery voltage?</td><td>Substitute a known-good PCM and recheck.</td><td>Faulty cruise control module or its circuit.
If OK, substitute a known-good PCM and recheck.</td></tr>
</table>

DIAGNOSTIC FLOW TABLE B-1 "O/D OFF" LIGHT CIRCUIT CHECK

("O/D OFF" LIGHT DOESN'T LIGHT AT IGNITION SWITCH ON BUT ENGINE STARTS UP)

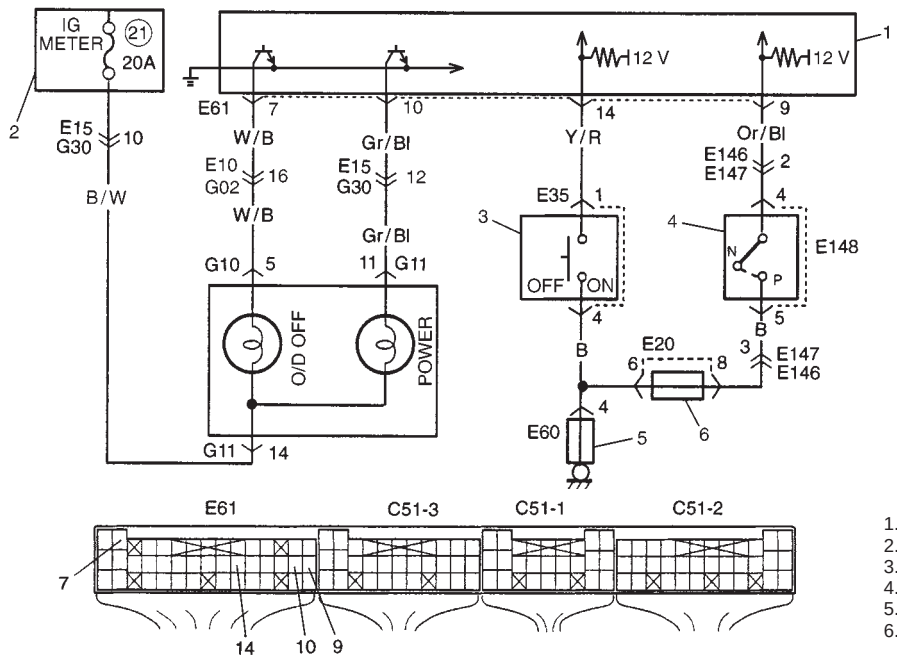
WIRING DIAGRAM

G16/J20 Engines



1. PCM
2. J/B
3. O/D cut switch
4. P/N change switch
5. J/C

H25 Engine



1. PCM
2. Fuse
3. O/D cut switch
4. P/N change switch
5. J/C
6. J/C

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	"O/D OFF" light circuit check: (1) With ignition switch OFF, disconnect couplers from PCM. (2) Using service wire, connect E61-20 (G16/J20 engines) or E61-7 (H25 engine) terminal of disconnected PCM coupler and ground. Does "O/D OFF" light turn ON at ignition switch ON?	Poor E61-20 (G16/J20 engines) or E61-7 (H25 engine) terminal connection. If OK, substitute a known-good PCM and recheck.	Bulb burned out or faulty "W/B", "B/W" wire.

DIAGNOSTIC FLOW TABLE B-2 "O/D OFF" LIGHT CIRCUIT CHECK

("O/D OFF" LIGHT COMES ON STEADILY)

WIRING DIAGRAM – Refer to Table B-1 in this section.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Check O/D cut Switch Position. Is O/D cut switch turned OFF (Is switch button at OFF position)?	Go to Step 2.	Turn O/D cut switch OFF.
2	Check Lamp Circuit for Short. 1) Turn ignition switch OFF and disconnect PCM connectors. 2) Turn ignition switch ON. Does "O/D OFF" lamp come ON steadily?	"W/B" circuit shorted to ground.	Go to Step 3.
3	Check O/D cut Switch Circuit. 1) Check resistance between terminal E61-33 (G16/J20 engines) or E61-14 (H25 engine) of disconnected PCM connector and body ground with O/D cut switch OFF. Is continuity indicated?	Go to Step 4.	Check PCM ground circuit for open. If ground circuit is OK, substitute a known-good PCM and recheck.
4	Check O/D cut Switch for Operation. 1) Remove console box. 2) Disconnect O/D cut switch connector. 3) Check continuity between switch terminals under each condition below. Switch OFF position: No continuity Switch ON position: Continuity Is check result satisfactory?	"Y/R" circuit shorted to ground.	Replace O/D cut switch.

Fig. for Step 1.

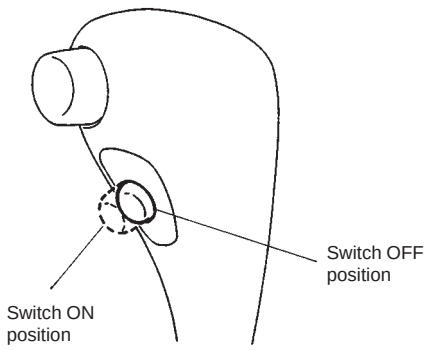
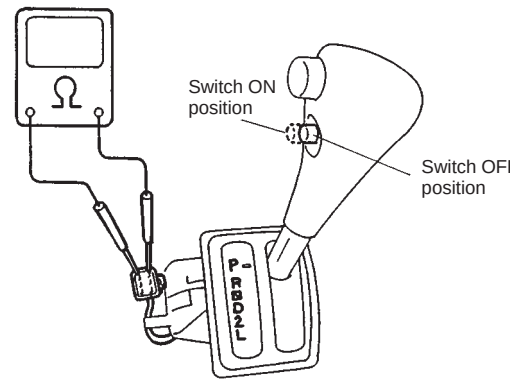


Fig. for Step 4.

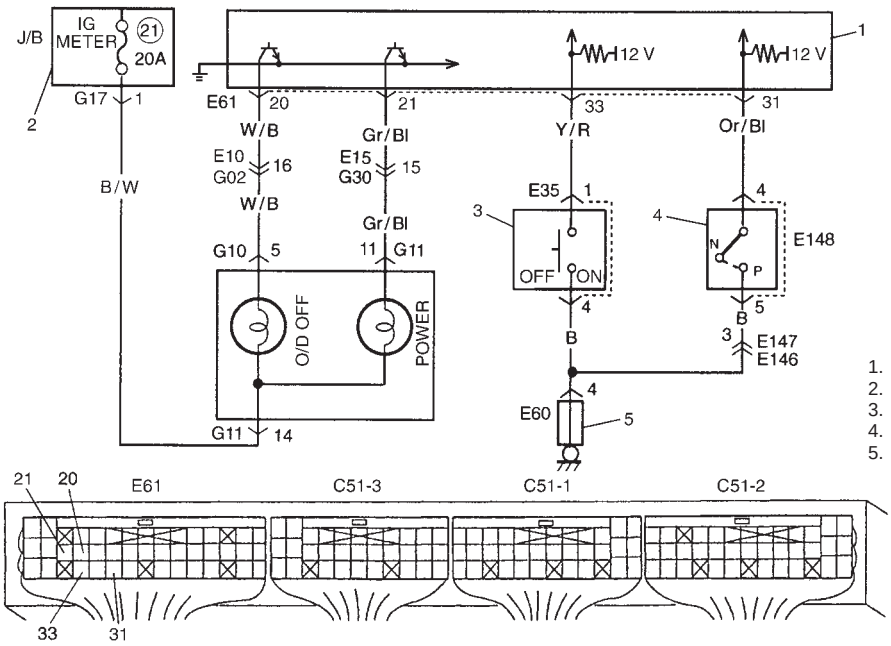


DIAGNOSTIC FLOW TABLE B-3 "POWER" LIGHT CIRCUIT CHECK

("POWER" LIGHT DOESN'T LIGHT AT IGNITION SWITCH ON BUT ENGINE STARTS UP)

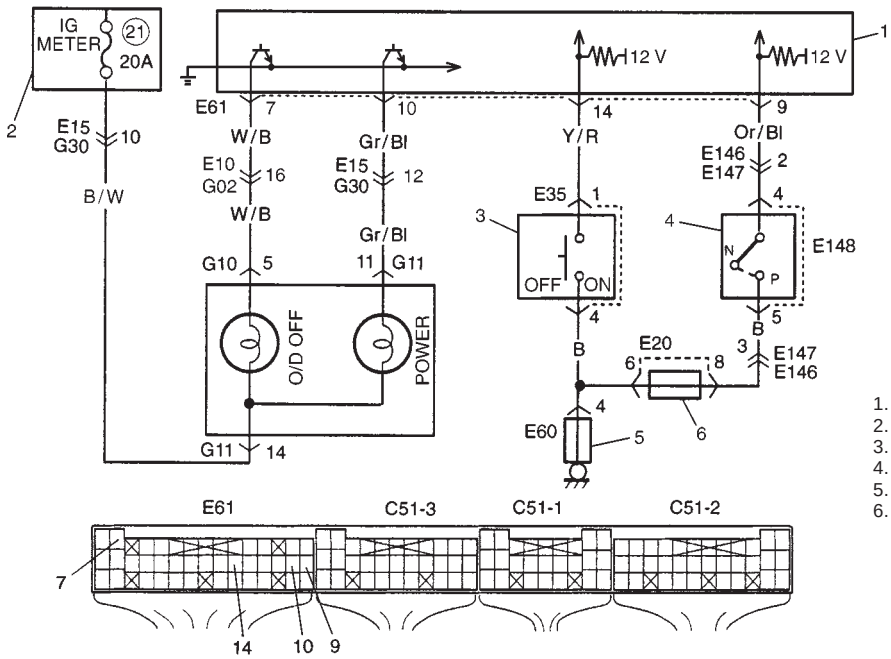
WIRING DIAGRAM

G16/J20 Engines



1. PCM
2. J/B
3. O/D cut switch
4. P/N change switch
5. J/C

H25 Engine



1. PCM
2. Fuse
3. O/D cut switch
4. P/N change switch
5. J/C
6. J/C

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	"POWER" light circuit check: (1) With ignition switch OFF, disconnect couplers from PCM. (2) Using service wire, connect E61-21 (G16/J20 engines) or E61-10 (H25 engine) terminal of disconnected PCM coupler and ground. Does "POWER" light turn ON at ignition switch ON?	Poor E61-21 (G16/J20 engines) or E61-10 (H25 engine) terminal connection. If OK, substitute a known-good PCM and recheck.	Bulb burned out or faulty "Gr/Bl", "B/W" wire.

DIAGNOSTIC FLOW TABLE B-4 "POWER" LIGHT CIRCUIT CHECK

("POWER" LIGHT COMES ON STEADILY)

WIRING DIAGRAM – Refer to Table B-3 in this section.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Check Power/Normal Change Switch Position. Is switch button at Normal position?	Go to Step 2.	Set Power/Normal change switch at Normal position.
2	Check Lamp Circuit for Short. 1) Turn ignition switch OFF and disconnect PCM connectors. 2) Turn ignition switch ON. Does "POWER" lamp come ON steadily?	"Gr/Bl" circuit shorted to ground.	Go to Step 3.
3	Check Power/Normal Change Switch Circuit. 1) Check resistance between terminal E61-31 (G16/J20 engines) or E61-9 (H25 engine) of disconnected PCM connector and body ground with P/N change switch OFF. Is continuity indicated?	Go to Step 4.	Check PCM ground circuit for open. If ground circuit is OK, substitute a known-good PCM and recheck.
4	Check Power/Normal Change Switch for Operation. 1) Remove Power/Normal change switch. 2) Check continuity between switch terminals "4" and "5" under each condition below. Normal position: No continuity Power position: Continuity. Is check result satisfactory?	"Or/Bl" circuit shorted to ground.	Replace Power/Normal change switch.

Fig. for Step 1.

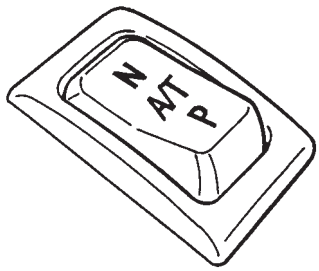
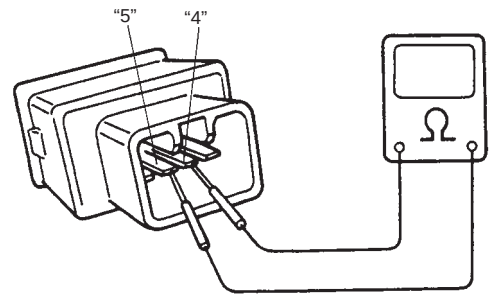


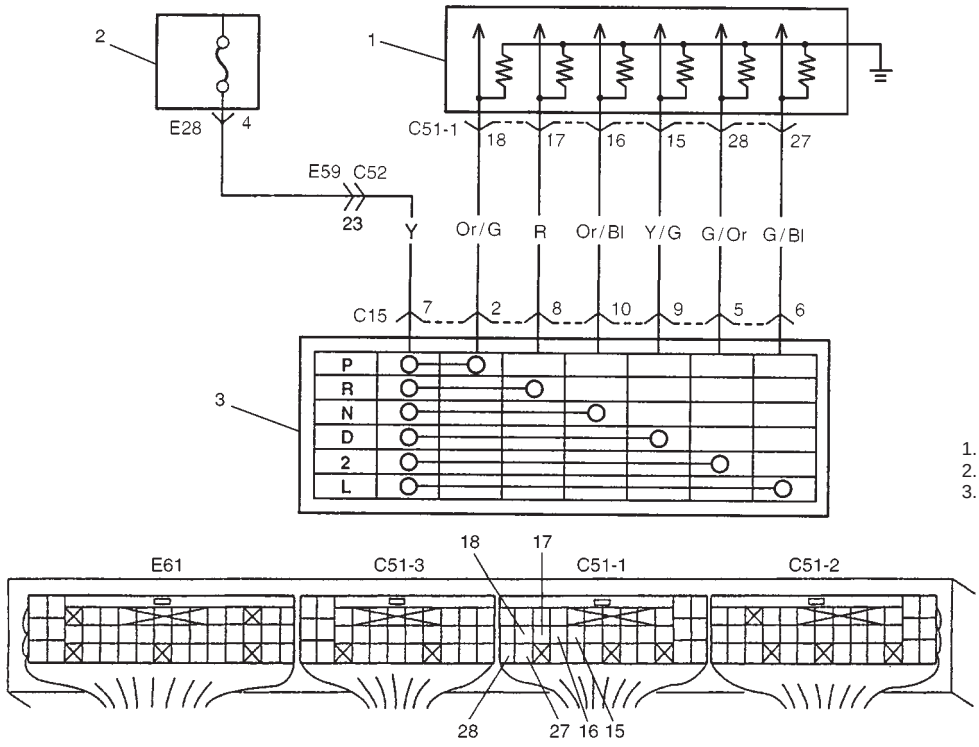
Fig. for Step 4.



DTC P0705 (DTC NO.72) TRANSMISSION RANGE SENSOR (SWITCH) CIRCUIT MALFUNCTION

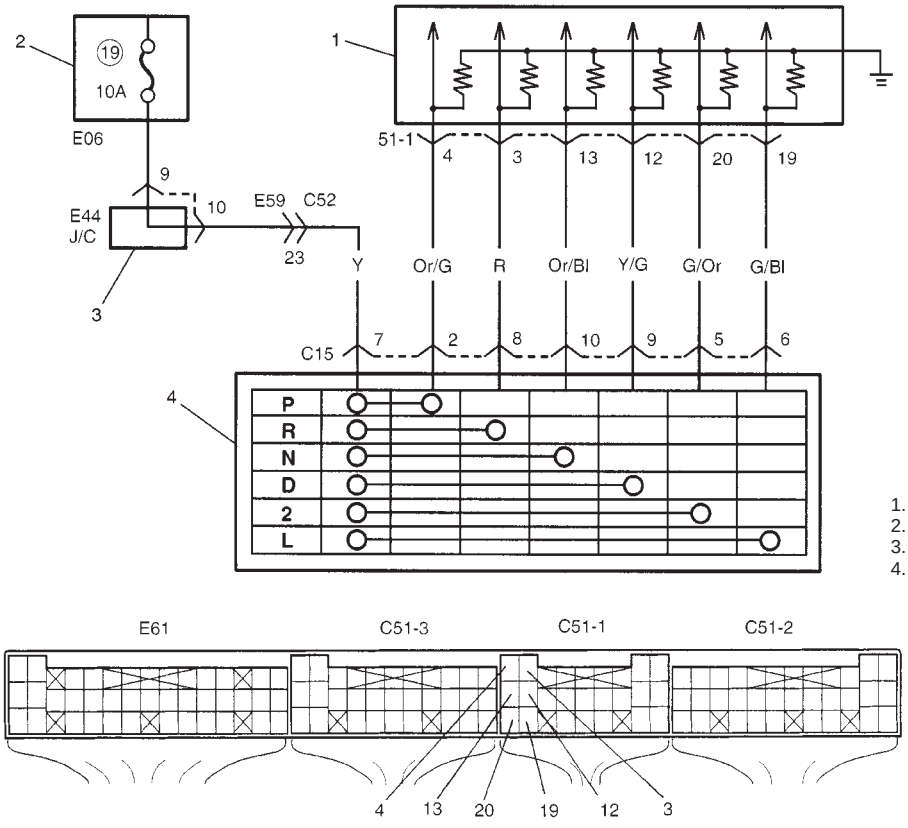
WIRING DIAGRAM

G16/J20 Engines



1. PCM
2. J/B
3. Transmission range sensor (switch)

H25 Engine



1. PCM
2. Fuse
3. J/C
4. Transmission range sensor (switch)

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
● Transmission range switch signal (P, R, N, D, 2 or L) is not inputted for 25 sec. at 60 km/h (38 mph) or higher vehicle speed. or ● Multiple signals are inputted simultaneously for 25 sec. (2 driving cycles detection logic)	● Transmission range sensor (switch) maladjusted. ● Transmission range sensor (switch) or its circuit 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 a tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC and start engine.
3) Shift A/T selector lever to each of L, 2, D, N, R and P ranges for 30 seconds each.
4) Increase vehicle speed to about 70 km/h (45 mph) in D range.
5) Keep driving above vehicle speed for 30 seconds.
6) Release accelerator pedal, decrease vehicle speed and stop vehicle.
7) Check DTC and/or pending DTC.

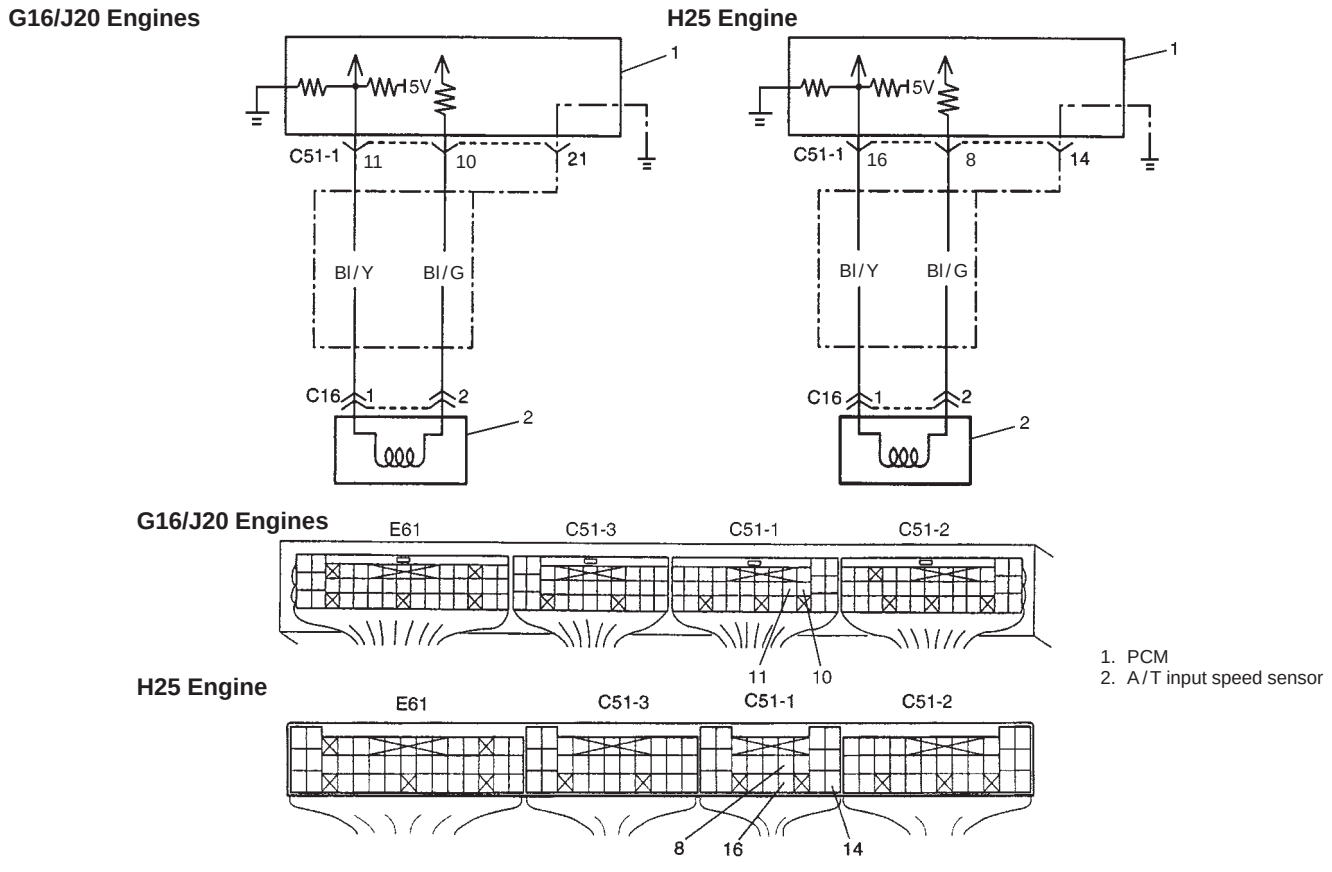
TROUBLESHOOTING (DTC P0705)

STEP	ACTION	YES	NO
1	Was “A/T DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “A/T DIAG. FLOW TABLE”.
2	Check Transmission Range Switch (Sensor) Circuit for Operation. When 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? When not using SUZUKI scan tool: 1) Turn ignition switch ON. 2) Check voltage at terminals C51-1-15, C51-1-16, C51-1-17, C51-1-18, C51-1-27 and C51-1-28 for G16/J20 (C51-1-4, C51-1-3, C51-1-13, C51-1-12, C51-1-20 and C51-1-19 for H25) respectively with select lever shifted to each range. Taking terminal C51-1-28 for G16/J20 (C51-1-20 for H25) 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 figure? 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 3.
3	Check Select Cable for Adjustment referring to “Select Cable Adjustment” in this section. Is it adjusted correctly?	Go to Step 4.	Adjust.
4	Check Transmission Range Switch for Installation Position. 1) Shift select lever to “N” range. 2) Check that “N” reference line on switch and center line on shaft are aligned. Are they aligned?	Go to Step 5.	Adjust.
5	Check Transmission Range Switch (Sensor) referring to “Transmission Range Switch” in this section. Are check results satisfactory?	“Y”, “Or/G”, “R”, “Or/Bl”, “Y/G”, “G/Or” or “G/Bl” circuit open or short. If wires and connections are OK, substitute a known-good PCM and recheck.	Replace TR switch.

Fig. for Step 2.

Terminal / Select lever position	G16/J20	C51-1-18	C51-1-17	C51-1-16	C51-1-15	C51-1-28	C51-1-27
	H25	C51-1-4	C51-1-3	C51-1-13	C51-1-12	C51-1-20	C51-1-19
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

DTC P0715 (DTC NO.76) INPUT/TURBINE SPEED SENSOR CIRCUIT MALFUNCTION
WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Input speed sensor detected speed is lower than specification while vehicle running under all of the following conditions: ● at higher than 10 km/h (7 mph) with 1st gear in D range for 1 sec. or more. ● at higher than 20 km/h (13 mph) with 2nd gear in D range for 2 sec. or more. ● at higher than 30 km/h (20 mph) with 3rd gear in D range for 2 sec. or more. (2 driving cycles detection logic)	● Input speed sensor and its circuit ● PCM

DTC CONFIRMATION PROCEDURE

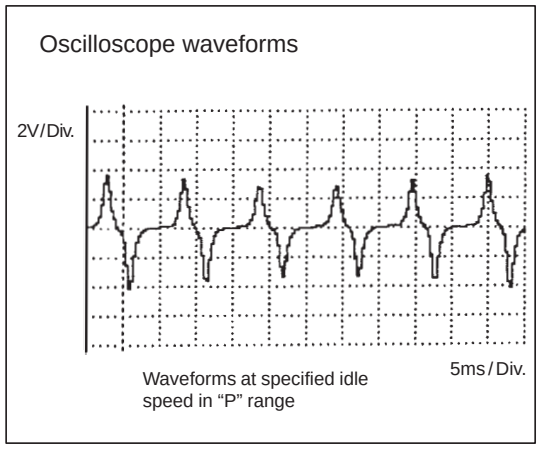
WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC.
3) Start engine and turn O/D cut switch ON.
4) Shift select lever to D range and start vehicle.
5) Keep vehicle speed at higher than 10 km/h (7 mph) with 1st gear in D range for 2 sec. or more.
6) Increase vehicle speed and keep it at higher than 20 km/h (13 mph) with 2nd gear in D range for 2 sec. or more.
7) Increase vehicle speed and keep it at higher than 30 km/h (20 mph) with 3rd gear in D range for 2 sec. or more.
8) Stop vehicle.
9) Check DTC and/or pending DTC.

TROUBLESHOOTING (DTC P0715)

STEP	ACTION	YES	NO
1	Was "A/T DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "A/T DIAG. FLOW TABLE".
2	Input speed sensor circuit check: 1) Remove PCM cover. 2) With ignition switch OFF, disconnect PCM connectors. 3) Check for proper connection to input speed sensor at C51-1-10 and C51-1-11 terminals for G16/J20 (at C51-1-8 and C51-1-16 terminals for H25) 4) If OK, check resistance of sensor circuit. Resistance between C51-1-10 and C51-1-11 for G16/J20 (C51-1-8 and C51-1-16 for H25): 530 – 650 Ω at 20°C, 68°F Resistance between C51-1-10/ C51-1-11 for G16/J20 (C51-1-8/ C51-1-16 for H25) and ground: 1 MΩ or more Are check results satisfactory?	Go to Step 4.	Go to Step 3.
3	Input speed sensor check: 1) With ignition switch OFF, disconnect input speed sensor connector. 2) Check for proper connection to input speed sensor at each terminals. 3) If OK, then check resistance of input speed sensor. Are measured values as specified in Step 2?	"Bl/G" or "Bl/Y" wire open or shorted to ground.	Replace input speed sensor.
4	Check visually input speed sensor and overdrive clutch drum for the followings. ● 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.	Clean, repair or replace.

Reference

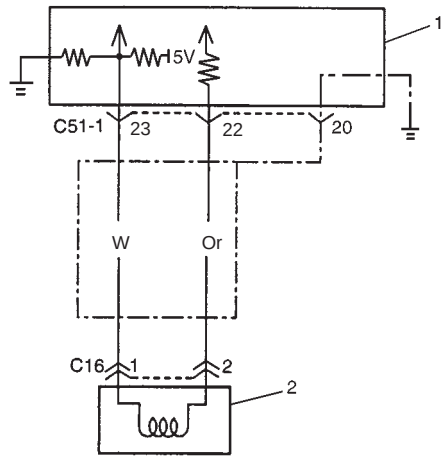


Connect oscilloscope between C51-1-11 (+) and C51-1-10 (–) for G16/J20 (C51-1-16 (+) and C51-1-8 (–) for H25) of PCM connector connected to PCM and check input speed sensor signal.

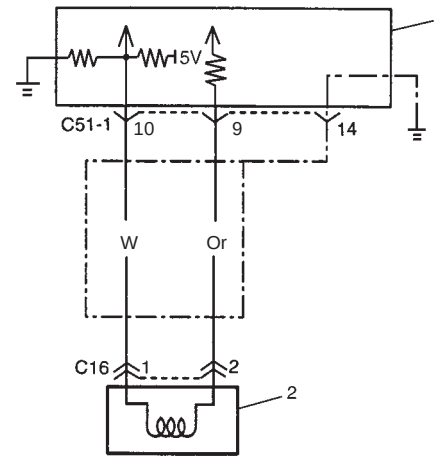
DTC P0720 (DTC NO.75) OUTPUT SPEED SENSOR CIRCUIT MALFUNCTION

WIRING DIAGRAM

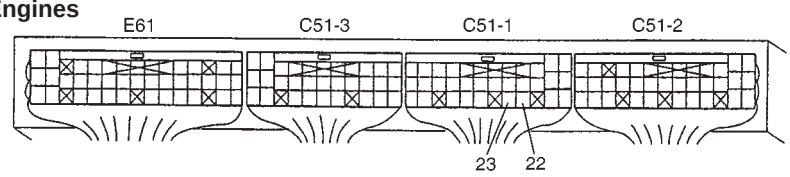
G16/J20 Engines



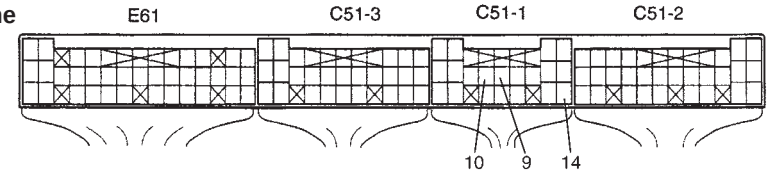
H25 Engine



G16/J20 Engines



H25 Engine



1. PCM
2. A/T output speed sensor

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
● With 4WD LOW switch OFF, no output speed sensor signal is inputted while vehicle speed sensor signal are inputted. or ● With 4WD LOW switch OFF, no output speed sensor signal is inputted while engine running at higher than specified engine speed with “D” range. (2 driving cycles detection logic)	● A/T output speed sensor or its circuit ● PCM

DTC CONFIRMATION PROCEDURE

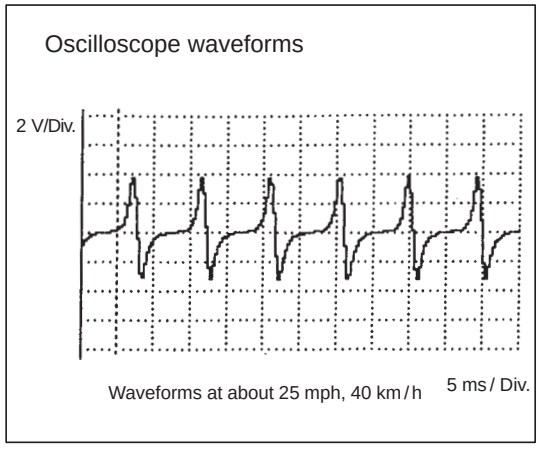
WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC.
3) Start engine and shift transfer lever to “2H” or “4H” range.
4) Drive vehicle at 40 km/h (25 mph) or more for longer than 10 sec. (or higher than 3500 rpm engine speed with D range for longer than 10 sec.)
5) Stop vehicle and check DTC and/or pending DTC.

TROUBLESHOOTING (DTC P0720)

STEP	ACTION	YES	NO
1	Was "A/T DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "A/T DIAG. FLOW TABLE".
2	Output speed sensor circuit check: 1) Remove PCM cover. 2) With ignition switch OFF, disconnect PCM connectors. 3) Check for proper connection to output speed sensor at C51-1-22 and C51-1-23 terminals for G16/J20 (at C51-1-9 and C51-1-10 terminals for H25). 4) If OK, check resistance of sensor circuit. Resistance between C51-1-22 and C51-1-23 for G16/J20 (C51-1-9 and C51-1-10 for H25): 387 – 473 Ω at 20 °C, 68 °F Resistance between C51-1-22/ C51-1-23 for G16/J20 (C51-1-9/ C51-1-10 for H25) and ground: 1 MΩ or more Are check results satisfactory?	Go to Step 4.	Go to Step 3.
3	Output speed sensor check: 1) With ignition switch OFF, disconnect output speed sensor connector. 2) Check for proper connection to output speed sensor at each terminals. 3) If OK, then check resistance of output speed sensor. Are measured values as specified in Step 2?	"Or" or "W" wire open or shorted to ground.	Replace output speed sensor.
4	Check visually output speed sensor and sensor rotor for the followings. ● 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.	Clean, repair or replace.

Reference



Connect oscilloscope between C51-1-23 (+) and C51-1-22 (–) for G16/J20 (C51-1-10 (+) and C51-1-9 (–) for H25) of PCM connector connected to PCM and check output speed sensor signal.

DTC P0741 TCC (LOCK-UP) SOLENOID VALVE PERFORMANCE OR STUCK OFF

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
While running in 2nd or 4th gear, D range, TCC control of PCM does not agree with actual operation of transmission TCC even though solenoid valve is electrically in good condition. (2 driving cycles detection logic)	● TCC (lock-up) solenoid valve stuck ● TCC control valve stuck ● Valve body fluid passage clogged ● TCC faulty

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.**

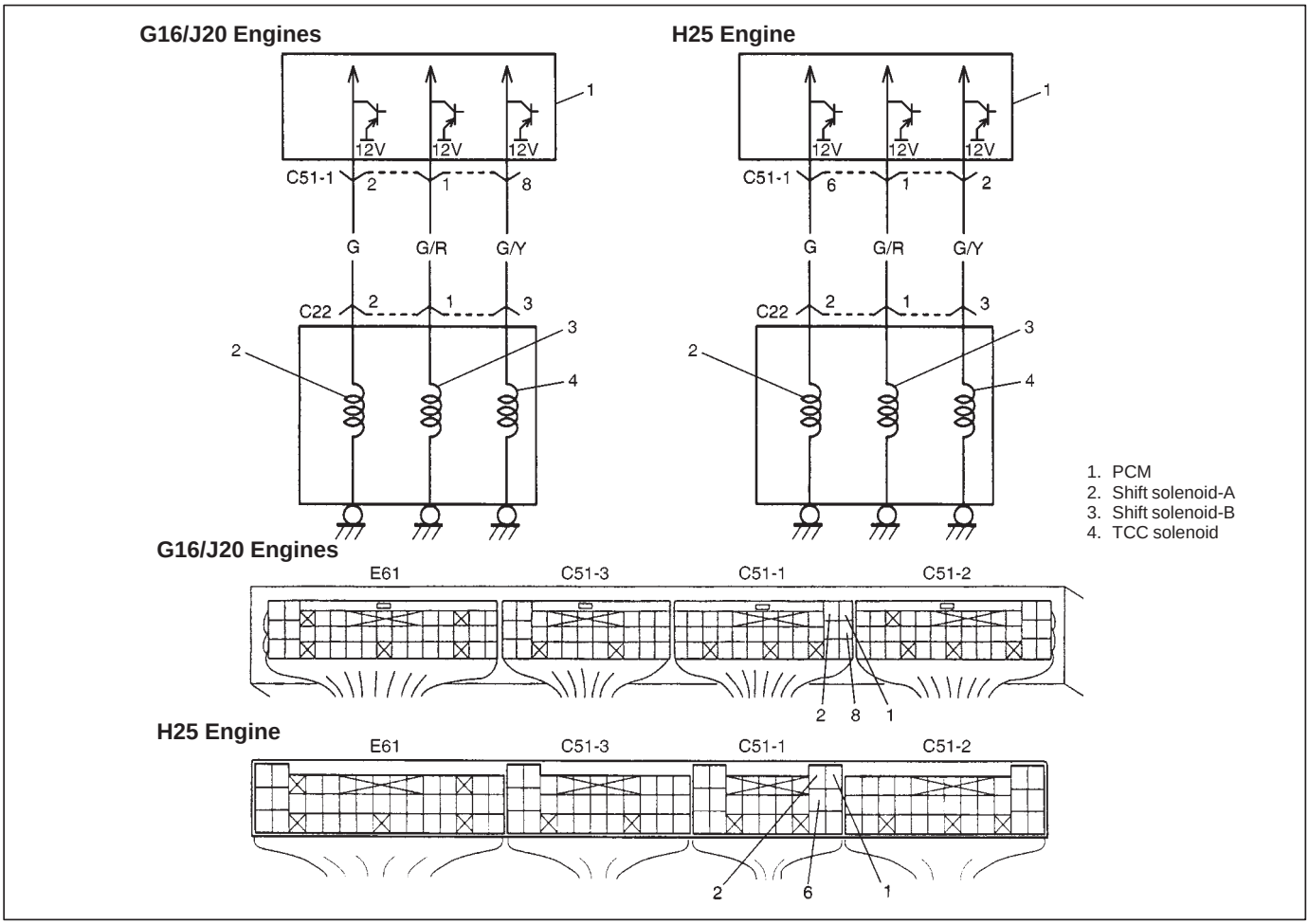
1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTC, pending DTC and freeze frame data in PCM memory by using scan tool and check fuel level meter indication is 1/4 or more.
3) Start engine, warm it up to normal operating temperature and shift transfer lever to “2H” or “4H” range.
4) Increase vehicle speed with D range, and check that gear position changes from 1st to 2nd and keep driving about 20 mph, 30 km/h in 2nd of “D” range for 10 seconds. (Throttle valve should be not at idle position and the opening should be kept constant in this step.)
5) Keep driving about 50 mph, 80 km/h in 4th of “D” range for 10 seconds.
6) Release accelerator pedal, decrease vehicle speed and stop vehicle.
7) Check pending DTC and DTC by using scan tool.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “A/T DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “A/T DIAG. FLOW TABLE”.
2	TCC solenoid valve operation check: 1) Check TCC solenoid valve operation referring to “Solenoid Valves Operation Check” in this section. Is it in good condition?	Go to Step 3.	Faulty TCC solenoid valve.
3	Valve body check: 1) Check valve body referring to “Unit Repair” in this section. Is it in good condition?	Faulty torque converter.	Faulty valve body.

DTC P0743 (DTC NO.65/66) TCC (LOCK-UP) SOLENOID ELECTRICAL

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Voltage at terminal C51-1-8 for G16/J20 (C51-1-2 for H25) of PCM is high while TCC solenoid OFF is commanded or low while TCC solenoid ON is commanded.	● TCC (lock-up) solenoid valve ● TCC (lock-up) solenoid valve circuit ● 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) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC.
3) Start engine, warm it up to normal operating temperature and shift transfer lever to “2H” or “4H” range.
4) Shift selector lever in D range and keep it there for 10 seconds.
5) Increase vehicle speed to about 80 km/h (50 mph) in 4th gear and in D range.
6) Keep driving at above speed for 20 seconds.
7) Release accelerator pedal, decrease vehicle speed and stop vehicle.
8) Check DTC and/or pending DTC.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “A/T DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “A/T DIAG. FLOW TABLE”.
2	Is the vehicle equipped with monitor connector?	Go to Step 3.	Go to Step 4.
3	Is DTC NO.65?	G to Step 4.	Go to Step 6.
4	Check TCC Solenoid Circuit for Open or Short. 1) Turn ignition switch OFF and disconnect PCM connectors. 2) Check for proper connection to PCM at terminals C51-1-8 for G16/J20 (C51-1-2 for H25). 3) If OK, then measure resistance between terminal C51-1-8 for G16/J20 (C51-1-2 for H25) of disconnected PCM connector and ground. Is it 11 – 15 Ω at 20°C, 68°F?	Go to Step 5.	“G/Y” circuit open or shorted to ground. If wire and connections are OK, replace malfunction shift solenoid.
5	Check TCC Solenoid Circuit for Short. 1) Turn ignition switch ON. 2) Measure voltage between terminal C51-1-8 for G16/J20 (C51-1-2 for H25) of disconnected PCM connector and ground. Is it about 0 V?	Intermittent trouble or faulty PCM. Check for “Intermittent and Poor Connection” in Section 0A.	“G/Y” circuit shorted to power circuit.
6	Check TCC Solenoid Circuit for Short. 1) Turn ignition switch OFF and disconnect PCM connectors. 2) Check for proper connection to PCM at terminals C51-1-8 for G16/J20 (C51-1-2 for H25) or C51-1-1. 3) If OK, then measure resistance between terminal C51-1-8 for G16/J20 (C51-1-2 for H25) of disconnected PCM connector and ground. Is it 11 – 15 Ω at 20°C, 68°F?	Intermittent trouble or faulty PCM. Check for “Intermittent and Poor Connection” in Section 0A.	“G/Y” circuit shorted to ground. If wire and connections are OK, replace malfunction shift solenoid.

DTC P0751 SHIFT SOLENOID VALVE-A (#1) PERFORMANCE OR STUCK OFF
DTC P0756 SHIFT SOLENOID VALVE-B (#2) PERFORMANCE OR STUCK OFF

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
While running in D range, gear change control from PCM to A/T does not agree with actual A/T gear position even though solenoid valve is electrically in good condition. (A/T gear position is calculated based on engine speed signal and vehicle speed sensor signal.) (2 driving cycles detection logic)	DTC P0751: ● Shift solenoid valve-A stuck or leakage. ● 2-3 shift valve stuck. ● Valve body fluid passage clogged. ● Mechanical malfunction in transmission. (Direct clutch malfunction) DTC P0756: ● Shift solenoid valve-B stuck or leakage. ● 1-2 shift valve stuck. ● 3-4 shift valve stuck. ● Valve body fluid passage clogged. ● Mechanical malfunction in transmission. (2nd brake 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.**

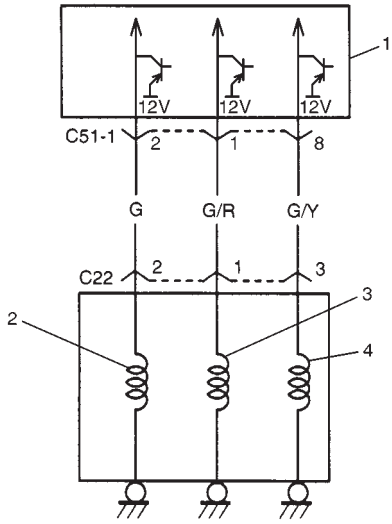
1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTC, pending DTC and freeze frame data in PCM memory by using scan tool and check fuel level meter indication is 1/4 or more.
3) Start engine, warm it up to normal operating temperature and shift transfer lever to “2H” or “4H” range.
4) Increase vehicle speed with D range, and check that gear position changes from 1st to 2nd, 3rd and 4th in that order as vehicle speed increases, referring to “Gear Shift Diagram” in this section.
5) Stop vehicle and check pending DTC and DTC by using scan tool.

TROUBLESHOOTING

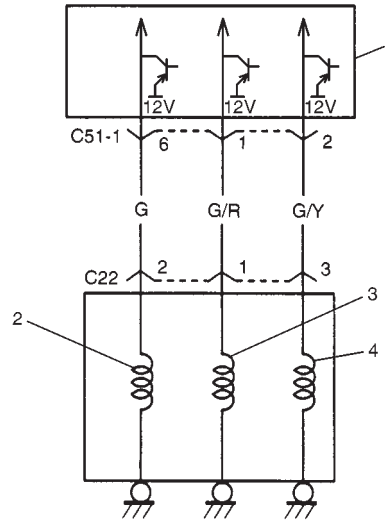
STEP	ACTION	YES	NO
1	Was “A/T DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “A/T DIAG. FLOW TABLE”.
2	Shift solenoid valve-A or -B operation check: 1) Check shift solenoid valve-A or -B for operation referring to “Solenoid Valves Operation Check” section. Is it in good condition?	Go to Step 3.	Faulty shift solenoid valve-A or -B.
3	Valve body check: 1) Check valve body and its passage referring to “Unit Repair” section. Are they in good condition?	Overhaul and repair automatic transmission.	Faulty valve body.

DTC P0753 (DTC NO.61/62) SHIFT SOLENOID-A (#1) ELECTRICAL
DTC P0758 (DTC NO.63/64) SHIFT SOLENOID-B (#2) ELECTRICAL
WIRING DIAGRAM

G16/J20 Engines

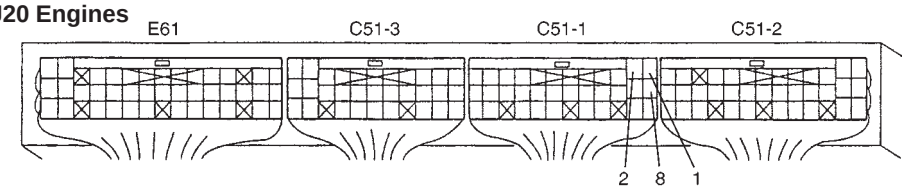


H25 Engine

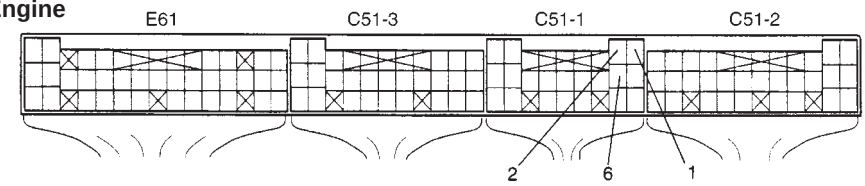


1. PCM
2. Shift solenoid-A
3. Shift solenoid-B
4. TCC solenoid

G16/J20 Engines



H25 Engine



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC P0753: Voltage detected at C51-1-2 for G16/J20 (C51-1-6 for H25) terminal is specified voltage or lower when shift solenoid valve-A is ON or specified voltage or higher when it is OFF.	● Shift solenoid valve-A ● Shift solenoid valve-A circuit ● PCM
DTC P0758: Voltage detected at C51-1-1 terminal is specified voltage or lower when shift solenoid valve-B is ON or specified voltage or higher when it is OFF.	● Shift solenoid valve-B ● Shift solenoid valve-B circuit ● 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.**

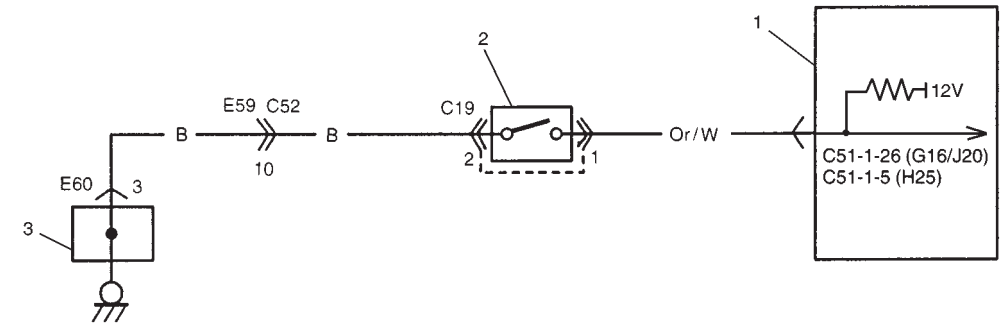
1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC.
3) Start engine and shift transfer lever to “2H” or “4H” range.
4) Shift selector lever in D range and keep it for 10 seconds.
5) Drive vehicle about 30 km/h (20 mph) with 2nd gear in D range for 10 seconds.
6) Increase vehicle speed to about 80 km/h (50 mph) with 4th gear in D range and keep it for 10 seconds.
7) Release accelerator pedal, decrease vehicle speed and stop vehicle.
8) Check DTC and/or pending DTC.

TROUBLESHOOTING (DTC P0753/P0758)

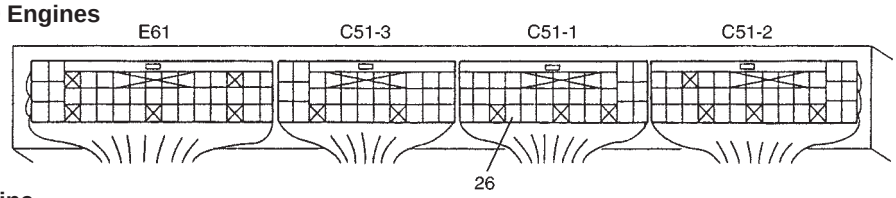
STEP	ACTION	YES	NO
1	Was “A/T DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “A/T DIAG. FLOW TABLE”.
2	Is the vehicle equipped with monitor connector?	Go to Step 3.	Go to Step 4.
3	Is DTC NO.61 or 63?	Go to Step 4.	Go to Step 6.
4	Check Shift Solenoid Circuit for Open or Short. 1) Turn ignition switch OFF and disconnect PCM connectors. 2) Check for proper connection to PCM at terminals C51-1-2 for G16/J20 (C51-1-6 for H25) or C51-1-1. 3) If OK, then measure resistance between terminal C51-1-2 for G16/J20 (C51-1-6 for H25) or C51-1-1 of disconnected PCM connector and ground. Is it 11 – 15 Ω at 20°C, 68°F?	Go to Step 5.	“G” or “G/R” circuit open or shorted to ground. If wire and connections are OK, replace malfunction shift solenoid.
5	Check Shift Solenoid Circuit for Short. 1) Turn ignition switch ON. 2) Measure voltage between terminal C51-1-2 for G16/J20 (C51-1-6 for H25) or C51-1-1 of disconnected PCM connector and ground. Is it about 0 V?	Intermittent trouble or faulty PCM. Check for “Intermittent and Poor Connection” in Section 0A.	“G” or “G/R” circuit shorted to power circuit.
6	Check Shift Solenoid Circuit for Short. 1) Turn ignition switch OFF and disconnect PCM connectors. 2) Check for proper connection to PCM at terminals C51-1-2 for G16/J20 (C51-1-6 for H25) or C51-1-1. 3) If OK, then measure resistance between terminal C51-1-2 for G16/J20 (C51-1-6 for H25) or C51-1-1 of disconnected PCM connector and ground. Is it 11 – 15 Ω at 20°C, 68°F?	Intermittent trouble or faulty PCM. Check for “Intermittent and Poor Connection” in Section 0A.	“G” or “G/R” circuit shorted to ground.

DTC P1875 4WD LOW SWITCH CIRCUIT MALFUNCTION (if equipped)

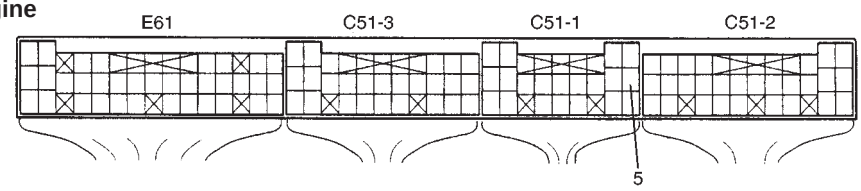
WIRING DIAGRAM



G16/J20 Engines



H25 Engine



1. PCM
2. 4WD low switch
3. J/C

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
While driving at higher than specified vehicle speed and with more than specified throttle valve opening, the following conditions are satisfied for specified time. ● Vehicle speed sensed by vehicle speed sensor is more than 10 km/h higher than that sensed by A/T output speed sensor. (2 driving cycles detection logic)	● 4WD LOW switch or its circuit ● PCM

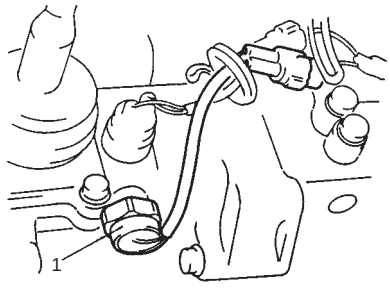
DTC CONFIRMATION PROCEDURE

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) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTC, pending DTC and freeze frame data in PCM memory by using scan tool.
3) Start engine.
4) Increase vehicle speed to about 30 km/h (19 mph) or more in D range and is in 2H position.
5) Keep driving at above vehicle speed for 30 seconds.
6) Stop vehicle and shift transfer lever to 4L position with A/T selector lever is in P range
7) Increase vehicle speed to about 25 km/h (15 mph) or more in D range and is in 4L position.
8) Keep driving at above vehicle speed for 30 seconds.
9) Stop vehicle and check pending DTC and DTC by using scan tool.

TROUBLESHOOTING (DTC P1875)

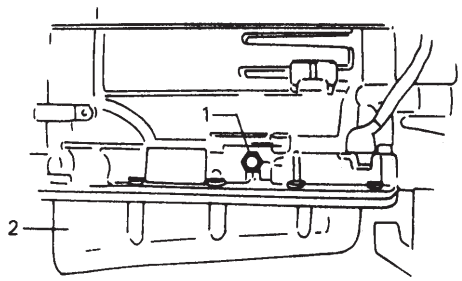
STEP	ACTION	YES	NO
1	Was "A/T DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "A/T DIAG. FLOW TABLE".
2	4WD low switch and its circuit check: When using SUZUKI scan tool: 1) Connect SUZUKI scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON. 3) Select "Data list" mode on scan tool. 4) Check 4WD low switch signal (ON or OFF) on display when shifting transfer lever to each position. 4H or 2H position: OFF 4L position : ON Is OFF/ON displayed as described above? When not using SUZUKI scan tool: 1) Remove PCM cover. 2) Turn ignition switch ON. 3) Check voltage at terminal C51-1-26 for G16/J20 (C51-1-5 for H25) of PCM connector connected when shifting transfer lever to each position. 4H or 2H position: 10 – 14 V 4L position : 0 – 1 V Is voltage as specified?	Check for poor connection at the terminal of PCM if voltmeter is used in Step 2. If connection is OK, intermittent trouble or faulty PCM. Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 3.
3	4WD low switch check: 1) Check 4WD low switch for operation referring to "4WD Low Switch Inspection" below. Is check result satisfactory?	"Or/W" or "B" circuit open or short. If wires and connections are OK, substitute a known-good PCM and recheck.	Replace 4WD low switch.



1. 4WD low switch

4WD Low Switch Inspection

1) Disconnect negative cable at battery.
2) Disconnect 4WD low switch coupler.
3) Check continuity between 4WD low switch terminals.
   There should be continuity when transfer lever shifted to 4L position and should be infinity when transfer lever shifted to 4H or 2H positions.
   If not, replace 4WD low switch.
4) Connect 4WD low switch coupler and battery negative cable.

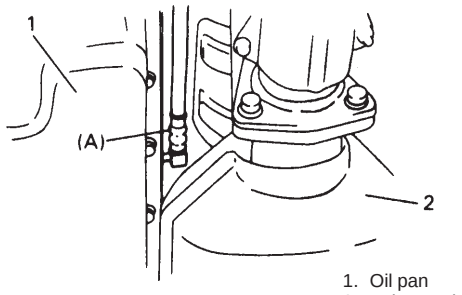


1. Fluid pressure check hole
2. Oil pan

LINE PRESSURE TEST

Purpose of this test is to check operating conditions of each part by measuring fluid pressure in fluid pressure line. Line pressure test requires following conditions.

- Automatic fluid is at normal operating temperature (70 to 80°C / 158 – 176°F).
- Fluid is filled to proper level (between FULL HOT and LOW HOT on dipstick).



1. Oil pan
2. Exhaust pipe

1) Apply parking brake securely and place checks against wheels.
2) Attach oil pressure gauge to fluid pressure check hole in transmission case.

Special Tool
(A): 09925-37810

CAUTION:
After attaching oil pressure gauge, check that not fluid leakage exists.

3) Depress foot brake fully, run engine at idle and stall and then check fluid pressure in “D” or “R” range.

CAUTION:
Do not continue running engine at stall speed longer than 5 seconds.

G16 Engine

Engine running mode	Line pressure	
	“D” range	“R” range
At idle speed	3.9 – 4.4 kg/cm^2 55 – 63 psi	5.1 – 5.7 kg/cm^2 73 – 81 psi
At stall speed	11.7 – 13.2 kg/cm^2 166 – 188 psi	14.2 – 16.7 kg/cm^2 202 – 237 psi

J20 Engine

Engine running mode	Line pressure	
	“D” range	“R” range
At idle speed	3.8 – 4.3 kg/cm^2 54 – 61 psi	5.3 – 5.9 kg/cm^2 75 – 84 psi
At stall speed	9.7 – 11.2 kg/cm^2 138 – 159 psi	12.9 – 15.5 kg/cm^2 183 – 220 psi

H25 Engine

Engine running mode	Line pressure	
	“D” range	“R” range
At idle speed	3.9 – 4.4 kg/cm^2 55 – 63 psi	6.6 – 7.2 kg/cm^2 94 – 102 psi
At stall speed	11.3 – 12.7 kg/cm^2 161 – 181 psi	14.7 – 22.7 kg/cm^2 209 – 323 psi

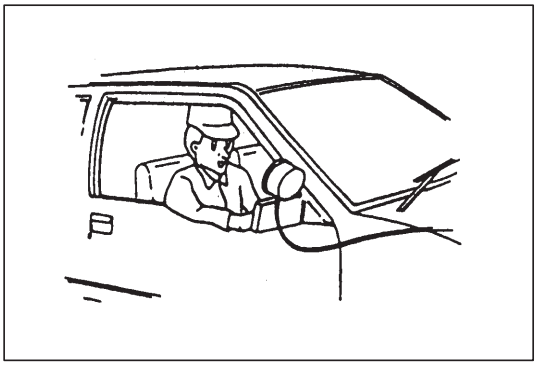
Check result	Possible cause
Line pressure higher than standard level in each range	● Malfunctioning regulator valve ● Malfunctioning throttle valve ● Maladjusted A/T throttle cable
Line pressure lower than standard level in each range	● Defective O/D clutch ● Defective oil pump ● Malfunctioning throttle valve ● Malfunctioning regulator value ● Maladjusted A/T throttle cable
Line pressure lower than standard level only in "D" range	● Fluid leakage from forward clutch ● Defective O/D clutch ● Leakage from "D" range fluid pressure circuit
Line pressure lower than standard level only in "R" range	● Fluid leakage from direct clutch ● Defective O/D clutch ● Fluid leakage from reverse brake ● Fluid leakage from "R" range fluid circuit

Tightening torque of transmission case plug:
17 N·m (1.7 kg-m, 12.0 lb-ft)

STALL TEST

This test is to check overall performance of automatic transmission and engine by measuring stall speed at "D" and "R" ranges. Be sure to perform this test only when transmission fluid is at normal operating temperature and its level is between FULL and LOW marks.

CAUTION:
- **Do not run engine at stall more than 5 seconds continuously, for fluid temperature may rise excessively high.**
- **After performing stall test, be sure to leave engine running at idle for longer than 30 seconds before another stall test.**



1) Apply parking brake and block wheels.
2) Install tachometer.
3) Start engine with select lever shifted to "P".
4) Depress brake pedal fully.
5) Shift select lever to "D" and depress accelerator pedal fully while watching tachometer. Read engine rpm quickly when it has become constant (stall speed).
6) Release accelerator pedal immediately after stall speed is checked.
7) In the same way, check stall speed in "R" range.

8) Stall speed should be within the following specification.

Stall speed: 2,100 – 2,400 r/min. for G16 engine
2,300 – 2,600 r/min. for J20 engine
2,300 – 2,600 r/min. for H25 engine

Check result	Possible cause
Lower than standard level	● Faulty engine output ● Defective torque converter
Higher than standard level in "D" range	● Slippery O/D clutch ● Slippery forward clutch ● Malfunctioning O/D one-way clutch ● Malfunctioning one-way clutch No. 2 ● Low line pressure
Higher than standard level in "R" range	● Slippery direct clutch ● Slippery reverse brake ● Low fluid pressure ● Slippery O/D clutch ● Defective O/D one-way clutch

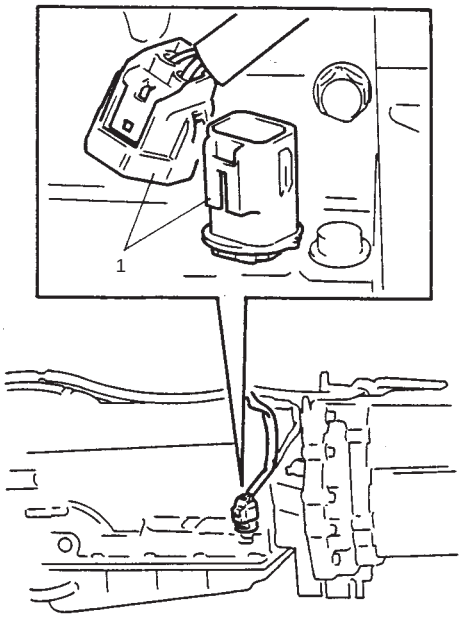
ROAD TEST

This test is to check if upshift and downshift take place at specified speed while actually driving vehicle on a level road.

WARNING:
- **Carry out test in very little traffic area to prevent an accident.**
- **Test requires 2 persons, a driver and a tester.**

1) Warm up engine.
2) With engine running at idle, shift select lever "D".
3) Accelerate vehicle speed by depressing accelerator pedal gradually.
4) While driving in "D" range, check if gear shift occurs properly as shown in Gear Shift Diagram in this section.

Test result	Possible cause
When 1 → 2 upshift fails to occur	1–2 shift valve stuck
When 2 → 3 upshift fails to occur	2–3 shift valve stuck
When 3 → O/D upshift fails to occur	3–4 shift valve stuck
When gear shift point is incorrect	● Maladjusted throttle cable ● Defective shift solenoid valve -A or -B ● 1–2, 2–3 or 3–4 shift valve not operating properly



1. Shift solenoids connector

MANUAL ROAD TEST

This test check the gear 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).

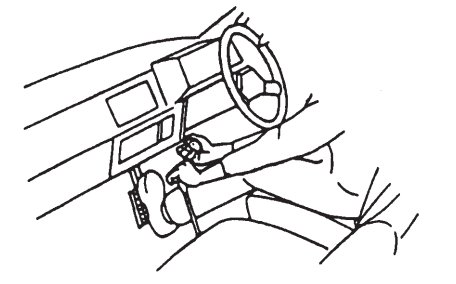
1) Disconnect coupler of shift solenoid valves on transmission.

> **WARNING:**
> **To avoid the danger of being burned, do not touch the hot exhaust system when disconnecting shift solenoid valves coupler.**

2) With select lever in “P”, start engine and warm it up.
3) With select lever in “L” range, start vehicle and accelerate to 20 km/h (12.5 mile/h). Check in this state that 1st gear is being used.
4) At 20 km/h (12.5 mile/h), shift select lever to 2 range and accelerate to 40 km/h (25 mile/h). Check in this state that 3rd gear is being used.
5) At 40 km/h (25 mile/h), shift select lever to D range and check that O/D gear is used when speed is higher than 40 km/h (25 mile/h).
6) After above checks, stop vehicle then engine, and connect shift solenoids coupler with ignition switch OFF.

> **WARNING:**
> **To avoid the danger of being burned, do not touch the hot exhaust system when connecting shift solenoid valves coupler.**

7) Clear DTC with scan tool.



TIME LAG TEST

This test is to check conditions of clutch, reverse brake and fluid pressure. “Time lag” means time elapsed since select lever is shifted with engine idling till shock is felt.

1) With chocks placed before and behind front and rear wheels respectively, depress brake pedal.
2) Start engine.
3) With stop watch ready, shift select lever from “N” to “D” range and measure time from that moment till shock is felt.
4) Similarly measure time lag by shifting select lever from “N” to “R” range.

Specification for time lag	“N”→“D”	Less than 1.2 sec.
	“N”→“R”	Less than 1.5 sec.

NOTE:
- **When repeating this test, be sure to wait at least minute after select lever is shifted back to “N” range.**
- **Engine should be warmed up fully for this test.**

Test result	Possible causes
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 reverse brake

ENGINE BRAKE TEST

WARNING:
Before test, make sure that there is no vehicle behind so as to prevent rear-end collision.

1) While driving vehicle in 3rd gear of “D” range, shift select lever down to “2” range and check if engine brake operates.
2) In the same way as in step 1, check engine brake for operation when select lever is shifted down to “L” range.
3) If engine brake fails to operate in above tests, possible causes for such failure are as follows. Check each part which is suspected to be the cause.

Condition	Possible cause
Fails to operate when shifted down to “2” range	Second coast brake defective
Fails to operate when shifted down to “L” range	Reverse brake defective

“P” RANGE TEST

1) Stop vehicle on a slope, shift select lever to “P” range and at the same time apply parking brake.
2) After stopping engine, depress brake pedal and release parking brake.
3) Then, release brake pedal gradually and check that vehicle remains stationary.
4) Depress brake pedal and shift select lever to “N” range.
5) Then, release brake pedal gradually and check that vehicle moves.

WARNING:
Before test, check to make sure no one is around vehicle or down on a slope and keep watchful for safety during test.

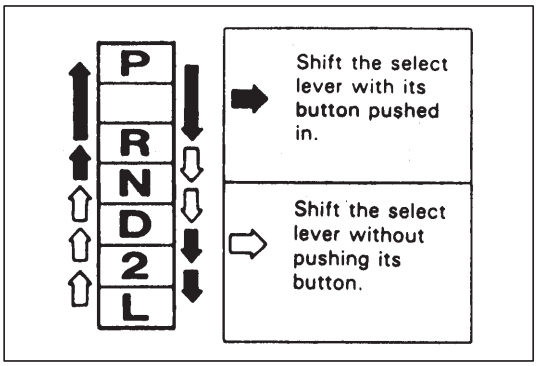
ON-VEHICLE SERVICE

MAINTENANCE SERVICE

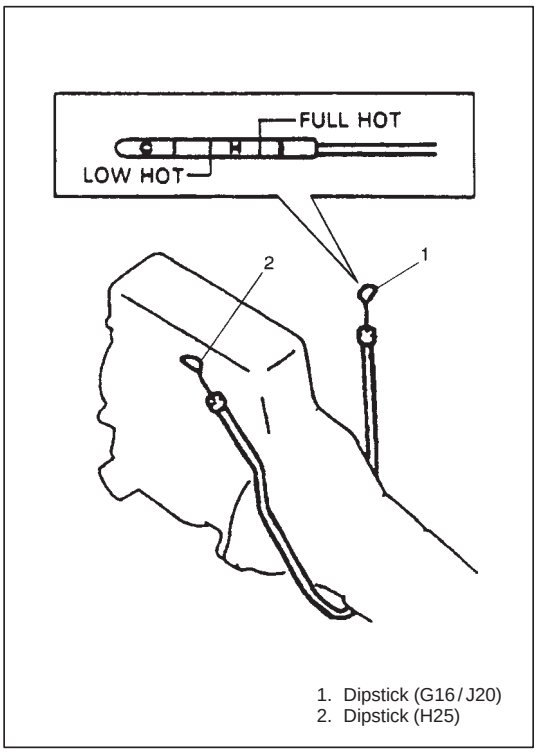
FLUID LEVEL

LEVEL CHECK AT NORMAL OPERATING TEMPERATURE

1) Stop vehicle and place it level.
2) Apply parking brake and place chocks against wheels.
3) With selector at P position, start engine.
4) Warm up engine till fluid temperature reaches normal operating temperature (70 – 80°C/158 – 176°F). As a guide to check fluid temperature, warm up engine till engine coolant temperature meter indicated around 1 unit above “C” point.



5) Keep engine idling and shift selector slowly to L and back to P position.
6) With engine idling, pull out dipstick, wipe it off with a clean cloth and put it back into place.



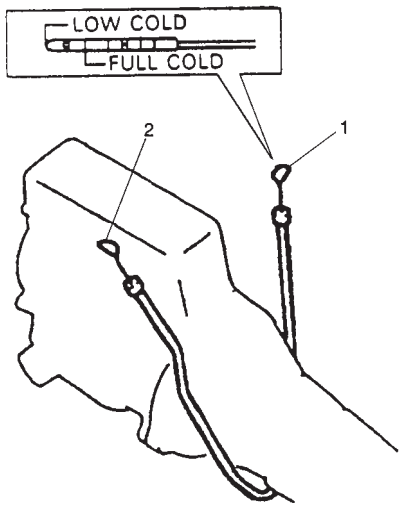
1. Dipstick (G16/J20)
2. Dipstick (H25)

7) Pull out dipstick again and check fluid level indicated on it. Fluid level should be between FULL HOT and LOW HOT. If it is below LOW HOT, add an equivalent of DEXRON®-III up to FULL HOT.

Fluid specification
An equivalent of DEXRON®-III

NOTE:

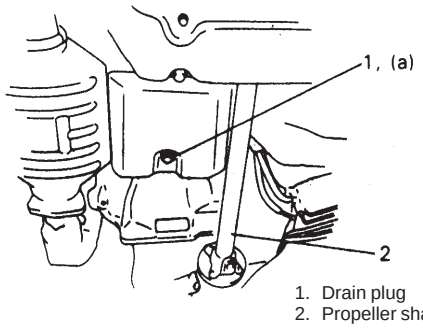
- **DO NOT RACE ENGINE while checking fluid level, even after the engine start.**
- **DO NOT OVERFILL. Overfilling can causes foaming and loss of fluid through breather. Then slippage and transmission failure can result.**
- **Bringing the level from LOW HOT to FULL HOT requires 0.3 liters (0.64/0.53 US/Imp.pt).**
- **If vehicle was driven under high load such as pulling a trailer, fluid level should be checked about half an hour after it is stopped.**



1. Dipstick (G16/J20)
2. Dipstick (H25)

LEVEL CHECK AT ROOM TEMPERATURE

The fluid level check at room temperature performed after repair or fluid change before test driving is just preparation for level check of normal operating temperature. The checking procedure itself is the same as that described previously. If the fluid level is between FULL COLD and LOW COLD, proceed to test drive. And when the fluid temperature has reached the normal operating temperature, check fluid level again and adjust it as necessary.

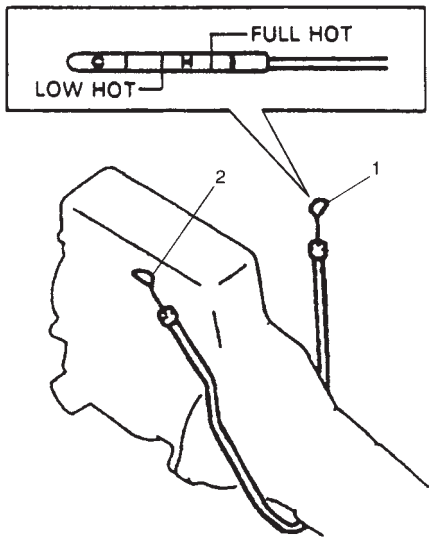


1. Drain plug
2. Propeller shaft

FLUID CHANGE

1) Lift up vehicle.
2) With engine is cool, remove drain plug from oil pan and drain A/T fluid.
3) Install drain plug.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

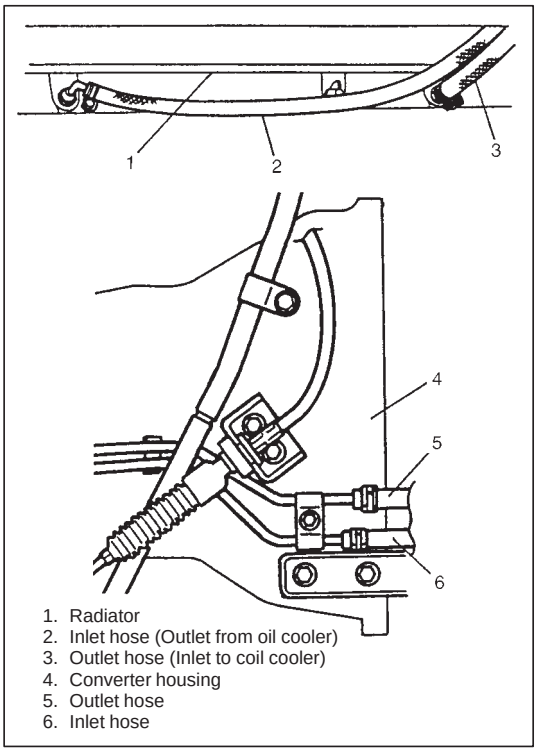


1. Dipstick (G16/J20)
2. Dipstick (H25)

4) Lower vehicle and fill proper amount of an equivalent of DEXRON®-III.
5) Check fluid level according to procedure described under LEVEL CHECK NORMAL OPERATING TEMPERATURE.

Fluid specification
An equivalent of DEXRON®-III

Fluid capacity	
When draining from drain plug hole	2.5 liters (5.28/4.40 US/lmp.pt.)
When overhauling	6.9 liters (14.58/12.14 US/lmp.pt.) for G16 7.1 liters (15.00/12.50 US/lmp.pt.) for J20/H25

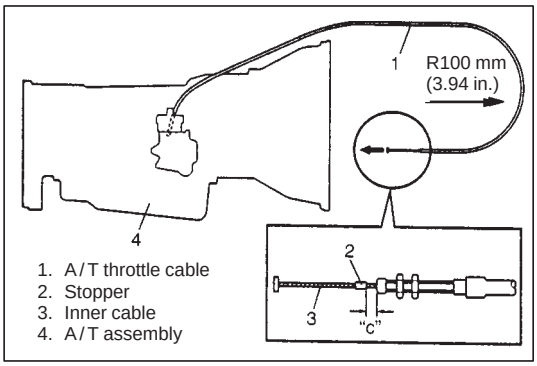


1. Radiator
2. Inlet hose (Outlet from oil cooler)
3. Outlet hose (Inlet to coil cooler)
4. Converter housing
5. Outlet hose
6. Inlet hose

OIL COOLER HOSES

When replacing them, be sure to note the followings.

- to replace clamps at the same time.
- to insert hose as far as its limit mark.
- to clamp hose securely.



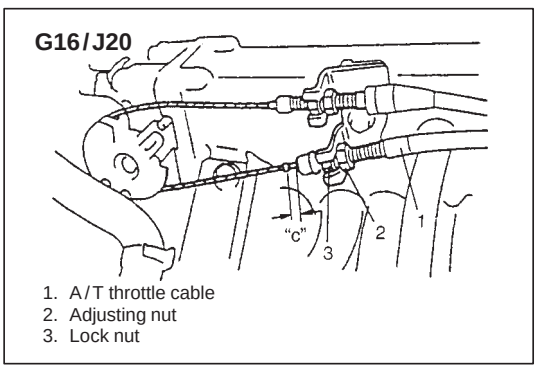
1. A/T throttle cable
2. Stopper
3. Inner cable
4. A/T assembly

A/T THROTTLE CABLE

ADJUSTMENT

1) Pull inner cable by force of 2 N (0.2 kg, 0.45 lb) or less to be no slack of inner cable with A/T throttle cable curved as shown in the figure.
2) Fix stopper to inner cable with clearance "c".

Clearance "c" : 0.8 – 1.5 mm (0.03 – 0.06 in.)

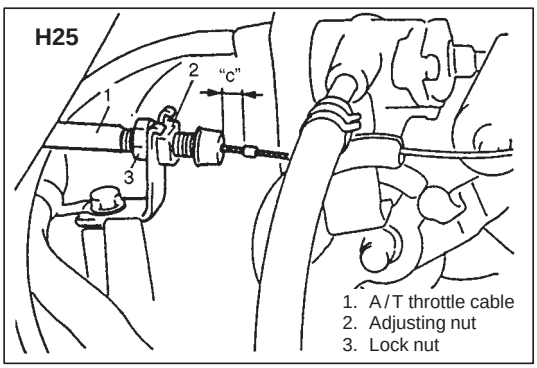


1. A/T throttle cable
2. Adjusting nut
3. Lock nut

3) **For G16/J20 engines**
   a) Check clearance "c". If it is out of specifications, adjust it by turning cable adjusting nut.

      Clearance "c" : 0.8 – 1.5 mm (0.03 – 0.06 in.)

   b) Tighten lock nut securely.



1. A/T throttle cable
2. Adjusting nut
3. Lock nut

For H25 engine

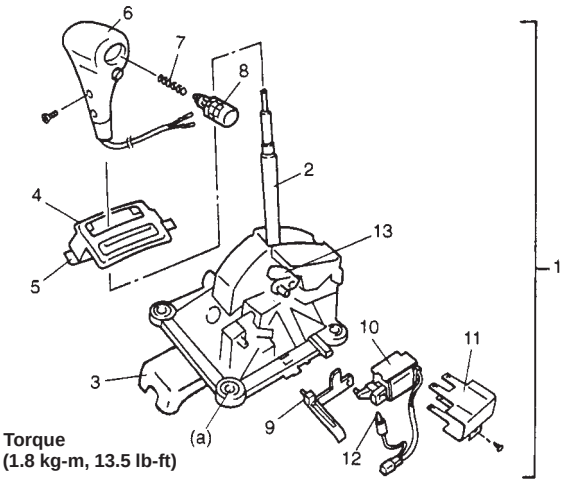
a) Warm up engine and transmission to normal operating temperature.
b) Make sure that accelerator cable is adjusted as specified.
c) With throttle valve closed, check clearance "c" which should be within the following specification.

Clearance "c" : 0.8 – 1.5 mm (0.03 – 0.06 in.)

If it is out of specification, adjust it by turning cable adjusting nut.

MANUAL SELECTOR ASSEMBLY

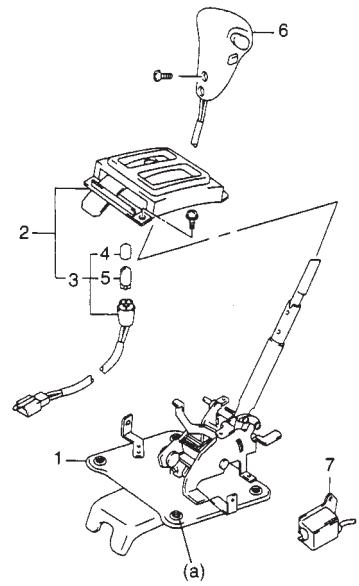
Type-1



Tightening Torque
(a): 18 N·m (1.8 kg-m, 13.5 lb-ft)

1. Manual selector assembly (Select lever assembly)
2. Manual lever assembly
3. Select cable bracket
4. Select indicator
5. Slide cover
6. Select lever knob
7. Spring
8. Knob button
9. Shift lock solenoid rod
10. Shift lock solenoid
11. Cover
12. Illumination lamp
13. Interlock cam

Type-2

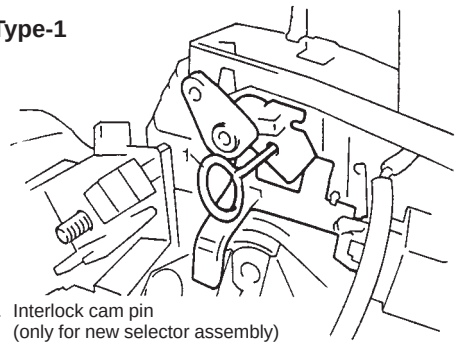


1. Manual lever assembly
2. Select indicator assembly
3. Illumination lamp assembly
4. Bulb filter
5. Bulb
6. Knob assembly
7. Shift lock solenoid

REMOVAL

1) Disconnect negative cable at battery.
2) Remove console box.
3) Disconnect connector for illumination lamp, shift lock solenoid and overdrive OFF switch.
4) Disconnect interlock cable from interlock cam of selector assembly.
5) Remove selector assembly mounting bolts.
6) Disconnect select cable from lever of selector assembly.

Type-1



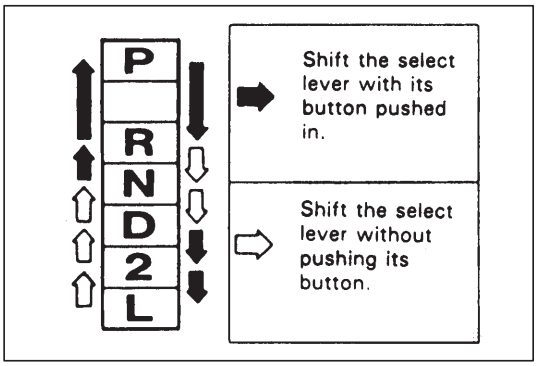
1. Interlock cam pin (only for new selector assembly)

INSTALLATION

NOTE:
New selector assembly of Type-1 is supplied with held interlock cam at interlock cable connecting position with pin. Remove this pin after connecting interlock cable to interlock cam and tightening cable nut.

Reverse removal procedure to install noting the followings.

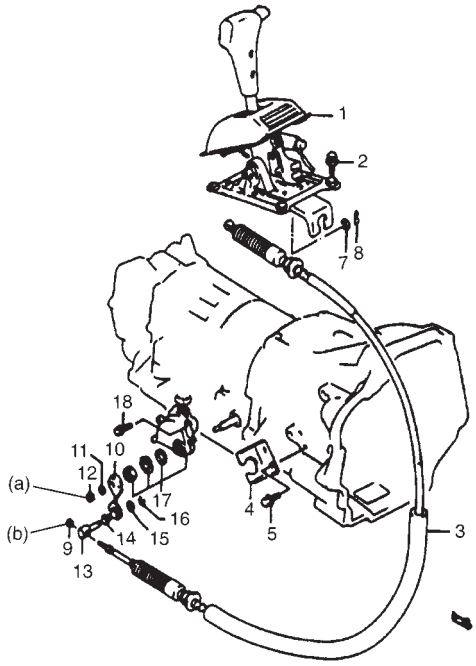
- Connect interlock cable end to cam referring to steps 2) to 8) of "Interlock Cable Installation" section.
- Upon completion of installation, confirm that brake (key) interlock system operates properly.



INSPECTION

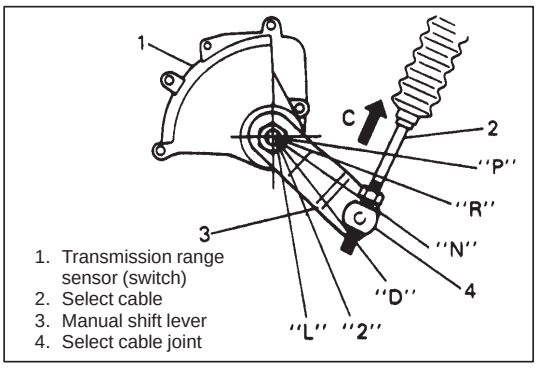
Check select lever for smooth and clear-cut movement and position indicator for correct indication.
For operation of select lever, refer to left figure.

SELECT CABLE



1. Select lever assembly
2. Bolt
3. Select cable
4. Cable bracket
5. Bolt
6. Blank
7. Washer
8. Clip
9. Nut
10. Manual select lever
11. Lock washer
12. Nut
13. Select cable joint
14. Bush
15. Washer
16. E-ring
17. Transmission range switch assembly
18. Bolt

Tightening Torque
(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)
(b): 7 N·m (0.7 kg-m, 5.5 lb-ft)



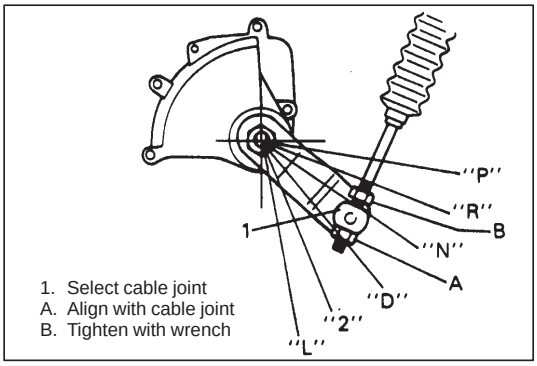
1. Transmission range sensor (switch)
2. Select cable
3. Manual shift lever
4. Select cable joint

ADJUSTMENT

1) Before tightening cable end nut, shift select lever to “N”.
2) Also shift manual shift lever to “N”.

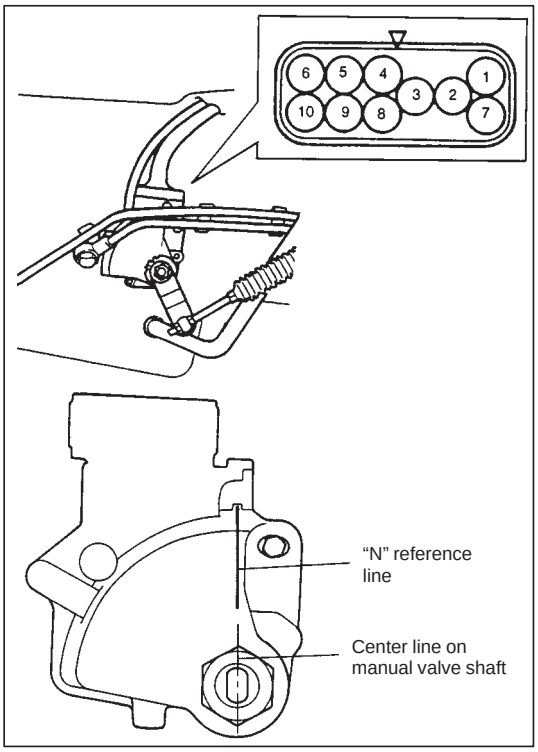
NOTE:

- **Make sure that nut and cable joint have clearance under above conditions.**
- **If select cable has been moved, push it in arrow C direction as shown in figure at the left till it stops and then confirm that select lever is in “N” position.**



1. Select cable joint
A. Align with cable joint
B. Tighten with wrench

3) Turn nut A by hand till it contacts manual select cable joint. Then tighten nut B with wrench.
4) After select cable was installed, check for the following.
   - Push vehicle with select lever shifted to “P”. Vehicle should not move.
   - Vehicle can not be driven in “N”.
   - Vehicle can be driven in “D”, “2”, and “L”.
   - Vehicle can be backed in “R”.

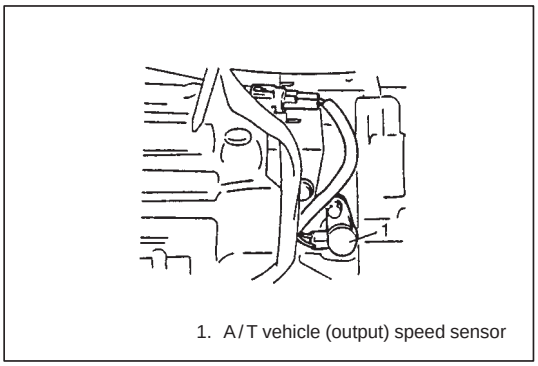


TRANSMISSION RANGE SWITCH (SENSOR)

INSPECTION & ADJUSTMENT

1) Shift select lever to "N" range.
2) Check that center line on manual valve shaft and "N" reference line on switch are aligned. If not, loosen switch bolt and align them.
3) Check that engine starts in "N" and "P" ranges but it doesn't start in "D", "2", "L" or "R" range. Also, check that back-up lamp lights in "R" range.
4) If faulty condition cannot be corrected by adjustment, disconnect transmission range switch coupler and check that continuity exists as shown by moving select lever.

Switch position \ Terminal No.	5	4	9	8	2	3	10	7	6
P					○	○		○	○
R				○					○
N					○	○	○		○
D			○						○
2		○							○
L	○								○



1. A/T vehicle (output) speed sensor

A/T OUTPUT SPEED SENSOR

INSPECTION

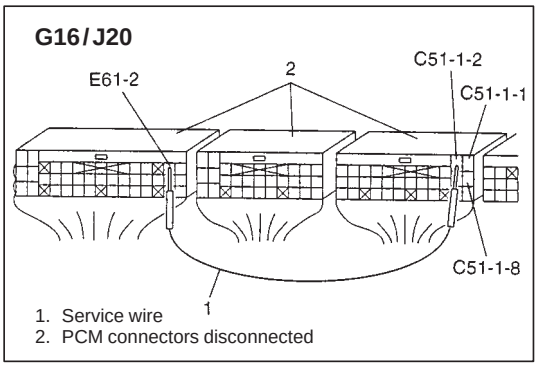
Check A/T output speed sensor for resistance between terminals of sensor or PCM coupler.

A/T output speed sensor resistance value : 387 – 473 Ω at 20°C, 68°F

O/D CUT SWITCH

INSPECTION

Check O/D cut switch for operation referring to step 4 of Diag. Flow Table B-2 in this section.
If malfunction is found, replace.



1. Service wire
2. PCM connectors disconnected

SOLENOID VALVES

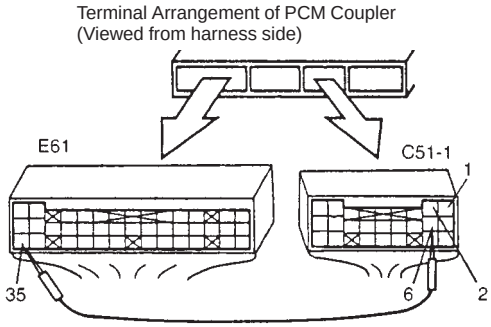
(Shift solenoid valves & TCC solenoid valve)

INSPECTION

With couplers of PCM disconnected and using service wire as shown at the left, check each solenoid valve for clicking sound.

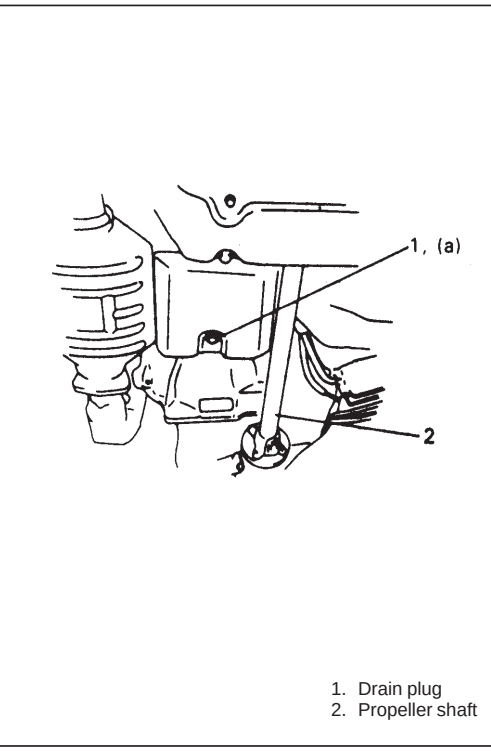
G16/J20 Engines

Shift solenoid valve - A (#1)	C51-1-2
Shift solenoid valve - B (#2)	C51-1-1
TCC (Lock-up) solenoid valve	C51-1-8



H25 Engine

Shift solenoid valve – A (#1)	C51-1-6
Shift solenoid valve – B (#2)	C51-1-1
TCC (Lock-up) solenoid valve	C51-1-2



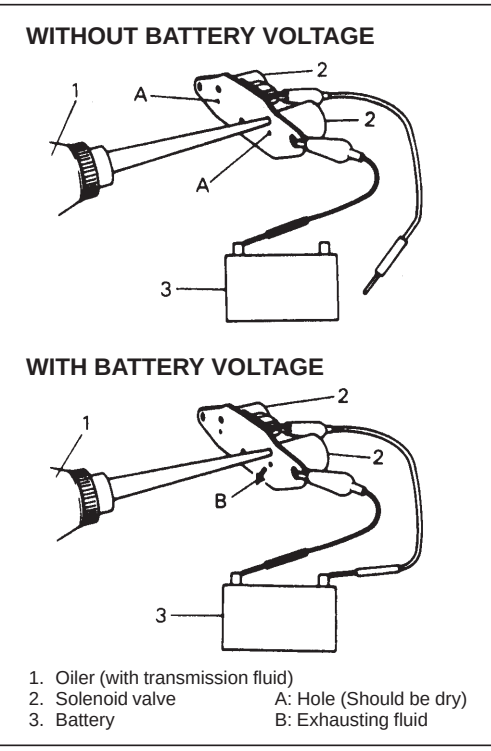
1. Drain plug
2. Propeller shaft

REMOVAL

1) Pull out dipstick and lift up vehicle.
2) With engine cooled, remove drain plug from oil pan and drain A/T fluid.
3) Install drain plug with gasket.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

4) Remove exhaust pipe bracket and disconnect front propeller shaft from front differential (if equipped).
5) Remove oil pan bolts.
6) Remove oil pan.
7) Remove oil tubes.
8) Remove solenoid valve No.1 (shift solenoid valve A and B) or solenoid valve No.2 (TCC solenoid valve).



1. Oiler (with transmission fluid)
2. Solenoid valve
3. Battery

A: Hole (Should be dry)
B: Exhausting fluid

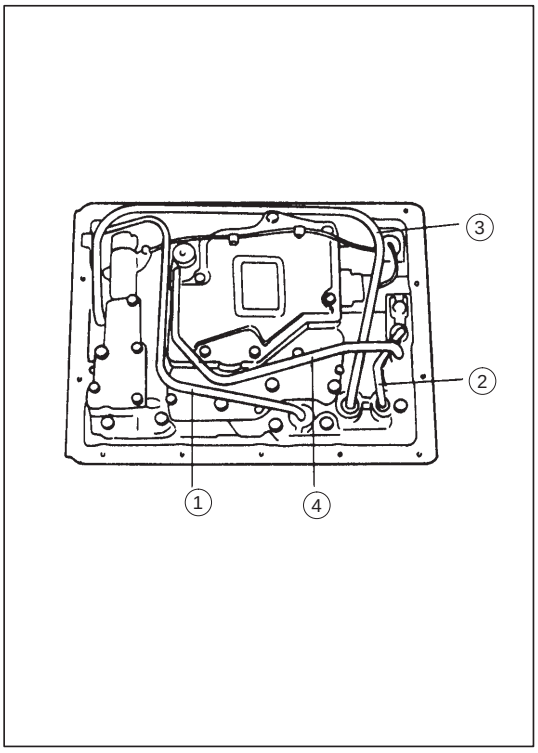
OPERATION CHECK

Whenever shift solenoid valves and TCC (lock-up) solenoid valve are removed from transmission, verify their valve function physically before they are reinstalled.

1) Apply oiler to solenoid valve and give compression by hands and then check to be sure that transmission fluid from oiler does not come out of holes in solenoid valve when battery voltage is not conducted.
2) Under the same conditions as above, conduct battery voltage and then make sure that fluid comes out with vigor.

NOTE:

- **If fluid does not come out with vigor in above step 2 inspection, do not re-use that solenoid valve.**
- **Figure at the left shows shift solenoid valve check. Check TCC solenoid valve also in the same way.**



INSTALLATION

Reverse removal procedure to install solenoid valves and noting the following points.

- For details of solenoid valve installation, refer to “Unit Repair” section. Use new gasket and O-ring.
- Install oil tubes in such order as shown in figure.
- For details of oil pan installation, refer to “Unit Repair” section. Use new oil pan gasket.
- Tighten universal joint flange bolts & nuts and exhaust pipe bracket bolts to specified torque.
- Fill A/T fluid and check fluid level according to procedure described in “CHANGING FLUID” previously.
- Check for fluid leakage after warming up A/T.

THROTTLE POSITION SENSOR

INSPECTION

Refer to SECTION 6E1/6E2 for inspection.

POWER/NORMAL CHANGE SWITCH

INSPECTION

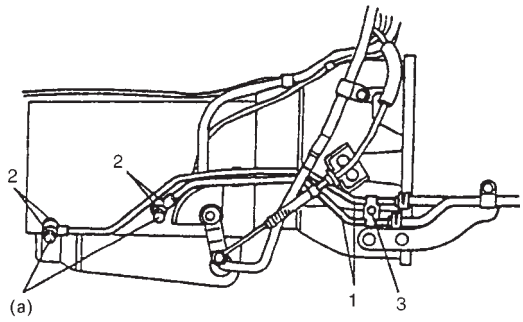
Check Power/Normal change switch for operation referring to Step 4 of Diag. Flow Table B-4 in this section.
If malfunction is found, replace.

OIL COOLER PIPES

REMOVAL

1) Lift up vehicle.
2) Make sure to wash dirt off from around pipe joints.
3) With engine is cool, loosen oil cooler pipe union bolts with oil outlet union locked and remove oil cooler pipes from oil outlet unions and hoses.

NOTE:
To avoid fluid leakage, plug open ends of oil outlet unions and hoses right after they are disconnected.



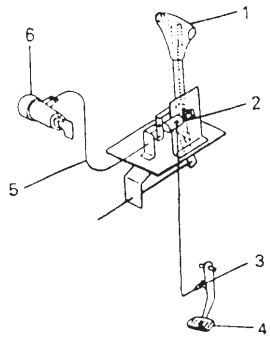
1. Oil cooler pipes
2. Union gaskets
3. Pipe bolt

INSTALLATION

1) Use new union gaskets and connect oil cooler pipes to oil outlet unions.
2) Connect hoses to pipes and clamp them securely.
3) Tighten union bolts to specified torque with oil outlet union locked.

Tightening Torque
(a): 35 N·m (3.5 kg-m, 25.5 lb-ft)

4) Tighten pipe bolt securely.
5) Check A/T fluid level according to procedure described in “Fluid Level” section.
   Add if necessary.
6) Check for fluid leakage after warming up A/T.



1. Select lever
2. Shift lock solenoid
3. Brake light switch
4. Brake pedal
5. Cable
6. Ignition switch

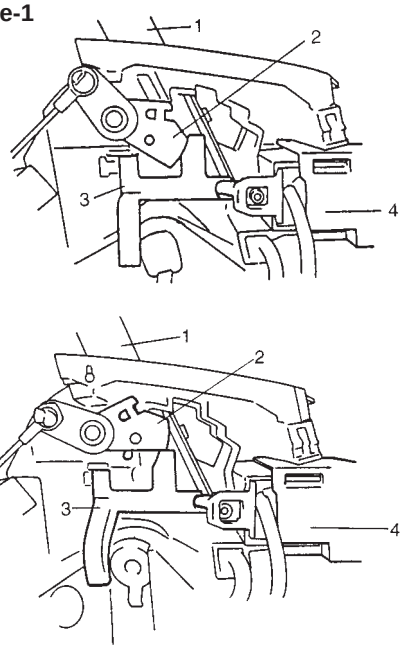
BRAKE INTERLOCK SYSTEM

SHIFT LOCK SOLENOID CONTROL

This system consists of shift lock solenoid control system and interlock cable control system.

The shift lock solenoid control system is so designed that the selector lever can not be shifted from “P” range position unless the ignition switch is turned ON and the brake pedal is depressed. And the interlock cable control system is so designed that the selector lever cannot be shifted from “P” range position unless the ignition switch is turned to “ACC” or “ON” position. Also, the ignition key cannot be pulled out of the key slot unless the selector lever is in “P” range.

Type-1



1. Select lever
2. Interlock cam
3. Shift lock solenoid rod
4. Shift lock solenoid

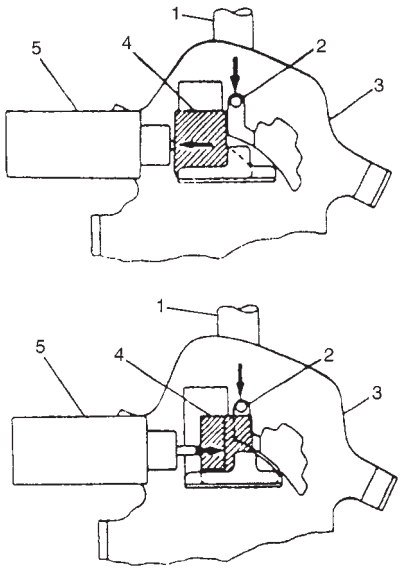
SHIFT LOCK SOLENOID CONTROL OPERATIONS

When the select lever is in “P” range, the ignition key position is “ON” and depressing the brake pedal cause the electric current to flow to the solenoid. As the shift lock solenoid rod (or the lock plate) is drawn toward the solenoid in this state, it frees the interlock cam (or the detent pin), which then allows the select lever to be shifted from “P” range to any other position.

Even when the select lever is in “P” range, if the ignition key position is “LOCK” or “ACC” or the brake pedal is not depressed, the electric current does not flow to the solenoid.

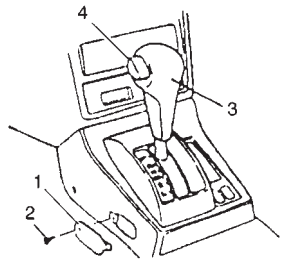
In this state, the shift lock solenoid rod (or the lock plate) is pushed away from the solenoid by spring force and it obstructs the interlock cam (or the detent pin) movement. Thus the select lever button does not work even when pressed and the select lever shift is prevented.

Type-2



1. Select lever
2. Detent pin
3. Detent plate
4. Lock plate
5. Shift lock solenoid

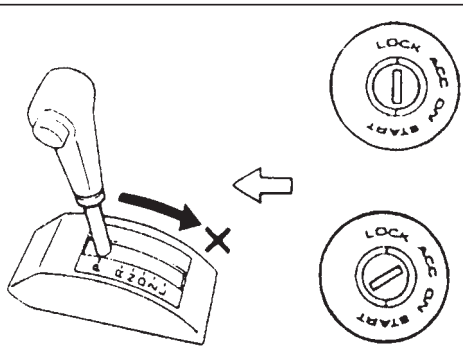
1. Cover
2. Screw
3. Select lever
4. Button



SHIFT LOCK (SOLENOID) MANUAL RELEASE

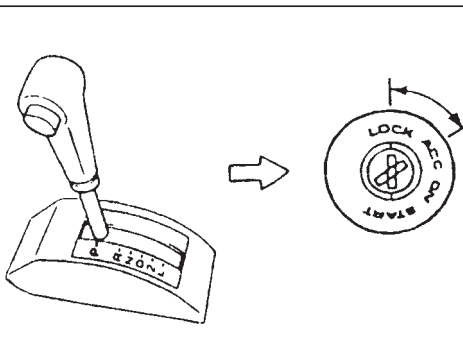
Shift lock can be manually released by following procedure.

1) Remove access hole cover by unfastening screw.
2) Turn ignition key to “ACC” position and move shift lock solenoid rod (or manual release plate) toward rear side of vehicle by using screw driver or the like.
3) In this state, select lever can be moved to any range or position.

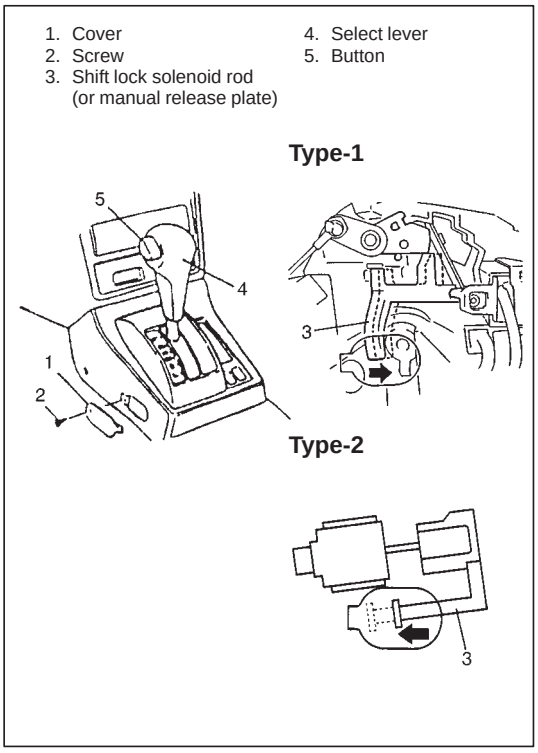


SYSTEM INSPECTION

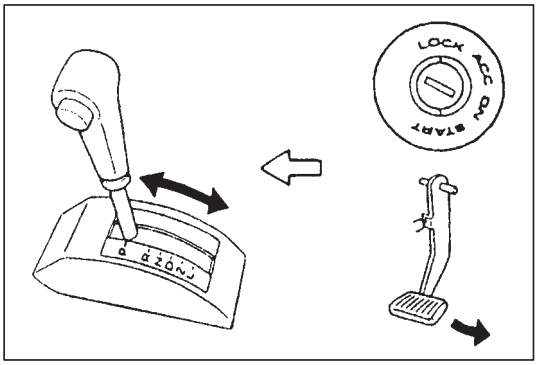
1) Check to make sure that select lever cannot be moved to any other range from “P” range position when ignition switch key is at “ACC” position, at “LOCK” position (or it is removed from key-hole of ignition switch) or brake pedal is not depressed.



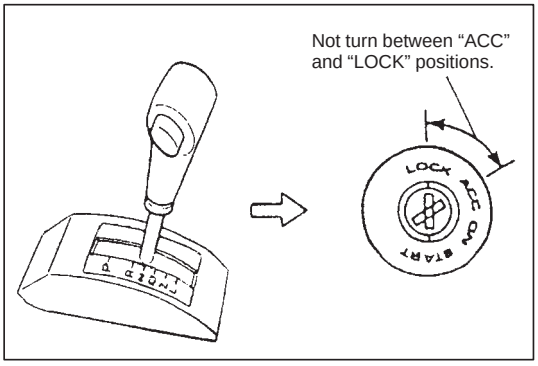
2) Shift select lever to “P” range position, release knob button and check for the following.
   - Ignition key can be turned between “LOCK” and “ACC” positions back and forth and also it can be removed from ignition switch.



- With shift lock solenoid rod (or manual release plate) moved in arrow direction and ignition key turned to “ACC” position, select lever can be shifted from “P” range position to any other range.
- With shift lock solenoid rod (or manual release plate) moved in arrow direction and ignition key turned to “LOCK” position, select lever can not be shifted from “P” range position to any other range.



- When ignition switch is turned “ON” and brake pedal is depressed, select lever can be shifted from “P” range position to any other range.



3) With select lever shifted to any position other than “P” range, check that ignition key cannot be turned “LOCK” position and it cannot be removed from ignition switch unless it is at “LOCK” position.

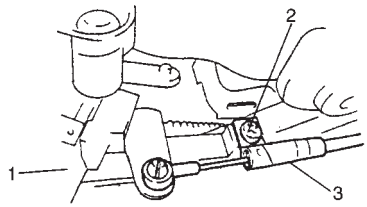
KEY INTERLOCK CABLE

NOTE:
Don't bend interlock cable excessively when removing and installing it, or system will not operate correctly.

Removal

1) Disconnect negative (–) cable from battery.
2) If equipped with air bag system, disable air bag system. Refer to "Disabling Air bag System" in Section 10B.
3) Remove steering column hole cover.
4) Tilt steering column if steering column is adjustable. If no adjustable, loosen steering column bolts.
5) Remove steering column cover.

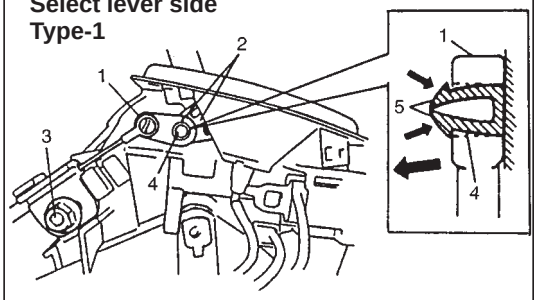
Ignition switch side



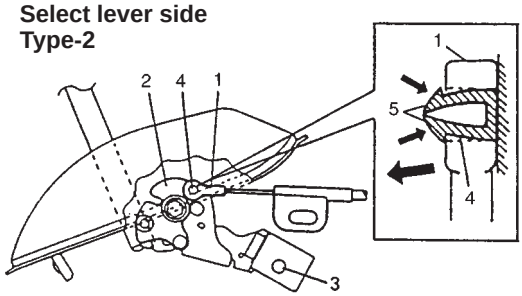
1. Ignition switch assembly
2. Clamp screw
3. Interlock cable

6) Remove interlock cable clamp screw located at ignition switch assembly.
7) Disconnect interlock cable inner end. (Ignition switch side.)

Select lever side
Type-1

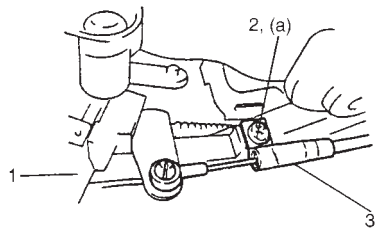


Select lever side
Type-2



1. Inner end of interlock cable
2. Interlock cam (or key release cam)
3. Stud bolt
4. Cam boss
5. Claw

8) With console box removed, take out interlock cable by loosening lock nuts.
9) Detach cable end from interlock cam (or key release cam) while pressing claws of interlock cam boss. At this time, be careful not to cause damage to its claws.

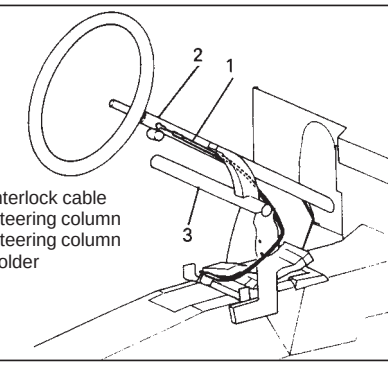


1. Ignition switch assembly
2. Clamp screw
3. Outer end

Installation

1) Shift select lever to “N” range and turn ignition key to “ACC” position.
2) Connect inner end of interlock cable to key interlock lever (Ignition switch side).
3) Install outer end bracket of interlock cable to ignition switch assembly, and tighten screw to specified torque.

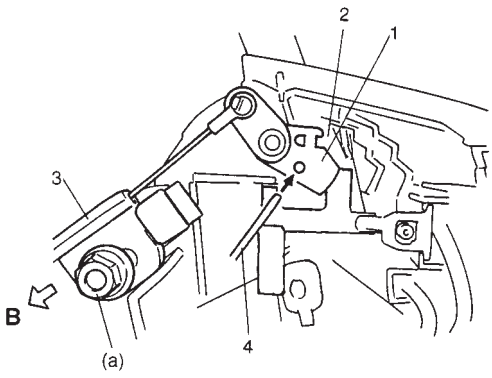
Tightening Torque
(a): 2.2 N·m (0.22 kg-m, 1.5 lb-ft)



1. Interlock cable
2. Steering column
3. Steering column holder

4) Pass and connect interlock cable as shown at the left figure.

Type-1



1. Interlock cam
2. Lever plate
3. Interlock cable
4. Pin with 4 mm (0.15 in.) dia.

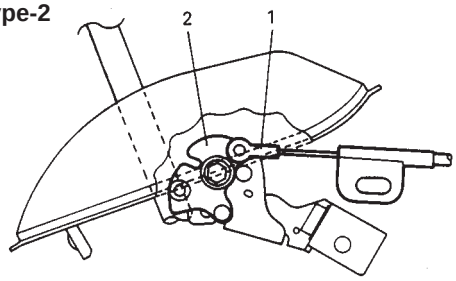
TYPE-1

5) Fix interlock cam by inserting pin with about 4 mm (0.15 in.) dia. into holes of cam and lever plate.
6) Install cable end to interlock cam and stud bolt and after making sure that cable outer is pushed in arrow direction B by leaf spring, tighten mounting nut to specified torque. Remove pin.

Tightening Torque
(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)

7) Turn ignition key to “ACC” position and shift select lever to “N” range, and check for the followings.
   a. When select lever is shifted at “P” range with knob button depressed, ignition key can not be turned from “ACC” to “LOCK” position.
   b. When knob button is released, ignition key can be turned to “LOCK” position.
   c. When ignition key is at “LOCK” position, select lever can not be shifted from “P” to any other range.
8) Install console box.
9) Install steering column cover.
10) Adjust steering column or tighten steering column bolts.
11) Install steering column hole cover.
12) If equipped with air bag system, enable air bag system. Refer to “Enabling Air bag System” in Section 10B.

Type-2

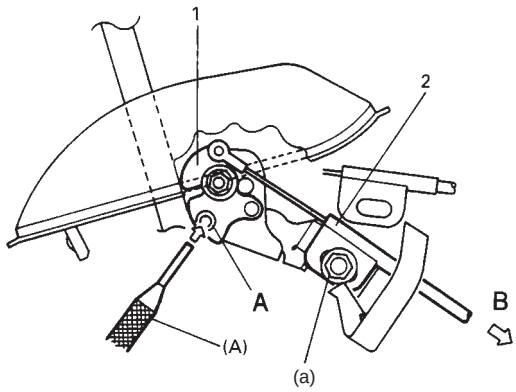


1. Inner end of interlock cable
2. Key release cam

TYPE-2

5) With key release cam set as shown at the left figure, connect inner end of interlock cable to key release cam. (Select lever side.)

Type-2



1. Key release cam
2. Cable outer

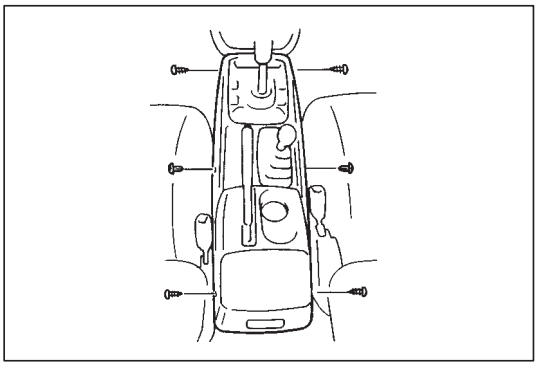
6) Move key release cam so that it is set at such angle as shown at the left figure and with special tool inserted in hole A , fix key release cam.

Special Tool
(A): 09925-78210 (6 mm)

7) With key release cam fixed with special tool, install cable outer to bracket and after making sure that cable outer is pushed in arrow direction B by leaf spring, tighten mounting nut to specified torque. Remove special tool.

Tightening Torque
(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)

8) Turn ignition key to “ACC” position and shift select lever to “N” range, and check for the followings.
   a. When select lever is shifted at “P” range with knob button depressed, ignition key can not be turned from “ACC” to “LOCK” position.
   b. When knob button is released, ignition key can be turned to “LOCK” position.
   c. When ignition key is at “LOCK” position, select lever can not be shifted from “P” to any other range.
9) Install console box.
10) Install steering column cover.
11) Adjust steering column or tighten steering column bolts.
12) Install steering column hole cover.
13) If equipped with air bag system, enable air bag system. Refer to “Enabling Air bag System” in Section 10B.

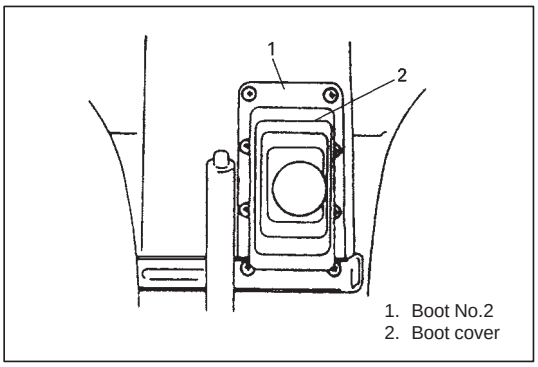


DISMOUNTING OF TRANSMISSION (WITH TRANSFER IF EQUIPPED)

IN CABIN

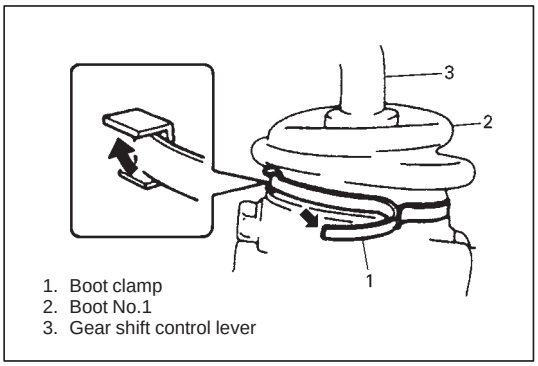
1) Remove console box.

NOTE:
To remove clip, push in its center pin first.



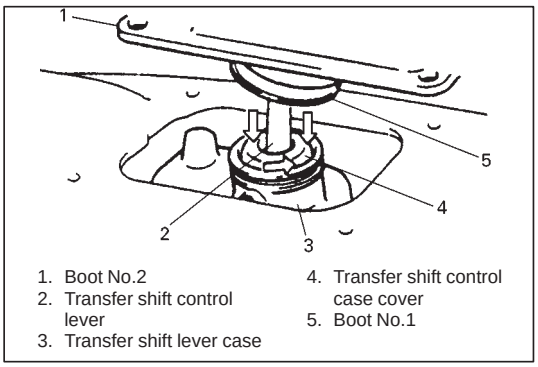
1. Boot No.2
2. Boot cover

2) Remove boot cover and boot No.2. (if equipped)



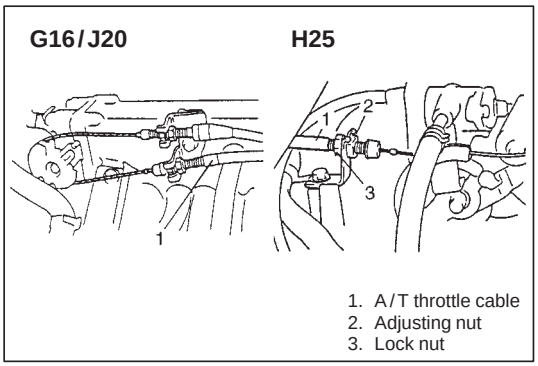
1. Boot clamp
2. Boot No.1
3. Gear shift control lever

3) Remove boot clamp and then remove boot No.1 from transfer gear shift lever case. (if equipped)



1. Boot No.2
2. Transfer shift control lever
3. Transfer shift lever case
4. Transfer shift control case cover
5. Boot No.1

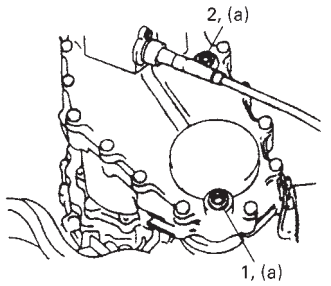
4) With transfer shift control case cover pushed down with fingers, turn it to counterclockwise and take out shift control lever. (if equipped)



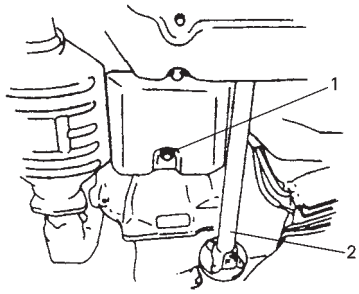
1. A/T throttle cable
2. Adjusting nut
3. Lock nut

IN ENGINE ROOM

1) Remove battery, dipstick and oil filler tube.
2) Disconnect A/T throttle cable from throttle cam and bracket.
3) Remove starter motor. But don't disconnect its wiring harness.
4) Remove transmission to engine bolt and nut.



1. Drain plug
2. Filler and level plug



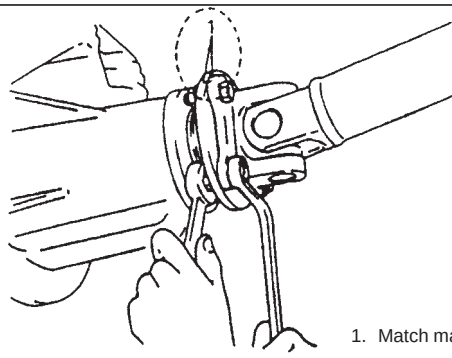
1. Drain plug
2. Front propeller shaft

ON LIFT

1) Drain transfer oil for 4WD vehicle or A/T fluid for 2WD vehicle.

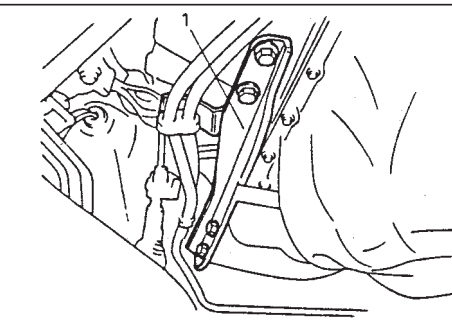
NOTE:
If 4WD automatic transmission is overhauled later on, draining A/T fluid at this point will facilitate work.

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)



1. Match marks

2) Before removing propeller shaft, give match marks on joint flange and propeller shaft as shown in left figure.
3) Remove universal joint flange bolts and take out rear propeller shaft.
4) Likewise, take out front propeller shaft. (if equipped)
5) Remove nut from the end of select cable and bracket to set cable free.
6) Remove select cable bracket by removing its 2 bolts.
7) Remove exhaust No.1 and No.2 pipe.

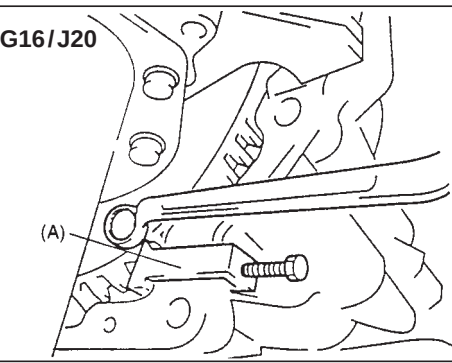


1. Right side transmission stiffener (if equipped)

8) Remove transmission stiffener (right side) if equipped.
9) Unclamp and disconnect oil cooler hoses from pipes.

NOTE:
To avoid leakage of transmission fluid, plug open ends of oil cooler pipes and hoses right after they are disconnected.

10) Remove torque converter housing lower plate.



11) Holding drive plate stationary with special tool or the like, remove torque converter mounting bolts with wrench.

Special Tool (only for G16/J20)
(A): 09927-56010

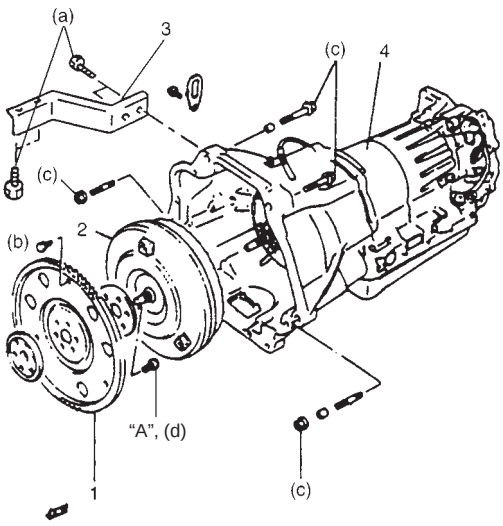
12) Remove engine to transmission nuts.
13) Disconnect connectors from VSS, output speed sensor, input speed sensor, TR switch, shift & TCC solenoid valves and other electrical parts, and release their wire harness from clamps.
14) Apply transmission jack and take off rear mounting member by removing its bolts.
15) With transmission (and transfer if equipped) assembly held up on jack, move them to the rear and lower them including torque converter.

WARNING:
Transmission (and transfer if equipped) assembly may tilt rearward on jack. It is recommended to use an auxiliary arm of jack for the purpose of safety.

AFTER DISMOUNTING

WARNING:
Be sure to keep transmission (and transfer if equipped) assembly horizontal throughout the work. Should they be tilted, torque converter may fall off and cause personal injury and A/T fluid may flow out.

1) Remove breather hoses.
2) Remove transfer by removing its bolts, if equipped.



"A": Sealant 99000-31110

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
(c): 85 N·m
8.5 kg-m
61.5 lb-ft
(d): 78 N·m
7.8 kg-m
56.5 lb-ft

1. Drive plate
2. Torque converter
3. Case right stiffener (if equipped)
4. Automatic transmission

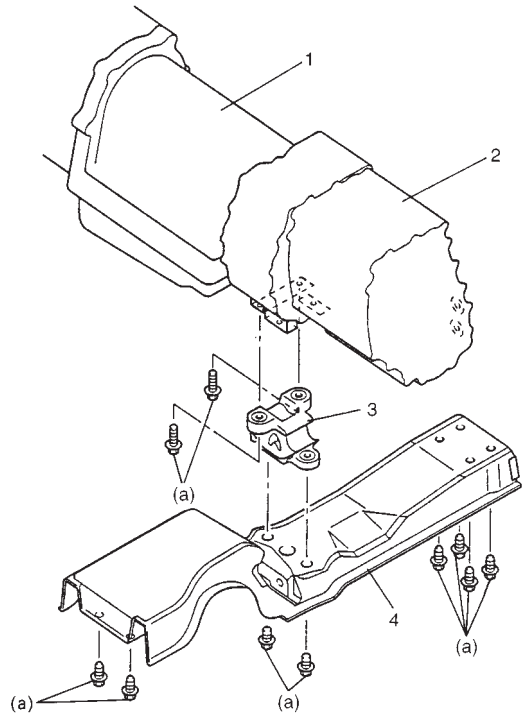
REMOUNTING

WARNING:
When moving transmission assembly with torque converter equipped in it, be sure to keep it horizontal. Tilting it with its front facing down may allow converter to fall off. Whereby an injury may result.

For remounting, reverse dismounting procedure. Use specified torque as given below and left.

Tightening torque	N·m	kg-m	lb-ft
Exhaust No.1 pipe to manifold bolts or nuts	50	5.0	36.5
Muffler to exhaust No.2 pipe nuts	60	6.0	43.5
Universal joint flange bolts and nuts	50	5.0	36.5
● Oil filler tube bolts ● Select cable bracket bolts	23	2.3	17.0

- Clamp wiring harness and hoses securely.
- Refer to "Select Cable" section for adjusting procedure of select cable.
- Refer to "A/T Throttle Cable" section for tuning of A/T throttle cable.
- Follow fluid level check procedure for refilling automatic transmission fluid and its level adjusting.
- Connect battery, and confirm that engine and transmission function acceptably.
- When remounting drive plate, use specified bolts.



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

1. Automatic transmission
2. Transfer (4WD)
3. Engine rear mounting
4. Engine rear mounting member

UNIT REPAIR

Refer to the same section of UNIT REPAIR MANUAL mentioned in FOREWORD of this manual.

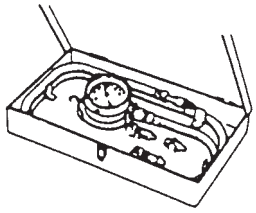
TIGHTENING TORQUE SPECIFICATIONS

Fastening portion		Tightening torque		
		N·m	kg-m	lb-ft
ON-VEHICLE SERVICE	Automatic transmission fluid drain plug	23	2.3	17.0
	Transfer oil filler / level and drain plugs	23	2.3	17.0
	Transmission case plug	17	1.7	12.5
	Manual select lever nut	13	1.3	9.5
	Manual select cable nut	7	0.7	5.5
	Manual selector assembly bolts	18	1.8	13.5
MOUNTING	Transmission to engine bolts and nuts	85	8.5	61.5
	Engine rear mounting bolts Engine rear mounting member bolts Transmission case right stiffener bolts	50	5.0	36.5
	Universal joint flange bolts and nuts	50	5.0	36.5
	Torque converter mounting bolts	65	6.5	47.0
EXTERNAL	Adapter case or extension case bolts (G16 engine)	35	3.5	25.5
	Adapter case or extension case bolts (J20 / H25 engines)	42	4.2	30.0
	Transmission range switch lock bolt	5.5	0.55	4.0
	Oil pipe union bolts	35	3.5	22.5
	Drive plate bolts	78	7.8	56.5
	Interlock cable clamp screw	2.2	0.22	1.5
	Interlock cable outer mounting nut	13	1.3	9.5

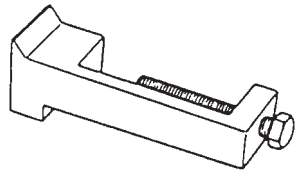
REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
A/T fluid	An equivalent of DEXRON®-III	● Automatic transmission ● Parts lubrication when installing
Lithium grease	SUZUKI SUPER GREASE A (99000–25010)	● Cable ends
Sealant	SUZUKI BOND NO.1215 (99000-31110)	● Flywheel bolts

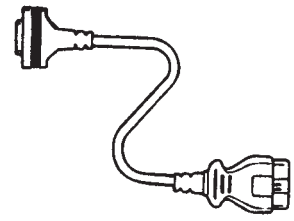
SPECIAL TOOLS



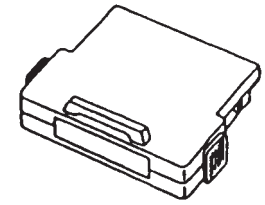
09925-37810
Oil pressure gauge



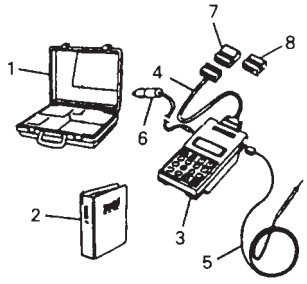
09927-56010
Gear stopper
(only for G16/J20)



09931-76030
16/14 pin DLC
(OBD-II adapter) cable



Mass storage cartridge



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

09931-76011
SUZUKI scan tool (Tech 1A) kit

SECTION 7C1

CLUTCH

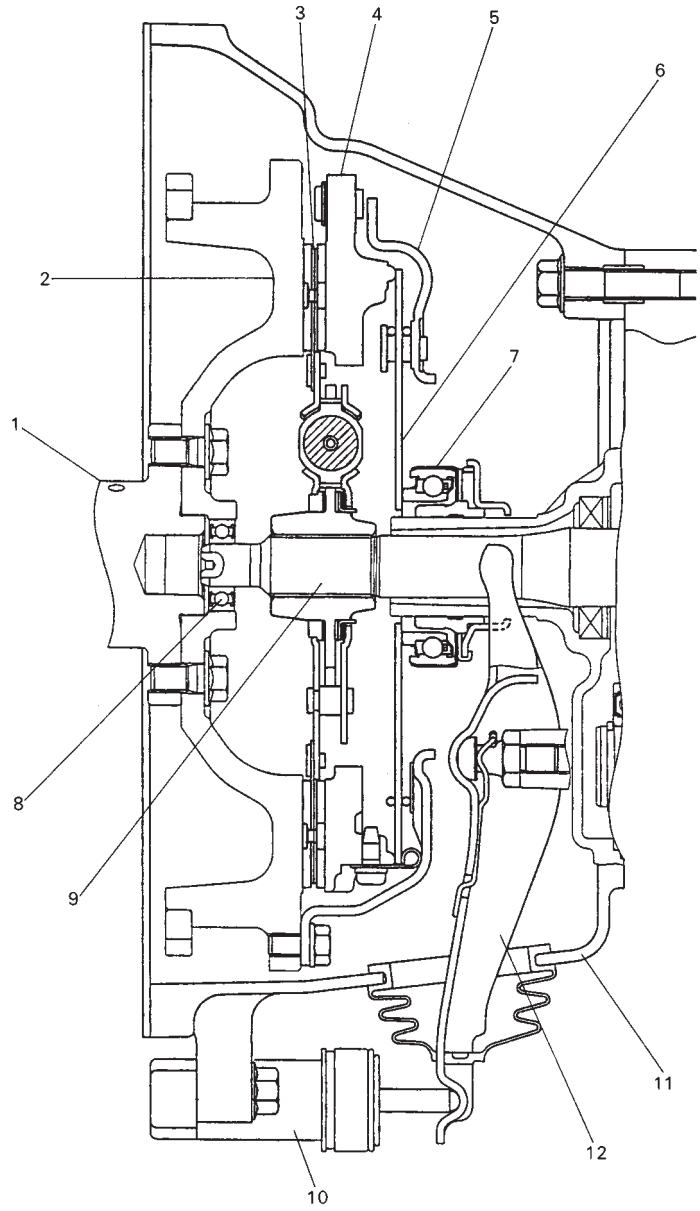
CONTENTS

GENERAL DESCRIPTION 7C1- 2
DIAGNOSIS 7C1- 3
ON-VEHICLE SERVICE 7C1- 4
Clutch Pedal Height 7C1- 4
Clutch Pedal Free Travel 7C1- 4
Clutch Fluid Pipe and Hose 7C1- 4
Clutch Master Cylinder 7C1- 5
Fluid Inspection 7C1- 6
Disassembly and Assembly Clutch Master Cylinder 7C1- 7
Clutch Operating Cylinder 7C1- 8
UNIT REPAIR 7C1-10
Clutch Cover, Clutch Disc and Flywheel 7C1-10
TIGHTENING TORQUE SPECIFICATIONS 7C1-14
REQUIRED SERVICE MATERIALS 7C1-14
SPECIAL TOOLS 7C1-14

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 torsional coil springs, is positioned on the transmission input shaft with an involute spline fit.
The clutch cover is secured to the flywheel, and carries the diaphragm spring in such a way that the peripheral edge part of the spring pushes on the pressure plate against the flywheel (with the disc in between), when the clutch release bearing is held back. This is the engaged condition of the clutch.

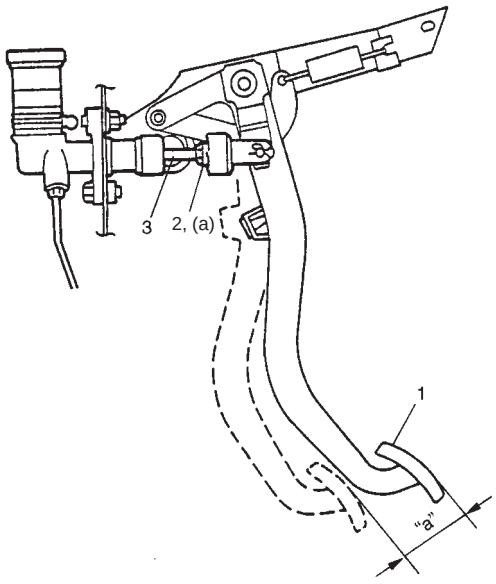
Depressing the clutch pedal causes the release bearing to advance and pushes on the tips of the tapered fingers of the diaphragm spring. When this happens, the diaphragm spring pulls the pressure plate away from the flywheel, thereby interrupting the flow of drive from flywheel through clutch disc to transmission input shaft.



1. Crankshaft
2. Flywheel
3. Clutch disc
4. Pressure plate
5. Clutch cover
6. Diaphragm spring
7. Release bearing
8. Input shaft bearing
9. Input shaft
10. Operating cylinder
11. Clutch housing
12. Release fork

DIAGNOSIS

Condition	Possible Cause	Correction
Slipping	● Improper clutch pedal free travel.	Bleed air or replace master cylinder.
	● 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.
	● Master cylinder piston or seal cup not returning.	Repair master cylinder.
Dragging clutch	● Improper clutch pedal free travel.	Bleed air or replace master cylinder.
	● 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.
	● Fluid leakage.	Repair or replace.
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.



1. Clutch pedal
2. Clevis lock nut
3. Push rod

ON-VEHICLE SERVICE

CLUTCH PEDAL HEIGHT

Adjust clutch pedal height by loosening clevis lock nut and turning push rod as shown.

Clutch pedal height is normal if clutch pedal is about 20 mm (0.79 in.) higher than brake pedal.

After adjusting, tighten lock nut to specified torque.

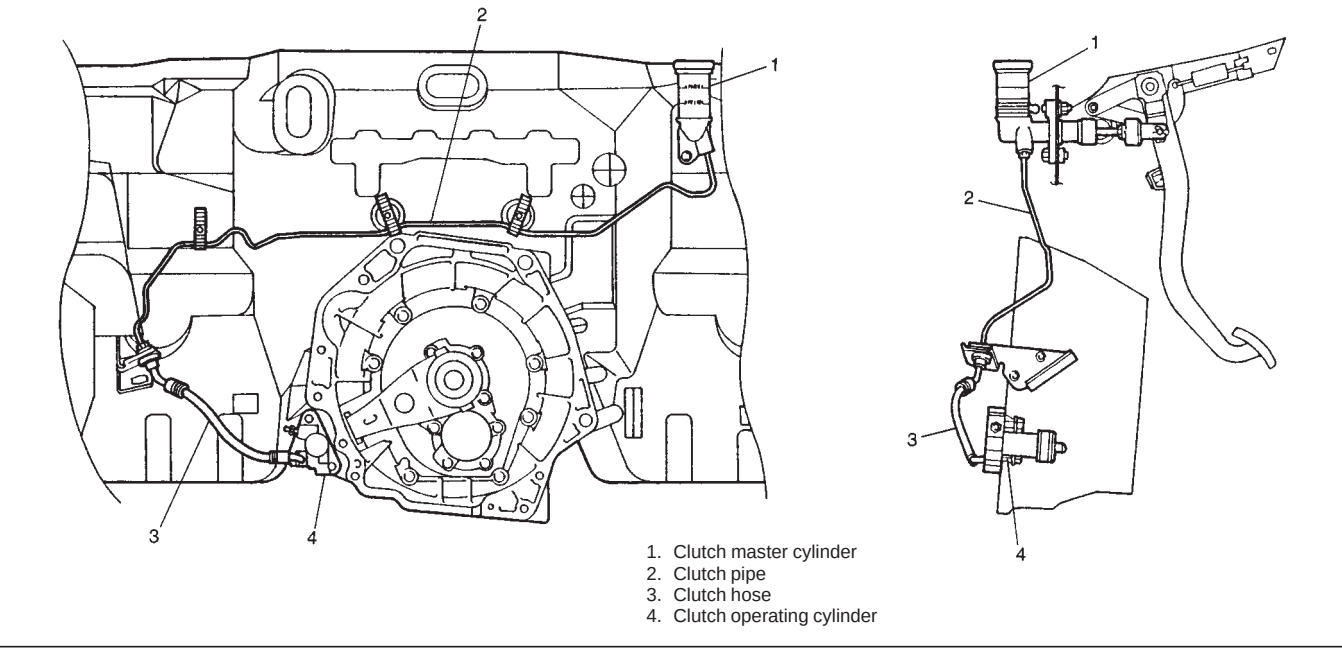
Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

CLUTCH PEDAL FREE TRAVEL

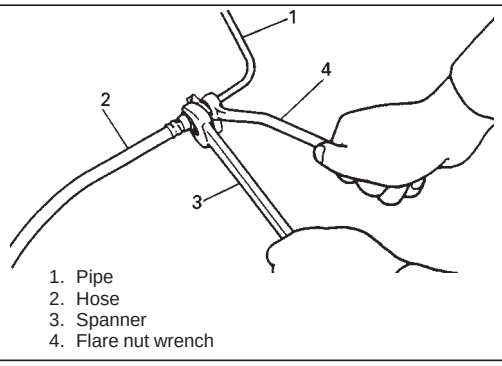
Depress clutch pedal, stop the moment clutch resistance is felt and measure distance (clutch pedal free travel). Free travel should be within following specification.

Pedal free travel "a": 15 – 25 mm (0.6 – 1.1 in.)

CLUTCH FLUID PIPE AND HOSE



1. Clutch master cylinder
2. Clutch pipe
3. Clutch hose
4. Clutch operating cylinder



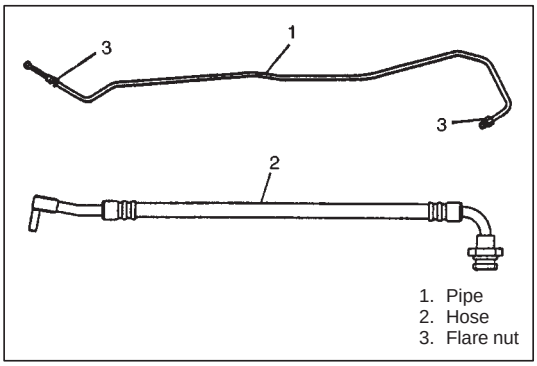
1. Pipe
2. Hose
3. Spanner
4. Flare nut wrench

REMOVAL

NOTE:
Do not allow fluid to get on painted surface.

1) Remove dust and dirt from each joint of hose and pipe to be disconnected and clean around reservoir cap.
2) Take out fluid with syringe or such.
3) Disconnect fluid pipe from hose.

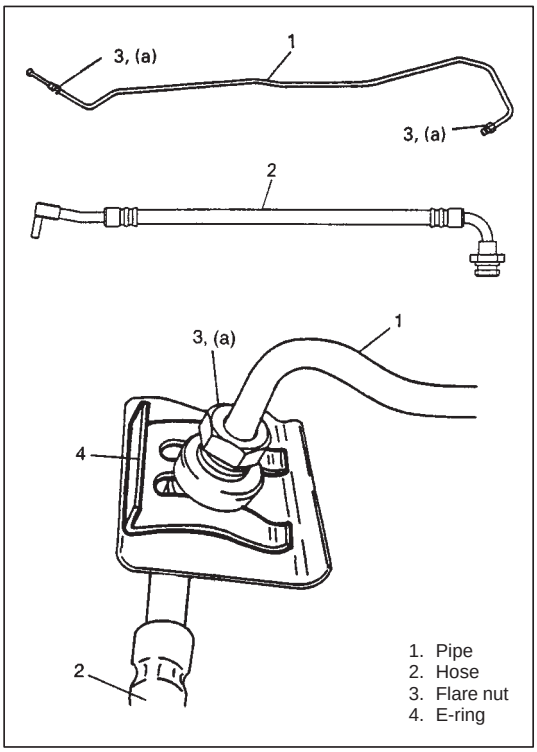
NOTE:
To disconnect pipe from hose, separate them by using flare nut wrench and spanner so as not to kink them.



1. Pipe
2. Hose
3. Flare nut

INSPECTION

Check pipe and hose for dent, kink, crack, dirt and dust. Replace if check result is not satisfactory.



1. Pipe
2. Hose
3. Flare nut
4. E-ring

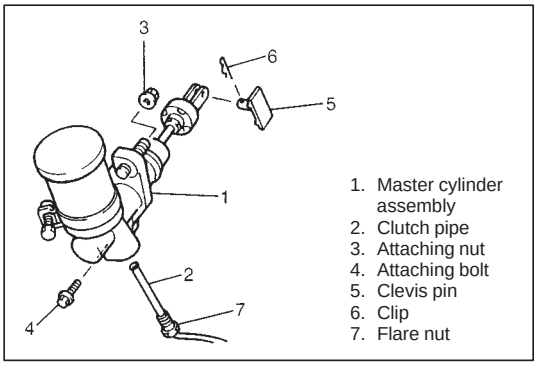
INSTALLATION

Reverse removal sequence noting following points.
Tighten flare nuts to specified torque.

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

NOTE:

- **For air bleeding of master cylinder alone, it must be removed from vehicle.**
  (For procedures of removal and installation of master cylinder assembly and air bleeding, refer to CLUTCH MASTER CYLINDER section.)
- **Do not allow fluid to get on painted surface.**
- **Do not allow pipe and hose to contact hard against vehicle or other parts.**
- **Install each clamp securely.**
- **Install E-ring securely as shown.**
- **After installation, check clutch pedal free travel and bleed air from system.**
- **Check fluid leakage.**
- **Add fluid close to MAX level of reservoir.**



1. Master cylinder assembly
2. Clutch pipe
3. Attaching nut
4. Attaching bolt
5. Clevis pin
6. Clip
7. Flare nut

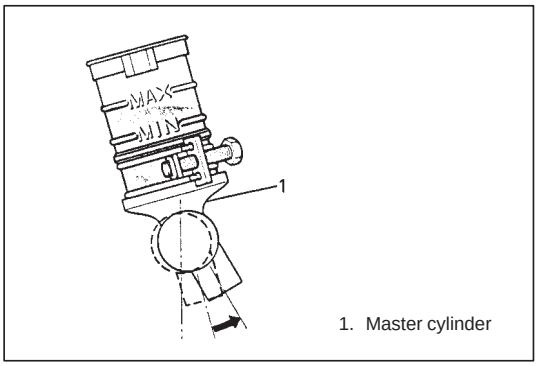
CLUTCH MASTER CYLINDER

REMOVAL

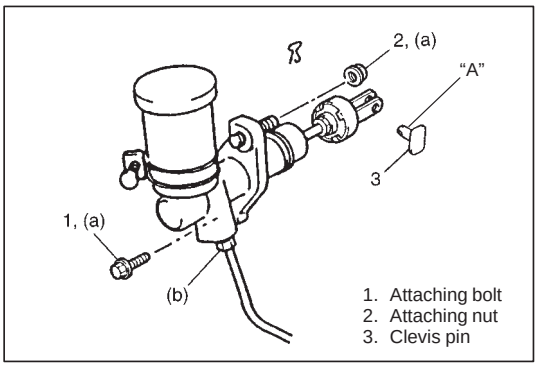
1) Clean around reservoir cap and take out fluid with syringe or such.
2) Remove push rod clevis pin.
3) Disconnect fluid pipe from master cylinder.

   NOTE:
   Do not allow fluid to get on painted surfaces.

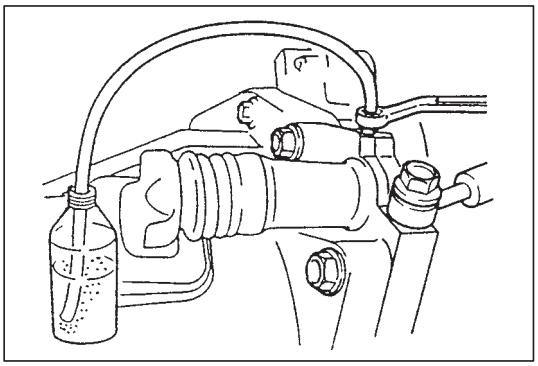
4) Remove master cylinder attaching nut and bolt.
5) Remove master cylinder assembly and gasket.

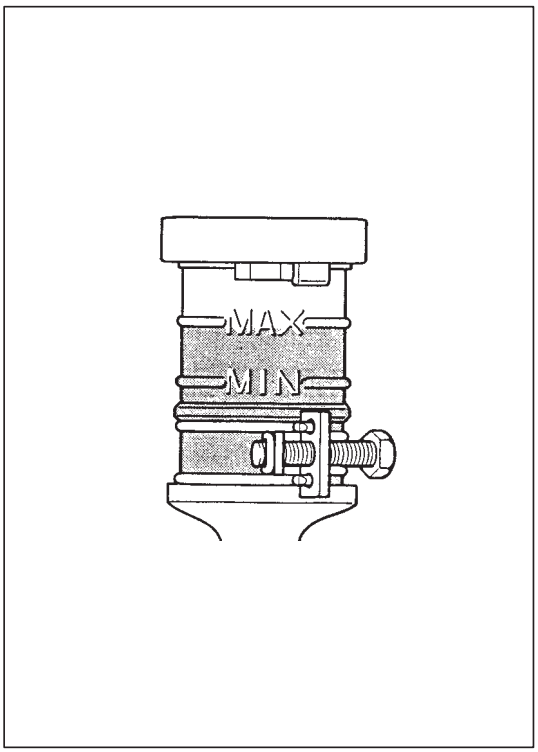


1. Master cylinder



1. Attaching bolt
2. Attaching nut
3. Clevis pin





INSTALLATION

1) To bleed air from master cylinder itself, tilt it as shown in figure and add fluid into it.

   NOTE:
   After bleeding air from master cylinder, plug pipe hole in it to prevent fluid from spilling out of it till pipe is connected.

2) Install master cylinder assembly and new gasket to body, attaching bolt, nuts and push rod clevis pin.

   NOTE:
   Do not reuse gasket.

3) Torque attaching bolt and nut to specification.
4) Connect fluid pipe and torque flare nut to specification.

   Tightening Torque
   (a): 13 N·m (1.3 kg-m, 9.5 lb-ft)
   (b): 16 N·m (1.6 kg-m, 11.5 lb-ft)

5) Apply grease to clevis pin and install it.

   "A": Grease 99000-25010

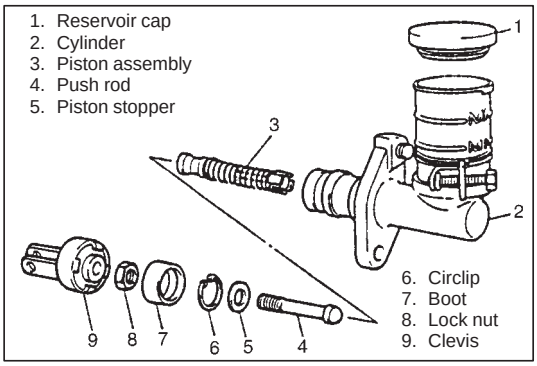
6) Fill reservoir with specified brake fluid and check fluid leakage.
7) After installation, bleed air from system and check clutch pedal free travel. Refer to BRAKE section for air bleeding procedure.

FLUID INSPECTION

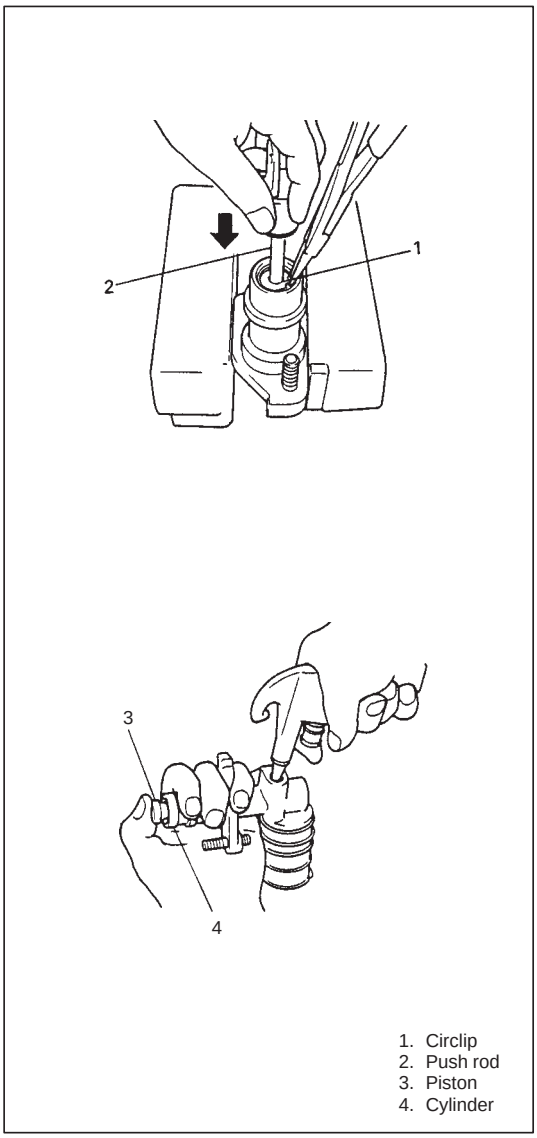
Fluid level should be always between MIN and MAX lines on reservoir. If fluid decreases quickly, check for leakage, repair leaky point, if any, and add fluid up to MAX level.

NOTE:

- **Brake fluid damages painted surface badly. Should it get on painted surface, remove it immediately and clean surface thoroughly.**
- **Do not use shock absorber fluid or any other fluid which contains mineral oil. Do not use container which has been used for mineral oil or which is wet from water. Mineral oil will cause swelling and distortion of rubber parts in hydraulic clutch system and water will mix with brake fluid, lowering fluid boiling point. Keep all fluid containers capped to prevent contamination.**
- **Make sure not to use fluid whose container cap was first opened more than a year ago.**



DISASSEMBLY AND ASSEMBLY CLUTCH MASTER CYLINDER



DISASSEMBLY

1) Remove boot and then circlip with piston pushed in.
2) Remove push rod and blow compressed air gradually into hole for pipe connection to remove piston assembly, using care to prevent it from jumping out.

INSPECTION

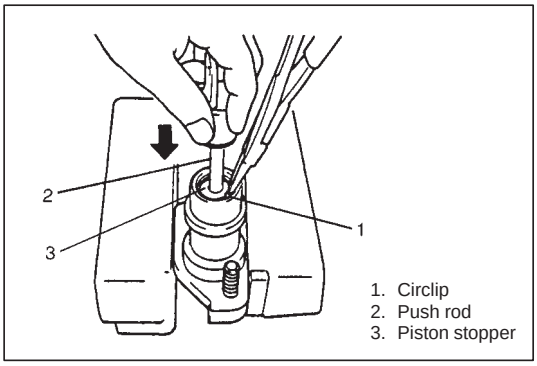
Inspect all disassembled parts for wear or damage and replace parts if necessary.

NOTE:
- **Wash disassembled parts with brake fluid.**
- **Do not reuse piston assembly and circlip.**

Inspect 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 cylinder with anything abrasive is prohibited, as damage to cylinder bore may occur.

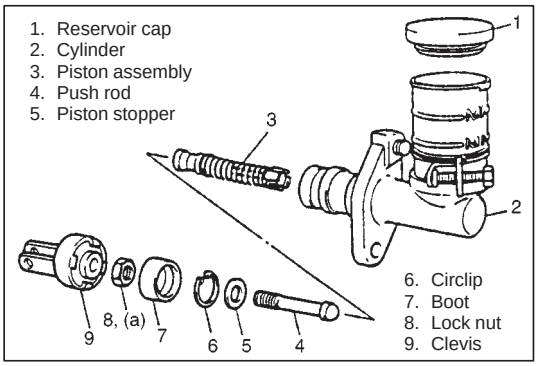
Rinse cylinder in clean brake fluid. Shake excess rinsing fluid from cylinder. Do not use a cloth to dry cylinder, as lint from cloth cannot be kept away from cylinder bore surfaces.



ASSEMBLY

NOTE:
Before installation, wash each part in specified brake fluid.

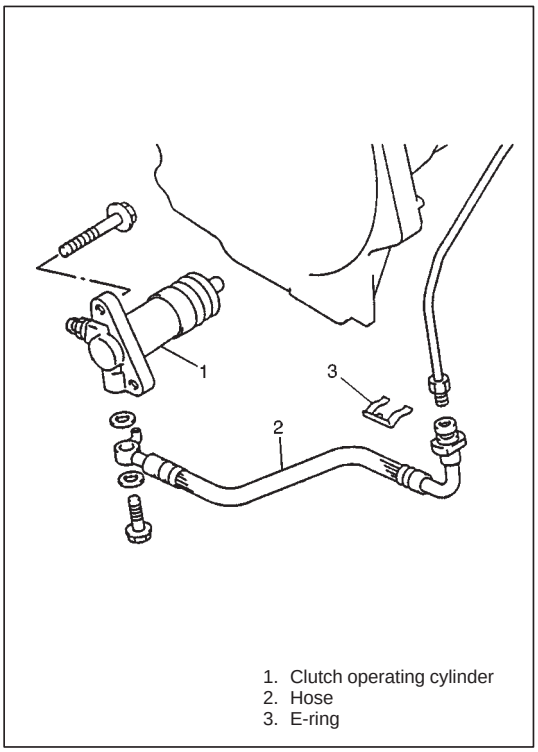
1) Apply brake fluid to inside of piston assembly and cylinder body.
2) Install piston assembly into cylinder.
3) With piston pushed down, install circlip as shown.
   And install boot.



4) Tighten lock nut to specified torque.

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

5) For installation of master cylinder to vehicle, refer to INSTALLATION described previously.

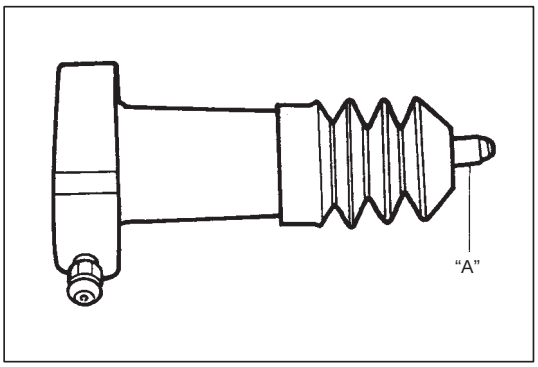


CLUTCH OPERATING CYLINDER

REMOVAL

NOTE:
Do not allow fluid to get on painted surfaces.

1) Clean around reservoir cap and take out fluid with syringe or such.
2) Disconnect fluid hose from operating cylinder.
3) Remove operating cylinder attaching bolts and operating cylinder.

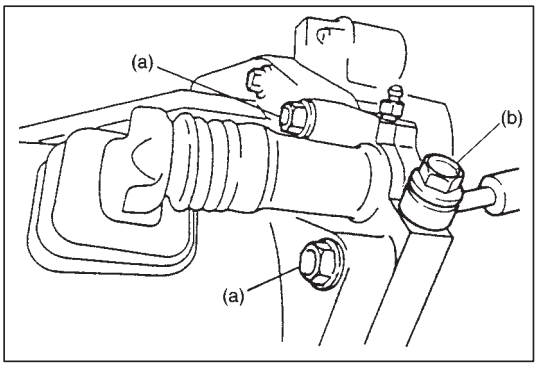


INSTALLATION

1) For air bleeding of master cylinder alone, it must be removed from vehicle.
   For procedures of removal and installation of master cylinder assembly and air bleeding, refer to CLUTCH MASTER CYLINDER section.
2) Apply small amount of grease to rod tip.

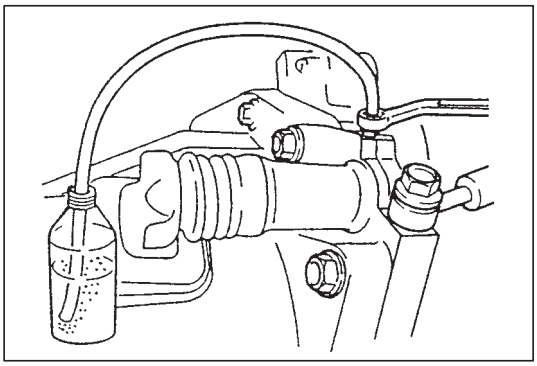
   "A": Grease 99000-25010

   NOTE:
   Don't allow any grease to be on boot.



3) Install clutch operating cylinder and torque attaching bolts to specification.
4) Connect clutch fluid hose and torque union bolt to specification.

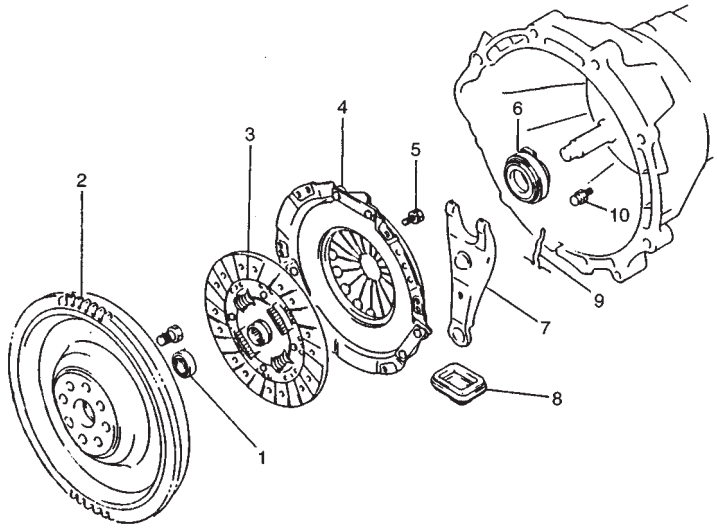
Tightening Torque
(a): 50 N·m (5.0 kg-m, 36.5 lb-ft)
(b): 23 N·m (2.3 kg-m, 16.5 lb-ft)



5) Fill reservoir with specified brake fluid and check for fluid leakage.
6) Bleed air from system and check clutch pedal free travel. Refer to BRAKE section for air bleeding procedure.

UNIT REPAIR

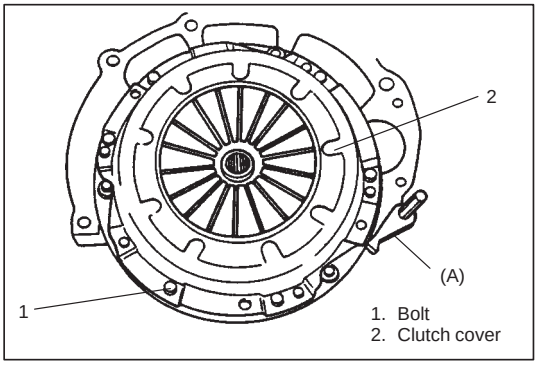
CLUTCH COVER, CLUTCH DISC AND FLYWHEEL



1. Input shaft bearing
2. Flywheel
3. Clutch disc
4. Clutch cover
5. Bolt
6. Release bearing
7. Clutch release fork
8. Boot
9. Clip
10. Clutch release fork support

DISMOUNTING / REMOUNTING

Refer to SECTION 7A “Dismounting / Remounting of Trans Unit”.

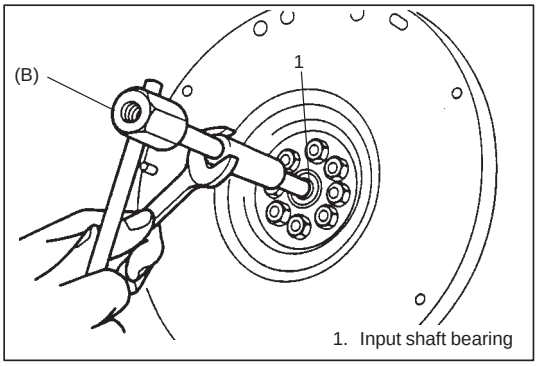


1. Bolt
2. Clutch cover

REMOVAL

1) Hold flywheel stationary with special tool (A) and remove clutch cover bolts, clutch cover and clutch disc.

Special Tool
(A): 09924-17810



1. Input shaft bearing

2) Pull out input shaft bearing by using special tool (B) and wrench.

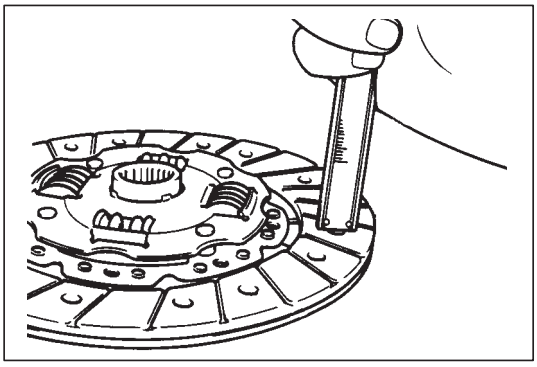
Special Tool
(B): 09917-58010 (G16 engine)
(B): 09923-73210 (J20 and H25 engines)

3) Remove release bearing and release fork.

INSPECTION

Input Shaft Bearing and Release Bearing

Check bearing 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.

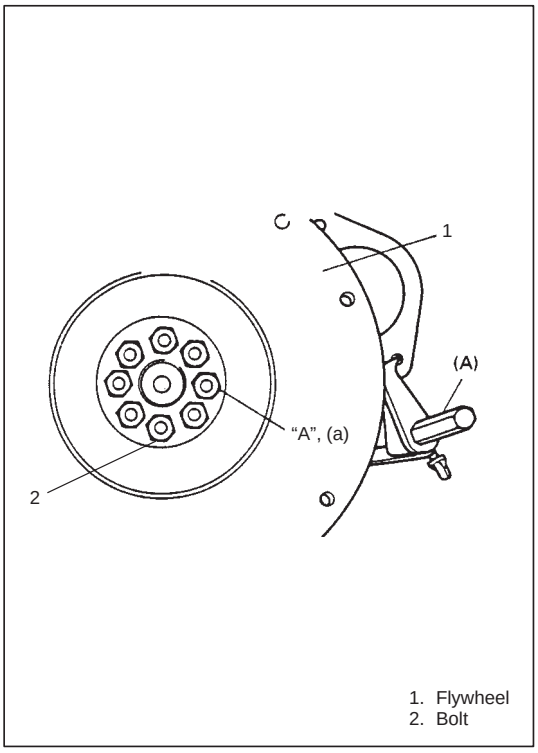
Rivet head depth
Standard: 1.6 mm (0.06 in.)
Service limit: 0.5 mm (0.02 in.)

Clutch Cover

1) Check diaphragm spring for abnormal wear or damage.
2) Inspect pressure plate for wear or heat spots.
3) 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.



1. Flywheel
2. Bolt

INSTALLATION

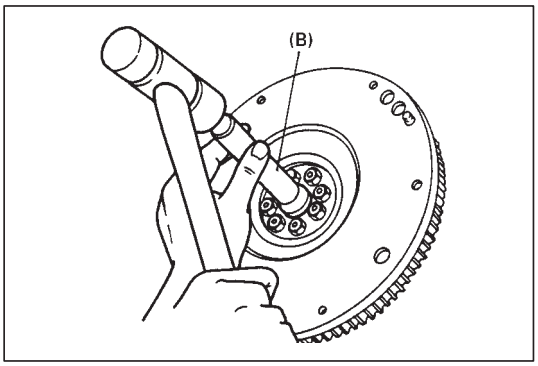
NOTE:
Before assembling, make sure that flywheel surface and pressure plate surface have been cleaned and dried thoroughly.

1) Install flywheel to crankshaft and tighten bolts to which sealant is applied to specification.

Special Tool
(A): 09924-17810

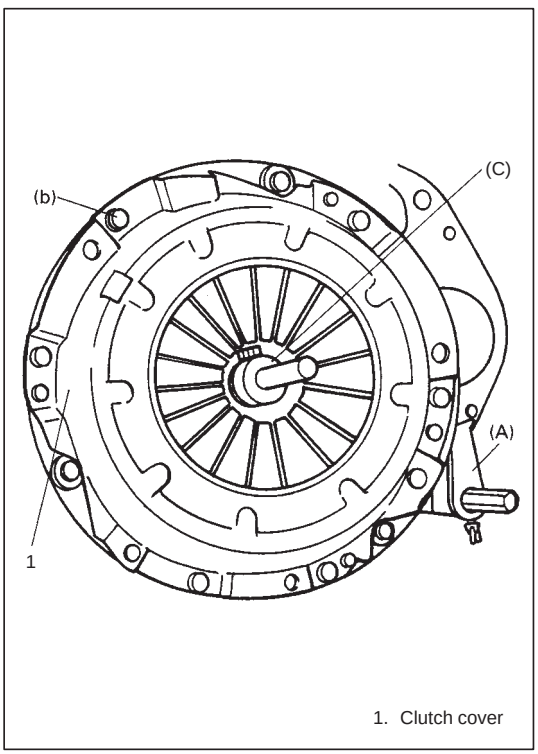
"A": Sealant 99000-31110

Tightening Torque
(a): 78 N·m (7.8 kg-m, 56.5 lb-ft) (G16 engine)
(a): 70 N·m (7.0 kg-m, 50.5 lb-ft) (J20 and H25 engines)



2) Using special tool (B), install input shaft bearing to flywheel.

Special Tool
(B): 09925-98210



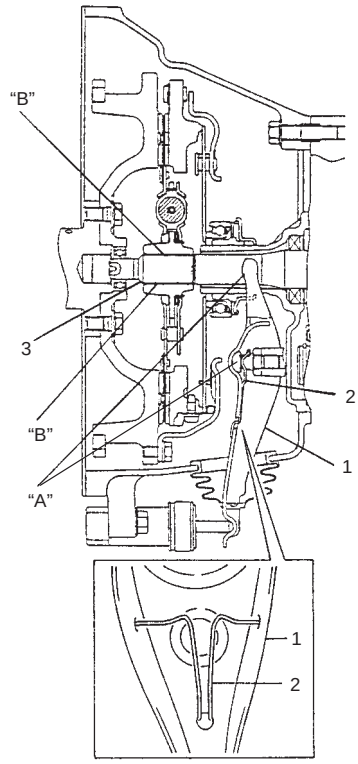
1. Clutch cover

3) Aligning clutch disc to flywheel center by using special tool (C), install clutch cover and bolts. Then tighten bolts to specification.

NOTE:
- **While tightening clutch cover bolts, compress clutch disc with special tool (C) by hand so that disc centered.**
- **Tighten cover bolts little by little evenly in diagonal order.**

Special Tools
(A): 09924-17810
(C): 09923-36330 (G16 engine)
(C): 09923-36320 (J20 and H25 engines)

Tightening Torque
(b): 23 N·m (2.3 kg-m, 16.5 lb-ft)



1. Release fork
2. Clip
3. Input shaft

4) Install clip to release fork and apply grease.

"A": Grease 99000-25010

Then install release fork and release bearing as shown in figure.

5) Slightly apply grease to input shaft and install clutch disc. Then join transmission transfer assembly with engine. Refer to SECTION 7A.

"B": Grease 99000-25210

NOTE:
Turn crankshaft with wrench from front while inserting transmission input shaft to clutch disc until splines mesh.

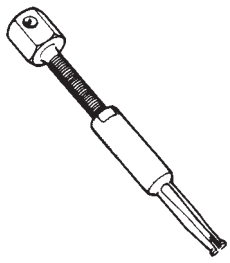
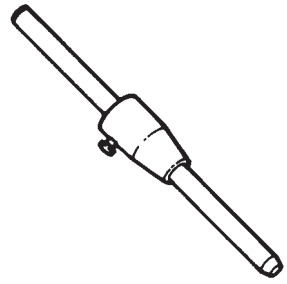
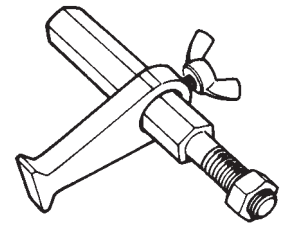
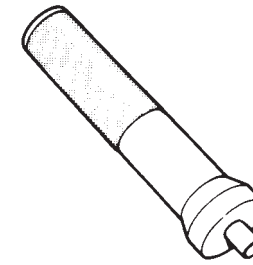
TIGHTENING TORQUE SPECIFICATIONS

Fastening portion		Tightening torque		
		N·m	kg-m	lb-ft
Flare nut		16	1.6	11.5
Master cylinder nut		13	1.3	9.5
Lock nut		10	1.0	7.5
Flywheel bolts	G16 engine	78	7.8	56.5
	J20 and H25 engines	70	7.0	50.5
Clutch cover bolts		23	2.3	16.5
Operating cylinder bolt		50	5.0	36.5
Clutch hose union bolt		23	2.3	16.5

REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	● Clutch master cylinder clevis pin. ● Release fork. ● Push rod tip of operating cylinder.
	SUZUKI SUPER GREASE I (99000-25210)	Input shaft spline front end.
Clutch fluid (Brake fluid)	DOT3 or SAE J1703	● Clutch reservoir. ● Clutch master cylinder. ● Clutch operating cylinder.
Sealant	SUZUKI BOND No.1215 (99000-31110)	Flywheel bolts

SPECIAL TOOLS

			
09917-58010 (G16 engine) 09923-73210 (J20 and H25 engines) Bearing remover	09923-36330 (G16 engine) 09923-36320 (J20 and H25 engines) Clutch center guide	09924-17810 Flywheel holder	09925-98210 Input shaft bearing installer

SECTION 7D

TRANSFER

CONTENTS

GENERAL DESCRIPTION 7D-1
DIAGNOSIS 7D-2
Diagnosis Table 7D-2
ON-VEHICLE SERVICE 7D-3
Gear Oil 7D-3
Transfer Oil Seals 7D-3
Speedometer Driven Gear 7D-4
Engine Rear Mounting 7D-4
Transfer Assembly 7D-5
Dismounting 7D-5
Remounting 7D-6
UNIT REPAIR 7D-7
TIGHTENING TORQUE SPECIFICATIONS 7D-7
REQUIRED SERVICE MATERIALS 7D-7
SPECIAL TOOL 7D-7

GENERAL DESCRIPTION

The aluminum transfer case directly connected to the back of the transmission contains the input gear, countershaft & gear, output rear shaft, output low gear and output front shaft (for front drive) connected by way of the hyvo-chain.
The transfer has such a selective mechanism as to enable the shift control lever to make selection of high speed (direct connection with transmission output: main shaft), low speed (speed reduction by input gear, counter gear and output low gear) or neutral by way of the reduction sleeve located between input gear and output low gear, and selection of two-wheel-drive (high speed only) or four-wheel-drive (high or low speed) by way of the front drive clutch sleeve located at the center of the output rear shaft. Also, with a synchronizer installed to the front drive clutch, it is possible to change the drive mode between 2WD (high speed only) and 4WD (high speed only) even while running.
The front drive shift fork has an auxiliary spring to make a smooth shift from 4H to 2H possible.
The case has an oil gutter and a plate at synchronizer to provide proper lubrication even under the strict conditions of use.

WARNING:
For towing the vehicle for the purpose of repair or the like, follow the towing instructions in OWNER'S MANUAL.

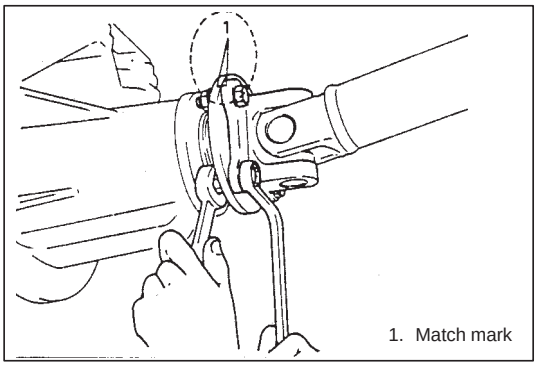
DIAGNOSIS

DIAGNOSIS TABLE

Before attempting to repair the transfer or related components for any reason other than mechanical failure, the condition and probable causes should be identified.
Transfer failures are revealed by shifting difficulties such as excessive shifting effort, gear clash, or gear grinding. When any of these conditions occur, the following inspections should be made before disassembling the transfer.

1) Check transfer oil level for insufficient or incorrect oil. Refer to “Transfer and Differential Oil Inspection and Change” in SECTION 0B “MAINTENANCE AND LUBRICATION”.
2) Check transfer mountings for wear or looseness.
3) Check gearshift control lever for distortion or excessive wear.
   After performing the above inspections, refer to following diagnosis table.

Condition	Possible Cause	Correction
Gear slipping out of mesh	● Worn shift fork shaft	Replace
	● Worn shift fork or synchronizer sleeve	Replace
	● Weak or damaged locating spring	Replace
	● Worn bearings on output rear shaft	Replace
	● Worn chamfered tooth on sleeve or gear	Replace sleeve and gear
	● Missing or disengagement of circlip(s)	Install
Gears refusing to disengage	● Weakened or broken synchronizer spring	Replace
	● Distorted shift shaft or shift fork	Replace
Hard shifting	● Weakened front drive shift shaft spring	Replace
	● Distorted or mispositioned front drive shift shaft circlip and washer	Replace
	● Inadequate or insufficient lubricant	Replenish
	● Worn synchronizer ring	Replace
	● Worn chamfered tooth on sleeve or gear	Replace sleeve and gear
	● Distorted shift shaft	Replace
Noise	● Inadequate or insufficient lubricant	Replenish
	● Damaged or worn bearing(s)	Replace
	● Damaged or worn gear(s)	Replace
	● Damaged or worn synchronizer ring	Replace
	● Damaged or worn chamfered tooth on sleeve or gear	Replace



ON-VEHICLE SERVICE

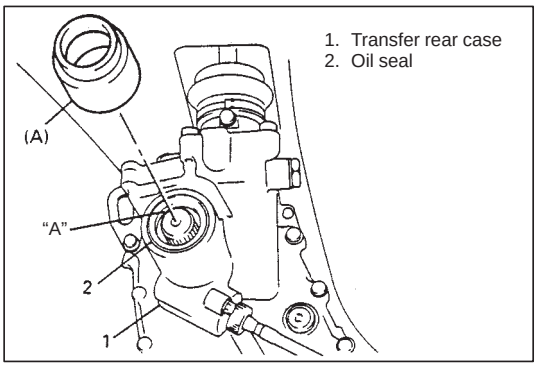
GEAR OIL

Refer to “ON-VEHICLE SERVICE” of Section 7A or 7A1.

TRANSFER OIL SEALS

REAR CASE OIL SEAL

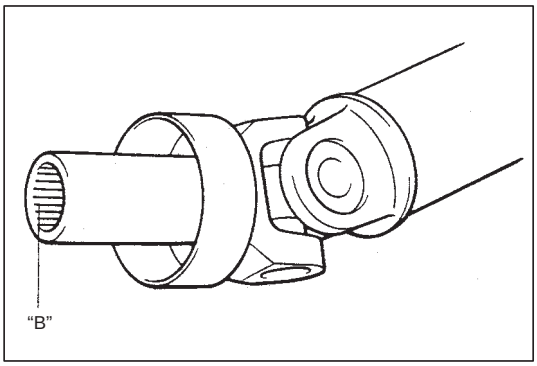
1) Lift up vehicle horizontally.
2) Give match marks on joint flange and propeller shaft as shown in figure.
3) Remove 4 bolts from rear propeller shaft flange and remove propeller shaft.
4) Using screwdriver, remove oil seal.



5) Using special tool(A) and plastic hammer, pressfit new oil seal up to case surface. Be sure to apply grease to oil seal lip.

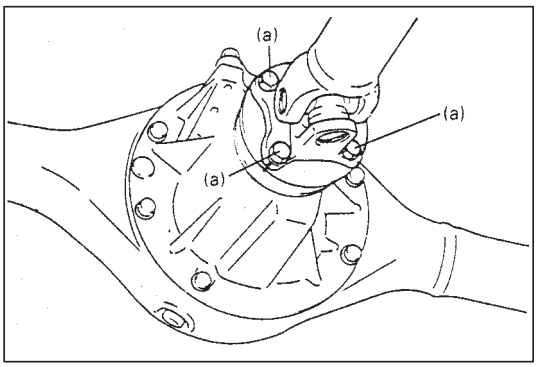
“A”: Grease 99000-25010

Special Tool
(A): 09940-53111



6) Clean and inspect sliding portion of propeller shaft front end (where oil seal contacts) before installation and if even small dent or scratch exists, correct and clean it again.
Then apply grease inside splines of propeller shaft.

“B”: Grease 99000-25010



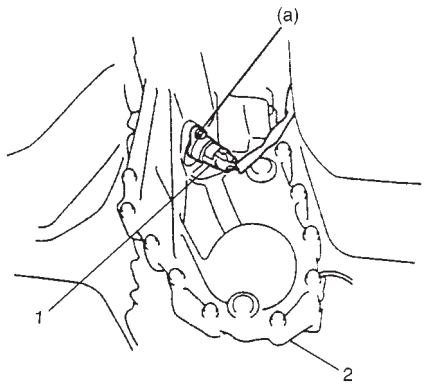
7) Install propeller shaft and torque universal joint flange bolts to specification.

CAUTION:
Be sure to use only specified bolts, nuts and lock washers for universal joint flange.

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

CENTER CASE OIL SEAL (Front side)

In addition to the procedure for rear case oil seal, it is necessary to drain and refill gear oil of transfer. Refer to Section 7A “ON-VEHICLE SERVICE” for oil specification.



1. Speed sensor assembly
2. Transfer

SPEEDOMETER DRIVEN GEAR

REMOVAL

1) Lift up vehicle horizontally or rear up.
2) Disconnect speed sensor coupler at transfer case.
3) Remove bolt and take off speed sensor from transfer.

INSTALLATION

1) Make sure that O-ring and speed sensor have not been damaged.
2) Inspect speedometer driven gear for abnormal wear of gear teeth or bend of shaft portion and replace it if necessary.
3) Make sure its smooth rotation.
4) Install speed sensor assembly to transfer and connect coupler as it was.

Tightening Torque
(a): 6 N·m (0.6 kg-m, 4.5 lb-ft)

ENGINE REAR MOUNTING

Refer to “ON-VEHICLE SERVICE” of Section 7A.

TRANSFER ASSEMBLY

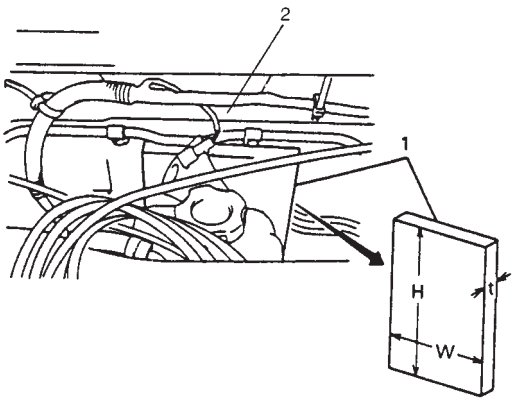
Dismounting and remounting of transfer and transmission together as a unit is described in Section 7A for Manual Transmission or 7B1 for Automatic Transmission, but it is also possible to dismount and remount transfer assembly by itself as described below.

DISMOUNTING

IN ENGINE ROOM

1) Disconnect negative (–) cable from battery.
2) Remove distributor assembly (if equipped).
3) Place wood block between engine and dash panel so that it serves as stopper when engine, transmission and transfer unit hangs down as rear mounting member is removed.

CAUTION:
Make sure to use wood block to prevent contact which may occur between dash panel and CMP sensor case (G16), CMP sensor (J20) or intake manifold (H25), and fan and shroud.



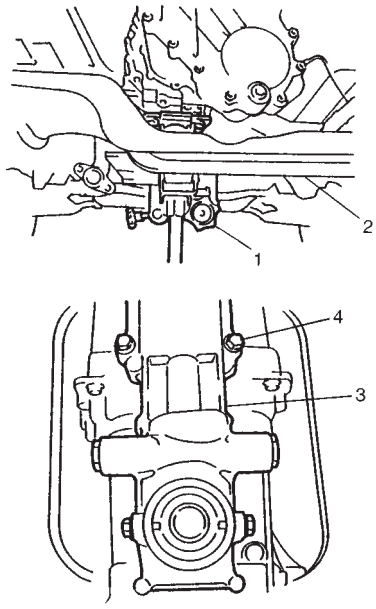
1. Wood block
2. Dash panel
t: 45 mm / 1.8 in.
H: 200 mm / 8 in.
W: 100 – 150 mm / 4 – 6 in.

IN CABIN

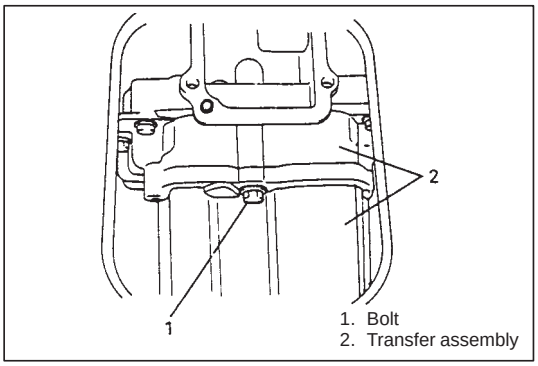
1) Remove console box.
2) Remove shift lever of transmission and transfer.

ON LIFT

1) Drain transfer oil.
2) Remove rear propeller shaft.
3) Remove front propeller shaft.
4) Disconnect exhaust center pipe.
5) Disconnect speed sensor coupler.
6) Place transmission jack and remove mounting member.
7) Lower transmission jack gradually and check to ensure that wood block serves as stopper between engine and dash panel.
8) Remove bolts for gear shift lever case.
9) Pull off breather hose.



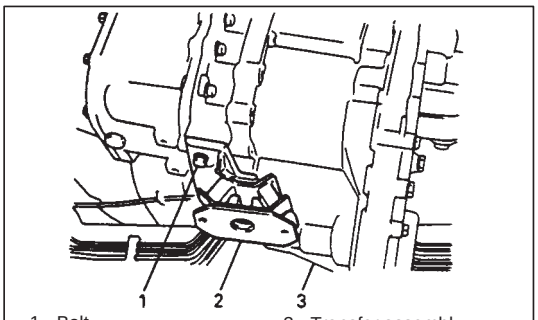
1. Transmission jack
2. Engine rear mounting member
3. Gear shift lever case
4. Bolt



1. Bolt
2. Transfer assembly

IN CABIN

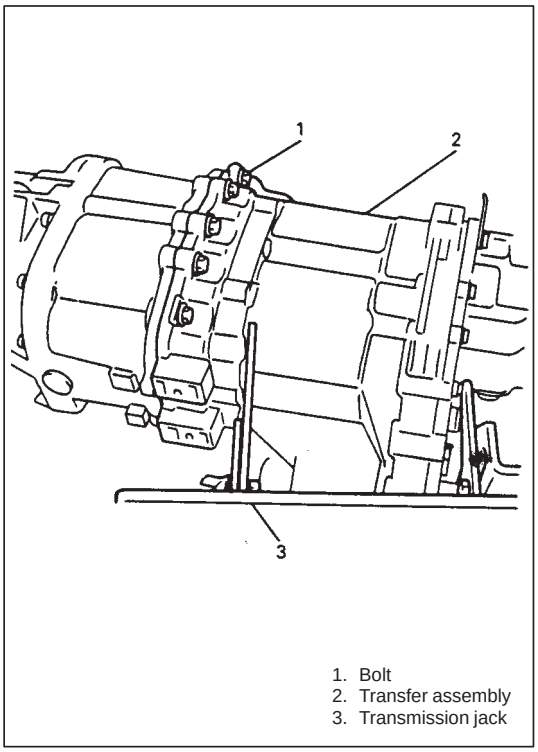
Remove gear shift lever case and then remove transfer center case bolt.



1. Bolt
2. Engine rear mounting
3. Transfer assembly

ON LIFT

1) Remove transfer mounting (engine rear mounting) by removing bolts.



1. Bolt
2. Transfer assembly
3. Transmission jack

2) Apply transmission jack to transfer to support it.
3) Remove couplers for 4WD/4WD-LOW switches lead.
4) Remove transfer front case bolts.
5) With transfer assembly supported with transmission jack, slide it rearward and when it is apart from transmission, lower it.

REMOUNTING

For remounting, reverse dismounting procedure described above, noting following.

- Be sure to use specified torque for tightening.
- Clamp wiring and breather hose securely.
- Clamp shift lever boot securely.
- Fill specified gear oil by specified amount.
- Connect battery and check for function.

UNIT REPAIR

Refer to the same section of UNIT REPAIR MANUAL mentioned in FOREWORD of this manual.

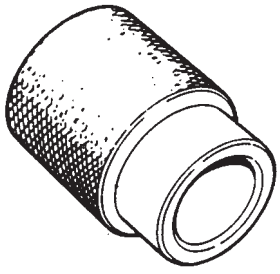
TIGHTENING TORQUE SPECIFICATIONS

Fastening portion	Tightening torque		
	N·m	kg-m	lb-ft
Oil filler/level and drain plugs	23	2.3	17.0
Engine rear mounting bolts	50	5.0	36.5
Universal joint flange bolts	50	5.0	36.5
Speed sensor bolt	6	0.6	4.5

REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Lithium grease	SUZUKI SUPER GREASE A (99000-25010)	● Oil seal lips and O-rings. ● Splines of propeller shaft. ● Select return system. ● Shift control lever.

SPECIAL TOOL



09940-53111
Bearing installer

SECTION 7E

DIFFERENTIAL (FRONT)

CONTENTS

GENERAL DESCRIPTION 7E- 1
4WD CONTROL SYSTEM 7E- 2
DIAGNOSIS 7E- 5
DIAGNOSIS TABLE 7E- 5
Differential Assembly 7E- 5
4WD Control System Diagnostic Flow Table 7E- 5
4WD CONTROL CIRCUIT INSPECTION 7E- 7
ON-VEHICLE SERVICE 7E- 9
MAINTENANCE SERVICE 7E- 9
Gear Oil Change 7E- 9
INSPECTION 7E-10
4WD Control System 7E-10
Actuator 7E-11
Air Pump Assembly 7E-12
REMOVAL AND INSTALLATION 7E-13
Differential Mountings 7E-13
DISMOUNTING 7E-15
REMOUNTING 7E-16
UNIT REPAIR 7E-17
TIGHTENING TORQUE SPECIFICATIONS 7E-17
REQUIRED SERVICE MATERIAL 7E-17
SPECIAL TOOLS 7E-17

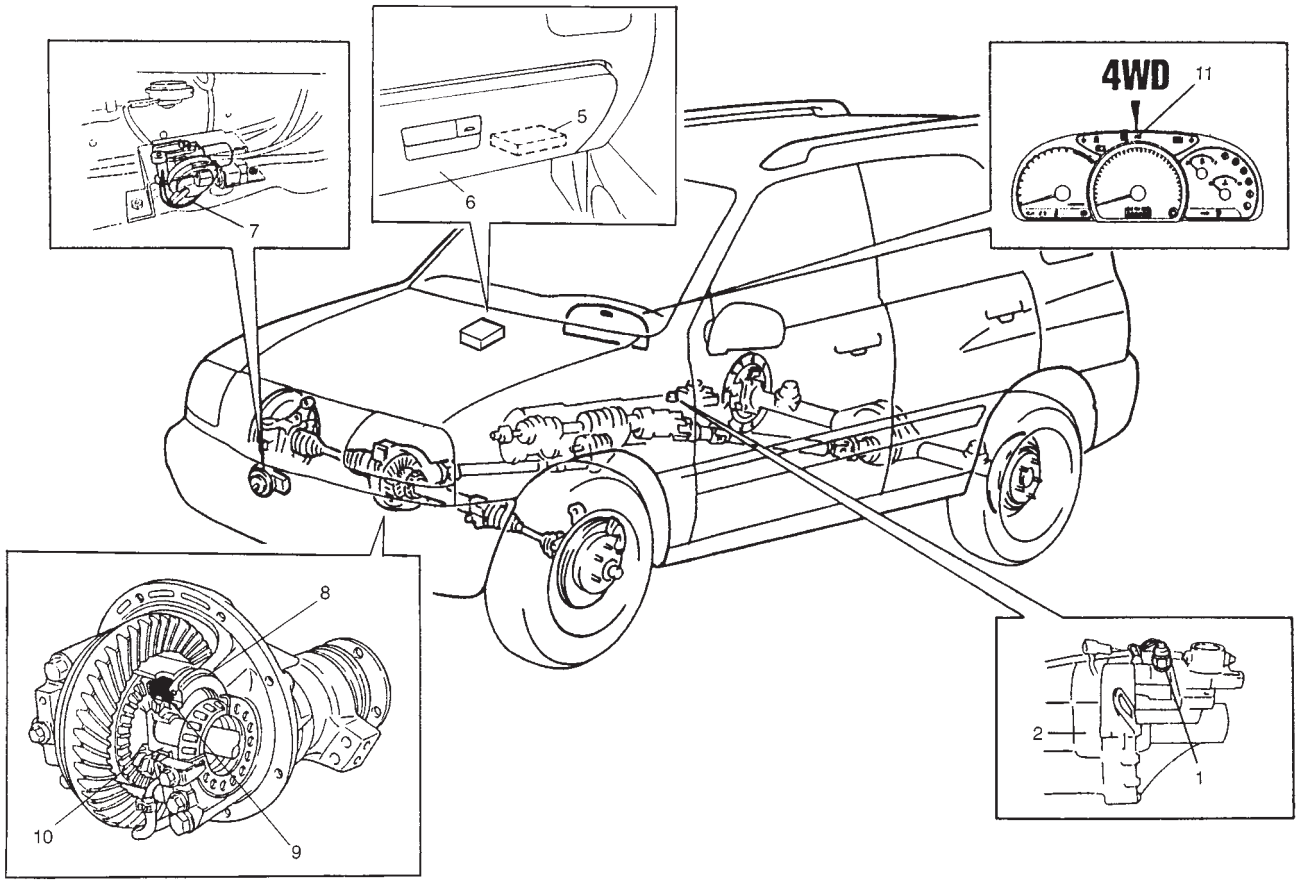
GENERAL DESCRIPTION

The differential assembly using a hypoid bevel pinion and gear is installed to the front axle.
4WD control system controls drive force to be transmitted to front axles or not. The reduction ratio varies depending on transmission or engine type.

The differential assembly is decisive in that the drive power is concentrated there. Therefore, use of genuine parts and specified torque is compulsory. Further, because of sliding tooth meshing with high pressure between bevel pinion and gear, it is mandatory to lubricate them by hypoid gear oil.

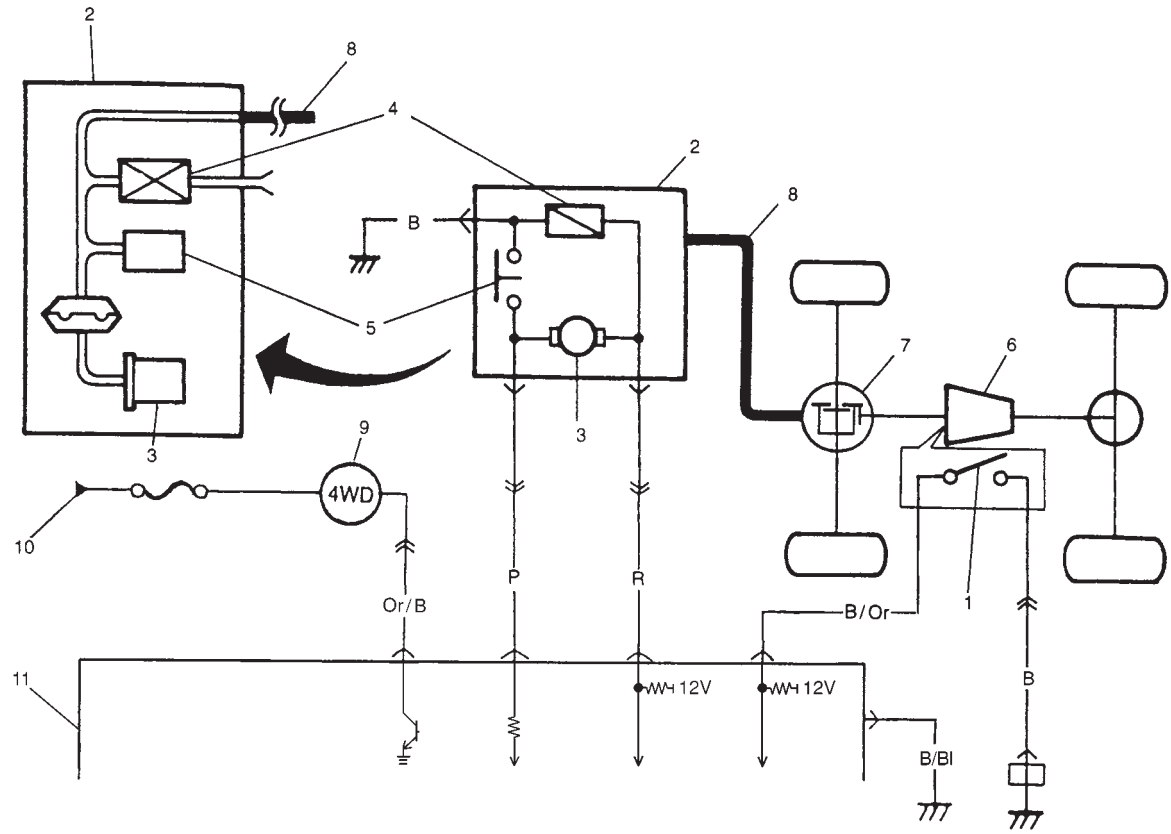
4WD CONTROL SYSTEM

When the 4WD switch is turned ON by shifting the transfer shift lever, ECM (PCM) (G16 and J20 engine models) or 4WD controller (H25 engine model) actuates (energizes) the air pump assembly. Then positive pressure is sent from the air pump assembly to the actuator installed to the differential case and causes the axle lock clutch and the free axle hub in the differential case to be engaged, resulting in the 4WD mode. Only when running in the 4WD mode, front axles are joined to differential case, and they become free when 2WD mode is used (or when transfer shift lever is shifted to N position), thereby reducing the power loss.



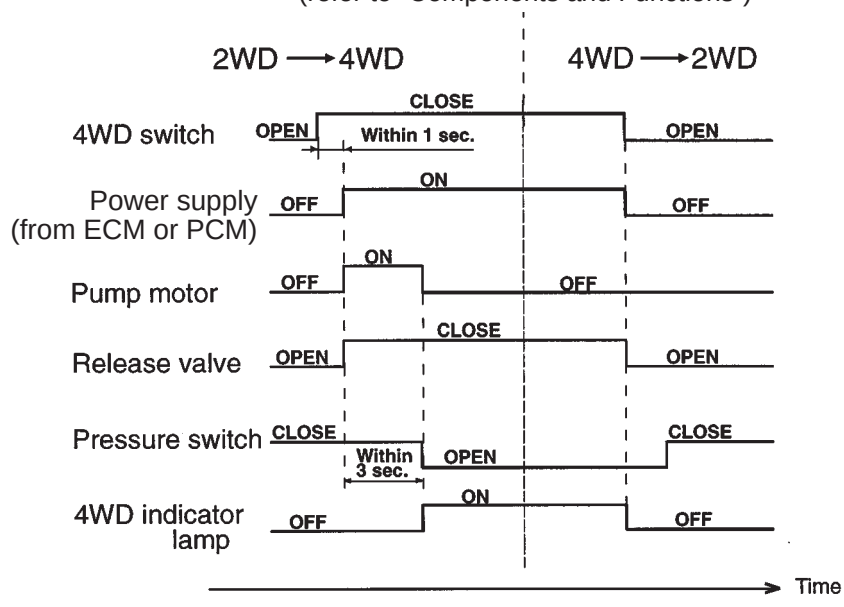
1. 4WD switch
2. Transfer
3. Blank
4. Blank
5. ECM or PCM
6. Glove box
7. Air pump assembly
8. Actuator
9. Axle lock clutch
10. Free axle hub
11. 4WD indicator lamp

System Circuit and Operation



1. 4WD switch
2. Air pump assembly
3. Pump motor
4. Release valve
5. Pressure switch
6. Transfer
7. Front differential
8. Air hose and pipe
9. 4WD indicator lamp
10. To ignition switch
11. ECM or PCM

Operation
(refer to “Components and Functions”)



Components and Functions

Component	Function
4WD switch	When the transfer shift lever is shifted to 4L or 4H position, this switch turns ON and causes the 4WD control system to turn ON, unless it is shifted to N or 2H within 1 second.
ECM or PCM	When the 4WD switch turns ON [unless it turns OFF within 1 second], this component actuates the pump assembly. If the pressure in the air pump assembly fails to increase higher than the set level even after the pump motor has run more than 10 seconds, this component stops the motor to protect it.
Air pump assembly ● Pump motor ● Release valve ● Pressure switch	The air pump assembly consists of a pump motor, release valve and a pressure switch. Pump motor: Produces positive pressure which actuates the actuator. Release valve: Closes when transfer shift lever is shifted to 4H or 4L so that the positive pressure is applied to the actuator, and opens when N or 2H to release the pressure to the atmosphere. Pressure switch: Turns ON and OFF depending on the pressure level in the pump assembly (whether higher or lower than the set pressure level). ECM or PCM detects the pressure level through this switch.
Differential case assembly ● Free axle hub ● Axle lock clutch ● Actuator	The free axle hub, axle lock clutch and actuator are installed in the differential left case. The positive pressure produced in the air pump assembly is applied to the actuator which then pushes the axle lock clutch to be engaged with the free axle hub. In this state, the drive force is transmitted to the front axle, resulting in the 4WD mode. When the actuator is free from the positive pressure [when it is under the atmospheric pressure], the axle lock clutch is pushed back by the return spring force and cannot be engaged with the free axle hub, resulting in the 2WD mode.
“4WD” indicator lamp	It lights up when 4WD control system is in the 4WD mode.

DIAGNOSIS

DIAGNOSIS TABLE

Differential Assembly

Condition	Possible Cause	Correction
Gear noise	● Deteriorated or water mixed lubricant	Repair and replenish
	● Inadequate or insufficient lubricant	Repair and replenish
	● Maladjusted backlash between bevel pinion and gear	Adjust
	● Improper tooth contact in the mesh between bevel pinion and gear	Adjust or replace
	● Loose bevel gear securing bolts	Replace or retighten
	● Damaged side gear(s) or side pinion(s)	Replace
Bearing noise	● (Constant noise) Deteriorated or water mixed lubricant	Repair and replenish
	● (Constant noise) Inadequate or insufficient lubricant	Repair and replenish
	● (Noise while coasting) Damaged bearing(s) of bevel pinion	Replace
	● (Noise while turning) Damaged diff. side bearing(s) or axle bearing(s)	Replace
Oil leakage	● Worn or damaged oil seal	Replace
	● Excessive oil	Adjust oil level
	● Loose differential carrier bolts	Replace or retighten
2WD/4WD switching error	● Defective actuator	Replace
	● Abnormality in 4WD control system	Inspect referring to “4WD CONTROL SYSTEM DIAGNOSTIC FLOW TABLE”.

4WD Control System Diagnostic Flow Table

Before performing the trouble diagnosis, check that the transfer and front differential are in good condition and there is no air leakage from air hoses and the actuator. Refer to “ON-VEHICLE SERVICE” in this section for air leakage.

[NOTES ON SYSTEM CIRCUIT INSPECTION]

- Be sure to read “Precautions for Electrical Circuit Service” in Section 0A before circuit inspection and observe what is written there.
- For system circuit, refer to the figure of “GENERAL DESCRIPTION” in this section.
- For terminal arrangement, refer to “4WD Control Circuit Inspection” in this section.

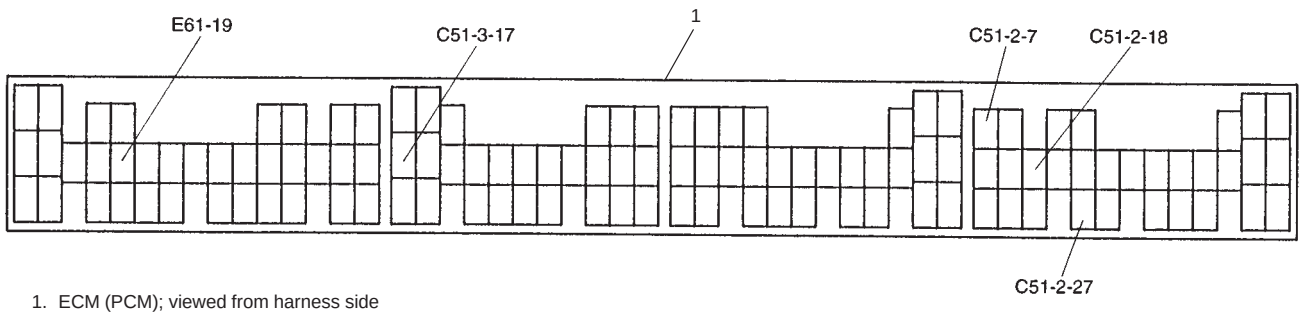
STEP	ACTION	YES	NO
1	Turn ON ignition switch (but engine at stop) and check malfunction indicator lamp. Does lamp light up?	Go to step 2.	A trouble has occurred at some place. Repair it referring to MALFUNCTION INDICATOR LAMP ("CHECK ENGINE" LAMP) CHECK in DIAGNOSIS of SECTION 6.
2	Check 4WD switch circuit. Turn ignition switch ON and check that voltage between terminal C51-2-18 and terminal C51-3-17 (ground) for G16/J20 (terminal C51-1-11 and terminal C51-3-26 (ground) for H25) is as follows. ● When transfer shift lever is in N or 2H: 10 – 14 V ● When transfer shift lever is in 4L or 4H: 0 – 1 V Is the check result satisfactory?	Go to step 3.	Check 4WD switch (refer to SECTION 7A), "B/Or" and "B" circuits of 4WD switch. If OK, substitute a known-good ECM (PCM) and recheck.
3	Check power supply. 1) Turn ignition switch ON. 2) Check voltage between C51-2-7 and C51-3-17 (ground) for G16/J20 (C51-1-15 and C51-3-26 (ground) for H25). The check results should be as follows. ● When transfer shift lever is in N or 2H: 0 – 1 V ● When transfer shift lever is in 4L or 4H: 10 – 14 V Is the check result satisfactory?	Go to step 4.	Check "R" circuit. If it is OK, substitute a known-good ECM (PCM) and recheck.
4	Check air pump assembly circuit. 1) Check for proper connection to air pump assembly at all terminals. 2) Turn ignition switch ON. 3) Check voltage between C51-2-27 and C51-3-17 (ground) for G16/J20 (C51-1-18 and C51-3-26 (ground) for H25). The check result should be as follows. ● When transfer shift lever is in 2H or N: 0 – 1 V ● When transfer shift lever is in 4L or 4H (more than 4 seconds after shifted to 4L or 4H): 10 – 14 V Is the check result satisfactory?	Go to step 5.	Check air pump assembly referring to "ON-VEHICLE SERVICE", and then "P" circuit. If OK, substitute a known-good ECM (PCM) and recheck.
5	Check 4WD indicator lamp circuit. 1) Turn ignition switch ON. 2) Check voltage between E61-19 and C51-3-17 (ground) for G16/J20 (C51-1-7 and C51-3-26 (ground) for H25). The check result should be as follows. ● When transfer shift lever is in 2H or N: 10 – 14 V ● When transfer shift lever is in 4L or 4H: 0 – 1 V Is the check result satisfactory?	4WD control system is in good condition.	Check "Or/B" circuit (including indicator lamp and combination meter). If OK, substitute a known-good ECM (PCM) and recheck.

4WD CONTROL CIRCUIT INSPECTION

Voltage Check [G16 and J20 engine models]

Check for input or output voltage (voltage between each circuit and body ground) of ECM (PCM) with ECM (PCM) connector connected and ignition switch turned ON.

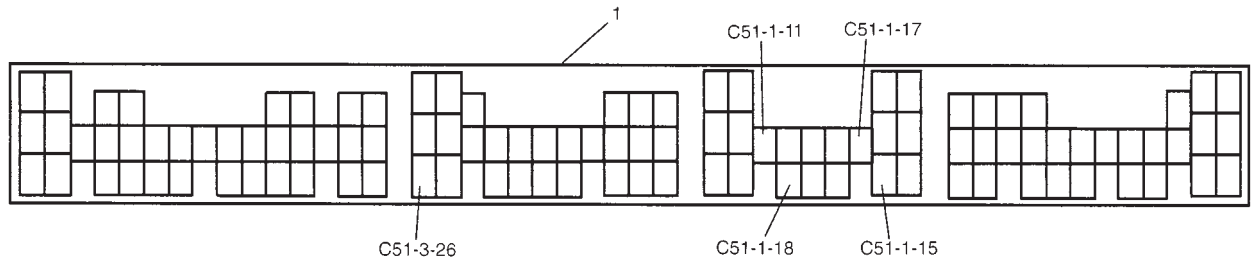
TERMINAL	CIRCUIT	WIRE COLOR	NORMAL VOLTAGE	CONDITION
E61-19	4WD Indicator lamp	Or/B	10 – 14 V	Transfer shift lever: 2H or N
			0 – 1 V	4 seconds after transfer shift lever shifted to 4H or 4L
C51-2-7	Air pump assembly (Pump motor and release valve)	R	0 – 1 V	Transfer shift lever: 2H or N
			10 – 14 V	1 seconds after transfer shift lever shifted to 4H or 4L
C51-2-18	4WD switch	B/Or	10 – 14 V	Transfer shift lever: 2H or N
			0 – 1 V	Transfer shift lever: 4H or 4L
C51-3-17	Ground	B/Bl	0 – 1 V	–
C51-2-27	Air pump assembly (pressure switch)	P	0 – 1 V	Transfer shift lever: 2H or N
			10 – 14 V	4 seconds after transfer shift lever shifted to 4H or 4L



1. ECM (PCM); viewed from harness side

Voltage Check [H25 engine model]

TER-MINAL	CIRCUIT	WIRE COLOR	NORMAL VOLTAGE	CONDITION
C51-1-7	4WD Indicator lamp	Or/B	10 – 14 V	Transfer shift lever: 2H or N
			0 – 1 V	4 seconds after transfer shift lever shifted to 4H or 4L
C51-1-15	Air pump assembly (Pump motor and release valve)	R	0 – 1 V	Transfer shift lever: 2H or N
			10 – 14 V	1 seconds after transfer shift lever shifted to 4H or 4L
C51-1-11	4WD switch	B/Or	10 – 14 V	Transfer shift lever: 2H or N
			0 – 1 V	Transfer shift lever: 4H or 4L
C51-3-26	Ground	B/Bl	0 – 1 V	–
C51-1-18	Air pump assembly (pressure switch)	P	0 – 1 V	Transfer shift lever: 2H or N
			10 – 14 V	4 seconds after transfer shift lever shifted to 4H or 4L



1. ECM (PCM); viewed from harness side

ON-VEHICLE SERVICE

MAINTENANCE SERVICE

NOTE:

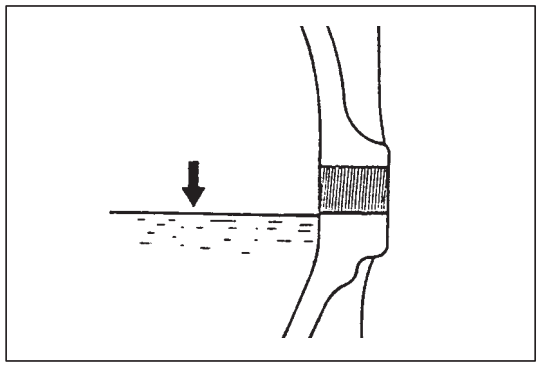
- **When having driven through water, check immediately if water has entered (if so, oil is cloudy). Water mixed oil must be changed at once.**
- **Whenever vehicle is hoisted for any other service work than oil change, also be sure to check for oil leakage and status of breather hoses.**

Gear Oil Change

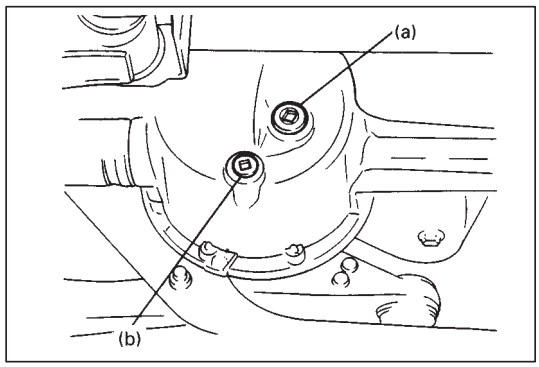
NOTE:

- **Hypoid gear oil must be used for differential.**
- **It is highly recommended to use SAE 80W – 90 viscosity.**

1) Before oil change or inspection, be sure to stop engine and lift up vehicle horizontally.



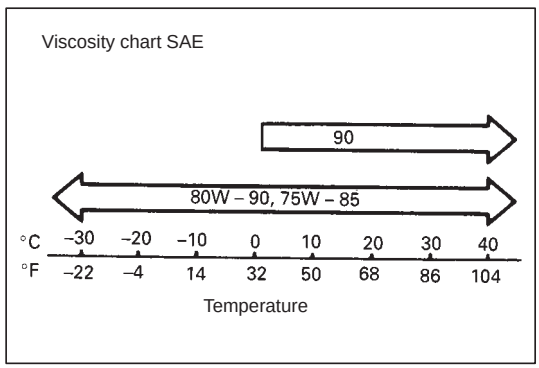
2) Check oil level and existence of leakage. If leakage is found, correct its cause.
3) Drain old oil and pour proper amount of gear oil as specified below (roughly up to level hole).



4) Apply sealant to thread of drain plug (b) and torque plugs to specification.

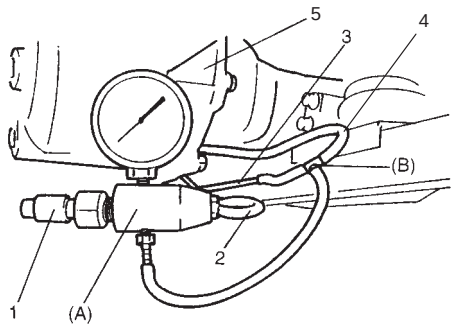
Sealant 99000-31110

Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)
(b): 23 N·m (2.3 kg-m, 17.0 lb-ft)



Specified gear oil: Hypoid gear oil API GL-5
SAE 75W – 85, 90 or 80W – 90
For oil viscosity, refer to left chart.

Oil capacity: 1.0 liters (2.1/1.8 US/Imp. pt)



1. Plugged hose
2. Adjusting screw
3. Pipe (to air pump assembly)
4. Hose (to differential carrier)
5. Differential housing

INSPECTION

4WD Control System

1) Install special tool to air hose connecting between air pump assembly and differential (actuator) as shown in figure. Tighten adjusting screw of special tool as far as it stops. Close air check side opening by using fuel hose as blind plug.

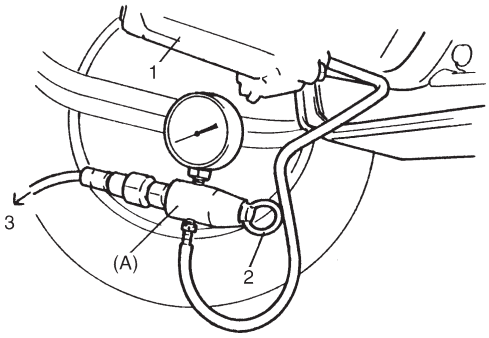
   Special Tool
   (A): 09918-18110
   (B): 09367-04002

   NOTE:
   Use care not to bend any part of hose.

2) Turn ON ignition switch and shift transfer lever from 2H to 4H range.
3) Check that motor starts running (a sound can be heard) within 1 second and it stops when gauge of special tool indicates specified pressure value.
   Check also for air leakage.

   Pressure specification:
   30.0 – 45.0 kPa (0.30 – 0.45 kg/cm^2, 4.25 – 6.40 psi)

4) Check that pressure value indicated on gauge of special tool drops as soon as transfer lever is shifted to 2H position.
5) Start motor by shifting transfer lever to 4H position again. Loosen adjusting screw to lower pressure value on gauge. Motor should start to run again and stop in about 4 seconds.
6) With the adjusting screw of special tool loosened, shift transfer shift lever to N or 2H position and then 4L or 4H position.
   Pump motor should stop about 10 seconds after motor starts to run.



1. Differential housing
2. Adjusting screw
3. To air compressor

Actuator

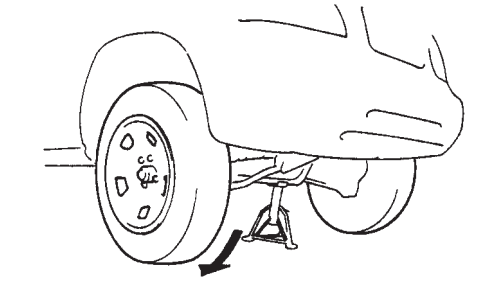
1) Disconnect air hose from pump assembly and install special tool to air hose as shown in figure. Loosen adjusting screw of special tool.

   Special Tool
   (A): 09918-18110

2) Connect compressor air hose to special tool.
   Blow air and turn adjusting screw to obtain specified pressure.

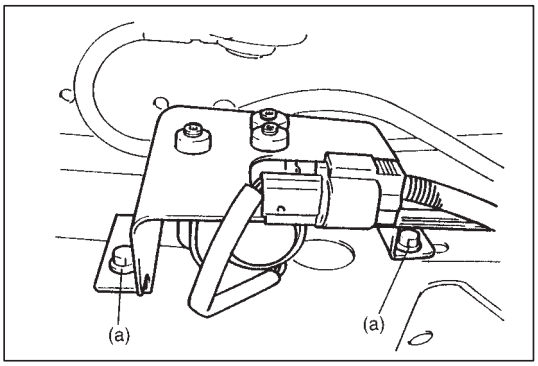
   Specified pressure: 30.0 kPa (0.3 kg/cm^2, 4.25 psi)

CAUTION:
Do not apply a pressure exceeding 200 kPa (2.0 kg/cm^2, 28.4 psi) which may cause damage to diaphragm.



3) With the vehicle lifted so that both of the front wheels are off the ground, turn one of the front wheels by hand and check the other wheel, which should act as described below.
   - When the pressure from compressor is applied to actuator:
     The other front wheel should turn in the direction opposite to the wheel being turned by hand.
   - When the pressure from compressor is not applied to actuator:
     The other front wheel should remain stationary while the wheel pushed by hand is turning.

   If the result is not satisfactory, inspect differential assembly. Refer to “INSPECTION” of SECTION 7E in UNIT REPAIR MANUAL.

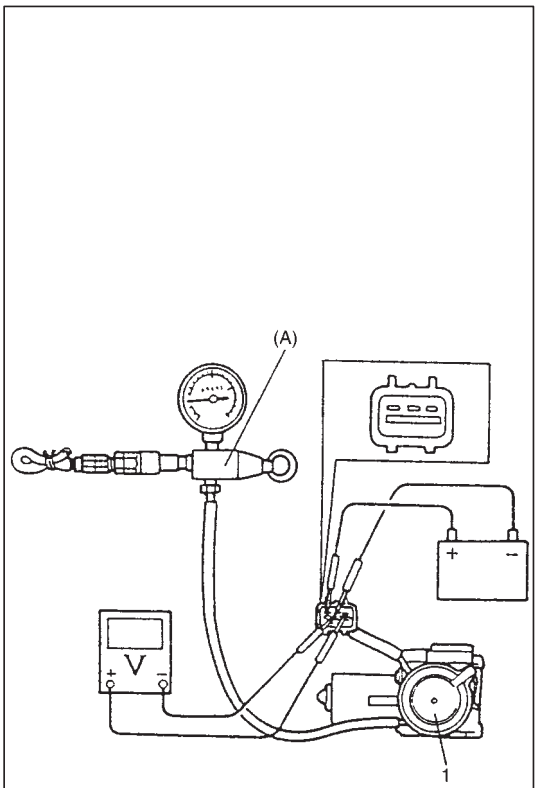


Air Pump Assembly

Removal / Installation

1) Disconnect air hoses and coupler from air pump assembly.
2) Remove pump assembly by removing bolts.
3) Reverse removal procedure for installation.

Tightening Torque
(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)



1. Pump assembly

Inspection

1) Install special tool, voltmeter and battery to pump assembly as shown in figure.
2) Tighten adjusting screw of special tool as far as it stops and close its air check side opening by using fuel hose as blind plug.

Special Tool
(A): 09918-18110

3) Check that motor starts to run (a sound can be heard) when battery is connected and it stops when specified pressure is obtained.
   Check also for air leakage.

Specified pressure: 30.0 – 45.0 kPa
(0.30 – 0.45 kg/cm^2, 4.25 – 6.40 psi)

4) Check that value indicated on voltmeter is within specification shown below.

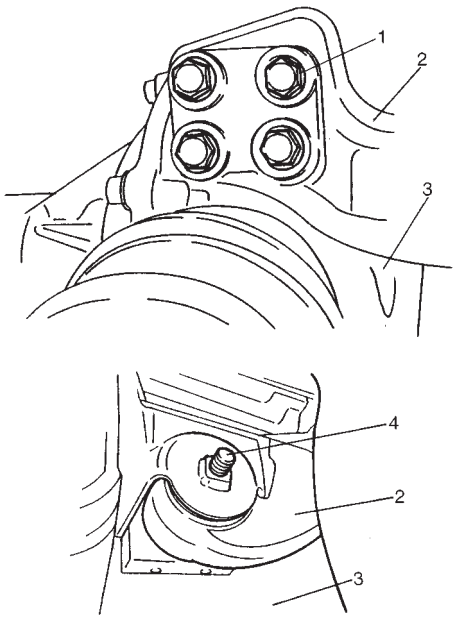
When motor is running: 0 – 1 V
When motor has stopped running: 10 – 14 V

CAUTION:
Do not run motor more than 10 seconds continuously to prevent motor breakage.

REMOVAL AND INSTALLATION

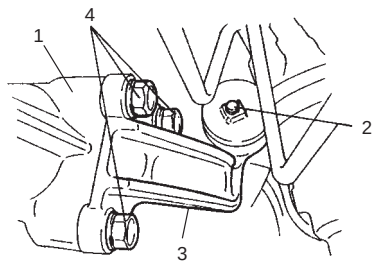
Differential Mountings

1) Lift up vehicle and turn steering wheel all way to the right.
2) Separate mounting bracket R from differential housing by removing bolts from its lower part.
3) Remove mounting bracket R by removing mounting front bolt from its upper part.



1. Mounting bracket bolt
2. Mounting bracket R
3. Differential housing
4. Mounting front bolt

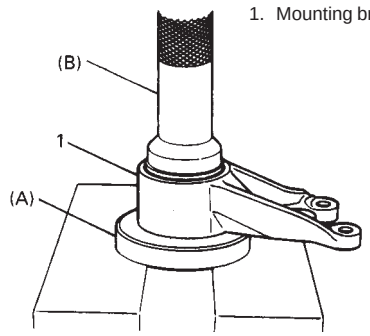
4) Remove mounting bracket L by removing upper and lower fastening bolts.



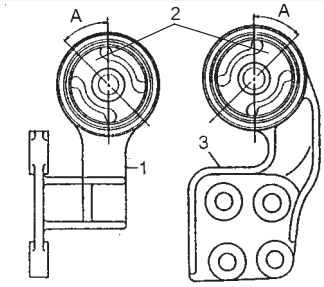
1. Differential housing
2. Mounting front bolt
3. Mounting bracket L
4. Mounting bracket bolt

5) Check conditions of each bush. If it is damaged or deteriorated, drive it out with special tools and press for replacement.

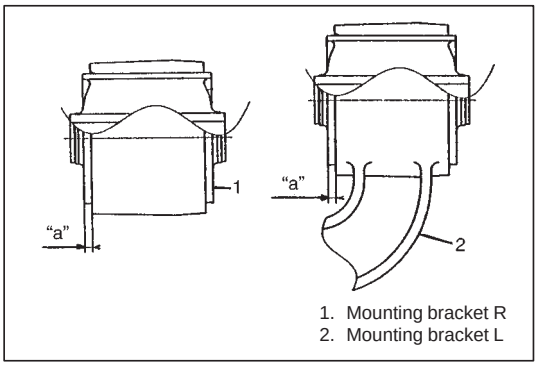
Special Tool
(A): 09951-26010
(B): 09951-16080



6) Position slit in each bush as shown when press-fitting it.



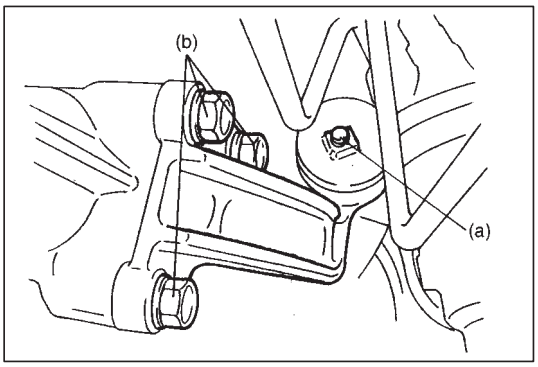
1. Mounting bracket L
2. Bush
3. Mounting bracket R
A: Slit alignment 45°



1. Mounting bracket R
2. Mounting bracket L

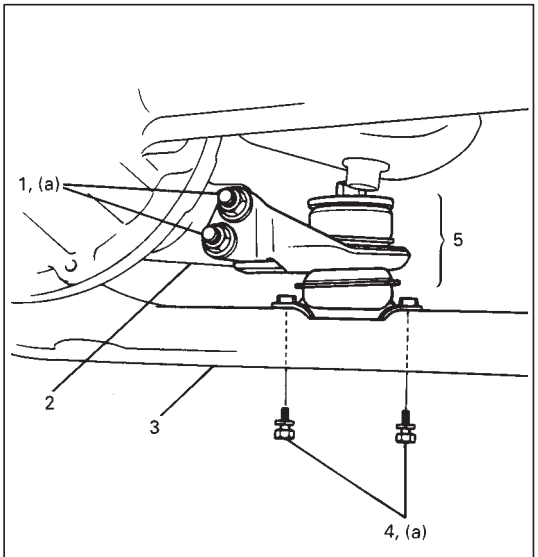
7) Position each bush to bracket as shown.

Length "a": 3.0 mm (0.12 in.)



8) Use following torque for reinstallation.

Tightening Torque
(a): 85 N·m (8.5 kg-m, 61.5 lb-ft)
(b): 50 N·m (5.0 kg-m, 36.5 lb-ft)



1. Bolt and nut
2. Differential carrier
3. Cross member
4. Bolt
5. Differential rear mounting assembly

REAR MOUNTING

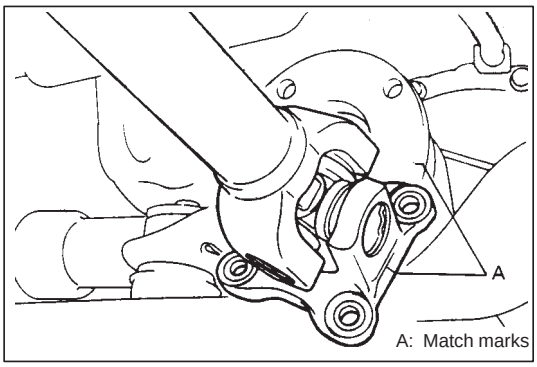
(For front differential carrier)

1) Lift up vehicle and remove mounting assembly by removing 2 bolts and nuts from differential carrier side and 2 bolts from cross member side.
2) Check mounting rubber for damage or deterioration and replace as necessary.
3) Use following torque for reinstallation.

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

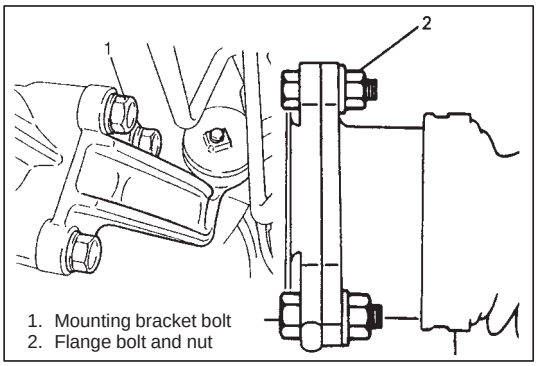
DISMOUNTING

1) Lift up vehicle and drain oil.
2) Disconnect air hose and breather hose from differential housing.

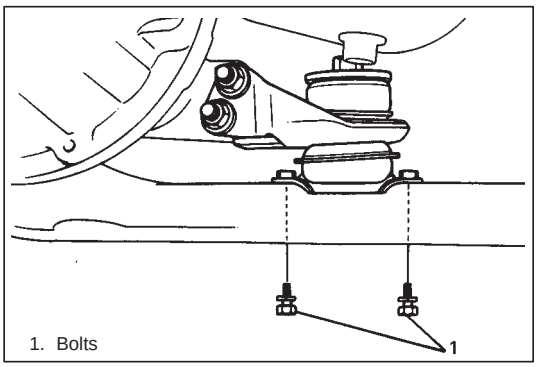


3) Before removing propeller shaft, give match marks on joint flange and propeller shaft as shown.
4) Remove propeller shaft flange by removing its 4 bolts and suspend it with cord or the like.

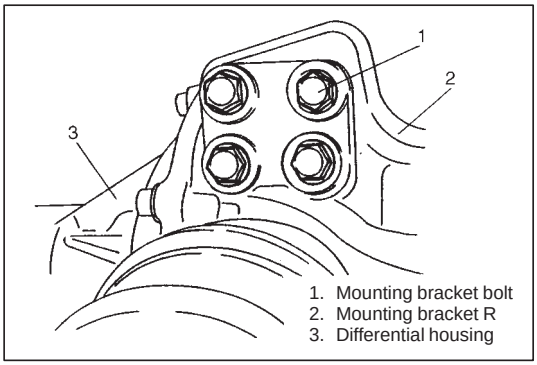
NOTE:
If pull out propeller shaft, transfer oil must be drained before pulling out.



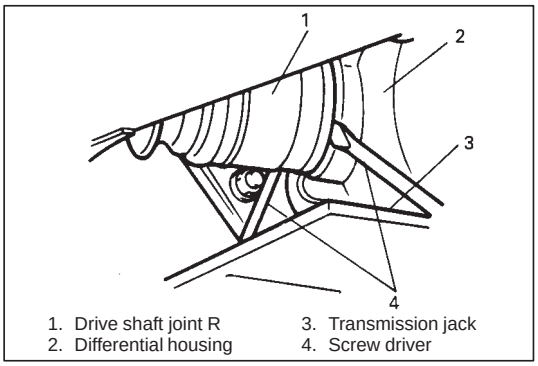
5) Remove 3 bolts for left mounting bracket and 3 bolts for drive shaft flange to set left side of differential free.



6) Remove 2 bolts from cross member to set differential rear mounting free.



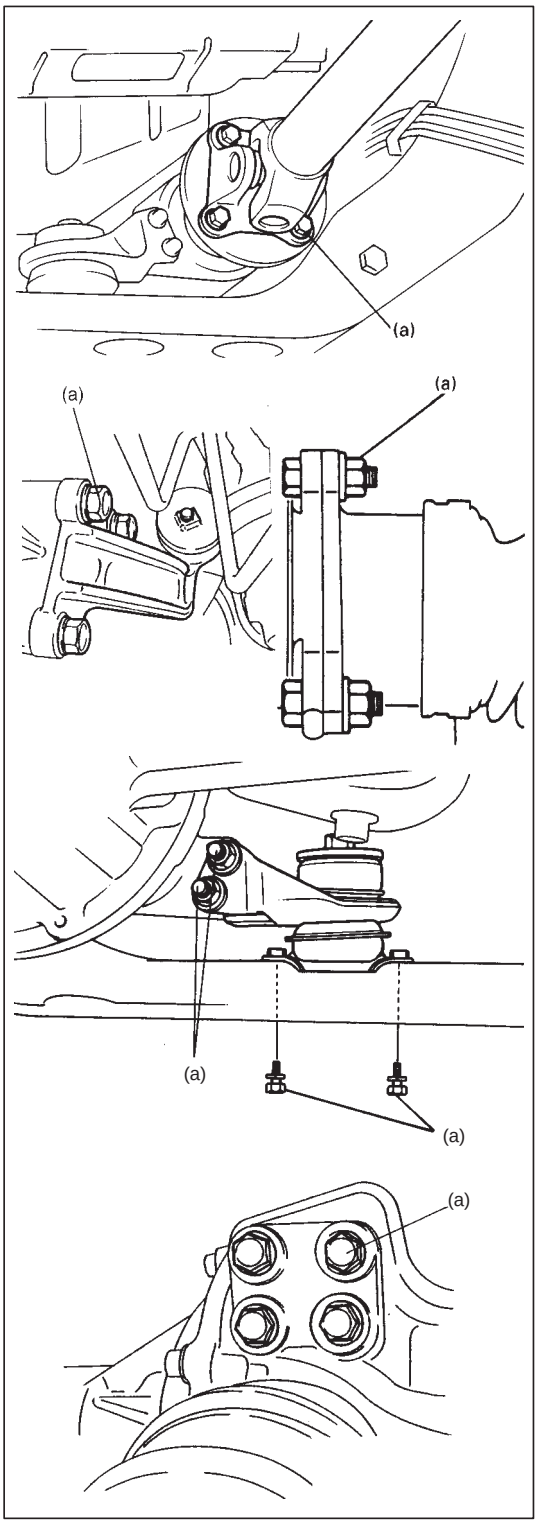
7) With differential housing assembly held with transmission jack, remove mounting bolts on right end of housing.



1. Drive shaft joint R
2. Differential housing
3. Transmission jack
4. Screw driver

8) Using 2 large screwdrivers as levers, pull out right side drive shaft joint from differential and dismount housing assembly from vehicle.

CAUTION:
During above work, use care not to cause damage to drive shaft boot.



REMOUNTING

For remounting, reverse dismounting procedure and use following tightening torque.

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

After tightening all fasteners properly, fill hypoid gear oil as specified and check tightening of plugs with specification.

UNIT REPAIR

Refer to the same section of UNIT REPAIR MANUAL mentioned in FOREWORD of this manual.

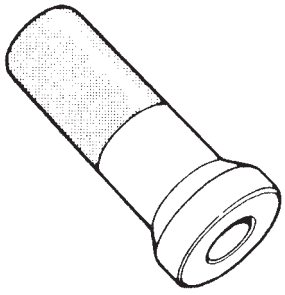
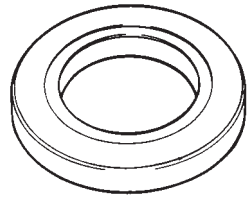
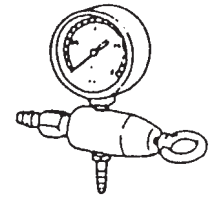
TIGHTENING TORQUE SPECIFICATIONS

Fastening portion	Tightening torque		
	N·m	Kg-m	lb-ft
Differential oil filler/level plug	23	2.3	17.0
Differential oil drain plug	23	2.3	17.0
Differential mounting front bolts	85	8.5	61.5
Differential mounting bracket bolts	50	5.0	36.5
Front drive shaft flange bolts	50	5.0	36.5
Propeller shaft flange bolts	50	5.0	36.5
Pump assembly bolts	13	1.3	9.5

REQUIRED SERVICE MATERIAL

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	Front differential drain plug

SPECIAL TOOLS

		
09951-16080 Bearing installer	09951-26010 Bush remover plate	09918-18110 Air pressure regulator 09367-04002 3-way joint

SECTION 7F

DIFFERENTIAL (REAR)

CONTENTS

GENERAL DESCRIPTION 7F-1
DIAGNOSIS 7F-2
ON-VEHICLE SERVICE 7F-3
Maintenance Service 7F-3
Dismounting 7F-4
Remounting 7F-5
UNIT REPAIR 7F-5
TIGHTENING TORQUE SPECIFICATIONS 7F-6
REQUIRED SERVICE MATERIALS 7F-6

GENERAL DESCRIPTION

The differential assembly using a hypoid bevel pinion and gear is installed to the rear axle. It is set in the conventional type axle housing.

The reduction ratio and differential case vary depending on transmission or engine type.

The differential assembly is decisive in that the drive power is concentrated there. Therefore, use of genuine parts and specified torque is compulsory. Further, because of sliding tooth meshing with high pressure between bevel pinion and gear, it is mandatory to lubricate them by hypoid gear oil.

DIAGNOSIS

Condition	Possible Cause	Correction
Gear noise	● Deteriorated or water mixed lubricant	Repair and replenish
	● Inadequate or insufficient lubricant	Repair and replenish
	● Maladjusted backlash between bevel pinion and gear	Adjust as prescribed
	● Improper tooth contact in the mesh between bevel pinion and gear	Adjust or replace
	● Loose bevel gear securing bolts	Replace or retighten
	● Damaged side gear(s) or side pinion(s)	Replace
Bearing noise	● (Constant noise) Deteriorated or water mixed lubricant	Repair and replenish
	● (Constant noise) Inadequate or insufficient lubricant	Repair and replenish
	● (Noise while coasting) Damaged bearing(s) of bevel pinion	Replace
	● (Noise while turning) Damaged diff. side bearing(s) or axle bearing(s)	Replace
Oil leakage	● Clogged breather plug	Clean
	● Worn or damaged oil seal	Replace
	● Excessive oil	Adjust oil level

ON-VEHICLE SERVICE

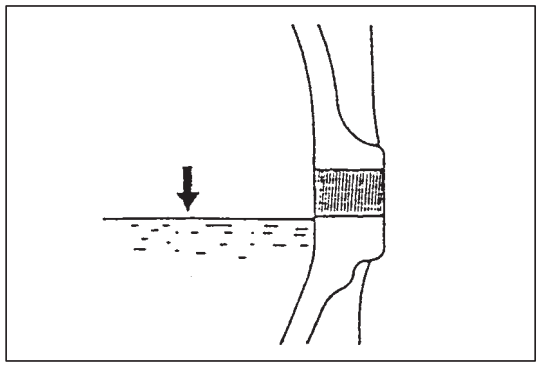
MAINTENANCE SERVICE

NOTE:
- **When having driven through water, check immediately if water has entered (if so, oil is cloudy). Water mixed oil must be changed at once.**
- **Whenever vehicle is hoisted for any other service work than oil change, also be sure to check for oil leakage and status of breather hoses.**

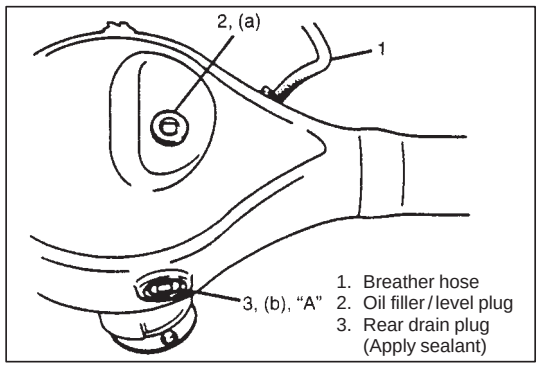
CHANGING OIL

NOTE:
- **Hypoid gear oil must be used for differential.**
- **It is highly recommended to use SAE 80W-90 viscosity.**

1) Before oil change or inspection, be sure to stop engine and lift up vehicle horizontally.



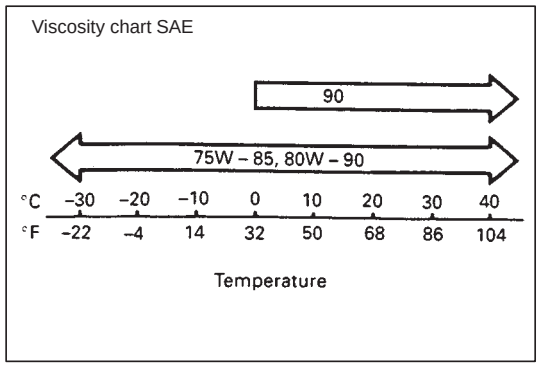
2) Check oil level and existence of leakage. If leakage is found, correct its cause.
3) Drain old oil and pour proper amount of gear oil as specified (roughly up to level hole).



4) Torque drain and level/filler plugs to specification.

"A": Sealant 99000-31110

Tightening Torque
(a): 50 N·m (5.0 kg-m, 36.5 lb-ft)
(b): 28 N·m (2.8 kg-m, 20.5 lb-ft)

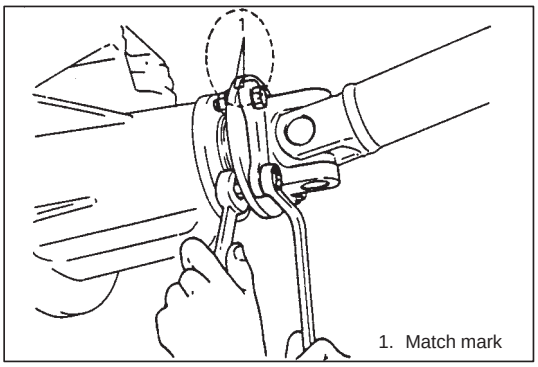


Specified gear oil: Hypoid gear oil API GL-5
SAE 75W-85, 80W-90 or 90
For oil viscosity, refer to the chart at the left.

Oil capacity : 2.2 liters (4.6/3.9 US/Imp. pt.)

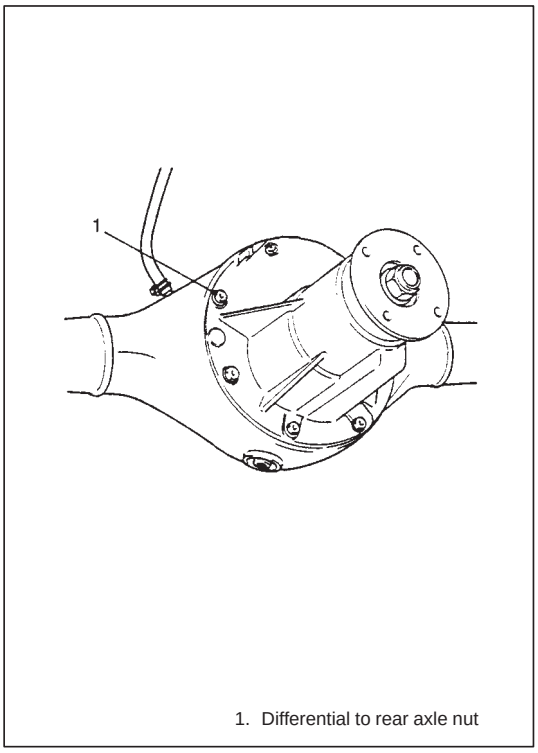
DISMOUNTING

1) Lift up vehicle and drain oil from rear differential housing.
2) Remove rear brake drums and pull out right and left rear axle shafts. (Refer to rear axle shaft removal of SECTION 3E.)



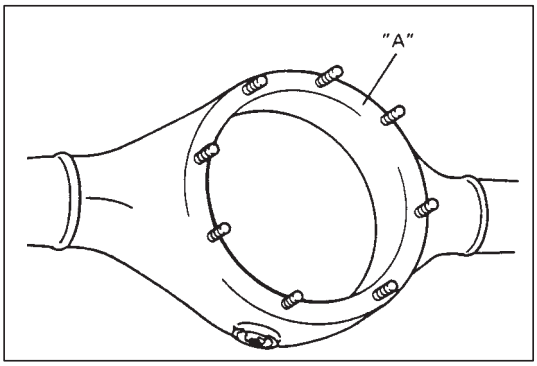
1. Match mark

3) Before removing propeller shaft, give match marks on joint flange and propeller shaft as shown.
4) Remove propeller shaft by removing its 4 flange bolts and nuts.



1. Differential to rear axle nut

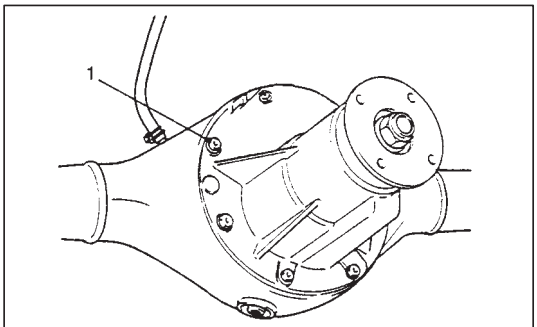
5) Remove differential assembly by removing its 8 fastening nuts.



REMOUNTING

1) Clean mating surfaces of rear axle and differential assembly and apply sealant (Suzuki bond 1215) to axle side evenly.

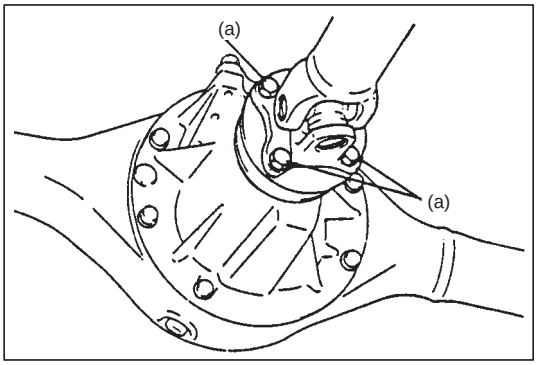
   "A": Sealant 99000-31110



1. Differential to rear axle nut

2) Install differential assembly to axle and fix it with nuts tightened to specified torque.

   Tightening Torque
   (a): 55 N·m (5.5 kg-m, 40.0 lb-ft)



3) Install propeller shaft to joint flange aligning match marks and torque flange bolts to specification.

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

4) Install right and left rear axle shafts and drums.
   (Refer to rear axle installation of SECTION 3E and rear brake drum installation of SECTION 5.)
5) Install wheels.
6) Fill hypoid gear oil as specified and tighten plug to specification.
   Lower lift.

UNIT REPAIR

Refer to the same section of UNIT REPAIR MANUAL mentioned in Foreword of this manual.

TIGHTENING TORQUE SPECIFICATIONS

Fastening portion	Tightening torque		
	N·m	kg-m	lb-ft
Differential oil filler/level plug	50	5.0	36.5
Differential oil drain plug	28	2.8	20.5
Propeller shaft flange bolts	50	5.0	36.5
Differential carrier nuts	55	5.5	40.0

REQUIRED SERVICE MATERIALS

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	● Rear differential oil drain plug ● Mating surface of differential housing ● Mating surface of rear axle housing

SECTION 8

BODY ELECTRICAL SYSTEM

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

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "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).**

WIRING SYSTEM
(Harnesses, Connectors, Fuses, Relay, Switches, Grounds, System Circuit Diagram) . . . . . Section 8A
LIGHTING SYSTEM . . . . . Section 8B
INSTRUMENTATION AND DRIVER INFORMATION . . . . . Section 8C
WINDOWS, MIRRORS, SECURITY AND LOCKS . . . . . Section 8D
IMMOBILIZER CONTROL SYSTEM . . . . . Section 8F

CONTENTS

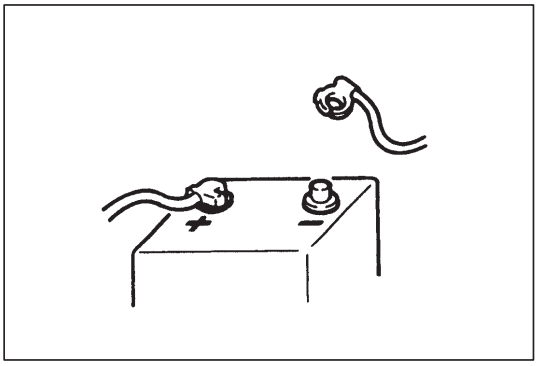
GENERAL DESCRIPTION 8-2
Cautions in Servicing 8-2
Symbols and Marks 8-4
Abbreviations 8-4
Wiring Color Symbols 8-5
Joint Connector 8-5
Fuse Box and Relay 8-5
Power Supply Diagram 8-6

GENERAL DESCRIPTION

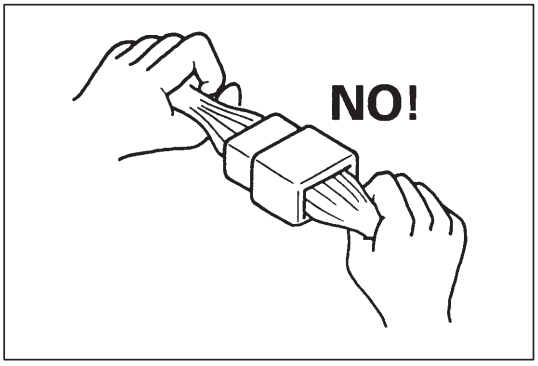
The body electrical components of this vehicle are designed to operate on 12 Volts power supplied by the battery. The electrical system utilizes negative ground polarity.

CAUTIONS IN SERVICING

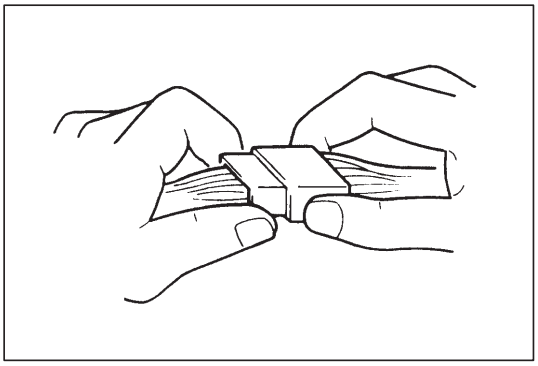
When performing works related to electric systems, observe following cautions for the purpose of protection of electrical parts and prevention of a fire from occurrence.



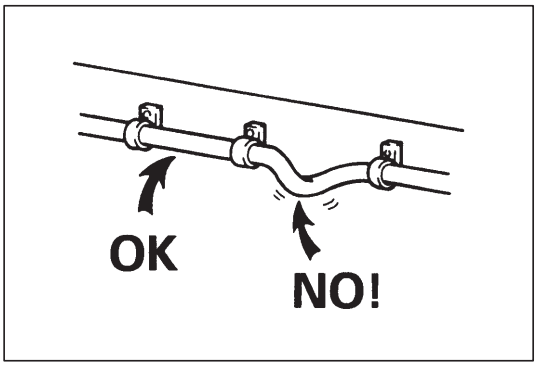
- When removing the battery from the vehicle or disconnecting the cable from the battery terminals for inspection or service works on the electric systems, always confirm first that the ignition switch and all the other switches have been turned OFF. Otherwise, the semi-conductor part may be damaged.
- 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.



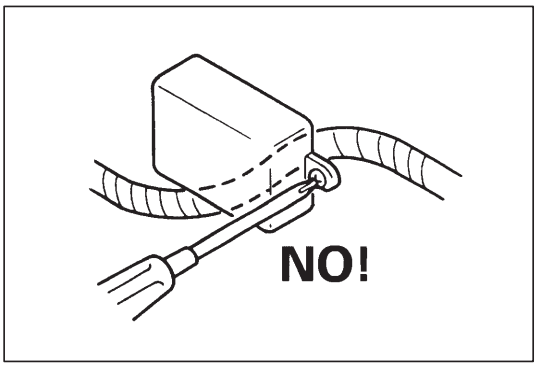
- When disconnecting connectors, never pull the wiring harnesses. Unlock the connector lock first and then pull them apart by holding connectors themselves.



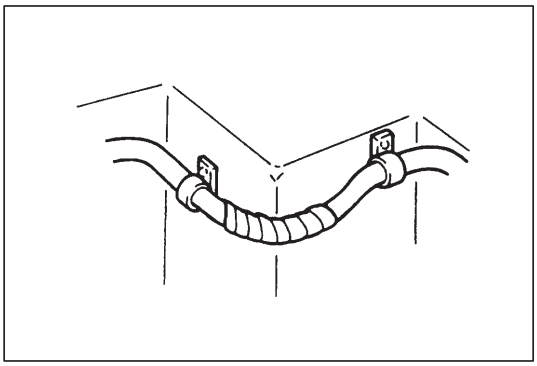
- When connecting connectors, also hold connectors and put them together until they lock securely (a click is heard).



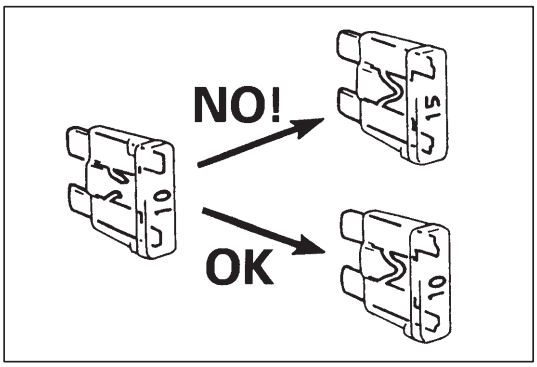
- When installing the wiring harness, fix it with clamps so that no slack is left.



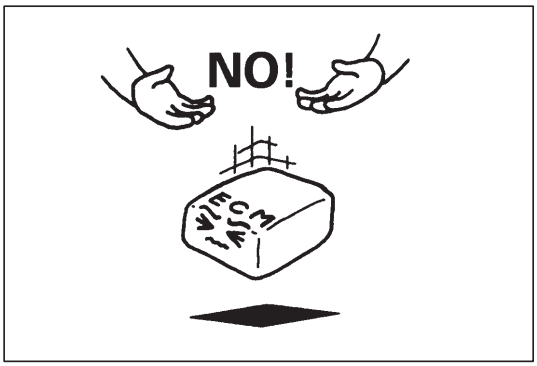
- When installing vehicle parts, be careful so that the wiring harness is not interfered with or caught by any other part.



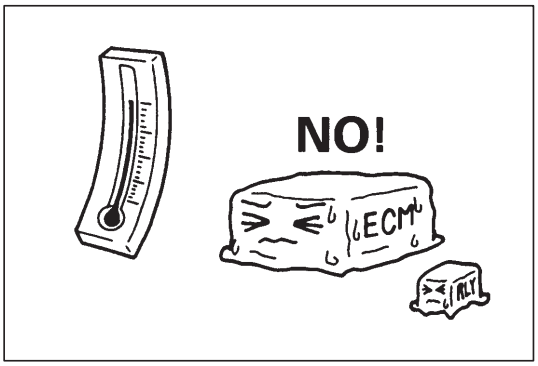
- To avoid damage to the harness, protect its part which may contact against a part forming a sharp angle by winding tape or the like around it.



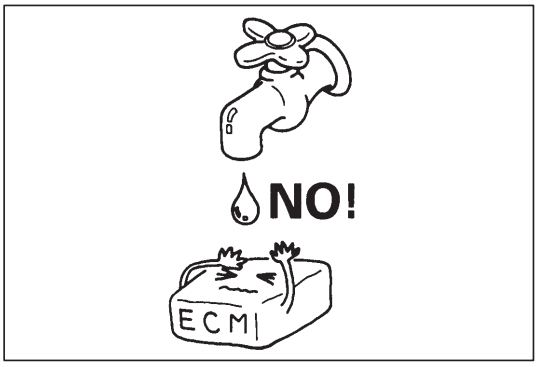
- When replacing a fuse, make sure to use a fuse of the specified capacity. Use of a fuse with a larger capacity will cause a damage to the electrical parts and a fire.



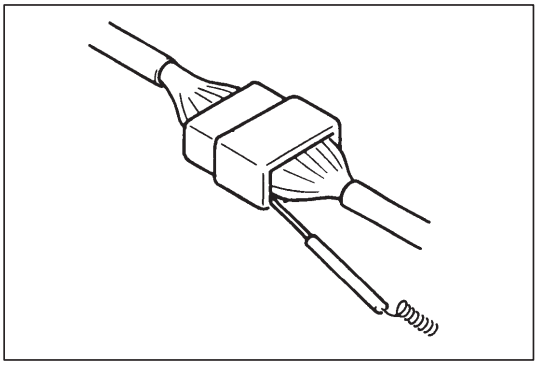
- Always be careful not to handle electrical parts (computer, relay, etc.) in a rough manner or drop them.



- 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.

SYMBOLS AND MARKS

Refer to Section 8A.

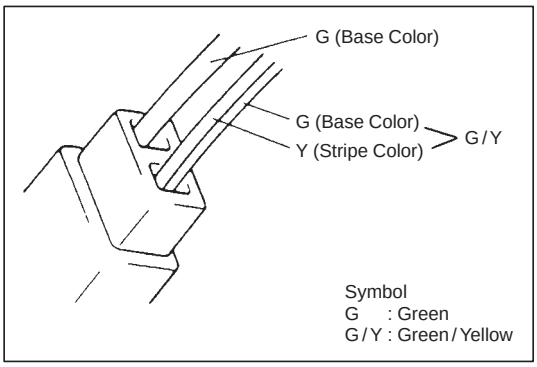
ABBREVIATIONS

Refer to Section 8A.

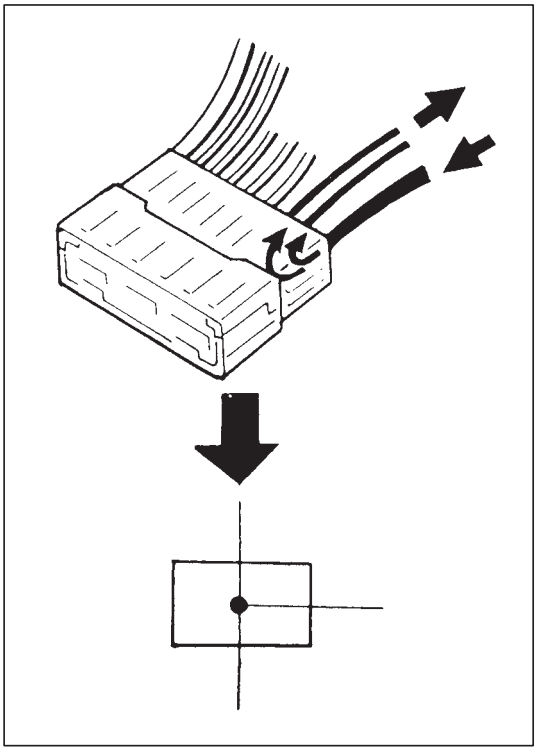
Symbol	Wire Color	Symbol	Wire Color
B	Black	O	Orange
Bl	Blue	R	Red
Br	Brown	W	White
G	Green	Y	Yellow
Gr	Gray	P	Pink
Lbl	Light blue	V	Violet
Lg	Light green		

WIRE COLOR SYMBOLS

The wire color is abbreviated to the first (or first two) alphabet(s) of each color.



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).



JOINT CONNECTOR (J/C)

- Wiring of this vehicle employs joint connector (J/C) which divide one wire into several different wires or combine several different wires into one wire.
- The joint connector is as shown in the figure.

FUSE BOX AND RELAY

Refer to Section 8A.

POWER SUPPLY DIAGRAM

Refer to Section 8A.

SECTION 8B

LIGHTING SYSTEM

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

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

CONTENTS

GENERAL DESCRIPTION 8B- 2
Cautions in Servicing 8B- 2
Symbols and Marks 8B- 2
Wiring Color Symbols 8B- 2
Abbreviations 8B- 2
Joint Connector 8B- 2
Fuse Box and Relay 8B- 2
Power Supply Diagram 8B- 2
Headlights 8B- 2
Headlight with Leveling System (If Equipped) 8B- 3
DIAGNOSIS 8B- 4
Headlights 8B- 4
Headlights with Leveling System (If Equipped) 8B- 4
Turn Signal and Hazard Warning Lights 8B- 4
Clearance, Tail and License Plate Lights 8B- 5
Back-up Lights 8B- 5
Brake Lights 8B- 5
Rear Fog Light (If Equipped) 8B- 5
Interior Lights 8B- 5
ON-VEHICLE SERVICE 8B- 6
Headlights 8B- 6
Headlights with Leveling System (If Equipped) 8B- 8
Turn Signal and Hazard Warning Lights 8B- 9
Rear Fog Light (If Equipped) 8B-11

GENERAL DESCRIPTION

CAUTIONS IN SERVICING

Refer to Section 8.

SYMBOLS AND MARKS

Refer to Section 8.

WIRING COLOR SYMBOLS

Refer to Section 8.

ABBREVIATIONS

Refer to Section 8.

JOINT CONNECTOR

Refer to Section 8.

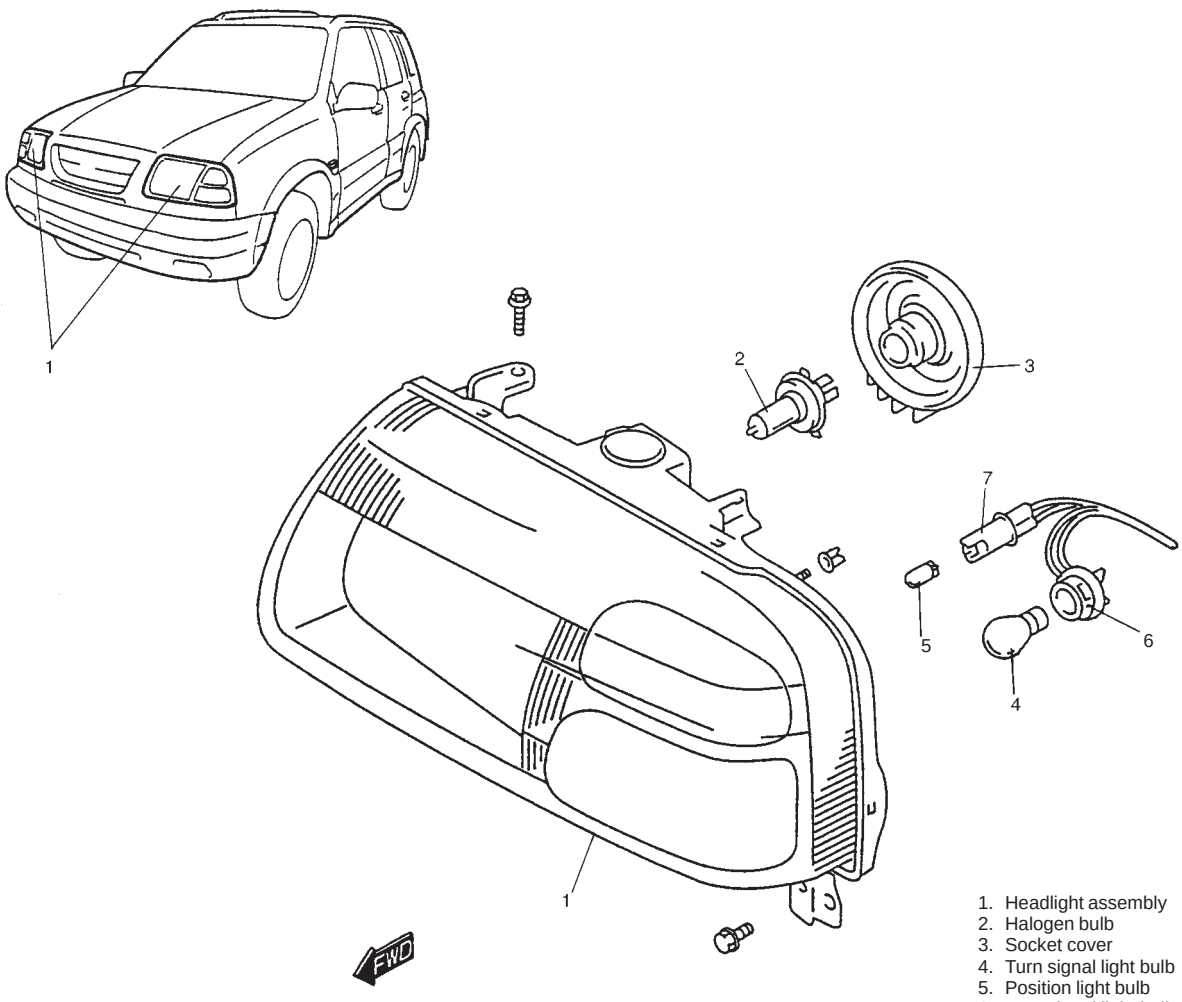
FUSE BOX AND RELAY

Refer to Section 8.

POWER SUPPLY DIAGRAM

Refer to Section 8.

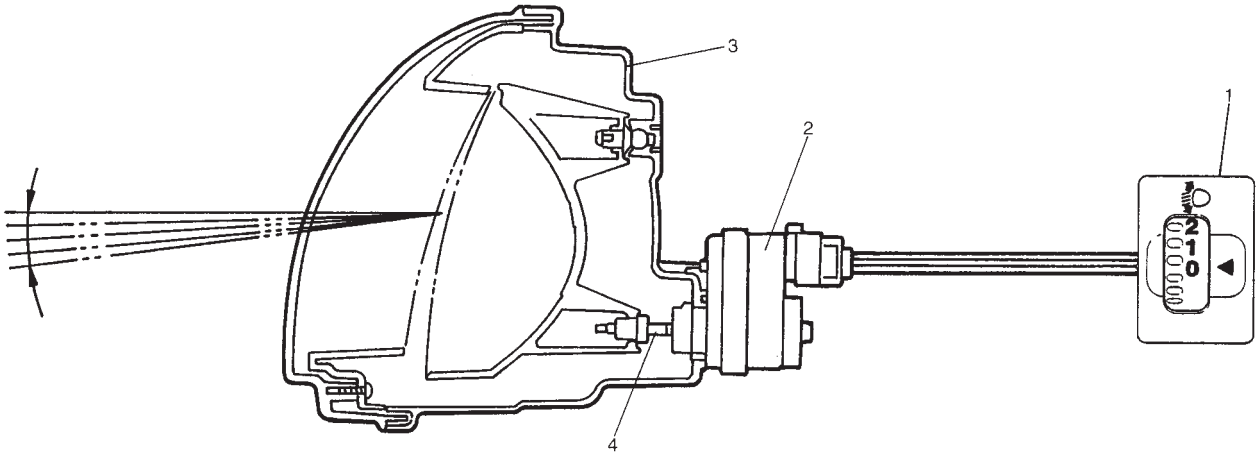
HEADLIGHTS



1. Headlight assembly
2. Halogen bulb
3. Socket cover
4. Turn signal light bulb
5. Position light bulb
6. Turn signal light bulb socket
7. Position light bulb socket

HEADLIGHT WITH LEVELING SYSTEM (IF EQUIPPED)

1. Headlight leveling switch
2. Headlight leveling unit (actuator)
3. Headlight
4. Headlight leveling unit shaft



Switch Position	Headlight beam down angle
0	———
1	0.624°
2	1.243°
3	1.867°
4	2.479°

DIAGNOSIS

NOTE:
Fuse name (“ ”) in the table below is shown on the fuse box cover (Hard Top Model) or the junction box (Canvas Top Model).

HEADLIGHTS

Trouble	Possible cause	Correction
Only one light does not light	● Bulb blown ● Headlight L or R fuse blown ● Socket, wiring or grounding faulty	Replace bulb Replace fuse to check for short Repair
Headlights do not light	● Headlight L and R fuses blown ● Lighting and dimmer switch faulty ● Defective light relay ● Wiring or grounding faulty	Replace fuses to check for short Replace switches Replace light relay Repair
Only one beam (“Hi” or “Lo”) does not light	● Bulb blown ● Lighting or dimmer switch faulty	Replace bulb Replace switch

HEADLIGHTS WITH LEVELING SYSTEM (IF EQUIPPED)

Trouble	Possible cause	Correction
Both headlights do not move	● “TURN/BACK” fuse blown (Hard Top Model) “TRN” fuse blown (Canvas Top Model) ● Leveling switch faulty ● Supply voltage too low	Replace fuse to check for short Replace switch Recharge or replace battery
One of headlights (either Right or Left) does not move	● Socket, wiring or grounding faulty ● Actuator faulty ● Vehicle body around headlight deformed ● Headlight ass’y itself deformed	Repair Replace actuator Repair body Replace headlight ass’y

TURN SIGNAL AND HAZARD WARNING LIGHTS

Trouble	Possible cause	Correction
Flash rate high or one side only flashes	● Incorrect bulb ● One of light bulbs burnt out ● Turn signal/hazard warning relay faulty ● Open circuit or high resistance existing between turn signal/hazard warning switch and lights on one side ● Wiring or grounding faulty	Replace bulb Replace Replace relay Repair Repair
No flashing	● “TURN/BACK” and/or “HAZARD” fuse(s) blown (Hard Top Model) “TRN” and/or “HAZ” fuse(s) blown (Canvas Top Model) ● Open circuit or high resistance existing between battery and switch ● Turn signal/hazard relay faulty ● Combination switch or hazard switch faulty ● Wiring or grounding faulty	Replace fuse(s) to check for short Check bulb and check circuit Replace relay Replace switch Repair
Flash rate low	● Supply voltage too low ● Turn signal/hazard relay faulty	Check charging system Replace relay

CLEARANCE, TAIL AND LICENCE PLATE LIGHTS

Trouble	Possible cause	Correction
All lights do not light	● "TAIL" fuse blown ● Lighting switch faulty ● Wiring or grounding faulty	Replace fuse to check for short Replace switch Repair
Some lights do not light up	● Bulb(s) blown ● Wiring or grounding faulty	Replace bulb(s) Repair

BACK-UP LIGHTS

Trouble	Possible cause	Correction
Back-up lights do not light	● "TURN/BACK" fuse blown (Hard Top Model) "TRN" fuse blown (Canvas Top Model) ● Bulb blown ● Back-up light switch or shift switch faulty ● Wiring or grounding faulty	Replace fuse to check for short Replace bulb Replace switch Repair
Back-up lights remains ON	● Back-up light switch or shift switch faulty ● Wiring or grounding faulty	Replace switch Repair

BRAKE LIGHTS

Trouble	Possible cause	Correction
Brake lights do not light up	● "STOP/HORN" fuse blown (Hard Top Model) "STP" fuse blown (Canvas Top Model) ● Bulb(s) blown ● Brake light switch faulty ● Wiring or grounding faulty	Replace fuse to check for short Replace bulb(s) Adjust or replace switch Repair
Brake lights stay on	● Brake light switch faulty	Adjust or replace switch
Only one light does not light	● Bulb blown ● Wiring or grounding faulty	Replace bulb Repair

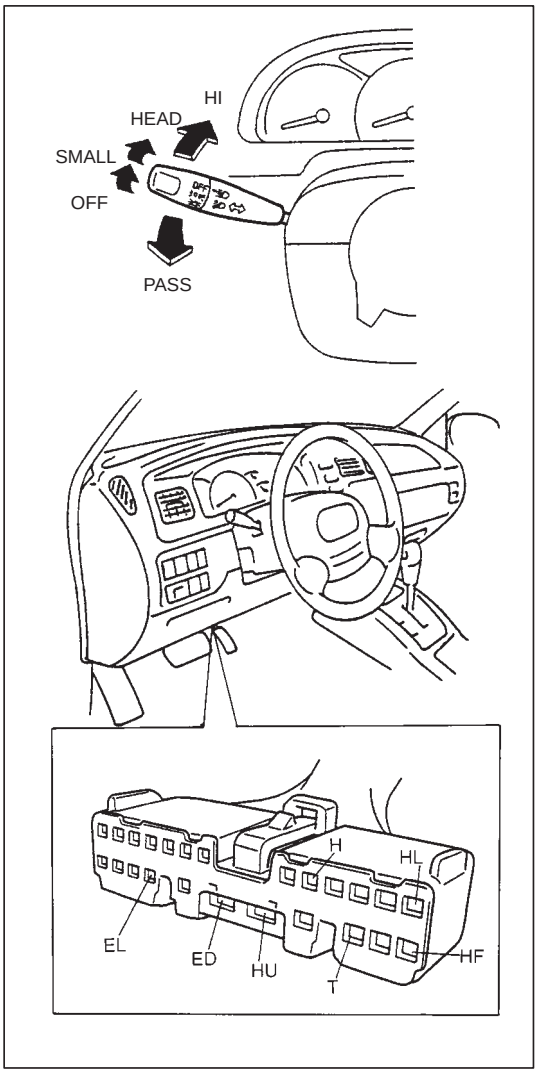
REAR FOG LIGHT (IF EQUIPPED)

Trouble	Possible cause	Correction
Rear fog light does not come on	● "FOG" fuse blown ● Rear fog light switch faulty ● Lighting switch faulty ● Wiring or grounding faulty ● Bulb blown	Replace fuse to check for short Replace fog light switch Replace switch Repair Replace bulb

INTERIOR LIGHTS

Trouble	Possible cause	Correction
Interior light (s) does (do) not light up	● Bulb(s) blown ● "DOME" fuse blown (Hard Top Model) "DOM" fuse blown (Canvas Top Model) ● Wiring or grounding faulty ● Door switch faulty ● Interior light switch faulty	Replace bulb(s) Replace fuse to check for short Repair Replace switch Replace light assy
Front spot lights do not light up	● Bulb(s) blown ● Wiring or grounding faulty ● Spot light switch faulty	Replace bulb(s) Repair Replace light assy

ON-VEHICLE SERVICE



HEADLIGHTS

HEADLIGHT SWITCH (IN COMBINATION SWITCH)

INSPECTION

1) Disconnect negative cable at battery.
2) Disconnect combination switch lead wire coupler.
3) Check for continuity between terminals at each switch position shown below. If check result is not as specified, replace switch.

Lighting Switch

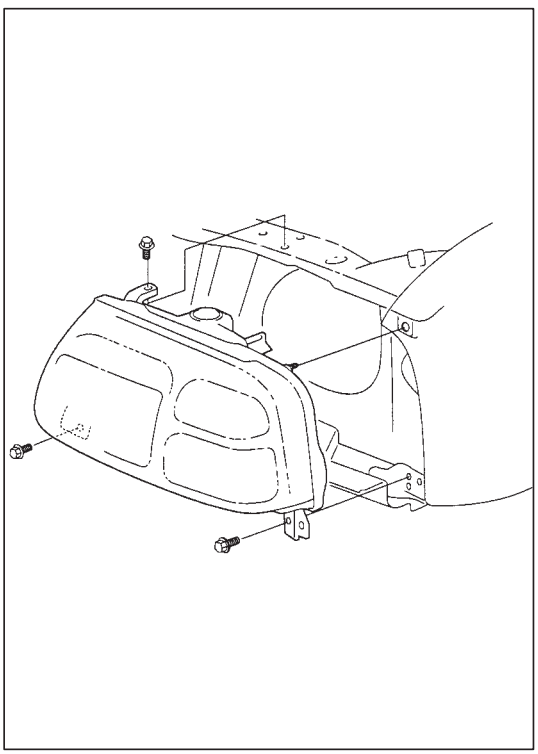
Terminal / Switch Position / Wire Color	EL	T	H
	W	G	R
OFF			
SMALL	○	○	
HEAD	○	○	○

Dimmer & Passing Switch

Terminal / Switch Position / Wire Color	ED	HL	HU	HF
	W/B	R/W	R	R/B
Passing (PASS)	○		○	○
Low Beam	○	○		
High Beam (HI)	○		○	

REMOVAL AND INSTALLATION

For vehicle without air bag system, refer to Section 3C COMBINATION SWITCH, and for vehicle with air bag system, refer to Section 3C1 CONTACT COIL AND COMBINATION SWITCH ASSEMBLY.

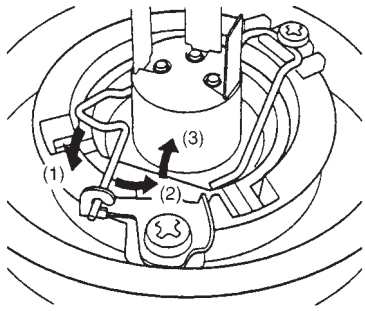


REMOVAL

1) Disconnect negative cable at battery.
2) Remove front grille.
3) Disconnect harness and couplers from headlight assembly.
4) Remove three bolts and pull headlight assembly off vehicle.

INSTALLATION

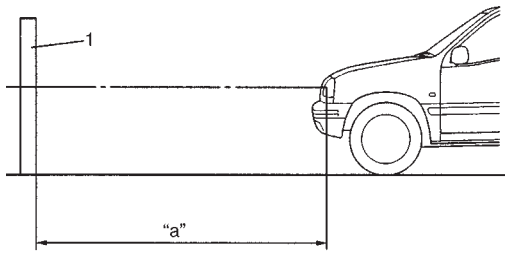
Reverse removal procedure for installation.
Make sure to follow HEADLIGHT AIMING WITH SCREEN and aim headlight after installation.



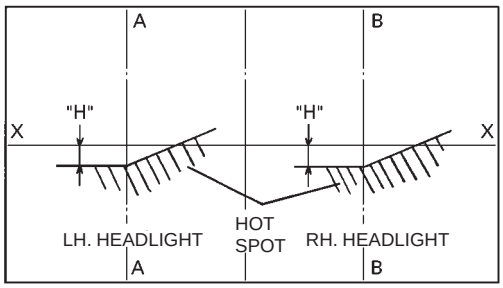
BULB REPLACEMENT

WARNING:
Don't touch when the bulb is hot.

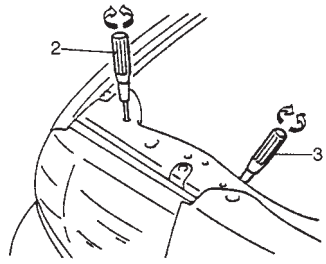
1) Disconnect negative cable at battery.
2) Disconnect harness from bulb.
3) Remove socket cover and bulb.
4) Replace bulb and install in reverse removal procedure.

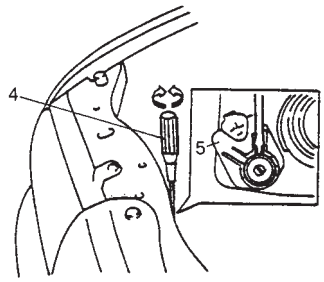


1. Screen



LH steering vehicle shown
X-X: Horizontal center line of headlight bulbs
A-A: Vertical center line of left headlight bulb
B-B: Vertical center line of right headlight bulb





2. For right / left adjustment
3. For up / down adjustment (for vehicle without leveling system)
4. For up / down adjustment (for vehicle with leveling system)
5. Headlight leveling actuator

HEADLIGHT AIMING WITH SCREEN

NOTE:
- **Unless otherwise obligated by local regulations, adjust headlight aiming according to following procedure.**
- **After replacing headlight, be sure to perform its aiming.**
- **When inspecting and adjusting headlight with leveling system, make sure to set the leveling switch to "0" position with IG switch ON.**

Before adjustment, make sure the following.
a) Place vehicle on a flat surface in front of blank wall as below ahead of headlight surface.

Clearance "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 one driver aboard.

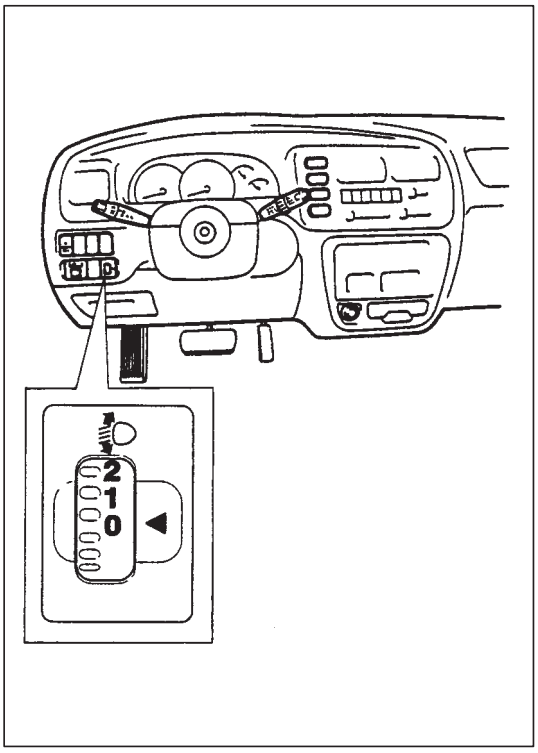
Driver's weight: 75 kg (165 lb)

Adjustment

1) Check to see if hot spot (high intensity zone) of each main (low) beam axis falls as illustrated.

Clearance "H": Approx. 130 mm (5.15 in.)

2) If headlight aiming is not set properly, align it to specification by adjusting aiming screw and aiming gear.



HEADLIGHTS WITH LEVELING SYSTEM (IF EQUIPPED)

LEVELING SWITCH

INSPECTION

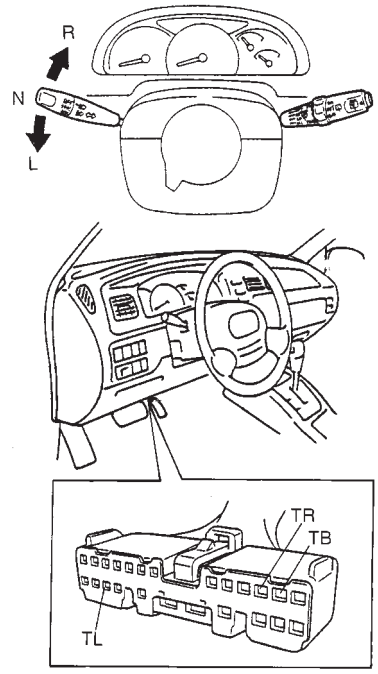
To check the switch operation, substitute it with a new one. If proper operation is obtained, it means the switch is defective.
Replace it with a new one.

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.

LH steering vehicle shown



TURN SIGNAL AND HAZARD WARNING LIGHTS

TURN SIGNAL SWITCH (IN COMBINATION SWITCH)

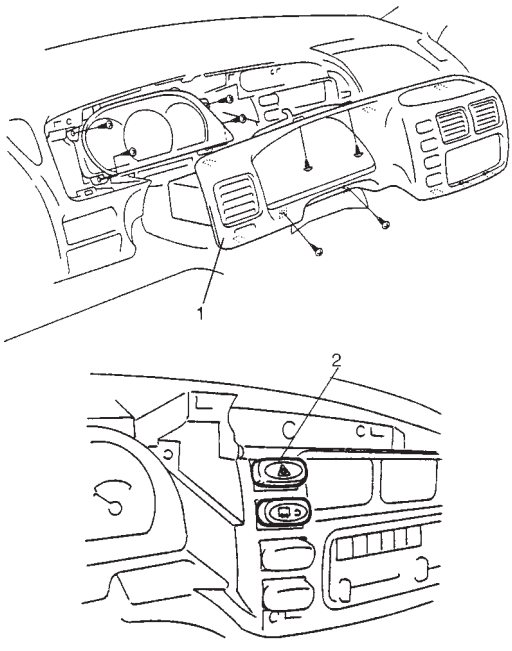
INSPECTION

1) Disconnect negative cable at battery.
2) Disconnect combination switch lead wire coupler.
3) Check for continuity between terminals at each switch position shown below. If check result is not as specified, replace switch.

Terminal / Wire Color / Switch Position	TL	TB	TR
	G/R	G	G/Y
L	○——	——○	
N			
R		○——	——○

REMOVAL AND INSTALLATION

Refer to Section 3C COMBINATION SWITCH for vehicle without air bag system and Section 3C1 CONTACT COIL AND COMBINATION SWITCH ASSEMBLY for vehicle with air bag system.



1. Meter cluster
2. Hazard switch

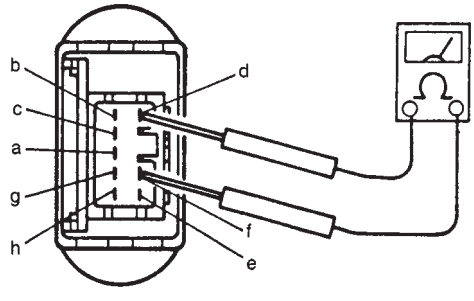
HAZARD SWITCH

REMOVAL

1) Remove meter cluster.
2) Pull hazard switch out of instrument panel.
3) Disconnect coupler from hazard switch.
4) Remove hazard switch.

INSTALLATION

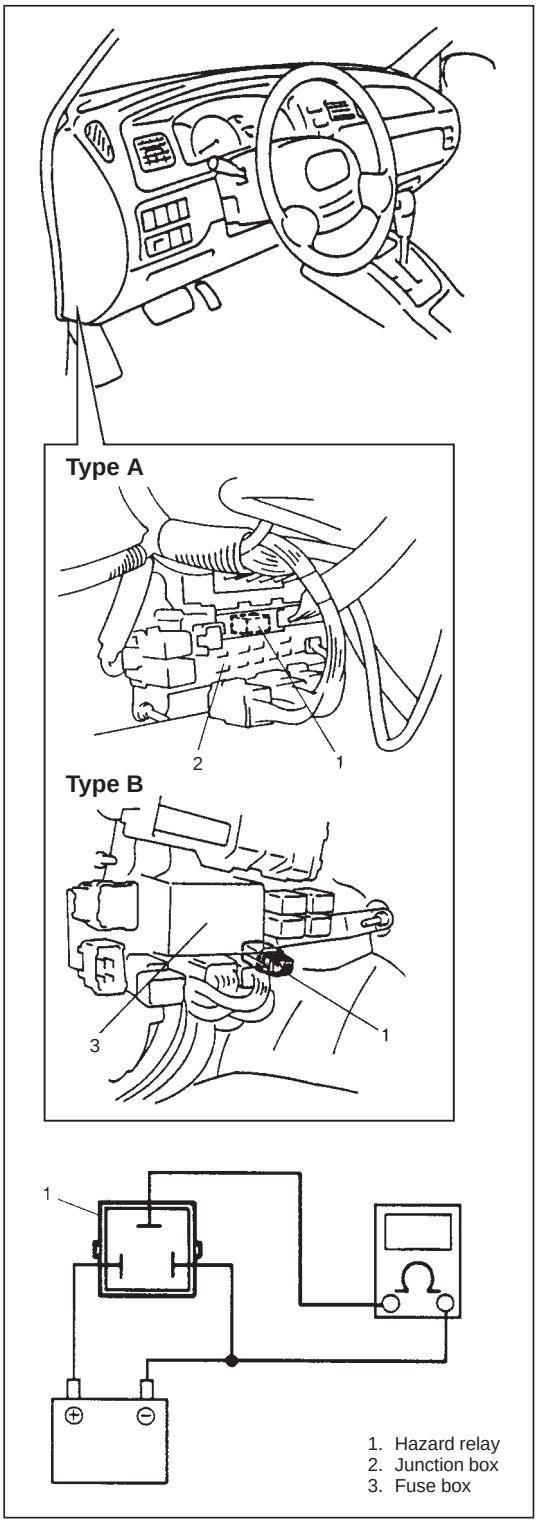
Reverse removal procedure.



INSPECTION

Check for continuity between terminals at each switch position shown below. If check result is not as specified, replace siwtch.

	a	b	c	d	e	f	g	h
OFF	○——	——○					○—⊖—○	
ON		○——	——○	○——	——○	——○	○—⊖—○	

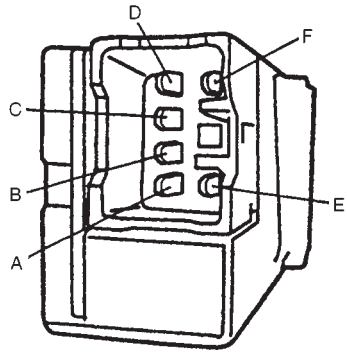


HAZARD RELAY

INSPECTION

Connect battery and tester as shown.

Unless a continued click sound is heard, replace relay.



REAR FOG LIGHT (IF EQUIPPED)

REAR FOG LIGHT SWITCH

INSPECTION

Check for continuity between terminals at each switch position shown below. Hold the switch button (ON or OFF) pushed in during checking switch.

RR FOG SW \ TERMINAL / OFF SW		B	E	D	A	C	F
FREE	FREE						
	PUSH						
PUSH	FREE						
	PUSH						

NOTE:

Rear fog light lights up only when headlights (low or high beams) or front fog lights (if equipped) are ON.

Rear fog lights turns OFF automatically when headlights or front lights are turned OFF.

SECTION 8C

INSTRUMENTATION/DRIVER INFORMATION

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

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

CONTENTS

GENERAL DESCRIPTION 8C- 2
Cautions in Servicing 8C- 2
Symbols and Marks 8C- 2
Wiring Color Symbols 8C- 2
Abbreviations 8C- 2
Joint Connector 8C- 2
Fuse Box and Relay 8C- 2
Power Supply Diagram 8C- 2
Combination Meter 8C- 2
DIAGNOSIS 8C- 4
Speedometer and VSS 8C- 4
Fuel Meter/Fuel Gauge Unit 8C- 4
Engine Coolant Temp. (ECT) Meter and Sensor 8C- 4
Oil Pressure Light 8C- 4
Brake and Parking Brake Warning Light 8C- 5
Light Remainder Warning Buzzer 8C- 5
Seat Belt Warning Light (If Equipped) . . . 8C- 5
Ignition Key Remainder Warning Buzzer (If Equipped) 8C- 5
Cigarette Lighter and Accessory Socket . 8C- 5
ON-VEHICLE SERVICE 8C- 6
Ignition (Main) Switch 8C- 6
Combination Meter 8C- 7
Speedometer and VSS 8C- 8
Fuel Meter/Fuel Gauge Unit 8C- 9
Engine Coolant Temp. (ECT) Meter and Sensor 8C-10
Oil Pressure Light 8C-11
Brake and Parking Brake Warning Light 8C-12
Ignition Key Remainder (If Equipped)/ Light Remainder Warning Buzzer 8C-12
Door Switch 8C-13
Seat Belt Warning Light (If Equipped) . . . 8C-13

GENERAL DESCRIPTION

CAUTIONS IN SERVICING

Refer to Section 8.

SYMBOLS AND MARKS

Refer to Section 8.

WIRING COLOR SYMBOLS

Refer to Section 8.

ABBREVIATIONS

Refer to Section 8.

JOINT CONNECTOR

Refer to Section 8.

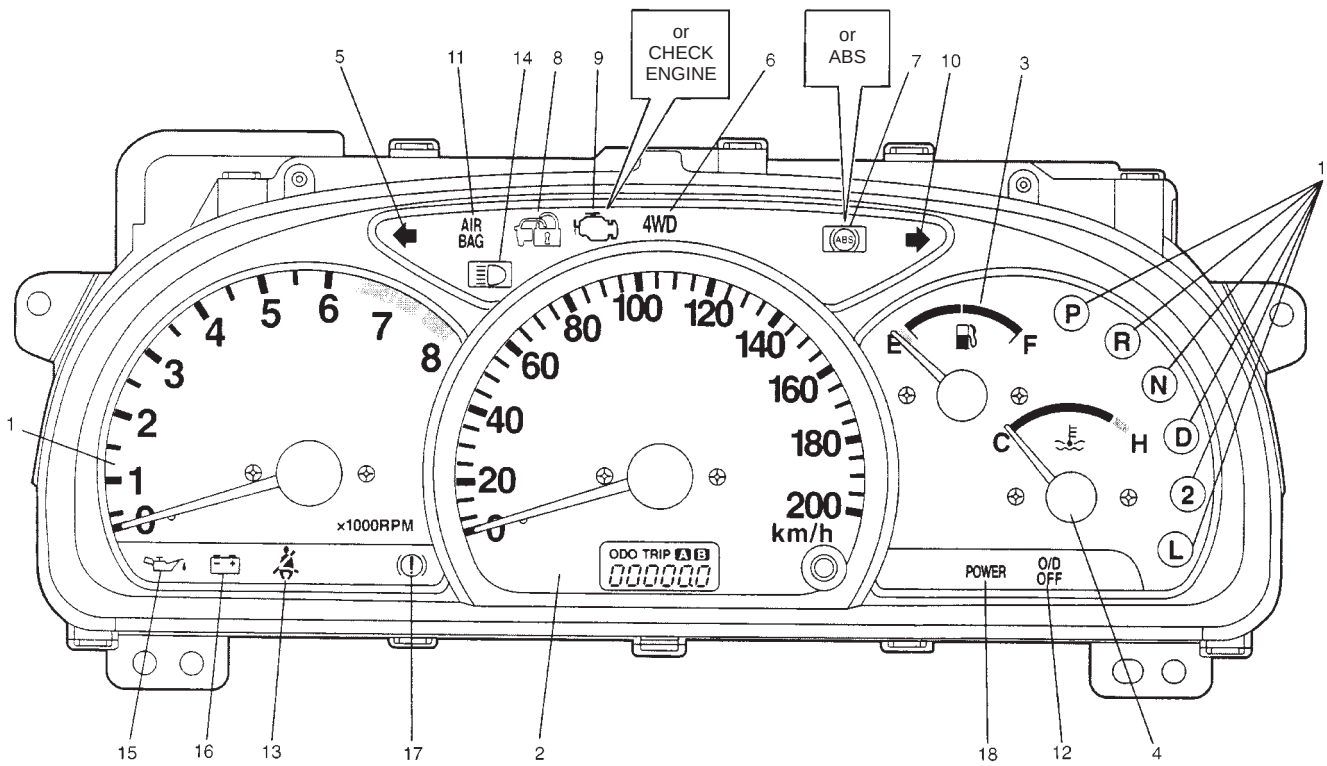
FUSE BOX AND RELAY

Refer to Section 8.

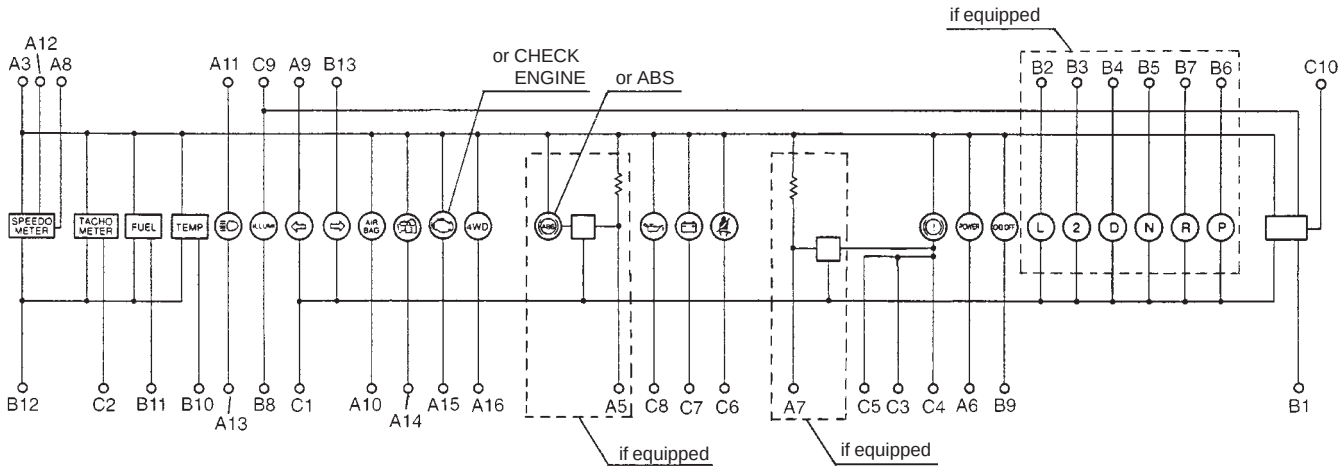
POWER SUPPLY DIAGRAM

Refer to Section 8.

COMBINATION METER

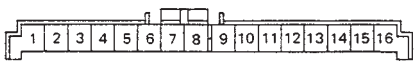


1. Tachometer
2. Speedometer
3. Fuel level meter
4. Water temperature meter
5. Turn signal pilot light (LH)
6. 4WD indicator (if equipped)
7. ABS warning light (if equipped)
8. Immobilizer warning light (if equipped)
9. CHECK ENGINE light
10. Turn signal pilot light (RH)
11. AIR BAG warning light (if equipped)
12. O / D OFF light (A / T vehicle only)
13. Fasten seat belt light (if equipped)
14. High beam light
15. Oil pressure warning light
16. Charge warning light
17. Brake and parking brake warning light
18. POWER indicator light (A / T vehicle only)
19. Shift position indicator (A / T vehicle, if equipped)

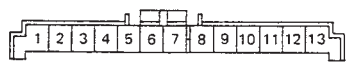


NOTE:
Terminal arrangement of coupler viewed from harness side.

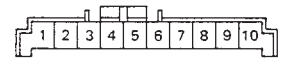
Coupler A



Coupler B



Coupler C



Coupler A

1.	Blank	——
2.	Blank	——
3.	To ignition switch	B / W
4.	Blank	——
5.	To ABS control module (if equipped)	Bl / O
6.	To PCM (A / T vehicle only)	Gr / Bl
7.	To ABS control module (if equipped)	Br
8.	To VSS	Bl / Y
9.	To combination switch	G / R
10.	To SDM (if equipped)	Y / G or Bl
11.	To main fuse	W / Bl
12.	To fuse box	W
13.	To combination switch	R
14.	To ECM (PCM for A / T vehicle) (if equipped)	V
15.	To ECM (PCM for A / T vehicle)	V / Y
16.	To ECM (PCM for A / T vehicle) (if equipped)	O / B

Coupler B

1.	To door switch (driver side)	B / Bl
2.	To transmission range switch (A / T vehicle only, if equipped) L	G / Bl
3.	To transmission range switch (A / T vehicle only, if equipped) 2	G / O
4.	To transmission range switch (A / T vehicle only, if equipped) D	Y / G
5.	To transmission range switch (A / T vehicle only, if equipped) N	O / Bl
6.	To transmission range switch (A / T vehicle only, if equipped) P	O / G
7.	To transmission range switch (A / T vehicle only, if equipped) R	R
8.	To ground	B
9.	To PCM (A / T vehicle only)	W / B
10.	To ECT sensor	Y / W
11.	To fuel level gauge	Bl / W
12.	To ground	B / Y
13.	To combination switch	G / Y

Coupler C

1.	To ground	B
2.	To ECM (PCM for A / T vehicle)	Br
3.	To ignition switch (if equipped)	V / R
4.	To brake fluid level switch	R / B
5.	To parking brake switch	V
6.	To seat belt switch (if equipped)	Gr / R
7.	To generator	W / R
8.	To oil pressure switch	Y / B
9.	To combination switch	R / Y
10.	To ignition switch (if equipped)	Bl / R

DIAGNOSIS

NOTE:
Fuse name (“ ”) in the table below is shown on the fuse box cover (Hard Top Model) or the junction box (Canvas Top Model).

SPEEDOMETER AND VSS

Trouble	Possible Cause	Correction
Speedometer shows no operation	● “IG/METER” fuse blown (Hard Top Model) “IG” fuse blown (Canvas Top Model)	Replace fuse to check for short
	● VSS faulty	Replace VSS
	● Printed plate in combination meter faulty	Replace printed plate
	● Speedometer faulty	Replace speedometer
	● Wiring or grounding faulty	Repair

FUEL METER/FUEL GAUGE UNIT

Trouble	Possible Cause	Correction
Fuel meter shows no operation	● “IG/METER” fuse blown (Hard Top Model) “IG” fuse blown (Canvas Top Model)	Replace fuse to check for short
	● Fuel gauge unit faulty	Replace fuel gauge unit
	● Printed plate in combination meter faulty	Replace printed plate
	● Fuel meter faulty	Replace fuel meter
	● Wiring or grounding faulty	Repair

ENGINE COOLANT TEMP. (ECT) METER AND SENSOR

Trouble	Possible Cause	Correction
Engine coolant temp. meter shows no operation	● “IG/METER” fuse blown (Hard Top Model) “IG” fuse blown (Canvas Top Model)	Replace fuse to check for short
	● ECT meter faulty	Replace ECT meter
	● Printed plate in combination meter faulty	Replace printed plate
	● ECT sensor faulty	Replace ECT sensor
	● Wiring or grounding faulty	Repair

OIL PRESSURE LIGHT

Trouble	Possible Cause	Correction
Oil pressure warning light does not light up	● Bulb in combination meter blown	Replace bulb
	● “IG/METER” fuse blown (Hard Top Model) “IG” fuse blown (Canvas Top Model)	Replace fuse to check for short
	● Printed plate in combination meter faulty	Replace printed plate
	● Oil pressure switch faulty	Replace oil pressure switch
	● Wiring or grounding faulty	Repair

BRAKE AND PARKING BRAKE WARNING LIGHT

Trouble	Possible Cause	Correction
Brake warning light does not light up	● Bulb in combination meter blown	Replace bulb
	● "IG/METER" fuse blown (Hard Top Model) "IG" fuse blown (Canvas Top Model)	Replace fuse to check for short
	● Printed plate in combination meter faulty	Replace printed plate
	● Parking brake switch faulty	Replace parking brake switch
	● Brake fluid level switch faulty	Replace brake fluid level switch
	● Wiring or grounding faulty	Repair

LIGHT REMAINDER WARNING BUZZER

Trouble	Possible Cause	Correction
Light remainder warning buzzer shows no sounding	● "TAIL" fuse blown	Replace fuse to check for short
	● Buzzer faulty	Replace buzzer
	● Wiring or grounding faulty	Repair
	● Driver side door switch faulty	Replace door switch

SEAT BELT WARNING LIGHT (IF EQUIPPED)

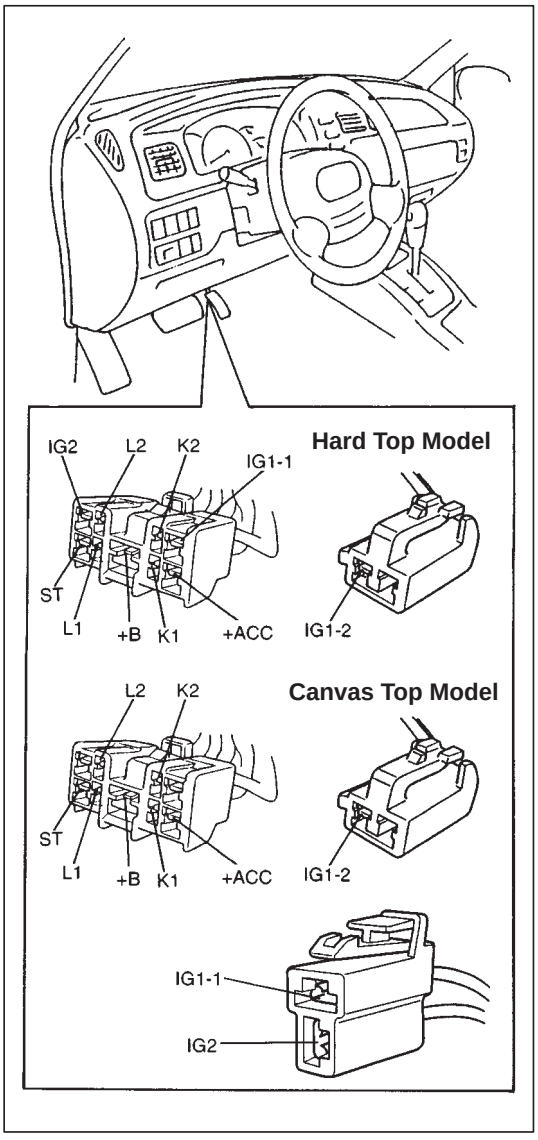
Trouble	Possible Cause	Correction
Seat belt warning light does not light up	● Bulb in combination meter blown	Replace bulb
	● "IG/METER" fuse blown (Hard Top Model) "IG" fuse blown (Canvas Top Model)	Replace fuse to check for short
	● Seat belt switch faulty	Replace seat belt switch
	● Wiring or grounding faulty	Repair

IGNITION KEY REMAINDER WARNING BUZZER (IF EQUIPPED)

Trouble	Possible Cause	Correction
Ignition key remainder warning buzzer shows no sounding	● "DOME" fuse blown (Hard Top Model) "DOM" fuse blown (Canvas Top Model)	Replace fuse to check for short
	● Buzzer faulty	Replace buzzer
	● Wiring or grounding faulty	Repair
	● Driver side door switch faulty	Replace door switch
	● Ignition key switch faulty	Replace ignition key switch

CIGARETTE LIGHTER AND ACCESSORY SOCKET

Trouble	Possible Cause	Correction
Cigarette lighter/ accessory socket shows no operation	● "CIGAR" fuse blown (Hard Top Model) "CIG" fuse blown (Canvas Top Model)	Replace fuse to check for short
	● Ignition switch faulty	Replace ignition switch
	● Cigarette lighter/accessory socket faulty	Replace cigarette lighter/accessory socket
	● Wiring or grounding faulty	Repair



ON-VEHICLE SERVICE

IGNITION (MAIN) SWITCH

INSPECTION

1) Disconnect negative cable at battery.
2) Disable air bag system. Refer to DISABLING AIR BAG SYSTEM in Section 10B of this manual.
3) Disconnect main switch lead wire coupler.
4) Check for continuity between terminals at each switch position shown below. If check result is not as specified, replace ignition (main) switch.

Terminal / Wire color		+B	+ACC	IG1-1	IG1-2	IG2	ST	L1	L2	K1	K2
Key / Position		W/Y	Bl	B/W	B/W	Y/B	B/Y	B	B	G	G
OUT											
IN	LOCK	○								○	○
	ACC	○	○								
	ON	○	○	○	○	○					
	START	○		○	○		○	○	○		

REMOVAL

1) Disconnect negative cable at battery.
2) Disable air bag system. Refer to DISABLING AIR BAG SYSTEM in Section 10B of this manual.
3) Remove steering column referring to Section 3C1 of this manual. Then remove steering lock/ignition (main) switch from steering column.

INSTALLATION

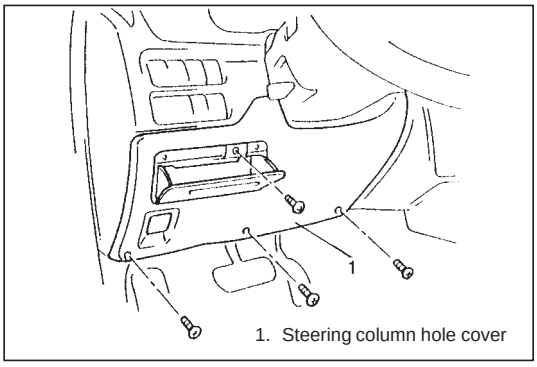
1) Install steering lock/ignition (main) switch to steering column. Install steering column assembly referring to Section 3C1 of this manual.
2) Enable air bag system. Refer to ENABLING AIR BAG SYSTEM in Section 10B of this manual.

NOTE:
When installing steering column, special care must be taken for tightening sequence and its torque.

COMBINATION METER

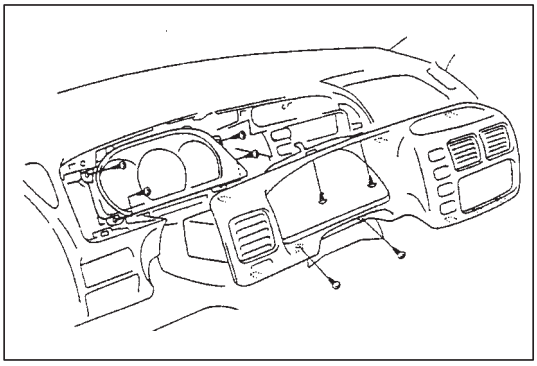
REMOVAL

1) Disconnect negative cable at battery.
2) If the vehicle is equipped with air bag system, disable air bag system. Refer to DISABLING AIR BAG SYSTEM in Section 10B of this manual.

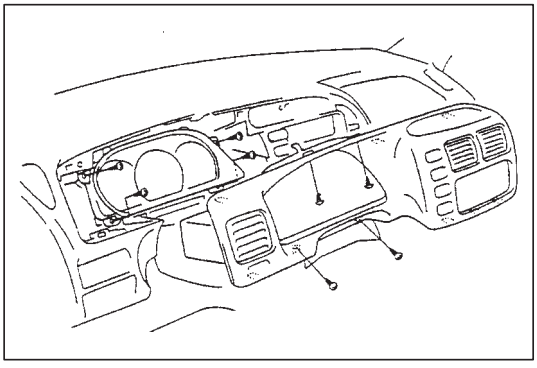


1. Steering column hole cover

3) Remove column hole cover.



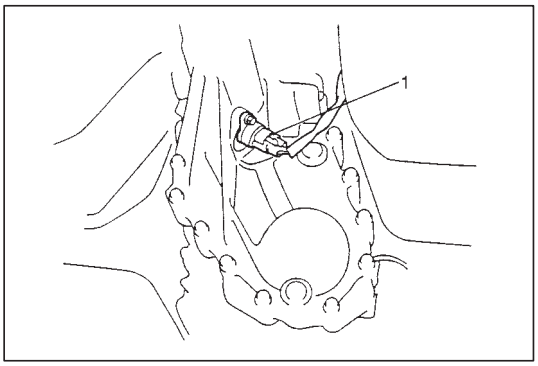
4) Remove instrument cluster panel.
5) Remove screws fastening combination meter.
6) Disconnect couplers from combination meter.
7) Remove combination meter from instrument panel.



INSTALLATION

Reverse removal procedure for installation, noting the following.

- If the vehicle is equipped with air bag system, be sure to enable air bag system after installation. Refer to ENABLING AIR BAG SYSTEM in Section 10B of this manual for details.

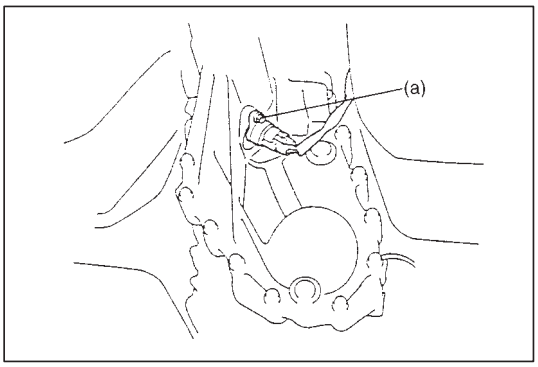


SPEEDOMETER AND VSS

VEHICLE SPEED SENSOR (VSS)

REMOVAL

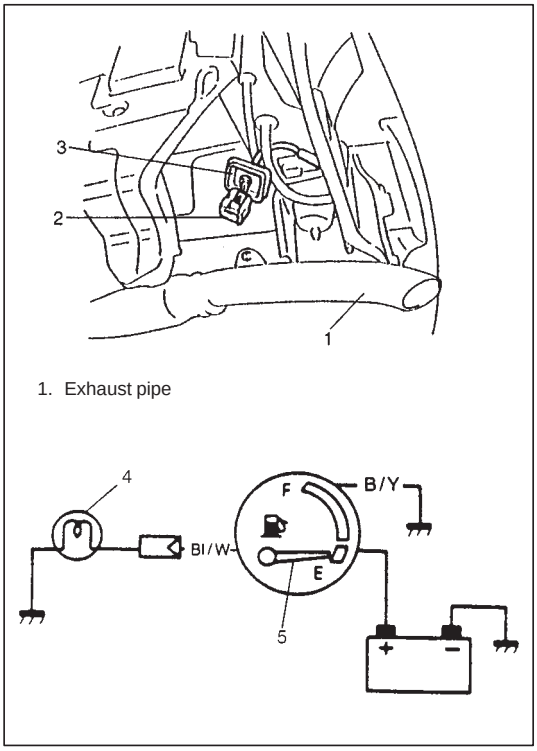
1) Hoist vehicle.
2) Disconnect coupler from VSS (1).
3) Remove VSS.



INSTALLATION

Reverse removal procedure for installation.

Tightening Torque
(a): 5.5 N·m (0.55 kg-m, 4.0 lb-ft)



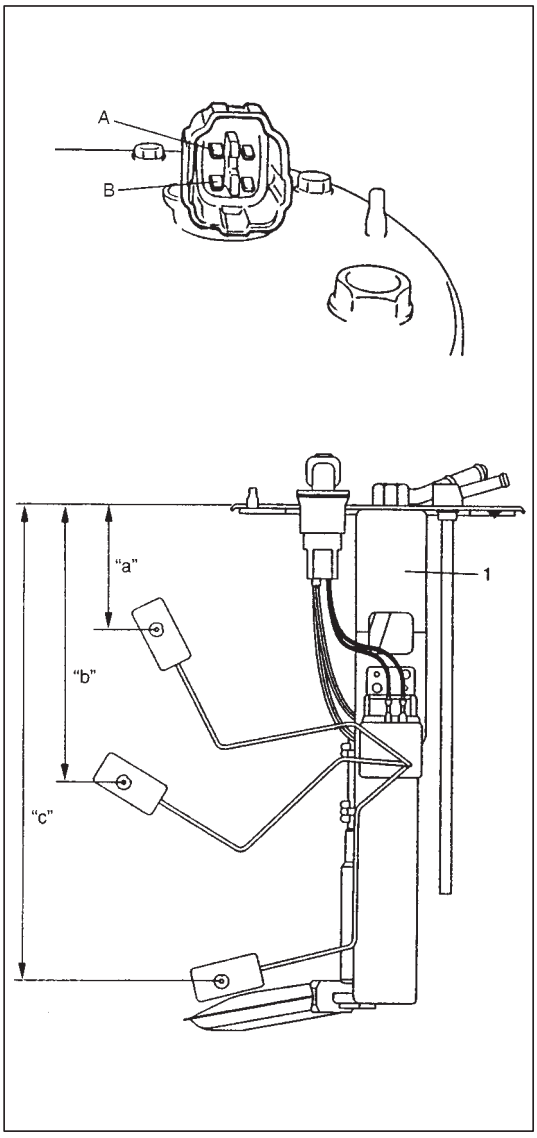
1. Exhaust pipe

FUEL METER/FUEL GAUGE UNIT

FUEL METER

INSPECTION

1) Remove rear bumper facing.
2) Detach grommet (3) from vehicle.
3) Disconnect coupler (2) of fuel pump and gauge.
4) Turning switch ON, and check that fuel meter indicates E.
5) Turn ignition switch OFF.
6) Ground Bl/W lead through a 3.4 W test bulb (4) as illustrated.
7) Turn ignition switch ON and check that bulb light up and pointer (5) moves to F side.
8) If fuel meter shows no operation, repair or replace defective parts.



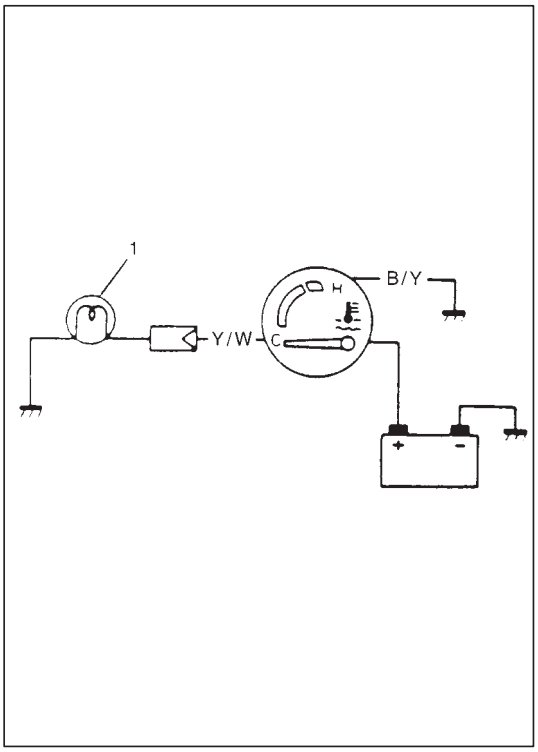
FUEL SENDER GAUGE

INSPECTION

1) Remove fuel pump assembly (1) referring to FUEL PUMP REMOVAL in Section 6C.
2) Check resistance between terminals (A) and (B) under each float position.

Float Position			Fuel Meter	Resistance (Ω)
	56 ℓ model	66 ℓ model		
"a"	88.3 mm (3.48 in.)	51.7 mm (2.04 in.)	F	6 – 8
"b"	157.2 mm (6.20 in.)	139.6 mm (5.50 in.)	1/2	29.5 – 35.5
"c"	254.9 mm (10.0 in.)	254.9 mm (10.0 in.)	E	94 – 96

If measured valve is out of specification, replace fuel sender gauge.

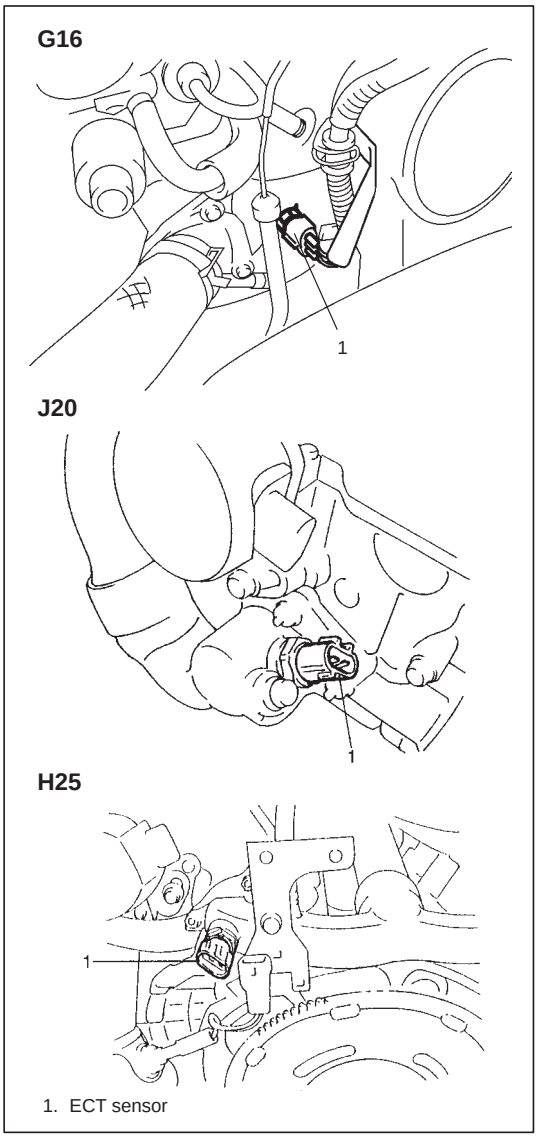


ENGINE COOLANT TEMP. (ECT) METER AND SENSOR

ENGINE COOLANT TEMPERATURE (ECT) METER

INSPECTION

1) Disconnect Y/W lead wire going to ECT sensor.
2) Turn ignition switch ON, and check that ECT meter indicates COOL.
3) Turn ignition switch OFF.
4) Ground Y/W lead wire through a 3.4 W test bulb (1) as illustrated.
5) Turn ignition switch ON, and check that bulb light up and pointer (2) moves to hot side.
6) If ECT meter shows no operation, repair or replace defective parts.

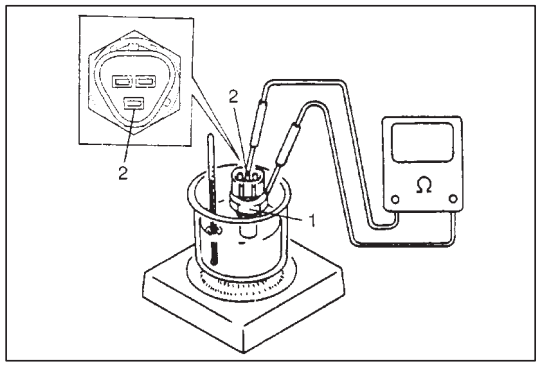


1. ECT sensor

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

REMOVAL AND INSTALLATION

Refer to ECT SENSOR in ON-VEHICLE SERVICE in Section 6E1 (for G16 and J20) or Section 6E2 (for H25) of this manual for details.



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, replace sensor.

Temperature	Resistance
50°C (122°F)	136 – 216 Ω

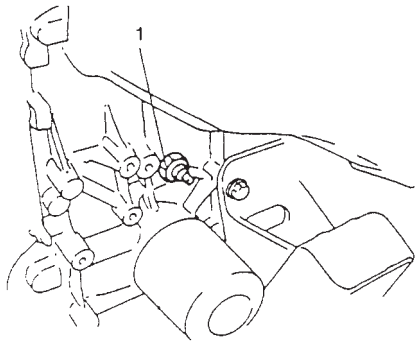
OIL PRESSURE LIGHT

OIL PRESSURE SWITCH

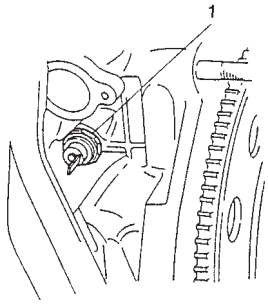
REMOVAL AND INSTALLATION

Refer to OIL PRESSURE CHECK in Section 6A1 (for G16), Section 6A2 (for H25), and Section 6A4 (for J20) of this manual for details.

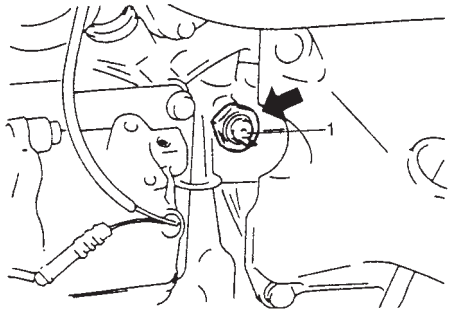
G16



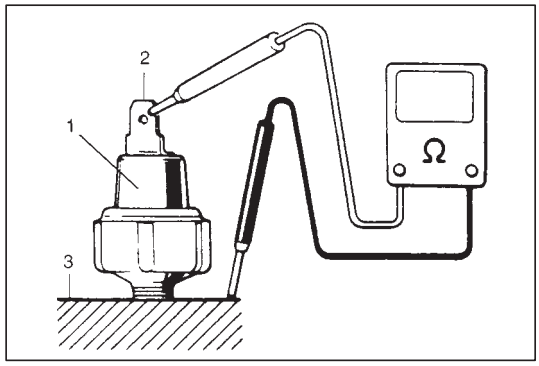
J20



H25



1. Oil pressure switch

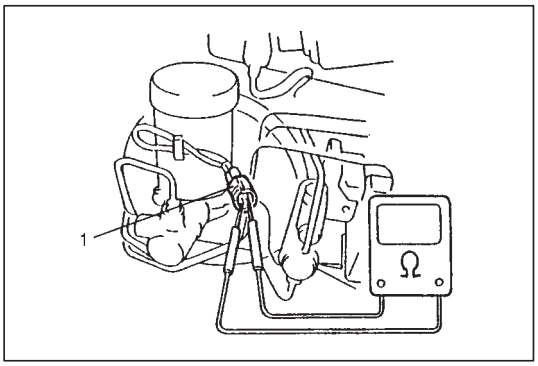


INSPECTION

1) Disconnect oil pressure switch (1) lead wire.
2) Check for continuity between 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 oil pressure switch (1).



BRAKE AND PARKING BRAKE WARNING LIGHT

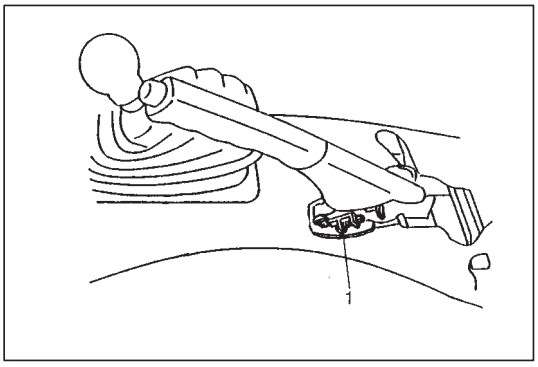
BRAKE FLUID LEVEL SWITCH

INSPECTION

Check switch (1) for continuity.

If check result is not as specified, replace switch (reservoir).

OFF position (float up)	No continuity
ON position (float down)	Continuity



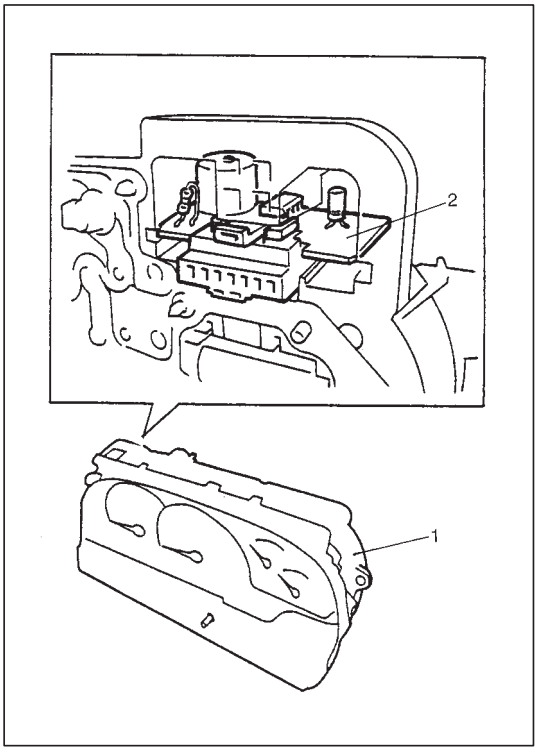
PARKING BRAKE SWITCH

INSPECTION

Check switch (1) for continuity.

If check result is not as specified, replace switch.

OFF position (parking brake lever released)	No continuity
ON position (parking brake lever pulled up)	Continuity



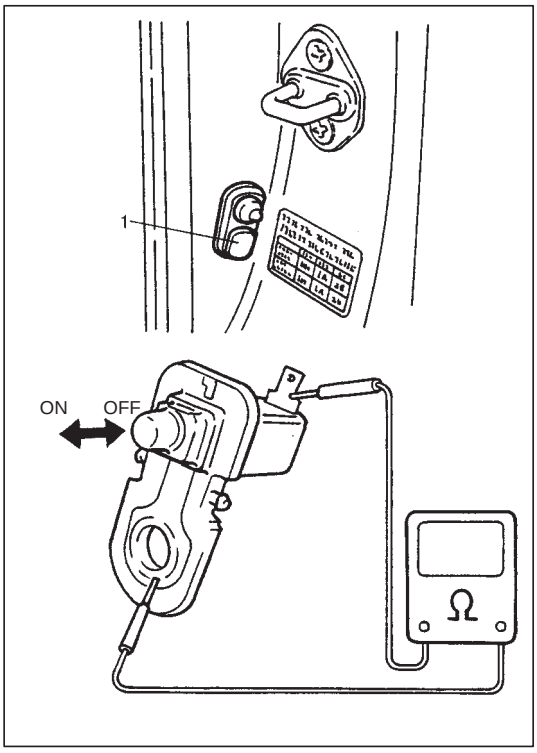
IGNITION KEY REMAINDER (IF EQUIPPED)/ LIGHT REMAINDER WARNING BUZZER

REMOVAL

1) Remove combination meter (1). Refer to COMBINATION METER in this section.
2) Remove buzzer unit (2) from combination meter.

INSTALLATION

Reverse removal procedure for installation.

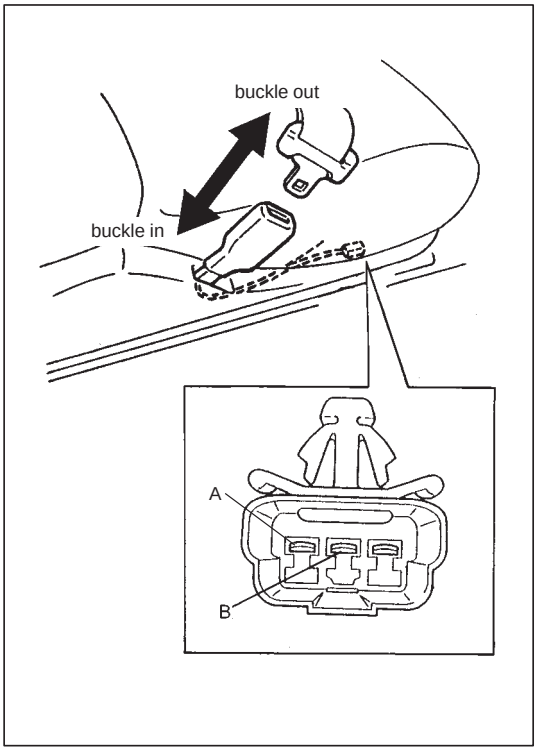


DOOR SWITCH

INSPECTION

Remove door switch (1) from body and check switch for continuity. If found defective, replace switch.

OFF position (Door closed)	No continuity
ON position (Door open)	Continuity



SEAT BELT WARNING LIGHT (IF EQUIPPED)

SEAT BELT BUCKLE SWITCH

INSPECTION

Check for continuity between seat belt buckle switch terminal A and B at following condition.

Buckle out (seat belt not fastened): Continuity
Buckle in (seat belt fastened): No Continuity

If seat belt buckle switch does not follow the above condition, replace seat belt buckle switch.

SECTION 8D

WINDOWS, MIRRORS, SECURITY AND LOCKS

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

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

CONTENTS

GENERAL DESCRIPTION 8D- 2
Cautions in Servicing 8D- 2
Symbols and Marks 8D- 2
Wiring Color Symbols 8D- 2
Abbreviations 8D- 2
Joint Connector 8D- 2
Fuse Box and Relay 8D- 2
Power Supply Diagram 8D- 2
Windshield Wiper and Washer 8D- 2
Front Wiper and Washer 8D- 2
Rear Wiper and Washer (If Equipped) . 8D- 3
Power Door Lock and Keyless Entry (If Equipped) System 8D- 4
DIAGNOSIS 8D- 5
Windshield Wiper and Washer 8D- 5
Front Wiper and Washer 8D- 5
Rear Wiper and Washer (If Equipped) . 8D- 5
Rear Window Defogger (If Equipped) . . . 8D- 5
Power Window Control System 8D- 5
Power Door Lock System (If Keyless Entry is not Equipped) 8D- 6
Power Door Lock and Keyless Entry System (If Keyless Entry is Equipped) . . 8D- 7
Power Door Mirror Control System 8D- 8
Door Mirror Heater (If Equipped) 8D- 8
Power Sliding Roof (If Equipped) 8D- 8
Front Seat Heater (If Equipped) 8D- 8
ON-VEHICLE SERVICE 8D- 9
Windshield Wiper and Washer 8D- 9
Front Wiper and Washer 8D- 9
Rear Wiper and Washer (If Equipped) . 8D-13
Rear Window Defogger (If Equipped) . . . 8D-16
Power Window Control System 8D-18
Power Door Lock System (If Keyless Entry is not Equipped) 8D-20
Power Door Lock and Keyless Entry System (If Keyless Entry is Equipped) . . 8D-23
Power Door Mirror Control System 8D-30
Door Mirror Heater (If Equipped) 8D-31
Power Sliding Roof (If Equipped) 8D-32
Front Seat Heater (If Equipped) 8D-33

GENERAL DESCRIPTION

CAUTIONS IN SERVICING

Refer to Section 8.

SYMBOLS AND MARKS

Refer to Section 8.

WIRING COLOR SYMBOLS

Refer to Section 8.

ABBREVIATIONS

Refer to Section 8.

JOINT CONNECTOR

Refer to Section 8.

FUSE BOX AND RELAY

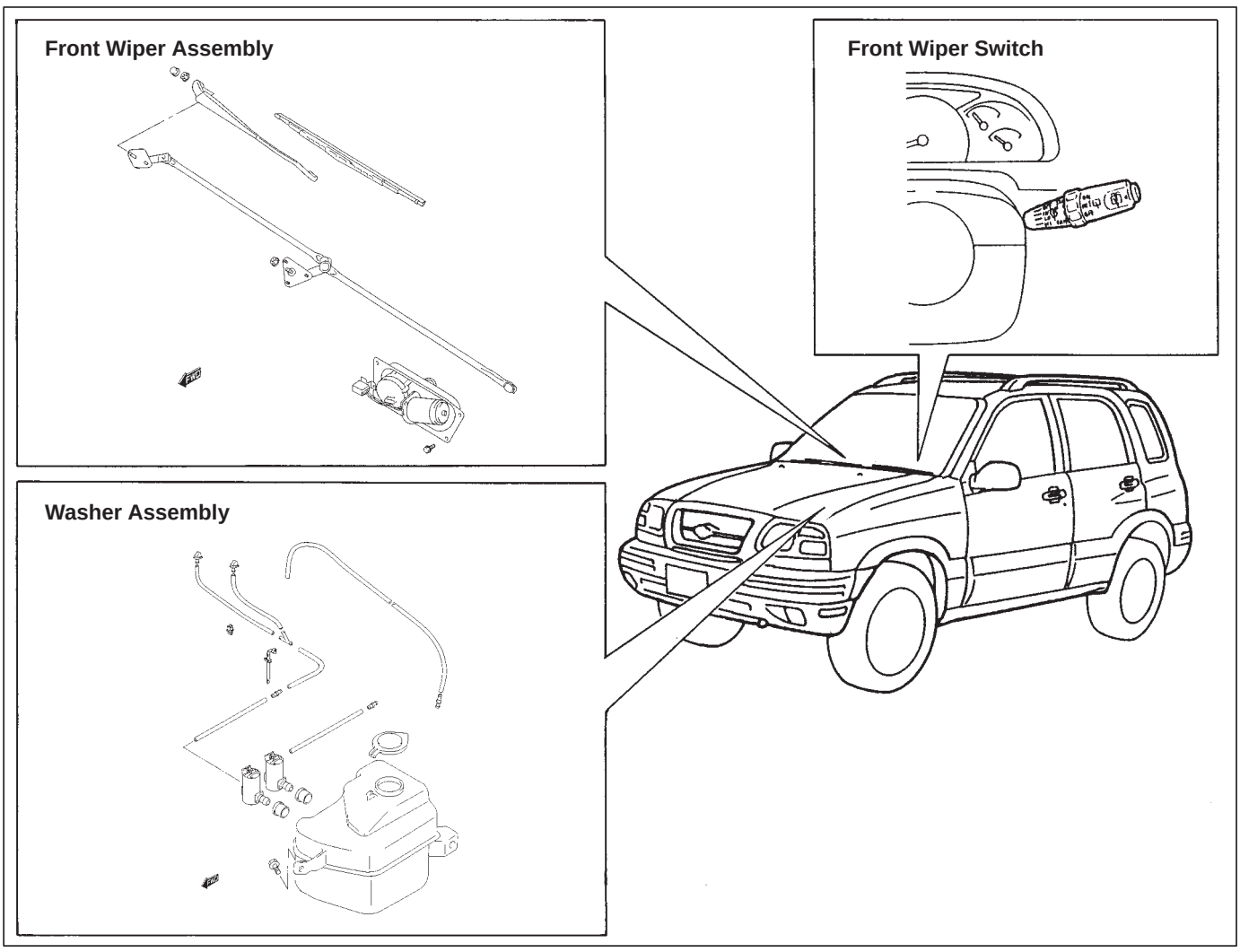
Refer to Section 8.

POWER SUPPLY DIAGRAM

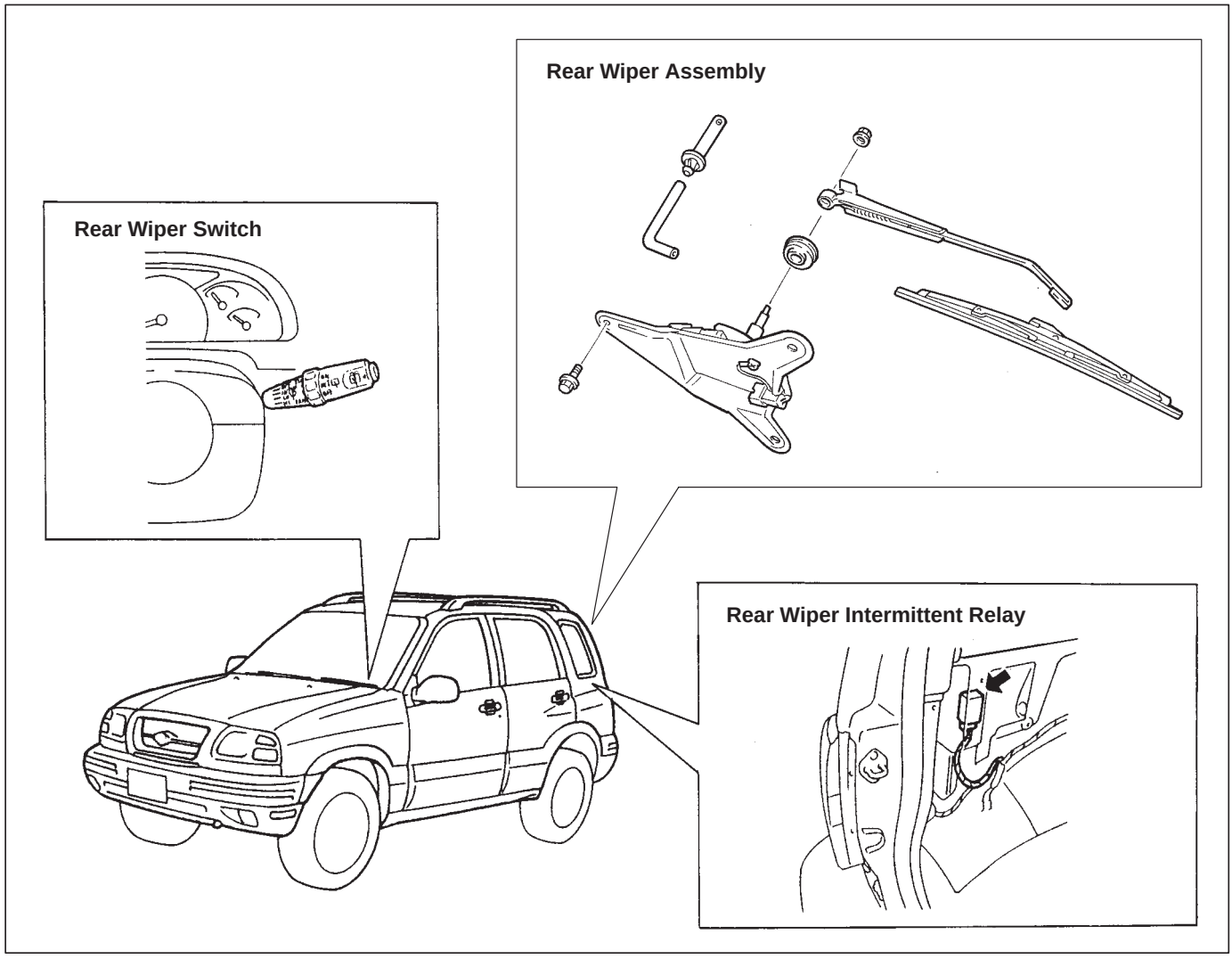
Refer to Section 8.

WINDSHIELD WIPER AND WASHER

FRONT WIPER AND WASHER

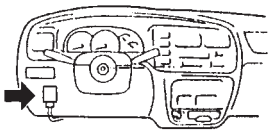


REAR WIPER AND WASHER (IF EQUIPPED)



POWER DOOR LOCK AND KEYLESS ENTRY (IF EQUIPPED) SYSTEM

Power Door Lock and Keyless Entry (if equipped) Controller (Hard Top Model)

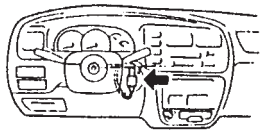


The illustration shows LH steering vehicle.
And RH steering vehicle is symmetrical.

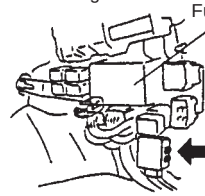
Keyless Entry Transmitter (If keyless entry is equipped)

Power Door Lock Controller (Canvas Top Model)

LH steering vehicle

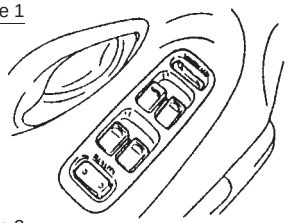


RH steering vehicle

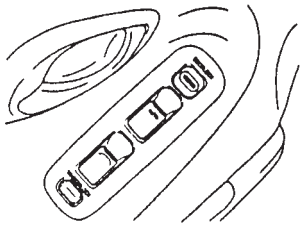


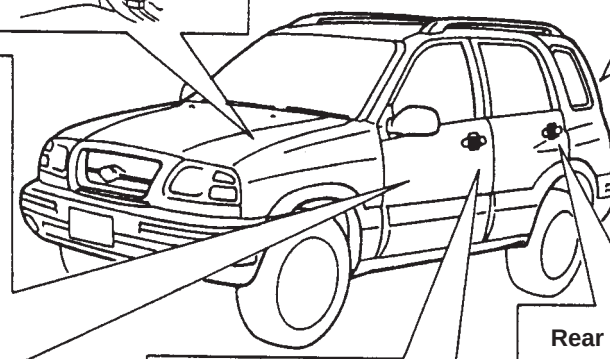
Power Door Lock Switch

Type 1



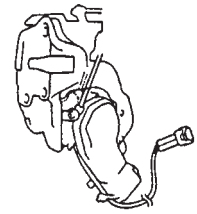
Type 2



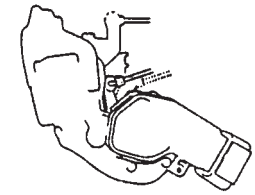


Back Door Actuator (except Canvas Top Model)

Front Door Actuator



Rear Door Actuator



DIAGNOSIS

NOTE:
Fuse name (“ ”) in the table below is shown on the fuse box cover (Hard Top Model) or the junction box (Canvas Top Model).

WINDSHIELD WIPER AND WASHER

FRONT WIPER AND WASHER

REAR WIPER AND WASHER (IF EQUIPPED)

Trouble	Possible cause	Correction
Wiper malfunctions	● “WIPER/WASHER” fuse blown (Hard Top Model) “WIP” fuse blown (Canvas Top Model)	Replace fuse to check for short
	● Wiper motor faulty	Replace motor
	● Wiper switch faulty	Replace switch
	● Wiring or grounding faulty	Repair
Washer malfunctions	● Washer hose or nozzle clogged	Clean or repair clogged hose or nozzle
	● “WIPER/WASHER” fuse blown (Hard Top Model) “WIP” fuse blown (Canvas Top Model)	Replace fuse to check for short
	● Washer motor faulty	Replace motor
	● Washer switch faulty	Replace switch
	● Wiring faulty	Repair

REAR WINDOW DEFOGGER (IF EQUIPPED)

Trouble	Possible cause	Correction
Defogger does not work	● “REAR DEFG” fuse blown	Replace fuse to check for short
	● Defogger switch faulty	Replace switch
	● Defogger heat wire faulty	Repair heat wire
	● Wiring or grounding faulty	Repair

POWER WINDOW CONTROL SYSTEM

Trouble	Possible cause	Correction
All power windows do not operate	● “POWER WINDOW” fuse blown (Hard Top Model) “P/W” fuse blown (Canvas Top Model)	Replace fuse to check for short
	● Ignition switch faulty	Replace switch
	● Wiring or grounding faulty	Repair
Only one power window does not operate	● Power window switch (main or sub) faulty	Replace switch
	● Power window motor faulty	Replace motor
	● Window lock switch faulty	Replace switch
	● Wiring or grounding faulty	Repair

POWER DOOR LOCK SYSTEM (IF KEYLESS ENTRY IS NOT EQUIPPED)

Trouble	Possible cause	Correction
All power doors are not locked/unlocked by both driver side door key switch and power door lock switch	● "DOOR LOCK" fuse blown (Hard Top Model) "D/L" fuse blown (Canvas Top Model) ● Power door controller faulty ● Wiring or grounding faulty	Replace fuse to check for short Replace controller Repair
All power doors are not locked/unlocked by only power door lock switch	● Power door lock switch faulty ● Wiring or grounding faulty	Replace switch Repair
All power doors are not locked/unlocked by only driver side door key switch	● Driver side door key switch faulty ● Wiring or grounding faulty	Replace switch Repair
Only one power door is not locked/unlocked	● Wiring or coupler faulty ● Actuator (door lock motor) faulty	Repair Replace actuator

POWER DOOR LOCK AND KEYLESS ENTRY SYSTEM (IF KEYLESS ENTRY IS EQUIPPED)

Trouble	Possible cause	Correction
● All power doors are not locked/unlocked by both driver side door key switch and power door lock switch. But all power doors are locked/unlocked by keyless entry transmitter **● All power doors are not locked/unlocked by driver side door key switch, power door lock switch and keyless entry transmitter** **● When power doors are locked/unlocked by keyless entry transmitter, hazard warning lights do not flash**	● "DOOR LOCK" fuse blown ● Power door lock and keyless entry system faulty	Replace fuse to check for short Refer to SYSTEM INSPECTION of POWER DOOR LOCK AND KEYLESS ENTRY SYSTEM (IF KEYLESS ENTRY IS EQUIPPED) in this section
All power doors are not locked/unlocked by only power door lock switch	● Power door lock switch faulty ● Wiring or grounding faulty	Replace switch Repair
All power doors are not locked/unlocked by only driver side door key switch	● Driver side door key switch faulty ● Wiring or grounding faulty	Replace switch Repair
All power doors are not locked/unlocked by only keyless entry transmitter	● Code registration error ● Transmitter battery dead ● Transmitter faulty ● Power door lock and keyless entry system faulty	Register code Replace battery Replace transmitter Refer to SYSTEM INSPECTION of POWER DOOR LOCK AND KEYLESS ENTRY SYSTEM (IF KEYLESS ENTRY IS EQUIPPED) in this section
Although any door is opened within 30 seconds after power door(s) unlocked by keyless entry transmitter, all power doors are locked again automatically	● Door switch faulty ● Wiring harness connected to door switch brakes	Replace switch Repair
Only one power door is not locked/unlocked	● Wiring or coupler faulty ● Actuator (door lock motor) faulty	Repair Replace actuator
Operation distance of keyless entry is unstable	● Transmitter battery dead ● Transmitter faulty	Replace battery Replace transmitter

POWER DOOR MIRROR CONTROL SYSTEM

Trouble	Possible cause	Correction
All power mirrors do not operate	● "CIGAR" fuse blown (Hard Top Model) "CIG" fuse blown (Canvas Top Model) ● Power door mirror switch faulty ● Wiring or grounding faulty	Replace fuse to check for short Replace switch Repair
One power mirror does not operate	● Power door mirror switch faulty ● Actuator (power door mirror motor) faulty ● Wiring or grounding faulty	Replace switch Replace actuator Repair

DOOR MIRROR HEATER (IF EQUIPPED)

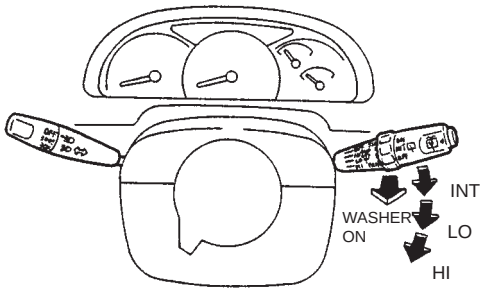
Trouble	Possible cause	Correction
The surface of mirror is not defrosted although door mirror heater switch is ON	● "REAR DEFG" fuse blown (Hard Top Model) "DEF" fuse blown (Canvas Top Model) ● Door mirror heater switch faulty ● Door mirror heater faulty ● Wiring or grounding faulty	Replace fuse to check for short Replace switch Replace outside mirror Repair

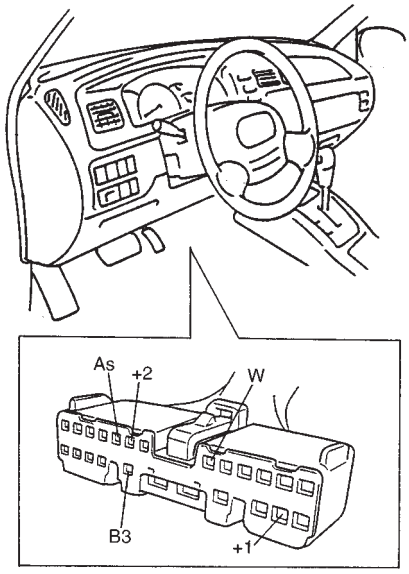
POWER SLIDING ROOF (IF EQUIPPED)

Trouble	Possible cause	Correction
Sliding roof does not operate (sliding roof motor runs OK)	● Foreign object stuck in sliding roof rail ● Misinstallation of sliding roof rail ● Conflicts of sliding roof parts ● Misinstallation of sliding roof drive cable	Remove or clean stuck object Install correctly Fix conflicts Install correctly
Sliding roof does not operate (sliding roof motor does not run)	● "SUN ROOF" fuse blown ● Sliding roof switch faulty ● Sliding roof motor ass'y faulty ● Wiring or grounding faulty	Replace fuse to check for short Replace switch Replace motor Repair

FRONT SEAT HEATER (IF EQUIPPED)

Trouble	Possible cause	Correction
Both seat back and cushion do not become hot although seat heater switch is LO/HI position	● "SEAT HTR" fuse blown (Hard Top Model) "S/H" fuse blown (Canvas Top Model) ● Seat heater switch faulty ● Seat heater circuit in seat back and/or seat cushion faulty ● Wiring or grounding faulty	Replace fuse to check for short Replace switch Replace heater front back and/or heater front cushion Repair
Only seat back does not become hot although seat heater switch is HI position	● Seat heater circuit in seat back faulty (Hard Top Model) ● Seat heater circuit in seat back and/or seat cushion faulty (Canvas Top Model) ● Seat heater switch faulty ● Wiring faulty	Replace heater front back Replace heater front back and/or heater front cushion Replace switch Repair
Only seat cushion does not become hot although seat heater switch is HI position	● Seat heater circuit in seat back and/or seat cushion faulty (Hard Top Model) ● Seat heater circuit in seat cushion (Canvas Top Model) ● Seat heater switch faulty ● Wiring faulty	Replace heater front back and/or heater front cushion Replace heater front cushion Replace switch Repair





ON-VEHICLE SERVICE

WINDSHIELD WIPER AND WASHER

FRONT WIPER AND WASHER

INSPECTION

Front Wiper and Washer Switch (in Combination Switch)

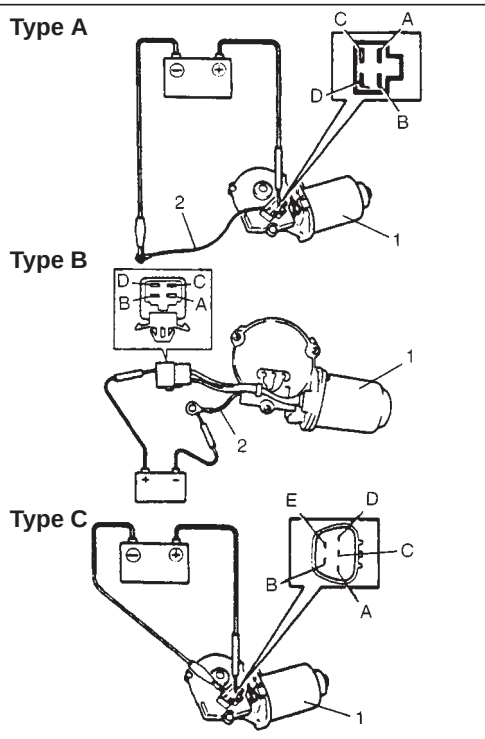
1) Disconnect negative cable at battery.
2) Disconnect combination switch lead wire coupler.
3) Check for continuity between terminals at each switch position as shown below. If check result is not as specified, replace switch.

Wiper SW \ Terminal	B3	+2	+1	As
OFF			○—○	
INT			○—○	
LO	○—	——	—○	
HI	○—	—○		

Wiper SW \ Terminal	B3	W
OFF		
ON	○—	—○

REMOVAL AND INSTALLATION

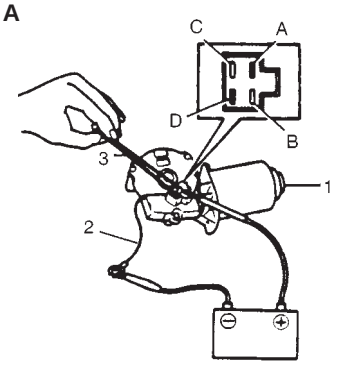
For vehicle without air bag system, refer to Section 3C COMBINATION SWITCH, and for vehicle with air bag system, refer to Section 3C1 CONTACT COIL AND COMBINATION SWITCH ASSEMBLY.



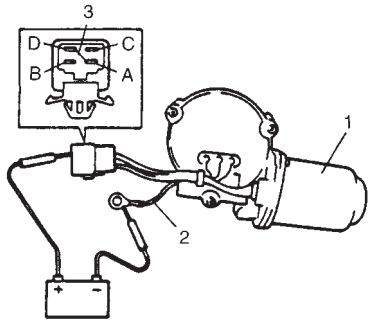
Wiper Motor

1) As illustrated, use a 12 V battery to connect its (+) terminal to terminal “A”, and its (–) terminal to Black lead wire (2) (Type A, B) or terminal “E” (Type C).
   If motor (1) rotates at a low revolution speed of 45 to 55 rpm, it is proper. For high speed check, connect battery (+) terminal to terminal “B”, and its (–) terminal to Black lead wire (2) (Type A, B) or terminal “E” (Type C). If motor rotates at a high revolution speed of 67 to 83 rpm, it is proper.

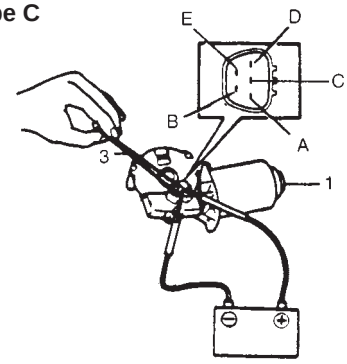
Type A



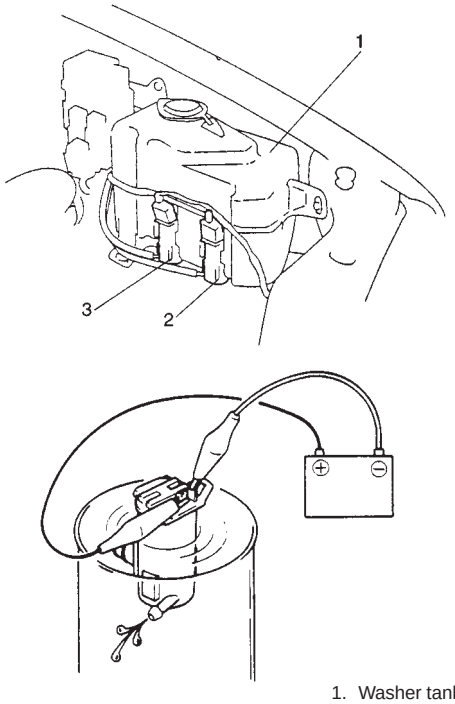
Type B



Type C



2) Testing automatic stop action.
   a) Connect 12 V battery (+) terminal to terminal "A" of wiper motor (1) and (–) terminal to Black lead wire (2) (Type A, B) or terminal "E" (Type C), and let the motor turn.
   b) Disconnect terminal "A" from battery, and let the motor stop.
   c) Connect terminal "A" and "D" with a jumper wire (3), and connect terminal "C" to battery (+) terminal. Observe the motor turns once again then stops at a given position.
   d) Repeat a) thru c) several times and inspect if the motor stops at the given position every time.



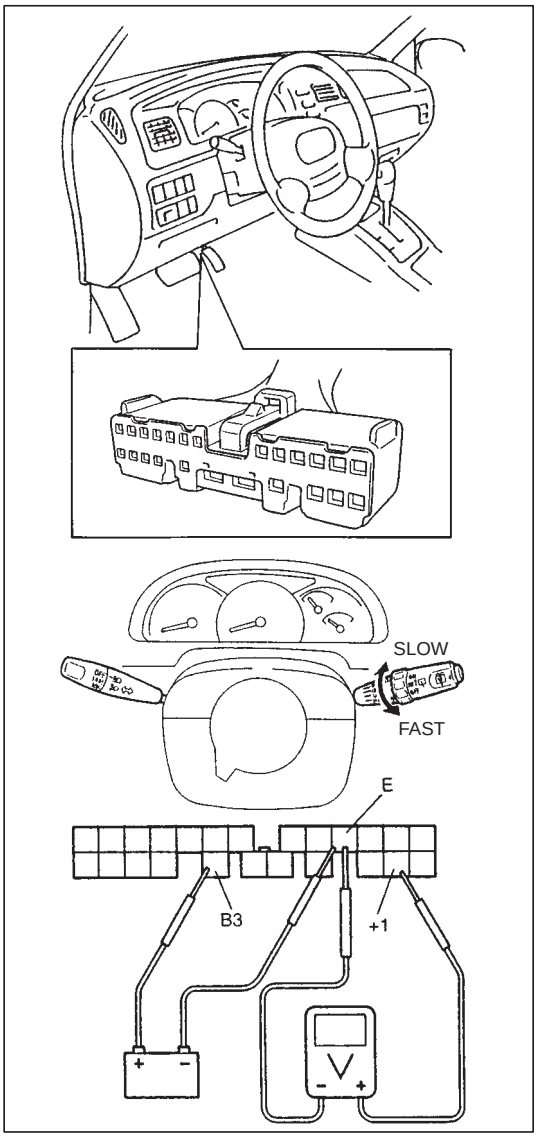
1. Washer tank

Washer Pump

Connect battery (+) and (–) terminals to pump (+) and (–) terminals respectively to check pumping rate.
Check for both front (3) and rear (2) (if equipped) washer pump.

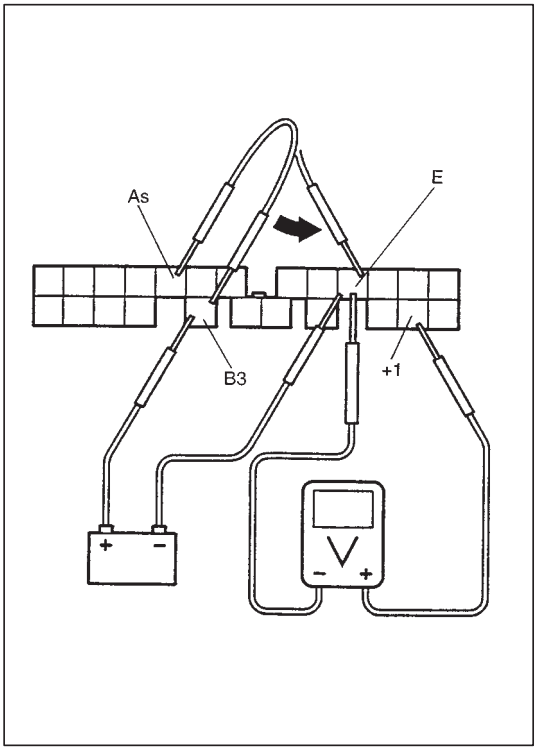
Pumping Rate:

Front and Rear (if equipped)	**more than 1.0 l/min. (2.1 US pt./min., 1.76 lmp pt./min.).**

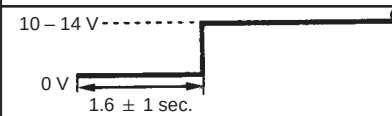
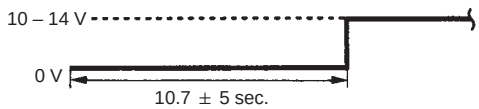


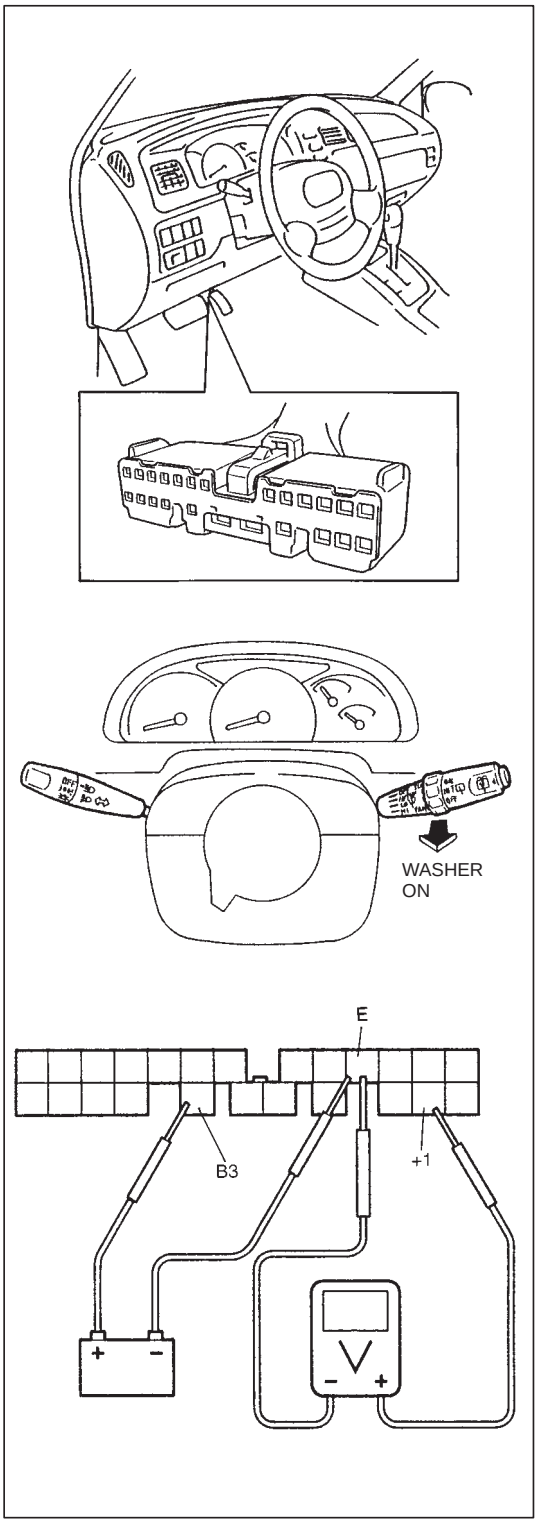
Intermittent Wiper Relay Circuit

1) Disconnect negative cable at battery.
2) Disconnect combination switch lead wire coupler.
3) Turn the front wiper switch to INT position.
4) Turn the intermittent time control switch to FAST position.
5) Connect battery positive terminal to terminal “B3” and battery negative terminal to terminal “E”.
6) Connect voltmeter positive lead to terminal “+1” and negative lead to terminal “E”.
   Check that the voltmeter indicates the battery voltage (10 – 14 V).



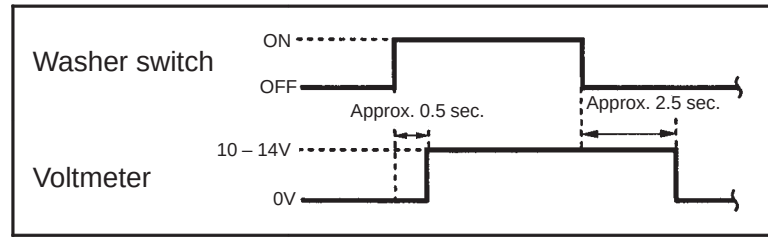
7) Connect terminal “As” and terminal “B3” by a jumper wire. Then move jumper wire end connected to terminal “B3” to terminal “E”. Observe the voltmeter voltage drops to 0 V right after connecting the jumper wire from terminal “B3” to “E”. Then the voltage rises to battery voltage (10 – 14 V) within the time shown in the table below.

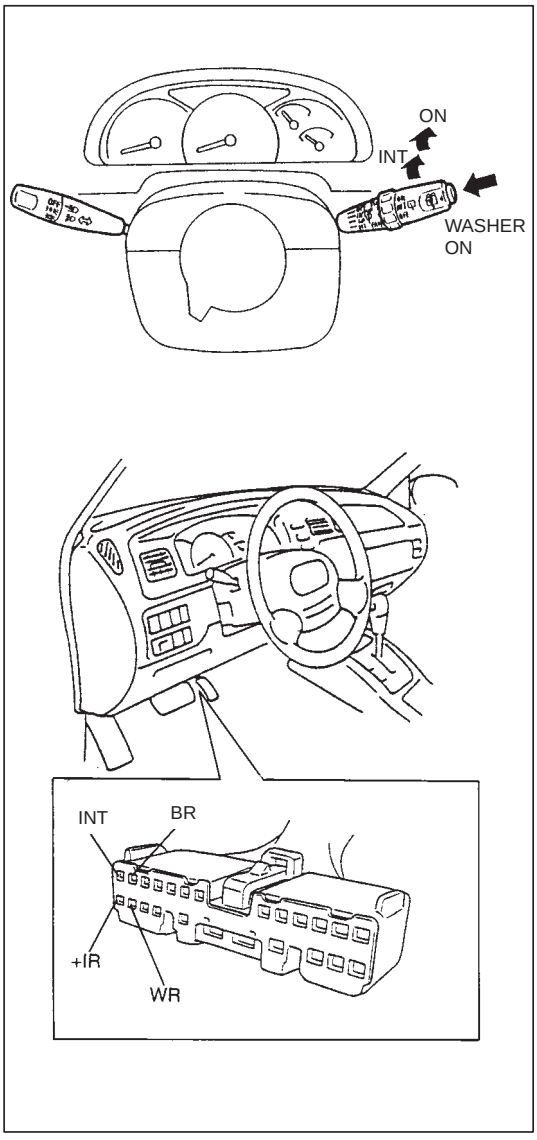
INT time control switch position	Voltage
FAST	
SLOW	



Washer Linked Operation

1) Disconnect negative cable at battery.
2) Disconnect combination switch lead wire coupler.
3) Make sure that front wiper switch is at OFF position.
4) Connect battery positive terminal to terminal “B3” and battery negative terminal to terminal “E”.
5) Connect voltmeter positive lead to terminal “+1” and negative lead to terminal “E”.
6) Pull washer switch and check that voltage changes as shown in the table.





REAR WIPER AND WASHER (IF EQUIPPED)

INSPECTION

Rear Wiper and Washer Switch (in Combination Switch)

1) Disconnect negative cable at battery.
2) Disconnect combination switch lead wire coupler.
3) Check for continuity between terminals at each switch position as shown below. If check result is not as specified, replace switch.

Rear Wiper Switch

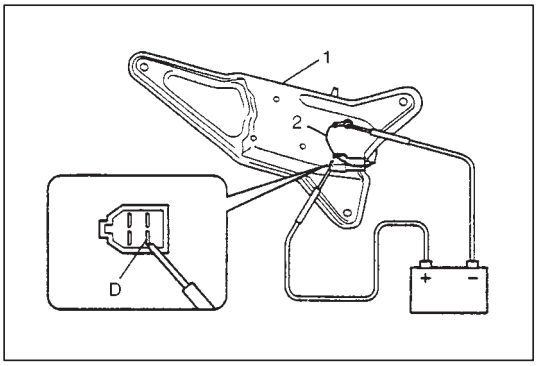
Switch \ Terminal	BR	INT	+IR
OFF			
INT	○	○	
ON	○		○

Rear Washer Switch

Switch \ Terminal	BR	WR
OFF		
ON	○	○

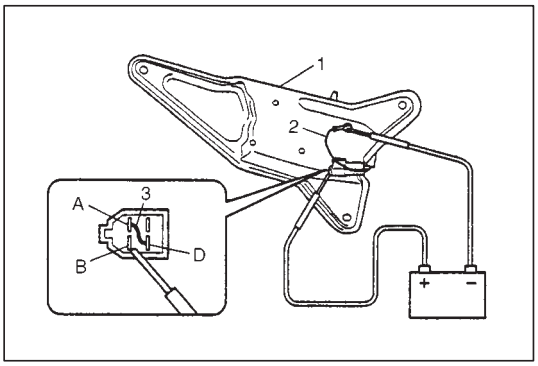
Washer Pump

Refer to FRONT WIPER AND WASHER INSPECTION in this section.

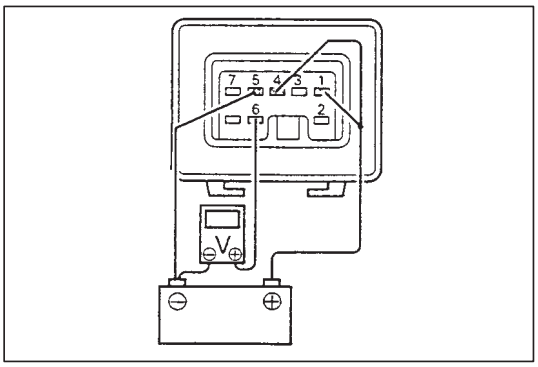


Wiper Motor

1) TESTING WIPER MOTOR
   As shown left, use a 12 V battery to connect its (+) and (–) terminals to terminal “D” and Black lead wire (2) respectively. Then motor (1) should rotate at 35 to 45 rpm.



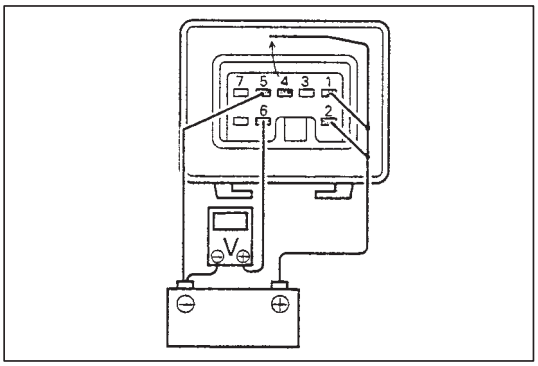
2) TESTING AUTOMATIC STOP ACTION
   a) First, connect battery (+) terminal to terminal “D” and battery (–) terminal to black lead wire (2) and let the motor (1) turn.
   b) Then disconnect terminal “D” from battery and let the motor stop.
   c) Next connect terminal “D” and terminal “A” with a jumper wire (3) and connect terminal “B” to battery (+) terminal. Observe the wiper motor turns once again, then stops at a given position.
   d) Repeat these steps several times, and inspect if the motor stops at the given position every time.



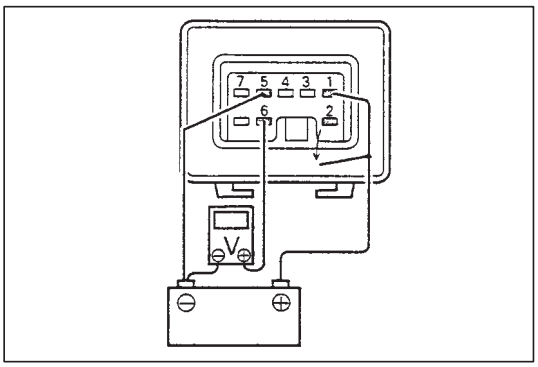
Rear Wiper Intermittent Relay

[ON circuit]

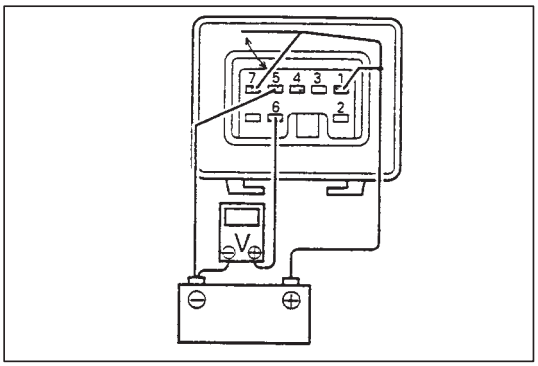
1) Connect positive terminal of battery to terminals “1” and “4” of relay, negative terminal to terminal “5” of relay and check voltage between terminals “6” and “5” of relay.
   If measured voltage is battery voltage, relay is in good condition.
   If not, replace relay.



2) Connect positive terminal of battery to terminal “2” of relay, then disconnect positive terminal from terminal “4” of relay and check voltage between terminals “6” and “5” of relay.
   If measured voltage is battery voltage, relay is in good condition.
   If not, replace relay.

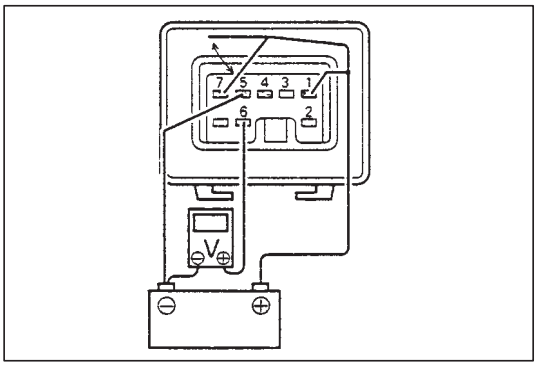


3) Disconnect positive terminal from terminal “2” of relay and check voltage between terminals “6” and “5” of relay.
   If measured voltage is about 0 V, relay is in good condition.
   If not, replace relay.

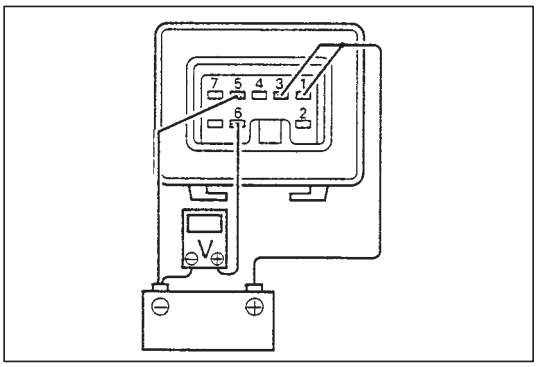


[WASH circuit]

1) Connect positive terminal of battery to terminal “1” of relay and negative terminal to terminal “5” of relay. Then connect positive terminal to terminal “7” checking voltage between terminals “6” and “5” of relay.
   If measured voltage changes from about 0 V to battery voltage 0.6 to 1.5 seconds after connecting positive terminal to terminal “7”, relay is in good condition. If not, replace relay.

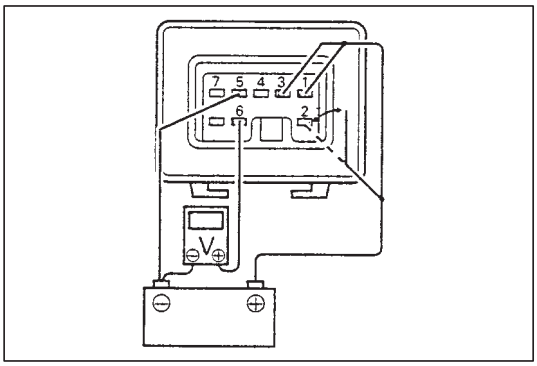


2) Disconnect positive terminal from terminal “7” checking voltage between terminal “6” and “5” of relay.
   If measured voltage changes from battery voltage to about 0 V 2.7 to 4.6 seconds after disconnecting positive terminal from terminal “7”, relay is in good condition.
   If not, replace relay.

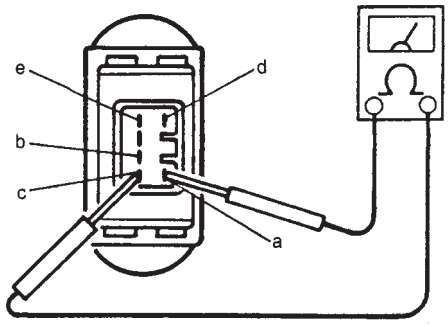


[INT circuit]

1) Connect positive terminal of battery to terminals “1” of relay and negative terminal to terminal “5” of relay. Then positive terminal to terminal “3” of relay checking voltage between terminals “6” and “5” of relay.
   If measured voltage changes from about 0 V to battery voltage when connecting positive terminal to terminal “3”, relay is in good condition.
   If not, replace relay.



2) Connect positive terminal of battery to terminal “2” of relay, then disconnect positive terminal from terminal “2” of relay checking voltage between terminals “6” and “5” of relay.
   If measured voltage changes from battery voltage to about 0 V when disconnecting positive terminal from terminal “2” and about 0 V to battery voltage 8 ± 2 seconds after disconnecting positive terminal from terminal “2”, relay is in good condition.
   If not, replace relay.



REAR WINDOW DEFOGGER (IF EQUIPPED)

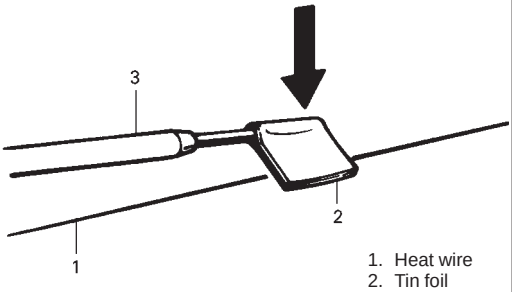
INSPECTION

DEFOGGER SWITCH

Check for continuity between terminals at each switch position as shown below.

If check result is not as specified, replace switch.

Terminal / Switch Position	a	b	c	d	e
OFF		○	○	○	○
ON (PUSH IN)	○	○	○	○	○



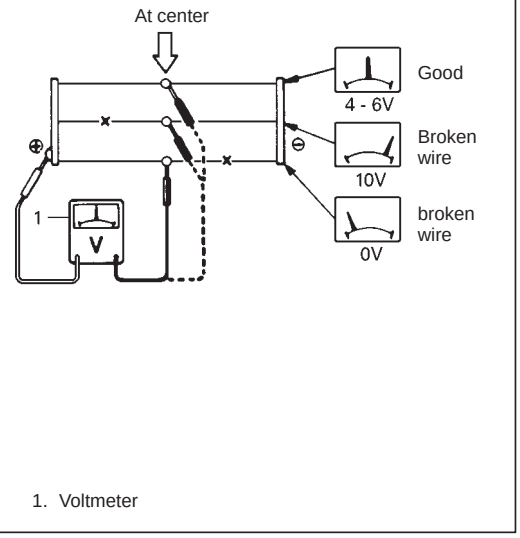
1. Heat wire
2. Tin foil
3. Tester probe

DEFOGGER WIRE

NOTE:

- **When cleaning rear window glass, use a dry cloth to wipe it along wire direction.**
- **When cleaning glass, do not use detergent or abrasive-containing glass cleaner.**
- **When measuring wire voltage, use a tester with negative probe wrapped with a tin foil which should be held down on wire by finger pressure.**

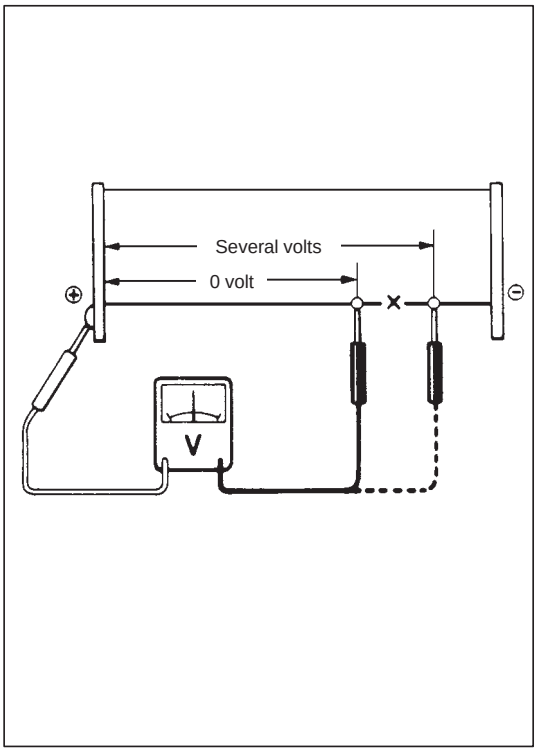
1) Checking wire damage
   a. Turn main switch ON.
   b. Turn defogger switch ON.
   c. Use a voltmeter to check voltage at the center of each heat wire, as shown.



1. Voltmeter

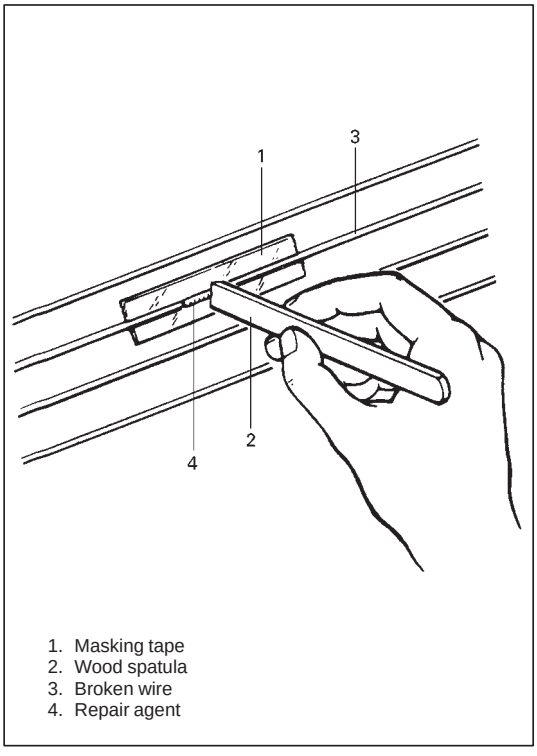
Voltage	Criteria
Approx. 5 V	Good (No break in wire)
Approx. 10 V or 0 V	Broken wire

If measured voltage is 10 V, wire must be damaged between its center and positive end. If voltage is zero, wire must be damaged between its center and ground.



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 12 V at heat wire positive terminal end and its indication should decrease gradually toward zero at the other terminal (ground).



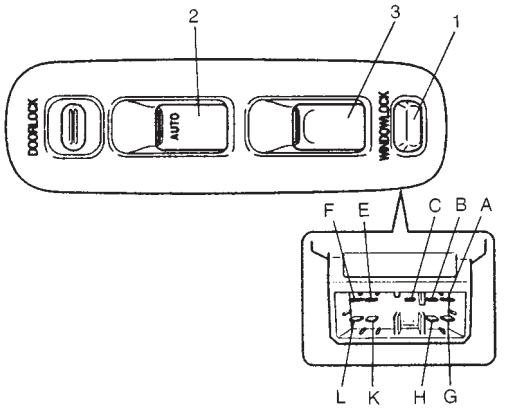
1. Masking tape
2. Wood spatula
3. Broken wire
4. Repair agent

REPAIR

DEFOGGER CIRCUIT

1) Use white gasoline for cleaning.
2) Apply masking tape at both upper and lower sides of heat wire to be repaired.
3) Apply commercially-available repair agent with a fine-tip brush.
4) Two to three minutes later, remove masking tapes previously applied.
5) Leave repaired heat wire as it is for at least 24 hours before operating defogger again.

Type 1



POWER WINDOW CONTROL SYSTEM

INSPECTION

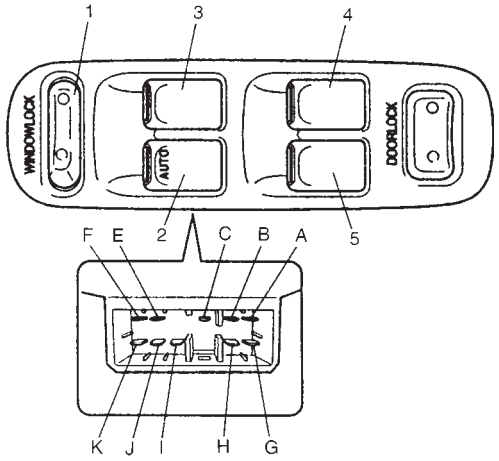
POWER WINDOW MAIN SWITCH

Check switch for continuity between terminals as shown below.

Type 1

Window Lock Switch (1)	Switch \ Terminal	Driver Side Window Switch (2)				Passenger Side Window Switch (3)					
		C	H	G	A	C	E	B	A	A	F
OFF	UP	○	○			○	○				
				○	○			○	○		
	OFF		○		○		○		○	○	○
				○	○			○	○		
	DOWN	○		○		○		○			
			○		○		○		○		
ON	UP	○	○			○	○				
				○	○						
	OFF		○		○		○	○			
				○	○						
	DOWN	○		○		○					
			○		○			○			

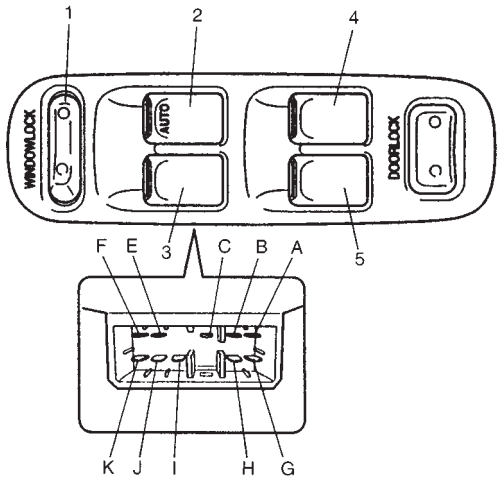
Type 2
LH steering vehicle



Type 2 LH steering vehicle

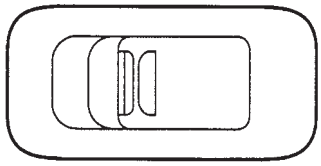
Window Lock Switch (1)	Switch \ Terminal	Driver Side Window Switch (2)				Passenger Side Window Switch (3)				Rear RH Window Switch (4)				Rear LH Window Switch (5)			
		K	C	A	B	K	C	E	F	K	C	I	J	K	C	G	H
OFF	UP	○		○		○		○		○		○		○		○	
			○		○		○		○		○		○		○		○
	OFF		○	○			○	○			○	○			○	○	
					○				○				○				○
	DOWN	○			○	○			○	○			○	○			○
			○	○			○	○			○	○			○	○	
ON	UP	○		○		○		○		○		○		○		○	
			○		○												
	OFF		○	○				○	○			○	○			○	○
					○												
	DOWN	○			○	○			○	○			○	○			○
			○	○													

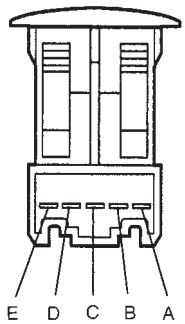
Type 2
RH steering vehicle



Type 2 RH steering vehicle

Window Lock Switch (1)	Terminal / Switch	Driver Side Window Switch (2)				Passenger Side Window Switch (3)				Rear RH Window Switch (4)				Rear LH Window Switch (5)			
		K	C	E	F	K	C	A	B	K	C	I	J	K	C	G	H
OFF	UP	○	○	○		○	○	○		○	○	○		○	○	○	
	OFF		○	○			○	○			○	○			○	○	
			○		○		○		○		○		○		○		○
	DOWN	○		○		○		○		○		○		○		○	
ON	UP	○	○	○		○		○		○		○		○		○	
	OFF		○	○				○	○			○	○			○	○
			○		○				○				○				○
	DOWN	○		○		○			○	○			○	○			○

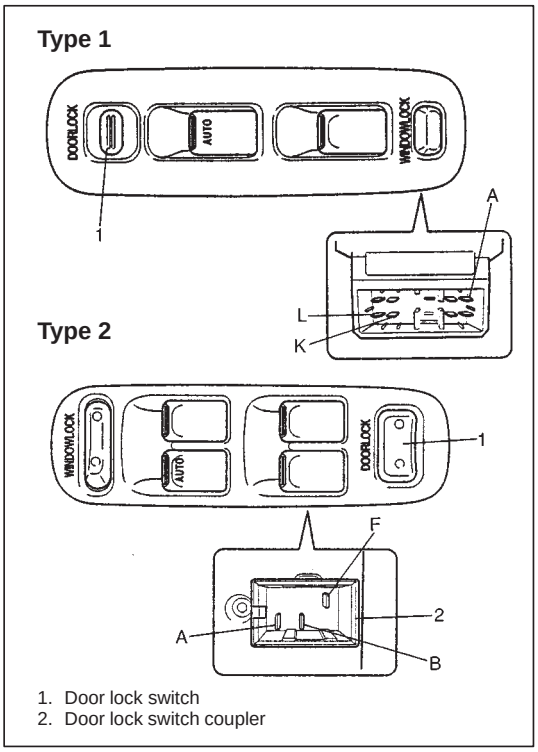




POWER WINDOW SUB SWITCH

Check switch for continuity between terminals as shown below.

Switch Position / Terminal	C	B	E	A	D
UP	○	○		○	○
OFF		○	○	○	○
DOWN	○		○	○	○



1. Door lock switch
2. Door lock switch coupler

POWER DOOR LOCK SYSTEM (IF KEYLESS ENTRY IS NOT EQUIPPED)

INSPECTION

POWER DOOR LOCK SWITCH

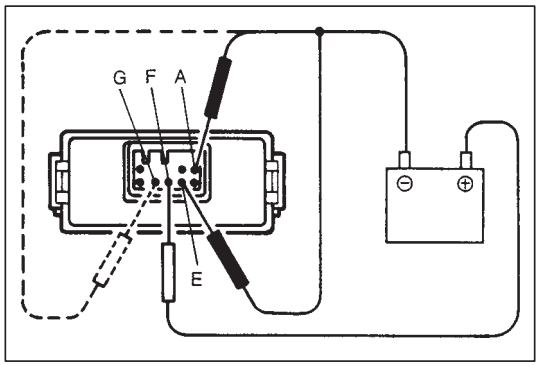
Check for continuity between terminals at each switch position as shown below.

Type 1

Switch \ Terminal	A	L	K
LOCK	○——	——○	
NEUTRAL			
UNLOCK	○——		——○

Type 2

Switch \ Terminal	A	B	F
LOCK	○——		——○
OFF			
UNLOCK	○——	——○	



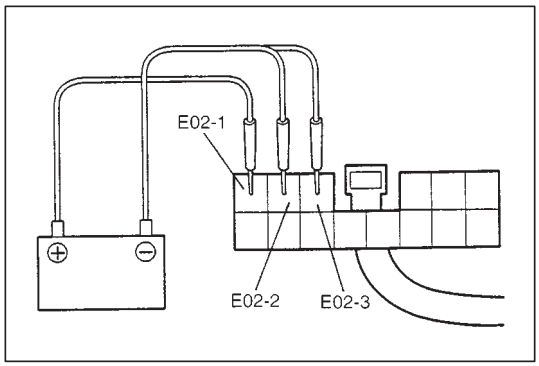
POWER DOOR LOCK CONTROLLER (CANVAS TOP MODEL)

1) Disconnect power door lock controller coupler.
2) Connect (+) wire and (–) wire of 12 V battery to terminal “A”, “E” and “F” as shown in figure.
3) Disconnect cord from terminal “E” and connect it to terminal “G”.
4) Repeat Steps 2) and 3) several times and if relay operation is heard every time, it means that controller is operating.

POWER DOOR LOCK CONTROLLER (HARD TOP MODEL)

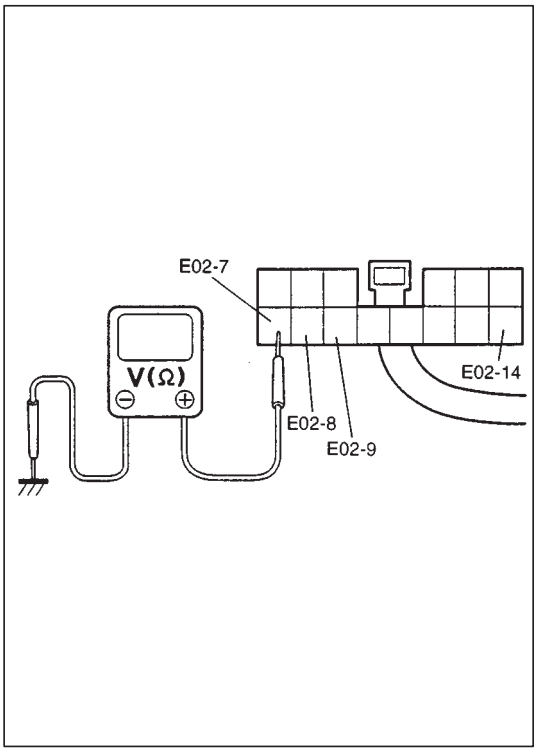
1) With the driver side door key turned LOCK, check all power doors are locked.
2) With the driver side door key turned UNLOCK, check only the driver side power door is unlocked.
   Turn the driver side door key to UNLOCK again within 5 seconds, check all power doors are unlocked.

If check result of Step 1) and Step 2) is satisfactory, power door lock controller is OK. If check result is not satisfactory, go to next Step 3).



3) Disconnect negative cable at battery.
4) Disconnect coupler of power door lock controller.
5) Use a 12 V battery to connect its (+) terminal to terminal E02-1, and its (–) terminal to terminal E02-2 and E02-3. Check all power doors are locked.

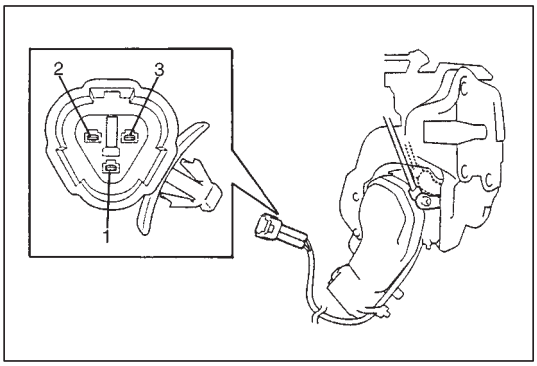
If check result is not satisfactory, repair circuit and recheck.
If check result is satisfactory, go to next Step 6).



6) Connect negative cable at battery.
7) Check that the voltage and resistance between following terminals are specifications.

Terminals	Condition	Specification
E02-7 and ground	Anytime	10 – 14 V
E02-14 and ground	Anytime	continuity
E02-8 and ground	When driver side door key switch is OFF position	No continuity
	When driver side door key switch is LOCK position	Continuity
E02-9 and ground	When driver side door key switch is OFF position	No continuity
	When driver side door key switch is UNLOCK position	Continuity

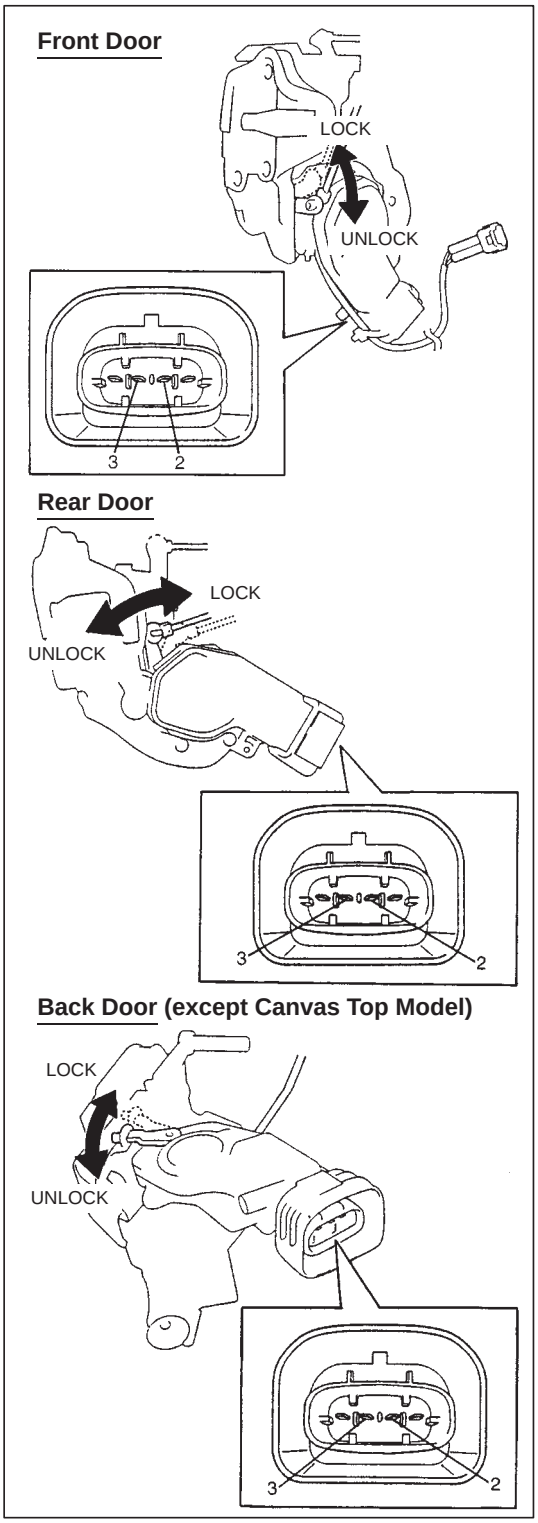
If check result is not satisfactory, repair circuit and recheck.
If check result is satisfactory, replace controller.



KEY CYLINDER SWITCH (DRIVER SIDE)

Check for continuity between terminals according to the key action shown below.

Terminal / Key	3	2	1
LOCK	○	○	
OFF			
UNLOCK		○	○



POWER DOOR LOCK ACTUATOR

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.

Operation / Terminal	UNLOCK	LOCK
2	⊖	⊕
3	⊕	⊖

POWER DOOR LOCK AND KEYLESS ENTRY SYSTEM (IF KEYLESS ENTRY IS EQUIPPED)

SYSTEM INSPECTION

STEP	ACTION	YES	NO
1	Check power door lock operation referring to its INSPECTION in this section. Is this operation OK?	Go to Step 2.	Go to Step 3.
2	Check keyless entry operation referring to its INSPECTION in this section. Is this operation OK?	Go to Step 4.	Go to Step 6.
3	Check keyless entry operation referring to its INSPECTION in this section. Is this operation OK?	Go to Step 5.	Go to Step 7.
4	Check hazard warning lights operation referring to its INSPECTION in this section. Is this operation OK?	This system is OK.	Go to Step 10.
5	Check door lock key and power door lock switch circuit referring to its INSPECTION in this section. Is this circuit OK?	Replace controller and recheck. And go to Step 4.	Repair circuit referring to WIRING DIAGRAM MANUAL and recheck. And go to Step 4.
6	Check ignition switch and door switch circuit referring to its INSPECTION in this section. Is this circuit OK?	Replace controller and recheck. And go to Step 4.	Repair circuit referring to WIRING DIAGRAM MANUAL and recheck. And go to Step 4.
7	Check power door lock actuator circuit referring to its INSPECTION in this section. Is this circuit OK?	Go to Step 8.	Repair circuit referring to WIRING DIAGRAM MANUAL and recheck. If OK, go to Step 4. If not OK, go to next Step 8.
8	Check power supply and grounding circuit referring to its INSPECTION in this section. Is this circuit OK?	Go to Step 9.	Repair circuit referring to WIRING DIAGRAM MANUAL and recheck. If OK, go to Step 4. If not OK, go to next Step 9.
9	1) Check door lock key and power door lock switch circuit referring to its INSPECTION in this section. 2) Check ignition switch and door switch circuit referring to its INSPECTION in this section. Are these circuits OK?	Replace controller and recheck. And go to Step 4.	Repair circuit referring to WIRING DIAGRAM MANUAL and recheck. And go to Step 4.

STEP	ACTION	YES	NO
10	Check that hazard warning lights flash with hazard switch ON. Is check result OK?	Go to Step 11.	Refer to “Turn Signal and Hazard Warning Lights” in DIAGNOSIS and repair. And go to Step 4.
11	Check door knob switch and turn signal relay circuit referring to its INSPECTION in this section. Is this circuit OK?	Replace controller and recheck.	Repair circuit referring to WIRING DIAGRAM MANUAL and recheck.

POWER DOOR LOCK OPERATION

INSPECTION

1) With the driver side door key turned LOCK, check all power doors are locked.
2) With the driver side door key turned UNLOCK, check only the driver side power door is unlocked.
   Turn the driver side door key to UNLOCK again within 5 seconds, check all power doors are unlocked.

If check result of Step 1) and Step 2) is satisfactory, this operation is OK.

KEYLESS ENTRY OPERATION

INSPECTION

1) With the IG switch OFF and all doors closed, push LOCK button on transmitter. Check all power doors are locked.
2) Push UNLOCK button on transmitter. Check only driver side power door is unlocked.
3) Push UNLOCK button on transmitter again within 5 seconds. Check all power doors are unlocked.
   But if any door is not opened within 30 seconds after power door(s) unlocked, all power doors are locked again automatically.

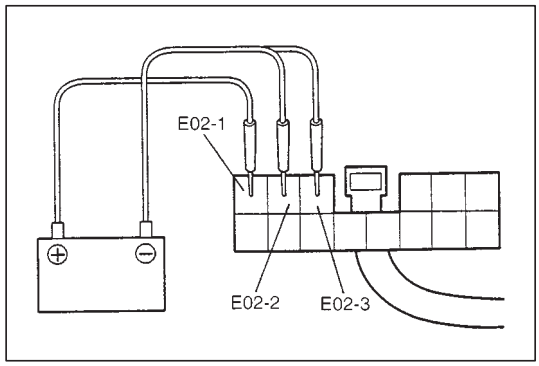
If check result of Step 1) to Step 3) is satisfactory, this operation is OK.

HAZARD WARNING LIGHTS OPERATION

INSPECTION

1) Check that hazard warning lights flash one time when power doors are locked by pushing LOCK button on transmitter.
2) Check that hazard warning lights flash two times when power door(s) is (are) unlocked by pushing UNLOCK button on transmitter.

If check result of Step 1) and Step 2) is satisfactory, this operation is OK.

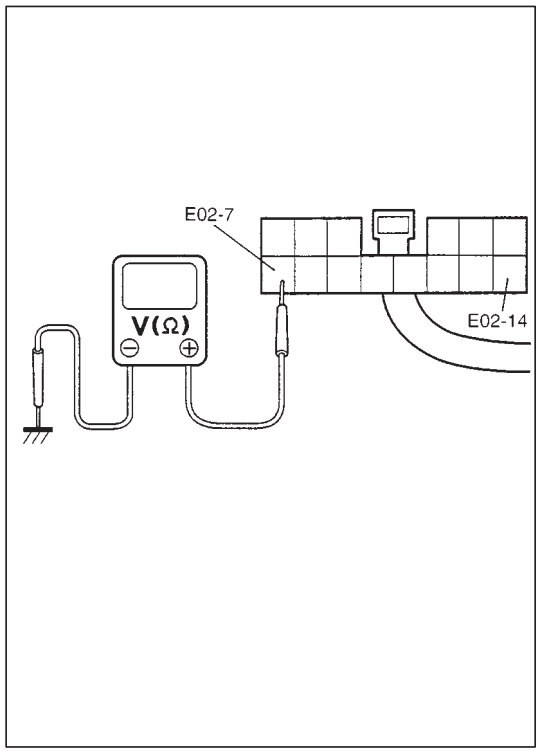


POWER DOOR LOCK ACTUATOR CIRCUIT

INSPECTION

1) Disconnect negative cable at battery.
2) Disconnect coupler of power door lock and keyless entry controller.
3) Use a 12 V battery to connect its (+) terminal to terminal E02-1, and its (–) terminal to terminal E02-2 and E02-3. Check all power doors are locked.

If check result is satisfactory, this circuit is OK.



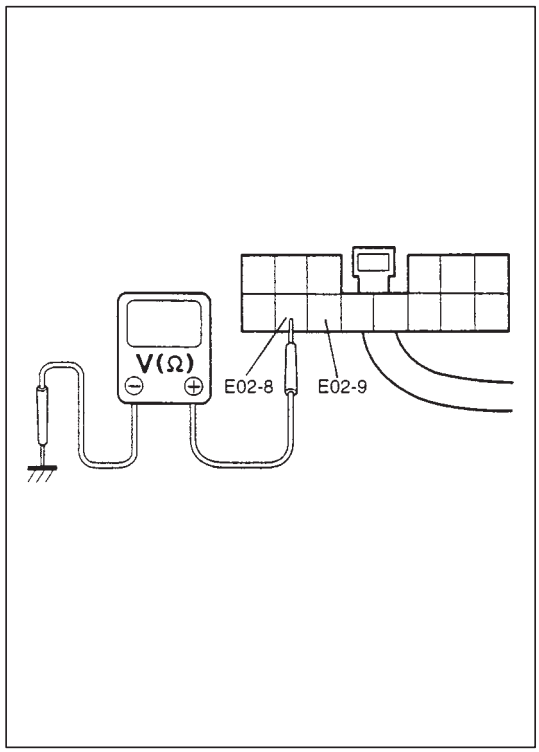
POWER SUPPLY AND GROUNDING CIRCUIT

INSPECTION

1) Disconnect negative cable at battery.
2) Disconnect coupler of power door lock and keyless entry controller, and connect negative cable at battery.
3) Check that the voltage and resistance between following terminals are specifications.

Terminals	Condition	Specification
E02-7 and ground	Anytime	10 – 14 V
E02-14 and ground	Anytime	Continuity

If check result is satisfactory, this circuit is OK.



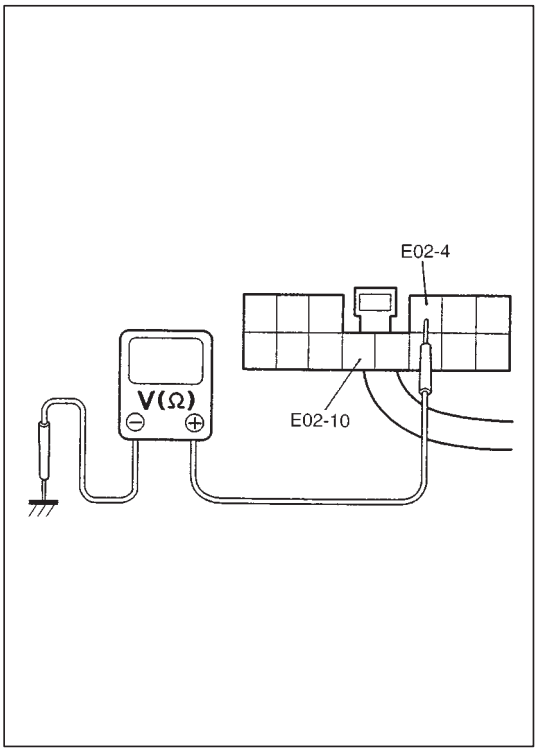
DOOR LOCK KEY AND POWER DOOR LOCK SWITCH CIRCUIT

INSPECTION

1) Disconnect negative cable at battery.
2) Disconnect coupler of power door lock and keyless entry controller.
3) Check for continuity between following terminals at each condition.

Terminals	Condition	Specification
E02-8 and ground	When driver side door key switch is OFF position	No continuity
	When driver side door key switch is LOCK position	Continuity
E02-9 and ground	When driver side door key switch is OFF position	No continuity
	When driver side door key switch is UNLOCK position	Continuity

If check result is satisfactory, this circuit is OK.



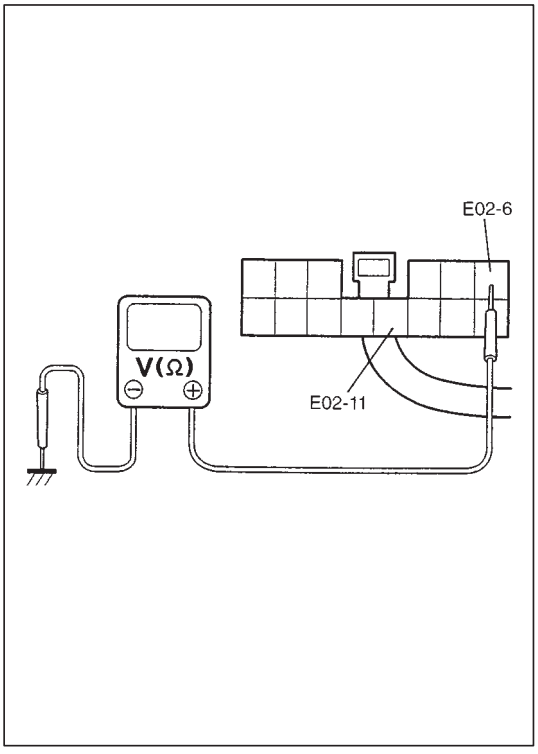
IGNITION SWITCH AND DOOR SWITCH CIRCUIT

INSPECTION

1) Disconnect negative cable at battery.
2) Disconnect coupler of power door lock and keyless entry controller, and connect negative cable at battery.
3) Check that the voltage and resistance between following terminals are specifications.

Terminals	Condition	Specification
E02-4 and ground	When ignition switch is OFF position	0 V
	When ignition switch is ON position	10 – 14 V
E02-10 and ground	When all doors are closed	No continuity
	When any one door is opened	Continuity

If check result is satisfactory, this circuit is OK.



DOOR KNOB SWITCH AND TURN SIGNAL RELAY CIRCUIT

INSPECTION

1) Disconnect negative cable at battery.
2) Disconnect coupler of power door lock and keyless entry controller, and connect negative cable at battery.
3) Check that the voltage and resistance between following terminals are specifications.

Terminals	Condition	Specification
E02-6 and ground	Anytime	10 – 14 V
E02-11 and ground	When driver side door lock knob is pulled up	Continuity
	When driver side door lock knob is pushed down	No continuity

If check result is satisfactory, this circuit is OK.

POWER DOOR LOCK SWITCH

INSPECTION

Refer to POWER DOOR LOCK SWITCH INSPECTION of POWER DOOR LOCK SYSTEM (IF KEYLESS ENTRY IS NOT EQUIPPED) in this section.

KEY CYLINDER SWITCH (DRIVER SIDE)

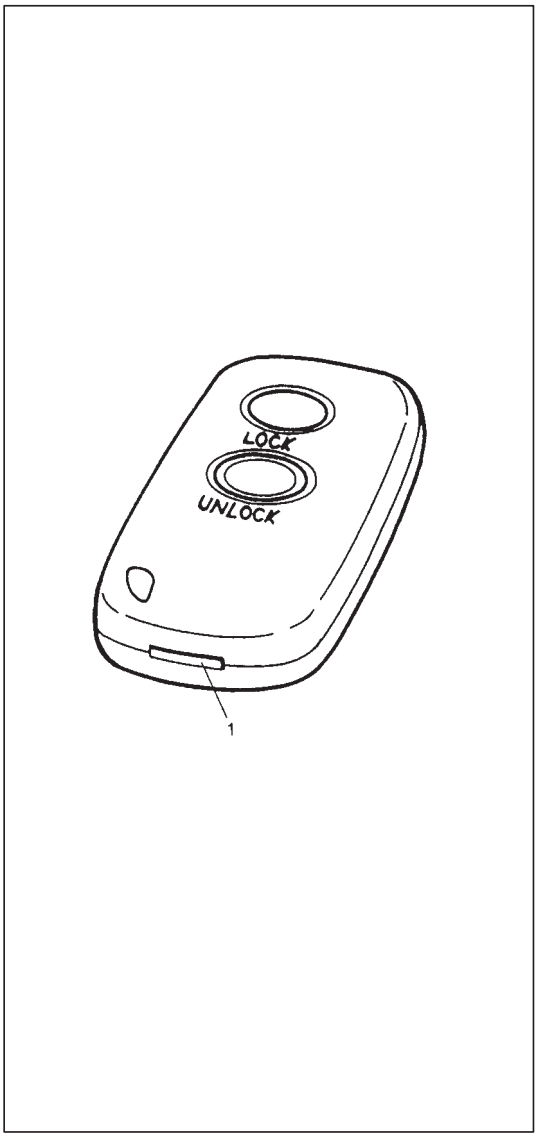
INSPECTION

Refer to KEY CYLINDER SWITCH (DRIVER SIDE) INSPECTION of POWER DOOR LOCK SYSTEM (IF KEYLESS ENTRY IS NOT EQUIPPED) in this section.

POWER DOOR LOCK ACTUATOR

INSPECTION

Refer to POWER DOOR LOCK ACTUATOR INSPECTION of POWER DOOR LOCK SYSTEM (IF KEYLESS ENTRY IS NOT EQUIPPED) in this section.



TRANSMITTER

REPLACEMENT OF THE BATTERY

If the transmitter becomes unreliable, replace the battery.
As the battery power is consumed, the operation distance will be shorter.

1) Put the edge of a coin or a flat blade screw driver in the slot (1) of the transmitter and pry it open.
2) Replace the battery (lithium disc-type CR2032 or equivalent) so its ⊕ terminal faces the "+" mark of the transmitter.

CAUTION:
Use care not to allow grease or dirt to be attached on the printed circuit board and the battery.

3) Close the transmitter firmly.
4) Make sure the door locks can be operated with the transmitter.

NOTE:

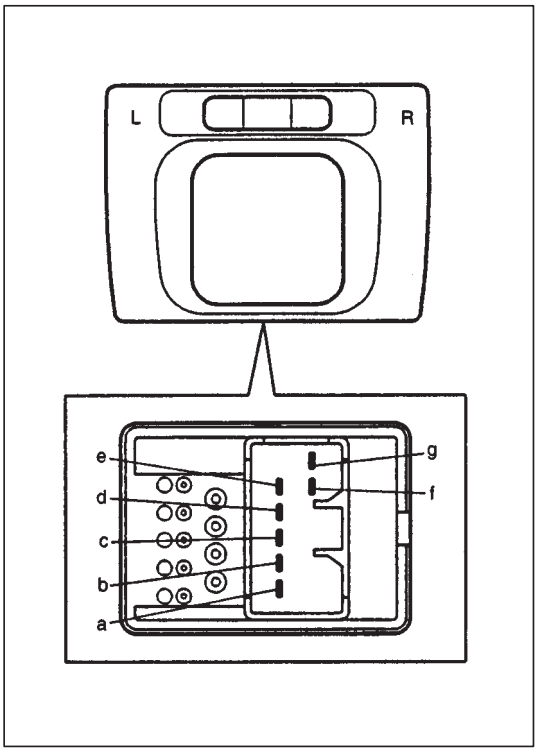
- **To prevent theft, be sure to break the transmitter before discarding it.**
- **Dispose of the used battery properly according to applicable rules or regulations. Do not dispose of lithium batteries with ordinary household trash.**

CODE REGISTRATION PROCEDURE

1) Confirm that IG switch is OFF position and all doors are closed.
2) Open driver side door and then turn the IG switch to ON position within 10 seconds.
3) Turn the IG switch to OFF position within 10 seconds after it is turned to ON position.
4) Push and release the door switch to turn OFF and ON at three times by hand within 20 seconds after the IG switch is turned to OFF position.
5) Within 10 seconds after the door switch is turned to ON, turn the IG switch to ON position and then OFF position.
6) Push and hold the LOCK and UNLOCK buttons on transmitter at the same time within 20 seconds after IG switch is turned to OFF position. Hold the buttons for at least 5 seconds. During this time, the driver side door should lock and unlock once.
7) Push LOCK or UNLOCK buttons on transmitter within 5 seconds after Step 6), and then confirm that driver side door is locked and unlocked once.

NOTE:

- **Two transmitter codes can be registered.**
- **When a new transmitter is registered, the oldest one will be cleared.**



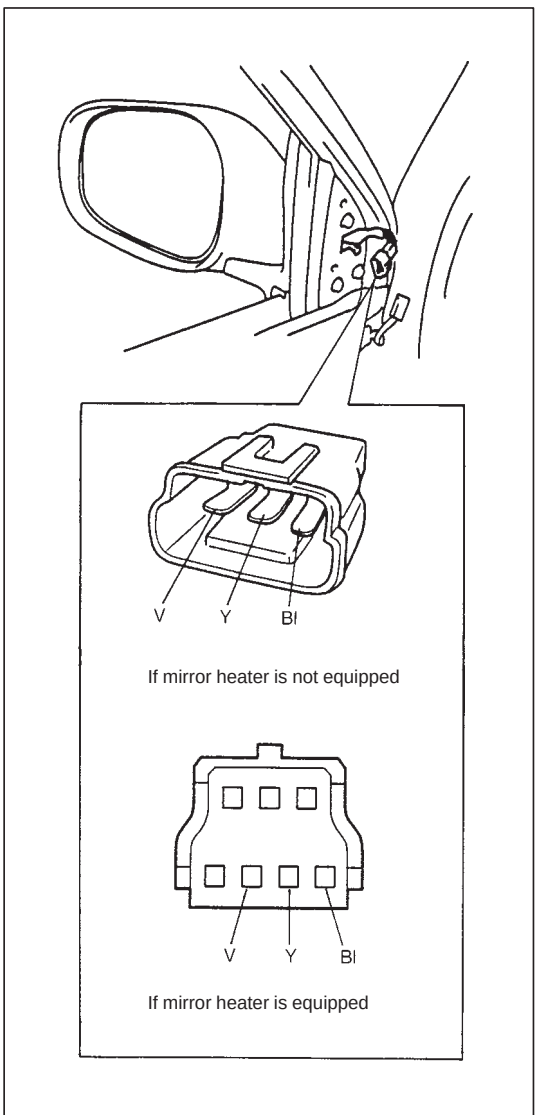
POWER DOOR MIRROR CONTROL SYSTEM

INSPECTION

MIRROR SWITCH

1) Remove mirror switch from instrument panel.
2) Check for continuity between terminals at each switch position as shown below.
   If check result is not as specified, replace mirror switch.

L / R	a	b	c	d / e	g / f
UP	○	○	○		○
DOWN	○	○	○		○
LEFT	○	○	○	○	
RIGHT	○	○	○	○	

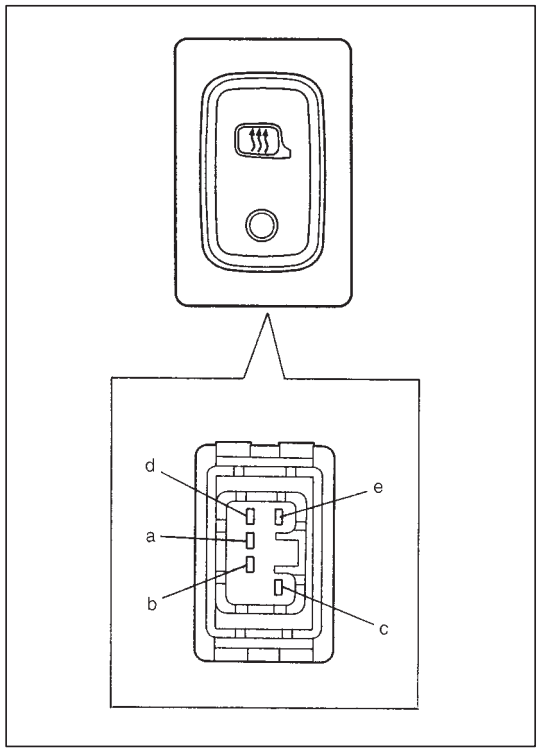


DOOR MIRROR ACTUATOR

1) Remove garnish from door.
2) Disconnect door mirror coupler.
3) Check that door mirror operates properly when battery voltage is applied to connector terminals.
   Connect battery positive and negative terminal to the door mirror terminal shown below and check operation.
   If it does not operate as specified in table below, replace door mirror assembly.

Terminal / Operation	V	Bl	Y
Up	⊖	⊕	
Down	⊕	⊖	
Left	⊖		⊕
Right	⊕		⊖

NOTE:
When installing door mirror to door, be careful not to pinch harness between door and door mirror.



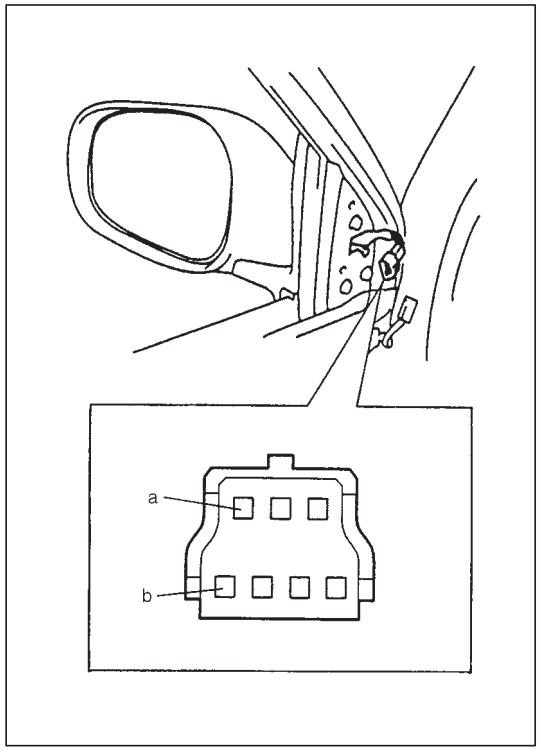
DOOR MIRROR HEATER (IF EQUIPPED)

INSPECTION

MIRROR HEATER SWITCH

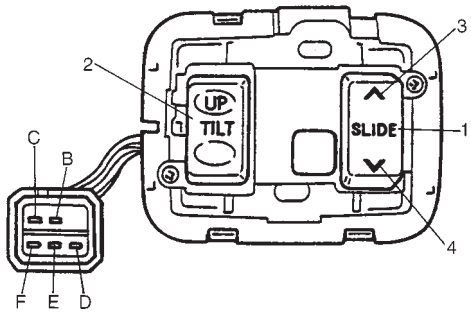
1) Remove mirror heater switch from instrument panel.
2) Check for continuity between terminals at each switch position as shown below. If check result is not as specified, replace switch.

Terminal / Position	a	b	c	d	e
FREE		○	○	○	○
PUSH	○	○	○	○	○



MIRROR HEATER (IF EQUIPPED)

1) Remove garnish from door.
2) Disconnect door mirror coupler.
3) Check for continuity between terminals “a” and ”b”.
   If not continuity, replace outside mirror.



3. To open
4. To close

POWER SLIDING ROOF (IF EQUIPPED)

INSPECTION

SLIDING ROOF SWITCH

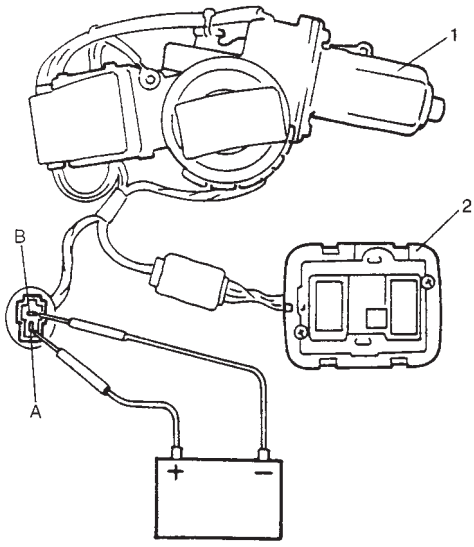
Check switch for continuity between terminals as shown below.

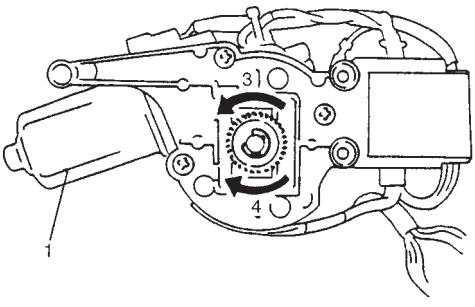
Slide Switch (1)

Terminal / Switch	C	D	F
OPEN	○	○	
OFF			
CLOSE		○	○

Tilt Switch (2)

Terminal / Switch	E	D	B
UP	○	○	
OFF			
DOWN		○	○





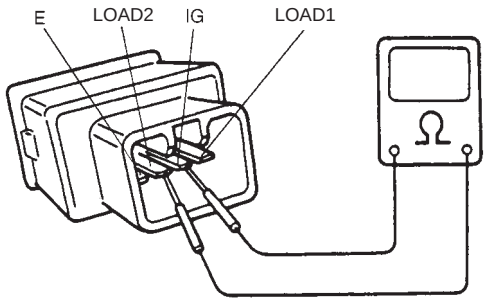
3. Left turn
4. Right turn

SLIDING ROOF MOTOR ASSEMBLY

1) Remove head lining. Refer to Section 9 for detail.
2) Remove sliding roof motor assembly (1).
3) Connect known-good sliding roof switch (2) to sliding roof motor assembly.
4) Connect 12 V battery positive terminal to terminal “A” of motor assembly (1) and battery negative terminal to terminal “B” of motor assembly (1).
5) Check that the sliding roof motor (1) runs according to the movement of the sliding roof switch (2).

Sliding Roof Switch	Motor
Tilt up	turns left
Tilt down	turns right
Slide open	turns right
Slide close	turns left

If motor does not operate as above, replace sliding roof motor assembly (1).



FRONT SEAT HEATER (IF EQUIPPED)

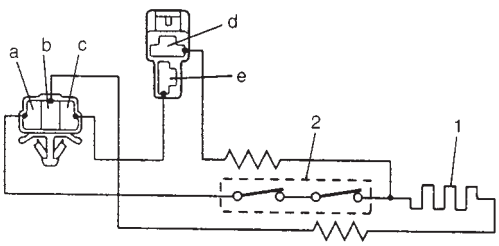
SEAT HEATER SWITCH (DRIVER AND PASSENGER SIDE)

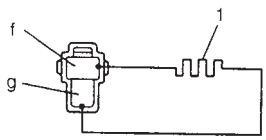
INSPECTION

1) Confirm that ignition switch is OFF position.
2) Pull out seat heater switch from front center console box.
3) Disconnect seat heater switch coupler.
4) Check for continuity between terminals at each switch position as shown below. If check result is not as specified, replace.

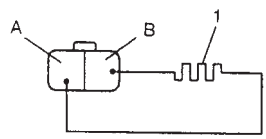
Switch Position \ Terminal	IG	LOAD 1	LOAD 2	E
OFF				
LO	●	○	●	○
HI	●	●	●	○

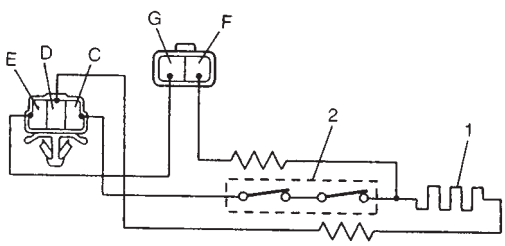
Hard Top Model





Canvas Top Model





1. Heater wire
2. Thermostat

SEAT HEATER WIRE

INSPECTION

1) Confirm that seat heater switch is OFF position.
2) Disconnect two couplers of seat heater under the seat cushion. (If seat under tray is equipped, pull out coupler between tray and seat cushion.)
3) Check for continuity between terminals as shown below. If not continuity, replace faulty seat heater.

Hard Top Model
Seat heater circuit in seat back
Between a and b
Between b and d
Between c and e
Seat heater circuit in seat cushion
Between f and g

Canvas Top Model
Seat heater circuit in seat back
Between A And B
Seat heater circuit in seat cushion
Between C and D
Between D and F
Between E and G

SECTION 8G

IMMOBILIZER CONTROL SYSTEM (IF EQUIPPED)

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

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

CONTENTS

GENERAL DESCRIPTION 8G- 2
Ignition Key 8G- 3
Coil Antenna 8G- 3
Immobilizer Control Module 8G- 4
ECM/PCM 8G- 4
On-Board Diagnostic System (Self-Diagnosis Function) 8G- 4
DIAGNOSIS 8G- 6
Precautions in Diagnosing Troubles 8G- 6
Diagnostic Flow Table <Vehicle equipped with monitor coupler> 8G- 9
Diagnostic Flow Table <Vehicle not equipped with monitor coupler> 8G-10
Diagnostic Trouble Code Check (Immobilizer Control Module) 8G-11
Diagnostic Trouble Code Check (ECM/PCM) 8G-11
Diagnostic Trouble Code Table 8G-13
TABLE A DTC is not Output from Diagnostic Output Terminal 8G-14
TABLE B Immobilizer Indicator Lamp Check (Immobilizer Indicator Lamp does not Light at Ignition Switch ON) . . . 8G-15
TABLE C Immobilizer Indicator Lamp Check (Immobilizer Indicator Lamp Remains on after Engine Starts) 8G-16
DTC11 Transponder Code Not Matched . . 8G-17
DTC31 Transponder Code Not Registered 8G-17
DTC12 Fault in Immobilizer Control Module 8G-17
DTC13 No Transponder Code Transmitted or Coil Antenna Opened/Shorted 8G-18
DTC21 ECM/Immobilizer Control Module Code Not Matched (Immobilizer Control Module Side) 8G-20
DTC81 (P1623) ECM/Immobilizer Control Module Code Not Matched (ECM/PCM Side) 8G-20
DTC84 (P1620) ECM/Immobilizer Control Module Code Not Registered 8G-20
DTC22 Ignition Switch Circuit Open/Short . . 8G-21
DTC23 No ECM/Immobilizer Control Module Code Transmitted from ECM/PCM or DLC Circuit Opened/Shorted 8G-22
DTC83 (P1621) No ECM/Immobilizer Control Module Code Transmitted from Immobilizer Control Module or DLC Circuit Opened/Shorted 8G-22
DTC82 (P1622) Fault in ECM/PCM 8G-23
Inspection of ECM/PCM, Immobilizer Control Module and Its Circuit 8G-24
Voltage Check 8G-24
Resistance Check 8G-25
ON-VEHICLE SERVICE 8G-26
Precautions in Handling Immobilizer Control System 8G-26
Immobilizer Control Module 8G-27
Coil Antenna 8G-27
HOW TO REGISTER IGNITION KEY 8G-28
PROCEDURE AFTER IMMOBILIZER CONTROL MODULE REPLACEMENT . . 8G-29
PROCEDURE AFTER ECM/PCM REPLACEMENT 8G-30
SPECIAL TOOLS 8G-30

GENERAL DESCRIPTION

The immobilizer control system designed to prevent vehicle burglar consists of following components.

- Engine control module (ECM)/Powertrain control module (PCM)
- Immobilizer control module
- Ignition key (with built-in transponder)
- Coil antenna

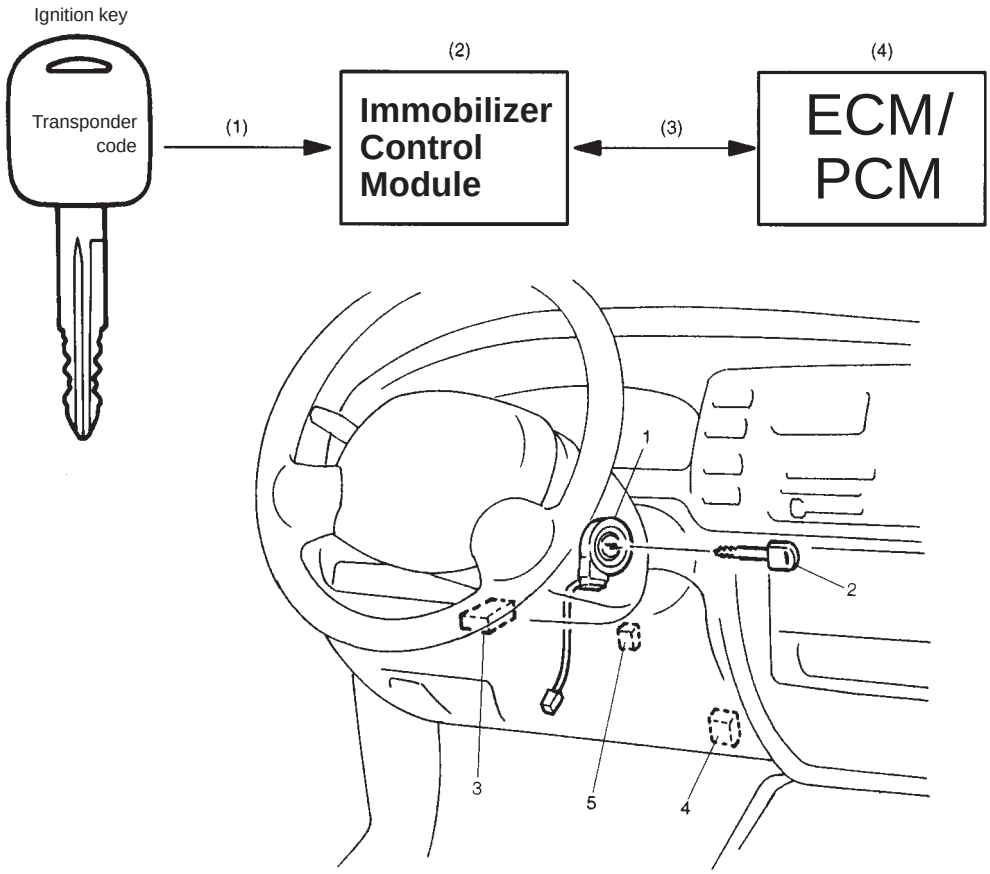
Operation of this system is as follows.

(1) Each ignition key has its own code (Transponder code) stored in memory. When the ignition switch is turned ON, Immobilizer Control Module tries to read the Transponder code through the coil antenna installed to the steering lock assembly.

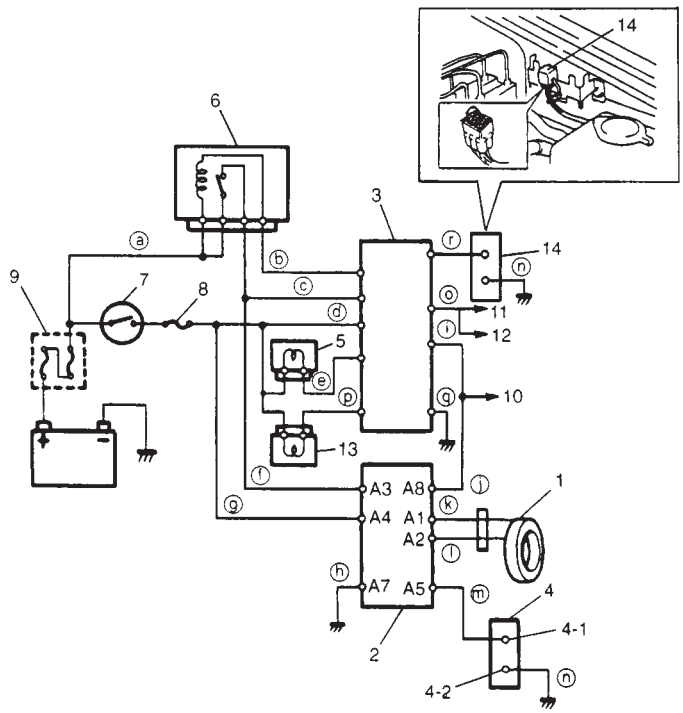
(2) Immobilizer Control Module compares the Transponder code read in (1) and that registered in Immobilizer Control Module and checks if they match.

(3) When it is confirmed that two Transponder codes match each other as described above, Immobilizer Control Module and ECM/PCM check if ECM/Immobilizer Control Module codes registered in them respectively match.

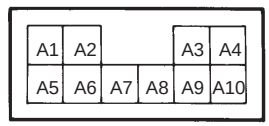
(4) Only when it is confirmed that ECM/Immobilizer Control Module codes match, the engine starts running. If Transponder codes in Step (2) or ECM/Immobilizer Control Module codes in Step (3) do not match, ECM/PCM will stop operation of the injector and ignition of spark plug.



1. Coil antenna
2. Ignition key
3. Immobilizer control module
4. Data link connector (DLC)
5. Immobilizer diagnostic coupler

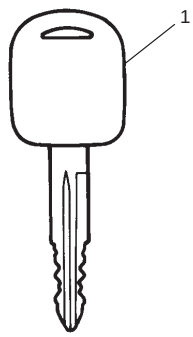


WIRE SYMBOL	WIRE COLOR
ⓐ	B/R
ⓑ	BI
ⓒ	BI/B
ⓓ	B/W
ⓔ	V/Y
ⓕ	BI/B
ⓖ	B/W
ⓗ	B
ⓘ	V/W
ⓙ	V/W
ⓚ	BI
ⓛ	R
ⓜ	SbI
ⓝ	B
ⓞ	V/G
ⓟ	V
ⓠ	B
ⓡ	R / Y



Terminal arrangement of Immobilizer Control Module coupler (Viewed from harness side)

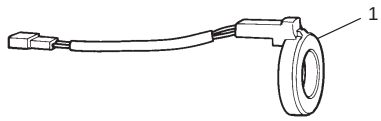
1. Coil antenna
2. Immobilizer Control Module
3. ECM/PCM
4. Immobilizer diagnostic coupler
4-1. Diagnostic output terminal
4-2. Ground terminal
5. Malfunction indicator lamp
6. Main relay
7. Ignition switch
8. Fuse
9. Main fuse
10. To #9-pin in Data link connector
11. To #7-pin in Data link connector
12. To ABS control module
13. Immobilizer indicator lamp (Vehicle not equipped with monitor coupler)
14. Monitor coupler (Vehicle not equipped with immobilizer indicator lamp))



1. Ignition key with built-in transponder

IGNITION KEY

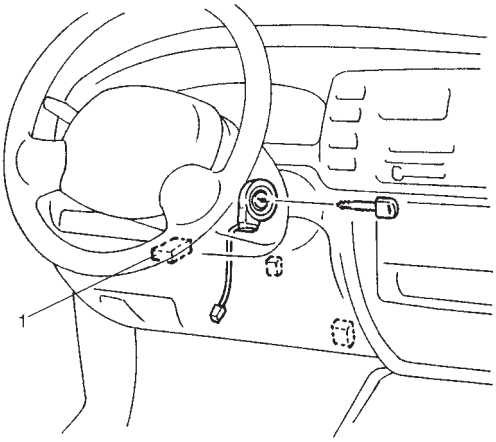
The ignition key for the immobilizer control system has a built-in transponder. Each transponder in the key has an each transmitting code (Transponder code). The code will transmitted from the key via the coil antenna to Immobilizer Control Module when the ignition switch is turned ON.



1. Coil antenna

COIL ANTENNA

The coil antenna is installed to the steering lock assembly. As it is energized by Immobilizer Control Module, it transmits the transponder code of the ignition key to Immobilizer Control Module.



1. Immobilizer Control Module

IMMOBILIZER CONTROL MODULE

Immobilizer Control Module is installed to the underside of the instrument panel at the driver's seat side.
As main functions, Immobilizer Control Module checks matching not only between the Transponder Code transmitted from the ignition key and that registered in Immobilizer Control Module (Up to 4 different Transponder codes can be registered.) but also between the ECM/Immobilizer Control Module code transmitted from ECM/PCM and that registered in Immobilizer Control Module. In addition, it has an on-board diagnostic system (self-diagnosis function) which is described in "On-Board Diagnostic System (Self-Diagnosis Function)" in this section.

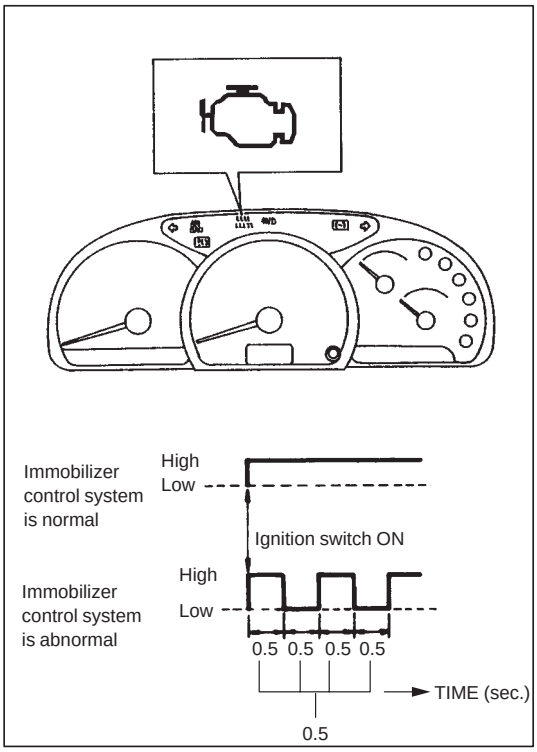
ECM/PCM

As main functions, ECM/PCM not only checks matching of ECM/Immobilizer Control Module code but also has an on-board diagnostic system (self-diagnosis function) as described in "On-Board Diagnostic System (Self-Diagnosis Function)" in this section.
For installation position of ECM/PCM, refer to Section 6E1 or 6E2.

ON-BOARD DIAGNOSTIC SYSTEM (SELF-DIAGNOSIS FUNCTION)

Immobilizer Control Module and ECM/PCM diagnose troubles which may occur in the area including the following parts when the ignition switch is ON.

ECM/PCM:	●ECM/Immobilizer Control Module code ●Serial data link circuit ●ECM/PCM
Immobilizer Control Module:	●Transponder code ●Coil antenna ●ECM/Immobilizer Control Module code ●Serial data link circuit ●Immobilizer Control Module ●Ignition signal

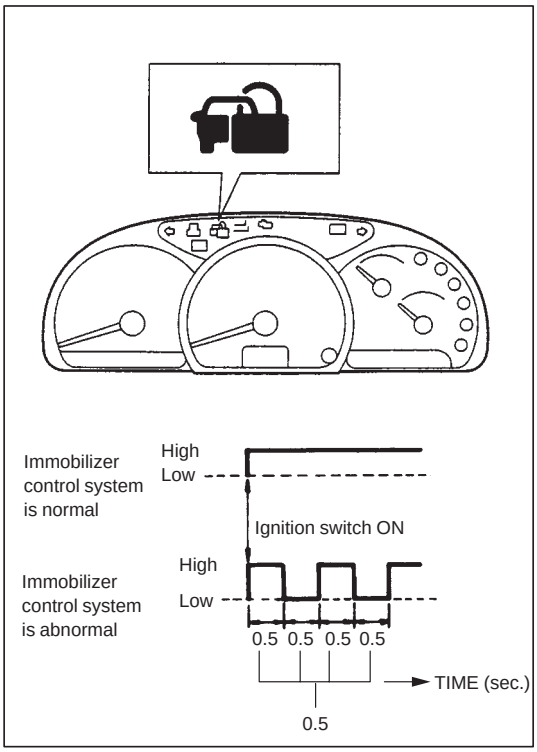


<Vehicle equipped with monitor coupler>

With the diagnosis switch terminal of monitor coupler for ECM/PCM not grounded, the ignition switch turned ON (but the engine at stop) and regardless of the condition of the electronic fuel injection system, ECM/PCM indicates whether a trouble has occurred in the immobilizer control system or not by causing the malfunction indicator lamp to flash or turn ON.

Malfunction indicator lamp is ON:
No trouble exists in the immobilizer control system.
Malfunction indicator lamp is flashing:
ECM/PCM or Immobilizer Control Module has detected some trouble in the immobilizer control system.

NOTE:
As soon as the ignition switch is turned ON, ECM/PCM and Immobilizer Control Module diagnose if a trouble has occurred in the immobilizer control system. While the diagnosis is being made, the malfunction indicator lamp stays ON and if the diagnosis result is "abnormal", it immediately changes to flashing but if the result is "normal", it remains ON. Diagnosis takes about 3 seconds at maximum.



<Vehicle not equipped with monitor coupler>

With the ignition switch turned ON (but the engine at stop) regardless of the condition of the electronic fuel injection system, ECM/PCM 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/PCM or Immobilizer Control Module has detected some trouble in the immobilizer control system.

NOTE:
As soon as the ignition switch is turned ON, ECM/PCM 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/PCM and Immobilizer Control Module detects a trouble which has occurred in the above areas, it stores DTC corresponding to the exact trouble area in ECM/PCM and Immobilizer Control Module memory.

DTCs stored in memory of each controller (Immobilizer Control Module and ECM/PCM) can be read by using the procedure described in "DIAGNOSTIC TROUBLE CODE CHECK (IMMOBILIZER CONTROL MODULE)" and "DIAGNOSTIC TROUBLE CODE CHECK (ECM/PCM)" in this section.

DIAGNOSIS

ECM/PCM and Immobilizer Control Module have on-board diagnostic system (a system self-diagnosis function) as described previously.
Investigate where the trouble is by referring to “Diagnostic Flow Table” and “Diagnostic Trouble Code Table” on later pages.

PRECAUTIONS IN DIAGNOSING TROUBLES

[PRECAUTIONS IN IDENTIFYING DIAGNOSTIC TROUBLE CODE]

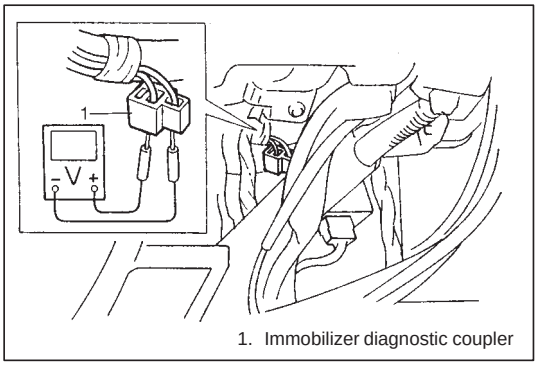
ECM/PCM

<Vehicle equipped with monitor coupler>

- Before identifying diagnostic trouble code indicated by malfunction indicator lamp, don’t disconnect couplers from ECM/PCM, battery cable from battery, ECM/PCM ground wire harness from engine.
  Such disconnection will clear trouble codes for electronic fuel injection system stored in memory of ECM/PCM.
- If abnormality or malfunction lies in two or more areas, malfunction indicator lamp indicates applicable codes three times each. And flashing of these codes is repeated as long as diagnosis terminal is grounded and ignition switch is held at ON position.
- When ECM/PCM detects a trouble in both electronic fuel injection system and immobilizer control system, malfunction indicator lamp indicates trouble codes of both systems alternately while the ignition switch is turned ON and the diagnosis terminal is grounded.
- Take a note of diagnostic trouble code indicated first.

<Vehicle not equipped with monitor coupler>

- Before identifying diagnostic trouble code indicated through Suzuki scan tool, don’t disconnect couplers from ECM/PCM, battery cable from battery, ECM/PCM ground wire harness from engine.
  Such disconnection will clear trouble codes for electronic fuel injection system stored in memory of ECM/PCM.
- Take a note of diagnostic trouble code indicated first.



1. Immobilizer diagnostic coupler

Immobilizer Control Module

- Take a note of diagnostic trouble code indicated first.

[INTERMITTENT TROUBLES]

<Vehicle equipped with monitor coupler>

- There are cases where output of diagnostic output terminal and/or malfunction indicator lamp 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/PCM and recheck.
  * When trouble can not be identified but output of diagnostic output terminal and/or malfunction indicator lamp indicate a trouble code:
    Diagnose trouble by using that code No. and if ignition key, coil antenna, wires and each connection are all in good condition, turn OFF ignition switch and then ON.

Then check what malfunction indicator lamp and/or output of diagnostic output terminal indicate.

Only when they indicate trouble code again, substitute a known-good ECM/PCM 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.

<Vehicle not equipped with monitor coupler>

- There are cases where output of diagnostic output terminal and/or Suzuki scan tool indicates 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/PCM and recheck.
  * When trouble can not be identified but output of diagnostic output terminal and/or Suzuki scan tool indicates 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 and/or output of diagnostic output terminal indicates.

Only when they indicate trouble code again, substitute a known-good ECM/PCM 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.

[NOTES ON SYSTEM CIRCUIT INSPECTION]
Refer to “Precautions for Electrical Circuit Service” and “Intermittents and Poor Connection” in Section 0A.

[Precaution after replacing ECM/PCM or Immobilizer Control Module]

- When ECM/PCM was replaced, including when replaced because rechecking by using a known-good ECM/PCM was necessary during trouble diagnosis, the ECM/Immobilizer Control Module code must be registered in ECM/PCM and Immobilizer Control Module by performing procedure described in “Procedure after ECM/PCM Replacement” on p. 8G-27. If it is not registered, the engine would not start and accurate trouble diagnosis would not be assured.
- When Immobilizer Control Module was replaced, including when replaced because rechecking by using a known-good Immobilizer Control Module was necessary during trouble diagnosis, the Transponder code and ECM/Immobilizer Control Module code must be registered in Immobilizer Control Module and ECM/Immobilizer Control Module code in ECM/PCM by performing procedure described in “Procedure after Immobilizer Control Module Replacement” on p. 8G-26. If they are not registered, the engine would not start and accurate trouble diagnosis would not be assured.

DIAGNOSTIC FLOW TABLE

<Vehicle equipped with monitor coupler>

STEP	ACTION	YES	NO
1	1) Make sure that diagnosis switch terminal in monitor coupler is not grounded by service wire. See Fig. 1. 2) Check malfunction indicator lamp while ignition switch is ON (but without starting engine). See Fig. 2. Dose malfunction indicator lamp flash?	Go to Step 3.	● If malfunction indicator lamp remains ON, go to Step 2. ● If malfunction indicator lamp remains OFF, go to "MALFUNCTION INDICATOR LAMP CHECK" in Section 6.
2	1) Using service wire, ground diagnosis switch terminal in monitor coupler. See Fig. 3. Dose malfunction indicator lamp flash?	Immobilizer control system is in good condition.	Go to "MALFUNCTION INDICATOR LAMP CHECK" in Section 6.
3	Dose malfunction indicator lamp flash as Fig. 4?	Go to Step 4.	Go to "MALFUNCTION INDICATOR LAMP CHECK" in Section 6.
4	1) Check DTC stored in immobilizer control module referring to "DIAGNOSTIC TROUBLE CODE CHECK (IMMOBILIZER CONTROL MODULE)" in this section. Is there any DTC(s)?	Go to flow table for DTC No.	Go to Step 5.
5	1) Check DTC stored in ECM/PCM referring to "DIAGNOSTIC TROUBLE CODE CHECK (ECM/PCM)" in this section. Is there any DTC(s)?	Go to flow table for DTC No.	Substitute a known-good ECM/PCM and recheck. NOTE: After replacing with a known-good ECM/PCM, register ECM/Immobilizer Control Module code in ECM/PCM by performing procedure described in "Procedure after ECM/PCM Replacement" section.

Fig. 1 for Step 1

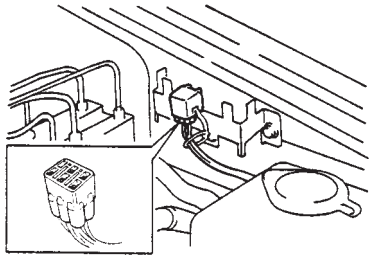


Fig. 2 for Step 1

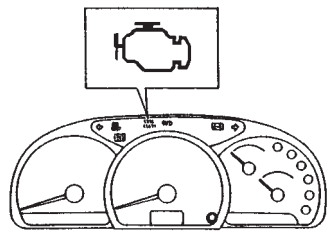
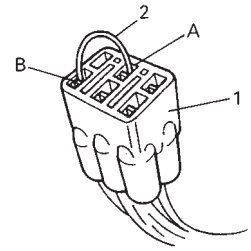


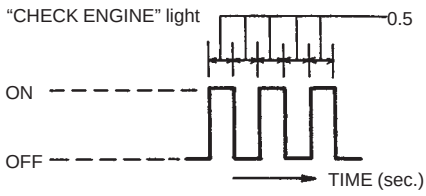
Fig. 3 for Step 2



1. Monitor coupler
2. Service wire

A: Diagnosis switch terminal
B: Ground terminal

Fig. 4 for Step 3

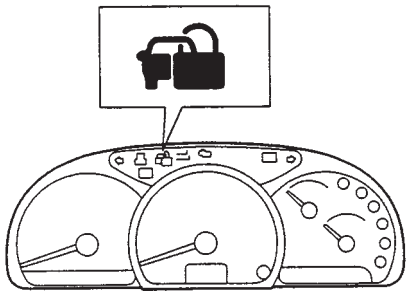


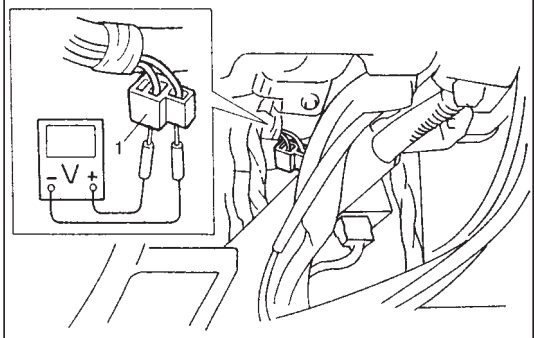
DIAGNOSTIC FLOW TABLE

<Vehicle not equipped with monitor coupler>

STEP	ACTION	YES	NO
1	1) Check immobilizer indicator lamp while ignition switch is ON (but without starting engine). See Fig. 1. Dose immobilizer indicator lamp flash?	Go to Step 3.	● If immobilizer indicator lamp remains ON, go to Step 2. ● If immobilizer indicator lamp remains OFF, go to "IMMOBILIZER INDICATOR LAMP CHECK" in this section.
2	1) Check DTC stored in ECM/PCM referring to "DIAGNOSTIC TROUBLE CODE CHECK (ECM/PCM)" in this section. Is there any DTC(s)?	Go to "IMMOBILIZER INDICATOR LAMP CHECK" in this section.	Immobilizer control system is in good condition.
3	1) Check DTC stored in immobilizer control module referring to "DIAGNOSTIC TROUBLE CODE CHECK (IMMOBILIZER CONTROL MODULE)" in this section. Is there any DTC(s)?	Go to flow table for DTC No.	Go to Step 4.
4	1) Check DTC stored in ECM/PCM referring to "DIAGNOSTIC TROUBLE CODE CHECK (ECM/PCM)" in this section. Is there any DTC(s) for immobilizer control system?	Go to flow table for DTC No.	Substitute a known-good ECM/PCM and recheck. NOTE: After replacing with a known-good ECM/PCM, register ECM/Immobilizer Control Module code in ECM/PCM by performing procedure described in "Procedure after ECM/PCM Replacement" section.

FIg. 1 for Step 1





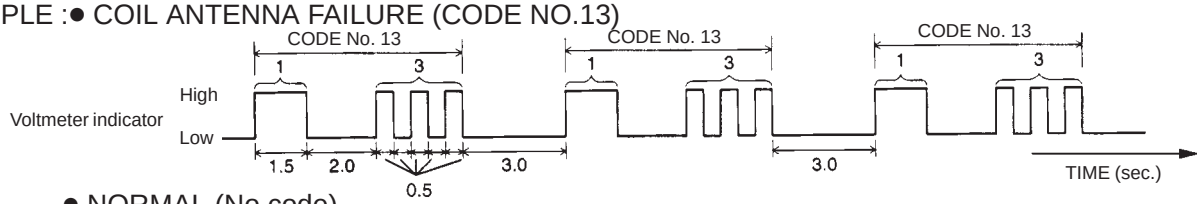
1. Immobilizer diagnostic coupler

DIAGNOSTIC TROUBLE CODE (DTC) CHECK (IMMOBILIZER CONTROL MODULE)

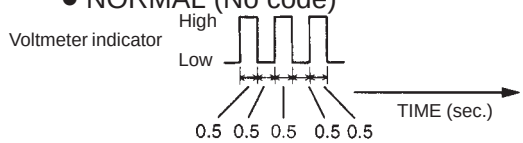
1) Using analog type voltmeter, connect positive probe to diagnostic output terminal and negative probe to ground of immobilizer diagnostic coupler with ignition switch turned ON.
2) Read deflection of voltmeter indicator which represents DTC as shown in example below and write it down. For details of DTC, refer to Immobilizer Control Module side in “Diagnostic Trouble Code Table”.
   If voltmeter indicator dose not deflect, go to “Diagnostic Flow Table A”.

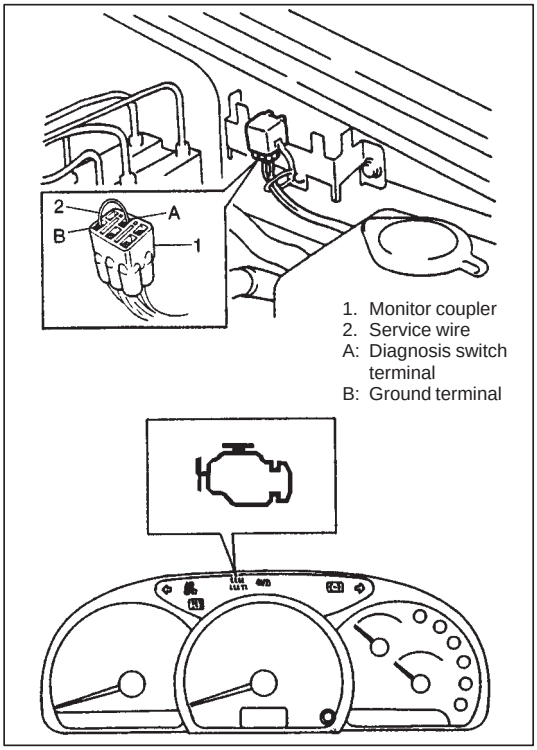
NOTE:
If abnormality or malfunction lies in two or more areas, voltmeter indicates applicable codes three times each.

EXAMPLE :● COIL ANTENNA FAILURE (CODE NO.13)



● NORMAL (No code)





1. Monitor coupler
2. Service wire
A: Diagnosis switch terminal
B: Ground terminal

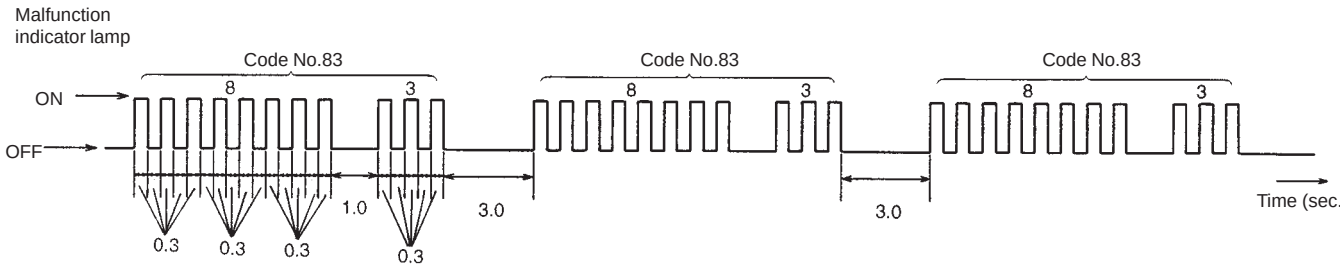
DIAGNOSTIC TROUBLE CODE (DTC) CHECK (ECM/PCM)

[Not using SUZUKI scan tool] (Vehicle equipped with monitor coupler)

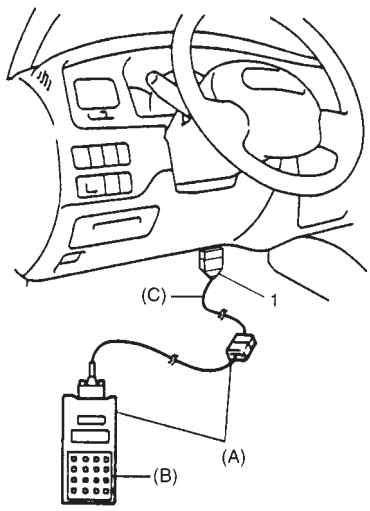
1) Using service wire, ground diagnostic switch terminal in monitor coupler.
2) Read DTC from flashing pattern of malfunction indicator lamp as shown in example below and write it down. For details of DTC, refer to ECM/PCM side in “Diagnostic Trouble Code Table”.
   If lamp remains ON, go to “Malfunction Indicator Lamp Check” in Section 6.

NOTE:
If abnormality or malfunction lies in two or more areas, malfunction indicator lamp indicates applicable codes three times each.
And flashing of these codes is repeated as long as diagnosis terminal is grounded and ignition switch is held at ON position.

EXAMPLE: When serial data link wire is defective (Code No.83)



3) After completing the check, turn ignition switch OFF and disconnect service wire from monitor coupler.



1. Data link connector (DLC)

[Using SUZUKI scan tool]

1) Turn ignition switch OFF.
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): 09931-76011 (Suzuki scan tool)
   (B): Mass storage cartridge
   (C): 09931-76030 (16/12 pin DLC adapter)

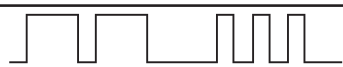
3) Turn ignition switch ON.
4) Read DTC according to instructions displayed on Suzuki scan tool and print it or write it down. Refer to Suzuki scan tool operator's manual for further details.

   NOTE:
   - **When reading DTC stored in ECM/PCM 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/PCM detects a trouble in both electric fuel injection system and immobilizer control system, Suzuki scan tool indicates trouble codes of both systems using Suzuki mode of ECM application.**

   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.
5) After completing the check, turn ignition switch OFF and disconnect Suzuki scan tool from data link connector (DLC).

DIAGNOSTIC TROUBLE CODE TABLE

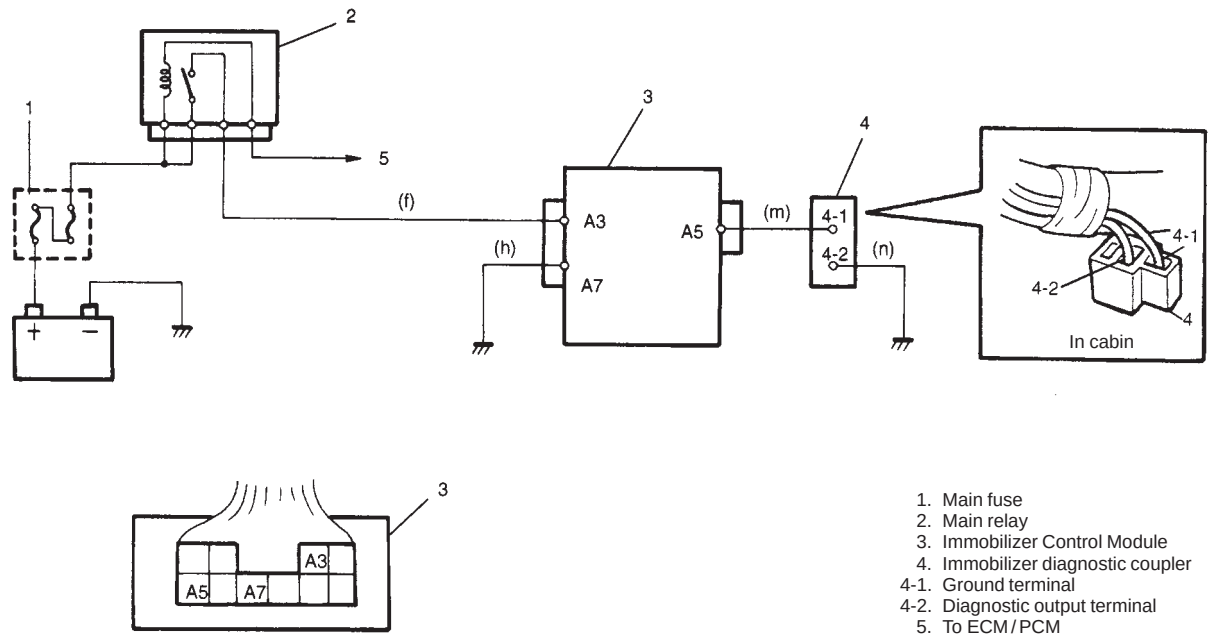
Immobilizer Control Module side

DIAGNOSTIC TROUBLE CODE		DIAGNOSTIC AREA	DIAGNOSIS
NO.	VOLTMETER INDICATION		
–		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			
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 wire	

ECM/PCM side

DTC (indicated on Suzuki scan tool)	DTC (indicated by MIL)	Malfunction Indicator lamp (MIL) flashing pattern	DIAGNOSTIC AREA	DIAGNOSIS
NO DTC	12		Normal	This code appears when it is confirmed that none of other trouble codes is set for immobilizer control system or electronic fuel injection system.
P1623	81		ECM/Immobilizer Control Module code	Diagnose trouble according to "DIAGNOSTIC FLOW TABLE" corresponding to each code No.
P1620	84			
P1622	82		ECM/PCM	
P1621	83		Serial data link wire	

TABLE A DTC IS NOT OUTPUT FROM DIAGNOSTIC OUTPUT TERMINAL



1. Main fuse
2. Main relay
3. Immobilizer Control Module
4. Immobilizer diagnostic coupler

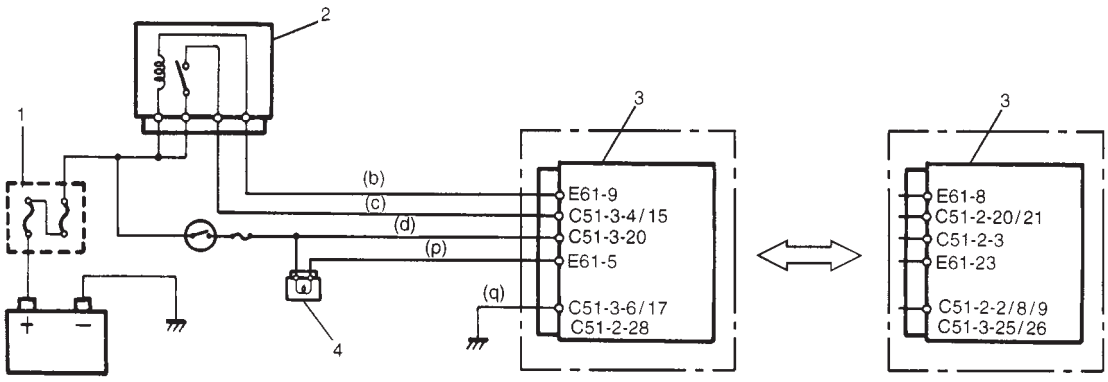
4-1. Ground terminal

4-2. Diagnostic output terminal

5. To ECM / PCM

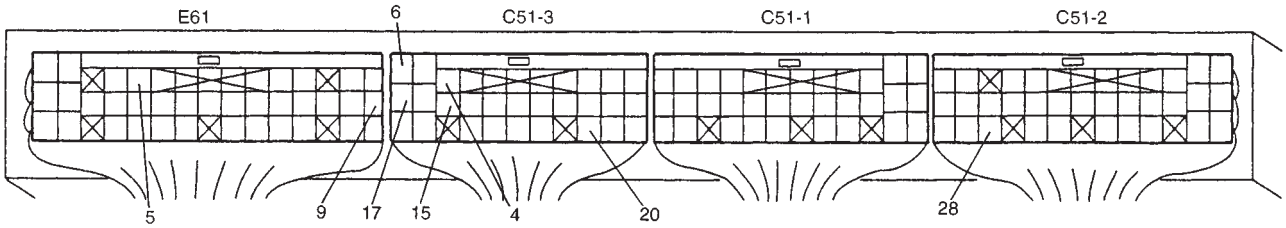
STEP	ACTION	YES	NO
1	Check voltage between A3 terminal and body ground with ignition switch turned ON. Is it 10 – 14V?	Go to Step 2.	"(f)" wire open.
2	1) Connect voltmeter between A5 terminal and body ground. 2) Does voltmeter indicator deflect?	Go to Step 3.	● Poor A3, A5 or A7 connection. ● "(h)" wire of A7 terminal open. ● "(m)" wire between A5 terminal and diagnostic output terminal of immobilizer diagnostic coupler short. If wire and connections are OK, substitute a known-good Immobilizer Control Module and recheck. **NOTE:** **After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM / PCM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure after Immobilizer Control Module Replacement" section.**
3	1) Connect voltmeter between diagnostic output terminal of immobilizer diagnostic coupler and body ground. 2) Is it possible to read DTC by checking deflection of voltmeter indicator?	"(n)" wire of ground terminal for immobilizer diagnostic coupler open.	"(m)" wire between A5 terminal and diagnostic output terminal of immobilizer diagnostic coupler open.

TABLE B IMMOBILIZER INDICATOR LAMP CHECK (IMMOBILIZER INDICATOR LAMP DOSE NOT LIGHT AT IGNITION SWITCH ON)

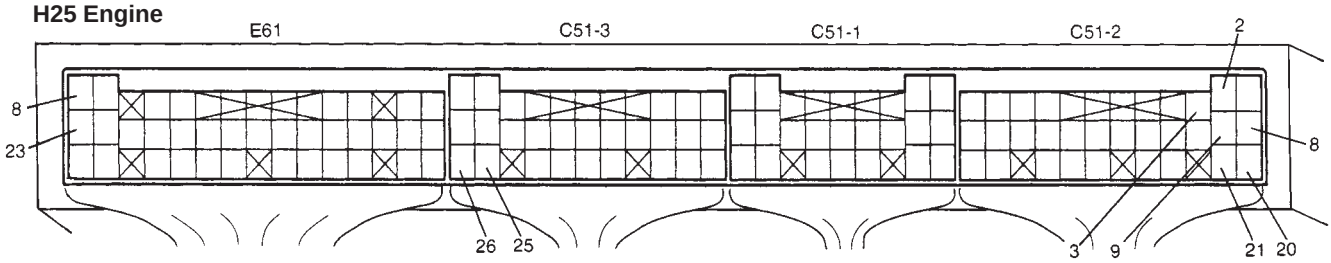


1. Main fuse
2. Main relay
3. ECM/PCM
4. Immobilizer indicator lamp (Vehicle not equipped with monitor coupler)

G16/J20 Engine

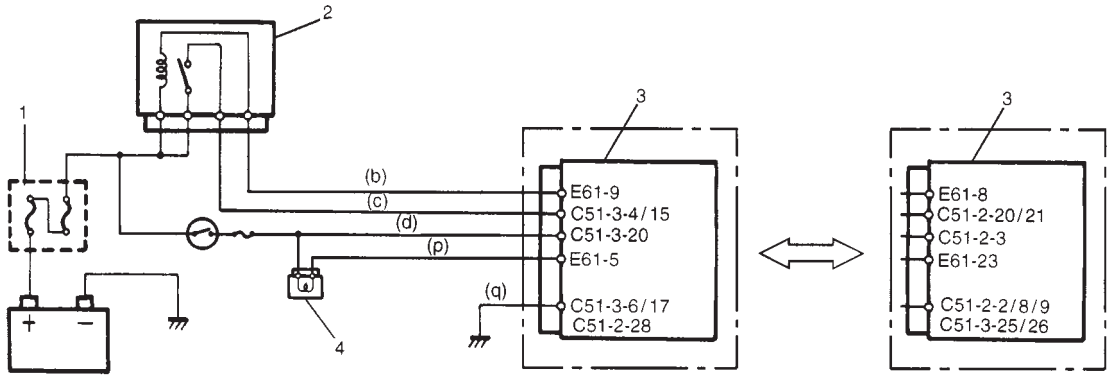


H25 Engine



STEP	ACTION	YES	NO
1	1) Turn ignition switch ON. Do other indicator/warning lights in combination meter come ON?	Go to Step 2.	"IG" fuse blown, main fuse blown, ignition switch malfunction, "B/W" circuit between "IG" fuse and combination meter or poor coupler connection at combination meter.
2	1) Turn ignition switch OFF and disconnect connectors from ECM/PCM. 2) Check for proper connection to ECM/PCM at terminal E61-5 for G16/J20 engine or E61-23 for H25 engine. 3) If OK, then using service wire, ground terminal E61-5 for G16/J20 engine or E61-23 for H25 engine in connector disconnected. Does immobilizer indicator lamp turn on at ignition switch ON?	Substitute a known-good ECM/PCM and recheck.	Bulb burned out or "(b)" wire circuit open.

TABLE C IMMOBILIZER INDICATOR LAMP CHECK (IMMOBILIZER INDICATOR LAMP REMAINS ON AFTER ENGINE STARTS)

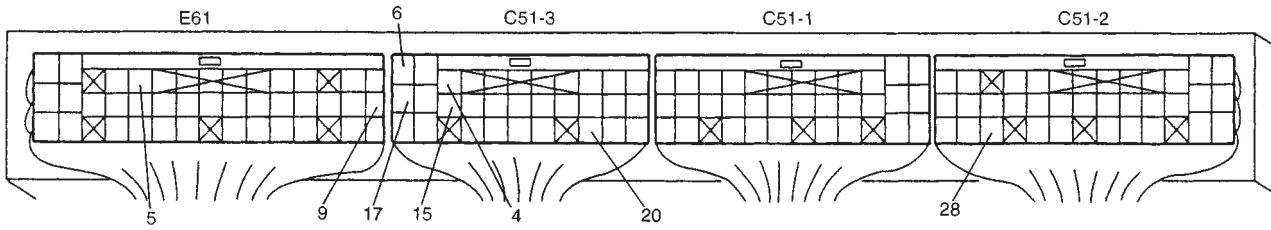


For G16/J20 engine

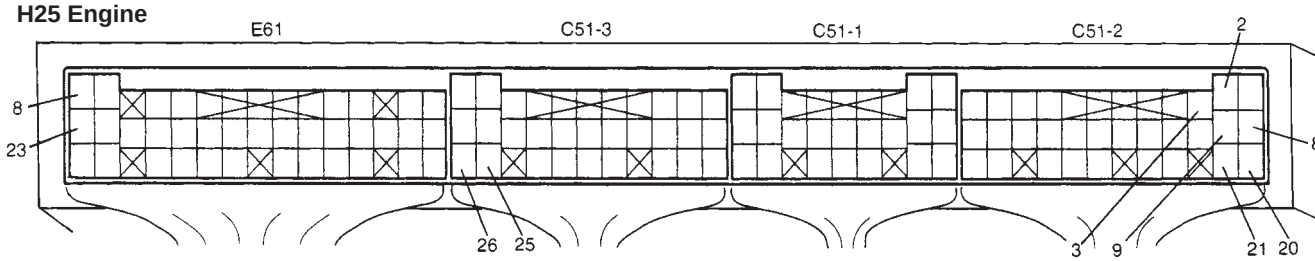
For H25 engine

1. Main fuse
2. Main relay
3. ECM/PCM
4. Immobilizer indicator lamp (Vehicle not equipped with monitor coupler)

G16/J20 Engine



H25 Engine



STEP	ACTION	YES	NO
1	1) With ignition switch OFF, disconnect couplers from ECM/PCM. Does immobilizer indicator lamp turn ON at ignition switch ON?	"(p)" wire shorted to ground circuit.	Substitute a known-good ECM/PCM and recheck.

DTC11 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, this DTC is set.

INSPECTION:

Register ignition key with built-in transponder by using Suzuki scan tool (TECH1 cartridge for immobilizer control system and TECH 1A kit) and performing following steps.

1) Register Transponder code in Immobilizer Control Module by performing procedure described in "How to register ignition key" section.
2) Turn ignition switch OFF, then turn it ON and check that DTC11 is not set.

DTC31 TRANSPONDER CODE NOT REGISTERED

DESCRIPTION:

Immobilizer Control Module checks if Transponder code transmitted from ignition key and that registered in Immobilizer Control Module match when ignition switch is ON. If there is no Transponder code registered in Immobilizer Control Module, this DTC is set.

INSPECTION:

Register ignition key with built-in transponder by using Suzuki scan tool (TECH1 cartridge for immobilizer control system and TECH 1A kit) and performing following steps.

1) Register Transponder code in Immobilizer Control Module by performing procedure described in "How to register ignition key" section.
2) Turn ignition switch OFF, then turn it ON and check that DTC31 is not set.

DTC12 FAULT IN IMMOBILIZER CONTROL MODULE

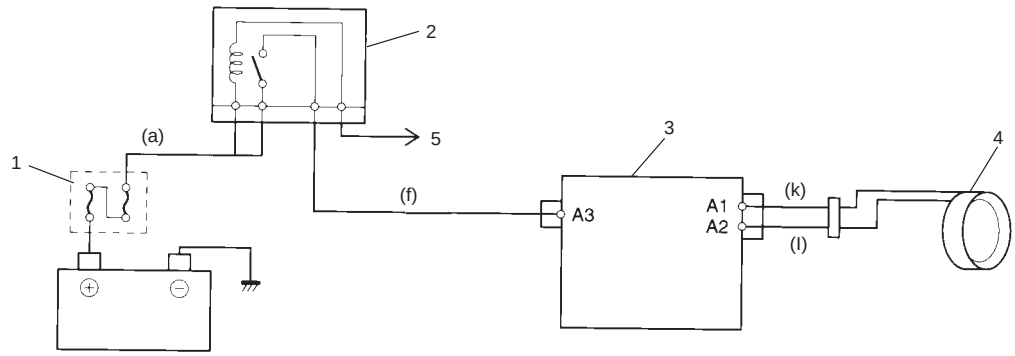
DESCRIPTION:

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. **NOTE:** **After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM/PCM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure after Immobilizer Control Module Replacement" section.**	Repair or replace.

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 / PCM

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	Does ignition key being used have built-in transponder? (See Fig. 1)	Go to Step 2.	Replace ignition key with built-in transponder and follow "DIAGNOSTIC FLOW TABLE" again.
2	1) Disconnect coil antenna coupler with ignition switch turned OFF. 2) Is there continuity between coil antenna coupler terminals A and B? (See Fig. 2)	Go to Step 3.	Coil antenna open.
3	Measure resistance between terminals of coil antenna coupler and body ground. (See Fig. 3) Is it ∞ (infinity) Ω ?	Go to Step 4.	Coil antenna shorted to ground.
4	1) With coil antenna coupler disconnected, disconnect Immobilizer Control Module coupler. 2) Measure resistance between coil antenna terminals of Immobilizer Control Module coupler. (See Fig. 4) Is it ∞ (infinity) Ω ?	Go to Step 5.	"(k)" wire shorted to "(l)"wire.
5	Measure resistance between terminal A1 of Immobilizer Control Module coupler and body ground. (See Fig. 5) Is it ∞ (infinity) Ω ?	Go to Step 6.	"(k)" wire shorted to ground.
6	Measure resistance between terminal A2 of Immobilizer Control Module coupler and body ground. (See Fig. 6) Is it ∞ (infinity) Ω ?	Go to Step 7.	"(l)" wire shorted to ground.
7	1) Connect coil antenna coupler. 2) Is there continuity between Immobilizer Control Module coupler terminals A1 and A2? (See Fig. 7)	Go to Step 8.	● "(k)" or "(l)" wire open. ● Poor coil antenna-to-coupler.

DTC13 NO TRANSPONDER CODE TRANSMITTED OR COIL ANTENNA OPENED/SHORTED (CONTINUED)

STEP	ACTION	YES	NO
8	Poor A1 or A2 connection. 1) If connections are OK, connect Immobilizer Control Module coupler and substitute a known-good coil antenna. 2) Is DTC 13 also indicated with ignition switch turned ON?	Go to Step 9.	Faulty coil antenna.
9	Is DTC 13 still indicated even when another ignition key (with built-in transponder) for that vehicle used?	Substitute a known-good Immobilizer Control Module and recheck. **NOTE:** **After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM/PCM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure after Immobilizer Control Module Replacement" section.**	Faulty ignition key.

Fig. 1 for Step 1

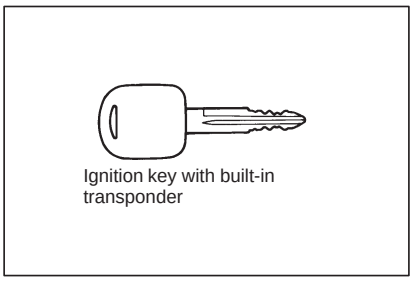


Fig. 2 for Step 2

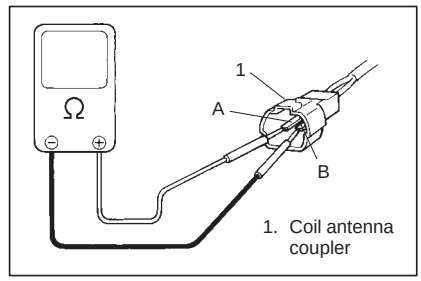


Fig. 3 for Step 3

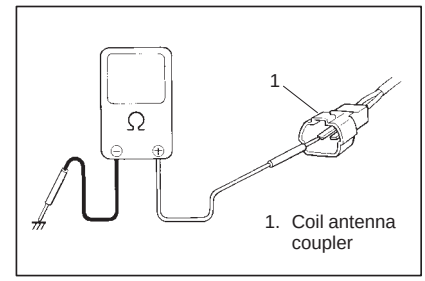


Fig. 4 for Step 4

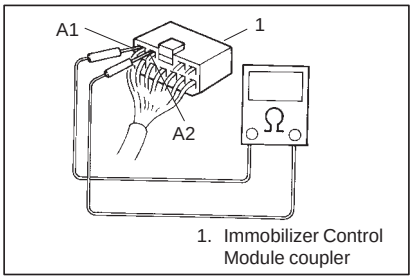


Fig. 5 for Step 5

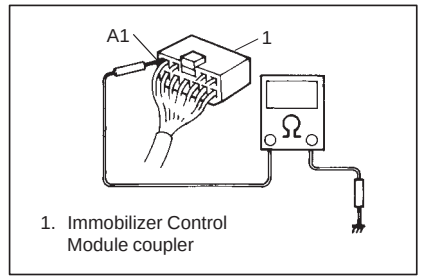


Fig. 6 for Step 6

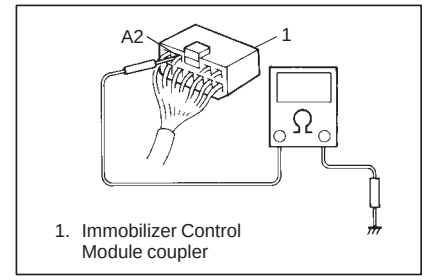
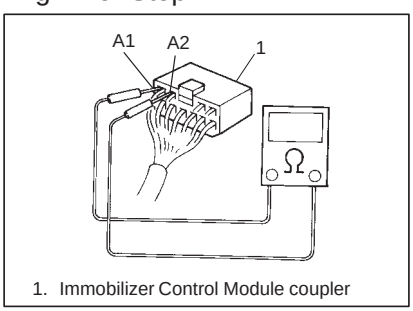


Fig. 7 for Step 7



DTC21 ECM/IMMOBILIZER CONTROL MODULE CODE NOT MATCHED (IMMOBILIZER CONTROL MODULE SIDE)
DTC81 (P1623) ECM/IMMOBILIZER CONTROL MODULE CODE NOT MATCHED (ECM/PCM SIDE)
DTC84 (P1620) ECM/IMMOBILIZER CONTROL MODULE CODE NOT REGISTERED

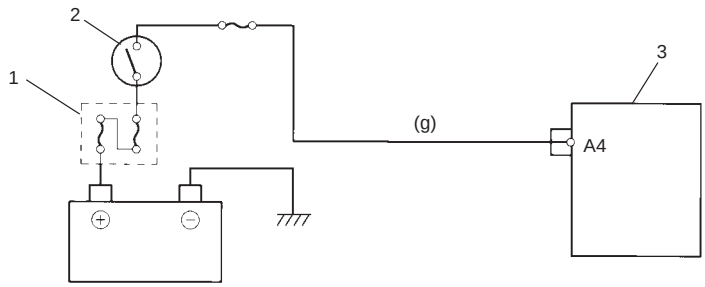
DESCRIPTION:

- DTC21
  Immobilizer Control Module checks if ECM/Immobilizer Control Module code transmitted from ECM/PCM and that registered in Immobilizer Control Module match when ignition switch is ON. If they do not, this DTC is set.
- DTC81 (P1623)
  ECM/PCM checks if ECM/Immobilizer Control Module code transmitted from Immobilizer Control Module and that registered in ECM/PCM match when ignition switch is ON. If they do not, this DTC is set.
- DTC84 (P1620)
  ECM/PCM checks if code transmitted from Immobilizer Control Module and that registered in ECM/PCM match when ignition switch is ON. If there is no ECM/Immobilizer Control Module code registered in ECM/PCM, this DTC is set.

INSPECTION:

Perform procedure described in “Procedure after ECM/PCM Replacement” section.

DTC22 IGNITION SWITCH CIRCUIT OPEN/SHORT



1. Main fuse
2. Ignition switch
3. Immobilizer Control Module

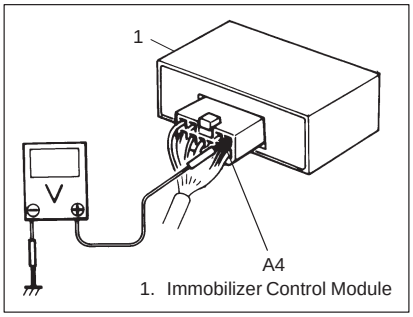
DESCRIPTION:

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:

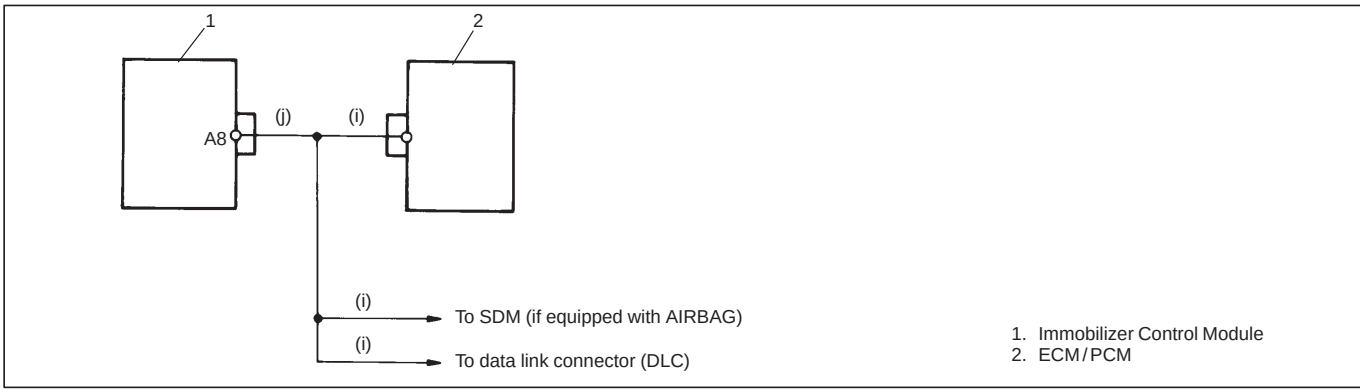
STEP	ACTION	YES	NO
1	Check voltage between Immobilizer Control Module coupler terminal A4 and body ground with ignition switch turned ON. (See Fig.1) Is it 10 – 14V?	Poor A4 terminal connection. If connection is OK, substitute a known-good Immobilizer Control Module and recheck. **NOTE:** **After replacing with a know-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM/PCM and Transponder code and ECM/ Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure after Immobilizer Control Module Replacement" section.**	"(g)" wire open or short.

Fig. 1 for Step 1



1. Immobilizer Control Module

DTC23 NO ECM/IMMOBILIZER CONTROL MODULE CODE TRANSMITTED FROM ECM/PCM OR DLC CIRCUIT OPENED/SHORTED
DTC83 (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/PCM and ECM/PCM requests Immobilizer Control Module to transmit ECM/Immobilizer Control Module code. If ECM/Immobilizer Control Module code is not transmitted from ECM/PCM or Immobilizer Control Module, Immobilizer Control Module sets DTC23 and ECM/PCM sets DTC83 (P1621).

INSPECTION:

STEP	ACTION	YES	NO
1	Check voltage between Immobilizer Control Module coupler terminal A8 and body ground with ignition switch turned ON. Is it 4 – 5V?	Go to Step 2.	"(i)" or "(j)" wire short.
2	1) Disconnect ECM/PCM coupler with ignition switch turned OFF. 2) Is there continuity between Immobilizer Control Module coupler terminal A8 and Data link connector terminal of ECM/PCM coupler? (For positions of Data link connector terminal of ECM/PCM coupler, refer to Section 6E1 or 6E2.)	Poor A8 connection (Immobilizer Control Module) or Poor Data link connector terminal connection (ECM/PCM). If connections are OK, substitute a known-good ECM/PCM or Immobilizer Control Module and recheck. **NOTE :** ● **After replacing with a known-good ECM/PCM, register ECM/Immobilizer Control Module code in ECM/PCM by performing procedure described in "Procedure after ECM/PCM Replacement" section.** ● **After replacing with a known-good Immobilizer Control Module, register ECM/Immobilizer Control Module code in ECM/PCM and Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module by performing procedure described in "Procedure after Immobilizer Control Module Replacement" section.**	"(i)" or "(j)" wire between Immobilizer Control Module and ECM/PCM open.

Fig. 1 for step 1

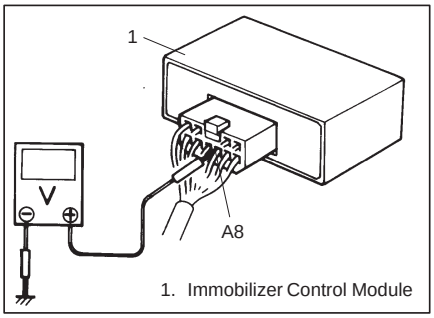
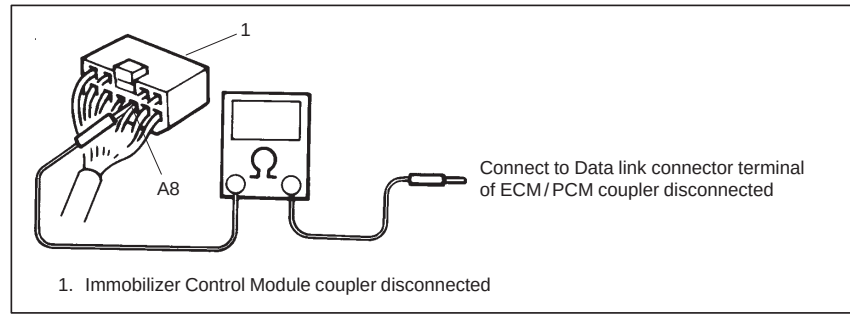


Fig. 2 for step 2



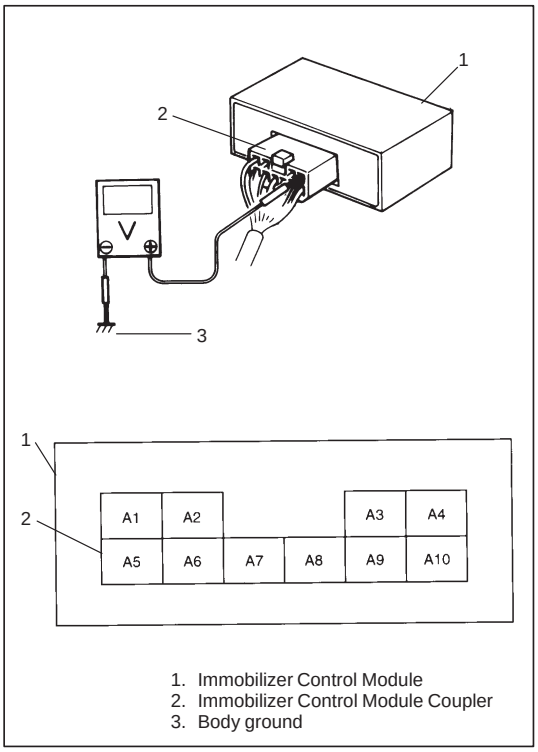
DTC82 (P1622) FAULT IN ECM/PCM

DESCRIPTION:

This DTC is set when an internal fault is detected in ECM/PCM.

INSPECTION:

STEP	ACTION	YES	NO
1	1) Ignition switch OFF. 2) Disconnect connectors from ECM/PCM. 3) Check for proper connection to ECM/PCM at all terminals. Are they in good condition?	Substitute a known-good ECM/PCM and recheck. **NOTE:** **After replacing with a known-good ECM/PCM, register ECM/Immobilizer Control Module code in ECM/PCM by performing procedure described in "Procedure after ECM/PCM Replacement" section.**	Repair or replace.



1. Immobilizer Control Module
2. Immobilizer Control Module Coupler
3. Body ground

INSPECTION OF ECM/PCM, IMMOBILIZER CONTROL MODULE AND ITS CIRCUIT

ECM/PCM, Immobilizer Control Module and its circuit can be checked at ECM/PCM wiring couplers and Immobilizer Control Module wiring coupler by measuring voltage and resistance. Described here is only inspection of Immobilizer Control Module. For inspection of ECM/PCM, refer to "SECTION 6E1 or 6E2".

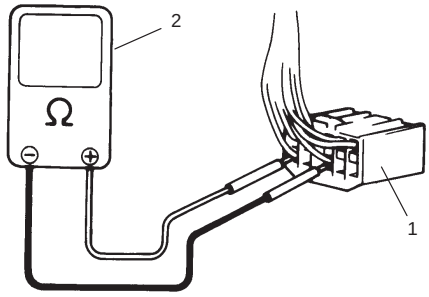
CAUTION:
Immobilizer Control Module cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to Immobilizer Control Module with coupler disconnected from it.

Voltage Check

1) Remove Immobilizer Control Module from body with ignition switch OFF, referring to p. 8G-24.
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 11 V or more when ignition switch is ON.

TERMINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
A1	Coil antenna 1	0 V	Ignition switch ON
A2	Coil antenna 2	0 V	
A3	Power source	10 – 14 V	
A4	Ignition signal	10 – 14 V	Ignition switch ON
		0 – 0.8 V	Ignition switch OFF
A5	Diagnosis output	0 – 14 V	Ignition switch ON
		0 V	Ignition switch OFF
A6	Blank	–	–
A7	Ground	–	–
A8	Data link connector (Serial data terminal)	4 – 5 V	Ignition switch ON
A9 A10	Blank	–	–

NOTE:
When measuring voltage at A1 and A2 terminals with ignition switch turned ON, be sure to turn ignition switch ON before connecting positive probe of voltmeter to A1 or A2 terminal. If it is not turned ON first, DTC13 (Diagnostic Trouble Code 13) may be indicated.



1. Immobilizer Control Module coupler disconnected
2. Ohmmeter

Resistance Check

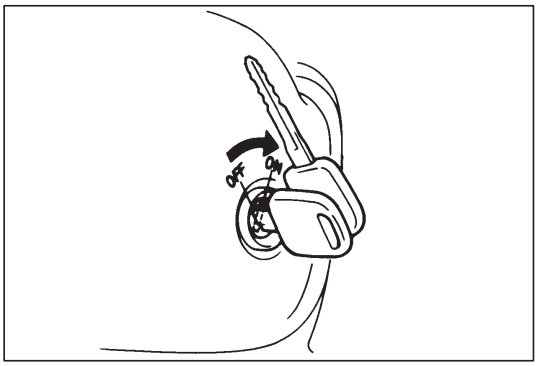
1) Disconnect Immobilizer Control Module couplers from Immobilizer Control Module with ignition switch OFF.

CAUTION:
Never touch terminals of Immobilizer Control Module itself or connect voltmeter or ohmmeter.

2) Check resistance between each terminal of coupler disconnected.

CAUTION:
- **Be sure to connect ohmmeter probe from wire harness side of coupler.**
- **Be sure to turn OFF ignition switch for this check.**
- **Resistance in table below represents that when parts temperature is 20°C (68°F).**

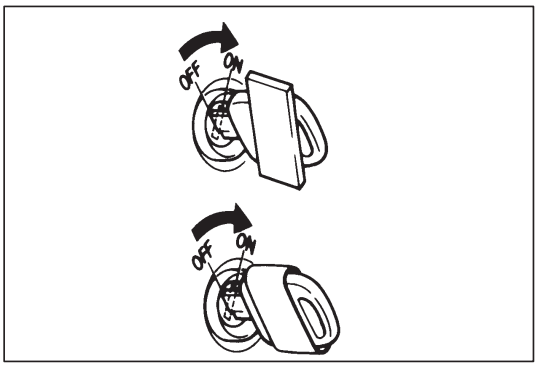
TERMINAL	CIRCUIT	NORMAL RESISTANCE	CONDITION
A1 – A2	Coil antenna	Continuity	–



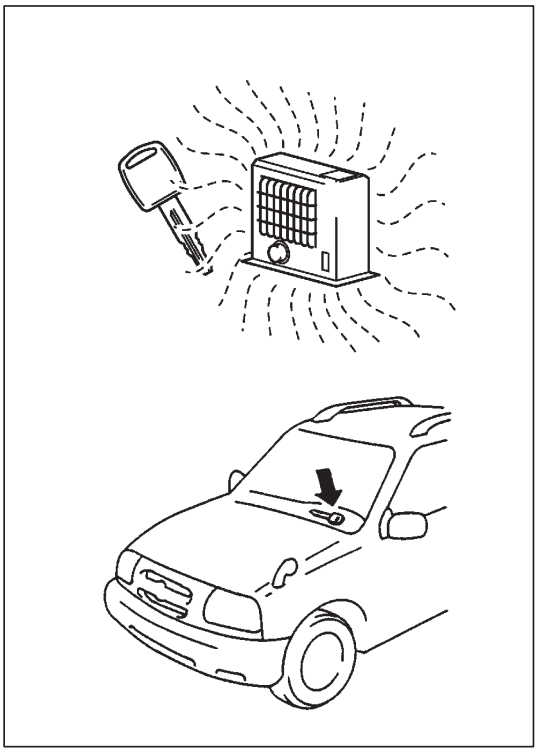
ON-VEHICLE SERVICE

PRECAUTIONS IN HANDLING IMMOBILIZER CONTROL SYSTEM

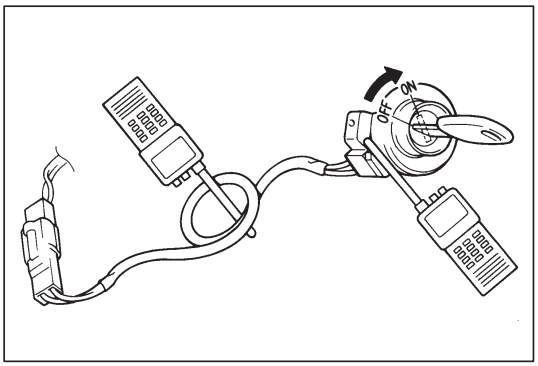
- Do not turn ON ignition switch with ignition key for immobilizer control system put together with another one or placed quite close to another one. Or the system may detect abnormal condition and prevent engine from starting.



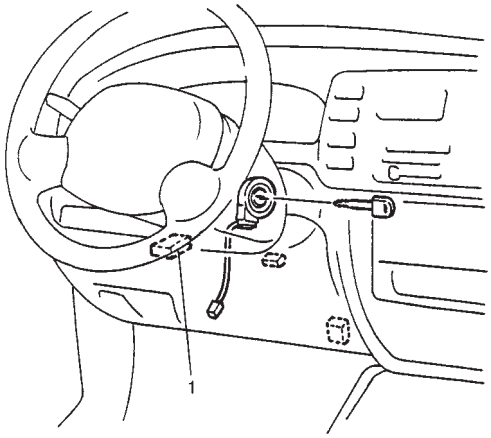
- Do not turn ON ignition switch by using ignition key with any type of metal wound around its grip or in contact with it. Or the system may detect abnormal condition and prevent engine from starting.



- Do not leave ignition key where high temperature is anticipated. High temperature will cause transponder in ignition key to be abnormal or damaged.



- Do not turn ON ignition switch with a radio antenna placed near coil antenna or its harness to Immobilizer Control Module. Or the system may detect abnormal condition and prevent engine from starting.



1. Immobilizer Control Module

IMMOBILIZER CONTROL MODULE

Removal

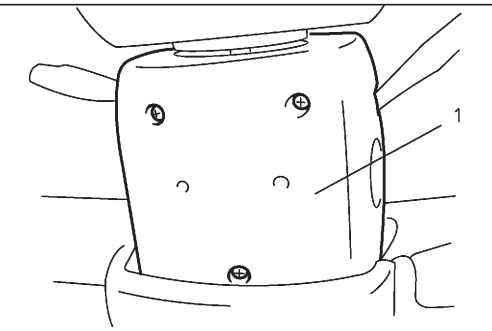
1) Disconnect negative (–) cable at battery.
2) Remove steering column hole cover.
3) Disconnect coupler at Immobilizer Control Module.
4) Remove Immobilizer Control Module.

Installation

Reverse removal procedure for installation.

NOTE:

After replacing Immobilizer Control Module, be sure to register Transponder code and ECM/Immobilizer Control Module code in Immobilizer Control Module and ECM/Immobilizer Control Module code in ECM / PCM by performing procedure described in "Procedure after Immobilizer Control Module Replacement" section.

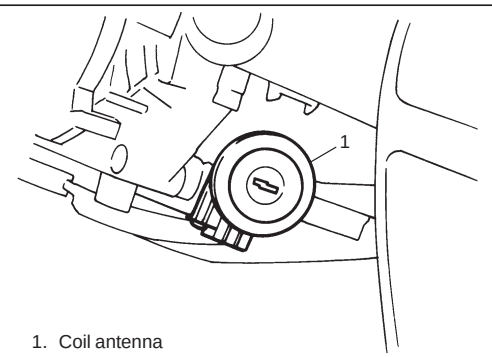


1. Steering column lower cover

COIL ANTENNA

Removal

1) Disconnect negative (–) cable at battery.
2) Remove steering column upper and lower cover by removing 3 screws.
3) Remove steering column hole cover.

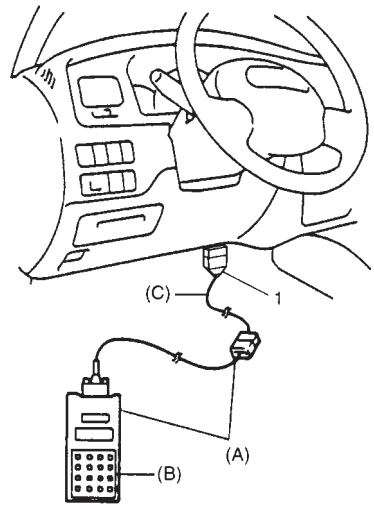


1. Coil antenna

4) Remove coil antenna.

Installation

For installation, reverse removal procedure.



1. Data link connector (DLC)

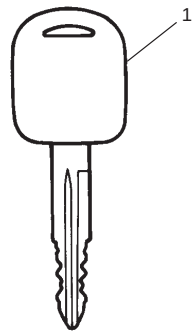
HOW TO REGISTER IGNITION KEY

Register the ignition key with a built-in transponder in Immobilizer Control Module by using the following procedure.

1) Prepare Suzuki scan tool (TECH 1A kit and cartridge for immobilizer control system).
2) With ignition switch OFF, connect Suzuki scan tool to data link connector (DLC) located on underside of instrument panel at driver's seat side.

Special Tool
(A): 09931-76011 (Tech 1A)
(B): Immobilizer cartridge
(C): 09931-76030 (16/14-pin DLC cable)

NOTE:
For operation procedure of Suzuki scan tool, refer to Suzuki scan tool operator's manual.



1. Ignition key with built-in transponder

3) Prepare ignition key with a built-in transponder. 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.

NOTE:
When "CLR. TRANS COD (CLEAR TP CODE)" command is executed with the malfunction indicator lamp (the lamp for vehicles equipped with the monitor coupler) ON or the immobilizer indicator lamp (the lamp for vehicle not equipped with the monitor coupler) 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) [Vehicle equipped with monitor coupler]
   Make sure that malfunction indicator lamp lights when ignition switch is turned OFF once and then ON.
   [Vehicle not equipped with monitor coupler]
   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/PCM by performing following procedure.

1) Perform Steps 1) and 2) described in "How to register ignition key" section.
2) Prepare ignition key with a built-in transponder. And then turn ignition switch ON by using it.
3) Using Suzuki scan tool, clear all transponder codes registered in Immobilizer Control Module by executing "CLR. TRANS COD (CLEAR TP CODE)" command in SELECT MODE menu.

NOTE:
When "CLR. TRANS COD (CLEAR TP CODE)" command is executed with the malfunction indicator lamp (the lamp for vehicles equipped with the monitor coupler) ON or the immobilizer indicator lamp (the lamp for vehicles not equipped with the monitor coupler) 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/PCM by executing "RECORD ECU (RECORD ECM/PCM/ICM)" command in SELECT MODE menu.
6) [Vehicle equipped with monitor coupler]
   Make sure that malfunction indicator lamp lights when ignition switch is turned OFF once and then ON.
   [Vehicle not equipped with monitor coupler]
   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).

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/PCM REPLACEMENT

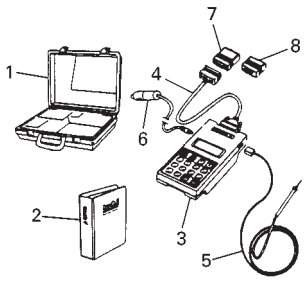
When ECM/PCM was replaced, including when replaced because rechecking by using a known-good ECM/PCM was necessary during trouble diagnosis, register ECM/Immobilizer Control Module code in ECM/PCM by performing following procedure.

1) Perform Steps 1) and 2) described in "How to register ignition key" section. And then turn ignition switch ON.
2) Using TECH1, register ECM/Immobilizer Control Module code in ECM/PCM by executing "RECORD ECU (RECORD ECM/PCM/ICM)" command in SELECT MODE menu.

   NOTE:
   For operation procedure of Suzuki scan tool, refer to TECH1 operator's manual.

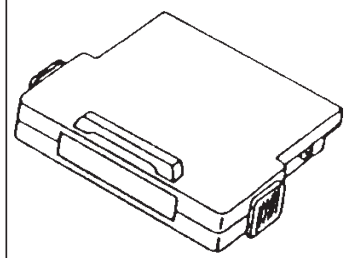
3) [Vehicle equipped with monitor coupler]
   Make sure that malfunction indicator lamp lights when ignition switch is turned OFF once and then ON.
   [Vehicle not equipped with monitor coupler]
   Make sure that immobilizer indicator lamp lights when ignition switch is turned OFF once and then ON.

SPECIAL TOOLS

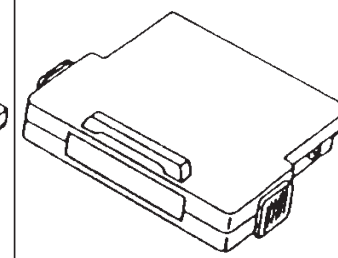


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable (14/26 pin, 09931-76040)
5. Test lead/probe
6. Power source cable
7. DLC cable adapter
8. Self-test adapter

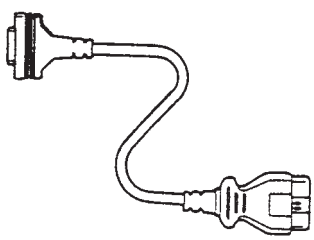
09931-76011
Suzuki scan tool (Tech 1A kit)



Immobilizer cartridge of version 1.1 or more



Mass storage cartridge of version1.5 or more



NOTE:
Use this cable only with immobilizer cartridge of version 1.1 or more.
Use of this cable with 96 immobilizer cartridge will disable 96 immobilizer cartridge from operating properly.

09931-76030
16/14 pin DLC cable

SECTION 9

BODY SERVICE

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

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

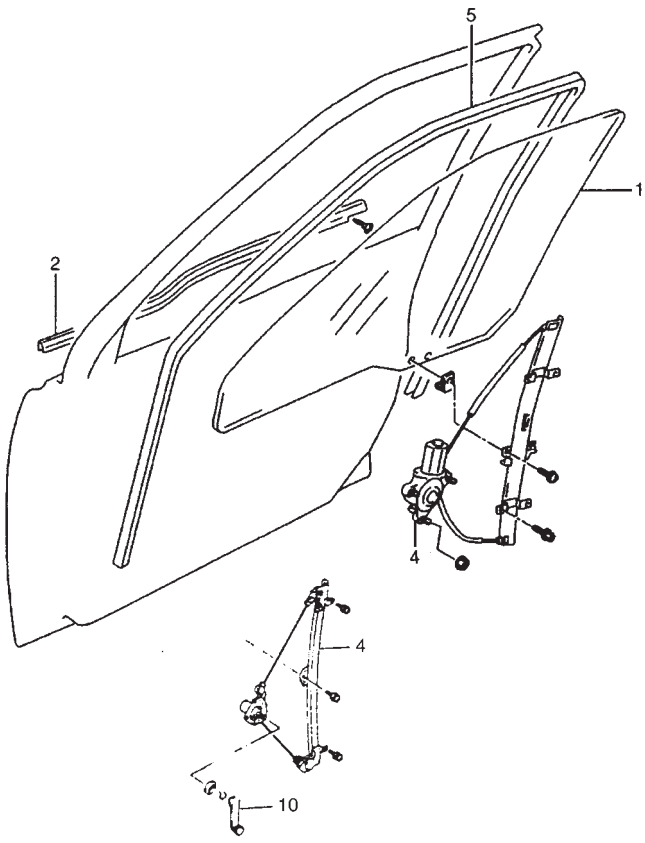
NOTE:
Fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number of with an equivalent part if replacement becomes necessary.
Do not use a replacement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

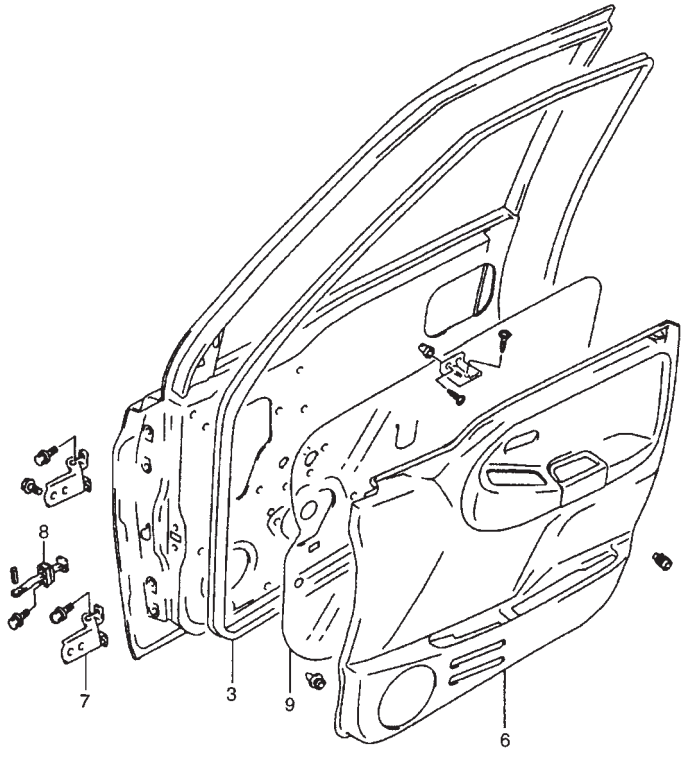
CONTENTS

GLASS, WINDOWS AND MIRRORS 9- 2
Front Door Glass 9- 2
Front Door Window Regulator 9- 5
Windshield 9- 6
Rear Door Glass 9-12
Rear Door Window Regulator 9-14
Quarter Window 9-15
Back Door Glass 9-16
BODY STRUCTURE 9-17
Front Door Assembly 9-17
Rear Door Assembly 9-18
Back Door/Rear Gate Assembly 9-19
Hood 9-21
Front Fender 9-22
Front Bumper 9-23
Rear Bumper 9-24
Under Body Dimensions 9-25
Body Dimensions 9-26
INSTRUMENTATION AND DRIVER INFORMATION 9-33
Instrument Panel 9-33
SEAT 9-34
Front Seat 9-34
Rear Seat 9-35
PAINT AND COATINGS 9-36
Anti-Corrosion Treatment 9-36
Metal Replacement Parts Finishing 9-37
Plastic Parts Finishing 9-58
SECURITY AND LOCKS 9-59
Front Door Lock Assembly 9-59
Rear Door Lock Assembly 9-61
Back Door/Rear Gate Lock Assembly 9-62
Key Coding 9-63
SUNROOF/CONVERTIBLE TOP 9-64
Sliding Roof (if equipped) 9-64
Canvas Top And Topbow Frames 9-71
EXTERIOR AND INTERIOR TRIM 9-72
Floor Carpet 9-72
Head lining 9-73
Roof Trim (2 Door Model) 9-75
Side Moldings (if equipped) 9-77
Splash Guard (if equipped) 9-78
Roof Rail (if equipped) 9-79
Roof Molding 9-79
Luggage Under Box 9-80

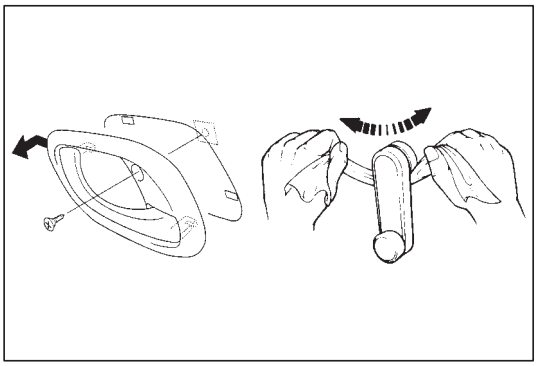
GLASS, WINDOWS AND MIRROR

FRONT DOOR GLASS





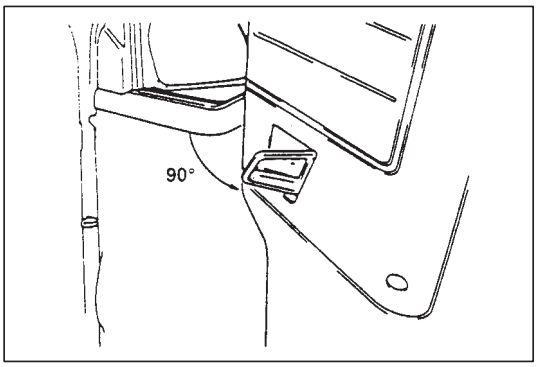
1. Door glass
2. Weatherstrip
3. Opening weatherstrip
4. Window regulator
5. Glass run
6. Door trim
7. Door hinge
8. Door open stop
9. Door sealing cover
10. Window regulator handle (if equipped)



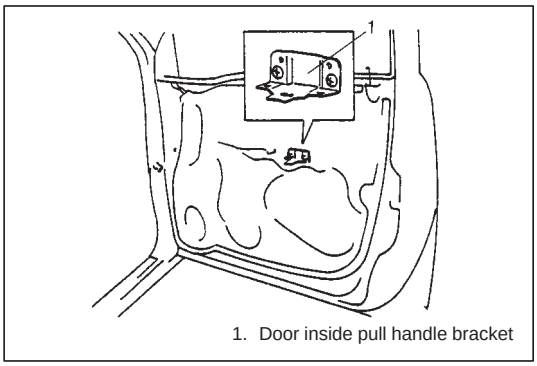
REMOVAL

1) Remove inside handle bezel.
2) Remove door mirror bezel (if equipped).
3) Remove inside lock knob and door inside pull handle case fitting screw.

3-1) Remove window regulator handle (if equipped).
To remove regulator handle, pull off snap ring by using a cloth as shown below.

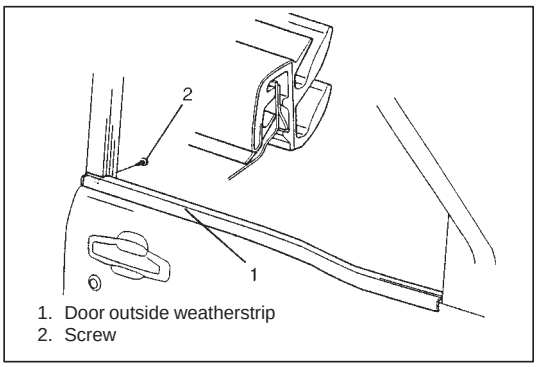


4) Remove door trim.
With inside handle bezel tilted as shown in figure, turn door trim 90° counterclockwise to remove it.
And disconnect power window switch lead wire at coupler (if equipped).



1. Door inside pull handle bracket

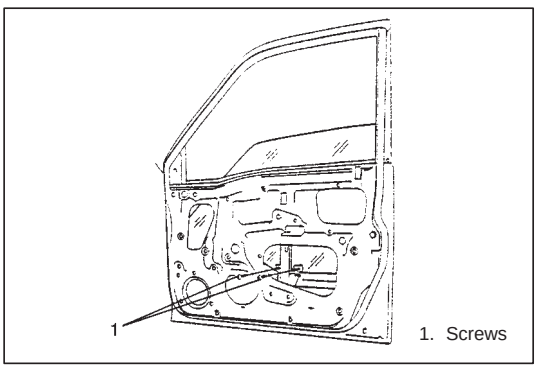
5) Remove door inside pull handle bracket.
6) Remove door sealing cover.



1. Door outside weatherstrip
2. Screw

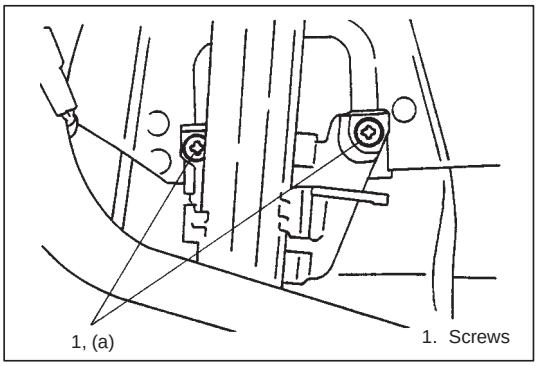
7) Remove door outside weatherstrip.
Lower window all the way down. Then, use a tape-wrapped putty knife (or screwdriver) to pry off weatherstrip.

CAUTION:
Use a tape-wrapped putty knife (or screwdriver) to pry off weatherstrip. Use of an unwrapped tool will cause damage to painting.



1. Screws

8) Remove glass attaching screws.
9) Take out door glass.



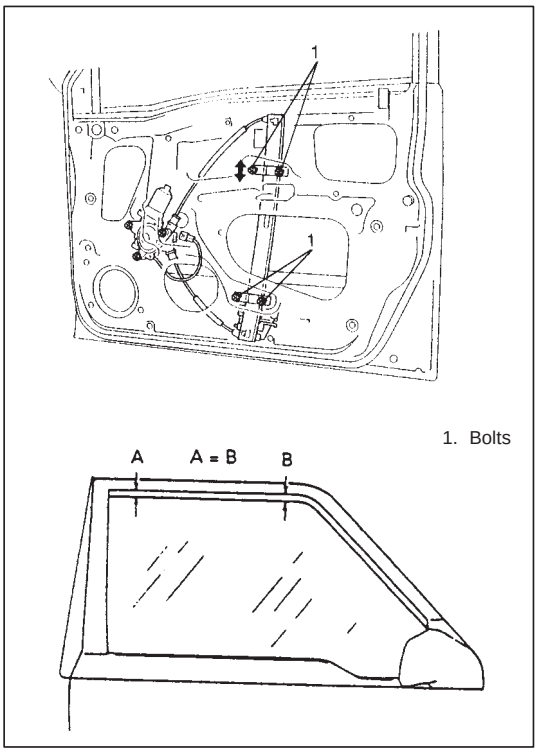
INSTALLATION

Reverse removal procedure to install door glass noting following points:

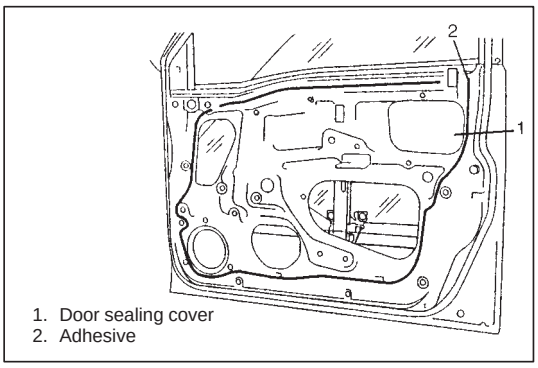
- Tighten glass attaching screws to specified torque. Tighten front screw first, then rear screw.

  Tightening Torque
  (a): 2.5 N·m (0.25 kg-m, 1.8 lb-ft)

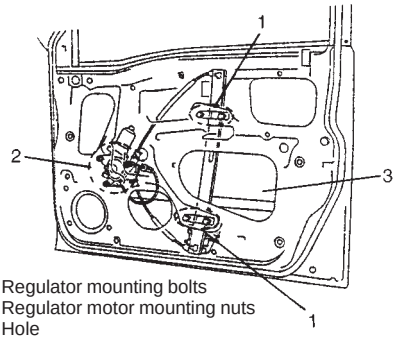
- When window becomes hard to raise and lower, adjust screws to correct tilted glass as shown in figure.



- Adjust equalizer of window regulator so that measurement A and B are equal.



- Secure door sealing cover with adhesive.

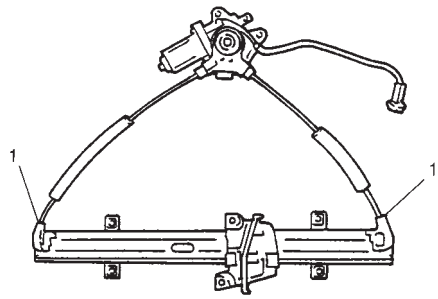


1. Regulator mounting bolts
2. Regulator motor mounting nuts
3. Hole

FRONT DOOR WINDOW REGULATOR

REMOVAL

1) Remove door glass, referring to steps 1) to 9) of FRONT DOOR GLASS REMOVAL in this section.
2) Disconnect power window motor lead wire at coupler and loosen clamp.
3) Loosen regulator mounting bolts, nuts and take out regulator through hole as shown in left figure.



1. Window regulator lubrication point

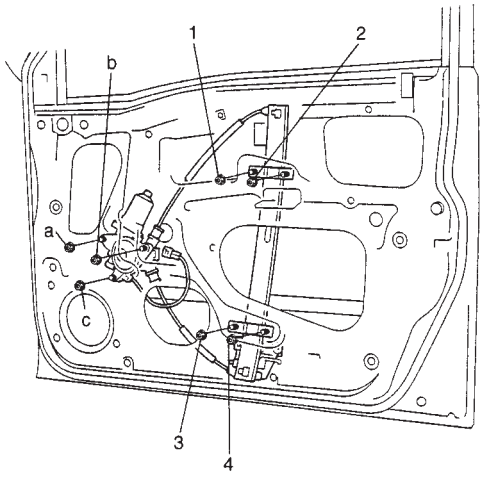
INSPECTION

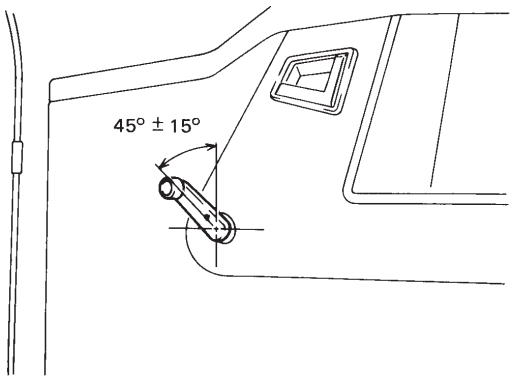
1) Check regulator sliding and rotating parts for greasing.
2) Check rollers for wear and damage.
3) Check wire for damage.

INSTALLATION

Reverse removal procedure to install window regulator noting the following point.

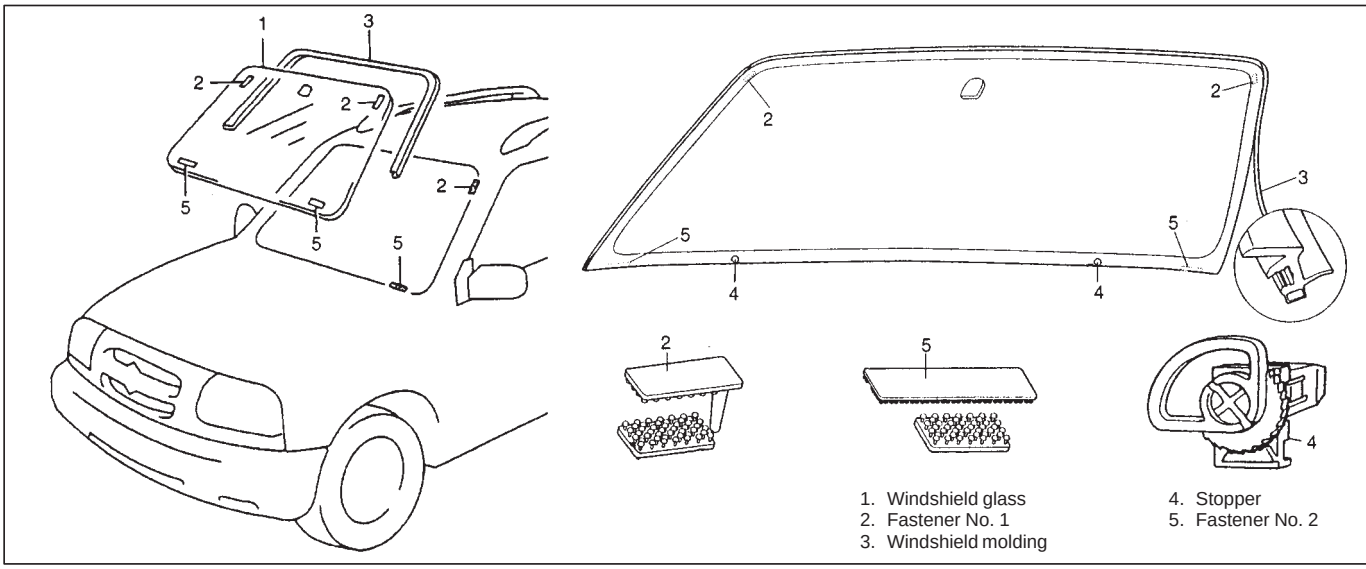
- Tighten bolts and nuts according to the order (a, b, c/1, 2, 3, 4) shown in left figure.
- When installing glass, check that the top part of the glass contacts the glass run evenly and that the glass moves up and down smoothly.
  If the glass is tilted with respect to the glass run, make a fine adjustment with the screws.
- Install door window regulator handle (if equipped) so that it has an angle as shown in figure when glass is fully closed.





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 the follow the proper procedure.



CAUTION:

- **Described in this section is the glass replacement by using 3 types of primers and 1 type of adhesive made by YOKOHAMA (one component urethane adhesive to be used with primer in combination). When using primer and adhesive made by other manufacturers, be sure to refer to handling instructions supplied with them. Negligence in following such procedure or misuse of the adhesive in any way hinders its inherent adhesive property. Therefore, before the work, make sure to read carefully the instruction and description given by the maker of the adhesive to be used and be sure to follow the procedure and observe each precaution throughout the work.**
- **Should coated surface be scratched or otherwise damaged, be sure to repair damaged part, or corrosion may start from there.**

Use an adhesive of above mentioned type which has following property.

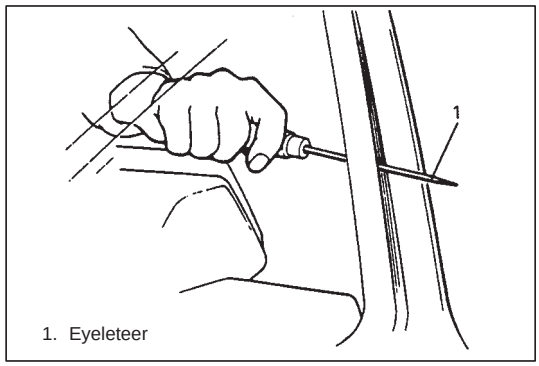
Shearing strength: 40 kg/cm^2 (569 lb/in^2) or more

Adhesive materials and tools required for removal and installation.

- One component urethane adhesive and primers used in combination (for one sheet of windshield).
  Adhesive (470 g (15.7 oz.))
  Primer for glass (30 g (1.0 oz.))
  Primer for body (30 g (1.0 oz.))
  Primer for molding (30 g (1.0 oz.))
- Eyeleteer
- Piano string
- Windshield knife
- Brush for primer application (2 pcs.)
- Knife
- Rubber sucker grip
- Sealant gun (for filling adhesive)
- Putty spatula (for correcting adhered parts)

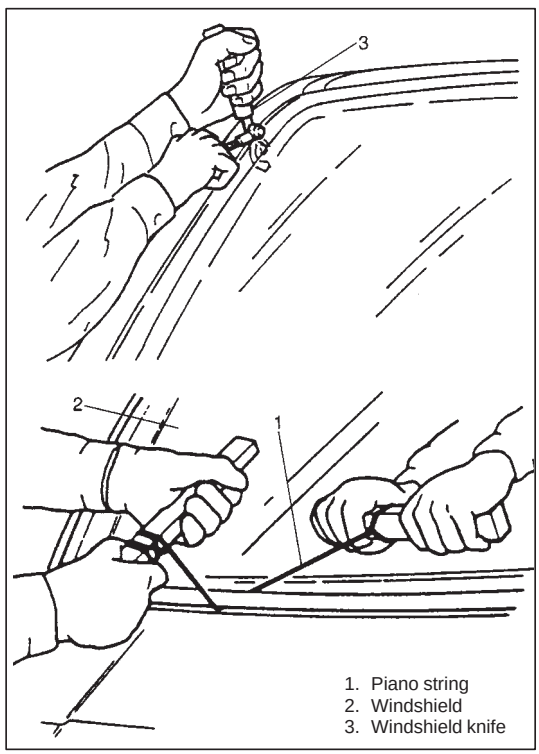
REMOVAL

1) Clean both inside and outside of glass and around it.
2) Remove wiper arms and garnish.
3) Using tape, cover body surface around glass to prevent any damage.
4) Remove rear view mirror, sunvisor, and front pillar trims (right & left).
5) If necessary, remove instrument panel. Refer to “INSTRUMENT PANEL” in this section.
6) If necessary, remove head lining. Refer to “HEAD LINING” in this section.
7) If necessary, remove roof trim. Refer to “ROOF TRIM” in this section.
8) Remove (or cut) windshield molding all around until windshield edge comes out.



1. Eyeleteer

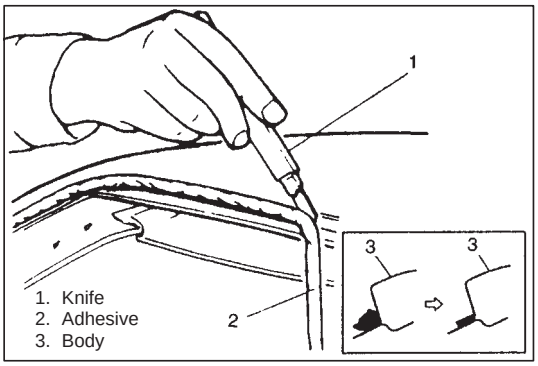
9) Drill hole with eyeletter through adhesive and let piano string through it.



1. Piano string
2. Windshield
3. Windshield knife

10) Cut adhesive all around windshield with piano string.
When using tool to cut adhesive, be careful not to cause damage to windshield. Use wire to cut adhesive along lower part of windshield.

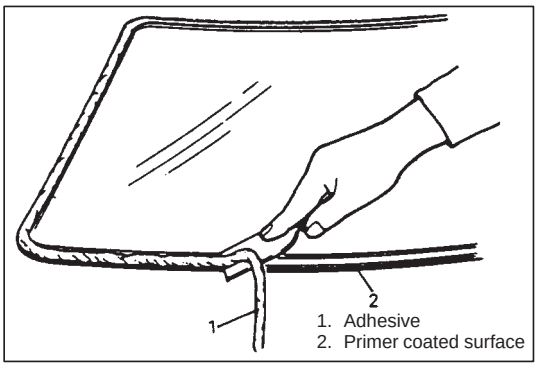
NOTE:
Use piano string as close to glass as possible so as to prevent damage to body and instrument panel.



1. Knife
2. Adhesive
3. Body

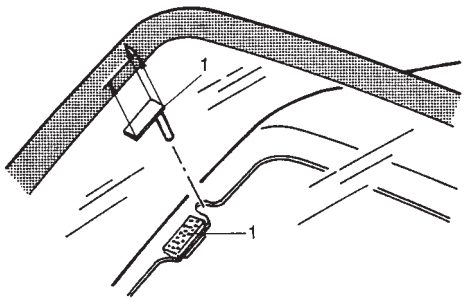
11) Using knife, smoothen adhesive remaining on body side so that it is 1 to 2 mm thick all around.

NOTE:
Before using knife, clean it with alcohol or the like to remove oil from it.



1. Adhesive
2. Primer coated surface

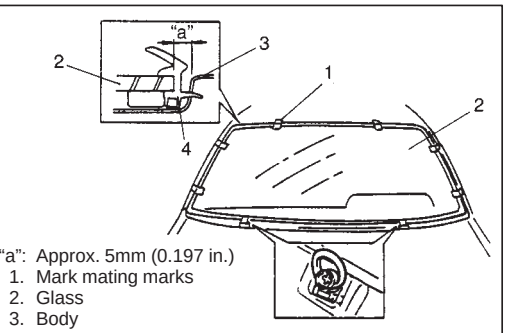
12) When reusing windshield, remove the adhesive from it, using care not to damage primer coated surface.



1. Fastener

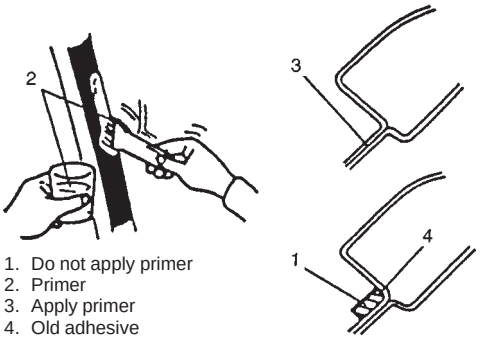
INSTALLATION

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 (2pcs.) to lower side of windshield and new fastener to body.
   When reusing wind shield, install new fastener to wind shield.



"a": Approx. 5mm (0.197 in.)
1. Mark mating marks
2. Glass
3. Body
4. Molding

3) To determine installing position of glass to body, position glass against body so that clearance between upper end of glass and body is about 5 mm (0.197 in.) and clearances between each side end (right & left) of glass and body are even. Place glass so that lug of fastener is matched with cut in body and fit fastener. Then mark mating marks on glass and body as shown.
   Upper clearance can be adjusted by moving stoppers position.



1. Do not apply primer
2. Primer
3. Apply primer
4. Old adhesive

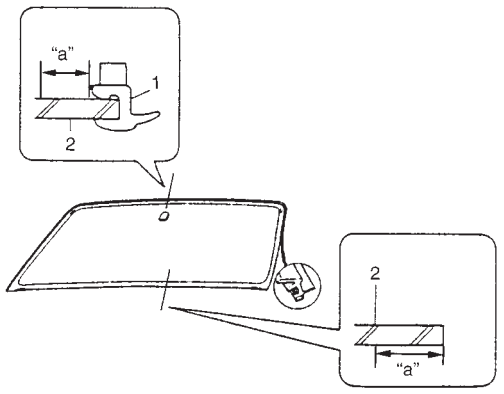
4) Clean contact surfaces of old adhesive, paint or bare metal thoroughly.
   If surfaces of paint or bare metal come out, apply primer for body with caution not to apply primer to surface of adhesive remaining on body.

   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.**

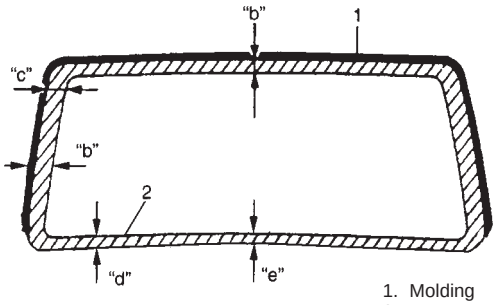
5) Install new molding to glass.
6) Clean glass surface to be adhered to body with clean cloth. If cleaning solvent is used, let it dry for more than 10 minutes.

Cleaning Area

Distance from the edge of glass or molding
"a": 30 – 50 mm (1.18 – 1.97 in.)



1. Molding
2. Glass



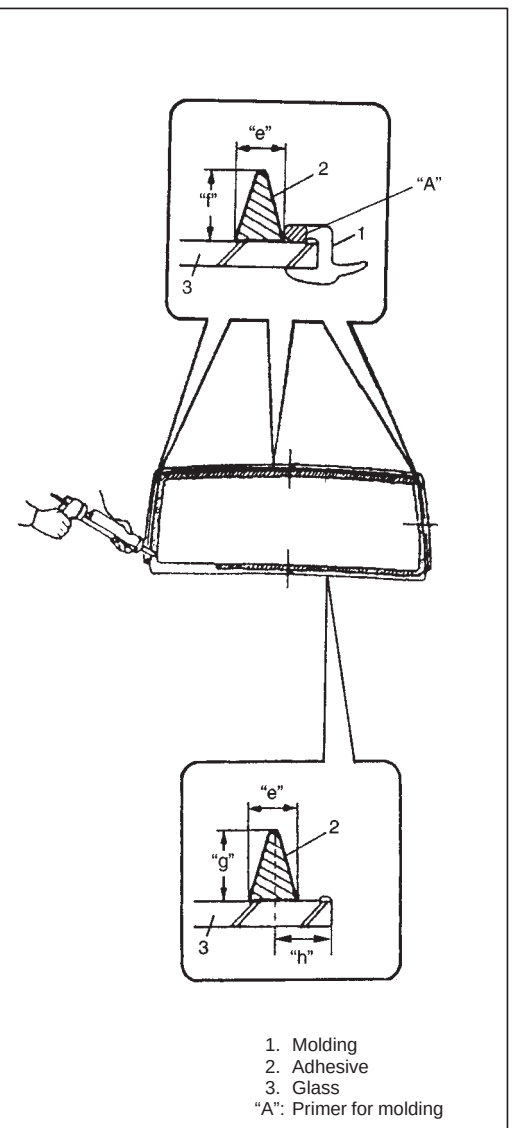
1. Molding
2. Fastener

7) Using new brush, apply sufficient amount of primer for glass along glass surface to be adhered to body.

NOTE:

- **Be sure to refer to maker's instruction for proper handling and drying time.**
- **Do not apply primer on outside of ceramic coated surface.**
- **Do not touch primer coated surface.**

Width "b": 18 – 19 mm (0.71 – 0.75 in.)
"c": 16 – 17 mm (0.63 – 0.67 in.)
"d": 24 mm (0.94 in.)
"e": 27 mm (1.06 in.)



1. Molding
2. Adhesive
3. Glass

"A": Primer for molding

8) Apply primer for molding along molding surface all around as shown in figure.

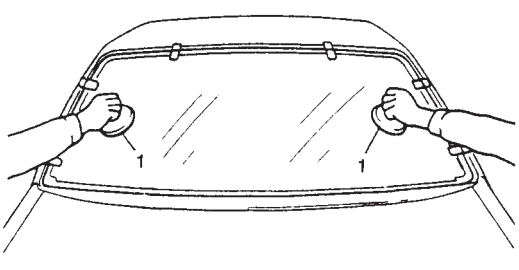
9) Apply adhesive referring to figure at the left.

NOTE:

- **Start from bottom side of glass.**
- **Be careful not to damage primer.**
- **Height of adhesive applied to lower side should be higher than that of other three sides.**

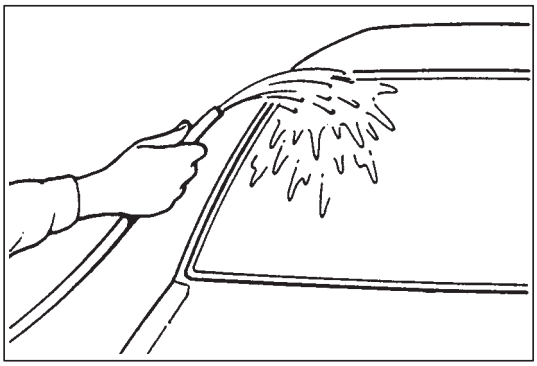
Upper, right and left sides
Width "e" : Approx. 11 mm (0.43 in.)
Height "f" : Approx. 17 mm (0.67 in.)
"g" : Approx. 25 mm (0.98 in.)
Distance "h" : Approx. 16 mm (0.63 in.)

- **Press glass against body quickly after adhesive is applied.**
- **Use of rubber sucker grip is helpful to hold and carry glass after adhesive is applied.**
- **Perform steps 9) to 10) within 10 min. to ensure sufficient adhesion.**
- **Be sure to refer to adhesive maker's instruction for proper handling and drying time.**



1. Rubber sucker grip

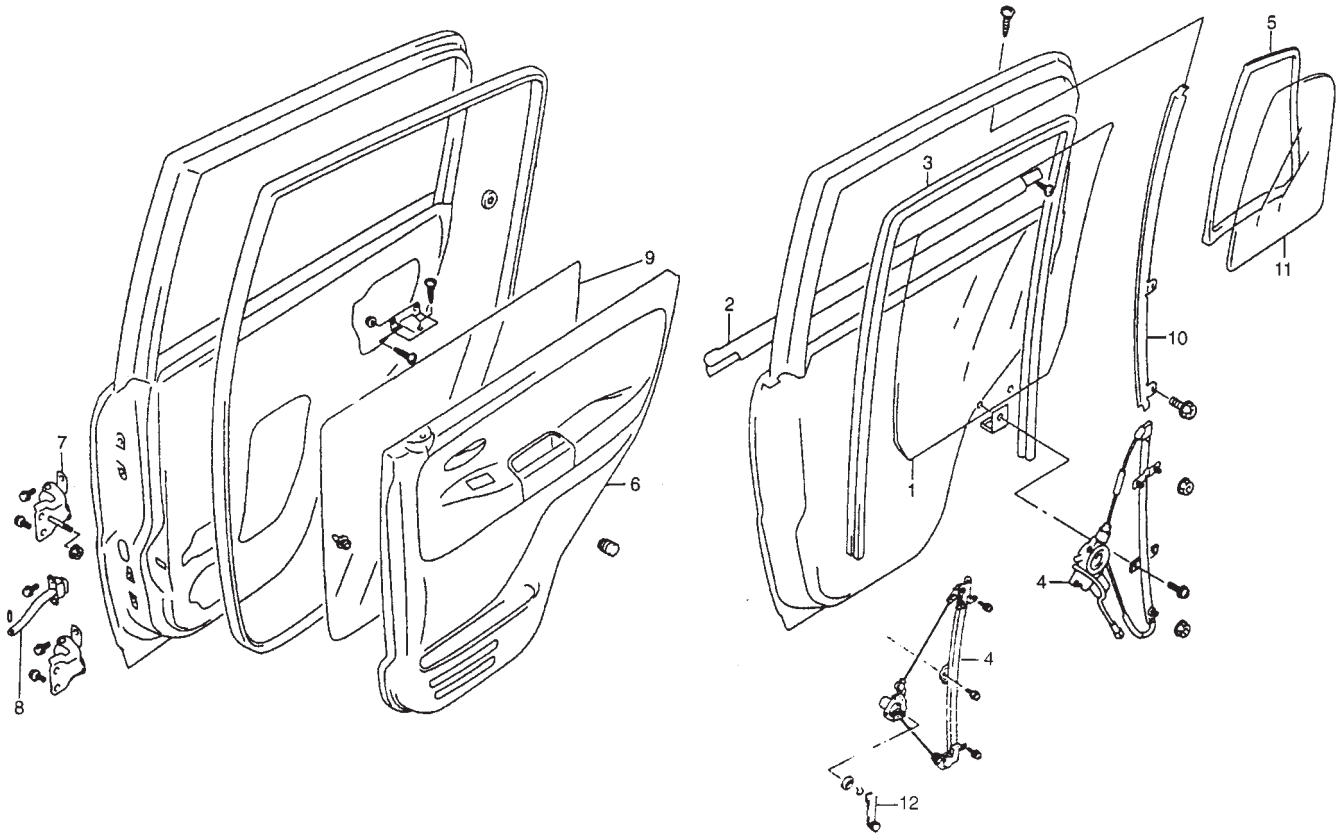
10) Holding rubber sucker grips, place glass onto body by aligning mating marks marked in step 3) and press it.



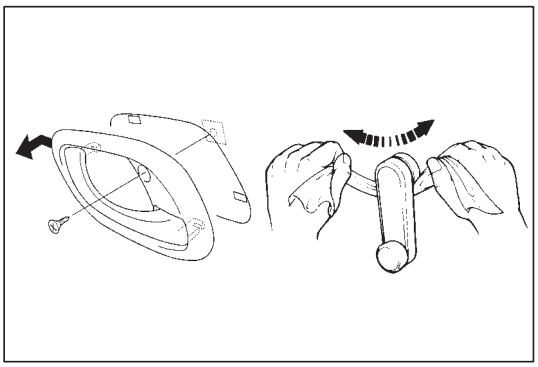
11) Check for water leakage by pouring water over windshield through hose. If leakage is found, dry windshield and fill leaky point with adhesive. If water still leaks even after that, remove glass and start installation procedure all over again.

CAUTION:
Upon completion of installation, note the following.
- **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.**
- **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.**

REAR DOOR GLASS



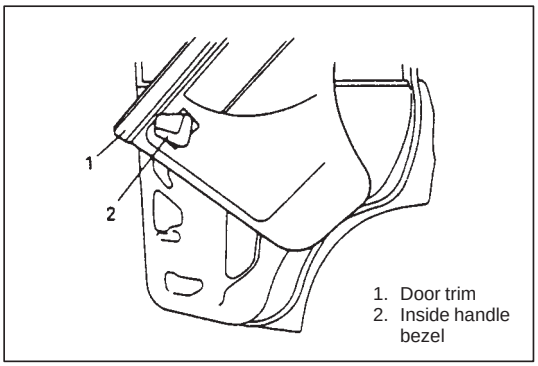
1. Door glass
2. Weatherstrip (outside)
3. Glass run
4. Window regulator
5. Partition weather strip
6. Door trim
7. Door hinge
8. Door open stop
9. Door sealing cover
10. Door center sash
11. Partition glass
12. Window regulator handle (if equipped)



REMOVAL

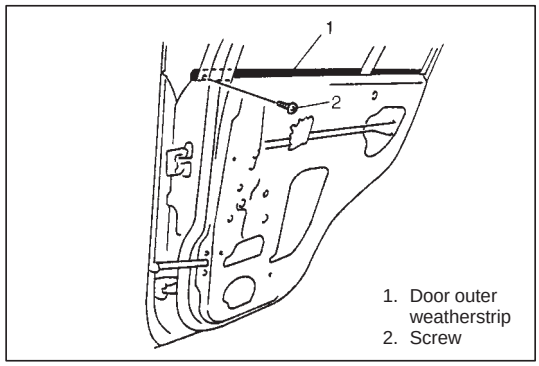
1) Remove inside handle bezel.
2) Remove inside lock knob and door inside pull handle case fitting screw.

2-1) Window regulator handle (if equipped).
To remove regulator handle, pull off snap ring by using a cloth as shown below.



1. Door trim
2. Inside handle bezel

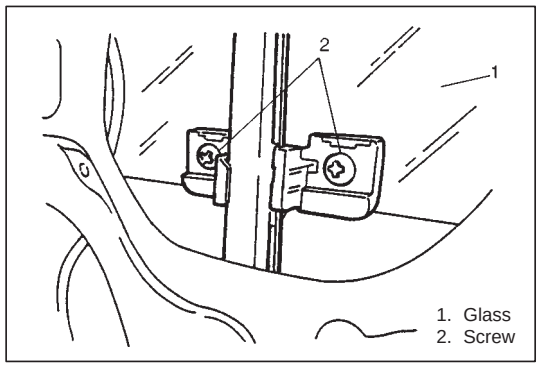
3) Remove door trim with inside weatherstrip.
With inside handle bezel tilted as shown in figure, turn door trim 90° counterclockwise to remove it. And disconnect power window switch lead wire.
4) Remove door sealing cover.



1. Door outer weatherstrip
2. Screw

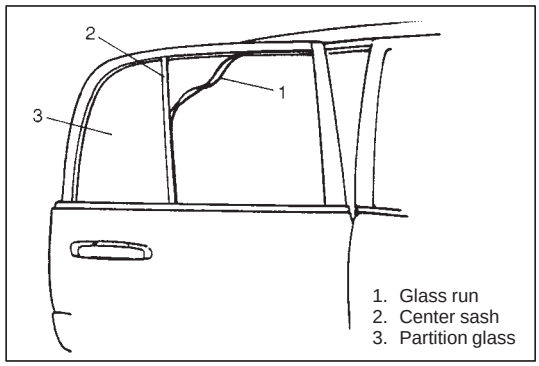
5) Remove outer weatherstrip.

CAUTION:
Using a tape-wrapped putty knife (or tape-wrapped screwdriver), pry off weatherstrip. Use of an unwrapped tool will cause damage to painting.



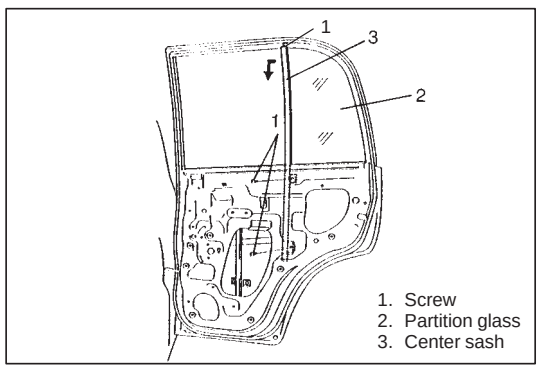
1. Glass
2. Screw

6) Remove glass fitting screws. Then down door glass.



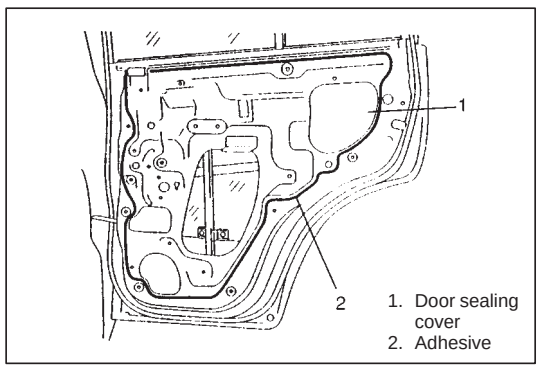
1. Glass run
2. Center sash
3. Partition glass

7) Detach rear part of glass run from center sash.



1. Screw
2. Partition glass
3. Center sash

8) Remove door center sash (by removing two screws with door glass lowered all the way down).
9) When remove partition glass, slide to front to remove it.
10) Take out glass.

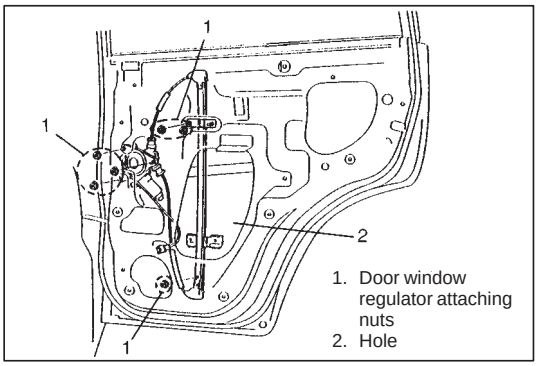


1. Door sealing cover
2. Adhesive

INSTALLATION

Reverse removal sequence to install door glass.
However, be careful of following points.

- Securely seal door sealing cover with adhesive.
- When weatherstrip is hardened, water leak may develop. In such case, replace it with new one.

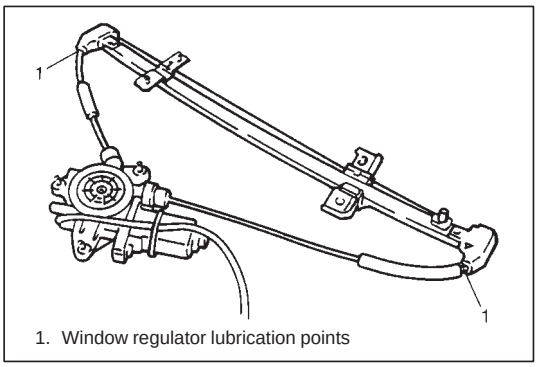


1. Door window regulator attaching nuts
2. Hole

REAR DOOR WINDOW REGULATOR

REMOVAL

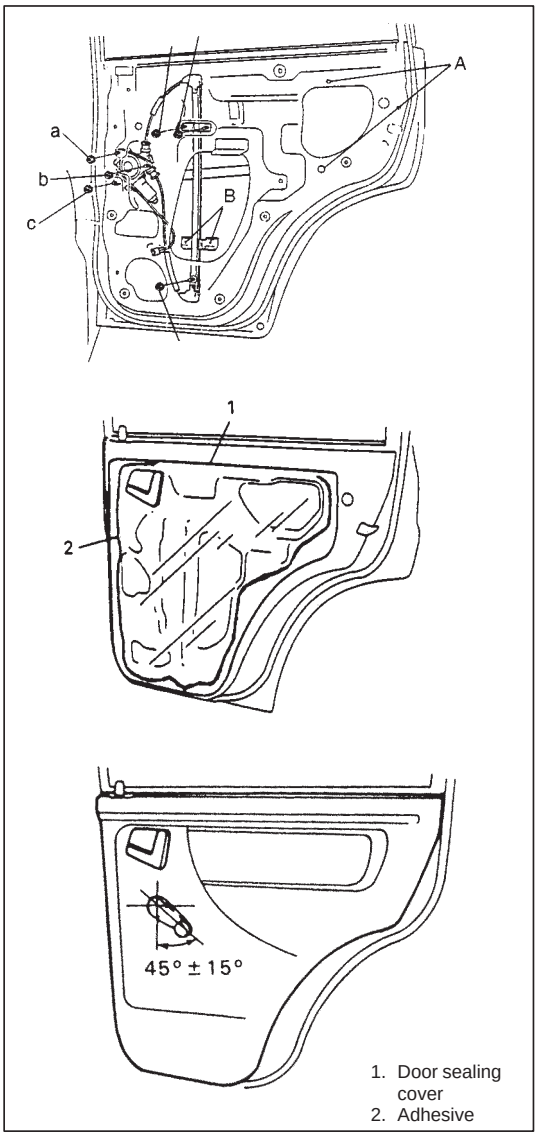
1) Remove door glass, refer to steps 1) to 10) of REAR DOOR GLASS REMOVAL in this section.
2) Disconnect power window motor lead wire at coupler and clamp.
3) Remove door window regulator attaching nuts (6 pcs.), and take out regulator through hole as shown in left figure.



1. Window regulator lubrication points

INSPECTION

1) Check regulator sliding and rotating parts for greasing.
2) Check rollers for wear and damage.
3) Check wire for damage.



1. Door sealing cover
2. Adhesive

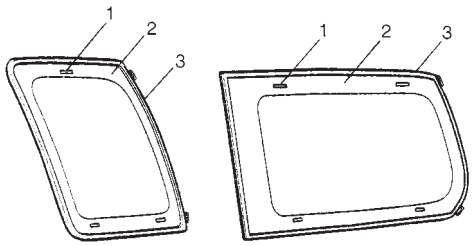
INSTALLATION

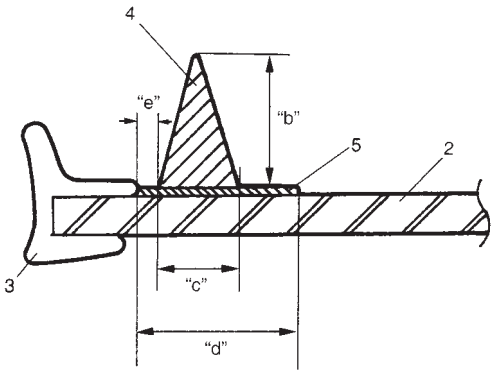
Reverse removal sequence to install door window regulator noting following points.

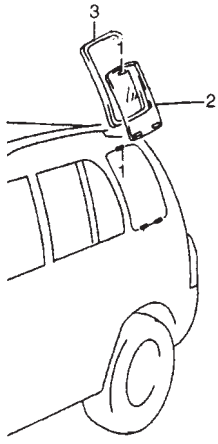
- Tighten regulator base nuts according to the order (a, b, c) shown in figure.
- Adjust door window regulator according to following procedure.
  a. Loosen three nuts, two screws and two bolts.
  b. Raise window fully.
  c. Tighten three regulator rail nuts according to the order (d, e, f) shown in figure and two center sash bolts A.
  d. Lower window.
  e. Tighten two screws B to specified torque. Tighten front screw first, then rear.

     Tightening Torque for glass attaching screws
     2.5 N·m (0.25 kg-m, 1.8 lb-ft)

  f. Check that the glass moves up and down smoothly and that the top part of the glass contacts the glass run evenly.
- Securely seal door sealing cover with adhesive.
- Install door window regulator handle (if equipped) so that it has an angle as shown when glass is fully closed.







1. Fastener
2. Glass
3. Molding
4. Adhesive
5. Primer

QUARTER WINDOW

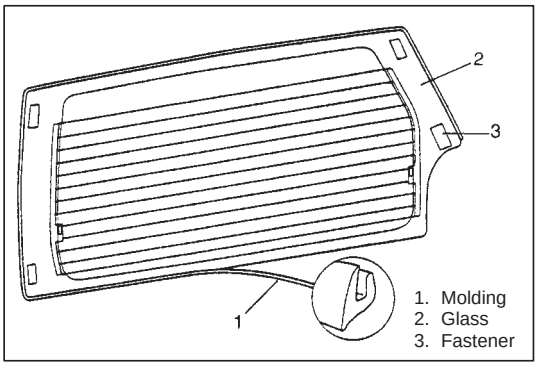
REMOVAL AND INSTALLATION

Refer to "WINDSHIELD" section as removal and installation procedures and cautions are basically the same. However, note the following.

NOTE:

- **Before applying primer to glass edge, install molding according to installing position shown in figure.**
- **Observe following precautions when applying adhesive along glass edge.**
  - **– Adhesive should be applied evenly especially in height.**
  - **– Be careful not to damage primer.**
  - **– Press glass against body quickly after adhesive is applied.**

Height	**"b" :**	**12 mm (0.47 in.)**
Width	**"d" :**	**16 mm (0.63 in.)**
	"c" :	**8 mm (0.31 in.)**
Clearance	**"e" :**	**1 mm (0.04 in.)**



1. Molding
2. Glass
3. Fastener

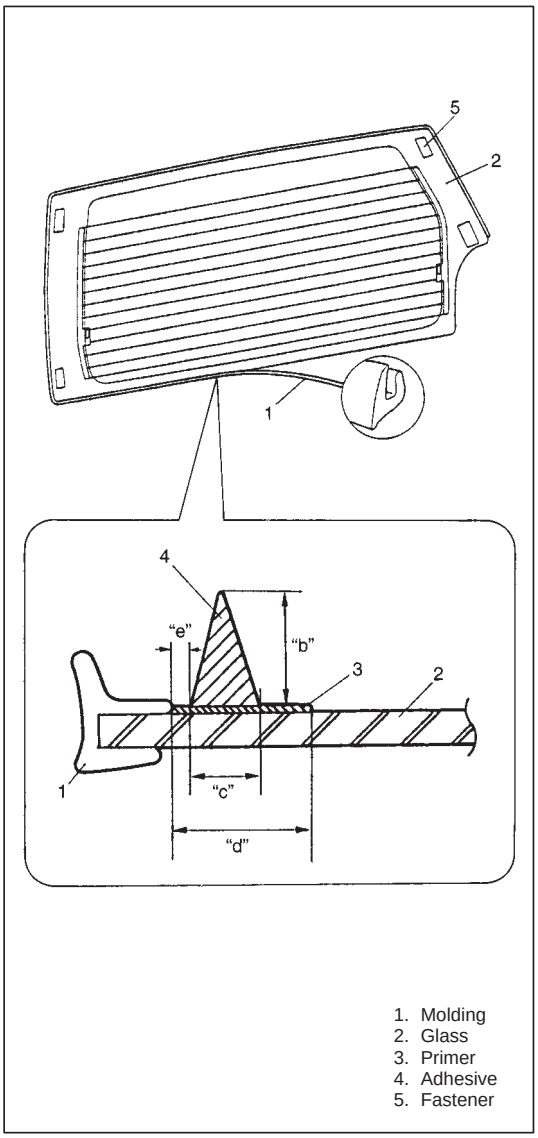
BACK DOOR GLASS

REMOVAL AND INSTALLATION

Refer to "WINDSHIELD" section as removal and installation procedures and cautions are basically the same. However, note the following.

NOTE:

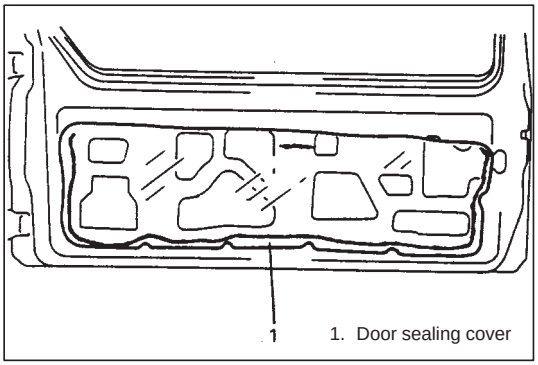
- **Before applying primer to glass edge, install molding according to installing position shown in figure.**



1. Molding
2. Glass
3. Primer
4. Adhesive
5. Fastener

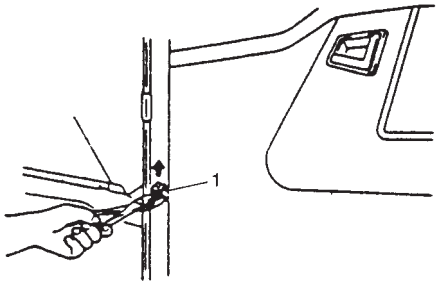
- **Observe following precautions when applying adhesive along glass edge.**
  - **– Adhesive should be applied evenly especially in height.**
  - **– Be careful not to damage primer.**
  - **– Press glass against body quickly after adhesive is applied.**

Height "b": 15 mm (0.59 in.)
Width "c": 8 mm (0.31 in.)
Width "d": 16 mm (0.63 in.)
Clearance "e": 1 mm (0.04 in.)



1. Door sealing cover

- **When replacing back door, coat replacement door inside with wax for proper anticorrosive treatment. Refer to "UNDER COATING/ANTI-CORROSION COMPOUND APPLICATION AREA" in this section.**
- **Apply sealing compound to peripheral of door hem area and reinstall door sealing cover.**
- **When weatherstrip is hardened and water leaks have developed, replace it.**



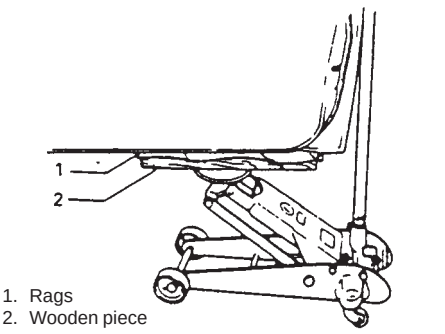
1. Stopper pin

BODY STRUCTURE

FRONT DOOR ASSEMBLY

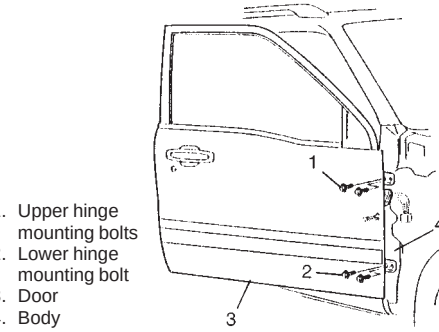
REMOVAL

1) Remove front fender. Refer to "FRONT FENDER" in this section.
2) Disconnect door harness lead wires at each coupler.
3) Remove stopper pin.



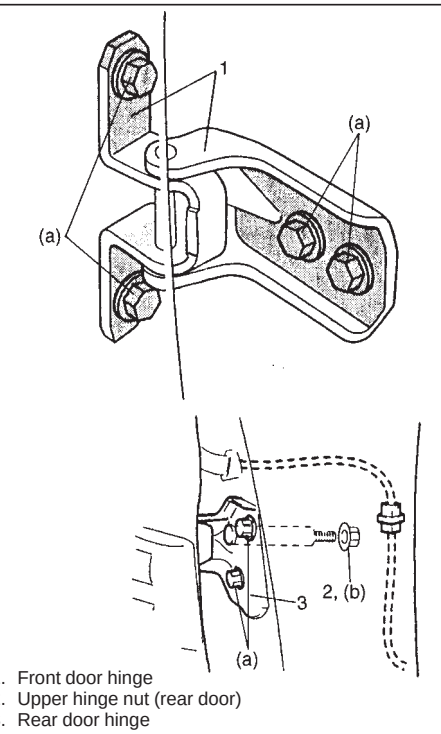
1. Rags
2. Wooden piece

4) Support door panel using a jack with a piece of wood placed between jack and panel, as shown.



1. Upper hinge mounting bolts
2. Lower hinge mounting bolt
3. Door
4. Body

5) Remove door assembly by loosening hinge mounting bolts.



1. Front door hinge
2. Upper hinge nut (rear door)
3. Rear door hinge

INSTALLATION

Reverse removal procedure to install door assembly, noting 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.

- Tighten door hinge bolts (and nut) to specified torque.

  Tightening torque
  (a): 27 N·m (2.7 kg-m, 19.5 lb-ft)
  (b): 23 N·m (2.3 kg-m, 17.0 lb-ft)

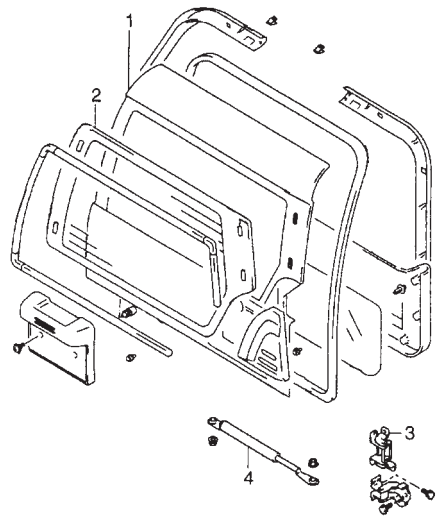
- Adjust door latch striker position by referring to "FRONT DOOR LOCK INSTALLATION" section so that door is positioned correctly.
- Adjust front door cushion so that door contacts body when closed.
- After installation, open and close the door to check looseness. Replace door open stopper pin when there is looseness.
- When weatherstrip is hardened, water leak may develop. In such case, replace it with new one.

REAR DOOR ASSEMBLY

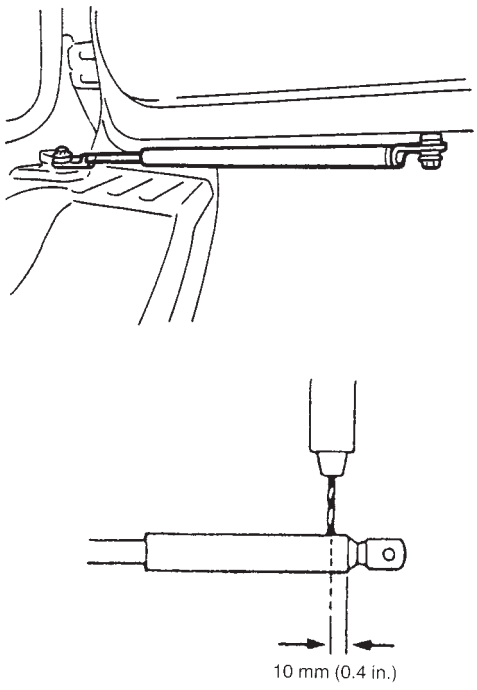
REMOVAL/INSTALLATION

Follow procedures for Front Door removal/installation in this section.

BACK DOOR/REAR GATE ASSEMBLY



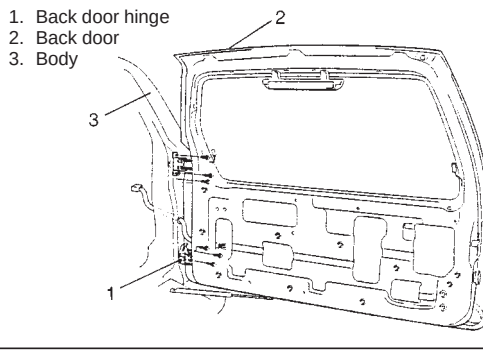
1. Back door panel assy
2. Back door window glass
3. Back door hinge
4. Back door / Rear gate balancer unit



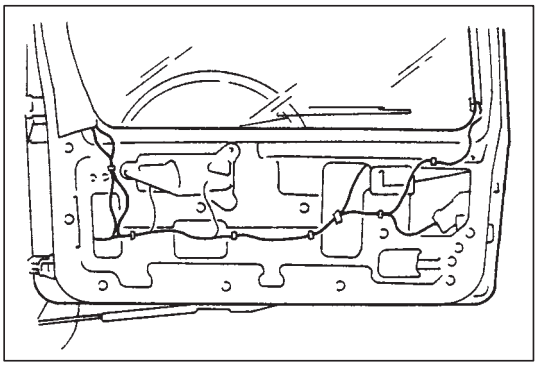
REMOVAL

1) Remove back door trim, and door/rear gate sealing cover, refer to steps 1) to 4) of BACK DOOR LOCK ASSEMBLY in this section.
2) Remove wire harness connector inside the back door/rear gate.
3) Remove back door/rear gate balancer (first at its door-side and next at its body-side), as shown.

WARNING:
Handling of Back Door/Rear Gate Balancer (Damper)
- **Do not disassemble balancer because its cylinder is filled with gas.**
- **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.**
- **When discarding removed back door/rear gate balancer (damper), use a 2 to 3 mm (0.08 to 0.12 in.) drill to make a hole as shown.**
- **Handle balancer carefully. Do not scar or scratch exposed surface of its piston rod, and never allow any paint or oil to stick to its surface.**
- **Do not turn piston rod with balancer fully extended.**



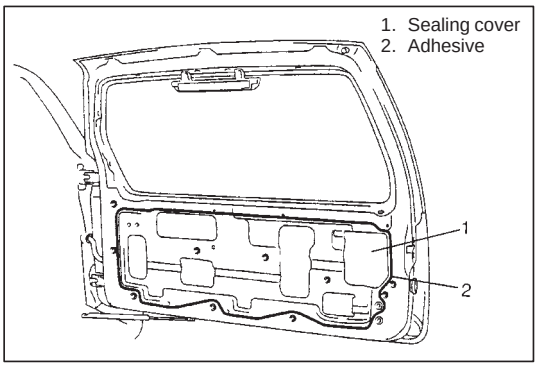
5) Remove back door/rear gate hinge bolts and back door/rear gate.



INSTALLATION

Reverse removal procedure to install back door/rear gate noting following points.

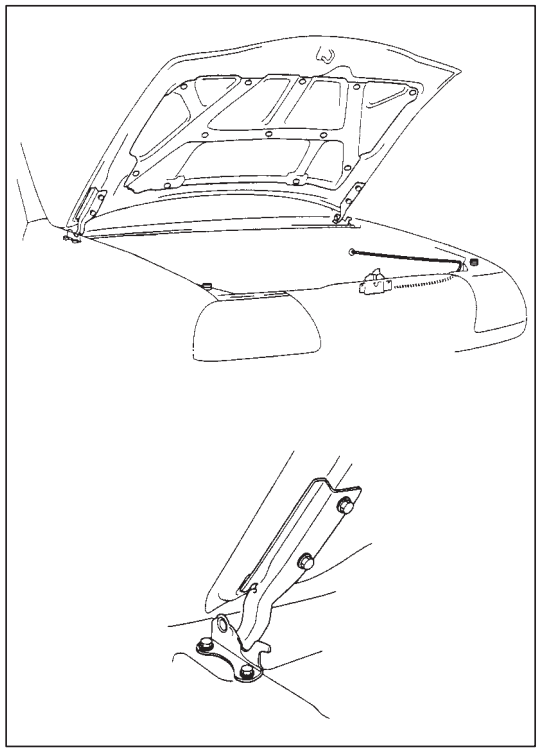
- Secure wiring harness.



- Secure back door/rear gate sealing cover.

  NOTE:
  Use adhesive to seal sealing cover to back door/rear gate.

- Adjust back door/rear gate latch striker position by referring "BACK DOOR LOCK ASSEMBLY INSTALLATION" so that back door/rear gate is positioned correctly.
- Adjust back door/rear gate cushion so that back door/rear gate contacts body when closed.



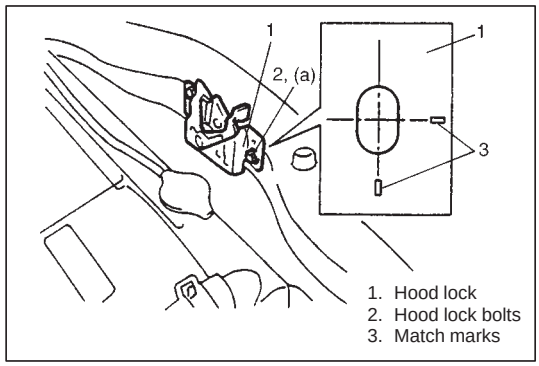
HOOD

REMOVAL

1) Remove window washer hose from hood.
2) Remove four mounting bolts to detach hood.

ADJUSTMENT

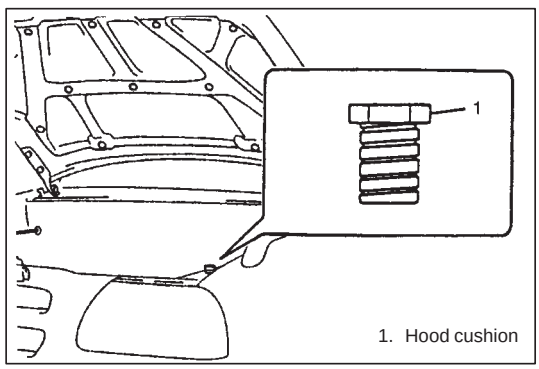
- Fore-and-aft and right-and-left adjustment.
  Loosen four mounting bolts for adjustment.



1. Hood lock
2. Hood lock bolts
3. Match marks

- Hood lock adjustment
  When installing hood lock, bring bolt at intersection point of match marks and move it in vertical direction for adjustment, if necessary.

  Tightening Torque
  (a): 10 N·m (1.0 kg-m, 7.5 lb-ft)



1. Hood cushion

- 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.

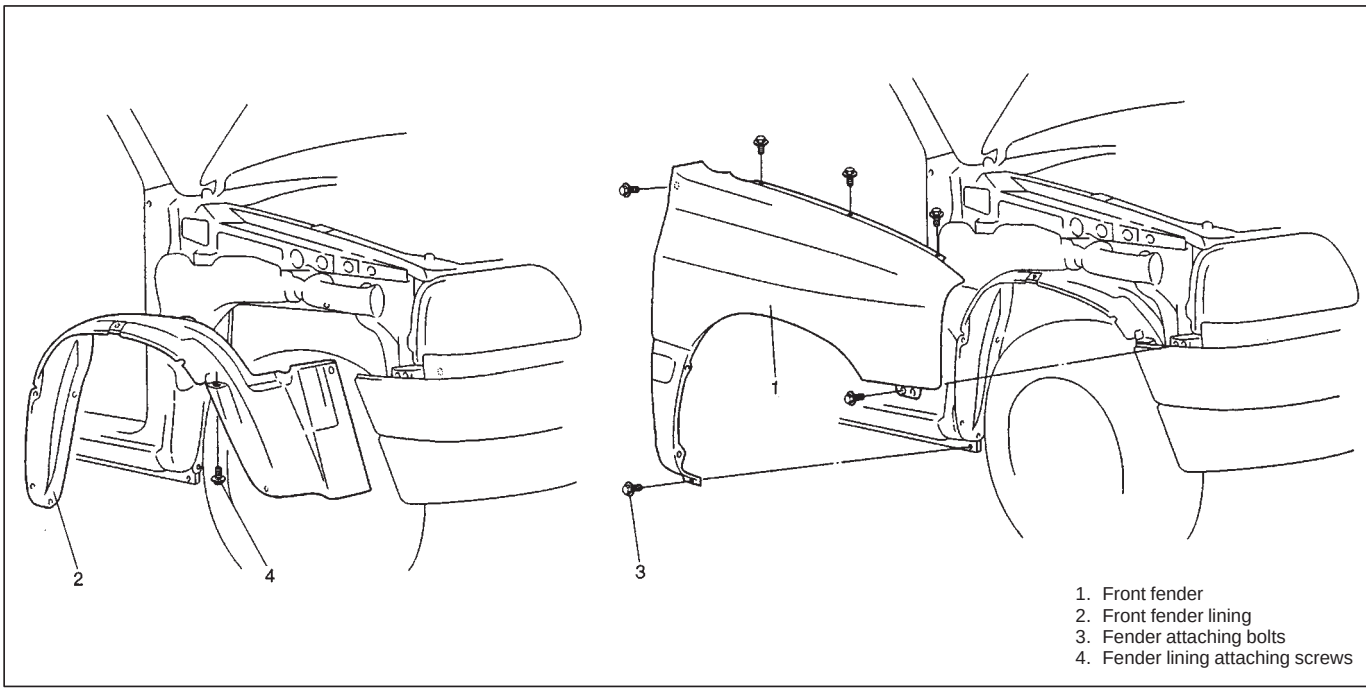
INSTALLATION

Reverse removal procedure to install 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.

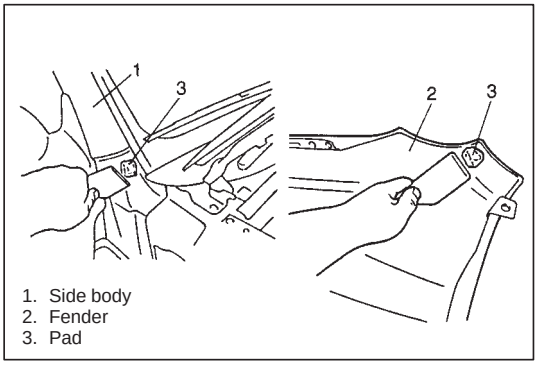
FRONT FENDER



1. Front fender
2. Front fender lining
3. Fender attaching bolts
4. Fender lining attaching screws

REMOVAL

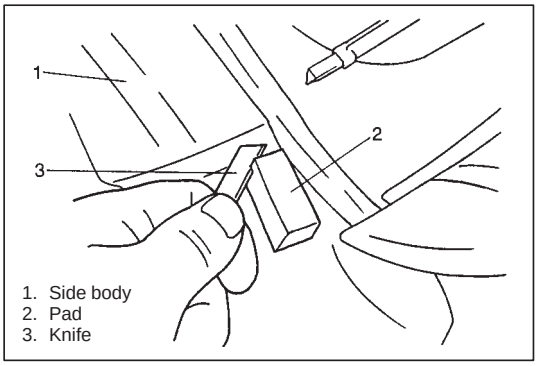
1) Remove front bumper.
2) Remove fender splush guard (H25 engine).
3) Remove front fender lining.
4) Remove front fender.



1. Side body
2. Fender
3. Pad

INSTALLATION

1) Remove pad from side body and (or) fender, using care not to damage painted surface.



1. Side body
2. Pad
3. Knife

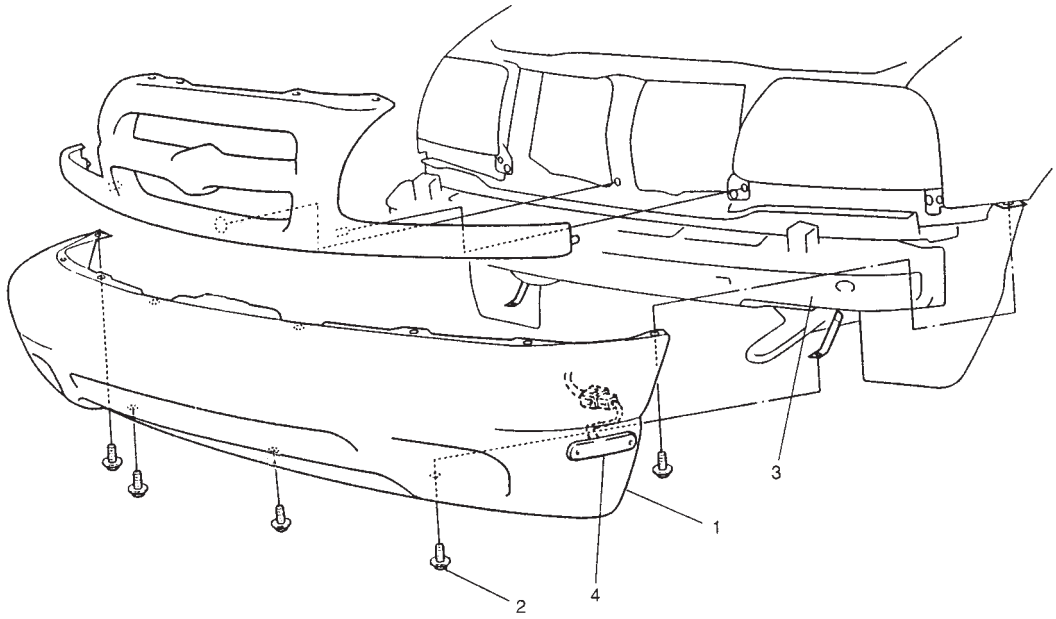
2) Attach new pad cutting appropriately size temporarily and adjust height with a knife so that fender becomes flush with side body.
3) Reverse removal procedure for installation.

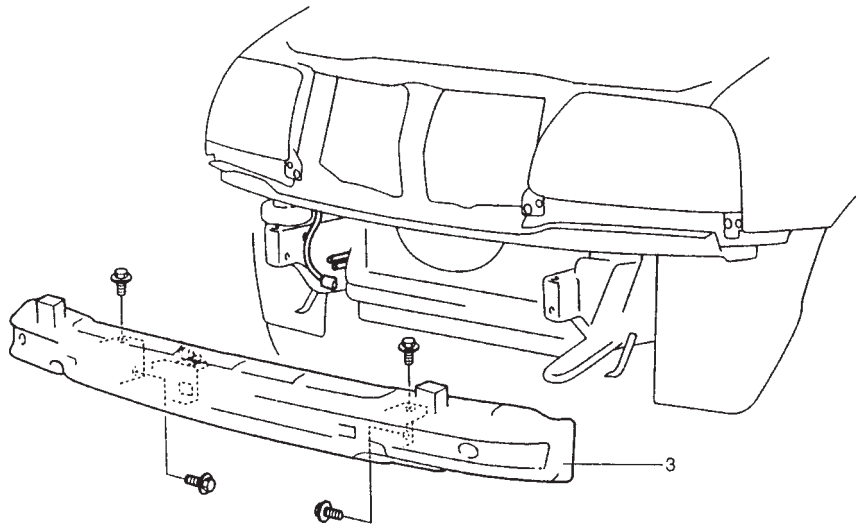
NOTE:
If paint on fender bolt is peeled off, be sure to apply paint again.

FRONT BUMPER

NOTE:

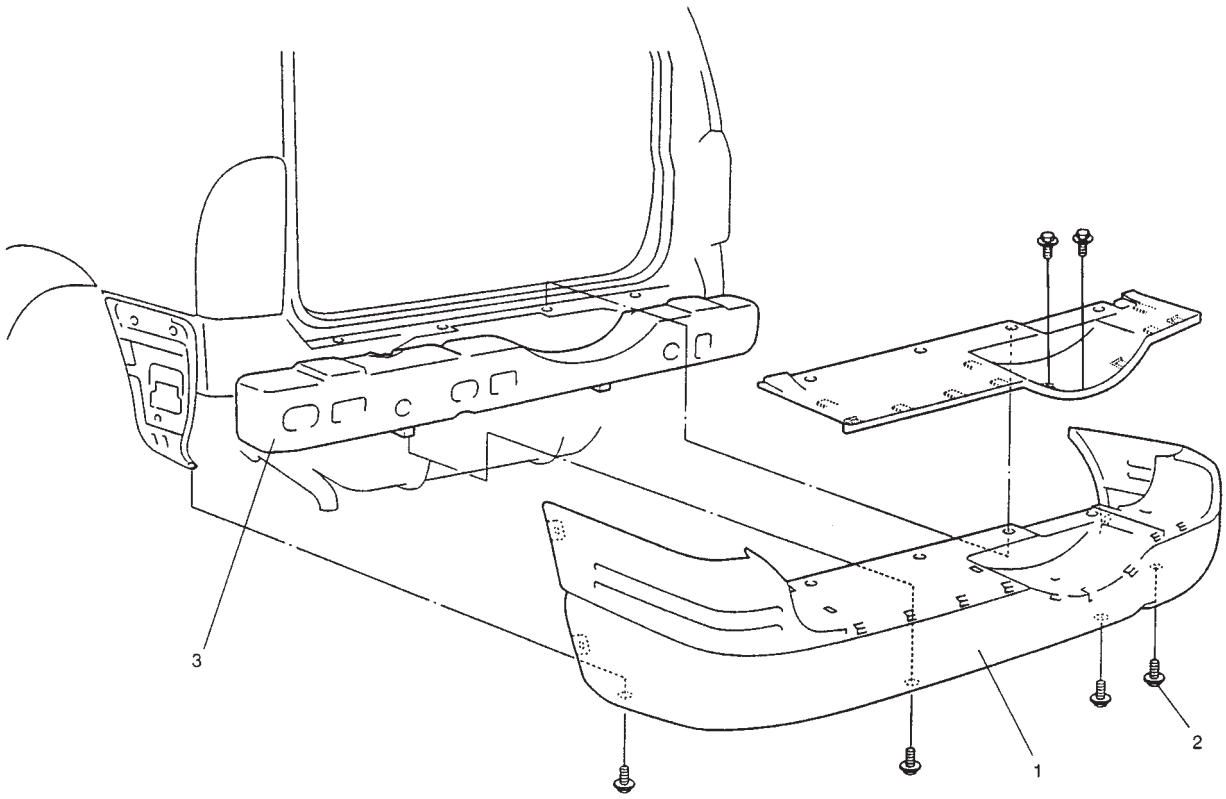
- **Fasteners are important attaching parts in that they could affect the performance of vital components and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary.**
  Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of these parts.
- **Before removing front bumper, remove fender lining and disconnect connector of side marker.**

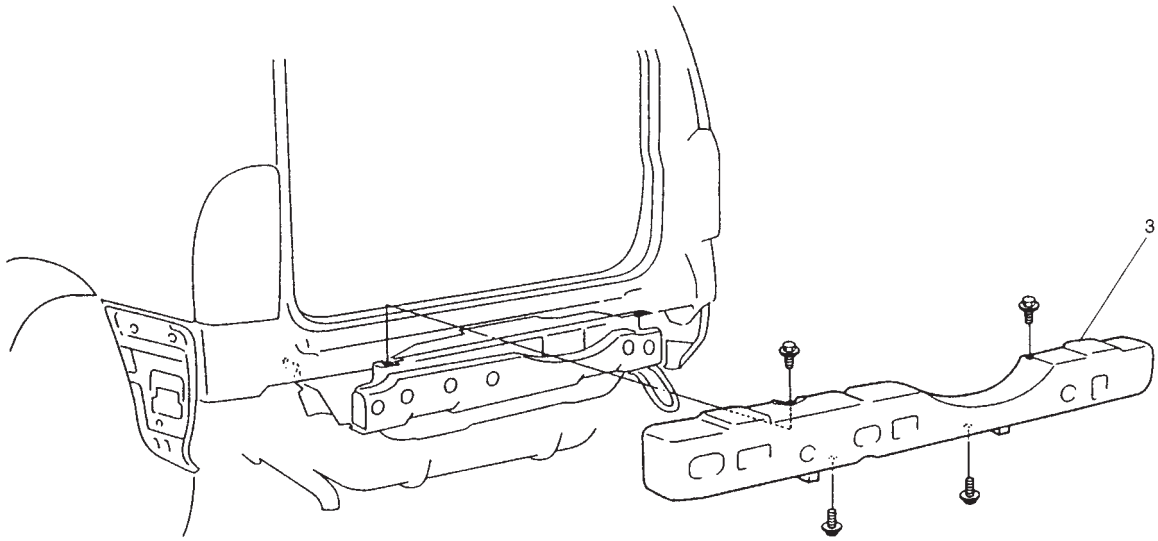




1. Front bumper
2. Screws
3. Front bumper member
4. Side marker

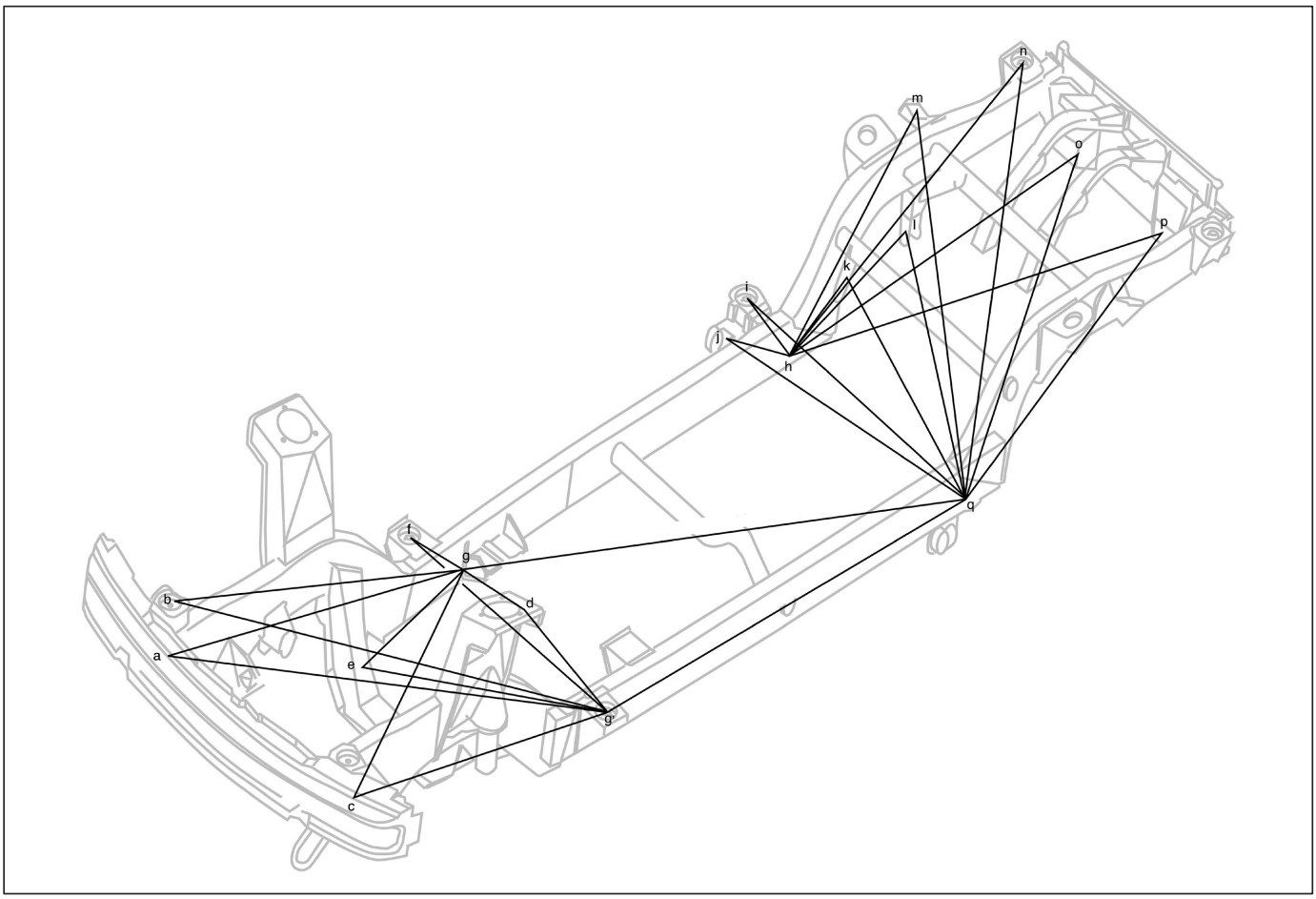
REAR BUMPER





1. Rear bumper
2. Rear bumper screws
3. Rear bumper member

UNDER BODY DIMENSIONS



a. Front bumper
b. 1st mounting
c. Suspension frame
d. Front strut
e. Suspension arm
f. 2nd mounting
g. ø20 zig hole
h. Zig hole
i. 3rd mounting
j. Lower rod
k. Upper rod
l. Lateral rod
m. Rear shock absorber
n. 4th mounting
o. Fuel tank
p. Fuel tank
q. Lower rod

a – g : 1315 mm (51.77 in.)
a – g' : 1534 mm (60.39 in.)
b – g : 1243 mm (48.94 in.)
b – g' : 1518 mm (59.76 in.)
c – g : 1377 mm (54.21 in.)
c – g' : 1105 mm (43.50 in.)
d – g' : 1319 mm (51.93 in.)
d – f : 874 mm (34.41 in.)
e – g : 525 mm (20.67 in.)
e – g' : 857 mm (33.74 in.)
f – g' : 927 mm (36.50 in.)
h – i : 178 mm (7.01 in.)
h – j : 133 mm (5.24 in.)
h – k : 325 mm (12.80 in.)
h – l : 674 mm (26.54 in.)

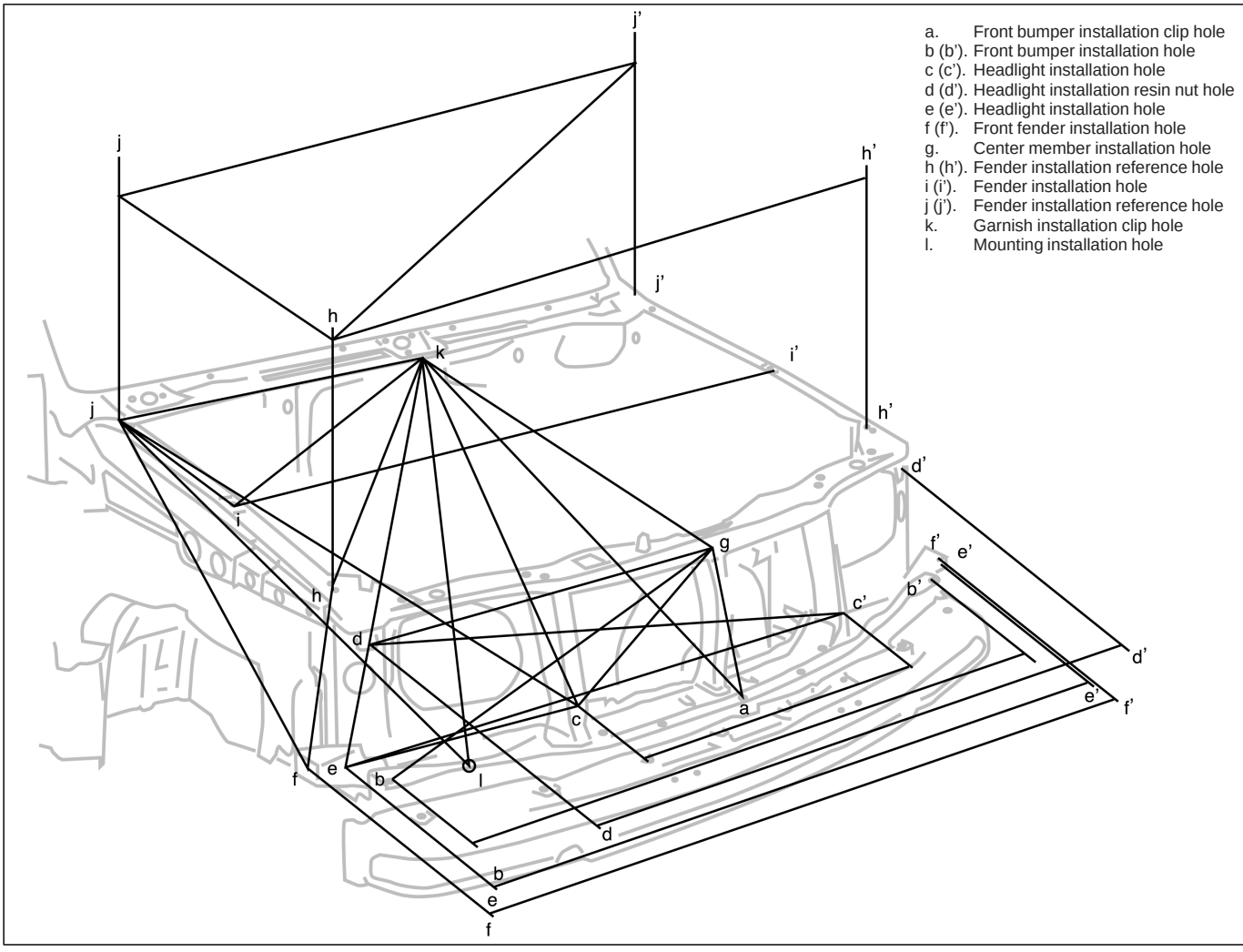
h – m : 803 mm (31.61 in.)
h – n : 1161 mm (45.71 in.)
h – o : 1184 mm (46.61 in.)
h – p : 1190 mm (46.85 in.)
i – q : 999 mm (39.33 in.)
j – q : 997 mm (39.25 in.)
k – q : 824 mm (32.44 in.)
l – q : 1130 mm (44.49 in.)
m – q : 1258 mm (49.53 in.)
n – q : 1483 mm (58.39 in.)
o – q : 1349 mm (53.11 in.)
p – q : 1334 mm (52.52 in.)

For 4 door model
g' – q : 1275 mm (50.20 in.)
g – q : 1534 mm (60.39 in.)

For 2 door model
g' – q : 995 mm (39.17 in.)
g – q : 1310 mm (51.57 in.)

BODY DIMENSIONS

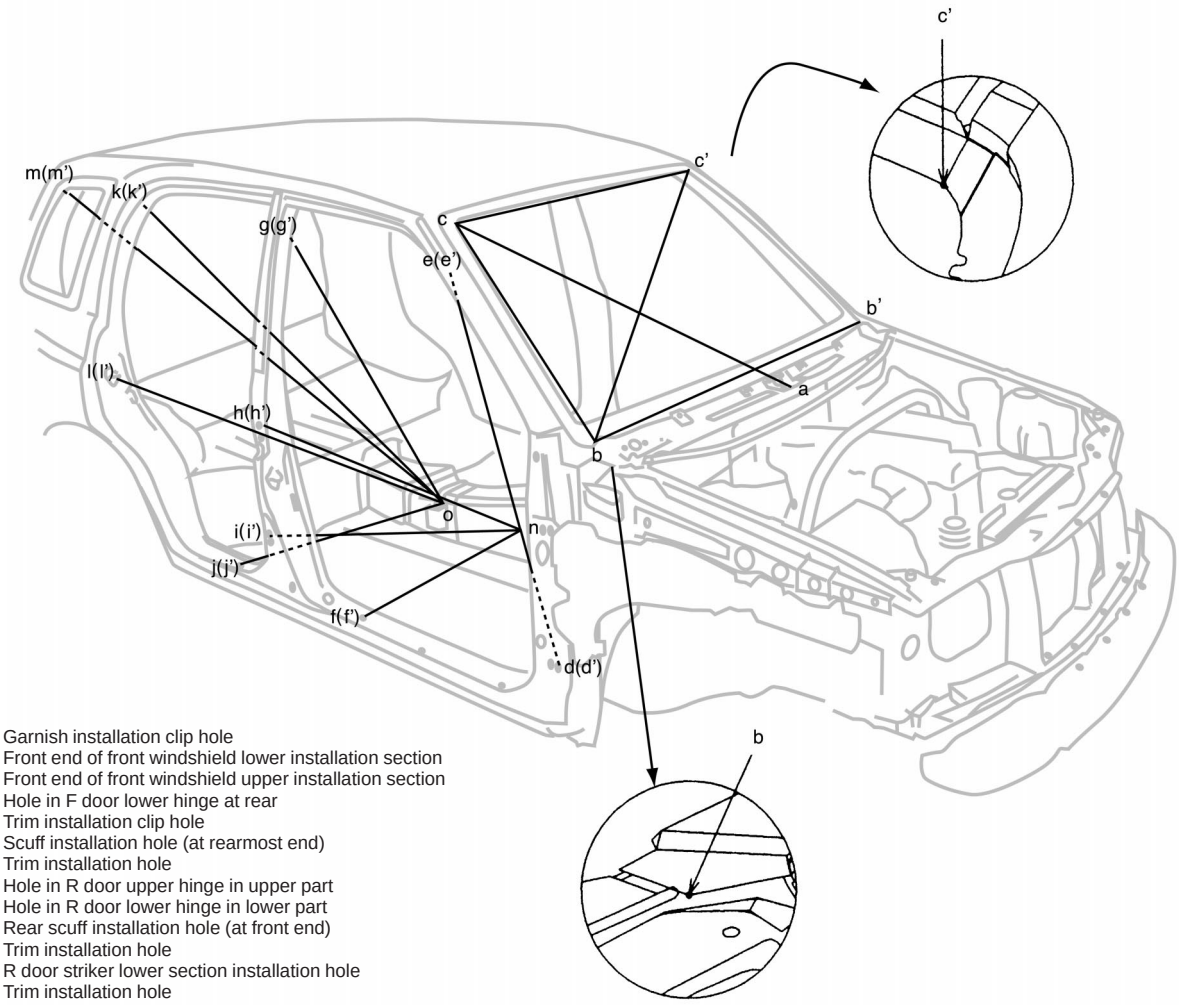
4 door model, 2 door model



Hole to hole distance

"a – g" : 276 mm (10.87 in.)
"a – k" : 1000 mm (39.37 in.)
"b – b'" : 1302 mm (51.26 in.)
"b – g" : 730 mm (28.74 in.)
"c – c'" : 668 mm (26.30 in.)
"c – e" : 414 mm (16.30 in.)
"c – g" : 406 mm (15.98 in.)
"c – j" : 1029 mm (40.51 in.)
"c – k" : 1000 mm (39.37 in.)
"d – d'" : 1302 mm (51.26 in.)
"d – e" : 189 mm (7.44 in.)
"d – c'" : 1016 mm (40.00 in.)
"d – g" : 672 mm (26.46 in.)
"d – k" : 968 mm (38.11 in.)
"e – e'" : 1456 mm (57.32 in.)
"f – f'" : 1550 mm (61.02 in.)
"f – h" : 299 mm (11.77 in.)
"f – j" : 811 mm (31.93 in.)
"g – k" : 854 mm (33.62 in.)
"h – h'" : 1339 mm (52.72 in.)
"h – j'" : 1504 mm (59.21 in.)
"h – j" : 677 mm (26.65 in.)
"h – k" : 927 mm (36.50 in.)
"i – i'" : 1344 mm (52.91 in.)
"i – j" : 391 mm (15.39 in.)
"i – k" : 760 mm (29.92 in.)
"j – j'" : 1348 mm (53.07 in.)
"j – k" : 676 mm (26.61 in.)
"l – j" : 961 mm (37.83 in.)
"l – k" : 1018 mm (40.08 in.)

4 door model

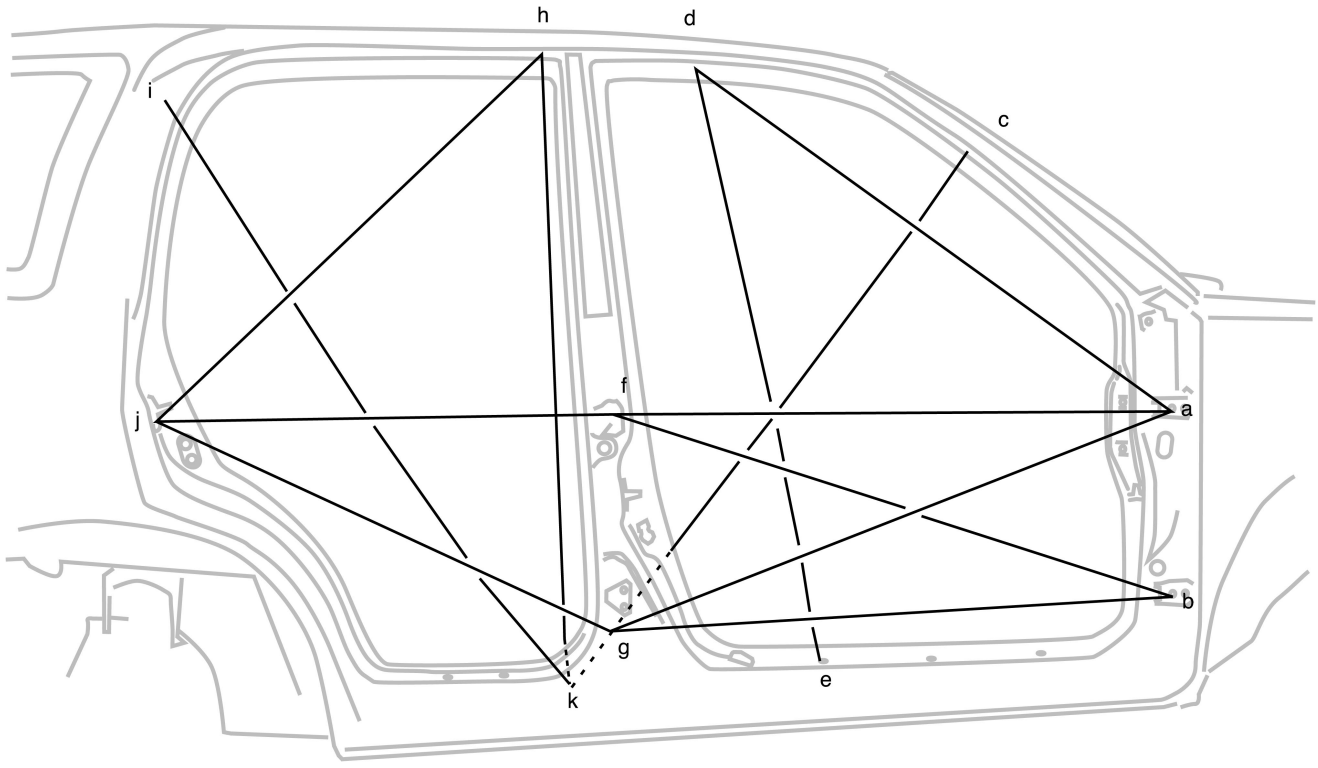


a. Garnish installation clip hole
b (b'). Front end of front windshield lower installation section
c (c'). Front end of front windshield upper installation section
d. Hole in F door lower hinge at rear
e. Trim installation clip hole
f (f'). Scuff installation hole (at rearmost end)
g (g'). Trim installation hole
h (h'). Hole in R door upper hinge in upper part
i (i'). Hole in R door lower hinge in lower part
j (j'). Rear scuff installation hole (at front end)
k (k'). Trim installation hole
l (l'). R door striker lower section installation hole
m (m'). Trim installation hole
n. Installation hole for F seat front inside
o. Installation hole for F seat rear inside
Opposite side of the point shown in figure

Hole to hole distance

"a – c" : 982 mm (38.66 in.)
"b – b'" : 1390 mm (54.72 in.)
"b – c'" : 1406 mm (55.35 in.)
"b – c" : 755 mm (29.72 in.)
"c – c'" : 1012 mm (39.84 in.)
"d – d'" : 1545 mm (60.83 in.)
"d – n" : 800 mm (31.50 in.)
"e – e'" : 1110 mm (43.70 in.)
"e – n" : 1036 mm (40.79 in.)
"f – f'" : 1511 mm (59.49 in.)
"f – n" : 620 mm (34.41 in.)
"g – g'" : 1085 mm (42.72 in.)
"g – o" : 1099 mm (43.27 in.)
"h – h'" : 1521 mm (59.88 in.)
"h – o" : 901 mm (35.47 in.)
"i – i'" : 1547 mm (60.91 in.)
"j – n" : 806 mm (31.73 in.)
"j – j'" : 1511 mm (59.49 in.)
"j – o" : 649 mm (25.55 in.)
"k – k'" : 1126 mm (44.33 in.)
"k – o" : 1350 mm (53.15 in.)
"l – l'" : 1491 mm (58.70 in.)
"l – o" : 1130 mm (44.49 in.)
"m – m'" : 939 mm (36.97 in.)
"m – o" : 1725 mm (67.91 in.)

4 door model

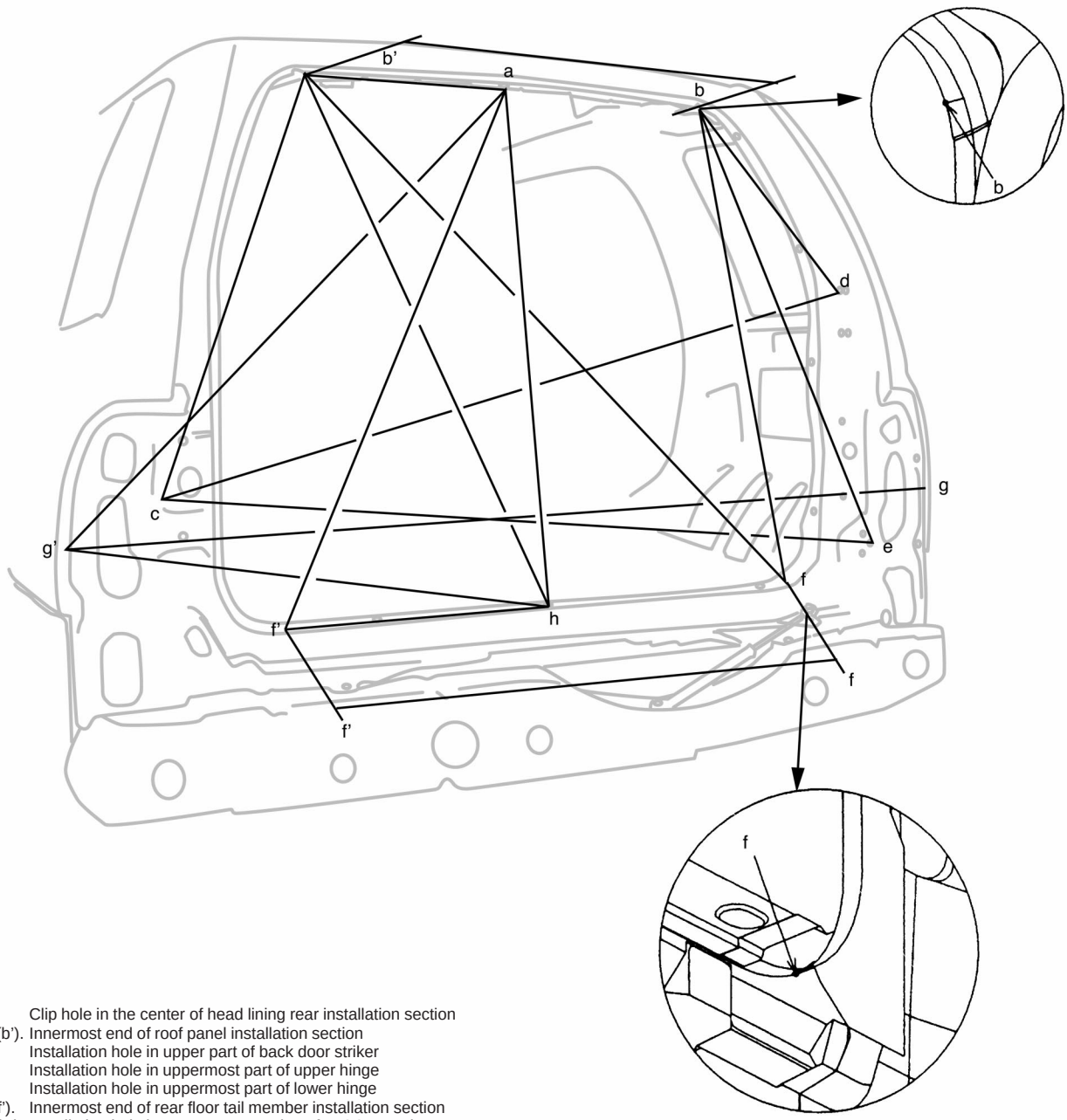


a. Hole in F door upper hinge at rear
b. Hole in F door lower hinge at rear
c. Trim installation clip hole
d. ø7 jig hole
e. Scuff installation hole (rearmost end)
f. Hole n R door upper hinge in upper part
g. Hole in R door lower hinge in lower part
h. Assistant grip installation hole
i. Trim installation hole
j. Door striker lower section installation hole
k. F seat belt installation hole

Hole to hole distance

“a – d” : 1155 mm (45.47 in.)
“a – g” : 1090 mm (42.91 in.)
“a – f” : 1046 mm (41.18 in.)
“b – f” : 1120 mm (44.09 in.)
“b – g” : 1140 mm (44.88 in.)
“c – k” : 1245 mm (49.02 in.)
“d – e” : 1174 mm (46.22 in.)
“f – j” : 839 mm (33.03 in.)
“g – j” : 918 mm (36.14 in.)
“h – j” : 941 mm (37.04 in.)
“h – k” : 1189 mm (46.81 in.)
“i – k” : 1309 mm (51.53 in.)

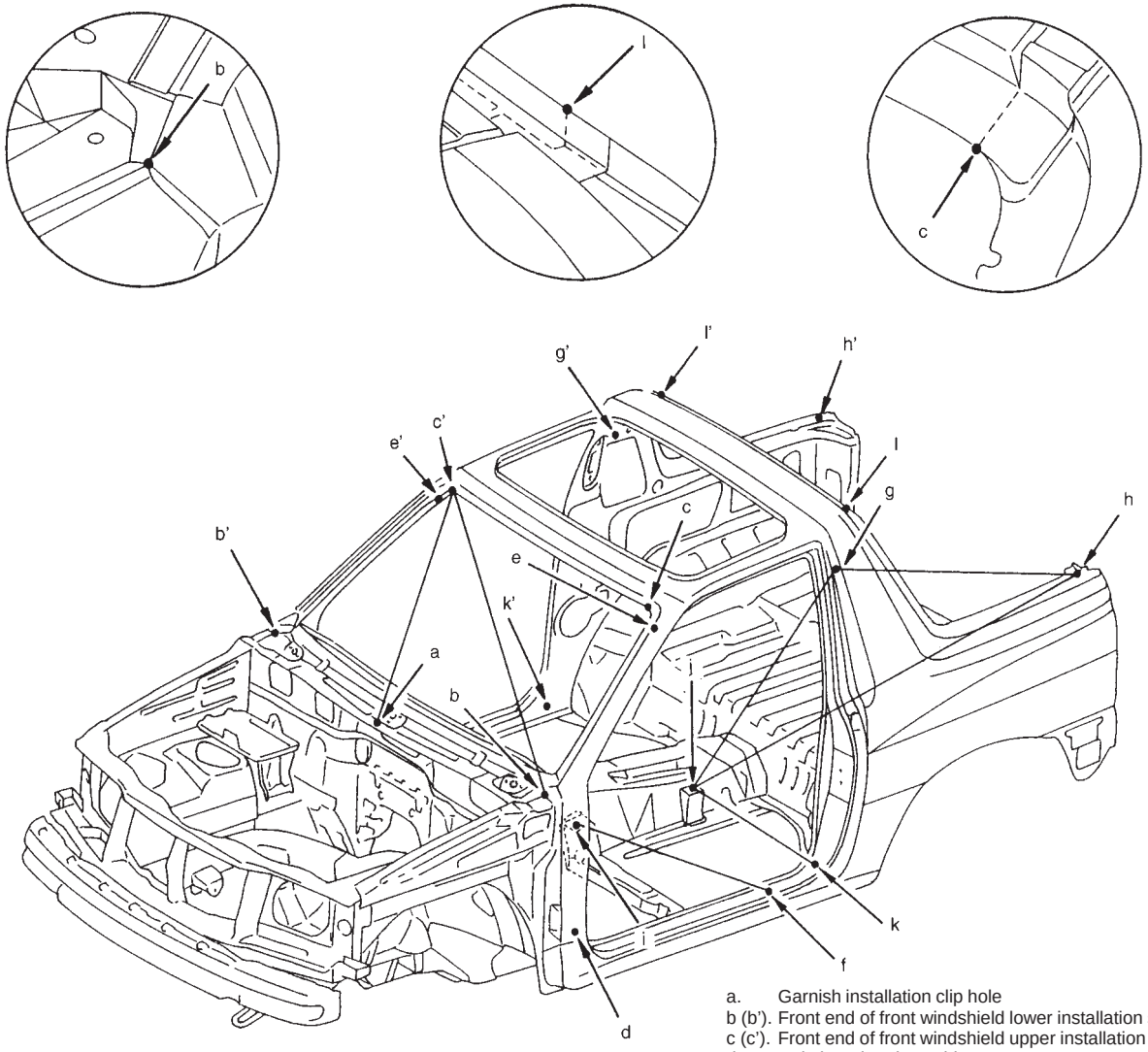
4 door model



a. Clip hole in the center of head lining rear installation section
b (b'). Innermost end of roof panel installation section
c. Installation hole in upper part of back door striker
d. Installation hole in uppermost part of upper hinge
e. Installation hole in uppermost part of lower hinge
f (f'). Innermost end of rear floor tail member installation section
g (g'). Installation hole in outer upper section of R-COMB R lamp
h. Nut hole

"a – b'"	448 mm (17.64 in.)	"b' – c"	650 mm (25.59 in.)
"a – f'"	1054 mm (41.50 in.)	"b' – g"	996 mm (39.21 in.)
"a – h"	926 mm (36.43 in.)	"b' – f"	1314 mm (51.73 in.)
"a – g"	1050 mm (41.34 in.)	"c – d"	1245 mm (49.02 in.)
"b – b'"	888 mm (34.96 in.)	"c – e"	1293 mm (50.90 in.)
"b – d"	400 mm (15.75 in.)	"f – f'"	1030 mm (40.55 in.)
"b' – f"	1314 mm (51.73 in.)	"f' – g"	512 mm (20.16 in.)
"b – e"	837 mm (32.95 in.)	"g – h"	808 mm (31.79 in.)
"b – f"	892 mm (35.12 in.)	"g – g'"	1544 mm (60.79 in.)

2 door model

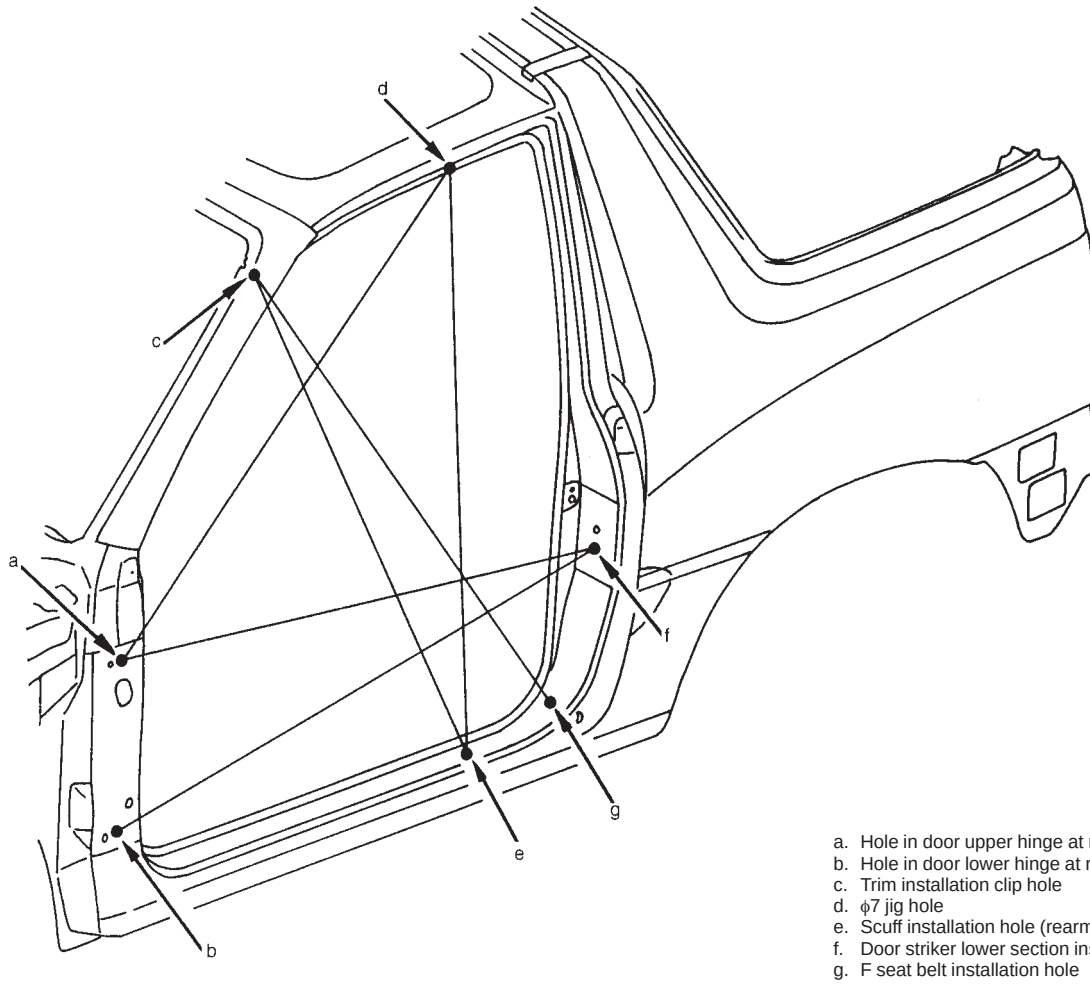


a. Garnish installation clip hole
b (b'). Front end of front windshield lower installation section
c (c'). Front end of front windshield upper installation section
d. Hole in F door lower hinge at rear
e. Trim installation clip hole
f (f'). Scuff installation hole (at rearmost end)
g (g'). Trim installation hole
h (h'). ϕ11 jig hole
i. Installation hole for F seat front inside
j. Installation hole for F seat rear inside
k (k'). F seat belt installation hole
l (l'). Innermost end of side body installation section

Hole to hole distance

a – c : 981 mm (38.62 in.)
b – b' : 1390 mm (54.72 in.)
b – c' : 1404 mm (55.28 in.)
c – c' : 1008 mm (39.69 in.)
e – e' : 1110 mm (43.70 in.)
e – i : 1036 mm (40.79 in.)
f – i : 688 mm (27.09 in.)
g – g' : 1145 mm (45.08 in.)
g – h : 1017 mm (40.04 in.)
g – j : 1078 mm (42.44 in.)
h – h' : 1338 mm (52.68 in.)
h – j : 1459 mm (57.44 in.)
j – k : 548 mm (21.57 in.)
l – l' : 956 mm (37.64 in.)

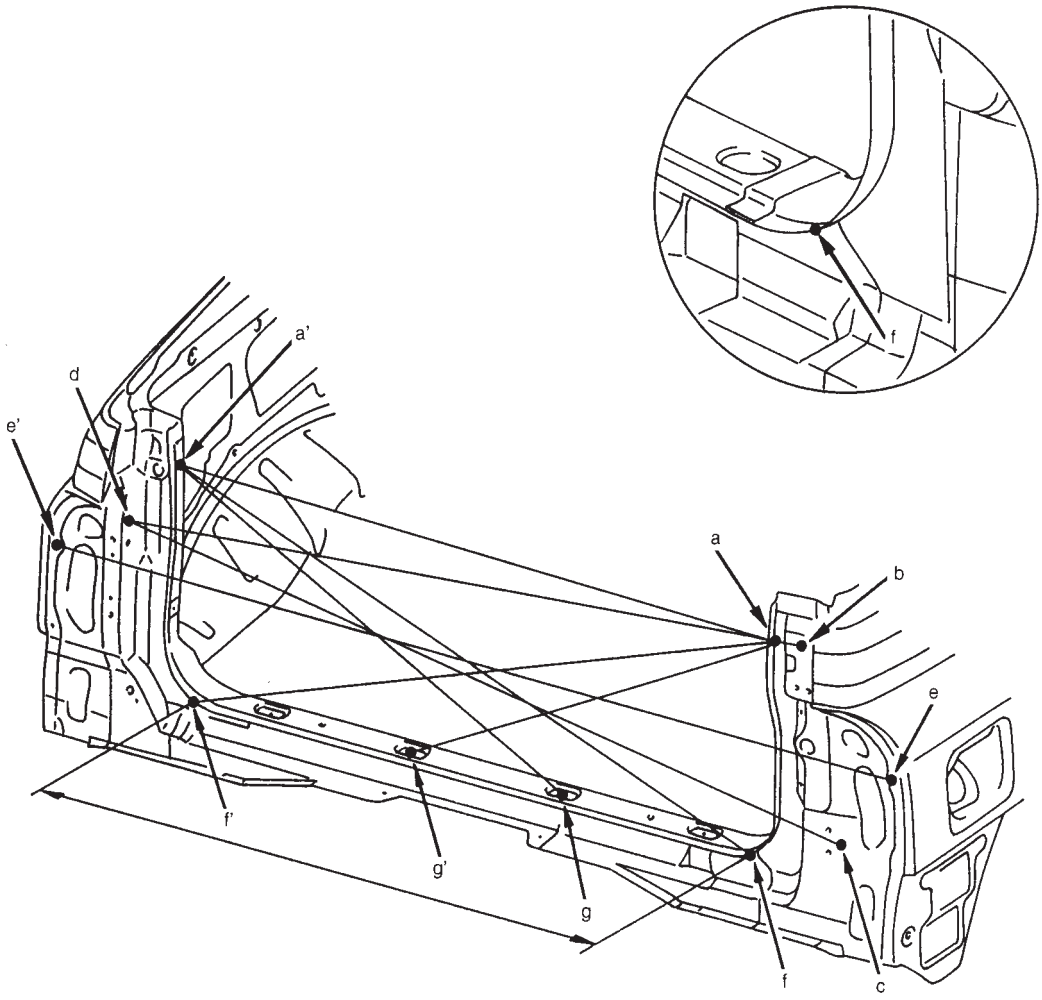
2 door model



a. Hole in door upper hinge at rear
b. Hole in door lower hinge at rear
c. Trim installation clip hole
d. ϕ7 jig hole
e. Scuff installation hole (rearmost end)
f. Door striker lower section installation hole
g. F seat belt installation hole

Hole to hole distance
a – d : 1154 mm (45.43 in.)
a – f : 1150 mm (45.28 in.)
b – f : 1165 mm (45.87 in.)
c – e : 1142 mm (44.96 in.)
c – g : 1246 mm (49.06 in.)
d – e : 1146 mm (45.12 in.)

2 door model

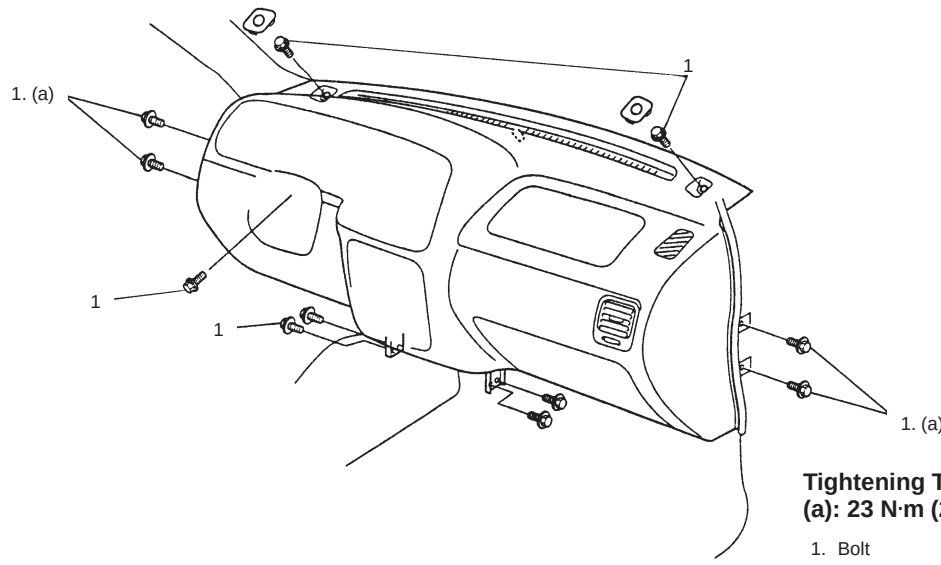


a (a'). Trim installation clip hole
b. Installation hole in uppermost part of upper hinge
c. Installation hole in outside part of lower hinge
d. Installation hole in uppermost part of rear gate striker
e (e'). Installation hole in outer upper section of R-COMB R (L) lamp
f (f'). Innermost end of rear floor tail member installation section
g (g'). Garnish installation clip hole

Hole to hole distance
a – a' : 1112 mm (43.78 in.)
a – f' : 1134 mm (44.65 in.)
a – g' : 796 mm (31.34 in.)
a' – f : 1156 mm (45.51 in.)
a' – g : 824 mm (32.44 in.)
b – d : 1229 mm (48.39 in.)
c – d : 1324 mm (52.13 in.)
e – e' : 1544 mm (60.79 in.)
f – f' : 1029 mm (40.51 in.)

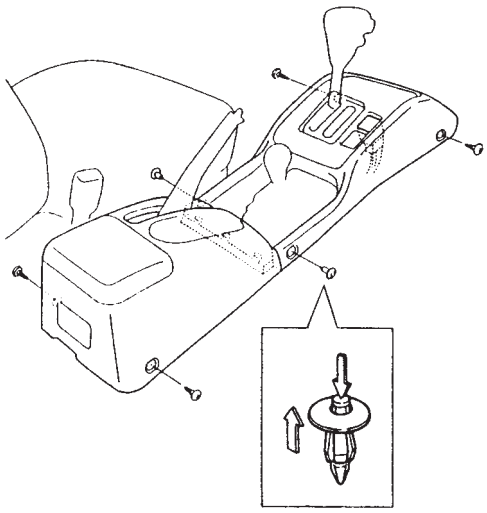
INSTRUMENTATION AND DRIVER INFORMATION

INSTRUMENT PANEL



Tightening Torque
(a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

1. Bolt



WARNING:
See WARNING at the beginning of this section.

REMOVAL

1) Disconnect negative cable at battery.
2) Disable air bag system. Refer to “Disabling Air Bag System” in Section 10B.
3) Remove console box.
4) Remove glove box and column hole cover.
5) Disconnect wires and cables from heater unit and blower motor assembly.
6) Remove steering column assembly. Refer to Section 3C1.
7) Disconnect speedometer connector and remove speedometer assembly. If equipped with air bag, disconnect wire coupler at SDM and air bag ground terminal for air bag.
8) Remove engine hood opener.
9) Disconnect couplers which need to be disconnected for removal for instrument panel.
10) Remove instrument panel mounting screws.
11) Remove instrument panel mounting bolt.
12) Remove instrument panel.

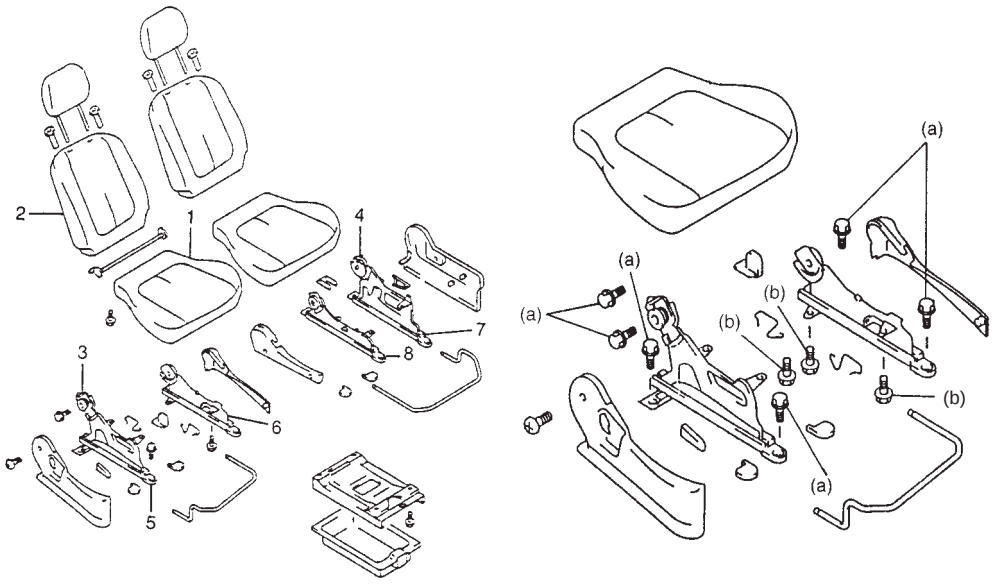
CAUTION:
For vehicle with Air Bag, instrument panel could not be removed with SDM coupler connected and ground terminal installed.
Use care not to damage Air Bag harness.

INSTALLATION

1) Install instrument panel by reversing removal procedure, noting the following items.
   - When installing each part, be careful not to catch any cable or wiring harness.
   - When installing steering column assembly, refer to “AIR BAG STEERING COLUMN INSTALLATION” in Section 3C1.
2) Adjust control cables. (Refer to Section 1A “HEATER CONTROL CABLES”.)
3) Enable air bag system. Refer to “Enabling Air Bag System” in Section 10B.

SEAT

FRONT SEAT

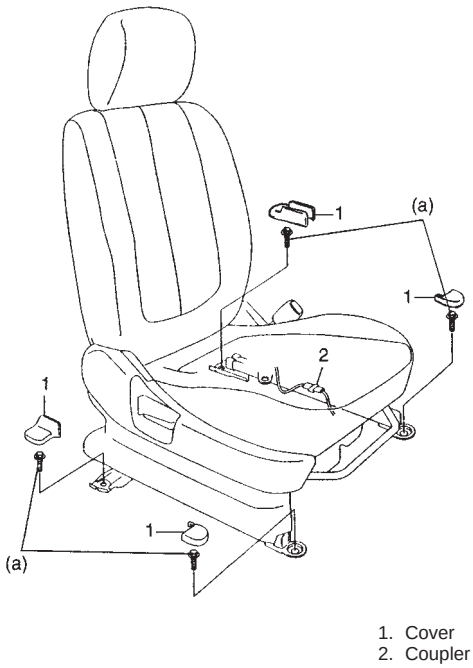


1. Seat cushion
2. Seat back
3. Reclining assy (RH side)
4. Reclining assy (LH side)
5. Seat adjuster (RH outside)
6. Seat adjuster (RH inside)
7. Seat adjuster (LH outside)
8. Seat adjuster (LH inside)

Tightening Torque
(a): 35 N·m (3.5 kg-m, 25.5 lb-ft)
(b): 23 N·m (2.3 kg-m, 17.0 lb-ft)

REMOVAL

1) Disconnect lead wire(s) at coupler (if equipped). Remove four mounting bolts fixing front seat to seat rail to remove front seat.
2) Disassemble and repair seat as necessary.



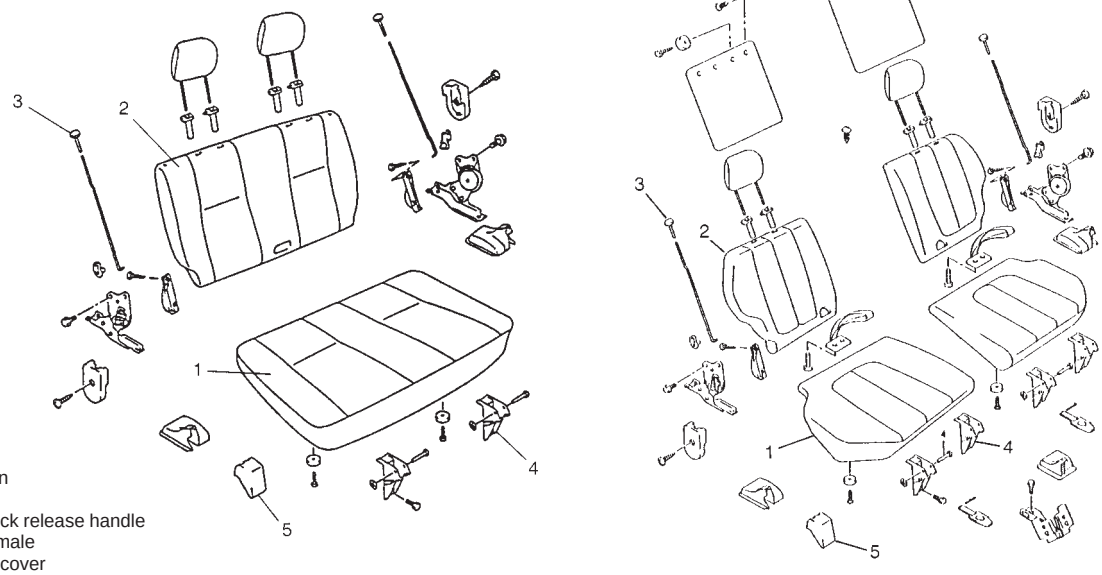
1. Cover
2. Coupler

INSTALLATION

Reverse removal procedure to install front seat.
Torque to specifications, as shown.

Tightening Torque
(a): 35 N·m (3.5 kg-m, 25.5 lb-ft)

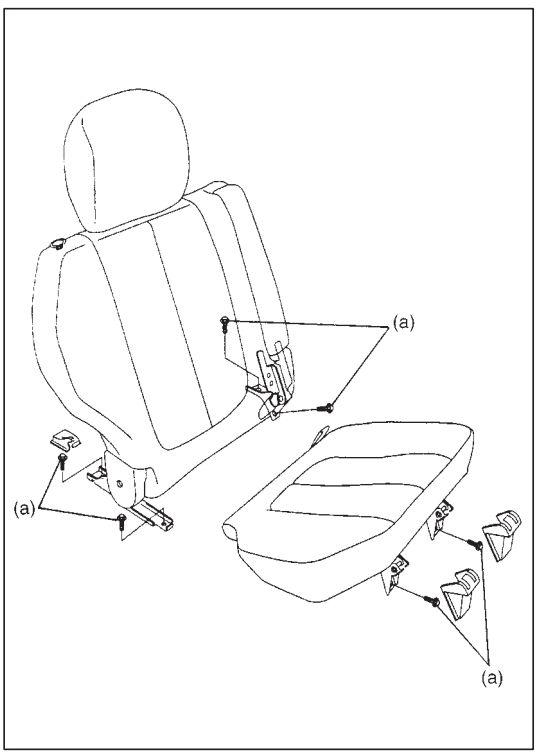
REAR SEAT



1. Seat cushion
2. Seat back
3. Seat auto lock release handle
4. Seat hinge male
5. Hinge male cover

REMOVAL

1) Remove four mounting bolt to remove seat cushion.
2) Remove four mounting bolts to remove seat back.
3) Disassemble and repair seat as necessary.



INSTALLATION

Reverse removal procedure to install rear seat.
Torque to specifications, as shown.

Tightening Torque

(a): 35 N·m (3.5 kg-m, 25.5 lb-ft)

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 anti-corrosion 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 paintability 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.
he sequence of the application steps of the anti-corrosion materials are as follows:

1) Clean and prepare the metal surface.
2) Apply primer.
3) Apply sealer (all joints sealed originally).
4) Apply color in areas where color is required such as hem flanges, exposed joints and under body components.
5) Apply anticorrosion compound (penetrative wax).
6) Apply undercoating (rust proof material).

When the welding or heating operation causes the original galvanization or other anticorrosive materials to be burnt, the interior and under-body panel surfaces must be cleaned.
Removal of residues of the burning should be carried out carefully when the relevant place has 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 elevant 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.

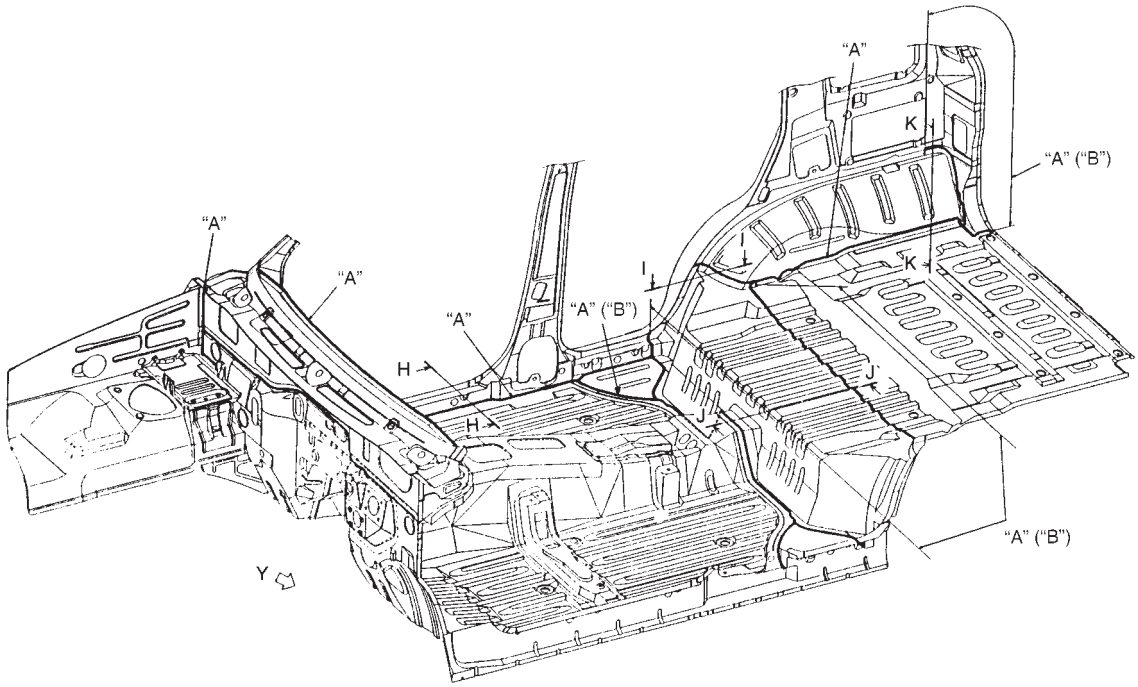
1) Use wax or grease-removing solvent to clean the part.
2) Use a wet or dry sand-paper (No. 400) to polish the panel lightly. Do not polish it forcibly to produce any scratch. Clean the part again.
3) If factory-applied primer coating is cut through to the bare metal, apply metal conditioner to the 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).

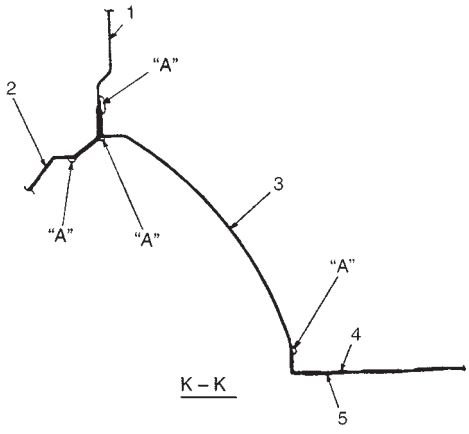
Before replacing exterior parts or assemblies, check paint conditions of all the covered or hidden interior surfaces. If any rust scale is found at these places, proceed as follows:

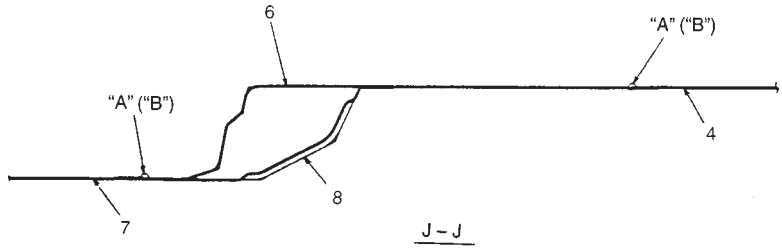
1) Use a proper wire brush, adhesive or liquid rust removing agent to remove rust. As for the method of use, follow directions advised for respecitve materials.
2) If necessary, wash parts with detergent, rinse, and dry them.
3) Before installing exterior body parts, apply anticorrosive compound to all cleaner surfaces of exterior body parts. Also, apply anticorrosive compound to inner surfaces of exterior body parts to be installed.

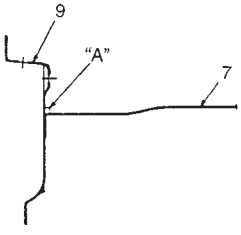
SEALANT APPLICATION AREA

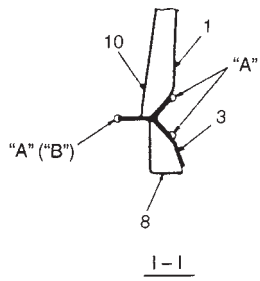
4 door model

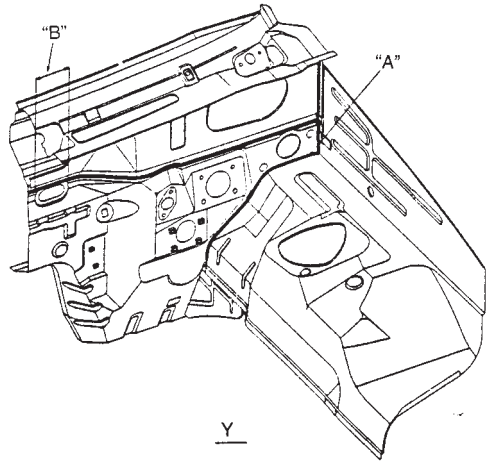






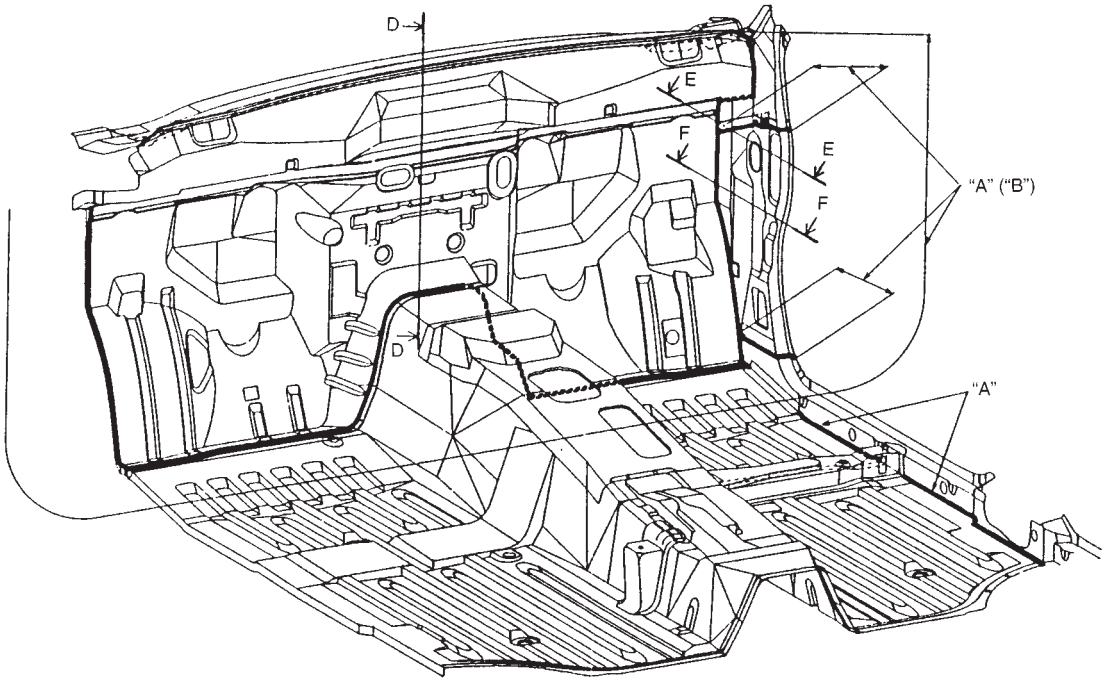




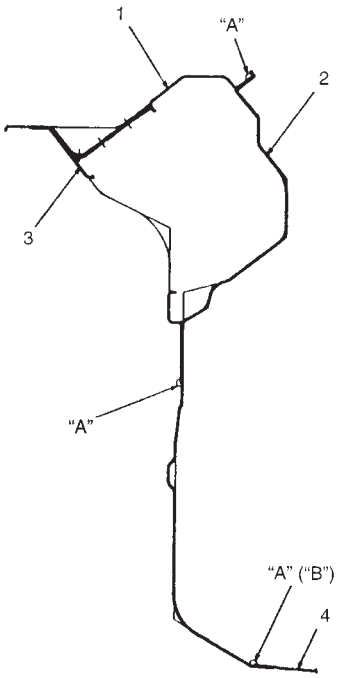


1. Side body inner panel
2. Rear wheel housing outer rear panel
3. Rear wheel housing panel
4. Rear floor panel
5. Tail lower member
6. Center floor panel
7. Front floor panel
8. Center floor member
9. Side sill inner panel
10. Side outer panel

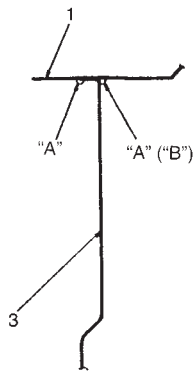
"A": Apply sealant
"B": Brush treatment



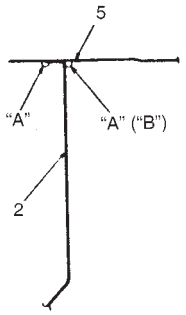
Z



D – D



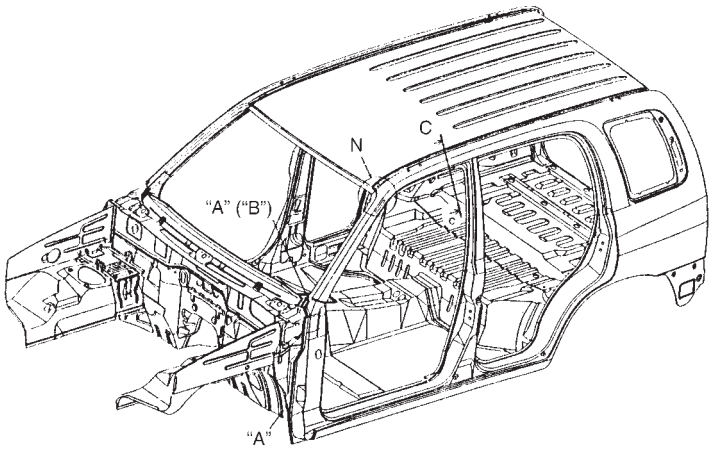
E – E

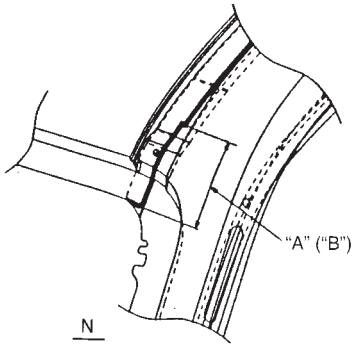


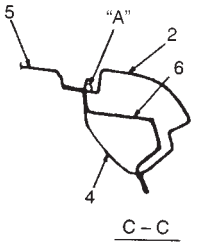
F – F

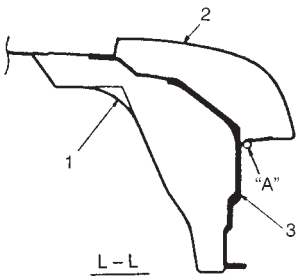
1. Cowl top panel
2. Dash panel
3. Cowl front panel
4. Front floor panel
5. Front pillar inner lower panel

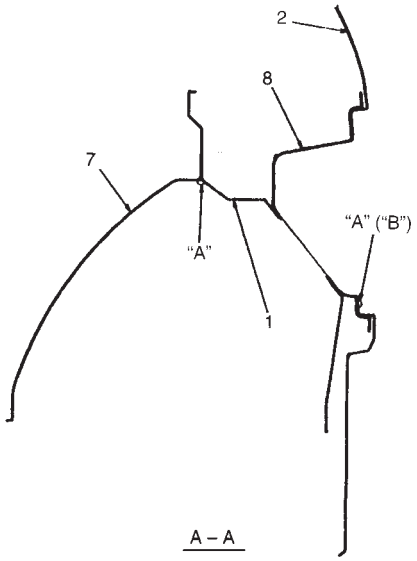
"A": Apply sealant
"B": Brush treatment

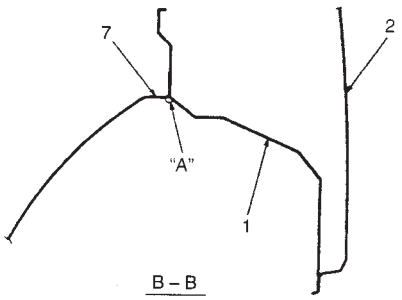


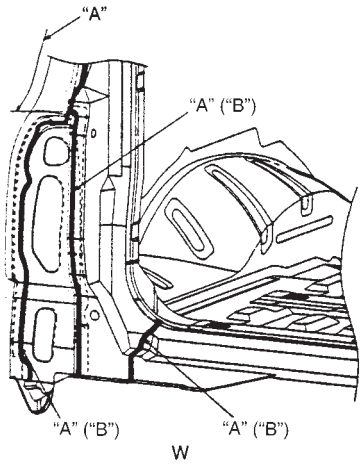


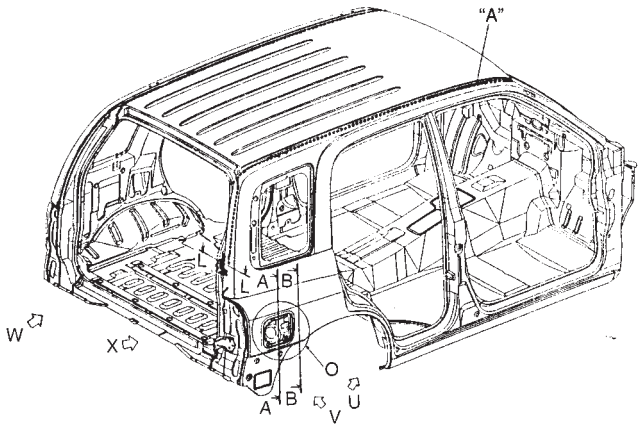






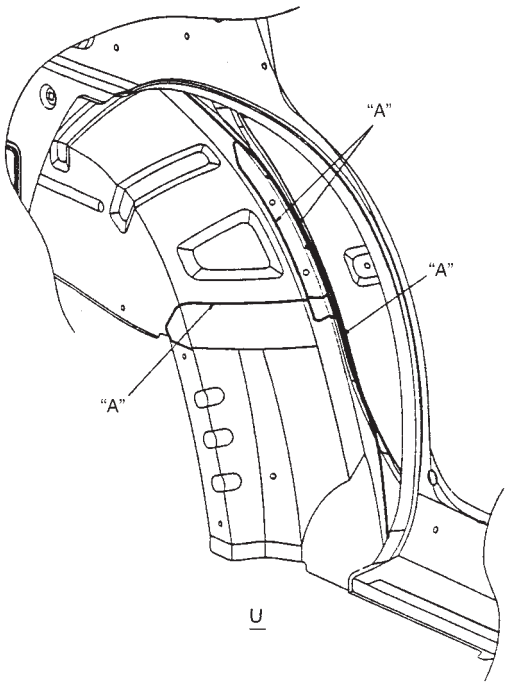






1. Side body inner panel
2. Side body outer panel
3. Back pillar outer panel
4. Front pillar inner panel
5. Roof panel
6. Front pillar upper reinforcement
7. Rear wheel housing panel
8. Fuel inlet box

"A": Apply sealant
"B": Brush treatment



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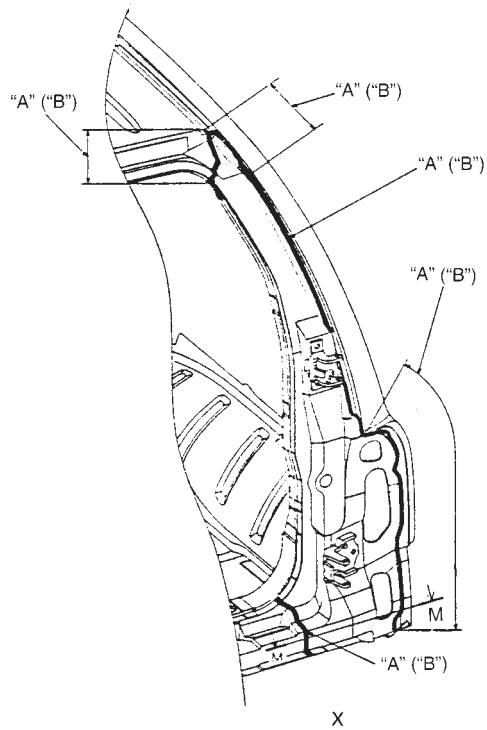
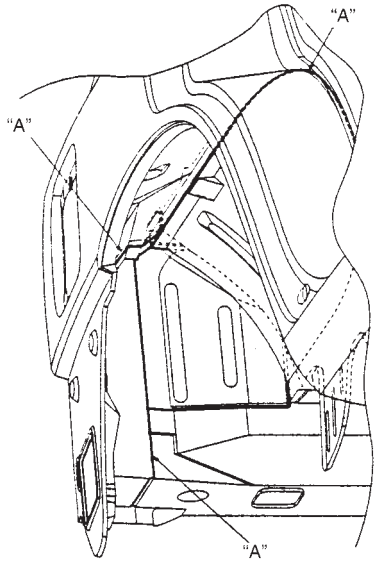
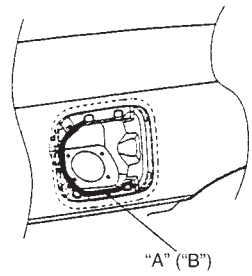


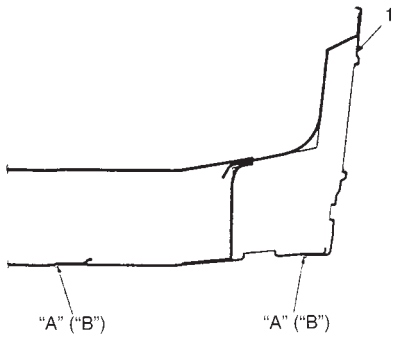
X



V



O

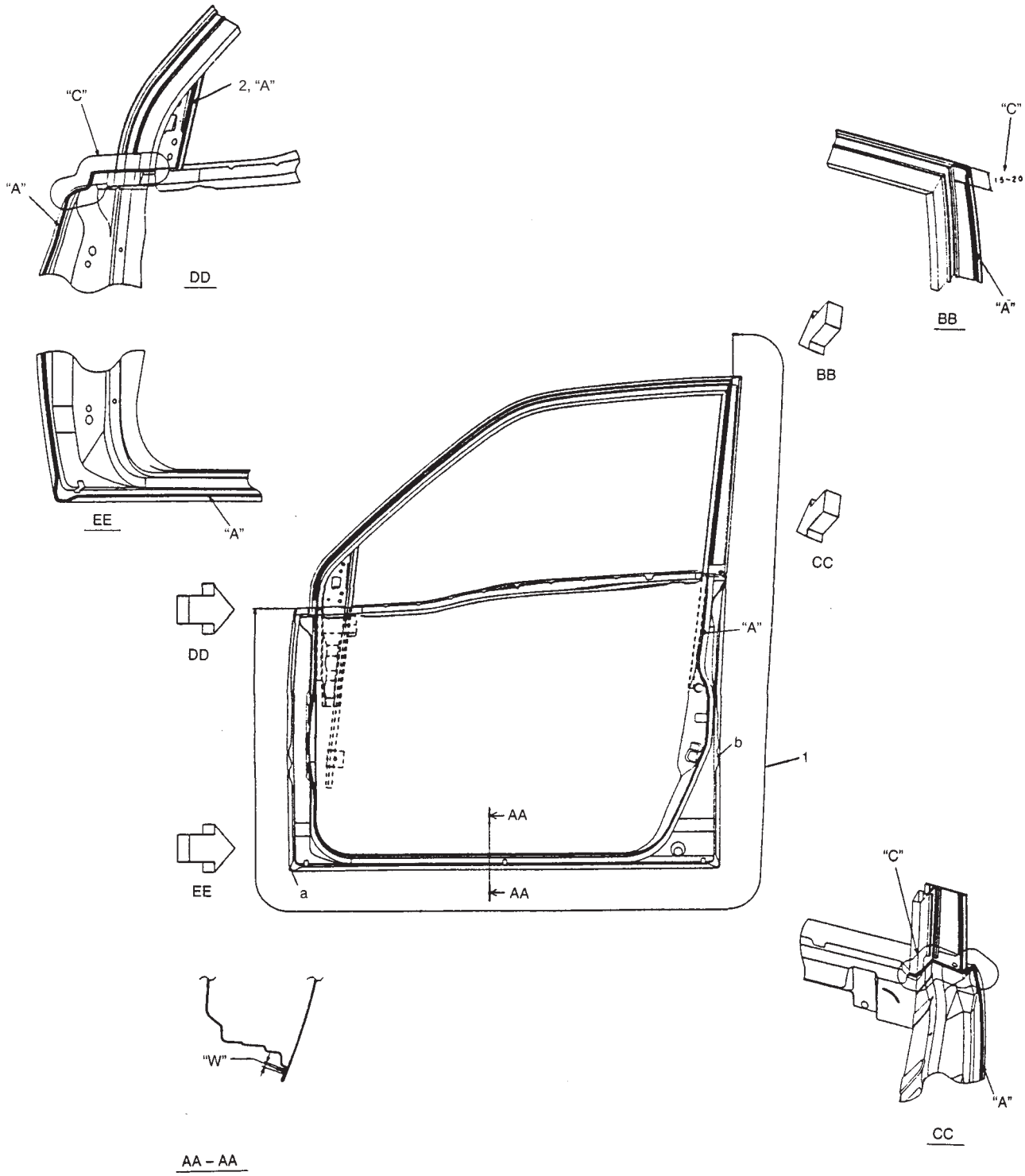


M – M

1. Side body outer panel

"A": Apply sealant
"B": Brush treatment

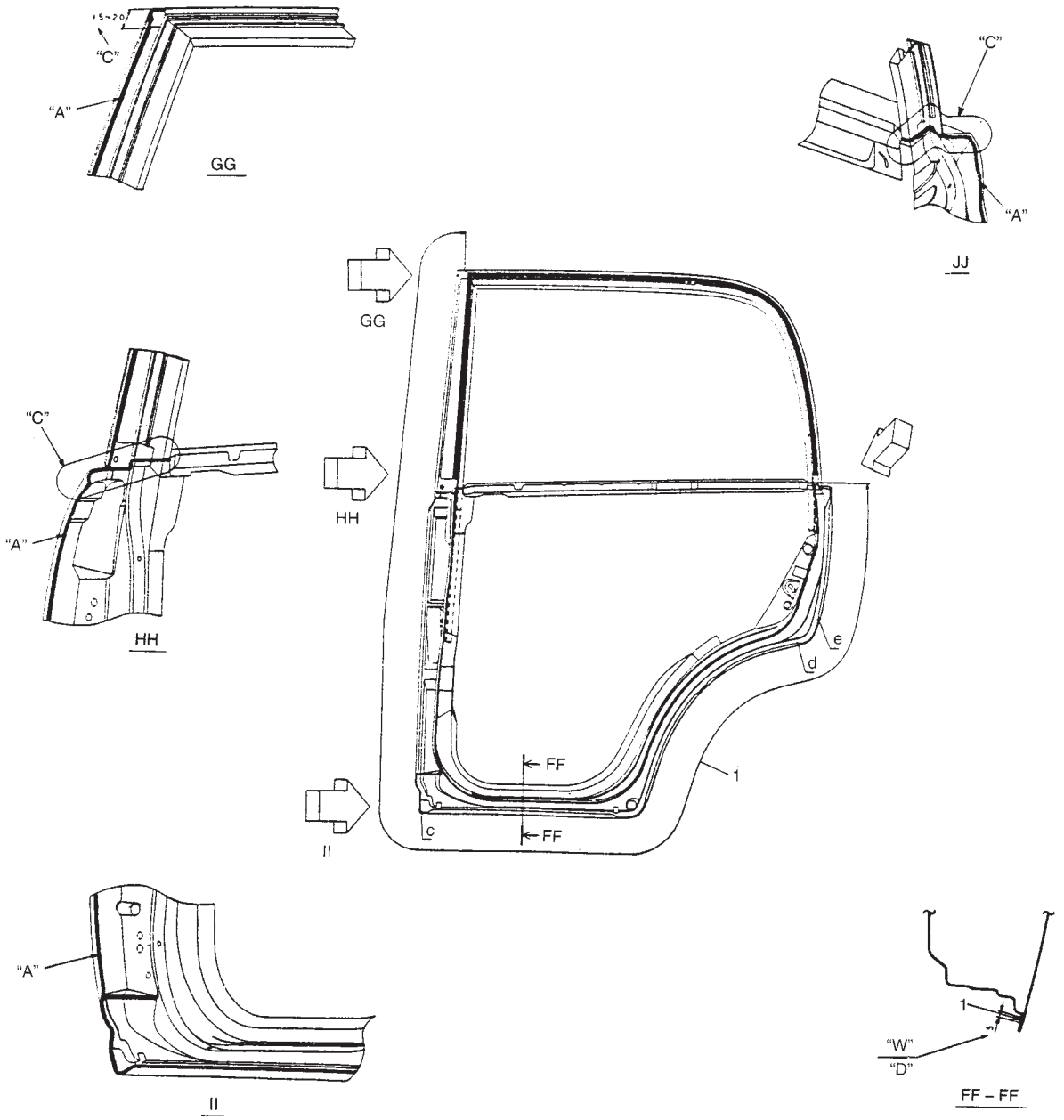
Vehicle produced in IWATA



Sealant width "W": more than 5 mm between a and b

"A": Apply sealant
"B": Brush treatment
"C": Wipe sealant away
1. Sealant application area
2. Outside of body

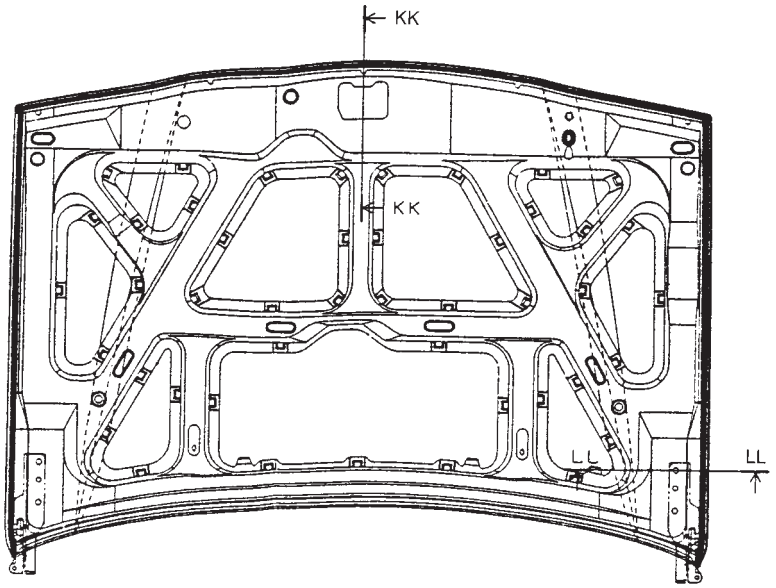
Vehicle produced in IWATA

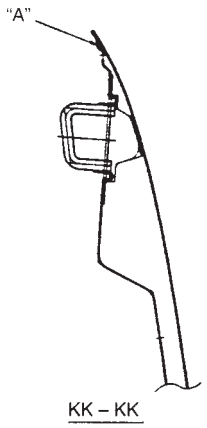


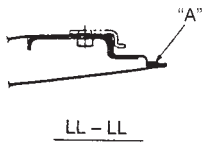
"A": Apply sealant
"B": Brush treatment
"C": Wipe sealant away
"D": Role sealant between d and e

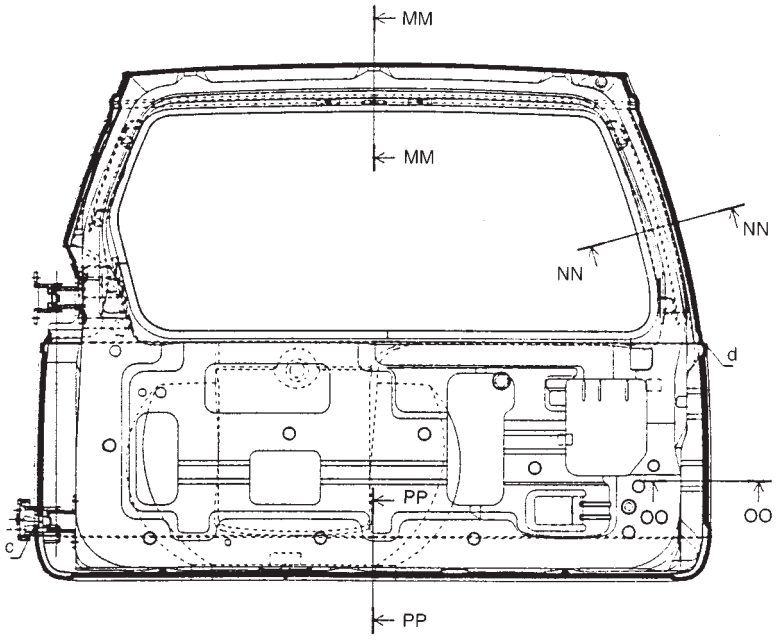
Sealant width "W": more than 5 mm between c and d
1. Sealant application area

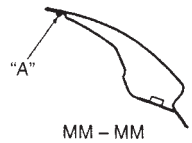
Vehicle produced in IWATA

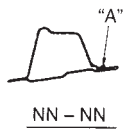


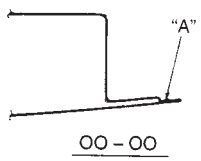


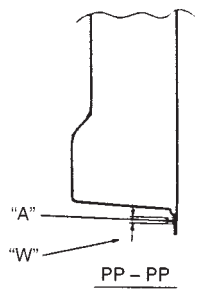








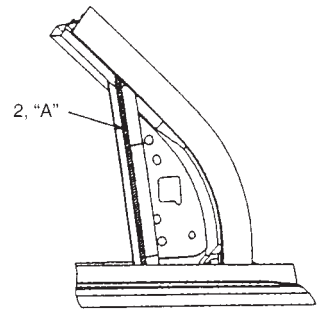




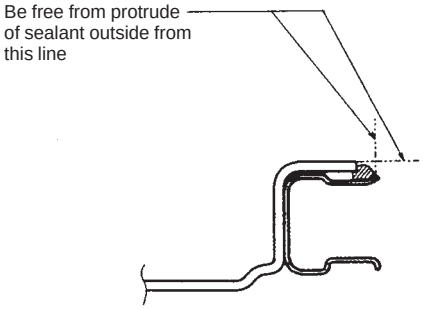
"A": Apply sealant

Sealant width "W": more than 5 mm between c and d

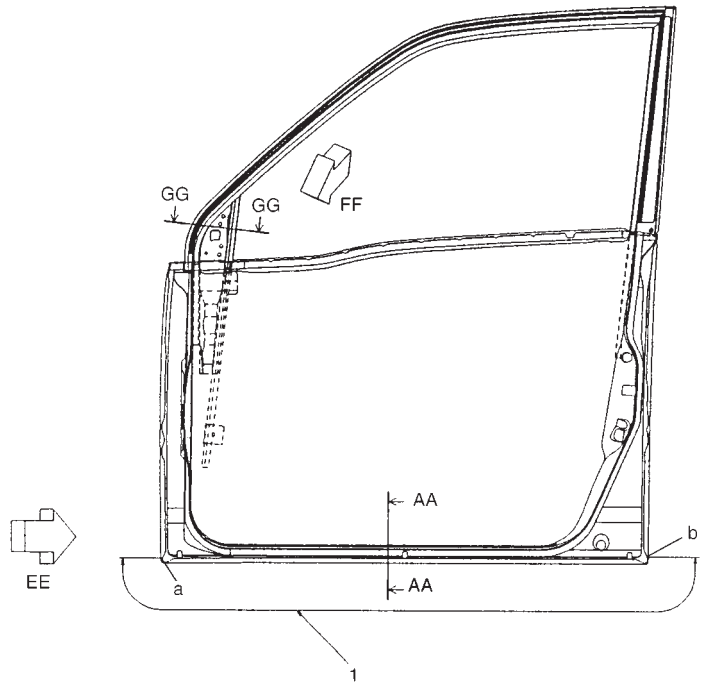
Vehicle produced in CAMI

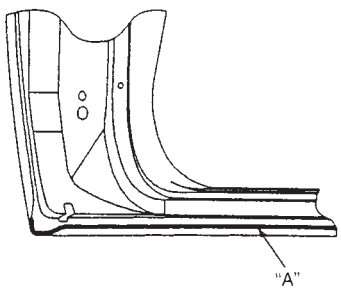


VIEW: FF

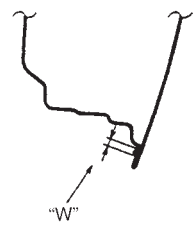


GG – GG





VIEW: EE

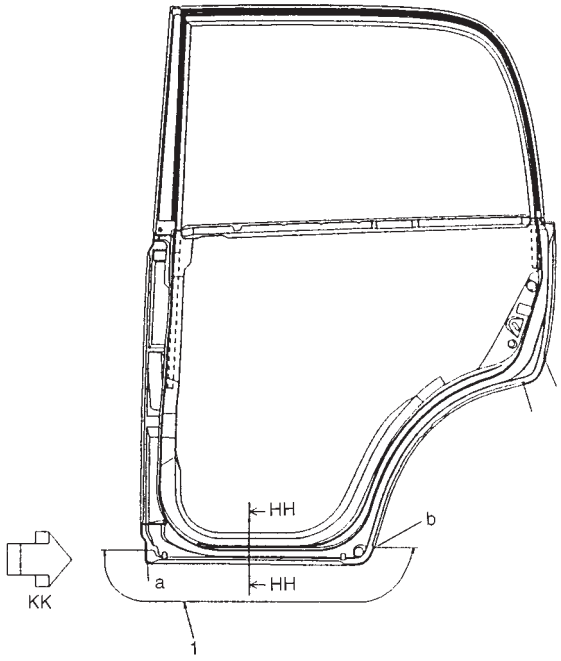


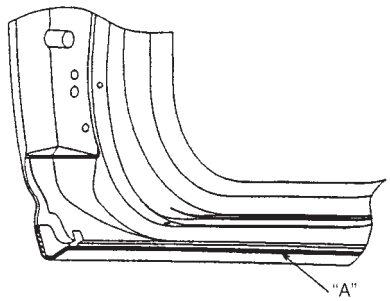
AA – AA

Sealant width "W": more than 5 mm between a and b

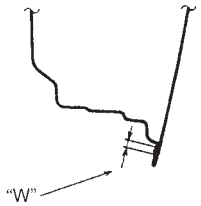
"A": Apply sealant
1. Sealant application area
2. Outside of body

Vehicle produced in CAMI

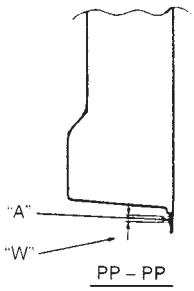




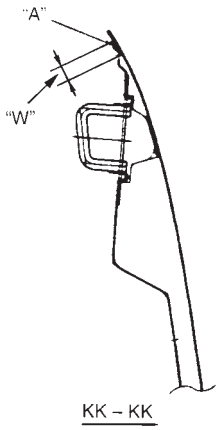
VIEW: KK



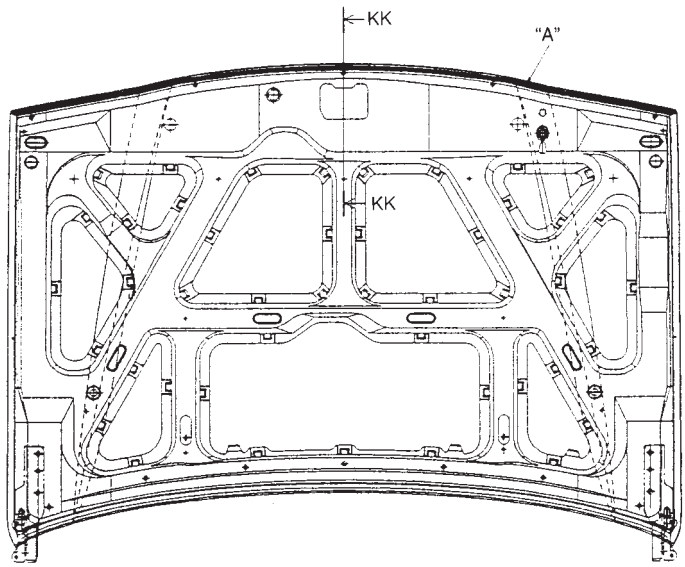
HH – HH

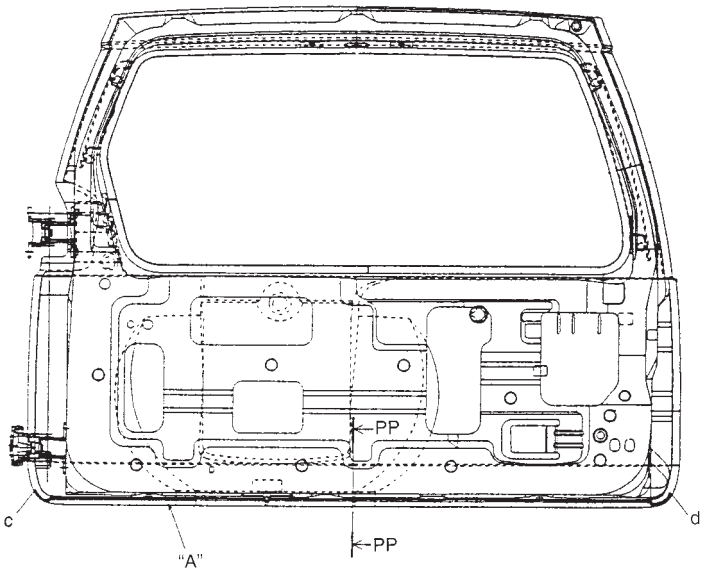


PP – PP



KK – KK

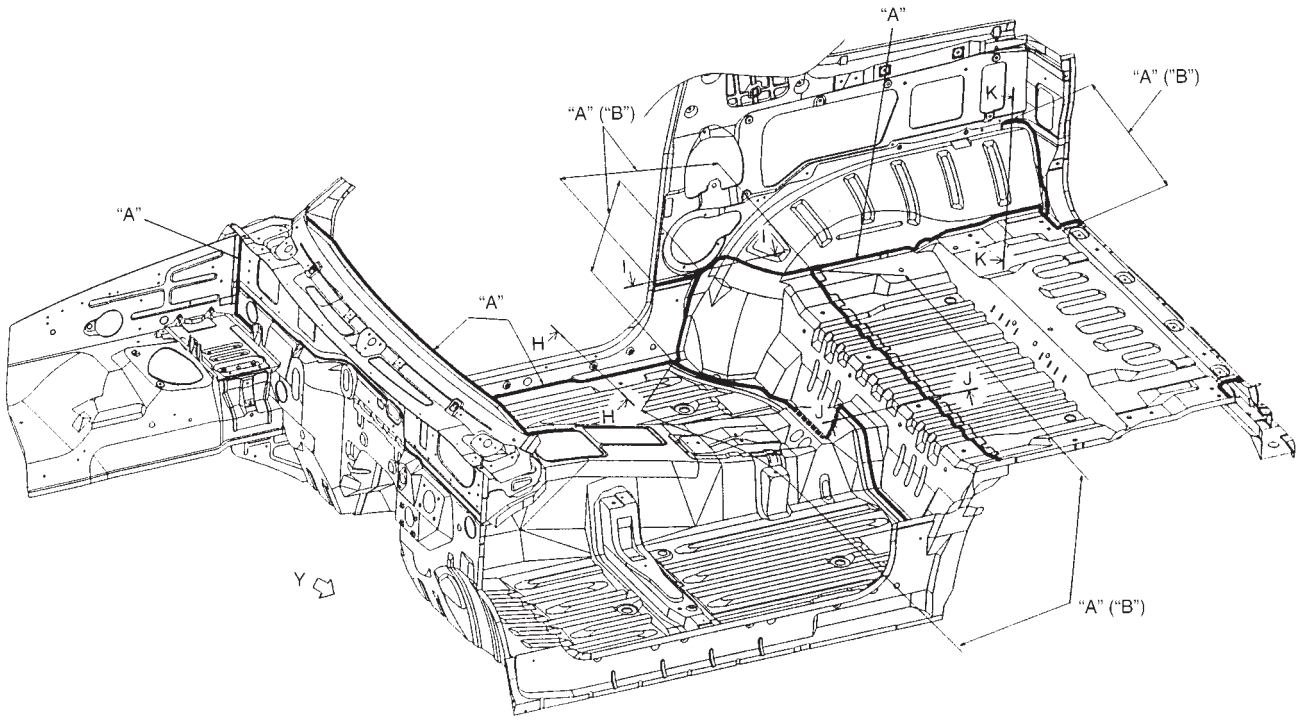


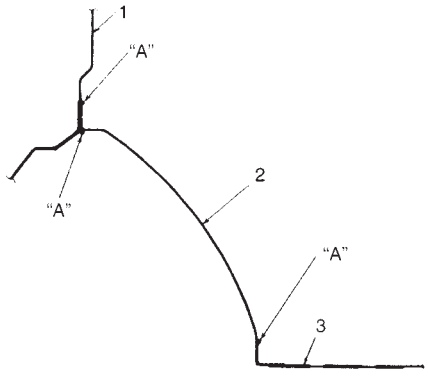


Sealant width "W": more than 5 mm
between a and b,
between c and d

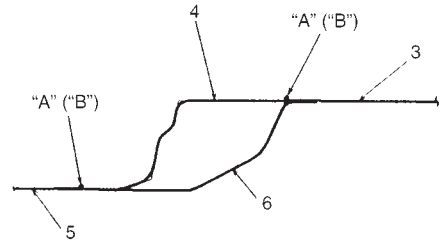
"A": Apply sealant
1. Sealant application area

2 DOOR MODEL

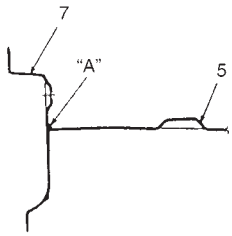




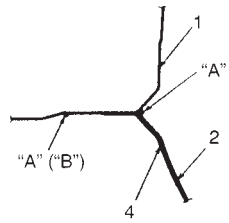
K – K



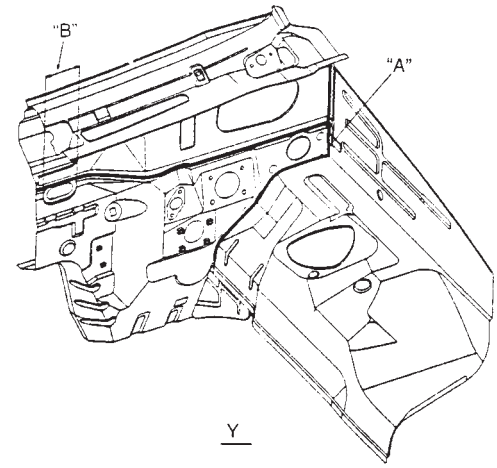
J – J



H – H



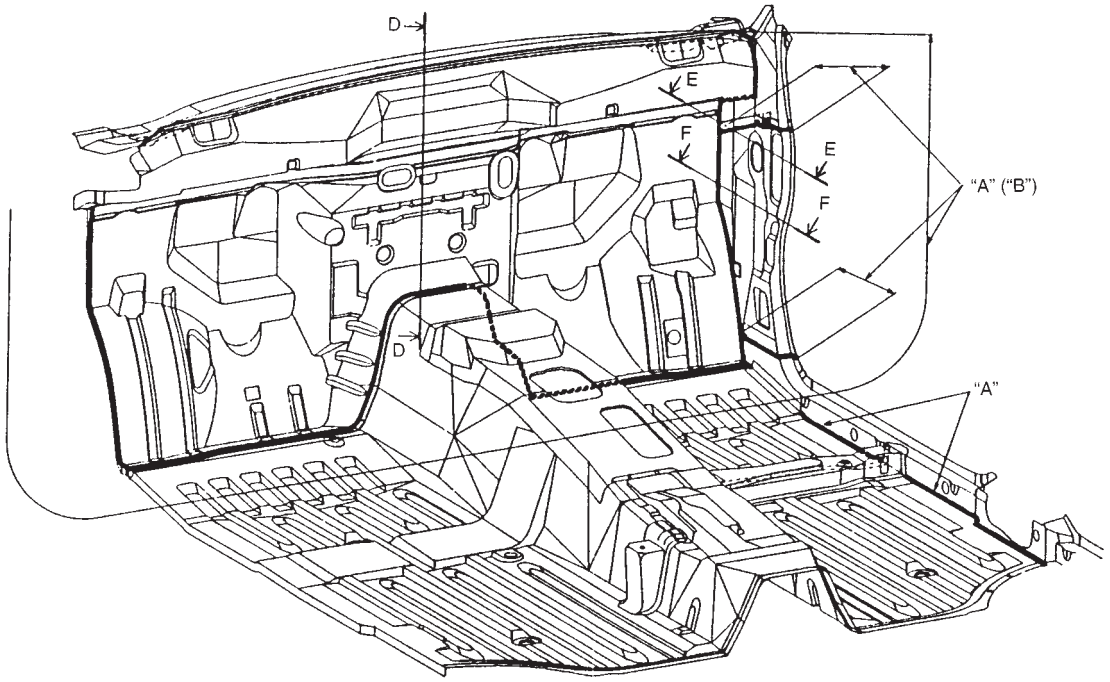
I – I



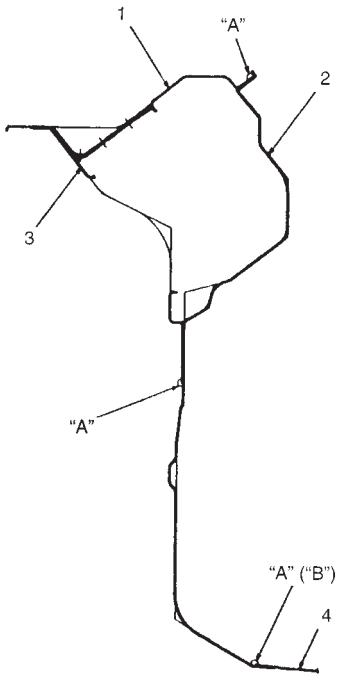
Y

1. Side body inner panel
2. Rear wheel housing panel
3. Rear floor panel
4. Center floor panel
5. Front floor panel
6. Center floor member
7. Side sill inner panel

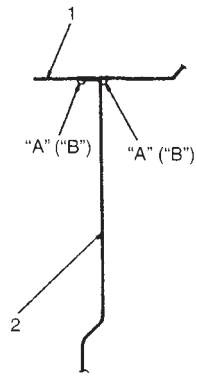
"A": Apply sealant
"B": Brush treatment



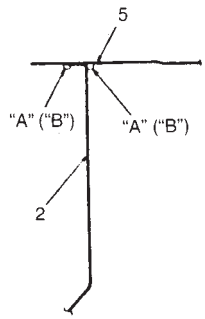
Z



D – D



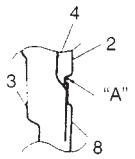
E – E



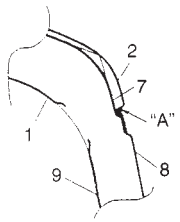
F – F

1. Cowl top panel
2. Dash panel
3. Cowl front panel
4. Front floor panel
5. Front pillar inner lower panel

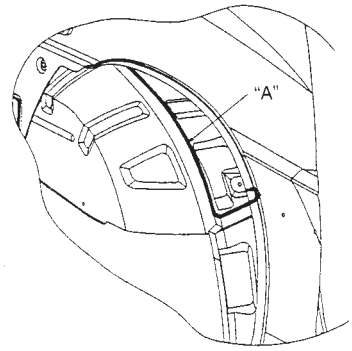
"A": Apply sealant
"B": Brush treatment



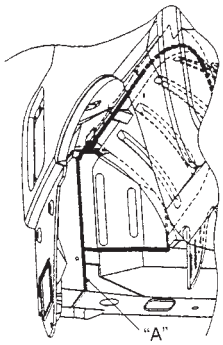
C – C



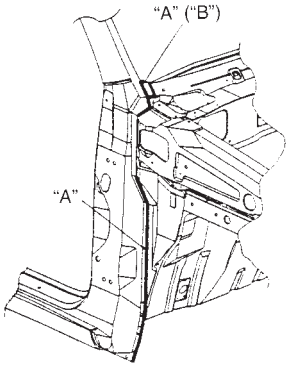
L – L



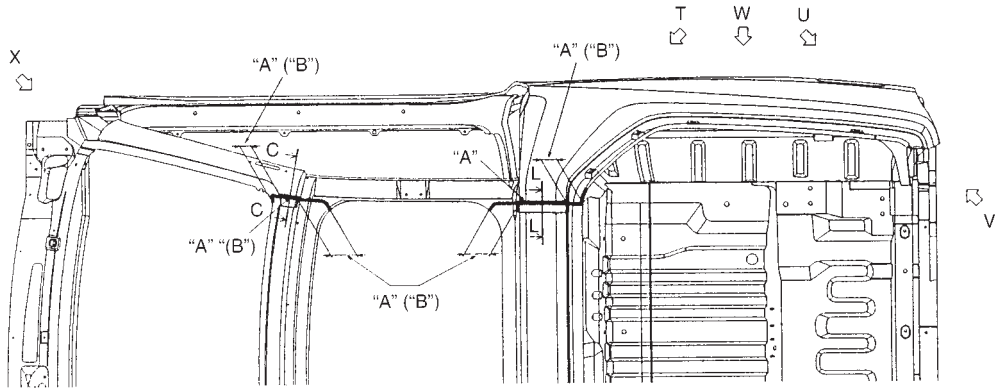
VIEW: T

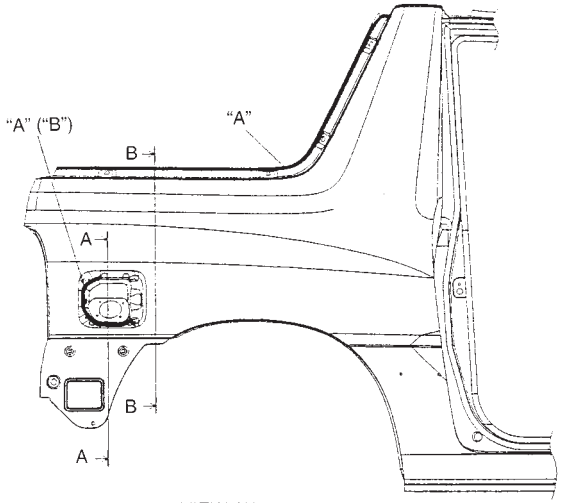


VIEW: U

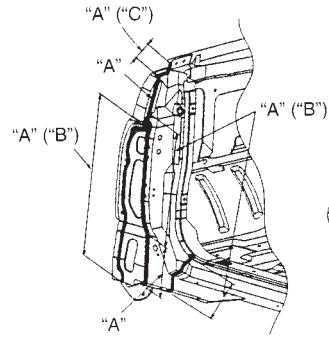


VIEW: X

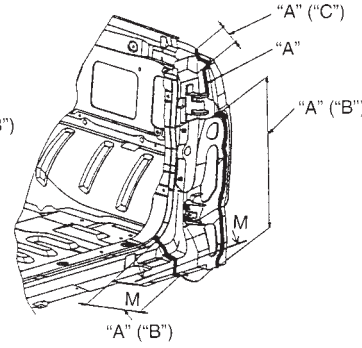




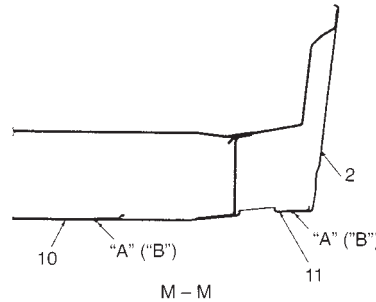
VIEW: W



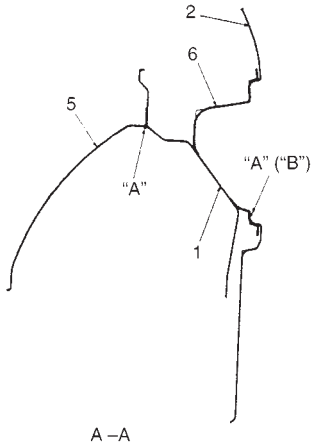
VIEW: V (LH)



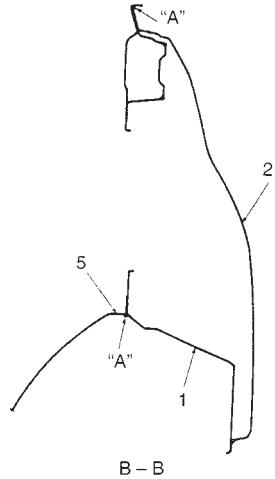
VIEW: V (RH)



M – M



A – A

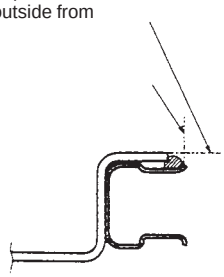


B – B

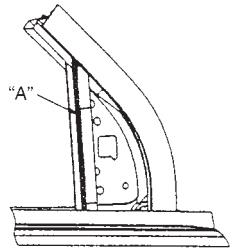
1. Side body inner panel
2. Side body outer panel
3. Front pillar inner panel
4. Front pillar upper reinforcement
5. Rear wheel housing panel
6. Fuel inlet box
7. Center pillar reinforcement
8. Center pillar joint outer panel
9. Center pillar joint inner panel
10. Tail upper member
11. Back pillar outer panel

"A": Apply sealant
"B": Brush treatment
"C": Wipe

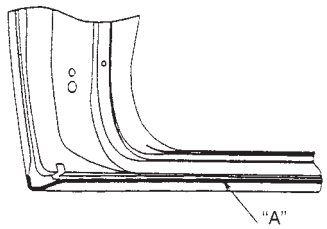
Be free from protrude of sealant outside from this line.



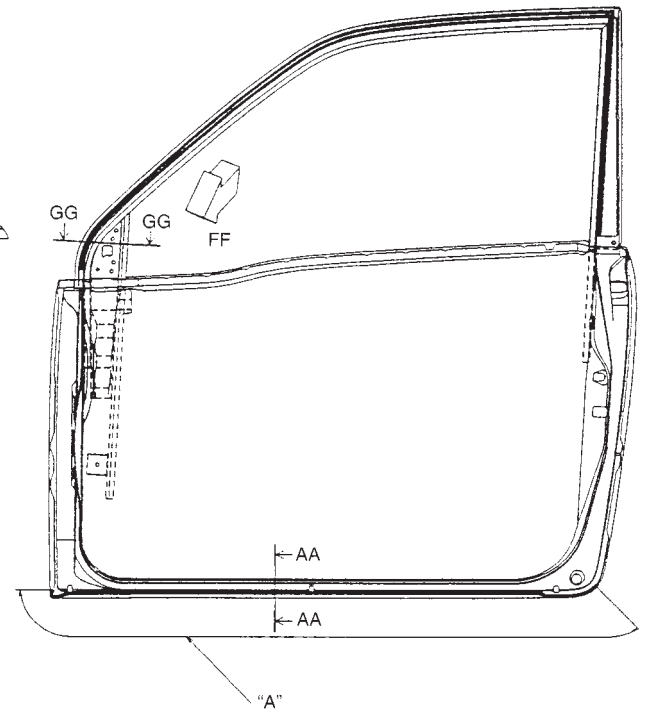
GG – GG

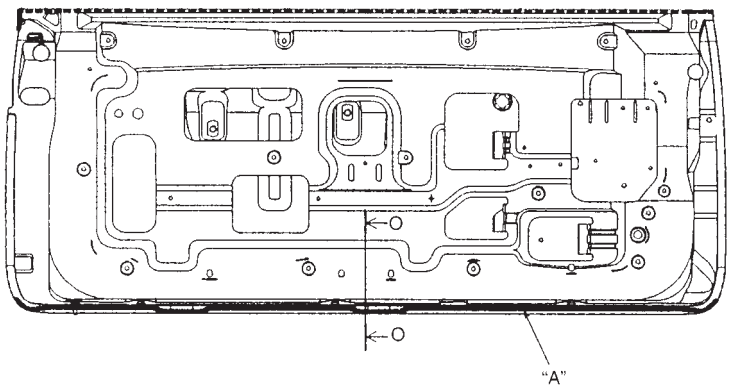


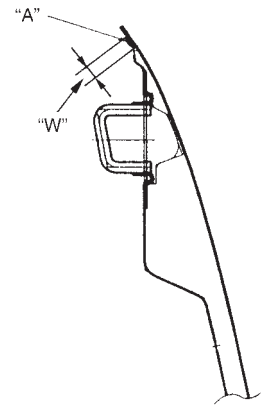
VIEW: FF



VIEW: EE







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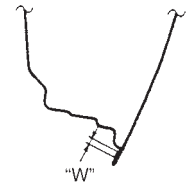
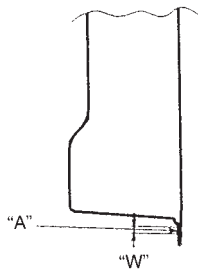
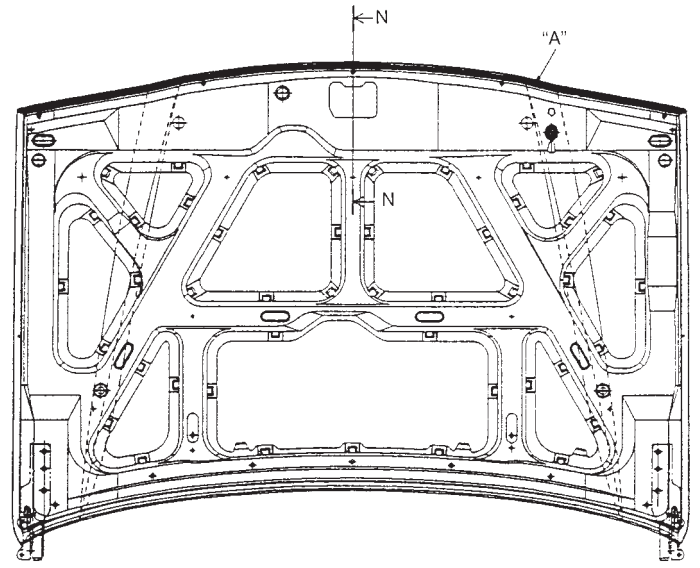


AA – AA



O – O

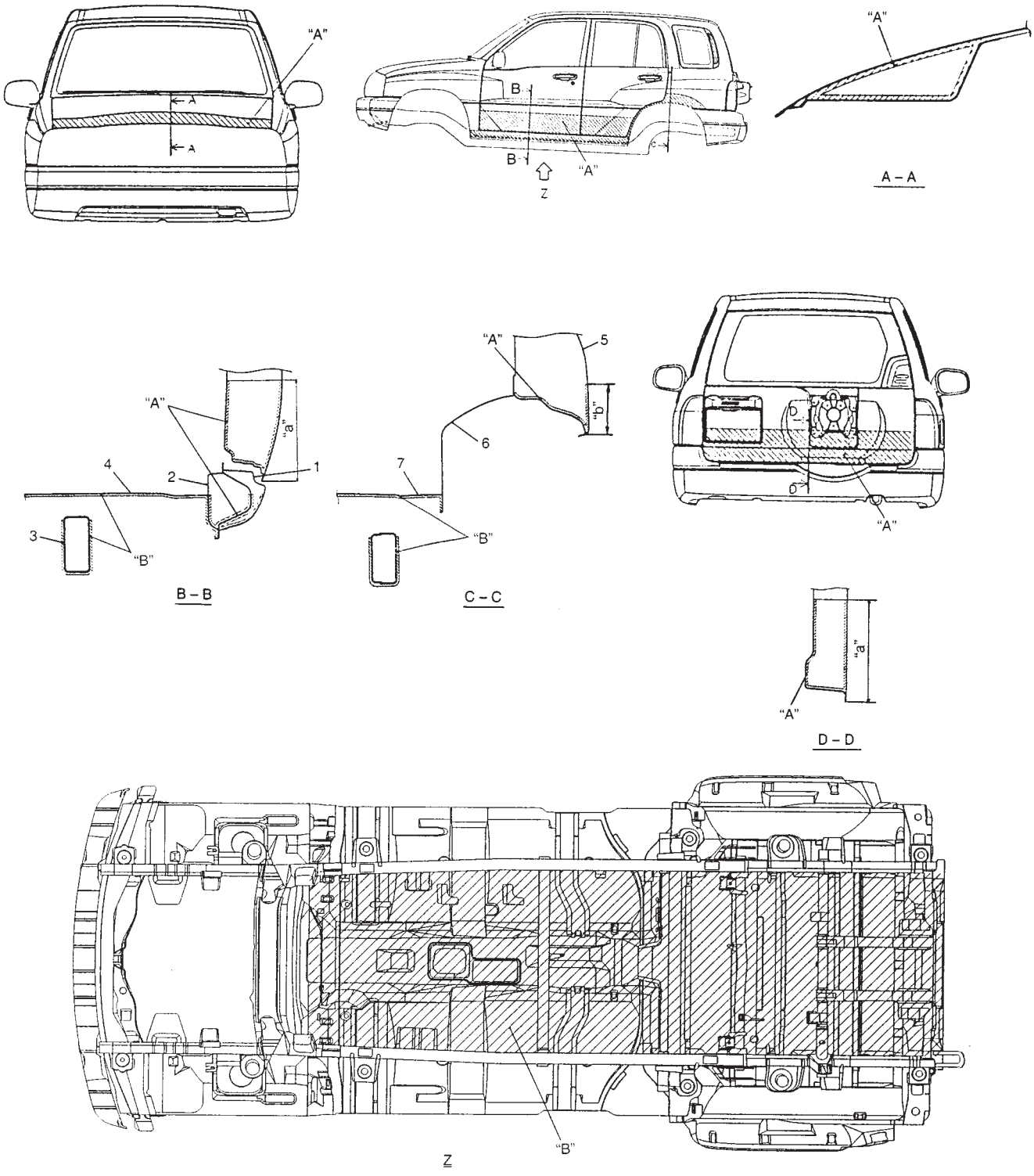


Sealant width "W": more than 5 mm

"A": Apply sealant

UNDERCOATING/ANTI-CORROSION COMPOUND APPLICATION AREA

4 door model

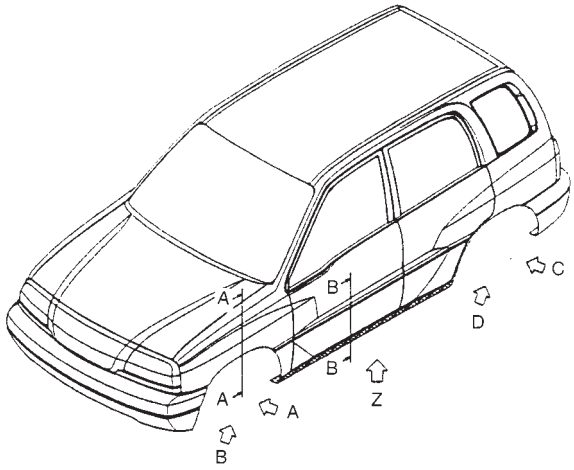


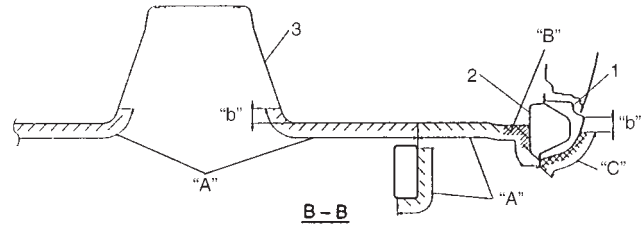
"a": 200 mm (7.87 in.)
"b": 100 mm (3.94 in.)

"A": Apply rust proof wax (hot wax 50 μm or more)
"B": Apply rust proof wax (high viscosity wax 50 μm or more)

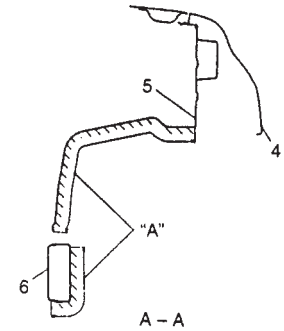
1. Side body outer
2. Side sill inner
3. Frame
4. Main floor
5. Rear fender
6. Rear wheel housing
7. Center floor

Vehicle produced in IWATA

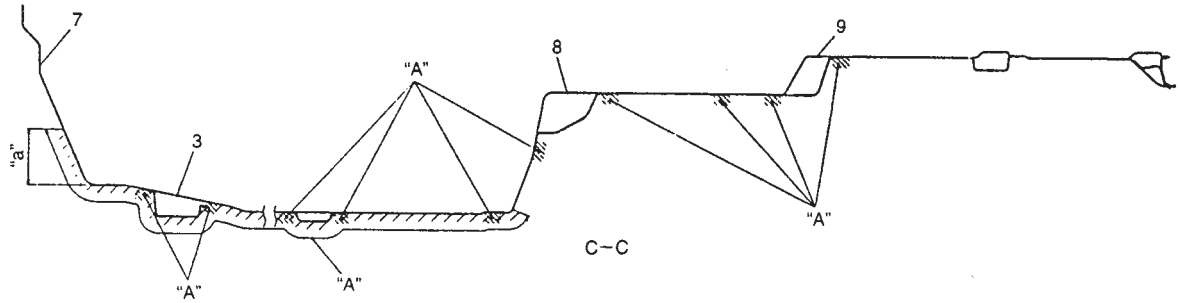




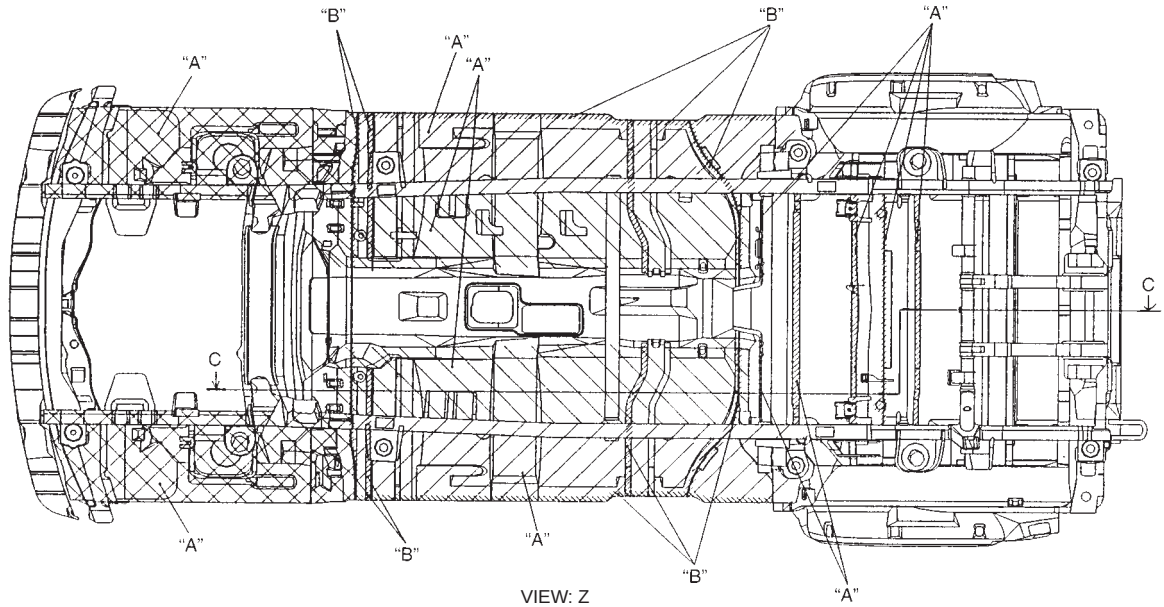
B – B



A – A



C – C



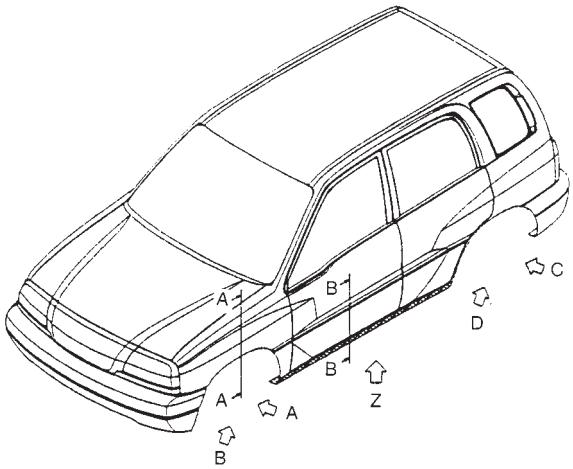
VIEW: Z

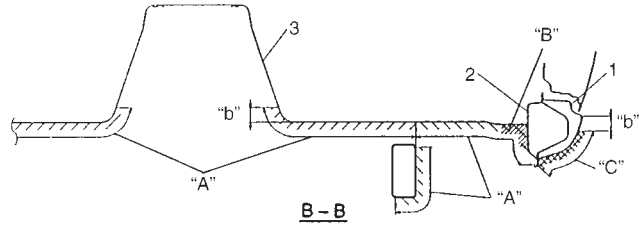
"a": 30 mm (1.18 in.)
"b": 100 mm (3.94 in.)

"A": Apply undercoating (PVC, 400 μm or more)
"B": Additional applying of under coating
(for 5 door vehicle without splush guard)
"C": Apply PVC chip resistant material (200 μm or more)

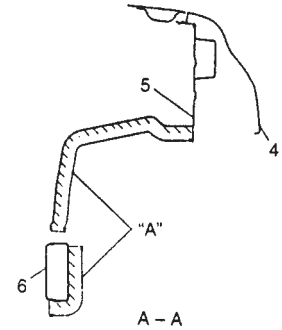
1. Side body outer
2. Side sill inner
3. Main floor
4. Front fender
5. Front wheel housing
6. Frame
7. Dash panel
8. Center floor
9. Rear floor

Vehicle produced in CAMI

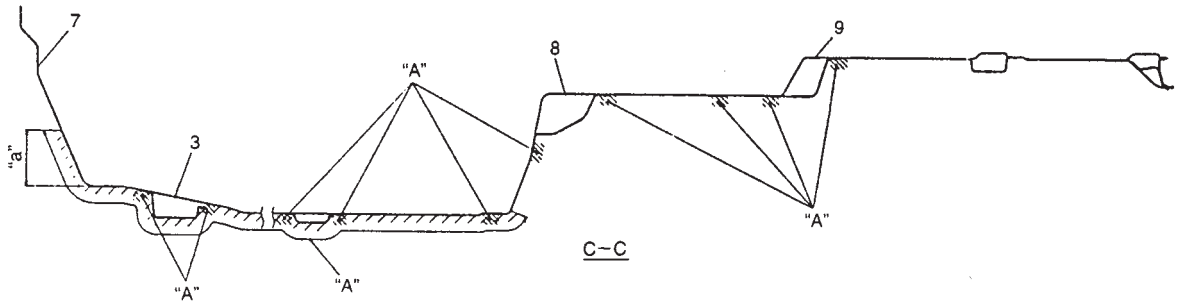




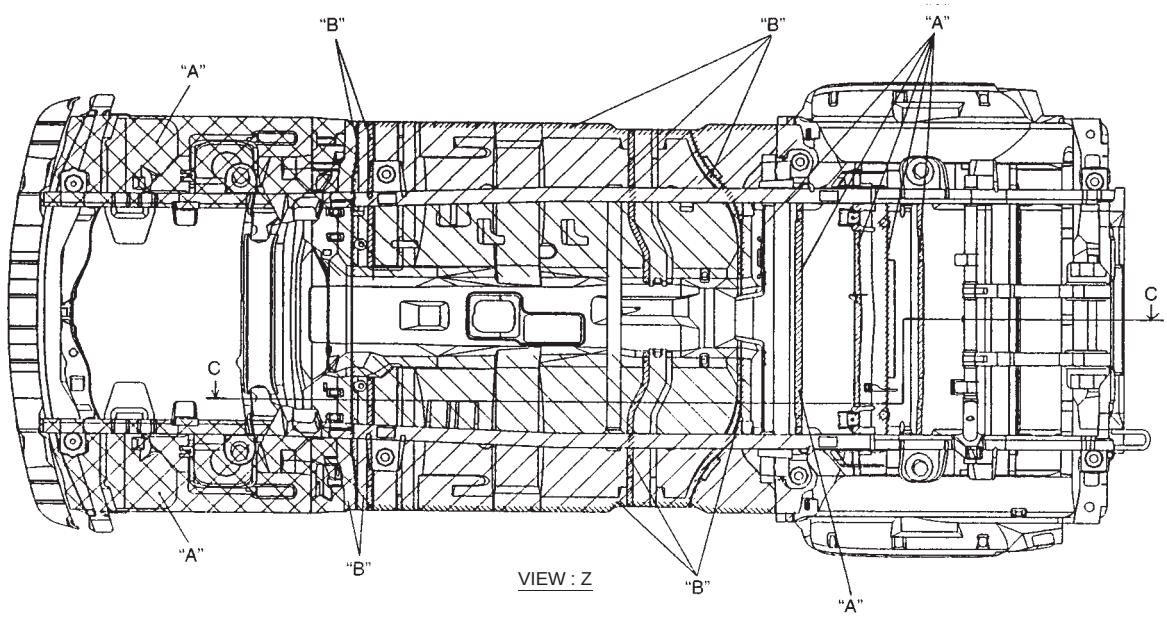
B – B



A – A



C – C



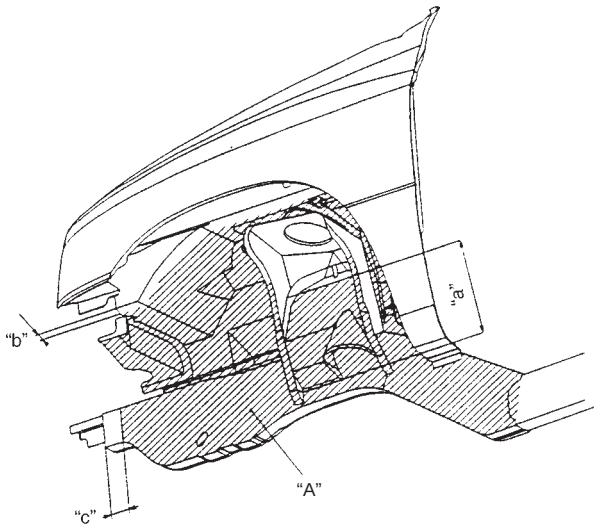
VIEW : Z

"a": 30 mm (1.18 in.)
"b": 100 mm (3.94 in.)

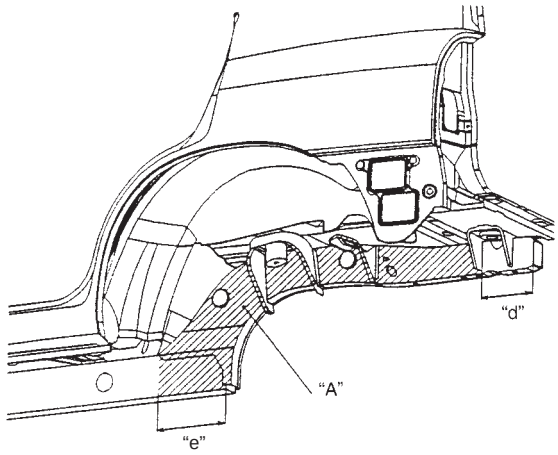
"A": Apply undercoating (PVC, 400 μm or more)
"B": Additional applying of under coating
(for 5 door vehicle without splush guard)
"C": Apply PVC chip resistant material (200 μm or more)

1. Side body outer
2. Side sill inner
3. Main floor
4. Front fender
5. Front wheel housing
6. Frame
7. Dash panel
8. Center floor
9. Rear floor

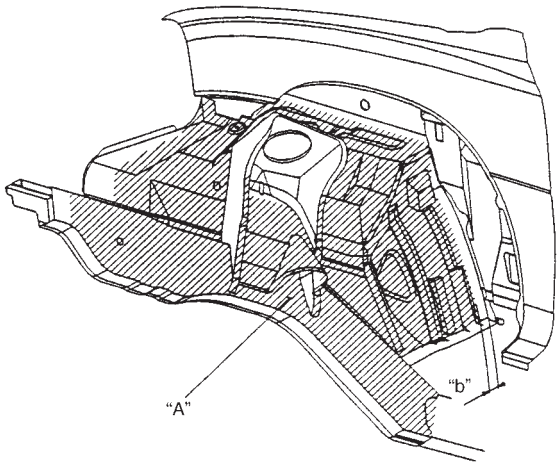
Vehicle produced in CAMI



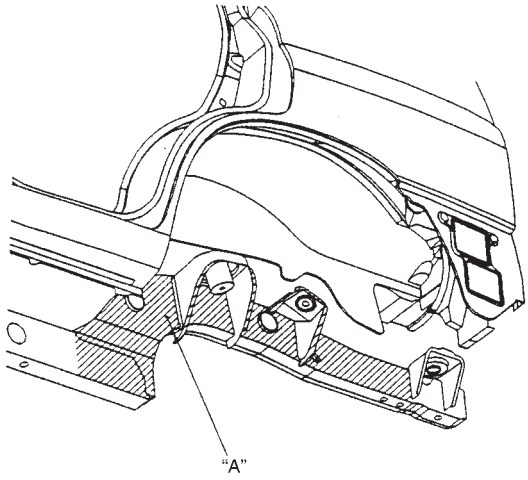
VIEW: A



VIEW: C



VIEW: B

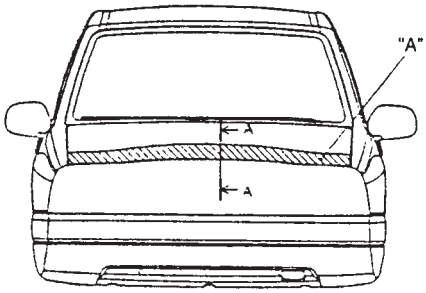


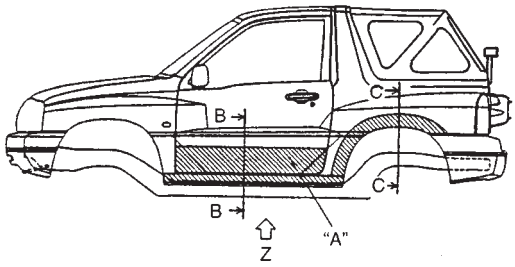
VIEW: D

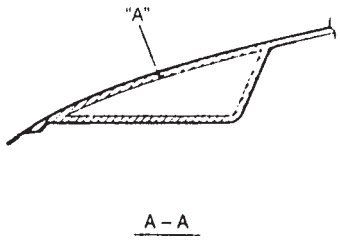
"a": 240 mm (9.45 in.)
"b": 20 mm (0.79 in.)
"c": 40 mm (1.57 in.)
"d": 134 mm (5.28 in.)
"e": 177 mm (6.97 in.)

"A": Black paint

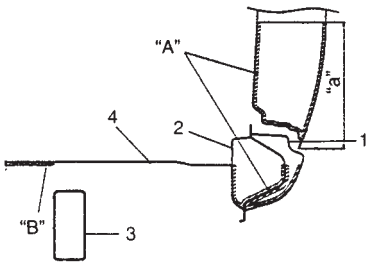
2 DOOR MODEL



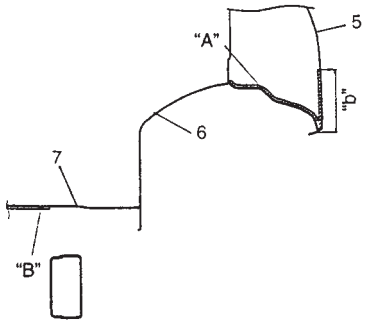




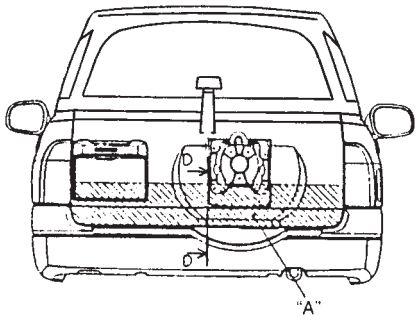
A – A

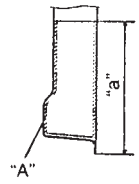


B – B

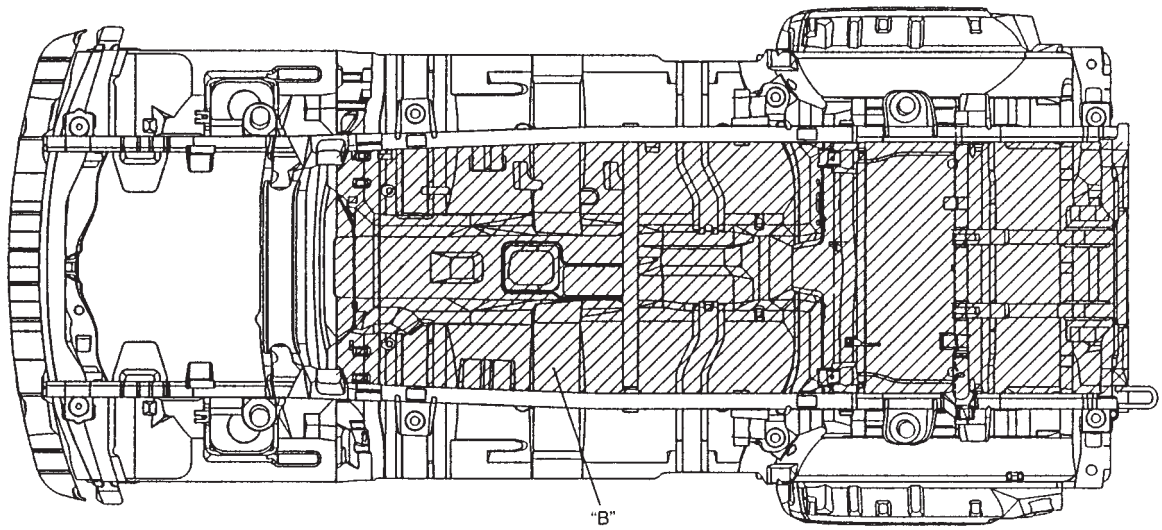


C – C





D – D

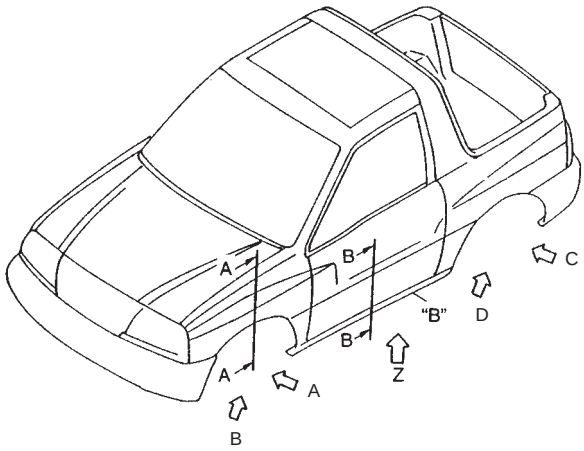


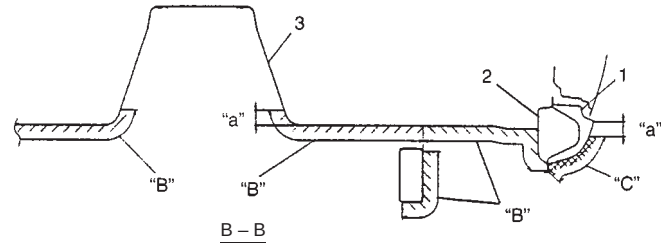
VIEW: Z

"a": 200 mm (7.87 in.)
"b": 100 mm (3.94 in.)

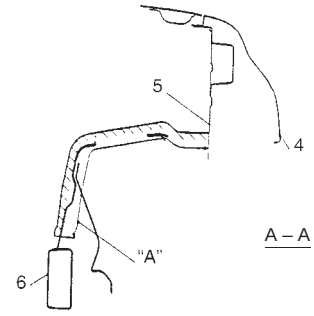
"A": Apply rust proof wax (hot wax 50 μm or more)
"B": Apply rust proof wax (high viscosity wax 50 μm or more)

1. Side body outer
2. Side sill inner
3. Frame
4. Main floor
5. Rear fender
6. Rear wheel housing
7. Center floor

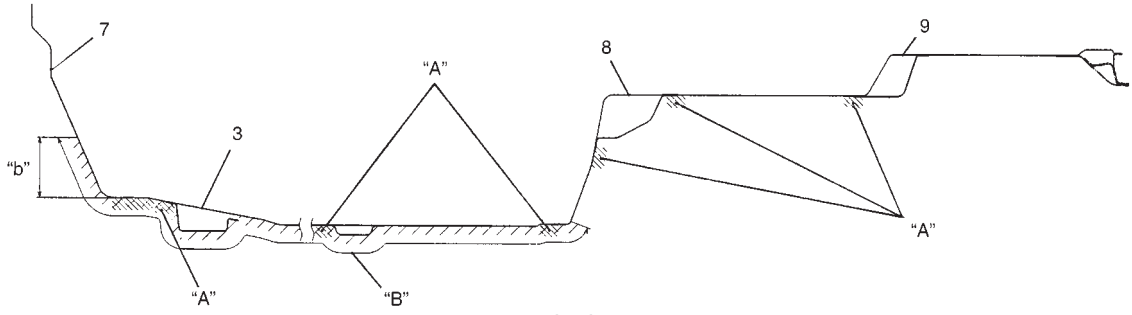




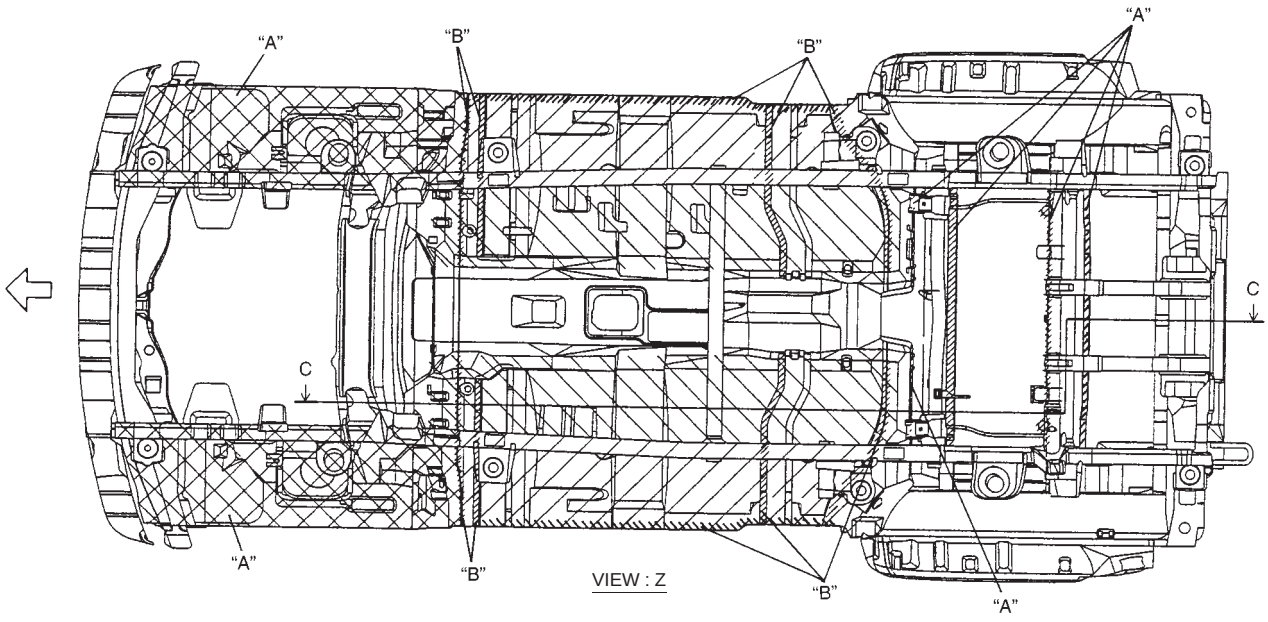
B – B



A – A



C – C

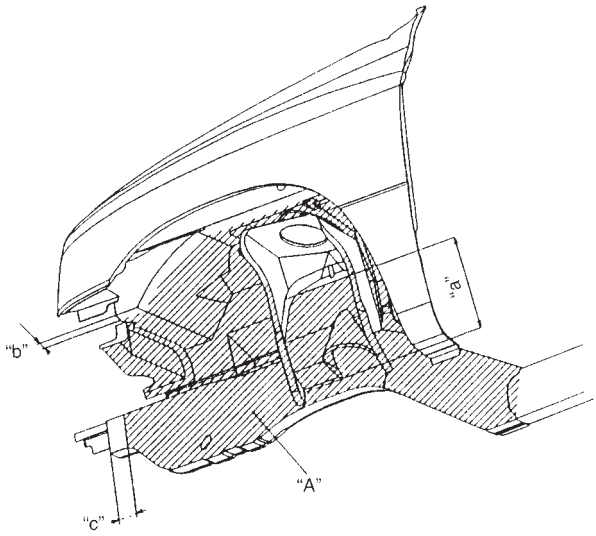


VIEW : Z

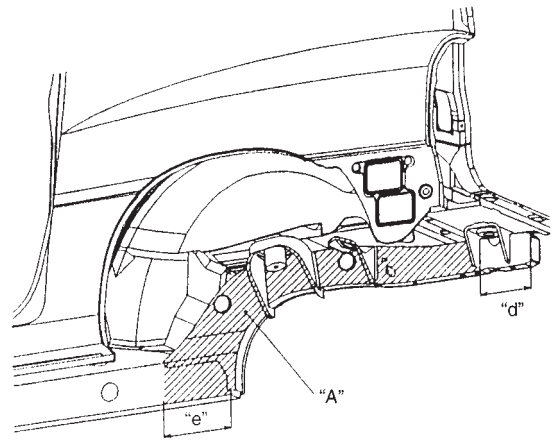
"a": 30 mm (1.18 in.)
"b": 100 mm (3.93 in.)

"A": Apply undercoating (PVC, 400 μm or more)
"B": Additional applying of under coating
(for 5 door vehicle without splush guard)
"C": Apply PVC chip resistant material (200 μm or more)

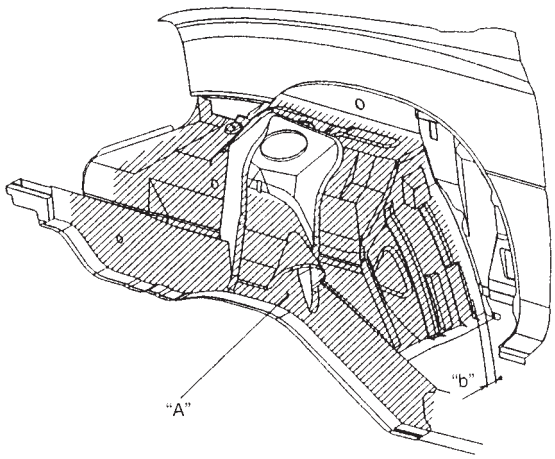
1. Side body outer
2. Side sill inner
3. Main floor
4. Front fender
5. Front wheel housing
6. Frame
7. Dash panel
8. Center floor
9. Rear floor



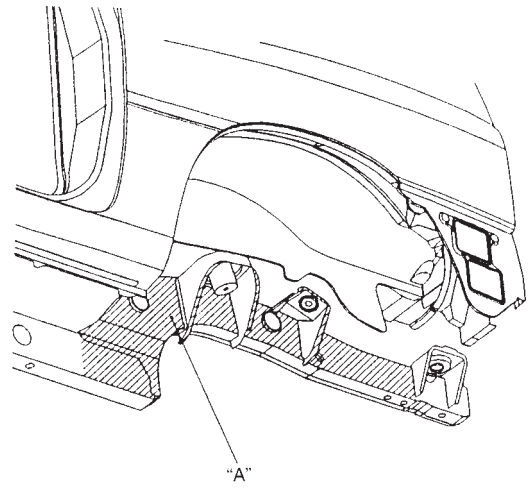
VIEW : A



VIEW : C



VIEW : B



VIEW : D

"a": 240 mm (9.45 in.)
"b": 20 mm (0.79 in.)
"c": 40 mm (1.57 in.)
"d": 134 mm (5.28 in.)
"e": 177 mm (6.97 in.)

"A": Black paint

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).

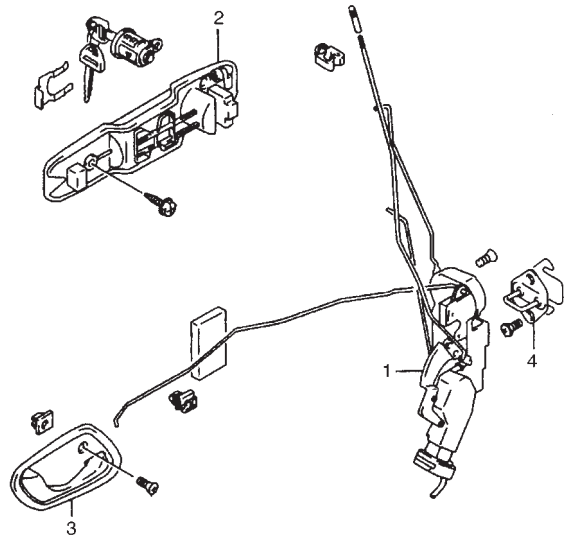
Reference

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.

SECURITY AND LOCKS

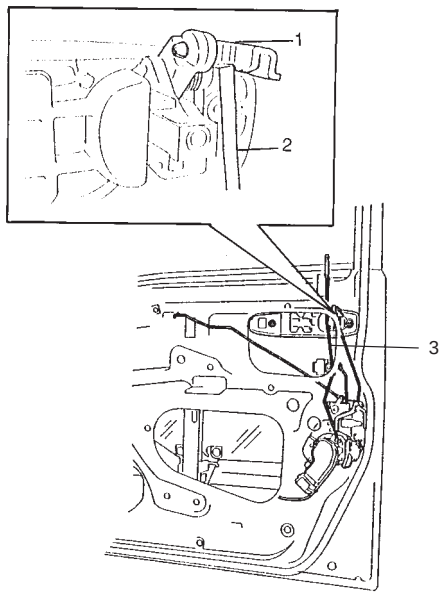
FRONT DOOR LOCK ASSEMBLY



1. Door latch
2. Outside handle
3. Inside handle bezel
4. Latch striker

REMOVAL

1) Raise window all the way up.
2) Remove door trim and door sealing cover, refer to steps 1) to 6) of FRONT DOOR GLASS REMOVAL in this section.

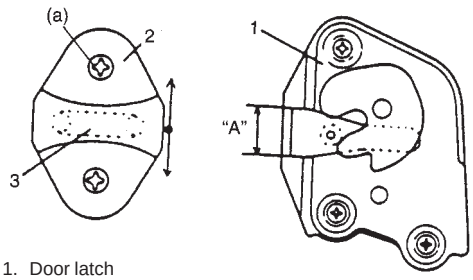


1. Door opening control rod pin retainer
2. Door opening control rod
3. Door lock control rod

3) Remove door opening control rods.
   Unlock door lock rod pin retainer and disconnect control rod.
4) Remove door lock control rod.
5) Disconnect door lock motor lead wire (if equipped).
6) Remove lock assembly.

INSTALLATION

To install front door lock, reverse removal procedure, noting following.

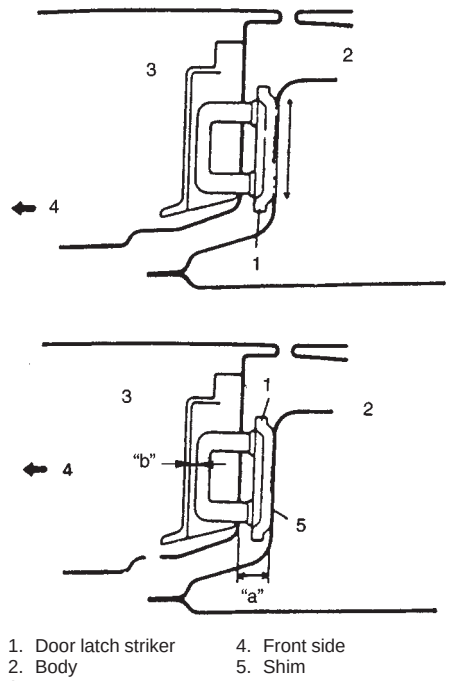


1. Door latch
2. Door latch striker
3. Shaft

- Door latch striker.
  Move door latch striker up or down so its center aligns with the center of groove "A" on the door, as shown.

NOTE:
Striker should be moved vertically and placed level. Do not adjust door lock.

Tightening Torque
(a): 13 N·m (1.3 kg-m, 9.5 lb-ft)



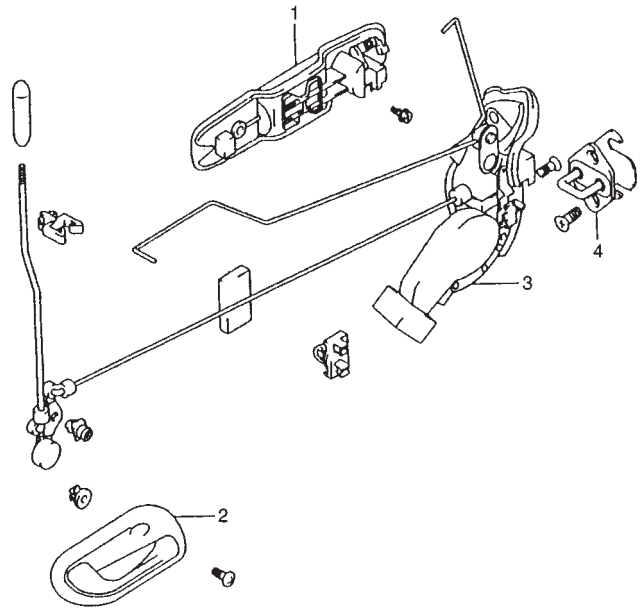
1. Door latch striker
2. Body
3. Door
4. Front side
5. Shim

- Move door latch striker sideways to adjust door surface flush with body surface, as shown.
  In order to correctly obtain door latch striker position in the fore-and-aft direction, increase or decrease number of shims inserted between body and striker to adjust it.

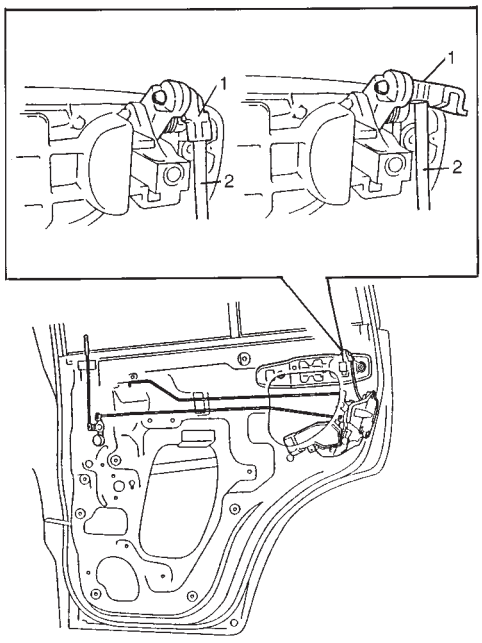
Dimension "a": 10.9 – 12.9 mm (0.43 – 0.5 in.)
"b": 3.4 – 5.4 mm (0.13 – 0.21 in.)

NOTE:
Apply oil or grease to striker joints periodically.

REAR DOOR LOCK ASSEMBLY



1. Outside handle
2. Inside handle bezel
3. Latch assembly
4. Latch striker



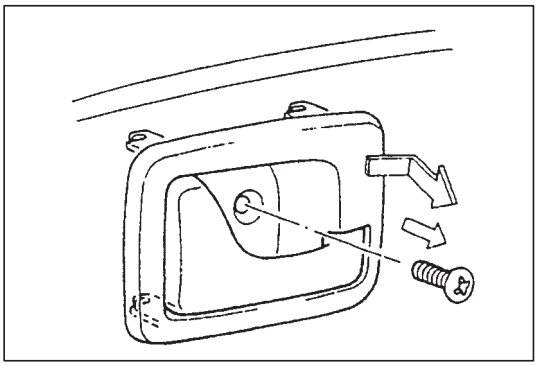
1. Door opening rod pin
2. Door opening control rod

REMOVAL

1) Remove door trim and door sealing cover, refer to steps 1) to 4) of REAR DOOR GLASS REMOVAL in this section.
2) Remove door opening control rod and door lock control rod.
3) Remove lock assembly.

INSTALLATION

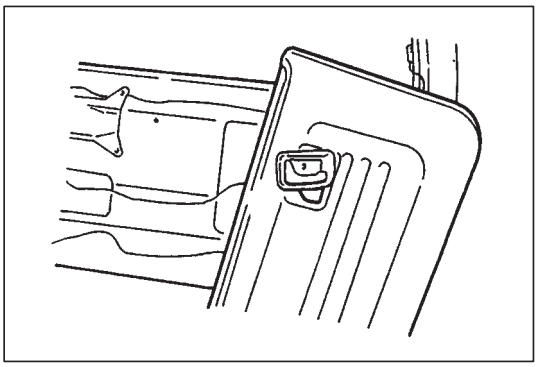
Reverse removal sequence to install rear door lock, noting points mentioned in “FRONT DOOR LOCK ASSEMBLY”.



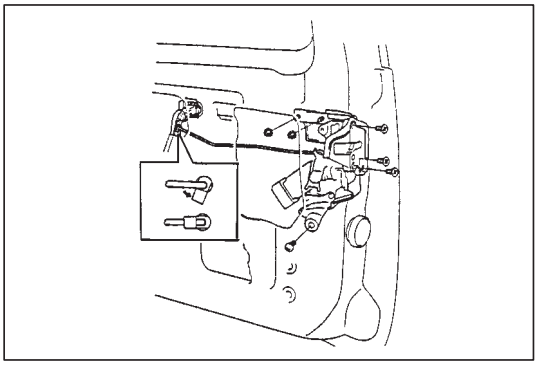
BACK DOOR/REAR GATE LOCK ASSEMBLY

REMOVAL

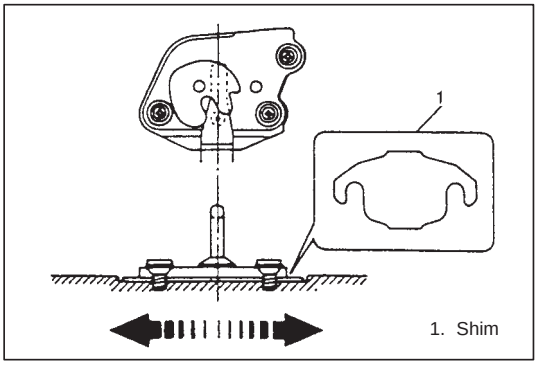
1) Remove inside handle bezel (if equipped).
2) Remove inside lock knob.



3) Remove door trim.
   With inside handle bezel tilted as shown in figure, turn door trim 90° counterclockwise to remove it (if equipped with inside handle).
4) Remove back door/rear gate sealing cover.



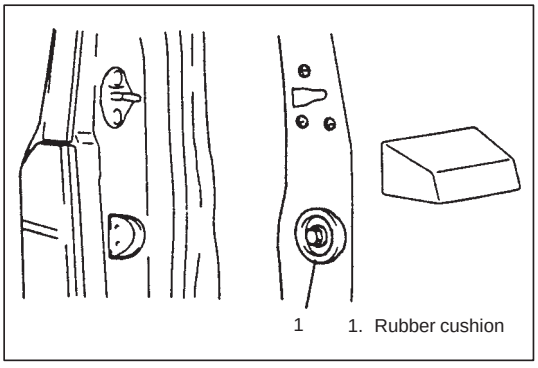
5) Remove back door/rear gate lock control rod.
   Unlock back door/rear gate lock rod pin retainer and disconnect control rod.
6) Disconnect back door lock motor lead wire (if equipped).
7) Remove lock assembly.



INSTALLATION

Reverse removal procedure to install back door/rear gate lock assembly noting following points.

- Back door/Rear gate latch striker.
  Adjust back door/rear gate latch striker so that its center aligns with the center of groove in back door/rear gate latch base.
  To adjust back door/rear gate latch and striker with each other, insert proper number of shims below the bottom of striker, as shown.



- Back door/Rear gate rubber cushion.
  Move rubber cushion installed at the left side of back door/rear gate to align it with its guide.

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 3C1, “AIR BAG STEERING WHEEL AND COLUMN”.

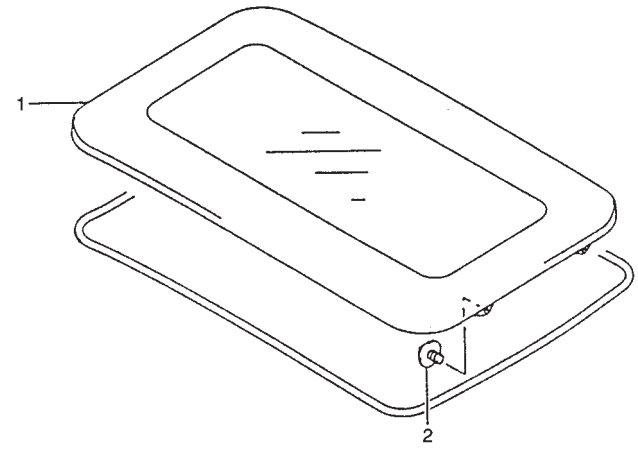
ELECTRICAL DIAGNOSIS

For ignition switch electrical troubleshooting, see Section 8, “BODY ELECTRICAL SYSTEM”.

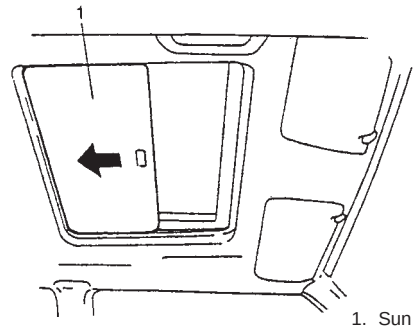
SUNROOF/CONVERTIBLE TOP

SLIDING ROOF (IF EQUIPPED)

SLIDING ROOF GLASS



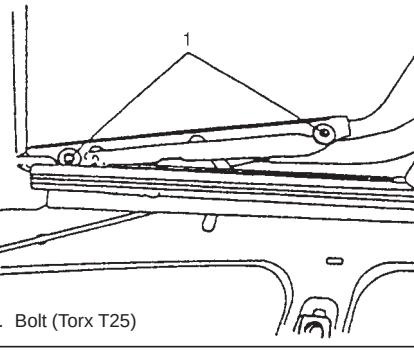
1. Sliding roof glass
2. Bolt



1. Sun shade

REMOVAL

1) Open sunshade fully and tilt up sliding roof.
2) Disconnect battery negative cable at battery.



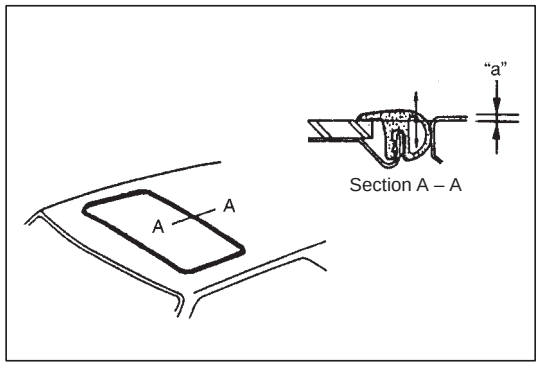
1. Bolt (Torx T25)

3) Remove sliding roof glass by removing bolts (torx).

INSTALLATION

For installation, reverse removal procedure, noting following points.

1) Tighten glass fixing bolts temporarily.
2) Position sliding roof glass by closing sliding roof glass completely.
3) Tighten glass fixing bolts.

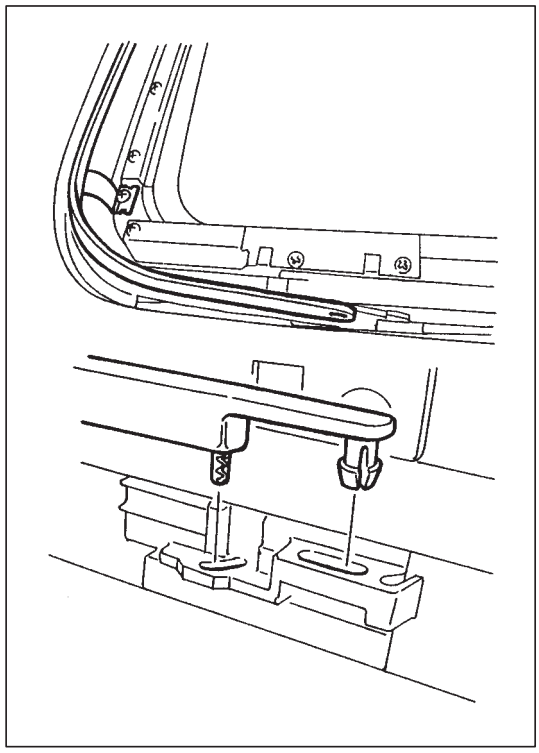


ADJUSTMENT

1) Loosen sunroof glass fixing screws (at 4 locations) and move sunroof glass up and down 2 to 3 times. In this way, sunroof glass can be positioned in both vertical and horizontal directions by elasticity of sliding roof weather strip.
2) Position sunroof glass by such dimensions with respect to roof panel surface as specified below.

   Dimension: "a": 0 mm (0.0 in.)

3) After installing all parts and adjusting properly, check sunroof for proper operation (open, close and up).



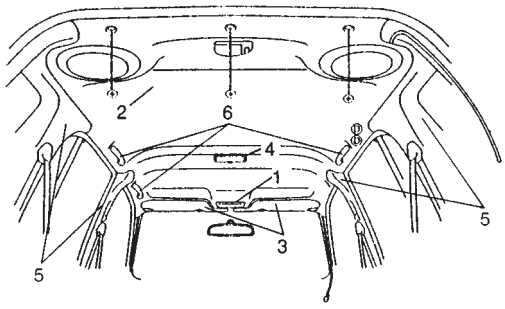
SLIDING ROOF DEFLECTOR

REMOVAL

1) Open sliding roof.
2) Disconnect negative cable at battery.
3) Remove screws and disconnect deflector from deflector link.

INSTALLATION

Reverse removal procedure to install deflector.

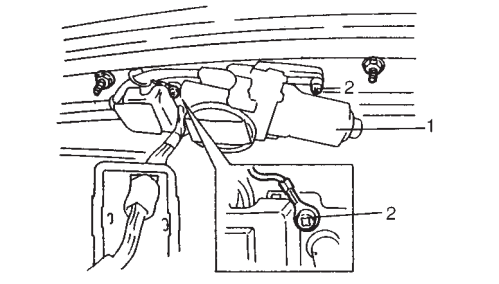


1. Spot light
2. Head lining
3. Sunvisor assemblies
4. Room light
5. Trim
6. Assist grips

SLIDING ROOF MOTOR/RELAY

REMOVAL

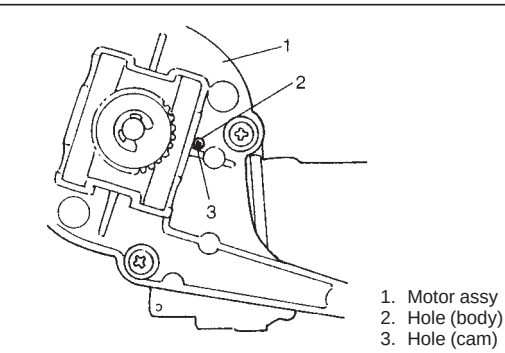
1) Remove head lining, refer to HEAD LINING REMOVAL in this section.



1. Sliding roof motor
2. Mounting screw

2) Disconnect coupler and remove sliding roof motor assembly by removing 3 screws.

CAUTION:
After removing sliding motor assembly, do not move guide and link.



1. Motor assy
2. Hole (body)
3. Hole (cam)

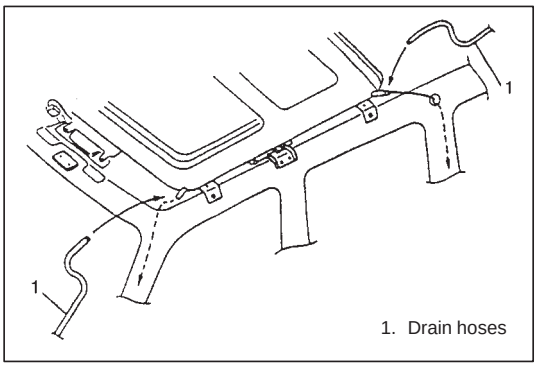
INSTALLATION

For installation, reverse removal procedure, noting following point.
Before installing, connect coupler and push the CLOSE side of the slide switch.

SLIDING ROOF ASSEMBLY

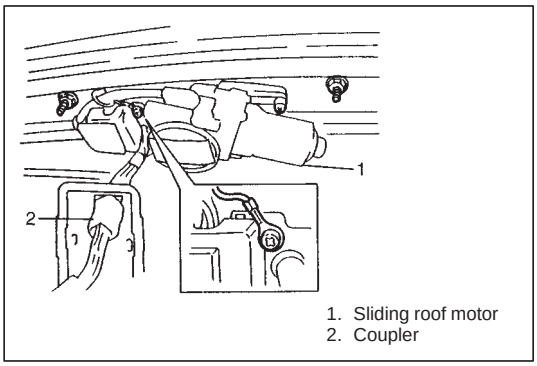
REMOVAL

1) Remove roof lining. Refer to HEAD LINING REMOVAL in this section.
2) Remove sliding roof glass. Refer to SLIDING ROOF GLASS REMOVAL.



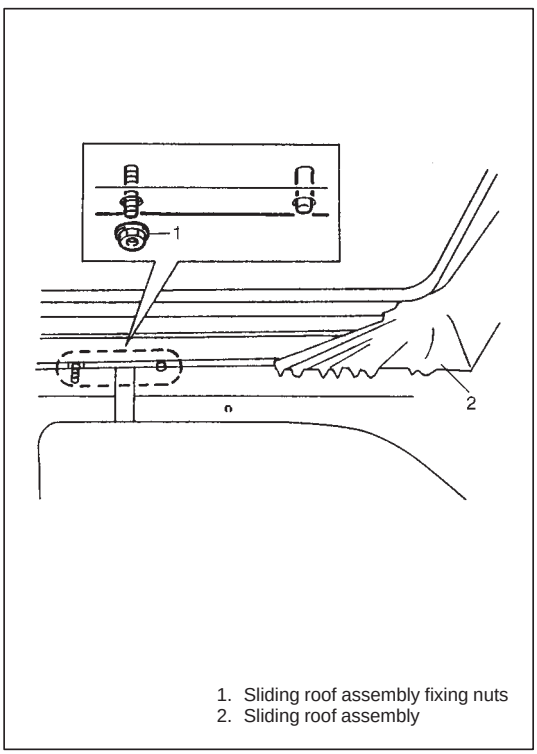
1. Drain hoses

3) Disconnect drain hoses connected to sliding roof assembly at 4 locations.



1. Sliding roof motor
2. Coupler

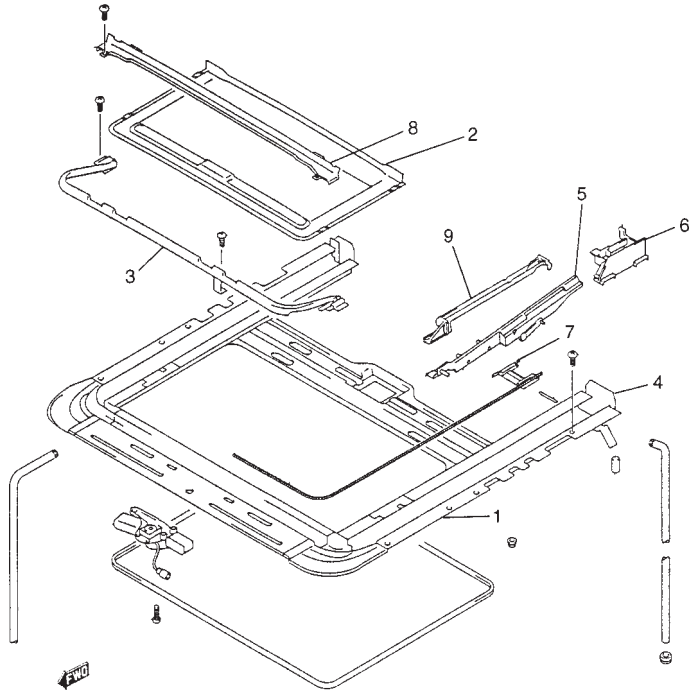
4) Disconnect sliding roof motor at coupler.



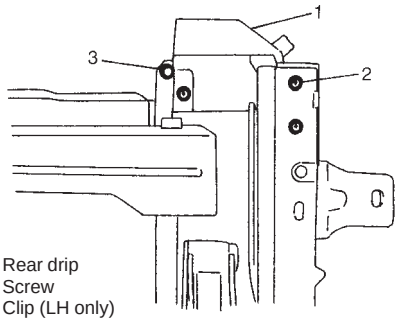
1. Sliding roof assembly fixing nuts
2. Sliding roof assembly

5) Remove 6 nuts and then remove sliding roof assembly.

DISASSEMBLY



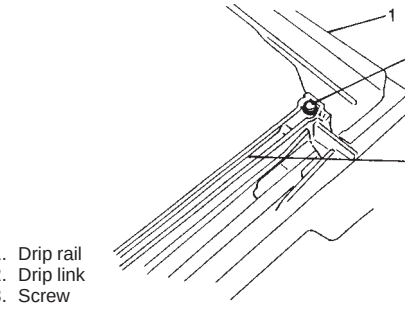
1. Sunroof frame
2. Sunshade
3. Deflector
4. Rear drip
5. Guide
6. Drip shoe
7. Cable
8. Drip rail
9. Drip link



1. Rear drip
2. Screw
3. Clip (LH only)

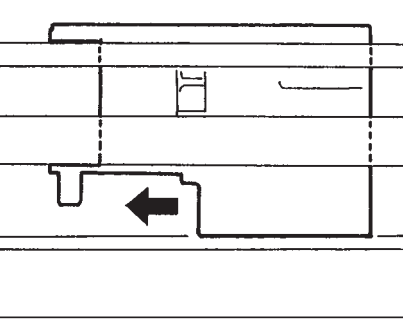
Before disassembling, be sure that sliding roof is “CLOSE” state.

1) Remove rear drip.

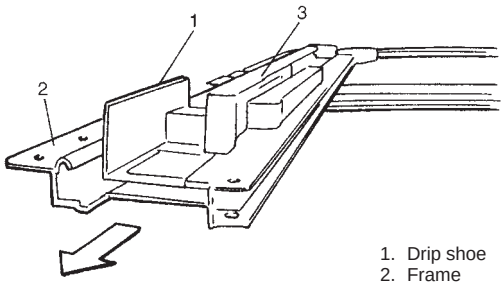


1. Drip rail
2. Drip link
3. Screw

2) Pull out sunshade by sliding it.
3) Remove drip rail.

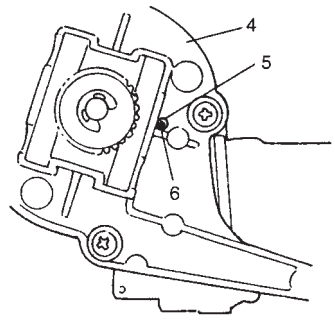


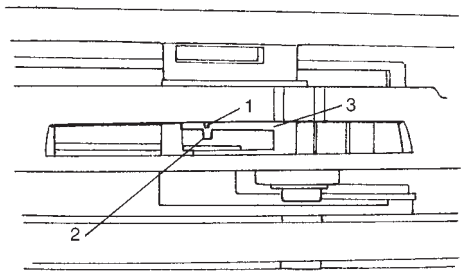
4) Remove sliding motor assy.
5) Move cable fully to the direction shown in figure.



1. Drip shoe
2. Frame
3. Guide

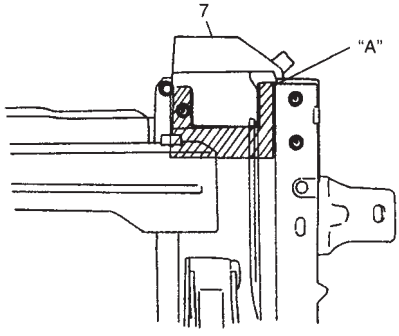
6) Remove sliding roof deflector.
7) Pull out drip shoe, guide and cable assy as a set.





1. Dent
2. Protrusion of lifter
3. Resin part
4. Motor assembly
5. Hole
6. Hole (cam)
7. Rear drip

"A": Apply sealant

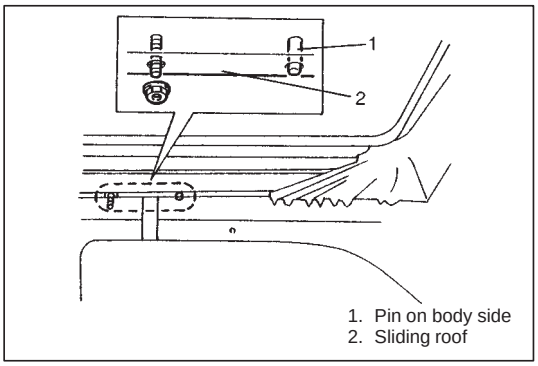


ASSEMBLY

Reverse disassembly procedure for assembly, observing following instructions.

CAUTION:
Match protrusion of guide and dent in cable for completely closed position of sliding roof drive cable and match marks (holes) for completely closed position of sliding roof motor assembly and then install sliding roof motor assembly.

- Press the CLOSE side switch to match marks of sliding roof motor assembly.
- Apply butyl rubber sealant to contact surface of the rear drip.

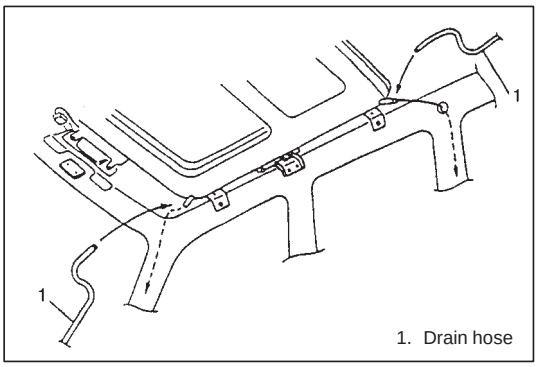


1. Pin on body side
2. Sliding roof

INSTALLATION

For installation, reverse removal procedure, noting following points.

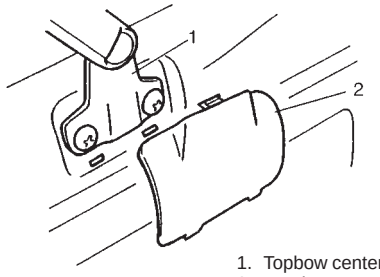
- Align positioning holes in sliding roof assembly at right and left and pins on body side for installation.



1. Drain hose

- Connect drain hoses to sliding roof assembly at 4 locations. Pass front drain hose between roof panel and inner panel and through front pillar down to sill side. Pass rear drain hose into baring hole in rear quarter inner panel and through C pillar down to jig hole in rear side bumper.

NOTE:
After reinstalling sliding roof assembly, be sure to make glass adjustment. (Refer to SLIDING ROOF GLASS ADJUSTMENT described previously.)

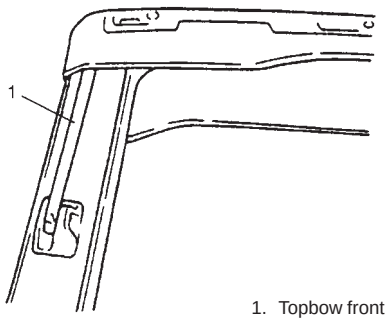


1. Topbow center frame
2. Bracket cover

CANVAS TOP AND TOPBOW FRAMES

Removal

1) Open canvas to referring to Owner's Manual.
2) Remove fording top and rear canvas top.
3) Remove topbow bracket cover.



1. Topbow front frame

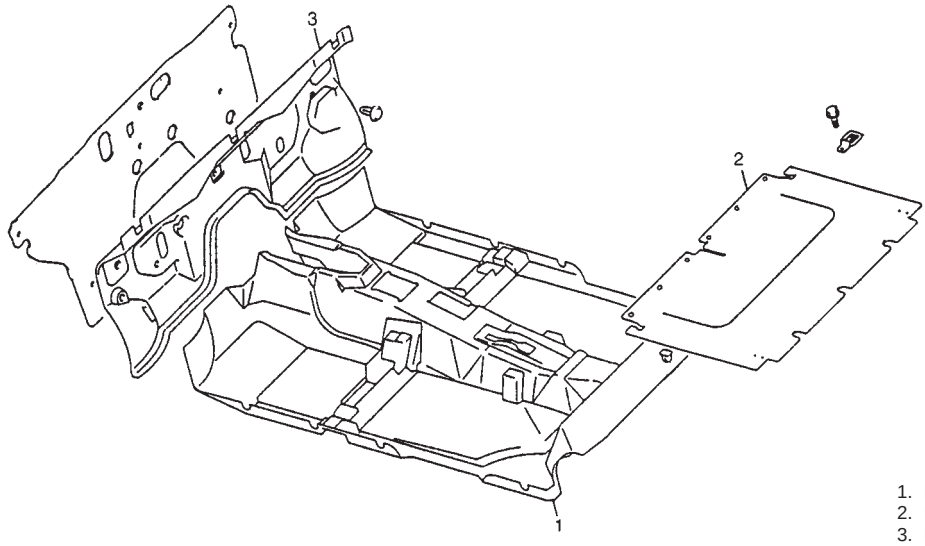
4) Remove topbow center frame.
5) Remove topbow front frame.

Installation

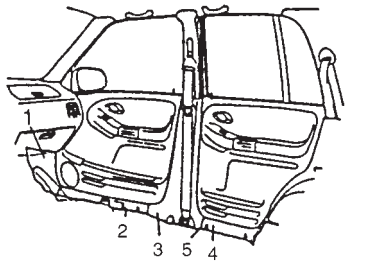
Install in reverse order of removal procedure.

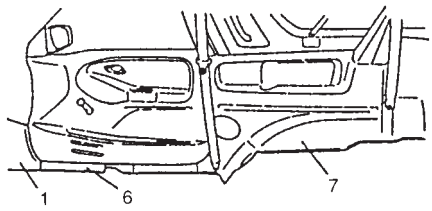
EXTERIOR AND INTERIOR TRIM

FLOOR CARPET



1. Front floor carpet
2. Luggage floor carpet
3. Dash panel insulation





1. Dash side trim
2. Front side sill scuffs
3. Center pillar inner lower trim
4. Rear side sill scuff
5. Fastener
6. Side sill scuff
7. Rear quarter lower trim

FRONT FLOOR CARPET

REMOVAL

1) Remove front seats and rear seat cushions.
2) Remove seat belt lower anchor bolt.
3) Remove dash side trims, front side sill scuffs (4 door model), center pillar inner lower rims (4 door model), rear side sill scuffs (4 door model), side sill scuffs (2 door model) and rear quarter lower trim.
4) Remove parking brake lever cover, console box and console box front extension.
5) Remove front floor carpet.

INSTALLATION

Reverse removal sequence to install front floor carpet, noting following point.

- When tightening seat belt anchor bolt, refer to Section 10A "FRONT SEAT BELT" for tightening torque.

LUGGAGE FLOOR CARPET

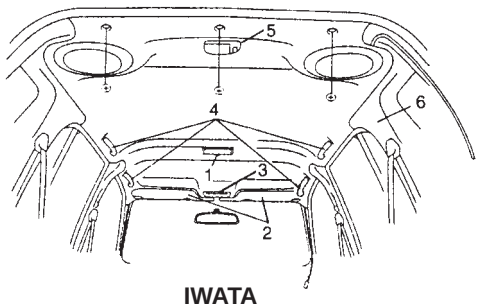
Luggage floor carpet is fixed to floor with clips.

REMOVAL

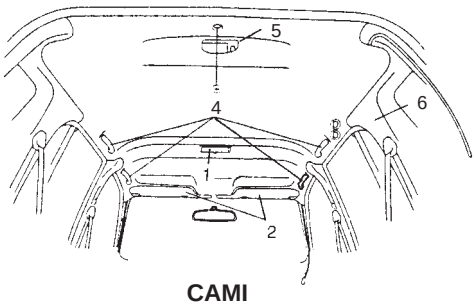
Detach clips, using care not to pull up carpet with force and break clips. And remove inner trim.

INSTALLATION

Reverse removal sequence to install luggage floor carpet.



IWATA



CAMI

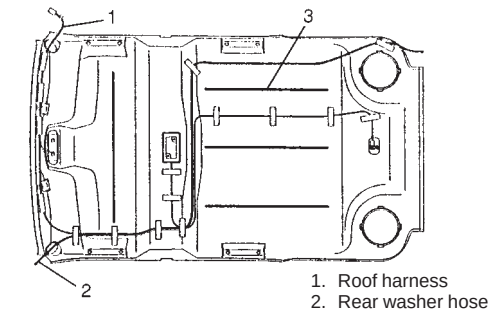
1. Room light
2. Sunshade assembly
3. Spot light
4. Assistant grip
5. Rear room light
6. Inner trim

HEAD LINING

REMOVAL

1) Remove spot light and sliding roof switch (if equipped).
2) Remove sunshade assembly.
3) Remove room light and spacer.
4) Remove assistant grips.
5) Remove inner trims covering head lining and door opening trim.
6) Remove rear speaker cover (if equipped).
7) Disconnect rear washer hose and roof harness from body.
8) Remove head lining.

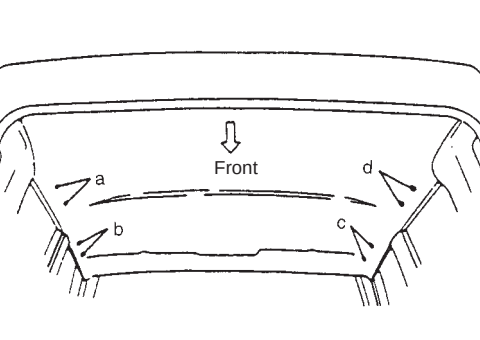
NOTE:
Adhesive double coated tape is used to attach rear part of head lining. Detach head lining from roof after removing all above parts.



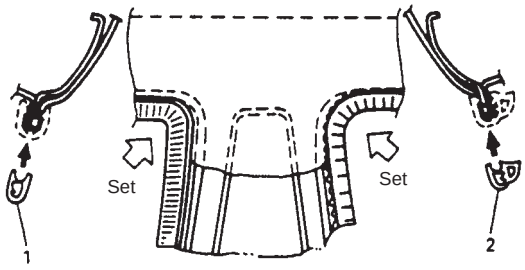
1. Roof harness
2. Rear washer hose
3. Adhesive tape

INSTALLATION

1) Set roof harness and washer hose to head lining with tape.
2) Clean roof where adhesive tape of head lining will be attached.
3) Peel off release liner of adhesive tape on head lining and install it to body.

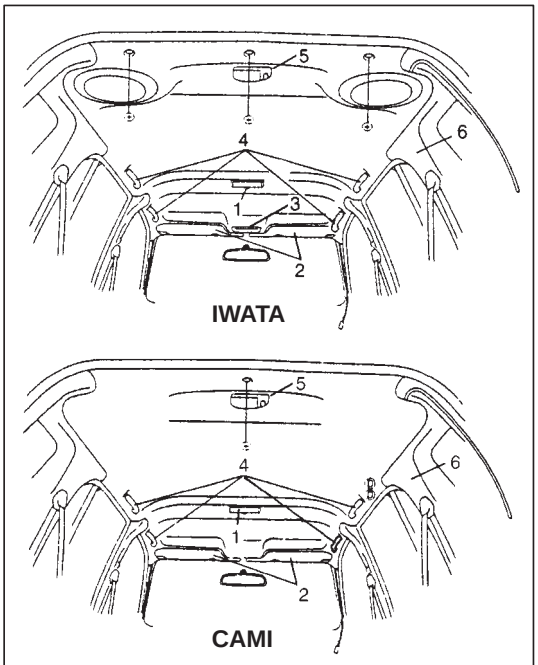


4) Install assistant grips a, b, c and d in that order.



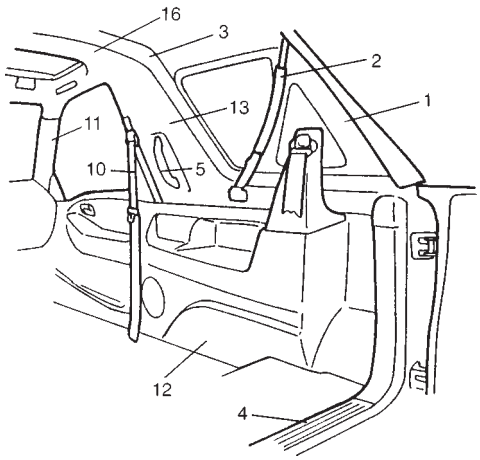
1. Door opening trim
2. Head lining

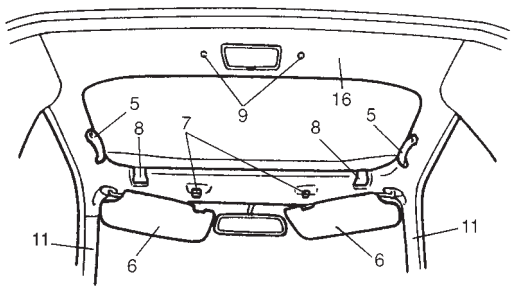
5) Install door opening trim.

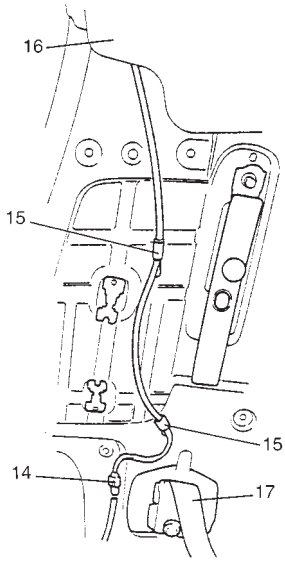


1. Room light
2. Sunshade assembly
3. Spot light
4. Assistant grip
5. Rear room light
6. Inner trim

6) Install spot light, sunshade assembly, speaker cover, room light and inner trims covering head lining.







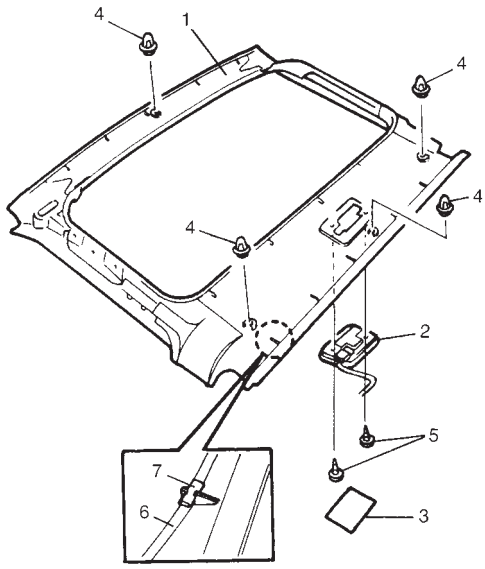
1. Canvas top
2. Rear topbow
3. Side body garnish
4. Luggage mat end garnish
5. Assistant grip
6. Sunshade assembly
7. Sunshade hook
8. Front topbow lock
9. Canvas top snap
10. Front seat belt
11. Front pillar trim
12. Rear side inner lower trim
13. Rear side inner upper trim
14. Room light connector
15. Room light harness clamp
16. Roof trim
17. Left-front seat belt

ROOF TRIM (2 DOOR MODEL)

REMOVAL

1) Remove canvas top.
2) Remove rear topbow.
3) Remove side body garnishes.
4) Remove luggage mat end garnish.
5) Remove assistant grips.
6) Remove sunshade assemblies.
7) Remove sunshade hooks.
8) Remove front topbow locks.
9) Remove canvas top snaps.
10) Remove front seat belts.
11) Remove front pillar trims.
12) Remove rear side inner lower trims.
13) Remove rear side inner upper trims.
14) Disconnect room light connector and remove room light harness clamp.
15) Remove roof trim.

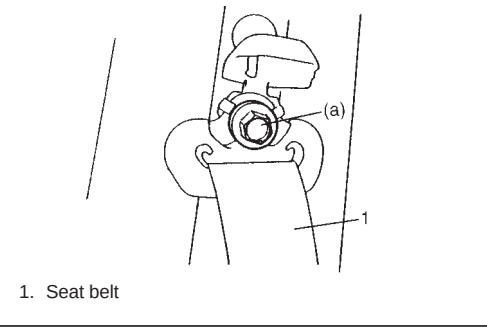
CAUTION:
Be very careful not to separate roof trim consists of 4 components when removing. If disassemble it, it could not be assembled to original unit.



1. Roof trim
2. Room light
3. Room light lens
4. Clip
5. Screw
6. Room light harness
7. Marking tape

INSTALLATION

1) Set room light and clip to roof trim.
2) Set room light harness to roof trim with marking tape.

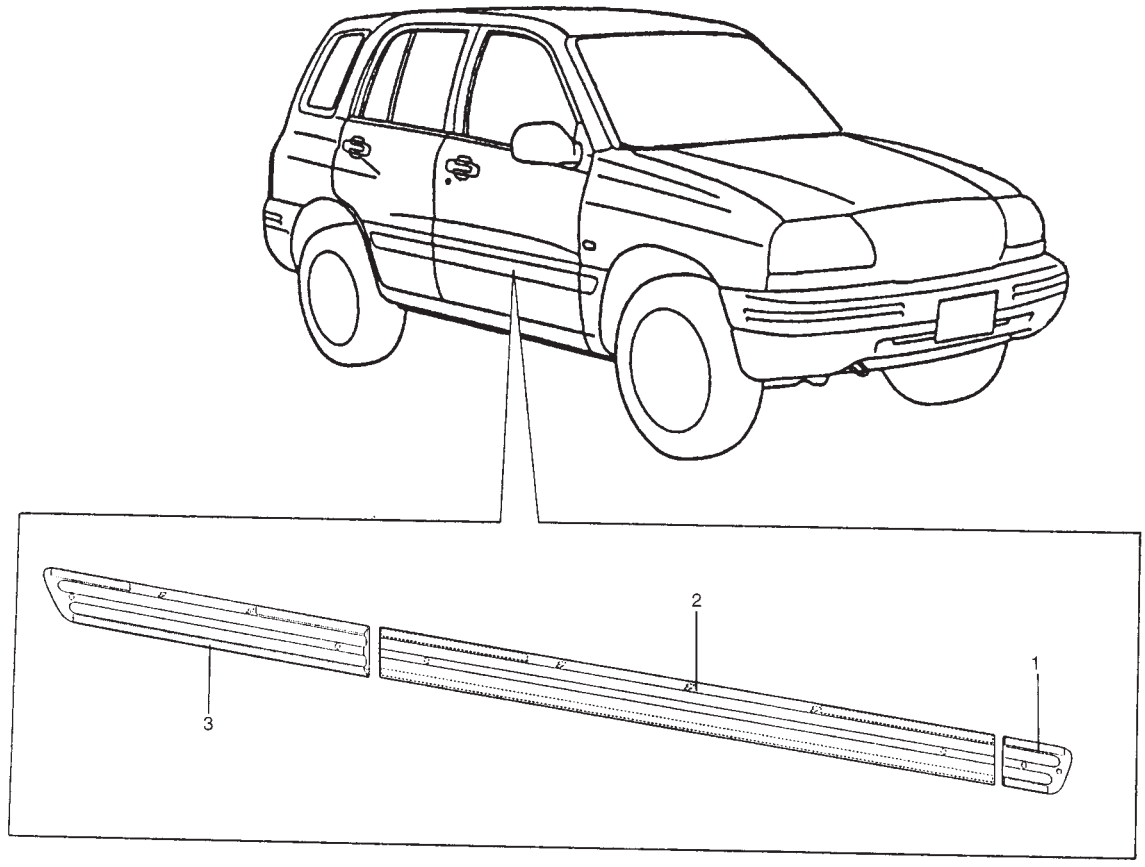


1. Seat belt

3) Reverse removal sequence to install roof trim.

Tightening Torque
(a): 35 N·m (3.5 kg-m, 25.3 lb-ft)

SIDE MOLDINGS (IF EQUIPPED)

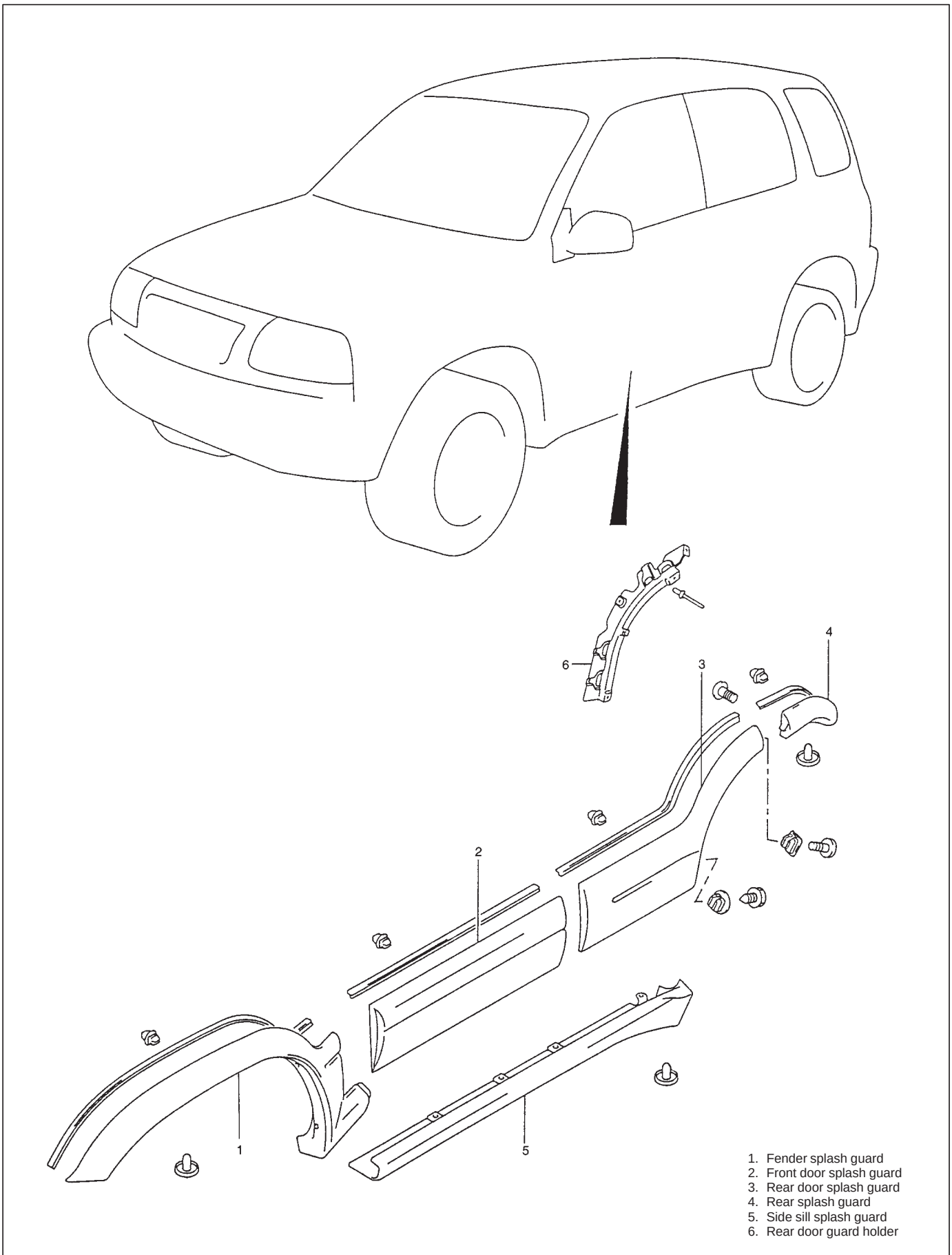


1. Front door molding
2. Rear door molding
3. Front fender molding

INSTALLATION

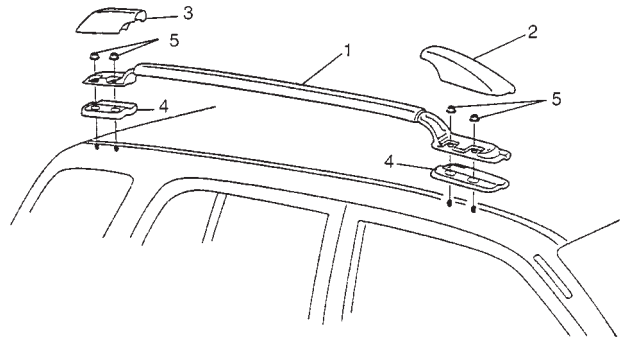
1) Bonding surfaces should be cleaned thoroughly.
2) Install molding by aligning it to clip holes and pulling it to the rear so that fender or door will not interfere with it when door is opened.
3) If adequate adhesive force is not available, use urethane adhesive.

SPLASH GUARD (IF EQUIPPED)

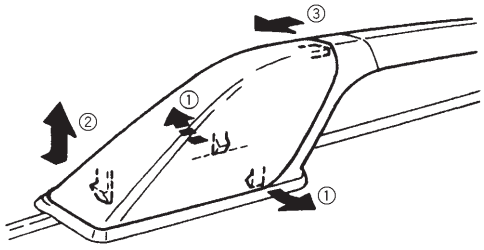


1. Fender splash guard
2. Front door splash guard
3. Rear door splash guard
4. Rear splash guard
5. Side sill splash guard
6. Rear door guard holder

ROOF RAIL (IF EQUIPPED)



1. Roof rail assembly
2. Front cap
3. Rear cap
4. Base seal
5. Nut



Removal

1) Remove roof rail front and rear caps as shown in figure.
2) Remove nuts.
3) Remove roof rail assembly.

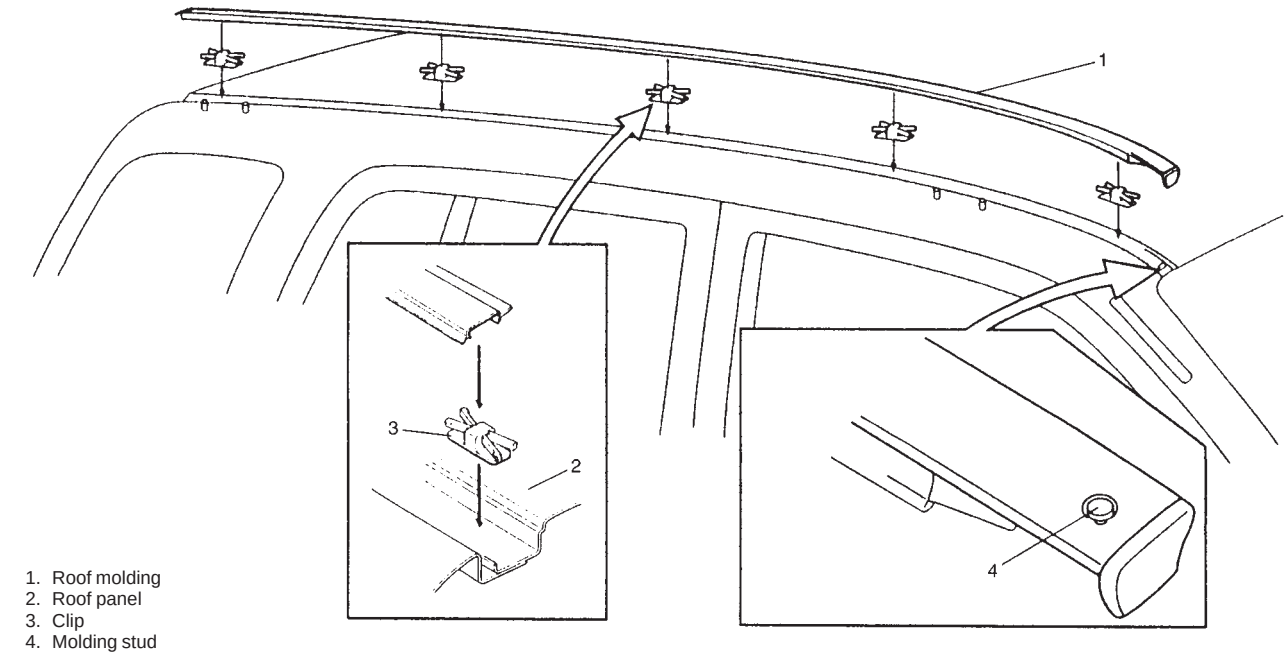
Installation

Reverse removal procedure for installation.
Confirm that each roof rail fixing nut is tightened securely.

ROOF MOLDING

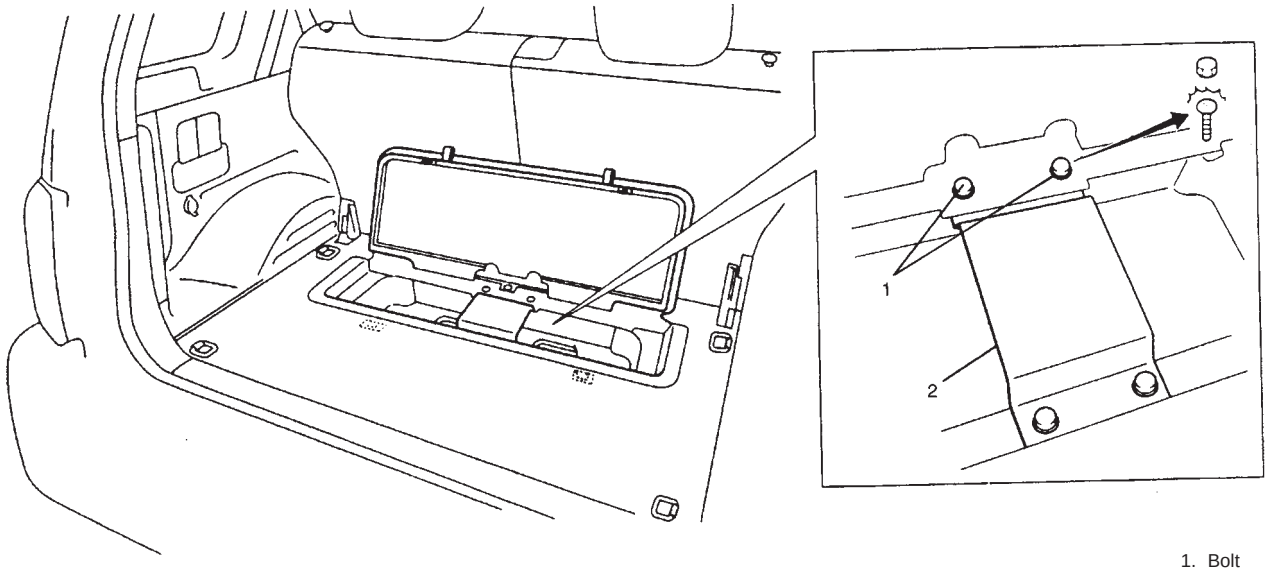
REMOVAL AND INSTALLATION

- If roof rail is equipped, remove it in advance (refer to “ROOF RAIL” section).
- When reusing roof molding, be careful not to make roof molding warped.



1. Roof molding
2. Roof panel
3. Clip
4. Molding stud

LUGGAGE UNDER BOX



1. Bolt
2. Member

WARNING:
Do not remove member in the center of luggage under box.

If member had to be removed temporarily for repair or for some other reason, be sure to reinstall it by using specified new bolts until head of bolt is broken off.

SECTION 10

RESTRAINT SYSTEM

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

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to "Air Bag System Components and Wiring Location View" under "General Description" in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and "Service Precautions" under "On-Vehicle Service" in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either 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).**

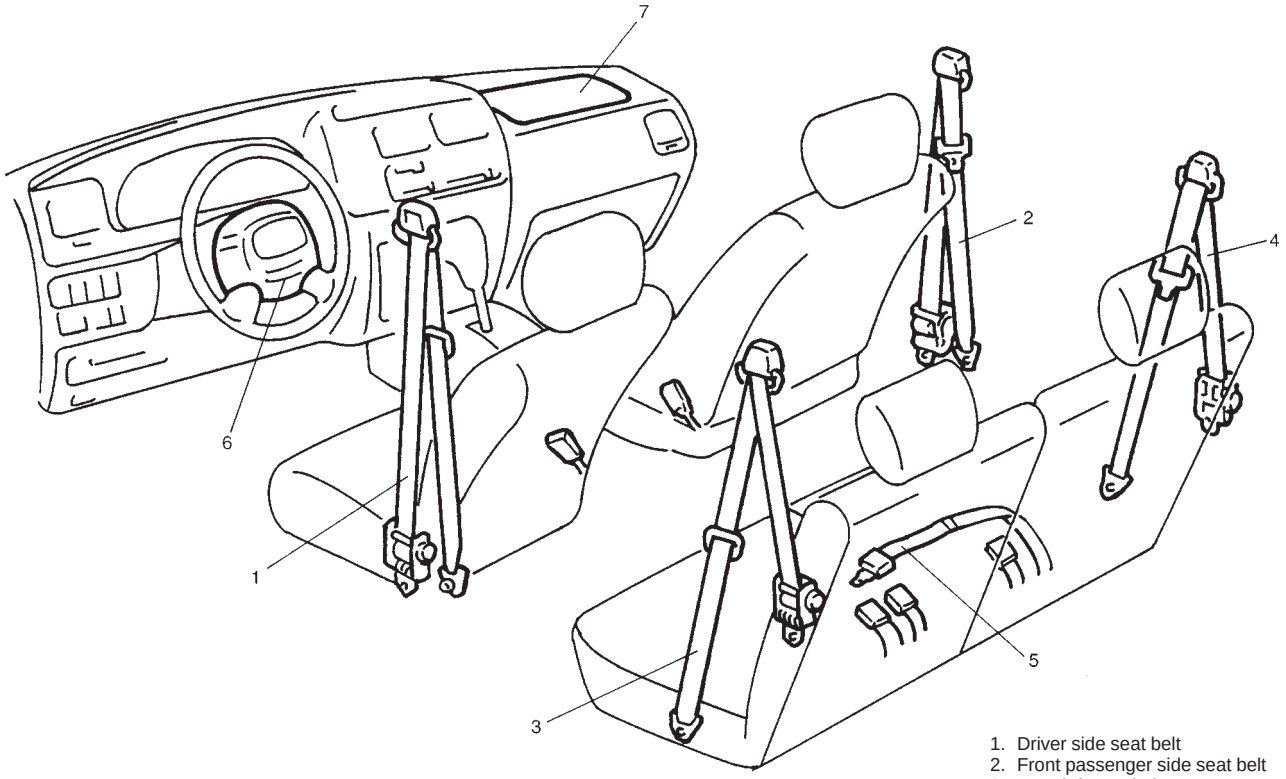
SEAT BELT . . . . . SECTION 10A
AIR BAG SYSTEM . . . . . SECTION 10B

CONTENTS

GENERAL DESCRIPTION 10-2
DIAGNOSIS . . . . . Refer to "Diagnosis" in SECTION 10A and 10B.

GENERAL DESCRIPTION

Driver Side Seat Belt:	**Seat belt with ELR**
Front Passenger Side Seat And Rear Left And Right Seat Belts:	**Seat belt with A-ELR**
Rear Center Seat Belt (If Equipped):	**Seat belt without ELR and A-ELR**
Supplemental Restraint System:	**Driver and front passenger side air bags**



1. Driver side seat belt
2. Front passenger side seat belt
3. Rear left seat belt
4. Rear right seat belt
5. Rear center seat belt (If equipped)
6. Driver side air bag
7. Passenger side 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, and 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.

Driver and front passenger side air bags

The driver and front passenger side air bags are components of the air bag system. In occurrence of a front collision with an impact larger than a certain set value, they are activated by the ignition signal from SDM to supplement protection offered by the driver and front passenger seat belts.

- the driver air bag (inflator) module is deployed from the center of the steering column
- the passenger air bag (inflator) module from the top of the instrument panel in front of the front passenger seat

For more information, refer to SECTION 10B “Air Bag System”.

SECTION 10A

SEAT BELT

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

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

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

CONTENTS

GENERAL DESCRIPTION . . . . . Refer to SECTION 10
ON-VEHICLE SERVICE 10A-2
Service precautions 10A-2
Front seat belt 10A-3
Rear seat belt 10A-6
TIGHTENING TORQUE SPECIFICATIONS 10A-6

ON-VEHICLE SERVICE

SERVICE PRECAUTIONS

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 following precautionary items.

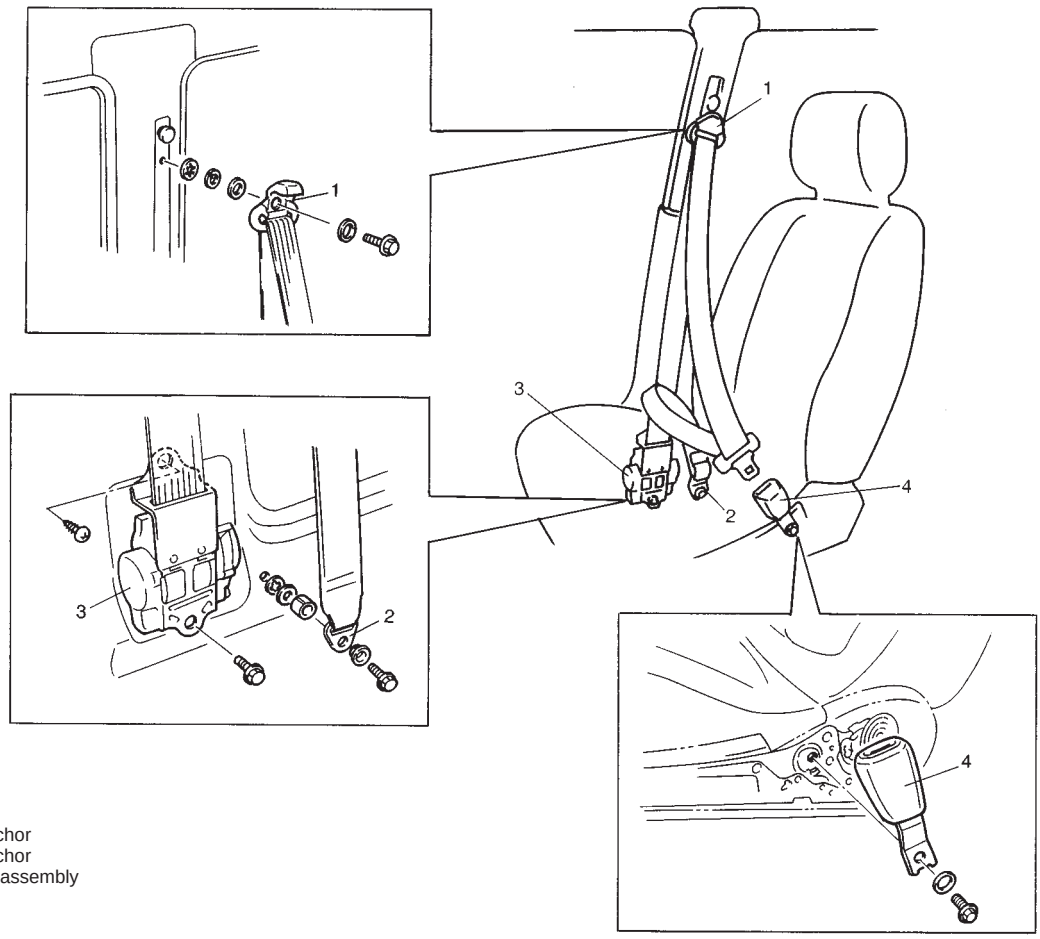
- Seat belts should be normal relative to strap retractor and buckle portions.
- Keep sharp edges and damaging objects away from belts. Avoid bending or damaging any portion of belt buckle, latch plate and ELR.
- Do not bleach or dye belt webbing. (Use only mild soap and lukewarm water to clean it.)
- When installing a seat belt anchor bolt, start bolt by hand to prevent cross-threading.
- Use only the correct seat belt anchor bolts and screws and tighten to the correct torque value.
- 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.

FRONT SEAT BELT

WARNING:
Be sure to read “Service Precautions” before starting to work and observe every precaution during work.

REMOVAL

Refer to the figure below to remove front seat belts.



1. Upper anchor
2. Lower anchor
3. Retractor assembly
4. Buckle

INSPECTION

Seat belts and attaching parts can affect the vital components and systems of a vehicle. Therefore, they should be inspected carefully and replaced with genuine parts only.

Seat belt

- The seat belt webbing or strap should be free from damage.
- Fully extend the seat belt to make sure there are no twists or tears in it.

Retractor assembly

Let the seat belt retract fully to confirm its easy retraction.

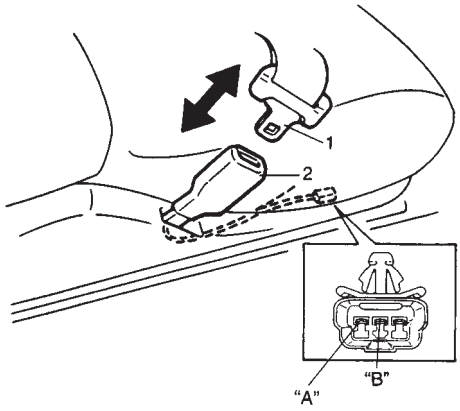
- The retractor assembly should lock webbing when pulled quickly.
- The retractor assembly should lock webbing even when tilted (approx. 15°) toward the fore and aft or right and left directions.

Anchor bolt

- Inspect all seat belt anchor bolts to verify that they are secure.
- All anchor bolts should be secure and torqued to specification.

Belt latch

- Belt latch should be secure when latched.
- Inspect the seat belt buckle, ensuring that it locks and unlocks easily.
- After buckling the seat belt, tug sharply on the belt, checking that the buckle remains locked.



1. Buckle tongue
2. Buckle catch

Warning system

Check driver side seat belt strap switch for continuity by using ohmmeter.

Without inserted buckle tongue to buckle catch:
Terminal "A" and "B": Continuity
With inserted buckle tongue to buckle catch:
Terminal "A" and "B": No continuity (∞Ω)

As to seat belts with ALR (other than driver side seat belt), check them as follows in addition to above check.

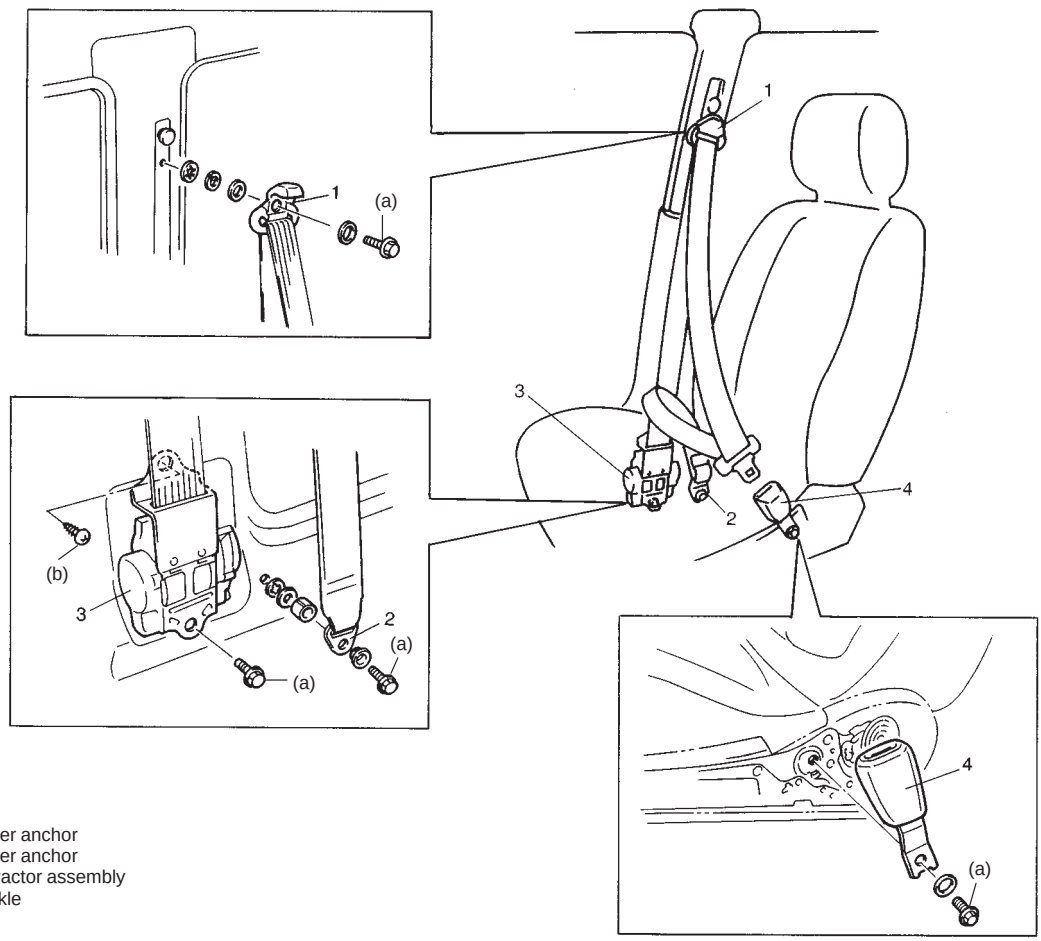
- With vehicle at stop, pull seat belt all the way out, let it retract a little and try to pull it. It should not be pulled out, that is, it should be locked where retracted.
- Let seat belt retract to its original state. Next, pull it half way out, let it retract a little and try to pull it again. It should be pulled out smoothly, that is it should not be locked at this time.

INSTALLATION

Install in reverse order of removal, noting the following.

- Seat belt anchor bolts should have an unified fine thread (7/16-20 UNF). Under no circumstances should any different sized or metric screw threads be used.
- Be sure to tighten seat belt anchor bolts to specified torque.

Tightening torque
(a): 35 N·m (3.5 kg-m, 25.5 lb-ft)
(b): 5.5 N·m (0.55 kg-m, 4.0 lb-ft)



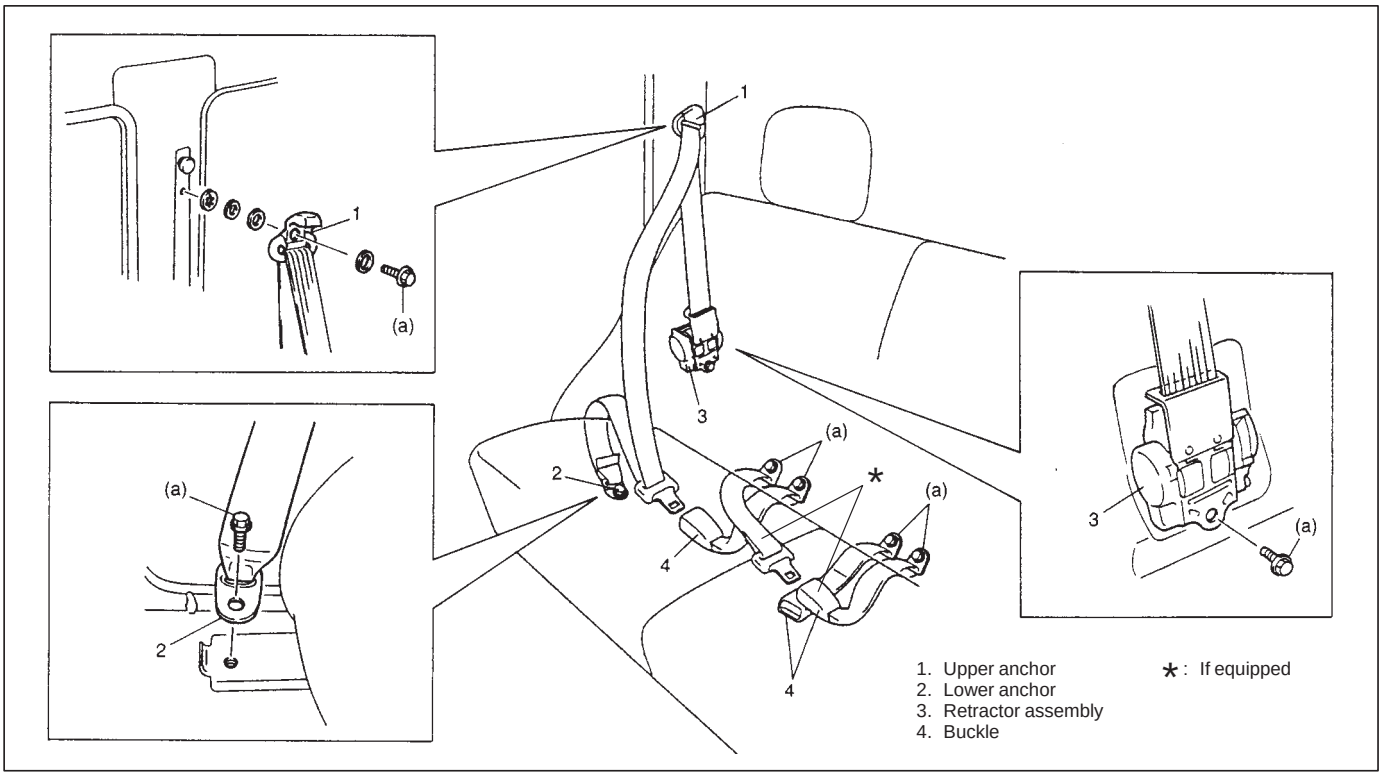
1. Upper anchor
2. Lower anchor
3. Retractor assembly
4. Buckle

REAR SEAT BELT

WARNING:
Be sure to read "Service Precautions" before starting to work and observe every precaution during work.

REMOVAL

Refer to the figure below to remove rear seat belts.



INSPECTION

Check the rear seat belt in the same way as when inspecting front seat belt. (Refer to page 10A-4.)

INSTALLATION

Install the rear seat belt observing the same precautions as when installing front seat belt. (Refer to page 10A-5.)

Tightening Torque
(a): 35 N·m (3.5 kg-m, 25.5 lb-ft)

TIGHTENING TORQUE SPECIFICATIONS

Fastening parts	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

SECTION 10B

AIR BAG SYSTEM

WARNING:

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

CAUTION:

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

CONTENTS

GENERAL DESCRIPTION 10B- 3
System Components and Wiring Location View and Connectors 10B- 4
System Wiring Diagram 10B- 5
DIAGNOSIS 10B- 6
Diagnostic Trouble Codes 10B- 6
Use of Special Tools 10B- 6
Intermittent and Poor Connections 10B- 8
Air Bag Diagnostic System Check 10B-10
Air bag diagnostic system check flow table 10B-11
Diagnostic trouble code (DTC) check . 10B-12
Diagnostic trouble code (DTC) clearance 10B-13
Diagnostic trouble code table 10B-14
Table A - "AIR BAG" warning lamp comes "ON" steady 10B-16
Table B - "AIR BAG" warning lamp does not come "ON" 10B-18
Table C - "AIR BAG" warning lamp flashes 10B-20
Table D - SDM cannot communicate through the serial data circuit 10B-22
Code 15 - Passenger air bag initiator circuit resistance high 10B-24
Code 16 - Passenger air bag initiator circuit resistance low 10B-26
Code 18 - Passenger air bag initiator circuit short to ground 10B-28
Code 19 - Passenger air bag initiator circuit short to power circuit 10B-30
Code 21 - Driver air bag initiator circuit resistance high 10B-32
Code 22 - Driver air bag initiator circuit resistance low 10B-34
Code 24 - Driver air bag initiator circuit short to ground 10B-36
Code 25 - Driver air bag initiator circuit short to power circuit 10B-38
Code 31 - Power source voltage high 10B-40
Code 32 - Power source voltage low . 10B-42
Code 41 - Driver pretensioner initiator circuit resistance high 10B-44
Code 45 - Passenger pretensioner initiator circuit resistance high 10B-44
Code 42 - Driver pretensioner initiator circuit resistance low 10B-46

Code 46 - Passenger pretensioner initiator circuit resistance low 10B-46
Code 43 - Driver pretensioner initiator circuit short to ground 10B-48
Code 47 - Passenger pretensioner initiator circuit short to ground 10B-48
Code 44 - Driver pretensioner initiator circuit short to power circuit 10B-50
Code 48 - Passenger pretensioner initiator circuit short to power circuit . 10B-50
Code 51 - Frontal crash detected (System activation command is outputted) 10B-52
Code 61 -“AIR BAG” warning lamp circuit failure 10B-53
Code 71 - Internal SDM fault 10B-54

ON-VEHICLE SERVICE 10B-55
Service Precautions 10B-55
Service and diagnosis 10B-55
Disabling air bag system 10B-56
Enabling air bag system 10B-56
Handling and storage 10B-57
Disposal 10B-62
Repairs and Inspections Required after an Accident 10B-63
Accident with deployment - component replacement 10B-63
Accident with or without deployment - component inspections 10B-64
Driver Air Bag (Inflator) Module 10B-66
Contact Coil and Combination Switch Assembly 10B-66
Seat Belt Pretensioner 10B-66
“AIR BAG” Warning Lamp 10B-66
SDM 10B-67
Passenger Air Bag (Inflator) Module . . . 10B-69

AIR BAG (INFLATOR) MODULES DISPOSAL 10B-71
Deployment Outside Vehicle 10B-71
Deployment Inside Vehicle 10B-78

SEAT BELT PRETENSIONERS DISPOSAL 10B-83
Activation Outside Vehicle 10B-83
Activation Inside Vehicle 10B-89

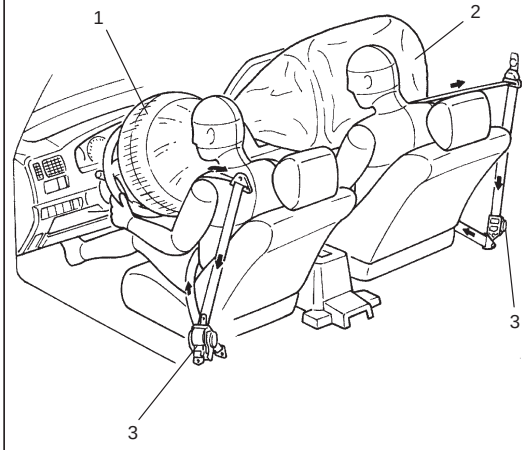
DEPLOYED AIR BAG (INFLATOR) MODULES DISPOSAL 10B-93

ACTIVATED SEAT BELT PRETENSIONERS DISPOSAL 10B-94

TIGHTENING TORQUE SPECIFICATIONS 10B-95

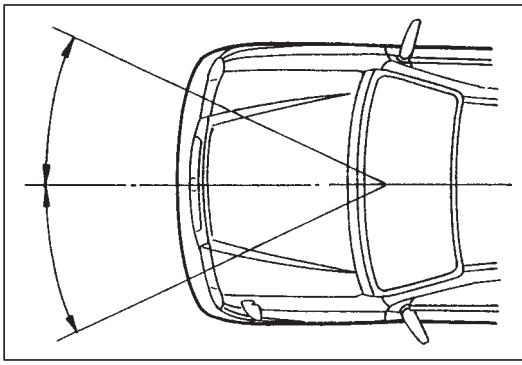
SPECIAL TOOLS 10B-95

GENERAL DESCRIPTION

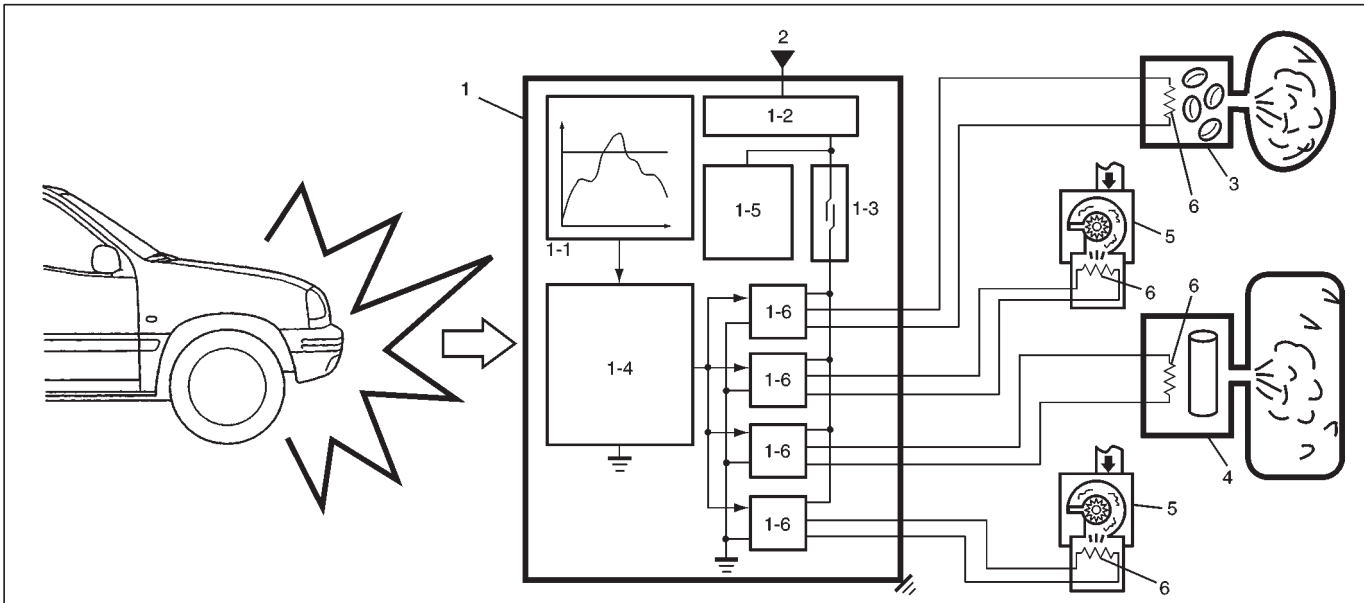


1. Driver side air bag
2. Passenger side air bag
3. Seat belt pretensioner (if equipped)

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 (if equipped), the sag of the seat belt is taken up, 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.

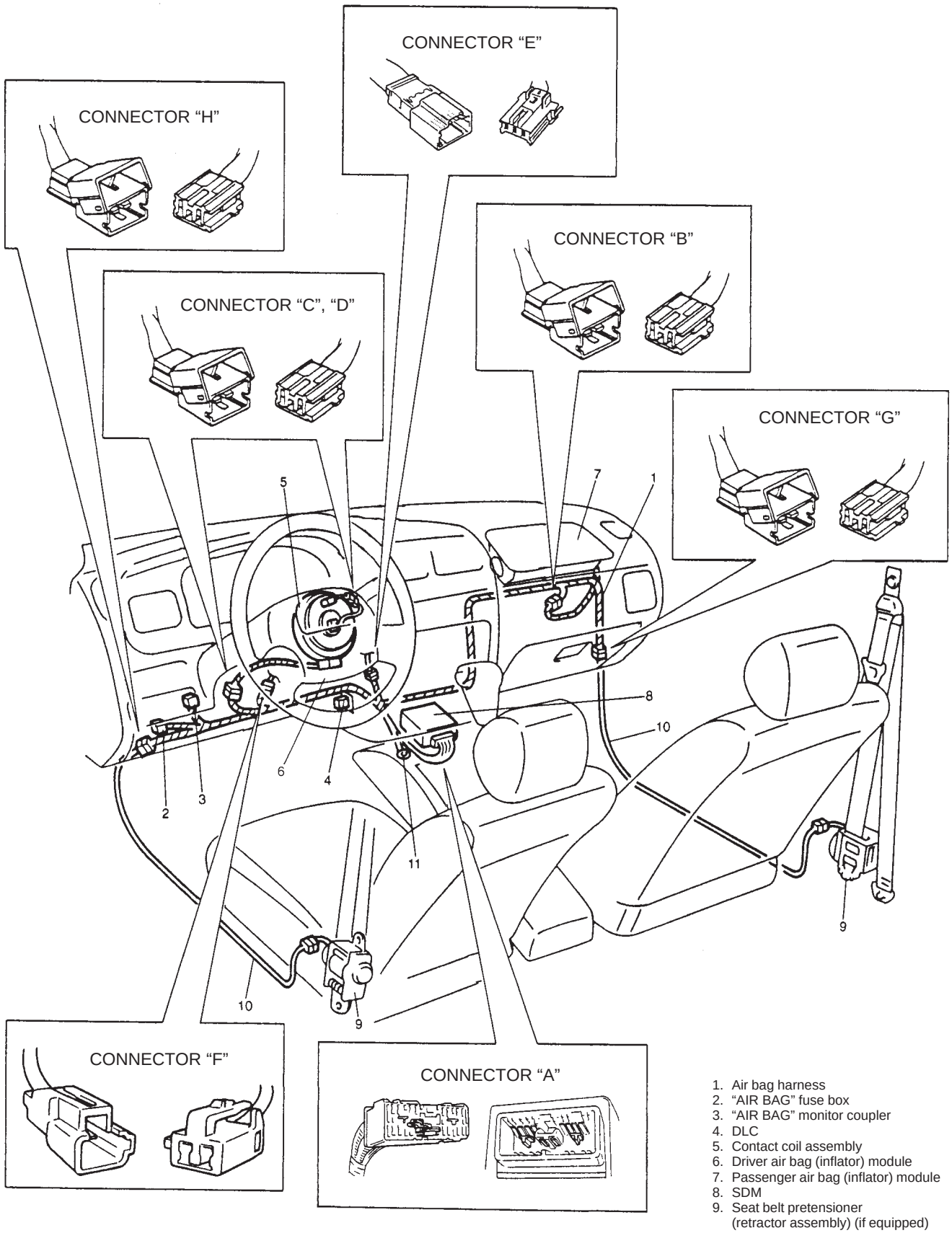


The air bag system is designed to activate only in severe frontal collisions. It is not designed to activate in rear impacts, side impacts, rollovers, or minor frontal collisions, since it would offer no protection in those types of accidents.



1. SDM
1-1. Sensor
1-2. Voltage converter
1-3. Safing sensor
1-4. Micro-controller
1-5. Energy reserve circuit
1-6. Ignition driver circuit
2. Power source
3. Driver air bag
4. Passenger air bag
5. Seat belt pretensioner (if equipped)
6. Squib circuit

SYSTEM COMPONENTS AND WIRING LOCATION VIEW AND CONNECTORS

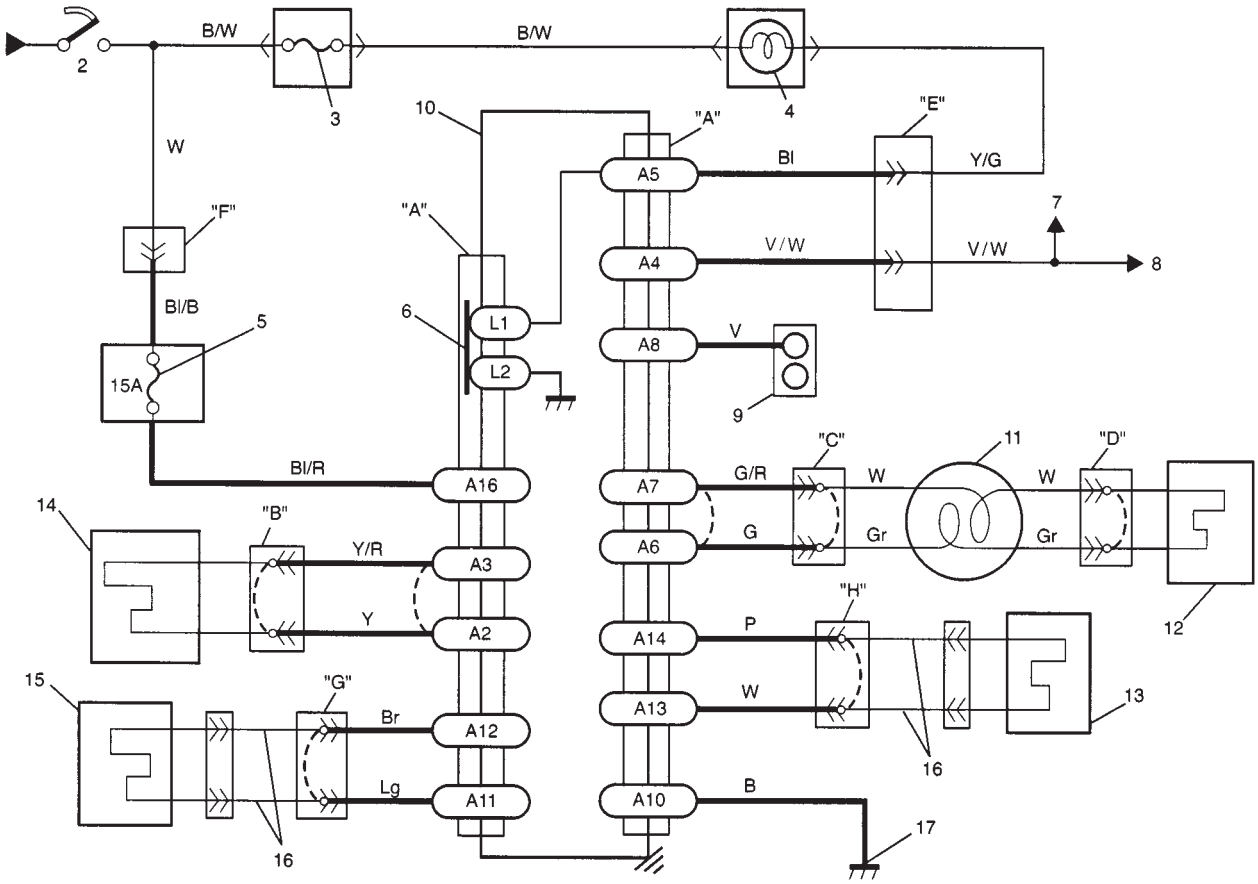


1. Air bag harness
2. "AIR BAG" fuse box
3. "AIR BAG" monitor coupler
4. DLC
5. Contact coil assembly
6. Driver air bag (inflator) module
7. Passenger air bag (inflator) module
8. SDM
9. Seat belt pretensioner (retractor assembly) (if equipped)
10. Pretensioner harness (if equipped)
11. Ground for air bag system

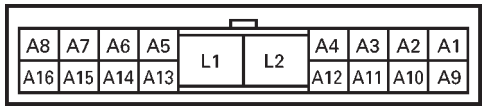
SYSTEM WIRING DIAGRAM

WIRE HARNESS COLOR

B	: Black	G	: Green	Y	: Yellow
B/W	: Black/White	Gr	: Gray	Y/G	: Yellow/Green
Bl	: Blue	G/R	: Green/Red	Y/R	: Yellow/Red
Bl/B	: Blue/Black	Lg	: Lightgreen	W	: White
Bl/R	: Blue/Red	P	: Pink	W/B	: White/Black
Br	: Brown	V	: Violet		



TERMINAL ARRANGEMENT OF SDM
(VIEWED FROM HARNESS SIDE)



1. From main fuse
2. Ignition switch
3. "IG·COIL METER" fuse in J/B
4. "AIR BAG" warning lamp in combination meter
5. "AIR BAG" fuse in "AIR BAG" fuse box
6. Connection detection pin
7. To ECM (or PCM), ICM (if equipped) and ABS controller (if equipped)
8. To data link connector (DLC)
9. "AIR BAG" monitor coupler
10. SDM
11. Contact coil assembly
12. Driver air bag (inflator) module
13. Driver seat belt pretensioner (if equipped)
14. Passenger air bag (inflator) module
15. Passenger seat belt pretensioner (if equipped)
16. Pretensioner harness (if equipped)
17. Ground for air bag system

CONNECTOR "A" (SDM connector)

TERMINAL	CIRCUIT	
A1	———	
A2	Passenger air bag (inflator) module	Low
A3		High
A4	Data link connector (DLC)	
A5	"AIR BAG" warning lamp	
A6	Driver air bag (inflator) module	Low
A7		High
A8	Diagnosis switch	
A9	———	
A10	Ground	
A11	Passenger pretensioner	Low
A12		High
A13	Driver pretensioner	Low
A14		High
A15	———	
A16	Ignition switch (power source)	
L1	Connection detection pin	
L2		

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 CODES

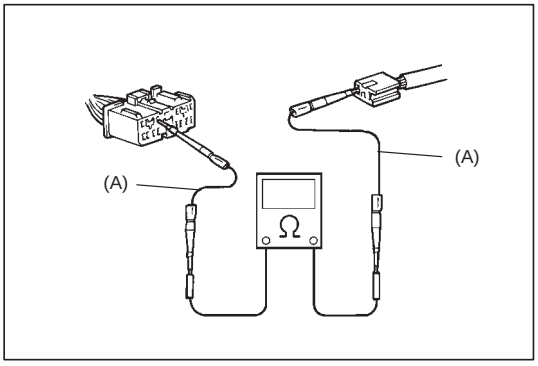
The "Air Bag Diagnostic System Check" must always be the starting point of any air bag system diagnosis. The "Air Bag Diagnostic System Check" checks for proper "AIR BAG" warning lamp operation and checks for air bag diagnostic trouble codes using the Tech-1 (scan tool) or on-board diagnosis function.

- Current diagnostic trouble code – Malfunction that are presently being detected.
- History diagnostic trouble code – All malfunction detected since the last time the history memory was cleared.

USE OF SPECIAL TOOLS

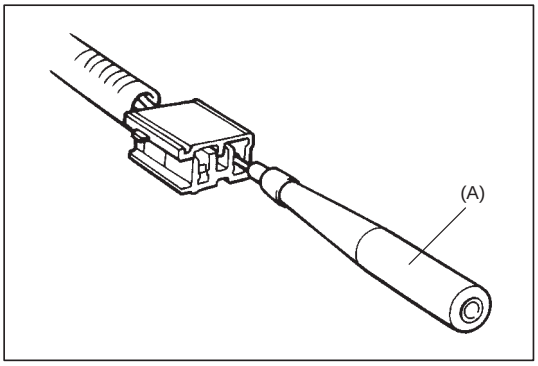
WARNING:
To avoid deployment when troubleshooting the air bag system, do not use electrical test equipment such as a battery powered or AC powered voltmeter, ohmmeter, etc., or any type of electrical equipment other than that specified in this manual. Do not use a non-powered probe type tester.
Instructions in this manual must be followed carefully, otherwise personal injury may result.

You should be familiar with the tools listed under "Special Tools" in this section. You should be able to measure voltage and resistance. You should be familiar with proper use of a scan tool such as the Tech-1 Diagnostic Computer, Driver/Passenger Load Tool, Connector Test Adapter Kit and the Digital Multimeter.

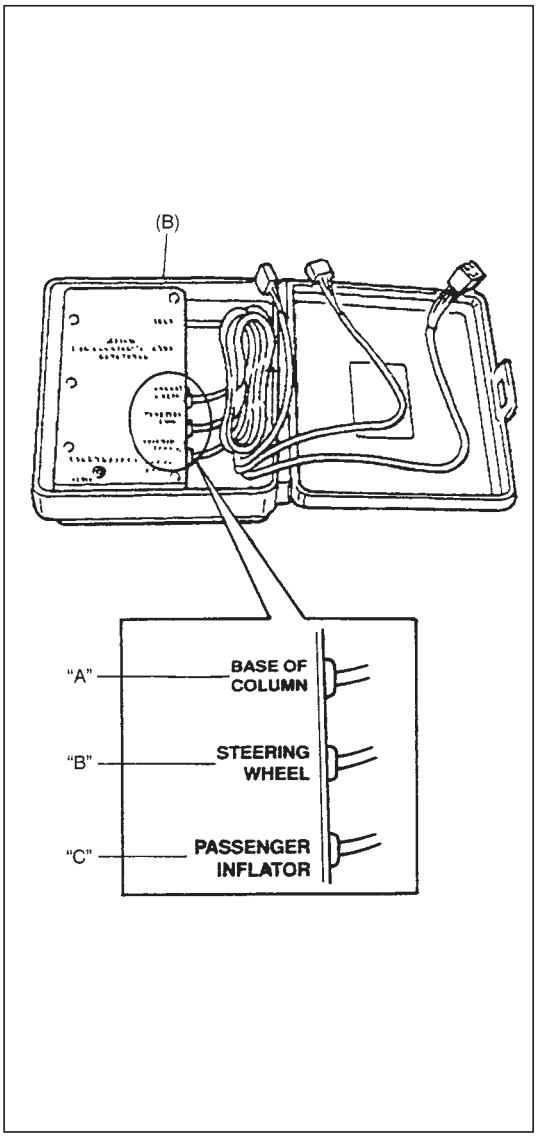


Special Tool (Connector Test Adapter Kit)
(A): 09932-76010

This must be used whenever a diagnostic procedure requests checking or probing a terminal.
Using the appropriate adapter in the special tool will ensure that no damage to the terminal will occur from the multimeter probe, such as spreading or bending.



The adapter will also give an idea of whether contact tension is sufficient, helping to find an open or intermittent open due to poor terminal contact.



Special Tool (Air Bag Driver/Passenger Load Tool) (B): 09932-75010

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 and seat belt pretensioner activation.
The load tool has three connectors attached to its case are electrically functional and serve as resistive load substitutions.
No more than two connectors are used at any time.

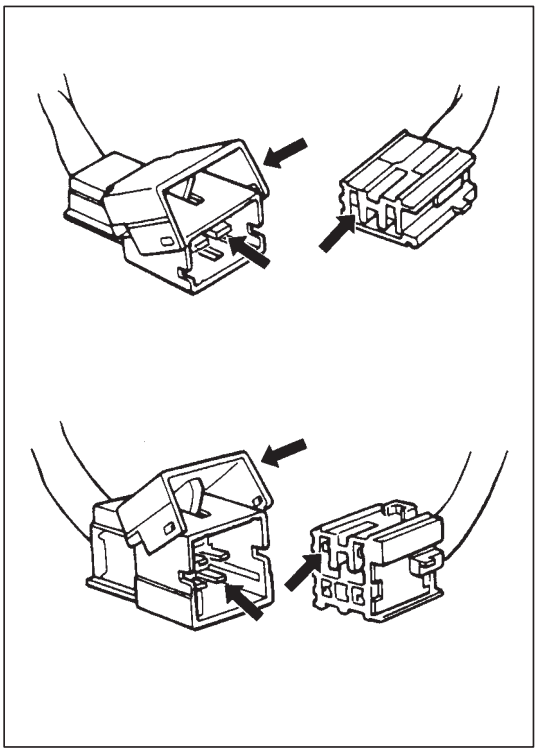
One of connectors ("A": BASE OF COLUMN) is used to substitute the load of the driver air bag (inflator) module and the contact coil assembly when it is connected at the base of the column to the air bag wire harness.
Another connector ("B": STEERING WHEEL) is used to substitute the load of followings.

- 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.
- Driver and passenger seat belt pretensioner when it is connected to air bag harness connector for driver and passenger seat belt pretensioner.

The third connector ("C": 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.

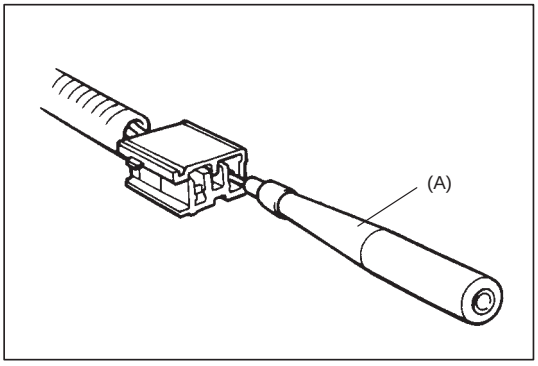
INTERMITTENT AND POOR CONNECTIONS

Most intermittent 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:



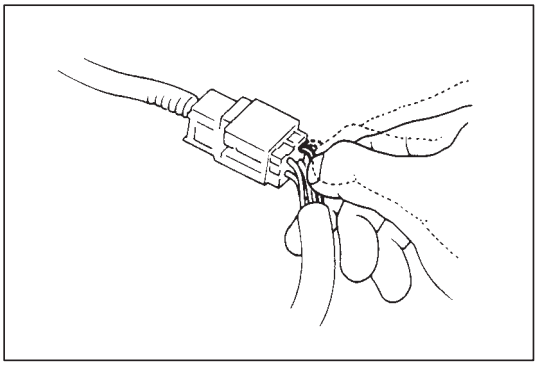
- Poor mating of connector halves, or terminals not fully seated in the connector body (backed out).
- Dirt or corrosion on the terminals. The terminals must be clean and free of any foreign material which could impede proper terminal contact.
  However, cleaning the terminal with a sand paper or the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

If any abnormality is found, repair or replace as a wire harness assembly.

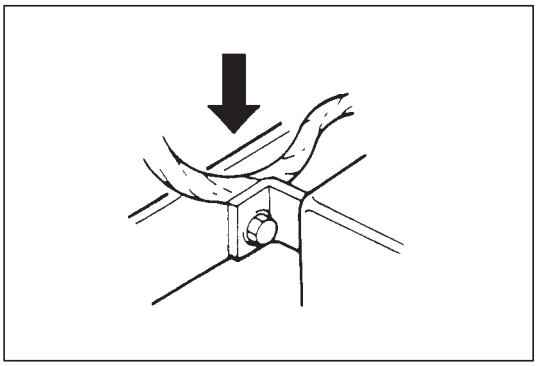


Check each connector terminal in problem circuits carefully to ensure good contact tension by using the corresponding mating terminal included in the connector test adapter kit (special tool).
If contact tension is not enough, reform it to increase contact tension or replace.

Special Tool (Connector Test Adapter Kit)
(A): 09932-76010



- 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.
- Wiring broken inside the insulation. This condition could cause a continuity check to show a good circuit, but if only 1 or 2 strands of a multi-strand-type wire are intact, resistance could be far too high.

If any abnormality is found, repair or replace as a wire harness assembly.

AIR BAG DIAGNOSTIC SYSTEM CHECK

WARNING:
To avoid deployment when troubleshooting the air bag system, do not use electrical test equipment such as a battery powered or AC powered voltmeter, ohmmeter, etc., or any type of electrical equipment other than that specified in this manual. Do not use a non-powered probe type tester.
Instructions in this manual must be followed carefully, otherwise personal injury may result.

CAUTION:
The order in which diagnostic trouble codes are diagnosed is very important. Failure to diagnose the diagnostic trouble codes in the order specified may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.

The diagnostic procedures used in this section are designed to find and repair air bag system malfunctions. To get the best results, it is important to use the diagnostic flow tables and follow the sequence listed below.

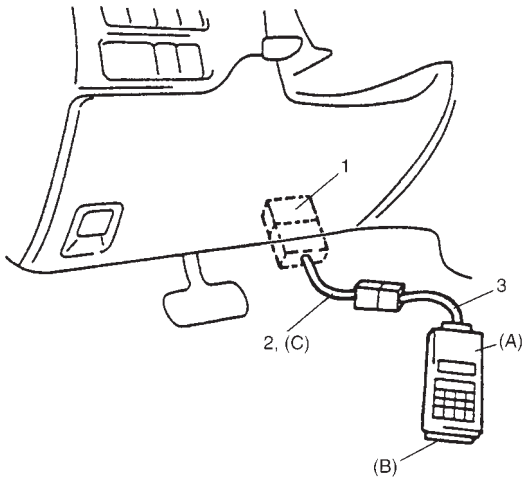
A. PERFORM THE “AIR BAG DIAGNOSTIC SYSTEM CHECK FLOW TABLE”
The “Air Bag Diagnostic System Check Flow Table” must be the starting point of any air bag system diagnostics. The “Air Bag Diagnostic System Check Flow Table” checks for proper “AIR BAG” warning lamp operation, the ability of the SDM to communicate through “AIR BAG” warning lamp and whether air bag diagnostic trouble codes exist.

B. 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 chart to diagnose any air bag system malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.

C. 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.

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 tuned ON. 3) Does "AIR BAG" warning lamp flash 6 times when ignition switch is tuned ON?	Go to step 2.	**"AIR BAG" warning lamp does not come "ON"** Proceed to "Table B" on p.10B-18.
2	Does "AIR BAG" warning lamp keep flashing (indicating DTC) when ignition switch is turned ON ?	**"AIR BAG" warning lamp flashes** Proceed to "Table C" on p.10B-20.	Go to step 3.
3	After flashing 6 times then does "AIR BAG" warning lamp turn OFF?	Go to step 4.	Go to step 5.
4	1) Check DTC, referring to "Diagnostic Trouble Code (DTC) Check" on p.10B-12. 2) [Using SUZUKI scan tool] Is "NO CODES" displayed ? **NOTE:** **If SDM cannot communicate through serial data circuit, proceed to "Table D" on p.10B-22.** [Not using SUZUKI scan tool] Is DTC 12 indicated ?	Air bag system is in good condition.	**NOTE:** **As execution of the "Diagnostic Trouble Code (DTC) Clearance" will clear all DTCs, be sure to record all DTCs before servicing.** 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 p.10B-13.) and repeat this table.
5	1) Check DTC, referring to "Diagnostic Trouble Code (DTC) Check" on p.10B-12. 2) [Using SUZUKI scan tool] Is "NO CODES" displayed ? **NOTE:** **If SDM cannot communicate through serial data circuit, proceed to "Table D" on p.10B-22.** [Not using SUZUKI scan tool] Is DTC 12 indicated ?	**"AIR BAG" warning lamp come "ON" steady** Proceed to "Table A" on p.10B-16.	**NOTE:** **As execution of the "Diagnostic Trouble Code (DTC) Clearance" will clear all DTCs, be sure to record all DTCs before servicing.** Check and repair according to Flow Table corresponding to that DTC.



1. Data link connector (DLC)
2. DLC cable adapter
3. DLC cable

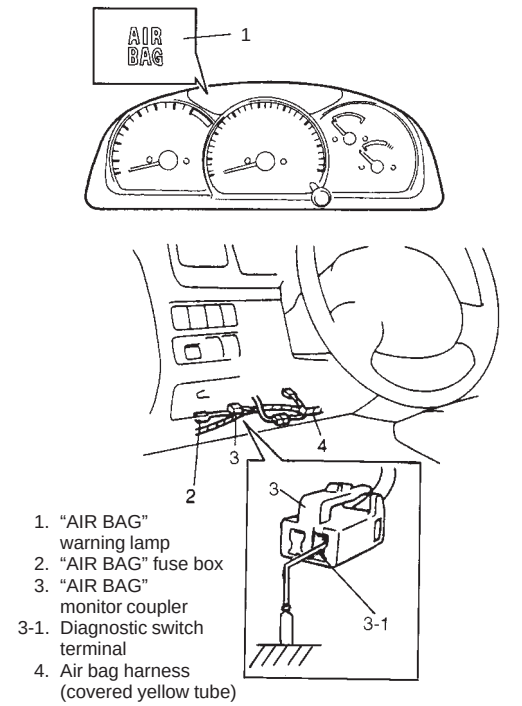
DIAGNOSTIC TROUBLE CODE (DTC) CHECK

[Using SUZUKI scan tool]

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

Special Tool
(A): 09931-76011 (Tech 1)
(B): Mass storage cartridge
(C): 09931-76030

3) Turn ignition switch ON.
4) Read DTC according to instructions displayed on Tech 1 and print it or write it down. Refer to Tech 1 operator's manual for further details.
5) After completing the check, turn ignition switch OFF and disconnect Tech 1 from data link connector (DLC).



1. "AIR BAG" warning lamp
2. "AIR BAG" fuse box
3. "AIR BAG" monitor coupler

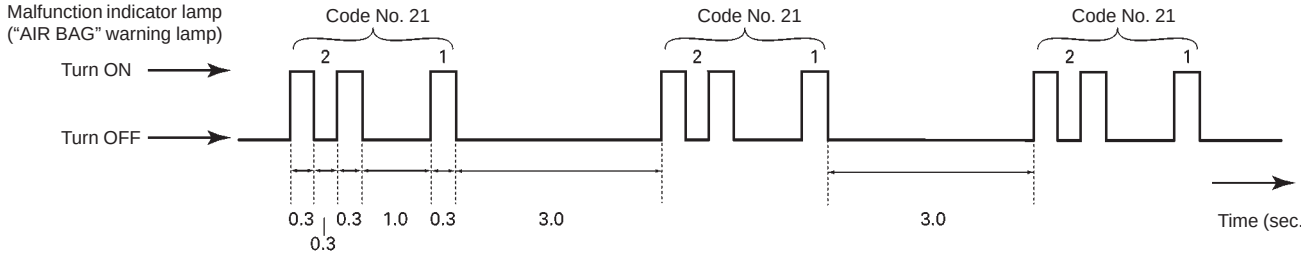
3-1. Diagnostic switch terminal

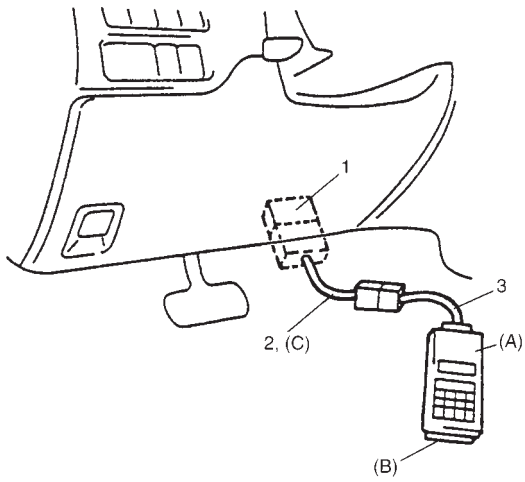
4. Air bag harness (covered yellow tube)

[Not using SUZUKI scan tool]

1) Check that malfunction indicator lamp ("AIR BAG" warning lamp) comes ON when ignition switch is turned ON.
   If it does not come "ON", proceed to "Table B" on p.10B-18.
2) Using service wire, ground diagnosis switch terminal in monitor coupler.
3) Read DTC from flashing pattern of malfunction indicator lamp ("AIR BAG" warning lamp). (Refer to "Diagnostic Trouble Code Table" on p.10B-14 and 10B-15.)
4) After completing the check, turn ignition switch OFF and disconnect service wire from "AIR BAG" monitor coupler.

EXAMPLE: When driver air bag initiator circuit resistance high (Code No.21) is set





1. Data link connector
2. DLC cable adapter
3. DLC cable

DIAGNOSTIC TROUBLE CODE (DTC) CLEARANCE

[Using SUZUKI scan tool]

1) Turn ignition switch OFF.
2) Connect Tech 1 to data link connector (DLC) in the same manner as when making this connection for DTC check.

   Special Tool
   (A): 09931-76011 (Tech 1)
   (B): Mass storage cartridge
   (C): 09931-76030

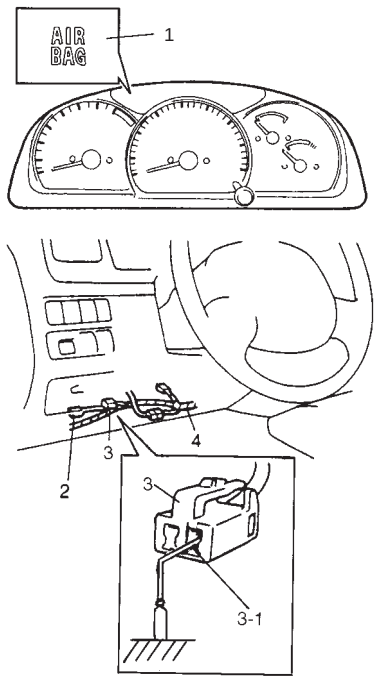
3) Turn ignition switch ON.
4) Erase DTC according to instructions displayed on Tech 1. Refer to Tech 1 operator's manual for further details.
5) After completing the check, turn ignition switch OFF and disconnect Tech 1 from data link connector (DLC).
6) Perform "Diagnosis Trouble Code (DTC) Check" and confirm that normal DTC (NO CODES) is displayed and not malfunction DTC.

   NOTE:
   If DTC 51 or DTC 71 is stored in SDM, it is not possible to clear DTC.

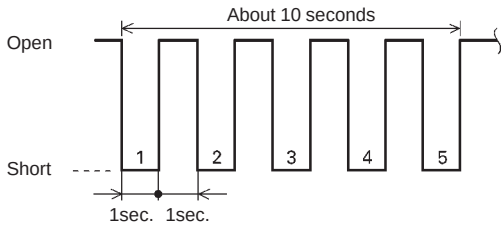
[Not using SUZUKI scan tool]

1) Turn ignition switch ON and wait about 6 seconds or more.
2) Using service wire, repeat shorting and opening between diagnosis switch terminal and ground terminal on "AIR BAG" monitor coupler 5 times at about 1 second intervals.
3) Perform "Diagnosis Trouble Code (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.

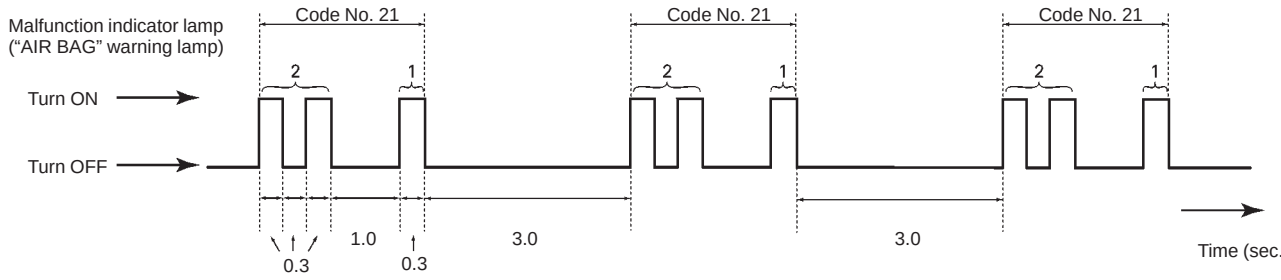


1. "AIR BAG" warning lamp
2. "AIR BAG" fuse box
3. "AIR BAG" monitor coupler
3-1. Diagnostic switch terminal
4. Air bag harness (covered yellow tube)



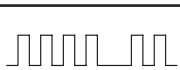
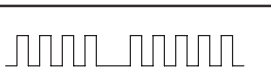
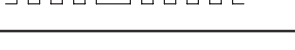
DIAGNOSTIC TROUBLE CODE TABLE (Page 1 of 2)

EXAMPLE: WHEN DRIVER AIR BAG INITIATOR CIRCUIT RESISTANCE HIGH (CODE NO.21) IS SET



DIAGNOSTIC TROUBLE CODE		DIAGNOSIS		
NO.	MODE			
12		Normal		———
15		Passenger air bag circuit	Resistance high	Diagnose trouble according to "Diagnostic Flow Table" corresponding to each code No.
16			Resistance low	
18			Short to ground	
19			Short to power circuit	
21		Driver air bag circuit	Resistance high	
22			Resistance low	
24			Short to ground	
25			Short to power circuit	
31		Power source voltage	Too high	
32			Too low	

DIAGNOSTIC TROUBLE CODE TABLE (Page 2 of 2)

DIAGNOSTIC TROUBLE CODE		DIAGNOSIS		
NO.	MODE			
41		Driver pretensioner circuit (if equipped)	Resistance high	Diagnose trouble according to "Diagnostic Flow Table" corresponding to each code No.
42			Resistance low	
43			Short to ground	
44			Short to power circuit	
45		Passenger pretensioner circuit (if equipped)	Resistance high	
46			Resistance low	
47			Short to ground	
48			Short to power circuit	
51		SDM	Frontal crash detected	
61		"AIR BAG" warning lamp circuit		
71		SDM	Internal fault	

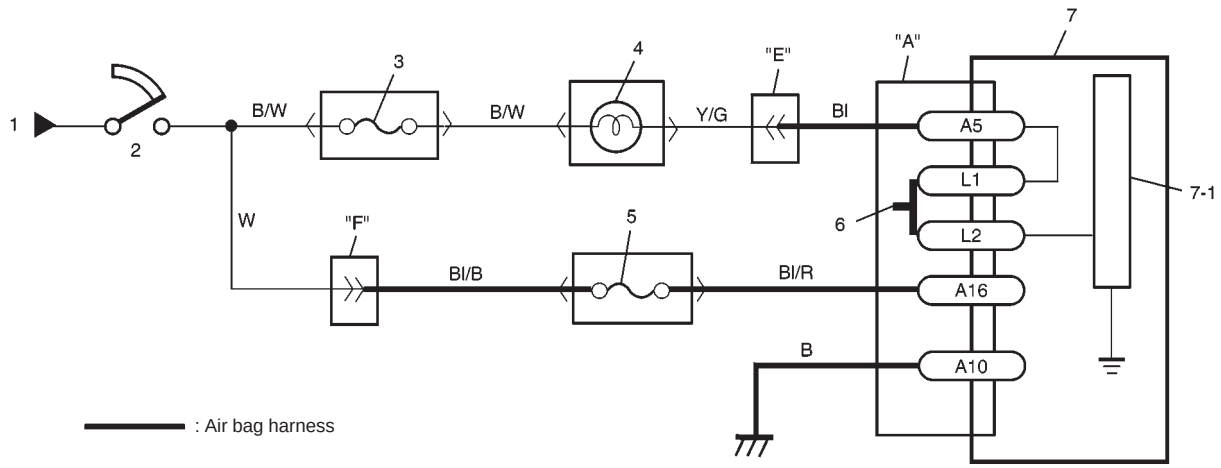
NOTE:

- **When 2 or more codes are indicated, the lowest numbered code will appear first.**
- **If a code not listed on the table is displayed, then the SDM is faulty.**
- **Current DTC and history DTC can be identified by lighting and flashing of "AIR BAG" warning lamp as follows.**

	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	**Remains ON.**	**Flashing 6 times and turns OFF.**
"AIR BAG" warning lamp when grounding diagnosis switch	**Current DTC is displayed.**	**History DTC is displayed.**

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 scan tool (Tech 1) will make identification possible.)

TABLE A – "AIR BAG" WARNING LAMP COMES "ON" STEADY (Page 1 of 2)



1. From main fuse
2. Ignition switch
3. "IG·COIL METER" fuse in J/B
4. "AIR BAG" warning lamp in combination meter
5. "AIR BAG" fuse in "AIR BAG" fuse box
6. Connection detection pin
7. SDM
7-1. "AIR BAG" warning lamp driver circuit

CAUTION:
- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

STEP	ACTION	YES	NO
1	1) Ignition switch OFF. 2) Remove and inspect "AIR BAG" fuse. 3) Is fuse good?	Go to step 2.	"BI/R" wire short to ground. After repair, replace "AIR BAG" fuse.
2	1) Disconnect SDM. 2) Check proper connection to SDM at terminal "A16". 3) If OK then check voltage between "A16" terminal of SDM connector and body ground with ignition switch ON. 4) Is it 8 V or more?	Go to step 3.	"BI/R" wire (between "AIR BAG" fuse and SDM connector) open "BI/B" wire (between ignition switch and "AIR BAG" fuse) open or short to ground.
3	1) Disconnect 16p connector from combination meter, referring to Section 8C. 2) Check resistance between "A5" terminal of SDM connector and body ground. 3) Is resistance 1 kΩ or more?	Substitute a known-good SDM and recheck.	"BI" wire (between combination meter and SDM connector) short to ground.

TABLE A – “AIR BAG” WARNING LAMP COMES “ON” STEADY (Page 2 of 2)

Fig. for STEP 2

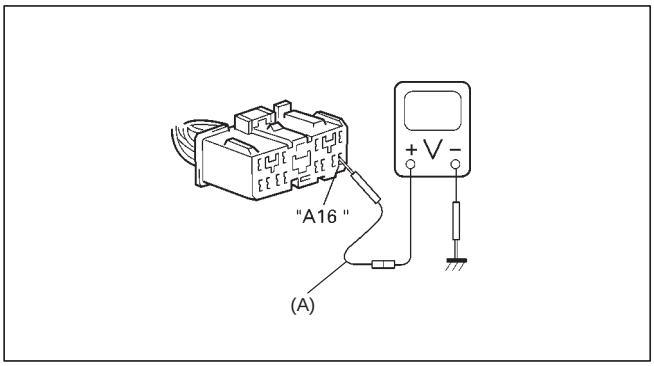
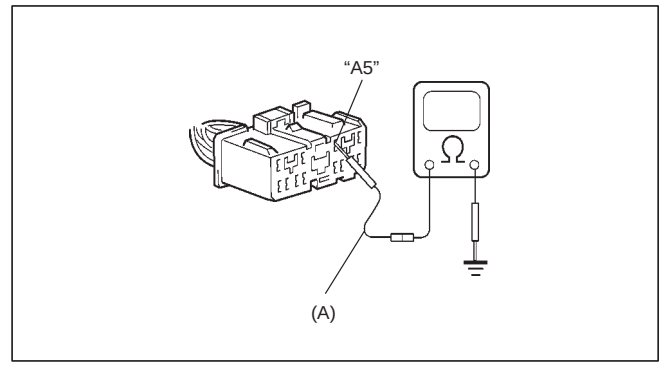


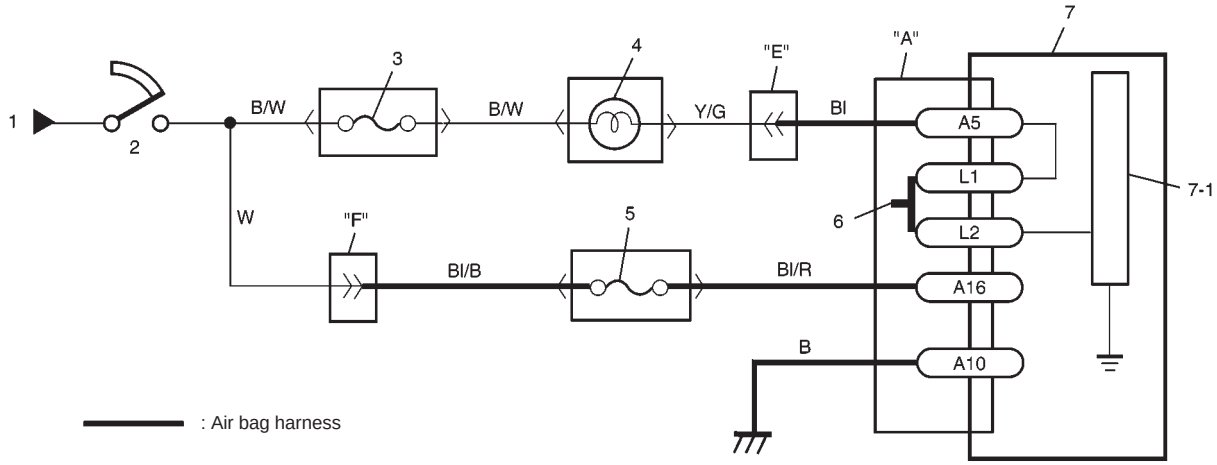
Fig. for STEP 3



Special Tool
(A): 09932-76010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Repeat “Air Bag Diagnostic System Check Flow Table”, referring to p.10B-11 to confirm that the trouble has been corrected.

TABLE B – "AIR BAG" WARNING LAMP DOES NOT COME "ON" (Page 1 of 2)



1. From main fuse
2. Ignition switch
3. "IG·COIL METER" fuse in J/B
4. "AIR BAG" warning lamp in combination meter
5. "AIR BAG" fuse in "AIR BAG" fuse box
6. Connection detection pin
7. SDM
7-1. "AIR BAG" warning lamp driver circuit

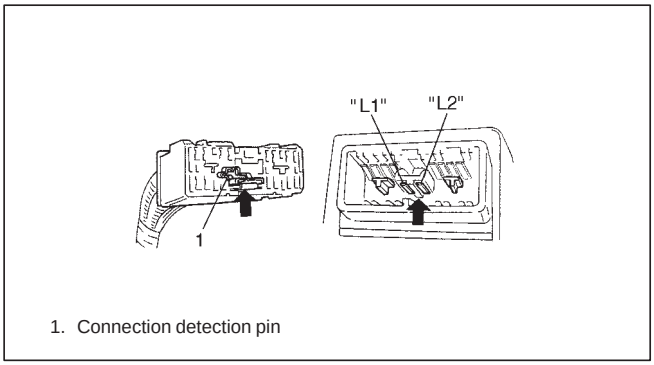
CAUTION:
- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **When an open in air bag wire harness, damaged wire harness, connector or terminal is found, replace wire harness, connectors and terminals as an assembly.**

STEP	ACTION	YES	NO
1	1) Set parking brake. 2) Note combination meter as ignition switch is turned ON. 3) Does the "BRAKE" indicator (warning lamp) come ON?	Go to step 2.	"B/W" wire, "IG·COIL METER" fuse or J/B (between ignition switch and combination meter) open or short to ground.
2	1) With ignition switch OFF, disconnect SDM. 2) Check electrical connection check mechanism (connection detection pin). 3) Is it in good condition?	Go to step 3.	Repair electrical connection check mechanism.
3	1) Disconnect SDM. 2) Check proper connection to SDM at terminal "A5". 3) If OK then check voltage from "A5" terminal of SDM connector to body ground with ignition switch ON. 4) Is it 9 V or more?	Substitute a known-good SDM and recheck.	Go to step 4 on the next page.

TABLE B – "AIR BAG" WARNING LAMP DOES NOT COME "ON" (Page 2 of 2)

STEP	ACTION	YES	NO
4	1) Remove combination meter, referring to SECTION 8C. 2) Check proper connection to combination meter at terminal for "AIR BAG" warning lamp and to SDM at terminal "A5". 3) If OK then check resistance between "Y/G" wire terminal of combination meter connector (16p) and "A5" terminal of SDM connector. 4) Is resistance 1 Ω or less?	Go to step 5.	Repair high resistance or open in "BI" or "Y/G" wire circuit (between combination meter and SDM).
5	1) Measure voltage from "A5" terminal of SDM connector to body ground with ignition switch ON. 2) Is it 9 V or more?	Repair short from "BI" or "Y/G" wire circuit (between combination meter and SDM) to power circuit.	Go to step 6.
6	1) Remove and inspect "AIR BAG" bulb. 2) Is bulb good?	Substitute a known-good combination meter and recheck.	Replace bulb.

Fig. for STEP 2



1. Connection detection pin

Fig. for STEP 3 and 5

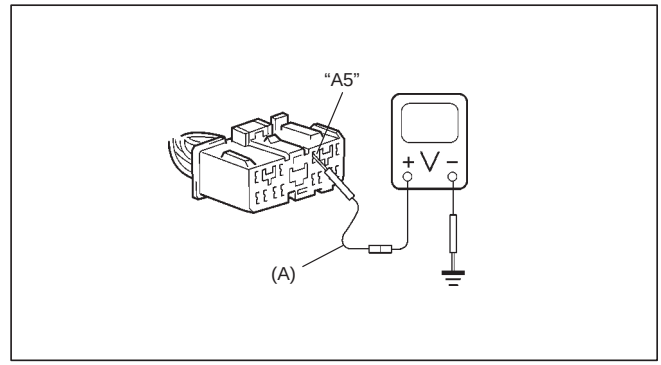
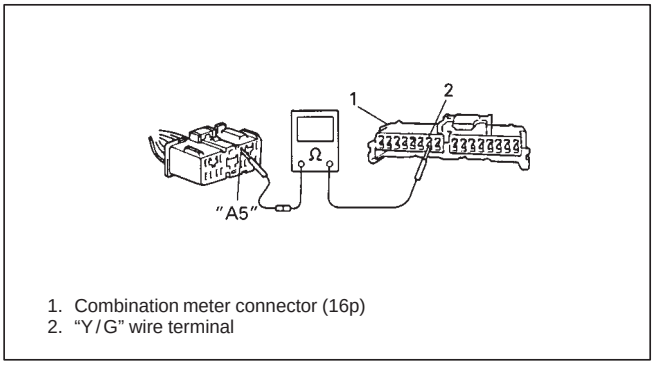


Fig. for STEP 4

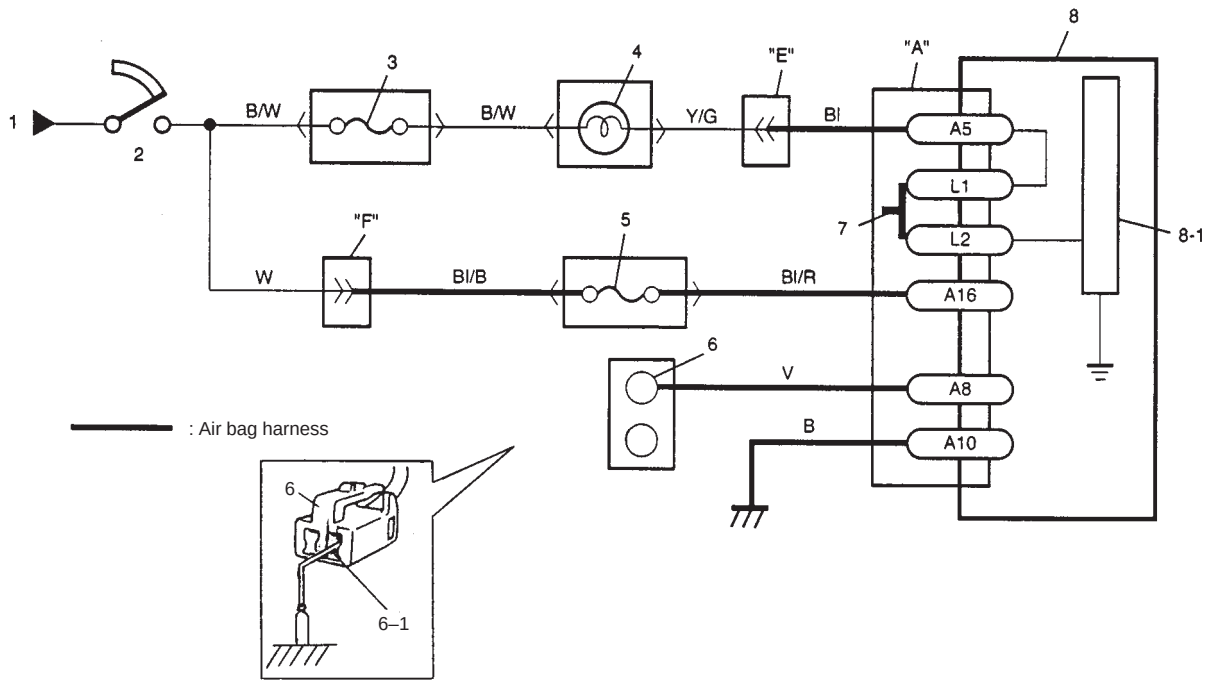


1. Combination meter connector (16p)
2. "Y/G" wire terminal

Special Tool
(A): 09932-76010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.

TABLE C – "AIR BAG" WARNING LAMP FLASHES (Page 1 of 2)



1. From main fuse
2. Ignition switch
3. "IG·COIL METER" fuse in J/B
4. "AIR BAG" warning lamp in combination meter
5. "AIR BAG" fuse in "AIR BAG" fuse box
6. "AIR BAG" monitor coupler

6-1. Diagnosis switch terminal

7. Connection detection pin
8. SDM

8-1. "AIR BAG" warning lamp driver circuit

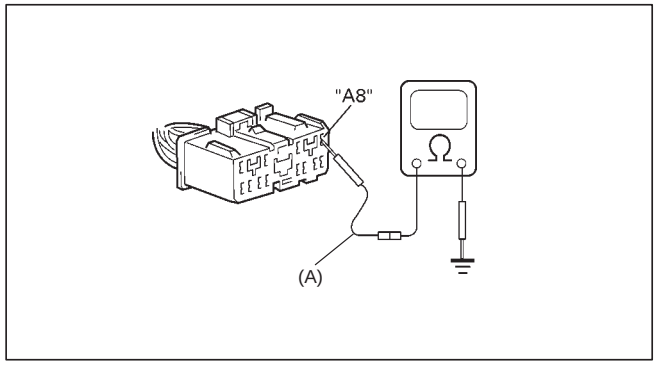
CAUTION:

- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

STEP	ACTION	YES	NO
1	1) Check "AIR BAG" monitor coupler. 2) 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. 2) Measure resistance between "A8" terminal of SDM connector and body ground. 3) Is resistance 1 kΩ or more?	Substitute a known-good SDM and recheck.	Repair short from "V" wire circuit to ground.

TABLE C – "AIR BAG" WARNING LAMP FLASHES (Page 2 of 2)

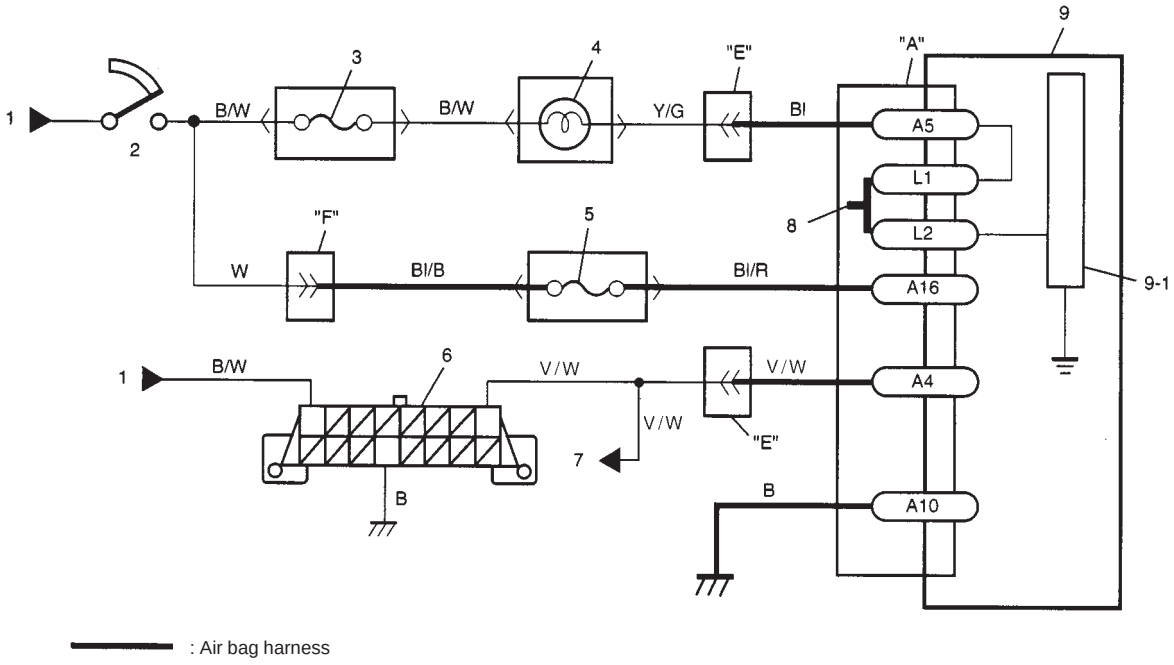
Fig. for STEP 2



Special Tool
(A): 09932-76010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.

TABLE D – SDM CANNOT COMMUNICATE THROUGH THE SERIAL DATA CIRCUIT (Page 1 of 2)



1. From main fuse
2. Ignition switch
3. "IG·COIL METER" fuse in J/B
4. "AIR BAG" warning lamp in combination lamp
5. "AIR BAG" fuse in "AIR BAG" fuse box
6. DLC
7. To, ICM (if equipped)
8. Connection detection pin
9. SDM

9-1. "AIR BAG" warning lamp driver circuit

CAUTION:

- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

STEP	ACTION	YES	NO
1	1) Make sure that scan tool (Tech 1) is free from malfunction and correct cartridge for air bag system is used. 2) Ignition switch OFF. 3) Check proper connection of scan tool (Tech 1) to DLC. 4) Is connection in good condition?	Go to step 2 on next page.	Properly connect scan tool to DLC.

TABLE D – SDM CANNOT COMMUNICATE THROUGH THE SERIAL DATA CIRCUIT (Page 2 of 2)

STEP	ACTION	YES	NO
2	1) Check if communication is possible by trying communication with other controller (ECM (or PCM), ICM or ABS controller). 2) Is it possible to communicate with other controller?	Go to step 3.	Repair open in common section of serial data circuit (“W/B” wire circuit) used by all controllers or short to ground or power circuit which has occurred somewhere in serial data circuit (“W/B” wire circuit).
3	1) With ignition switch OFF, disconnect SDM and “Lamp, DLC and Monitor Coupler Ground” (“E”) connector. 2) Check proper connection at “W/B” wire terminal for DLC in “E” connector. 3) If OK, then check resistance between “W/B” wire terminal in “E” connector and “A4” terminal of SDM connector. 4) Is resistance 1 Ω or less?	Substitute a known-good SDM and recheck.	Repair high resistance or open in “W/B” wire circuit (in air bag harness).

Fig. for STEP 1

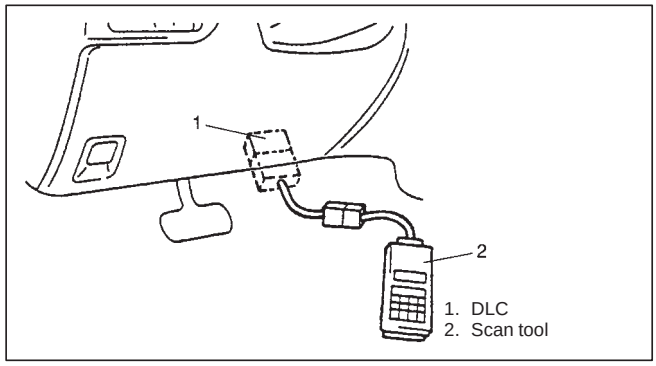
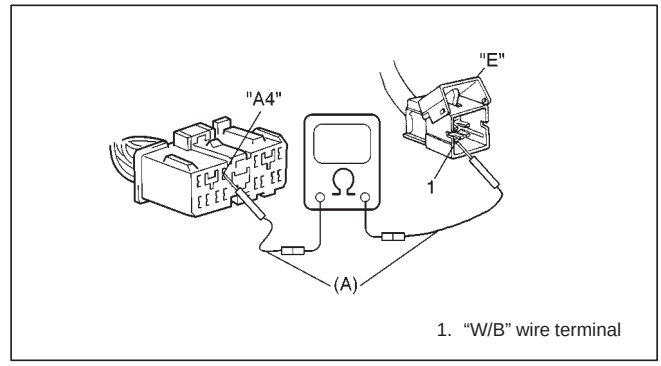


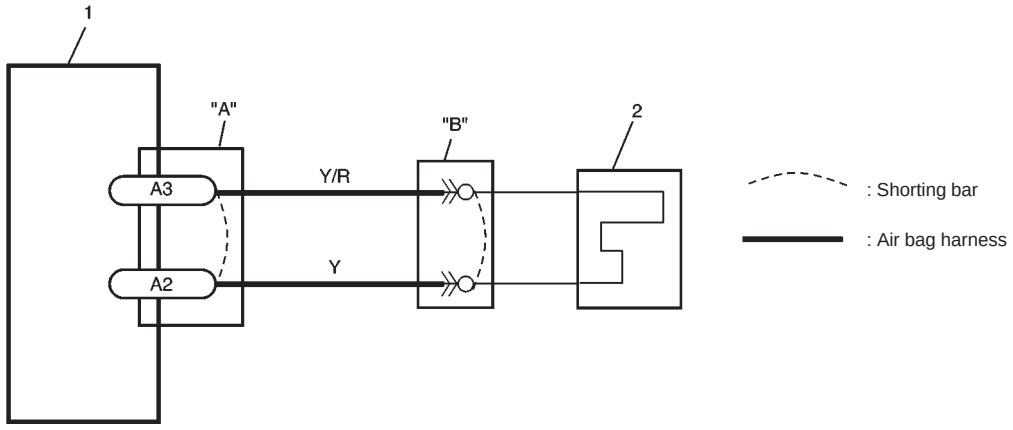
Fig. for STEP 3



Special Tool
(A): 09932-76010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Repeat “Air Bag Diagnostic System Check Flow Table”, referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 15 – PASSENGER AIR BAG INITIATOR CIRCUIT RESISTANCE HIGH (Page 1 of 2)



1. SDM
2. Passenger air bag (inflator) module

CAUTION:

- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:

The combined resistance of the passenger air bag (inflator) module, harness wiring and connector terminal contact is above a specified value for specified time.

CODE 15 – PASSENGER AIR BAG INITIATOR CIRCUIT RESISTANCE HIGH (Page 2 of 2)

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in "B" connector. 3) If OK then connect Special Tool (B) to passenger air bag (inflator) module connector disconnected at the step 1). 4) With ignition switch ON, is DTC 15 current?	Go to step 2.	1) Ignition switch OFF. 2) Replace passenger air bag (inflator) module.
2	1) With ignition switch OFF, disconnect SDM. 2) Check proper connection to SDM at terminals "A2" and "A3". 3) Release shorting bar in SDM connector by inserting a piece of paper, referring to the figure below. 4) If OK then measure resistance between "A2" and "A3" terminals with connected Special Tool (B). 5) Is resistance 2.9 Ω or less?	Substitute a known-good SDM and recheck.	Repair high resistance or open in "Y" or "Y/R" wire circuit.

Fig. for STEP 1 and 2

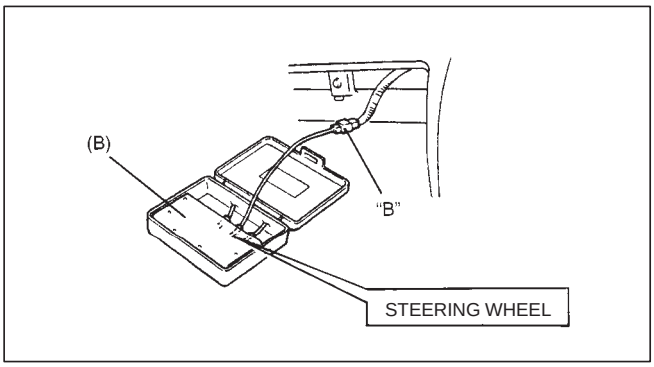
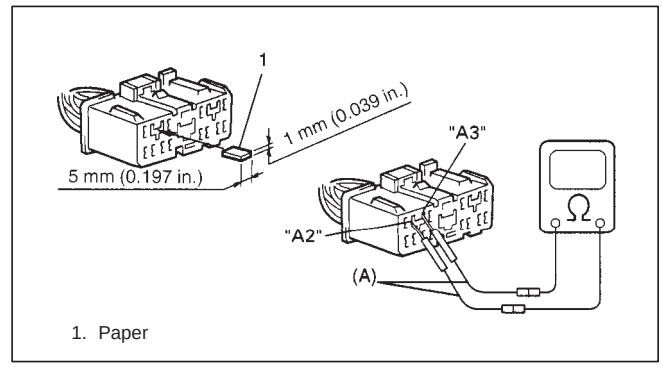


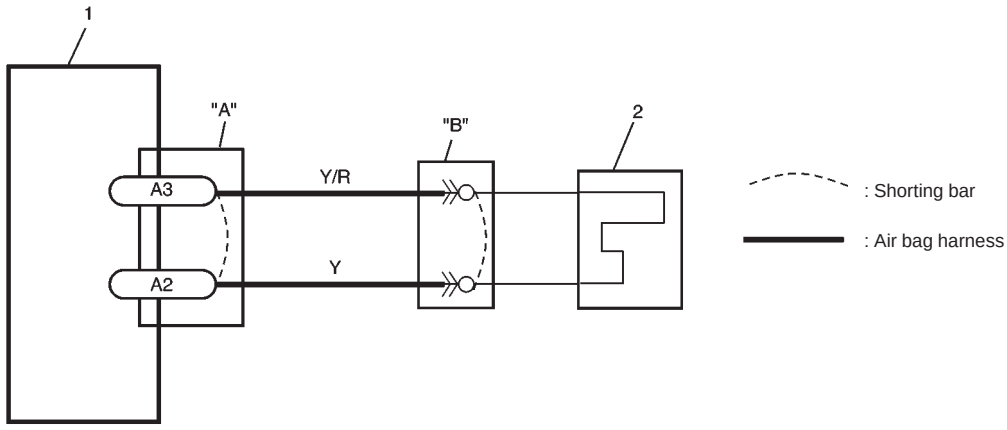
Fig. for STEP 2



Special Tool
(A): 09932-76010
(B): 09932-75010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.
3) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 16 – PASSENGER AIR BAG INITIATOR CIRCUIT RESISTANCE LOW (Page 1 of 2)



1. SDM
2. Passenger air bag (inflator) module

CAUTION:

- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:

The combined resistance of the passenger air bag (inflator) module, harness wiring and connector terminal contact is below a specified value for specified time.

CODE 16 – PASSENGER AIR BAG INITIATOR CIRCUIT RESISTANCE LOW (Page 2 of 2)

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in "B" connector. 3) If OK then connect Special Tool (B) to passenger air bag (inflator) module connector disconnected at the step 1). 4) With ignition switch ON, is DTC 16 current?	Go to step 2.	1) Ignition switch OFF. 2) Replace passenger air bag (inflator) module.
2	1) With ignition switch OFF, disconnect SDM. 2) Check proper connection to SDM at terminals "A2" and "A3". 3) Release shorting bar in SDM connector by inserting a piece of paper, referring to the figure below. 4) If OK then measure resistance between "A2" and "A3" terminals with connected Special Tool (B). 5) Is resistance 1.7 Ω or more?	Substitute a known-good SDM and recheck.	Repair short from "Y" wire circuit to "Y/R" wire circuit or from "Y" or "Y/R" wire circuit to other wire circuit.

Fig. for STEP 1 and 2

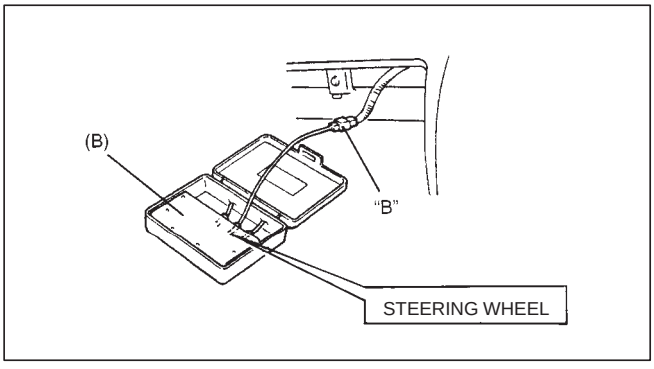
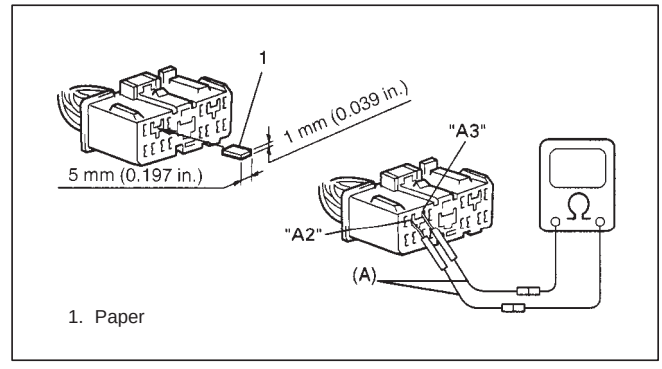


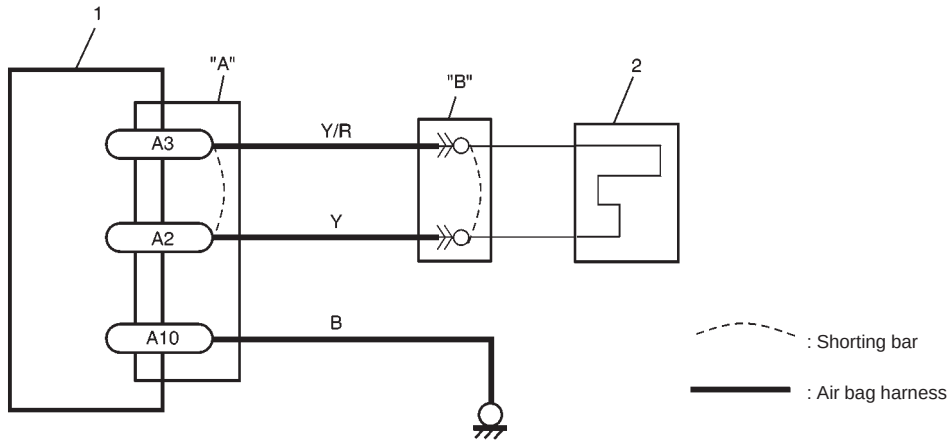
Fig. for STEP 2



Special Tool
(A): 09932-76010
(B): 09932-75010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.
3) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 18 – PASSENGER AIR BAG INITIATOR CIRCUIT SHORT TO GROUND (Page 1 of 2)



1. SDM
2. Passenger air bag (inflator) module

CAUTION:

- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:

The voltage measured at passenger air bag initiator circuit is below a specified value for specified time.

CODE 18 – PASSENGER AIR BAG INITIATOR CIRCUIT SHORT TO GROUND (Page 2 of 2)

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in "B" connector. 3) If OK then connect Special Tool (B) to passenger air bag (inflator) module connector disconnected at the step 1). 4) With ignition switch ON, is DTC 18 current?	Go to step 2.	1) Ignition switch OFF. 2) Replace passenger air bag (inflator) module.
2	1) With ignition switch OFF, disconnect Special Tool (B) and SDM. 2) Measure resistance between "A2" and "A10" terminals. 3) Is resistance 1 kΩ or more?	Substitute a known-good SDM and recheck.	Repair short from "Y" or "Y/R" wire circuit to ground.

Fig. for STEP 1 and 2

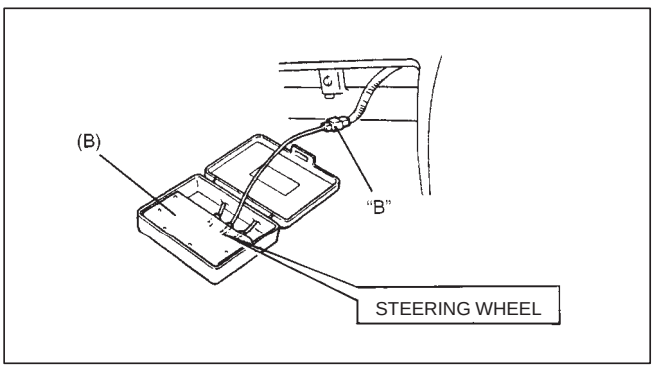
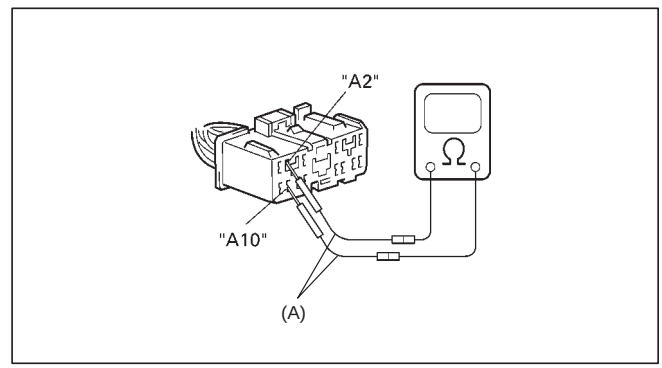


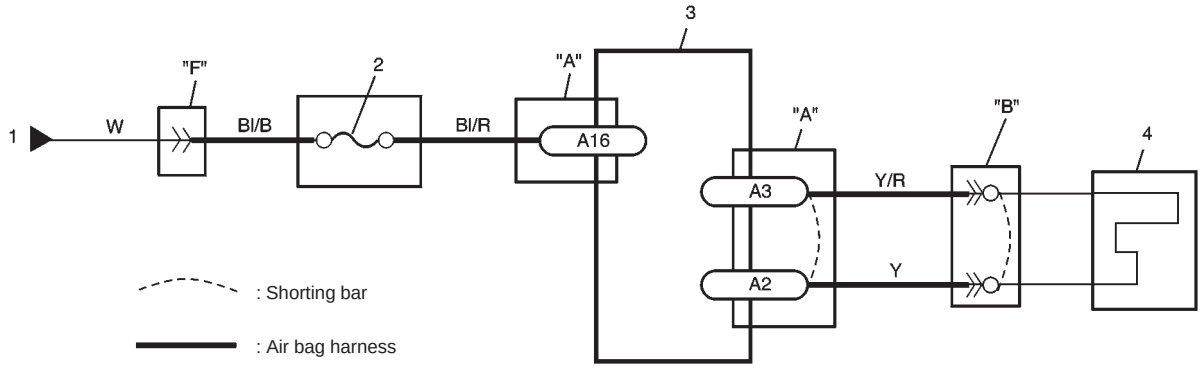
Fig. for STEP 2



Special Tool
(A): 09932-76010
(B): 09932-75010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.
3) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 19 – PASSENGER AIR BAG INITIATOR CIRCUIT SHORT TO POWER CIRCUIT (Page 1 of 2)



1. From ignition switch
2. "AIR BAG" fuse in "AIR BAG" fuse box
3. SDM
4. Passenger air bag (inflator) module

CAUTION:

- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:

The voltage measured at passenger air bag initiator circuit is above a specified value for specified time.

CODE 19 – PASSENGER AIR BAG INITIATOR CIRCUIT SHORT TO POWER CIRCUIT (Page 2 of 2)

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) With ignition switch OFF, disconnect passenger air bag (inflator) module connector behind the glove box. 2) Check proper connection to passenger air bag (inflator) module at terminals in "B" connector. 3) If OK then connect Special Tool (B) to passenger air bag (inflator) module connector disconnected at the step 1). 4) With ignition switch ON, is DTC 19 current?	Go to step 2.	1) Ignition switch OFF. 2) Replace passenger air bag (inflator) module.
2	1) With ignition switch OFF, disconnect Special Tool (B) and SDM. 2) Measure voltage from "A3" terminal to body ground. 3) With ignition switch ON, is voltage 1 V or less?	Substitute a known-good SDM and recheck.	Repair short from "Y" or "Y/R" wire circuit to power circuit.

Fig. for STEP 1 and 2

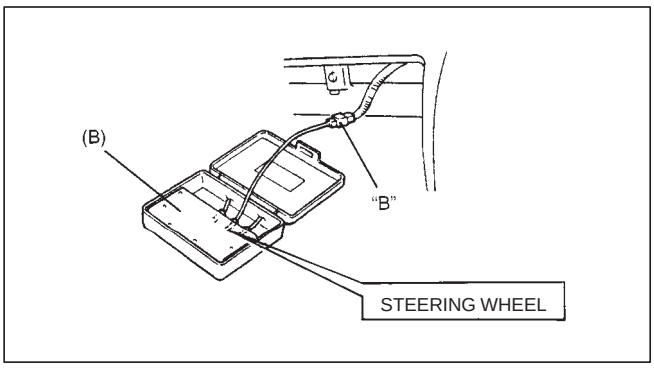
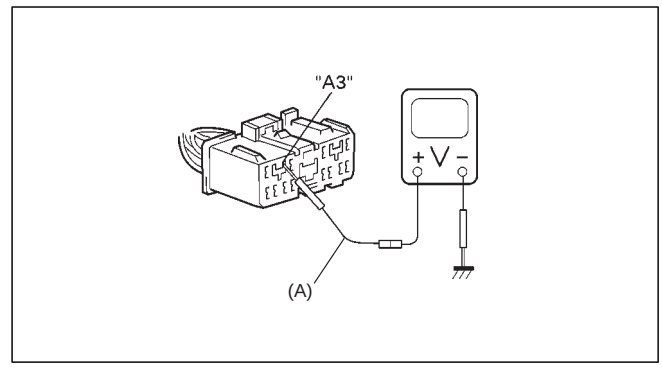


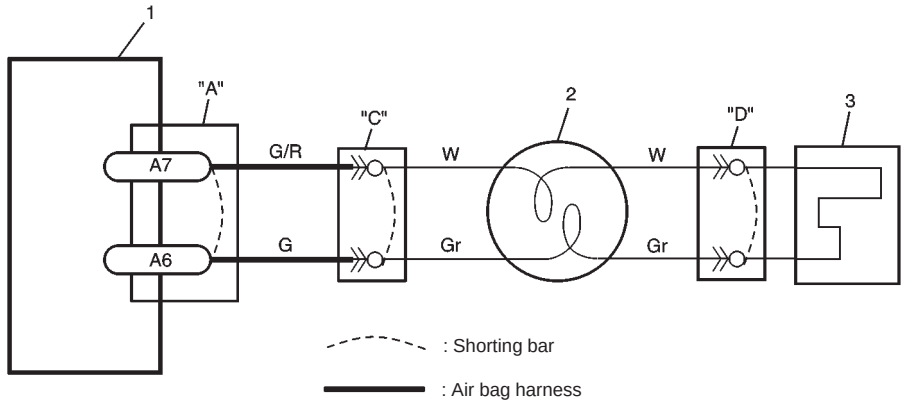
Fig. for STEP 2



Special Tool
(A): 09932-76010
(B): 09932-75010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.
3) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 21 – DRIVER AIR BAG INITIATOR CIRCUIT RESISTANCE HIGH (Page 1 of 2)



1. SDM
2. Contact coil assembly
3. Driver air bag (inflator) module

CAUTION:
- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittents and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:
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.

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) With ignition switch OFF, disconnect contact coil connector located near the base of the steering column. 2) Check proper connection to contact coil at terminals in "C" connector. 3) If OK then connect Special Tool (B) to contact coil connector disconnected at step 1). 4) With ignition switch ON, is DTC 21 current?	Go to step 2.	Go to step 3 on the next page.
2	1) With ignition switch OFF, disconnect SDM. 2) Check proper connection to SDM at terminals "A6" and "A7". 3) Release shorting bar in SDM connector, referring to the figure below. 4) If OK then measure resistance between "A6" and "A7" terminals with connected Special Tool (B). 5) Is resistance 3.5 Ω or less?	Substitute a known-good SDM and recheck.	Repair high resistance or open in "G" or "G/R" wire circuit.

CODE 21 – DRIVER AIR BAG INITIATOR CIRCUIT RESISTANCE HIGH (Page 2 of 2)

STEP	ACTION	YES	NO
3	1) With ignition switch OFF, disconnect Special Tool (B) then reconnect contact coil connector located near the base of the steering column. 2) Remove driver air bag (inflator) module from steering wheel (Refer to SECTION 3C1). 3) Check proper connection to driver air bag (inflator) module at terminals in “D” connector. 4) If OK then connect Special Tool (B) to driver air bag (inflator) module disconnected at step 2). 5) With ignition switch ON, is DTC 21 current?	1) Ignition switch OFF. 2) Replace contact coil assembly (Refer to SECTION 3C1).	1) Ignition switch OFF. 2) Replace driver air bag (inflator) module (Refer to SECTION 3C1).

Fig. for STEP 1 and 2

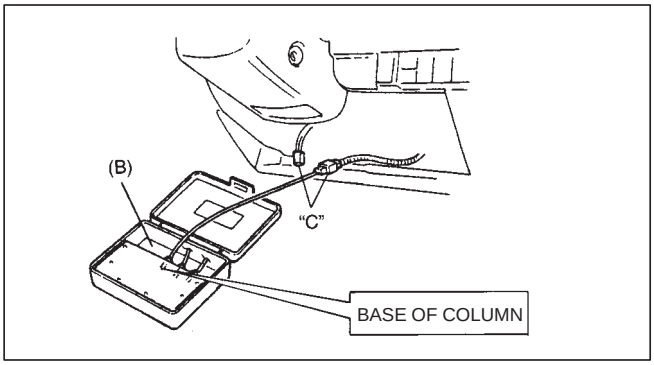


Fig. for STEP 2

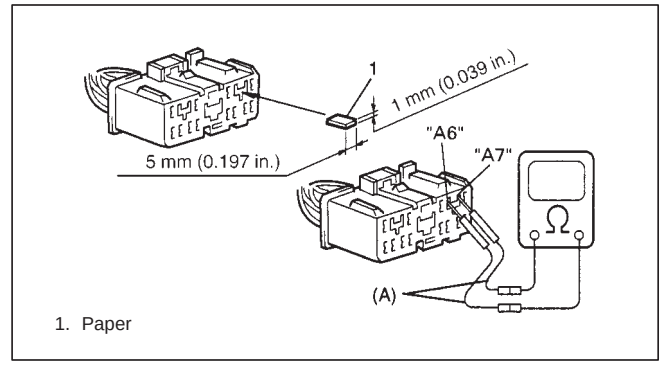
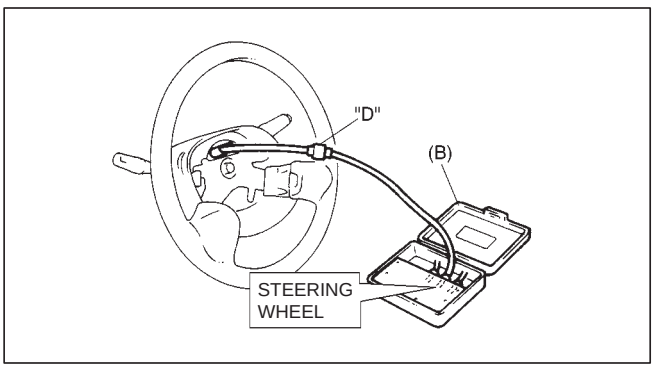


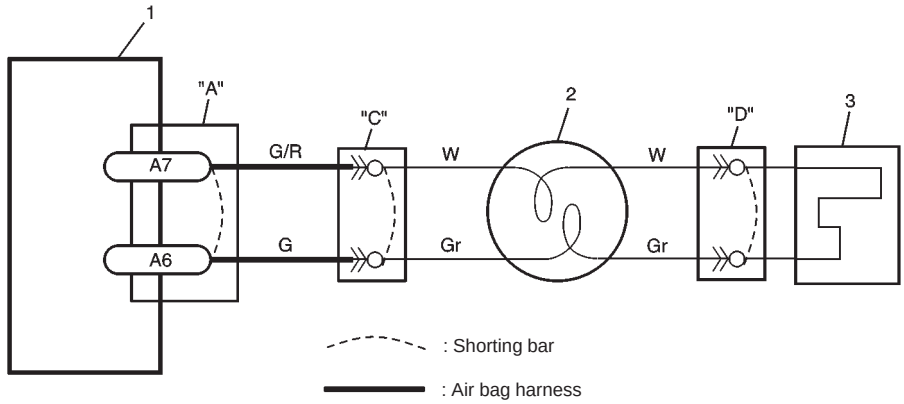
Fig. for STEP 3



Special Tool
(A): 09932-76010
(B): 09932-75010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to “Diagnostic Trouble Code (DTC) Clearance”), if any.
3) Repeat “Air Bag Diagnostic System Check Flow Table”, referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 22 – DRIVER AIR BAG INITIATOR CIRCUIT RESISTANCE LOW (Page 1 of 2)



1. SDM
2. Contact coil assembly
3. Driver air bag (inflator) module

CAUTION:
- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:
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.

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) With ignition switch OFF, disconnect contact coil connector located near the base of the steering column. 2) Check proper connection to contact coil at terminals in "C" connector. 3) If OK then connect Special Tool (B) to contact coil connector disconnected at step 1). 4) With ignition switch ON, is DTC 22 current?	Go to step 2.	Go to step 3 on the next page.
2	1) With ignition switch OFF, disconnect SDM. 2) Check proper connection to SDM at terminals "A6" and "A7". 3) Release shorting bar in SDM connector, referring to the figure below. 4) If OK then measure resistance between "A6" and "A7" terminals with connected Special Tool (B). 5) Is resistance 1.7 Ω or more?	Substitute a known-good SDM and recheck.	Repair short from "G" wire circuit to "G/R" wire circuit or from "G" or "G/R" wire circuit to other wire circuit.

CODE 22 – DRIVER AIR BAG INITIATOR CIRCUIT RESISTANCE LOW (Page 2 of 2)

STEP	ACTION	YES	NO
3	1) With ignition switch OFF, disconnect Special Tool (B) then reconnect contact coil connector located near the base of the steering column. 2) Remove driver air bag (inflator) module from steering wheel (Refer to SECTION 3C1). 3) Check proper connection to driver air bag (inflator) module at terminals in “D” connector. 4) If OK then connect Special Tool (B) to driver air bag (inflator) module disconnected at step 2). 5) With ignition switch ON, is DTC 22 current?	1) Ignition switch OFF. 2) Replace contact coil assembly (Refer to SECTION 3C1).	1) Ignition switch OFF. 2) Replace driver air bag (inflator) module (Refer to SECTION 3C1).

Fig. for STEP 1 and 2

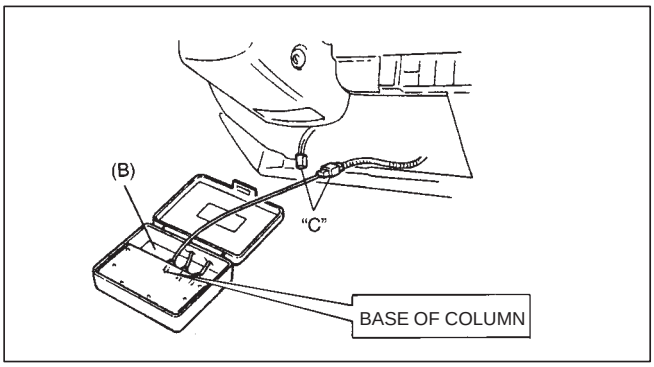


Fig. for STEP 2

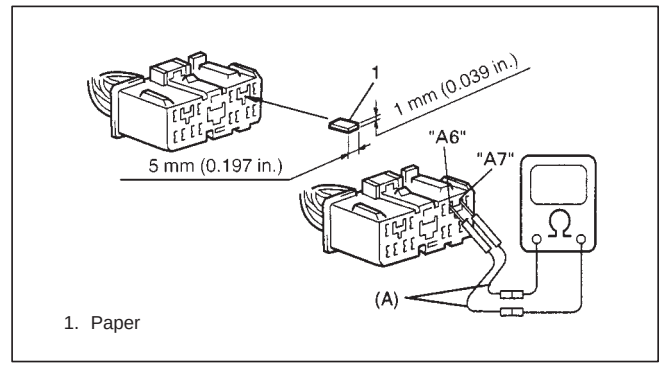
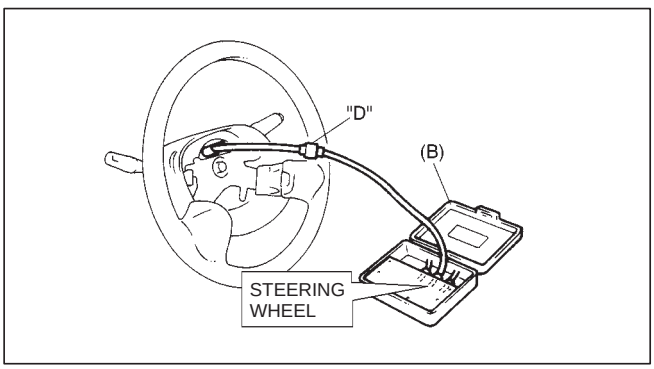


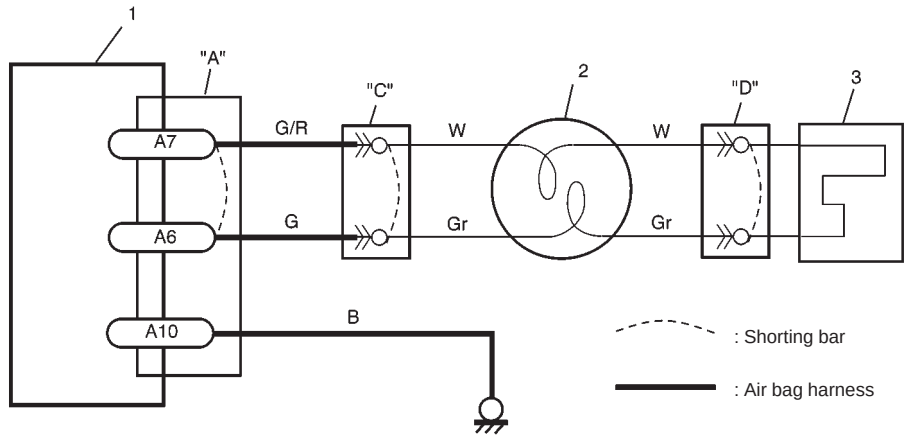
Fig. for STEP 3



Special Tool
(A): 09932-76010
(B): 09932-75010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to “Diagnostic Trouble Code (DTC) Clearance”), if any.
3) Repeat “Air Bag Diagnostic System Check Flow Table”, referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 24 –DRIVER AIR BAG INITIATOR CIRCUIT SHORT TO GROUND (Page 1 of 2)



1. SDM
2. Contact coil assembly
3. Driver air bag (inflator) module

CAUTION:
- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:
The voltage measured at driver air bag initiator circuit is below a specified value for specified time.

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) With ignition switch OFF, disconnect contact coil connector located near the base of the steering column. 2) Check proper connection to contact coil at terminals in "C" connector. 3) If OK then connect Special Tool (B) to contact coil connector disconnected at step 1). 4) With ignition switch ON, is DTC 24 current?	Go to step 2.	Go to step 3 on the next page.
2	1) With ignition switch OFF, disconnect Special Tool (B) and SDM. 2) Measure resistance between "A6" and "A10" terminals. 3) Is resistance 1 kΩ or more?	Substitute a known-good SDM and recheck.	Repair short from "G" or "G/R" wire circuit to ground.

CODE 24 –DRIVER AIR BAG INITIATOR CIRCUIT SHORT TO GROUND (Page 2 of 2)

STEP	ACTION	YES	NO
3	1) With ignition switch OFF, disconnect Special Tool (B) then reconnect contact coil connector located near the base of the steering column. 2) Remove driver air bag (inflator) module from steering wheel (Refer to SECTION 3C1). 3) Check proper connection to driver air bag (inflator) module at terminals in “D” connector. 4) If OK then connect Special Tool (B) to driver air bag (inflator) module disconnected at step 2). 5) With ignition switch ON, is DTC 24 current?	1) Ignition switch OFF. 2) Replace contact coil assembly (Refer to SECTION 3C1).	1) Ignition switch OFF. 2) Replace driver air bag (inflator) module (Refer to SECTION 3C1).

Fig. for STEP 1 and 2

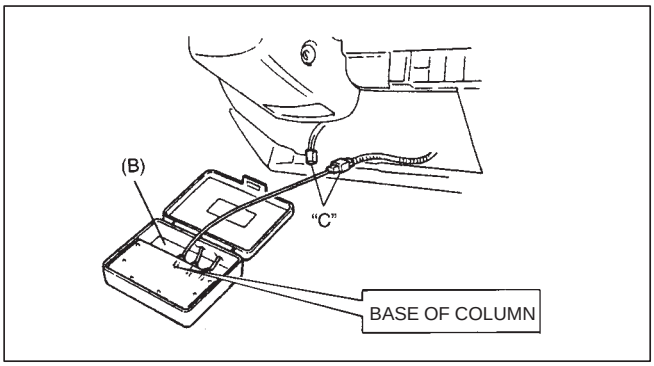


Fig. for STEP 2

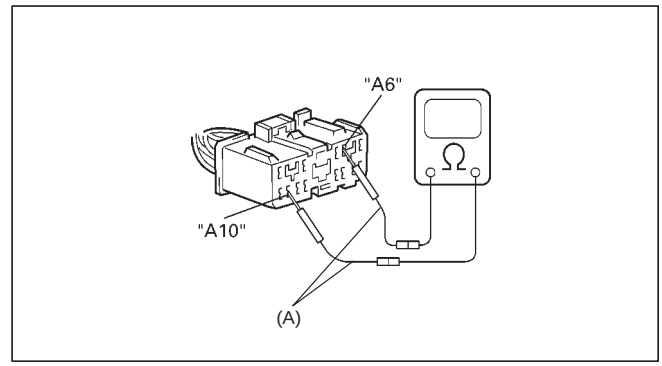
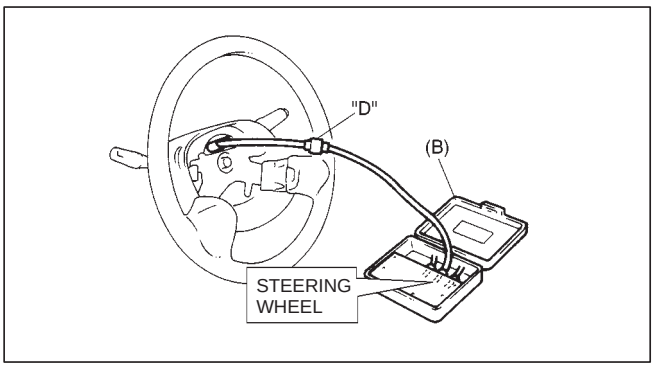


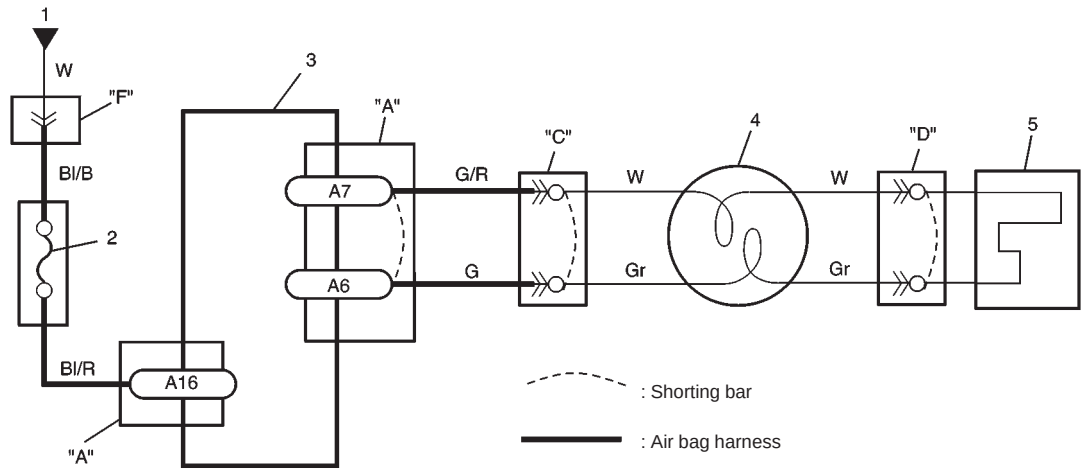
Fig. for STEP 3



Special Tool
(A): 09932-76010
(B): 09932-75010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to “Diagnostic Trouble Code (DTC) Clearance”), if any.
3) Repeat “Air Bag Diagnostic System Check Flow Table”, referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 25 – DRIVER AIR BAG INITIATOR CIRCUIT SHORT TO POWER CIRCUIT (Page 1 of 2)



1. From ignition switch
2. "AIR BAG" fuse in "AIR BAG" fuse box
3. SDM
4. Contact coil assembly
5. Driver air bag (inflator) module

CAUTION:
- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:

The voltage measured at driver air bag initiator circuit is above a specified value for specified time.

NOTE:

Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) With ignition switch OFF, disconnect contact coil connector located near the base of the steering column. 2) Check proper connection to contact coil at terminals in "C" connector. 3) If OK then connect Special Tool (B) to contact coil connector disconnected at step 1). 4) With ignition switch ON, is DTC 25 current?	Go to step 2.	Go to step 3 on the next page.
2	1) With ignition switch OFF, disconnect Special Tool (B) and SDM. 2) Measure voltage from "A7" terminal to body ground. 3) With ignition switch ON, is voltage 1 V or less?	Substitute a known-good SDM and recheck.	Repair short from "G" or "G/R" wire circuit to power circuit.

CODE 25 – DRIVER AIR BAG INITIATOR CIRCUIT SHORT TO POWER CIRCUIT (Page 2 of 2)

STEP	ACTION	YES	NO
3	1) With ignition switch OFF, disconnect Special Tool (B) then reconnect contact coil connector located near the base of the steering column. 2) Remove driver air bag (inflator) module from steering wheel (Refer to SECTION 3C1). 3) Check proper connection to driver air bag (inflator) module at terminals in "D" connector. 4) If OK then connect Special Tool (B) to driver air bag (inflator) module disconnected at step 2). 5) With ignition switch ON, is DTC 25 current?	1) Ignition switch OFF. 2) Replace contact coil assembly (Refer to SECTION 3C1).	1) Ignition switch OFF. 2) Replace driver air bag (inflator) module (Refer to SECTION 3C1).

Fig. for STEP 1 and 2

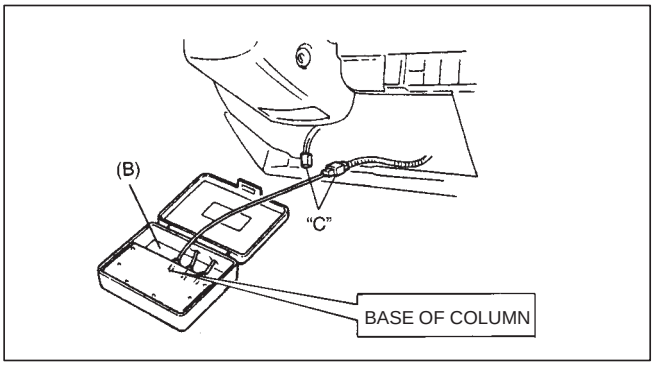


Fig. for STEP 2

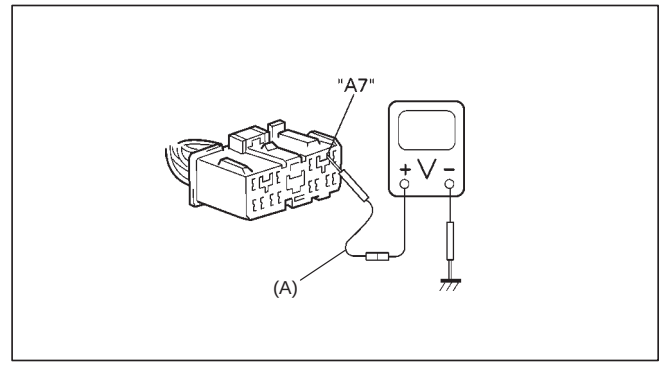
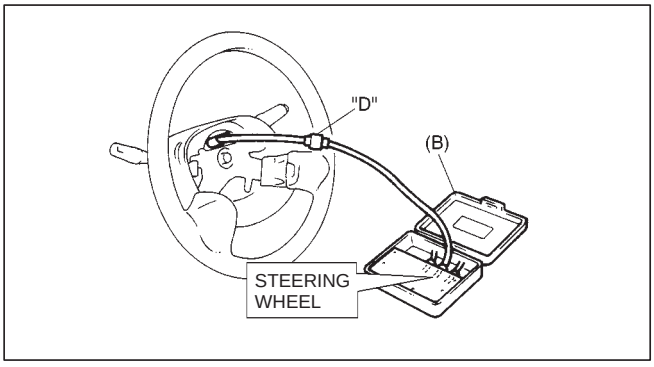


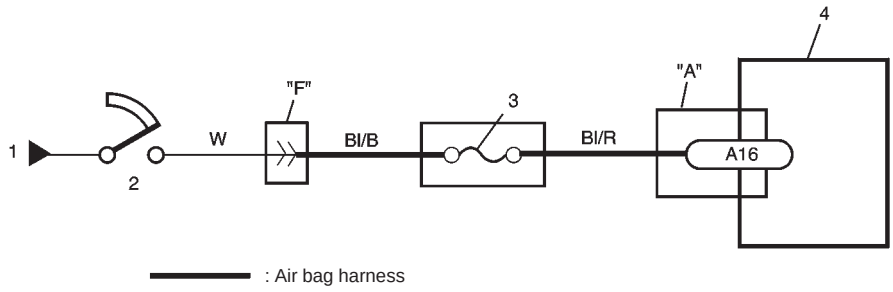
Fig. for STEP 3



Special Tool
(A): 09932-76010
(B): 09932-75010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.
3) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 31 – POWER SOURCE VOLTAGE HIGH (Page 1 of 2)



1. From main fuse
2. Ignition switch
3. "AIR BAG" fuse in "AIR BAG" fuse box
4. SDM

CAUTION:

- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:

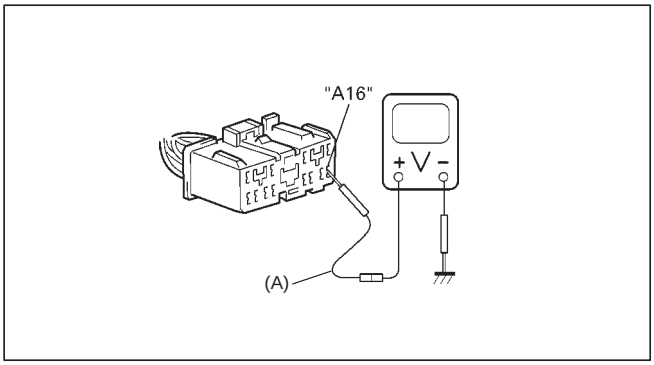
The power source voltage to SDM is above specified value for specified time.

CODE 31 – POWER SOURCE VOLTAGE HIGH (Page 2 of 2)

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) With ignition switch OFF, disconnect SDM. 2) Check proper connection to SDM at "A16" terminal. 3) If OK then ignition switch ON, and then check voltage from "A16" terminal on SDM harness connector to body ground. 4) Is voltage 14 V or less?	Go to step 2.	Check Charging System and repair as necessary. (Refer to SECTION 6H "Changing System")
2	1) With ignition switch OFF, reconnect SDM 2) With ignition switch ON, is DTC 31 current?	Substitute a known-good SDM and recheck.	Check Charging System and repair as necessary. (Refer to SECTION 6H "Changing System")

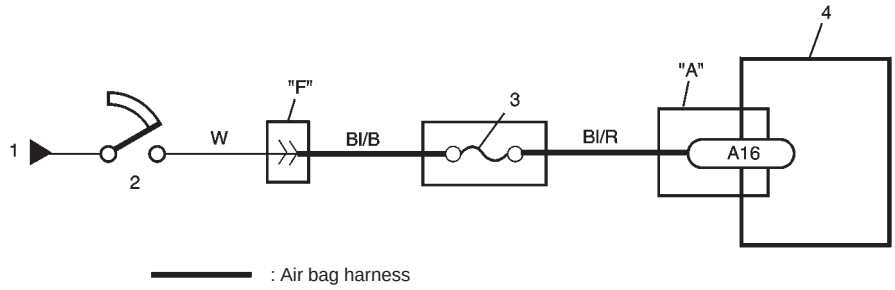
Fig. for STEP 1



Special Tool
(A): 09932-76010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.
3) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 32 – POWER SOURCE VOLTAGE LOW (Page 1 of 2)



1. From main fuse
2. Ignition switch
3. "AIR BAG" fuse in "AIR BAG" fuse box
4. SDM

CAUTION:

- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:

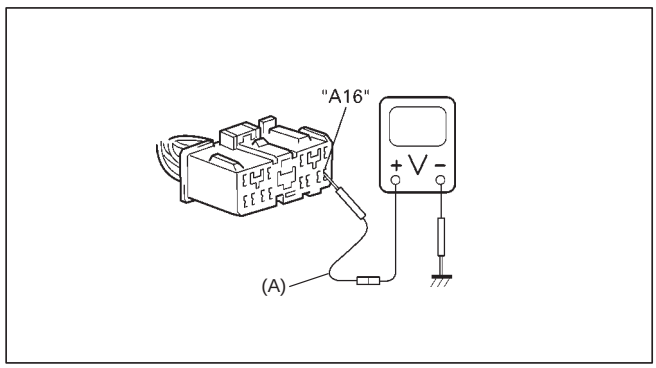
The power source voltage is below an approx. 8 V for specified time.

CODE 32 – POWER SOURCE VOLTAGE LOW (Page 2 of 2)

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) Measure voltage on battery. 2) Is voltage 11 V or more?	Go to step 2.	Check Charging System and repair as necessary. (Refer to SECTION 6H "Changing System")
2	1) With ignition switch OFF, disconnect SDM. 2) Check proper connection to SDM at "A16" terminal. 3) If OK then ignition switch ON, and then check voltage from "A16" terminal on SDM harness connector to body ground. 4) Is voltage 8 V or more?	Go to step 4.	Go to step 3.
3	1) With ignition switch OFF, disconnect ignition connector ("F" connector) in air bag harness. 2) Check proper connection at terminal in "F" connector. 3) If OK then ignition switch ON, and then check voltage from terminal in "F" connector on main harness to body ground. 4) Is voltage 8 V or more?	Repair poor connection, high resistance in "BI/R" or "BI/B" 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 "F" connector ● Charging System (Refer to SECTION 6H "Changing System")
4	1) With ignition switch OFF, reconnect SDM 2) With ignition switch ON, is DTC 32 current?	Substitute a known-good SDM and recheck.	Check Charging System and repair as necessary. (Refer to SECTION 6H "Changing System")

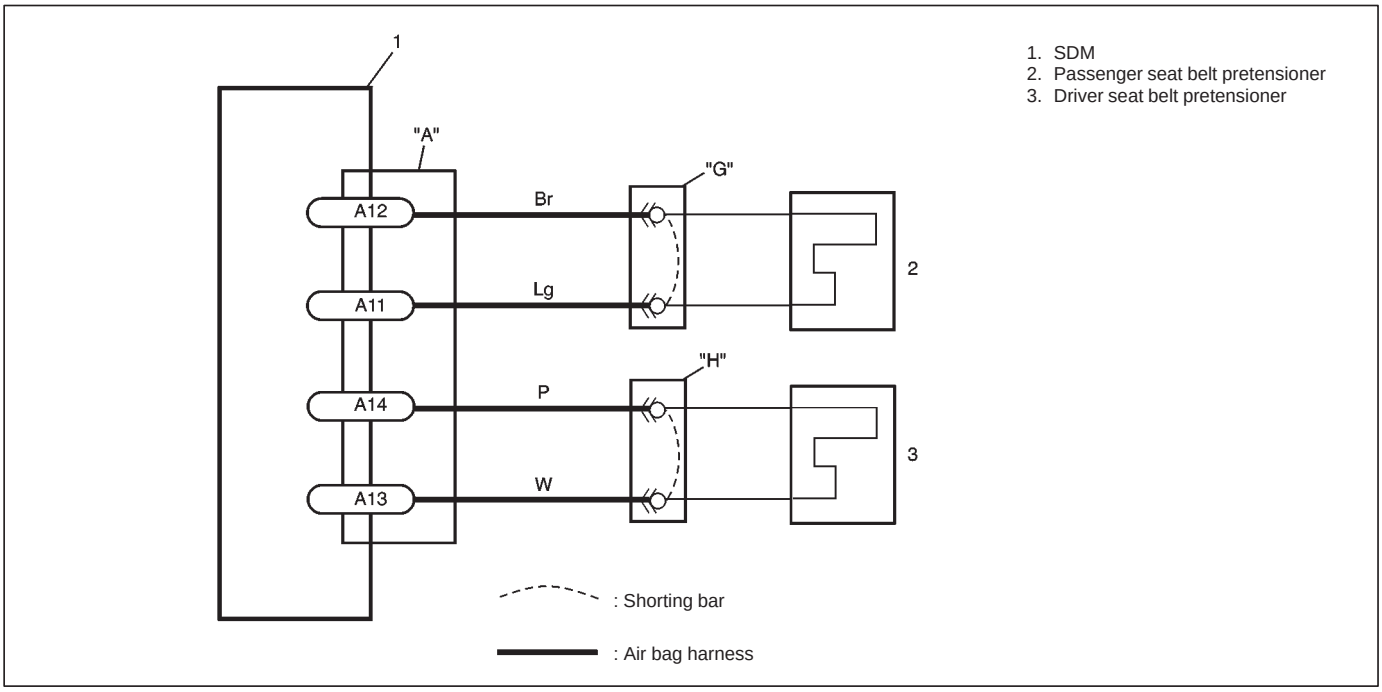
Fig. for STEP 2



Special Tool
(A): 09932-76010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.
3) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 41 – DRIVER PRETENSIONER INITIATOR CIRCUIT RESISTANCE HIGH
CODE 45 – PASSENGER PRETENSIONER INITIATOR CIRCUIT RESISTANCE HIGH (Page 1 of 2)



CAUTION:
- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:

The resistance of driver or passenger seat belt pretensioner initiator circuit is above a specified value for specified time.

CODE 41 – DRIVER PRETENSIONER INITIATOR CIRCUIT RESISTANCE HIGH
CODE 45 – PASSENGER PRETENSIONER INITIATOR CIRCUIT RESISTANCE HIGH (Page 2 of 2)

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) With ignition switch OFF, remove front pillar lower trim of applicable side then disconnect seat belt pretensioner connector. 2) Check proper connection to applicable seat belt pretensioner at terminals in "G" or "H" connector. 3) If OK then connect Special Tool (B) to seat belt pretensioner connector disconnected at the step 1). 4) With ignition switch ON, is DTC 41 or 45 still current?	Go to step 2.	1) Ignition switch OFF. 2) Replace seat belt pretensioner (Refer to SECTION 10A).
2	1) With ignition switch OFF, disconnect SDM. 2) Check proper connection to SDM at terminals "A13" and "A14" or "A11" and "A12". 3) If OK then measure resistance between "A13" and "A14" terminals or "A11" and "A12" terminals with connected Special Tool (B). 4) Is resistance 2.9 Ω or less?	Substitute a known-good SDM and recheck.	**DTC41:** Repair high resistance or open in "P" or "W" wire circuit. **DTC45:** Repair high resistance or open in "Lg" or "Br" wire circuit.

Fig. for STEP 1 and 2

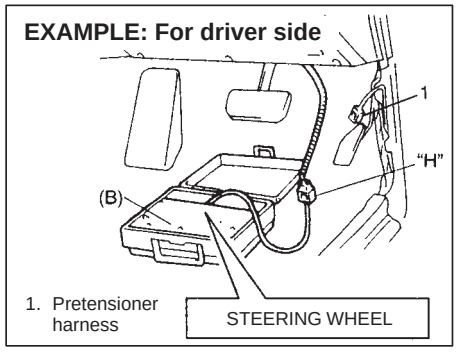
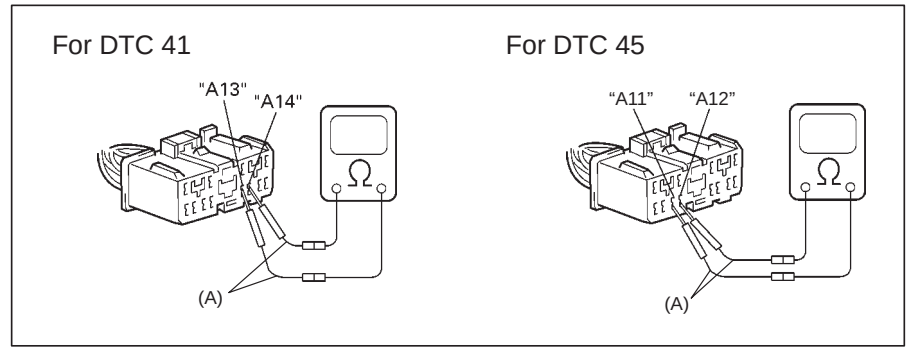


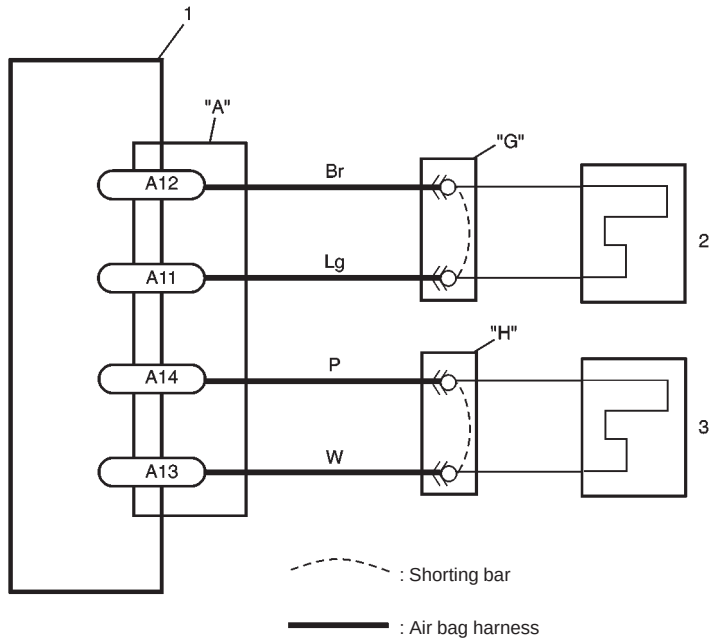
Fig. for STEP 2



Special Tool
(A): 09932-76010
(B): 09932-75010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.
3) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 42 – DRIVER PRETENSIONER INITIATOR CIRCUIT RESISTANCE LOW
CODE 46 – PASSENGER PRETENSIONER INITIATOR CIRCUIT RESISTANCE LOW (Page 1 of 2)



1. SDM
2. Passenger seat belt pretensioner
3. Driver seat belt pretensioner

CAUTION:
- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:

The resistance of driver or passenger seat belt pretensioner initiator circuit is below a specified value for specified time.

CODE 42 – DRIVER PRETENSIONER INITIATOR CIRCUIT RESISTANCE LOW
CODE 46 – PASSENGER PRETENSIONER INITIATOR CIRCUIT RESISTANCE LOW (Page 2 of 2)

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) With ignition switch OFF, remove front pillar lower trim of applicable side then disconnect seat belt pretensioner connector. 2) Check proper connection to applicable seat belt pretensioner at terminals in "G" or "H" connector. 3) If OK then connect Special Tool (B) to seat belt pretensioner connector disconnected at the step 1). 4) With ignition switch ON, is DTC 42 or 46 still current?	Go to step 2.	1) Ignition switch OFF. 2) Replace seat belt pretensioner (Refer to SECTION 10A).
2	1) With ignition switch OFF, disconnect SDM. 2) Check proper connection to SDM at terminals "A13" and "A14" or "A11" and "A12". 3) If OK then measure resistance between "A13" and "A14" terminals or "A11" and "A12" terminals with connected Special Tool (B). 4) Is resistance 1.7 Ω or more?	Substitute a known-good SDM and recheck.	**DTC42:** Repair short from "P" wire circuit to "W" wire circuit or from "P" or "W" wire circuit to other wire circuit. **DTC46:** Repair short from "Lg" wire circuit to "Br" wire circuit or from "Lg" or "Br" wire circuit to other wire circuit.

Fig. for STEP 1 and 2

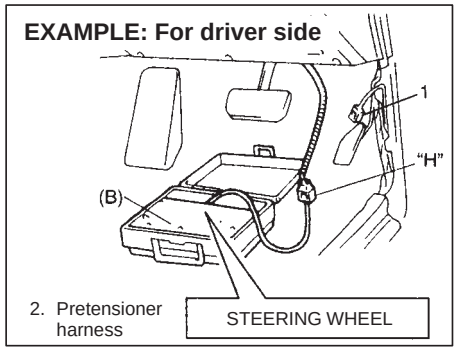
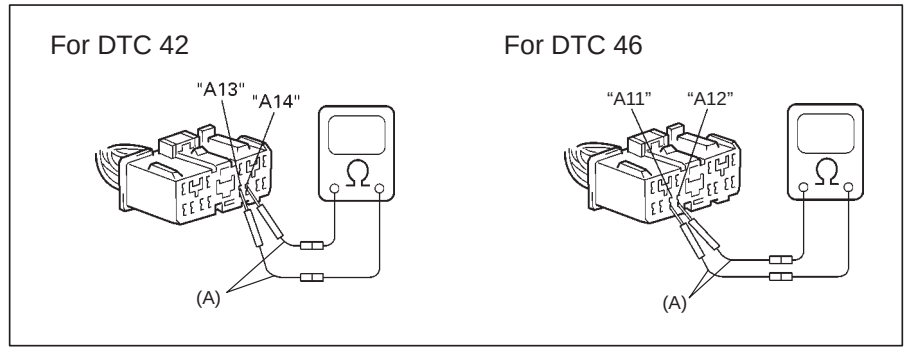


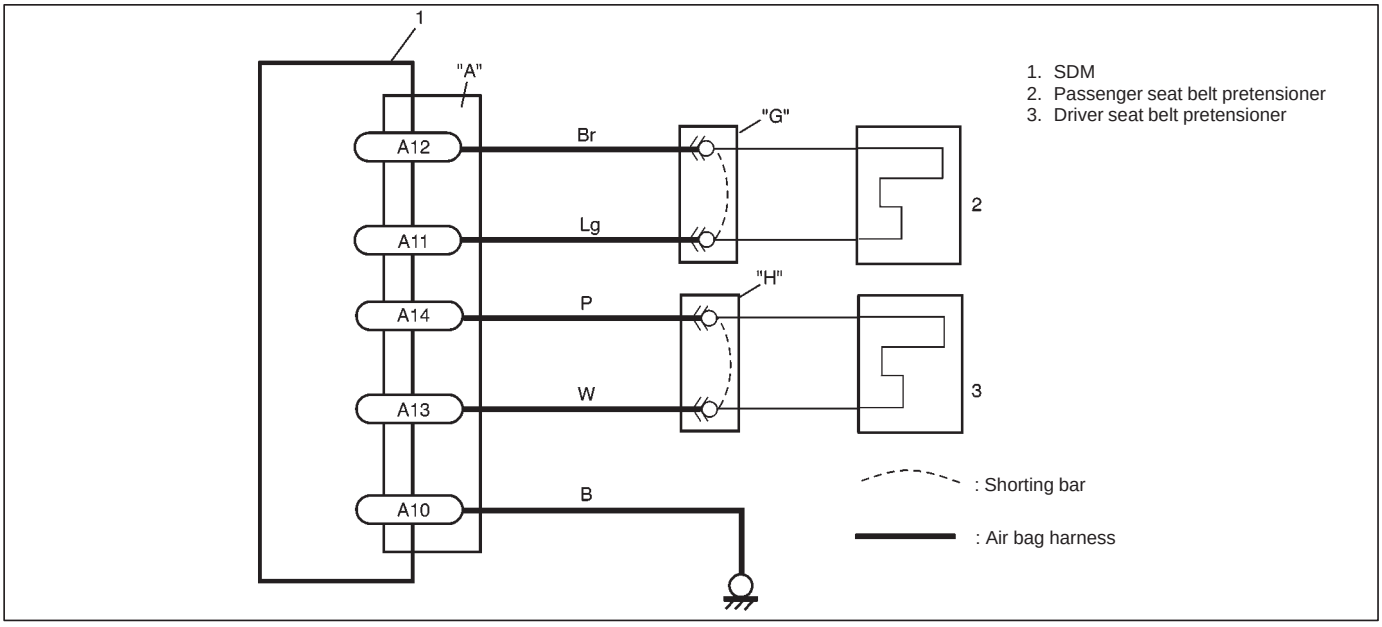
Fig. for STEP 2



Special Tool
(A): 09932-76010
(B): 09932-75010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.
3) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 43 – DRIVER PRETENSIONER INITIATOR CIRCUIT SHORT TO GROUND
CODE 47 – PASSENGER PRETENSIONER INITIATOR CIRCUIT SHORT TO GROUND (Page 1 of 2)



CAUTION:
- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:

The voltage measured at driver or passenger seat belt pretensioner initiator circuit is below a specified value for specified time.

CODE 43 – DRIVER PRETENSIONER INITIATOR CIRCUIT SHORT TO GROUND
CODE 47 – PASSENGER PRETENSIONER INITIATOR CIRCUIT SHORT TO GROUND (Page 2 of 2)

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) With ignition switch OFF, remove front pillar lower trim of applicable side then disconnect seat belt pretensioner connector. 2) Check proper connection to applicable seat belt pretensioner at terminals in "G" or "H" connector. 3) If OK then connect Special Tool (B) to seat belt pretensioner connector disconnected at the step 1). 4) With ignition switch ON, is DTC 43 or 47 still current?	Go to step 2.	1) Ignition switch OFF. 2) Replace seat belt pretensioner (Refer to SECTION 10A).
2	1) With ignition switch OFF, disconnect Special Tool (B) and SDM. 2) Measure resistance between "A13" or "A11" and "A10" terminals. 3) Is resistance 1 kΩ or more?	Substitute a known-good SDM and recheck.	**DTC43:** Repair short "P" or "W" wire circuit to ground. **DTC47:** Repair short from "Lg" or "Br" wire circuit to ground.

Fig. for STEP 1 and 2

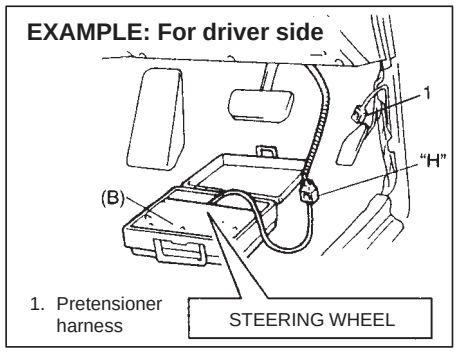
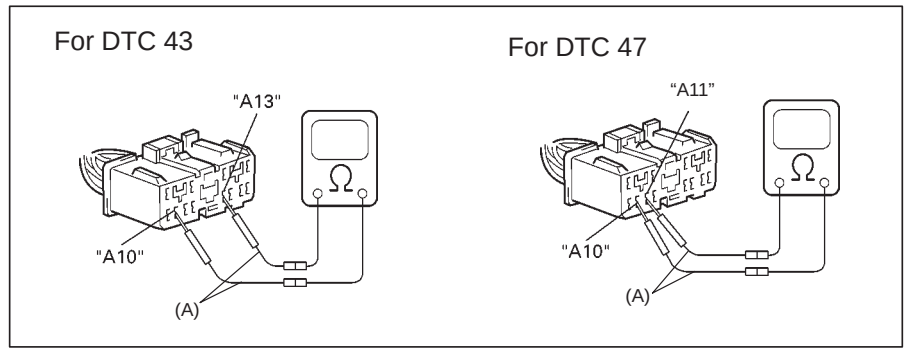


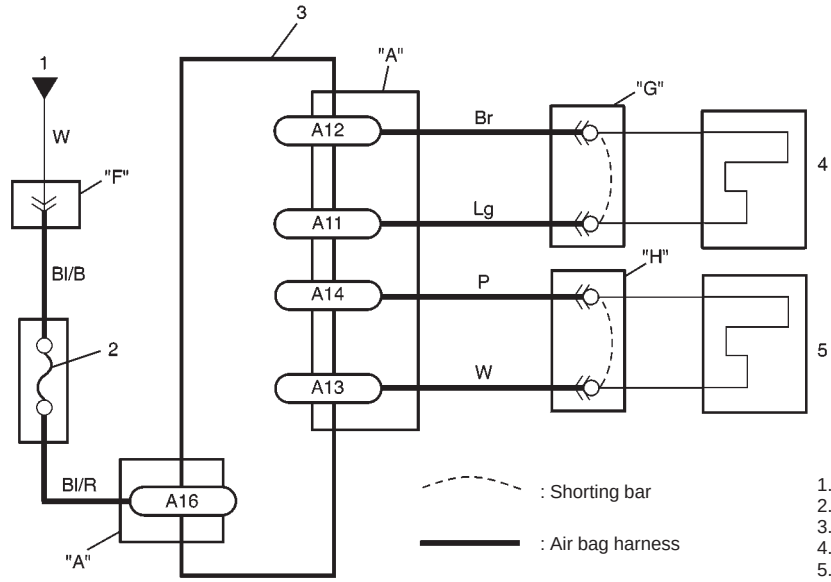
Fig. for STEP 2



Special Tool
(A): 09932-76010
(B): 09932-75010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.
3) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 44 – DRIVER PRETENSIONER INITIATOR CIRCUIT SHORT TO POWER CIRCUIT
CODE 48 – PASSENGER PRETENSIONER INITIATOR CIRCUIT SHORT TO POWER CIRCUIT (Page 1 of 2)



1. From ignition switch
2. "AIR BAG" fuse in "AIR BAG" fuse box
3. SDM
4. Passenger seat belt pretensioner
5. Driver seat belt pretensioner

CAUTION:
- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:

The voltage measured at driver or passenger seat belt pretensioner initiator circuit is above a specified value for specified time.

CODE 44 – DRIVER PRETENSIONER INITIATOR CIRCUIT SHORT TO POWER CIRCUIT
CODE 48 – PASSENGER PRETENSIONER INITIATOR CIRCUIT SHORT TO POWER CIRCUIT (Page 2 of 2)

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) With ignition switch OFF, remove front pillar lower trim of applicable side then disconnect seat belt pretensioner connector. 2) Check proper connection to applicable seat belt pretensioner at terminals in "G" or "H" connector. 3) If OK then connect Special Tool (B) to seat belt pretensioner connector disconnected at the step 1). 4) With ignition switch ON, is DTC 44 or 48 still current?	Go to step 2.	1) Ignition switch OFF. 2) Replace seat belt pretensioner (Refer to SECTION 10A).
2	1) With ignition switch OFF, disconnect Special Tool (B) and SDM. 2) Measure voltage from "A14" or "A12" terminal to body ground. 3) With ignition switch ON, is voltage 1 V or less?	Substitute a known-good SDM and recheck.	**DTC44:** Repair short "P" or "W" wire circuit to power circuit. **DTC48:** Repair short from "Lg" or "Br" wire circuit to power circuit.

Fig. for STEP 1 and 2

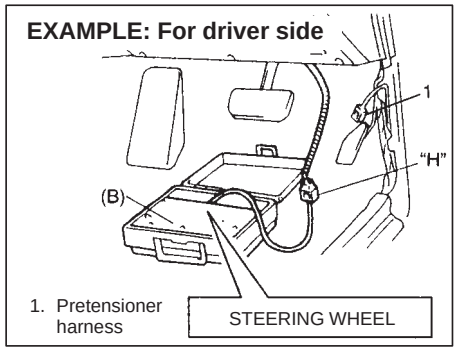
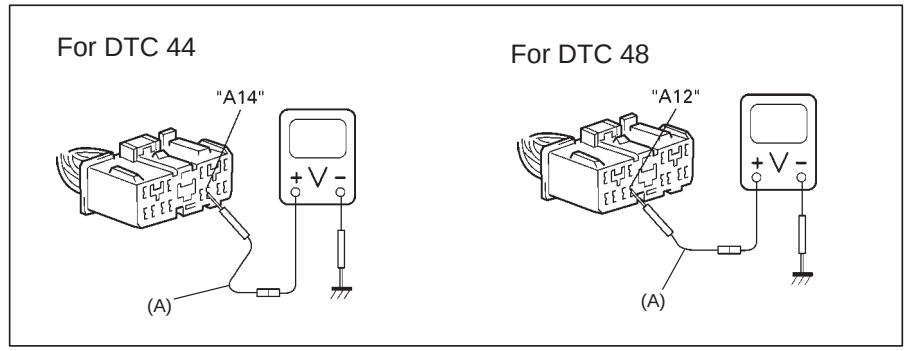


Fig. for STEP 2



Special Tool
(A): 09932-76010
(B): 09932-75010

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Clear diagnostic trouble codes (refer to "Diagnostic Trouble Code (DTC) Clearance"), if any.
3) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.

CODE 51 – FRONTAL CRASH DETECTED (SYSTEM ACTIVATION COMMAND IS OUTPUTTED)

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/activation command.)

NOTE:

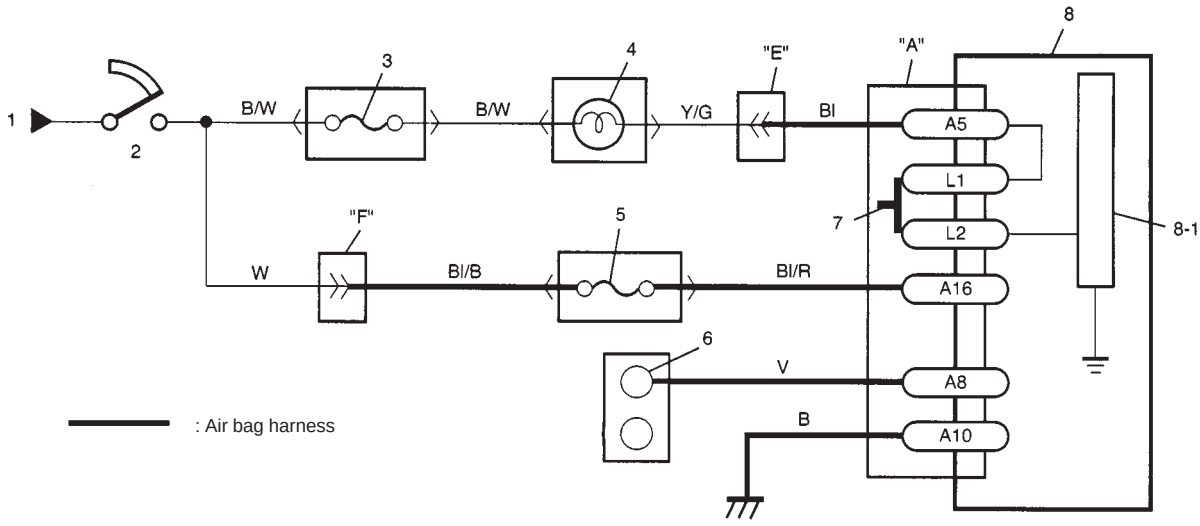
Before executing items in this table, be sure to perform "Air Bag Diagnostic Check Flow Table".

STEP	ACTION	YES	NO
1	1) Ignition switch OFF. 2) Has air bag system 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. 2) 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:

- **CODE 51 can never be cleared once it has been set.**
- **Upon completion of inspection and repair work, perform following items.**
  1) **Replace SDM.**
  2) **Reconnect all air bag system components, ensure all components are properly mounted.**
  3) **Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11 to confirm that the trouble has been corrected.**

CODE 61 – "AIR BAG" WARNING LAMP CIRCUIT FAILURE (Page 1 of 2)



1. From main fuse
2. Ignition switch
3. "IG·COIL METER" fuse in J/B
4. "AIR BAG" warning lamp in combination meter
5. "AIR BAG" fuse in "AIR BAG" fuse box
6. "AIR BAG" monitor coupler
7. Connection detection pin
8. SDM

8-1. "AIR BAG" warning lamp driver circuit

CAUTION:

- **When measurements are requested in this chart use specified digital multimeter with correct terminal adapter from special tool (Connector test adapter kit).**
- **When a check for proper connection is requested refer to "Intermittent and Poor Connections" in this section.**
- **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.**

DTC WILL SET WHEN:

The voltage at the "AIR BAG" warning lamp circuit terminal "A5" does not match the commanded state of the warning lamp driver for specified time.

CODE 61 – "AIR BAG" WARNING LAMP CIRCUIT FAILURE (Page 2 of 2)

NOTE:
Before executing items in this table, be sure to perform "Air Bag Diagnostic System Check 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 Flow Table" may also result in misdiagnosis. Therefore, check "AIR BAG" warning lamp circuit again according to "Air Bag Diagnostic System Check Flow Table". 2) Is "AIR BAG" warning lamp circuit in good condition?	Go to step 2.	Repair "AIR BAG" warning lamp circuit.
2	1) Clear diagnostic trouble codes. 2) Is DTC 61 set ?	Substitute a known-good SDM and recheck.	Recheck air bag system, referring to "Air Bag Diagnostic System Check Flow Table".

NOTE:
Upon completion of inspection and repair work, perform following items.
1) Reconnect all air bag system components, ensure all components are properly mounted.
2) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p. 10B-11 to confirm that the trouble has been corrected.

CODE 71 – INTERNAL SDM FAULT

DTC WILL SET WHEN:
An internal SDM fault is detected by SDM.

NOTE:
CODE 71 can never be cleared once it has been set.

1) Ignition switch OFF.
2) Replace SDM.
3) Repeat "Air Bag Diagnostic System Check Flow Table", referring to p.10B-11.

ON-VEHICLE SERVICE

SERVICE PRECAUTIONS

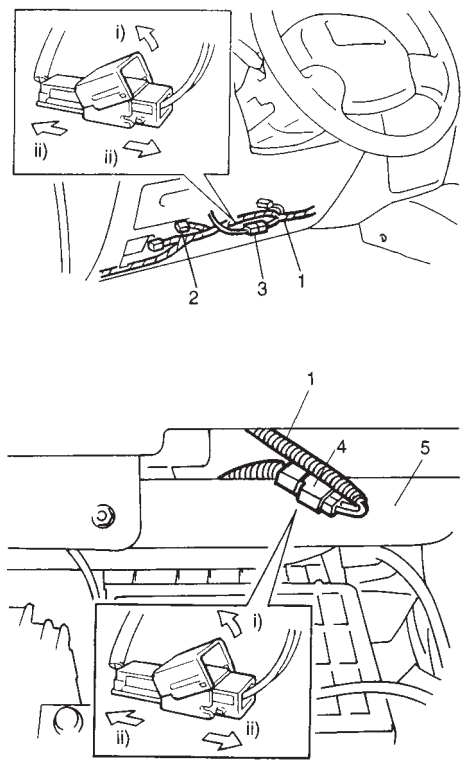
SERVICE AND DIAGNOSIS

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 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) modules (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.
- 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 chart 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 servicing, if shocks may be applied (eg., dropped from a height of 90 cm (3 ft) or more) to air bag system component parts, remove those parts beforehand.
- When using electric welding, be sure to disconnect air bag (inflator) module 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. Refer to appropriate service manual procedures. Failure to follow procedures could result in possible air bag system activation, personal injury or unneeded air bag system repairs.

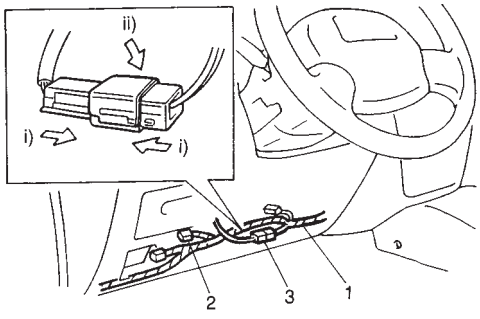


1. Air bag harness
2. "AIR BAG" monitor coupler
3. Yellow connector of contact coil and combination switch assembly
4. Yellow connector of passenger air bag (inflator) module
5. Steering support member

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 from "AIR BAG" fuse box.
4) Disconnect Yellow connector of contact coil and combination switch assembly.
   i) Release locking of lock lever.
   ii) After unlocked, disconnect to connector.
5) Pull out glove box while pushing its stopper from both right and left sides and disconnect Yellow connector of passenger air bag (inflator) module.
   i) Release locking of lock lever.
   ii) After unlocked, disconnect to connector.

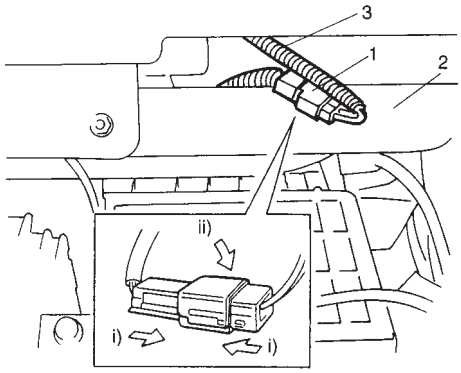
NOTE:
With "AIR BAG" fuse removed and ignition switch ON, "AIR BAG" warning lamp will be ON.
This is normal operation and does not indicate an air bag system malfunction.



1. Air bag harness
2. "AIR BAG" monitor coupler
3. Yellow connector of contact coil and combination switch assembly

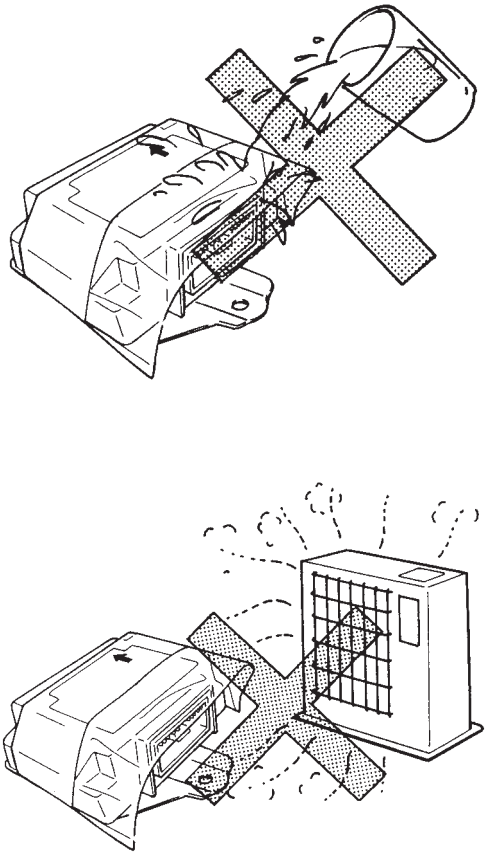
ENABLING AIR BAG SYSTEM

1) Turn ignition switch to "LOCK" and remove key.
2) Connect Yellow connector of contact coil and combination switch assembly, and be sure to lock connector with lock lever.
   i) Connect connector.
   ii) Lock connector with lock lever.



1. Yellow connector of passenger air bag (inflator) module
2. Steering support member
3. Air bag harness

3) Connect Yellow connector of passenger air bag (inflator) module, and be sure to lock connector with lock lever.
   i) Connect connector.
   ii) Lock connector with lock lever.
4) Install glove box.
5) Install "AIR BAG" fuse to "AIR BAG" fuse box.
6) Turn ignition switch to ON and verify that "AIR BAG" warning lamp flashes 6 times and then turns off.
   If it does not operate as described, perform "Air Bag Diagnostic System Check" in this section.



HANDLING AND STORAGE

SDM

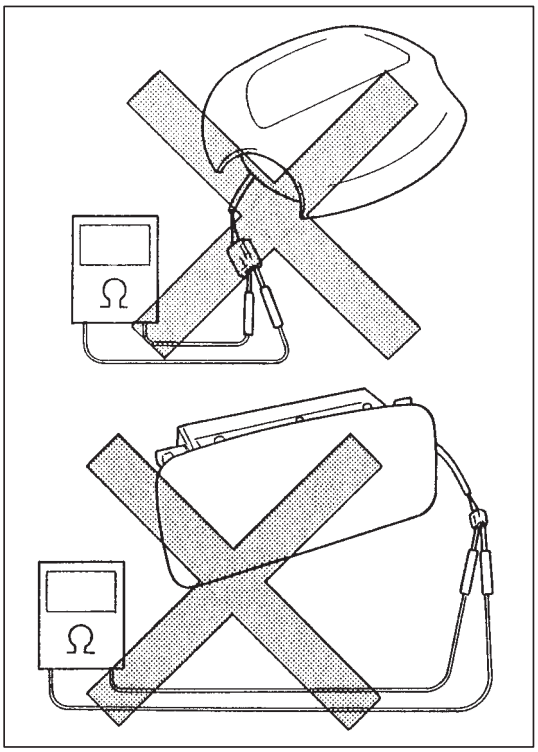
WARNING:
Never power up air bag system when SDM is not rigidly attached to the vehicle. Otherwise, personal injury may result.

CAUTION:
After detecting one time of such collision as to meet deployment conditions, the SDM must not be used.
Refer to "Diagnosis" when checking the SDM.

- Never attempt disassembly of SDM.
- When storing SDM, select a place where neither high temperature nor high humidity is anticipated and oil, water and dust are kept off.
- If SDM was dropped from a height of 90 cm (3 ft) or more or if it is found to be damaged or deformed, replace it with a new one.
- If installation part of SDM was damaged, repair that part completely before reinstallation.
- All SDM and mounting bracket fasteners must be carefully torqued and the arrow must be pointed toward the front of the vehicle to ensure proper operation of the air bag system.

LIVE (UNDEPLOYED) AIR BAG (INFLATOR) MODULES

Special care is necessary when handling and storing a live (undeployed) air bag (inflator) modules.
The rapid gas generation produced during deployment of the air bag could cause the air bag (inflator) module, or an object in front of the air bag (inflator) module, to be thrown through the air in the unlikely event of an accidental deployment.



WARNING:
Never attempt to measure the resistance of the air bag (inflator) modules (driver and passenger). It is very dangerous as the electric current from the tester may deploy the air bag.

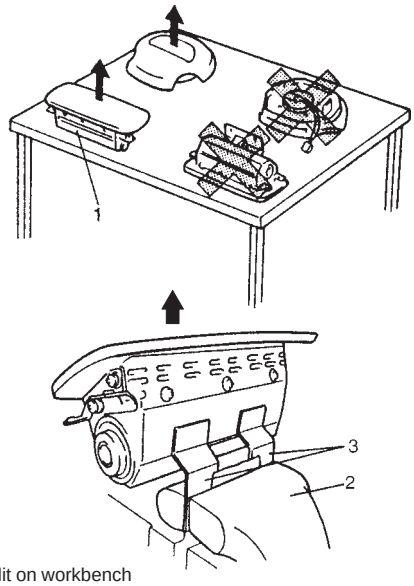
- Never attempt disassembly of the air bag (inflator) modules.
- If any abnormality is found, be sure to replace it with new one as an assembly.
- When an abnormality is noted as existing in the live (undeployed) air bag (inflator) module, be sure to deploy it before discarding it.
- When grease, cleaning agent, oil, water, etc., got on the air bag (inflator) modules (driver and passenger), wipe it off immediately with a dry cloth.
- If air bag (inflator) module was dropped from a height of 90 cm (3 ft) or more, it should be replaced with a new one as an assembly.

ALWAYS CARRY AIR BAG (INFLATOR) MODULE WITH TRIM COVER (AIR BAG OPENING) AWAY FROM BODY.

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.**

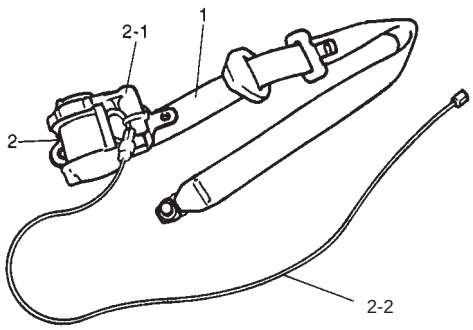
Otherwise, personal injury may result.

ALWAYS PLACE AIR BAG (INFLATOR) MODULE ON WORKBENCH WITH TRIM COVER (AIR BAG OPENING) UP, AWAY FROM LOOSE OBJECTS.



1. Slit on workbench
2. Workbench vise
3. Lower mounting bracket

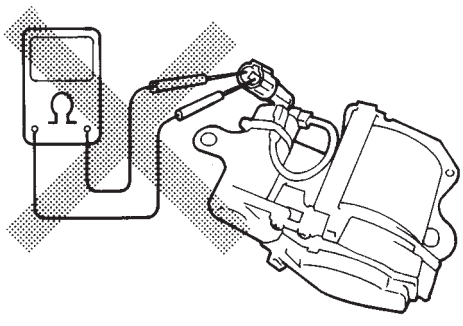
WARNING:
When placing a live air bag (inflator) module on bench or other surface, always face the bag up, away from the surface. As the live passenger air bag (inflator) module must be placed with its bag (trim cover) facing up, place it on the workbench with a slit or use the workbench vise to hold it securely at its lower mounting bracket.
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.



1. Webbing
2. Retractor assembly
2-1. Seat belt pretensioner
2-2. Seat belt pretensioner harness

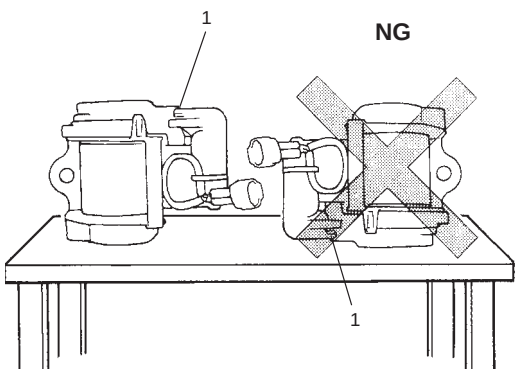
LIVE (INACTIVATED) SEAT BELT PRETENSIONERS

Special care is necessary when handling and storing a live (inactivated) seat belt pretensioners.
Also, when the seat belt pretensioners activate, gas is generated and the seat belt is retracted into the retractor 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.



1. Exhaust hole

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 wires or connector on the underside of the 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 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.

DEPLOYED AIR BAG (INFLATOR) MODULES

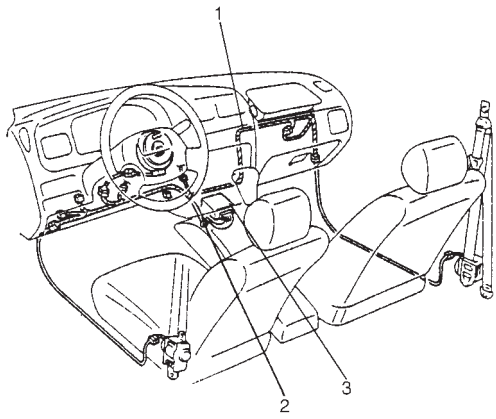
WARNING:
- **The air bag (inflator) module immediately after deployment is very hot. Wait for at least 30 minutes to cool it off before proceeding the work.**
- **Do not apply water, oil, etc. to deployed air bag (inflator) module.**
- **After an air bag (inflator) module has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and byproducts 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) Modules Disposal" in this section.

ACTIVATED SEAT BELT PRETENSIONERS

WARNING:
- **The seat belt pretensioner immediately after 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 activated seat belt pretensioner.**
- **With many service procedures, gloves and safety glasses should be worn to prevent any possible irritation of the skin or eyes.**
- **Wash your hands with mild soap and water after completing the work.**

Refer to the procedure described under "Activated Seat Belt Pretensioners Disposal" in this section.



1. Air bag wire harness
2. Ground
3. SDM case ground

AIR BAG WIRE HARNESS AND CONNECTORS

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.
- When installing it, be careful so that the air bag wire harness is not caught or does not interfere with other parts.
- Make sure all air bag system grounding points 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 the air bag according to deployment procedure described under “Air Bag (Inflator) Modules Disposal” and to activate the pretensioner according to activation procedure described under “Seat Belt Pretensioners Disposal”.

WARNING:
Failure to follow proper air bag (inflator) module and seat belt pretensioner disposal procedures can result in air bag deployment and pretensioner activation which could cause personal injury. Undeployed air bag (inflator) module and inactivated seat belt pretensioner must not be disposed of through normal refuse channels.
The undeployed air bag (inflator) module and inactivated seat belt pretensioner contain substances that can cause severe illness or personal injury if the sealed container is damaged during disposal.

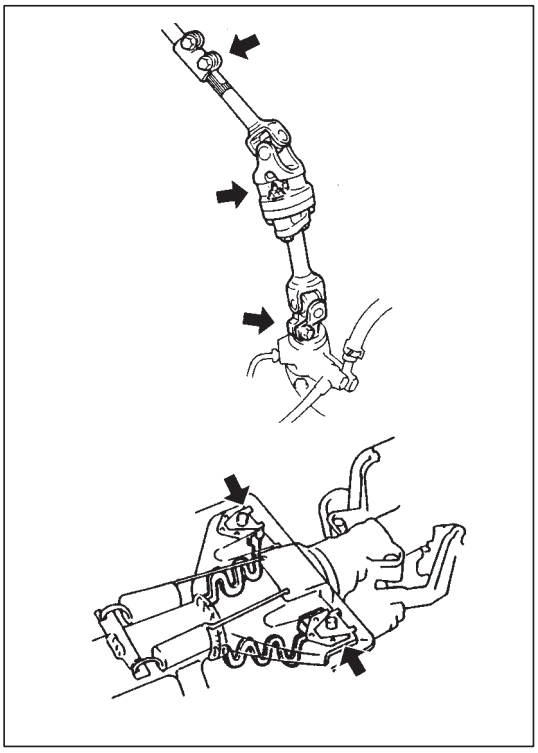
REPAIRS AND INSPECTIONS REQUIRED AFTER AN ACCIDENT

CAUTION:
- **All air bag system components, including the electrical harness (component mounting points), must be inspected after an accident. If any components are damaged or bent, they must be replaced even if air bag system activation did not occur.**
- **Never use air bag system parts from another vehicle.**
- **Do not attempt to service the parts below. Service of these parts is by replacement only.**
  - **– Driver/Passenger air bag (inflator) module**
  - **– Driver/Passenger seat belt pretensioner**
  - **– SDM**
  - **– Contact coil and combination switch assembly**
  - **– Air bag wire harness**
- **Proper operation of the sensors and 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 "Diagnosis" when checking the SDM.

ACCIDENT WITH DEPLOYMENT – COMPONENT REPLACEMENT

Certain air bag system components must be replaced. Those components are:
- Driver and passenger air bag (inflator) modules
  - – Replace with new one.
- Driver and passenger seat belt pretensioners
  - – Replace with new one as an assembly.
- SDM after detecting such collision as to meet deployment conditions
  - – Replace with new one.

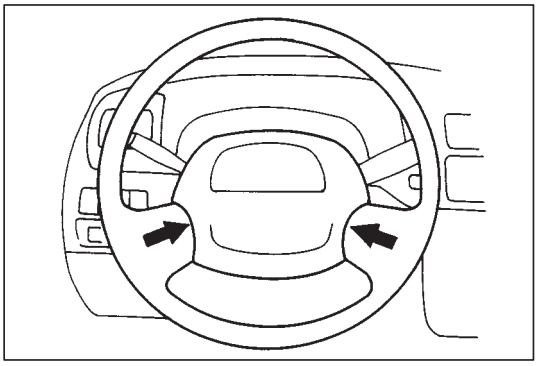


ACCIDENT WITH OR WITHOUT DEPLOYMENT – COMPONENT INSPECTIONS

Certain air bag and restraint system components must be inspected after any crash, whether the air bag deployed or not.
Those components are:

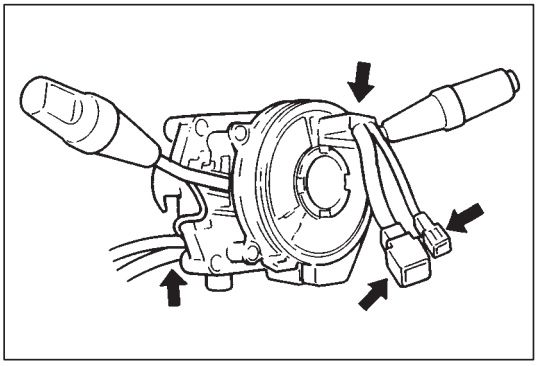
- Steering column and shaft joints
  – Check for length, damage and bend according to “Checking Steering Column for Accident Damage” in SECTION 3C1.
- Steering column bracket and capsules
  – Check for damage and bent.

  If any faulty condition is found in above checks, replace faulty part.



- Steering wheel and driver air bag (inflator) module
  – Check for damage or air bag (inflator) module fitness.
  – Check trim cover (pad surface) for cracks.
  – Check wire harness and connector for damage or tightness.

  If any faulty condition is found in above checks, replace faulty part.

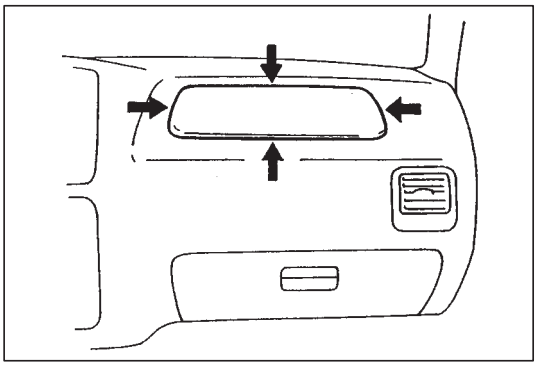


- Contact coil and combination switch assembly
  – Check wire harness and connectors for damage or tightness.
  – Check contact coil case for damage.

  If any faulty condition is found in above checks, replace.

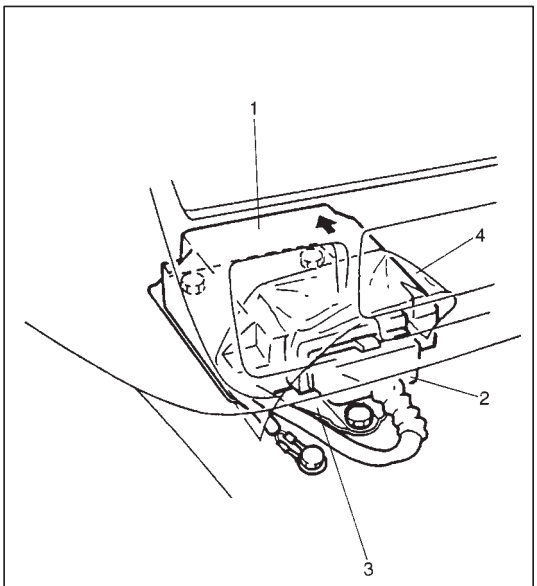
- Instrument panel member and reinforcement
  – Check for any distortion, bending, cracking or other damage.

  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.

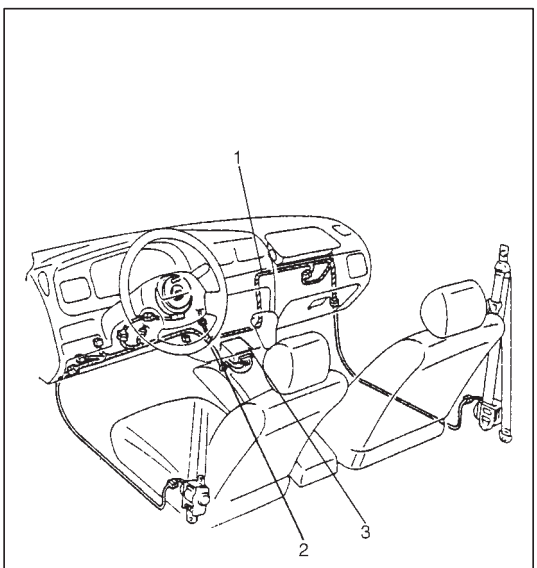
  If any faulty condition is found in above checks, replace.



1. SDM
2. SDM connector
3. SDM plate
4. SDM cover

- SDM and SDM plate
  - Check for external damage such as deformation, scratch, crack, peeled paint, etc.
  - Check whether SDM can installed properly due to a cause in itself. (There is a gap between SDM and SDM plate, or it cannot be fixed securely.)
  - Check whether connector or lead wire of SDM has a scorching, melting or damage.
  - Check whether connector can be connected securely or locked.
  - Check SDM connector and terminals for tightness.
  - Check SDM sets a diagnostic trouble code and the diagnostic table leads to a malfunctioning SDM.

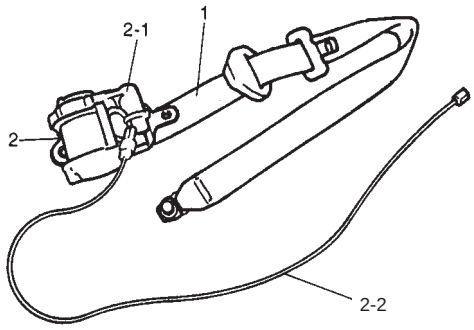
  If any faulty condition is found in above checks, replace.



1. Air bag wire harness
2. Ground
3. SDM case ground

- Air bag wire harness and connections
  - Check for damages, deformities or poor connections.
    (Refer to “Intermittent And Poor Connections” in this section.)
  - Check wire harness clamps for tightness.

  If any faulty condition is found, correct or replace.



1. Webbing
2. Retractor assembly
2-1. Seat belt pretensioner
2-2. Seat belt pretensioner harness

- 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 SECTION 10A.
- “AIR BAG” warning lamp (air bag system)
  – After vehicle is completely repaired, perform “Air Bag Diagnostic System Check” under “Diagnosis” in this section.

DRIVER AIR BAG (INFLATOR) MODULE

Refer to SECTION 3C1 for removal, inspection and installation.

CONTACT COIL AND COMBINATION SWITCH ASSEMBLY

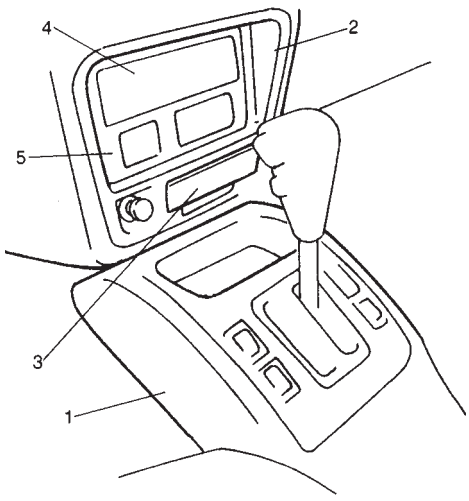
Refer to SECTION 3C1 for removal, inspection and installation.

SEAT BELT PRETENSIONER

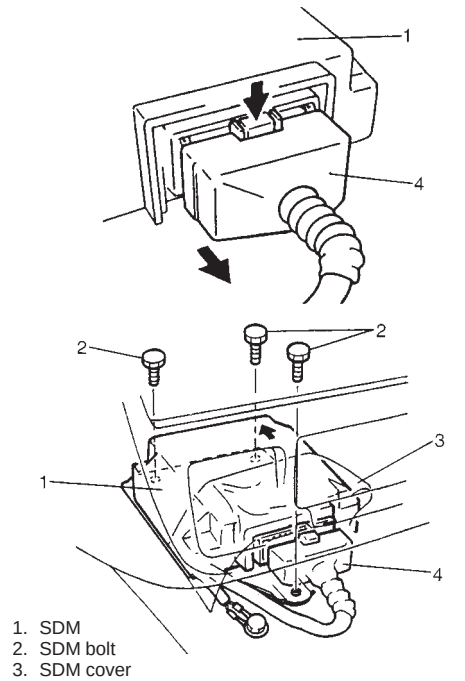
Refer to SECTION 10A for removal, inspection and installation.

“AIR BAG” WARNING LAMP

Refer to SECTION 8C for removal and installation of combination meter.



1. Front center console box
2. Center garnish panel
3. Ashtray
4. Radio hole cover
5. Clock assembly



1. SDM
2. SDM bolt
3. SDM cover
4. SDM connector

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" earlier in this section.
3) Remove rear and front center console box by removing screw and clips.
4) Remove center garnish panel.
5) Remove ashtray and tuner assembly, clock assembly, tuner pocket, radio hole cover, etc.
6) Disconnect SDM connector from SDM.
7) Remove SDM (with SDM plate) as an assembly from vehicle.

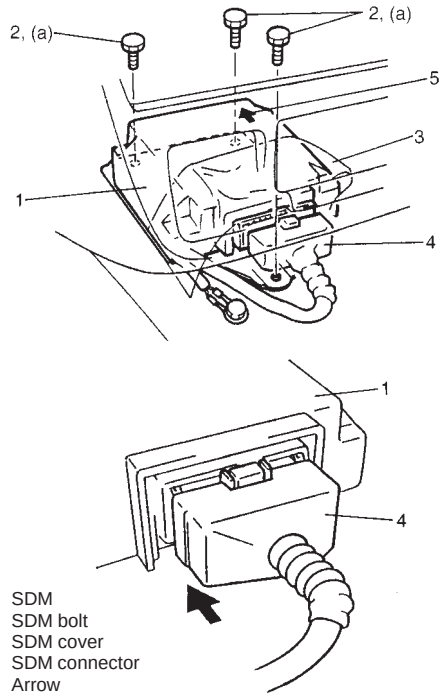
NOTE:
Do not separate SDM and SDM plate.

INSPECTION

CAUTION:
- **Do not connect a tester whatever type it may be.**
- **Never repair or disassemble SDM.**
- **If SDM was dropped from a height of 90 cm (3 ft) or more, it should be replaced.**

- Check SDM and SDM plate for dents, cracks or deformation.
- Check SDM connector for damage, cracks or lock mechanism.
- Check SDM terminal for bent, corrosion or rust.

If any faulty condition is found in above checks, replace.



1. SDM
2. SDM bolt
3. SDM cover
4. SDM connector
5. Arrow

INSTALLATION

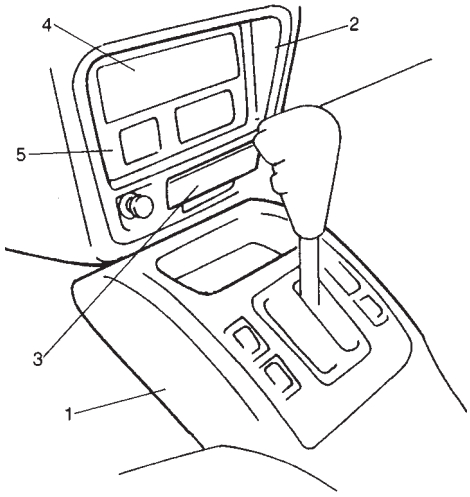
1) Check that none of following faulty conditions exists.
   - Bend, scratch, deformity in vehicle body mounted on SDM
   - Foreign matter or rust on mating surface of vehicle body mounted on SDM
2) Install SDM (with SDM plate) to vehicle.

CAUTION:
Ensure that arrow on the SDM is pointing toward the front of the vehicle.

3) Tighten SDM bolts to specified torque.

   Tightening Torque
   (a): 6.0 N·m (0.6 kg-m, 4.5 lb-ft)

4) Connect SDM connector to SDM securely.

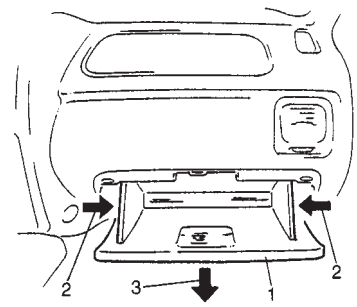


1. Front center console box
2. Center garnish panel
3. Ashtray
4. Radio hole cover
5. Clock assembly

5) Install tuner assembly, clock assembly, tuner pocket, radio hole cover, etc. and ashtray.
6) Install center garnish panel.
7) Install front and rear center console box.
8) Connect negative cable to battery.
9) Enable air bag system. Refer to “Enabling Air Bag System” earlier in this section.

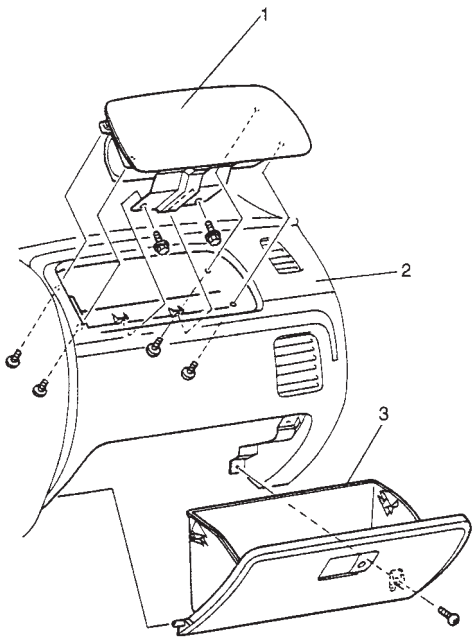
PASSENGER AIR BAG (INFLATOR) MODULE

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 battery cable at battery.
2) Disable air bag system. Refer to "Disabling Air Bag System" earlier in this section.
3) Open glove box, then while pressing glove box stopper, pull out glove box from instrument panel.

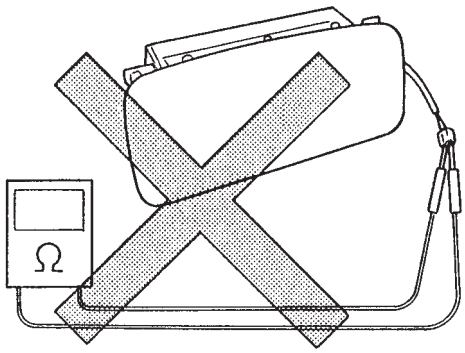


1. Passenger air bag (inflator) module
2. Instrument panel
3. Glove box

4) Remove glove box from instrument panel.
5) Remove passenger air bag (inflator) module attaching bolts and screws, and passenger air bag (inflator) module from vehicle.

WARNING:
- **When carrying a live air bag (inflator) module, make sure the bag opening is pointed away from you.**
  Never carry air bag (inflator) module by wires or connector on the side of the module. In case of an accidental deployment, the bag will then deploy with minimal chance of injury.
- **As the live passenger air bag (inflator) module must be kept with its bag (trim cover) facing up while being stored or left standing, place it on the workbench with a slit or use the workbench vise to hold it securely at its lower mounting bracket. This is necessary so that a free space is provided to allow the air bag to expand in the unlikely event of accidental deployment.**
- **Observe "Service Precautions" earlier in this section for handling and storing it.**

Otherwise personal injury may result.



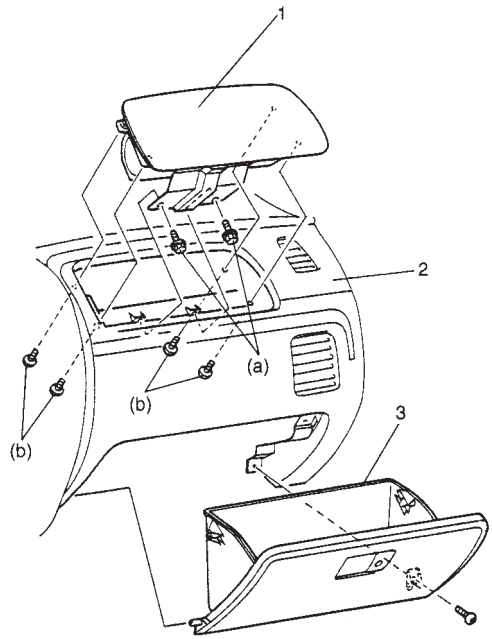
INSPECTION

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 (e.g., dropping) was applied to it.



1. Passenger air bag (inflator) module
2. Instrument panel
3. Glove box

INSTALLATION

1) Install passenger air bag (inflator) module to vehicle.
2) Tighten passenger air bag (inflator) module attaching bolts and screws to specified torque.

   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 16.5 lb-ft)
   (b): 5.5 N·m (0.55 kg-m, 4.0 lb-ft)

3) Connect negative battery cable to battery.
4) Enable air bag system. Refer to “Enabling Air Bag System” earlier in this section.

AIR BAG (INFLATOR) MODULES DISPOSAL

WARNING:
Failure to follow proper air bag (inflator) module disposal procedures can result in air bag deployment which may cause personal injury. Undeployed air bag (inflator) module must not be disposed of through normal refuse channels.
The undeployed air bag (inflator) module contain substances that can cause severe illness or personal injury if the sealed container is damaged during disposal.

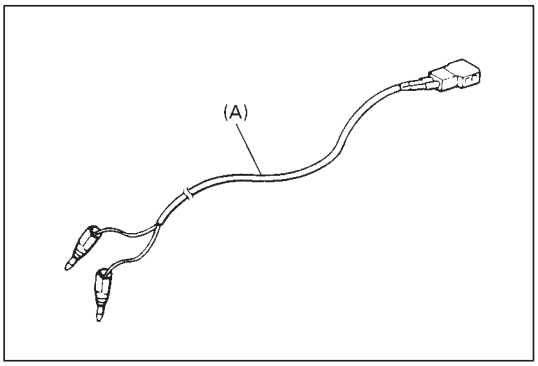
Do not dispose of the live (undeployed) air bag (inflator) modules.
The method employed depends upon the final disposition of the particular vehicle, as noted in “Deployment Outside Vehicle” and “Deployment Inside Vehicle” in this section.
Deployment Outside Vehicle . . . . . disposing of the air bag (inflator) module(s) only (i.e., the vehicle itself will be used again).
Deployment Inside Vehicle . . . . . scrapping the entire vehicle including the air bag (inflator) module(s).

DEPLOYMENT OUTSIDE VEHICLE

Use this procedure when the vehicle itself is used again (only the air bag (inflator) module(s) are disposed of).

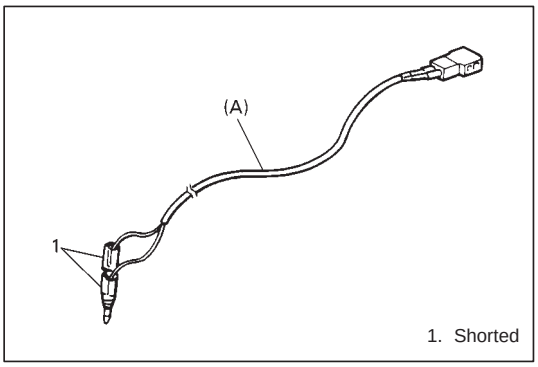
WARNING:
Following precautions must be observed for this work. Failure to observe any of them may result in personal injury.
- **To avoid an accidental deployment, this work should be performed by no more than one person.**
- **The procedure should be followed strictly as described here.**
- **Be sure to read “Service Precautions” in this section for the air bag (inflater) module beforehand.**
- **Never connect deployment harness to any power source before connecting deployment harness to the air bag (inflator) module. Deployment harness shall remain shorted and not be connected to a power source until the air bag is to be deployed.**
- **Since a large amount of smoke is produced when air bag is deployed, select a well-ventilated area.**
- **The air bag (inflator) module will immediately deploy the air bag when a power source is connected to it. Wear safety glasses throughout this entire deployment and disposal procedure.**
- **Wear suitable ear protection when deploying air bag. Also, advise those who are in the area close to deployment site to wear suitable ear protection.**
- **Do not deploy driver and passenger air bag (inflator) modules at the same time.**

The following procedure requires use of special tool(s) (deployment harness and passenger air bag (inflator) module deployment fixture). Do not attempt procedure without it (them).



1) Turn ignition switch to “LOCK”, remove key and put on safety glasses.
2) Check that there is no open, short or damage in special tool (deployment harness). If any faulty is found, do not use it and be sure to use new deployment harness.

Special Tool
(A): 09932-75030



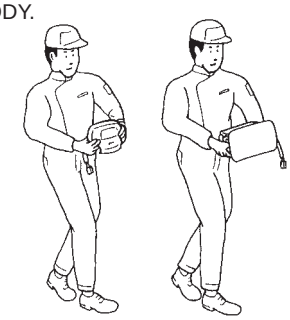
1. Shorted

3) Short the two deployment harness leads together by fully seating one banana plug into the other.

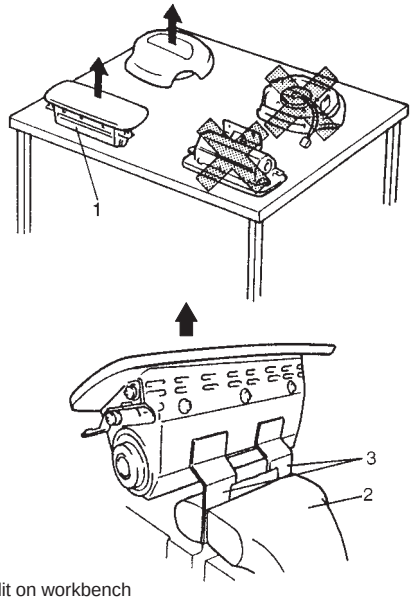
WARNING:
Deployment harness shall remain shorted and not be connected to a power source until the air bag is to be deployed.

Special Tool
(A): 09932-75030

ALWAYS CARRY AIR BAG (INFLATOR) MODULE WITH TRIM COVER (AIR BAG OPENING) AWAY FROM BODY.



ALWAYS PLACE AIR BAG (INFLATOR) MODULE ON WORKBENCH WITH TRIM COVER (AIR BAG OPENING) UP, AWAY FROM LOOSE OBJECTS.



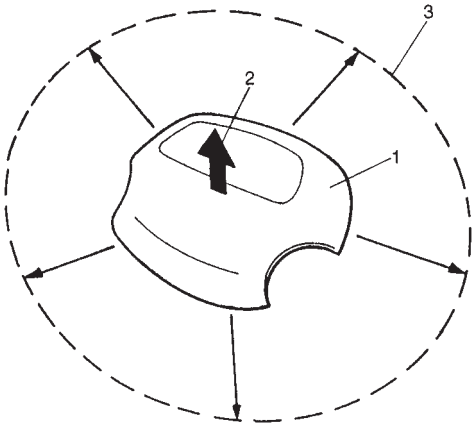
1. Slit on workbench
2. Workbench vise
3. Lower mounting bracket

4) Remove driver or passenger air bag (inflator) module from vehicle, referring to SECTION 3C1 or 10B.

WARNING:
- **Always carry live air bag (inflator) module with trim cover away from you.**
- **When storing a live air bag (inflator) module or when leaving a live air bag (inflator) module unattended on a bench or other surface, always face the bag and trim cover up and 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 or use the workbench vise to hold it securely at its lower mounting bracket.**
  This is necessary so that a free space is provided to allow the air bag to expand in the unlikely event of accidental deployment.

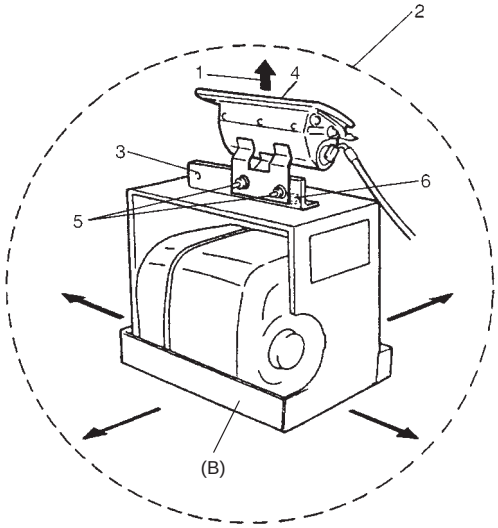
Failure to follow procedures may result in personal injury.

5) Temporarily place driver or passenger air bag (inflator) module on the workbench or the vise according to above WARNING.



1. Driver air bag (inflator) module
2. Trim cover must face up
3. 185 cm (6 ft) of clearance

6) [In case of Driver Air Bag (Inflator) Module]
   i) Clear a space on the ground about 185 cm (6 ft) in diameter where the driver air bag (inflator) module is to be deployed. A paved, outdoor location where there is no activity is preferred. If an outdoor location is not available, a space on the shop floor where there is no activity and sufficient ventilation is recommended.
   Ensure no loose or flammable objects are within the deployment area.
   ii) Place the driver air bag (inflator) module, with its vinyl trim cover facing up, on the ground in the space just cleared.



1. Trim cover must face up
2. 185 cm (6 ft) of clearance
3. Mounting attachment
4. Bag opening side
5. M8 bolt and nut
6. Hold-down bolt and nut

[In case of Passenger Air Bag (Inflator) Module]
   i) Clear a space on the ground about 185 cm (6 ft) in diameter where the fixture (special tool) with attached air bag (inflator) module is to be placed for deployment. A paved outdoor location where there is no activity is preferred. If an outdoor location is not available, a space on the shop floor where there is no activity and sufficient ventilation is recommended. Ensure that no loose or flammable objects are within the deployment area.
   ii) Place special tool (passenger air bag (inflator) module deployment fixture) on the ground in the space cleared in step i), if it has not already been placed there.
   Special Tool
   (B): 09932-75040

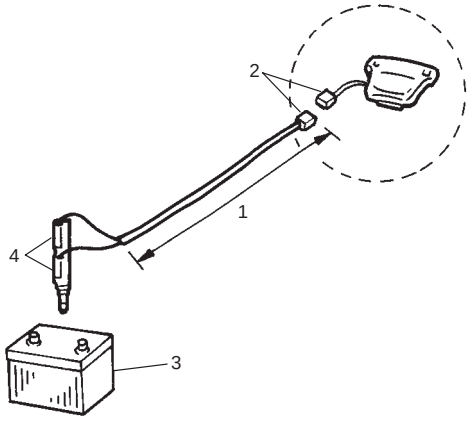
   iii) Fill plastic reservoir in fixture (special tool) with water or sand. This is necessary to provide sufficient stabilization of the fixture during deployment.
   iv) Securely attach the passenger air bag (inflator) module in the fixture (special tool) using mounting attachment, hold-down bolts and nuts and M8 bolts and nuts.

CAUTION:
Be sure to use the following bolt and nut for fixing passenger air bag (inflator) module to mounting attachment. Size: M8, Strength: 7T

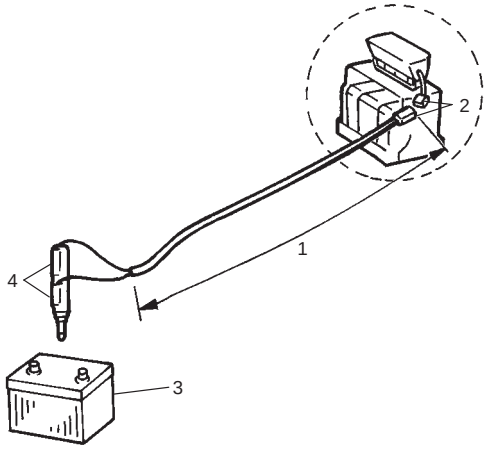
Passenger air bag (inflator) module must be mounted so that the bag will deploy upward. Securely tighten all fastener prior to deployment.

7) Stretch the deployment harness from the driver or passenger air bag (inflator) module to its full length 10 m (33 ft).
8) Place a power source near the shorted end of the deployment harness. Recommended application: 12 Volts minimum, 2 amps minimum. A vehicle battery is suggested.
9) Verify that the area around the driver or passenger air bag (inflator) module is clear of all people and loose or flammable objects.
10) [In case of Driver Air Bag (Inflater) Module]
Verify that the driver air bag (inflator) module is resting with its vinyl trim cover facing up.
[In case of Passenger Air Bag (Inflator) Module]
Verify that the passenger air bag (inflator) module is firmly and properly secured in passenger air bag (inflator) module deployment fixture (special tool).

For driver air bag (inflator) module



For passenger air bag (inflator) module



1. Stretch deployment harness to full length 10 m (33 ft).
2. Connect connectors.
3. Power source (12V vehicle battery).
4. Short the two deployment harness leads.

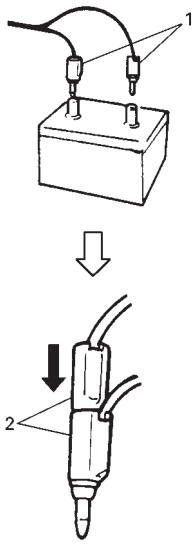
11) Connect the driver or passenger air bag (inflator) module to the deployment harness connector and lock connector with lock lever.
12) Notify all people in the immediate area that you intend to deploy the air bag (inflator) module.

NOTE:

- **When the air bag deploys, the rapid gas expansion will create a substantial report. Wear suitable ear protection. Notify all people in the immediate area that you intend to deploy the air bag (inflator) module and suitable ear protection should be worn.**
- **When the air bag deploys, the driver air bag (inflator) module may jump about 30 cm (1 ft) vertically. This is a normal reaction of the driver air bag (inflator) module to the force of the rapid gas expansion inside the air bag.**
- **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 byproducts of the chemical reaction.**

WARNING:
- **After deployment, the metal surfaces of the air bag (inflator) module will be very hot. Do not touch the metal areas of the air bag (inflator) module for about 30 minutes after deployment.**
- **Do not place the deployed air bag (inflator) module near any flammable objects.**
- **Do not apply water, oil, etc. to deployed air bag (inflator) module.**
- **If the deployed air bag (inflator) module must be moved before it is cool, wear gloves and handle it by using nonmetal material such as the air bag and vinyl trim.**

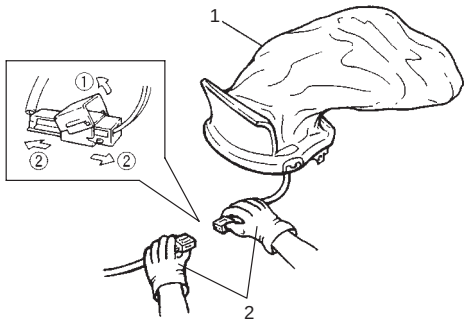
Failure to follow procedures may result in fire or personal injury.



1. Connect one banana plug to positive terminal of power source (12V vehicle battery) and then the other to negative terminal to immediately deploy.
2. Short to two deployment harness leads.

13) Separate the two banana plugs on the deployment harness.
14) Connect the deployment harness to the power source (12V vehicle battery) to immediately deploy the driver or passenger air bag.
15) Disconnect the deployment harness from power source (12V vehicle battery) and short the two deployment harness leads together by fully seating one banana plug into the other.
16) In the unlikely event that the driver or passenger air bag (inflator) module did not deploy after following these procedures, proceed immediately with Steps 21) through 24). If the air bag (inflator) module did deploy, proceed with Steps 17) through 20).

For driver air bag (inflator) module

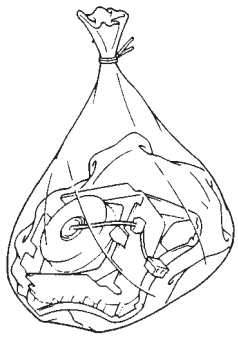


1. Deployed driver air bag (inflator) module
2. Gloves

17) Put on a pair of shop gloves to protect your hands from possible irritation and heat when handling the deployed air bag (inflator) module.

NOTE:
As a precaution, gloves and safety glasses are recommended to prevent any possible irritation of the skin or eyes.

18) Disconnect the deployment harness from the air bag (inflator) module as soon after deployment as possible. This will prevent damage to the deployment harness due to possible contact with the hot air bag (inflator) module canister. The deployment harness are designed to be reused. They should, however, be inspected for damage after each deployment and replaced if necessary.

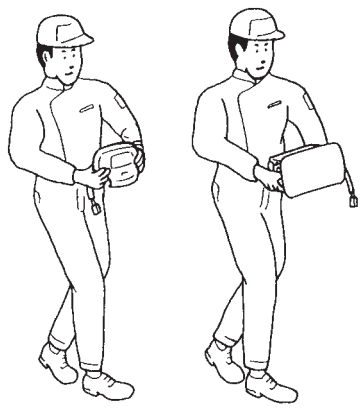


19) Dispose of the deployed air bag (inflator) module through normal refuse channels after it has cooled for at least 30 minutes and tightly seal the air bag (inflator) module in a strong vinyl bag. (Refer to “Deployed Air Bag (Inflator) Modules Disposal” in detail.)
20) Wash your hands with mild soap and water afterward.

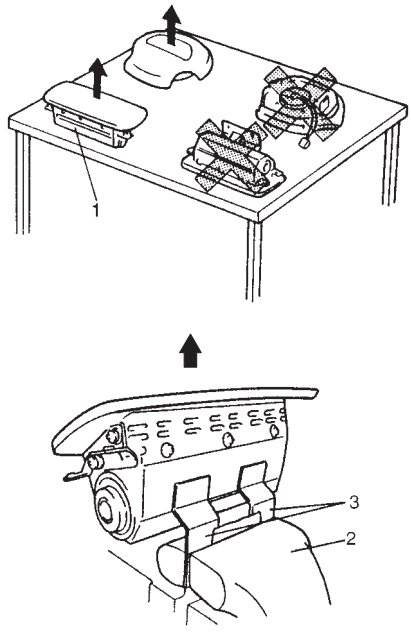
NOTE:
The remaining steps are to be followed in the unlikely event that the air bag (inflator) module did not deploy after following these procedures.

21) Ensure that the deployment harness has been disconnected from the power source and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
22) Disconnect the deployment harness from the air bag (inflator) module.

ALWAYS CARRY AIR BAG (INFLATOR) MODULE WITH TRIM COVER (AIR BAG OPENING) AWAY FROM BODY.



ALWAYS PLACE AIR BAG (INFLATOR) MODULE ON WORKBENCH WITH TRIM COVER (AIR BAG OPENING) UP, AWAY FROM LOOSE OBJECTS.



1. Slit on workbench
2. Workbench vise
3. Lower mounting bracket

WARNING:
- **Always carry a live air bag (inflator) module with trim cover away from you.**
- **When storing a live air bag (inflator) module or when leaving a live air bag (inflator) module unattended on a bench or other surface, always face the bag and trim cover up and away from the surface. As the live passenger air bag (inflator) module must be placed with its bag (trim cover) facing up, place it or the workbench with a slit or use the workbench vise to hold it securely at its lower mounting bracket.**
- **This is necessary so that a free space is provided to allow the air bag to expand in the unlikely event of accidental deployment.**

Failure to follow procedures may result in personal injury.

23) Temporarily store the air bag (inflator) module with its vinyl trim cover facing up, away from the surface upon which it rests. Refer to “Service Precautions” in this section for details.
24) Contact your local distributor for further assistance.

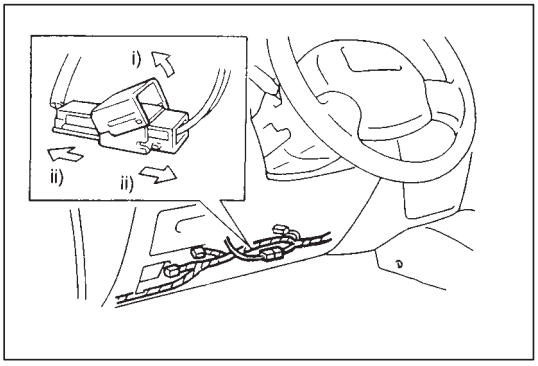
DEPLOYMENT INSIDE VEHICLE

Use this procedure when scrapping the entire vehicle including the driver and passenger air bag (inflator) modules.

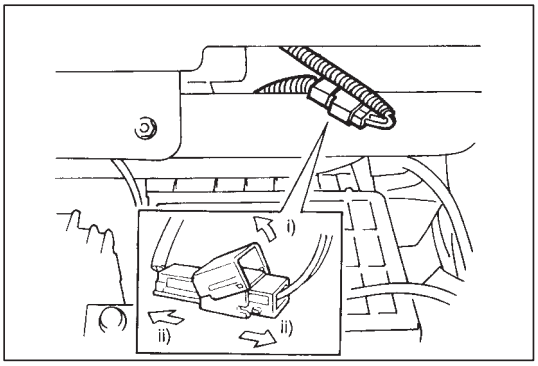
CAUTION:
When vehicle itself will be used again, deploy the air bag outside vehicle according to "Deployment Outside Vehicle", for deploying it inside will cause the instrument panel, glove box and their vicinity to be deformed.
Failure to observe this CAUTION may require unneeded vehicle inspection and repair.

WARNING:
Following precautions must be observed for this work. Failure to observe any of them may result in personal injury.
- **To avoid an accidental deployment, this work should be performed by no more than one person.**
- **The procedure should be followed strictly as described here.**
- **Be sure to read "Service Precautions" for the air bag (inflator) module beforehand.**
- **Never connect deployment harness to any power source before connecting deployment harness to the air bag (inflator) module. Deployment harness shall remain shorted and not be connected to a power source until the air bag is to be deployed.**
- **The air bag (inflator) module will immediately deploy the air bag when a power source is connected to it. Wear safety glasses throughout this entire deployment and disposal procedure.**
- **Wear suitable ear protection when deploying air bag. Also, advise those who are in the area close to deployment site to wear suitable ear protection.**
- **Do not deploy driver and passenger air bag (inflator) modules at the same time.**

1) Turn ignition switch to "LOCK", remove key and put on safety glasses.
2) Remove all loose objects from front seats and instrument panel.

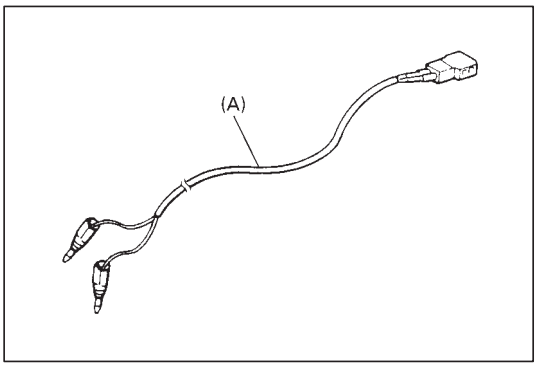


3) [For driver air bag (inflator) module]
Disconnect contact coil connector (yellow connector) located near the base of the steering column.
i) Release locking of lock lever.
ii) After unlocked, disconnect to connector.



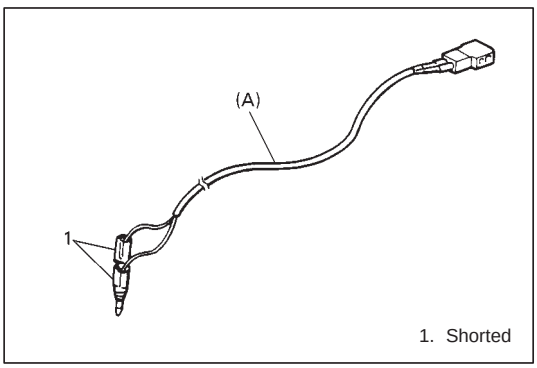
[For passenger air bag (inflator) module]
Remove glove box from instrument panel and disconnect passenger air bag (inflator) module connector (yellow connector).
i) Release locking of lock lever.
ii) After unlocked, disconnect to connector.

4) Confirm that each air bag (inflator) module is securely mounted.



5) Check that there is no open/short or damage in special tool (deployment harness). If any faulty condition is found, do not use it and be sure to use new deployment harness.

Special Tool
(A): 09932-75030



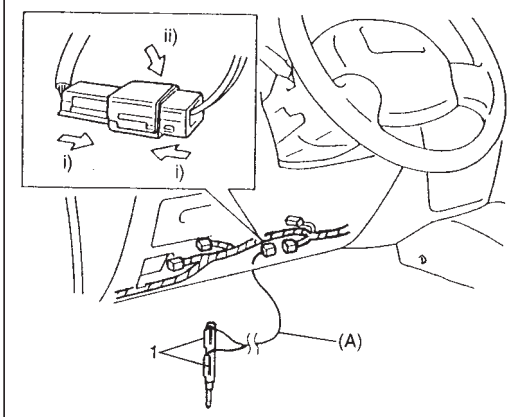
1. Shorted

6) Short the two deployment harness leads together by fully seating one banana plug into the other.

WARNING:
Deployment wires shall remain shorted and not be connected to a power source until the air bag is to be deployed.

Special Tool
(A): 09932-75030

For driver air bag (inflator) module

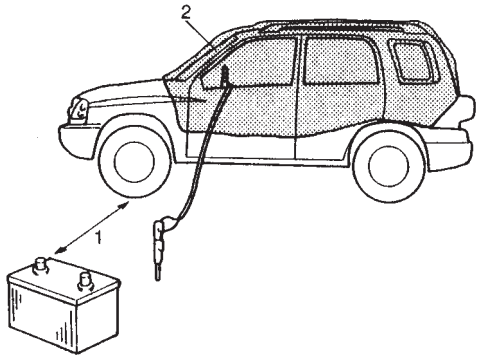


1. Short deployment harness leads

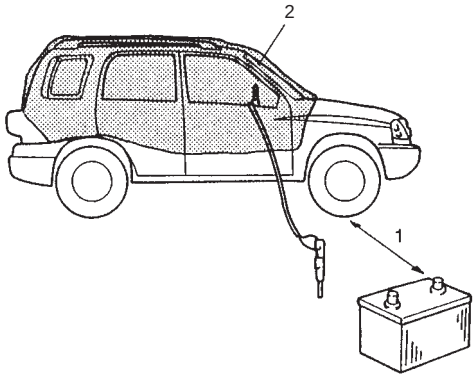
7) Connect deployment harness connector to air bag (inflator) module (driver or passenger) and lock connector with lock lever.

Special Tool
(A): 09932-75030

Driver side for left hand steering vehicle



Driver side for right hand steering vehicle



1. Stretch deployment harness to its full length 10 m (33 ft).
2. Drop cloth, blanket or similar item

8) Route deployment harness out the vehicle.
9) Verify that the inside of the vehicle and the area surrounding the vehicle are clear of all people and loose or flammable objects.
10) Stretch the deployment harness to its full length 10 m (33 ft).
11) Place a power source near the shorted end of the deployment harness. Recommended application: 12 Volts minimum, 2 amps minimum. A vehicle battery is suggested.
12) Completely cover windshield area and front door window openings with a drop cloth, blanket to similar item. This reduces the possibility of injury due to possible fragmentation of the vehicle's glass or interior.
13) Notify all people in the immediate area that you intend to deploy the air bag (inflator) module.

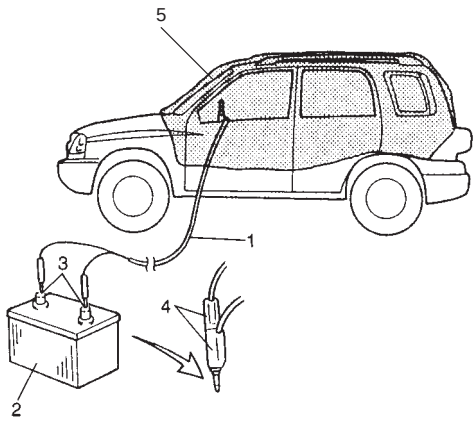
NOTE:

- **When the air bag deploys, the rapid gas expansion will create a substantial report. Wear suitable ear protection. Notify all people in the immediate area that you intend to deploy the air bag (inflator) module and suitable ear protection should be worn.**
- **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 byproducts of the chemical reaction.**

WARNING:
Safety precautions must be observed when handling a deployed air bag (inflator) module.

- **After deployment, the metal surfaces of the air bag (inflator) module will be very hot. Do not touch the metal areas of the air bag (inflator) module for about 30 minutes after deployment.**
- **Do not apply water, oil, etc. to deployed air bag (inflator) module.**
- **If the deployed air bag (inflator) module must be moved before it is cool, wear gloves and handle by the air bag or vinyl trim.**

Failure to follow procedures may result in fire or personal injury.



1. Stretch it to full length 10m (33 ft).
2. Power source (12V vehicle battery)
3. Connect one banana plug to positive terminal of power source (12V vehicle battery) and then the other to negative terminal to immediately deploy.
4. Short harness leads after deployment.
5. Drop cloth, blanket or similar them

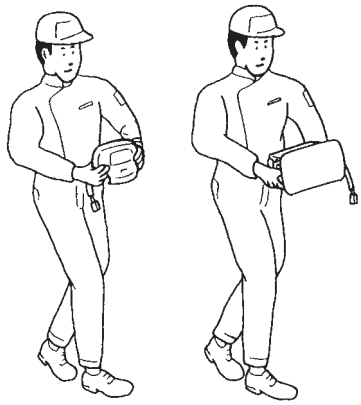
14) Separate the two banana plugs on the deployment harness.
15) Connect the deployment harness to the power source (12 V vehicle battery) to immediately deploy the driver or passenger air bag.
16) Disconnect the deployment harness from the power source (12 V vehicle battery) and short the two deployment harness leads together by fully seating one banana plug into the other.
17) Put on a pair of shop gloves to protect your hands from possible irritation and heat when handling the deployed air bag (inflator) module.

    NOTE:
    As a precaution, gloves and safety glasses are recommended to prevent any possible irritation of the skin or eyes.

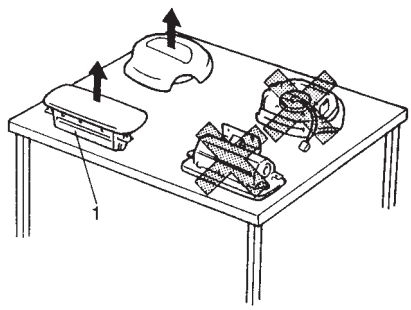
18) Disconnect the deployment harness from the air bag (inflator) module as soon after deployment as possible. This will prevent damage to the deployment harness due to possible contact with the hot air bag (inflator) module canister. The deployment harness are designed to be reused. They should, however, be inspected for damage after each deployment and replaced if necessary.
19) Carefully remove drop cloth from vehicle and clean off any fragments or discard drop cloth entirely.
20) Repeat Steps 2) through 19) to deploy driver or passenger air bag (inflator) module which has not been deployed, if any.

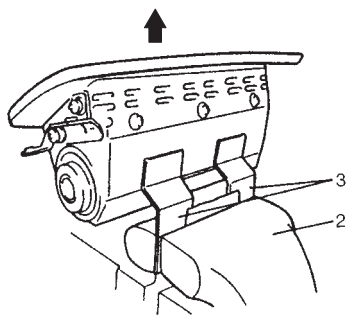
21) In the unlikely event that either or both of the air bag (inflator) modules proceed immediately with Steps 23) through 25). If the air bag (inflator) module did deploy, proceed with Steps 22).
22) With air bags deployed the vehicle may be scrapped in the same manner as a non-air bag system equipped vehicle.

ALWAYS CARRY AIR BAG (INFLATOR) MODULE WITH TRIM COVER (AIR BAG OPENING) AWAY FROM BODY.



ALWAYS PLACE AIR BAG (INFLATOR) MODULE ON WORKBENCH WITH TRIM COVER (AIR BAG OPENING) UP, AWAY FROM LOOSE OBJECTS.





1. Slit on workbench
2. Workbench vise
3. Lower mounting bracket

23) Remove the undeployed air bag (inflator) module(s) from the vehicle. For driver air bag (inflator) module refer to SECTION 3C1, for passenger air bag (inflator) module refer to “On-Vehicle Service” in this section.

WARNING:
- **Always carry a live air bag (inflator) module with trim cover away from you.**
- **When storing a live air bag (inflator) module or when leaving a live air bag (inflator) module unattended on a bench or other surface, always face the bag up, away from the surface.**
  This is necessary so that a free space is provided to allow the air bag to expand in the unlikely event of accidental deployment.

Failure to follow procedures could result in personal injury.

24) Temporarily store the air bag (inflator) module with its vinyl trim cover facing up, away from the surface upon which it rests. Refer to “Service Precautions” in this section for details.
25) Contact your local distributor for further assistance.

SEAT BELT PRETENSIONERS DISPOSAL

WARNING:
Failure to follow proper seat belt pretensioner (retractor assembly) disposal procedures can result in pretensioner activation which may cause personal injury. Inactivated seat belt pretensioner must not be disposed of through normal refuse channels.
The inactivated seat belt pretensioner contain substances that can cause severe illness or personal injury if the sealed container is damaged during disposal.

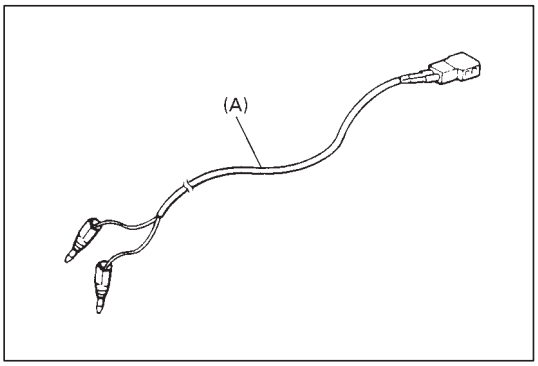
Do not dispose of the live (inactivated) seat belt pretensioners.
The method employed depends upon the final disposition of the particular vehicle, as noted in "Activation Outside Vehicle" and "Activation Inside Vehicle" in this section.
Activation Outside Vehicle . . . . . disposing of the seat belt pretension(s) only (i.e., the vehicle itself will be used again).
Activation Inside Vehicle . . . . . scrapping the entire vehicle including the seat belt pretensioners.

ACTIVATION OUTSIDE VEHICLE

Use this procedure when the vehicle itself is used again (only the seat belt pretensioner(s) are disposed of).

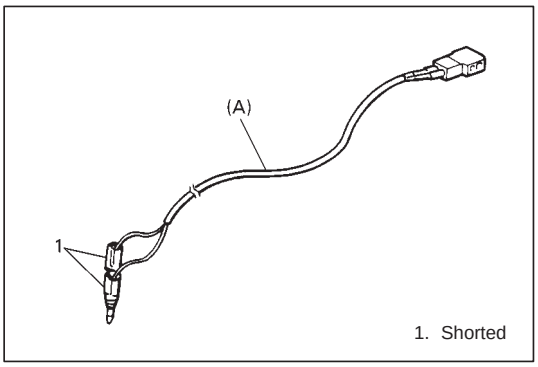
WARNING:
Following precautions must be observed for this work. Failure to observe any of them may result in personal injury.
- **To avoid an accidental activation, this work should be performed by no more than one person.**
- **The procedure should be followed strictly as described here.**
- **Be sure to read "Service Precautions" in this section for the seat belt pretensioner beforehand.**
- **Never connect deployment harness to any power source before connecting deployment harness to the seat belt pretensioner. Deployment harness shall remain shorted and not be connected to a power source until the pretensioner is to be activated.**
- **The seat belt pretensioner will immediately activate the pretensioner when a power source is connected to it. Wear safety glasses throughout this entire activation and disposal procedure.**
- **Wear suitable ear protection when activating pretensioner. Also, advise those who are in the area close to activation site to wear suitable ear protection.**
- **Do not activate driver and passenger seat belt pretensioners at the same time.**

The following procedure requires use of special tools (deployment harness). Do not attempt procedure without it.



1) Turn ignition switch to “LOCK”, remove key and put on safety glasses.
2) Check that there is no open, short or damage in special tool (deployment harness). If any faulty is found, do not use it and be sure to use new deployment harness.

Special Tool
(A): 09932-75030

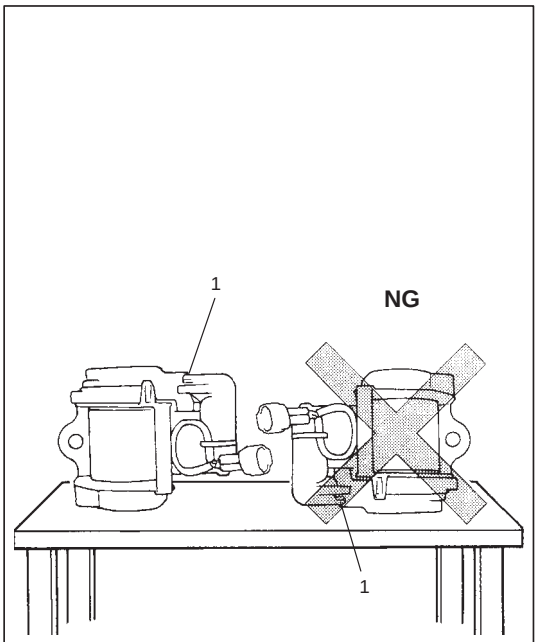


1. Shorted

3) Short the two deployment harness leads together by fully seating one banana plug into the other.

WARNING:
Deployment harness shall remain shorted and not be connected to a power source until the pretensioner is to be activated.

Special Tool
(A): 09932-75030



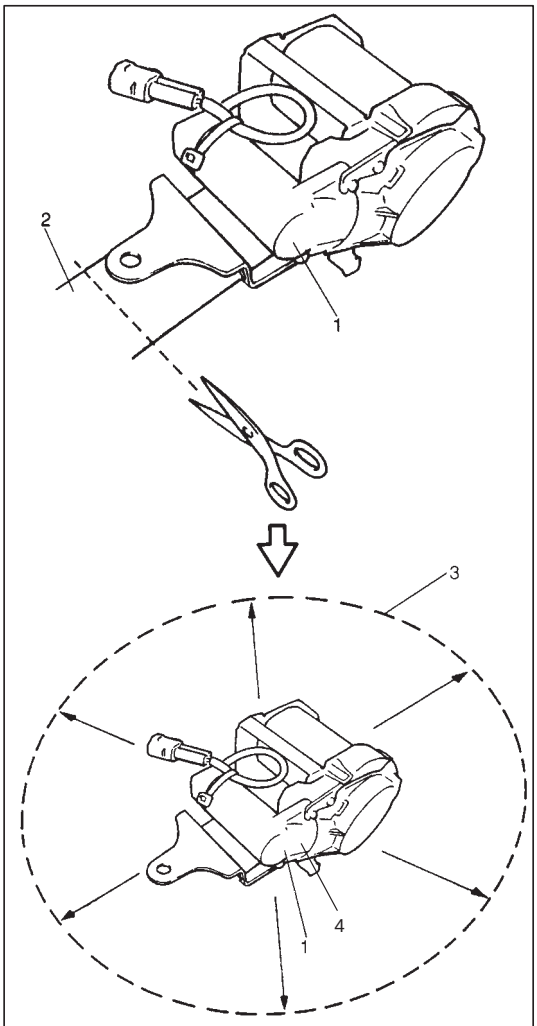
1. Exhaust hole

4) Remove driver or passenger seat belt pretensioner(s) and seat belt pretensioner harness(s) from vehicle, referring to SECTION 10A.

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 wires or connector on the underside of the pretensioner.**
- **When placing a live seat belt pretensioner on the workbench or some place like that, be sure not to lay with its exhaust hole 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.

5) Temporarily place seat belt pretensioner on the workbench according to above WARNING.

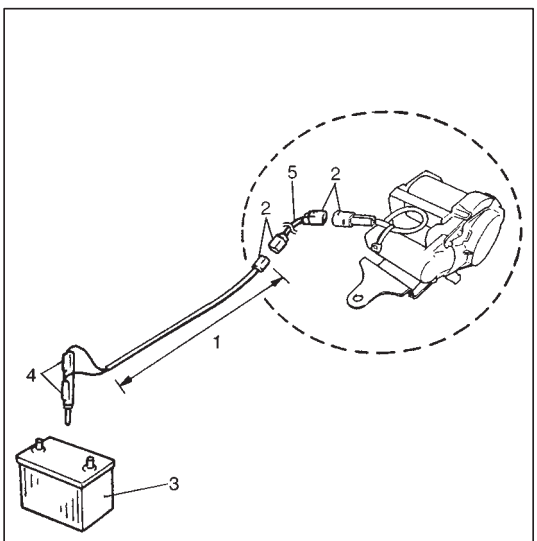


1. Seat belt pretensioner (retractor assembly)
2. Webbing
3. 185 cm (6 ft) of clearance
4. Exhaust hole

6) Pull out the webbing fully as shown at the left and cut it at the root of the pretensioner (retractor assembly) as shown in the figure.

WARNING:
As the drum of the retractor assembly turns very quickly as soon as the webbing is cut, fix the retractor assembly with a vise on the workbench and keep your hands and fingers away from it when cutting the webbing.

7) Clear a space on the ground about 185 cm (6 ft) in diameter where the seat belt pretensioner is to be activated. A paved, outdoor location where there is no activity is preferred. If an outdoor location is not available, a space on the shop floor where there is no activity and sufficient ventilation is recommended. Ensure no loose or flammable objects are within the activation area.
8) Place the seat belt pretensioner as shown in the figure on the ground in the space just cleared.



1. Stretch deployment harness to full length 10 m (33 ft).
2. Connect connectors.
3. Power source (12V vehicle battery)
4. Short the two deployment harness leads.
5. Seat belt pretensioner harness

9) Stretch the deployment harness from the seat belt pretensioner to its full length 10 m (33 ft).
10) Place a power source near the shorted end of the deployment harness. Recommended application: 12 Volts minimum, 2 amps minimum. A vehicle battery is suggested.
11) Verify that the area around the seat belt pretensioner is clear of all people and loose or flammable objects.
12) Verify that the seat belt pretensioner is placed as shown in the figure on the ground in the space just cleared.
13) Connect the seat belt pretensioner harness to the deployment harness connector and lock the connector with lock lever.

Special Tool
(A): 09932-75030

14) Notify all people in the immediate area that you intend to activate the seat belt pretensioner.

NOTE:

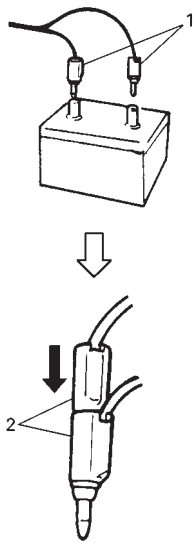
- **When the pretensioner activates, the rapid gas expansion will create a substantial report. Wear suitable ear protection. Notify all people in the immediate area that you intend to activate the seat belt pretensioner and suitable ear protection should be worn.**
- **When the pretensioner activates, the seat belt pretensioner may jump about 30 cm (1 ft) vertically. This is a normal reaction of the seat belt pretensioner to the force of the rapid gas expansion inside the pretensioner.**

WARNING:
Safety precautions must be observed when handling an activated seat belt pretensioner.

- **After activation, the metal surfaces of the seat belt pretensioner will be very hot. Do not touch the metal areas of the seat belt pretensioner for about 30 minutes after activation.**
- **Do not place the activated seat belt pretensioner near any flammable objects.**
- **Do not apply water, oil, etc. to the activated seat belt pretensioner.**
- **If the activated seat belt pretensioner must be moved before it is cool, wear gloves and handle it by using nonmetal material.**

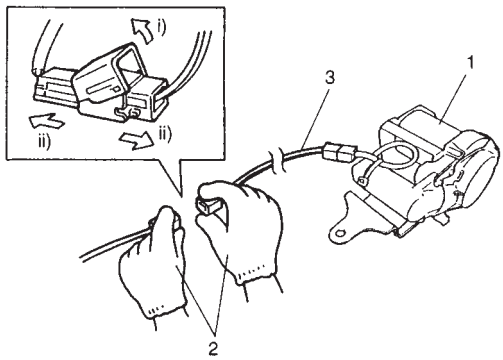
Failure to follow procedures may result in fire or personal injury.

15) Separate the two banana plugs on the deployment harness.
16) Connect the deployment harness to the power source (12V vehicle battery) to immediately activate the pretensioner.
17) Disconnect the deployment harness from power source (12V vehicle battery) and short the two deployment harness leads together by fully seating one banana plug into the other.



1. Connect one banana plug to positive terminal of power source (12V vehicle battery) and then the other to negative terminal to immediately activate.
2. Short to two deployment harness leads.

18) In the unlikely event that the seat belt pretensioner did not activate after following these procedures, proceed immediately with Steps 23) through 26). If the the seat belt pretensioner did activate, proceed with Steps 19) through 22).

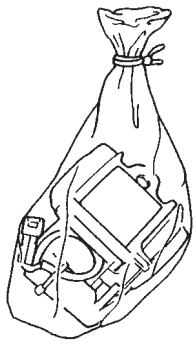


1. Activated seat belt pretensioner
2. Gloves
3. Pretensioner harness

19) Put on a pair of shop gloves to protect your hands from possible irritation and heat when handling the activated seat belt pretensioner.

NOTE:
As a precaution, gloves and safety glasses are recommended to prevent any possible irritation of the skin or eyes.

20) Disconnect the deployment harness from the seat belt pretensioner as soon after activation as possible. This will prevent damage to the deployment harness due to possible contact with the hot seat belt pretensioner canister. The deployment harness are designed to be reused. They should, however, be inspected for damage after each activation and replaced if necessary.

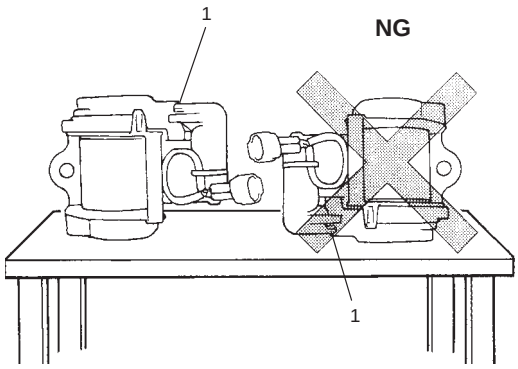


21) Dispose of the activated seat belt pretensioner through normal refuse channels after it has cooled for at least 30 minutes and tightly seal the seat belt pretensioner in a strong vinyl bag. (Refer to “Activated Seat Belt Pretensioners Disposal” in detail.)

22) Wash your hands with mild soap and water afterward.

NOTE:
The remaining steps are to be followed in the unlikely event that the seat belt pretensioner did not activate after following these procedures.

23) Ensure that the deployment harness has been disconnected from the power source and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
24) Disconnect the deployment harness from the seat belt pretensioner.



1. Exhaust hole

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 wires or connector on the underside of the 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 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.

25) Temporarily store the seat belt pretensioner. At that time, be sure NOT to face its exhaust hole provided side down. It must face up. Refer to “Service Precautions” in this section for detail.
26) Contact your local distributor for further assistance.

ACTIVATION INSIDE VEHICLE

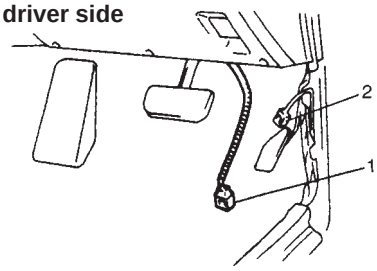
Use this procedure when scrapping the entire vehicle including the seat belt pretensioners.

CAUTION:
When vehicle itself will be used again, activate pretensioner outside vehicle according to "Activation Outside Vehicle", for activating it inside will cause the center pillar inner garnish and their vicinity to be deformed.
Failure to observe this CAUTION may require unneeded vehicle inspection and repair.

WARNING:
Following precautions must be observed for this work. Failure to observe any of them may result in personal injury.
- **To avoid an accidental activation, this work should be performed by no more than one person.**
- **The procedure should be followed strictly as described here.**
- **Be sure to read "Service Precautions" for the seat belt pretensioner beforehand.**
- **Never connect deployment harness to any power source before connecting deployment harness to the seat belt pretensioner. Deployment harness shall remain shorted and not be connected to a power source until the pretensioner is to be activated.**
- **The seat belt pretensioner will immediately activate the pretensioner when a power source is connected to it. Wear safety glasses throughout this entire activation and disposal procedure.**
- **Wear suitable ear protection when activating pretensioner. Also, advise those who are in the area close to activation site to wear suitable ear protection.**
- **Do not activate driver and passenger seat belt pretensioners at the same time.**

1) Turn ignition switch to "LOCK", remove key and put on safety glasses.
2) Remove all loose objects from front seats and instrument panel.

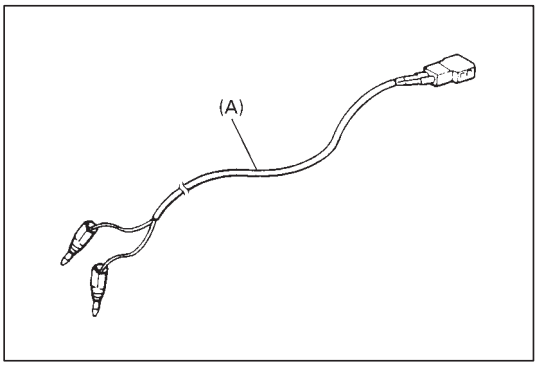
For driver side



1. Air bag harness
2. Seat belt pretensioner harness

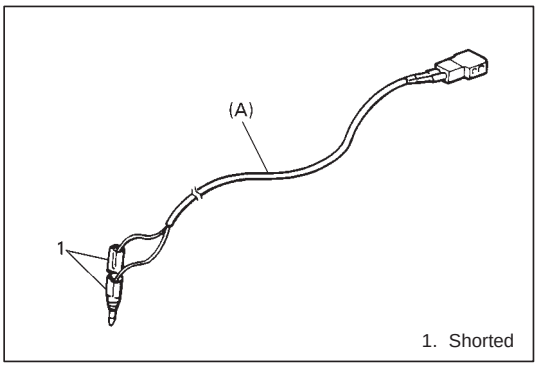
3) Remove both side (driver and passenger side) front pillar lower trims and disconnect seat belt pretensioner harnesses from air bag harness.

4) Confirm that each seat belt pretensioner is securely mounted.



5) Check that there is no open/short or damage in special tool (deployment harness). If any faulty condition is found, do not use it and be sure to use new deployment harness.

Special Tool
(A): 09932-75030



1. Shorted

6) Short the two deployment harness leads together by fully seating one banana plug into the other.

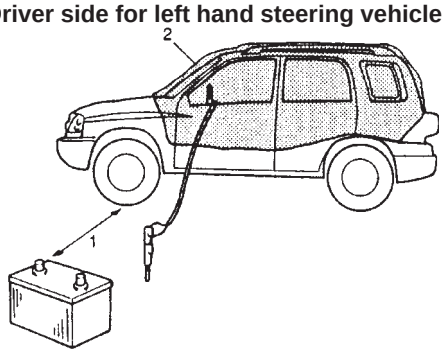
WARNING:
Deployment wires shall remain shorted and not be connected to a power source until the pretensioner is to be activated.

Special Tool
(A): 09932-75030

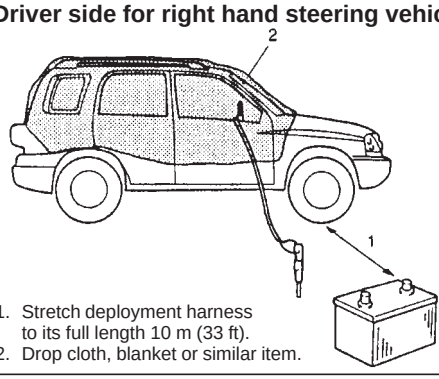
7) Connect the deployment harness connector to the seat belt pretensioner harness and lock the connector with lock lever.

Special Tool
(A): 09932-75030

Driver side for left hand steering vehicle



Driver side for right hand steering vehicle



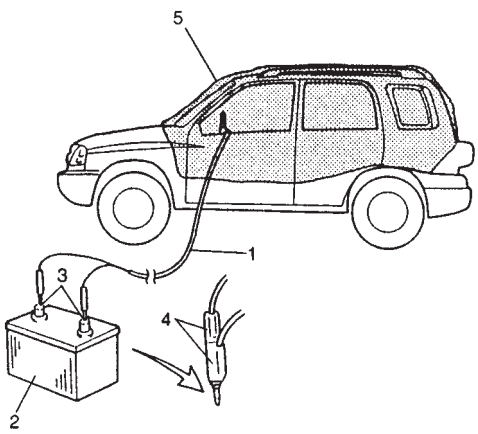
1. Stretch deployment harness to its full length 10 m (33 ft).
2. Drop cloth, blanket or similar item.

8) Route deployment harness out the vehicle.
9) Verify that the inside of the vehicle and the area surrounding the vehicle are clear of all people and loose or flammable objects.
10) Stretch the deployment harness to its full length 10 m (33 ft).
11) Place a power source near the shorted end of the deployment harness. Recommended application: 12 Volts minimum, 2 amps minimum. A vehicle battery is suggested.
12) Completely cover windshield area and front door window openings with a drop cloth, blanket to similar item. This reduces the possibility of injury due to possible fragmentation of the vehicle's glass or interior.
13) Notify all people in the immediate area that you intend to activate the seat belt pretensioner.

NOTE:
When the pretensioner activates, the rapid gas expansion will create a substantial report. Wear suitable ear protection. Notify all people in the immediate area that you intend to activate the seat belt pretensioner and suitable ear protection should be worn.

WARNING:
Safety precautions must be observed when handling an activated seat belt pretensioner.
- **After activation, the metal surfaces of the seat belt pretensioner will be very hot. Do not touch the metal areas of the seat belt pretensioner for about 30 minutes after activation.**
- **Do not apply water, oil, etc. to activated seat belt pretensioner.**
- **If the activated seat belt pretensioner must be moved before it is cool, wear gloves and handle by using non-metal material.**

Failure to follow procedures may result in fire or personal injury.



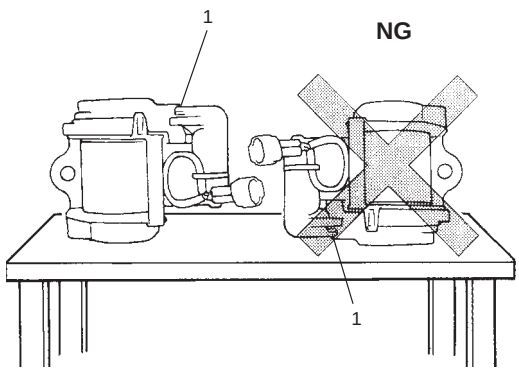
1. Stretch it to full length 10m (33 ft).
2. Power source (12V vehicle battery)
3. Connect one banana plug to positive terminal of power source (12V vehicle battery) and then the other to negative terminal to immediately activate.
4. Short harness leads after activation.
5. Drop cloth, blanket or similar them.

14) Separate the two banana plugs on the deployment harness.
15) Connect the deployment harness to the power source (12 V vehicle battery) to immediately activate the pretensioner.
16) Disconnect the deployment harness from the power source (12 V vehicle battery) and short the two deployment harness leads together by fully seating one banana plug into the other.

17) Put on a pair of shop gloves to protect your hands from possible irritation and heat when handling the activated seat belt pretensioner.

NOTE:
As a precaution, gloves and safety glasses are recommended to prevent any possible irritation of the skin or eyes.

18) Disconnect the deployment harness from the seat belt pretensioner as soon after activation as possible. This will prevent damage to the deployment harness due to possible contact with the hot seat belt pretensioner canister. The deployment harness are designed to be reused. They should, however, be inspected for damage after each activation and replaced if necessary.
19) Carefully remove drop cloth from vehicle and clean off any fragments or discard drop cloth entirely.
20) Repeat steps 2) through 19) to activate seat belt pretensioner which has not been activated, if any.
21) In the unlikely event that either or both of the seat belt pretensioners proceed immediately with steps 23) through 25). If the seat belt pretensioner did activate, proceed with step 22).
22) With pretensioners activated the vehicle may be scrapped in the same manner as a non-air bag system equipped vehicle.



1. Exhaust hole

23) Remove the inactivated seat belt pretensioner(s) from the vehicle. Refer to SECTION 10A.

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 wires or connector on the underside of the 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 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.

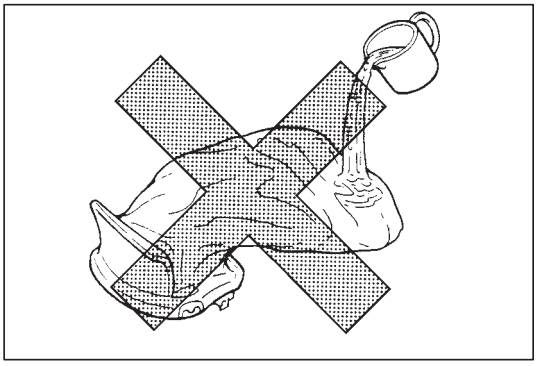
24) Temporarily store the seat belt pretensioner. At that time, be sure NOT to face its exhaust hole provided side down. It must face up. Refer to “Service Precautions” in this section for details.
25) Contact your local distributor for further assistance.

DEPLOYED AIR BAG (INFLATOR) MODULES DISPOSAL

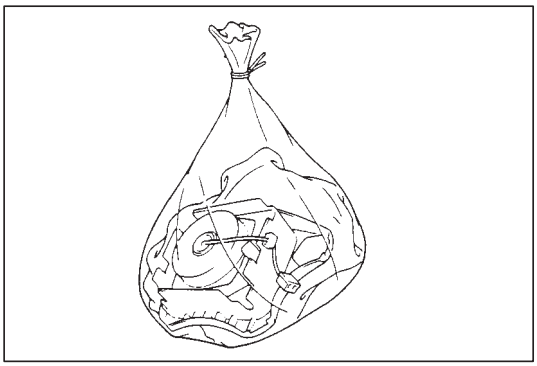
WARNING:
Failure to follow proper air bag (inflator) module disposal procedures can result in air bag deployment which may cause personal injury. Undeployed air bag (inflator) module must not be disposed of through normal refuse channels. The undeployed air bag (inflator) module contains substances that can cause severe illness or personal injury if the sealed container is damaged during disposal.

Deployed air bag (inflator) modules (driver/passenger) 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 immediately after deployment 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 to cool it off and be careful so that water, oil etc. does not get on the deployed air bag (inflator) module.
- 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 byproducts of the chemical reaction. As with many service procedures, you should wear gloves and safety glasses.



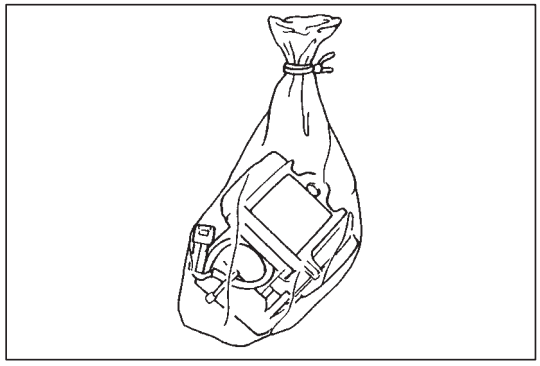
- When disposing of the deployed air bag (inflator) module, be sure to seal it in a vinyl bag.
- When air bag (inflator) module(s) have been deployed inside the vehicle which is going to be scrapped, leave them as installed to the vehicle.
- Be sure to wash your hands with mild soap and water after handling it.

ACTIVATED SEAT BELT PRETENSIONERS DISPOSAL

WARNING:
Failure to follow proper seat belt pretensioner (retractor assembly) disposal procedures can result in pretensioner activation which may cause personal injury. Inactivated seat belt pretensioner must not be disposed of through normal refuse channels.
The inactivated seat belt pretensioner contains substances that can cause severe illness or personal injury if the sealed container is damaged during disposal.

Activated seat belt pretensioners (driver/passenger) can be disposed of through normal refuse channels just like any other parts. For their disposal, however, following points should be noted.

- The seat belt pretensioner immediately after activation is very hot. Wait for 30 minutes to cool it off before handling it.
- Never apply water, oil, etc. to activated seat belt pretensioner to cool it off and be careful so that water, oil etc. does not get on the activated seat belt pretensioner.
- With many service procedures, gloves and safety glasses should be worn to prevent any possible irritation of the skin or eyes.

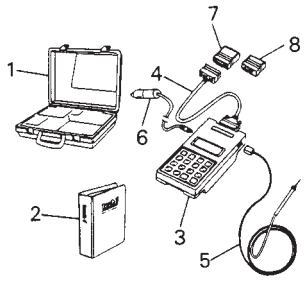


- When disposing of the activated seat belt pretensioner alone, be sure to seal it in a vinyl bag.
- When seat belt pretensioners have been activated inside the vehicle which is going to be scrapped, leave them as installed to the vehicle.
- Be sure to wash your hands with mild soap and water after handling it.

TIGHTENING TORQUE SPECIFICATIONS

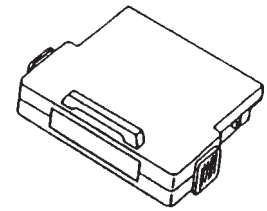
Fastening parts		Tightening torque		
		N·m	kg-m	lb-ft
SDM bolt		6	0.6	4.5
Passenger air bag (inflator) module	screw	5.5	0.55	4.0
	bolt	23	2.3	16.5
Driver air bag (inflator) module bolt		Refer to SECTION 3C1.		
Seat belt pretensioner (retractor assembly) bolt		Refer to SECTION 10A.		

SPECIAL TOOLS

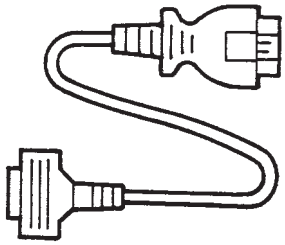


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable
5. Test lead/probe
6. Power source cable
7. DLC cable adapter
8. Self-test adapter

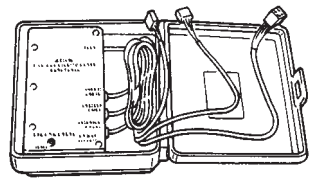
09931-76011
Suzuki scan tool (tech 1A) kit



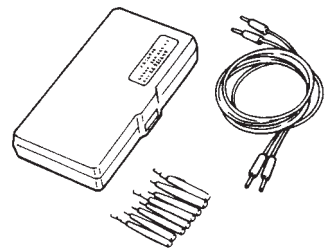
Mass storage cartridge for air bag system



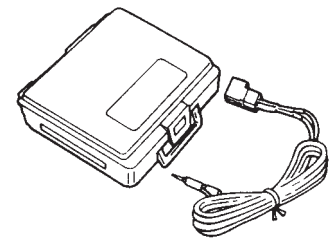
09931-76030
16/14 pin DLC cable



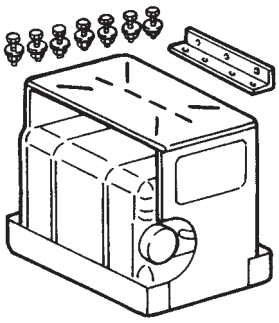
09932-75010
Air bag driver/passenger load tool



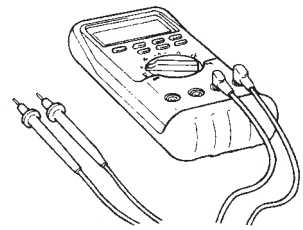
09932-76010
Connector test adapter kit



09932-75030
Air bag deployment harness



09932-75040
Passenger air bag (inflator) module deployment fixture



Digital multimeter for which the maximum test current is 10 mA or less at the minimum range of resistance measurement.

WARNING:
Be sure to use the specified digital multimeter. Otherwise, air bag deployment or personal injury may result.

Prepared by

SUZUKI MOTOR CORPORATION

Overseas Service Department

1st Ed. April, 2000

Printed in Japan

Printing: April, 2000 820

IMPORTANT

WARNING/CAUTION/NOTE

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

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

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

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

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

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

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

FOREWORD

This manual (Volumes 1 and 2) contains procedures for diagnosis, maintenance, adjustments, minor service operations, replacement of components (Service) and for disassembly and assembly of major components (Unit Repair-Overhaul).

VOLUME 1 contains Chassis, Electrical and Body sections (all sections except engine).
VOLUME 2 contains Engine sections (Sections 6 – 6K).

Applicable model: SQ416/SQ420/SQ625 of and after the vehicle identification number below.

☒ JSAFTA03V00150001☒	JS3TA03V☐14150001	2S2GTA03C00470001
☒ JSAFTA03V10150001☒	JS3TA52V☐14150001	2S2GTA03C10470001
☒ JSAFTA03V14150001☒	JS3TL52V☐14150001	2S2GTA03C16470001
☒ JSAFTA52V00150001☒	JS3TD62V☐14150001	2S3TA03C☐16100001
☒ JSAFTA52V10150001☒		2S3TA52C☐16100001
☒ JSAFTA52V14150001☒		2S2GTA52C00470001
☒ JSAFTL52V00150001☒		2S2GTA52C10470001
☒ JSAFTL52V10150001☒		
☒ JSAFTL52V14150001☒		
☒ JSAFTD62V00150001☒		
☒ JSAFTD62V10150001☒		
☒ JSAFTD62V14150001☒		

The contents are classified into sections each of which is given a section number as indicated in the Table of Contents on next 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.

NOTE:
Refer to the next page for RELATED MANUALS.

SUZUKI MOTOR CORPORATION
OVERSEAS SERVICE DEPARTMENT

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RELATED MANUAL

MANUAL NAME	MANUAL NO.	APPLICABILITY
SQ416/SQ420/SQ625 Unit Repair Manual	99501-65D01-xxx	Transmission, Transfer and Differentials (Front and Rear) of SQ series.
SQ416/SQ420/SQ625 Wiring Diagram Manual	99512-65D10-015	Applicable model mentioned in FOREWORD of this manual.
SQ416/SQ420/SQ625 Service Manual	99500-65D00-xxx	Vehicles before the vehicle identification number mentioned in FOREWORD of this manual.
SQ416/SQ420/SQ625 Wiring Diagram Manual	99512-65D01-015	

TABLE OF CONTENTS	SECTION
GENERAL INFORMATION	
General Information	0A
Maintenance and Lubrication	0B
HEATING AND AIR CONDITIONING	
Heater and Ventilation	1A
Air Conditioning	1B
STEERING, SUSPENSION, WHEELS AND TIRES	3
Front End Alignment	3A
Power Steering (P/S) System	3B1
Steering Wheel and Column (Not Equipped with Air Bag)	3C
Air Bag Steering Wheel and Column	3C1
Front Suspension	3D
Rear Suspension	3E
Wheel and Tires	3F
DRIVE SHAFT/PROP. SHAFT	
Front Drive Shaft/Shaft Bearing, Oil Seal	4A2
Propeller Shaft	4B
BRAKES	5
Brake Pipe/Hose/Master Cylinder	5A
Front Brakes	5B
Parking and Rear Brakes	5C
Antilock Brake System	5E1

TABLE OF CONTENTS	SECTION
ENGINE	
General Information and Diagnosis (G16/J20)	6
General Information and Diagnosis (H25)	6-1
Engine Mechanical (G16)	6A1
Engine Mechanical (H25)	6A2
Engine Mechanical (J20)	6A4
Engine Cooling	6B
Engine Fuel	6C
Engine and Emission Control System (SFI for G16/J20)	6E1
Engine and Emission Control System (SFI for H25)	6E2
Ignition System (G16)	6F1
Ignition System (J20/H25)	6F2
Cranking System (Reduction Type)	6G
Cranking System (No-Reduction Type)	6G1
Charging System	6H
Exhaust System	6K
TRANSMISSION, CLUTCH AND DIFFERENTIAL	
Manual Transmission (Type 1)	7A
Manual Transmission (Type 2)	7A1
Automatic Transmission	7B1
Clutch (Hydraulic Type)	7C1
Transfer	7D
Differential (Front)	7E
Differential (Rear)	7F
BODY ELECTRICAL SYSTEM	8
Wiring Diagram	8A
Lighting System	8B
Instrumentation/Driver Information	8C
Windows, Mirrors, Security and Lock	8D
Immobilizer Control System	8G
BODY SERVICE	9
RESTRAINT SYSTEM	10
Seat Belt	10A
Air Bag System	10B

NOTE:
The screen toned Sections 0A – 5E1 and 7A – 10B are included in Volume 1 and section 8A is in Wiring Diagram Manual.

SECTION 6

ENGINE GENERAL INFORMATION AND DIAGNOSIS (G16/J20 ENGINES)

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

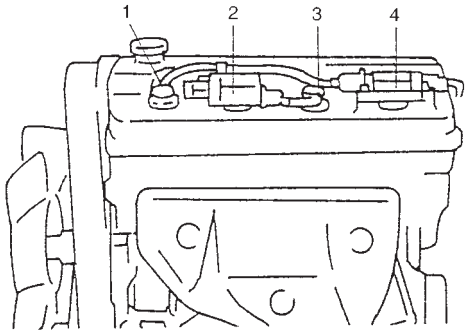
NOTE:
Whether following systems (parts) are used in the particular vehicle or not depends on specifications. Be sure to bear this in mind when performing service work.
- **MAP sensor**
- **EGR valve**
- **Heated oxygen sensor(s) or CO adjusting resistor**
- **Three way catalytic converter, warm-up three way catalytic converter**
- **Ignition timing adjusting register or CKP sensor**
- **Monitor connector**

ENGINE GENERAL INFORMATION AND DIAGNOSIS (G16/J20 ENGINES) 6-1
ENGINE MECHANICAL (G16 ENGINE) 6A1-1
ENGINE MECHANICAL (J20 ENGINE) 6A4-1
ENGINE COOLING 6B-1
ENGINE FUEL 6C-1
ENGINE AND EMISSION CONTROL SYSTEM (G16/J20 ENGINES) 6E1-1
IGNITION SYSTEM (G16 ENGINE) 6F1-1
IGNITION SYSTEM (J20/H25 ENGINES) 6F2-1
CRANKING SYSTEM 6G-1
CHARGING SYSTEM 6H-1
EXHAUST SYSTEM 6K-1

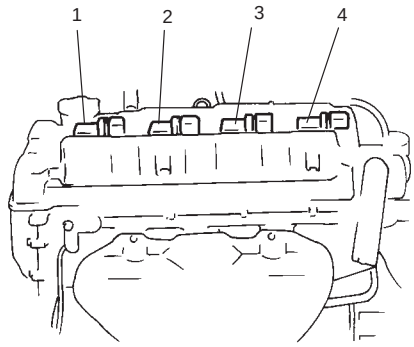
CONTENTS

GENERAL INFORMATION 6- 3
ENGINE DIAGNOSIS 6- 6
General Description 6- 6
On-Board Diagnostic System 6- 6
Precaution in Diagnosing Trouble 6- 11
Engine Diagnostic Flow Table 6- 12
Customer Problem Inspection Form 6- 14
Malfunction Indicator Lamp (MIL) Check 6- 15
Diagnostic Trouble Code (DTC) Check 6- 15
Diagnostic Trouble Code (DTC) Clearance 6- 16
Fail-Safe Table 6- 17
Diagnostic Trouble Code (DTC) Table . . . 6- 18
Scan Tool Data 6- 21
Visual Inspection 6- 27
Engine Basic Check 6- 28
Engine Diagnosis Table 6- 29
Inspection of PCM (ECM) and Its Circuits 6- 34
Voltage Check 6- 34
Resistance Check 6- 40
Table A-1 MIL Circuit Check (MIL does not come ON) 6- 41
Table A-2 MIL Circuit Check (MIL remains ON) 6- 42
Table A-3 MIL Circuit Check (MIL flashes) 6- 42
Table A-4 MIL Circuit Check (MIL does not flash or just remains ON) 6- 42
Table A-5 ECM (PCM) Power and Ground Circuit Check 6- 43
DTC P0100 (DTC No.33, 34) MAF Circuit Malfunction 6- 45
DTC P0110 (DTC No.23, 25) IAT Circuit Malfunction 6- 47
DTC P0115 (DTC No.14, 15) Engine Coolant Temp. Sensor Circuit Malfunction 6- 49
DTC P0120 (DTC No.21, 22) TP Circuit Malfunction 6- 51
DTC P0121 TP Range/Performance Problem 6- 53
DTC P0130 (DTC No.13) HO2S-1 Circuit Malfunction 6- 55
DTC P0133 HO2S-1 Circuit Slow Response 6- 58
DTC P0134 HO2S-1 No Activity Detected 6- 59
DTC P0135 HO2S-1 Heater Circuit Malfunction 6- 60
DTC P0136 HO2S-2 Circuit Malfunction 6- 62
DTC P0141 HO2S-2 Heater Circuit Malfunction 6- 64
DTC P0171 Fuel System too Lean or DTC P0172 Fuel System too Rich 6- 66
DTC P0300 Random Misfire Detected, DTC P0301 Cylinder 1 Misfire Detected, DTC P0302 Cylinder 2 Misfire Detected, DTC P0303 Cylinder 3 Misfire Detected or DTC P0304 Cylinder 4 Misfire Detected 6- 68
DTC P0325 (DTC No.43) Knock Sensor Circuit Malfunction 6- 70
DTC P0335 CKP Sensor Circuit Malfunction 6- 72
DTC P0340 (DTC No.42) CMP Sensor Circuit Malfunction 6- 75
DTC P0400 EGR Flow Malfunction 6- 79
DTC P0403 (DTC No.51) EGR Circuit Malfunction 6- 82
DTC P0420 Catalyst System Efficiency Below Threshold 6- 84
DTC P0443 EVAP Control System Purge Control Valve Circuit Malfunction 6- 86
DTC P0500 (DTC No.24) Vehicle Speed Sensor Malfunction 6- 89
DTC P0505 Idle Air Control System Malfunction 6- 91
DTC P0601 (DTC No.71) Internal Control Module Memory Check Sum Error 6- 93
DTC P1408 Manifold Absolute Pressure Sensor Circuit Malfunction 6- 94
DTC P1450 Barometric Pressure Sensor Circuit Malfunction 6- 96
DTC P1451 Barometric Pressure Sensor Performance Problem 6- 96
DTC P1500 Engine Starter Signal Circuit Malfunction 6- 97
DTC P1510 ECM Back-Up Power Supply Malfunction 6- 98
Table B-1 Fuel Pump Circuit Inspection 6- 99
Table B-2 Fuel Injectors and Circuit Inspection 6-100
Table B-3 Fuel Pressure Inspection 6-101
Table B-4 Idle Air Control System Inspection 6-103
Table B-5 A/C Signal Circuits Inspection . 6-105
Table B-6 A/C Condenser Fan Motor Relay Control System Inspection 6-106
SPECIAL TOOLS 6-107

G16



J20



1. No.1 cylinder
2. No.2 cylinder
3. No.3 cylinder
4. No.4 cylinder

GENERAL INFORMATION

STATEMENT OF 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.

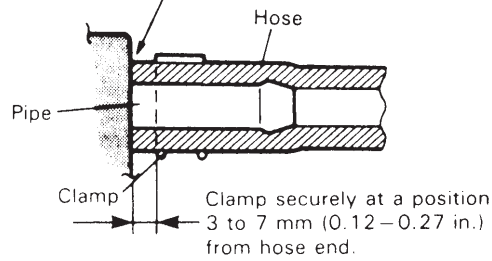
- A liberal coating of engine oil should be applied to friction areas during assembly to protect and lubricate the surface on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings and crankshaft journal bearings are removed for service, they should be retained in order. At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables may result in damage to wire harness or other electrical parts.
- Throughout this manual, the four cylinders of the engine are identified by numbers: No.1, No.2, No.3 and No.4 as counted from crankshaft pulley side to flywheel side.

GENERAL INFORMATION ON ENGINE SERVICE

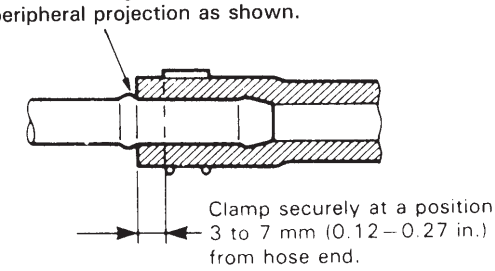
THE FOLLOWING INFORMATION ON ENGINE SERVICE SHOULD BE NOTED CAREFULLY, AS IT IS IMPORTANT IN PREVENTING DAMAGE, AND IN CONTRIBUTING TO RELIABLE ENGINE PERFORMANCE.

- When raising or supporting engine for any reason, do not use a jack under oil pan. Due to small clearance between oil pan and oil pump strainer, jacking against oil pan may cause it to be bent against strainer resulting in damaged oil pick-up unit.
- It should be kept in mind, while working on engine, that 12-volt electrical system is capable of violent and damaging short circuits. When performing any work where electrical terminals could possibly be grounded, ground cable of the battery should be disconnected at battery.
- Any time the air cleaner, air intake pipe, 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.

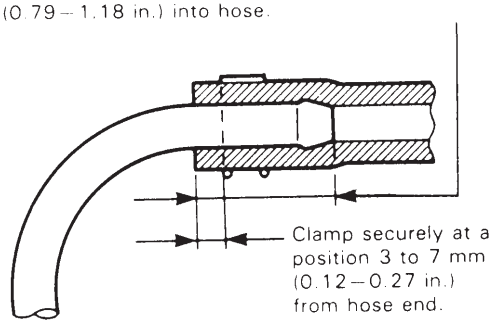
With short pipe, fit hose as far as it reaches pipe joint as shown.



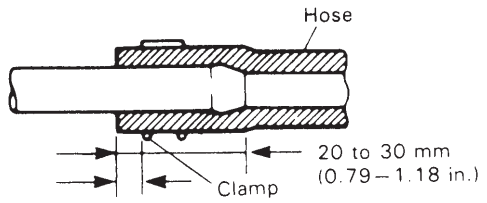
With following type pipe, fit hose as far as its peripheral projection as shown.



With bent pipe, fit hose as far as its bent part as shown or till pipe is about 20 – 30 mm (0.79 – 1.18 in.) into hose.



With straight pipe, fit hose till pipe is about 20 to 30 mm (0.79 – 1.18 in.) the hose.



Clamp securely at a position 3 to 7 mm (0.12 – 0.27 in.) from hose end.

PRECAUTION ON FUEL SYSTEM SERVICE

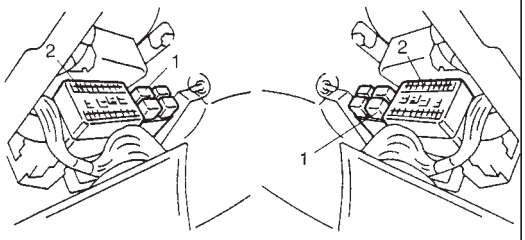
- Work must be done with no smoking, in a well-ventilated area and away from any open flames.
- As fuel feed line (between fuel pump and fuel pressure regulator) is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected.
  Before loosening or disconnecting fuel feed line, make sure to release fuel pressure according to “FUEL PRESSURE RELIEF PROCEDURE”.
  A small amount of fuel may be released after fuel line is disconnected.
  In order to reduce the chance of personal injury, cover 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 figure “Hose Connection”.
  After connecting, make sure that it has no twist or kink.
- When installing fuel filter union bolt or plug bolt on union bolt, always use new gasket and tighten it to specified torque. See Section 6C for specified torque.
- When installing injector, fuel feed pipe or fuel pressure regulator, lubricate its O-ring with spindle oil or gasoline.
- When connecting fuel pipe flare nut, first tighten flare nut by hand and then tighten it to specified torque, using back-up wrench.

FUEL PRESSURE RELIEF PROCEDURE

CAUTION:
This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

After making sure that engine is cold, release fuel pressure as follows.

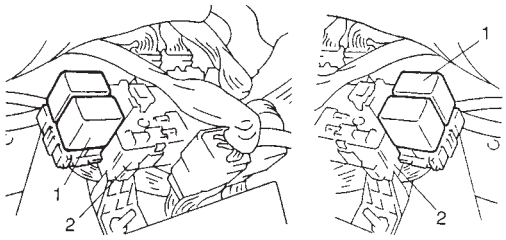
Left hand steering vehicle **Right hand steering vehicle**



1. Fuel pump relay
2. Fuse box

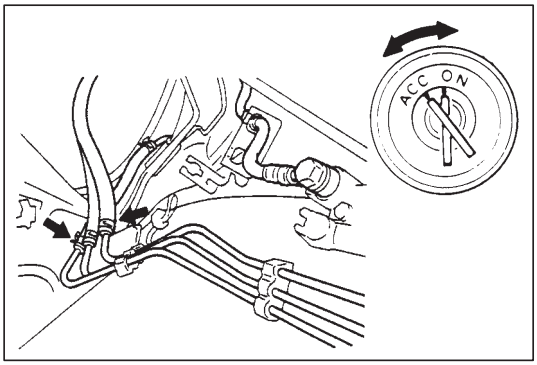
[CANVAS TOP MODEL]

Left hand steering vehicle **Right hand steering vehicle**



1. Fuel pump relay
2. Junction (Fuse) box

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) Disconnect fuel pump relay from its connector.
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, connect fuel pump relay to its connector.



FUEL LEAKAGE CHECK PROCEDURE

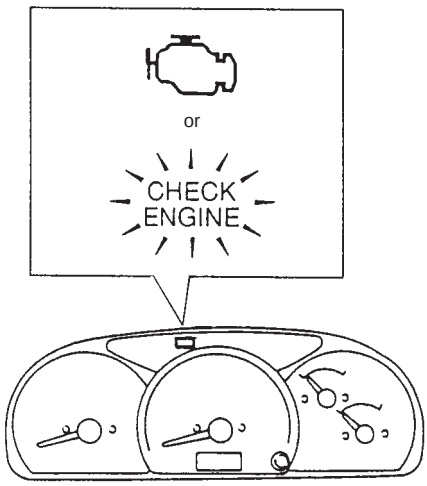
After performing any service on fuel system, check to make sure that there are no fuel leakages as follows.

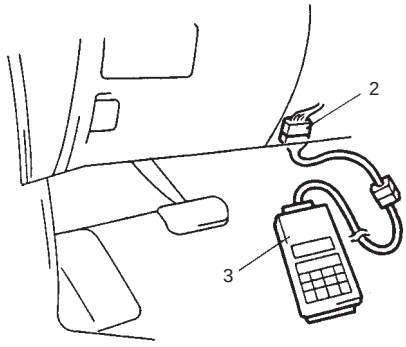
1) Turn ON ignition switch for 3 seconds (to operate fuel pump) and then turn it OFF. Repeat this (ON and OFF) 3 or 4 times and apply fuel pressure to fuel line (till fuel pressure is felt by hand placed on fuel return hose).
2) In this state, check to see that there are no fuel leakages from any part of fuel system.

ENGINE DIAGNOSIS

GENERAL DESCRIPTION

This vehicle is equipped with an engine and emission control system which are under control of ECM (PCM). 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 and abnormality of those parts that influence the engine exhaust emission. When diagnosing engine troubles, be sure to have full understanding of the outline of “On-Board Diagnostic System” and each item in “Precaution in Diagnosing Trouble” and execute diagnosis according to “ENGINE DIAGNOSTIC FLOW TABLE”.
There is a close relationship between the engine mechanical, engine cooling system, ignition system, exhaust system, etc. and the engine and emission control system in their structure and operation. In case of an engine trouble, even when the malfunction indicator lamp (MIL, “SERVICE ENGINE SOON” lamp) doesn’t turn ON, it should be diagnosed according to this flow table.





1. Malfunction indicator lamp (MIL)
2. Data link connector (DLC)
3. SUZUKI scan tool (TECH 1)

ON-BOARD DIAGNOSTIC SYSTEM (VEHICLE WITHOUT MONITOR CONNECTOR)

ECM (PCM) in this vehicle has the following functions.

- When the ignition switch is turned ON with the engine at a stop, MIL turns ON to check the bulb of the malfunction indicator lamp (MIL).
- 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 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 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 due to that malfunction, 2 driving cycles 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 (Tech-1) but also generic scan tool. (Diagnostic information can be accessed by using a scan tool.)

Warm-Up Cycle

A “warm-up cycle” means sufficient vehicle operation such that the coolant temperature has risen by at least 22°C (40°F) from engine starting and reaches a minimum temperature of 70°C (160°F).

Driving Cycle

A “driving cycle” consists of two parts, engine startup and engine shutoff.

2 Driving Cycle Detection Logic

The malfunction detected in the first driving cycle is stored in ECM (PCM) memory (in the form of pending DTC) but the malfunction indicator lamp does not light at this time. It lights up at the second detection of same malfunction also in the next driving cycle.

Pending Diagnostic Trouble Code (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.

An Example of Freeze Frame Data

1.	Trouble Code	P0102	(1st)
2.	Engine Speed	782 RPM	
3.	Eng Cool Tmp	80°C	
4.	Vehicle Spd.	0 km/h	
5.	MAP Sensor	39kPa	
6.	St. Term FT1	–0.8% Lean	
7.	Lg. Term FT1	–1.6% Lean	
8.	Fuel 1 Stat.	Closed Loop	
9.	Fuel 2 Stat.	Not used	
10.	Load value	25.5%	

1st, 2nd or 3rd in parentheses here represents which position in the order the malfunction is detected.

Freeze Frame Data

ECM (PCM) stores the engine and driving conditions (in the form of data as shown at the left) 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.

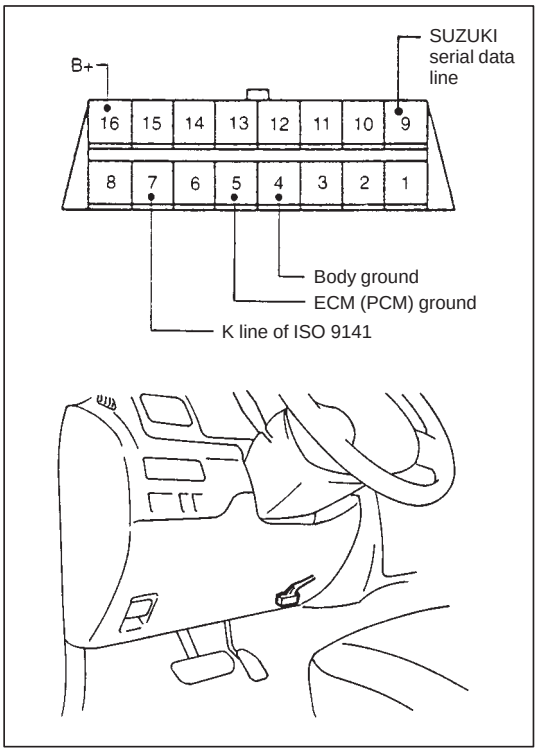
Priority of freeze frame data:
ECM (PCM) has 4 frames where the freeze frame data can be stored. The first frame stores the freeze frame data of the malfunction which was detected first. However, the freeze frame data stored in this frame is updated according to the priority described below. (If malfunction 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”.)

PRIORITY	FREEZE FRAME DATA IN FRAME 1
1	Freeze frame data at initial detection of malfunction among misfire detected (P0300～P0304), fuel system too lean (P0171) and fuel system too rich (P0172).
2	Freeze frame data when a malfunction other than those in “1” above is detected.

In the 2nd through the 4th frames, the freeze frame data of each malfunction is stored in the order as the malfunction is detected. These data are not updated.
Shown in the table below are examples of how freeze frame data are stored when two or more malfunctions are detected.

FRAME / MALFUNCTION DETECTED ORDER		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
	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).

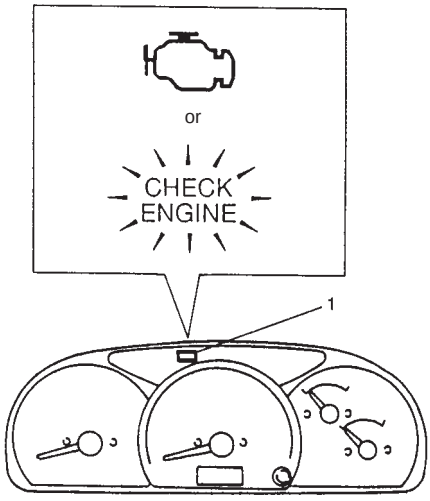


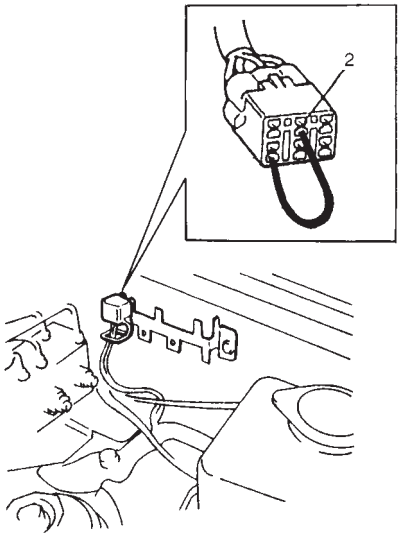
Data Link Connector (DLC)

DLC in compliance with SAE J1962 in its installation position, the shape of connector and pin assignment.

K line of ISO 9141 is used for SUZUKI scan tool (Tech-1) or generic scan tool to communication with ECM (PCM) and ABS control module.

SUZUKI serial data line is used for SUZUKI scan tool (Tech-1) to communicate with an electronic control unit (Airbag SDM, etc.).





ON-BOARD DIAGNOSTIC SYSTEM (VEHICLE WITHOUT MONITOR CONNECTOR)

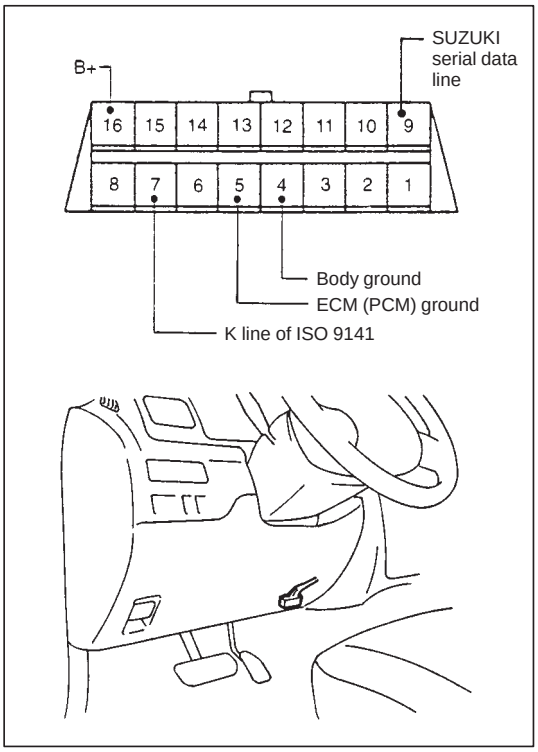
ECM diagnosis troubles which may occur in the area including the following parts when the ignition switch is ON and the engine is running, and indicates the result by turning on or flashing malfunction indicator lamp (1).

- Heated oxygen sensor
- ECT sensor
- TP sensor
- IAT sensor
- MAP sensor
- CMP sensor
- MAF sensor
- VSS
- EGR valve (if equipped)
- CKP sensor (if equipped)
- CPU (Central Processing Unit) of ECM

ECM and malfunction indicator lamp (1) operate as follows.

- Malfunction indicator lamp (1) lights when the ignition switch is turned ON (but the engine at stop) with the diagnosis switch terminal ungrounded regardless of the condition of Engine and Emission Control system. This is only to check the malfunction indicator lamp (1) bulb and its circuit.
- If the above areas of Engine and Emission Control system is free from any trouble after the engine start (while engine is running), malfunction indicator lamp (1) turns OFF.
- When ECM detects a trouble which has occurred in the above areas, it makes malfunction indicator lamp (1) turn ON while the engine is running to warn the driver of such occurrence of trouble and at the same time it stores the trouble area in ECM back-up memory. (The memory is kept as it is even if the trouble was only temporary and disappeared immediately. And it is not erased unless the power to ECM is shut off for specified time below.)
  ECM also indicates trouble area in memory by means of flashing of malfunction indicator lamp (1) at the time of inspection. (i.e. when diagnosis switch terminal (2) is grounded and ignition switch is turned ON.)

NOTE:
When a trouble occurs in the above areas and disappears soon while the diagnosis switch terminal is ungrounded and the engine is running, malfunction indicator lamp (1) lights and remains ON as long as the trouble exists but it turns OFF when the normal condition is restored.



Data Link Connector (DLC)

DLC is in compliance with SAEJ1962 in its installation position, the shape of connector and pin assignment.

K line of ISO 9141 is used for SUZUKI scan tool (Tech-1) to communicate with ECM and ABS control module.
SUZUKI serial data line is used for SUZUKI scan tool (Tech-1) to communicate with an electronic control unit (Airbag SDM, etc.).

PRECAUTION IN DIAGNOSING TROUBLE

- Don't disconnect couplers from ECM (PCM), battery cable from battery, ECM (PCM) ground wire harness from engine or main fuse before confirming diagnostic information (DTC, freeze frame data, etc.) stored in ECM (PCM) memory.
- Diagnostic information stored in ECM (PCM) memory can be cleared as well as checked by using SUZUKI scan tool (Tech-1) or generic scan tool. Before using scan tool, read its Operator's (Instruction) Manual carefully to have good understanding as to what functions are available and how to use it.
- Priorities for diagnosing troubles (Vehicle without monitor connector)
  If two or more diagnostic trouble codes (DTCs) are stored, proceed to the flow table of the DTC which has detected earliest in the order and follow the instruction in that table.
  If no instructions are given, troubleshoot diagnostic trouble codes according to the following priorities.
  (1) Diagnostic trouble codes other than fuel trim malfunction (DTC P0171, P0172), EGR (DTC P0400), and misfire (DTC P0300 ~ P0304).
  (2) Fuel trim malfunction (DTC P0171, P0172) and EGR (DTC P0400).
  (3) Misfire (DTC P0300 ~ P0304)
- Be sure to read "Precautions for Electrical Circuit Service" in Section 0A before inspection and observe what is written there.
- ECM (PCM) replacement or substitution
  When substituting a known-good ECM, check for following conditions. Neglecting this check may cause damage to known-good ECM.
  – Resistance value of all relays, actuators is as specified respectively.
  – MAF sensor, MAP sensor and TP sensor are in good condition and none of power circuits of these sensors is shorted to ground.

ENGINE DIAGNOSTIC FLOW TABLE

Refer to the following pages for the details of each step.

STEP	ACTION	YES	NO
1	Customer Complaint Analysis 1) Perform customer complaint analysis. Was customer complaint analysis performed?	Go to Step 2.	Perform customer complaint analysis.
2	Diagnostic Trouble Code (DTC) and Freeze Frame Data Check, Record and Clearance 1) Check for DTC referring to the next page. Is there any DTC(s)?	1) Print DTC and freeze frame data or write then down and clear by referring to "DTC Clearance" in this section. 2) 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?	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 "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 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 "DTC Check" in this section. 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.	1) Check and repair malfunction part(s). 2) Go to Step 11.
9	Troubleshooting for DTC 1) Check and repair according to applicable DTC diag. flow table in this section. Are check and repair complete?		
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

Record details of the problem (failure, complaint) and how it occurred as described by the customer. For this purpose, use of such an inspection form will facilitate collecting information to the point required for proper analysis and diagnosis.

2. DIAGNOSTIC TROUBLE CODE (DTC)/FREEZE FRAME DATA CHECK, RECORD AND CLEARANCE

First, check DTC (including pending DTC), referring to "DTC check" section. If DTC is indicated, print it and freeze frame data or write them down and then clear them by referring to DTC clearance section. DTC indicates malfunction that occurred in the system but does not indicate whether it exists now or it occurred in the past and the normal condition has been restored now. To check which case applies, check the symptom in question according to Step 5 and recheck DTC according to Step 6 and 7.

Attempt to diagnose a trouble based on DTC in this step only or failure to clear the DTC (including pending DTC) in this step will lead to incorrect diagnosis, trouble diagnosis of a normal circuit or difficulty in trouble-shooting.

NOTE:

If only automatic transmission DTC P0705 (No.72) to P0758 (No.63/64), or P1875 is indicated in this step, proceed to DIAGNOSIS in Section 7B1

3 and 4. VISUAL INSPECTION

As a preliminary step, be sure to perform visual check of the items that support proper function of the engine referring to "Visual Inspection" section.

5. TROUBLE SYMPTOM CONFIRMATION

Based on information obtained in Step 1 Customer complaint analysis and Step 2 DTC/freeze frame data check, confirm trouble symptoms. Also, reconfirm DTC according to "DTC Confirmation Procedure" described in each DTC Diagnosis section.

6 and 7. DTC/FREEZE FRAME DATA RECHECK, RECORD AND CLEARANCE

Refer to "DTC CHECK" section for checking procedure.

8. ENGINE BASIC CHECK AND ENGINE DIAGNOSIS TABLE

Perform basic engine check according to the "Engine Basic Check 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.

9. TROUBLESHOOTING FOR DTC (See each DTC Diag. Flow Table)

Based on the DTC indicated in Step 6 or 7 and referring to the applicable DTC diag. flow table in this section, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ECM (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 and perform DTC confirmation procedure and confirm that no DTC is indicated.

CUSTOMER PROBLEM INSPECTION FORM (EXAMPLE)

User name:	Model:	VIN:	
Date of issue:	Date Reg.	Date of problem:	Mileage:

PROBLEM SYMPTOMS

☐Difficult Starting	**☐Poor Driveability**
☐No cranking ☐No initial combustion ☐Poor starting at (☐Cold/☐Warm/☐Always) ☐Other _____	☐Hesitation on acceleration ☐Back fire/After fire ☐Loss of power ☐Surging ☐Abnormal knocking ☐Other _____
☐Poor Idling	**☐Engine Stall when**
☐Poor fast idle ☐Abnormal idling speed (☐High ☐Low) (r/min.) ☐Unstable ☐Hunting (r/min. to r/min.) ☐Other _____	☐Immediately after start ☐Accel. pedal is depressed ☐Accel. pedal is released ☐Load is applied ☐A/C ☐Electrical load ☐P/S ☐Other _____

☐OTHERS:

VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS

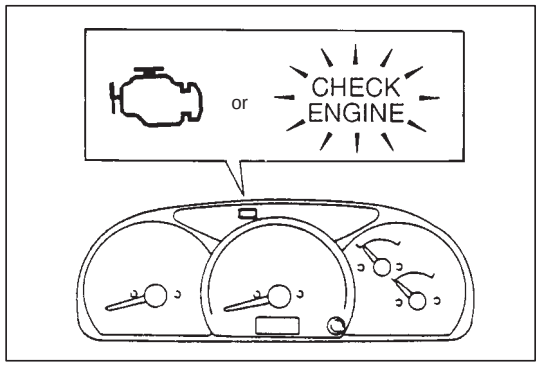
Environmental Condition

Weather	☐Fair ☐Cloudy ☐Rain ☐Snow ☐Always ☐Other _____ (°F/ °C)
Temperature	☐Hot ☐Warm ☐Cool ☐Cold ☐Always
Frequency	☐Always ☐Sometimes (times/ day, month) ☐Only once ☐Under certain condition
Road	☐Urban ☐Suburbs ☐Highways ☐Mountainous (☐Uphill ☐Downhill) ☐Paved road ☐Gravel
	☐Other _____

Vehicle Condition

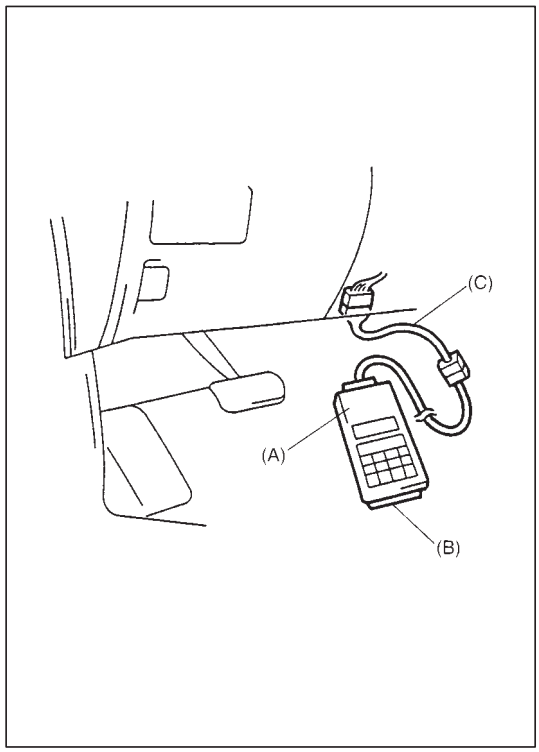
Engine condition	☐Cold ☐Warming up phase ☐Warmed up ☐Always ☐Other at starting ☐Immediately after start/ ☐Racing without load ☐Engine speed (r/min.)
Vehicle condition	☐During driving: ☐Constant speed (km/h, mile/h) ☐Accelerating ☐Decelerating ☐Right hand corner ☐Left hand corner ☐When shifting (Lever position) ☐At stop ☐Other ( )
Malfunction indicator lamp condition	☐Always ON ☐Sometimes ON ☐Always OFF ☐Good condition ☐Flashing
Diagnostic trouble code	First check: ☐No code ☐Malfunction code ( )
	Second check: ☐No code ☐Malfunction code ( )

NOTE:
The above form is standard sample. It should be modified according to conditions characteristic of each market.



MALFUNCTION INDICATOR LAMP (MIL) CHECK

1) Turn ON ignition switch (but the engine at stop) and check that MIL lights.
   If MIL does not light up or dims, go to "Diagnostic Flow Table A-1" for troubleshooting.
   If MIL flushes, go to "Diagnostic Flow Table A-3" (vehicle with monitor connector).
2) Start engine and check that MIL turns OFF.
   If MIL remains ON, and no DTC is stored in ECM (PCM), go to "Diagnostic Flow Table A-2" for troubleshooting.



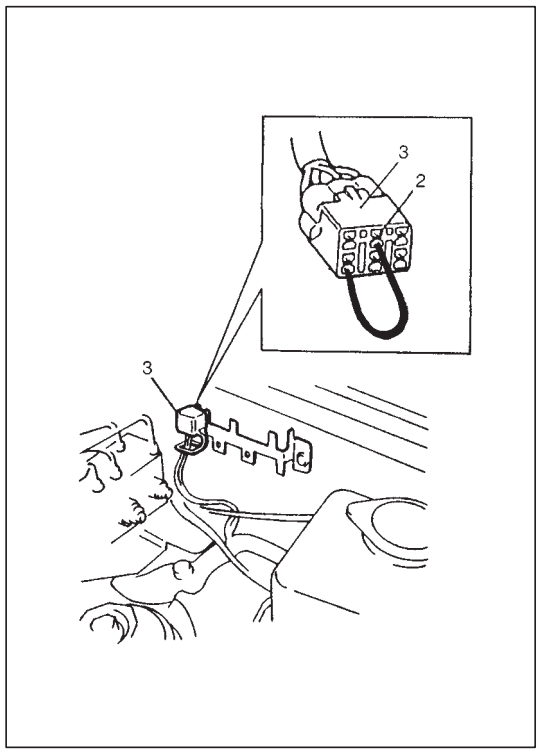
DIAGNOSTIC TROUBLE CODE (DTC) CHECK

[Using SUZUKI scan tool]

1) Prepare generic scan tool or SUZUKI scan tool (Tech-1).
2) Connect it to data link connector (DLC) located on underside of instrument panel at driver's seat side.

   Special Tool
   (A): SUZUKI scan tool
   (B): Mass storage cartridge
   (C): 16/14 pin DLC cable (OBD-II adapter cable)

3) Turn ignition switch ON and confirm that MIL lights.
4) Read DTC, pending DTC and freeze frame data according to instructions displayed on scan tool and print them or write them down. Refer to scan tool operator's manual for further details.
   If communication between scan tool and ECM (PCM) is not possible, check if scan tool is communicable by connecting it to ECM (PCM) in another car. If communication is possible in this case, scan tool is in good condition. Then check data link connector and serial data line (circuit) in the car with which communication was not possible.
5) After completing the check, turn ignition switch off and disconnect scan tool from data link connector.



[Not using SUZUKI scan tool] (vehicle with monitor connector only)

1) Check malfunction indicator lamp referring to "Malfunction Indicator Lamp Check" in this section.
2) With the ignition switch OFF position, disconnect SUZUKI scan tool if connected and using service wire (1), ground diagnosis switch terminal (2) in monitor connector (3).
3) With the ignition switch ON position and leaving engine OFF, read DTC from flashing pattern of malfunction indicator lamp. Refer to "Diagnostic Trouble Code Table".
   If lamp remains ON or does not flash, go to "Diagnostic Flow Table A-4".

   NOTE:
   - **If abnormality or malfunction lies in two or more areas, malfunction indicator lamp indicates applicable codes three times each.**
     And flashing of these codes is repeated as long as diagnosis terminal is grounded and ignition switch is held at ON position.
   - **Take a note of diagnostic trouble code indicated first.**

4) After completing the check, turn the ignition switch OFF position and disconnect service wire from monitor coupler.

DIAGNOSTIC TROUBLE CODE (DTC) CLEARANCE

[Using scan tool]

1) Connect generic scan tool or SUZUKI scan tool (Tech-1) to data link connector in the same manner as when making this connection for DTC check.
2) Turn ignition switch OFF and then ON.
3) Erase DTC and pending DTC according to instructions displayed on scan tool. Refer to scan tool operator's manual for further details.
4) After completing the clearance, turn ignition switch OFF and disconnect scan tool from data link connector.

NOTE:
DTC and freeze frame data stored in ECM (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 connectors).**
- **When the same malfunction (DTC) is not detected again during 40 engine warm-up cycles (see P.6–7) (vehicle without monitor connector).**

[Not using scan tool]

1) Turn the ignition switch OFF position.
2) Disconnect battery negative cable for specified time below to erase diagnostic trouble code stored in ECM memory and reconnect it.

Time required to erase DTC:

Ambient temperature	Time to cut power to ECM
Over 0°C (32°F)	30 sec. or longer
Under 0°C (32°F)	Not specifiable. Select a place with higher than 0°C (32°F) temperature.

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 detects normal condition after that.

DTC NO.	TROUBLE AREA	FAIL SAFE OPERATION
P0100 (No.33, 34)	MAF SENSOR	● Injector drive time (fuel injection volume) is determined according to throttle valve opening and engine speed. ● EGR valve stops. ● Air flow of IAC valve is limited.
P0110 (No.23, 25)	IAT SENSOR	Each control is performed on the basis of 21.8°C intake air temp.
P0115 (No.14, 15)	ECT SENSOR	● Each control except 4-A/T is performed on the basis of 30.1°C engine coolant temp. ● 4-A/T control is performed assuming 31°C (engine warmed up) or higher after 15 min. from engine start.
P0120 (No.21, 22)	TP SENSOR	● Each control except 4-A/T is performed on the basis of 124.5° throttle valve opening. ● 4-A/T control is performed on the basis of 0° throttle valve opening.
P0500 (No.24)	VEHICLE SPEED SENSOR	Air flow of IAC valve is limited.
P1450	BAROMETRIC PRESSURE SENSOR	Each control is performed based on 760 mmHg barometric pressure.
P0705 (No.72)	TR SWITCH	A/T control is performed in priority order of L, 2, N, D, R and P.
P0720 (No.75)	OUTPUT SPEED SENSOR CIRCUIT MALFUNCTION	A/T control is performed by using signal from VSS.
P0753 (No.61, 62)	SHIFT SOLENOID A (#1)	● A/T control using 3rd gear is performed when D range, 1st, or 2nd gear is used. ● TCC solenoid OFF
P0758 (No.63, 64)	SHIFT SOLENOID B (#2)	● A/T control using 4th gear is performed when D range, 2nd or 3rd gear is used. ● When both shift solenoids A (#1) and B (#2) failed simultaneously, A/T control using 4th gear is always performed in D range. ● TCC solenoid OFF
P0743 (No.65, 66)	TCC (Lock-up) SOLENOID	TCC (Lock-up) solenoid OFF

DIAGNOSTIC TROUBLE CODE (DTC) TABLE

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL (vehicle without monitor connector)	MIL (vehicle with monitor connector)
P0100 (No.34)	Mass air flow circuit malfunction	Sensor output low voltage (or MAF sensor circuit shorted to ground)	1 driving cycle	1 driving cycle
P0100 (No.33)		Sensor output high voltage (or MAF sensor circuit open)		
P0110 (No.25)	Intake air temp. circuit malfunction	Intake air temp. circuit low input	1 driving cycle	1 driving cycle
P0110 (No.23)		Intake air temp. circuit high input		
P0115 (No.15)	Engine coolant temp. circuit malfunction	Engine coolant temp. circuit low input	1 driving cycle	1 driving cycle
P0115 (No.14)		Engine coolant temp. circuit high input		
P0120 (No.22)	Throttle position circuit malfunction	Throttle position circuit low input	1 driving cycle	1 driving cycle
P0120 (No.21)		Throttle position circuit high input		
P0121	Throttle position circuit performance problem	Poor performance of TP sensor	2 driving cycles	Not applicable
P0130	HO2S circuit malfunction (Sensor-1)	Min. output voltage of HO2S-higher than specification	2 driving cycles	Not applicable
		Max. output voltage of HO2S-lower than specification		
P0133	HO2S circuit slow response (Sensor-1)	Response time of HO2S-1 output voltage between rich and lean is longer than specification.	2 driving cycles	Not applicable
P1034 (No.13)	HO2S-1 no activity detected	Output voltage of HO2S-1 fails to go above specification (or HO2S-1 circuit shorted to ground).	2 driving cycles	1 driving cycle
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	1 driving cycle
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	Not applicable
P0141	HO2S heater circuit malfunction (Sensor-2)	Terminal voltage is lower than specification at heater OFF or it is higher at heater ON. (or heater circuit or short)	2 driving cycles	Not applicable
P0171	Fuel system too lean	Short term fuel trim or total fuel trim (short and long terms added) is larger than specification for specified time or longer. (Fuel trim toward rich side is large.)	2 driving cycles	Not applicable
P0172	Fuel system too rich	Short term fuel trim or total fuel trim (short and long term added) is smaller than specification for specified time or longer. (Fuel trim toward lean side is large.)	2 driving cycles	Not applicable

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL (vehicle with EGR valve)	MIL (vehicle without EGR valve)
P0300 P0301 P0302 P0303 P0304	Random misfire detected Cylinder 1 misfire detected Cylinder 2 misfire detected Cylinder 3 misfire detected Cylinder 4 misfire detected	Misfire of such level as to cause damage to three way catalyst	MIL flashing during misfire detection	Not applicable
		Misfire of such level as to deteriorate emission but not to cause damage to three way catalyst	2 driving cycles	Not applicable
P0325 (No.43)	Knock sensor circuit malfunction	Knock sensor circuit low input Knock sensor circuit high input	1 driving cycle	1 driving cycle
P0335	Crankshaft position sensor circuit malfunction	No signal for 2 sec. during engine cranking	1 driving cycle	1 driving cycle
P0340 (No.42)	Camshaft position sensor circuit malfunction	No signal during engine running	1 driving cycle	1 driving cycle
P0400	Exhaust gas recirculation flow malfunction detected	Excessive or insufficient EGR flow	2 driving cycles	Not applicable
P0403 (No.51)	EGR valve circuit malfunction	EGR valve electrical circuit open or short	1 driving cycle	1 driving cycle
P0420	Catalyst system efficiency below threshold	Output waveforms of HO2S-1 and HO2S-2 are similar. (Time from output voltage change of HO2S-1 to that of HO2S-2 is shorter than specification.)	2 driving cycles	Not applicable
P0443	Purge control valve circuit malfunction	Purge control valve circuit is open or shorted to ground.	2 driving cycles	Not applicable
P0460	Fuel level sensor circuit high input	Fuel level sensor circuit open (high voltage)	2 driving cycles	Not applicable
P0500 (No.24)	Vehicle speed sensor malfunction	No signal while running in “D” range or during fuel cut at decelerating	2 driving cycles	1 driving cycle
P0505	Idle control system malfunction	No closed signal to IAC valve is detected.	2 driving cycles	Not applicable
P0601 (No.71)	Internal control module memory check sum error	Data write error (or check sum error) when written into ECM	2 driving cycles	1 driving cycle
P1408	Manifold absolute pressure sensor circuit malfunction	Manifold absolute pressure sensor output voltage is higher or lower than specified value (or sensor circuit shorted to ground or open).	2 driving cycles	Not applicable
P1450	Barometric pressure sensor circuit malfunction	Barometric pressure is lower or higher than specification. (or sensor malfunction)	1 driving cycle	1 driving cycle
P1451	Barometric pressure sensor performance problem	Difference between manifold absolute pressure (MAP sensor value) and barometric pressure (barometric pressure sensor value) is larger than specification during cranking.	2 driving cycles	Not applicable
P1500	Starter signal circuit malfunction	Starter signal is not inputted from engine cranking till its start and after or it is always inputted	2 driving cycles	Not applicable
P1510	ECM backup power source malfunction	No backup power after starting engine	1 driving cycle	Not applicable

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0705 (No.72)	Transmission Range Switch Circuit Malfunction	Refer to Section 7B	
P0715 (No.76)	Input/Turbine Speed Sensor Circuit Malfunction		
P0720 (No.75)	Output Speed Sensor Circuit Malfunction		
P0741	Torque Converter Clutch Circuit Performance or Stuck off		
P0743 (No.65 No.66)	TCC Solenoid Valve Electrical		
P0751	Shift Solenoid A (#1) Performance or Stuck off		
P0753 (No.61 No.62)	Shift Solenoid Valve A (#1)		
P0756	Shift Solenoid B (#2) Performance or Stuck off		
P0758 (No.63 No.64)	Shift Solenoid Valve B (#2)		
P1875	4WD Low Switch Circuit		
P1620 (No.84)	ECU Code not Registered	Refer to Section 8G	
P1621 (No.83)	No ECU Code Transmitted from Immobilizer Control Module		
P1622 (No.82)	Fault in ECM		
P1623 (No.81)	ECU Code not Matched		

Note:

- **For ( ) marked No. in DTC column, it is used for vehicle without EGR valve.**
- **DTC No.12 appears when none of the other codes is identified.**

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 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:

- **For asterisk (⁎) marked item in OTHER column, item can be read only SUZUKI scan tool.**
- **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.**
- **Star (☆) marked data in the table below can not be read for vehicle with monitor connector.**

SCAN TOOL DATA	CONDITION		NORMAL CONDITION/ REFERENCE VALUE		OTHER
COOLANT TEMP. (Engine Coolant Temp.)	At specified idle speed after warming up		G16	80 – 105°C (176 – 221°F)	
			J20	70 – 100°C (158 – 212°F)	
INTAKE AIR TEMP.	At specified idle speed after warming up		Environmental temp.	+35°C (+63°F) –5°C (–9°F)	
DESIRE IDLE (Desired Idle Speed)	At idling with no load after warming up		750 rpm		⁎
CLOSED THROT POS (Closed Throttle Position)	Ignition switch ON	Accelerator pedal released	ON		⁎
		Accelerator pedal depressed	OFF		
IAC FLOW DUTY	At specified idle speed after warming up		2 – 30 %		⁎
ENGINE SPEED	At idling with no load after warming up		Desired idle speed ± 50 rpm		
SHORT FT B1 (Short Term Fuel Trim)	At specified idle speed after warming up		–20 – +20 %		
LONG FT B1 (Long Term Fuel Trim)	At specified idle speed after warming up		–15 – +15 %		
IGNITION ADVANCE	At specified idle speed with no load after warming up		G16	6 – 10°	
			J20	12 – 16°	
BATTERY VOLTAGE	Ignition switch ON/engine stopped		10 – 14 V		⁎
MAF (Mass Air Flow Rate)	At specified idle speed with no load after warming up.		G16	1.1 – 2.9 g/s 0.14 – 0.38 lb/min.	
			J20	1.5 – 4.0 g/s 0.20 – 0.53 lb/min.	
	At 2500 r/min. with no load after warming up.		G16	5.0 – 9.0 g/s 0.66 – 1.12 lb/min.	
			J20	5.0 – 10.0 g/s 0.66 – 1.32 lb/min.	
INJ PULSE WIDTH (Fuel Injection Pulse Width)	At specified idle speed with no load after warming up.		1.3 – 5.0 msec		⁎
	At 2500 r/min. with no load after warming up.		1.3 – 5.0 msec		
THROTTLE POS (Absolute Throttle Position)	Ignition switch ON/ warmed up engine stopped.	Accelerator pedal released	0 %		
		Accelerator pedal depressed fully	95 – 100 %		
TP SENSOR VOLT (TP Sensor Output Voltage)	Ignition switch ON/ warmed up engine stopped.	Accelerator pedal released	0.2 – 0.6 V		⁎
		Accelerator pedal depressed fully	3.5 – 4.5 V		

SCAN TOOL DATA	CONDITION		NORMAL CONDITION/ REFERENCE VALUE	OTHER
OXYGEN SENSOR B1 S1 (HO2S-1 Output Voltage)	At specified idle speed after warming up.		0.01 – 0.95 V	
OXYGEN SENSOR B1 S2 (HO2S-2 Output Voltage)	When engine is running at 2000 r/min. for 3 min. or longer after warming up.		0.01 – 0.95 V	
FUEL SYSTEM (Fuel System Status)	At specified idle speed after warming up.		Closed	
CALC LOAD (Calculated Load Value)	At specified idle speed with no load after warming up.		10 – 25 %	
	At 2500 r/min with no load after warming up.		10 – 25 %	
TOTAL FUEL TRIM	At specified idle speed after warming up.		–35 – +35 %	✳
MAP (Intake Manifold Absolute Pressure)	At specified idle speed after warming up.		25 – 35 kPa, 7.4 – 10 in. Hg	
CANIST PRG DUTY (EVAP Canister Purge Flow Duty)	At specified idle speed after warming up.		0 %	✳
VEHICLE SPEED	At stop.		0 km/h 0 MPH	
FUEL CUT	When engine is at fuel cut condition.		ON	✳
	Other than fuel cut condition.		OFF	
EGR VALVE	At specified idle speed after warming up.		0%	✳
A/C SWITCH (if equipped)	When A/C not operating.		OFF	✳
	When A/C operating.		ON	
PSP SWITCH (if equipped).	Engine running at idle speed and steering wheel at straight-ahead position.		OFF	✳
	Engine running at idle speed and steering wheel turned to the right or left as far as it stops.		ON	
PNP SIGNAL (Transmission Range Switch) A/T only.	Ignition switch ON	Selector lever in “P” or “N” position	P/N Range	✳
		Selector lever in “R”, “D”, “2” or “L position	D Range	
FUEL TANK LEVEL	Ignition switch ON		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	
BRAKE SW	Ignition switch ON	Brake pedal is depressing	ON	
		Brake pedal is releasing	OFF	
BLOWER FAN	Ignition switch ON	Blower fan switch ON	ON	
		Blower fan switch OFF	OFF	
A/C CONDENSER FAN	Ignition switch ON	A/C not operating	OFF	
		A/C operating	ON	
ELECTRIC LOAD	Ignition switch ON / Headlight, small light, heater fan and rear window defogger all turned OFF.		OFF	
	Ignition switch ON / Headlight, small light, heater fan or rear window defogger turned ON.		ON	

SCAN TOOL DATA	CONDITION	NORMAL CONDITION/ REFERENCE VALUE	OTHER
VSS (for 4-A/T) (Vehicle Speed Sensor)	At stop.	0 km/h 0 MPH	*
GEAR POSITION (for 4-A/T)	Ignition switch ON, selector lever is shifted at "R", "D", "2" or "L" range and vehicle stops.	1st	*
THROT POS LEVEL (Throttle Position Level for 4-A/T)	"0" (about idle position), "1", "2", "3", "4", "5", "6" or "7" (about full open) appears according to throttle valve opening.		*
SHIFT SOL #1 (A) CON (Shift Solenoid #1 Command Signal) MON (Shift Solenoid #1 Monitor)	Ignition switch ON Selector lever is shifted at "P", "R", "N", "D", "2" or "L" range. Vehicle stops.	ON	*
SHIFT SOL #2 (B) CON (Shift Solenoid #2 Command Signal) MON (Shift Solenoid #2 Monitor)	Ignition switch ON Selector lever is shifted at "P", "R", "N", "D", "2" or "L" range. Vehicle stops.	OFF	*
TCC SOL CON (Torque Converter Clutch Solenoid Command Signal) MON (Torque Converter Clutch Solenoid Monitor)	Ignition switch ON Selector lever is shifted at "P", "R", "N", "D", "2" or "L" range. Vehicle stops.	OFF	*
TRANS RANGE	Ignition switch ON, selector lever is at "P", "R", "N", "D", "2" or "L" range.	P, R, N, D, 2 or L	*
BRAKE SW (Brake, Stop Lamp, Switch)	Ignition switch ON, Brake pedal is released.	OFF	*
	Ignition switch ON, Brake pedal is depressed.	ON	
O/D OFF SW (Overdrive Cut Switch)	Ignition switch ON, Overdrive cut switch OFF.	OFF	*
	Ignition switch ON, Overdrive cut switch ON.	ON	
MODE SELECT SW (Power/Normal Change Switch)	Ignition switch ON, P/N change switch is at normal position.	NORMAL	*
	Ignition switch ON, P/N change switch is at power position.	POWER	
4WD-L SW (4WD Low Switch)	Ignition switch ON, Transfer lever is shifted at "4H" or "2H" position.	OFF	*
	Ignition switch ON, Transfer lever is shifted at "4L" position.	ON	

SCAN TOOL DATA DEFINITIONS

COOLANT TEMP (ENGINE COOLANT TEMP., °C/°F)
It is detected by engine coolant temp. sensor.

INTAKE AIR TEMP (°C/°F)
It is detected by intake air temp. sensor.

DESIRE IDLE (DESIRED IDLE SPEED RPM)
The desired idle speed is an ECM internal parameter which indicates the ECM requested idle. If the engine is not running, the number is not valid.

CLOSED THROT POS (CLOSED THROTTLE POSITION ON/OFF)
This parameter will read ON when the throttle valve is fully closed, or OFF when the throttle is not fully closed.

IAC FLOW DUTY (%)
This parameter indicates IAC valve opening rate which controls bypass air flow.

VEHICLE SPEED (km/h, MPH)
It is computed based on pulse signals from vehicle speed sensor on transfer or transmission.

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.

IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER, °)
Ignition timing of No.1 cylinder is commanded by ECM. The actual ignition timing should be checked by using the timing light.

ENGINE SPEED (RPM)
It is computed by reference pulses from the Camshaft Position Sensor.

MAF (MASS AIR FLOW RATE, g/s, lb/min.)
It represents total mass of air entering intake manifold which is measured by mass air flow sensor.

CALC LOAD (CALCULATED LOAD VALUE, %)
Engine load displayed as a percentage of maximum possible load. Value is calculated mathematically using the formula: actual (current) intake air volume ÷ maximum possible intake air volume x 100%.

INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH, msec)
This parameter indicates time of the injector drive (valve opening) pulse which is output from ECM (but injector drive time of No.1 cylinder for multi port fuel injection).

BATTERY VOLTAGE (V)
This parameter indicates battery positive voltage inputted from main relay to ECM.

THROTTLE POS (ABSOLUTE THROTTLE POSITION, %)
When throttle position sensor is fully closed position, throttle opening is indicated as 0% and 100% for full open position.

TP SENSOR VOLT (TP SENSOR OUTPUT VOLTAGE, V)
Throttle Position Sensor reading provides throttle valve opening information in the form of voltage.

OXYGEN SENSOR B1 S1 (HO2S-1 OUTPUT VOLTAGE, V)
It indicates output voltage of HO2S-1 installed on exhaust manifold (pre-catalyst).

OXYGEN SENSOR B1 S2 (HO2S-2 OUTPUT VOLTAGE, V)
It indicates output voltage of HO2S-2 installed on exhaust pipe (post-catalyst). It is used to detect catalyst deterioration.

FUEL SYSTEM (FUEL SYSTEM STATUS)
Air/fuel ratio feedback loop status displayed as one of the followings.
OPEN: Open loop-has not yet satisfied conditions to go closed loop.
CLOSED: Closed loop-using oxygen sensor(s) as feedback for fuel control.
OPEN-DRIVE COND: Open loop due to driving conditions (Power enrichment, etc.).
OPEN SYS FAULT: Open loop due to detected system fault.
CLOSED-ONE O2S: Closed loop, but fault with at least one oxygen sensor-may be using single oxygen sensor for fuel control.

TOTAL FUEL TRIM (%)
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.

MAP (MANIFOLD ABSOLUTE PRESSURE, mmHg, kPaA)
It is detected by manifold absolute pressure sensor.

BAROMETRIC PRESS (kPa, inHg)
This parameter represents a measurement of barometric air pressure and is used for altitude correction of the fuel injection quantity and IAC valve control.

CANIST PRG DUTY (EVAP CANISTER PURGE FLOW DUTY, %)
This parameter indicates valve ON (valve open) time rate within a certain set cycle of EVAP canister purge valve which controls the amount of EVAP purge.

FUEL TANK LEVEL (%)
This parameter indicates approximate fuel level in the fuel tank.

FUEL PUMP (ON/OFF)
ON is displayed when the ECM (or PCM) activates the fuel pump via the fuel pump relay switch.

FUEL CUT (ON/OFF)
ON: Fuel being cut (output signal to injector is stopped).
OFF: Fuel not being cut.

EGR VALVE (%)
This parameter indicates opening rate of EGR valve which controls the amount of EGR flow.

PSP SWITCH (ON/OFF)
ON: PSP switch detects P/S operation (high PS pressure).
OFF: PSP switch not detects P/S operation.

A/C SWITCH (ON/OFF)
ON: Command for operation being output from A/C amplifier to compressor.
OFF: Command for operation not being output.

PNP SIGNAL (TRANSMISSION RANGE SWITCH, P/N or D range)
Whether the transmission range switch (P/N position switch) at P or N range or at R, D, 2 or L range is displayed. If at P or N range, “P/N range” is displayed and if at R, D, 2 or L range, “D range” is displayed.

A/C CONDENSER FAN (ON/OFF)
This parameter indicates the state of the A/C Condenser Fan control signal.

ELECTRIC LOAD (ON/OFF)
ON: Headlight, small light, heater fan or rear window defogger ON signal inputted.
OFF: Above electric loads all turned OFF.

BRAKE SW (ON/OFF)
This parameter indicates the state of the brake switch.

BLOWER FAN (ON/OFF)
This parameter indicates the state of the blower fan motor switch.

VSS (4-A/T) (km/h, MPH)
It is computed by using pulse signals from vehicle (output) speed sensor on 4-speed automatic transmission.

GEAR POSITION (1ST, 2ND, 3RD or 4TH)
The gear position is determined on the basis of the command state signals generated from PCM (ECM) to shift solenoids A and B (#1 and #2) and displayed as shown in the table below.

SOLENOID / DISPLAY	PCM COMMAND	
	SHIFT SOLENOID-A	SHIFT SOLENOID-B
1ST	ON	OFF
2ND	ON	ON
3RD	OFF	ON
4TH	OFF	OFF

THROT POS LEVEL (THROTTLE POSITION LEVEL FOR 4-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) controls the automatic gear change of the automatic transmission by using these signals according to the signal from the TP sensor.

SHIFT SOL #1 CON/MON (SHIFT SOLENOID #1, A COMMAND/MONITOR, ON/OFF)
CON-ON: ON command being output to shift solenoid #1, A.
CON-OFF: ON command not being output.
MON-ON: Electricity being passed to shift solenoid #1, A.
MON-OFF: Electricity not being passed.

SHIFT SOL #2 CON/MON (SHIFT SOLENOID #2, B COMMAND/MONITOR, ON/OFF)
CON-ON: ON command being output to shift solenoid #2, B.
CON-OFF: ON command not being output.
MON-ON: Electricity being passed to shift solenoid #2, B.
MON-OFF: Electricity not being passed.

TCC SOL CON/MON (TORQUE CONVERTER CLUTCH SOLENOID COMMAND/MONITOR, ON/OFF)
CON-ON: ON command being output to TCC solenoid.
CON-OFF: ON command not being output.
MON-ON: Electricity being passed to TCC solenoid.
MON-OFF: Electricity not being passed.

TRANS RANGE (TRANSMISSION RANGE, P, R, N, D, 2 or L)
It indicates transmission range according to transmission range switch signal.

BRAKE SW (BRAKE, STOP LAMP, SWITCH, ON/OFF)
OFF: Brake pedal is released.
ON: Brake pedal is depressed.

O/D OFF SW (OVERDRIVE CUT SWITCH, ON/OFF)
OFF: Overdrive cut switch OFF
ON: Overdrive cut switch ON

MODE SELECT SW (POWER/NORMAL CHANGE SWITCH, POWER/NORMAL)
POWER: Switch button is at POWER position.
NORMAL: Switch button is at NORMAL position.

4WD-L SW (4WD-LOW SWITCH, ON/OFF)
ON: Transfer lever is shifted to 4L position.
OFF: Transfer lever is shifted to 4H or 2H position.

VISUAL INSPECTION

Visually check following parts and systems.

INSPECTION ITEM	REFERRING SECTION
● Engine oil – – – – – level, leakage	Section 0B
● Engine coolant – – – – – level, leakage	Section 0B
● Fuel – – – – – level, leakage	Section 0B
● A/T fluid – – – – – level, leakage	Section 0B
● Air cleaner element – – – – – dirt, clogging	Section 0B
● Battery – – – – – fluid level, corrosion of terminal	
● Drive belt – – – – – tension, damage	Section 0B
● Throttle cable – – – – – play (after warm up engine), installation	Section 6E1/6E2
● 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 add following items at engine start, if possible.	
● Malfunction indicator lamp	Section 6
● Charge warning lamp	Section 6H
● Engine oil pressure warning lamp (Operation)	Section 8 (Section 6A1/6A4 for pressure check)
● Engine coolant temp. meter (Operation)	Section 8
● Fuel level 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	

ENGINE BASIC CHECK

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 or 6G1.
4	Does engine start?	Go to Step 5.	Go to Step 7.
5	Check engine idle speed/IAC duty referring to “Idle speed/IAC Duty Inspection” in Section 6E1. Is check result as specified?	Go to Step 6.	Go to “Engine Diagnosis Table” in this section.
6	Check ignition timing referring to “Ignition Timing Inspection” in Section 6F1 or 6F2. Is check result as specified?	Go to “Engine Diagnosis Table” in this section.	Adjust ignition timing or check input signals related to ignition system.
7	Is immobilizer control system equipped?	Go to Step 8.	Go to Step 9.
8	Check immobilizer system malfunction as follows. 1) Check immobilizer indicator lamp or MIL (malfunction indicator lamp) for flashing. Is it flashing when ignition switch is turned to ON position?	Go to “DIAGNOSIS” in Section 8G.	Go to Step 9.
9	Check fuel supply as follows: 1) Check to make sure that enough fuel is filled in fuel tank. 2) Turn ON ignition switch for 3 seconds and then OFF. Repeat this a few times. Is fuel return pressure (returning sounds) felt from fuel return hose when ignition switch is turned ON?	Go to Step 11.	Go to Step 10.
10	Check fuel pump for operating. 1) Was fuel pump operating sound heard from fuel filler for about 3 seconds after ignition switch ON and stop?	Go to “Diag. Flow Table B-3”.	Go to “Diag. Flow Table B-1”.
11	Check ignition spark referring to “Ignition Spark Test” in Section 6F1 or 6F2. Is it in good condition?	Go to Step 12.	Go to “DIAGNOSIS” in Section 6F1 or 6F2.
12	Check fuel injector referring to “Fuel Injector Inspection” in Section 6E1. Is it in good condition?	Go to “Engine Diagnosis Table” in this section.	Go to “Diag. Flow Table B-2”.

ENGINE DIAGNOSIS TABLE

Perform troubleshooting referring to following table when ECM (PCM) has detected no DTC and no abnormality has been found in visual inspection and engine basic inspection previously.

Condition	Possible Cause	Reference Item
Hard starting (Engine cranks OK)	**Engine and emission control system out of order.**	
	● Faulty idle air control system	DTC P0505 Diag. Flow Table or Table B-4 in this Section.
	● Faulty ECT sensor or MAF sensor	ECT sensor or MAF sensor in Engine and Emission Control System Section.
	● Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this Section.
	Low compression.	Compression check in Engine Mechanical Section.
	● Faulty hydraulic valve lash adjuster	Valve lash adjuster in Engine Mechanical Section.
	● Compression leak from valve seat	Valves inspection in Engine Mechanical Section.
	● Sticky valve stem	Valves inspection in Engine Mechanical Section.
	● Weak or damaged valve springs	Valves spring inspection in Engine Mechanical Section.
	● Compression leak at cylinder head gasket	Cylinder head inspection in Engine Mechanical Section.
	● Sticking or damaged piston ring	Piston ring inspection in Engine Mechanical Section.
	● Worn piston, ring or cylinder	Cylinders, pistons and piston rings inspection in Engine Mechanical Section.
	Others	
	● Malfunctioning PCV valve	PCV system inspection in Engine and Emission Control System Section.
Engine has no power	**Engine overheating.**	Refer to “Overheating” Section.
	Ignition system out of order.	
	● Defective spark plug.	Spark plugs in Ignition System Section.
	● Faulty ignition coil with ignitor	Ignition coil in Ignition System Section.
	Fuel system out of order.	
	● Fuel pressure out of specification – Dirty fuel filter – Dirty or clogged fuel hose or pipe – Malfunctioning fuel pressure regulator – Malfunctioning fuel pump	Diag. Flow Table B-3 in this Section.
	Engine and emission control system out of order.	
	● Maladjusted TP sensor installation angle	TP sensor in Engine and Emission Control System Section.
	● Faulty EGR system	DTC P0400 Diag. Flow Table in this Section.
	● Faulty injector	Fuel injector in Engine and Emission Control System Section.
	● Faulty TP sensor, ECT sensor or MAF sensor	TP sensor, ECT sensor or MAF sensor in Engine and Emission Control System Section.
	● Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this Section.
	Low compression.	Previously outlined.
	Others	
	● Dragging brakes	Diagnosis in BRAKES Section.
	● Slipping clutch	Diagnosis in Clutch Section.

Condition	Possible Cause	Reference Item
Improper engine idling or engine fails to idle	**Ignition system out of order.**	
	● Faulty spark plug	Spark plugs in Ignition System Section.
	● Faulty ignition coil with ignitor	Ignition coil in Ignition System Section.
	Fuel system out of order.	
	● Fuel pressure out of specification	Diag. Flow Table B-3 in this Section.
	Engine overheating.	Refer to “Overheating” Section.
	Engine and emission control system out of order.	
	● Maladjusted TP sensor installation angle if adjustable	TP sensor in Engine and Emission Control System Section.
	● Faulty idle air control system	DTC P0505 Diag. Flow Table or Table B-4 in this Section.
	● Faulty evaporative emission control system	DTC P0440 Diag. Flow Table in this Section.
	● Faulty EGR system	DTC P0400 Diag. Flow Table in this Section.
	● Faulty injector	Fuel injection in Engine and Emission Control System Section.
	● Faulty ECT sensor, TP sensor or MAF sensor	ECT sensor, TP sensor or MAF sensor in Engine and Emission Control System Section.
	● Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this Section.
	Low compression	Previously outlined.
	Others	
	● Malfunctioning PCV valve	PCV system inspection in Engine and Emission Control System Section.
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 Ignition System Section.
	Fuel system out of order.	Diag. Flow Table B-3 in this Section.
	● Fuel pressure out of specification – Clogged fuel filter – Faulty fuel pressure regulator	
	● Clogged fuel filter, hose or pipe	
	Engine overheating	Refer to “Overheating” Section.
	Engine and emission control system out of order.	
	● Faulty EGR system	DTC P0440 Diag. Flow Table in this Section.
	● Faulty injector	Fuel injector in Engine and Emission Control System Section.
	● Faulty TP sensor, ECT sensor or MAF sensor	TP sensor, ECT sensor or MAF sensor in Engine and Emission Control System Section.
	● Faulty ECM (PCM).	Inspection of ECM (PCM) and its circuit in this Section.
	Low compression	Previously outlined.

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.) **Fuel system out of order.** ● Variable fuel pressure – Clogged fuel filter – Kinky or damaged fuel hose and line – Faulty fuel pressure regulator **Engine and emission control system out of order.** ● Faulty EGR system ● Faulty MAF sensor ● Faulty injector ● Faulty ECM (PCM)	Spark plugs in Ignition System Section. Diag. Flow Table B-3 in this Section. DTC P0400 Diag. Flow Table in this Section. MAF sensor in Engine and Emission Control System Section. Fuel injector in Engine and Emission Control System Section. Inspection of ECM (PCM) and its circuit in this Section.
Excessive detonation (The engine makes sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.)	**Engine overheating** **Ignition system out of order.** ● Faulty spark plug ● Improper ignition timing **Fuel system out of order.** ● Clogged fuel filter and fuel lines **Engine and emission control system out of order.** ● Faulty EGR system ● Faulty ECT sensor or MAF sensor ● Faulty injector ● Faulty ECM (PCM) **Others** ● Excessive combustion chamber deposits	Refer to “Overheating” Section. Spark plugs in Ignition System Section. Ignition timing in Ignition System Section. Fuel pressure check in Engine and Emission Control System Section. DTC P0400 Diag. Flow Table in this Section. ECT sensor or MAF sensor in Engine and Emission Control System Section. Fuel injector in Engine and Emission Control System Section. Inspection of ECM (PCM) and its circuit in this Section. Piston and cylinder head cleaning in Engine Mechanical Section.

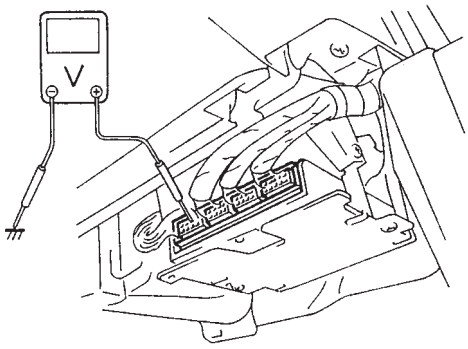
Condition	Possible Cause	Reference Item
Overheating	● Inoperative thermostat	Thermostat in Engine Cooling Section.
	● Poor water pump performance	Water pump in Engine Cooling Section.
	● Clogged or leaky radiator	Radiator in Engine Cooling Section.
	● Improper engine oil grade	Engine oil and oil filter change in Maintenance and Lubrication Section.
	● Clogged oil filter or oil strainer	Oil pressure check in Engine Mechanical Section.
	● Poor oil pump performance	Oil pressure check in Engine Mechanical Section.
	● Dragging brakes	Diagnosis in BRAKES Section.
	● Slipping clutch	Diagnosis in Clutch Section.
	● Blown cylinder head gasket	Cylinder head inspection in Engine Mechanical Section.
Poor gasoline mileage	**Ignition system out of order.**	
	● Faulty spark plug (improper gap, heavy deposits, and burned electrodes, etc.)	Spark plugs in Ignition System Section.
	Engine and emission control system out of order.	
	● Fuel pressure out of specification	Diag. Flow Table B-3 in this Section.
	● Faulty TP sensor, ECT sensor or MAF sensor	TP sensor, ECT sensor or MAF sensor in Engine and Emission Control System Section.
	● Faulty EGR system	DTC P0400 Diag. Flow Table in this Section.
	● Faulty injector	Fuel injector in Engine and Emission Control System Section.
	● Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this Section.
	Low compression	Previously outlined.
	Others	
	● Poor valve seating	Valves inspection in Engine Mechanical Section.
	● Dragging brakes	Diagnosis in BRAKES Section.
	● Slipping clutch	Diagnosis in Clutch Section.
	● Thermostat out of order	Thermostat in Engine Cooling Section.
	● Improper tire pressure	
Excessive engine oil consumption	**Oil entering combustion chamber**	
	● Sticky piston ring	Piston cleaning in Engine Mechanical Section.
	● Worn piston and cylinder	Cylinders, pistons and piston rings inspection in Engine Mechanical Section.
	● Worn piston ring groove and ring	Pistons and piston rings inspection in Engine Mechanical Section.
	● Improper location of piston ring gap	Pistons installation in Engine Mechanical Section.
	● Worn or damaged valve stem seal	Valves and cylinder head in Engine Mechanical Section.
	● Worn valve stem	Valves inspection in Engine Mechanical Section.

Condition	Possible Cause	Reference Item
Low oil pressure	● Improper oil viscosity	Engine oil and oil filter change in Maintenance and Lubrication Section.
	● Malfunctioning oil pressure switch	Oil pressure switch inspection in Body Electrical System Section.
	● Clogged oil strainer	Oil pan and oil pump strainer cleaning in Engine Mechanical Section.
	● Functional deterioration of oil pump	Oil pump in Engine Mechanical Section.
	● Worn oil pump relief valve	Oil pump in Engine Mechanical Section.
	● Excessive clearance in various sliding parts	
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**	
	● Faulty hydraulic valve lash adjuster	Hydraulic valve lash adjuster in Engine Mechanical Section.
	● Worn valve stem and guide	Valves inspection in Engine Mechanical Section.
	● Weak or broken valve spring	Valve springs inspection in Engine Mechanical Section.
	● Warped or bent valve	Valves inspection in Engine Mechanical Section.
	● Loose camshaft housing bolts	Camshafts in Engine Mechanical Section.
	Piston, ring and cylinder noise	
	● Worn piston, ring and cylinder bore	Pistons and cylinders inspection in Engine Mechanical Section.
	Connecting rod noise	
	● Worn crankpin bearing	Crankpin and connecting rod bearing inspection in Engine Mechanical Section.
	● Worn crankpin	Crankpin and connecting rod bearing inspection in Engine Mechanical Section.
	● Loose connecting rod nuts	Connecting rod installation in Engine Mechanical Section.
	● Low oil pressure	Previously outlined.
	Crankshaft noise	
	● Low oil pressure	Previously outlined.
	● Worn crankshaft journal bearing	Crankshaft and bearing inspection in Engine Mechanical Section.
	● Worn crankshaft journal	Crankshaft and bearing inspection in Engine Mechanical Section.
	● Loose lower crankcase (bearing cap) bolts	Crankshaft installation in Engine Mechanical Section.
	● Excessive crankshaft thrust play	Crankshaft inspection in Engine Mechanical Section.

INSPECTION OF PCM (ECM) AND ITS CIRCUITS

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

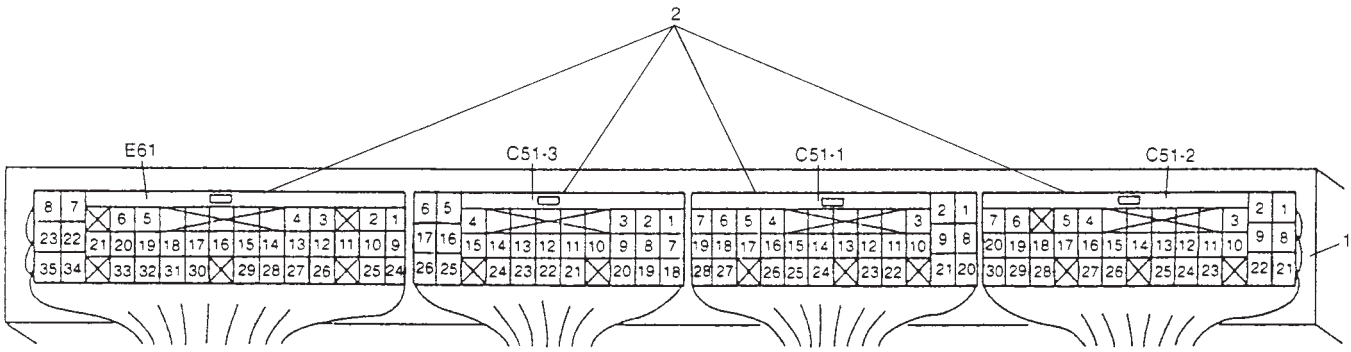
CAUTION:
PCM / ECM cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to PCM (ECM) with couplers disconnected from it.



Voltage Check

1) Remove PCM (ECM) cover from bracket referring to PCM (ECM) REMOVAL.
2) 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.



1. PCM (ECM)
2. PCM (ECM) connector
   (Viewed from harness side)

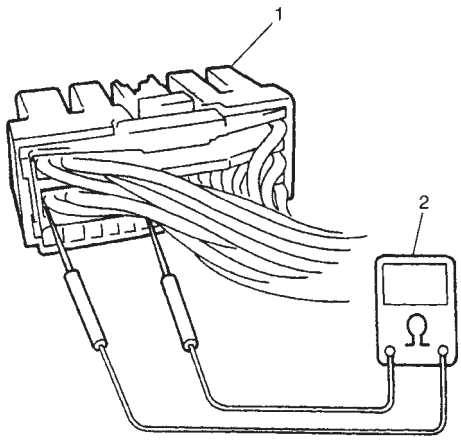
TERMINAL		CIRCUIT	NORMAL VOLTAGE	CONDITION
E61	1	Power source for CO adjusting resistor (if equipped)	4.75 – 5.25 V	Ignition switch ON
	2	Power source for back up	10 – 14 V	Ignition switch ON and OFF
	3	Heater of HO2S-2 (if equipped)	10 – 14 V	Ignition switch ON
			0 – 2 V	At specified condition
	4	———	——	———
	5	Immobilizer indicator lamp (without monitor connector)	0 – 1 V	Ignition switch ON, engine stops
			10 – 14 V	Engine running
		Duty output terminal (with monitor connector)	0 – 1 V	Ignition switch ON
	6	Tachometer	0 – 1 V	Ignition switch ON
	7	Malfunction indicator lamp	0 – 2.5 V	Ignition switch ON, engine stops
			10 – 14 V	Engine running
	8	A/C cut signal (if equipped)	0 – 1.5 V	A/C is not operating
			10 – 14 V	A/C is operating
	9	Main relay	10 – 14 V	Ignition switch OFF
			0 – 2 V	Ignition switch ON or for 4 seconds after ignition switch OFF
	10	CO adjusting resistor (if equipped)	——	———
	11	———	——	———
	12	Data link connector (5 V) (if equipped)	4 – 6 V	Ignition switch ON
	13	Data link connector (12 V)	10 – 14 V	Ignition switch ON
	14	Test switch terminal (if equipped)	10 – 14 V	Ignition switch ON
	15	Rear defogger switch (if equipped)	0 – 1.5 V	Ignition switch ON, rear defogger switch OFF and lighting switch OFF
			10 – 14 V	Ignition switch ON, rear defogger switch or lighting switch ON
	16	Heater blower switch	10 – 14 V	Ignition switch ON, heater blower switch OFF
			0 – 1.5 V	Ignition switch ON, heater blower switch ON
	17	A/C signal (if equipped)	10 – 14 V	Ignition switch ON, A/C switch or heater blower switch OFF
			0 – 1 V	Ignition switch ON, A/C switch ON and heater blower switch ON
	18	———	——	———
	19	“4WD” lamp (if equipped)	0 – 1 V	Ignition switch ON, Transfer lever: H4 or 4L range
			10 – 14 V	Ignition switch ON, Transfer lever: 2H range
	20	“O/D OFF” lamp (if equipped)	0 – 1 V	For 4 sec. after ignition switch ON or overdrive cut switch ON
			10 – 14 V	After 4 sec. from ignition switch ON and overdrive cut switch OFF
	21	“POWER” lamp (if equipped)	0 – 1 V	Ignition switch ON, P/N change switch: POWER mode
			10 – 14 V	Ignition switch ON, P/N change switch: NORMAL mode
	22	A/C condenser fan motor relay (if equipped)	10 – 14 V	Ignition switch ON, Engine coolant temp.: less than 113°C, 235°F
	23	Fuel pump relay	0 – 2.5 V	For 3 sec. after ignition switch ON or while engine running
			10 – 14 V	After 3 sec. from ignition switch ON with engine stopped
	24	Ground for HO2S-2 or CO adjusting resistor	——	———

TERMINAL		CIRCUIT	NORMAL VOLTAGE	CONDITION
E61	25	———	——	———
	26	Heated oxygen sensor-2 (if equipped)	0.01 – 0.95 V	While engine running at 2000 r/min. for 3 min. or longer after warming up.
	27	———	——	———
	28	Fuel level sensor	0 – 6 V	Ignition switch ON Voltage depends on fuel level
	29	Diagnosis switch terminal (if equipped)	10 – 14 V	Ignition switch ON
	30	ABS control module (if equipped)	10 – 14 V	Ignition switch ON
	31	Power/Normal change switch (if equipped)	0 – 1 V	Ignition switch ON, P/N change switch: POWER mode
			10 – 14 V	Ignition switch ON, P/N change switch: NORMAL mode
	32	Lighting switch (if equipped)	0 – 1 V	Ignition switch ON, Lighting switch OFF
			10 – 14 V	Ignition switch ON, Lighting switch ON
	33	Overdrive cut switch	10 – 14 V	Ignition switch ON, Overdrive cut switch OFF
			0 – 1 V	Ignition switch ON, Overdrive cut switch ON
	34	Stop lamp switch	0 – 1 V	Brake pedal released (switch OFF), Ignition switch ON
			10 – 14 V	Brake pedal depressed (switch ON), Ignition switch ON
	35	———	———	———
C51-3	1	Intake air temp. sensor	2.2 – 3.0 V	Ignition switch ON, Sensor ambient temp.: 20°C, 68°F
	2	Engine coolant temp. sensor	0.5 – 0.9 V	Ignition switch ON, Engine coolant temp.: 80°C, 176°F
	3	Knock sensor (J20)	About 2.5 V	Ignition switch ON
		Ignition timing adjusting resistor (G16) (if equipped)	——	———
	4	Power source	10 – 14 V	Ignition switch ON
	5	Ground for MAF sensor	——	———
	6	Ground	——	———
	7	Power steering pressure switch	10 – 14 V	Ignition switch ON
			0 – 1 V	With engine running at idle speed, turning steering wheel to the right or left as far as it stops.
	8	Manifold absolute pressure sensor	3.3 – 4.3 V	Ignition switch ON
	9	Throttle position sensor	0.5 – 1.2 V	Ignition switch ON, Throttle valve at idle position
			3.4 – 4.7 V	Ignition switch ON, Throttle valve at full open position
	10	Mass air flow sensor	1.0 – 1.6 V	Ignition switch ON and engine stops
			1.7 – 2.0 V	With engine running at idle speed
	11	Heated oxygen sensor-1	Deflects between over and under 0.45 V	While engine running at 2,000 r/min. for 1 min. or longer after warmed up.

TERMINAL		CIRCUIT	NORMAL VOLTAGE	CONDITION
C51-3	12	Ground for HO2S-1 shield wire	——	———
	13	Power source for TP sensor	4.75 – 5.25 V	Ignition switch ON
	14	Power source for MAP sensor		
	15	Power source	10 – 14 V	Ignition switch ON
	16	———	——	———
	17	Ground	——	———
	18	Engine start signal	6 – 14 V	While engine cranking
			0 – 1 V	Other than above
	19	———	——	———
	20	Ignition switch	10 – 14 V	Ignition switch ON
	21	Ground for TP sensor	——	———
	22	Ground for HO2S-1 sensor	——	———
	23	———	——	———
	24	———	——	———
	25	Ground for IAT sensor, ECT sensor, MAP sensor and ignition timing resistor	——	———
	26	Ground for CMP sensor	——	———
C51-1 (A/T)	1	Shift solenoid B	0 – 1 V	Ignition switch ON
	2	Shift solenoid A	10 – 14 V	Ignition switch ON
	3 ~ 7	———	——	———
	8	TCC solenoid	0 – 1 V	Ignition switch ON
	9	———	——	———
	10	A/T input speed sensor (–)	About 2.5 V	Ignition switch ON
	11	A/T input speed sensor (+)	About 2.5 V	Ignition switch ON
	12 ~ 14	———	——	———
	15	Transmission range switch “D”	10 – 14 V	Ignition switch ON, selector lever: “D” range
			0 – 1 V	Ignition switch ON, selector lever: Other than “D” range
	16	Transmission range switch “N”	10 – 14 V	Ignition switch ON, selector lever: “N” range
			0 – 1 V	Ignition switch ON, selector lever: Other than “N” range
	17	Transmission range switch “R”	10 – 14 V	Ignition switch ON, selector lever: “R” range
			0 – 1 V	Ignition switch ON, selector lever: Other than “R” range
	18	Transmission range switch “P”	10 – 14 V	Ignition switch ON, selector lever: “P” range
			0 – 1 V	Ignition switch ON, selector lever: Other than “P” range
	19	———	——	———
	20	Shield wire ground for A/T output speed sensor	——	———
	21	Shield wire ground for A/T input speed sensor	——	———

TERMINAL		CIRCUIT	NORMAL VOLTAGE	CONDITION
C51-1 (A/T)	22	A/T output speed sensor (–)	About 2.5 V	Ignition switch ON
	23	A/T output speed sensor (+)	About 2.5 V	Ignition switch ON
	24-25	———	———	———
	26	4WD low switch	0 – 1 V	Ignition switch ON, Transfer lever: 4WD low range
			10 – 14 V	Ignition switch ON, Transfer lever: 4H or 2H range
	27	Transmission range switch “L”	10 – 14 V	Ignition switch ON, Selector lever: “L” range
			0 – 1 V	Ignition switch ON, Selector lever: Other than “L” range
	28	Transmission range switch “2”	10 – 14 V	Ignition switch ON, Selector lever: “2” range
			0 – 1 V	Ignition switch ON, Selector lever: Other than “2” range
C51-2	1	Fuel injector No.2	10 – 14 V	Ignition switch ON
	2	Fuel injector No.1		
	3	IAC valve (stepper motor coil 1)	———	———
	4	Heater of HO2S-1 (if equipped)	10 – 14 V	Ignition switch ON
			0 – 2 V	At specified idle speed after engine warmed up.
	5	———	———	———
	6	———	———	———
	7	4WD air pump assembly (if equipped)	10 – 14 V	Ignition switch ON, Transfer lever: 4H or 4L range
			0 – 1 V	Ignition switch ON, Transfer lever: 2H range
	8	Fuel injector No.4	10 – 14 V	Ignition switch ON
	9	Fuel injector No.3		
	10	IAC valve (stepper motor coil 4)	———	———
	11	IAC valve (stepper motor coil 3)	———	
	12	IAC valve (stepper motor coil 2)	———	
	13	EGR valve (stepper motor coil 4) (if equipped)	0 – 1 V	Ignition switch ON
	14	EGR valve (stepper motor coil 3) (if equipped)	10 – 14 V	
	15	EGR valve (stepper motor coil 2) (if equipped)	10 – 14 V	
	16	EGR valve (stepper motor coil 1) (if equipped)	0 – 1 V	
	17	EVAP canister purge valve	10 – 14 V	Ignition switch ON
	18	4WD switch	0 – 1 V	Ignition switch ON, Transfer lever: 4H or 4L range
			10 – 14 V	Ignition switch ON, Transfer lever: 2H range
	19	Crankshaft position sensor (+) (if equipped)	———	———
	20	Crankshaft position sensor (–) (if equipped)	———	———
	21	Ignition coil assembly for No.4 (J20)	———	———
	22	Ignition coil assembly for No.3 (J20)	———	———
	23	Ignition coil assembly for No.2 and No.3 (G16)	———	———
		Ignition coil assembly for No.2 (J20)	———	———
	24	Ignition coil assembly for No.1 and No.4 (G16)	———	———
		Ignition coil assembly for No.1 (J20)	———	———

TERMINAL		CIRCUIT	NORMAL VOLTAGE	CONDITION
C51-2	25	Vehicle speed sensor	Deflects between 0 – 1 V and over 4 V	Ignition switch ON, Rear right tire turned slowly with rear left tire locked
	26	Camshaft position sensor (+)	Deflects between 0 – 1 V and 4 – 6 V	Ignition switch ON, crankshaft turned slowly
	27	Pressure switch in 4WD air pump assembly (if equipped)	10 – 14 V	Ignition switch ON, Transfer lever: 4H or 4L range
			0 V	Ignition switch ON, Transfer lever: 2H range
	28	Ground	——	———
	29	———	——	———
	30	Ground for CKP sensor shield wire (if equipped)	——	———



1. ECM/PCM coupler disconnected
2. Ohmmeter

Resistance Check

1) Disconnect couplers from ECM/PCM with ignition switch OFF.

CAUTION:
Never touch terminals of ECM/PCM itself or connect voltmeter or ohmmeter.

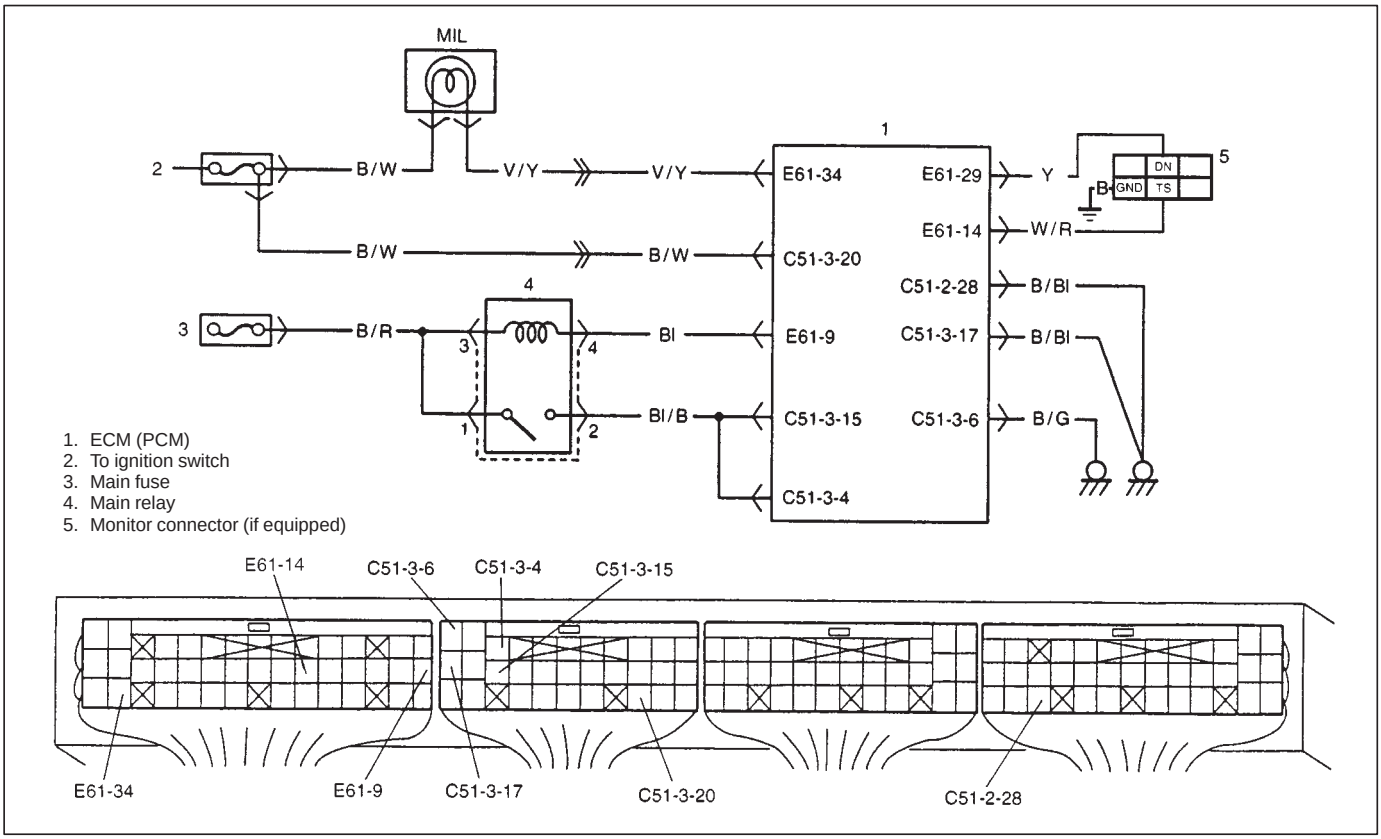
2) Check resistance between each pair of terminals of disconnected couplers as listed in the following table.

CAUTION:
- **Be sure to connect ohmmeter probe from wire harness side of coupler.**
- **Be sure to turn OFF ignition switch for this check.**
- **Resistance in table represents that when parts temperature is 20°C (68°F).**

TERMINALS	CIRCUIT	STANDARD RESISTANCE	CONDITION
E61-3 and C51-3-20	Heater of HO2S-2 (if equipped)	11.7 – 14.3 Ω	——
E61-9 and E61-2	Main relay	79 – 95 Ω	——
E61-22 and C51-3-20	A/C fan motor relay (if equipped)	75 – 110 Ω	Battery disconnected and ignition switch ON
E61-23 and C51-3-20	Fuel pump relay	79 – 95 Ω	——
C51-3-6 and Body ground	Ground	Continuity	——
C51-3-17 and Body ground	Ground	Continuity	——
C51-1-1 and Body ground	Shift solenoid B (A/T)	11 – 15 Ω	——
C51-1-2 and Body ground	Shift solenoid A (A/T)		
C51-1-8 and Body ground	TCC solenoid (A/T)		
C51-2-1- and C51-3-4	Fuel injector No.2	13 – 16 Ω	——
C51-2-2 and C51-3-4	Fuel injector No.1		
C51-2-3 and C51-3-4	IAC valve (stepper motor coil 1)	35 – 43 Ω	——
C51-2-4 and C51-3-20	Heater of HO2S-1 (if equipped)	5 – 6.4 Ω	——
C51-2-8 and C51-3-4	Fuel injector No.4	13 – 16 Ω	——
C51-2-9 and C51-3-4	Fuel injector No.3		
C51-2-10 and C51-3-4	IAC valve (stepper motor coil 4)	35 – 43 Ω	——
C51-2-11 and C51-3-4	IAC valve (stepper motor coil 3)		
C51-2-12 and C51-3-4	IAC valve (stepper motor coil 2)		
C51-2-13 and C51-3-4	EGR valve (stepper motor coil 4) (if equipped)	20 – 24 Ω	——
C51-2-14 and C51-3-4	EGR valve (stepper motor coil 3) (if equipped)		
C51-2-15 and C51-3-4	EGR valve (stepper motor coil 2) (if equipped)		
C51-2-16 and C51-3-4	EGR valve (stepper motor coil 1) (if equipped)		
C51-2-17 and C51-3-4	EVAP canister purge valve	28 – 35 Ω	——
C51-2-28 and Body ground	Ground	Continuity	——

TABLE A-1 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK – MIL DOES NOT COME "ON" OR DIMS AT IGNITION SWITCH ON (BUT ENGINE AT STOP)

WIRING DIAGRAM



CIRCUIT DESCRIPTION

When the ignition switch is turned ON, ECM causes the main relay to turn ON (close the contact point). Then, ECM being supplied with the main power, turns ON the malfunction indicator lamp (MIL). When the engine starts to run and no malfunction is detected in the system, MIL goes OFF but if a malfunction was or is detected, MIL remains ON even when the engine is running.

INSPECTION

STEP	ACTION	YES	NO
1	MIL Power Supply Check: 1) Turn ignition switch ON. Do other indicator/warning lights in combination meter comes ON?	Go to Step 2.	"IG" fuse blown, main fuse blown, Ignition switch malfunction, "B/W" circuit between "IG" fuse and combination meter or poor coupler connection at combination meter.
2	ECM Power and Ground Circuit Check: Does engine start?	Go to Step 3.	Go to TABLE A-5 ECM (PCM) POWER AND GROUND CIRCUIT CHECK. If engine is not cranked, go to DIAGNOSIS in Section 6G or 6G1.
3	MIL Circuit Check: 1) Turn ignition switch OFF and disconnect connectors from ECM. 2) Check for proper connection to ECM at terminal E61-34. 3) If OK, then using service wire, ground terminal E61-34 in connector disconnected. Does MIL turn on at ignition switch ON?	"W/R" circuit shorted to ground or test switch terminal of monitor connector is shorted to ground (if equipped). If OK, substitute a known-good ECM (PCM) and recheck.	Bulb burned out or "V/Y" wire circuit open.

TABLE A-2 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK – MIL REMAINS "ON" AFTER ENGINE STARTS

WIRING DIAGRAM/CIRCUIT DESCRIPTION

Refer to TABLE A-1.

INSPECTION

STEP	ACTION	YES	NO
1	DTC Check: 1) With ignition switch OFF, install scan tool. 2) Start engine and check DTC. Is there any DTC(s).	Go to Step 2 of "ENGINE DIAG. FLOW TABLE" in this section.	Go to Step 2.
2	MIL circuit Check: (1) With ignition switch OFF, disconnect couplers from ECM (PCM). Does MIL turn ON at ignition switch ON?	"V/Y" wire shorted to ground circuit.	Substitute a known-good ECM (PCM) and recheck.

TABLE A-3 MIL CHECK – MIL FLASHES AT IGNITION SWITCH ON (vehicle with monitor connector)

WIRING DIAGRAM/CIRCUIT DESCRIPTION

Refer to TABLE A-1.

INSPECTION

STEP	ACTION	YES	NO
1	MIL Flashing Pattern Check: 1) Turn ignition switch ON. Does lamp flashing pattern indicate diagnostic trouble code?	Go to Step 2.	Go to "Diagnosis" in Section 8G.
2	Diag. Switch Circuit Check: Is diag. switch terminal connected to ground via service wire?	System is in good condition.	"Y" circuit shorted to ground. If circuit is OK substitute a known-good ECM (PCM) and recheck.

TABLE A-4 MIL CHECK – MIL DOES NOT FLASH OR JUST REMAINS ON EVEN WITH GROUNDING DIAGNOSIS SWITCH TERMINAL

WIRING DIAGRAM/CIRCUIT DESCRIPTION

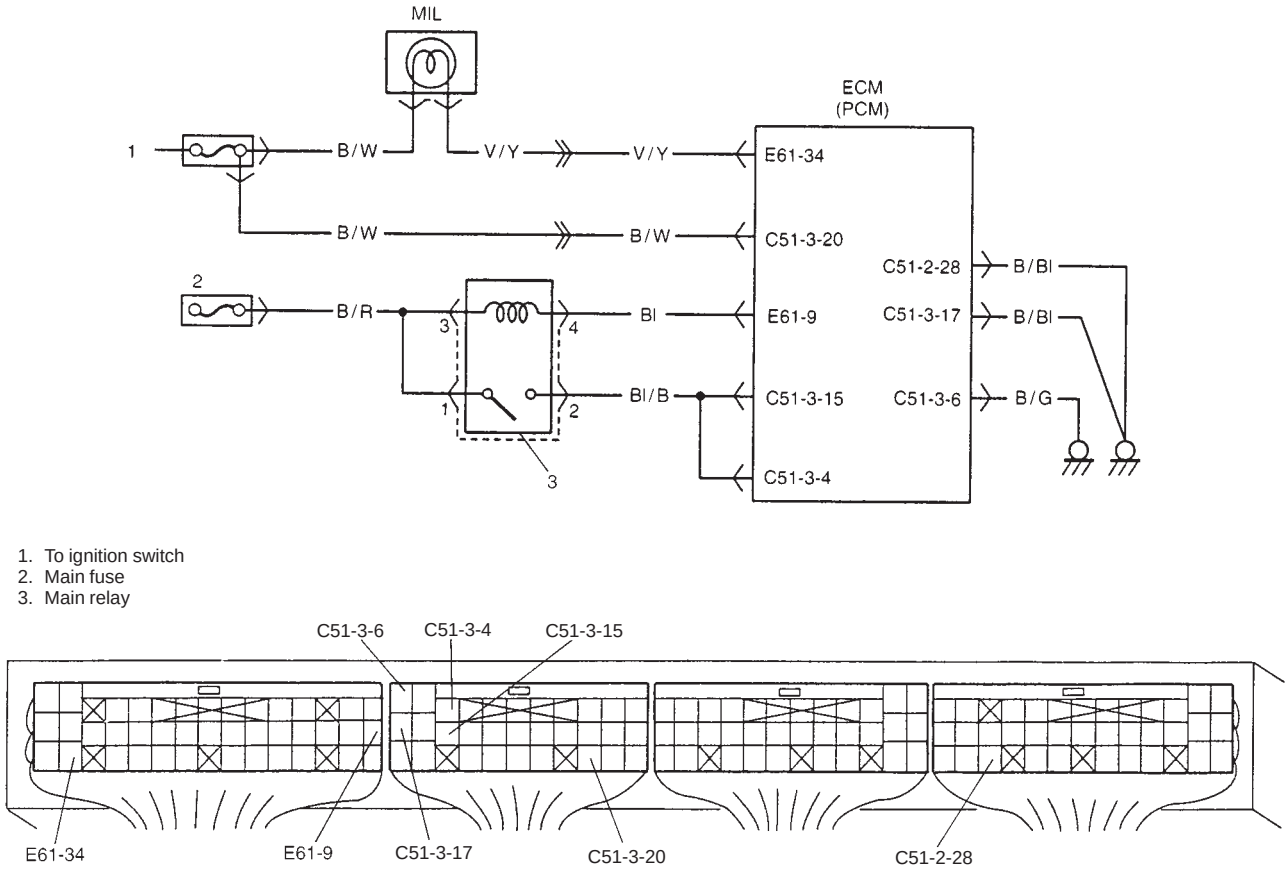
Refer to TABLE A-1.

INSPECTION

STEP	ACTION	YES	NO
1	MIL Circuit Check: 1) Turn ignition switch OFF and disconnect connectors from ECM (PCM). Does MIL turn ON at ignition switch ON?	"V/Y" circuit shorted to ground.	Go to Step 2.
2	ECM/PCM Connection Check: 1) Turn ignition switch OFF. Is connector (E61-29 connection) connected to ECM/PCM properly?	Go to Step 3.	Poor connector connection.
3	Diag. switch Terminal Circuit Check: 1) Connect connectors to ECM (PCM). 2) Using service wire, ground E61-29 terminal with connectors connected to ECM (PCM). 3) Turn ignition switch ON. Does MIL flash?	"Y" or "B" circuit open.	Substitute a known-good ECM (PCM) and recheck.

TABLE A-5 ECM (PCM) POWER AND GROUND CIRCUIT CHECK – MIL DOESN'T LIGHT AT IGNITION SWITCH ON AND ENGINE DOESN'T START THOUGH IT IS CRANKED UP.

WIRING DIAGRAM



CIRCUIT DESCRIPTION

When the ignition switch is turned ON, the main relay turns ON (the contact point closes) and the main power is supplied to ECM (PCM).

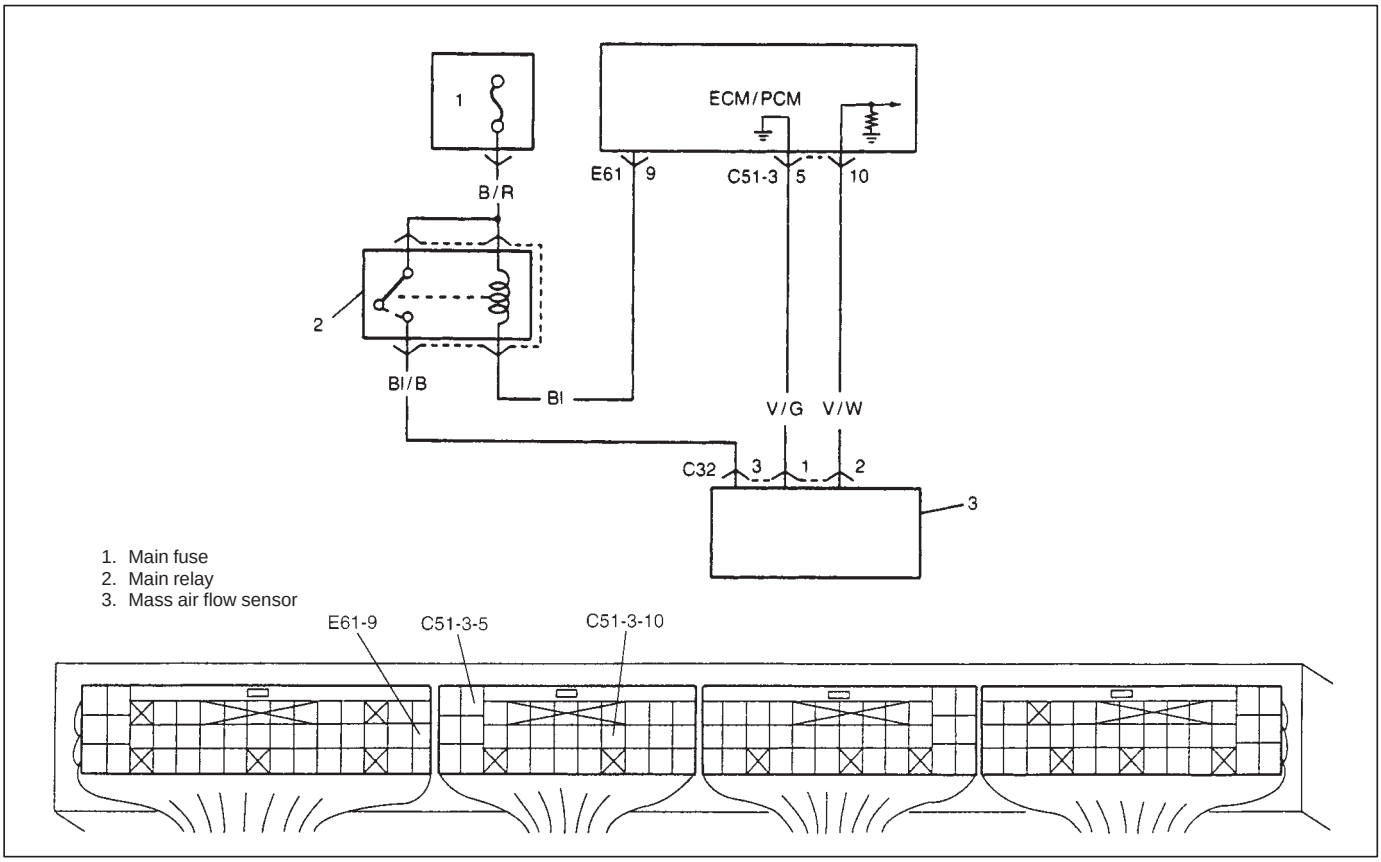
TABLE A-5

INSPECTION

STEP	ACTION	YES	NO
1	Main Relay Operating Sound Check: Is operating sound of main relay heard at ignition switch ON?	Go to Step 5.	Go to Step 2.
2	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 3 and 4. 3) If OK, check main relay for resistance and operation referring to "Main Relay Inspection" in Section 6E1. Is check result satisfactory?	Go to Step 4.	Replace main relay.
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 C51-3-20, E61-9, C51-3-15 and C51-3-4. 3) If OK, then measure voltage between terminal C51-3-20 and ground, E61-9 and ground with ignition switch ON. Is each voltage 10 – 14 V?	Go to Step 5.	"B/W", "Bl" or "B/R" circuit open.
5	ECM Power Circuit Check: 1) Using service wire, ground terminal E61-9 and measure voltage between terminal C51-3-15 and ground at ignition switch ON. Is it 10 – 14 V?	Check ground circuits "B/G" and "B/Bl" 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/R" or "Bl/B" wire open.
7	Main Relay Check: 1) Check main relay according to procedure in Step 3. Is main relay in good condition?	"B/R" or "Bl/B" wire open.	Replace main relay.

DTC P0100 (DTC No.33, 34) MASS AIR FLOW CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following conditions are detected for 5 sec. continuously. ● Engine running ● Less than 0.64 mA MAF sensor output current continues for 100 msec or more than 3 sec. after ignition switch ON and more than 4.90 mA MAF sensor output current continues for 100 msec.	● MAF sensor circuit open or short ● MAF sensor ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

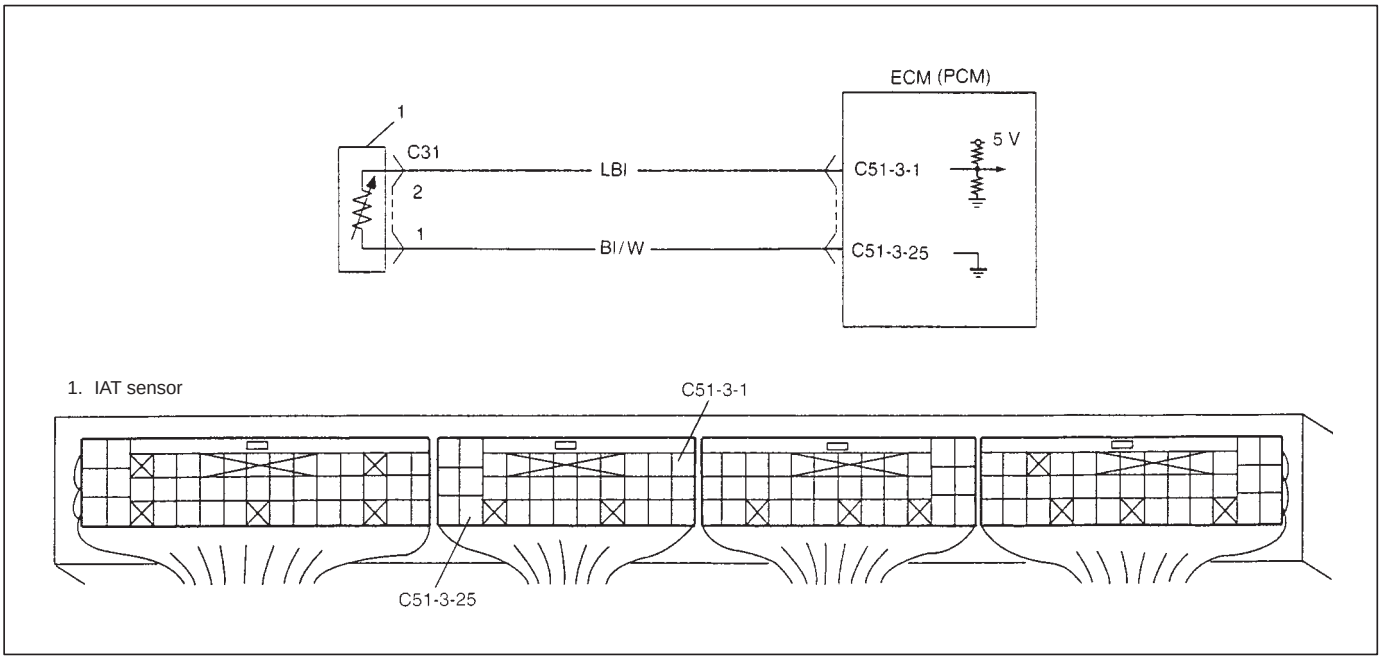
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed for 20 sec. or more.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	MAF sensor Check: 1) Connect scan tool to DLC with ignition switch OFF. 2) Start engine and check MAF value displayed on scan tool. (Refer to “Scan Tool Data” for normal value.) Is normal value indicated?	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	MAF sensor power supply Check: 1) With ignition switch OFF, disconnect MAF sensor coupler. 2) With ignition switch ON, check voltage between C32-3 of MAF sensor coupler and ground. Is voltage 10 – 14 V?	Go to Step 4.	Faulty “Bl/B” wire.
4	MAF sensor output voltage Check: 1) With ignition switch OFF, connect MAF sensor coupler. 2) Remove ECM (PCM) cover. 3) With ignition switch ON leaving engine OFF, check voltage between C51-3-10 and C51-3-5 terminal. Is voltage 1.0 – 1.6 V?	Poor C51-3-10 connection. If OK, substitute a known-good ECM (PCM) and recheck.	Faulty “V/W” wire. Poor C32 coupler terminal connection. If wire and connection are OK, substitute a known-good MAF sensor and recheck.

DTC P0110 (DTC No.23, 25) INTAKE AIR TEMP. (IAT) CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following conditions are detected. ● Engine running ● High intake air temperature or low temperature (Low voltage – Low resistance or High voltage – High resistance)	● IAT sensor circuit short ● IAT sensor ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

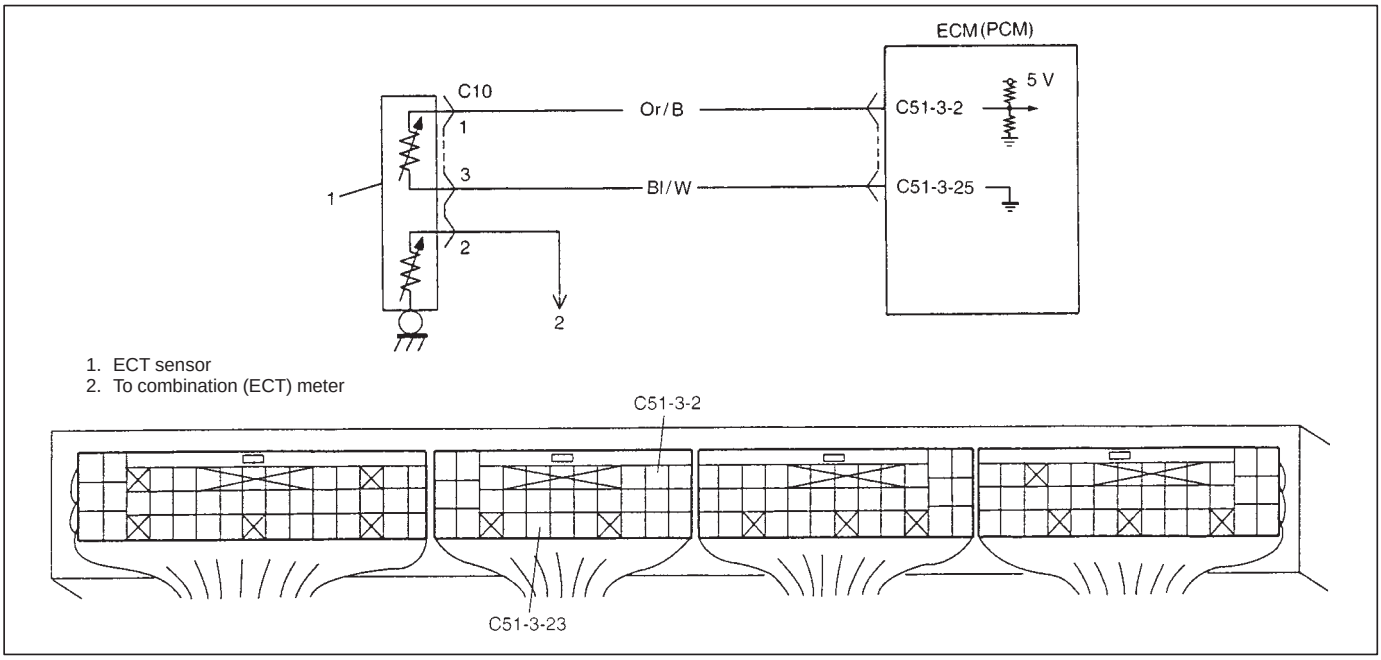
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed and engine coolant temp. 110°C, 230°F or lower for 10 sec. or more.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

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 with ignition switch OFF. 2) Turn ignition switch ON. 3) Check intake air temp. displayed on scan tool. Is –40°C (–40°F) or 165°C (329°F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.
3	Check Wire Harness. 1) Disconnect IAT sensor connector with ignition switch OFF. 2) Check for proper connection to IAT sensor at “LBl” and “Bl/W” wire terminals. 3) If OK, then with ignition switch ON, is voltage applied to “LBl” wire terminal about 4 – 6 V?	Go to Step 4.	“LBl” wire open or shorted to power, or poor C51-3-1 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.
4	Does scan tool indicate –40°C (–40°F) at Step 2?	Go to Step 6.	Go to Step 5.
5	Check Wire Harness. 1) Disconnect IAT sensor connector. 2) Check intake air temp. displayed on scan tool. Is –40°C (–40°F) indicated?	Replace IAT sensor.	“LBl” wire shorted to ground. If wire is OK, substitute a known-good ECM (PCM) and recheck.
6	Check Wire Harness. 1) Using service wire, connect IAT sensor connector terminals. 2) Turn ignition switch ON and check intake air temp. displayed on scan tool. Is 165°C (329°F) indicated?	Replace IAT sensor.	“Bl/W” wire open or poor C51-3-25 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.

DTC P0115 (DTC No.14,15) ENGINE COOLANT TEMP. SENSOR CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following conditions are detected for 5 sec. continuously. ● Engine running ● High engine coolant temperature or Low temperature (Low voltage – Low resistance or High voltage – High resistance)	● ECT sensor circuit short ● ECT sensor ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

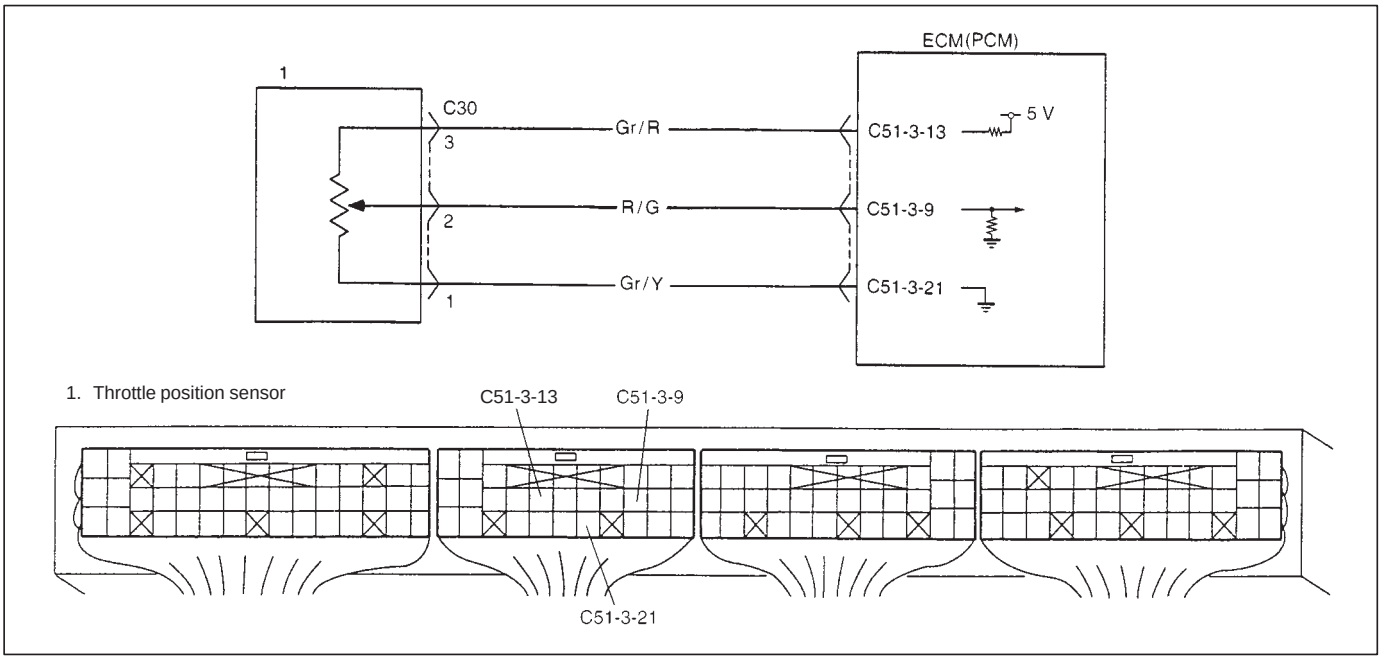
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed for 10 sec. or more.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

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 164°C (327°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/B” and “Bl” wire terminals. 3) If OK, then with ignition switch ON, is voltage applied to “Or/B” wire terminal about 4 – 6 V?	Go to Step 4.	“Or/B” wire open or shorted to power, or poor C51-3-2 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.
4	Does scan tool indicate –40°C (–40°F) at Step 2?	Go to Step 6.	Go to Step 5.
5	Check Wire Harness. 1) Disconnect ECT sensor connector. 2) Check intake air temp. displayed on scan tool. Is –40°C (–40°F) indicated?	Replace ECT sensor.	“Or/B” wire shorted to ground. If wire is OK, substitute a known-good ECM (PCM) and recheck.
6	Check Wire Harness. 1) Using service wire, connect ECT sensor connector terminals. 2) Turn ignition switch ON and check engine coolant temp. displayed on scan tool. Is 164°C (327°F) indicated?	Replace ECT sensor.	“Bl/W” wire open or poor C51-3-23 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.

DTC P0120 (DTC No.21, 22) THROTTLE POSITION CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following conditions are detected for 5 sec. continuously. ● Engine running ● Signal voltage low or high	● TP sensor circuit open or short ● TP sensor ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed for 10 sec. or more.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check TP Sensor and Its Circuit. 1) Connect scan tool to DLC with ignition switch OFF and then turn ignition switch ON. 2) Check throttle valve opening percentage displayed on scan tool while opening throttle valve from idle position to full open position. Is it displayed 0% or 100%?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.
3	Check Wire Harness. 1) Disconnect connector from TP sensor with ignition switch OFF. 2) Check for proper connection to TP sensor at each terminals C30-3 and C30-2. 3) If OK, then with ignition switch ON, check voltage between C30-3, and C30-1 terminals at connector. Is voltage about 4 – 6 V?	Go to Step 4.	“Gr/R” wire open, “Gr/R” wire shorted to ground circuit/power circuit, “Gr/Y” wire open, poor C51-3-21 connection, or poor C51-3-13 connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.
4	Check TP Sensor. 1) Check resistance between terminals of TP sensor referring to “TP Sensor Inspection” in Section 6E1. Are measured values within specifications?	“R/G” wire open/shorted to ground, “R/G” wire shorted to power circuit, or poor C51-3-9 connection. If OK, substitute a known-good ECM (PCM) and recheck.	Replace TP sensor.

DTC P0121 THROTTLE POSITION RANGE/PERFORMANCE PROBREM

WIRING DIAGRAM

Refer to previous page (DTC P0120).

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Throttle opening change is smaller than specification while intake air volume changes and engine is running at constant speed. (2 driving cycles detection logic)	● TP sensor ● ECM (PCM) ● High resistance in circuit

DTC CONFIRMATION PROCEDURE

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

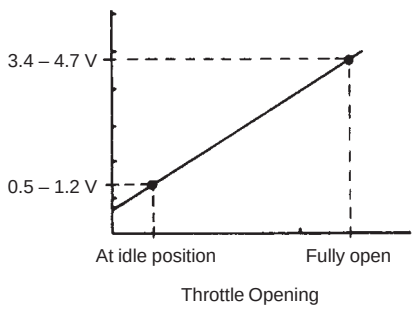
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude barometric pressure: 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and start engine.
3) Increase vehicle speed to 60 km/h (40 mph).
4) Keep driving above vehicle speed for 5 min. (Change of vehicle speed is permitted in this step).
5) Stop vehicle and run engine at idle speed for 1 min.
6) Increase vehicle speed till engine speed is reached 2,000 – 3,000 r/min in proper gear.
7) Keep driving at that engine speed for 30 sec. or more (Engine speed is kept constant in this step).
8) Stop vehicle.
9) Repeat step 6) to 8).
10) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0121)

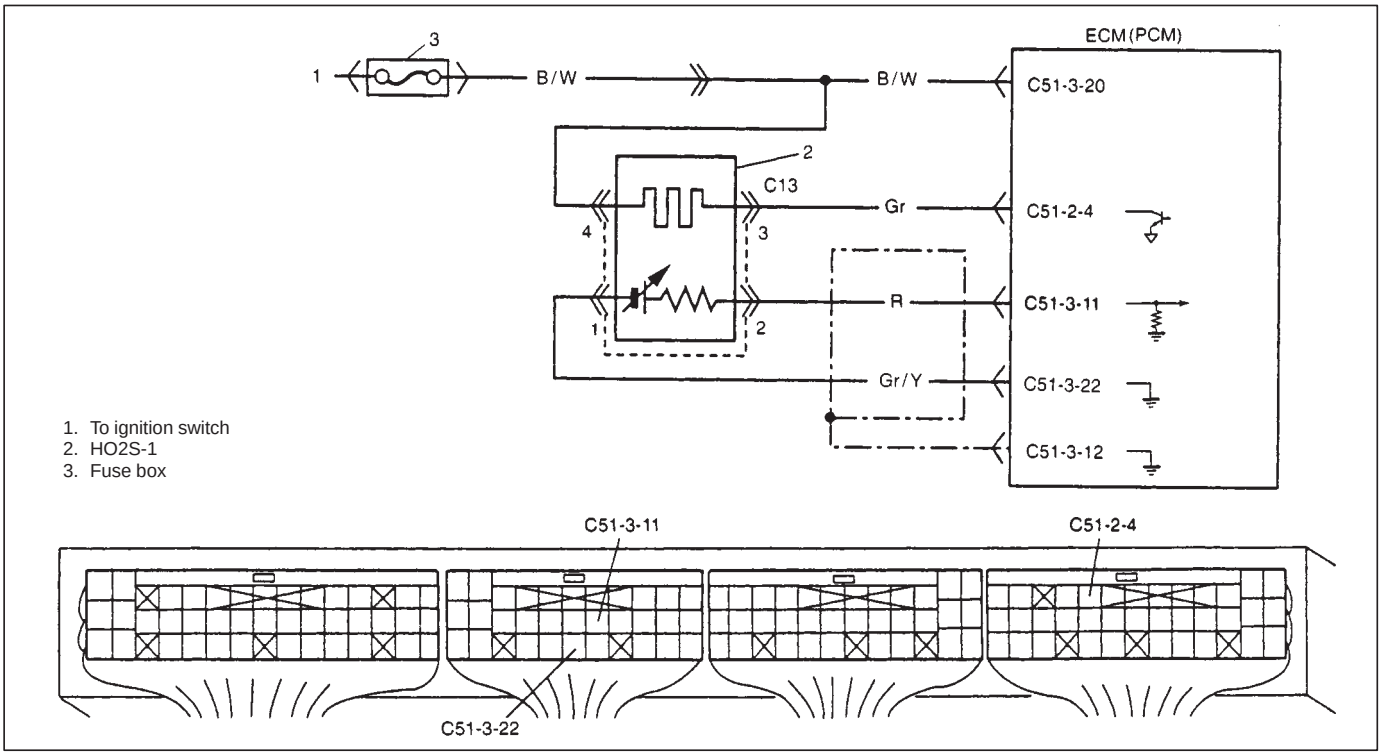
STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Is there a DTC related to TP sensor (DTC P0122 and P0123)?	Go to applicable DTC Diag. Flow Table.	Go to Step 3.
3	Check TP Sensor and its Circuit. When using SUZUKI scan tool: 1) Turn ignition 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. When not using SUZUKI scan tool: 1) Turn ignition switch ON. 2) Check voltage at terminal C51-3-9 of ECM connector connected, when throttle valve is at idle position and fully opened. Does voltage vary within specified value linearly as shown in figure?	If voltmeter was used, check terminal C51-3-9 for poor connection. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 4.
4	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, check TP sensor for resistance referring to "TP sensor Inspection" in Section 6E1. Is check result satisfactory?	High resistance in "Gr/R", "R/G" or "Gr/Y" circuit. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace TP sensor.

Fig. for Step 3



DTC P0130 (DTC No.13) HO2S-1 CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following conditions are detected in idle state while running under driving conditions described for DTC CONFIRMATION PROCEDURE. P0130 (LOW VOLTAGE) ● 4.5 V or more HO2S circuit voltage is detected, when 5 V power is connected to HO2S circuit in ECM (PCM), or ● Max. output voltage of HO2S is 0.6 V or lower on average and its minimum voltage on average is 0.3 V or lower. (2 driving cycle detection logic) P0130 (HIGH VOLTAGE) ● Min. output voltage of HO2S is over 3.0 V or ● Max. output voltage of HO2S is 0.74 V or higher on average and its min. voltage on average is 0.33 V or higher. (2 driving cycle detection logic)	● HO2S-1 or its circuit ● Fuel system ● 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.**

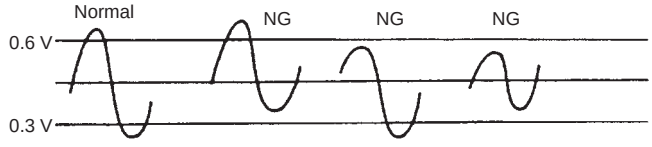
NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and start engine.
3) Increase vehicle speed to 55 km/h (35 mph) or more.
4) Keep driving above vehicle speed for 2 min. or more (Change of vehicle speed is permitted in this step).
5) Stop vehicle, and run engine at idle speed for 1 min.
6) Check if DTC and pending DTC exists by using scan tool. If not, check if oxygen sensor monitoring test has completed by using scan tool. If not in both of above checks (i.e., no pending DTC and oxygen sensor monitoring test not completed), check vehicle condition (environmental) and repeat step 3) through 6).

TROUBLESHOOTING (DTC P0130)

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S-1 Output Voltage Check: 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 to enrich A/F mixture and take foot off from pedal to enlean) and check HO2S output voltage displayed on scan tool. See Fig. 1. Is over 0.6 V and below 0.3 V indicated?	Go to Step 4.	Go to Step 3.
3	HO2S-1 Check: 1) With ignition switch OFF, disconnect HO2S-1 connector. 2) Check for proper connection to HO2S-1 at each terminal. 3) If OK, connect voltmeter “1” and “2” terminal of HO2S-1 connector. 4) Start engine and check voltmeter while repeating racing engine. Is over 0.6 V and below 0.3 V indicated?	“R” or “Gr/Y” circuit open or short. If wire and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace HO2S-1.
4	Short Term Fuel Trim Check: 1) Run engine at 2000 r/min. for 60 sec. 2) With engine idling, check short term fuel trim displayed on scan tool. Is it within –20 to +20%?	Intermittent trouble or faulty ECM (PCM). Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to DTC P0171/P0172 Diag. Flow Table.

Fig. 1 for Step 2



DTC P0133 HO2S-1 CIRCUIT SLOW RESPONSE

WIRING DIAGRAM

Refer to page (DTC P0130).

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following conditions are detected in idle state while running under driving conditions described for DTC CONFIRMATION PROCEDURE. Hi / Lo cycle (TRANS TIME displayed on scan tool) of HO2S-1 output voltage is longer than specification or response rates of Hi → Lo and Lo → Hi (TRANS TIME displayed as R → L threshold V or L → R threshold V on scan tool) are longer than specification. (2 driving cycles detection logic)	● HO2S-1 ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

Refer to previous page (DTC P0130).

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	1) Replace HO2S-1 and recheck. Is DTC P0133 detected?	Substitute a known-good ECM (PCM) and recheck.	HO2S-1 malfunction.

DTC P0134 HO2S-1 NO ACTIVITY DETECTED

WIRING DIAGRAM

Refer to page (DTC P0130).

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following conditions are detected in vehicle running state while running under driving conditions described for DTC CONFIRMATION PROCEDURE. Output voltage of HO2S-1 does not exceed 0.45 V for specified time. (2 driving cycles detection logic)	● HO2S-1 or its circuit ● Fuel system ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

Refer to page (DTC P0130).

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S-1 Output Voltage Check: 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 to enrich A/F mixture and take foot off from pedal to enlean) and check HO2S output voltage displayed on scan tool. Is over 0.6 V and below 0.3 V indicated?	Go to Step 4.	Go to Step 3.
3	HO2S-1 Check: 1) With ignition switch OFF, disconnect HO2S-1 connector. 2) Check for proper connection to HO2S-1 at each terminal. 3) If OK, connect voltmeter “1” and “2” terminal of HO2S-1 connector. 4) Start engine and check voltmeter while repeating racing engine. Is over 0.6 V and below 0.3 V indicated?	“R” or “Gr/Y” circuit open or short. If wire and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace HO2S-1.
4	Short Term Fuel Trim Check: 1) Run engine at 2000 r/min. for 60 sec. 2) With engine idling, check short term fuel trim displayed on scan tool. Is it within –20 to +20%?	Intermittent trouble or faulty ECM (PCM). Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to DTC P0171/P0172 Diag. Flow Table.

DTC P0135 HO2S-1 HEATER CIRCUIT MALFUNCTION

WIRING DIAGRAM

Refer to DTC P0130 section.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following condition is detected when HO2S heater is electrically live. ● Current of HO2S heater is 5.3 A or more or less than 0.15 A, or ● Voltage of HO2S heater is 13.8 V or higher or lower than 8.7 V. (2 driving cycles detection logic)	● HO2S-1 heater circuit ● HO2S-1 heater ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: −8°C, 18°F or higher**
- **Engine coolant temp.: −8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

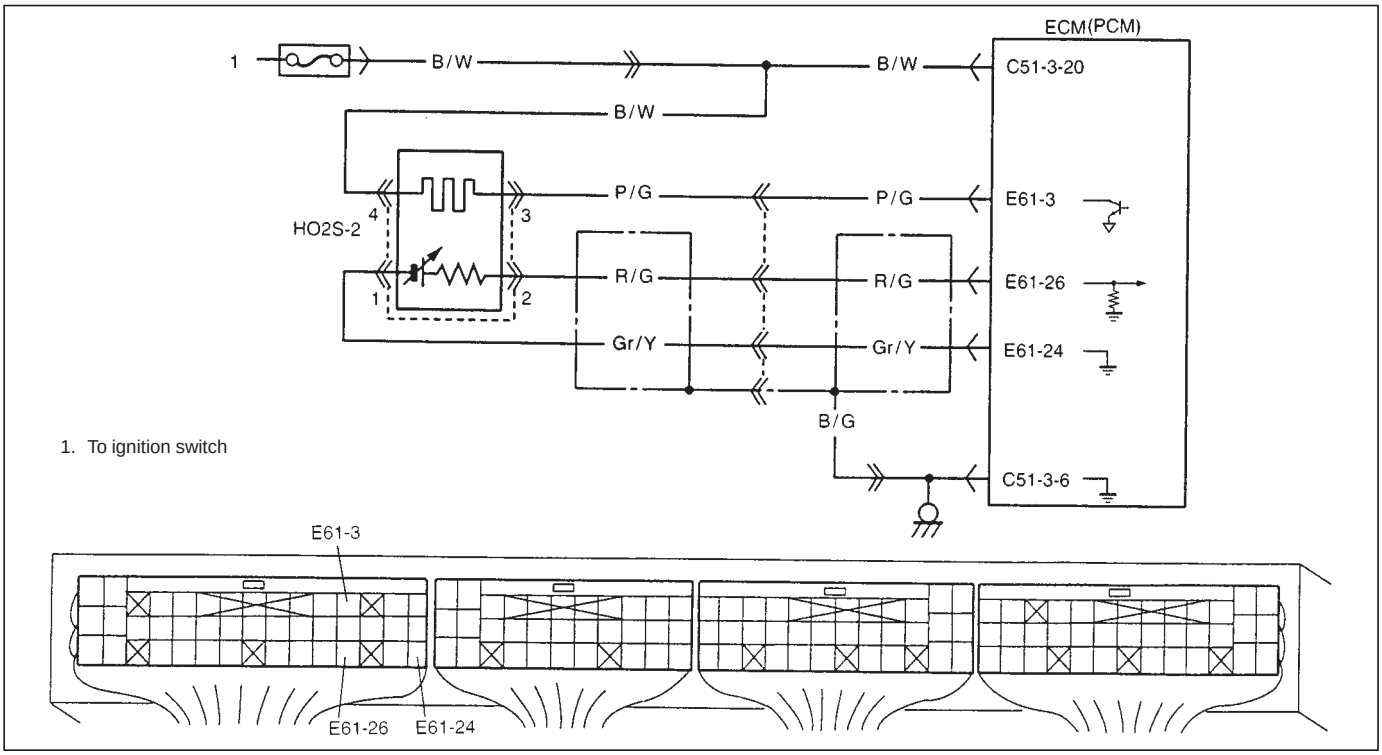
1) Connect scan tool with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed for 5 min.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0135)

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S-1 Heater Check: 1) Disconnect HO2S-1 coupler with ignition switch OFF. 2) Check resistance between “3” and “4” terminal of HO2S-1 coupler. Resistance: 5 – 6.4 Ω (at 20°C, 68°F) Is it within above specification?	Go to Step 3.	Replace HO2S-1.
3	HO2S-1 Heater Power Supply Check: 1) Connect HO2S coupler. 2) Check voltage between C51-2-4 terminal of ECM (PCM) coupler and body ground with ignition switch ON. Is it 10 – 14 V?	Go to Step 4.	“B/W”, or “Gr” wire open, poor HO2S coupler connection “Gr” wire shorted to ground. If wire and connections are OK, substitute a known-good ECM (PCM) and recheck.
4	HO2S-1 Heater Operation Check: 1) Warm up engine, and check voltage between C51-2-4 terminal of ECM (PCM) coupler and body ground with engine idling. Is it 0 – 1 V?	Intermittent trouble. Check intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Poor C51-2-4 connection of ECM (PCM) coupler. If connection is OK, substitute a known-good ECM (PCM) and recheck.

DTC P0136 HO2S-2 CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC will set when any one of following conditions is detected. ● 4.5 V or more HO2S circuit voltage is detected when 5 V power is connected to HO2S circuit in ECM (PCM). ● While running with A/F feed back, average output voltage during specified time is too high or too low. or ● while running with A/F feed back, max output voltage during specified time is lower than specified value or min. output voltage during specified time is higher than specified value. (2 driving cycles detection logic)	● HO2S-2 or its circuit ● Fuel system ● 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.**

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data in ECM memory by using scan tool and start engine.
3) Increase vehicle speed to 55 km/h (40 mph) or more.
4) Keep driving above vehicle speed till engine is warmed up completely (Change of vehicle speed is permitted in this step).
5) Keep driving 50 – 60 km/h (30 – 40 mph) for 8 min. or more.
6) Stop vehicle and check if DTC and pending DTC exists by using scan tool. If not, check if oxygen sensor monitoring test has completed by using scan tool. If not in both of above checks (i.e., no pending DTC and oxygen sensor monitoring test not completed), check vehicle conditions (environmental) and repeat Steps 3) through 6).

TROUBLESHOOTING (DTC P0136)

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S-2 Output Voltage Check: 1) Connect scan tool to DLC with ignition switch OFF. 2) Drive vehicle about 35 mph, 55 km/h for 2 min. or more. 3) Stop vehicle and check HO2S-2 output voltage displayed on scan tool while repeating racing engine. Is over and below 0.3 V indicated?	Go to Step 4.	Go to Step 3.
3	HO2S-2 Check: 1) With ignition switch OFF, disconnect HO2S-2 coupler. 2) Connect voltmeter between “2” and “1” of HO2S-2 coupler. 3) Start engine and check voltmeter while repeating racing engine. Is over and below 0.3 V indicated?	“R/G” or “Gr/Y” circuit open/short. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.	Replace HO2S-2.
4	Short Term Fuel Trim Check: 1) Run engine at 2000 r/min. for 60 sec. 2) With engine idling, check short term fuel trim displayed on scan tool. Is it within –20 to +20%?	Intermittent trouble or faulty ECM (PCM). Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to DTC P0171/ P0172 Diag. Flow Table.

DTC P0141 HO2S-2 HEATER CIRCUIT MALFUNCTION

WIRING DIAGRAM

Refer to DTC P0136 section.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Following condition is detected when HO2S-2 heater operates. ● Current of HO2S-2 heater is more than 5.3 A or less than 0.15 A, or ● Voltage of HO2S-2 heater is more than 13.8 V or less than 8.7 V. (2 driving cycles detection logic)	● HO2S-2 heater or its circuit ● 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.**

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: −8°C, 18°F or higher**
- **Engine coolant temp.: −8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data in ECM memory by using scan tool and start engine.
3) Increase vehicle speed to 50 – 60 km/h (30 – 40 mph).
4) Keep driving above vehicle speed for 5 min. (Change of vehicle speed is permitted in this step).
5) Stop vehicle and check if DTC and pending DTC exists by using scan tool. If not, check if oxygen sensor heater monitoring test has completed by using scan tool. If not in both of above checks (i.e., no pending DTC and oxygen sensor heater monitoring test not completed), check vehicle conditions (environmental) and repeat Steps 3) through 5).

TROUBLESHOOTING (DTC P0141)

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S-2 Heater Check: 1) Disconnect HO2S-2 coupler with ignition switch OFF. 2) Check resistance between “3” and “4” terminal of HO2S-2 connector. Is it within 11.7 – 14.3 Ω (at 20°C, 68°F)?	Go to Step 3.	Replace HO2S-2.
3	HO2S-2 Power Supply Check: 1) Connect HO2S-2 connector. 2) Check voltage between E61-3 terminal of ECM (PCM) connector and body ground with ignition switch ON. Is it 10 – 14 V?	Go to Step 4.	“B/W” or “P/G” circuit open/shorted to ground. If wire and connections are OK, substitute a known-good ECM (PCM) and recheck.
4	HO2S-2 Heater Operation Check: 1) Drive vehicle about 30 – 40 mph (50 – 60 km/h) for 2 min. or more. 2) Stop vehicle and check voltage between E61-3 terminal of ECM (PCM) connector and body ground with engine idling. Is it 0 – 1 V?	Intermittent trouble. Check intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Poor E61-3 connection. If connection is OK, substitute a known-good ECM (PCM) and recheck.

DTC P0171 FUEL SYSTEM TOO LEAN
DTC P0172 FUEL SYSTEM TOO RICH

SYSTEM DIAGRAM
Refer to Section 6E1.

DTC DETECTING CONDITION AND POSSIBLE CAUSE

DTC DETECTING CONDITION	POSSIBLE CAUSE
When running after engine warmed ● Short term fuel trim exceeding 15 % or long term fuel trim exceeding 20% and total trim exceeding 43 % is detected. —— Fuel system too lean ● Short term fuel trim less than –11% or long term fuel trim less than –11% and total trim less than –30% is detected. —— Fuel trim too rich (2 driving cycles detection logic)	● Vacuum leaks (air inhaling) ● Exhaust gas leakage ● Fuel pressure out of specification ● Heated oxygen sensor malfunction ● EGR system malfunction ● MAF sensor poor performance ● ECT sensor poor performance ● Fuel level sensor

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp. at start: –8 – 60°C (18 – 140°F)**
- **Engine coolant temp. at start: –8 – 95°C (18 – 203°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: 110°C, 230°F or lower**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine completely.
3) Increase vehicle speed to 50 – 60 km/h (30 – 40 mph).
4) Keep driving above vehicle speed for 3 min. or more.
5) Stop vehicle and check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0171/P0172)

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 “DTC P0171/P0172”?	Go to applicable DTC FLOW TABLE.	Go to Step 3.
3	Check intake system and exhaust system for leakage. Are intake system and exhaust system in good condition?	Go to Step 4.	Repair or replace.
4	Check fuel pressure referring to TABLE B-3 in this section. Is check result satisfactory?	Go to Step 5.	Repair or replace.
5	Check fuel injectors referring to “FUEL INJECTOR INSPECTION” in “ENGINE AND EMISSION CONTROL SYSTEM” section. Is check result satisfactory?	Go to Step 6.	Faulty injector(s).
6	Check fuel level sensor referring to DTC P0461 Diag. Flow Table. Is check result satisfactory?	Go to Step 7.	Faulty fuel level sensor or its circuit.
7	Check MAF sensor for performance referring to DTC P0101 Diag. Flow Table. Is check result satisfactory?	Go to Step 8.	Faulty MAF sensor or its circuit.
8	Check ECT sensor referring to “ENGINE AND EMISSION CONTROL SYSTEM” section. Is check result satisfactory?	Go to Step 9.	Faulty ECT sensor.
9	Check HO2S-1 referring to DTC P0131/P0132 Diag. Flow Table. Is check result satisfactory?	Substitute a known-good ECM (PCM) and recheck.	Faulty HO2S-1.

DTC P0300 RANDOM MISFIRE DETECTED
DTC P0301 CYLINDER 1 MISFIRE DETECTED
DTC P0302 CYLINDER 2 MISFIRE DETECTED
DTC P0303 CYLINDER 3 MISFIRE DETECTED
DTC P0304 CYLINDER 4 MISFIRE DETECTED

SYSTEM DESCRIPTION

ECM (PCM) measures the angle speed of the crankshaft based on the pulse signal from the CKP sensor and CMP sensor for each cylinder. If it detects a large change in the angle speed of the crankshaft, it concludes occurrence of a misfire. When the number of misfire is counted by the ECM (PCM) beyond the DTC detecting condition, it determines the cylinder where the misfire occurred and outputs it as DTC.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION		TROUBLE AREA
DTC P0300	● Misfire which causes catalyst to overheat during 200 engine revolutions is detected at 2 or more cylinders. (MIL flashes as long as this misfire occurs continuously.) ● Misfire which affects exhaust emission adversely during 1000 engine revolutions is detected at 2 or more cylinders (2 driving cycles detection logic)	● Ignition system ● Fuel injector and its circuit ● Fuel line pressure ● Engine compression ● Abnormal air drawn in ● EGR system ● Fuel level sensor ● Valve clearance (valve lash adjuster) ● Valve timing
DTC P0301, P0302, P0303, P0304	● Misfire which causes catalyst to overheat during 200 engine revolutions is detected at 1 cylinder. (MIL flashes as long as this misfire occurs continuously.) ● Misfire which affects exhaust emission adversely during 1000 engine revolutions is detected at 1 cylinder (2 driving cycles detection logic)	

DTC CONFIRMATION PROCEDURE

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8 – 70°C (18 – 158°F)**
- **Engine coolant temp.: –8°C, 18°F or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

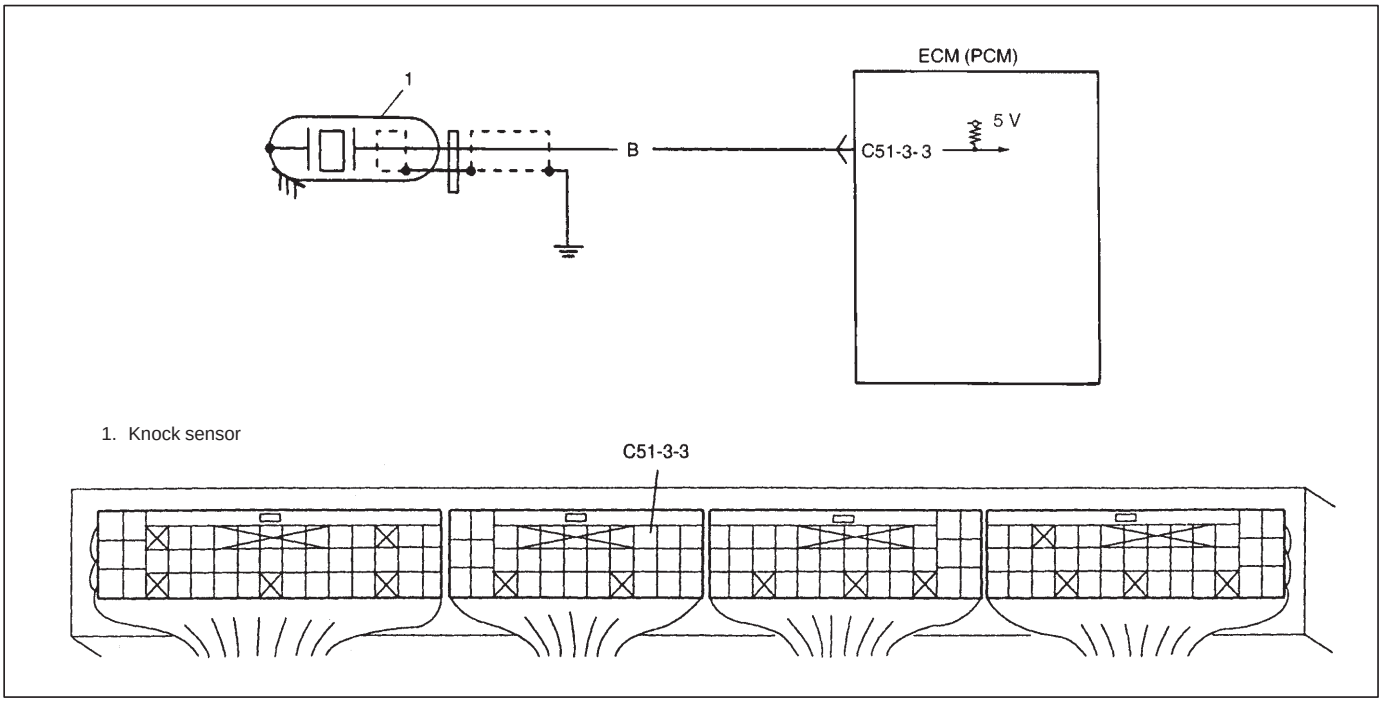
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and start engine.
3) Increase vehicle speed to speed recorded as freeze frame data (V) ± 5 km/h when detecting misfire.
4) Keep driving above vehicle speed for 5 min.
5) Stop vehicle and check DTC (or pending DTC) by using scan tool.

TROUBLESHOOTING (DTC P0300/P0301/P0302/P0303/P0304)

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Ignition System Inspection: 1) Check spark plug and ignition spark of cylinder where misfire occurs, referring to “IGNITION SYSTEM” section. Is it in good condition?	Go to Step 3.	Faulty ignition coil, wire harness, or other system parts.
3	Fuel Injector Circuit Inspection: 1) Using sound scope, check each injector operating sound at engine cranking or idling. Do all injectors make operating sound?	Go to Step 4.	Check coupler connection and wire harness of injector not making operating sound and injector itself. If OK, substitute a known-good ECM (PCM) and recheck.
4	Fuel Pressure Inspection: 1) Check fuel pressure referring to TABLE B-3 in this section. Is check result satisfactory?	Go to Step 5.	Repair or replace.
5	Fuel Injector Inspection: 1) Check fuel injector(s) referring to “ENGINE AND EMISSION CONTROL SYSTEM” section. Is check result satisfactory?	Go to Step 6.	Replace.
6	Ignition Timing Inspection: 1) Check ignition timing referring to “IGNITION SYSTEM” section. Is check result satisfactory?	Go to Step 7.	Adjust or check system related parts.
7	EGR System Inspection: 1) Check EGR system referring to “ENGINE AND EMISSION CONTROL SYSTEM” section. Is check result satisfactory?	Go to Step 8.	Repair or replace.
8	Fuel Level Sensor Inspection: 1) Check fuel level sensor referring to DTC P0461 Diag. Flow Table. Is check result satisfactory?	Go to Step 9.	Repair or replace.
9	Check engine mechanical parts or system which can cause engine rough idle or poor performance. – Engine compression (See “ENGINE MECHANICAL” section). – Valve lash or lash adjuster (See “ENGINE MECHANICAL” section). – Valve timing (Timing belt or chain installation. See “ENGINE MECHANICAL” section). 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.

DTC P0325 (DTC No.43) KNOCK SENSOR CIRCUIT MALFUNCTION

CIRCUIT DESCRIPTION



DTC DETECTING CONDITION	TROUBLE AREA
● Knock sensor output voltage: 3.98 V or more ● Knock sensor output voltage: 0.90 V or less	● "B" circuit open or shorted to ground ● Knock sensor malfunction ● ECM malfunction

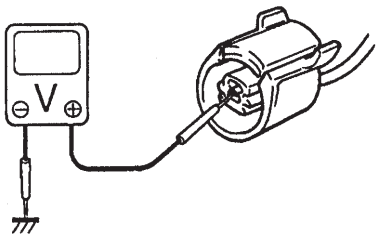
DTC CONFIRMATION PROCEDURE

1) Connect scan tool to DLC with ignition OFF.
2) Turn ON ignition switch and clear DTC by using scan tool and run engine at idle speed for 5 sec. or more.
3) Check DTC by using scan tool.

INSPECTION

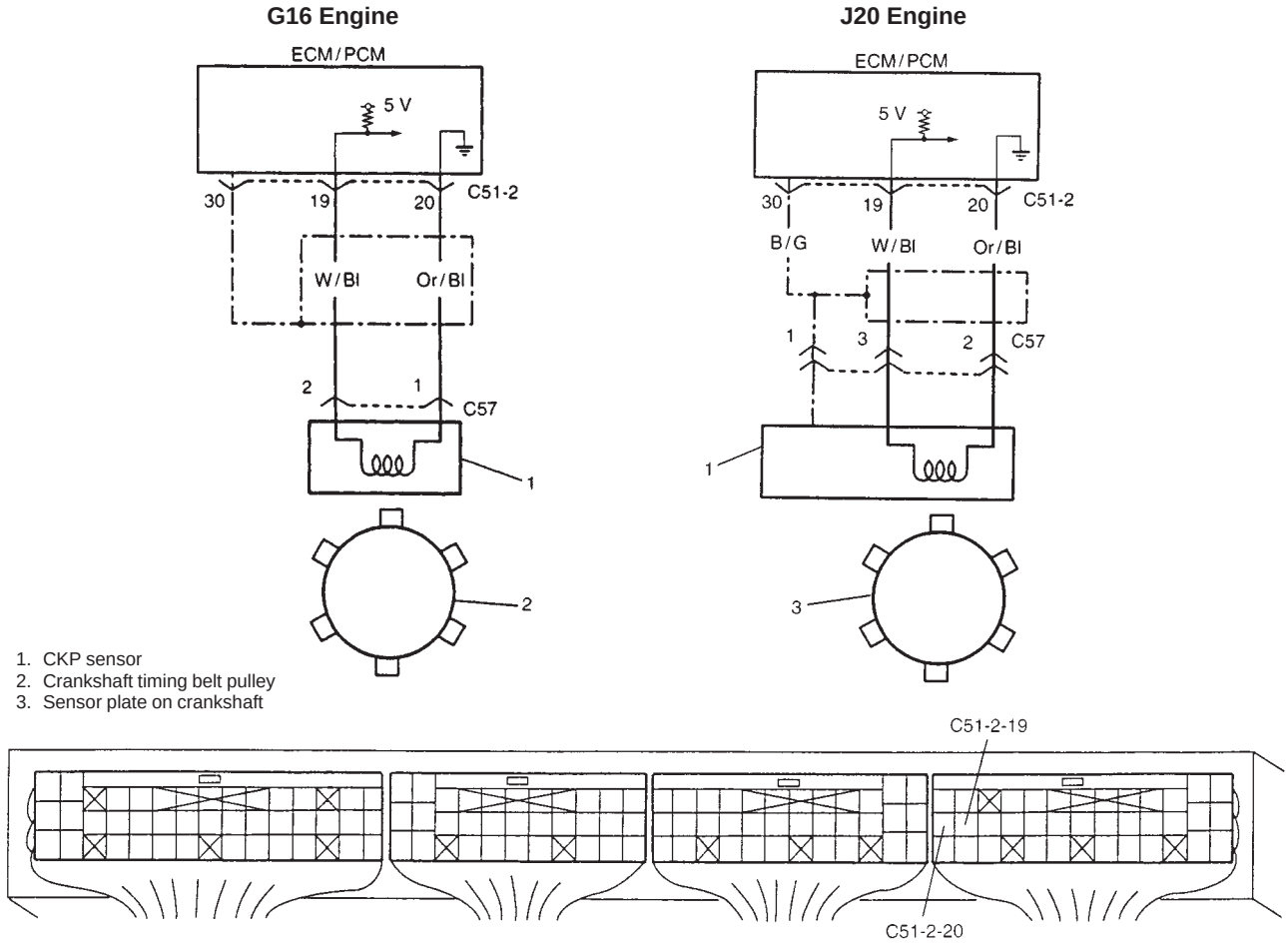
STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	1) With engine running, check voltage from C51-3-3 terminal of ECM connector to body ground. 2) Is voltage about 0.90 – 3.98 V?	Knock sensor and its circuit are in good condition. Intermittent 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 "B" to body ground terminal of knock sensor connector. See Fig. 1. 4) Is it 4 – 5 V?	Substitute a known-good knock sensor and recheck.	"B" wire open, shorted to ground circuit or poor C51-3-3 connection. If wire and connection are OK, substitute a known-good ECM and recheck.

Fig. 1 for Step 3



DTC P0335 CRANKSHAFT POSITION SENSOR CIRCUIT MALFUNCTION

WIRING DIAGRAM

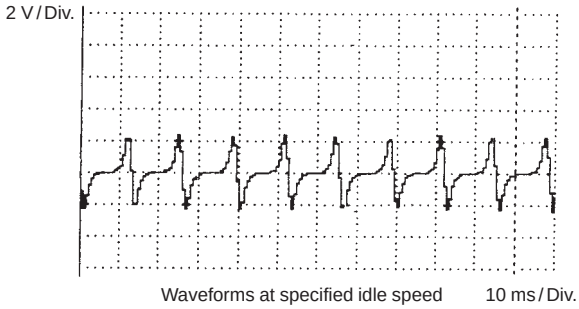


Reference

Connect oscilloscope between terminals C51-2-19 (+) and C51-2-20 (–) of ECM (PCM) connector connected to ECM (PCM) and check CKP sensor signal.

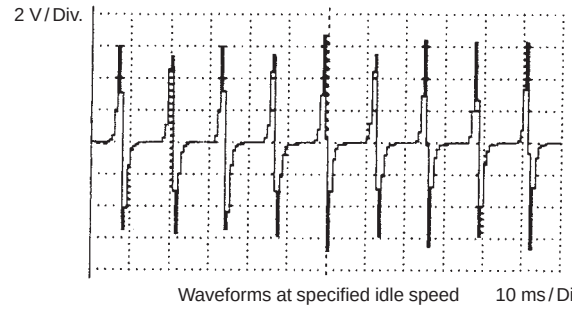
Oscilloscope Waveforms

G16 Engine



Waveforms at specified idle speed 10 ms / Div.

J20 Engine



Waveforms at specified idle speed 10 ms / Div.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
CKP sensor signal is not input while 20 pulses of CMP sensor signal are input after engine start.	● CKP sensor circuit ● CKP sensor ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

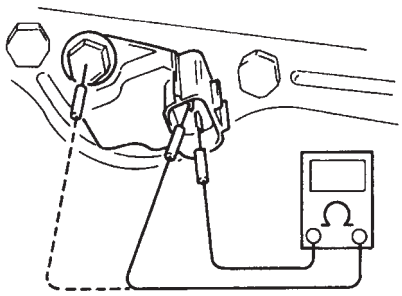
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed for 10 sec.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0335)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	CKP Sensor and Its Circuit Resistance Check: 1) With ignition switch OFF, disconnect ECM (PCM) coupler (C51-2). 2) Check for proper connection to ECM (PCM) at C51-2-19 and C51-2-20 terminals. 3) If OK, check resistance of followings. Resistance between C51-2-19 and C51-2-20 terminals: 360 – 460 Ω at 20°C, 68°F (G16) 484 – 656 Ω at 20°C, 68°F (J20) Resistance between each terminal and ground: 1M Ω or more Is check result satisfactory?	Go to Step 4.	Go to Step 3.
3	CKP Sensor Resistance Check: 1) With ignition switch OFF, disconnect CKP sensor coupler. 2) Check resistance between terminals of CKP sensor coupler for G16 engine, between "2" and "3" terminals for J20 engine and between each terminal and ground. (See Fig.) Were measured resistance values as specified in Step 2?	Faulty "W/Bl" wire or "Or/Bl" wire.	Faulty CKP sensor.
4	CKP Sensor Visual Inspection: 1) Check visually CKP sensor and signal rotor (crankshaft timing belt pulley for G16 or CKP sensor plate on crankshaft for J20) for the followings. (See Fig.) – 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.	Replace or reinstall.

Fig. for Step 3

G16 Engine



J20 Engine

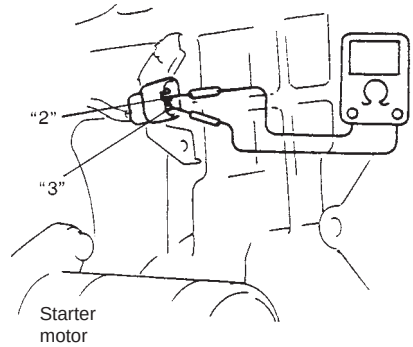


Fig. for Step 4

G16 Engine

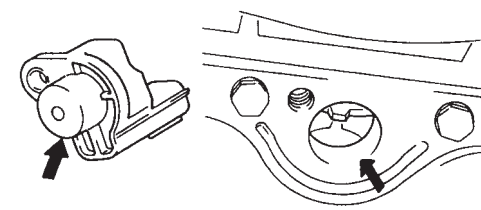
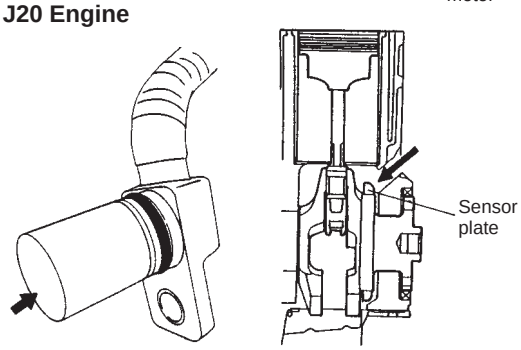


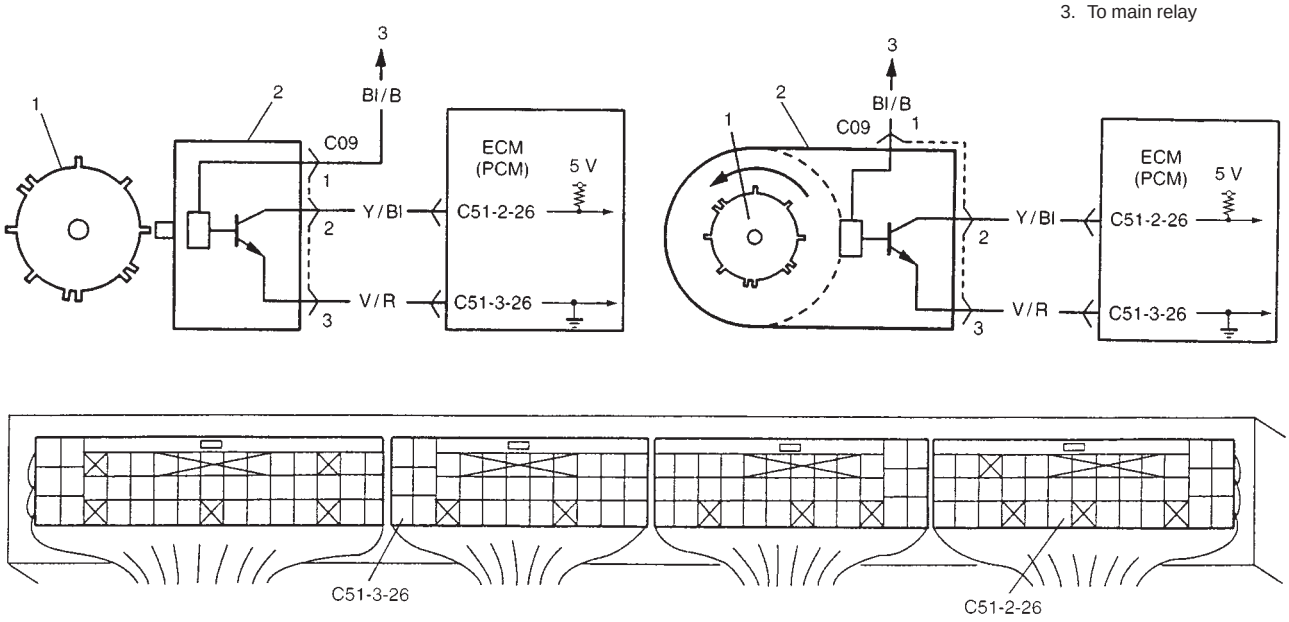
Fig. for Step 4.

J20 Engine



DTC P0340 (DTC No.42) CAMSHAFT POSITION SENSOR CIRCUIT MALFUNCTION

WIRING DIAGRAM

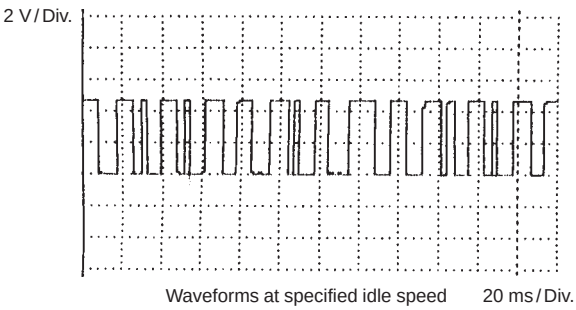


Reference

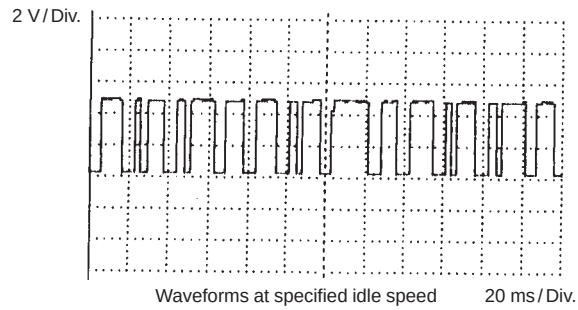
Connect oscilloscope between terminals C51-2-26 and C51-3-26 (ground) of ECM (PCM) connector connected to ECM (PCM) and check CMP sensor signal.

Oscilloscope Waveforms

G16 Engine



J20 Engine



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
● CMP sensor signal is not inputted for 3 sec. even though engine start signal is being inputted.	● CMP sensor circuit ● CMP sensor ● Engine starter signal circuit ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: −8°C, 18°F or higher**
- **Engine coolant temp.: −8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

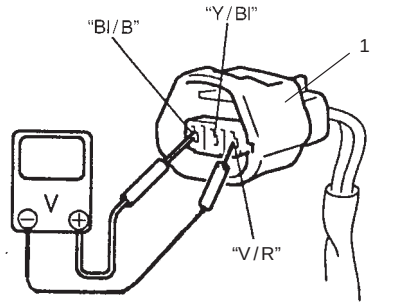
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool.
3) Crank engine for 3 seconds or more and keep it at idle for 1 min. if engine start.
4) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0340/DTC No.42)

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is engine cranked?	Go to Step 3.	Go to “CRANKING SYSTEM” section.
3	Is there DTC P1500 (Engine starter signal circuit)?	Go to DTC P1500 Diag. Flow Table.	Go to Step 4.
4	Check CMP Sensor and connector for proper installation. Is CMP sensor installed properly and connector connected securely?	Go to Step 5.	Correct.
5	Check Wire Harness and Connection. 1) Disconnect connector from CMP sensor. 2) Check for proper connection to CMP sensor at each terminal. 3) If OK, turn ignition switch ON and check for voltage between “Bl/B” and “V/R” terminals of sensor connector disconnected. Is voltage 10 – 14 V?	Go to Step. 6.	“Bl/B” or “V/R” wire open, short or poor connection.
6	Check for voltage between “Y/Bl” and “V/R” terminals of sensor connector disconnected. Is voltage 4 – 5 V?	Go to Step 5.	“Y/Bl” wire open, short or poor connection. If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.
7	Check CMP Sensor for Operation. G16 Engine: 1) Remove CMP sensor from sensor case. 2) Remove metal particles on end face of CMP sensor, if any. 3) Connect connector to CMP sensor. Disconnect connectors from ignition coil assemblies and fuel injectors. 4) Turn ignition switch ON. 5) Check for voltage at terminal C51-2-26 of connector connected to ECM (PCM) by passing magnetic substance (iron) while keeping approximately 1 mm (0.03 in.) gap with respect to end face of CMP sensor. Does voltage vary from low (0 – 1 V) to high (4 – 6 V) or from high to low? J20 Engine: 1) Remove CMP sensor. 2) Connect connector to CMP sensor. Disconnect connectors from ignition coil assemblies and fuel injectors. 3) Turn ignition switch ON. 4) Check for voltage between C51-2-26 and C51-3-26 of connector connected to ECM (PCM) by rotating CMP sensor coupling. Does voltage vary from low (0 – 1 V) to high (4 – 6 V) or from high to low?	Go to Step 8.	Replace CMP sensor.

STEP	ACTION	YES	NO
8	G16 Engine: Check signal rotor for the following, using mirror. ● Damage ● No foreign material attached Is it in good condition? J20 Engine: Check Signal Rotor. 1) Remove rotor cover from CMP sensor. 2) Check signal rotor for the following. ● Damage ● No foreign material attached Is it in good condition?	Intermittent trouble or faulty ECM (PCM). Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	G16 Engine: Clean rotor teeth or replace camshaft. J20 Engine: Clean rotor teeth or replace CMP sensor.

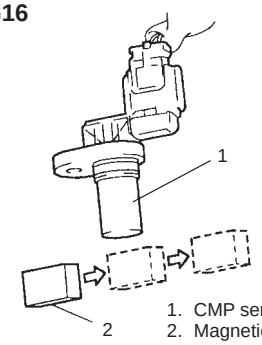
Fig. for Step 5



1. CMP sensor coupler

Fig. for Step 7

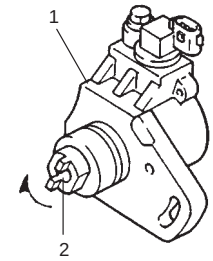
G16



1. CMP sensor
2. Magnetic substance (iron)

Fig. for Step 7

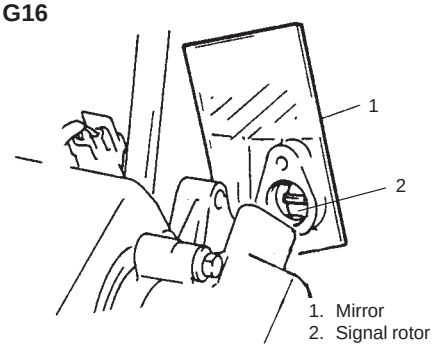
J20



1. CMP sensor
2. Coupling

Fig. for Step 8

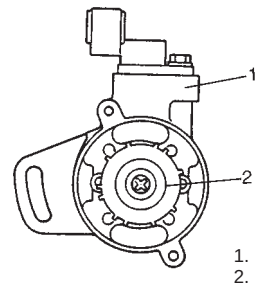
G16



1. Mirror
2. Signal rotor

Fig. for Step 8

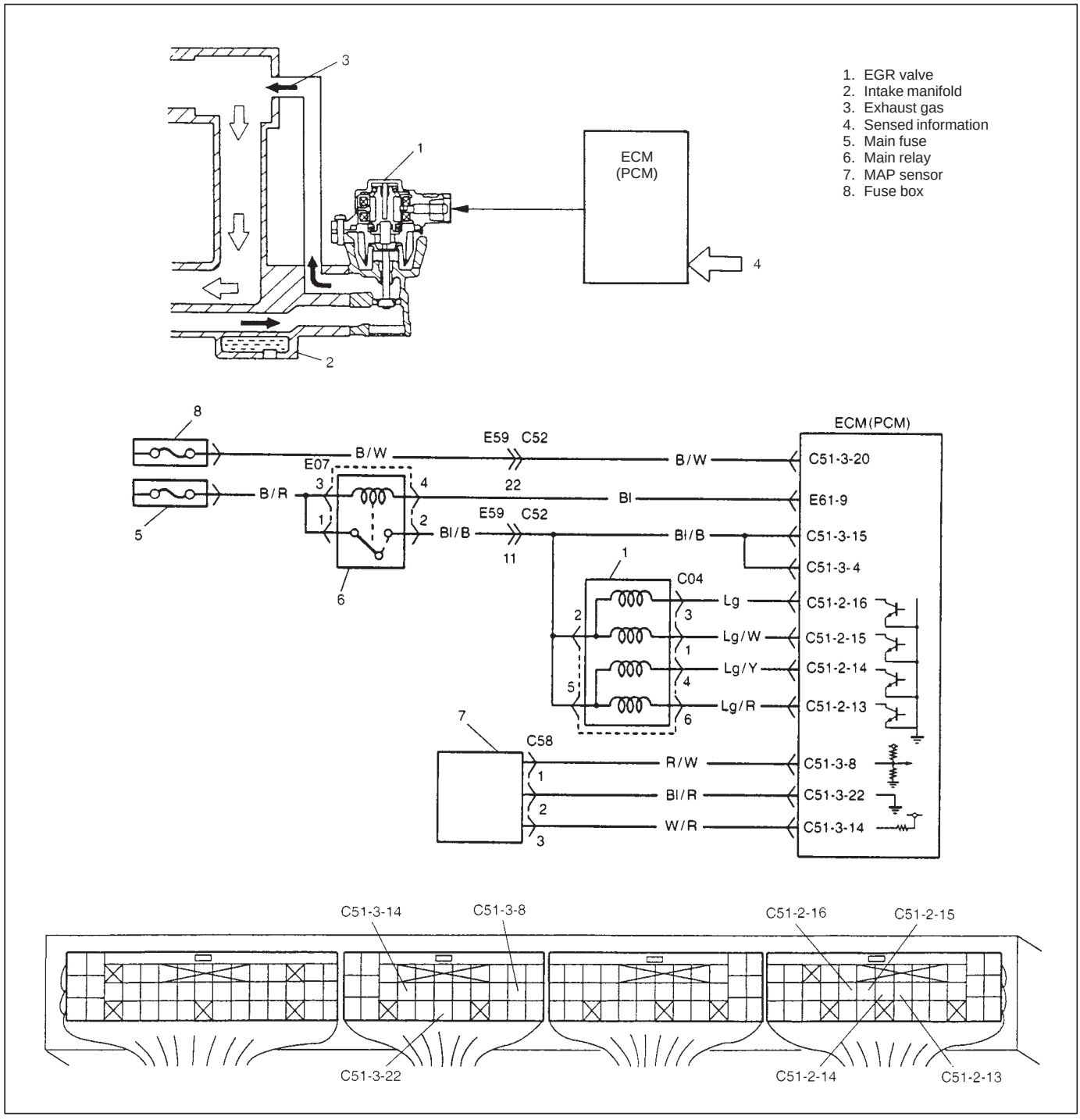
J20



1. CMP sensor
2. Rotor

DTC P0400 EXHAUST GAS RECIRCULATION FLOW MALFUNCTION

SYSTEM/WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

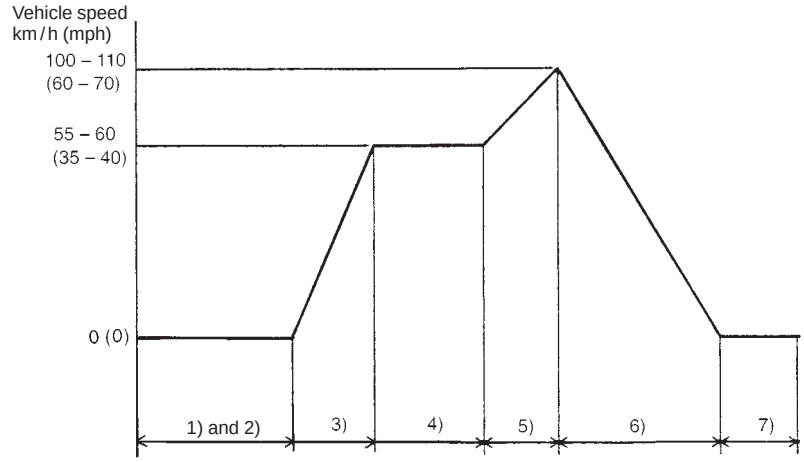
DTC DETECTING CONDITION	TROUBLE AREA
During deceleration (engine speed high with closed throttle position) in which fuel cut is involved, difference in intake manifold pressure between when EGR valve is opened and when it is closed is smaller than specified value. (2 driving cycles detection logic)	● EGR valve ● EGR passage ● Manifold absolute pressure sensor ● 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.**

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine completely.
3) Increase vehicle speed to 55 – 60 km/h (35 – 40 mph).
4) Keep driving above vehicle speed for 7 min. or more.
5) Increase vehicle speed to 100 – 110 km/h (60 – 70 mph).
6) Release accelerator pedal and with engine brake applied, keep vehicle coasting and then stop vehicle.
7) Check if DTC and pending DTC exists by using scan tool. If not, check if EGR system monitoring test has completed by using scan tool. If not in both of above checks (i.e., no pending DTC and EGR system monitoring test not completed), check vehicle conditions (environmental) and repeat Steps 3) through 6).

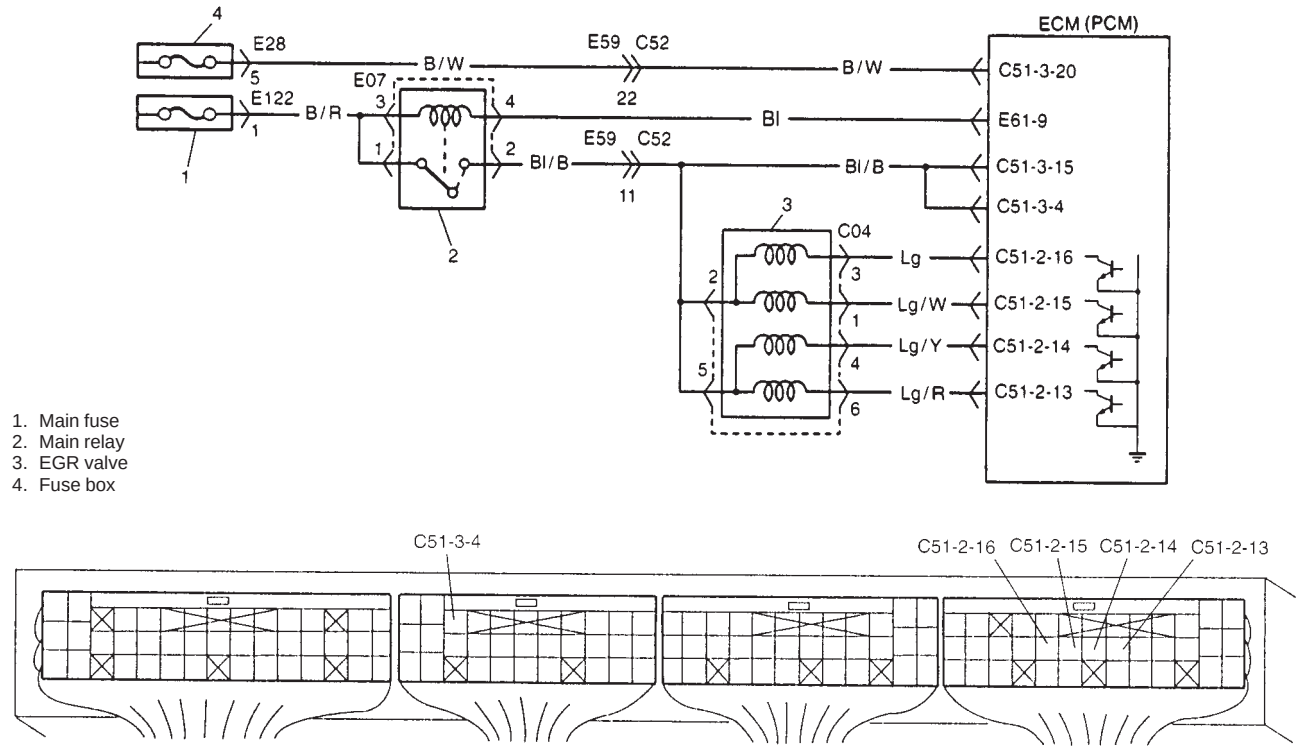


TROUBLESHOOTING (DTC P0400)

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 P0403 (EGR circuit malfunction)?	Go to DTC P0403 Diag. Flow Table.	Go to Step 3.
3	Do you have SUZUKI scan tool?	Go to Step 4.	Go to Step 6.
4	EGR Valve Operation Check: 1) With ignition switch OFF, install SUZUKI scan tool. 2) Check EGR system referring to Section 6E1. Is it in good condition?	Go to Step 5.	Go to Step 6.
5	MAP Sensor Check: 1) Check MAP sensor for performance referring to 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.
6	EGR Valve Power Supply Circuit Check: 1) With ignition switch OFF, disconnect EGR valve coupler. 2) With ignition switch ON, check voltage between C04-2 and ground, C04-5 and ground. Is each voltage 10 – 14 V?	Go to Step 7.	Faulty “Bl/B” wire.
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 C51-3-4 and C51-2-13, C51-2-14, C51-2-15, C51-2-16. Is each resistance 20 – 24 Ω at 20°C, 68°F?	Go to Step 8.	Faulty “Lg”, “Lg/W”, “Lg/R”, “Lg/Y” wire or EGR valve.
8	MAP Sensor Check: 1) Check MAP sensor for performance referring to Section 6E1. 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.

DTC P0403 (DTC No.51) EXHAUST GAS RECIRCULATION CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Low voltage is detected at EGR valve stepping motor electrical circuit for specified time continuously. (Circuit open or short).	EGR valve (stepping motor) or its circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

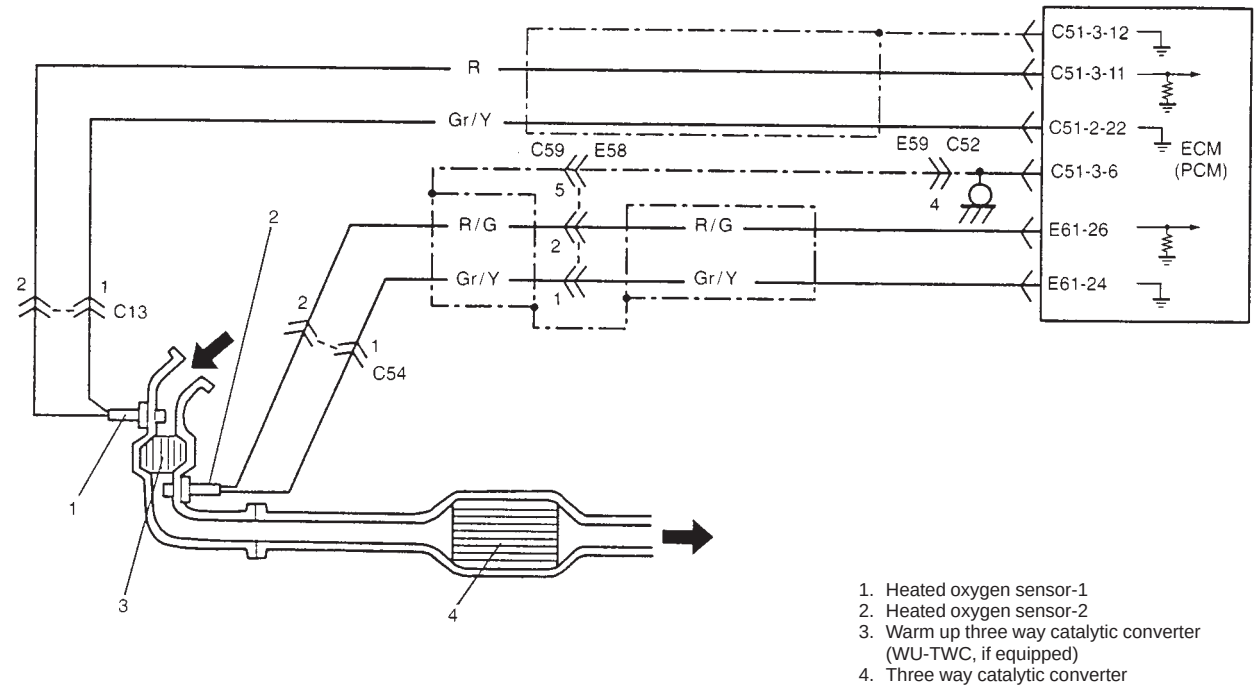
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0403/DTC No.51)

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	EGR Valve Check: 1) With ignition switch OFF, disconnect connector from EGR valve. 2) Check for proper connection to EGR valve at each terminal. 3) If OK, check EGR valve for resistance referring to “EGR Valve Inspection” in Section 6E1. Is check result as specified?	Go to Step 3.	EGR valve malfunction.
3	Wire Harness Check: 1) Connect connector to EGR valve. 2) Remove ECM (PCM) cover and disconnect connector from ECM (PCM). 3) Check for proper connection to ECM (PCM) at system related terminals. 4) If OK, check for resistance between following terminals of ECM (PCM) connector disconnected. C51-2-13 and C51-3-4 C51-2-14 and C51-3-4 C51-2-15 and C51-3-4 C51-2-16 and C51-3-4 — 20 – 24 Ω at 20°C, 68°F C51-2-13 and ground C51-2-14 and ground C51-2-15 and ground C51-2-16 and ground — Infinity (∞) Is check result as specified?	Intermittent trouble or faulty ECM (PCM). Recheck referring to “Intermittent and Poor Connection” in Section 0A.	“Bl/B”, “Lg”, “Lg/W” “Lg/Y” or “Lg/R” circuit open or shorted to ground.

DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD

SYSTEM DIAGRAM



1. Heated oxygen sensor-1
2. Heated oxygen sensor-2
3. Warm up three way catalytic converter (WU-TWC, if equipped)
4. Three way catalytic converter

CIRCUIT DESCRIPTION

Exhaust oxygen concentration at the pre-TWC and the post-TWC is detected from HO2S-1 and HO2S-2 respectively and accordingly ECM (PCM) controls the closed loop which then controls the fuel injection volume. (Refer to Section 6E1.) While the above control is going on and if TWC is in good condition, the output voltage of HO2S-2 is maintained at specified level. As TWC becomes deteriorated, even when the above control is going on, the exhaust gas which has passed TWC then passes HO2S-2 at the exhaust oxygen concentration similar to that of the pre-catalyst without being oxygenated or converted. Thus, waveforms of HO2S-1 and HO2S-2 output voltages become alike. ECM (PCM) judges deterioration of TWC by comparing waveforms of HO2S-1 and HO2S-2.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
While running under conditions described for DTC CONFIRMATION PROCEDURE, output waveform of HO2S-1 becomes similar to that of HO2S-2. (2 driving cycles detection logic)	● Exhaust gas leakage ● Three way catalytic convertor ● Heated oxygen sensor –2 or its circuit ● 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.**

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: −8°C, 18°F or higher**
- **Engine coolant temp.: −8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

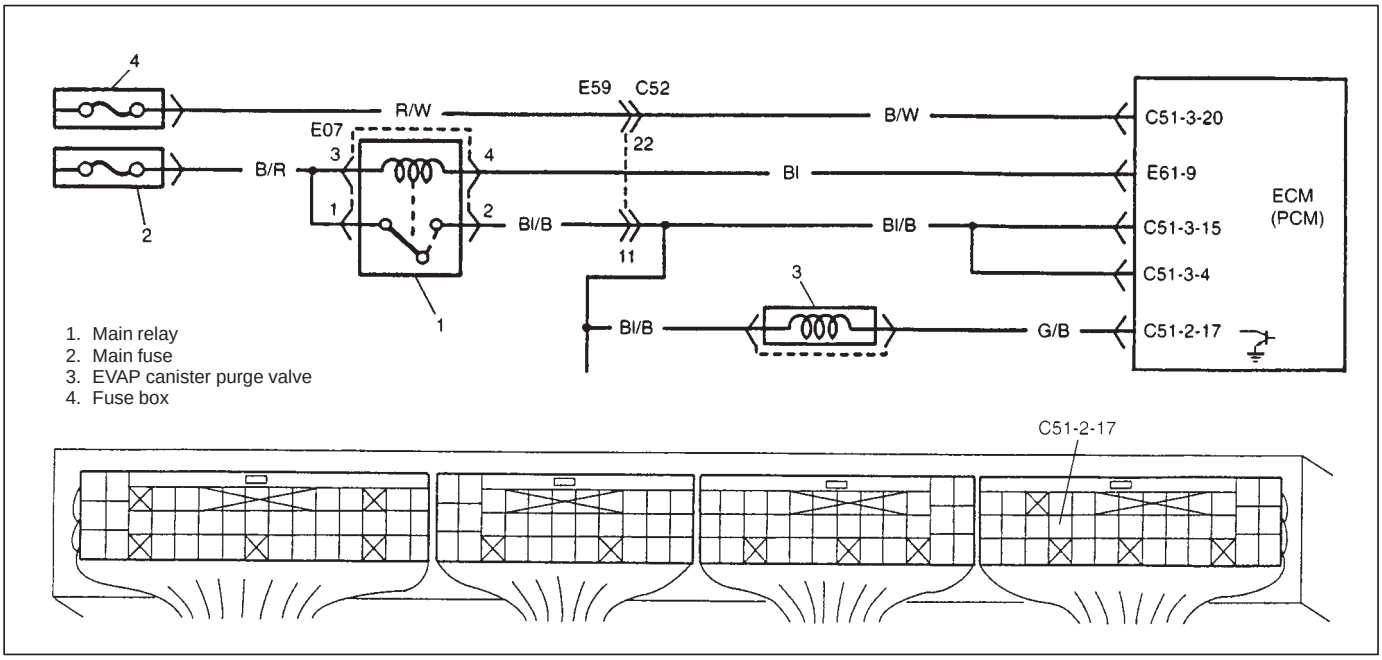
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool.
3) Increase vehicle speed to 80 – 90 km/h (50 – 56 mph).
4) Keep above vehicle speed for 5 min. or more (Throttle valve opening is kept constant in this step).
5) Stop vehicle and check if DTC and pending DTC exists by using scan tool. If not, check if catalyst monitoring test has completed by using scan tool. If not in both of above checks (i.e., no pending DTC and catalyst monitoring test not completed), check vehicle condition (environmental) and repeat Step 3) through 5).

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Exhaust System Visual Inspection: 1) Check exhaust system for leaks, damage and loose connection. Is it in good condition?	Go to Step 3.	Repair or replace.
3	HO2S-2 Output Voltage Check: 1) Check output voltage of HO2S-2 referring Step 2 of DTC P0136 Diag. Flow Table. Is check result satisfactory?	Replace three way catalytic converter.	Check “R/G” and “Gr/Y” wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-2.

DTC P0443 EVAP CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Monitor signal of EVAP canister purge valve is different from command signal. (Circuit open or short) (2 driving cycles detection logic)	● EVAP canister purge valve and its circuit ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

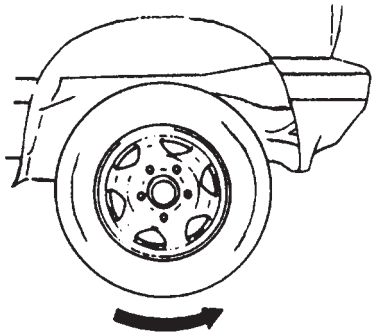
WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

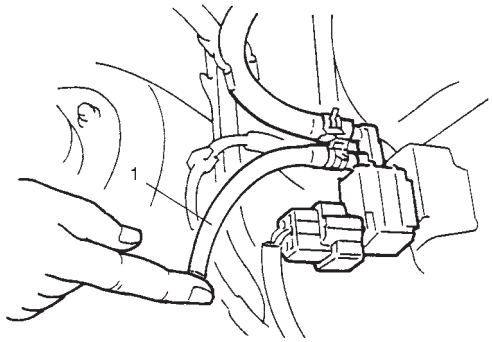
NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool.
3) Start engine and warm up it completely.
4) Increase vehicle speed to 55 km/h (35 mph) or more.
5) Keep driving above vehicle speed for 20 min. or more (Change of vehicle speed is permitted in this step).
6) Release accelerator pedal, stop vehicle and run engine at idle speed for 2 min.
7) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0443)

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check EVAP canister purge system for operation referring to “EVAP Canister Purge System Check”. Is check result satisfactory?	Intermittent trouble or faulty ECM (PCM). Check for intermittent referring to “Intermit tent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check EVAP canister purge valve for resistance referring to “EVAP Canister Purge Valve Inspection”. Is resistance as specified?	“G/B” or “Bl/B” circuit open or short. If wire and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace EVAP canister purge valve.





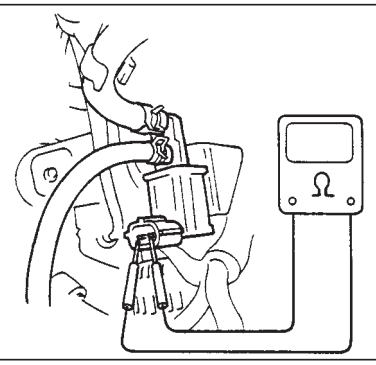
1. Purge hose

EVAP Canister Purge System Check

1) Warm up engine to normal operating temperature.
2) Hoist vehicle so that all wheels rotate freely.
3) Set M/T in "Neutral" or A/T in "P" position and parking brake.
4) Disconnect purge hose from EVAP canister.
5) Place finger against the end of disconnected hose and check that vacuum is not felt there when engine is running at idle speed.
6) Release parking brake lever, set transfer in "2H" and M/T in "1st" or A/T in "L".

WARNING:
Make sure that transfer is set to "2H" range position for this check. If it is set to "4H" or "4L" position, front and rear wheels turn at high speed and a very dangerous situation may occur.

7) Also check that vacuum is felt when engine speed is increased to higher than about 1,500 r/min. and keep it for 3 min. or more. If check result is not described in steps 5) and 7), check EVAP canister purge valve, wire harness and vacuum passage.

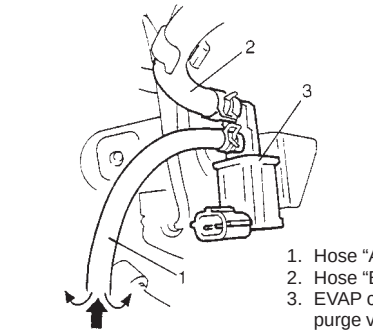


EVAP Canister Purge Valve Inspection

1) With ignition switch OFF, disconnect coupler from canister purge valve.
2) Check resistance between two terminals of EVAP canister purge valve.

Resistance of EVAP canister purge valve:
28 – 35 Ω at 20°C (68°F)

If resistance is as specified, proceed to next operation check. If not, replace.

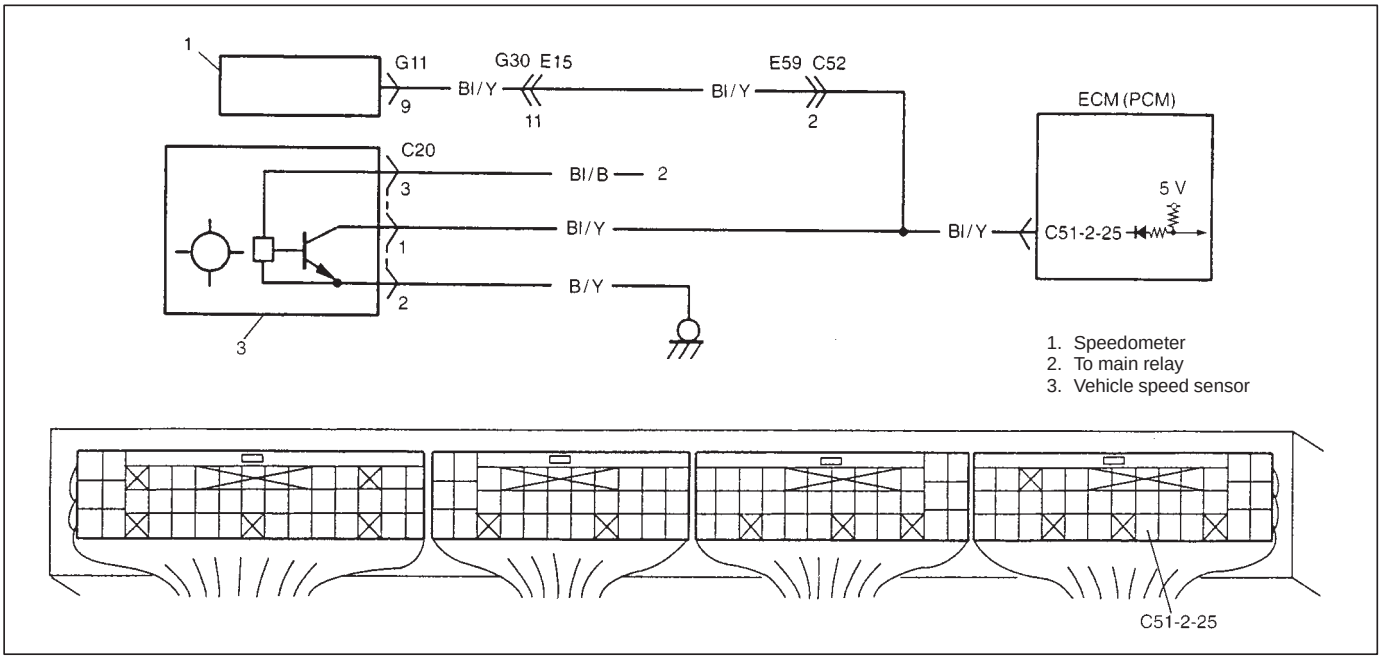


1. Hose "A"
2. Hose "B"
3. EVAP canister purge valve

3) Disconnect vacuum hoses from intake manifold and its EVAP canister.
4) With coupler disconnected, blow into hose "A". Air should not come out of hose "B".

DTC P0500 (DTC No.24) VEHICLE SPEED SENSOR MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Vehicle speed signal not inputted although fuel is kept cut for longer than 5 seconds. (2 driving cycles detection logic)	● Vehicle speed sensor circuit open or short ● Vehicle speed sensor ● Vehicle speed sensor drive gear or driven gear ● Speedometer malfunction ● 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.**

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

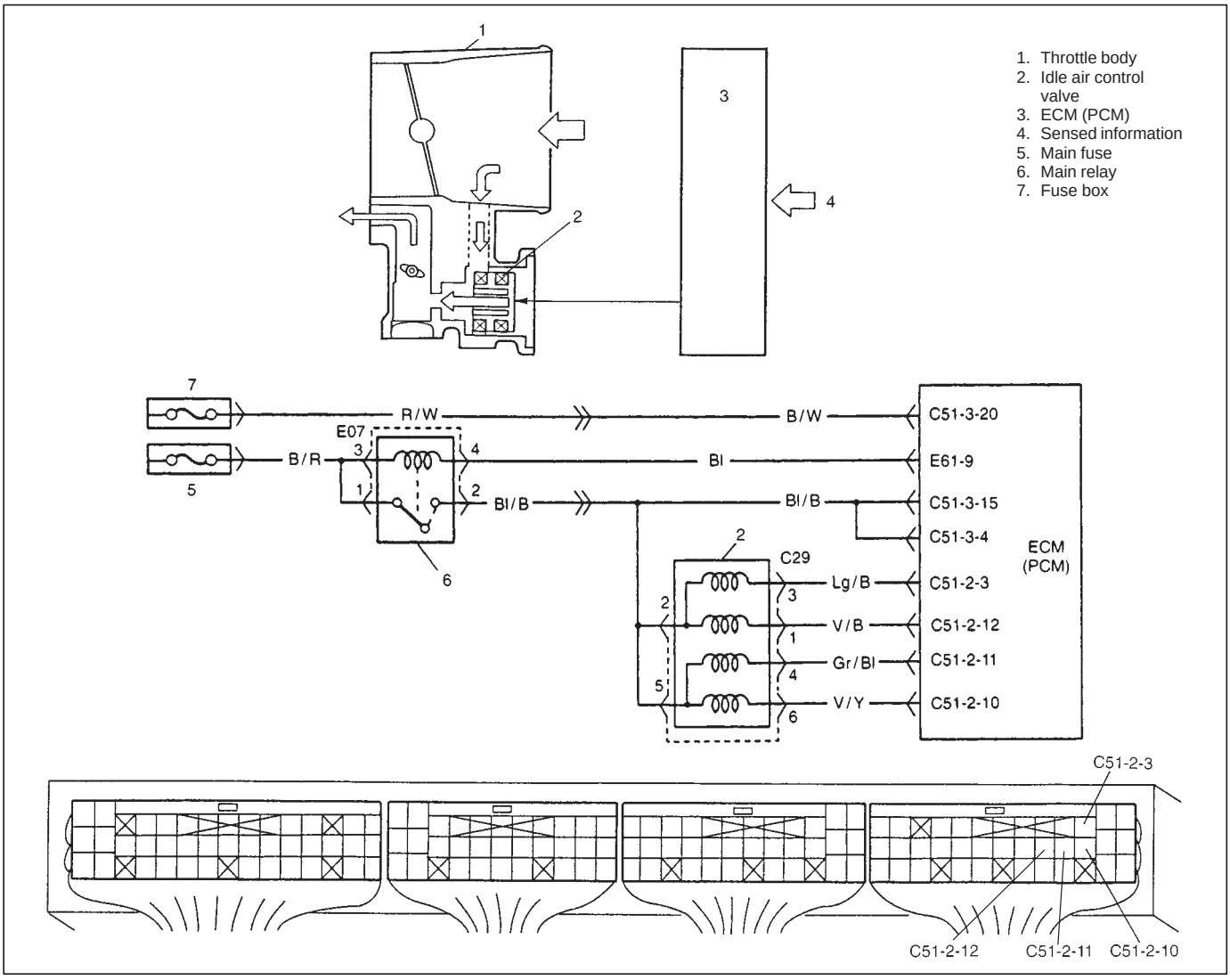
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine completely.
3) Increase vehicle speed to 100 – 110 km/h (60 – 70 mph).
4) Release accelerator pedal and with engine brake applied, keep vehicle coasting and then stop vehicle.
5) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P0500/DTC No.24)

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?	Faulty “Bl/Y” wire or poor C51-2-25 connection. If wire and connection are OK, intermittent trouble or faulty ECM (PCM). Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	VSS Power Supply Voltage Check: 1) With ignition switch OFF, remove VSS coupler. 2) With ignition switch ON leaving engine OFF, check voltage between C20-3 and C20-2 terminal of VSS coupler. Is voltage 10 – 14 V?	Go to Step 4.	“B/Bl” or “B/Y” wire open/short.
4	VSS Signal Harness Check: 1) With ignition switch ON leaving engine OFF, check voltage between C20-1 and C20-2 terminal of VSS coupler. Is voltage 4 V or more?	Go to Step 5.	Go to Step 6.
5	VSS Visual Inspection: 1) Remove VSS referring to “TRANSFER” section. 2) Check VSS drive and driven gears for damage and excessive wear. Are they in good condition?	Poor VSS connection or VSS malfunction. If connection is OK, substitute a known-good VSS and recheck.	Replace VSS.
6	Speedometer Circuit Check: 1) With ignition switch OFF, disconnect G11 coupler from combination meter. 2) With ignition switch ON leaving engine OFF, check voltage between C20-1 and C20-2 terminal of VSS coupler. Is voltage 4 V or more?	Substitute a known-good combination meter and recheck.	“Bl/Y” wire open/short or faulty ECM (PCM). If wire and connection are OK, substitute a known-good ECM (PCM) and recheck.

DTC P0505 IDLE AIR CONTROL SYSTEM MALFUNCTION

SYSTEM/WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
● Engine idle speed is 100 r/min. or more lower than target idle speed for longer than 20 sec. continuously. or ● Engine idle speed is 200 r/min or more higher than target idle speed for longer than 20 sec. continuously. (2 driving cycles detection logic)	● IAC valve or its circuit ● Abnormal air drawn in air intake system

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temp.: –8°C, 18°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine completely.
3) Run engine at idle speed for 1 min.
4) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (P0505)

STEP	ACTION	YES	NO
1	Was "ENGINE DIAG. FLOW TABLE" performed?	Go to Step 2.	Go to "ENGINE DIAG. FLOW TABLE".
2	Idle Speed Check: 1) Check engine idle speed referring to "Idle Speed/Idle Air Control Duty Inspection" in Section 6E1. Is engine idle speed within specification?	Intermittent trouble or faulty ECM (PCM). Check for intermittent referring to "Intermittent and Poor Connection" in Section 0A.	Go to Step 3.
3	IAC Valve Check: 1) Check IAC valve referring to "IAC Valve Inspection" in Section 6E1. Is check result as specified?	Go to Step 6.	Go to Step 4.
4	IAC Valve Circuit Check: 1) With ignition switch OFF, disconnect ECM (PCM) couplers. 2) Check for proper connection to IAC valve at C51-2-3, C51-2-12, C51-2-11 and C51-2-10 terminals. 3) If OK, check resistance between C51-2-3 and C51-2-12, C51-2-10 and C51-2-11. Is each resistance 70 – 86 Ω?	Go to Step 5.	"Lg/B", "V/B", "Gr/Bl" or "V/Y" wire open or short. If wire and connections are OK, replace IAC valve.
5	IAC Valve Power Supply Voltage Check: 1) Connect ECM (PCM) couplers. 2) With ignition switch OFF, disconnect C29 coupler of IAC valve. 3) With ignition switch ON, check voltage between C29-2 and ground, C29-5 and ground. Is each voltage 10 – 14 V?	IAC valve or ECM (PCM) malfunction.	Open "Bl/B" wire.
6	Was idle speed higher than specification in Step 2?	Check abnormal air inhaling from intake manifold, throttle body, PCV valve and EVAP canister purge control system.	Check parts or system which can cause engine low idle. – Air inhaling from between throttle body and MAF sensor. – EGR valve malfunction (leakage from valve seat) – Accessary engine load – Clog of idle air passage – Engine mechanical – Engine overheat – Etc.

DTC P0601 (DTC No.71) INTERNAL CONTROL MODULE MEMORY CHECK SUM ERROR

SYSTEM DESCRIPTION

Internal control module is installed in ECM (PCM).

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Data write error or check sum error	ECM (PCM)

DTC CONFIRMATION PROCEDURE

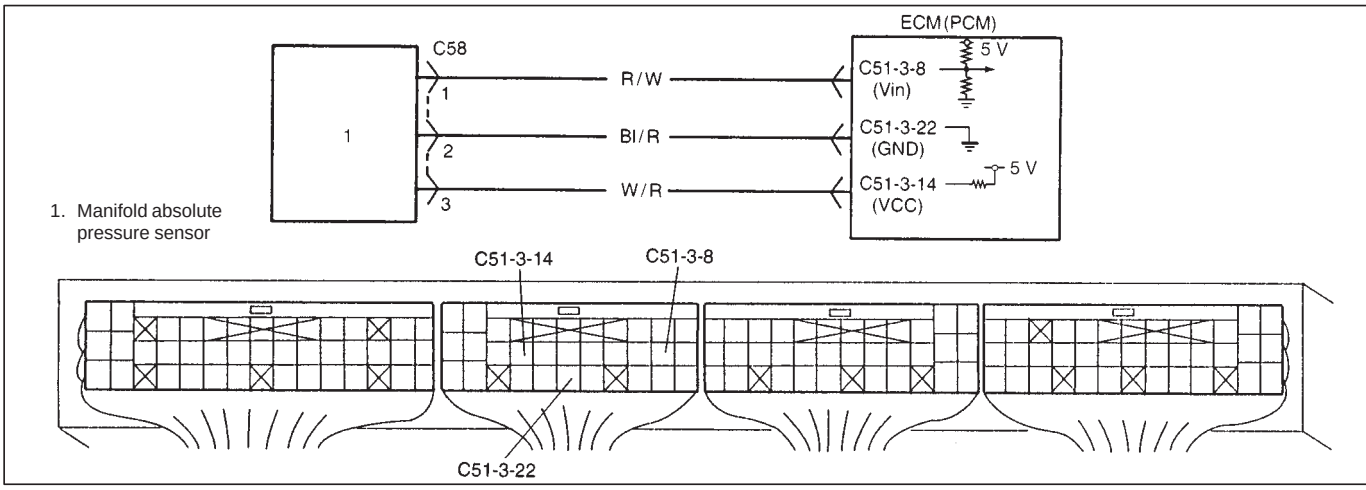
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool.
3) Start engine and run it at idle if possible.
4) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

Substitute a known-good ECM (PCM) and recheck.

DTC P1408 MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
● While engine is running after being warmed up and with throttle opening smaller than specification, higher than 4.6 V manifold absolute pressure sensor output voltage is detected for specified time or with throttle opening larger than specification, lower than 0.2 V manifold absolute pressure output voltage is detected for specified time. (2 driving cycles detection logic)	● Manifold absolute pressure sensor ● Manifold absolute pressure sensor vacuum 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.**

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temp.: 5°C, 41°F or higher**
- **Engine coolant temp.: –8 – 110°C (18 – 230°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine completely.
3) Run engine at idle speed for 1 min.
4) Increase vehicle speed to 80 km/h (50 mph).
5) Keep driving above vehicle speed for 1 min. (Change of vehicle speed is permitted in this step).
6) Stop vehicle and check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P1408)

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	MAP Sensor Signal Check: 1) Remove ECM (PCM) cover. 2) Check voltage between C51-3-8 and C51-3-22 under following conditions. With ignition switch ON leaving engine OFF: 0.2 V or higher At idling: 4.6 V or lower Is check result as specified?	Intermittent trouble or faulty ECM (PCM). Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	MAP Sensor Check: 1) Disconnect connector from MAP sensor. 2) Check for proper connection to MAP sensor at each terminal. 3) If OK, check MAP sensor for performance referring to “MAP Sensor Inspection” in Section 6E1. Is check result satisfactory?	“R/W”, “Bl/R” or “W/R” circuit open/short. If wire and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace MAP sensor.

DTC P1450 BAROMETRIC PRESSURE SENSOR CIRCUIT MALFUNCTION
DTC P1451 BAROMETRIC PRESSURE SENSOR PERFORMANCE PROBLEM

SYSTEM DESCRIPTION
Barometric pressure sensor is installed in ECM (PCM).

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
DTC P1450: Barometric pressure out of specification is detected.	● Barometric pressure sensor in ECM (PCM)
DTC P1451: While running under conditions described for DTC CONFIRMATION PROCEDURE, barometric pressure value compared with intake manifold vacuum value in fuel cut state is not as specified. (DTC P1451: 2 driving cycles detection logic)	● Manifold absolute pressure sensor performance problem ● Barometric pressure sensor in ECM (PCM)

DTC CONFIRMATION PROCEDURE (DTC P1450)
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC by using scan tool and run engine for 1 min.
3) Check DTC and pending DTC by using scan tool.

DTC CONFIRMATION PROCEDURE (DTC P1451)

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

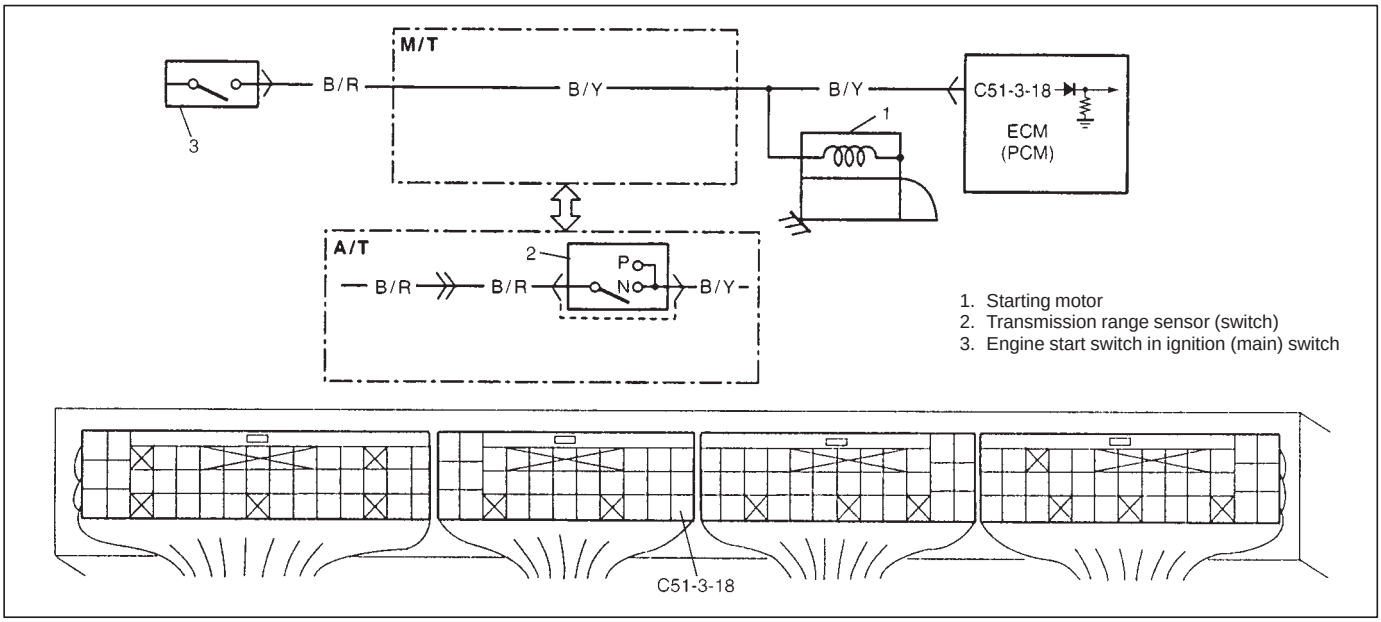
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine to normal operating temperature.
3) Increase engine speed to 3,000 r/min. in 3rd gear in case of M/T and “2” range in case of A/T.
4) Release accelerator pedal and with engine brake applied, keep vehicle coasting for 5 sec. or more. (Keep fuel cut condition for 5 sec. or more) If fuel cut condition is not kept for 5 sec. or more, coast down a slope in engine speed 1600 – 3000 r/min for 5 sec. or more.
5) Stop vehicle and run engine at idle.
6) Repeat steps 3) ~ 5) 2 times.
7) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P1450/P1451)

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is DTC P1451?	Go to Step 3.	Substitute a known-good ECM (PCM) and recheck.
3	MAP Sensor Check: 1) Check MAP sensor and its circuit referring to Steps 2 and 3 of DTC P1408 Diag. Flow Table. Is check result satisfactory?	Substitute a known-good ECM (PCM) and recheck.	MAP sensor or its circuit malfunction.

DTC P1500 ENGINE STARTER SIGNAL CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Engine starts even though vehicle is at stop and engine start signal is not inputted. Engine start signal is inputted for specified time while engine is running. (2 driving cycles detection logic)	● Engine start signal circuit ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

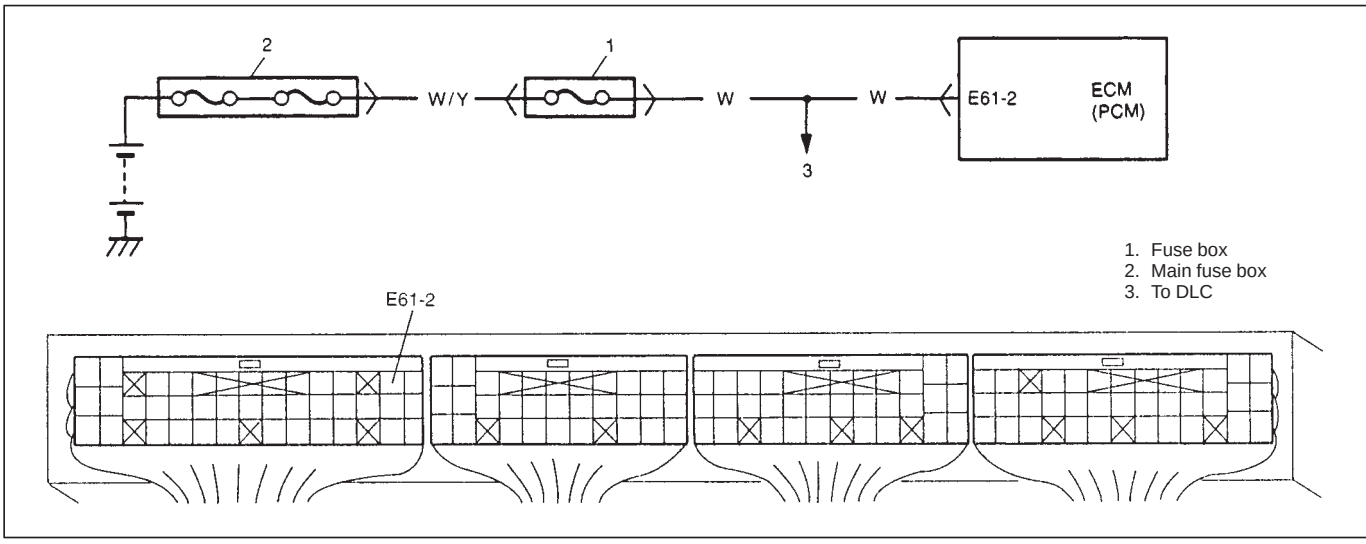
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC by using scan tool, then start engine and run it for 3 min. or more.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING (DTC P1500)

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 C51-3-18 of ECM (PCM) connector connected, under following condition. While engine cranking : 6 – 14 V After starting engine : 0 – 1 V Is voltage as specified?	Poor C51-3-18 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.

DTC P1510 ECM BACK-UP POWER SUPPLY MALFUNCTION

WIRING DIAGRAM



CIRCUIT DESCRIPTION

Battery voltage is supplied to keep DTC memory, values that ECM has learned to control engine, etc. in ECM even when ignition switch is turned OFF.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Back-up circuit voltage lower than specification is detected while engine is running.	● ECM (PCM) back-up circuit ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

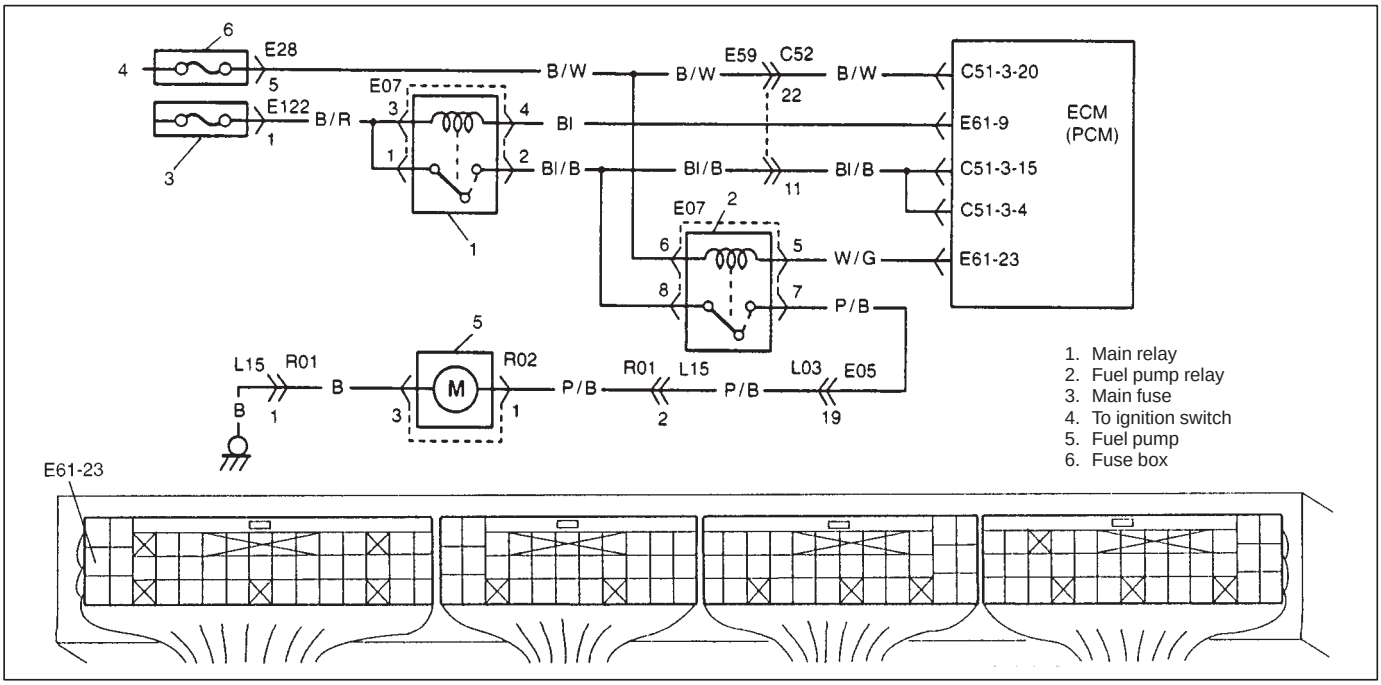
1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and run engine at idle speed for 1 min.
3) Check DTC and pending DTC by using scan tool.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Battery Voltage Supply Circuit Check: 1) Remove ECM (PCM) cover. 2) While engine running, check voltage between E61-2 and ground. Is voltage 10 – 14 V?	Poor E61-2 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” circuit open or short.

TABLE B-1 FUEL PUMP CIRCUIT INSPECTION

WIRING DIAGRAM



INSPECTION

STEP	ACTION	YES	NO
1	Fuel Pump Operation Check: 1) Remove fuel filler cap. 2) Turn ON ignition switch. Is fuel pump operation sound heard for 3 sec. after ignition switch ON?	Fuel pump circuit is in good condition.	Go to Step 2.
2	Fuel Pump Circuit Check: 1) With ignition switch OFF, remove fuel pump relay from connector. 2) Check for proper connection to relay at each terminal. 3) If OK, using service wire, connect terminals E07-7 and E07-8 of relay connector. **CAUTION: Check to make sure that connection is made between correct terminals. Wrong connection can cause damage to ECM, wire harness etc.** Is fuel pump heard to operate at ignition switch ON?	Go to Step 3.	"Bl/B", "P/B" or "B" circuit open or fuel pump malfunction.
3	Fuel Pump Relay Check: 1) Check fuel pump relay referring to "Fuel Pump Relay Inspection" in Section 6E1. Is it in good condition?	"B/W" or "W/G" circuit open.	Replace fuel pump.

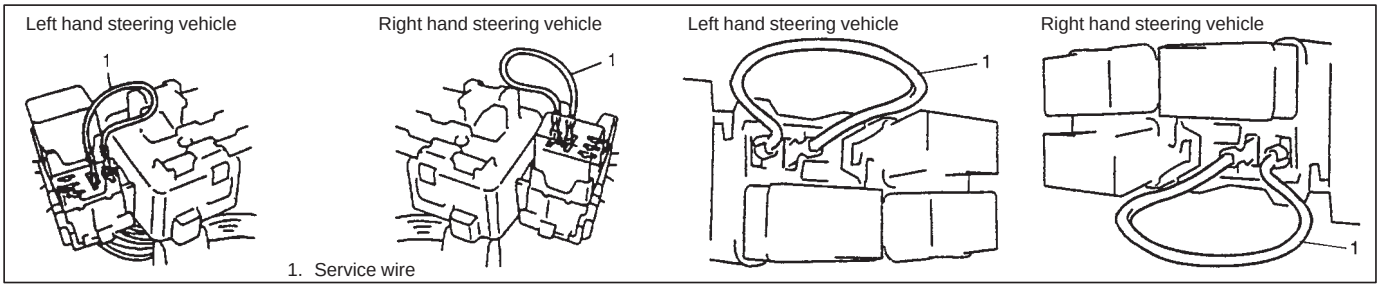
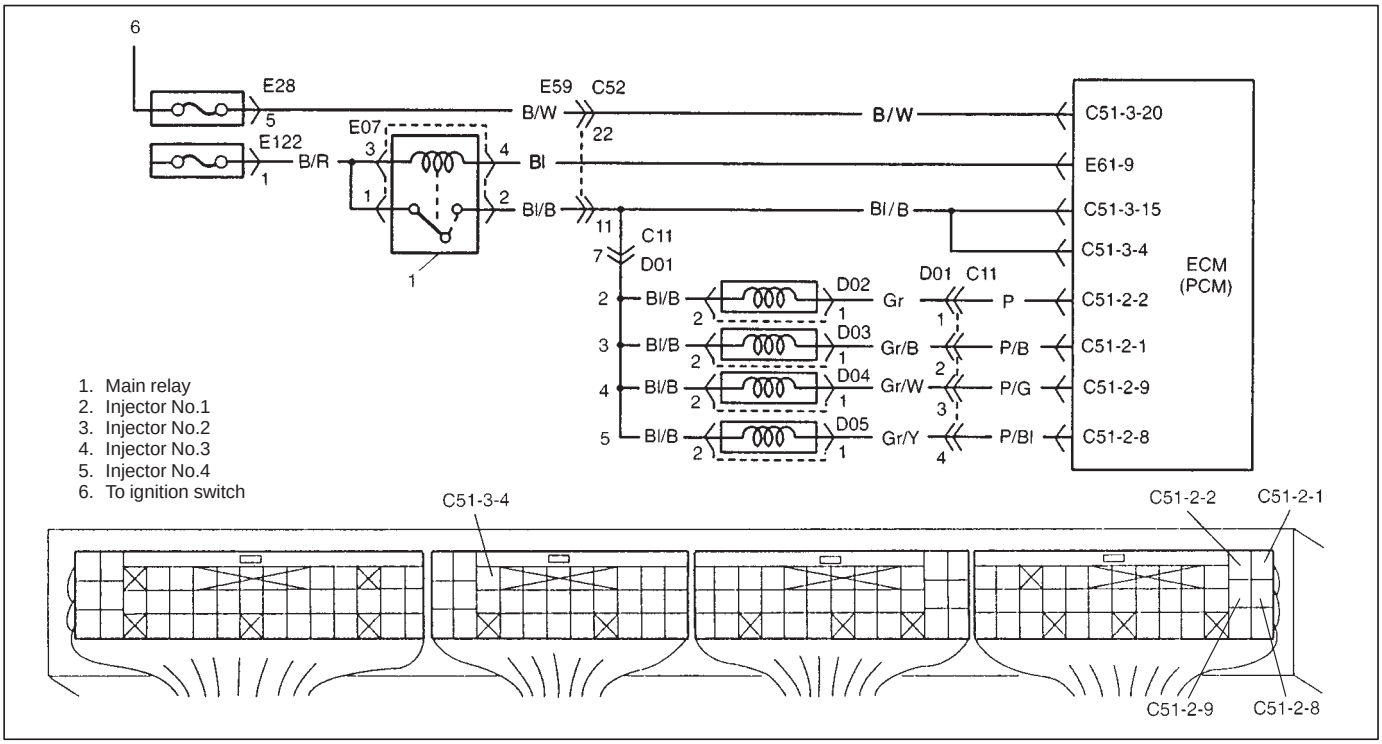


TABLE B-2 FUEL INJECTORS AND CIRCUIT INSPECTION

WIRING DIAGRAM

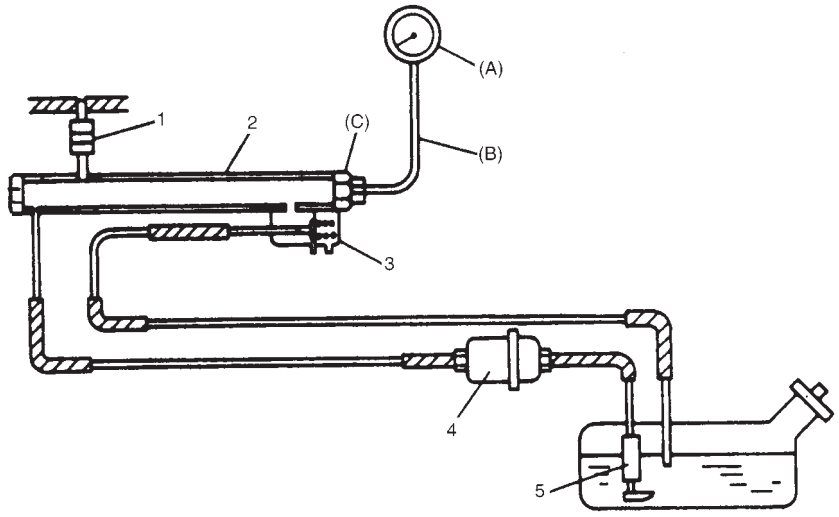


INSPECTION

STEP	ACTION	YES	NO
1	Check Injector for Operating Sound. Using sound scope, check each injector for operating sound at engine cranking. Do all 4 injectors make operating sound?	Go to Step 2.	Go to Step 3.
2	Wire Harness Check: 1) Remove ECM (PCM) cover and disconnect connectors from ECM (PCM). 2) Check for resistance between following terminals of ECM (PCM) connector disconnected. C51-2-1 – C51-3-4 C51-2-2 – C51-3-4 C51-2-8 – C51-3-4 C51-2-9 – C51-3-4 — 13 – 16 Ω at 20°C, 68°F Is check result as specified?	Fuel injector circuit is in good condition.	"P", "P/B", "P/G" and "P/Bl" shorted each other.
3	Does none of 4 injectors make operating sound at Step 1?	Go to Step 4.	Check coupler connection and wire harness of injector not making operating sound and injector itself (Refer to "Fuel Injector Inspection" in Section 6E1).
4	Check power circuit of injectors for open and short. Is it normal?	Check all 4 injectors for resistance respectively. If resistance is OK, substitute a known-good ECM (PCM) and recheck.	Power circuit open or short.

TABLE B-3 FUEL PRESSURE INSPECTION

SYSTEM DIAGRAM



1. Injector
2. Delivery pipe
3. Fuel pressure regulator
4. Fuel filter
5. Fuel pump

(A): Gauge
(B): Hose
(C): Attachment

INSPECTION

NOTE:

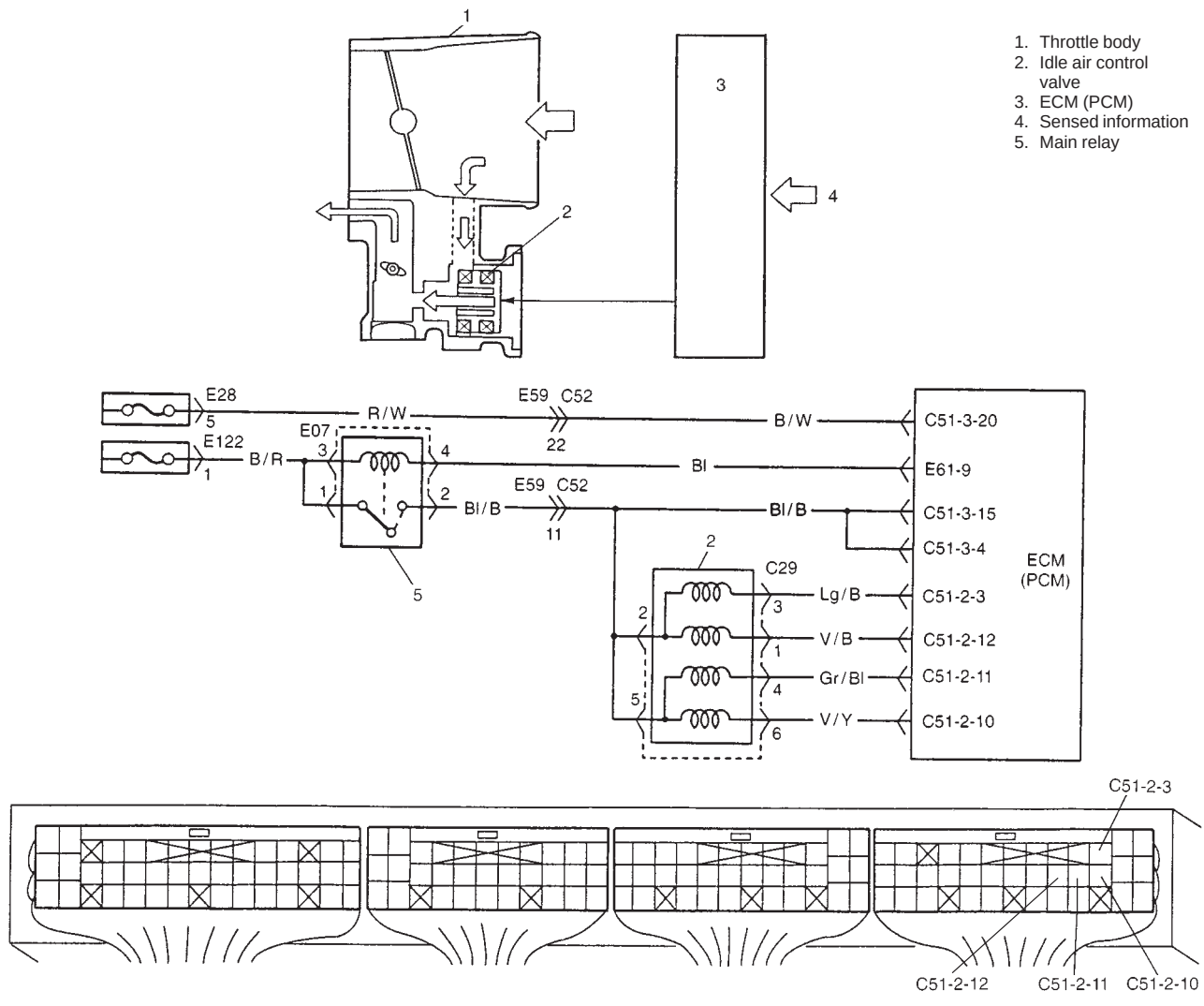
Before using following flow table, check to make sure that battery voltage is higher than 11 V. If battery voltage is low, pressure becomes lower than specification even if fuel pump and line are in good condition.

STEP	ACTION	YES	NO
1	1) Install fuel pressure gauge, referring to "Fuel Pressure Inspection" in Section 6E1. 2) Operate fuel pump. Is fuel pressure then 250 – 300 kPa (2.5 – 3.0 kg/cm^2, 35.6 – 42.7 psi)?	Go to Step 2.	Go to Step 5.
2	Is 180 kPa (1.8 kg/cm^2, 25.6 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 210 – 260 kPa (2.1 – 2.6 kg/cm^2, 29.8 – 37.0 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 joint?	Fuel leakage from hose, pipe or joint.	Go to Step 10 on the next page.
5	Was fuel pressure higher than spec. in Step 1?	Go to Step 6.	Go to Step 7.
6	1) Disconnect fuel return hose from fuel pipe and connect new 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 on the next page.	Go to Step 9 on the next page. **(Low pressure is measured.)**

STEP	ACTION	YES	NO
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 defective (Refer to Table B-1 “Fuel Pump Circuit Inspection”).
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, 64.0 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 fuel pipe and connect new hose to it. 2) Put the other end of new return hose into approved gasoline container. 3) Check again if specified fuel pressure is retained. While doing so, does fuel come out return hose?	Faulty fuel pressure regulator.	Fuel leakage from injector, faulty fuel pump (faulty check valve in fuel pump) or fuel leakage from fuel pressure regulator diaphragm.

TABLE B-4 IDLE AIR CONTROL SYSTEM INSPECTION

WIRING DIAGRAM



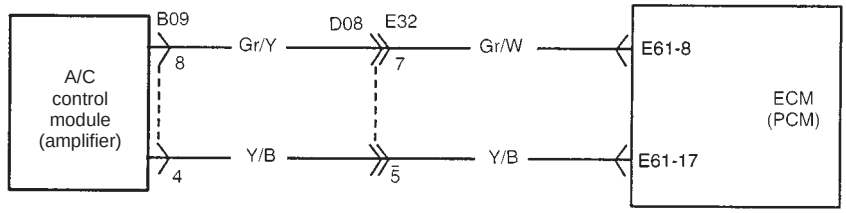
INSPECTION

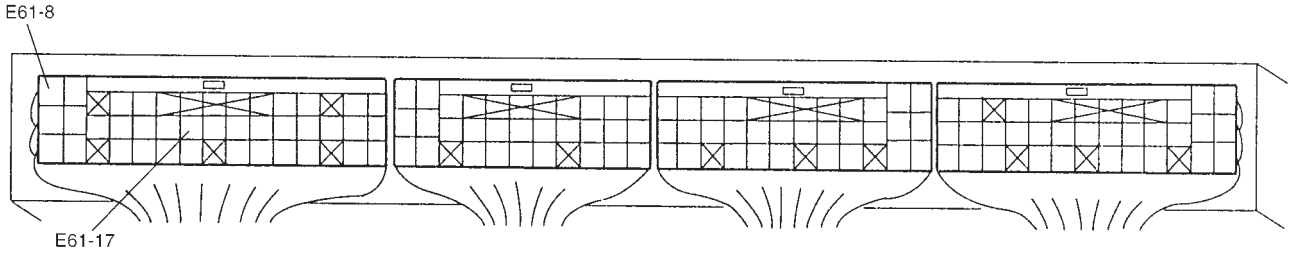
STEP	ACTION	YES	NO
1	Check engine idle speed and IAC duty referring to “Idle Speed/IAC Duty Inspection” in Section 6E1. Is idle speed/IAC duty within specification?	Go to Step 2.	Go to Step 3.
2	Is engine idle speed kept specified speed even with headlights turned ON?	System is in good condition.	Go to Step 3.
3	Check IAC valve referring to “IAC Valve Inspection” in Section 6E1. Is check result as specified?	Go to Step 4.	IAC valve malfunction, “Bl/B”, “Lg/B”, “V/B”, “Gr/Bl” or “V/Y” wire open or short or poor coupler connection. If all above are OK, substitute a known-good ECM (PCM) and recheck.

STEP	ACTION	YES	NO
4	Was idle speed within specification in Step 1?	Check for following: – Vacuum leaks – Air inhaling – EVAP canister purge control system – Accessory engine load – Stuck of PCV valve – Clog of idle air passage – MAF sensor – TP sensor – ECT sensor – EGR valve malfunction (leakage from valve seat) – A/C signal – Transmission range switch signal	Go to Step 5.
5	Was idle speed higher than specification in Step 1?	Go to Step 6.	Go to Step 9.
6	Check A/C (input) signal circuit referring to Step 1 of Table B-5 A/C Signal Circuit Check, if equipped. (A/C signal can be also checked by using Tech-1.) Is it in good condition?	Go to Step 7.	A/C signal circuit open or short, or A/C system malfunction.
7	Check ABS signal circuit for voltage if equipped. 1) Turn ignition switch ON. 2) Check voltage between E61-30 terminal of ECM (PCM) connector connected and body ground. Is voltage 10 – 14 V?	Go to step 8.	ABS signal circuit shorted to ground or ABS malfunction.
8	Was IAC duty less than about 2% in Step 1 of this table?	Check abnormal air inhaling from intake manifold, throttle body, 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) and recheck.
9	Check transmission range switch signal referring to “Inspection of ECM (PCM) and its Circuit” in this section. Is check result satisfactory?	Go to Step 10.	Transmission range switch malfunction or its circuits open or short.
10	Was IAC duty more than about 30% in Step 1 of this table?	Check parts or system which can cause engine low idle. – Air inhaling from between throttle body and MAF sensor. – EGR valve malfunction (leakage from valve seat) – Accessory engine load – Clog of idle air passage – Etc.	Substitute a known-good ECM (PCM) and recheck.

TABLE B-5 A/C SIGNAL CIRCUITS INSPECTION (IF EQUIPPED)

WIRING DIAGRAM



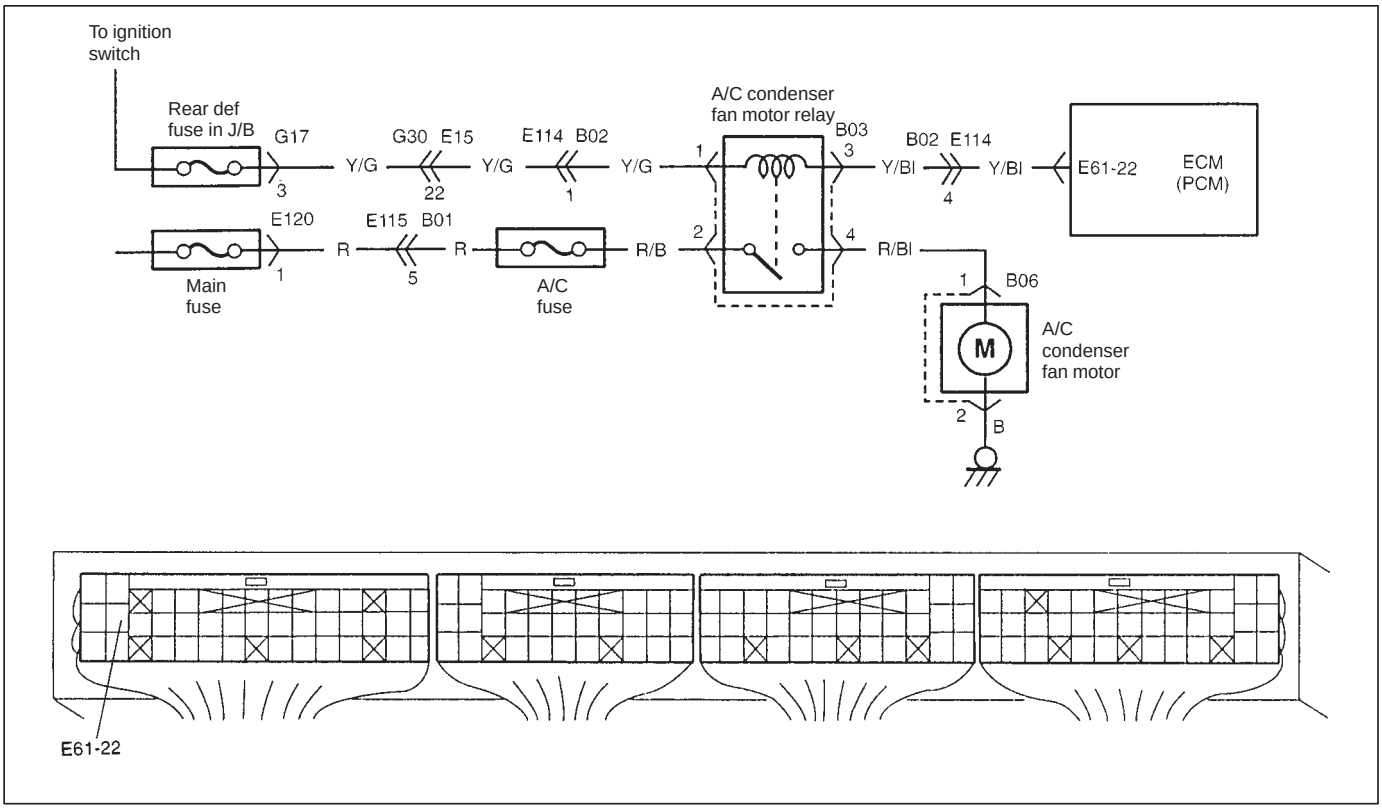


INSPECTION

STEP	ACTION	YES	NO
1	Check A/C Signal Circuit. 1) Check voltage at terminal E61-17 with ignition switch ON. A/C switch and/or heater blower switch OFF (A/C is not operating): 10 – 14 V Both A/C switch and heater blower switch ON: 0 – 1.5 V Are check result as specified?	Go to Step 2.	"Y/B" circuit open or short, Evaporative temperature is below 1°C (34°F) or faulty A/C system.
2	Check A/C Cut Signal Circuit. 1) Check voltage at terminal E61-8. While engine running and A/C switch and/or heater blower switch OFF (A/C is not operating): 0 – 1.5 V While engine running at idle speed and both A/C switch and heater blower switch ON (A/C is operating): 10 – 14 V Are check result as specified?	A/C control signal circuits are in good condition.	"Gr/W" or "Gr/Y" circuit open or short, Poor performance of ECT sensor, TP sensor, Engine start signal inputted or A/C amplifier malfunction. If none of the above exists, substitute a known-good ECM (PCM) and recheck.

TABLE B-6 A/C CONDENSER FAN MOTOR RELAY CONTROL SYSTEM INSPECTION (IF EQUIPPED)

WIRING DIAGRAM

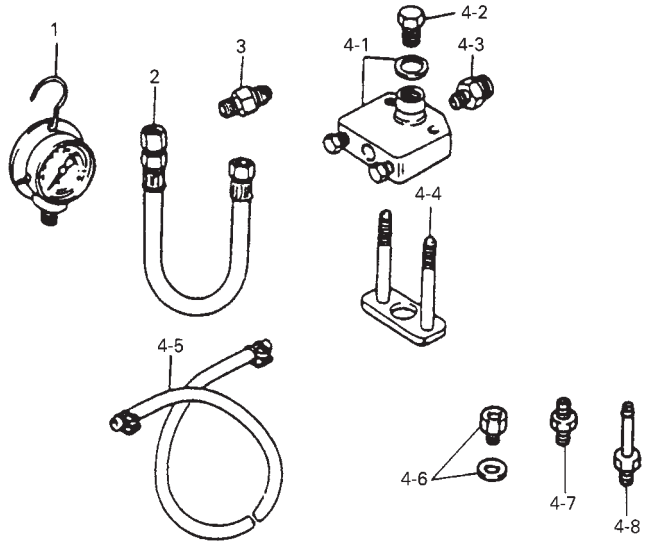


INSPECTION

WARNING:
Keep hands, tools, and clothing away from A/C condenser fan to help prevent personal injury. This fan is electric and can come on whether or not the engine is running. The fan can start automatically in response to the ECT sensor with the ignition switch in the "ON" position.

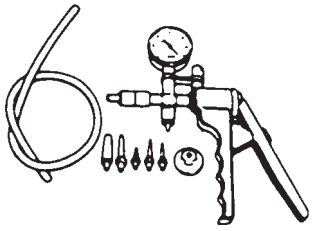
STEP	ACTION	YES	NO
1	1) Check DTC referring to "DTC Check" in this section. Is there any malfunction DTC?	Go to applicable DTC Diag. Flow Table.	Go to Step 2.
2	1) Check A/C condenser fan for operation. A/C condenser fan should be operated under following condition A or B only. A: When engine is running and A/C is operating. B: When engine coolant temp. is 113°C, 235°F or more with ignition switch ON. Is check result as specified?	This system is in good condition.	Go to Step 3.
3	1) Remove ECM (PCM) cover. 2) Check voltage between E61-22 terminal of ECM (PCM) connected coupler and ground. Other than conditions A and B in Step 2: 10 – 14 V Under condition A or B in Step 2: 0 – 1 V Is check result as specified?	Fuse blown, "R", "R/B" or "R/Bl" circuit open, malfunction of condenser fan motor or relay.	"Y/G" circuit open, "Y/Bl" circuit open or short, or relay malfunction. If above are OK, substitute a known-good ECM (PCM) and recheck.

SPECIAL TOOLS

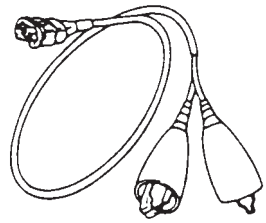


1. Pressure gauge
   09912-58441
2. Pressure hose
   09912-58431
3. Attachment
   09919-46010
4. Checking tool set
   09912-58421

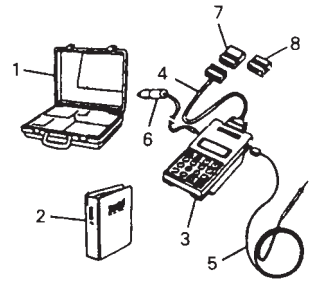
4-1. Tool body & washer
4-2. Body plug
4-3. Body attachment
4-4. Holder
4-5. Return hose & clamp
4-6. Body attachment-2 & washer
4-7. Hose attachment-1
4-8. Hose attachment-2



09917-47010
Vacuum pump gauge

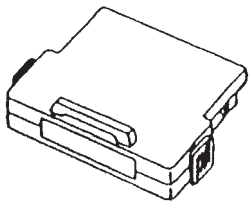


09930-88530
Injector test lead

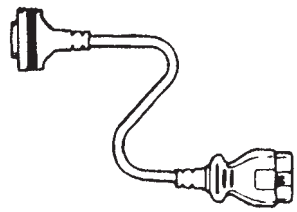


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self–test adaptor

09931-76011
SUZUKI scan tool (tech 1) kit



Mass storage cartridge



09931-76030
16 / 14 pin DLC cable

SECTION 6-1

ENGINE GENERAL INFORMATION AND DIAGNOSIS
(H25 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).**

NOTE:
Whether following systems (parts) are used in the particular vehicle or not depends on specifications. Be sure to bear this in mind when performing service work.
- **Monitor connector**
- **CKP sensor**
- **MAP sensor**
- **EGR valve**
- **Heated oxygen sensor or CO adjusting resistor**
- **Three way catalytic converter, Warm-up three way catalytic converter**

ENGINE GENERAL INFORMATION AND DIAGNOSIS (H25 ENGINE) 6-1-1
ENGINE MECHANICAL 6A2-1
ENGINE COOLING 6B-1
ENGINE FUEL 6C-1
ENGINE AND EMISSION CONTROL SYSTEM 6E2-1
ENGINE IGNITION SYSTEM 6F2-1
CRANKING SYSTEM 6G-1
CHARGING SYSTEM 6H-1
ENGINE EXHAUST 6K-1

CONTENTS

GENERAL INFORMATION 6-1- 4
Statement of Cleanliness and Care 6-1- 4
General Information on Engine Service . . 6-1- 5
Precaution on Fuel System Service . . . 6-1- 6

Fuel Pressure Relief Procedure 6-1- 7
Fuel Leakage Check Procedure 6-1- 8

ENGINE DIAGNOSIS 6-1- 9
General Description 6-1- 9
On-Board Diagnostic System (Vehicle without Monitor Connector) ... 6-1- 9
On-Board Diagnostic System (Vehicle with Monitor Connector) 6-1-12
Precaution in Diagnosing Trouble 6-1-14
Engine Diagnostic Flow Table 6-1-15
Malfunction Indicator Lamp (MIL) Check 6-1-20
Diagnostic Trouble Code (DTC) Check .. 6-1-20
Diagnostic Trouble Code (DTC) Clearance 6-1-21
Diagnostic Trouble Code (DTC) Table ... 6-1-22
Fail-Safe Table 6-1-26
Scan Tool Data 6-1-27
Scan Tool Data Definitions 6-1-30
Engine Diagnosis Table 6-1-33
ECM (PCM) Substitution 6-1-38
Inspection of ECM (PCM) and Its Circuits 6-1-38
Voltage Check 6-1-38
Resistance Check 6-1-44
Table A-1 Malfunction Indicator Lamp Circuit Check 6-1-46
Table A-2 Malfunction Indicator Lamp Circuit Check 6-1-48
Table A-3 Malfunction Indicator Lamp Check 6-1-48
Table A-4 Malfunction Indicator Lamp Check 6-1-49
Table A-5 ECM (PCM) Power and Ground Circuit Check 6-1-50
DTC P0100 (DTC No.33, 34) Mass Air Flow Sensor Circuit Malfunction 6-1-52
DTC P0110 (DTC No.23, 25) Intake Air Temp. Circuit Malfunction 6-1-54
DTC P0115 (DTC No.14, 15) Engine Coolant Temp. Circuit Malfunction ... 6-1-56
DTC P0120 (DTC No.21, 22) Throttle Position Circuit Malfunction 6-1-58
DTC P0121 Throttle Position Circuit Performance Problem 6-1-60
DTC P0130 HO2S (Bank-1 Sensor-1) Circuit Malfunction 6-1-62
DTC P0133 HO2S (Bank-1 Sensor-1) Circuit Slow Response 6-1-64
DTC P0134 (DTC No.13) HO2S (Bank-1 Sensor-1) No Activity Detected 6-1-65
DTC P0135 HO2S (Bank-1 Sensor-1) Heater Circuit Malfunction 6-1-67
DTC P0136 HO2S (Bank-1 Sensor-2) Circuit Malfunction 6-1-69
DTC P0141 HO2S (Bank-1 Sensor-2) Heater Circuit Malfunction 6-1-71
DTC P0150 HO2S (Bank-2 Sensor-1) Circuit Malfunction 6-1-73
DTC P0153 HO2S (Bank-2 Sensor-1) Circuit Slow Response 6-1-75
DTC P0154 (DTC No.26) HO2S (Bank-2 Sensor-1) No Activity Detected 6-1-76
DTC P0155 HO2S (Bank-2 Sensor-1) Heater Circuit Malfunction 6-1-78
DTC P0156 HO2S (Bank-1 Sensor-2) Circuit Malfunction 6-1-80
DTC P0161 HO2S (Bank-2 Sensor-2) Heater Circuit Malfunction 6-1-82
DTC P0171 Fuel System too Lean (Bank-1) 6-1-84
DTC P0172 Fuel System too Rich (Bank-1) 6-1-84
DTC P0174 Fuel System too Lean (Bank-2) 6-1-86
DTC P0175 Fuel System too Rich (Bank-2) 6-1-86
DTC P0300 Random Misfire Detected 6-1-88
DTC P0301 Cylinder 1 Misfire Detected 6-1-88
DTC P0302 Cylinder 2 Misfire Detected 6-1-88
DTC P0303 Cylinder 3 Misfire Detected 6-1-88
DTC P0304 Cylinder 4 Misfire Detected 6-1-88
DTC P0305 Cylinder 5 Misfire Detected 6-1-88
DTC P0306 Cylinder 6 Misfire Detected 6-1-88
DTC P0335 Crankshaft Position Sensor Circuit Malfunction 6-1-90
DTC P0340 (DTC No.42) Camshaft Position Sensor Circuit Malfunction .. 6-1-92
DTC P0400 (DTC No.51) Exhaust Gas Recirculation Flow Malfunction .. 6-1-95
DTC P0420 Catalyst System (Bank-1) Efficiency Below Threshold 6-1-98
DTC P0430 Catalyst System (Bank-2) Efficiency Below Threshold 6-1-98
DTC P0443 EVAP Control System Purge Control Valve Circuit Malfunction 6-1-100
DTC P0460 Fuel level sensor circuit high input 6-1-105
DTC P0500 (DTC No.24) Vehicle Speed Sensor Malfunction 6-1-107
DTC P0505 Idle Air Control System Malfunction 6-1-110
DTC P0601 Internal Control Module Memory Check Sum Error 6-1-113

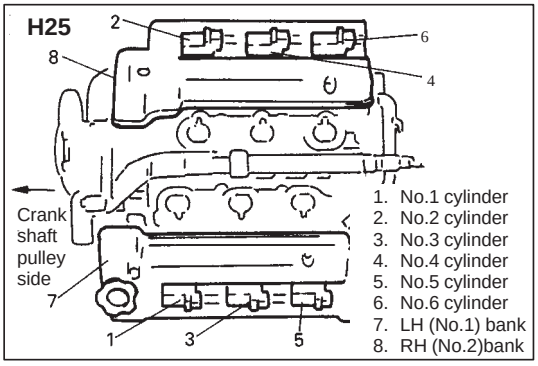
DTC P1408 Manifold Absolute Pressure Sensor Circuit Malfunction .. 6-1-114
DTC P1450 Barometric Pressure Sensor Circuit Malfunction 6-1-116
DTC P1451 Barometric Pressure Sensor Performance Problem 6-1-116
DTC P1500 Engine Start Signal Circuit Malfunction 6-1-118
DTC P1510 ECM Back-Up Power Supply Malfunction 6-1-120
Table B-1 Fuel Pump Circuit Check .. 6-1-121
Table B-2 Fuel Injector Circuit Check . 6-1-123
Table B-3 Fuel Pressure Check 6-1-125
Table B-4 A/C Signal Circuit Check (if equipped) 6-1-127
Table B-5 A/C Condenser Fan Motor Relay Control System Check (if equipped) 6-1-129
SPECIAL TOOLS 6-1-131

GENERAL INFORMATION

STATEMENT OF 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 surface 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 6 cylinders of the engine are identified by numbers; No.1, No.2, No.3, No.4, No.5 and No.6 as counted from crankshaft pulley side to flywheel side.
- Figure at the left shows engine with intake manifold removed and viewed from the top.
  LH (No.1) bank consists of No.1, No.3 and No.5 cylinders.
  RH (No.2) bank consists of No.2, No.4 and No.6 cylinders.

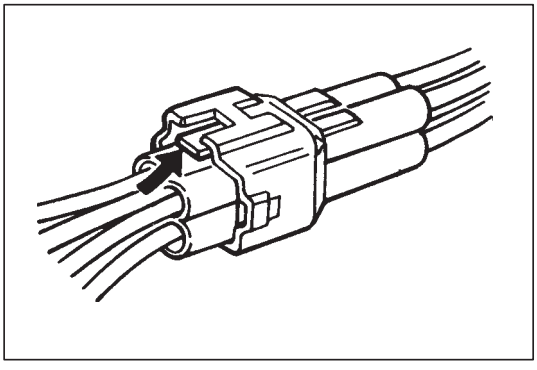
GENERAL INFORMATION ON ENGINE SERVICE

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.

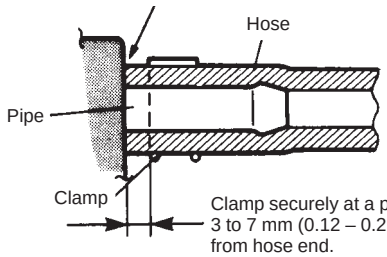
  When performing any work where electrical terminals could possibly be grounded, ground cable of the battery should be disconnected at battery.

- Any time the air cleaner, air cleaner outlet hose, throttle body, surge tank pipe, intake collector 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.

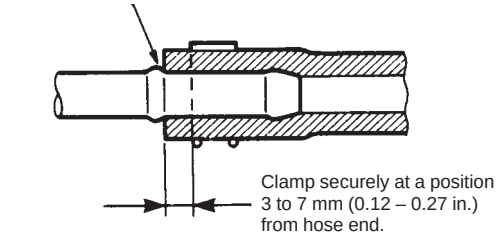


- When disconnecting couplers, don't pull wire harness but make sure to hold coupler itself. With lock type coupler, be sure to unlock before disconnection. Attempt to disconnect coupler without unlocking may result in damage to coupler. When connecting lock type coupler, insert it till clicking sound is heard and connect it securely.

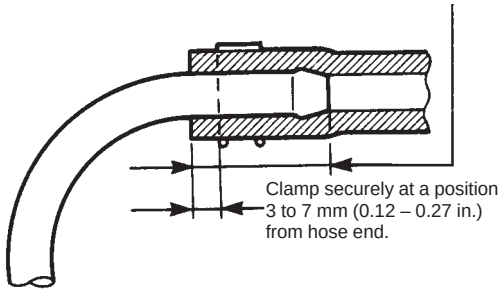
With short pipe, fit hose as far as it reaches pipe joint as shown.



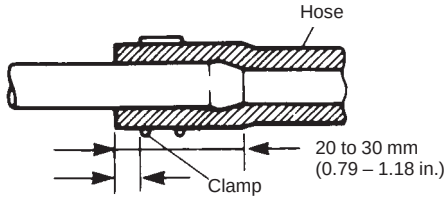
With following type pipe, fit hose as far as its peripheral projection as shown.



With bent pipe, fit hose as far as its bent part as shown or till pipe is about 20 to 30 mm (0.79 – 1.18 in.) into the hose.



With straight pipe, fit hose till pipe is about 20 to 30 mm (0.79 – 1.18 in.) into the hose.



Clamp securely at a position 3 to 7 mm (0.12 – 0.27 in.) from hose end.

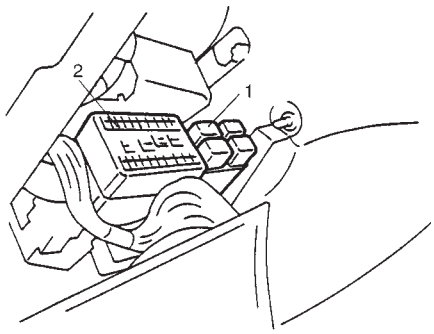
PRECAUTION ON FUEL SYSTEM SERVICE

- Work must be done with no smoking, in a well-ventilated area and away from any open flames.
- As fuel feed line (between fuel pump and fuel pressure regulator) is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected.
  Before loosening or disconnecting fuel feed line, make sure to release fuel pressure according to “FUEL PRESSURE RELIEF PROCEDURE” in this section.
  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 fuel union bolt gasket, always use new gasket and tighten union bolt to specified torque.
- When installing injector, fuel feed pipe or fuel pressure regulator, lubricate its O-ring with gasoline.
- When connecting fuel pipe flare nut, first tighten flare nut by hand and then tighten it to specified torque.

FUEL PRESSURE RELIEF PROCEDURE

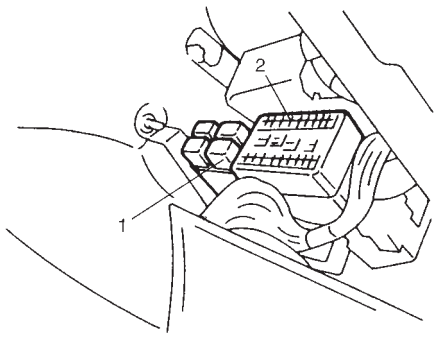
CAUTION:
This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

Left hand steering vehicle



1. Fuel pump relay
2. Fuse box

Right hand steering vehicle



1. Fuel pump relay
2. Fuse box

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 from relay box.
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 of 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 box.

FUEL LEAKAGE CHECK PROCEDURE

After performing any service on fuel system, check to make sure that there are no fuel leakages as follows.

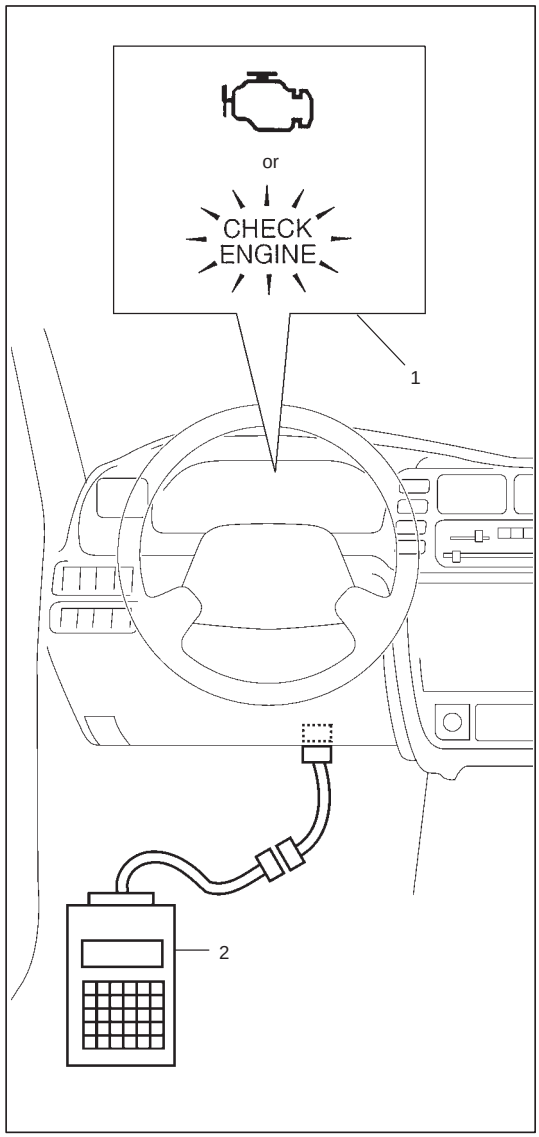
1) Turn ON ignition switch for 3 seconds (to operate fuel pump) and then turn it OFF.
   Repeat this (ON and OFF) 3 or 4 times and apply fuel pressure to fuel line (till fuel pressure is felt by hand placed on fuel return hose).

2) In this state, check to see that there are no fuel leakages from any part of fuel system.

ENGINE DIAGNOSIS

GENERAL DESCRIPTION

This vehicle is equipped with an engine and emission control system which are under control of ECM (PCM). 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 and abnormality of those parts that influence the engine exhaust emission. When diagnosing engine troubles, be sure to have full understanding of the outline of "ON-BOARD DIAGNOSTIC SYSTEM" and each item in "PRECAUTION IN DIAGNOSING TROUBLE" and execute diagnosis according to "ENGINE DIAGNOSTIC FLOW TABLE" in this section.
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 "ENGINE DIAGNOSTIC FLOW TABLE" in this section.



ON-BOARD DIAGNOSTIC SYSTEM (VEHICLE WITHOUT MONITOR CONNECTOR)

ECM (PCM) in this vehicle has following functions.

- When the ignition switch is turned ON with the engine at a stop, MIL (1) turns ON to check the bulb of the malfunction indicator lamp (MIL).
- 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 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 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 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 (Tech-1) (2) but also generic scan tool. (Diagnostic information can be accessed by using a scan tool.)

Warm-Up Cycle
A warm-up cycle means sufficient vehicle operation such that the coolant temperature has risen by at least 22°C (40°F) from engine starting and reaches a minimum temperature of 70°C (160°F).

Driving Cycle
A “Driving Cycle” consists of engine startup and engine shutoff.

2 Driving Cycles Detection Logic
The malfunction detected in the first driving cycle is stored in ECM (PCM) 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 cycles detection logic.

An Example of Freeze Frame Data

1.	TROUBLE CODE	P0102	(1st)
2.	COOLANT TEMP.	80°C	
3.	ENGINE SPEED	750 RPM	
4.	SHORT FT B1	–0.8 %	
5.	SHORT FT B2	–0.1 %	
6.	LONG FT B1	–1.3 %	
7.	LONG FT B2	–1.5 %	
8.	CALC LOAD	20.5 %	
9.	FUEL SYSTEM B1	CLOSED	
10.	FUEL SYSTEM B2	CLOSED	
11.	MAP	30.6 kPa	
12.	VEHICLE SPEED	0 km/h	

1st, 2nd or 3rd in parentheses here represents which position in the order the malfunction is detected.

Freeze Frame Data
ECM (PCM) stores the engine and driving conditions (in the form of data as shown at the left) 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.

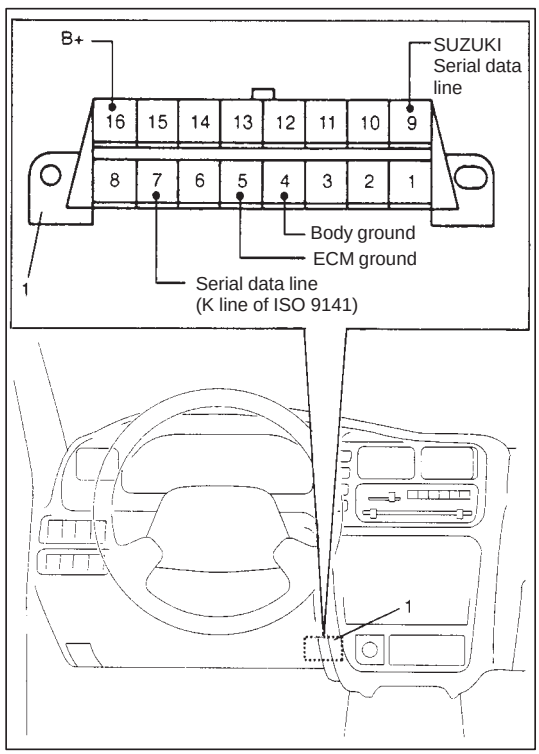
Priority of freeze frame data:
ECM (PCM) has 4 frames where the freeze frame data can be stored. The first frame stores the freeze frame data of the malfunction which was detected first. However, the freeze frame data stored in this frame is updated according to the priority described below. (If malfunction 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”.)

PRIORITY	FREEZE FRAME DATA IN FRAME 1
1	Freeze frame data at initial detection of malfunction among misfire detected (P0300-P0306), fuel system too lean (P0171, P0174) and fuel system too rich (P0172, P0175).
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 regardless of the priority.
Shown in the table below are examples of how freeze frame data are stored when two or more malfunctions are detected.

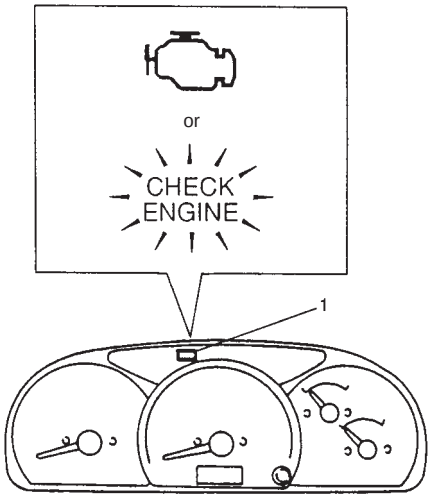
MAL-FUNCTION DETECTED ORDER \ FRAME		FRAME 1	FRAME 2	FRAME 3	FRAME 4
		FREEZE FRAME DATA to be updated	1st FREEZE FRAME DATA	2nd FREEZE FRAME DATA	3rd FREEZE FRAME DATA
	No malfunction	No freeze frame data	No freeze frame data	No freeze frame data	No freeze frame data
1	P0112 (IAT) detected	Data at P0112 detection	Data at P0112 detection	No freeze frame data	No freeze frame data
2	P0171 (Fuel system) detected	Data at P0171 detection	Data at P0112 detection	Data at P0171 detection	No freeze frame data
3	P0300 (Misfire) detected	Data at P0171 detection	Data at P0112 detection	Data at P0171 detection	Data at P0300 detection
4	P0301 (Misfire) detected	Data at P0171 detection	Data at P0112 detection	Data at P0171 detection	Data at P0300 detection

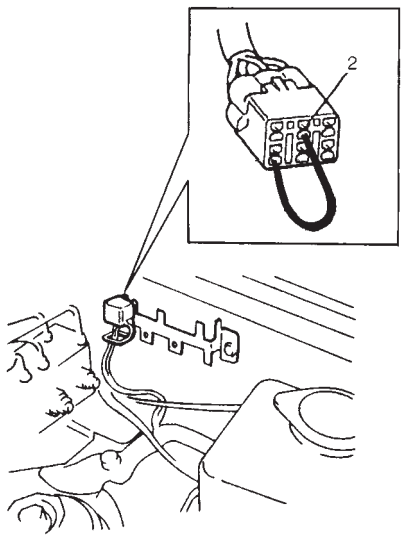
Freeze frame data clearance:
The freeze frame data is cleared at the same time as clearance of DTC.



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 (Tech-1) or generic scan tool to communicate with ECM (PCM) and ABS control module. SUZUKI serial data line is used for SUZUKI scan tool (Tech-1) to communicate with an electronic control unit (Airbag SDM, etc.).





ON-BOARD DIAGNOSTIC SYSTEM (VEHICLE WITH MONITOR CONNECTOR)

ECM diagnosis troubles which may occur in the area including the following parts when the ignition switch is ON and the engine is running, and indicates the result by turning on or flashing malfunction indicator lamp (1).

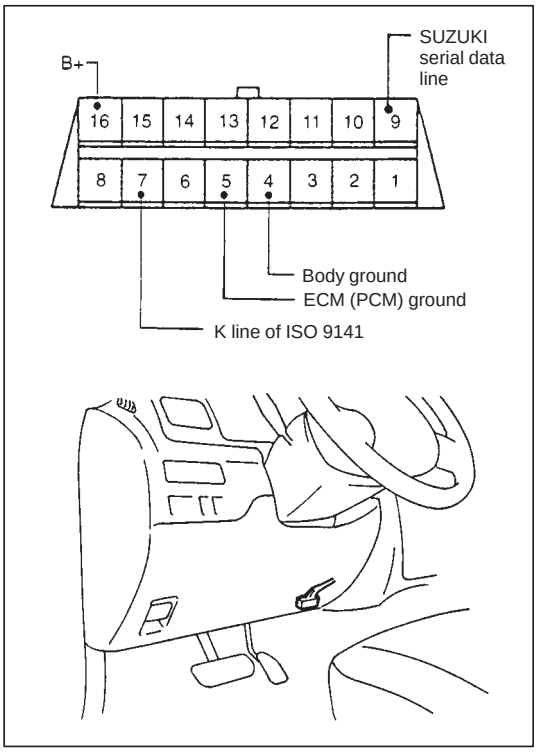
- Heated oxygen sensor
- ECT sensor
- TP sensor
- IAT sensor
- MAP sensor
- CMP sensor
- MAF sensor
- VSS
- CPU (Central Processing Unit) of ECM
- EGR valve (if equipped)
- CKP sensor (if equipped)

ECM and malfunction indicator lamp (1) operate as follows.

- Malfunction indicator lamp (1) lights when the ignition switch is turned ON (but the engine at stop) with the diagnosis switch terminal ungrounded regardless of the condition of Electronic Fuel Injection system. This is only to check the malfunction indicator lamp (1) bulb and its circuit.
- If the above areas of Electronic Fuel Injection system is free from any trouble after the engine start (while engine is running), malfunction indicator lamp (1) turns OFF.
- When ECM detects a trouble which has occurred in the above areas, it makes malfunction indicator lamp (1) turn ON while the engine is running to warn the driver of such occurrence of trouble and at the same time it stores the trouble area in ECM back-up memory. (The memory is kept as it is even if the trouble was only temporary and disappeared immediately. And it is not erased unless the power to ECM is shut off for specified time below.)
  ECM also indicates trouble area in memory by means of flashing of malfunction indicator lamp (1) at the time of inspection. (I.e. when diagnosis switch terminal (2) is grounded and ignition switch is turned ON.)

NOTE:

- **When a trouble occurs in the above areas and disappears soon while the diagnosis switch terminal is ungrounded and the engine is running, malfunction indicator lamp (1) lights and remains ON as long as the trouble exists but it turns OFF when the normal condition is restored.**



Data Link Connector (DLC)

DLC in compliance with SAE J1962 in its installation position, the shape of connector and pin assignment.

K line of ISO 9141 is used for SUZUKI scan tool to communication with ECM (PCM) and ABS control module. SUZUKI serial data line is used for SUZUKI scan tool to communicate with an electronic control units (Airbag SDM, etc.).

PRECAUTION IN DIAGNOSING TROUBLE

- Don't disconnect couplers from ECM (PCM), battery cable from battery, ECM (PCM) ground wire harness from engine or main fuse before confirming diagnostic information (DTC, freeze frame data, etc.) stored in ECM (PCM) memory. Such disconnection will erase memorized information in ECM (PCM) memory.
- Diagnostic information stored in ECM (PCM) memory can be cleared as well as checked by using SUZUKI scan tool (Tech-1) or generic scan tool. Before using scan tool, read its Operator's (Instruction) Manual carefully to have good understanding as to what functions are available and how to use it.
- Priorities for diagnosing troubles (vehicle without monitor connector).

  If two or more diagnostic trouble codes (DTCs) are stored, proceed to the flow table of the DTC which was detected earliest in the order and follow the instruction in that table.

  If no instructions are given, troubleshoot diagnostic trouble codes according to the following priorities.

  1. Diagnostic trouble codes (DTCs) other than DTC P0171/P0172/P0174/P0175 (Fuel system too lean/too rich), DTC P0300/P0301/P0302/P0303/P0304/P0305/P0306 (Misfire detected) and DTC P0400 (EGR flow malfunction)
  2. DTC P0171/P0172/P0174/P0175 (Fuel system too lean/too rich) and DTC P0400 (EGR flow malfunction)
  3. DTC P0300/P0301/P0302/P0303/P0304/P0305/P0306 (Misfire detected)
- Be sure to read "PRECAUTIONS FOR ELECTRICAL CIRCUIT SERVICE" in "GENERAL INFORMATION" section 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 a known-good ECM (PCM).

  – Resistance value of all relays, actuators is as specified respectively.
  – MAP sensor and TP sensor are in good condition and none of power circuits of these sensors is shorted to ground.

ENGINE DIAGNOSTIC FLOW TABLE

Refer to following pages for the detail 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	DTC(s)/Freeze Frame Data Check 1) Check DTC(s)/Freeze frame data. Is there any malfunction DTC(s)?	1) Record DTC(s)/ Freeze frame data. 2) Clear DTC(s). Go to Step 3.	Go to Step 4.
3	Visual Inspection 1) Perform visual inspection. Is there any faulty condition?	1) Repair or replace malfunction part. Go to Step 11.	Go to Step 5.
4	Visual Inspection 1) Perform visual inspection. Is there any faulty condition?	1) Repair or replace malfunction part. Go to Step 11.	Go to Step 8.
5	Trouble Symptom Confirmation 1) Confirm trouble symptom based on customer complaint analysis, DTC(s)/freeze frame data in Step 1. Is trouble symptom identified?	Go to Step 6.	Go to Step 7.
6	DTC/Freeze Frame Data Recheck 1) Recheck DTC/freeze frame data. Is there any malfunction DTC(s)?	Go to Step 9.	Go to Step 8.
7	DTC/Freeze Frame Data Recheck 1) Recheck DTC/freeze frame data. Is there any malfunction DTC(s)?	Go to Step 9.	Go to Step 10.
8	Engine Basic Inspection 1) Check and repair according to “ENGINE BASIC INSPECTION FLOW TABLE” and “ENGINE DIAGNOSIS TABLE” in this section. Are check and repair complete?	Go to Step 11.	1) Check and repair malfunction part(s). Go to Step 11.
9	DTC Trouble Shooting 1) Check and repair according to applicable “DTC Diag. flow table” in this section. Are check and repair complete?	Go to Step 11.	1) Check and repair malfunction part(s). Go to Step 11.
10	Intermittent Problems Check 1) Check for intermittent problems referring to “Check for Intermittent Problem” in “GENERAL INFORMATION” section. Is there any faulty condition?	1) Repair or replace malfunction part. Go to Step 11.	Go to Step 11.
11	Final Confirmation Test 1) Clear DTC if any. 2) Perform final confirmation test referring to “DTC CONFIRMATION PROCEDURE” in this section. Is there any problem symptom, malfunction DTC or abnormal condition?	Go to Step 6.	END.

1. CUSTOMER COMPLAINT ANALYSIS

Record details of the problem (failure, complaint) and how it occurred as described by the customer. For this purpose, use of such an inspection form will facilitate collecting information to the point required for proper analysis and diagnosis.

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 ☐ Accel. pedal is depressed ☐ Accel. pedal is released ☐ Load is applied ☐ A/C ☐ Electric load ☐ P/S ☐ Other_____ ☐ Other_____
☐ OTHERS:	

VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather Temperature Frequency Road	☐ Fair ☐ Cloudy ☐ Rain ☐ Snow ☐ Always ☐ Other_____ ☐ Hot ☐ Warm ☐ Cool ☐ Cold (°F/ °C) ☐ Always ☐ Always ☐ Sometimes (times/ day, month) ☐ Only once ☐ Under certain condition ☐ Urban ☐ Suburb ☐ Highway ☐ Mountainous (☐ Uphill ☐ Downhill) ☐ Tarmacadam ☐ Gravel ☐ Other_____
Vehicle Condition	
Engine Condition	☐ Cold ☐ Warming up phase ☐ Warmed up ☐ Always ☐ Other at starting ☐ Immediately after start ☐ Racing without load ☐ Engine speed (r/min)
Vehicle Condition	☐ During driving: ☐ Constant speed ☐ Accelerating ☐ Decelerating ☐ Right hand corner ☐ left hand corner ☐ When shifting (Lever position) ☐ At stop ☐ Vehicle speed when problem occurs (km/h, Mile/h) ☐ Other_____

Malfunction Indicator Lamp Condition	☐ Always ON ☐ Sometimes ON ☐ Always OFF ☐ Good condition	
Diagnostic Trouble Code	First check:	☐ No code ☐ 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.

2. DIAGNOSTIC TROUBLE CODE (DTC)/FREEZE FRAME DATA CHECK

First, check DTC, referring to "DIAGNOSTIC TROUBLE CODE CHECK" in this section. If DTC is indicated, record DTC and freeze frame data.

- After that clear DTC referring to "DIAGNOSTIC TROUBLE CODE CLEARANCE" in this section. DTC indicates malfunction that occurred in the system but does not indicate whether it exists now or it occurred in the past and the normal condition has been restored now. To check which case applies, check the symptom in question according to Step 5 and recheck DTC according to Step 6, 7.
  Attempt to diagnose a trouble based on DTC in this step only or failure to clear the DTC (including pending DTC) in this step will lead to incorrect diagnosis, trouble diagnosis of a normal circuit or difficulty in trouble-shooting.

NOTE:
For A/T vehicle, if only DTC P0705 (No.72), P0715 (No.76), P0720 (No.75), P0741, P0743 (No. 65/66), P0751, P0753, P0756, P0758 (No. 63/64), or P1875 is indicated in this step, proceed to DIAGNOSIS in "AUTOMATIC TRANSMISSION" section.

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	MAINTENANCE AND LUBRICATION section
● Engine coolant – – – – – level, leakage	MAINTENANCE AND LUBRICATION section
● Fuel – – – – – level, leakage	MAINTENANCE AND LUBRICATION section
● A/T fluid – – – – – level, leakage	MAINTENANCE AND LUBRICATION section
● Air cleaner element – – – – – dirt, clogging	MAINTENANCE AND LUBRICATION section
● Battery – – – – – fluid level, corrosion of terminal	MAINTENANCE AND LUBRICATION section
● Water pump belt and/or cooling fan belt – – – – – tension, damage	
● Accelerator cable – – – – – play, installation	ENGINE AND EMISSION CONTROL SYSTEM section
● A/T throttle cable – – – – – play, installation	ENGINE AND EMISSION CONTROL SYSTEM section
● Vacuum hoses of air intake system – – – – – disconnection, looseness, deterioration, bend	
● Connectors of electric wire harness – – – – – disconnection, friction	
● Fuses – – – – – burning	BODY ELECTRICAL SYSTEM section
● Parts – – – – – installation, bolt – – – – – looseness	
● Parts – – – – – deformation	
● Other parts that can be checked visually	
Also check following items at engine start, if possible	
● Malfunction indicator lamp – – – – – operation	ENGINE DIAGNOSIS section
● Charge warning lamp – – – – – operation	CHARGING SYSTEM section
● Engine oil pressure warning lamp – – – – – operation	BODY ELECTRICAL SYSTEM section/ ENGINE MECHANICAL section
● Engine coolant temp. meter – – – – – operation	BODY ELECTRICAL SYSTEM section
● Fuel lever meter – – – – – operation	BODY ELECTRICAL SYSTEM section
● 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 CONFORMATION PROCEDURE” described in each “DTC FLOW TABLE”.

6. and 7. RECHECKING AND RECORD OF DTC

Refer to “DTC Check” in this section 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.

ENGINE BASIC INSPECTION FLOW TABLE

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 “CRANKING SYSTEM” section.
4	Does engine start?	Go to Step 5.	Go to Step 7.
5	Check engine idle speed/IAC duty referring to “Idle Speed/IAC Duty Inspection” in “ENGINE AND EMISSION CONTROL” section. Is check result as specified?	Go to Step 6.	Go to “ENGINE DIAGNOSIS TABLE” in this section.
6	Check ignition timing referring to “Ignition Timing Inspection” in “IGNITION SYSTEM” section. Is check result as specified?	Go to “ENGINE DIAGNOSIS TABLE” in this section.	Adjust ignition timing.
7	Check fuel supply as follows: 1) Check to make sure that enough fuel is filled in fuel tank. 2) Turn ON ignition switch for 3 seconds and then OFF. Repeat this a few times. Is fuel return pressure (returning sounds) felt from fuel return hose when ignition switch is turned ON?	Go to Step 9.	Go to Step 8.
8	Check fuel pump for operating. 1) Was fuel pump operating sound heard from fuel filler for about 3 seconds after ignition switch ON and stop?	Go to “Diag. Flow Table B-3” in this section.	Go to “Diag. Flow Table B-1” in this section.
9	Check ignition spark referring to “Ignition Spark Test” in “IGNITION SYSTEM” section. Is it in good condition?	Go to Step 10.	Go to “DIAGNOSIS” in “IGNITION SYSTEM section.
10	Check fuel injector referring to “Fuel Injector Inspection” in “ENGINE AND EMISSION CONTROL” section. Is it in good condition?	Go to “ENGINE DIAGNOSIS TABLE” in this section.	Go to “Diag. Flow Table B-2 in this section.

9. TROUBLESHOOTING FOR DTC

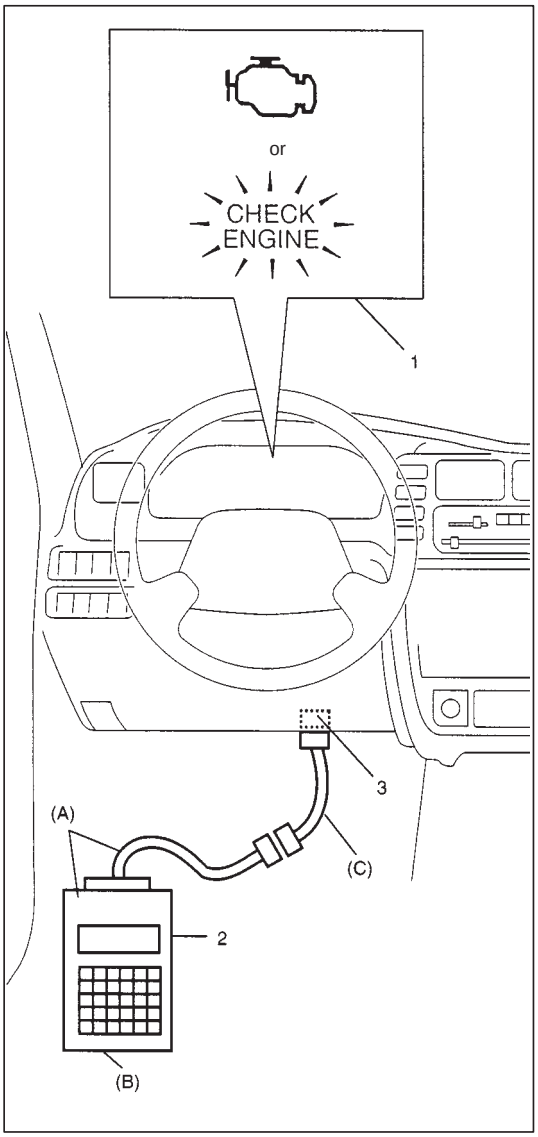
Based on the DTC indicated in Step 6 or 7 and referring to the applicable DTC diag. flow table in this section, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ECM (PCM) or other part and repair or replace faulty parts.

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 “GENERAL INFORMATION” section 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 the engine at stop) and check that MIL (1) lights.
   If MIL does not light up, go to "Diagnostic Flow Table A-1" for troubleshooting.
2) Start engine and check that MIL turns OFF.
   If MIL remains ON, and no DTC is stored in ECM (PCM), go to "Diagnostic Flow Table A-2" for troubleshooting.

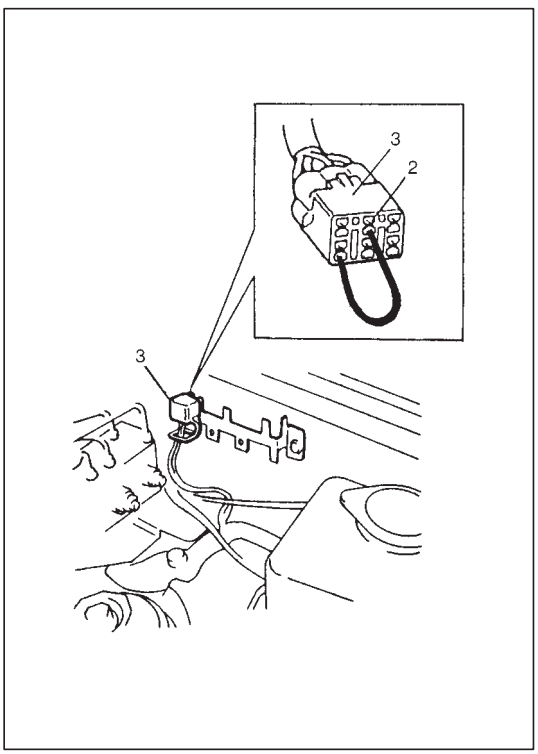
DIAGNOSTIC TROUBLE CODE (DTC) CHECK

[Using scan tool]

1) Prepare generic scan tool (2) or SUZUKI scan tool (Tech-1).
2) With ignition switch OFF, connect it to data link connector (DLC) (3) located on underside of instrument panel at driver's seat side.

   Special Tool
   (A): SUZUKI scan tool
   (B): Mass storage cartridge
   (C): 16/14 pin DLC cable (OBD-II adapter cable)

3) Turn ignition switch ON and confirm that MIL lights.
4) Read DTC and freeze frame data according to instructions displayed on scan tool and print them or write them down. Refer to scan tool operator's manual for further details.
   If communication between scan tool and ECM (PCM) is not possible, check if scan tool is communicable by connecting it to ECM (PCM) in another vehicle. If communication is possible in this case, scan tool is good condition. Then check data link connector and serial data line (circuit) in the vehicle with which communication was not possible.
5) After completing the check, turn ignition switch off and disconnect scan tool from data link connector.



[Not using SUZUKI scan tool] (vehicle with monitor connector)

1) Check malfunction indicator lamp referring to "Malfunction Indicator Lamp Check" in this section.
2) With the ignition switch OFF position, disconnect SUZUKI scan tool if connected and using service wire (1), ground diagnosis switch terminal (2) in monitor coupler (3).
3) With the ignition switch ON position and leaving engine OFF, read DTC from flashing pattern of malfunction indicator lamp. Refer to "DIAGNOSTIC TROUBLE CODE TABLE".
   If lamp remains ON, go to "Diagnostic Flow Table A-1".

   NOTE:
   - **If abnormality or malfunction lies in two or more areas, malfunction indicator lamp indicates applicable codes three times each.**
     And flashing of these codes is repeated as long as diagnosis terminal is grounded and ignition switch is held at ON position.
   - **Take a note of diagnostic trouble code indicated first.**

4) After completing the check, turn the ignition switch OFF position and disconnect service wire from monitor coupler.

DIAGNOSTIC TROUBLE CODE (DTC) CLEARANCE

[Using scan tool]

1) With ignition switch OFF, connect generic scan tool or SUZUKI scan tool (Tech-1) to data link connector (DLC).
2) Turn ignition switch ON.
3) Erase DTC according to instructions displayed on scan tool. Freeze frame data is cleared with the DTC. Refer to scan tool operator's manual for further details.
4) After completing the clearance, turn ignition switch off and disconnect scan tool from data link connector.

NOTE:
DTC and freeze frame data stored in ECM (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)**
- **When the same malfunction (DTC) is not detected again during 40 engine warm-up cycles (refer to "Warm-Up Cycle" of "ON-BOARD DIAGNOSTIC SYSTEM" in this section) (vehicle without monitor connector)**

[Not using SUZUKI scan tool]

1) Turn the ignition switch OFF position.
2) Disconnect battery negative cable for specified time below to erase diagnostic trouble code stored in ECM memory and reconnect it.

Time required to erase DTC:

Ambient temperature	Time to cut power to ECM
Over 0°C (32°F)	30 sec. or longer
Under 0°C (32°F)	Not specifiable. Select a place with higher than 0°C (32°F) temperature.

DIAGNOSTIC TROUBLE CODE (DTC) TABLE

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL (vehicle without monitor connector	MIL (vehicle with monitor connector
P0100 (No.34)	Mass air flow circuit malfunction	Sensor output too low	1 driving cycle	1 driving cycle
P0100 (No.33)		Sensor output too high		
P0110 (No.25)	Intake air temp. circuit malfunction	Intake air temp. circuit low input	1 driving cycle	1 driving cycle
P0110 (No.23)		Intake air temp. circuit high input		
P0115 (No.15)	Engine coolant temp. circuit malfunction	Engine coolant temp. circuit low input	1 driving cycle	1 driving cycle
P0115 (No.14)		Engine coolant temp. circuit high input		
P0120 (No.22)	Throttle position circuit malfunction	Throttle position circuit low input	1 driving cycle	1 driving cycle
P0120 (No.21)		Throttle position circuit high input		
P0121	Throttle position circuit performance problem	Poor performance of TP sensor	2 driving cycles	Not applicable
P0130	HO2S circuit malfunction (Bank 1 – Sensor 1)	Min. output voltage of HO2S-1 is higher than specification.	2 driving cycles	Not applicable
		Max. output voltage of HO2S-1 is lower than specification.		
P0133	HO2S circuit slow response (Bank 1 – Sensor 1)	Response time of HO2S-1 output voltage between rich and lean is longer than specification.	2 driving cycles	Not applicable
P0134 (No.13)	HO2S (Bank 1 – Sensor 1) no activity detected	Output voltage of HO2S-1 fails to go above specification (or HO2S-1 circuit open).	2 driving cycles	2 driving cycles
P0135	HO2S heater circuit malfunction (Bank 1 – Sensor 1)	Terminal voltage is lower than specification at heater OFF or it is higher at heater ON.	2 driving cycles	Not applicable
P0136	HO2S circuit malfunction (Bank 1 – Sensor 2)	Max. voltage of HO2S-2 is lower than specification or its min. voltage is higher than specification.	2 driving cycles	Not applicable
P0141	HO2S heater circuit malfunction (Bank 1 – Sensor 2)	Terminal voltage is lower than specification at heater OFF or it is higher at heater ON.	2 driving cycles	Not applicable
P0150	HO2S circuit malfunction (Bank 2 – Sensor 1)	Max. output voltage of HO2S-1 is lower than specification.	2 driving cycles	Not applicable
P0153	HO2S circuit slow response (Bank 2 – Sensor 1)	Response time of HO2S-1 output voltage between rich and lean is longer than specification.	2 driving cycles	Not applicable

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL (vehicle without monitor connector	MIL (vehicle with monitor connector
P0154 (No.26)	HO2S (Bank 2 – Sensor 1) no activity detected	Output voltage of HO2S-1 fails to go above specification (or HO2S-1 circuit open).	2 driving cycles	2 driving cycles
P0155	HO2S heater circuit malfunction (Bank 2 – Sensor 1)	Terminal voltage is lower than specification at heater OFF or it is higher at heater ON.	2 driving cycles	Not applicable
P0156	HO2S circuit malfunction (Bank 2 – Sensor 2)	Max. voltage of HO2S-2 is lower than specification or its min. voltage is higher than specification.	2 driving cycles	Not applicable
P0161	HO2S heater circuit malfunction (Bank 2 – Sensor 2)	Terminal voltage is lower than specification at heater OFF or it is higher at heater ON (or heater circuit or short).	2 driving cycles	Not applicable
P0171	Fuel system too lean (Bank 1)	Short term fuel trim or total fuel trim (short and long terms added) is larger than specification for specified time or longer. (Fuel trim toward rich side is large.)	2 driving cycles	Not applicable
P0172	Fuel system too rich (Bank 1)	Short term fuel trim or total fuel trim (short and long term added) is smaller than specification for specified time or longer. (Fuel trim toward lean side is large.)	2 driving cycles	Not applicable
P0174	Fuel system too lean (Bank 2)	Short term fuel trim or total fuel trim (short and long terms added) is larger than specification for specified time or longer. (Fuel trim toward rich side is large.)	2 driving cycles	Not applicable
P0175	Fuel system too rich (Bank 2)	Short term fuel trim or total fuel trim (short and long term added) is smaller than specification for specified time or longer. (Fuel trim toward lean side is large.)	2 driving cycles	Not applicable
P0300 P0301 P0302 P0303 P0304 P0305 P0306	Random misfire detected Cylinder 1 misfire detected Cylinder 2 misfire detected Cylinder 3 misfire detected Cylinder 4 misfire detected Cylinder 5 misfire detected Cylinder 6 misfire detected	Misfire of such level as to cause damage to three way catalyst	MIL flashing during misfire detection	Not applicable
		Misfire of such level as to deteriorate emission but not to cause damage to three way catalyst	2 driving cycles	Not applicable
P0335	Crankshaft position sensor circuit malfunction	No signal for 2 sec. during engine cranking	1 driving cycle	Not applicable
P0340 (No.42)	Camshaft position sensor circuit malfunction	No signal during engine running.	1 driving cycle	1 driving cycle
P0400	Exhaust gas recirculation flow malfunction detected	Excessive or insufficient EGR flow.	2 driving cycles	Not applicable

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL (vehicle without monitor connector	MIL (vehicle with monitor connector
P0420	Catalyst system efficiency below threshold (Bank 1)	Output waveforms of HO2S-1 and HO2S-2 are similar. (Time from output voltage change of HO2S-1 to that of HO2S-2 is shorter than specification.)	2 driving cycles	Not applicable
P0430	Catalyst system efficiency below threshold (Bank 2)	Output waveforms of HO2S-1 and HO2S-2 are similar. (Time from output voltage change of HO2S-1 to that of HO2S-2 is shorter than specification.)	2 driving cycles	Not applicable
P0443	Purge control valve circuit malfunction	Purge control valve circuit is open or shorted to ground.	2 driving cycles	Not applicable
P0460	Fuel level sensor high input	Fuel level sensor circuit open (high voltage).	2 driving cycles	Not applicable
P0500 (No.24)	Vehicle speed sensor malfunction	No signal while running in “D” range or during fuel cut at decelerating.	1 driving cycle	1 driving cycle
P0505	Idle control system malfunction	No closed signal to IAC valve is detected.	2 driving cycles	1 driving cycle
P0601 (No.71)	Internal control module memory check sum error	Data write error (or check sum error) when written into ECM	1 driving cycle	Not applicable
P1408	Manifold absolute pressure sensor circuit malfunction	Manifold absolute pressure sensor output voltage is higher or lower than specified value (or sensor circuit shorted to ground or open).	2 driving cycles	Not applicable
P1450	Barometric pressure sensor circuit malfunction	Barometric pressure is lower or higher than specification (or sensor malfunction).	1 driving cycle	1 driving cycle
P1451	Barometric pressure sensor performance problem	Difference between manifold absolute pressure (MAP sensor value) and barometric pressure (barometric pressure sensor value) is larger than specification during cranking.	2 driving cycles	Not applicable
P1500	Starter signal circuit malfunction	Starter signal is not inputted from engine cranking till its start and after or it is always inputted.	2 driving cycles	Not applicable
P1510	ECM backup power source malfunction	No backup power after starting engine.	1 driving cycle	Not applicable

DTC NO.	DETECTING ITEM	DETECTING CONDITION (DTC will set when detecting:)	MIL
P0705 (No.72)	Transmission range circuit malfunction	Refer to Section 7B1	
P0715 (No.76)	Input/turbine speed sensor circuit malfunction		
P0720 (No.75)	A/T VSS signal circuit malfunction		
P0741	Torque converter clutch circuit performance or stuck off		
P0743 (No.65) (No.66)	Torque converter clutch circuit electrical		
P0751	Shift solenoid A (#1) performance or stuck off		
P0753 (No.61) (No.62)	Shift solenoid A (#1) electrical		
P0756	Shift solenoid B (#2) performance or stuck off		
P0758 (No.63) (No.64)	Shift solenoid B (#2) electrical		
P1875	4WD low switch circuit malfunction		
☆P1620 (No.84)	ECU code not registered	Refer to Section 8G	
☆P1621 (No.83)	NO ECU code transmitted from Immobilizer Control Module		
☆P1622 (No.82)	Fault in ECM		
☆P1623 (No.81)	ECU code not matched		

NOTE:

- **For ( ) marked No. in DTC column, it is used for vehicle with monitor connector.**
- **DTC No.12 appears when none of the other codes is identified.**
- **With the generic scan tool, only star (☆) marked data in the above table can not be read.**

FAIL-SAFE TABLE

When any of the following DTCs is detected, ECM enters fall-safe mode as long as malfunction continues to exist but that mode is canceled when ECM detects normal condition after that.

DTC NO.	TROUBLE AREA	FAIL SAFE OPERATION	FAIL SAFE MODE REACTIVATION CONDITION
P0100 (No.33, 34)	MAF SENSOR	Injector drive time (fuel injection volume) is determined according to throttle valve operating (idle position or not).	Detected value of MAF sensor output voltage is 0.3 V min. and 5.0 V max.
P0110 (No.23, 25)	IAT SENSOR	ENGINE control is performed on the basis of 40°C intake air temp.	Detected value of IAT sensor output voltage is 0.16 V min. and 5.00 V max.
P0115 (No.14, 15)	ECT SENSOR	● ENGINE control is performed on the basis of 80°C engine coolant temp. ● A/T control is performed on the basis of 31°C engine coolant temp.	Detected value of ECT sensor output voltage is 0.16 V min. and 5.00 V max.
P0120 (No.21, 22)	TP SENSOR	● ENGINE control is performed on the basis of 8 deg. throttle opening. ● A/T control is performed on the basis of 0 % throttle position.	Detected value of TP sensor output voltage is 0.10 V min. and 4.80 V max.
P0500 (No.24)	VEHICLE SPEED SENSOR	ENGINE control is performed on the basis of 10 km/h vehicle speed. And air flow at IAC valve is limited.	Vehicle speed sensor signal is detected.
P0705	TR SWITCH	A/T control is performed in priority order of L, 2, N, D and R when more than one of R, D, N, 2 and L signals are inputted simultaneously.	Single signal is inputted.
P0720	OUTPUT SPEED SENSOR CIRCUIT MALFUNCTION	A/T control is performed by using signal from VSS.	Detected vehicle speed signal is 10 km/h (6 mph) or more.
P0753	SHIFT SOLENOID A (#1)	SHIFT SOLENOID #1 : OFF SHIFT SOLENOID #2 : ON TCC SOLENOID : OFF	Monitor signal ON is detected when solenoid A (#1) is ON and monitor signal OFF is detected when it is OFF.
P0758	SHIFT SOLENOID B (#2)	SHIFT SOLENOID #1 : OFF SHIFT SOLENOID #2 : OFF TCC SOLENOID : OFF	Monitor signal ON is detected when solenoid B (#2) is ON and monitor signal OFF is detected when it is OFF.
P0743	TCC (LOCK-UP) SOLENOID	TCC (Lock-up) solenoid OFF	Monitor signal ON is detected when TCC control solenoid is ON and monitor signal OFF is detected when it is OFF.

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 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:

- **For asterisk (⁎) marked item in OTHER column, item can be read only SUZUKI scan tool.**
- **When checking the data with the engine running at idle or racing, be sure to shift M/T gear to the neutral gear position and A/T gear to the "Park" position and pull the parking brake fully. Also, if nothing or "no load" is indicated, turn OFF A/C, all electric loads, P/S and all the other necessary switches.**

SCAN TOOL DATA	CONDITION		NORMAL CONDITION/ REFERENCE VALUE	OTHER
COOLANT TEMP. (Engine Coolant Temp.)	At specified idle speed after warming up.		80 – 100°C (176 – 212°F)	
INTAKE AIR TEMP.	At specified idle speed after warming up.		Environmental temp. +20°C (+36°F) –5°C (–9°F)	
DESIRE IDLE (Desired Idle Speed)	At idling with no load after warming up.	Without monitor connector	675 rpm	⁎
		With monitor connector	750 rpm	
CLOSED THROT POS (Closed Throttle Position)	Ignition switch ON	Accelerator pedal released.	ON	⁎
		Accelerator pedal depressed.	OFF	
IAC FLOW DUTY	At specified idle speed after warming up.		10 – 50 %	⁎
ENGINE SPEED	At idling with no load after warming up.		Desired idle speed ± 50 rpm	
SHORT FT B1 (Short Term Fuel Trim)	At specified idle speed after warming up.		–20 ~ +20% –15 ~ +15 %	
SHORT FT B2 (Short Term Fuel Trim)	At specified idle speed after warming up.		–15 ~ +15 %	
LONG FT B1 (Long Term Fuel Trim)	At specified idle speed after warming up.		–15 ~ +15 %	
LONG FT B2 (Long Term Full Trim)	At specified idle speed after warning up.		–15 ~ +15 %	
IGNITION ADVANCE	At specified idle speed with no load after warming up.	Without monitor connector	6 – 12 deg.	
		With monitor connector	10 – 16 deg.	
BATTERY VOLTAGE	Ignition switch ON/engine stopped		10 – 14 V	⁎
MAF (Mass Air Flow Rate)	At specified idle speed with no load after warming up.		2.5 ~ 4.6 g/s 0.20 ~ 0.53 lb/min.	
	At 2500 r/min. with no load after warming up.		8.2 ~ 15.0 gm/s 0.66 ~ 1.32 lb/min.	
INJ PULSE WIDTH B1 (Fuel Injection Pulse Width)	At specified idle speed with no load after warming up.		2.0 ~ 3.4 msec	⁎
	At 2500 r/min. with no load after warming up.		2.0 ~ 3.4 msec	
INJ PULSE WIDTH B2	At specified idle speed with no load after warming up.		2.0 ~ 3.4 msec	⁎
	At 2500 r/min. with no load after warming up.		2.0 ~ 3.4 msec	

SCAN TOOL DATA	CONDITION		NORMAL CONDITION/ REFERENCE VALUE	OTHER
THROTTLE POS (Absolute Throttle Position)	Ignition switch ON/warmed up engine stopped.	Accelerator pedal released.	10 ± 5 %	
		Accelerator pedal depressed fully.	80 ± 10 %	
TP SENSOR VOLT (TP Sensor Output Voltage)	Ignition switch ON/warmed up engine stopped.	Accelerator pedal released.	0.35 ~ 0.65 V	✳
		Accelerator pedal depressed fully.	3.0 ~ 3.8 V	
OXYGEN SENSOR B1 S1 (HO2S1 Output Voltage)	At specified idle speed after warming up.		0.05 ~ 0.95 V	
OXYGEN SENSOR B1 S2 (HO2S2 Output Voltage)	When engine is running at 2000 r/min. for 3 min or longer after warming up.		0.05 ~ 0.95 V	
OXYGEN SENSOR B2 S1 (HO2S2 Output Voltage)	When engine is running at 2000 r/min. for 3 min or longer after warming up.		0.05 ~ 0.95 V	
OXYGEN SENSOR B2 S2 (HO2S2 Output Voltage)	When engine is running at 2000 r/min. for 3 min or longer after warming up.		0.05 ~ 0.95 V	
FUEL SYSTEM B1 (Fuel System Status)	At specified idle speed after warming up.		Closed	✳
FUEL SYSTEM B2 (Fuel System Status)	At specified idle speed after warming up.		Closed	
CALC LOAD (Calculated Load Value)	At specified idle speed with no load after warming up.		1.8 ~ 3.8 %	
	At 2500 r/min with no load after warming up.		6.0 ~ 11.5 %	
TOTAL FUEL TRIM B1	At specified idle speed after warming up.		–30 ~ +30 %	✳
TOTAL FUEL TRIM B2	At specified idle speed after warming up.		–30 ~ +30 %	
MAP	At specified idle speed after warming up.		25 ~ 35 kPa	
CANIST PRG DUTY (EVAP Canister Purge Flow Duty)	At specified idle speed after warming up.		0 ~ 10 %	✳
Vehicle Speed	At stop.		0 km/h 0MPH	
FUEL CUT	When engine is at fuel cut condition.		ON	✳
	Other than fuel cut condition.		OFF	
EGR VALVE	At specified idle speed after warming up.		0 %	✳
PSP SWITCH (if equipped)	Engine running at idle speed and steering wheel at straightahead position.		OFF	✳
	Engine running at idle speed and steering wheel turned to the right or left as far as it stops.		ON	
A/C SWITCH (if equipped)	When A/C not operating.		OFF	✳
	When A/C operating.		ON	
PNP SIGNAL (Transmission Range Switch) A/T only	Ignition switch ON	Selector lever in “P” or “N” position	P/N Range	✳
		Selector lever in “R”, “D”, “2” or “L” position	D Range	
FUEL TANK LEVEL	Ignition switch ON		0 ~ 100 %	✳

SCAN TOOL DATA	CONDITION	NORMAL CONDITION/ REFERENCE VALUE	OTHER
ELECTRIC LOAD	Ignition ON, small light OFF	OFF	✳
	Ignition switch ON, small light ON	ON	✳
VSS (for 4-A/T) (Vehicle Speed Sensor)	At stop.	0 km/h 0 MPH	✳
GEAR POSITION (for 4-A/T)	Ignition switch ON, selector lever is shifted at "R", "D", "2" or "L" range and vehicle stops.	1st	✳
THROT POS LEVEL (Throttle Position Level for 4-A/T)	"0"(about idle position), "1","2","3","4","5","6" or "7" (about full open) appears according to throttle valve opening.		✳
SHIFT SOL #1 (A) CON (Shift Solenoid #1 Command Signal) MON (Shift Solenoid #1 Monitor)	Ignition switch ON Selector lever is shifted at "P", "R", "N", "D", "2" or "L" range. Vehicle stops.	ON	✳
SHIFT SOL #2 (B) CON (Shift Solenoid #2 Command Signal) MON (Shift Solenoid #2 Monitor)	Ignition switch ON Selector lever is shifted at "P", "R", "N", "D", "2" or "L" range. Vehicle stops.	OFF	✳
TCC SOL CON (Torque Converter Clutch Solenoid Command Signal) MON (Torque Converter Clutch Solenoid Monitor)	Ignition switch ON Selector lever is shifted at "P", "R", "N", "D", "2" or "L" range. Vehicle stops.	OFF	✳
TRANS RANGE	Ignition switch ON, selector lever is at "R", "N", "D", "2" or "L" range.	R, N, D, 2 or L	✳
BRAKE SW (Brake, Stop Lamp, Switch)	Ignition switch ON, brake pedal is released.	OFF	✳
	Ignition switch ON, brake pedal is depressed.	ON	
O/D OFF SW (Overdrive Cut Switch)	Ignition switch ON, overdrive cut switch OFF	OFF	✳
	Ignition switch ON, overdrive cut switch ON	ON	
MODE SELECT SW (Power/Normal Change Switch)	Ignition switch ON, P/N change switch is at normal position.	NORMAL	✳
	Ignition switch ON, P/N change switch is at power position.	POWER	
4WD-L SW (4WD Low Switch)	Ignition switch ON, transfer lever is shifted at "4H" or "2H" position.	OFF	✳
	Ignition switch ON, transfer lever is shifted at "4L" position.	ON	
O/D & TCC OFF SIG	Ignition switch ON, vehicle stops.	OFF	✳
BLOWER FAN	Ignition switch ON, blower fan switch OFF	OFF	
	Ignition switch ON, blower fan switch ON	ON	
A/C CONDENSER FAN	A/C is not operated.	OFF	
	A/C is operated.	ON	

SCAN TOOL DATA DEFINITIONS

COOLANT TEMP (ENGINE COOLANT TEMP., °C/°F)
It is detected by engine coolant temp. sensor.

INTAKE AIR TEMP (°C/°F)
It is detected by intake air temp. sensor.

DESIRE 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, the number is not valid.

CLOSED THROT POS (CLOSED THROTTLE POSITION ON/OFF)
This parameter will read ON when the throttle valve is fully closed. Or OFF when the throttle is not fully closed.

IAC FLOW DUTY (%)
This parameter indicates ON (valve open) time rate within a certain set cycle of IAC valve which controls bypass air flow.

ENGINE SPEED (RPM)
It is computed by reference pulses from the Camshaft Position Sensor.

SHORT FT B1 (SHORT TERM FUEL TRIM BANK 1, %)
SHORT FT B2 (SHORT TERM FUEL TRIM BANK 2, %)
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 BANK 1, %)
LONG FT B2 (LONG TERM FUEL TRIM BANK 2, %)
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.

IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER, deg)
Ignition timing of No.1 cylinder is commanded by ECM (PCM). The actual ignition timing should be checked by using the timing light.

BATTERY VOLTAGE (V)
This parameter indicates battery positive voltage inputted from main relay to ECM (PCM).

MAF (MASS AIR FLOW RATE, g/s, lb/min.)
It represents total mass of air entering intake manifold which is measured by mass air flow sensor.

INJ PULSE WIDTH B1 (FUEL INJECTION PULSE WIDTH BANK 1, msec)
INJ PULSE WIDTH B2 (FUEL INJECTION PULSE WIDTH BANK 2, msec)
This parameter indicates time of the injector drive (valve opening) pulse which is output from ECM (PCM).

THROTTLE POS (ABSOLUTE THROTTLE POSITION, %)
When throttle position sensor is fully closed position, throttle opening is indicated as 0 % and 100 % for full open position.

TP SENSOR VOLT (TP SENSOR OUTPUT VOLTAGE, V)
Throttle Position Sensor reading provides throttle valve opening information in the from of voltage.

OXYGEN SENSOR B1 S1 (HO2S BANK 1 SENSOR 1 OUTPUT VOLTAGE, V)
OXYGEN SENSOR B2 S1 (HO2S BANK 2 SENSOR 1 OUTPUT VOLTAGE, V)
It indicates output voltage of HO2S SENSOR 1 installed on exhaust manifold (pre-catalyst).

OXYGEN SENSOR B1 S2 (HO2S BANK 1 SENSOR 2 OUTPUT VOLTAGE, V)
OXYGEN SENSOR B1 S2 (HO2S BANK 2 SENSOR 2 OUTPUT VOLTAGE, V)
It indicates output voltage of HO2S SENSOR 2 installed on exhaust pipe (post-catalyst). It is used to detect catalyst deterioration.

FUEL SYSTEM B1 (FUEL SYSTEM BANK 1 STATUS)
FUEL SYSTEM B2 (FUEL SYSTEM BANK 2 STATUS)
Air/fuel ratio feedback loop status displayed as one of the followings.
OPEN: Open loop-has not yet satisfied conditions to go closed loop.
CLOSED: Closed loop-using oxygen sensor(s) as feedback for fuel control.
OPEN-DRIVE COND: Open loop due to driving conditions (Power enrichment, etc.).
OPEN SYS FAULT: Open loop due to detected system fault.
CLOSED-ONE O2S: Closed loop, but fault with at least one oxygen sensor-may be using single oxygen sensor for fuel control.

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%.

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.

CANIST PRG DUTY (EVAP CANISTER PURGE FLOW DUTY, %)
This parameter indicates valve ON (valve open) time rate within a certain set cycle of EVAP canister purge valve which controls the amount of EVAP purge.

VEHICLE SPEED (km/h, MPH)
It is computed based on pulse signals from vehicle speed sensor in combination meter.

FUEL CUT (ON/OFF)
ON: Fuel being cut. (output signal to injector is stopped.)
OFF: Fuel not being cut.

MAP (MANIFOLD ABSOLUTE PRESSURE, mmHg, kPa)
This parameter indicates the pressure in the intake manifold absolute pressure.

EGR VALVE (%)
This parameter indicates opening rate of EGR valve which controls the amount of EGR flow.

A/C SWITCH (ON/OFF)
ON: Command for operation being output from A/C amplifier to compressor.
OFF: Command for operation not being output.

PSP SWITCH (ON/OFF)
ON: PSP switch detects P/S operation. (high PS pressure)
OFF: PSP switch not detects P/S operation.

PNP SIGNAL (TRANSMISSION RANGE SWITCH, P/N or D range)
Whether the transmission range switch (P/N position switch) at P or N range or at R, D, 2 or L range is displayed. If at P or N range, “P/N range” is displayed and if at R, D, 2 or L range, “D range” is displayed.

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.

ELECTRIC LOAD (ON/OFF)
ON: Small light switch ON or rear window defogger switch ON.
OFF: Small light switch OFF and rear window defogger switch OFF.

VSS (4-A/T) (km/h, MPH)
It is computed by using pulse signals from vehicle speed sensor on 4-speed automatic transmission.

GEAR POSITION (1ST, 2ND, 3RD or 4TH)

The gear position is determined on the basis of the command state signals generated from PCM to shift solenoids A and B (#1 and #2) and displayed as shown in the table below.

SOLENOID / DISPLAY	PCM COMMAND	
	SHIFT SOLENOID-A	SHIFT SOLENOID-B
1ST	ON	OFF
2ND	ON	ON
3RD	OFF	ON
4TH	OFF	OFF

THROT POS LEVEL (THROTTLE POSITION LEVEL FOR 4-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). PCM controls the automatic gear change of the automatic transmission by using these signals according to the signal from the TP sensor.

SHIFT SOL #1 CON/MON (SHIFT SOLENOID #1, A COMMAND/MONITOR, ON/OFF)

CON-ON: ON command being output to shift solenoid #1, A.

CON-OFF: ON command not being output.

MON-ON: Electricity being passed to shift solenoid #1, A.

MON-OFF: Electricity not being passed.

SHIFT SOL #2 CON/MON (SHIFT SOLENOID #2, B COMMAND/MONITOR, ON/OFF)

CON-ON: ON command being output to shift solenoid #2, B.

CON-OFF: ON command not being output.

MON-ON: Electricity being passed to shift solenoid #2, B.

MON-OFF: Electricity not being passed.

TCC SOL CON/MON (TORQUE CONVERTER CLUTCH SOLENOID COMMAND/MONITOR, ON/OFF)

CON-ON: ON command being output to TCC solenoid.

CON-OFF: ON command not being output.

MON-ON: Electricity being passed to TCC solenoid.

MON-OFF: Electricity not being passed.

TRANS RANGE (TRANSMISSION RANGE, R, N, D, 2 or L)

It indicates transmission range according to transmission range switch signal.

BRAKE SW (BRAKE, STOP LAMP, SWITCH, ON/OFF)

OFF: Brake pedal is released.

ON: Brake pedal is depressed.

O/D OFF SW (OVERDRIVE CUT SWITCH, ON/OFF)

OFF: Overdrive cut switch OFF.

ON: Overdrive cut switch ON.

MODE SELECT SW (POWER/NORMAL CHANGE SWITCH, POWER/NORMAL)

POWER: Switch button is at POWER position.

NORMAL: Switch button is at NORMAL position.

4WD-L SW (4WD-LOW SWITCH, ON/OFF)

ON: Transfer lever is shifted to 4L position.

OFF: Transfer lever is shifted to 4H or 2H position.

BLOWER FAN (ON/OFF)

ON: Blower fan switch ON.

OFF: Blower fan switch OFF.

A/C CONDENSER FAN (A/C CONDENSER FAN RELAY, ON/OFF)

ON: A/C condenser fan is operated.

OFF: A/C condenser is not operated.

ENGINE DIAGNOSIS TABLE

Perform troubleshooting referring to following table when ECM (PCM) has detected no DTC and no abnormality has been found in visual inspection and engine basic inspection previously.

Condition	Possible Cause	Reference Item
Hard starting (Engine cranks OK.)	**Engine and emission control system out of order.**	
	● Faulty idle air control system	DTC P0505 Diag. Flow Table in this section.
	● Faulty ECT sensor or MAF sensor	ECT sensor or MAF sensor in Engine and Emission Control System section.
	● Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this section.
	Low compression.	Compression check in Engine Mechanical section.
	● Faulty hydraulic valve lash adjuster	Valve lash adjuster in Engine Mechanical section.
	● Compression leak from valve seat	Valves inspection in Engine Mechanical section.
	● Sticky valve stem	Valves inspection in Engine Mechanical section.
	● Weak or damaged valve springs	Valves spring inspection in Engine Mechanical section.
	● Compression leak at cylinder head gasket	Cylinder head inspection in Engine Mechanical section.
	● Sticking or damaged piston ring	Piston ring inspection in Engine Mechanical section.
	● Worn piston, ring or cylinder	Cylinders, pistons and piston rings inspection in Engine Mechanical section.
	Others	
	● Malfunctioning PCV valve	PCV system inspection in Engine and Emission Control System section.
Engine has no power	**Engine overheating.**	Refer to “Overheating” section.
	Ignition system out of order.	
	● Defective spark plug	Spark plugs in Ignition System section.
	● Faulty ignition coil with ignitor	Ignition coil in Ignition System section.
	Fuel system out of order.	
	● Fuel pressure out of specification – Dirty fuel filter – Dirty or clogged fuel hose or pipe – Malfunctioning fuel pressure regulator – Malfunctioning fuel pump	Diag. Flow Table B-3 in this section.
	Engine and emission control system out of order.	
	● Maladjusted TP sensor installation angle	TP sensor in Engine and Emission Control System section.
	● Faulty EGR system	DTC P0400 Diag. Flow Table in this section.
	● Faulty injector	Fuel injector in Engine and Emission Control System section.
	● Faulty TP sensor, ECT sensor or MAF sensor	TP sensor, ECT sensor or MAF sensor in Engine and Emission Control System section.
	● Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this section.
	Low compression.	Previously outlined.
	Others	
	● Dragging brakes	Diagnosis in BRAKES section.
	● Slipping clutch	Diagnosis in Clutch section.

Condition	Possible Cause	Reference Item
Improper engine idling or engine fails to idle	**Ignition system out of order.**	
	● Faulty spark plug	Spark plugs in Ignition System section.
	● Faulty ignition coil with ignitor	Ignition coil in Ignition System section.
	Fuel system out of order.	
	● Fuel pressure out of specification	Diag. Flow Table B-3 in this section.
	Engine overheating.	Refer to “Overheating” section.
	Engine and emission control system out of order.	
	● Maladjusted TP sensor installation angle if adjustable	TP sensor in Engine and Emission Control System section.
	● Faulty idle air control system	DTC P0505 Diag. Flow Table in this section.
	● Faulty evaporative emission control system	EVAP control system in Engine and Emission Control System section.
	● Faulty EGR system	DTC P0400 Diag. Flow Table in this section.
	● Faulty injector	Fuel injection in Engine and Emission Control System section.
	● Faulty ECT sensor, TP sensor or MAF sensor	ECT sensor, TP sensor or MAF sensor in Engine and Emission Control System section.
	● Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this section.
	Low compression	Previously outlined.
	Others	
	● Malfunctioning PCV valve	PCV system inspection in Engine and Emission Control System section.
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 Ignition System section.
	Fuel system out of order.	
	● Fuel pressure out of specification – Clogged fuel filter – Faulty fuel pressure regulator	Diag. Flow Table B-3 in this section.
	● Clogged fuel filter, hose or pipe	
	Engine overheating	Refer to “Overheating” section.
	Engine and emission control system out of order.	
	● Faulty EGR system	DTC P0440 Diag. Flow Table in this section.
	● Faulty injector	Fuel injector in Engine and Emission Control System section.
	● Faulty TP sensor, ECT sensor or MAF sensor	TP sensor, ECT sensor or MAF sensor in Engine and Emission Control System section.
	● Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this section.
	Low compression	Previously outlined.

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.) **Fuel system out of order.** ● Variable fuel pressure – Clogged fuel filter – Kinky or damaged fuel hose and line – Faulty fuel pressure regulator **Engine and emission control system out of order.** ● Faulty EGR system ● Faulty MAF sensor ● Faulty injector ● Faulty ECM (PCM)	Spark plugs in Ignition System section. Diag. Flow Table B-3 in this section. DTC P0400 Diag. Flow Table in this section. MAF sensor in Engine and Emission Control System section. Fuel injector in Engine and Emission Control System section. Inspection of ECM (PCM) and its circuit in this section.
Excessive detonation (The engine makes sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.)	**Engine overheating** **Ignition system out of order.** ● Faulty spark plug ● Improper ignition timing **Fuel system out of order.** ● Clogged fuel filter and fuel lines **Engine and emission control system out of order.** ● Faulty EGR system ● Faulty ECT sensor or MAF sensor ● Faulty injector ● Faulty ECM (PCM) **Others** ● Excessive combustion chamber deposits	Refer to “Overheating” section. Spark plugs in Ignition System section. Ignition timing in Ignition System section. Fuel pressure check in Engine and Emission Control System section. DTC P0400 Diag. Flow Table in this section. ECT sensor or MAF sensor in Engine and Emission Control System section. Fuel injector in Engine and Emission Control System section. Inspection of ECM (PCM) and its circuit in this section. Piston and cylinder head cleaning in Engine Mechanical section.

Condition	Possible Cause	Reference Item
Overheating	● Inoperative thermostat	Thermostat in Engine Cooling section.
	● Poor water pump performance	Water pump in Engine Cooling section.
	● Clogged or leaky radiator	Radiator in Engine Cooling section.
	● Improper engine oil grade	Engine oil and oil filter change in Maintenance and Lubrication section.
	● Clogged oil filter or oil strainer	Oil pressure check in Engine Mechanical section.
	● Poor oil pump performance	Oil pressure check in Engine Mechanical section.
	● Dragging brakes	Diagnosis in BRAKES section.
	● Slipping clutch	Diagnosis in Clutch section.
	● Blown cylinder head gasket	Cylinder head inspection in Engine Mechanical section.
Poor gasoline mileage	**Ignition system out of order.**	
	● Faulty spark plug (improper gap, heavy deposits, and burned electrodes, etc.)	Spark plugs in Ignition System section.
	Engine and emission control system out of order.	
	● Fuel pressure out of specification	Diag. Flow Table B-3 in this section.
	● Faulty TP sensor, ECT sensor or MAF sensor	TP sensor, ECT sensor or MAF sensor in Engine and Emission Control System section.
	● Faulty EGR system	DTC P0400 Diag. Flow Table in this section.
	● Faulty injector	Fuel injector in Engine and Emission Control System section.
	● Faulty ECM (PCM)	Inspection of ECM (PCM) and its circuit in this section.
	Low compression	Previously outlined.
	Others	
	● Poor valve seating	Valves inspection in Engine Mechanical section.
	● Dragging brakes	Diagnosis in Brake section.
	● Slipping clutch	Diagnosis in Clutch section.
	● Thermostat out of order	Thermostat in Engine Cooling section.
	● Improper tire pressure	
Excessive engine oil consumption	**Oil entering combustion chamber**	
	● Sticky piston ring	Piston cleaning in Engine Mechanical section.
	● Worn piston and cylinder	Cylinders, pistons and piston rings inspection in Engine Mechanical section.
	● Worn piston ring groove and ring	Pistons and piston rings inspection in Engine Mechanical section.
	● Improper location of piston ring gap	Pistons installation in Engine Mechanical section.
	● Worn or damaged valve stem seal	Valves and cylinder head in Engine Mechanical section.
	● Worn valve stem	Valves inspection in Engine Mechanical section.

Condition	Possible Cause	Reference Item
Low oil pressure	● Improper oil viscosity	Engine oil and oil filter change in Maintenance and Lubrication section.
	● Malfunctioning oil pressure switch	Oil pressure switch inspection in BODY ELECTRICAL SYSTEM section.
	● Clogged oil strainer	Oil pan and oil pump strainer cleaning in Engine Mechanical section.
	● Functional deterioration of oil pump	Oil pump in Engine Mechanical section.
	● Worn oil pump relief valve	Oil pump in Engine Mechanical section.
	● Excessive clearance in various sliding parts	
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** ● Faulty hydraulic valve lash adjuster	Hydraulic valve lash adjuster in Engine Mechanical section.
	● Worn valve stem and guide	Valves inspection in Engine Mechanical section.
	● Weak or broken valve spring	Valve springs inspection in Engine Mechanical section.
	● Warped or bent valve	Valves inspection in Engine Mechanical section.
	● Loose camshaft housing bolts	Camshafts in Engine Mechanical section.
	Piston, ring and cylinder noise ● Worn piston, ring and cylinder bore	Pistons and cylinders inspection in Engine Mechanical section.
	Connecting rod noise ● Worn crankpin bearing	Crankpin and connecting rod bearing inspection in Engine Mechanical section.
	● Worn crankpin	Crankpin and connecting rod bearing inspection in Engine Mechanical section.
	● Loose connecting rod nuts	Connecting rod installation in Engine Mechanical section.
	● Low oil pressure	Previously outlined.
	Crankshaft noise ● Low oil pressure	Previously outlined.
	● Worn crankshaft journal bearing	Crankshaft and bearing inspection in Engine Mechanical section.
	● Worn crankshaft journal	Crankshaft and bearing inspection in Engine Mechanical section.
	● Loose lower crankcase (bearing cap) bolts	Crankshaft installation in Engine Mechanical section.
	● Excessive crankshaft thrust play	Crankshaft inspection in Engine Mechanical section.

ECM (PCM) SUBSTITUTION

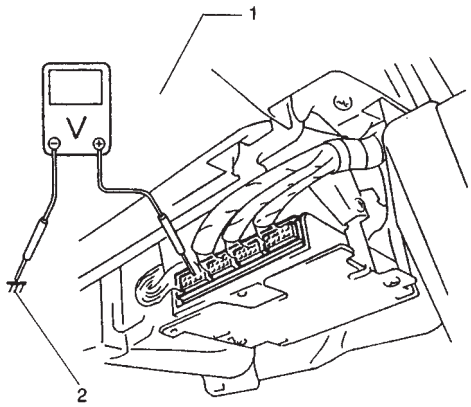
When substituting a known-good ECM (PCM), check for following conditions. Neglecting this check may cause damage to known-good ECM (PCM).

– Resistance value of all relays, actuators is as specified respectively.
– MAF sensor, MAP sensor, TP sensor and fuel tank pressure sensor are in good condition and none of power circuits of these sensors is shorted to ground.

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.

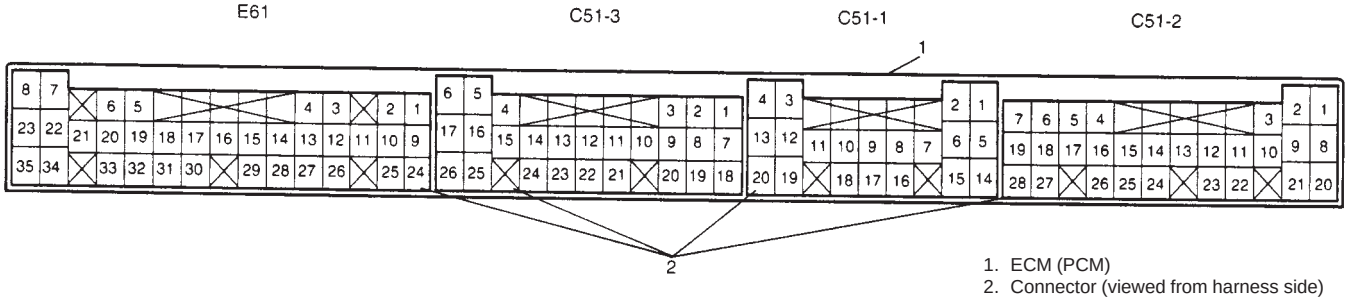


1. Glove box
2. Engine ground

VOLTAGE CHECK

1) Remove ECM (PCM) cover from bracket referring to “ECM (PCM) REMOVAL”.
2) 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.



1. ECM (PCM)
2. Connector (viewed from harness side)

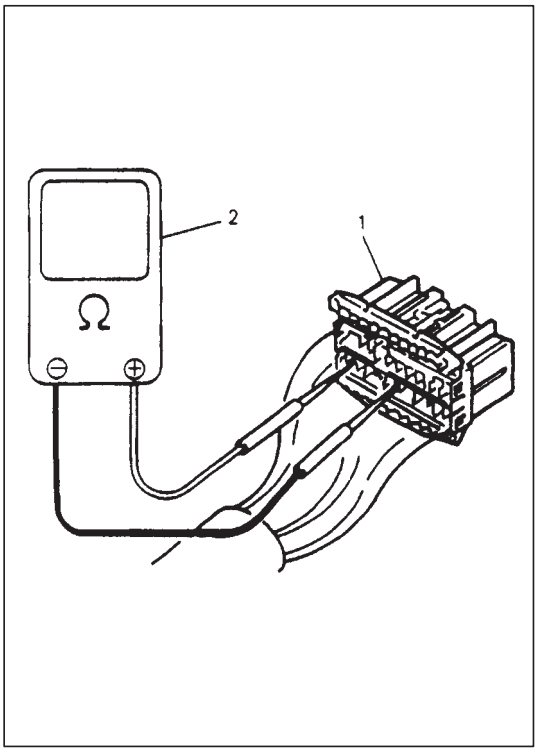
TERMINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
E61-1	Fuel pump relay	0 – 2.5 V	For 3 sec. after ignition switch ON or while engine running.
		10 – 14 V	After 3 sec. from ignition switch ON with engine stopped.
E61-2	———	———	———
E61-3	———	———	———
E61-4	Tachometer	0 – 0.8 V	Ignition switch ON, engine stops.
E61-5	A/C condenser fan motor relay (if equipped)	10 – 14 V	Ignition switch ON.
		0 – 2.5 V	A/C condenser fan motor ON.
E61-6	———	———	———
E61-7	"O/D OFF" lamp (A/T VEHICLE)	0 – 2.5 V	For 4 sec. after ignition switch ON, overdrive cut switch ON.
		10 – 14 V	After 4 sec. from ignition switch ON and overdrive cut switch OFF.
E61-8	Main relay	10 – 14 V	Ignition switch OFF.
		0 – 2 V	Ignition switch ON.
E61-9	Power/Normal change switch (A/T VEHICLE)	0 – 1 V	For 4 sec. after ignition switch ON, P/N change switch in POWER mode
		10 – 14 V	Ignition switch ON, P/N change switch: NORMAL mode
E61-10	"POWER" lamp (A/T VEHICLE)	0 – 2.5 V	Ignition switch ON, P/N change switch: POWER mode
		10 – 14 V	Ignition switch ON, P/N change switch: NORMAL mode
E61-11	———	———	———
E61-12	Fuel level sensor	0.7 – 5.5 V (Full) (Empty)	Ignition switch ON.
E61-13	Heater blower switch	10 – 14 V	Ignition switch ON, heater blower switch OFF.
		0 – 2.5 V	Ignition switch ON, heater blower switch ON.
E61-14	Overdrive cut switch (A/T VEHICLE)	10 – 14 V	Ignition switch ON, overdrive cut switch OFF.
		0 – 1 V	Ignition switch ON, overdrive cut switch ON.
E61-15	Rear defogger switch (if equipped)	0 – 1 V	Rear defogger switch OFF.
		10 – 14 V	Ignition switch ON. Rear defogger switch ON.
E61-16	Test switch terminal (vehicle with monitor connector)	10 – 14 V	Ignition switch ON.
E61-17	Output duty select switch terminal (vehicle with monitor connector)	10 – 14 V	Ignition switch ON.
E61-18	ABS control module (if equipped)	10 – 14 V	Ignition switch ON.
E61-19	CO adjusting resistor (if equipped)	———	———
E61-20	———	———	———

TERMINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
E61-21, 22	———	———	———
E61-23	Immobilizer indicator lamp (vehicle without monitor connector)	0 – 1 V	Ignition switch ON
		10 – 14 V	Engine running
	Duty output terminal (vehicle with monitor connector)	0 – 1 V	Ignition switch ON
E61-24	Data link connector (5 V)	4 – 6 V	Ignition switch ON
E61-25	Data link connector (12 V)	10 – 14 V	Ignition switch ON
E61-26	Power steering pressure switch	10 – 14 V	Ignition switch ON
		0 – 1 V	With engine running at idle speed, turning steering wheel to the right or left as far as it stops
E61-27	A/C cut signal (if equipped)	0 – 1 V	A/C is not operating
		10 – 14 V	A/C is operating
E61-28	A/C signal (if equipped)	10 – 14 V	Ignition switch ON, A/C switch or heater blower switch OFF
		0 – 1.5 V	Ignition switch ON, A/C switch ON and heater blower switch ON
E61-29	Lighting switch	0 – 1 V	Ignition switch ON, lighting switch OFF
		10 – 14 V	Ignition switch ON, lighting switch ON
E61-30	Diag. switch terminal (vehicle with monitor connector)	10 – 14 V	Ignition switch ON
E61-31	Stop lamp switch (A/T VEHICLE)	0 – 1 V	Brake pedal released (switch OFF), Ignition switch ON
		10 – 14 V	Brake pedal depressed (switch ON), Ignition switch ON
E61-32	CO adjusting resistor ground (if equipped)	———	———
E61-33	Power source for CO adjusting resistor (if equipped)	4.75 – 5.25 V	Ignition switch ON
E61-34	Malfunction indicator lamp	0 – 2.5 V	Ignition switch ON, engine stops
		10 – 14 V	Engine running
E61-35	Power source for back up	10 – 14 V	Ignition switch ON and OFF
C51-3-1	Vehicle speed sensor	Deflects between 0 and over 4 V	Ignition switch ON, Rear right tire turned slowly with rear left tire locked
C51-3-2	Crankshaft position (CKP) sensor (if equipped)	———	———
C51-3-3	Crankshaft position (CKP) sensor (if equipped)	———	———
C51-3-4	Heated oxygen sensor (Bank 1 – Sensor 1) (if equipped)	Deflects between over and under 0.5 V	While engine running at 2,000 r/min. for 1 min. or longer after warmed up
C51-3-5	Heater of HO2S (Bank 2 – Sensor 1) (if equipped)	10 – 14 V	Ignition switch ON
		Deflects between 0 – 1 V and 10 – 14 V	At specified idle speed after engine warmed up
C51-3-6	Heater of HO2S (Bank 1 – Sensor 1) (if equipped)	10 – 14 V	Ignition switch ON
		Deflects between 0 – 1 V and 10 – 14 V	At specified idle speed after engine warmed up
C51-3-7	———	———	———
C51-3-8	Intake air temp. sensor	2.2 – 3.0 V	Ignition switch ON, Sensor ambient temp.: 20°C, 68°F

TERMINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
C51-3-9	Camshaft position sensor (POS)	Deflects between 0 – 1 V and 4 – 6 V	Ignition switch ON, crankshaft turned slowly.
C51-3-10	Camshaft position sensor (REF)	Deflects between 0 – 1 V and 4 – 6 V	Ignition switch ON, camshaft turned slowly.
C51-3-11	Power source for TP sensor and MAP sensor	4.75 – 5.25 V	Ignition switch ON.
C51-3-12	Throttle position sensor	0.35 – 0.65 V	Ignition switch ON, throttle valve at idle position.
		3.5 – 4.5 V	Ignition switch ON, throttle valve at full open position.
C51-3-13	Manifold absolute pressure sensor	3.3 – 4.3 V	Ignition switch ON.
C51-3-14	Heated oxygen sensor (Bank 1 – Sensor 2) (if equipped)	——-	———
C51-3-15	Heated oxygen sensor (Bank 2 – Sensor 1) (if equipped)	Deflect between over and under 0.5 V	While engine running at 2000 r/min. for 1 min. or longer after warmed up.
C51-3-16	Heater of HO2S (Bank 2 – Sensor 2) (if equipped)	10 – 14 V	Ignition switch ON.
		Deflect between 0 – 1 V and 10 – 14 V	At specified idle speed after engine warmed up.
C51-3-17	Heater of HO2S (Bank 1 – Sensor 2) (if equipped)	10 – 14 V	Ignition switch ON.
		Deflect between 0 – 1 V and 10 – 14 V	At specified idle speed after engine warmed up.
C51-3-18	———	———	———
C51-3-19	———	———	———
C51-3-20, 21	Ground	———	———
C51-3-22	Engine coolant temp. sensor	0.5 – 0.9 V	Ignition switch ON, Engine coolant temp.: 80°C, 176°F
C51-3-23	Mass air flow sensor	0.5 – 1.0 V	Ignition switch ON and engine stops.
		1.5 – 1.8 V	With engine running at idle speed.
C51-3-24	Heated oxygen sensor (Bank 2 – Sensor 2) (if equipped)	———	———
C51-3-25, 26	Ground	———	———
C51-1-1	Shift solenoid B (A/T VEHICLE)	0 – 1 V	Ignition switch ON.
C51-1-2	TCC solenoid (A/T VEHICLE)	0 – 1 V	Ignition switch ON.
C51-1-3	Transmission range switch “R” (A/T VEHICLE)	10 – 14 V	Ignition switch ON, selector lever: “R” range
		0 – 1 V	Ignition switch ON, selector lever: Other than “R” range
C51-1-4	Transmission range switch “P” (A/T VEHICLE)	10 – 14 V	Ignition switch ON, selector lever: “P” range
		0 – 1 V	Ignition switch ON, selector lever: Other than “P” range
C51-1-5	4WD low switch (if equipped) (A/T VEHICLE)	0 – 1 V	Ignition switch ON, transfer lever: 4WD low range
		10 – 14 V	Ignition switch ON, transfer lever: 4H or 2H range

TERMINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
C51-1-6	Shift solenoid A (A/T VEHICLE)	10 – 14 V	Ignition switch ON
C51-1-7	4WD lamp (if equipped)	10 – 14 V	Ignition switch ON, Transfer lever: N or 2H range
		0 – 1 V	Ignition switch ON, Transfer lever: 4L or 4H range
C51-1-8	A/T input speed sensor (A/T VEHICLE)	———	———
C51-1-9	A/T vehicle (output) speed sensor (A/T VEHICLE)	———	———
C51-1-10	A/T vehicle (output) speed sensor (A/T VEHICLE)	———	———
C51-1-11	4WD switch (if equipped)	10 – 14 V	Ignition switch ON, Transfer lever: N or 2H range
		0 – 1 V	Ignition switch ON, Transfer lever: 4L or 4H range
C51-1-12	Transmission range switch “D” (A/T VEHICLE)	10 – 14 V	Ignition switch ON, selector lever: “D” range
		0 – 1 V	Ignition switch ON, selector lever: Other than “D” range
C51-1-13	Transmission range switch “N”	10 – 14 V	Ignition switch ON, selector lever. “N” range
		0 – 1 V	Ignition switch ON, selector lever: Other than “N” range
C51-1-14	Shield wire ground for A/T input speed sensor and A/T vehicle (output) speed sensor (A/T VEHICLE)	———	———
C51-1-15	4WD actuator (if equipped)	10 – 14 V	Ignition switch ON, Transfer lever: 4L or 4H range
		0 – 1 V	Ignition switch ON, Transfer lever: N or 2H range
C51-1-16	A/T input speed sensor (A/T VEHICLE)	———	———
C51-1-17	———	———	———
C51-1-18	4WD pressure switch (if equipped)	10 – 14 V	Ignition switch ON, Transfer lever: 4L or 4H range
		0 V	Ignition switch ON, Transfer lever: N or 2H range
C51-1-19	Transmission range switch “L” (A/T VEHICLE)	10 – 14 V	Ignition switch ON, selector lever: “L” range
		0 – 1 V	Ignition switch ON, selector lever: Other than “L” range
C51-1-20	Transmission range switch “2” (A/T VEHICLE)	10 – 14 V	Ignition switch ON, selector lever: “2” range
		0 – 1 V	Ignition switch ON, selector lever: Other than “2” range
C51-2-1	EVAP canister purge valve	10 – 14 V	Ignition switch ON
C51-2-2	Ground	———	———
C51-2-3	Ignition switch	10 – 14 V	Ignition switch ON
C51-2-4	EGR valve (stepper motor coil 2) (if equipped)	10 – 14 V	Ignition switch ON
C51-2-5	EGR valve (stepper motor coil 1) (if equipped)	0 – 1 V	
C51-2-6	Fuel injector No.2	10 – 14 V	Ignition switch ON
C51-2-7	Fuel injector No.1		
C51-2-8, 9	Ground	———	———
	Ground	———	———
C51-2-10	Ignition coil assembly for No.4	———	———
C51-2-11	Ignition coil assembly for No.3	———	———
C51-2-12	Ignition coil assembly for No.2	———	———
C51-2-13	Ignition coil assembly for No.1	———	———

TERMINAL	CIRCUIT	NORMAL VOLTAGE	CONDITION
C51-2-14	IAC valve (stepper motor coil 2)	———	———
C51-2-15	IAC valve (stepper motor coil 1)	———	———
C51-2-16	EGR valve (stepper motor coil 4) (if equipped)	0 – 1 V	Ignition switch ON
C51-2-17	EGR valve (stepper motor coil 3) (if equipped)	10 – 14 V	
C51-2-18	Fuel injector No.4	10 – 14 V	Ignition switch ON
C51-2-19	Fuel injector No.3		
C51-2-20, 21	Power source	10 – 14 V	Ignition switch ON
C51-2-22	Ignition coil assembly for No.6	———	———
C51-2-23	Ignition coil assembly for No.5	———	———
C51-2-24	IAC valve (stepper motor coil 4)	———	———
C51-2-25	IAC valve (stepper motor coil 3)	———	———
C51-2-26	Engine start signal	6 – 14 V	While engine cranking
		0 – 1 V	Other than above
C51-2-27	Fuel injector No.6	10 – 14 V	Ignition switch ON
C51-2-28	Fuel injector No.5		



RESISTANCE CHECK

1) Disconnect ECM couplers (1) from ECM with ignition switch OFF.

CAUTION:
Never touch terminals of ECM itself or connect voltmeter or ohmmeter (2).

2) Check resistance between each pair of terminals of disconnected couplers as listed in following table.

CAUTION:
- **Be sure to connect ohmmeter probe from wire harness side of coupler.**
- **Be sure to turn OFF ignition switch for this check.**
- **Resistance in table represents that when parts temperature is 20°C (68°F).**

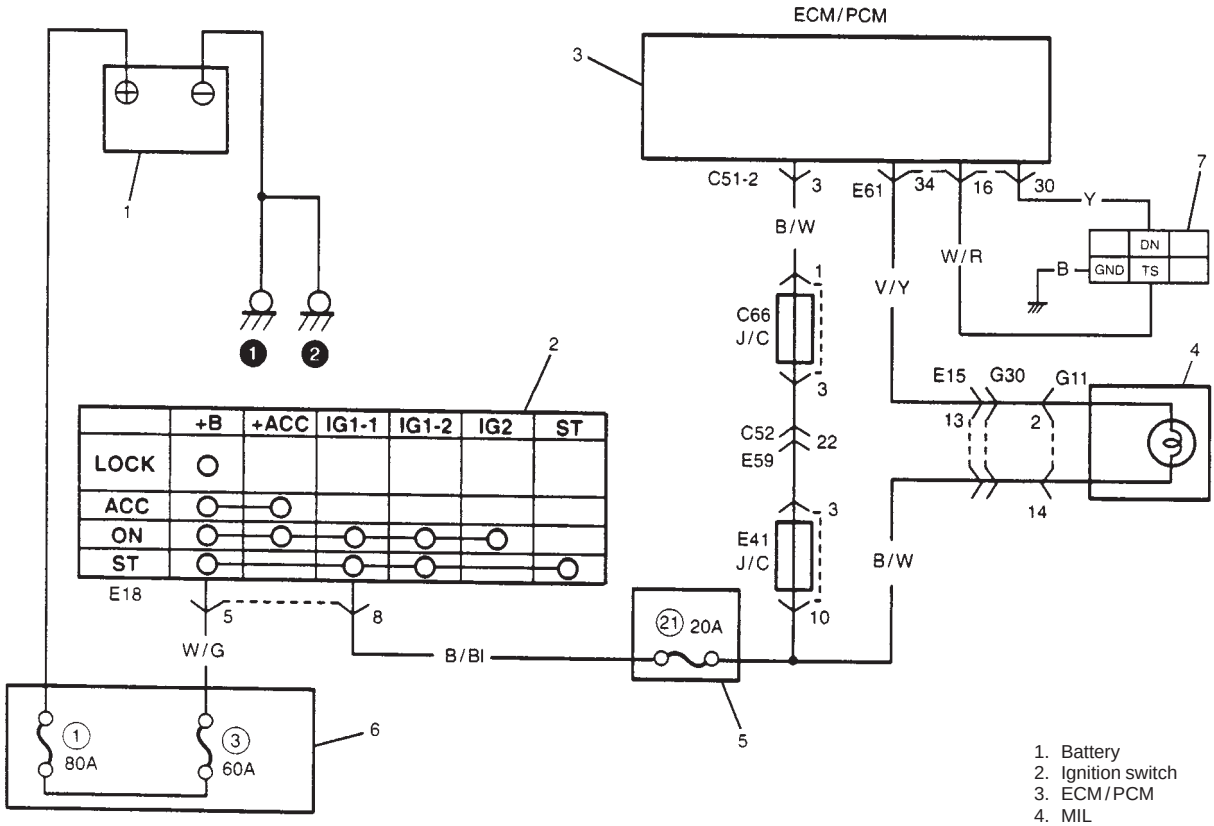
TERMINAL	CIRCUIT	STANDARD RESISTANCE	CONDITION
E61-1 – C51-2-3	Fuel pump relay	70 – 110 Ω	—
E61-5 – C51-2-3	A/C condenser fan relay	75 – 110 Ω	Battery disconnected and ignition switch ON.
E61-8 – E61-35	Main relay	70 – 110 Ω	—
E61-12 – Body ground	Fuel level sensor	117.5 – 122.5 Ω	Fuel level is Empty.
		1.5 – 4.5 Ω	Fuel level is Full.
C51-3-2 – C51-3-3	CKP sensor	485 – 655 Ω	—
C51-3-8 – C51-3-20	IAT sensor	2.09 – 2.81 kΩ	—
C51-3-22 – C51-3-21	ECT sensor	303 – 326 Ω	Engine coolant temp.: 80°C (176°F)

TERMINAL	CIRCUIT	STANDARD RESISTANCE	CONDITION
C51-1-1 – Body ground	Shift solenoid-B	11 – 15 Ω	—
C51-1-2 – Body ground	TCC solenoid		
C51-1-6 – Body ground	Shift solenoid-A		
C51-1-8 – C51-1-16	A/T input speed sensor	560 – 680 Ω	—
C51-1-9 – C51-1-10	A/T output speed sensor	369 – 451 Ω	—
C51-2-1 – C51-2-20	EVAP canister purge valve	28 – 36 Ω	—
C51-2-5 – C51-2-20	EGR valve (stepper motor coil 1)	20 – 24 Ω	—
C51-2-4 – C51-2-20	EGR valve (stepper motor coil 2)		
C51-2-17 – C51-2-20	EGR valve (stepper motor coil 3)		
C51-2-16 – C51-2-20	EGR valve (stepper motor coil 4)		
C51-2-7 – C51-2-20	Fuel injector No.1	10 – 14 Ω	—
C51-2-6 – C51-2-20	Fuel injector No.2		
C51-2-19 – C51-2-20	Fuel injector No.3		
C51-2-18 – C51-2-20	Fuel injector No.4		
C51-2-28 – C51-2-20	Fuel injector No.5		
C51-2-27 – C51-2-20	Fuel injector No.6		
C51-2-15 – C51-2-20	IAC valve (stepper motor coil 1)	21 – 23 Ω	—
C51-2-14 – C51-2-20	IAC valve (stepper motor coil 2)		
C51-2-25 – C51-2-20	IAC valve (stepper motor coil 3)		
C51-2-24 – C51-2-20	IAC valve (stepper motor coil 4)		

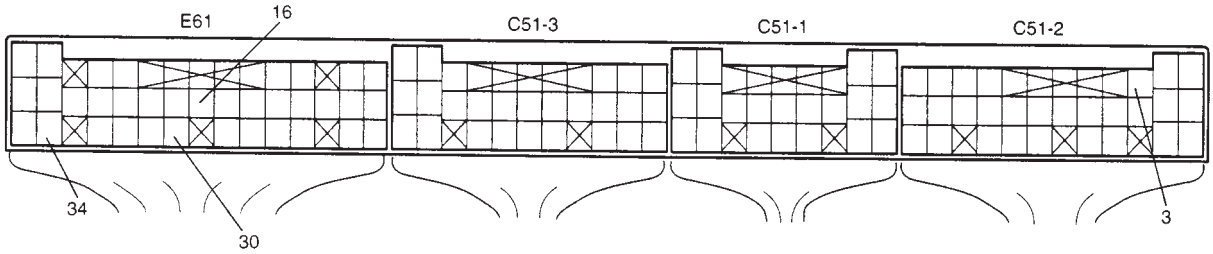
TABLE A-1 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK

MIL DOES NOT COME ON OR MIL DIMMS AT IGNITION SWITCH ON LEAVING ENGINE OFF

WIRING DIAGRAM



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



CIRCUIT DESCRIPTION

When the ignition switch is turned ON, ignition switch signal is sent to ECM. The ECM causes the main relay to turn ON. Then, ECM (PCM) being supplied with the main power, turns ON the malfunction indicator lamp. 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 when the engine is running.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Test Switch Terminal check (vehicle with monitor connector): (1) Check test switch terminal of monitor connector for being grounded. (2) With ignition switch ON leaving engine OFF, measure voltage between E61-16 and ground. Check the voltage for 10 – 14 V. Are they in good condition?	Go to Step 2.	Test switch terminal circuit is shorted to ground. Repair or correct.
2	Ignition Switch Signal check: (1) Remove ECM (PCM) cover. (2) With ignition switch ON leaving engine OFF, check voltage between C51-2-3 and ground. Is voltage 10 – 14 V?	Go to Step 3.	Fuse (1, 3 or 21) blown. Faulty circuit (Battery – C51-2-3).
3	MIL Bulb and Circuit check: (1) Using service wire, ground E61-34 terminal. Does MIL turn ON at ignition switch ON?	Go to TABLE A-3 “ECM (PCM) POWER AND GROUND CIRCUIT CHECK” in this section.	Faulty circuit (Fuse 21 – E61-34). MIL bulb burned out.

TABLE A-2 MALFUNCTION INDICATOR LAMP CIRCUIT CHECK

MIL REMAINS ON AFTER ENGINE STARTS

WIRING DIAGRAM/CIRCUIT DESCRIPTION

Refer to TABLE A-1.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	DTC check: (1) With ignition switch OFF, install scan tool. (2) Start engine and check DTC. Is there any DTC(s)?	Go to Step 2 of "ENGINE DIAG. FLOW TABLE" in this section.	Go to Step 2.
2	MIL Circuit check: (1) With ignition switch OFF, disconnect couplers from ECM (PCM). Does MIL turn ON at ignition switch ON?	"V/Y" wire shorted to ground circuit.	Substitute a known-good ECM (PCM) and recheck.

TABLE A-3 MALFUNCTION INDICATOR LAMP CHECK

MIL FLASHES AT IGNITION SWITCH ON (vehicle with monitor connector)

WIRING DIAGRAM/CIRCUIT DESCRIPTION

Refer to TABLE A-1.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	MIL Flashing Pattern check: 1) Turn ignition switch ON. Does lamp flashing pattern indicate diagnostic trouble code?	Go to Step 2.	Go to "Diagnosis" in Section 8G.
2	Diag. Switch Circuit check: Is diag. switch terminal connected to ground via service wire?	System is in good condition.	"Y" circuit shorted to ground. If circuit is OK substitute a known-good ECM (PCM) and recheck.

TABLE A-4 MALFUNCTION INDICATOR LAMP CHECK

MIL DOES NOT FLASH OR JUST REMAINS ON EVEN WITH GROUNDING DIAGNOSIS SWITCH TERMINAL (vehicle with monitor connector)

WIRING DIAGRAM/CIRCUIT DESCRIPTION

Refer to TABLE A-1.

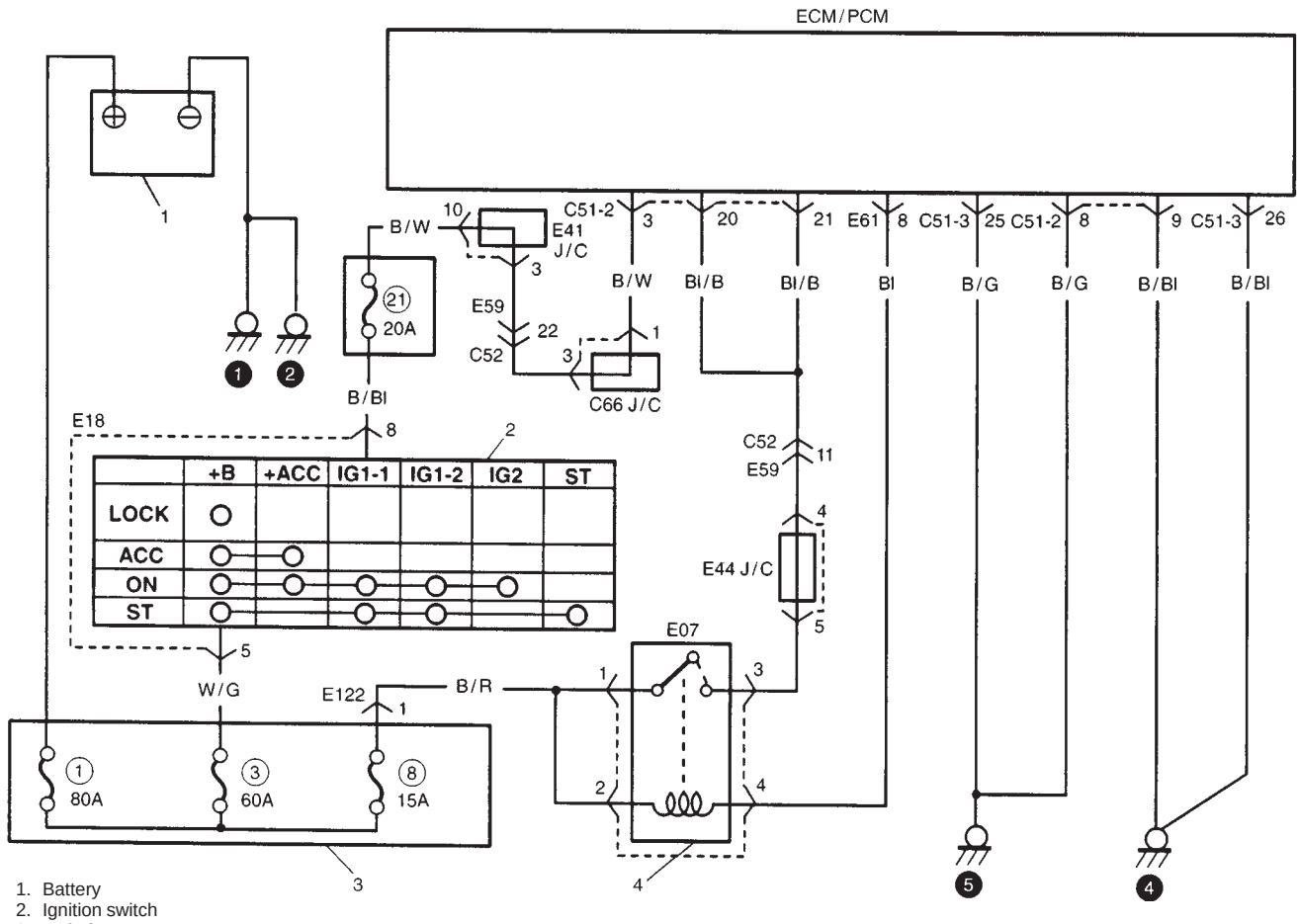
TROUBLESHOOTING

STEP	ACTION	YES	NO
1	MIL Circuit check: 1) Turn ignition switch OFF and disconnect connectors from ECM (PCM). Does MIL turn ON at ignition switch ON?	"V/Y" circuit shorted to ground.	Go to Step 2.
2	ECM (PCM) Connection check: 1) Turn ignition switch OFF. Is connector (E61-30 connection) connected to ECM (PCM) properly?	Go to Step 3.	Poor connector connection.
3	Diag. switch Terminal Circuit check: 1) Connect connectors to ECM (PCM). 2) Using service wire, ground E61-30 terminal with connectors connected to ECM (PCM). 3) Turn ignition switch ON. Does MIL flash?	"Y" or "B" circuit open.	Substitute a known-good ECM (PCM) and recheck.

TABLE A-5 ECM (PCM) POWER AND GROUND CIRCUIT CHECK

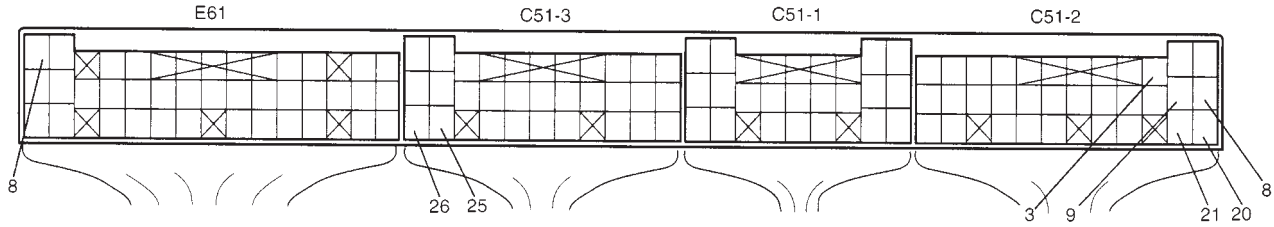
MIL DOES NOT LIGHT AT IGNITION SWITCH ON AND ENGINE DOES NOT START THOUGH IT IS CRANKED UP.

WIRING DIAGRAM



1. Battery
2. Ignition switch
3. Main fuse
4. Main relay

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



CIRCUIT DESCRIPTION

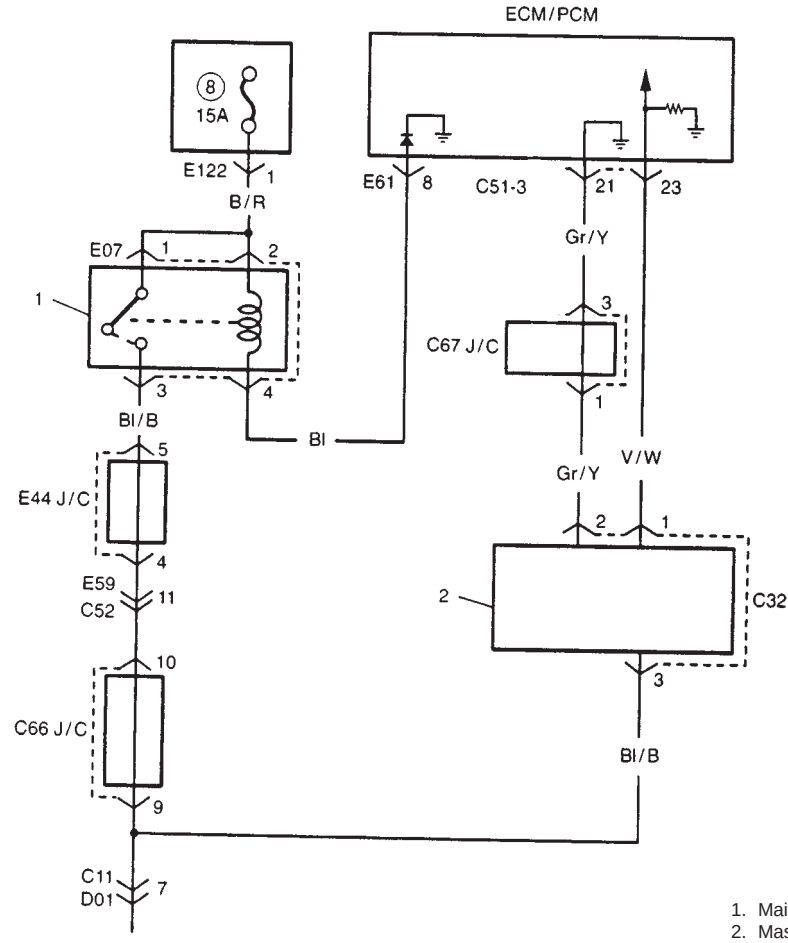
When the ignition switch is turned ON, the main relay turns ON and the main power is supplied to ECM (PCM).

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Main Relay Operating Sound check: Is operating sound of main relay heard at ignition switch ON?	Go to Step 5.	Go to Step 2.
2	Fuse check: Is fuse 8 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 E07-2 and E07-4. 3) If OK, check main relay for resistance and operation referring to “Main Relay Inspection” in section 6E2. Is check result satisfactory?	Go to Step 4.	Replace main relay.
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 C51-2-3, 20, 21 and E61-8. 3) If OK, then measure voltage between terminal C51-2-3 and ground, E61-8 and ground with ignition switch ON. Is each voltage 10 – 14 V?	Go to Step 5.	“B/W”, “Bl” or “B/R” circuit open.
5	ECM Power Circuit check: 1) Using service wire, ground terminal E61-8 and measure voltage between terminal C51-2-20 and ground at ignition switch ON. Is it 10 – 14 V?	Check ground circuits “B/G” and “B/Bl” 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/R” or “Bl” wire open.
7	Main Relay check: 1) Check main relay according to procedure in Step 3. Is main relay in good condition?	“B/R” or “Bl” wire open.	Replace main relay.

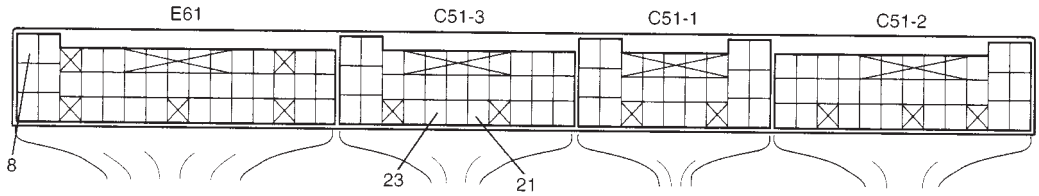
DTC P0100 MASS AIR FLOW SENSOR CIRCUIT MALFUNCTION (DTC No.33, 34)

WIRING DIAGRAM



1. Main relay
2. Mass air flow sensor

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



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
● Engine running and more than 5.0 V MAF sensor output voltage continues for 1 sec. ● Engine running and less than 0.3 V MAF sensor output voltage continues for 1 sec.	Air intake system MAF sensor circuit MAF sensor MAP sensor ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

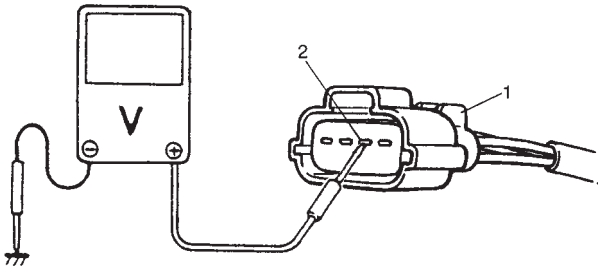
- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and run it for 10 sec.
(4) Check DTC by using scan tool.

DTC TROUBLESHOOTING

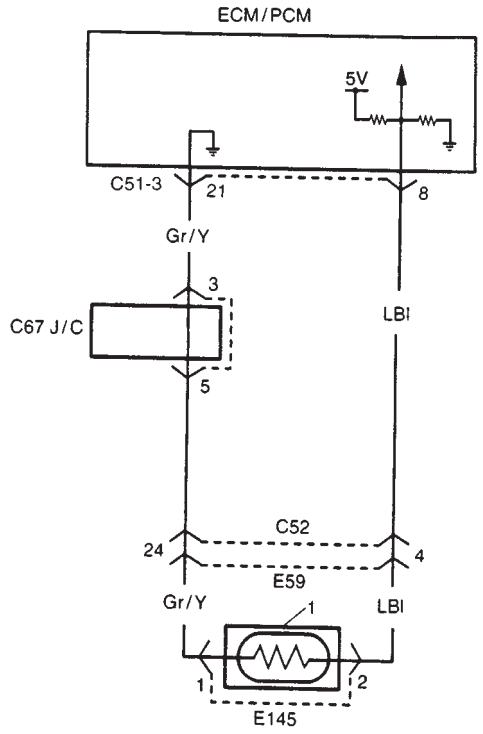
STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	MAF Sensor Power Supply Voltage check: (1) With ignition switch OFF, disconnect MAF sensor coupler (1). (2) With ignition switch ON, check voltage between C32-3 (2) and ground. Is voltage 10 – 14 V?	Go to Step 3.	Faulty “Bl/B” wire.
3	MAF Sensor Output Voltage check: (1) With ignition switch OFF, connect MAF sensor coupler. (2) Remove ECM (PCM) cover. (3) With ignition switch ON leaving engine OFF, check voltage between C51-3-23 and C51-3-21 terminal. Is voltage 0.5 – 1.0 V?	Poor C51-3-23 or/ and C51-3- 21 terminal connection. If OK, substitute a known-good ECM (PCM) and recheck.	Faulty “V/W” wire and “Gr/Y” wire. Poor C32 coupler terminal connection. If wire and connection are OK, substitute a known-good MAF sensor and recheck.

Fig. for STEP 2



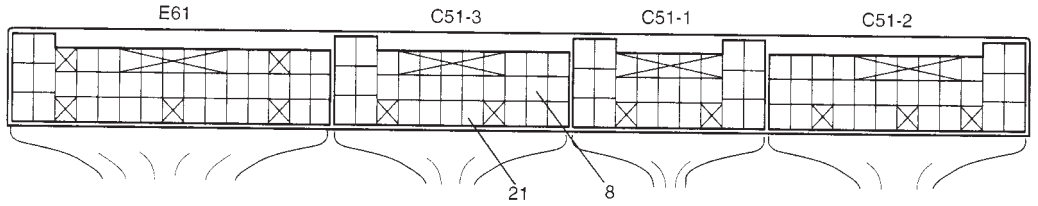
DTC P0110 INTAKE AIR TEMP. CIRCUIT MALFUNCTION (DTC No.23, 25)

WIRING DIAGRAM



1. IAT sensor

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



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
● Less than 0.16 V IAT sensor output voltage continues for 5 sec. ● More than 5.0 V IAT sensor output voltage continues for 5 sec.	IAT sensor circuit IAT sensor ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14°C and 70°C (68°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch, clear DTC if any.
(3) Start engine and run it for 10 sec.
(4) Check DTC by using scan tool.

DTC TROUBLESHOOTING

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 205°C (401°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 (1) with ignition switch OFF. 2) Check for proper connection to IAT sensor at “LBl” and “Gr/Y” wire terminals. 3) If OK, then with ignition switch ON, is voltage applied to “LBl” wire terminal about 4.5 – 5.5 V?	Go to Step 5.	“LBl” wire open or shorted to power, or poor C51-3-8 connection. If wire and connection are OK, substitute a known-good ECM and recheck.
4	Does scan tool indicate –40°C (–40°F) at Step 2.	Go to Step 6.	Go to Step 5.
5	Check Wire Harness 1) Check intake air temp. displayed on scan tool with ignition switch ON. Is –40°C (–40°F) indicated?	Replace IAT sensor.	“LBl” wire shorted to ground. If wire is OK, substitute a known-good ECM and recheck.
6	Check Wire Harness. 1) Using service wire (2), connect IAT sensor connector terminals. 2) Check intake air temp. displayed on scan tool with ignition switch ON. Is 205°C (401°F) indicated?	Replace IAT sensor.	“LBl” wire open or poor C51-3-21 connection. If wire and connection are OK, substitute a known-good ECM and recheck.

Fig. for STEP 3

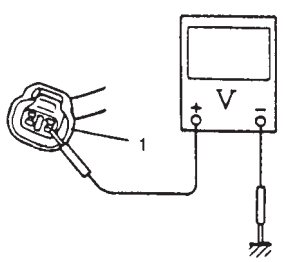
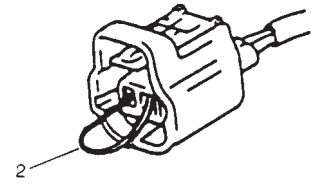
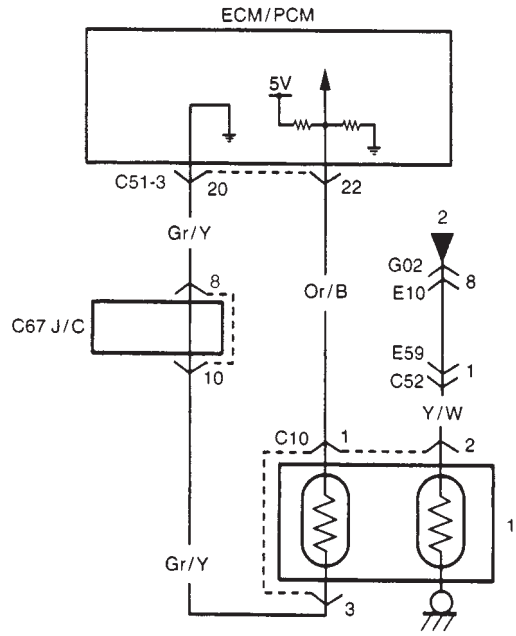


Fig. for STEP 6



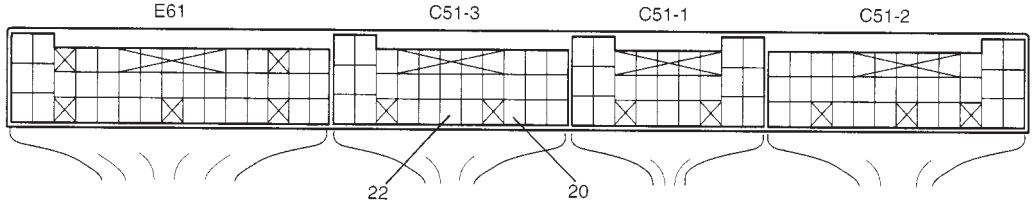
DTC P0115 ENGINE COOLANT TEMP. CIRCUIT MALFUNCTION (DTC No.14, 15)

WIRING DIAGRAM



1. ECT sensor
2. Combination meter

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



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
● ECT sensor signal terminal voltage is less than 0.16 V for 5 sec. ● ECT sensor signal terminal voltage is more than 5.0 V for 5 sec.	ECT sensor ECT sensor circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch, clear DTC if any.
(3) Start engine and run it for 10 sec.
(4) Check DTC by using scan tool.

DTC TROUBLESHOOTING

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 205°C (401°F) indicated?	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection” in Section 0 A.
3	Check Wire Harness. 1) Disconnect ECT sensor connector. 2) Check engine coolant temp. displayed on scan tool. Is –40°C (–40°F) indicated?	Replace ECT sensor.	“Or/B” wire shorted to ground. If wire is OK, substitute a known-good ECM and recheck.
4	Does scan tool indicate –40°C (–40°F) at Step 2.	Go to Step 6.	Go to Step 5.
5	Check Wire Harness. 1) Disconnect ECT sensor connector (1) with ignition switch OFF. 2) Check for proper connection to ECT sensor at “Gr/Y” and “Or/B” wire terminals. 3) If OK, then with ignition switch ON, is voltage applied to “Or/B” wire terminal about 4.5 – 5.5 V?	Go to Step 4.	“Or/B” wire open or shorted to power, or poor C51-3-22 connection. If wire and connection are OK, substitute a known-good ECM and recheck.
6	Check Wire Harness. 1) Using service wire (2), connect ECT sensor connector terminals. See Fig. 2. 2) Turn ignition switch ON and check engine coolant temp. displayed on scan tool. Is 205°C (401°F) indicated?	Replace ECT sensor.	“Gr/Y” wire open or poor C51-3-20 connection. If wire and connection are OK, substitute a known-good ECM and recheck.

Fig. for STEP 5

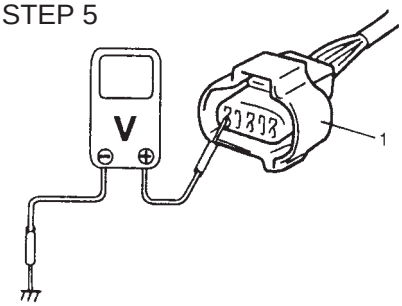
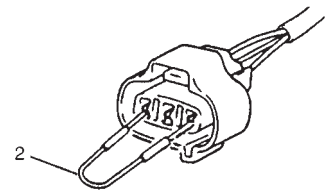
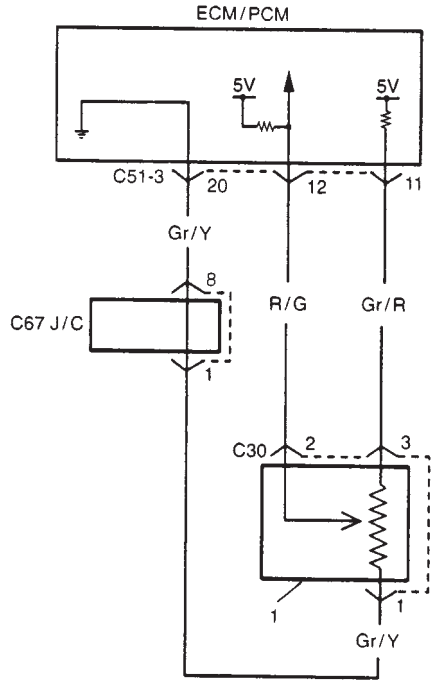


Fig. for STEP 6



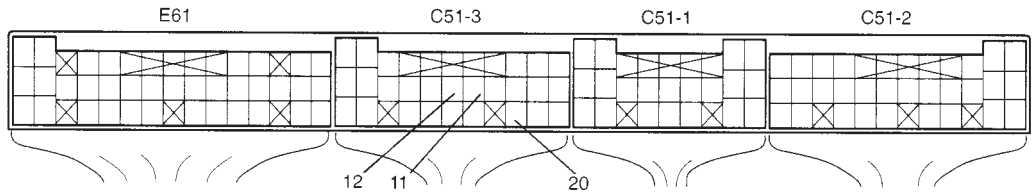
DTC P0120 THROTTLE POSITION CIRCUIT MALFUNCTION (DTC No.21, 22)

WIRING DIAGRAM



1. Throttle position sensor

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



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
TP sensor signal terminal voltage continues less than 0.1 V for 1 sec. TP sensor signal terminal voltage continues more than 4.8 V for 1 sec.	TP sensor TP sensor circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

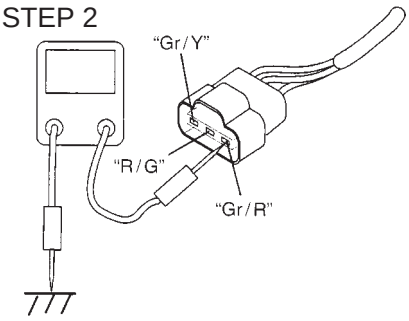
- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and run it for 10 sec.
(4) Check DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	TP Sensor Reference Voltage check: (1) Wit ignition switch OFF, disconnect C30-3 coupler. (2) Check voltage between C30-3 and ground. Is voltage 4.5 – 5.5 V?	Go to Step 3.	“Gr/R” wire open or shorted to ground circuit or power circuit or poor C51-3-11 connection. “Gr/Y” wire open or poor C51-3-20 connection. If OK, substitute a known-good ECM (PCM) and recheck.
3	TP Sensor check: 1) Check TP sensor referring to “ENGINE AND EMISSION CONTROL” section. Is check result as specified?	“R/G” wire open/ shorted to ground circuit or power circuit or poor C51-3-12 connection. If OK, substitute a known-good ECM (PCM) and recheck.	

Fig. for STEP 2



DTC P0121 THROTTLE POSITION CIRCUIT PERFORMANCE PROBLEM

WIRING DIAGRAM

Refer to DTC P0120 (DTC No.21, 22).

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Throttle opening is detected as small (rationality-low) while engine is running under high road and high speed conditions or as large (rationality-high) while engine is running under low load and low speed conditions.	Air intake system TP sensor TP sensor circuit 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 very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

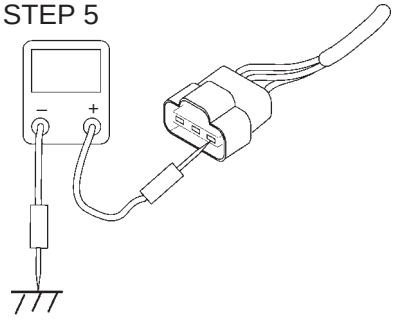
NOTE:
Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle till engine speed is reach ed 3300 – 3700 r/min. for 10 sec.
(5) Stop vehicle and run engine at idle speed for 10 sec.
(6) Check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

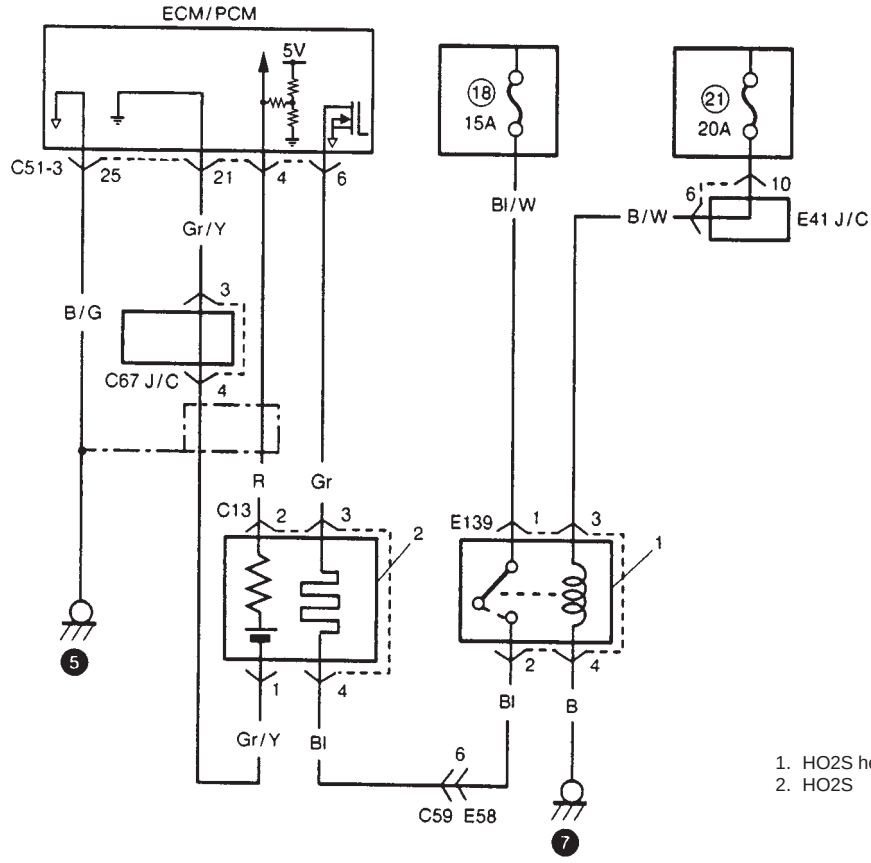
STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	TP Sensor Signal check: (1) Remove ECM (PCM) cover. (2) Start engine and warm up for normal operating temperature then stop engine. (3) With ignition switch ON leaving engine stop, check voltage between C51-3-12 and C51-3-20. Fully close: 0.35 – 0.65 V Fully open: 3.5 – 4.5 V Is check result as specified?	Go to Step 3.	Go to Step 4.
3	Air Intake System inspection: (1) Check air intake system for clog and air inhabit. Is air intake system in good condition?	Substitute a known-good ECM (PCM) and recheck.	Repair or replace.
4	TP Sensor Performance check: (1) Check TP sensor referring to “ENGINE AND EMISSION CONTROL” section. Is check result as specified?	Go to Step 5.	Faulty TP sensor.
5	TP Sensor Reference Voltage check: (1) With ignition switch OFF, disconnect TP sensor coupler (C30). (2) With ignition switch ON, check voltage between C30-3 and ground. Is the voltage 4.5 – 5.5 V?	Go to Step 6.	Faulty “Gr/R” wire. If OK, substitute a known-good ECM (PCM) and recheck.
6	TP Sensor Ground Circuit check: (1) Check continuity between C30-1 and ground. Is continuity in good condition?	Go to Step 7.	Faulty “Gr/Y” wire. If OK, substitute a known-good ECM (PCM) and recheck.
7	TP Sensor Installation check: (1) Check TP sensor installation referring to “ENGINE AND EMISSION CONTROL” section. Is TP sensor installation as specified?	Substitute a known-good ECM (PCM) and recheck.	Adjust TP sensor referring to “ENGINE AND EMISSION CONTROL” section and recheck.

Fig. for STEP 5

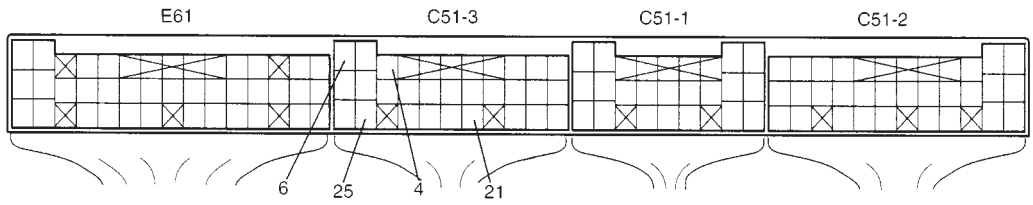


DTC P0130 HO2S (BANK-1 SENSOR-1) CIRCUIT MALFUNCTION

WIRING DIAGRAM



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



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
● Minimum HO2S voltage is 0.4 V or higher. ● Maximum HO2S voltage is higher than 1.2 V or less than 0.6 V.	HO2S HO2S circuit Fuel injector Fuel pressure control system 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 very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

NOTE:
Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTC is not detected: P0135**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed till engine speed is reached 2000 – 3000 r/min.
(5) Keep above vehicle speed for 1 min. (Throttle valve operating is kept constant in this step.)
(6) Stop vehicle and check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S Voltage check: (1) With ignition switch OFF, install scan tool. (2) Operate engine for 60 sec or more with following condition. Engine coolant temp. > 70°C Engine speed > 2000 r/min. (3) While repeating racing engine, check “O2S B1 S1” (HO2S voltage) displayed on scan tool. Is less than 0.4 V voltage displayed?	Intermittent trouble. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 3.
3	HO2S Voltage check: (1) Remove ECM (PCM) cover. (2) Start engine and check voltage between C51-3-4 and C51-3-21 while repeating racing engine. Is the voltage while fuel is cut less than 0.1 V?	Substitute a known-good ECM (PCM) and recheck.	Go to Step 4.
4	HO2S Wire Harness check: (1) Check “R” and “Gr/Y” wire. Are they in good condition?	Go to Step 5.	Repair or replace.
5	Fuel Injector Circuit check: (1) Check fuel injector circuit referring to “TABLE B-2” in this section. Is it in good condition?	Go to Step 6.	Repair or replace.
6	Fuel Injector inspection: (1) Inspect fuel injectors (No.1, 3, 5) referring to “ENGINE AND EMISSION CONTROL” section. Are they in good condition?	Go to Step 7.	Faulty fuel injector(s).
7	Fuel Pressure inspection: (1) Check fuel pressure referring to following “TABLE B-3” in this section. Is fuel pressure within specification?	Replace HO2S and recheck. If DTC P0131 detected, substitute a known-good ECM (PCM) and recheck.	Repair or replace.

DTC P0133 HO2S (BANK-1 SENSOR-1) CIRCUIT SLOW RESPONSE

WIRING DIAGRAM

Refer to DTC P0130.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Hi/Low switch cycle average of HO2S voltage is longer than 5 sec.	HO2S HO2S circuit 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 very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

NOTE:
Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTC is not detected: P0135**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed to 80 – 100 km/h (50 – 60 mph). (engine speed; 2500 – 3000 r/min.)
(5) Keep above vehicle speed for 1 min. (Throttle valve operating is kept constant in this step.)
(6) Stop vehicle and check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Wire Harness check: (1) Check “R” and “Gr/Y” wire. Are they in good condition?	Go to Step 3.	Repair or replace.
3	(1) Replace HO2S (B-1 S-1) and recheck. Is DTC P0133 detected?	Substitute a known-good ECM (PCM) and recheck.	Faulty HO2S (B-1 S-1).

DTC P0134 HO2S (BANK-1 SENSOR-1) NO ACTIVITY DETECTED (DTC No.13)

WIRING DIAGRAM

Refer to DTC P0130.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
HO2S voltage is lower than 0.5 V.	HO2S HO2S circuit Fuel injector Fuel pressure control system 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 very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

NOTE:
Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTCs are not detected: P0100, P0115 and P0135**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature (Run engine for 2 min. or more).
(4) Increase vehicle speed to 65 – 80 km/h (40 – 50 mph).
(5) Keep above vehicle speed for 2 min. (Throttle valve operating is kept constant in this step.)
(6) Stop vehicle and check DTC and pending DTC by using scan tool.

DTC TROUBLE SHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S Voltage check: (1) With ignition switch OFF, install scan tool. (2) Operate engine for 60 sec. or more with following condition. Engine coolant temp. > 70°C Engine speed > 2000 r/min. (3) With above condition, check “O2S B1 S1” (HO2S voltage) displayed on scan tool. Does above voltage deflect over and under 0.5 V?	Intermittent trouble. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 3.

STEP	ACTION	YES	NO
3	HO2S Voltage check: (1) Remove ECM (PCM) cover. (2) Start engine and check voltage between C51-3-4 and C51-3-21 while repeating racing engine. Does the voltage indicate 0.5 V or more even at once?	Poor C51-3-4 and/or C51-3-21 terminal connection. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 4.
4	Wire Harness check: (1) Check "R" and "Gr/Y" wire. Are they in good condition?	Go to Step 5.	Repair or replace.
5	Fuel Injector Circuit check: (1) Check fuel injector circuit referring to "TABLE B-2" in this section. Is it in good condition?	Go to Step 6.	Repair or replace.
6	Fuel Injector inspection: (1) Inspect fuel injectors (No.1, 3, 5) referring to "ENGINE AND EMISSION CONTROL" section. Are they in good condition?	Go to Step 7.	Faulty fuel injector(s).
7	Fuel Pressure inspection: (1) Check fuel pressure referring to following "TABLE B-3" in this section. Is fuel pressure within specification?	Replace HO2S and recheck. If DTC P0134 (DTC No.13) detected, substitute a known-good ECM (PCM) and recheck.	Repair or replace.

DTC P0135 HO2S (BANK-1 SENSOR-1) HEATER CIRCUIT MALFUNCTION

WIRING DIAGRAM

Refer to DTC P0130.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Current of HO2S heater is higher than specified value or lower than specified value.	HO2S HO2S circuit 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 very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

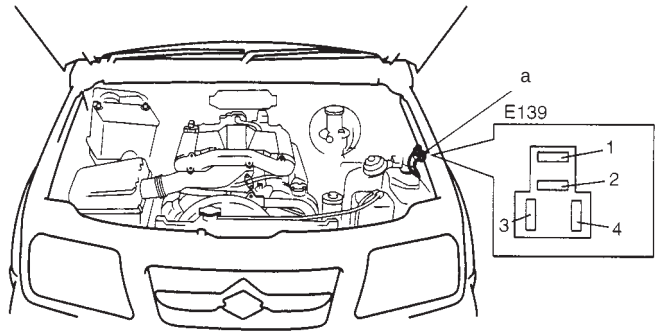
NOTE:
Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed to 56 km/h (35 mph) or more.
(5) Keep above vehicle speed for 5 min. (Throttle valve operating is kept constant in this step.)
(6) Stop vehicle and run engine at idle speed for 1 min.
(7) Check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S Heater check: (1) With ignition switch OFF, disconnect HO2S heater relay. (2) Check resistance between C51-3-6 and E139-2. Is the resistance 3 – 3.6 Ω at 20°C?	Go to Step 3.	Faulty “Bl”, “Gr” wire. Faulty HO2S.
3	HO2S Heater Power Supply check: (1) With ignition switch ON leaving engine OFF, check voltage between E139-3 and ground, E139-1 and ground. Is each voltage 10 – 14 V?	Go to Step 4.	18 and/or 21 fuse blown. If OK, faulty “B/W” wire or “Bl/W” wire.
4	HO2S Heater Control Circuit check: (1) With ignition switch OFF, install HO2S heater relay. (2) With ignition switch ON leaving engine OFF, check voltage between C51-3-6 and ground. Is the voltage 10 – 14 V?	Substitute a known-good ECM (PCM) and recheck.	Faulty HO2S heater relay or “Gr” wire shorted to ground circuit. If OK, substitute a known-good ECM (PCM) and recheck.

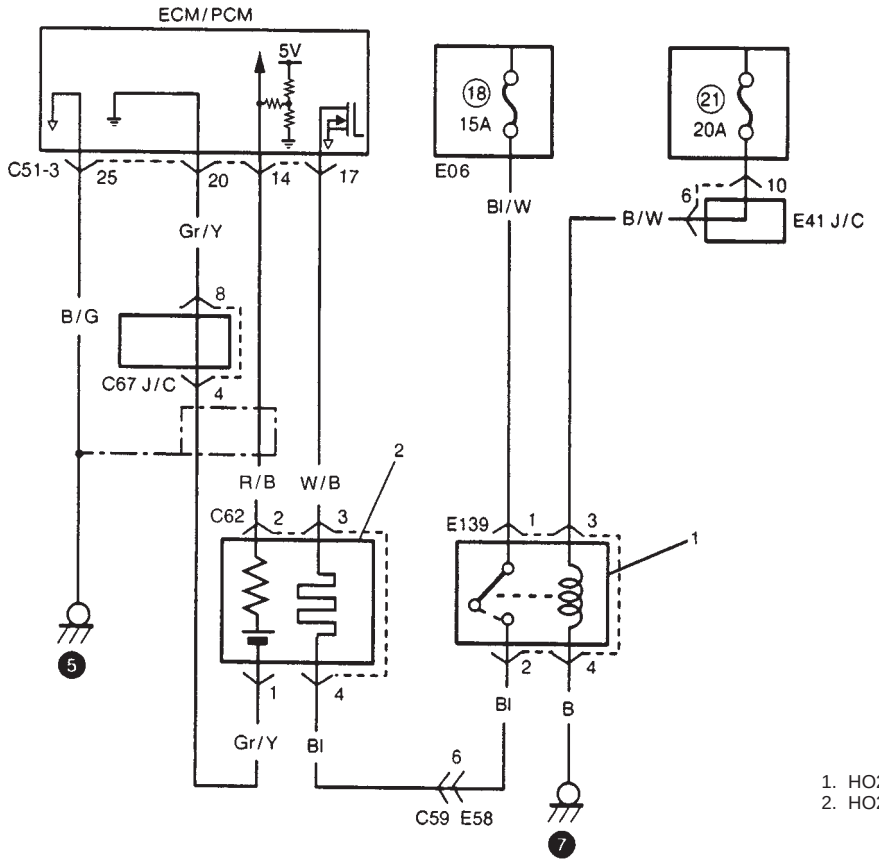
Fig. for STEP 2, 3



a. HO2S heater relay

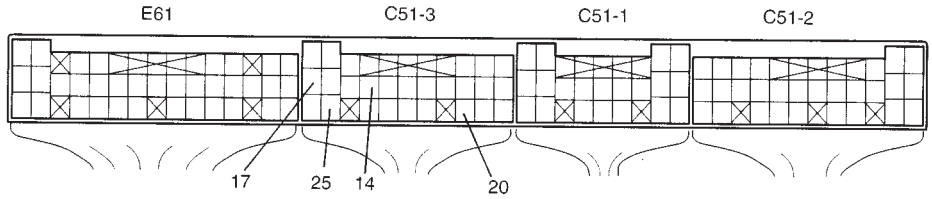
DTC P0136 HO2S (BANK-1 SENSOR-2) CIRCUIT MALFUNCTION

WIRING DIAGRAM



1. HO2S heater relay
2. HO2S

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



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTION CONDITION	TROUBLE AREA
Maximum HO2S voltage is higher than 2.0 V for 20 sec. Maximum HO2S voltage is less than 0.35 V for 8 min. Maximum HO2S voltage is higher than 2.5 V for 4 sec. while fuel is cut.	HO2S HO2S circuit Fuel injector Fuel pressure control system ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTCs are not detected: P0110 (No.23, 25), P0335, P0460, P1450 and P1451**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed to 56 km/h (35 mph) or more.
(5) Keep above vehicle speed for 5 min. (Throttle valve operating is kept constant in this step.)
(6) Increase vehicle speed to 80 – 100 km/h (50 – 60 mph). (engine speed; 2500 – 3000 r/min.)
(7) Keep above vehicle speed for 1 min. (Throttle valve operating is kept constant in this step.)
(8) Release accelerator pedal and with engine brake applied, keep vehicle coasting and then stop vehicle.
(9) Check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S Voltage check: (1) With ignition switch OFF, install scan tool. (2) Start engine and check “O2S B1 S2” (HO2S voltage) displayed on scan tool while repeating racing engine. Does the voltage deflect between 0 – 0.25 V and 0.35 – 2.0 V?	Intermittent trouble. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 3.
3	Wire Harness check: (1) Check “R/B” and “Gr/Y” wire. Are they in good condition?	Go to Step 4.	Repair or replace.
4	Fuel Injector Circuit check: (1) Check fuel injector circuit referring to “TABLE B-2” in this section. Is it in good condition?	Go to Step 5.	Repair or replace.
5	Fuel Injection inspection: (1) Inspect fuel injectors (No.1, 3, 5) referring to “ENGINE AND EMISSION CONTROL” section. Are they in good condition?	Go to Step 6.	Faulty fuel injector(s).
6	Fuel Pressure inspection: (1) Check fuel pressure referring to following “TABLE B-3” in this section. Is fuel pressure within specification?	Replace HO2S and recheck. If DTC P0136 detected, substitute a known-good ECM (PCM) and recheck.	Repair or replace.

DTC P0141 HO2S (BANK-1 SENSOR-2) HEATER CIRCUIT MALFUNCTION

WIRING DIAGRAM

Refer to DTC P0136.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Current of HO2S heater is higher than specified value or lower than specified value.	HO2S HO2S circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

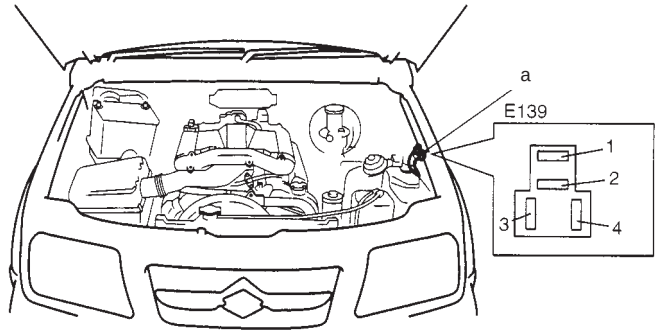
(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed to 56 km/h (35 mph) or more.
(5) Keep above vehicle speed for 5 min. (Throttle valve operating is kept constant in this step.)
(6) Stop vehicle and run engine at idle speed for 1 min.
(7) Check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S Heater check: (1) With ignition switch OFF, disconnect HO2S heater relay. (2) Check resistance between C51-3-17 and E139-2. Is the resistance 5 – 7 Ω at 20°C?	Go to Step 3.	Faulty “Bl”, “W/B” wire. Faulty HO2S.
3	HO2S Heater Power Supply check: (1) With ignition switch ON leaving engine OFF, check voltage between E139-3 and ground, E139-1 and ground Is each voltage 10 – 14 V?	Go to Step 4.	Fuse 18 and/or 21 blown. If OK, faulty “B/W” wire or “Bl/W” wire.

STEP	ACTION	YES	NO
4	HO2S Heater Control Circuit check: (1) With ignition switch OFF, install HO2S heater relay. (2) With ignition switch ON leaving engine OFF, check voltage between C51-3-17 and ground. Is the voltage 10 – 14 V?	Substitute a known-good ECM (PCM) and recheck.	Faulty HO2S heater relay or "W/B" wire shorted to ground circuit. If OK, substitute a known-good ECM (PCM) and recheck.

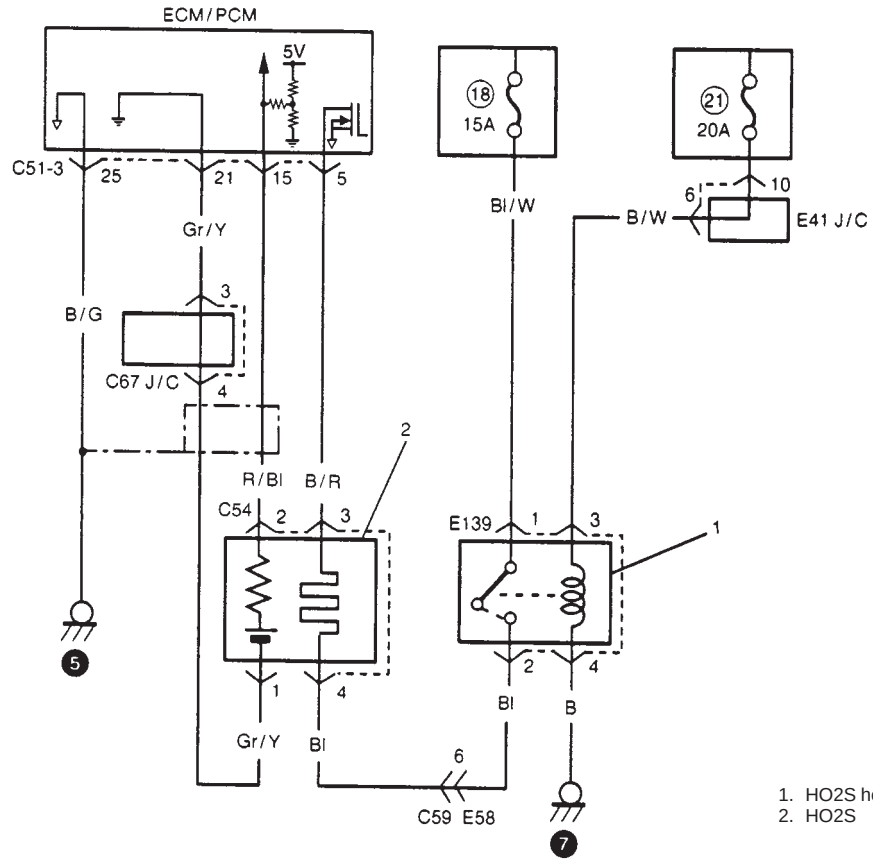
Fig. for STEP 2, 3



a. HO2S heater relay

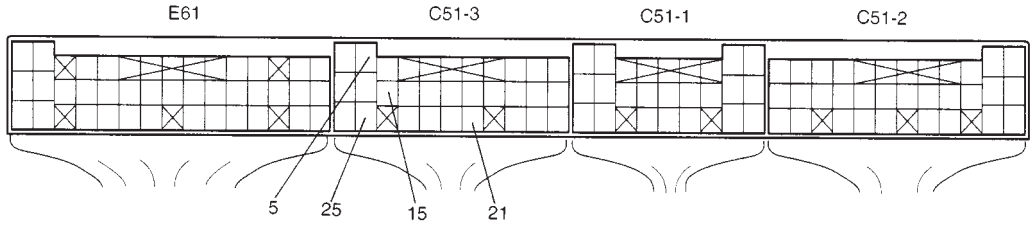
DTC P0150 HO2S (BANK-2 SENSOR-1) CIRCUIT MALFUNCTION

WIRING DIAGRAM



1. HO2S heater relay
2. HO2S

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



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
● Minimum HO2S voltage is 0.4 V or higher. ● Maximum HO2S voltage is higher than 1.2 V or less than 0.6 V.	HO2S HO2S circuit Fuel injector Fuel pressure control system ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTC is not detected: P0135**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed till engine speed is reached 2000 – 3000 r/min.
(5) Keep above vehicle speed for 1 min. (Throttle valve operating is kept constant in this step.)
(6) Stop vehicle and check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S Voltage check: (1) With ignition switch OFF, install scan tool. (2) Operate engine for 60 sec. or more with following condition. Engine coolant temp. > 70°C Engine speed > 2000 r/min. (3) While repeating racing engine, check “O2S B1 S1” (HO2S voltage) displayed on scan tool. Is less than 0.4 V voltage displayed?	Intermittent trouble. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 3.
3	HO2S Voltage check: (1) Remove ECM (PCM) cover. (2) Start engine and check voltage between C51-3-15 and C51-3-21 while repeating racing engine. Is the voltage while fuel is cut less than 0.1 V?	Substitute a known-good ECM (PCM) and recheck.	Go to Step 4.
4	HO2S Wire Harness check: (1) Check “R/Bl” and “Gr/Y” wire. Are they in good condition?	Go to Step 5.	Repair or replace.
5	Fuel Injector Circuit check: (1) Check fuel injector circuit referring to “TABLE B-2” in this section. Is it in good condition?	Go to Step 6.	Repair or replace.
6	Fuel Injector inspection: (1) Inspect fuel injectors (No.2, 4, 6) referring to “ENGINE AND EMISSION CONTROL” section. Are they in good condition?	Go to Step 7.	Faulty fuel injector(s).
7	Fuel Pressure inspection: (1) Check fuel pressure referring to following “TABLE B-3” in this section. Is fuel pressure within specification?	Replace HO2S and recheck. If DTC P0151 detected, substitute a known good ECM (PCM) and recheck.	Repair or replace.

DTC P0153 HO2S (BANK-2 SENSOR-1) CIRCUIT SLOW RESPONSE

WIRING DIAGRAM

Refer to DTC P0150 (DTC No.26).

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Hi/Low switch cycle average of HO2S voltage is longer than 5 sec.	HO2S HO2S circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTC is not detected: P0135**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed to 80 – 100 km/h (50 – 60 mph). (engine speed; 2500 – 3000 r/min.)
(5) Keep above vehicle speed for 1 min. (Throttle valve operating is kept constant in this step.)
(6) Stop vehicle and check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Wire Harness check: (1) Check “R/Bl” and “Gr/Y” wire. Are they in good condition?	Go to Step 3.	Repair or replace.
3	(1) Replace HO2S (B-2 S-1) and recheck. Is DTC P0153 detected?	Substitute a known-good ECM (PCM) and recheck.	Faulty HO2S (B-2 S-1).

DTC P0154 HO2S (BANK-2 SENSOR-1) NO ACTIVITY DETECTED (DTC No.26)

WIRING DIAGRAM

Refer to DTC P0150.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
HO2S voltage is lower than 0.5 V.	HO2S HO2S circuit Fuel injector Fuel pressure control system ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTCs are not detected: P0100 (No.33, 34), P0115 (No.14, 15) and P0135**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature (Run engine for 2 min. or more).
(4) Increase vehicle speed to 65 – 80 km/h (40 – 50 mph).
(5) Keep above vehicle speed for 2 min. (Throttle valve operating is kept constant in this step.)
(6) Stop vehicle and check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S Voltage check: (1) With ignition switch OFF, install scan tool. (2) Operate engine for 60 sec. or more with following condition. Engine coolant temp. > 70°C Engine speed > 2000 r/min. (3) With above condition, check “O2S B2 S1” (HO2S voltage) displayed on scan tool. Does above voltage deflect over and under 0.5 V?	Intermittent trouble. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 3.

STEP	ACTION	YES	NO
3	HO2S Voltage check: (1) Remove ECM (PCM) cover. (2) Start engine and check voltage between C51-3-15 and C51-3-21 while repeating racing engine. Does the voltage indicate 0.5 V or more even at once?	Poor C51-3-15 and/or C51-3- 21 terminal connection. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 4.
4	Wire Harness check: (1) Check “R/Bl” and “Gr/Y” wire. Are they in good condition?	Go to Step 5.	Repair or replace.
5	Fuel Injector Circuit check: (1) Check fuel injector circuit referring to “TABLE B-2” in this section. Is it in good condition?	Go to Step 6.	Repair or replace.
6	Fuel Injector inspection: (1) Inspect fuel injectors (No.2, 4, 6) referring to “ENGINE AND EMISSION CONTROL” section. Are they in good condition?	Go to Step 7.	Faulty fuel injector(s).
7	Fuel Pressure inspection: (1) Check fuel pressure referring to following “TABLE B-3” in this section. Is fuel pressure within specification?	Replace HO2S and recheck. If DTC P0154 (DTC No.26) detected, substitute a known-good ECM (PCM) and recheck.	Repair or replace.

DTC P0155 HO2S (BANK-2 SENSOR-1) HEATER CIRCUIT MALFUNCTION

WIRING DIAGRAM

Refer to DTC P0150.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Current of HO2S heater is higher than specified value or lower than specified value.	HO2S HO2S circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

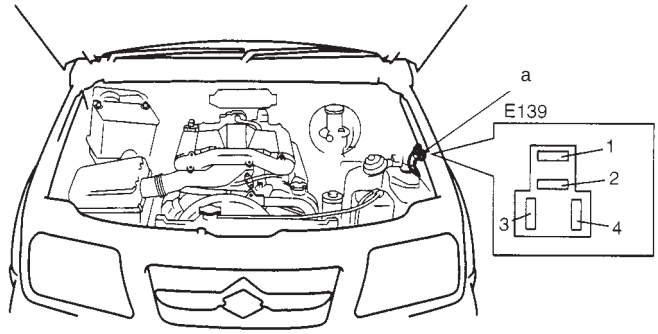
- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed to 56 km/h (35 mph) or more.
(5) Keep above vehicle speed for 5 min. (Throttle valve operating is kept constant in this step.)
(6) Stop vehicle and run engine at idle speed for 1 min.
(7) Check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	GO to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S Heater check: (1) With ignition switch OFF, disconnect HO2S heater relay. (2) Check resistance between C51-3-5 and E139-2. Is the resistance 3 – 3.6 Ω at 20°C?	Go to Step 3.	Faulty “Bl”, “B/R” wire. Faulty HO2S.
3	HO2S Heater Power Supply check: (1) With ignition switch ON leaving engine OFF, check voltage between E139-3 and ground, E139-1 and ground. Is each voltage 10 – 14 V?	Go to Step 4.	18 and/or 21 fuse blown. If OK, faulty “B/W” wire or “Bl/W” wire.
4	HO2S Heater Control Circuit check: (1) With ignition switch OFF, install HO2S heater relay. (2) With ignition switch ON leaving engine OFF, check voltage between C51-3-5 and ground. Is the voltage 10 – 14 V?	Substitute a known-good ECM (PCM) and recheck.	Faulty HO2S heater relay or “B/R” wire shorted to ground circuit. If OK, substitute a known-good ECM (PCM) and recheck.

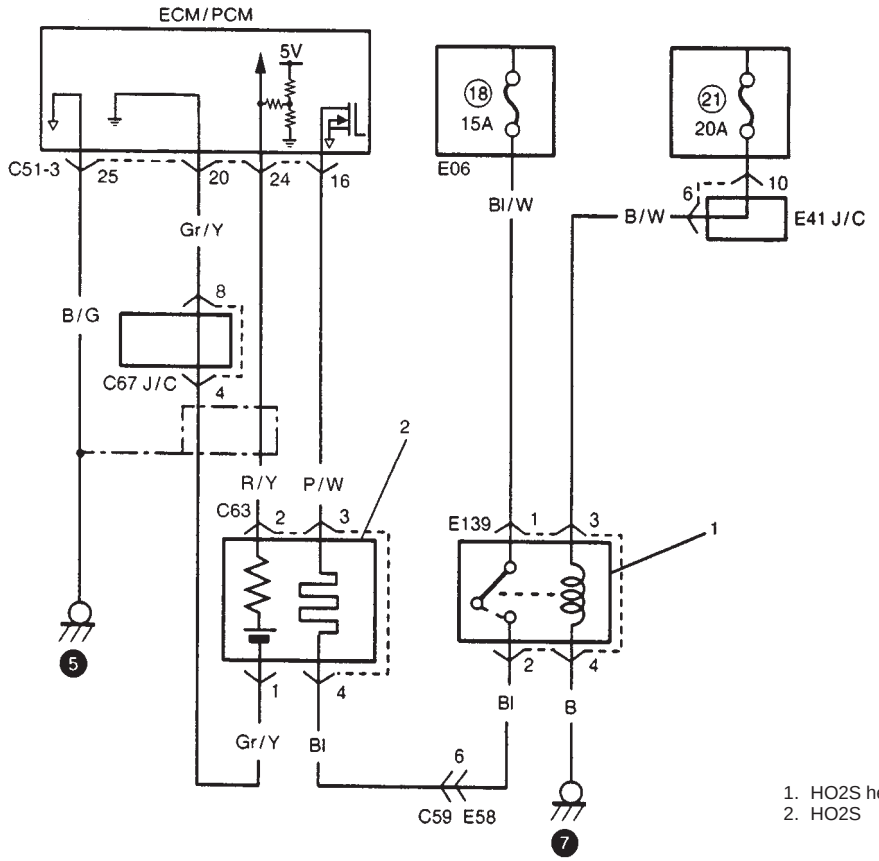
Fig. for STEP 2, 3



a. HO2S heater relay

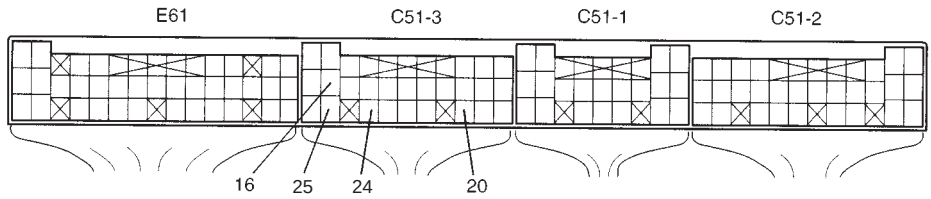
DTC P0156 HO2S (BANK-2 SENSOR-2) CIRCUIT MALFUNCTION

WIRING DIAGRAM



1. HO2S heater relay
2. HO2S

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



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTION CONDITION	TROUBLE AREA
Maximum HO2S voltage is higher than 2.0 V for 20 sec. Maximum HO2S voltage is less than 0.35 V for 8 min. Minimum HO2S voltage is higher than 0.25 V for 4 sec. while fuel is cut.	HO2S HO2S circuit Fuel injector Fuel pressure control system ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTCs are not detected: P0110 (No.23, 25), P0335, P0460, P01450 and P01451**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed to 56 km/h (35 mph) or more.
(5) Keep above vehicle speed for 5 min. (Throttle valve operating is kept constant in this step.)
(6) Increase vehicle speed to 80 – 100 km/h (50 – 60 mph). (engine speed; 2500 – 3000 r/min.)
(7) Keep above vehicle speed for 1 min. (Throttle valve operating is kept constant in this step.)
(8) Release accelerator pedal and with engine brake applied, keep vehicle coasting and then stop vehicle.
(9) Check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S Voltage check: (1) With ignition switch OFF, install scan tool. (2) Start engine and check “O2S B2 S2” (HO2S voltage) displayed on scan tool while repeating racing engine. Does the voltage deflect between 0 – 0.25 V and 0.35 – 2.0 V?	Intermittent trouble. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 3.
3	Wire Harness check: (1) Check “R/Y” and “Gr/Y” wire. Are they in good condition?	Go to Step 4.	Repair or replace.
4	Fuel Injector Circuit check: (1) Check fuel injector circuit referring to “TABLE B-2” in this section. Is it in good condition?	Go to Step 5.	Repair or replace.
5	Fuel Injector inspection: (1) Inspect fuel injectors (No.2, 4, 6) referring to “ENGINE AND EMISSION CONTROL” section. Are they in good condition?	Go to Step 6.	Faulty fuel injector(s).
6	Fuel Pressure inspection: (1) Check fuel pressure referring to following “TABLE B-3” in this section. Is fuel pressure within specification?	Replace HO2S and recheck. If DTC P0156 detected, substitute a known-good ECM (PCM) and recheck.	Repair or replace.

DTC P0161 HO2S (BANK-2 SENSOR-2) HEATER CIRCUIT MALFUNCTION

WIRING DIAGRAM

Refer to DTC P0156.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Current of HO2S heater is higher than specified value or lower than specified value.	HO2S HO2S circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

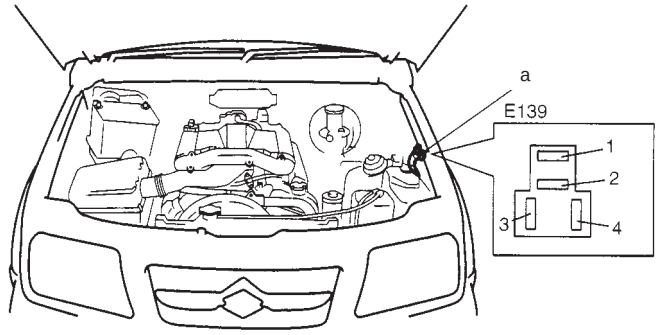
(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed to 56 km/h (35 mph) or more.
(5) Keep above vehicle speed for 5 min. (Throttle valve operating is kept constant in this step.)
(6) Stop vehicle and run engine at idle speed for 1 min.
(7) Check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	HO2S Heater check: (1) With ignition switch OFF, disconnect HO2S heater relay. (2) Check resistance between C51-3-16 and E139-2. Is the resistance 5 – 7 Ω at 20°C?	Go to Step 3.	Faulty “Bl”, “P/W” wire. Faulty HO2S.
3	HO2S Heater Power Supply check: (1) With ignition switch ON leaving engine OFF, check voltage between E139-3 and ground, E139-1 and ground. Is each voltage 10 – 14 V?	Go to Step 4.	Fuse 18 and/or 21 blown. If OK, faulty “B/W” wire or “Bl/W” wire.

STEP	ACTION	YES	NO
4	HO2S Heater Control Circuit check: (1) With ignition switch OFF, install HO2S heater relay. (2) With ignition switch ON leaving engine OFF, check voltage between C51-3-16 and ground. Is the voltage 10 – 14 V?	Substitute a known-good ECM (PCM) and recheck.	Faulty HO2S heater relay or “P/W” wire shorted to ground circuit. If OK, substitute a known-good ECM (PCM) and recheck.

Fig. for STEP 2, 3



a. HO2S heater relay

DTC P0171 FUEL SYSTEM TOO LEAN (BANK-1)
DTC P0172 FUEL SYSTEM TOO RICH (BANK-1)

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
P0171 Total fuel trim of BANK-1 is higher than 33 %. **P0172** Total fuel trim of BANK-1 is lower than –33 %.	Vacuum leaks Exhaust gas leakage Fuel pressure out of specification Fuel injector malfunction Heated oxygen sensor malfunction MAF sensor malfunction ECT sensor malfunction Fuel level sensor malfunction

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using the DTC CONFIRMATION PROCEDURE.

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTCs are not detected: P0130, P0133 and P0134 (No.13)**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Operate vehicle within freeze frame data condition as noted for 5 min.
(5) Stop vehicle and check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

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 “P0171” and “P0172”?	Go to applicable DTC FLOW TABLE.	Go to Step 3.
3	Check intake system and exhaust system for leakage. Are intake system and exhaust system in good condition?	Go to Step 4.	Repair or replace.
4	Check fuel pressure referring to “TABLE B-3” in this section. Is check result satisfactory?	Go to Step 5.	Repair or replace.
5	Check fuel injectors (No.1, 3, 5) referring to “ENGINE AND EMISSION CONTROL” section. Is check result satisfactory?	Go to Step 6.	Faulty injector(s).

STEP	ACTION	YES	NO
6	Check fuel injector circuit referring to “TABLE B-3” in this section. Is it in good condition?	Go to Step 7.	Repair or replace.
7	Check fuel level sensor referring to “ENGINE AND EMISSION CONTROL” section. Is check result satisfactory?	Go to Step 8.	Faulty fuel level sensor or its circuit.
8	Check MAF sensor referring to “ENGINE AND EMISSION CONTROL” section. Is check result satisfactory?	Go to Step 9.	Faulty MAF sensor or its circuit.
9	Check ECT sensor referring to “ENGINE AND EMISSION CONTROL” section. Is check result satisfactory?	Go to Step 10.	Faulty ECT sensor.
10	Check HO2S referring to Step 2 of DTC P0134 (DTC No.13) Diag. Flow Table. Is check result satisfactory?	Substitute a known-good ECM (PCM) and recheck.	Faulty HO2S.

DTC P0174 FUEL SYSTEM TOO LEAN (BANK-2)
DTC P0175 FUEL SYSTEM TOO RICH (BANK-2)

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
P0174 Total fuel trim of BANK-2 is higher than 33 %. **P0175** Total fuel trim of BANK-2 is lower than –33 %.	Vacuum leaks Exhaust gas leakage Fuel pressure out of specification Fuel injector malfunction Heated oxygen sensor malfunction MAF sensor malfunction ECT sensor malfunction Fuel level sensor malfunction

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using the DTC CONFIRMATION PROCEDURE.

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTCs are not detected: P0130, P0133 and P0134 (No.13)**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Operate vehicle within freeze frame data condition as noted for 5 min.
(5) Stop vehicle and check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

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 “P0174” and “P0175”?	Go to applicable DTC FLOW TABLE.	Go to Step 3.
3	Check intake system and exhaust system for leakage. Are intake system and exhaust system in good condition?	Go to Step 4.	Repair or replace.
4	Check fuel pressure referring to “TABLE B-3” in this section. Is check result satisfactory?	Go to Step 5.	Repair or replace.
5	Check fuel injectors (No. 2, 4, 6) referring to “ENGINE AND EMISSION CONTROL” section. Is check result satisfactory?	Go to Step 6.	Faulty injector(s).

STEP	ACTION	YES	NO
6	Check fuel injector circuit referring to “TABLE B-3” in this section. Is it in good condition?	Go to Step 7.	Repair or replace.
7	Check fuel level sensor referring to “ENGINE AND EMISSION CONTROL” section. Is check result satisfactory?	Go to Step 8.	Faulty fuel level sensor or its circuit.
8	Check MAF sensor referring to “ENGINE AND EMISSION CONTROL” section. Is check result satisfactory?	Go to Step 9.	Faulty MAF sensor or its circuit.
9	Check ECT sensor referring to “ENGINE AND EMISSION CONTROL” section. Is check result satisfactory?	Go to Step 10.	Faulty ECT sensor.
10	Check HO2S referring to Step 2 of DTC P0154 (DTC No.26) Diag. Flow Table. Is check result satisfactory?	Substitute a known-good ECM (PCM) and recheck.	Faulty HO2S.

DTC P0300 RANDOM MISFIRE DETECTED
DTC P0301 CYLINDER 1 MISFIRE DETECTED
DTC P0302 CYLINDER 2 MISFIRE DETECTED
DTC P0303 CYLINDER 3 MISFIRE DETECTED
DTC P0304 CYLINDER 4 MISFIRE DETECTED
DTC P0305 CYLINDER 5 MISFIRE DETECTED
DTC P0306 CYLINDER 6 MISFIRE DETECTED

SYSTEM DESCRIPTION

ECM (PCM) measure the angle of the crankshaft based on the pulse signal from the CKP sensor and CMP sensor for each cylinder. If it detects a large change in the angle speed of the crankshaft, it concludes occurrence of a misfire. When the number of misfire is counted by ECM (PCM) beyond the DTC detecting condition, it determine the cylinder where the misfire occurred and output it as DTC.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
P0300 Misfire, which causes catalyst to overheat during 200 engine revolutions, is detected at 2 or more cylinders. (MIL flashes as long as this misfire occurs continuously.) Misfire, which affects exhaust emission adversely during 1000 engine revolution, is detected at 2 or more cylinders.	Ignition system Fuel injector and its circuit Fuel pressure EGR system Fuel level sensor Abnormal air drawn in Engine compression Valve lash adjuster Valve timing
P0301, P0302, P0303, P0304, P0305, P0306 Misfire, which causes catalyst to overheat during 200 engine revolutions, is detected at 1 cylinder. (MIL flashes as long as this misfire occurs continuously.) Misfire, which affects exhaust emission adversely during 1000 engine revolution, is detected at 1 cylinder.	

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14 °C and 70 °C (6.8 °F and 158 °F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTCs are not detected: P0335 and P0340 (No.42)**

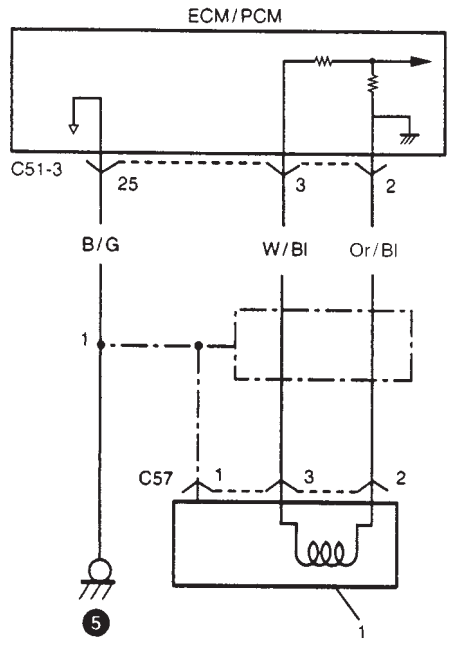
(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Operate vehicle within freeze frame data condition as noted for 1 min.
(4) Stop vehicle and check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Ignition System inspection: (1) Check spark plug and ignition spark of cylinder where misfire occurs, referring to “IGNITION SYSTEM” section. Is it in good condition?	Go to Step 3.	Faulty ignition coil, wire harness or spark plug. If OK, substitute a known-good ECM (PCM) and recheck.
3	Fuel Injector Circuit check: (1) Check fuel injector circuit referring to “TABLE B-2” in this section. Is it in good condition?	Go to Step 4.	Repair or replace.
4	Fuel Injector Operation check: (1) Using sound scope, check each injector operating sound at engine cranking or idling. Do all injectors make operating sound?	Go to Step 5.	Check injector not making operating sound. If OK, substitute a known-good ECM (PCM) and recheck.
5	Fuel Pressure inspection: (1) Check fuel pressure referring to “TABLE B-3” in this section. Is check result satisfactory?	Go to Step 6.	Repair or replace.
6	Fuel Injector inspection: (1) Check fuel injector(s) referring to “ENGINE AND EMISSION CONTROL SYSTEM” section. Is check result satisfactory?	Go to Step 7.	Replace.
7	Ignition Timing inspection: (1) Check ignition timing referring to “IGNITION SYSTEM” section. Is check result satisfactory?	Go to Step 8.	Adjust.
8	EGR System inspection: (1) Check EGR system referring to “ENGINE AND EMISSION CONTROL SYSTEM” section. Is check result satisfactory?	Go to Step 9.	Repair or replace.
9	Fuel Level Sensor inspection: (1) Check fuel level sensor referring to “ENGINE AND EMISSION CONTROL SYSTEM” section. Is check result satisfactory?	Go to Step 10.	Repair or replace.
10	Engine Mechanical Systems check: (1) Check engine mechanical systems referring to “ENGINE MECHANICAL” section. Is check result satisfactory?	Substitute a known-good ECM (PCM) and recheck.	Repair or replace.

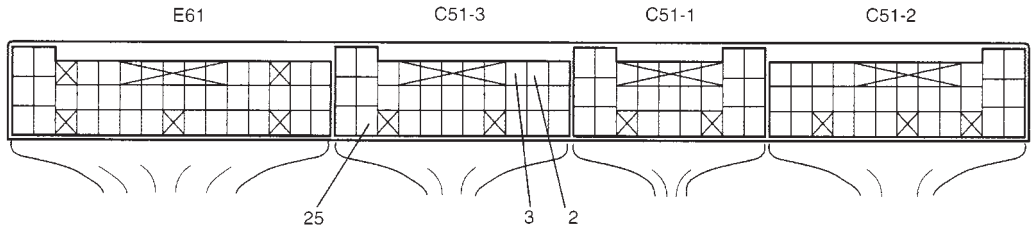
DTC P0335 CRANKSHAFT POSITION SENSOR CIRCUIT MALFUNCTION

WIRING DIAGRAM



1. CKP sensor

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



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
CKP sensor signal is not input for 3 sec. after engine start.	CKP sensor CKP sensor circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

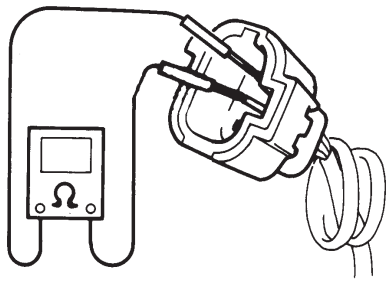
- **Intake air temperature: between –14 °C and 70 °C (6.8 °F and 158 °F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTC is not detected: P0340 (No.42)**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and run it for 10 sec.
(4) Check DTC by using scan tool.

DTC TROUBLESHOOTING

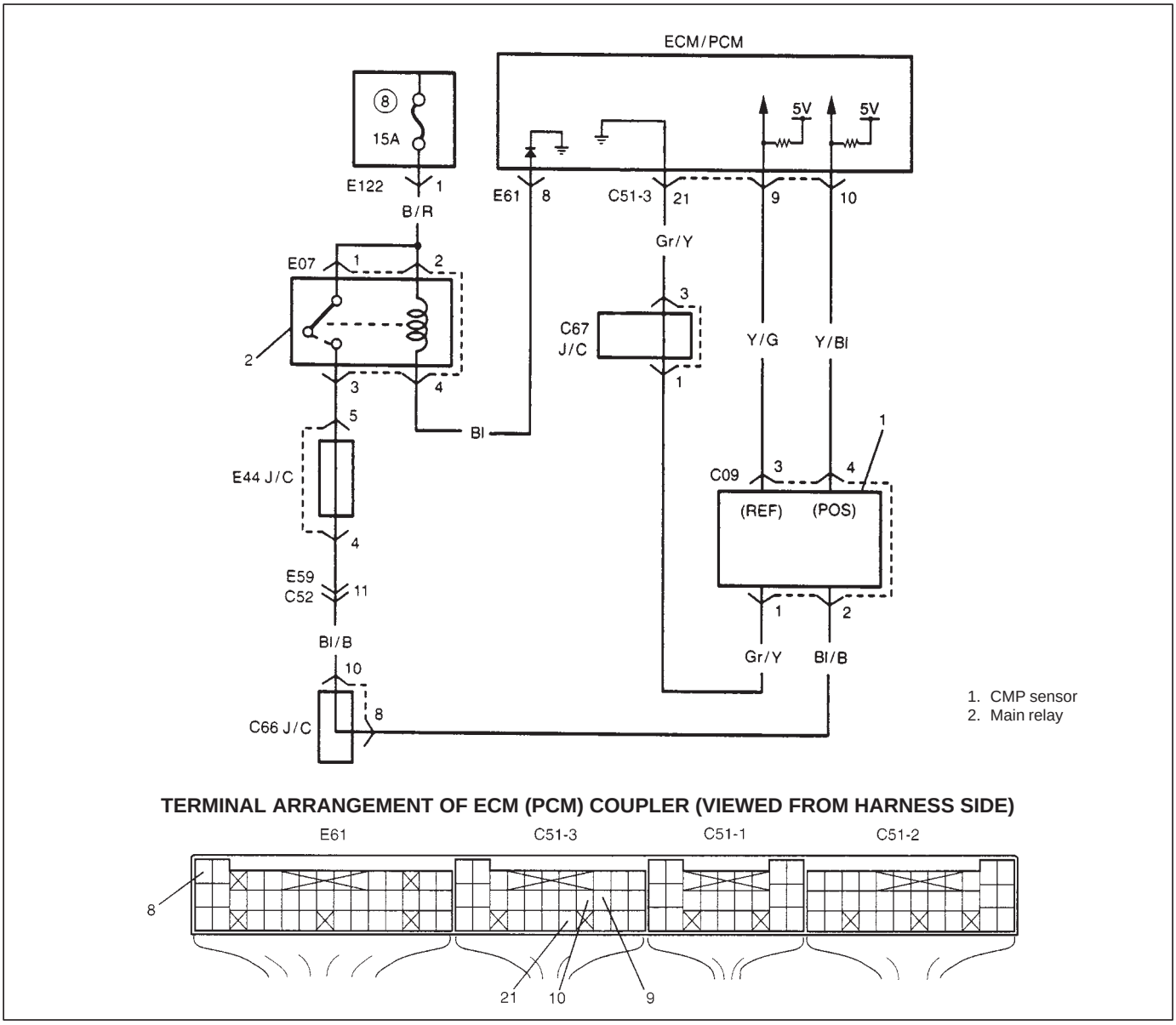
STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	CKP Sensor and Its Circuit Resistance check: (1) With ignition switch OFF, disconnect ECM (PCM) coupler (C51-3). (2) Check resistance between C51-3-2 and C51-3-3. Is the resistance 484 – 656 Ω?	Go to Step 4.	Go to Step 3.
3	CKP Sensor Resistance check: (1) With ignition switch OFF, disconnect CKP sensor coupler. (2) Check resistance between “2” and “3” terminal of CKP sensor coupler. Is the resistance 485 – 655 Ω?	Faulty “W/Bl” wire or “Or/B” wire.	Faulty CKP sensor.
4	CKP Sensor Visual inspection: (1) Check CKP sensor installation and teeth of crankshaft referring to “ENGINE MECHANICAL” section. Are they OK?	Poor C51-3-2 and/or C51-3-3 terminal of ECM (PCM) coupler connection. “W/Bl” wire or “Or/Bl” wire shorted to other circuit. If OK, substitute a known-good ECM (PCM) and recheck.	Replace or reinstall.

Fig. for STEP 3



DTC P0340 CAMSHAFT POSITION SENSOR CIRCUIT MALFUNCTION (DTC No.42)

WIRING DIAGRAM



SYSTEM DESCRIPTION

CMP sensor detects REF signal and POS signal.

- **REF signal:** 6 pulses/1 revolution of camshaft. Each of REF signals has different wavelength. Based on REF signal, ECM (PCM) judges which cylinder is at TDC.
- **POS signal:** 360 pulses/1 revolution of camshaft. Each of POS signals has equivalent wavelength. Based on POS signal, ECM (PCM) judges the wavelength of REF signals, engine speed and piston position.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Engine start signal is input but CMP sensor signal is not input for 5 sec. CMP sensor signal is input less than 10 while 2 CKP sensor signal is input.	CMP sensor CMP sensor circuit Engine start signal circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

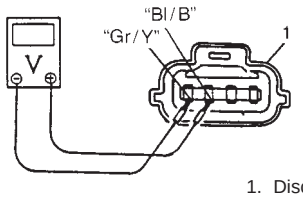
- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTC is not detected: P0335**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Crank engine for 8 sec.
(4) Check DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Is engine cranked?	Go to Step 3.	Go to “CRANKING SYSTEM” section.
3	Engine Start Signal check: (1) Check engine start signal circuit referring to “DTC P1500” in this section. Is the result satisfactory?	Go to Step 4.	Repair or replace.
4	CMP Sensor Power Supply Voltage check: (1) With ignition switch OFF, disconnect CMP sensor coupler (1). (2) With ignition switch ON, check voltage between C09-2 and C09-1 terminal. Is the voltage 10 – 14 V?	Go to Step 5.	Faulty “Bl/B” wire and/or “Gr/Y” wire.
5	CMP Sensor (REF) Signal check: (1) With ignition switch OFF, connect CMP sensor coupler (1). (2) Disconnect couplers from ignition coil assembly and fuel injectors. (3) With ignition switch ON and crankshaft turned slowly, check voltage between C51-3-10 and C51-3-21. Does voltmeter indicator deflect between 0 – 1 V and 4 – 6 V 6 times while crankshaft turned two revolutions?	Go to Step 6.	Faulty “Y/Bl” wire or CMP sensor. If OK, substitute a known-good ECM (PCM) and recheck.
6	CMP Sensor (POS) Signal check: (1) With ignition switch ON and crankshaft turned slowly, check voltage between C51-3-9 and C51-3-21. Does voltmeter indicator deflect between 0 – 1 V and 4 – 6 V?	Poor C51-3-9 and/or C51-3-10 terminal of ECM (PCM) coupler connection. If OK, substitute a known-good ECM (PCM) and recheck.	Faulty “Y/G” wire or CMP sensor. If OK, substitute a known-good ECM (PCM) and recheck.

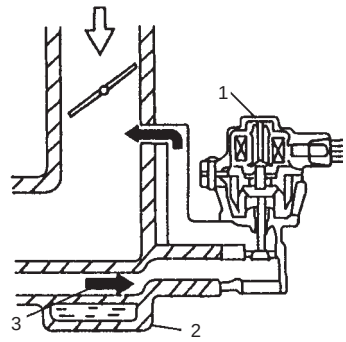
Fig. for STEP 4



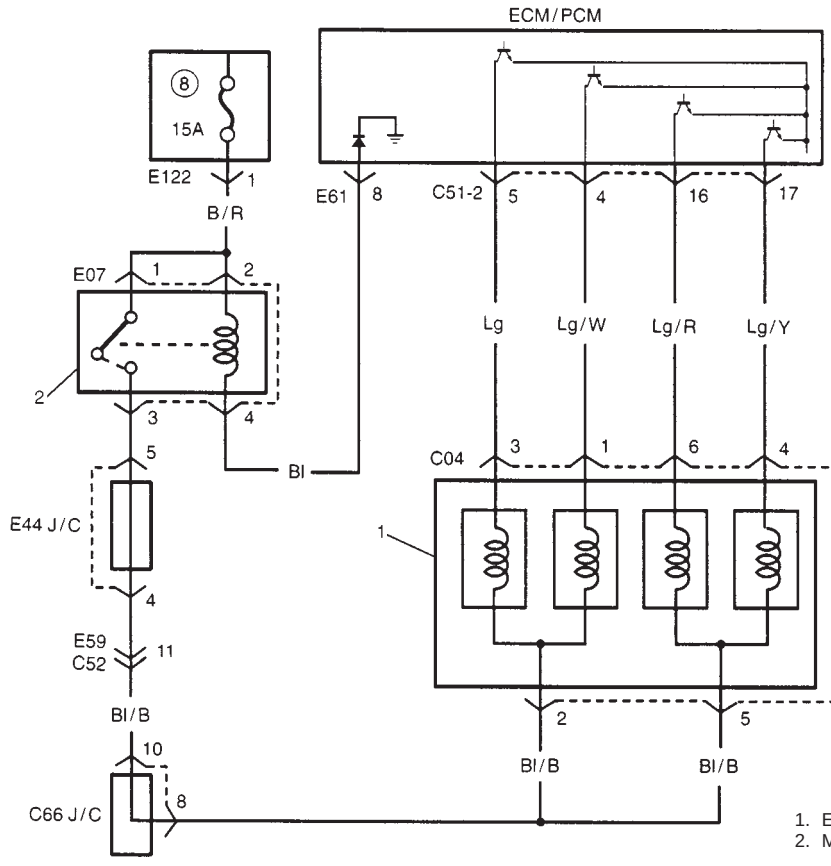
1. Disconnected CMP sensor coupler
2. "Bl / B" wire terminal
3. "Gr / Y" wire terminal

DTC P0400 EXHAUST GAS RECIRCULATION FLOW MALFUNCTION (DTC No.51)

SYSTEM/WIRING DIAGRAM

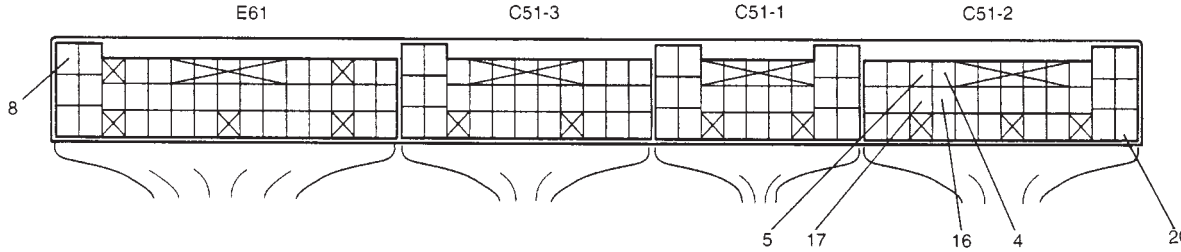


1. EGR valve
2. Intake manifold
3. Exhaust gas



1. EGR valve (stepper motor)
2. Main relay

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



SYSTEM DESCRIPTION

EGR system consists of EGR valve and its passage. ECM (PCM) judges EGR valve opening based on following items. (engine speed, engine load, engine coolant temperature, intake air temperature and vehicle speed)
If EGR system is in good condition, intake manifold absolute pressure is varied within specified value as soon as ECM (PCM) opens EGR valve.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
The difference of intake manifold absolute pressure before and after EGR valve is opened is out of specification.	EGR valve EGR circuit EGR system MAP sensor ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14°C and 70°C (6.8°F and 158°F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTC is not detected: P1408**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed to 50 – 65 km/h (30 – 40 mph) (engine speed; 2000 – 3000 r/min.).
(5) Keep above vehicle speed for 3 min. (Throttle valve operating is kept constant in this step.)
(6) Stop vehicle and check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Do you have SUZUKI scan tool?	Go to Step 3.	Go to Step 4.
3	EGR Valve Operation check: (1) With ignition switch OFF, install SUZUKI scan tool. (2) Check EGR system referring to “ENGINE AND EMISSION CONTROL” section. Is it in good condition?	Intermittent trouble. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 4.
4	EGR Valve Power Supply Circuit check: (1) With ignition switch OFF, disconnect EGR valve coupler (1). (2) With ignition switch ON, check voltage between C04-2 (b) and ground, C04-5 (e) and ground. Is each voltage 10 – 14 V?	Go to Step 5.	Faulty “BI/B” wire.

STEP	ACTION	YES	NO
5	EGR Valve Stepper Motor Coil Circuit check: (1) With ignition switch OFF, connect EGR coupler and disconnect ECM (PCM) couplers. (2) Check resistance between C51-2-20 and C51-2-4, C51-2-5, C51-2-16, C51-2-17. Is each resistance 20 – 24 Ω?	Stuck or faulty EGR valve. Clogged EGR gas passage. MAP sensor malfunction. If OK, substitute a known-good ECM (PCM) and recheck.	Faulty “Lg”, “Lg/W”, “Lg/R”, “Lg/Y” wire or EGR valve.

Fig. for STEP 4

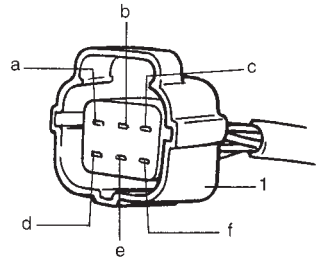
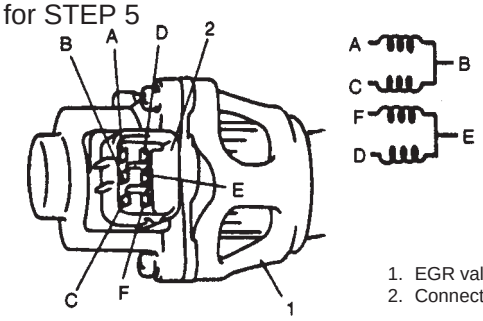


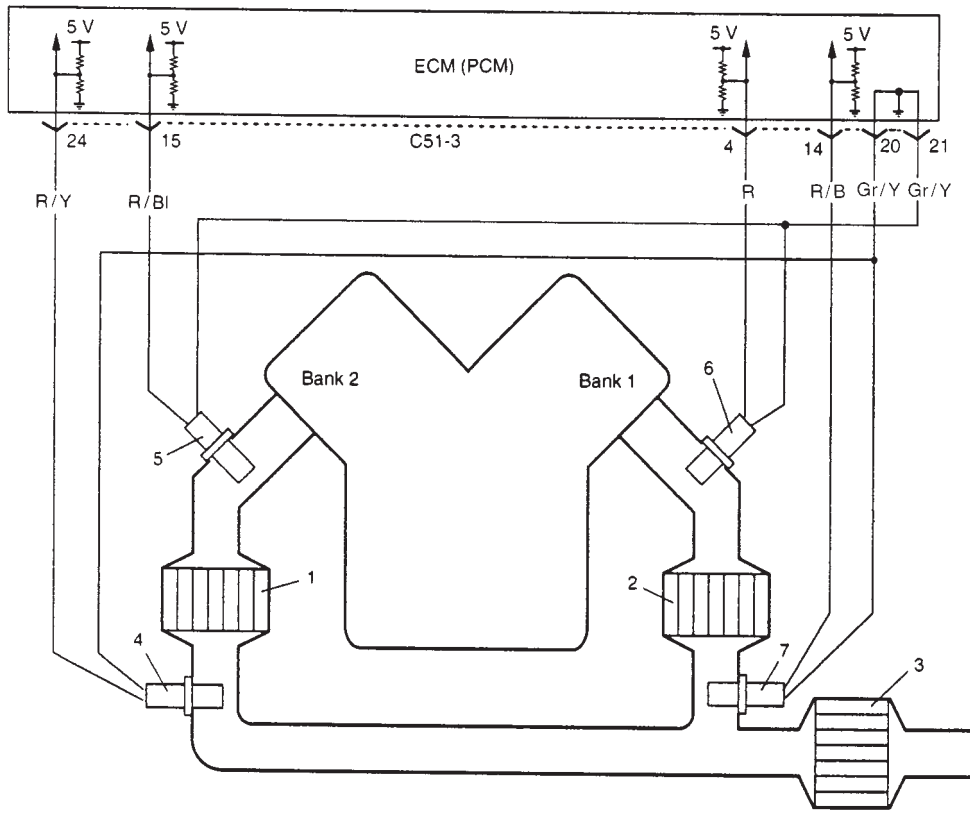
Fig. for STEP 5



1. EGR valve
2. Connector

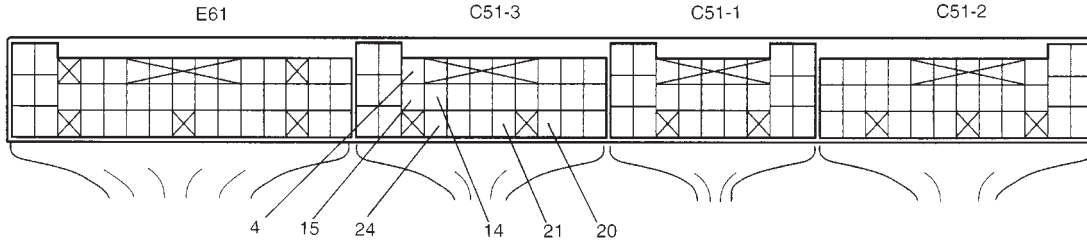
DTC P0420 CATALYST SYSTEM (BANK-1) EFFICIENCY BELOW THRESHOLD
DTC P0430 CATALYST SYSTEM (BANK-2) EFFICIENCY BELOW THRESHOLD

SYSTEM/WIRING DIAGRAM



1. Warm up TWC converter (Bank 2)
2. Warm up TWC converter (Bank 1)
3. TWC converter
4. HO2S (Bank 2, Sensor 2)
5. HO2S (Bank 2, Sensor 1)
6. HO2S (Bank 1, Sensor 1)
7. HO2S (Bank 1, Sensor 2)

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



SYSTEM DESCRIPTION

Exhaust oxygen concentration at the upper part and the lower part of TWC is detected from HO2S-1 and HO2S-2 respectively and accordingly ECM (PCM) controls the closed loop which then controls the fuel injection volume. While the above control is going on and if TWC is in good condition, the output voltage of HO2S-2 is maintained at specified level. As TWC is in becomes deteriorated, even when the above control is going on, the exhaust gas which has passed TWC then passes HO2S-2 at the exhaust oxygen concentration similar to that of the upper part of TWC without being oxygenated or converted. Thus, waveforms of HO2S-1 and HO2S-2 output voltage become alike. ECM (PCM) judges deterioration of TWC by comparing waveforms of HO2S-1 and HO2S-2.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Output waveform of HO2S (S-2) becomes similar to that of HO2S (S-1).	TWC converter Exhaust system HO2S (SENSOR 2) HO2S (SENSOR 2) circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14 °C and 70 °C (6.8 °F and 158 °F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**
- **Following DTCs are not detected: P0100 (No.33, 34), P0110 (No.23, 25), P0115 (No.14, 15), P0130, P0133, P0134 (No.13), P0135, P0136, P0141, P0335, P0460, P0500 (No.24), P1450 and P1451**

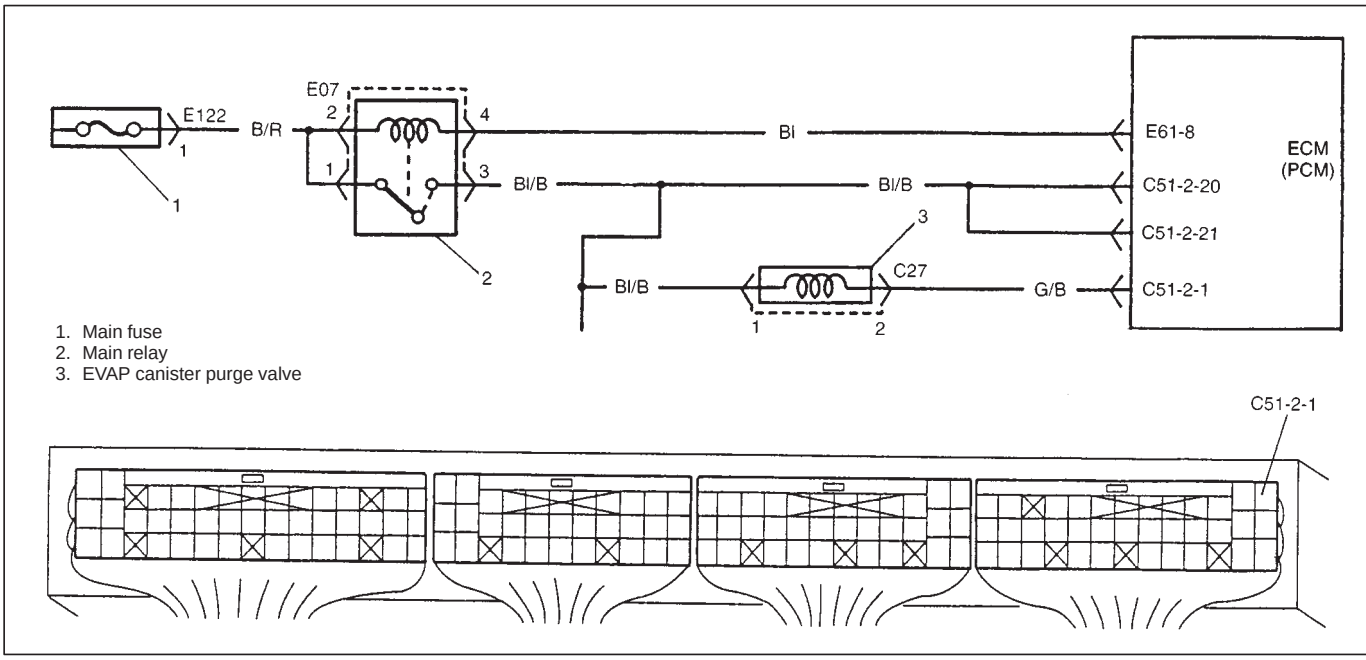
(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed to 56 km/h (35 mph) or more.
(5) Keep above vehicle speed for 5 min. (Throttle valve operating is kept constant in this step.)
(6) Increase vehicle speed to 80 – 100 km/h (50 – 60 mph). (engine speed; 2500 – 3000 r/min.)
(7) Keep above vehicle speed for 1 min. (Throttle valve operating is kept constant in this step.)
(8) Stop vehicle and check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Exhaust System Visual inspection: (1) Check exhaust system for leaks, damage and loose. Is it in good condition?	Go to Step 3.	Repair or replace.
3	HO2S BANK-1 (BANK-2) SENSOR-2 Circuit check: (1) Check “R/B” and “Gr/Y” wire (“R/Y” and “Gr/Y” wire). Are they in good condition?	Go to Step 4.	Repair or replace.
4	(1) Replace BANK-1 (BANK-2) HO2S SENSOR-2. (2) Perform DTC confirmation procedure. Is DTC P0420 (P0430) detected?	Go to Step 5.	Faulty BANK-1 (BANK-2) HO2S SENSOR-2.
5	(1) Replace BANK-1 (BANK-2) warm up TWC converter. (2) Perform DTC confirmation procedure. Is DTC P0420 (P0430) detected?	Substitute a known-good ECM (PCM) and recheck.	Replace TWC converter.

DTC P0443 EVAP CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT MALFUNCTION

WIRING DIAGRAM



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Monitor signal of EVAP canister purge valve is different from command signal. (Circuit open or short) (2 driving cycle detection logic)	● EVAP canister purge valve and its circuit ● ECM (PCM)

DTC CONFIRMATION PROCEDURE

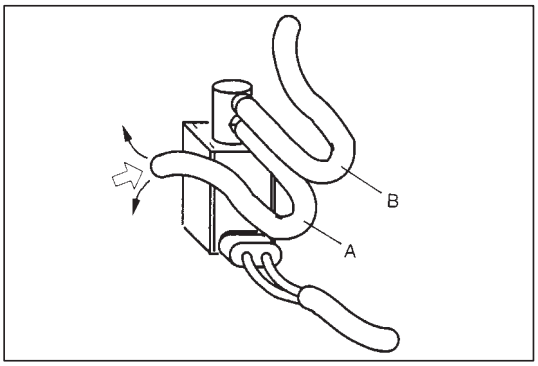
WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out with 2 persons, a driver and a tester, on a level road.**

NOTE:
Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.
- **Intake air temperature: between –14 ℃ and 70 °C (6.8 °F and 158 °F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool.
3) Start engine and warm up it completely.
4) Increase vehicle speed to 40 km/h (25 mph) or more.
5) Keep driving above vehicle speed for 5 min. or more (Change of vehicle speed is permitted in this step).
6) Release accelerator pedal, stop vehicle and run engine at idle speed for 2 min.
7) Check DTC and pending DTC by using scan tool.

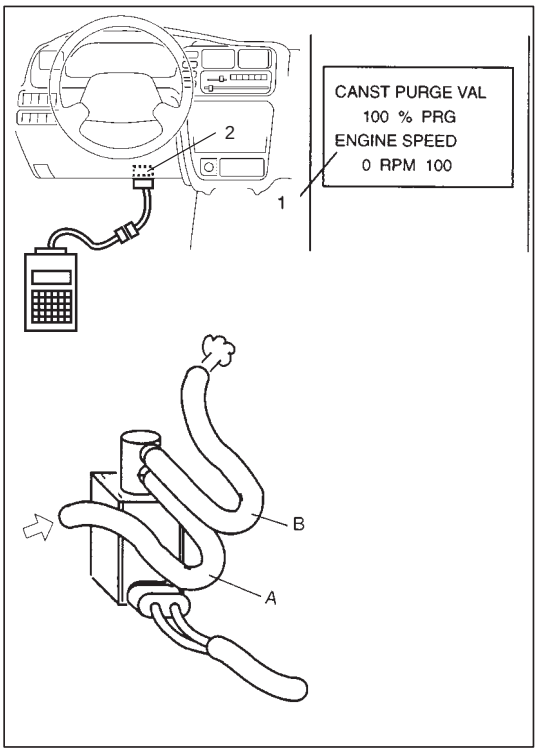
TROUBLESHOOTING (DTC P0443)

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Check EVAP canister purge system for operation referring to “EVAP Canister Purge System” check. Is check result satisfactory?	Intermittent trouble or faulty ECM (PCM). Check for intermittent referring to “Intermittent and Poor Connection” in Section 0A.	Go to Step 3.
3	Check EVAP canister purge valve for resistance referring to “EVAP Canister Purge Valve” and its circuit check. Is resistance as specified?	“G/B” or “Bl/B” circuit open or short. If wire and connections are OK, substitute a known-good ECM (PCM) and recheck.	Replace EVAP canister purge valve.



EVAP Canister Purge Valve and Its Circuit Check.

1) Disconnect vacuum hoses from vacuum pipes.
2) With ignition switch ON, blow into hose “A”. Air should not come out of hose “B”.



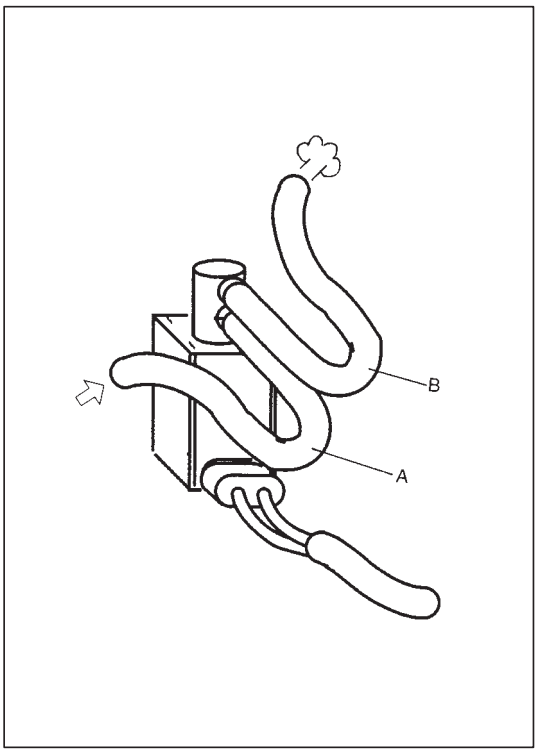
Using SUZUKI scan tool

3) Connect SUZUKI scan tool (1) to DLC (2) with ignition switch OFF.

3-1) Turn ON EVAP canister purge valve by using SUZUKI scan tool with ignition switch ON.
In this state, blow hose “A”.
Air should come out of hose “B”.

WARNING:
Do not suck the air through valve. Fuel vapor inside valve is harmful.

If check results are as described above, EVAP canister purge valve and its circuit are in good condition, connect vacuum hoses securely.
If not, proceed to step 4).



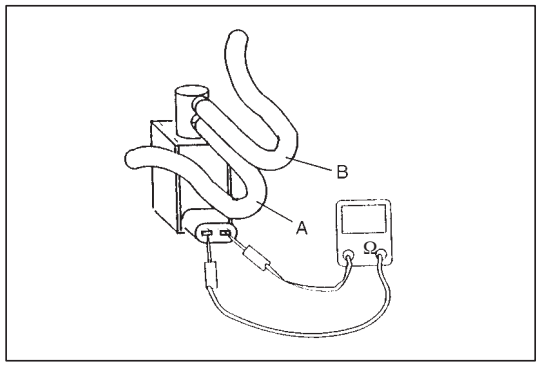
Not using SUZUKI scan tool

3) Using service wire, connect C51-2-1 terminal of ECM (PCM) coupler and body ground with ignition switch OFF.

3-1) Turn ON ignition switch.
In this state, blow hose “A”.
Air should come out of hose “B”.

WARNING:
Do not suck the air through valve. Fuel vapor inside valve is harmful.

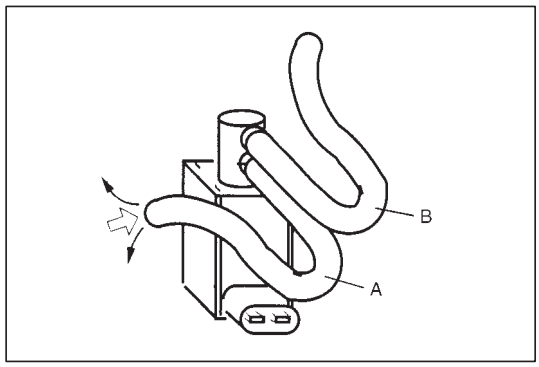
If check results are as described above and C51-2-1 terminal to ECM connection is OK, EVAP canister purge valve and its circuit are in good condition, connect vacuum hoses securely.
If not, proceed to step 4).



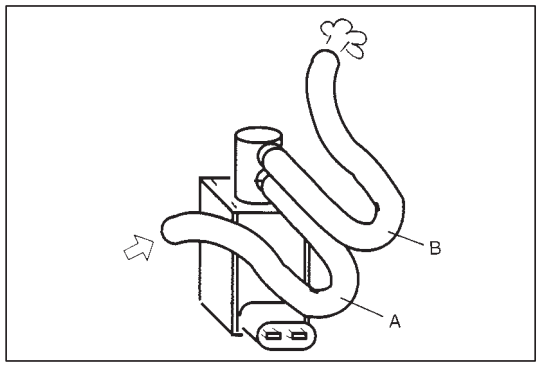
4) With ignition switch OFF, disconnect coupler from EVAP canister purge valve.
5) Check resistance between two terminals of EVAP canister purge valve.

   Resistance of EVAP canister purge valve:
   28 – 36 Ω at 20°C (68°F)

   If resistance is as specified, proceed to next operation check.
   If not, replace.



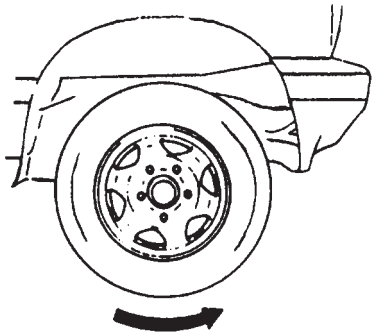
6) With coupler disconnected, blow into hose “A”. Air should not come out of hose “B”.
   If not, replace EVAP canister purge valve.

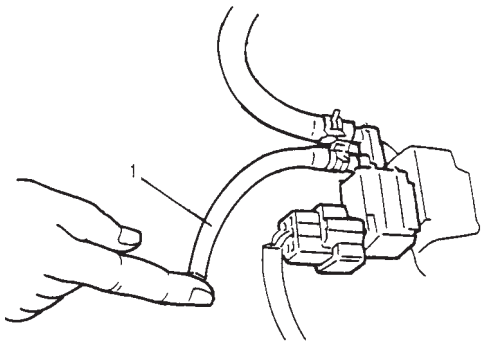


7) Connect 12 V-battery to solenoid purge valve terminals. In this state, blow hose “A”.
   Air should come out of hose “B”.

   WARNING:
   Do not suck the air through valve. Fuel vapor inside valve is harmful.

   If check result is as specified above, check EVAP canister purge valve harness.
   If not, replace EVAP canister purge valve.
8) Connect vacuum hoses.
9) Connect EVAP canister purge valve coupler securely.





1. Purge hose

EVAP Canister Purge System Check

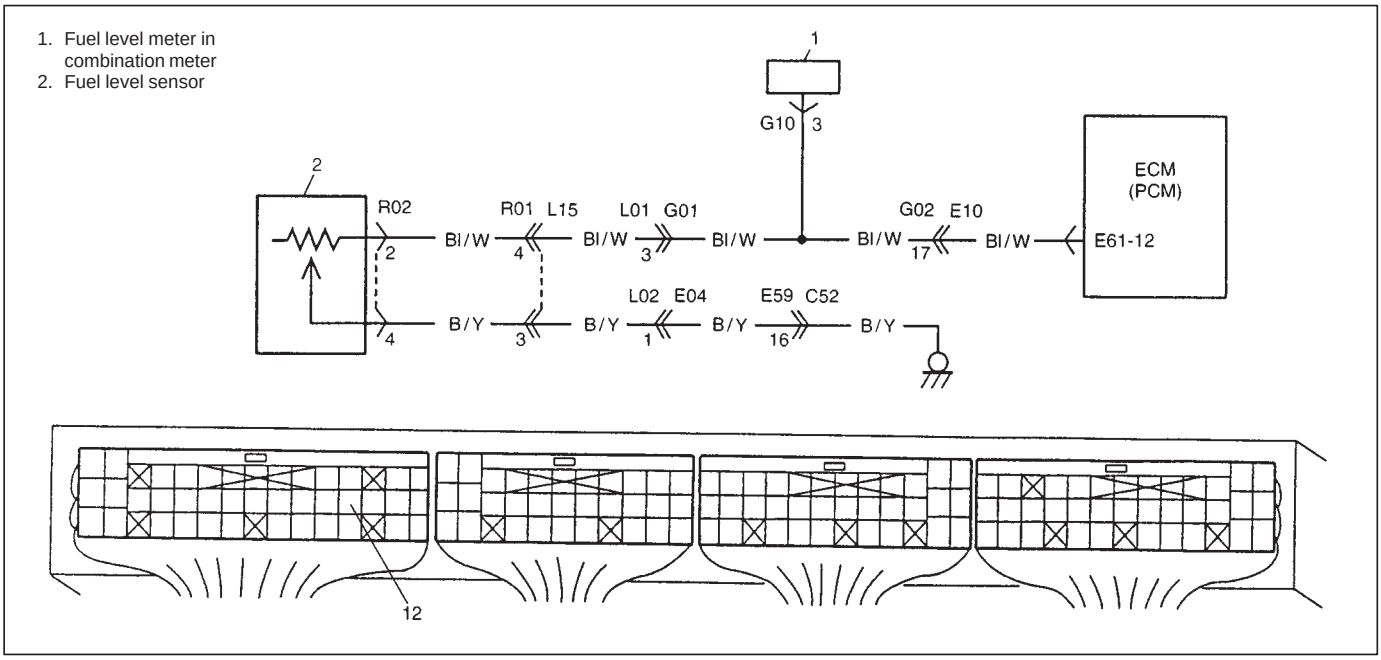
1) Warm up engine to normal operating temperature.
2) Hoist vehicle so that all wheels rotate freely.
3) Set M/T in “Neutral” or A/T in “P” position and parking brake.
4) Disconnect purge hose from EVAP canister.
5) Place finger against the end of disconnected hose and check that vacuum is not felt there when engine is running at idle speed.
6) Release parking brake lever, set transfer in “2H” and M/T in “1st” or A/T in “L”.

WARNING:
Make sure that transfer is set to “2H” range position for this check. If it is set to “4H” or “4L” position, front and rear wheels turn at high speed and a very dangerous situation may occur.

7) Also check that vacuum is felt when engine speed is increased to higher than about 1,500 r/min. and keep it for 3 min. or more. If check result is not described in steps 5) and 7), check EVAP canister purge valve, wire harness and vacuum passage.

DTC P0460 FUEL LEVEL SENSOR CIRCUIT HIGH INPUT

WIRING DIAGRAM/CIRCUIT DESCRIPTION



DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Fuel level sensor voltage higher than specified value.	Fuel level sensor and/or its circuit Fuel level meter and/or its circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that the following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temperature: between −14 °C and 70 °C (6.8 °F and 158 °F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

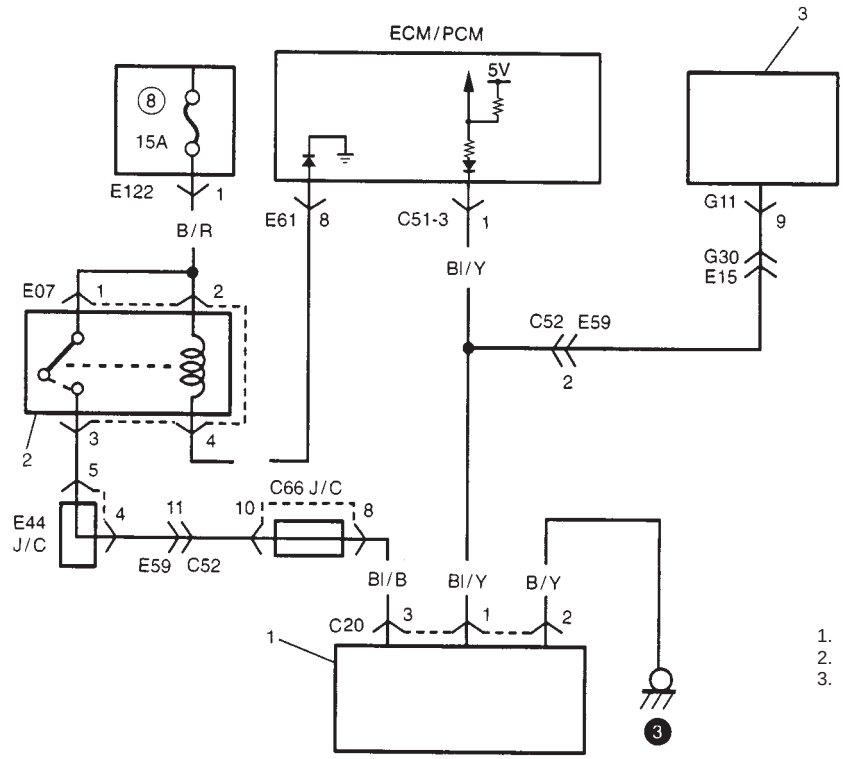
(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and run it for 10 sec.
(4) Check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Fuel Level Sensor Signal Circuit check: (1) With ignition switch OFF, disconnect G10 of combination meter coupler. (2) Remove ECM (PCM) cover. (3) With ignition switch ON leaving engine OFF, check voltage between E61-12 and ground. Is voltage about 0 V?	Go to Step 3.	“Bl/W” wire shorted to power circuit.
3	Fuel Level Sensor check: (1) Remove fuel level sensor referring to “ENGINE FUEL” section. (2) With ignition switch OFF, connect L15 coupler to R01 coupler. (3) With ignition switch OFF, disconnect G10 coupler of combination meter. (4) Check resistance between E61-12 and ground. float level “FULL” 2 – 4 Ω float level “EMPTY” 119 – 121 Ω Is check result satisfied?	Go to Step 4.	Faulty fuel level sensor or its harness.
4	Fuel Level Sensor Voltage check: (1) With ignition switch OFF, connect G10 coupler of combination meter. (2) With ignition switch ON leaving engine OFF, check voltage between E61-12 and ground. float level “FULL” about 0 V float level “EMPTY” about 6 V Is check result satisfied?	Intermittent trouble. If OK, substitute a known-good ECM (PCM) and recheck.	Substitute a known-good combination meter and recheck.

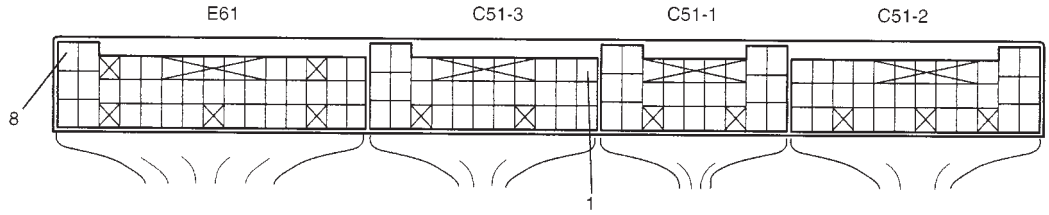
DTC P0500 VEHICLE SPEED SENSOR MALFUNCTION (DTC No.24)

WIRING DIAGRAM



1. Vehicle speed sensor
2. Main relay
3. Speedometer

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



CIRCUIT DESCRIPTION

Refer to “ENGINE AND EMISSION CONTROL” section.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Vehicle speed sensor signal is not inputted while fuel is cut for 4 sec.	Vehicle speed sensor Vehicle speed sensor circuit Vehicle speed sensor driven gear Speedometer ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:
- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

- **Intake air temperature: between –14 ℃ and 70 °C (6.8 °F and 158 °F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed till engine speed is reached 4000 r/min. in 3rd gear (M/T) or 2nd range (A/T).
(5) Release accelerator pedal and with engine brake applied, keep vehicle coasting and then stop vehicle.
(6) Check DTC by using scan tool.

DTC TROUBLESHOOTING

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?	Faulty “Bl/Y” wire, poor C51-3-1 connection or intermittent trouble. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 3.
3	VSS Power Supply Voltage check: (1) Remove ECM (PCM) cover. (2) With ignition switch OFF, remove VSS coupler (1). (3) With ignition switch ON leaving engine OFF, check voltage between C20-3 and C20-2 terminal of VSS coupler. Is voltage 10 – 14 V?	Go to Step 4.	Faulty “B/Bl”, “B/Y” wire.
4	VSS Signal Harness check: (1) With ignition switch ON leaving engine OFF, check voltage between C20-1 and C20-2 terminal of VSS coupler. Is voltage 4 V or more?	Go to Step 5.	Go to Step 6.
5	VSS Visual inspection: (1) Remove VSS (2) referring to “TRANSFER” section. (2) Check VSS drive gear (4) and driven gear (3) for damage and excessive wear. Are they in good condition?	Poor VSS connection. If OK, substitute a known-good VSS and recheck.	Replace VSS.

STEP	ACTION	YES	NO
6	Speedometer Circuit check: (1) With ignition switch OFF, disconnect G11 coupler from combination meter. (2) With ignition switch ON leaving engine OFF, check voltage between C20-1 and C20-2 terminal of VSS coupler. Is voltage 4 V or more?	Substitute a known-good combination meter and recheck.	Faulty “Bl/Y” wire. If OK, substitute a known-good ECM (PCM) and recheck.

Fig. for STEP 3

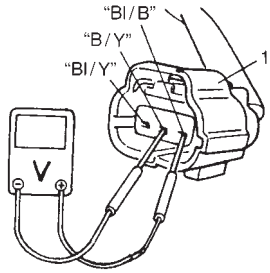


Fig. for STEP 4, 6

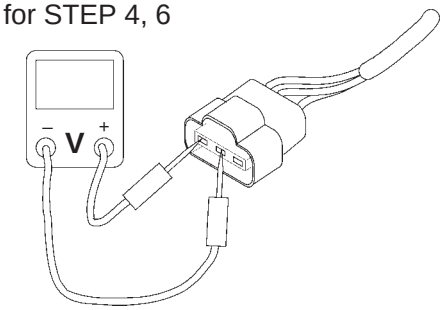
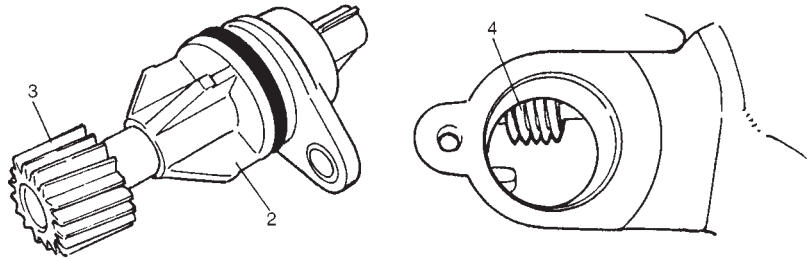
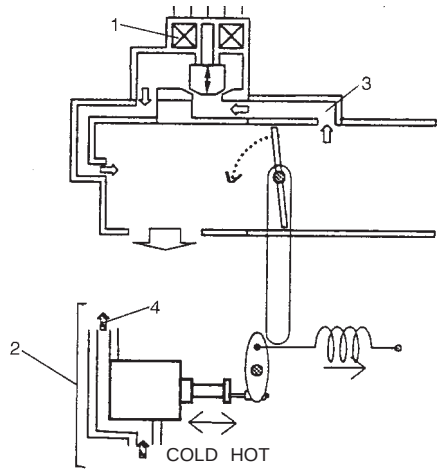


Fig. for STEP 5

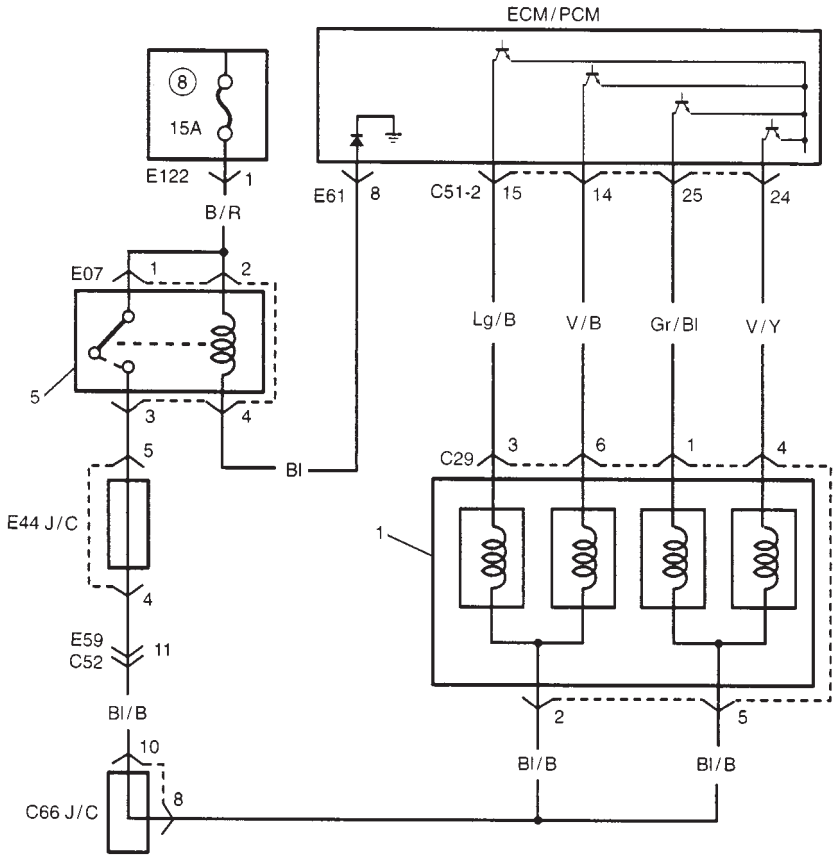


DTC P0505 IDLE AIR CONTROL SYSTEM MALFUNCTION

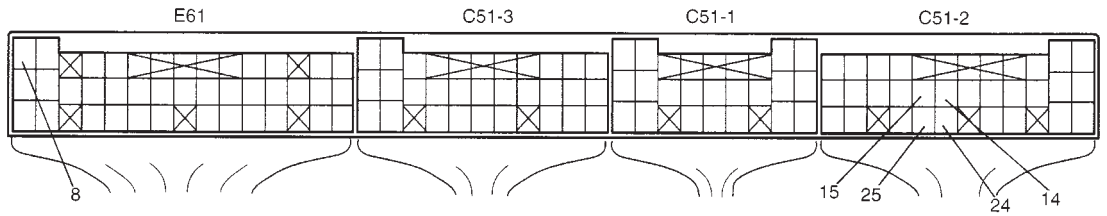
SYSTEM/WIRING DIAGRAM



1. IAC valve
2. Fast idle control system
3. Bypass air
4. Engine coolant
5. Main relay



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



SYSTEM/CIRCUIT DESCRIPTION

Refer to “ENGINE AND EMISSION CONTROL” section.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Idle engine speed is lower than desired engine speed 100 r/min. though IAC valve opening is about 100 %. Idle engine speed is higher than desired engine speed 200 r/min. though IAC valve opening is about 0 %. IAC valve monitor voltage is high.	IAC valve or its circuit Air intake system VSS Engine mechanical External load ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temperature: between –14 °C and 70 °C (6.8 °F and 158 °F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

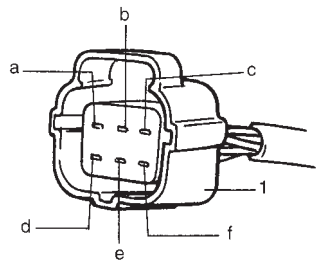
(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Run engine at idle speed for 30 sec.
(5) Check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Idle Speed check: (1) Check idle speed and idle air control duty referring to “ENGINE AND EMISSION CONTROL” section. Are they in good condition?	Intermittent trouble. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 3.
3	IAC Valve inspection: (1) Inspect IAC valve referring to “ENGINE AND EMISSION CONTROL” section. Is it in good condition?	Go to Step 6.	Go to Step 4.
4	IAC Valve Circuit check: (1) With ignition switch OFF, disconnect ECM (PCM) couplers. (2) Check resistance between C51-2-14 and C51-2-15, C51-2-24 and C51-2-25. Is each resistance 40 – 48 Ω?	Go to Step 5.	Faulty “Lg/B”, “V/B”, “Gr/Bl” or “V/Y” wire. If OK, faulty IAC valve.
5	IAC Valve Power Supply Voltage check: (1) Connect ECM (PCM) couplers. (2) With ignition switch OFF, disconnect C29 coupler (1) of IAC valve. (3) With ignition switch ON, check voltage between C29-2 (b) and ground, C29-5 (e) and ground. Is each voltage 10 – 14 V?	IAC valve or ECM (PCM) malfunction.	Faulty “Bl/B” wire.

STEP	ACTION	YES	NO
6	Air Intake System check: (1) Check air intake system for clog and air inhabit. (2) Check fast idle up system referring to “ENGINE AND EMISSION CONTROL” section. Are they in good condition?	Go to Step 7.	Repair or replace.
7	VSS check: (1) Perform DTC confirm procedure of VSS referring to DTC P0500. Is DTC P0500 detected?	Go to DTC P0500 flow table.	Go to Step 8.
8	Engine Mechanical check: (1) Check engine mechanical referring to “ENGINE MECHANICAL” section. Is engine mechanical in good condition?	Go to Step 9.	Repair or replace.
9	External Load check: (1) Check external loads (power steering pump, air conditioner compressor, alternator, transmission, etc.). Are they in good condition?	Substitute a known-good ECM (PCM) and recheck.	Repair or replace.

Fig. for STEP 5



DTC P0601 INTERNAL CONTROL MODULE MEMORY CHECK SUM ERROR

SYSTEM DESCRIPTION

Internal control module is installed in ECM (PCM).

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Check sum is not equal to specified value.	ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

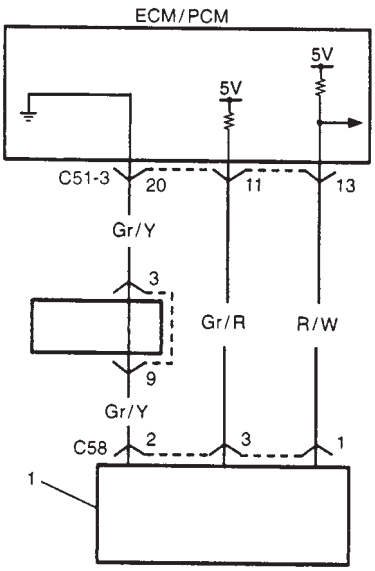
(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and run it for 10 sec.
(4) Check DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Substitute a known-good ECM (PCM) and recheck.	Go to “ENGINE DIAG. FLOW TABLE”.

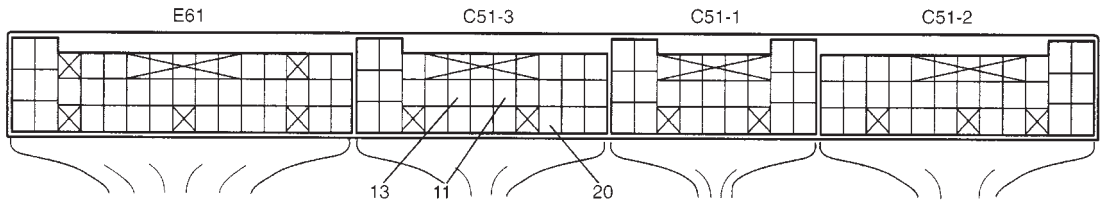
DTC P1408 MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT MALFUNCTION

WIRING DIAGRAM



1. MAP sensor

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



CIRCUIT DESCRIPTION

Refer to “ENGINE AND EMISSION CONTROL” section.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
MAP sensor signal voltage continues more than 2.7 V for 5 sec. under low load condition. MAP sensor signal voltage continues less than 1.1 V for 5 sec. under high load condition.	MAP sensor and its circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

WARNING:

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and very careful during to avoid occurrence of an accident.**
- **Road test, should be carried out with 2 person, a driver and tester, on a level road.**

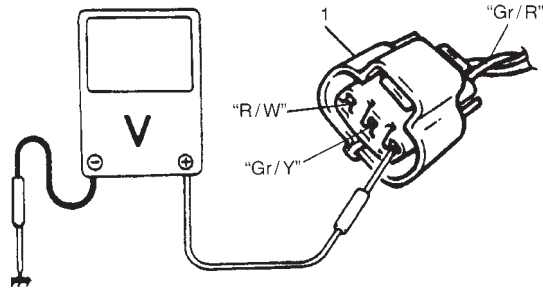
- **Intake air temperature: between 5 °C and 70 °C (6.8 °F and 158 °F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Increase vehicle speed to 56 km/h (35 mph) for 30 sec.
(5) Stop vehicle and run engine at idle speed for 10 sec.
(6) Check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	MAP Sensor Signal check: (1) Remove ECM (PCM) cover. (2) Check voltage between C51-3-13 and C51-3-20 as following conditions. with ignition switch on leaving engine OFF: 3.3 – 4.3 V idling: less than 3.3 V Is check result as specified?	Intermittent trouble. If OK, substitute a known-good ECM (PCM) and recheck.	Go to Step 3.
3	MAP Sensor Power Supply Voltage check: (1) With ignition switch OFF, disconnect C58 coupler from MAP sensor. (2) Check voltage between C58-3 and C58-2 terminal. Is voltage 4.5 – 5.5 V?	Faulty “R/W” wire. If OK, substitute a known-good MAP sensor and recheck.	Faulty “Gr/R”, “Gr/Y” wire. If OK, substitute a known-good ECM (PCM) and recheck.

Fig. for STEP 3



DTC P1450 BAROMETRIC PRESSURE SENSOR CIRCUIT MALFUNCTION
DTC P1451 BAROMETRIC PRESSURE SENSOR PERFORMANCE PROBLEM

SYSTEM DESCRIPTION

Barometric pressure sensor is installed in ECM (PCM).

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
P1450 Barometric pressure sensor voltage is less than 0.1 V or more than 5.1 V. **P1451** Barometric pressure value does not agree with calculated barometric pressure.	Barometric pressure sensor in ECM (PCM). MAP sensor

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

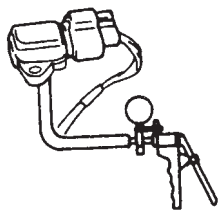
- **Intake air temperature: between 5 °C and 70 °C (6.8 °F and 158° F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and warm up to normal operating temperature.
(4) Run engine at idle speed for 30 sec.
(5) Check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

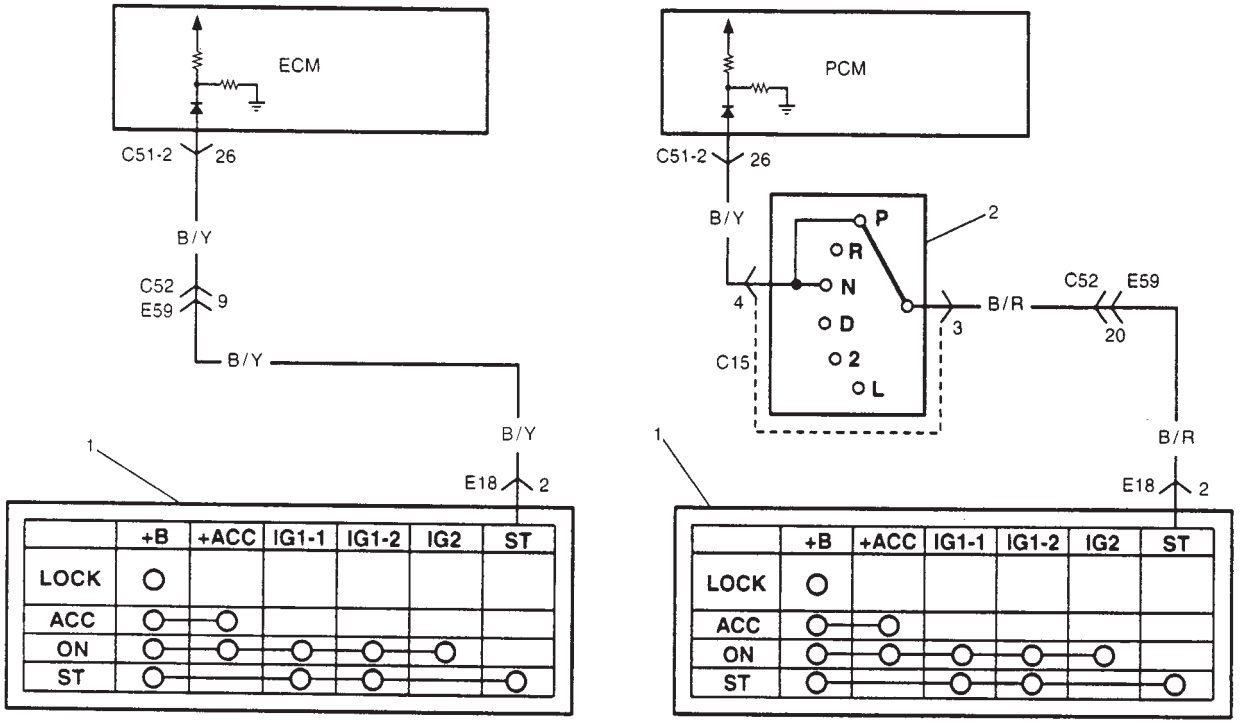
<table>
<tr><th>STEP</th><th>ACTION</th><th>YES</th><th>NO</th></tr>
<tr><td>1</td><td>Was “ENGINE DIAG. FLOW TABLE” performed?</td><td>Go to Step 2.</td><td>Go to “ENGINE DIAG. FLOW TABLE”.</td></tr>
<tr><td>2</td><td>1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ignition switch ON and select “DATA LIST” mode on scan tool.
3) Check manifold absolute pressure.
Is it barometric pressure (approx. 100 kPa, 760 mmHg) at seal level?</td><td>Substitute a known-good ECM (PCM) and recheck.</td><td>Go to Step 2.</td></tr>
<tr><td>3</td><td>Check MAP Sensor
1) Remove MAP sensor from intake manifold and connect vacuum pump gauge to MAP sensor.
2) Connect scan tool to DLC and turn ignition switch ON.
3) Check intake manifold absolute pressure displayed on scan tool under following conditions.
<table><tr><th>Applying Vacuum</th><th>Displayed Value on Scan Tool</th></tr><tr><td>0</td><td>Barometric pressure (Approx. 100 kPa, 760 mmHg)</td></tr><tr><td>27 kPa
200 mmHg</td><td>Barometric pressure –27 kPa (Approx. 73 kPa, 560 mmHg</td></tr><tr><td>67 kPa
500 mmHg</td><td>Barometric pressure –67 kPa (Approx. 33 kPa, 260 mmHg)</td></tr></table>Is check result satisfactory?</td><td>Check air intake system for air being drawn in and engine compression.
If OK, then substitute a known-good ECM and recheck.</td><td>Replace MAP sensor.</td></tr>
</table>

Fig. for STEP 3



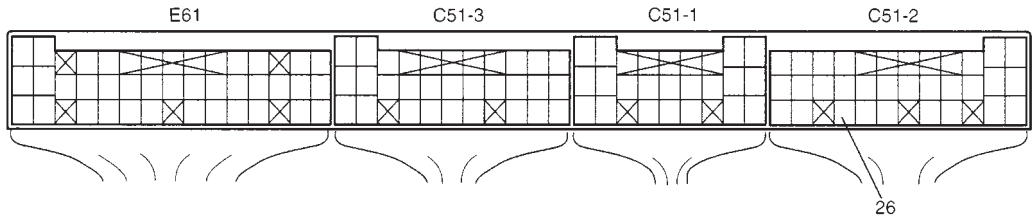
DTC P1500 ENGINE START SIGNAL CIRCUIT MALFUNCTION

WIRING DIAGRAM



1. Ignition switch
2. Transmission range switch

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



CIRCUIT DESCRIPTION

Engine start signal is sent from engine starter circuit while engine cranking.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Though engine starts, engine start signal is not inputted. Engine start signal is inputted for 20 sec. or more.	Engine start signal circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temperature: between –14 °C and 70 °C (6.8 °F and 158 °F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

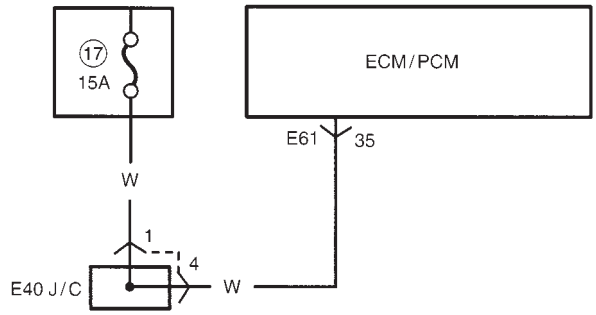
(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and run it for 5 min.
(4) Check DTC and pending DTC by using scan tool.

DTC TROUBLESHOOTING

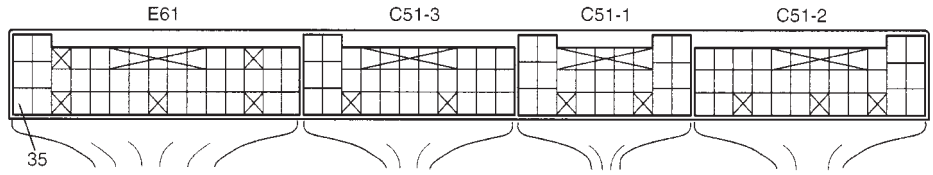
STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Engine Start Signal check: (1) Remove ECM (PCM) cover. (2) While engine running, check voltage between C51-2-26 and ground. Is voltage 0 – 1 V?	Go to Step 3.	“B/Y” wire shorted to power circuit.
3	Engine Start Signal check: (1) While engine cranking, check voltage between C51-2-26 and ground. Is voltage 6 – 14 V?	Intermittent trouble. If OK, substitute a known-good ECM (PCM) and recheck.	“B/Y” wire open. If OK, substitute a known-good ECM (PCM) and recheck.

DTC P1510 ECM BACK-UP POWER SUPPLY MALFUNCTION

WIRING DIAGRAM



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



CIRCUIT DESCRIPTION

Battery voltage is translated to 5 V in ECM (PCM) back-up circuit. The voltage is supplied to keep DTC memory, values that ECM (PCM) has learned to control engine, etc. in ECM (PCM) even when ignition switch is turned OFF.

DTC DETECTING CONDITION AND TROUBLE AREA

DTC DETECTING CONDITION	TROUBLE AREA
Back-up circuit voltage is out of specification.	Battery voltage supply circuit ECM (PCM)

DTC CONFIRMATION PROCEDURE

NOTE:

Check to make sure that following conditions are satisfied when using this DTC CONFIRMATION PROCEDURE.

- **Intake air temperature: between –14 °C and 70 °C (6.8 °F and 158 °F)**
- **Atmospheric pressure: higher than 560 mmHg (Altitude: lower than 2790 m (9150 ft))**

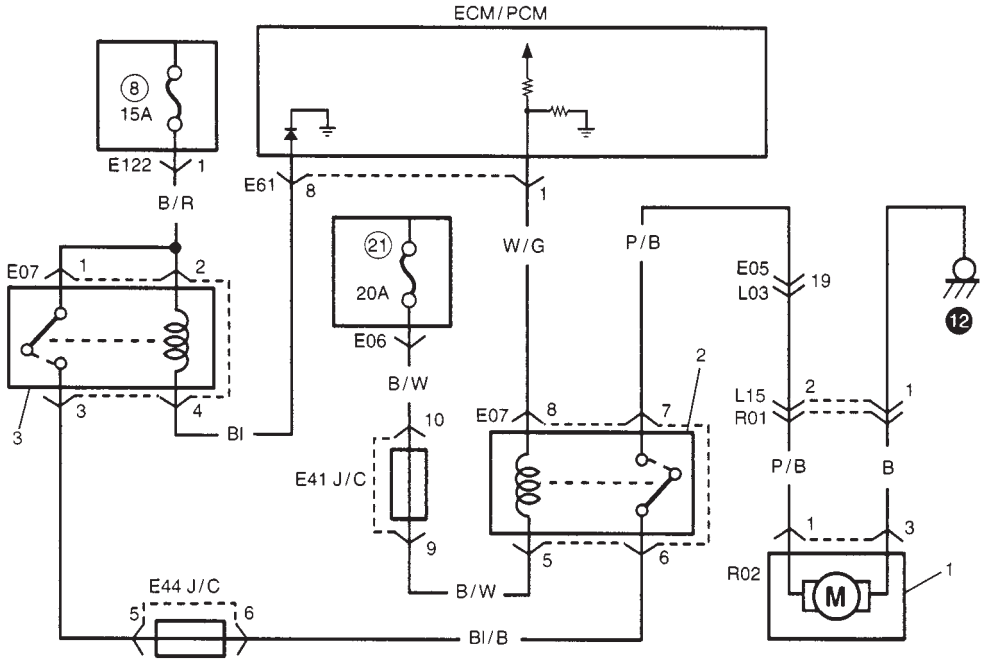
(1) With ignition switch OFF, connect scan tool.
(2) Turn ON ignition switch and clear DTC by using scan tool if any.
(3) Start engine and run it for 10 sec.
(4) Check DTC by using scan tool.

DTC TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Was “ENGINE DIAG. FLOW TABLE” performed?	Go to Step 2.	Go to “ENGINE DIAG. FLOW TABLE”.
2	Battery Voltage Supply Circuit check: (1) Remove ECM (PCM) cover. (2) While engine running, check voltage between E61-35 and ground. Is voltage 10 – 14 V?	Intermittent trouble. If OK, substitute a known-good ECM (PCM) and recheck.	Fuse 17 is blown or faulty “W” wire.

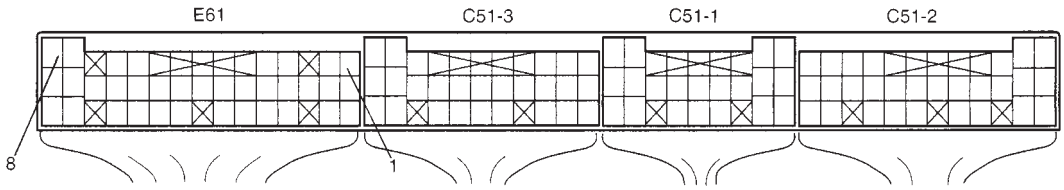
TABLE B-1 FUEL PUMP CIRCUIT CHECK

WIRING DIAGRAM



1. Fuel pump
2. Fuel pump relay
3. Main relay

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



CIRCUIT DESCRIPTION

Fuel pump relay is turned ON

- for 3 sec. after ignition switch is turned ON
- while start engine signal is inputted.
- while engine is running.

TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Fuel Pump Operation check: (1) Remove fuel filler cap. (2) Turn On ignition switch. Is fuel pump operation sound heard for 3 sec. after ignition switch ON?	Fuel pump circuit is in good condition.	Go to Step 2.
2	Fuel Pump Circuit check: (1) With ignition switch OFF, remove fuel pump relay from relay box. (2) Using service wire (1), connect E07-6 and E07-7. Is fuel pump operation sound heard with ignition switch ON?	Go to Step 3.	"Bl/B", "P/B" wire open. "B" wire open, poor 12 connection. Fuel pump malfunction.
3	Fuel Pump Relay check: (1) Check fuel pump relay referring to "ENGINE AND EMISSION CONTROL" section. Is it in good condition?	"B/W", "W/G" wire open.	Faulty fuel pump relay.

Fig. for STEP 2

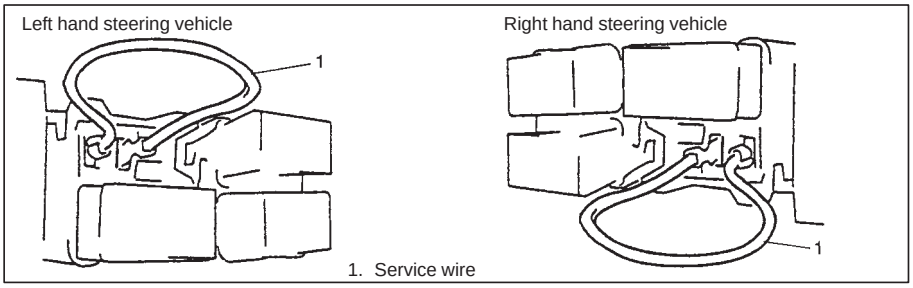
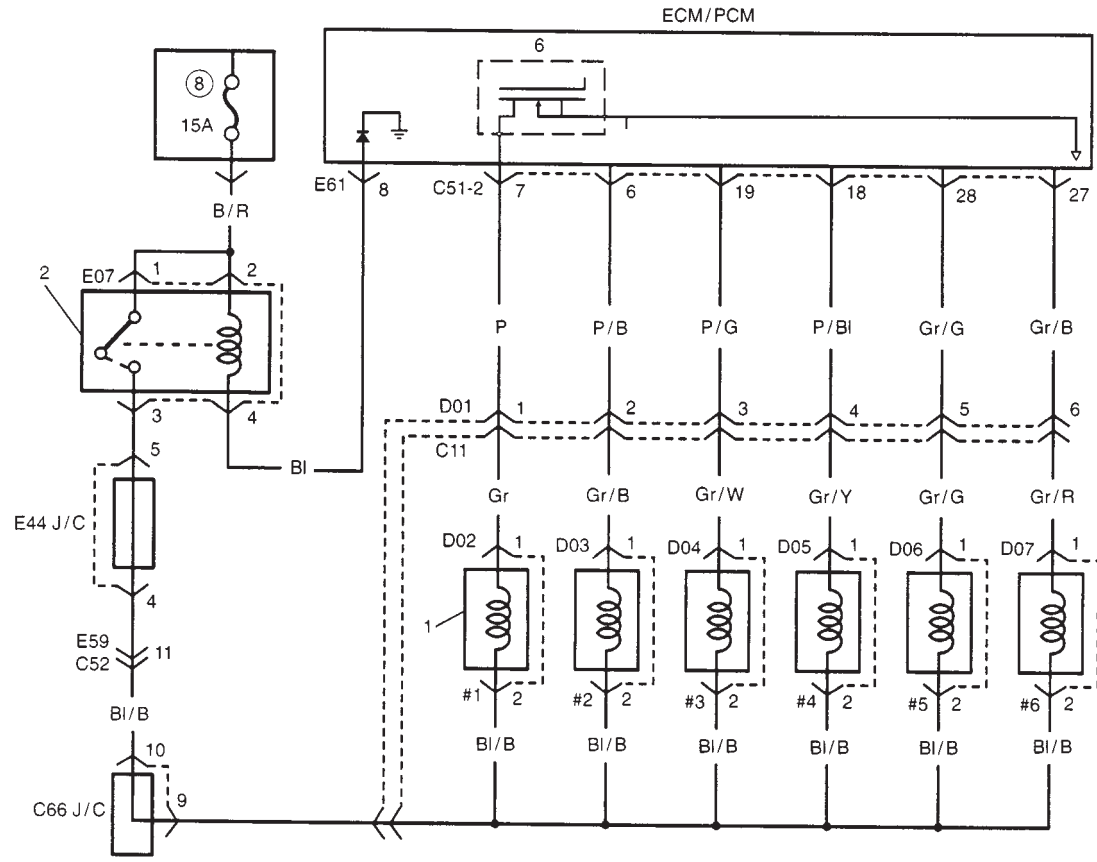


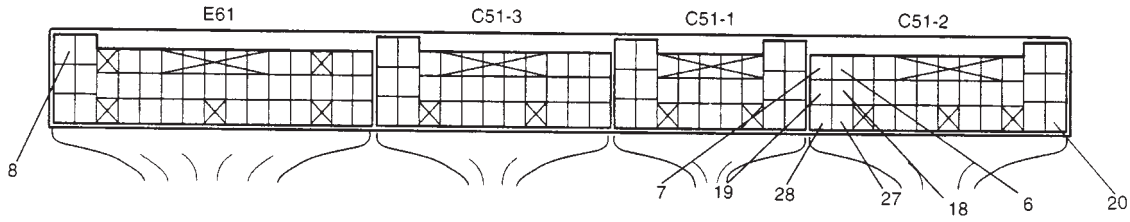
TABLE B-2 FUEL INJECTOR CIRCUIT CHECK

WIRING DIAGRAM



1. Fuel injector
2. Main relay

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

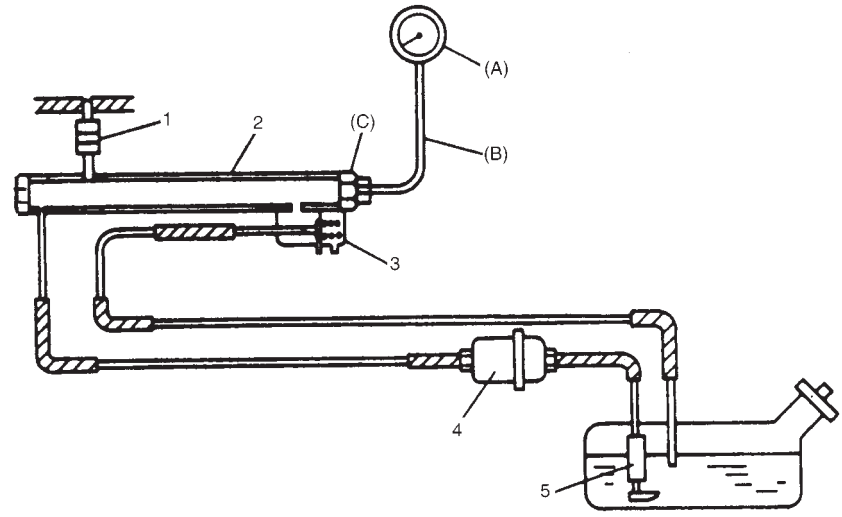


TROUBLESHOOTING

STEP	ACTION	YES	NO
1	Fuel Injector Operation check: (1) Using sound scope, check each injector for operating sound at engine cranking. Do all 6 injectors make operating sound?	Go to Step 2.	Go to Step 3.
2	Fuel Injector Circuit check: (1) Remove ECM (PCM) cover. (2) With ignition switch OFF, remove ECM (PCM) couplers. (3) Check resistance between following terminals. C51-2-6 – C51-2-20 C51-2-7 – C51-2-20 C51-2-18 – C51-2-20 C51-2-19 – C51-2-20 C51-2-27 – C51-2-20 C51-2-28 – C51-2-20 10 – 14 Ω at 20°C Is check result as specified?	Fuel injector circuit is in good condition.	Go to Step 3.
3	Does not of 6 injectors make operating sound at Step 1?	Go to Step 4.	Faulty wire harness.
4	Fuel Injector Power Circuit check: (1) Connect ECM (PCM) couplers. (2) With ignition switch ON, check voltage between following terminals. C51-2-6 – ground C51-2-7 – ground C51-2-18 – ground C51-2-19 – ground C51-2-27 – ground C51-2-28 – ground 10 – 14 V Is check result as specified?	Substitute a known-good ECM (PCM) and recheck.	Faulty “Bl/B” wire.

TABLE B-3 FUEL PRESSURE CHECK

SYSTEM DIAGRAM



1. Injector
2. Delivery pipe
3. Fuel pressure regulator
4. Fuel filter
5. Fuel pump

(A): Gauge
(B): Hose
(C): Attachment

SYSTEM DESCRIPTION

Fuel pressure regulator keeps the fuel pressure applied to injector 290 kPa higher than that in intake manifold at all times.

INSPECTION

NOTE:

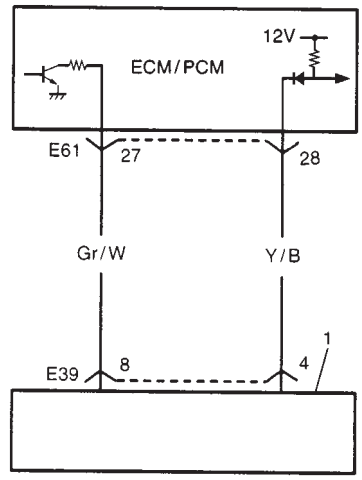
Before using following table, check to make sure that battery voltage is higher than 11 V. If battery voltage is low, pressure becomes lower than specification even if fuel pump and line are in good condition.

STEP	ACTION	YES	NO
1	Fuel Pump Operation check: (1) Remove fuel filler cap. (2) Turn ON ignition switch. Is fuel pump operation sound heard for 3 sec. after ignition switch ON?	Go to Step 2.	Go to B-1 flow table.
2	Fuel Pressure check (engine stops): (1) Install fuel filler cap and fuel pressure gauge referring to “ENGINE AND EMISSION CONTROL” section. (2) Operate fuel pump. Is fuel pressure 270 – 310 kPa?	Go to Step 3.	Go to Step 6.
3	Is 200 kPa or higher fuel pressure retained for 1 minute after fuel pump is stopped at Step 2?	Go to Step 4.	Go to Step 5.
4	Fuel Pressure check (idling): (1) Start engine and warm it up to normal operating temperature. (2) Keep it running at specified idle speed. Is fuel pressure 210 – 260 kPa?	Normal fuel pressure.	Faulty vacuum passage for fuel pressure regulator or fuel pressure regulator.

STEP	ACTION	YES	NO
5	Is there fuel leakage from fuel feed line hose, pipe or joint?	Fuel leakage from fuel feed line hose, pipe or joint.	Fuel leakage from injector, fuel pressure regulator or fuel pump.
6	Was fuel pressure higher than specification in Step 2?	Go to Step 7.	Go to Step 8.
7	Fuel Return Line check: (1) Disconnect fuel return hose from fuel pipe and connect new hose to it. (2) Put the other end of new return hose into approved gasoline container. (3) Operate fuel pump. Is fuel pressure 270 – 310 kPa?	Restricted fuel return hose or pipe.	Faulty fuel pressure regulator.
8	Fuel Pressure Regulator check: (1) With fuel pump operated and fuel return hose blocked by pinching. Is fuel pressure applied then?	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.

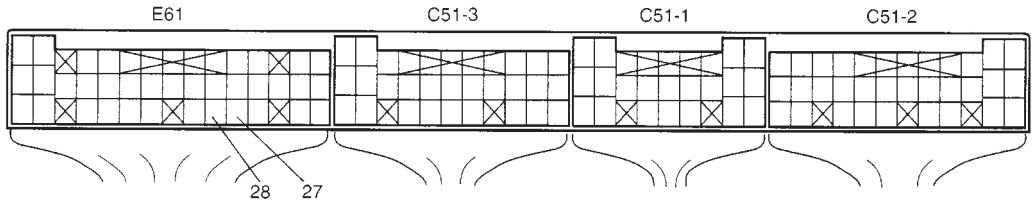
TABLE B-4 A/C SIGNAL CIRCUIT CHECK (IF EQUIPPED)

CIRCUIT DIAGRAM



1. A/C control module

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



CIRCUIT DESCRIPTION

ECM (PCM) outputs A/C ON signal (one of the signals for A/C control module to control the A/C) to A/C control module when A/C switch signal inputted to ECM (PCM) and engine conditions are specified.

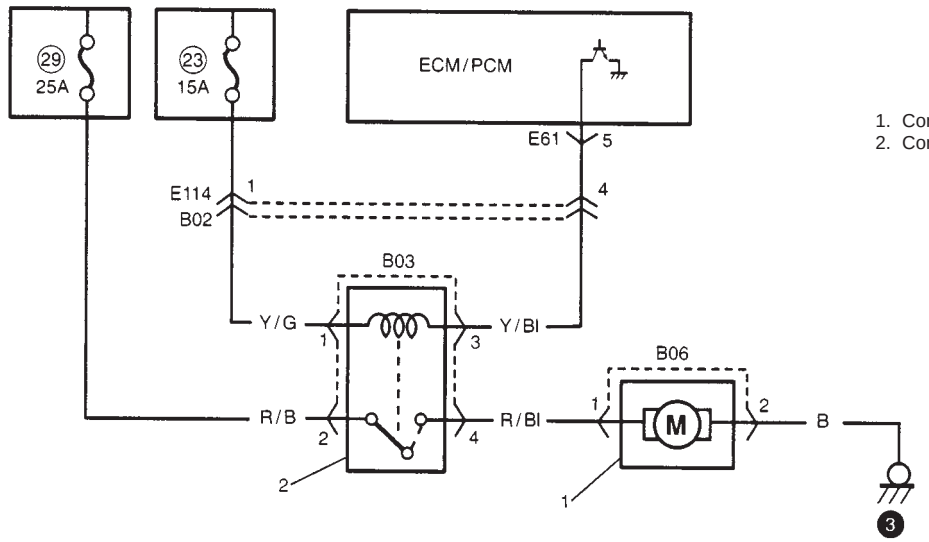
INSPECTION

STEP	ACTION	YES	NO
1	A/C Switch Signal Circuit check: (1) Remove ECM (PCM) cover. (2) Check voltage between E61-28 and ground under following conditions. Ignition switch ON and A/C switch and/or heater blower switch OFF 10 – 14 V Ignition switch ON and both A/C switch and heater blower switch ON 0 – 1.5 V Are check results as specified?	Go to Step 2.	Faulty “Y/B” wire, evaporative temperature is bellow 1°C or faulty A/C system.

STEP	ACTION	YES	NO
2	A/C ON Signal check: (1) Check voltage between E61-27 and ground under following conditions. Engine running and A/C switch and/or heater blower switch OFF 0 – 1.5 V Ignition switch ON and both A/C switch and heater blower switch ON 10 – 14 V Are check results as specified?	A/C signal circuit is in good condition.	Faulty “Gr/W”, poor performance of ECT sensor, TP sensor, inputted engine start signal or faulty A/C control module. If none of the above exists, substitute a known-good ECM (PCM) and recheck.

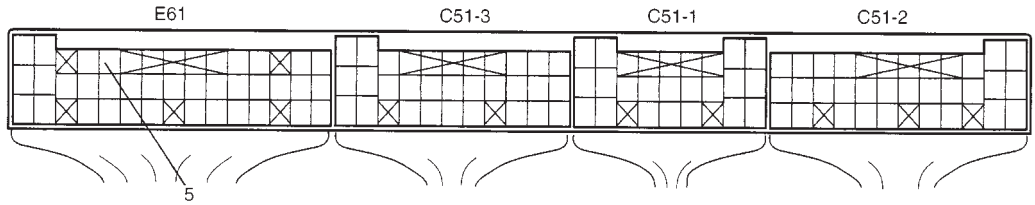
TABLE B-5 A/C CONDENSER FAN MOTOR RELAY CONTROL SYSTEM CHECK (IF EQUIPPED)

CIRCUIT DIAGRAM



1. Condenser fan
2. Condenser fan relay

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



CIRCUIT DESCRIPTION

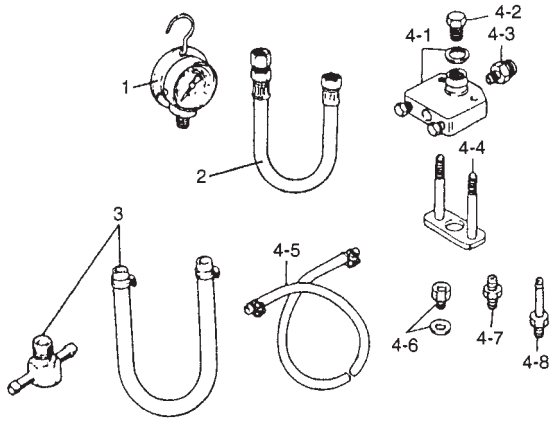
A/C condenser fan is turned ON by ECM (PCM) when engine coolant temperature is higher than specified value regardless A/C ON or OFF.

INSPECTION

STEP	ACTION	YES	NO
1	A/C Condenser Fan Operation check: (1) Check A/C condenser fan for operation. A/C condenser fan should be operated under following condition A or B only. A: When engine is running and A/C is operating. B: When engine coolant temperature is more than 113°C with ignition switch ON. Is check result as specified?	This system is in good condition.	Go to Step 2.

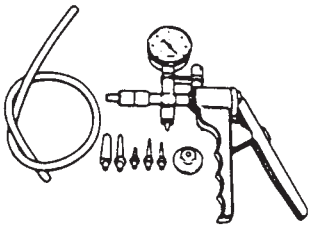
STEP	ACTION	YES	NO
2	A/C Condenser Fan Control Signal check: (1) Remove ECM (PCM) cover. (2) Check voltage between E61-5 and ground under following conditions. Other than conditions A and B in Step 1: 10 – 14 V Under condition A or B in Step 1: 0 – 1 V Are check results as specified?	Fuse 29 blown, faulty “R/B”, “R/Bl”, or “B” wire, faulty A/C condenser fan motor or relay.	Fuse 23 blown, faulty “Y/G”, “Y/Bl” wire or A/C condenser fan relay. If OK, substitute a known-good ECM (PCM) and recheck.

SPECIAL TOOLS

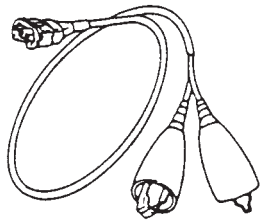


1. Pressure gauge
   09912-58441
2. Pressure hose
   09912-58431
3. 3-way joint & hose
   09912-58490
4. Checking tool set
   09912-58421

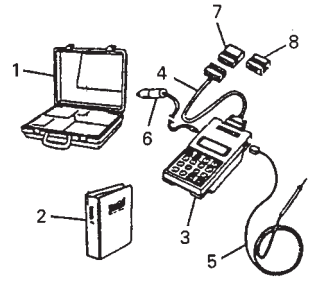
4-1. Tool body & washer
4-2. Body plug
4-3. Body attachment-1
4-4. Holder
4-5. Return hose & clamp
4-6. Body attachment-2 & washer
4-7. Hose attachment-1
4-8. Hose attachment-2



09917-47010
Vacuum pump gauge

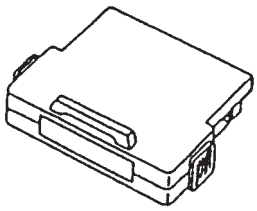


09930-88521
Injector test lead

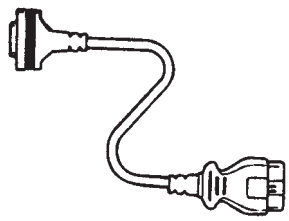


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self-test adaptor

09931-76011
SUZUKI scan tool (Tech 1)



SUZUKI scan tool
mass storage cartridge



09931-76030
16/14 pin DLC cable

SECTION 6A1

ENGINE MECHANICAL (G16 ENGINE)

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

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

CONTENTS

GENERAL DESCRIPTION 6A1- 2
ON-VEHICLE SERVICE 6A1- 4
Compression Check 6A1- 4
Engine Vacuum Check 6A1- 6
Oil Pressure Check 6A1- 7
Valve Lash (Clearance) 6A1- 9
Air Cleaner Element 6A1-11
Cylinder Head Cover 6A1-12
Throttle Body and Intake Manifold 6A1-13
Exhaust Manifold 6A1-16
Timing Belt and Belt Tensioner 6A1-18
Oil Pan and Oil Pump Strainer 6A1-23
Oil Pump 6A1-27
Rocker Arms, Rocker Arm Shaft and Camshaft 6A1-32
Valves and Cylinder Head 6A1-41
Piston, Piston Rings, Connecting Rods and Cylinders 6A1-54
UNIT REPAIR OVERHAUL 6A1-64
Engine Assembly 6A1-64
Main Bearings, Crankshaft and Cylinder Block 6A1-69
SPECIAL TOOLS 6A1-81
REQUIRED SERVICE MATERIALS 6A1-82

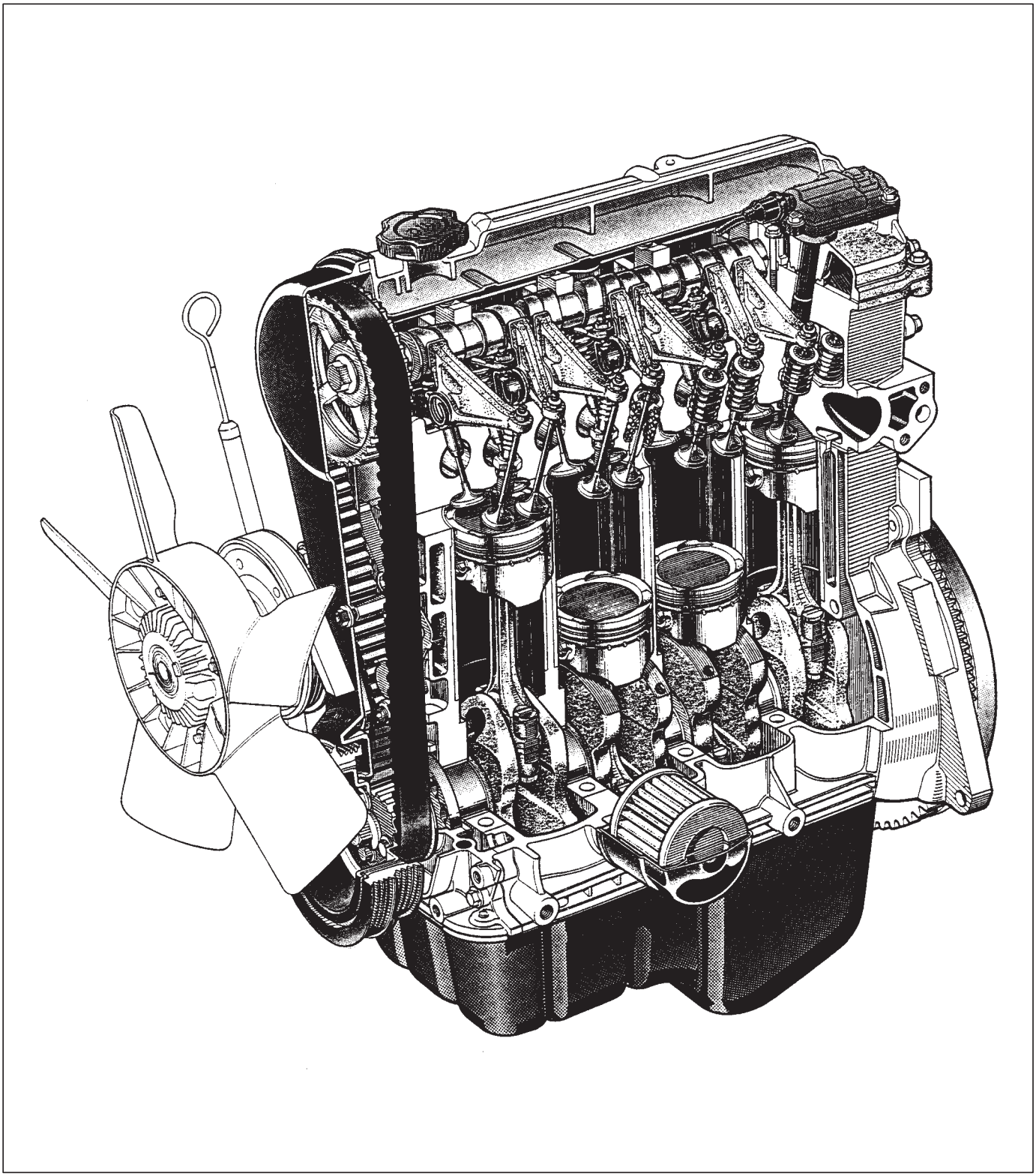
NOTE:
For what each abbreviation stands for (i.e., full term), refer to SECTION 0A.

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.

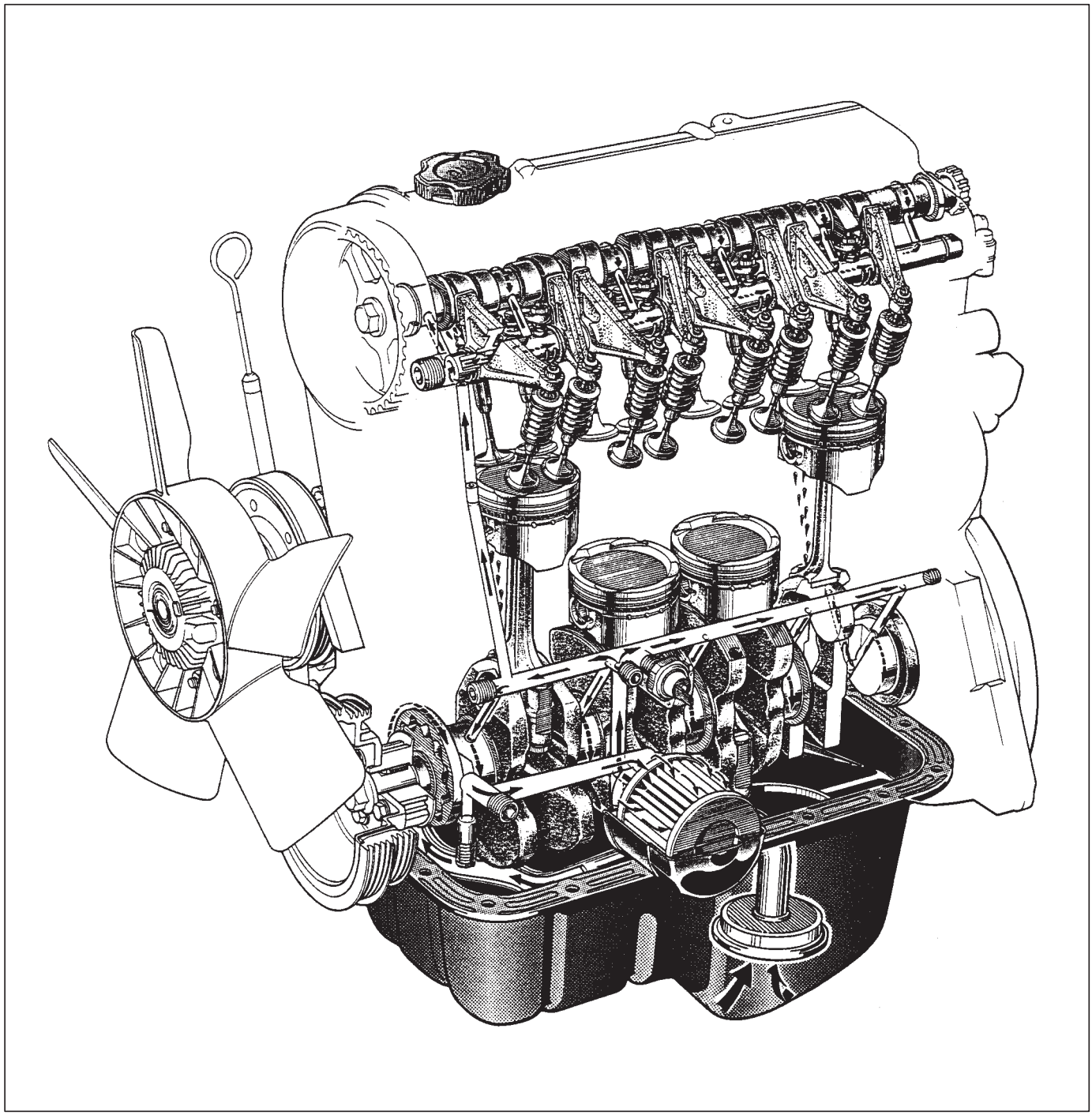


ENGINE LUBRICATION

The oil pump is of a trochoid type, and mounted on crankshaft at crankshaft pulley side.
Oil is drawn up through 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/cm^2, 56.9 psi). Relieved oil drains back to oil pan.



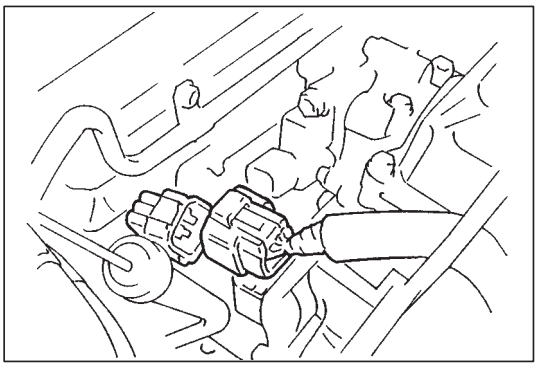
ON-VEHICLE SERVICE

COMPRESSION CHECK

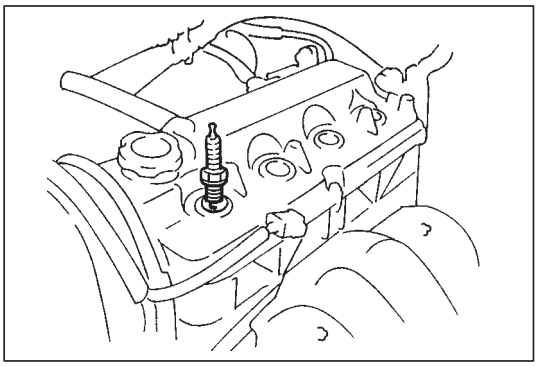
Check compression pressure on all four cylinders as follows:

1) Warm up engine.
2) Stop engine after warming up.

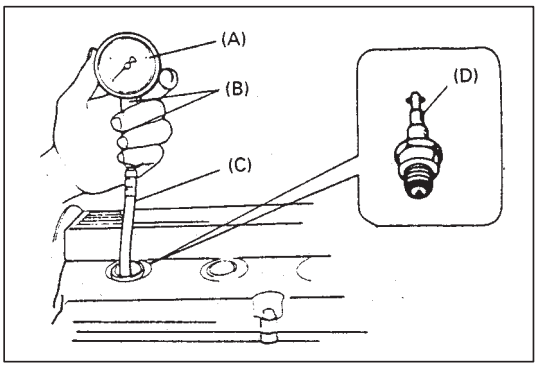
NOTE:
After warming up engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake and block drive wheels.



3) Disconnect fuel injector wire harness connector.

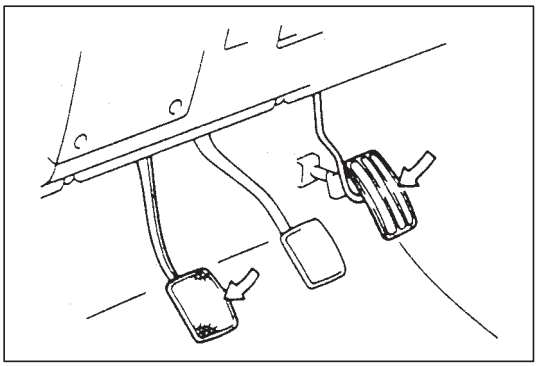


4) Remove ignition coil assemblies and all spark plugs referring to section 6F1.



5) Install special tool (Compression gauge) into spark plug hole.

Special Tool
(A): 09915-64510-001
(B): 09915-64510-002
(C): 09915-64530
(D): 09915-67010

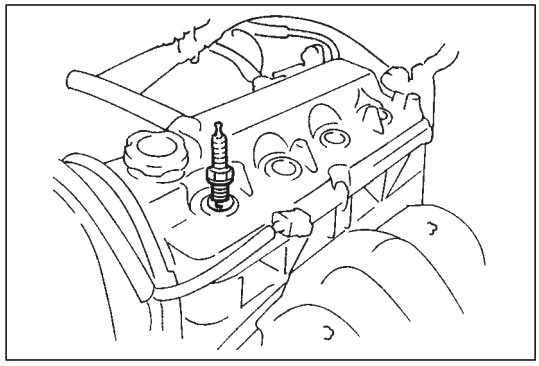


6) Disengage clutch (to lighten starting load on engine) for M/T model, and depress accelerator pedal all the way to make throttle valve full-open.

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	1200 kPa (12.0 kg/cm^2, 170.0 psi)
Max. difference between any two cylinders	100 kPa (1.0 kg/cm^2, 14.2 psi)



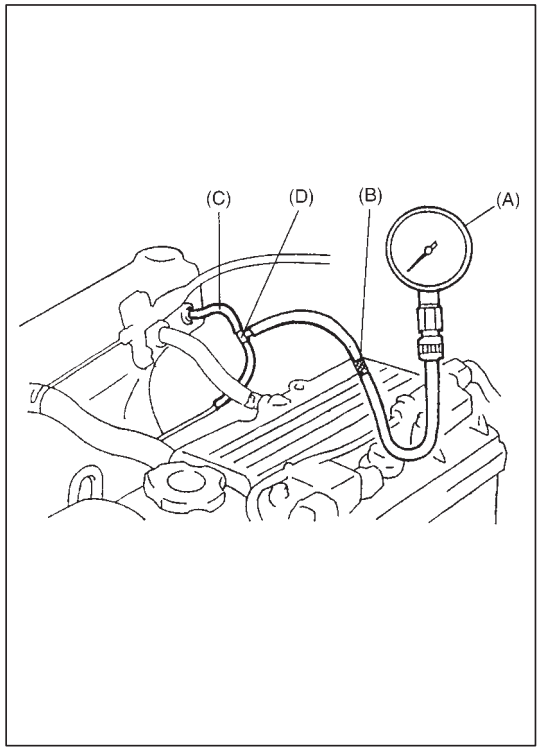
8) Carry out steps 5) through 7) on each cylinder to obtain four readings.
9) After checking, install spark plugs and ignition coil assemblies and connect injector wire harness connector securely.

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.



2) With engine stopped, disconnect fuel pressure regulator vacuum hose from intake manifold and connect 3-way joint, hoses and special tool (vacuum gauge and joint) between intake manifold and vacuum hose disconnected.

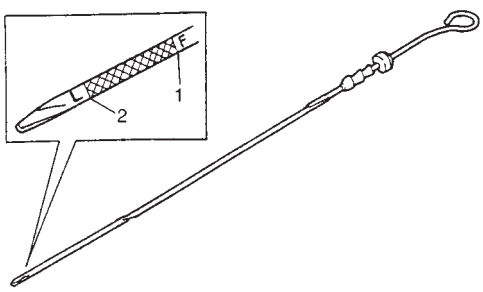
   Special Tool
   (A): 09915-67310
   (B): 09918-08210

   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):
   52.6 – 72.3 kPa (40 – 55 cmHg, 15.7 – 21.6 in.Hg) at specified idling speed

4) After checking, connect vacuum hose to intake manifold.

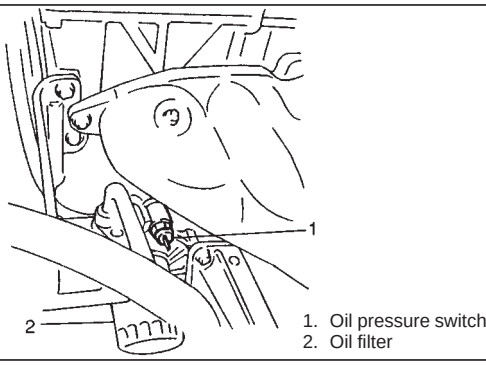


1. Full level mark
2. Low level mark

OIL PRESSURE CHECK

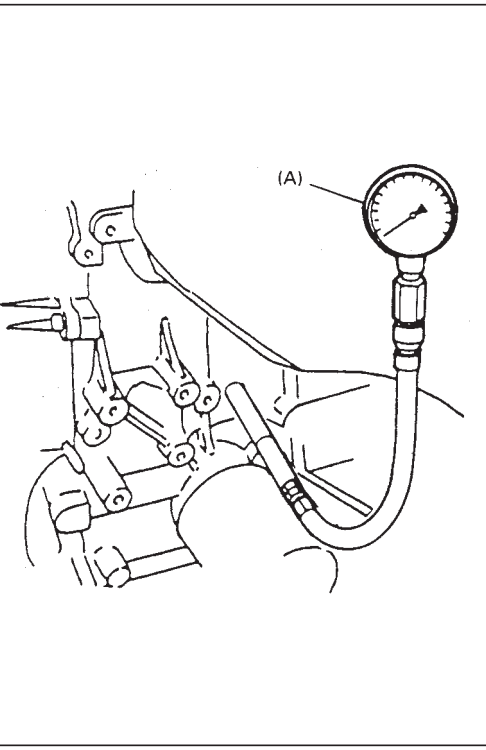
NOTE:
Prior to checking oil pressure, check following items.

- **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.



1. Oil pressure switch
2. Oil filter

1) Remove oil pressure switch from cylinder block.



2) Install special tool (Oil pressure gauge) to vacated threaded hole.

   Special Tool
   (A): 09915-77310

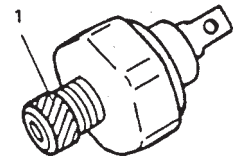
3) Start engine and warm it up to normal operating temperature.

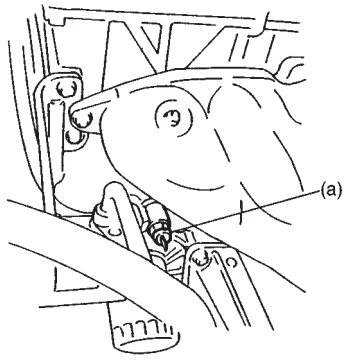
   NOTE:
   Be sure to place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake and block drive wheels.

4) After warming up, raise engine speed to 4,000 r/min and measure oil pressure.

   Oil pressure specification:
   330 – 430 kPa (3.3 – 4.3 kg/cm^2, 46.9 – 61.1 psi) at 4,000 r/min (rpm)

5) Stop engine and remove oil pressure gauge.





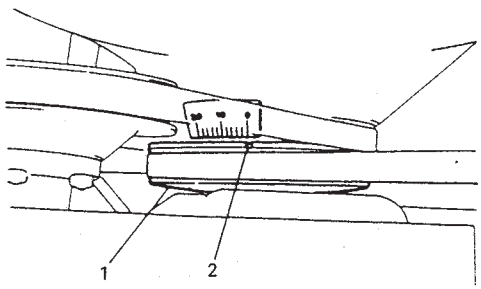
1. Sealing tape

6) Before reinstalling oil pressure switch, 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)

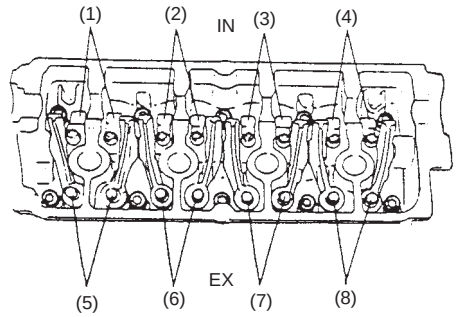
7) Start engine and check oil pressure switch for oil leakage.



1. Crankshaft pulley
2. V mark

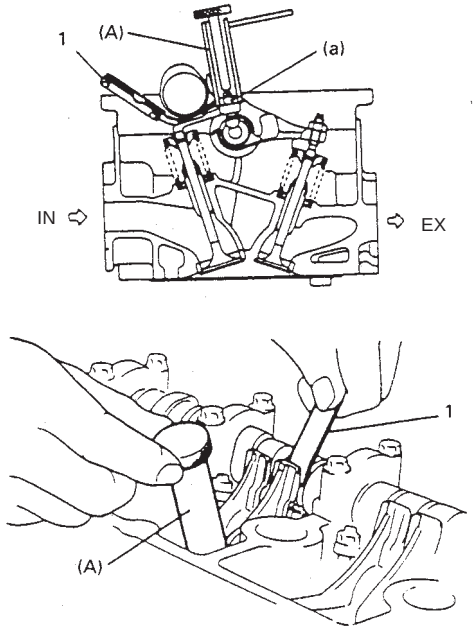
VALVE LASH (CLEARANCE)

1) Remove negative cable at battery.
2) Remove cylinder head cover referring to item “Cylinder Head cover”.
3) Using 17 mm socket, turn crankshaft pulley clockwise until “V” mark (in white paint) on pulley aligns with “0” (zero) calibrated 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.



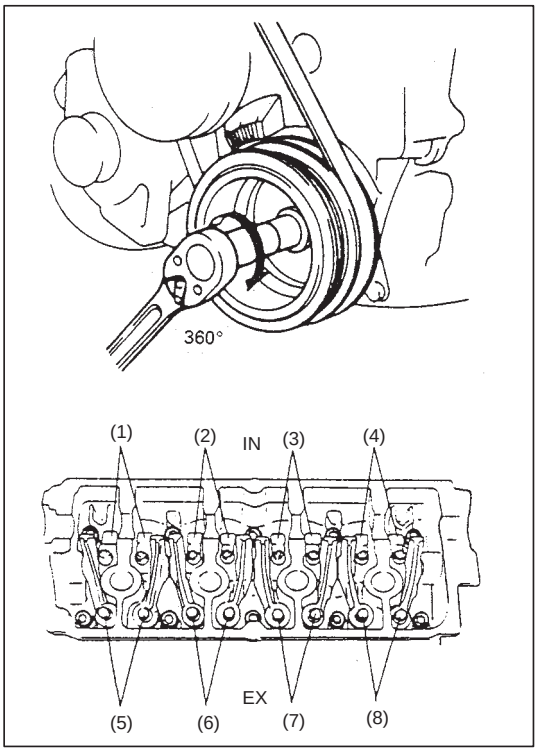
1. Thickness gauge

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 holding adjusting screw stationary, and then make sure again that valve lash is within specification.

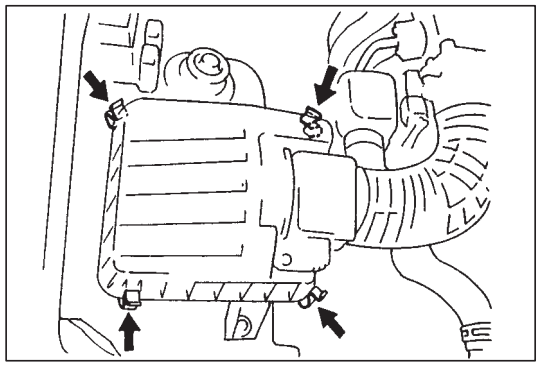
		When cold (Coolant temperature is 15 – 25°C or 59 – 77°F)	When hot (Coolant temperature is 60 – 68°C or 140 – 154°F)
Valve clearance specification	Intake	0.13 – 0.17 mm (0.005 – 0.007 in.)	0.17 – 0.21 mm (0.007 – 0.008 in.)
	Exhaust	0.23 – 0.27 mm (0.009 – 0.011 in.)	0.28 – 0.32 mm (0.011 – 0.013 in.)

Special Tool
(A): 09917-18210

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



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.



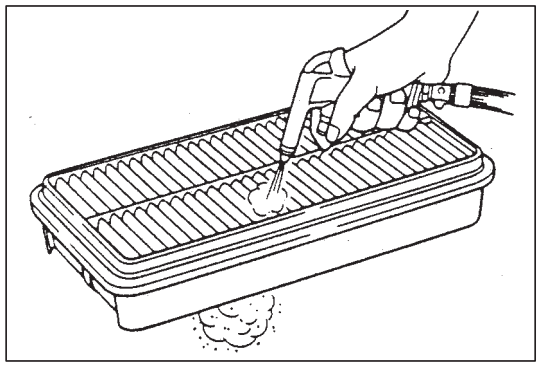
AIR CLEANER ELEMENT

REMOVAL

1) Remove air cleaner case clamps.
2) Remove air cleaner element from case.

INSPECTION

Check air cleaner element for dirt. Replace excessively dirty element.



CLEAN

Blow off dust by compressed air from air outlet side of element.

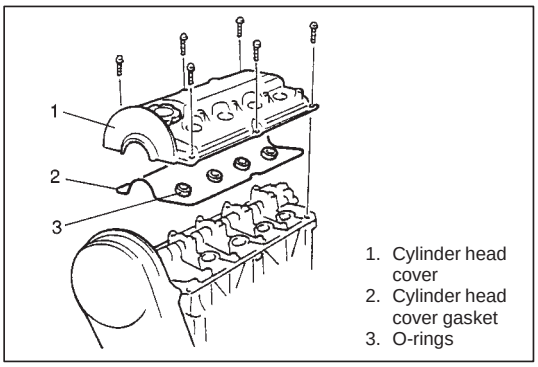
INSTALLATION

Reverse removal procedure for installation.

CYLINDER HEAD COVER

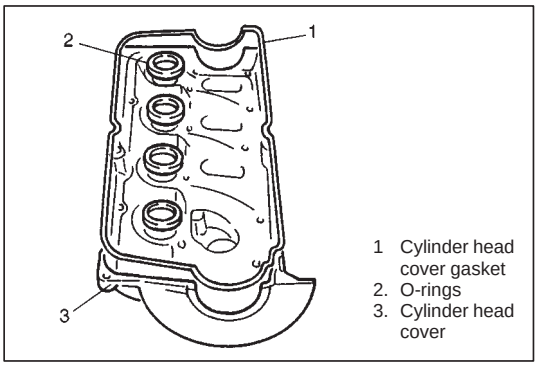
REMOVAL

1) Disconnect negative cable at battery.
2) Remove ignition coil assemblies with high-tension cord.
3) Disconnect PCV valve and breather hose from head cover.
4) Detach accelerator cable from clamp.



1. Cylinder head cover
2. Cylinder head cover gasket
3. O-rings

5) Remove cylinder head cover with cylinder head cover gasket and O-rings.

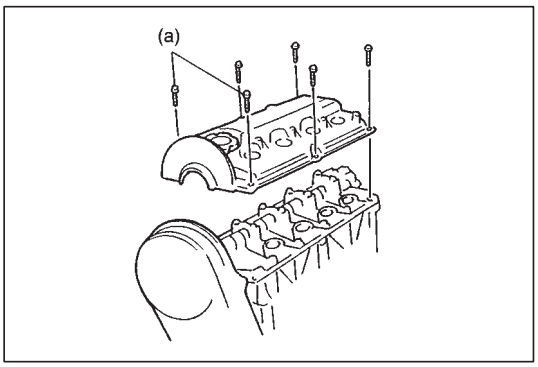


1 Cylinder head cover gasket
2. O-rings
3. Cylinder head cover

INSTALLATION

1) Install O-rings and cylinder head cover gasket to cylinder head cover.

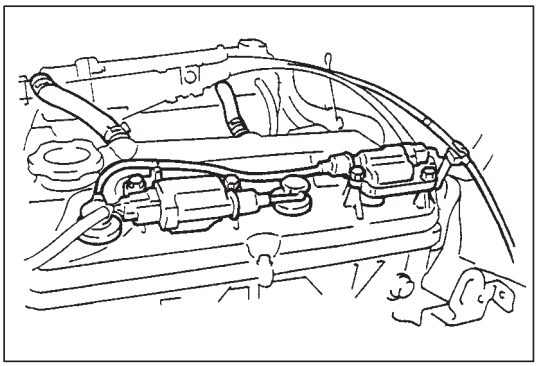
NOTE:
Be sure to check each of these parts for deterioration or any damage before installation and replace if found defective.



2) Install cylinder head cover to cylinder head and tighten cover bolts to specified torque.

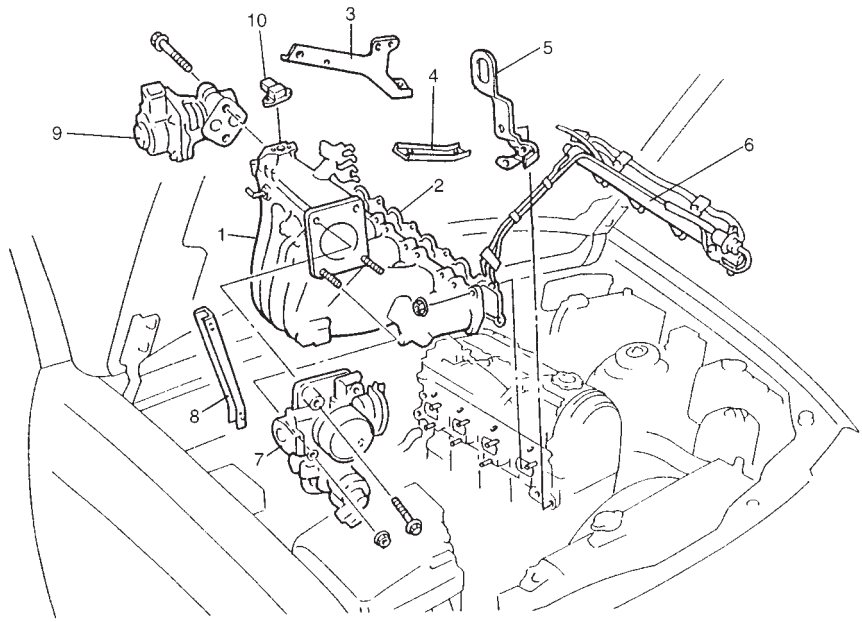
Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

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) Fix accelerator cable with clamp.
4) Install ignition coil assemblies with high-tension cord.
5) Connect PCV valve and breather hose to head cover.
6) Connect negative cable at battery.

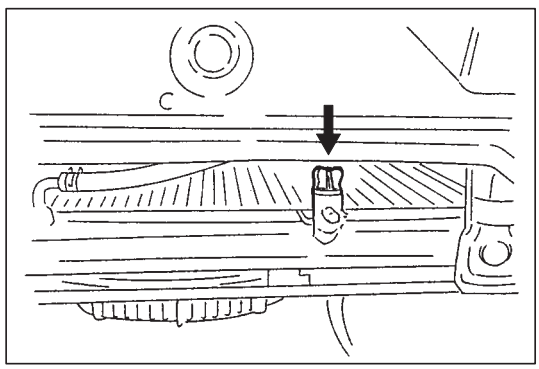
THROTTLE BODY AND INTAKE MANIFOLD



1. Intake manifold
2. Gasket
3. Intake manifold No.2 stiffener
4. Intake manifold stiffener (Front)
5. Engine hook
6. Fuel delivery pipe
7. Throttle body
8. Intake manifold stiffener (Rear)
9. EGR valve
10. Manifold absolute pressure (MAP) sensor

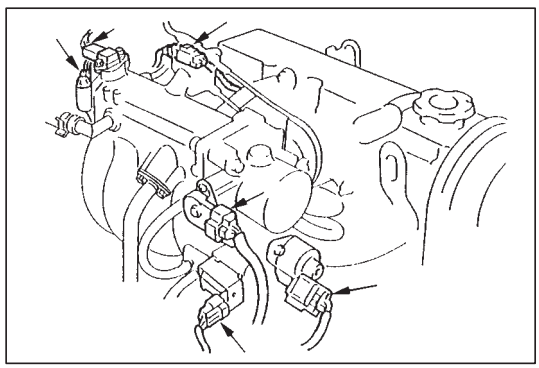
REMOVAL

1) Relieve fuel pressure according to fuel pressure relief procedure described in section 6.
2) Disconnect negative cable at battery.

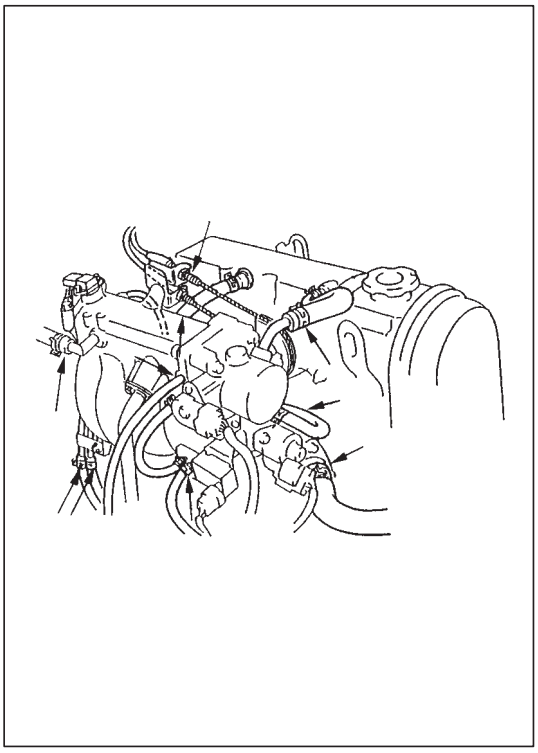


3) Drain cooling system.

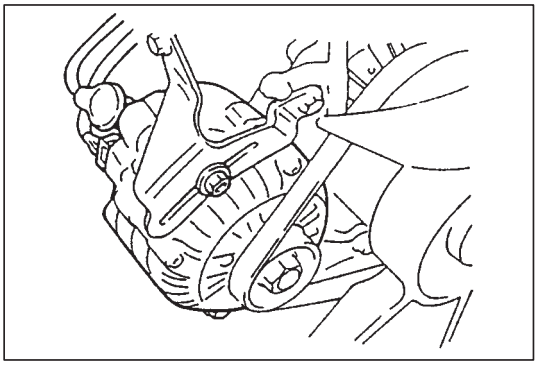
WARNING:
To help avoid danger of being burned, do not remove drain plug and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.



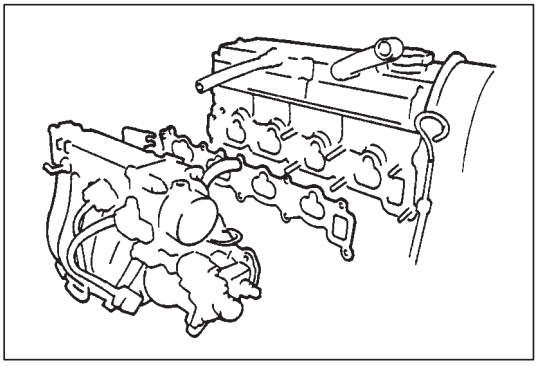
4) Remove air intake hose.
5) Disconnect following electric lead wires:
   - EGR valve
   - Ground wires from intake manifold
   - Manifold absolute pressure (MAP) sensor
   - Engine coolant temperature (ECT) sensor
   - Injectors lead wires at the coupler
   - EVAP canister purge valve
   - Throttle position sensor
   - Idle air control valve



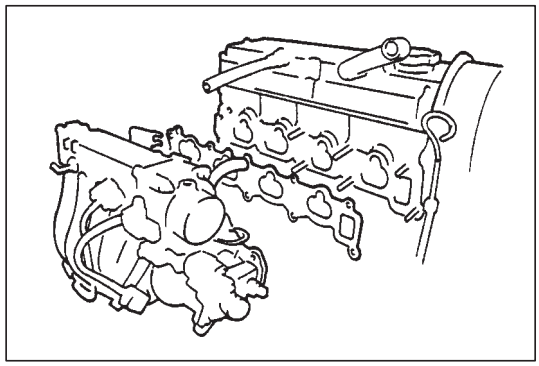
6) Disconnect accelerator cable and A/T throttle cable (for A/T) from throttle body.
7) Disconnect following hoses:
   - ° Brake booster hose from intake manifold
   - ° Canister purge hose from EVAP canister purge valve
   - ° Engine cooling water (coolant) hose (outlet side) from throttle body
   - ° Radiator inlet hose from thermostat cap
   - ° PCV hoses from intake manifold and throttle body
   - ° Fuel feed hose and return hose from each pipe
   - ° Vacuum hose from intake manifold



8) Remove generator adjust arm.
9) Remove intake manifold stiffeners from intake manifold.



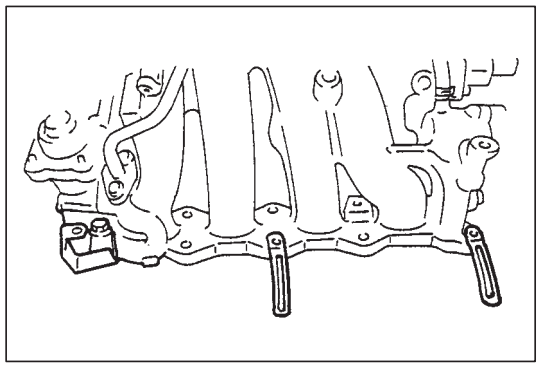
10) Remove intake manifold with throttle body from cylinder head, and then its gasket.



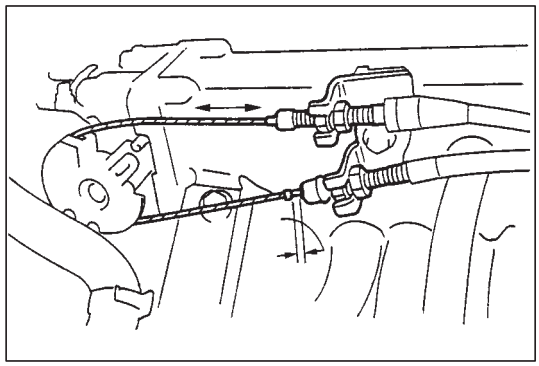
INSTALLATION

Reverse removal procedure for installation noting the followings.

° Use new intake manifold gasket.



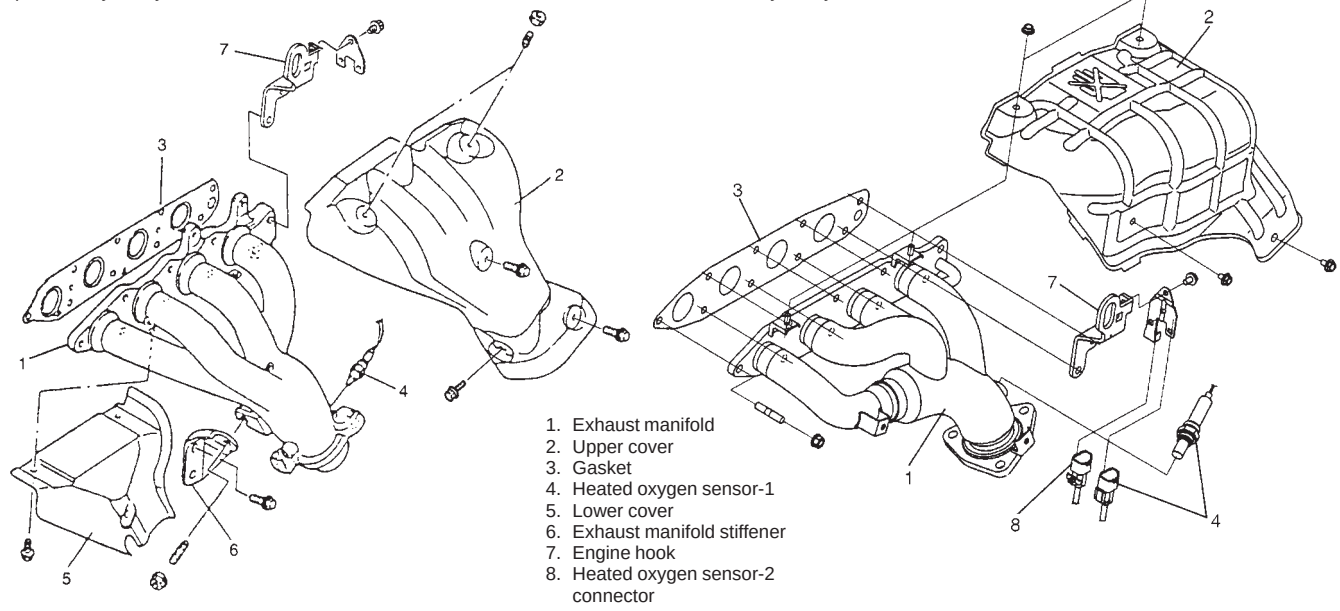
° When installing intake manifold, install clamps at positions as shown in figure.



° Adjust accelerator cable play and A/T throttle cable (for A/T) 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 “ENGINE COOLING” section.
° Adjust water pump drive belt tension, referring to “ENGINE COOLING” section.
° Upon completion of installation, turn ignition switch ON but engine OFF and check for fuel leaks.
° Finally, start engine and check for engine coolant leaks.

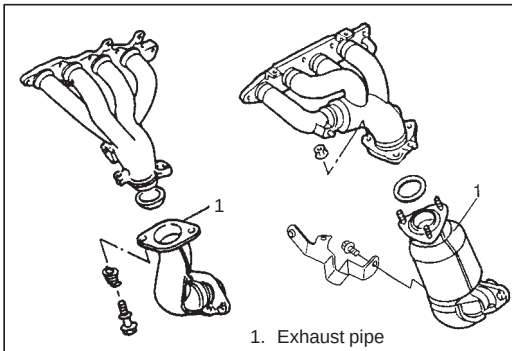
EXHAUST MANIFOLD



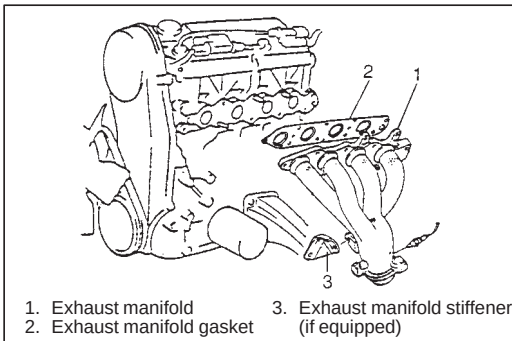
WARNING:
To avoid danger of being burned, do not service exhaust system while it is still hot. Service should be performed after system cools down.

REMOVAL

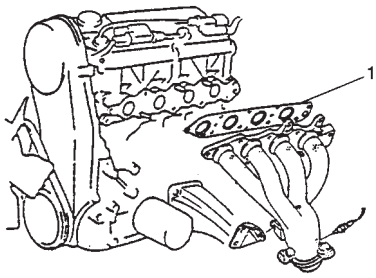
1) Disconnect negative cable at battery.
2) Disconnect heated oxygen sensor-1 coupler.
3) Remove upper cover of exhaust manifold.



4) Remove exhaust pipe bolts or nuts and exhaust pipe bracket bolt (if equipped).



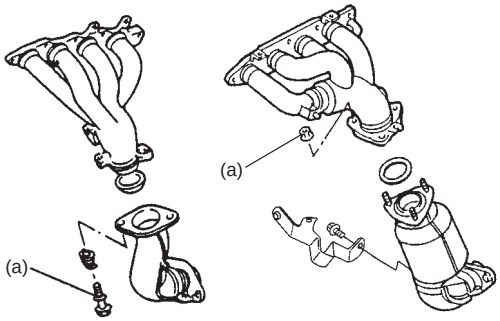
5) Remove exhaust manifold stiffener (if equipped).
6) Remove exhaust manifold and its gasket from cylinder head.



1. Exhaust manifold gasket

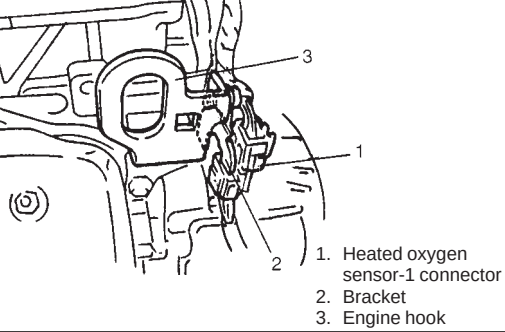
INSTALLATION

1) Install new gasket to cylinder head.
2) Install exhaust manifold and stiffener (if equipped).
   Tighten bolts and nuts to specified torque.



3) Install pipe gasket and install exhaust pipe to exhaust manifold.
   Before installing pipe gasket, check it for deterioration or damage, and replace as necessary. Use new lock nuts if used.
   Tighten pipe fasteners to specified torque.

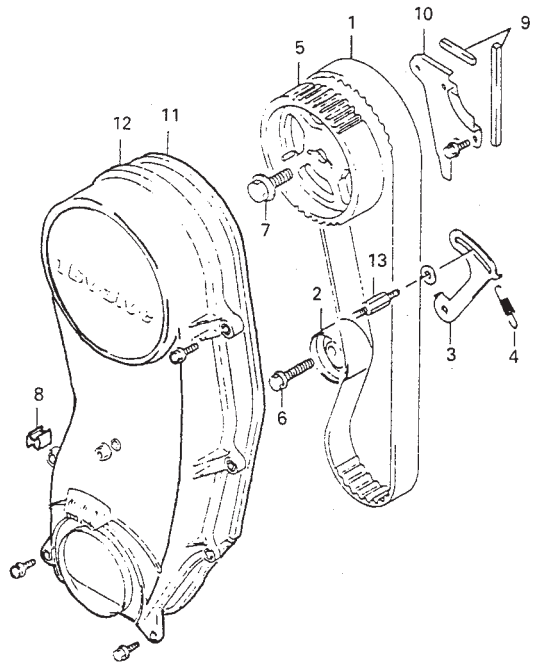
   Tightening Torque
   (a): 50 N·m (5.0 kg-m, 36.5 lb-ft)



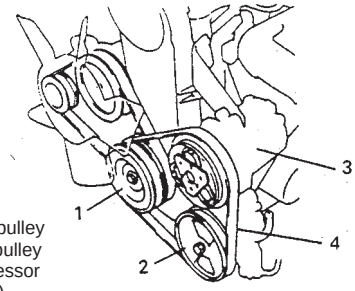
1. Heated oxygen sensor-1 connector
2. Bracket
3. Engine hook

4) Install upper cover to exhaust manifold.
5) Connect heated oxygen sensor-1 connector and fit connector to bracket.
6) Connect negative cable at battery.
   Check exhaust system for exhaust gas leakage.

TIMING BELT AND BELT TENSIONER



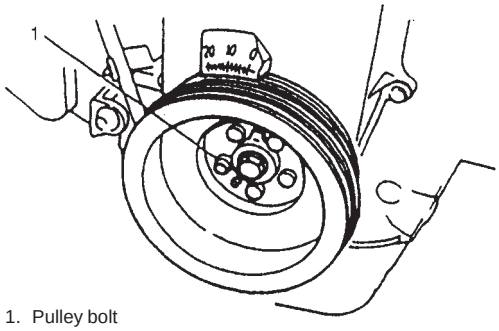
1. Timing belt
2. Tensioner
3. Tensioner plate
4. Tensioner spring
5. Camshaft timing pulley
6. Tensioner bolt
7. Pulley bolt
8. Seal
9. Inside cover seal
10. Inside cover
11. Outside cover seal
12. Outside cover
13. Tensioner stud



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

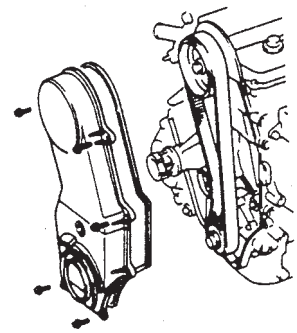
REMOVAL

1) Disconnect negative cable at battery.
2) Drain engine coolant and disconnect inlet hose from radiator.
3) Remove power steering pump belt or A/C compressor belt, if equipped.
4) Remove radiator cooling fan, water pump pulley, water pump drive belt and fan shroud.

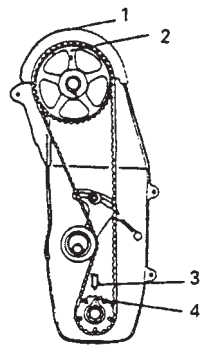


1. Pulley bolt

5) Remove crankshaft pulley by removing 5 pulley bolts.

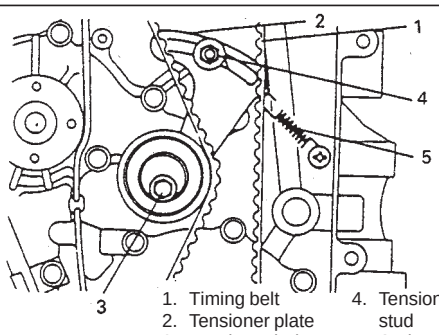


6) Remove timing belt outside cover.



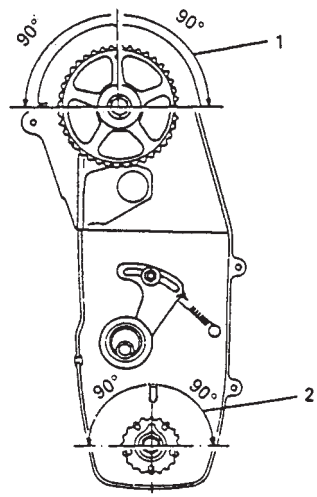
1. "V" mark on cylinder head cover
2. Timing mark by "E" on camshaft timing belt pulley
3. Arrow mark on oil pump case
4. Punch mark on crankshaft timing belt pulley

7) For installation of timing belt, align 4 timing marks as shown in figure by turning crankshaft.



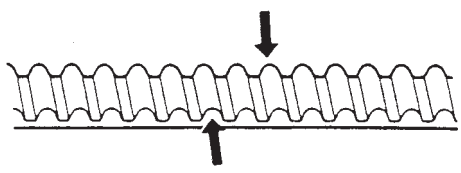
1. Timing belt
2. Tensioner plate
3. Tensioner bolt
4. Tensioner stud
5. Spring

8) Remove timing belt tensioner, tensioner plate, tensioner spring and timing belt.



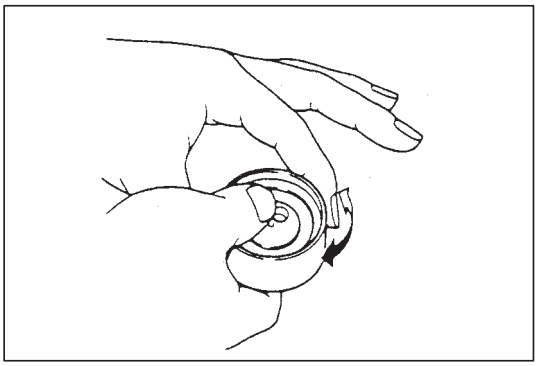
1. Camshaft allowable turning range - - - By timing mark, within 90° from "V" mark on head cover on both right and left.
2. Crankshaft allowable turning range - - - By punch mark, within 90° from arrow mark on oil pump case on both right and left.

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.**

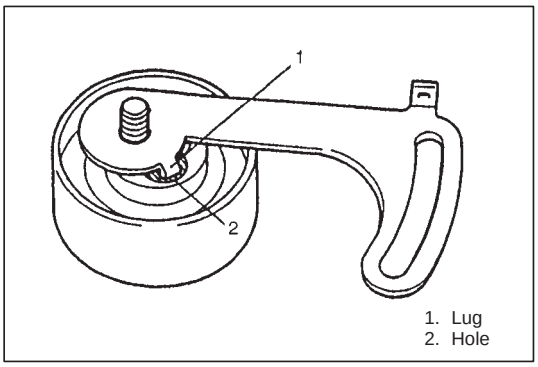


INSPECTION

- Inspect timing belt for wear or crack.
  Replace it as necessary.



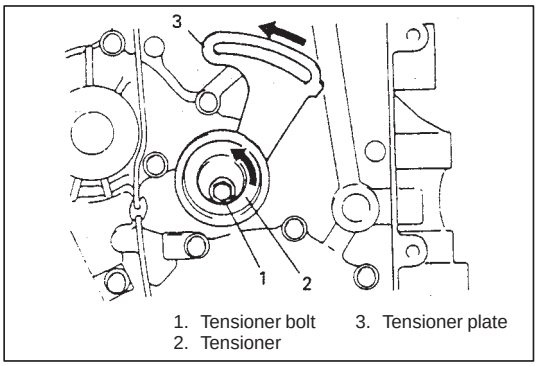
° Inspect tensioner for smooth rotation.



1. Lug
2. Hole

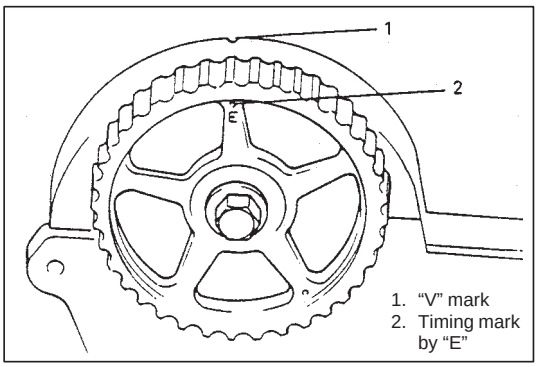
INSTALLATION

1) Install tensioner plate to tensioner.
   Insert lug of tensioner plate into hole in tensioner.



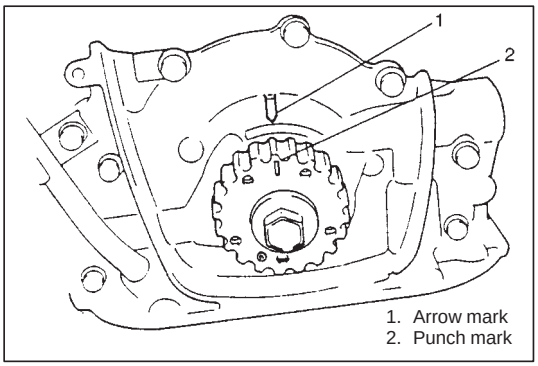
1. Tensioner bolt
2. Tensioner
3. Tensioner plate

2) Install tensioner and tensioner plate:
   Do not tighten tensioner bolt with wrench yet. Hand tighten only at this time.
   Check to ensure that plate movement in arrow direction as shown in figure causes tensioner to move in the same direction. If no associated movement between plate and tensioner occurs, remove tensioner and plate again and reinsert plate lug into tensioner hole.



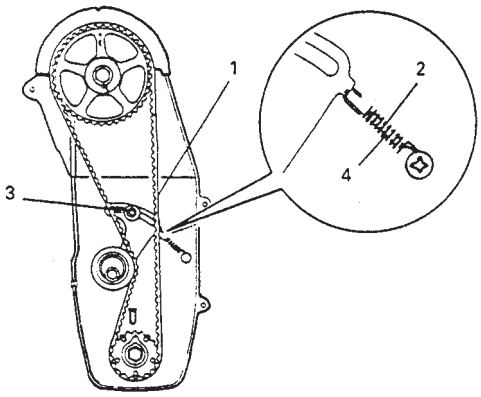
1. "V" mark
2. Timing mark by "E"

3) Check that timing mark on camshaft timing belt pulley is aligned with "V" mark on cylinder head 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 page 6A1-19.



1. Arrow mark
2. Punch mark

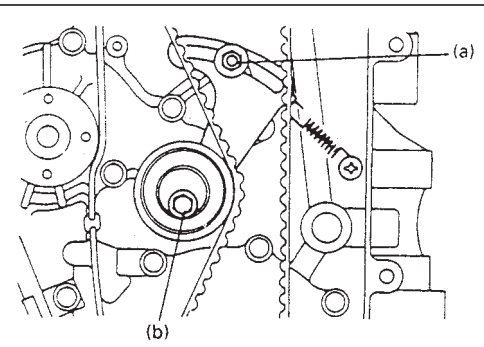
4) Check that punch mark on crankshaft timing belt pulley is aligned with arrow mark on oil pump case. If not, align two marks by turning crankshaft but be careful not to turn it more than its allowable turning range which is described on page 6A1-19.



1. Drive side of belt
2. Tensioner spring
3. Tensioner stud
4. Damper

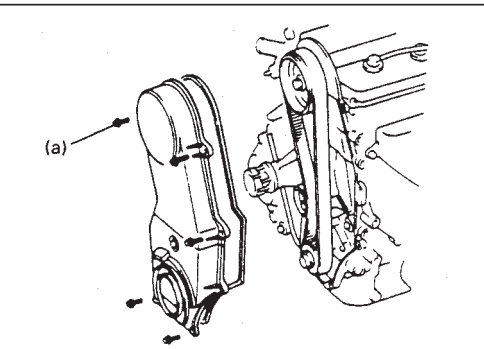
5) Install timing belt and tensioner spring.
With two sets of marks aligned and tensioner plate pushed up, install timing belt on two pulleys in such a way that drive side of belt is free from any slack.
And then install tensioner spring as shown in figure, and hand-tighten tensioner stud.

NOTE:
- **When installing timing belt, match arrow mark (⇨) on timing belt with rotating direction of crankshaft.**
- **In this state, No. 4 piston is at top dead center of compression stroke.**



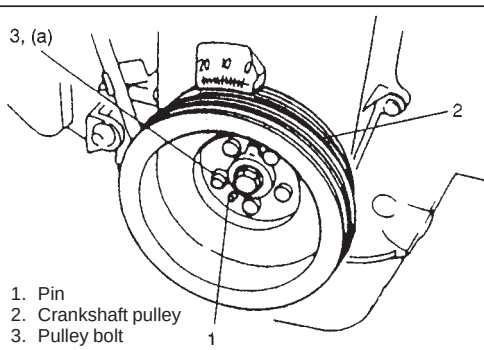
6) To take up slack of timing belt, turn crankshaft two rotations clockwise after installing it. After making sure that belt is free from slack, tighten tensioner stud first and then tensioner bolt to each specified torque.
Then confirm again that two sets of marks are aligned respectively.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)
(b): 25 N·m (2.5 kg-m, 18.0 lb-ft)



7) 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)



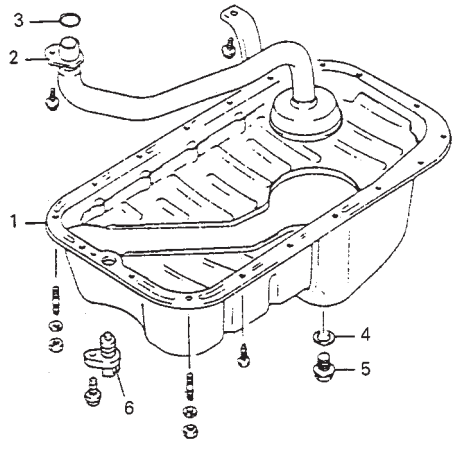
1. Pin
2. Crankshaft pulley
3. Pulley bolt

8) Install crankshaft pulley.
Fit hole of pulley to pin on crankshaft timing belt pulley, and tighten pulley bolts to specified torque.

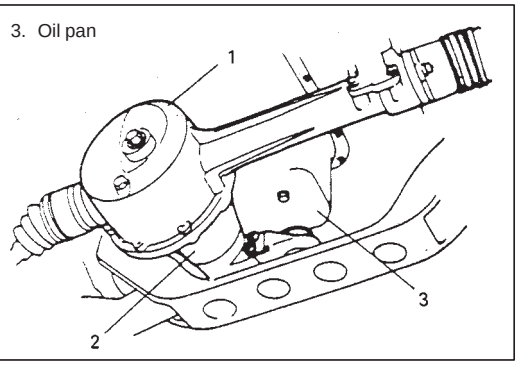
Tightening Torque
(a): 16 N·m (1.6 kg-m, 11.5 lb-ft)

9) Install radiator fan shroud, water pump pulley, cooling fan and water pump drive belt.
   Adjust water pump drive belt tension, referring to “ENGINE COOLING” section.
10) Install power steering pump belt or A/C compressor belt, if equipped.
   Adjust its belt tension, referring to section 0B.
11) Connect radiator inlet hose to radiator.
12) Refill cooling system, referring to “ENGINE COOLING” section.
13) Connect negative cable to battery.
14) Verify that there is no coolant leakage at hose connection.

OIL PAN AND OIL PUMP STRAINER

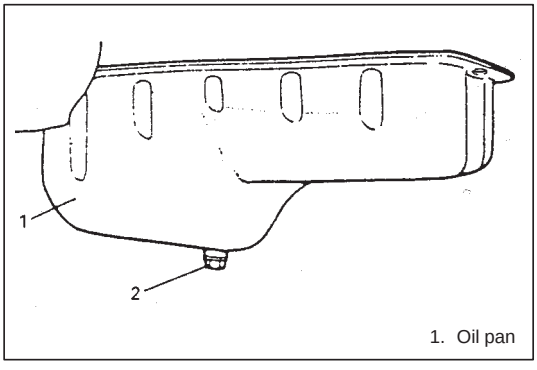


1. Oil pan
2. Oil pump strainer
3. Seal
4. Drain plug gasket
5. Drain plug
6. CKP sensor



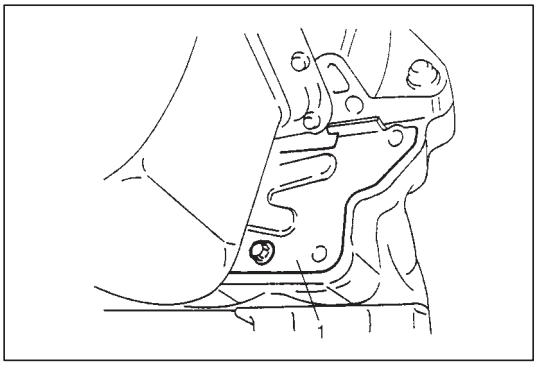
REMOVAL

1) Raise vehicle.
2) Remove front differential housing (1) with differential (2), referring to “DIFFERENTIAL” section.

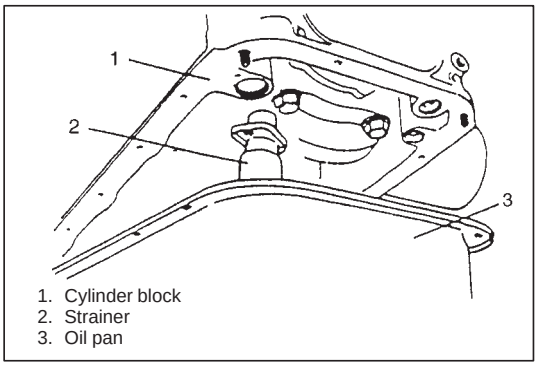


1. Oil pan

3) Disconnect CKP sensor coupler and remove CKP sensor by removing its bolt. (if equipped)
4) Drain engine oil by removing drain plug (2).

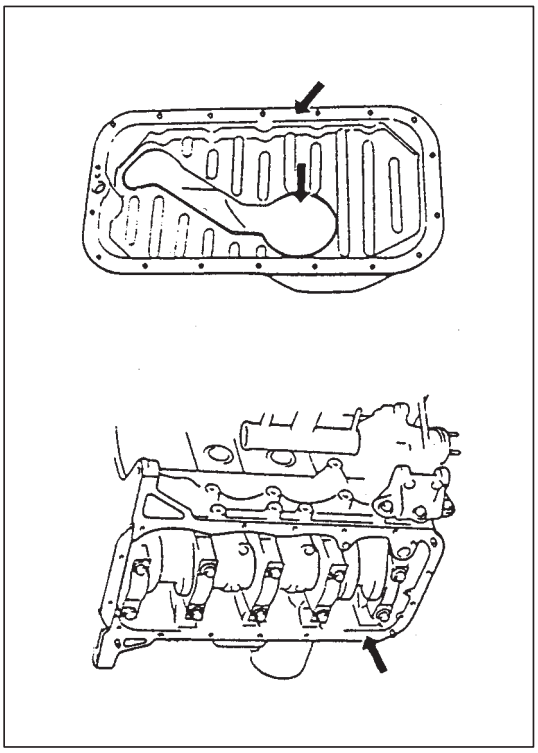


5) Remove clutch housing (torque converter housing for A/T) lower plate (1).



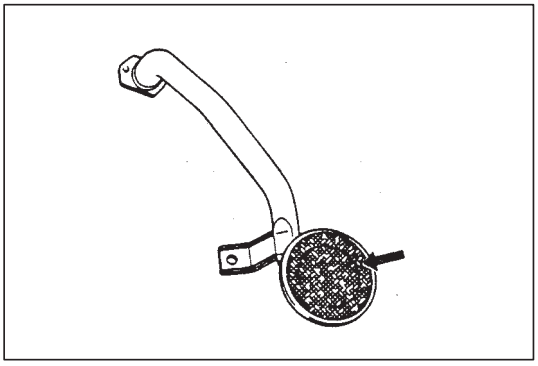
1. Cylinder block
2. Strainer
3. Oil pan

6) Remove oil pan and then oil pump strainer.

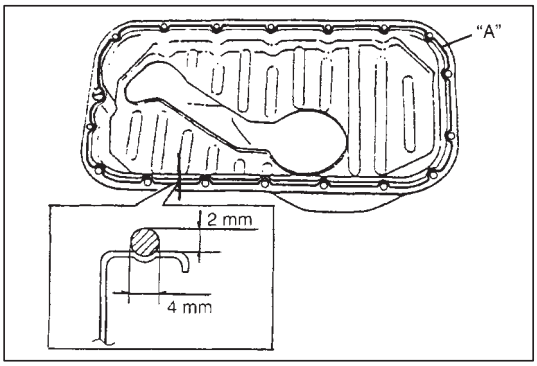


CLEANING

° Clean mating surfaces of oil pan and cylinder block.
Remove oil, old sealant, and dusts from mating surfaces and oil pan inside.



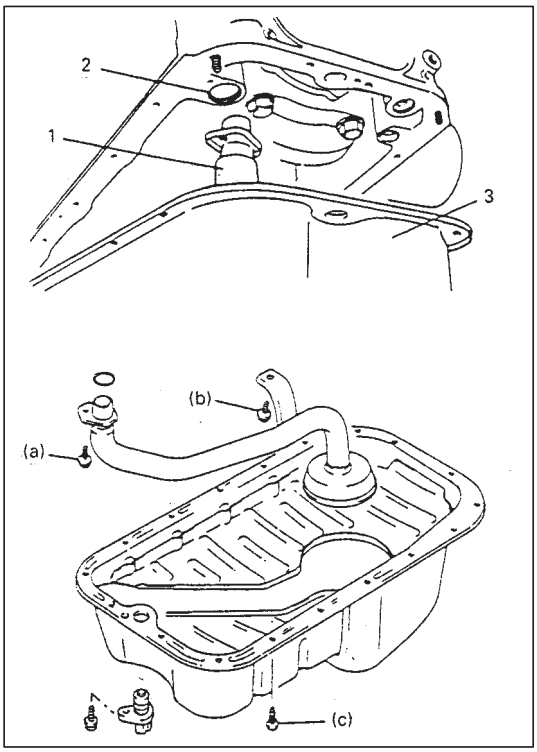
° Clean oil pump strainer screen.



INSTALLATION

1) Apply sealant to oil pan mating surface continuously as shown in figure.

   "A" Sealant: 99000-31150

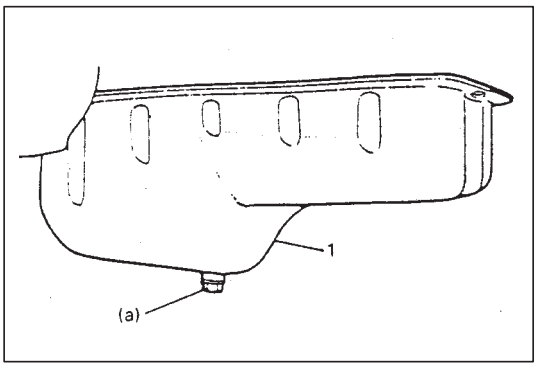


2) Install oil pump strainer (1) and oil pan (3).
   Install seal (2) in the position as shown in figure.
   Tighten strainer bolt first and then bracket bolt to specified torque.

   Tightening Torque
   (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)
   (b): 11 N·m (1.1 kg-m, 8.0 lb-ft)

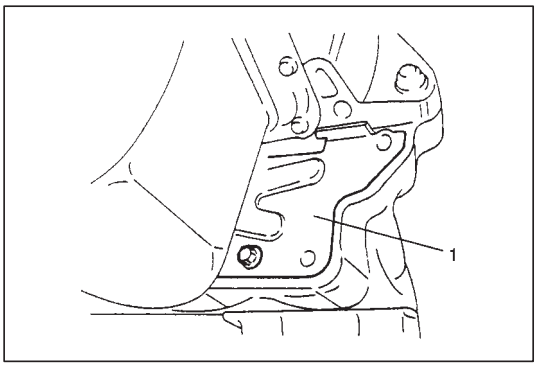
   After fitting oil pan to cylinder block, run in securing bolts and start tightening at the center: move wrench outward, tightening one bolt at a time.
   Tighten bolts to specified torque.

   Tightening Torque
   (c): 11 N·m (1.1 kg-m, 8.0 lb-ft)

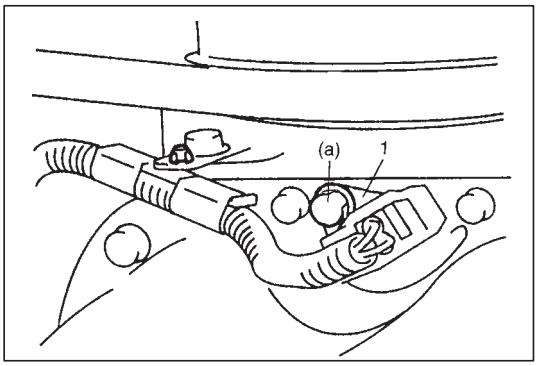


3) Install gasket and drain plug to oil pan (1).
   Tighten drain plug to specified torque.

   Tightening Torque
   (a): 35 N·m (3.5 kg-m, 25.5 lb-ft)



4) Install clutch (torque converter) housing lower plate (1).

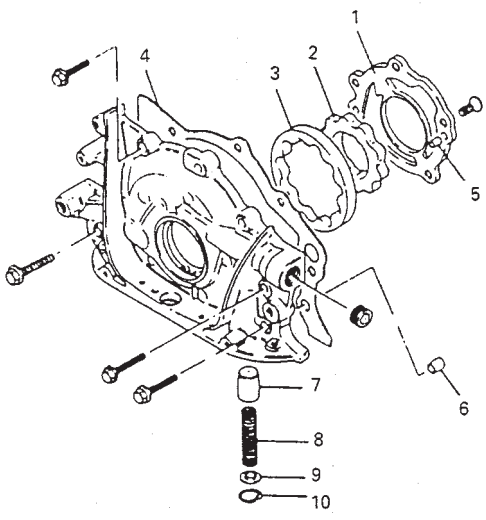


5) Install CKP sensor (1) and connect its coupler.

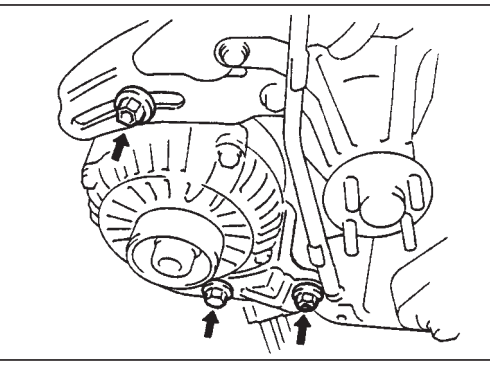
Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

6) Install front differential housing with differential according to installation procedure described in “DIFFERENTIAL” section.
7) Refill front differential housing with gear oil, referring to “DIFFERENTIAL” section.
8) Refill engine with engine oil, referring to item “ENGINE OIL CHANGE” in section 0B.
9) Verify that there is no engine oil leakage and differential oil leakage at each connection.

OIL PUMP



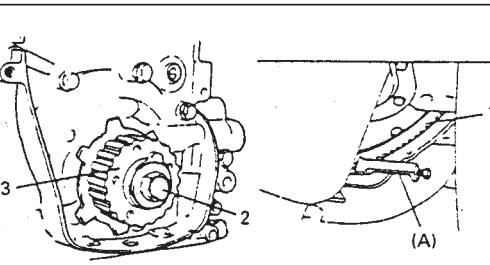
1. Rotor plate
2. Inner rotor
3. Outer rotor
4. Gasket
5. Pin
6. Pin
7. Relief valve
8. Spring
9. Retainer
10. Retainer ring



REMOVAL

1) Disconnect negative cable at battery.
2) Remove timing belt as previously outlined.
3) Remove generator and its bracket.

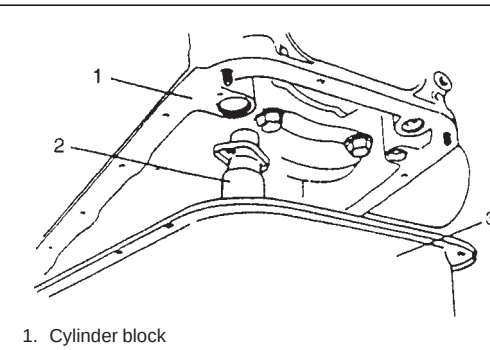
NOTE:
When installing bracket, fasten nut first.



1. Flywheel (Drive plate for A/T)
2. Pulley bolt
3. Crank timing belt pulley

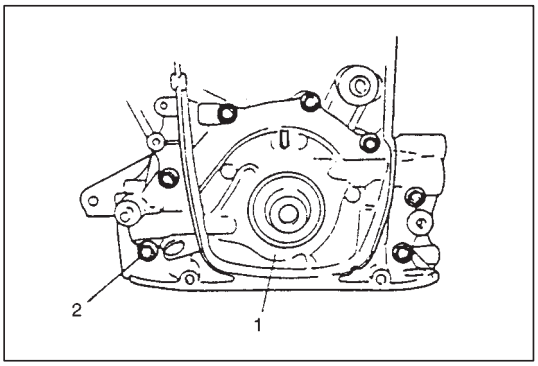
4) Remove crankshaft timing belt pulley.
To lock crankshaft, engage special tool (gear stopper) with flywheel ring gear (drive plate ring gear for A/T).
With crankshaft locked, remove crankshaft timing belt pulley bolt.

Special Tool
(A): 09927-56010

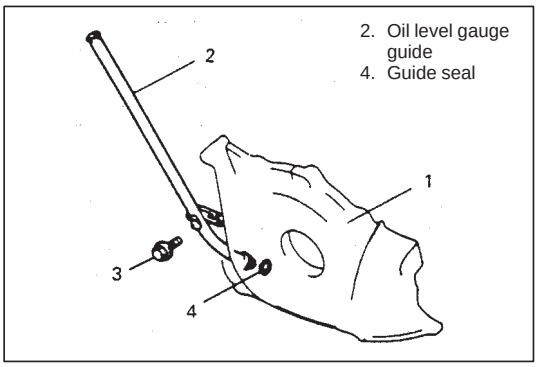


1. Cylinder block

5) Remove oil pan (3) and oil pump strainer (2) as previously outlined.

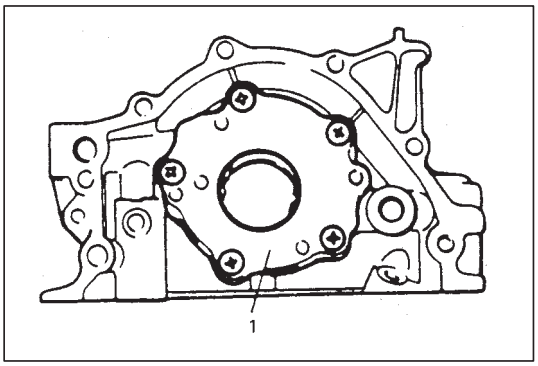


6) Remove oil pump assembly (1) after removing bolts (2).

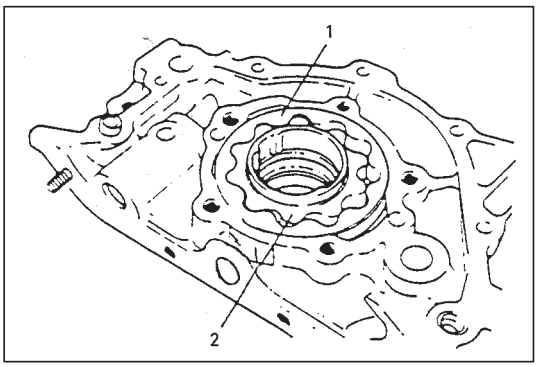


DISASSEMBLY

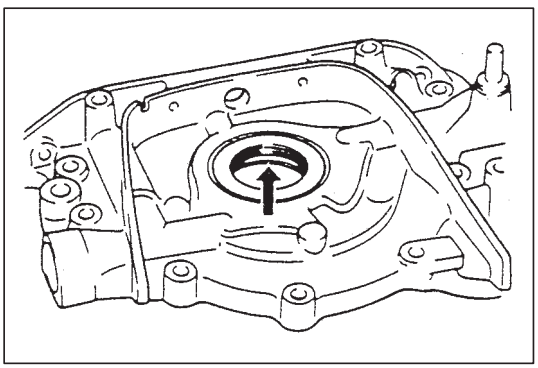
1) Remove oil level gauge guide bolt (3) and pull out guide from oil pump (1).



2) Remove rotor plate (1).

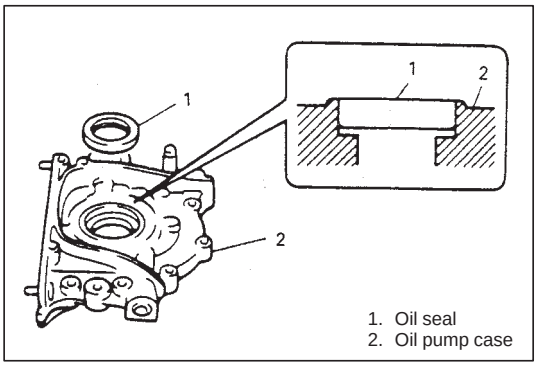


3) Remove outer rotor (1) and inner rotor (2).



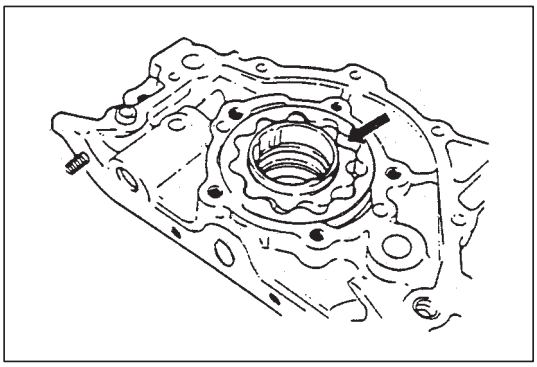
INSPECTION

◦ Check oil seal lip for fault or other damage. Replace as necessary.

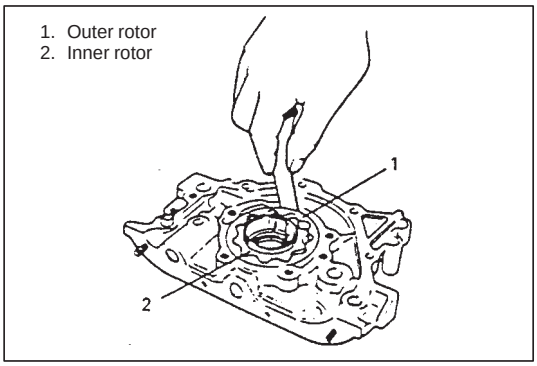


1. Oil seal
2. Oil pump case

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.



1. Outer rotor
2. Inner rotor

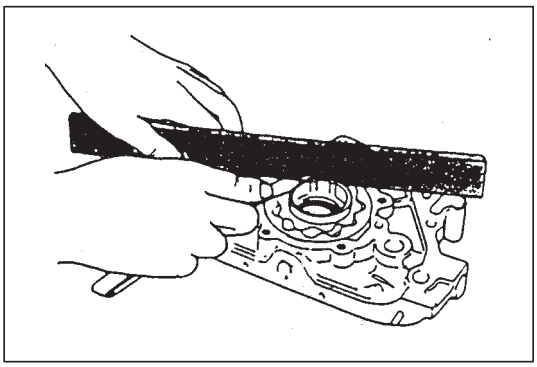
MEASUREMENT

° **Radial clearance**

Check radial clearance between outer rotor and case, using thickness gauge.

If clearance exceeds its limit, replace outer rotor or case.

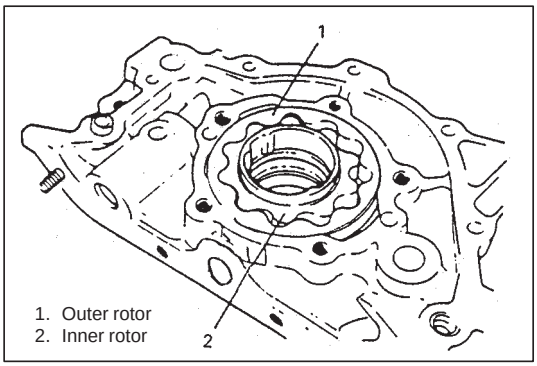
Limit on radial clearance between outer rotor and case: 0.310 mm (0.0122 in.)



° **Side clearance**

Using straight edge and thickness gauge, measure side clearance.

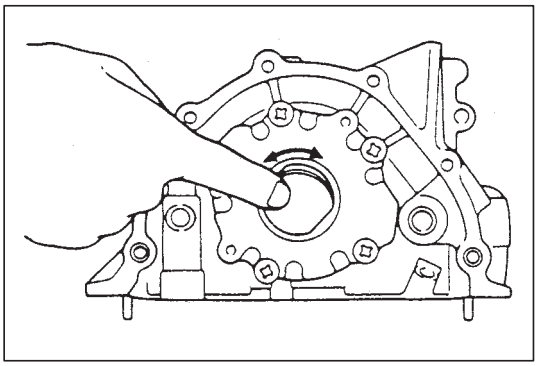
Limit on side clearance: 0.15 mm (0.0059 in.)



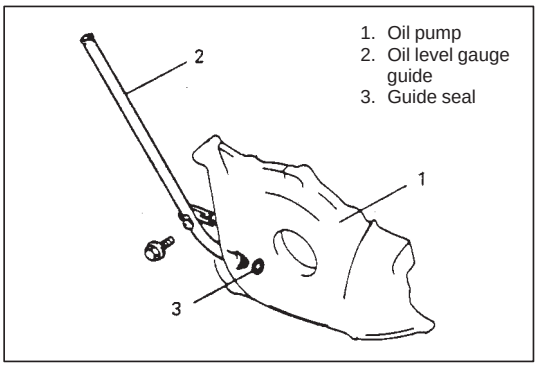
1. Outer rotor
2. Inner rotor

ASSEMBLY

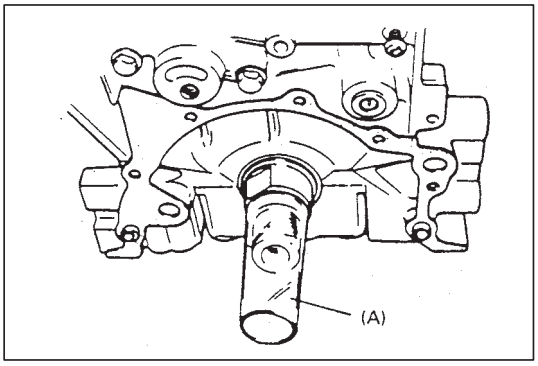
1) Wash, clean and then dry all disassembled parts.
2) Apply thin coat of engine oil to inner and outer rotors, oil seal lip portion, and inside surfaces of oil pump case and plate.
3) Install outer and inner rotors to pump case.



4) Install rotor plate. Tighten 5 screw securely.
After installing plate, check to be sure that gears turn smoothly by hand.



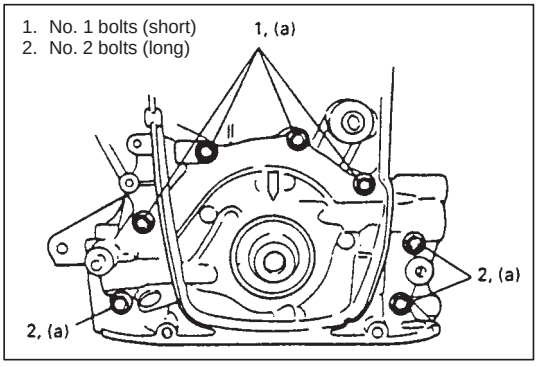
5) Apply engine oil to guide seal and install guide seal and guide.



INSTALLATION

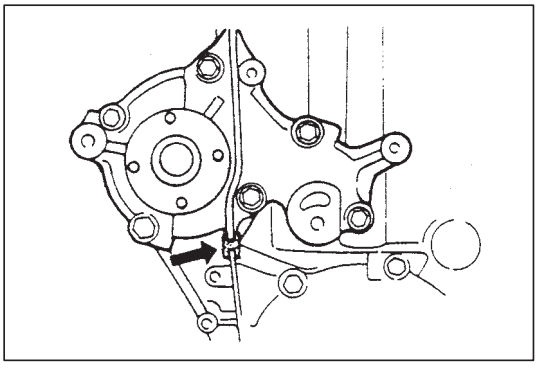
1) Install two oil pump pins and oil pump gasket to cylinder block. Use a new gasket.
2) To prevent oil seal lip from being damaged or upturned when installing oil pump to crankshaft, fit special tool (Oil seal guide) to crankshaft, and apply engine oil to special tool.

Special Tool
(A): 09926-18210

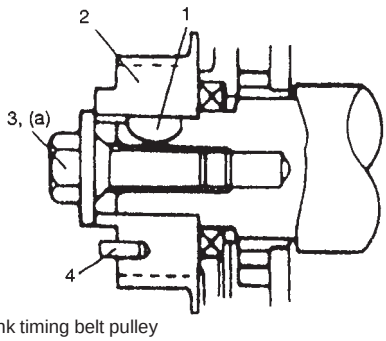


3) Install oil pump to cylinder block.
As there are 2 types of oil pump bolts, refer to figure for their correct use and tighten them to specified torque.

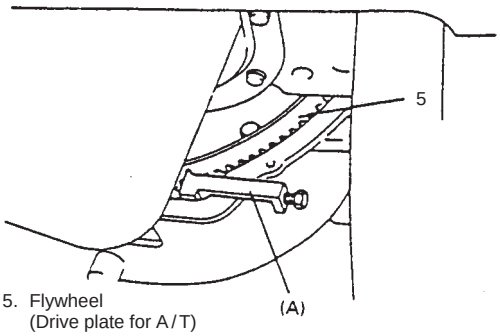
Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



4) Install rubber seal between oil pump and water pump.



1. Key
2. Crank timing belt pulley
3. Pulley bolt
4. Dowel pin (crankshaft pulley pin)



5. Flywheel
(Drive plate for A/T)

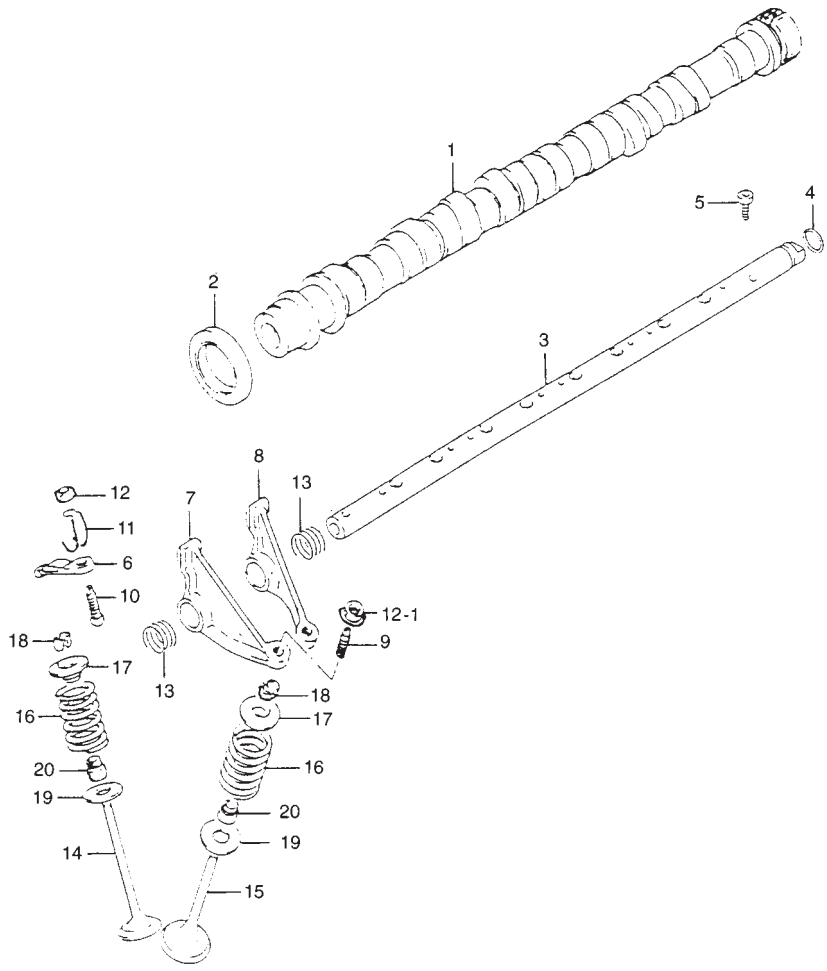
5) Install timing pulley key and crank timing belt pulley. Refer to figure for proper installation of these parts.
With crankshaft locked, tighten crank timing belt pulley bolt to specified torque.

Tightening Torque
(a): 130 N·m (13.0 kg-m, 94.0 lb-ft)

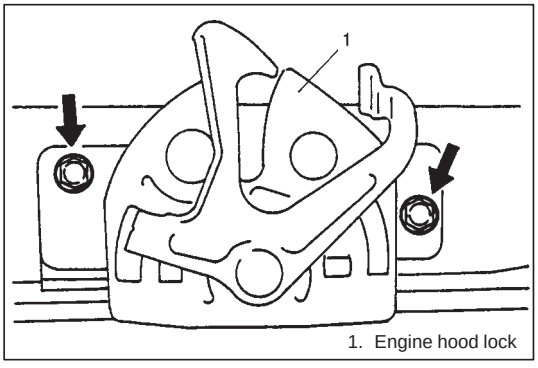
Special Tool
(A): 09927-56010

6) Install timing belt, tensioner, oil pump strainer, oil pan and other parts as previously outlined.
7) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
8) Adjust water pump drive belt tension, referring to “ENGINE COOLING” section.
9) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped. Refer to section 0B.
10) Refill engine with engine oil, referring to item “ENGINE OIL CHANGE” in section 0B.
11) Refill front differential housing with gear oil, referring to “DIFFERENTIAL” section.
12) Connect negative cable at battery.
13) Verify that there is no coolant leakage and each oil leakage at each connection.
14) After completing installation, check oil pressure by running engine.

ROCKER ARMS, ROCKER ARM SHAFT AND CAMSHAFT



1. Camshaft
2. Camshaft oil seal
3. Rocker arm shaft
4. O-ring
5. Rocker shaft bolt
6. Rocker arm (IN)
7. Rocker arm No. 1 (EX)
8. Rocker arm No. 2 (EX)
9. Valve adjusting screw
10. Valve adjusting screw
11. Clip
12. Lock nut (without flange)
12-1. Lock nut (with flange)
13. Rocker arm spring
14. Intake valve
15. Exhaust valve
16. Valve spring
17. Valve spring retainer
18. Valve cotter
19. Valve spring seat
20. Valve stem seal

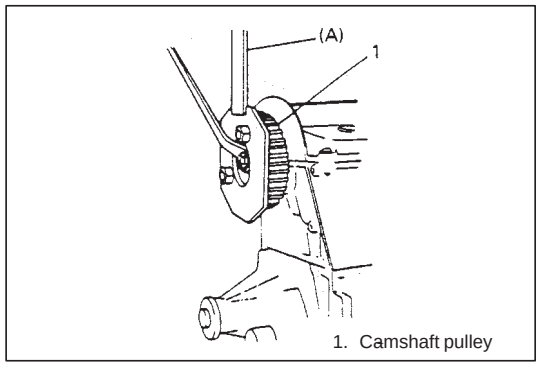


1. Engine hood lock

REMOVAL

1) Disconnect negative cable at battery.
2) Removal engine hood lock from front upper member.

3) Remove radiator referring to “ENGINE COOLING” section.
4) Remove timing belt as previously outlined.

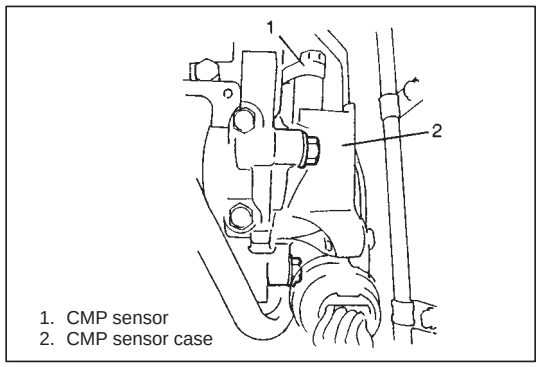


1. Camshaft pulley

5) Remove camshaft timing belt pulley by using special tool.

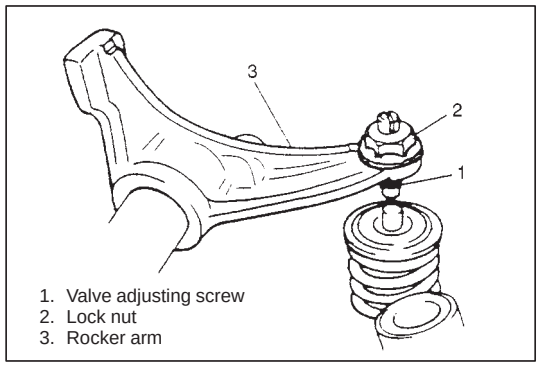
Special Tool
(A): 09917-68220

6) Remove cylinder head cover as previously outlined.



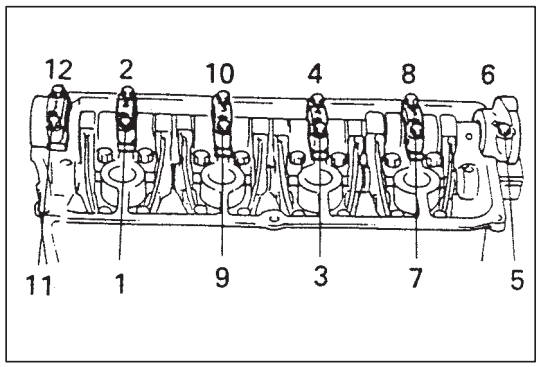
1. CMP sensor
2. CMP sensor case

7) Disconnect CMP sensor connector and remove CMP sensor case from cylinder head.
Place a container or rag under CMP sensor case, for a small amount of oil flows out during removal of case.



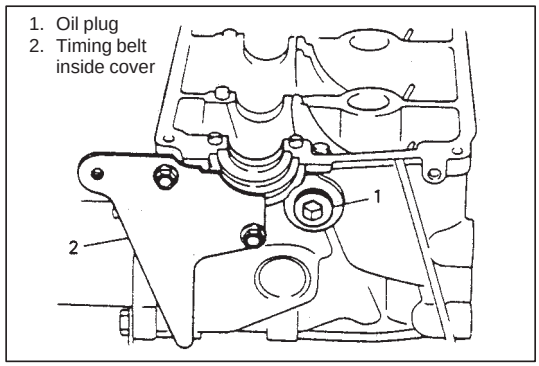
1. Valve adjusting screw
2. Lock nut
3. Rocker arm

8) After loosening all valve adjusting screw lock nuts, turn adjusting screws back all the way to allow all rocker arms to move freely.



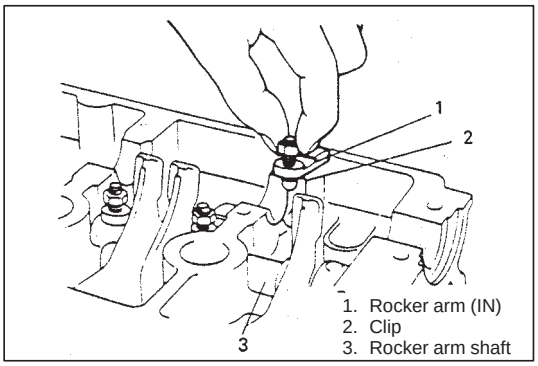
9) Remove camshaft housing and camshaft.

NOTE:
To remove camshaft housing bolts, loosen them in such order as indicated in figure, a little at a time.



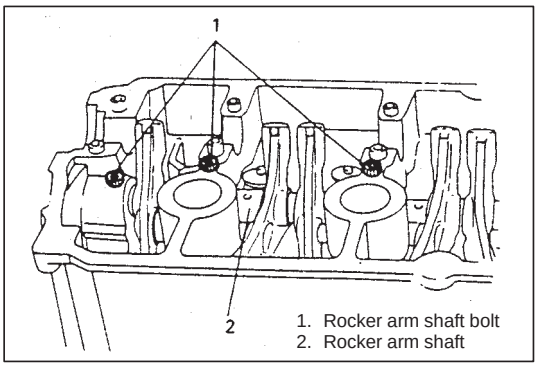
1. Oil plug
2. Timing belt inside cover

10) Remove rocker arm shaft plug and timing belt inside cover.

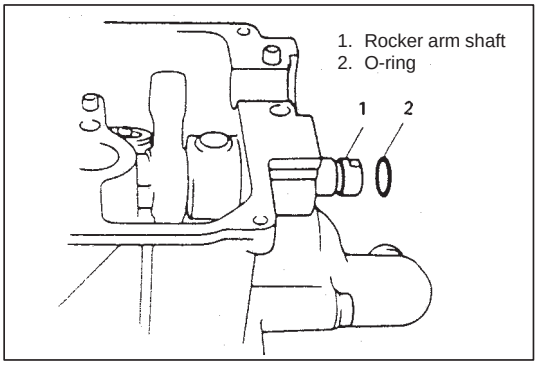


11) Remove intake rocker arm with clip from rocker arm shaft.

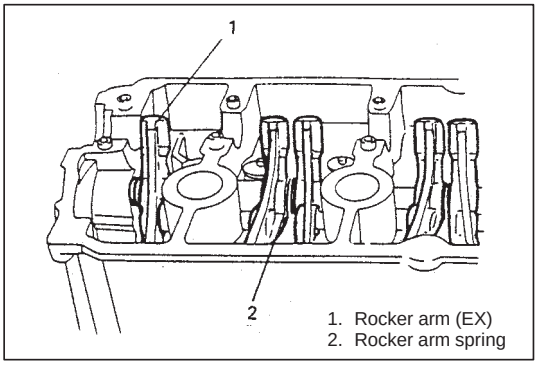
NOTE:
Do not bend clip when removing intake rocker arm.



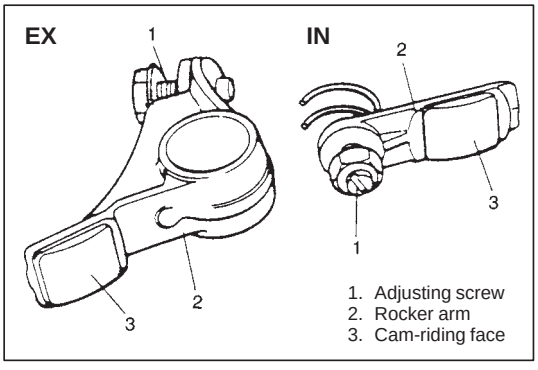
12) Remove rocker arm shaft bolts.



13) Push off rocker arm shaft end to CMP sensor case side and remove O-ring from shaft.



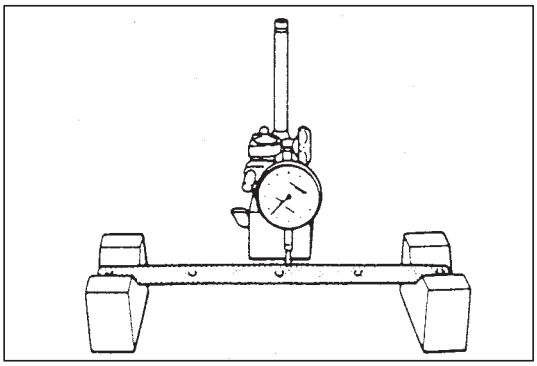
14) Remove exhaust rocker arms and rocker arm spring by pulling rocker arm shaft to front side.



INSPECTION

Adjusting Screw and Rocker Arm

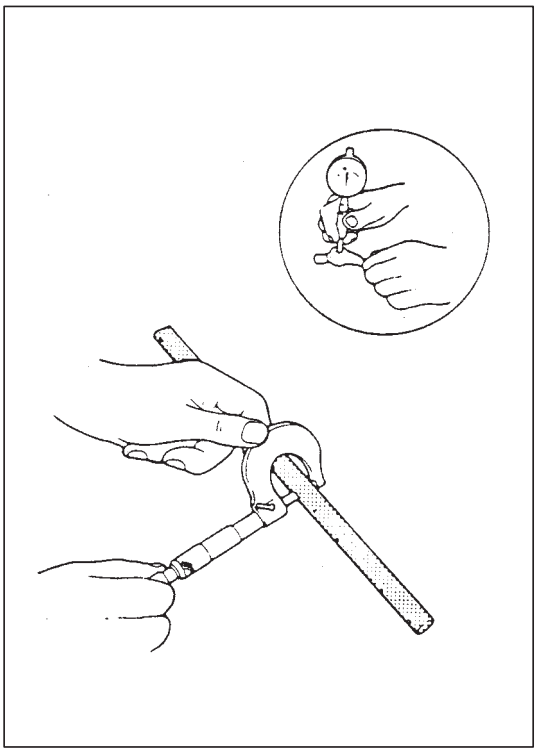
If tip of adjusting screw is badly worn, replace it.
Rocker arm must be replaced if its cam-riding face is badly worn.



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.)



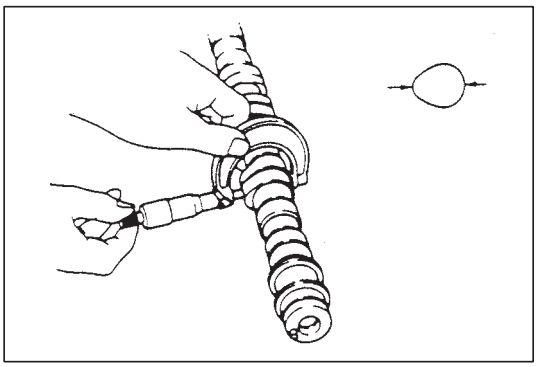
Rocker Arm-to-Rocker Arm Shaft Clearance

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.

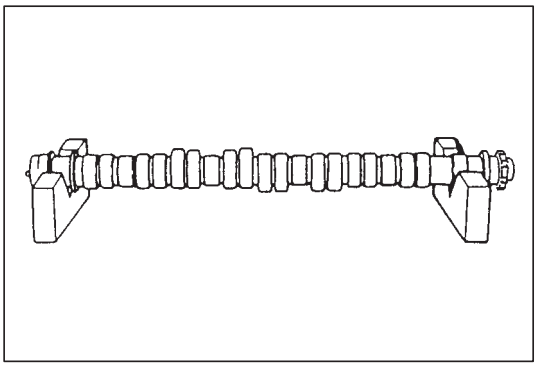
Item	Standard	Limit
Rocker arm I.D.	15.996 – 16.014 mm (0.6298 – 0.6305 in.)	———
Rocker arm shaft dia.	15.969 – 15.984 mm (0.6287 – 0.6293 in.)	———
Arm-to-shaft clearance	0.012 – 0.045 mm (0.0005 – 0.0018 in.)	0.09 mm (0.0035 in.)



Cam Wear

Using a micrometer, measured height of cam. If measured height is below limit, replace camshaft.

Cam height	Standard	Limit
Intake cam	36.184 – 36.344 mm (1.4246 – 1.4308 in.)	36.084 mm (1.4206 in.)
Exhaust cam	35.900 – 36.060 mm (1.4134 – 1.4197 in.)	35.800 mm (1.4094 in.)

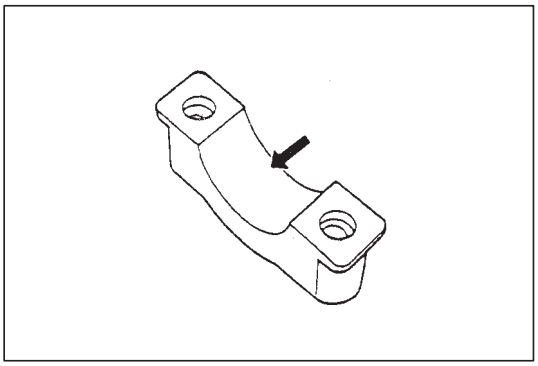


Camshaft Runout

Hold camshaft between two “V” blocks, and measure runout by using a dial gauge.

If runout exceeds the limit, replace camshaft.

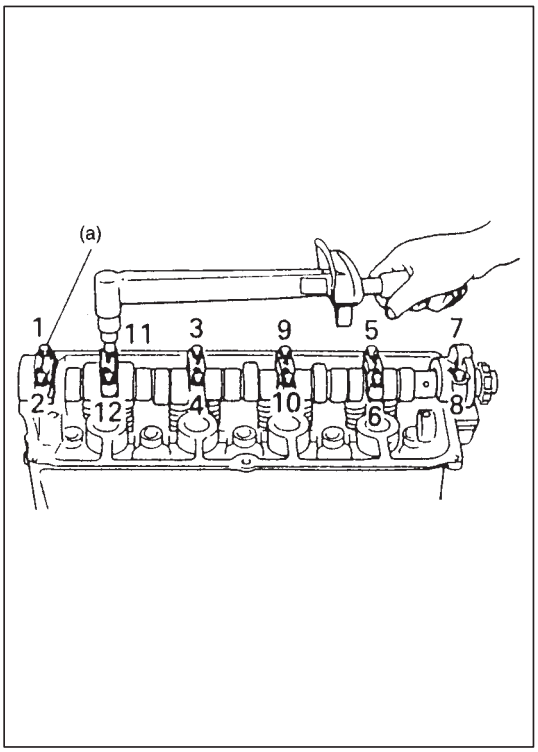
Runout limit: 0.10 mm (0.0039 in.)



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.



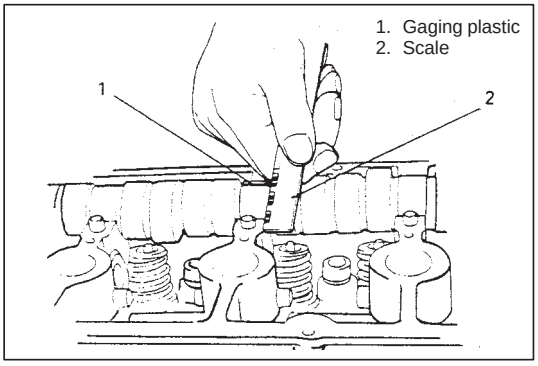
Check clearance by using gaging plastic.

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 page 6A1-38.
5) Tighten camshaft housing bolts in such order as indicated in figure a little at a time till they are tightened to specified torque.

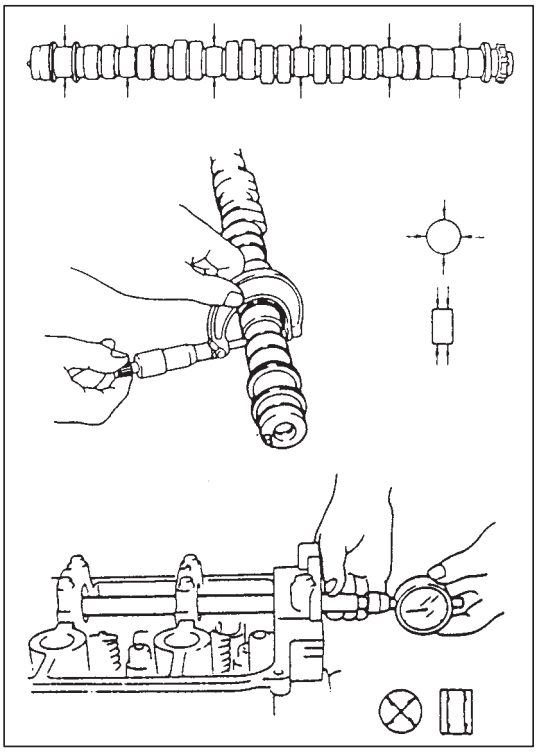
Tightening Torque
(a): 11 N·m (1.1kg-m, 8.0 lb-ft)

NOTE:
Do not rotate camshaft while gaging plastic is installed.



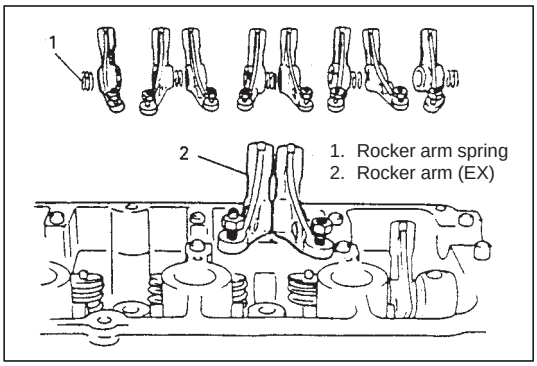
6) Remove housing and using scale on gaging plastic envelope, measure gaging plastic width at its widest point.

	Standard	Limit
Journal clearance	0.040 – 0.082 mm (0.0016 – 0.0032 in.)	0.12 mm (0.0047 in.)



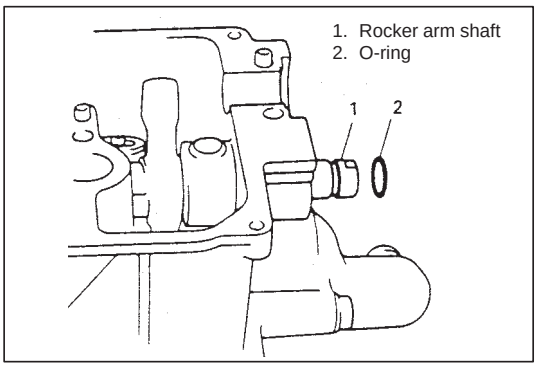
If measured camshaft journal clearance exceeds limit, measure journal (housing) bore and outside diameter of camshaft journal. Replace camshaft or cylinder head assembly whichever the difference from specification is greater.

Item	Standard
Camshaft Journal bore dia.	28.000 – 28.021 mm (1.1024 – 1.1031 in.)
Camshaft journal O.D.	27.939 – 27.960 mm (1.1000 – 1.1008 in.)

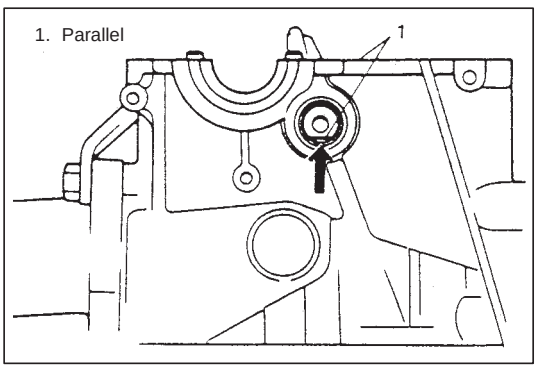


INSTALLATION

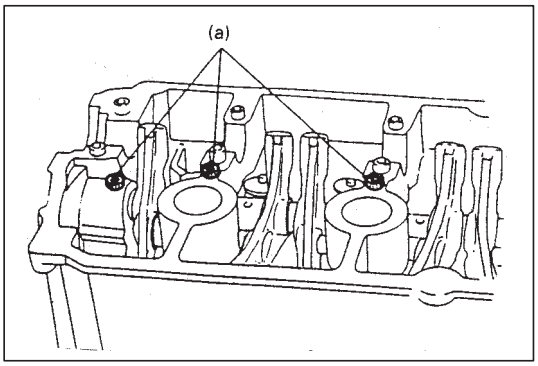
1) Apply engine oil to rocker arm shaft and rocker arms.
2) Install rocker arm shaft, rocker arm (exhaust side) and rocker arm spring.



3) Check O-ring for damage or deterioration. With O-ring groove in rocker arm shaft exposed to transmission side once, install O-ring to rocker arm shaft.

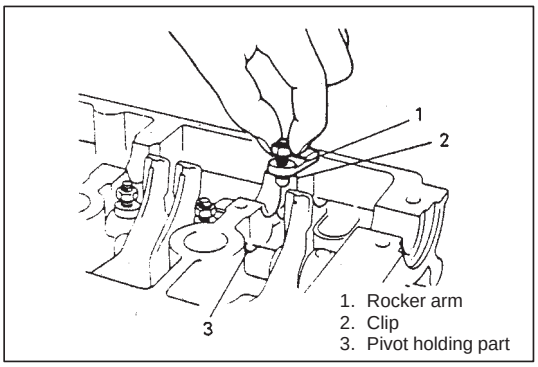


4) Set rocker arm shaft so that its cut part faces down and becomes in parallel with head cover mating surface.



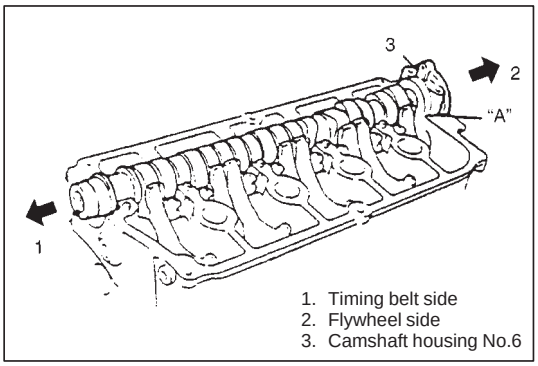
5) Install rocker arm shaft bolts and tighten them to specified torque.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



1. Rocker arm
2. Clip
3. Pivot holding part

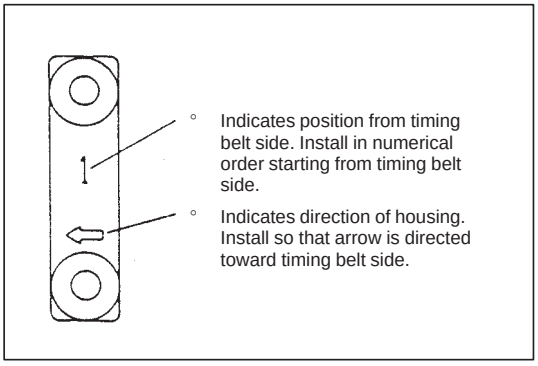
6) Fill small amount of engine oil into arm pivot holding part of rocker arm shaft. Install rocker arm (intake side) with clips to rocker arm shaft.



1. Timing belt side
2. Flywheel side
3. Camshaft housing No.6

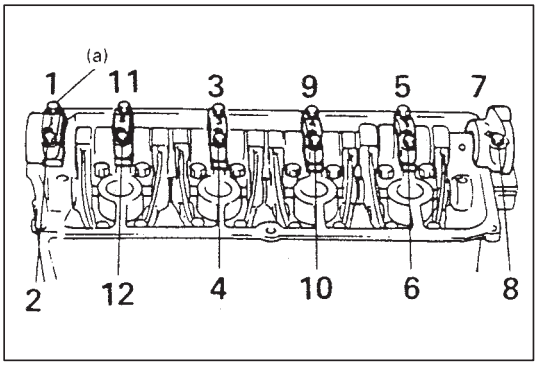
7) Apply engine oil to cams and journals on camshaft and put camshaft on cylinder head. Install camshaft housing to camshaft and cylinder head.
   - ° Apply engine oil to sliding surface of each housing against camshaft journal.
   - ° Apply sealant to mating surface of camshaft housing No.6 which will mate with cylinder head.

"A" Sealant: 99000-31110



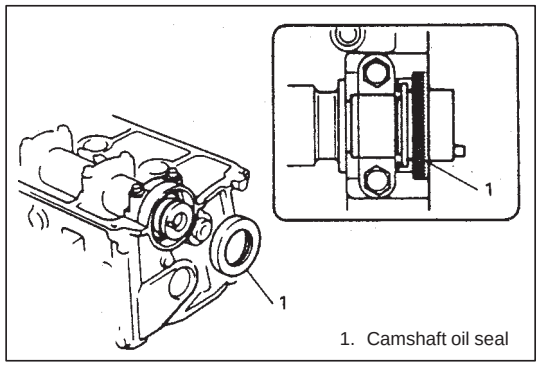
- ° Indicates position from timing belt side. Install in numerical order starting from timing belt side.
- ° Indicates direction of housing. Install so that arrow is directed toward timing belt side.

   - ° 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.



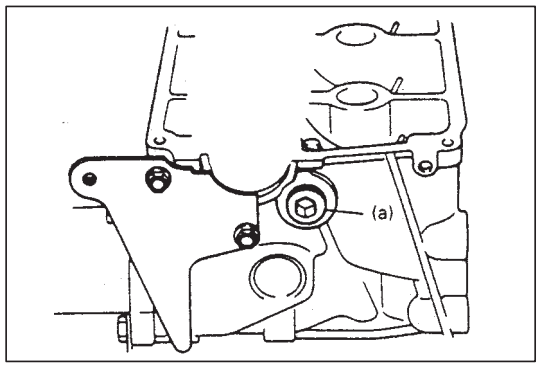
   - ° After applying engine oil to housing bolts, tighten them temporarily first. Then tighten them by following sequence as indicated in figure.
     Tighten a little at a time and evenly among bolts and repeat tightening sequence three to four times before they are tightened to specified torque.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



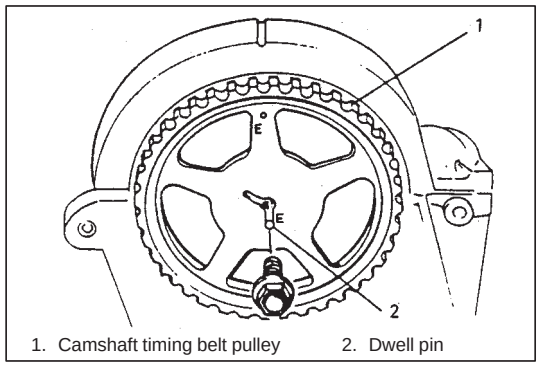
1. Camshaft oil seal

8) Install camshaft oil seal.
After applying engine oil to oil seal lip, press-fit camshaft oil seal till oil seal surface becomes flush with housing surface.



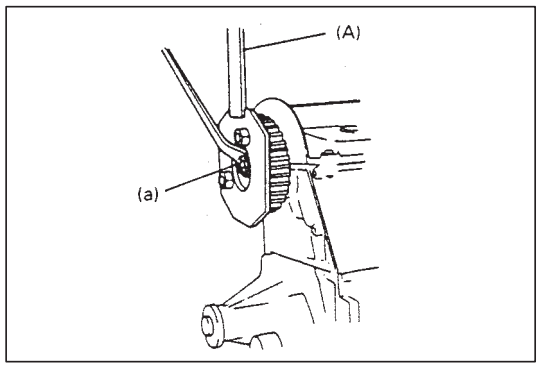
9) Install rocker arm shaft plug and timing belt inside cover. Then tighten rocker arm shaft plug to specified torque.

Tightening Torque
(a): 33 N·m (3.3 kg-m, 24.0 lb-ft)



1. Camshaft timing belt pulley 2. Dwell pin

10) Install camshaft timing belt pulley to camshaft while fitting pin on camshaft into slot at “E” mark.

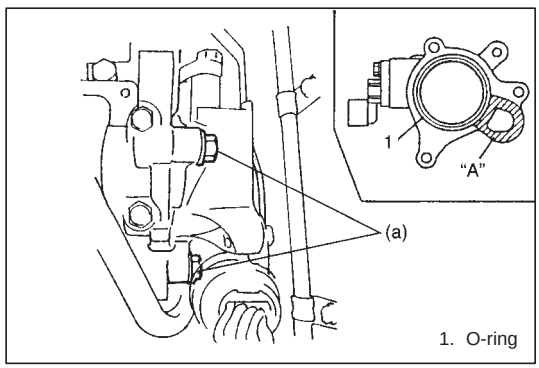


11) Using special tool, tighten pulley bolt to specified torque.

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

Special Tool
(A): 09917-68220

12) Install belt tensioner, timing belt, outside cover, crankshaft pulley and water pump belt as previously outlined.



1. O-ring

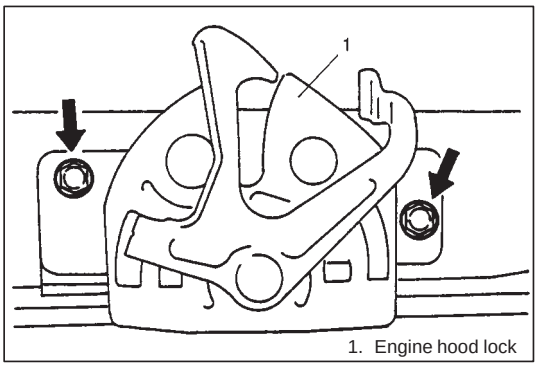
13) After applying sealant to part “A” as shown in figure at the left, install CMP sensor case to cylinder head and tighten its fixing bolts to specified torque.

“A” Sealant: 99000-31110

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

Connect CMP sensor connector.

14) Adjust valve clearance as previously outlined.
15) Install cylinder head cover.
16) Install radiator and refill cooling system referring to “ENGINE COOLING” section.

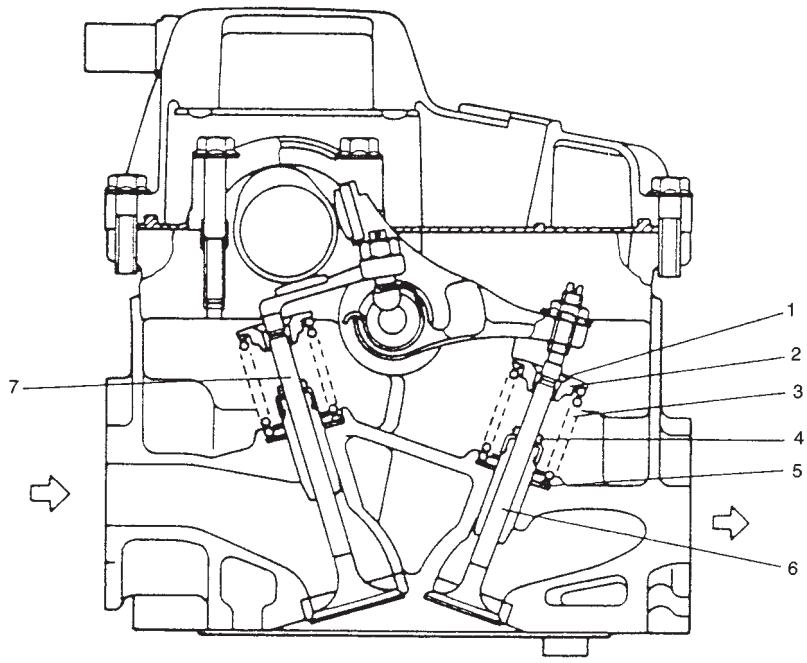


1. Engine hood lock

17) Install hood lock to front upper member and adjust lock position referring to “BODY SERVICE” section.

18) Refill A/T fluid referring to “AUTOMATIC TRANSMISSION” section.
19) Connect negative cable at battery.
20) Upon completion of installation, verify that there is no coolant leakage or A/T fluid leakage (for A/T vehicle) at each connection.
21) Confirm that ignition timing is within specification referring to “IGNITION SYSTEM (FOR G16 ENGINE)” section.

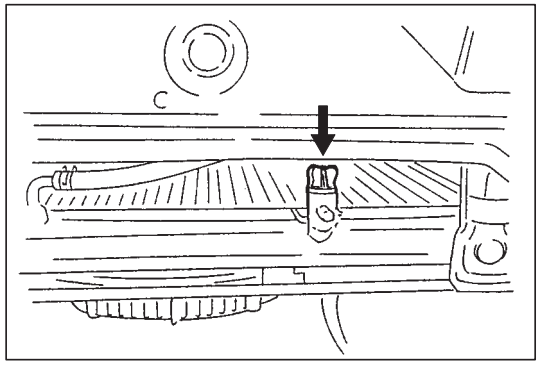
VALVES AND CYLINDER HEAD



1. Valve cotters
2. Valve spring retainer
3. Valve spring
4. Valve stem seal
5. Valve spring seat
6. Exhaust valve
7. Intake valve

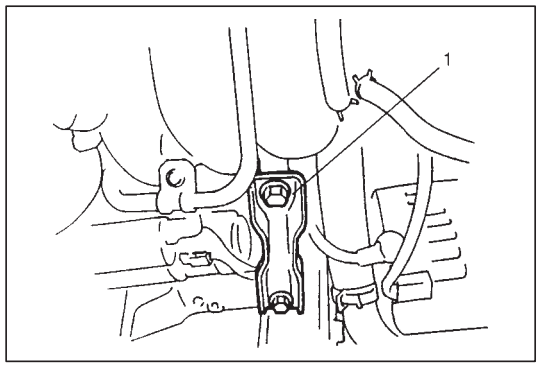
REMOVAL

1) Relieve fuel pressure according to fuel pressure relief procedure described in section 6.
2) Disconnect negative cable at battery.

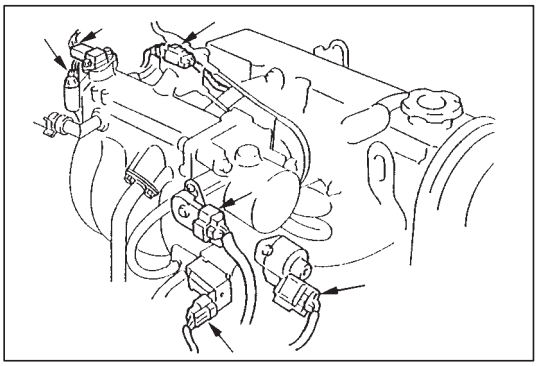


3) Drain cooling system.

WARNING
- **Check to make sure that engine coolant temperature is cold before removing any part of cooling system.**
- **Also be sure to disconnect negative cable from battery terminal before removing any part.**

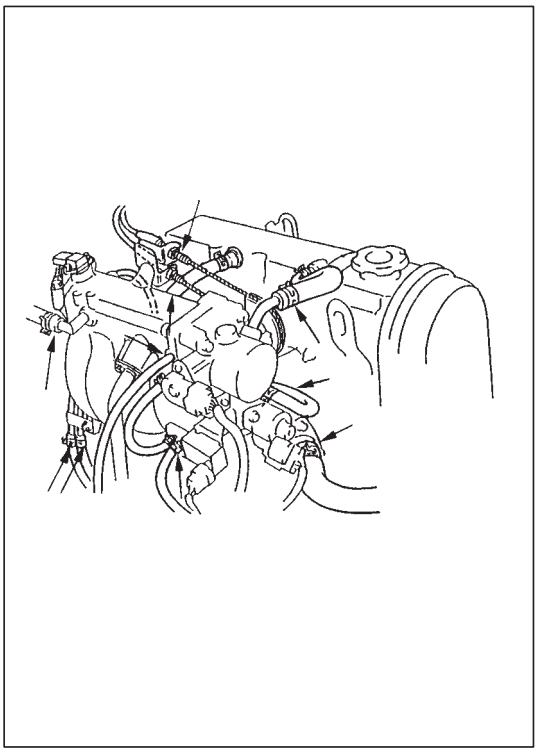


4) Remove intake manifold stiffener (1).

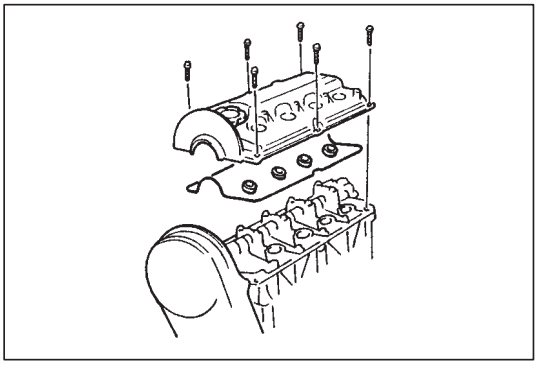


5) Remove air intake hose.
6) Disconnect following electric wires:
   - Throttle position sensor
   - Idle air control valve
   - Engine coolant temp. sensor
   - Camshaft position sensor
   - Ground wires from intake manifold
   - EGR valve
   - Manifold differential pressure sensor
   - EVAP canister purge valve
   - Injector wires at the coupler
   - Heated oxygen sensor-1

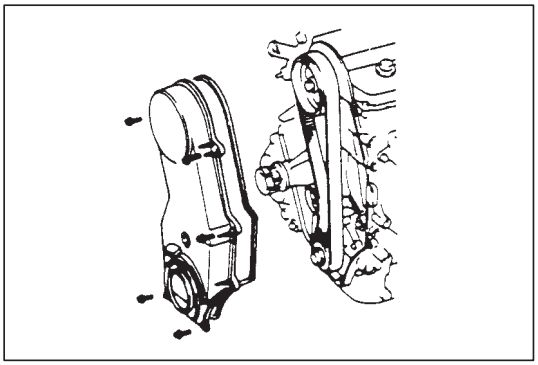
   and then release above wire harnesses from clamps.



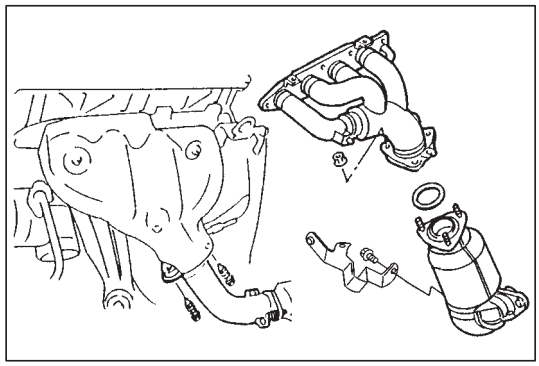
7) Disconnect following hoses:
   - EVAP canister purge hose from EVAP canister purge valve
   - Brake booster hose from intake manifold
   - Engine coolant hose (outlet side) from throttle body
   - Radiator inlet hose from thermostat cap
   - Heater inlet hose from pipe
   - Fuel feed hose and return hose from each pipe
   - Vacuum hose from intake manifold
8) Disconnect accelerator cable and A/T throttle cable (if equipped) from throttle body.



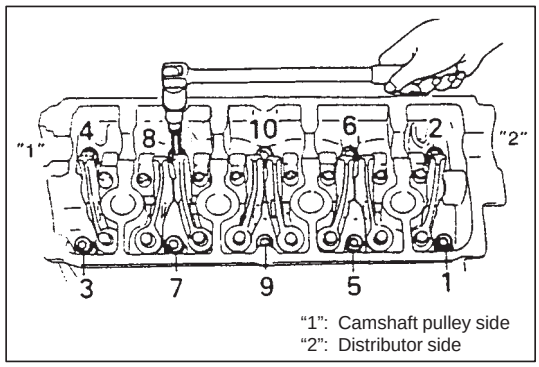
9) Remove cylinder head cover as previously outlined. Loosen all valve lash adjusting screws fully.



10) Remove timing belt and camshaft as previously outlined.
11) Remove generator adjust arm from intake manifold.
12) Remove air conditioning compressor adjust arm from cylinder head. (if equipped)



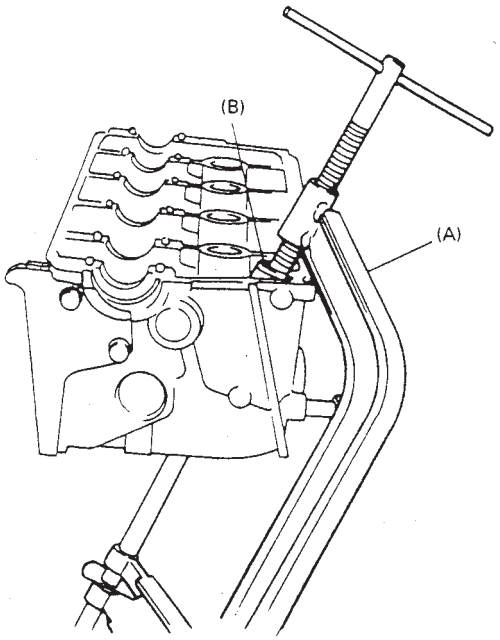
13) Disconnect exhaust pipe from exhaust manifold and remove exhaust manifold stiffener or exhaust pipe bracket bolt.



"1": Camshaft pulley side
"2": Distributor side

14) Loosen cylinder head bolts in such order as indicated in figure and remove them.
15) Check all around cylinder head for any other parts required to be removed or disconnected and remove or disconnect whatever necessary.

16) Remove cylinder head with intake manifold and exhaust manifold, using lifting device.



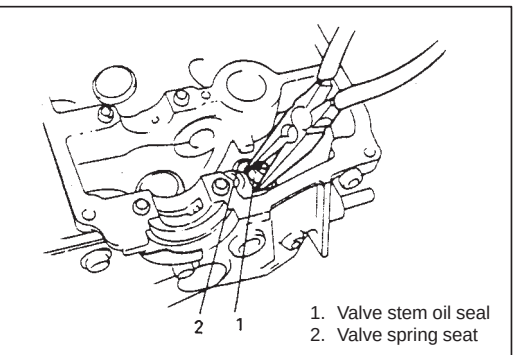
1. Valve cotters

DISASSEMBLY

1) For ease in servicing cylinder head, remove intake manifold with throttle body and exhaust manifold from cylinder head.
2) Remove intake rocker arm with clip from rocker arm shaft, remove rocker arm shaft bolts and remove exhaust rocker arms and springs by pulling its shaft out to transmission side.
3) 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
(C): 09916-84511

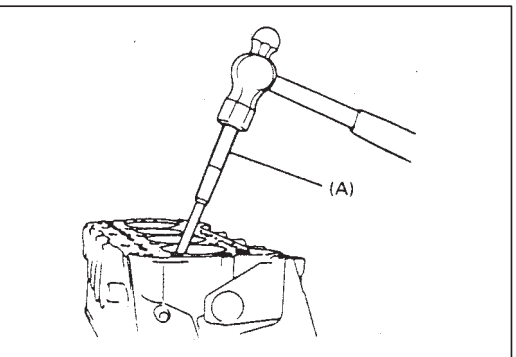
4) Release special tool, and remove spring retainer and valve spring.
5) Remove valve from combustion chamber side.



1. Valve stem oil seal
2. Valve spring seat

6) Remove valve stem oil seal from valve guide, and then valve spring seat.

NOTE:
Do not reuse oil seal once disassembled. Be sure to use new oil seal when assembling.

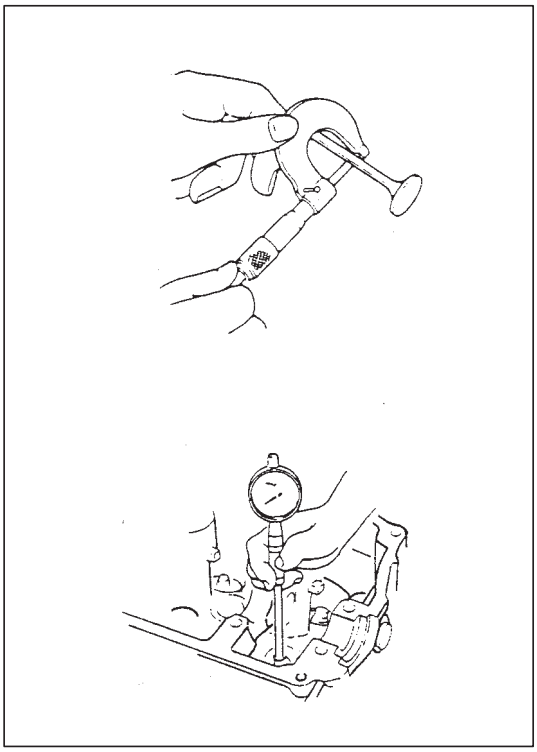


7) Using special tool (Valve guide remover), drive valve guide out from combustion chamber side to valve spring side.

Special Tool
(A): 09916-44910

NOTE:
Do not reuse valve guide once disassembled. Be sure to use new valve guide (Oversize) when assembling.

8) Place disassembled parts except valve stem seal and valve guide in order, so that they can be installed in their original position.

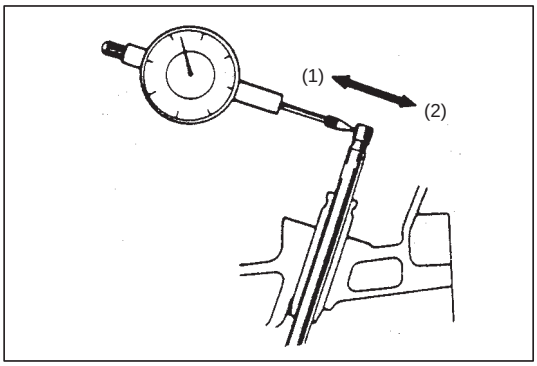


INSPECTION

Valve Guides

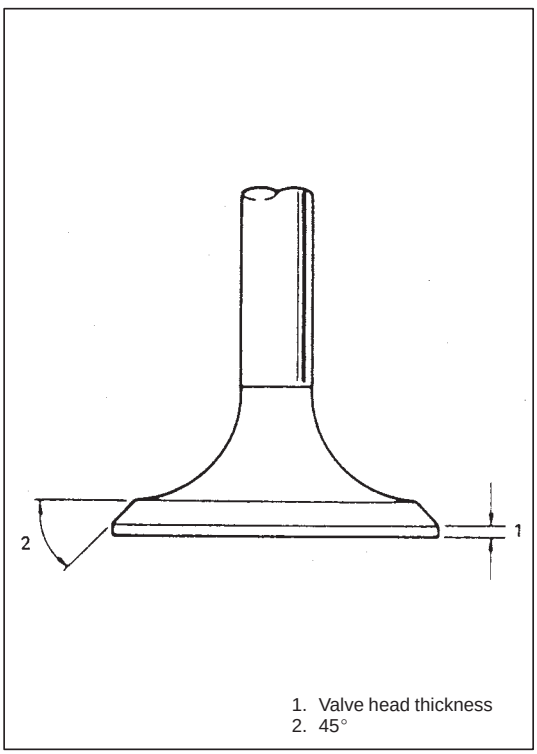
Using a micrometer and bore gauge, take diameter readings on valve stems and guides to check stem-to-guide clearance.
Be sure to take reading at more than one place along the length of each stem and guide.
If clearance exceeds limit, replace valve and valve guide.

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 (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 bore gauge is not available, check end deflection of valve stem with a dial gauge instead.
Move stem end in directions (1) and (2) to measure end deflection.
If deflection exceeds its limit, replace valve stem and valve guide.

Valve stem end deflection limit	In	0.14 mm (0.005 in.)
	Ex	0.18 mm (0.007 in.)

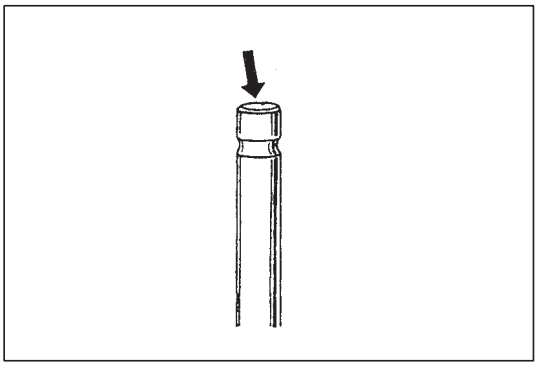


1. Valve head thickness
2. 45°

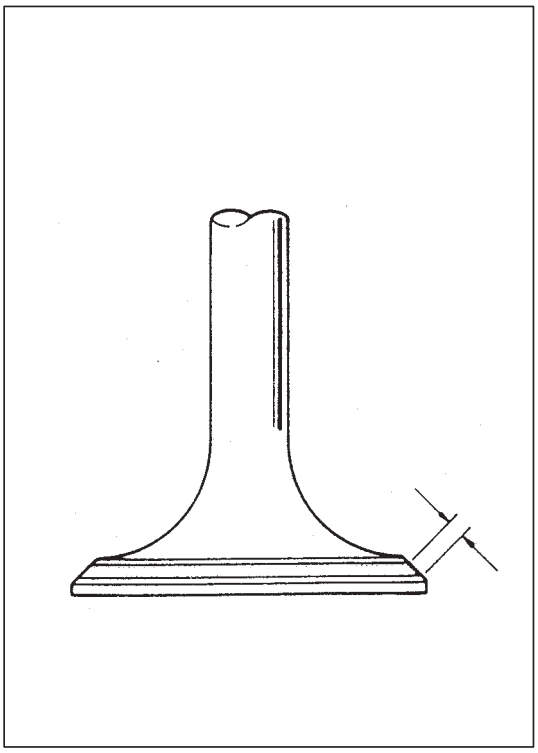
Valves

- 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 mm (0.03 – 0.047 in.)	0.6 mm (0.024 in.)
Ex		0.7 mm (0.027 in.)



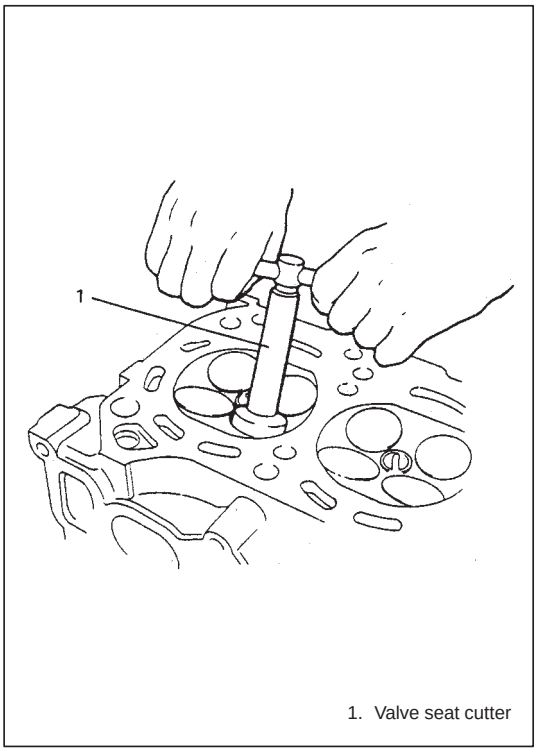
- Inspect valve stem end face for pitting and wear. If pitting or wear is found there, valve stem end may be resurfaced, but not so much as to grind off its chamfer. When it is worn so much that its chamfer is gone, replace valve.



- 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	1.1 – 1.3 mm (0.0433 – 0.0512 in.)
	Ex	

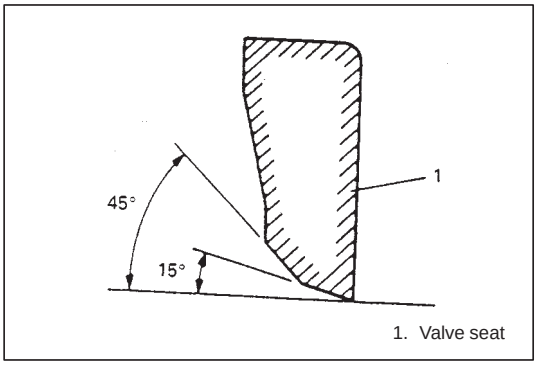


1. Valve seat cutter

● 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:
1.1 – 1.3 mm (0.0433 – 0.0512 in.)

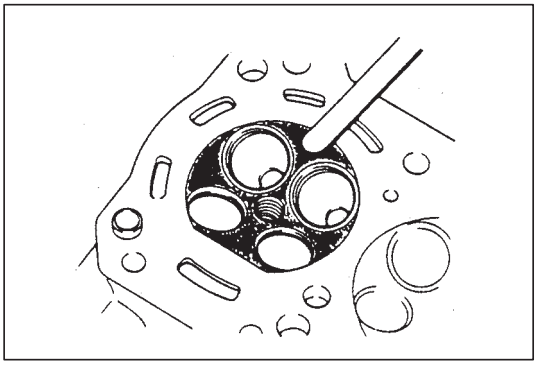


1. Valve seat

2) INTAKE VALVE SEAT: Cutting sequence is the same as for exhaust valve seats.

Seat width for intake valve seat:
1.1 – 1.3 mm (0.0433 – 0.0512 in.)

3) VALVE LAPPING: Lap valve on seat in two steps, first with coarse size lapping compound applied to face and the second with fine-size compound, each time using valve lapper according to usual lapping method.

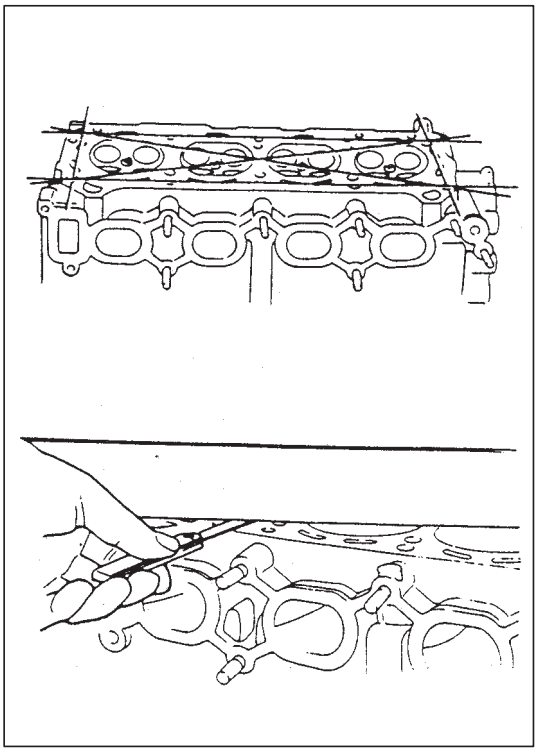


Cylinder Head

● Remove all carbon from combustion chambers.

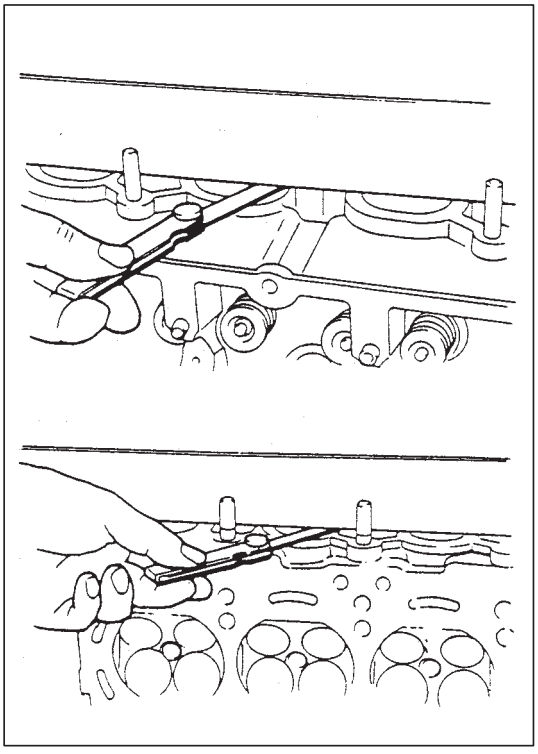
NOTE:
Do not use any sharp-edged tool to scrape off carbon. Be careful not to scuff or nick metal surfaces when decarboning. The same applies to valves and valve seats, too.

● Check cylinder head for cracks in intake and exhaust ports, combustion chambers, and head surface.



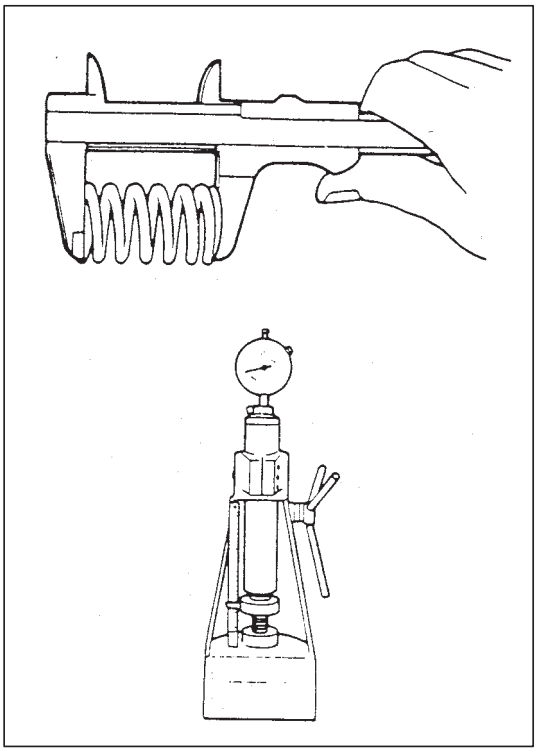
- Flatness of gasketed surface:
  Using a straightedge and thickness gauge, check surface at a total of 6 locations. If distortion limit, given below, is exceeded, correct gasketed surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper): place paper on 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.)



- 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.

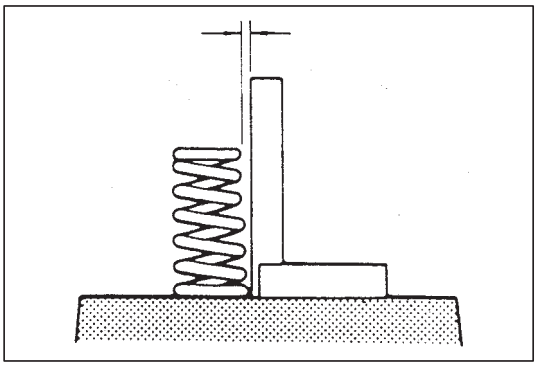
  Limit of distortion: 0.10 mm (0.004 in.)



Valve Springs

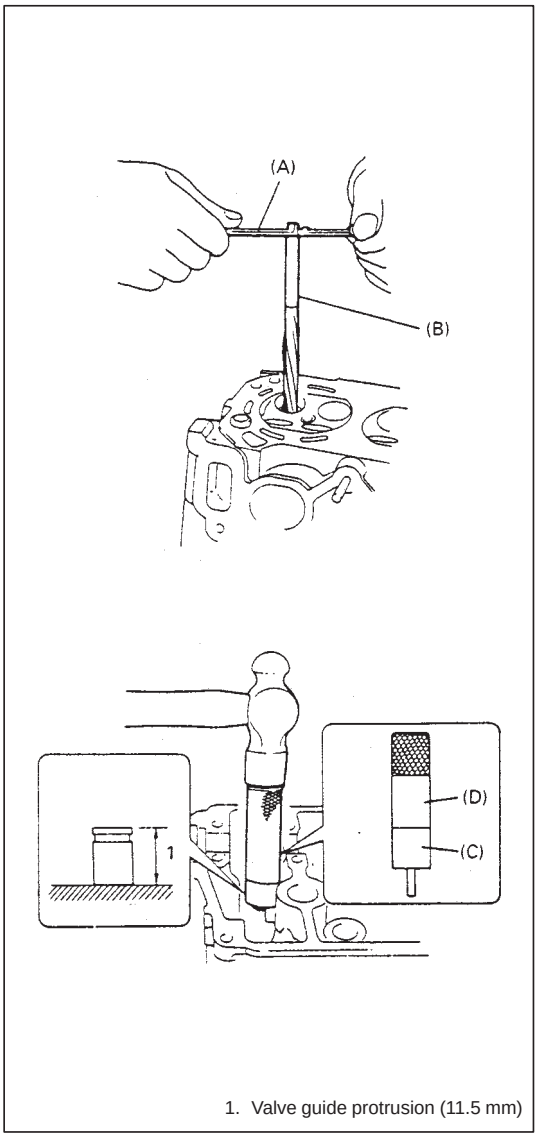
- Referring to data given below, check to be sure that each spring is in sound condition, free of any evidence of breakage or weakening. Remember, weakened valve springs can cause chatter, not to mention possibility of reducing power output due to gas leakage caused by decreased seating pressure.

Item	Standard	Limit
Valve spring free length	36.83 mm (1.4500 in.)	35.67 mm (1.4043 in.)
Valve spring preload	10.7 – 12.5 kg for 31.5 mm (23.6 – 27.5 lb/ 1.24 in.)	9.3 kg for 31.5 mm (20.5 lb/ 1.24 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.)



1. Valve guide protrusion (11.5 mm)

ASSEMBLY

1) Before installing valve guide into cylinder head, ream guide hole with special tool (11 mm reamer) so remove burrs and make it truly round.

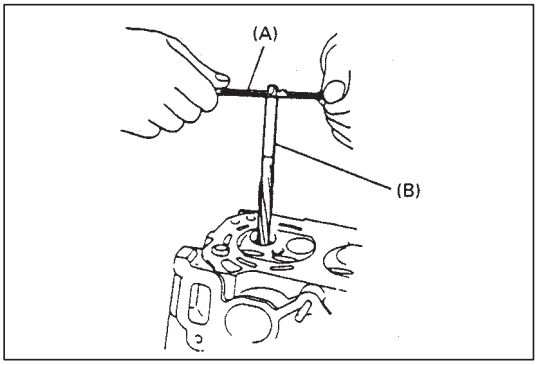
Special Tool
(A): 09916-34542
(B): 09916-38210

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 11.5 mm (0.45 in.) from cylinder head.

Special Tool
(C): 09916-56011
(D): 09916-58210

NOTE:
- **Do not reuse valve guide once disassembled. Install new valve guide (Oversize).**
- **Intake and exhaust valve guides are identical.**

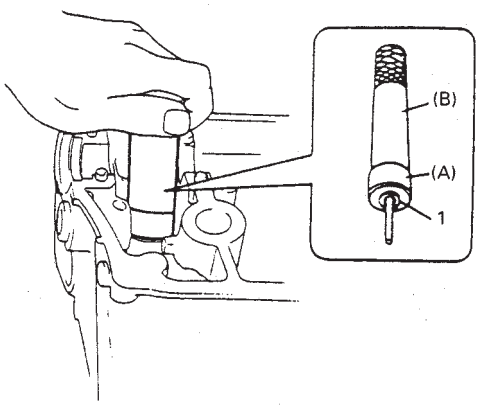
Valve guide oversize: 0.03 mm (0.0012 in.)
Valve guide protrusion (In and Ex): 11.5 mm (0.45 in.)



3) Ream valve guide bore with special tool (5.5 mm reamer). After reaming, clean bore.

Special Tool
(A): 09916-34542
(B): 09916-34550

4) Install valve spring seat to cylinder head.

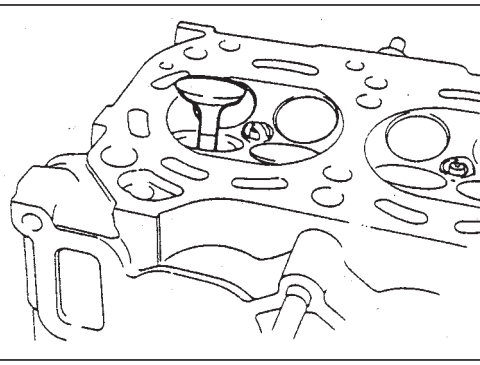


1. Valve stem seal

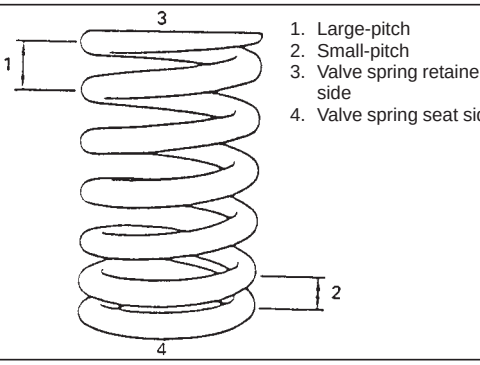
5) Install new valve stem seal to valve guide.
After applying engine oil to seal and spindle of special tool (Valve guide installer handle), fit oil seal to spindle, and then install seal to valve guide by pushing special tool by hand.
After installing, check to be sure that seal is properly fixed to 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.**

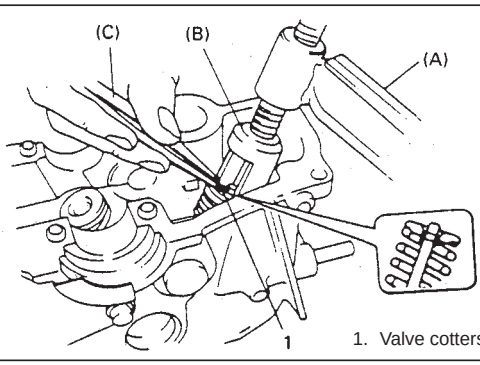


6) Install valve to valve guide.
Before installing valve to valve guide, apply engine oil to stem seal, valve guide bore, and valve stem.



1. Large-pitch
2. Small-pitch
3. Valve spring retainer side
4. Valve spring seat side

7) Install valve spring and spring retainer.
Each valve spring has top end (large-pitch end) and bottom end (small-pitch end). Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).

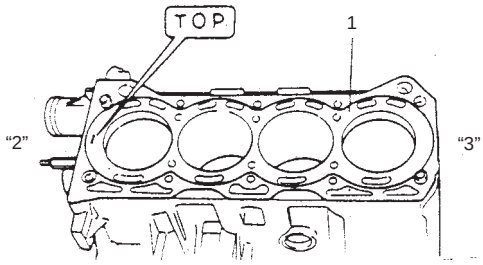


1. Valve cotters

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
(C): 09916-84511

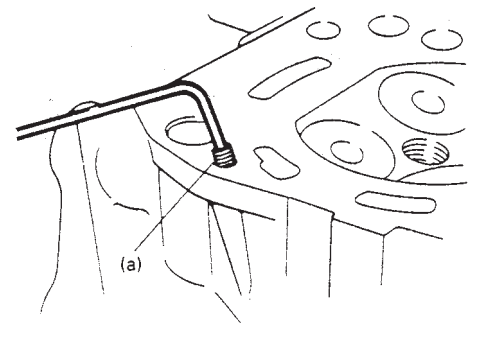
9) Install rocker arms, springs and rocker arm shaft as previously outlined.
10) Install intake manifold and exhaust manifold.



1. Cylinder head gasket
"2". Crankshaft pulley side
"3". Flywheel side

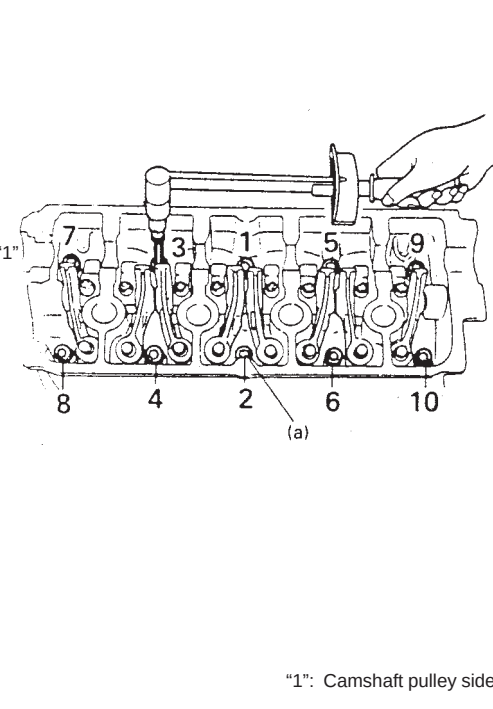
INSTALLATION

1) Remove old gasket and oil on mating surfaces and install new head gasket as shown in figure, that is, "TOP" mark provided on gasket comes to crankshaft pulley side, 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): 3.5 N·m (0.35 kg-m, 2.5 lb-ft)

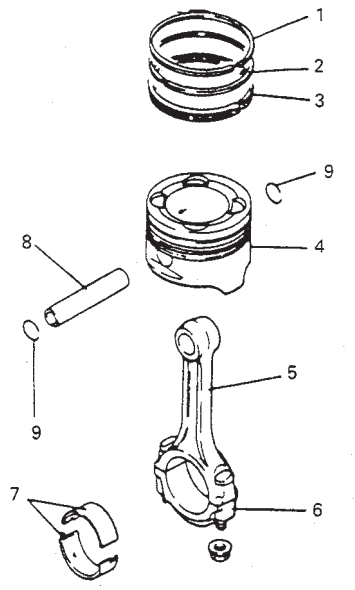


"1": Camshaft pulley side

3) Apply engine oil to cylinder head bolts and tighten them gradually as follows.
(1) Tighten all bolts to 35 N·m (3.5 kg-m, 25.0 lb-ft) according to numerical order in figure.
(2) In the same manner as in (1), tighten them to 55 N·m (5.5 kg-m, 40.0 lb-ft).
(3) Loosen all bolts until tightening torque is reduced to 0 in reverse order of tightening.
(4) In the same manner as in (1), tighten them to 35 N·m (3.5 kg-m, 25.0 lb-ft).
(5) In the same manner as in (1) again, tighten them to specified torque.

Tightening Torque
(a): 68 N·m (6.8 kg-m, 49.5 lb-ft)

4) Reverse removal procedure for installation.
5) Adjust water pump drive belt tension, referring to “ENGINE COOLING” section.
6) Adjust power steering pump belt tension or 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 and A/T throttle 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 “ENGINE COOLING” section.
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 “IGNITION SYSTEM (FOR G16 ENGINE)” section.

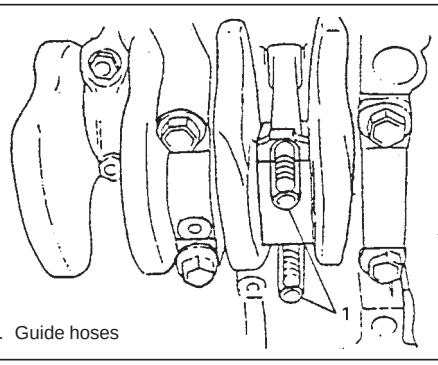


1. Top ring
2. 2nd ring
3. Oil ring
4. Piston
5. Connecting rod
6. Connecting rod bearing cap
7. Connecting rod bearing
8. Piston pin
9. Piston pin circlip

PISTON, PISTON RINGS, CONNECTING RODS AND CYLINDERS

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.

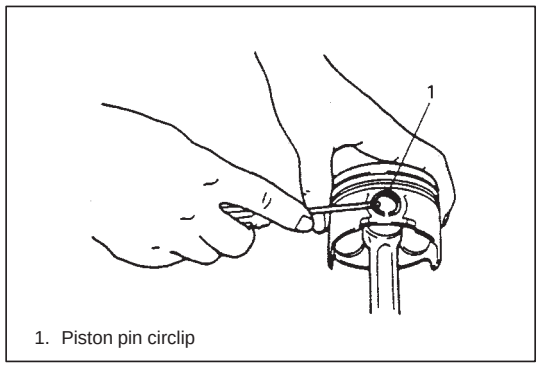


1. Guide hoses

5) Remove rod bearing caps.
6) Install guide hose 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.

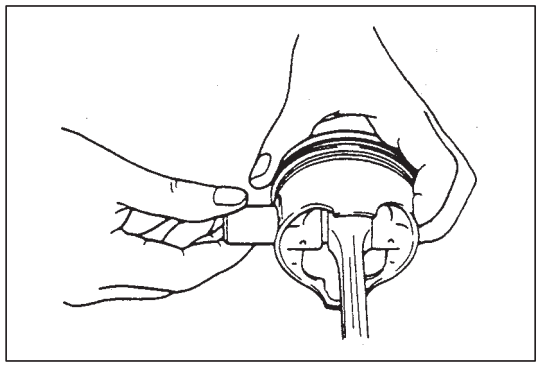
DISASSEMBLY

1) Using piston ring expander, remove two compression rings (Top and 2nd) and oil ring from piston.



1. Piston pin circlip

2) Remove piston pin from connecting rod.
   - Ease out piston pin circlips, as shown.



- Force piston pin out.

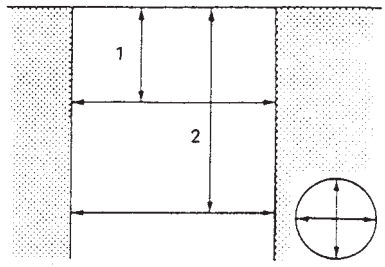
CLEANING

Clean carbon from piston head and ring grooves, using a suitable tool.

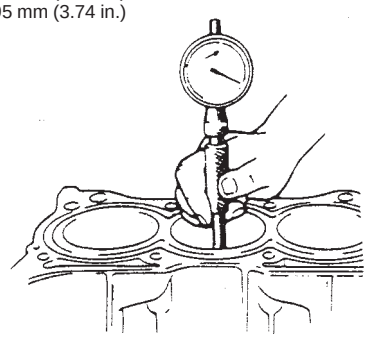
INSPECTION

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.



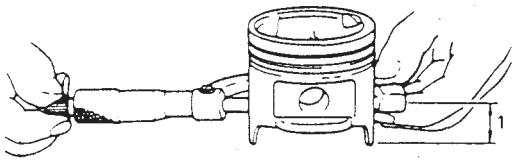
1. 50 mm (1.96 in.)
2. 95 mm (3.74 in.)



- 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: 75.15 mm (2.9586 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.

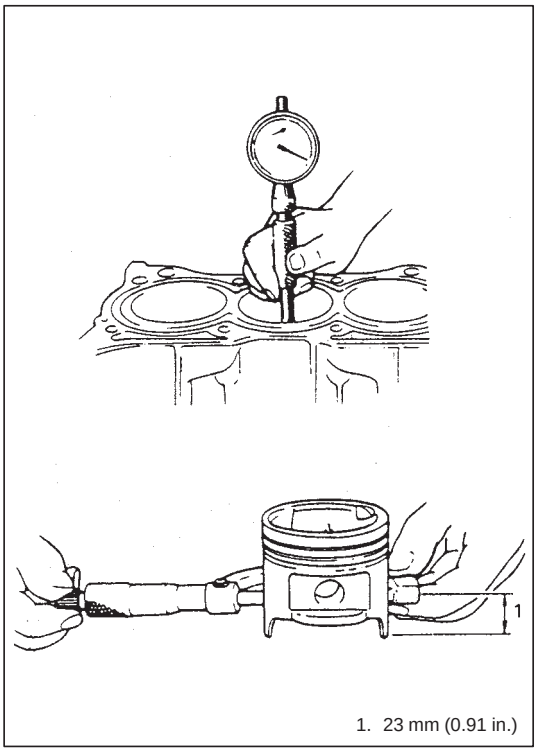


1. 23 mm (0.91 in.)

Pistons

- Inspect piston for faults, cracks or other damaged.
  Damaged or faulty piston should be replaced.
- Piston diameter:
  As indicated in figure, piston diameter should be measured at a position 23 mm (0.91 in.) from piston skirt end in the direction perpendicular to piston pin.

Piston diameter	Standard	74.970 – 94.990 mm (2.9516 – 2.9523 in.)
	Oversize: 0.25 mm (0.0098 in.)	75.220 – 75.230 mm (2.9614 – 2.9618 in.)
	0.50 mm (0.0196 in.)	75.470 –75.480 mm (2.9712 – 2.9716 in.)

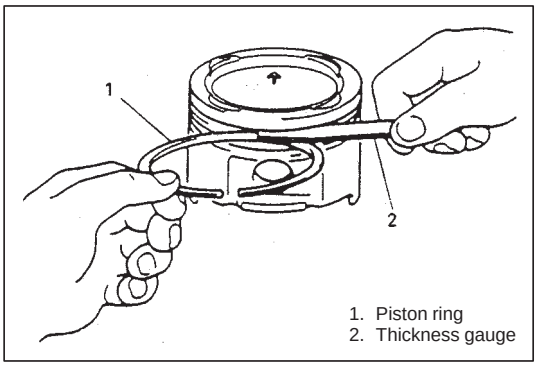


1. 23 mm (0.91 in.)

● Piston clearance:
Measure cylinder bore diameter and piston diameter to find their difference which is piston clearance. Piston clearance should be within specification as given below. If it is out of specification, re-bore cylinder and use oversize piston.

Piston clearance: 0.02 – 0.04 mm (0.0008 – 0.0015 in.)

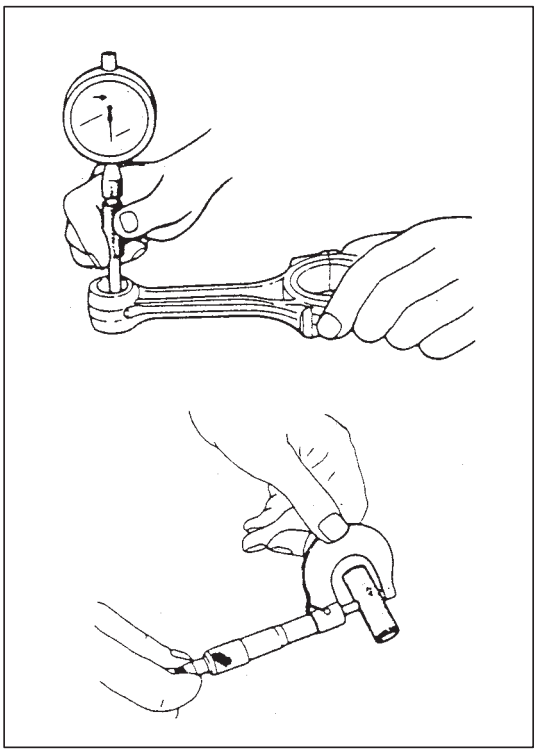
NOTE:
Cylinder bore diameters used here are measured in thrust direction at two positions.



1. Piston ring
2. Thickness gauge

● 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 and ring land by using thickness gauge.
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.)



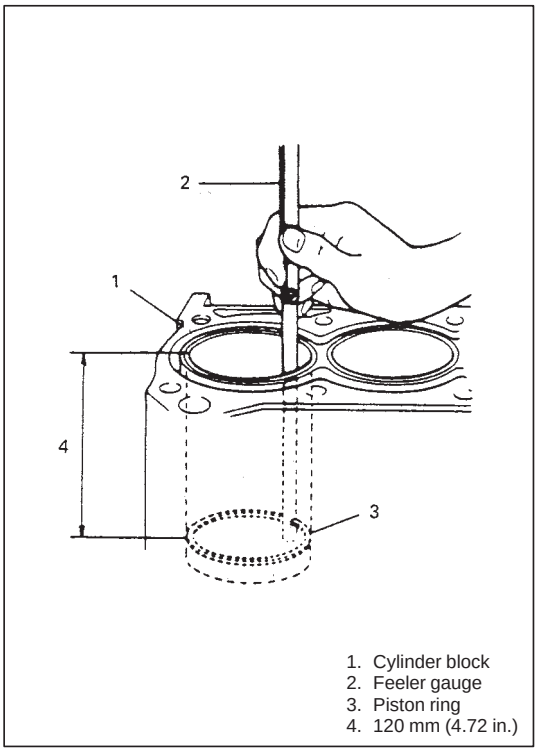
Piston Pin

● 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 clearance in small end	0.003 – 0.014 mm (0.0001 – 0.0006 in.)	0.05 mm (0.0020 in.)

Small-end bore:
19.003 – 19.011 mm (0.7482 – 0.7486 in.)

Piston pin dia.:
18.997 – 19.000 mm (0.7479 – 0.7480 in.)



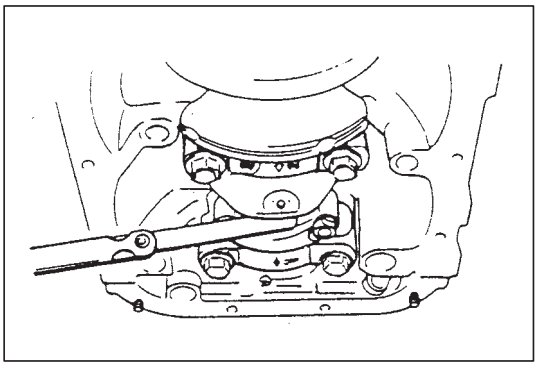
1. Cylinder block
2. Feeler gauge
3. Piston ring
4. 120 mm (4.72 in.)

Piston Rings

To measure end gap, insert piston ring into cylinder bore and then measure the gap by using thickness gauge.
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	0.2 – 0.35 mm (0.0079 – 0.0137 in.)	0.7 mm (0.0275 in.)
	2nd ring	0.35 – 0.50 mm (0.0138 – 0.0197 in.)	0.7 mm (0.0275 in.)
	Oil ring	0.1 – 0.4 mm (0.0039 – 0.0157 in.)	1.7 mm (0.0669 in.)



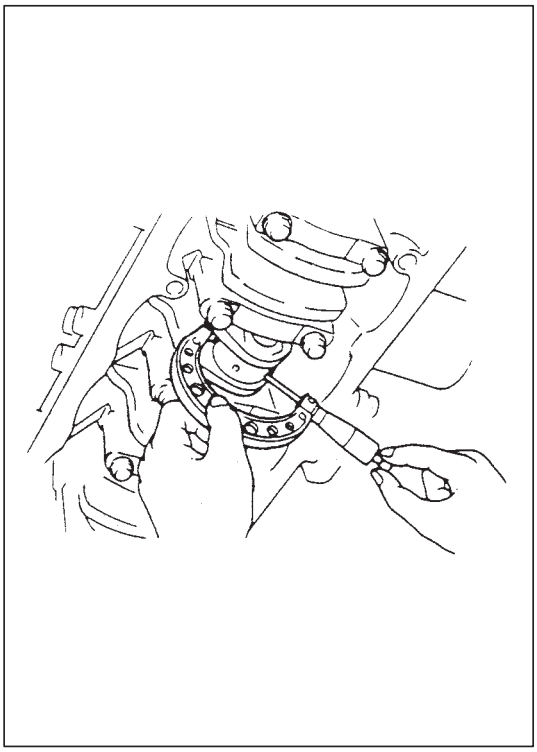
Connecting Rod

- Big-end side clearance:
  Check big-end of connecting rod for side clearance, with rod fitted and connected to its crank pin in the normal manner. If measured clearance is found to exceed its limit, replace connecting rod.

Item	Standard	Limit
Big-end side clearance	0.10 – 0.25 mm (0.0039 – 0.0098 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.)

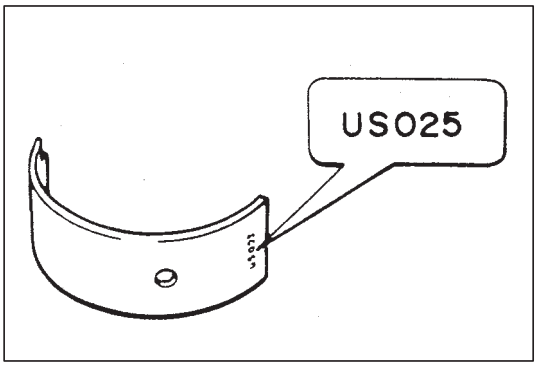


Crank Pin and Connecting Rod Bearings

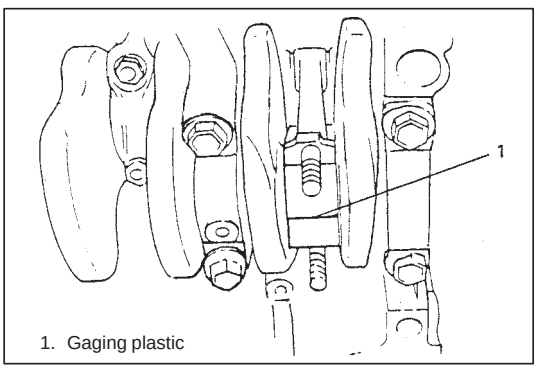
- Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged, or out-of-round or taper is out of limit, replace crankshaft or regrind crank pin referring to following step 6).

Connecting rod bearing size	Crank pin diameter
Standard	43.982 – 44.000 mm (1.7316 – 1.7322 in.)
0.25 mm undersize	43.732 – 43.750 mm (1.7218 – 1.7224 in.)

Out-of-round and taper limit: 0.01 mm (0.0004 in.)

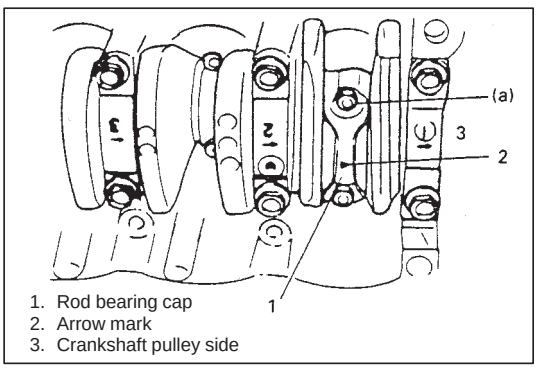


- Rod bearing:
  Inspect bearing shells for signs of fusion, pitting, burn or flaking and observe contact pattern. Bearing shells found in defective condition must be replaced.
  Two kinds of rod bearing are available; standard size bearing and 0.25 mm undersize bearing. To distinguish them, 0. 25 mm undersize bearing has the stamped number (US025) on its backside as indicated in figure, but standard size one has no number.



1. Gaging plastic

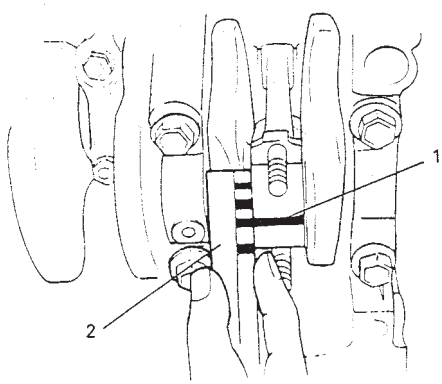
- Rod bearing clearance:
  1) Before checking bearing clearance, clean bearing and crank pin.
  2) Install bearing in connecting rod and bearing cap.
  3) Place a piece of gaging plastic to full width of crankpin as contacted by bearing (parallel to crankshaft), avoiding oil hole.



1. Rod bearing cap
2. Arrow mark
3. Crankshaft pulley side

4) Install rod bearing cap to connecting rod.
   When installing cap, be sure to point arrow mark on cap to crankshaft pulley side, 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): 35 N·m (3.5 kg-m, 25.5 lb-ft)



1. Gaging plastic
2. Scale

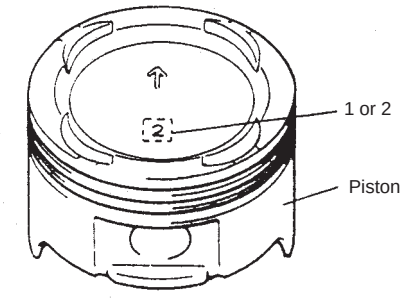
5) Remove cap and using a scale on gaging plastic envelope, measure gaging plastic width at the widest point (clearance). If clearance exceeds its limit, use a new standard size bearing and remeasure clearance.

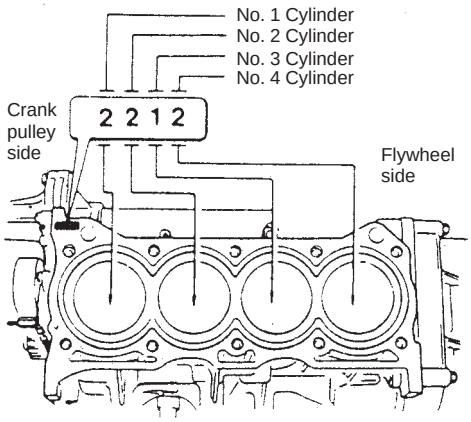
Item	Standard	Limit
Bearing clearance	0.020 – 0.050 mm (0.0008 – 0.0019 in.)	0.080 mm (0.0031 in.)

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)	–	0.035 mm (0.0014 in.)

   – Confirm that bearing clearance is within above standard value.

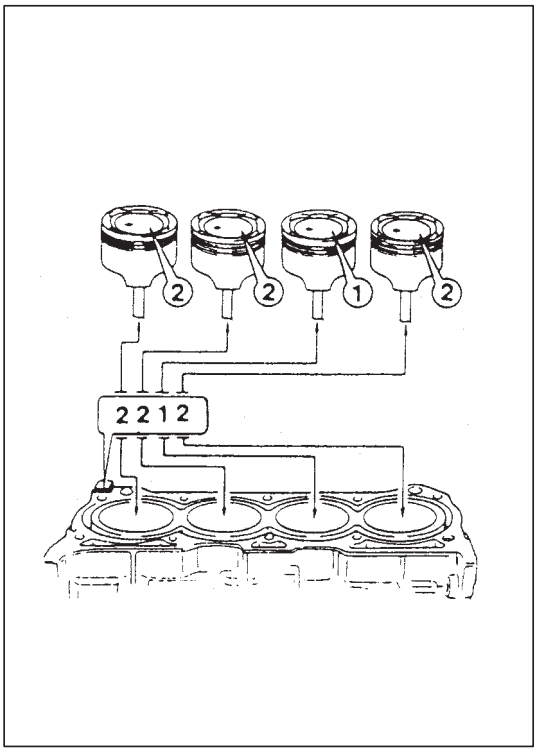




ASSEMBLY

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.

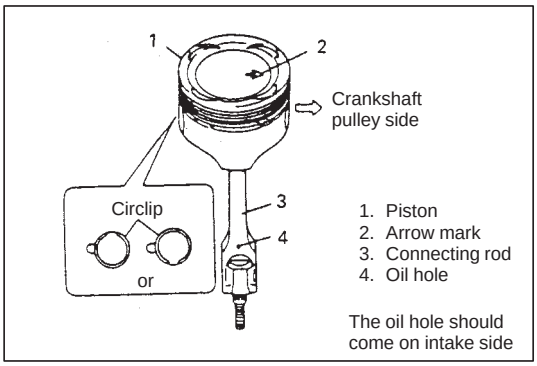
a) Each piston has stamped number 1 or 2 as shown. It represents outer diameter of piston.
b) There are also stamped numbers of 1 and 2 on the cylinder block as shown. The first number represents inner diameter of No.1 cylinder, the second number of No.2 cylinder, the third number of No.3 cylinder and the fourth number of No.4 cylinder.



c) Stamped number on piston and that on cylinder block should correspond. That is, install number 2 stamped piston to cylinder which is identified with number 2 and a number 1 piston to cylinder with number 1.

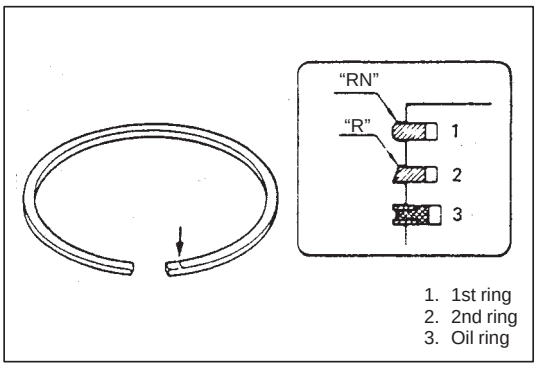
Piston		Cylinder		Piston-to-cylinder clearance
Number at the top (mark)	Outer diameter	Number (mark)	Bore diameter	
1	74.98 – 74.99 mm (2.9520 – 2.9524 in.)	1	75.01 – 75.02 mm (2.9531 – 2.9535 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)
2	74.97 – 74.98 mm (2.9516 – 2.9520 in.)	2	75.00 – 75.01 mm (2.9528 – 2.9531 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)

Also, a letter A, B or C is stamped on piston head but ordinarily it is not necessary to discriminate each piston by this letter.

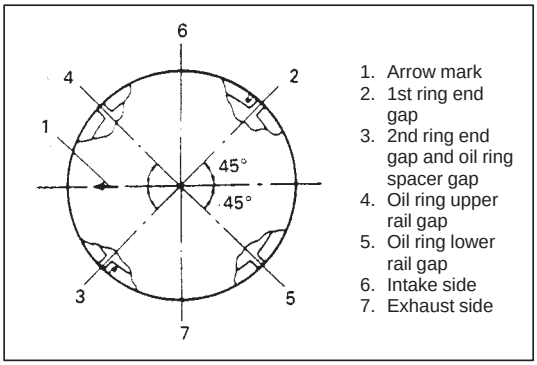


1) Install piston pin to piston and connecting rod:
After applying engine oil to piston pin and piston pin holes in piston and connecting rod, fit connecting rod to piston as shown in figure and insert piston pin to piston and connecting rod, and install piston pin circlips.

NOTE:
Circlip should be installed with its cut part facing either up or down as shown in figure.



2) Install piston rings to piston:
- As indicated in figure at the left, 1st and 2nd rings have "RN", "T" or "R" mark 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.

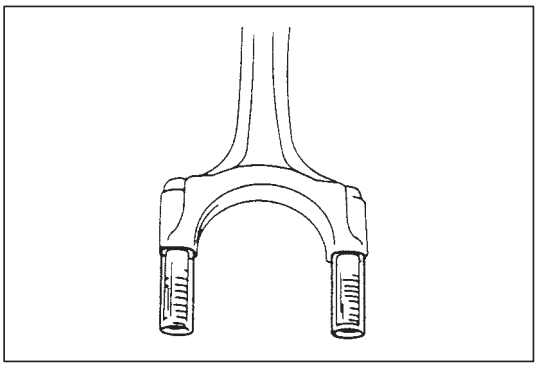


3) After installing three rings (1st, 2nd and oil rings), distribute their end gaps as shown in figure.

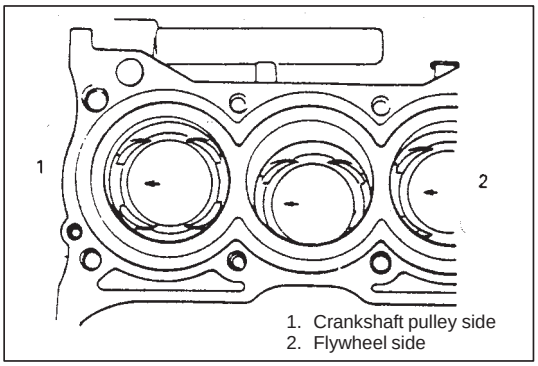
INSTALLATION OR CONNECTION

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.

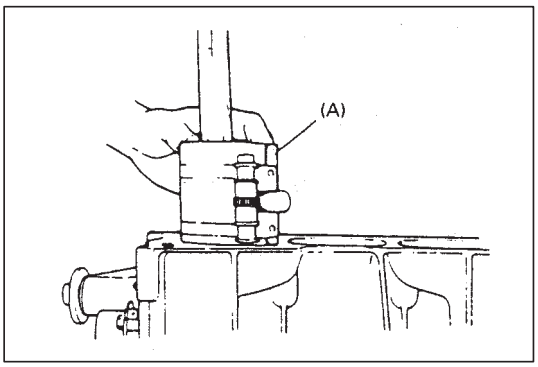


2) Install guide hoses over connecting rod bolts.
These guide hoses protect crankpin and threads of rod bolt from damage during installation of connecting rod and piston assembly.



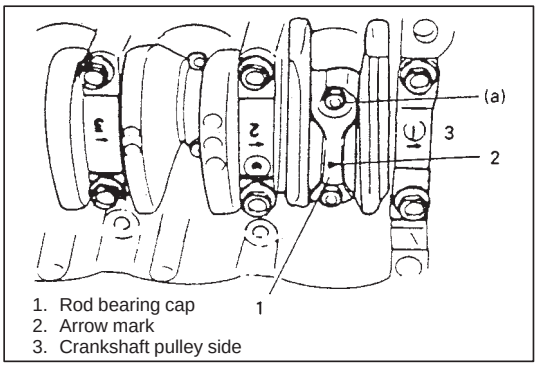
1. Crankshaft pulley side
2. Flywheel side

3) When installing piston and connecting rod assembly into cylinder bore, point arrow mark on piston head to crankshaft pulley side.



4) Install piston and connecting rod assembly into cylinder bore. Use special tool (Piston ring compressor) to compress rings. Guide connecting rod into place on crankshaft.
Using a hammer handle, tap piston head to install piston into bore. Hold ring compressor firmly against cylinder block until all piston rings have entered cylinder bore.

Special Tool
(A): 09916-77310



1. Rod bearing cap
2. Arrow mark
3. Crankshaft pulley side

5) Install bearing cap:
Point arrow mark on cap to crankshaft pulley side.
Tighten cap nuts to specification.

Tightening Torque
(a): 35 N·m (3.5 kg-m, 25.5 lb-ft)

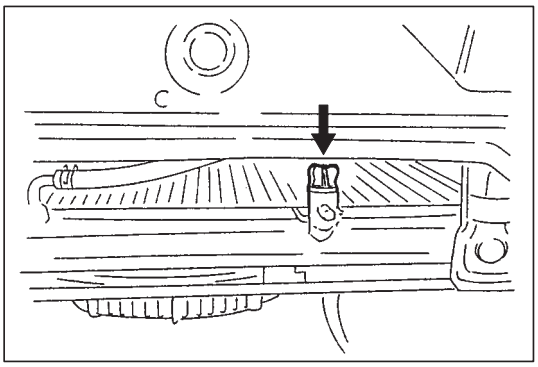
6) Reverse removal procedure for installation, as previously outlined.
7) Adjust water pump drive belt tension, referring to section 0B.
8) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped. Refer to section 0B.
9) Adjust intake and exhaust valve lashes as previously outlined.
10) Adjust accelerator cable play and A/T throttle cable (for 4 A/T model) 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 “ENGINE COOLING” section.
14) Refill front differential housing with gear oil, referring to “DIFFERENTIAL” section.
15) Connect negative cable at battery.
16) Verify that there is no fuel leakage, coolant leakage, oil leakage and exhaust gas leakage at each connection.
17) Verify that ignition timing is within specification referring to “IGNITION SYSTEM (FOR G16 ENGINE)” section.

UNIT REPAIR OVERHAUL

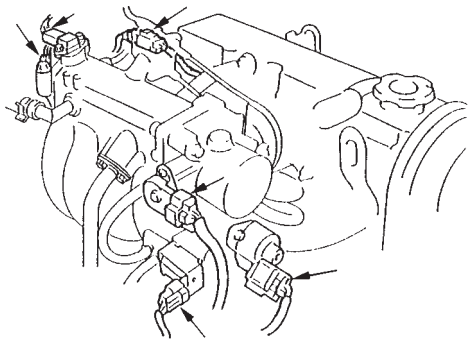
ENGINE ASSEMBLY

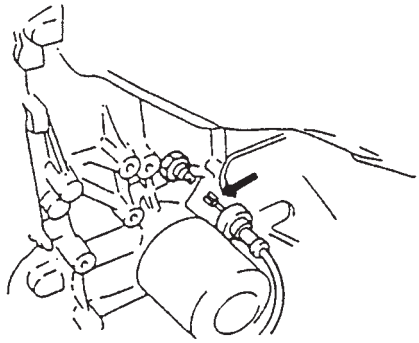
REMOVAL

1) Release fuel pressure in fuel feed line by referring to Fuel Pressure Relief Procedure in section 6.
2) Disconnect negative cable from battery.
3) Remove engine hood.



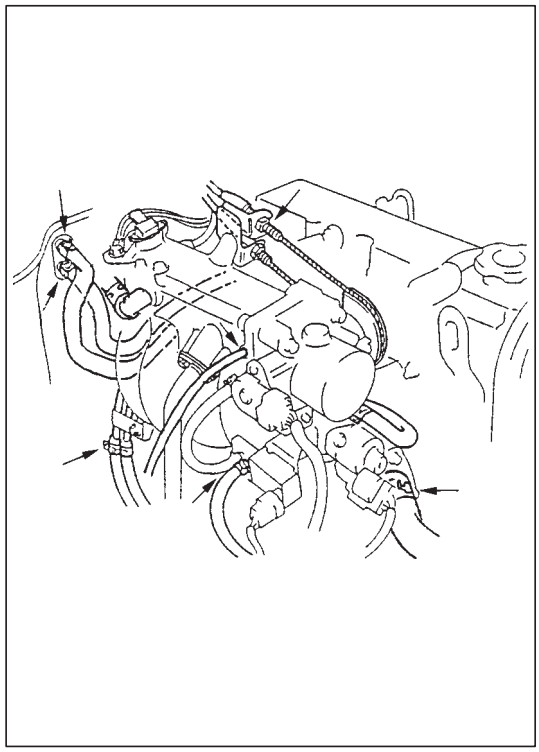
4) Drain cooling system.
5) Remove radiator fan and fan shroud.
   Refer to “ENGINE COOLING” section.



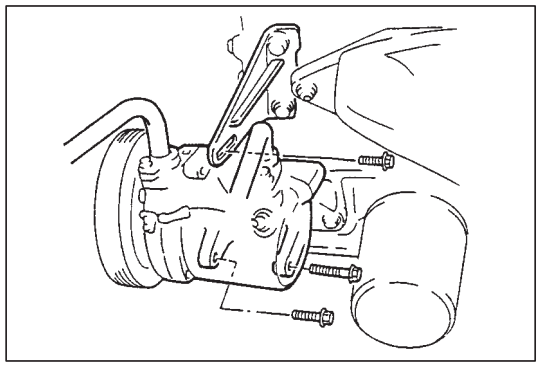


6) Remove air intake hose.
7) Disconnect following electric wires:
   - Ground wires from intake manifold
   - Manifold differential pressure sensor
   - Camshaft position sensor
   - EGR valve
   - EVAP canister purge valve
   - Engine coolant temp. sensor
   - Throttle position sensor
   - Idle air control valve
   - Fuel injector wire at the connector
   - Intake air temp. sensor
   - Mass air flow sensor
   - Tank pressure control solenoid valve
   - EVAP canister air valve
   - Crankshaft position sensor
   - Generator
   - Ground cable from cylinder block (if equipped)
   - Heated oxygen sensor-1 and -2
   - Engine oil pressure switch
   - Power steering pressure switch (if equipped)

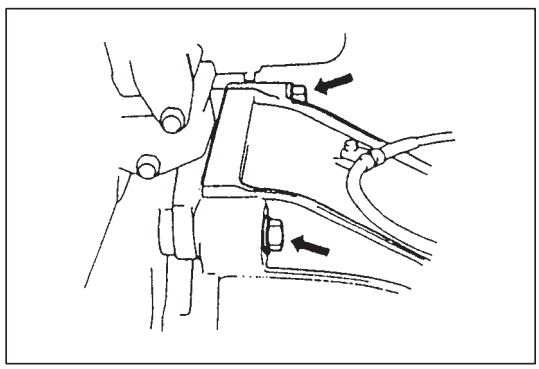
   and then release wire harnesses from clamps.
8) Remove starter motor.



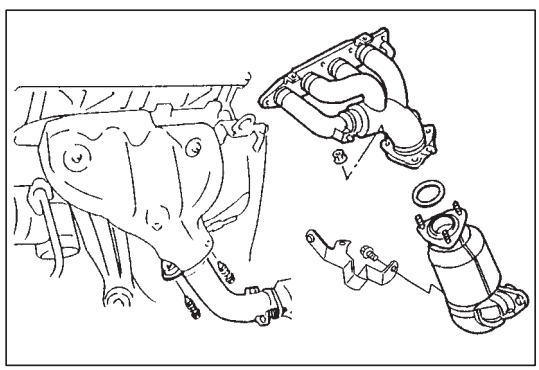
9) Disconnect following hoses:
   - Canister purge hose from EVAP canister purge valve
   - Radiator outlet hose from inlet pipe
   - Brake booster hose from intake manifold
   - Vacuum hose from intake manifold
   - Heater inlet and outlet hose from pipe
   - Fuel feed hose and return hose from each pipe
   - A/T fluid hose clamp from bracket
10) Disconnect accelerator cable and A/T throttle cable (if equipped) from throttle body and each clamp.



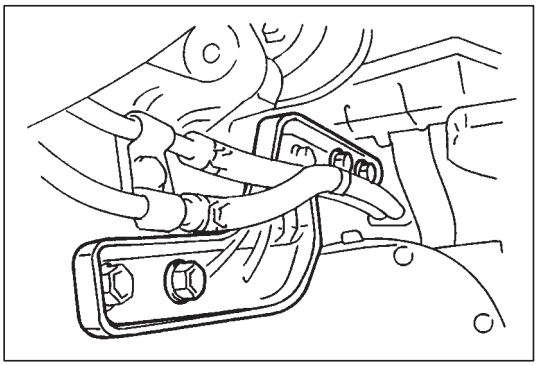
11) With hose connected, detach A/C compressor and/or power steering pump with bracket from cylinder block if equipped.



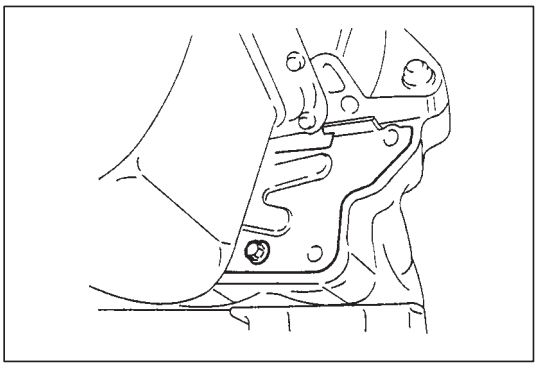
12) Loosen bolts fastening cylinder block and transmission.



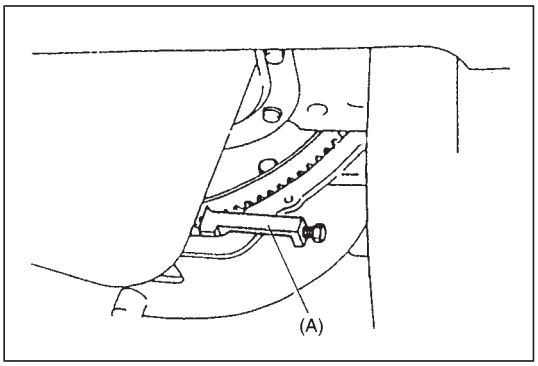
13) Hoist vehicle.
14) Drain engine oil if necessary.
15) Remove exhaust pipe bolts or exhaust pipe.



16) Remove right side transmission stiffener from transmission and cylinder block (A/T).

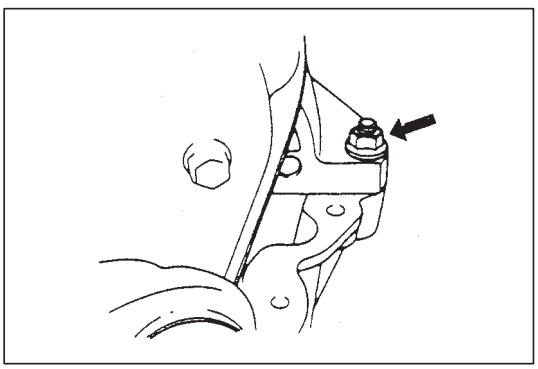


17) Remove clutch housing (torque converter housing) lower plate.

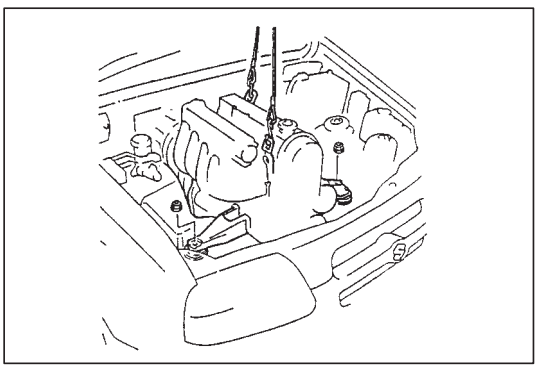


18) Remove torque converter bolts (A/T).

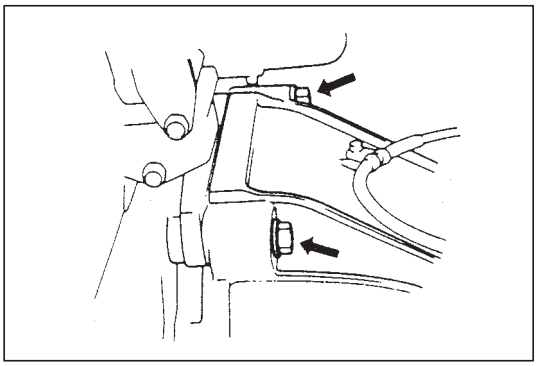
Special Tool
(A): 09927-56010



19) Remove nuts fastening cylinder block and transmission.
20) Lower vehicle.
21) Support transmission with jack.
With A/T vehicle, don't jack under A/T oil pan to support transmission.

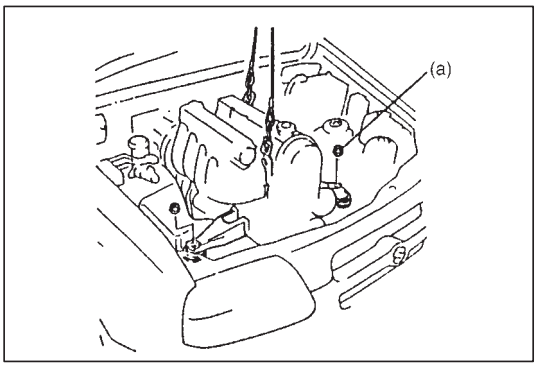


22) Install lifting device.
23) Remove engine mounting bracket nuts (R & L).
24) Before lifting engine, check to ensure all hoses, electric wires and cables are disconnected from engine.
25) Remove engine assembly from chassis and transmission by lifting a little, sliding towards the front side, and then carefully hoist engine assembly.



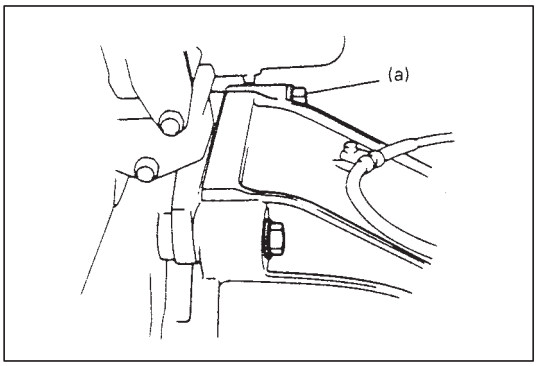
INSTALLATION

1) Lower engine assembly into engine compartment and connect engine to transmission.
   Hand-tighten bolts and nuts fastening cylinder block and transmission.



2) Tighten engine mounting bracket nuts (R & L).

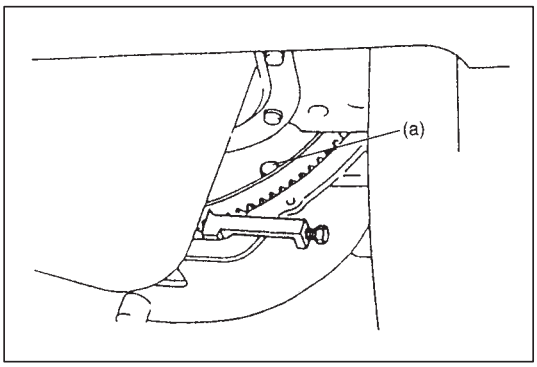
   Tightening Torque
   (a): 50 N·m (5.0 kg-m, 36.5 lb-ft)



3) Tighten bolts fastening cylinder block and transmission to specified torque.

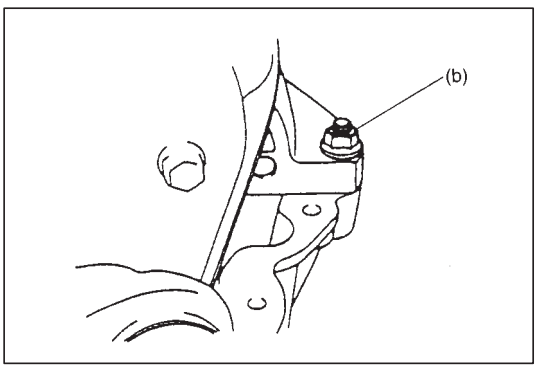
   Tightening Torque
   (a): 85 N·m (8.5 kg-m, 61.5 lb-ft)

4) Remove lifting device.



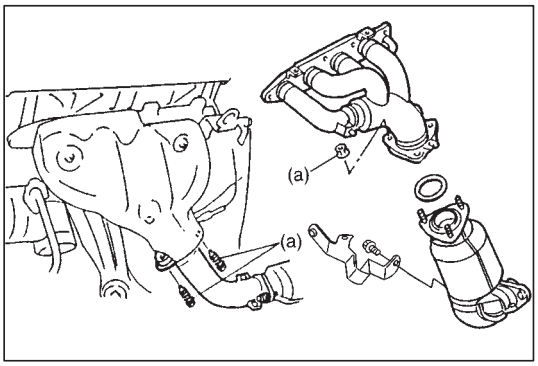
5) Reverse removal procedure for installation, noting the following.
   - Tighten torque converter bolts to specified torque (A/T).

   Tightening Torque
   (a): 65 N·m (6.5 kg-m, 47.0 lb-ft)



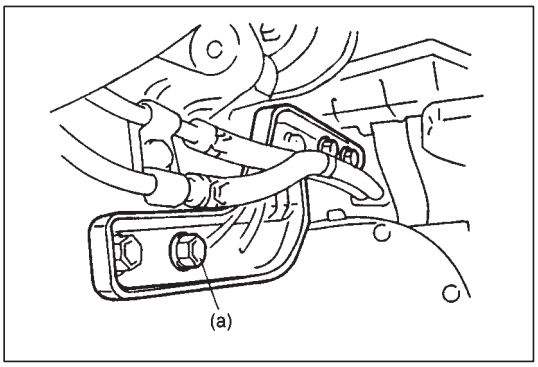
   - Tighten nuts fastening cylinder block and transmission to specified torque.

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



- Tighten bolts of exhaust pipes to specified torque.

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

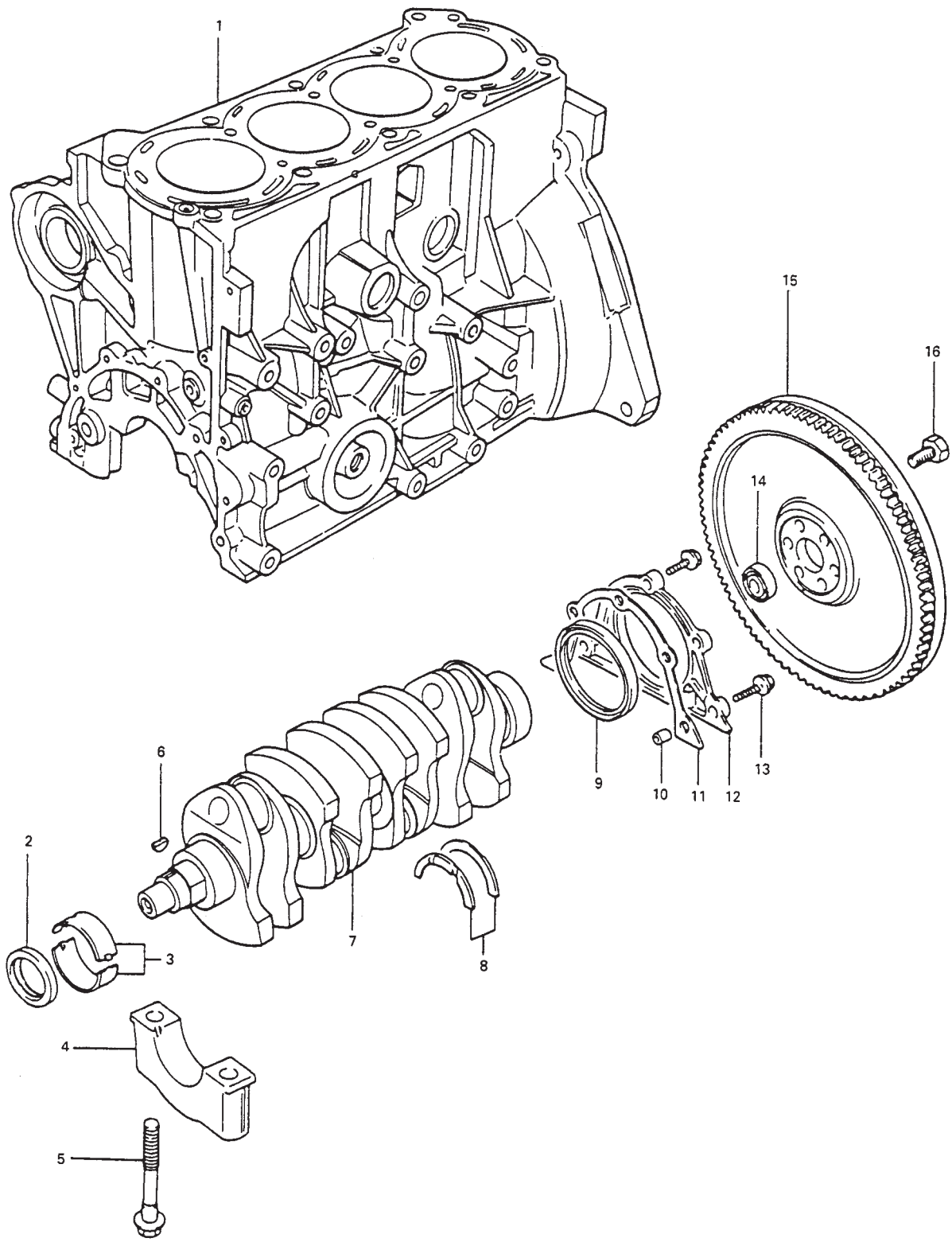


- Tighten transmission stiffener bolts (right side) to specified torque (A/T).

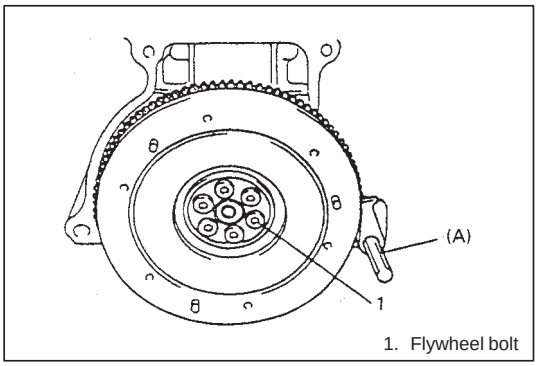
Tightening Torque
(a): 50 N·m (5.0 kg-m, 36.5 lb-ft)

6) Adjust water pump drive belt tension, referring to “ENGINE COOLING” section.
7) Adjust power steering pump belt tension or A/C compressor belt tension, if equipped. Refer to section 0B.
8) Adjust accelerator cable play and A/T throttle cable (for A/T) 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 engine with engine oil, referring to item “ENGINE OIL CHANGE” in section 0B.
11) Refill cooling system referring to “ENGINE COOLING” section.
12) Verify that there is no fuel leakage, coolant leakage and exhaust gas leakage at each connection.

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK



1. Cylinder block
2. Front oil seal
3. Main bearing
4. Bearing cap
5. Cap bolt
6. Timing pulley key
7. Crankshaft
8. Thrust bearing
9. Rear oil seal
10. Pin
11. Oil seal housing gasket
12. Oil seal housing
13. Housing bolt
14. Input shaft bearing
15. Flywheel
16. Flywheel bolt

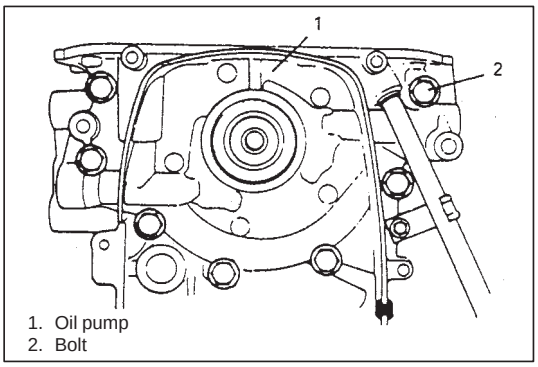


1. Flywheel bolt

REMOVAL

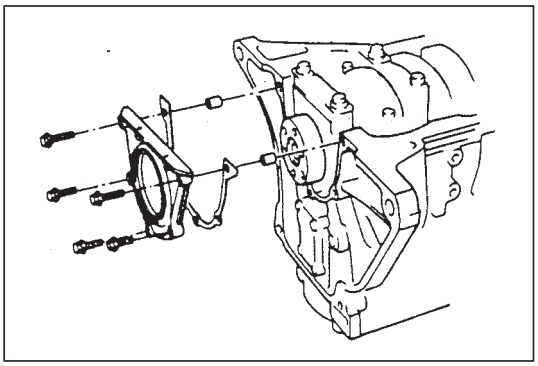
1) Remove engine assembly from body as previously outlined.
2) Remove clutch cover, clutch disc and flywheel (drive plate for A/T).

Special Tool
(A): 09924-17810

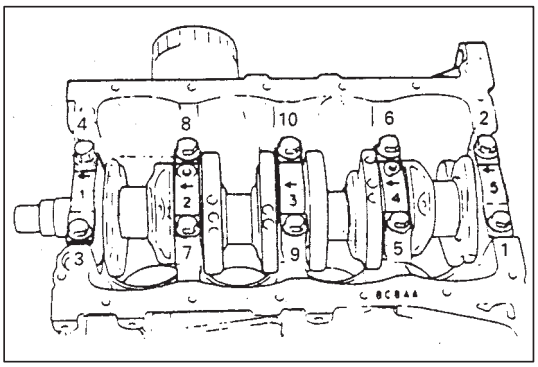


1. Oil pump
2. Bolt

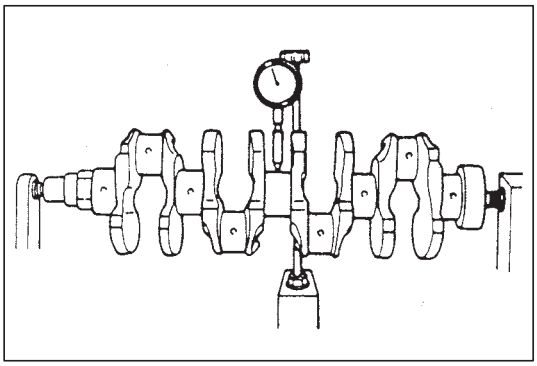
3) Remove crankshaft pulley, timing belt and crankshaft timing pulley.
4) Remove cylinder head assembly.
5) Remove oil pan and oil pump strainer.
6) Remove oil pump.



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.



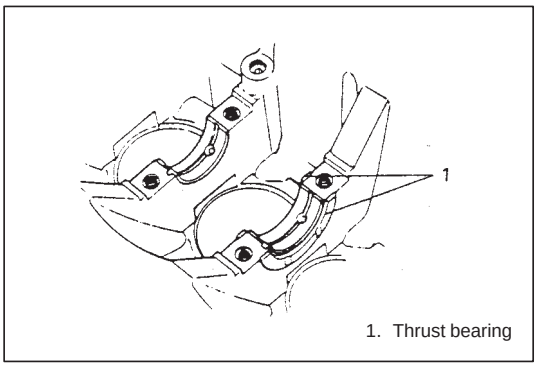
INSPECTION

Crankshaft

Crankshaft runout

Using a dial gauge, measure runout at center journal. Rotate crankshaft slowly. If runout exceeds its limit, replace crankshaft.

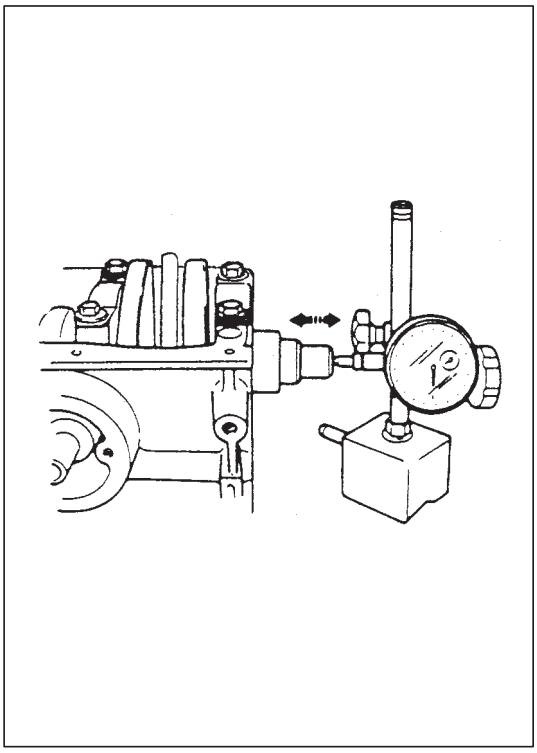
Limit on runout: 0.06 mm (0.0023 in.)



1. Thrust bearing

Crankshaft thrust play

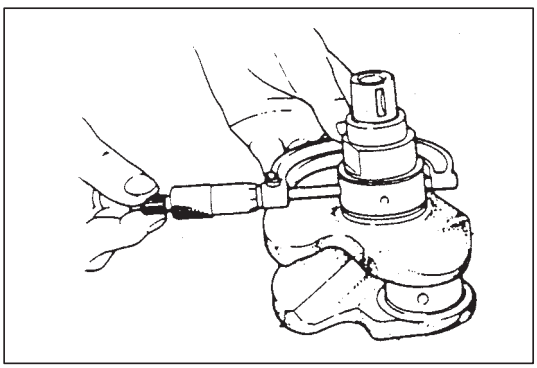
Measure this play with crankshaft set in cylinder block in the normal manner, that is, with thrust bearing and journal bearing caps installed.



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.)	0.38 mm (0.0149 in.)

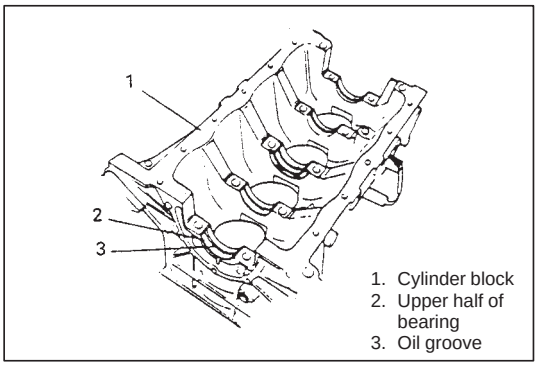
Thickness of crankshaft thrust bearing	Standard		2.500 mm (0.0984 in.)
	Oversize:	0.125 mm (0.0049 in.)	2.563 mm (0.1009 in.)



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.)

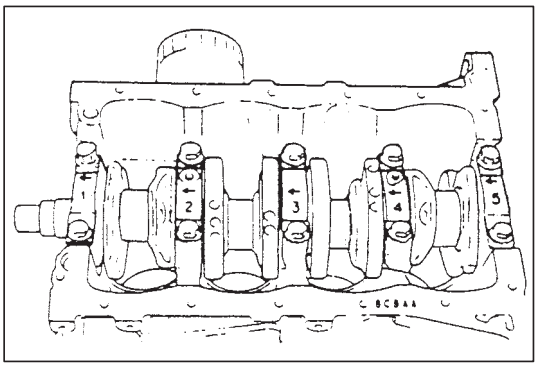


1. Cylinder block
2. Upper half of bearing
3. Oil groove

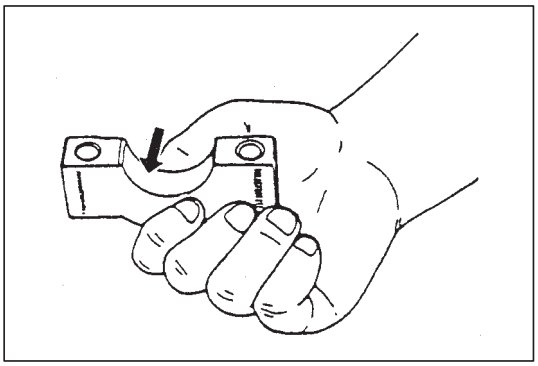
Main Bearings

General information

- Service main bearings are available in standardsize and 0.25 mm (0.0098 in.) undersize, and each of them has 5 kinds of bearings differing in tolerance.
- Upper half of bearing has oil groove as shown in figure. Install this half with oil groove to cylinder block.

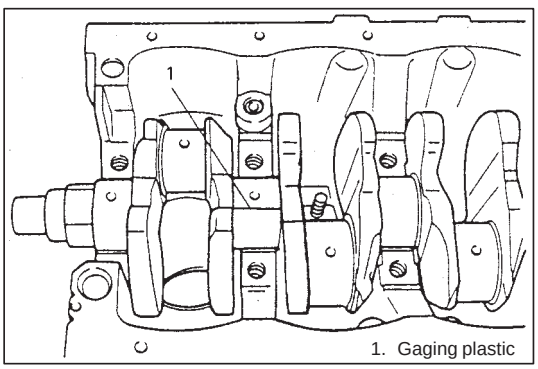


- On each main bearing cap, arrow mark and number are embossed as shown in figure.
  When installing each bearing cap to cylinder block, point arrow mark toward crankshaft pulley side and install each cap from that side to flywheel side in ascending order of numbers “1”, “2”, “3”, “4” and “5”. Tighten cap bolts to specified torque.



Inspection

Check bearings for pitting, scratches, wear or damage.
If any malcondition is found, replace both upper and lower halves.
Never replace one half without replacing the other half.

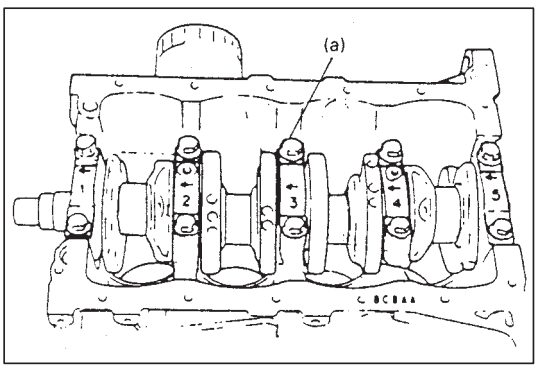


1. Gaging plastic

Main bearing clearance

Check clearance by using gaging plastic according to following procedure.

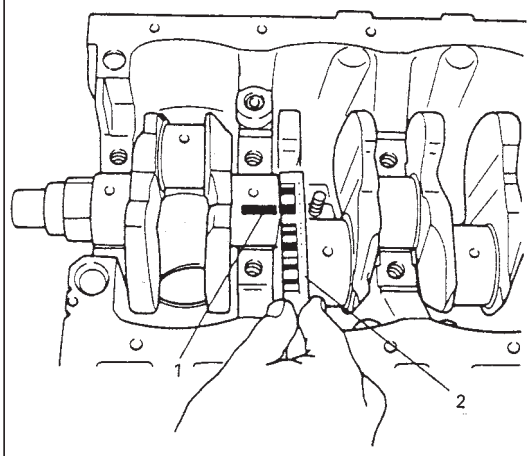
1) Remove bearing caps.
2) Clean bearings and main journals.
3) Place a piece of gaging plastic to full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.



4) Install bearing cap as previously outlined and evenly toque cap bolts to specified torque.
   Bearing cap must be torqued to specification in order to assure proper reading of clearance.

   Tightening Torque
   (a): 54 N·m (5.4 kg-m, 39.0 lb-ft)

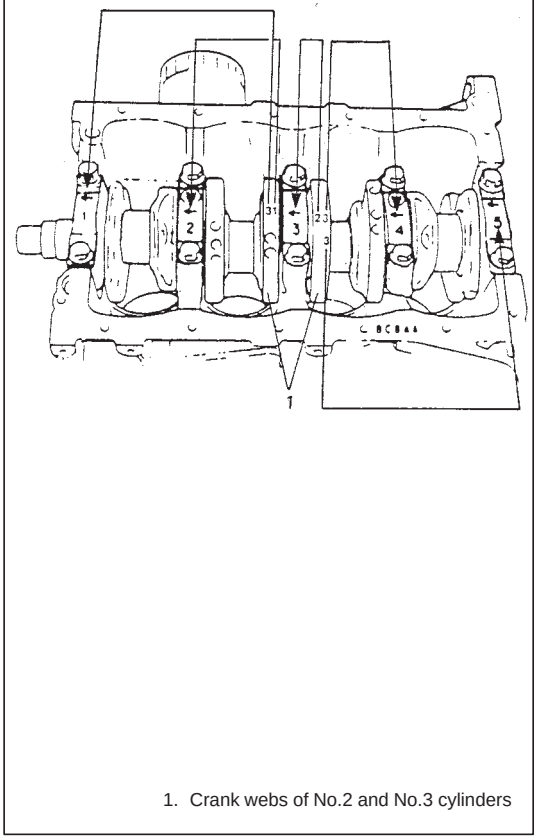
   NOTE:
   Do not rotate crankshaft while gaging plastic is installed.



1. Gaging plastic
2. Scale

5) Remove cap and using scale on gaging plastic 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	0.016 – 0.036 mm (0.0006 – 0.0014 in.)	0.060 mm (0.0023 in.)



1. Crank webs of No.2 and No.3 cylinders

Selection of main bearings

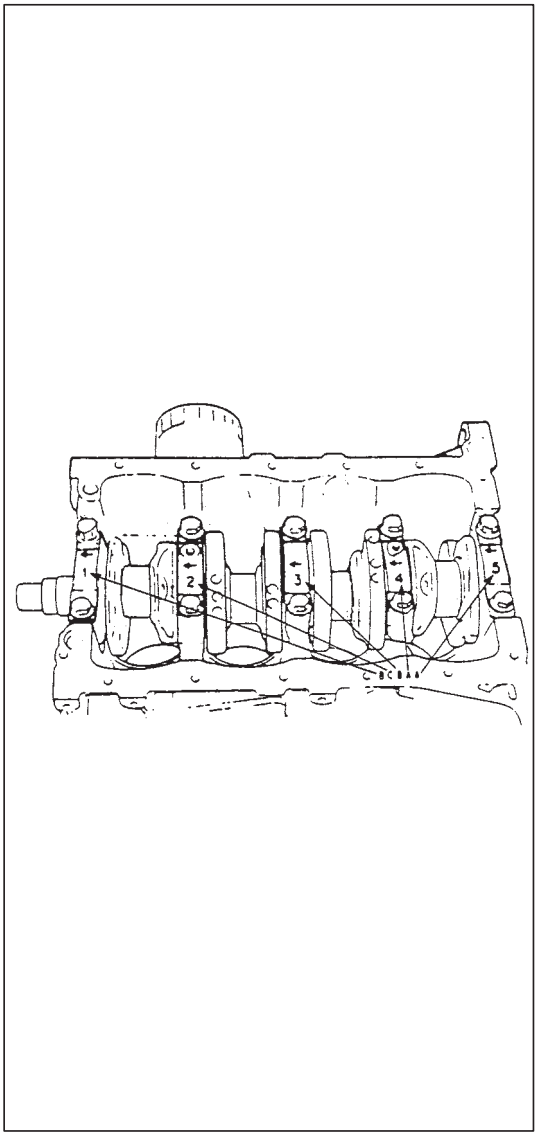
STANDARD BEARING:

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 webs of No.2 and No.3 cylinders have five stamped numerals.
Three kinds of numerals (“1”, “2” and “3”) represent following journal diameters.

Numeral stamped	Journal diameter
1	51.994 – 52.000 mm (2.0470 – 2.0472 in.)
2	51.988 – 51.994 mm (2.0468 – 2.0470 in.)
3	51.982 – 51.988 mm (2.0465 – 2.0468 in.)

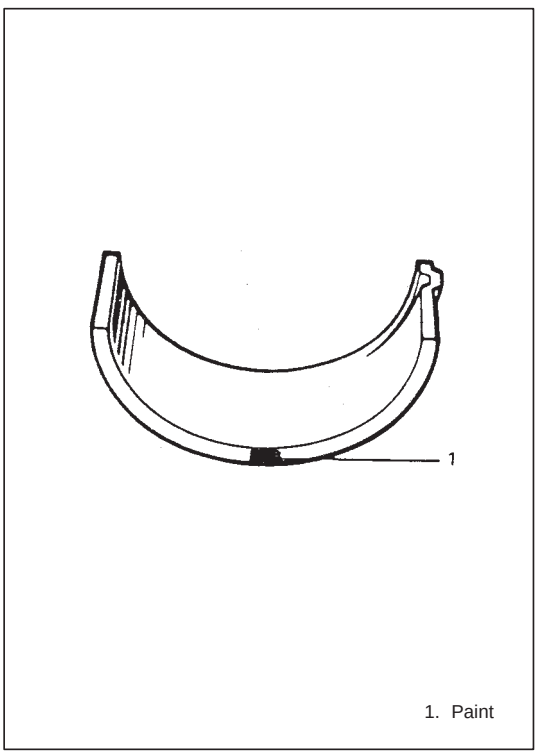
The first, second, third, fourth and fifth (left to right) stamped numerals represent journal diameters at bearing caps “1”, “2”, “3”, “4” and “5” respectively.
For example, in figure, the first (leftmost) numeral “3” indicates that journal dia. at bearing cap “1” is within 51.982 – 51.988 mm, and second one “1” indicate that journal dia. at cap “2” is within 51.994 – 52.000 mm.



2) Next, check bearing cap bore diameter without bearing. On mating surface of cylinder block, four alphabets are stamped as shown in figure.
Three kinds of alphabets (“A”, “B” and “C”) represent following cap bore diameters.

Alphabet stamped	Bearing cap bore diameter (without bearing)
A	56.000 – 56.006 mm (2.2047 – 2.2050 in.)
B	56.006 – 56.012 mm (2.2050 – 2.2052 in.)
C	56.012 – 56.018 mm (2.2052 – 2.2054 in.)

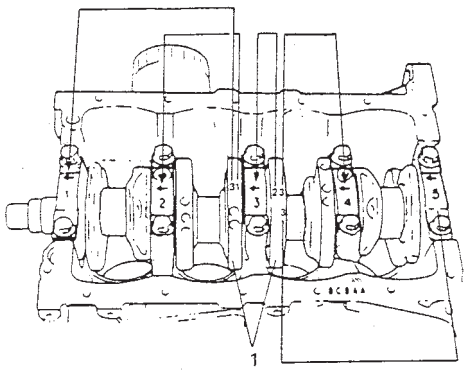
The first, second, third, fourth and fifth (left to right) stamped alphabets represent cap bore diameters of bearing caps “1”, “2”, “3”, “4” and “5”, respectively.
For example, in figure, the first (leftmost) alphabet “B” indicates that cap bore dia. of bearing cap “1” is within 56.006 – 56.012 mm, and the fifth (rightmost) alphabet “A” indicates that cap bore dia. of cap “5” is within 56.000 – 56.006 mm.



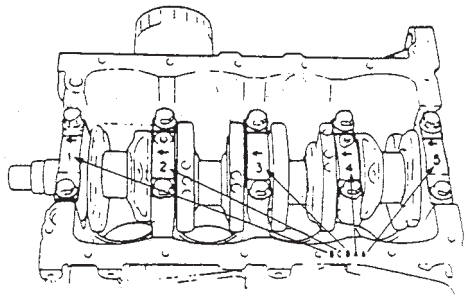
1. Paint

3) There are five kinds fo 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	1.998 – 2.002 mm (0.0787 – 0.0788 in.)
Black	2.001 – 2.005 mm (0.0788 – 0.0789 in.)
Colorless (no paint)	2.004 – 2.008 mm (0.0789 – 0.0790 in.)
Yellow	2.007 – 2.011 mm (0.0790 – 0.0791 in.)
Blue	2.010 – 2.014 mm (0.0791 – 0.0792 in.)

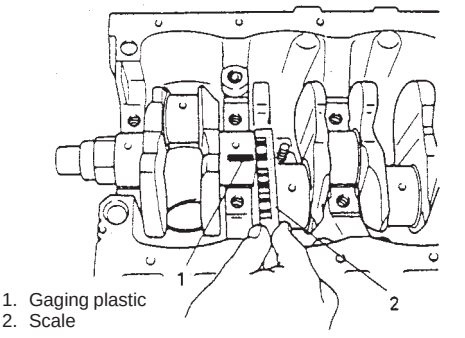


1. Crank webs of No.2 and No.3 cylinders



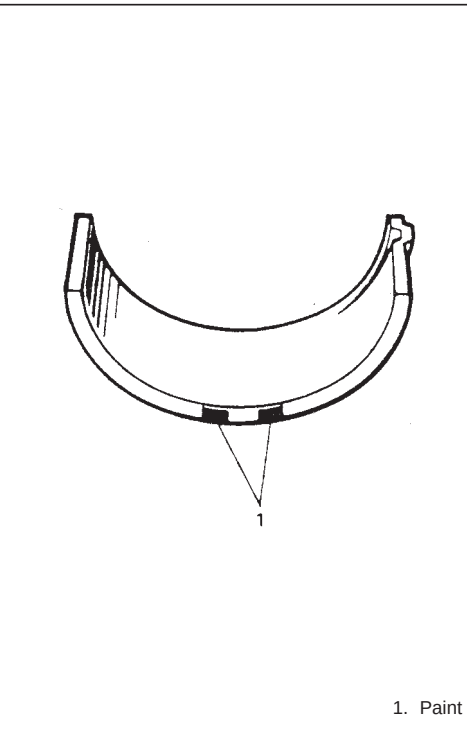
4) From numerals stamped on crank webs of No.2 and No.3 cylinders and the alphabets stamped on mating surface of cylinder block, determine new standard bearing to be installed to journal, by referring to table given below.
For example, if numeral stamped on crank web is “1” and alphabet stamped on mating surface is “B”, 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.)	A	Green	Black	Colorless
	B	Black	Colorless	Yellow
	C	Colorless	Yellow	Blue
		New standard bearing to be installed.		



1. Gaging plastic
2. Scale

5) Using gaging plastic, 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.



1. Paint

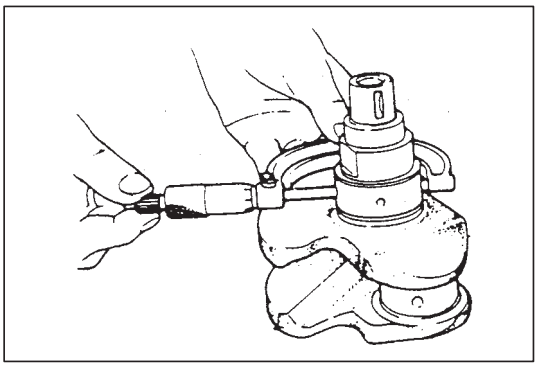
UNDERSIZE BEARING (0.25 mm):

- 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 & Red	2.123 – 2.127 mm (0.0836 – 0.0837 in.)
Black & Red	2.126 – 2.130 mm (0.0837 – 0.0838 in.)
Red only	2.129 – 2.133 mm (0.0838 – 0.0839 in.)
Yellow & Red	2.132 – 2.136 mm (0.0839 – 0.0840 in.)
Blue & Red	2.135 – 2.139 mm (0.0840 – 0.0841 in.)

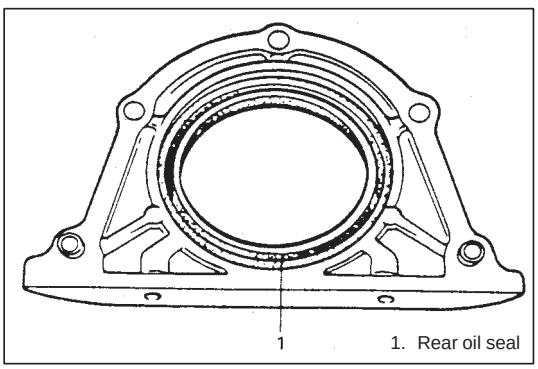
- If necessary, regrind crankshaft journal and select under-size bearing to use with it as follows.
  1) Regrind journal to following finished diameter.

Finished diameter: 51.732 – 51.750 mm (2.0367 – 2.0373 in.)



2) Using micrometer, measure reground journal diameter. Measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.
3) Using journal diameter measured above and alphabets stamped on mating surface of cylinder block, select an under-size bearing by referring to table given below.
   Check bearing clearance with newly selected undersize bearing.

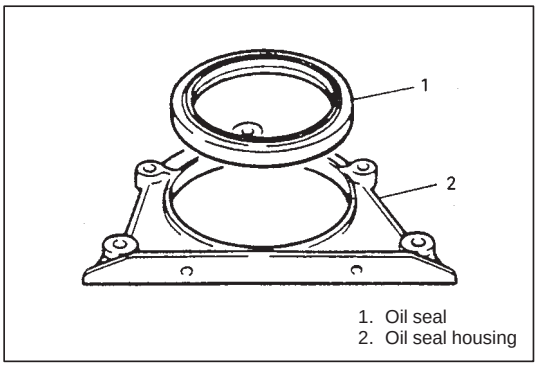
		Measured journal diameter		
		51.744 – 51.750 mm (2.0371 – 2.0373 in.)	51.738 – 51.744 mm (2.0369 – 2.0371 in.)	51.732 – 51.738 mm (2.0367 – 2.0369 in.)
Alphabets stamped on mating surface of cylinder block	A	Green & Red	Black & Red	Red only
	B	Black & Red	Red only	Yellow & Red
	C	Red only	Yellow & Red	Blue & Red
		Undersize bearing to be installed		



1. Rear oil seal

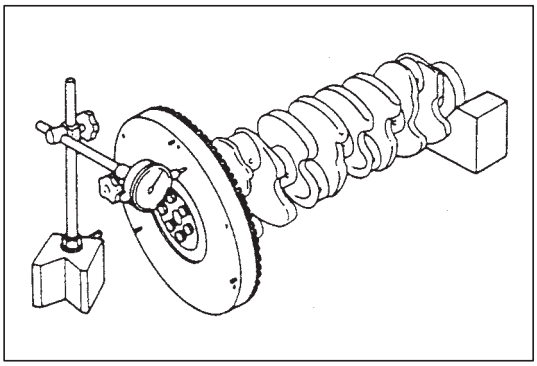
Rear Oil Seal

Carefully inspect oil seal for wear or damage. If its lip is worn or damaged, replace it.



1. Oil seal
2. Oil seal housing

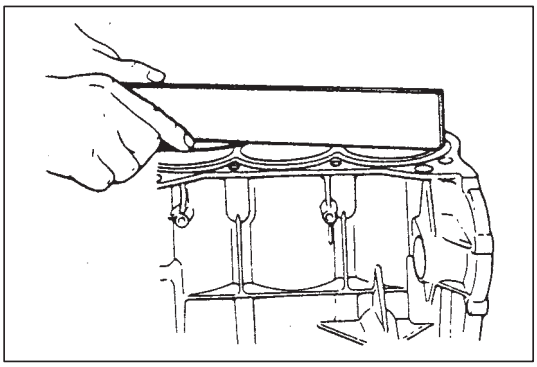
For oil seal installation, press-fit rear oil seal so that oil seal housing end face is flush with oil seal end face.



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

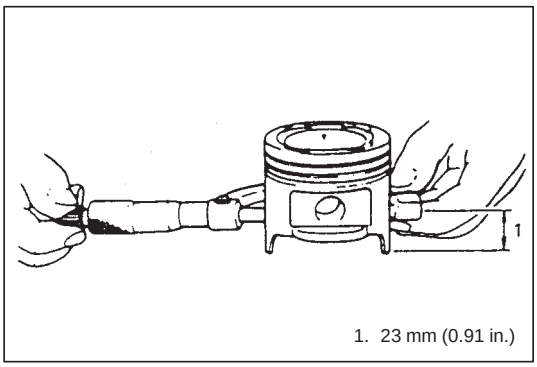
Using straightedge and thickness gauge, check gasketed surface for distortion and, if flatness exceeds its limit, correct it.

Item	Standard	Limit
Flatness	0.03 mm (0.0012 in.)	0.06 mm (0.0024 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 0.25	75.220 – 75.230 mm (2.9614 – 2.9618 in.)
O/S 0.50	75.470 – 75.480 mm (2.9712 – 2.9716 in.)



1. 23 mm (0.91 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 = 0.02 – 0.04 mm (0.0008 – 0.0015 in.)
   C: Allowance for honing = 0.02 mm (0.0008 in.)

5) Rebore and hone cylinder to calculated dimension.

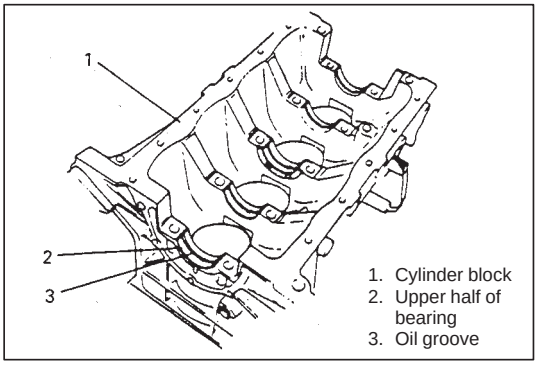
NOTE:
Before reboring, install all main bearing caps in place and tighten to specification to avoid distortion of bearing bores.

6) Measure piston clearance after honing.

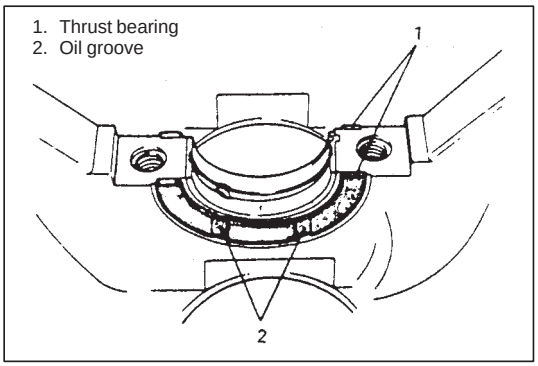
INSTALLATION

NOTE:

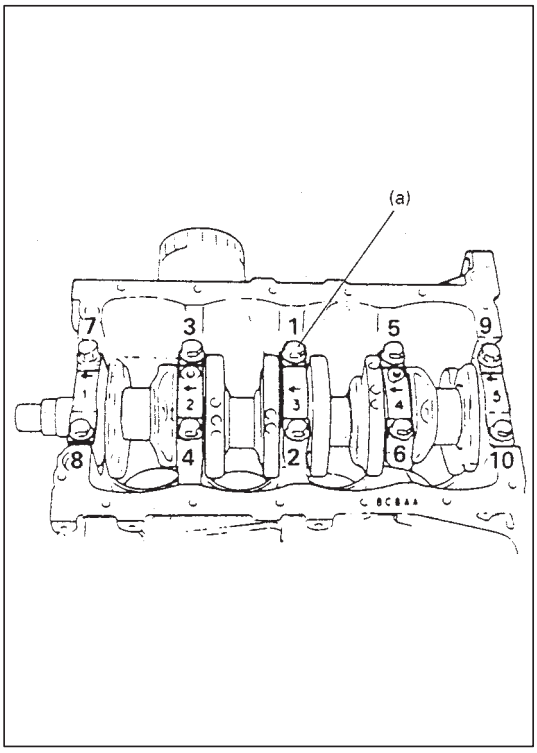
- **All parts to be installed must be perfectly clean.**
- **Be sure to oil crankshaft journals, journal bearings, thrust bearings, crankpins, connecting rod bearings, pistons, piston rings and cylinder bores.**
- **Journal bearings, bearing caps, connecting rods, rod bearings, rod bearing caps, pistons 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.
One of two halves of main bearing, has an oil groove. 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.



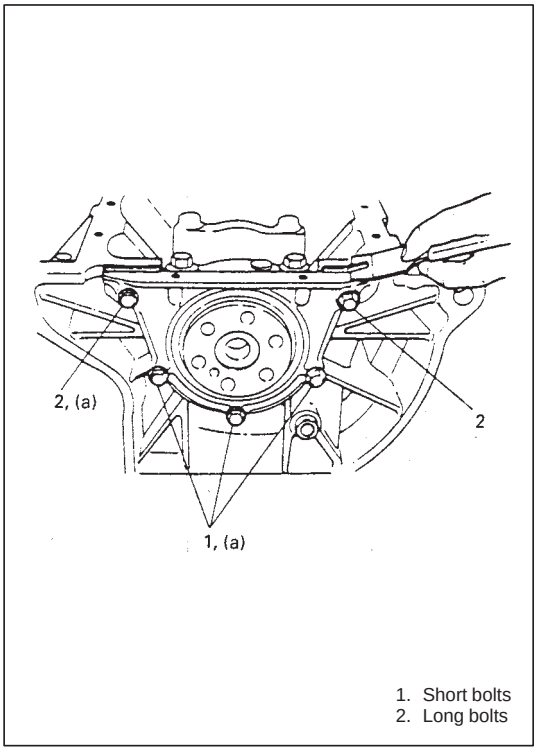
2) Install thrust bearings to cylinder block between No.2 and No.3 cylinders. Face oil groove sides to crank webs.



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. After installing bearing cap stiffeners, 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): 54 N·m (5.4 kg-m, 39.0 lb-ft)

NOTE:
After tightening cap bolts, check to be sure that crankshaft rotates smoothly when turning it by 8.0 N·m (0.8 kg-m, 5.8 lb-ft) torque or below.



1. Short bolts
2. Long bolts

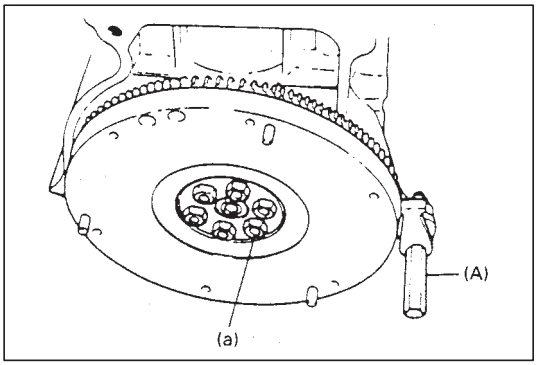
5) Install new gasket and oil seal housing.
Do not reuse gasket removed in disassembly. Apply engine oil to oil seal lip before installation. Tighten housing bolts to specification.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

NOTE:
As there are 2 types 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.

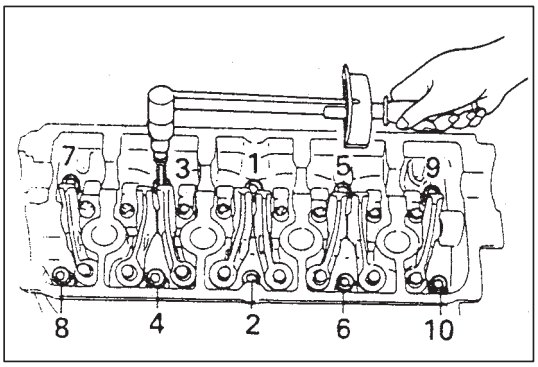


7) Install flywheel (M/T model) or drive plate (A/T model).
Using special tool, lock flywheel or drive plate, and torque its bolts to specification.

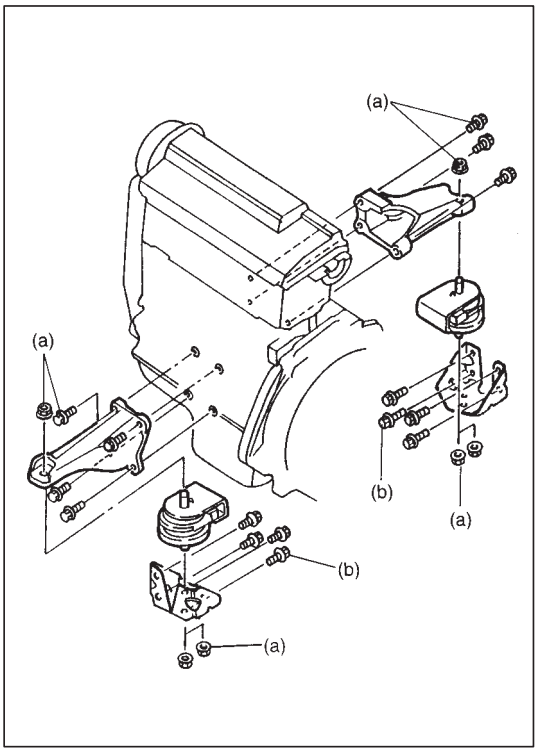
Special Tool
(A): 09924-17810

Tightening Torque
(a): 78 N·m (7.8 kg-m, 56.5 lb-ft)

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 as previously outlined.
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 “CLUTCH” section.

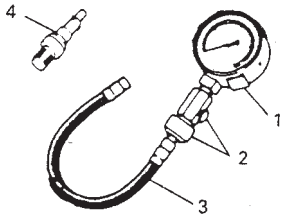
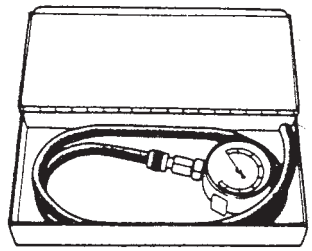
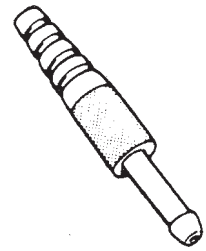
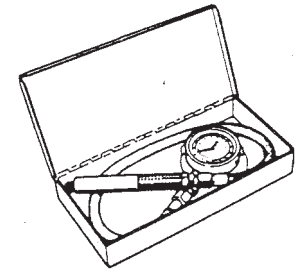
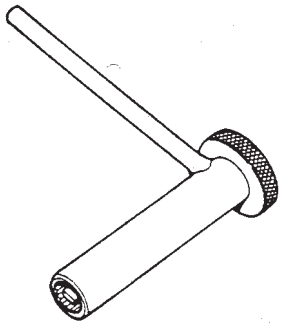
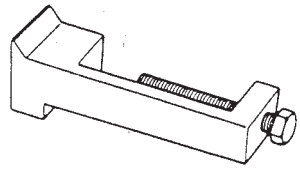
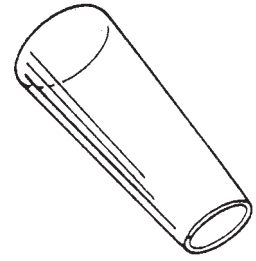
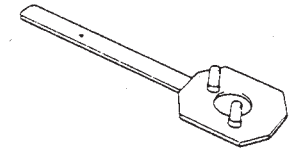
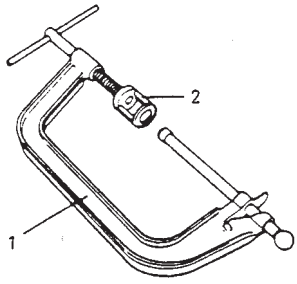
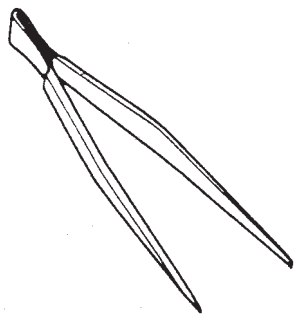
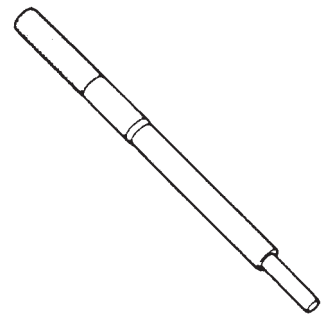
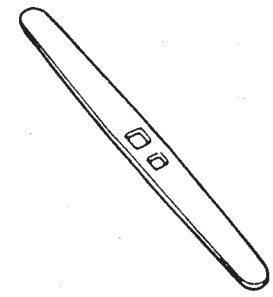
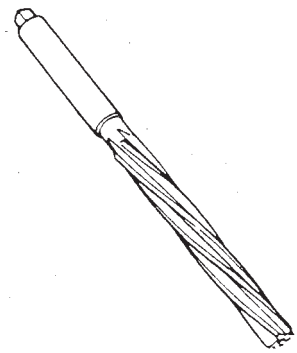
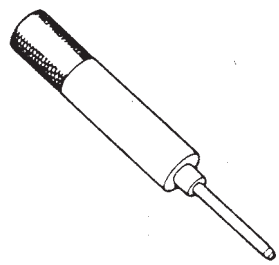
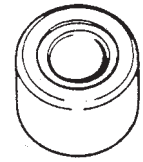
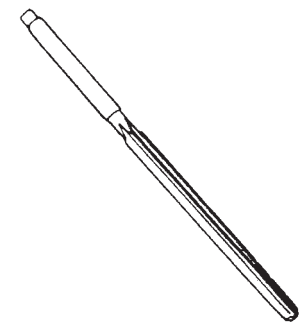


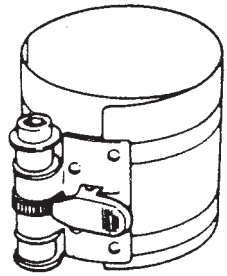
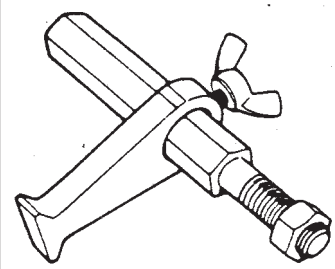
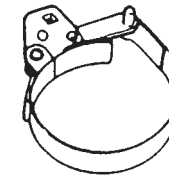
13) Install engine mountings brackets.

Tightening Torque
(a): 50 N·m (5.0 kg-m, 36.5 lb-ft)
(b): 85 N·m (8.5 kg-m, 61.5 lb-ft)

14) Install engine assembly to vehicle as previously outlined.

SPECIAL TOOLS

 1. 09915-64510-001 Compression gauge 2. 09915-64510-002 Connector 3. 09915-64530 Hose 4. 09915-67010 Attachment	 09915-67310 Vacuum gauge	 09918-08210 Vacuum gauge hose joint	 09915-77310 Oil pressure gauge
 09917-18210 Tappet adjuster wrench	 09927-56010 Gear stopper	 09926-18210 Oil seal guide (Vinyl resin)	 09917-68220 Camshaft pulley holder
 1. 09916-14510 Valve lifter 2. 09916-14910 Valve lifter attachment	 09916-84511 Forceps	 09916-44910 Valve guide remover	 09916-34542 Reamer handle
 09916-38210 Reamer (11 mm)	 09916-58210 Valve guide installer handle	 09916-56011 Valve guide installer attachment	 09916-34550 Reamer (5.5 mm)

			
09917-98221 Valve stem seal installer	09916-77310 Piston ring compressor	09924-17810 Flywheel holder	09915-47330 Oil filter wrench

REQUIRED SERVICE MATERIALS

MATERIALS	RECOMMENDED SUZUKI PRODUCT	USE
Sealant	SUZUKI BOND NO.1207C (99000-31150)	● Mating surfaces of cylinder block and oil pan.
Sealant	SUZUKI BOND NO.1215 (99000-31110)	● Mating surfaces of camshaft housings (No.6). ● Mating surfaces of camshaft position sensor case and cylinder head.

SECTION 6A2

ENGINE MECHANICAL (H25 ENGINE)

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

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

CONTENTS

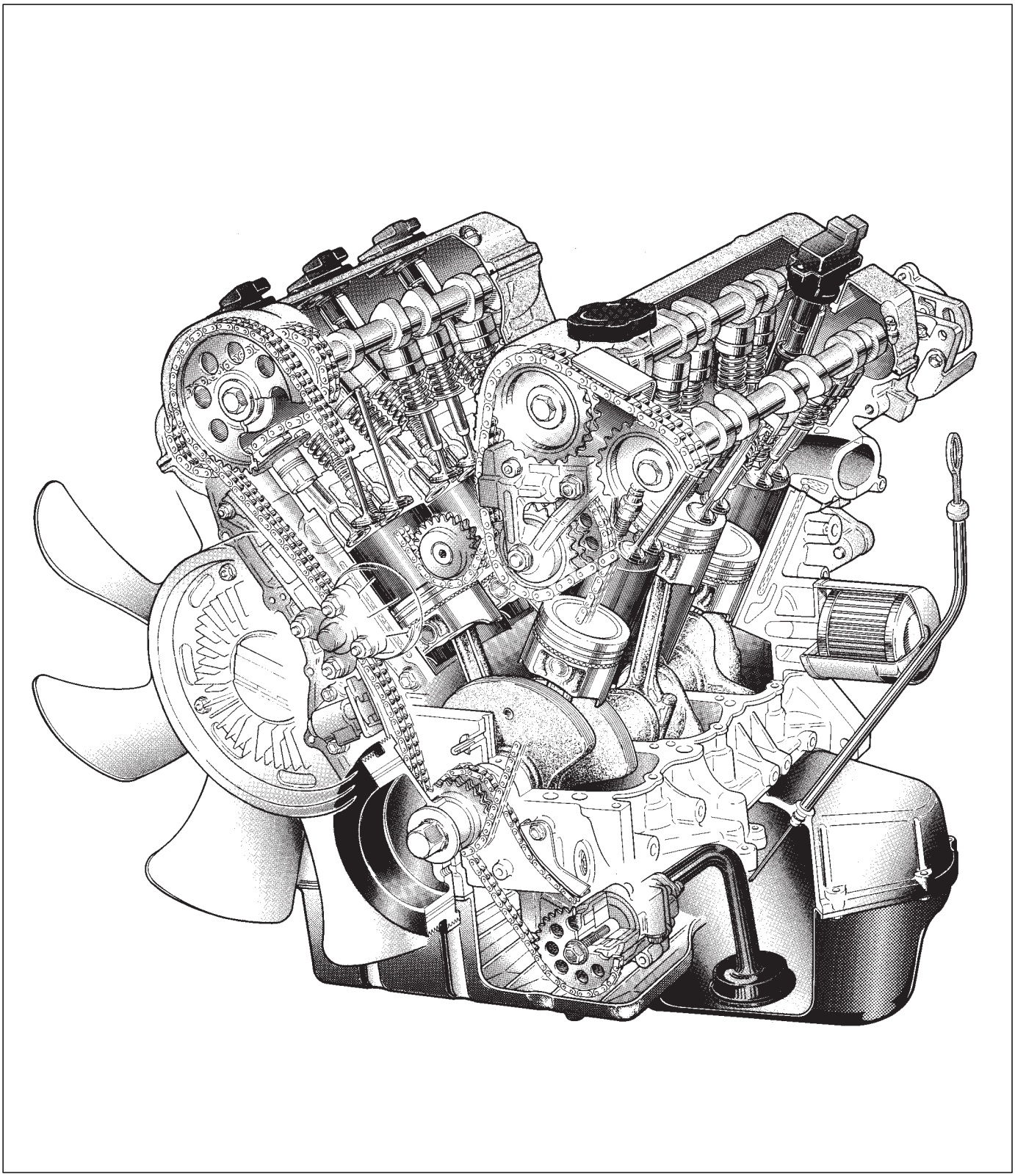
GENERAL DESCRIPTION 6A2- 2
ON-VEHICLE SERVICE 6A2- 4
Compression Check 6A2- 4
Engine Vacuum Check 6A2- 5
Oil Pressure Check 6A2- 6
Air Cleaner Element 6A2- 7
Throttle Body and Intake Manifold 6A2- 8
Exhaust Manifold 6A2-14
Cylinder Head Covers 6A2-18
Oil Pan and Oil Pump Strainer 6A2-19
Timing Chain Cover 6A2-22
Oil Pump 6A2-24
LH (NO.1) Bank 2nd Timing Chain and Chain Tensioner 6A2-27
1st Timing Chain and Chain Tensioner 6A2-33
RH (NO.2) Bank 2nd Timing Chain and Chain Tensioner 6A2-41
Oil Pump Chain 6A2-46
Camshaft and Valve Lash Adjuster 6A2-50
Valve Lash Adjuster Noise Diagnosis 6A2-57
Valves and Cylinder Heads 6A2-58
Piston, Piston Rings, Connecting Rods and Cylinders 6A2-69
UNIT REPAIR OVERHAUL 6A2-80
Engine Assembly 6A2-80
Main Bearings, Crankshaft and Cylinder Block 6A2-84
SPECIAL TOOLS 6A2-94
REQUIRED SERVICE MATERIAL 6A2-95

GENERAL DESCRIPTION

ENGINE

The engine is a water-cooled, 60° V6 cylinders, 4 stroke cycle gasoline unit with its DOHC (Double overhead camshaft) valve mechanism arranged for "V" type valve configuration.

The double overhead camshaft is mounted over the cylinder head; it is driven from crankshaft through timing chains, and no push rods are provided in the valve train system.

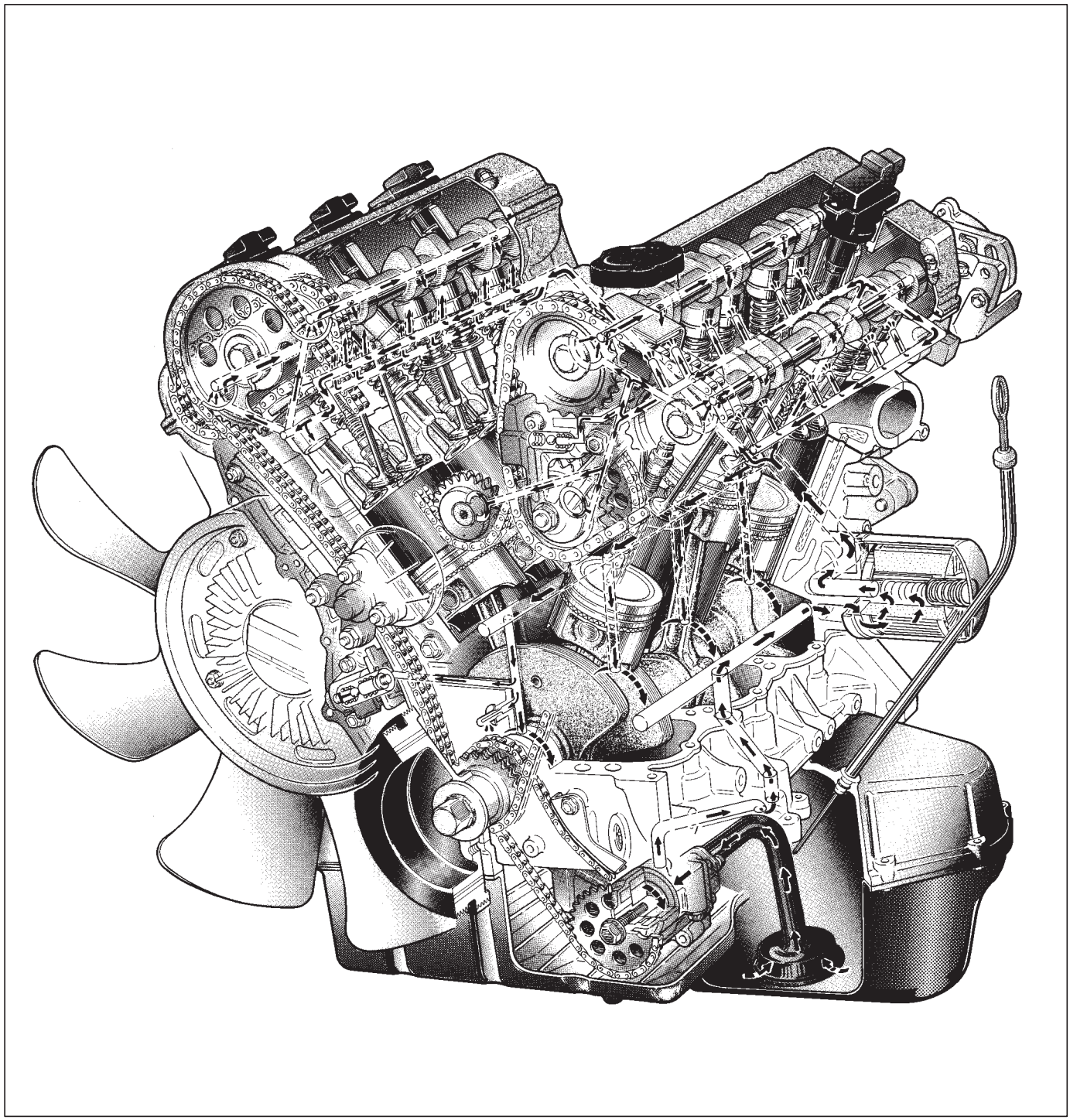


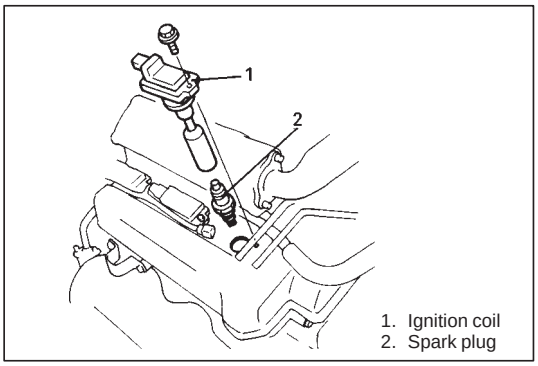
ENGINE LUBRICATION

The oil pump is of a trochoid type, and mounted under the crankshaft. Oil is drawn up through the oil pump strainer and passed through the pump to the oil filter. The filtered oil flows into 3 paths in cylinder block.
In one path, oil reaches the crankshaft journal bearings. Oil from the crankshaft journal bearings is supplied to the connecting rod bearings by means of intersecting passages drilled in the crankshaft, and then injected from the big end of connecting rod to lubricate piston, rings, and cylinder wall.

In other paths oil goes up to the cylinder heads and lubricates valves and camshafts, etc., after passing through the internal oilway of camshafts.

An oil relief valve is provided on the oil pump. This valve starts relieving oil pressure when the pressure exceeds about 430 kPa (4.3 kg/cm^2, 61.1 psi).





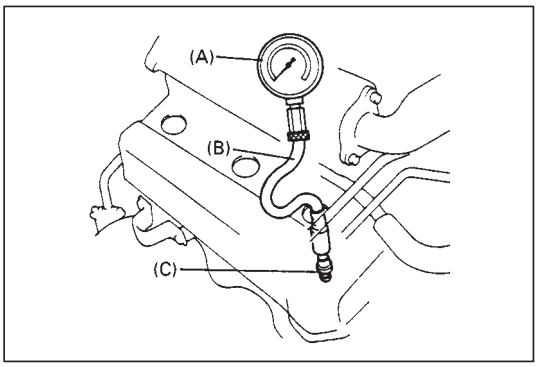
1. Ignition coil
2. Spark plug

ON-VEHICLE SERVICE

COMPRESSION CHECK

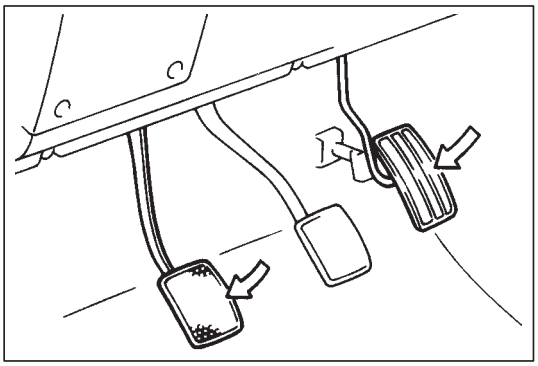
Check compression pressure on all 6 cylinders as follows:

1) Warm up engine.
2) Stop engine after warming up.
3) Remove ignition coil covers and disconnect ignition coil harness couplers.
4) Remove all ignition coils and spark plugs.
5) Remove surge tank cover.
6) Disconnect fuel injector wire harness at connector.



7) Install special tool (Compression gauge) into spark plug hole.

Special Tool
(A): 09915-64510
(B): 09915-64530
(C): 09915-67010



8) Disengage clutch (to lighten starting load on engine) for M/T vehicle, and depress accelerator pedal all the way to make throttle fully open.

9) Crank engine with fully charged battery, and read the highest pressure on compression gauge.

NOTE:
For measuring compression pressure, crank engine at least 250 r/min (rpm) by using fully charged battery.

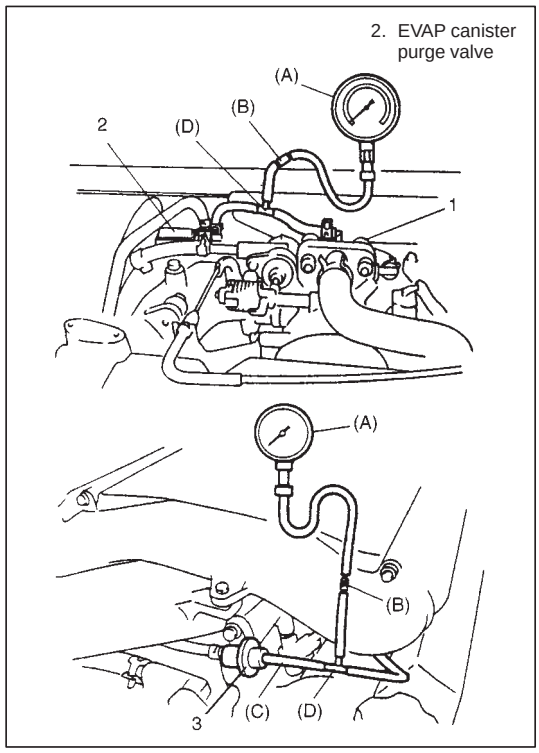
Compression pressure
Standard: 14.0 – 16.0 kg/cm^2
(199.0 – 227.5 psi, 1400 – 1600 kPa)
Limit: 13.0 kg/cm^2 (185.0 psi, 1300 kPa)
Max. difference between any two cylinders:
1.0 kg/cm^2 (14.2 psi, 100 kPa)

10) Carry out steps 7), 8) and 9) on each cylinder to obtain 6 readings.

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 and make sure that engine idle speed is within specification.



2) Stop engine and disconnect vacuum hoses from fuel pressure regulator valve (3) or intake collector (1) to EVAP canister purge valve (2).
3) Connect special tools (Vacuum gauge and hose joint) and 3way joint between vacuum hose and valve.

Special Tool
(A): 09915-67310
(B): 09918-08210

SUZUKI GENUINE PARTS
(C): Hose 09343-03087
(D): 3way joint 09367-04002

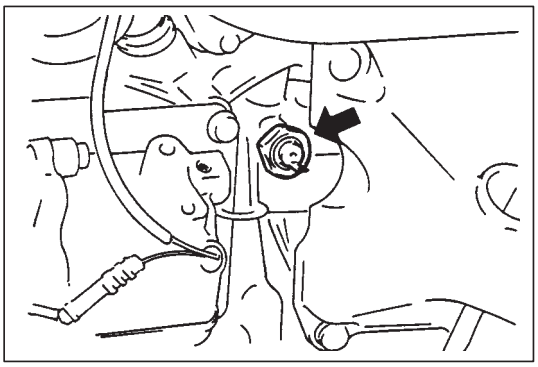
4) Start engine and run engine at specified idle speed, and read vacuum gauge. Vacuum should be within specification.

Vacuum specification: 450 – 600 mm Hg
(sea level) (17.7 – 23.7 in.Hg)
at specified idle speed

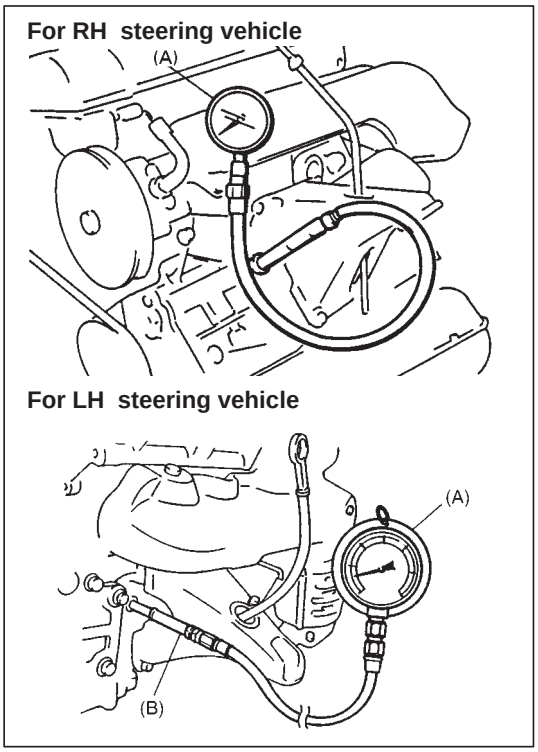
5) After checking, remove vacuum gauge and hose joint.
6) Connect vacuum hoses to fuel pressure regulator valve.

OIL PRESSURE CHECK

NOTE:
Prior to checking oil pressure, check the followings.
- **Oil level in oil pan**
  If oil level is low, add oil up to Full level hole on oil level gauge.
- **Oil quality**
  If oil is discolored, or deteriorated, change it.
  For particular oil to be used, refer to Section 0B.
- **Oil leaks**
  If leak is found, repair it.



1) Remove oil pressure switch from cylinder block.



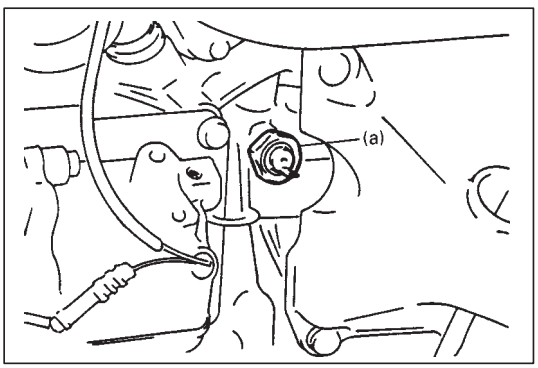
2) Install special tool (Oil pressure gauge) to vacated threaded hole.
   For LH steering vehicle, use oil pressure gauge (special tool (A)) with special tool (B) instead of the steel adaptor supplied in special tool (A).

   Special Tool
   (A): 09915-77310
   (B): 09915-76510

3) Start engine and warm it up to normal operating temperature.
4) After warming up, raise engine speed to 4,000 r/min. (rpm) and measure oil pressure.

   Oil pressure specification:
   390 – 470 kPa (3.9 – 4.7 kg/cm^2, 55.5 – 66.8 psi) at 4,000 r/min (rpm)

5) After checking oil pressure, stop engine and remove oil pressure gauge.

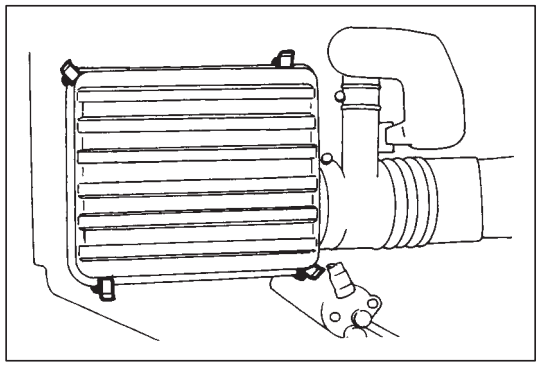


6) Before reinstalling oil pressure switch, be sure to wrap its screw threads with sealing tape and tighten switch to specified torque.

   Tightening Torque
   (a): 14 N·m (1.4 kg-m, 10.0 lb-ft)

   NOTE:
   If sealing tape edge is bulged out from screw threads of switch, cut it off.

7) Start engine and check oil pressure switch for oil leakage.



AIR CLEANER ELEMENT

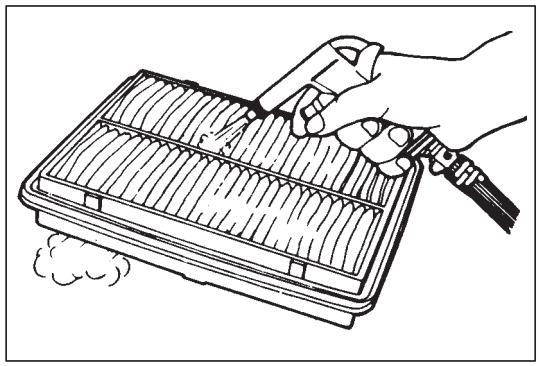
This air cleaner element is of dry type. Note that it needs cleaning according to the following method.

REMOVAL

1) Remove air cleaner upper case.
2) Remove air cleaner element.

INSPECTION

Check element for dirt.



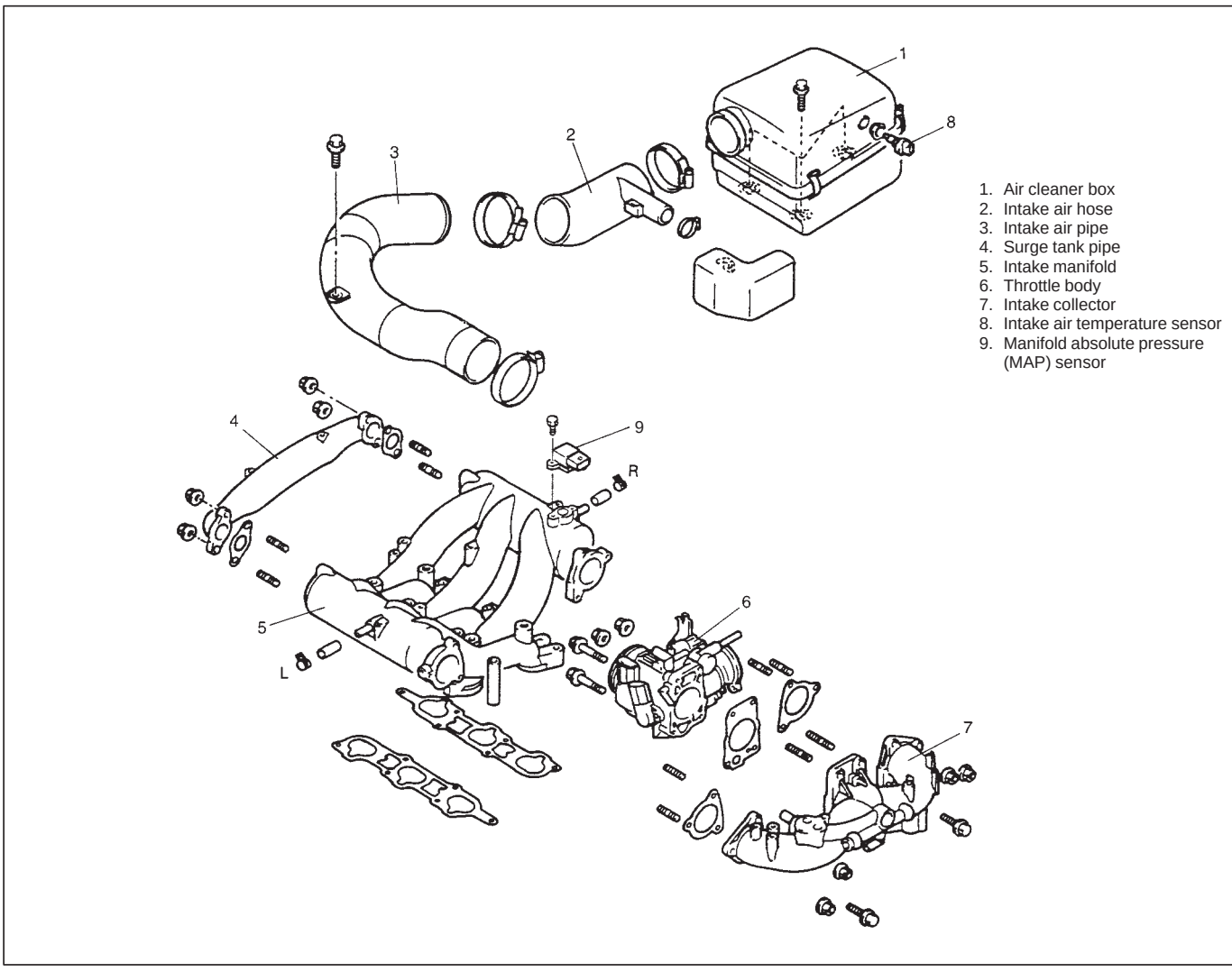
CLEAN

Blow off dust by blowing compressed air from air outlet side of element (i.e., the side facing up when installed in air cleaner case).

INSTALLATION

1) Install element to air cleaner box.
2) Install air cleaner upper case.

THROTTLE BODY AND INTAKE MANIFOLD



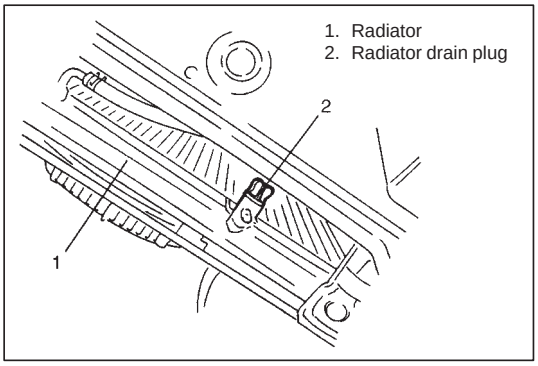
1. Air cleaner box
2. Intake air hose
3. Intake air pipe
4. Surge tank pipe
5. Intake manifold
6. Throttle body
7. Intake collector
8. Intake air temperature sensor
9. Manifold absolute pressure (MAP) sensor

REMOVAL

1) Release fuel pressure in fuel feed line by referring to 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.

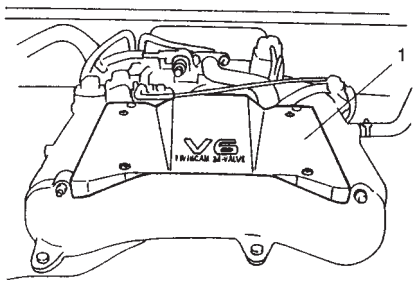


1. Radiator
2. Radiator drain plug

3) Drain coolant.

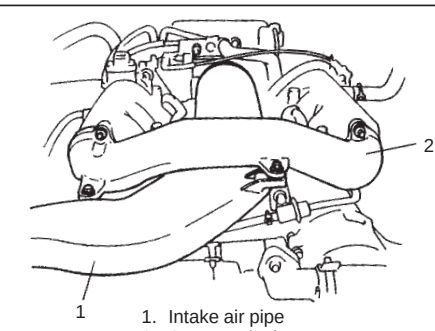
WARNING:
To help avoid danger of being burned, do not remove drain plug and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.

4) Remove strut tower bar.
5) Disconnect coupler from intake air temp. sensor.



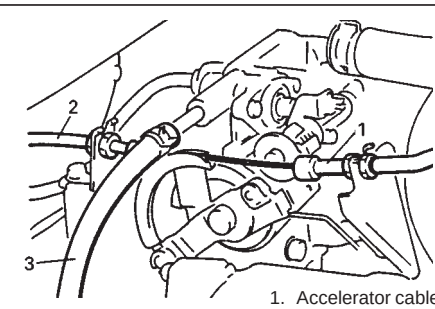
1. Surge tank cover

6) Remove surge tank cover.



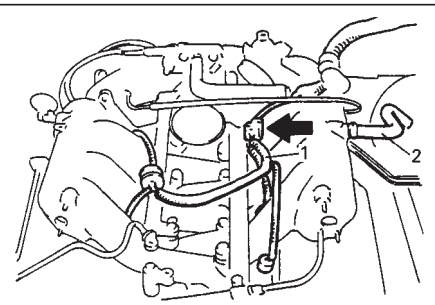
1. Intake air pipe
2. Surge tank pipe

7) Remove air cleaner upper case, intake air hose, intake air pipe and surge tank pipe as one component. Do not disassemble them, when removing and reinstalling.



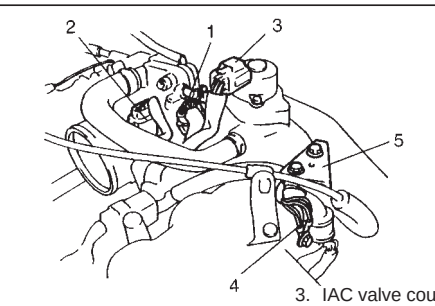
1. Accelerator cable
2. A/T throttle cable
3. Water hose

8) Disconnect accelerator cable and A/T throttle cable (for A/T vehicle) from throttle body.
9) Disconnect water hoses from throttle body.



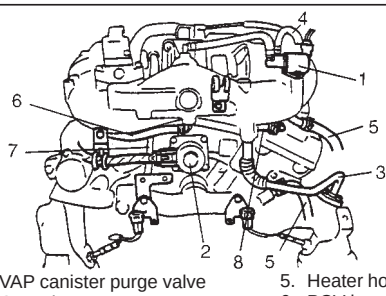
1. Injector wire
2. Brake booster hose

10) Disconnect injector wire coupler.
11) Disconnect brake booster hose from intake manifold.



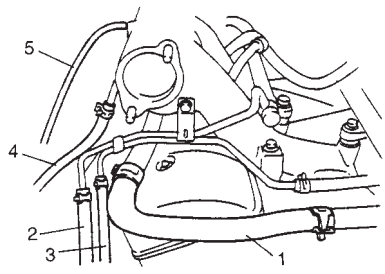
1. TP sensor
2. MAF sensor
3. IAC valve coupler
4. Earth wires
5. Clamp bracket

12) Disconnect couplers of TP sensor, MAF sensor and IAC valve.
13) Disconnect earth terminal from intake collector.
14) Remove clamp bracket from intake collector.



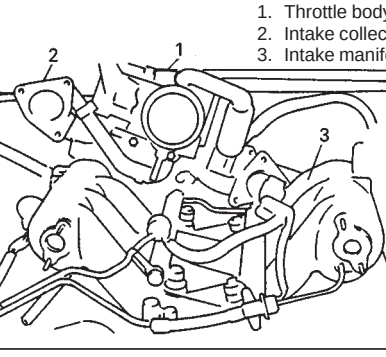
1. EVAP canister purge valve
2. EGR valve
3. EGR pipe
4. EVAP canister purge valve hose
5. Heater hose
6. PCV hose
7. Water hose
8. Breather hose

15) Disconnect couplers from manifold absolute pressure (MAP) sensor, EVAP canister purge valve and EGR valve.
16) Disconnect PCV hose from cylinder head cover.
Disconnect breather hoses from throttle body or cylinder head cover.
17) Disconnect hoses of EVAP canister purge valve and heater.
18) Remove EGR pipe.

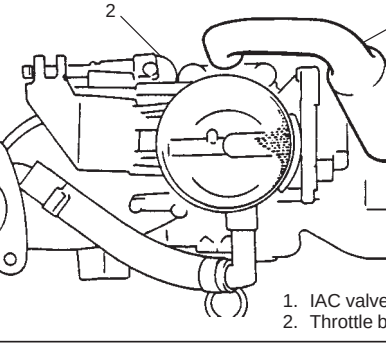


1. Heater hose
2. Fuel feed hose
3. Fuel return hose
4. EVAP canister hose
5. Vacuum hose

19) Disconnect hoses of heater, EVAP canister, tank pressure control solenoid valve, fuel feed and fuel return.

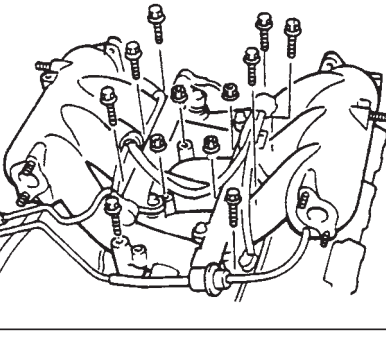


20) Remove throttle body and intake collector from intake manifold.

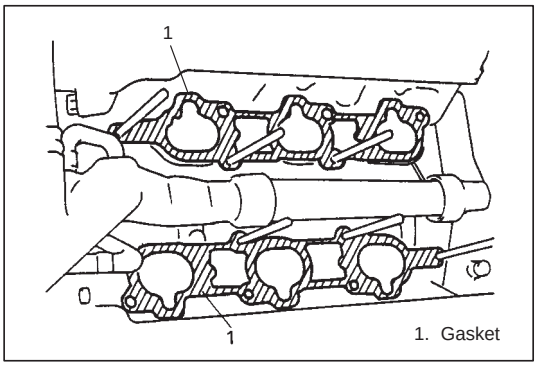


1. IAC valve hose
2. Throttle body

21) Disconnect hoses of IAC valve and EVAP canister purge valve from intake collector.
22) Remove throttle body from intake collector.
23) Remove IAC valve, EGR valve and EVAP canister purge valve from intake collector.

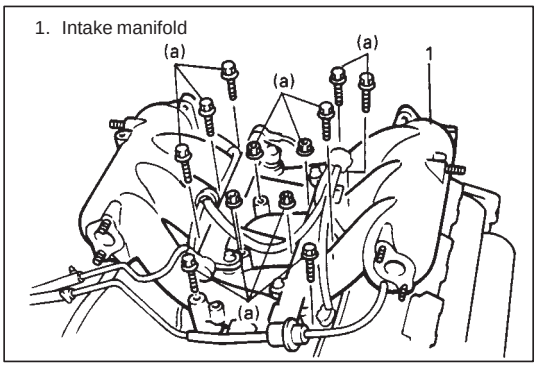


24) Remove intake manifold bolts (8 pc.) and nuts (4 pc.).
25) Remove intake manifold.



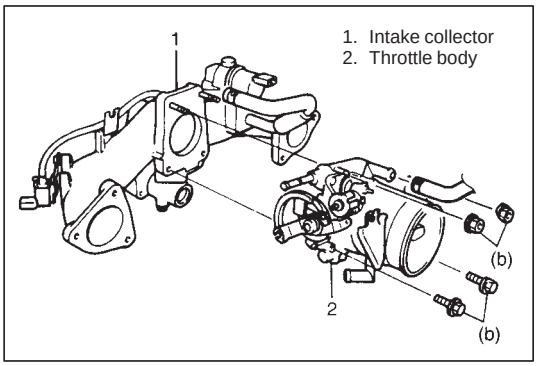
INSTALLATION

1) Install new intake manifold gaskets to cylinder heads.



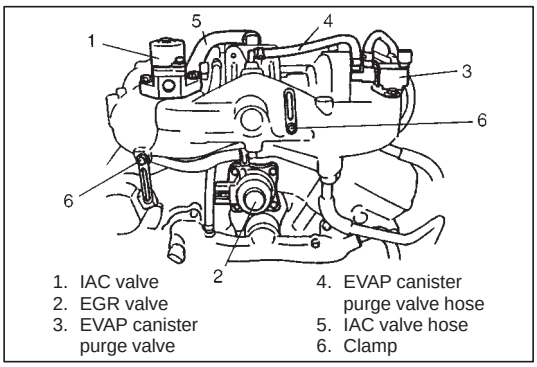
2) Install intake manifold.
Tighten bolts and nuts to specified torque.

Tightening Torque
(a): 23.0 N·m (2.3 kg-m, 16.5 lb-ft)

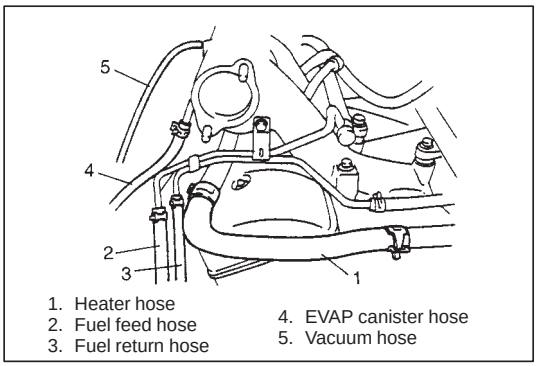


3) Install throttle body to intake collector with new throttle body gasket.
Tighten bolts and nuts to specified torque.

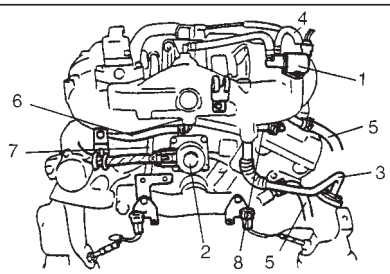
Tightening Torque
(b): 23 N·m (2.3 kg-m, 16.5 lb-ft)



4) Install IAC valve, EGR valve, EVAP canister purge valve, manifold absolute pressure (MAP) sensor, clamps and each hoses to intake collector and throttle body if removed.
Use new gasket, when installing IAC valve and EGR valve.
5) Install throttle body and intake collector assembly to intake manifold with new intake collector gaskets.

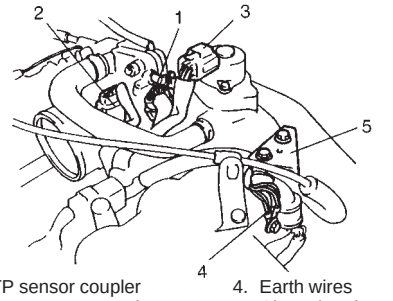


6) Connect hoses of heater, EVAP canister, tank pressure control solenoid valve, fuel feed and fuel return.



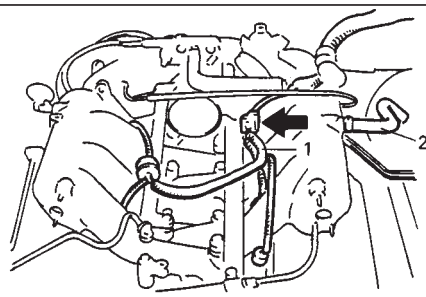
1. EVAP canister purge valve
2. EGR valve
3. EGR pipe
4. EVAP canister purge valve hose
5. Heater hose
6. PCV hose
7. Water hose
8. Breather hose

7) Install EGR pipe with new gaskets.
8) Connect hoses of EVAP canister purge valve and heater.
9) Connect hoses of PCV, breather and water.
10) Connect couplers of manifold absolute pressure (MAP) sensor, EVAP canister purge valve and EGR valve.
Fix wire harness with clamps.



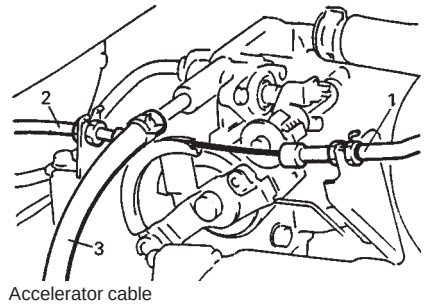
1. TP sensor coupler
2. MAF sensor coupler
3. IAC valve coupler
4. Earth wires
5. Clamp bracket

11) Install clamp bracket to intake collector.
12) Connect earth terminal to intake collector.
13) Connect couplers of TP sensor, MAF sensor and IAC valve.



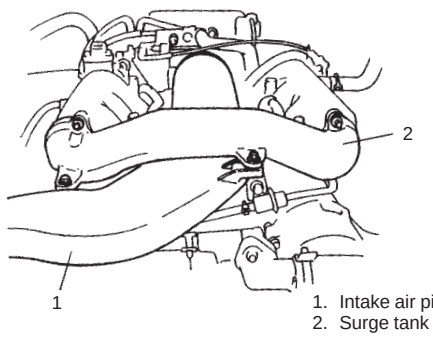
1. Injector wire
2. Brake booster hose

14) Connect brake booster hose to intake manifold.
15) Connect injector wire coupler.



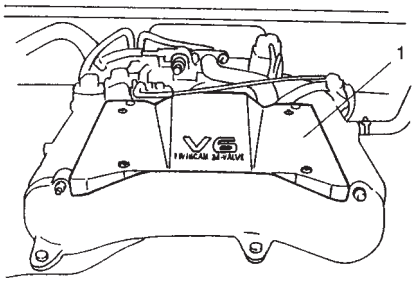
1. Accelerator cable
2. A/T throttle cable
3. Water hose

16) Connect water hoses to throttle body.
17) Connect accelerator cable and A/T throttle cable (for A/T vehicle) to throttle body.



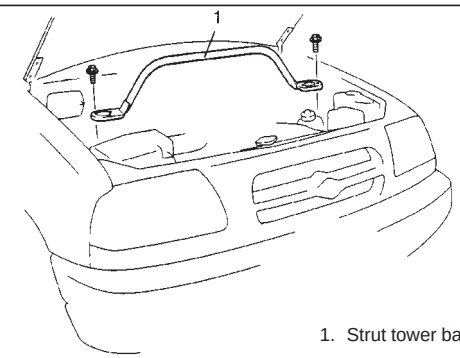
1. Intake air pipe
2. Surge tank pipe

18) Install surge tank pipe to intake manifold with new gaskets and intake air pipe to throttle body.



1. Surge tank cover

19) Install surge tank cover.



1. Strut tower bar

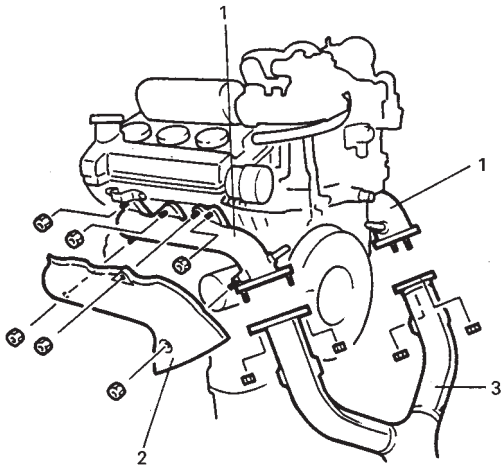
20) Install air cleaner upper case.
21) Connect coupler to intake air temp. sensor.
22) Install strut tower bar.

23) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
24) Refill cooling system, referring to Section 6B.
25) Connect negative cable at battery.
26) Upon completion of installation, verify that there is no fuel leakage at each connection according to procedure described in Section 6.

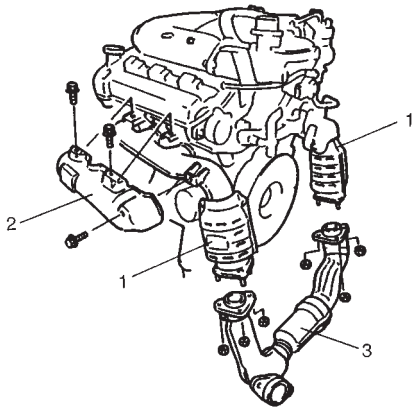
EXHAUST MANIFOLD

WARNING:
To avoid danger of being burned, do not service exhaust system while it is still hot. Service should be performed after system has cooled off.

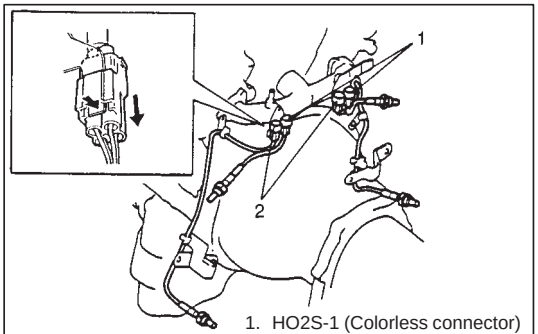
Type 1



Type 2



1. Exhaust manifold
2. Exhaust manifold cover
3. Exhaust No.1 pipe

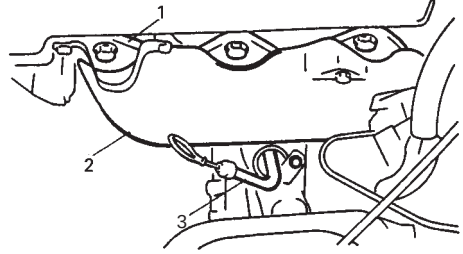


1. HO2S-1 (Colorless connector)
2. HO2S-2 (Black connector)

REMOVAL

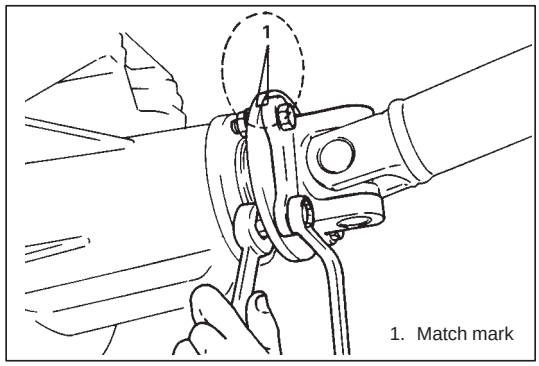
1) Disconnect negative cable at battery.
2) Remove air cleaner upper case and intake air hose.
3) Detach couplers from their bracket and disconnect oxygen sensor lead wires at couplers.

1. Exhaust manifold
2. Exhaust manifold cover
3. Oil level gauge guide



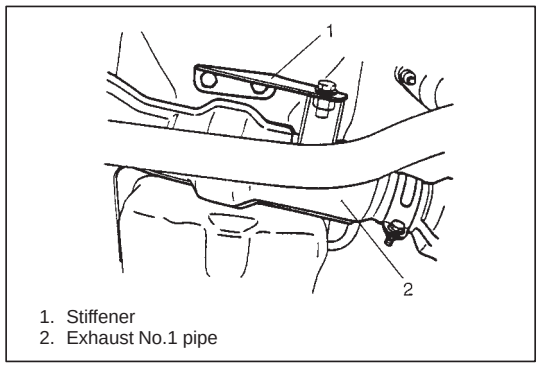
4) Remove oil level gauge guide.
5) Disconnect EGR pipe from right (No.2) bank exhaust manifold.
6) Remove exhaust manifold covers from exhaust manifolds.

NOTE:
Detach EVAP canister from its bracket if necessary.



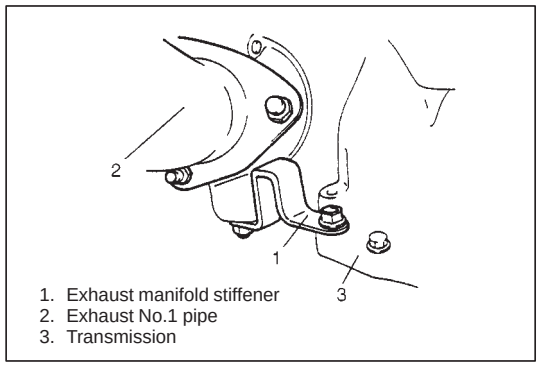
1. Match mark

7) Hoist vehicle.
8) For 4WD vehicle, before disconnecting front propeller shaft, put match mark on joint flange and propeller shaft to facilitate their installation as shown in figure.
9) For 4WD vehicle, disconnect propeller shaft from front differential.



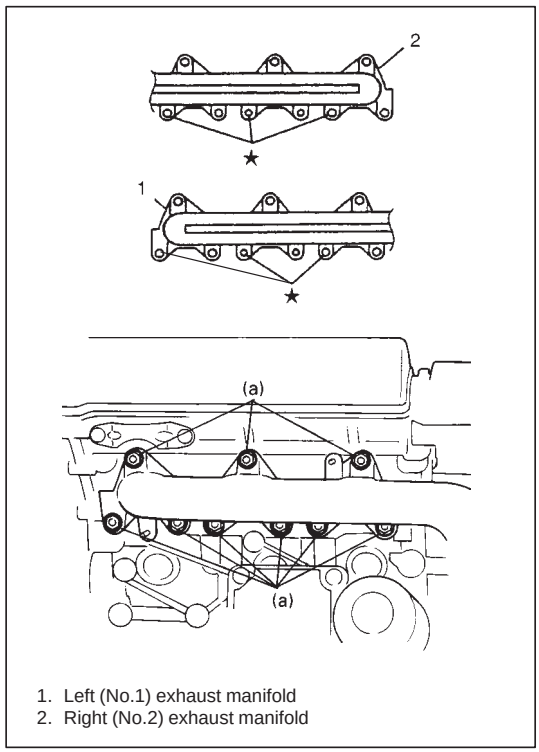
1. Stiffener
2. Exhaust No.1 pipe

10) Remove exhaust No.1 pipe.



1. Exhaust manifold stiffener
2. Exhaust No.1 pipe
3. Transmission

11) Detach exhaust manifold stiffener from transmission case.
12) Remove exhaust manifolds and their gaskets from cylinder heads.



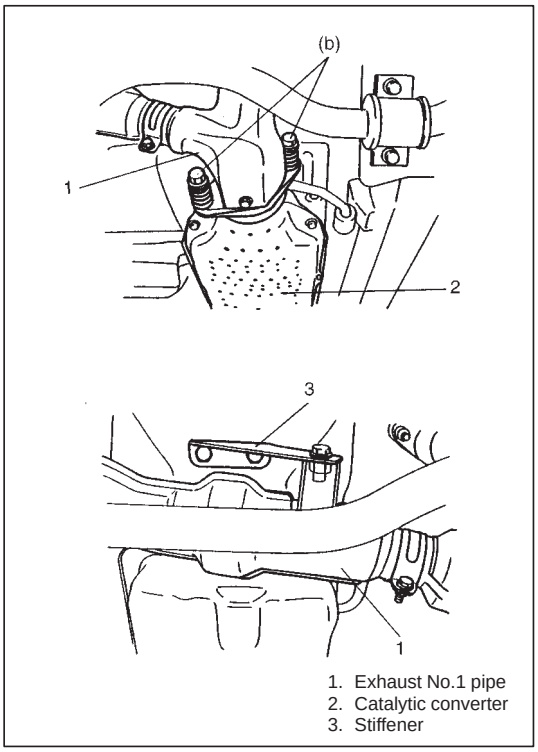
1. Left (No.1) exhaust manifold
2. Right (No.2) exhaust manifold

INSTALLATION

1) Install new manifold gaskets to cylinder heads and No.1 pipe gasket to exhaust No.1 pipe.
2) Install exhaust manifolds.
   - Always install new bolts with pre-coated adhesive to the locations with ★ mark.
   - Tighten both manifold nuts and bolts to specified torque.

   Tightening Torque
   (a): 30 N·m (3.0 kg-m, 21.5 lb-ft)

3) Attach exhaust manifold stiffener to transmission.

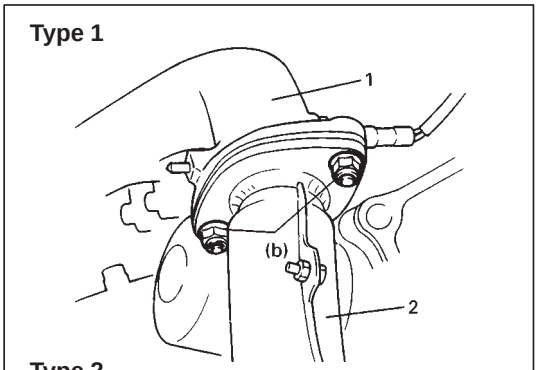


1. Exhaust No.1 pipe
2. Catalytic converter
3. Stiffener

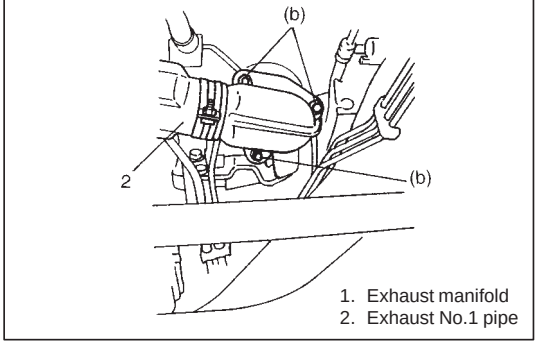
4) Install exhaust No.1 pipe and stiffener.
Tighten exhaust No.1 pipe bolts and nuts to specified torque.

Tightening Torque
(b): 50 N·m (5.0 kg-m, 36.5 lb-ft)

Type 1

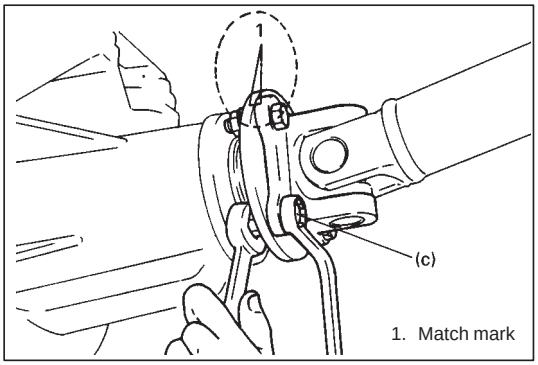


Type 2



1. Exhaust manifold
2. Exhaust No.1 pipe

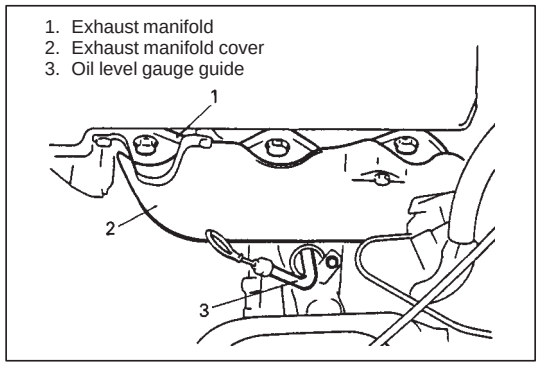
Tightening Torque
(b): 50 N·m (5.0 kg-m, 36.5 lb-ft)



1. Match mark

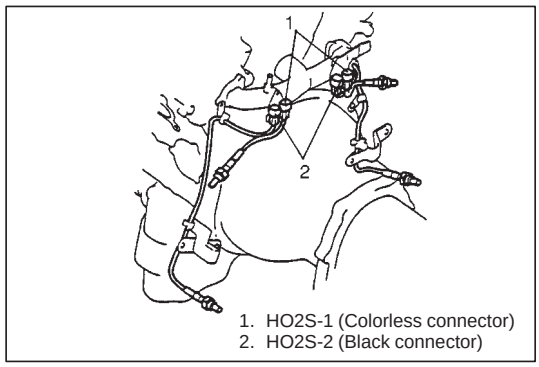
5) Reverse removal procedure to install front propeller shaft if removed.
When installing propeller shaft, align match mark.
Use following specification to torque universal joint flange.

Tightening Torque
(c): 55 N·m (5.5 kg-m, 40.0 lb-ft)



1. Exhaust manifold
2. Exhaust manifold cover
3. Oil level gauge guide

6) Connect EGR pipe to left (No.1) bank exhaust manifold.
7) Install exhaust manifold covers.
8) Install oil level gauge guide using new O-ring.



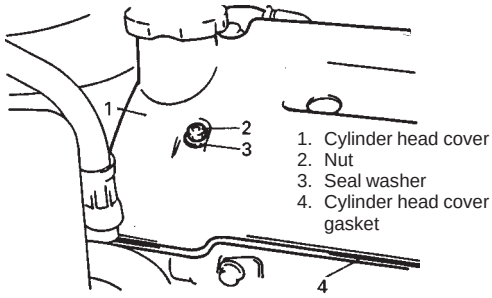
1. HO2S-1 (Colorless connector)
2. HO2S-2 (Black connector)

9) Connect oxygen sensor lead wire couplers.
   Be sure to clamp its lead wires.
10) Connect negative cable to battery.
    Upon completion of installation, start engine and check that no exhaust gas leakage exists.

CYLINDER HEAD COVERS

REMOVAL

1) Remove throttle body and intake manifold.
   Refer to item “THROTTLE BODY AND INTAKE MANIFOLD” in this section for removal.
2) Remove ignition coil covers.
3) Disconnect ignition coil couplers and remove ignition coils.



1. Cylinder head cover
2. Nut
3. Seal washer
4. Cylinder head cover gasket

4) Remove cylinder head covers.

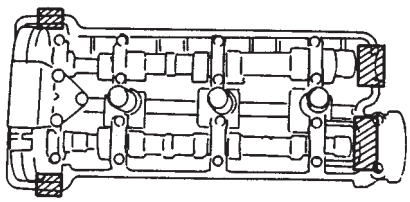
INSTALLATION

1) Clean sealing surfaces on cylinder heads and covers.
2) Remove oil, old sealant, and dust from sealing surfaces. After cleaning, apply sealant “A” to cylinder heads sealing surface area as shown in figure.

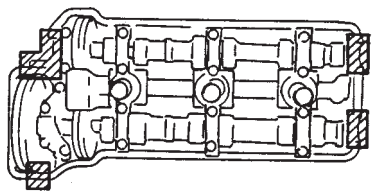
   “A”: Sealant 99000-31150

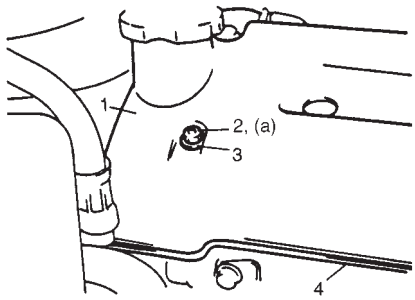
3) Install new cylinder head cover gaskets to head covers.

Left (No.1) cylinder
▨: Area to apply sealant “A”



Right (No.2) cylinder
▨: Area to apply sealant “A”



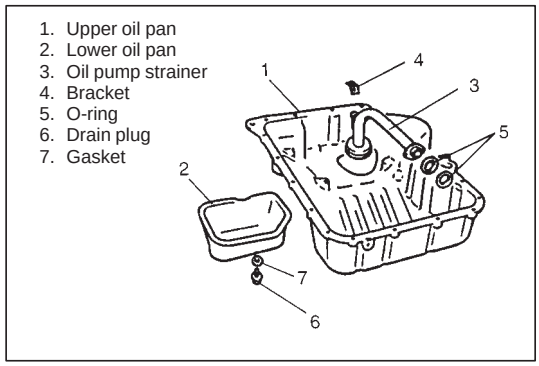


1. Cylinder head cover
2. Nut
3. Seal washer
4. Cylinder head cover gasket

4) Install cylinder head covers to cylinder heads.
5) Using new seal washers, tighten nuts to specified torque.

   Tightening Torque
   (a): 10.5 N·m (1.1 kg-m, 7.5 lb-ft)

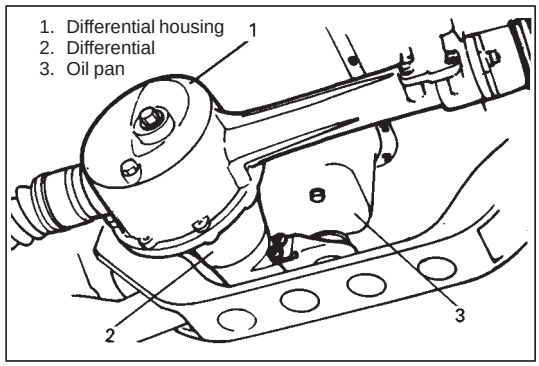
6) Install ignition coils and connect ignition coil couplers.
7) Install ignition coil covers.
8) Install throttle body and intake manifold.
   Refer to item “THROTTLE BODY AND INTAKE MANIFOLD” in this section for installation.



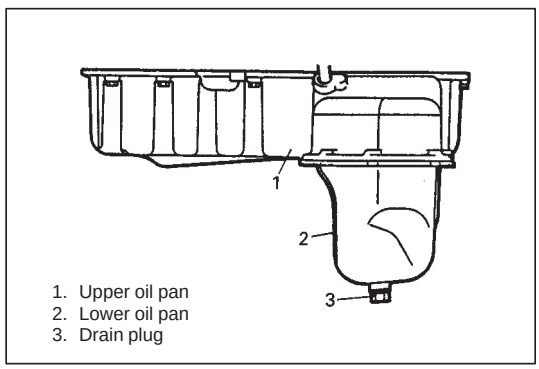
OIL PAN AND OIL PUMP STRAINER

REMOVAL

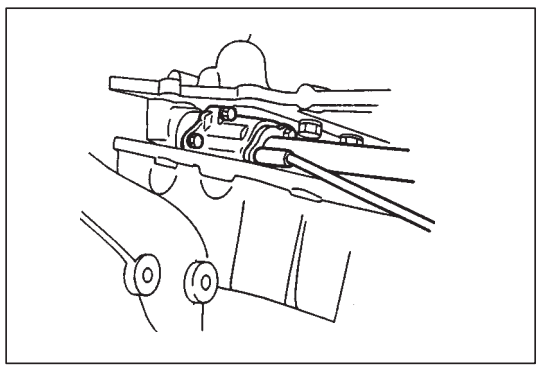
1) Remove oil level gauge guide.
2) Raise vehicle and remove both front wheels.
3) Remove rack and pinion assembly.
   Refer to Section 3B1 for removal.



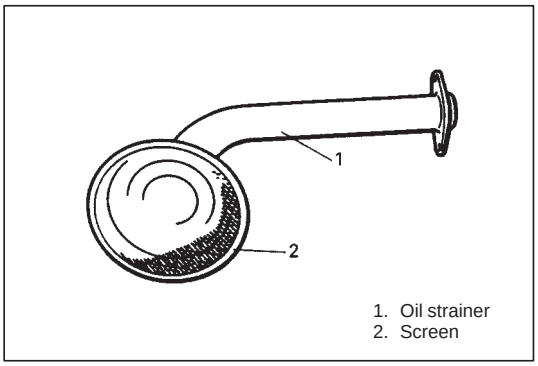
4) Remove front differential housing with differential from chassis if equipped.
   Refer to Section 7E for removal.



5) Drain engine oil by removing drain plug.
6) Remove lower oil pan from upper oil pan.
7) Remove oil strainer bracket.
8) Detach radiator outlet pipe from upper oil pan.



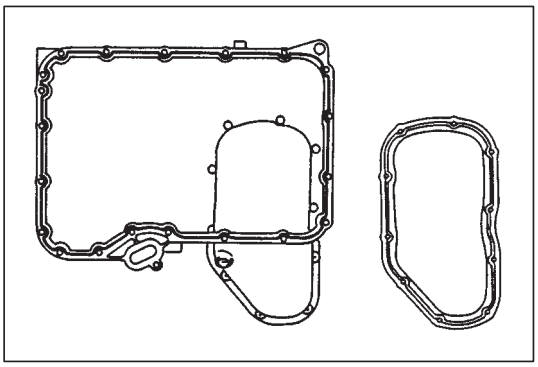
9) Remove upper oil pan according to following procedure.
   Lower upper oil pan until it stops by way of cross member and oil pump strainer and keep it at that position temporarily.
   With wrench inserted between upper oil pan and lower crankcase, and oil pump strainer mounting bolt removed, remove oil pump strainer.
   Then remove upper oil pan from temporarily supported position.



1. Oil strainer
2. Screen

CLEAN

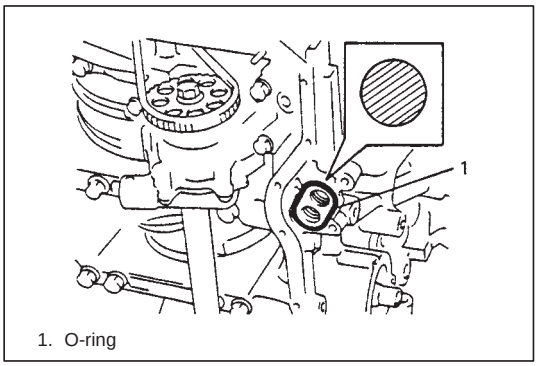
- Inside of oil pan and oil pump strainer screen.



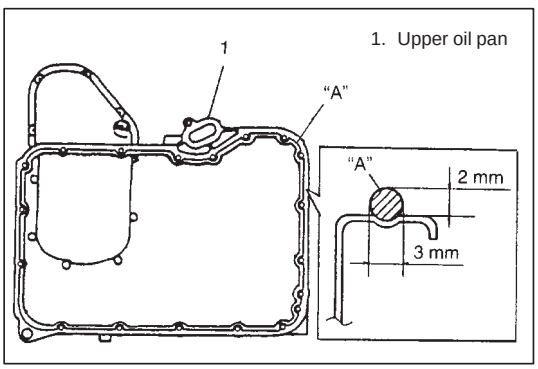
- Clean sealing surface on upper oil pan, lower oil pan and lower crankcase.
  Remove oil, old sealant, and dust from sealing surface.

INSTALLATION

1) Install new O-ring to lower crankcase as shown in figure.
2) Install two new O-rings to oil pump strainer.



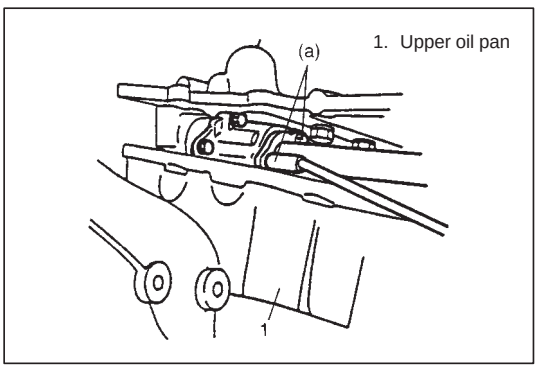
1. O-ring



1. Upper oil pan

3) Apply sealant "A" to upper oil pan sealing surface area as shown in figure.

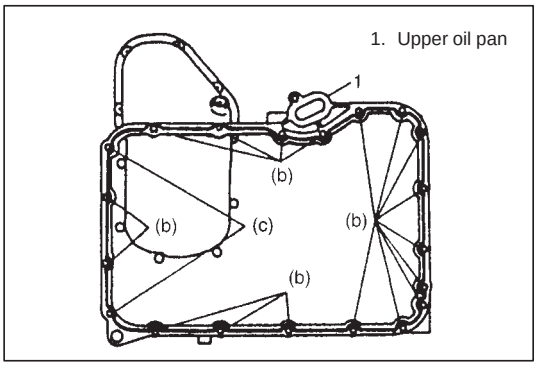
   "A": Sealant 99000-31150



1. Upper oil pan

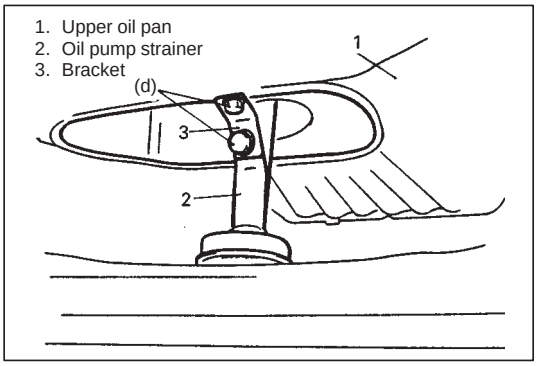
4) Place the upper oil pan on the cross member and suspension member (just beneath the lower crankcase).
   At this point install oil pump strainer.

   Tightening Torque
   (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



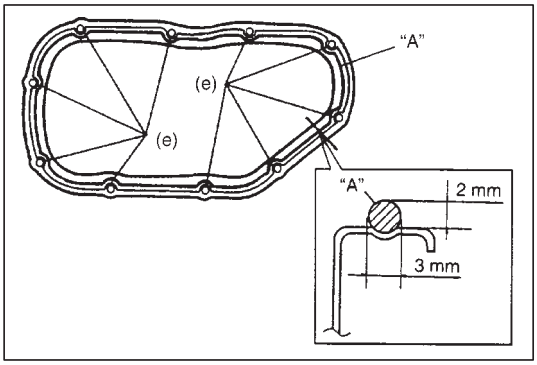
5) Install upper oil pan to lower crankcase.

Tightening Torque
(b): 11.0 N·m (1.1 kg-m, 8.0 lb-ft)
(c): 27.0 N·m (2.7 kg-m, 19.5 lb-ft)



6) Install bracket to oil pump strainer and upper oil pan.

Tightening Torque
(d): 11 N·m (1.1 kg-m, 8.0 lb-ft)

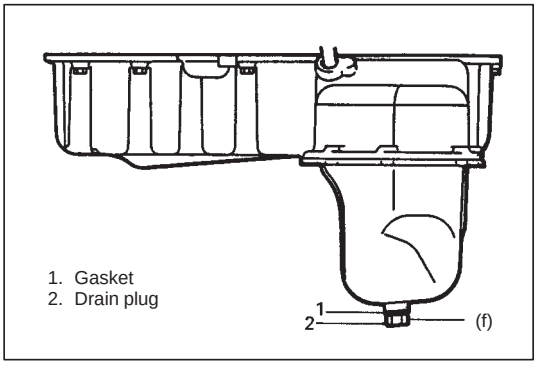


7) Apply sealant "A" to lower oil pan sealing surface area as shown in figure.

"A": Sealant 99000-31150

8) Install lower oil pan to upper oil pan.

Tightening Torque
(e): 11 N·m (1.1 kg-m, 8.0 lb-ft)

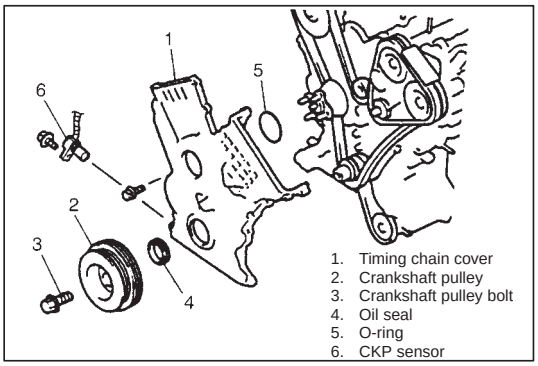


9) Install gasket and drain plug to oil pan.

Tightening Torque
(f): 35.0 N·m (3.5 kg-m, 25.3 lb-ft)

10) Attach radiator outlet pipe to upper oil pan.

11) Install front differential housing according to installation procedure described in Section 7E if removed.
12) Install rack and pinion assembly.
Refer to Section 3B1 for installation.
13) Refill front differential housing with gear oil if drained, referring to Section 7E.
14) Install oil level gauge guide with new O-ring.
15) Refill engine with engine oil, referring to item "ENGINE OIL CHANGE" in Section 0B.
16) Check wheel alignment, referring to Section 3.

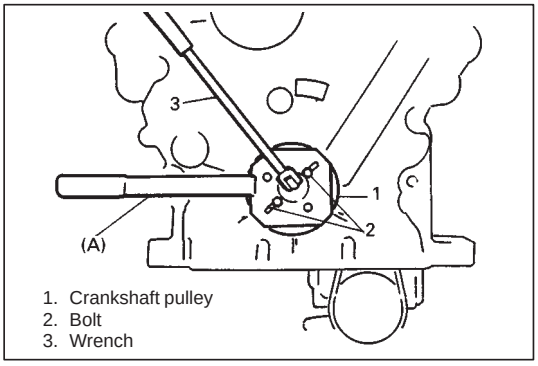


1. Timing chain cover
2. Crankshaft pulley
3. Crankshaft pulley bolt
4. Oil seal
5. O-ring
6. CKP sensor

TIMING CHAIN COVER

REMOVAL

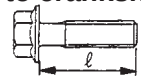
1) Disconnect negative cable at battery.
2) Drain engine oil.
3) Drain coolant.
4) Remove throttle body and intake manifold.
   Refer to item “THROTTLE BODY AND INTAKE MANIFOLD” in this section for removal.
5) Remove cylinder head covers.
   Refer to item “CYLINDER HEAD COVER” in this section for removal.
6) Remove cooling fan, fan clutch and water pump pulley.
   Refer to Section 6B for removal.
7) Remove radiator.
   Refer to Section 6B for removal.
8) Remove thermostat cap.
   Refer to Section 6B for removal.
9) Remove P/S pump (A/C compressor) drive belt.
   Refer to Section 3B1 for removal.
10) Remove water pump drive belt.
    Refer to Section 6B for removal.
11) Remove P/S pump and P/S pump bracket.
    Refer to Section 3B1 for removal.
12) Raise vehicle.
13) Remove oil pan.
    Refer to item “OIL PAN AND OIL PUMP STRAINER” in this section for removal.



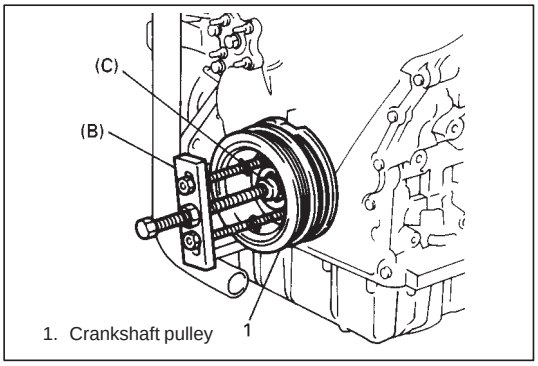
1. Crankshaft pulley
2. Bolt
3. Wrench

14) Remove crankshaft pulley bolt.
    To lock crankshaft pulley, use special tool (camshaft pulley holder) as shown in figure.
    Special Tool
    (A): 09917-68221

CAUTION:
Be sure to use the following bolt for fixing special tool to crankshaft pulley.



Bolt size: M8, P1.25 ℓ = 45 mm
Strength: 7T

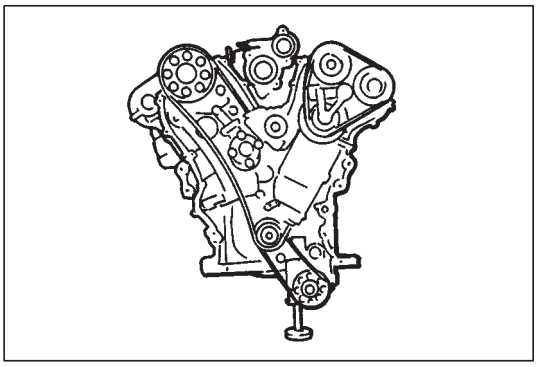


1. Crankshaft pulley

15) Remove crankshaft pulley.
    If it is hard to remove, use special tools (Steering wheel remover, Bearing puller attachment) as shown in figure.
    If bolts of steering wheel remover are too long, replace them with those of suitable length.
    Special Tool
    (B): 09944-36011
    (C): 09926-58010

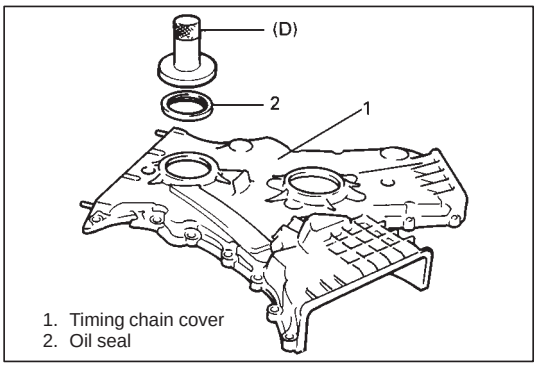
15-1) Disconnect CKP sensor connector and remove CKP sensor if necessary.

16) Remove timing chain cover.



CLEAN

Clean sealing surface on timing chain cover, crankcase, cylinder block and cylinder heads.
Remove oil, old sealant, and dust from sealing surface.



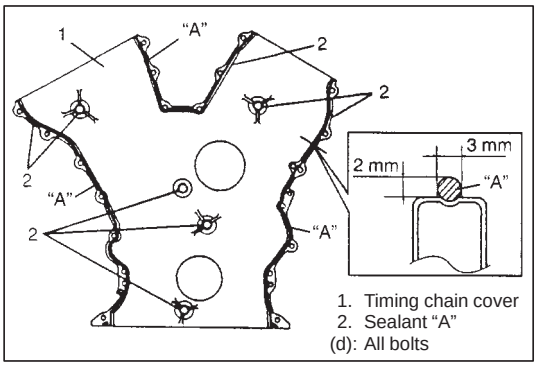
1. Timing chain cover
2. Oil seal

INSPECTION

Check oil seal lip for damages or deterioration.
Replace as necessary.

NOTE:
When installing new oil seal, top it in until its surface is flash with edge of timing chain cover.
To install oil seal, use special tool (bearing installer).

Special Tool
(D): 09913-75510



1. Timing chain cover
2. Sealant "A"

(d): All bolts

INSTALLATION

Reverse removal sequence to install timing chain cover noting following points.

1) Apply sealant "A" to timing chain cover sealing surface area as shown in figure.

   "A": Sealant 99000-31150

2) Apply engine oil to oil seal lip and water pump O-ring, then install timing chain cover.

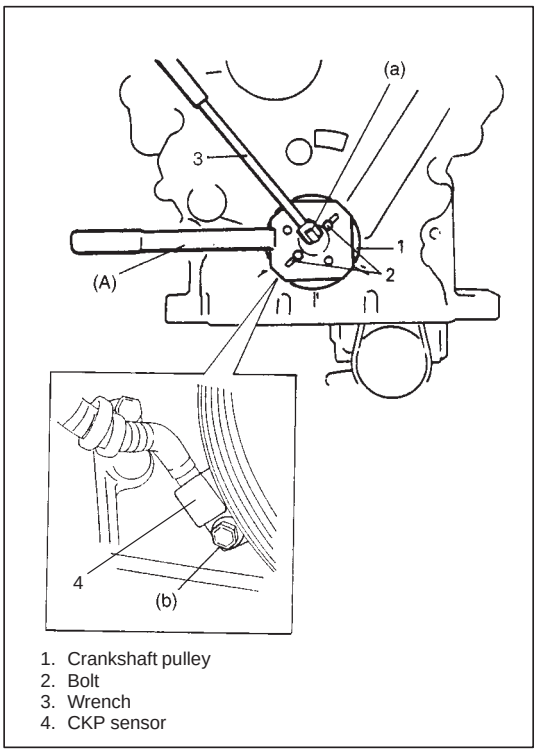
   Tightening Torque
   (d): 11.0 N·m (1.1 kg-m, 7.5 lb-ft)

3) Apply engine oil to O-ring of CKP sensor and install CKP sensor to timing chain cover.

   Tightening torque
   (b): 6 N·m (0.6 kg-m, 4.5 lb-ft)

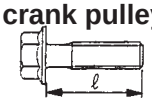
4) Install crankshaft pulley.
   To lock crankshaft pulley, use special tool (camshaft pulley holder) with it at shown in figure.

   Special Tool
   (A): 09917-68221



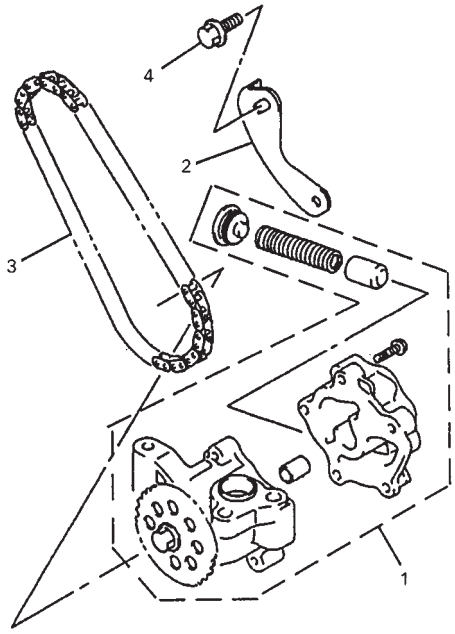
1. Crankshaft pulley
2. Bolt
3. Wrench
4. CKP sensor

CAUTION:
Be sure to use the following bolt for fixing special tool to crank pulley.



Bolt size: M8, P1.25 ℓ = 45 mm
Strength: 7T

Tightening Torque
(a): 150 N·m (15 kg-m, 108.5 lb-ft)

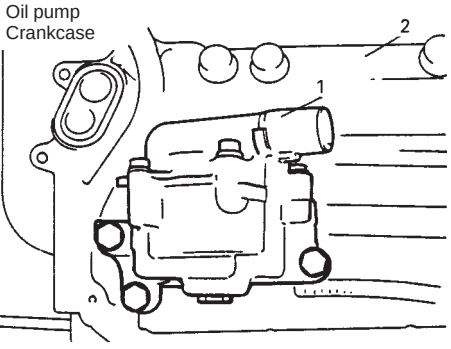


1. Oil pump ass'y
2. Oil pump chain guide
3. Oil pump chain
4. Bolt

OIL PUMP

REMOVAL

1) Disconnect negative cable at battery.
2) Drain engine oil.
3) Drain coolant.
4) Remove oil pan, oil pump strainer and timing chain cover. Refer to item "TIMING CHAIN COVER" in this section.
5) Loosen oil pump chain guide bolts.



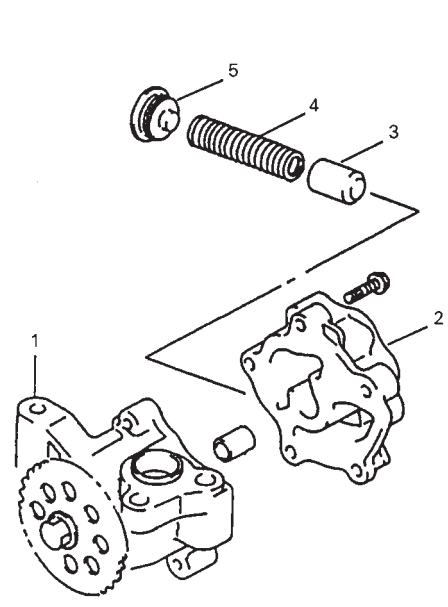
6) Remove oil pump from crankcase.

CAUTION:
Do not remove oil pump sprocket or bolt.
Otherwise, oil pump sprocket and/or oil pump rotor shaft might be damaged.

DISASSEMBLY

Disassemble oil pump as shown in figure.

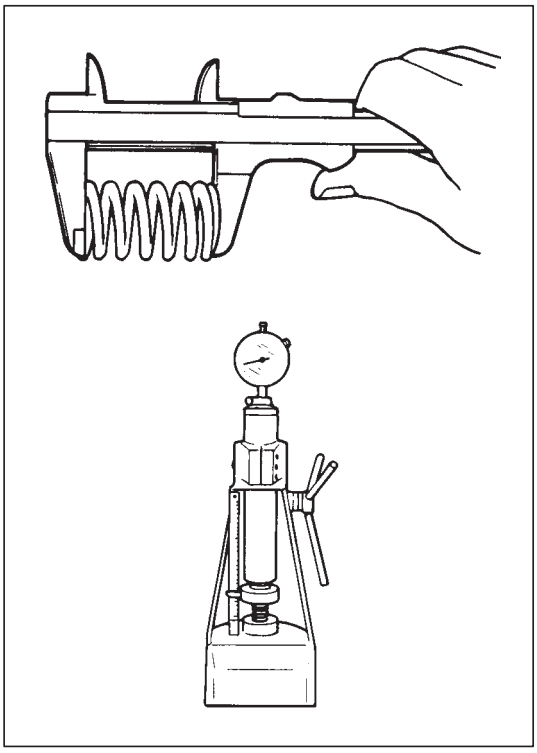
CAUTION:
Do not remove oil pump sprocket or bolt.
Otherwise, oil pump sprocket and/or oil pump rotor shaft might be damaged.



1. Oil pump case No.1
2. Oil pump case No.2
3. Relief valve
4. Relief spring
5. Retainer

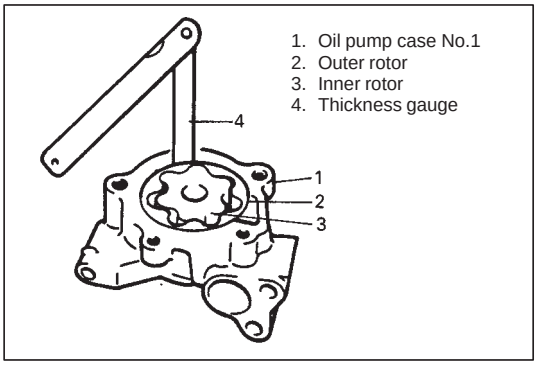
INSPECTION

- Check outer rotor, inner rotor and oil pump cases for excessive wear or damage.
- Check relief valve for excessive wear or damage.



● Measure free length and tension of oil relief spring.

Item	Standard
Spring free length	63.5 mm (2.5 in.)
Spring preload	86.0 N for 52.0 mm (8.6 kg for 52.0 mm 62.2 lb/ 2.05 in.)



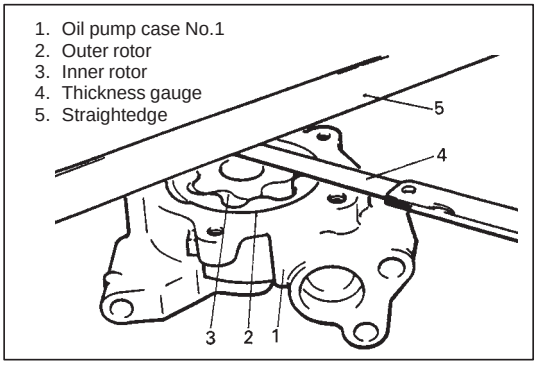
● Measure clearance of oil pump rotor and oil pump case.

Radial Clearance

Check radial clearance between outer rotor and case, using thickness gauge.

If clearance exceeds its limit, replace oil pump assembly.

Limit on radial clearance between outer rotor and case: 0.15 mm (0.0059 in.)



Side Clearance

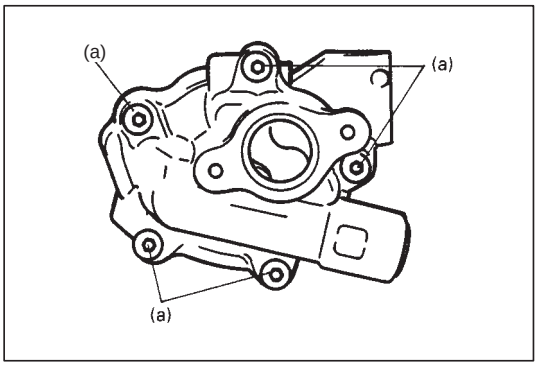
Using straightedge and thickness gauge, measure side clearance.

If clearance exceeds its limit, replace oil pump assembly.

Limit on side clearance: 0.11 mm (0.0043 in.)

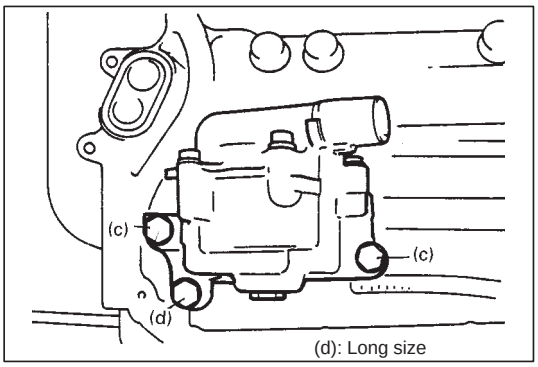
ASSEMBLY

1) Wash, clean and then dry all disassembled parts.
2) Apply thin coat of engine oil to inner and outer rotors, and inside surfaces of oil pump case.



3) Assemble oil pump. After assembling oil pump check to be sure that rotor turns smoothly by hand.

Tightening Torque
(a): 12.0 N·m (1.2 kg-m, 8.5 lb-ft)

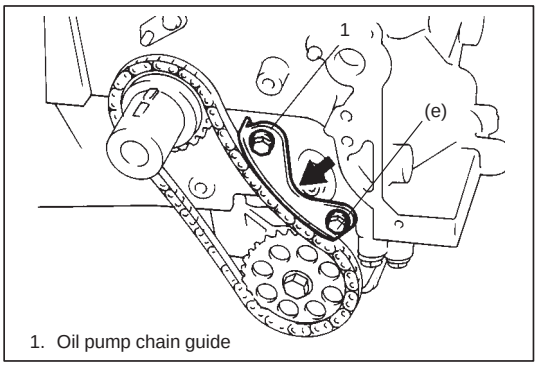


(d): Long size

INSTALLATION

1) Install oil pump to crankcase.

Tightening Torque
(c), (d): 27.0 N·m (2.7 kg-m, 19.5 lb-ft)



1. Oil pump chain guide

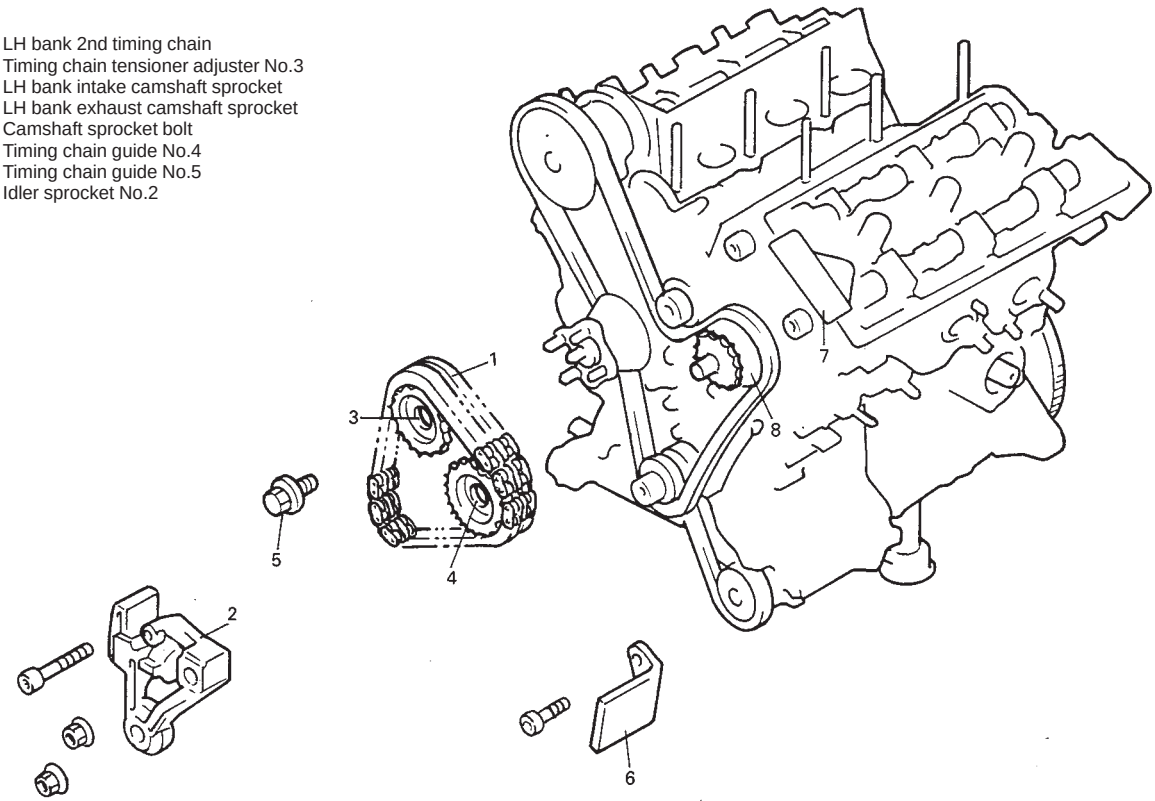
2) Hand-tighten oil pump chain guide bolts.
3) To take up slack of oil pump chain, push center of oil pump chain guide with a force of 0.5 to 0.6 N (50 – 60 g, 0.11 – 0.13 lb) then tighten oil pump chain guide bolts to specified torque.

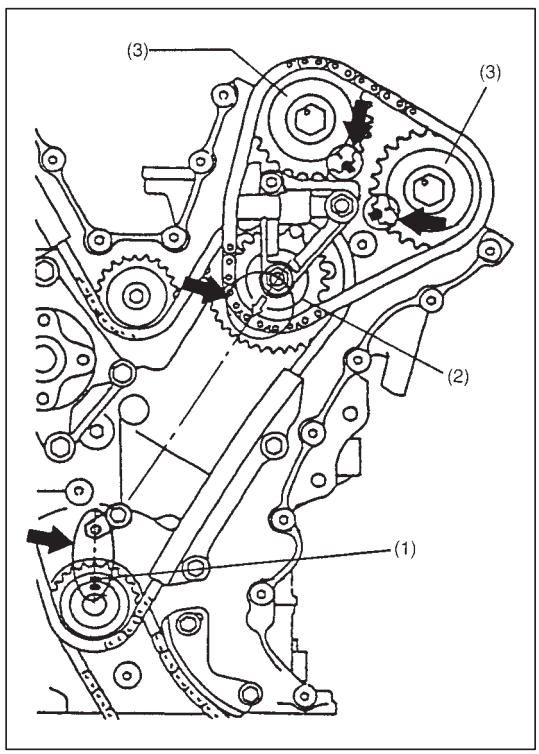
Tightening Torque
(e): 11 N·m (1.1 kg-m, 7.5 lb-ft)

4) Install timing chain cover, oil pump strainer and oil pan. Refer to item “TIMING CHAIN COVER” in this section.

LH (NO.1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER

1. LH bank 2nd timing chain
2. Timing chain tensioner adjuster No.3
3. LH bank intake camshaft sprocket
4. LH bank exhaust camshaft sprocket
5. Camshaft sprocket bolt
6. Timing chain guide No.4
7. Timing chain guide No.5
8. Idler sprocket No.2

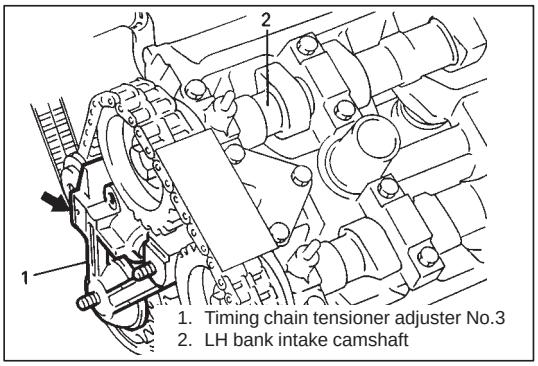




REMOVAL

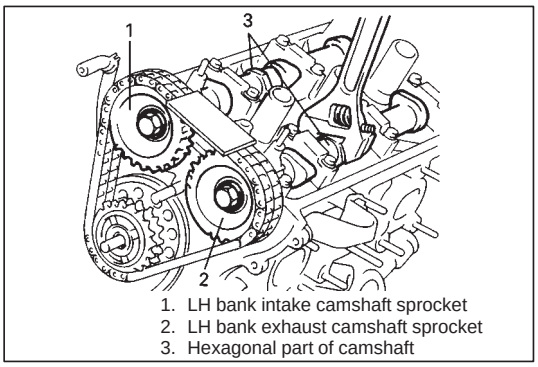
1) Disconnect negative cable at battery.
2) Drain engine oil.
3) Drain coolant.
4) Remove timing chain cover.
   Refer to item “TIMING CHAIN COVER” in this section for removal.
5) Turn crankshaft to meet following condition.
   - Key (1) on crankshaft positions as shown.
   - Arrow mark on idler sprocket No.2 (2) points the center of crankshaft.
   - The marks on sprockets (3) match with marks on cylinder head.

   Note that this step must be followed for reinstallation of timing chain.



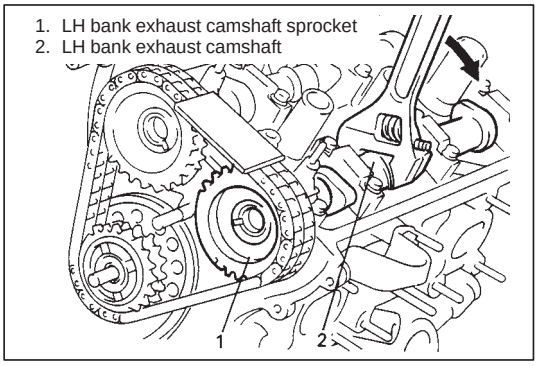
1. Timing chain tensioner adjuster No.3
2. LH bank intake camshaft

6) Remove timing chain tensioner adjuster No.3.
To remove it, slacken LH bank 2nd timing chain by turning intake camshaft counterclockwise a little while pushing back pad.



1. LH bank intake camshaft sprocket
2. LH bank exhaust camshaft sprocket
3. Hexagonal part of camshaft

7) Remove LH bank intake and exhaust camshaft sprocket bolts.
To remove it, fit a spanner to hexagonal part at the center of camshaft to hold it stationary.

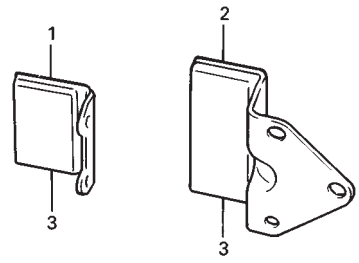


8) Remove LH bank exhaust camshaft sprocket.

CAUTION:
Removing sprocket from camshaft may cause cam to turn, resulting in damage to valve and piston. To prevent this, when removing sprocket, hold camshaft stationary by using a spanner at its hexagonal part.

9) Remove LH bank intake camshaft sprocket.

10) Remove LH bank 2nd timing chain.

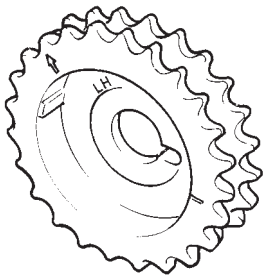


1. Timing chain guide No.4
2. Timing chain guide No.5
3. Shoe

INSPECTION

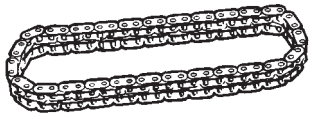
Timing chain guide No.4 and No.5

Check shoe for wear or damage.



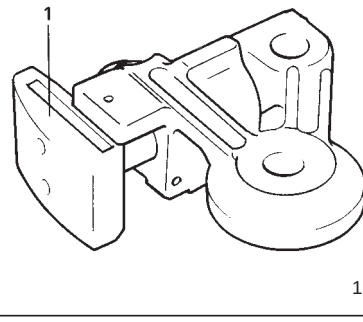
Camshaft sprocket

Check teeth of sprocket for wear or damage.



Timing chain

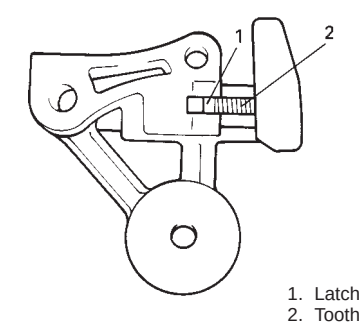
Check timing chain for wear or damage.



1. Shoe

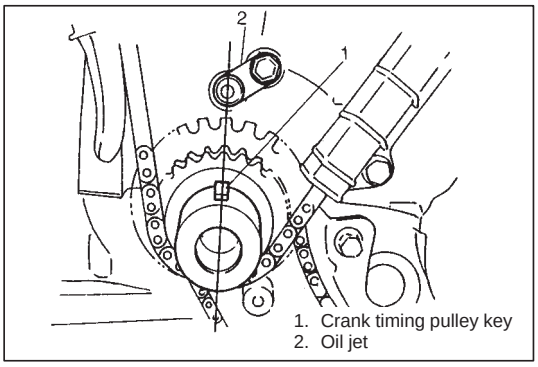
Tensioner adjuster No.3

- Check shoe for wear or damage.



1. Latch
2. Tooth surface

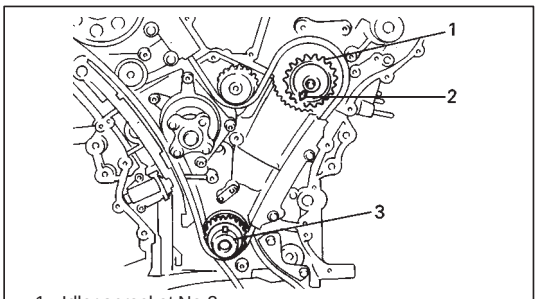
- Check that latch and tooth surface are free from damage and latch functions properly.



1. Crank timing pulley key
2. Oil jet

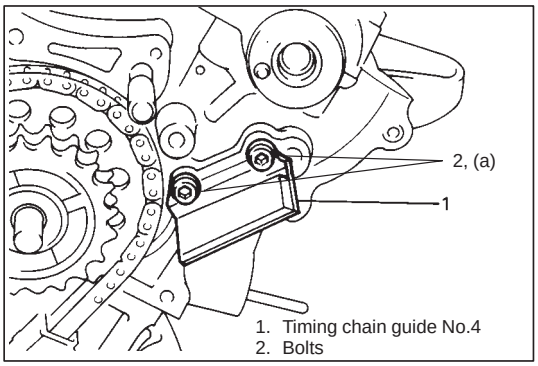
INSTALLATION

1) Check timing mark on crankshaft as shown in figure.



1. Idler sprocket No.2
2. ⇨ mark
3. Crankshaft

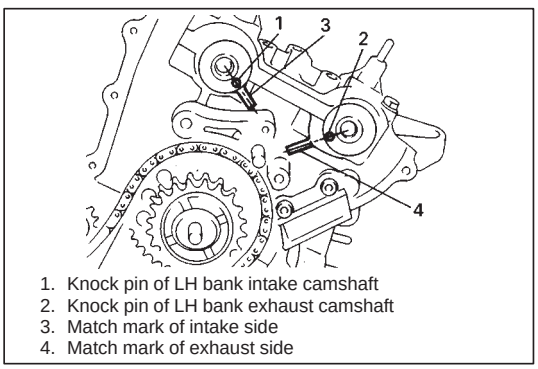
2) Check timing mark on idler sprocket No.2 as shown in figure.



1. Timing chain guide No.4
2. Bolts

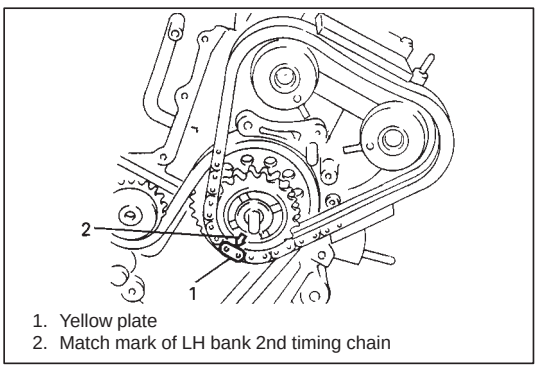
3) Install timing chain guide No.4.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 7.5 lb-ft)



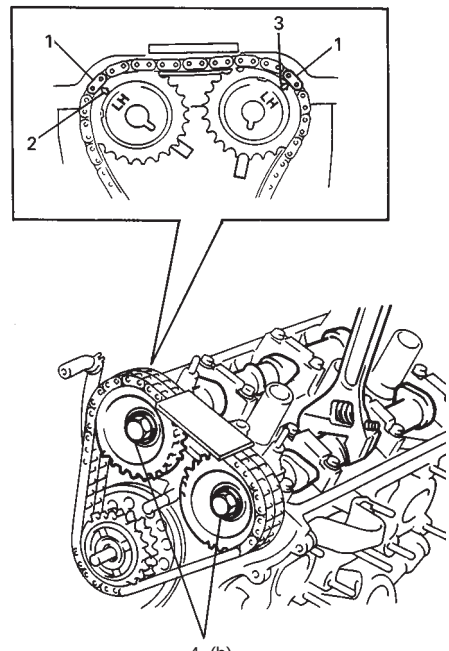
1. Knock pin of LH bank intake camshaft
2. Knock pin of LH bank exhaust camshaft
3. Match mark of intake side
4. Match mark of exhaust side

4) Check that knock-pins of intake and exhaust camshafts are aligned with match marks on cylinder head as shown in figure.



1. Yellow plate
2. Match mark of LH bank 2nd timing chain

5) Install by aligning match marks on yellow plate of LH bank 2nd timing chain and idler sprocket No.2.



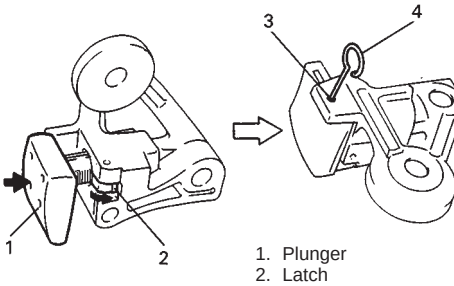
1. Silver plate
2. Arrow mark on intake camshaft timing sprocket
3. Arrow mark on exhaust camshaft timing sprocket
4. Sprocket bolt

6) Install sprockets to intake and exhaust camshafts by aligning silver plate of LH bank 2nd timing chain, match marks on intake sprocket and exhaust sprocket respectively.

CAUTION:
Do not turn camshaft more than necessary.
If turned excessively, valve and piston may get damaged.

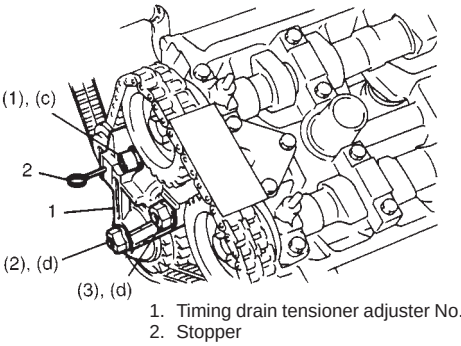
7) Install LH bank intake and exhaust camshaft timing sprockets. To install it, fit a spanner to hexagonal part at the center of camshaft to hold stationary.

Tightening Torque
(b): 80 N·m (8.0 kg-m, 57.5 lb-ft)



1. Plunger
2. Latch
3. Set hole
4. Stopper (Pin)

8) With latch of tensioner adjuster No.3 returned and plunger pushed back into body, insert stopper (pin) into set hole.
After inserting it, check to make sure that plunger will not come out.



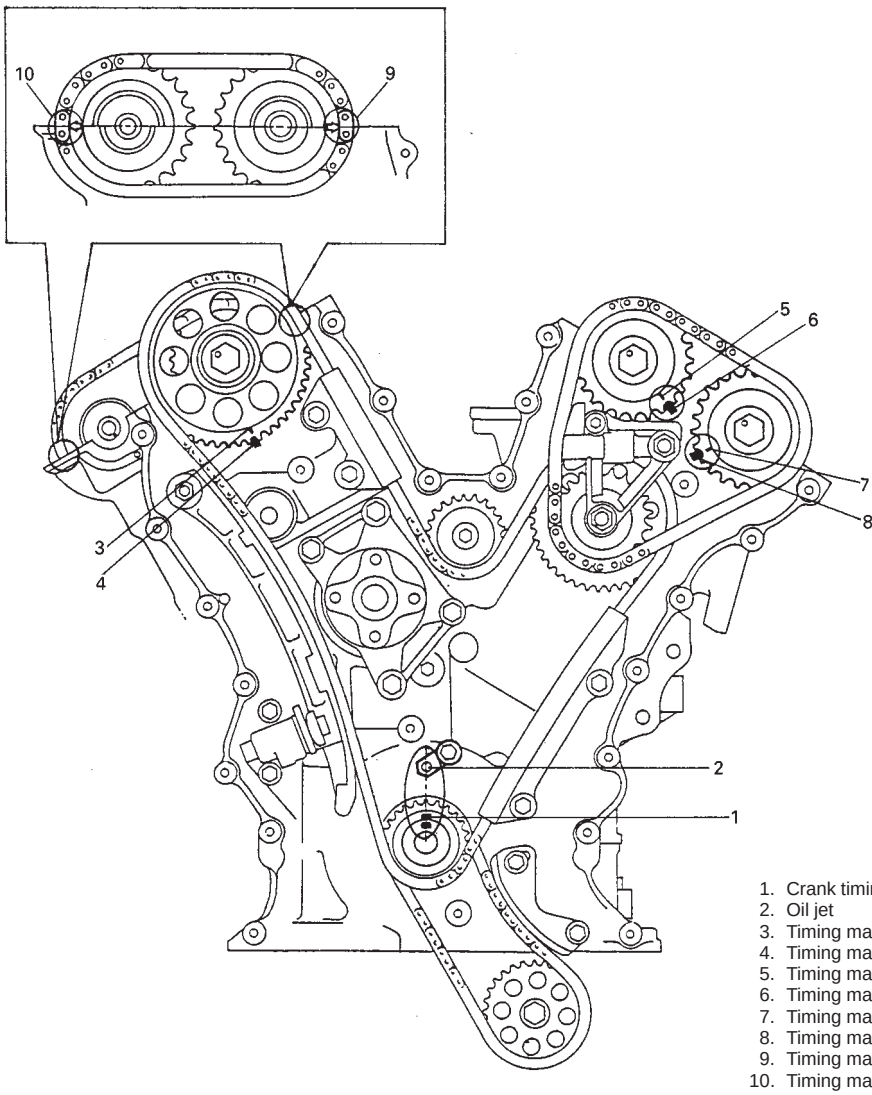
1. Timing drain tensioner adjuster No.3
2. Stopper

9) Install timing chain tensioner adjuster No.3.

Tightening Torque
(c): 25 N·m (2.5 kg-m, 18.0 lb-ft)
(d): 45 N·m (4.5 kg-m, 32.5 lb-ft)
Tightening order: (1) → (2) → (3)

10) Pull out stopper (pin) from set hole.

11) Turn crankshaft two rotations clockwise then align timing mark on crankshaft and timing mark on cylinder block as shown in figure.
Check each other timing marks that align them shown in figure.

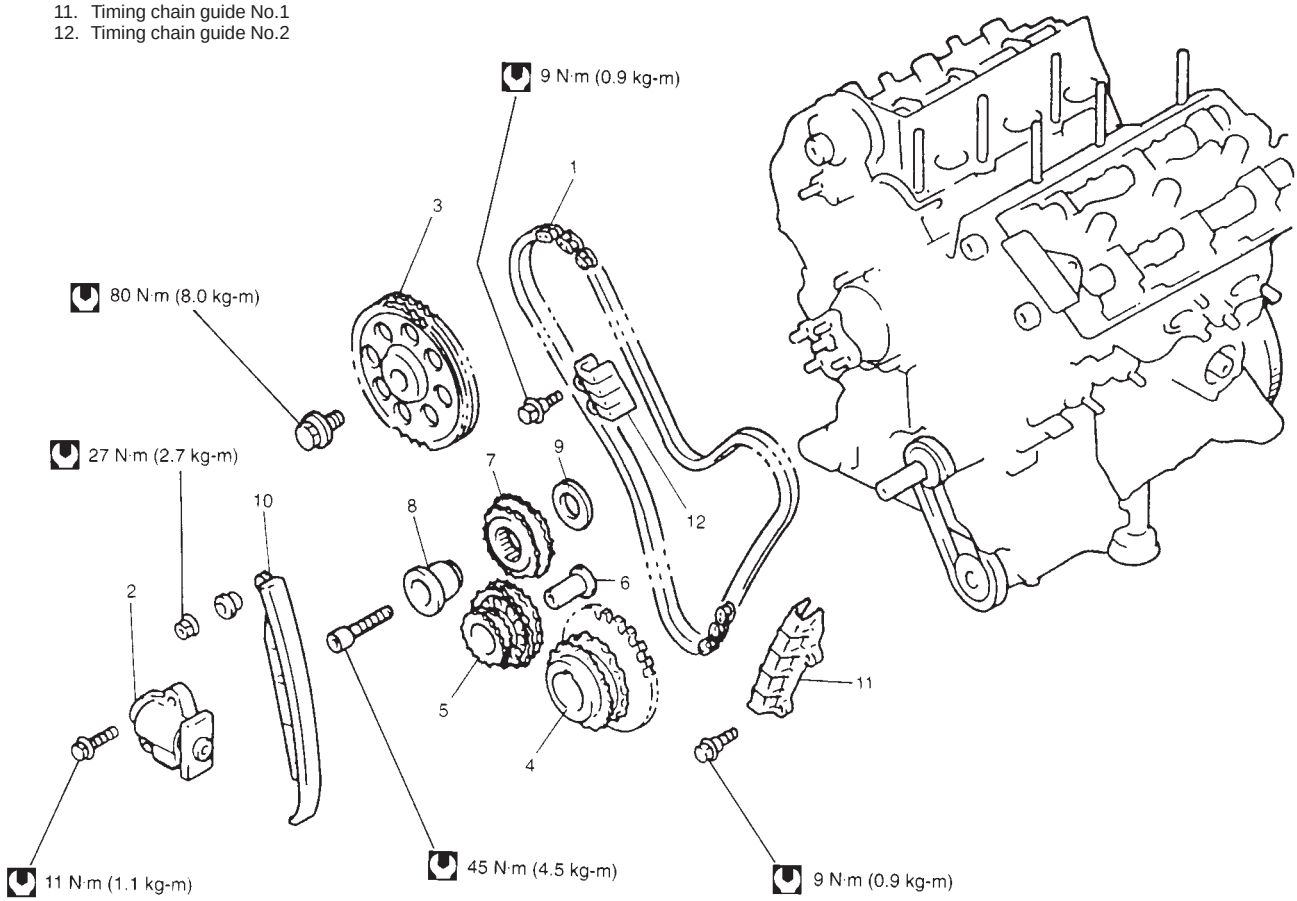


1. Crank timing pulley key
2. Oil jet
3. Timing mark of RH bank 1st timing chain sprocket
4. Timing mark of RH bank 1st timing chain
5. Timing mark or LH bank 2nd timing chain intake sprocket
6. Timing mark of LH bank 2nd timing chain
7. Timing mark of LH bank 2nd timing chain exhaust sprocket
8. Timing mark of LH bank 2nd timing chain
9. Timing mark of RH bank 2nd timing chain intake sprocket
10. Timing mark of RH bank 2nd timing chain exhaust sprocket

12) Apply oil to timing chains, tensioner adjusters sprockets, and guides.
13) Install timing chain cover, oil pan, front differential housing, P/S system, cooling system, intake manifold with throttle body and other parts.
14) Refill cooling system, P/S system, front differential and engine with each oil/fluid.
15) Check wheel alignment, referring to Section 3.
16) Verify that there is no fuel leakage, water leakage and oil leakage at each connection.

1ST TIMING CHAIN AND CHAIN TENSIONER

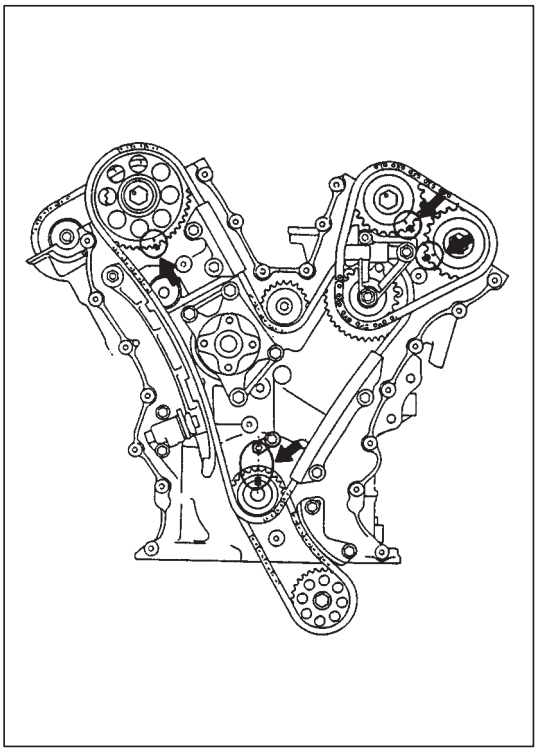
1. 1st timing chain
2. Timing chain tensioner adjuster No.1
3. RH bank 1st timing chain intake camshaft sprocket
4. 1st timing chain crankshaft sprocket
5. Idler sprocket No.2
6. Shaft
7. Idler sprocket No.1
8. Shaft
9. Washer
10. Timing chain tensioner
11. Timing chain guide No.1
12. Timing chain guide No.2



: Tightening Torque

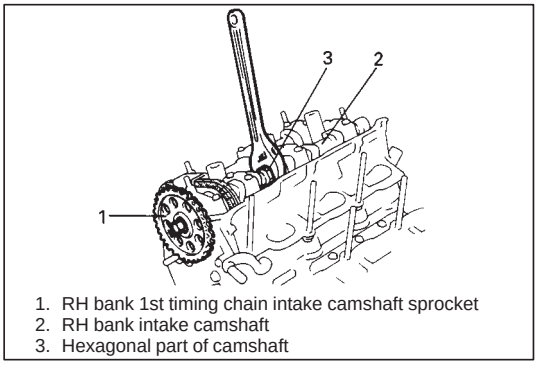
REMOVAL

1) Disconnect negative cable at battery.
2) Drain engine oil.
3) Drain coolant.
4) Remove timing chain cover.
   Refer to item “TIMING CHAIN COVER” in this section for removal.



5) For reinstallation of timing chain, align 8 timing marks as shown in figure by turning crankshaft.
6) Remove LH bank 2nd timing chain.
   Refer to item “LH (NO.1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER” in this section for removal.

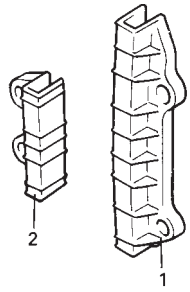
7) Remove timing chain guide No.1.
8) Remove timing chain guide No.2.
9) Remove timing chain tensioner adjuster No.1.
10) Remove idler sprocket No.1 and 1st timing chain.
11) Remove idler sprocket No.2 and sprocket shaft.
12) Remove timing chain tensioner.



1. RH bank 1st timing chain intake camshaft sprocket
2. RH bank intake camshaft
3. Hexagonal part of camshaft

13) Remove RH bank 1st timing chain intake camshaft sprocket bolt. To remove it, fit a spanner to hexagonal part at the center of camshaft to hold it stationary.
14) Remove RH bank 1st timing chain intake camshaft sprocket.

15) Remove 1st timing chain crankshaft sprocket.

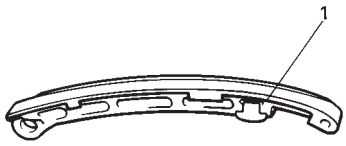


1. Timing chain guide No.1
2. Timing chain guide No.2

INSPECTION

Timing chain guides No.1 and No.2

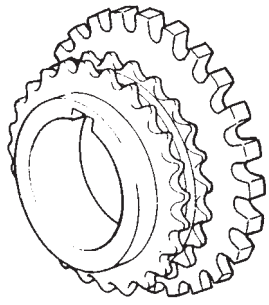
Check shoe for wear or damage.



1. Shoe

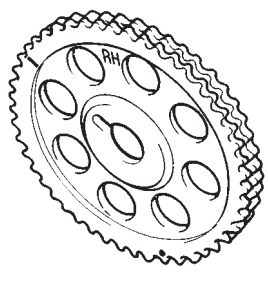
Timing chain tensioner

Check shoe for wear or damage.



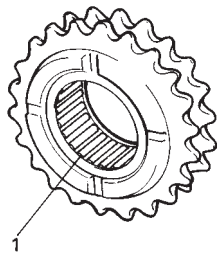
1st timing chain crankshaft sprocket

Check teeth of sprocket for wear or damage.



RH bank 1st timing chain intake camshaft sprocket

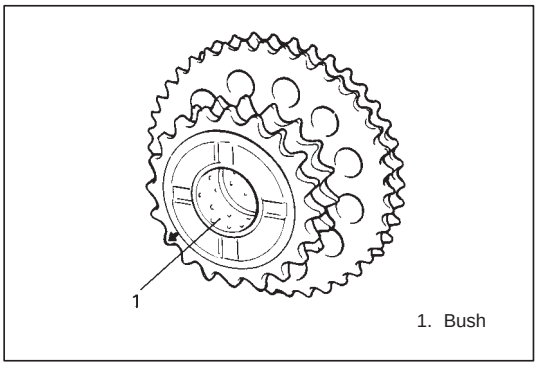
Check teeth of sprocket for wear or damage.



1. Bearing

Idler sprocket No.1

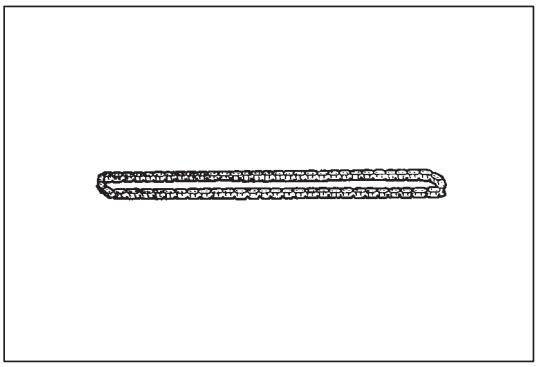
Check teeth of sprocket for wear or damage.



1. Bush

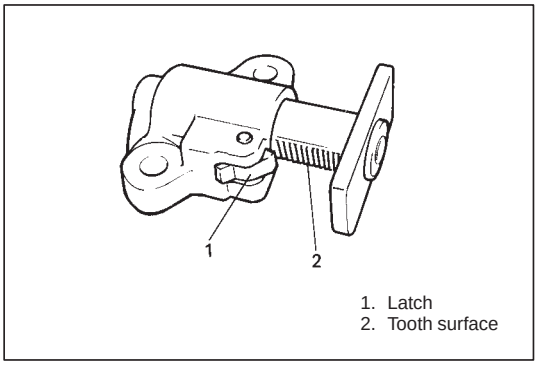
Idler sprocket No.2

Check teeth of sprocket for wear or damage.



1st timing chain

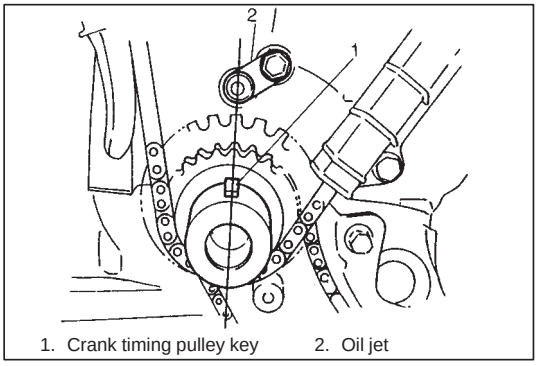
Check timing chain for wear or damage.



1. Latch
2. Tooth surface

Timing chain tensioner adjuster No.1

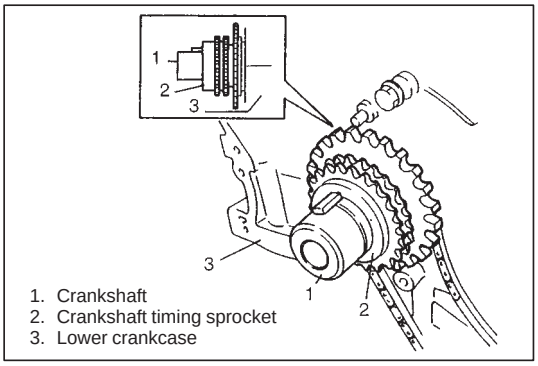
Check that latch and tooth surface are free from damage and latch functions properly.



1. Crank timing pulley key
2. Oil jet

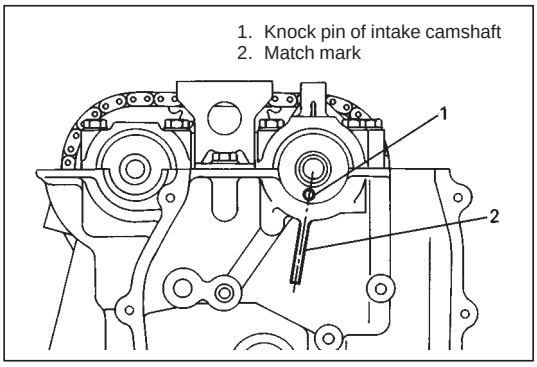
INSTALLATION

1) Check timing mark on crankshaft as shown in figure.



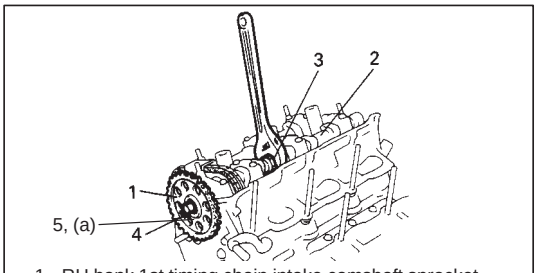
1. Crankshaft
2. Crankshaft timing sprocket
3. Lower crankcase

2) Install 1st timing chain crankshaft sprocket as shown in figure. Confirm that tooth for CKP sensor are free from metal particles and damage.



1. Knock pin of intake camshaft
2. Match mark

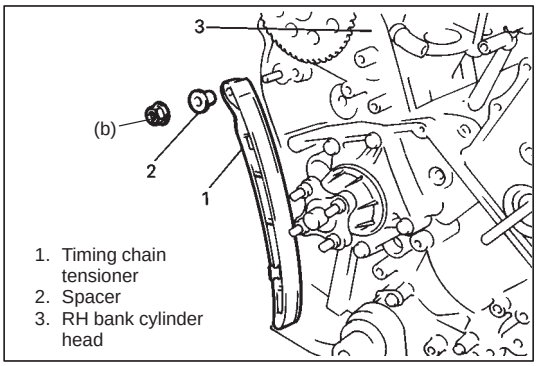
3) Check timing mark on RH bank intake camshaft as shown in figure.



1. RH bank 1st timing chain intake camshaft sprocket
2. RH bank intake camshaft
3. Hexagonal part of camshaft
4. RH mark
5. Bolt

4) Install RH bank 1st timing chain intake camshaft sprocket noting following points.
- The sprocket should be set in such way that its RH mark can be seen.
- Camshaft should be held stationary by using a spanner at its hexagonal parts as shown in figure.

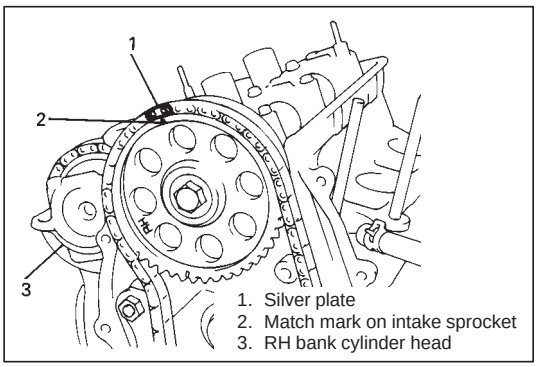
Tightening Torque
(a): 80 N·m (8.0 kg-m, 57.5 lb-ft)



1. Timing chain tensioner
2. Spacer
3. RH bank cylinder head

5) Install timing chain tensioner as shown in figure.

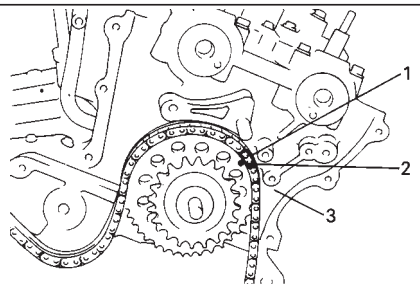
Tightening Torque
(b): 27 N·m (2.7 kg-m, 19.5 lb-ft)



1. Silver plate
2. Match mark on intake sprocket
3. RH bank cylinder head

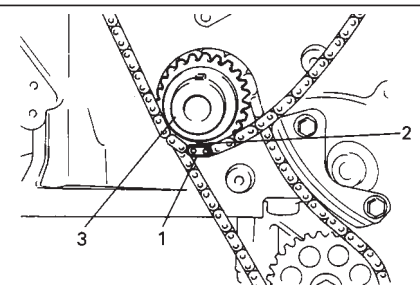
6) Install 1st timing chain by aligning match marks on RH silver plate of 1st timing chain and RH bank 1st timing chain intake camshaft sprocket.

7) Apply oil to bush of idler sprocket No.2.
8) Install idler sprocket No.2 and sprocket shaft.



1. Silver plate
2. Match mark on intake sprocket
3. RH bank cylinder head

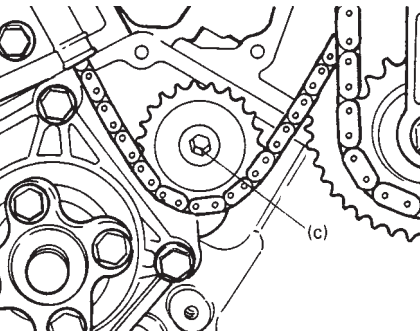
9) Install idler sprocket No.2 by aligning match marks on LH silver plate of 1st timing chain.



1. Gold or Yellow plate
2. Match mark on crankshaft timing sprocket
3. Crankshaft

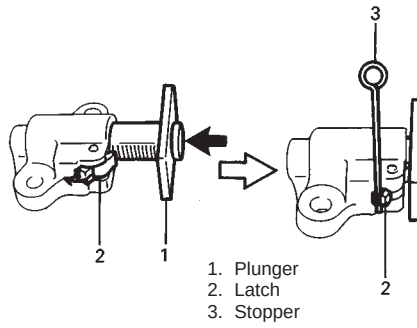
10) Install crankshaft sprocket by aligning match marks on gold or yellow plate of 1st timing chain and crankshaft timing sprocket. To install it, fit a spanner to hexagonal part at the center of RH bank intake camshaft to turn a little.

CAUTION:
Do not turn camshaft more than necessary.
If turned excessively, valve and piston may get damaged.



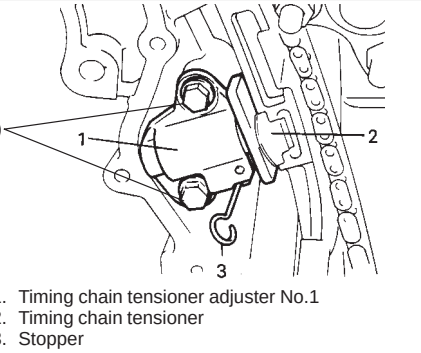
11) Apply oil to bearing of idler sprocket No.1.
12) Install idler sprocket No.1.

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



1. Plunger
2. Latch
3. Stopper

13) With latch of tensioner adjuster No.1 returned and plunger pushed back into body, insert stopper into latch and body. After inserting it, check to make sure that plunger will not come out.

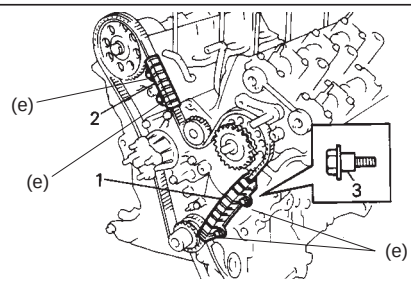


1. Timing chain tensioner adjuster No.1
2. Timing chain tensioner
3. Stopper

14) Install timing chain tensioner adjuster No.1.

Tightening Torque
(d): 11 N·m (1.1 kg-m, 7.5 lb-ft)

15) Pull out stopper from adjuster No.1.

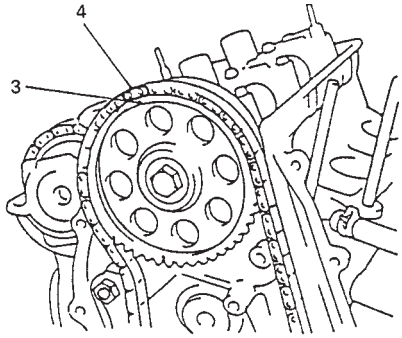


1. Timing chain guide No.2
2. Timing chain guide No.1
3. Guide bolts

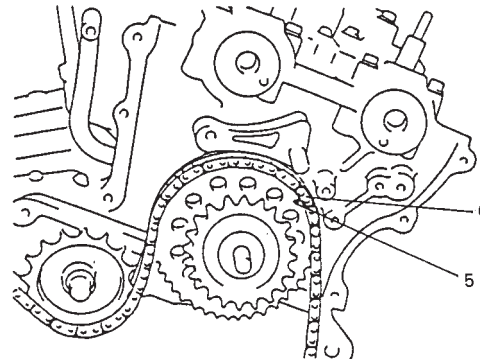
16) Install timing chain guide No.1 and No.2.

Tightening Torque
(e): 9 N·m (0.9 kg-m, 6.5 lb-ft)

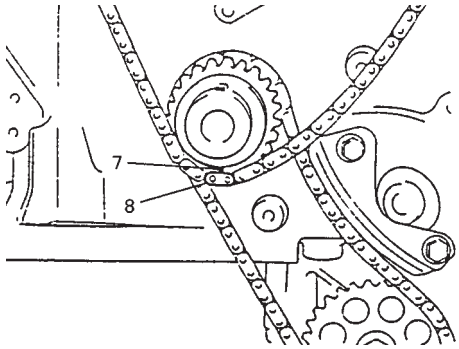
17) Check each aligned timing marks as shown in figure.



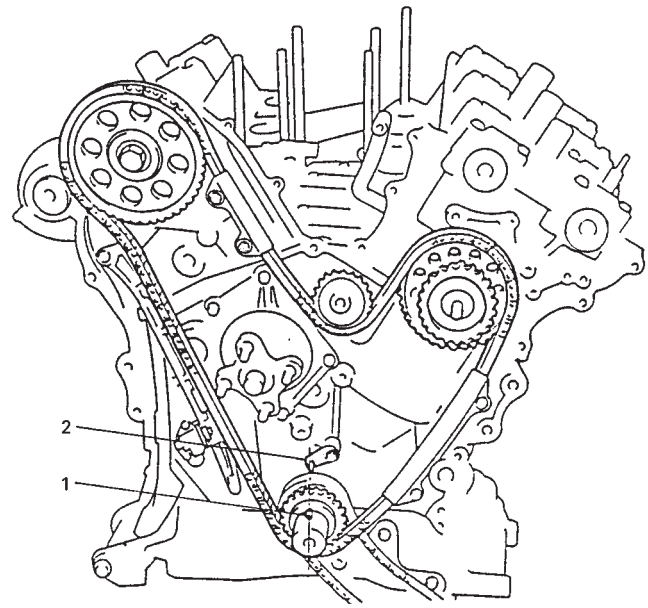
3. Match mark of RH bank 1st timing chain sprocket
4. Silver plate (LH) of 1st timing chain



5. Match mark of idler sprocket No.2
6. Silver plate (RH) of 1st timing chain



7. Match mark of crankshaft timing sprocket
8. Gold or Yellow plate of 1st timing chain

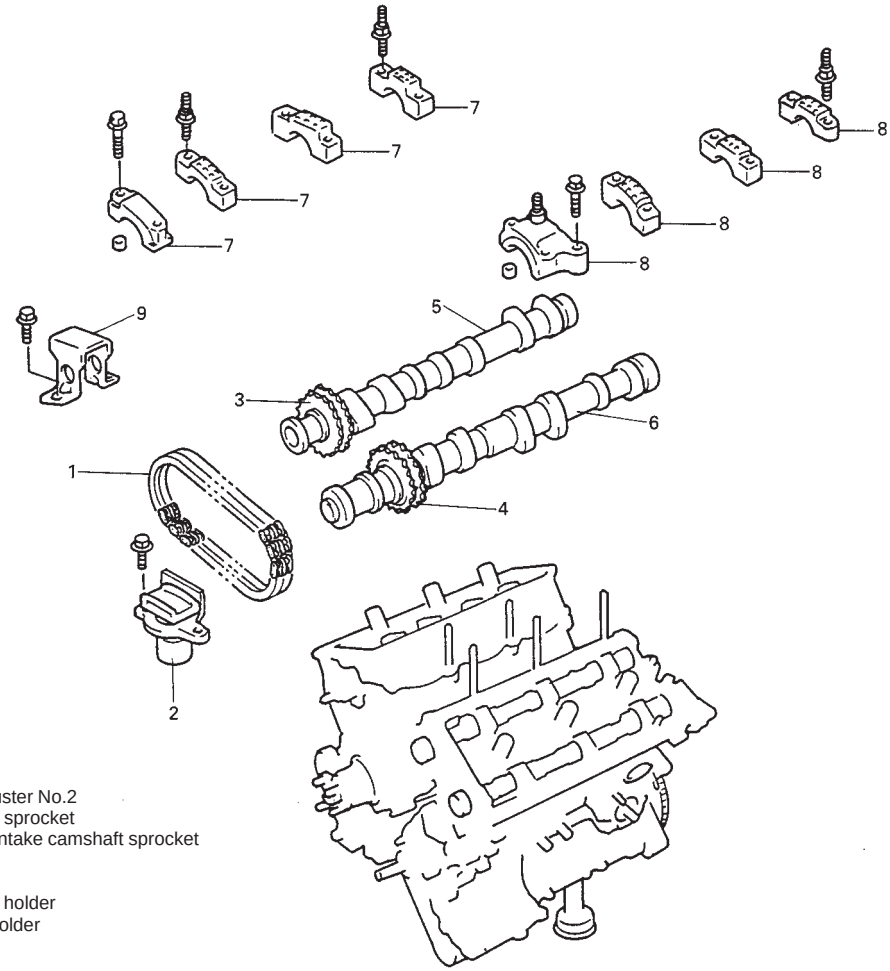


1. Crank timing pulley key
2. Oil jet

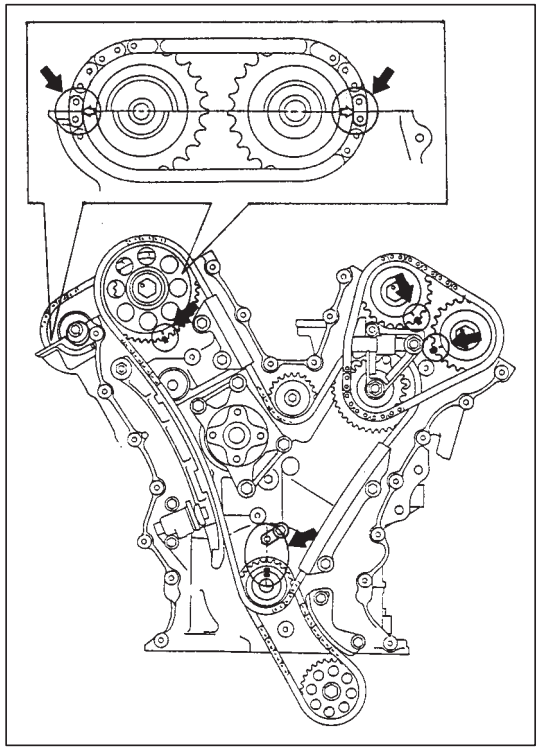
18) Install LH bank 2nd timing chain.
    Refer to item “LH (NO.1) BANK 2ND TIMING CHAIN AND TENSIONER” in this section for installation.

19) Install timing chain cover.
    Refer to item “TIMING CHAIN COVER” in this section for installation.
20) Install oil pan, front differential housing, P/S system, cooling system, intake manifold with throttle body and other parts.
21) Refill cooling system with coolant, front differential with gear oil, P/S system with specified fluid and engine with engine oil.
22) Check wheel alignment referring to Section 3.
23) Verify that there is no fuel leakage, water leakage and oil leakage at each connection.

RH (NO.2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER



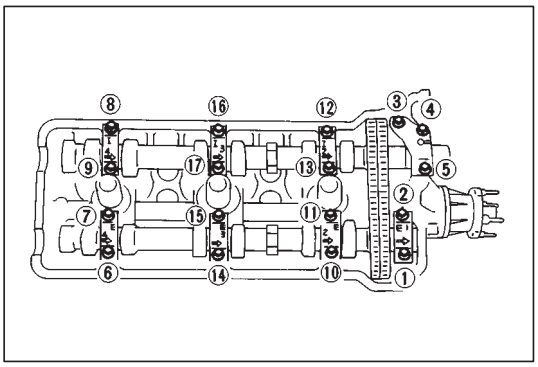
1. RH bank 2nd timing chain
2. Timing chain tensioner adjuster No.2
3. RH bank exhaust camshaft sprocket
4. RH bank 2nd timing chain intake camshaft sprocket
5. RH bank exhaust camshaft
6. RH bank intake camshaft
7. RH bank exhaust camshaft holder
8. RH bank intake camshaft holder
9. Timing chain guide No.3



REMOVAL

1) For reinstallation of timing chain, align 12 timing marks as shown in figure by turning crankshaft.

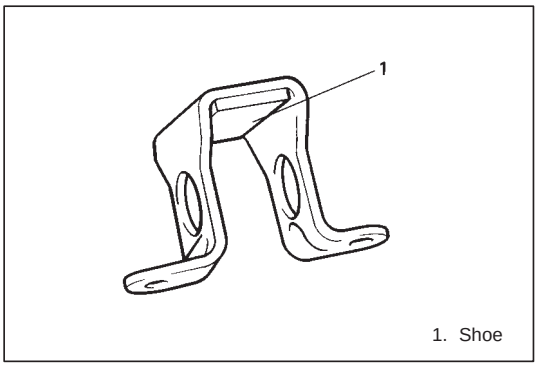
2) Remove LH bank 2nd timing chain.
   Refer to item “LH (NO.1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER” in this section for removal.
3) Remove 1st timing chain.
   Refer to item “1ST TIMING CHAIN AND CHAIN TENSIONER” in this section for removal.
4) Remove timing chain guide No.3.



5) Loosen camshaft housing bolts in such order as indicated in figure and remove them.
6) Remove camshaft housings.

7) Remove RH bank intake camshaft, RH bank exhaust camshaft, and RH bank 2nd timing chain as a set.

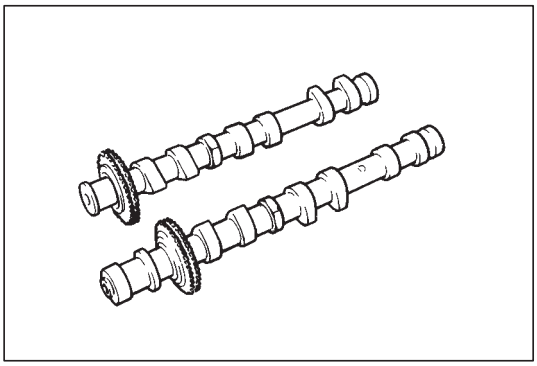
8) Remove timing chain tensioner adjuster No.2.



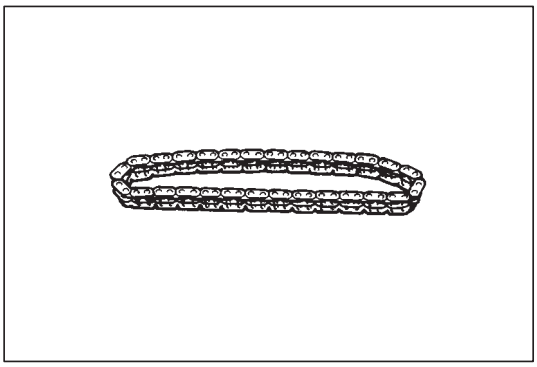
INSPECTION

Timing chain guide No.3

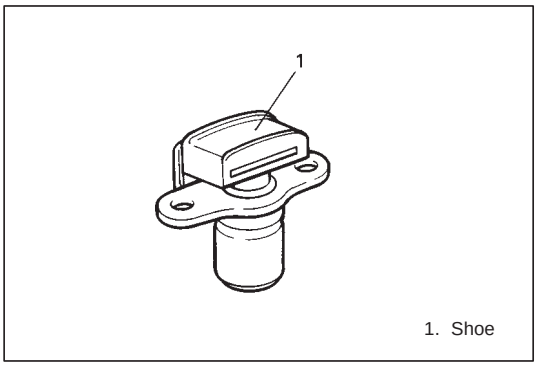
Check shoe for wear or damage.



RH bank 2nd timing chain sprockets
Check teeth of sprocket for wear or damage.

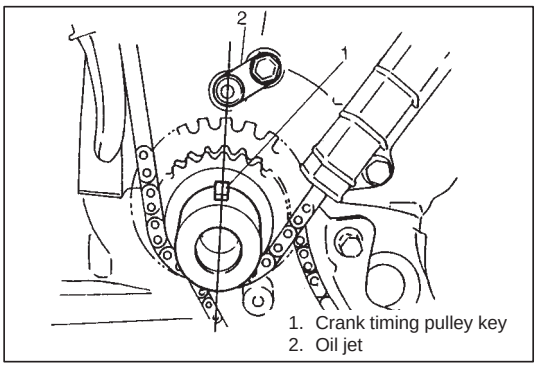


RH bank 2nd timing chain
Check timing chain for wear or damage.



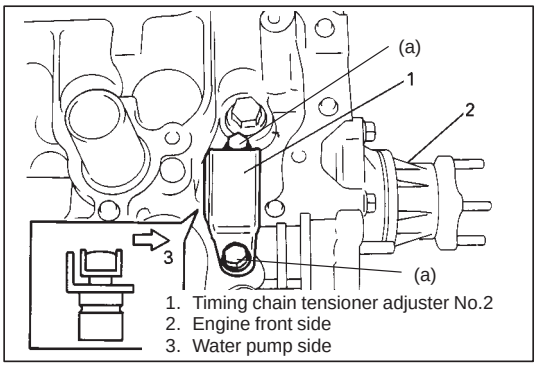
1. Shoe

Timing chain tensioner adjuster No.2
- Check shoe for wear or damage.
- Check that plunger slides smoothly.



1. Crank timing pulley key
2. Oil jet

INSTALLATION
1) Check timing mark on crankshaft as shown in figure.

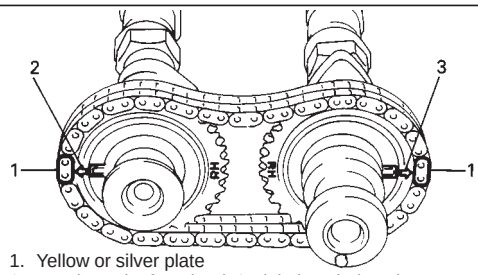


1. Timing chain tensioner adjuster No.2
2. Engine front side
3. Water pump side

2) Apply oil to timing chain tensioner adjuster No.2.
3) Install timing chain tensioner adjuster No.2.

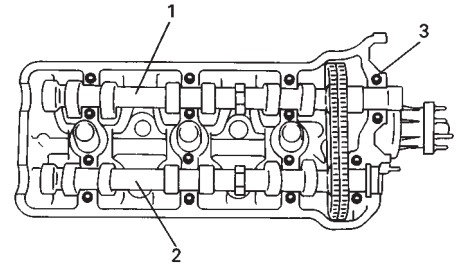
Tightening Torque
(a): 11 N·m (1.1 kg-m, 7.5 lb-ft)

4) Apply oil to sliding surface of each camshafts and camshaft journals.



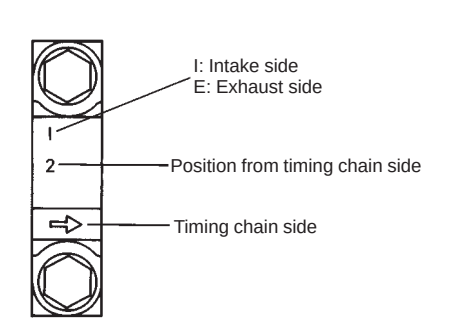
1. Yellow or silver plate
2. Match mark of RH bank 2nd timing chain exhaust camshaft sprocket
3. Match mark of RH bank 2nd timing chain intake camshaft sprocket

5) Install RH bank 2nd timing chain by aligning match marks on yellow or silver plates of RH bank 2nd timing chain, RH bank 2nd timing chain intake camshaft sprocket and RH bank 2nd timing chain exhaust camshaft sprocket as shown in figure.

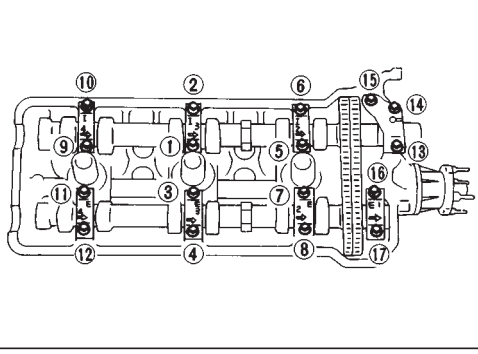


1. RH bank intake camshaft
2. RH bank exhaust camshaft
3. Pin

6) Install camshaft housing pins as shown in figure.

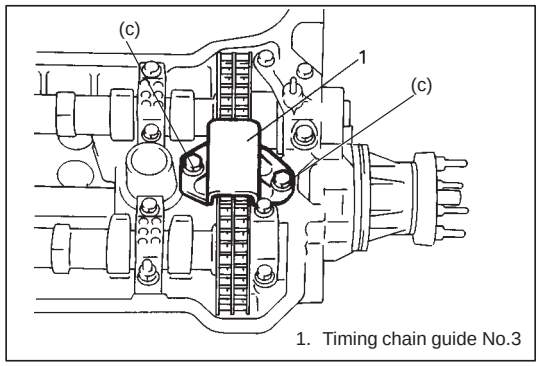


7) Check position of camshaft housings.
Embossed marks are provided on each camshaft housing, indicating position and direction for installation. Install housings as indicated by these marks.



8) After applying 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 two or three times before they are tightened to specified torque below.

Tightening Torque
12 N·m (1.2 kg-m, 8.5 lb-ft)



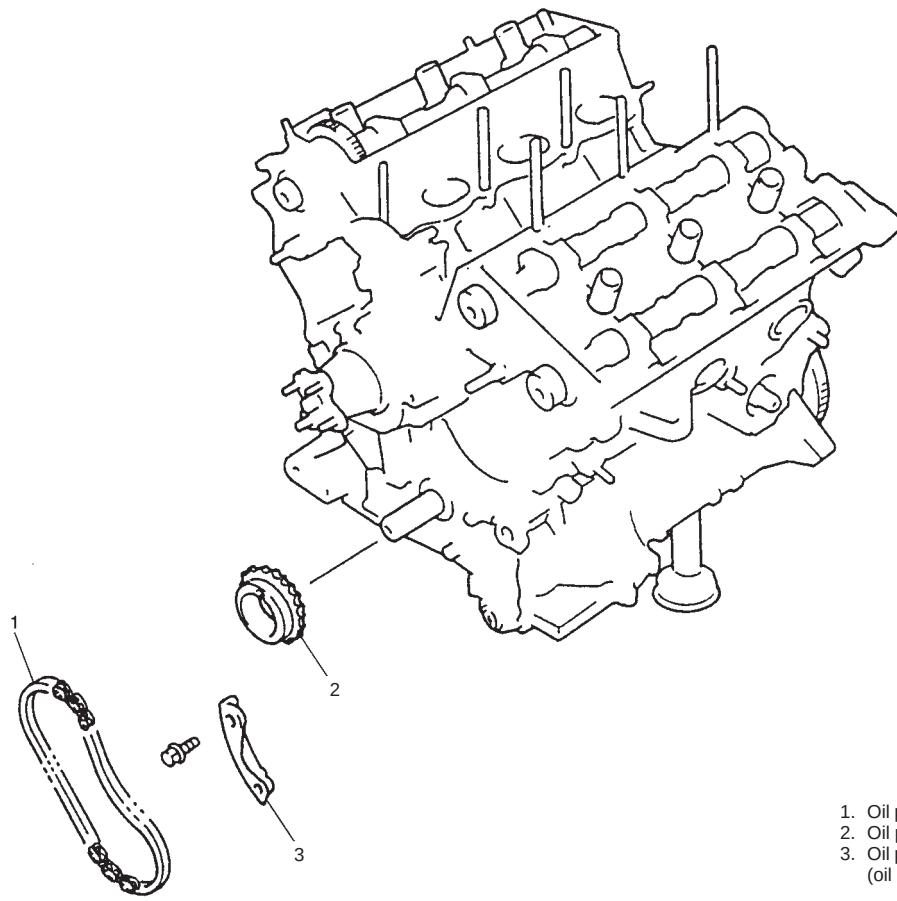
1. Timing chain guide No.3

9) Install timing chain guide No.3.

Tightening Torque
(c): 11 N·m (1.1 kg-m, 7.5 lb-ft)

10) Install 1st timing chain.
Refer to item “1ST TIMING CHAIN AND CHAIN TENSIONER” in this section for installation.
11) Install LH bank 2nd timing chain.
Refer to item “LH (NO.1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER” in this section for installation.
12) Install timing chain cover.
Refer to item “TIMING CHAIN COVER” for installation.
13) Install oil pan, front differential housing, P/S system, cooling system, intake manifold with throttle body and other parts.
14) Refill cooling system with coolant, front differential with gear oil, P/S system with specified fluid and engine with engine oil.
15) Check wheel alignment referring to Section 3.
16) Verify that there is no fuel leakage, water leakage and oil leakage at each connection.

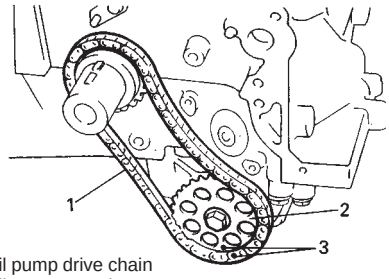
OIL PUMP CHAIN



1. Oil pump chain
2. Oil pump drive sprocket
3. Oil pump chain tensioner (oil pump guide)

REMOVAL

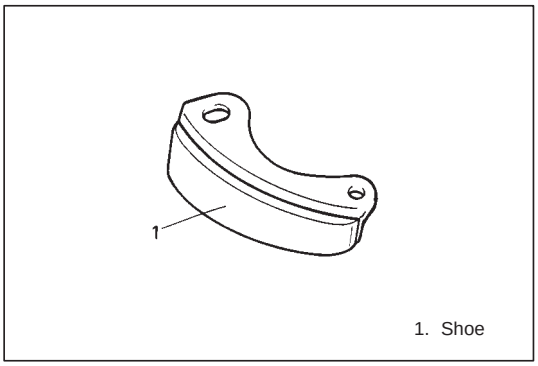
1) Disconnect negative cable at battery.
2) Drain engine oil.
3) Drain coolant.
4) Remove timing chain cover.
   Refer to item “TIMING CHAIN COVER” in this section for removal.
5) Remove LH bank 2nd timing chain.
   Refer to item “LH (NO.1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER” in this section for removal.
6) Remove 1st timing chain.
   Refer to item “1ST TIMING CHAIN AND CHAIN TENSIONER” in this section for removal.



1. Oil pump drive chain
2. Oil pump sprocket
3. Match mark

7) Put match marks to oil pump chain and oil pump sprocket.

8) Remove oil pump chain guide.
9) Remove oil pump chain.
10) Remove oil pump drive sprocket.

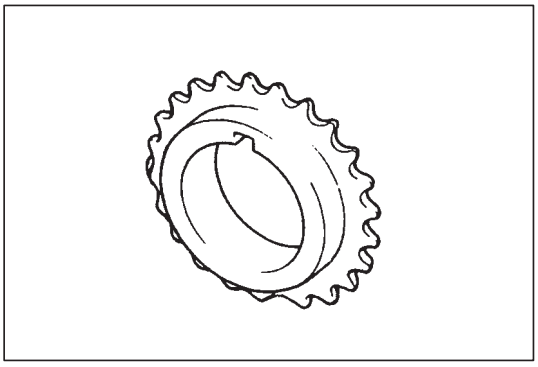


1. Shoe

INSPECTION

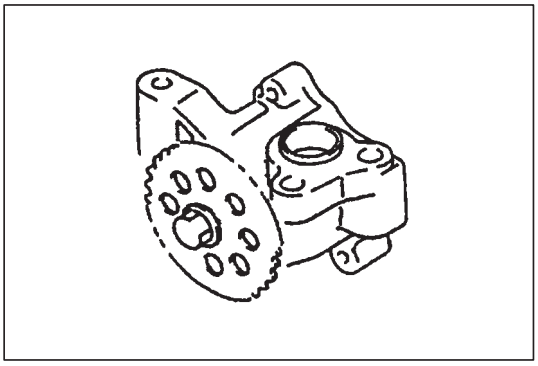
Oil pump chain guide

Check shoe for wear or damage.



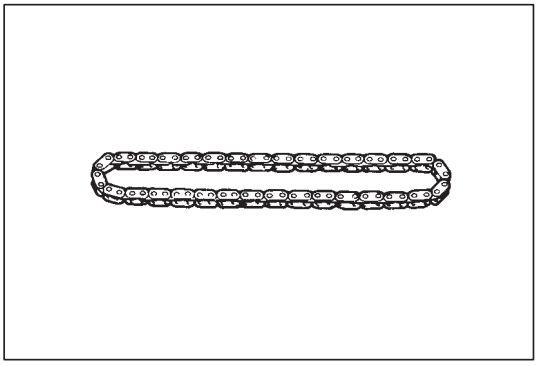
Oil pump drive sprocket

Check teeth of sprocket for wear or damage.



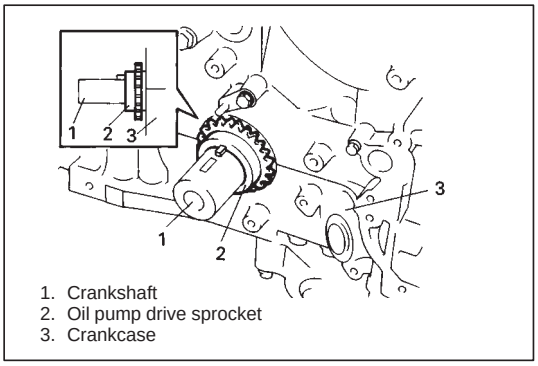
Oil pump sprocket

Check teeth of sprocket for wear or damage.



Oil pump chain

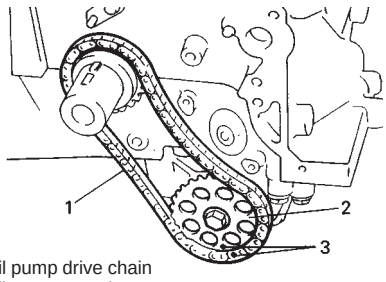
Check oil pump chain for wear or damage.



1. Crankshaft
2. Oil pump drive sprocket
3. Crankcase

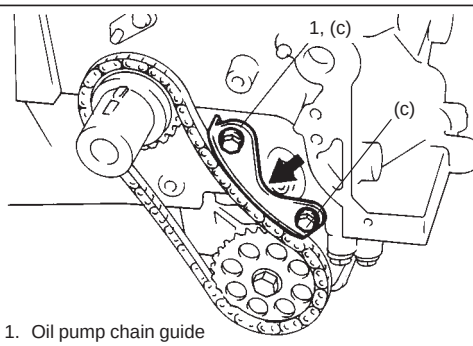
INSTALLATION

1) Install oil pump drive sprocket as shown in figure.



1. Oil pump drive chain
2. Oil pump sprocket
3. Match mark

2) Install oil pump chain by aligning match marks on oil pump chain and oil pump sprocket.



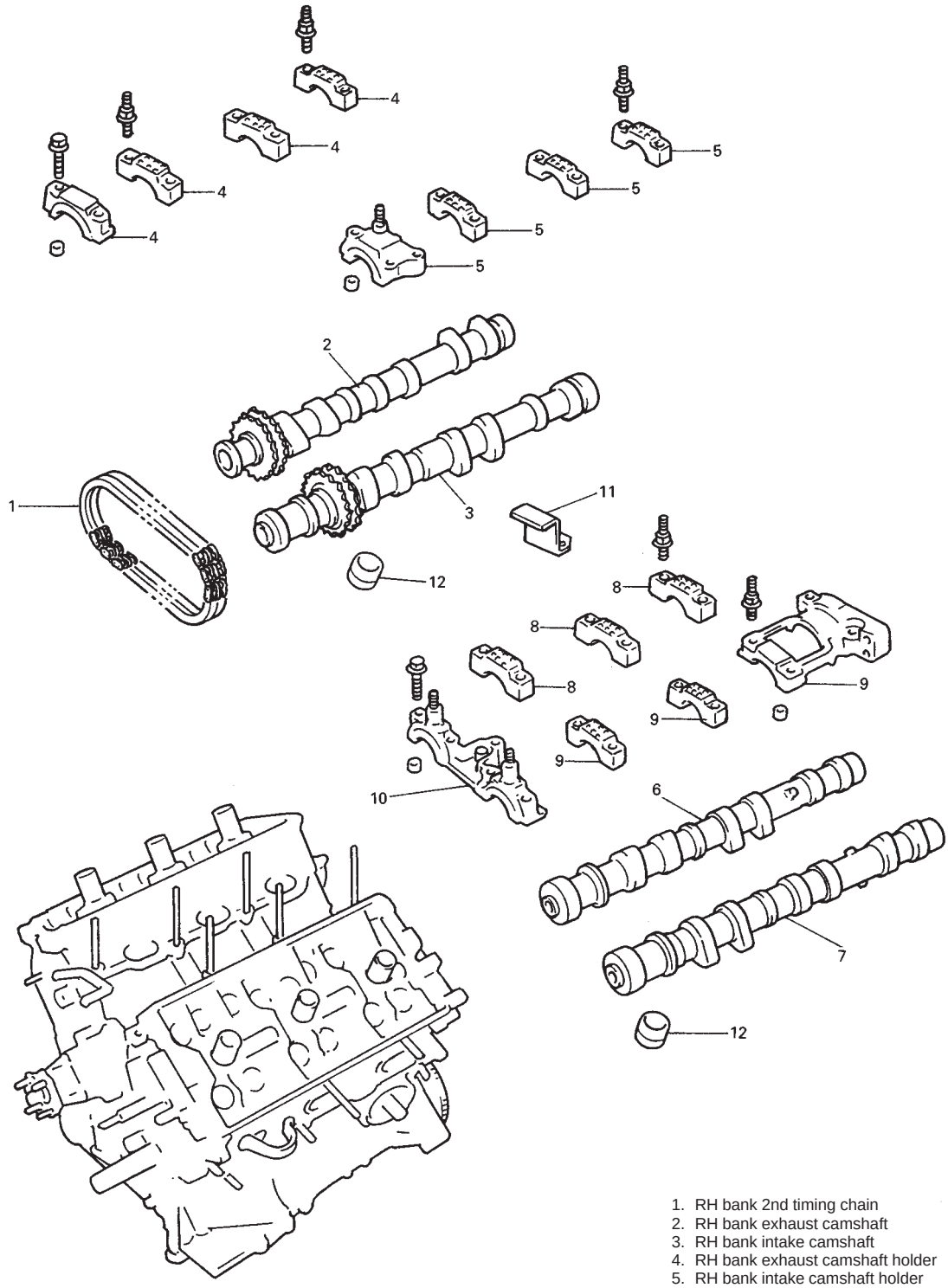
1. Oil pump chain guide

3) Install oil pump chain guide and hand-tighten oil pump chain guide bolts.
4) To take up slack of oil pump chain, push center of oil pump chain guide with a force of 0.5 to 0.6 N (50 – 60 g, 0.11 – 0.13 lb) then tighten oil pump chain guide bolts to specified torque.

Tightening Torque
(c): 11 N·m (1.1 kg-m, 7.5 lb-ft)

5) Install 1st timing chain.
   Refer to item "1ST TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
6) Install LH bank 2nd timing chain.
   Refer to item "LH (NO.1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
7) Install timing chain cover.
   Refer to item "TIMING CHAIN COVER" in this section for installation.
8) Install oil pan, front differential housing, P/S system, cooling system, intake manifold with throttle body and other parts.
9) Refill cooling system with coolant, front differential with gear oil, P/S system with specified fluid and engine with engine oil.
10) Check wheel alignment referring to Section 3.
11) Verify that there is no fuel leakage, water leakage and oil leakage at each connection.

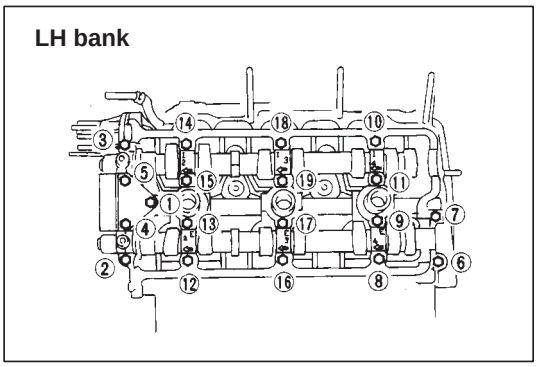
CAMSHAFT AND VALVE LASH ADJUSTER



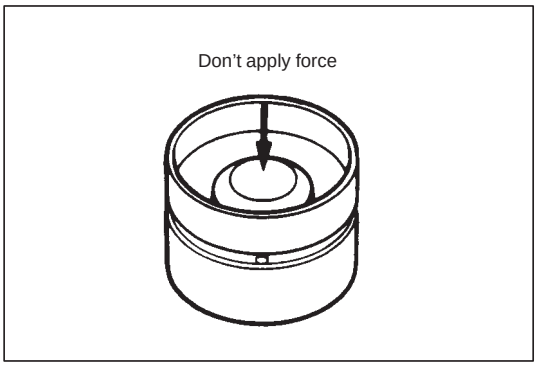
1. RH bank 2nd timing chain
2. RH bank exhaust camshaft
3. RH bank intake camshaft
4. RH bank exhaust camshaft holder
5. RH bank intake camshaft holder
6. LH bank intake camshaft
7. LH bank exhaust camshaft
8. LH bank intake camshaft holder
9. LH bank exhaust camshaft holder
10. LH bank camshaft holder
11. Timing chain guide No.5
12. Valve lash adjuster

REMOVAL

1) Disconnect negative cable at battery.
2) Drain engine oil.
3) Drain coolant.
4) Remove timing chain cover.
   Refer to item “TIMING CHAIN COVER” in this section for removal.
5) Remove LH bank 2nd timing chain.
   Refer to item “LH (NO.1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER” in this section for removal.
6) Remove 1st timing chain.
   Refer to item “1ST TIMING CHAIN AND CHAIN TENSIONER” in this section for removal.



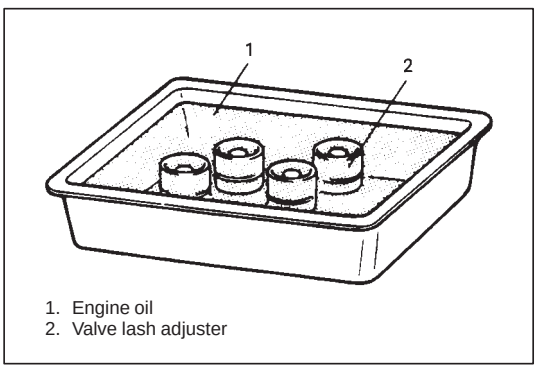
7) Remove RH bank camshafts.
   Refer to item “RH (NO.2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER” in this section for removal.
8) Remove CMP sensor. Refer to Section 6F2 for removal.
9) Loosen LH bank camshaft housing bolts in such order as indicated in figure and remove them.
10) Remove LH bank camshaft housings.
11) Remove LH bank camshafts.



12) Remove valve lash adjuster.

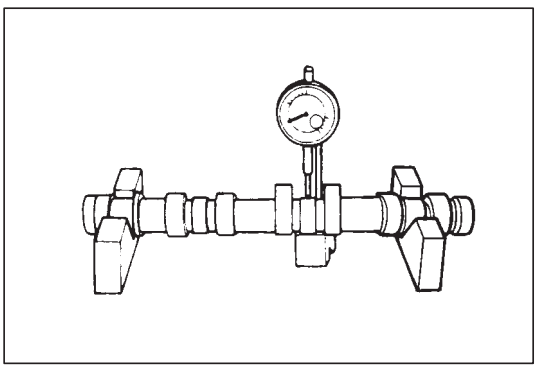
NOTE:

- **Never disassemble hydraulic valve lash adjuster.**
- **Don’t apply force to body of adjuster, oil in high pressure chamber in adjuster will leak.**



1. Engine oil
2. Valve lash adjuster

- **Immerse removed adjuster in clean engine oil and keep it there till reinstalling it so as to prevent oil leakage. If it is left in air, place it with its bucket body facing down. Don’t place on its side or with bucket body facing up.**

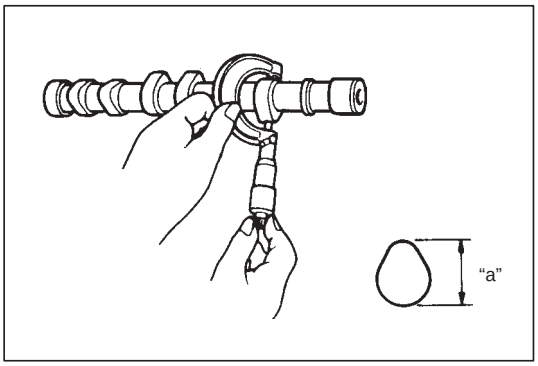


INSPECTION

Cam Wear

Using a micrometer, measure cam height. If measured height is below its limit, replace camshaft.

Cam height	Standard	Limit
Intake cam	39.445 – 39.605 mm (1.5530 – 1.5593 in.)	39.400 mm (1.5512 in.)
Exhaust cam	39.428 – 39.588 mm (1.5523 – 1.5586 in.)	39.400 mm (1.5512 in.)

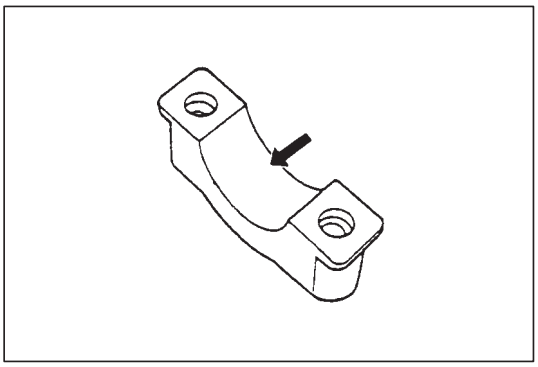


Camshaft Runout

Set camshaft between two "V" blocks, and measure its runout by using a dial gauge.

If measured runout exceeds below specified limit, replace camshaft.

Runout limit	0.10 mm (0.0039 in.)

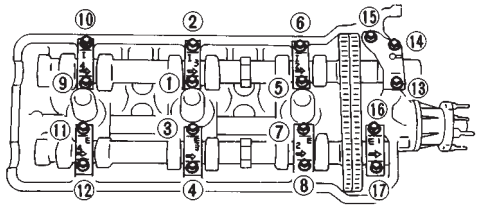


Camshaft Journal Wear

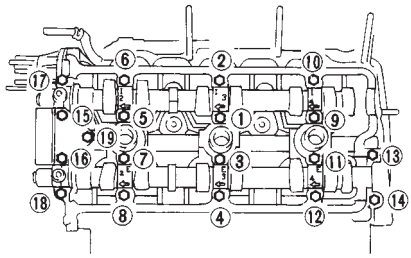
Check camshaft journals and camshaft housings for pitting, scratches, wear or damage.

If any malcondition is found, replace camshaft or cylinder head with housing. Never replace cylinder head without replacing housings.

RH bank



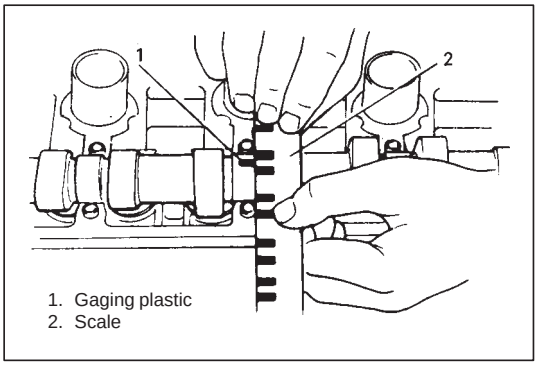
LH bank



Check clearance by using gaging plastic. The procedure is as follows.

1) Clean housings and camshaft journals.
2) Make sure that all valve lash adjusters are removed and 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.
5) Tighten camshaft housing bolts in such order as indicated in figure a little at a time till they are tightened to specified torque.

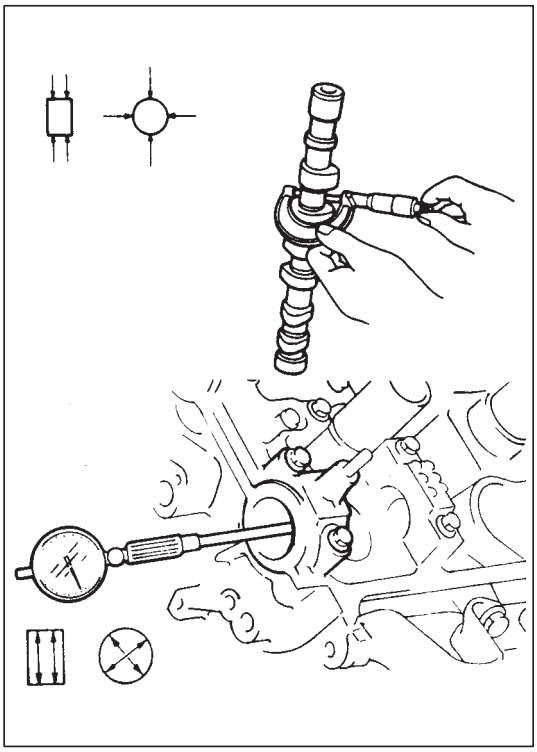
NOTE:
Do not rotate camshaft while gaging plastic is installed.



1. Gaging plastic
2. Scale

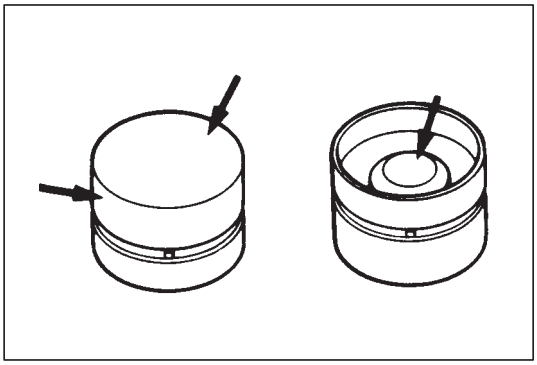
6) Remove housing, and using scale on gaging plastic envelop, measure gaging plastic width at its widest point.

	Standard	Limit
Journal clearance	0.045 – 0.099 mm (0.0018 – 0.0039 in.)	0.12 mm (0.0047 in.)



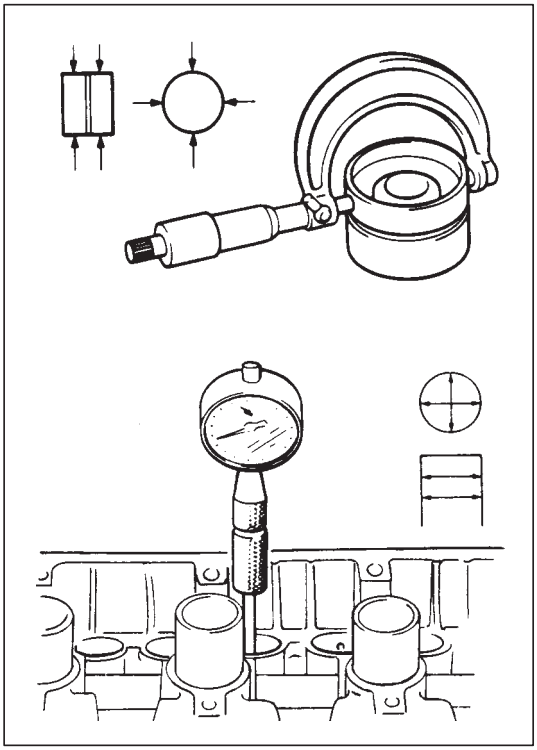
If measured camshaft journal clearance exceeds limit, measure journal (housing) bore and outside diameter of camshaft journal. Replace camshaft or cylinder head assembly whichever the difference from specification is greater.

	Standard
Camshaft journal bore dia. (IN & EX)	26.000 – 26.033 mm (1.0236 – 1.0249 in.)
Camshaft journal O.D. (IN & EX)	25.934 – 25.955 mm (1.0210 – 1.0218 in.)



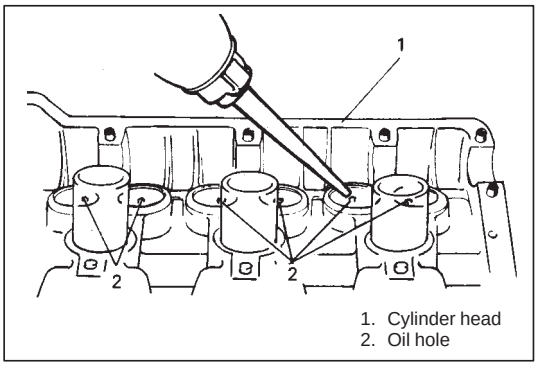
Wear of Hydraulic Valve Lash Adjuster

Check adjuster for pitting, scratches, or damage.
If any malcondition is found, replace.



Measure cylinder head bore and adjuster outside diameter to determine cylinder head-to-adjuster clearance. If clearance exceeds limit, replace adjuster or cylinder head.

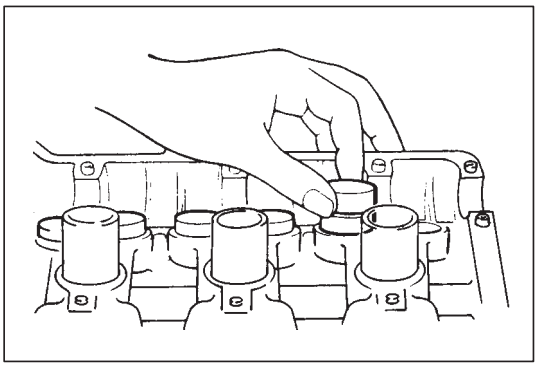
Item	Standard	Limit
Hydraulic valve lash adjuster O.D.	30.959 – 30.975 mm (1.2188 – 1.2194 in.)	–
Cylinder head bore	31.000 – 31.025 mm (1.2205 – 1.2214 in.)	–
Cylinder head to adjuster clearance	0.025 – 0.066 mm (0.0010 – 0.0025 in.)	0.15 mm (0.0059 in.)



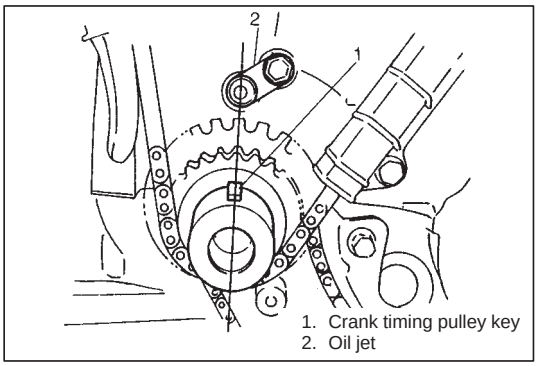
1. Cylinder head
2. Oil hole

INSTALLATION

1) Before installing valve lash adjuster to cylinder head, fill oil passage of cylinder head with engine oil according to following procedure.
   Pour engine oil through oil holes and check that oil comes out from oil holes in sliding part of valve lash adjuster.
   Perform this check on both intake and exhaust sides.



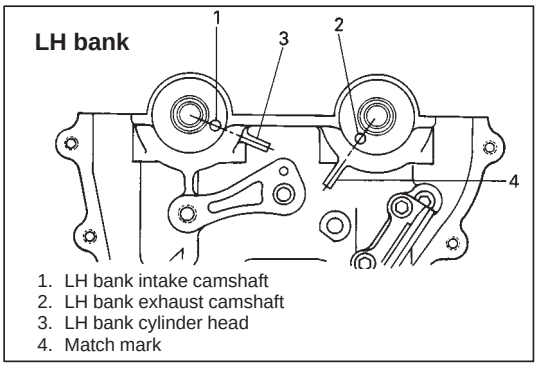
2) Valve lash adjuster to cylinder head.
   Apply engine oil around valve lash adjuster and then install it to cylinder head.



1. Crank timing pulley key
2. Oil jet

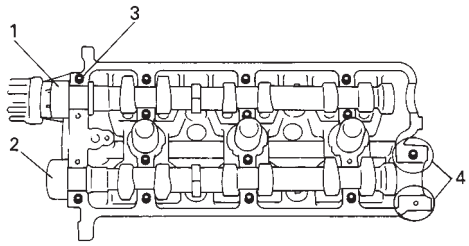
3) Check timing mark on crankshaft as shown in figure.

4) Install RH bank camshafts, referring to item “RH (NO.2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER” in this section for installation.



1. LH bank intake camshaft
2. LH bank exhaust camshaft
3. LH bank cylinder head
4. Match mark

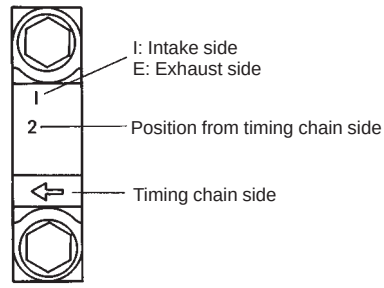
5) Install LH bank camshafts.
   Apply oil to sliding surface of each camshaft and camshaft journal then install them by aligning match marks on cylinder head and LH bank camshafts as shown in figure.



1. LH bank intake camshaft
2. LH bank exhaust camshaft
3. Pin installation position
4. Area to apply sealant “A”

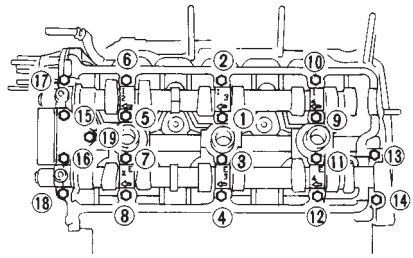
6) Install LH bank camshaft housing pins as shown in figure.
7) Apply sealant “A” to LH bank exhaust camshaft housing No.5 sealing surface area as shown in figure.

“A”: Sealant 99000-31150



8) Check position of LH bank camshaft housings.
Embossed marks are provided on each camshaft housing, indicating position and direction for installation. Install housings as indicated by these marks.

LH bank



9) After applying 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 two or three times before they are tightened to specified torque below.

Tightening Torque
12 N·m (1.2 kg-m, 8.5 lb-ft)

10) Install 1st timing chain.
    Refer to item "1ST TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
11) Install LH bank 2nd timing chain.
    Refer to item "LH (NO.1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
12) Install timing chain cover.
    Refer to item "TIMING CHAIN COVER" in this section for installation.
13) Install oil pan, front differential housing, P/S system, cooling system, intake manifold with throttle body and other parts.
14) Install CMP sensor. Refer to Section 6F2 for details.
15) Refill cooling system with coolant, front differential with gear oil, P/S system with specified fluid and engine with engine oil.
16) Check wheel alignment referring to Section 3.
17) Verify that there is no fuel leakage, water leakage and oil leakage at each connection.
18) Check ignition timing, referring to Section 6F2.

CAUTION:

- **Don't turn camshafts or start engine (i.e., valves should not be operated) for about half an hour after reinstalling hydraulic valve lash adjusters and camshafts. As it takes time for valves to settle in place, operating engine within half an hour after their installation may cause interference to occur between valves themselves or valves and piston.**
- **If air is trapped in valve lash adjuster, valve may make tapping sound when engine is operated after valve lash adjuster is installed. In such a case, run engine for about half an hour at about 2,000 – 3,000 r/min., and then air will be purged and tapping sound will cease. Should tapping sound not cease, it is possible that valve lash adjuster is defective. Replace it if defective.**

  If defective adjuster can't be located by hearing among 24 of them, check as follows.

  1) Stop engine and remove cylinder head cover.
  2) Push adjuster downward by hand (with less than 20 kg or 44 lbs force) when cam crest is not on adjuster to be checked and check if clearance exists between cam and adjuster. If it does, adjuster is defective and needs replacement.

VALVE LASH ADJUSTER NOISE DIAGNOSIS

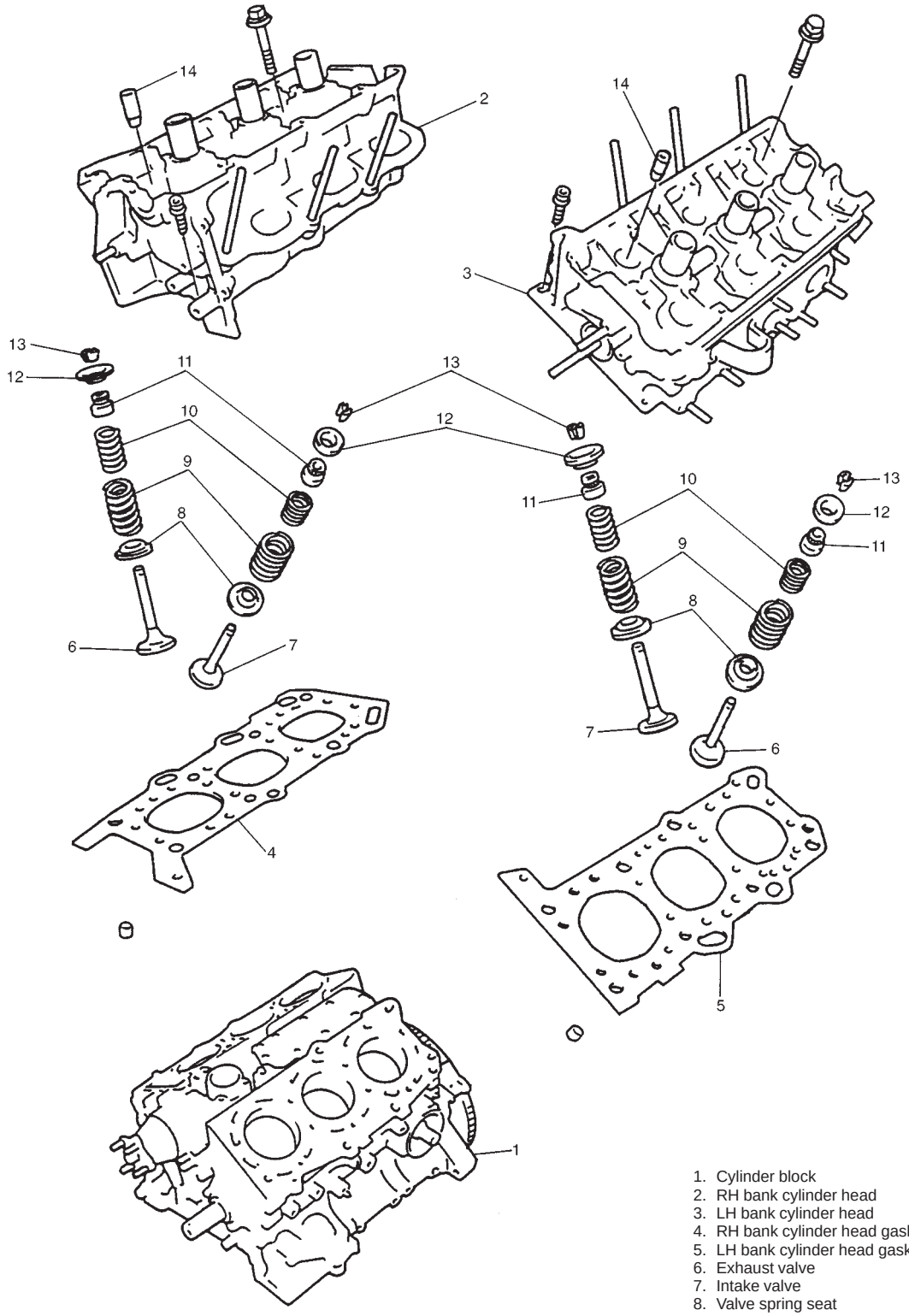
In case of the followings, valve lash adjuster noise may be caused by air trapped into valve lash adjusters.

- Vehicle is left for 24 hours or more.
- Engine oil is changed.
- Hydraulic lash adjuster is replaced or reinstalled.
- Engine is overhauled.

If noise from valve lash adjusters is suspected, perform the following checks.

1) Check engine oil for the followings.
   - Oil level in oil pan
     If oil level is low, add oil up to Full level hole on oil level gauge.
   - Oil quality
     If oil is discolored, or deteriorated, change it.
     For particular oil to be used, refer to Section 0B.
   - Oil leaks
     If leak is found, repair it.
   - Oil pressure (refer to Oil Pressure Check in this section)
     If defective pressure is found, repair it.
2) Run engine for about half an hour at about 2,000 to 3,000 r/min., and then air will be purge and tapping sound will cease.
3) Should tapping sound not cease, it is possible that hydraulic valve lash adjuster is defective.
   Replace it if defective.
   If defective adjuster can't be located by hearing among 24 of them, check as follows.
   i) Stop engine and remove cylinder head cover.
   ii) Push adjuster downward by hand (with less than 20 kg or 44 lbs. Force) when cam crest is not on adjuster to be check if clearance exists between cam and adjuster.
   If it does, adjuster is defective and needs replacement.

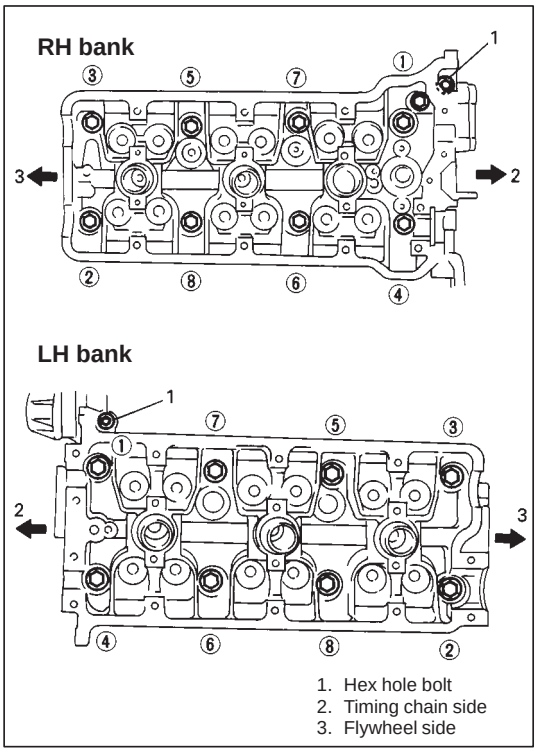
VALVES AND CYLINDER HEADS



1. Cylinder block
2. RH bank cylinder head
3. LH bank cylinder head
4. RH bank cylinder head gasket
5. LH bank cylinder head gasket
6. Exhaust valve
7. Intake valve
8. Valve spring seat
9. Outer valve spring
10. Inner valve spring
11. Valve stem oil seal
12. Valve spring retainer
13. Valve cotter
14. Valve guide

REMOVAL

1) Relieve fuel pressure according to procedure described in Section 6.
2) Disconnect negative cable at battery.
3) Drain engine oil.
4) Drain coolant.
5) Remove CMP sensor, camshaft and valve lash adjuster.
   Refer to Section 6F2 for CMP sensor removal and item “CAMSHAFT AND VALVE LASH ADJUSTER” in this section for camshaft and valve lash adjuster removal.
6) Remove exhaust manifold.
   Refer to item “EXHAUST MANIFOLD” in this section for removal.
7) Remove water outlet cap.

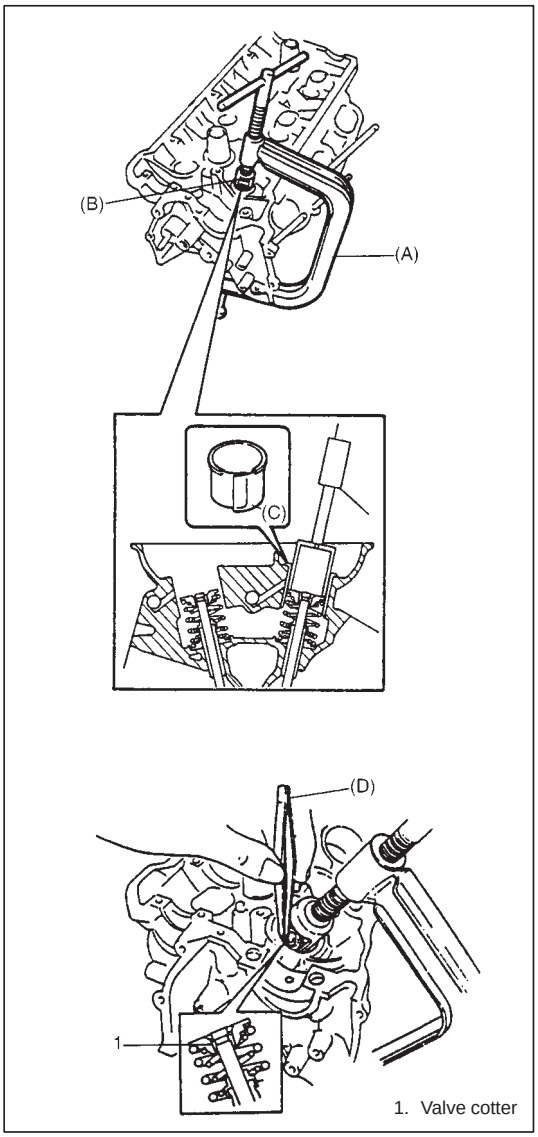


1. Hex hole bolt
2. Timing chain side
3. Flywheel side

8) Loosen cylinder head bolts in such order as indicated in figure and remove them.

   NOTE:
   Don’t forget to remove two hex bolts shown in figure.

9) Remove cylinder heads.

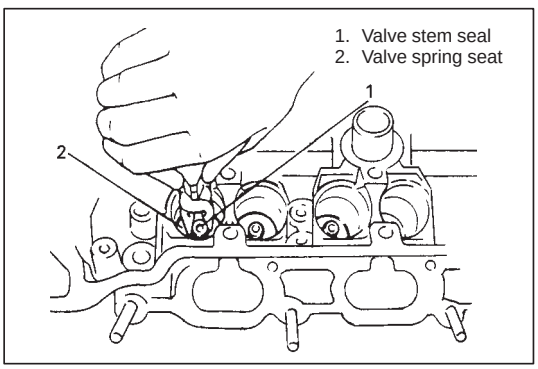


DISASSEMBLY

1) Using special tools (A), (B) & (C), compress valve springs and then remove valve cotters by using special tool (D).

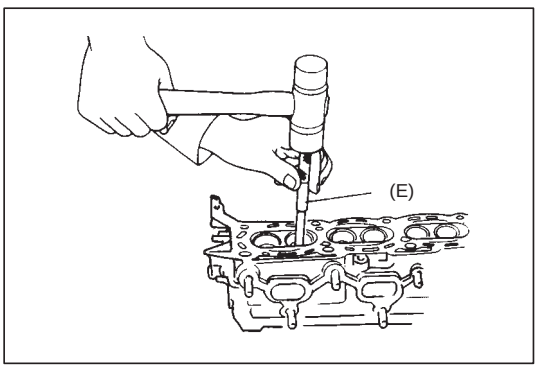
   Special Tool
   (A): 09916-14510
   (B): 09916-14910
   (C): 09919-28610
   (D): 09916-84511

2) Release special tool, and remove spring retainer and valve spring.
3) Remove valve from combustion chamber side.



4) Remove valve stem seal from valve guide, and then valve spring seat.

   NOTE:
   Do not reuse seal once disassembled. Be sure to use new seal when assembling.

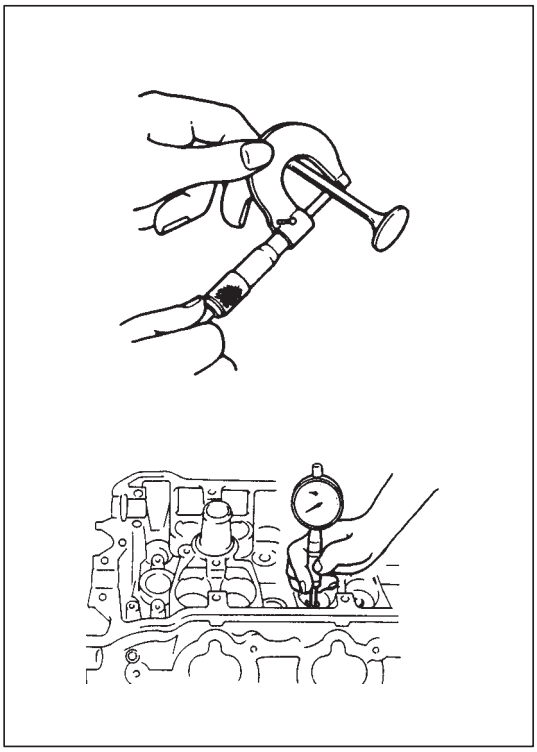


5) Using special tool (E) (Valve guide remover), drive valve guide out from combustion chamber side to valve spring side.

   Special Tool
   (E): 09916-44910

   NOTE:
   Do not reuse valve guide once disassembled. Be sure to use new valve guide (Oversize) when assembling.

6) Place disassembled parts except valve stem seal and valve guide in order so that they can be installed in their original positions.



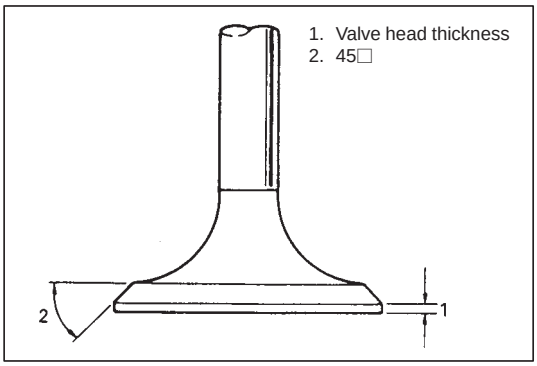
INSPECTION

Valve Guides

Using a micrometer and bore gauge, take diameter readings on valve stems and guides to check stem-to-guide clearance. Be sure to take reading at more than one place along the length of each stem and guide.

If clearance exceeds limit, replace valve and valve guide.

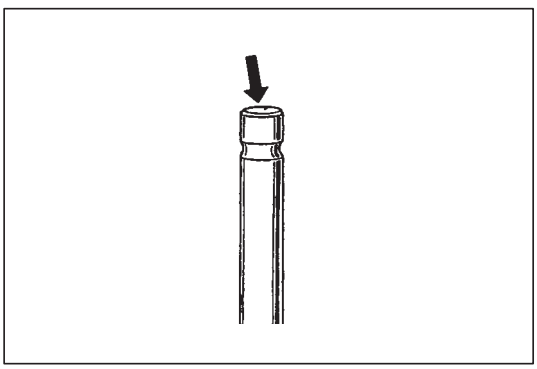
Item		Standard	Limit
Valve stem diameter	Intake	5.965 – 5.980 mm (0.2348 – 0.2354 in.)	–
	Exhaust	5.940 – 5.955 mm (0.2339 – 0.2344 in.)	–
Valve guide I.D.	In & Ex	6.000 – 6.012 mm (0.2362 – 0.2367 in.)	–
Stem-to-guide clearance	Intake	0.020 – 0.047 mm (0.0008 – 0.0018 in.)	0.07 mm (0.0027 in.)
	Exhaust	0.045 – 0.072 mm (0.0018 – 0.0028 in.)	0.09 mm (0.0035 in.)



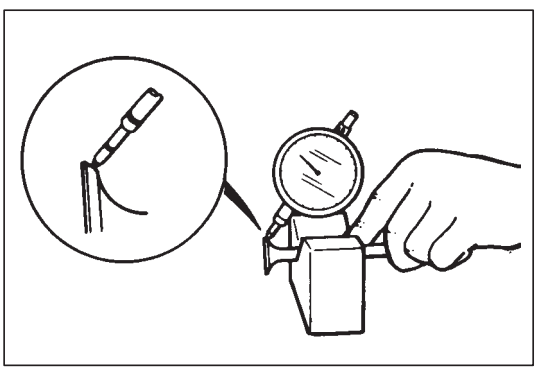
Valves

° 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.

Item	Standard	Limit
Intake	1.0 mm (0.039 in.)	0.6 mm (0.023 in.)
Exhaust	1.2 mm (0.047 in.)	0.7 mm (0.027 in.)

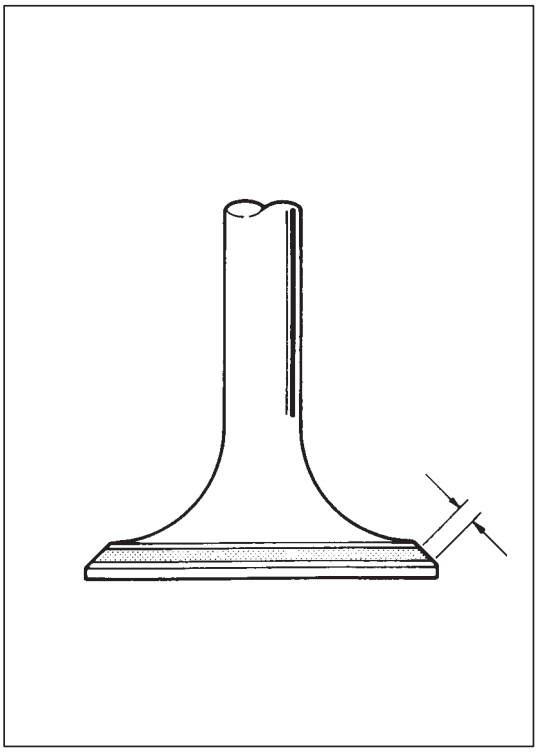


° Inspect valve stem end face for pitting and wear. If pitting or wear is found there, valve stem end may be resurfaced, but not too much to grind off its chamber. When it is worn out too much that its chamber is gone, replace valve.



° Check each valve for radial runout with a dial gauge and "V" block. To check runout, rotate valve slowly. If runout exceeds its limit, replace valve.

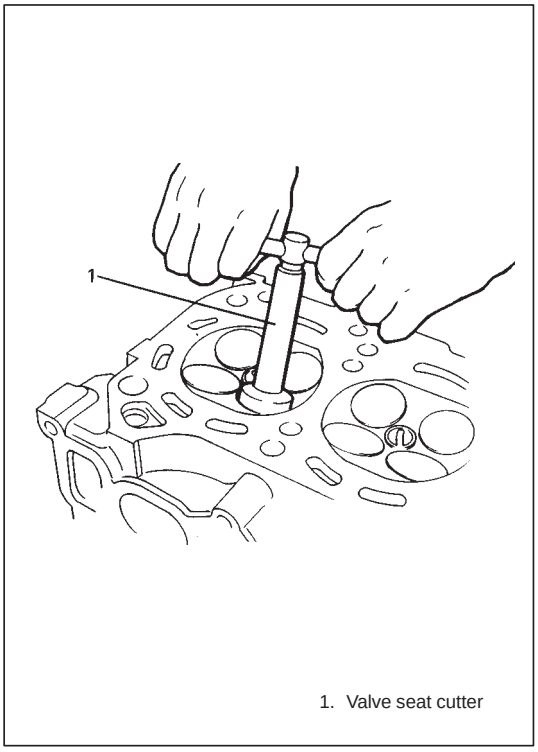
Limit on valve head radial runout:
0.08 mm (0.003 in.)



● Seating contact width:
Create contact pattern one 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	Intake	1.1 – 1.3 mm (0.0433 – 0.0512 in.)
	Exhaust	



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.

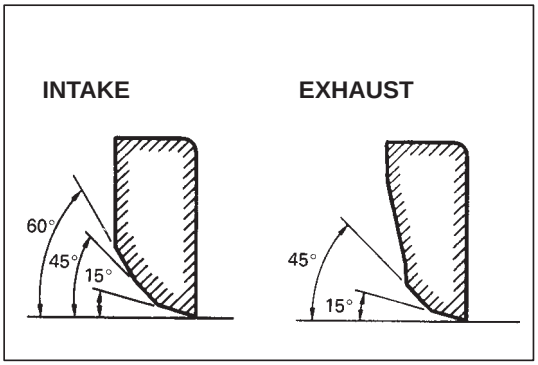
1) VALVE SEAT: Use valve seat cutters to make two cuts as illustrated in figure. Two cutters must be used: the first for making 15° angle, and the second for making 45° angle. The second cut must be made to produce desired seat width.

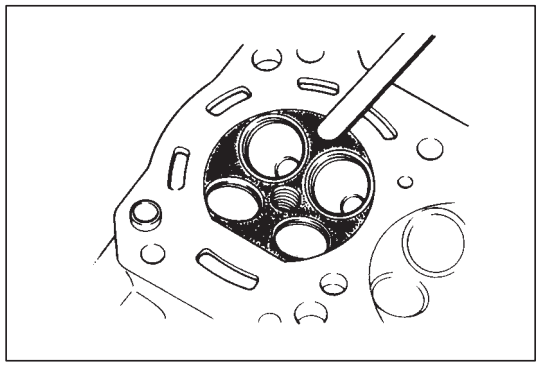
   Seat width for valve seat:
   1.1 – 1.3 mm (0.0433 – 0.0512 in.)

2) INTAKE VALVE SEAT: Use valve seat cutters to make three cuts as illustrated in figure. Three cutters must be used: the 1st for making 15° angle, the 2nd for making 60° angle, and 3rd for making 45° angle. The 3rd cut (45°) must be made to produce desired seat width.

   Seat width for intake valve seat:
   1.1 – 1.3 mm (0.0433 – 0.0512 in.)

3) VALVE LAPPING: Lap valve on seat in two steps, first with coarse size lapping compound applied to face and the second with fine-size compound, each time using valve lapper according to usual lapping method.

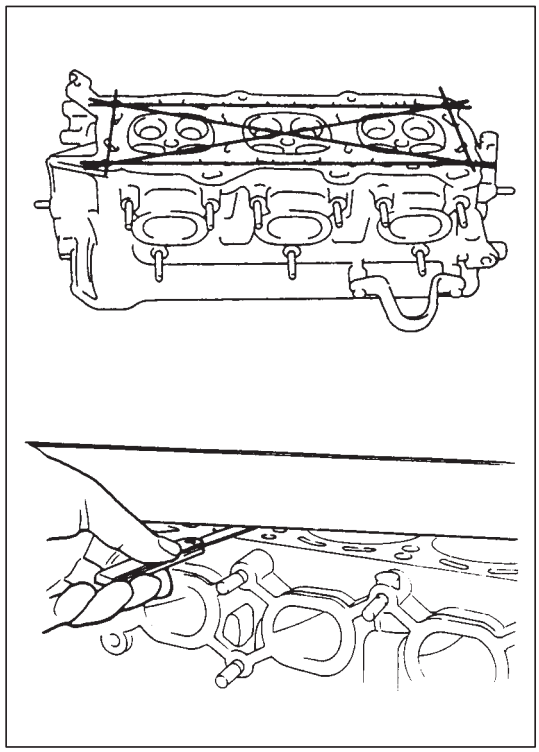




Cylinder Head

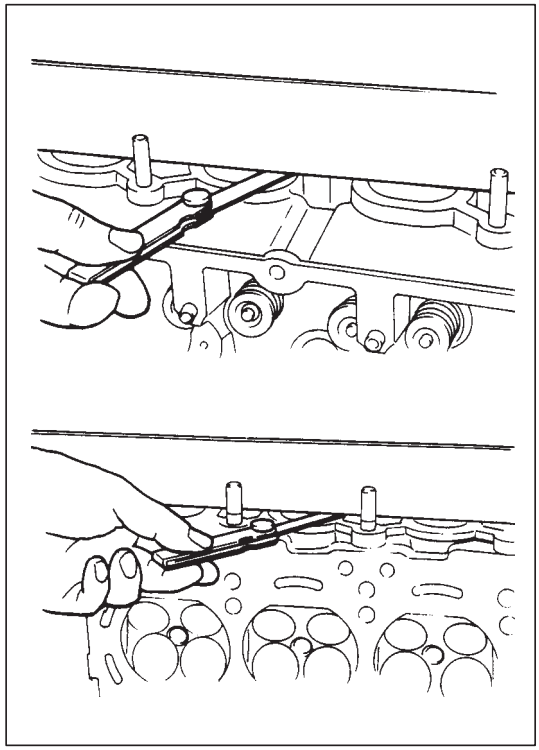
- Remove all carbon from combustion chambers.

NOTE:
Do not use any sharp-edged tool to scrape off carbon. Be careful not to scuff or nick metal surfaces when decarbonning. The same applies to valves and valve seats, too.



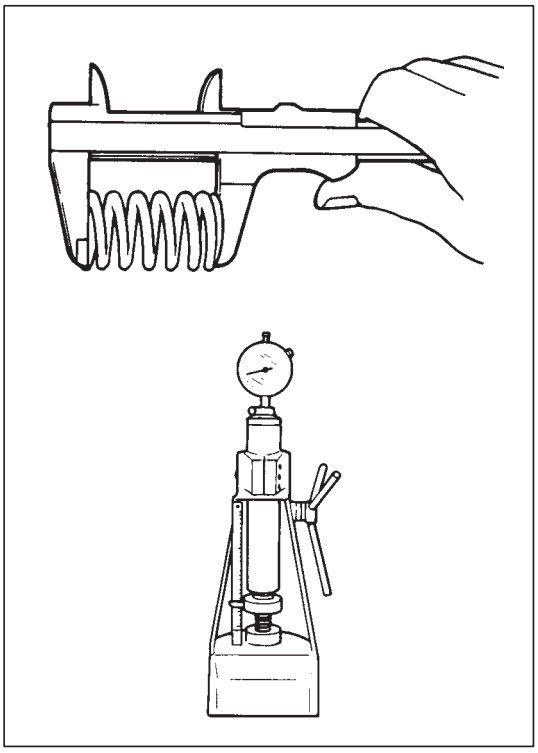
- Check cylinder head for cracks on intake and exhaust ports, combustion chambers, and head surface.
  Using straightedge and thickness gauge, check flatness of gasketed surface at a total of 6 locations. If distortion limit, given below, is exceeded, correct gasketed surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper): Place abrasive paper on and over surface plate, and rub gasketed surface against paper to grind off high spots. Should this fail to reduce thickness gauge readings to within limit, replace cylinder head.
  Leakage of combustion gases from this gasketed joint is often due to warped gasketed surface: such leakage results in reduced power output.

  Limit of distortion: 0.05 mm (0.002 in.)



- Distortion of manifold seating faces:
  Check seating faces of cylinder head for manifolds, using a straightedge and thickness gauge, in order to determine whether these faces should be corrected or cylinder head replaced.

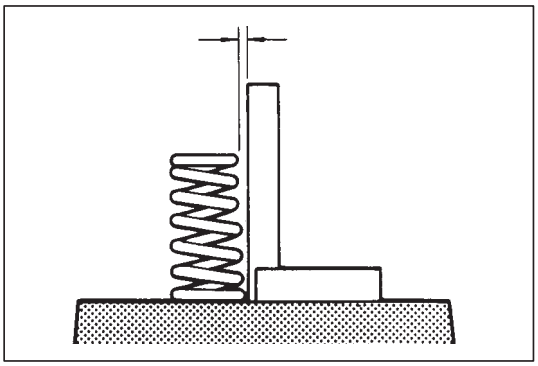
  Limit of distortion: 0.10 mm (0.004 in.)



Valve Springs

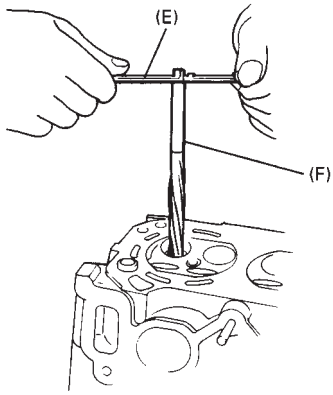
- Referring to data given below, check to be sure that each spring is in sound condition, free of any evidence of breakage or weakening. Remember, weakened valve springs can cause chatter, not to mention possibility of reducing power output due to gas leakage caused by decreased seating pressure.

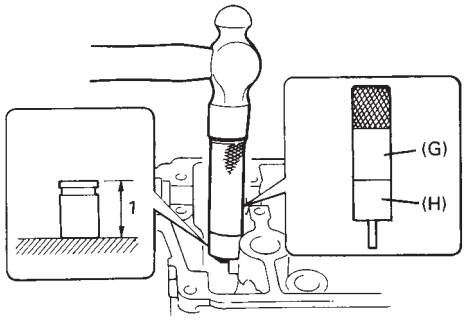
Item		Standard	Limit
Valve spring free length	Inner	36.08 mm (1.4204 in.)	35.00 mm (1.3780 in.)
	Outer	40.44 mm (1.5921 in.)	39.22 mm (1.5441 in.)
Valve spring preload	Inner	6.9 – 7.9 kg for 27.5 mm (15.2 – 17.4 lb/ 1.08 in.)	5.9 kg for 27.5 mm (13.0 lb/ 1.08 in.)
	Outer	15.4 – 17.8 kg for 31.7 mm (33.9 – 39.2 lb/ 1.25 in.)	13.3 kg for 31.7 mm (30.0 lb/ 1.25 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: **Inner spring 1.6 mm (0.063 in.)**
Outer spring 1.8 mm (0.070 in.)





1. Valve guide protrusion (13.5 mm)

ASSEMBLY

1) Before installing valve guide into cylinder head, ream guide hole with special tool (11 mm reamer) so as to remove burrs and make it truly round.

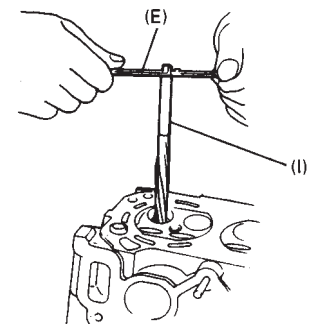
Special Tool
(E): 09916-34542
(F): 09916-38210

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 13.5 mm (0.53 in.) from cylinder head.

Special Tool
(G): 09916-58210
(H): 09917-87810

NOTE:
- **Do not reuse valve guide once disassembled. Install new valve guide (Oversize).**
- **Intake and exhaust valve guides are identical.**

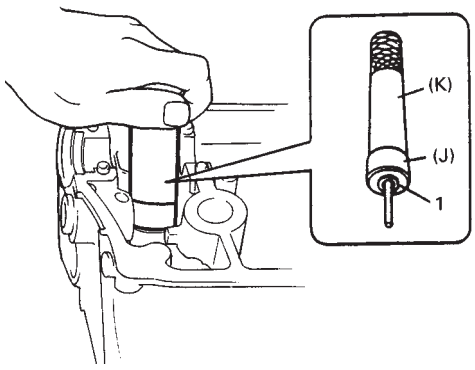
Valve guide oversize: 0.03 mm (0.0012 in.)
Valve guide protrusion (In and Ex): 13.5 mm (0.53 in.)



3) Ream valve guide bore with special tool (6.0 mm reamer). After reaming, clean bore.

Special Tool
(E): 09916-34542
(I): 09916-37810

4) Install valve spring seat to cylinder head.

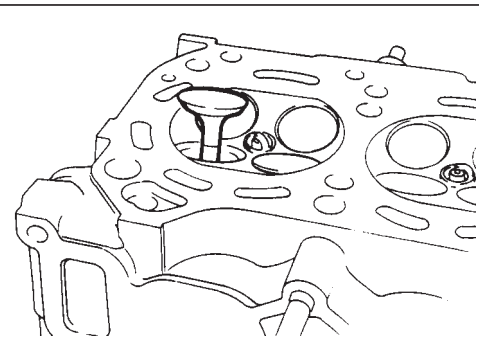


1. Valve stem seal

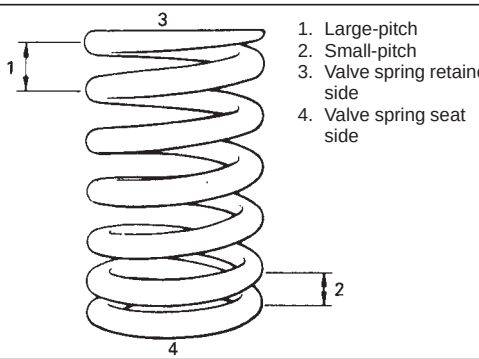
5) Install new valve stem seal to valve guide.
After applying engine oil to seal and spindle of special tool (Valve guide installer handle), fit oil seal to spindle, and then install seal to valve guide by pushing special tool by hand.
After installing, check to be sure that seal is properly fixed to valve guide.

Special Tool
(J): 09917-98221
(K): 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.**

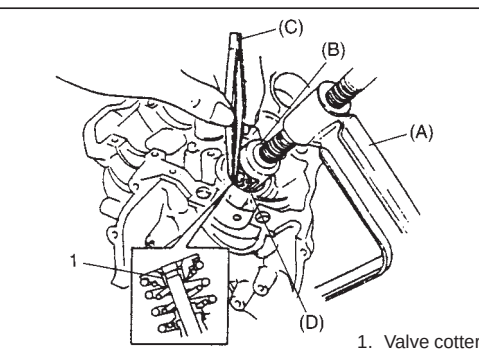


6) Install valve to valve guide.
Before installing valve to valve guide, apply engine oil to stem seal, valve guide bore, and valve stem.



1. Large-pitch
2. Small-pitch
3. Valve spring retainer side
4. Valve spring seat side

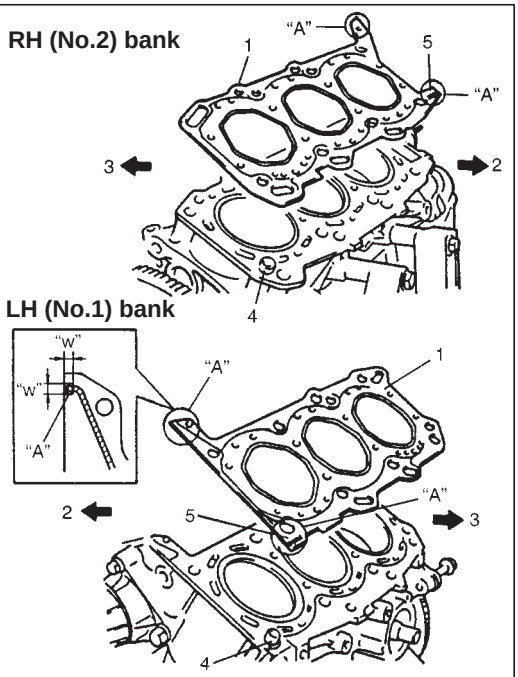
7) Install valve springs (inner and outer) and spring retainer.
Each valve spring has top end (large-pitch end) and bottom end (small-pitch end). Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).



1. Valve cotters

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
(C): 09916-84511
(D): 09919-28610



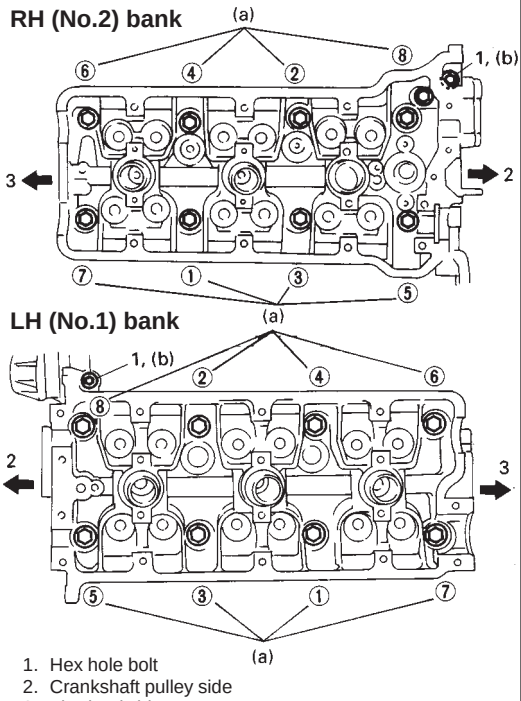
1. Cylinder head gasket
2. Crankshaft pulley side
3. Flywheel side
4. Knock pin
5. "86FA" mark

INSTALLATION

1) Clean mating surface on cylinder head and cylinder block. Remove oil, old gasket and dust from mating surface.
2) Install knock pin to cylinder block.
3) Apply sealant "A" to cylinder head gasket as shown in figure.

   "A": Sealant 99000-31150
   Width "w": Min. 4 mm (0.158 in.)

4) Install new cylinder head gasket to cylinder block as shown in figure. "86FA" mark on cylinder head gasket should face up (toward cylinder head side).



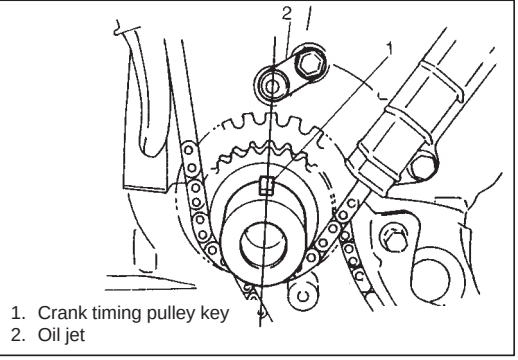
1. Hex hole bolt
2. Crankshaft pulley side
3. Flywheel side

5) Install cylinder head to block.
   After applying oil to cylinder head bolts, tighten them gradually as follows.
   (1) Tighten all bolts to 53 N·m (5.3 kg-m, 38.5 lb-ft) according to numerical order in figure.
   (2) In the same manner as in (1), tighten them to 84 N·m (8.4 kg-m, 61.0 lb-ft).
   (3) Loosen all bolts until tightening torque is reduced to 0 in reverse order of tightening.
   (4) In the same manner as in (1), tighten them to 53 N·m (5.3 kg-m, 38.5 lb-ft).
   (5) In the same manner as in (1) again, tighten them to specified torque.

   Tightening Torque
   (a): 105 N·m (10.5 kg-m, 76.0 lb-ft)
   (b): 11 N·m (1.1 kg-m, 7.5 lb-ft)

   NOTE:
   Don't forget to install (b) bolts as shown in figure.

6) Install water outlet cap.

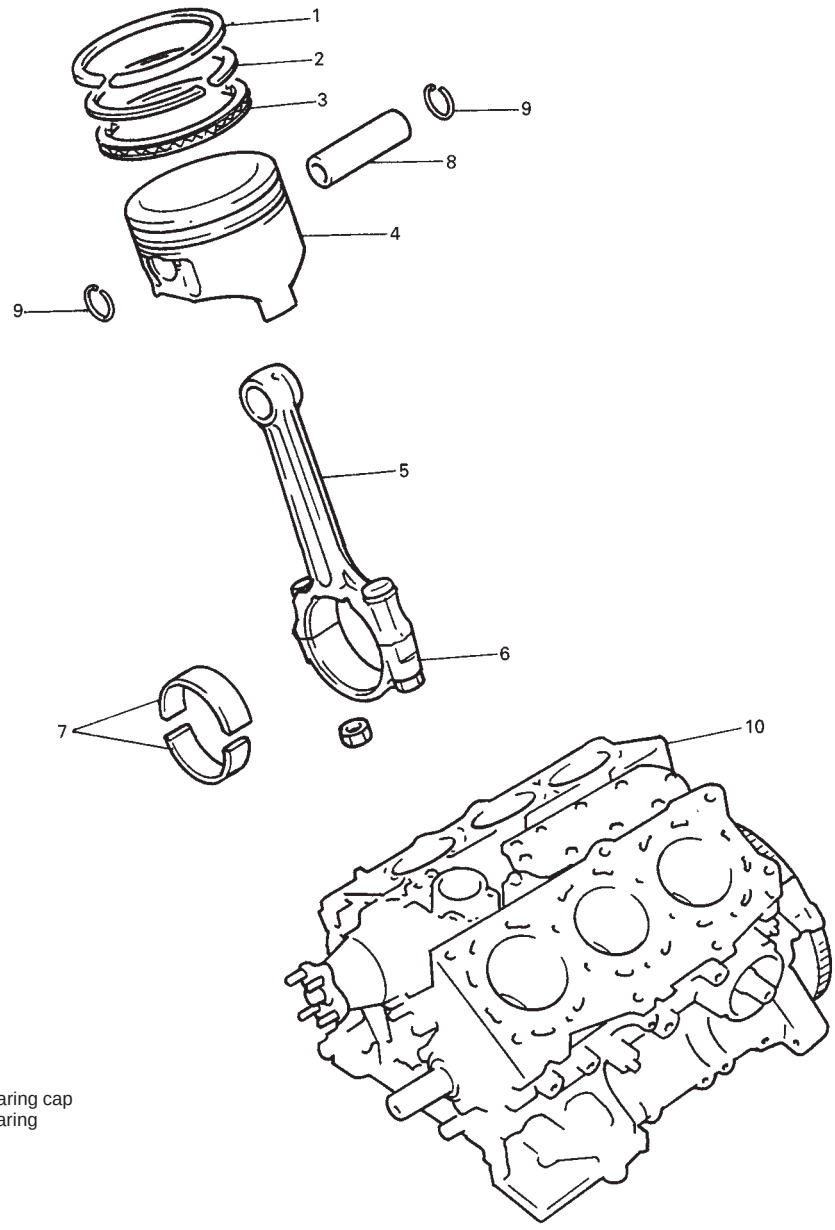


1. Crank timing pulley key
2. Oil jet

7) Check timing mark on crankshaft as shown in figure.

8) Install valve lash adjuster, camshaft, CMP sensor and RH bank 2nd timing chain.
   Refer to item “CAMSHAFT AND VALVE LASH ADJUSTER” and “RH (NO.2) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER” in this section. For CMP sensor, refer to Section 6F2 for installation.
9) Install 1st timing chain.
   Refer to item “1ST TIMING CHAIN AND CHAIN TENSIONER” in this section for installation.
10) Install LH bank 2nd timing chain.
    Refer to item “LH (NO.1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER” in this section for installation.
11) Install timing chain cover.
    Refer to item “TIMING CHAIN COVER” in this section for installation.
12) Install oil pan and oil pump strainer.
    Refer to item “OIL PAN AND OIL PUMP STRAINER” in this section for installation.
13) Install cylinder head cover.
    Refer to item “CYLINDER HEAD COVER” in this section for installation.
14) Install exhaust manifold.
    Refer to item “EXHAUST MANIFOLD” in this section for installation.
15) Install radiator outlet pipe radiator, cooling fan and water hose.
    Refer to Section 6B installation.
16) Install throttle body and intake manifold.
    Refer to item “THROTTLE BODY AND INTAKE MANIFOLD” in this section for installation.
17) Adjust water pump drive belt tension.
    Refer to Section 6B for adjusting procedure.
18) Adjust power steering pump drive belt tension.
    Refer to Section 3B1 for adjusting procedure.
19) Adjust accelerator cable play and A/T throttle cable play. Refer to Section 6E2.
20) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
21) Refill engine with engine oil, referring to item “ENGINE OIL CHANGE” in Section 0B.
22) Refill cooling system referring to Section 6B.
23) Refill front differential housing with gear oil if drained, referring to “DIFFERENTIAL” section.
24) Connect negative cable at battery.
25) Check ignition timing and adjust as necessary, referring to Section 6F2.
26) Verify that there is no fuel leakage, water leakage, oil leakage and exhaust gas leakage at each connection.
27) Check wheel alignment, referring to Section 3.

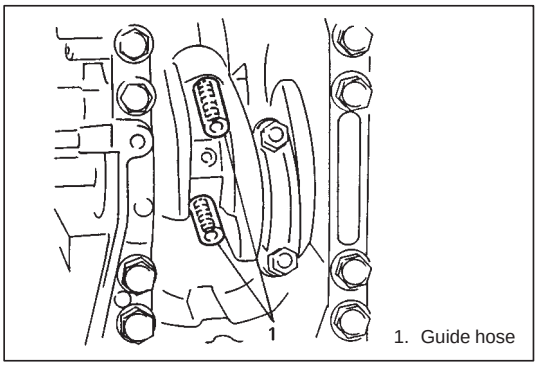
PISTON, PISTON RINGS, CONNECTING RODS AND CYLINDERS



1. Top ring
2. 2nd ring
3. Oil ring
4. Piston
5. Connecting rod
6. Connecting rod bearing cap
7. Connecting rod bearing
8. Piston pin
9. Piston pin circlip
10. Cylinder block

REMOVAL

1) Disconnect negative cable at battery.
2) Drain engine oil.
3) Drain coolant.
4) Remove cylinder heads.
   Refer to item “VALVES AND CYLINDER HEADS” in this section for removal.
5) Remove oil pump.
   Refer to item “OIL PUMP” in this section for removal.

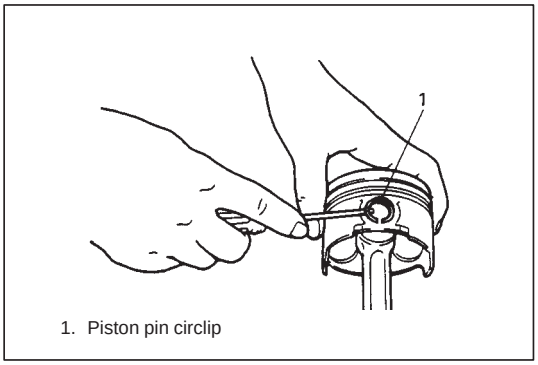


1. Guide hose

6) Mark cylinder number on all pistons, connecting rods and connecting rod caps.
7) Remove rod bearing caps.
8) Install guide hose over threads of rod bolts.
   This prevents damage to bearing journal and rod bolt threads when removing connecting rod.
9) Clean carbon from top of cylinder bore before removing piston from cylinder.
10) Push piston and connecting rod assembly out through the top of cylinder bore.

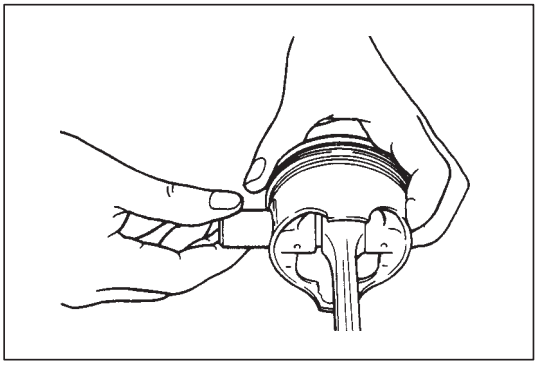
DISASSEMBLY

1) Using piston ring expander, remove two compression rings (Top and 2nd) and oil ring from piston.



1. Piston pin circlip

2) Remove piston pin from connecting rod.
   - Ease out piston pin circlips, as shown.



- Force piston pin out.

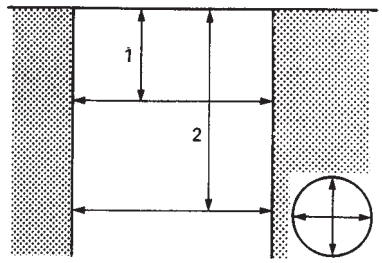
CLEANING

Clean carbon from piston head and ring grooves, using a suitable tool.

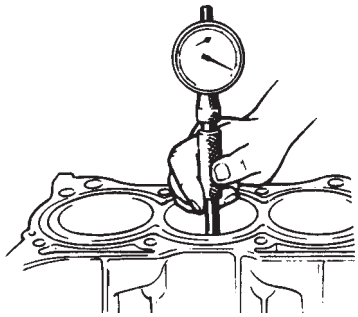
INSPECTION

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 over size piston.



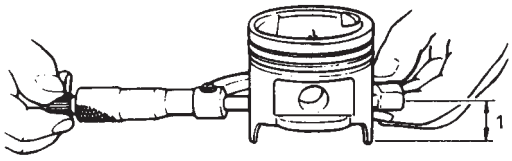
1. 50 mm (1.96 in.)
2. 95 mm (3.74 in.)



- Using a cylinder gauge, measure cylinder bore in thrust and axial directions at two positions as shown in figure.
  If any of the following conditions is noted, rebore cylinder.
  1. Cylinder bore dia. exceeds limit.
  2. Difference of measurements at two positions exceeds taper limit.
  3. Difference between thrust and axial measurements exceeds out-of-round limit.

  Cylinder bore dia. limit: 84.050 mm (3.3090 in.)
  Taper and out-of-round limit: 0.10 mm (0.004 in.)

  NOTE:
  If any one of six cylinders has to be rebored, rebore all six to the same next oversize. This is necessary for the sake of uniformity and balance.

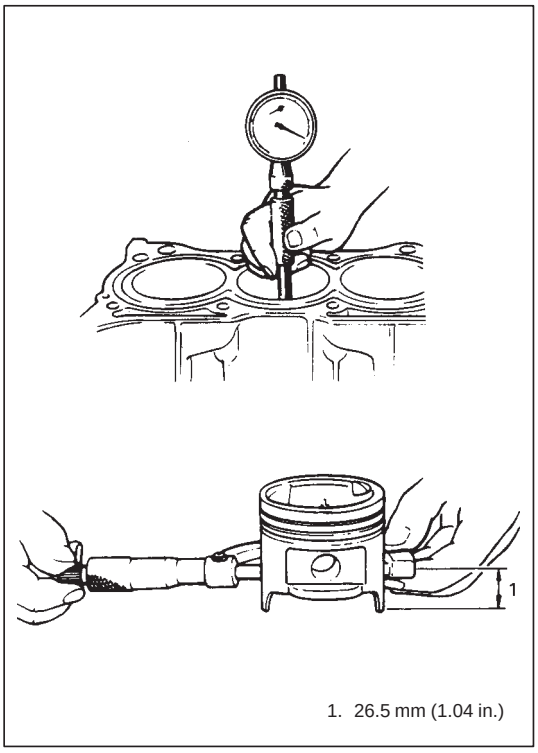


1. 26.5 mm (1.04 in.)

Pistons

- Inspect piston for faults, cracks or other damages.
  Damaged or faulty piston should be replaced.
- Piston diameter:
  As indicated in figure, piston diameter should be measured at a position 26.5 mm (1.04 in.) from piston skirt end in the direction perpendicular to piston pin.

Piston diameter	Standard	83.970 – 83.990 mm (3.3059 – 3.3067 in.)
	Oversize: 0.25 mm (0.0098 in.)	84.220 – 84.240 mm (3.3157 – 3.3165 in.)
	0.50 mm (0.0196 in.)	84.470 – 84.490 mm (3.3256 – 3.3264 in.)

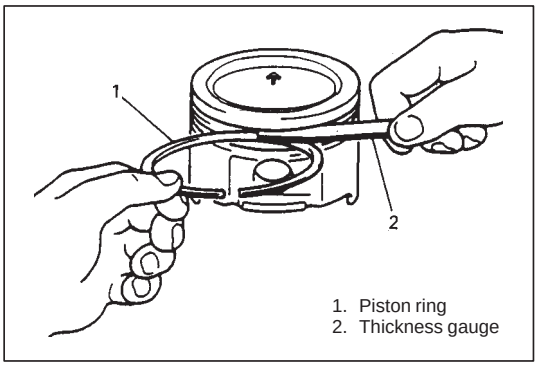


1. 26.5 mm (1.04 in.)

- Piston clearance:
  Measure cylinder bore diameter and piston diameter to find their difference which is piston clearance. Piston clearance should be within specification as given below. If it is out of specification, re-bore cylinder and use oversize piston.

  Piston clearance: 0.02 – 0.04 mm (0.0008 – 0.0015 in.)

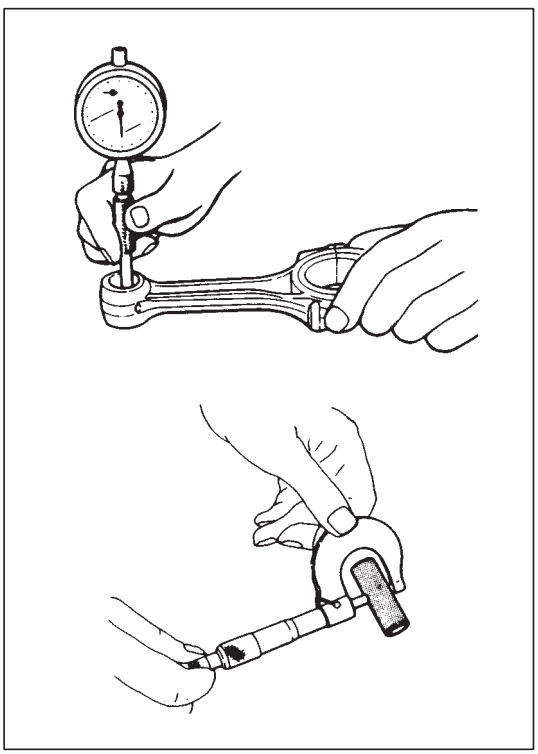
  NOTE:
  Cylinder bore diameters used here are measured in thrust direction at two positions.



1. Piston ring
2. Thickness gauge

- 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 and ring land by using thickness gauge. 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.)



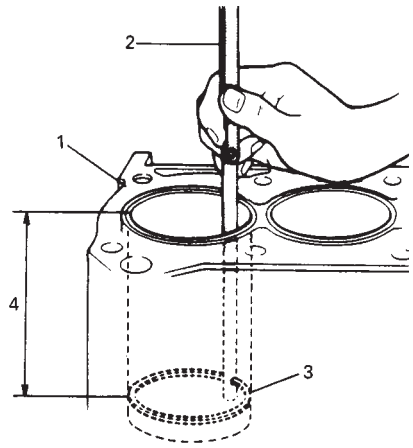
Piston Pin

- 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
Piston clearance in small end	0.003 – 0.014 mm (0.0001 – 0.0005 in.)

Small-end bore:
21.003 – 21.011 mm (0.8269 – 0.8272 in.)

Piston pin dia.:
20.997 – 21.000 mm (0.8266 – 0.8268 in.)



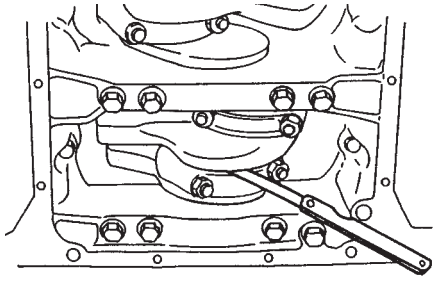
1. Cylinder block
2. Feeler gauge
3. Piston ring
4. 120 mm (4.72 in.)

Piston Rings

To measure end gap, insert piston ring into cylinder bore and then measure the gap by using thickness gauge.
If measure gap is out of specification, replace ring.

NOTE:
Clean carbon and any other dirt from top of cylinder bore before inserting piston ring.

Item		Standard	Limit
Piston ring end gap	Top ring	0.20 – 0.35 mm (0.0079 – 0.0137 in.)	0.7 mm (0.0276 in.)
	2nd ring	0.35 – 0.50 mm (0.0138 – 0.0196 in.)	0.7 mm (0.0276 in.)
	Oil ring	0.20 – 0.70 mm (0.0079 – 0.0275 in.)	1.8 mm (0.0709 in.)



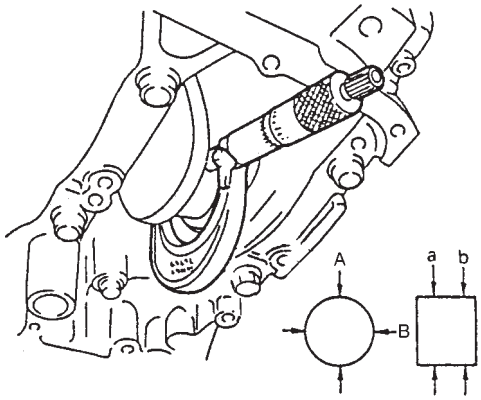
Connecting Rod

- 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 connecting rod.

Item	Standard	Limit
Big-end side clearance	0.25 – 0.40 mm (0.0099 – 0.0157 in.)	0.45 mm (0.0177 in.)

- Connecting rod alignment:
  Mount connecting rod on aligner to check it for bow and twist. If limit is exceeded, replace it.

  Limit on bow: 0.05 mm (0.0020 in.)
  Limit on twist: 0.10 mm (0.0039 in.)

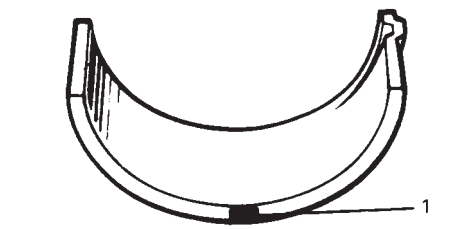


Crank Pin and Connecting Rod Bearings

- Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged, or out-of-round or taper is out of limit, replace crankshaft or regrind crank pin referring to following step 6).

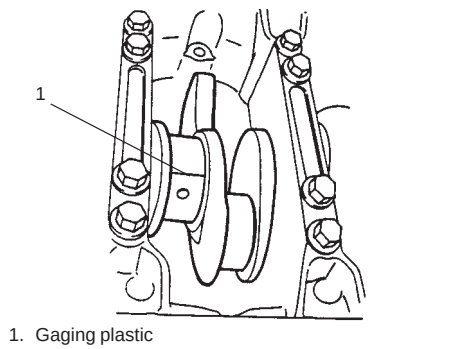
Connecting rod bearing size	Crank pin diameter
Standard	49.982 – 50.000 mm (1.9678 – 1.9685 in.)
0.25 mm (0.0098 in.) undersize	49.732 – 49.750 mm (1.9580 – 1.9586 in.)

Out-of-round: A – B
Taper limit : a – b
Out-of-round and taper limit: 0.01 mm (0.0004 in.)



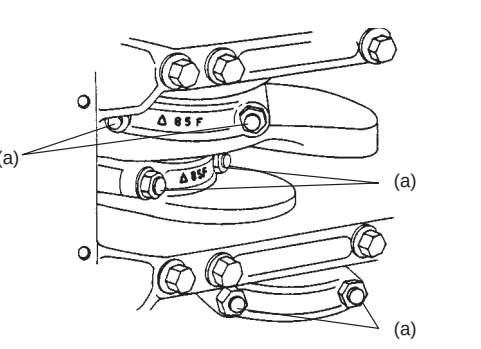
1. Red paint

- 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. For identification of undersize bearing, it is painted red at the position as indicated in figure, undersize bearing thickness is 1.605 – 1.615 mm (0.0632 – 0.0635 in.) at the center of it.



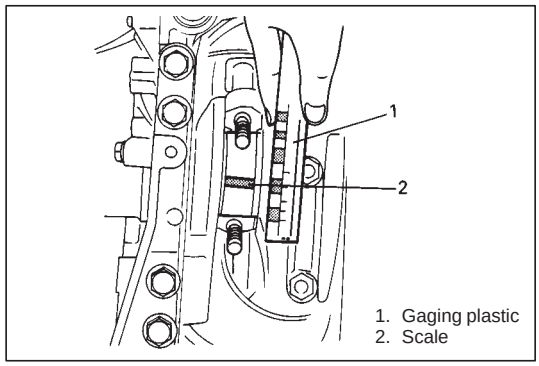
1. Gaging plastic

- 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 to full width of crank pin as contacted by bearing (parallel to crankshaft), avoiding oil hole.



  4) Install rod bearing cap to connecting rod.
     When installing cap, be sure to point arrow mark on cap to crankshaft pulley side, 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): 45 N·m (4.5 kg-m, 32.5 lb-ft)



1. Gaging plastic
2. Scale

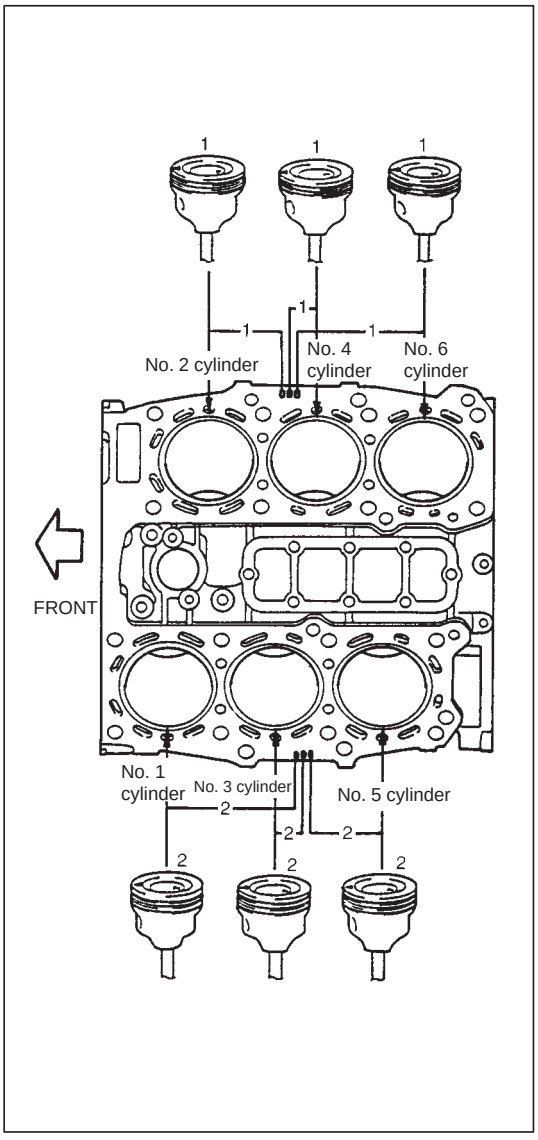
5) Remove cap and using a scale on gaging plastic envelope, measure gaging plastic width at the widest point (clearance). If clearance exceeds its limit, use a new standard size bearing and remeasure clearance.

Item	Standard	Limit
Bearing clearance	0.045 – 0.063 mm (0.0018 – 0.0025 in.)	0.08 mm (0.0031 in.)

6) If clearance can not be brought to within its limit even by using a new standard size bearing, regrind crank pin to undersize as follows.
   a) Install 0.25 mm undersize bearing to connecting rod big end.
   b) Measure bore diameter of connecting rod big end.
   c) Regrind crank pin to following finished diameter:

Finished crank pin dia.	=	Measured big end bore dia. (including under-size bearing)	–	0.054 mm (0.0021 in.)

   d) Confirm that bearing clearance is within above standard value.



ASSEMBLY

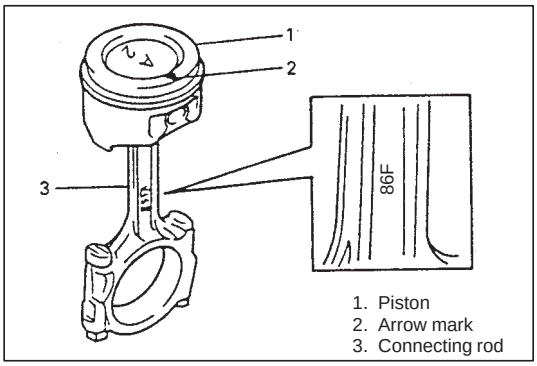
NOTE:

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 piston has stamped number (1 or 2) on its piston head. It represents outer diameter of piston.
b) There are also stamped numbers of 1 and 2 on the cylinder block as shown.
c) Stamped number on piston and cylinder block must correspond. That is, install number “2” stamped piston to cylinder which is stamped also number “2” and a number “1” piston to cylinder with number “1”.

Piston		Cylinder		Piston-to-cylinder clearance
Number at the top (mark)	Outer diameter	Number on cylinder block	Bore diameter	
1	83.98 – 83.99 mm (3.3063 – 3.3066 in.)	1	84.01 – 84.02 mm (3.3075 – 3.3078 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)
2	83.97 – 83.98 mm (3.3059 – 3.3062 in.)	2	84.00 – 84.01 mm (3.3071 – 3.3074 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)

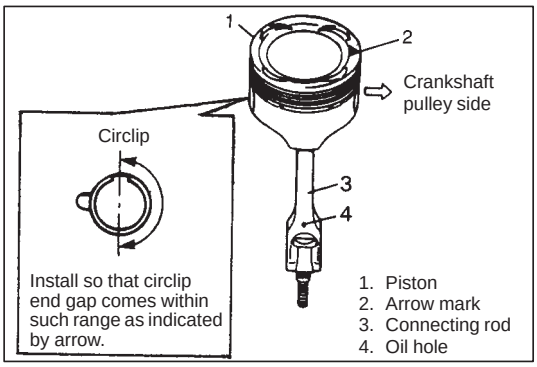
Also, a letter A, B or C is stamped on piston head but ordinarily it is not necessary to distinguish each piston by this letter.



1. Piston
2. Arrow mark
3. Connecting rod

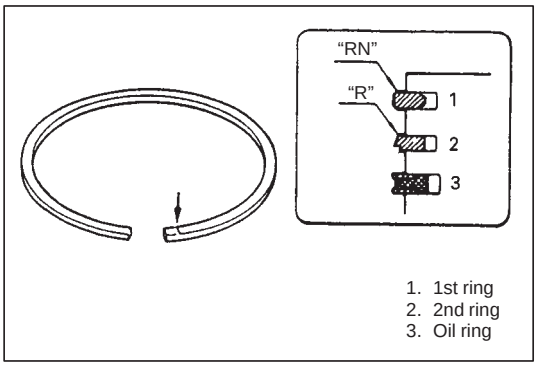
1) Install piston pin to piston and connecting rod:
After applying engine oil to piston pin and piston pin holes in piston and connecting rod, fit connecting rod to piston as shown in figure and insert piston pin to piston and connecting rod, and install piston pin circlips.

NOTE:
- **"86F" mark on connecting rod must face toward crankshaft pulley side.**



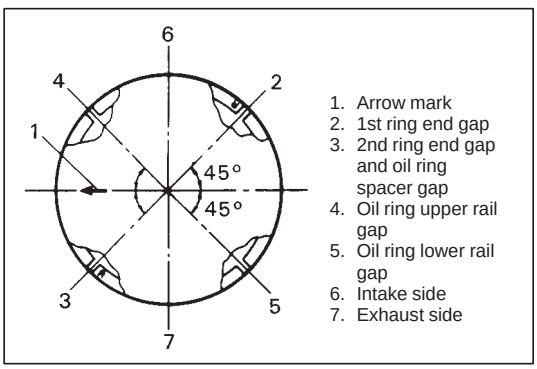
1. Piston
2. Arrow mark
3. Connecting rod
4. Oil hole

- **Install circlip with its cut part facing as shown in figure.**



1. 1st ring
2. 2nd ring
3. Oil ring

2) Install piston rings to piston:
- As indicated in figure at the left, 1st and 2nd rings have "RN" or "R" mark respectively. When installing these piston rings to piston, direct marked side of each ring toward top of piston.
- 1st rings 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.



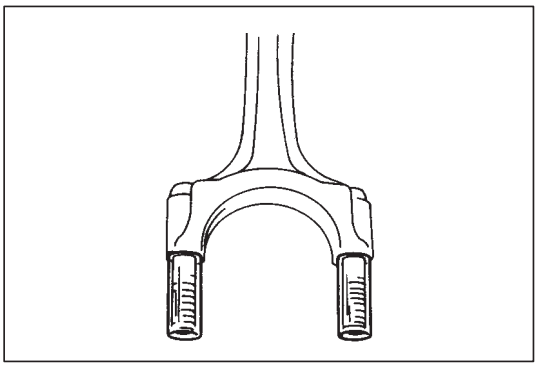
1. Arrow mark
2. 1st ring end gap
3. 2nd ring end gap and oil ring spacer gap
4. Oil ring upper rail gap
5. Oil ring lower rail gap
6. Intake side
7. Exhaust side

3) After installing three rings (1st, 2nd and oil rings), distribute their end gaps as shown in figure.

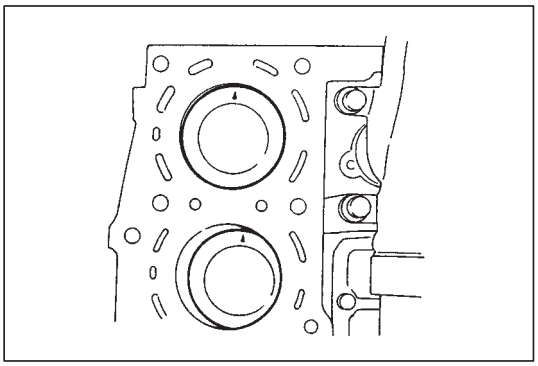
INSTALLATION

1) Apply engine oil to pistons, rings, cylinder walls, connecting rod bearings and crank pins.

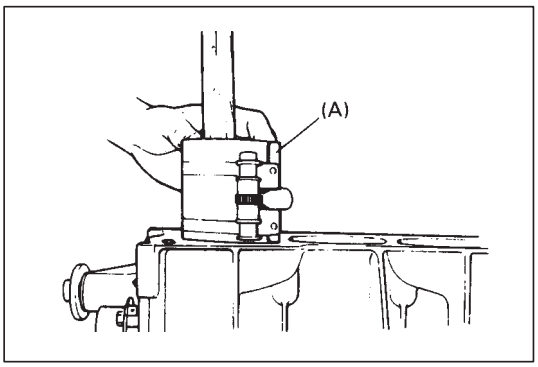
NOTE:
Do not apply oil between connecting rod and bearing or between bearing cap and bearing.



2) Install guide hoses over connecting rod bolts.
These guide hoses protect crank pin and threads of rod bolt from damage during installation of connecting rod and piston assembly.

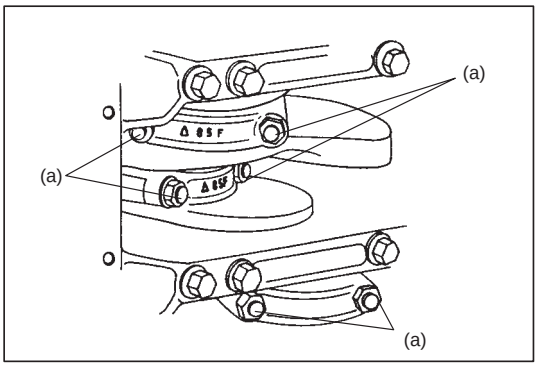


3) When installing piston and connecting rod assembly into cylinder bore, point arrow mark on piston head to crankshaft pulley side.



4) Install piston and connecting rod assembly into cylinder bore. Use special tool (Piston ring compressor) to compress rings. Guide connecting rod into place on crankshaft.
Using a hammer handle, tap piston head to install piston into bore. Hold ring compressor firmly against cylinder block until all piston rings have entered cylinder bore.

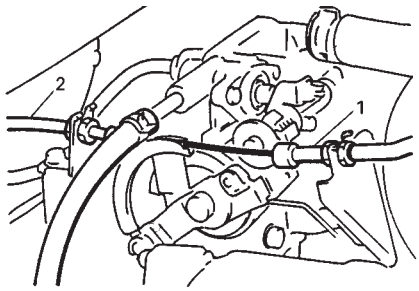
Special Tool
(A): 09916-77310



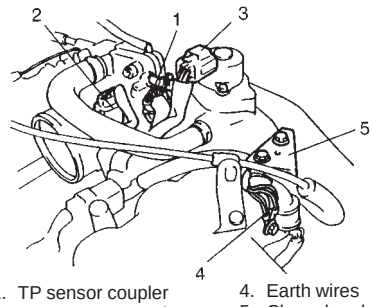
5) Install bearing cap:
Point arrow mark on cap to crankshaft pulley side.
Tighten cap nuts to specification.

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

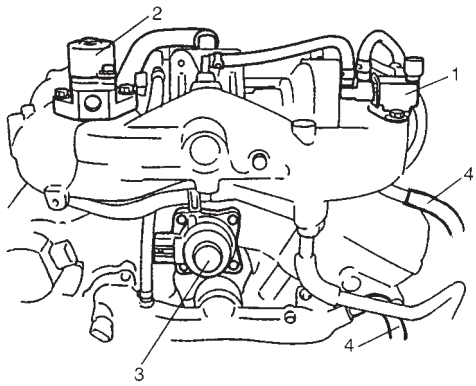
6) Install cylinder heads and oil pump to cylinder block.
   Refer to item “VALVES AND CYLINDER HEADS” and “OIL PUMP” in this section.
7) Install valve lash adjusters, camshafts and RH bank 2nd timing chain.
   Refer to item “CAMSHAFT AND VALVE LASH ADJUSTER” and “RH (NO.2.) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER” in this section for installation.
8) Install 1st timing chain.
   Refer to item “1ST TIMING CHAIN AND CHAIN TENSIONER” in this section for installation.
9) Install LH bank 2nd timing chain.
   Refer to item “LH (NO.1) BANK 2ND TIMING CHAIN AND CHAIN TENSIONER” in this section for installation.
10) Install timing chain cover.
    Refer to item “TIMING CHAIN COVER” in this section for installation.
11) Install oil pan and pump strainer.
    Refer to item “OIL PAN AND OIL PUMP STRAINER” in this section for installation.
12) Install cylinder head cover.
    Refer to item “CYLINDER HEAD COVER” in this section for installation.
13) Install exhaust manifold.
    Refer to item “EXHAUST MANIFOLD” in this section for installation.
14) Install radiator outlet pipe, radiator, cooling fan and water hose.
    Refer to Section 6B for installation.
15) Install throttle body and intake manifold.
    Refer to item “THROTTLE BODY AND INTAKE MANIFOLD” in this section for installation.
16) Adjust water pump drive belt tension.
    Refer to Section 6B for adjusting procedure.
17) Adjust power steering pump drive belt tension.
    Refer to Section 3B1 for adjusting procedure.
18) Adjust accelerator cable play and A/T throttle cable play. Refer to Section 6E2.
19) Check to ensure that all removed parts are back in place.
    Reinstall any necessary parts which have not been reinstalled.
20) Refill engine with engine oil, referring to item “ENGINE OIL CHANGE” in Section 0B.
21) Refill cooling system referring to Section 6B.
22) Refill front differential housing with gear oil if drained, referring to “DIFFERENTIAL” section.
23) Connect negative cable at battery.
24) Check ignition timing and adjust as necessary, referring to Section 6F2.
25) Verify that there is no fuel leakage, water leakage, oil leakage and exhaust gas leakage at each connection.
26) Check wheel alignment, referring to Section 3.



1. Accelerator cable
2. A/T throttle cable



1. TP sensor coupler
2. MAF sensor coupler
3. IAC valve coupler
4. Earth wires
5. Clamp bracket



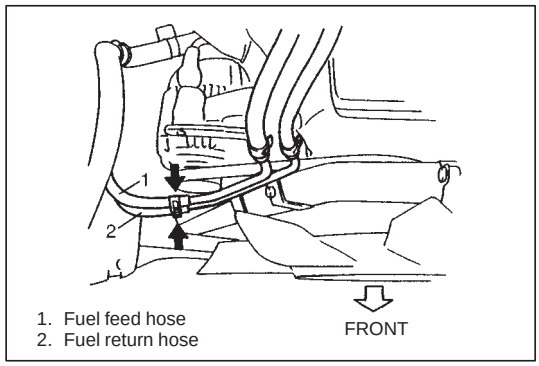
1. EVAP canister purge valve
2. IAC valve
3. EGR valve
4. Heater hose

UNIT REPAIR OVERHAUL

ENGINE ASSEMBLY

REMOVAL

1) Release fuel pressure in fuel feed line. Refer to Section 6.
2) Disconnect negative cable at battery.
3) Remove engine hood.
4) Drain engine oil.
5) Drain coolant.
6) Remove radiator, radiator fan shroud, cooling fan and radiator reservoir. Refer to Section 6B for removal.
7) Disconnect accelerator cable and A/T throttle cable (for A/T vehicle) from throttle body.
8) Remove strut tower bar and surge tank cover.
9) Disconnect IAT sensor coupler then remove air cleaner upper case, intake air hose, intake air pipe and surge tank pipe as a component.
10) Remove engine oil level gauge guide and A/T fluid level gauge guide (for A/T vehicle).
11) Remove ignition coil covers.
12) Disconnect following electric lead wires:
    - Injector wire coupler
    - CMP sensor coupler
    - Ignition coil couplers
    - CKP sensor coupler
    - MAP sensor coupler
    - TP sensor coupler
    - MAF sensor coupler
    - IAC valve coupler
    - Earth wire from surge tank
    - EVAP canister purge valve coupler
    - EGR valve coupler
    - Oxygen sensor -1 and -2 couplers (Refer to “Exhaust Manifold” in this section for disconnection)
    - Coolant temperature sensor coupler
    - Generator wires
    - Startor wires
    - Oil pressure wire
    - P/S pump wire
    - Earth wire from generator bracket
13) Remove clamps and brackets.
14) Disconnect following hoses:
    - Heater hose from heater water pipe
    - Heater hose from water outlet cap
    - EVAP canister hose from canister pipe
    - Brake booster vacuum hose
    - Tank pressure control solenoid valve hose from intake manifold
15) Remove IAC valve and EVAP canister purge valve.

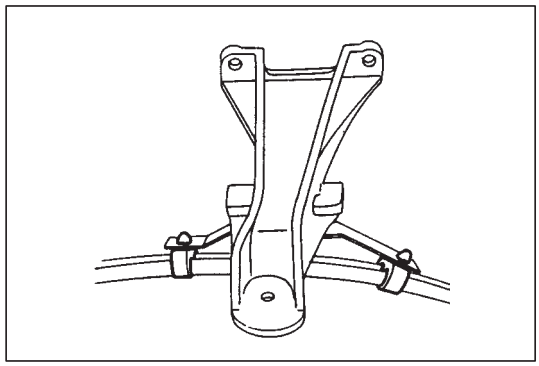


1. Fuel feed hose
2. Fuel return hose

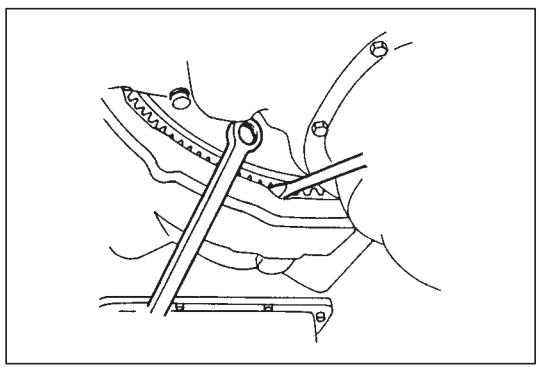
16) Disconnect following hoses at the location shown in figure:
- Fuel feed hose from fuel feed pipe
- Fuel return hose from fuel return pipe

17) Remove EVAP canister.

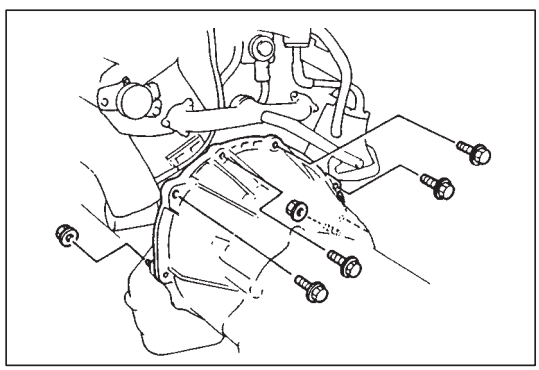
18) Remove P/S pump ass'y. Refer to Section 3B1 for details.
19) Remove A/C compressor ass'y. Refer to Section 1B for details.
20) Remove steering shaft lower assembly. Refer to Section 3C/3C1 for details.



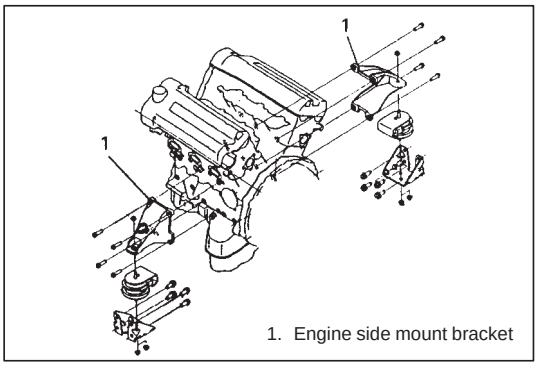
21) Raise vehicle.
22) Remove front differential housing with differential from chassis if equipped. Refer to Section 7E for removal.
23) Remove exhaust No.1 pipe. Refer to item "EXHAUST MANIFOLD" in this section for removal.
24) Remove exhaust manifold stiffener from transmission.
25) Remove A/T fluid hose clamps from engine mounting bracket. (for A/T vehicle)



26) Remove clutch housing lower plate.
27) Remove torque converter bolts (for A/T vehicle).
28) Remove starter motor.
29) Lower vehicle.



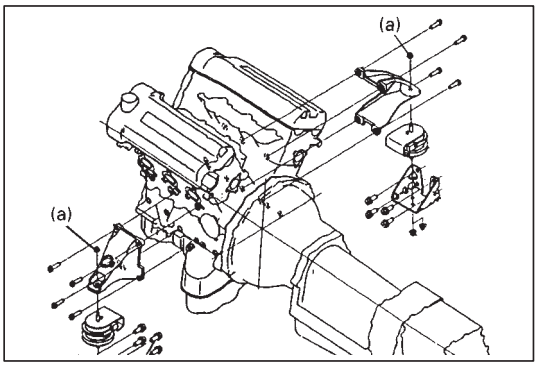
30) Support transmission. For A/T vehicle, don't jack under A/T oil pan to support transmission.
31) Remove bolts and nuts fastening cylinder block and transmission.



1. Engine side mount bracket

32) Install lifting device.
33) Disconnect engine side mounting brackets to engine mountings.

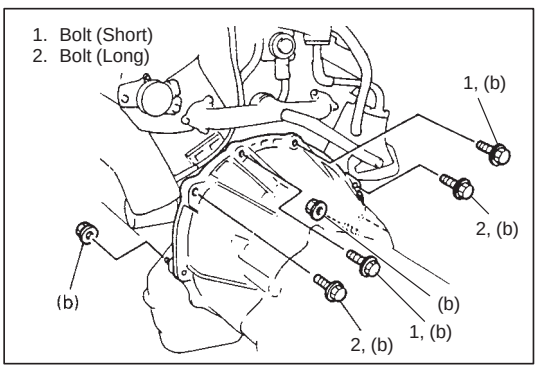
34) Before lifting engine, check to ensure all hoses, wires and cables are disconnected from engine.
35) Remove engine assembly from chassis and transmission by sliding toward front, and then, carefully hoist engine assembly.



INSTALLATION

Reverse removal procedure for installation, noting following points.
1) Lower engine assembly into engine compartment. Connect engine to transmission and engine side mounting brackets to engine mountings.
2) Tighten nuts fastening engine side mounting brackets and engine mountings.

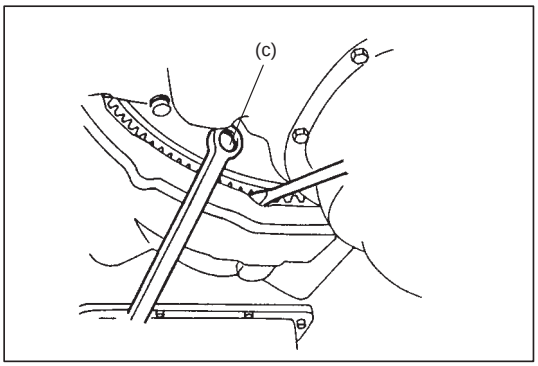
Tightening Torque
(a): 50 N·m (5.0 kg-m, 36.5 lb-ft)



3) Tighten bolts and nuts fastening cylinder block and transmission to specified torque.

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

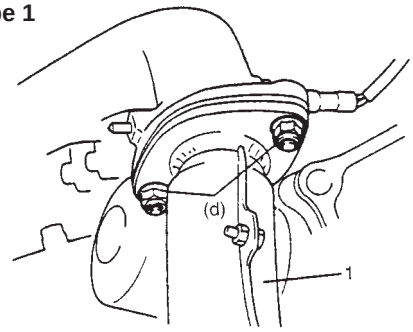
4) Remove lifting device



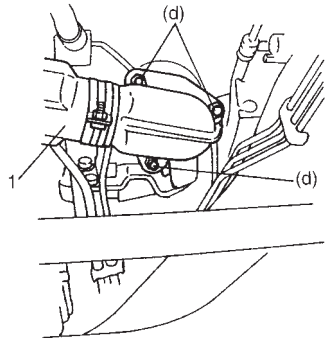
5) Tighten torque converter bolts to specified torque (for A/T vehicle).

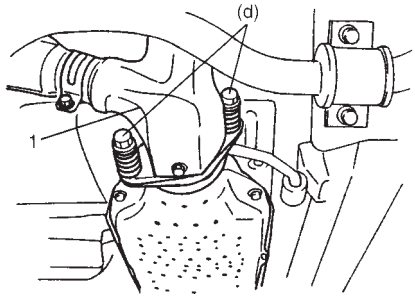
Tightening Torque
(c): 65 N·m (6.5 kg-m, 47.0 lb-ft)

Type 1



Type 2





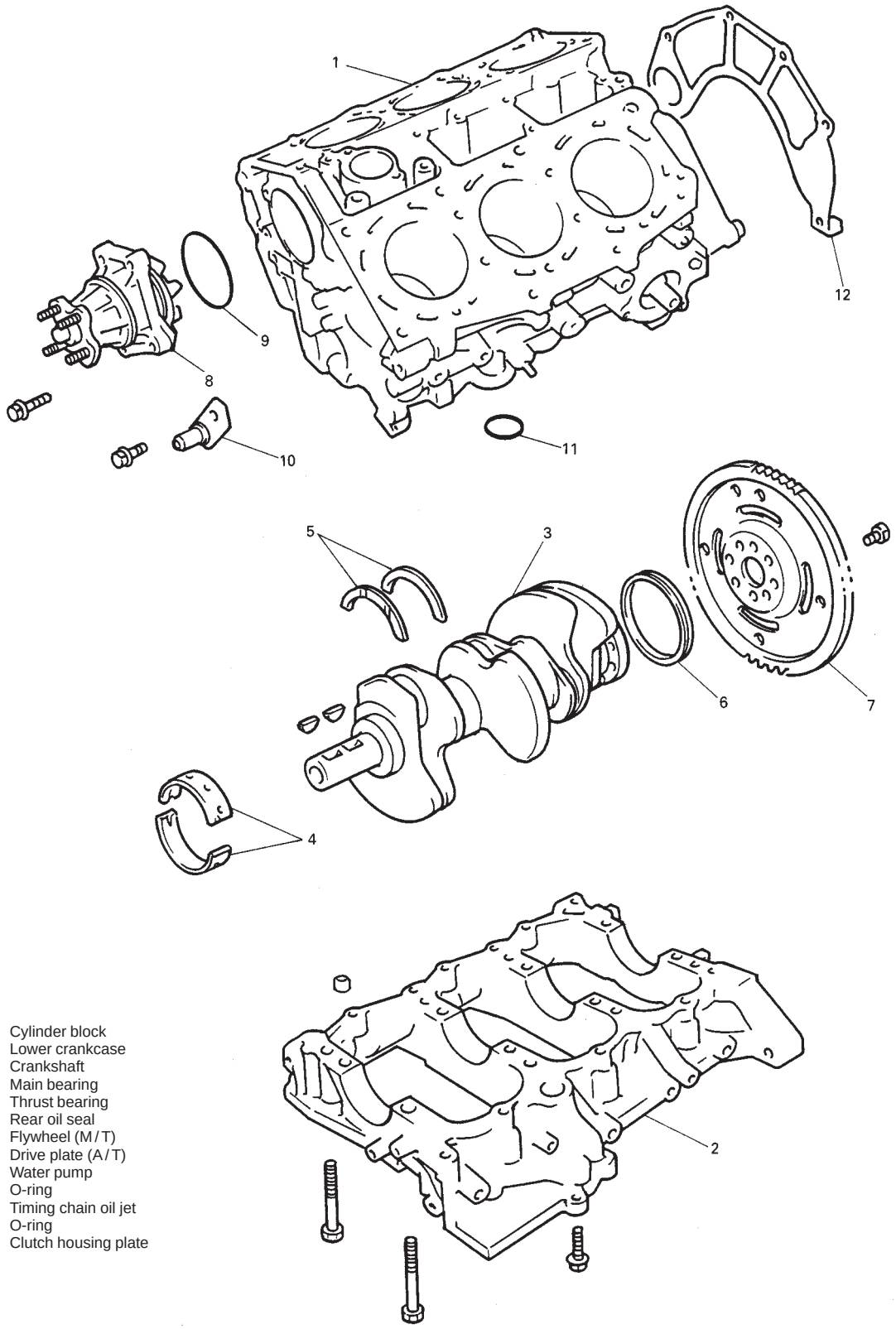
1. Exhaust No.1 pipe

6) Tighten bolts and nuts of exhaust No.1 pipe to specified torque.

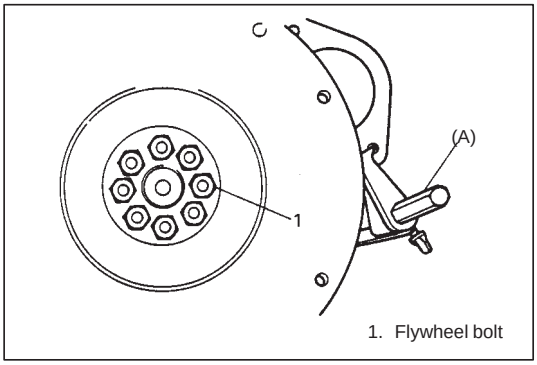
Tightening Torque
(d): 50 N·m (5.0 kg-m, 36.5 lb-ft)

7) Install front differential housing with differential to chassis if removed. Refer to Section 7E for installation.
8) Install steering shaft lower assembly. Refer to Section 3C/3C1 for details.
9) Install A/C compressor ass'y. Refer to Section 1B for details.
10) Install P/S pump ass'y. Refer to Section 3B1 for details.
11) Connect hoses, cables and electric wires.
12) Adjust accelerator cable and A/T throttle cable (for A/T vehicle) according to procedure described in Section 6E2.
13) Refill engine with engine oil referring to item "ENGINE OIL CHANGE" in Section 0B.
14) Refill cooling system, referring to Section 6B.
15) Check to ensure that all fasteners and clamps are tightened.
16) Upon completion of installation, verify that there is no fuel leakage, coolant leakage, P/S fluid leakage or exhaust gas leakage at each connection.

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK



1. Cylinder block
2. Lower crankcase
3. Crankshaft
4. Main bearing
5. Thrust bearing
6. Rear oil seal
7. Flywheel (M/T)
   Drive plate (A/T)
8. Water pump
9. O-ring
10. Timing chain oil jet
11. O-ring
12. Clutch housing plate



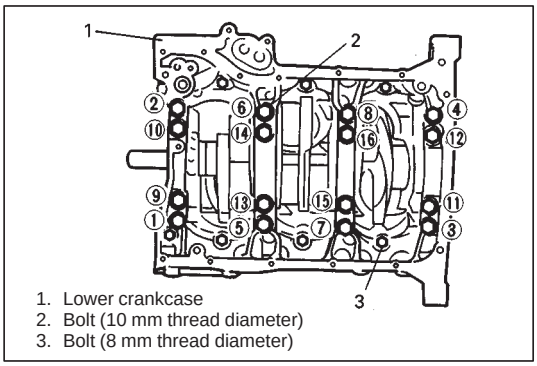
1. Flywheel bolt

REMOVAL

1) Remove engine assembly from vehicle as previously outlined.
2) Remove clutch and flywheel (for M/T vehicle) or drive plate (for A/T vehicle). For clutch removal, refer to Section 7C1.
   Using special tool (flywheel holder), remove flywheel (M/T vehicle) or drive plate (A/T vehicle).

   Special Tool
   (A): 09924-17810

3) Remove throttle body, intake manifold, exhaust manifolds.
4) Remove oil pans (lower and upper) and oil pump strainer. Refer to item “OIL PAN AND OIL PUMP STRAINER” in this section for removal.
5) Remove cylinder head cover.
6) Remove timing chain cover. Refer to item “TIMING CHAIN COVER” in this section for removal.
7) Remove timing chains and chain tensioners, LH Bank 2nd timing chain, 1st timing chain and RH Bank 2nd timing chain.
8) Remove cylinder head assembly.
9) Remove pistons and connecting rods.
10) Remove oil pump and oil pump chain.

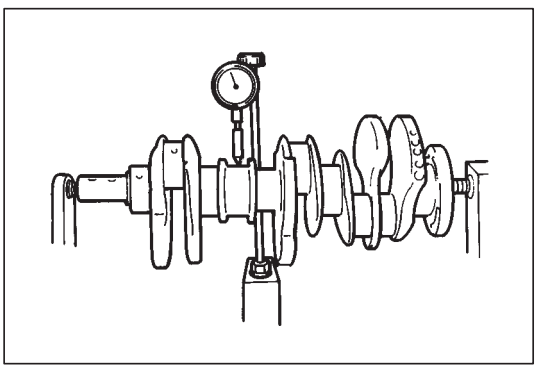


1. Lower crankcase
2. Bolt (10 mm thread diameter)
3. Bolt (8 mm thread diameter)

11) Loosen crankcase bolts, following sequence in figure and remove them.

    NOTE:
    Loosen 8 mm thread diameter bolts first, then loosen 10 mm thread diameter bolts following the order shown in figure.

12) Remove crankshaft from cylinder block.

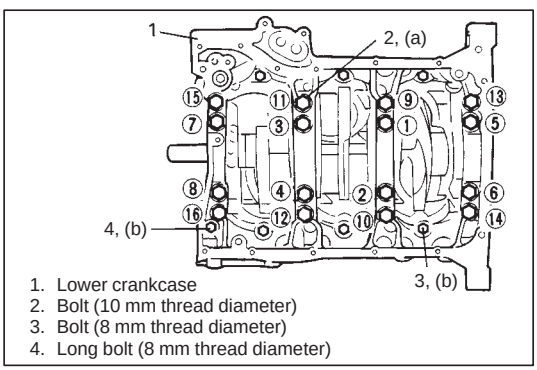


INSPECTION

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.)



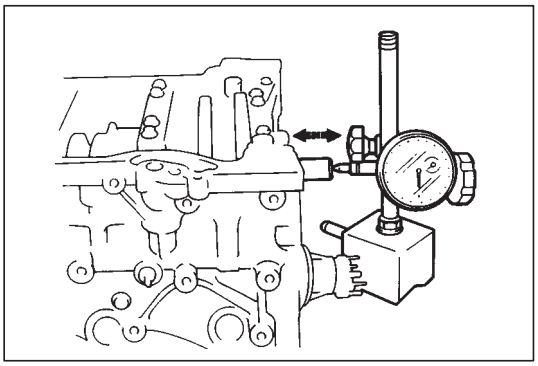
1. Lower crankcase
2. Bolt (10 mm thread diameter)
3. Bolt (8 mm thread diameter)
4. Long bolt (8 mm thread diameter)

Crankshaft thrust play

Measure this play with crankshaft set in cylinder block in the normal manner, that is, with thrust bearing and journal bearing caps installed. Tighten crankcase bolts to specified torque in such order as indicated in figure.

NOTE:
Tighten 10 mm thread diameter bolts first (following the order shown in figure), then tighten 8 mm thread diameter bolts.

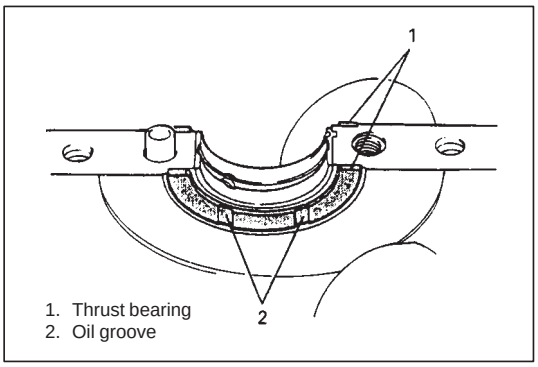
Tightening Torque
(a): 60 N·m (6.0 kg-m, 43.5 lb-ft)
(b): 27 N·m (2.7 kg-m, 19.5 lb-ft)



Use a dial gauge to read displacement in axial (thrust) direction of crankshaft.
If its limit is exceeded, replace thrust bearing with new standard one or oversize one to obtain standard thrust play.

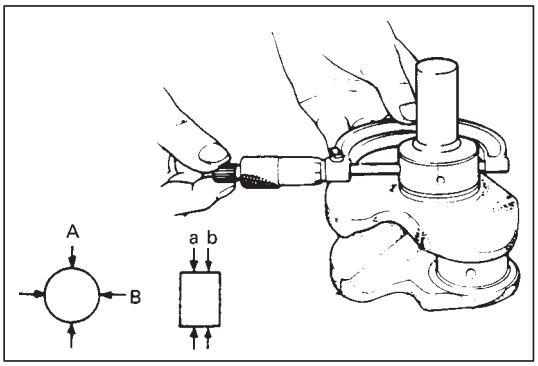
Crankshaft Thrust Play

Standard: 0.11 – 0.31 mm (0.0044 – 0.0122 in.)
Limit: 0.38 mm (0.0149 in.)



1. Thrust bearing
2. Oil groove

Item \ Thrust Bearing	Standard	Oversize 0.125 mm (0.0049 in.)
Thickness of crankshaft thrust bearing	2.500 mm (0.984 in.)	2.563 mm (0.1009 in.)



Out-of-round and taper (uneven wear) of journals

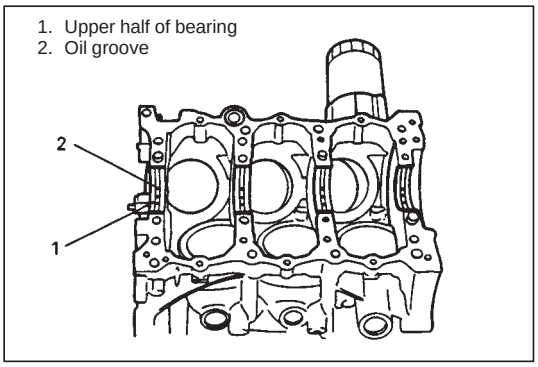
An unevenly worn crankshaft journal shows up as a difference in diameter at a cross section or along its length (or both). This difference, if any, is determined by taking micrometer readings. If any one of journals is badly damaged or if amount of uneven wear in the sense explained above exceeds its limit, regrind or replace crankshaft.

Limit on out-of-round and taper: 0.01 mm (0.0004 in.)
Out-of-round: A – B
Taper: a – b

Main Bearings

General information

- Service main bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and each of them has 5 kinds of bearings differing in tolerance.

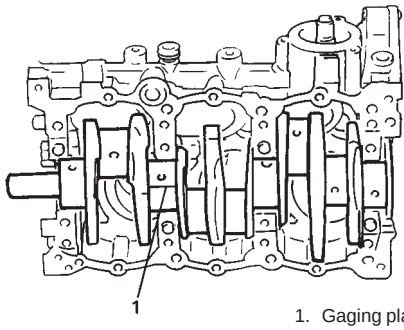


1. Upper half of bearing
2. Oil groove

- Upper half of bearing has oil groove as shown in figure. Install this half with oil groove toward cylinder block.
- Lower half of bearing does not have oil groove.

Inspect

Check bearings for pitting, scratches, wear or damage.
If any malcondition is found, replace both upper and lower halves.
Never replace either half without replacing the other half.

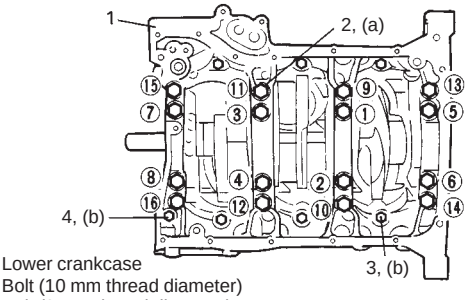


1. Gaging plastic

Main bearing clearance

Check clearance by using gaging plastic according to following procedure.

1) Remove crankcase.
2) Clean bearings and main journals.
3) Place a piece of gaging plastic to full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.



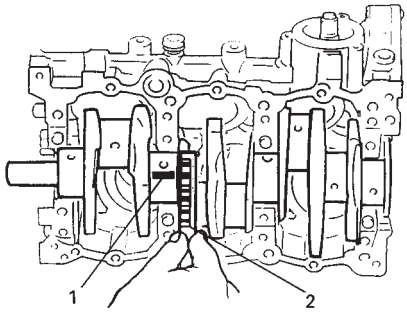
1. Lower crankcase
2. Bolt (10 mm thread diameter)
3. Bolt (8 mm thread diameter)
4. Long bolt (8 mm thread diameter)

4) Install crankcase to cylinder block.
Tighten crankcase bolts, following sequence in figure. Tighten crankcase bolts to specified torque.

NOTE:
Tighten 10 mm thread diameter bolts first (following the order shown in figure) then tighten 8 mm thread diameter bolts.

Tightening Torque
(a): 60 N·m (6.0 kg-m, 43.5 lb-ft)
(b): 27 N·m (2.7 kg-m, 19.5 lb-ft)

NOTE:
Do not rotate crankshaft while gaging plastic is installed.

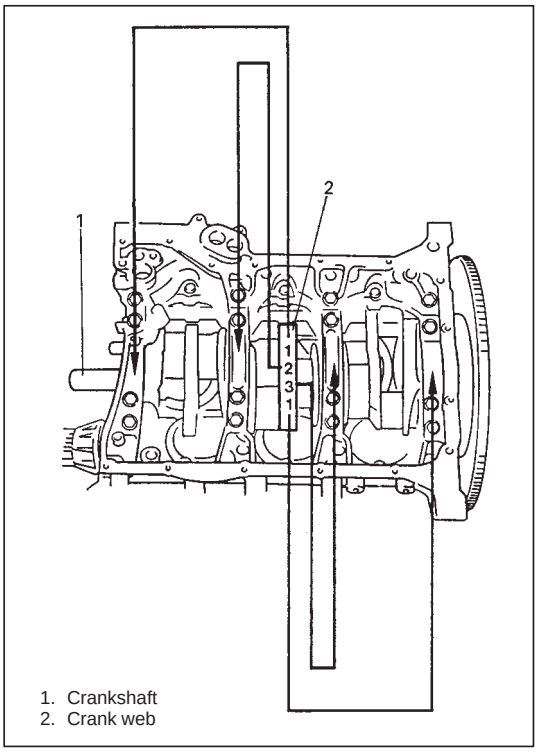


1. Gaging plastic
2. Scale

5) Remove crankcase and using scale on gaging plastic envelop, measure gaging plastic width at its widest point. If clearance exceeds its limit, replace bearing. Always replace both upper and lower inserts as a unit.
A new standard bearing may produce proper clearance. If not, it will be necessary to regrind crankshaft journal for use of 0.25 mm undersize bearing.
After selecting new bearing, recheck clearance.

Bearing Clearance

Standard: 0.026 – 0.046 mm (0.0010 – 0.0018 in.)
Limit: 0.060 mm (0.0023 in.)



1. Crankshaft
2. Crank web

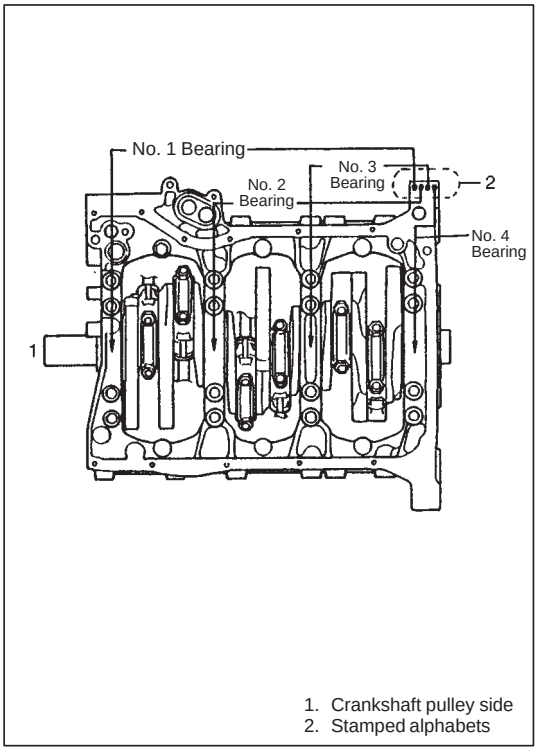
Selection of main bearings

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. As shown in figure, crank web has stamped numbers and alphabet at the center.
   Three kinds of numbers (“1”, “2” and “3”) represent following journal diameters.

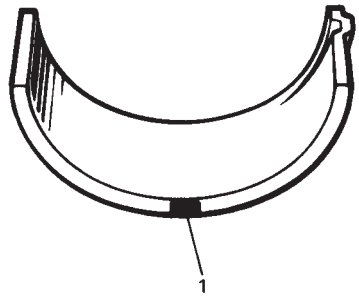
Stamped numbers	Journal diameter
1	64.994 – 65.000 mm (2.5588 – 2.5590 in.)
2	64.988 – 64.994 mm (2.5586 – 2.5588 in.)
3	64.982 – 64.988 mm (2.5583 – 2.5586 in.)



1. Crankshaft pulley side
2. Stamped alphabets

2) Next, check crankcase (bearing cap) bore diameter without bearing. On lower surface of lower crankcase 4 alphabets are stamped as shown in figure.
   Three kinds of alphabets (A, B and C) represent following cap bore diameters.

Stamped alphabet	Bearing cap bore diameter (without bearing)
A	70.000 – 70.006 mm (2.7559 – 2.7561 in.)
B	70.006 – 70.012 mm (2.7561 – 2.7563 in.)
C	70.012 – 70.018 mm (2.7563 – 2.7566 in.)



1. Paint

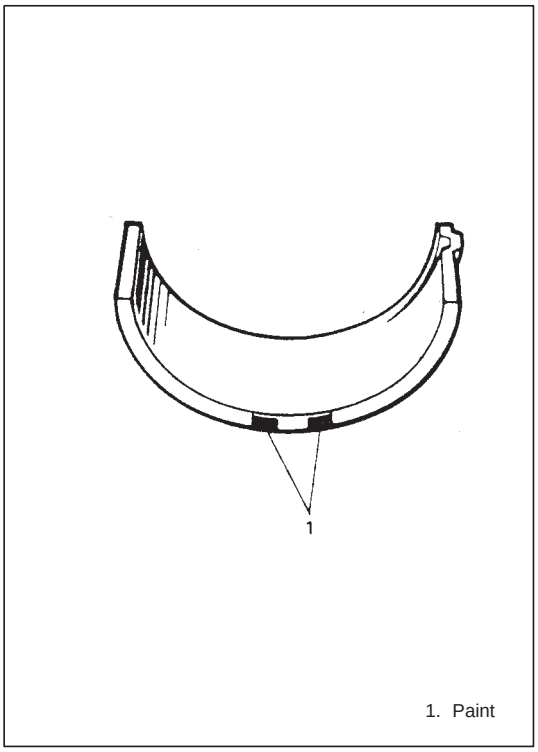
3) There are five kinds of standard bearings differing in thickness. To distinguish them, they are painted in following colors at the position as indicated in figure.
Each color indicates following thickness at the center of bearing.

Color painted	Bearing thickness
Green	2.493 – 2.497 mm (0.0982 – 0.0983 in.)
Black	2.496 – 2.500 mm (0.0983 – 0.0984 in.)
Colorless (no paint)	2.499 – 2.503 mm (0.0984 – 0.0985 in.)
Yellow	2.502 – 2.506 mm (0.0985 – 0.0986 in.)
Blue	2.505 – 2.509 mm (0.0986 – 0.0987 in.)

4) From number stamped on crank webs at its center and alphabets stamped on crankcase lower side, determine new standard bearing to be installed to journal, by referring to table shown below.
For example, if number stamped on crank webs is “1” and alphabet stamped on crankcase is “B”, install a new standard bearing painted in “Black” to its journal.

		Number stamped on crank web (Journal diameter)		
		1	2	3
Alphabet stamped on lower crankcase (Cap bore dia.)	A	Green	Black	Colorless
	B	Black	Colorless	Yellow
	C	Colorless	Yellow	Blue
		New standard bearing to be installed.		

5) Using gaging plastic, 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 and crank case due to any reason, select new standard bearings to be installed by referring to number stamped on new crankshaft or alphabets stamped on new crankcase lower side.



1. Paint

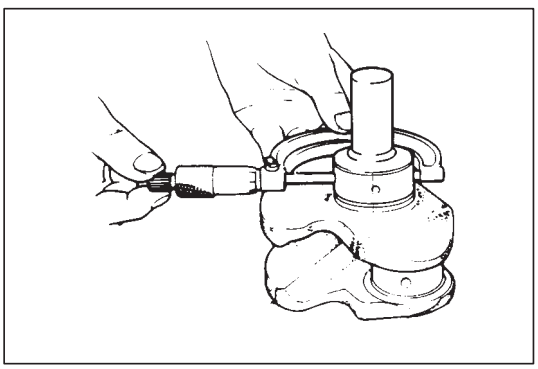
UNDERSIZE BEARING (0.25 mm):

- 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 & Red	2.618 – 2.622 mm (0.1031 – 0.1032 in.)
Black & Red	2.621 – 2.625 mm (0.1032 – 0.1033 in.)
Red only	2.624 – 2.628 mm (0.1033 – 0.1034 in.)
Yellow & Red	2.627 – 2.631 mm (0.1034 – 0.1035 in.)
Blue & Red	2.630 – 2.634 mm (0.1035 – 0.1036 in.)

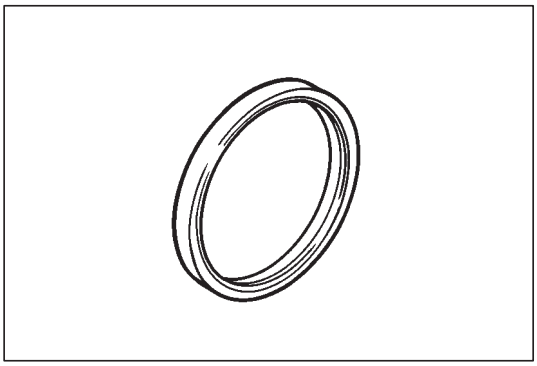
- If necessary, regrind crankshaft journal and select undersize bearing to use with it as follows.
  1) Regrind journal to following finished diameter.

Finished diameter: 64.732 – 64.750 mm (2.5485 – 2.5492 in.)



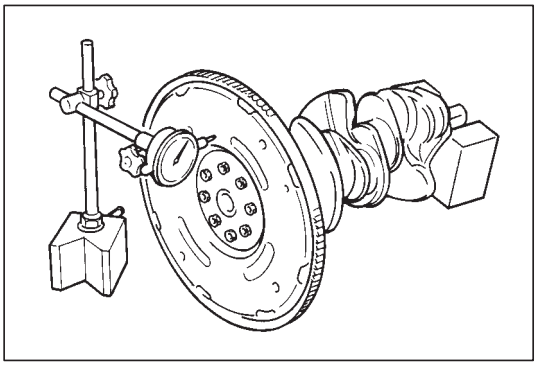
2) Using micrometer, measure reground journal diameter.
   Measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.
3) Using journal diameter measured above and alphabets stamped on lower crankcase, select an undersize bearing by referring to table given below.
   Check bearing clearance with newly selected undersize bearing.

		Measured journal diameter		
		64.744 – 64.750 mm (2.5489 – 2.5492 in.)	64.738 – 64.744 mm (2.5487 – 2.5489 in.)	64.732 – 64.738 mm (2.5485 – 2.5487 in.)
Alphabets stamped on lower crankcase	A	Green & Red	Black & Red	Red only
	B	Black & Red	Red only	Yellow & Red
	C	Red only	Yellow & Red	Blue & Red
		Undersize bearing to be installed		



Rear Oil Seal

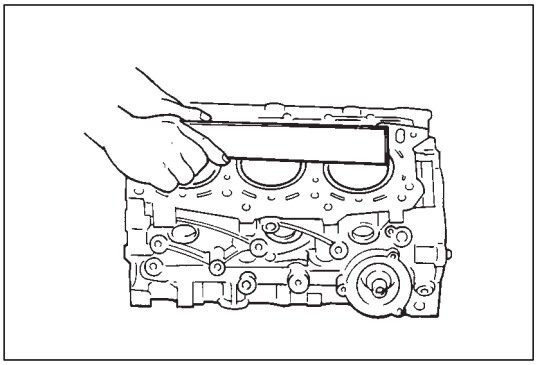
Carefully inspect oil seal for wear or damage. If lip portion is worn or damaged, replace oil seal.



Flywheel

- If ring gear is damaged, cracked or worn, replace flywheel.
- If the surface contacting clutch disc is damaged, or excessively worn, replace flywheel.
- Check flywheel for face runout with a dial gauge.
  If runout exceeds its limit, replace flywheel.

  Limit on runout: 0.2 mm (0.0078 in.)

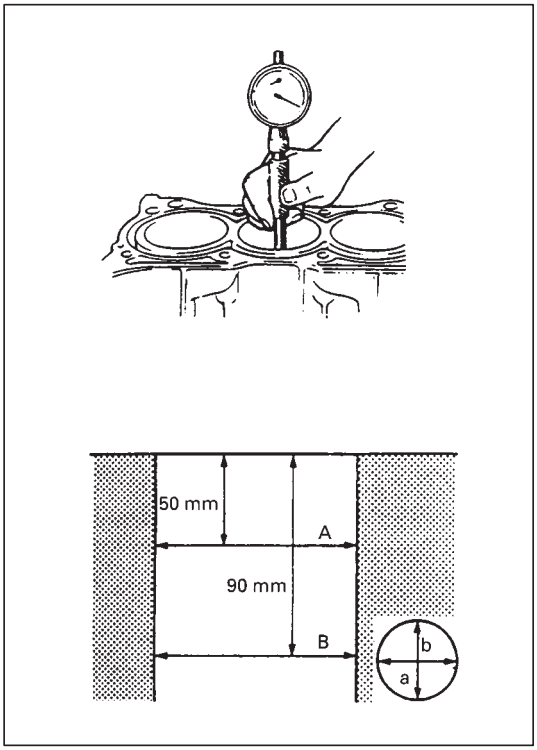


Cylinder Block

Distortion of gasketed surface

- Using straightedge and thickness gauge, check gasketed surface for distortion and, if flatness exceeds its limit, correct it.

  Flatness Limit: 0.06 mm (0.0024 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.

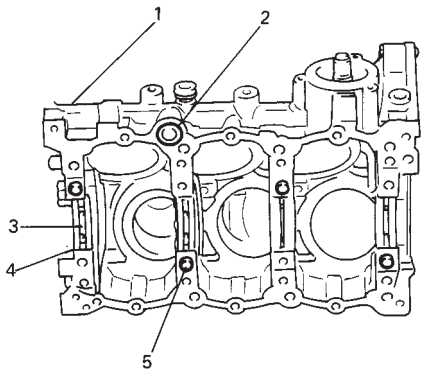
Size	Piston diameter
STD	83.970 – 83.990 mm (3.3059 – 3.3067 in.)
O/S 0.25	84.220 – 84.240 mm (3.3157 – 3.3165 in.)
O/S 0.50	84.470 – 84.490 mm (3.3256 – 3.3264 in.)

3) Using micrometer, measure piston diameter.
4) Calculate cylinder bore diameter to be rebored as follows.
   D = A + B – C
   D: Cylinder bore diameter to be rebored
   A: Piston diameter as measured
   B: Piston clearance = 0.02 – 0.04 mm (0.0008 – 0.0015 in.)
   C: Allowance for honing = 0.02 mm (0.0008 in.)

5) Rebore and hone cylinder to calculated dimension.

NOTE:
Before reboring, install all main bearing caps in place and tighten to specification to avoid distortion of bearing bores.

6) Measure piston clearance after honing.



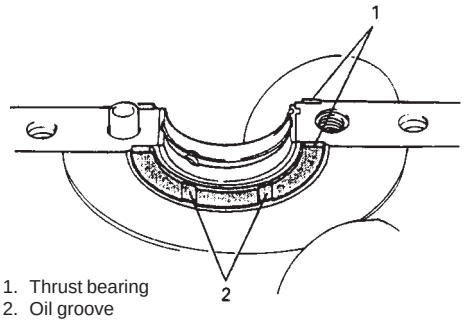
1. Cylinder block
2. O-ring
3. Oil groove
4. Bearing
5. Knock pin

INSTALLATION

NOTE:

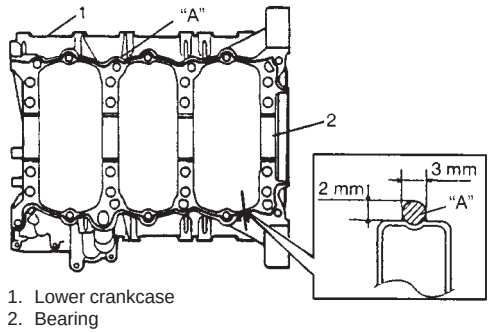
- **All parts to be installed must be perfectly clean.**
- **Be sure to oil crankshaft journals, journal bearings, thrust bearings, crank pins, connecting rod bearings, pistons, piston rings and cylinder bores.**
- **Journal bearings, crankcase (bearings caps), connecting rods, rod bearings, rod bearing caps, pistons and piston rings are in combination sets. Do not disturb combination and try to see that each part goes back to where it came from, when installing.**
- **Clean mating surface of cylinder block and crankcase, remove oil, old sealant and dust from mating surface.**

1) Fit main bearings to cylinder block.
   One of two halves of main bearing, has oil groove. Install this half with oil groove to cylinder block, and another half without oil groove to crankcase.
   Make sure that two halves are painted in the same color.
2) Install O-ring to cylinder block.



1. Thrust bearing
2. Oil groove

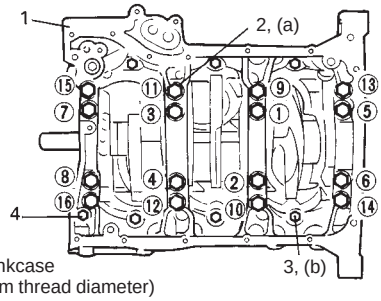
3) Fit thrust bearings to cylinder block between No.2 and No.3 cylinders. Face oil groove sides to crank webs.
4) Put crankshaft to cylinder block.



1. Lower crankcase
2. Bearing

5) Apply sealant "A" to crankcase mating surface area as shown in figure.

"A": Sealant 99000-31150



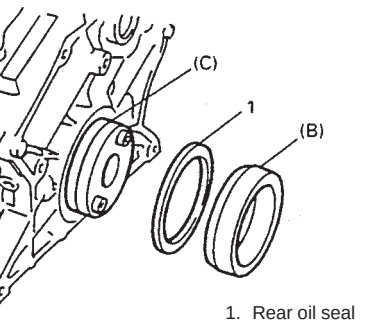
1. Lower crankcase
2. Bolt (10 mm thread diameter)
3. Bolt (8 mm thread diameter)
4. Long bolt (8 mm thread diameter)

6) Install crankcase to cylinder block. Apply oil to crankcase bolts before installing them. Tighten crankcase bolts, following sequence in figure. Tighten crankcase bolts to specified torque.

NOTE:
Tighten 10 mm thread diameter bolts first (following the order shown in figure), then tighten 8 mm thread diameter bolts.

Tightening Torque
(a): 60 N·m (6.0 kg-m, 43.5 lb-ft)
(b): 27 N·m (2.7 kg-m, 19.5 lb-ft)

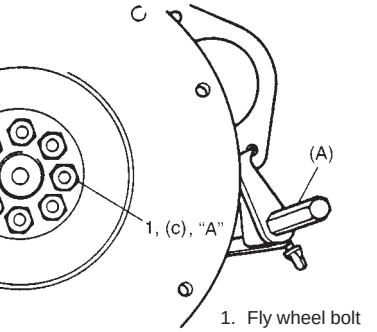
NOTE:
After tightening crankcase bolts, check to be sure that crankshaft rotates smoothly when turned by hand.



1. Rear oil seal

7) Using special tools (Oil seal installer and oil seal guide), install rear oil seal.

Special Tool
(B): 09911-97810
(C): 09911-97710



1. Fly wheel bolt

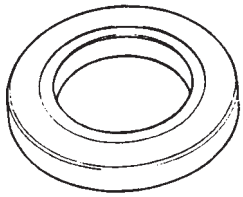
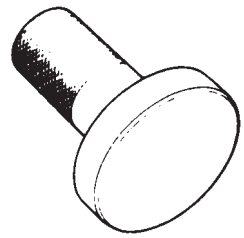
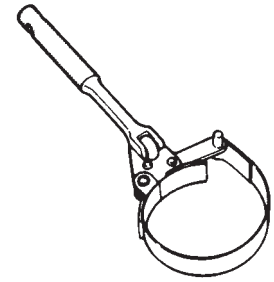
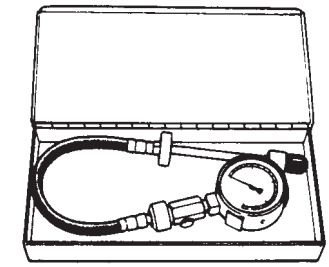
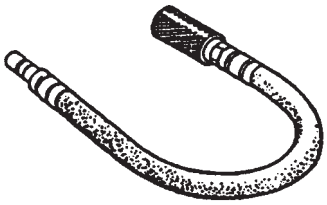
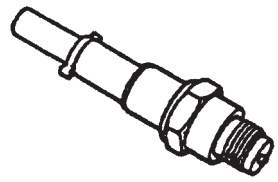
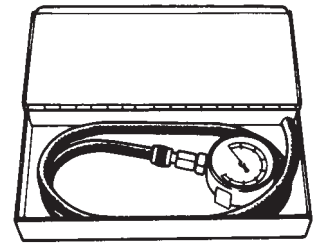
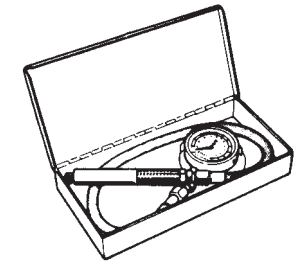
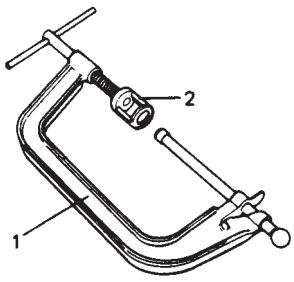
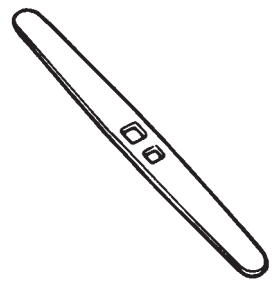
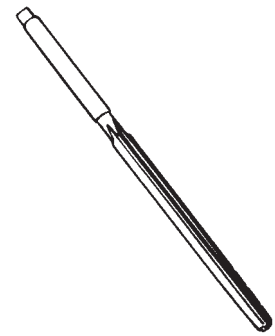
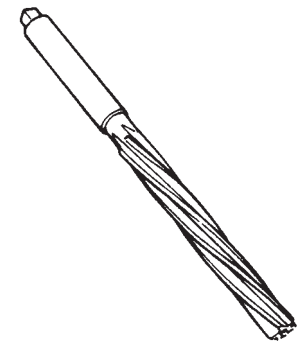
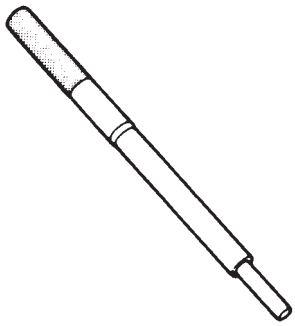
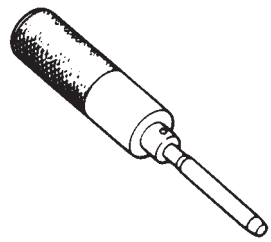
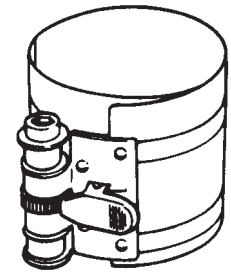
8) Install flywheel (M/T vehicle) or drive plate (A/T vehicle). Using special tool, lock flywheel or drive plate, and tighten flywheel or drive plate bolts applied with sealant to specification.

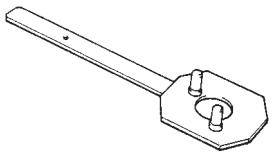
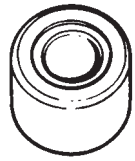
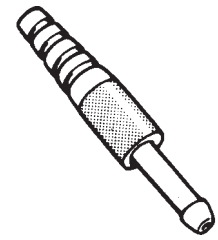
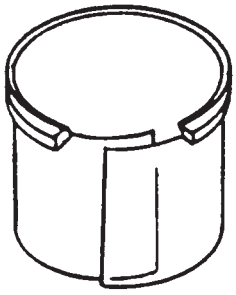
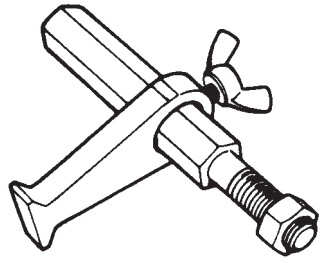
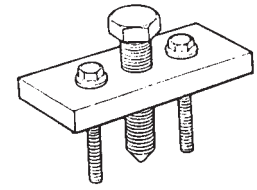
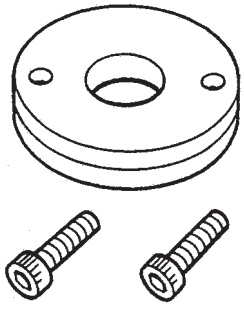
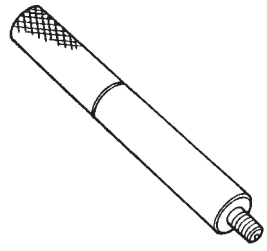
"A": Sealant 1215 99000-31110

Special Tool
(A): 09924-17810
Tightening Torque
(c): 70 N·m (7.0 kg-m, 50.5 lb-ft)

9) Install oil pump, pistons and connecting rods as previously outlined.
10) Install oil pump strainer and oil pan.
11) Install cylinder heads assembly to cylinder block as previously outlined.
12) Install crankshaft oil pump sprocket, timing chain sprocket, oil pump chain, timing chain, timing chain cover, crankshaft pulley, water pump pulley, etc., as previously outlined.
13) Install clutch to flywheel (for M/T vehicle). For clutch installation, refer to Section 7C1.
14) Install engine assembly to vehicle as previously outlined.

SPECIAL TOOLS

 09911-97810 Oil seal installer	 09913-75510 Bearing installer	 09915-47310 Oil filter wrench	 09915-64510 Compression gauge
 09915-64530 Compression gauge hose	 09915-67010 Compression gauge attachment (c)	 09915-67310 Vacuum gauge	 09915-77310 Oil pressure gauge
 1. 09916-14510 Valve lifter 2. 09916-14910 Valve lifter attachment	 09916-34541 Reamer handle	 09916-37810 Reamer (6 mm)	 09916-38210 Reamer (11 mm)
 09916-44910 Valve guide remover	 09916-58210 Valve guide installer handle	 09916-77310 Piston ring compressor	 09916-84511 Forceps

 09917-68221 Camshaft lock holder	 09917-87810 Valve guide installer	 09917-98221 Valve stem seal installer	 09918-08210 Vacuum gauge hose joint
 09919-28610 Protective sleeve	 09924-17810 Flywheel holder	 09926-58010 Bearing puller attachment	 09944-36011 Steering wheel remover
 09911-97710 Oil seal guide	 09915-76510 Oil pressure gauge attachment		

REQUIRED SERVICE MATERIAL

RECOMMENDED SUZUKI PRODUCT	USE
Sealant 1207C 99000-31150	● To apply to mating surfaces of cylinder block and oil pan. ● To apply to mating surfaces of cylinder block and timing chain cover.
Sealant 1215 99000-31110	● To flywheel (M/T) or drive plate (A/T) bolts.

SECTION 6A4

ENGINE MECHANICAL (J20 ENGINE)

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

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

CONTENTS

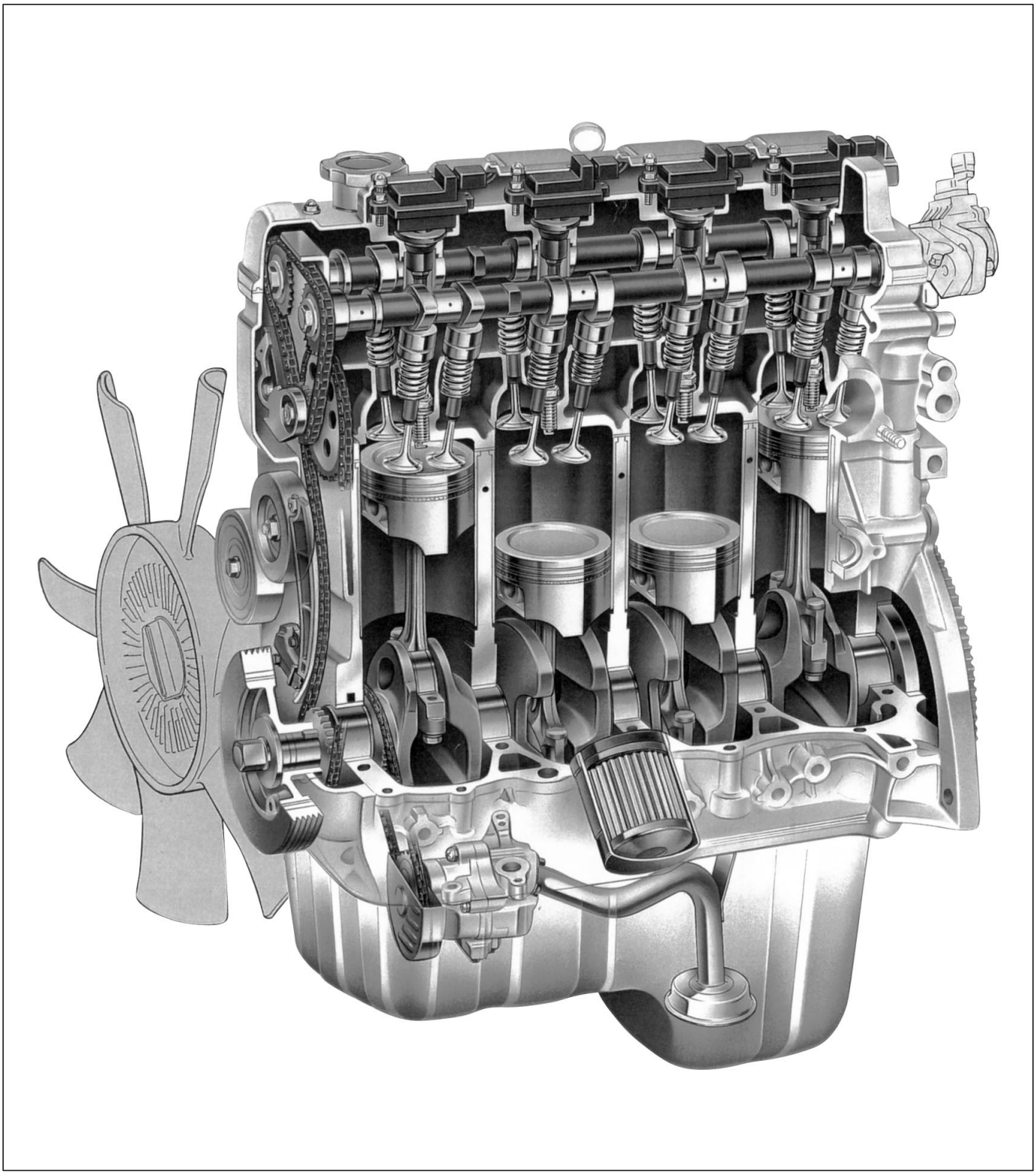
GENERAL DESCRIPTION 6A4- 2
ON-VEHICLE SERVICE 6A4- 4
Compression Check 6A4- 4
Engine Vacuum Check 6A4- 6
Oil Pressure Check 6A4- 7
Air Cleaner Element 6A4- 8
Throttle Body and Intake Manifold 6A4- 9
Exhaust Manifold 6A4-12
Cylinder Head Cover 6A4-15
Oil Pan and Oil Pump Strainer 6A4-16
Oil Pump 6A4-19
Timing Chain Cover 6A4-22
2nd Timing Chain and Chain Tensioner 6A4-26
1st Timing Chain and Chain Tensioner 6A4-32
Camshafts and Valve Lash Adjusters 6A4-38
Valve Lash Adjuster Noise Diagnosis 6A4-44
Valves and Cylinder Head 6A4-45
Pistons, Piston Rings, Connecting Rods and Cylinders 6A4-57
Engine Mountings 6A4-67
UNIT REPAIR OVERHAUL 6A4-68
Engine Assembly 6A4-68
Main Bearings, Crankshaft and Cylinder Block 6A4-72
SPECIAL TOOLS 6A4-85
REQUIRED SERVICE MATERIALS 6A4-86

GENERAL DESCRIPTION

ENGINE

The engine is water-cooled, in line 4 cylinders, 4 stroke cycle gasoline unit with its DOHC (Double overhead camshaft) valve mechanism arranged for "V" type valve configuration and 16 valves (4 valves/one cylinder).

The double overhead camshaft is mounted over the cylinder head; it is driven from crankshaft through timing chains, and no push rods are provided in the valve train system.

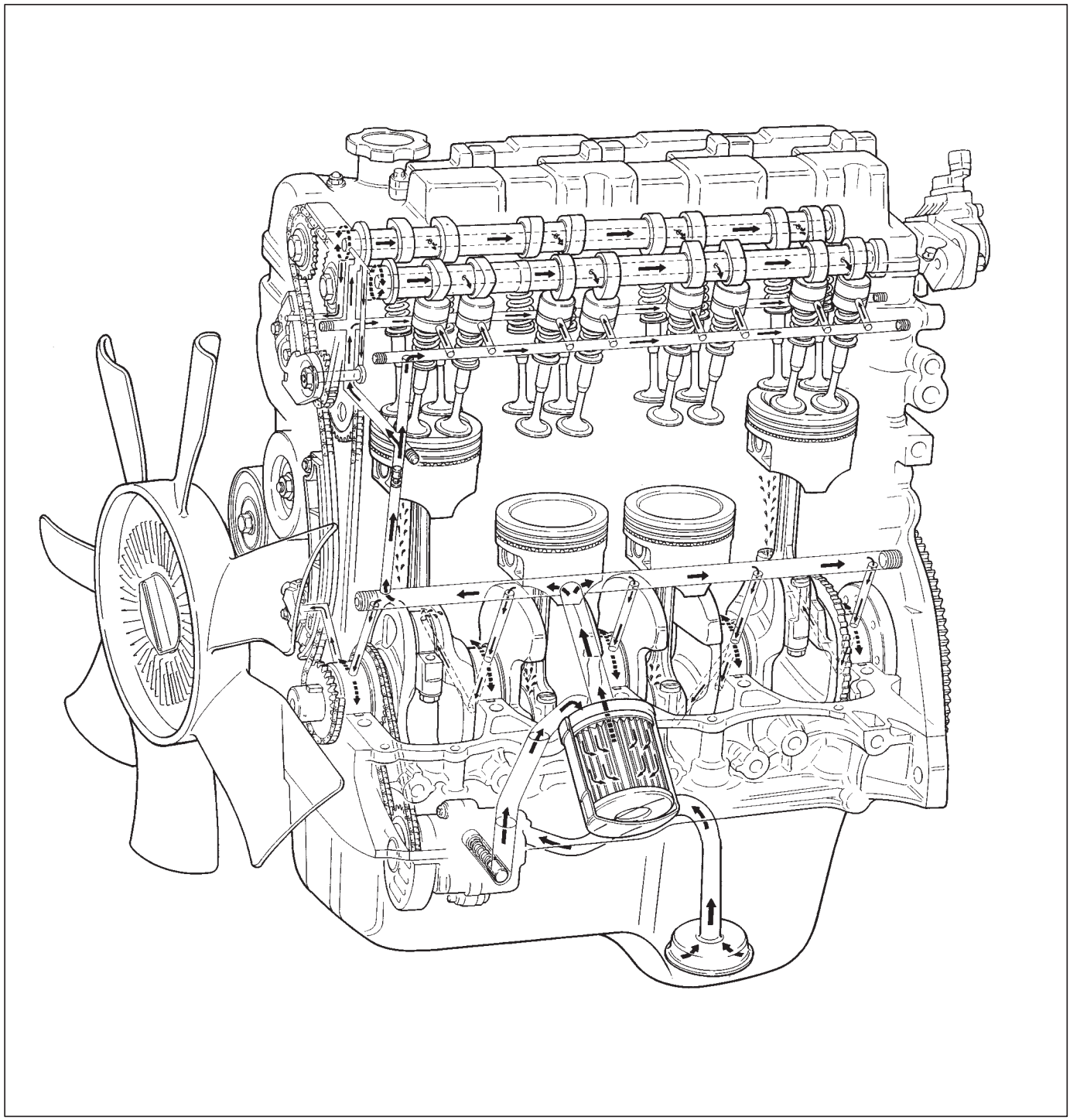


ENGINE LUBRICATION

The oil pump is of a trochoid type, and mounted under the crankshaft. Oil is drawn up through the oil pump strainer and passed through the pump to the oil filter. The filtered oil flows into 2 paths in cylinder block.
In one path, oil reaches the crankshaft journal bearings. Oil from the crankshaft journal bearings is supplied to the connecting rod bearings by means of intersecting passages drilled in the crankshaft, and then injected from the big end of connecting rod to lubricate piston, rings, and cylinder wall.

In other path oil goes up to the cylinder head and lubricates valves and camshafts, etc., after passing through the internal oilway of camshafts.

An oil relief valve is provided on the oil pump. This valve starts relieving oil pressure when the pressure exceeds about 420 kPa (4.2 kg/cm^2, 59.7 psi).



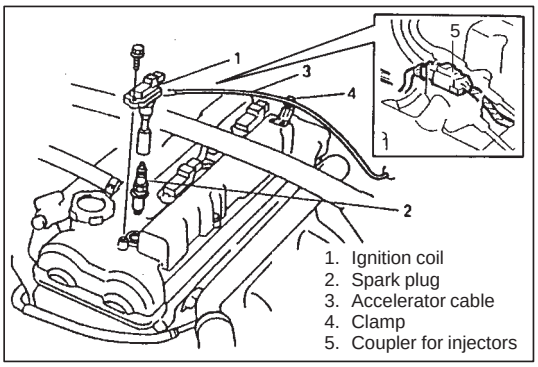
ON-VEHICLE SERVICE

COMPRESSION CHECK

Check compression pressure on all 4 cylinders as follows:

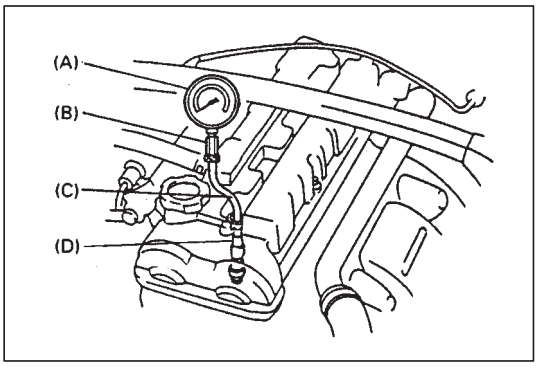
1) Warm up engine.
2) Stop engine after warming up.

NOTE:
After warming up engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake and block drive wheels.



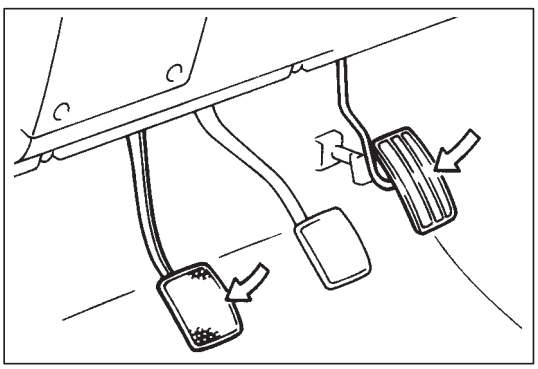
1. Ignition coil
2. Spark plug
3. Accelerator cable
4. Clamp
5. Coupler for injectors

3) Disconnect accelerator cable from clamp (For LH steering vehicle only).
4) Disconnect ignition coil couplers.
5) Remove ignition coils.
6) Remove all spark plugs.
7) Disconnect fuel injector wires at the coupler.



8) Install special tool (Compression gauge) into spark plug hole.

Special Tool
(A): 09915-64510-001
(B): 09915-64510-002
(C): 09915-64530
(D): 09915-67010

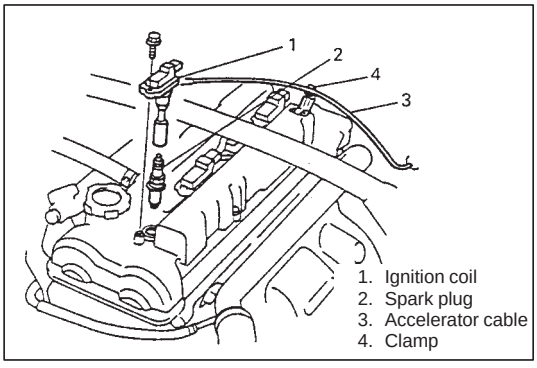


9) Disengage clutch (to lighten starting load on engine) for M/T vehicle, and depress accelerator pedal all the way to make throttle fully open.

10) 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	1200 kPa (12.0 kg/cm^2, 170.0 psi)
Max. difference between any two cylinders	100 kPa (1.0 kg/cm^2, 14.2 psi)



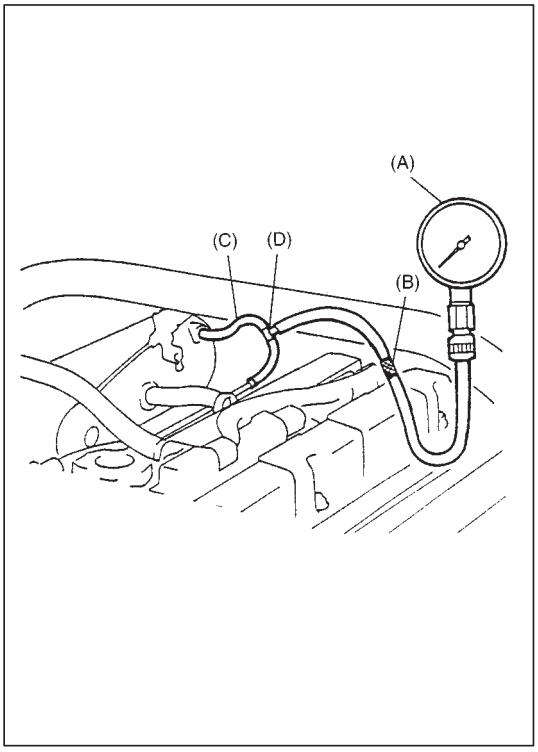
11) Carry out steps 8), 9) and 10) on each cylinder to obtain 4 readings.
12) After checking, install spark plugs and ignition coils.
13) Connect ignition coil couplers.
14) Connect accelerator cable to clamp (For LH steering vehicle only).

ENGINE VACUUM CHECK

The engine vacuum that develops in the intake line is a good indicator of the condition of the engine. The vacuum checking procedure is as follows:

1) Warm up engine to normal operating temperature and make sure that engine idle speed is within specification.

   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.



2) Stop engine and disconnect vacuum hose from intake manifold.
3) Connect special tools (vacuum gauge and hose joint) to vacuum hose and intake manifold.

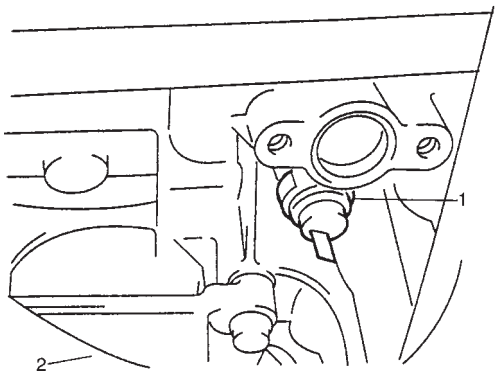
   Special Tool
   (A): 09915-67310
   (B): 09918-08210

   SUZUKI GENUINE PARTS
   (C): Hose 09343-03087
   (D): 3-way joint 09367-04002

4) Start engine and run engine at specified idle speed (see section 6E1), and read vacuum gauge. Vacuum should be within specification.

   Vacuum specification: 52.6 – 65.8 kPa
   (at sea level) (40 – 50 cm Hg, 15.7 – 19.7 in Hg)
   at specified idle speed

5) After checking, remove vacuum gauge and hose joint.
6) Connect vacuum hose to intake manifold.



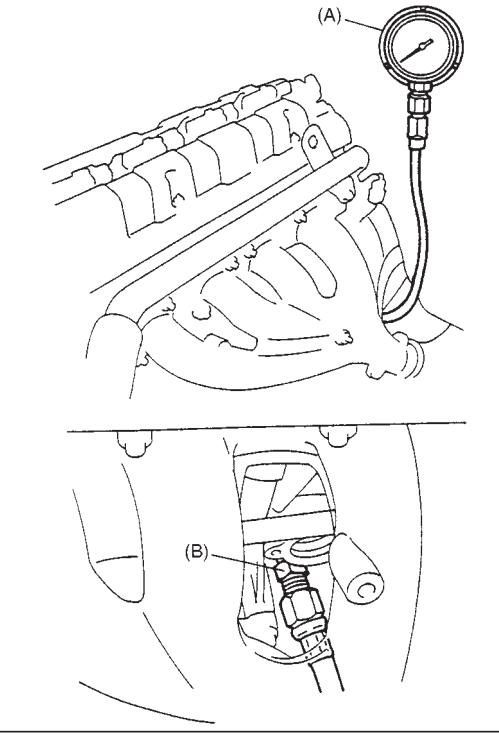
1. Oil pressure switch
2. Exhaust manifold

OIL PRESSURE CHECK

WARNING:
To avoid danger of being burned, do not touch exhaust manifold when exhaust system is hot.
When servicing, be sure to perform it after exhaust system has cooled down.

NOTE:
Prior to checking oil pressure, check the followings.
- **Oil level in oil pan.**
  If oil level is low, add oil up to full level hole on oil level gauge.
- **Oil quality.**
  If oil is discolored, or deteriorated, change it.
  For particular oil to be used, refer to Section 0B.
- **Oil leaks.**
  If leak is found, repair it.

1) Remove exhaust manifold cover and then oil pressure switch from cylinder block.



2) Install special tool (Oil pressure gauge) to vacated threaded hole.

Special Tool
(A): 09915-77310
(B): 09915-78211

CAUTION:
Be careful not to make special tool touch exhaust manifold when installing because exhaust manifold becomes very hot.

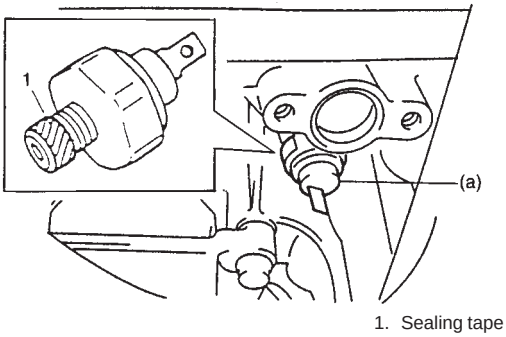
3) Start engine and warm it up to normal operating temperature.

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 measure oil pressure.

Oil pressure specification:
390 – 470 kPa (3.9 – 4.7 kg/cm^2, 55.5 – 66.8 psi) at 4,000 r/min (rpm)

5) After checking oil pressure, stop engine and remove oil pressure gauge.



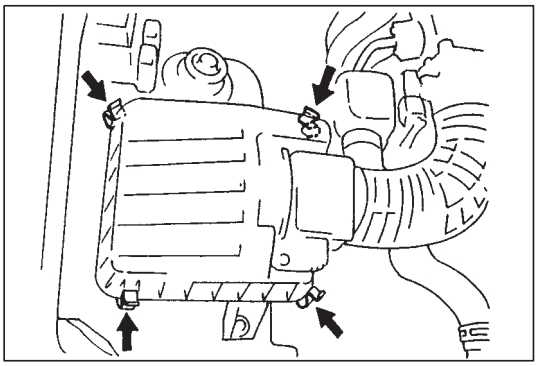
1. Sealing tape

6) Before reinstalling oil pressure switch, be sure to wrap its screw threads with sealing tape and tighten switch to specified torque.

Tightening Torque
(a): 14 N·m (1.4 kg-m, 10.5 lb-ft)

NOTE:
If sealing tape edge is bulged out from screw threads of switch, cut it off.

7) Start engine and check oil pressure switch for oil leakage.



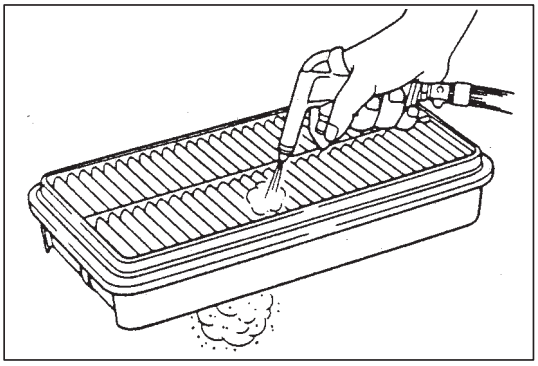
AIR CLEANER ELEMENT

REMOVAL

1) Remove air cleaner case clamps.
2) Remove air cleaner element from case.

INSPECT

Check air cleaner element for dirt. Replace excessively dirty element.



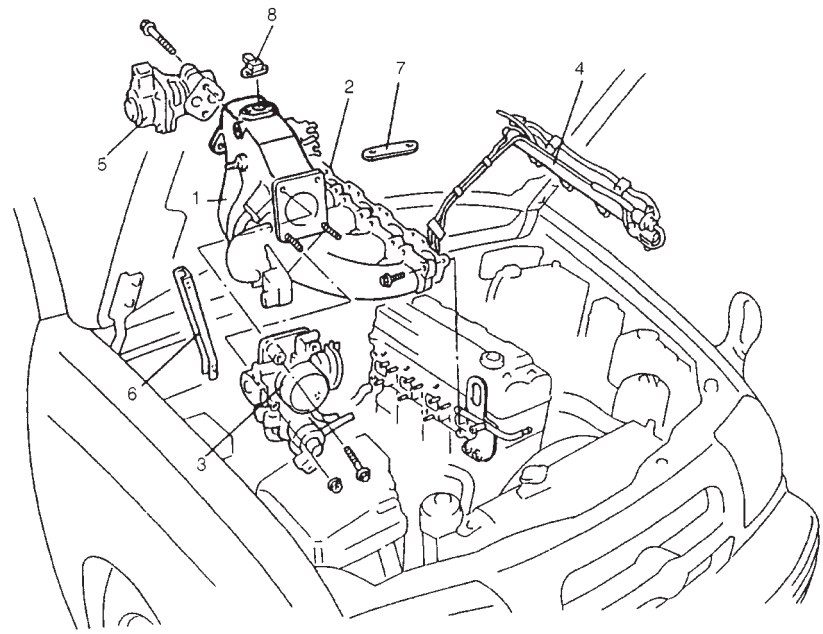
CLEAN

Blow off dust by compressed air from air outlet side of element.

INSTALLATION

Reverse removal procedure for installation.

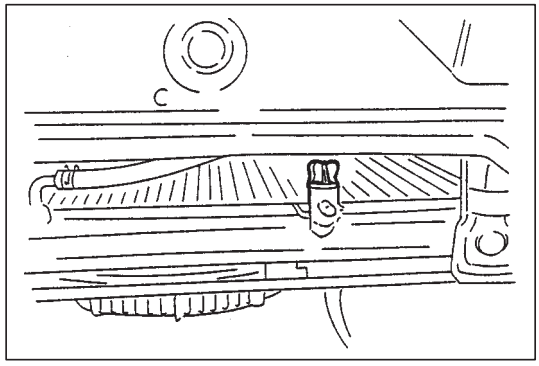
THROTTLE BODY AND INTAKE MANIFOLD



1. Intake manifold
2. Intake manifold gasket
3. Throttle body
4. Fuel delivery pipe
5. EGR valve
6. Intake manifold rear stiffener
7. Intake manifold front stiffener
8. Manifold differential pressure sensor

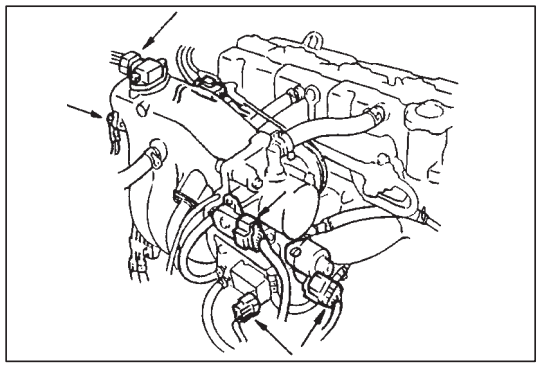
REMOVAL

1) Relieve fuel pressure according to fuel pressure relief procedure described in Section 6.
2) Disconnect negative cable at battery.

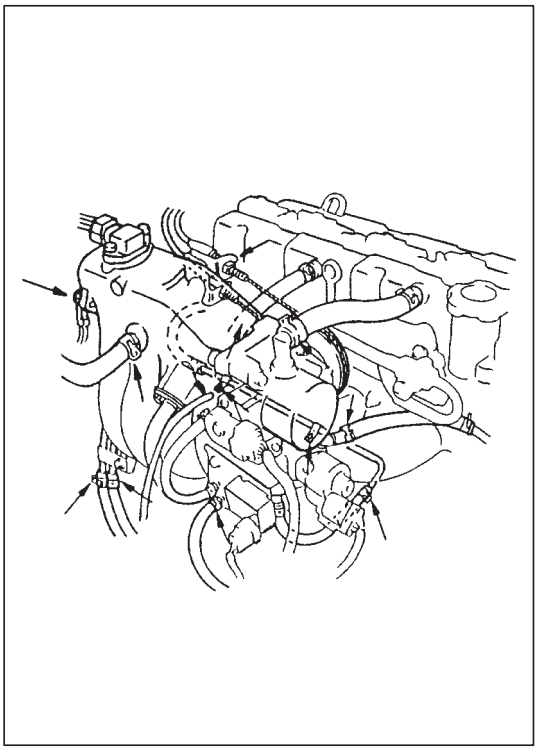


3) Drain coolant.

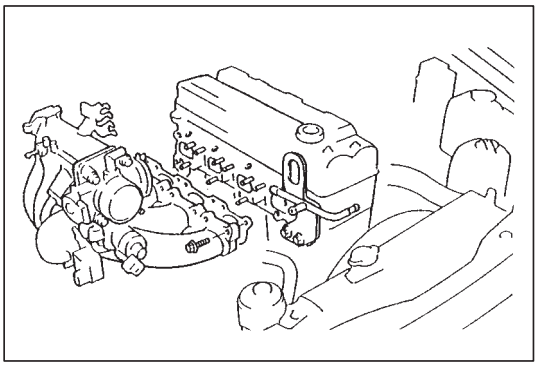
WARNING:
To help avoid danger of being burned, do not remove drain plug and radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if plug and cap are taken off too soon.



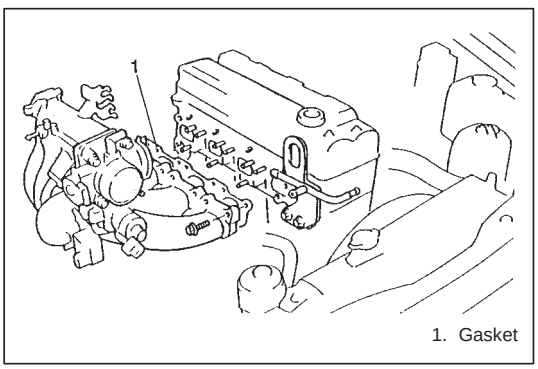
4) Remove air cleaner outlet hose.
5) Disconnect following electric lead wires:
   - EGR valve coupler
   - IAC valve coupler
   - TP sensor coupler
   - EVAP canister purge valve coupler
   - Ground terminal from intake manifold
   - MAP sensor



6) Disconnect accelerator cable and A/T throttle cable (For A/T vehicle) from throttle body.
7) Disconnect following hoses:
   ° Brake booster hose from intake manifold
   ° PCV hose from intake manifold
   ° Fuel pressure regulator vacuum hose from intake manifold
   ° Canister purge hose from EVAP canister purge valve
   ° Vacuum hose from intake manifold
   ° Water hoses from throttle body and water bypass pipe
   ° Breather hose from throttle body
   ° Fuel feed hose and return hose from each pipe
8) Remove fuel delivery pipe with fuel injectors from cylinder head.
9) Remove intake manifold front stiffener and rear stiffener.
10) Detach water pipe from intake manifold.



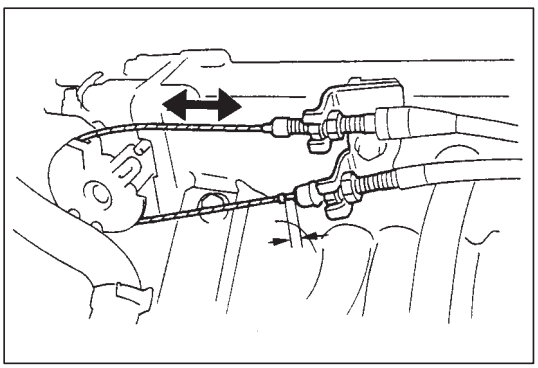
11) Remove intake manifold from cylinder head, and then its gasket.



1. Gasket

INSTALLATION

Reverse removal procedure for installation noting the followings.
° Use new intake manifold gasket.
° Install fuel delivery pipe with fuel injectors to cylinder head referring to “Fuel Injector Installation” in Section 6E1.

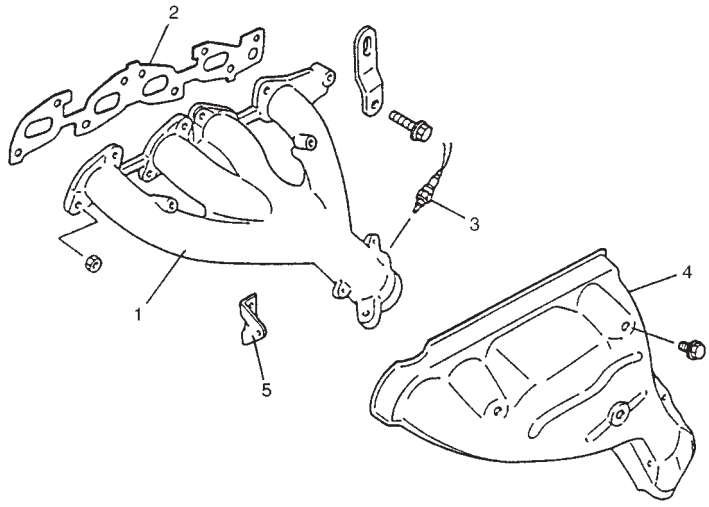


° Adjust accelerator cable play and A/T throttle cable play (for vehicle with A/T), referring to Section 6E1.

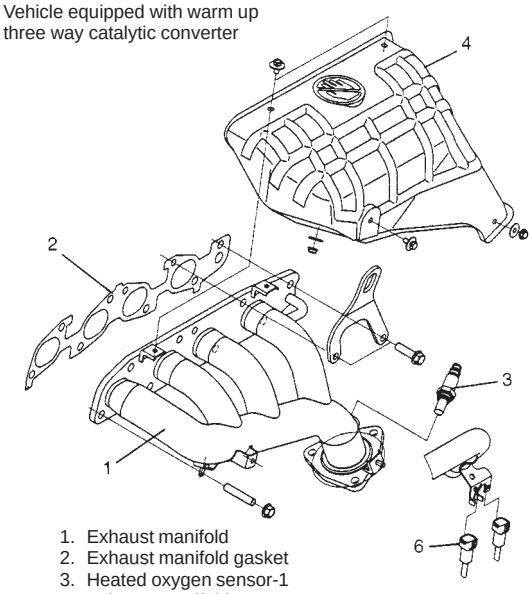
- Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
- Refill cooling system, referring to Section 6B.
- Upon completion of installation, turn ignition switch ON but engine OFF and check for fuel leaks.
- Finally, start engine and check for engine coolant leaks.

EXHAUST MANIFOLD

Vehicle not equipped with warm up three way catalytic converter

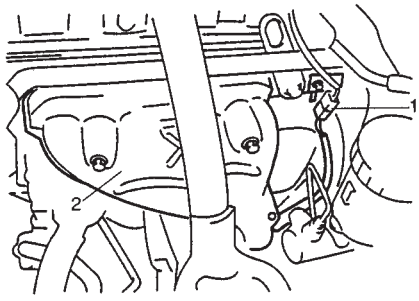


Vehicle equipped with warm up three way catalytic converter



1. Exhaust manifold
2. Exhaust manifold gasket
3. Heated oxygen sensor-1
4. Exhaust manifold upper cover
5. Exhaust manifold stiffener
6. Heated oxygen sensor-2 connector

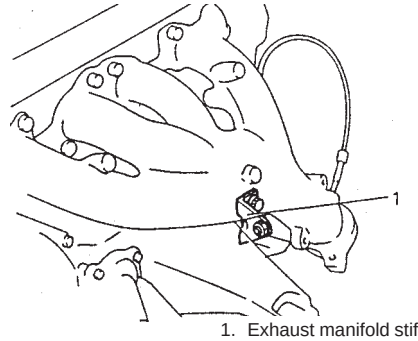
WARNING:
To avoid danger of being burned, do not service exhaust system while it is still hot. Service should be performed after system cools down.



1. Heated oxygen sensor coupler
2. Exhaust manifold upper cover

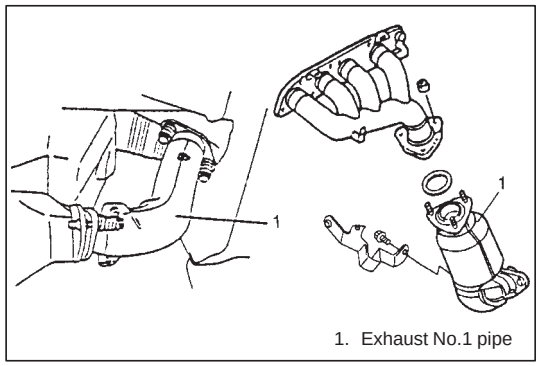
REMOVAL

1) Disconnect negative cable at battery.
2) Disconnect heated oxygen sensor-1 coupler and detach it from its stay.
3) Remove upper cover of exhaust manifold.



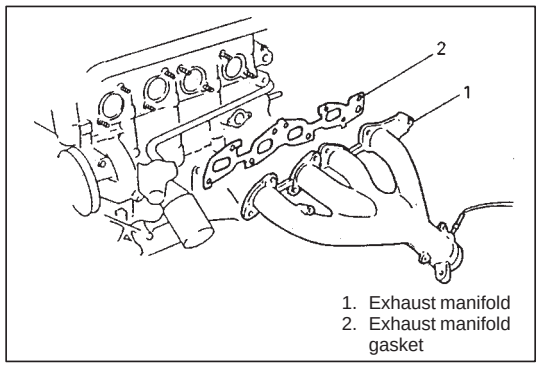
1. Exhaust manifold stiffener

4) Remove exhaust manifold stiffener if equipped.



1. Exhaust No.1 pipe

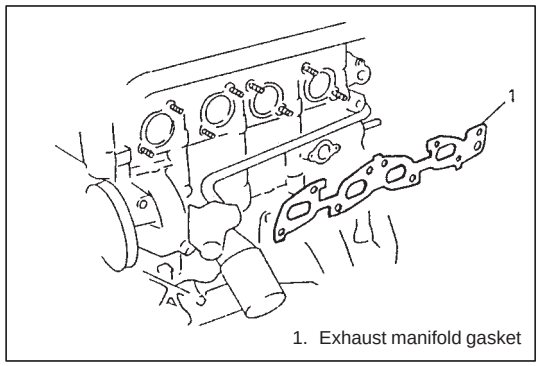
5) Remove exhaust pipe bolts or nuts and exhaust pipe bracket bolt (if equipped).



1. Exhaust manifold
2. Exhaust manifold gasket

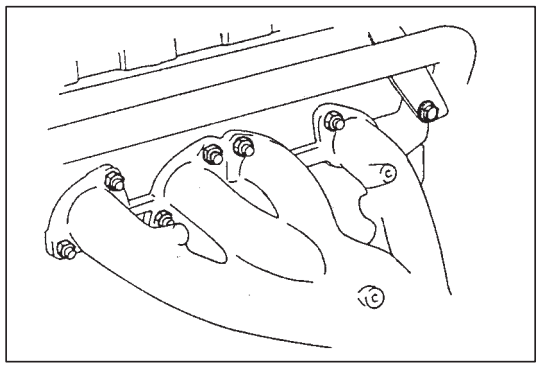
6) Remove exhaust manifold and its gasket from cylinder head.

INSTALLATION

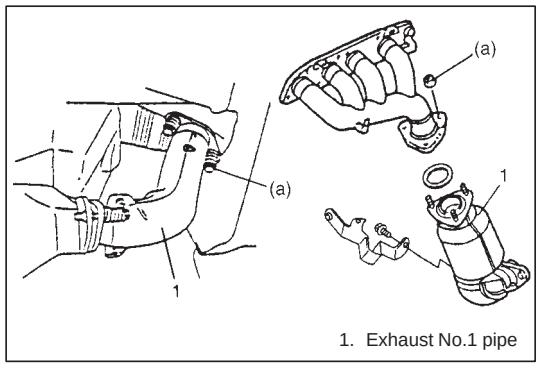


1. Exhaust manifold gasket

1) Install new gasket to cylinder head.



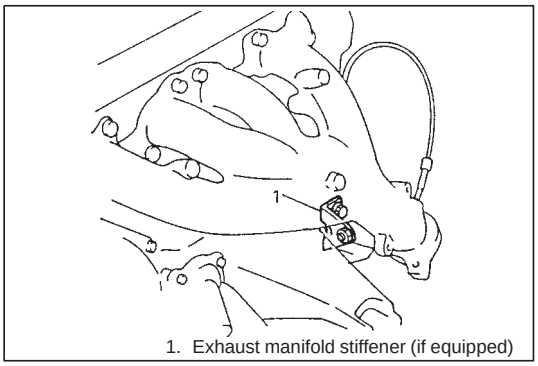
2) Install exhaust manifold.
Tighten manifold bolts and nuts to specified torque.



1. Exhaust No.1 pipe

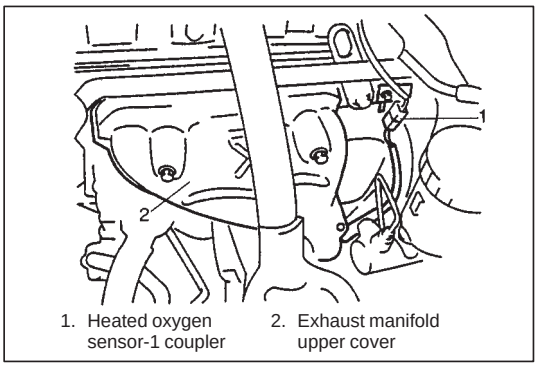
3) Install seal ring and install exhaust No.1 pipe to exhaust manifold.
Before installing seal ring, check it for deterioration or damage, and replace as necessary. Use new lock nuts if used.
Tighten pipe fasteners to specified torque.

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



1. Exhaust manifold stiffener (if equipped)

4) Install exhaust manifold stiffener if equipped.
   Tighten exhaust manifold stiffener nut and bolt to specified torque.



1. Heated oxygen sensor-1 coupler
2. Exhaust manifold upper cover

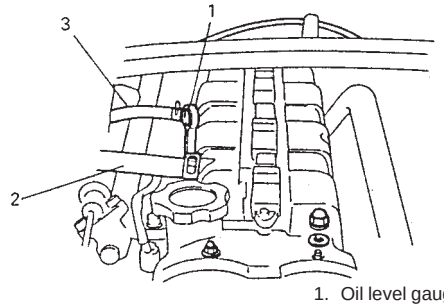
5) Install upper cover to exhaust manifold.
6) Connect heated oxygen sensor-1 coupler and fit coupler to bracket securely.

7) Connect negative cable at battery.
8) Check exhaust system for exhaust gas leakage.

CYLINDER HEAD COVER

REMOVAL

1) Disconnect negative cable at battery.
2) Disconnect ignition coil couplers.
3) Remove ignition coils.



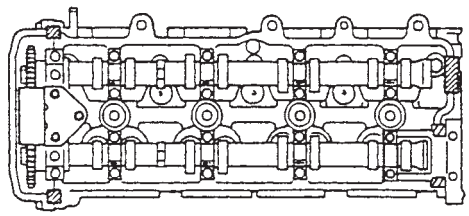
1. Oil level gauge
2. Breather hose
3. PCV hose

4) Disconnect accelerator cable from clamp (For LH steering vehicle only).
5) Remove oil level gauge.
6) Disconnect breather hose and PCV hose from cylinder head cover.
7) Remove cylinder head cover.

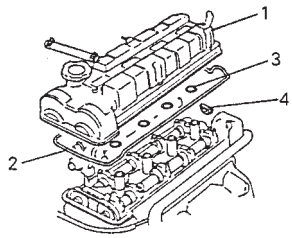
INSTALLATION

1) Remove oil, old sealant, and dust from sealing surfaces on cylinder head and cover. After cleaning, apply sealant "A" to cylinder head sealing surface area as shown in figure.

   "A": Sealant 99000-31150



▨ : Area to apply sealant "A"

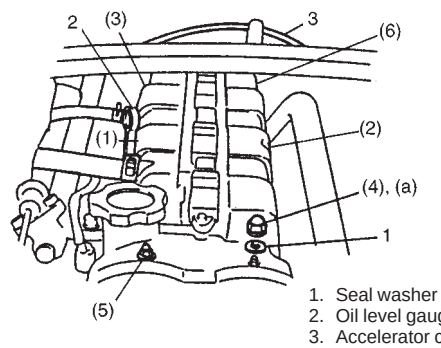


1. Cylinder head cover
2. Cylinder head cover gasket
3. O-ring
4. Cylinder head side seal

2) Install O-rings and cylinder head cover gasket to cylinder head cover.

   NOTE:
   Be sure to check each of these parts for deterioration or any damage before installation and replace if found defective.

3) Install cylinder head side seal and cylinder head cover to cylinder head.



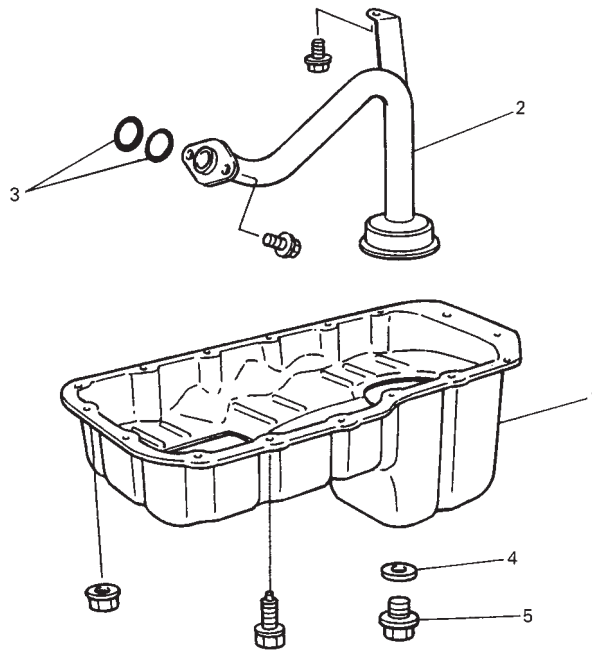
1. Seal washer
2. Oil level gauge
3. Accelerator cable

4) Tighten nuts in such order as indicated in figure a little at a time till they are tightened to specified torque.
   ° Use new seal washers.

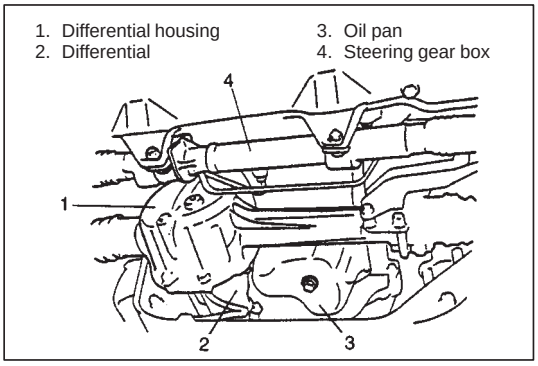
   Tightening Torque
   (a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

5) Install ignition coils and connect ignition coil couplers.
6) Install oil level gauge.
7) Connect breather hose and PCV hose to cylinder head cover.
8) Connect accelerator cable to clamp (For LH steering vehicle only).

OIL PAN AND OIL PUMP STRAINER



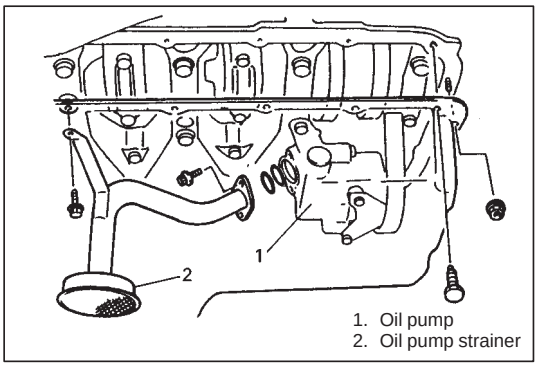
1. Oil pan
2. Strainer
3. O-ring
4. Gasket
5. Drain plug



1. Differential housing
2. Differential
3. Oil pan
4. Steering gear box

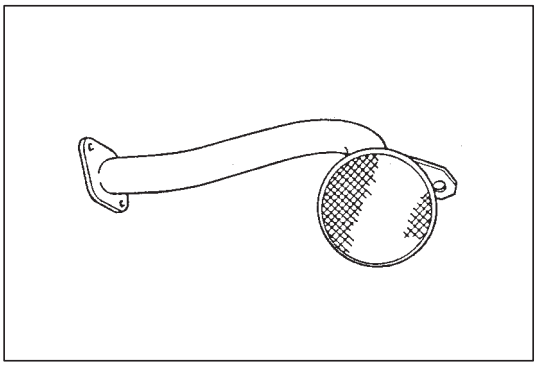
REMOVAL

1) Remove oil level gauge.
2) Raise vehicle and remove both front wheels.
3) Remove steering gear box from vehicle referring to “Steering Gear Box Removal” in Section 3B1.
4) Remove front differential housing with differential from chassis. Refer to Section 7E for removal.
5) Drain engine oil by removing drain plug.
6) Remove transmission stiffener if equipped.
7) Remove clutch (torque converter) housing lower plate.



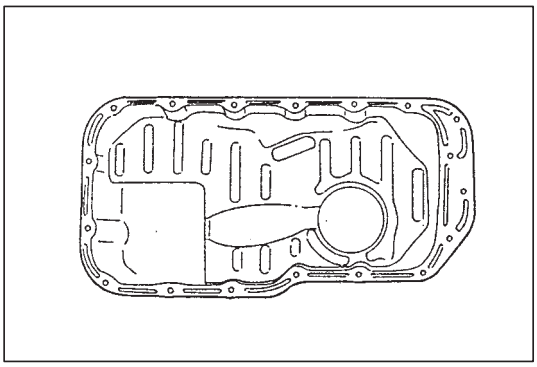
1. Oil pump
2. Oil pump strainer

8) Remove oil pan and oil pump strainer from crankcase.

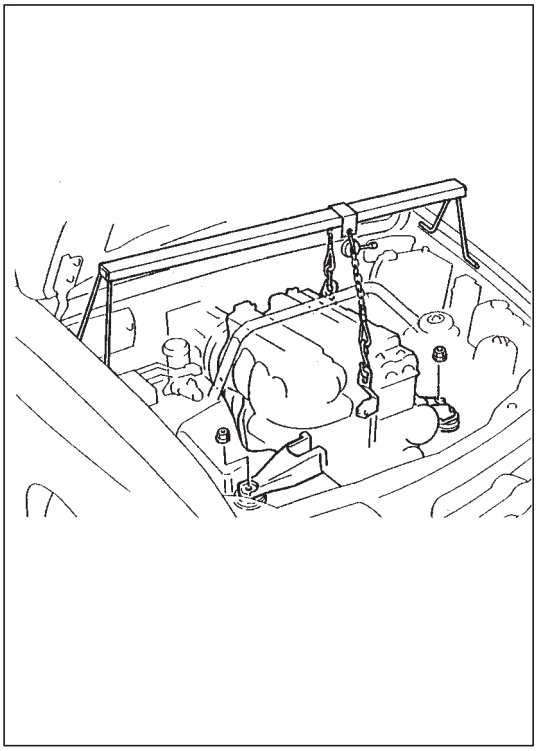


CLEAN

1) Inside of oil pan and oil pump strainer screen.



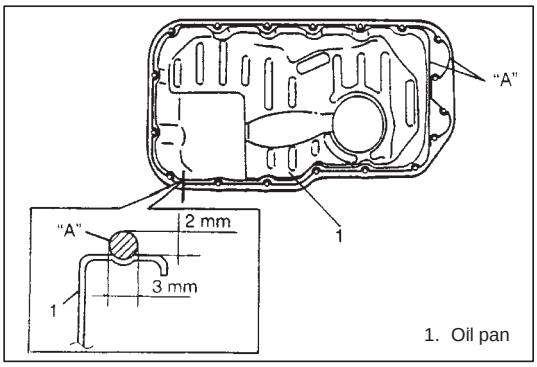
2) Clean sealing surface on oil pan and crankcase.
   Remove oil, old sealant, and dust from sealing surface.



INSTALLATION

1) To facilitate and ensure installation of oil pan, increase clearance between engine and vehicle body according to following procedure.
   a. Remove strut tower bar.
   b. Disconnect exhaust pipe from exhaust manifold.
   c. Remove engine mounting nuts (Right & Left).
   d. Using engine support jack, hoist engine 2 – 3 cm (about 1 in.).

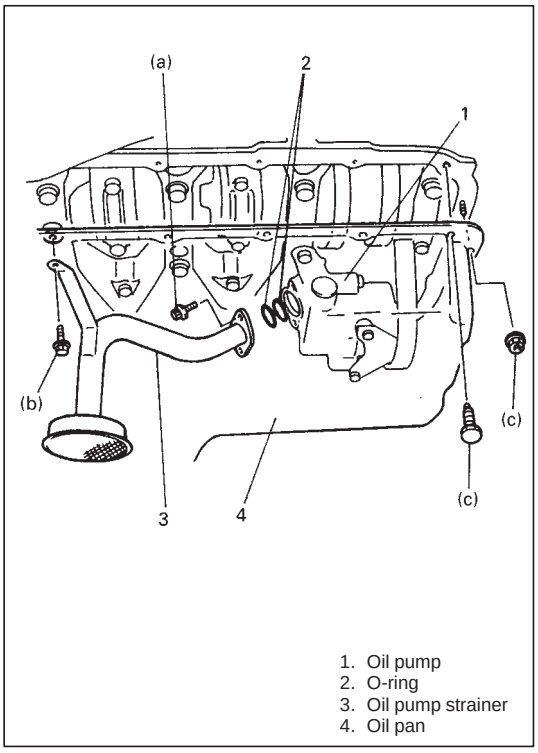
CAUTION:
Do not hoist engine more than instructed above. That may cause trouble to engine or transmission.



1. Oil pan

2) Apply sealant continuously to oil pan mating surface as shown in figure.

"A" Sealant: 99000-31150



1. Oil pump
2. O-ring
3. Oil pump strainer
4. Oil pan

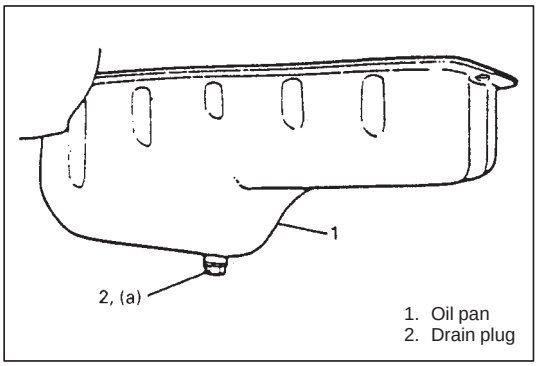
3) Install O-rings in the position as shown in figure and install oil pump strainer to oil pump.
Tighten strainer bolts first and then bracket bolt to specified torque.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)
(b): 11 N·m (1.1 kg-m, 8.0 lb-ft)

4) After fitting oil pan to cylinder block, run in securing bolts and start tightening at the center: move wrench outward, tightening one bolt at a time.
Tighten bolts and nuts to specified torque.

Tightening Torque
(c): 11 N·m (1.1 kg-m, 8.0 lb-ft)

5) Lower engine and tighten engine mounting nuts to specified torque referring to “Engine Assembly Installation” in this section.



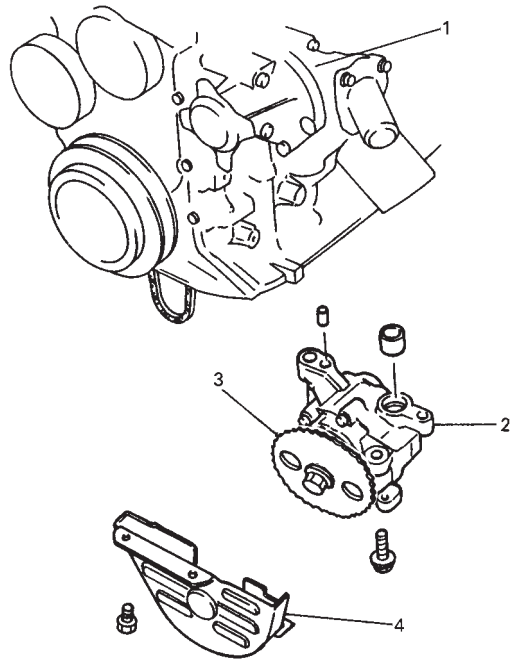
1. Oil pan
2. Drain plug

6) Install gasket and drain plug to oil pan.
Tighten drain plug to specified torque.

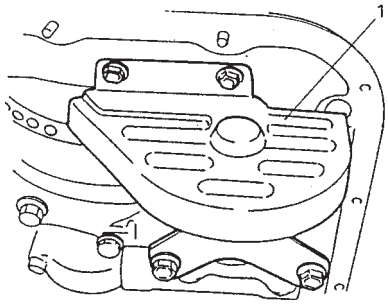
Tightening Torque
(a): 35 N·m (3.5 kg-m, 25.5 lb-ft)

7) Install clutch (torque converter) housing lower plate.
8) Connect exhaust pipe to exhaust manifold referring to Section 6K.
9) Install transmission stiffener to transmission and cylinder block if equipped.
10) Install front differential housing according to installation procedure described in Section 7E.
11) Refill front differential housing with gear oil, referring to Section 7E.
12) Install steering gear box to vehicle referring to “Steering Gear Box Installation” in Section 3B1.
13) Install oil level gauge.
14) Refill engine with engine oil, referring to item “ENGINE OIL CHANGE” in Section 0B.
15) Refill power steering system with specified fluid referring to Section 3B1.
16) Verify that there is no engine oil leakage, differential oil leakage and power steering fluid leakage at each connection.

OIL PUMP



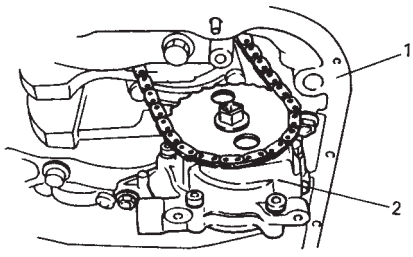
1. Cylinder block
2. Oil pump
3. Oil pump sprocket
4. Oil pump sprocket cover



1. Oil pump sprocket cover

REMOVAL

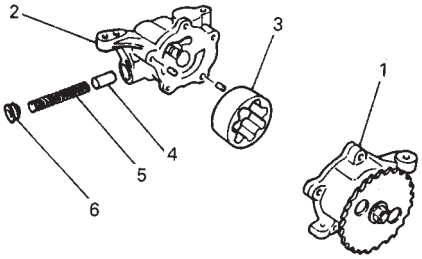
1) Disconnect negative cable at battery.
2) Drain engine oil.
3) Remove oil pan and oil pump strainer.
   Refer to item “OIL PAN AND OIL PUMP STRAINER” in this section.
4) Remove oil pump sprocket cover.



1. Lower crankcase
2. Oil pump

5) Remove oil pump from lower crankcase.

CAUTION:
Don’t remove sprocket out of oil pump. Or damage of oil pump center shaft and abnormal operation of oil pump could result.



1. Oil pump case No.1
2. Oil pump case No.2
3. Outer rotor
4. Relief valve
5. Relief spring
6. Retainer

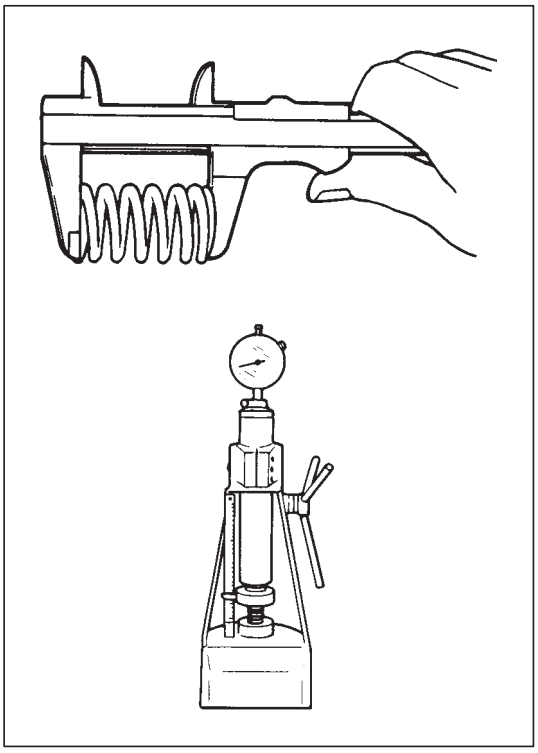
DISASSEMBLY

° Disassemble oil pump as shown in figure.

INSPECTION

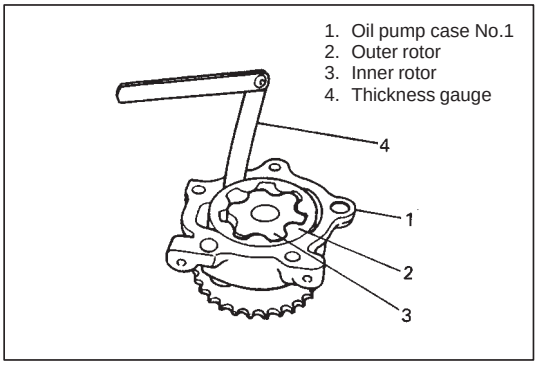
° Check outer rotor, inner rotor and oil pump cases for excessive wear or damage.
° Check relief valve for excessive wear or damage.

NOTE:
If any repair is required on outer rotor, inner rotor and oil pump cases, replace them as an assembly.



° Measure free length and tension of oil relief spring.

Item	Standard
Spring free length	63.5 mm (2.5 in.)
Spring preload	86.0 N for 52.0 mm 8.6 kg for 52.0 mm 62.2 lb/ 2.05 in.



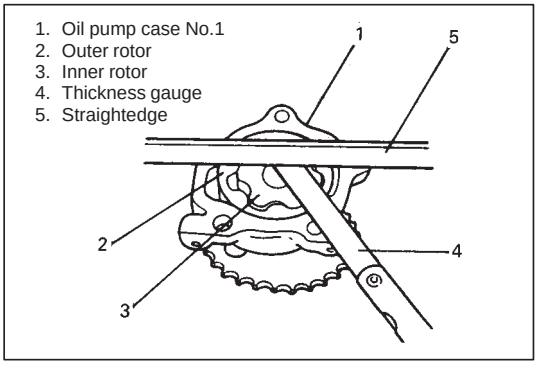
° Measure clearance of oil pump rotor and oil pump case.

Radial Clearance

Check radial clearance between outer rotor and case, using thickness gauge.

If clearance exceeds its limit, replace outer rotor or case.

Limit on radial clearance between outer rotor and case: 0.15 mm (0.0059 in.)



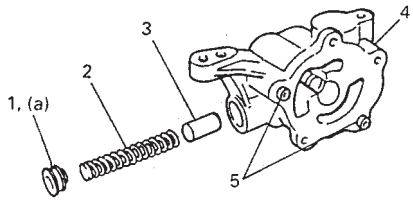
Side Clearance

Using straightedge and thickness gauge, measure side clearance.

Limit on side clearance: 0.11 mm (0.0043 in.)

ASSEMBLY

1) Wash, clean and then dry all disassembled parts.
2) Apply thin coat of engine oil to inner and outer rotors, and inside surfaces of oil pump case.
3) Install outer rotor to pump case No.1.

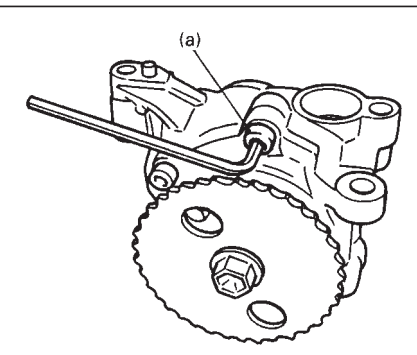


1. Retainer
2. Relief spring
3. Relief valve
4. Oil pump case No.2
5. Oil pump case pin

4) Install relief valve, relief spring and retainer to oil pump case No.2.
Tighten retainer to specified torque.

Tightening Torque
(a): 29 N·m (2.9 kg-m, 21.0 lb-ft)

5) Install oil pump case pins to oil pump case No.2.



6) Assemble oil pump. After assembling oil pump check to be sure that rotor turns smoothly by hand.

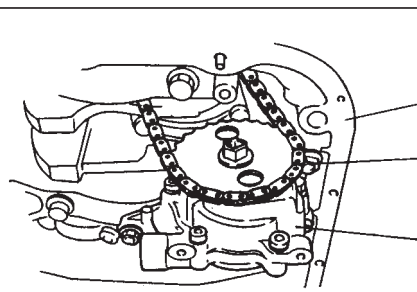
Tightening Torque
(a): 12 N·m (1.2 kg-m, 9.0 lb-ft)

INSTALLATION

1) Install oil pump to lower crankcase and tighten bolts to specified torque.

NOTE:
When installing oil pump, be careful not to allow pins to fall off.

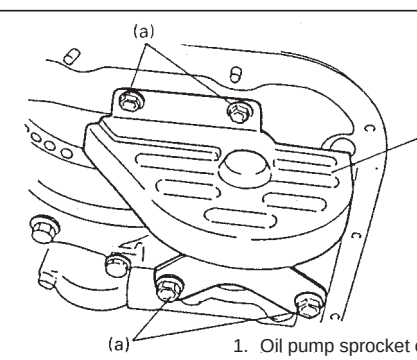
Tightening Torque
(a): 27 N·m (2.7 kg-m, 19.5 lb-ft)



1. Lower crankcase
2. Oil pump

2) Install oil pump sprocket cover and tighten bolts to specified torque.

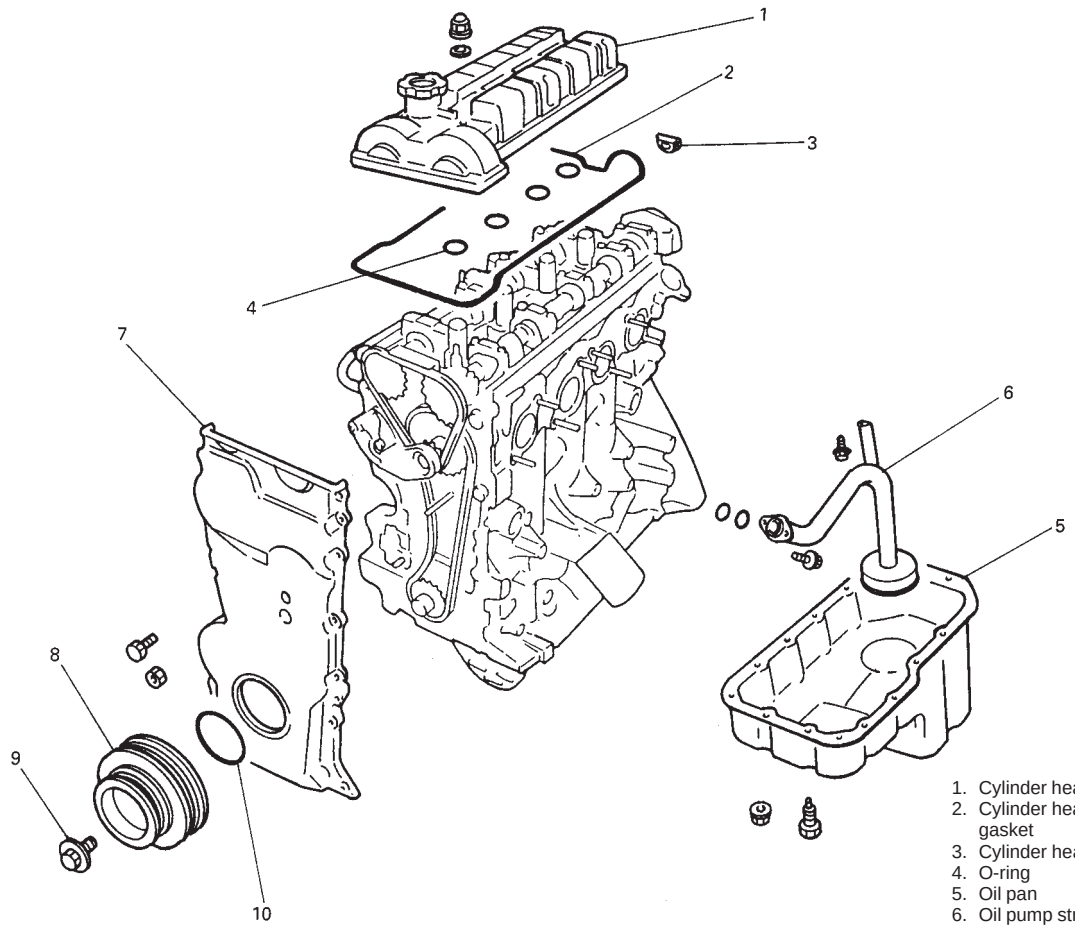
Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



1. Oil pump sprocket cover

3) Install oil pan and oil pump strainer. Refer to “OIL PAN AND OIL PUMP STRAINER” in this section.
4) Refill engine with engine oil, referring to item “ENGINE OIL CHANGE” in Section 0B.
5) Connect negative cable at battery.
6) After completing installation, check oil pressure by running engine. Refer to “OIL PRESSURE CHECK” in this section.

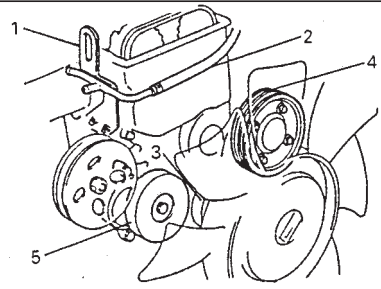
TIMING CHAIN COVER



1. Cylinder head cover
2. Cylinder head cover gasket
3. Cylinder head side seal
4. O-ring
5. Oil pan
6. Oil pump strainer
7. Timing chain cover
8. Crankshaft pulley
9. Crankshaft pulley bolt
10. Oil seal

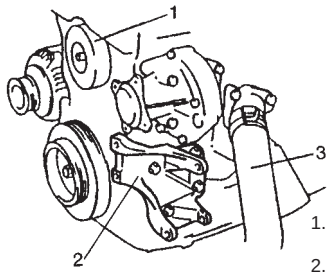
REMOVAL

1) Disconnect negative cable at battery.
2) Drain engine oil.
3) Drain coolant.
4) Remove oil pan and oil pump strainer.
   Refer to item “OIL PAN AND OIL PUMP STRAINER” in this section for removal.
5) Remove cylinder head cover.
   Refer to item “CYLINDER HEAD COVER” in this section for removal.



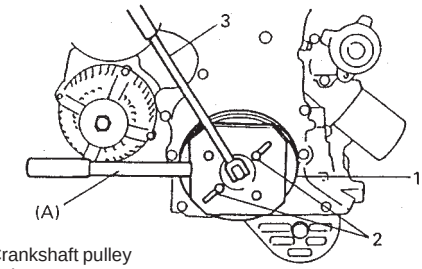
1. Water bypass pipe
2. Water bypass hose No.2
3. Cooling fan pulley
4. Water pump pulley
5. Generator belt tensioner

6) Remove water bypass pipe and bypass hose No.2.
7) Remove cooling fan and fan shroud referring to Section 6B. And then remove cooling fan belt and cooling fan pulley.
8) Remove generator belt by turning generator belt tensioner center bolt clockwise to loosen tension of generator belt. Refer to Section 6H for removal.
9) Remove water pump pulley.
10) Remove generator belt tensioner.



1. Generator belt idler pulley
2. A/C compressor bracket
3. Radiator outlet hose

11) Remove generator belt idler pulley.
12) Disconnect radiator outlet hose from thermostat cap.
13) With hoses connected, detach A/C compressor from compressor bracket if equipped.
14) Remove A/C compressor bracket if equipped.

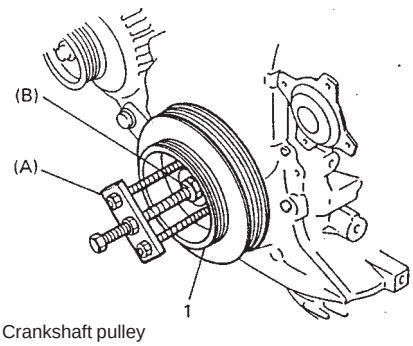


1. Crankshaft pulley
2. Bolt
3. Wrench

15) Remove crankshaft pulley bolt.
To lock crankshaft pulley, use special tool (camshaft pulley holder) with it as shown in figure.

Special Tool
(A): 09917-68221

NOTE:
Be sure to use the following bolt for fixing special tool to crankshaft pulley.
Bolt size: M8, P1.25, L = 45 mm
Strength: 7T



1. Crankshaft pulley

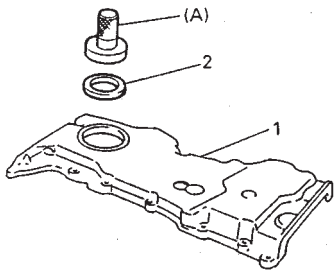
16) Remove crankshaft pulley.
If it is hard to remove, use special tools (Steering wheel remover and Bearing puller attachment) as shown in figure.
If bolts of steering wheel remover are too long, replace them with those of suitable length.

Special Tool
(A): 09944-36011
(B): 09926-58010

17) Remove timing chain cover.

CLEAN

° Clean sealing surface on timing chain cover, crankcase, cylinder block and cylinder head.
Remove oil, old sealant, and dust from sealing surface.



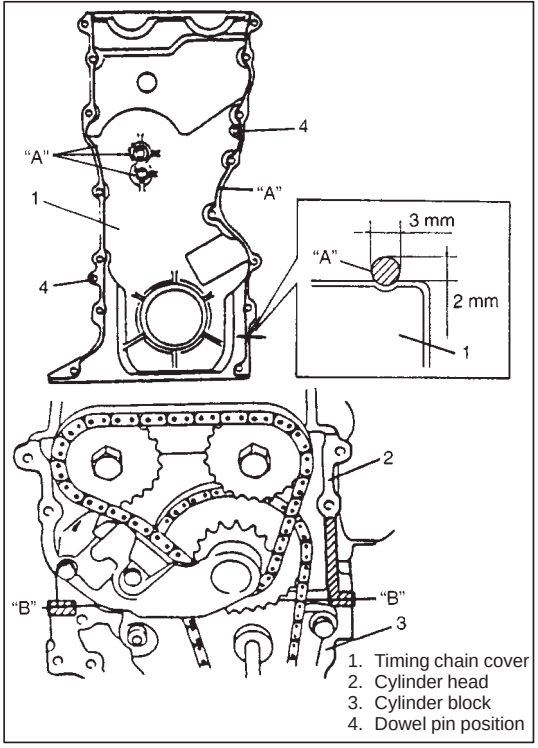
1. Timing chain cover
2. Oil seal

INSPECTION

° Check oil seal lip for fault or other damage.
Replace as necessary.

NOTE:
When installing new oil seal, tap it in until its surface is flash with edge of timing chain cover.
To install oil seal, use special tool (bearing installer).

Special Tool
(A): 09913-75510



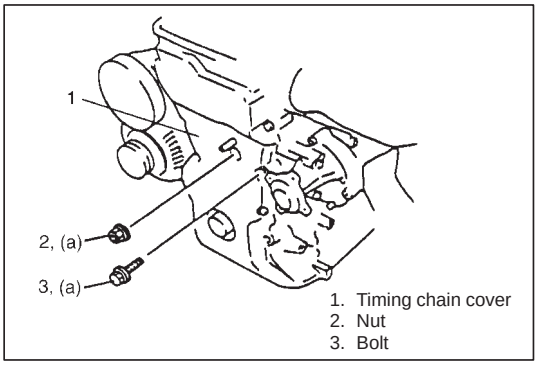
1. Timing chain cover
2. Cylinder head
3. Cylinder block
4. Dowel pin position

INSTALLATION

Reverse removal sequence to install timing chain cover noting following points.

1) Apply sealant "A" and "B" to area as shown in figure.

"A": Sealant 99000-31150
"B": Sealant 99000-31140

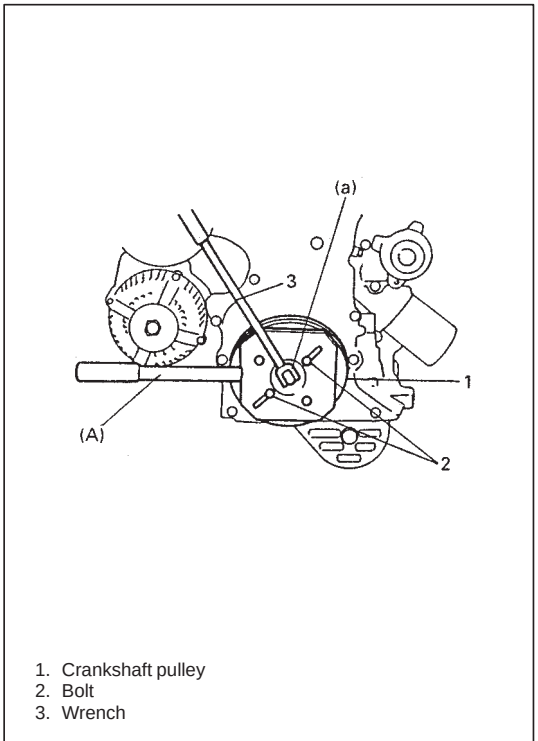


1. Timing chain cover
2. Nut
3. Bolt

2) Apply engine oil to oil seal lip, then install timing chain cover. Tighten bolts and nut to specified torque.

NOTE:
Before installing timing chain cover, check that pin is securely fitted.

Tightening Torque
(a): 11.0 N·m (1.1 kg-m, 8.0 lb-ft)



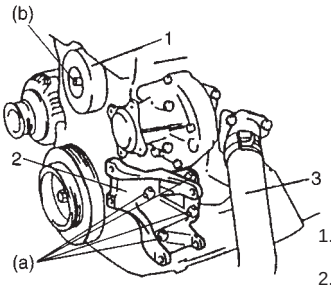
1. Crankshaft pulley
2. Bolt
3. Wrench

3) Install crankshaft pulley.
To lock crankshaft pulley, use special tool (camshaft pulley holder) with it at shown in figure.

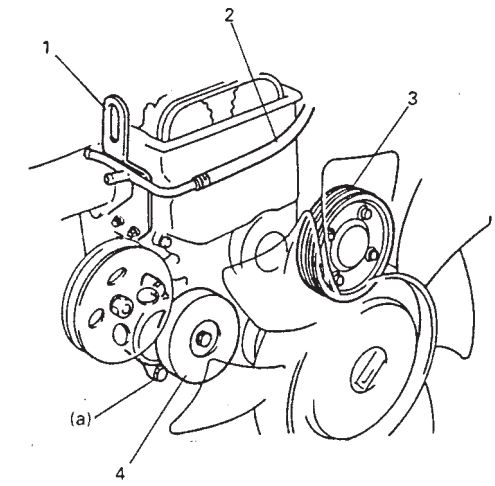
Special Tool
(A): 09917-68221

NOTE:
Be sure to use the following bolt for fixing special tool to crankshaft pulley.
Bolt size: M8, P1.25, L = 45 mm
Strength: 7T

Tightening Torque
(a): 150 N·m (15 kg-m 108.5 lb-ft)



1. Generator belt idler pulley
2. A/C compressor bracket
3. Radiator outlet hose



1. Water bypass pipe
2. Water bypass hose No.2
3. Water pump pulley
4. Generator belt tensioner

4) Install A/C compressor bracket if equipped.
   Tighten bracket bolts to specified torque.

   Tightening Torque
   (a): 55 N·m (5.5 kg-m, 40.0 lb-ft)

5) Install generator belt idler pulley.
   Tighten nut to specified torque.

   Tightening Torque
   (b): 45 N·m (4.5 kg-m, 33.0 lb-ft)

6) Connect radiator outlet hose to thermostat cap.

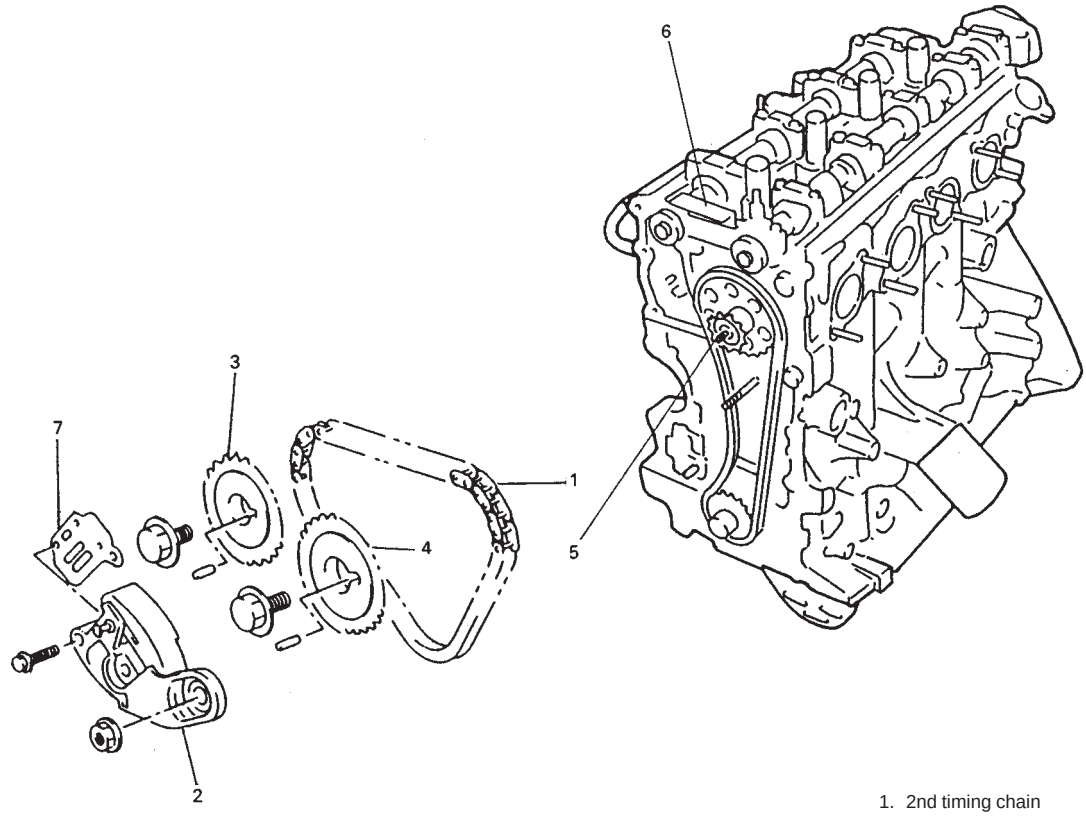
7) Install generator belt tensioner.
   Tighten bolts to specified torque.

   Tightening Torque
   (a): 25 N·m (2.5 kg-m, 18.5 lb-ft)

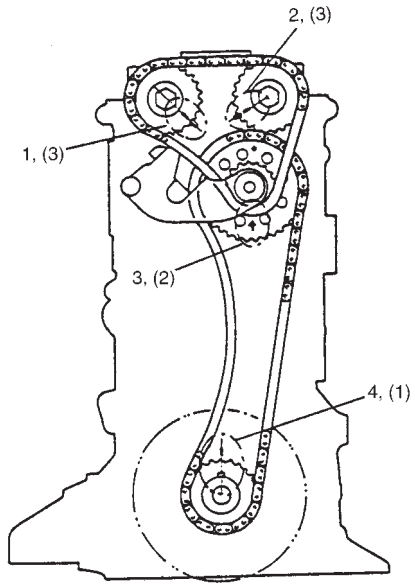
8) Install water pump pulley.
9) Install generator belt by turning generator belt tensioner center bolt clockwise to loosen tension of generator belt.
10) Install cooling fan belt, fan pulley, cooling fan and shroud.
11) Install bypass pipe and water bypass hose No.2.

12) Install cylinder head cover.
    Refer to item “CYLINDER HEAD COVER” in this section for installation.
13) Install oil pan and oil pump strainer.
    Refer to item “OIL PAN AND OIL PUMP STRAINER” in this section for installation.
14) Adjust cooling fan belt tension.
    Refer to Section 6B for adjusting procedure.
15) Refill cooling system with coolant, front differential with gear oil, engine with engine oil and power steering system with specified fluid.
16) Verify that there is no coolant leakage, oil leakage, power steering fluid leakage and exhaust gas leakage at each connection.

2ND TIMING CHAIN AND CHAIN TENSIONER



1. 2nd timing chain
2. Timing chain tensioner adjuster No.2
3. Intake camshaft timing sprocket
4. Exhaust camshaft timing sprocket
5. Idler sprocket
6. Timing chain guide No.2
7. Tensioner adjuster No.2 gasket

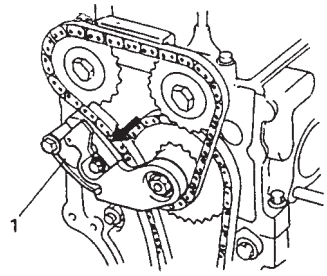


1. Timing marks of intake camshaft timing sprocket
2. Timing marks of exhaust camshaft timing sprocket
3. Arrow mark on idler sprocket
4. Timing marks of crankshaft timing sprocket

REMOVAL

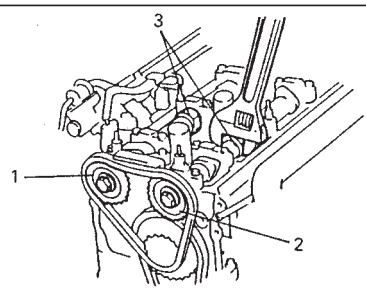
1) Disconnect negative cable at battery.
2) Drain engine oil.
3) Drain coolant.
4) Remove oil pan and oil pump strainer.
   Refer to item “OIL PAN AND OIL PUMP STRAINER” in this section for removal.
5) Remove cylinder head cover.
   Refer to item “CYLINDER HEAD COVER” in this section for removal.
6) Remove timing chain cover.
   Refer to item “TIMING CHAIN COVER” in this section for removal.
7) Turn crankshaft to meet following condition.
   - Key (1) on crankshaft position as shown.
   - Arrow mark on idler sprocket (2) points upward vertically.
   - The marks on sprockets (3) match with marks on cylinder head.

   Note that this step must be followed for reinstallation of timing chain.



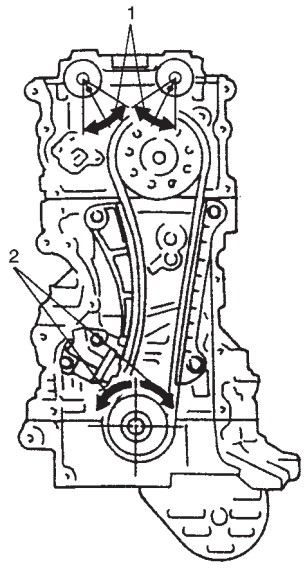
1. Timing chain tensioner adjuster No.2

8) Remove timing chain tensioner adjuster No.2.
To remove it, slacken 2nd timing chain by turning intake camshaft counterclockwise a little while pushing back pad.



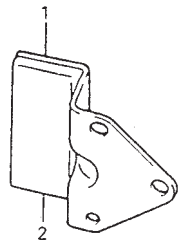
1. Intake camshaft timing sprocket
2. Exhaust camshaft timing sprocket
3. Hexagonal part of camshaft

9) Remove intake and exhaust camshaft timing sprocket bolts.
To remove it, fit a spanner to hexagonal part at the center of camshaft to hold it stationary.
10) Remove camshaft timing sprockets and 2nd timing chain.



1. Camshafts (IN & EX) allowable turning range . . . . .
By knock pin on camshaft within 15° from mark on cylinder head on both right and left
2. Crankshaft allowable turning range . . . . .
By key on crankshaft, within 90° from mark on cylinder block on both right and left

CAUTION:
After 2nd timing chain is removed, never turn intake camshaft, exhaust camshaft and crankshaft independently more than such an extent as shown. If turned, interference may occur between piston and valves and valves themselves, and parts related to piston and valves may be damaged.

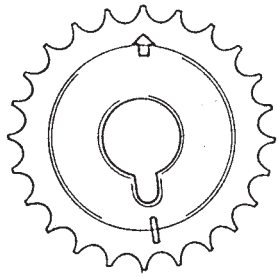


1. Timing chain guide No.2
2. Shoe

INSPECTION

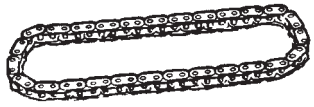
Timing Chain Guide No.2

° Check shoe for wear or damage.



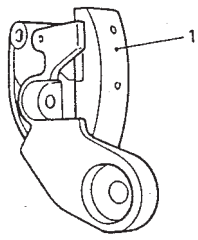
Camshaft Sprocket

° Check teeth of sprocket for wear or damage.



Timing Chain

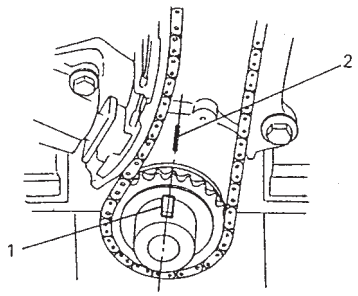
° Check timing chain for wear or damage.



1. Shoe

Tensioner Adjuster No.2

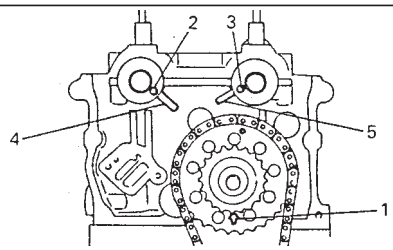
° Check shoe for wear or damage.



1. Crank timing sprocket key
2. Timing mark

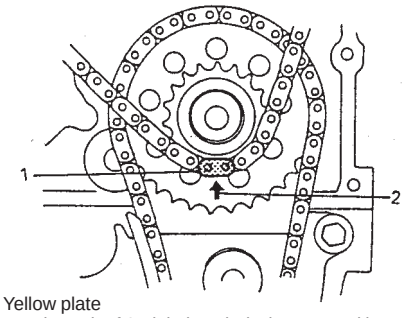
INSTALLATION

1) Check that crank timing sprocket key is in match with timing mark on cylinder block as shown in figure.



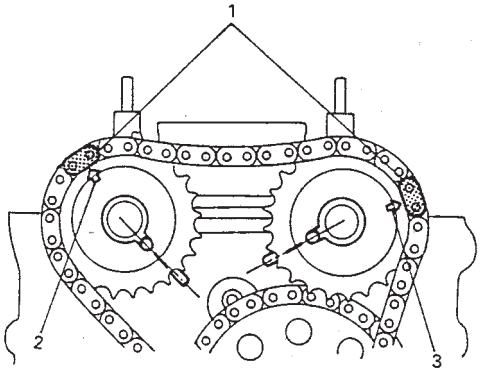
1. Arrow mark on idler sprocket
2. Knock pin of intake camshaft
3. Knock pin of exhaust camshaft
4. Timing mark of intake side
5. Timing mark of exhaust side

2) Check that arrow mark on idler sprocket faces upward as shown in figure.
3) Check that knock pins of intake and exhaust camshafts are aligned with timing marks on cylinder head as shown in figure.



1. Yellow plate
2. Match mark of 2nd timing chain (Arrow mark)

4) Install 2nd timing chain by aligning yellow plate of 2nd timing chain with arrow mark on idler sprocket.

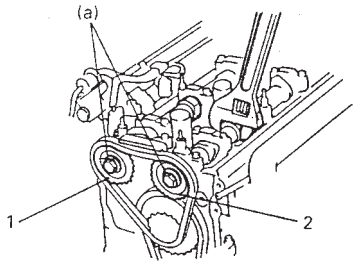


1. Dark blue
2. Arrow mark on intake camshaft timing sprocket
3. Arrow mark on exhaust camshaft timing sprocket

5) Install sprockets to intake and exhaust camshafts by aligning dark blue plate of 2nd timing chain with arrow marks on intake sprocket and exhaust sprocket respectively.

CAUTION:
Do not turn camshaft more than allowable turning range. If turned excessively, valve and piston may get damaged.

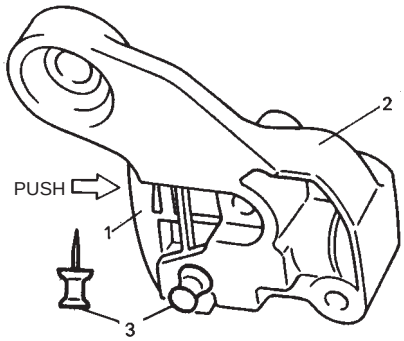
NOTE:
As an arrow mark is provided on both sides, camshaft timing sprocket has no specific installation direction.



1. Intake camshaft timing sprocket
2. Exhaust camshaft timing sprocket

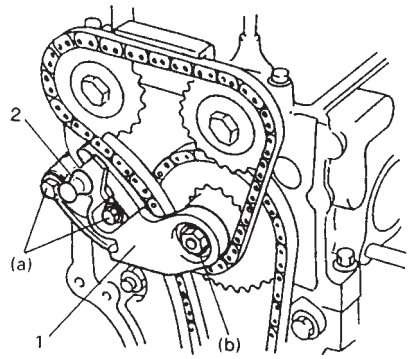
6) Install intake and exhaust camshaft timing sprocket bolts. To install it, fit a spanner to hexagonal part at the center of camshaft to hold stationary.

Tightening Torque
(a): 80 N·m (8.0 kg-m, 57.5 lb-ft)



1. Plunger
2. Body
3. Stopper

7) Push back plunger into tensioner body and hold it with stopper at the position by inserting stopper into body.

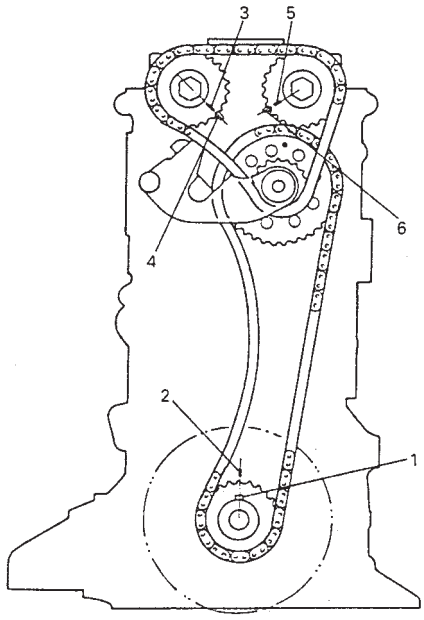


1. Timing chain tensioner adjuster No.2
2. Stopper

8) Install timing chain tensioner adjuster No.2 with gasket.

Tightening Torque
(a): 11 N·m (1,1 kg-m, 8.0 lb-ft)
(b): 45 N·m (4.5 kg-m, 33.0 lb-ft)

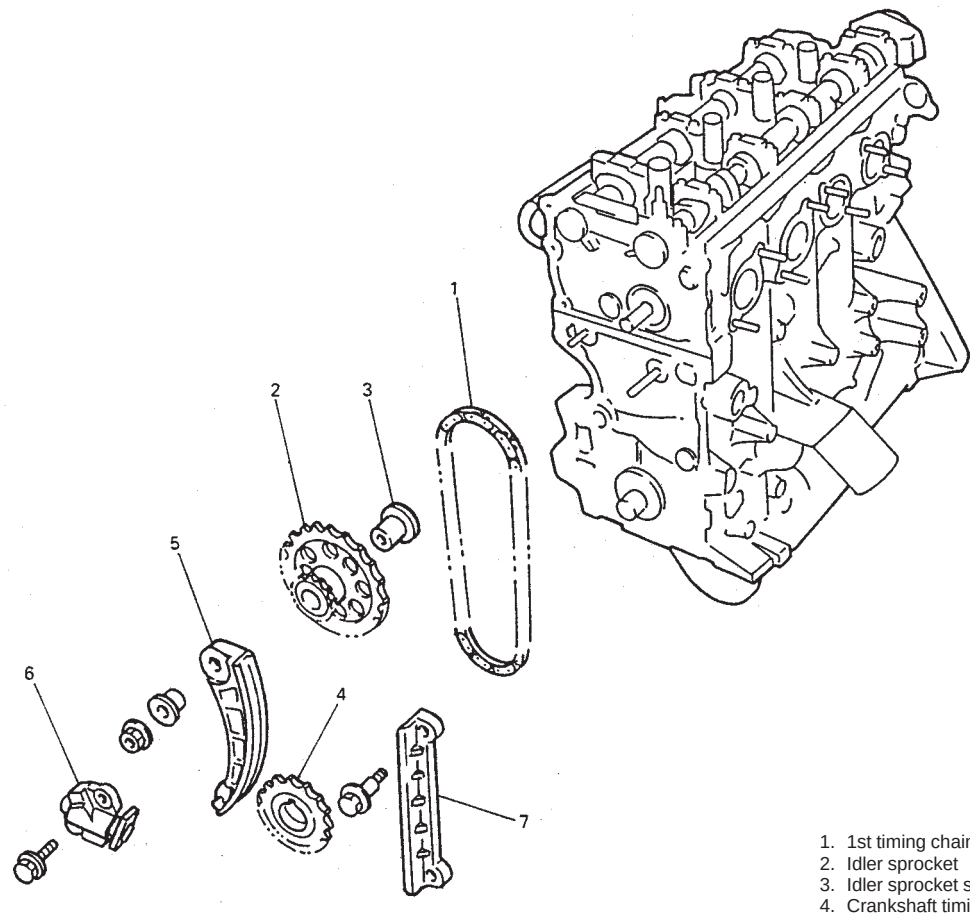
9) Pull out stopper from timing chain tensioner adjuster No.2.



1. Crank timing sprocket key
2. Timing mark for crank timing sprocket key
3. Timing mark on intake camshaft timing sprocket
4. Timing mark for intake camshaft timing sprocket
5. Timing mark on exhaust camshaft timing sprocket
6. Timing mark for exhaust camshaft timing sprocket

10) Turn crankshaft two rotations clockwise then align timing mark on crankshaft and timing mark on cylinder block as shown in figure.
    Check that timing marks of cylinder head and cylinder block are in match with match marks on sprockets respectively.
11) Apply oil to timing chains, tensioner, tensioner adjusters, sprockets and guides.
12) Install timing chain cover.
    Refer to item “TIMING CHAIN COVER” in this section for installation.
13) Install cylinder head cover.
    Refer to item “CYLINDER HEAD COVER” in this section for installation.
14) Install oil pan and oil pump strainer.
    Refer to item “OIL PAN AND OIL PUMP STRAINER” in this section for installation.
15) Install cooling system and other parts.
16) Refill cooling system with coolant, front differential with gear oil, engine with engine oil and power steering system with specified fluid.
17) Verify that there is no coolant leakage, power steering fluid leakage, exhaust gas leakage and oil leakage at each connection.

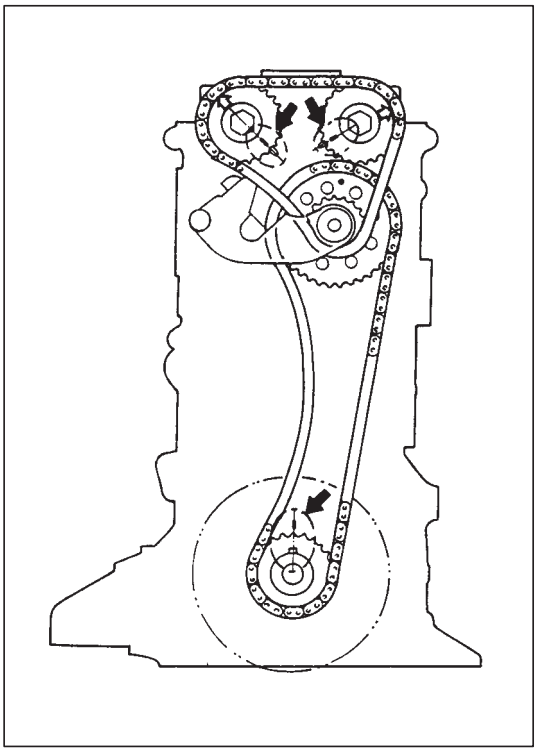
1ST TIMING CHAIN AND CHAIN TENSIONER



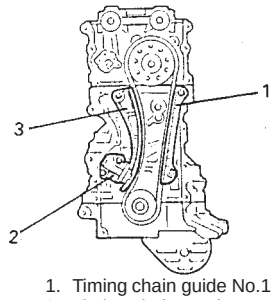
1. 1st timing chain
2. Idler sprocket
3. Idler sprocket shaft
4. Crankshaft timing sprocket
5. Timing chain tensioner
6. Timing chain tensioner adjuster No.1
7. Timing chain guide No.1

REMOVAL

1) Disconnect negative cable at battery.
2) Drain engine oil.
3) Drain coolant.
4) Remove oil pan and oil pump strainer.
   Refer to item “OIL PAN AND OIL PUMP STRAINER” in this section for removal.
5) Remove cylinder head cover.
   Refer to item “CYLINDER HEAD COVER” in this section for removal.
6) Remove timing chain cover.
   Refer to item “TIMING CHAIN COVER” in this section for removal.

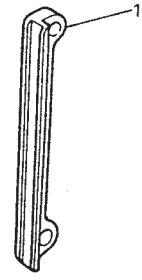


7) For reinstallation of timing chain, turn crankshaft so that timing marks on cylinder head and cylinder block match with those on sprockets as shown in figure.
8) Remove 2nd timing chain.
   Refer to item “2ND TIMING CHAIN AND CHAIN TENSIONER” in this section for removal.



1. Timing chain guide No.1
2. Timing chain tensioner adjuster No.1
3. Timing chain tensioner

9) Remove timing chain guide No.1.
10) Remove timing chain tensioner adjuster No.1.
11) Remove timing chain tensioner.
12) Remove idler sprocket and 1st timing chain.
13) Remove crankshaft timing sprocket.

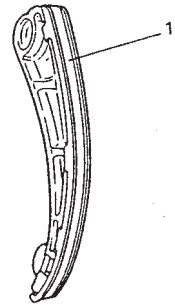


1. Timing chain guide No.1

INSPECTION

Timing Chain Guide No.1

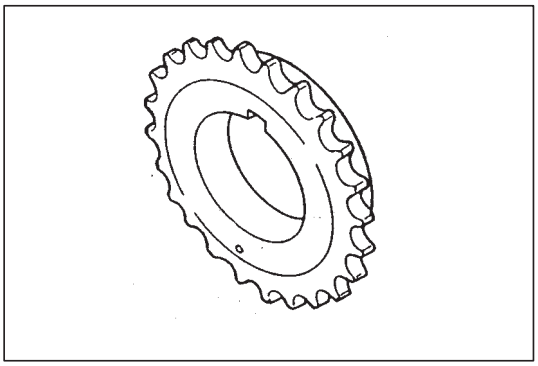
° Check shoe for wear or damage.



1. Shoe

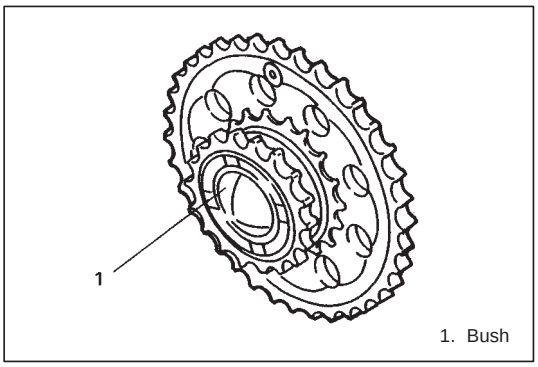
Timing Chain Tensioner

° Check shoe for wear or damage.



Crankshaft Timing Sprocket

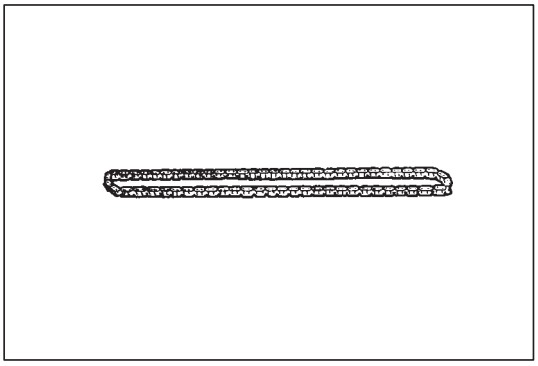
° Check teeth of sprocket for wear or damage.



1. Bush

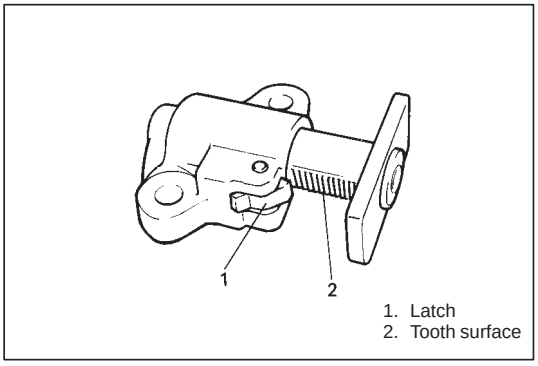
Idler Sprocket

° Check teeth and bush of sprocket for wear or damage.



1st Timing Chain

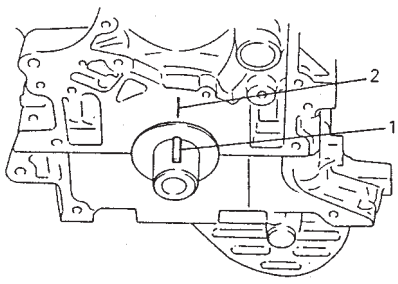
° Check timing chain for wear or damage.



1. Latch
2. Tooth surface

Timing Chain Tensioner Adjuster No.1

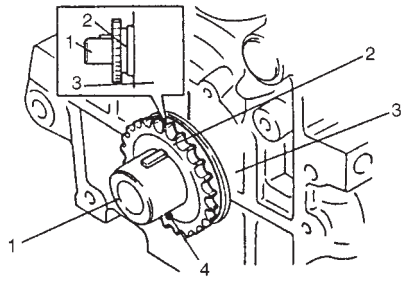
° Check that latch and tooth surface are free from damage and latch functions properly.



1. Crank timing sprocket key
2. Timing mark

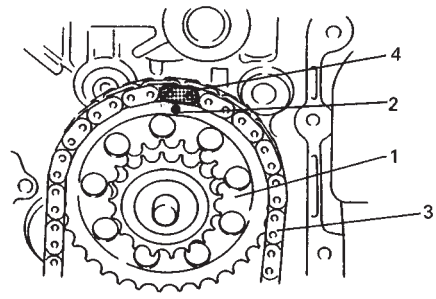
INSTALLATION

1) Check that crank timing sprocket key is in match with timing mark on cylinder block.



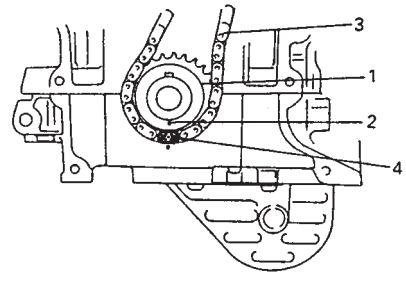
1. Crankshaft
2. Crankshaft timing sprocket
3. Cylinder block
4. Mark

2) Install crankshaft timing sprocket as shown in figure. Match mark faces to chain cover.



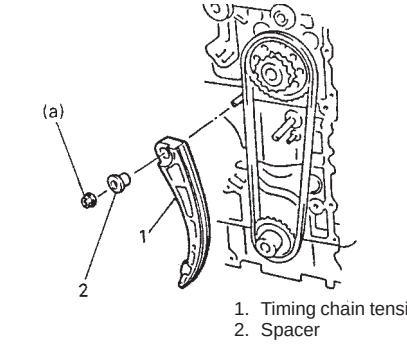
1. Idler sprocket
2. Match mark on idler sprocket
3. 1st timing chain
4. Dark blue plate

3) Apply oil to bush of idler sprocket.
4) Install sprocket shaft and idler sprocket.
5) Install 1st timing chain by aligning dark blue plate of 1st timing chain and match mark on idler sprocket.



1. Crankshaft timing sprocket
2. Match mark
3. 1st timing chain
4. Yellow plate

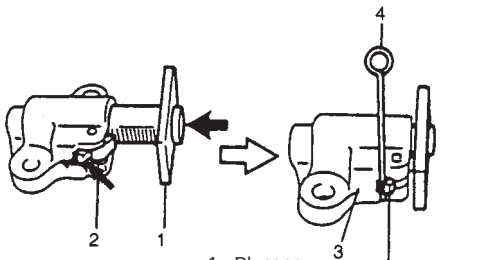
6) Bring yellow plate of 1st timing chain into match with match mark on crankshaft timing sprocket.



1. Timing chain tensioner
2. Spacer

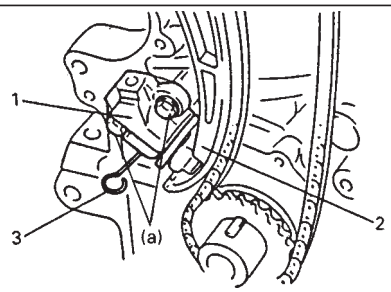
7) Install timing chain tensioner as shown in figure.

Tightening Torque
(a): 25 N·m (2.5 kg-m, 18.5 lb-ft)



1. Plunger
2. Latch
3. Body
4. Stopper

8) With latch of tensioner adjuster No.1 returned and plunger pushed back into body, hold it at the position by inserting stopper between latch and body.

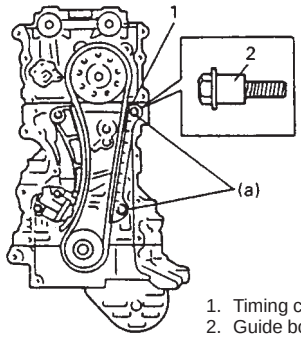


1. Timing chain tensioner adjuster No.1
2. Timing chain tensioner
3. Stopper

9) Install timing chain tensioner adjuster No.1.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

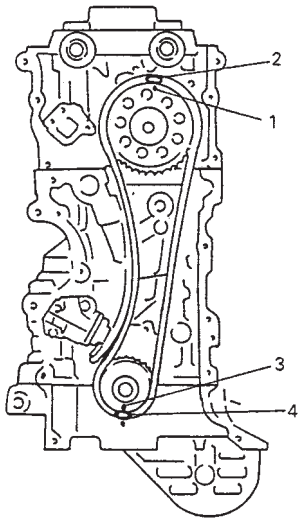
10) Pull out stopper from adjuster No.1.



1. Timing chain guide No.1
2. Guide bolts

11) Install timing chain guide No.1.

Tightening Torque
(a): 9 N·m (0.9 kg-m, 6.5 lb-ft)

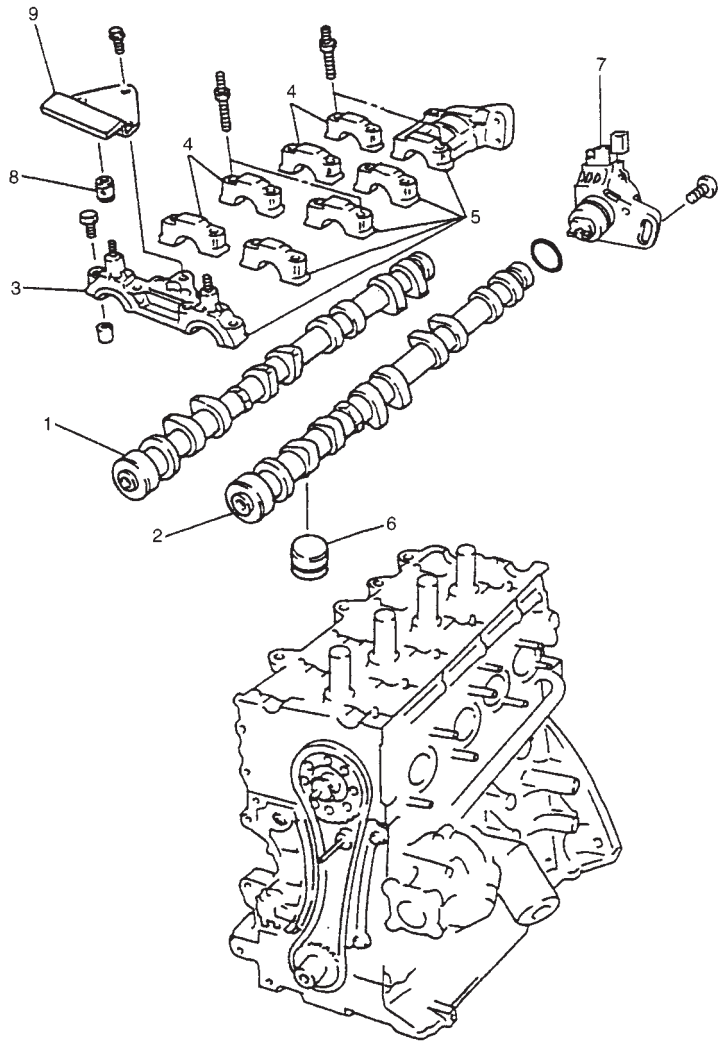


1. Match mark on idler sprocket
2. Dark blue plate
3. Match mark on crank timing sprocket
4. Yellow plate

12) Check that dark blue and yellow plate of 1st timing chain are in match with match marks on sprockets respectively.

13) Install 2nd timing chain.
    Refer to item “2ND TIMING CHAIN AND CHAIN TENSIONER” in this section for installation.
14) Install timing chain cover.
    Refer to item “TIMING CHAIN COVER” in this section for installation.
15) Install cylinder head cover.
    Refer to item “CYLINDER HEAD COVER” in this section for installation.
16) Install oil pan and oil pump strainer.
    Refer to item “OIL PAN AND OIL PUMP STRAINER” in this section for installation.
17) Install cooling system and other parts.
18) Refill cooling system with coolant, front differential with gear oil, engine with engine oil and power steering system with specified fluid.
19) Verify that there is no coolant leakage, power steering fluid leakage, exhaust gas leakage and oil leakage at each connection.

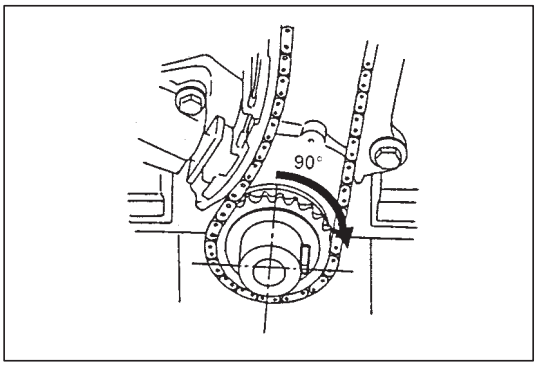
CAMSHAFTS AND VALVE LASH ADJUSTERS



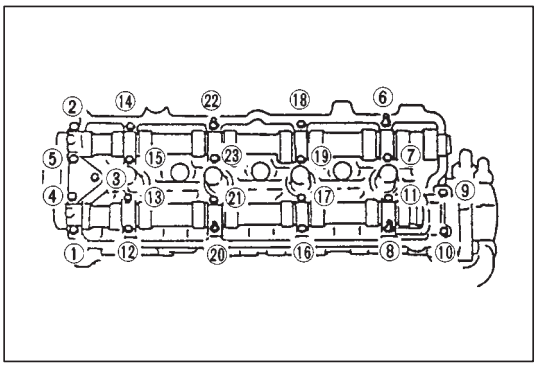
1. Intake camshaft
2. Exhaust camshaft
3. Camshaft housing
4. Intake camshaft housing
5. Exhaust camshaft housing
6. Valve lash adjuster
7. CMP sensor
8. Oil relief valve
9. Timing chain guide No.2

REMOVAL

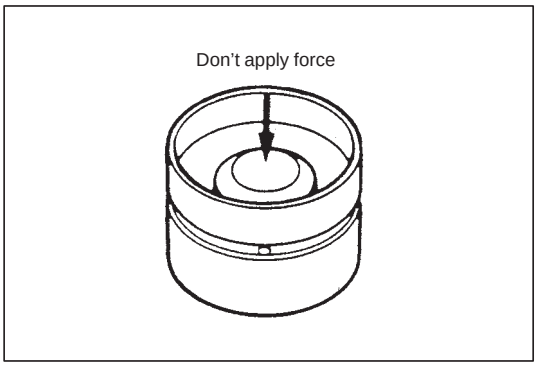
1) Disconnect negative cable at battery.
2) Drain engine oil.
3) Drain coolant.
4) Remove oil pan and oil pump strainer.
   Refer to item “OIL PAN AND OIL PUMP STRAINER” in this section for removal.
5) Remove cylinder head cover.
   Refer to item “CYLINDER HEAD COVER” in this section for removal.
6) Remove timing chain cover.
   Refer to item “TIMING CHAIN COVER” in this section for removal.
7) Remove 2nd timing chain.
   Refer to item “2ND TIMING CHAIN AND CHAIN TENSIONER” in this section for removal.
8) Remove CMP sensor.
   Refer to Section 6F2 for CMP sensor removal.



9) After removing 2nd timing chain, set key on crankshaft in position as shown by turning crankshaft. This is to prevent interference between valves and piston.

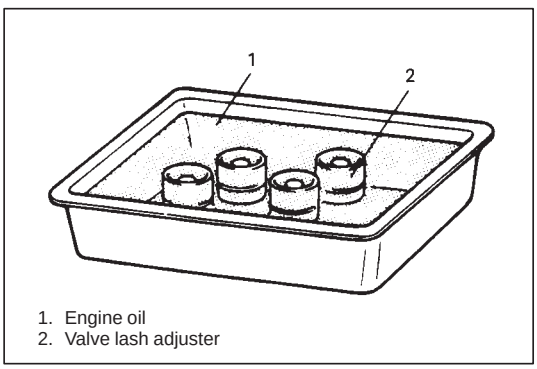


10) Loosen camshaft housing bolts in such order as indicated in figure and remove them.
11) Remove camshaft housings.
12) Remove camshafts.



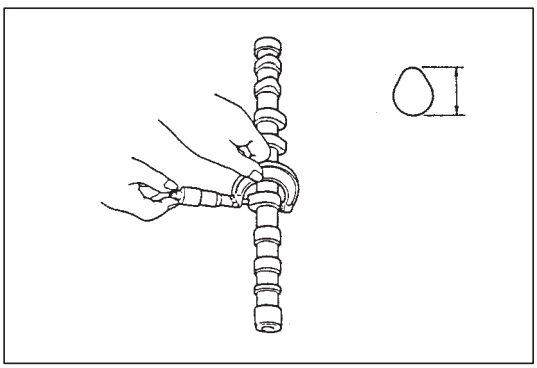
13) Remove valve lash adjusters.

NOTE:
- **Never disassemble hydraulic valve lash adjuster.**
- **Don't apply force to body of adjuster, oil in high pressure chamber in adjuster will leak.**



1. Engine oil
2. Valve lash adjuster

- **Immerse removed adjuster in clean engine oil and keep it there till reinstalling it so as to prevent oil leakage. If it is left in air, place it with its bucket body facing down. Don't place on its side or with bucket body facing up.**

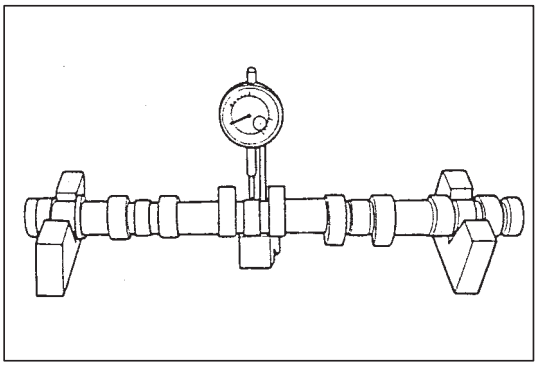


INSPECTION

Cam Wear

Using a micrometer, measure cam height. If measured height is below its limit, replace camshaft.

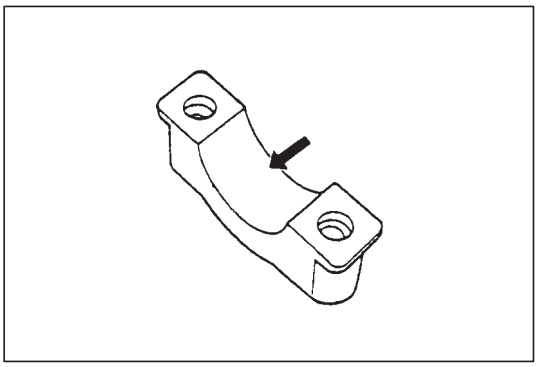
Cam height	Standard	Limit
Intake cam	40.402 – 40.562 mm (1.5906 – 1.5969 in.)	40.202 mm (1.5827 in.)
Exhaust cam	39.921 – 40.081 mm (1.5717 – 1.5780 in.)	39.721 mm (1.5638 in.)



Camshaft Runout

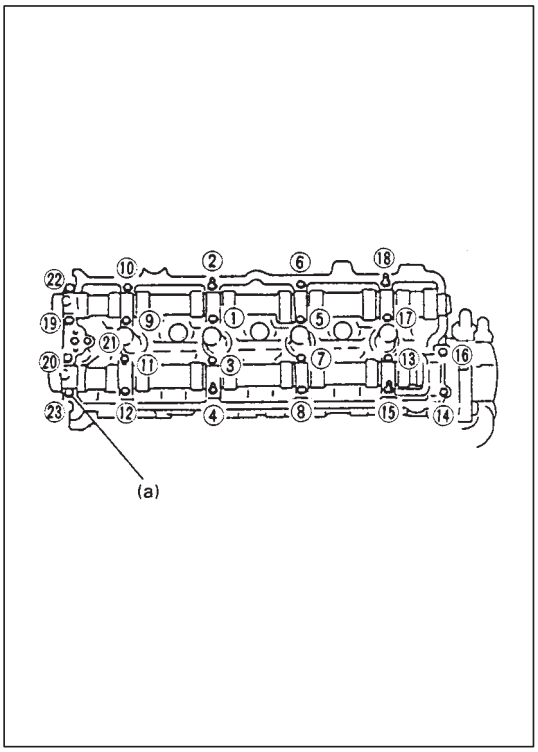
Set camshaft between two “V” blocks, and measure its runout by using a dial gauge.
If measured runout exceed below specified limit, replace camshaft.

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 housings.

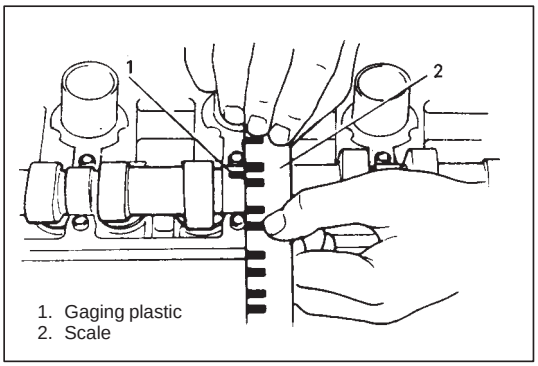


Check clearance by using gaging plastic. The procedure is as follows.

1) Clean housings and camshaft journals.
2) Make sure that all valve lash adjusters are removed and 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.
5) Tighten camshaft housing bolts in such order as indicated in figure a little at a time till they are tightened to specified torque.

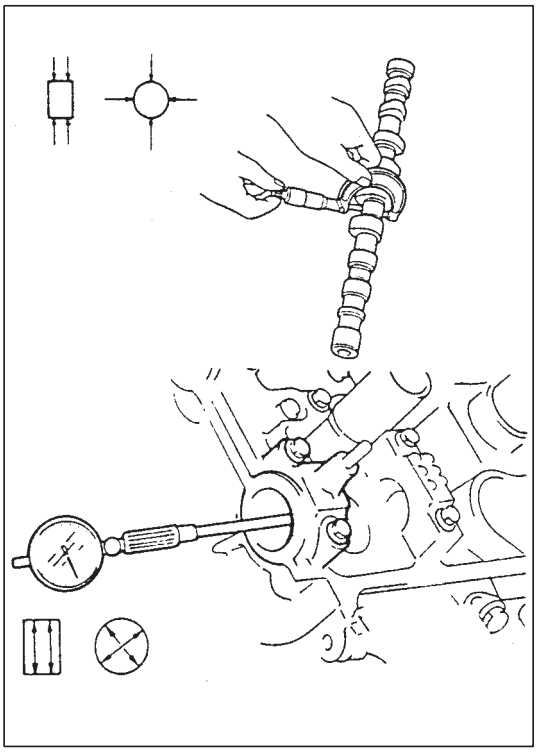
NOTE:
Do not rotate camshaft while gaging plastic is installed.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



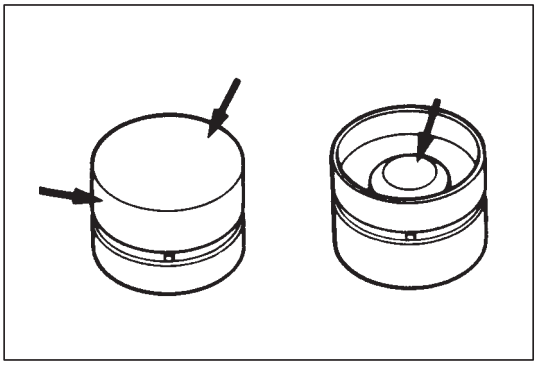
6) Remove housing, and using scale on gaging plastic envelop, measure gaging plastic width at its widest point.

	Standard	Limit
Journal clearance	0.045 – 0.099 mm (0.0018 – 0.0039 in.)	0.12 mm (0.0047 in.)



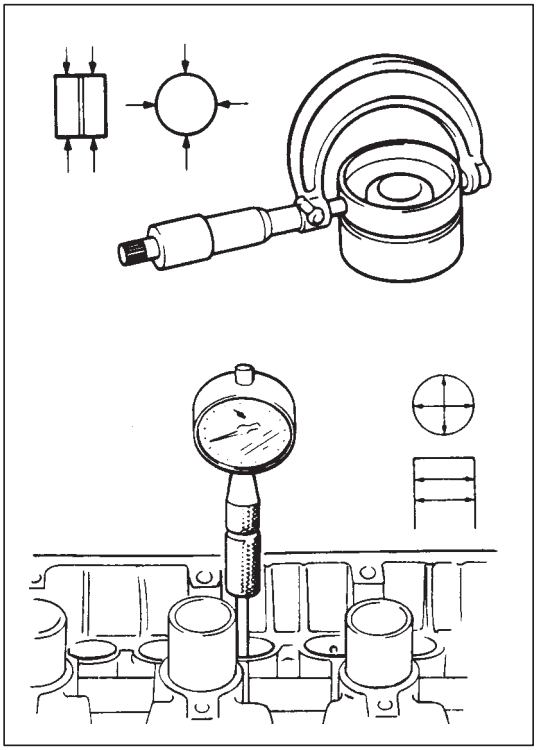
If measured camshaft journal clearance exceeds limit, measure journal (housing) bore and outside diameter of camshaft journal. Replace camshaft or cylinder head assembly whichever the difference from specification is greater.

Item	Standard
Camshaft journal bore dia. (IN & EX)	26.000 – 26.033 mm (1.0236 – 1.0249 in.)
Camshaft journal O.D. (IN & EX)	25.934 – 25.955 mm (1.0210 – 1.0218 in.)



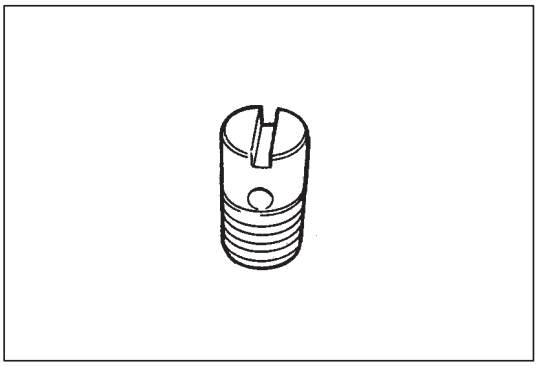
Wear of Hydraulic Valve Lash Adjuster

Check adjuster for pitting, scratches, or damage.
If any malcondition is found, replace.



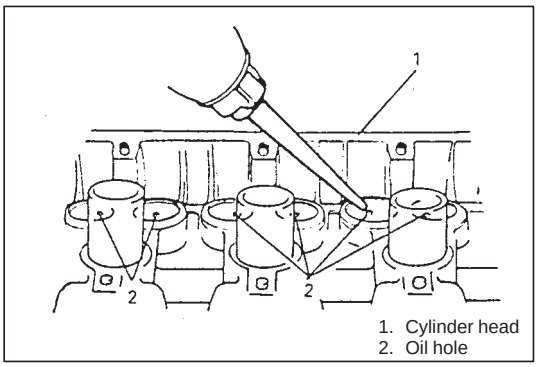
Measure cylinder head bore and adjuster outside diameter to determine cylinder head-to-adjuster clearance. If clearance exceeds limit, replace adjuster or cylinder head.

Item	Standard	Limit
Hydraulic valve lash adjuster O.D.	30.959 – 30.975 mm (1.2189 – 1.2194 in.)	–
Cylinder head bore	31.000 – 31.025 mm (1.2205 – 1.2214 in.)	–
Cylinder head to adjuster clearance	0.025 – 0.066 mm (0.0010 – 0.0025 in.)	0.15 mm (0.0059 in.)



Oil Relief Valve

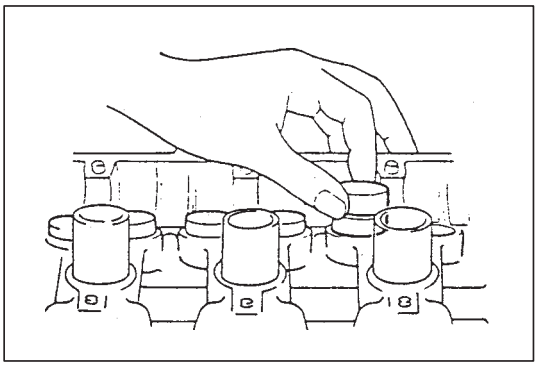
Check oil relief valve for clogging and ball for being stuck.



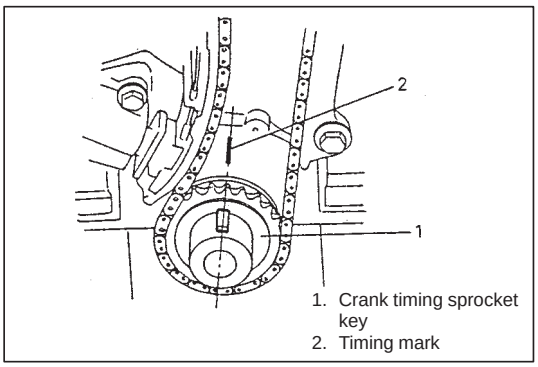
1. Cylinder head
2. Oil hole

INSTALLATION

1) Before installing valve lash adjuster to cylinder head, fill oil passage of cylinder head with engine oil according to following procedure.
   Pour engine oil through oil holes and check that oil comes out from oil holes in sliding part of valve lash adjuster.
   Perform this check on both intake and exhaust sides.

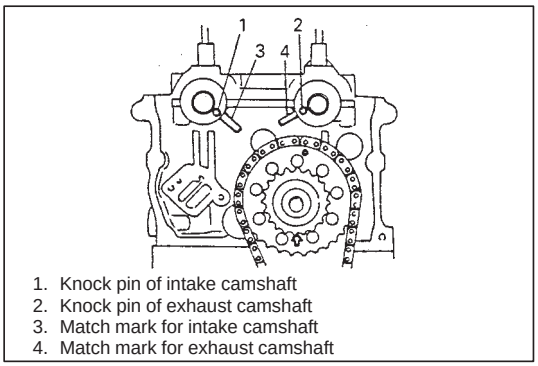


2) Install valve lash adjusters to cylinder head.
   Apply engine oil around valve lash adjuster and then install it to cylinder head.



1. Crank timing sprocket key
2. Timing mark

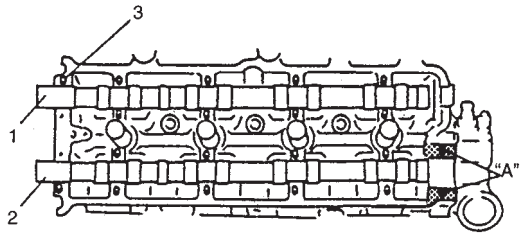
3) Match key on crankshaft to timing mark as shown in figure.



1. Knock pin of intake camshaft
2. Knock pin of exhaust camshaft
3. Match mark for intake camshaft
4. Match mark for exhaust camshaft

4) Install camshafts.
   Apply oil to sliding surface of each camshaft and camshaft journal then install them by aligning match marks on cylinder head and pins on camshafts as shown in figure.

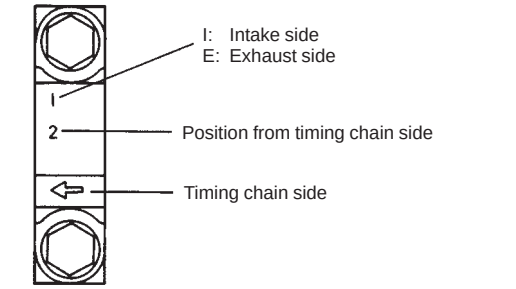
   NOTE:
   Install camshaft in such direction that its end with groove for CMP sensor installation comes to exhaust side.



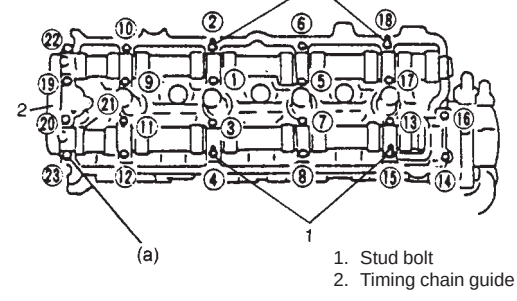
1. Intake camshaft
2. Exhaust camshaft
3. Pin installation position

5) Install camshaft housing pins as shown in figure.
6) Apply sealant "A" to exhaust camshaft end housing sealing surface area as shown in figure.

"A": Sealant 99000-31150



7) Check position of camshaft housings.
Embossed marks are provided on each camshaft housing, indicating position and direction for installation. Install housings as indicated by these marks.



1. Stud bolt
2. Timing chain guide

8) After applying 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 two or three times before they are tightened to specified torque.

Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)

9) Install CMP sensor.
Refer to Section 6F2 for CMP sensor installation.
10) Install 2nd timing chain.
Refer to item "2ND TIMING CHAIN AND CHAIN TENSIONER" in this section for installation.
11) Install timing chain cover.
Refer to item "TIMING CHAIN COVER" in this section for installation.
12) Install cylinder head cover. Refer to item "CYLINDER HEAD COVER" in this section for installation.
13) Install oil pan and oil pump strainer.
Refer to item "OIL PAN AND OIL PUMP STRAINER" in this section for installation.
14) Install cooling system and other parts.
15) Refill cooling system with coolant, front differential with gear oil, engine with engine oil and power steering system with specified fluid.
16) Verify that there is no coolant leakage, power steering fluid leakage, exhaust gas leakage and oil leakage at each connection.
17) Check ignition timing and adjust as necessary, referring to Section 6F2.

CAUTION:
- **Don't turn camshafts or start engine (i.e., valves should not be operated) for about half an hour after reinstalling hydraulic valve lash adjusters and camshafts. As it takes time for valves to settle in place, operating engine within half an hour after their installation may cause interference to occur between valves themselves or valves and piston.**
- **If air is trapped in valve lash adjuster, valve may make tapping sound when engine is operated after valve lash adjuster is installed. In such a case, run engine for about half an hour at about 2,000 – 3,000 r/min., and then air will be purged and tapping sound will cease. Should tapping sound not cease, it is possible that valve lash adjuster is defective. Replace it if defective.**
  If defective adjuster can't be located by hearing among 16 of them, check as follows.
  1) Stop engine and remove cylinder head cover.
  2) Push adjuster downward by hand (with less than 20 kg or 44 lbs force) when cam crest is not on adjuster to be checked and check if clearance exists between cam and adjuster. If it does, adjuster is defective and needs replacement.

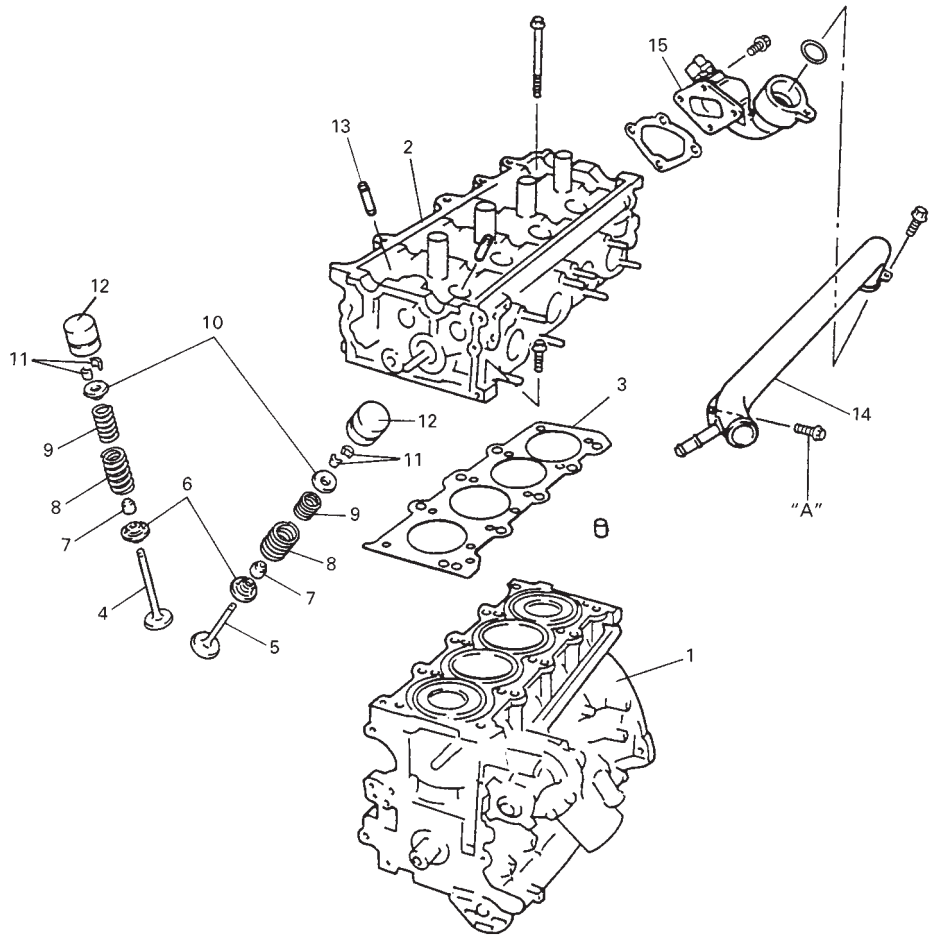
VALVE LASH ADJUSTER NOISE DIAGNOSIS

In case of the followings, valve lash adjuster noise may be caused by air trapped into valve lash adjusters.
- Vehicle is left for 24 hours or more.
- Engine oil is changed.
- Hydraulic lash adjuster is replaced or reinstalled.
- Engine is overhauled.

If noise from valve lash adjusters is suspected, perform the following checks.

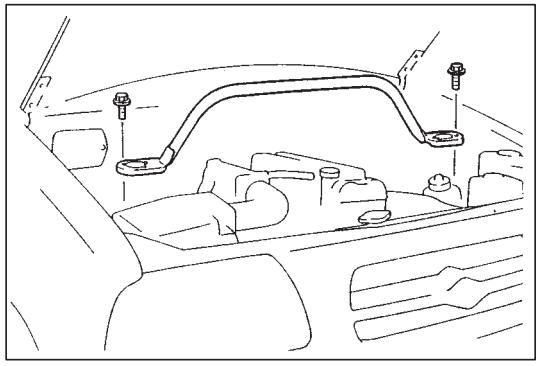
1) Check engine oil for the followings.
   - Oil level oil pan
     If oil level is low, add oil up to Full level hole on oil level gauge.
   - Oil quality
     If oil is discolored, or deteriorated, change it.
     For particular oil to be used, refer to Section 0B.
   - Oil leaks
     If leak is found, repair it.
   - Oil pressure (refer to Oil Pressure Check in this section)
     If defective pressure is found, repair it.
2) Run engine for about half an hour at about 2,000 to 3,000 r/min., and then air will be purge and tapping sound will cease.
3) Should tapping sound not cease, it is possible that hydraulic valve lash adjuster is defective.
   Replace it if defective.
   If defective adjuster can't be located by hearing among 16 of them, check as follows.
   i) Stop engine and remove cylinder head cover.
   ii) Push adjuster downward by hand (with less than 20 kg or 44 lbs. Force) when cam crest is not on adjuster to be check if clearance exists between cam and adjuster.
   If it does, adjuster is defective and needs replacement.

VALVES AND CYLINDER HEAD



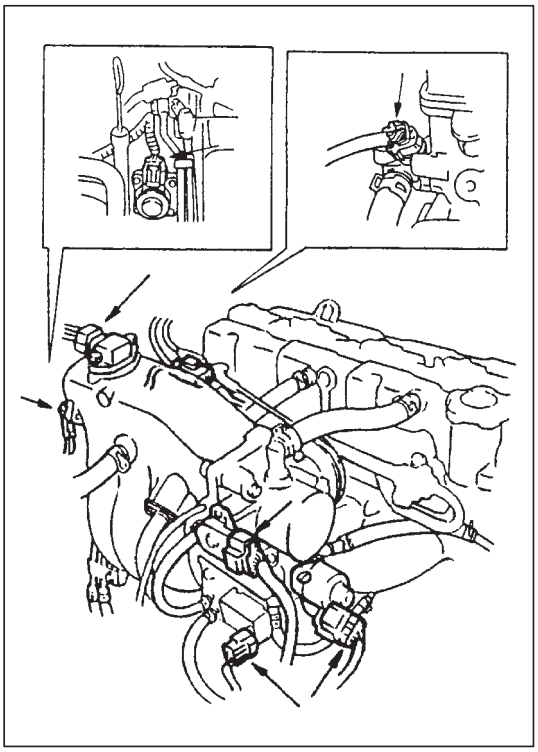
1. Cylinder block
2. Cylinder head
3. Cylinder head gasket
4. Intake valve
5. Exhaust valve
6. Valve spring seat
7. Valve stem seal
8. Valve spring (outer)
9. Valve spring (inner)
10. Valve spring retainer
11. Valve cotter
12. Hydraulic valve lash adjuster
13. Valve guide
14. Water outlet pipe
15. Water outlet cap

"A": Apply sealant (SUZUKI BOND No. 1215, 99000-31110) to thread

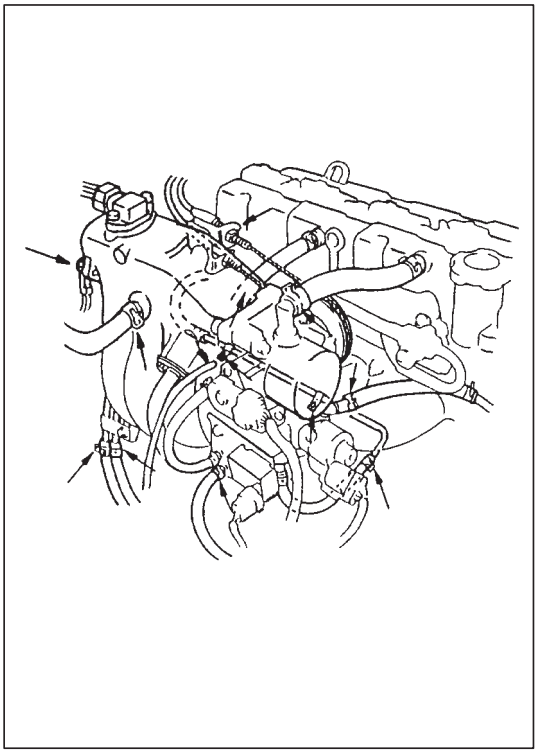


REMOVAL

1) Relieve fuel pressure according to procedure described in Section 6.
2) Disconnect negative cable at battery.
3) Drain engine oil.
4) Drain coolant.
5) Remove strut tower bar.
6) Remove air cleaner outlet hose.

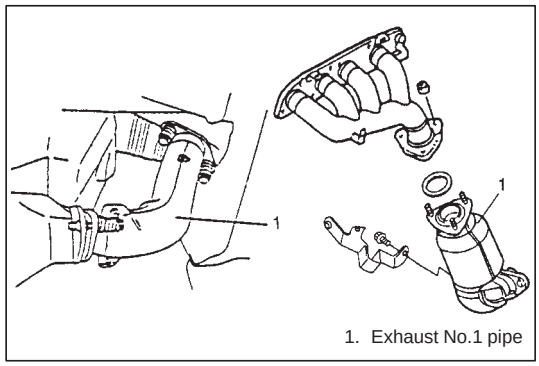


7) Disconnect following electric lead wires:
   - EGR valve coupler
   - IAC valve coupler
   - TP sensor coupler
   - EVAP canister purge valve coupler
   - Ground terminal from intake manifold
   - Heated oxygen sensor-1 and/or -2 coupler
   - CMP sensor coupler
   - ECT sensor coupler
   - Injector wire harness coupler
   - Ground wire at the coupler
   - Ignition coils couplers
   - Wire harness clamps



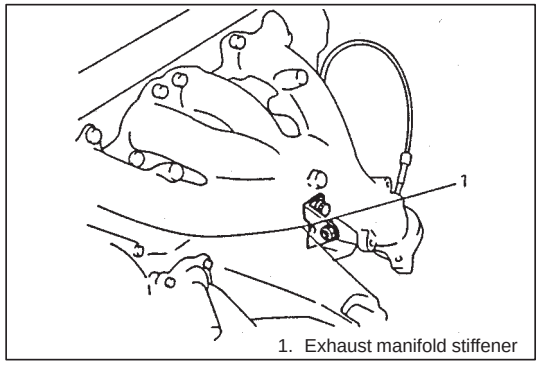
8) Disconnect accelerator cable and A/T throttle cable (for vehicle with A/T) from throttle body.
9) Disconnect following hoses:
   - Brake booster hose from intake manifold
   - Vacuum hose from intake manifold
   - Canister purge hose from EVAP canister
   - Water hose from bypass pipe
   - Fuel feed hose and return hose from each pipe
   - Heater hose from heater outlet pipe
   - Radiator inlet hose from water outlet pipe
10) Remove intake manifold rear stiffener.
11) Detach water pipe from intake manifold.

12) Remove cylinder head cover, oil pan, timing chain cover, 2nd and 1st timing chains, camshafts and valve lash adjusters referring to item “CAMSHAFTS AND VALVE LASH ADJUSTERS” in this section.



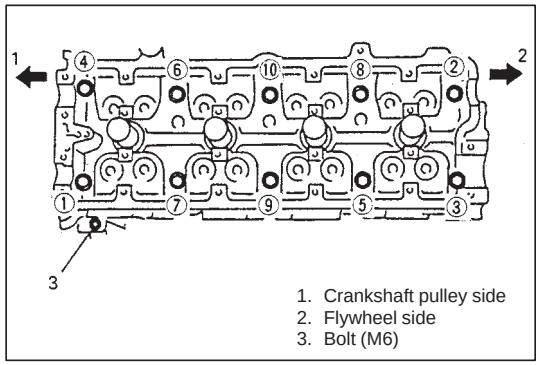
1. Exhaust No.1 pipe

13) Disconnect exhaust No. 1 pipe from exhaust manifold.



1. Exhaust manifold stiffener

14) Remove exhaust manifold stiffener (if equipped).

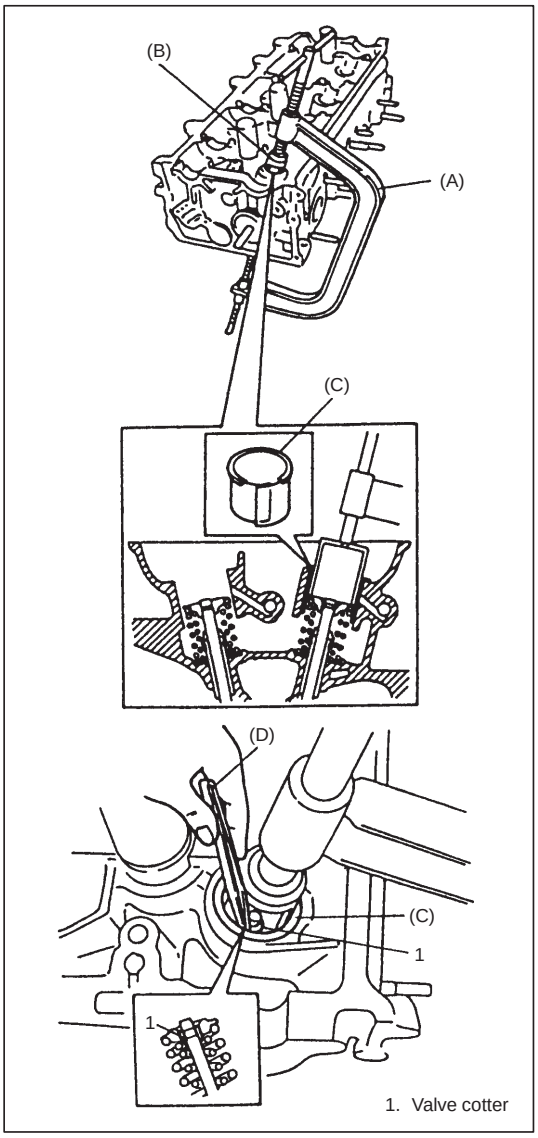


1. Crankshaft pulley side
2. Flywheel side
3. Bolt (M6)

15) Loosen cylinder head bolts in such order as indicated in figure and remove them.

NOTE:
Don't forget to remove bolt (M6) shown in figure.

16) Check all around cylinder head for any other parts required to be removed or disconnected and remove or disconnect whatever necessary.
17) Remove cylinder head with intake manifold, exhaust manifold and water outlet pipe. Use lifting device if necessary.



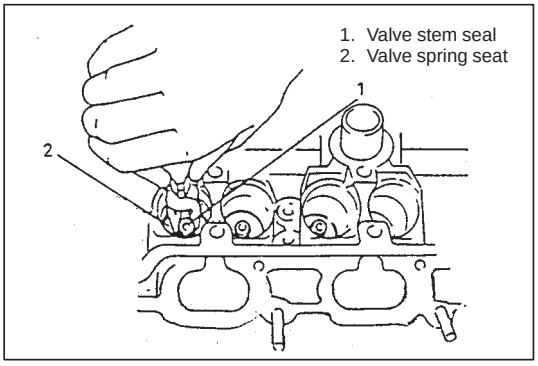
1. Valve cotter

DISASSEMBLY

1) When servicing cylinder head, remove intake manifold, injectors, exhaust manifold, water outlet pipe and water outlet cap from cylinder head.
2) Using special tools, compress valve springs and then remove valve cotters by using special tool.

Special Tool
(A): 09916-14510
(B): 09916-14910
(C): 09919-28610
(D): 09916-84511

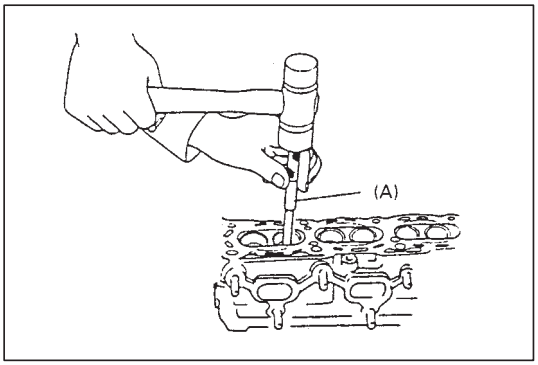
3) Release special tool, and remove spring retainers and valve springs.
4) Remove valve from combustion chamber side.



1. Valve stem seal
2. Valve spring seat

5) Remove valve stem seal from valve guide, and then valve spring seat.

NOTE:
Do not reuse seal once disassembled. Be sure to use new seal when assembling.

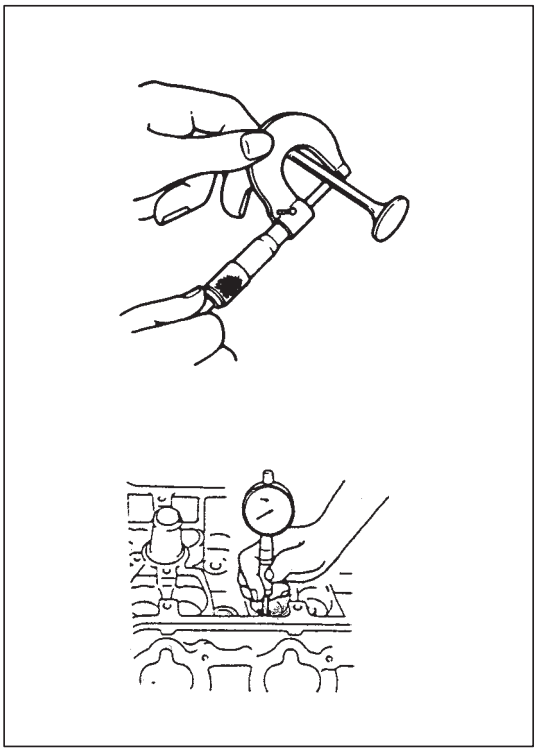


6) Using special tool (Valve guide remover), drive valve guide out from combustion chamber side to valve spring side.

Special Tool
(A): 09916-44910

NOTE:
Do not reuse valve guide once disassembled. Be sure to use new valve guide (Oversize) when assembling.

7) Place disassembled parts except valve stem seal and valve guide in order so that they can be installed in their original positions.



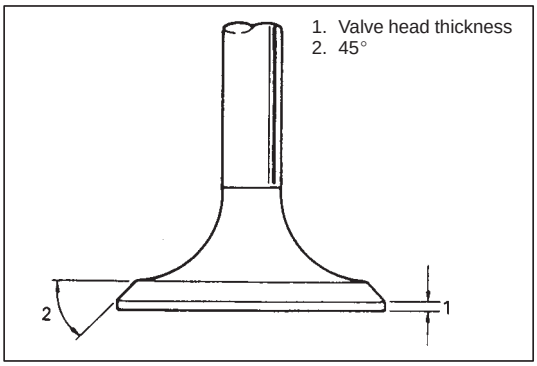
INSPECTION

Valve Guides

Using a micrometer and bore gauge, take diameter readings on valve stems and guides to check stem-to-guide clearance. Be sure to take reading at more than one place along the length of each stem and guide.

If clearance exceeds limit, replace valve and valve guide.

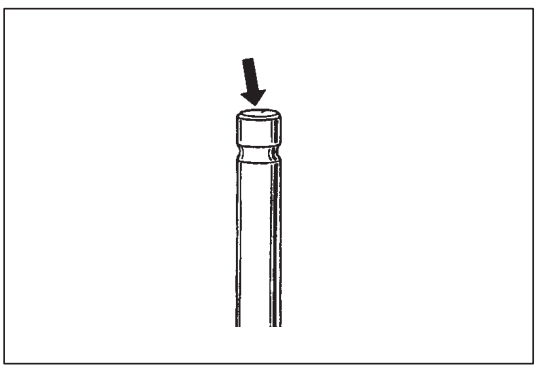
Item		Standard	Limit
Valve stem diameter	In	5.965 – 5.980 mm (0.2348 – 0.2354 in.)	–
	Ex	5.940 – 5.955 mm (0.2339 – 0.2344 in.)	–
Valve guide I.D.	In & Ex	6.000 – 6.012 mm (0.2362 – 0.2366 in.)	–
Stem-to-guide clearance	In	0.020 – 0.047 mm (0.0008 – 0.0018 in.)	0.07 mm (0.0027 in.)
	Ex	0.045 – 0.072 mm (0.0018 – 0.0028 in.)	0.09 mm (0.0035 in.)



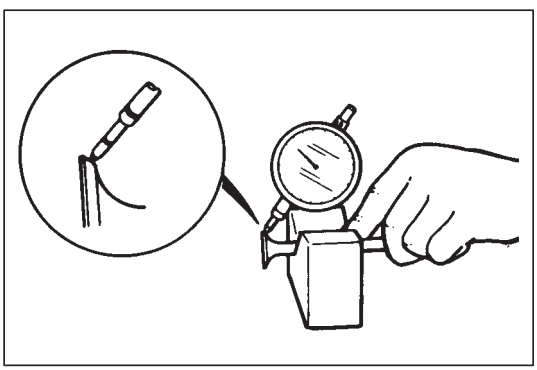
Valves

- Remove all carbon deposits from valves.
- Inspect each valve for wear, burn or distortion at its face and stem, replace as necessary.
- Measure thickness of valve head. If measured thickness exceeds limit, replace valve.

Item	Standard	Limit
In	1.0 mm (0.039 in.)	0.6 mm (0.024 in.)
Ex	1.2 mm (0.047 in.)	0.7 mm (0.028 in.)

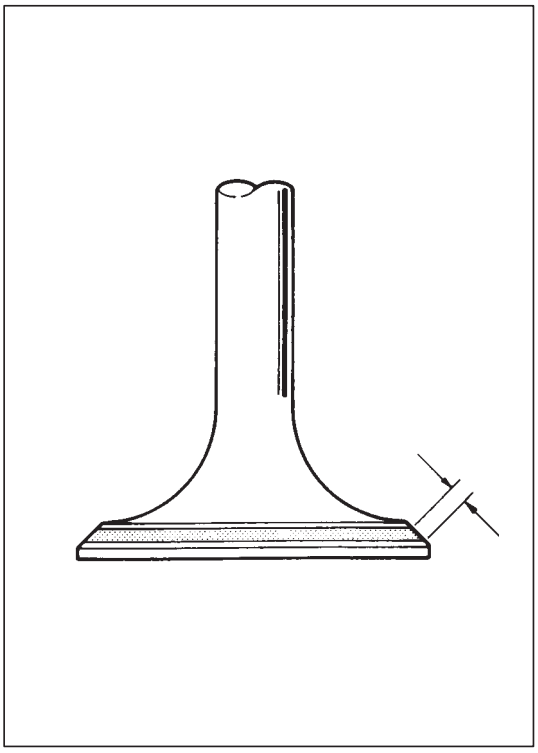


- Inspect valve stem end face for pitting and wear. If pitting or wear is found there, valve stem end may be resurfaced, but not too much to grind off its chamber. When it is worn out too much that its chamber is gone, replace valve.



- Check each valve for radial runout with a dial gauge and "V" block. To check runout, rotate valve slowly. If runout exceeds its limit, replace valve.

Limit on valve head radial runout:
0.08 mm (0.003 in.)



● Seating contact width:
Create contact pattern on each valve in the usual manner, i.e. by giving uniform coat of marking compound to valve seat and by rotatingly tapping seat with valve head. Valve lapper (tool used in valve lapping) must be used.

Pattern produced on seating face of valve must be a continuous ring without any break, and the width of pattern must be within specified range.

Standard seating width revealed by contact pattern on valve face	In	1.1 – 1.3 mm (0.0433 – 0.0512 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.

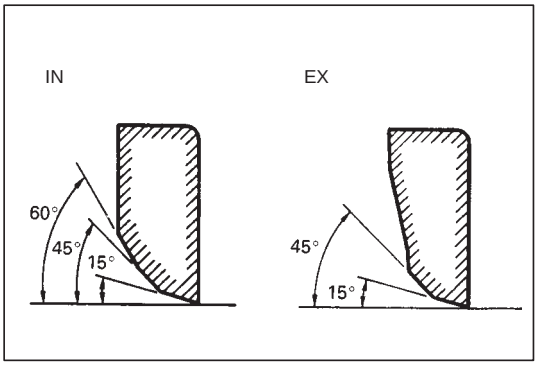
1) EXHAUST VALVE SEAT: Use valve seat cutters to make two cuts as illustrated in figure. Two cutters must be used: the first for making 15° angle, and the second for making 45° angle. The second cut must be made to produce desired seat width.

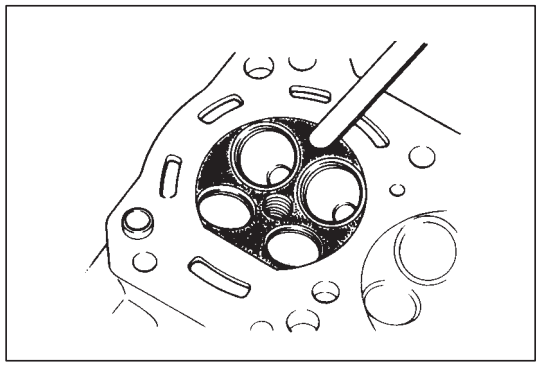
   Seat width for valve seat:
   1.1 – 1.3 mm (0.0433 – 0.0512 in.)

2) INTAKE VALVE SEAT: Use valve seat cutters to make three cuts as illustrated in figure. Three cutters must be used: the 1st for making 15° angle, the 2nd for making 60° angle, and 3rd for making 45° angle. The 3rd cut (45°) must be made to produce desired seat width.

   Seat width for intake valve seat:
   1.1 – 1.3 mm (0.0433 – 0.0512 in.)

3) VALVE LAPPING: Lap valve on seat in two steps, first with coarse size lapping compound applied to face and the second with fine-size compound, each time using valve lapper according to usual lapping method.

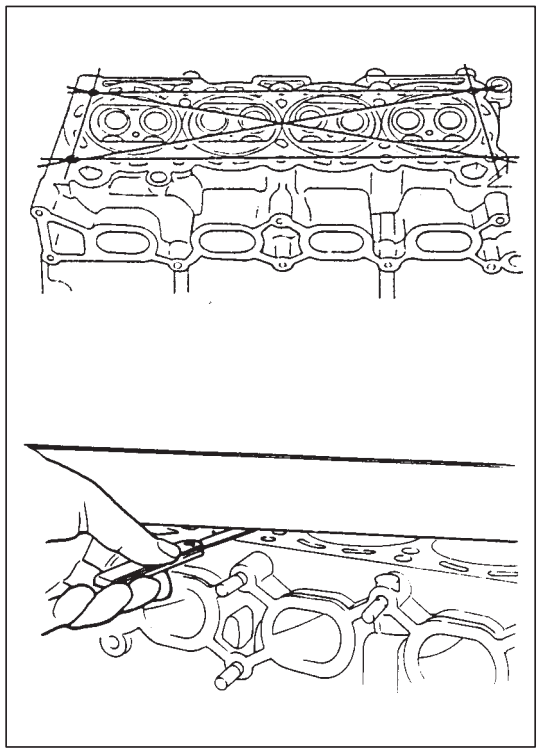




Cylinder Head

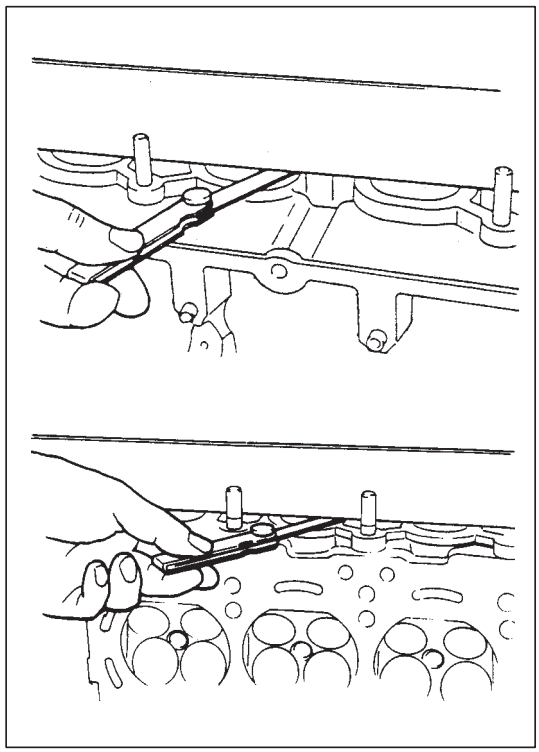
- Remove all carbon deposits from combustion chambers.

NOTE:
Do not use any sharp-edged tool to scrape off carbon deposits. Be careful not to scuff or nick metal surfaces when decarboning. The same applies to valves and valve seats, too.



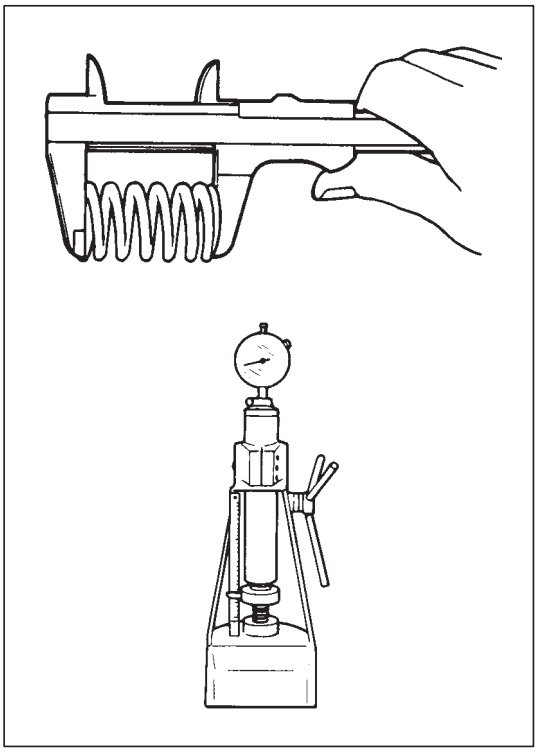
- Check cylinder head for cracks on intake and exhaust ports, combustion chambers, and head surface.
  Using straightedge and thickness gauge, check flatness of gasketed surface at a total of 6 locations. If distortion limit, given below, is exceeded, correct gasketed surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper): Place abrasive paper on and over surface plate, and rub gasketed surface against paper to grind off high spots. Should this fail to reduce thickness gauge readings to within limit, replace cylinder head.
  Leakage of combustion gases from this gasketed joint is often due to warped gasketed surface: such leakage results in reduced power output.

Limit of distortion: 0.05 mm (0.002 in.)



- Distortion of manifold seating faces:
  Check seating faces of cylinder head for manifolds, using a straightedge and thickness gauge, in order to determine whether these faces should be corrected or cylinder head replaced.

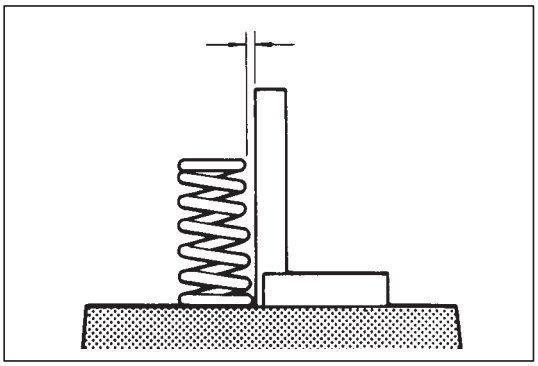
Limit of distortion: 0.10 mm (0.004 in.)



Valve Springs

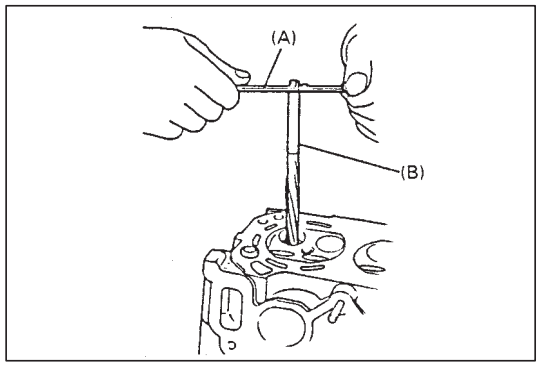
- Referring to data given below, check to be sure that each spring is in sound condition, free of any evidence of breakage or weakening. Remember, weakened valve springs can cause chatter, not to mention possibility of reducing power output due to gas leakage caused by decreased seating pressure.

Item		Standard	Limit
Valve spring free length	Inner	36.08 mm (1.4204 in.)	35.00 mm (1.3780 in.)
	Outer	40.44 mm (1.5921 in.)	39.22 mm (1.5441 in.)
Valve spring preload	Inner	6.9 – 7.9 kg for 27.5 mm (15.2 – 17.4 lb/ 1.08 in.)	6.2 kg for 27.5 mm (13.6 lb/ 1.08 in.)
	Outer	15.4 – 17.8 kg for 31.7 mm (33.9 – 39.2 lb/ 1.25 in.)	13.8 kg for 31.7 mm (30.4 lb/ 1.25 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.

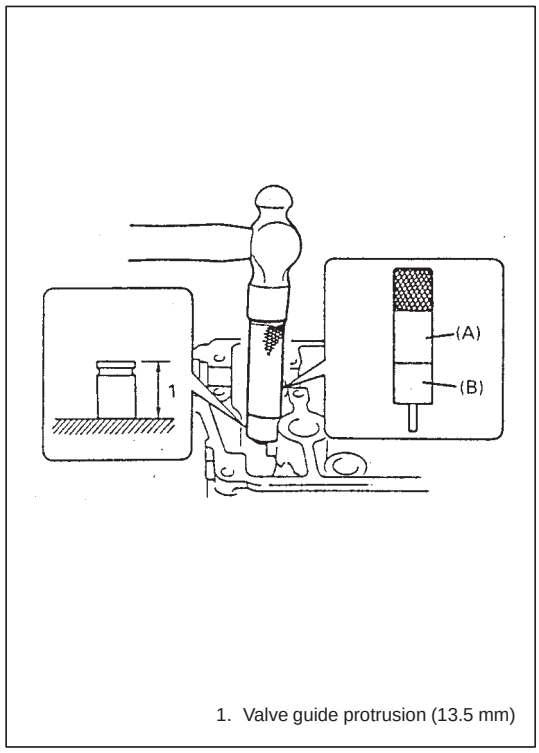
  Valve spring squareness limit: 2.0 mm (0.079 in.)



ASSEMBLY

1) Before installing valve guide into cylinder head, ream guide hole with special tool (11 mm reamer) so as to remove burrs and make it truly round.

Special Tool
(A): 09916-34542
(B): 09916-38210



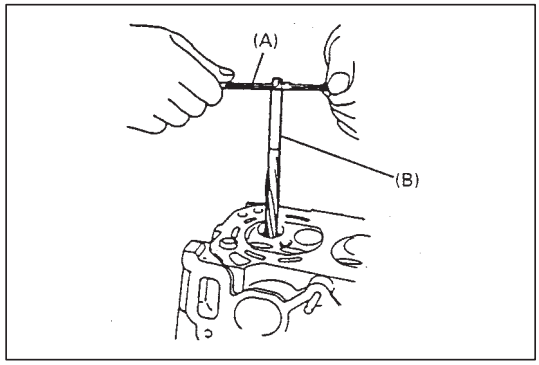
1. Valve guide protrusion (13.5 mm)

2) Install valve guide to cylinder head.
Heat cylinder head uniformly to a temperature of 80 to 100°C (176 to 212°F) so that head will not be distorted, and drive new valve guide into hole with special tools. Drive in new valve guide until special tool (Valve guide installer) contacts cylinder head.
After installing, make sure that valve guide protrudes by 13.5 mm (0.53 in.) from cylinder head.

Special Tool
(A): 09916-58210
(B): 09917-87810

NOTE:
- **Do not reuse once-disassembled valve guide. Install new valve guide (Oversize).**
- **Intake and exhaust valve guides are identical.**

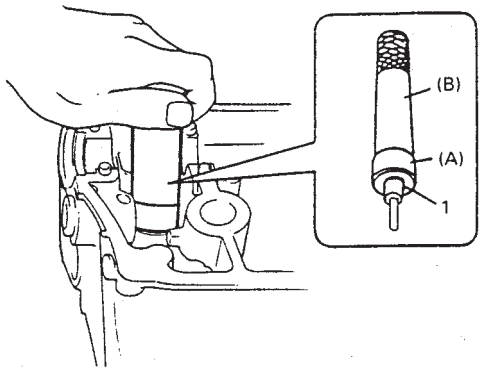
Valve guide oversize:	**0.03 mm (0.0012 in.)**
Valve guide protrusion (In and Ex):	**13.5 mm (0.53 in.)**



3) Ream valve guide bore with special tool (6.0 mm reamer). After reaming, clean bore.

Special Tool
(A): 09916-34542
(B): 09916-37810

4) Install valve spring seat to cylinder head.

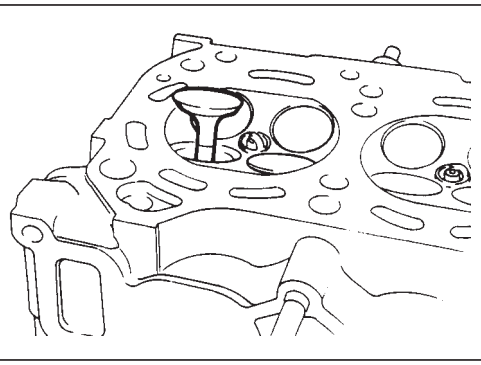


1. Valve stem seal

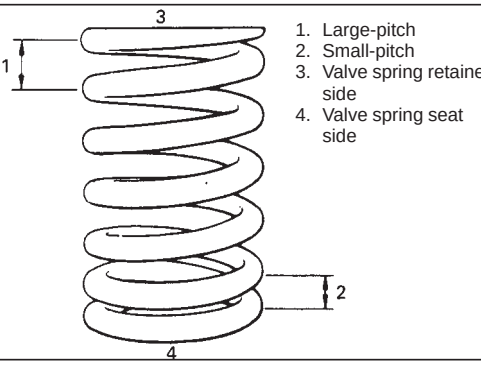
5) Install new valve stem seal to valve guide.
After applying engine oil to seal and spindle of special tool (Valve guide installer handle), fit oil seal to spindle, and then install seal to valve guide by pushing special tool by hand.
After installing, check to be sure that seal is properly fixed to valve guide.

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

NOTE:
- **Do not reuse once-disassembled seal. Be sure to install new seal.**
- **When installing, 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.**

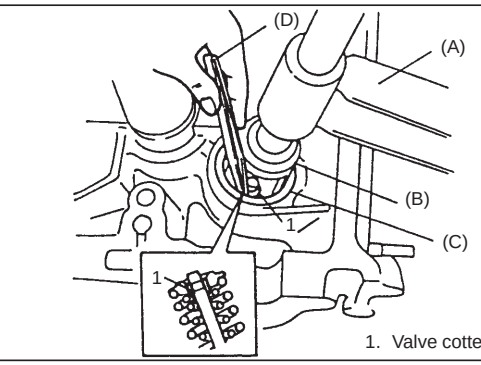


6) Install valve to valve guide.
Before installing valve to valve guide, apply engine oil to stem seal, valve guide bore, and valve stem.



1. Large-pitch
2. Small-pitch
3. Valve spring retainer side
4. Valve spring seat side

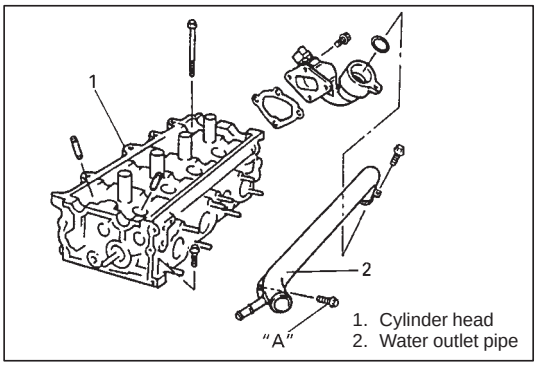
7) Install valve springs (inner and outer springs) and spring retainer.
Each valve spring has top end (large-pitch end) and bottom end (small-pitch end). Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).



1. Valve cotter

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
(C): 09919-28610
(D): 09916-84511

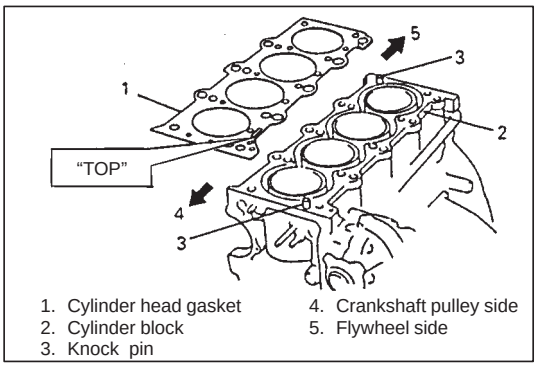


1. Cylinder head
2. Water outlet pipe

9) Install intake manifold, injectors, exhaust manifold, water outlet pipe and water outlet cap to cylinder head.

NOTE:
When installing water outlet pipe, apply sealant to the thread of the bolt shown in figure.

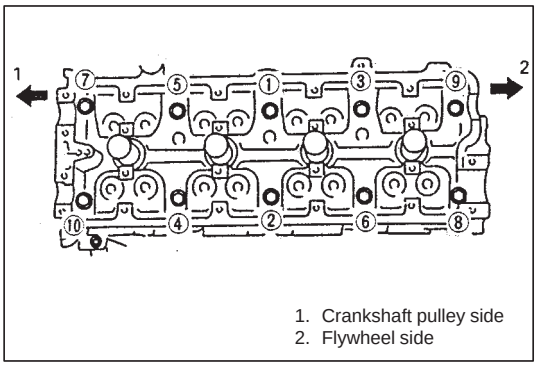
"A": Sealant 99000-31110



1. Cylinder head gasket
2. Cylinder block
3. Knock pin
4. Crankshaft pulley side
5. Flywheel side

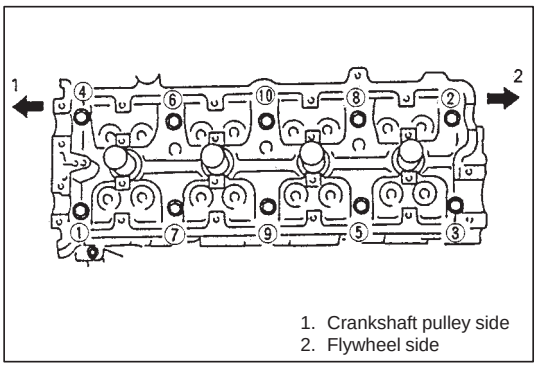
INSTALLATION

1) Clean mating surface of cylinder head and cylinder block.
   Remove oil, old gasket and dust from mating surface.
2) Install knock pins to cylinder block.
3) Install new cylinder head gasket to cylinder block.
   "TOP" mark provided on gasket comes to crankshaft pulley side, facing up (toward cylinder head side).



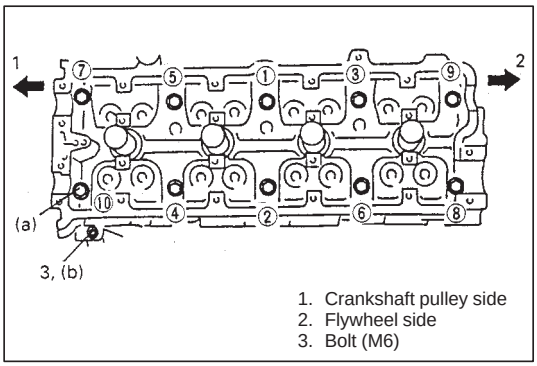
1. Crankshaft pulley side
2. Flywheel side

4) Install cylinder head to cylinder block.
   Apply engine oil to cylinder head bolts and tighten them gradually as follows.
   (1) Tighten all bolts to 53 N·m (5.3 kg-m, 38.5 lb-ft) according to numerical order in figure.
   (2) In the same manner as in (1), tighten them to 84 N·m (8.4 kg-m, 61.0 lb-ft).



1. Crankshaft pulley side
2. Flywheel side

(3) Loosen all bolts until tightening torque is reduced to 0 in the illustrated order.

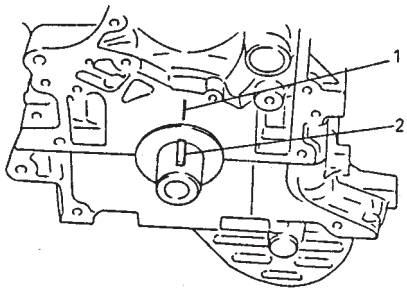


1. Crankshaft pulley side
2. Flywheel side
3. Bolt (M6)

(4) Tighten all bolts to 53 N·m (5.3 kg-m, 38.5 lb-ft) according to numerical order in figure.
(5) In the same manner as in (4) again, tighten them to specified torque.

Tightening Torque
(a): 105 N·m (10.5 kg-m, 76.0 lb-ft)
(b): 11 N·m (1.1 kg-m, 8.0 lb-ft)

NOTE:
Be sure to tighten M6 bolt after securing the other bolt.

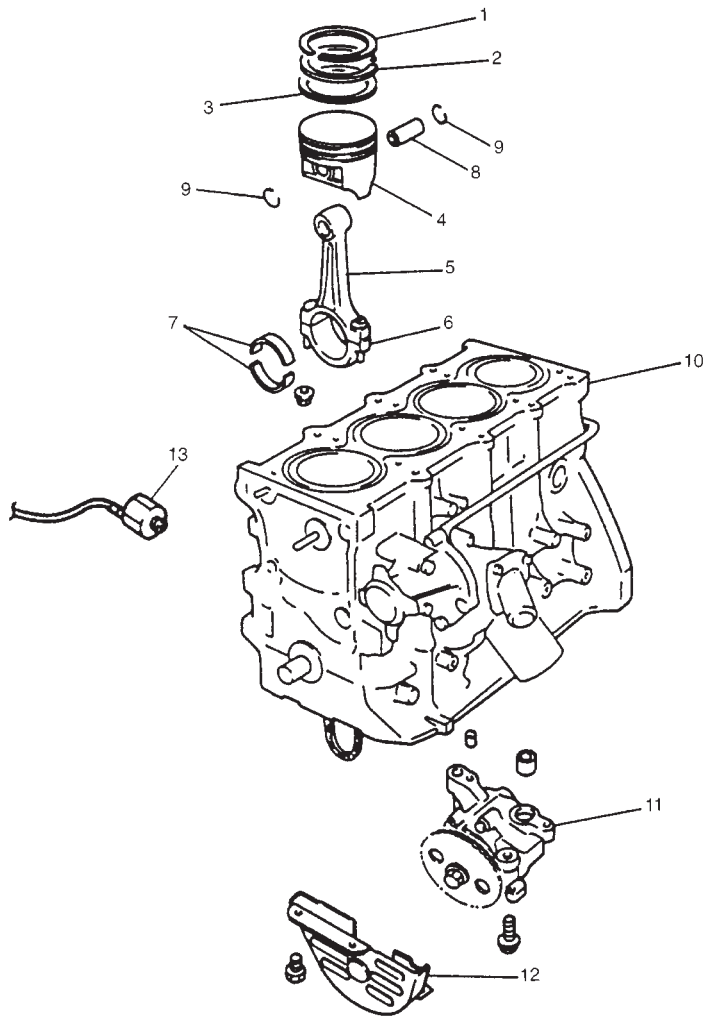


1. Timing mark
2. Crank timing sprocket key

5) Check that key on crankshaft aligns with timing mark as shown in figure.

6) Reverse removal procedure for installation.
7) Adjust cooling fan belt tension.
   Refer to Section 6B for adjusting procedure.
8) Adjust accelerator cable play and A/T throttle cable play (for vehicle with A/T). 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 engine with engine oil, referring to item “ENGINE OIL CHANGE” in Section 0B.
11) Refill cooling system referring to Section 6B.
12) Refill front differential housing with gear oil, referring to “DIFFERENTIAL” section.
13) Refill power steering system with specified fluid referring to Section 3B1.
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) Check ignition timing and adjust as necessary, referring to Section 6F2.

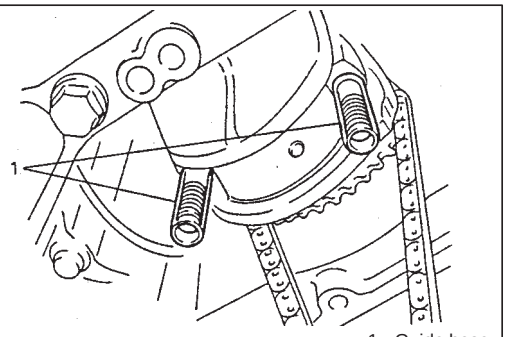
PISTONS, PISTON RINGS, CONNECTING RODS AND CYLINDERS



1. Top ring
2. 2nd ring
3. Oil ring
4. Piston
5. Connecting rod
6. Connecting rod bearing cap
7. Connecting rod bearing
8. Piston pin
9. Piston pin circlip
10. Cylinder block
11. Oil pump
12. Oil pump sprocket cover
13. Knock sensor

REMOVAL

1) Relieve fuel pressure according to procedure described in Section 6.
2) Disconnect negative cable at battery.
3) Drain engine oil.
4) Drain coolant.
5) Remove cylinder head with intake manifold, exhaust manifold and water outlet pipe. Refer to item “VALVES AND CYLINDER HEAD” in this section for removal.
6) Remove oil pump. Refer to item “OIL PUMP” in this section for removal.

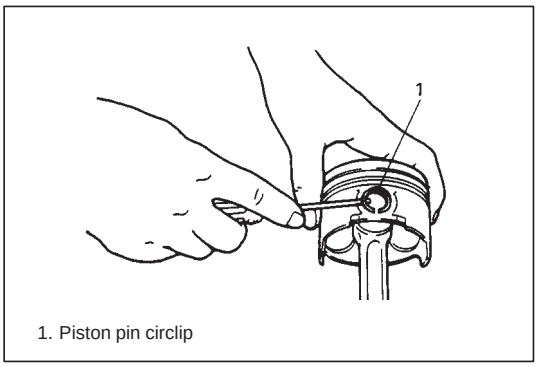


1. Guide hose

7) Mark cylinder number on all pistons, connecting rods and connecting rod caps.
8) Remove rod bearing caps.
9) Install guide hose over threads of rod bolts.
   This prevents damage to bearing journal and rod bolt threads when removing connecting rod.
10) Clean carbon deposits from top of cylinder bore before removing piston from cylinder.
11) Push piston and connecting rod assembly out through the top of cylinder bore.

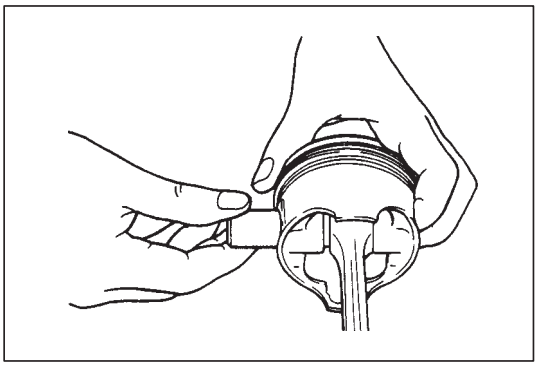
DISASSEMBLY

1) Using piston ring expander, remove two compression rings (Top and 2nd) and oil ring from piston.



1. Piston pin circlip

2) Remove piston pin from connecting rod.
   - Ease out piston pin circlips, as shown.



- Force piston pin out.

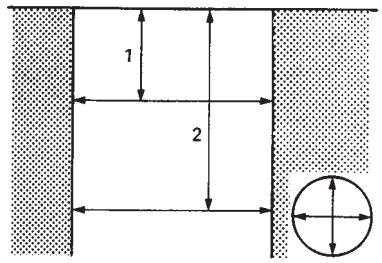
CLEANING

Clean carbon deposits from piston head and ring grooves, using a suitable tool.

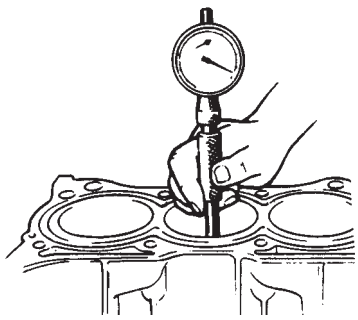
INSPECTION

Cylinder

- Inspect cylinder walls for scratches, roughness, or ridges which indicate excessive wear. If cylinder bore is very rough or deeply scratched, or ridged, rebore cylinder and use over size piston.



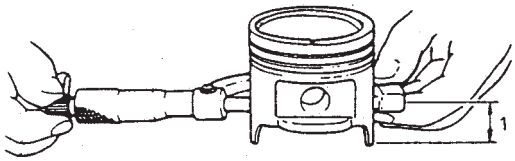
1. 50 mm (1.96 in.)
2. 95 mm (3.74 in.)



- Using a cylinder gauge, measure cylinder bore in thrust and axial directions at two positions as shown in figure.
  If any of the following conditions is noted, rebore cylinder.
  1. Cylinder bore dia. exceeds limit.
  2. Difference of measurements at two positions exceeds taper limit.
  3. Difference between thrust and axial measurements exceeds out-of-round limit.

  Cylinder bore dia. limit: 84.050 mm (3.3090 in.)
  Taper and out-of-round limit: 0.10 mm (0.004in.)

  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.

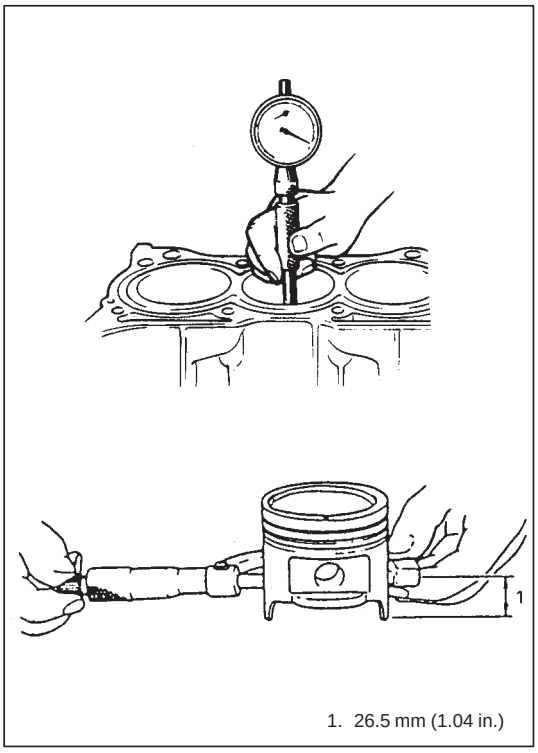


1. 26.5 mm (1.04 in.)

Pistons

- Inspect piston for faults, cracks or other damages.
  Damaged or faulty piston should be replaced.
- Piston diameter:
  As indicated in figure, piston diameter should be measured at a position 26.5 mm (1.04 in.) from piston skirt end in the direction perpendicular to piston pin.

Piston diameter	Standard	83.970 – 83.990 mm (3.3059 – 3.3066 in.)
	Oversize: 0.25 mm (0.0098 in.)	84.220 – 84.240 mm (3.3157 – 3.3165 in.)
	0.50 mm (0.0196 in.)	84.470 – 84.490 mm (3.3256 – 3.3263 in.)

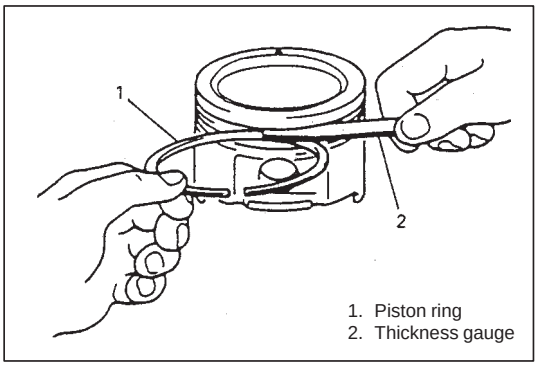


1. 26.5 mm (1.04 in.)

- Piston clearance:
  Measure cylinder bore diameter and piston diameter to find their difference which is piston clearance. Piston clearance should be within specification as given below. If it is out of specification, re-bore cylinder and use oversize piston.

  Piston clearance: 0.02 – 0.04 mm (0.0008 – 0.0015 in.)

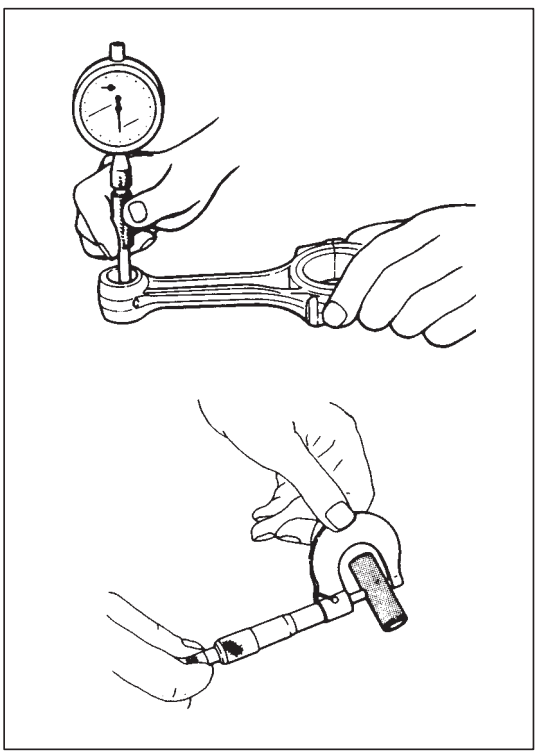
  NOTE:
  Cylinder bore diameters used here are measured in thrust direction at two positions.



1. Piston ring
2. Thickness gauge

- Ring groove clearance:
  Before checking, piston grooves must be clean, dry and free of carbon deposits.
  Fit new piston ring into piston groove, and measure clearance between ring and ring land by using thickness gauge. 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.)



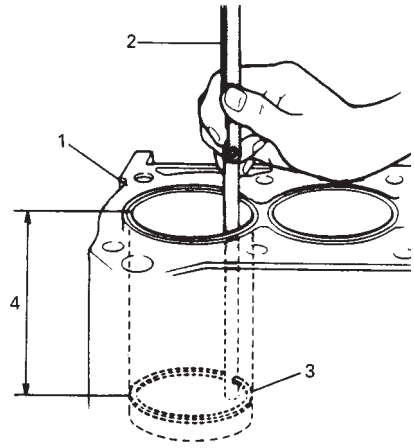
Piston Pin

- 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
Piston clearance in small end	0.003 – 0.014 mm (0.0001 – 0.0005 in.)

Small-end bore:
21.003 – 21.011 mm (0.8269 – 0.8272 in.)

Piston pin dia.:
20.997 – 21.000 mm (0.8267 – 0.8268 in.)



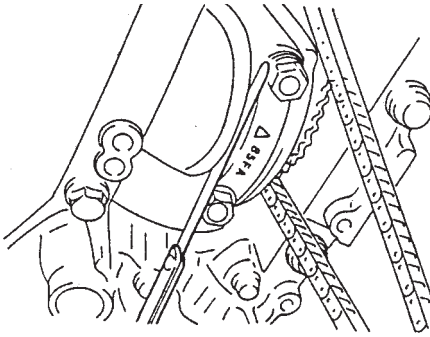
1. Cylinder block
2. Feeler gauge
3. Piston ring
4. 120 mm (4.72 in.)

Piston Rings

To measure end gap, insert piston ring into cylinder bore and then measure the gap by using thickness gauge.
If measured gap is out of specification, replace ring.

NOTE:
Clean carbon deposits and any other dirt from top of cylinder bore before inserting piston ring.

Item		Standard	Limit
Piston ring end gap	Top ring	0.20 – 0.35 mm (0.0079 – 0.0137 in.)	0.7 mm (0.0276 in.)
	2nd ring	0.35 – 0.50 mm (0.0138 – 0.0196 in.)	0.7 mm (0.0276 in.)
	Oil ring	0.20 – 0.70 mm (0.0079 – 0.0275 in.)	1.8 mm (0.0709 in.)



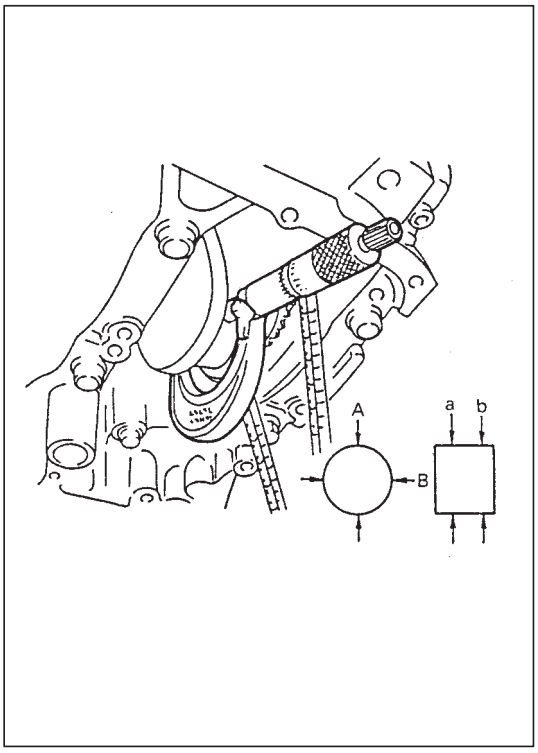
Connecting Rod

- 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 connecting rod.

Item	Standard	Limit
Big-end side clearance	0.25 – 0.40 mm (0.0099 – 0.0157 in.)	0.45 mm (0.0177 in.)

- Connecting rod alignment:
  Mount connecting rod on aligner to check it for bow and twist. If limit is exceeded, replace it.

  Limit on bow: 0.05 mm (0.0020 in.)
  Limit on twist: 0.10 mm (0.0039 in.)

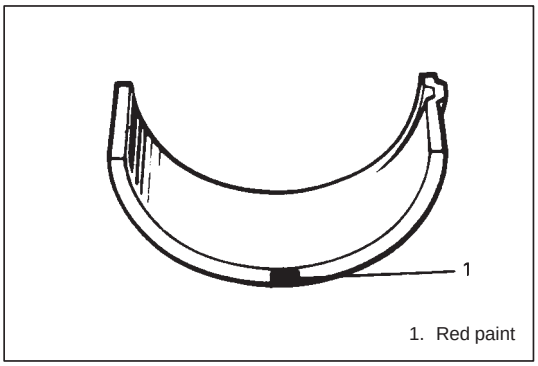


Crank Pin and Connecting Rod Bearings

- Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged, or out-of round or taper is out of limit, replace crankshaft or regrind crank pin referring to following step 6).

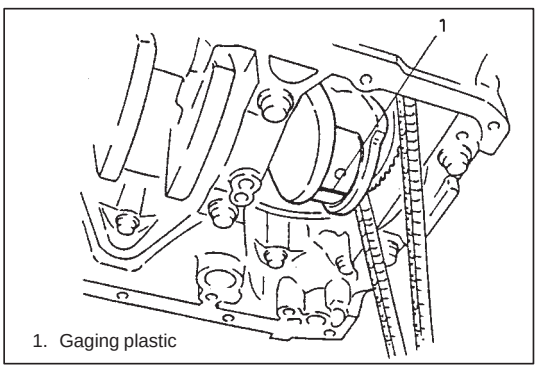
Connecting rod bearing size	Crank pin diameter
Standard	49.982 – 50.000 mm (1.9678 – 1.9685 in.)
0.25 mm undersize	49.732 – 49.750 mm (1.9580 – 1.9586 in.)

Out-of-round: A – B
Taper limit : a – b
Out-of-round and taper limit: 0.01 mm (0.0004 in.)



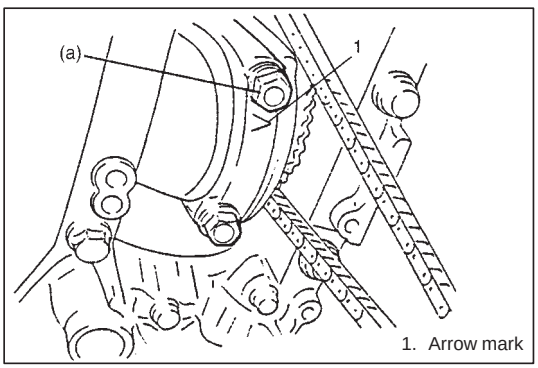
1. Red paint

- Rod bearing:
  Inspect bearing shells for signs of fusion, pitting, burn or flaking and observe contact pattern. Bearing shells found in defective condition must be replaced.
  Two kinds of rod bearing are available; standard size bearing and 0.25 mm (0.0098 in.) undersize bearing. For identification of undersize bearing, it is painted red at the position as indicated in figure, undersize bearing thickness is 1.605 – 1.615 mm (0.0632 – 0.0635 in.) at the center of it.



1. Gaging plastic

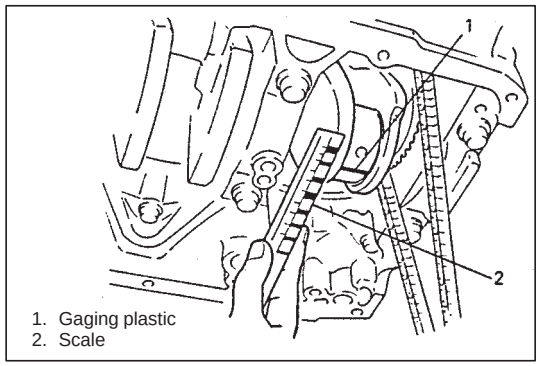
- Rod bearing clearance:
  1) Before checking bearing clearance, clean bearing and crank pin.
  2) Install bearing in connecting rod and bearing cap.
  3) Place a piece of gaging plastic to full width of crank pin as contacted by bearing (parallel to crankshaft), avoiding oil hole.



1. Arrow mark

  4) Install rod bearing cap to connecting rod.
     When installing cap, be sure to point arrow mark on cap to crankshaft pulley side, 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): 45 N·m (4.5 kg-m, 33.0 lb-ft)



1. Gaging plastic
2. Scale

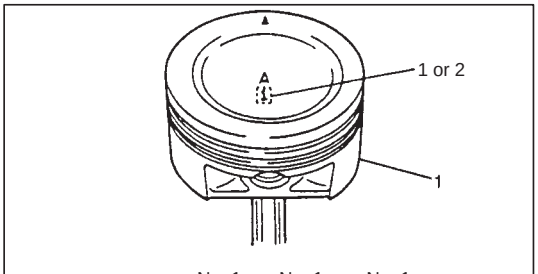
5) Remove cap and using a scale on gaging plastic envelope, measure gaging plastic width at the widest point (clearance).
If clearance exceeds its limit, use a new standard size bearing and remeasure clearance.

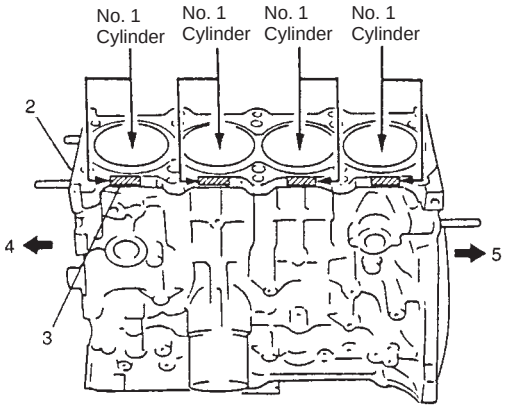
Item	Standard	Limit
Bearing clearance	0.039 – 0.057 mm (0.0016 – 0.0022 in.)	0.08 mm (0.0031 in.)

6) If clearance can not be brought to within its limit even by using a new standard size bearing, replace crankshaft or regrind crank pin to undersize as follows.
– Install 0.25 mm undersize bearing to connecting rod big-end.
– Measure bore diameter of connecting rod big-end.
– Regrind crank pin to following finished diameter

Finished crank pin dia. = Measured big-end bore dia. (including undersize bearing) – 0.048 mm (0.0018 in.)

– Confirm that bearing clearance is within above standard value.



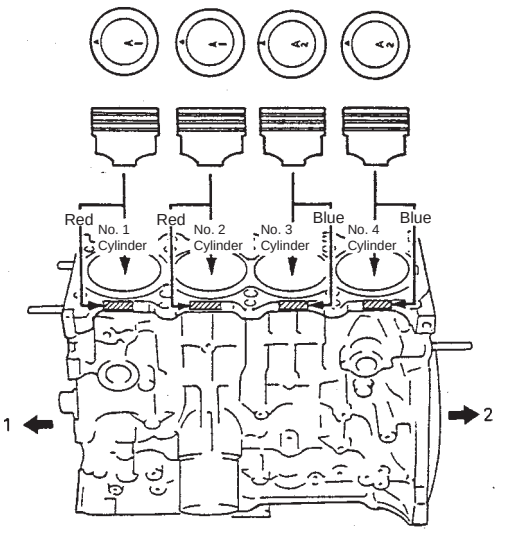


1. Piston
2. Cylinder block
3. Paint
4. Crankshaft pulley side
5. Flywheel side

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 piston has stamped number 1 or 2 as shown. It represents outer diameter of piston.
b) There are also painted color of red or blue on the cylinder block as shown. It represent inner diameter of cylinder.

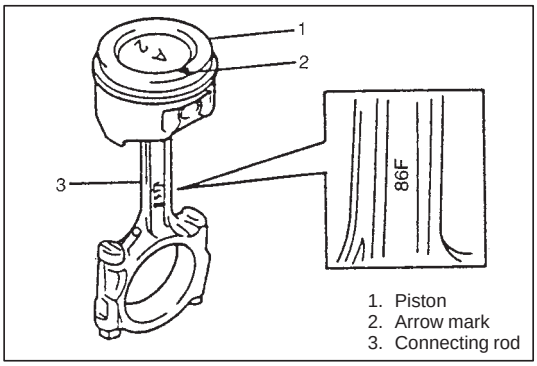


1. Crankshaft pulley side
2. Flywheel side

c) Stamped number on piston and painted mark on cylinder block should correspond. That is, install number 2 stamped piston to cylinder which is identified with mark blue and a number 1 piston to cylinder with mark red.

Piston		Cylinder		Piston-to-cylinder clearance
Number at the top (mark)	Outer diameter	Mark	Bore diameter	
1	83.98 – 83.99 mm (3.3063 – 3.3066 in.)	Red	84.01 – 84.02 mm (3.3075 – 3.3078 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)
2	83.97 – 83.98 mm (3.3059 – 3.3062 in.)	Blue	84.00 – 84.01 mm (3.3071 – 3.3074 in.)	0.02 – 0.04 mm (0.0008 – 0.0015 in.)

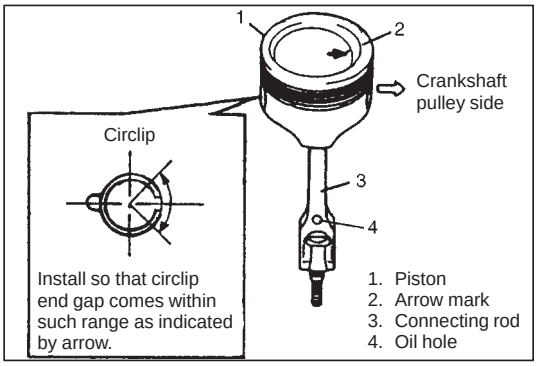
Also, a letter A, B or C is stamped on piston head but ordinarily it is not necessary to discriminate each piston by this letter.



1. Piston
2. Arrow mark
3. Connecting rod

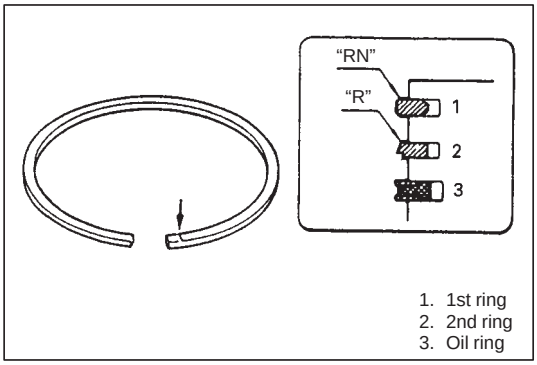
1) Install piston pin to piston and connecting rod:
After applying engine oil to piston pin and piston pin holes in piston and connecting rod, fit connecting rod to piston as shown in figure and insert piston pin to piston and connecting rod, and install piston pin circlips.

NOTE:
- **"86F" mark on connecting rod should come on crankshaft pulley side.**



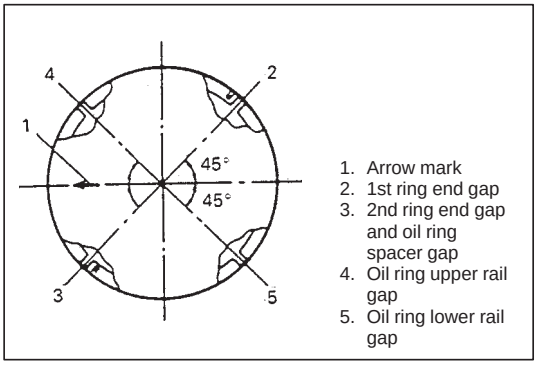
1. Piston
2. Arrow mark
3. Connecting rod
4. Oil hole

- **Circlip should be installed with its cut part facing as shown in figure.**



1. 1st ring
2. 2nd ring
3. Oil ring

2) Install piston rings to piston:
- As indicated in figure at the left, 1st and 2nd rings have "RN" or "R" mark respectively. When installing these piston rings to piston, direct marked side of each ring toward top of piston.
- 1st rings 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.



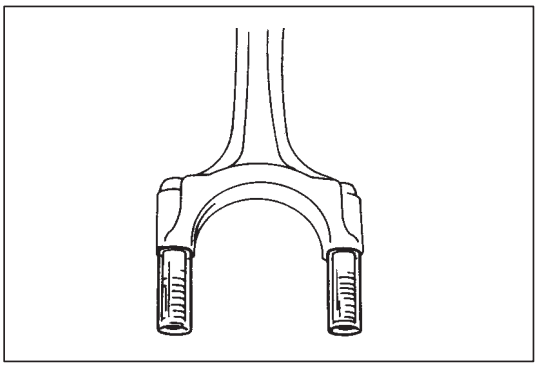
1. Arrow mark
2. 1st ring end gap
3. 2nd ring end gap and oil ring spacer gap
4. Oil ring upper rail gap
5. Oil ring lower rail gap

3) After installing three rings (1st, 2nd and oil rings), distribute their end gaps as shown in figure.

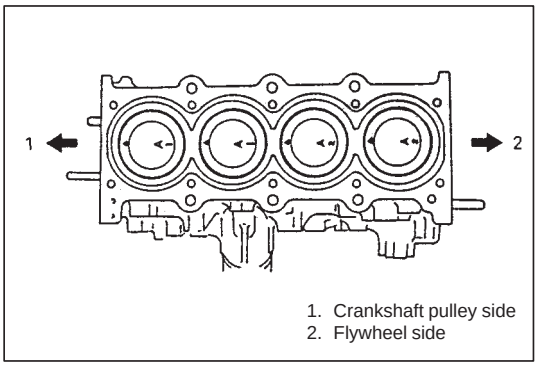
INSTALLATION

1) Apply engine oil to pistons, rings, cylinder walls, connecting rod bearings and crank pins.

NOTE:
Do not apply oil between connecting rod and bearing or between bearing cap and bearing.

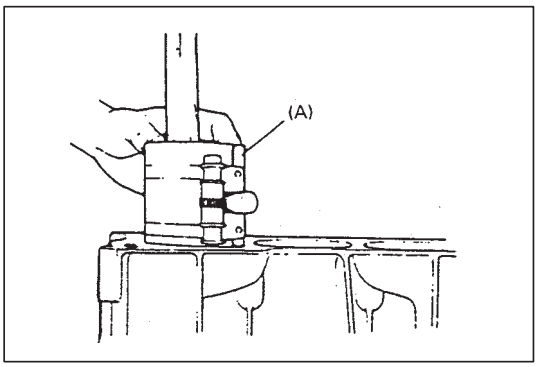


2) Install guide hoses over connecting rod bolts.
These guide hoses protect crank pin and threads of rod bolt from damage during installation of connecting rod and piston assembly.



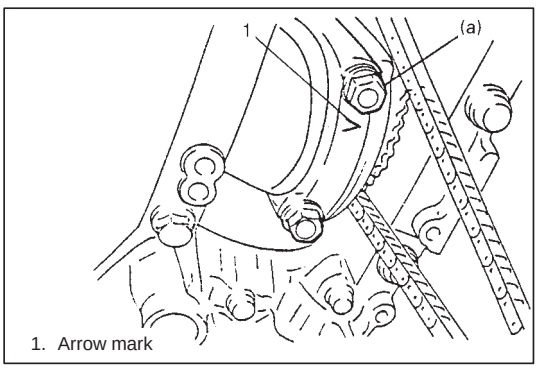
1. Crankshaft pulley side
2. Flywheel side

3) When installing piston and connecting rod assembly into cylinder bore, point arrow mark on piston head to crankshaft pulley side.



4) Install piston and connecting rod assembly into cylinder bore. Use special tool (Piston ring compressor) to compress rings. Guide connecting rod into place on crankshaft.
Using a hammer handle, tap piston head to install piston into bore. Hold ring compressor firmly against cylinder block until all piston rings have entered cylinder bore.

Special Tool
(A): 09916-77310



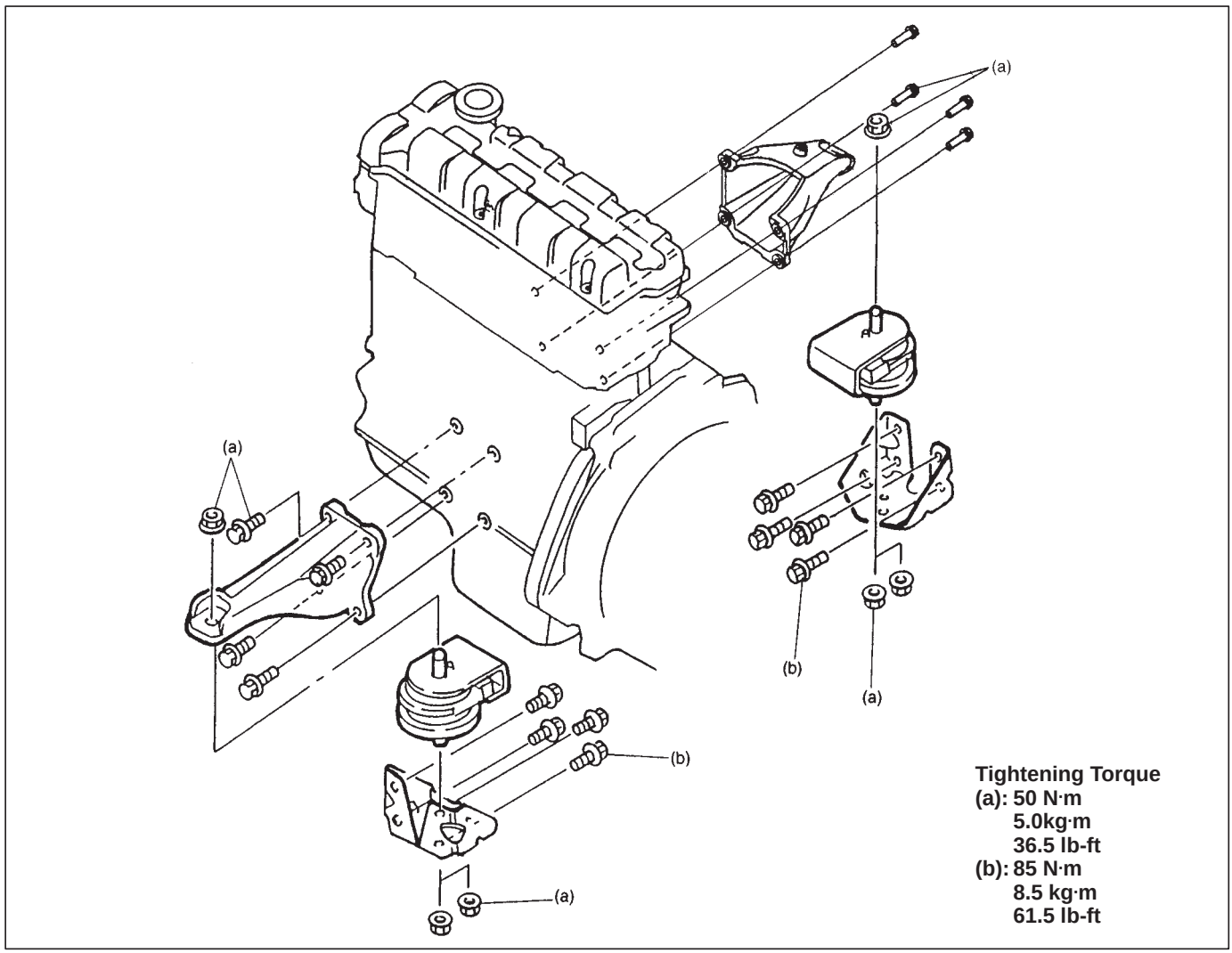
1. Arrow mark

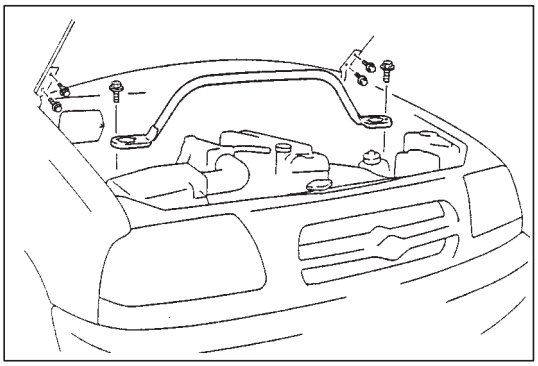
5) Install bearing cap.
Point arrow mark on cap to crankshaft pulley side.
Tighten cap nuts to specification.

Tightening Torque
(a): 45 N·m (4.5 kg-m, 33.0 lb-ft)

6) Reverse removal procedure for installation, as previously outlined.
7) Adjust cooling fan belt tension.
   Refer to Section 6B for adjusting procedure.
8) Adjust accelerator cable play and A/T throttle cable play (for vehicle with A/T). 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 engine with engine oil, referring to item “ENGINE OIL CHANGE” in Section 0B.
11) Refill cooling system referring to Section 6B.
12) Refill front differential housing with gear oil, referring to “DIFFERENTIAL” section.
13) Refill power steering system with specified fluid referring to Section 3B1.
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) Check ignition timing and adjust as necessary, referring to Section 6F2.

ENGINE MOUNTINGS



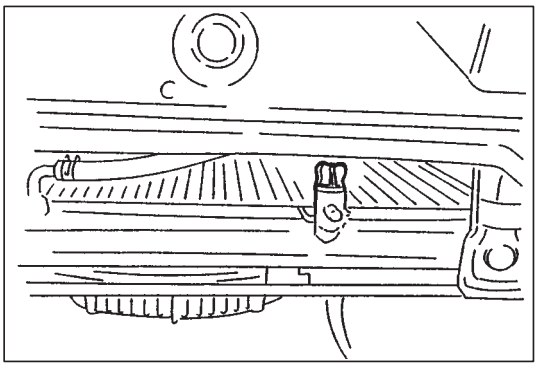


UNIT REPAIR OVERHAUL

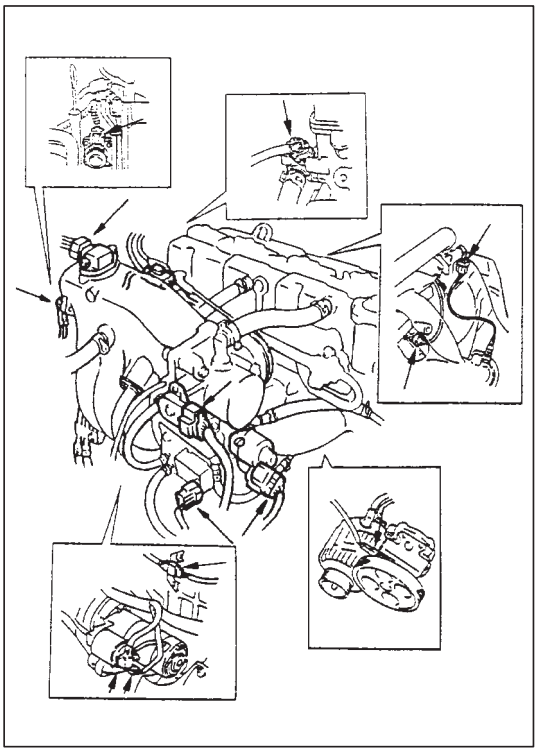
ENGINE ASSEMBLY

REMOVAL

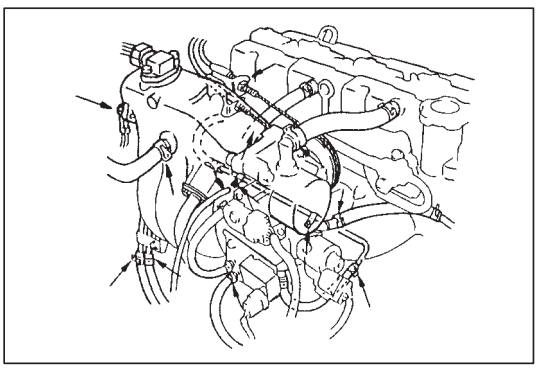
1) Release fuel pressure in fuel feed line. Refer to Section 6.
2) Disconnect negative cable at battery.
3) Remove engine hood.
4) Remove strut tower bar.



5) Drain coolant.
6) Remove radiator, radiator fan shroud and cooling fan. Refer to Section 6B for removal.
7) Remove air cleaner outlet hose.

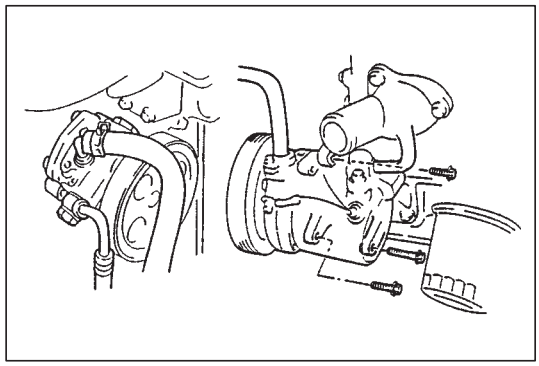


8) Disconnect following electric lead wires:
   - Injector wire harness coupler
   - CMP sensor coupler
   - Ignition coil couplers
   - TP sensor coupler
   - MAF sensor coupler
   - IAT sensor coupler
   - IAC valve coupler
   - Manifold differential pressure sensor
   - Crankshaft position sensor
   - EVAP canister air valve
   - Tank pressure control solenoid valve
   - Ground wire from intake manifold
   - EVAP canister purge valve coupler
   - EGR valve coupler
   - Heated oxygen sensor-1 and/or -2 wire
   - ECT sensor coupler
   - Generator wires
   - Starter wires
   - Oil pressure switch wire
   - Power steering pressure switch wire
   - Wire harness clamps
9) Remove starter motor.



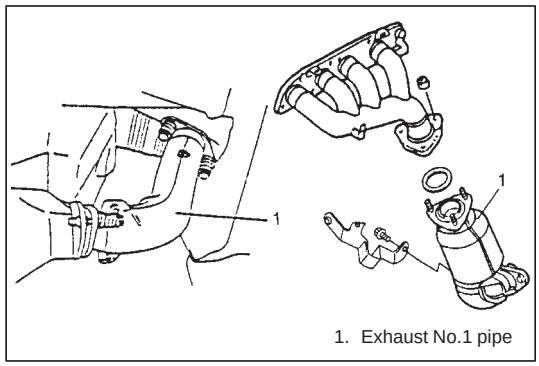
10) Disconnect accelerator cable and A/T throttle cable (for A/T vehicle) from throttle body.
11) Disconnect following hoses:
    - Fuel feed hose and return hose from each pipe
    - Heater hoses from heater core
    - Vacuum hose from intake manifold
    - Brake booster vacuum hose

    Remove EVAP canister from vehicle body.



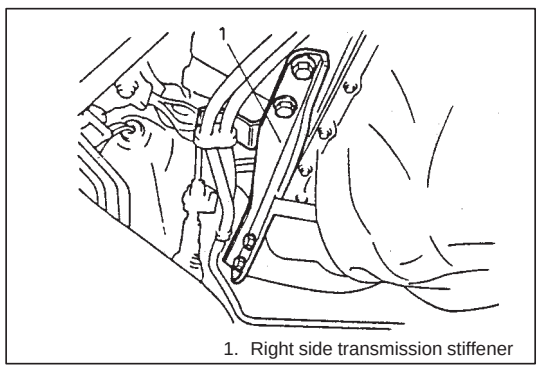
12) With hoses connected, detach power steering pump and A/C compressor from cylinder block if equipped.

13) Raise vehicle.
14) Drain engine oil if necessary.
15) Remove front differential housing with differential from chassis. Refer to Section 7E for removal.



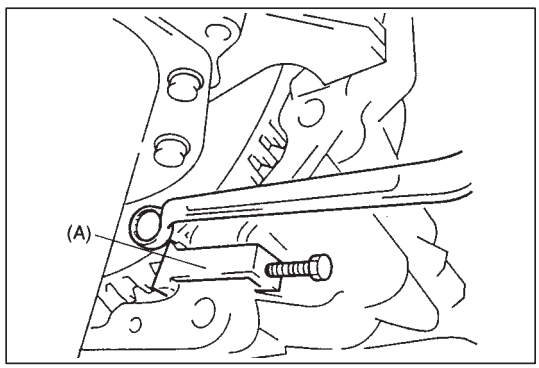
1. Exhaust No.1 pipe

16) Remove exhaust pipe bolt or exhaust pipe.



1. Right side transmission stiffener

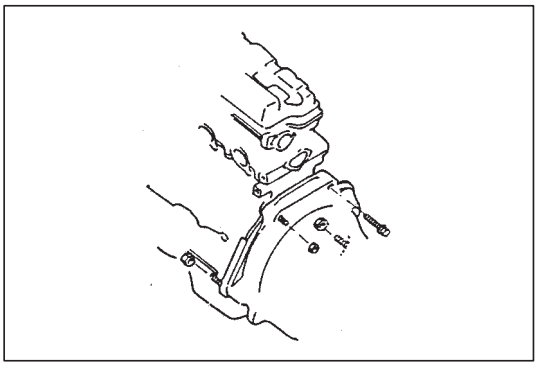
17) Release A/T fluid hoses from clamps (for A/T vehicle).
18) Remove right side transmission stiffener (if equipped).



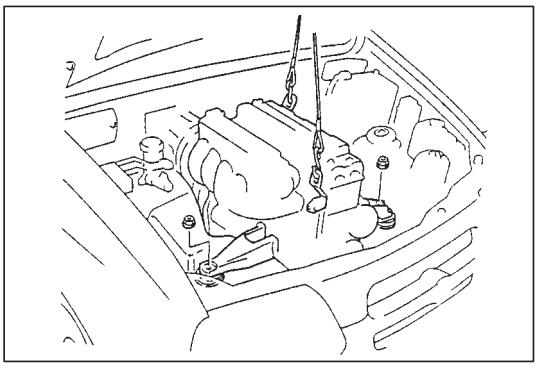
19) Remove clutch housing lower plate.
20) Remove torque converter bolts (for A/T vehicle).

Special Tool
(A): 09927-56010

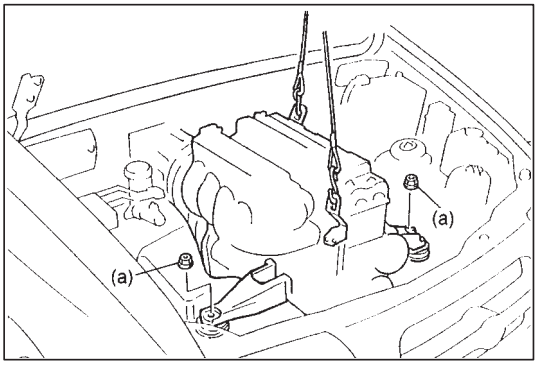
21) Lower vehicle.
22) Support transmission. For A/T vehicle, don't jack under A/T oil pan to support transmission.



23) Remove bolt and nuts fastening cylinder block and transmission.



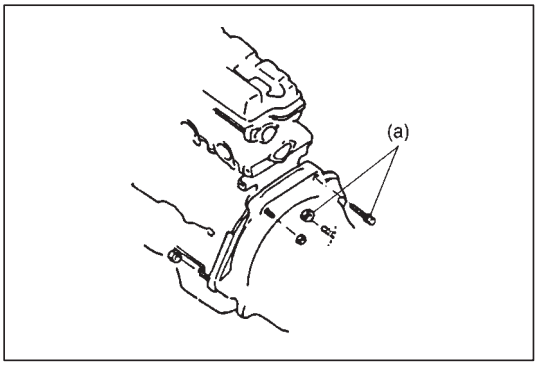
24) Install lifting device.
25) Remove engine side mounting bracket nuts from engine mountings.
26) Before lifting engine, check to ensure all hoses, wires and cables are disconnected from engine.
27) Remove engine assembly from chassis and transmission by lifting a little, sliding toward front, and then, carefully hoist engine assembly.



INSTALLATION

Reverse removal procedure for installation, noting following points.
1) Lower engine assembly into engine compartment. Connect engine to transmission and engine side mounting brackets to engine mountings.
2) Tighten nuts fastening engine side mounting brackets and engine mountings.

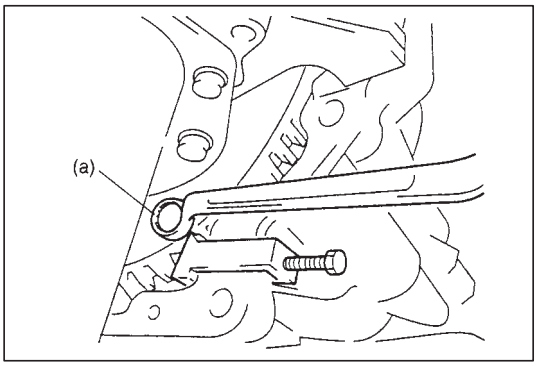
Tightening Torque
(a): 50 N·m (5.0 kg-m, 36.5 lb-ft)



3) Tighten bolt and nuts fastening cylinder block and transmission to specified torque.

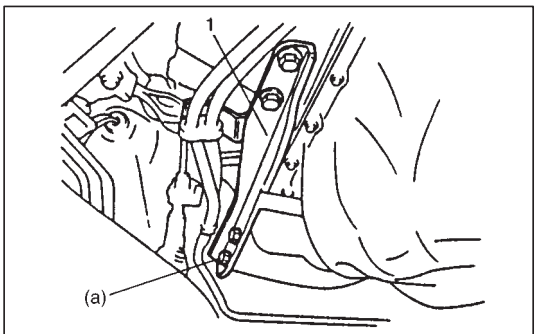
Tightening Torque
(a): 85 N·m (8.5 kg-m, 61.5 lb-ft)

4) Remove lifting device.



5) Tighten torque converter bolts to specified torque (for A/T vehicle).

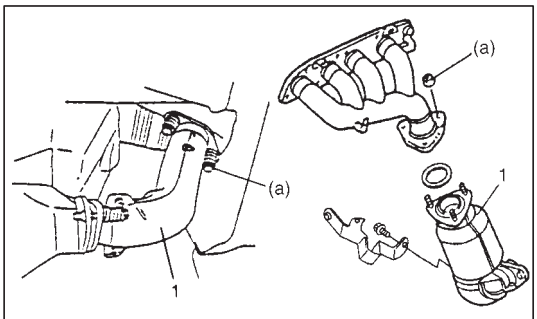
Tightening Torque
(a): 65 N·m (6.5 kg-m, 47.0 lb-ft)



1. Right side transmission stiffener

6) Tighten transmission stiffener bolts to specified torque if equipped.

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



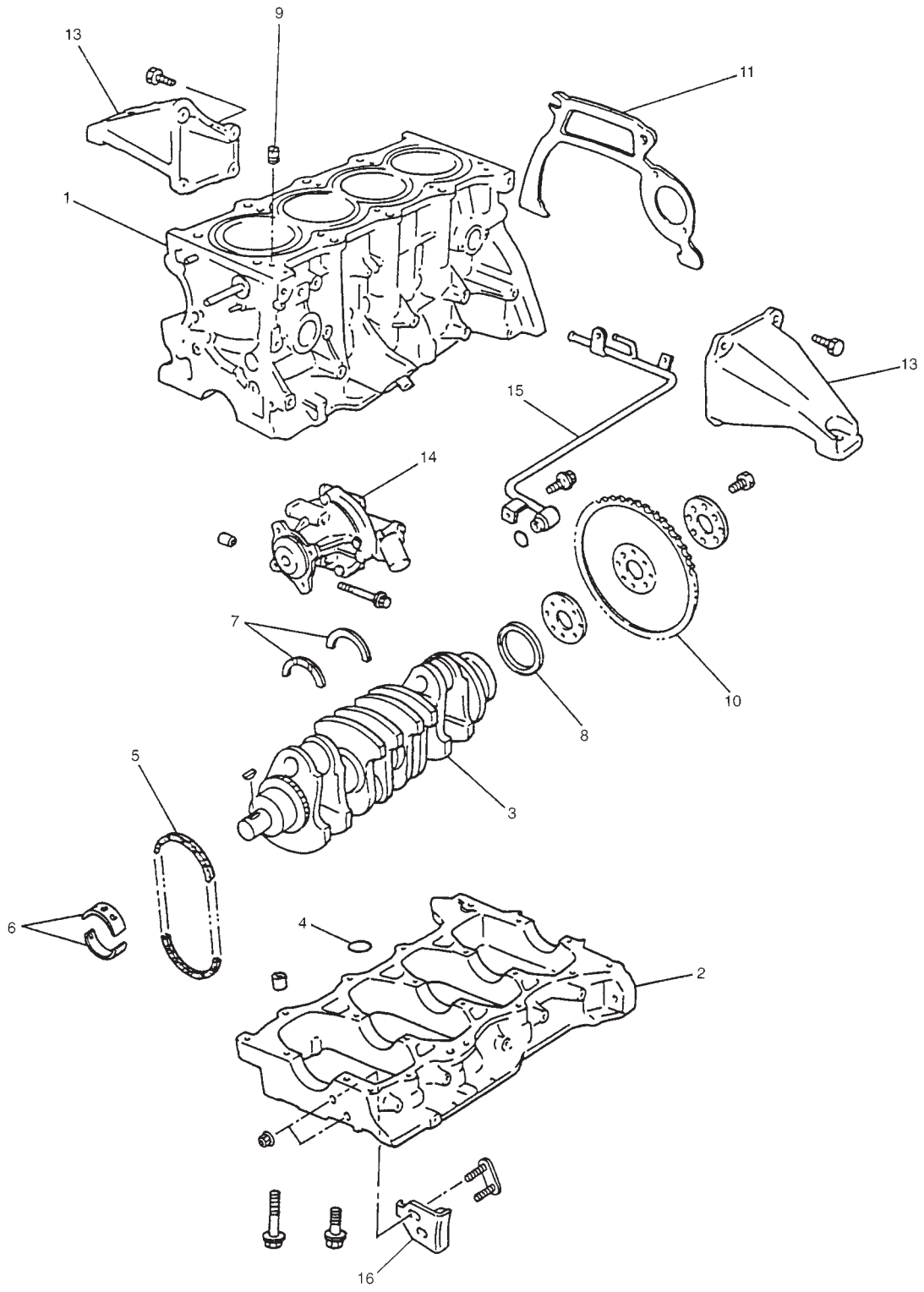
1. Exhaust No.1 pipe

7) Tighten bolts of exhaust No.1 pipe to specified torque.

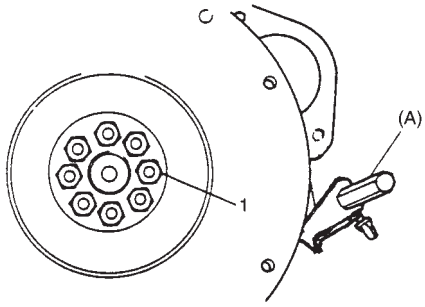
Tightening Torque
(a): 50 N·m (5.0 kg-m, 36.5 lb-ft)

8) Install front differential housing with differential to chassis. Refer to Section 7E for installation.
9) Reverse disconnected hoses, cables and electric wires for connection.
10) Adjust cooling fan belt tension, referring to Section 6B.
11) Adjust accelerator cable and A/T throttle cable (for A/T vehicle) according to procedure described in Section 6E1.
12) Check to ensure that all removed parts are back in place. Reinstall any necessary parts which have not been reinstalled.
13) Refill engine with engine oil referring to item “ENGINE OIL CHANGE” in Section 0B.
14) Refill cooling system, referring to Section 6B.
15) Check to ensure that all fasteners and clamps are tightened.
16) Upon completion of installation, verify that there is no fuel leakage, coolant leakage or exhaust gas leakage at each connection.

MAIN BEARINGS, CRANKSHAFT AND CYLINDER BLOCK



1. Cylinder block
2. Lower crankcase
3. Crankshaft
4. O-ring
5. Oil pump drive chain
6. Main bearing
7. Thrust bearing
8. Rear oil seal
9. Check valve
10. Flywheel (M/T)
    Drive plate (A/T)
11. Clutch housing plate
12. Blank
13. Engine side mounting bracket
14. Water pump
15. Heater outlet pipe
16. Oil pump chain guide

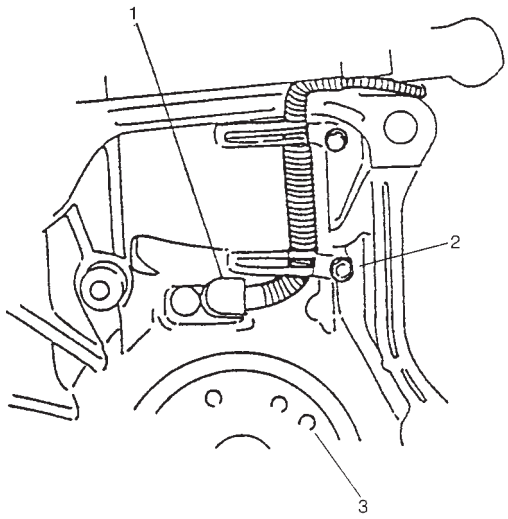


1. Flywheel bolt

REMOVAL

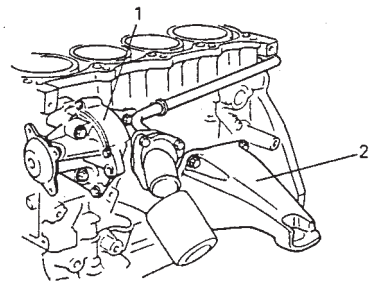
1) Remove engine assembly from vehicle as previously outlined.
2) Remove clutch and flywheel (for M/T vehicle) or drive plate (for A/T vehicle). For clutch removal, refer to Section 7C1.

Special Tool
(A): 09924-17810



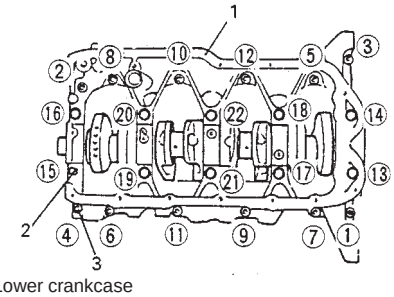
1. CKP sensor
2. Cylinder block
3. Crankshaft

3) Remove throttle body, intake manifold, exhaust manifold.
4) Remove oil pan and oil pump strainer.
   Refer to item “OIL PAN AND OIL PUMP STRAINER” in this section for removal.
5) Remove oil pump.
6) Remove cylinder head cover.
7) Remove timing chain cover. Refer to item “TIMING CHAIN COVER” in this section for removal.
8) Remove timing chain guide, chain tensioner, tensioner adjusters, 2nd timing chain and 1st timing chain.
9) Remove cylinder head assembly.
10) Remove pistons and connecting rods.
10-1) Remove crankshaft position sensor.



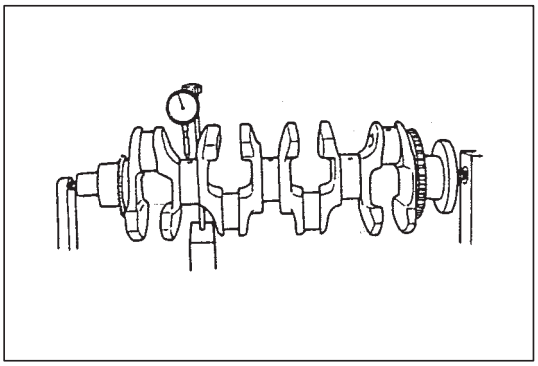
1. Water pump
2. Engine side mounting bracket

11) Remove water pump and heater outlet pipe.
12) Remove engine side mounting brackets (right and left).



1. Lower crankcase
2. Bolt (10 mm thread diameter)
3. Bolt (8 mm thread diameter)

13) Loosen crankcase bolts, following sequence in figure and remove them.
14) Remove crankshaft from cylinder block.



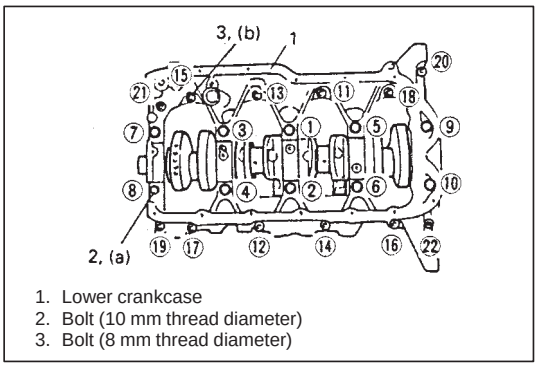
INSPECTION

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.)

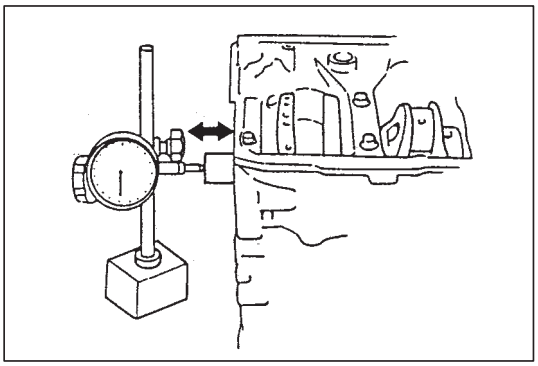


1. Lower crankcase
2. Bolt (10 mm thread diameter)
3. Bolt (8 mm thread diameter)

Crankshaft thrust play

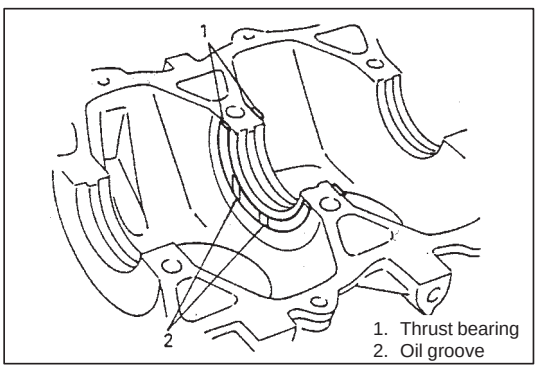
Measure this play with crankshaft set in cylinder block in the normal manner, that is, with thrust bearing and journal bearing caps installed. Tighten crankcase bolts to specified torque in such order as indicated in figure.

Tightening Torque
(a): 60 N·m (6.0 kg-m, 43.5 lb-ft)
(b): 27 N·m (2.7 kg-m, 19.5 lb-ft)



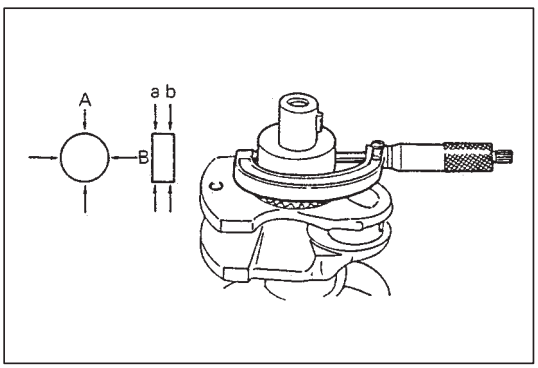
Use a dial gauge to read displacement in axial (thrust) direction of crankshaft.
If its limit is exceeded, replace thrust bearing with new standard one or oversize one to obtain standard thrust play.

Crankshaft Thrust Play
Standard: 0.10 – 0.35 mm (0.0039 – 0.0138 in.)
Limit: 0.42 mm (0.0165 in.)



1. Thrust bearing
2. Oil groove

Thickness of crankshaft thrust bearing	Standard		2.500 mm (0.984 in.)
	Oversize:	0.125 mm (0.0049 in.)	2.563 mm (0.1009 in.)



Out-of-round and taper (uneven wear) of journals

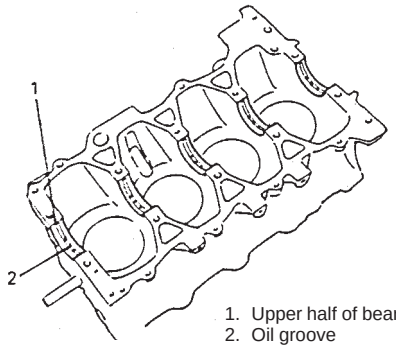
An unevenly worn crankshaft journal shows up as a difference in diameter at a cross section or along its length (or both). This difference, if any, is determined by taking micrometer readings. If any one of journals is badly damaged or if amount of uneven wear in the sense explained above exceeds its limit, regrind or replace crankshaft.

Limit on out-of-round and taper: 0.01 mm (0.0004 in.)
Out-of-round: A – B
Taper: a – b

Main Bearings

General information

- Service main bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and each of them has 5 kinds of bearings differing in tolerance.

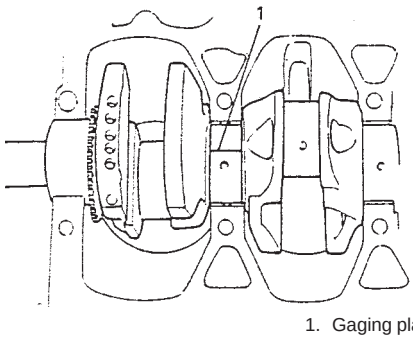


1. Upper half of bearing
2. Oil groove

- Upper half of bearing has oil groove as shown in figure. Install this half with oil groove to cylinder block.
- Lower half of bearing does not have oil groove.

Inspect

Check bearings for pitting, scratches, wear or damage.
If any malcondition is found, replace both upper and lower halves.
Never replace either half without replacing the other half.

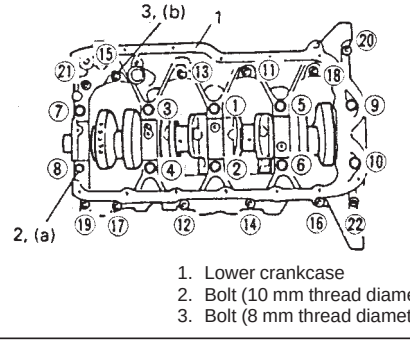


1. Gaging plastic

Main bearing clearance

Check clearance by using gaging plastic according to following procedure.

1) Remove lower crankcase.
2) Clean bearings and main journals.
3) Place a piece of gaging plastic the full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.

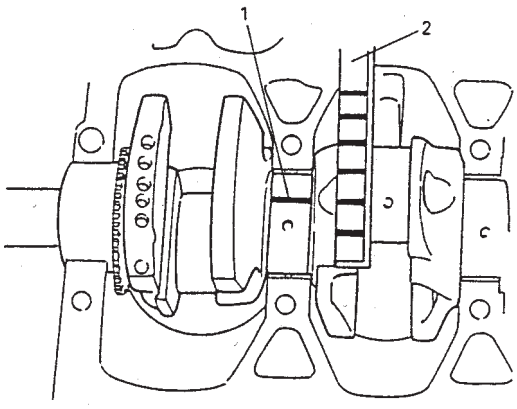


1. Lower crankcase
2. Bolt (10 mm thread diameter)
3. Bolt (8 mm thread diameter)

4) Install lower crankcase to cylinder block.
   Tighten crankcase bolts, following sequence in figure.
   Tighten crankcase bolts to specified torque.

   Tightening Torque
   (a): 60 N·m (6.0 kg-m, 43.5 lb-ft)
   (b): 27 N·m (2.7 kg-m, 19.5 lb-ft)

   NOTE:
   Do not rotate crankshaft while gaging plastic is installed.

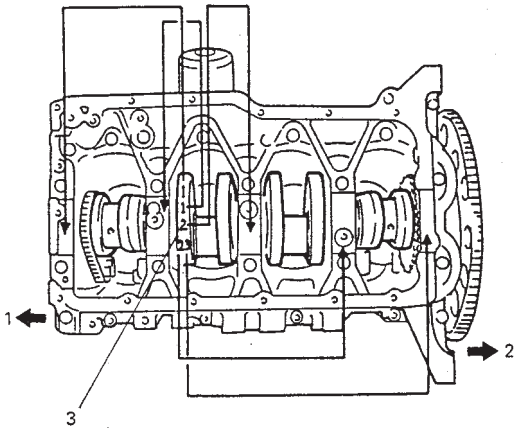


1. Gaging plastic
2. Scale

5) Remove lower crankcase and using scale on gaging plastic envelop, measure gaging plastic width at its widest point. If clearance exceeds its limit, replace bearing. Always replace both upper and lower inserts as a unit.
A new standard bearing may produce proper clearance. If not, it will be necessary to regrind crankshaft journal for use of 0.25 mm undersize bearing.
After selecting new bearing, recheck clearance.

Bearing Clearance

Standard: 0.032 – 0.052 mm (0.0013 – 0.0020 in.)
Limit: 0.060 mm (0.0023 in.)



1. Crankshaft pulley side
2. Flywheel side
3. Crankshaft web No.2

Selection of main bearings

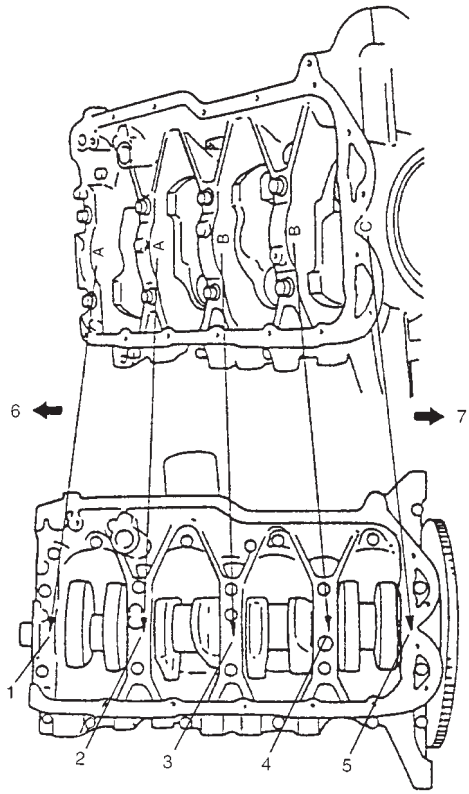
STANDARD BEARING:

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. As shown in figure, crank web No.2 has stamped numbers.
Three kinds of numbers (“1”, “2” and “3”) represent following journal diameters.

Stamped numbers	Journal diameter
1	57.994 – 58.000 mm (2.2832 – 2.2834 in.)
2	57.988 – 57.994 mm (2.2830 – 2.2832 in.)
3	57.982 – 57.988 mm (2.2828 – 2.2829 in.)

Stamped numbers on crank web No.2 represent journal diameters marked with an arrow in figure respectively.
For example, stamped number “1” indicates that corresponding journal diameter is 57.994 – 58.000 mm.



1. Bearing cap No.1
2. Bearing cap No.2
3. Bearing cap No.3
4. Bearing cap No.4
5. Bearing cap No.5
6. Crankshaft pulley side
7. Flywheel side

2) Next, check crankcase (bearing cap) bore diameter without bearing. On lower crankcase five alphabets are stamped as shown in figure.
Three kinds of alphabets (“A”, “B” and “C”) represent following cap bore diameters.

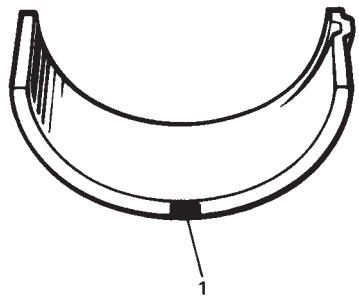
[For Bearing cap No.1, No.2, No.3 and No.5]

Stamped alphabet	Bearing cap bore diameter (without bearing)
A	62.000 – 62.006 mm (2.4409 – 2.4411 in.)
B	62.006 – 62.012 mm (2.4412 – 2.4414 in.)
C	62.012 – 62.018 mm (2.4414 – 2.4416 in.)

[For Bearing cap No.4]

Stamped alphabet	Bearing cap bore diameter (without bearing)
A	62.006 – 62.012 mm (2.4411 – 2.4414 in.)
B	62.012 – 62.018 mm (2.4414 – 2.4416 in.)
C	62.018 – 62.024 mm (2.4416 – 2.4419 in.)

Stamped alphabets on lower crankcase represent crankcase bore diameter marked with an arrow in figure respectively.
For example, stamped alphabet “A” at bearing cap No.2 indicates that bearing cap bore diameter of bearing cap No.2 is 62.000 – 62.006 mm.



1. Paint

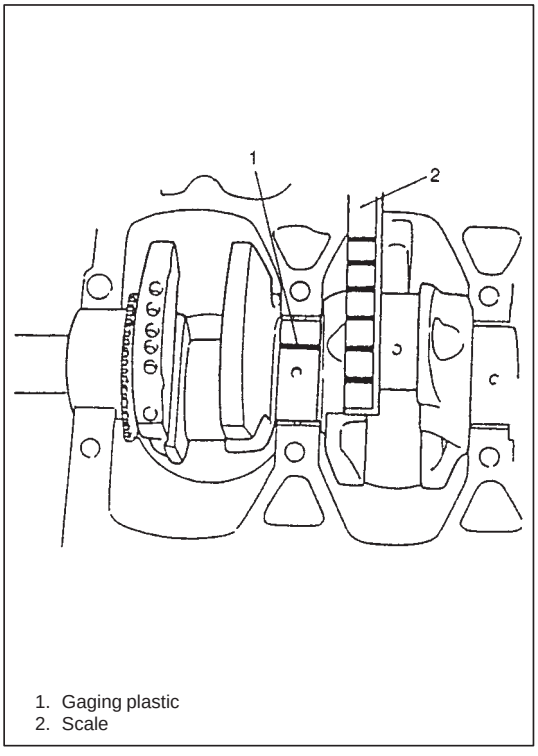
3) There are five kinds of standard bearings differing in thickness. To distinguish them, they are painted in following colors at the position as indicated in figure.
Each color indicated following thickness at the center of bearing.

Color painted	Bearing thickness
Green	1.990 – 1.994 mm (0.0783 – 0.0785 in.)
Black	1.993 – 1.997 mm (0.0785 – 0.0786 in.)
Colorless (no paint)	1.996 – 2.000 mm (0.0786 – 0.0787 in.)
Yellow	1.999 – 2.003 mm (0.0787 – 0.0788 in.)
Blue	2.002 – 2.006 mm (0.0786 – 0.0789 in.)

4) From number stamped on crank web No.2 and alphabets stamped on lower crankcase, determine new standard bearing to be installed to journal, by referring to table shown below.
For example, if number stamped on crank web No.2 is “1” and alphabet stamped on lower crankcase is “B”, install a new standard bearing painted in “Black” to its journal.

[For all journals]

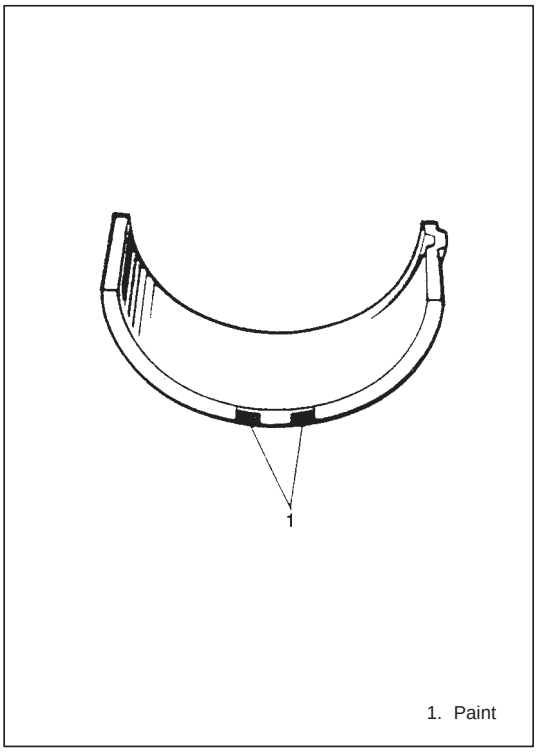
		Number stamped on crank web (Journal diameter)		
		1	2	3
Alphabet stamped on lower crankcase (Cap bore dia.)	A	Green	Black	Colorless
	B	Black	Colorless	Yellow
	C	Colorless	Yellow	Blue
		New standard bearing to be installed.		



1. Gaging plastic
2. Scale

5) Using gaging plastic, 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 and lower crankcase due to any reason, select new standard bearings to be installed by referring to number stamped on new crankshaft or alphabets stamped on new lower crankcase.



1. Paint

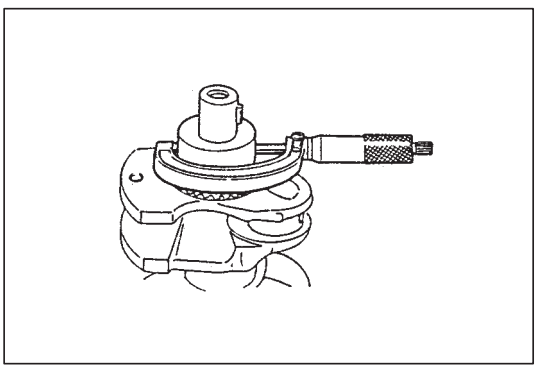
UNDERSIZE BEARING (0.25 mm):

- 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 & Red	2.121 – 2.125 mm (0.0835 – 0.0836 in.)
Black & Red	2.124 – 2.128 mm (0.0836 – 0.0837 in.)
Red only	2.127 – 2.131 mm (0.0837 – 0.0838 in.)
Yellow & Red	2.130 – 2.134 mm (0.0838 – 0.0839 in.)
Blue & Red	2.133 – 2.137 mm (0.0839 – 0.0840 in.)

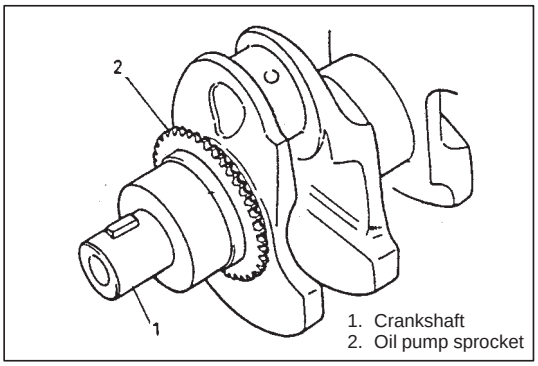
- If necessary, regrind crankshaft journal and select under-size bearing to use with it as follows.
  1) Regrind journal to following finished diameter.

Finished diameter: 57.732 – 57.750 mm (2.2729 – 2.2736 in.)



2) Using micrometer, measure reground journal diameter.
   Measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.
3) Using journal diameter measured above and alphabets stamped on lower crankcase, select an undersize bearing by referring to table given below.
   Check bearing clearance with newly selected undersize bearing.

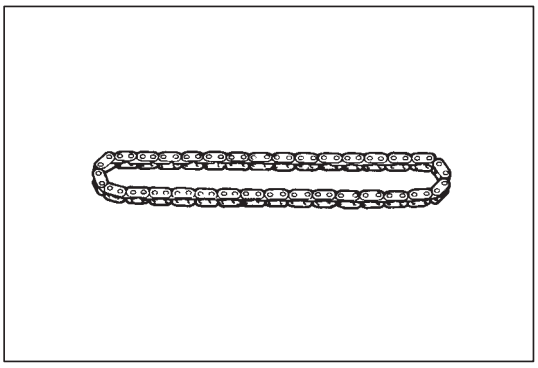
		Measured journal diameter		
		57.744 – 57.750 mm (2.2734 – 2.2736 in.)	57.738 – 57.744 mm (2.2731 – 2.2733 in.)	57.732 – 57.738 mm (2.2729 – 2.2731 in.)
Alphabets stamped on lower crankcase	A	Green & Red	Black & Red	Red only
	B	Black & Red	Red only	Yellow & Red
	C	Red only	Yellow & Red	Blue & Red
		Undersize bearing to be installed		



1. Crankshaft
2. Oil pump sprocket

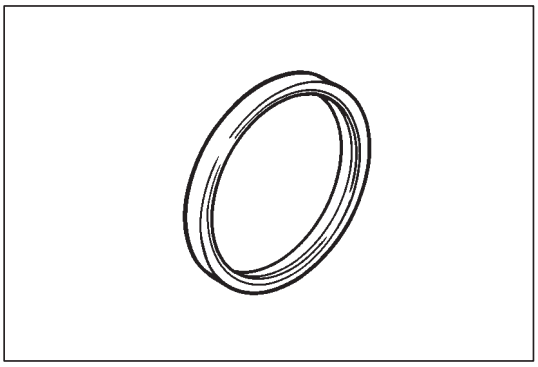
Oil Pump Sprocket

- Check teeth of sprocket for wear or damage.
  If any damage or wear is found, replace crankshaft.



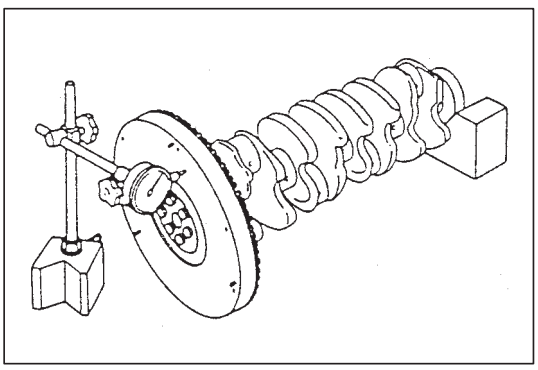
Oil Pump Drive Chain

- Check oil pump drive chain for wear or damage.



Rear Oil Seal

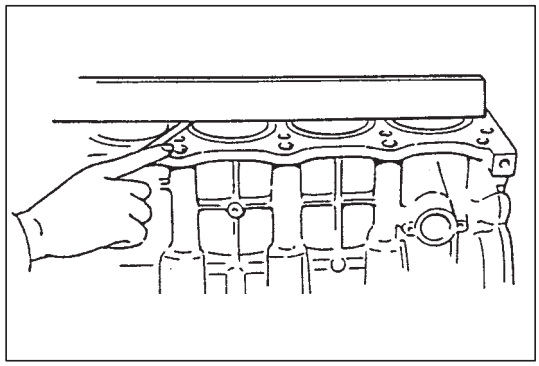
Carefully inspect oil seal for wear or damage. If lip portion is worn or damaged, replace oil seal.



Flywheel

- If ring gear is damaged, cracked or worn, replace flywheel.
- If the surface contacting clutch disc is damaged, or excessively worn, replace flywheel.
- Check flywheel for face runout with a dial gauge.
  If runout exceeds its limit, replace flywheel.

  Limit on runout: 0.2 mm (0.0078 in.)



Cylinder Block

Distortion of gasketed surface

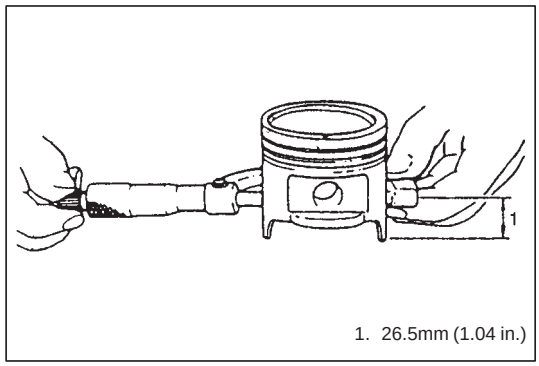
- Using straightedge and thickness gauge, check gasketed surface for distortion and, if flatness exceeds its limit, correct it.

Flatness Limit: 0.06 mm (0.0024 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
STD	83.970 – 83.990 mm (3.3059 – 3.3066 in.)
O/S 0.25	84.220 – 84.240 mm (3.3157 – 3.3165 in.)
O/S 0.50	84.470 – 84.490 mm (3.3256 – 3.3263 in.)

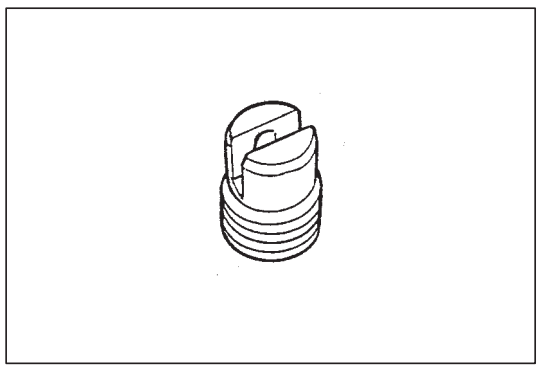


1. 26.5mm (1.04 in.)

3) Using micrometer, measure piston diameter.
4) Calculate cylinder bore diameter to be rebored as follows.
   D = A + B – C
   D: Cylinder bore diameter to be rebored.
   A: Piston diameter as measured.
   B: Piston clearance = 0.02 – 0.04 mm
   (0.0008 – 0.0015 in.)
   C: Allowance for honing = 0.02 mm
   (0.0008 in.)
5) Rebore and hone cylinder to calculated dimension.

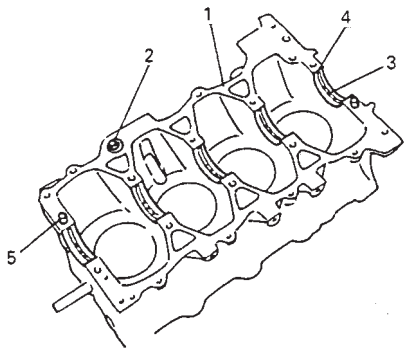
NOTE:
Before reboring, install lower crankcase and tighten to specification to avoid distortion of bearing bores.

6) Measure piston clearance after honing.



Check valve

Inspect check valve for clogging and ball for being stuck.



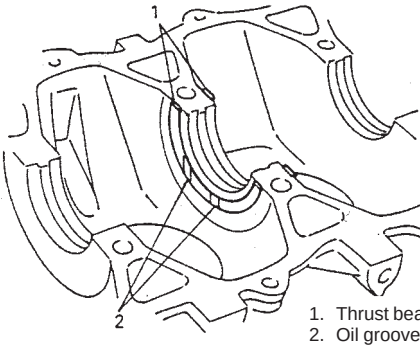
1. Cylinder block
2. O-ring
3. Oil groove
4. Bearing
5. Knock pin

INSTALLATION

NOTE:

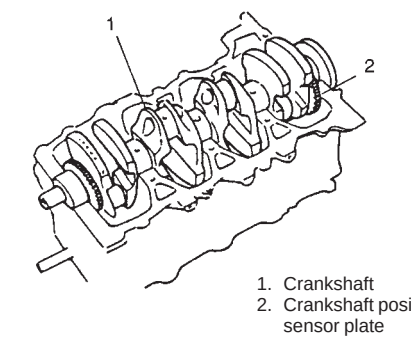
- **All parts to be installed must be perfectly clean.**
- **Be sure to oil crankshaft journals, journal bearings, thrust bearings, crank pins, connecting rod bearings, pistons, piston rings and cylinder bores.**
- **Journal bearings, crankcase (bearings caps), connecting rods, rod bearings, rod bearing caps, pistons and piston rings are in combination sets. Do not disturb combination and try to see that each part goes back to where it came from, when installing.**
- **Clean mating surface of cylinder block and lower crankcase, remove oil, old sealant and dust from mating surface.**

1) Fit main bearings to cylinder block.
   One of two halves of main bearing, has oil groove. Install this half with oil groove to cylinder block, and another half without oil groove to lower crankcase.
   Make sure that two halves are painted in the same color.
2) Install O-ring to cylinder block.



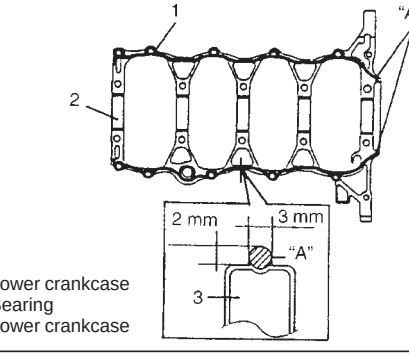
1. Thrust bearing
2. Oil groove

3) Fit thrust bearings to cylinder block between No.2 and No.3 cylinders. Face oil groove sides to crank webs.



1. Crankshaft
2. Crankshaft position sensor plate

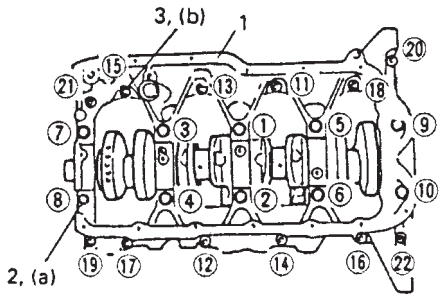
4) Put crankshaft with oil pump drive chain to cylinder block.
   Check to make sure that crankshaft position sensor plate is free from metal particles and damage.



1. Lower crankcase
2. Bearing
3. Lower crankcase

5) Apply sealant "A" to lower crankcase mating surface area as shown in figure.

   "A": Sealant 99000-31150

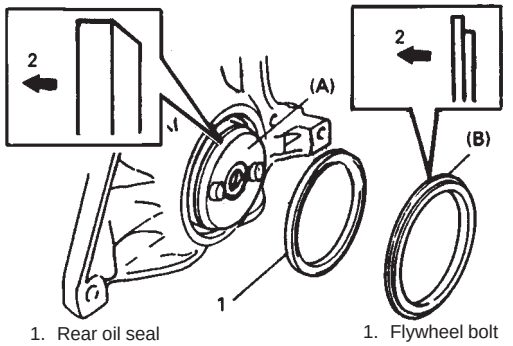


1. Lower crankcase
2. Bolt (10 mm thread diameter)
3. Bolt (8 mm thread diameter)

6) Install lower crankcase to cylinder block. Apply oil to crankcase bolts before installing them. Tighten crankcase bolts to 70% torque of specified torque, following sequence in figure and then tighten crankcase bolts to specified torque according to numerical order in figure.

Tightening Torque
(a): 60 N·m (6.0 kg-m, 43.5 lb-ft)
(b): 27 N·m (2.7 kg-m, 19.5 lb-ft)

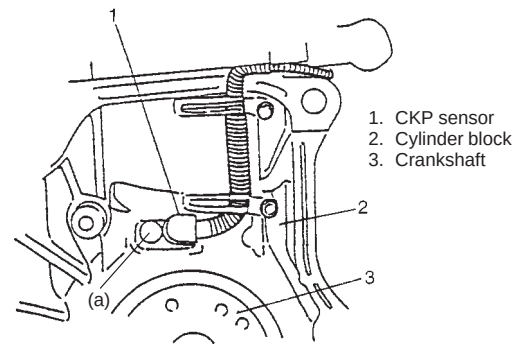
NOTE:
After tightening crankcase bolts, check to be sure that crankshaft rotates smoothly when turned by hand.



1. Rear oil seal
1. Flywheel bolt

7) Install rear oil seal by using plastic hammer and special tools.

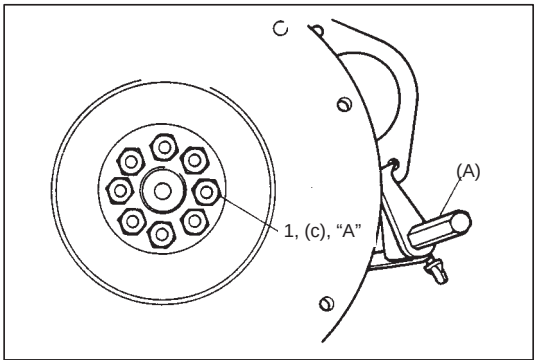
Special Tool
(A): 09911-97710
(B): 09911-97810



1. CKP sensor
2. Cylinder block
3. Crankshaft

7-1) Install crankshaft position sensor and fix its wire harness with bracket.

Tightening Torque
(a): 6 N·m (0.6 kg-m, 4.5 lb-ft)

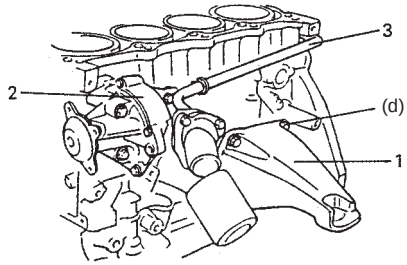


8) Install flywheel (M/T vehicle) or drive plate (A/T vehicle). Using special tool, lock flywheel or drive plate, and tighten flywheel or drive plate bolts applied with sealant to specification.

"A": Sealant 1215 99000-31110

Special Tool
(A): 09924-17810

Tightening Torque
(c): 70 N·m (7.0 kg-m, 51.0 lb-ft)

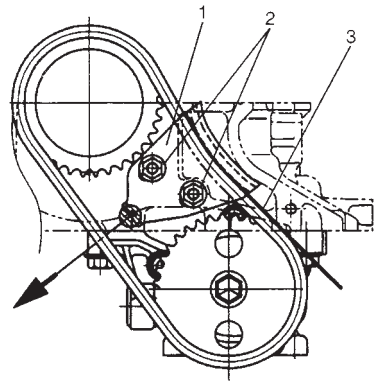


1. Engine side mounting bracket
2. Water pump
3. Heater outlet pipe

9) Install engine side mounting brackets (right and left). Tighten bracket bolts to specified torque.

Tightening Torque
(d): 50 N·m (5.0 kg-m, 36.5 lb-ft)

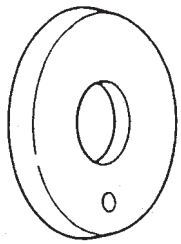
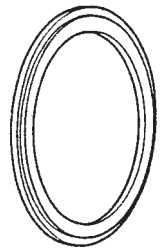
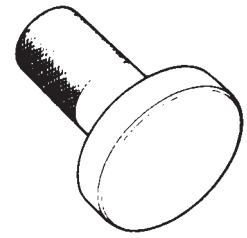
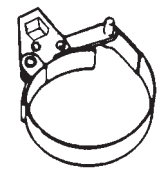
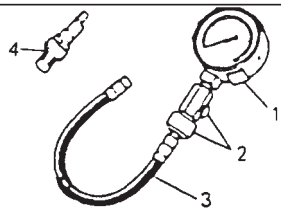
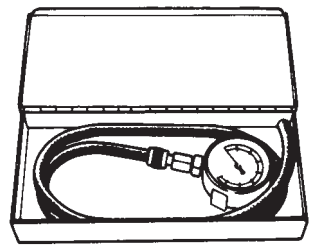
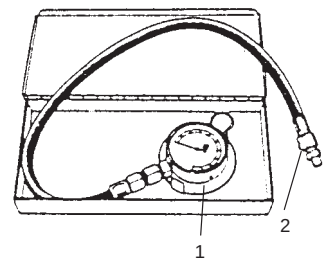
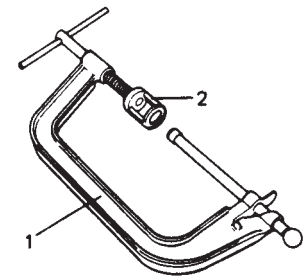
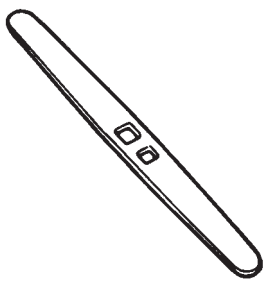
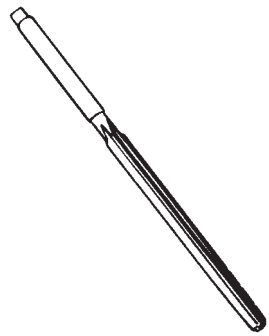
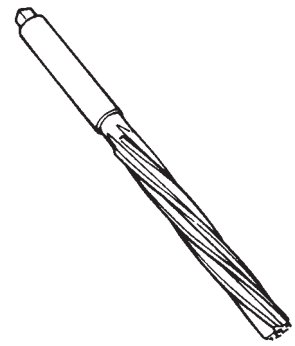
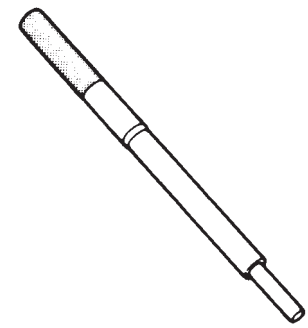
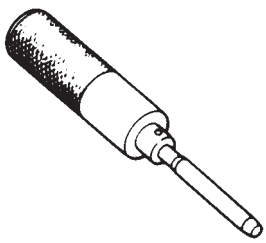
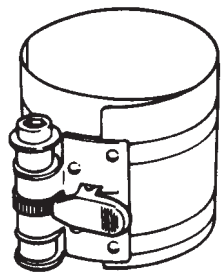
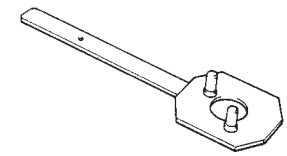
10) Install water pump and heater outlet pipe. Refer to Section 6B.
11) Install pistons and connecting rods as previously outlined.

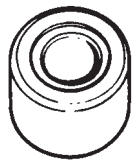
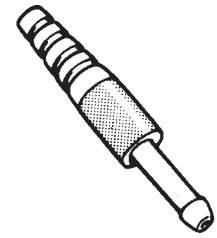
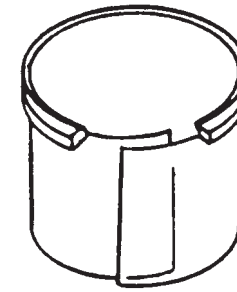
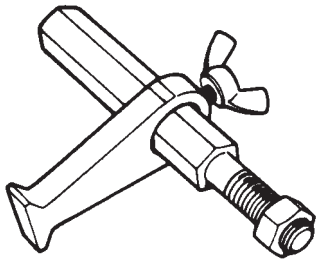
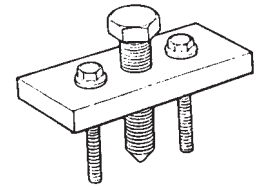
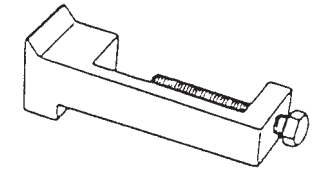


1. Oil pump chain guide
2. Oil pump chain guide nuts
3. Thickness gauge

12) Install oil pump. Refer to “Oil pump” in this section.
13) In case of oil pump chain guide is reinstalled or new oil pump chain is installed, if chain guide hole is oval type, adjust clearance between oil pump chain and oil pump chain guide as follows:
    i) Install oil pump chain guide and nuts temporarily.
    ii) To take up slack of oil pump chain, insert 0.5 mm (0.020 in.) thickness gauge between chain guide and chain and pull chain guide in arrow direction with a force of 20 to 30 N (2 – 3 kg, 4.4 – 6.6 lb).
    iii) With pulling chain guide in step ii), tighten oil pump chain guide nuts and pull out thickness gauge.
14) Install cylinder head assembly to cylinder block as previously outlined.
15) Install timing chains, timing chain tensioner, timing chain guide, timing chain sprockets, timing chain cover, crankshaft pulley, water pump pulley, etc., as previously outlined.
16) Install oil pump strainer and oil pan.
17) Install clutch to flywheel (for M/T vehicle). For clutch installation, refer to Section 7C1.
18) Install engine assembly to vehicle as previously outlined.

SPECIAL TOOLS

 09911-97710 Oil seal guide	 09911-97810 Oil seal installer	 09913-75510 Bearing installer	 09915-47330 Oil filter wrench
 1. 09915-64510-001 Compression gauge 2. 09915-64510-002 Connector 3. 09915-64530 Hose 4. 09915-67010 Attachment	 09915-67310 Vacuum gauge	 1. 09915-77310 Oil pressure gauge 2. 09915-78211 Oil pressure gauge attachment	 1. 09916-14510 Valve lifter 2. 09916-14910 Valve lifter attachment
 09916-34542 Reamer handle	 09916-37810 Reamer (6 mm)	 09916-38210 Reamer (11 mm)	 09916-44910 Valve guide remover
 09916-58210 Valve guide installer handle	 09916-77310 Piston ring compressor	 09916-84511 Forceps	 09917-68221 Camshaft lock holder

 09917-87810 Valve guide installer	 09917-98221 Valve stem seal installer	 09918-08210 Vacuum gauge hose joint	 09919-28610 Protective sleeve
 09924-17810 Flywheel holder	 09926-58010 Bearing puller attachment	 09944-36011 Steering wheel remover	 09927-56010 Gear stopper

REQUIRED SERVICE MATERIALS

RECOMMENDED SUZUKI PRODUCT	USE
Sealant 1207C 99000-31150	● To apply to mating surfaces of cylinder block and oil pan. ● To apply to mating surfaces of cylinder block and timing chain cover.
Sealant 1207B 99000-31140	● To apply to mating surface of cylinder block, cylinder head and timing chain cover.
Sealant 1215 99000-31110	● To apply to the thread of the bolt of water outlet pipe. ● To flywheel (M/T) or drive plate (A/T) bolts.

SECTION 6B

ENGINE COOLING

CONTENTS

GENERAL DESCRIPTION 6B- 2
- Cooling System Circulation 6B- 2
- Thermostat 6B- 4
- Cooling Fan Clutch 6B- 4
- Coolant 6B- 5

DIAGNOSIS 6B- 6
- Diagnosis Table 6B- 6

MAINTENANCE 6B- 6
- Coolant Level Check 6B- 6
- Cooling System Service 6B- 7
- Cooling System Flush and Refill 6B- 7
- Cooling Fan Belt Tension Check and Adjustment 6B- 9

ON-VEHICLE SERVICE 6B-11
- Coolant Draining 6B-11
- Cooling Water Pipes or Hoses 6B-11
- Thermostat 6B-13
- Cooling Fan Belt 6B-15
- Cooling Fan and Fan Clutch 6B-16
- Radiator 6B-17
- Water Pump 6B-19
- Engine Coolant Temperature (ECT) Sensor . . . . . Refer to 6E1 (G16 and J20 engines) 6E2 (H25 engine)

REQUIRED SERVICE MATERIAL 6B-24

TIGHTENING TORQUE SPECIFICATION 6B-24

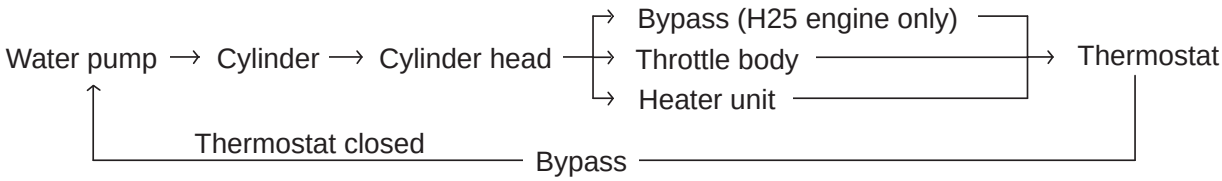
GENERAL DESCRIPTION

The cooling system consists of the radiator cap, radiator, coolant reservoir, hoses, water pump, cooling fan, and thermostat. The radiator is of tube-and-fin type.

WARNING:
- **Do not remove radiator cap to check engine coolant level; check coolant visually at the see-through coolant reservoir.**
  Coolant should be added only to reservoir as necessary.
- **As long as there is pressure in the cooling system, the temperature can be considerably higher than the boiling temperature of the solution in the radiator without causing the solution to boil. Removal of the radiator cap while engine is hot and pressure is high will cause the solution to boil instantaneously and possibly with explosive force, spewing the solution over engine, fenders and person removing cap. If the solution contains flammable anti-freeze such as alcohol (not recommended for use at any time), there is also the possibility of causing a serious fire.**

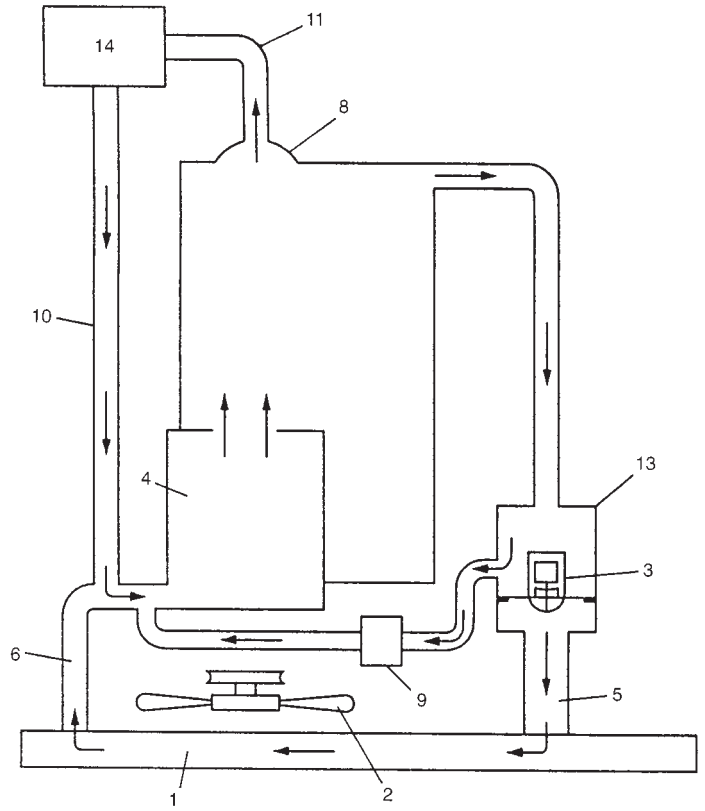
COOLING SYSTEM CIRCULATION

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.

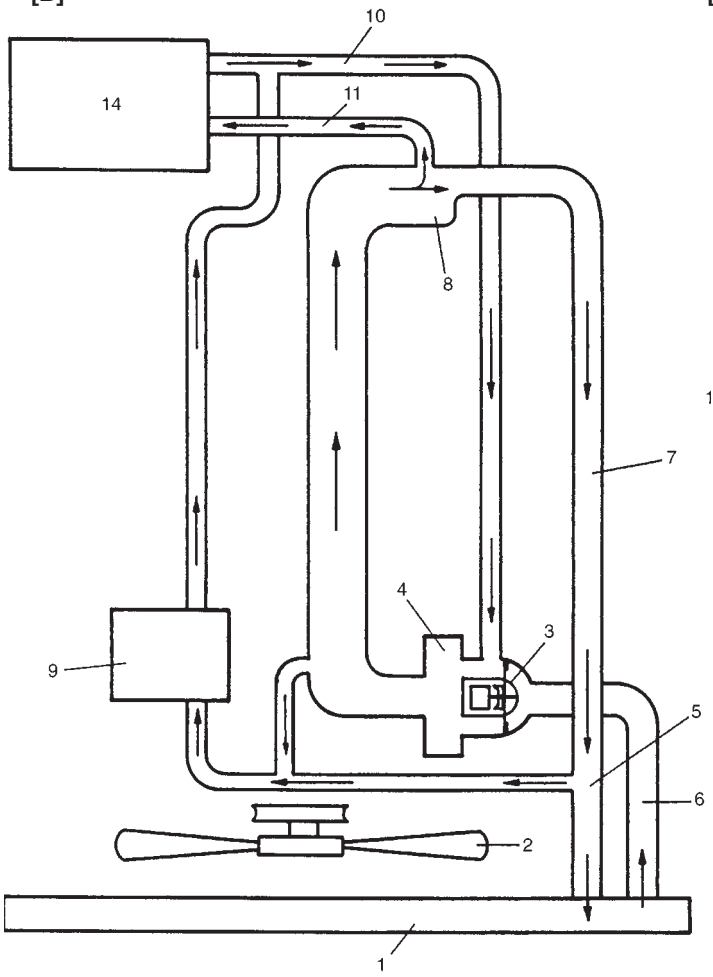
[A]



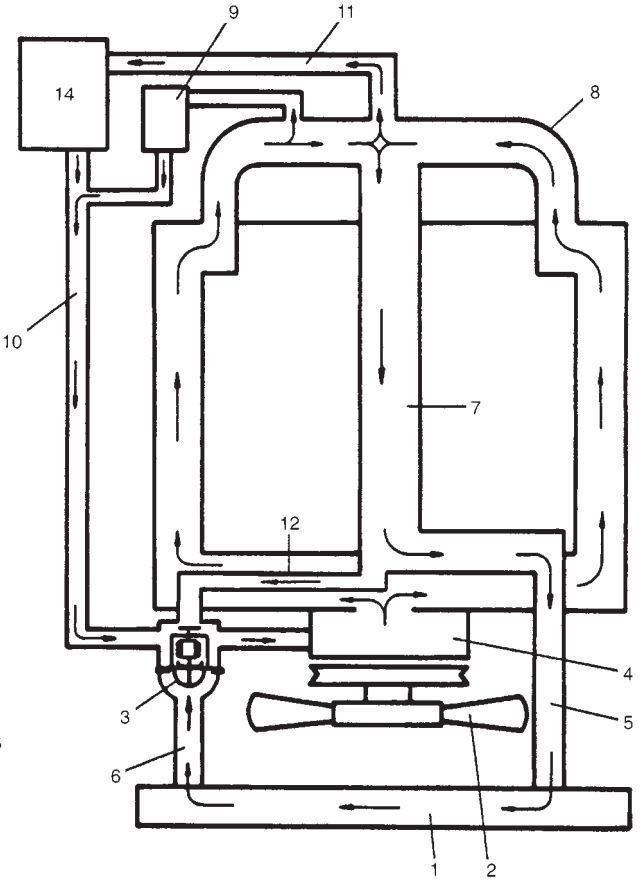
[A]: G16 engine
[B]: J20 engine
[C]: H25 engine

1. Radiator
2. Cooling fan
3. Thermostat
4. Water pump
5. Radiator inlet way
6. Radiator outlet way
7. Outlet pipe
8. Outlet cap
9. Throttle body
10. Heater outlet way
11. Heater inlet way
12. Bypass
13. Intake manifold
14. Heater unit

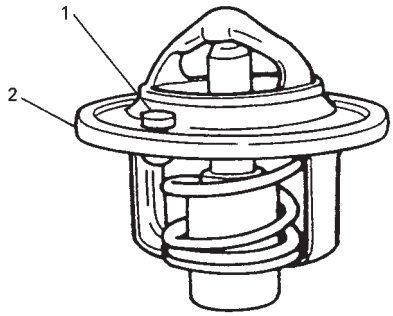
[B]



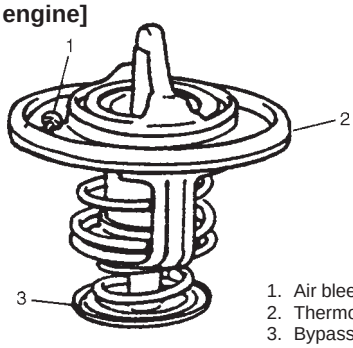
[C]



[G16 & J20 engines]



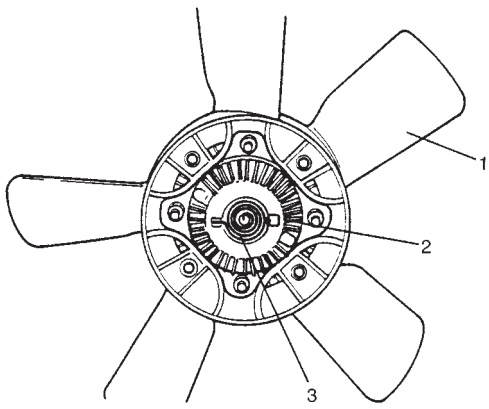
[H25 engine]

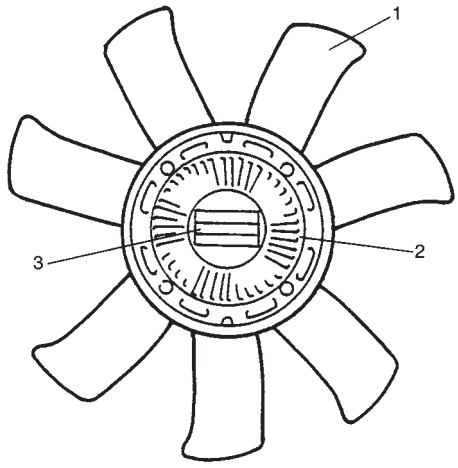


1. Air bleed valve
2. Thermostat seal
3. Bypass valve

THERMOSTAT

Temp. at which valve begins to open	J20 and H25 engines : 82 ± 2°C (179 ± 3.6°F) G16 engine : 88 ± 2°C (190 ± 3.6°F)
Temp. at which valve becomes fully open	J20 and H25 engines: 95°C (203°F) G16 engine : 100°C (212°F)
Valve lift	J20 and H25 engines: More than 8 mm at 95°C (203°F) G16 engine : More than 8 mm at 100°C (212°F)





1. Cooling fan
2. Fan clutch
3. Bimetal

COOLING FAN CLUTCH

Fluid is enclosed in the cooling fan clutch and at its center front, there is a bimetal whose thermal reaction and the engine speed control the cooling fan speed.

The relation between the temperature detected by the fan clutch and operation of the fan clutch is as follows.
While the fan clutch detects a temperature lower than 50°C, it remains OFF and the fan revolution speed is constant (400 to 900 r/min. (rpm) : J20 and H25 engines, 600 to 1,300 r/min.(rpm) : G16 engine) regardless of the engine speed. As the temperature reaches 50°C to 70°C, the fan clutch turns ON gradually and the fan revolution speed increases.
A temperature exceeding 70°C causes the fan clutch to turn ON and the fan revolution speed to increase in proportion with the engine speed.
Once the engine speed exceeds 4,000 r/min.(rpm), however, the fan revolution speed becomes constant (2,350 to 2,650 r/min.(rpm) : J20 and H25 engines, 2,800 to 3,100 r/min.(rpm) : G16 engine).

CAUTION:
Do not disassemble fan clutch.

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.
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).

Anti-freeze proportioning chart:

Freezing temperature		°C	–16	–36
		°F	3	–33
Antifreeze/Anticorrosion coolant concentration		%	30	50
Ratio of compound to cooling water	G16 engine	ltr.	1.7/3.8	2.8/2.8
		US pt	3.5/8.1	5.8/5.8
		Imp. pt.	2.9/6.8	4.9/4.9
	J20 engine	ltr.	2.0/4.5	3.3/3.3
		US pt	4.1/9.6	6.9/6.9
		Imp. pt.	3.4/8.0	5.7/5.7
	H25 engine	ltr.	2.4/5.6	4.0/4.0
		US pt	5.1/11.8	8.5/8.5
		Imp. pt.	4.2/9.9	7.1/7.1

Coolant capacity

		Engine, radiator and heater	Reservoir	Total
G16 engine	ltr. (US/Imp. pt.)	4.6 (9.7/8.1)	0.9 (1.9/1.6)	5.5 (11.6/9.7)
J20 engine	ltr. (US/Imp. pt.)	5.6 (11.8/9.1)	0.9 (1.9/1.6)	6.5 (13.7/11.4)
H25 engine	ltr. (US/Imp. pt.)	7.1 (15.0/12.5)	0.9 (1.9/1.6)	8.0 (16.9/14.1)

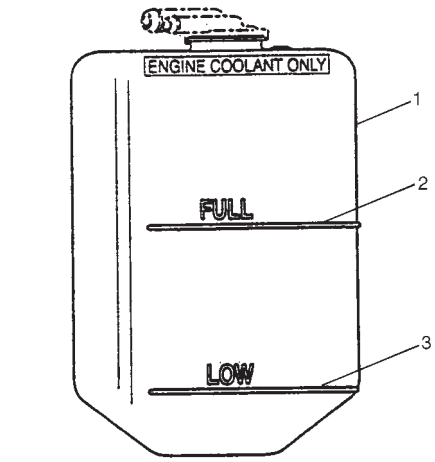
NOTE:

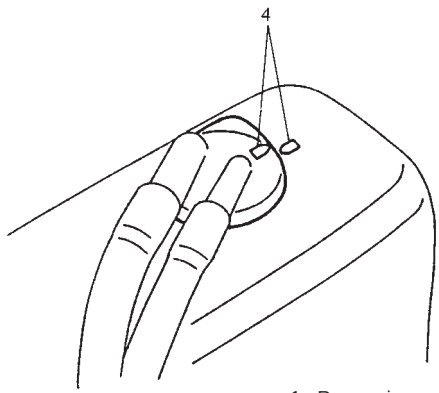
- **Alcohol or methanol base coolant or plain water alone should not be used in cooling system at any time as damage to cooling system could occur.**
- **Even in a market where no freezing temperature is anticipated, mixture of 70% water and 30% ethylene glycol antifreeze (Antifreeze/Anticorrosion coolant) should be used for the purpose of corrosion protection and lubrication.**
- **"Hard water", if used, will foul up the cooling circuit by scale formation. Tap water available from city water supply is the best available water, in a practical sense, for the cooling system. Distilled water is ideal but is a luxury in most cases.**

DIAGNOSIS

DIAGNOSIS TABLE

Condition	Possible Cause	Correction
Engine overheats	° Loose or broken water pump belt	Adjust or replace.
	° Not enough coolant	Check coolant level and add as necessary.
	° Faulty thermostat	Replace.
	° Faulty water pump	Replace.
	° Dirty or bent radiator fins	Clean or remedy.
	° Coolant leakage on cooling system	Repair.
	° Defective cooling fan clutch or thermo switch	Check and replace as necessary.
	° Plugged radiator	Check and replace radiator as necessary.
	° Faulty radiator cap	Replace.





1. Reservoir
2. FULL level mark
3. LOW level mark
4. Arrow mark

MAINTENANCE

COOLANT LEVEL CHECK

WARNING:
To help avoid danger of being burned:
- **Do not remove reservoir cap while coolant is "boiling", and**
- **Do not remove radiator cap while engine and radiator are still hot.**

Scalding fluid and steam can be blown out under pressure if either cap is taken off too soon.

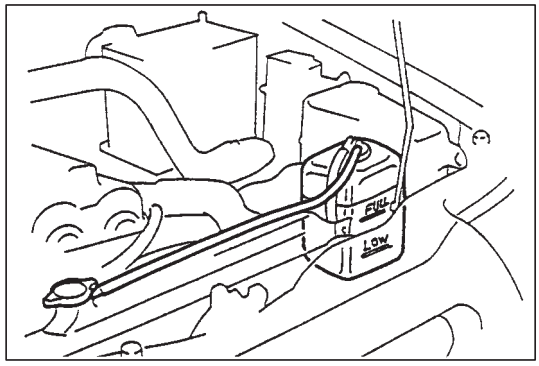
To check level, lift hood and look at "see-through" coolant reservoir. It is not necessary to remove radiator cap to check coolant level. When engine is cool, check coolant level in reservoir.
A normal coolant level should be between "FULL" and "LOW" marks on reservoir.
If coolant level is below "LOW" mark, remove reservoir cap and add proper coolant to reservoir to bring coolant level up to "FULL" mark. Then, reinstall cap.

NOTE:
- **If recommended quality antifreeze is used, there is no need to add extra inhibitors or additives that claim to improve system.**
  They may be harmful to proper operation of system.
- **When installing reservoir cap, 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.
4) Using a pressure tester, check system and radiator cap for proper pressure holding capacity 110 kPa (1.1 kg/cm^2, 15.6 psi). If replacement of cap is required, use proper cap specified for this vehicle.



NOTE:
After installing radiator cap to radiator, make sure that its ear is aligned with reservoir hose as shown in figure. If not, turn cap more to align its ear with hose.

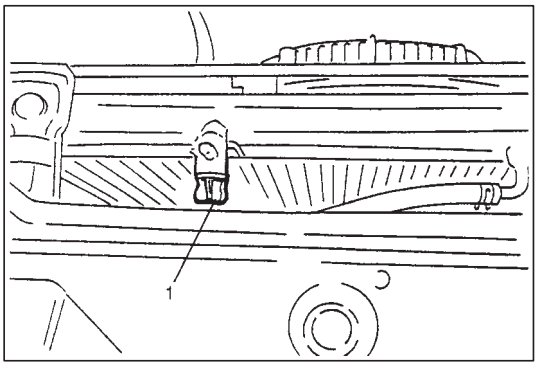
5) Make sure that hose clamps are tightened securely and inspect all hoses.
   Replace hoses whenever cracked, swollen or otherwise deteriorated.
6) Clean frontal area of radiator core.

COOLING SYSTEM FLUSH AND REFILL

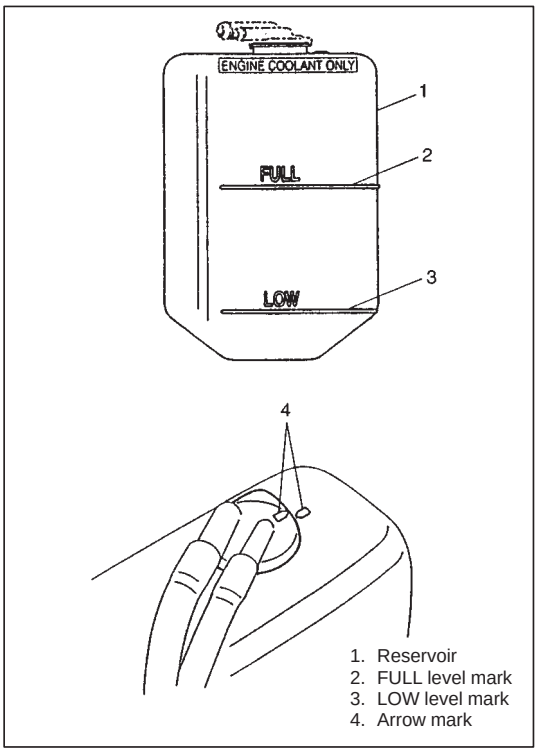
1) Remove radiator cap when engine is cool.
   Turn cap slowly to the left until it reaches a “stop” (Do not press down while turning it).
   Wait until pressure is relieved (indicated by a hissing sound) then press down on cap and continue to turn it to the left.

   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).

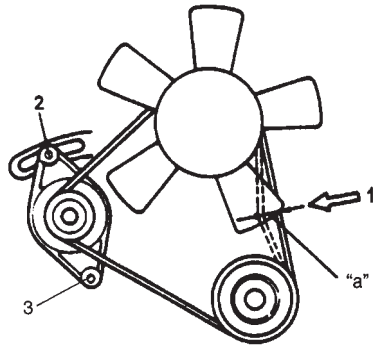


3) Stop engine and open radiator drain plug to drain coolant.
4) Close drain plug (1). Add water until system is filled and run engine until upper radiator hose is hot again.
5) Repeat steps 3) and 4) several times until drained liquid is nearly colorless.
6) Drain cooling system and then close radiator drain plug tightly.

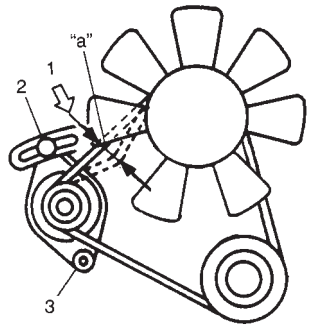


7) Disconnect hose from reservoir. Remove reservoir and pour out any fluid. Scrub and clean inside of reservoir with soap and water. Flush it well with clean water and drain.
   Reinstall reservoir and hose.
8) Add 50/50 mixture of good quality ethylene glycol antifreeze and water to radiator and tank.
   Fill radiator to the base of radiator filler neck and reservoir to "FULL" level mark. Reinstall reservoir cap, aligning the arrow marks on the 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 up with reservoir hose.

[G16 engine]



[H25 engine]



1. 10 kg (22 lbs)
2. Adjusting bolt
3. Pivot bolt

"a": Belt tension

COOLING FAN BELT TENSION CHECK AND ADJUSTMENT

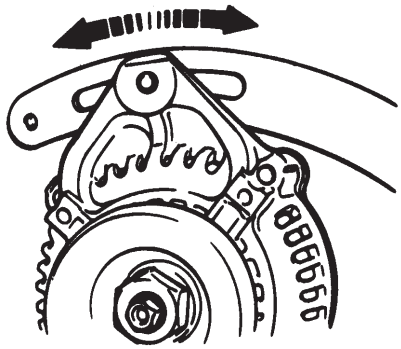
WARNING:
Disconnect negative cable at battery before checking and adjusting belt tension.

For G16 and H25 engines

1) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If so, replace belt.
2) Check belt for tension. Belt is in proper tension when it deflects 6 to 8 mm (0.24 – 0.32 in.) under thumb pressure (about 10 kg or 22 lbs).

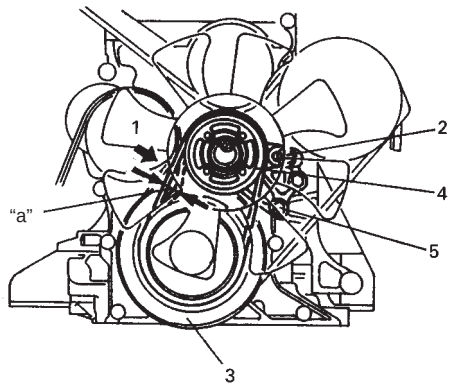
Cooling fan belt tension "a" (as deflection/10 kg (22 lbs))
For G16 engine:
6 – 8 mm (0.24 – 0.32 in.)
For H25 engine:
9 – 11 mm (0.35 – 0.43 in.)

NOTE:
When replacing belt with a new one, adjust belt tension to 5 – 7 mm (0.20 – 0.27 in.) (G16 engine) or 7 – 9 mm (0.27 – 0.35 in.) (H25 engine).



3) If belt is too tight or too loose, adjust it to proper tension by displacing generator position.
4) Tighten generator adjusting bolt and pivot bolt.
5) Connect negative (–) cable at battery.

[J20 engine]



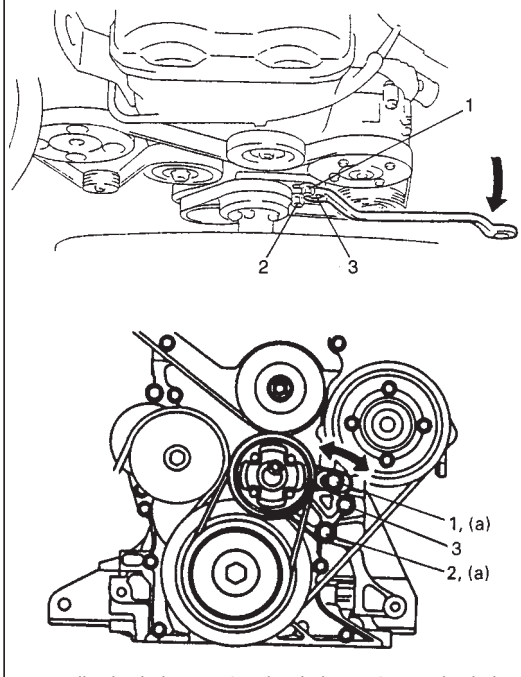
1. 10 kg (22 lbs)
2. Adjusting bolt
3. Crankshaft pulley
4. Fan pulley
5. Pivot bolt
"a": Belt tension

For J20 engine

1) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If so, replace belt.
2) Check belt for tension. Belt is in proper tension when it deflects 5 to 7 mm (0.20 – 0.27 in.) under thumb pressure (about 10 kg or 22 lbs).

Cooling fan belt tension "a" (as deflection/10 kg (22 lbs))
For J20 engine:
5 – 7 mm (0.20 – 0.27 in.)

NOTE:
When replacing belt with a new one, adjust belt tension to 4 – 5 mm (0.16 – 0.20 in.).



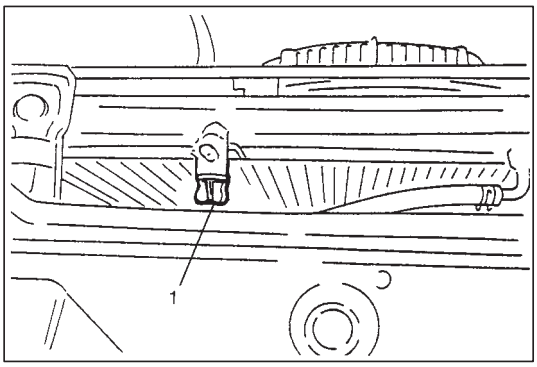
1. Adjusting bolt
2. Pivot bolt
3. Tension bolt

3) If belt is too tight or too loose, adjust it as follows:
   a) Loosen adjusting bolt and pivot bolt.
   b) Tighten adjusting bolt during keeping fan belt in proper tension by tightening tension bolt with wrench as shown in the figure.
   c) Tighten adjusting bolt and pivot bolt to specified torque.

Tightening torque
Cooling fan pulley adjusting bolt (for J20 engine) (a):
45 N·m (4.5 kg-m, 32.5 lb-ft)
Cooling fan pulley pivot bolt (for J20 engine) (a):
45 N·m (4.5 kg-m, 32.5 lb-ft)

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 cable from battery terminal before removing any part.**



COOLANT 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 "COOLANT" and steps 8) to 10) of "COOLING SYSTEM FLUSH AND REFILL" in this section.

COOLING WATER PIPES OR HOSES

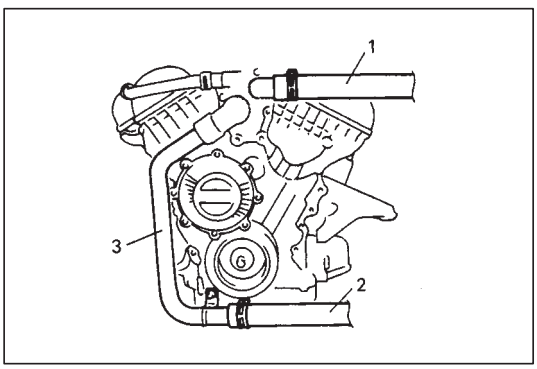
REMOVAL

For G16 and J20 engines

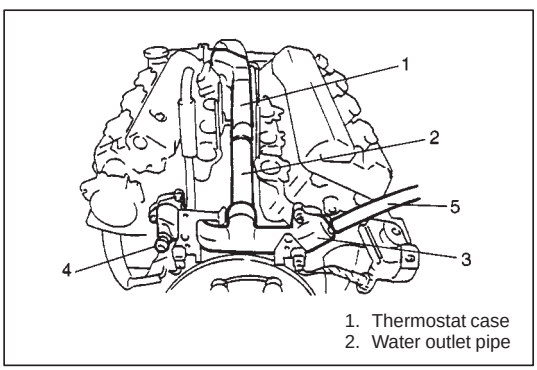
1) Disconnect negative (–) cable at battery.
2) Drain cooling system.
3) To remove these pipes or hoses, loosen screw on each pipe or hose clip and pull hose end off.

For H25 engine

1) Disconnect negative (–) cable at battery.
2) Drain cooling system.

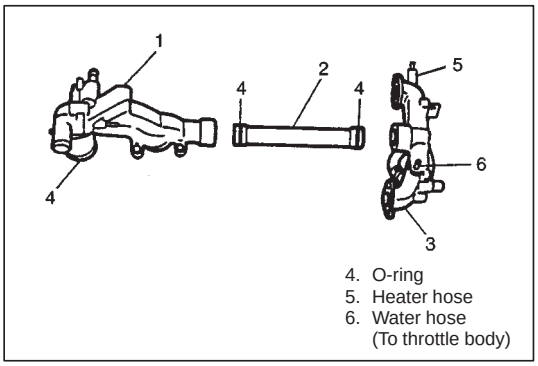


3) Remove radiator inlet, outlet hoses (1), (2) and radiator outlet pipe (3).
4) Remove throttle body and intake manifold.
   Refer to Section 6A2 for removal.



1. Thermostat case
2. Water outlet pipe

5) Disconnect ECT sensor (4) coupler.
6) Disconnect heater inlet hose (5) from water outlet cap (3).



4. O-ring
5. Heater hose
6. Water hose (To throttle body)

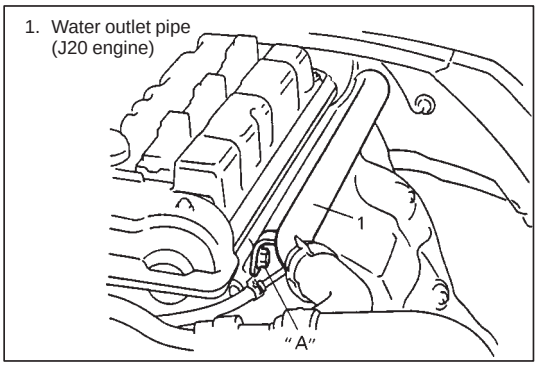
7) Remove water outlet cap (3) from cylinder heads.
8) Remove water outlet pipe (2) from thermostat case (1).
9) Remove thermostat case (1) from cylinder block.

INSTALLATION

For G16 and J20 engines

Install removed parts in reverse order of removal procedure, noting the following.

◦ Tighten each clamp bolt securely.



◦ When installing water outlet pipe to cylinder head, apply sealant to pipe bolt thread and then tighten it (J20 engine only).

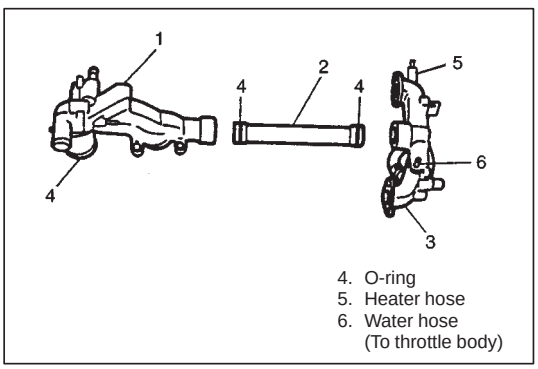
Sealant "A": 99000-31110

◦ Refill cooling system with proper coolant, referring to description on "COOLANT" and steps 8) to 10) of "COOLING SYSTEM FLUSH AND REFILL" in this section.

◦ Check each part for leakage.

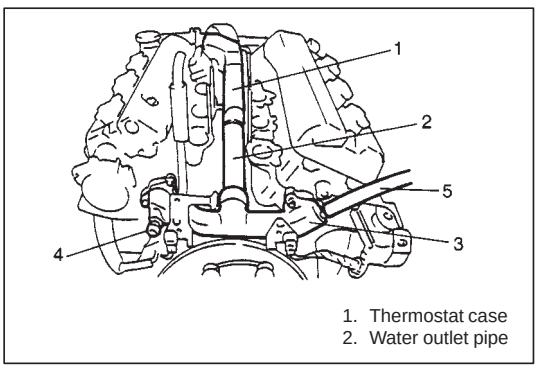
For H25 engine

1) Install thermostat case (1) to cylinder block with new O-ring.
2) Install water outlet pipe (2) to thermostat case (1) with new O-rings.
3) Install water outlet cap (3) to cylinder heads with new gaskets.

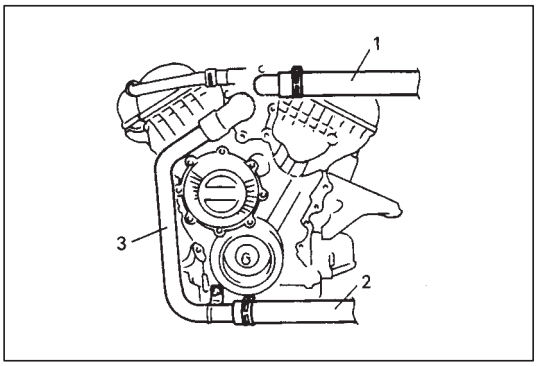


4. O-ring
5. Heater hose
6. Water hose (To throttle body)

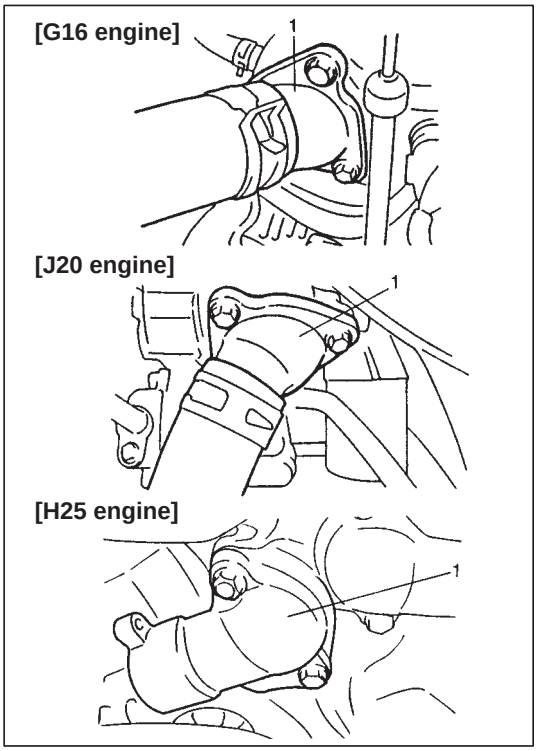
4) Connect heater inlet hose (5) to water outlet cap (3).
5) Connect ECT sensor (4) coupler.



1. Thermostat case
2. Water outlet pipe



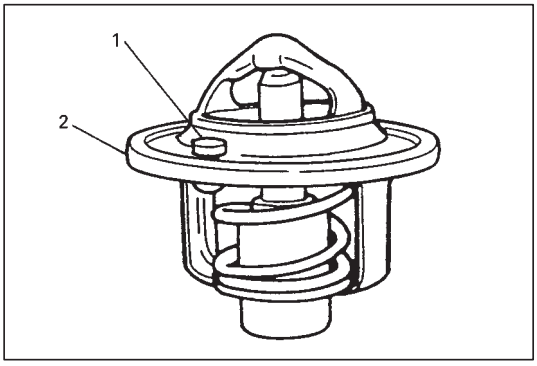
6) Install throttle body and intake manifold.
   Refer to Section 6A2 for installation.
7) Install radiator outlet pipe (3) to thermostat case with new O-ring.
8) Install radiator inlet and outlet hoses (1), (2).
9) Refill cooling system with proper coolant, referring to description on “COOLANT” and steps 8) to 10) of “COOLING SYSTEM FLUSH AND REFILL” in this section.



THERMOSTAT

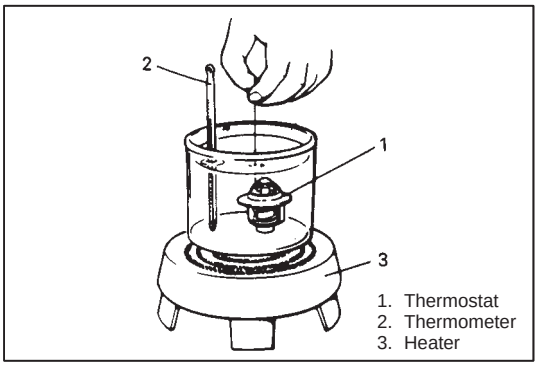
REMOVAL

1) Drain cooling system and tighten drain plug.
2) Remove fan shroud with cooling fan after disconnecting radiator inlet hose from radiator (H25 engine only).
3) Remove thermostat cap (1).
4) Remove thermostat.



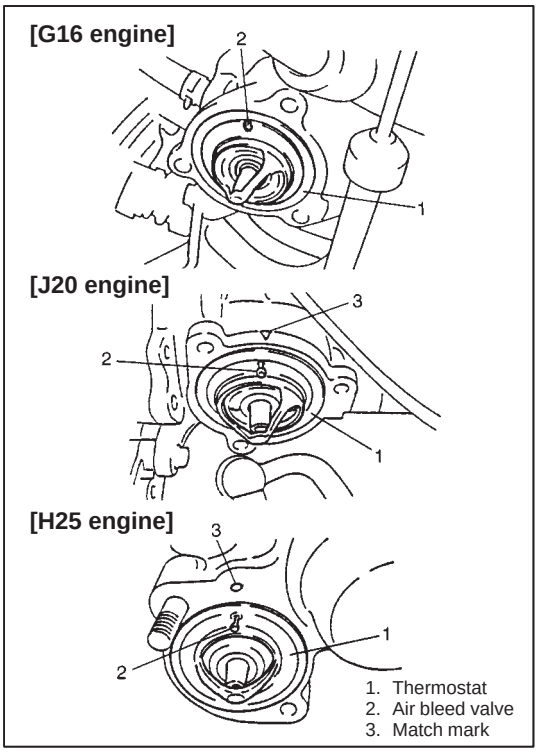
INSPECTION

- Make sure that air bleed valve (1) of thermostat is clean. Should this valve be clogged, engine would tend to overheat.
- Check to make sure that valve seat is free from foreign matters which would prevent valve from seating tight.
- Check thermostat seal (2) and O-ring for breakage, deterioration or any other damage.



° Check thermostatic movement of wax pellet as follows:
a) Immerse thermostat in water, and heat water gradually.
b) Check that valve starts to open at specific temperature.
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.

Temp. at which valve begins to open	J20 and H25 engines : 82 ± 2°C (179 ± 3.6°F) G16 engine : 88 ± 2°C (190 ± 3.6°F)
Temp. at which valve becomes fully open	J20 and H25 engines: 95°C (203°F) G16 engine : 100°C (212°F)
Valve lift	J20 and H25 engines: More than 8 mm at 95°C (203°F) G16 engine : More than 8 mm at 100°C (212°F)



INSTALLATION

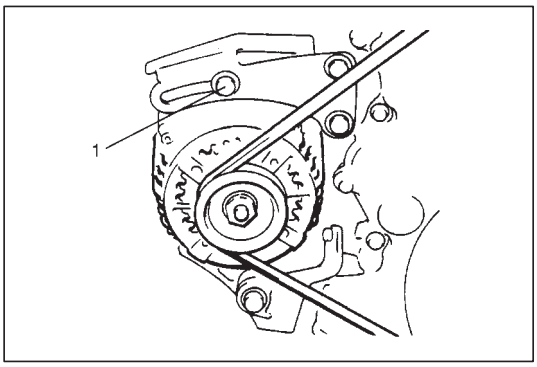
1) When positioning thermostat and O-ring on thermostat case, be sure to position it so that
° air bleed valve comes at top (G16 engine).
° air bleed valve comes at match mark and into the recession of thermostat case (J20 and H25 engines).
2) Install thermostat cap to intake manifold (G16 engine), water pump (J20 engine) or thermostat case (H25 engine).
3) Install cooling fan and fan shroud and connect radiator inlet hose to radiator (H25 engine only).
4) Fill cooling system. Refer to “COOLANT” and steps 8) to 10) of “COOLING SYSTEM FLUSH AND REFILL” in this section.
5) Connect negative (–) cable at battery.
6) After installation, check each part for leakage.

COOLING FAN BELT

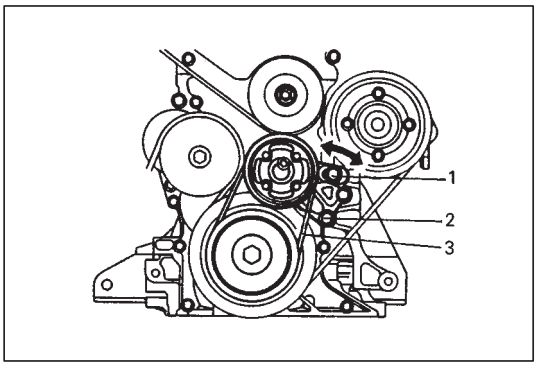
REMOVAL

For G16 and H25 engines

1) Disconnect negative (–) cable at battery.
2) Loosen P/S pump drive belt adjusting bolt and then remove P/S pump belt.



3) Loosen adjusting bolt (1) and pivot bolt.
4) Slacken belt by displacing generator and then remove it.



For J20 engine

1) Disconnect negative (–) cable at battery.
2) Loosen adjusting bolt (1) and pivot bolt (2).
3) Slacken belt by displacing fan pulley.
4) Remove cooling fan. Just detach the fan/clutch from fan pulley.
5) Remove cooling fan belt (3).

INSTALLATION

For G16 and H25 engines

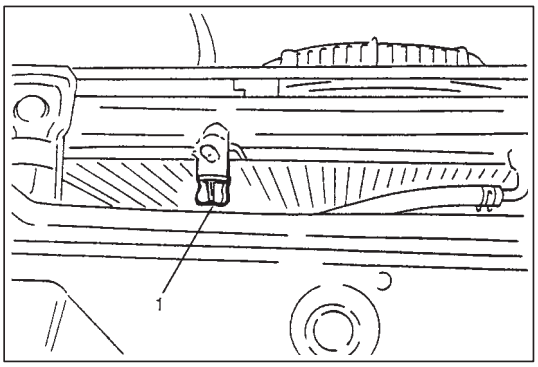
1) Install belt to water pump pulley, crankshaft pulley and generator pulley. Install P/S pump drive belt.
2) Adjust belt tension as specified.
   For Adjustment of P/S pump drive belt tension, refer to Section 0B.
3) Tighten adjusting bolt and pivot bolt.
4) Connect negative (–) cable at battery.

For J20 engine

1) Install belt to fan pulley and crankshaft pulley.
2) Install cooling fan. Refer to “COOLING FAN AND FAN CLUTCH” in this section.
3) Adjust belt tension as specified. Refer to “COOLING FAN BELT TENSION CHECK AND ADJUSTMENT” in this section.
4) Tighten adjusting bolt and pivot bolt.
5) Connect negative (–) cable at battery.

COOLING FAN BELT TENSION INSPECTION

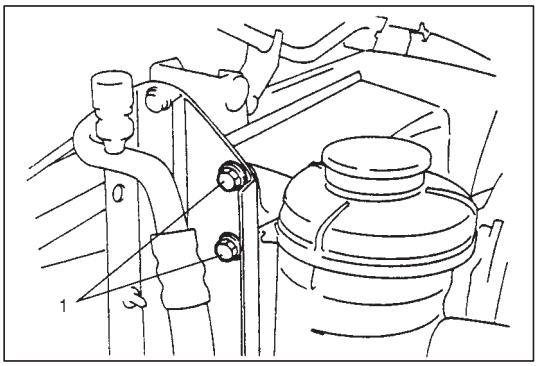
Inspect belt and check belt tension. Refer to "COOLING FAN BELT TENSION CHECK AND ADJUSTMENT" in this section.



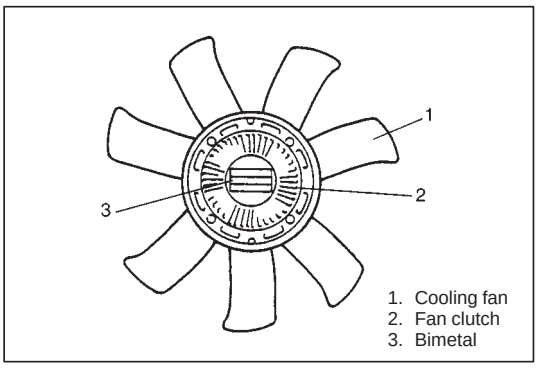
COOLING FAN AND FAN CLUTCH

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Drain cooling system by loosing drain plug (1) of radiator.
3) Disconnect radiator inlet hose from radiator.
4) Loosen cooling fan/clutch nuts.



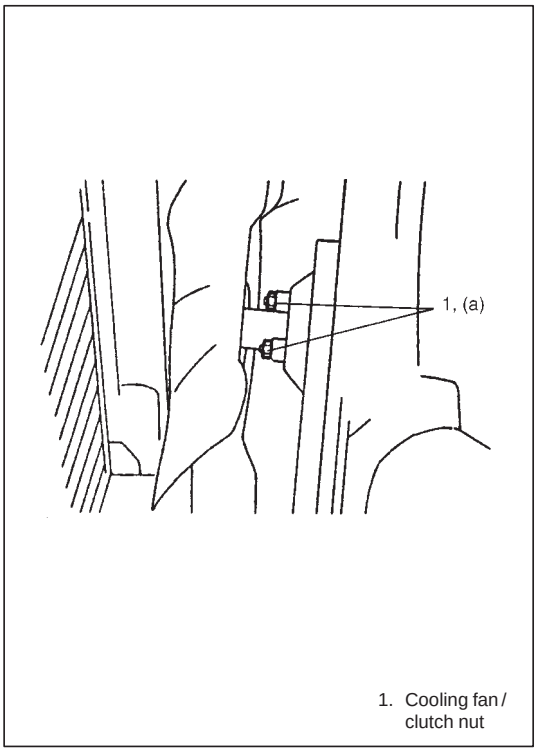
5) Remove P/S oil tank stay bolts (1) from radiator stay (G16 and H25 engines only).
6) Remove radiator shroud securing clips.
7) Then remove cooling fan/clutch and radiator shroud.



INSPECTION

Inspect fluid coupling for oil leakage.

If necessary, replace fan clutch assembly. Do not disassemble clutch assembly.



1. Cooling fan / clutch nut

INSTALLATION

Install removed parts in reverse order of removal procedure.

° After installation, adjust belt tension for specification and tighten each bolt and nut securely.

Tightening Torque
Cooling fan/dutch nut (G16 engine) (a):
11 N·m (1.1 kg-m, 8.0 lb-ft)
Cooling fan/dutch nut (H25 and J20 engines) (a):
25 N·m (2.5 kg-m, 18.0 lb-ft)

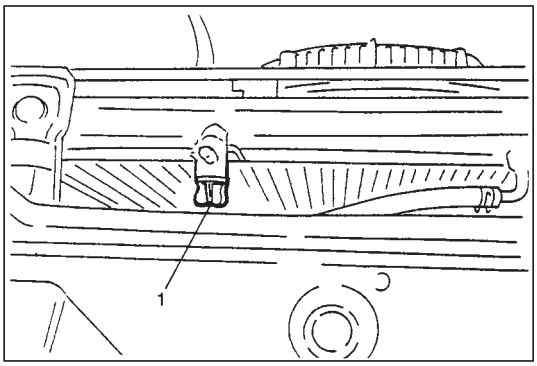
° Refill cooling system with proper coolant referring to "COOLANT" and steps 8) to 10) of "COOLING SYSTEM FLUSH AND REFILL" in this section.

° After installation, check each joint for leakage.

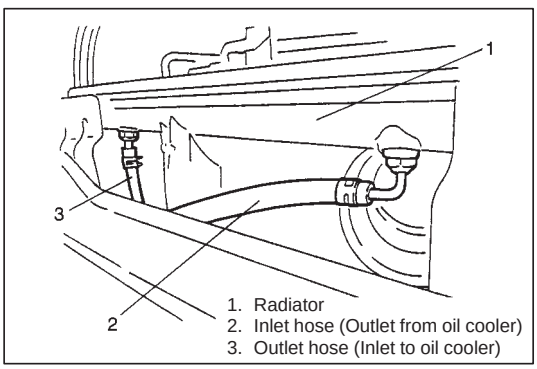
RADIATOR

REMOVAL

1) Disconnect negative (–) cable at battery.
2) Drain cooling system by loosening drain plug (1) of radiator.

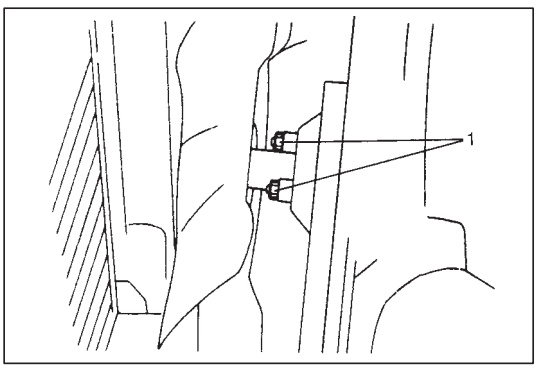


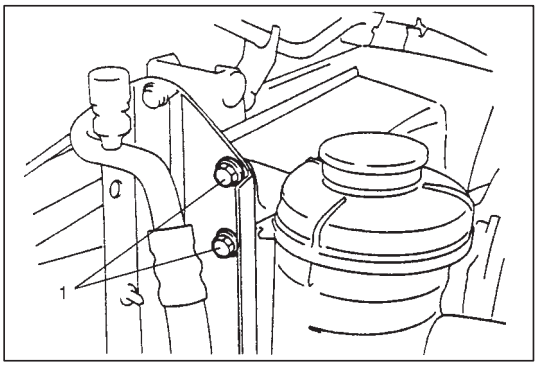
3) When servicing A/T vehicle, place oil pan under radiator (1) and disconnect A/T fluid hoses (2), (3) from radiator.



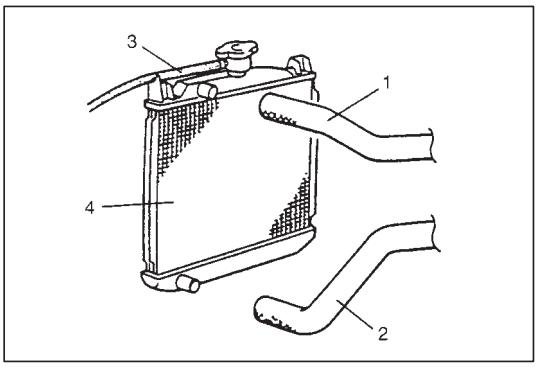
1. Radiator
2. Inlet hose (Outlet from oil cooler)
3. Outlet hose (Inlet to oil cooler)

4) Loosen cooling fan/clutch nuts (1).
5) Disconnect radiator inlet hose from radiator.





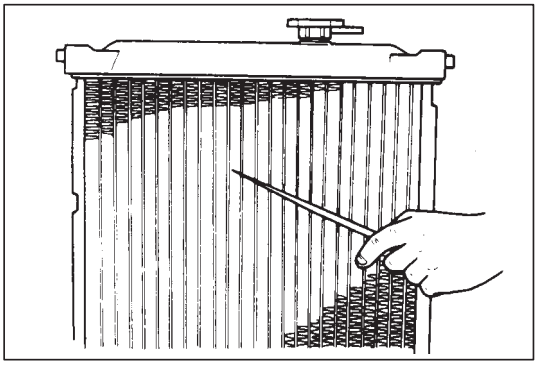
6) Remove P/S oil tank stay bolts (1) from radiator stay.
7) Remove radiator shroud securing clips.
8) Then remove cooling fan/clutch and radiator shroud.



9) Disconnect water inlet and outlet hose (1), (2) and reservoir tank hose (3) from radiator.
10) Remove radiator (4).

INSPECTION

Check radiator for leakage or damage. Straighten bent fins, if any.



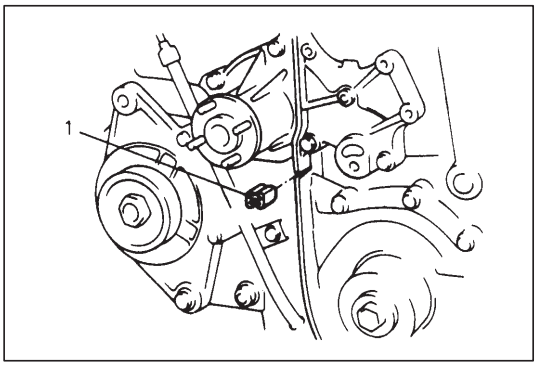
CLEAN

Clean frontal area of radiator cores.

INSTALLATION

Reverse removal procedures, noting the followings.

- Refill cooling system with proper coolant referring to "COOLANT" and steps 8) to 10) of "COOLING SYSTEM FLUSH AND REFILL" in this section.
- Adjust cooling fan belt tension to specification. Refer to "COOLING FAN BELT TENSION CHECK AND ADJUSTMENT" in this section.
- With A/T vehicle, check A/T fluid level, referring to Section 7B1.
- After installation, check each joint for leakage.

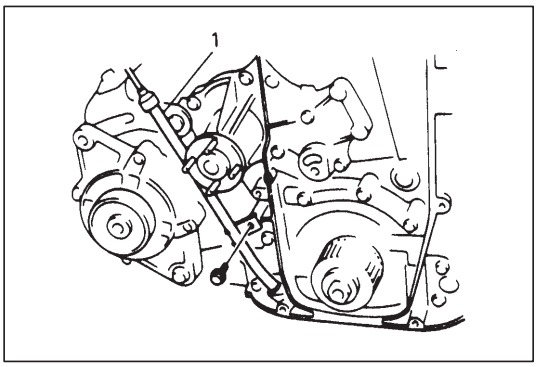


WATER PUMP

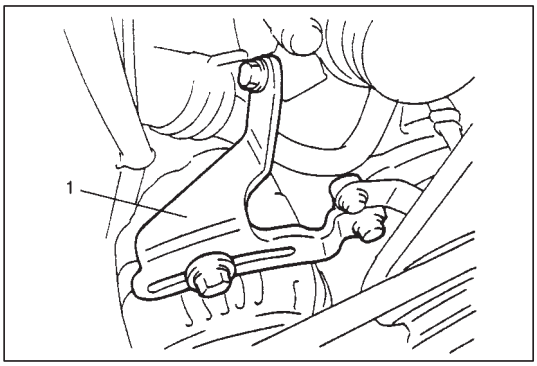
REMOVAL

For G16 engine

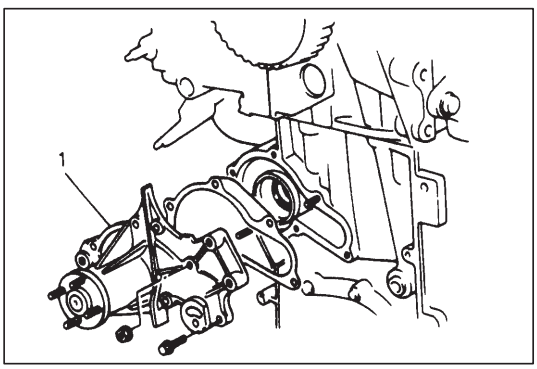
1) Disconnect negative (–) cable at battery.
2) Drain cooling system.
3) Remove timing belt and tensioner referring to “TIMING BELT AND BELT TENSIONER” in Section 6A1.
4) Remove rubber seal (1) between oil pump and water pump.



5) Remove oil level gauge guide (1) with oil level gauge.

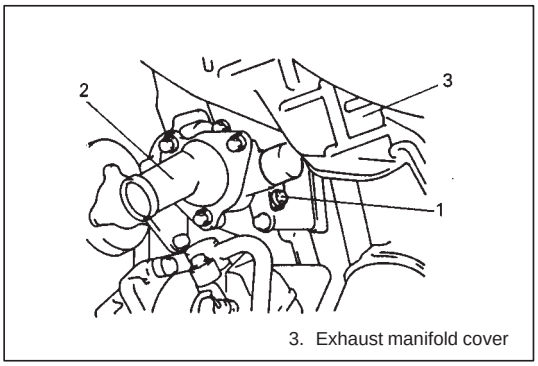


6) Remove generator adjusting arm (1).



7) Remove water pump assembly (1).

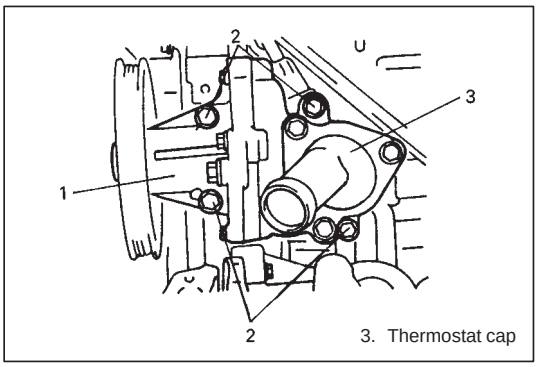
CAUTION:
Do not disassemble water pump.
If any repair is required on pump, replace it as assembly.



3. Exhaust manifold cover

For J20 engine

1) Disconnect negative (–) cable at battery.
2) Drain coolant.
3) Remove radiator outlet hose from thermostat cap (2).
4) Remove heater outlet pipe bolt (1).
5) Remove generator belt by loosening tensioner pulley. Refer to Section 6H.



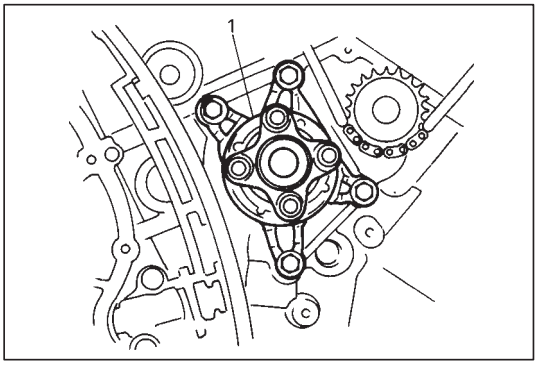
3. Thermostat cap

6) Remove water pump assembly (1) by removing its 4 bolts (2).

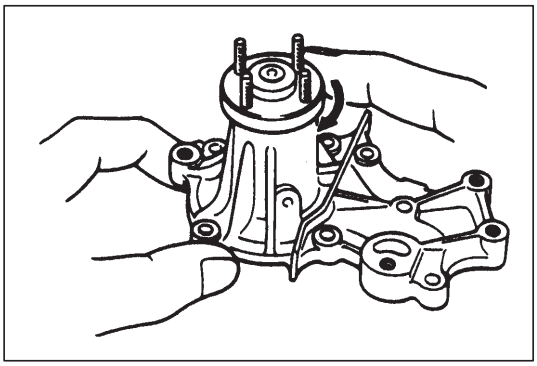
NOTE:
Do not lose dowel pin when removing water pump (1).

For H25 engine

1) Disconnect negative (–) cable at battery.
2) Drain engine oil.
3) Drain cooling system.
4) Remove timing chain cover. Refer to Section 6A2.



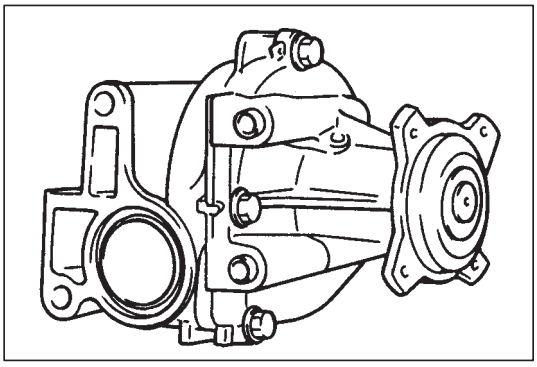
5) Remove water pump assembly (1).



INSPECTION

For G16 engine

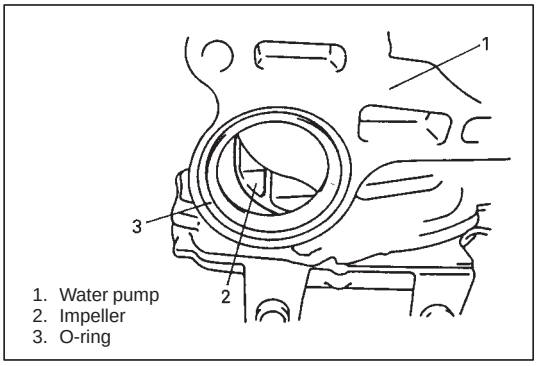
Rotate water pump by hand to check for smooth operation.
If pump does not rotate smoothly or makes abnormal noise, replace it.



For J20 engine

CAUTION:
Do not disassemble water pump.
If any repair is required on pump, replace it as assembly.

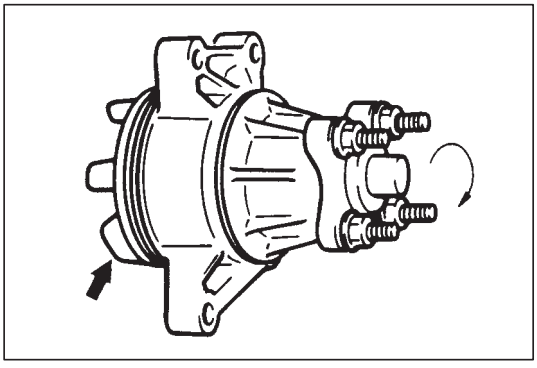
° Rotate water pump by hand to check for smooth operation. If pump does not rotate smoothly or makes abnormal noise, replace it.



1. Water pump
2. Impeller
3. O-ring

° Inspect water pump impeller for damage.
Replace as necessary.

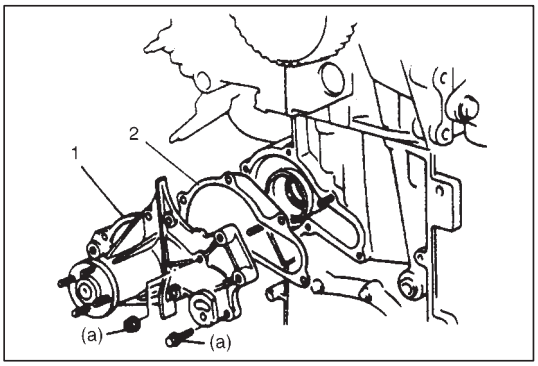
CAUTION:
Do not disassemble water pump to check the water pump impeller.



For H25 engine

CAUTION:
Do not disassemble water pump.
If any repair is required on pump, replace it as assembly.

° Rotate water pump by hand to check for smooth operation. If pump does not rotate smoothly or makes abnormal noise, replace it.
° Inspect water pump impeller for damage.
Replace as necessary.

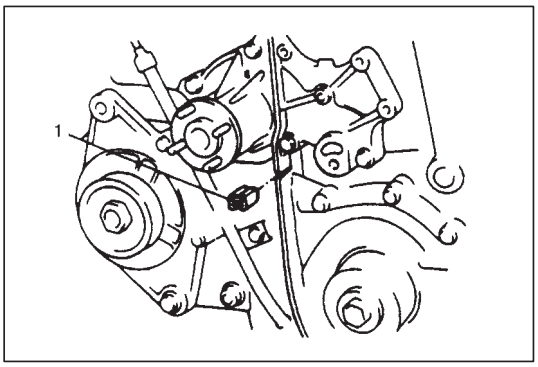


INSTALLATION

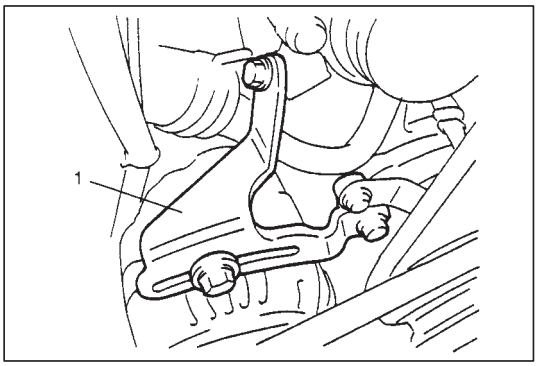
For G16 engine

1) Install new pump gasket (2) to cylinder block.
2) Install water pump (1) to cylinder block.

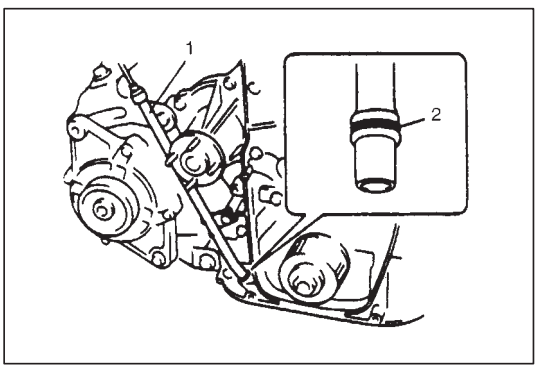
Tightening Torque
Water pump bolt (G16 engine) (a): 12 N·m (1.2 kg-m, 8.5 lb-ft)



3) After installing water pump, install rubber seal (1) between water pump and oil pump.
4) Install belt tensioner, timing belt and timing belt outside cover referring to "TIMING BELT AND BELT TENSIONER" in Section 6A1.



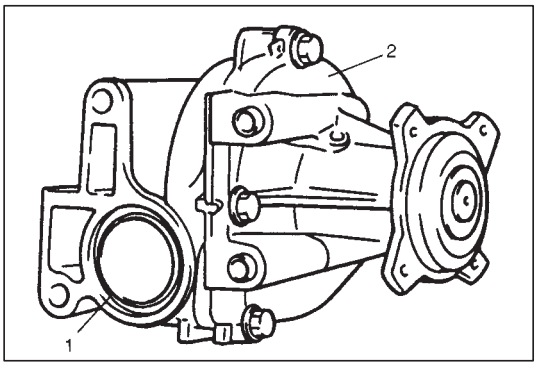
5) Install generator adjusting arm (1).



6) With engine oil applied to O-ring (2), install oil level gauge guide (1).
7) Install crankshaft pulley, water pump pulley, pump drive belt, cooling fan/clutch and fan shroud.

Tightening Torque
Cooling fan/clutch nuts (G16 engine):
11 N·m (1.1 kg-m, 8.0 lb-ft)
Crankshaft pulley No.2 bolts (G16 engine):
16 N·m (1.6 kg-m, 11.5 lb-ft)

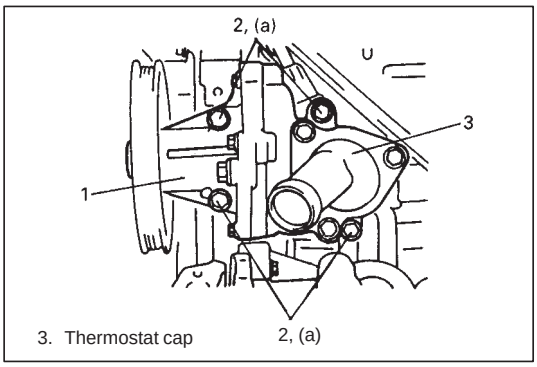
8) Adjust cooling fan belt tension as previously outlined.
9) Connect negative cable (–) at battery.
10) Fill coolant.
11) After installation, check each part for leakage.



For J20 engine

1) Install new O-ring (1) to water pump (2).

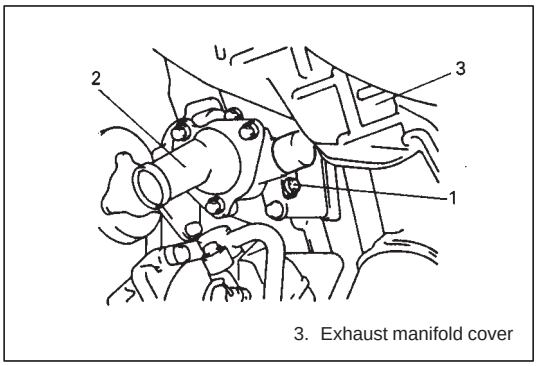
NOTE:
Do not forget to install dowel pins on water pump side before mounting water pump to engine block.



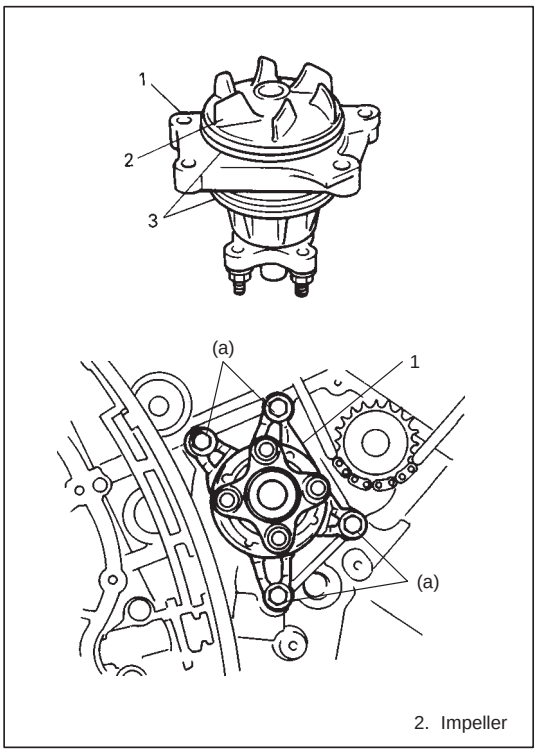
2) Install water pump (1) by using new bolts (2) to cylinder block and tighten to specified torque.

NOTE:
Use new bolts (total of 4) to install water pump to engine block. Failure to do so may result water leakage.

Tightening Torque
Water pump bolt (J20 engine) (a): 27 N·m (2.7 kg-m, 19.5 lb-ft)



3) Install heater outlet pipe bolt (1).
4) Install generator belt. Refer to Section 6H.
5) Install radiator outlet hose to thermostat cap (2).
6) Fill coolant.
7) Connect negative cable at battery.



For H25 engine

1) Install new O-rings (3) to water pump (1).
2) Install water pump to cylinder block.

Tightening Torque
Water pump bolt (H25 engine) (a): 27 N·m (2.7 kg-m, 19.5 lb-ft)

3) Install timing chain cover. Refer to Section 6A2.
4) Install oil pan, front differential housing, P/S system, cooling system, intake manifold with throttle body and other parts.
5) Refill cooling system with coolant, front differential with gear oil, P/S system with specified fluid and engine with engine oil.
6) Check wheel alignment referring to Section 3A.
7) Verify that there is no fuel leakage, water leakage and oil leakage at each connection.
8) Connect negative (–) cable at battery.

ENGINE COOLANT TEMPERATURE (ECT) SENSOR

Refer to Section 6E1 (for G16 and J20 engine) or 6E2 (for H25 engine).

REQUIRED SERVICE MATERIAL

MATERIAL	RECOMMENDED SUZUKI PRODUCT	USE
Ethylene glycol base coolant (Anti-freeze/Anti-corrosion coolant)	———	Additive to engine cooling system for improving cooling efficiency and for protection against rusting.
Sealant	SUZUKI BOND NO. 1215 (99000-31110)	Water outlet pipe bolt

TIGHTENING TORQUE SPECIFICATION

Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Cooling fan pulley adjusting and pivot bolts (J20 engine)	45	4.5	32.5
Cooling fan/clutch nuts (G16 engine)	11	1.1	8.0
Cooling fan/clutch nuts (H25 and J20 engines)	25	2.5	18.0
Water pump bolts (G16 engine)	12	1.2	8.5
Water pump bolts (J20 and H25 engines)	27	2.7	19.5
Crankshaft pulley No.2 bolts (G16 engine)	16	1.6	11.5

SECTION 6C

ENGINE FUEL

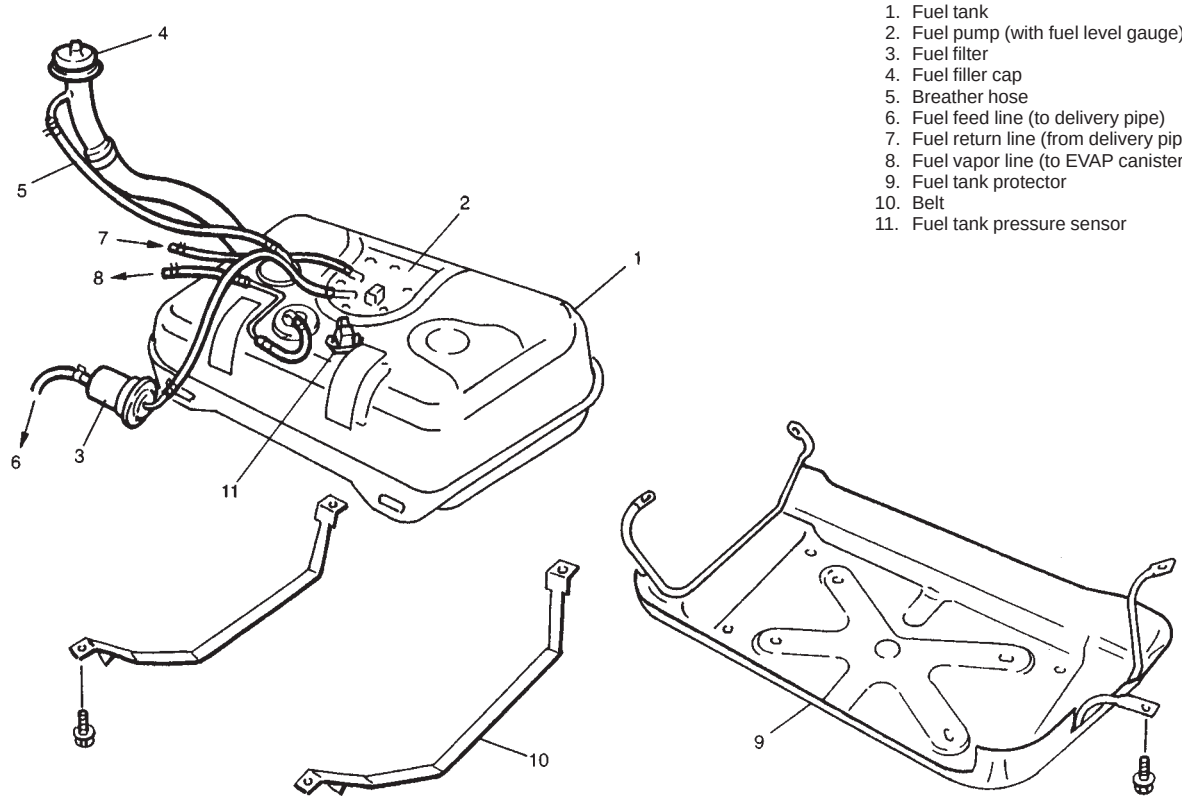
CONTENTS

GENERAL DESCRIPTION 6C-1
Fuel System 6C-1
DIAGNOSIS
Diagnosis Table . . . . . Refer to SECTION 6
ON-VEHICLE SERVICE 6C-2
Precautions . . . . . Refer to SECTION 0A and 6
Fuel Pump 6C-3
Fuel Filter 6C-3
Fuel Lines 6C-4
Fuel Filler Cap 6C-5
Fuel Tank 6C-5
TIGHTENING TORQUE SPECIFICATION 6C-8

GENERAL DESCRIPTION

FUEL SYSTEM

The main components of the fuel system are fuel tank, fuel pump, fuel filter and fuel level gauge and it includes three lines, fuel feed line, fuel return line and fuel vapor line.
For the details of fuel flow and fuel vapor flow, refer to SECTION 6E1 or 6E2.



DIAGNOSIS

DIAGNOSIS TABLE

Refer to ENGINE DIAGNOSIS in SECTION 6.

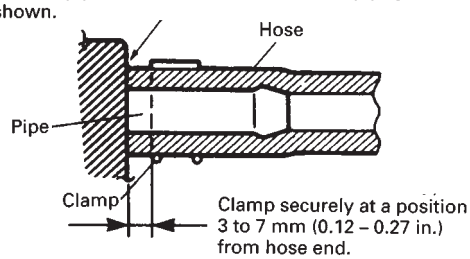
ON-VEHICLE SERVICE

PRECAUTIONS

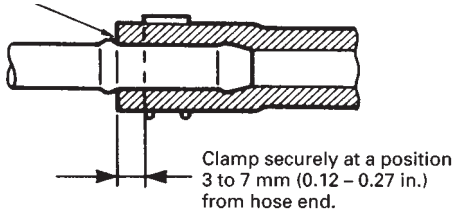
WARNING:
Before attempting service of any type on fuel system, following cautions should be always observed.

- **Disconnect negative cable at battery.**
- **DO NOT smoke, and place "NO SMOKING" signs near work area.**
- **Be sure to have CO_2 fire extinguisher handy.**
- **Be sure to perform work in a well-ventilated area and away from any open flames (such as gas hot heater).**
- **Wear safety glasses.**
- **To release fuel vapor pressure in fuel tank, remove fuel filler cap from fuel filler neck and then reinstall it.**
- **As fuel feed line is still under high fuel pressure even after engine was stopped, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel to occur where loosened or disconnected. Before loosening or disconnecting fuel feed line, make sure to release fuel pressure according to procedure described in SECTION 6 or SECTION 6-1.**
- **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.
- **Note that fuel hose connection varies with each type of pipe. Be sure to connect and clamp each hose correctly referring to the following.**
- **When performing any work that requires to lift up vehicle, check fuel hose clamp for rust.**
- **For other information, refer to "PRECAUTIONS" in SECTION 0A and SECTION 6 or SECTION 6-1 of this manual.**

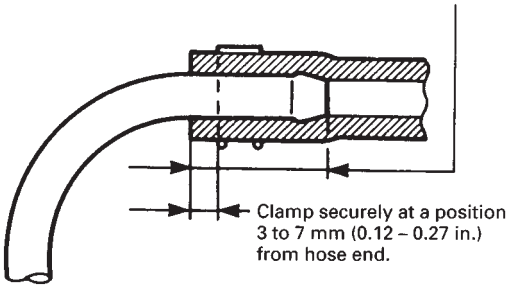
With short pipe, fit hose as far as it reaches pipe joint as shown.



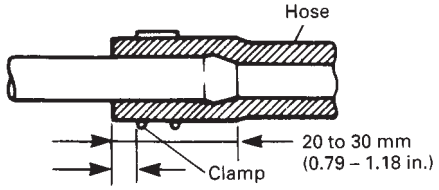
With following type pipe, fit hose as far as its peripheral projection as shown.



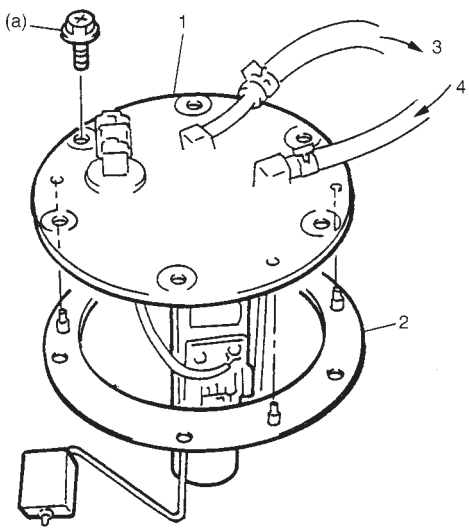
With bent pipe, fit hose as far its bent part as shown or till pipe is about 20 to 30 mm (0.79 – 1.18 in.) into the hose.



With straight pipe, fit hose till pipe is about 20 to 30 mm (0.79 – 1.18 in.) in the hose.



Clamp securely at a position 3 to 7 mm (0.12 – 0.27 in.) from hose end.



1. Fuel pump assembly
2. Gasket
3. To fuel filter
4. From delivery pipe

FUEL PUMP

REMOVAL

1) Remove fuel tank. Refer to “FUEL TANK” in this section.
2) Remove fuel pump assembly 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

Reverse removal procedure for installation noting the followings.

- Use new gasket.
- Tighten fuel pump bolts to specified torque.

Tightening Torque
Fuel pump bolt (a): 5.0 N·m (0.5 kg-m, 3.5 lb-ft)

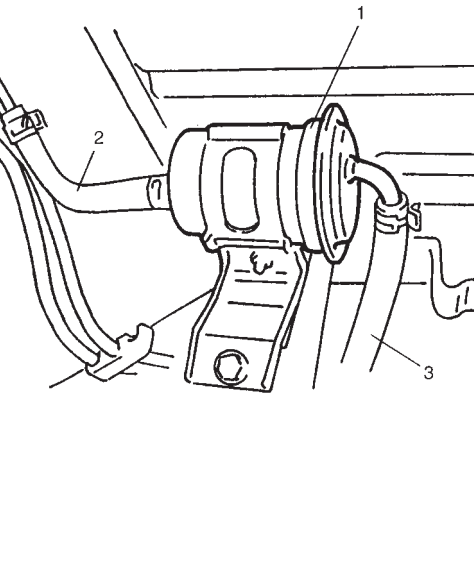
FUEL FILTER

REMOVAL

1) Relieve fuel pressure in fuel feed line referring to SECTION 6 or SECTION 6-1.

CAUTION:
This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

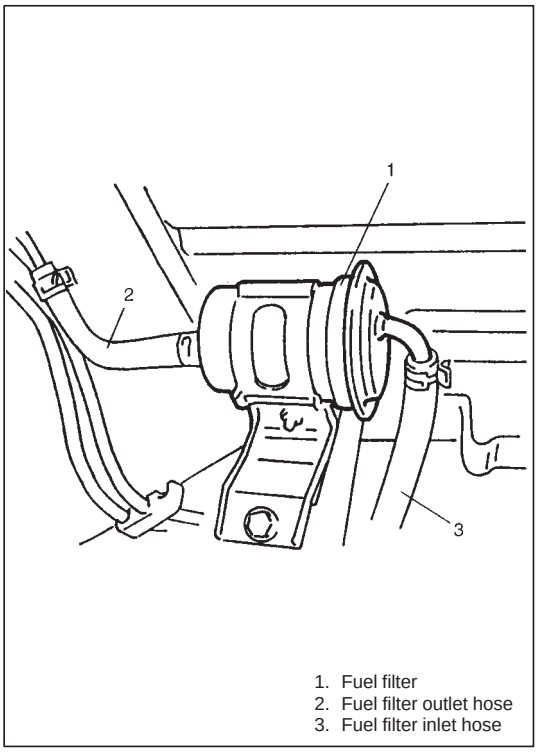
2) Disconnect negative (–) cable at battery.
3) Hoist vehicle.



4) Disconnect inlet and outlet hoses (2), (3) from fuel filter (1).

WARNING:
A small amount of fuel may be released after 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.

5) Remove fuel filter (1) from chassis frame.

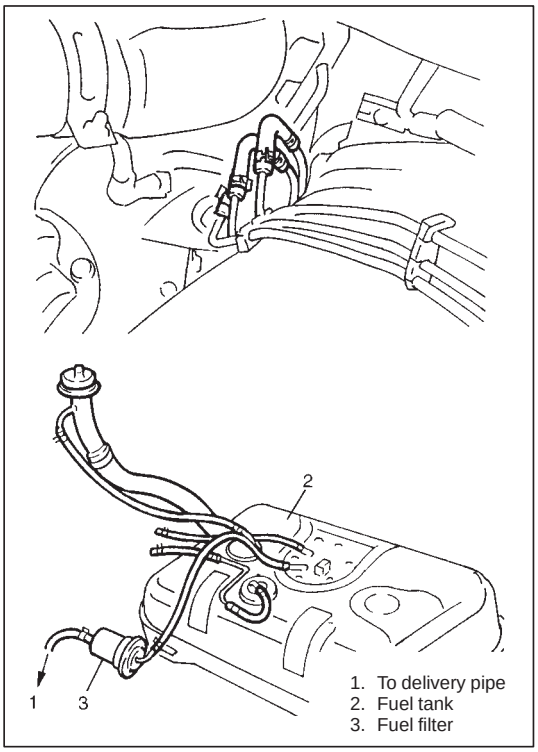


1. Fuel filter
2. Fuel filter outlet hose
3. Fuel filter inlet hose

INSTALLATION

Reverse removal procedure noting the following.

- Upon completion of installation, verify that there is no fuel leakage at each connection referring to SECTION 6 or SECTION 6-1.

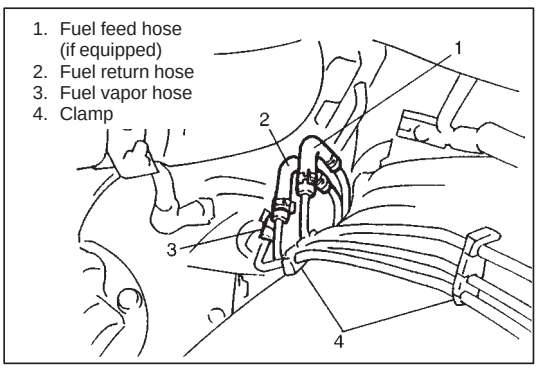


1. To delivery pipe
2. Fuel tank
3. Fuel filter

FUEL LINES

NOTE:

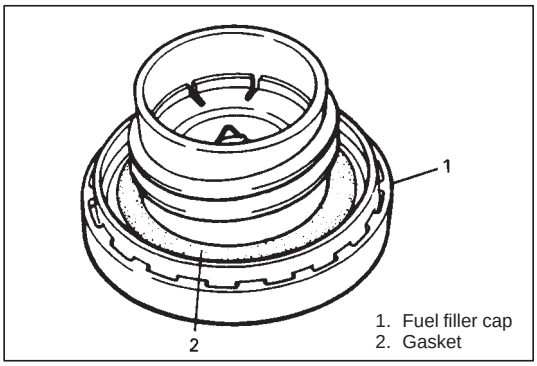
Due to the fact that fuel feed line is under high pressure, this system requires special consideration for service.
The feed pipe uses screw couplings and hose clamps.



1. Fuel feed hose (if equipped)
2. Fuel return hose
3. Fuel vapor hose
4. Clamp

INSPECTION

Visually inspect fuel lines for evidence of fuel leakage, hose cracking and deterioration, or damage. Make sure all clamps are secure. Replace parts as needed.



1. Fuel filler cap
2. Gasket

FUEL FILLER CAP

INSPECTION

Remove cap, and check gasket for even filler neck imprint, and deterioration or any damage.
If gasket is in malcondition, replace cap.

CAUTION:
If cap requires replacement, only a cap with the same features should be used. Failure to use correct cap can result in serious malfunction of the system.

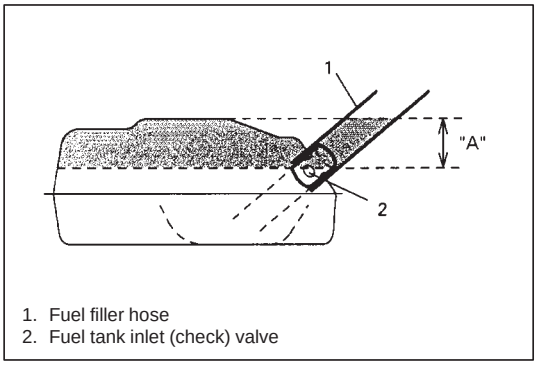
FUEL TANK

REMOVAL

1) Relieve fuel pressure in fuel feed line referring to SECTION 6 or SECTION 6-1.

CAUTION:
This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

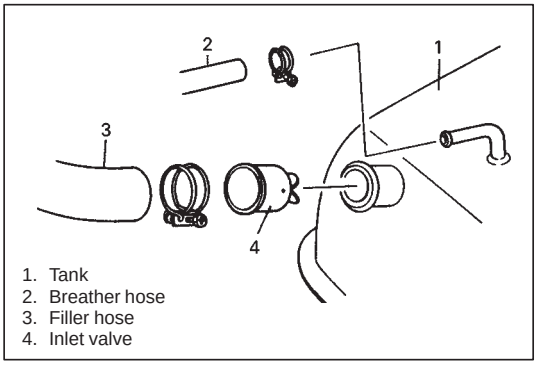
2) Disconnect negative (–) cable at battery.



1. Fuel filler hose
2. Fuel tank inlet (check) valve

3) Insert hose of a hand operated pump into fuel filler hose and drain fuel in space “A” in the figure (drain fuel through it till fuel stops).

CAUTION:
Do not force hose of a hand operated pump into fuel tank. Doing so can damage inlet valve.

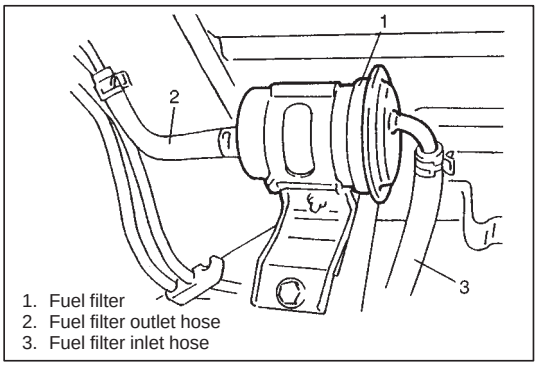


1. Tank
2. Breather hose
3. Filler hose
4. Inlet valve

4) Remove fuel tank filler hose protector.
5) Disconnect filler hose from fuel tank and breather hose from fuel filler neck.
6) Remove fuel tank inlet valve. Use care not to damage inlet valve when removing.

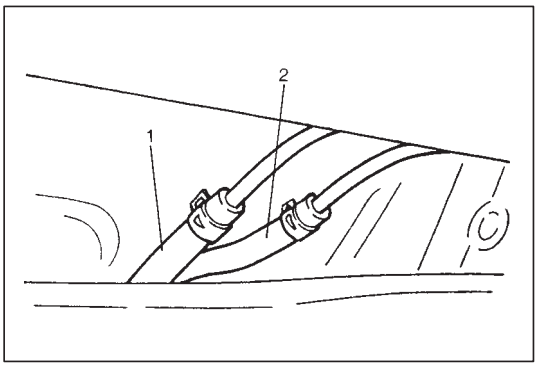
7) Drain fuel tank by pumping fuel out through fuel tank filler. Use hand operated pump device to drain fuel tank.

CAUTION:
Never drain or store fuel in an open container due to possibility of fire or explosion.

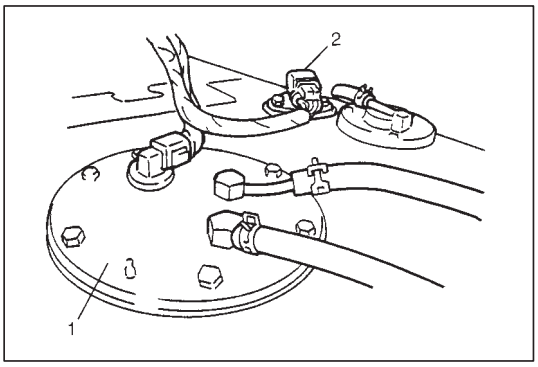


1. Fuel filter
2. Fuel filter outlet hose
3. Fuel filter inlet hose

8) Disconnect fuel filter inlet hose from filter.



9) Disconnect fuel vapor hose (1) and return hose (2) from pipes.
10) Remove fuel tank protector from vehicle.

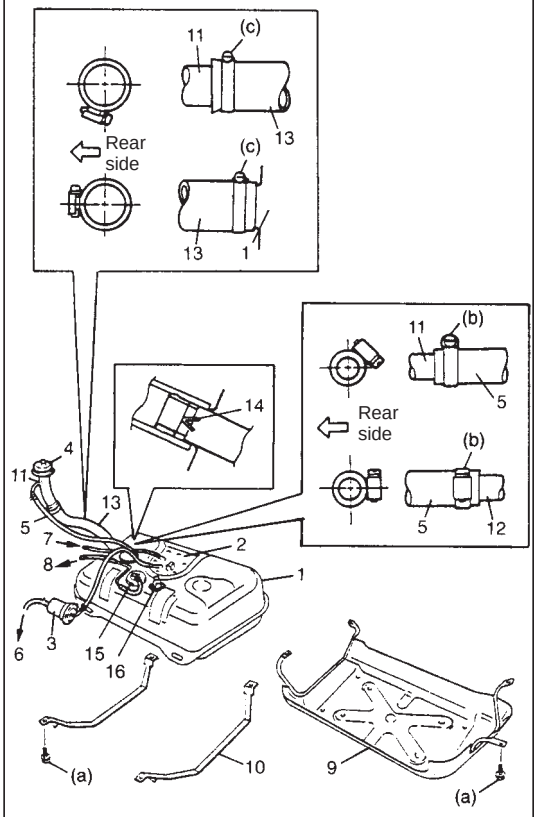


11) Lower fuel tank gradually while holding it horizontally and pull out each coupler from fuel pump (1) and fuel tank pressure sensor (2).

INSPECTION

After removing fuel tank, check hoses and pipes connected to fuel tank for leaks, loose connections, deterioration or damage. Also check fuel pump and level gauge gaskets for leaks, visually inspect fuel tank for leaks and damage.

Replace any damaged or malconditioned parts.



1. Fuel tank
2. Fuel pump (with fuel level gauge)
3. Fuel filter
4. Fuel filler cap
5. Breather hose
6. Fuel feed line (to delivery pipe)
7. Fuel return line (from delivery pipe)
8. Fuel vapor line (to EVAP canister)
9. Fuel tank protector
10. Belt
11. Filler neck
12. Breather pipe
13. Filler hose
14. Tank inlet valve
15. Fuel cut valve
16. Fuel tank pressure sensor

INSTALLATION

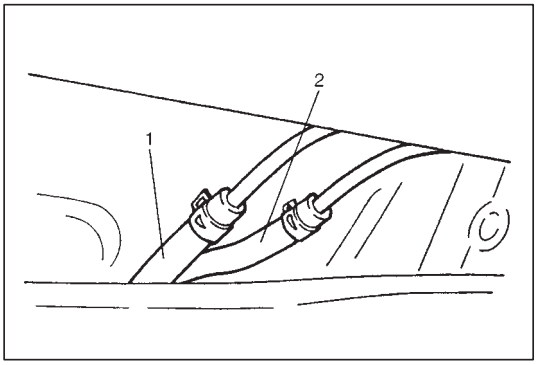
1) Install fuel pump assembly and fuel cut valve to fuel tank. Refer to “FUEL PUMP” in this section.
2) Connect fuel hoses to fuel tank, fuel cut valve and fuel pump assembly.
   After connecting, clamp hoses securely.
3) Install inlet valve to fuel tank.
   If deformed or damaged in any other way, replace with a new one.
4) Install fuel tank by using fuel tank belts and then install protector to vehicle.

   Tightening Torque
   Fuel tank bolt (a): 50 N·m (5.0 kg-m, 36.5 lb-ft)
   Fuel tank protector bolt (a): (50 N·m (5.0 kg-m, 36.5 lb-ft)

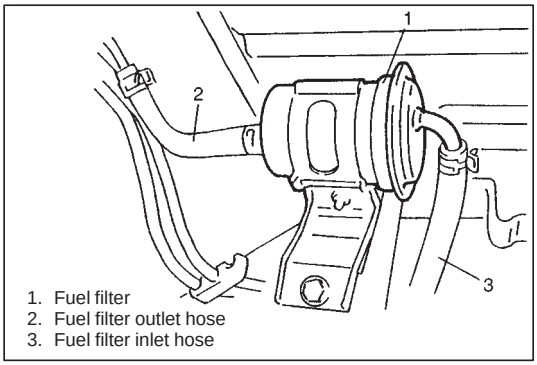
5) Connect fuel filler hose to fuel tank and breather hose to fuel filler neck. Clamp them securely.

   Tightening Torque
   Breather hose clamp (b): 2.0 N·m (0.2 kg-m, 2.0 lb-ft)
   Fuel filler hose clamp (c): 4.0 N·m (0.4 kg-m, 3.0 lb-ft)

6) Install fuel filler hose protector.



7) Connect fuel vapor hose (1) and return hose (2) to fuel pipe and clamp them securely.



1. Fuel filter
2. Fuel filter outlet hose
3. Fuel filter inlet hose

8) Connect fuel filter inlet hose to fuel filter.

9) Connect coupler to fuel pump assembly and tank pressure sensor respectively.
10) Connect negative (–) cable to battery.
11) Upon completion of installation, check fuel system for leakage.

FUEL TANK PURGING PROCEDURE

CAUTION:
This purging procedure will NOT remove all fuel vapor. Do not attempt any repair on tank where heat or flame is required, as an explosion resulting in personal injury could occur.

The following procedure is used for purging the fuel tank.
1) After removing fuel tank, remove all hoses and fuel pump assembly from fuel tank.
2) Drain all remaining fuel from tank.
3) Move tank to flushing area.
4) Fill tank with warm water or tap water, and agitate vigorously and drain. Repeat this washing until inside of tank is clean. Replace tank if its inside is rusty.
5) Completely flush out remaining water after washing.

TIGHTENING TORQUE SPECIFICATION

Fastening portion	Tightening torque		
	N·m	kg-m	lb-ft
Fuel pump assembly bolt	5.0	0.5	3.5
Fuel tank bolt	50	5.0	36.5
Fuel tank protector bolt			
Breather hose clamp	2.0	0.2	2.0
Fuel filler hose clamp	4.0	0.4	3.0

SECTION 6E1

ENGINE AND EMISSION CONTROL SYSTEM
(SEQUENTIAL MULTIPORT FUEL INJECTION FOR G16/J20 ENGINES)

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

NOTE:
Whether following systems (parts) are used in the particular vehicle or not depends on specifications. Be sure to bear this in mind when performing service work.
- **EGR valve**
- **Heated oxygen sensor(s) or CO adjusting resistor**
- **Three way catalytic converter(s)**
- **MAP sensor**
- **Ignition timing adjusting resistor or CKP sensor**
- **Monitor connector**

CONTENTS

GENERAL DESCRIPTION 6E1- 3
AIR INTAKE SYSTEM 6E1- 8
FUEL DELIVERY SYSTEM 6E1- 9
ELECTRONIC CONTROL SYSTEM 6E1-10
Engine & Emission Control Input/ Output Table 6E1-16
ON-VEHICLE SERVICE 6E1-17
General 6E1-18
Accelerator Cable Adjustment 6E1-18
A/T Throttle Cable Adjustment (4 A/T) . . . 6E1-18
Idle Speed/Idle Air Control Duty Inspection 6E1-19
Idle Mixture Inspection/Adjustment 6E1-20
AIR INTAKE SYSTEM 6E1-21
Throttle Body 6E1-21
Idle Air Control Valve 6E1-23
FUEL DELIVERY SYSTEM 6E1-24
Fuel Pressure Inspection 6E1-24
Fuel Pump 6E1-25
Fuel Pressure Regulator 6E1-26
Fuel Injector 6E1-27
ELECTRONIC CONTROL SYSTEM 6E1-31
ECM/PCM 6E1-31
MAF Sensor 6E1-32
IAT Sensor 6E1-34
TP Sensor 6E1-35
ECT Sensor 6E1-36

HO2S -1 and -2 . . . . . 6E1-37
Vehicle Speed Sensor 6E1-39
Camshaft Position Sensor 6E1-39
Crankshaft Position Sensor 6E1-40
Manifold Absolute Pressure Sensor 6E1-41
Fuel Level Sensor 6E1-42
Main Relay 6E1-43
Fuel Pump Relay 6E1-44
Fuel Cut Operation (Inspection) 6E1-45
EMISSION CONTROL SYSTEM 6E1-46
EGR System 6E1-46
Evaporative Emission Control System . . . 6E1-48
PCV System 6E1-50
TIGHTENING TORQUE SPECIFICATIONS 6E1-51
SPECIAL TOOLS 6E1-51

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.

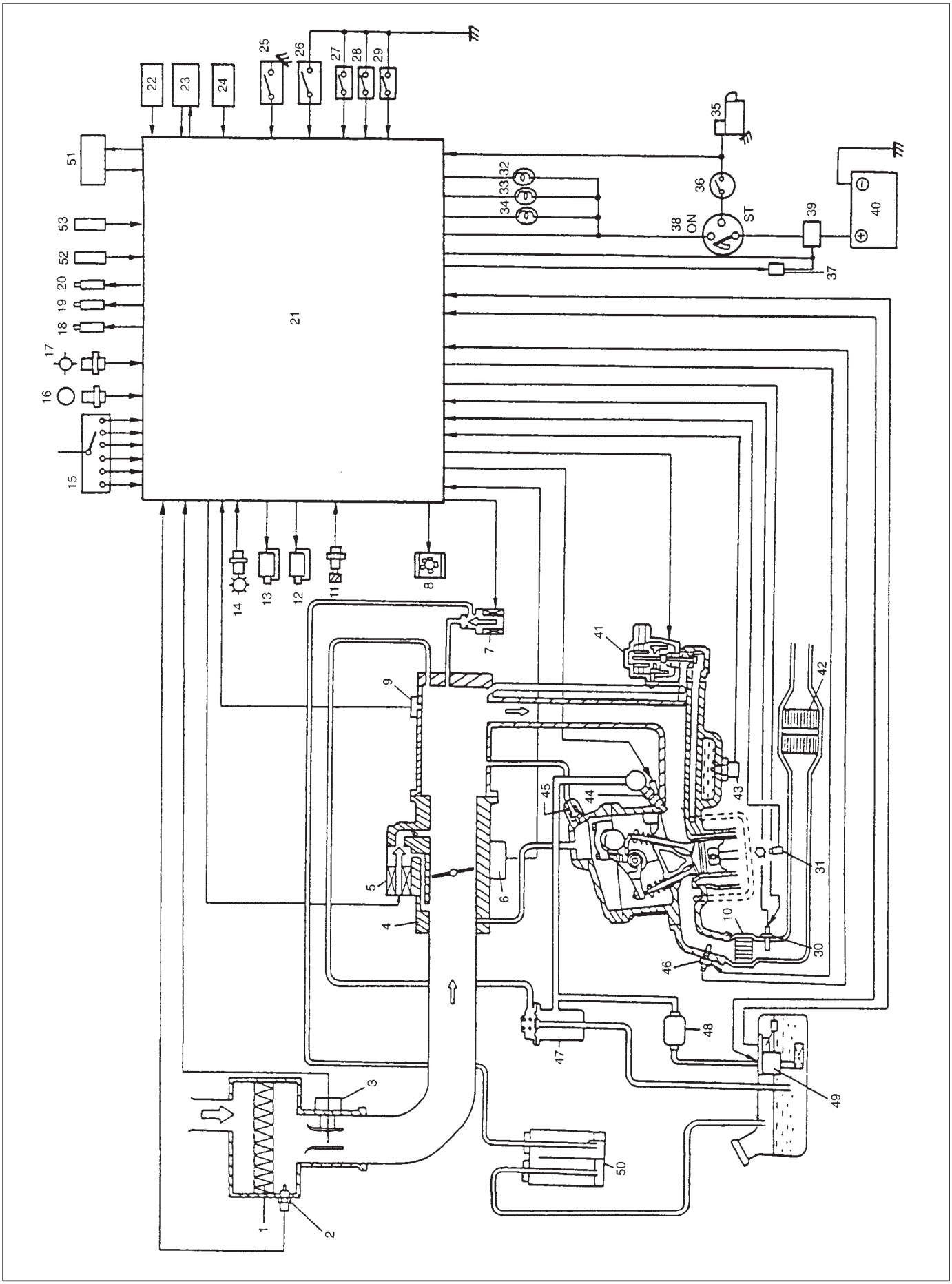
Air intake system includes air cleaner, mass air flow sensor, throttle body, idle air control valve and intake manifold.

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.

G16 ENGINE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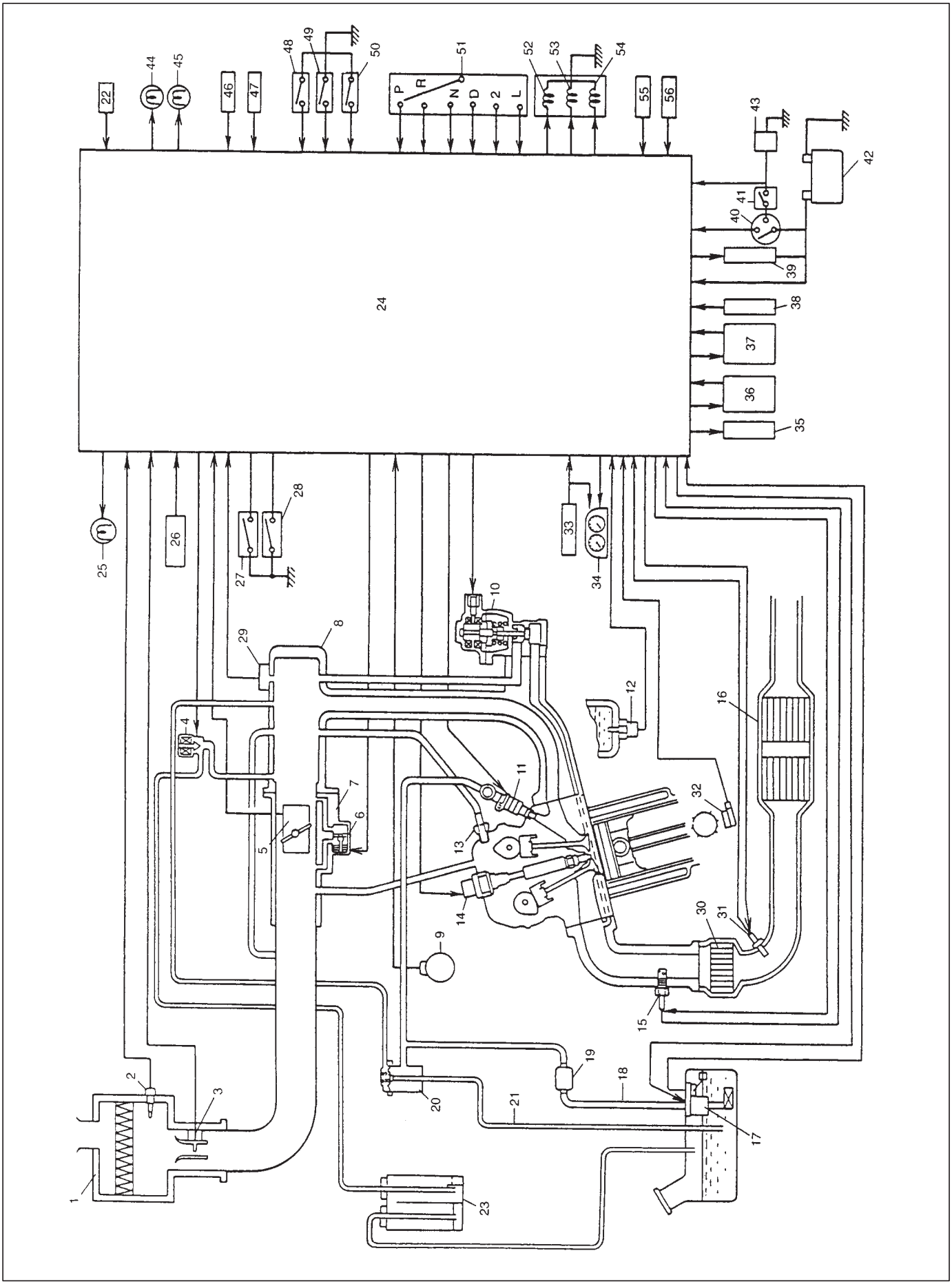
1. Air cleaner
2. Intake air temp. sensor
3. Mass air flow sensor
4. Throttle body
5. Idle air control valve
6. Throttle position sensor
7. EVAP canister purge valve
8. A/C condenser fan motor through relay (if equipped)
9. Manifold absolute pressure sensor (if equipped)
10. Warm-up three way catalytic converter (if equipped)
11. Vehicle speed sensor
12. Ignition coil assembly for No.1 and No.4 spark plugs
13. Ignition coil assembly for No.2 and No.3 spark plugs
14. Camshaft position sensor
15. Transmission range switch (sensor) (A/T)
16. A/T input speed sensor
17. A/T vehicle (output) speed sensor (A/T)
18. Shift solenoid valve A (A/T)
19. Shift solenoid valve B (A/T)
20. TCC solenoid valve (A/T)
21. ECM/PCM (Engine control module/ Powertrain control module)
22. ABS control module (if equipped)
23. A/C control module (amplifier) (if equipped)
24. Electric load (s)
    – Heater blower motor (if equipped)
    – Rear defogger (if equipped)
    – Lighting
25. Power steering pressure switch (if equipped)
26. Stop lamp switch (A/T)
27. Power/Normal change switch (A/T)
28. O/D cut switch (A/T)
29. 4WD low switch (A/T)
30. Heated oxygen sensor-2 (if equipped)
31. Crankshaft position sensor (if equipped)
32. Malfunction indicator lamp
33. "O/D OFF" lamp
34. "POWER" lamp
35. Starter
36. Park/Neutral position switch in TR switch (A/T)
37. Main relay
38. Main switch
39. Main fuse
40. Battery
41. EGR valve (if equipped)
42. Three way catalytic converter (if equipped)
43. Engine coolant temp. sensor
44. Fuel injectors
45. PCV valve
46. Heated oxygen sensor-1 (if equipped)
47. Fuel pressure regulator
48. Fuel filter
49. Fuel pump with fuel level sensor
50. EVAP canister
51. Data link connector
52. Ignition timing adjusting resistor (if equipped)
53. CO adjusting resistor (if equipped)

J20 ENGINE



1. Air cleaner
2. Intake air temp. sensor
3. Mass air flow sensor
4. EVAP canister purge valve
5. Throttle position sensor
6. Idle air control valve
7. Throttle body
8. Intake manifold
9. Camshaft position sensor
10. EGR valve (if equipped)
11. Fuel injector
12. Engine coolant temp. sensor
13. PCV valve
14. Ignition coil assembly
15. Heated oxygen sensor-1 (if equipped)
16. Three way catalytic converter (if equipped)
17. Fuel pump with fuel level sensor
18. Fuel feed line
19. Fuel filter
20. Fuel pressure regulator
21. Fuel return line
22. CO adjusting resistor (if equipped)
23. EVAP canister
24. ECM/PCM (Engine control module/Powertrain control module)
25. Malfunction indicator lamp
26. Electric loads
    - – Rear defogger (if equipped)
    - – Lighting
27. Power steering pressure switch (if equipped)
28. Heater blower fan switch
29. Manifold absolute pressure sensor (if equipped)
30. Warm-up three way catalytic converter (if equipped)
31. Heated oxygen sensor-2 (if equipped)
32. Crankshaft position sensor
33. Vehicle speed sensor
34. Combination meter
35. A/C condenser fan relay (if equipped)
36. A/C control module (amplifier) (if equipped)
37. Data link connector
38. ABS control module (if equipped)
39. Main relay
40. Main switch
41. Park/Neutral position switch in TR switch (A/T)
42. Battery
43. Starter magnetic switch
44. "O/D OFF" lamp (A/T)
45. "POWER" lamp (A/T)
46. Lighting switch (A/T)
47. Stop lamp switch (A/T)
48. O/D cut switch (A/T)
49. POWER/NORMAL change switch (A/T)
50. 4WD low switch (A/T)
51. Transmission range switch (A/T)
52. Shift solenoid valve A (A/T)
53. Shift solenoid valve B (A/T)
54. TCC solenoid valve (A/T)
55. A/T input speed sensor (A/T)
56. A/T vehicle (output) speed sensor (A/T)

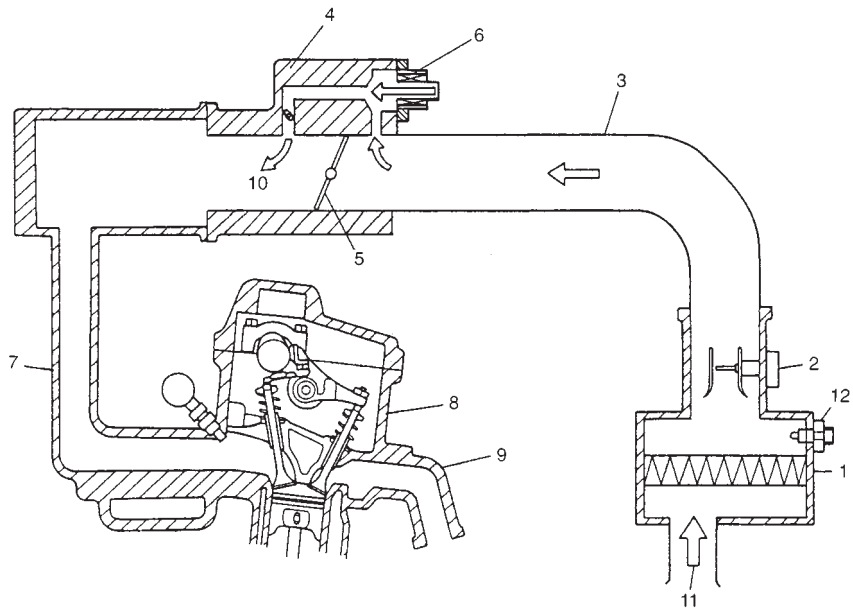
AIR INTAKE SYSTEM

The main components of the air intake system are air cleaner, mass air flow sensor, air cleaner outlet hose, throttle body, idle air control valve and intake manifold.

The air (by the amount corresponding to the throttle valve 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.

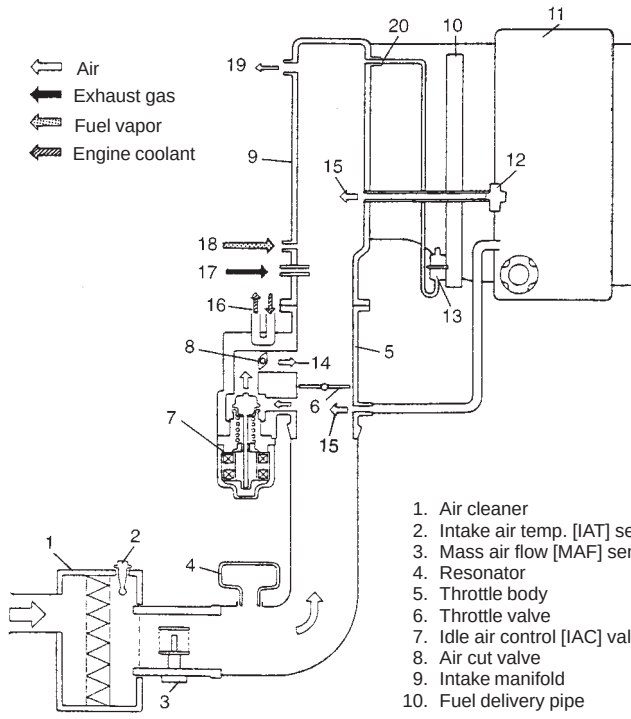
When the idle air control valve is opened according to the signal from PCM (ECM), the air bypasses the throttle valve through bypass passage and is finally drawn into the intake manifold.

G16 ENGINE



1. Air cleaner
2. Mass air flow sensor (MAF sensor)
3. Air cleaner outlet hose
4. Throttle body
5. Throttle valve
6. Idle air control valve (IAC valve)
7. Intake manifold
8. Cylinder head
9. Exhaust manifold
10. Bypass air flow
11. Fresh air
12. Intake air temperature sensor

J20 ENGINE



1. Air cleaner
2. Intake air temp. [IAT] sensor
3. Mass air flow [MAF] sensor
4. Resonator
5. Throttle body
6. Throttle valve
7. Idle air control [IAC] valve
8. Air cut valve
9. Intake manifold
10. Fuel delivery pipe
11. Engine
12. PCV valve
13. Fuel pressure regulator
14. Bypass air flow
15. PCV air flow
16. Engine coolant flow
17. EGR flow (if equipped)
18. EVAP purge flow
19. To brake booster
20. Fuel pressure control vacuum

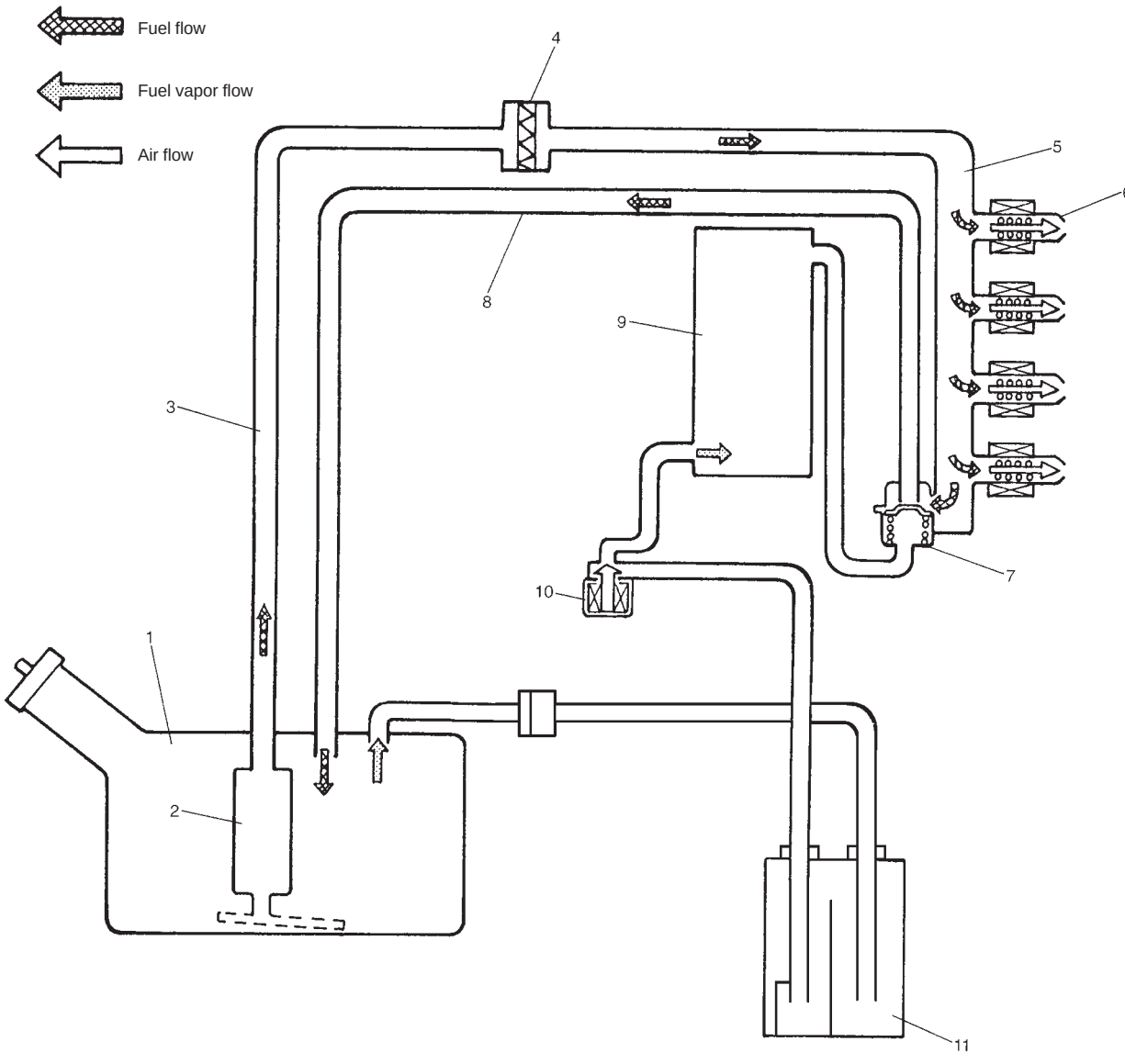
FUEL DELIVERY SYSTEM

The fuel delivery system consists of the fuel tank, fuel pump, fuel filter, 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 through the delivery pipe.

As the fuel pressure applied to the injector (the fuel pressure in the fuel feed line) is always kept a certain amount higher than the pressure in the intake manifold by the fuel pressure regulator, the fuel is injected into the intake port of the cylinder head when the injector opens according to the injection signal from PCM (ECM).

The fuel relieved by the fuel pressure regulator returns through the fuel return line to the fuel tank.



1. Fuel tank
2. Fuel pump
3. Fuel feed line
4. Fuel filter
5. Fuel delivery pipe
6. Fuel injectors
7. Fuel pressure regulator
8. Fuel return line
9. Intake manifold
10. EVAP canister purge valve
11. EVAP canister
12. Tank pressure control valve

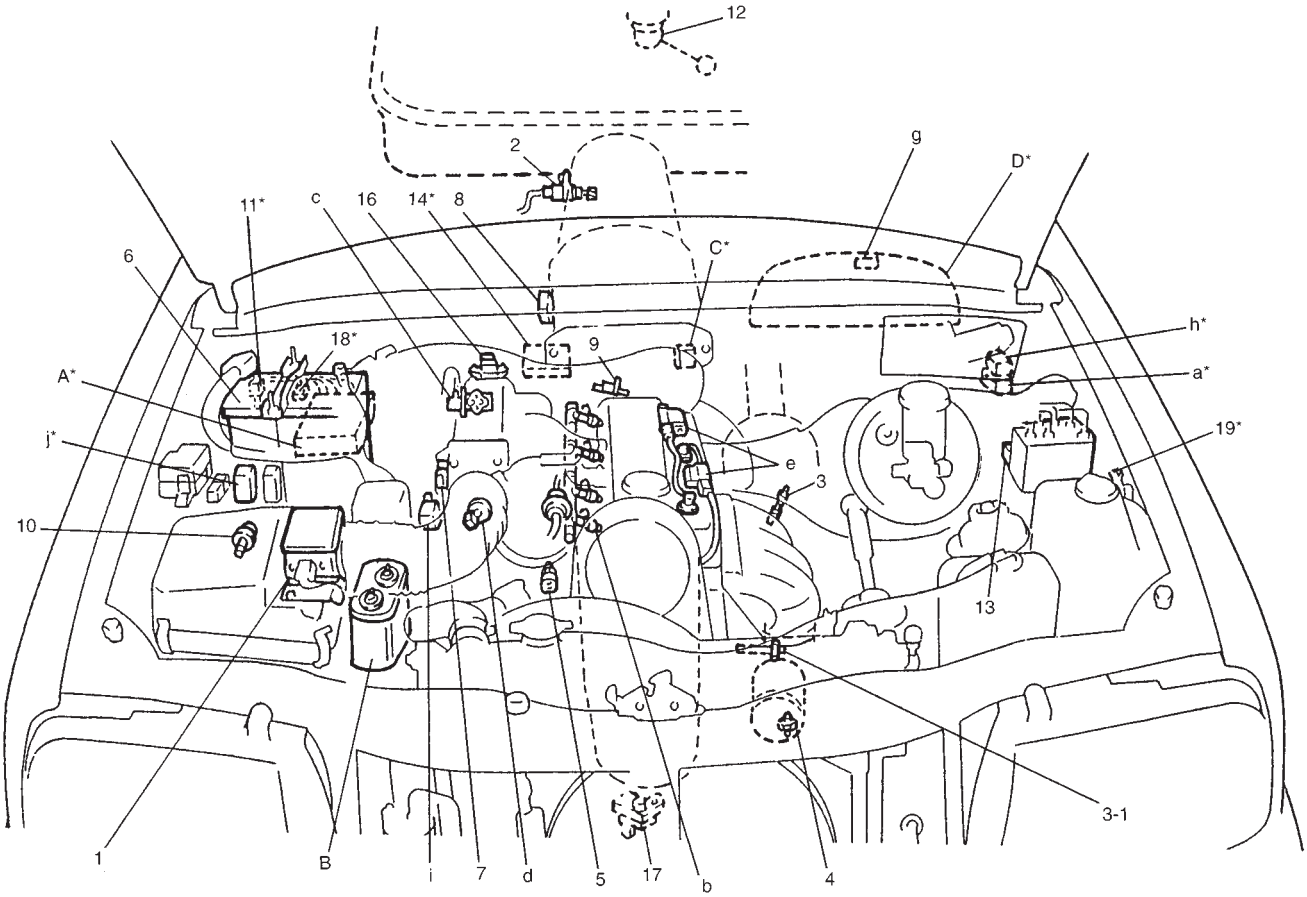
ELECTRONIC CONTROL SYSTEM

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
- Heated oxygen sensor heater control system
- Idle air control system
- Fuel pump control system
- Evaporative emission control system
- Ignition control system
- EGR system

Also, with 4 A/T model, PCM controls A/T.

G16 ENGINE



INFORMATION SENSORS
1. MAF sensor
2. VSS
3. Heated oxygen sensor-1

3-1. Heated oxygen sensor-2 (if equipped)

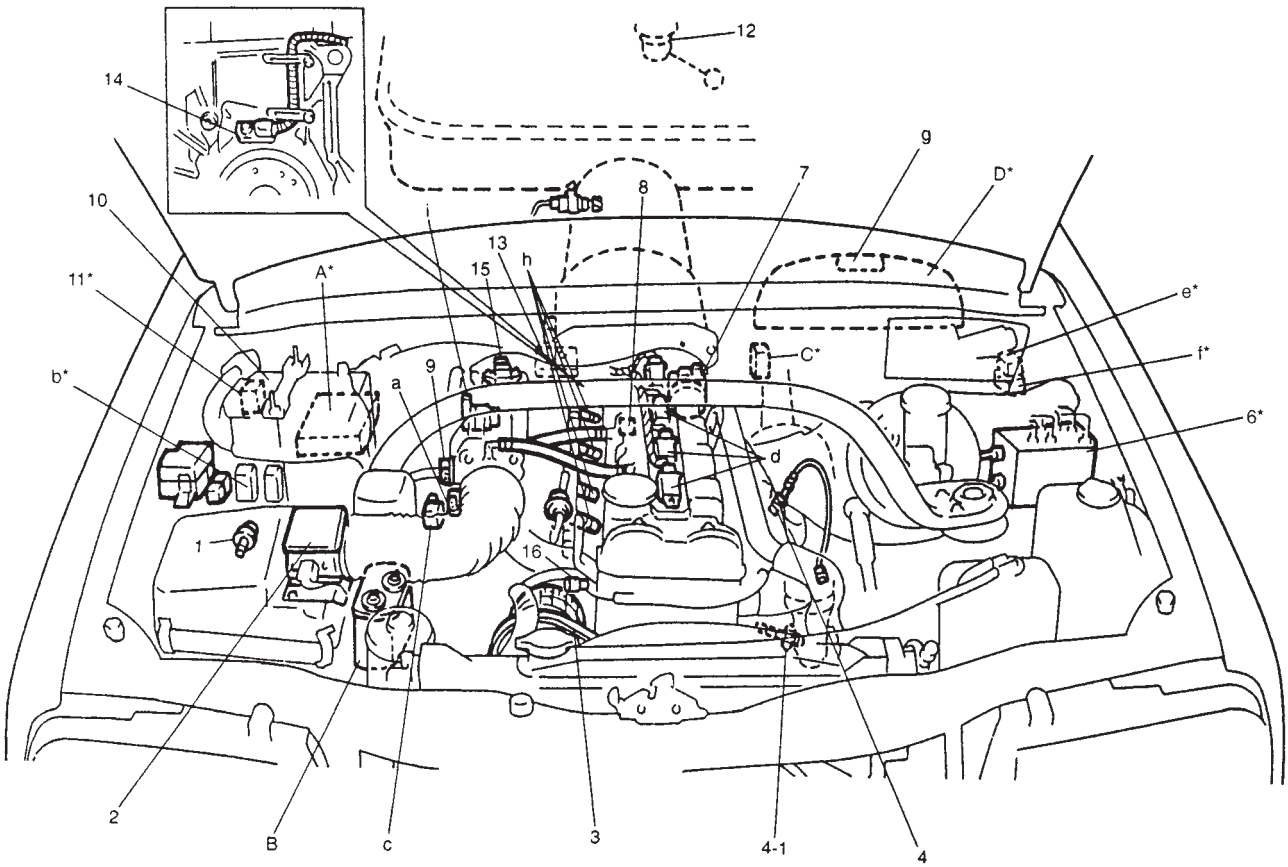
4. Power steering pressure switch
5. ECT sensor
6. Battery
7. TP sensor
8. Transmission range switch (A/T only)
9. Camshaft position sensor (CMP sensor)
10. IAT sensor
11. CO adjusting resistor (if equipped)
12. Fuel level sensor
13. ABS control module (if equipped)
14. A/C control module (amplifier) (if equipped)
15. Blank
16. MAP sensor
17. Crankshaft position sensor (if equipped)
18. Ignition timing adjusting resistor (if equipped)
19. Monitor connector (if equipped)

CONTROLLED DEVICES
a : Fuel pump relay (Canvas top)/ Main relay (Hard top)
b : Injectors
c : EGR valve (if equipped)
d : Idle air control valve
e : Ignition coil assemblies
g : Malfunction indicator lamp
h : Main relay (Canvas top)/ Fuel pump relay (Hard top)
i : EVAP canister purge valve
j : A/C condenser fan motor relay (if equipped)

OTHERS
A : PCM/ECM
B : EVAP canister
C : Data link connector
D : Combination meter

NOTE:
Above figure shows left-hand steering vehicle. For right-hand steering vehicle, parts with (*) are installed at the other side.

J20 ENGINE



INFORMATION SENSORS
1. IAT sensor
2. MAF sensor
3. Power steering pressure switch (if equipped)
4. Heated oxygen sensor-1

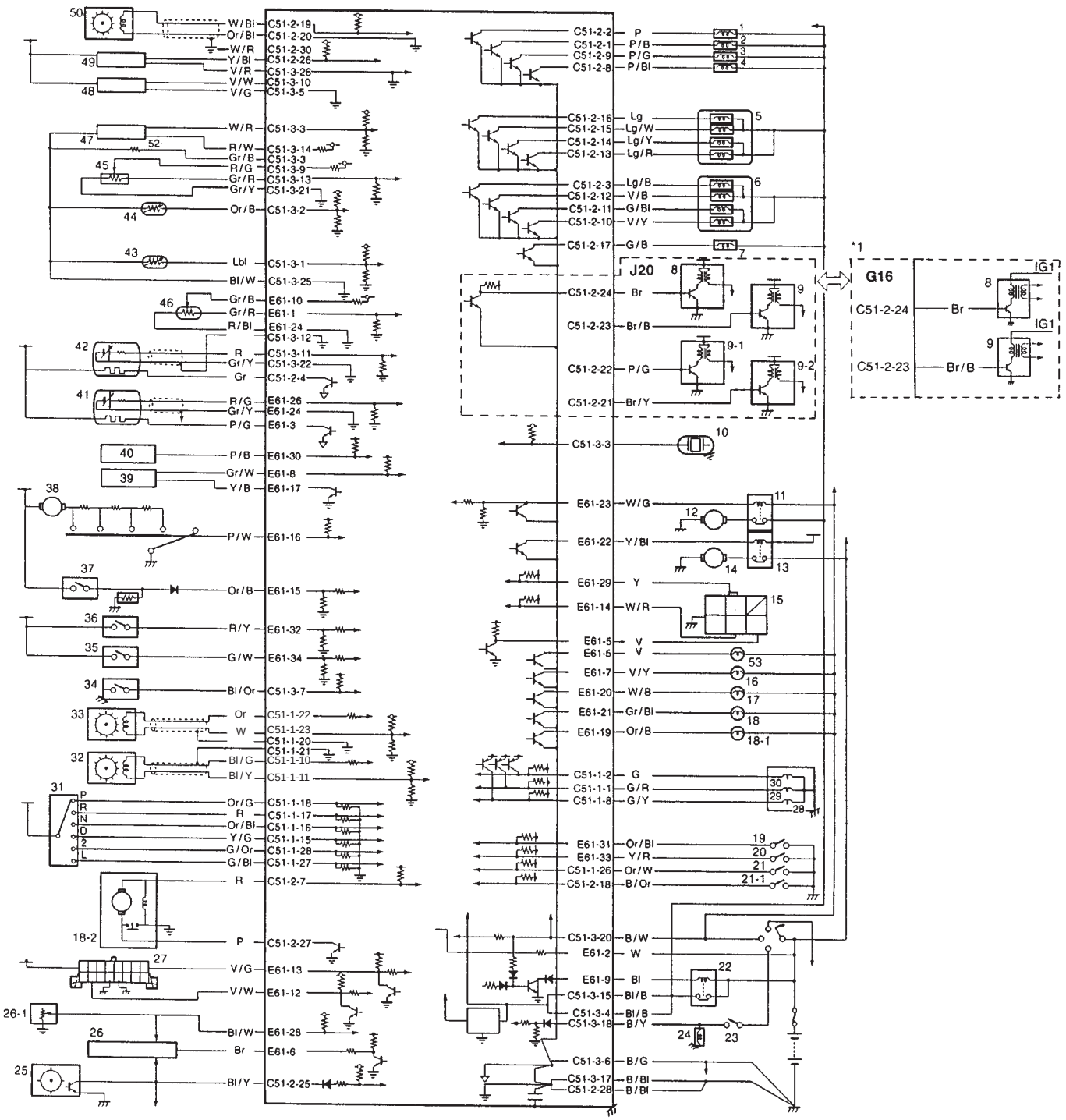
4-1. Heated oxygen sensor-2 (if equipped)

5. Blank
6. ABS control module (if equipped)
7. Camshaft position sensor (CMP sensor)
8. ECT sensor
9. TP sensor
10. Battery
11. CO adjusting resistor (if equipped)
12. Fuel level sensor
13. A / C control module (Amplifier) (if equipped)
14. Crankshaft position sensor (if equipped)
15. Manifold absolute pressure sensor (if equipped)
16. Knock sensor

CONTROLLED DEVICES
- a : Idle air control valve
- b : A / C condenser fan motor relay (if equipped)
- c : EVAP canister purge valve
- d : Ignition coil assemblies
- e : Main relay (Canvas top) / Fuel pump relay (Hard top)
- f : Fuel pump relay (Canvas top) / Main relay (Hard top)
- g : Malfunction indicator lamp
- h : Injectors
- i : EGR valve (if equipped)

OTHERS
- A : ECM (PCM)
- B : EVAP canister
- C : Data link connector
- D : Combination meter

NOTE:
Above figure shows left-hand steering vehicle. For right-hand steering vehicle, parts with (*) are installed at the other side.


J20
G16
*1
IG1
C51-2-24
C51-2-23
Br
Br/B

1. Fuel injector No.1
2. Fuel injector No.2
3. Fuel injector No.3
4. Fuel injector No.4
5. EGR valve (if equipped)
6. Idle air control (IAC) valve
7. EVAP canister purge valve
8. Ignition coil assembly for No.1 and No.4 spark plugs (G16)
   Ignition coil assembly for No.1 (J20)
9. Ignition coil assembly for No.2 and No.3 spark plugs (G16)
   Ignition coil for No.2 (J20)

9-1. Ignition coil for No.3 (J20)
9-2. Ignition coil for No.4 (J20)

10. Knock sensor (J20)
11. Fuel pump relay
12. Fuel pump
13. A/C condenser fan relay (if equipped)
14. A/C condenser fan motor (if equipped)
15. Monitor connector (if equipped)
16. Malfunction indicator lamp
17. “O/D OFF” lamp (A/T)
18. “POWER” lamp (A/T)

18-1. “4WD” lamp
18-2. 4WD air pump assembly

19. Power/Normal change switch (A/T)
20. O/D cut switch (A/T)
21. 4WD low switch

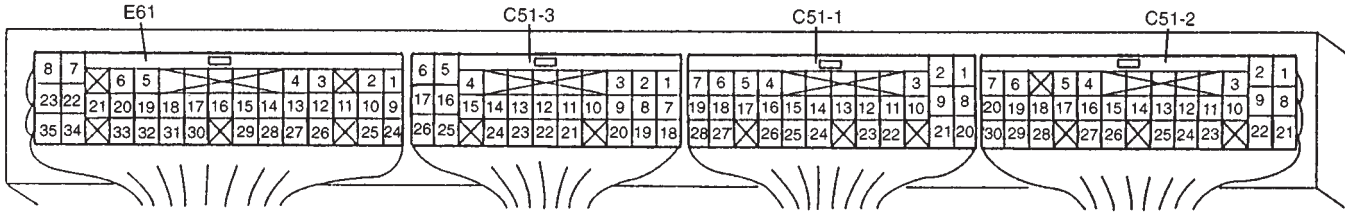
21-1. 4WD switch

22. Main relay
23. Transmission range switch (Park/Neutral position switch)
24. Starter magnetic switch
25. Vehicle speed sensor
26. Combination meter

26-1. Fuel level sensor

27. Data link connector
28. TCC solenoid (A/T)
29. Shift solenoid-B (A/T)
30. Shift solenoid-A (A/T)
31. Transmission range switch (sensor) (A/T)
32. A/T input speed sensor (A/T)
33. A/T vehicle (output) speed sensor (A/T)
34. Power steering pressure switch
35. Stop lamp switch (Brake pedal switch)
36. Lighting switch
37. Rear defogger switch (if equipped)
38. Heater blower motor (if equipped)
39. A/C control module (Amplifier) (if equipped)
40. ABS control module (if equipped)
41. Heated oxygen sensor-1 (if equipped)
42. Heated oxygen sensor-2 (if equipped)
43. Intake air temp. sensor
44. Engine coolant temp. sensor
45. Throttle position sensor
46. CO adjusting resistor (if equipped)
47. Manifold absolute pressure sensor (if equipped)
48. Mass air flow sensor
49. Camshaft position sensor
50. Crankshaft position sensor (if equipped)
51. Engine control module (Powertrain control module)
52. Ignition timing adjusting resister (if equipped)
53. Immobilizer indicator lamp

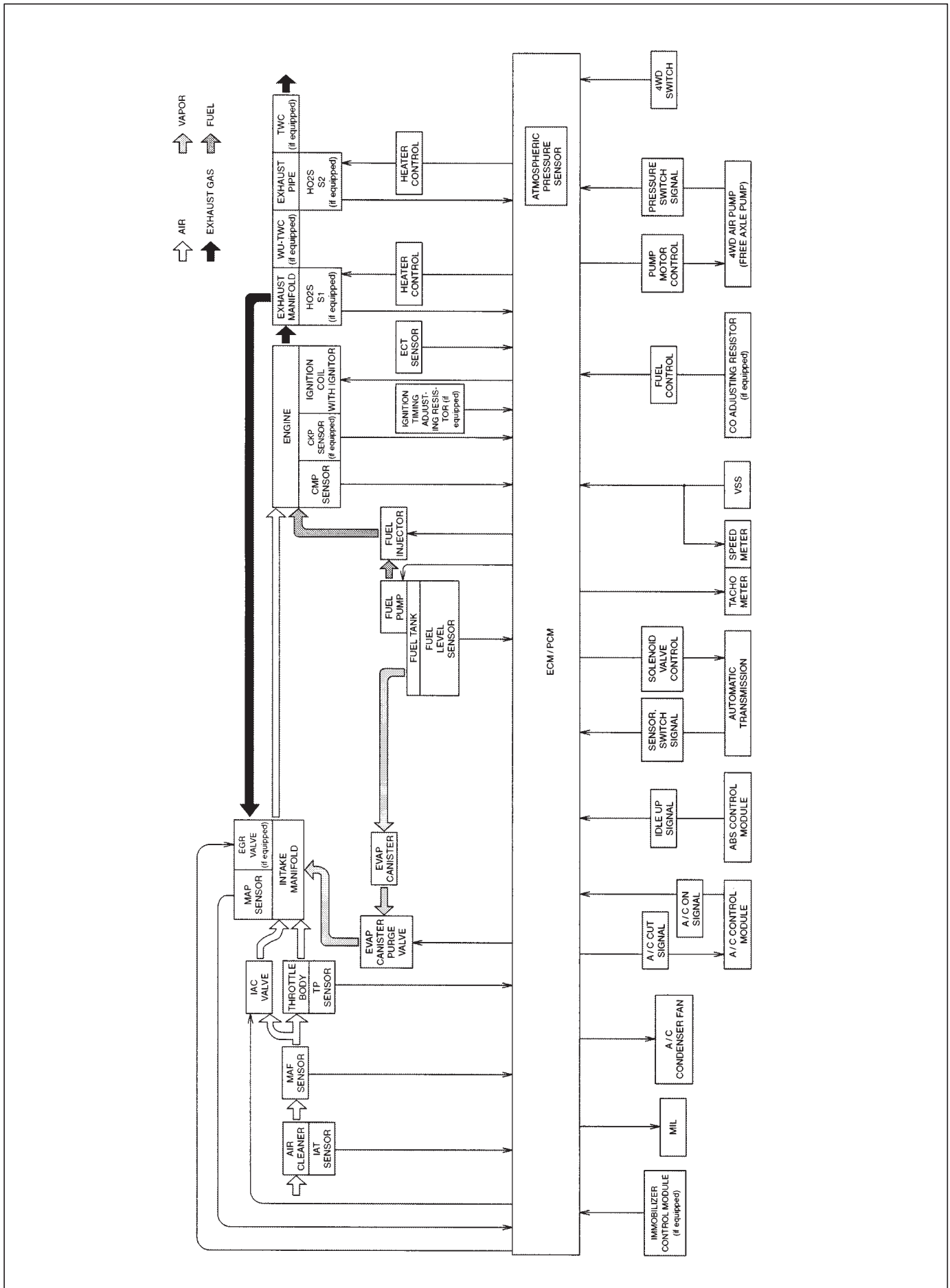
TERMINAL ARRANGEMENT OF ECM (PCM) CONNECTOR (VIEWED FROM HARNESS SIDE)



TERMINAL		CIRCUIT
E61	1	Power source for CO adjusting resistor
	2	Power source for back up
	3	Heater of HO2S-2 (if equipped)
	4	——
	5	Duty output terminal (if equipped)
	6	Tachometer
	7	MIL
	8	A/C cut signal (if equipped)
	9	Main relay
	10	CO adjusting resistor (if equipped)
	11-12	——
	13	Data link connector
	14	Test switch terminal (if equipped)
	15	Rear defogger switch (if equipped)
	16	Heater blower switch
	17	A/C signal (if equipped)
	18	——
	19	"4WD" lamp (4WD)
	20	"O/D OFF" lamp (A/T)
	21	"POWER" lamp (A/T)
	22	A/C fan motor relay (if equipped)
	23	Fuel pump relay
	24	Ground for HO2S–2
		Ground for CO adjusting resistor
	25	——
	26	Heated oxygen sensor-2 (if equipped)
	27	——
	28	Fuel level sensor
	29	Diagnosis switch terminal (if equipped)
	30	ABS control module (if equipped)
	31	Power/Normal change switch (A/T)
	32	Lighting switch
	33	O/D cut switch (A/T)
	34	Stop lamp switch (Brake pedal switch)
	35	——
C51-3	1	Intake air temp. sensor
	2	Engine coolant temp. sensor
	3	Knock sensor (J20)
		Ignition timing adjusting resistor (G16, if equipped)
	4	Power source

TERMINAL		CIRCUIT
C51-3	5	Ground for MAF sensor
	6	Ground
	7	Power steering pressure switch
	8	Manifold absolute pressure (MAP) sensor
	9	Throttle position (TP) sensor
	10	Mass air flow (MAF) sensor
	11	Heated oxygen sensor-1 (if equipped)
	12	Ground for HO2S-1 shield wire
	13	Power source for TP sensor
	14	Power source for MAP sensor
	15	Power source
	16	——
	17	Ground
	18	Engine start signal
	19	——
	20	Ignition switch
	21	Ground for TP sensor
	22	Ground for HO2S-1
	23	——
	24	——
	25	Ground for IAT sensor, ECT sensor MAP sensor and/or Ignition timing adjusting resistor
	26	Ground for CMP sensor
C51-1	1	Shift solenoid-B (A/T)
	2	Shift solenoid-A (A/T)
	3–7	——
	8	TCC solenoid (A/T)
	9	——
	10	A/T input speed sensor (–)
	11	A/T input speed sensor (+)
	12-14	——
	15	Transmission range switch "D" (A/T)
	16	Transmission range switch "N" (A/T)
	17	Transmission range switch "R" (A/T)
	18	Transmission range switch "P" (A/T)
	19	——
	20	Shield wire ground for A/T output speed sensor
	21	Shield wire ground for A/T input speed sensor

TERMINAL		CIRCUIT
C51-1	22	A/T output speed sensor (–)
	23	A/T output speed sensor (+)
	24-25	——
	26	4WD low switch
	27	Transmission range switch "L" (A/T)
	28	Transmission range switch "2" (A/T)
C51-2	1	Fuel injector No.2
	2	Fuel injector No.1
	3	IAC valve (stepper motor coil 1)
	4	Heater of HO2S-1
	5	——
	6	——
	7	4WD air pump assembly (if equipped)
	8	Fuel injector No.4
	9	Fuel injector No.3
	10	IAC valve (stepper motor coil 4)
	11	IAC valve (stepper motor coil 3)
	12	IAC valve (stepper motor coil 2)
	13	EGR valve (stepper motor coil 4)
	14	EGR valve (stepper motor coil 3)
	15	EGR valve (stepper motor coil 2)
	16	EGR valve (stepper motor coil 1)
	17	EVAP canister purge valve
	18	4WD switch (if equipped)
	19	CKP sensor (+)
	20	CKP sensor (–)
	21	Ignition coil assembly for No.4 (J20)
	22	Ignition coil assembly for No. 3 (J20)
	23	Ignition coil assembly for No.2 and No.3 spark plugs (G16)
		Ignition coil assembly for No.2 (J20)
	24	Ignition coil assembly for No.1 and No.4 spark plugs (G16)
		Ignition coil assembly for No.1 (J20)
	25	Vehicle speed sensor
	26	CMP sensor (+)
	27	Pressure switch in 4WD air pump assembly (if equipped)
	28	Ground
	29	Ground for DLC
	30	Ground for CKP sensor shield wire

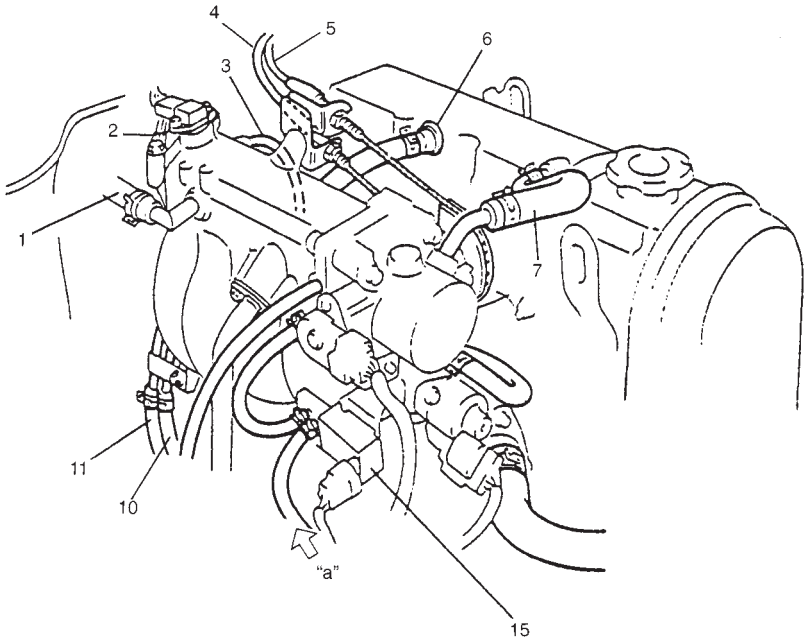

AIR
EXHAUST GAS
VAPOR
FUEL
TWC (if equipped)
EXHAUST PIPE
HO2S S2 (if equipped)
WU-TWC (if equipped)
EXHAUST MANIFOLD
HO2S S1 (if equipped)
HEATER CONTROL
ENGINE
IGNITION COIL WITH IGNITOR
CKP SENSOR (if equipped)
CMP SENSOR
ECT SENSOR
IGNITION TIMING ADJUSTING RESISTOR (if equipped)
FUEL INJECTOR
FUEL PUMP
FUEL TANK
FUEL LEVEL SENSOR
EGR VALVE (if equipped)
INTAKE MANIFOLD
MAP SENSOR
EVAP CANISTER
EVAP CANISTER PURGE VALVE
IAC VALVE
THROTTLE BODY
TP SENSOR
MAF SENSOR
AIR CLEANER
IAT SENSOR
MIL
IMMOBILIZER CONTROL MODULE (if equipped)
A/C CONDENSER FAN
A/C CONTROL MODULE
A/C ON SIGNAL
A/C CUT SIGNAL
IDLE UP SIGNAL
ABS CONTROL MODULE
SENSOR, SWITCH SIGNAL
SOLENOID VALVE CONTROL
AUTOMATIC TRANSMISSION
ECM / PCM
ATMOSPHERIC PRESSURE SENSOR
TACHO METER
SPEED METER
VSS
FUEL CONTROL
CO ADJUSTING RESISTOR (if equipped)
PUMP MOTOR CONTROL
PRESSURE SWITCH SIGNAL
4WD AIR PUMP (FREE AXLE PUMP)
4WD SWITCH

ENGINE & EMISSION CONTROL INPUT/OUTPUT TABLE

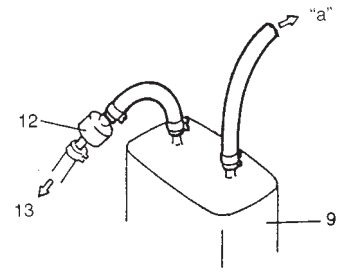
Function	Input / Output	CMP sensor	MAF sensor	TP sensor	ECT sensor	IAT sensor	HO2S	VSS	Blower fan switch	Rear defogger switch (if equipped)	PSP switch	DLC	Ignition switch	Starter switch	ABS control module (if equipped)	A/C amplifier (if equipped)	TR switch (A/T vehicle)	Light switch	Brake switch (A/T vehicle)	CO adjusting resistor (if equipped)	CKP sensor (if equipped)	Ignition timing adjusting resistor (if equipped)	Knock sensor (J20 engine)
Main relay control	Main relay												○										
Fuel pump control	Fuel pump relay	○											○	○									
Injection control	Injectors	○	○	○	○	○	○	○						○	○	○	○		○	○			
Idle air control	IAC valve	○	○	○	○	○		○	○	○	○	○	○	○	○	○	○	○					
Ignition control	Ignition coil with igniter	○	○	○	○	○		○	○	○	○	○		○		○	○				○	○	○
MIL control	MIL	○										○											
EVAP purge control	EVAP canister purge valve	○	○	○	○			○															
EGR control	EGR valve (if equipped)	○	○	○	○	○		○				○	○	○									
HO2S-1 and HO2S-2 heater control	HO2S (if equipped)	○	○		○			○					○	○									
A/C control	A/C amplifier (if equipped)	○		○	○			○						○		○							
A/C condensor fan control	A/C condensor fan relay (if equipped)	○		○	○			○						○		○							

ON-VEHICLE SERVICE

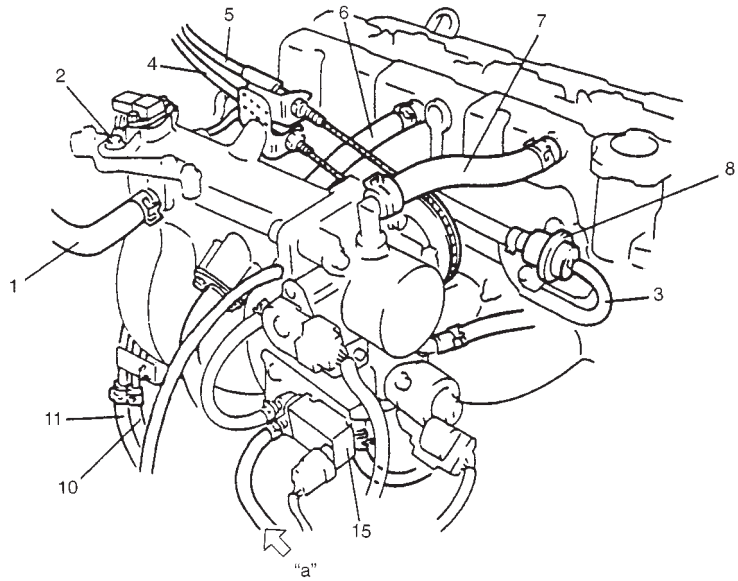
G16 ENGINE



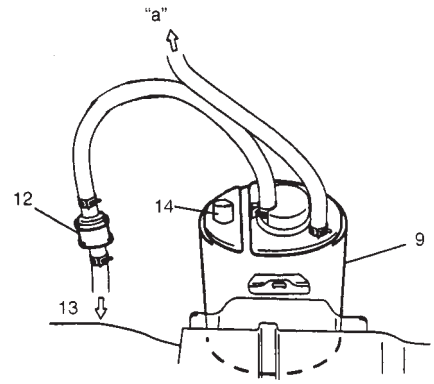
[A]



J20 ENGINE



[B]

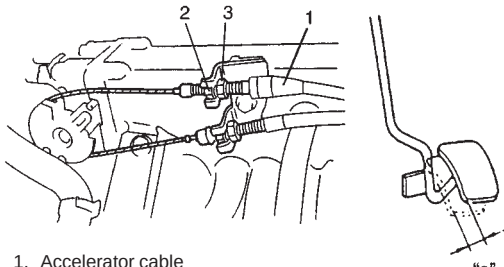


[A]: Vehicle without immobilizer indicator lamp
[B]: Vehicle with immobilizer indicator lamp

1. Brake booster hose
2. Engine ground
3. Vacuum hose for fuel pressure regulator
4. A / T throttle cable (A / T)
5. Throttle cable
6. PCV hose
7. Breather hose
8. Fuel pressure regulator
9. EVAP canister
10. Fuel return hose
11. Fuel feed hose
12. Tank pressure control valve
13. Fuel tank
14. Air cap
15. EVAP canister purge valve

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 Emission Control Information Label or figure on previous page for proper routing of hoses.



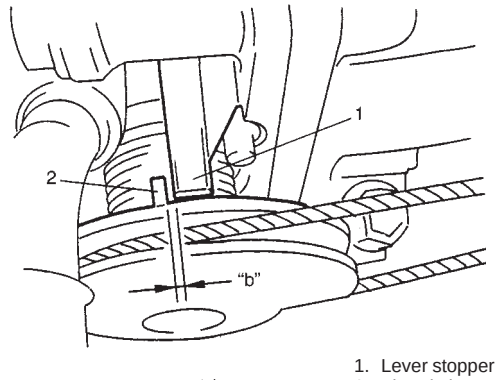
1. Accelerator cable
2. Adjusting nut
3. Lock nut

ACCELERATOR CABLE ADJUSTMENT

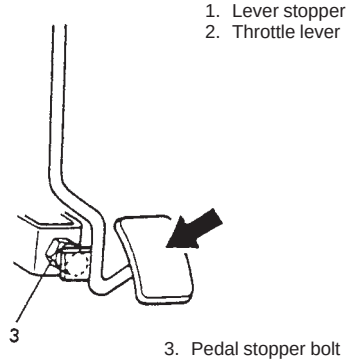
1) With throttle valve closed, check accelerator pedal play which should be within following specification.

   Pedal play "a": 2 – 7 mm (0.08 – 0.27 in.)

   If measured value is out of specification, adjust it to specification with cable adjusting nut.



1. Lever stopper
2. Throttle lever

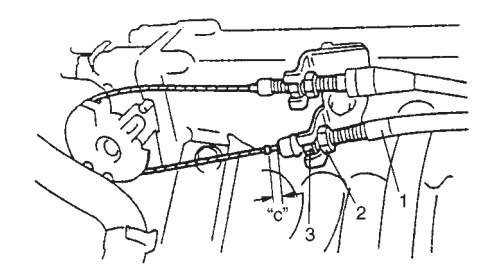


3. Pedal stopper bolt

2) With accelerator pedal depressed fully, check clearance between throttle lever and lever stopper (throttle body) which should be within following specification.

   Clearance "b": 0.5 – 2.0 mm (0.02 – 0.07 in.)
   (With pedal depressed fully)

   If measured value is out of specification, adjust it to specification by changing height of pedal stopper bolt.



1. A/T throttle cable
2. Adjusting nut
3. Lock nut

A/T THROTTLE CABLE ADJUSTMENT (4 A/T)

1) Make sure that accelerator cable is adjusted as specified.
2) Check clearance "c". If it is out of specification, adjust it by turning cable adjusting nut.

   Clearance "c": 0.8 – 1.5 mm (0.03 – 0.06 in.)

3) Tighten lock nut securely.

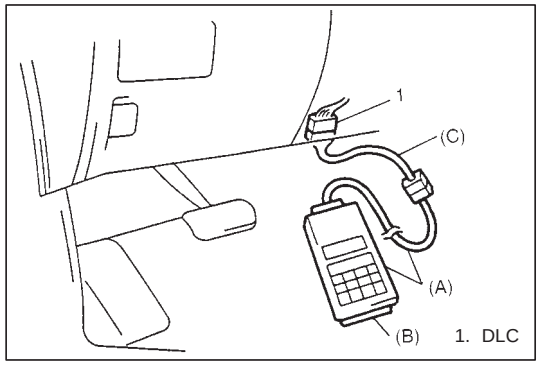
IDLE SPEED/IDLE AIR CONTROL (IAC) DUTY INSPECTION

Before idle speed and IAC duty check, make sure of the following.

- Lead wires and hoses of engine/emission control systems are connected securely.
- Accelerator cable has some play, that is, it is not tight.
- Valve lash is checked and adjusted according to maintenance schedule.
- Ignition timing is within specification.
- All accessories (wipers, heater, lights, A/C, etc.) are out of service.
- Air cleaner has been properly installed and is in good condition.
- 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. DLC

1) Connect SUZUKI scan tool to DLC with ignition switch OFF.

   Special Tool
   (A): SUZUKI scan tool, Tech 1
   (B): Mass storage cartridge
   (C): 16/14 pin DLC cable (OBD-II adapter cable)

2) Warm up engine to normal operating temperature.

3) Check idle speed and IAC duty by using "Data List" mode of SUZUKI scan tool.

	A/C OFF	A/C ON
Engine idle speed	750 ± 50 r/min.	850 ± 50 r/min. for G16
IAC duty at specified idle speed	2 – 30 %	800 ± 50 r/min. for J20

   If idle speed and /or IAC duty is out of specifications, check idle air control system referring to "Diagnostic Flow Table B-4 Idle Air Control System Check" in "ENGINE DIAGNOSIS" section.

4) Check that specified engine idle speed is obtained with A/C ON if vehicle is equipped with A/C.
   If not, check A/C signal circuit and idle air control system.

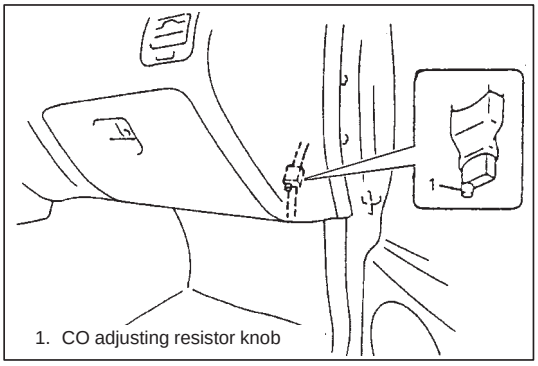
IDLE MIXTURE INSPECTION / ADJUSTMENT (VEHICLE WITHOUT HEATED OXYGEN SENSOR)

All vehicles not equipped with heated oxygen sensor are shipped with their CO% factory adjusted as follows.

Engine idle mixture (CO%)	0.8 – 1.3% at specified idle speed

Idle mixture adjustment should never be changed from the original factory setting. However, if during diagnosis, the check indicates idle mixture to be the cause of a driver performance complaint or emission failure, the idle mixture can be adjusted using the following procedures.

NOTE:
For this inspection and adjustment, exhaust gas tester (CO meter) and engine tachometer are necessary.

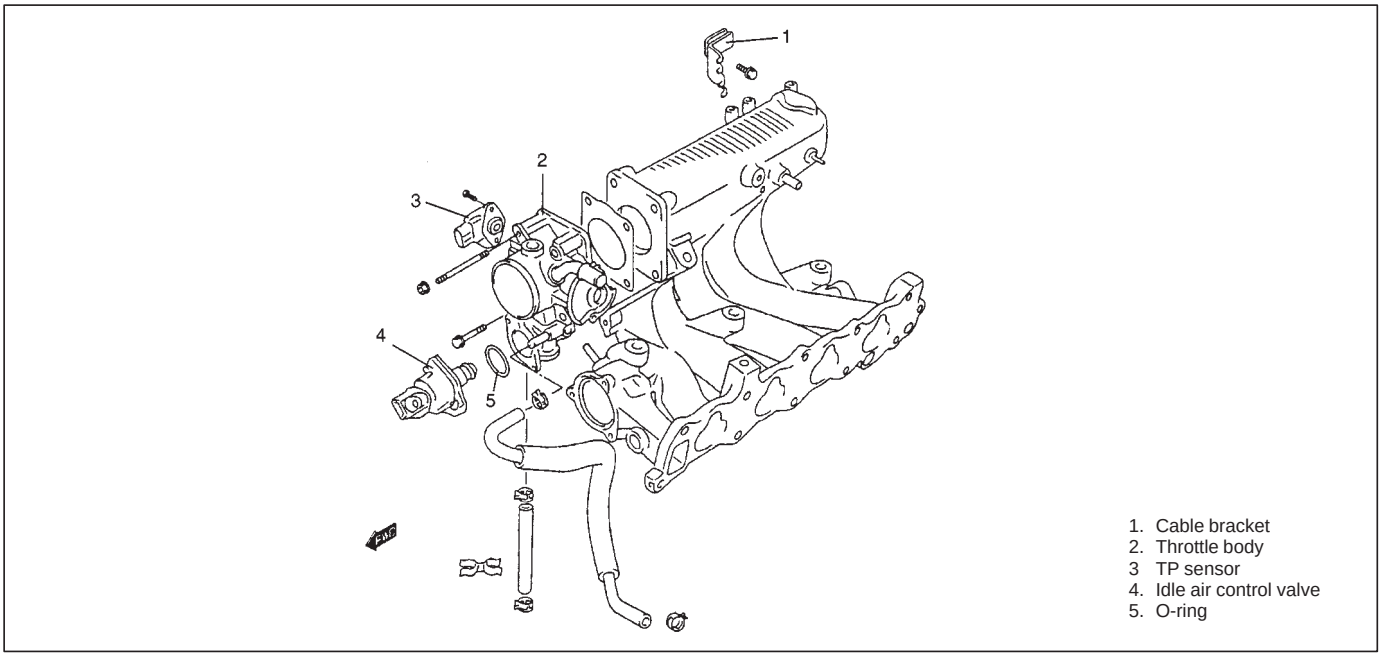


1. CO adjusting resistor knob

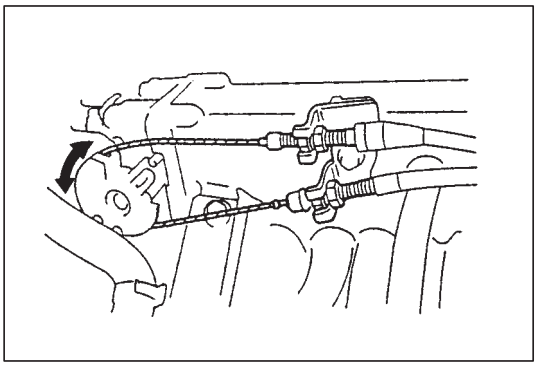
1) Check idle speed according to “Idle Speed Inspection” section.
2) Using exhaust gas tester, check that idle mixture CO% is within above specification. If it is out of specification, adjust it to specification by turning resistor knob.
3) If idle mixture has been adjusted, confirm that idle speed is within specification.

AIR INTAKE SYSTEM

THROTTLE BODY

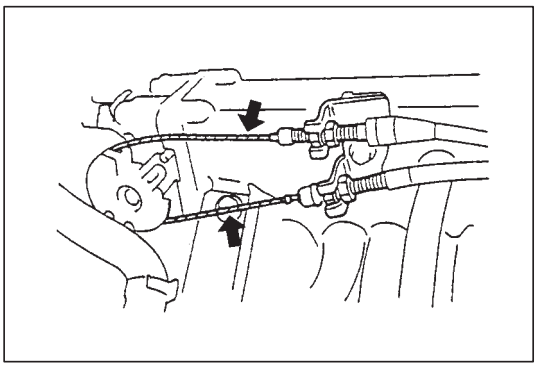


1. Cable bracket
2. Throttle body
3 TP sensor
4. Idle air control valve
5. O-ring



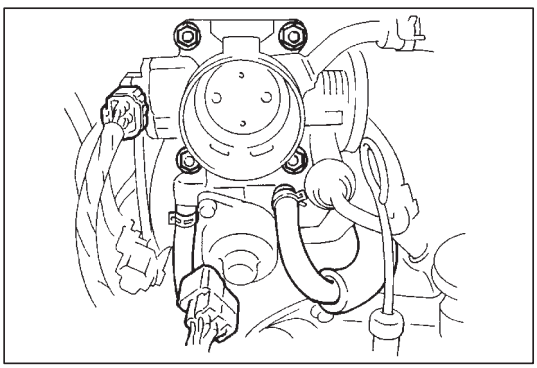
On-Vehicle Inspection

- Check that throttle valve lever moves smoothly.

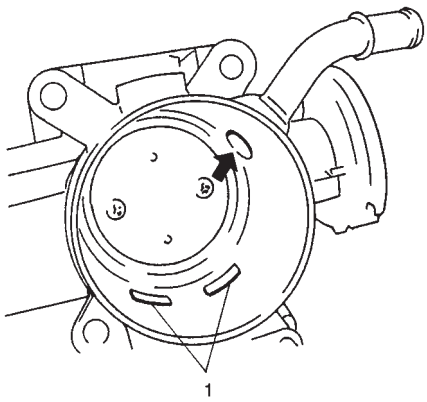


Removal

1) Disconnect negative cable at battery.
2) Drain cooling system.
3) Disconnect accelerator cable and/or A/T throttle cable from throttle body.
4) Remove air cleaner outlet hose.



5) Disconnect electric coupler from TP sensor and IAC valve.
6) Disconnect coolant hoses from throttle body.
7) Remove throttle body from intake manifold.

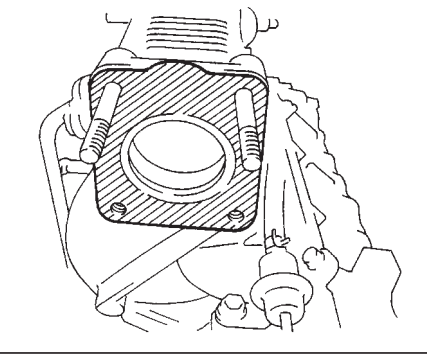


1. Bypass air passage

Cleaning

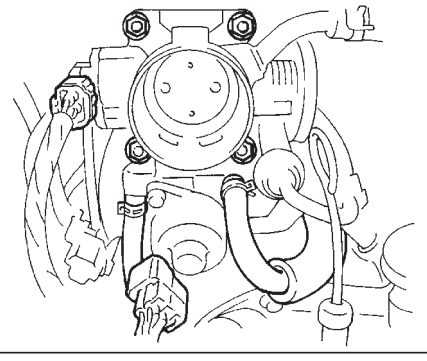
1) Remove IAC valve from throttle body.
2) Clean throttle body bore and bypass air passages by blowing compressed air.

CAUTION:
- **Do not blow compressed air through bypass air passage with IAC valve installed to throttle body. This will cause IAC valve to malfunction.**
- **TP sensor, idle air control valve or other components containing rubber must not be places in a solvent or cleaner bath.**
  A chemical reaction will cause these parts to swell, harden or get distorted.

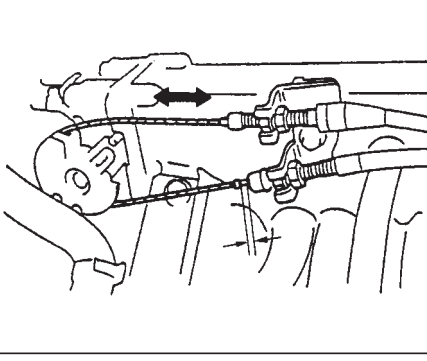


Installation

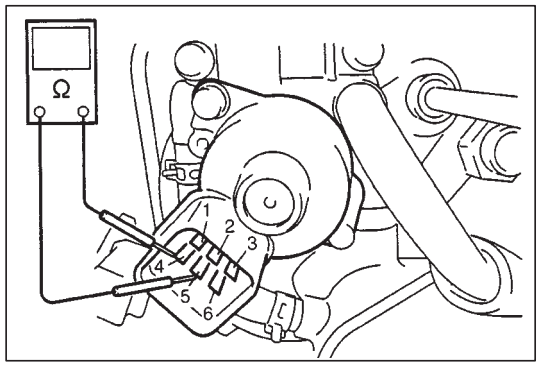
1) Clean mating surfaces and install throttle body gasket to intake manifold.
   Use new gasket.



2) Install throttle body to intake manifold and tighten bolts and nuts to specified torque.
3) Connect coolant hoses to throttle body.
4) Connect couplers to TP sensor and IAC valve securely.
5) Install air cleaner outlet hose.



6) Connect accelerator cable and A/T throttle cable, and adjust each cable play to specification.
7) Refill cooling system.
8) Connect negative cable at battery.



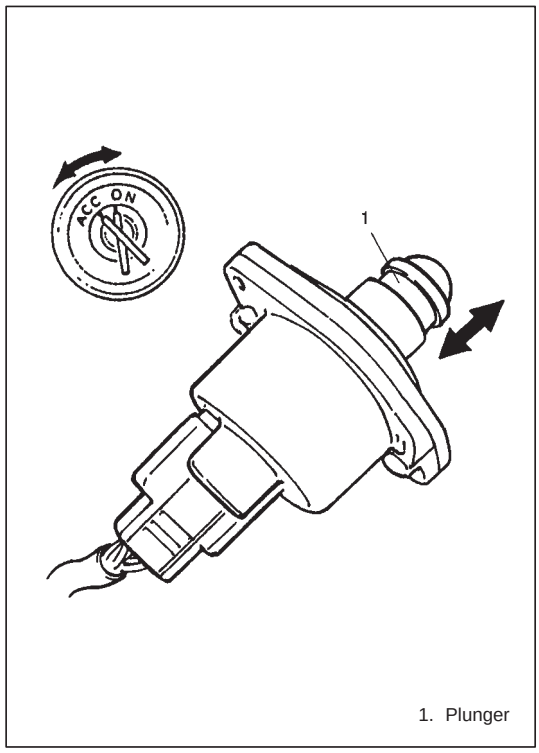
IDLE AIR CONTROL VALVE (IAC VALVE)

Inspection

1) Disconnect connector from IAC valve.
2) Check each coil of IAC valve for resistance.

Terminals	Resistance
Between "1" and "2" "3" and "2" "4" and "5" "6" and "5"	35 – 43 Ω

If resistances is out of specification, replace.



1. Plunger

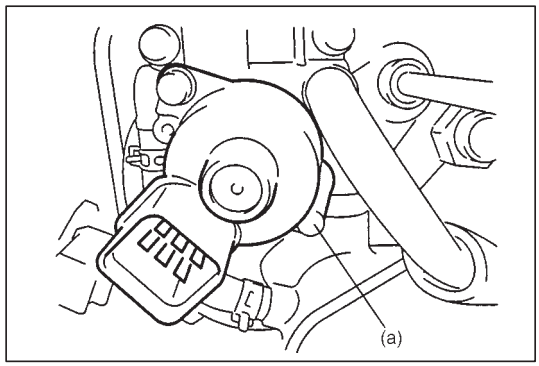
3) Remove air cleaner outlet hose and remove IAC valve from throttle body.
4) Connect connector to IAC valve.
5) Check that plunger of IAC valve moves once and then stops as soon as ignition switch is turned OFF after cranking engine for 2 seconds.

NOTE:
This check should be performed by two people, one person operates ignition switch while the other checks plunger operation.

If plunger 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.

Removal

1) Disconnect negative cable from battery.
2) Disconnect connector from IAC valve.
3) Remove IAC valve from throttle body.



Installation

1) Install new O-ring to throttle body.
2) Install IAC valve to throttle body.
   Tighten IAC valve screws to specified torque.

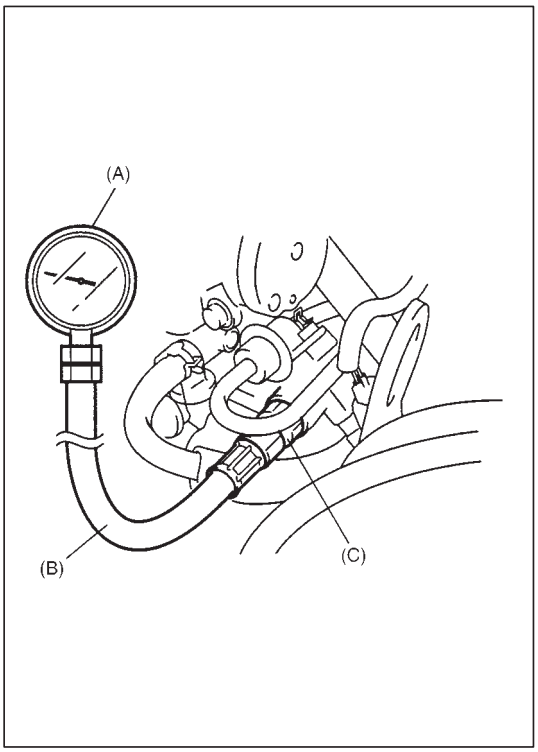
Tightening Torque
(a): 3.5 N·m (0.35 kg-m, 2.5 lb-ft)

3) Connect IAC valve connector securely.
4) Connect negative cable to battery.

FUEL DELIVERY SYSTEM

FUEL PRESSURE INSPECTION

1) Relieve fuel pressure in fuel feed line referring to p. 6-4.



2) Using backup wrench, loosen plug bolt on fuel delivery pipe and remove it. Connect special tools (fuel pressure gauge) to delivery pipe.

CAUTION:
A small amount of fuel may be released when plug bolt is loosened. Place container under the bolt or cover bolt hole with a shop cloth so that released fuel is caught in container or absorbed in cloth. Place that cloth in an approved container.

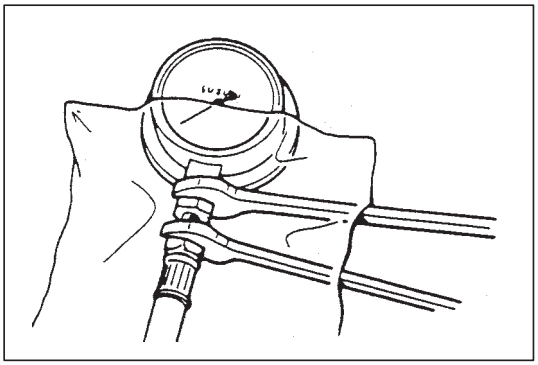
Special Tool
(A): 09912-58441
(B): 09912-58431
(C): 09919-46010

3) Check that battery voltage is above 11V.

CONDITION	FUEL PRESSURE
With fuel pump operating and engine stopped	250 – 300 KPa 2.5 – 3.0 kg/cm^2 35.6 – 42.7 psi
At specified idle speed	210 – 260 KPa 2.1 – 2.6 kg/cm^2 29.8 – 37.0 psi
With 1 min. after engine (fuel pump) stopped (Pressure reduces as time passes.)	over 180 kPa 1.8 kg/cm^2 25.6 psi

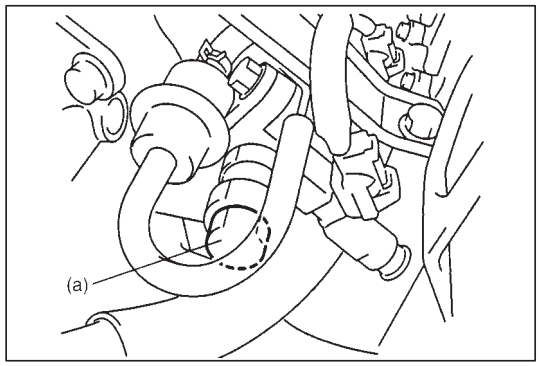
4) Turn ignition switch ON to operate fuel pump and after 3 seconds turn it OFF. Repeat this 3 or 4 times and then check fuel pressure.
5) Start engine.
6) Measure fuel pressure at idling.

If measured pressure doesn't satisfy specification, refer to "Diagnostic Flow Table B-3" in "ENGINE DIAGNOSIS" section and check each possibly defective part. Replace if found defective.



7) 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.**



8) Install plug bolt to fuel delivery pipe.
   Use new gasket.
   Tighten it to specified torque, using backup wrench.

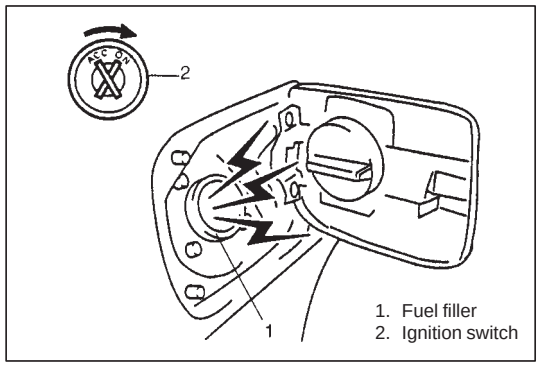
   Tightening Torque
   (a): 30 N·m (3.0 kg-m, 22.0 lb-ft)

9) With engine "OFF" and ignition switch "ON", check for fuel leaks.

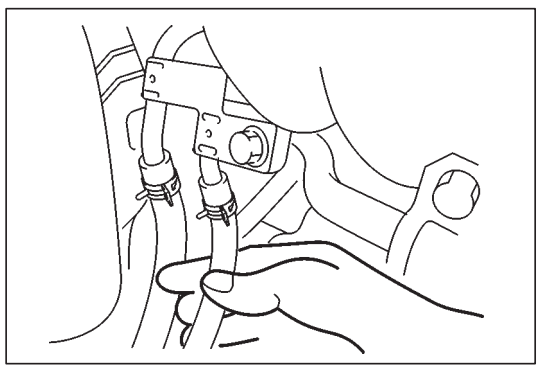
FUEL PUMP

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. Then fuel pump operating sound be heard from fuel filler for about 3 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 "ENGINE DIAGNOSIS" section.



2) Fuel pressure should be felt at fuel return hose for 3 seconds after ignition switch ON.
   If fuel pressure is not felt, advance to "Diagnostic Flow Table B-3" in "ENGINE DIAGNOSIS" section.

Removal

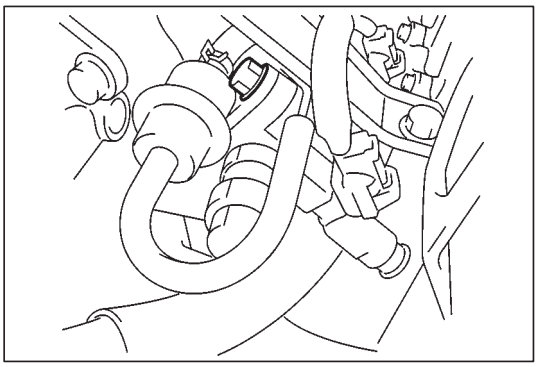
1) Remove fuel tank from body according to procedure described in Section 6C and remove fuel pump from fuel tank.

Inspection

Check fuel pump filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel tank.

Installation

1) Install fuel pump to its bracket.
2) Install fuel pump to fuel tank and then install fuel tank to body according to procedure described in “Fuel System” section.



FUEL PRESSURE REGULATOR

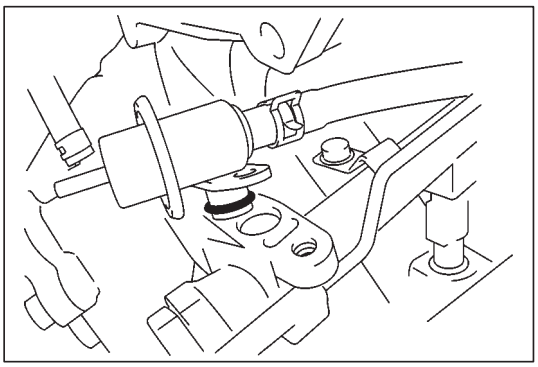
Removal

1) Relieve fuel pressure according to procedure described on p. 6-4.
2) Disconnect battery negative cable from battery.
3) Disconnect vacuum hose from fuel pressure regulator.

4) Remove fuel pressure regulator from fuel delivery pipe.

CAUTION:
A small amount of fuel may be released when it is from delivery pipe.
Place a shop cloth under delivery pipe so that released fuel is absorbed in it.

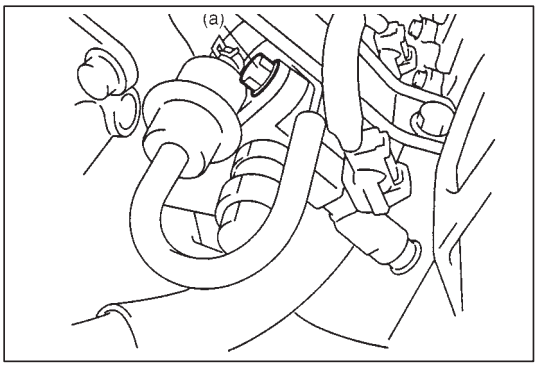
5) Disconnect fuel return hose from fuel pressure regulator.



Installation

For installation, reverse removal procedure and note following precautions.

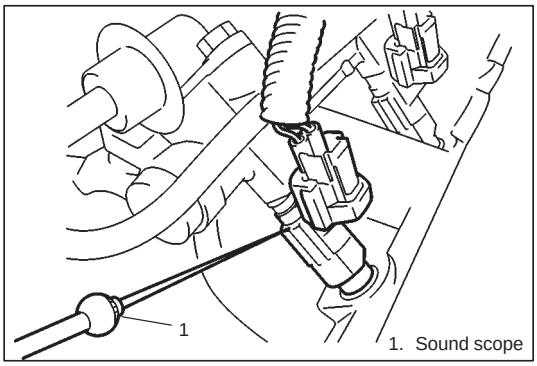
- Use new O-ring.
- Apply thin coat of gasoline to O-ring to facilitate installation.



- Tighten fuel pressure regulator bolts to specified torque.

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

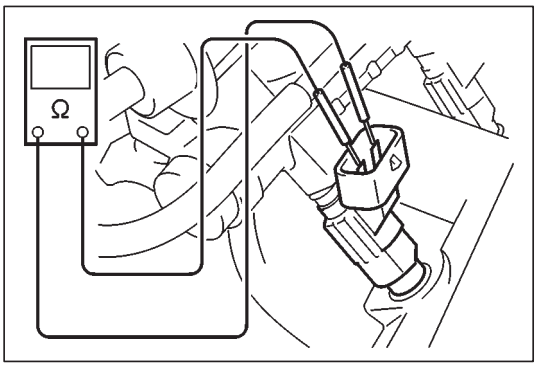
- With engine “OFF” and ignition switch “ON”, check for fuel leaks around fuel line connection.



FUEL INJECTOR

On-Vehicle Inspection

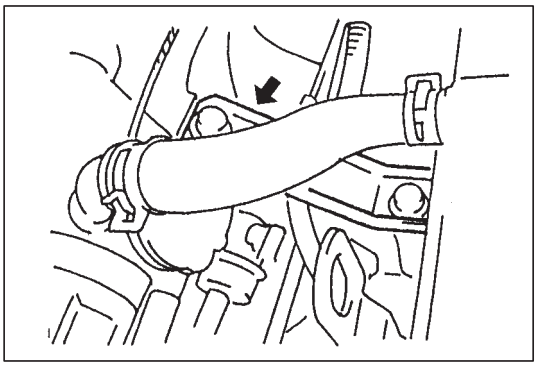
1) Using sound scope or such, check operating sound of injector when engine is running or cranking.
   Cycle of operating sound should vary according to engine speed.
   If no sound or an unusual sound is heard, check injector circuit (wire or coupler) or injector.



2) Disconnect coupler from injector, connect ohmmeter between terminals of injector and check resistance.

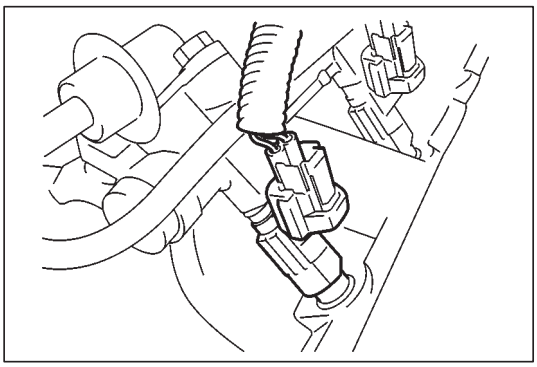
   Resistance of injector: 13 – 16 Ω at 20°C, 68 °F

   If resistance is out of specification, replace.
3) Connect coupler to injector securely.

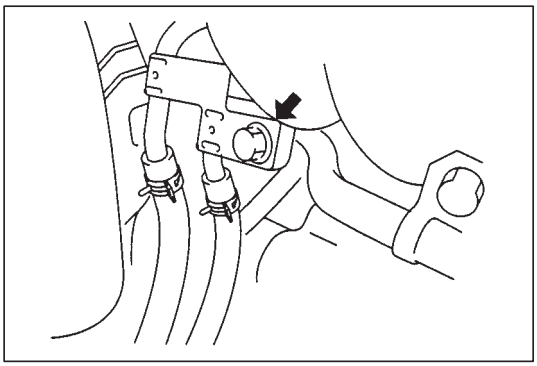


Removal

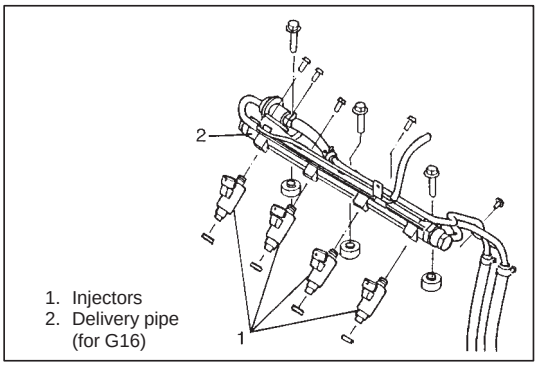
1) Relieve fuel pressure according to procedure described on p. 6-4.
2) Disconnect battery negative cable at battery.
3) Detach intake manifold stiffener (front) from intake manifold (for G16 engine).
   Remove PCV hose and breather hose (for J20 engine).



4) Disconnect coupler from each injector.



5) Remove clamp bolt for fuel feed pipe and return pipe.



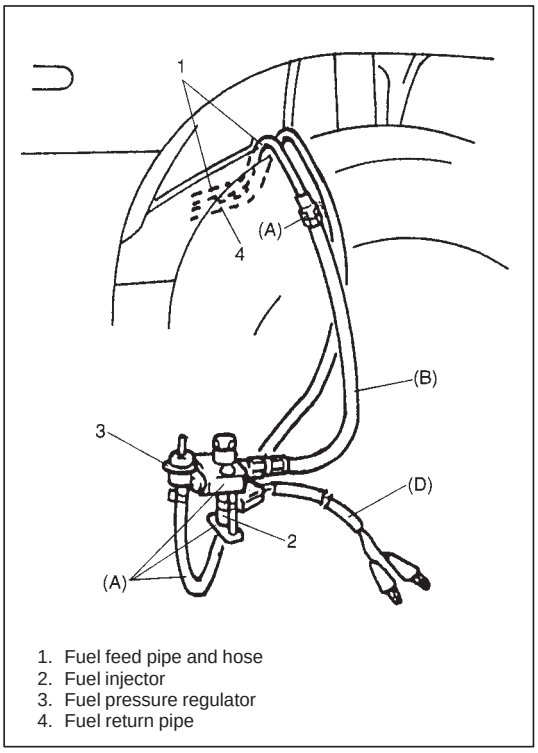
1. Injectors
2. Delivery pipe (for G16)

6) Remove fuel delivery pipe bolts.
7) Remove fuel injector(s) from delivery pipe and intake manifold or cylinder head.

WARNING:
A small amount of fuel may be released when fuel injector is removed. In order to reduce the chance of personal injury, cover than with a shop cloth.

Inspection

WARNING:
As fuel is injected in this inspection, perform in a well ventilated area and away from open flames.
Use special care to prevent sparking when connecting and disconnecting test lead to and from battery.



1. Fuel feed pipe and hose
2. Fuel injector
3. Fuel pressure regulator
4. Fuel return pipe

1) Install injector and fuel pressure regulator to special tool (injector checking tool).

Special Tool
(A): 09912-58421

2) Connect special tools (hoses and attachment) to hose and pipe of vehicle.

Special Tool
(B): 09912-58431

3) Connect special tool (test lead) to injector.

Special Tool
(D): 09930-88530

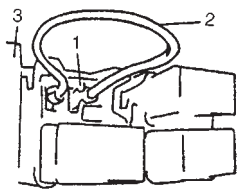
When using SUZUKI scan tool:

1. Fuel pump relay connector
2. Service wire
3. Junction (Fuse) box

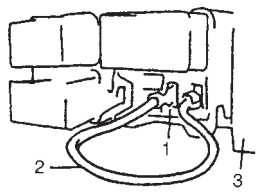
When not using SUZUKI scan tool:

[A]: LH steering vehicle (canvas top)
[B]: RH steering vehicle (canvas top)
[C]: LH steering vehicle (hard top)
[D]: RH steering vehicle (hard top)

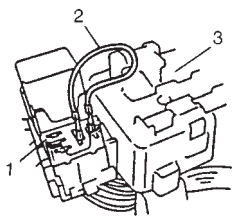
[A]



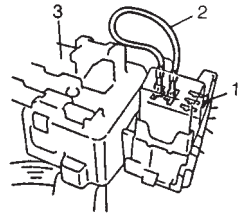
[B]

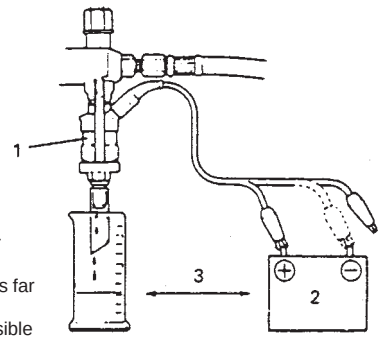


[C]



[D]





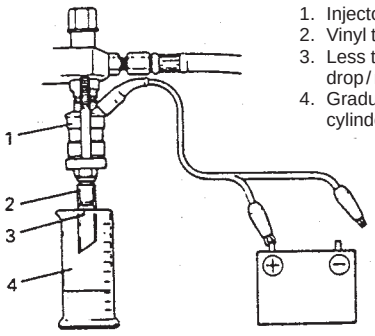
1. Injector
2. Battery
3. Keep as far apart as possible

4) Install suitable vinyl tube onto injector nozzle to prevent fuel from splashing out when injecting.
5) Put graduated cylinder under injector as shown.
6) Operate fuel pump and apply fuel pressure to injector as follows:
   When SUZUKI scan tool can be used:
   (1) Connect SUZUKI scan tool to DLC with ignition switch OFF.
   (2) Turn ignition switch ON, clear DTC and select "MISC TEST" mode on SUZUKI scan tool.
   (3) Turn fuel pump ON by using SUZUKI scan tool.
   When not using SUZUKI scan tool:
   (1) Remove fuel pump relay from connector.
   (2) Connect two terminals of relay connector using service wire as shown in figure.

CAUTION:
Check to make sure that connection is made between correct terminals. Wrong connection can cause damage to ECM (PCM), wire harness, etc.

   (3) Turn ignition switch ON.
7) 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.

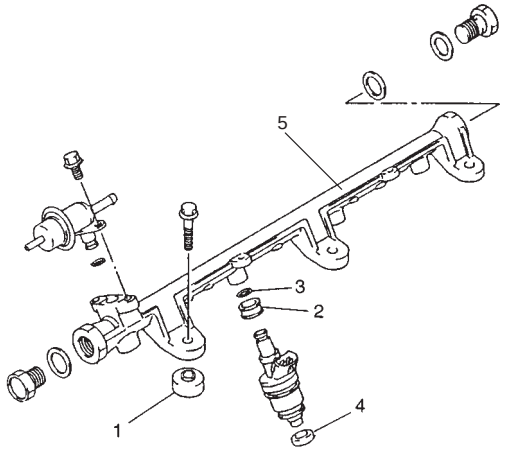
Injected fuel volume:
42 – 52 cc/15 sec. (1.42/1.48 – 1.75/1.83 US/Imp. oz/15 sec.) for G16 engine.
55 – 62 cc/15 sec. (1.94/2.09 – 2.18/2.36 US/Imp. oz/15 sec.) for J20 engine.



1. Injector
2. Vinyl tube
3. Less than one fuel drop/min.
4. Graduated cylinder

8) Check fuel leakage from injector nozzle. Do not operate injector for this check (but fuel pump should be at work).
   If fuel leaks more than following specifications, replace.

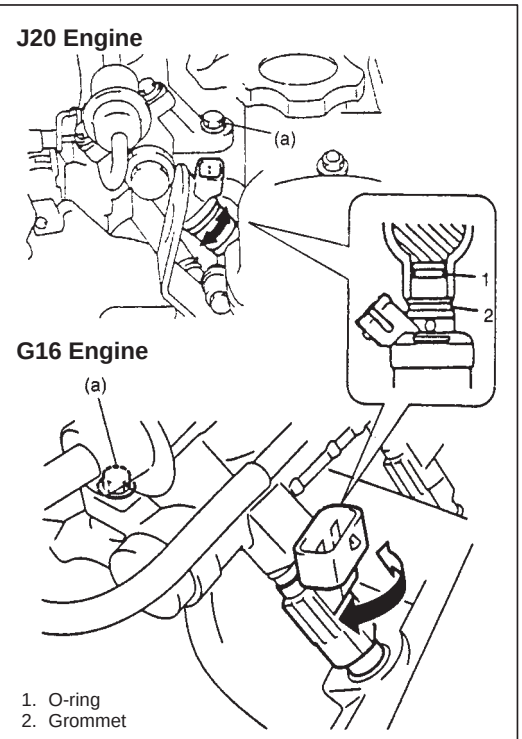
Fuel leakage: Less than 1 drop/min.



1. Insulator
2. Grommet
3. O-ring
4. Cushion
5. Delivery pipe (for J20)

Installation

1) Replace injector O-ring with new one using care not to damage it. Install grommet to injector.
2) Check if insulator is scored or damaged. If it is, replace with new one.
   Install insulators and cushions to intake manifold or cylinder head.



1. O-ring
2. Grommet

3) Apply thin coat of fuel to O-rings and then install injectors into delivery pipe and intake manifold or cylinder head.
   Make sure that injectors rotate smoothly. If not, probable cause is incorrect installation of O-ring. Replace O-ring with new one.
4) Tighten delivery pipe bolts and make sure that injectors rotate smoothly.

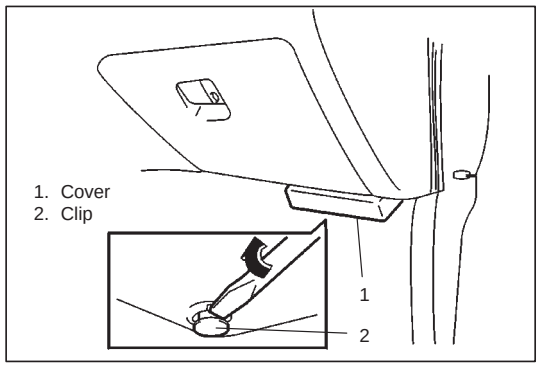
   Tightening Torque
   (a): 23 N·m (2.3 kg-m, 17.0 lb-ft)

5) Connect couplers to injectors securely.
6) Install intake manifold stiffener (front) to intake manifold (for G16 engine).
   Install PCV hose and breather hose and clamp then securely (for J20 engine).
7) Install clamp bolts for fuel feed pipe and return pipe.
8) Connect battery negative cable.
9) With engine “OFF” and ignition switch “ON”, check for fuel leaks around fuel line connection.

ELECTRONIC CONTROL SYSTEM

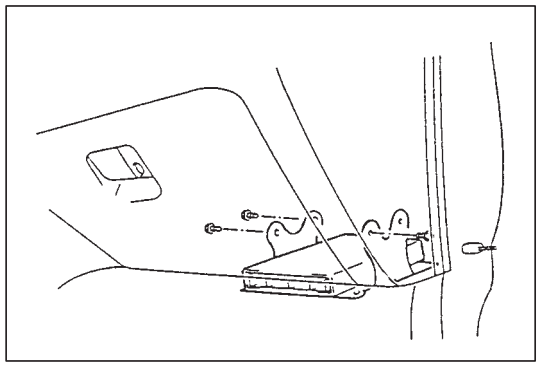
ENGINE CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE (PCM)

CAUTION:
As ECM/PCM consists of precision parts, be careful not to expose it to excessive shock.



Removal

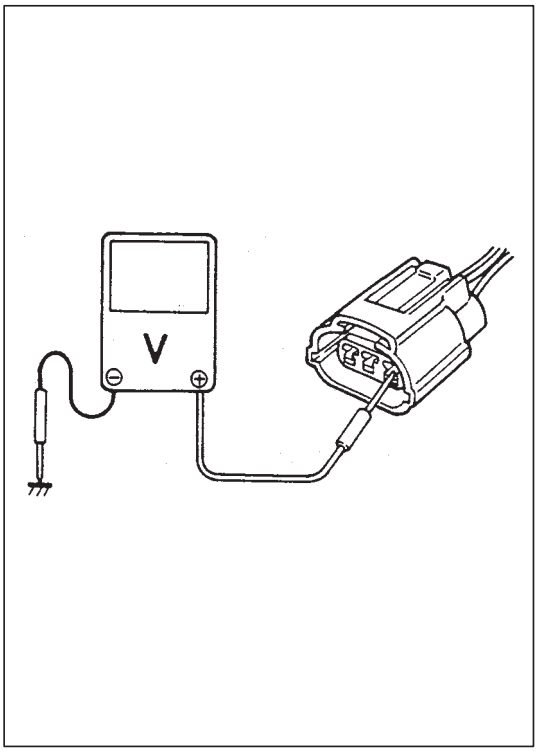
1) Disconnect battery negative cable from battery.
2) Disable air bag system (if equipped) referring to “Disabling the Air Bag System” in “Air Bag System” section.
3) Remove ECM/PCM cover from bracket.



4) Disconnect connectors from ECM/PCM.
5) Remove ECM/PCM with bracket.

Installation

1) Install ECM/PCM with bracket to vehicle.
2) Connect connectors to ECM/PCM securely.
3) Install ECM/PCM cover to bracket.
4) Enable air bag system (if equipped) referring to “Enabling Air Bag System” in “Air Bag System” section.
5) Connect negative cable to battery.



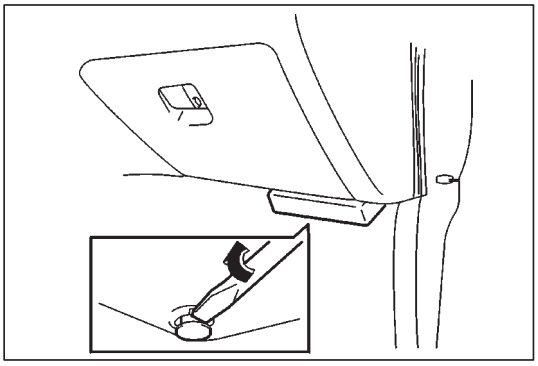
MASS AIR FLOW SENSOR (MAF SENSOR)

Inspection

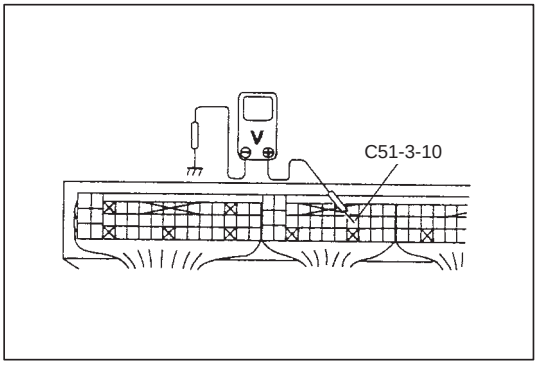
NOTE:

Use voltmeter with high-impedance (10 kΩ/V minimum) or digital type voltmeter.

1) Connect voltmeter to "B +" terminal of MAF sensor coupler disconnected and ground.
2) Turn ignition switch ON and check that voltage is battery voltage.
   If not, check if wire harness is open or connection is poor.



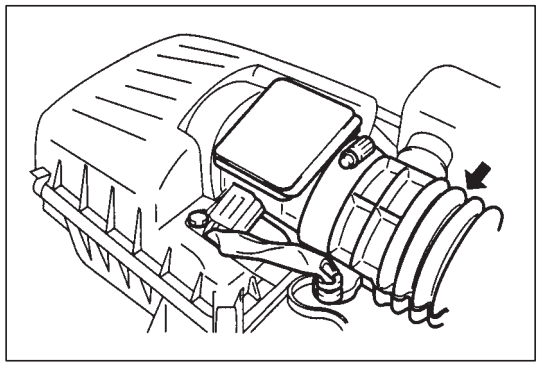
3) Turn ignition switch OFF and remove ECM/PCM cover from bracket.



4) Connect MAF sensor coupler to MAF sensor.
5) Turn ignition switch ON and check voltage at MAF sensor output terminal.

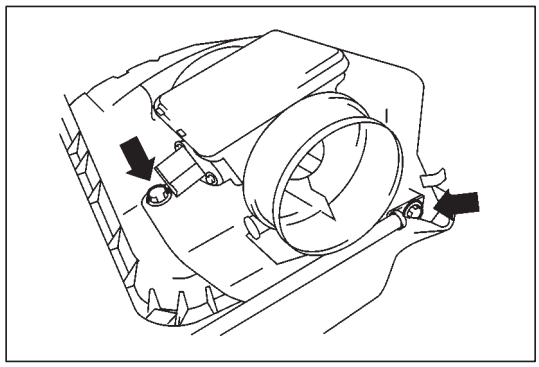
   Voltage: 1.0 – 1.6 V

6) Start engine and check that voltage is lower than 5 V and it rises as engine speed increases.
   (Reference data: 1.7 – 2.0 V at specified idle speed)
   If check result is not as specified above, cause may lie in wire harness, coupler connection, MAF sensor or ECM/PCM.



Removal

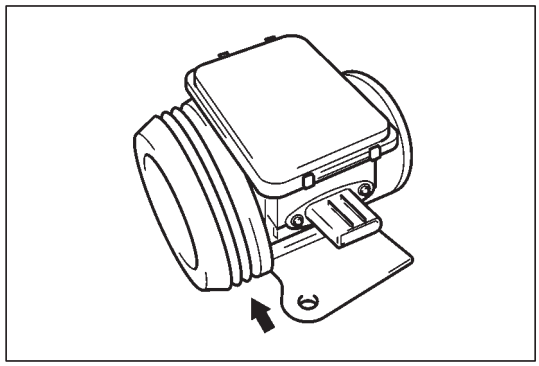
1) Disconnect negative cable at battery and coupler from MAF sensor.
2) Remove air cleaner outlet hose from throttle body and MAF sensor.



3) Remove MAF sensor from air cleaner case.

NOTE:
Don't disassemble MAF sensor.

CAUTION:
- **Do not expose MAF sensor to any shock.**
- **Do not blow compressed air by using air gun or the like.**
- **Do not put finger or any other object into MAF sensor. Malfunction may occur.**



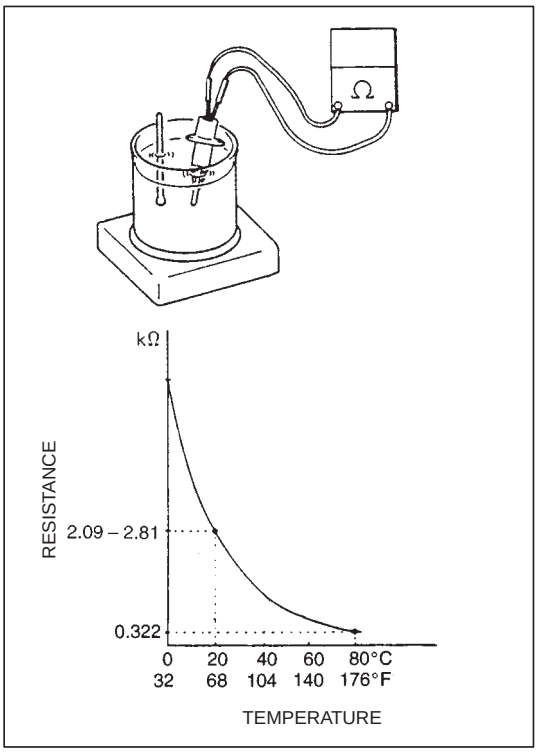
Installation

1) Check MAF sensor seal for deterioration and damage.
2) Install MAF sensor to air cleaner case.
3) Install air cleaner outlet hose.
4) Connect MAF sensor coupler securely.
5) Connect battery negative cable to battery.

INTAKE AIR TEMPERATURE (IAT) SENSOR

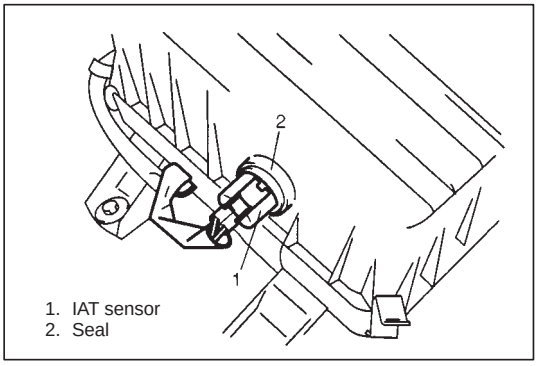
Removal

1) Disconnect negative cable from battery.
2) Disconnect IAT sensor coupler.
3) Remove IAT sensor from air cleaner case.



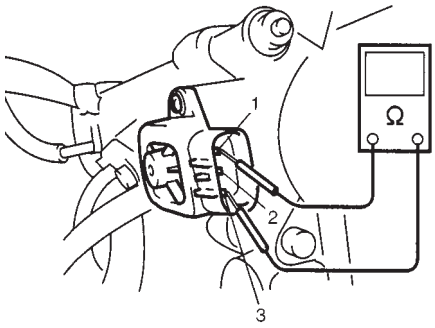
Inspection

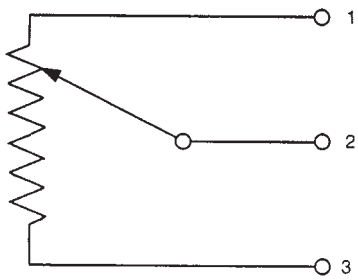
Immerse temperature sensing part of IAT sensor in water (or ice) and measure resistance between sensor terminals while heating water gradually.
If measured resistance doesn't show such characteristic as shown in figure, replace IAT sensor.



Installation

1) Clean mating surface of sensor and seal on air cleaner case.
2) Install IAT sensor into seal.
3) Connect connector to IAT sensor securely.





1. Ground terminal
2. Output voltage terminal
3. Reference voltage terminal

THROTTLE POSITION SENSOR (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.

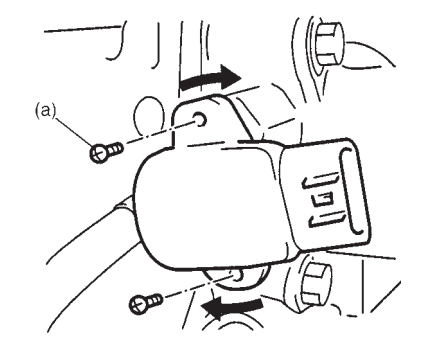
TERMINALS	RESISTANCE
Between 1 and 3 terminals	4.0 – 6.0 kΩ
Between 1 and 2 terminals	0.02 – 6.0 kΩ , varying linearly according to throttle valve opening

If check result is not satisfactory, replace TP sensor.

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.

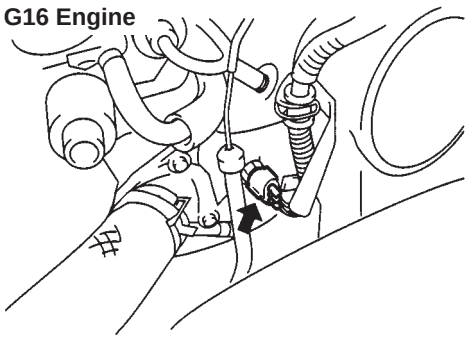


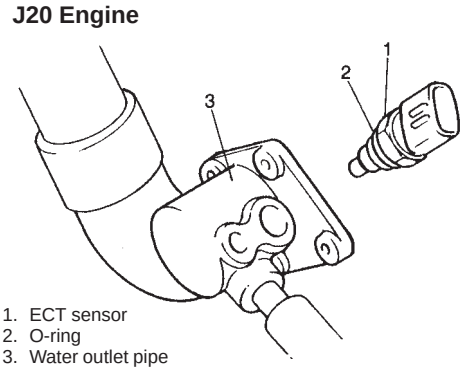
Installation

1) Install TP sensor to throttle body.
   Fit TP sensor to throttle body in such way that its holes are a little away from TP sensor screw holes as shown in left figure and turn TP sensor clockwise so that those holes align.

   Tightening Torque
   (a): 3.5 N·m (0.35 kg-m, 2.5 lb-ft)

2) Connect coupler to TP sensor securely.
3) Connect battery negative cable to battery.



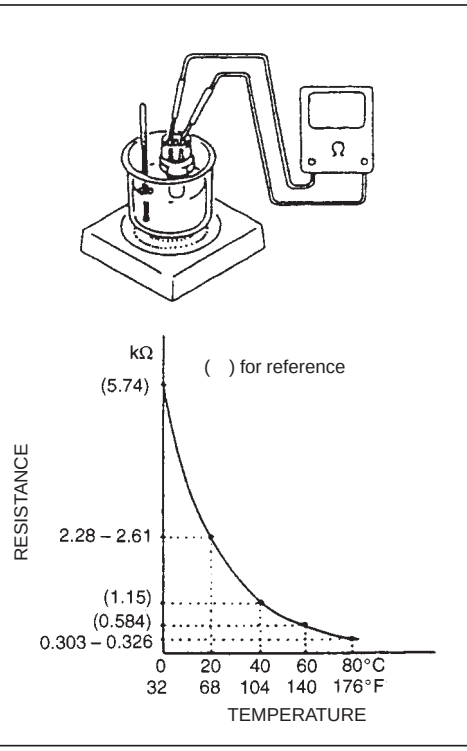


1. ECT sensor
2. O-ring
3. Water outlet pipe

ENGINE COOLANT TEMPERATURE SENSOR (ECT SENSOR)

Removal

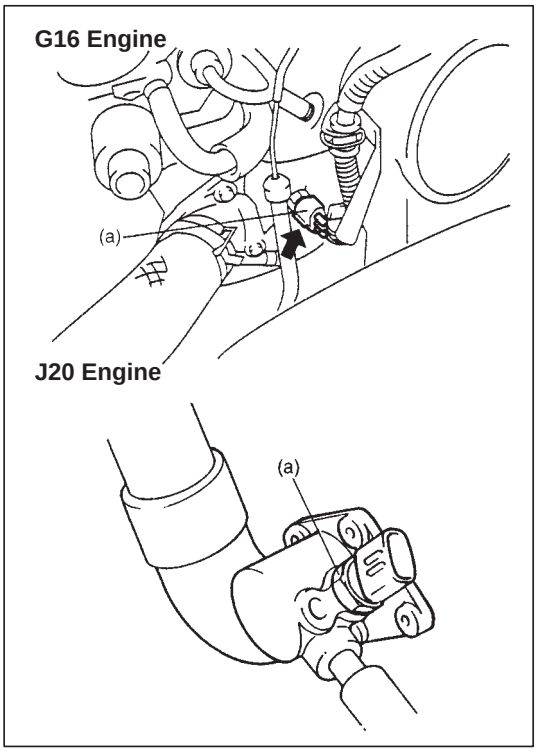
1) Disconnect negative cable from battery.
2) Drain cooling system.
3) Disconnect coupler from ECT sensor.
4) Remove ECT sensor from intake manifold or water outlet cap.



Inspection

Immerse temperature sensing part of ECT sensor in water and measure resistance between sensor terminals while heating water gradually.

If measured resistance doesn't shown such characteristic as shown, replace ECT sensor.



Installation

Reverse removal procedure noting the following.

- Clean mating surfaces of sensor and intake manifold.
- Check O-ring for damage and replace if necessary.
- Tighten ECT sensor to specified torque.

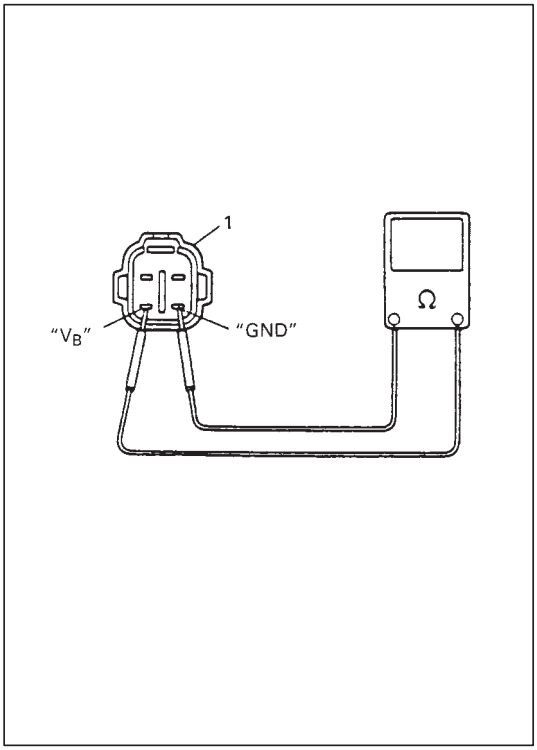
Tightening Torque
(a): 15 N·m (1.5 kg-m, 11.0 lb-ft)

- Connect coupler to sensor securely.
- Refill cooling system.

HEATED OXYGEN SENSOR-1 and -2 (HO2S-1 and HO2S-2)

Oxygen Sensor-1 Inspection

Inspect oxygen sensor and its circuit referring to "DTC P0130 Diag. Flow Table" in "Engine Diagnosis" section. If malfunction is found, replace.



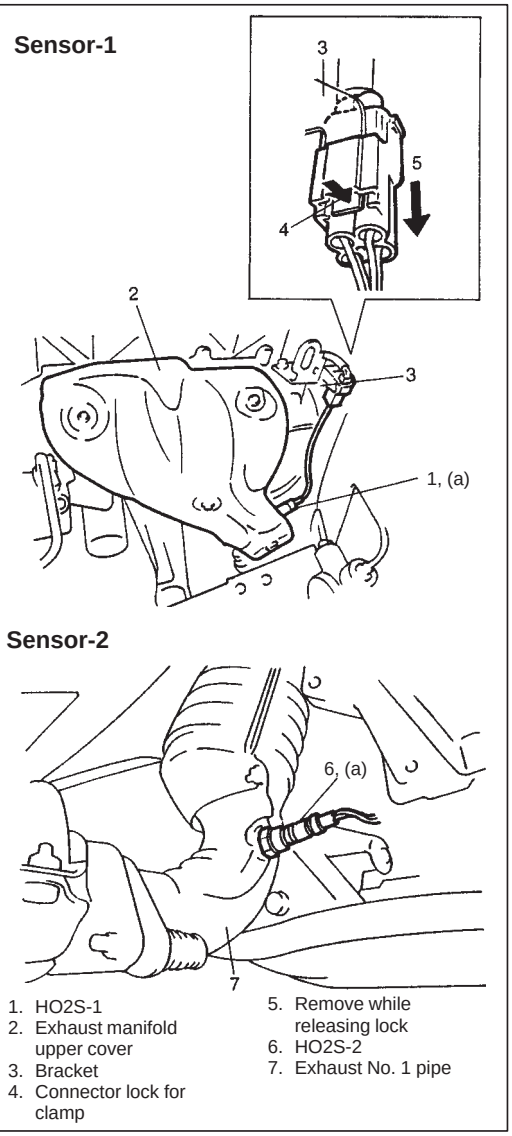
Oxygen Sensor Heater Inspection (Sensor-1 and -2)

1) Disconnect oxygen sensor coupler (1).
2) Using ohmmeter, measure resistance between terminals "V_B" and "GND" of sensor coupler.

   NOTE:
   Temperature of sensor affects resistance value largely. Make sure that sensor heater is at correct temperature.

   Resistance of oxygen sensor heater:
   11.7 – 14.3 Ω (at 20°C, 68°F) for HO2S-2
   4.5 – 5.7 Ω (at 20°C, 68°F) for HO2S-1

   If found faulty, replace oxygen sensor.
3) Connect oxygen sensor coupler securely.



1. HO2S-1
2. Exhaust manifold upper cover
3. Bracket
4. Connector lock for clamp
5. Remove while releasing lock
6. HO2S-2
7. Exhaust No. 1 pipe

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 from battery.
2) Remove connector from bracket and disconnect coupler of oxygen sensor.
3) Remove exhaust manifold upper cover if necessary.
4) Hoist vehicle when removing sensor-2.
5) Remove oxygen sensor from exhaust manifold or exhaust pipe.

CAUTION:
Be careful not to expose it to excessive shock.
It may cause damage to sensor inside.

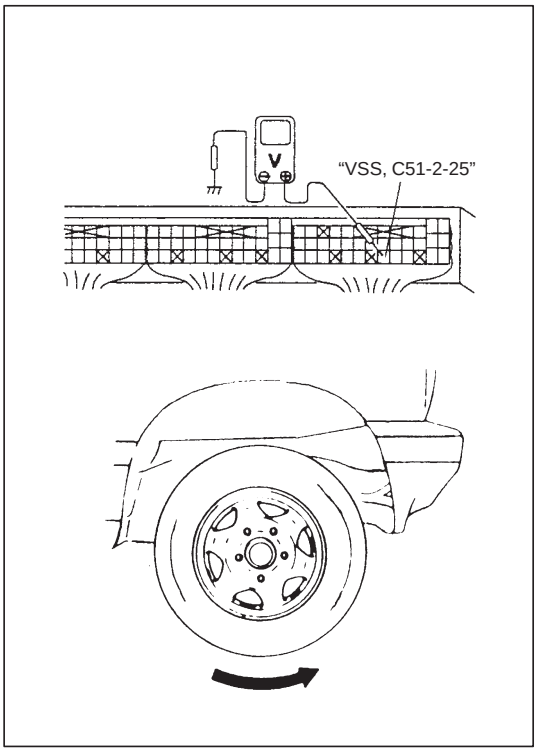
Installation

Reverse removal procedure noting the following.

- Tighten oxygen sensor to specified torque.

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

- Connect coupler of oxygen sensor and fit connector to bracket.
- After installing oxygen sensor, start engine and check that no exhaust gas leakage exists.



VEHICLE SPEED SENSOR (VSS)

On-Vehicle Inspection

1) Hoist vehicle.
2) Release parking brake lever, set transmission in neutral and transfer in "2H".
3) Remove ECM/PCM cover.
4) Connector voltmeter between VSS terminal of ECM/PCM connector and body ground.
5) Turn ignition switch ON and turn rear right tire slowly with rear left tire locked.
   Voltmeter should indicate deflection between 0 – 1 V and 8 – 14 V a few times while tire is turned one revolution.
   If check result is not satisfactory, proceed to Step 2 of "DTC P0500 (No.24) Diag. Flow Table" in "Engine Diagnosis" section.

CAMSHAFT POSITION SENSOR (CMP SENSOR)

On-Vehicle Inspection

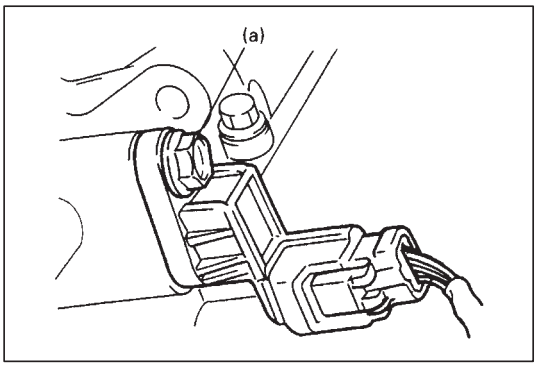
Check CMP sensor and its circuits referring to flow table of diagnostic trouble code P0340 in "Engine Diagnosis" section.
If malfunction is found, replace.

Removal and Installation (J20 Engine)

Refer to "CMP Sensor Removal/Installation" in Section 6F2.

Removal (G16 Engine)

1) Disconnect negative cable from battery.
2) Disconnect connector from CMP sensor.
3) Remove CMP sensor from sensor case.

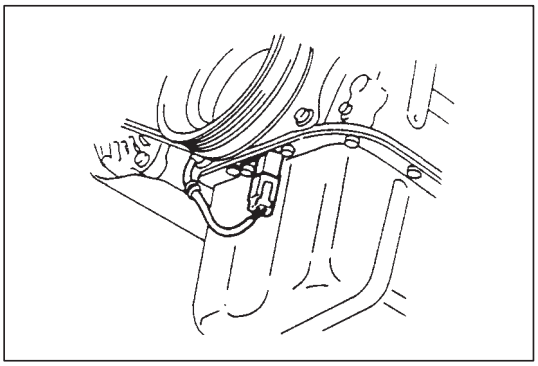


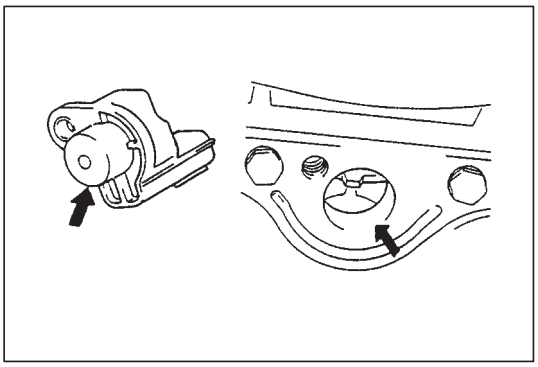
Installation (G16 Engine)

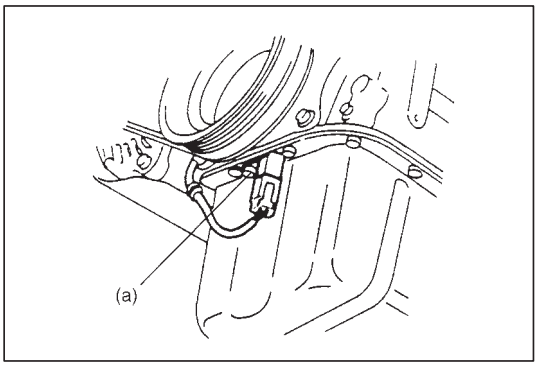
1) Check that O-ring is free from damage.
2) Check that CMP sensor and signal rotor tooth are free from any metal particles and damage.
3) Install CMP sensor to sensor case.

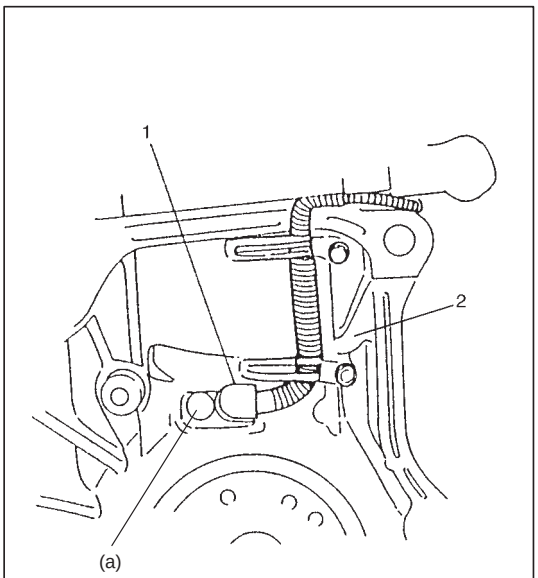
   Tightening Torque
   (a): 9 N·m (0.9 kg-m, 6.5 lb-ft)

4) Connect connector to it securely.
5) Connect negative cable to battery.









1. Crankshaft position sensor
2. Cylinder block

CRANKSHAFT POSITION SENSOR (G16 Engine)

Inspection

Check crankshaft position sensor referring to Steps 2 and 3 of DTC P0335 Diag. Flow Table in “Engine Diagnosis” section. If malfunction is found, replace.

Removal

1) Hoist vehicle.
2) Disconnect connector from crankshaft position sensor.
3) Remove crankshaft position sensor from oil pan.

Installation

1) Check to make sure that crankshaft position sensor and pulley tooth is free from any metal particles and damage.
2) Install crankshaft position sensor to oil pan.

   Tightening Torque
   (a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

   CAUTION:
   Be sure to tighten to specified torque. CKP sensor will be deformed if overtightened and correct CKP sensor signal will not be fed if loosened.

3) Connect connector to it securely.

CRANKSHAFT POSITION SENSOR (J20 Engine)

Inspection

Check crankshaft position sensor referring to Steps 2 and 3 of DTC P0335 Diag. Flow Table in “Engine Diagnosis” section. If malfunction is found, replace.

Removal

1) Remove transmission from vehicle and then remove flywheel or drive plate from crankshaft.
2) Disconnect connector from crankshaft position sensor.
3) Remove crankshaft position sensor from cylinder block.

Installation

Reverse removal procedure noting the following.

- Check to make sure that crankshaft position sensor is free from any metal particles and damage.
- Apply engine oil to O-ring of sensor.
- Install crankshaft position sensor to cylinder block.

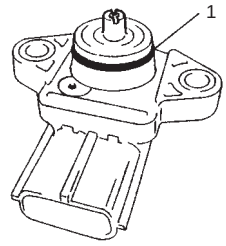
  Tightening Torque
  (a): 6 N·m (0.6 kg-m, 4.5 lb-ft)

- Connect connector and fix wire harness with clamp securely.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

Removal

1) Disconnect negative cable at battery.
2) Disconnect connector from MAP sensor.
3) Remove MAP sensor from intake manifold.



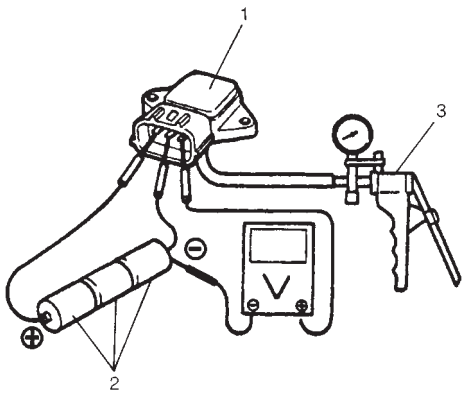
1. O-ring

Inspection

1) Check vacuum passage on intake manifold, and vacuum passage for clog. Clean if clogged.

CAUTION:
Do not put wires into air vent hole for cleaning.
It causes damage in sensor.

2) Check sensor O-ring for damage and deterioration.
   Replace as necessary.



1. MAP sensor
2. 1.5 V battery
   (4.5 – 5.5 V in total)
3. Vacuum pump

3) Arrange 3 new 1.5 V batteries in series and connect its positive terminal to “Vin” terminal of coupler and negative terminal to “Ground” terminal. Then check voltage between “Vout” and “Ground”.
   Also, check if voltage reduces when vacuum is slowly applied up to 400 mmHg by using vacuum pump.

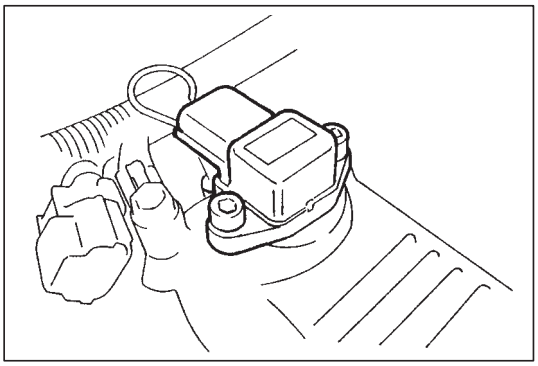
CAUTION:
As connection to wrong terminal will cause damage to MAP sensor, make absolutely sure to connect properly as shown in left figure.

Output voltage (When sensor input voltage is 4.5 – 5.5 V, ambient temp. 20 – 30°C, 68 – 86°F)

ALTITUDE (Reference)		BAROMETRIC PRESSURE		OUTPUT VOLTAGE
(ft)	(m)	(mmHg)	(kPa)	(V)
0 | 2 000	0 | 610	760 | 707	100 | 94	3.3 – 4.3
2 001 | 5 000	611 | 1 524	Under 707 over 634	94 | 85	3.0 – 4.1
5 001 | 8 000	1 525 | 2 438	Under 634 over 567	85 | 76	2.7 – 3.7
8 001 | 10 000	2 439 | 3 048	Under 567 over 526	76 | 70	2.5 – 3.3

If check result is not satisfactory, replace MAP sensor.

4) Install MAP sensor securely.
5) Connect MAP sensor coupler securely.



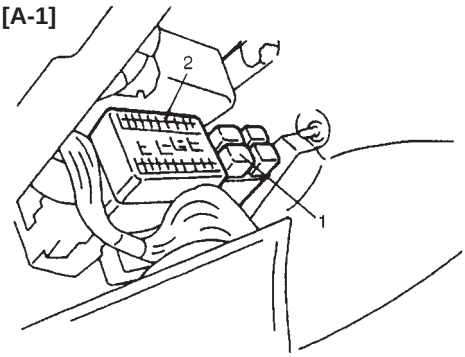
Installation

1) Confirm that vacuum passage on intake manifold is free from clog.
2) Apply engine oil to O-ring of sensor.
3) Install sensor to intake manifold.
4) Connect connector to sensor securely.

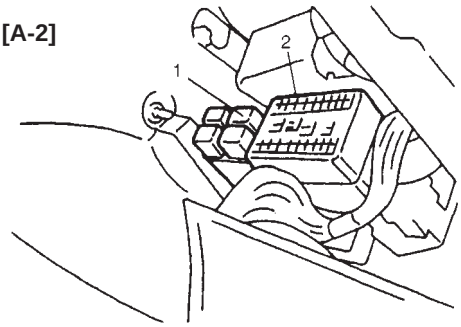
FUEL LEVEL SENSOR (SENDER GAUGE)

Refer to Section 8C.

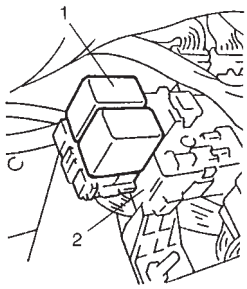
[A-1]



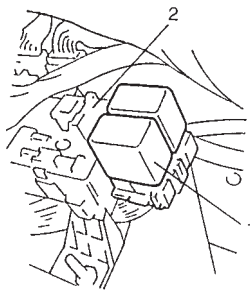
[A-2]



[B-1]



[B-2]



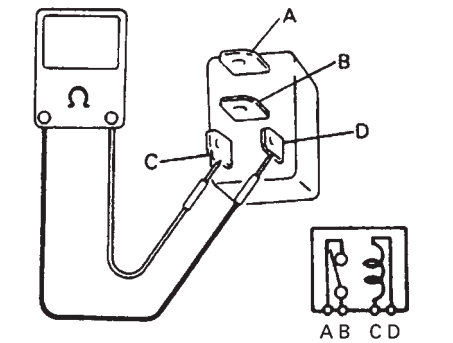
1. Main relay
2. Junction (Fuse) box

[A-1]: Left-hand steering hard top model
[A-2]: Right-hand steering hard top model
[B-1]: Left-hand steering canvas top model
[B-2]: Right-hand steering canvas top model

MAIN RELAY

Inspection

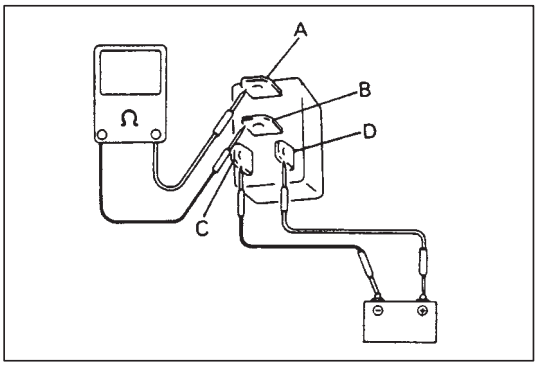
1) Disconnect negative cable at battery.
2) Remove main relay (1) from connector.



3) Check resistance between each two terminals as in table below.

TERMINALS		RESISTANCE	
Between A and B		∞ (Infinity)	
Between C and D	CANVAS TOP	79 – 95	at 20°C, 68°F
	HARD TOP	70 – 110	

If check results are as specified, proceed to next operation check. If not, replace.



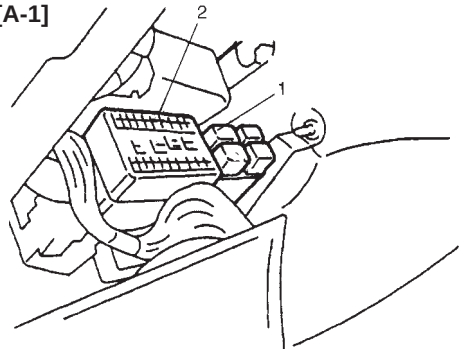
4) Check that there is continuity between terminals “A” and “B” when battery is connected to terminals “C” and “D”.
   If malfunction is found, replace.

FUEL PUMP RELAY

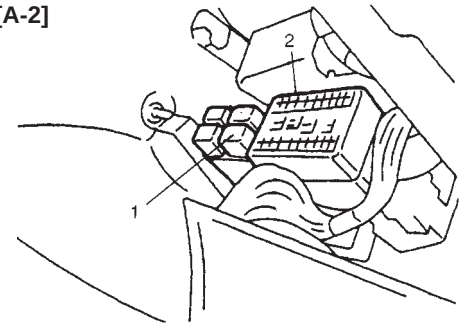
Inspection

1) Disconnect negative cable at battery.
2) Remove fuel pump relay (1) from connector.
3) Structure of fuel pump relay is the same as that of main relay. Check its resistance and operation using the same procedure as that for main relay.
   If malfunction is found, replace.

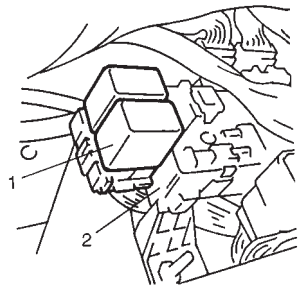
[A-1]



[A-2]

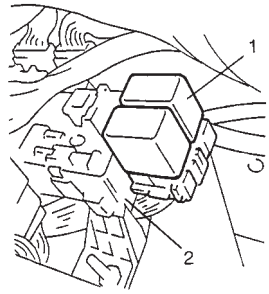


[B-1]

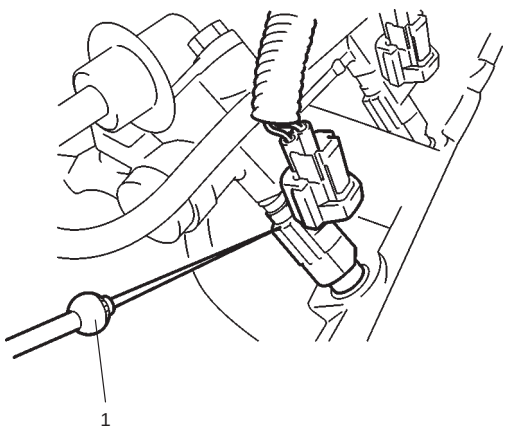


[B-2]

1. Fuel pump relay
2. Junction (Fuse) box



[A-1]: Left-hand steering hard top model
[A-2]: Right-hand steering hard top model
[B-1]: Left-hand steering canvas top model
[B-2]: Right-hand steering canvas top model



1. Sound scope

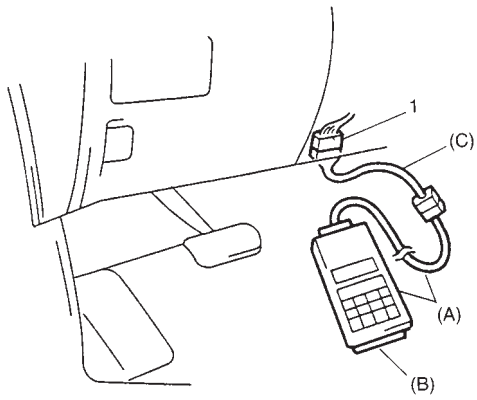
FUEL CUT OPERATION

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 by using sound scope 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.



1. Data link connector

EMISSION CONTROL SYSTEM

EGR SYSTEM

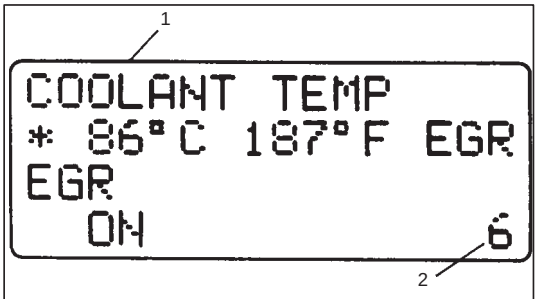
System Inspection [Using SUZUKI scan tool (Tech 1)]

1) Connect Tech 1 to data link connector (DLC) with ignition switch OFF.

Special tool
(A): SUZUKI scan tool, Tech 1
(B): Mass storage cartridge
(C): 16/14 pin DLC cable (OBD-II adapter cable)

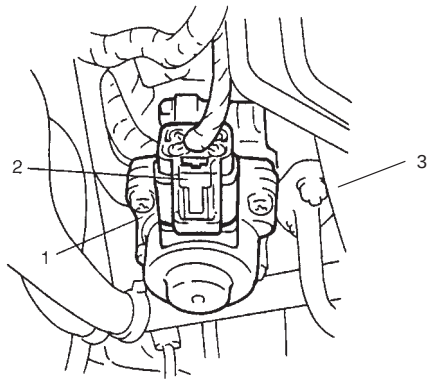
NOTE:
For operation procedure of cartridge, refer to its cartridge operator's manual.

2) Start engine and warm up it to normal operating temperature.



1. Tech 1 display
2. EGR valve opening (0: Close, 100: Full Open)

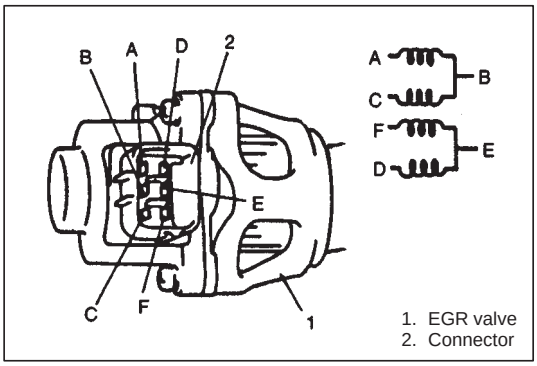
3) With engine idling (without depressing accelerator pedal), open EGR valve by using "MISC. TEST" mode.
In this state, according as EGR valve opening increases engine idle speed drops. If not, possible cause is clogged EGR gas passage, stuck or faulty EGR valve.



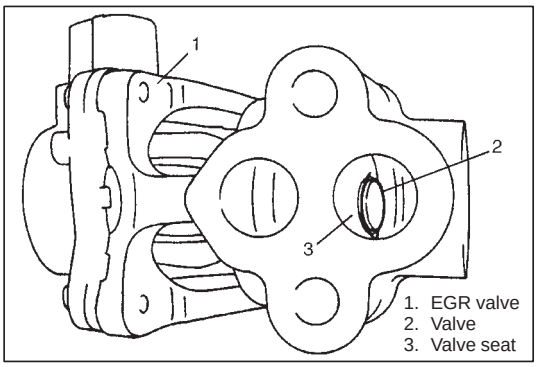
1. EGR valve
2. EGR valve coupler
3. Intake manifold

Removal

1) Disconnect negative cable at battery.
2) Disconnect EGR valve coupler.
3) Remove EGR valve and gasket from intake manifold.

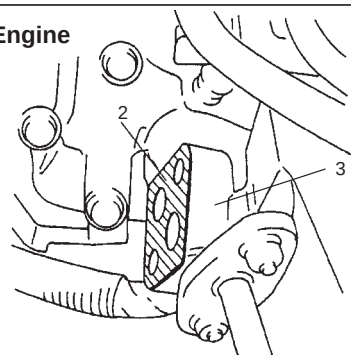


1. EGR valve
2. Connector

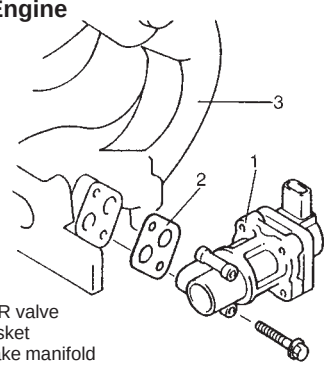


1. EGR valve
2. Valve
3. Valve seat

G16 Engine



J20 Engine



1. EGR valve
2. Gasket
3. Intake manifold

Inspection

1) Check resistance between following terminals of EGR valve in each pair.

TERMINALS	STANDARD RESISTANCE
A – B C – B F – E D – E	20 – 24 Ω at 20°C, 68°F
B – valve body E – valve body	Infinity (∞)

If found faulty, replace EGR valve assembly

2) Remove carbon from EGR valve gas passage.

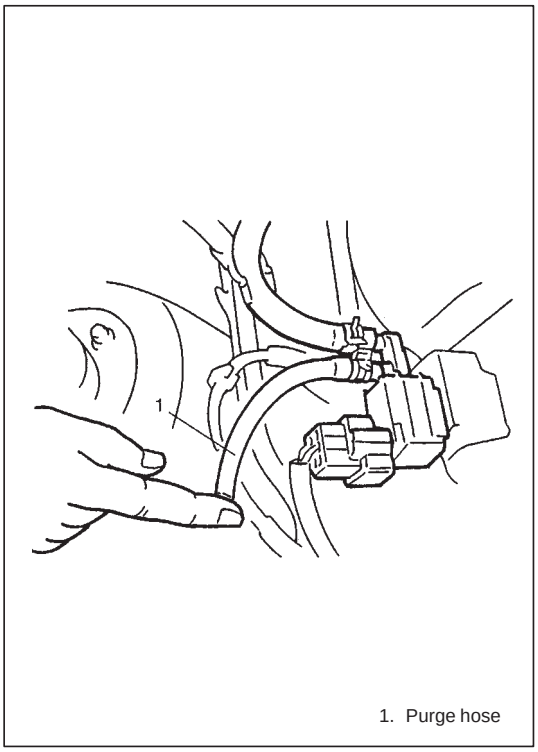
NOTE:
Do not use any sharp–edged tool to remove carbon.
Be careful not to damage or bend EGR valve, valve seat and rod.

3) Inspect valve, 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 gasket.



1. Purge hose

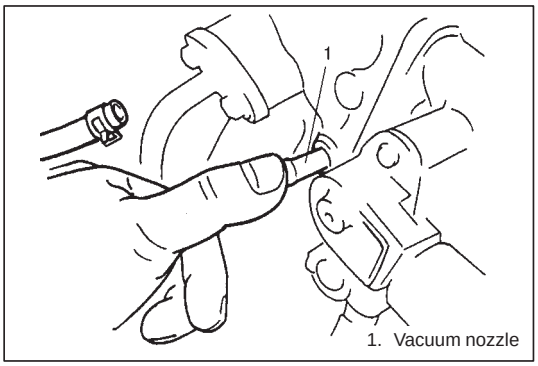
EVAPORATIVE EMISSION CONTROL SYSTEM

Evap Canister Purge System Check

1) Warm up engine to normal operating temperature.
2) Stop engine and hoist vehicle so that all wheels rotate freely.
3) Start engine, release parking brake lever, set transfer in "2H" and M/T in "5th" or A/T in "D".

WARNING:
Make sure that transfer is set to "2H" range position for this check. If it is set to "4H" or "4L" position, front wheel turn at high speed and a very dangerous situation may occur.

4) Disconnect purge hose from EVAP canister.
5) Place finger against the end of disconnected hose and check that vacuum is not felt there when engine is running at idle speed.
6) Also check that vacuum is felt when throttle valve is opened and vehicle speed (speedometer indication) is higher than 40 km/h.



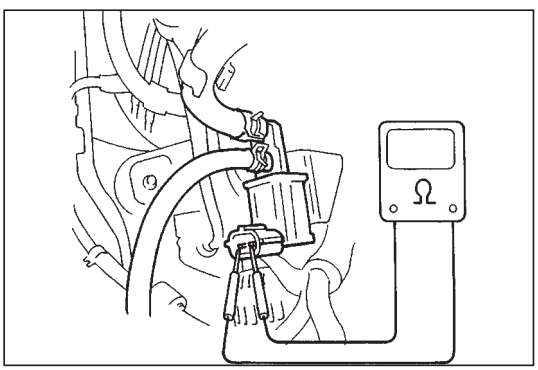
1. Vacuum nozzle

Vacuum Passage Inspection

Start engine and run it at idle speed. With finger placed against vacuum nozzle, check that vacuum is applied.
If it is not applied, clean vacuum passage by blowing compressed air.

Vacuum Hose Inspection

Check hoses for connection, leakage, clog and deterioration.
Replace as necessary.

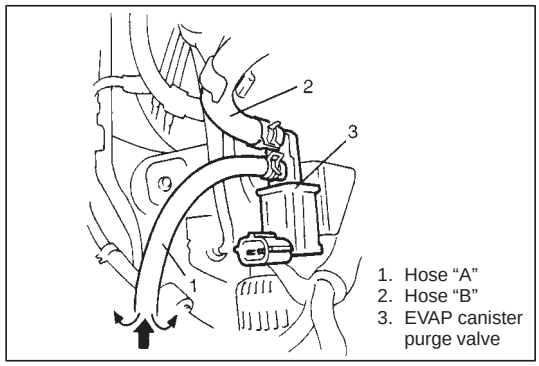


EVAP Canister Purge Valve Inspection

1) With ignition switch OFF, disconnect coupler from canister purge valve.
2) Check resistance between two terminals of EVAP canister purge valve.

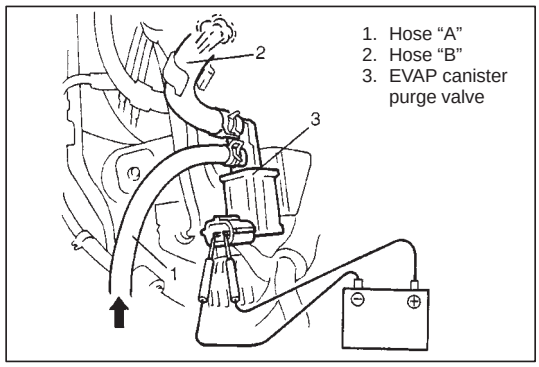
Resistance of EVAP canister purge valve:
28 – 35 Ω at 20°C (68°F)

If resistance is as specified, proceed to next operation check. If not, replace.



1. Hose “A”
2. Hose “B”
3. EVAP canister purge valve

3) Disconnect vacuum hoses from intake manifold and its EVAP canister.
4) With coupler disconnected, blow into hose “A”. Air should not come out of hose “B”.



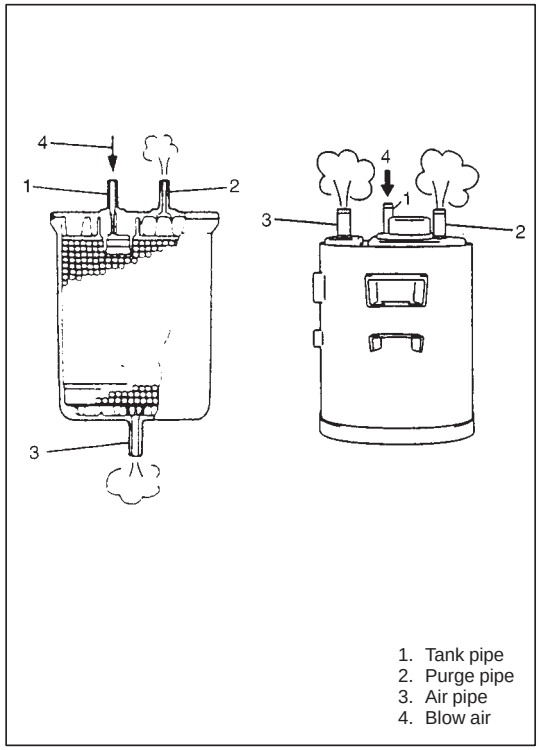
1. Hose “A”
2. Hose “B”
3. EVAP canister purge valve

5) Connect 12V-battery to EVAP canister purge valve terminals. In this state, blow hose “A”.
   Air should come out of hose “B”.

WARNING:
Do not suck the air through valve. Fuel vapor inside valve is harmful.

   If check result is not as described, replace EVAP canister purge valve.

6) Connect vacuum hoses.
7) Connect EVAP canister purge valve coupler securely.

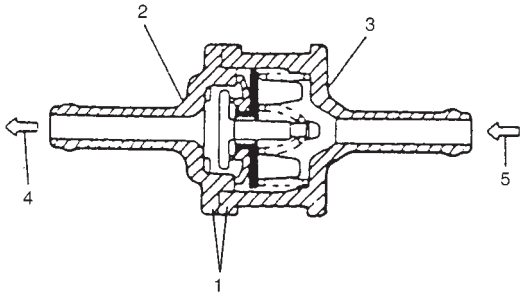


1. Tank pipe
2. Purge pipe
3. Air pipe
4. Blow air

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 and remove EVAP canister.
2) When air is blown into tank pipe, there should be no restriction of flow through purge pipe and air pipe.
   If operation differs from above description, EVAP canister must be replaced.
3) Install EVAP canister and connect hoses to canister.



1. Tank pressure control valve
2. Orange side
3. Black side
4. To canister
5. From fuel tank

Tank Pressure Control Valve Inspection

1) Remove tank pressure control valve installed around EVAP canister.
2) Air should pass through valve smoothly from fuel tank side (black side of tank pressure control valve) to orange side when blown hard.
3) From orange side, even when blown softly, air should come out of black side.
4) If air doesn't pass through valve in step 2) or hard blow is required in step 3), replace tank pressure control valve.

WARNING:
DO NOT SUCK air through tank pressure control valve. Fuel vapor inside the valve is harmful.

5) Install tank pressure control valve.

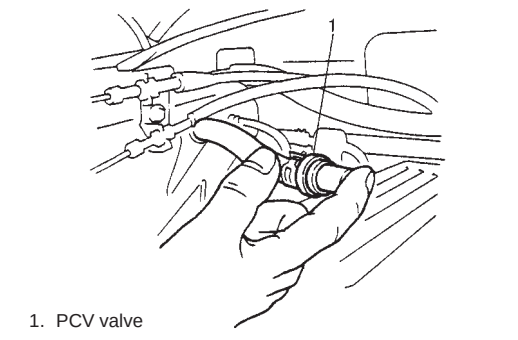
NOTE:
When connecting tank pressure control valve between hoses, refer to figure at the left for installing direction.

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.

PCV HOSE

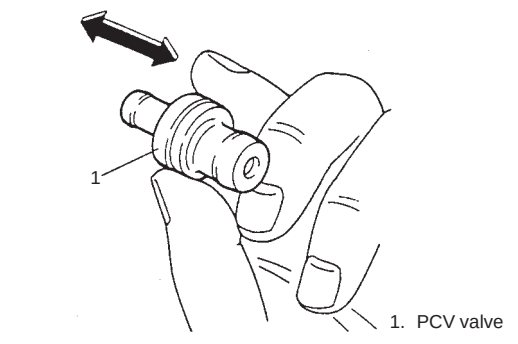
Check hoses for connection, leakage, clog, and deterioration. Replace as necessary.



1. PCV valve

PCV VALVE

1) Disconnect PCV valve from cylinder head cover and plug head cover hole.
2) Run engine at idle.
3) Place your finger over end of PCV valve to check for vacuum. If there is no vacuum, check for clogged valve. Replace as necessary.



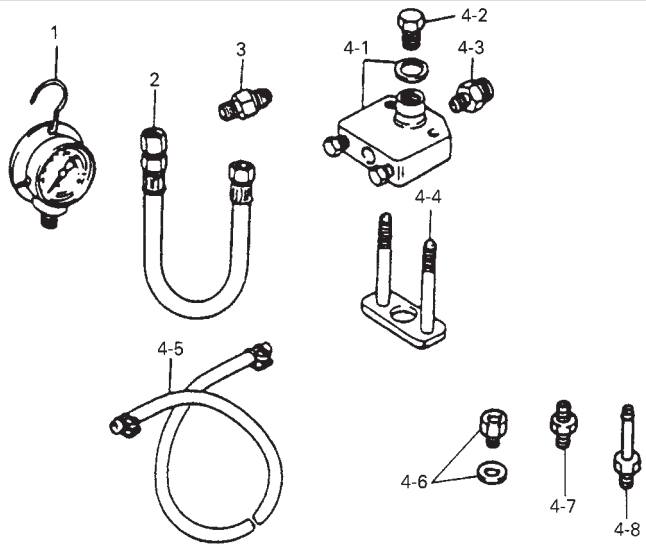
1. PCV valve

4) After checking vacuum, stop engine and remove PCV valve. Shake valve and listen for the rattle of check needle inside the valve. If valve does not rattle, replace valve.
5) After checking, connect PCV valve, PCV hose and clamp securely.

TIGHTENING TORQUE SPECIFICATIONS

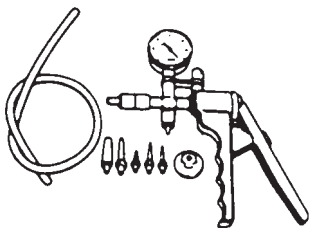
Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Delivery pipe plug bolt	30	3.0	22.0
Delivery pipe bolts	23	2.3	17.0
Camshaft position sensor bolt (G16 engine)	9	0.9	6.5
Heated oxygen sensor-1 and sensor-2	45	4.5	32.5
Fuel pressure regulator bolts	10	1.0	7.5
Engine coolant temp. (ECT) sensor	15	1.5	11.0
Crankshaft position sensor bolt (G16 engine)	10	1.0	7.5
Crankshaft position sensor bolt (J20 engine)	6	0.6	4.5

SPECIAL TOOLS

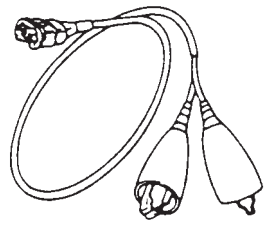


1. Pressure gauge 09912-58441
2. Pressure hose 09912-58431
3. Attachment 09919-46010
4. Checking tool set 09912-58421

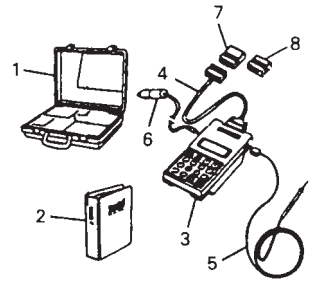
4-1. Tool body & washer
4-2. Body plug
4-3. Body attachment
4-4. Holder
4-5. Return hose & clamp
4-6. Body attachment-2 & washer
4-7. Hose attachment-1
4-8. Hose attachment-2



09917-47010
Vacuum pump gauge

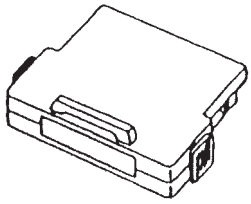


09930-88530
Injector test lead

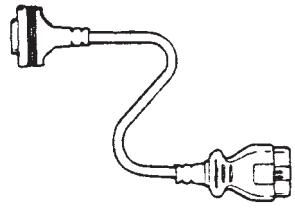


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self–test adaptor

09931-76011
Suzuki scan tool kit



Mass storage cartridge



09931-76030
16/14 pin DLC (OBD-II adapter) cable

SECTION 6E2

ENGINE AND EMISSION CONTROL SYSTEM (SEQUENTIAL MULTIPORT FUEL INJECTION FOR H25 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).**

NOTE:
Whether following systems (parts) are used in the particular vehicle or not depends on specifications. Be sure to bear this in mind when performing service work.

- **EGR valve**
- **Heated oxygen sensor(s) or CO adjusting resistor**
- **Three way catalytic converter(s)**
- **CKP sensor**
- **MAP sensor**
- **Monitor connector**

CONTENTS

GENERAL DESCRIPTION 6E2- 3
AIR INTAKE SYSTEM 6E2- 6
FUEL DELIVERY SYSTEM 6E2- 7
ELECTRONIC CONTROL SYSTEM 6E2- 8
ENGINE & EMISSION CONTROL INPUT/OUTPUT TABLE 6E2-12
ON-VEHICLE SERVICE 6E2-13
General 6E2-14
Accelerator Cable Adjustment 6E2-14
A/T Throttle Cable Adjustment 6E2-14
Idle Speed/Idle Air Control Duty Inspection 6E2-15
AIR INTAKE SYSTEM 6E2-18
Throttle Body 6E2-18
Idle Air Control Valve 6E2-21
FUEL DELIVERY SYSTEM 6E2-23
Fuel Pressure Inspection 6E2-23
Fuel Pump 6E2-24
Fuel Pressure Regulator 6E2-25
Fuel Injector 6E2-26
ELECTRONIC CONTROL SYSTEM 6E2-31
ECM (PCM) 6E2-31
MAF Sensor 6E2-32
IAT Sensor 6E2-34
TP Sensor 6E2-35
ECT Sensor 6E2-37
HO2S Sensor 1 . . . . . 6E2-38
HO2S Sensor 2 . . . . . 6E2-39

VSS 6E2-40
MAP Sensor 6E2-41
CKP Sensor 6E2-41
Main Relay 6E2-42
Fuel Pump Relay 6E2-43
Fuel Cut Operation 6E2-43
EMISSION CONTROL SYSTEM 6E2-44
EGR System (if equipped) 6E2-44
Evaporative Emission Control System 6E2-46
PCV System 6E2-46
TIGHTENING TORQUE SPECIFICATIONS 6E2-48
SPECIAL TOOLS 6E2-48

GENERAL DESCRIPTION

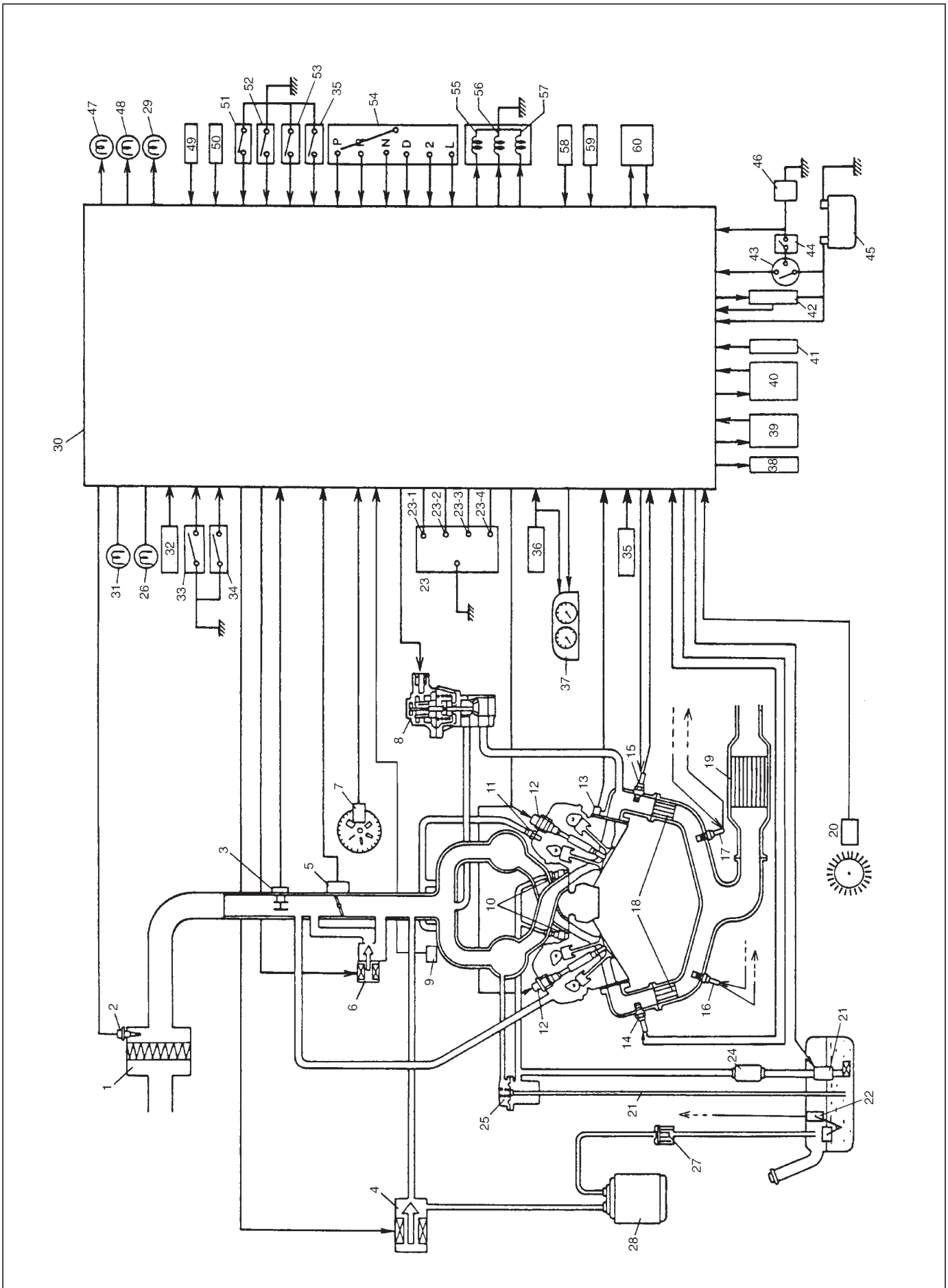
The engine and emission control system has 4 major sub-systems: air intake system, fuel delivery system, electronic control system and emission control system.

Air intake system includes air cleaner, mass air flow sensor, throttle body, idle air control 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.


P
R
N
D
2
L

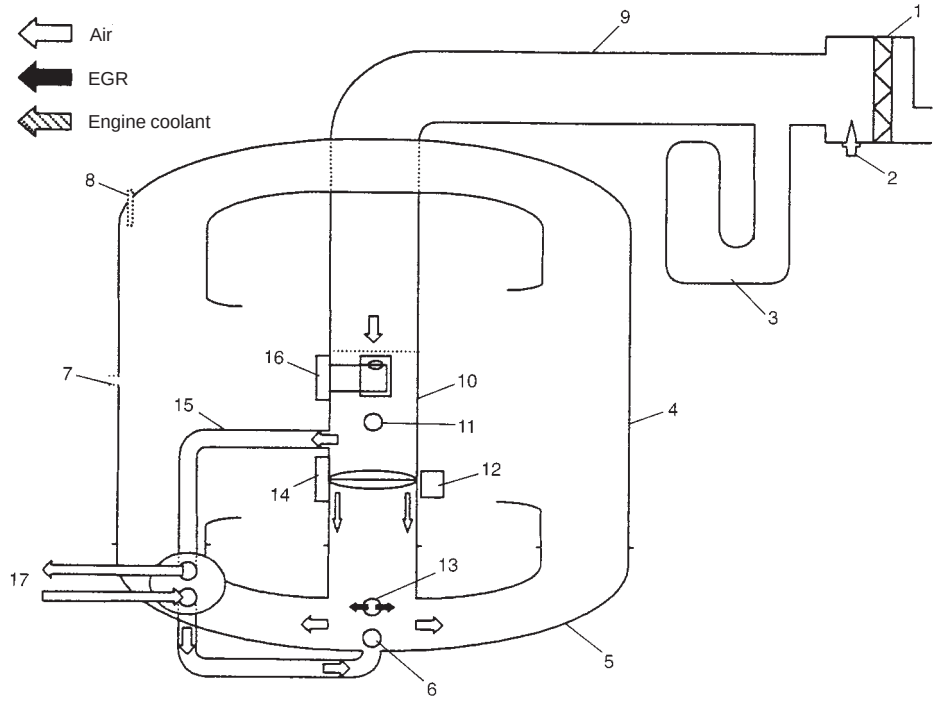
1. Air cleaner
2. Intake air temp. sensor
3. Mass air flow sensor
4. EVAP canister purge valve
5. Throttle position sensor
6. Idle air control valve
7. Camshaft position sensor
8. EGR valve (if equipped)
9. Manifold absolute pressure sensor (if equipped)
10. Fuel injector
11. PCV valve
12. Ignition coil assembly
13. Engine coolant temp. sensor
14. Heated oxygen sensor (bank 1 sensor 1) (if equipped)
15. Heated oxygen sensor (bank 2 sensor 1) (if equipped)
16. Heated oxygen sensor (bank 1 sensor 2) (if equipped)
17. Heated oxygen sensor (bank 2 sensor 2) (if equipped)
18. Warm-up three way catalytic converter (if equipped)
19. Three way catalytic converter (if equipped)
20. Crank shaft position sensor (if equipped)
21. Fuel pump
22. Fuel level sensor
23. Monitor connector (if equipped)
23-1. Diag. switch terminal
23-2. Test switch terminal
23-3. Output duty select switch terminal
23-4. Duty output terminal
24. Fuel filter
25. Fuel pressure regulator
26. Immobilizer indicator lamp (if equipped)
27. Tank pressure control valve
28. EVAP canister
29. 4WD lamp
30. ECM/PCM (Engine control module/Powertrain control module)
31. Malfunction indicator lamp
32. Electric load
    – Rear defogger (if equipped)
33. Power steering pressure switch (if equipped)
34. Heater blower fan switch
35. 4WD switch
36. Vehicle speed sensor
37. Combination meter
38. A/C condenser fan relay (if equipped)
39. A/C controller (if equipped)
40. Data link connector/Immobilizer control module (if equipped)
41. ABS control module (if equipped)
42. Main relay
43. Ignition switch
44. Park/Neutral position switch in TR switch (A/T)
45. Battery
46. Starter magnetic switch
47. "O/D OFF" lamp (A/T)
48. "POWER" lamp (A/T)
49. Lighting switch
50. Stop lamp switch (A/T)
51. O/D cut switch (A/T)
52. POWER/NORMAL change switch (A/T)
53. 4WD low switch (A/T)
54. Transmission range switch (A/T)
55. Solenoid valve A (A/T)
56. Solenoid valve B (A/T)
57. TCC solenoid valve (A/T)
58. A/T input speed sensor (A/T)
59. A/T vehicle (output) speed sensor (A/T)
60. 4WD actuator

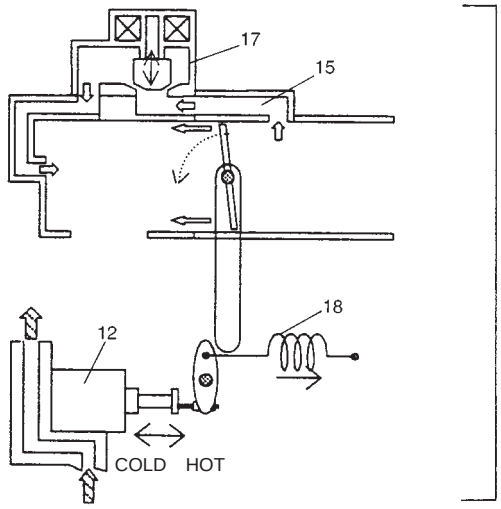
AIR INTAKE SYSTEM

The main components of the air intake system are air cleaner, mass air flow sensor, air cleaner intake air pipe, throttle body, intake collector, idle air control valve and intake manifold.

The air (by the amount corresponding to the throttle valve 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 idle air control 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.





IAC valve and fast idle control system

1. Air cleaner
2. IAT sensor
3. Resonator
4. Intake manifold
5. Intake collector
6. PCV hose
7. Brake booster
8. Fuel pressure regulator hose
9. Intake air pipe
10. Throttle body
11. Breather hose
12. Fast idle up thermo wax
13. EGR valve
14. TP sensor
15. IAC hose
16. MAF sensor
17. IAC valve
18. Spring

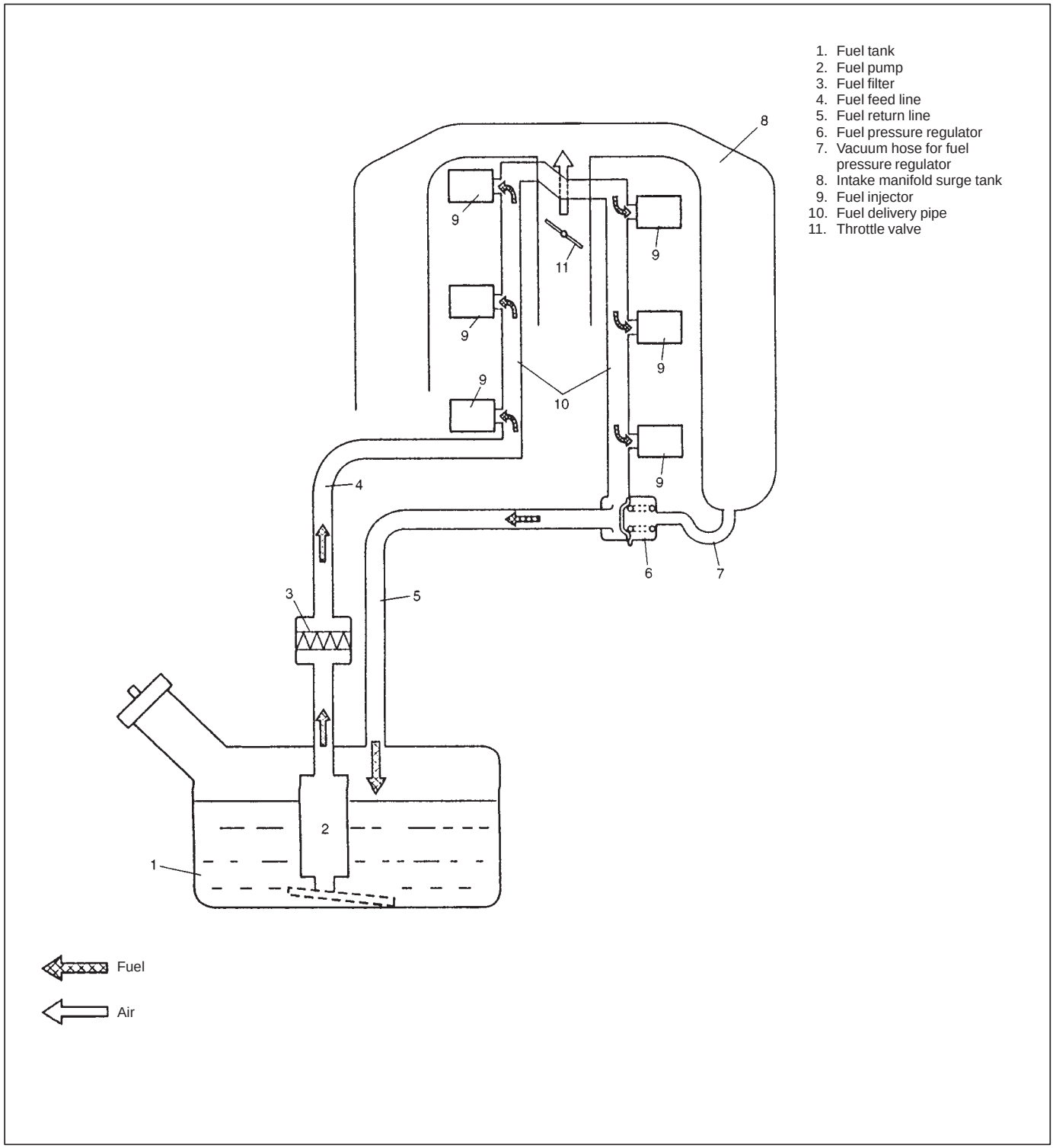
FUEL DELIVERY SYSTEM

The fuel delivery system consists of the fuel tank, fuel pump, fuel filter, 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 through the delivery pipe.

As the fuel pressure applied to the injector (the fuel pressure in the fuel feed line) is always kept a certain amount higher than the pressure in the intake manifold by the fuel pressure regulator, the fuel is injected into the intake port of the cylinder head when the injector opens according to the injection signal from ECM (PCM).

The fuel relieved by the fuel pressure regulator returns through the fuel return line to the fuel tank.

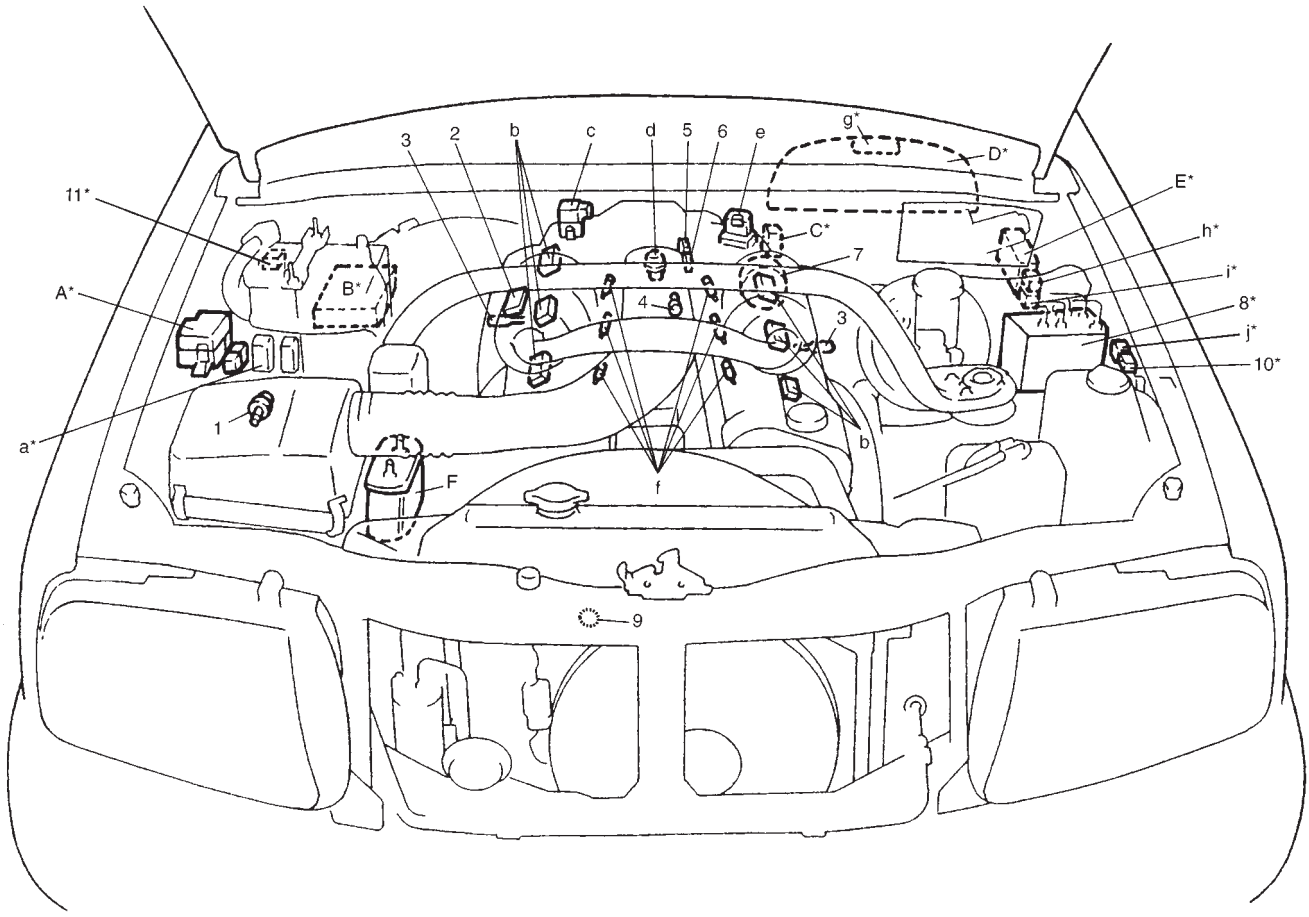


ELECTRONIC CONTROL SYSTEM

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
- Heated oxygen sensor heater control system (if equipped)
- Idle air control system
- Fuel pump control system
- Evaporative emission control system
- Ignition control system
- EGR system

Also, with A/T model, PCM controls A/T.

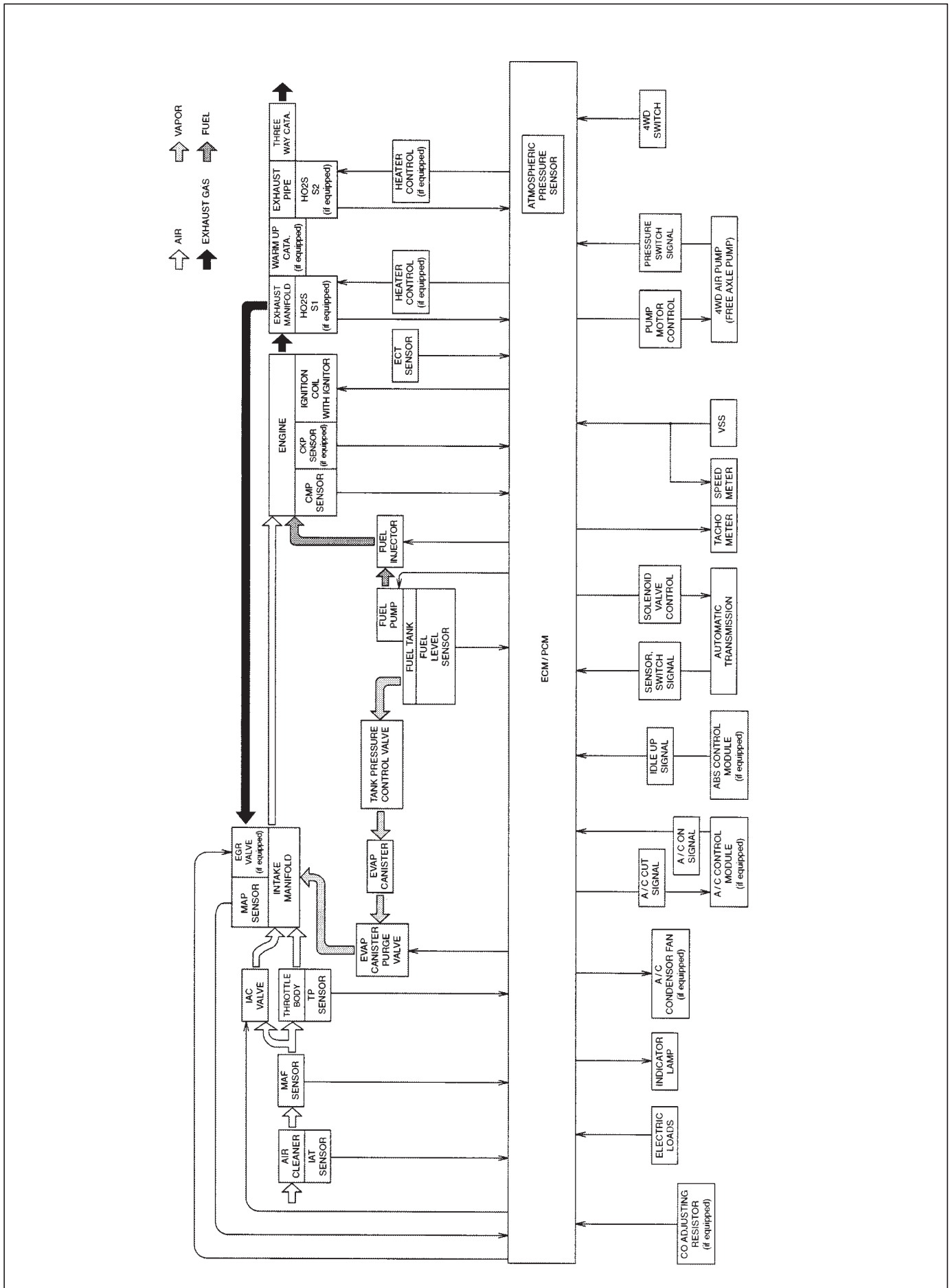


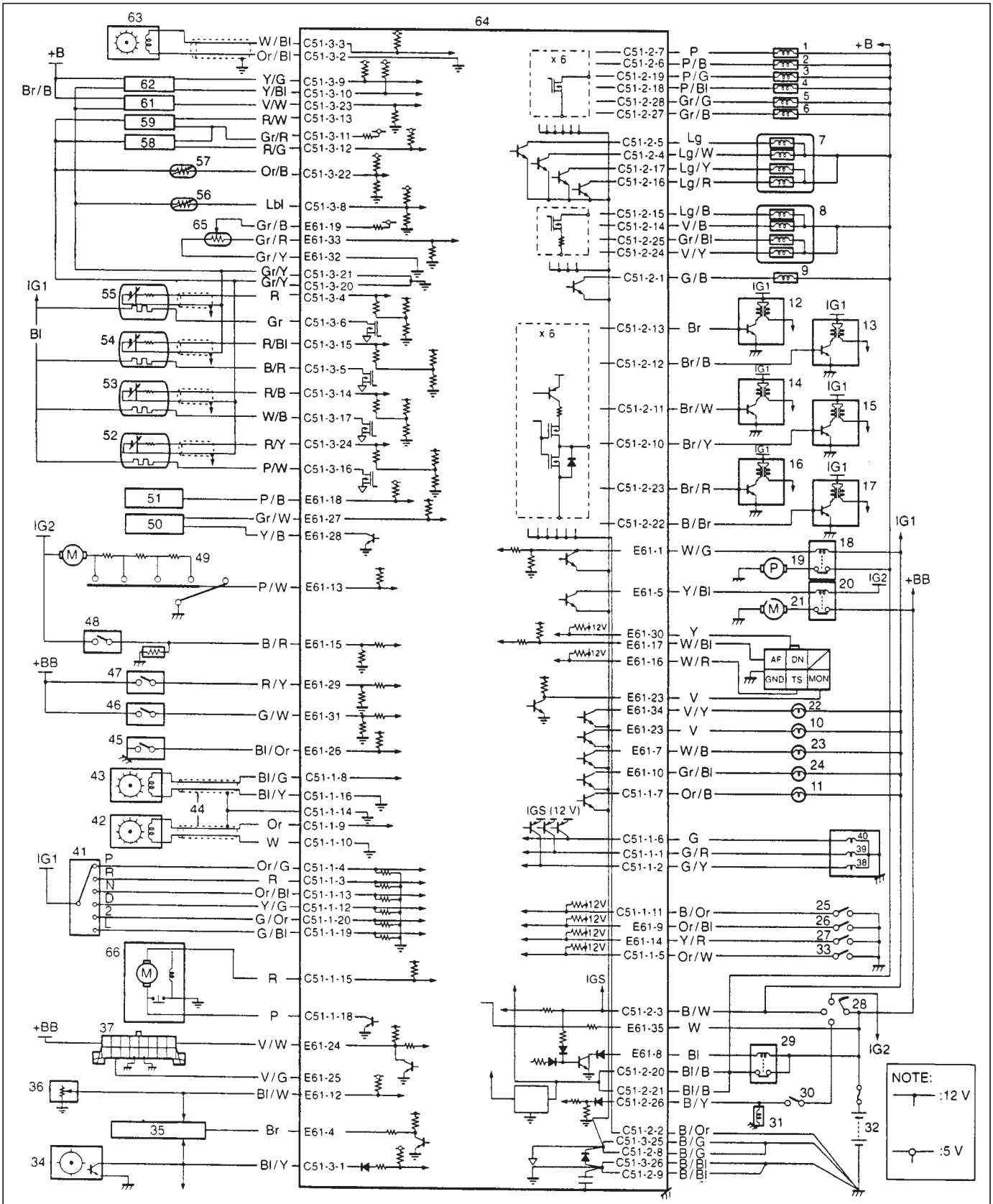
INFORMATION SENSORS
1. IAT sensor
2. MAP sensor (if equipped)
3. Heated oxygen sensor (sensor 1) (if equipped)
4. ECT sensor
5. TP sensor
6. MAF sensor
7. Camshaft position sensor (CMP sensor)
8. ABS control module (if equipped)
9. Crank shaft position sensor (CKP sensor) (if equipped)
10. Monitor connector (if equipped)
11. CO adjusting resistor (if equipped)

CONTROLLED DEVICES
- a : A/C condenser fan motor relay (if equipped)
- b : Ignition coil assemblies
- c : EVAP canister purge valve
- d : EGR valve (if equipped)
- e : Idle air control valve
- f : Injectors
- g : Malfunction indicator lamp
- h : Fuel pump relay
- i : Main relay
- j : Oxygen sensor heater relay (if equipped)

OTHERS
- A : Main fuse box
- B : ECM (PCM)
- C : Data link connector
- D : Combination meter
- E : Fuse box
- F : EVAP canister

NOTE:
Above figure shows left-hand steering vehicle. For right-hand steering vehicle, parts with (*) are installed at the other side.


AIR
EXHAUST GAS
VAPOR
FUEL
THREE WAY CATA.
EXHAUST PIPE
HO2S S2 (if equipped)
WARM UP CATA. (if equipped)
EXHAUST MANIFOLD
HO2S S1 (if equipped)
ENGINE
CMP SENSOR
CKP SENSOR (if equipped)
IGNITION COIL WITH IGNITOR
FUEL INJECTOR
FUEL PUMP
FUEL TANK
FUEL LEVEL SENSOR
TANK PRESSURE CONTROL VALVE
EVAP CANISTER
EVAP CANISTER PURGE VALVE
EGR VALVE (if equipped)
INTAKE MANIFOLD
MAP SENSOR
IAC VALVE
THROTTLE BODY
TP SENSOR
MAF SENSOR
AIR CLEANER
IAT SENSOR
CO ADJUSTING RESISTOR (if equipped)
ELECTRIC LOADS
INDICATOR LAMP
A/C CONDENSOR FAN (if equipped)
A/C CONTROL MODULE (if equipped)
A/C ON SIGNAL
A/C CUT SIGNAL
IDLE UP SIGNAL
ABS CONTROL MODULE (if equipped)
SENSOR, SWITCH SIGNAL
SOLENOID VALVE CONTROL
AUTOMATIC TRANSMISSION
TACHO METER
SPEED METER
VSS
PUMP MOTOR CONTROL
PRESSURE SWITCH SIGNAL
4WD AIR PUMP (FREE AXLE PUMP)
4WD SWITCH
ATMOSPHERIC PRESSURE SENSOR
HEATER CONTROL (if equipped)
HEATER CONTROL (if equipped)
ECT SENSOR
ECM / PCM



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

E61

8	7									2	1	
23	22	21	20	19	18	17	16	15	14	13	12	11	10	9
35	34		33	32	31	30		29	28	27	26		25	24

C51-3

6	5						3	2	1
17	16	15	14	13	12	11	10	9	8	7
26	25		24	23	22	21		20	19	18

C51-1

4	3					2	1
13	12	11	10	9	8	7	6	5
20	19		18	17	16		15	14

C51-2

7	6	5	4					3	2	1
19	18	17	16	15	14	13	12	11	10	9	8
28	27		26	25	24		23	22		21	20

1. Fuel injector No.1
2. Fuel injector No.2
3. Fuel injector No.3
4. Fuel injector No.4
5. Fuel injector No.5
6. Fuel injector No.6
7. EGR valve (if equipped)
8. Idle air control (IAC) valve
9. EVAP canister purge valve
10. Immobilizer indicator lamp
11. 4WD lamp
12. Ignition coil assembly for No.1 spark plug
13. Ignition coil assembly for No.2 spark plug
14. Ignition coil assembly for No.3 spark plug
15. Ignition coil assembly for No.4 spark plug
16. Ignition coil assembly for No.5 spark plug
17. Ignition coil assembly for No.6 spark plug
18. Fuel pump relay
19. Fuel pump
20. A/C condenser fan relay (if equipped)
21. A/C condenser fan motor (if equipped)
22. Malfunction indicator lamp
23. "O/D OFF" lamp
24. "POWER" lamp
25. 4WD switch
26. Power/Normal change switch
27. O/D cut switch
28. Ignition switch
29. Main relay
30. Transmission range switch (Park/neutral position switch)
31. Starter magnetic switch
32. Battery
33. 4WD low switch
34. Vehicle speed sensor
35. Combination meter
36. Fuel level sensor
37. Data link connector
38. TCC solenoid valve
39. Solenoid valve No.1(-B)
40. Solenoid valve No.1(-A)
41. Transmission range switch (Sensor)
42. A/T vehicle (output) speed sensor
43. A/T input speed sensor
44. Shield wire
45. Power steering pressure switch
46. Stop lamp switch (Brake pedal switch)
47. Lighting switch
48. Rear defogger switch (if equipped)
49. Heater blower switch
50. A/C amplifier (if equipped)
51. ABS control module (if equipped)
52. HO2S Bank 2 Sensor 2 (if equipped)
53. HO2S Bank 1 Sensor 2 (if equipped)
54. HO2S Bank 2 Sensor 1 (if equipped)
55. HO2S Bank 1 Sensor 1 (if equipped)
56. Intake air temp. sensor
57. Engine coolant temp. sensor
58. Throttle position sensor
59. MAP sensor (if equipped)
60. Monitor connector (if equipped)
61. Mass air flow sensor
62. Camshaft position sensor
63. CKP sensor (if equipped)
64. ECM (PCM)
65. CO adjusting resistor (if equipped)
66. 4WD actuator

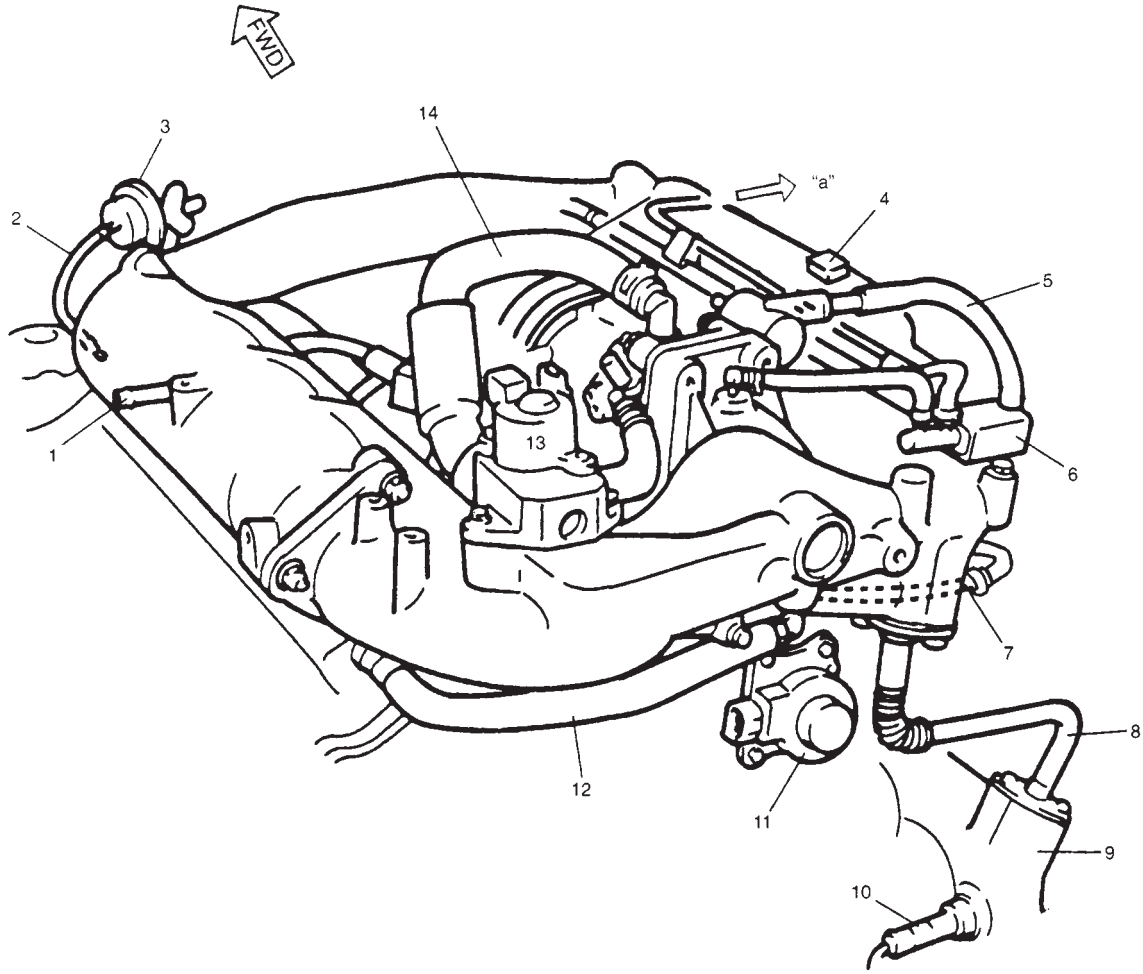
TERMINAL	CIRCUIT
E61-1	Fuel pump relay
E61-2	——
E61-3	——
E61-4	Tachometer
E61-5	A/C condenser fan motor (if equipped)
E61-6	——
E61-7	"O/D OFF" lamp (A/T vehicle)
E61-8	Main relay
E61-9	Power/normal change switch (A/T vehicle)
E61-10	"POWER" lamp (A/T vehicle)
E61-11	——
E61-12	Fuel level sensor
E61-13	Heater blower fan switch
E61-14	O/D OFF switch (A/T vehicle)
E61-15	Rear defogger switch (if equipped)
E61-16	Test switch terminal (Vehicle with monitor connector)
E61-17	Output duty select switch terminal (Vehicle with monitor connector)
E61-18	ABS control module (if equipped)
E61-19	CO adjusting resistor (if equipped)
E61-20	——
E61-21	——
E61-22	——
E61-23	Immobilizer indicator lamp (Vehicle without monitor connector)
	Duty output terminal (Vehicle with monitor connector)
E61-24	Data link connector 5 V (if equipped)
E61-25	Data link connector 12 V
E61-26	Power steering pressure switch
E61-27	A/C cut switch (if equipped)
E61-28	A/C signal (if equipped)
E61-29	Lighting switch
E61-30	Diag. switch terminal (vehicle with monitor connector)
E61-31	Stop lamp switch (A/T vehicle)
E61-32	CO adjusting resistor (if equipped)
E61-33	Power source for CO adjusting resistor (if equipped)
E61-34	Malfunction indicator lamp
E61-35	Power source for back up
C51-3-1	Vehicle speed sensor
C51-3-2	Crankshaft position sensor (–) (if equipped)
C51-3-3	Crankshaft position sensor (+) (if equipped)
C51-3-4	Heated oxygen sensor (bank 1 sensor 1) (if equipped)
C51-3-5	Heater of HO2S (bank 2 sensor 1) (if equipped)
C51-3-6	Heater of HO2S (bank 1 sensor 1) (if equipped)
C51-3-7	——
C51-3-8	Intake air temp. sensor
C51-3-9	Camshaft position sensor (POS)
C51-3-10	Camshaft position sensor (REF)
C51-3-11	Power source for TP sensor and MAP sensor
C51-3-12	Throttle position sensor
C51-3-13	Manifold absolute pressure sensor
C51-3-14	Heated oxygen sensor (bank 1 sensor 2) (if equipped)
C51-3-15	Heated oxygen sensor (bank 2 sensor 1) (if equipped)
C51-3-16	Heater of HO2S (bank 2 sensor 2) (if equipped)
C51-3-17	Heater of HO2S (bank 1 sensor 2) (if equipped)

TERMINAL	CIRCUIT
C51-3-18	——
C51-3-19	——
C51-3-20	Ground
C51-3-21	Ground
C51-3-22	Engine coolant temp. sensor
C51-3-23	Mass air flow sensor
C51-3-24	Heated oxygen sensor (bank 2 sensor 2) (if equipped)
C51-3-25	Ground
C51-3-26	Ground
C51-1-1	Shift solenoid No.1-B (A/T vehicle)
C51-1-2	Shift solenoid No.2 (TCC) (A/T vehicle)
C51-1-3	Transmission range switch "R" (A/T vehicle)
C51-1-4	Transmission range switch "P" (A/T vehicle)
C51-1-5	4WD low switch (if equipped) (A/T vehicle)
C51-1-6	Shift solenoid No.1-A (A/T vehicle)
C51-1-7	4WD lamp
C51-1-8	A/T input speed sensor (A/T vehicle)
C51-1-9	A/T output speed sensor (A/T vehicle)
C51-1-10	A/T output speed sensor (A/T vehicle)
C51-1-11	4WD switch
C51-1-12	Transmission range switch "D" (A/T vehicle)
C51-1-13	Transmission range switch "N" (A/T vehicle)
C51-1-14	Shield wire ground for A/T input speed sensor and A/T output speed sensor (A/T vehicle)
C51-1-15	4WD actuator
C51-1-16	A/T input speed sensor (A/T vehicle)
C51-1-17	——
C51-1-18	4WD pressure switch
C51-1-19	Transmission range switch "L" (A/T vehicle)
C51-1-20	Transmission range switch "2" (A/T vehicle)
C51-2-1	EVAP canister purge valve
C51-2-2	Ground
C51-2-3	Ignition switch
C51-2-4	EGR valve (stepper motor coil 2)
C51-2-5	EGR valve (stepper motor coil 1)
C51-2-6	Fuel injector No.2
C51-2-7	Fuel injector No.1
C51-2-8	Ground
C51-2-9	Ground
C51-2-10	Ignition coil assembly for No.4
C51-2-11	Ignition coil assembly for No.3
C51-2-12	Ignition coil assembly for No.2
C51-2-13	Ignition coil assembly for No.1
C51-2-14	IAC valve (stepper motor coil 2)
C51-2-15	IAC valve (stepper motor coil 1)
C51-2-16	EGR valve (stepper motor coil 4)
C51-2-17	EGR valve (stepper motor coil 3)
C51-2-18	Fuel injector No.4
C51-2-19	Fuel injector No.3
C51-2-20	Power source
C51-2-21	Power source
C51-2-22	Ignition coil assembly for No.6
C51-2-23	Ignition coil assembly for No.5
C51-2-24	IAC valve (stepper motor coil 4)
C51-2-25	IAC valve (stepper motor coil 3)
C51-2-26	Engine start signal
C51-2-27	Fuel injector No.6
C51-2-28	Fuel injector No.5

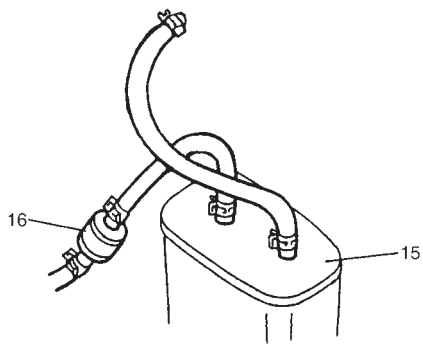
ENGINE & EMISSION CONTROL INPUT/OUTPUT TABLE

Function	Input / Output	CMP sensor	MAF sensor	TP sensor	ECT sensor	IAT sensor	HO2S (Sensor 1)	CO adjusting resistor (if equipped)	VSS	Blower fan switch	Rear defogger switch	PSP switch	DLC	Diag. switch terminal (Vehicle with monitor connector)	Test switch terminal (Vehicle with monitor connector)	Ignition switch	Starter switch	ABS control module (if equipped)	A/C amplifier (if equipped)	TR switch (A/T VEHICLE)	Light switch	Stop lamp switch (A/T VEHICLE)
Main relay control	Main relay															○						
Fuel pump control	Fuel pump relay	○														○	○					
Injection control	Injectors	○	○	○	○		○	○									○	○				
Idle air control	IAC valve	○	○	○	○	○			○	○	○	○	○					○	○	○	○	○
Ignition control	Ignition coil with igniter	○	○		○	○							○		○		○					
MIL control	MIL	○												○								
EVAP purge control	EVAP canister purge valve	○	○	○	○				○													
EGR control	EGR valve (if equipped)	○	○	○	○	○			○				○									
HO2S heater control	HO2S (if equipped)	○	○																			
A/C control	A/C amplifier (if equipped)	○		○	○												○		○			
A/C condensor fan control	A/C condensor fan relay (if equipped)				○														○			

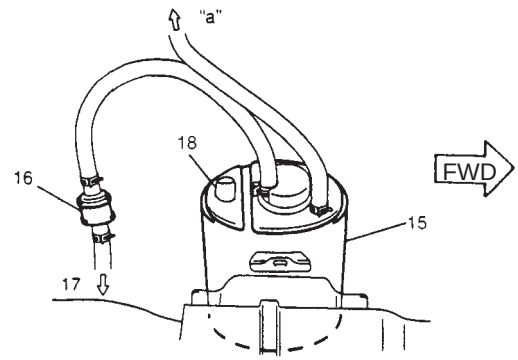
ON-VEHICLE SERVICE



[A]



[B]



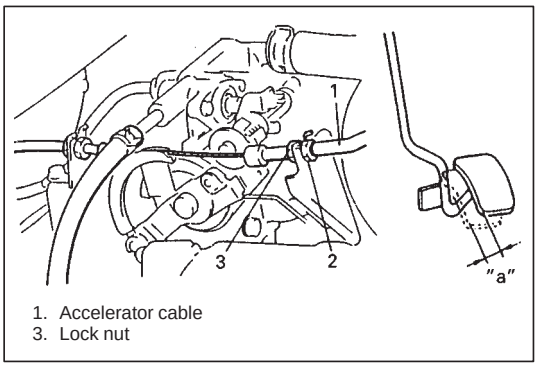
1. Brake booster hose pipe
2. Vacuum hose for fuel pressure regulator
3. Fuel pressure regulator
4. MAP sensor
5. Engine coolant hose
6. EVAP canister purge valve
7. Breather hose
8. EGR pipe
9. Exhaust manifold
10. Heated oxygen sensor
11. EGR valve
12. PCV hose
13. IAC valve
14. IAC hose
15. EVAP canister
16. Tank pressure control valve
17. Fuel tank
18. Air cap

[A]: Vehicle without immobilizer indicator lamp

[B]: Vehicle with immobilizer indicator lamp

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.



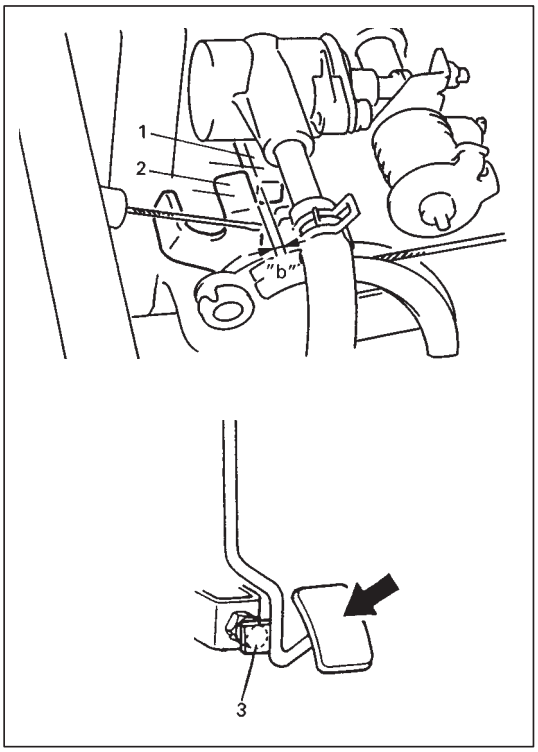
1. Accelerator cable
3. Lock nut

ACCELERATOR CABLE ADJUSTMENT

1) Warm up engine to normal operating temperature. And check to make sure that fast idle control cam is off cam follower lever, if not check fast idle control system referring to "THROTTLE BODY INSPECTION" in this section.
2) With accelerator pedal depressed fully, check clearance between throttle lever and lever stopper (throttle body) which should be within following specification.

   Pedal play "a": 2 – 7 mm (0.08 – 0.27 in.)

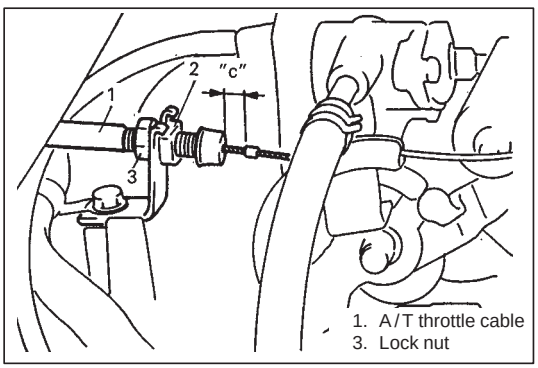
   If measured value is out of specification, adjust it to specification with cable adjusting nut (2).



3) With accelerator pedal depressed fully, check clearance between throttle lever (2) and lever stopper (1) (throttle body) which should be within following specification.

   Clearance "b": 0.5 – 2.0 mm (0.02 – 0.07 in.)
   (With pedal depressed fully)

   If measured value is out of specification, adjust it to specification by changing height of pedal stopper bolt (3).



1. A/T throttle cable
3. Lock nut

A/T THROTTLE CABLE ADJUSTMENT (A/T VEHICLE)

1) Make sure that accelerator cable is adjusted as specified.
2) With throttle valve closed, check clearance "c" which should be within following specification.

   Clearance "c": 0.8 – 1.5 mm (0.03 – 0.06 in.)

   If it is out of specification, adjust it by turning cable adjusting nut (2).

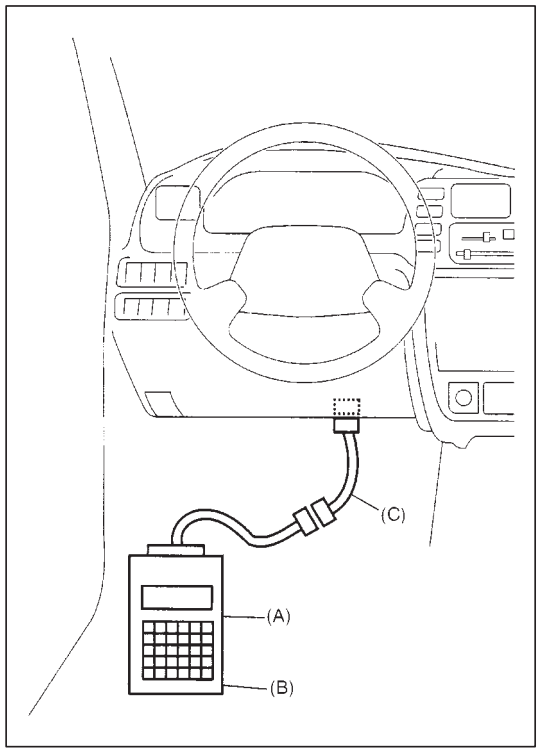
IDLE SPEED/IDLE AIR CONTROL (IAC) DUTY INSPECTION

Before idle speed/IAC duty check, make sure of the following.

- Lead wires and hoses of engine/emission control systems are connected securely.
- Accelerator cable is adjusted.
- 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.
- 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.



[Using SUZUKI scan tool, Tech 1]

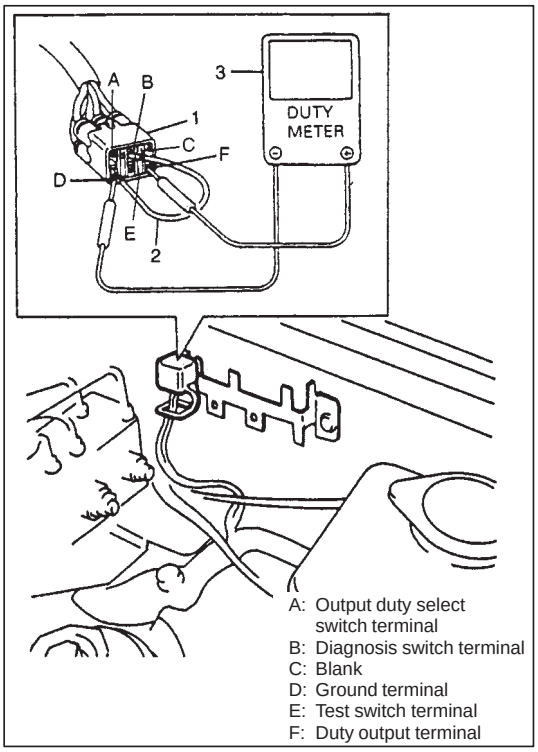
1) Connect SUZUKI scan tool to DLC with ignition switch OFF.

   Special Tool
   (A): SUZUKI scan tool, Tech 1
   (B): Mass storage cartridge
   (C): 16/14 pin DLC cable

2) Warm up engine to normal operating temperature.
3) Check IAC duty and idle speed by using "Data List" mode of SUZUKI scan tool.

		A/C OFF	A/C ON
Engine idle speed:	without monitor connector	675 ± 50 r/min.	800 ± 50 r/min.
	with monitor connector	750 ± 50 r/min.	
IAC duty at specified idle speed:		10 – 50%	

   If duty and/or idle speed is out of specifications, check idle air control system referring to Diagnostic Flow Table "DTC P0505 IDLE AIR CONTROL SYSTEM MALFUNCTION" in "ENGINE" section.
4) Check that specified engine idle speed is obtained with A/C ON if vehicle is equipped with A/C.
   If not, check A/C ON signal circuit and idle air control system.



[Not using SUZUKI scan tool] (vehicle with monitor connector)

NOTE:
If ECM (PCM) parts No. ends with "0", ECM (PCM) does not output IAC duty through duty output terminal in monitor coupler. First of all, check label on ECM (PCM) for part No. if so, check IAC duty by using Tech 1.

1) Disconnect scan tool from DLC if connected.
2) Warm up engine to normal operating temperature.
3) Stop engine and connect duty meter (3) between duty output terminal and ground terminal of monitor connector (1).
4) Using service wire (2), ground diagnosis switch terminal in monitor connector.
5) Set tachometer.
6) Start engine and warm it up completely.
7) Check IAC duty and idle speed. If duty and/or idle speed is out of specifications, check idle air control system referring to Diagnostic Flow Table B-4 "IDLE AIR CONTROL SYSTEM CHECK" in this section.

	A/C OFF	A/C ON
Engine idle speed:	750 ± 50 r/min.	800 ± 50 r/min.
IAC duty at specified idle speed:	10 – 50% (1.4 – 7.0 V when battery voltage is 14 V)	———

NOTE:
IAC duty can be checked roughly by using voltmeter. IAC duty to voltage relation is as follows.

ON DUTY METER INDICATION (%)	OFF DUTY METER INDICATION (%)	VOLTMETER INDICATION (V)
0	100	0
50	50	0.5 x V_B
100	0	V_B

- **"OFF DUTY METER" is such duty meter that indicates approx. 100% when terminal voltage is approx. "0 V".**
- **"V_B" represents battery voltage while engine of vehicle being checked is running.**

8) Remove service wire from monitor connector.
9) Install cap to monitor connector.
10) Check that specified engine idle speed is obtained with A/C ON if vehicle is equipped with A/C.
If not, check A/C ON signal circuit and idle air control system.

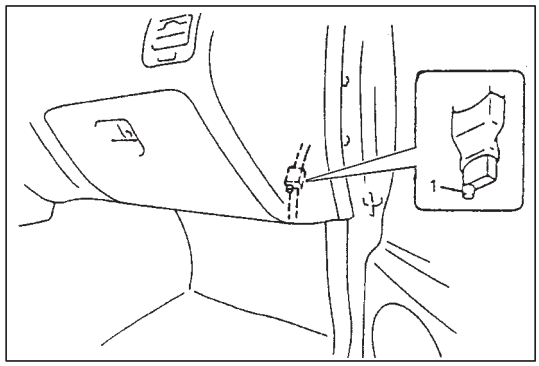
IDLE MIXTURE INSPECTION/ADJUSTMENT (VEHICLE WITHOUT HEATED OXYGEN SENSOR)

All vehicles not equipped with heated oxygen sensor are shipped with their CO% factory adjusted as follows.

Engine idle mixture (CO%)	0.8 – 1.3% at specified idle speed

Idle mixture adjustment should never be changed from the original factory setting. However, if during diagnosis, the check indicates idle mixture to be the cause of a driver performance complaint or emission failure, the idle mixture can be adjusted using the following procedures.

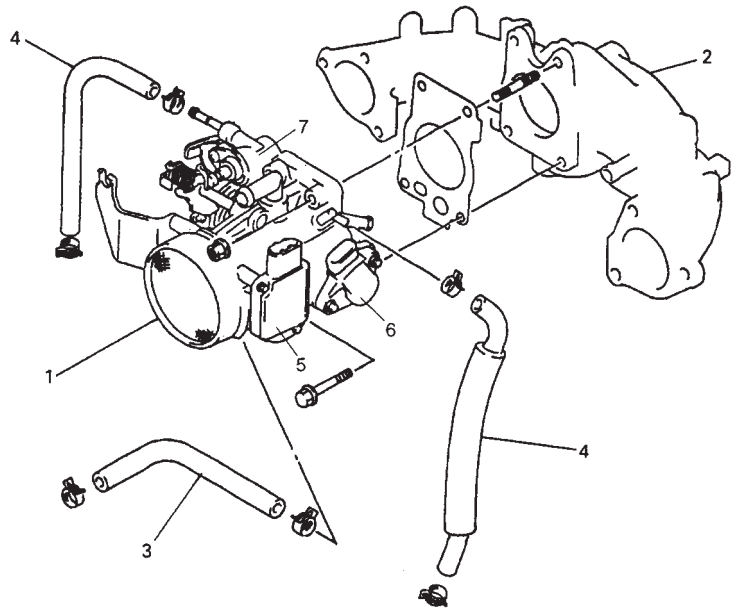
NOTE:
For this inspection and adjustment, exhaust gas tester (CO meter) and engine tachometer are necessary.



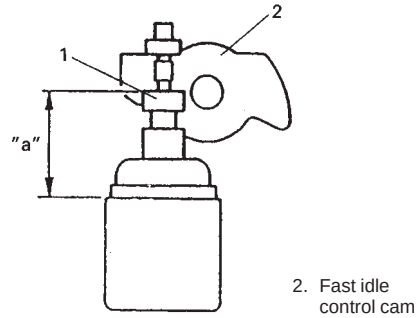
1) Check idle speed according to “IDLE SPEED/IDLE AIR CONTROL DUTY INSPECTION” section.
2) Using exhaust gas tester, check that idle mixture CO% is within above specification. If it is out of specification, adjust it to specification by turning resistor knob (1).
3) If idle mixture has been adjusted, confirm that idle speed/IAC duty is within specification.

AIR INTAKE SYSTEM

THROTTLE BODY



1. Throttle body
2. Intake collector
3. Breather hose
4. Water hose
5. MAF sensor
6. TP sensor
7. Fast idle up thermo wax

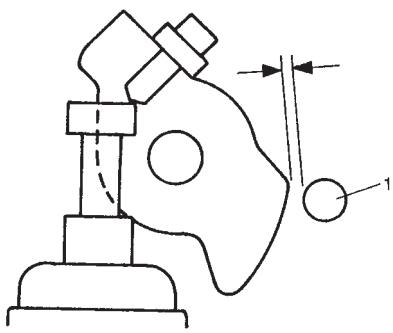


2. Fast idle control cam

On-Vehicle Inspection

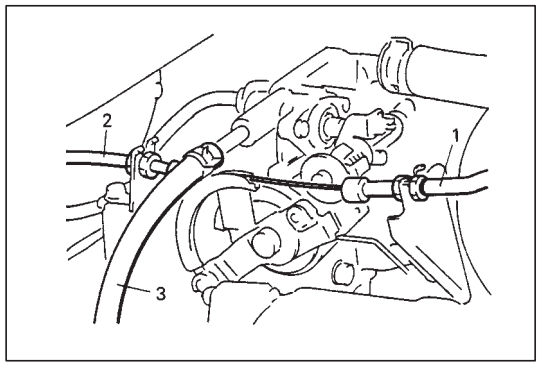
1) Check that throttle valve lever moves smoothly.
2) Measure plunger (1) protrusion "a" at engine coolant temp. is 25°C (77°F).

Plunger protrusion "a": 26.6 – 27.4 mm (1.048 – 1.078 in.)



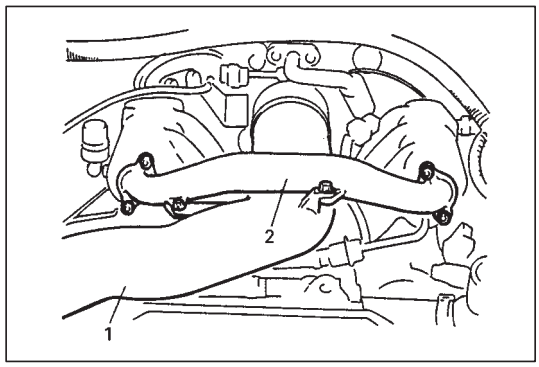
3) Warm up engine and check to make sure that fast control cam is off cam follower lever (1) at engine coolant temp. is 52 – 68°C (126 – 154°F).

If check result in step 2) or 3) is out of specification, replace throttle body assembly.

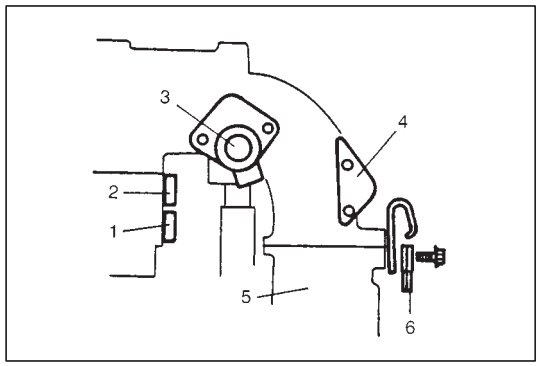


Removal

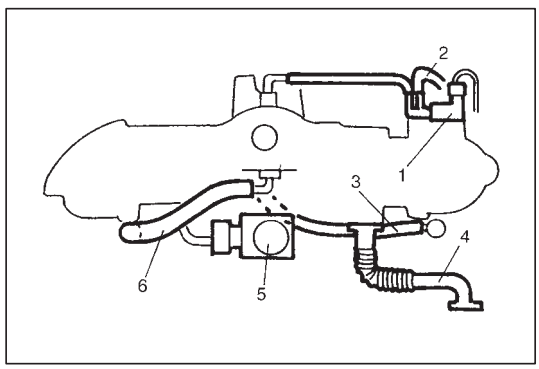
1) Disconnect negative cable at battery.
2) Drain cooling system.
3) Remove strut tower bar.
4) Disconnect accelerator cable (1) and or A/T throttle cable (2) from throttle body.
5) Disconnect water hose (3) from throttle body.
6) Remove surge tank cover.



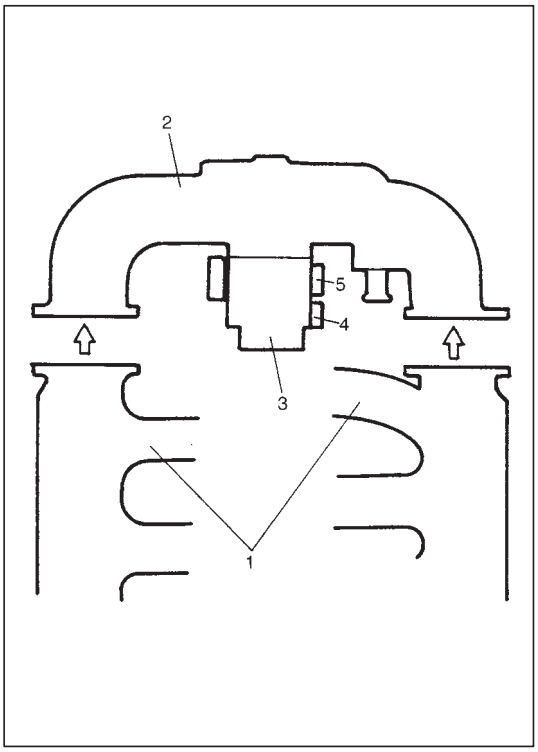
7) Remove intake air pipe (1) and surge tank pipe (2).



8) Disconnect connector of injector wire.
9) Disconnect connectors of TP sensor (2), MAF sensor (1) and IAC valve (3).
10) Disconnect ground terminal (6) from intake manifold (5).
11) Remove clamp bracket (4) from intake collector.



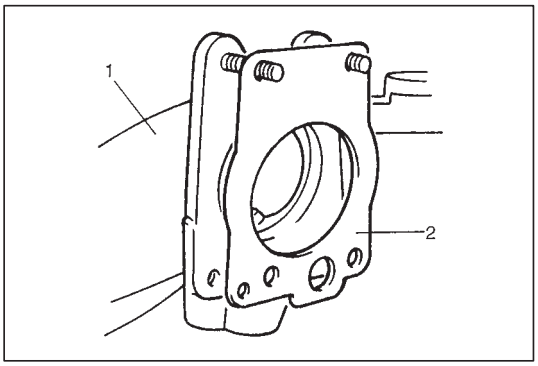
12) Disconnect connectors of EVAP canister purge valve (1) and EGR valve (5) (if equipped).
13) Disconnect PCV hose (6), breather hose (3) and EVAP canister purge valve hose (2).
14) Remove EGR pipe (4).



15) Remove throttle body (3) and intake collector (2) from intake manifold (1).
15) Disconnect hoses of IAC valve and PCV from throttle body.
16) Remove throttle body from intake collector.

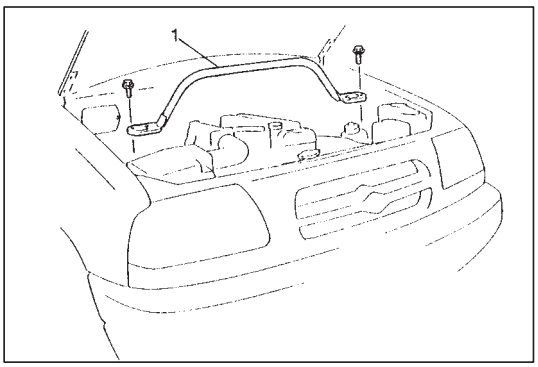
NOTE:

- **MAF sensor (4), TP sensor (5), 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.**
- **Don't put drills or wires into passages for cleaning. It causes damages in passages.**

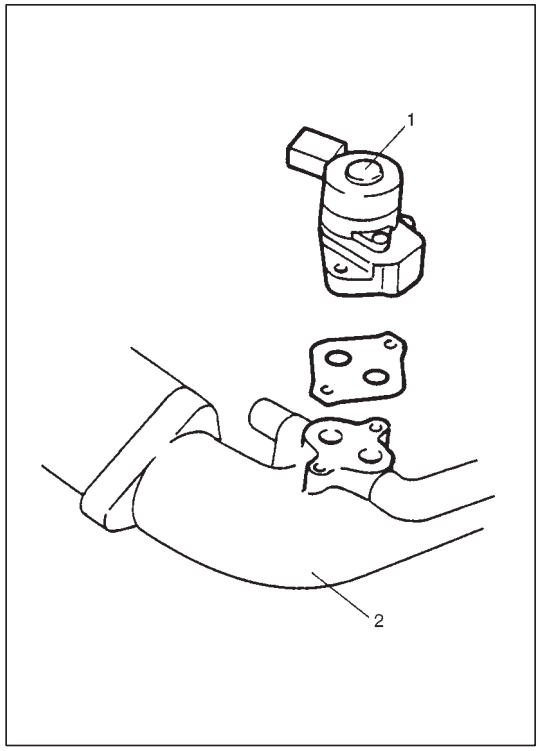


Installation

1) Clean mating surfaces and install throttle body gasket to intake collector (1) with new gasket (2).
2) Install throttle body to intake collector and tighten bolts.
3) Connect IAC valve hose and PCV hose.
4) Install throttle body and intake collector to intake manifold with new intake collector gaskets.
5) Install EGR pipe with new gaskets.
6) Connect PCV hose, breather hose and EVAP canister purge valve hose.
7) Connect connectors of EVAP canister purge valve and EGR valve.
   Fix wire harness with clamps.
8) Install clamp bracket to intake collector.
9) Connect ground terminal to intake manifold.
10) Connect connectors of TP sensor, MAF sensor and IAC valve.
11) Connect connector of injector wire.
12) Install surge tank pipe to intake manifold with new gaskets and intake air pipe to throttle body.
13) Install surge tank cover.
14) Connect engine coolant hoses to throttle body.
15) Connect accelerator cable and A/T throttle cable (A/T).



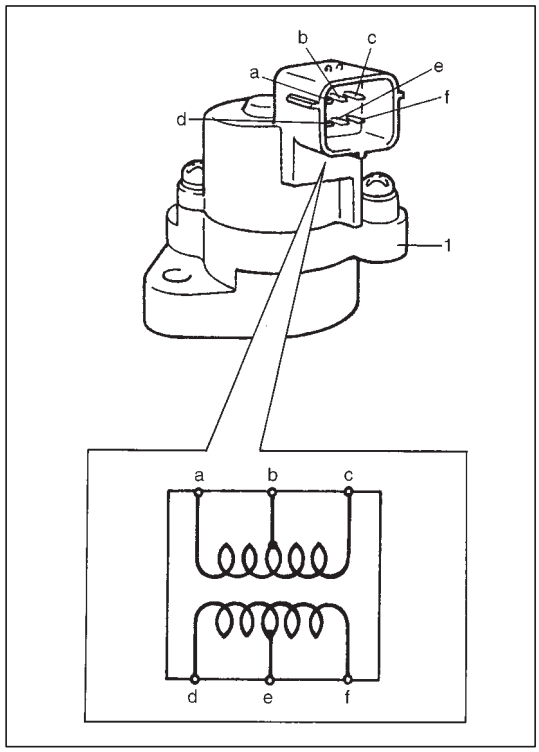
16) Install strut tower bar (1) and tighten bolts.
17) Refill cooling system.
18) Connect negative cable at battery.
19) Adjust accelerator cable and A/T throttle cable, refer to "ACCELERATOR CABLE ADJUSTMENT" and "A/T THROTTLE CABLE ADJUSTMENT" in this section.



IDLE AIR CONTROL VALVE (IAC VALVE)

Removal

1) Disconnect battery negative cable at battery.
2) Disconnect IAC valve connector.
3) Remove IAC valve (1) from intake collector (2).



On-Vehicle Inspection

1) Disconnect connector from IAC valve (1).
2) Check each coil of IAC valve for resistance.

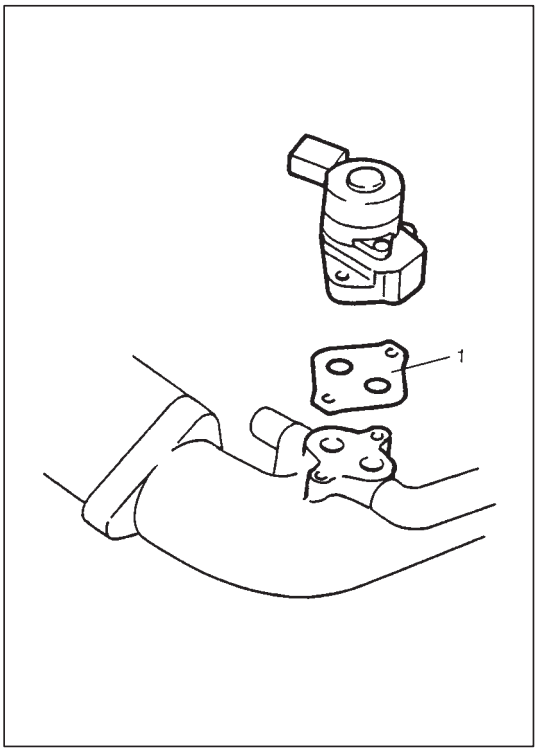
Terminals	Resistance
Between “a” and “b” “b” and “c” “d” and “e” “e” and “f”	20 – 24 Ω at 20°C, 68°F

If resistances is out of specification, replace.

3) Remove IAC valve from intake collector.
4) Connect connector to IAC valve.
5) Check that plunger of IAC valve moves once and then stops as soon as ignition switch is turned OFF.

NOTE:
This check should be performed by two people, one person operates ignition switch while the other checks plunger operation.

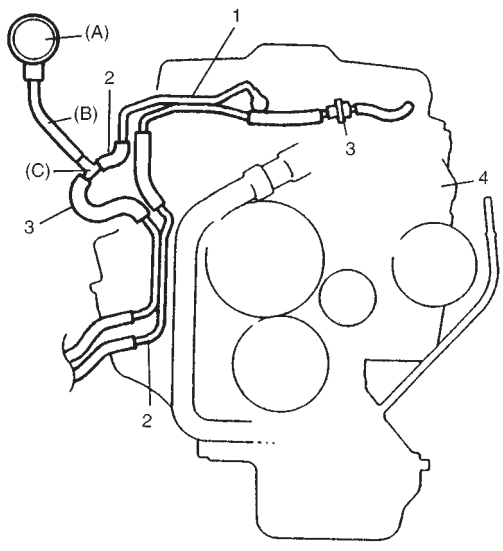
If plunger of IAC valve does not operate at all, check wire harnesses for open and short. If wire harnesses are in good condition, replace IAC valve and recheck.



Installation

For installation, reverse removal procedure and note following precautions.

- Use new gaskets (1).



2. Fuel return pipe
3. Fuel pressure regulator
4. Engine

FUEL DELIVERY SYSTEM

FUEL PRESSURE INSPECTION

1) Relieve fuel pressure in fuel feed line referring to “Fuel Pressure Relief Procedure” in “ENGINE GENERAL INFORMATION” section.
2) Disconnect fuel feed hose (3) from delivery fuel feed pipe (1).

CAUTION:
A small amount of fuel may be released when fuel feed hose is removed. Place container under the fuel feed hose or fuel feed pipe with a shop cloth so that released fuel is caught in container or absorbed in cloth. Place that cloth in an approved container.

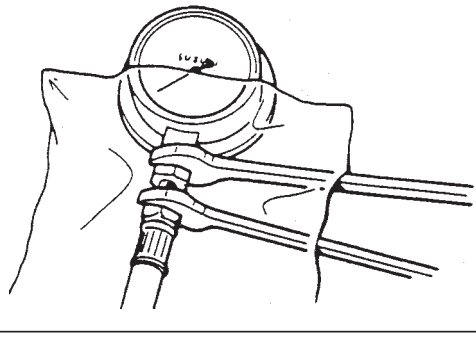
3) Connect special tools and hose (2) between fuel feed hose and fuel feed pipe as shown in figure, and clamp hose securely to ensure no leaks occur during checking.

Special Tool
(A): 09912-58441
(B): 09912-58431
(C): 09912-58490

4) Check that battery voltage is above 11 V.

CONDITION	FUEL PRESSURE
With fuel pump operating and engine stopped	270 – 310 KPa 2.7 – 3.1 kg/cm^2 38.4 – 44.0 psi
At specified idle speed	210 – 260 KPa 2.1 – 2.6 kg/cm^2 29.8 – 37.0 psi
With 1 min. after engine (fuel pump) stopped (Pressure reduces as time passes)	over 200 kPa 2.0 kg/cm^2 28.4 psi

5) Turn ignition switch ON to operate fuel pump and after 3 seconds turn it OFF. Repeat this 3 or 4 times and then check fuel pressure.
6) Start engine.
7) Measure fuel pressure at idling.
   If measure pressure doesn’t satisfy specification, refer to “Diagnostic Flow Table B-3” and check each possibly defective part. Replace if found defective.



8) After checking fuel pressure, remove fuel pressure gauge.

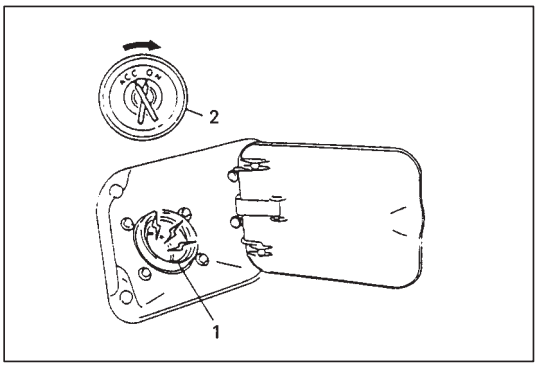
CAUTION:
As fuel feed line is still under high fuel pressure, make sure to release fuel pressure according to following procedures.
- **Place fuel container under joint.**
- **Cover joint with rag and loosen joint nut slowly to release fuel pressure gradually.**

9) Remove fuel pressure gauge, hose and 3-way joint.
10) Connect fuel feed hose and clamp it securely.
11) With engine “OFF” and ignition switch “ON”, check for fuel leaks.

FUEL PUMP

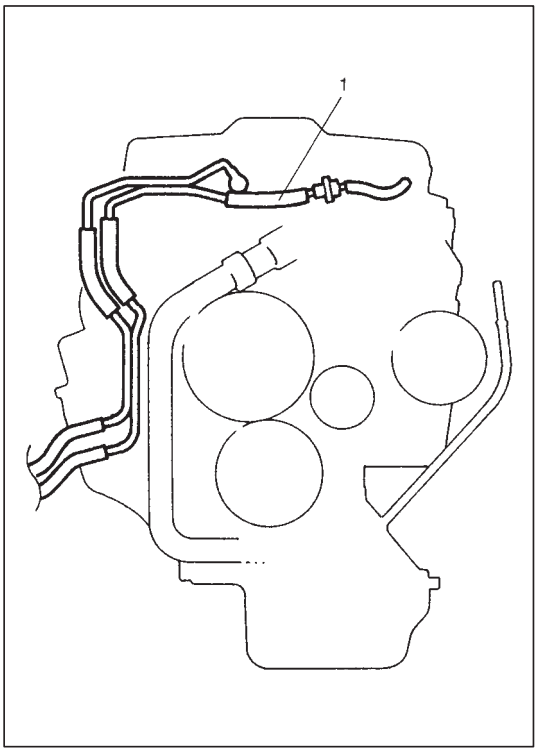
On-Vehicle Inspection

CAUTION:
When fuel filler cap is removed in any procedure, work must be done in a well-ventilated area, keep away from any open flames and without smoking.



1) Remove filler cap and turn ON ignition switch (2). Then fuel pump operating sound should be heard from fuel filler (1) for about 3 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 “ENGINE” section.



2) Fuel pressure should be felt at fuel return hose (1) for 3 seconds after ignition switch ON.

   If fuel pressure is not felt, advance to “Diagnostic Flow Table B-3” in “ENGINE” section.

Removal

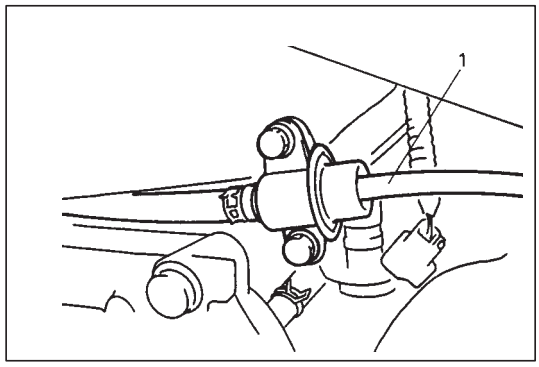
1) Remove fuel tank from body according to procedure described in Section 6C and remove fuel pump from fuel tank.

Inspection

Check fuel pump filter for evidence of dirt and contamination. If present, clean and check for presence of dirt in fuel tank.

Installation

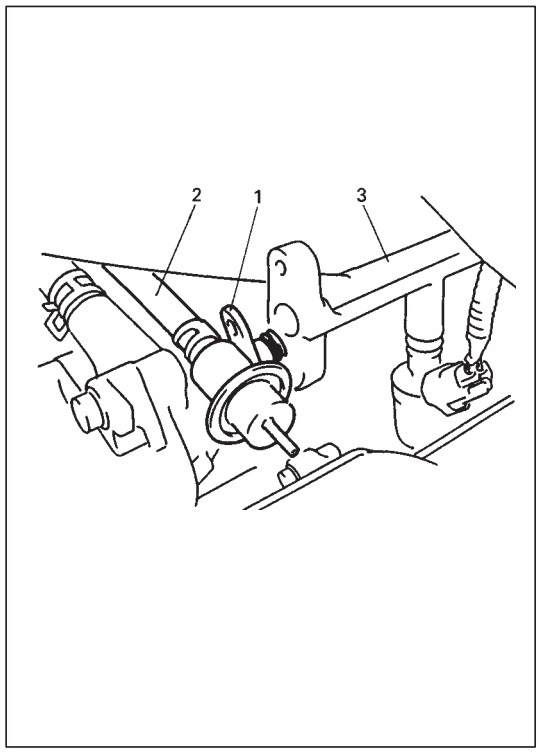
1) Install fuel pump to fuel tank and then install fuel tank to body according to procedure described in “ENGINE FUEL” section.



FUEL PRESSURE REGULATOR

Removal

1) Relieve fuel pressure in fuel feed line referring to “Fuel Pressure Relief Procedure” in “ENGINE” section.
2) Disconnect battery negative cable from battery.
3) Disconnect vacuum hose (1) from fuel pressure regulator.

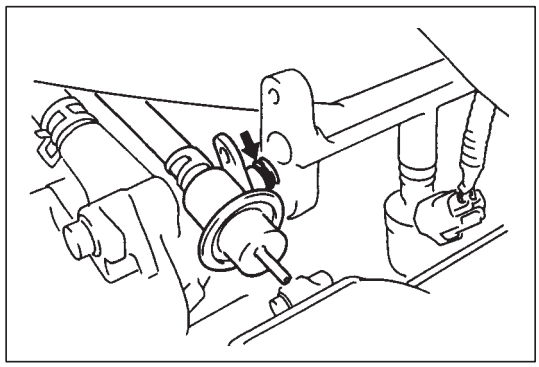


4) Remove fuel pressure regulator (1) from fuel delivery pipe (3).

CAUTION:
A small amount of fuel may be released when it is from delivery pipe.
Place a shop cloth under delivery pipe so that released fuel is absorbed in it.

5) Disconnect fuel return hose (2) from fuel pressure regulator.

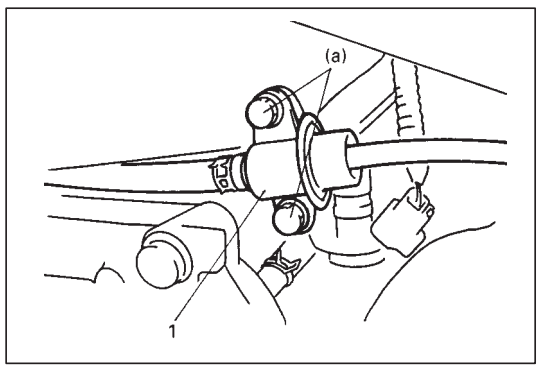
CAUTION:
A small amount of fuel may be released when hose is disconnected. Cover hose to be disconnected with a shop cloth.



Installation

For installation, reverse removal procedure and note following precautions.

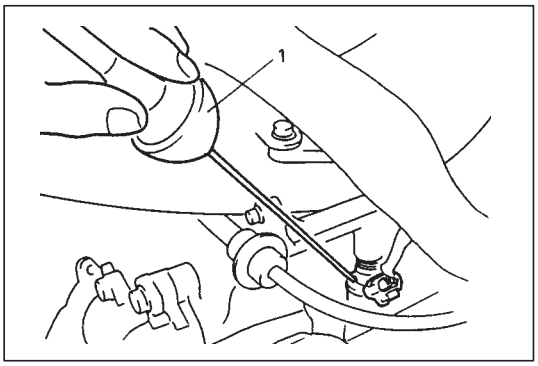
- Use new O-ring.
- Apply thin coat of gasoline to O-ring to facilitate installation.



- Tighten fuel pressure regulator (1) bolts to specified torque.

Tightening Torque
(a): 10 N·m (1.0 kg-m, 7.5 lb-ft)

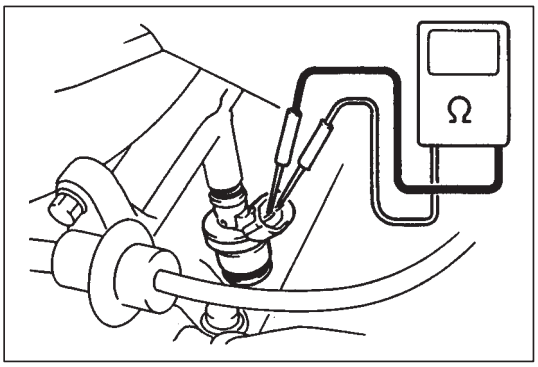
- With engine “OFF” and ignition switch “ON”, check for fuel leaks around fuel line connection.



FUEL INJECTOR

On-Vehicle Inspection

1) Using sound scope (1) or such, check operating sound of injector when engine is running or cranking.
   Cycle of operating sound should vary according to engine speed.
   If no sound or an unusual sound is heard, check injector circuit (wire or coupler) or injector.



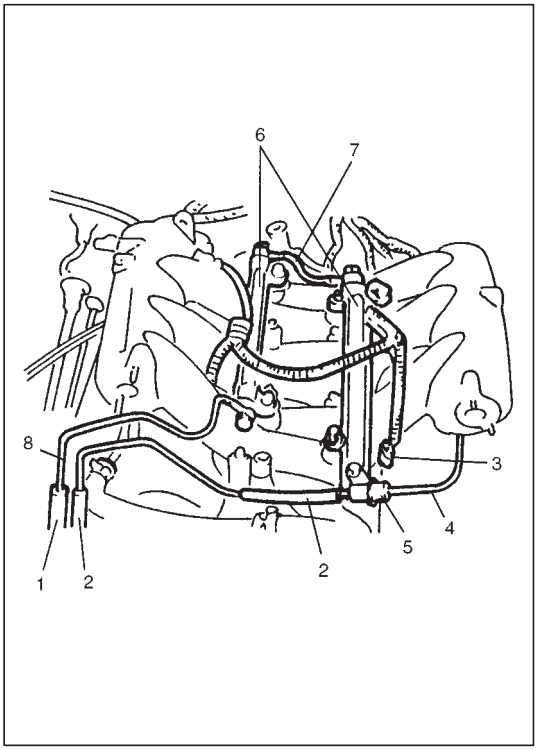
2) Disconnect connector from injector, connect ohmmeter between terminals of injector and check resistance.

   Resistance of injector: 10 – 14 Ω at 20°C (68°F)

   If resistance is out of specification, replace.
3) Connect connector to injector securely.

Removal

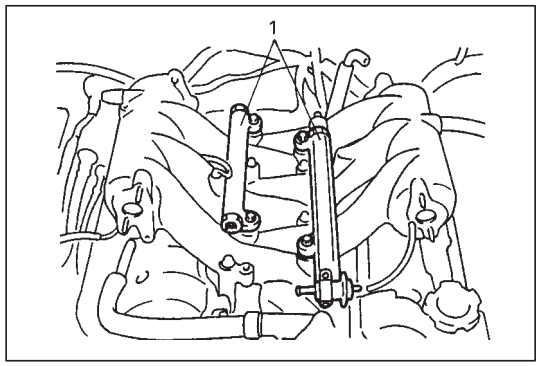
1) Relieve fuel pressure in fuel feed line referring to “Fuel Pressure Relief Procedure” in “ENGINE” section.
2) Remove throttle body intake collector, refer to “THROTTLE BODY REMOVAL” in this section.



3) Disconnect fuel feed hose (1) and fuel return hose (2).
4) Disconnect vacuum hose (4) and fuel return hose from fuel pressure regulator (5).
5) Remove fuel feed pipe (8) and fuel connect pipe (7) from delivery pipes (6) (right and left).

> **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.**

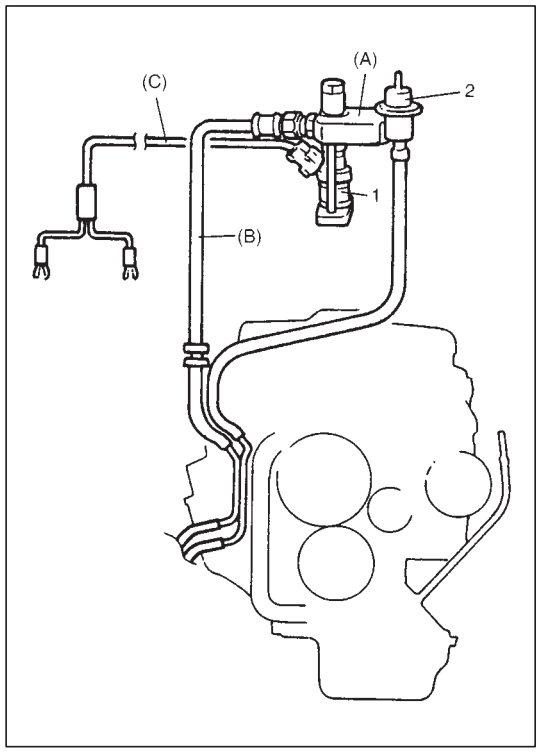
6) Disconnect connector (3) from each injector.



7) Remove delivery pipes (1) (right and left) from intake manifold.
8) Remove fuel injector(s).

Inspection

WARNING:
As fuel is injected in this inspection, perform in a well ventilated area and away from open flames.
Use special care to prevent sparking when connecting and disconnecting test lead to and from battery.



1) Install injector (1) and fuel pressure regulator (2) to special tool (injector checking tool).

   NOTE:
   Remove grommet from injector, then install injector to special tool and tighten bolts by hand.

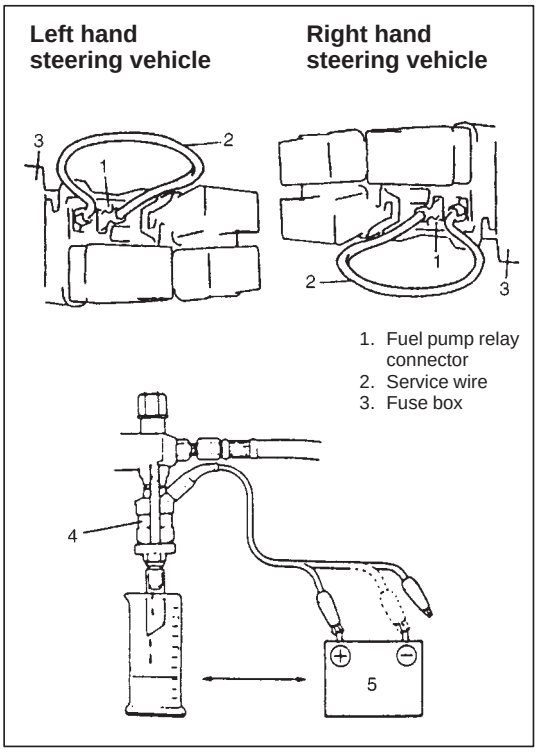
   Special Tool
   (A): 09912-58421

2) Connect special tools (hoses and attachment) to pipes of vehicle.

   Special Tool
   (B): 09912-58431

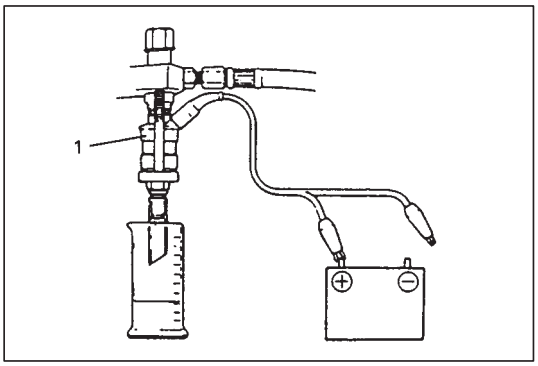
3) Connect special tool (test lead) to injector.

   Special Tool
   (C): 09930-88521



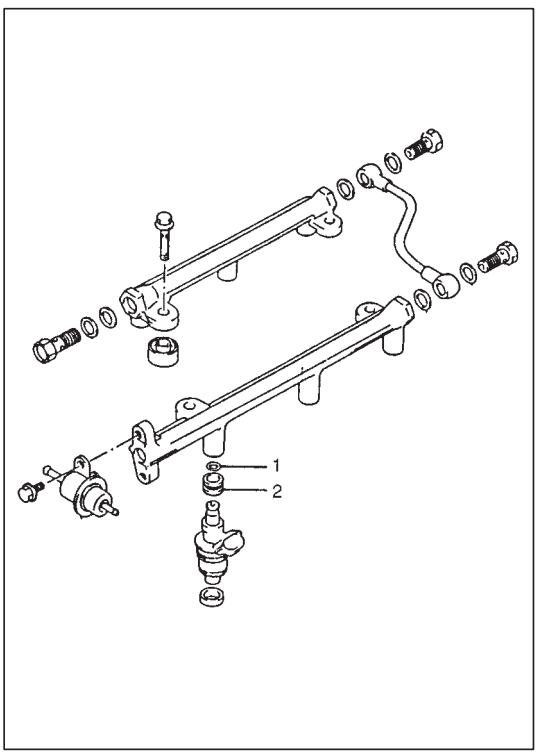
4) Install suitable vinyl tube onto injector (4) nozzle to prevent fuel from splashing out when injecting.
5) Put graduated cylinder under injector as fan apart as possible.
6) Disconnect fuel pump relay.
7) To operate fuel pump and apply fuel pressure to injector, using wire harness as thick as the one used for fuel pump circuit, connect two terminals of relay connector as shown in figure.
8) Apply battery (5) 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:
   64 – 70 cc/15 sec. (2.16/2.25 – 2.37/2.47 US/Imp. oz/15 sec.)



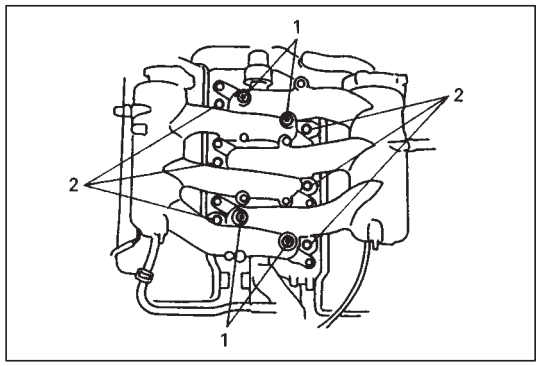
9) Check fuel leakage from injector (1) nozzle. Do not operate injector for this check (but fuel pump should be at work). If fuel leaks more than following specifications, replace.

   Fuel leakage: Less than 1 drop/min.

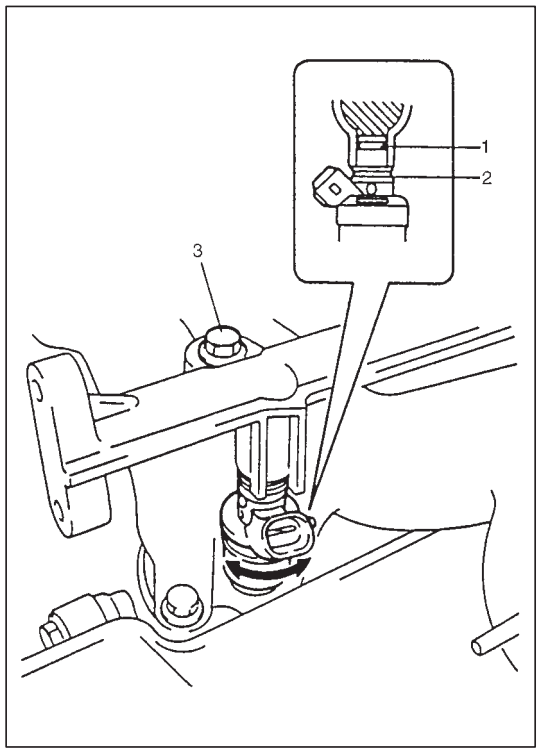


Installation

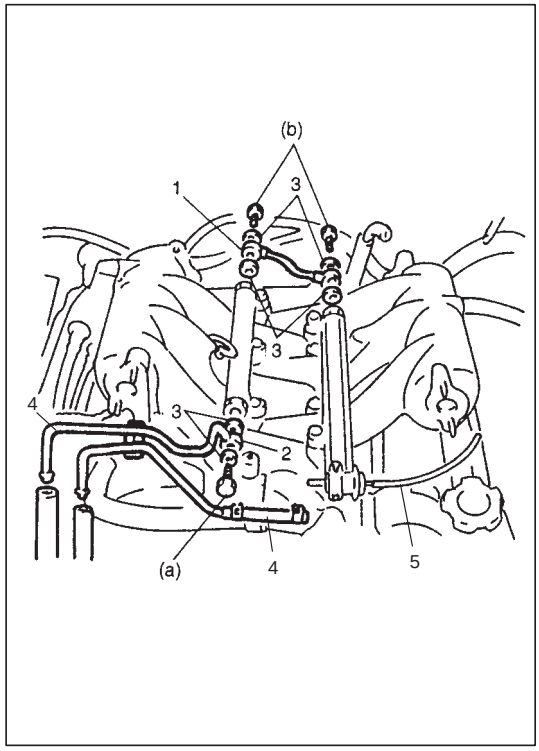
1) Replace injector O-ring (1) with new one using care not to damage it. Install grommet (2) to injector.



2) Check if insulator (1) is scored or damaged. If it is, replace with new one.
   Install insulators and cushions (2) to intake manifold.



3) Apply thin coat of fuel to O-rings (1) and then install injectors into delivery pipes (right and left) and intake manifold.
   Make sure that injectors rotate smoothly. If not, probable cause is incorrect installation of O-ring or grommet (2). Replace O-ring with new one.
4) Tighten delivery pipe bolts (3) and make sure that injectors rotate smoothly.



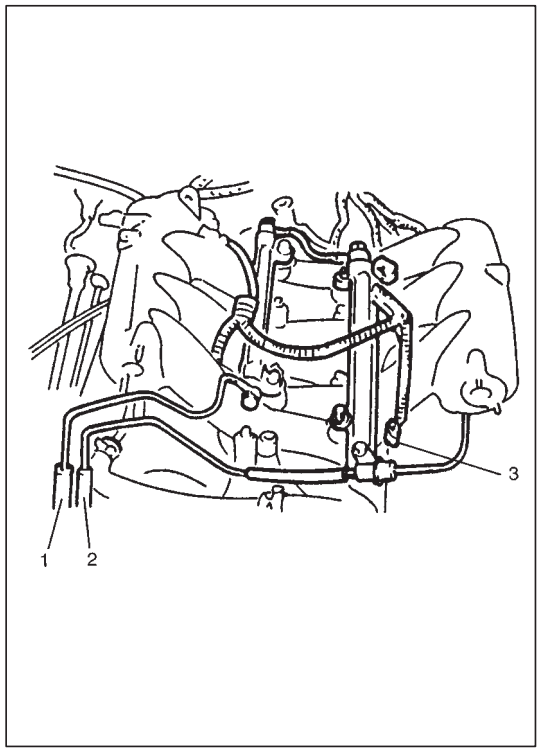
5) Install fuel connect pipe (1) and tighten union bolts to specified torque with new gaskets (3).

   Tightening Torque
   (b): 30 N·m (3.0 kg-m, 22.0 lb-ft)

6) Install fuel feed pipe (2) and tighten union bolt to specified torque with new gaskets.

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

7) Connect vacuum hose (5) and fuel return hose (4) to fuel pressure regulator.

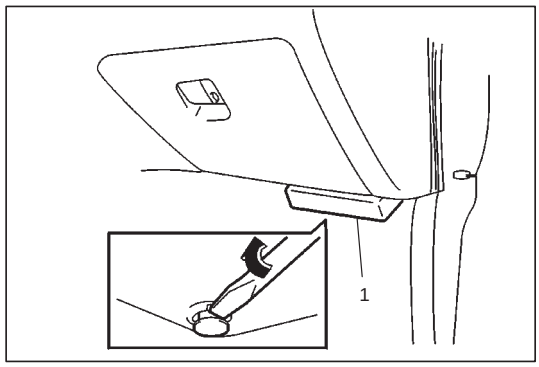


8) Connect fuel feed hose (1) and fuel return hose (2).
9) Connect connectors (3) to injectors.
10) Install throttle body and intake collector, refer to “THROTTLE BODY INSTALLATION” in this section.
11) With engine “OFF” and ignition switch “ON”, check for fuel leaks around fuel line connection.

ELECTRONIC CONTROL SYSTEM

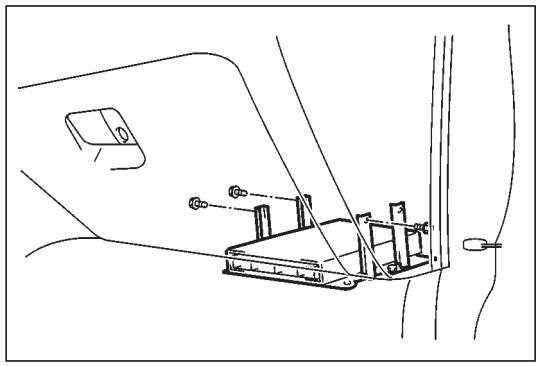
ENGINE CONTROL MODULE (ECM)/POWERTRAIN CONTROL MODULE (PCM)

CAUTION:
As ECM (PCM) consists of precision parts, be careful not to expose it to excessive shock.



Removal

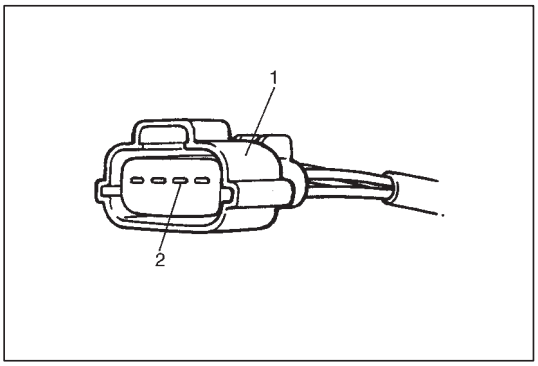
1) Disconnect battery negative cable from battery.
2) Disable air bag system (if equipped) referring to “Disabling the Air Bag System” in Air Bag System section.
3) Remove ECM (PCM) cover (1) from bracket.



4) Disconnect connectors from ECM (PCM).
5) Remove ECM (PCM) with bracket.

Installation

1) Install ECM (PCM) with bracket to vehicle.
2) Connect connectors to ECM (PCM) securely.
3) Install ECM (PCM) cover to bracket.
4) Enable air bag system (if equipped) referring to “Enabling Air Bag System” in Air Bag system section.
5) Connect negative cable to battery.



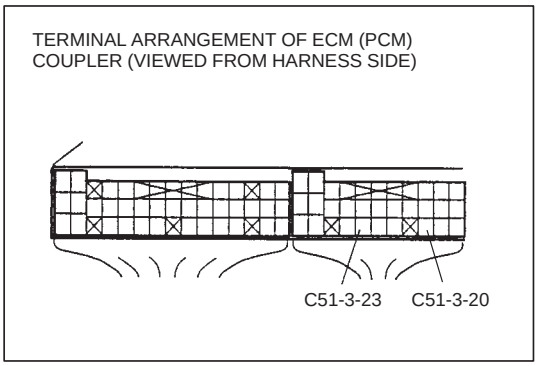
MASS AIR FLOW SENSOR (MAF SENSOR)

Inspection

NOTE:

Use voltmeter with high-impedance (10 kΩ/V minimum) or digital type voltmeter.

1) Remove ECM (PCM) cover from bracket.
2) With ignition switch OFF, disconnect MAF sensor connector (1).
3) Connect voltmeter to C32-3 terminal (2) of MAF sensor connector disconnected and ground.
4) Turn ignition switch ON and check that voltage is battery voltage.
   If not, check if wire harness is open or connection is poor.
5) Turn ignition switch OFF and connect MAF sensor connector to MAF sensor.

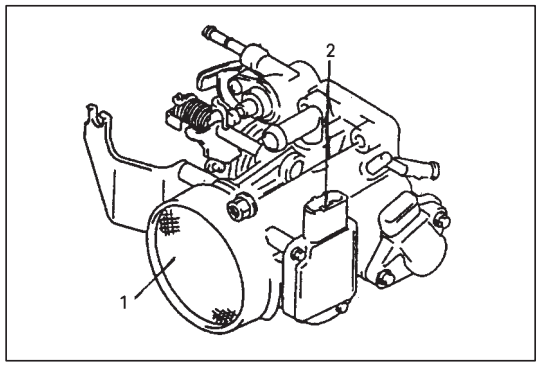


6) Turn ignition switch ON and check voltage between C51-3-23 and C51-3-20 terminal.

   Standard voltage: 0.5 – 1.0 V

7) Start engine and check that voltage is lower than 5V and it rises as engine speed increases.
   (Reference data: 1.5 – 1.8 V at specified idle speed)

   If check result is not as specified above, cause may lie in wire harness, coupler connection, MAF sensor or ECM (PCM).



Removal

1) Disconnect negative cable at battery and coupler from MAF sensor (2).
2) Remove throttle body (1), referring to “THROTTLE BODY REMOVAL” in this section.

NOTE:
Don’t remove MAF sensor.

CAUTION:
- **Do not expose MAF sensor (throttle body) to any shock.**
- **Do not blow compressed air by using air gun or the like.**
- **Do not put finger or any other object into MAF sensor and keep away from net. Malfunction may occur.**

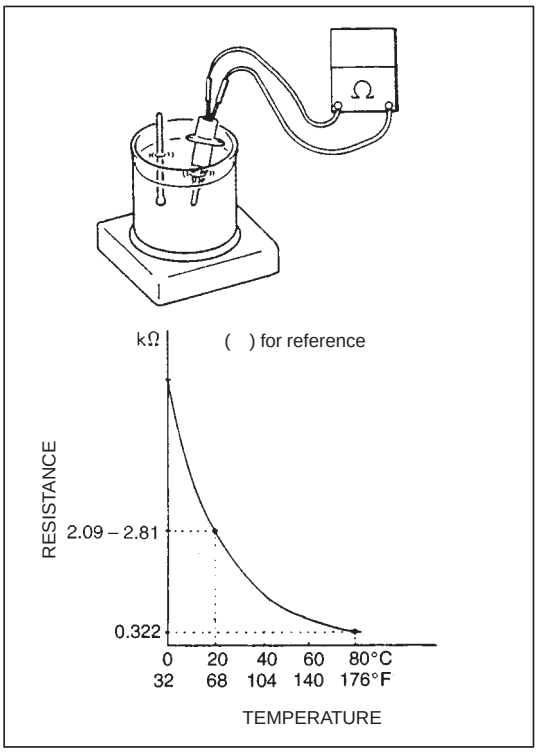
Installation

1) Install throttle body, referring to “THROTTLE BODY INSTALLATION” in this section.

INTAKE AIR TEMPERATURE (IAT) SENSOR

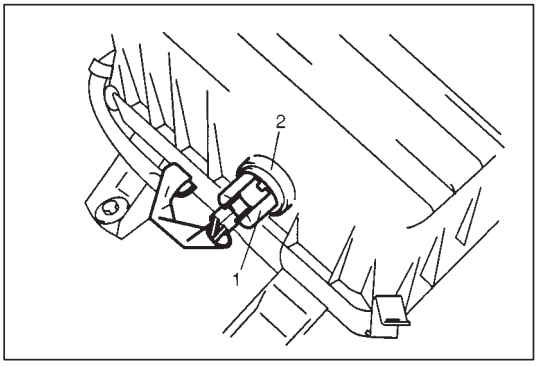
Removal

1) Disconnect negative cable from battery.
2) Disconnect IAT sensor coupler.
3) Remove IAT sensor from air cleaner case.



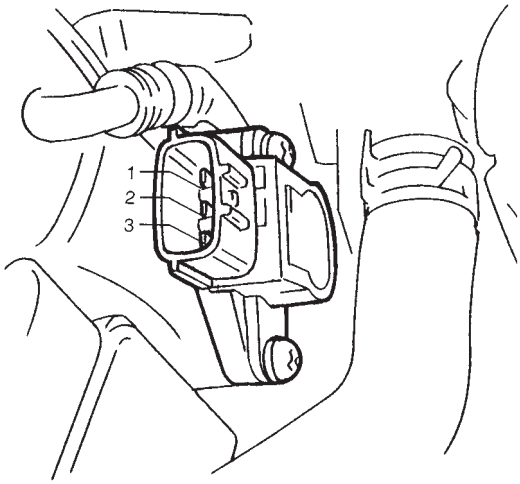
Inspection

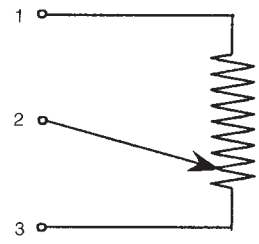
Immerse temperature sensing part of IAT sensor in water (or ice) and measure resistance between sensor terminals while heating water gradually.
If measured resistance doesn't show such characteristic as shown in figure, replace IAT sensor.



Installation

1) Clean mating surface of sensor and seal on air cleaner case.
2) Install IAT sensor (1) into seal (2).
3) Connect connector to IAT sensor securely.





1. Reference voltage terminal
2. Output voltage terminal
3. Ground terminal

THROTTLE POSITION SENSOR (TP SENSOR)

Inspection

1) Warm up engine and stop it when its temperature has reached normal operating temperature (Check to make sure that they have some clearance between fast idle cam and cam follow lever.).
2) Disconnect negative cable at battery and coupler from TP sensor.
3) Using ohmmeter, check resistance between terminals under each condition given in table below.

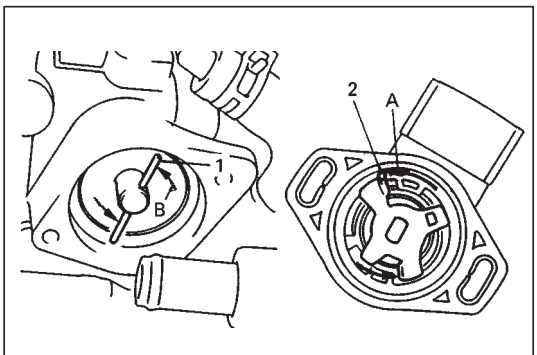
TERMINALS	RESISTANCE
Between 1 and 3 terminals	4 – 6 kΩ
Between 2 and 3 terminals	0 – 4.6 kΩ, varying linearly according to throttle valve opening

If check result is not satisfactory, replace TP sensor.

4) Connect TP sensor coupler securely.
5) Connect negative cable to battery.

Removal

1) Disconnect battery negative cable at battery.
2) Disconnect connector from TP sensor.
3) Remove TP sensor from throttle body.



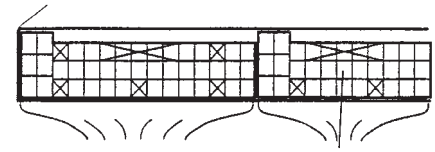
Installation

1) To install sensor, place it onto throttle body so that sensor pickup lever (2) can engage with throttle body lever (1). A should engage with B.
2) Hand-tighten TP sensor screws.
3) Connect connector to TP sensor securely.
4) Connect battery negative cable to battery.
5) Adjust installation angle of TP sensor according to procedure described in item “Adjustment”.

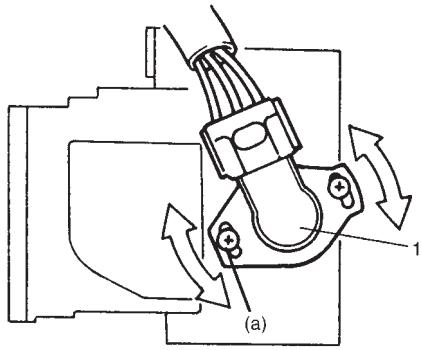
Adjustment

1) Warm up engine to normal operating temperature.
2) Check to make sure that fast idle cam and cam follower lever are not in contact with each other. If they are, check fast idle control system.

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



C51-3-12



3) Loosen TP sensor screws.
4) Remove ECM (PCM) cover from bracket.
5) Turn TP sensor (1) clockwise or counterclockwise and tighten TP sensor screw at a position where voltage as specified below is obtained at coupler terminal C51-3-12.

   NOTE:
   If tech 1 and cartridge are available, make an adjustment by using tech 1 while observing TP sensor voltage.

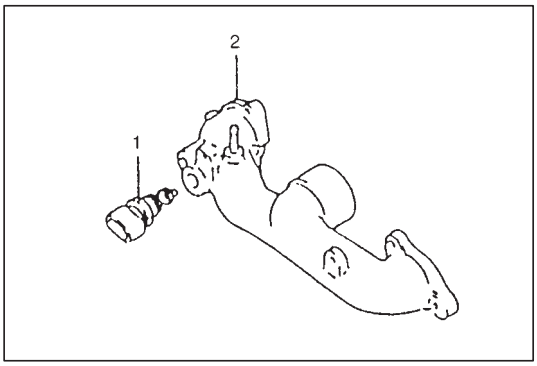
   TP sensor voltage when throttle is fully close: 0.50 ± 0.15 [V]

   Tightening Torque
   (a): 2.5 N·m (0.25 kg-m, 1.8 lb-ft)

6) Check to make sure that when throttle is fully open TP sensor voltage is as shown below.

   TP sensor voltage when throttle is fully open: 4.0 ± 0.5 [V]

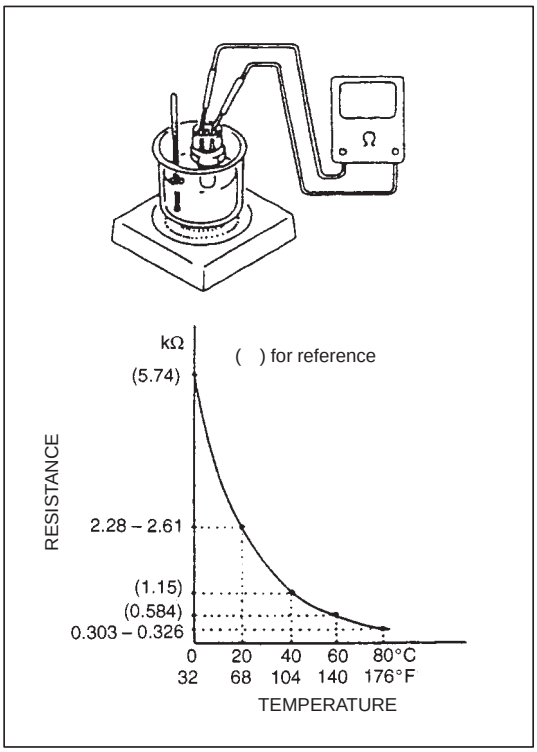
7) Install ECM (PCM) cover.
8) Disconnect negative cable at battery for 30 sec. or more and connect negative cable at battery.



ENGINE COOLANT TEMPERATURE SENSOR (ECT SENSOR)

Removal

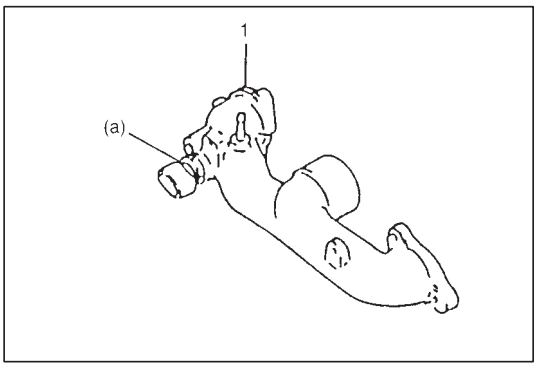
1) Disconnect negative cable from battery.
2) Drain cooling system.
3) Disconnect coupler from ECT sensor (1).
4) Remove ECT sensor from water outlet cap (2).



Inspection

Immerse temperature sensing part of ECT sensor in water and measure resistance between sensor terminals while heating water gradually.

If measured resistance doesn't shown such characteristic as shown, replace ECT sensor.



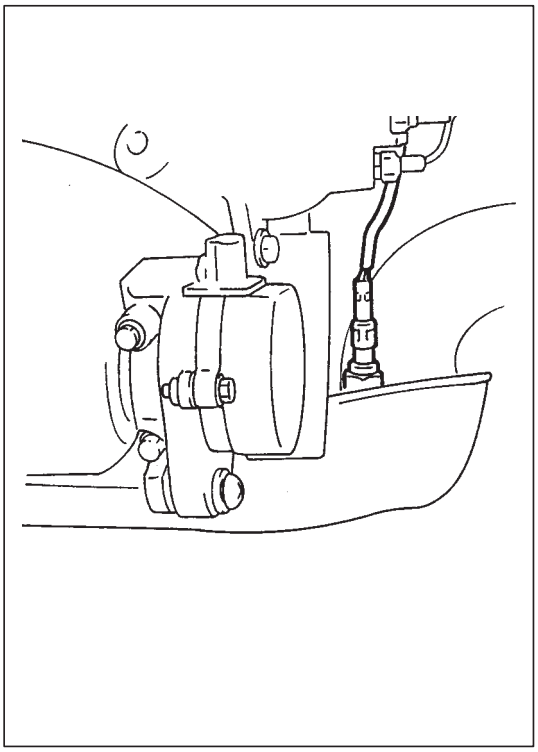
Installation

Reverse removal procedure noting the following.

- Clean mating surfaces of sensor and water outlet cap (1).
- Use new O-ring.
- Tighten ECT sensor to specified torque.

Tightening Torque
(a): 15 N·m (1.5 kg-m, 11.0 lb-ft)

- Connect coupler to sensor securely.
- Refill cooling system.



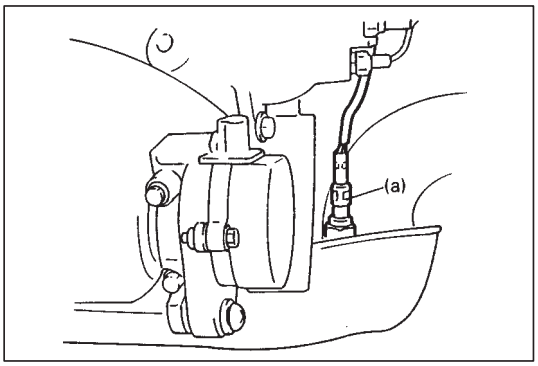
HEATED OXYGEN SENSOR (SENSOR 1)

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 from battery.
2) Disconnect coupler of oxygen sensor(s).
3) Remove oxygen sensor(s) from exhaust manifold(s).

NOTE:
Be careful not to expose it to excessive shock.



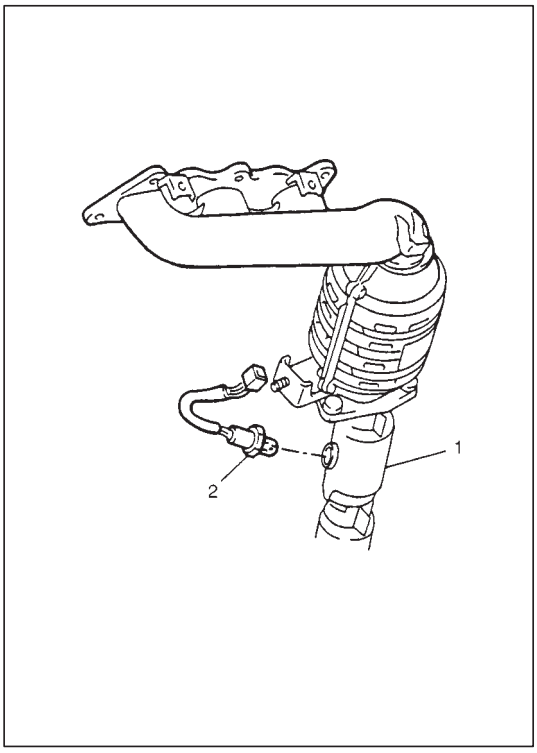
Installation

Reverse removal procedure noting the followings.

- Tighten oxygen sensor(s) to specified torque.

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

- Connect connector of oxygen sensor(s) and clamp wire harness securely.
- After installing oxygen sensor(s), start engine and check that no exhaust gas leakage exists.



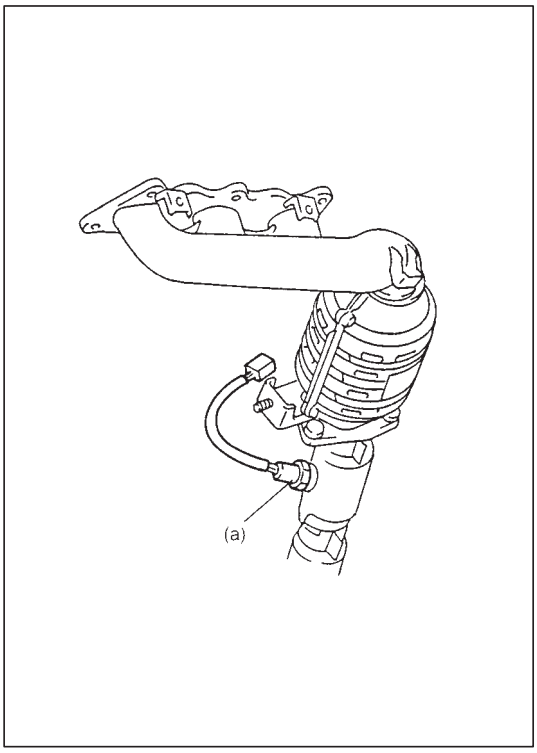
HEATED OXYGEN SENSOR (SENSOR 2)

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 from battery.
2) Disconnect coupler of oxygen sensor(s).
3) Remove oxygen sensor(s) (2) from exhaust No.1 pipe (1).

NOTE:
Be careful not to expose it to excessive shock.



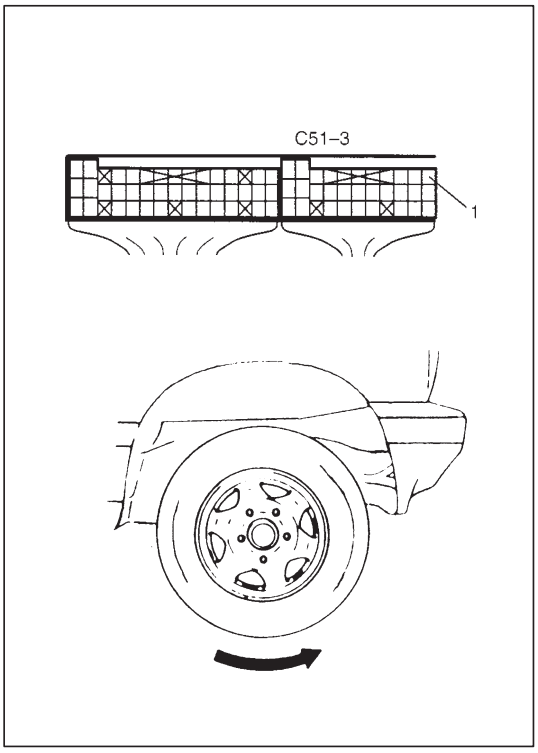
Installation

Reverse removal procedure noting the followings.

- Tighten oxygen sensor(s) to specified torque.

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

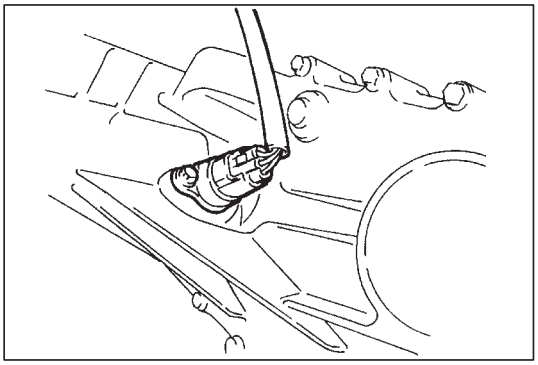
- Connect connector of oxygen sensor(s) and clamp wire harness securely.
- After installing oxygen sensor(s), start engine and check that no exhaust gas leakage exists.



VEHICLE SPEED SENSOR (VSS)

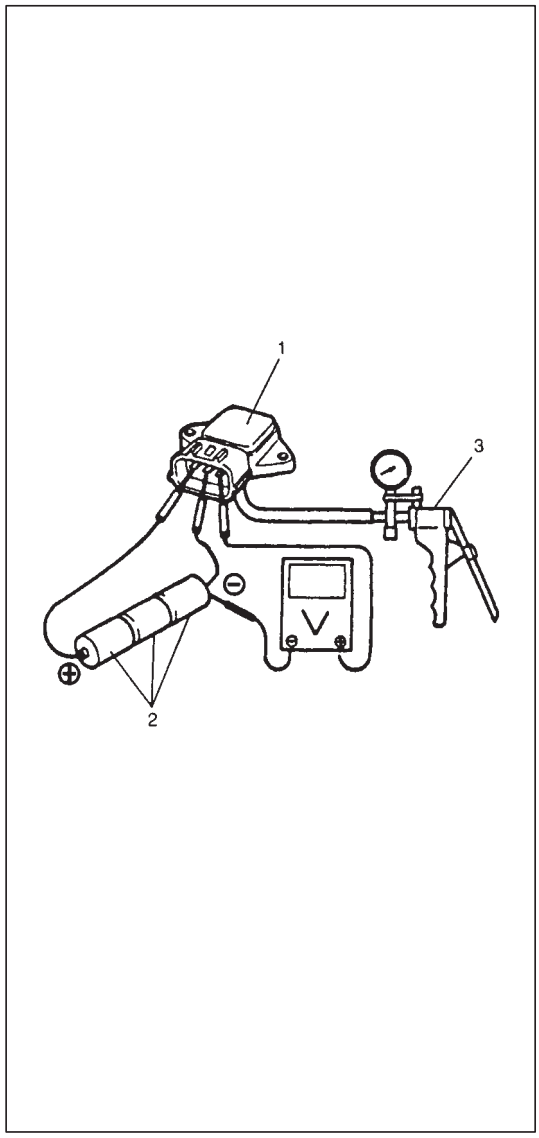
On-Vehicle Inspection

1) Hoist vehicle.
2) Release parking brake lever, set transmission in neutral and transfer in “2H”.
3) Remove ECM (PCM) cover.
4) Connector voltmeter between VSS terminal C51-3-1 of ECM (PCM) connector and body ground.
5) Turn ignition switch ON and turn rear right tire slowly with rear left tire locked.
   Voltmeter should indicate deflection between 0 – 1 V and 8 – 14 V a few times while tire is turned one revolution.
   If check result is not satisfactory, proceed to flow table of DTC P0500 in “ENGINE” section.



Removal, Inspection and Installation

Refer to “VSS Removal, Inspection or Installation” in “TRANSFER” section.



MANIFOLD ABSOLUTE PRESSURE SENSOR

Inspection

1) Disconnect coupler from MAP sensor (1).
2) Remove MAP sensor (1).
3) Arrange 3 new 1.5 V batteries (2) in series (check that total voltage is 4.5 – 5.0 V) and connect its positive terminal to "Vin" terminal of sensor and negative terminal to "Ground" terminal. Then check voltage between "Vout" and "Ground".
   Also, check if voltage reduces when vacuum is applied up to 400 mmHg by using vacuum pump (3).
   If check result is not satisfactory, replace MAP sensor (1).

   Output voltage (Vin voltage 4.5 – 5.5 V, ambient temp. 20 – 30°C, 68 – 86°F)

ALTITUDE (Reference)		BAROMETRIC PRESSURE		OUTPUT VOLTAGE
(ft)	(m)	(mmHg)	(kPa)	(V)
0 | 2 000	0 | 610	760 | 707	100 | 94	3.3 – 4.3
2 001 | 5 000	611 | 1 524	Under 707 over 634	94 | 85	3.0 – 4.1
5 001 | 8 000	1 525 | 2 438	Under 634 over 567	85 | 76	2.7 – 3.7
8 001 | 10 000	2 439 | 3 048	Under 567 over 526	76 | 70	2.5 – 3.3

4) Install MAP sensor (1) securely.
5) Connect MAP sensor (1) coupler securely.

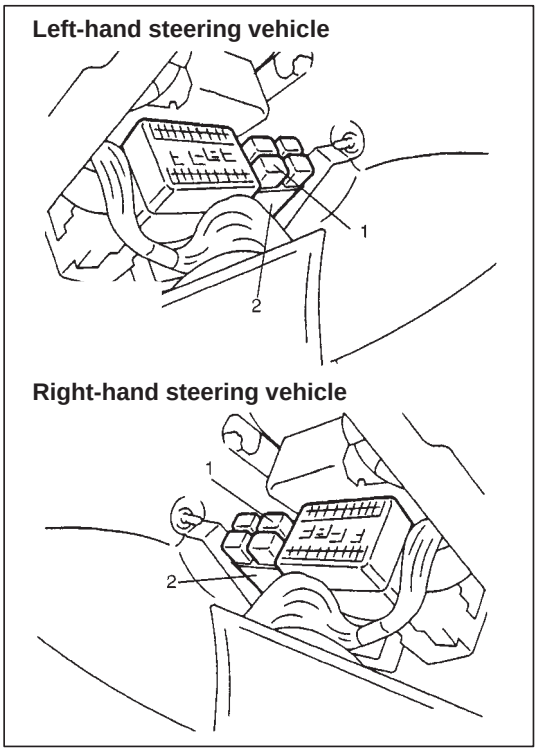
CRANK SHAFT POSITION SENSOR

Removal / Installation

Refer to "ENGINE MECHANICAL" section.

Inspection

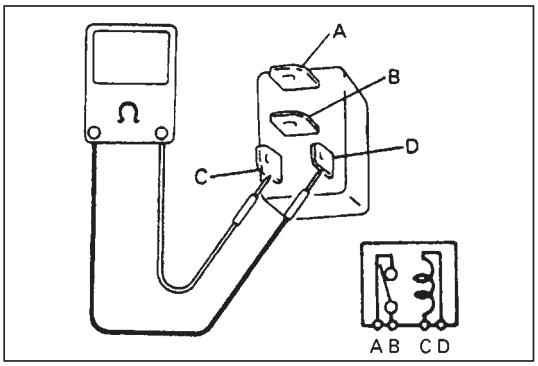
Refer to "ENGINE" section.



MAIN RELAY

Inspection

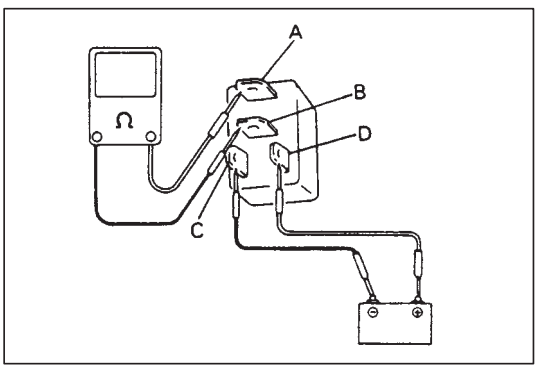
1) Disconnect negative cable at battery.
2) Remove main relay (1) from relay box (2).



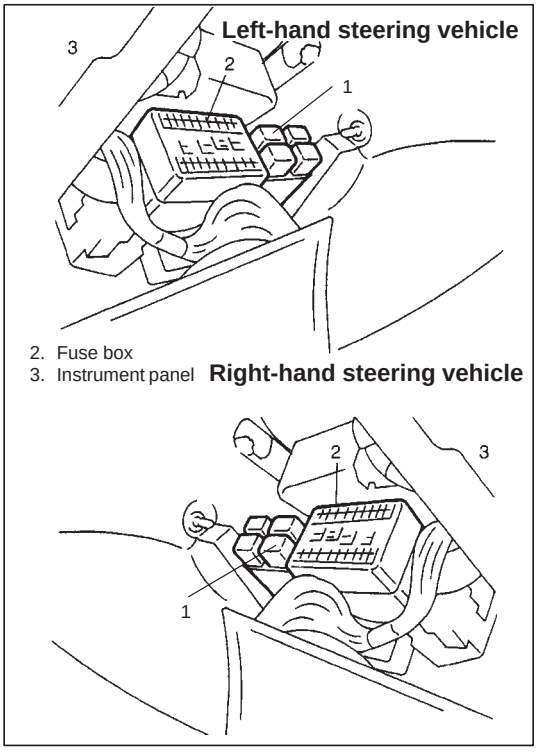
3) Check resistance between each two terminals as in table below.

TERMINALS	RESISTANCE
Between A and B	∞ (Infinity)
Between C and D	70 – 110 Ω at 20°C, 68°F

If check results are as specified, proceed to next operation check. If not, replace.



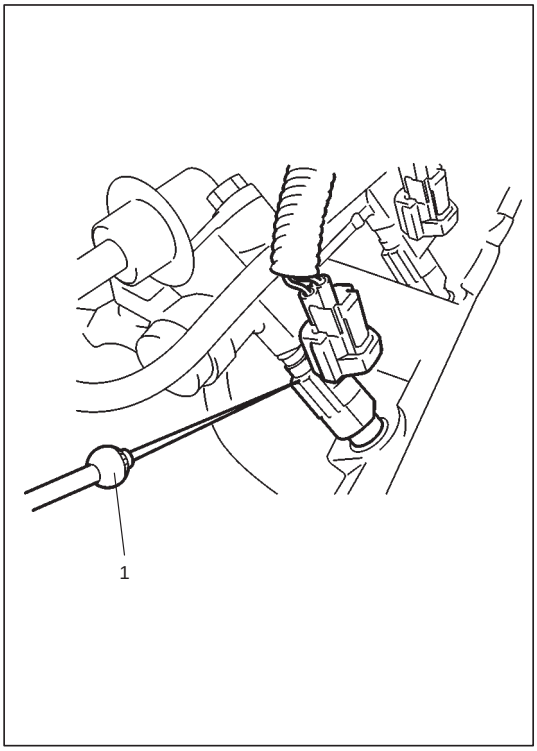
4) Check that there is continuity between terminals “A” and “B” when battery is connected to terminals “C” and “D”.
If malfunction is found, replace.



FUEL PUMP RELAY

Inspection

1) Disconnect negative cable at battery.
2) Remove fuel pump relay (1) from relay box.
3) Structure of fuel pump relay is the same as that of main relay. Check its resistance and operation using the same procedure as that for main relay.
   If malfunction is found, replace.



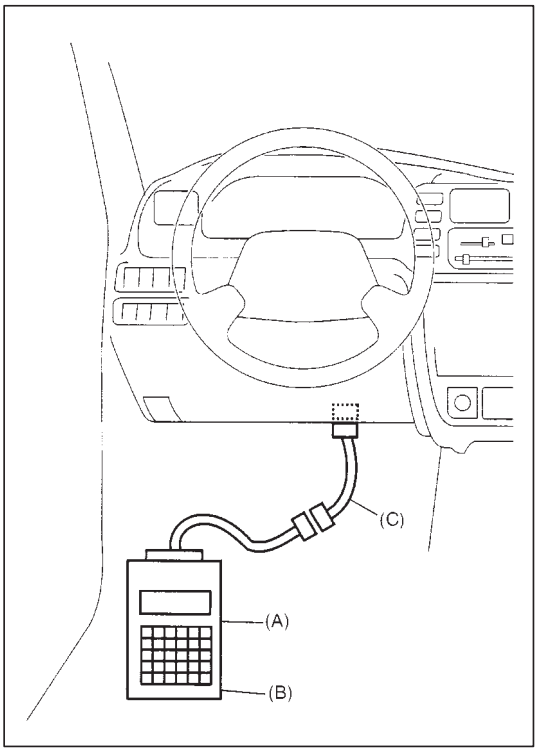
FUEL CUT OPERATION

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 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.



EMISSION CONTROL SYSTEM

EGR SYSTEM (IF EQUIPPED)

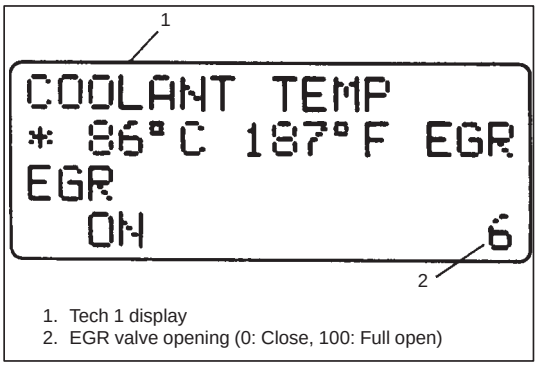
System Inspection [Using SUZUKI scan tool (Tech 1)]

1) Connect Tech 1 to data link connector (DLC) with ignition switch OFF.

   Special tool
   (A): SUZUKI scan tool, Tech 1
   (B): Mass storage cartridge
   (C): 16/14 pin DLC cable

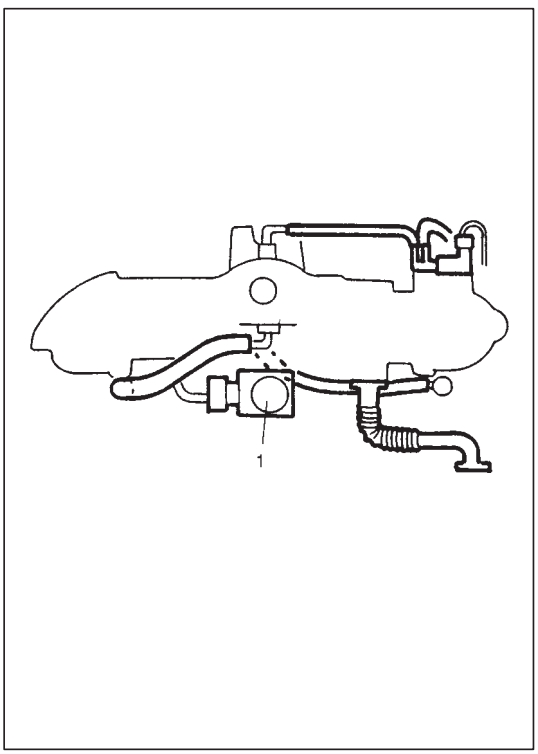
   NOTE:
   For operation procedure of cartridge, refer to its cartridge operator's manual.

2) Start engine and warm up it to normal operating temperature.



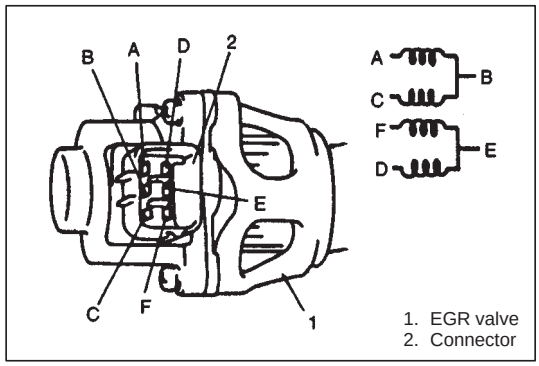
1. Tech 1 display
2. EGR valve opening (0: Close, 100: Full open)

3) With engine idling (without depressing accelerator pedal), open EGR valve by using "MISC. TEST" mode.
   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.

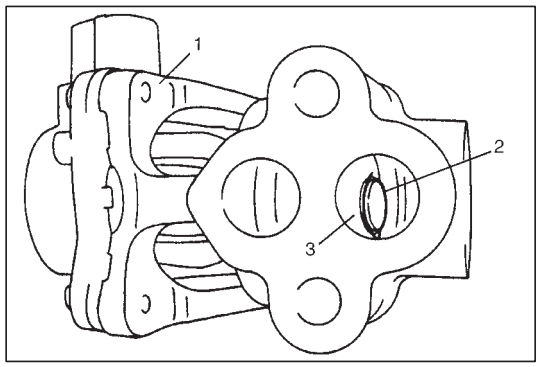


Removal

1) Disconnect negative cable at battery.
2) Disconnect EGR valve coupler.
3) Remove EGR valve (1) and gasket from intake collector.



1. EGR valve
2. Connector



Inspection

1) Check resistance between following terminals of EGR valve in each pair.

Terminals	Standard resistance
A – B C – B F – E D – E	20 – 24 Ω at 20°C, 68F
B – valve body E – valve body	Infinity (∞)

If found faulty, replace EGR valve assembly

2) Remove carbon from EGR valve (1) gas passage.

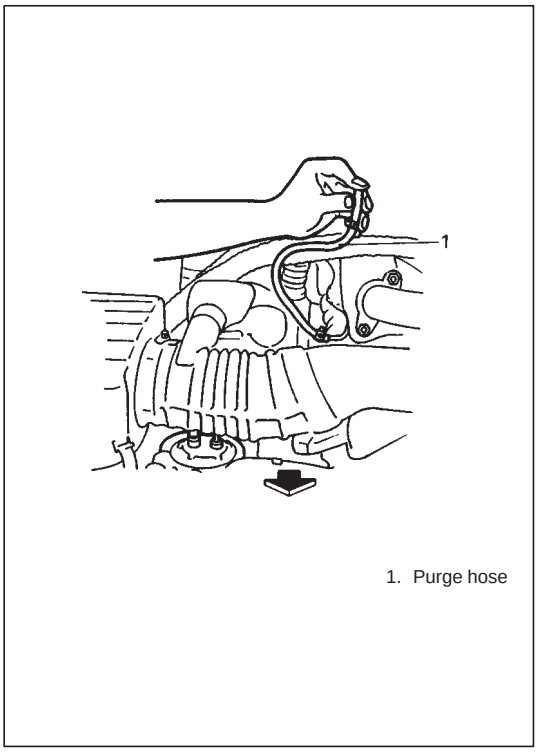
NOTE:
Do not use any sharp–edged tool to remove carbon.
Be careful not to damage or bend EGR valve, valve seat (3) and rod.

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 gasket.



1. Purge hose

EVAPORATIVE EMISSION CONTROL SYSTEM

EVAP Canister Purge Inspection

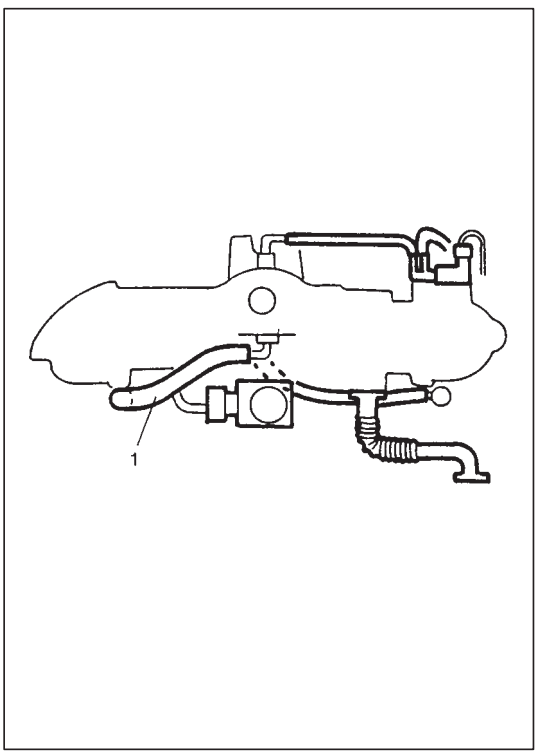
1) Warm up engine to normal operating temperature and keep idling 5 min. or more.
2) Disconnect purge hose from EVAP canister when engine is running at idle speed.
3) Place finger against the end of disconnected hose and check that vacuum is not felt but vibration is felt there when engine is running at idle speed.
4) Also check that vacuum is felt when engine speed is increased to higher than about 2,000 r/min.
   If check result is not satisfactory, check vacuum passage, hoses, EVAP canister purge valve, wire harness and ECM (PCM).

EVAP Canister Purge Valve Inspection

EVAP Canister Inspection

Tank Pressure Control Valve Inspection

Refer to Section 6E1.



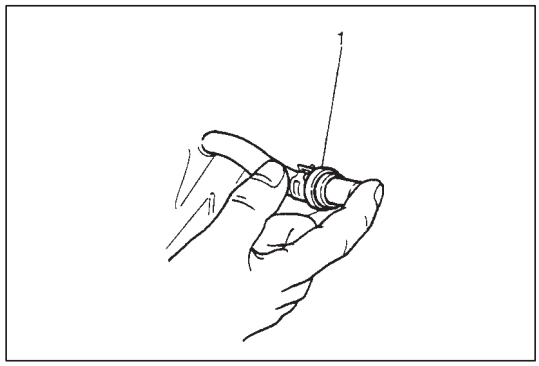
PCV SYSTEM

NOTE:

Be sure to check that there is no obstruction in PCV valve or its hoses (1) before checking engine idle speed/IAC duty for obstructed PCV valve or hose hampers its accurate checking.

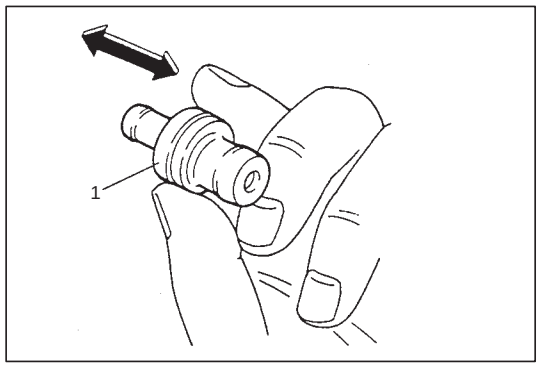
PCV HOSE

Check hoses for connection, leakage, clog, and deterioration.
Replace as necessary.



PCV VALVE

1) Disconnect PCV valve (1) from cylinder head cover and plug head cover hole.
2) Run engine at idle.
3) Place your finger over end of PCV valve to check for vacuum. If there is no vacuum, check for clogged valve. Replace as necessary.

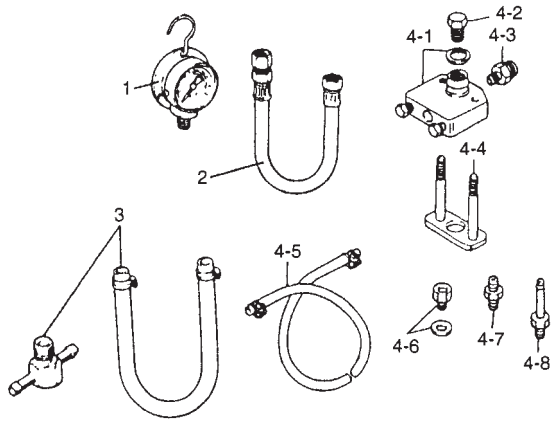


4) After checking vacuum, stop engine and remove PCV valve (1). Shake valve and listen for the rattle of check needle inside the valve. If valve does not rattle, replace valve.
5) After checking, connect PCV valve, PCV hose and clamp securely.

TIGHTENING TORQUE SPECIFICATIONS

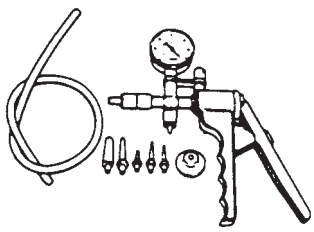
Fastening parts	Tightening torque		
	N·m	kg-m	lb-ft
Heated oxygen sensor	45	4.5	32.5
Fuel pressure regulator bolts	10	1.0	7.5
Fuel pipe union bolts	30	3.0	22.0
Engine coolant temp. sensor	15	1.5	11.0

SPECIAL TOOLS

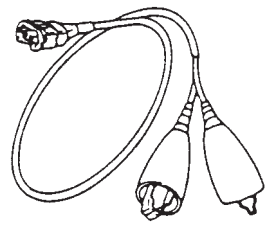


1. Pressure gauge 09912-58441
2. Pressure hose 09912-58431
3. 3-way joint & hose 09912-58490
4. Checking tool set 09912-58421

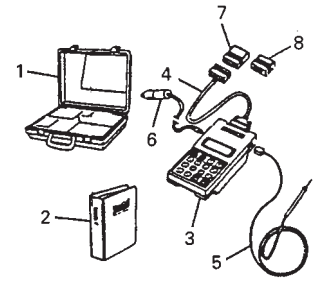
4-1. Tool body & washer
4-2. Body plug
4-3. Body attachment-1
4-4. Holder
4-5. Return hose & clamp
4-6. Body attachment-2 & washer
4-7. Hose attachment-1
4-8. Hose attachment-2



09917-47010
Vacuum pump gauge

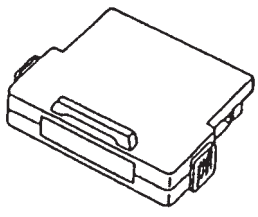


09930-88521
Injector test lead

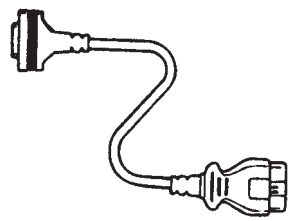


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable
5. Test lead/probe
6. Power source cable
7. DLC cable adaptor
8. Self-test adaptor

09931-76011
SUZUKI scan tool (Tech 1A)



SUZUKI scan tool mass storage cartridge



09931-76030
16/14 pin DLC cable

SECTION 6F1

IGNITION SYSTEM (FOR G16 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).**

NOTE:
Whether the following parts are installed in the particular vehicle or not depends on vehicle specifications. Be sure to bear this in mind when performing service work.

- **Ignition timing adjusting resistor.**
- **Monitor connector.**

CONTENTS

GENERAL DESCRIPTION 6F1- 2
System wiring 6F1- 2
Components 6F1- 3
DIAGNOSIS 6F1- 3
Diagnostic flow table 6F1- 4
Ignition spark check 6F1- 5
Ignition timing check 6F1- 6
ON-VEHICLE SERVICE 6F1- 8
High-tension cord 6F1- 8
Ignition coil assembly (Igniter and ignition coil) 6F1- 9
Spark plug 6F1-10
Ignition timing adjusting resistor (if equipped) 6F1-10
CMP sensor 6F1-11
Noise suppressor 6F1-11
TIGHTENING TORQUE SPECIFICATION 6F1-12
SPECIAL TOOLS 6F1-12

GENERAL DESCRIPTION

The ignition system is a distributorless ignition system. Its consists of the parts as described below and has an electronic ignition control system.

° ECM (or PCM)
It detects the engine condition 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 igniter (in ignition coil assembly).

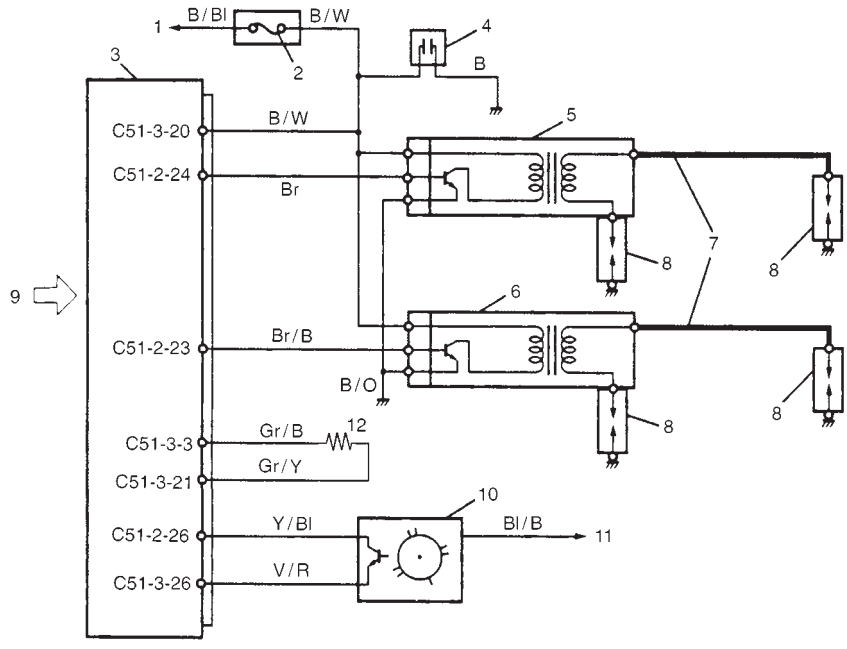
° Ignition coil assembly (including an igniter and an ignition coil)
The ignition coil assembly has a built-in igniter and ignition coil which turns ON and OFF the primary current of the ignition coil according to the signal from ECM (or PCM). When the ignition coil primary current is turned OFF, a high voltage is induced in the secondary wiring.

° Spark plug , high-tension cord and noise suppressor

° CMP sensor, TP sensor, ECT sensor, MAF sensor and other sensors/switches.
For their details, refer to SECTION 6E1.

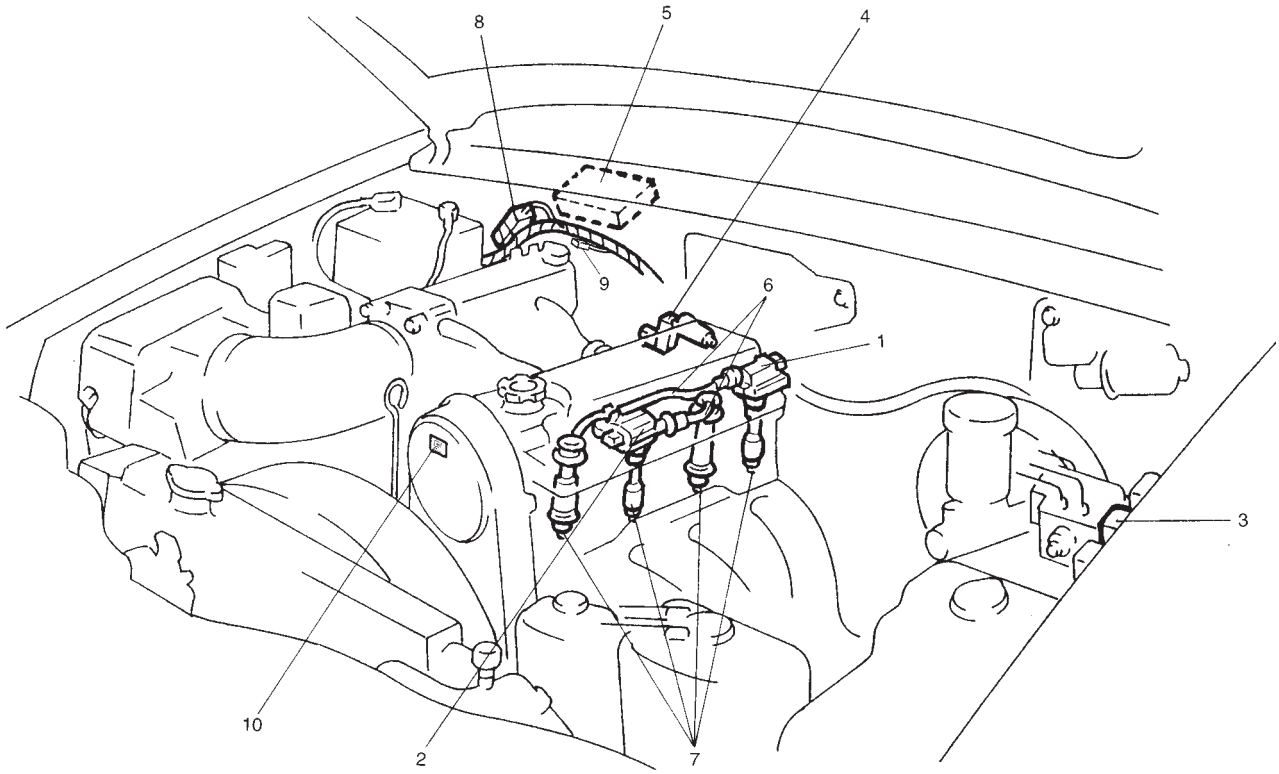
Although this ignition system does not have a distributor, it has two ignition coil assemblies (one is for No.1 and No.4 spark plugs and the other is for No.2 and No.3 spark plugs). When an ignition signal is sent from ECM (or PCM) to the igniter in the ignition coil assembly for No.1 and No.4 spark plugs, a high voltage is induced in the secondary coil. Then, it is fed to No.1 spark plug through high-tension cords and to No.4 spark plug directly from ignition coil assembly to cause both of these plugs to spark simultaneously. Likewise, when an ignition signal is sent from ECM (or PCM) to the ignition coil assembly for No.2 and No.3 spark plugs, a high voltage is induced in the secondary coil. Then, it is fed to No.3 spark plug through high-tension cords and to No.2 spark plug directly from ignition coil assembly to cause both No.2 and No.3 spark plugs to spark simultaneously.
The ignition system of vehicle with CKP sensor needs no adjustment of initial ignition timing.

SYSTEM WIRING



1. To ignition switch
2. "IG·COIL METER" fuse
3. ECM (or PCM)
4. Noise suppressor
5. Ignition coil assembly (igniter and ignition coil) for No.1 and No.4 cylinders
6. Ignition coil assembly (igniter and ignition coil) for No.2 and No.3 cylinders
7. High-tension cord
8. Spark plug
9. Sensed information
   – MAF sensor
   – ECT sensor
   – IAT sensor
   – TP sensor
   – CKP sensor (if equipped)
   – Engine start switch
   – VSS
10. CMP sensor
11. To main relay
12. Ignition timing adjusting resistor (if equipped)

COMPONENTS



1. Ignition coil assembly for No.1 and No.4 cylinders
2. Ignition coil assembly for No.2 and No.3 cylinders
3. Monitor coupler (*)
4. CMP sensor
5. ECM (or PCM) (*)
6. High-tension cord
7. Spark plug
8. Noise suppressor
9. Ignition timing adjusting resistor (*) (if equipped)
10. Ignition label (if equipped)

NOTE:
Above figure shows left hand steering vehicle. For right hand steering vehicle, parts with (*) are installed at the other side. Ignition timing adjusting resistor is equipped in the vehicle which is not equipped with CKP sensor.

DIAGNOSIS

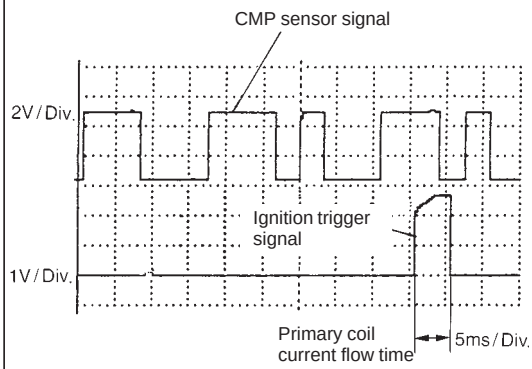
Condition	Possible Cause	Correction
Engine cranks, but will not start or hard to start	**No spark**	
	° Blown fuse for ignition coil	Replace.
	° Loose connection or disconnection of lead wire or high-tension cord(s)	Connect securely.
	° Faulty high-tension cord(s)	Replace.
	° Faulty spark plug(s)	Adjust, clean or replace.
	° Faulty ignition coil assembly(s)	Replace.
	° Faulty CMP sensor	Clean, tighten or replace.
	° Faulty ECM (or PCM)	Replace.
Poor fuel economy or engine performance	° Incorrect ignition timing	Adjust ignition timing if adjustable or check system related sensor.
	° Faulty high-tension cord(s)	Replace.
	° Faulty spark plug(s)	Adjust, clean or replace.
	° Faulty ignition coil assembly(s)	Replace.
	° Faulty CMP sensor	Clean, tighten or replace.
	° Faulty ECM (or PCM)	Replace.

DIAGNOSTIC FLOW TABLE

STEP	ACTION	YES	NO
1	Was “Engine Diagnostic Flow Table” in SECTION 6 performed ?	Go to Step 2.	Go to “Engine Diagnostic Flow Table” in SECTION 6.
2	Ignition Spark Test 1) Check all spark plug for condition and type, referring to “Spark Plug” in this section. 2) If OK, perform ignition spark test, referring to “Ignition Spark Check” in this section. Is spark emitted from all spark plugs?	Go to Step 10 on the next page.	Go to Step 3.
3	Diagnostic Trouble Code (DTC) Check 1) Check DTC stored in ECM (or PCM), referring to “Diagnostic Trouble Code (DTC) Check” in SECTION 6. Is DTC stored?	Go to applicable DTC Diag. Flow Table in SECTION 6.	Go to Step 4.
4	Electrical Connection Check 1) Check ignition coil assemblies for electrical connection. Are they connected securely?	Go to Step 5.	Connect securely.
5	High-tension Cord Check 1) Check high-tension cord for resistance, referring to “High-tension Cord” in this section. Is check result satisfactory?	Go to Step 6.	Replace high-tension cord(s).
6	Ignition Coil Assembly Power Supply, Ground and Trigger Signal Circuits Check 1) Check these circuits for open and short. Are circuits in good condition?	Go to Step 7.	Repair or replace.
7	Ignition Coil Assembly Check 1) Check ignition coil assembly for damage, deterioration and terminal corrosion, referring to “Ignition Coil Assembly” in this section. Is check result satisfactory?	Go to Step 8.	Replace ignition coil assembly.
8	Ignition Coil Assembly Check 1) Substitute a known-good ignition coil assembly and then repeat Step 2. Is check result of Step 2 satisfactory?	Malfunction of ignition coil assembly.	Go to Step 9.
9	CMP Sensor Check 1) Check CMP sensor and signal rotor, referring to Steps 6 and 7 of DTC P0340 (No.42) Diag. Flow table in SECTION 6. Is check result satisfactory?	Substitute a known-good ECM (or PCM) and then repeat Step 2.	Tighten CMP sensor bolt, replace CMP sensor or camshaft.

STEP	ACTION	YES	NO
10	Ignition Timing Check 1) Check initial ignition timing and ignition timing advance, referring to “Ignition Timing Check” in this section. Is check result satisfactory?	System is in good condition.	Adjust ignition timing if adjustable or check CMP sensor, signal rotor (camshaft looseness), crankshaft pulley /timing belt cover installation and input signals related to ignition system.

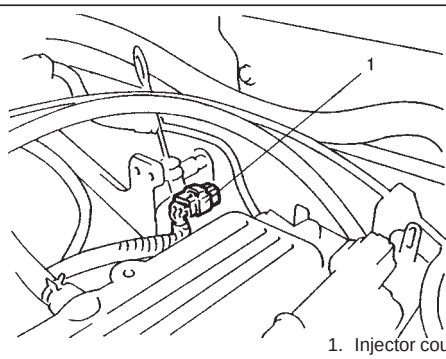
Oscilloscope waveforms



Waveforms at specified idle speed

Reference

Oscilloscope waveforms of CMP sensor and ignition trigger signal are as shown in figure when connecting oscilloscope between terminals C51-2-26 and C51-3-26 of ECM (PCM) connectors connected to ECM (PCM), and between terminal C51-2-24 and ground.



1. Injector coupler

IGNITION SPARK CHECK

1) Disconnect injector coupler.

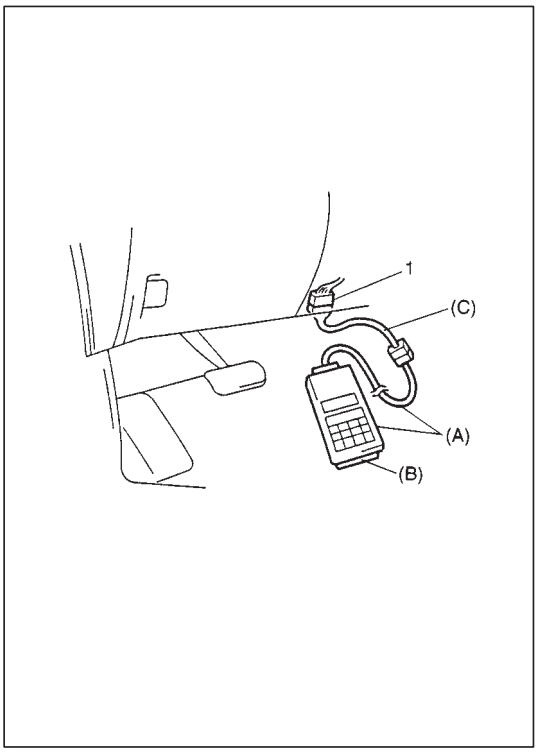
WARNING:
Without disconnection of injector coupler, combustible gas may come out from spark plug holes during this test and may get ignited in engine room.

2) Remove spark plug and check it for condition and type, referring to “Spark Plug” under “On-Vehicle Service” later in this section.
3) 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.
4) Crank engine and check if each spark plug sparks.
   If no spark is emitted, inspect the related parts as described under ”Diagnosis” earlier in this section.
6) After checking, install spark plug and ignition coil, referring to “Spark Plug” and “Ignition Coil Assembly” under “On-Vehicle Service” later in this section.
7) Connect injector coupler.

IGNITION TIMING CHECK

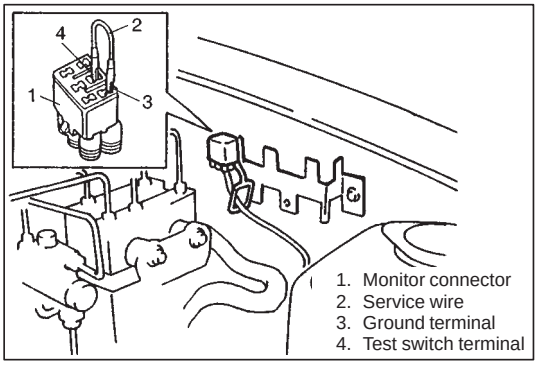
NOTE:
Before starting engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T model), and set parking brake.

1) Start engine and warm it up to normal operating temperature.
2) Make sure that all of electrical loads except ignition are switched off.



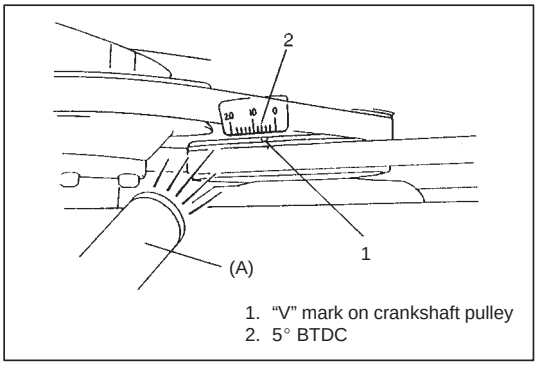
3) Check to be sure that idle speed is within specification. (Refer to SECTION 6E1.)
4) Fix ignition timing as follows.
   [Using SUZUKI scan tool (Tech 1)]
   Connect SUZUKI scan tool (Tech 1) to DLC (1) with ignition switch OFF, restart engine and fix ignition timing by using fixed spark mode of SUZUKI scan tool (Tech 1).

   Special Tool
   (A): 09931-76011 (SUZUKI scan tool)
   (B): Mass storage cartridge
   (C): 16/14 pin DLC (OBD-II adapter) cable



1. Monitor connector
2. Service wire
3. Ground terminal
4. Test switch terminal

   [Not using SUZUKI scan tool (Tech 1)] (for vehicle with monitor connector)
   a) Remove monitor connector cap.
   b) Ground test switch terminal in monitor connector by using service wire so that ignition timing is fixed on initial one.

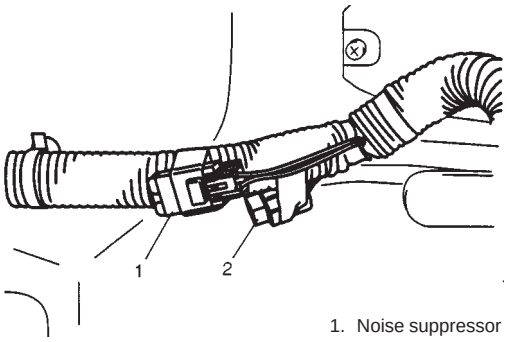


1. "V" mark on crankshaft pulley
2. 5° BTDC

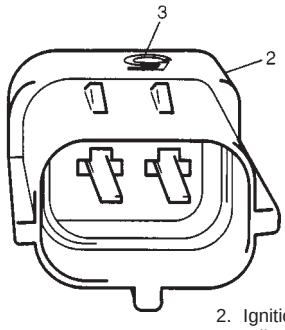
5) Set timing light to high-tension cord for No.1 cylinder.
6) Using timing light, check that timing is within specification.

   Initial ignition timing of viewpoint (test switch terminal grounded): 5 ± 1° BTDC
   Ignition order: 1-3-4-2

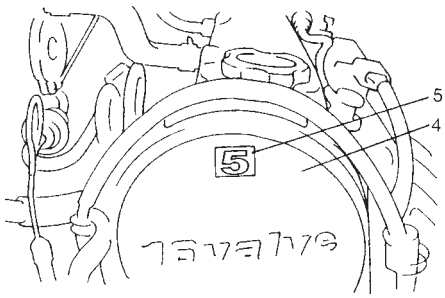
   Special Tool
   (A): 09930-76420



1. Noise suppressor



2. Ignition timing adjusting resistor
3. Character on resistor



4. Timing belt cover
5. Ignition label

7) If ignition timing is out of specification, check as follows.
   For vehicle equipped with ignition timing adjusting resistor.
   a) Check resistance of ignition timing adjusting resistor (if equipped), referring to “Ignition Resistor” under “On-Vehicle Service” later in this section.
   b) If check result is not satisfactory, change ignition resistor with consecutive character for the original one recheck that initial ignition timing is within specification.
      Select and check resistor with the next consecutive character until specified ignition timing is obtained.
      For example, if the vehicle being serviced has an ignition resistor with an “5” mark, initial ignition timing can be changed by replacing it with “4” or “N”.

Character on resistor (3)	1	2	3	4
Difference in advance degrees as compared with those of “N”	–5°	–4°	–3°	–2°

5	N	6	7	8	9	10	11
–1°	0°	1°	2°	3°	4°	5°	6°

NOTE:
If ignition resistor has been replaced, be sure to also replace ignition label attached to timing belt cover with the one that has the same symbol as that marked on ignition resistor.

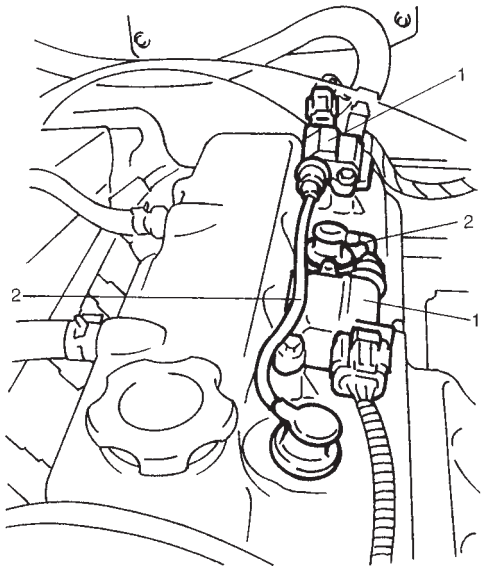
For vehicle not equipped with ignition timing adjusting resistor.
Check the followings:
– CMP sensor and CKP sensor (if equipped)
– Signal rotor on camshaft
– TP sensor
– VSS
– Crankshaft pulley/timing belt cover installation

8) After checking, end fixed spark mode of SUZUKI scan tool or remove service wire from monitor connector.

CAUTION:
Driving with test switch terminal grounded will cause damage to catalyst. Be sure to disconnect service wire after adjustment.

NOTE:
In this state, ignition timing may vary more or less of initial ignition timing but it is nothing abnormal.

9) With engine idling (closed throttle position and vehicle stopped), check that ignition timing is about BTDC 6° –10°. Also, check that increasing engine speed advances ignition timing. If above check results are not satisfactory, check input signals related to ignition system.



1. Ignition coil assembly
2. High-tension cord

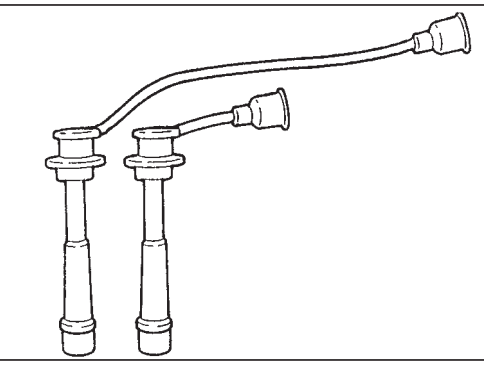
ON-VEHICLE SERVICE

HIGH-TENSION CORD

REMOVAL

1) Remove high-tension cord from ignition coil assembly while gripping its cap.
2) Pull out high-tension cord from spark plug while gripping its cap.

CAUTION:
- **Removal of high-tension cords together with clamps will be recommended so as to damage their inside wire (resistive conductor).**
- **For the same reason, pull out each connection by gripping cap portion.**

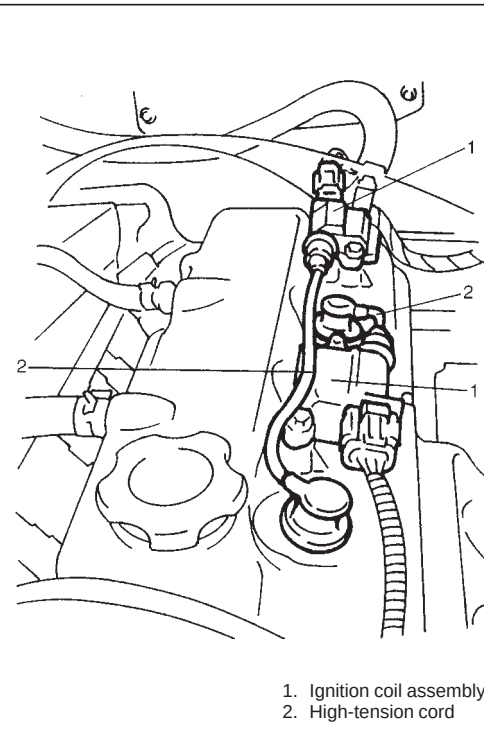


INSPECTION

Measure resistance of high-tension cord by using ohmmeter.

High-tension cord resistance: 4 – 10 kΩ/m (1.2 – 3.0 kΩ/ft)

Check for damage, deterioration and terminal corrosion.
If check result is not satisfactory, replace high-tension cord(s).

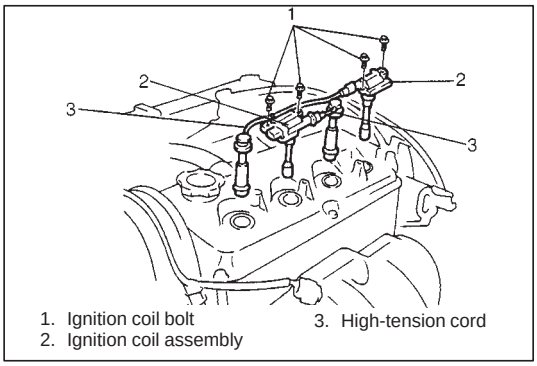


1. Ignition coil assembly
2. High-tension cord

INSTALLATION

1) Install high-tension cord to spark plug and ignition coil assembly while gripping its cap.

CAUTION:
- **Never attempt to use metal conductor high-tension cord(s) as replacing parts.**
- **Insert each cap potion fully when installing high-tension cords.**

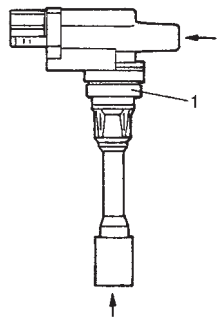


1. Ignition coil bolt
2. Ignition coil assembly
3. High-tension cord

IGNITION COIL ASSEMBLY (IGNITER AND IGNITION COIL)

REMOVAL

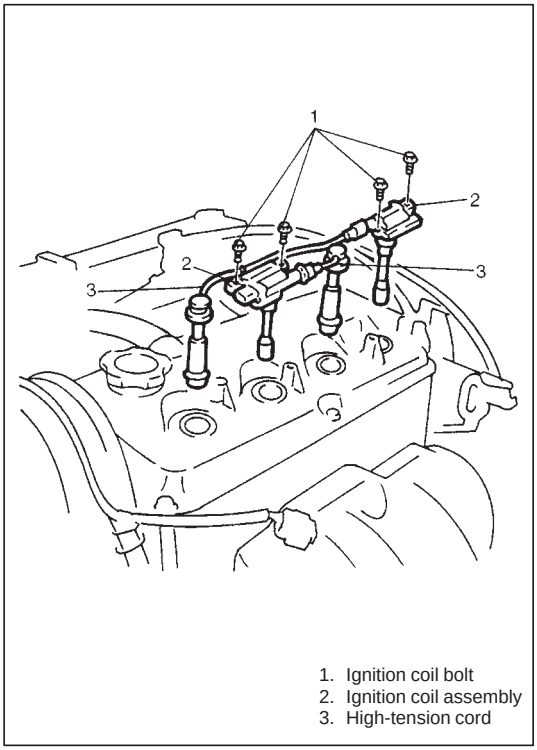
1) Disconnect ignition coil coupler.
2) Disconnect high-tension cord from ignition coil assembly.
3) Remove ignition coil bolt, and then pull out ignition coil assembly.



1. Ignition coil assembly

INSPECTION

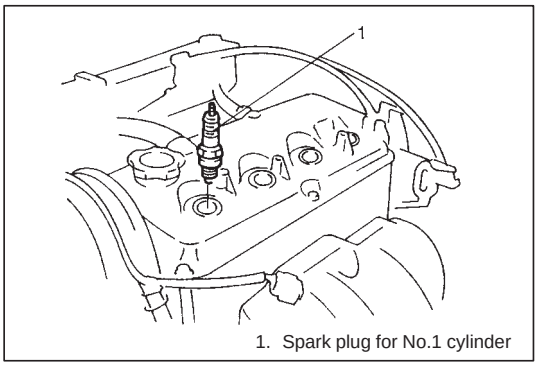
Check for damage, deterioration and terminal corrosion.
If check result is not satisfactory, replace ignition coil assembly.



1. Ignition coil bolt
2. Ignition coil assembly
3. High-tension cord

INSTALLATION

1) Install ignition coil assembly.
2) Tighten ignition coil bolt, and then connect ignition coil coupler.
3) Install high-tension cord to ignition coil assembly while gripping its cap.

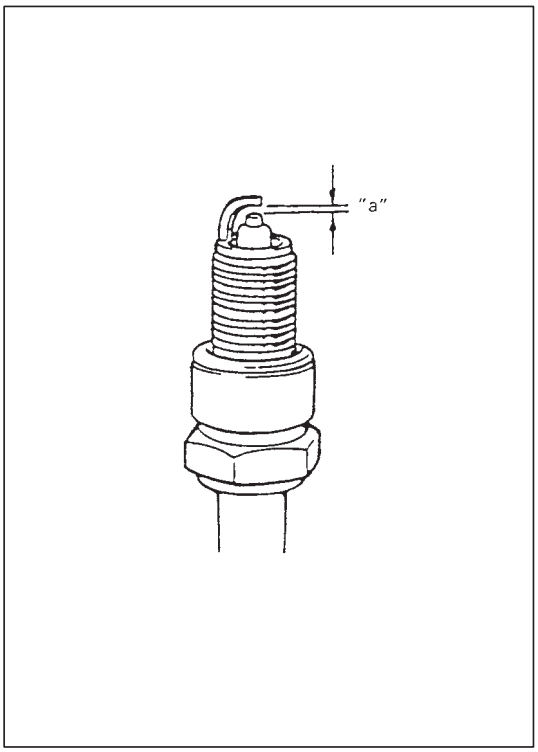


1. Spark plug for No.1 cylinder

SPARK PLUG

REMOVAL

1) Pull out high-tension cord while gripping its cap.
2) Remove ignition coil assembly, referring to "Ignition Coil Assembly" under "On-Vehicle Service" earlier in this section.
3) Remove spark plug



INSPECTION

Inspect them for:

° Electrode wear
° Carbon deposits
° Insulator damage

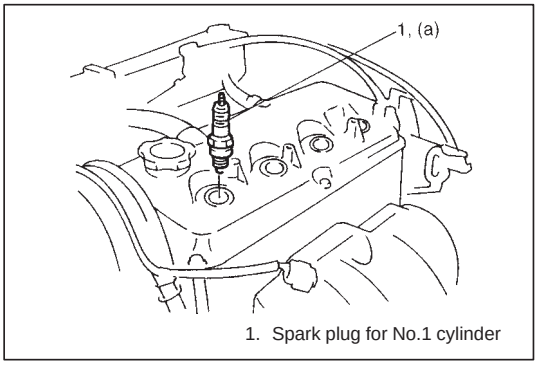
If any abnormality is found, adjust air gap, clean with spark plug cleaner or replace them with specified new plug.

Spark plug air gap "a": 1.0 – 1.1 mm (0.039 – 0.043 in.)

Spark plug type: NGK BKR6E-11/IFR6E11
DENSO K20PR-U11/SK20PR-A11

NOTE:
It is highly recommended to use NGK IFR6E11 for better engine starting performance.

CAUTION:
When servicing the iridium/platinum sparkplugs (slender center electrode type plugs), do not touch the center electrode to avoid damage to it. The electrode is not strong enough against mechanical force as it is slender and its material is not mechanically tough.



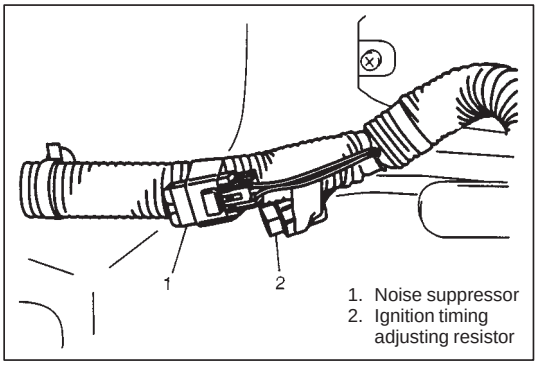
1. Spark plug for No.1 cylinder

INSTALLATION

1) Install spark plug and tighten it to specified torque.

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

2) Install ignition coil assembly, referring to "Ignition Coil Assembly" under "On-Vehicle Service" earlier in this section.
3) Install high-tension cord while gripping its cap.

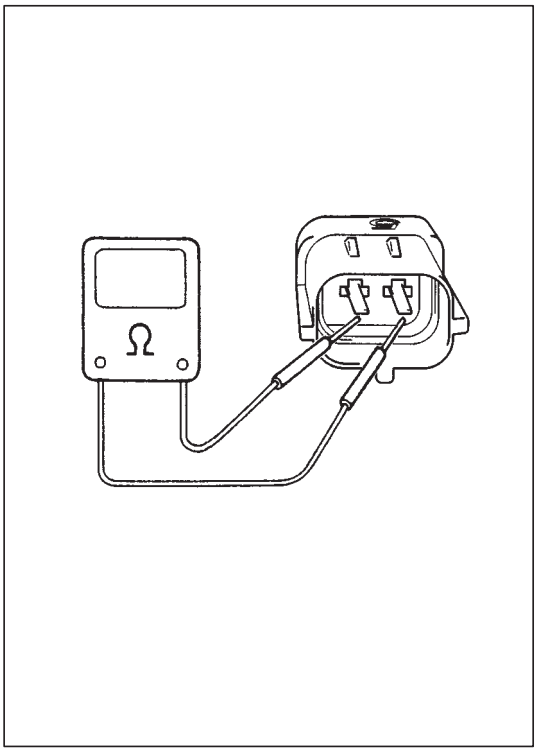


1. Noise suppressor
2. Ignition timing adjusting resistor

IGNITION TIMING ADJUSTING RESISTOR (IF EQUIPPED)

REMOVAL

1) With ignition switch OFF, remove ECM (or PCM), referring to "ECM (or PCM)" under "On-Vehicle Service" in SECTION 6E1.
2) Remove ignition timing adjusting resistor.



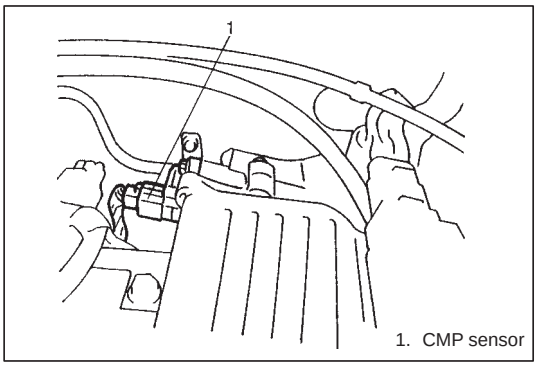
INSPECTION
Measure resistance of ignition timing adjusting resistor by using ohmmeter.

NOTE:
Depending on number marked on ignition timing adjusting resistor, resistor value varies as follows.

1:	**0 Ω**	**6:**	**980 – 1020 Ω**
2:	**80 – 84 Ω**	**7:**	**1.35 – 1.53 kΩ**
3:	**157 – 163 Ω**	**8:**	**2.16 – 2.24 kΩ**
4:	**265 – 274 Ω**	**9:**	**3.53 – 3.67 kΩ**
5:	**421 – 439 Ω**	**10:**	**6.08 – 6.32 kΩ**
N:	**666 – 694 Ω**	**11:**	**11.8 – 12.2 kΩ**

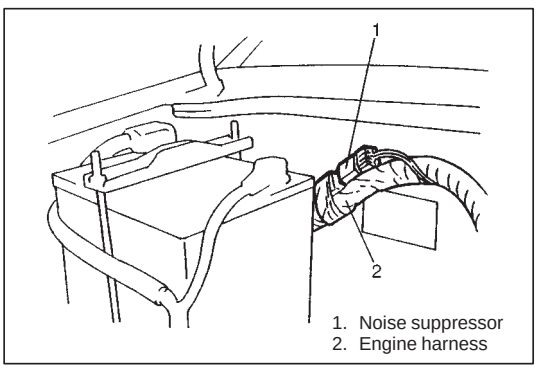
If check result is not satisfactory, replace ignition timing adjusting resistor.

INSTALLATION
For installation, reverse removal procedure.



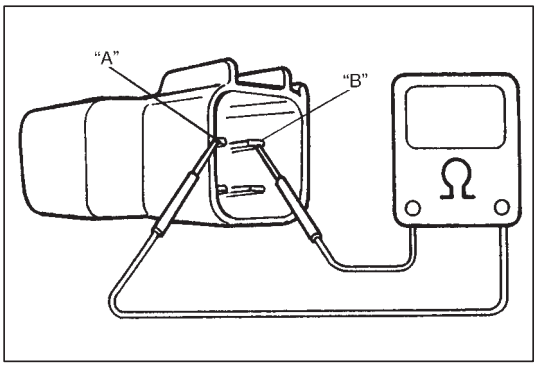
CMP SENSOR

Refer to “CMP Sensor” under “On-Vehicle Service” in SECTION 6E1 for removal, inspection and installation.



NOISE SUPPRESSOR

REMOVAL
1) Disconnect coupler of noise suppressor.
2) Remove noise suppressor.



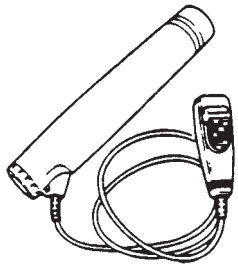
INSPECTION
Using ohmmeter, check to be sure that capacitor (condenser) in noise suppressor is not conductive.
If check result is not satisfactory, replace noise suppressor.

INSTALLATION
For installation, reverse removal procedure.

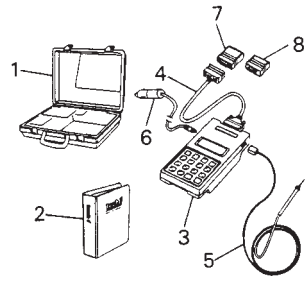
TIGHTENING TORQUE SPECIFICATION

Fastening portion	Tightening torque		
	N·m	kg-m	lb-ft
Spark plug	25	2.5	18.0

SPECIAL TOOLS

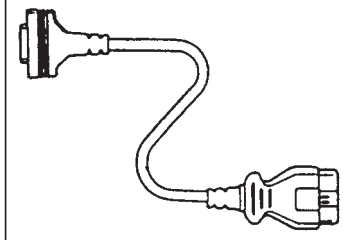


09930-76420
Timing light (Dry cell type)

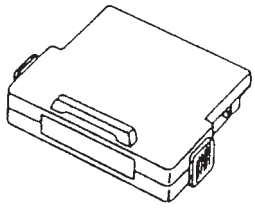


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable
5. Test lead / probe
6. Power source cable
7. DLC cable adapter
8. Self-test adapter

09931-76011
SUZUKI scan tool (Tech 1A) kit



09931-76030
16 / 14 pin DLC cable



Mass storage cartridge

SECTION 6F2

IGNITION SYSTEM (FOR J20/H25 ENGINES)

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

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

CONTENTS

GENERAL DESCRIPTION 6F2- 2
System wiring 6F2- 2
Components 6F2- 3
DIAGNOSIS 6F2- 4
Diagnostic flow table 6F2- 4
Ignition spark check 6F2- 6
Ignition timing check and adjustment 6F2- 6
ON-VEHICLE SERVICE 6F2- 9
Ignition coil assembly (igniter and ignition coil) 6F2- 9
Spark plug 6F2- 9
CMP sensor 6F2-11
Noise suppressor 6F2-12
TIGHTENING TORQUE SPECIFICATIONS 6F2-14
SPECIAL TOOLS 6F2-14

GENERAL DESCRIPTION

The ignition system is a direct ignition system. It consists of the parts as described below and has an electronic ignition control system.

° ECM (or PCM)
It detects the engine condition 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 igniter (in ignition coil assembly).

° Ignition coil assembly (including an igniter and an ignition coil)
The ignition coil assembly has a built-in igniter and ignition coil which turns ON and OFF the primary current of the ignition coil according to the signal from ECM (or PCM). When the ignition coil primary current is turned OFF, a high voltage is induced in the secondary wiring. One ignition coil is in charge of ignition of one cylinder only.

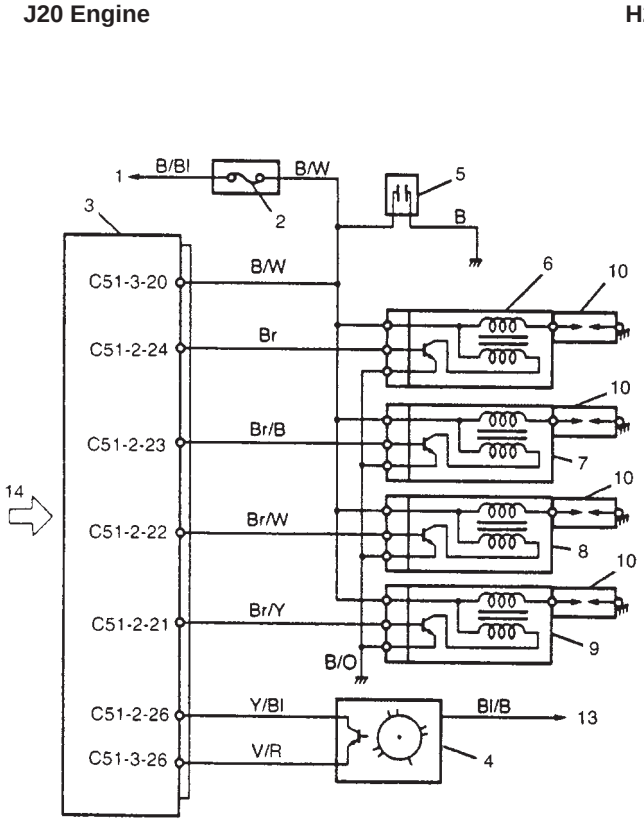
° Spark plug and noise suppressor

° CMP sensor, TP sensor, ECT sensor and MAF sensor
For their details, refer to SECTION 6E1 or 6E2.

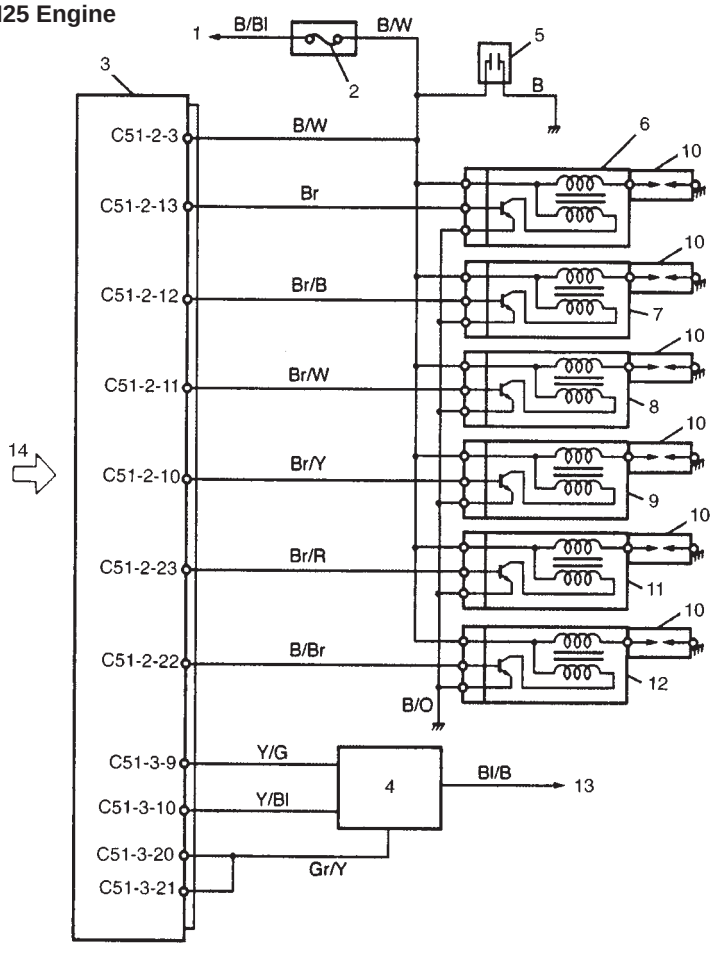
This ignition system does not have a distributor and high-tension cords but each cylinder has an ignition coil assembly (igniter and ignition coil) and the secondary voltage which occurred in the ignition coil is sent to the spark plug directly. Also, the signal(s) are sent from the CMP sensor to ECM (or PCM) so as to control each ignition coil independently through the igniter (in ignition coil assembly).

SYSTEM WIRING

J20 Engine



H25 Engine

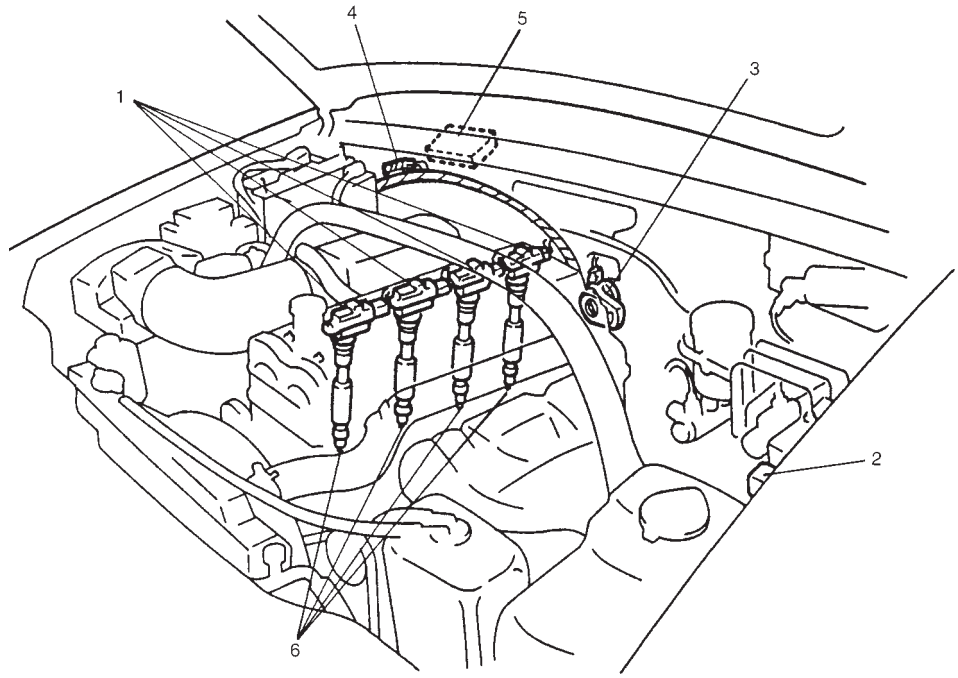


NOTE:
For ECM (PCM) terminal assignment, refer to SECTION 6E1 or 6E2.

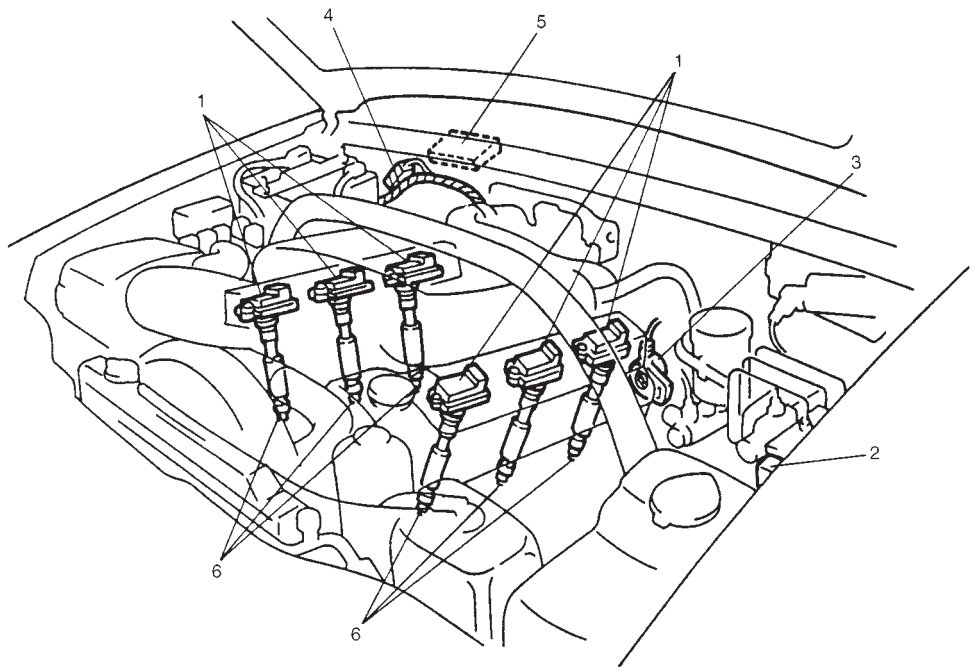
1. To ignition switch
2. "IG·COIL METER" fuse
3. ECM (or PCM)
4. CMP sensor
5. Noise suppressor
6. Ignition coil assembly (For No.1 cylinder)
7. Ignition coil assembly (For No.2 cylinder)
8. Ignition coil assembly (For No.3 cylinder)
9. Ignition coil assembly (For No.4 cylinder)
10. Spark plug
11. Ignition coil assembly (For No.5 cylinder)
12. Ignition coil assembly (For No.6 cylinder)
13. To main relay
14. Sensed information

COMPONENTS

J20 Engine



H25 Engine



NOTE:
Above figure shows left hand steering vehicle.
For right hand steering vehicle, parts with (*) are installed at the other side.

1. Ignition coil assembly (Igniter and ignition coil)
2. Monitor coupler (*) (if equipped)
3. CMP sensor
4. Noise suppressor
5. ECM (or PCM) (*)
6. Spark plug

DIAGNOSIS

Condition	Possible Cause	Correction
Engine cranks, but will not start or hard to start	**No spark**	
	° Blown fuse for ignition coil assembly	Replace
	° Loose connection or disconnection of lead wire	Connect securely
	° Faulty spark plug(s)	Adjust, clean or replace
	° Faulty ignition coil assembly(s)	Replace
	° Faulty CMP sensor	Replace
	° Faulty ECM (or PCM)	Replace
	° Maladjusted ignition timing	Adjust
Poor fuel economy or engine performance	° Incorrect ignition timing	Adjust
	° Faulty spark plug(s)	Adjust, clean or replace
	° Faulty ignition coil assembly(s)	Replace
	° Faulty CMP sensor	Replace
	° Faulty ECM (or PCM)	Replace

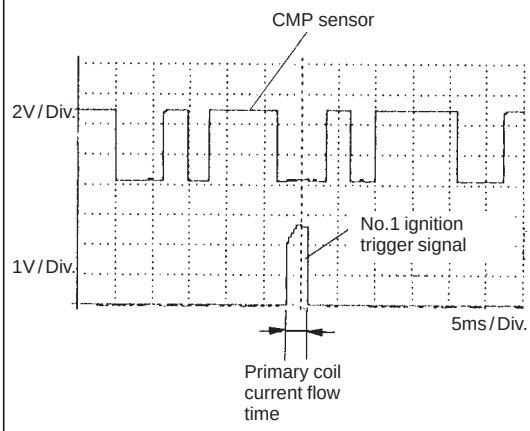
DIAGNOSTIC FLOW TABLE

STEP	ACTION	YES	NO
1	Was “Engine Diagnostic Flow Table” in SECTION 6 or 6-1 performed?	Go to Step 2.	Go to “Engine Diagnostic Flow Table” in SECTION 6 or 6-1.
2	Ignition Spark Test 1) Check all spark plug for condition and type, referring to “Spark Plug” in this section. 2) If OK, perform ignition spark test, referring to “Ignition Spark Check” in this section. Is spark emitted from all spark plugs?	Go to Step 8 on the next page.	Go to Step 3.
3	Diagnostic Trouble Code (DTC) Check 1) Check DTC stored in ECM (or PCM), referring to “Diagnostic Trouble Code (DTC) Check” in SECTION 6E1 or 6E2. Is DTC stored?	Go to applicable flow table corresponding to that code No. in SECTION 6E1 or 6E2.	Go to Step 4.
4	Electrical Connection Check 1) Check ignition coil assemblies for electrical connection. Are they connected securely?	Go to Step 5.	Connect securely.
5	Ignition Coil Assembly Power Supply, Ground and Trigger Signal Circuits Check 1) Check these circuits for open and short. Are circuits in good condition?	Go to Step 6 on the next page.	Repair or replace.

STEP	ACTION	YES	NO
6	Ignition Coil Assembly Check 1) Substitute a known-good ignition coil assembly and then repeat Step 2. Is check result of Step 2 satisfactory?	Malfunction of ignition coil assembly.	Go to Step 7.
7	CMP Sensor Check 1) Check CMP sensor. Refer to Step 6 or 7 of DTC P0340 Diag. Flow Table in SECTION 6 or 6-1. Is check result satisfactory?	Substitute a known-good ECM (or PCM) and then repeat Step 2.	Tighten CMP sensor bolt or replace CMP sensor.
8	Ignition Timing Check 1) Check initial ignition timing and ignition timing advance, referring to “Ignition Timing Check And Adjustment” in this section. Is check result satisfactory?	System is in good condition.	Adjust ignition timing or check ECM (PCM) input signals related to this system.

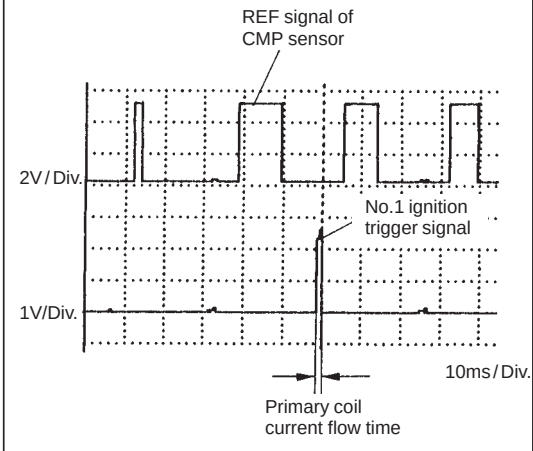
Oscilloscope waveforms

J20 Engine



Waveforms at specified idle speed

H25 Engine



Waveforms at specified idle speed

Reference

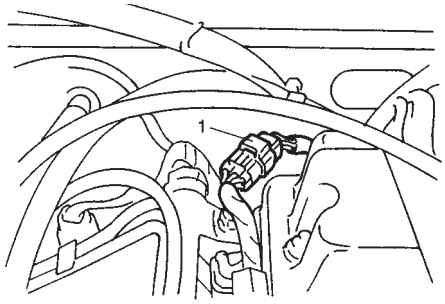
J20 engine

Oscilloscope waveforms of CMP sensor and No.1 ignition trigger signal are as shown in figure when connecting oscilloscope between terminals C51-2-26 and C51-3-26 of ECM (PCM) connectors connected to ECM (PCM), and between terminal C51-2-24 and ground.

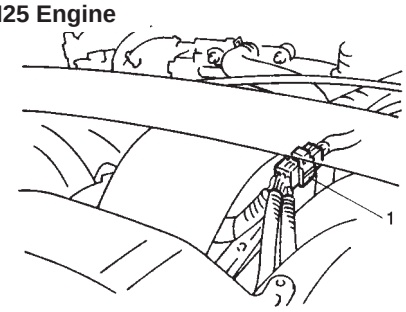
H25 engine

Oscilloscope waveforms of CMP sensor REF signal and No.1 ignition trigger signal are as shown in figure when connecting oscilloscope between terminal C51-3-10 of ECM (PCM) connector connected to ECM (PCM) and ground, and between terminal C51-2-13 and ground.

J20 Engine



H25 Engine



1. Injector coupler

IGNITION SPARK CHECK

1) For H25 engine, remove surge tank cover.
2) Disconnect injector coupler.

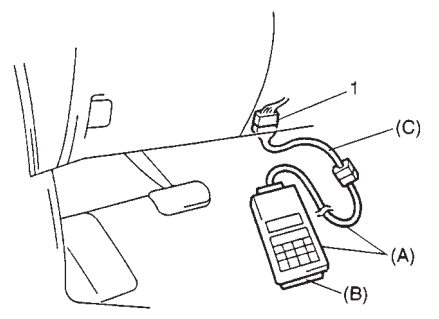
WARNING:
Without disconnection of injector coupler, combustible gas may come out from spark plug holes during this test and may get ignited in engine room.

3) Remove spark plug and check it for condition and type, referring to "Spark Plug" under "On-Vehicle Service" later in this section.
4) If OK, connect ignition coil coupler to ignition coil assembly and connect spark plug to ignition coil assembly. Ground spark plug.
5) Crank engine and check if each spark plug sparks.
   If no spark is emitted, inspect the related parts as described under "Diagnosis" earlier in this section.
6) After checking, install spark plug, referring to "Spark Plug" under "On-Vehicle Service" later in this section.
7) Connect injector coupler.
8) For H25 engine, install surge tank cover.

IGNITION TIMING CHECK AND ADJUSTMENT

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.

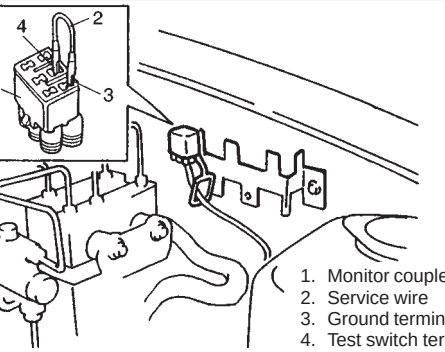
1) Start engine and warm it up to normal operating temperature.
2) Make sure that all of electrical loads except ignition are switched off.
3) Check to be sure that idle speed is within specification.
   Refer to SECTION 6E1 or 6E2.



1. DLC

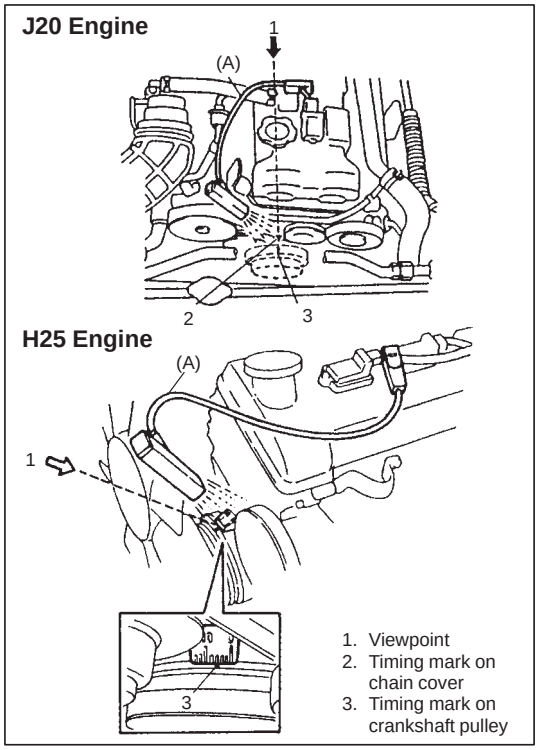
4) [Using SUZUKI scan tool (Tech 1)]
   Connect SUZUKI scan tool (Tech 1) to DLC (1) with ignition switch OFF, restart engine and fix ignition timing by using fixed spark mode of SUZUKI scan tool (Tech 1).

   Special Tool
   (A): 09931-76011 (SUZUKI scan tool)
   (B): Mass storage cartridge
   (C): 16/14 pin DLC (OBD-II adaptor) cable



1. Monitor coupler
2. Service wire
3. Ground terminal
4. Test switch terminal

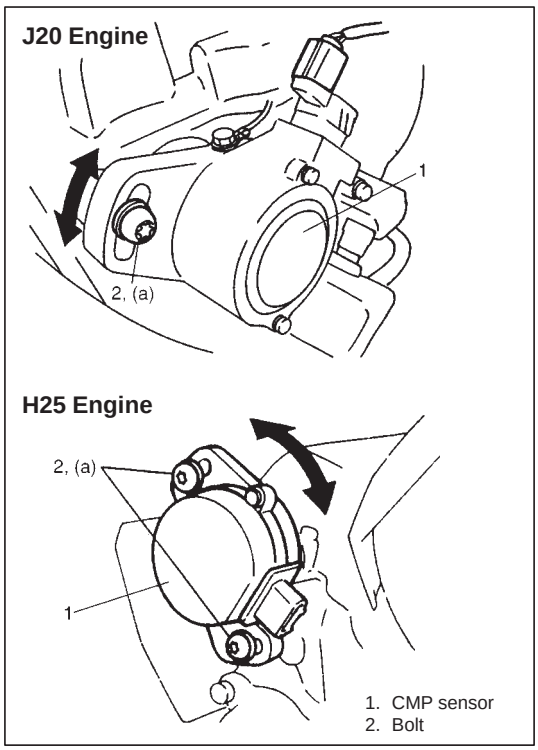
[Not using SUZUKI scan tool (Tech 1)]
a) Remove monitor coupler cap.
b) Ground test switch terminal in monitor coupler by using service wire so that ignition timing is fixed on initial one.



5) Set timing light to ignition harness for No.1 cylinder.
6) Using timing light, check that timing observed from viewpoint is within specification.

Initial ignition timing of viewpoint
(when it is fixed by Tech 1 or service wire): 5 ± 1° BTDC
Ignition order: 1-3-4-2 (J20 engine)
: 1-6-5-4-3-2 (H25 engine)

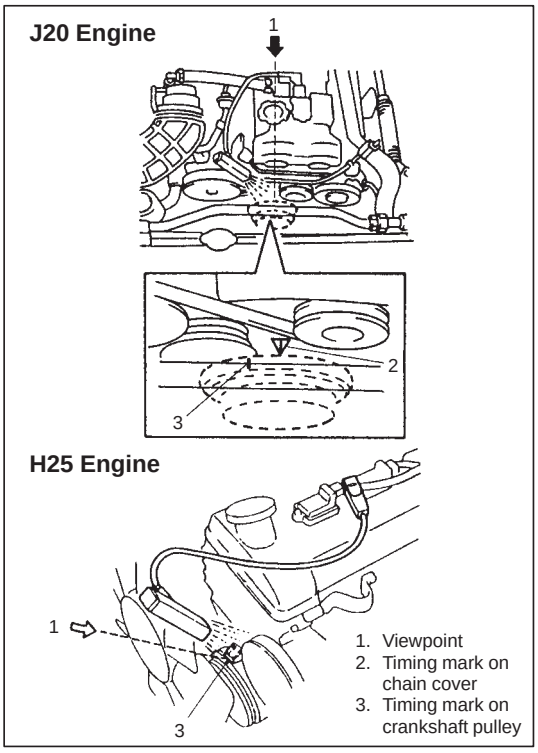
Special Tool
(A): 09930-76420



7) If ignition timing is out of specification, loosen flange bolt(s), adjust timing by turning CMP sensor while engine is running, and then tighten bolt(s).

Tightening Torque
(a): 15 N·m (1.5 kg-m, 11.0 lb-ft)

8) After tightening bolt(s), recheck that ignition timing is within specification.



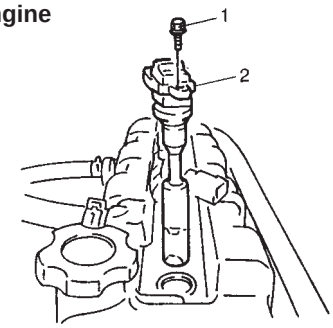
9) After checking and/or adjusting, end fixed spark mode of SUZUKI scan tool or disconnect service wire from monitor coupler.

CAUTION:
Driving with test switch terminal grounded will cause damage to catalyst.
Be sure to disconnect service wire after adjustment.

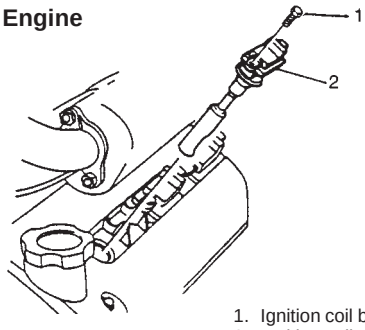
NOTE:
In this state, ignition timing may vary more or less of initial ignition timing but it is nothing abnormal.

10) With engine idling (closed throttle position and vehicle stopped), check that ignition timing is about BTDC 12° – 16° (J20 engine), 10° –13° (H25 engine with monitor connector), 6° – 12° (H25 engine without monitor connector) (shown in the figure). Also, check that increasing engine speed advances ignition timing.
If above check results are not satisfactory, check input signals related to this system.

J20 Engine



H25 Engine



1. Ignition coil bolt
2. Ignition coil assembly

ON-VEHICLE SERVICE

IGNITION COIL ASSEMBLY (IGNITER AND IGNITION COIL)

REMOVAL

1) For H25 engine, remove ignition coil cover.
2) Disconnect ignition coil coupler.
3) Remove ignition coil bolt, and then pull out ignition coil assembly.

INSPECTION

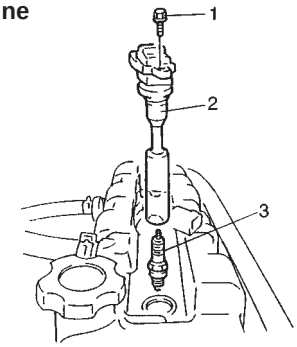
Check ignition coil assembly for the following:

° Damage
° Deterioration
° Terminal for corrosion

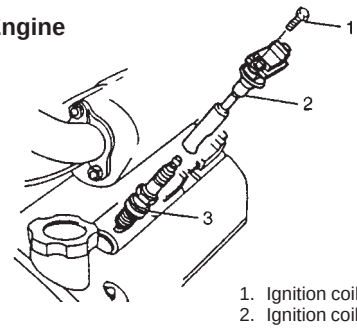
INSTALLATION

Install in reverse order of removal.

J20 Engine



H25 Engine

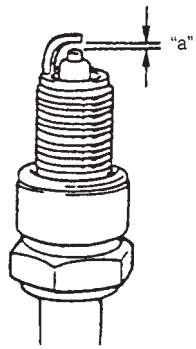


1. Ignition coil bolt
2. Ignition coil
3. Spark plug

SPARK PLUG

REMOVAL

1) For H25 engine, remove ignition coil cover.
2) Disconnect ignition coil coupler.
3) Remove ignition coil bolt, and then pull out ignition coil assembly.
4) Remove spark plug.



INSPECTION

CAUTION:
When servicing the iridium / platinum sparkplugs (slender center electrode type plugs), do not touch the center electrode to avoid damage to it. The electrode is not strong enough against mechanical force as it is slender and its material is not mechanically tough.

Inspect them for electrode wear, carbon deposits and insulator damage.

If any abnormality is found, adjust air gap, clean with spark plug cleaner or replace them with specified new plug.

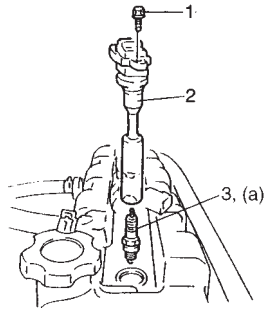
Spark plug air gap "a": 1.0 – 1.1 mm (0.039 – 0.043 in.)

Spark plug type:

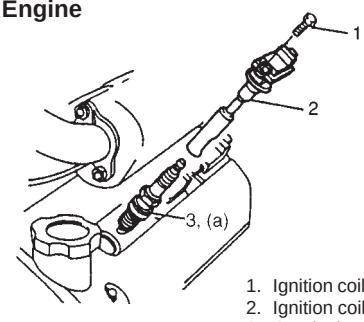
DENSO K20PR-U11 / SK16PR11
NGK BKR6E-11 / *IFR5J11

NOTE:
Under –25°C (–13°F), the spark plugs with an asterisk (*) are highly recommend for better engine starting performance.

J20 Engine



H25 Engine



1. Ignition coil bolt
2. Ignition coil assembly
3. Spark plug

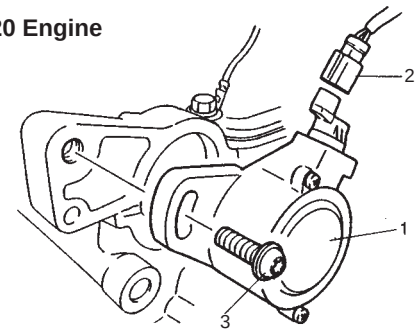
INSTALLATION

1) Install spark plug(s) and tighten them to specified torque.

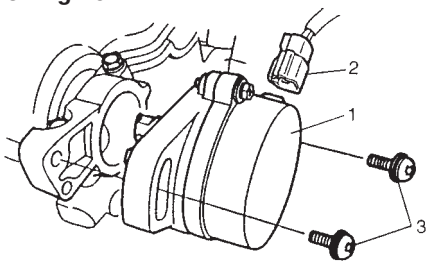
Tightening Torque
(a): 25 N·m (2.5 kg-m, 18.0 lb-ft)

2) Install ignition coil assembly securely.
3) Tighten ignition coil bolt, and then connect ignition coil coupler.
4) For H25 engine, install ignition coil cover.

J20 Engine



H25 Engine



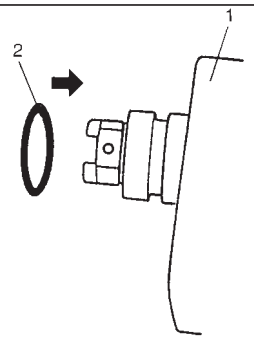
1. CMP sensor
2. CMP sensor coupler
3. Bolt

CMP SENSOR

CAUTION:
Disassembly is prohibited. If anything faulty is found, replace as an assembly unit.

REMOVAL

1) Disconnect CMP sensor coupler.
2) Remove CMP sensor by removing bolt(s).

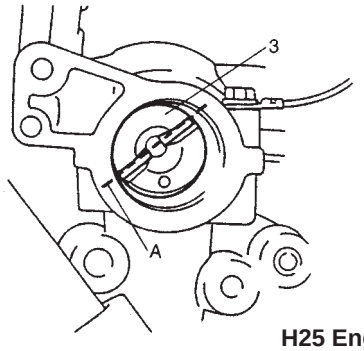


1. CMP sensor
2. O-ring

INSTALLATION

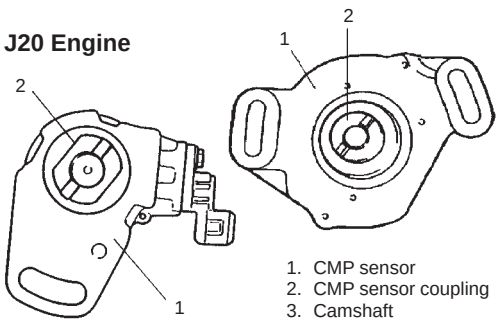
NOTE:
After installing CMP sensor, adjust ignition timing. (Refer to "Ignition Timing Check And Adjustment" in this section.)

1) Install a new O-ring with engine oil applied to CMP sensor.



H25 Engine

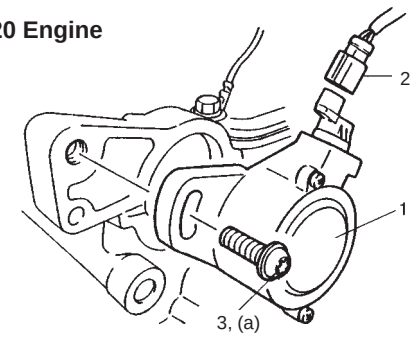
J20 Engine



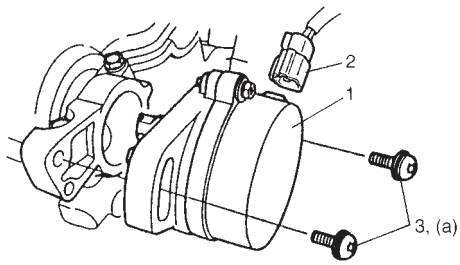
1. CMP sensor
2. CMP sensor coupling
3. Camshaft
A: Slot offset

2) Install CMP sensor to camshaft.
Fit the dog of CMP sensor coupling into the slots of camshaft, when installing. The dogs of CMP sensor coupling are offset. Therefore, if the dogs can not be fitted into the slots, turn the CMP sensor shaft by 180 degree and try again.

J20 Engine



H25 Engine



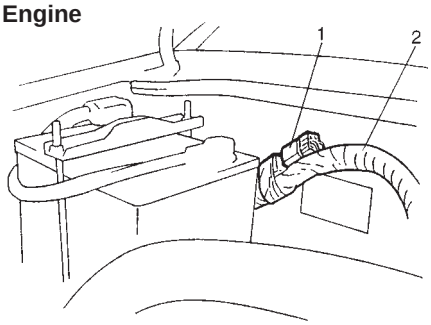
1. CMP sensor
2. CMP sensor coupler
3. Bolt

3) Tighten CMP sensor bolts.

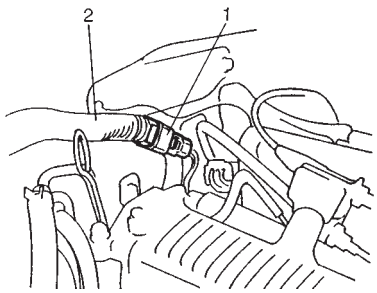
Tightening Torque
(a): 15 N·m (1.5 kg-m, 11.0 lb-ft)

4) Connect CMP sensor coupler.

J20 Engine



H25 Engine

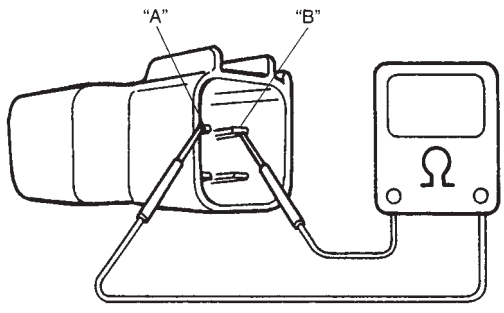


1. Noise suppressor
2. Engine harness

NOISE SUPPRESSOR

REMOVAL

1) Disconnect coupler of noise suppressor.
2) Remove noise suppressor.



INSPECTION

Using ohmmeter, check to be sure that capacitor (condenser) in noise suppressor is not conductive.
If check result is not satisfactory, replace noise suppressor.

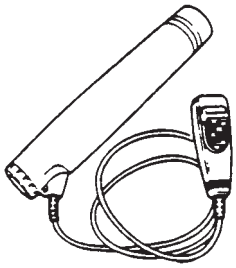
INSTALLATION

For installation, reverse removal procedure.

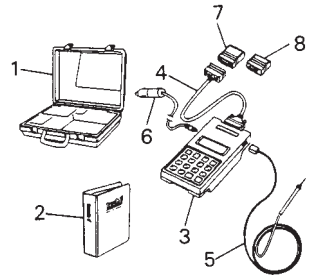
TIGHTENING TORQUE SPECIFICATIONS

Fastening portion	Tightening torque		
	N·m	kg-m	lb-ft
Spark plug	25	2.5	18.0
CMP sensor bolt	15	1.5	11.0

SPECIAL TOOLS

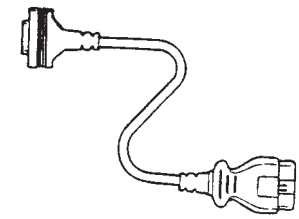


09930-76420
Timing light (Dry cell type)

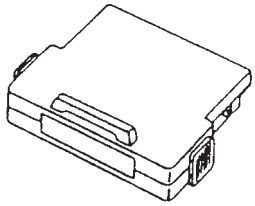


1. Storage case
2. Operator's manual
3. Tech 1A
4. DLC cable
5. Test lead / probe
6. Power source cable
7. DLC cable adapter
8. Self-test adapter

09931-76011
SUZUKI scan tool (Tech 1A) kit



09931-76030
16 / 14 pin DLC cable



Mass storage cartridge

SECTION 6G

CRANKING SYSTEM
(0.9 kW, 1.2 kW and 1.4 kW Reduction Type)

NOTE:
Starting motor vary depending on specifications, etc.
Therefore, be sure to check model and specification of the vehicle being serviced before replacing parts.

CONTENTS

GENERAL DESCRIPTION 6G- 2
Cranking Circuit 6G- 2
Starting Motor Circuit 6G- 2
Starting Motor 6G- 3
DIAGNOSIS 6G- 4
UNIT REPAIR OVERHAUL 6G- 6
Dismounting and Remounting 6G- 6
Disassembly 6G- 6
Reassembly 6G-10
Inspection 6G-12
Performance Test 6G-16
Pull-in test 6G-16
Hold-in test 6G-16
Plunger and pinion return test 6G-16
No-load performance test 6G-16
SPECIFICATIONS 6G-17
REQUIRED SERVICE MATERIAL 6G-18
SPECIAL TOOL 6G-18

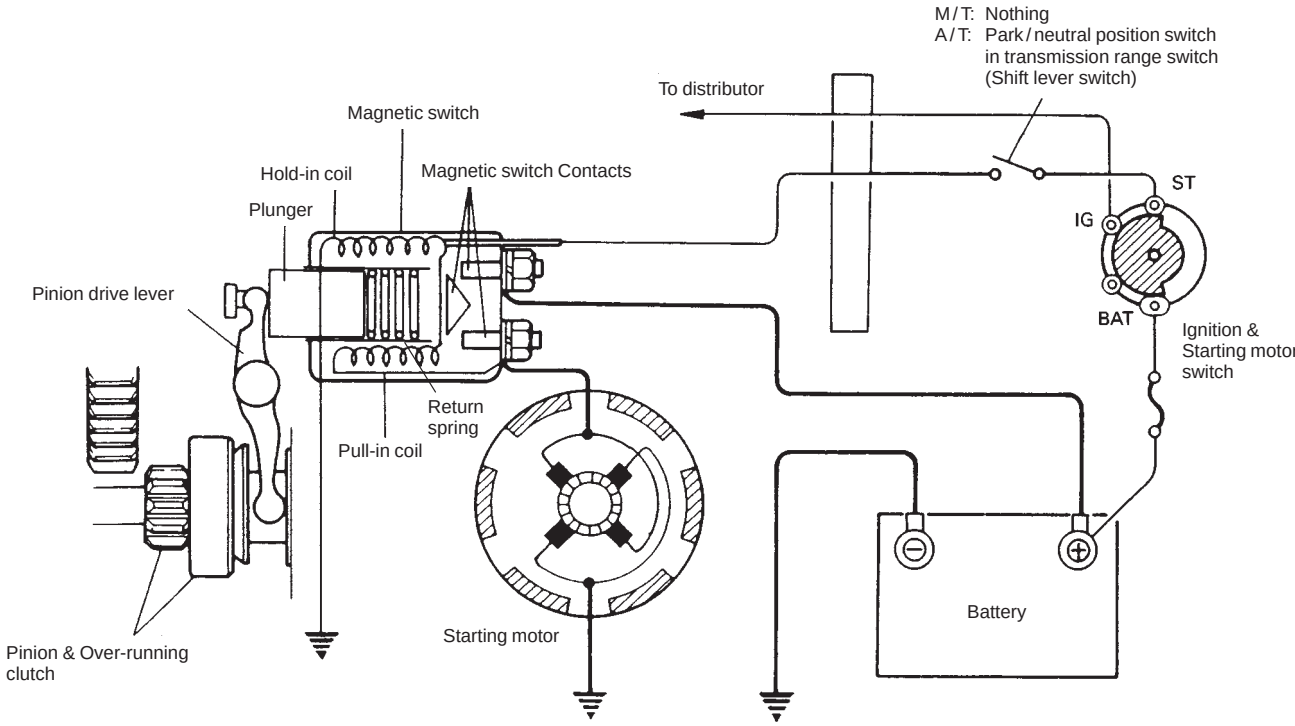
GENERAL DESCRIPTION

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

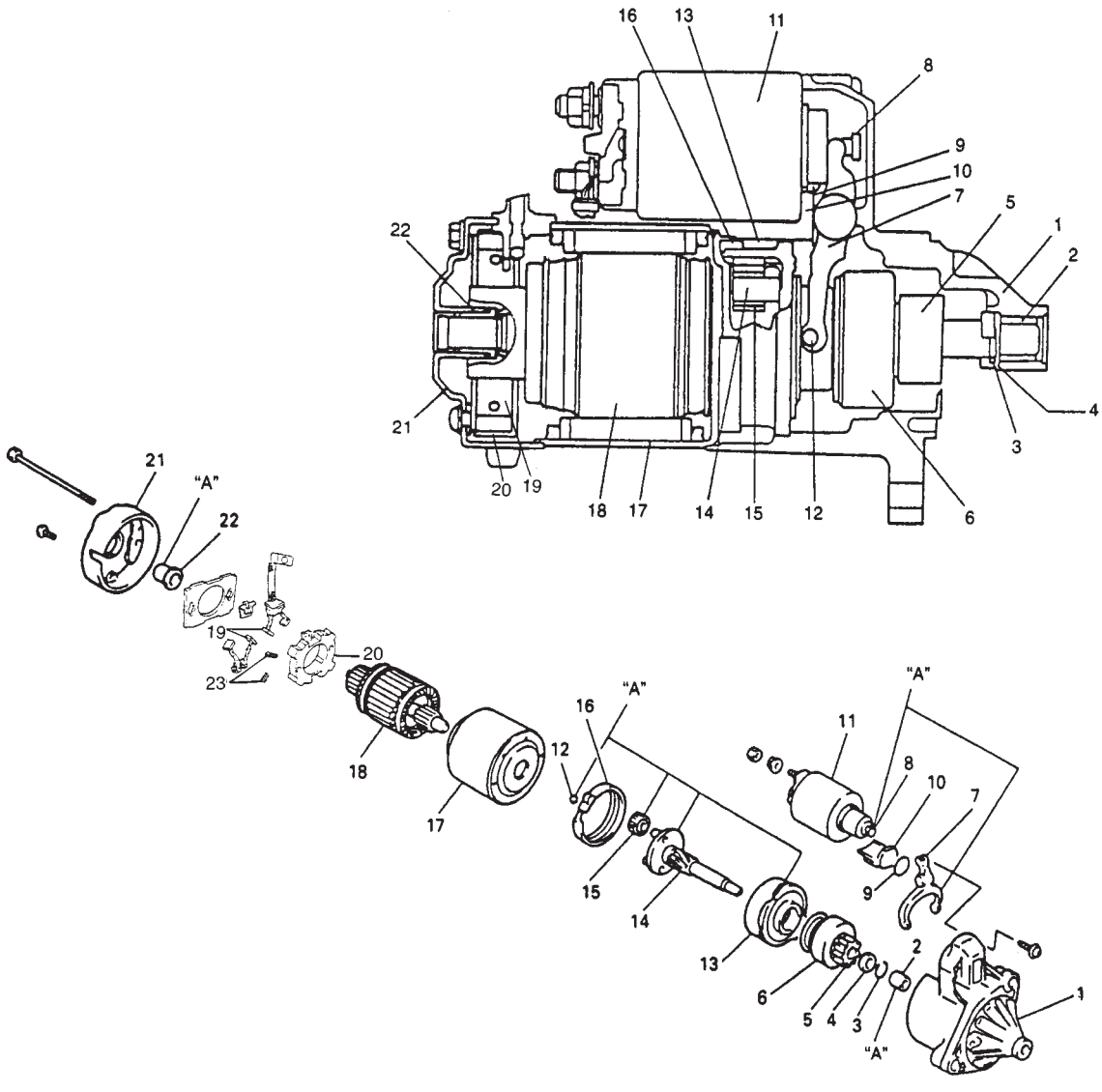
- The magnetic switch coils are magnetized when the ignition switch is closed.
- The resulting plunger and pinion drive lever movement causes the pinion to engage the engine flywheel gear and the magnetic switch main contacts to close, and cranking takes place.
- When the engine starts, the pinion over-running clutch protects the armature from excessive speed until the switch is opened, at which time the return spring causes the pinion to disengage.



STARTING MOTOR

The starting motor consists of parts shown in below and has permanent magnets mounted in starting motor yoke (frame).
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.

NOTE:
- **Make sure to apply grease before assembly where so indicated "A" in the figure below.**
- **Spare parts have been lubricated.**



"A": Apply grease (99000-25010)

1. Front housing
2. Bush
3. Snap ring
4. Pinion stop ring
5. Pinion gear
6. Over-running clutch
7. Lever
8. Plunger
9. Plate
10. Seal rubber
11. Magnetic switch
12. Ball
13. Internal gear
14. Planetary carrier shaft
15. Planetary gear
16. Packing
17. Yoke
18. Armature
19. Brush
20. Brush holder
21. Rear bracket
22. Rear bush
23. Brush spring

DIAGNOSIS

Possible symptoms due to starting system trouble would be as follows:
° Starting motor does not run (or runs slowly)
° Starting motor runs but fails to crank engine
° Abnormal noise is heard

Proper diagnosis must be made to determine exactly where the cause of each trouble lies.....in battery, wiring harness, (including starting motor switch), starting motor or engine.

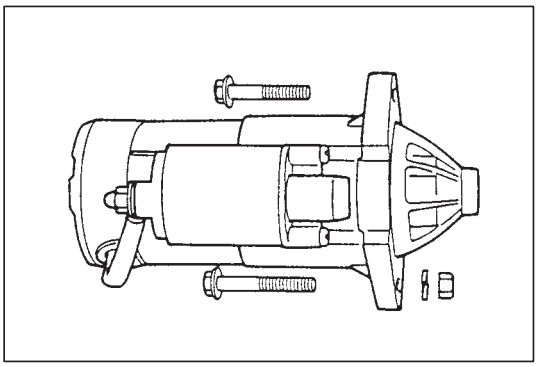
Do not remove motor just because starting motor does not run. Check following items and narrow down scope of possible causes.
1) Condition of trouble
2) Tightness of battery terminals (including ground cable connection on engine side) and starting motor terminals
3) Discharge of battery
4) Mounting of starting motor

Condition	Possible Cause	Correction
Motor not running	**No operating sound of magnetic switch**	
	° Shift lever switch is not in P or N, or not adjusted (A/T)	Shift in P or N, or adjust switch.
	° Battery run down	Recharge battery.
	° Battery voltage too low due to battery deterioration	Replace battery.
	° Poor contact in battery terminal connection	Retighten or replace.
	° Loose grounding cable connection	Retighten.
	° Fuse set loose or blown off	Tighten or replace.
	° Poor contacting action of ignition switch and magnetic switch	Replace.
	° Lead wire coupler loose in place	Retighten.
	° Open-circuit between ignition switch and magnetic switch	Repair.
	° Open-circuit in pull-in coil	Replace magnetic switch.
	° Brushes are seating poorly or worn down	Repair or replace.
	° Poor sliding or 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.

Condition	Possible Cause	Correction
Motor not running	° Burnt commutator	Replace armature.
	° Layer short-circuit of armature	Replace.
	° Crankshaft rotation obstructed	Repair.
Starting motor running but too slow (small torque)	**If battery and wiring are satisfactory, inspect starting motor**	
	° Insufficient contact of magnetic switch main contacts	Replace magnetic switch.
	° Layer short-circuit of armature	Replace.
	° Disconnected, burnt or worn commutator	Repair commutator or replace armature.
	° Worn brushes	Replace brush.
	° Weakened brush springs	Replace spring.
	° Burnt or abnormally worn end bush	Replace bush.
Starting motor running, but not cranking engine	° Worn pinion tip	Replace over-running clutch.
	° Poor sliding of over-running clutch	Repair.
	° Over-running clutch slipping	Replace over-running clutch.
	° Worn teeth of ring gear	Replace flywheel (M/T) or drive plate (A/T).
Noise	° Abnormally worn bush	Replace bush.
	° Worn pinion or worn teeth of ring gear	Replace over-running clutch, flywheel (M/T) or drive plate (A/T).
	° Poor sliding of pinion (failure in return movement)	Repair or replace.
	° Worn internal or planetary gear teeth	Replace.
	° Lack of oil in each part	Lubricate.
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.

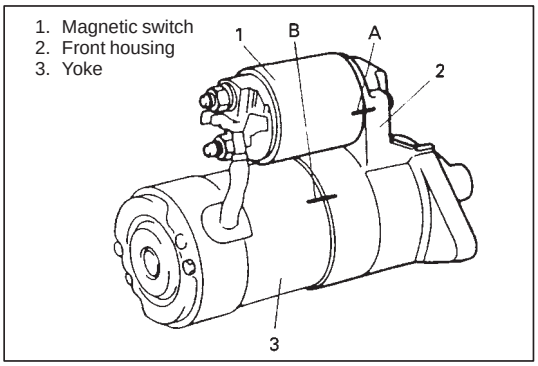
UNIT REPAIR OVERHAUL

DISMOUNTING AND REMOUNTING



Use following procedure to remove starter:

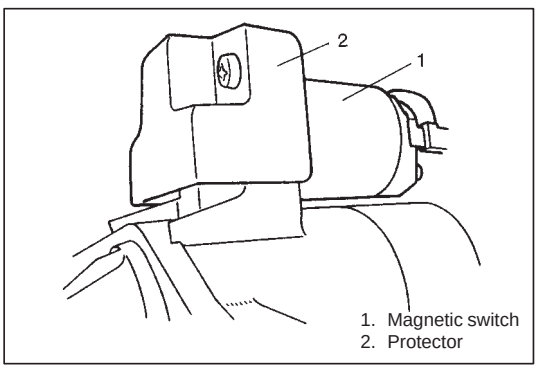
1) Disconnect negative battery lead at battery.
2) Disconnect magnetic switch lead wire and battery cable from starting motor terminals.
3) Remove two starting motor mount bolts.
4) Remove starting motor.
5) To install, reverse the above procedure.



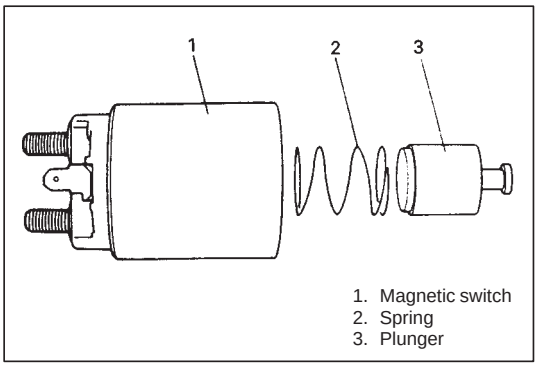
DISASSEMBLY

NOTE:

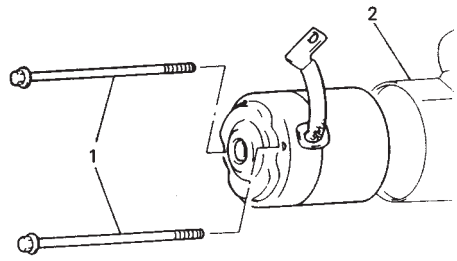
- **Before disassembling starting motor, be sure to put match marks at two locations (A & B) as shown in figure left so that any possible mistake can be avoided.**
- **Do not clamp yoke in a vise or strike it with a hammer during repair operations.**



1) Remove protector (if equipped) and magnetic switch.



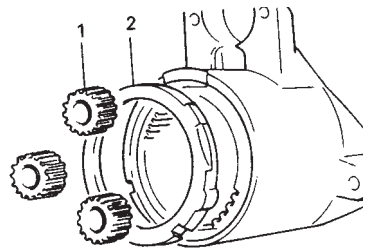
NOTE:
Don't disassemble this switch. If defective, replace as a complete assembly.



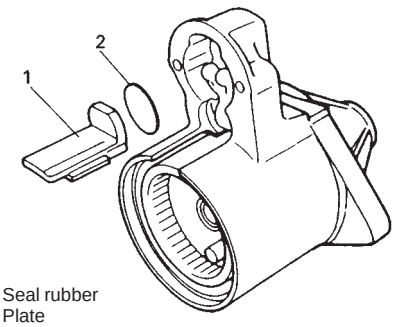
1. Bolts
2. Reduction gear assembly

2) Remove bolts shown in left figure, then separate reduction gear assembly from starting motor assembly.

1. Planetary gear
2. Packing

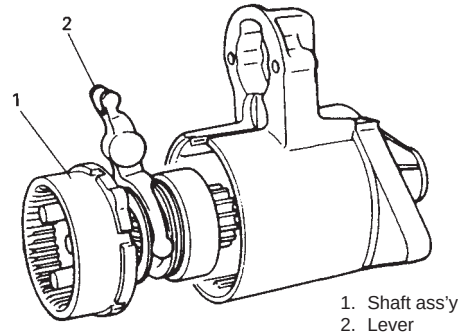


3) To overhaul reduction gear assembly, remove packing and planetary gears.



1. Seal rubber
2. Plate

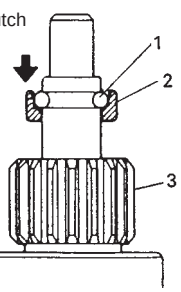
4) Remove seal rubber and plate.



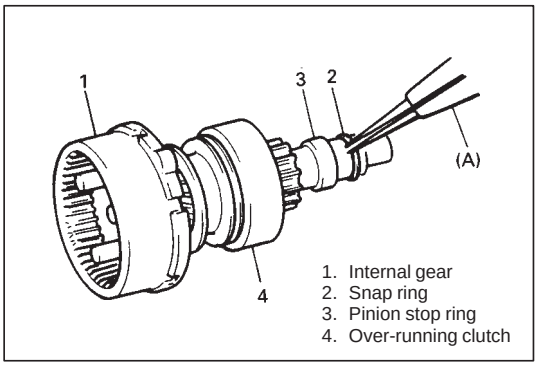
1. Shaft ass'y
2. Lever

5) Remove shaft assembly with lever.

1. Snap ring
2. Pinion stop ring
3. Over-running clutch assembly

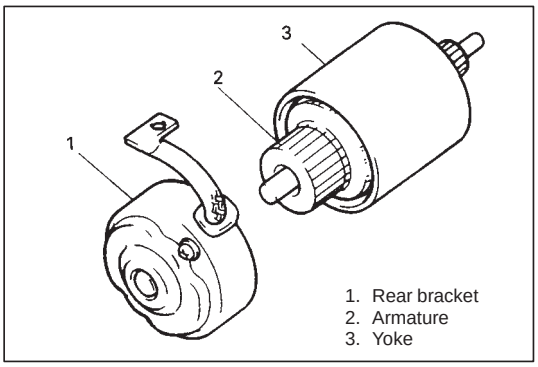


6) Loosen pinion stop ring fixed by snap ring.

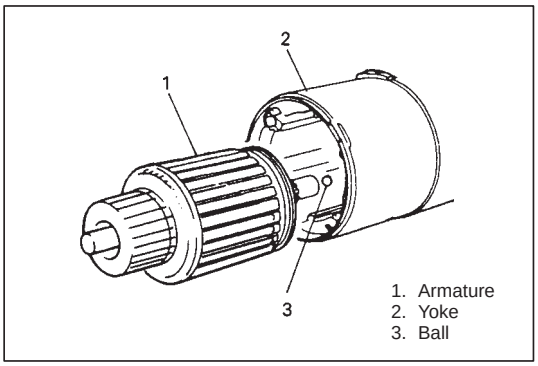


7) Remove snap ring, then pull out pinion stop ring and over-running clutch and internal gear.

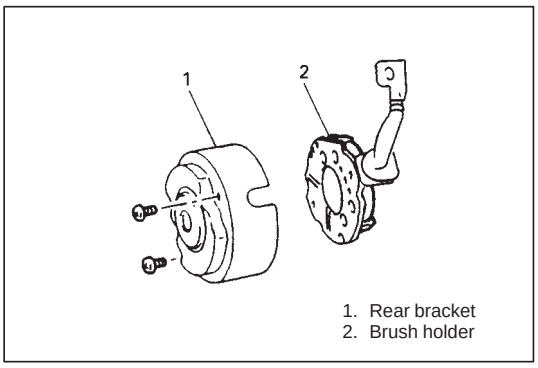
Special Tool
(A): 09900-06107



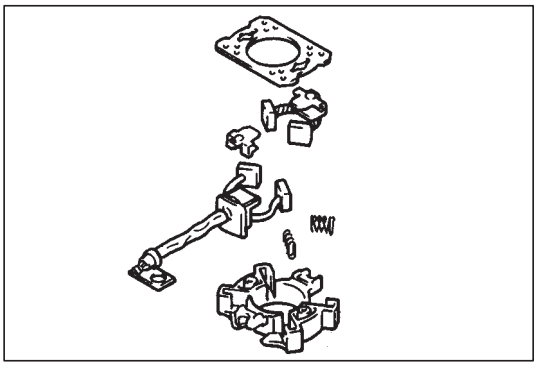
8) Remove rear bracket and brush holder.



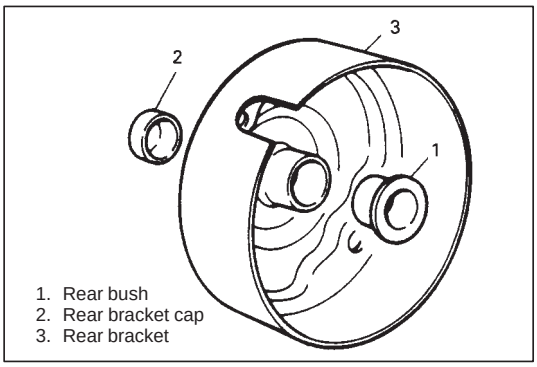
9) Remove armature from yoke and then ball from the end of armature shaft.



10) Remove brush holder from rear bracket.



11) Remove brush springs and brushes.

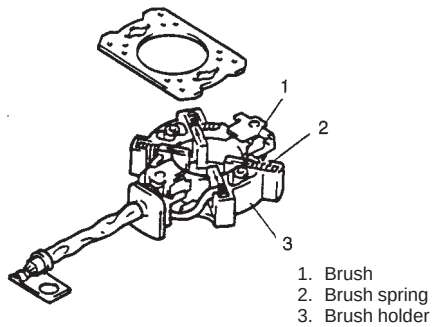


1. Rear bush
2. Rear bracket cap
3. Rear bracket

12) Remove rear bracket cap, and then remove rear bush, as required.

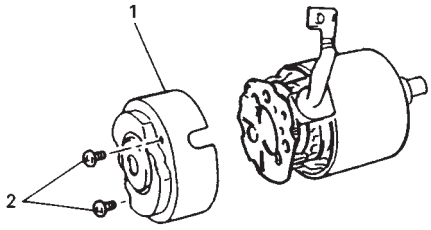
REASSEMBLY

CAUTION:
- **Washing, adjusting and disassembling of shock absorber (clutch plate) are not allowed.**
- **New oilless bearing have been lubricated when they are supplied as spare parts. DO NOT wash with grease dissolving solvent nor lubricate them with other lubricant.**



1. Brush
2. Brush spring
3. Brush holder

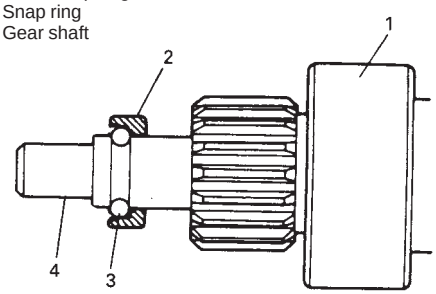
1) Inspect component parts (Refer to page 6G-12) and replace with new ones as necessary.
2) Apply grease (Refer to page 6G-3).
3) Install armature to yoke.
4) Install brushes and brush springs to brush holder.
5) Install brush holder to armature while pushing 4 brushes outward.



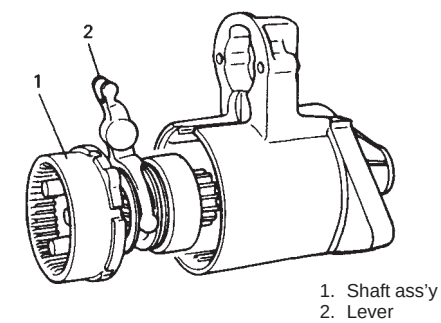
1. Rear bracket
2. Brush holder screws

6) Install rear bush and then rear bracket cap.
7) Install rear bracket.
8) Tighten brush holder screws.

1. Over-running clutch
2. Pinion stop ring
3. Snap ring
4. Gear shaft

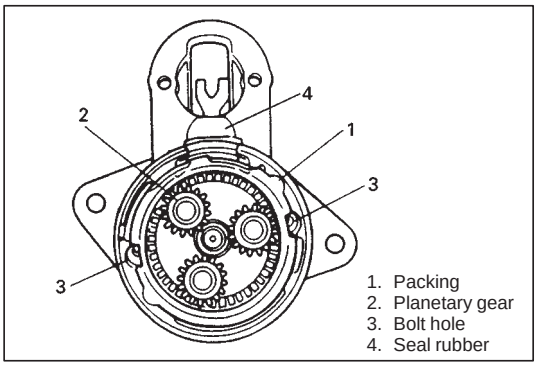


9) Install over-running clutch assembly to gear shaft, using care for installing direction of pinion stop ring.



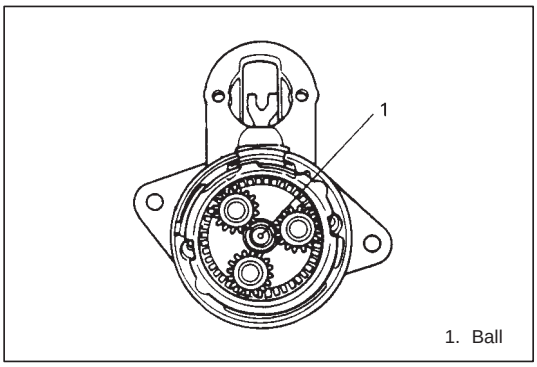
1. Shaft ass'y
2. Lever

10) Insert shaft ass'y into front housing with lever positioned as shown left figure.



1. Packing
2. Planetary gear
3. Bolt hole
4. Seal rubber

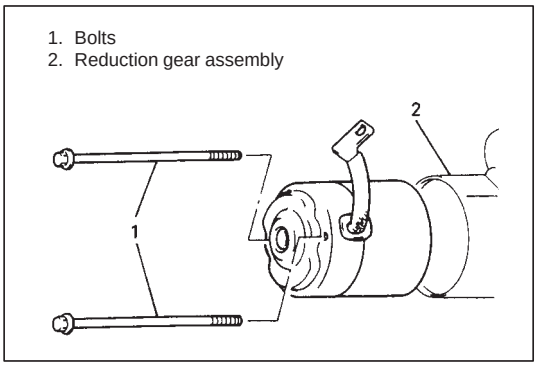
11) Install packing so that cuts in packing align with holes for through bolts in front housing.
12) Install plate and seal rubber to front housing.



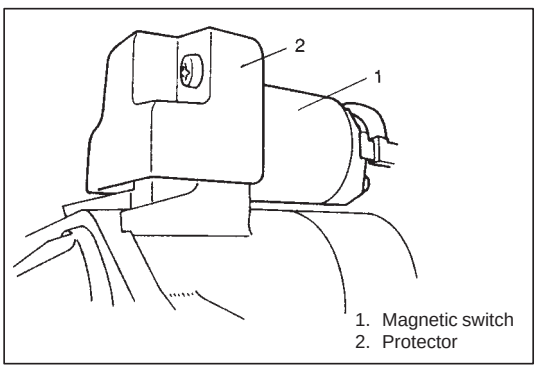
1. Ball

13) Apply grease to ball and install ball into shaft hole.

1. Bolts
2. Reduction gear assembly

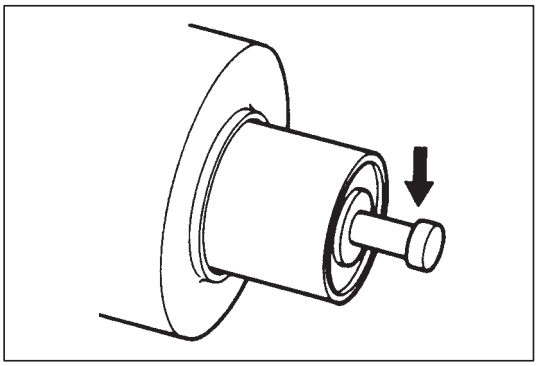


14) Install yoke, armature, brush holder and rear bracket to front housing by aligning match marks provided before removal.
15) Tighten through bolts.



1. Magnetic switch
2. Protector

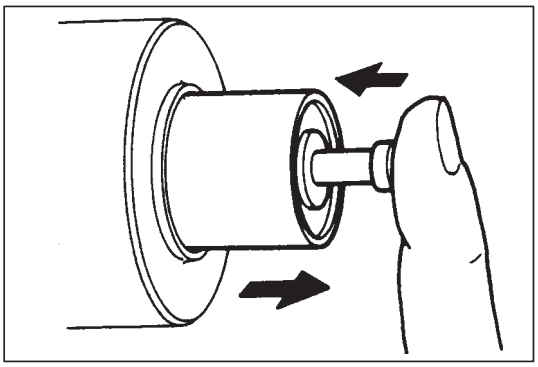
16) Install magnetic switch assembly and protector (if equipped). Connect wire (switch to motor) to switch terminal.
17) Upon completion of assembly, carry out PERFORMANCE TEST. (Refer to page 6G-16.)



INSPECTION

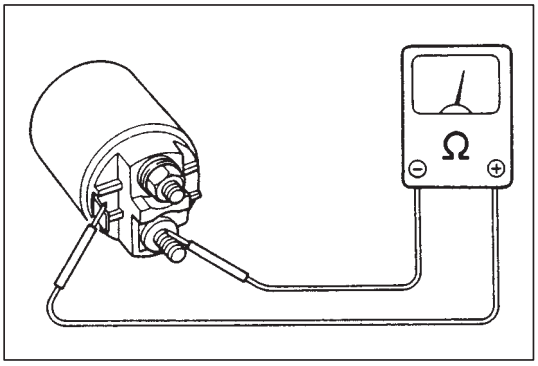
1. PLUNGER

Inspect plunger for wear. Replace if necessary.



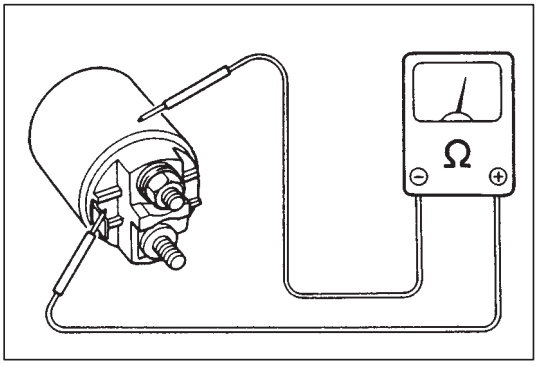
2. MAGNETIC SWITCH

Push in plunger and release it. The plunger should return quickly to its original position. Replace if necessary.



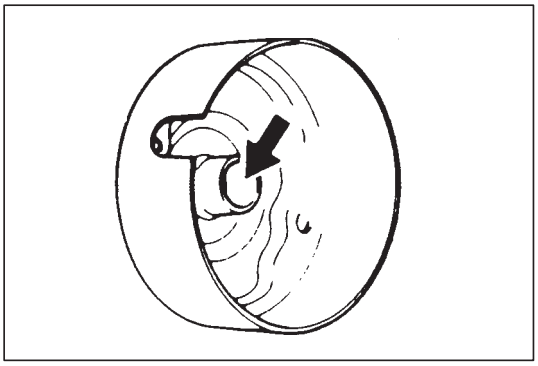
° **Pull-In Coil Open Circuit Test**

Check for continuity across magnetic switch 'S' terminal and 'M' terminal. If no continuity exists, coil is open and should be replaced.



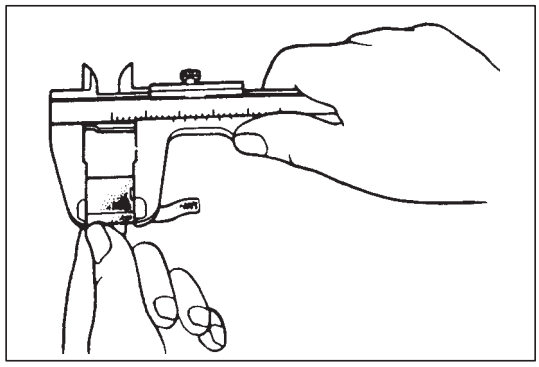
° **Hold-In Coil Open Circuit Test**

Check for continuity across magnetic switch 'S' terminal and coil case. If no continuity exists, coil is open and should be replaced.



3. ARMATURE SHAFT BUSH

Inspect bush for wear or damage. Replace if necessary.



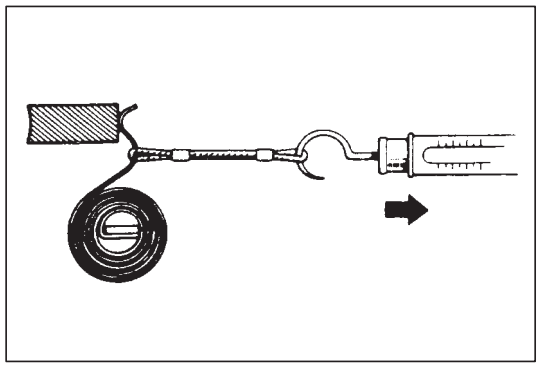
4. BRUSH

° Check brushes for wear.
Measure length of brushes and if below limit, replace brush.

Brush length

	0.9 kW and 1.2 kW types	1.4 kW type
Standard	12.3 mm (0.44 in.)	16.5 mm (0.65 in.)
Limit	7 mm (0.28 in.)	

° Install brushes to each brush holder and check for smooth movement.

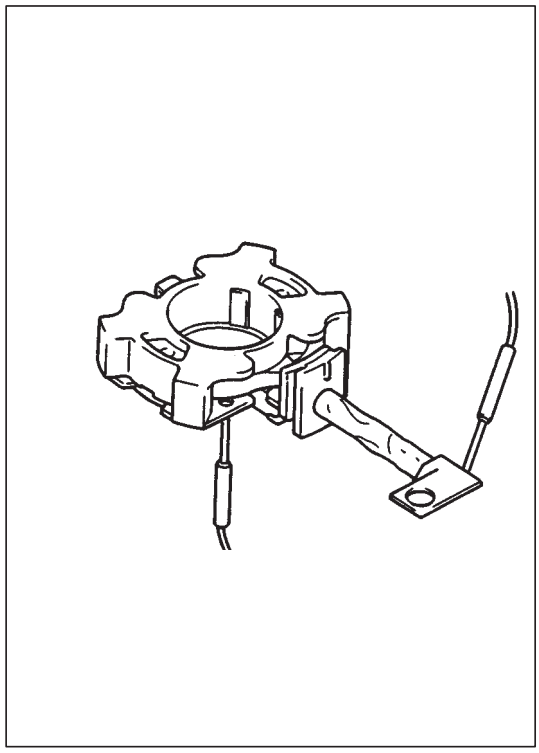


5. SPRING

Inspect brush springs for wear, damage or other abnormal conditions. Replace if necessary.

Brush spring tension

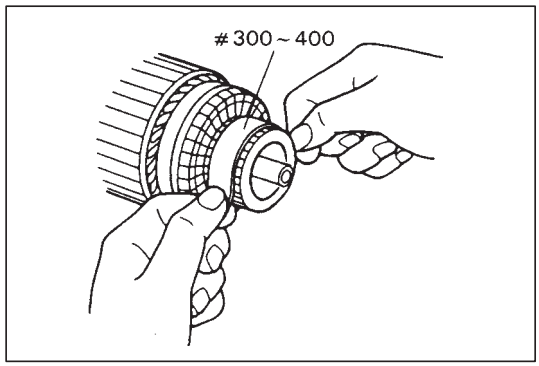
Standard	1.9 – 2.5 kg (3.97 lb)
Limit	0.6 kg (1.32 lb)



6. BRUSH HOLDER

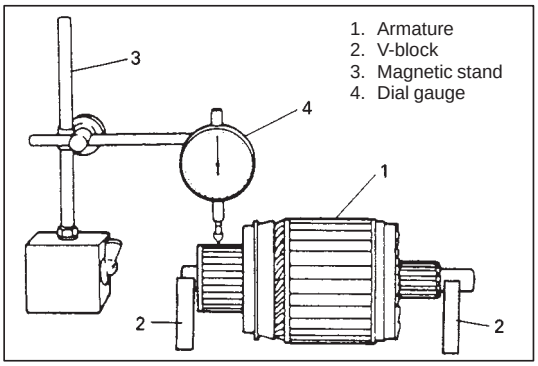
° Check movement of brush in brush holder. If brush movement within brush holder is sluggish, check brush holder for distortion and sliding faces for contamination. Clean or correct as necessary.

° Check for continuity across brush positive terminal and grounded brush holder. If continuity exists, brush holder is grounded due to defective insulation and should be replaced.



7. ARMATURE

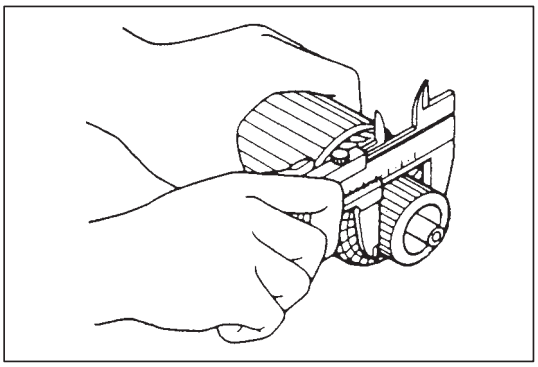
° Inspect commutator for dirt or burn. Correct with sandpaper or lathe, if necessary.



° Check commutator for uneven wear with armature supported on V-blocks. If deflection of dial gauge pointer exceeds limit, repair or replace.

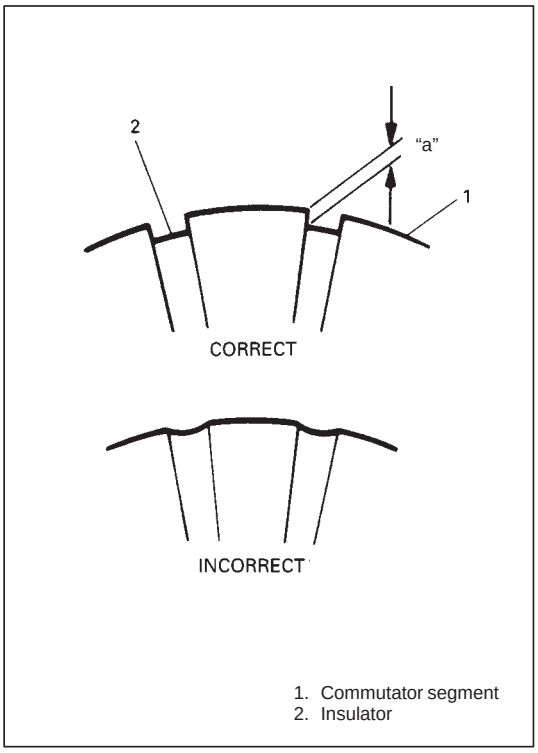
NOTE:
Below specification presupposes that armature is free from bend. Bent armature must be replaced.

Commutator out of round
Standard : 0.05 mm (0.002 in.) or less
Limit : 0.4 mm (0.015 in.)



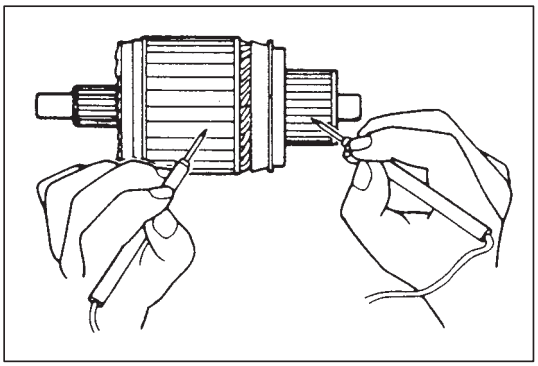
° Inspect commutator for wear. If diameter is below limit, replace armature.

Commutator outside diameter
Standard : 29.4 mm (1.16 in.)
Limit : 28.8 mm (1.13 in.)

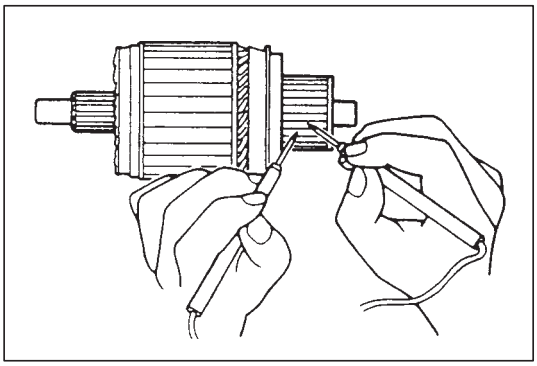


° Inspect commutator for insulator depth. Correct or replace if below limit.

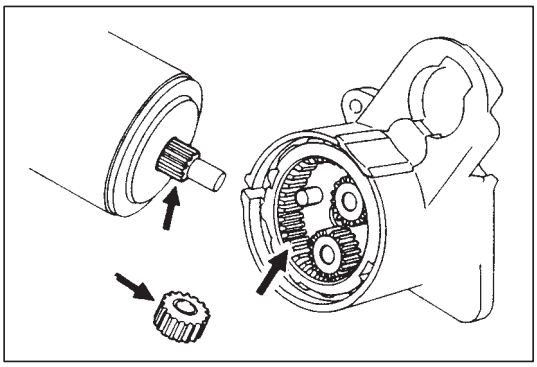
Commutator insulator depth "a"
Standard : 0.4 – 0.6 mm (0.015 – 0.023 in.)
Limit : 0.2 mm (0.008 in.)



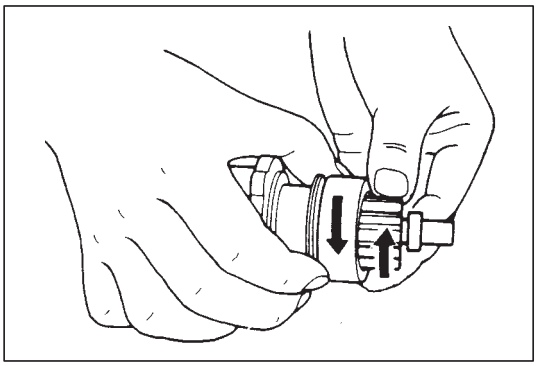
° **Ground Test**
Check commutator and armature core. If there is continuity, armature is grounded and must be replaced.



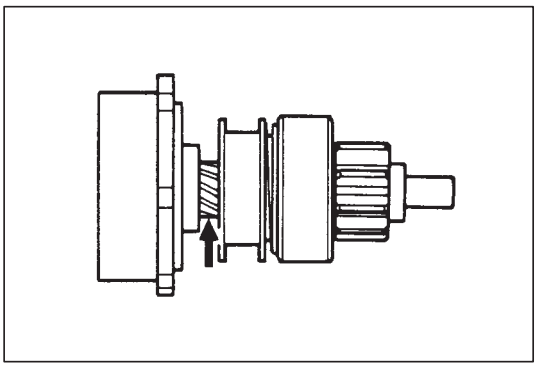
° **Open Circuit Test**
Check for continuity between segments. If there is no continuity at any test point, there is an open circuit and armature must be replaced.



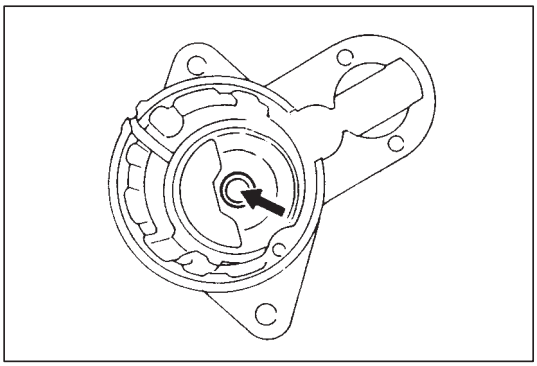
8. GEARS
Inspect internal gear and planetary gears for wear, damage or other abnormal conditions. Replace if necessary.



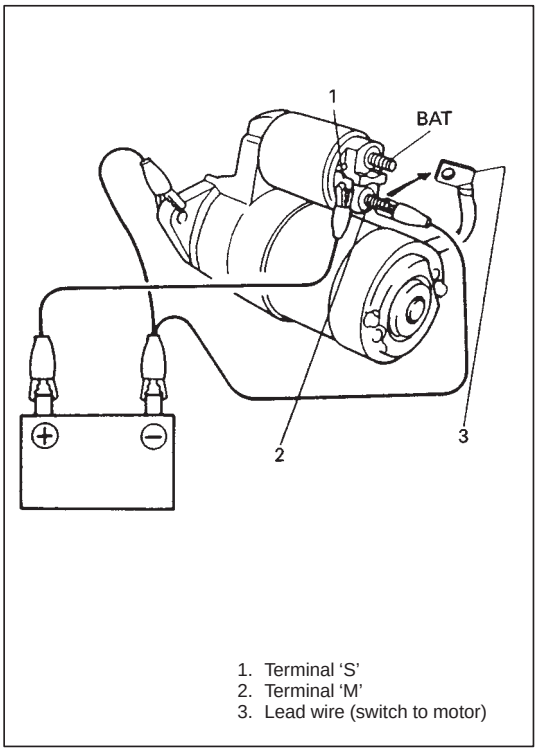
9. PINION AND OVER-RUNNING CLUTCH
° Inspect pinion for wear, damage or other abnormal conditions. Check that clutch locks up when turned in direction of drive and rotates smoothly in reverse direction. Replace if necessary.



° Inspect spline teeth for wear or damage. Replace if necessary. Inspect pinion for smooth movement.



10. FRONT HOUSING BUSH
Inspect bush for wear or damage. Replace if necessary.



1. Terminal 'S'
2. Terminal 'M'
3. Lead wire (switch to motor)

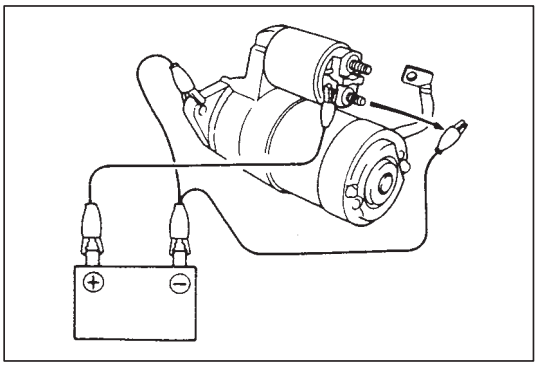
PERFORMANCE TEST

CAUTION:
Each test must be performed within 3 – 5 seconds to avoid coil from burning.

1) Pull-In Test

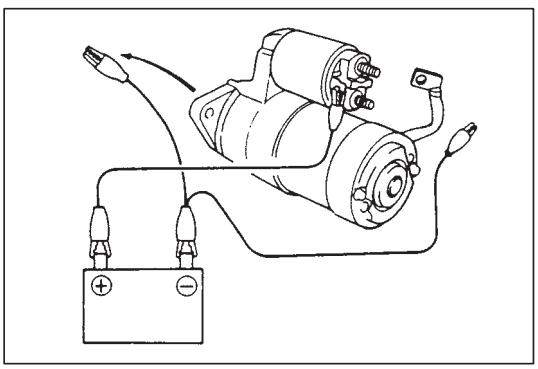
Connect battery to magnetic switch as shown.
Check that plunger and pinion move outward.
If plunger and pinion don't move, replace magnetic switch.

NOTE:
Before testing, disconnect lead wire from terminal M.



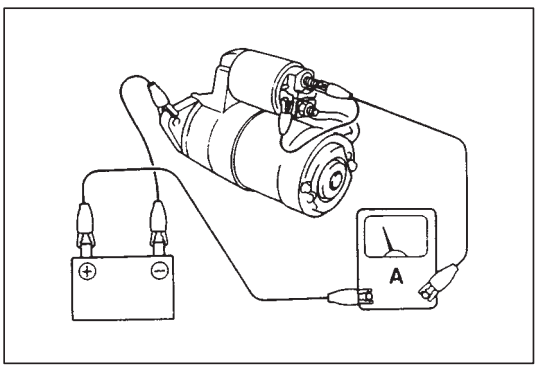
2) Hold-In Test

While connected as above with plunger out, disconnect negative lead from terminal 'M'.
Check that plunger and pinion remain out.
If plunger and pinion return inward, replace magnetic switch.



3) Plunger and Pinion Return Test

Disconnect negative lead from switch body.
Check that plunger and pinion return inward.
If plunger and pinion don't return, disassemble and inspect starting motor.



4) No-Load Performance Test

a) Connect battery and ammeter to starter as shown.
b) Check that starter rotates smoothly and steadily with pinion moving out. Check that ammeter indicates specified current.

Specified current: 90A MAX. at 11V

NOTE:
Use wires as thick as possible and tighten each terminal fully.

SPECIFICATIONS

1.2 kW type (1.4 kW type)

Voltage			12 volts
Output			1.2 kW (1.4 kW)
Rating			30 seconds
Direction of rotation			Clockwise as viewed from pinion side
Brush length			12.3 mm (0.44 in.) (16.5 mm (0.65 in.))
Number of pinion teeth			8
Performance		Condition	Guarantee
Around at 20 °C (68 °F)	No load characteristic	11.0 V	90 A maximum 2,500 rpm minimum (3,000 rpm minimum)
	Load characteristic	7.5 V (7.7 V) 300 A	10.5 N·m (1.05 kg-m, 7.59 lb-ft) minimum 880 rpm minimum (9.81 N·m (0.98 kg-m, 7.0 lb-ft) minimum 1,000 rpm minimum)
	Locked characteristic	4.0 V	760 A maximum 19.5 N·m (1.95 kg-m, 14.1 lb-ft) minimum (980 A maximum 23 N·m (2.3 kg-m, 16.5 lb-ft) minimum)
	Magnetic switch operating voltage		8 volts maximum

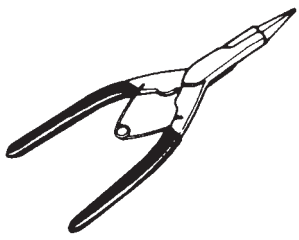
0.9 kW type

Voltage			12 volts
Output			0.9 kW
Rating			30 seconds
Direction of rotation			Clockwise as viewed from pinion side
Brush length			12.3 mm (0.44 in.)
Number of pinion teeth			8
Performance		Condition	Guarantee
Around at 20 °C (68 °F)	No load characteristic	11.0 V	90 A maximum 2,800 rpm minimum
	Load characteristic	8 V 200 A	4.8 N·m (0.48 kg-m, 3.5 lb-ft) minimum 1,260 rpm minimum
	Locked characteristic	3.5 V	550 A maximum 12.2 N·m (1.22 kg-m, 8.9 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)	° Front and rear bush. ° Plunger. ° Pinion drive lever. ° Internal gear. ° Planetary carrier shaft. ° Planetary gear ° Ball

SPECIAL TOOL



09900-06107
Snap ring pliers
(Opening type)

SECTION 6G1

CRANKING SYSTEM
(0.9 kW No-Reduction Type)

CONTENTS

GENERAL DESCRIPTION 6G1-2
- Cranking Circuit 6G1-2
- Starting Motor 6G1-2

DIAGNOSIS 6G1-4

UNIT REPAIR OVERHAUL 6G1-6
- Dismounting 6G1-6
- Remounting 6G1-6
- Disassembly 6G1-7
- Reassembly 6G1-8
- Inspection 6G1- 8
- Performance Test 6G1-12
  - Pull-in test 6G1-12
  - Hold-in test 6G1-12
  - Check pinion return 6G1-12
  - No-load performance test 6G1-12

SPECIFICATIONS 6G1-13

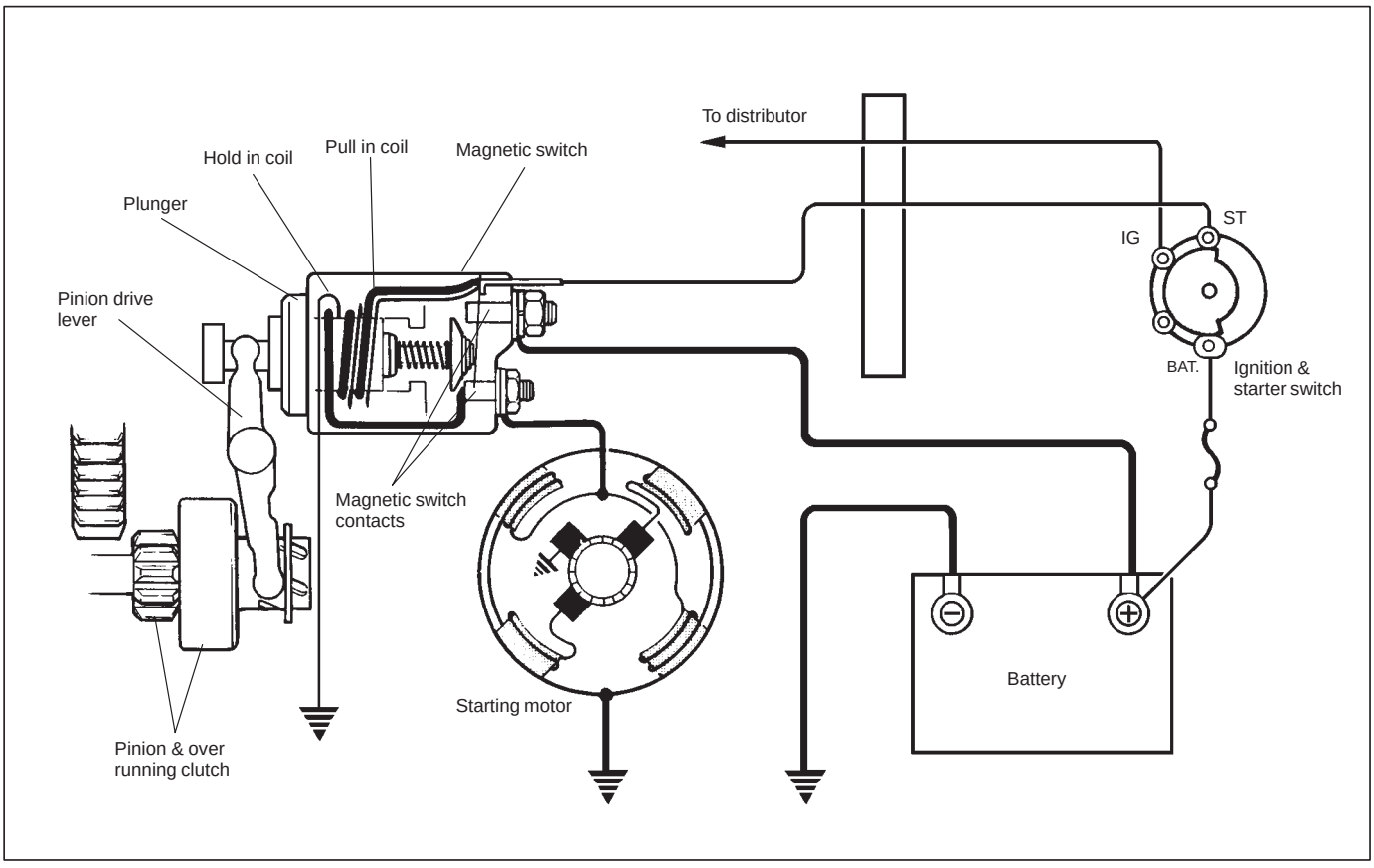
REQUIRED SERVICE MATERIAL 6G1-13

SPECIAL TOOL 6G1-13

GENERAL DESCRIPTION

CRANKING CIRCUIT

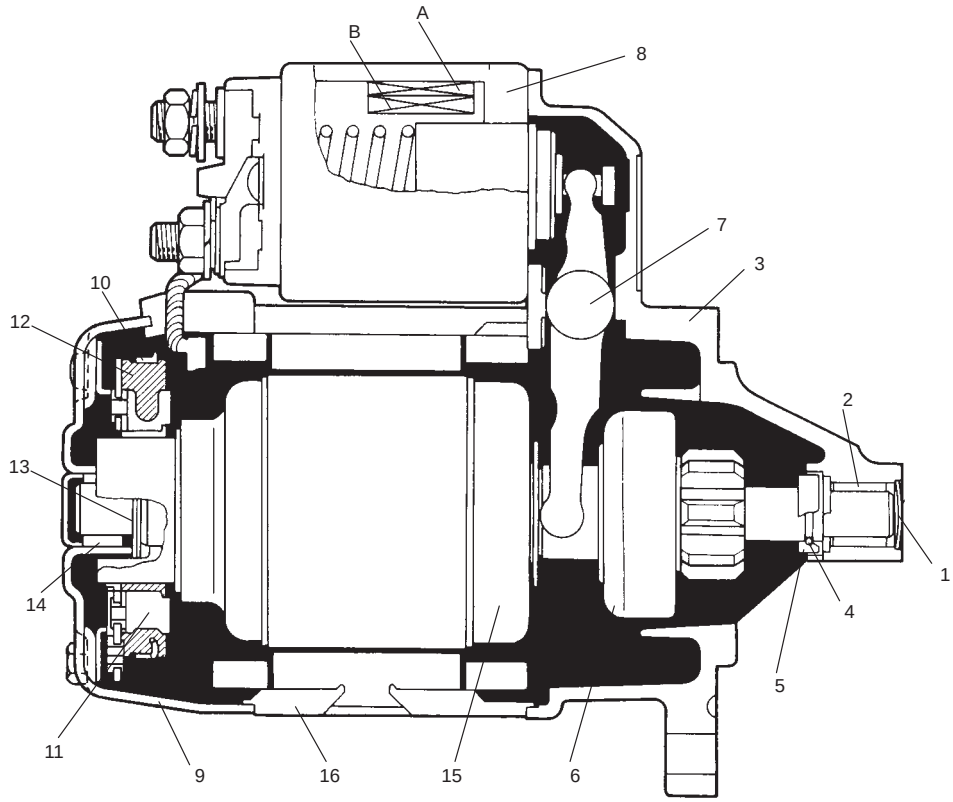
The cranking circuit consists of the battery, starting motor, ignition switch, and related electrical wiring. These components are connected electrically as shown below.
Only the starting motor will be covered in this section.



STARTING MOTOR

The starting motor consist of parts shown following page and has field coils mounted in starting motor yoke (frame). 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.
In the circuit shown above, the magnetic (motor) 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 overrunning clutch protects the armature from excessive speed until the switch is opened, at which time the return spring causes the pinion to disengage.

NOTE:
- **Starting motor does not require lubrication except during overhaul.**
- **Make sure to apply grease before assembly where so indicated “A” in the figure below.**

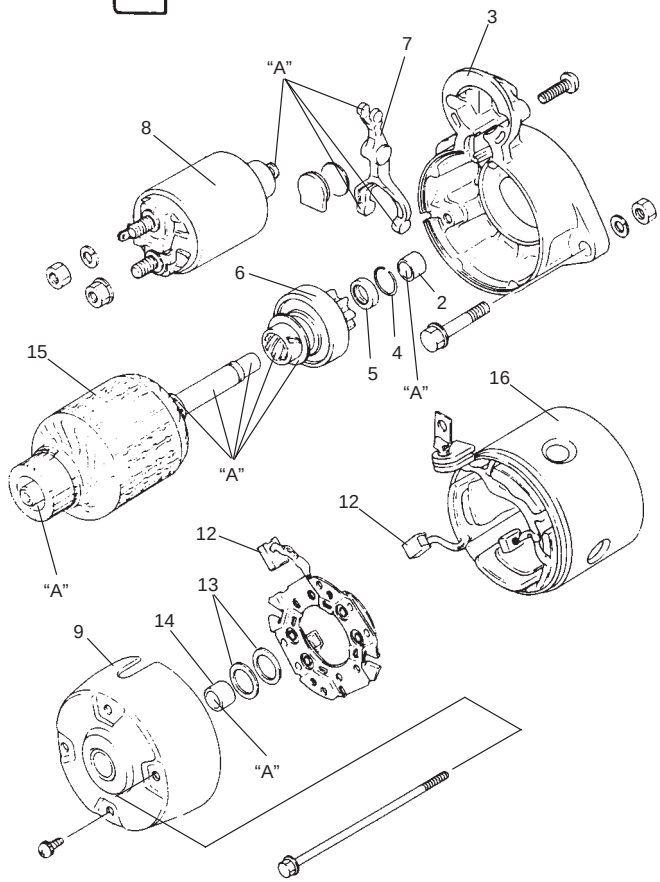


1. Drive housing cover
2. Drive bush
3. Drive housing
4. Armature ring
5. Armature stop ring
6. Over running clutch
7. Pinion drive lever
8. Magnetic switch
9. Commutator end cover
10. Brush spring
11. Brush holder
12. Brush
13. Washer
14. Commutator end bushing
15. Armature
16. Starting motor yoke

A: Hold-in coil

B: Pull-in coil

"A" : Apply grease (99000-25010)



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

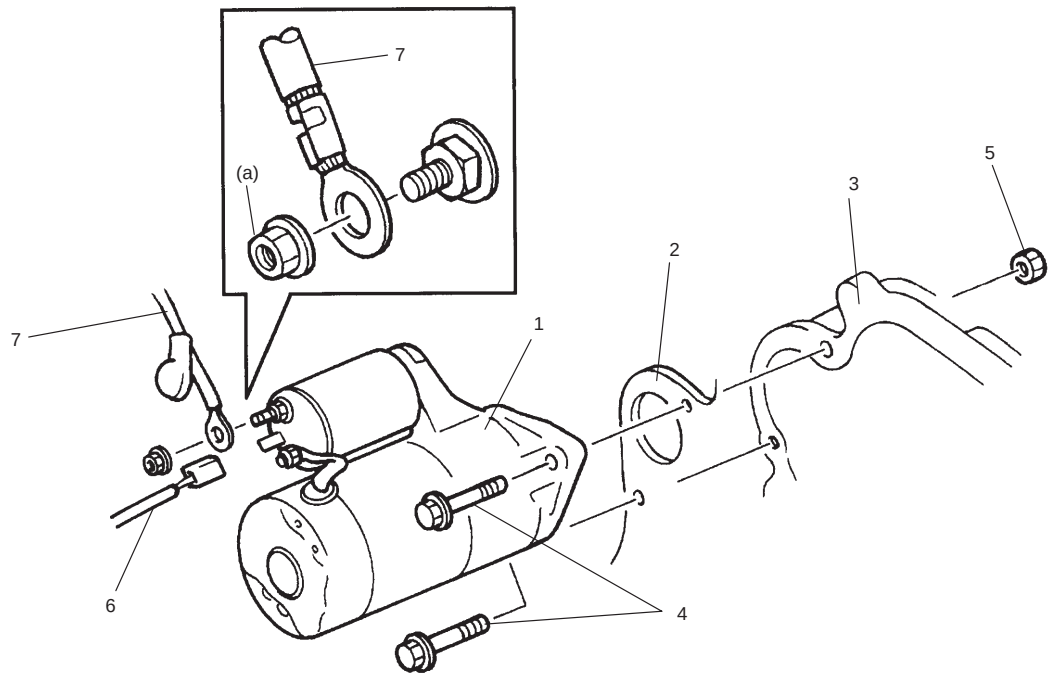
Proper diagnosis must be made to determine exactly where the cause of each trouble lies ..... in battery, wiring harness, (including ignition and starter switch), starting motor or engine.

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**	
	● 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.
	● Poor sliding of plunger and/or pinion	Repair.
	● Shift lever switch is not in P or N, or not adjusted (A/T)	Shift in P or N, or adjust switch.
	● Brushes are seating poorly or worn down	Repair or replace.
	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.

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 or replace.
	● 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 grease 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.

UNIT REPAIR OVERHAUL



1. Starting motor
2. Clutch housing upper plate
3. Transmission case
4. Starting motor mounting bolt
5. Starting motor mounting nut
6. Magnetic switch lead wire
7. Battery cable

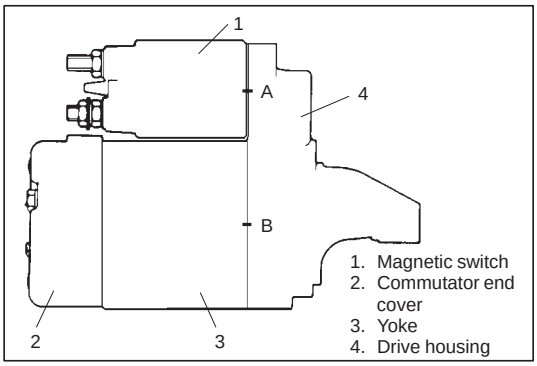
DISMOUNTING

1) Disconnect negative battery lead at battery.
2) Disconnect magnetic switch lead wire and battery cable from starting motor.
3) Remove starting motor mounting bolts and nut.
4) Remove starting motor.

REMOUNTING

Reverse the dismounting procedure.

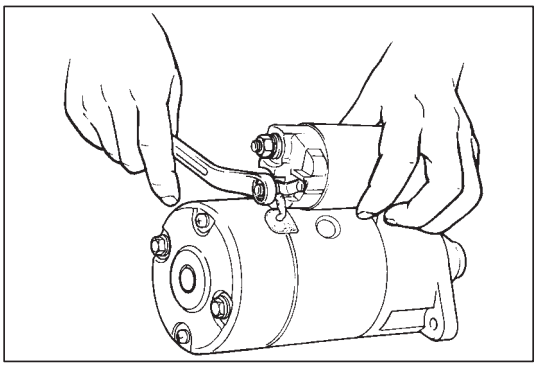
Tightening Torque
(a): 11 N·m (1.1 kg-m, 8.0 lb-ft)



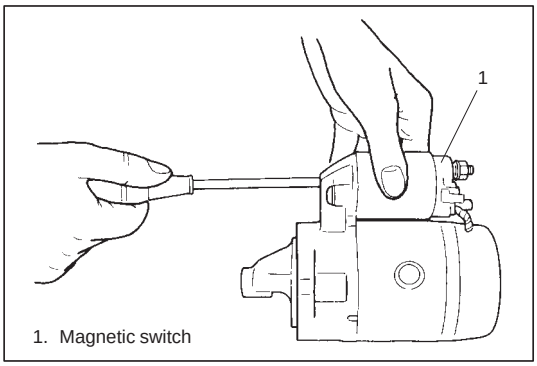
DISASSEMBLY

NOTE:

- **Before disassembling starting motor, be sure to put match marks at two locations (A and B) as shown in the left figure so that any possible mistakes can be avoided.**
- **Do not clamp yoke in a vise or strike it with a hammer during disassembling and reassembling.**

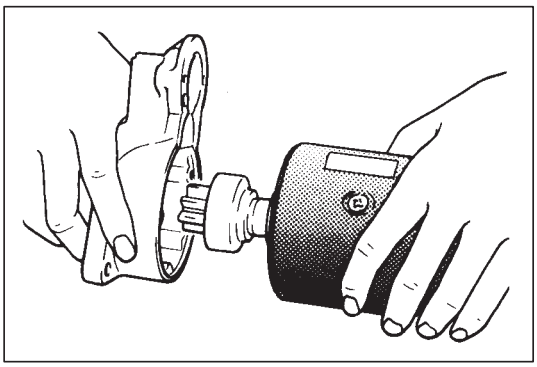


1) Remove nut securing the end of field coil lead to terminal on the head of magnetic switch.

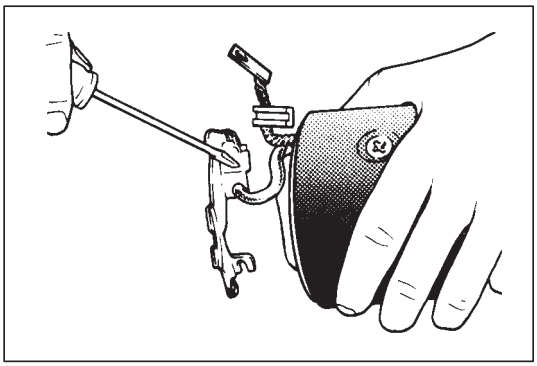


2) Take off magnetic switch from starting motor body by removing 2 mounting screws.

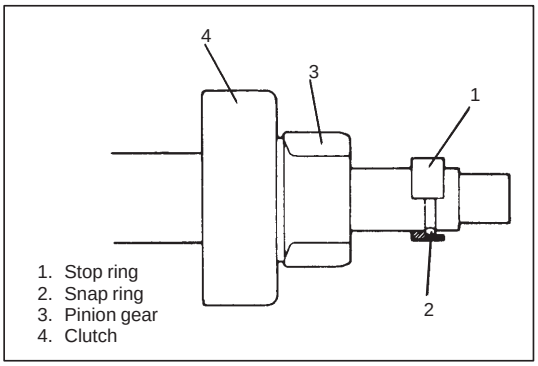
NOTE:
Don't disassemble this switch. If defective, replace as a complete assembly.



3) Loosen 2 bolts and 2 screws to remove commutator end cover.
4) Separate drive housing and armature from yoke.



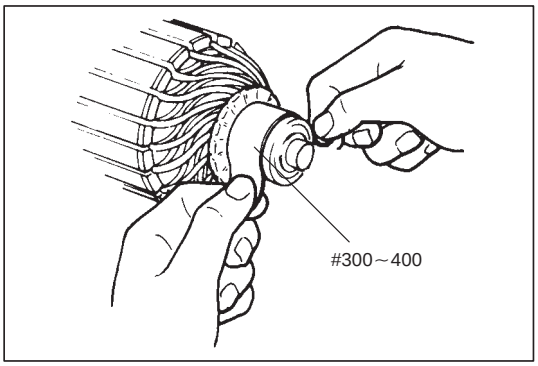
5) Draw brushes out of holder.



6) Draw off over running clutch, as follows:
   (1) Draw stop ring toward clutch side.
   (2) Remove armature ring and side off clutch.

REASSEMBLY

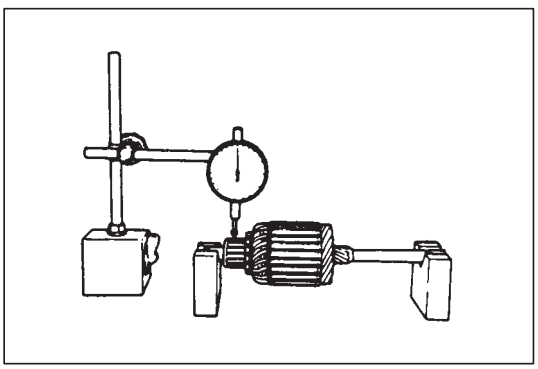
Assemble in reverse order of Disassembly, noting the following.
1) Apply grease. (Refer to page 6G1-3.)
2) Install pinion drive lever into drive housing, referring to 6G1-3 especially for its direction.
3) Upon completion of assembly, carry out “PERFORMANCE TEST”. (Refer to page 6G1-12.)
4) Tighten battery cable nut to specified torque. (Refer to page 6G1-6)



INSPECTION

1. ARMATURE

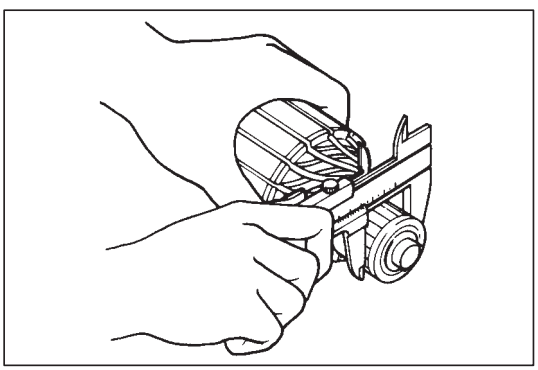
- Inspect commutator for dirt or burn. Correct with sandpaper or lathe, if necessary.



- Check commutator for uneven wear. If deflection of dial gauge pointer exceeds limit, repair or replace.

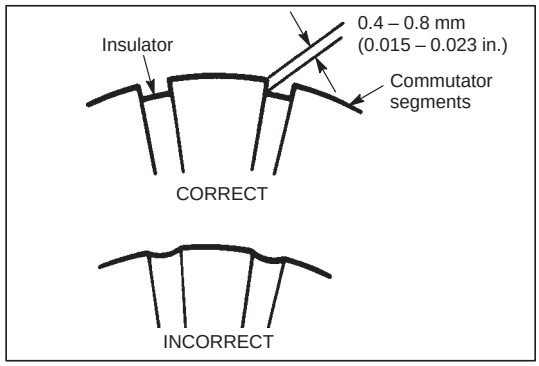
NOTE:
Below specification presupposes that armature is free from bend. Bent shaft must be replaced.

Commutator out round
Standard: 0.05 mm (0.0019 in.) or less
Limit: 0.4 mm (0.015 in.)



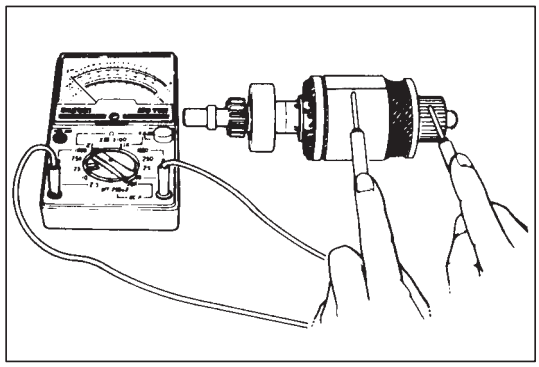
- Inspect commutator for wear.
  If below limit, replace armature.

Commutator outside diameter
Standard: 32.0 mm (1.26 in.)
Limit: 31.4 mm (1.24 in.)

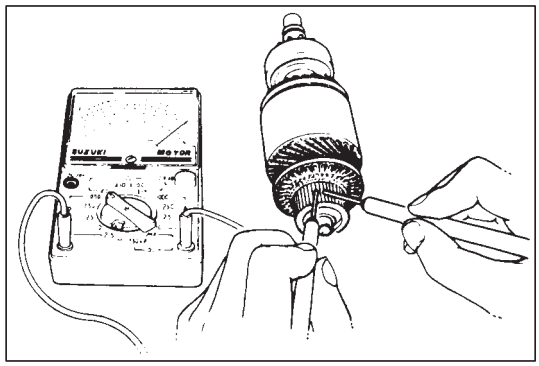


- Inspect commutator for insulator depth. Correct or replace if below limit.

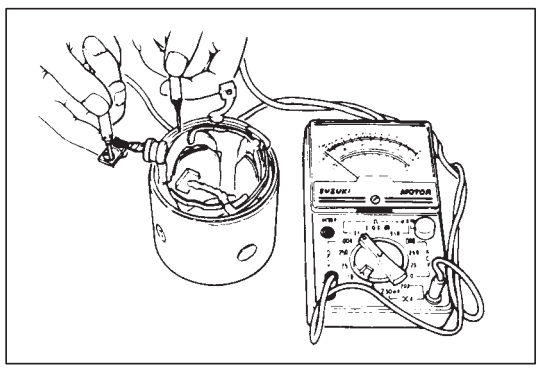
Commutator mica depth
Standard: 0.4 – 0.6 mm (0.015 – 0.023 in.)
Limit: 0.2 mm (0.0078 in.)



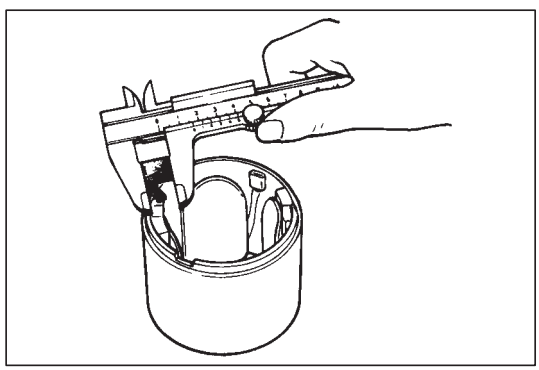
- **Ground test**
  Check commutator and armature core. If there is continuity, armature is grounded and must be replaced.



- **Open circuit test**
  Check for continuity between segments. If there is no continuity at any point, there is an open circuit and armature must be replaced.

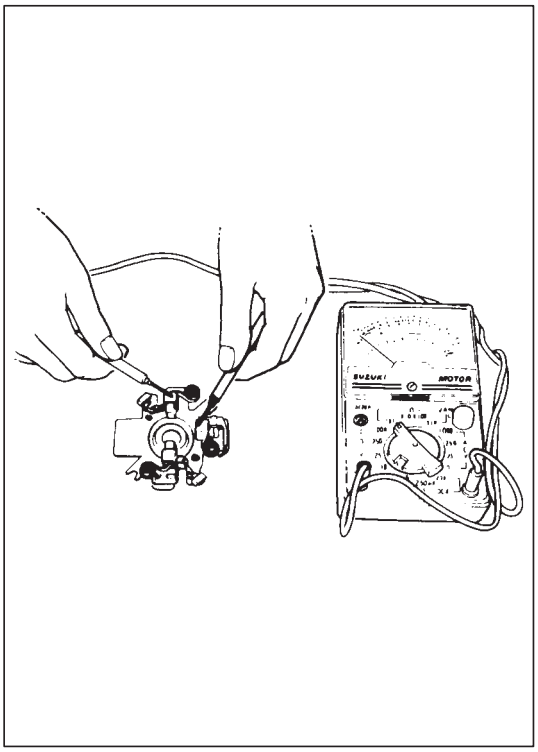


2. FIELD COIL
Ground test
Check continuity between brush and bare surface.
If there is continuity, field windings are grounded.
The yoke ass'y must be replaced.



3. BRUSH
Check brushes for wear. If below limit, replace brush.

Brush length
Standard: 17.0 mm (0.67 in.)
Limit: 11.5 mm (0.45 in.)



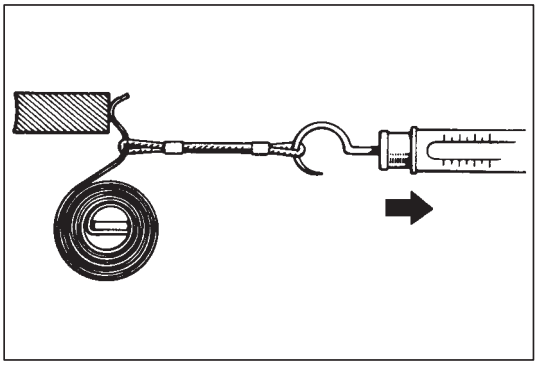
4. BRUSH HOLDER

Check movement of brush in brush holder. If brush movement within brush holder is sluggish, check brush holder for distortion and sliding faces for correct contamination.

Clean or correct as necessary.

Clean for continuity across insulated brush holder (positive side) and grounded brush holder (negative side).

If continuity exists, brush holder is grounded due to defective insulation and should be replaced.



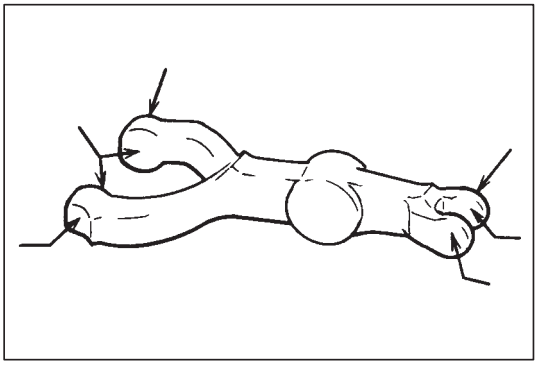
5. SPRING

Inspect brush spring for wear, damage or other abnormal conditions. Replace if necessary.

Brush spring tension

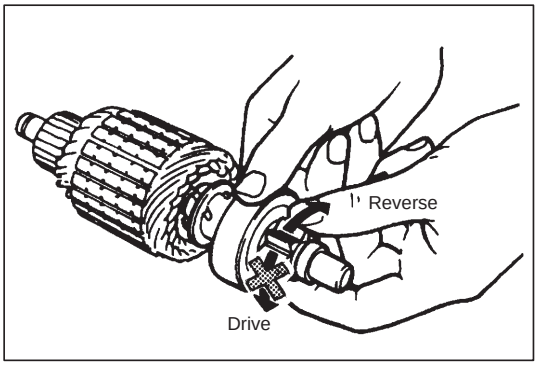
Standard: 1.95 kg (4.3 lb)

Limit: 0.9 kg (1.98 lb)



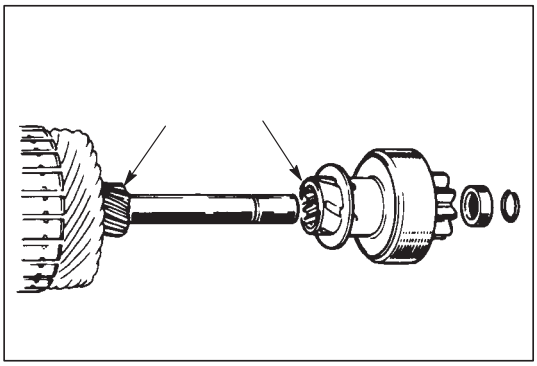
6. DRIVE LEVER

Inspect drive lever for wear. Replace if necessary.

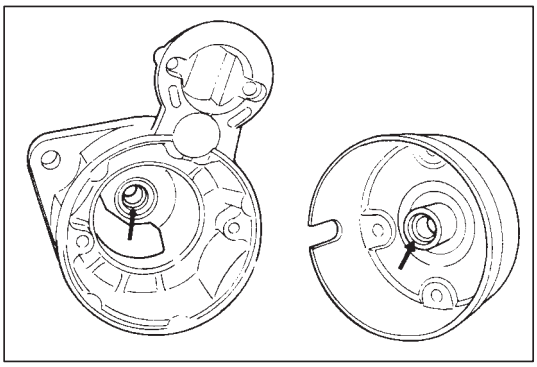


7. PINION AND OVER-RUNNING CLUTCH

- Inspect pinion for wear, damage or other abnormal conditions. Check that clutch locks up when turned in direction of drive and rotates smoothly in reverse direction. Replace if necessary.

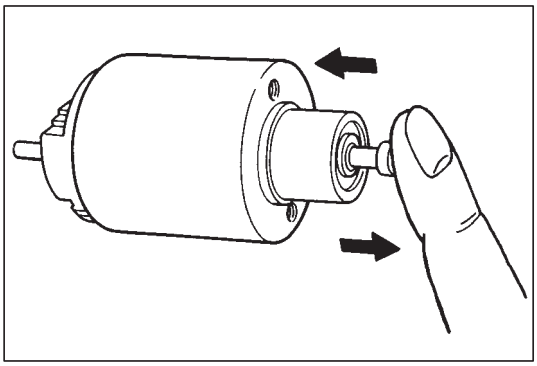


● Inspect spline teeth for wear or damage. Replace if necessary. Inspect pinion for smooth movement.



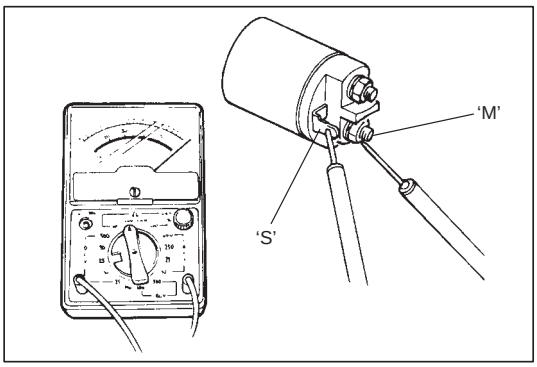
8. ARMATURE SHAFT BUSH

Inspect bushes for wear or damage. Replace if necessary.



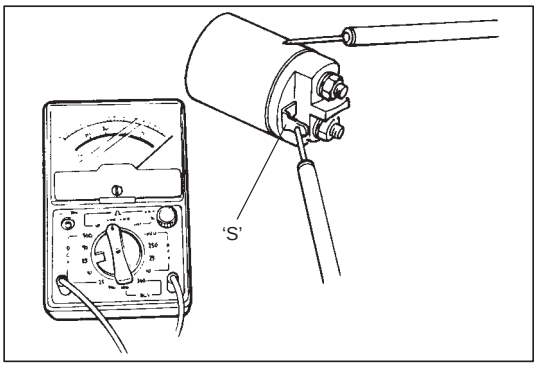
9. MAGNETIC SWITCH

Push in plunger and release it. 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 and 'M' terminal. If no continuity exists, coil is open and should be replaced.

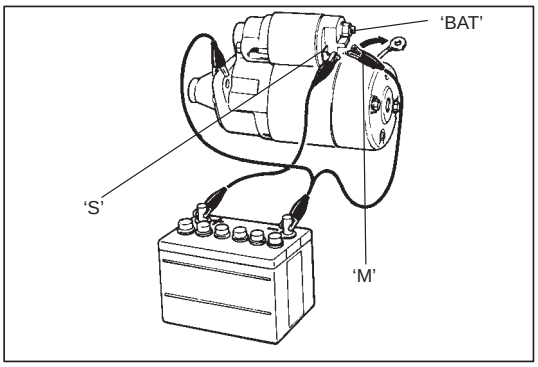


● **Hold-in coil open circuit test**

Check for continuity across magnetic switch 'S' terminal and coil case. If no continuity exists, coil is open and should be replaced.

PERFORMANCE TEST

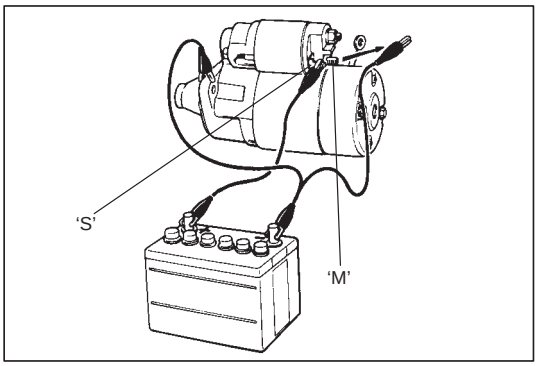
CAUTION:
These tests must be performed within 3 - 5 seconds to avoid coil from burning.



● **PULL-IN TEST**

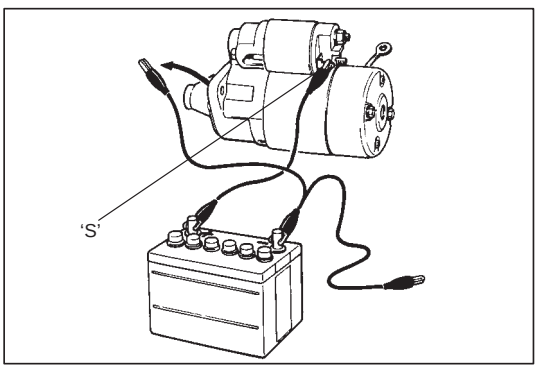
Connect battery to magnetic switch as shown.
Check that pinion moves outward.
If pinion does not move, replace magnetic switch.

NOTE:
Before testing, disconnect field coil lead from Terminal 'M'.



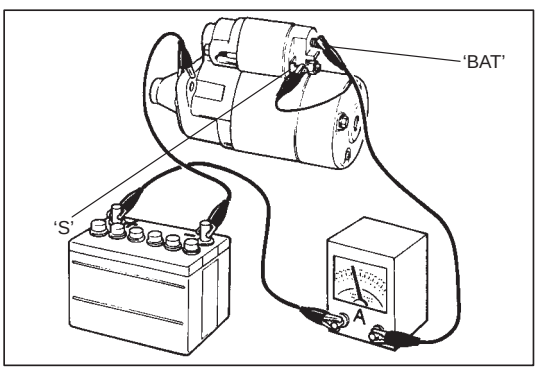
● **HOLD-IN TEST**

While connected as left figure with pinion out, disconnect negative lead from terminal 'M'.
Check that pinion remains out.
If pinion returns inward, replace magnetic switch.



● **CHECK PINION RETURN**

Disconnect negative lead from magnetic switch body.
Check that pinion returns inward.
If pinion does not return, replace magnetic switch.



● **NO-LOAD PERFORMANCE TEST**

a) Connect battery and ammeter to starter as shown.
b) Check that starter rotates smoothly and steadily with pinion moving out. Check that ammeter reads specified current.

Specified current: Less than 60 A at 11.5 V

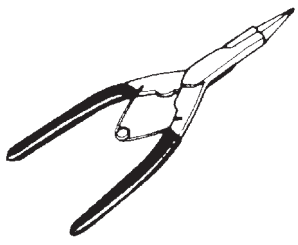
SPECIFICATIONS

Voltage			12 volts
Output			0.9 kW
Rating			30 seconds
Direction of rotation			Clockwise as viewed from pinion side
Brush length			17.0 mm (0.67 in.)
Number of pinion teeth			8
Performance		Condition	Guarantee
Around at 20°C (68°F)	No load characteristic	11.5V	60 A maximum 6600 rpm minimum
	Load characteristic	9 V 150 A	2.8 N·m (0.28 kg-m, 2.0 lb-ft) 1900 rpm minimum
	Locked rotor current	5 V	500 A maximum 11.3 N·m (1.13 kg-m, 8.2 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. ● Commutator end cap. ● Drive lever.

SPECIAL TOOL



09900-06107
Snap ring pliers
(Opening type)

SECTION 6H

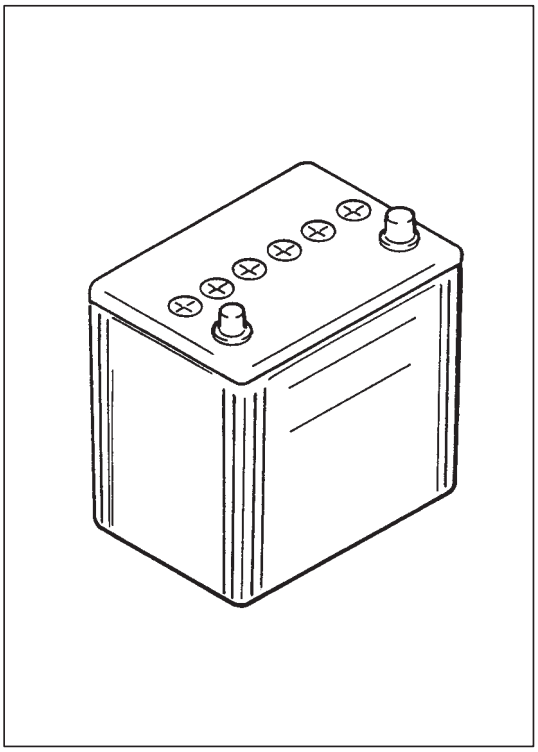
CHARGING SYSTEM

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

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

CONTENTS

GENERAL DESCRIPTION 6H- 2
BATTERY 6H- 2
GENERATOR 6H- 4
DIAGNOSIS 6H- 6
BATTERY 6H- 6
GENERATOR 6H- 8
ON-VEHICLE SERVICE 6H-11
BATTERY 6H-11
Jump Starting in Case of Emergency 6H-11
Dismounting 6H-12
Handling 6H-12
Remounting 6H-12
GENERATOR 6H-13
Generator Belt 6H-13
UNIT REPAIR OVERHAUL 6H-14
GENERATOR 6H-14
Dismounting 6H-14
Remounting 6H-15
Disassembly 6H-16
Inspection 6H-22
Replace Brush 6H-26
Reassembly 6H-27
SPECIFICATIONS 6H-31
BATTERY 6H-31
GENERATOR 6H-31
TIGHTENING TORQUE SPECIFICATIONS 6H-31



GENERAL DESCRIPTION

BATTERY

The battery has three major functions in the electrical system.

- It is a source of electrical energy for cranking the engine.
- It acts as a voltage stabilizer for the electrical system.
- It can, for a limited time, provide energy when the electrical load exceeds the output of the generator.

CARRIER AND HOLD-DOWN

The battery carrier should be in good condition so that it will support the battery securely and keep it level.

Before installing the battery, the battery carrier and hold-down clamp should be clean and free from corrosion and make certain there are no parts in carrier.

To prevent the battery from shaking in its carrier, the hold-down bolts should be tight enough but not over-tightened.

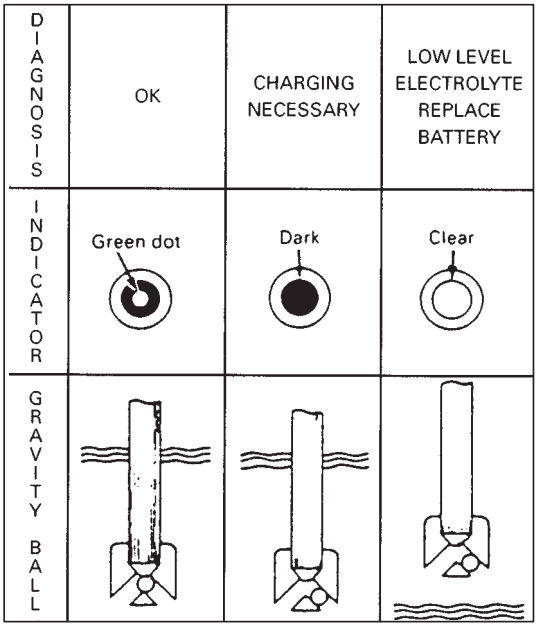
ELECTROLYTE FREEZING

The freezing point of electrolyte depends on its specific gravity. Since freezing may ruin a battery, it should be protected against freezing by keeping it in a fully charged condition. If a battery is frozen accidentally, it should not be charged until it is warmed.

SULFATION

If the battery is allowed to stand for a long period in discharged condition, the lead sulfate becomes converted into a hard, crystalline substance, which will not easily turn back to the active material again during the subsequent recharging. “Sulfation” means the result as well as the process of that reaction.

Such a battery can be revived by very slow charging and may be restored to usable condition but its capacity is lower than before.



BUILT-IN INDICATOR (IF EQUIPPED)

The battery has a built-in temperature compensated indicator in the top of the battery. This indicator is to be used with the following diagnostic procedure. When checking the indicator, make sure that the battery has a clean top. A light may be needed in some poorly-lit areas.

Three types of indication available under normal operation are as follows.

1. **Green Dot**
   Battery is sufficiently charged for testing.
2. **Dark**
   Battery must be charged before testing.
   If there is a cranking complaint, battery should be tested as described in Diagnosis section. Charging and electrical systems should also be checked at this time.
3. **Clear or Light Yellow**
   This means that fluid level is below the bottom of hydrometer. Its possible cause is excessive or prolonged charging, a broken case, excessive tipping or normal battery deterioration.
   When the battery is found in such condition, it is possible that high charging voltage is caused by the faulty charging system and therefore, charging and electrical systems need to be checked. If there is a trouble in cranking and its cause lies in the battery, it should be replaced.

CARE OF BATTERY

WARNING:
- **Never expose battery to open flame or electric spark because of battery generate gas which is flammable and explosive.**
- **Do not allow battery fluid to contact eyes, skin, fabrics, or painted surfaces as fluid is a corrosive acid. Flush any contacted area with water immediately and thoroughly.**
- **Batteries should always be kept out of reach of children.**

1) The battery is a very reliable component, but needs periodical attentions.
   - Keep the battery carrier clean
   - Prevent rust formation on the terminal posts
   - Keep the electrolyte up to the upper level uniformly in all cells.

   When keeping battery on vehicle over a long period of time, follow instructions given below.
   - Weekly, start the engine and run it until it reaches normal operating temperature with engine speed of 2000 to 3000 rpm. Make sure all electric switches are off before storing the vehicle.
   - Recharge the battery twice a month to prevent it from discharging excessively. This is especially important when ambient temperature is low.
     The battery discharges even when it is not used, while vehicles are being stored. Battery electrolyte can freeze and battery case can crack at cold ambient condition if battery is not properly charged.

2) Keep the battery cable connections clean.
   The cable connections, particularly at the positive (+) terminal post, tend to become corroded. The product of corrosion, or rust, on the mating faces of conductors resists the flow of current.
   Clean the terminals and fittings periodically to ensure good metal-to-metal contact, and grease the connections after each cleaning to protect them against rusting.

3) Be always in the know as to the state of charge of the battery.
   The simplest way to tell the state of charge is to carry out a hydrometer test. The hydrometer is an instrument for measuring the specific gravity (S.G.) of the battery electrolyte. The S.G. of the electrolyte is indicative of the state of charge. Refer to “DIAGNOSIS” of BATTERY in this section.

GENERATOR

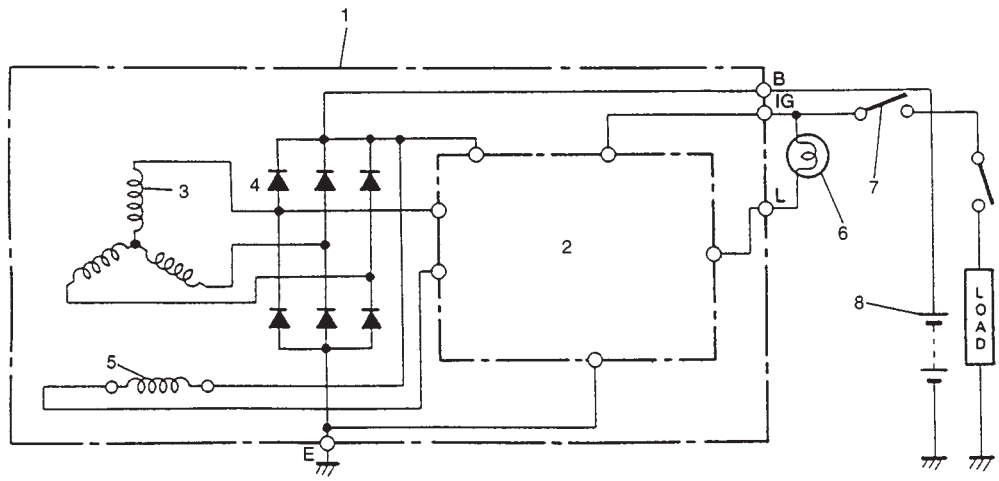
The generator is a small and high performance type with an IC regulator incorporated.
The internal components are connected electrically as shown below figure.

The generator features are as follows:

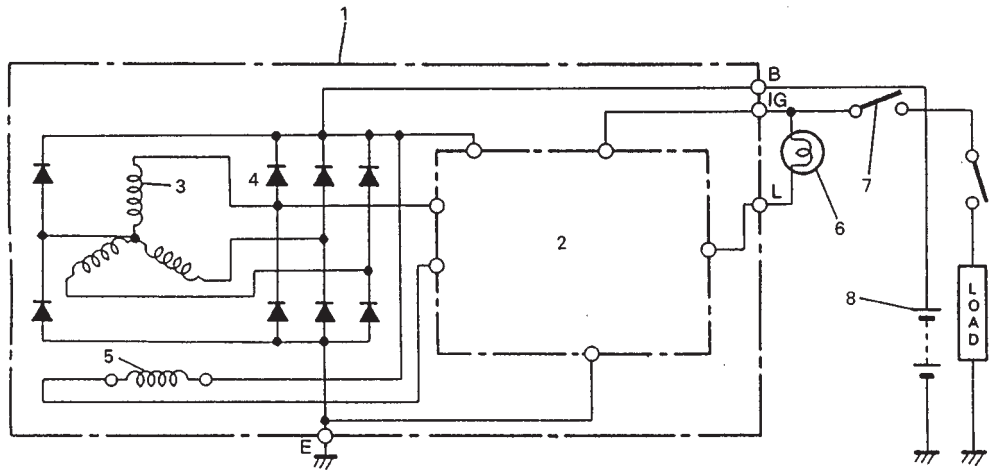
- Solid state regulator is mounted inside the generator.
- All regulator components are enclosed into a solid mold.
- This unit along with the brush holder assembly is attached to the rear housing.
- The IC regulator uses integrated circuits and controls the voltage produced by the generator, and the voltage setting cannot be adjusted.
- The generator rotor bearings contain enough grease to eliminate the need for periodic lubrication. Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long period of attention-free service.
- The stator windings are assembled on the inside of a laminated core that forms part of the generator frame.
- A condenser mounted in the rear housing suppresses radio noise.

NOTE:
The generator used in each vehicle is one of the following three types, depending on specification.

[60 A type]

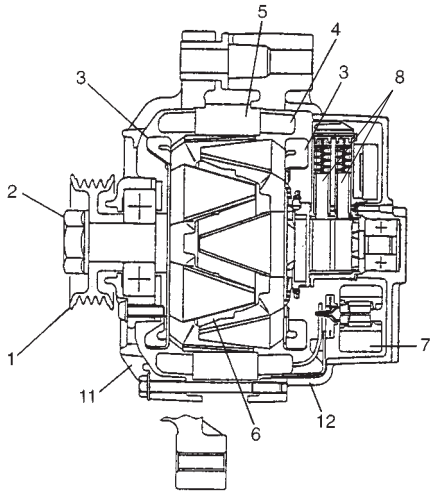


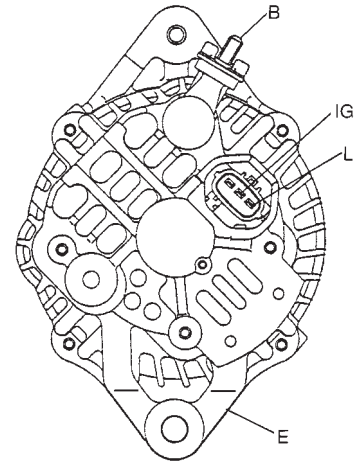
[70 A and 85 A types]



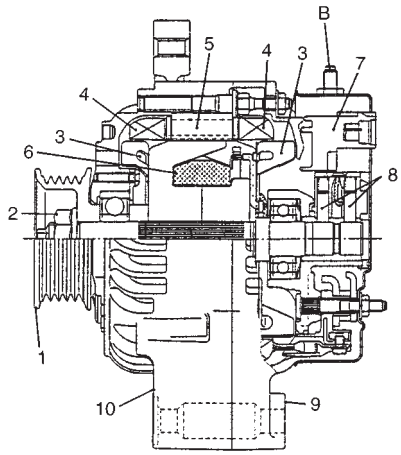
1. Generator with regulator ass'y
2. I.C. regulator
3. Stator coil
4. Diode
5. Field coil (rotor coil)
6. Charge indicator light
7. Main switch
8. Battery

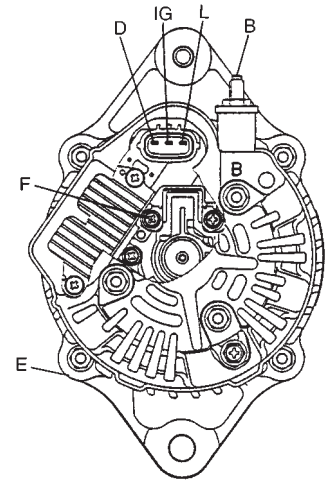
[60 A type]



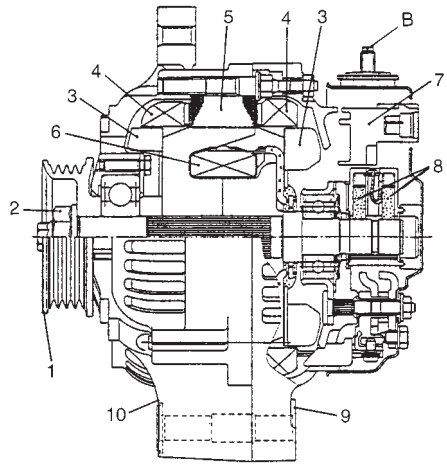


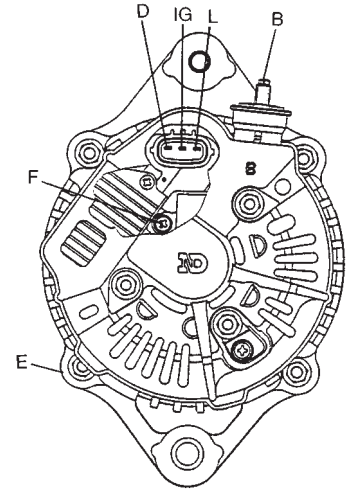
[70 A type]





[85 A type]





1. Pulley
2. Pulley nut
3. Rotor fan
4. Stator coil
5. Stator core
6. Field coil
7. Regulator
8. Brush
9. Rear end frame
10. Drive end frame
11. Front housing
12. Rear housing

B : Generator output (Battery terminal)
D : Dummy terminal
E : Ground
F : Field coil terminal
IG : Ignition terminal
L : Lamp terminal

DIAGNOSIS

BATTERY

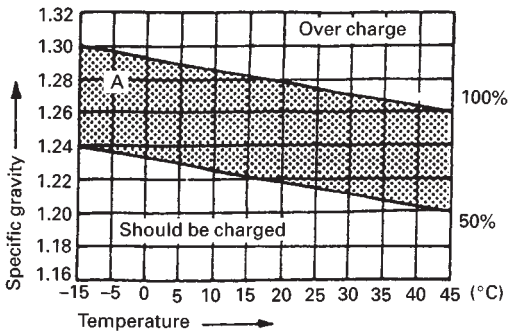
COMMON CAUSES OF FAILURE

A battery is not designed to last indefinitely; however, with proper care, it will provide many years of service. If the battery performs satisfactorily during test but fails to operate properly for no apparent reason, the following are some factors that may point to the cause of trouble:

- Accessories left on overnight or for an extended period without the generator operating.
- Slow average driving speeds for short periods.
- Electrical load exceeding generator output particularly with addition of aftermarket equipment.
- Defects in charging system such as high resistance, slipping drive belt, loose generator output terminal, faulty generator or voltage regulator. Refer to “GENERATOR” in this “DIAGNOSIS” section.
- Battery abuse, including failure to keep battery cable terminals clean and tight or loose battery hold down.
- Mechanical problems in electrical system such as shorted or pinched wires.

VISUAL INSPECTION

Check for obvious damage, such as cracked or broken case or cover, that could permit loss of electrolyte. If obvious damage is noted, replace battery. Determine cause of damage and correct as needed.



HYDROMETER TEST

The direct method of checking the battery for state of charge is to carry out a high rate discharge test, which involves a special precise voltmeter and an expensive instrument used in the service shops, but not recommendable to the user of the vehicle.

At 20 °C of battery temperature (electrolyte temperature):

– The battery is in FULLY CHARGED STATE if the electrolyte S.G. is 1.280.
– The battery is in HALF CHARGED STATE if the S.G. is 1.220.
– The battery is in NEARLY DISCHARGED STATE if the S.G. is 1.150 and is in danger of freezing.

As the S.G. varies with the temperature, if battery temperature is not at 20°C (68°F), you have to correct your S.G. reading (taken with your hydrometer) to the value at 20°C (68°F) and apply the corrected S.G. value to the three-point guide stated value.

For the manner of correction, refer to the graph showing the relation between S.G. value and temperature at the left.

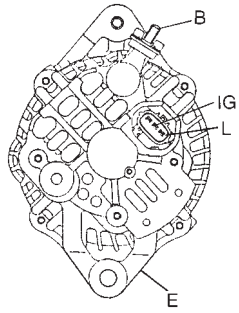
How to use the temperature-corrected state-of-charge graph

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.

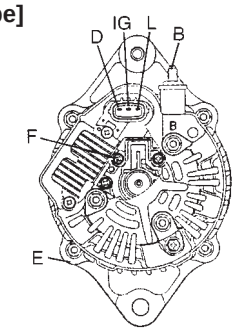
The intersection is within the “A” zone (shaded area in the graph) and that means CHARGED STATE.

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.

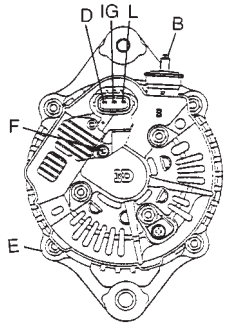
[60 A type]



[70 A type]



[85 A type]



B : Generator output (Battery terminal)
D : Dummy terminal
E : Ground
F : Field coil terminal
IG : Ignition terminal
L : Lamp terminal

GENERATOR

CAUTION:
- **Do not mistake polarities of IG terminal and L terminal.**
- **Do not create a short circuit between IG and L terminals. Always connect these terminals through a lamp.**
- **Do not connect any load between L and E.**
- **When connecting a charger or a booster battery to vehicle battery, refer to this section describing battery charging.**

Trouble in charging system will show up as one or more of following conditions:

1) Faulty indicator lamp operation.
2) An undercharged battery as evidenced by slow cranking or indicator dark.
3) An overcharged battery as evidenced by excessive spewing of electrolyte from vents.

Noise from generator may be caused by a loose drive pulley, loose mounting bolts, worn or dirty bearings, defective diode, or defective stator.

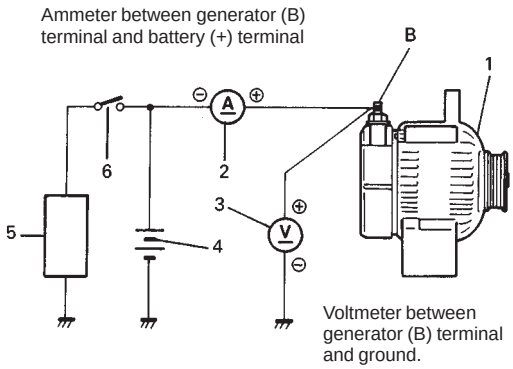
FAULTY INDICATOR LAMP OPERATION

PROBLEM	POSSIBLE CAUSE	CORRECTION
Charge light does not light with ignition ON and engine off	° Fuse blown	Check fuse.
	° Light burned out	Replace light.
	° Wiring connection loose	Tighten loose connection.
	° IC regulator faulty (60 A type only)	Check generator.
	° IC regulator or field coil faulty (70 A and 85 A types only)	Check generator.
	° Poor contact between brush and slip ring (70 A and 85 A types only)	Repair or replace.
Charge light does not go out with engine running (battery requires frequent recharging)	° Drive belt loose or worn	Adjust or replace drive belt.
	° IC regulator or generator faulty	Check charging system.
	° Wiring faulty	Repair wiring.

UNDERCHARGED BATTERY

This condition, as evidenced by slow cranking or indicator clear with red dot can be caused by one or more of the following conditions even though indicator lamp may be operating normal.
Following procedure also applies to cars with voltmeter and ammeter.

1) Make sure that undercharged condition has not been caused by accessories left on for extended period of time.
2) Check drive belt for proper tension.
3) If battery defect is suspected, refer to BATTERY section.
4) Inspect wiring for defects. Check all connections for tightness and cleanliness, battery cable connections at battery, starting motor and ignition ground cable.
5) Connect voltmeter and ammeter as shown in left figure.



1. Generator
2. Ammeter
3. Voltmeter
4. Battery
5. Load
6. Switch

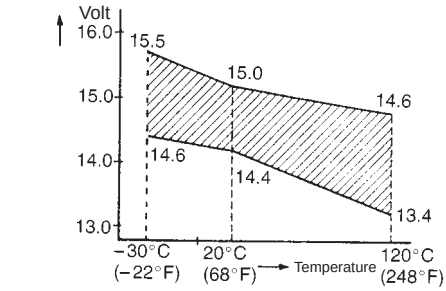
Voltmeter
Set between generator B terminal and ground.

Ammeter
Set between generator B terminal and battery (+) terminal.

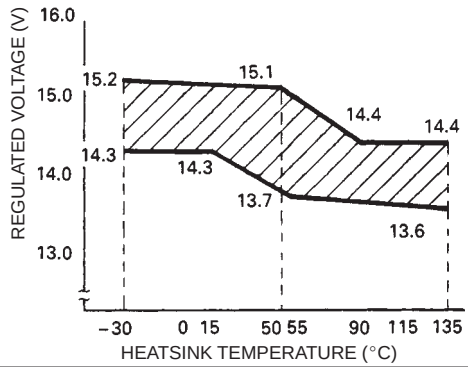
NOTE:
Use fully charged battery.

6) Measure current and voltage.

[60 A type]



[70 A and 85 A types]



No-load Check

1) Run engine from idling up to 2,000 rpm and read meters.

NOTE:
Turn off switches of all accessories (wiper, heater etc.).

Standard current: 10 A maximum

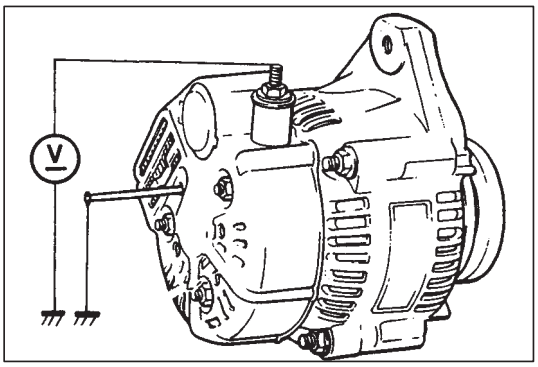
Standard voltage: 14.4 – 15.0 V (at 20°C, 85°F) 60 A type
14.1 – 15.2 V (at 20°C, 68°F) 70 A and 85 A types

NOTE:
Consideration should be taken that voltage will differ somewhat with regulator case temperature as shown in left figure.

Higher Voltage
If voltage is higher than standard value, check ground of brushes. If brushes are not grounded, replace IC regulator.

Lower Voltage
[60 A type]
If voltage is below or in standard value, increase engine speed up to 2000 – 2500 rpm soon after starting engine, and read maximum value on ammeter immediately.
If current is less than 42 A, repair or replace generator.

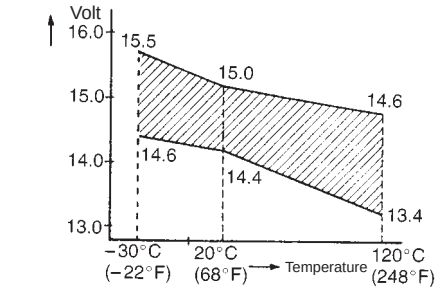
[70 A and 85 A types]
If voltage is lower than standard value, proceed to following check.



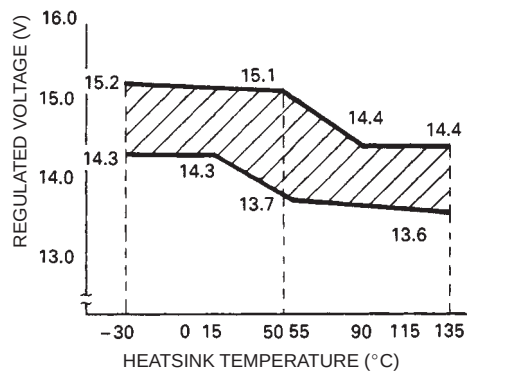
2) Ground F terminal and start engine, then measure voltage at B terminal as shown in left figure.
   - ° Voltage is higher than standard value
     It is considered that generator itself is good but IC regulator has been damaged, replace IC regulator.
   - ° Voltage is lower than standard value
     Generator itself has problem, check the generator.

Load Check [70 A and 85 A types only]
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 (70A type) or 30 A (85 A type) repair or replace generator.

[60 A type]



[70 A and 85 A types]



OVERCHARGED BATTERY
1) To determine battery condition, refer to BATTERY section.
2) If obvious overcharge condition exists as evidenced by excessive spewing of electrolyte, measure generator B terminal voltage at engine 2000 rpm.
3) If measured voltage is higher than upper limit value, proceed to disassembly section of generator service.
4) Check ground of brushes. If brushes are not grounded, replace IC regulator. Then check field coil for grounds and shorts, referring to “INSPECTION” section.

ON-VEHICLE SERVICE

BATTERY

JUMP STARTING IN CASE OF EMERGENCY

WITH AUXILIARY (BOOSTER) BATTERY

CAUTION:
If vehicle is manual transmission model and has a catalytic converter, do not push or tow it to start. Damage to its emission system and/or to other parts may result.

Both booster and discharged battery should be treated carefully when using jumper cables. Follow procedure outlined below, being careful not to cause sparks.

WARNING:
- **Departure from these conditions or procedure described below could result in:**
  (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.**

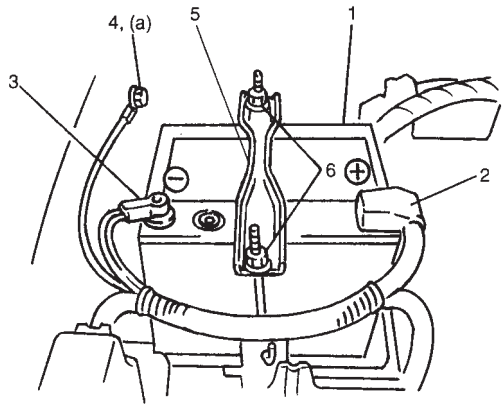
1) Set parking brake and place automatic transmission in PARK (NEUTRAL on manual transmission). Turn off ignition, turn off lights and all other electrical loads.
2) Check electrolyte level. If it is below low level line, add distilled water.
3) Attach end of one jumper cable to positive terminal of booster battery and the other end of the same cable to positive terminal of discharged battery. (Use 12-volt battery only to jump start engine).
4) Attach one end of the remaining negative cable to negative terminal of booster battery, and the other end to a solid engine ground (such as exhaust manifold) at least 45 cm (18 in.) away from battery of vehicle being started.

   WARNING:
   Do not connect negative cable directly to negative terminal of dead battery.

5) Start engine of vehicle with booster battery and turn off electrical accessories. Then Start engine of the vehicle with discharged battery.
6) Disconnect jumper cables in the exact reverse order.

WITH CHARGING EQUIPMENT

CAUTION:
When jump starting engine with charging equipment, be sure equipment used is 12-volt and negative ground. Do not use 24-volt charging equipment. Using such equipment can cause serious damage to electrical system or electronic parts.



1. Battery
2. Positive cable
3. Negative cable
4. Body ground bolt
5. Retainer
6. Nut

DISMOUNTING

1) Disconnect negative cable.
2) Disconnect positive cable.
3) Remove retainer.
4) Remove battery.

HANDLING

When handling battery, following safety precautions should be followed:

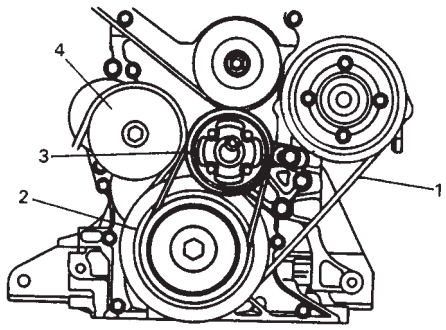
° Hydrogen gas is produced by battery. A flame or spark near battery may cause the gas to ignite.
° Battery fluid is highly acidic. Avoid spilling on clothing or other fabric. Any spilled electrolyte should be flushed with large quantity of water and cleaned immediately.

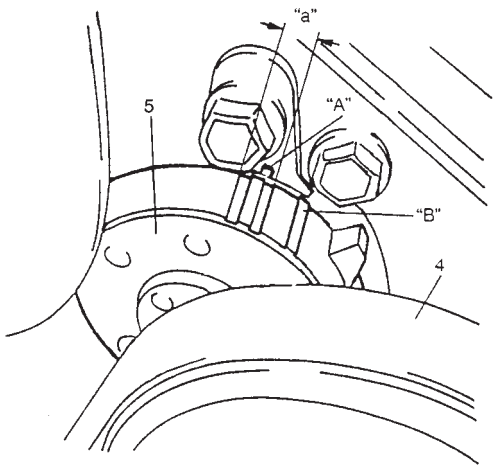
REMOUNTING

1) Reverse removal procedure.
2) Torque battery cables to specification.

NOTE:
Check to be sure that ground cable has enough clearance to hood panel by terminal.

Tightening Torque
(a): 8.0 N·m (0.8 kg-m, 6.0 lb-ft)





1. Generator belt
2. Crankshaft pulley
3. Radiator fan pulley
4. Tension pulley
5. Tensioner

GENERATOR

GENERATOR BELT

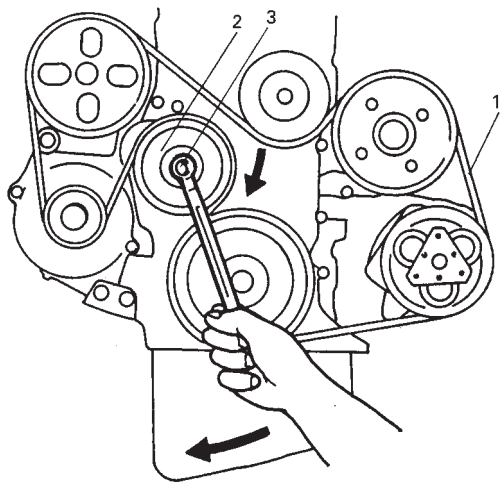
[G16 and H25 engines]

Refer to "COOLING FAN BELT" in SECTION 6B "ENGINE COOLING".

[J20 engine]

INSPECTION

- Inspect belt for cracks, cuts, deformation, wear and cleanliness. If any of above conditions are found replace generator belt.
- Check to make sure that tension indicators are as follows in the left figure by using mirror.
  (a) If the tension indicator "B" is found to the left of the indicator "A", replace the generator belt.
  (b) If new generator belt has been installed, indicator "A" should be within "a" of the left figure.
  If it isn't, it means that belt is not installed properly.
  Reinstall it properly.



1. Generator belt
2. Tensioner
3. Tensioner bolt

REMOVAL

WARNING:
Disconnect negative cable at battery before removing and installing generator belt.

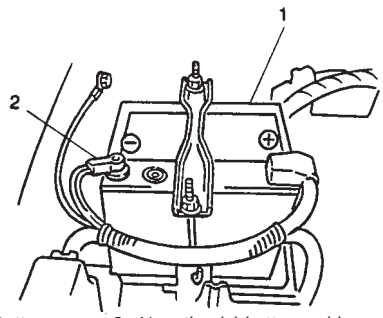
1) Loosen tensioner by turning the tensioner pulley clock wise.
2) While holding the tensioner and belt loose, remove generator belt.

INSTALLATION

1) Loosen tensioner by turning the tensioner pulley clockwise.
2) While holding the tensioner, install generator belt.

NOTE:

- **Make sure that the belt fits each pulley's groove properly.**
- **After installing generator belt, perform checks described above and make sure that tension indicator is within standard range.**



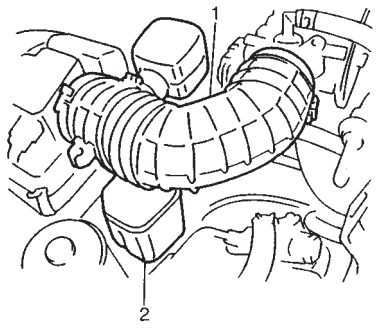
1. Battery
2. Negative (–) battery cable

UNIT REPAIR OVERHAUL

GENERATOR

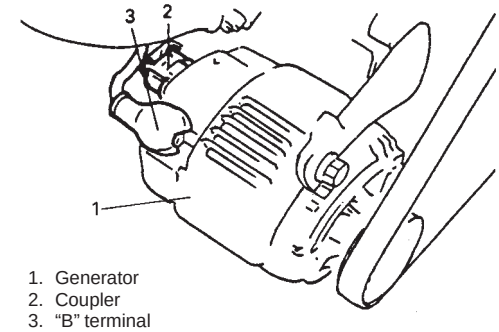
DISMOUNTING

1) Disconnect negative (–) cable at battery.



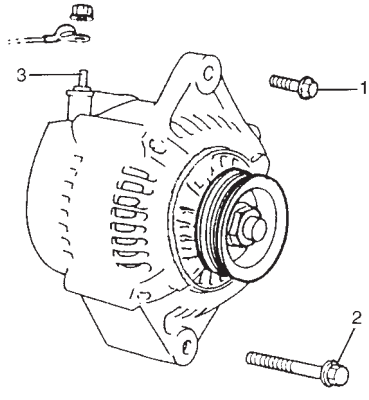
1. Air cleaner outlet hose
2. Canister

2) Remove air cleaner outlet hose.
3) Remove canister from its bracket.



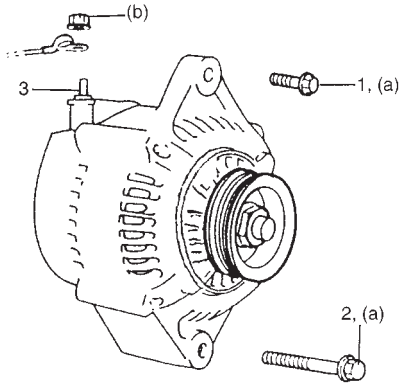
1. Generator
2. Coupler
3. "B" terminal

4) Disconnect "B" terminal wire and coupler from generator.



1. Upper generator bolt (Short)
2. Lower generator bolt (Long)
3. "B" terminal

5) Remove generator belt. Refer to SECTION 6B "ENGINE COOLING" (G16 and H25 engines) or "GENERATOR BELT" (J20 engine) in this section.
6) Remove generator.



1. Upper generator bolt (Short)
2. Lower generator bolt (Long)
3. “B” terminal

REMOUNTING

1) Mount generator on the generator bracket.
2) Tighten generator bolts.

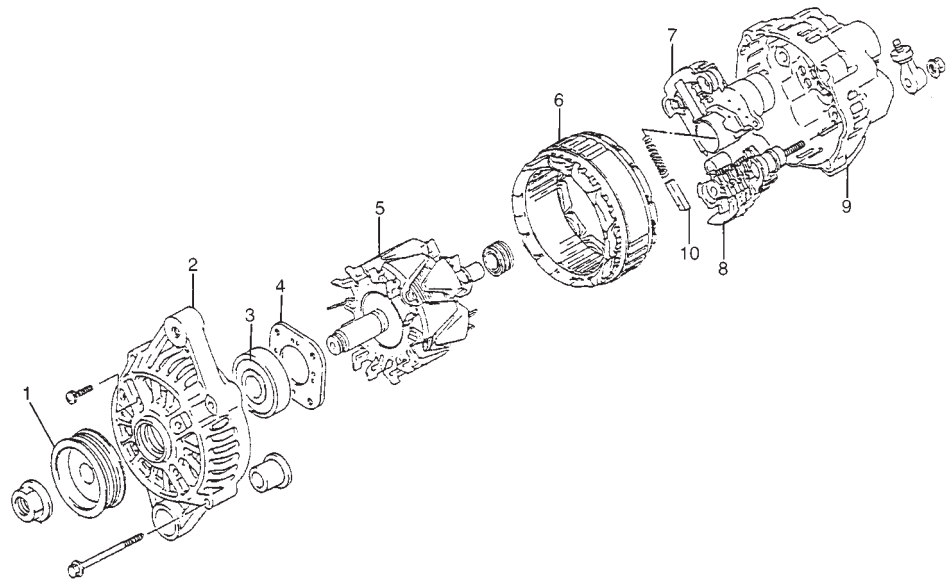
Tightening Torque
(a): 23 N·m (2.3 kg-m, 16.5 lb-ft)

3) Install generator (cooling fan) belt. Refer to SECTION 6B “ENGINE COOLING” (G16 and H25 engines) or “GENERATOR BELT” (J20 engine) in this section.
4) Install cooling fan belt (J20 engine only). Refer to SECTION 6B “ENGINE COOLING”.
5) Connect “B” terminal wire and coupler to generator.

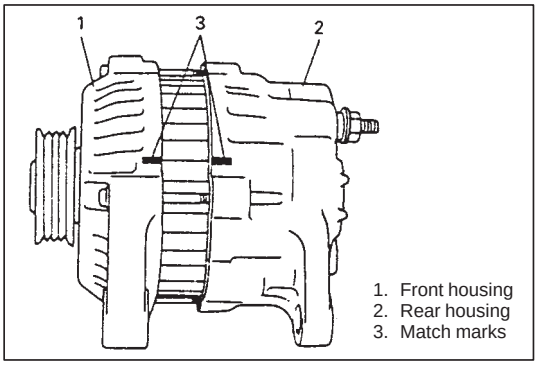
Tightening Torque
(b): 8.0 N·m (0.8 kg-m, 6.0 lb-ft)

6) Install canister.
7) Install air cleaner outlet hose.
8) Connect negative (–) cable at battery.

DISASSEMBLY [60 A type]

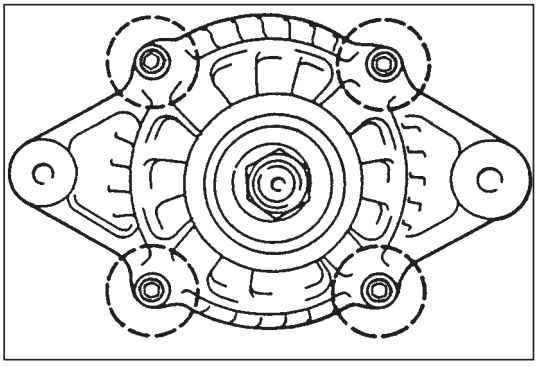


1. Pulley
2. Front housing
3. Bearing
4. Retainer
5. Rotor
6. Stator
7. IC regulator
8. Rectifier
9. Rear housing
10. Brush

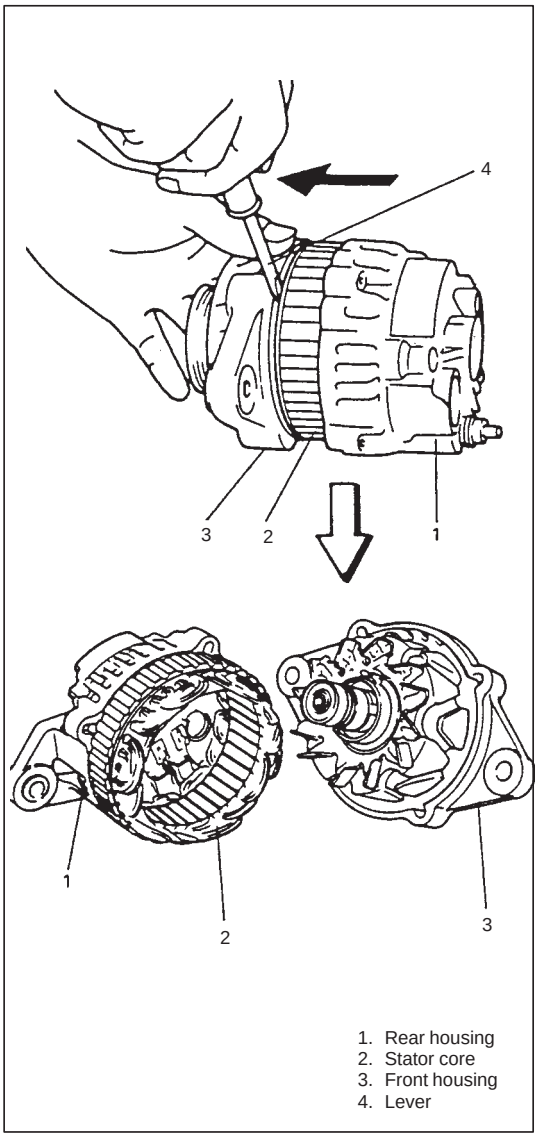


1. Front housing
2. Rear housing
3. Match marks

1) For easier reinstallation, provide match marks on both front and rear housings as shown in left figure before separating them.

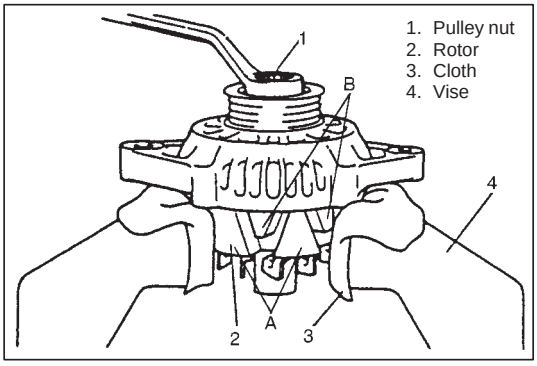


2) Remove housing bolts from generator.



1. Rear housing
2. Stator core
3. Front housing
4. Lever

3) With lever inserted between stator core and front housing, separate generator into front and rear sides.



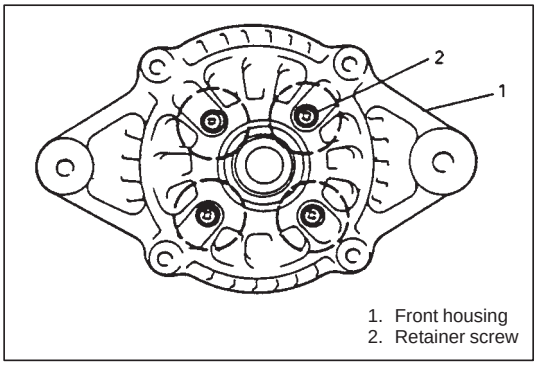
1. Pulley nut
2. Rotor
3. Cloth
4. Vise

4) Loosen pulley nut by using vise and take off pulley.

NOTE:

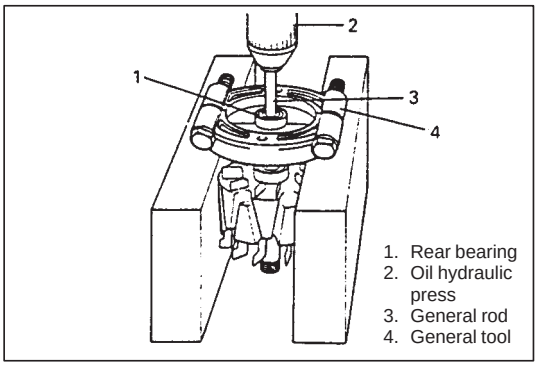
- **When using vise, put clean cloth between rotor and vise so as not to cause damage to rotor.**
- **Be sure to hold the location A. Do not hold the location B as it does not have enough structural strength.**

5) Remove rotor from front housing.



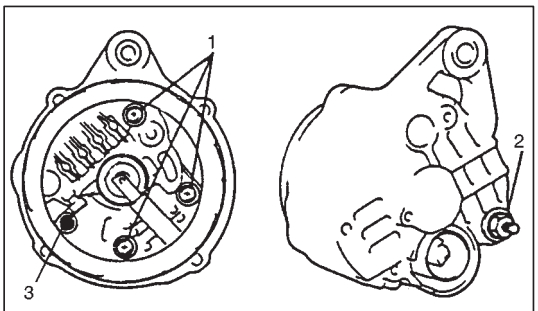
1. Front housing
2. Retainer screw

6) When removing front bearing, remove bearing retainer screws and retainer.



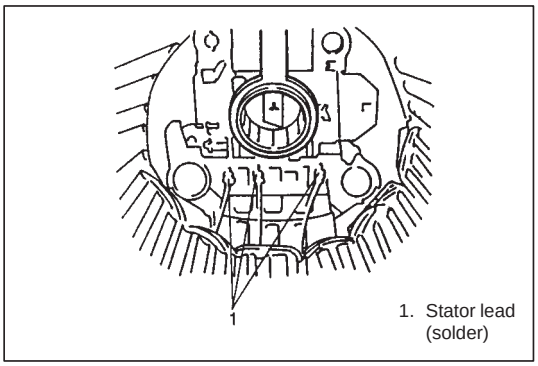
1. Rear bearing
2. Oil hydraulic press
3. General rod
4. General tool

7) When removing rear bearing, use oil hydraulic press.



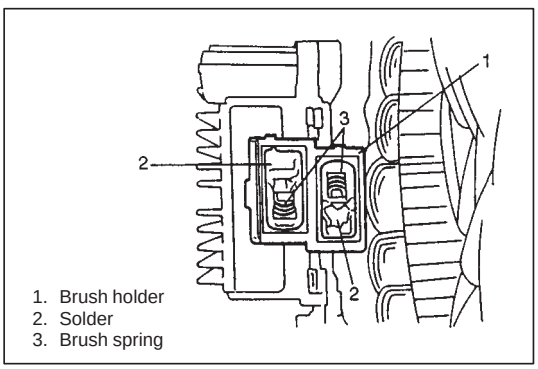
1. Screw
2. Generator "B" terminal nut
3. "B" terminal

8) Remove three screws and generator "B" terminal nut.



1. Stator lead (solder)

9) Unsolder stator leads and remove stator from rear housing and regulator assembly.

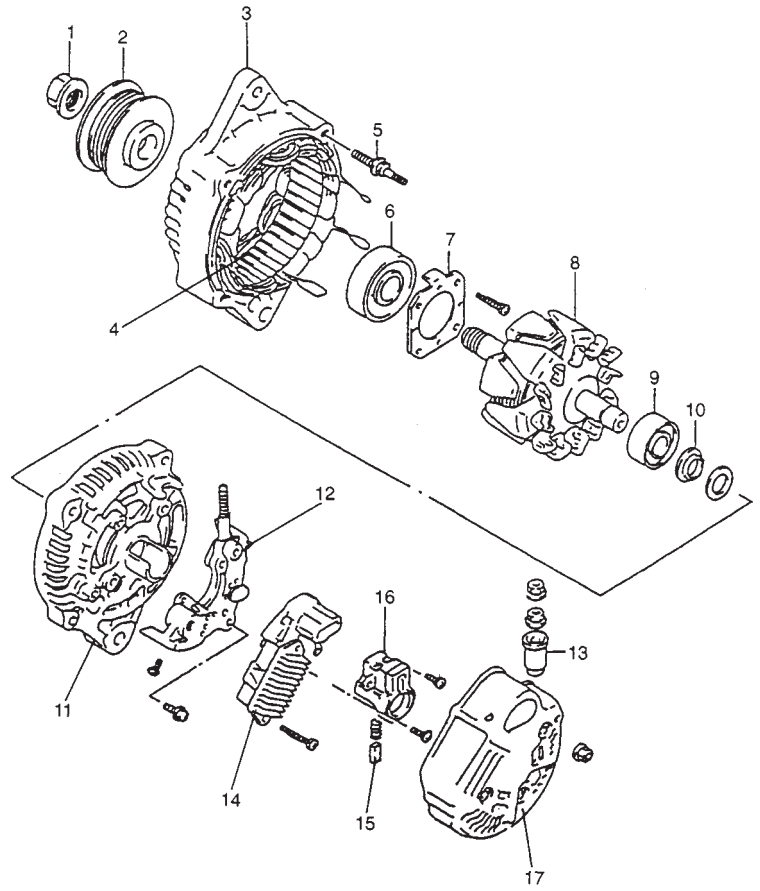


1. Brush holder
2. Solder
3. Brush spring

10) To remove brush, remove holder cover from brush holder and then disconnect brush wire from regulator terminal by using soldering iron.

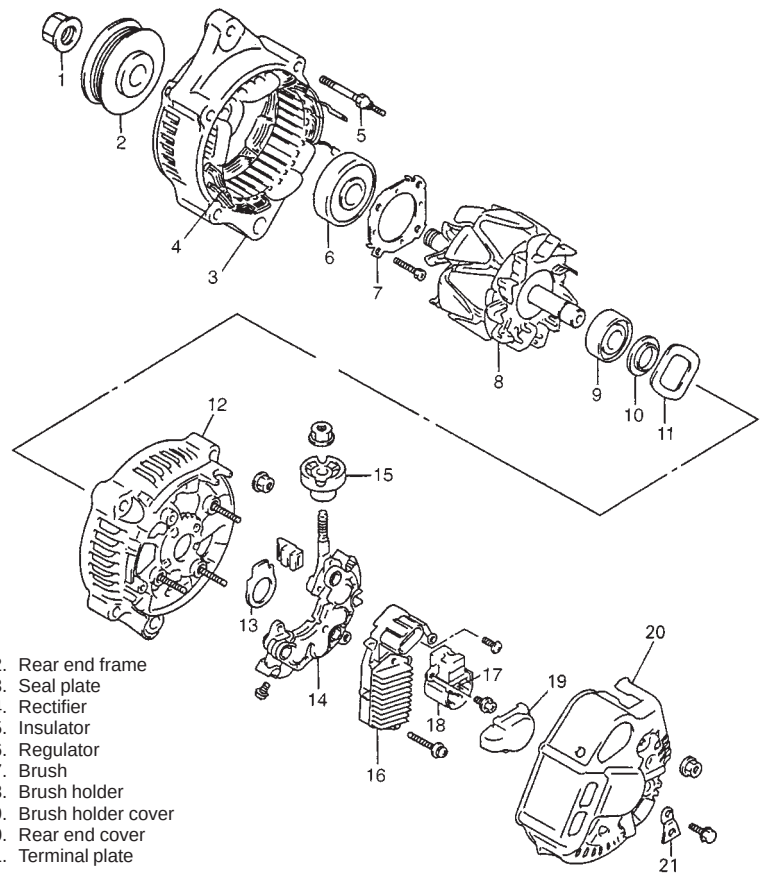
DISASSEMBLY [70 A and 85 A types]

[70A type]

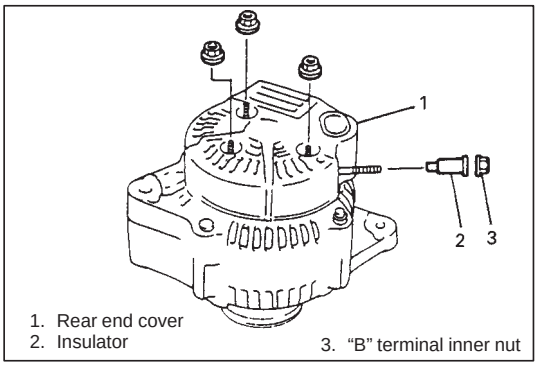


1. Pulley nut
2. Pulley
3. Drive end frame
4. Stator
5. Stud bolt
6. Drive end bearing
7. Bearing retainer
8. Rotor
9. End housing bearing
10. Bearing cover
11. Rear end frame
12. Rectifier
13. Insulator
14. Regulator
15. Brush
16. Brush holder
17. Rear end cover

[85 A type]

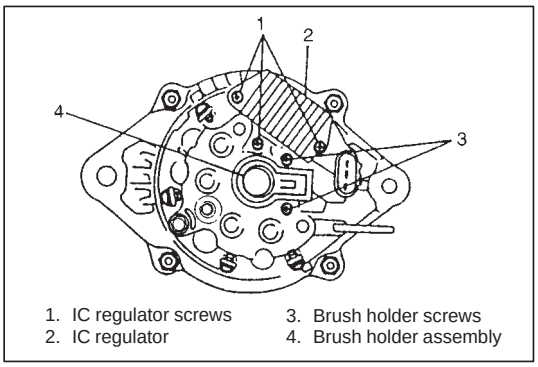


1. Pulley nut
2. Pulley
3. Drive end frame
4. Stator
5. Stud bolt
6. Drive end bearing
7. Bearing retainer
8. Rotor
9. End housing bearing
10. Bearing cover
11. Wave washer
12. Rear end frame
13. Seal plate
14. Rectifier
15. Insulator
16. Regulator
17. Brush
18. Brush holder
19. Brush holder cover
20. Rear end cover
21. Terminal plate



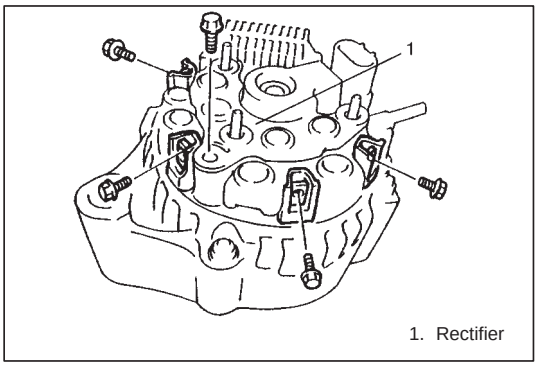
1. Rear end cover
2. Insulator
3. "B" terminal inner nut

1) Remove "B" terminal inner nut and insulator.
2) Remove rear end cover.



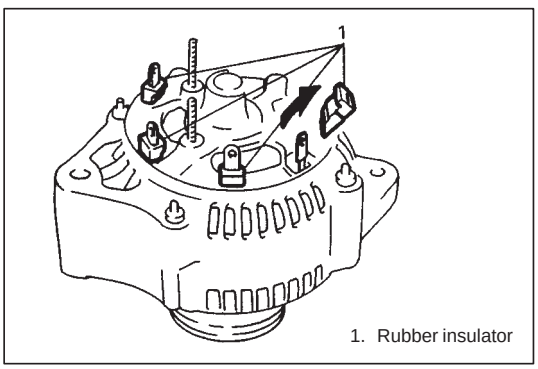
1. IC regulator screws
2. IC regulator
3. Brush holder screws
4. Brush holder assembly

3) Remove 2 screws and pull out brush holder assembly.
4) Remove 3 screws and IC regulator.
5) Remove brush holder cover from brush holder.



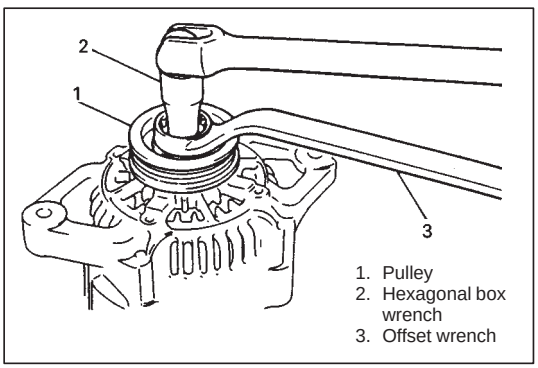
1. Rectifier

6) Remove 4 screws, 1 bolt and rectifier.



1. Rubber insulator

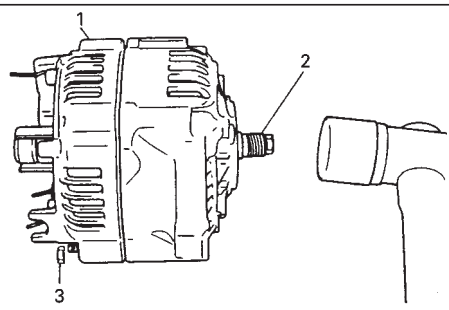
7) Remove 4 rubber insulators (85 A type only).



1. Pulley
2. Hexagonal box wrench
3. Offset wrench

8) Hold shaft by using hexagonal box wrench and remove pulley nut, and then pull out pulley.

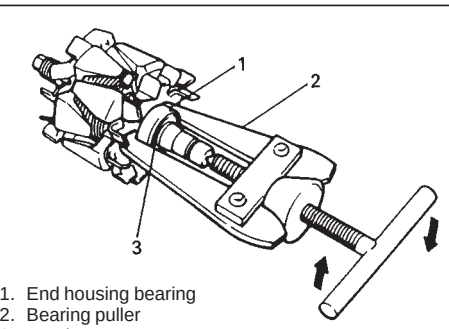
CAUTION:
- **To hold shaft, use hexagonal box. Duodecimal box may cause slipping and consequential shaft or tool damage.**
- **Do not attempt to hold pulley by using vise or pipe wrench so as not to distort it.**



1. Rear end frame
2. Rotor shaft
3. Rear end frame nut

9) Remove 4 rear end frame nuts.
10) Drive out rear end frame with rotor tapping shaft lightly by using plastic hammer.
11) Separate rear end frame from rotor evenly by using plastic hammer.

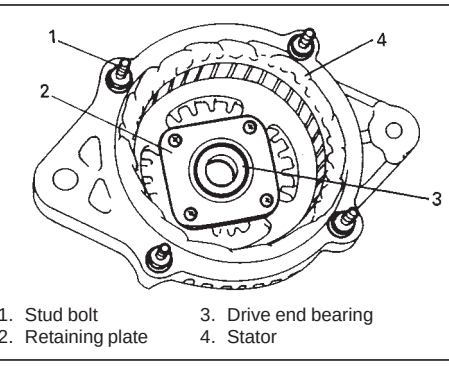
CAUTION:
Do not hit shaft at slip ring side, when separating rotor and rear end frame.



1. End housing bearing
2. Bearing puller
3. Bearing cover

12) If required, use bearing puller to remove end housing bearing and bearing cover.

CAUTION:
Care must be exercised so as not to distort cooling fan blade while applying puller.

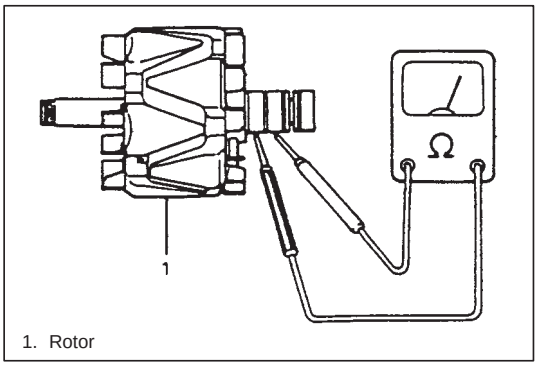


1. Stud bolt
2. Retaining plate
3. Drive end bearing
4. Stator

13) If required, remove 4 screws, retainer plate and then drive out drive end bearing.

14) If required, remove stud bolts and then pull out stator.

NOTE:
Heating drive end frame may facilitate removal of stator.



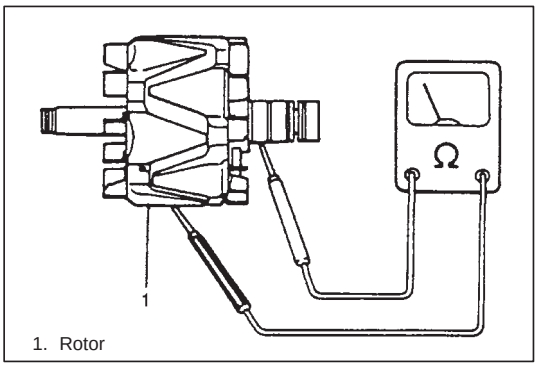
1. Rotor

INSPECTION [60 A type]

Rotor

1) Using ohmmeter, check for continuity between slip rings of rotor. If there is no continuity, replace rotor.

Standard resistance: 2.5 – 2.9 Ω

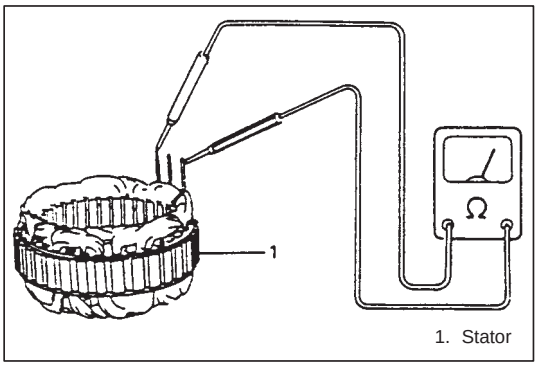


1. Rotor

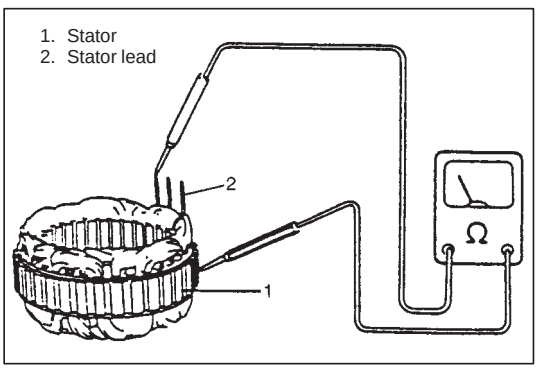
2) Using ohmmeter, check that there is no continuity between slip ring and rotor core. If there is continuity, replace rotor.
3) Check slip rings for roughness or scoring. If rough or scored, replace rotor.

Stator

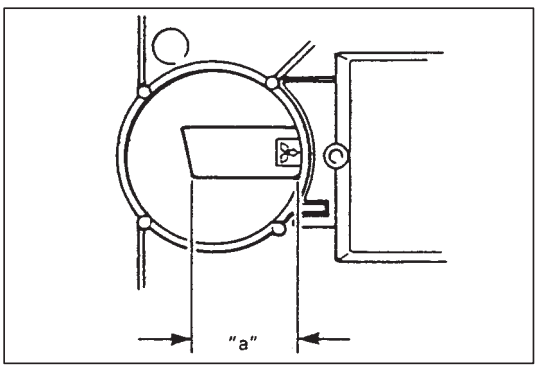
1) Using ohmmeter, check all leads for continuity. If there is no continuity, replace stator.



1. Stator



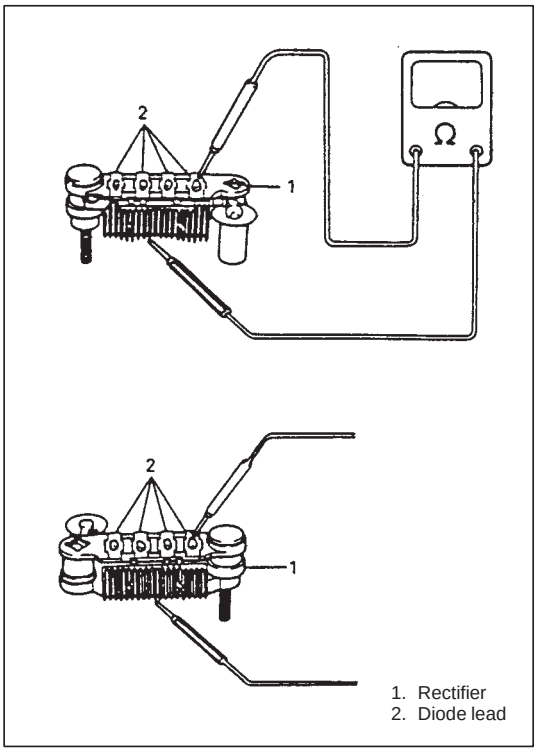
2) Using ohmmeter, check that there is no continuity between coil leads and stator core. If there is continuity, replace stator.



Brush and brush holder

Check each brush for wear by measuring its length.
If brush is found worn down to service limit, replace brush.

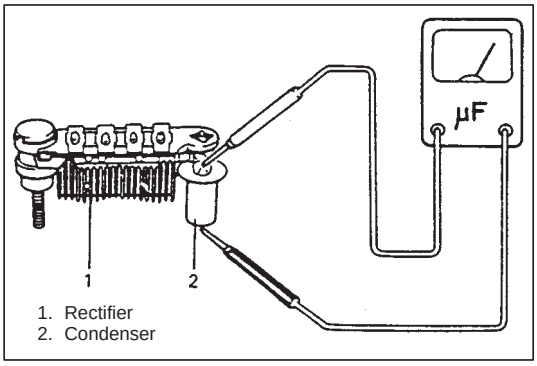
Brush length "a"
Standard: 16 mm (0.63 in.)
Service limit: 2 mm (0.08 in.)



1. Rectifier
2. Diode lead

Rectifier

1) Using ohmmeter, check continuity between each of upper and lower rectifier bodies and each diode lead.
   Check both directions by reversing probes of ohmmeter and there should be only one-way continuity in each case.
   If check result is not satisfactory, replace rectifier.
2) In the same manner as described in above step 1), check that there is only one-way continuity between both leads of diode trio.

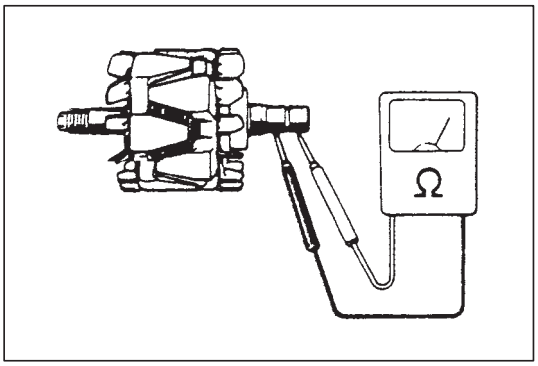


1. Rectifier
2. Condenser

Condenser

Check condenser capacity.

Condenser capacity: 0.5 μF

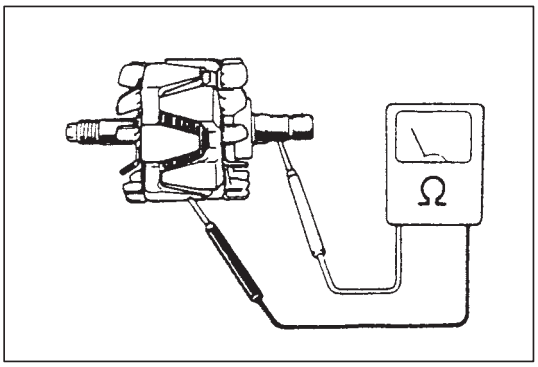


INSPECTION [70 A and 85 A types]

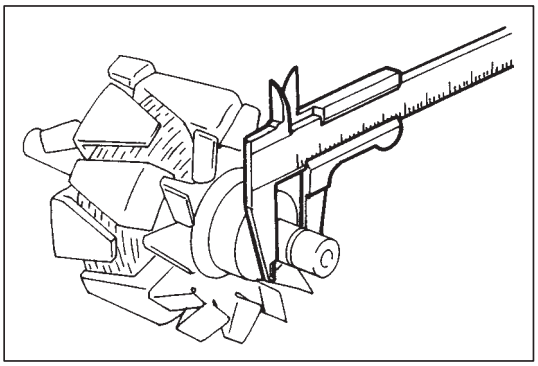
Rotor

° Using ohmmeter, check for continuity between slip rings of rotor. If there is no continuity, replace rotor.

Standard resistance: About 2.9 Ω



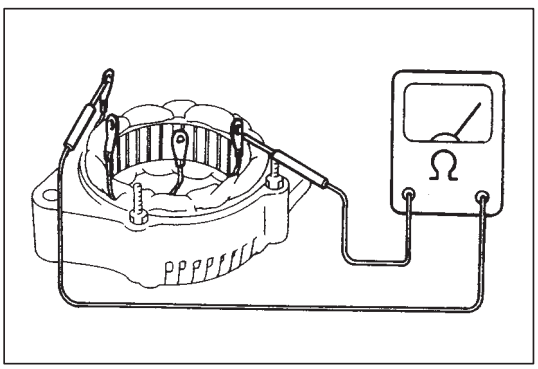
° Using ohmmeter, check that there is no continuity between slip ring and rotor. If there is continuity, replace rotor.



° Check slip rings for roughness or scoring. If rough or scored, replace rotor.
Using a vernier caliper, measure the slip ring diameter.

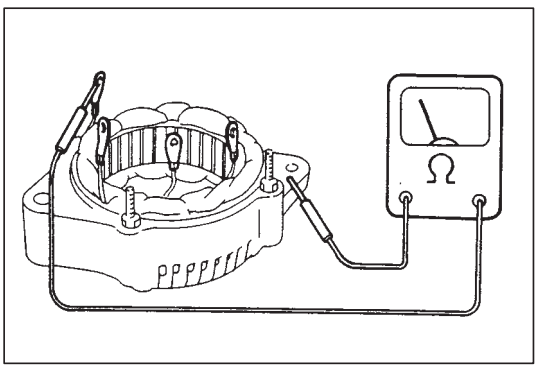
Standard diameter: 14.2 – 14.4 mm (0.557 – 0.567 in.)
Minimum diameter: 12.8 mm (0.504 in.)

If the diameter is less than minimum, replace the rotor.

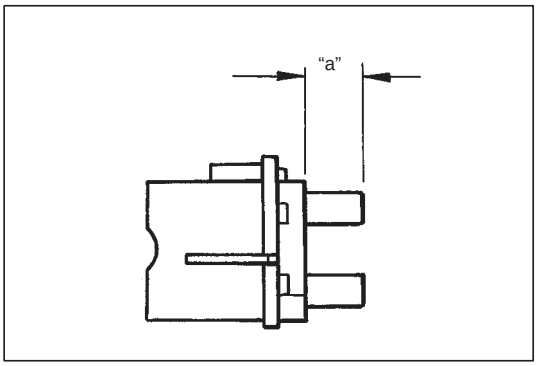


Stator

° Using ohmmeter, check all leads for continuity. If there is no continuity, replace stator.



° Using ohmmeter, check that there is no continuity between coil leads and stator core. If there is continuity, replace stator.

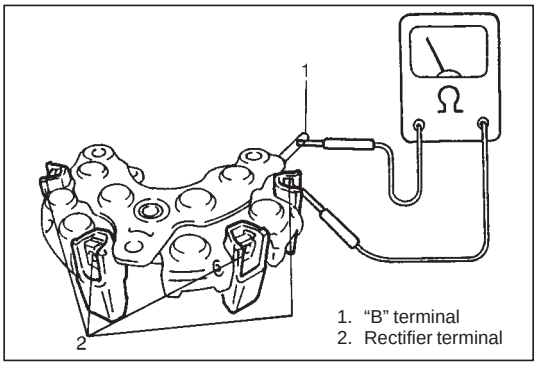


Brush and brush holder

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"

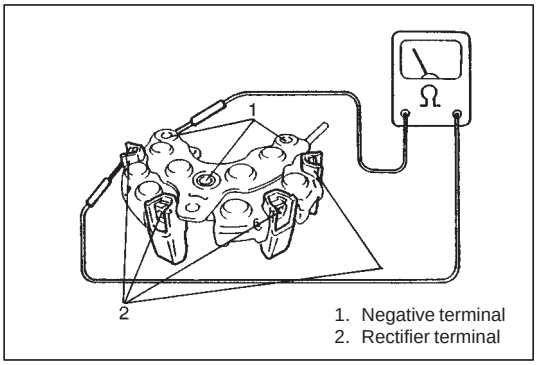
Standard: 10.5 mm (0.413 in.)
Limit : 4.5 mm (0.351 in.)



Rectifier

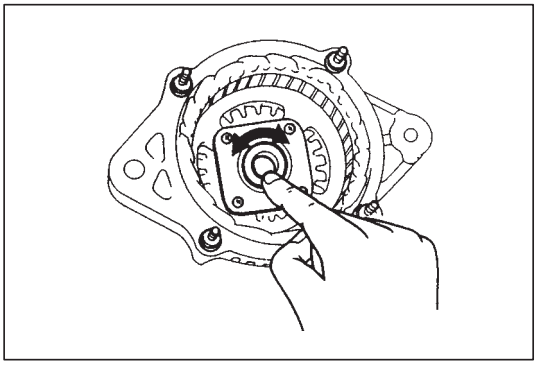
° **Positive Rectifier**

1) Using an ohmmeter, connect one tester probe to the "B" terminal and the other to each rectifier terminal.
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.



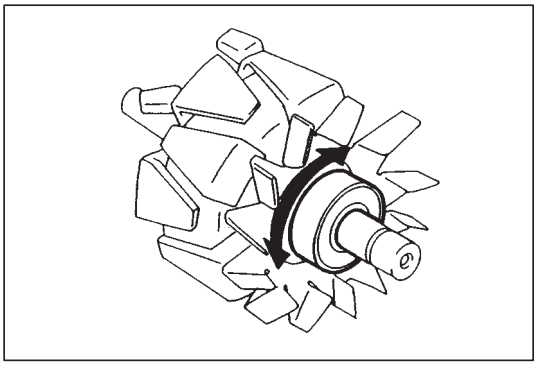
° **Negative Rectifier**

1) Using an ohmmeter, connect one tester probe to each negative terminal and the other to each rectifier terminal.
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.

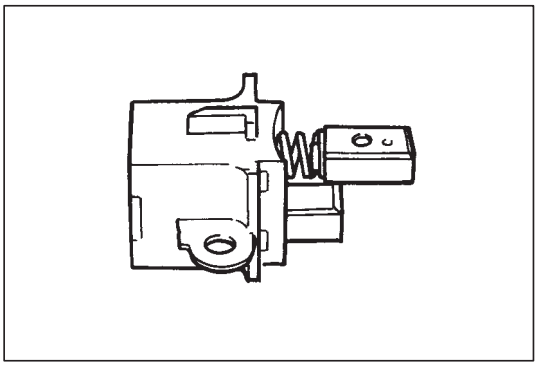


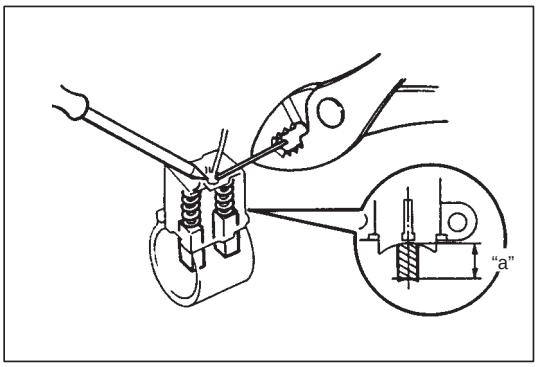
Bearing

° Check that drive and bearing is not rough or worn.



° Check that end housing bearing is not rough or worn.





REPLACE BRUSH

[60 A type]

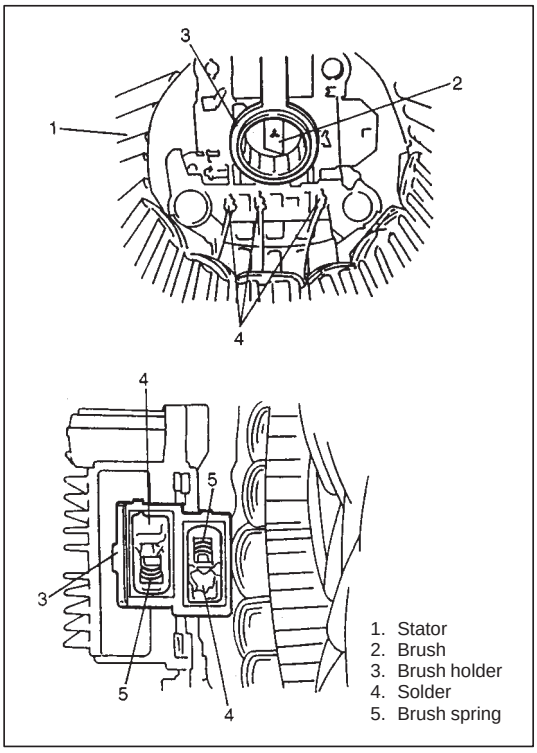
Refer to "DISASSEMBLY" and "REASSEMBLY" of 60 A type.

[70 A and 85 A types]

1) Remove rear end cover and then brush holder.
2) Unsolder and remove the brush and spring.
3) Run the wire of a new brush through the spring and the hole in the brush holder, and insert the spring and brush into the brush holder.
4) Solder the brush wire to the brush holder at specified exposed length.

   Exposed length "a": 10.5 mm (0.413 in.)

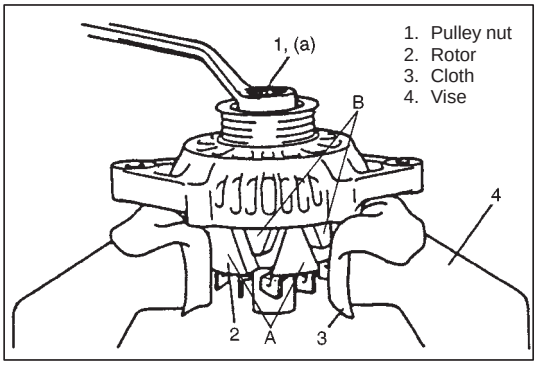
5) Check that the brush moves smoothly in the brush holder.
6) Cut off the excess wire.
7) Apply insulation paint to the soldered area.



REASSEMBLY [60 A type]

Assemble in reverse order of DISASSEMBLY, noting the following.

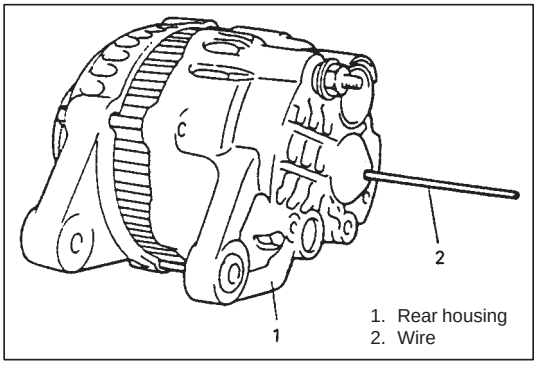
1) Be sure to install brushes in the proper direction and solder brush wires and stator leads.



2) Tighten generator pulley nut to specified torque.

Tightening Torque
(a): 118 N·m (11.8 kg-m, 85.5 lb-ft)

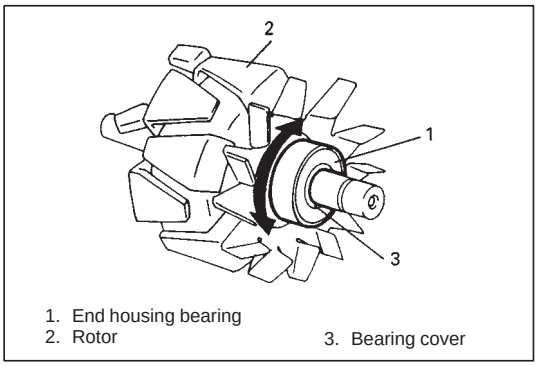
NOTE:
- **When using vise, put clean cloth between rotor and vise so as not to cause damage to rotor.**
- **Be sure to hold the location A. Do not hold the location B as it does not have enough structural strength.**



3) Push brushes into brush holder, then support brushes by inserting appropriate wire from hole of rear housing.

NOTE:
- **After installing rotor, remove wire.**
- **Check to make sure that match marks on front and rear housing are aligned.**
- **Do not apply grease to rear (rotor) bearing. Remove oil completely if found in bearing box of rear housing.**

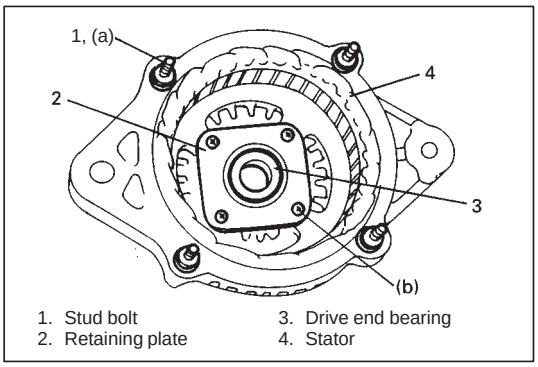
4) After assembling generator, make sure that rotor turns smoothly.



1. End housing bearing
2. Rotor
3. Bearing cover

REASSEMBLY [70 A and 85 A types]

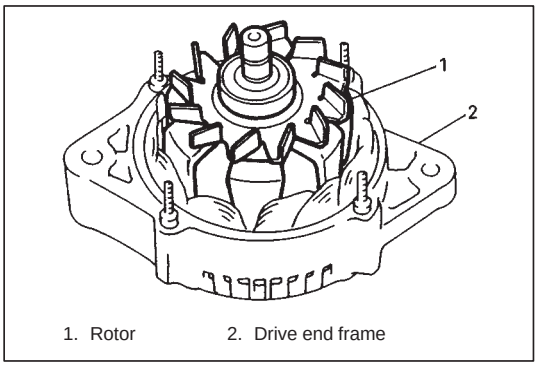
1) If end housing bearing is removed, install it.
2) Check end housing bearing turns smoothly.



1. Stud bolt
2. Retaining plate
3. Drive end bearing
4. Stator

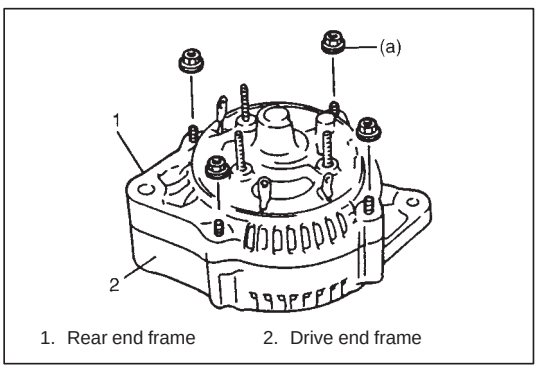
3) If stator is removed, install stator and tighten stud bolts.
4) If drive end bearing is removed, install it.
5) Check drive end bearing turns smoothly.

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)



1. Rotor
2. Drive end frame

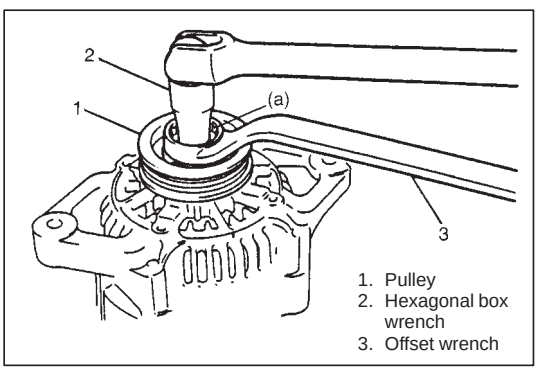
6) Place drive end frame on pulley, and then install rotor to drive end frame.



1. Rear end frame
2. Drive end frame

7) Install rear end frame to drive end frame.
8) Tighten 4 nuts to specified torque.

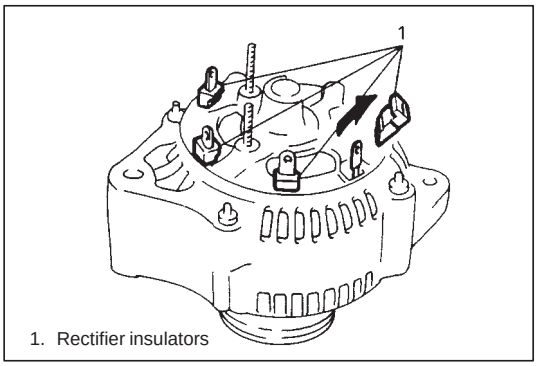
Tightening Torque
(a): 4.5 N·m (0.45 kg-m, 3.5 lb-ft)



1. Pulley
2. Hexagonal box wrench
3. Offset wrench

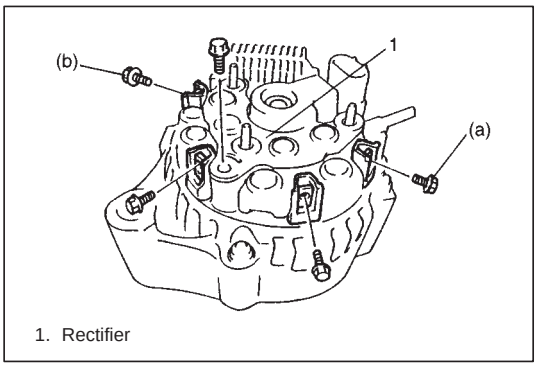
9) Install pulley and tighten pulley nut with holding shaft by using hexagonal box wrench to specified torque.

Tightening Torque
(a): 111 N·m (11.1 kg-m, 80.5 lb-ft)



1. Rectifier insulators

10) Install 4 rubber insulators.

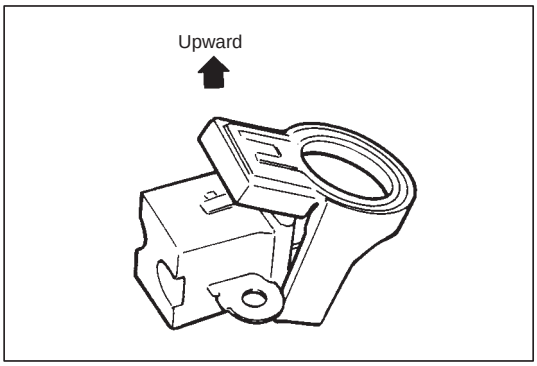


1. Rectifier

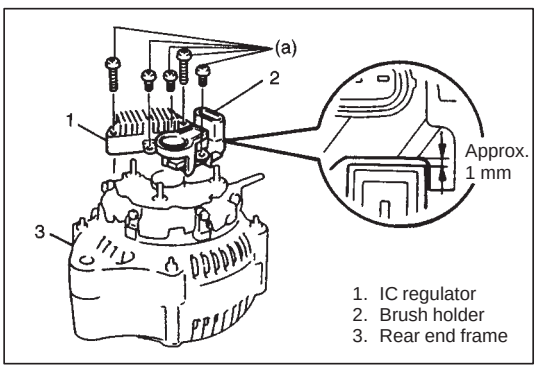
11) Install rectifier.

CAUTION:
When installing rectifier, check to confirm that stator leads have enough clearance with cooling fan blades.

Tightening Torque
(a): 2.0 N·m (0.2 kg-m, 1.5 lb-ft)
(b): 3.9 N·m (0.39 kg-m, 3.0 lb-ft)



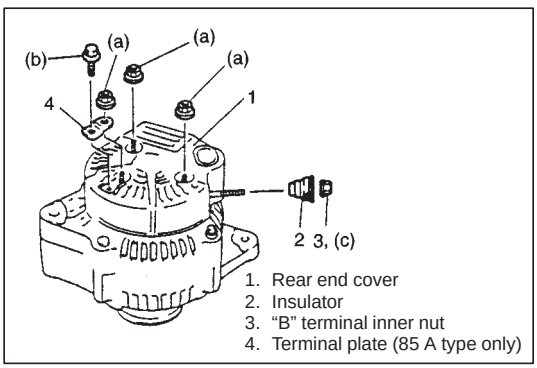
12) Install brush holder cover to brush holder.



1. IC regulator
2. Brush holder
3. Rear end frame

13) Place the IC regulator together with the brush holder horizontally on the rear end frame.
14) Install the 5 screws until there is a clearance of approx. 1 mm (0.04 in.) between the brush holder and connector.

Tightening Torque
(a): 2.0 N·m (0.2 kg-m, 1.5 lb-ft)



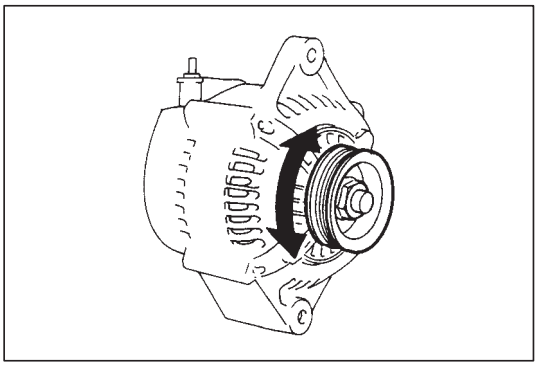
1. Rear end cover
2. Insulator
3. "B" terminal inner nut
4. Terminal plate (85 A type only)

15) Install rear end cover and terminal plate.

Tightening Torque
(a): 4.5 N·m (0.45 kg-m, 3.5 lb-ft)
(b): 3.8 N·m (0.38 kg-m, 3.0 lb-ft) (85 A type only)

16) Install insulator and tighten "B" terminal inner nut to specified torque.

Tightening Torque
(c): 4.2 N·m (0.42 kg-m, 3.0 lb-ft)



17) Make sure that rotor turns smoothly.

SPECIFICATIONS

BATTERY

NOTE:
The battery used in each vehicle is one of the following four types, depending on specification.

Battery type		38B20L	55B24L (S)	55D23L	75D23L
Rated capacity	AH/5HR, 12 Volts	28	36	48	54
Electrolyte	L (US/Imp. pt)	2.8 (5.92/4.93)	3.1 (6.55/5.46)	3.9 (8.24/6.86)	3.9 (8.24/6.86)
Electrolyte S.G.		1.28 when fully charged at 20°C (68°F)			

GENERATOR

NOTE:
The generator used in each vehicle is one of the following three types, depending on specification.

Type	60 A type	70 A type	85 A type
Rated voltage	12 V		
Nominal output	60 A	70 A	85 A
Permissible max. speed	18000 r/min.		
No-load speed	1300 r/min (rpm)	1250 r/min (rpm)	950 r/min (rpm)
Setting voltage	14.4 to 15.0 V	13.6 to 14.4 V	
Permissible ambient temperature	–30 to 90°C (–22 to 194°F)		
Polarity	Negative ground		
Rotation	Clockwise viewed from pulley side		

TIGHTENING TORQUE SPECIFICATIONS

Fastening		Tightening torque		
		N·m	kg-m	lb-ft
° Body ground bolt		8	0.8	6.0
° Generator mounting bolts and nut		23	2.3	16.5
° “B” terminal inner nut		4.2	0.42	3.0
° “B” terminal outer nut		8	0.8	6.0
° Pulley nut	60 A type	118	11.8	85.5
	70 A and 85 A types	111	11.1	80.5
° Rear end frame nuts		4.5	0.45	3.5
° Rear end cover nuts				
° Rectifier “B” bolt		3.9	0.39	3.0
° Stator stud bolts		8.8	0.88	6.5
° Drive end bearing plate screws		2.6	0.26	2.0
° Rectifier screws		2.0	0.20	1.5
° Regulator and brush holder screws				
° Terminal plate bolt		3.8	0.38	3.0

SECTION 6K

EXHAUST SYSTEM

CAUTION:
Be sure to use UNLEADED FUEL for the catalytic converter equipped vehicle. Use of LEADED FUEL will affect performance of the catalytic converter adversely to a great extent.

CONTENTS

GENERAL DESCRIPTION 6K-1
MAINTENANCE 6K-3
ON-VEHICLE SERVICE 6K-4

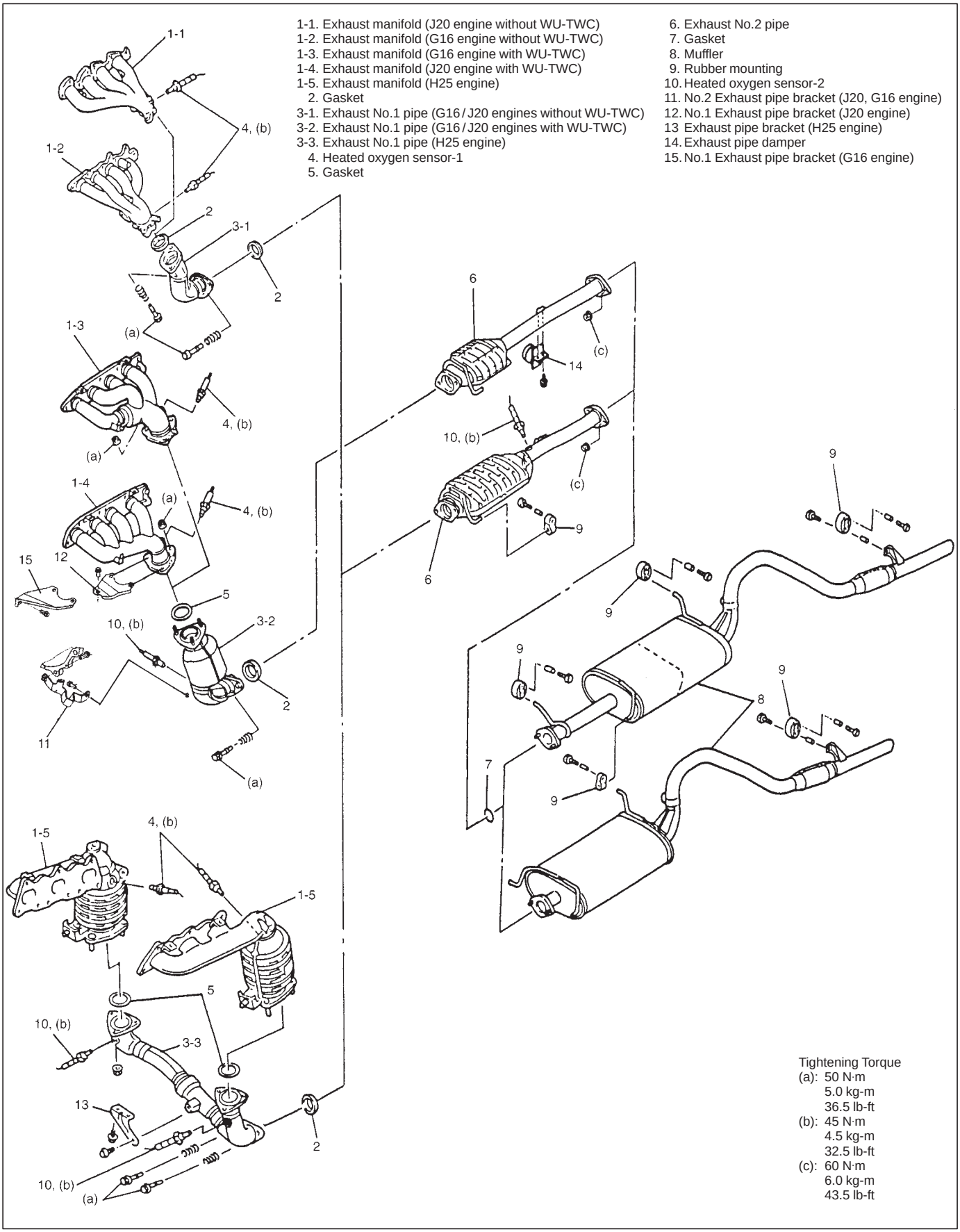
GENERAL DESCRIPTION

The exhaust system of the vehicle consists of the exhaust manifold, exhaust No.1 pipe (with Warm Up Three-Way Catalytic Convertor, WU-TWC, if equipped), exhaust No.2 pipe (with Three-Way Catalytic Converter, TWC), muffler, seals, gasket, etc. The three way catalytic converter is an emission control device added to the exhaust system to lower the level of Hydrocarbon (HC), Carbon Monoxide (CO) and Oxides of Nitrogen (NOx) pollutants in the exhaust gas.

COMPONENTS

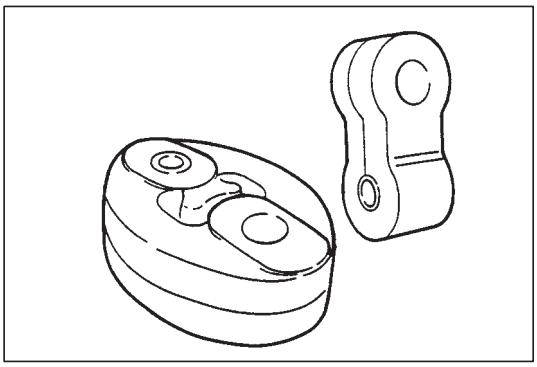
NOTE:

Tighten bolts and nuts ((a), (b), (c)) to specified torque, referring to “MUFFLER” in this section.



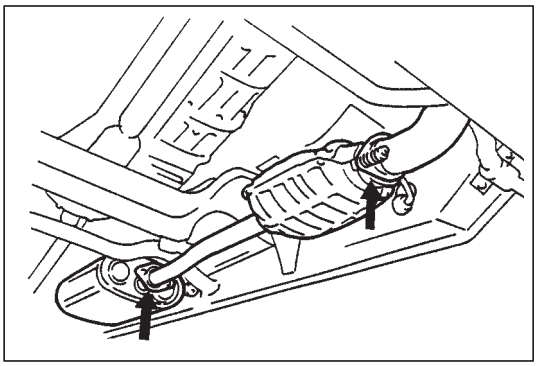
MAINTENANCE

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 “MUFFLER” in this section for torque data.
- Check nearby body areas damaged, missing, or mispositioned part, open seam, hole connection or any other defect which could permit exhaust fumes to seep into vehicle.
- Make sure that exhaust system components have enough clearance from underbody to avoid overheating and possible damage to passenger compartment carpet.
- Any defect should be fixed at once.

ON-VEHICLE SERVICE

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

Refer to Section 6A1, 6A2 or 6A4 for removal and installation procedures. Before installation, check gasket and seal for deterioration or damage. Replace them as necessary.

MUFFLER

CAUTION:
As exhaust pipe has 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.

Using the following specified torques, tighten bolts and nut ((a), (b), (c)) referring to “COMPONENTS” in this section.

Tightening torque
Exhaust pipe bolt (a): 50 N·m (5.0 kg-m, 36.5 lb-ft)
Exhaust pipe nut (to exhaust manifold):
50 N·m (5.0 kg-m, 36.5 lb-ft)
Heated oxygen sensor (b): 45 N·m (4.5 kg-m, 32.5 lb-ft)
Exhaust pipe nut (c): 60 N·m (6.0 kg-m, 43.5 lb-ft)

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